
Groundwater Remediation Work Plan
Voluntary Cleanup Agreement R1-0001-01-01

Glenwood Landing Gas Plant Site

Glenwood Landing,
Nassau County,
New York

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Introduction

This work plan outlines a phased groundwater remediation program designed to address chlorinated volatile organic constituents (CVOCs) in Area-1A of KeySpan's Glenwood Landing Gas Plant Site (the site) located in Glenwood Landing, Nassau County, New York. The site is located on approximately 800-feet of waterfront on the east shore of Hempstead Harbor, and extends east across Shore Road. The site is bounded on the south by a Mobil Oil/Storage Terminal, to the west by Hempstead Harbor, and on the north and east by the North Shore Country Club. Refer to Figure 1, which is a Site Location map.

KeySpan Corporation (KeySpan) entered into a Voluntary Cleanup Agreement (VCA), number R1-0001-01-01, with the New York State Department of Environmental Conservation (NYSDEC) to guide investigation and subsequent remediation activities for the site. Specifically, soil remediation has been completed in Areas-2 and -3 and a soil cap was installed in Area-1B. Groundwater remediation in Area-1A is also a component of the VCA, and this work plan provides specific details regarding the design and implementation of the proposed remedial alternative, in-situ chemical oxidation (ISCO).

Based on the data collected to date, and discussions with NYSDEC, VHB has developed a phased approach to groundwater in Area 1A of the site that provides:

- A program that meets the criteria and objectives of NYSDEC articulated within the VCA; and
- Integrated rationale endpoints for proper site closure.

The plan is predicated on data which indicates that the concentration of volatile organic compounds (VOCs) detected in groundwater, while above published guidance values, are not clearly defined as a threat to human health or the environment. This statement is based on the fact that: 1) there is not enough data to make such judgment; and, 2) an exposure assessment on a statistically significant data set has not been performed.

Traces of VOCs were detected in shallow groundwater in Area 1B. However, the compounds were only found at one sample point and at low concentrations relative to state guidance values. Data from additional sampling in the adjacent tidal wetland indicates no VOCs are present, and thus no migration from shallow

groundwater at Area 1B is observed. Area 1B has been capped preventing exposure to and migration of the limited and low level compounds detected in this area. Since Area 1B will have a deed restriction, no risk has been identified, and no appreciable environmental benefit can be achieved from treatment, groundwater treatment in Area 1B is not warranted and/or included as part of this remedial action.

The goal of the program is to implement a rational, logical, and phased approach. The steps include supplemental groundwater investigation, a pilot study, and full-field implementation, with go/no-go decision points and criteria established at each step.

The investigation task includes further characterization of the plume and, more importantly, a risk-based definition of the issue. The end-result of the supplemental investigation is a go/no-go decision to remediate, and if remediation is necessary, then the definition of appropriate clean-up goals. Furthermore, VHB is unable to complete an engineering evaluation to implement ISCO without the additional investigation proposed in this work plan. If it can be clearly determined that no risks are present based on concentrations detected, the spatial distribution of said contaminants, and exposure scenarios, then future action at the site may be limited simply to monitoring or completely eliminated.

The pilot study task will include small-scale field implementation of ISCO to determine efficacy, evaluation of the potential for producing deleterious by-products, and the logistics of full-scale implementation. If significant reductions in contaminants are not achieved or if the deleterious impacts are significant, then a full-scale program will not be conducted.

The full-scale implementation will include a series of injections. Given the nature of the technology and site dynamics, treatment will be terminated based on meeting clean-up objectives, or identification of asymptotic conditions with respect to chemicals of concern (COC) reductions, and finally limited to three rounds of injections. Monitoring to verify post-treatment site conditions will follow the full-scale program.

The following subsections describe site background information, previous investigations, hydrogeology, and the remedial alternative selected.

Site Background

The site was initially developed as a modern liquid petroleum (LP) gas cracking plant in 1949. Subsequent development included a natural gas regulating station (compressor station), laboratory, and propane storage field. These facilities have since been decommissioned and/or demolished to make way for the redevelopment of the property as a 79-megawatt power generation facility.

The site has been subdivided into three discrete areas: Areas-1, -2, and -3 (refer to Figure 2). Area-1 includes the entire site west of Shore Road and has been subdivided into Area-1A and Area-1B. Area-1A contained a former propane tank farm. Area-1B is a greenspace and tidal wetland. Area-2 is east of Shore Road and north of the site access road where the laboratory, electrical substation, and storage buildings are located. Area-3 is east of Shore Road and south of the site access road where the compressor building was formerly located.

Previous Investigations

Six previous investigations as detailed below were conducted at the site:

- A Phase I Environmental Site Assessment (ESA) was performed by Fluor Daniel GTI, Inc. and reported in January 1999;
- A Phase II ESA was performed by Fluor Daniel GTI Inc. and reported in May 1999;
- A Supplemental ESA was performed by IT Corporation and reported in June 1999;
- A Supplemental ESA of Area-1, including a Human Health and Ecological Risk Analysis was performed by VHB and reported in December 1999;
- An Upgradient Shallow Groundwater Investigation was performed by VHB in March 2000; and
- A Supplemental ESA, associated with VCA R1-0001-01-01, was performed by VHB in September 2001.

The following discussion summarizes these investigations and their findings, as they pertain to the subsurface impacts in Area-1.

Phase I, Phase II, and Supplemental ESAs – January through June 1999

The Phase I ESA by Fluor Daniel GTI suggested the presence of several potential Recognized Environmental Conditions (RECs) in each of the three site areas (Area-1, Area-2, and Area-3). These RECs included leach fields, former above ground storage tanks (ASTs), fill deposits/areas, debris piles, structures, and gas handling/processing facilities.

During the Phase II ESA performed by Fluor Daniel GTI, VOCs were detected in shallow groundwater in Area-1 at concentrations above published background

levels. A "likely" source of the VOC impacts in Area-1 was not identified during this investigation.

The Supplemental ESA by IT Corporation was conducted to "delineate the chemicals detected during [the] Phase II [ESA], and [determine] remediation cost estimates based on the delineation of chemical impacts." During this investigation, VOCs were detected in shallow groundwater on the west side of Area-1A at concentrations exceeding NYSDEC groundwater standards.

Supplemental ESA – December 1999

VHB performed an additional investigation and confirmed the presence of VOCs, principally Trichloroethene (TCE) and Tetrachloroethene (PCE) in shallow groundwater at concentrations ranging from 0.88 to 260 ppb and 0.26 to 29 ppb, respectively. A preliminary assessment of the human health and ecological risks was conducted on the available data at that time. Risks associated with the presence of VOCs in shallow groundwater were identified relative to KeySpan's proposed redevelopment scenarios. As a result of this investigation a recommendation for additional sampling to attempt locating/identifying a source of VOCs was proposed. Specific tasks included a shallow groundwater investigation via Geoprobe® upgradient of Area-1A, and a storm sewer survey to verify as-built documents which could lead to potential on or off-site sources of VOCs.

Shallow Groundwater Investigation – March 2000

VHB conducted a shallow groundwater investigation. The results of the investigation indicated that TCE and PCE were present in shallow groundwater upgradient of Area-1A, but in concentrations well below published background values and the concentrations detected in Area-1A. This information suggests that a VOC source is likely located within Area-1A, and that the contaminants detected here are not resultant from an up-gradient source.

Supplemental ESA – September 2001

VHB installed new shallow and deep monitoring wells in Area-1A; sampled the wells and shallow groundwater in Area-1B via Geoprobe; and dye tested and sampled storm sewers. Shallow groundwater results in Area-1A were consistent with previous data. Additionally, VOCs (including 1,2-dichloroethene [DCE], PCE, and TCE) were detected at depth in two of the new deep monitoring wells. DCE and vinyl chloride (VC) were found in shallow groundwater in Area-1B. The chemical signature of VOC impacts in Area-1A and Area-1B are unique, suggesting two separate sources.

The storm sewer dye testing found the existing sewer to be constructed consistent with as-built documentation. Subsequent sampling indicated that the main 36-inch

discharge from the site is not a source, and the two discrete 10-inch vitreous clay pipe (VCP) bulkhead drains may be acting as a conduit for releases from shallow groundwater to Hempstead harbor. Concentrations of VOCs at the bulkhead discharges were higher than concentrations in the shallow wells on the west side of the site; consequently a discrete source of VOCs may be located near the interior of the bulkhead.

Based on the results of this investigation, VHB recommended the following actions for Area-1:

- Area-1A: Hot spot removal (excavation and off-site disposal) of surface soils which contain concentrations of carcinogenic polynuclear aromatic hydrocarbons (CPAHs) in excess of site clean-up objectives. In-situ groundwater treatment for VOCs in groundwater.
- Area-1B: Cover fill area to prevent exposure to, and mitigate migration potential of, elevated levels of inorganics. Area will require a deed restriction to maintain as a green space or passive recreation area. In-situ groundwater treatment for VOCs in the northeast portion of this area.

The soil remediation and soil cap installation activities have already been completed under the VCA.

Hydrogeology

A thorough understanding of site-specific hydrogeology is necessary to design and implement a comprehensive and effective remedial plan. Based on information obtained from a variety of published sources as well as site-specific geologic/hydrogeologic information (compiled during the aforementioned investigations), VHB has developed a conceptual site model outlining the hydrogeology at the site. This information is presented below.

Regional Hydrogeology

The following major geological units are present in the site vicinity (USGS, 1989):

- Upper Glacial Aquifer - ground surface to approximately 110 feet below ground surface (bgs)
- Magothy Aquifer - approximately 110 to 210 feet bgs
- Raritan Formation - approximately 210 to 350 feet bgs
- Lloyd Aquifer - approximately 350 to 450 feet bgs
- Bedrock - approximately 450 feet bgs

It should be noted that, the sequence presented above is based on interpretations derived from "limited" geologic data. Geology/hydrogeology can vary immensely over short geographical distances. Subsequently, the above-referenced stratigraphy is presented as guidance regarding regional hydrogeology. Investigation completed at the site has well characterized the local hydrogeological framework, which will be further refined through the work proposed herein.

Detailed descriptions of the primary stratigraphic units, pertinent to the proposed remedial alternative, are presented below.

Upper Glacial Aquifer

The Upper Glacial aquifer consists of all recent or Pleistocene sediments (deposited 0.1 to 1.6 million years ago [mya]) including artificial fill, marsh, river and shore deposits, which appear discontinuously at land surface. These deposits include: (1) a body of glacial till; (2) an extensive body of stratified sand and gravel deposited as glacial outwash; and, (3) a thin deposit of marine clay (the "20-foot" clay) which is interbedded with the outwash sediments in some areas along the south shore of Long Island. Of these, the outwash deposits comprise the bulk of the upper Pleistocene deposits, and are exposed at land surface in about 80 percent of the area. The outwash deposits consist mainly of stratified fine to coarse sand and of sand and gravel, and may locally contain thin clay and silt interbeds.

The Upper Glacial aquifer is highly permeable, and readily allows recharge water to percolate downward to the water table. Aquifer testing indicates that the average permeability of outwash deposits is 1,300 gallons per day (gpd) per square foot (approximately 170 feet per day). Individual wells drilled in the outwash deposits have reported yields as high as 1,700 gallons per minute (gpm) and specific capacities as high as 109 gpm per foot. Additionally, in some areas, the outwash deposits below the "20-foot" clay are under artesian pressure.

Magothy Aquifer

The Magothy aquifer is the principal aquifer underlying Long Island and is the island's main source of potable water. The water bearing characteristics of the Magothy aquifer vary according to its varied lithology, however, well capacities of over 2,200 gpm are reported in the literature, with specific capacities between 30 and 80 gpm per foot. Reported permeabilities range from 500 to 1,450 gpd per square foot (approximately 70 to 190 feet per day).

The aquifer is composed of upper Cretaceous sediments (deposited 65 to 146 mya) that overlie the clay member of the Raritan formation. The Magothy is composed primarily of non-marine, lenticular and discontinuous beds of very fine to medium sand, commonly clayey or containing thin clay lenses, that are interbedded with clay

and sandy clay, silt and some sand and gravel. Coarse beds of sand and gravel commonly occur in the lower portions of the aquifer. Overall, the Magothy aquifer sediments appear to grade upward from coarser grained sediments at the base, to finer grained at the top. The greater proportion of clay and sandy clay occurs in the upper half of the aquifer. The Magothy aquifer ranges in thickness from 30 to 1000 feet across Nassau County.

Raritan Formation – Lloyd Sand Member

The thickness of the Raritan formation ranges from 300 to 600 feet. The Raritan across Nassau County is composed of two members, the lower Lloyd Sand member and an upper clay member. The Lloyd member is comprised of fine to coarse sands with gravel and some interbedded clay lenses. Based on the occurrence of marine beds in the Raritan formation in New Jersey, it can be assumed that the Lloyd grades into marine beds at some distance offshore. Water in the Lloyd sand is confined by the upper clay member and artesian, and the permeabilities measured in the Lloyd are high, ranging up to 900 gpd per square foot (approximately 120 feet per day).

The upper clay member of the Raritan formation is approximately 150-feet thick in the site area, and is composed primarily of beds of silt and clay with some lenses of sand, sandy clay, and gravel. Overall, while saturated, this unit is not a water-bearing formation due to low permeability, acting instead as an aquiclude between the lower Lloyd sand and the overlying Magothy aquifer.

Site-Specific Hydrogeology

Available site-specific geologic information suggests that subsurface soils in Area-1A consist primarily of homogenous uniform sands that extend from ground surface to approximately 132 feet below ground surface (bgs). These soils have a relatively high permeability and hydraulic conductivity. The pH in the subsurface soil/water at the site is fairly neutral with observed data ranging from 5.5 to 7.5. Naturally occurring organics in site soils are relatively low, particularly in Area-1A. Slightly higher organic content was observed in soils in Area-1B. Available information suggests that surficial soils in Area-1B, from ground surface to approximately 4 feet bgs, are primarily red-brown sands (of varying textures) with some gravel, ash, and peat. Minimal geological information is available at depths greater than 4 feet bgs in Area-1B. However based on available site-specific geological information, VHB believes that at depths greater than 4 feet bgs, Area-1B has a similar stratigraphic profile to the remainder of the Site, *i.e.*, uniform sands to approximately 132 feet bgs.

Bulkheads on the western and southern edges of Area-1 and a storm sewer and associated recessed vault (along the northern edge of this area) act to hydraulically segregate and define Area-1A. To date a true confining layer, such as the Raritan Formation, has yet to be identified in Area-1. A discontinuous lower permeability layer composed of sand, clay and silt-sized particles was observed at varying depths

ranging from approximately 60 to 90 feet bgs. Deep monitoring wells MWD-01 through MWD-03 were screened just into this layer.

Depth to groundwater in the shallow aquifer in Area-1 ranges from approximately 3 to 8 feet bgs. Groundwater flows across this area in generally a westerly direction, discharging to Hempstead Harbor. Using a soil porosity of approximately 30% (Gelhar, 1992), VHB calculated the average groundwater velocity in the shallow aquifer to be approximately 2.4 feet per day. The groundwater velocity for the deeper aquifer was calculated to be approximately 4.1 feet per day. It should be noted that significant assumptions (such as hydraulic conductivity values for the site) were made to arrive at these estimated values, and that the work proposed herein will provide the additional data required to refine these calculations.

A 1999 Tidal Survey revealed that during tidal cycles, groundwater elevations on the western portion of Area-1 vary by as much as 1 foot, whereas groundwater elevations on the eastern portion of this area vary by approximately 0.1 foot. This survey indicated that the vertical gradient, between the shallow aquifer and the surface water in Hempstead Harbor, varies from nearly zero (at high-tide) to approximately 9 feet (at low tide). Subsequently, groundwater discharge to the harbor is greatest during low tide. Based on available information, it appears as though subsurface soils in Area-1 (ranging from ground surface to approximately 132 feet bgs) are primarily outwash deposits consistent with both the Upper Glacial and Magothy aquifers. The lower permeability soil layer, observed at depths ranging from 60-90 feet bgs, likely contains minor amounts of clays and silts. Site-specific geologic/hydrogeologic information suggests that the water table at the site is within the upper Pleistocene deposits of the Upper Glacial aquifer. As previously discussed, the Raritan formation has not been identified at the site.

Identification of Remedial Alternative

Based on the above-described geologic parameters, as well as available analytical data regarding contaminant distribution, ISCO appears to be the most viable remedial alternative for treating dissolved CVOCs in site groundwater. Based on our initial engineering assessment, VHB proposes using sodium permanganate as the oxidant, based on the following rationale:

- The oxidant is proven effective on CVOCs.
- Sodium permanganate is more effective over a broader range of pH than potassium permanganate. Specifically, potassium permanganate requires pH within 7 to 8; VHB has observed ranges of 5.5 to 7.5 at the site.
- Sodium permanganate has a much higher water solubility which allows use at higher concentration, thus reducing time required to oxidize contaminants.

- Permanganates allow for greater flexibility in delivery to the subsurface versus hydrogen peroxide (Fenton's) or ozone.
- Permanganates are more stable than hydrogen peroxide or ozone.
- Sodium permanganate is available in liquid form (40% solution) allowing for easier handling in the field. Sodium permanganate is also available in 5 gallon and 55 gallon packages.

A preliminary design of this program has been prepared by VHB and is presented herein. Additional site-specific geologic/ hydrogeologic and analytical data will be acquired during the proposed work. Specifically, the work plan has been designed to acquire the following additional site-specific soil/groundwater information within Area-1A to supplement existing site information, and refine the design of the proposed remedial alternative:

- Biological oxygen demand (BOD)
- Chemical oxygen demand (COD)
- Dissolved oxygen (DO)
- Soluble Inorganics in soil/groundwater
- Refined understanding of the spatial distribution of the dissolved CVOC contaminant plume
- Geophysical and geotechnical soil data
- Hydraulic conductivity and groundwater velocity (as determined by slug testing)
- Refined information regarding tidal influence on groundwater flow in the shallow and deep portions of the aquifer
- Actual dispersion rates of oxidant

This information will be used to: (1) optimize oxidant loading requirements; (2) determine the most effective delivery method/volume; (3) refine implementation protocol; and (4) specify operations and maintenance (O&M) requirements. The information will also be used to finalize and determine operational logistics associated with implementing the proposed remedial design.

2

Supplemental Investigation and Pilot Study

This section describes the phased approach for addressing site groundwater relative to potential ISCO implementation. The purpose of the investigation and pilot study can be broken down into seven discrete objectives:

1. Perform a geophysical investigation and conduct additional soil and groundwater sampling to delineate the nature and extent of the CVOC plume.
2. Perform an exposure assessment of CVOCs if the Supplemental Site Investigation data provides a supporting basis.
3. Verify the in-situ effectiveness of sodium permanganate on oxidizing VOCs in groundwater and soils in Area-1A.
4. Refine oxidant concentrations, volumes, injection depths, and pressures.
5. Determine effective radii of influence (ROI) for the injection points.
6. Identify potential ROI in highly conductive areas adjacent to bulkhead and drywells via dye injections.
7. Gather hydrogeologic and geotechnical data required for subsequent implementation phases.

The tasks required to obtain the necessary data and meet the work plan objectives include: a field effort to obtain representative site samples and collect site data; perform injections; field measurement of ROI; laboratory analysis of the field samples to determine pre- and post-treatment concentrations of CVOCs and relevant variables; and a summary report.

Fieldwork Summary

All fieldwork and investigation activities will be performed in compliance with VHB's site specific Health and Safety Plan (HASP), included in Appendix A. All sample collection, packaging, shipping, and analytical procedures will be performed in compliance with the Quality Assurance Project Plan (QAPP), included in Appendix B.

The fieldwork includes hydrogeologic investigation, geophysical investigation, groundwater sampling, installing piezometers to measure water levels and oxidant delivery, Geoprobe points for testing groundwater, injecting oxidant, measuring ROI, and groundwater sampling.

The following paragraphs identify the general requirements and activities associated with the investigation phases and tasks. Table 1 provides site specific information regarding the number of wells, samples, and required field activities. Refer to Figure 2 for proposed injection, piezometer, and sample collection locations.

Phase I—Geophysical Investigation and Supplemental Environmental Sampling

Phase 1 is designed to further refine the understanding of both CVOC distribution and subsurface lithological conditions at the site, which will assist in optimizing operational logistics and focus oxidant delivery to the subsurface. This investigation will be conducted utilizing a combination Membrane Interface Probe and Direct Sensing Soil Conductivity (MIP/SC) system developed by Geoprobe Systems and operated by an experienced drilling subcontractor. This system is proposed based upon both efficiency and information value considerations.

Geophysical Investigation

This geophysical investigation will be particularly focused within the footprint of the former propane tank field, in the central portion of Area-1A. Three transects of borings will be advanced generally from the area just east of existing monitoring well MW-01 to the area of MW-05/MWD-03. Refer to Figure 2. It is currently anticipated that up to five borings (GWMIP-01 through GWMIP-15) will be advanced along each transect. However, the exact spacing and number of borings will be determined in the field. Subsurface physical conditions, *e.g.*, pore pressure and subsurface geological conditions, will determine the maximum boring depths. Based on VHB's current understanding of subsurface conditions, planned boring depths will be to approximately 30 - 40 feet bgs depending on field conditions. The MIP/SC system and operational procedures are described below.

System Description & Operation

The MIP/SC probe is driven into the ground at a rate of one-foot per minute using standard Geoprobe soil probing equipment. As the operator advances the probe sensor into the subsurface, a series of logs are displayed on the field computer's screen. The logs provide real-time data regarding total VOC concentrations in the subsurface using a Photoionization Detector (PID), Flameionization Detector (FID)

and Electron Capture Detector (ECD) in series. Real-time logs of depth/speed, electrical conductivity of the formation, and temperature of the heated sensor are also generated as the probe is driven to depth.

Specifically, the MIP portion of the system is a percussion tolerant VOC sensor that can continuously log volatile organics that diffuse through a semi-permeable membrane as it is advanced into the subsurface. The membrane consists of a thin (6.35 mm diameter) film fluorocarbon polymer membrane that is in direct contact with the soil. The membrane is impregnated into a stainless steel screen which serves as a rigid support for the fluorocarbon polymer. The membrane is typically heated to a temperature of 100° to 120° Celsius. As the probe is pushed into the soil, VOCs in the subsurface come in contact with the heated surface of the membrane and partition/adsorb into it. Using a carrier gas (typically nitrogen, helium and/or certified clean air), the VOCs are brought to the surface through tubing that is connected to the laboratory grade PID, FID, and ECD discussed above. All three of these detectors are mounted in a Hewlett Packard 5890 Series II Gas Chromatograph cabinet. This system provides instantaneous information regarding subsurface CVOC distribution, thereby allowing dynamic changes to the investigation plan and/or precision location of potential source areas, or "hot spots", while mobilized in the field. The MIP data will also determine the appropriate intervals for collection of confirmatory soil and groundwater sampling data, as discussed below.

The SC system is an integral component of this system. The SC utilizes a specially designed probe that will withstand the rigors of percussion probing, while taking continuous measurements of soil conductivity as it is being driven into the ground. The SC utilizes a dipole measurement arrangement through which an alternative electrical current is passed from the center, isolated pin of the SC probe to the probe body. The voltage response of the soil to the imposed current is measured across the same two points. The SC is linked to a control box where the signal is received by the field computer. The signal from the probe is matched with precise depth measurements and logged on the screen. The SC is reasonably accurate for measurement of soil conductivities in the range of 5 to 400 ms/M. Changes in the conductivity profile are used to identify lithological variations, contaminant plumes, salt-water intrusion, or any other subsurface condition that responds to an electrical impulse, such as transition from the vadose zone to the water table.

Confirmatory Sampling

Data collected from the MIP/SC will determine the intervals and depths at which confirmatory soil and groundwater samples will be collected. It is anticipated that up to two confirmatory soil and groundwater samples will be collected at each boring location. Both soil and groundwater samples will be collected utilizing a Geoprobe and narrow-diameter sampling tools to retrieve samples at discrete intervals. All sampling tools will be decontaminated between borings using a deionized water and Liquinox[®] wash.

Upon collection, all samples will be screened for total organic vapors utilizing a PID. All soil samples will be inspected for purposes of determining the physical characteristics of the soil and presence of visual staining and chemical constituents, if applicable. All soil samples will be described in the project field log-book consistent with American Society for Testing and Materials (ASTM) standard D 2488-00, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). All samples collected will be managed and handled per the provisions of the QAPP, included as Appendix B. Following completion each confirmatory boring location will be backfilled with bentonite to prevent vertical migration of subsurface materials, and capped at grade with a bentonite seal.

Data Output

Running MIP logs on a grid or targeted pattern across the investigated area as proposed herein will provide a three dimensional view of CVOC distribution and subsurface lithology. Data from the MIP/SC system will be exported to a contouring and surface mapping application, such as Surfer 8, which will enable the construction of cross-sections from the MIP and SC logs. The cross-sections will provide a three-dimensional understanding of contaminant distribution and migration pathways at the site. This information will be used to refine the ISCO design and optimize oxidant delivery to areas of the site where it is most critical. Focusing of remedial efforts at the site should allow for the realization of an overall reduction in the cost of implementing the proposed remedial alternative.

Baseline Groundwater Sampling

Baseline sampling will be conducted in all shallow and deep on-site groundwater monitoring wells located in Area-1A. Depth to groundwater and total well depth measurements will be collected relative to the north side of the casing in all of the existing wells prior to sampling, to determine purge volumes and potentiometric surface characteristics. Low flow (minimal drawdown) groundwater sampling procedures will be employed to sample all of the wells. Parameters such as turbidity, pH, temperature, specific conductance and dissolved oxygen will be monitored and recorded during purging in preparation for sampling. All samples will be collected, managed and handled per the provisions of the QAPP (Appendix B). Analytical parameters are summarized in Table 1.

Report

At the conclusion of the geophysical investigation and supplemental environmental sampling (Phase 1), a letter report will be prepared which identifies the specifics of the investigation and provides a summary of the results. A recommendations and

conclusions section will present the basis for an exposure assessment, or rationale for proceeding with the pilot study.

Phase II—ISCO Pilot Study

The following subsections provide details regarding the pilot study proposed at the site prior to full-scale implementation of the ISCO remedial alternative.

Dye Injection

An area of concern associated with the implementation of this technology is “short-circuiting” or premature migration of the oxidant from the site subsurface to the harbor. The concern is associated with the fact that the area of the site between the existing drywells and the bulkhead is highly conductive, and direct conduits between the drywells and the harbor exist. Previous dye tests have shown that the network of drainage tiles connected to the drywells are tied to the outfalls at the bulkhead.

A subcontractor with a Geoprobe capable of injecting prescribed volumes of dye at a specific depth and pressure will be used. The proposed field program includes injecting dye at one location in Area-1A.

VHB proposes to inject an environmental benign dye (“Bright-Dyes”) using a Geoprobe at a prescribed depth and quantity (consistent with oxidant loadings) at one location near the bulkhead and drywells to measure the effective ROI. See Figure 2 for dye test injection point. The purpose of the test is to determine the potential for injecting in areas along the bulkhead, and establish minimum setbacks to prevent “short-circuiting” of oxidant during full scale injection. Refer to Table 1 for dye injection protocol.

Dye Tracing

24-hours, 48-hours, and one week following the injections, monitoring will be performed downgradient of the test injection point by utilizing existing monitoring wells, dry wells, and observations at the bulkhead discharges to determine the migration of the dye. Tracing will be performed using a field transportable colorimeter which will allow for rapid field determination of the presence of the dye. Iterations of samples will be performed until a determination regarding an effective safe distance from both the bulkhead and drywells for purposes of injecting is obtained.

Oxidant Injection

A subcontractor with a Geoprobe capable of obtaining depth discrete groundwater samples and injecting prescribed volumes of oxidant at variable pressures will be used. The proposed field program includes injecting oxidant at nine locations in Area-1A at five discrete depth intervals (see Figure 2).

The proposed injection pilot study is broken down into two sub-tests. One set of tests will be performed using a clean "potable" water source. The other set of tests will be performed using treated groundwater as a source of water to reinject. Refer to the Pilot scale delivery system schematic in Figure 2.

Clean Water Injection

The 40% oxidant solution will be mixed with clean water to the prescribed concentration and injected at volumes of 150 to 200 gallons per point. Pressures have been calculated based on the minimum force required to overcome atmospheric pressure, and static pressures from soils and saturated soils above the injection point. For purposes of this test, VHB has estimated that overburden soils have a density of 100 pounds per cubic foot, and saturated soils have a density of 130 pounds per cubic foot.

The injection points will be performed sufficient distances apart to preclude interference from other injections. Where possible, the injection test points have been located upgradient of existing monitoring wells to support subsequent tracing.

Prior to injection at a specific interval, a grab groundwater sample will be collected from that interval for subsequent comparisons to post-treatment samples. Measurements of pH, conductivity, temperature, DO, and ORP will be recorded during pre-treatment sampling. Throughout the course of the pilot study, continuous measurement of the tidal influence will be recorded. Refer to Figure 2 for proposed sample locations. Refer to Table 1 for the Pilot injection matrix.

Groundwater Reinjection

During the groundwater reinjection tests, VHB will withdraw water from downgradient wells and store this water in holding tanks (frac tanks) on-site. The recovered water will be allowed to settle for 24-hours prior to ex-situ treatment. This water will be dosed with sufficient oxidant to support oxidation of the VOCs in the stored volume of water. 24-hours following treatment, the water will be sampled. Following the ex-situ treatment, the water will be amended with the prescribed concentration of oxidant and injected as described in the preceding section. The rationale for this test variable is to determine if on-site groundwater is viable for reinjection. If so, substantial savings can be realized when considering costs associated with using potable water. Additionally, pumping from wells located in

the downgradient portion of Area-1A will create a zone of influence and artificial gradient under operational conditions that will help mitigate any potential off-site migration of VOCs.

Oxidant Tracing

24-hours, 48-hours, and one week following the injections, monitoring will be performed downgradient of the test injection point by utilizing existing monitoring wells, new piezometers, and/or advancing depth discrete borings using a Geoprobe. At the prescribed interval, a groundwater sample will be collected and field analyzed for the presence of the permanganate. Tracing will be performed using a field transportable colorimeter which will allow for rapid field determination of the presence of reaction byproducts of the oxidant (particularly manganese dioxide [MnO_2]) in a sample. Iterations of borings and samples will be performed until two variables are identified:

1. The distance the oxidant has traveled (both vertical and horizontal), and
2. The effective ROI, or volume of groundwater in-situ which has been effectively treated.

When the aforementioned variables are identified in the field, post-treatment groundwater samples will be collected and laboratory analyzed for VOCs. Measurements of pH, conductivity, temperature, DO, and ORP will be recorded during post-treatment sampling. Refer to Table 1 for sample details.

Sample Analysis

All laboratory analyzed samples will be shipped via overnight delivery within 24 hours of sample collection. Samples will generally be analyzed for the following parameters by the methods indicated:

- Volatile Organic Constituents—EPA Method 8260B
- Inorganic (RCRA Metals)—EPA Method 6010B/7471A
- Biological Oxygen Demand—NYSDOH Method 405.1
- Chemical Oxygen Demand—NYSDOH Method 410.4

One duplicate sample from each matrix per site will be collected. Refer to Table 1 for additional details concerning the analytical program for the Pilot study.

Report

At the conclusion of the Pilot study, a letter report will be prepared which identifies the specifics of the study and provides a summary of the results. A

recommendations and conclusions section will present the basis for a go/no-go decision on the use of this technology at the site, and pending approval for use, a summary of key findings with respect to full-scale implementation.

Phase III—Aquifer Testing and Geotechnical Soil Sampling

This work will provide additional important information regarding the aquifer, which will be used to support the design of the proposed ISCO remedial alternative. The information will assist in our efforts to optimize operational logistics and oxidant delivery to the subsurface. The proposed aquifer test will consist of Slug Testing and a Tidal Survey, both of which are discussed in detail below. Portions of the Phase III may not be implemented if sufficient understanding of ISCO delivery and behavior is obtained during Phases I and II.

Slug Testing

Slug tests will be conducted in all existing shallow and deep groundwater monitoring wells located in Area-1A during low, high and inter-tidal stages within Hempstead Harbor. These tests will be performed to determine the hydraulic conductivity (K) of the formation in the immediate vicinity of all of the existing monitoring wells. During a slug test, a known volume of water is quickly drawn from or added to the monitoring well, and the rate at which the water level rises or falls is measured. The water level in the wells may either: (1) recover to initial static level in a smooth manner that is approximately exponential (overdamped response); or (2) oscillate about the static-water level with decreasing magnitude over time until the oscillation ceases (underdamped response). VHB anticipates that the later response will be recognized at the site. Such a response is typical of wells with a long water column that are screened in a highly transmissive aquifer. The following considerations will be utilized during the performance of the slug testing at the site:

- Three or more slug tests will be performed at a given well;
- Two or more different initial placements will be used during testing of a given well;
- The slug will be introduced in a near-instantaneous fashion and a good estimate of the initial displacement will be obtained;
- Appropriate data acquisition equipment (as discussed below) will be used; and
- The method chosen for data analysis (as discussed below) should be appropriate for site conditions.

The slug test will be conducted utilizing a prefabricated and precisely weighed slug consisting of PVC filled with clean sand, or the like, and sealed at both ends. The

slug will fit snugly inside the existing 2-inch diameter wells at the site to produce the required response. A pressure transducer (Solinst® Levellogger™, In-Situ Inc. miniTROLL, etc.) will be utilized to measure and record water levels in each of the wells. The pressure transducer will have internal data-logging capabilities, and will be installed approximately 4 to 7 feet above the bottom of each well. The exact placement of the transducer will be dependant on the well construction. Prior to deployment in each of the wells, the data-logger will be calibrated and configured to convert the pressure head of the water column above it to elevation head, *i.e.*, height of the water column above it. Configured in this manner, the pressure transducer will provide precise measurements of water table level variations produced during slug testing. This head data will then be normalized relative to mean sea level elevation using the previously surveyed elevations of the existing wells.

The water table elevation data collected during slug testing will be downloaded directly from the data-logger to aquifer test analysis software (AQTESOLV™ by HydroSOLVE, Inc.) in order to estimate horizontal *K* for the aquifer in the immediate vicinity of each respective well. It is anticipated that the *Bouwer and Rice* slug test solution for unconfined aquifers will be utilized for the estimation of *K*. The following assumptions will be employed utilizing this mathematical solution:

- The aquifer has infinite areal extent;
- The aquifer is homogeneous and of uniform thickness;
- The aquifer potentiometric surface is initially horizontal;
- The test well is partially penetrating;
- A volume of water is discharged from the well instantaneously;
- The aquifer is unconfined; and
- Flow is steady.

The *K* data for all of the deep and shallow wells will be averaged to provide typically representative values within these intervals of the aquifers. The *K* data will also be correlated to the tidal stage during collection to determine the effects, if any, on the aquifer as a result of tidal fluctuations in adjacent Hempstead Harbor. Finally, the average *K* data, as well as horizontal hydraulic gradient and effective porosity data, will be used to calculate refined groundwater velocities in the shallower and deeper portions of the aquifer at the site. This data will greatly assist in optimizing the design of the proposed remedial alternative, particularly in regards to estimating the potential radius of influence to be propagated during oxidant injection under full-scale implementation.

Tidal Study

The periodic rise and fall of tidewater in coastal waters and tidal estuaries occurs primarily in response to the gravitational interaction between the earth, moon and sun. The tidal sequence produces sinusoidally fluctuating groundwater levels in aquifers that are hydraulically connected to these surface waters. The extent to which an aquifer is affected by tidal influence is dependent on the following:

- The tidal range of the surface water;
- The degree to which the aquifer is in hydraulic communication with the surface water;
- The thickness and hydraulic conductivity of the aquifer;
- The net prevailing hydraulic gradient at the seepage face; and
- The configuration of the shore-face.

As mentioned previously, a tidal study was performed previously at the site. This survey indicated that there is a correlation between the tidal cycles and water level changes in the shallow portion of the aquifer. The study proposed herein will further refine our understanding of the effects of diurnal tidal influences on groundwater conditions in both the shallow and deep portions of the aquifer. In particular, it is anticipated that three of the shallow and two of the deep groundwater monitoring wells existing at the site will be utilized for water level monitoring during the approximately 48-hour long study. In addition, a tidal gauge will need to be deployed within Hempstead Harbor during the study to gauge the level and intensity of groundwater fluctuations in the aquifer in response to tidal fluctuations in this surface water body. This tidal gauge will be fastened to either the bulkhead of the adjacent marina, or the bulkhead of the KeySpan facility, located to the south of the site along the west side of Shore Road. The relative elevation and position of the tidal gauge will be tied into the local coordinate system and datum.

Pressure transducers (Solinst® Levellogger™, In-Situ Inc. miniTROLL, etc.) will be utilized to measure and record water levels in the five monitoring wells and the tidal gauge over the course of the study. The pressure transducers to be utilized during the test will have internal data-logging capabilities, and they will be installed approximately 4 to 7 feet from the bottom of each of the wells depending on their construction. The pressure transducer deployed in the tidal gauge will be positioned as close to the bottom as practical to minimize the influence of wave action on the collected data, and to maintain complete submergence throughout the duration of the study. Prior to deployment, the data-logger in each of the pressure transducers will be calibrated and configured to convert the pressure head of the water column above it to elevation head, *i.e.*, height of the water column above it. Configured in this manner, the pressure transducers will provide precise measurements of water table level variations produced as a result of tidal influences. This head data will

then be normalized relative to mean sea level elevation using the previously surveyed elevations of the wells and tidal gauge.

Vendor software packages for data extraction provided with the pressure transducers, as well as a spreadsheet application such as Microsoft® Excel, will be utilized to reduce and manipulate the data gathered during the tidal study. Graphical representations of water table level fluctuations/response as a function of time and tidal stage will be generated based on the data collected during the study.

Geotechnical Soil Sampling

Saturated soil samples will be collected for geotechnical testing, in order to further refine the understanding of physical characteristics of the aquifer at the site. A total of three soil borings from Area-1A will be advanced to collect saturated soil samples for geotechnical analyses. It is anticipated that the borings will be advanced to a maximum depth of 60 to 70 feet bgs utilizing an HSA drill rig. Samples will be collected continuously from these borings from grade to the terminal depth of the borings using a split-spoon sampler. Upon collection, all samples will be screened for total organic vapors utilizing a PID, and logged as discussed previously. All descriptive information for the soil borings samples will be entered into and maintained in the project field log-book.

The presence of discontinuous layers of lower permeability soils have been documented during previous site investigations. This information is particularly important in regards to determining chemical constituent fate and transport at the site, since the lower permeability layers will inhibit the vertical migration of CVOCs. The information collected during boring advancement will determine the depths at which significant lithological changes are encountered, as well as guide the intervals for collection of samples for geotechnical analyses. Up to 4 subsurface soil samples will be collected from the borings for analysis using Shelby tubes. Refer to Table 1 for a sample summary.

Appropriate steps will be taken, if necessary based on conditions determined in the field, to protect the integrity of any substantial lower permeability layers previously undetected at the site.

Report

At the conclusion of the aquifer testing (Phase 3), a letter report will be prepared which identifies the specifics of the study and provides a summary of the results. Critical data relative to proper ISCO final design, and a summary of key findings with respect to full-scale implementation will be prepared.

3

ISCO Design

Preliminary Design

ISCO technology is proposed for groundwater remediation in Area-1A. The proposed remedial action in this area was selected because:

- It is protective of human health and the environment by removing/reducing through oxidation, the CVOC contaminants from the site. Site remedial action objectives will be achieved and verified through subsequent sampling.
- This technology is proven effective, and readily implementable. Oxidation of the VOCs in groundwater from the site achieves both short and long-term remedial action objectives. Industry and state accepted standards and procedures (air monitoring, quarterly groundwater sampling, zone control, etc.) during application activities are required to ensure that contaminants do not mobilize and/or migrate during treatment.
- It is more cost effective versus traditional pump and treat technologies.
- More reliable than containment technologies due to the nature of this site.
- More cost effective and efficient than in-situ biological technology.
- Precludes migration and eliminates long-term monitoring associated with natural attenuation.
- The site conditions of homogenous sandy soils, no free product, and no free organics provide good conditions for the implementation of the technology.
- NYSDEC has reviewed and approved preliminary plans to perform this work.

Implementation of this technology will require an engineering design to determine the oxidant loading, application locations, depths, volume of oxidants, and correlation with tidal fluctuations to optimize treatment. Site monitoring will be required to determine short and long-term effectiveness.

Selection of Permanganate

VHB has selected Sodium Permanganate as the oxidant for this site. The rationale for the selection of this oxidant is based on:

- The oxidant is proven effective on CVOCs.
- Sodium permanganate is more effective over a broader range of pH than potassium permanganate. Specifically, potassium permanganate requires pH within 7 to 8; VHB has observed ranges of 5.5 to 7.5 at the site.
- Sodium permanganate has a much higher water solubility which allows use at higher concentration, thus reducing time required to oxidize contaminants.
- Permanganates allow for greater flexibility in delivery to the subsurface versus hydrogen peroxide (Fenton's) or ozone.
- Permanganates are more stable than hydrogen peroxide or ozone.
- Sodium permanganate is available in liquid form (40% solution) allowing for easier handling in the field. Sodium permanganate is also available in 5-gallon and 55-gallon packages.

VHB also evaluated the potential impact to the existing bulkhead from the application of the oxidant. Specific concerns are that over accelerated degradation and/or oxidation of the bulkhead may be precipitated by the oxidant. VHB has identified the most significant potential impact may be caused by galvanic corrosion since we are introducing dissimilar metals, manganese from the sodium permanganate with the low alloy steel of the bulkhead. We will ignore sodium since the additional concentrations to be introduced during injection are insignificant to background (salt water).

Given the age and structural characteristics of the bulkhead, the steel used is most likely an ASTM standard A7 structural steel. This steel has less than 5% alloys and therefore we can assume is principally iron. The oxidant we plan to use is a combination of sodium, manganese, and oxygen. The sodium drops out of consideration as noted above. We are left with an evaluation of the potential reaction between iron and manganese.

Iron is more noble, hence manganese will "anodize" or give itself up to the iron. While manganese is more reactive, it is important to note that these materials are not widely separated in the galvanic series, and, therefore, dramatic reactions between the two metals are not anticipated. Significant galvanic action is further limited by dynamic groundwater flow adjacent to the bulkhead which reduces reaction times. Further, the concentrations and total volume of manganese introduced is very small relative to the mass of the bulkhead. Given the preceding information, our analysis indicates that there will be no measurable impact to the bulkhead from oxidant injections and subsequent reactions.

In order to determine the proper amount (both concentration and volume) of permanganate to inject we must identify:

1. Area and Contaminant Mass; and
2. Oxidant Requirements based on stoichiometric balance and molecular weights.

Area and Contaminant Mass

Based on the previous rounds of analytical data, VHB estimated the areal extent of the VOC plumes in Area-1 A. The volume of the plume is estimated at 1,980,000 cf. A soil porosity of 30% was assumed for the subsurface to differentiate between the volume of subsurface soil, and pore space or water volume assuming saturated conditions.

VHB has performed calculations to determine the mass of VOCs associated with the volume of groundwater and subsurface soil for Area-1A. The average concentration of the various VOC compounds were calculated based on the latest round of investigation data. In Area-1A, the average concentration of VOCs was higher in the deep groundwater monitoring wells, and, therefore, the more conservative (higher concentration) was used. In conjunction with the groundwater data, subsurface soil data was also summarized and averaged.

The average concentrations for both soil and groundwater were then converted to pounds mass of VOCs by proportional computation relative to the mass calculated for soil and water for each area. The VOC mass calculated for both soil and groundwater were summed to identify the total mass of VOCs in the subsurface in Area-1A.

Based on the information to date, a total mass of 25.90 pounds of VOCs is present in the subsurface in Area-1A. Prior to determining oxidant loading requirements, the mass of VOCs was multiplied by a factor of 1.1 to incorporate the mass of NOM, which was estimated at 10%.

Oxidant Requirements

Generally, permanganate oxidizes specific VOC compounds at a ratio of 1 to 3 moles of permanganate per mole of VOC. VHB identified the specific VOCs and determined the proportion of each of the specific compounds with respect to that area. This step is required to determine the molecular weight of the typical VOC composite compound, and the corresponding number of moles of permanganate required to reduce this composite.

Based on the existing site data, VHB calculated that Area-1A requires 1.60 moles of permanganate per mole of VOCs. VOCs in Area-1A are predominantly PCE and TCE which are oxidized between 1.33 and 2 moles of permanganate per mole. Converting molecular weights to mass, 34.2 pounds of permanganate are required to

oxidize VOCs in Area-1A. Calculations and Stoichiometric balances are attached in Appendix C.

Injection Protocol

Injections of sodium permanganate will be performed surgically based on the subsurface geophysical data collected during the supplemental investigation, and the ROI identified during the Pilot study. The injection program will focus on hot spot treatment, followed by monitoring. Subsequent rounds of injections to address hot spots, or to address residuals, may be required. A Geoprobe will be used to inject the permanganate at prescribed volumes and depths. For Area-1A, injection will start upgradient near Shore Road.

24-hours, 48-hours, and one week following injections, piezometers, existing monitoring wells, and a Geoprobe will be used to determine the effective ROI of the injection round, and drive subsequent injections. A colorimetric analysis will be used to determine the travel and efficacy of the permanganate. After one-week, when the ROI has been verified, grab groundwater samples will be collected downgradient of the injection points. The program will be dynamic, thereby allowing modifications in the field.

Care must be exercised with injections adjacent to the existing storm sewer, under-drains, and bulkhead. To preclude short-circuiting of injected agents, existing openings/outfalls in the steel bulkhead will be temporarily sealed with inflatable seals. Additionally, applications will be coordinated with tidal sequences to ensure optimal retention. Specifically, applications will be initially made near high tide to enhance retention time. The time during the tide cycle for injection may be modified based on field observations. Information obtained from the ROI measurements will be used to determine minimum safe clearances to these features to prevent premature migration of the permanganate.

Monitoring and Performance

Existing monitoring wells and piezometers will be used to monitor performance in Area-1A. Samples will be collected on a quarterly basis during remediation. In-situ groundwater parameter/chemistry (pH, conductivity, temperature, etc.) data will be collected in conjunction with samples which will be analyzed for VOCs via method 8260B at a NYSDOH ELAP laboratory. Duplicate samples will be collected at a rate of 1 per 10 samples.

Groundwater sampling will be conducted prior to injection, 3 months following the initial application, prior to the second application, and 3 months subsequent to the second application. A review of remedial program performance will be conducted at this time to modify and/or terminate subsequent applications.

Treatment will be suspended upon the completion of two consecutive rounds of quarterly groundwater sampling that indicate the levels of VOCs are at or below prescribed action levels, or asymptotic conditions are observed. Subsequent annual sampling will be conducted for a period of 2 years to monitor long-term efficacy of the remedial action.

Final Design—Plans and Specifications

Using data from previous investigations, and Pilot study, a design will be completed which identifies the specifications for the full-scale program. Specific elements of the design will include:

- A site map identifying the locations of the proposed injection points and horizontal extent of treatment area;
- Profile of Area-1A which delineates plume configuration and prescribed injection depths, and anticipated ROI;
- A matrix summary of injection points, depths, volumes, and pressures;
- A protocol for field modifications; and
- Anticipated schedule.

4

Waste Management Plan

The purpose of this plan is to provide guidance to the user of the work plan with regard to the handling and disposal of waste materials generated during the course of the project site activities.

Parameters and Assumptions

This plan has been drafted based on the following parameters and assumptions:

- VHB will be responsible for sampling the project waste streams based on the KeySpan approved disposal facility requirements and advising KeySpan of the sample results;
- VHB will work with KeySpan to arrange for the proper transportation and disposal of project wastes at KeySpan approved facilities;
- KeySpan is completing the field work pursuant to a Voluntary Cleanup Agreement with the NYSDEC; and
- All work performed at the sites will be performed in conformance with this project work plan.

Chemicals of Concern

The following COCs have been identified in Area-1A at the site during the various investigation previously completed, as summarized in Section 1 of this work plan.

Contaminant	Matrix	Concentration (ppb)
Trichloroethene (TCE)	Soil/Groundwater	Variable by Sample Location
Tetrachloroethene (PCE)	Soil/Groundwater	Variable by Sample Location
Lead	Soil/Groundwater	Variable by Sample Location
Arsenic	Soil/Groundwater	Variable by Sample Location

Regulatory Drivers and Guidance

The primary drivers for the waste activities at this site are provided below.

NYSDEC's Hazardous Waste Regulations, 6 NYCRR 371

These regulations provide the hazardous waste management regulations for generating, storing, treating, disposing and transporting hazardous wastes.

NYSDEC's Solid Waste Regulations, 6 NYCRR 360

These regulations provide the solid waste management requirements for generating, storing, treating, disposing and transporting solid wastes.

NYSDEC's Solid Waste Transporter Regulations, 6 NYCRR 364

These regulations provide the operational and permitting requirements for solid waste transporters in New York State.

USDOT Regulations, 49 CFR 172, et seq.

These regulations provide the requirements for containerizing and transporting wastes on public roadways.

Expected Waste Streams and Estimated Quantities

The primary waste streams to be generated during this project and the proposed storage/disposal methods are provided below:

Waste Stream	Estimated Quantity	Anticipated Classification	Storage/Disposal Method
Soil Cuttings	< 50 cubic yards	Non-Hazardous	55-gallon drums/Off-site disposal
Decontamination and Well Development Wastewaters	< 200 gallons	Non-Hazardous	Containerize/Off-site disposal
Personal Protective Equipment (PPE)/ Miscellaneous Debris	< 25 cubic feet	Non-Hazardous	Containerize/Off-site disposal

Waste Management Requirements

Soils

Soils will be generated during the installation of groundwater piezometers and injection points. Excess soils generated during the installations will be stored in 55-gallon drums for off-site disposal.

Prior to characterization, all excavated soils will be staged in a manner that does not pose a threat to health or the environment. For example, the soils should not be placed within proximity to a monitoring well, within or adjacent to an environmentally sensitive area (e.g., wetlands, stream bank, etc.), or near a site boundary adjacent to stormwater catch basins or residential/commercial uses. In addition, soils are not to be consolidated or otherwise blended together prior to visual assessment and characterization.

If the soils are determined to be hazardous waste via TCLP analysis, the requirements for hazardous waste management contained in Exhibit 1 must be followed. Hazardous waste requirements include those pertaining to the storage, transport and tracking of hazardous wastes from the point of generation to the ultimate permitted disposal facility. Soils which are not hazardous, must be managed in accordance with the solid waste requirements contained in Exhibit 2.

Wastewaters

Liquid wastes (*i.e.*, well development water, dewatering and decontamination waters) may be potentially contaminated with COCs from on-site sources. The presence of any hazardous constituents in the wastewaters is expected to be dilute. Therefore, the wastewaters are not expected to be classified as hazardous waste. The wastewaters are not likely to contain hazardous waste pursuant to the contained-in policy (*i.e.*, environmental media which contain a listed hazardous waste are to be managed as a hazardous waste).

It is anticipated that liquid wastes will be placed in bulk containers, 55-gallon drums or similar containers for off-site disposal as non-hazardous waste in accordance with Exhibit 2.

PPE/Miscellaneous Debris

Personal protective equipment and miscellaneous debris will be generated at the site. These materials are anticipated to be classified as non-hazardous wastes and, therefore, are to be managed as solid wastes in conformance with the requirements of Exhibit 2.

Waste Transporters and Disposal Approvals

Transporters

Transporters for the removal of solid and hazardous wastes must be reviewed and approved by VHB and KeySpan prior to use. Transporters are reviewed primarily for their USDOT safety rating and accident record. If site generated wastes are deemed non-hazardous and do not exhibit any other USDOT hazardous materials hazard class (*e.g.*, flammability, combustibility, corrosiveness, etc.), they may be transported as non-DOT regulated materials.

Disposal Facilities

Solid, liquid and hazardous waste treatment/disposal facilities, including off-site POTWs, must be reviewed and approved by VHB and KeySpan prior to use. Disposal facilities are reviewed for permitting requirements, licenses and regulatory enforcement status.

Waste Documentation and Notification Requirements

Hazardous Waste

KeySpan will be the generator of record for this project and will provide the EPA ID Number for any shipment of hazardous wastes. No waste will be transported for disposal without prior approval of KeySpan. Completed manifests will be provided by the waste transporters for review and approval by VHB and KeySpan. A KeySpan representative will sign all manifests. Copies of fully executed manifests will be provided to VHB by the waste transporter. VHB and KeySpan will be responsible for filing any exception reports that are needed if the return copies of the manifest are not received from the disposal facility within 20 days of the shipment.

Solid Waste

KeySpan will be the generator of record for all solid wastes transported from the site. No prior regulatory notification for the solid waste shipments will be required. A bill of lading corresponding to each shipment of solid waste will be completed by the waste transporter for review and approval by VHB and KeySpan. One copy of the bill of lading will be retained by VHB for the project files. No return copies of the bills of lading will be required.

Project Management Plan

Project Staffing

VHB is the KeySpan's consultant for this groundwater remediation project, and is exclusively responsible for the execution of this work plan. VHB is reporting directly to Mr. Patrick Van Rossem who is the Project Manager for KeySpan. VHB will use the following key staff to execute this work plan:

- **Program Manager:** Kurt Frantzen, Ph.D.
- **Project Manager:** Matthew Wawrowski, P.E.
- **Field Operations Manager:** Christopher Poole, P.G., CPG
- **Site Safety Officer:** To be decided

Project Subcontractors

VHB will provide all surveying services necessary to support this project. VHB will seek KeySpan's approval of all project subconsultants/subcontractors prior to implementation of the proposed work at the site. However, the following is a preliminary summary of the subconsultants/subcontractors VHB proposes to utilize to implement this work plan and their associated roles during the project:

- **Miller Environmental Group**—General Contracting Services and Drilling
- **Zebra Environmental Corporation**—Drilling and Geophysical Services
- **H2M LABS, Inc.**—Analytical Laboratory Services
- **Golder Associates, Inc.**—Geotechnical Laboratory Services
- **Environmental Quality Associates, Inc.**—Analytical Data Validation Services
- **Clean Water of New York, Inc.**—Remediation Waste Management and Disposal

Project Schedule

A detailed schedule for the ISCO remediation project proposed at the site is presented as Figure 3. All activities have been scheduled to start as soon as possible and logical ties reflect the general approach to developing a critical path for the timing and sequencing of the remediation program. The schedule includes the specific tasks/sub-tasks of this work plan and the anticipated time necessary to complete these tasks. NYSDEC review periods associated with the work plan submittal and pre-design field test report submittal have been built into the schedule.

Project Documentation

VHB will maintain all project documentation associated with the ISCO remedial program. Documentation will include, but not be limited to:

- Equipment inspection/calibration forms
- Health and Safety Reports
- Field change requests
- Site logbook and field reports
- Bills of lading and manifests
- Photo documentation of site activities
- Waste characterization analytical results
- Summary reports

6

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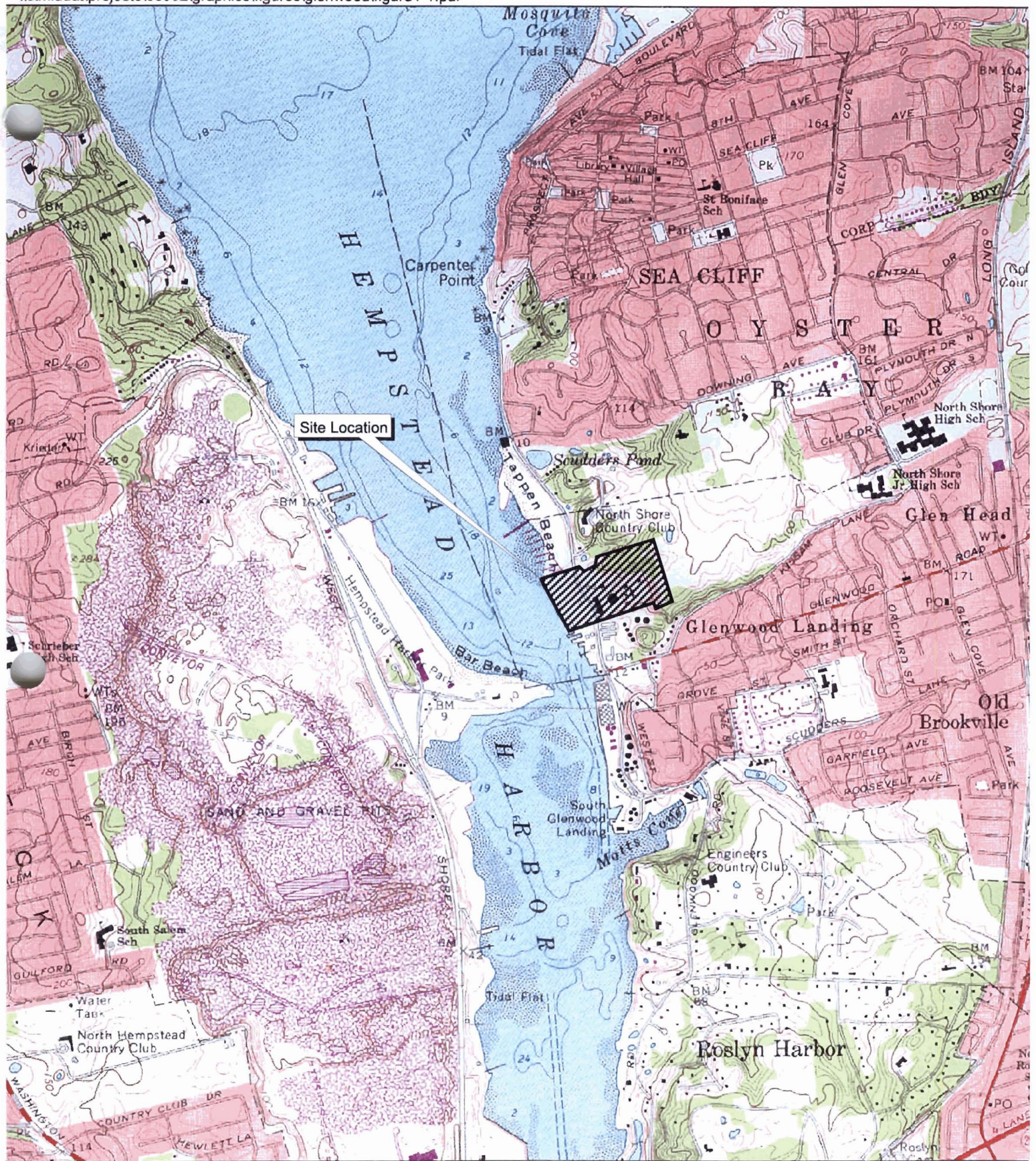
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Figures



BASE MAP SOURCE:

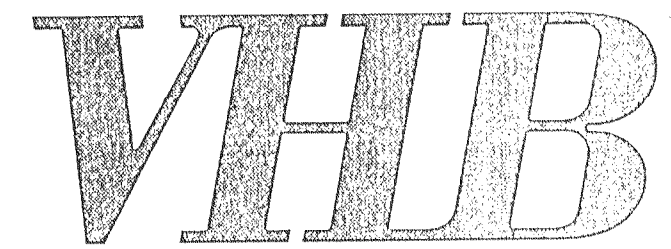
U.S. G.S. QUAD MAP
SEA CLIFF, N.Y. QUADRANGLE - 1979

Vanasse Hangen Brustlin, Inc.



Figure 1-1
Site Location Map
Glenwood Landing Gas Plant Site
Glenwood Landing, New York

0 0.25 0.5 0.75 1 Miles



Vanasse Hangen Brustlin, Inc.

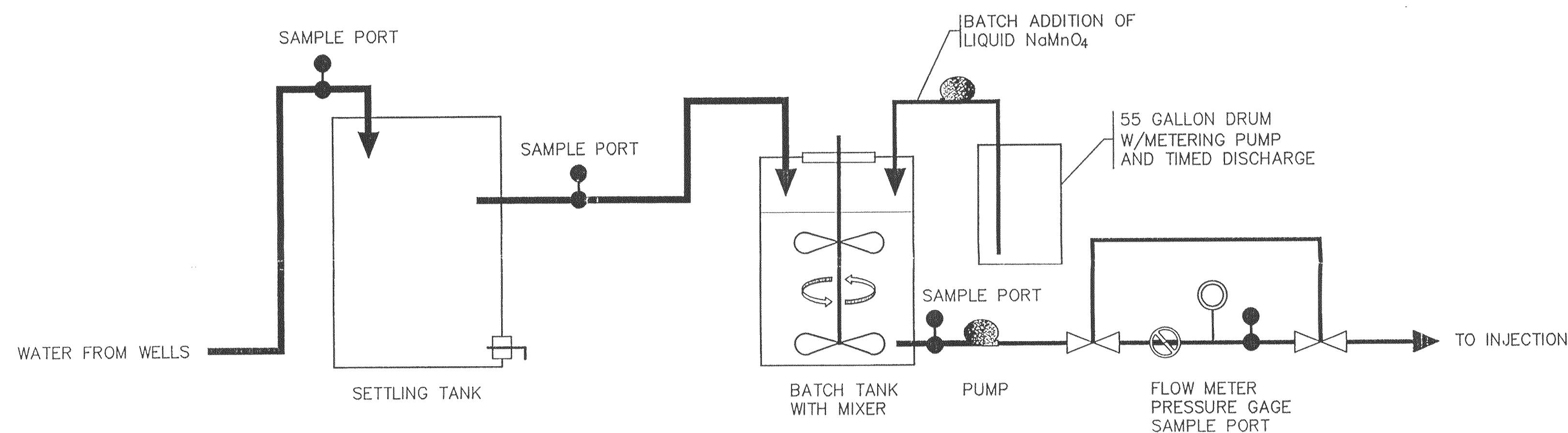
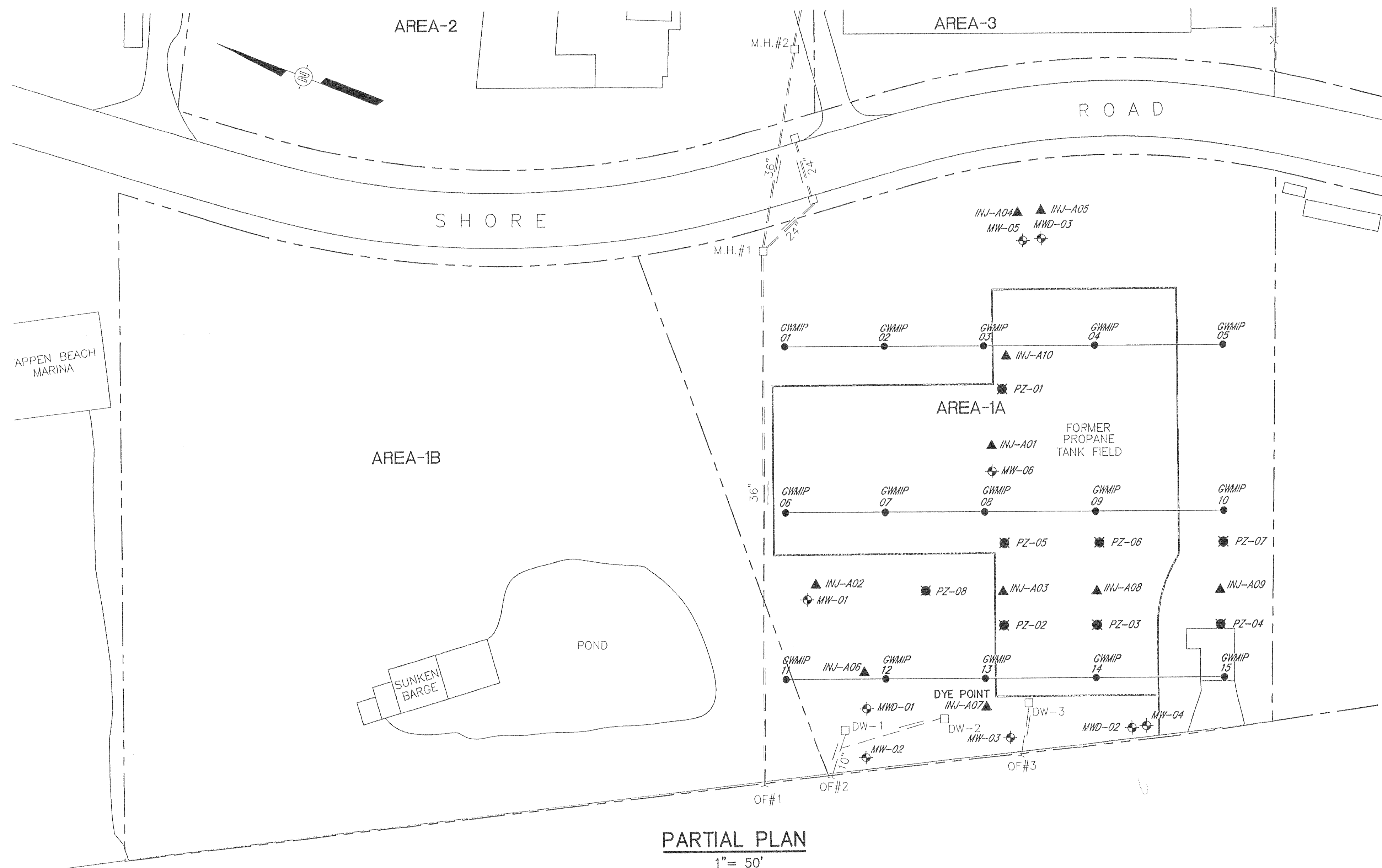
Transportation
Land Development
Environmental Services

54 Tuttle Place
Middletown, Connecticut 06457
860 632 1500 • FAX 860 632 7879

LEGEND

- M.H. MANHOLE
- DW DRYWELL
- O.F. OUTFALL
- EXISTING MONITORING WELL (MW-01 THROUGH MW-06 AND MWD-01 THROUGH MWD-03)
- GEOPROBE MIP/SC TEST POINTS (GWMIP-01 THROUGH GWMIP-15)
- PILOT TEST INJECTION POINTS (INJ-A01 THROUGH INJ-A10, INJ-B01 THROUGH INJ-B06)
- PROPOSED PIEZOMETER PZ-01 THROUGH PZ-08

PIEZOMETER SCHEDULE	
LOCATION	DEPTH
PZ-01	50'
PZ-02	30'
PZ-03	20'
PZ-04	40'
PZ-05	30'
PZ-06	30'
PZ-07	40'
PZ-08	30'



SCHEMATIC OF PILOT SCALE DELIVERY SYSTEM
N.T.S.

NOTES

- DYE INJECTION TESTING WILL BE PREFORMED AT INJECTION POINT INJ-A07.
- AREA 1A SLUG TESTING TO BE CONDUCTED ON ALL EXISTING MONITORING WELLS (MW-01 TO -06), AND (MWD-01 TO -03).
- AREA 1A TRIAL STUDY TO BE CONDUCTED ON MW-03, MW-05, MW-06, MWD-01 AND MWD-03.

MAP REFERENCE

- BASE MAP SOURCE: DRAWINGS AND AERIAL PHOTOGRAPHS BY LONG ISLAND LIGHTING COMPANY, AS MODIFIED BY IT CORPORATION.
- ALL ELEVATIONS ARE BASED ON A PLANT DATUM.

Glenwood Landing

Gas Plant Site

Glenwood Landing, New York

Issued for



Drawing Title

FIELD INVESTIGATION
SUMMARY AND
PILOT STUDY DETAILS

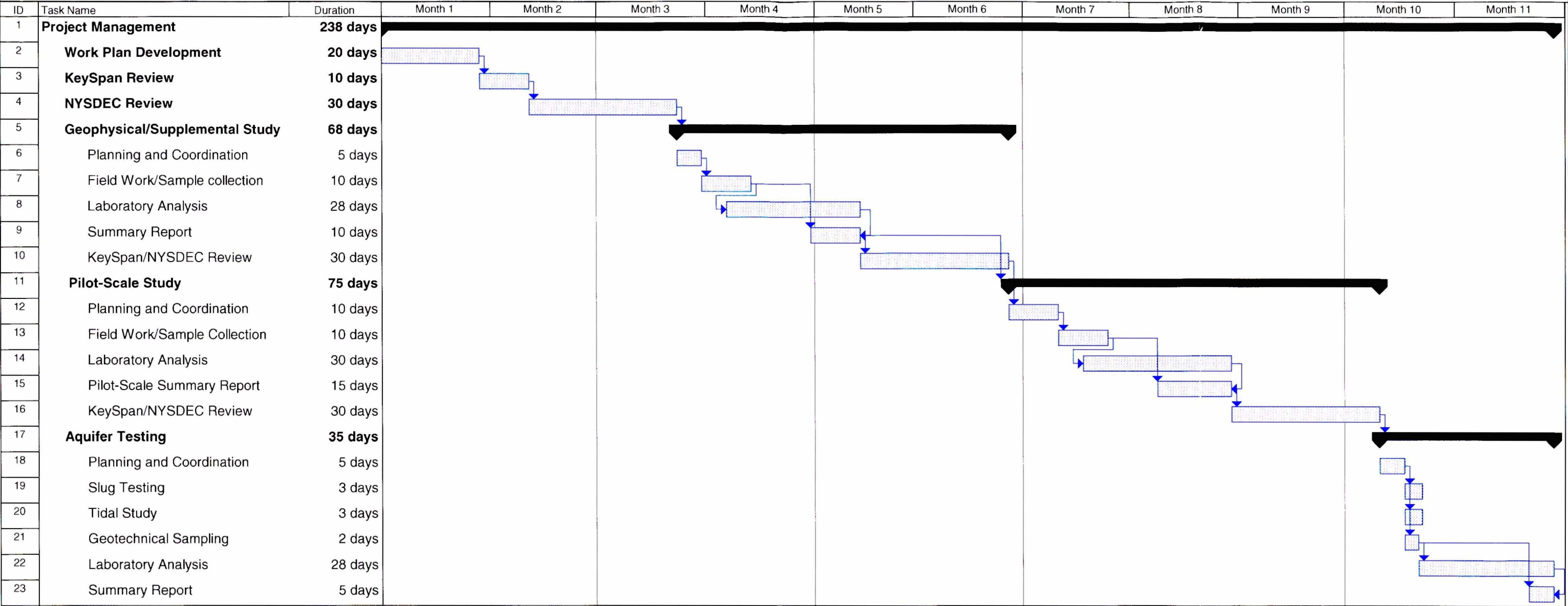
Drawing Number

2

Sheet of
1 1

Project Number
06392-26

Figure 3
ISCO Remediation Schedule



Project: Glenwood ISCO Schedule
Date: October 2002

Task

Progress

Milestone

Summary

Rolled Up Task

Rolled Up Milestone

Rolled Up Progress

Split

External Tasks

Project Summary

External Milestone

External Milestone

Tables

Table 1 - Area 1A Study Sample Matrix

Sample Location/Designation	Depth (feet)	Pre-Treatment		Treatment Parameters				Post-Treatment Analysis			QA/QC Samples	Sample Containers
		Number of samples for VOC Analysis	Minimum Pressure (PSI)	Volume of Oxidant (gal)	Estimated ROI* (feet)	Concentration of Oxidant (moles/mole)	Water Source	Number of samples	Properties	Chemical Analysis		
MW-01 - MW-06	n/a	6	n/a	n/a	n/a	n/a	n/a	6	Ph, Cond., Temp., Turb., DO, ORP	Water - VOCs (8260), Inorganics (filtered & unfiltered), COD, BOD	1	VOAs, Amber Liters
MWD-01 - MWD-03	n/a	3	n/a	n/a	n/a	n/a	n/a	3	"	"	1	"
INJ-A01	10	1	22.06	150	2.5	2.5	Clean	1	"	Water - VOCs (8260), Inorganics (filtered & unfiltered), COD, BOD Soil - TOC, Porosity, Grain Size	1	Shelby Tubes, 8oz. Soil Jars, VOAs, Amber Liters
INJ-A02	20	1	31.09	150	2.5	5	Recirc	1	"	Water - VOCs (8260), Inorganics (filtered & unfiltered), COD, BOD	n/a	VOAs, Amber Liters
INJ-A03 (PZ-02/05/08)	30	3	40.12	150	2.5	7.5	Clean	3	"	"	n/a	"
INJ-A04	40	1	49.14	150	2.5	10	Recirc	1	"	"	n/a	"
INJ-A05	50	1	58.17	150	2.5	12.5	Clean	1	"	"	n/a	"
INJ-A06	10	1	22.06	250	3	12.5	Recirc	1	"	Water - VOCs (8260), Inorganics (filtered & unfiltered), COD, BOD Soil - TOC, Porosity, Grain Size	1	Shelby Tubes, 8oz. Soil Jars, VOAs, Amber Liters
INJ-A07 (dye)	20	1	31.09	250	3	n/a	Clean	1	Colorimetric	n/a	n/a	n/a
INJ-A08 (PZ-03/06)	30	2	40.12	250	3	7.5	Recirc	2	Ph, Cond., Temp., Turb., DO, ORP	Water - VOCs (8260), Inorganics (filtered & unfiltered), COD, BOD Soil - TOC, Porosity, Grain Size	1	Shelby Tubes, 8oz. Soil Jars, VOAs, Amber Liters
INJ-A09 (PZ-04/07)	40	2	49.14	250	3	5	Clean	2	"	"	n/a	VOAs, Amber Liters
INJ-A10 (PZ-01)	50	1	58.17	250	3	2.5	Recirc	1	"	"	n/a	"

Notes:

- 1) INJ - Oxidant Test Injection Points
- 2) PSI - Pounds Per Square Inch
- 3) DO - Dissolved Oxygen
- 4) ORP - Oxidation-Reduction Potential
- 5) VOC - Volatile Organic Constituents
- 6) COD - Chemical Oxygen Demand
- 7) BOD - Biological Oxygen Demand
- 8) TOC - Total Organic Carbon
- * = ROI at injection

Exhibits

EXHIBIT 1

NYSDEC SMALL QUANTITY HAZARDOUS WASTE GENERATOR REQUIREMENTS

Regulatory Standard	Requirements
Hazardous Waste Determination	- TCLP testing will be used to verify if waste is hazardous. - Wastes will also be tested for PCB content.
EPA Identification Number	EPA ID No. needed if waste is hazardous.
Packaging	- Soils must be placed in USDOT Type 1A2 steel drums (open top) or roll-offs. - Liquid wastes are to be placed in USDOT Type 1A1 steel drums (closed top).
Labeling	<u>NYSDEC Hazardous waste labels</u> – must be affixed to each drum when the first quantity of soil is placed in the drum. Labels must contain the following information: ➤ <u>Wording</u>: “Hazardous Waste – Federal Law Prohibits Improper Disposal. If found, contact the nearest police or public safety authority or the USEPA.” must be on each label. ➤ <u>Generator’s Name</u>: KeySpan Energy c/o _____ ➤ <u>Address</u>: c/o _____ ➤ <u>Accumulation Start Date</u>: Date first quantity of waste is placed in drum. ➤ <u>EPA Waste Number</u>: To be Determined (TBD). ➤ <u>EPA ID Number</u>: TBD. ➤ <u>Manifest Document Number</u>: TBD, but must match unique manifest number. <u>USDOT Labels</u> – must be affixed to each drum containing a hazardous waste before the drum is shipped. USDOT labels are pre-printed designating the hazard class of the material. Most likely, if the soils are hazardous, the drums will require a Class 9 DOT label.
Placarding	Placards declaring the USDOT Hazard Class of the waste must be provided to the transporter of the waste by the shipper.
Manifesting	- Manifests from the state to which the waste is shipped are to be used. - If the state does not have its own manifests, then NYSDEC manifests will be used. - Manifests will be signed by KeySpan personnel.
Accumulation/On-site Storage Time	- Small Quantity Generator (SQG) – 180 days maximum or 270 days if TSDF is located more than 200 miles away (see below for additional requirements for SQGs). - If SQG maximum quantities are exceeded, the maximum on-site storage time is 90 days.
Small Quantity Generator Requirements	- Total quantity of waste accumulated on-site can never exceed 6,000 kilograms (12,200 lbs.). - At all times, there is at least one employee on the premises or on call. - Post the following information near telephone:

**EXHIBIT 1
NYSDEC SMALL QUANTITY HAZARDOUS WASTE GENERATOR REQUIREMENTS**

Regulatory Standard	Requirements
	➤ Name and telephone number of the emergency coordinator. ➤ Location of fire extinguishers and spill control material. ➤ Fire Department telephone number.
Container Requirements	• Storage containers must be in good condition and be made of materials which are compatible with the waste being stored; • Containers must be kept closed except to add or remove the oil, and they must be managed to prevent leaking; • Containers must be inspected every week looking for leaks or deterioration and results of the inspection must be documented in a weekly inspection log; • Containers must be marked with the date on which the accumulation period began (when waste is first placed in the container); • Each container is labeled or marked clearly with the words HAZARDOUS WASTE; • Containers destined for off-site shipment must be labeled and marked in accordance with USDOT hazardous materials requirements; and • Appropriate hazardous waste training is provided to project personnel, contingency plans are available to address any fire, spill or emergency and appropriate emergency response equipment is available.

EXHIBIT 2

NYSDEC SOLID WASTE GENERATOR REQUIREMENTS

Regulatory Standard	Requirements
Solid Waste Determination	Wastes which are not hazardous wastes are to be managed as solid waste.
EPA Identification Number	No EPA ID No. needed.
Packaging	- Soils are to be placed in USDOT Type 1A2 steel drums. - Liquid wastes are to be placed in USDOT Type 1A1 steel drums (closed top). - Solid wastes are to be placed in USDOT Type 1A2 steel drums (open top).
Labeling	<u>Non-hazardous waste labels</u> – may be affixed to each drum when the first quantity of soil is placed in the drum. Labels must contain the following information: ➤ <u>Wording</u>: “Non-Hazardous Waste” should appear in bold lettering on the label. ➤ <u>Shipper’s Name</u>: KeySpan Energy c/o _____ ➤ <u>Address</u>: _____ ➤ <u>Contents</u>: Description of contents. <u>USDOT Labels</u> – must be affixed to each drum containing a hazardous waste before the drum is shipped. USDOT labels are pre-printed designating the hazard class of the material. Most likely, if the wastes are non-hazardous, the drums will not require DOT labels (with the exception of soils with strong odors, which are to be managed as DOT Class 9 materials). This should be confirmed based on sample results prior to shipment.
Placarding	Placards declaring the USDOT Hazard Class of the waste must be provided to the transporter of the waste by the shipper.
Bill of Lading	A bill of lading detailing the name and addresses of the generator, transporter and disposal facility and the weight and description of the contents should be completed by the transporter prior to the off-site shipment of material.
Accumulation Time	- In New York State, there are no set accumulation times for solid wastes. - However, 180 days should be used as a guideline for the maximum accumulation/on-site storage period.

Appendix A

Site Specific Health & Safety Plan

Site-Specific Health and Safety Plan

Glenwood Landing Gas Plant Site

Glenwood Landing,
Nassau County,
New York

Prepared for: **KeySpan Corporation**
One MetroTech Center
Brooklyn, New York 11201-3850

Prepared by: ***VHB* /Vanasse Hangen Brustlin, Inc.**
Environmental Risk Management
54 Tuttle Place
Middletown, Connecticut 06457

October 2002

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B	Personnel Training Certificates
C	NIOSH Chemical Properties and Hazards
D	Material Safety Data Sheets
E	Health and Safety Form Templates

Introduction

Policy Statement

This Health and Safety Plan (HASP) establishes the minimum procedures and requirements to ensure the health and safety of all site workers participating in the proposed fieldwork activities at the former KeySpan Corporation (KeySpan) Glenwood Landing Gas Plant site (the site). This HASP takes into account site-specific hazards and establishes the procedures to be followed by all on-site personnel covered under this HASP in order to avoid and protect against site-related hazards during Vanasse Hangen Brustlin, Inc.'s (VHB's) on-site activities. This HASP has been prepared consistent with the requirements of the Occupational Safety and Health Administration (OSHA), in particular 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER). The HASP is also consistent with the provisions of the VHB's Corporate Health and Safety Program. The minimum guidelines established herein are also consistent with KeySpan's internal health and safety guidelines.

All personnel conducting fieldwork activities at the site during the implementation of this work plan have a responsibility to work safely. Prior to the 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. It will include site and facility layout, hazards and emergency services at the site and will highlight all provisions contained within the HASP. Attendees will print, sign and date the Field Team Review and Acceptance Form as documentation that they have knowledge and understanding of the HASP. This form will be maintained on site by VHB for the project record.

Further, each person has a responsibility to understand how to safely perform each assigned task; to identify potential problems and help to fix them; and to stop work if they believe that an imminent danger exists. VHB will review the requirements of this HASP with all authorized field personnel and/or site visitors, and ensure that they have the required training to perform site-related tasks and/or access the site. All work conducted by personnel other than VHB that includes site activities not covered under this HASP must be included in a supplemental HASP. In the case of VHB's subconsultants and/or subcontractors, the supplemental HASPs will be submitted to VHB for review prior to implementation.

Applicability

VHB does not guarantee the health or safety of any person entering this site. In accordance with the OSH Act, Section 5(a)(1), "each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees." Due to the nature of this site and the activities occurring thereon, it is not possible to discover, evaluate and provide protection for all possible hazards that may be encountered. Strict adherence to the health and safety guidelines integrated herein during the course of the fieldwork activities will reduce, but not eliminate, the potential for injury. The health and safety guidelines in this HASP were prepared specifically for this site and should not be used on any other project.

This HASP applies to all personnel participating in the proposed fieldwork activities at the site as discussed herein. In particular, this HASP extends guidelines for the following parties:

- All VHB personnel, subconsultants and subcontractors;
- All KeySpan representatives; and
- All Federal, State and/or Local government representatives.

Training

Prior to commencing site activities, all field team members will be required to provide evidence that they have received the training, as applicable, indicated below:

-
- ✓ 40-hour OSHA HAZWOPER Training (29 CFR 1910.120)¹
 - ✓ Annual 8-hour OSHA Refresher Training (29 CFR 1910.120)
 - ✓ OSHA 8-hour Supervisor's Training²
 - ✓ OSHA Hazard Communication (29 CFR 1910.1200)
 - ✓ First Aid and CPR³
 - ✓ Other: Site-Specific/On-Site Training
-

Note:

1 Initial training also includes 3 days of actual field experience under the direct supervision of a trained, experienced supervisor.

2 Supervisory personnel shall have received appropriate instruction in addition to the initial 40-hours.

3 It is expected that there will be at least one person on-site at all times with appropriate emergency medical training.

In addition, all personnel will have an opportunity to read and understand the project work plan including all applicable components (e.g., sampling and analysis plan, quality assurance project plan, etc.). Source hyperlinks to OSHA Standards referenced in the above table as well as other pertinent references are provided below:

- OSH Act—Occupation Safety & Health Act of 1970:
http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=OSHA CT&p_id=2743&p_text_version=FALSE
- OSHA 1910—Occupational Safety & Health Standards:
http://www.osha.gov/pls/oshaweb/owastand.display_standard_group?p_toc_level=1&p_part_number=1910&p_text_version=FALSE
- OSHA 1910.120—Hazardous Waste Site Operations & Emergency Response:
http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDSD&p_id=9765&p_text_version=FALSE
- OSHA 1910.1200—Hazard Communication:
http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDSD&p_id=10099&p_text_version=FALSE
- OSHA 1926—Safety & Health Regulations for Construction:
http://www.osha.gov/pls/oshaweb/owastand.display_standard_group?p_toc_level=1&p_part_number=1926&p_text_version=FALSE

Medical Surveillance

All VHB employees whose work is subject to the HAZWOPER regulations must be included in a medical surveillance program. The medical surveillance program of VHB includes the following components:

- Medical examination prior to assignment;
- Periodic medical examinations, at least once every 12 months;
- Immediate medical examinations if personnel develop any signs or symptoms of overexposure to hazardous conditions; and
- Termination or exit examinations as appropriate.

All subcontractor and/or subconsultant personnel performing fieldwork where potential exposure to contaminants exists at the site are required to have passed a complete medical surveillance examination following, at a minimum, the frequency and requirements presented above. VHB will require provision of and maintain a *physician's medical release for work* before any personnel can work in the exclusion zone. In addition, a medical data sheet (see Attachment E) should be completed by all field personnel and will be maintained at the site. The medical data sheet will be maintained in a secure location, treated as confidential, and used on a need-to-know basis (*e.g.*, during a medical emergency).

Respiratory Protection

It is the goal of VHB to minimize employee's exposures to hazardous chemicals/ compounds, dusts, radionuclides and organic vapors while performing work in the field, laboratory or other setting. This is accomplished in various ways, which include good work practices, administrative controls, engineering controls and field monitoring. Where effective engineering controls are not feasible, VHB will provide appropriate respiratory protection to its employees, when necessary, to protect the health of the employee. Prior to issuance of respirators, each employee must be medically monitored by a physician to insure there are no physical restrictions for the employee to wear the respirator. This respirator program has been developed and maintained in accordance with the OSHA **29 CFR 1910.134**, General Industry Standard on Respiratory Protection. Written standard operating procedures governing the selection and use of respirators have been developed and are described in detail in VHB's Corporate Respiratory Protection Program. This program also includes qualitative fit testing program prior to employee use of respirator.

Project Organization & Responsibilities

Project Organization

The following provides a summary of the project organization including personnel responsibilities and related contact information:

Contact	Name	Phone Number
KeySpan Project Manager:	Pat Van Rossem	1-516-545-2578 (Office) 1-917-572-4075 (Cell)
KeySpan Field Coordinator:	Andrew Prophete	1-718-403-1048 (Office) 1-516-790-1654 (Cell)
VHB Project Manager (PM):	Matt Wawrowski	1-716-655-2734 (Office) 1-716-830-5245 (Cell)
VHB Field Operations Manager (FOM):	Chris Poole	1-860-632-1500 (Office) 1-203-376-9697 (Cell)
VHB Site Safety Officer (SSO):	Scott Shorette	1-860-632-1500 (Office) 1-860-306-4324 (Cell)
VHB Regional Health & Safety Coordinator (RHSC):	Debbie Wojcicki	1-860-632-1500 (Office)
NYSDEC Regulatory Contact:	Gary Kline	1-518-402-9655
Subcontractors:	TBD	--
Other:		

Project Responsibilities

The following subsections further describe the responsibilities of the VHB personnel indicated in the above summary.

Regional Health & Safety Coordinator (RHSC)

The RHSC is an appropriately trained and certified VHB employee experienced in hazardous waste site investigation and remediation. The RHSC responsibilities include the following:

- Provides for proper development and approval of the HASP;
- Serves as the primary contact to review health and safety matters;
- Reviews and approves revised or new safety protocols for field operations including upgrading and/or downgrading personal protective equipment (PPE);
- Approves individuals who are assigned SSO responsibilities in addition to other assigned project capacities;
- Coordinates revisions of this HASP with field personnel; and
- Assists in the investigation of major incidents.

VHB Project Manager (PM)

The VHB PM's responsibilities include the following:

- Ensures implementation of this program through coordination with the responsible RHSC;
- Conducts periodic site inspections;
- Participates in major incident investigations;
- Ensures the HASP has all required approvals before any site work is conducted;
- Ensures that the RHSC or FOM is informed of project changes which require modifications of the site safety-plan; and
- Has overall project responsibility for Project Health and Safety.

Field Operations Manager (FOM)

The FOM's responsibilities include the following:

- Ensures that the HASP is implemented in conjunction with the RHSC and SSO;
- Coordinate with the RHSC and SSO regarding any changes to the HASP and upgrade/downgrade of PPE levels;
- Ensures that field work is scheduled with adequate personnel and equipment resources to complete the job safely;
- Ensures that adequate communication between field crews and emergency response personnel is maintained;
- Ensures that personnel are adequately trained and qualified to work at the site;

- Enforces site health and safety rules;
- Investigates major incidents;
- Assists in conducting daily safety briefings, as applicable;
- Conducts periodic site inspections; and
- Acts as Emergency Coordinator.

Site Safety Officer (SSO)

The SSO is a VHB employee who is knowledgeable and experienced with the appropriate safety and health regulations with at least one year of experience on hazardous waste investigation and remediation sites. The SSO's responsibilities include the following:

- Works as a member of the project team to ensure implementation of the HASP;
- Ensures health and safety activities identified in the HASP are implemented;
- Identifies operational changes which require modifications to health and safety procedures, and ensures that the procedure modifications are implemented and documented through changes to the HASP, with RHSC approval;
- Directs and coordinates health and safety monitoring activities;
- Ensures that proper PPE is utilized by field teams;
- Assists in conducting and documenting daily safety briefings, as applicable;
- Monitors compliance with this HASP;
- Notifies FOM of all health and safety incidents;
- Coordinates with FOM and PM in any health and safety incident investigation;
- Assists in the maintenance of Incident Report Forms;
- Determines upgrades or downgrades of PPE based on site conditions and/or real-time monitoring results;
- Ensures that monitoring instruments are calibrated; and
- Reports to the RHSC to provide summaries of field operations and progress.

In addition to the above, all project subconsultants and/or subcontractors will designate a SSO who will be responsible for coordinating with, at a minimum, the FOM and SSO regarding health and safety matters, and enforcing the health and safety rules and compliance of their personnel with this HASP and their own HASP.

3

Site & Project Description

The following subsections provide details regarding the site, site history and a general description regarding the project scope of work.

General Site & Project Information

Site Name: Glenwood Landing Gas Plant Site
Location: 400 Shore Road, Glenwood Landing,
Nassau County, New York

VHB Project No: 06392.00 (00031)
Today's Date: October 2002
Date of Field Activities: 2002-2003

Site Description

The site is located on approximately 800-feet of waterfront on the east shore of Hempstead Harbor, and extends east across Shore Road. The site is bounded on the south by a Mobil Oil/Storage Terminal, to the west by Hempstead Harbor, and on the north and east by the North Shore Country Club.

The site was initially developed as a modern liquid petroleum (LP) gas cracking plant in 1949. Subsequent development included a natural gas regulating station (compressor station), laboratory, and propane storage field. These facilities have since been decommissioned and/or demolished to make way for the redevelopment of the property as a 79-megawatt power generation facility.

The site was divided into three discrete areas for this project: Areas-1, -2, and -3. Area-1 includes the entire site west of Shore Road and has been subdivided into Area-1A and Area-1B. Area-1A contained a former propane tank farm. Area-1B is a greenspace and tidal wetland. Area-2 is east of Shore Road and north of the site access road where the laboratory, electrical substation, and storage buildings are located. Area-3 is east of Shore Road and south of the site access road where the compressor building was formerly located.

Project Description

KeySpan entered into a Voluntary Cleanup Agreement (VCA) with the New York State Department of Environmental Conservation (NYSDEC) to guide investigation and subsequent remediation activities at the Site. Specifically, soil remediation has occurred in Areas-2 and -3 and a soil cap was installed in Area-1B.

Groundwater remediation in the western portion of the site (Areas-1A and -1B) is also a component of the VCA. Previous subsurface investigations in this portion of the site have identified chlorinated volatile organic constituents (CVOCs), arsenic and lead in groundwater at concentrations exceeding state criteria. VHB has developed a work plan that outlines a remedial alternative, In-Situ Chemical Oxidation (ISCO), designed to specifically reduce concentrations of CVOCs in groundwater in this area of the site. This HASP has been developed to support and identify proper health and safety guidelines and procedures that will be employed during execution of the work plan.

Project Tasks

Major fieldwork divisions and subtasks to be performed during the execution of the groundwater remediation work plan at the site are summarized as follows:

Mobilization/Demobilization:

1. Equipment & Supplies Mobilization/Demobilization
2. Site Inspection/Review

Supplementary Field Investigation:

1. Geophysical Investigation
2. Subsurface Soil Borings & Sampling (Geotechnical & Environmental)
3. Monitoring Well Drilling, Installation & Development
4. Monitoring Well Water Level Gauging & Sampling
5. Groundwater Probe Installation & Sampling
6. Aquifer Testing (Slug Testing & Tidal Study)
7. Land Surveying
8. Decontamination

Pilot Scale ISCO Study:

1. Monitoring Well Water Level Gauging & Sampling
2. Groundwater Probe Installation & Sampling
3. Chemical (Oxidant) Handling, Mixing & Storage
4. Injection Probe Installation
5. In-Situ Chemical & Water Injection

6. Decontamination

Full Scale ISCO Implementation:

1. Monitoring Well Water Level Gauging & Sampling
2. Groundwater Probe Installation & Sampling
3. Chemical (Oxidant) Handling, Mixing & Storage
4. Injection Probe Installation
5. In-Situ Chemical & Water Injection
6. Decontamination

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Site Hazard Overview

This section presents an assessment of the physical and chemical hazards that may be encountered during the implementation of the project tasks, as specified above, associated with the proposed groundwater remediation work plan. The following table summarizes potential site hazards that have been identified based on the completion of various environmental investigation programs and other work at the site.

Potential Site Hazards:

Waste Type(s)		Waste Characteristics		Type/Form of Hazard	
Petroleum		Toxic	✓	Dust	✓
Liquid	✓	Corrosive	✓	Liquid	✓
Sludge	✓	Ignitable		Gas	
Soil	✓	Volatile	✓	Vapors	✓
Unknown	✓	Radioactive		Contact	✓
Other		Reactive	✓	IDLH	
		Unknown		Other	

Note:
IDLH – Immediately Dangerous to Life and Health

Activity Hazard Analysis

The Activity Hazard Analysis (AHA) is a systematic way of identifying the potential health and safety hazards associated with major phases of work on the project and the methods to avoid, control and mitigate those hazards. AHAs have been developed, as necessary, for all fieldwork activities associated with this project. The AHAs will be used to train all field personnel in proper project safety procedures. The AHAs have been developed for the site consistent with the Project Tasks section presented above, and are included as Attachment A to this HASP. Subconsultant's and subcontractor's AHAs not included in this HASP will be included in each separate subconsultant's and subcontractor's site-specific HASP.

Physical Hazard Assessment

Physical hazards that may exist at the site are summarized as follows:

Physical Hazards of Concern (check as many as apply):	
✓ Biological	✓ Heat Stress
✓ Cold Stress	Heights (Scaffolding, Ladders)
Compressed Gas Cylinders	✓ Noise
Confined Space	Radiological
✓ Corrosives	Ultraviolet Radiation
✓ Drums and Containers	✓ Utility Lines
✓ Electrical	✓ Weather Extremes
✓ Flammable/Explosive	✓ Other: Steam/Heat/Splashing
✓ General Construction/Overhead Obstructions	✓ Working Near Water

The dangers that may be attributed to these hazards are discussed below.

Biological

Potential hazards include poison ivy, deer tick bites, stinging insects, etc. Identify site-specific hazards and establish procedures to avoid identified hazards. Carry barrier creams and poison oak and ivy cleaners. Any team members allergic to bee stings will notify all team members of their condition. Prescription medication must be carried. Current (5 to 10 years) tetanus shots for all personnel will be required.

Cold Stress

Cold injury (frostbite and hypothermia) and impaired ability to work are dangers at low temperatures and when the wind-chill factor is low. To guard against them: wear appropriate clothing; have warm shelter readily available; provide warm non-caffeinated beverages, carefully schedule work and rest periods, and monitor workers' physical conditions.

Corrosives

Corrosive acids are present as preservatives in water sampling vials. Care to prevent skin contact should be taken when sampling with these corrosive materials; appropriate personal protective equipment shall be donned prior to sampling.

Drums and Containers

Ensure compliance with 29 CFR 1910.120(j). Consider unlabeled drums to contain hazardous substances. Move drums only as necessary; use caution and warn nearby personnel of potential hazards. VHB will not move shock-sensitive (crystallized

solids), leaking, or damaged drums. Properly distinguish empty drums by laying them on their sides in a designated, secured area.

Electrical

Ensure compliance with **29 CFR 1910 Subparts J and S**. Locate and mark energized lines. If necessary, a licensed electrician will be contracted to de-energize lines. All electrical equipment will be equipped with ground fault circuit interrupters (GFCI). Evaluate areas of standing water with respect to nearby electrical sources or equipment.

Flammable/Explosive

Potential flammable/explosive hazards present at the Site are limited to ISCO chemicals (refer to "ISCO Chemical Considerations" section below for further discussion). Ensure compliance with **29 CFR 1910 Subpart H**. Inform personnel of potential hazards. Establish site-specific procedures for working around flammables. Ensure that appropriate fire suppression equipment and systems are available and in good working order and employees are trained in the use of fire suppression equipment. Define requirements for intrinsically safe equipment.

General Construction/Overhead Obstructions

The greatest potential hazard at most sites is related to the operation of heavy equipment, especially in the case of malfunction, misuse or improper operation. Only qualified personnel should operate heavy equipment. Personnel not directly involved with equipment operation should stand a safe distance away from the machinery. All personnel should wear hard-hats and safety boots (steel toes and shanks) when working near heavy equipment and any time there is a potential hazard from overhead or falling objects. During excavation and trenching, ensure compliance with **29 CFR 1926 Subpart P**.

Heat Stress

Heat related illness (heat cramps, heat exhaustion, and heat stroke) and impaired ability to work are possible at temperatures greater than 60 degrees Fahrenheit with high humidity. To guard against them: wear appropriate clothing; provide shade from direct sunlight, have an ample supply of stress beverages and water available, carefully schedule work and rest periods, and monitor workers' physical conditions.

Noise

Ensure compliance with **29 CFR 1910.85**. Elevated noise levels may be encountered during heavy equipment use. Persons working in close proximity to construction equipment shall wear sufficient hearing protection. This equipment may include

foam ear plugs or foam ear muffs. Hand signals must be used for communication in these situations. Prior to donning protective hearing equipment, all team members will establish and practice hand signals. Establish noise level standards, inform personnel of hearing protection requirements, and define site-specific requirements for noise monitoring as appropriate.

Utility Lines

Identify and locate all existing utilities prior to work. Ensure that electrical utility lines are at least 25 feet away from project activities. Always look for overhead utilities when climbing ladders, etc. or when raising drill rig masts, crane booms, etc. The appropriate "One-Call Network" indicated below should be contacted a minimum of four days prior to the implementation of intrusive activities at the site:

- New York City and Long Island: 1-800-272-4480

Weather Extremes

Establish site-specific contingency plans for severe weather. In the event of immediate danger, air-horns or whistles will be used to indicate evacuation to a designated safe shelter. Weatherize equipment as appropriate (water-proof, freeze prevention, etc.). Cease work and relocate to a safe indoor location or vehicle during electrical storms.

Steam/Heat/Splashing

Exposure to steam/heat/splashing hazards can occur during steam cleaning activities. Exposure can result in scalding/burns, eye injury, and puncture wounds. Appropriate PPE (including water-proof rain suit or similar, rubber or outer nitrile gloves and hard hat with face shield) in addition to standard level D protection will be worn as necessary.

Working Near Water

The site is located to the west of Hempstead Harbor. The potential of someone falling into the harbor waters poses a significant risk. Workers and visitors will not be allowed to enter the bulkhead area without proper authorization. If for any reason workers are required to work near the bulkhead area (i.e. to collect tidal gauge data) personnel will be required to wear appropriate floatation vests and/or safety harnesses and employ the buddy system for the duration of the task.

High Loss Potential Hazards

Activities to be conducted at the site will involve operations that have the potential for a serious injury to occur. These activities include:

Drilling

When conducting drilling activities, there is the potential for encountering fire and explosion hazards from underground utilities and gases. The locations of underground utilities will be verified prior to performing any intrusive activities. Additionally, because of the inherently hazardous nature of drilling operations, safety and accident prevention are crucial when drilling operations are performed. Therefore, at a minimum, the following procedures will be implemented to reduce the risk of injury:

- The SSO shall conduct a documented initial safety assessment of the drill rig in accordance with the subcontractors HASP for drill rig operations.
- Drill rig operators will be responsible for operating their assigned pieces of equipment in a safe manner.
- Daily pre-operation inspection and walk around inspection will be conducted by the operators. Any pieces of the equipment deemed unsafe to operate will not be used. The FOM will be apprised of the unsatisfactory condition of the equipment as soon as possible and the equipment will be placed out-of-service and tagged to identify its safety failing until the equipment can be repaired, or decontaminated and demobilized from the site.
- Maintain a minimum of 25 ft clearance from all overhead electric lines.
- All unattended boreholes must be adequately covered or otherwise protected to prevent drill rig personnel, site visitors or animals from stepping or falling into the hole. All open boreholes shall be covered, protected or backfilled adequately and according to local or state regulations on completion of the drilling project.
- Terminate drilling operations during an electrical storm and move the entire crew away from the drill rig.

Heavy Equipment Operation

If heavy equipment is utilized, it will be operated under the following conditions:

- Operation of heavy equipment will be limited to the authorized personnel specifically trained in its operation.
- The operator will use the safety devices provided with the equipment, including seat belts. Backup warning alarms and horns will be operable at all times.
- While in operation, all personnel not directly required in the area will keep a safe distance from the equipment.
- Areas blinded from the operators vision will be avoided. Spotters will be used when personnel may be in areas where the operator's view is obstructed.

- Additional riders will not be allowed on equipment unless it is specifically designed for that purpose.

Chemical Hazard Assessment

Toxic chemicals potentially present at the site are summarized below. Also presented are the associated symptoms of acute exposure to such contaminants. Since additional unsuspected hazards may exist at a site, periodic air quality monitoring and evaluation of site conditions will be performed during all on-site activities.

Site-Specific Chemicals of Potential Concern:

Chemicals of Potential Concern	Potential Hazards	OSHA PEL	NIOSH REL
Volatile Organics	Toxic by ingestion, inhalation, skin absorption, and eye contact. Irritant to eyes, nose. Headache, dilated pupils, tearing, confusion, dizziness, and nervousness may occur	1,2-Dichloroethene: 200 ppm Tetrachloroethene: 100 ppm Trichloroethene: 100 ppm Vinyl Chloride: 1 ppm	1,2-Dichloroethene: 200 ppm Tetrachloroethene: LFC Trichloroethene: 25 ppm Vinyl Chloride: NA
Inorganics	Toxic by ingestion, inhalation, skin absorption, and eye contact. Irritant to nose, eyes, throat. Dermatitis, gastrointestinal disturbances, respiratory irritation may occur.	Arsenic: 0.01 mg/m ³ Lead: 0.05 mg/m ³	Arsenic: 0.002 mg/m ³ Lead: <0.1 mg/m ³
Particulates	Irritant to nose, eyes, throat. May cause coughing, wheezing and/or choking.	10 mg/m ³ (ACGIH TLV)	NA

Note:

LFC – Lowest Feasible Concentration

NA – Not Applicable

Symptoms of Chemical Exposure

On-site workers should be aware of the specific symptoms of acute chemical exposure listed above. In general, workers should also be aware of some indications of toxic effects of chemical exposure which are described below:

Exposure indicators observable by others:

- Changes in complexion, skin discoloration;
- Increased rate of respiration, gasping;
- Lack of coordination;
- Changes in demeanor;
- Excessive salivation, papillary response; and
- Changes in speech pattern

Exposure indicators not observable by others:

- Headaches;
- Dizziness;
- Blurred vision;
- Cramps;
- Weakness;
- Nausea; and
- Irritation of eyes, skin, or respiratory tract

Volatile Organic Compounds

VOCs may be encountered during the site investigations. Total VOCs will be routinely monitored in ambient air with a photoionization detector within various work zones at the site. If action levels are exceeded (see below), an increase in personal protective equipment shall be performed and/or engineering controls to mitigate the release of VOCs shall be implemented.

Inorganic Compounds

Arsenic, lead and particulates may be encountered during the fieldwork. These analytes will be continually monitored via instrumentation in the work zone areas (see below). If action levels (see below) are exceeded in ambient air, an increase in personal protective equipment or cessation of work activities may be warranted.

ISCO Chemical Hazards & Handling Considerations

Particular care and attention is required during the handling of oxidants to prevent serious health and safety incidents such as explosions and/or fires. Given the proposed injection application, health and safety risks will be substantially reduced following delivery of the oxidant to the subsurface since the ground surface will not be disturbed. However, adequate engineering controls and/or contingencies will need to be integrated into the process to prevent direct exposure should oxidant surfacing during application become an issue.

Physical Characteristics & Compatibility:

The oxidant selected for use during the implementation of the groundwater remediation work plan is liquid (40 Wt.%) sodium permanganate (NaMnO_4). Its physical appearance is a dark purple liquid with a metallic luster and it is odorless. NaMnO_4 is compatible with many metals (e.g., stainless steel) and synthetic materials (e.g., Teflon, polypropylene and high-density polyethylene [HDPE]). Natural rubbers and fibers are often incompatible. Solution pH and temperature are also important factors.

As an oxidant, NaMnO_4 itself is non-combustible, but will accelerate the burning of combustible materials. Therefore, contact with all combustible materials and/or chemicals must be avoided. These include, but are not limited to: wood, cloth, organic chemicals, and charcoal. Avoid contact with acids, peroxides, sulfites, oxalates, and all other oxidizable inorganic chemicals. An example of NaMnO_4 chemical incompatibility: contact with hydrochloric acid liberates chlorine gas.

Handling, PPE & Storage:

Protective equipment used during the handling of NaMnO_4 should include face shields and/or goggles, synthetic rubber or plastic gloves, synthetic rubber or plastic apron. If clothing becomes spotted with the oxidant, wash off immediately since spontaneous ignition can occur with cloth or paper. In cases where significant exposure potential exists, the use of an appropriate dust or mist air-purifying respirator or air supplied respirator will be required. Consultation and approval of the SSO and/or RHSC will be required in this situation.

NaMnO_4 should be stored in a cool, dry area in closed containers. For the purposes of this project, it is proposed that the oxidant will be stored in closed containers in a fully enclosed, secured and vented overseas freight container or trailer. The drums will *not* be stored on wooden pallets or decks. Any spillage will be collected and disposed of properly. Contain and dilute spillage to approximately 6% with water and reduce with sodium thiosulfate, a bisulfite, or ferrous salt. The bisulfite or ferrous salt may require dilute sulfuric acid to promote reduction. Neutralize any acid used with sodium bicarbonate.

Chemical Properties and MSDS

Chemical properties and hazards for site-specific chemicals of potential concern as discussed above and defined by the National Institute for Occupational Safety and Health (NIOSH) are provided in Attachment C. In addition, Material Safety Data Sheets (MSDSs) for common substances and chemicals that may be utilized during the fieldwork, as well as NaMnO_4 , are provided in Attachment D.

Site Control & Monitoring

Site Control Zones

A VHB employee will be designated to coordinate access control to the work zone. No unauthorized personnel should enter the work zone without appropriate 40-hour OSHA site worker safety training. Control boundaries will be established as follows:

- **Exclusion Zone**—A minimum 10-foot radius around the sampling point will be treated as the Exclusion Zone.
- **Contaminant Reduction Zone (CRZ)**—A 5-10 foot perimeter around the Exclusion Zone will be treated as the CRZ.
- **Support Zone**—The remainder of the site outside of the CRZ will be considered the Support Zone.

Monitoring Procedures

Based on the potential chemical hazards present at the site, the following real-time monitoring equipment will be used.

Monitoring/Surveillance Equipment:

Contaminant/Analyte	Instrument	Work Area Action Level (above background)
✓ Organic Vapors (measured & reported as TVOC concentrations)	Photoionization Detector (Photovac 2020, or equivalent)	0 - 5 ppm TVOC sustained: Level D >5 ppm TVOC sustained: cease work and consult with RHSC and SSO
✓ Vinyl Chloride (VC) Vapors	Sensidyne or Drager Hand Pump using VC detector tubes	>1 ppm VC detected with tube: cease work and consult with RHSC and SSO
✓ Aerosol/Dust	Personal Aerosol Meter (MIE PDM-3 Miniram, or equivalent)	>10 mg/m ³ : institute engineering controls to reduce dust

VHB will perform real-time air monitoring within the work zone during the performance of all intrusive work activities. Monitoring level results will be documented and used to determine what type of site control and/or respiratory protection measures will be necessary, if any. All field meters used for the monitoring program will be calibrated at least daily following manufacturers

suggested procedures. Calibration checks may be used during the field operations to confirm instrument accuracy.

Community Air Monitoring Plan and Action Levels

Real-time air monitoring for organic vapors and aerosols/dust will be performed at the perimeter of the work area during all intrusive activities on a periodic basis. Downwind air monitoring frequency will be based upon the levels obtained in the work area and the judgment of the SSO. The following action levels will apply:

Analyte	Action Level	Response
Organic Vapors	☛ any detection in ambient air	☛ Modify work practices to minimize volatilization of contaminants
	☛ >1 ppm sustained reading in ambient air	☛ Stop work until controls are identified that will reduce volatilization of contaminants. Do not restart work unless authorized by the PM, FOM, and/or the SSO.
Aerosol/Dust	☛ Downwind reading 5 mg/m ³ greater than upwind reading	☛ Implement dust suppression (water) controls.

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Personal Protection & Decontamination

Personal Protective Equipment

The initial level of personal protective equipment (PPE) will be Level D unless otherwise indicated on the HASP Addendum. Changes to levels of protection will be based on the action levels described above. All changes in the level of protection shall be approved by the SSO.

Level D PPE will include:

- Gloves (work gloves for general activities, latex or neoprene gloves for sampling, decontamination, etc.);
- Long sleeve shirt and long pants;
- Boots/shoes, leather or chemical-resistant, steel toe and shank;
- Safety glasses or chemical splash goggles (required in both Exclusion Zone and CRZ);
- Hard hat;
- Hearing protection;
- Optional: Tyvek coveralls for dusty/dirty conditions, Saranex coveralls for splash protection.

Level C PPE will include:

- Tyvek coveralls (Saranex if splash protection is required);
- Air purifying respirator (full-faced mask) with dust and organic vapor cartridge;
- Hard hat;
- Boots/shoes, steel toe and shank;
- Chemical-resistant outer boots;
- Inner and outer gloves;
- Hearing protection.

Level B PPE will include:

Consult with RHSC for specific PPE requirements.

Decontamination Procedures

Decontamination procedures to be implemented during the fieldwork activities are:

Sampling Equipment Decontamination:

Dedicated sampling equipment will be used to the maximum extent possible to eliminate the need for equipment decontamination. However, all non-expendable equipment will be cleaned according to Standard Operating Protocols. This protocol includes:

- Rinse with potable water;
- Wash with laboratory-grade detergent (Alconox) and water;
- Rinse with potable water;
- Rinse with a 1:10 solution of HNO_3 ;
- Rinse with potable water;
- Rinse with methanol;
- Triple rinse with laboratory deionized water (distilled water may be substituted where deionized water is not available); and
- Allow to air dry.

Personnel Decontamination:

The decontamination procedure for Level D requires the disposal of gloves, boot covers, coveralls (if used) in polyethylene-lined containers on-site. All used PPE will be rendered unusable prior to disposal.

The decontamination procedures utilized for Level C site conditions will consist of the following nine-step process:

- All sampling devices, monitoring instruments and other equipment used on-site will be segregated into piles on a polyethylene drop cloth and decontaminated as necessary.
- Outer boots and gloves will be washed with soap and water and then rinsed with water or appropriately disposed.
- The tape around the outer boots and gloves will be removed and deposited into a polyethylene-lined container.
- Outer boots will be removed and placed on the polyethylene drop cloth.
- Outer gloves will be removed and disposed of in polyethylene-lined containers.

- Tyvek coveralls will be removed and disposed of in polyethylene-lined containers.
- Respirator will be removed and washed with clean water and sanitized.
- Inner gloves will be removed and disposed in a polyethylene-lined container.
- Worker's hands and face will be washed with soap and water before leaving the site.

Personnel and equipment leaving the Exclusion Zone shall be thoroughly decontaminated. The standard Level D Decontamination Protocol shall be used unless conditions require an upgrade to Level C PPE and Decontamination Protocols.

Heavy Equipment Decontamination:

An area will be designated as the heavy equipment decontamination area. A steam generator and/or pressure washer and brushes will be used to clean drill rigs, vehicles, and tools. Decontamination will take place in lined decontamination areas where decontamination water can be contained and collected for disposal. No heavy equipment will be permitted to leave the exclusion zone unless it has been decontaminated and visually inspected by VHB. These inspections will be documented in the Health and Safety Log Book or the Field Log Book.

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General Safety Procedures

The following general safety procedures will be followed by all persons entering and/or working on the site:

- Safety requires the attention and cooperation of every worker and site visitor.
- A safety and operations meeting will be conducted at the commencement of a field program and as required thereafter for all personnel working at the site and documented on a safety meeting record form or in the field notebook. The information obtained as site work progresses will be addressed in the meetings and will be used to update the HASP, as necessary.
- Work will be conducted during daylight hours only unless there is prior written approval from KeySpan and the VHB RHSC or his/her designee and the associated illumination requirements of **29 CFR 1910.120(m)** are satisfied.
- No employee or subcontractor may be allowed in the on-site support zone without the prior knowledge and consent of the SSO and review of these Health and Safety Procedures.
- No one will be allowed in the exclusion zone on-site who has not been 40-hour OSHA health and safety trained or without the prior knowledge and consent of the SSO.
- There will be no activities conducted on-site without sufficient backup personnel. At a minimum, two persons ("buddy system") must be present at the site.
- All subcontractor or subconsultant personnel will bring to the attention of the SSO or FOM any unsafe condition or practice associated with the site activities that they are unable to correct themselves.
- There will be no smoking, eating, chewing gum or tobacco, applying cosmetics, or drinking except in the support zone.
- Hands shall be thoroughly cleaned prior to smoking, eating, drinking, applying cosmetics or other activities outside the contaminant reduction zone.
- Team members will avoid unnecessary contact with contamination (i.e., walking through known or suspected "hot" zones or contaminated puddles, kneeling or sitting on the ground, leaning against potentially contaminated barrels/drums or equipment).
- Respirators will not be worn with beards, long sideburns, or under other conditions that prevent a proper seal. A current medical, fit test, and respirator training will be required prior to donning respirators.

- No visitors will be allowed access without the knowledge and consent of the FOM and/or SSO. All visitors will be required to sign-in and be briefed on safety procedures and must be escorted while on-site.
- Work will *not* be conducted during electrical storms. Work conducted during other inclement weather must be approved by the PM and RHSC or his/her designee.

Emergency Response Plan

Emergency Information and Local Resources

In the case of a project emergency, the following emergency agencies and/or contacts will be notified where and when appropriate:

Agency	Name	Phone Number
Ambulance:	--	911
Hospital:	North Shore University Hospital 101 Saint Andrews Lane Glen Cove, NY 11542-2254 (See Hospital Route Map)	1-516-674-7300
Fire Department:	Glenwood Landing Fire Department	1-516-676-2822, 911, or *77 on cell phone
Police:	Nassau County Police	1-516-571-2113, 911, or *77 on cell phone
Poison Control:	National Poison Control Center	1-800-682-9211
Spill Control:	National Reporting Center NYSDEC Spill Hotline	1-800-424-8802 1-800-457-7362
VHB RHSC	Deborah Wojcicki	1-860-632-1500
Other:	NYSDEC – Region 1 (General)	1-631-444-0354

Emergency Medical Care

Emergency medical care procedures to be implemented at the site are as follows:

First Aid

On-site VHB personnel will keep an approved first-aid kit at the site during all field activities. At least one VHB team member will be properly trained, at a minimum, in Basic First-Aid and Adult CPR by the American Red Cross, or equivalent group. General first aid procedures for exposure include, but are not limited to, the following procedures:

- If contaminant contacts the eyes, irrigate immediately with large amounts of water;
- If contaminant contacts skin, wash with soap and water promptly;
- If contaminant is inhaled, move the exposed person to fresh air immediately. If the person's breathing has stopped, perform artificial respiration **ONLY** if appropriately trained and currently certified by the American Red Cross or equivalent. Request appropriate medical attention as soon as possible using telephone number(s) listed above (Emergency Information and Local Resources).

First Aid equipment will be available on-site at the following locations:

First Aid Kit: located in field vehicle

Emergency Eye Wash: located in field vehicle

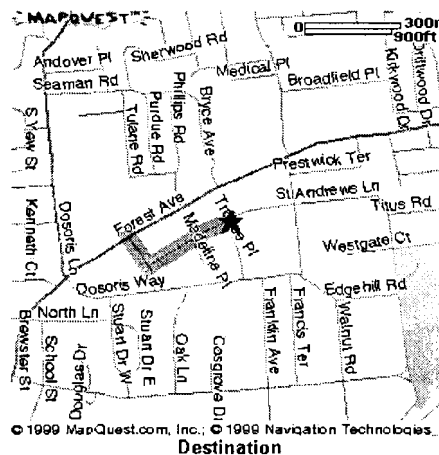
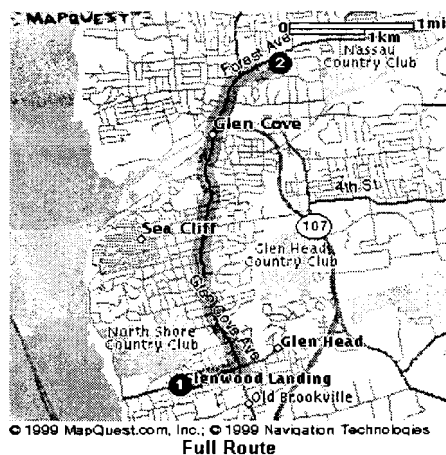
Emergency Shower: located in 1st floor bathroom of former laboratory building

Other (Specify): _____

Hospital Route Directions and Map

Starting From:	Arriving At:	Distance:	Approximate Travel Time:	Reverse Driving Directions
400 Shore Rd Glenwood Landing, NY	North Shore University Hosp 101 Saint Andrews Ln Glen Cove, NY 11542-2254 (516) 674-7300	3.6 miles	8 mins	

Directions	Miles
1. Start out going East on GLENWOOD RD towards CODY AVE by turning right.	0.5
2. Turn LEFT onto GLEN COVE AVE.	2.1
3. Stay straight to go onto BREWSTER ST.	0.5
4. BREWSTER ST becomes FOREST AVE.	0.1
5. Turn RIGHT onto ELLIOTT PL.	0.1
6. Turn LEFT onto ST ANDREWS LN.	0.2



Emergency Procedures

The following standard emergency procedures will be used by on-site personnel. These procedures may be modified as appropriate or required for each incident. The SSO will be notified of any on-site emergencies and will be responsible for ensuring that the appropriate procedures are followed.

- **Fire/Explosion:** The fire department will be notified and all personnel moved to a safe distance from the involved area.
- **Personal Protective Equipment Failure:** If any site worker experiences a failure or malfunction of personal protective equipment that adversely affects the protection factor, that person and his/her buddy will immediately leave the Exclusion Zone. Re-entry will not be permitted until the equipment has been repaired or replaced.
- **Other Equipment Failure:** If any other equipment on-site fails to operate properly, the Site Manager and SSO will be notified and will then evaluate the effect of such failure on continuing operations. If the failure affects personnel safety and/or prevents completion of the investigation activities, all personnel will leave the Exclusion Zone until the situation is remedied through appropriate action(s).

Approvals & Field Team Review

Approval Signatures

I have read, understood, and approve the provisions set forth in this Site-Specific Health and Safety Plan.

Matthew Wawrowski

Project Manager

Signature

Date

Christopher Poole

*Field Operations
Manager*

Signature

Date

Scott Shorette

Site Safety Officer

Signature

Date

Deborah Wojcicki

*Regional Health &
Safety Coordinator*

Signature

Date

Field Team Review & Acceptance

The undersigned acknowledge that they have read, understand, and agree to abide by this Site-Specific Health and Safety Plan:

Printed Name	Signature	Affiliation	Date

[illegible]

Attachment A

Activity Hazard Analyses

ACTIVITY HAZARD ANALYSIS

Page 1 of 1

Project: KeySpan Corporation
Activity: Mobilization/Demobilization

Location: Glenwood Landing Gas Plant Site
Analysis Reviewed By: Deborah Wojcicki

MAJOR FIELDWORK DIVISION:	POTENTIAL HAZARDS:	PROTECTIVE MEASURES/CONTROLS:
1. Equipment & Supplies Mobilization/Demobilization.	1. Back Injuries (Manual Lifting and Material Handling)	1. Site personnel will be instructed on proper lifting techniques; mechanical devices should be used to reduce manual handling of materials; team lifting should be utilized if mechanical devices are not available.
2. Site Inspection/Review	2. Slips/Trips/Falls	2. Maintain work areas safe and orderly; unloading areas should be on even terrain; mark and repair if possible tripping hazards.
	3. Vehicular Traffic	3. Spotters will be used when backing up trucks and heavy equipment and moving equipment.
	4. Overhead Hazards	4. Personnel will be required to wear hard hats that meet ANSI Standard Z89.1.
	5. Dropped Objects	5. Steel toe boots meeting ANSI Standard Z41 will be worn during all site activities.
	6. Heavy Equipment Operation (Drill Rigs)	6. Only trained personnel will operate equipment. A spotter will be used at all times during movement. Operational safety check will be performed by operator prior to commencement of activities.
	7. Pinch/Cut/Slash	7. Use hand tools properly and wear appropriate protective equipment, cut resistant work gloves will be worn when dealing with sharp objects; all hand and power tools will be maintained in safe condition; guards will be kept in place while using hand and power tools.
	8. Biological Hazards	8. Wear insect repellent; follow procedures for tick bites; be aware of poisonous plants; FOM should be aware of on-site personnel with allergic reactions to insect bites, etc.
	9. Temperature Extremes	9. Drink plenty of fluids; train personnel of signs/symptoms of heat/cold stress; monitor air temperatures when extreme weather conditions are present; stay in visual and verbal contact with your buddy.
	10. Hand and Power Tools	10. Daily inspections will be performed; remove broken or damaged tools from service; use the tool for its intended purpose; and use in accordance with manufacturers instructions.
	11. Inclement Weather	11. Monitor weather conditions daily.
EQUIPMENT USED:	INSPECTION REQUIREMENTS:	TRAINING REQUIREMENTS:
1. Heavy Equipment	1. Initial inspection of heavy equipment will be performed upon arrival on-site.	1. Personnel have read and comply with HASP.
2. Hand & Power Tools	2. Hand and power tools will be inspected to ensure they are serviceable prior to each days use.	2. Personnel will receive site specific training.
3. Personal Protective Equipment	3. PPE, including respirators, will be inspected before and after each use.	3. Only qualified operators can operate heavy equipment or vehicles.
		4. Personnel have knowledge of proper use of hand and power tools.
		5. At least one individual on-site will have current CPR and first aid training.

ACTIVITY HAZARD ANALYSIS

Page 1 of 2

Project: KeySpan Corporation

Location: Glenwood Landing Gas Plant Site

Activity: Supplementary Field Investigation

Analysis Reviewed By: Deborah Wojcicki

MAJOR FIELDWORK DIVISION:	POTENTIAL HAZARDS:	PROTECTIVE MEASURES/CONTROLS:
1. Geophysical Investigation	1. Back Injuries (Manual Lifting and Material Handling)	1. Site personnel will be instructed on proper lifting techniques; mechanical devices should be used to reduce manual handling of materials; team lifting should be utilized if mechanical devices are not available.
2. Subsurface Soil Borings & Sampling (Geotechnical & Environmental)	2. Slips/Trips/Falls	2. Maintain work areas safe and orderly; unloading areas should be on even terrain; mark and repair if possible tripping hazards.
3. Monitoring Well Drilling, Installation & Development	3. Vehicular Traffic	3. Spotters will be used when backing up trucks and heavy equipment and moving equipment.
4. Monitoring Well Water Level Gauging & Sampling	4. Overhead Hazards	4. Personnel will be required to wear hard hats that meet ANSI Standard Z89.1.
5. Groundwater Probe Installation & Sampling	5. Dropped Objects	5. Steel toe boots meeting ANSI Standard Z41 will be worn during all site activities.
6. Aquifer Testing (Slug Testing & Tidal Study)	6. Heavy Equipment Operation (Drill Rigs)	6. Only trained personnel will operate equipment. A spotter will be used at all times during movement. Operational safety check will be performed by operator prior to commencement of activities.
7. Land Surveying	7. Noise	7. Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); SSO will determine the need for hearing protection; all equipment will be equipped with manufacturer's required mufflers.
8. Decontamination	8. Pinch/Cut/Slash	8. Use hand tools properly and wear appropriate protective equipment, cut resistant work gloves will be worn when dealing with sharp objects; all hand and power tools will be maintained in safe condition; guards will be kept in place while using hand and power tools.
	9. Underground and Overhead Utilities	9. All underground/overhead utilities will be identified prior to equipment operations; no equipment or personnel closer than 25 feet to energized electrical lines or unprotected/unshielded circuits or similar structures.
	10. Biological Hazards	10. Wear insect repellent; follow procedures for tick bites; be aware of poisonous plants; FOM should be aware of on-site personnel with allergic reactions to insect bites, etc.
	11. Chemical Hazards and Exposure	11. Perform work zone air monitoring and practice contamination avoidance. Wear proper PPE during sampling & other site operations; rinse skin with water immediately if contact with hazardous material occurs. A first aid kit and portable eyewash will be located by work zone. Follow good personal hygiene practices. Ensure proper on-site haz-com training for decontamination and sample preservation chemicals.
	12. Temperature Extremes	12. Drink plenty of fluids; train personnel of signs/symptoms of heat/cold stress; monitor air temperatures when extreme weather conditions are present; stay in visual and verbal contact with your buddy.
	13. Hand and Power Tools	13. Daily inspections will be performed; remove broken or damaged tools from service; use the tool for its intended purpose; and use in accordance with manufacturers instructions.
	14. Steam/Heat and Splashing	14. Use face shield and safety glasses or goggles; stay out of the splash/steam radius; do not direct steam at anyone; do not hold objects with your foot and steam area near it; ensure that direction of spray minimizes spread of constituents of concern; use shielding as necessary.
	15. Fire	15. ABC type fire extinguishers will be readily available. Smoking in work zone is prohibited.
	16. Inclement Weather	16. Monitor weather conditions daily.

ACTIVITY HAZARD ANALYSIS

Page 2 of 2

Project: KeySpan Corporation**Location:** Glenwood Landing Gas Plant Site**Activity:** Supplementary Field Investigation**Analysis Reviewed By:** Deborah Wojcicki

EQUIPMENT USED:	INSPECTION REQUIREMENTS:	TRAINING REQUIREMENTS:
1. Heavy Equipment	1. Initial inspection of heavy equipment will be performed upon arrival on-site and prior to each use.	1. Personnel have read and comply with HASP.
2. Hand & Power Tools	2. Hand and power tools will be inspected to ensure they are serviceable prior to each days use.	2. Personnel will receive site specific training.
3. Personal Protective Equipment	3. PPE, including respirators, will be inspected before and after each use.	3. Only qualified operators can operate heavy equipment or vehicles.
4. Pressure Washer	4. Pressure washers will be inspected daily, prior to each days use.	4. Personnel have knowledge of proper use of hand and power tools.
5. First Aid Kits & Eyewash	5. First aid kits and portable eyewash will be inspected monthly.	5. At least one individual on-site will have current CPR and first aid training.
6. Fire Extinguisher	6. Fire extinguishers will be inspected monthly.	
7. Air Monitoring Equipment	7. Monitoring equipment will be inspected and calibrated daily following manufacturers instructions. Calibration checks may be used during operations to confirm instrument accuracy.	

ACTIVITY HAZARD ANALYSIS

Page 1 of 2

Project: KeySpan Corporation

Location: Glenwood Landing Gas Plant Site

Activity: Pilot Scale ISCO Study

Analysis Reviewed By: Deborah Wojcicki

MAJOR FIELDWORK DIVISION:	POTENTIAL HAZARDS:	PROTECTIVE MEASURES/CONTROLS:
1. Monitoring Well Water Level Gauging & Sampling	1. Back Injuries (Manual Lifting and Material Handling)	1. Site personnel will be instructed on proper lifting techniques; mechanical devices should be used to reduce manual handling of materials; team lifting should be utilized if mechanical devices are not available.
2. Groundwater Probe Installation & Sampling	2. Slips/Trips/Falls	2. Maintain work areas safe and orderly; unloading areas should be on even terrain; mark and repair if possible tripping hazards.
3. Chemical (Oxidant) Handling, Mixing & Storage	3. Vehicular Traffic	3. Spotters will be used when backing up trucks and heavy equipment and moving equipment.
4. Injection Probe Installation	4. Overhead Hazards	4. Personnel will be required to wear hard hats that meet ANSI Standard Z89.1.
5. In-Situ Chemical & Water Injection	5. Dropped Objects	5. Steel toe boots meeting ANSI Standard Z41 will be worn during all site activities.
6. Decontamination	6. Heavy Equipment Operation (Drill Rigs)	6. Only trained personnel will operate equipment. A spotter will be used at all times during movement. Operational safety check will be performed by operator prior to commencement of activities.
	7. Noise	7. Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); SSO will determine the need for hearing protection; all equipment will be equipped with manufacturer's required mufflers.
	8. Pinch/Cut/Slash	8. Use hand tools properly and wear appropriate protective equipment, cut resistant work gloves will be worn when dealing with sharp objects; all hand and power tools will be maintained in safe condition; guards will be kept in place while using hand and power tools.
	9. Underground and Overhead Utilities	9. All underground/overhead utilities will be identified prior to equipment operations; no equipment or personnel closer than 25 feet to energized electrical lines or unprotected/unshielded circuits or similar structures.
	10. Biological Hazards	10. Wear insect repellent; follow procedures for tick bites; be aware of poisonous plants; FOM should be aware of on-site personnel with allergic reactions to insect bites, etc.
	11. Chemical Hazards and Exposure	11. Perform work zone air monitoring and practice contamination avoidance. Wear proper PPE during sampling & other site operations; rinse skin with water immediately if contact with hazardous material occurs. A first aid kit and portable eyewash will be located by work zone. Follow good personal hygiene practices. Ensure proper on-site haz-com training for decontamination and sample preservation chemicals.
	12. Chemical Handling and Storage	12. Oxidant will be stored in closed containers in an enclosed, secured and vented area; concrete floor is preferable. PPE used during oxidant handling will include face shields/goggles, gloves, and aprons. Use of an APR or other respirator may be required in certain high exposure situations; SSO and/or RHSC will approve this upgrade. Any spillage will be contained, neutralized, collected and disposed of properly. Avoid contact with combustible materials, acids, peroxides, sulfites, oxalates, and all other oxidizable inorganic chemicals. See section 4 of HASP for further discussion.
	13. Temperature Extremes	13. Drink plenty of fluids; train personnel of signs/symptoms of heat/cold stress; monitor air temperatures when extreme weather conditions are present; stay in visual and verbal contact with your buddy.
	14. Hand and Power Tools	14. Daily inspections will be performed; remove broken or damaged tools from service; use the tool for its intended purpose; and use in accordance with manufacturers instructions.

ACTIVITY HAZARD ANALYSIS

Page 2 of 2

Project: KeySpan Corporation
Activity: Pilot Scale ISCO Study

Location: Glenwood Landing Gas Plant Site
Analysis Reviewed By: Deborah Wojcicki

	15. Steam/Heat and Splashing	15. Use face shield and safety glasses or goggles; stay out of the splash/steam radius; do not direct steam at anyone; do not hold objects with your foot and steam area near it; ensure that direction of spray minimizes spread of constituents of concern; use shielding as necessary.
	16. Fire	16. ABC type fire extinguishers will be readily available. Smoking in work zone is prohibited.
	17. Inclement Weather	17. Monitor weather conditions daily.
EQUIPMENT USED:	INSPECTION REQUIREMENTS:	TRAINING REQUIREMENTS:
1. Heavy Equipment	1. Initial inspection of heavy equipment will be performed upon arrival on-site and prior to each use.	1. Personnel have read and comply with HASP.
2. Hand & Power Tools	2. Hand and power tools will be inspected to ensure they are serviceable prior to each days use.	2. Personnel will receive site specific training.
3. Personal Protective Equipment	3. PPE, including respirators, will be inspected before and after each use.	3. Only qualified operators can operate heavy equipment or vehicles.
4. Pressure Washer	4. Pressure washers will be inspected daily, prior to each days use.	4. Personnel have knowledge of proper use of hand and power tools.
5. First Aid Kits & Eyewash	5. First aid kits and portable eyewash will be inspected monthly.	5. At least one individual on-site will have current CPR and first aid training.
6. Fire Extinguisher	6. Fire extinguishers will be inspected monthly.	
7. Drum Dolly	7. Inspect drum dolly prior to each use.	
8. Air Monitoring Equipment	8. Monitoring equipment will be inspected and calibrated daily following manufacturers instructions. Calibration checks may be used during operations to confirm instrument accuracy.	

ACTIVITY HAZARD ANALYSIS

Page 1 of 2

Project: KeySpan Corporation

Location: Glenwood Landing Gas Plant Site

Activity: Full Scale ISCO Implementation

Analysis Reviewed By: Deborah Wojcicki

MAJOR FIELDWORK DIVISION:	POTENTIAL HAZARDS:	PROTECTIVE MEASURES/CONTROLS:
1. Monitoring Well Water Level Gauging & Sampling	1. Back Injuries (Manual Lifting and Material Handling)	1. Site personnel will be instructed on proper lifting techniques; mechanical devices should be used to reduce manual handling of materials; team lifting should be utilized if mechanical devices are not available.
2. Groundwater Probe Installation & Sampling	2. Slips/Trips/Falls	2. Maintain work areas safe and orderly; unloading areas should be on even terrain; mark and repair if possible tripping hazards.
3. Chemical (Oxidant) Handling, Mixing & Storage	3. Vehicular Traffic	3. Spotters will be used when backing up trucks and heavy equipment and moving equipment.
4. Injection Probe Installation	4. Overhead Hazards	4. Personnel will be required to wear hard hats that meet ANSI Standard Z89.1.
5. In-Situ Chemical & Water Injection	5. Dropped Objects	5. Steel toe boots meeting ANSI Standard Z41 will be worn during all site activities.
6. Decontamination	6. Heavy Equipment Operation (Drill Rigs)	6. Only trained personnel will operate equipment. A spotter will be used at all times during movement. Operational safety check will be performed by operator prior to commencement of activities.
	7. Noise	7. Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); SSO will determine the need for hearing protection; all equipment will be equipped with manufacturer's required mufflers.
	8. Pinch/Cut/Slash	8. Use hand tools properly and wear appropriate protective equipment, cut resistant work gloves will be worn when dealing with sharp objects; all hand and power tools will be maintained in safe condition; guards will be kept in place while using hand and power tools.
	9. Underground and Overhead Utilities	9. All underground/overhead utilities will be identified prior to equipment operations; no equipment or personnel closer than 25 feet to energized electrical lines or unprotected/unshielded circuits or similar structures.
	10. Biological Hazards	10. Wear insect repellent; follow procedures for tick bites; be aware of poisonous plants; FOM should be aware of on-site personnel with allergic reactions to insect bites, etc.
	11. Chemical Hazards and Exposure	11. Perform work zone air monitoring and practice contamination avoidance. Wear proper PPE during sampling & other site operations; rinse skin with water immediately if contact with hazardous material occurs. A first aid kit and portable eyewash will be located by work zone. Follow good personal hygiene practices. Ensure proper on-site haz-com training for decontamination and sample preservation chemicals.
	12. Chemical Handling and Storage	12. Oxidant will be stored in closed containers in an enclosed, secured and vented area; concrete floor is preferable. PPE used during oxidant handling will include face shields/goggles, gloves, and aprons. Use of an APR or other respirator may be required in certain high exposure situations; SSO and/or RHSC will approve this upgrade. Any spillage will be contained, neutralized, collected and disposed of properly. Avoid contact with combustible materials, acids, peroxides, sulfites, oxalates, and all other oxidizable inorganic chemicals. See section 4 of HASP for further discussion.
	13. Temperature Extremes	13. Drink plenty of fluids; train personnel of signs/symptoms of heat/cold stress; monitor air temperatures when extreme weather conditions are present; stay in visual and verbal contact with your buddy.
	14. Hand and Power Tools	14. Daily inspections will be performed; remove broken or damaged tools from service; use the tool for its intended purpose; and use in accordance with manufacturers instructions.

ACTIVITY HAZARD ANALYSIS

Page 2 of 2

Project: KeySpan Corporation Activity: Full Scale ISCO Implementation		Location: Glenwood Landing Gas Plant Site Analysis Reviewed By: Deborah Wojcicki	
1. Heavy Equipment 2. Hand & Power Tools 3. Personal Protective Equipment 4. Pressure Washer 5. First Aid Kits & Eyewash 6. Fire Extinguisher 7. Drum Dolly 8. Air Monitoring Equipment	15. Steam/Heat and Splashing	15. Use face shield and safety glasses or goggles; stay out of the splash/steam radius; do not direct steam at anyone; do not hold objects with your foot and steam area near it; ensure that direction of spray minimizes spread of constituents of concern; use shielding as necessary.	
	16. Fire	16. ABC type fire extinguishers will be readily available. Smoking in work zone is prohibited.	
	17. Inclement Weather	17. Monitor weather conditions daily.	
EQUIPMENT USED:		TRAINING REQUIREMENTS:	
1. Initial inspection of heavy equipment will be performed upon arrival on-site and prior to each use.		1. Personnel have read and comply with HASP.	
2. Hand and power tools will be inspected to ensure they are serviceable prior to each days use.		2. Personnel will receive site specific training.	
3. PPE, including respirators, will be inspected before and after each use.		3. Only qualified operators can operate heavy equipment or vehicles.	
4. Pressure washers will be inspected daily, prior to each days use.		4. Personnel have knowledge of proper use of hand and power tools.	
5. First aid kits and portable eyewash will be inspected monthly.		5. At least one individual on-site will have current CPR and first aid training.	
6. Fire extinguishers will be inspected monthly.			
7. Inspect drum dolly prior to each use.			
8. Monitoring equipment will be inspected and calibrated daily following manufacturers instructions. Calibration checks may be used during operations to confirm instrument accuracy.			

Attachment B

Personnel Training Certificates

OSHA and other training certificates for all personnel working on site will be maintained on site by the SSO.

CERTIFICATE OF ACHIEVEMENT

This certifies that

Scott Shorette

has successfully completed the

**40 Hour Health & Safety Training for
Hazardous Waste Site Activities
per 29 CFR 1910.120**

conducted by
ATC Associates Inc.
39 Spruce Street
East Longmeadow, MA 01028
(413) 525-1198

Ed Lepore
Principal Instructor

January 18-21, 2000

Date of Course

January 21, 2001

Expiration Date

Martin A. Stevens

Regional Manager

HM-1424

Certificate Number

January 21, 2000

Examination Date

CERTIFICATE OF ACHIEVEMENT

This certifies that

Scott Shorette

has successfully completed the

**8 Hour Health & Safety Refresher Training for
Hazardous Waste Site Activities
per 29 CFR 1910.120**

conducted by
**ATC Associates Inc.
39 Spruce Street
East Longmeadow, MA 01028
(413) 525-1198**

Edward V. Ryan Jr.

Principal Instructor

June 13, 2002

Date of Course

June 13, 2003

Expiration Date

Nagory J. Morach

Regional Manager

8HMR-7846

Certificate Number

Not Applicable

Examination Date



ecology and environment, inc.

International Specialists in the Environment

BUFFALO CORPORATE CENTER

368 Pleasant View Drive, Lancaster, New York 14086

Tel: 716/684-8060, Fax: 716/684-0844

November 18, 1999

To Whom It May Concern:

This is to verify that Matt Wawrowski completed 40 hour HAZWOPER training on 4/6/87 and 8-hour HAZWOPER refresher training on 3/12/99 while employed with Ecology & Environment, Inc.

If you have any questions regarding this information, please call me at 716-684-8060.

Sincerely,

Thomas Siener, CIH
Corporate Health and Safety

CERTIFICATE OF COMPLETION

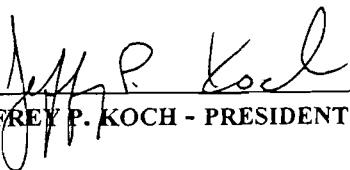
May It Be Known That This Certificate Has Been Presented To

Matthew Wawrowski

For Completion Of

*8 Hour Site Worker
Refresher Training*

29 CFR 1910.120


JEFFREY P. KOCH - PRESIDENT

October 17, 2000


Compliance Management, Inc.

CERTIFICATE OF ACHIEVEMENT

This certifies that

Christopher Poole

has successfully completed the

**8 Hour Health & Safety Refresher Training for
Hazardous Waste Site Activities
per 29 CFR 1910.120**

conducted by
ATC Associates Inc.
39 Spruce Street
East Longmeadow, MA 01028
(413) 525-1198

Jeff Malo
Principal Instructor

August 8, 2002
Date of Course

August 8, 2003
Expiration Date

Gregory J. Morand
Regional Manager

8HMR-7943
Certificate Number

Not Applicable
Examination Date

CERTIFICATE OF ACHIEVEMENT

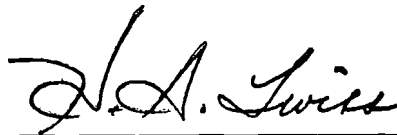
This certifies that

Chris Poole

has successfully completed the

**8 Hour Health & Safety Refresher Training for
Hazardous Waste Site Activities
per 29 CFR 1910.120**

conducted by
ATC Associates Inc.
39 Spruce Street
East Longmeadow, MA 01028
(413) 525-1198



Principal Instructor

July 6, 2001
Date of Course

July 6, 2002
Expiration Date



Regional Manager

8HMR-6631
Certificate Number

July 6, 2001
Examination Date

American
Red Cross



Together, we can save a life

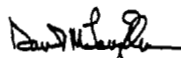
This recognizes that
Christopher Poole
has completed the requirements for

First Aid Basic

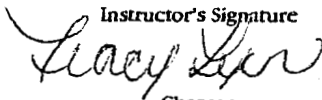
conducted by

WALLINGFORD / MERIDEN
Date completed 8-01-02

The American Red Cross recognizes this certificate
as valid for 3 year(s) from completion date.

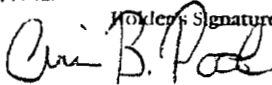

Chairman, American Red Cross

Instructor's Signature


Chapter

WALLINGFORD / MERIDEN

Holder's Signature



Cert. 653999 (Rev. Oct. 2001)

American
Red Cross



This recognizes that
Christopher Poole
has completed the requirements for
ADULT, INFANT, AND CHILD CPR

conducted by

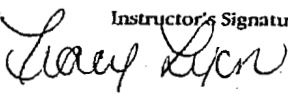
WALLINGFORD / MERIDEN
Date completed 7-31-02

The American Red Cross recognizes this certificate
as valid for 1 year from completion date.



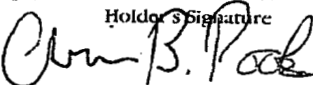

Chairman, American Red Cross

Instructor's Signature


Chapter

WALLINGFORD / MERIDEN

Holder's Signature





32107



HIV/AIDS
Education



Cert. 653213L (Rev. July 1997)

CERTIFICATE OF ACHIEVEMENT

This certifies that

Frank Kehoe

has successfully completed the

**8 Hour Health & Safety Refresher Training for
Hazardous Waste Site Activities
per 29 CFR 1910.120**

conducted by
ATC Associates Inc.
39 Spruce Street
East Longmeadow, MA 01028
(413) 525-1198

Jeff Malo
Principal Instructor

August 8, 2002
Date of Course

August 8, 2003
Expiration Date

Gregory J. March
Regional Manager

8HMR-7945
Certificate Number

Not Applicable
Examination Date

Certificate #9706204602

presented to

Francis Kehoe

in recognition of satisfactory completion
of a course of instruction entitled

29 CFR 1910.120 (e) & 1910.146

40-Hour Hazardous Waste Operations and Emergency
Response with Confined Space Operations


JAMES R. LAPRADE, JR.
Training Director

June 20, 1997

The Right Training, Right Now!



HIGHLAND SAFETY &
ENVIRONMENT, LTD.
5815 W 6th Ave., Suite 2PA
Lakewood, CO 80214
(303) 238-5335 (888) 238-5336

Attachment C

NIOSH Chemical Properties and Hazards

The following are presented in this Attachment:

- Arsenic
- Lead
- 1,2-Dichloroethene (DCE)
- Tetrachloroethene (PCE)
- Trichloroethene (TCE)
- Vinyl Chloride (VC)

(Source: <http://www.cdc.gov/niosh/npg/npg.html>)

NIOSH Pocket Guide to Chemical Hazards

Arsenic (inorganic compounds, as As)		CAS 7440-38-2 (metal)	
As (metal)		RTECS CG0525000 (metal)	
Synonyms & Trade Names Arsenic metal: Arsenia Other synonyms vary depending upon the specific As compound. [Note: OSHA considers "Inorganic Arsenic" to mean copper acetoarsenite & all inorganic compounds containing arsenic except ARSINE.]		DOT ID & Guide 1558 152 (metal) 1562 152 (dust)	
Exposure Limits	NIOSH REL: Ca C 0.002 mg/m ³ [15-minute] See Appendix A		
	OSHA PEL: [1910.1018] TWA 0.010 mg/m ³		
IDLH Ca [5 mg/m ³ (as As)] See: IDLH INDEX		Conversion	
Physical Description Metal: Silver-gray or tin-white, brittle, odorless solid.			
MW: 74.9	BP: Sublimes	MLT: 1135°F (Sublimes)	Sol: Insoluble
VP: 0 mmHg (approx)	IP: NA		Sp.Gr: 5.73 (metal)
Fl.P: NA	UEL: NA	LEL: NA	
Metal: Noncombustible Solid in bulk form, but a slight explosion hazard in the form of dust when exposed to flame.			
Compatibilities & Reactivities Strong oxidizers, bromine azide [Note: Hydrogen gas can react with inorganic arsenic to form the highly toxic gas arsine.]			
Measurement Methods NIOSH 7300, 7900; OSHA ID105 See: NMAM or OSHA Methods			
Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated/Daily Remove: When wet or contaminated Change: Daily 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 acid gas canister having a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus			
Exposure Routes inhalation, skin absorption, skin and/or eye contact ingestion			
Symptoms Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, [potential occupational carcinogen]			
Target Organs Liver, kidneys, skin, lungs, lymphatic system			

Cancer Site [lung & lymphatic cancer]

See also: INTRODUCTION See ICSC CARD: 0013 See MEDICAL TESTS: 0017

International Chemical Safety Cards

ARSENIC

ICSC: 0013



Grey arsenic
As
Atomic mass: 74.9

ICSC # 0013
CAS # 7440-38-2
RTECS # CG0525000
UN # 1558
EC # 033-001-00-X



TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with strong oxidizers. NO contact with hot surfaces.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Risk of fire and explosion is slight when exposed to hot surfaces or flames in the form of fine powder or dust.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		PREVENT DISPERSION OF DUST! AVOID ALL CONTACT! AVOID EXPOSURE OF (PREGNANT) WOMEN!	IN ALL CASES CONSULT A DOCTOR!
•INHALATION	Cough. Sore throat. Shortness of breath. Weakness. (See Ingestion).	Closed system and ventilation.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
•SKIN	Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
•EYES	Redness.	Face shield, or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Abdominal pain. Diarrhoea. Nausea. Vomiting. Burning sensation in the throat and chest. Shock or collapse. Unconsciousness.	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Sweep spilled substance into sealable containers. Carefully collect remainder, then remove to safe place. Chemical protection suit including self-contained breathing apparatus. Do NOT let chemical enter the environment.	Separated from strong oxidants, acids, halogens, food and feedstuffs. Well closed.	Do not transport with food and feedstuffs. Marine pollutant. T symbol R: 23/25 S: 1/2-20/21-28-45 UN Hazard Class: 6.1 UN Packing Group: II

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0013

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1999. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

International Chemical Safety Cards

ARSENIC

ICSC: 0013

I M P O R T A N T D A T A	PHYSICAL STATE; APPEARANCE: ODOURLESS, BRITTLE, GREY, METALLIC-LOOKING CRYSTALS.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.	
	PHYSICAL DANGERS:	INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly, when dispersed.	
	CHEMICAL DANGERS: Upon heating, toxic fumes are formed. Reacts violently with strong oxidants halogens, causing fire and explosion hazard. Reacts with acids to produce	EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes the skin the respiratory tract. The substance may cause effects on the gastrointestinal tract cardiovascular system central nervous system kidneys resulting in severe gastroenteritis, loss of fluid, and electrolytes, cardiac disorders shock convulsions kidney impairment Exposure above OEL may result in death. The effects may be delayed. Medical observation is indicated.	
	OCCUPATIONAL EXPOSURE LIMITS: TLV: ppm; 0.01 mg/m ³ (as TWA) A1 (ACGIH 1999). NIOSH REL: Ca C 0.002 mg/m ³ 15-minute <u>See Appendix A</u> NIOSH IDLH: Potential occupational carcinogen 5 mg/m ³ (as As)	EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may cause dermatitis. Repeated or prolonged contact may cause skin sensitization. The substance may have effects on the mucous membranes, skin, peripheral nervous system liver bone marrow, resulting in pigmentation disorders, hyperkeratosis, perforation of nasal septum, neuropathy, liver impairment anaemia This substance is carcinogenic to humans. Animal tests show that this substance possibly causes malformations in human babies.	
	PHYSICAL PROPERTIES	Sublimation point: 613°C Density: 5.7 g/cm ³	Solubility in water: none
	ENVIRONMENTAL DATA	The substance is toxic to aquatic organisms. It is strongly advised not to let the chemical enter into the environment because it persists in the environment.	
NOTES			
The substance is combustible but no flash point is available in literature. Depending on the degree of exposure, periodic medical examination is indicated. Do NOT take working clothes home. Refer also to cards for specific arsenic compounds, e.g., Arsenic pentoxide (ICSC # 0377), Arsenic trichloride (ICSC # 0221), Arsenic trioxide (ICSC # 0378), Arsine (ICSC # 0222).			
Transport Emergency Card: TEC (R)-61G64b			
ADDITIONAL INFORMATION			
ICSC: 0013			
(C) IPCS, CEC, 1999			
ARSENIC			
IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.		

NIOSH Pocket Guide to Chemical Hazards

Lead			CAS 7439-92-1
			RTECS OF7525000
Synonyms & Trade Names Lead metal, Plumbum			DOT ID & Guide
Exposure Limits	NIOSH REL*: TWA 0.050 mg/m ³ See Appendix C [*Note: The REL also applies to other lead compounds (as Pb) -- see Appendix C.]		
	OSHA PEL*: [1910.1025] TWA 0.050 mg/m ³ See Appendix C [*Note: The PEL also applies to other lead compounds (as Pb) -- see Appendix C.]		
IDLH 100 mg/m ³ (as Pb) See: 7439921		Conversion	
Physical Description A heavy, ductile, soft, gray solid.			
MW: 207.2	BP: 3164°F	MLT: 621°F	Sol: Insoluble
VP: 0 mmHg (approx)	IP: NA		Sp.Gr: 11.34
Fl.P: NA	UEL: NA	LEL: NA	
Noncombustible Solid in bulk form.			
Incompatibilities & Reactivities Strong oxidizers, hydrogen peroxide, acids			
Measurement Methods NIOSH 7082, 7105, 7300, 7700, 7701, 7702; OSHA ID121, ID125G, ID206 See: NMAM or OSHA Methods			
Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: Daily Remove: When wet or contaminated Change: Daily		First Aid (See procedures) Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately	
Respirator Recommendations NIOSH/OSHA Up to 0.5 mg/m ³ : (APF = 10) Any air-purifying respirator with a high-efficiency particulate filter/(APF = 10) Any supplied-air respirator Up to 1.25 mg/m ³ : (APF = 25) Any supplied-air respirator operated in a continuous-flow mode/(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter Up to 2.5 mg/m ³ : (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter/(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode/(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and 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 Up to 50 mg/m ³ : (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode Up to 100 mg/m ³ : (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode 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 with a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus

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

Symptoms Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypotension

Target Organs Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue

See also: INTRODUCTION See ICSC CARD: 0052 See MEDICAL TESTS: 0127

International Chemical Safety Cards

LEAD

ICSC: 0052



Lead metal
Plumbum
Pb

Atomic mass: 207.2

(powder)

Atomic mass: Atomic mass: 207.2

ICSC # 0052

CAS # 7439-92-1

RTECS # OF7525000

UN #

EC #

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Finely divided lead powder is flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking (if in powder form).	In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!	IN ALL CASES CONSULT A DOCTOR!
• INHALATION	Abdominal cramps. Drowsiness. Headache. Nausea. Vomiting. Weakness. Pallor. Hemoglobinuria. Collapse.	Ventilation (not if powder). Avoid inhalation of fine dust and mist. Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
• SKIN			
• EYES			
• INGESTION	Abdominal cramps (further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.
SPILLAGE DISPOSAL		STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment (extra personal protection: P2 or respirator for harmful particles).		Separated from strong oxidants, strong bases, strong acids, food and feedstuffs.	R: S: UN Hazard Class:

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0052

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International Chemical Safety Cards

LEAD

ICSC: 0052

I M P O R T A N T D A T A	PHYSICAL STATE; APPEARANCE: BLUISH-WHITE OR SILVERY-GREY SOLID IN VARIOUS FORMS. TURNS TARNISHED ON EXPOSURE TO AIR.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.	
	PHYSICAL DANGERS: Dust explosion possible if in powder or granular form, mixed with air.	INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.	
	CHEMICAL DANGERS: Upon heating, toxic fumes are formed. Reacts with hot concentrated nitric acid, boiling concentrated hydrochloric and sulfuric acids. Attacked by pure water and by weak organic acids in the presence of oxygen.	EFFECTS OF SHORT-TERM EXPOSURE: The substance may cause effects on the gastrointestinal tract, blood, central nervous system and kidneys , resulting in colics, shock, anemia, kidney damage and encephalopathy. Exposure may result in death. The effects may be delayed. Medical observation is indicated.	
	OCCUPATIONAL EXPOSURE LIMITS: TLV: ppm; 0.15 mg/m ³ (as TWA) (ACGIH 1993-1994). OSHA PEL*: 1910.1025 TWA 0.050 mg/m ³ <u>See Appendix C</u> *Note: The PEL also applies to other lead NIOSH REL*: TWA 0.050 mg/m ³ <u>See Appendix C</u> *Note: The REL also applies to other lead NIOSH IDLH: 100 mg/m ³ (as Pb)	EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: The substance may have effects on the gastrointestinal tract, nervous system, blood, kidneys and immune system , resulting in severe lead colics, paralysis of muscle groups of the upper extremities (forearm, wrist and fingers), anemia, mood and personality changes, retarded mental development, and irreversible nephropathy. May cause retarded development of the new-born. Danger of cumulative effect.	
	PHYSICAL PROPERTIES	Boiling point: 1740°C Melting point: 327.5°C	Relative density (water = 1): 11.34 Solubility in water: none
	ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to air and water. In the food chain important to humans, bioaccumulation takes place, specifically in plants and water organisms, especially shellfish.	
NOTES			
Explosive limits are unknown in literature. Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is indicated. Do NOT take working clothes home. Refer also to cards for specific lead compounds, e.g., lead chromate (ICSC # 0003), lead(II) oxide (ICSC # 0288).			
Transport Emergency Card: TEC (R)-61G12b			
ADDITIONAL INFORMATION			
ICSC: 0052			
(C) IPCS, CEC, 1999			
LEAD			
IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.		

NIOSH Pocket Guide to Chemical Hazards

1 2-Dichloroethylene		CAS 540-59-0
CH=CHCl		RTECS KV9360000
Synonyms & Trade Names Acetylene dichloride, cis-Acetylene dichloride, trans-Acetylene dichloride, sym-Dichloroethylene		DOT ID & Guide 1150 132P
Exposure Limits	NIOSH REL: TWA 200 ppm (790 mg/m ³)	
	OSHA PEL: TWA 200 ppm (790 mg/m ³)	
IDLH 1000 ppm See: 540590		Conversion 1 ppm = 3.97 mg/m ³
Physical Description Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor.		
MW: 97.0	BP: 118-140°F	FRZ: -57 to -115°F
VP: 180-265 mmHg	IP: 9.65 eV	Sp.Gr(77°F): 1.27
FLP: 36-39°F	UEL: 12.8%	LEL: 5.6%
Class IB Flammable Liquid: FLP. below 73°F and BP at or above 100°F.		
Incompatibilities & Reactivities Strong oxidizers, strong alkalis, potassium hydroxide, copper [Note: Usually contains inhibitors to prevent polymerization.]		
Measurement Methods NIOSH 1003; OSHA 7 See: NMAM or OSHA Methods		
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 2000 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) [£] /(APF = 50) Any chemical cartridge respirator with a full facepiece and 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 = 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/Any appropriate escape-type, self-contained breathing apparatus		
Exposure Routes inhalation, ingestion, skin and/or eye contact		
Symptoms Irritation eyes, respiratory system; central nervous system depression		
Target Organs Eyes, respiratory system, central nervous system		

International Chemical Safety Cards

1,2-DICHLOROETHYLENE (cis/trans MIXTURE)

ICSC: 0436



1,2-Dichloroethene
Acetylene dichloride
sym-Dichloroethylene
 $C_2H_2Cl_2$ / $ClCH=CHCl$
Molecular mass: 96.95

ICSC # 0436
CAS # 540-59-0
RTECS # KV9360000
UN # 1150
EC # 602-026-00-3



TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Highly flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		STRICT HYGIENE!	
• INHALATION	Cough. Sore throat. Dizziness. Nausea. Drowsiness. Weakness. Unconsciousness. Vomiting.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
• SKIN	Dry skin.	Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
• EYES	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION	Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Ventilation. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in dry sand or inert absorbent and remove to safe place. Do NOT wash away into sewer (extra personal protection: self-contained breathing apparatus).	Fireproof. See Chemical Dangers.	Note: C F symbol Xn symbol R: 11-20-50/53 S: 2-7-16-29-61 UN Hazard Class: 3 UN Packing Group: II

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0436

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1998. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

International Chemical Safety Cards

1,2-DICHLOROETHYLENE (cis/trans MIXTURE)

ICSC: 0436

I M P O R T A N T D A T A	PHYSICAL STATE; APPEARANCE: COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its vapour and by ingestion.
	PHYSICAL DANGERS: The vapour is heavier than air and may travel along the ground; distant ignition possible.	INHALATION RISK: A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20°C.
	CHEMICAL DANGERS: The substance decomposes on heating and on burning producing toxic and corrosive fumes including hydrogen chloride. Reacts with strong oxidants. Reacts with potassium hydroxide, copper or copper alloys producing toxic chloroacetylene which is spontaneously flammable in contact with air. Attacks some form of plastic.	EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes and the respiratory tract. The substance may cause effects on the central nervous system at high level , resulting in narcosis.
	OCCUPATIONAL EXPOSURE LIMITS: TLV (as TWA): 200 ppm; 793 mg/m ³ (ACGIH 1997). OSHA PEL: TWA 200 ppm (790 mg/m ³) NIOSH REL: TWA 200 ppm (790 mg/m ³) NIOSH IDLH: 1000 ppm	EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: The liquid defats the skin.
PHYSICAL PROPERTIES	Boiling point: 60.3(cis); 48.0-48.5(trans)°C Melting point: -81.5(cis); -49.4(trans)°C Relative density (water = 1): 1.28(cis); 1.26(trans) Solubility in water: poor Vapour pressure, kPa at 20°C: 24.0(cis), 35.3(trans)	Relative vapour density (air = 1): 3.34 Flash point: 6°C c.c.(cis); 2-4°C c.c.(trans) Auto-ignition temperature: 460°C Explosive limits, vol% in air: 9.7-12.8 Octanol/water partition coefficient as log Pow: 1.86(cis); 2.09(trans)
ENVIRONMENTAL DATA		
NOTES		
Dioform is a trade name.		
Transport Emergency Card: TEC (R)-30G30 NFPA Code: H2; F3; R2;		
ADDITIONAL INFORMATION		
ICSC: 0436		
1,2-DICHLOROETHYLENE (cis/trans MIXTURE)		
(C) IPCS, CEC, 1998		
IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.	

NIOSH Pocket Guide to Chemical Hazards

Tetrachloroethylene		CAS 127-18-4
<chem>ClC(Cl)(Cl)Cl</chem>		RTECS KX3850000
Synonyms & Trade Names Perchlorethylene, Perchloroethylene, Perk, Tetrachlorethylene		DOT ID & Guide 1897 160
Exposure Limits	NIOSH REL: Ca Minimize workplace exposure concentrations. See Appendix A	
	OSHA PEL†: TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 3-hours)	
IDLH Ca [150 ppm] See: 127184		Conversion 1 ppm = 6.78 mg/m ³
Physical Description Colorless liquid with a mild, chloroform-like odor.		
MW: 165.8	BP: 250°F	FRZ: -2°F
VP: 14 mmHg	IP: 9.32 eV	Sp.Gr: 1.62
Fl.P: NA	UEL: NA	LEL: NA
Noncombustible Liquid, but decomposes in a fire to hydrogen chloride and phosgene.		
Incompatibilities & Reactivities Strong oxidizers; chemically-active metals such as lithium, beryllium & barium; caustic soda; sodium hydroxide; potash		
Measurement Methods NIOSH 1003; OSHA 1001 See: NMAM or OSHA Methods		
Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet or contaminated Change: No recommendation Provide: Eyewash, Quick drench		First Aid (See procedures) Eye: Irrigate immediately Skin: Soap wash promptly 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, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]		
Target Organs Eyes, skin, respiratory system, liver, kidneys, central nervous system		
Cancer Site [in animals: liver tumors]		
See also: INTRODUCTION See ICSC CARD: 0076 See MEDICAL TESTS: 0179		

International Chemical Safety Cards

TETRACHLOROETHYLENE

ICSC: 0076



1,1,2,2-Tetrachloroethylene
 Perchloroethylene
 Tetrachloroethene
 $C_2Cl_4 / Cl_2C=CCl_2$
 Molecular mass: 165.8

ICSC # 0076
 CAS # 127-18-4
 RTECS # KX3850000
 UN # 1897
 EC # 602-028-00-4



TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION			
EXPOSURE		STRICT HYGIENE! PREVENT GENERATION OF MISTS!	
• INHALATION	Dizziness. Drowsiness. Headache. Nausea. Weakness. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• SKIN	Dry skin. Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• EYES	Redness. Pain.	Safety goggles, face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION	Abdominal pain (further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Give plenty of water to drink. Rest.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Ventilation. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment. (Extra personal protection: filter respirator for organic gases and vapours).	Separated from metals see Chemical Dangers food and feedstuffs Keep in the dark. Ventilation along the floor.	Do not transport with food and feedstuffs. Marine pollutant. Xn symbol N symbol R: 40-51/53 S: (2-)23-36/37-61 UN Hazard Class: 6.1 UN Packing Group: III

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0076

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 2000. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

TETRACHLOROETHYLENE

ICSC: 0076

I M P O R T A N T D A T A	PHYSICAL STATE; APPEARANCE: COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR. PHYSICAL DANGERS: The vapour is heavier than air. CHEMICAL DANGERS: On contact with hot surfaces or flames this substance decomposes forming toxic and corrosive fumes (hydrogen chloride, phosgene, chlorine). The substance decomposes slowly on contact with moisture producing trichloroacetic acid and hydrochloric acid. Reacts with metals such as aluminium, lithium, barium, beryllium. OCCUPATIONAL EXPOSURE LIMITS: TLV: 25 ppm; (STEL): 100 ppm; (ACGIH 1999). OSHA PEL: TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 3-hours) NIOSH REL: Ca Minimize workplace exposure concentrations. <u>See Appendix A</u> NIOSH IDLH: Potential occupational carcinogen 150 ppm	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation and by ingestion. INHALATION RISK: A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C. EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes, the skin and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous system. Exposure at high levels may result in unconsciousness. EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the liver and kidneys. This substance is probably carcinogenic to humans.
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PHYSICAL PROPERTIES	Boiling point: 121°C Melting point: -22°C Relative density (water = 1): 1.6 Solubility in water, g/100 ml at 20°C: 0.015	Vapour pressure, kPa at 20°C: 1.9 Relative vapour density (air = 1): 5.8 Relative density of the vapour/air-mixture at 20°C (air = 1): 1.09 Octanol/water partition coefficient as log Pow: 2.9
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ENVIRONMENTAL DATA	The substance is toxic to aquatic organisms. The substance may cause long-term effects in the aquatic environment.	
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NOTES

Depending on the degree of exposure, periodic medical examination is indicated. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding. An added stabilizer or inhibitor can influence the toxicological properties of this substance, consult an expert.	Transport Emergency Card: TEC (R)-722 NFPA Code: H2; F0; R0;
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ADDITIONAL INFORMATION

ICSC: 0076	TETRACHLOROETHYLENE
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(C) IPCS, CEC, 2000

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.
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NIOSH Pocket Guide to Chemical Hazards

Trichloroethylene		CAS 79-01-6	
CH=CCl ₂		RTECS KX4550000	
Synonyms & Trade Names Ethylene trichloride, TCE, Trichloroethene, Trilene		DOT ID & Guide 1710 160	
Exposure Limits	NIOSH REL: Ca See Appendix A See Appendix C		
	OSHA PEL†: TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours)		
IDLH Ca [1000 ppm] See: 79016		Conversion 1 ppm = 5.37 mg/m ³	
Physical Description Colorless liquid (unless dyed blue) with a chloroform-like odor.			
MW: 131.4	BP: 189°F	FRZ: -99°F	Sol(77°F): 0.1%
VP: 58 mmHg	IP: 9.45 eV		Sp.Gr: 1.46
FLP: ?	UEL(77°F): 10.5%	LEL(77°F): 8%	
Combustible Liquid, but burns with difficulty.			
Incompatibilities & Reactivities Strong caustics & alkalis; chemically-active metals (such as barium, lithium, sodium, magnesium, titanium & beryllium)			
Measurement Methods NIOSH 1022, 3800; OSHA 1001 See: NMAM or OSHA Methods			
Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet or contaminated Change: No recommendation Provide: Eyewash, Quick drench		First Aid (See procedures) Eye: Irrigate immediately Skin: Soap wash promptly 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; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]			
Target Organs Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system			
Cancer Site [in animals: liver & kidney cancer]			
See also: INTRODUCTION See ICSC CARD: 0081 See MEDICAL TESTS: 0236			

International Chemical Safety Cards

TRICHLOROETHYLENE

ICSC: 0081



1,1,2-Trichloroethylene
Trichloroethene
Ethylene trichloride
Acetylene trichloride
 C_2HCl_3 / $ClCH=CCl_2$
Molecular mass: 131.4

ICSC # 0081
CAS # 79-01-6
RTECS # KX4550000
UN # 1710
EC # 602-027-00-9



TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible under specific conditions. See Notes.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION		Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT GENERATION OF MISTS! STRICT HYGIENE!	
• INHALATION	Dizziness. Drowsiness. Headache. Weakness. Nausea. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• SKIN	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• EYES	Redness. Pain.	Safety spectacles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION	Abdominal pain (further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Give plenty of water to drink. Rest.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Ventilation. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. (Extra personal protection: filter respirator for organic gases and vapours). Do NOT let this chemical enter the environment.	Separated from metals see Chemical Dangers strong bases, food and feedstuffs Dry. Keep in the dark. Ventilation along the floor.	Do not transport with food and feedstuffs. Marine pollutant. Xn symbol R: 40-52/53 S: 2-23-36/37-61 UN Hazard Class: 6.1 UN Packing Group: III

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0081

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 2000. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

International Chemical Safety Cards

TRICHLOROETHYLENE

ICSC: 0081

I M P O R T A N T D A T A	PHYSICAL STATE; APPEARANCE: COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation and by ingestion.
	PHYSICAL DANGERS: The vapour is heavier than air. As a result of flow, agitation, etc., electrostatic charges can be generated.	INHALATION RISK: A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20°C.
	CHEMICAL DANGERS: On contact with hot surfaces or flames this substance decomposes forming toxic and corrosive fumes phosgene hydrogen chloride The substance decomposes on contact with strong alkali producing dichloroacetylene , which increases fire hazard. Reacts violently with metal powders such as magnesium, aluminium, titanium, and barium. Slowly decomposed by light in presence of moisture, with formation of corrosive hydrochloric acid.	EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes and the skin. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous system , resulting in respiratory failure Exposure could cause lowering of consciousness.
	OCCUPATIONAL EXPOSURE LIMITS: TLV: 50 A5 ppm;(STEL): 100 ppm; (ACGIH 2000). OSHA PEL: TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours) NIOSH REL: Ca See Appendix A See Appendix C NIOSH IDLH: Potential occupational carcinogen 1000 ppm	EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the central nervous system , resulting in loss of memory. The substance may have effects on the liver kidneys (see notes). This substance is probably carcinogenic to humans.
PHYSICAL PROPERTIES	Boiling point: 87°C Melting point: -73°C Relative density (water = 1): 1.5 Solubility in water, g/100 ml at 20°C: 0.1 Vapour pressure, kPa at 20°C: 7.8 Relative vapour density (air = 1): 4.5	Relative density of the vapour/air-mixture at 20°C (air = 1): 1.3 Auto-ignition temperature: 410°C Explosive limits, vol% in air: 8-10.5 Octanol/water partition coefficient as log Pow: 2.42 Electrical conductivity (NOT on card): 800pS/m
ENVIRONMENTAL DATA	The substance is harmful to aquatic organisms. The substance may cause long-term effects in the aquatic environment.	
NOTES		
Combustible vapour/air mixtures difficult to ignite, may be developed under certain conditions. Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is indicated. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding. An added stabilizer or inhibitor can influence the toxicological properties of this substance, consult an expert.		
Transport Emergency Card: TEC (R)-723 NFPA Code: H2; F1; R0;		
ADDITIONAL INFORMATION		
ICSC: 0081		
TRICHLOROETHYLENE		
(C) IPCS, CEC, 2000		
IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.	

NIOSH Pocket Guide to Chemical Hazards

Vinyl chloride		CAS 75-01-4	
CH ₂ =CHCl		RTECS KU9625000	
Synonyms & Trade Names Chloroethene, Chloroethylene, Ethylene monochloride, Monochloroethene, Monochloroethylene, VC, Vinyl chloride monomer (VCM)		DOT ID & Guide 1086 116P	
Exposure Limits	NIOSH REL: Ca See Appendix A		
	OSHA PEL: [1910.1017] TWA 1 ppm C 5 ppm [15-minute]		
IDLH Ca [N.D.] See: IDLH INDEX		Conversion 1 ppm = 2.56 mg/m ³	
Physical Description Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations. [Note: Shipped as a liquefied compressed gas.]			
MW: 62.5	BP: 7°F	FRZ: -256°F	Sol(77°F): 0.1%
VP: 3.3 atm	IP: 9.99 eV	RGasD: 2.21	
Fl.P: NA (Gas)	UEL: 33.0%	LEL: 3.6%	
Flammable Gas			
Incompatibilities & Reactivities Copper, oxidizers, aluminum, peroxides, iron, steel [Note: Polymerizes in air, sunlight, or heat unless stabilized by inhibitors such as phenol. Attacks iron & steel in presence of moisture.]			
Measurement Methods NIOSH 1007; OSHA 4, 75 See: NMAM or OSHA Methods			
Personal Protection & Sanitation Skin: Frostbite Eyes: Frostbite Wash skin: No recommendation Remove: When wet (flammable) Change: No recommendation Provide: Frostbite		First Aid (See procedures) Eye: Frostbite Skin: Frostbite Breathing: Respiratory support	
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 canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus			
Exposure Routes inhalation, skin, and/or eye contact (liquid)			
Symptoms Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]			
Target Organs Liver, central nervous system, blood, respiratory system, lymphatic system			
Cancer Site [liver cancer]			

International Chemical Safety Cards

VINYL CHLORIDE

ICSC: 0082



Chloroethene
Chloroethylene
VCM
 $C_2H_3Cl / H_2C=CHCl$
Molecular mass: 62.5
(cylinder)

ICSC # 0082
CAS # 75-01-4
RTECS # KU9625000
UN # 1086 (stabilized)
EC # 602-023-00-7



TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Extremely flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking.	Shut off supply; if not possible and no risk to surroundings, let the fire burn itself out; in other cases extinguish with powder, carbon dioxide.
EXPLOSION	Gas/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Use non-sparking handtools.	In case of fire: keep cylinder cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
•INHALATION	Dizziness. Drowsiness. Headache. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	ON CONTACT WITH LIQUID: FROSTBITE.	Protective gloves. Cold-insulating gloves. Protective clothing.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes.
•EYES	Redness. Pain.	Safety goggles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION		Do not eat, drink, or smoke during work.	

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Ventilation. Remove all ignition sources. (Extra personal protection: complete protective clothing including self-contained breathing apparatus).	Fireproof. Separated from incompatible materials (see Chemical Dangers). Cool. Store only if stabilized.	Note: D F+ symbol T symbol R: 45-12 S: 53-45 UN Hazard Class: 2.1

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0082

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 2000. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

International Chemical Safety Cards

VINYL CHLORIDE

ICSC: 0082

I M P O R T A N T D A T A	PHYSICAL STATE; APPEARANCE: COLOURLESS COMPRESSED LIQUEFIED GAS , WITH CHARACTERISTIC ODOUR.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation.
	PHYSICAL DANGERS: The gas is heavier than air, and may travel along the ground; distant ignition possible.	INHALATION RISK: A harmful concentration of this gas in the air will be reached very quickly on loss of containment.
	CHEMICAL DANGERS: The substance can under specific circumstances form peroxides, initiating explosive polymerization. The substance will polymerize readily due to heating and under the influence of air, light, and on contact with a catalyst, strong oxidizing agents and metals such as copper and aluminium, with fire or explosion hazard. The substance decomposes on burning producing toxic and corrosive fumes hydrogen chloride phosgene Attacks iron and steel in the presence of moisture.	EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes. The liquid may cause frostbite. The substance may cause effects on the central nervous system Exposure could cause lowering of consciousness. Medical observation is indicated.
	OCCUPATIONAL EXPOSURE LIMITS: TLV: 1 ppm; A1 (ACGIH 1999). OSHA PEL: 1910.1017 TWA 1 ppm C 5 ppm 15-minute NIOSH REL: Ca See Appendix A NIOSH IDLH: Potential occupational carcinogen No data	EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: The substance may have effects on the liver, spleen, blood and peripheral blood vessels, and tissue and bones of the fingers. This substance is carcinogenic to humans.

PHYSICAL PROPERTIES	Boiling point: -13°C Melting point: -154°C Relative density (water = 1): (liquid) 0.9 Density: (vapour) at 15°C 8 g/l Solubility in water: none	Relative vapour density (air = 1): 2.2 Flash point: -78°C c.c. Auto-ignition temperature: 472°C Explosive limits, vol% in air: 3.6-33 Octanol/water partition coefficient as log Pow: 0.6
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to ground water	



NOTES

Depending on the degree of exposure, periodic medical examination is indicated. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding. An added stabilizer or inhibitor can influence the toxicological properties of this substance, consult an expert.

Transport Emergency Card: TEC (R)-150
NFPA Code: H 2; F 4; R 2;

ADDITIONAL INFORMATION

ICSC: 0082

VINYL CHLORIDE

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Attachment D

Material Safety Data Sheets

The following MSDSs are presented in this attachment:

- Alconox
- Concrete mix (Portland)
- Gasoline (Nonleaded)
- Gojo Hand Cleaner
- Hydrochloric Acid
- Isobutylene in air
- Methanol Reagent
- Nitric Acid Reagent
- Sodium Hydroxide Reagent
- Sodium Permanganate (Liquid; 40 Wt.%)
- Sulfuric Acid Reagent

(Suggested source: <http://msds.pdc.cornell.edu/msdssrch.asp>)

ALCONOX -- ALCONOX - DETERGENT, SURGICAL INSTRUMENT
MATERIAL SAFETY DATA SHEET
NSN: 6505008398894
Manufacturer's CAGE: 17534
Part No. Indicator: A
Part Number/Trade Name: ALCONOX

=====

General Information

=====

Item Name: DETERGENT, SURGICAL INSTRUMENT
Company's Name: ALCONOX INC
Company's Street: 215 PARK AVE S
Company's City: NEW YORK
Company's State: NY
Company's Country: US
Company's Zip Code: 10003
Company's Emerg Ph #: 212-473-1300
Company's Info Ph #: 212-473-1300
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 14AUG92
Safety Data Review Date: 28SEP92
MSDS Serial Number: BPXXV
Hazard Characteristic Code: NK

=====

Ingredients/Identity Information

=====

Proprietary: NO
Ingredient: ALCONOX
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: 1002102NX
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

=====

Physical/Chemical Characteristics

=====

Appearance And Odor: WHITE POWDER INTERSPERSED W/CREAM COLORED FLAKES-
ODORLESS
Boiling Point: N/A
Vapor Pressure (MM Hg/70 F): N/A
Vapor Density (Air=1): N/A
Specific Gravity: N/A
Evaporation Rate And Ref: NOT APPLICABLE
Solubility In Water: APPRECIABLE
Percent Volatiles By Volume: N/A

=====

Fire and Explosion Hazard Data

=====

Flash Point: NONE
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: WATER, CARBON DIOXIDE, DRY CHEMICAL, FOAM SAND/EARTH.
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED SCBA AND FULL
PROTECTIVE EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: NONE.

=====

Reactivity Data

=====

Stability: YES
Cond To Avoid (Stability): NONE.
Materials To Avoid: AVOID STRONG ACIDS.
Hazardous Decomp Products: MAY RELEASE CARBON DIOXIDE GAS ON BURNING.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT

=====

Health Hazard Data

=====

LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO

Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: PROLONGED EXPOSURE TO DUST MAY IRRITATE
MUCOUS MEMBRANES.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NOT RELEVANT
Signs/Symptoms Of Overexp: SEE HEALTH HAZARDS.
Used Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: EYES: FLUSH WITH PLENTY OF WATER FOR AT LEAST 15
MIN. SKIN: FLUSH WITH PLENTY OF WATER. INGEST: DRINK LARGE QTY OF WATER TO
DILUTE MATERIAL. GET MED ATTN FOR DISCOMFORT. INHAL: REMOVE TO FRESH AIR.
SUPPORT BRTHG (GIVE O*2/ARTF RESP) (FP N).

=====

Precautions for Safe Handling and Use

=====

Steps If Matl Released/Spill: MATERIAL FOAMS PROFUSELY, SHOVEL & RECOVER
AS MUCH AS POSSIBLE. RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETELY
BIODEGRADABLE.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: SMALL QTY MAY BE DISPOSED OF IN SEWER. LARGE QTY
SHOULD BE DISPOSED OF ACCORDING TO LOCAL, FEDERAL & STATE REQUIREMENTS FOR
NON-HAZARDOUS DETERGENT.
Precautions-Handling/Storing: SHOULD BE STORED IN A DRY AREA TO PREVENT
CAKING.
Other Precautions: NO SPECIAL REQUIREMENTS OTHER THAN THE GOOD INDUSTRIAL
HYGIENE & SAFETY PRACTICES EMPLOYED WITH ANY INDUSTRIAL CHEMICAL.

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Control Measures

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Respiratory Protection: NIOSH/MSHA APPROVED DUST MASK.
Ventilation: LOCAL EXHAUST: NORMAL.
Protective Gloves: IMPERVIOUS GLOVES (FP N).
Eye Protection: CHEMICAL WORKERS GOGGLES (FP N).
Other Protective Equipment: NOT REQUIRED.
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.

=====

Transportation Data

=====

Trans Data Review Date: 93053
DOT PSN Code: ZZZ
DOT Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
IMO PSN Code: ZZZ
IMO Proper Shipping Name: NOT REGULATED FOR THIS MODE OF TRANSPORTATION
IATA PSN Code: ZZZ
IATA Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
AFI PSN Code: ZZZ
AFI Prop. Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
Additional Trans Data: NOT REGULATED FOR TRANSPORTATION

=====

Disposal Data

=====

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Label Data

=====

Label Required: YES
Technical Review Date: 18SEP92
Label Date: 18SEP92
Label Status: G
Common Name: ALCONOX
Chronic Hazard: NO
Signal Word: CAUTION!
Acute Health Hazard-Slight: X
Contact Hazard-Slight: X
Reactive Hazard-None: X
Oxidizability Hazard-None: X
Special Hazard Precautions: ACUTE: PROLONGED EXPOSURE TO DUST MAY IRRITATE
MUCOUS MEMBRANES. CHRONIC: NONE SPECIFIED BY MANUFACTURER.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y

Label Name: ALCONOX INC
Label Street: 215 PARK AVE S
Label City: NEW YORK
Label State: NY
Label Zip Code: 10003
Label Country: US
Label Emergency Number: 212-473-1300

ARTESIA READY MIX CONCRETE -- PORTLAND CEMENT CONCRETE (READY MIXED CONCRETE)
MATERIAL SAFETY DATA SHEET
NSN: 561000N080167
Manufacturer's CAGE: ARTES
Part No. Indicator: A
rt Number/Trade Name: PORTLAND CEMENT CONCRETE (READY MIXED CONCRETE)

General Information

Company's Name: ARTESIA READY MIX CONCRETE INC
Company's Street: 1000 SOUTH 19TH AVE
Company's City: LEMOORE
Company's State: CA
Company's Country: US
Company's Emerg Ph #: 209-686-1596
Company's Info Ph #: 209-686-1596
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 01NOV96
Safety Data Review Date: 07NOV97
MSDS Serial Number: CFPXX

Ingredients/Identity Information

Proprietary: NO
Ingredient: PORTLAND CEMENT
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: VV8770000
CAS Number: 65997-15-1
OSHA PEL: 50 MPPCF
ACGIH TLV: 10 MG/M3 TDUST

Proprietary: NO
Ingredient: SAND
Ingredient Sequence Number: 02
NIOSH (RTECS) Number: 1005020SA
OSHA PEL: 0.05 MG/M3 RESP DUST
ACGIH TLV: 0.05 MG/M3 RESP DUST

Proprietary: NO
Ingredient: GRAVEL
Ingredient Sequence Number: 03
NIOSH (RTECS) Number: 1013976GL
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Proprietary: NO
Ingredient: SILICA, CRYSTALLINE - QUARTZ
Ingredient Sequence Number: 04
NIOSH (RTECS) Number: VV7330000
CAS Number: 14808-60-7
OSHA PEL: SEE TABLE Z-3
ACGIH TLV: 0.1 MG/M3 RDUST

Proprietary: NO
Ingredient: FLY ASH
Ingredient Sequence Number: 05
NIOSH (RTECS) Number: 1009659FA
CAS Number: 68131-74-8
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Proprietary: NO
Ingredient: WATER
Ingredient Sequence Number: 06
NIOSH (RTECS) Number: ZC0110000
CAS Number: 7732-18-5
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Proprietary: NO
Ingredient: HEAVY METALS
Ingredient Sequence Number: 07
Percent: TRACE
NIOSH (RTECS) Number: 1000104HM
OSHA PEL: N/K (FP N)
GIH TLV: N/K (FP N)

=====

Physical/Chemical Characteristics

=====

Appearance And Odor: WET MASS OF PORTLAND CEMENT & FINE & COARSE AGGREGATE
HAVING LITTLE/NO ODOR

=====

Fire and Explosion Hazard Data

=====

Extinguishing Media: USE MEDIA SUITABLE FOR SURROUNDING FIRE (FP N).
Special Fire Fighting Proc: WEAR NIOSH APPROVED SCBA & FULL PROTECTIVE
EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: PORTLAND CEMENT IS NON-COMBUSTIBLE AND NOT
EXPLOSIVE.

=====

Reactivity Data

=====

Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: PORTLAND CEMENT-AGGREGATE MIXES, WHEN MIXED W/WATER TO
PRDCE CONCRETE, FORM BINDER BASICALLY OF CALCIUM (SUP DAT)
Hazardous Decomp Products: CONCRETE WILL NOT DECOMPOSE IN HAZARDOUS BY-
PRODUCTS.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT.

=====

Health Hazard Data

=====

LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: ACUTE: WET PORTLAND CEMENT CONCRETE IN A
PLASTIC STATE CAN DRY THE SKIN AND CAUSE ALKALI IRRITATION.
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: SILICA, CRYSTALLINE-QUARTZ: IARC MONO, VOL
68, 1997: GROUP 1. NTP 7TH ANNUAL RPT ON CARCINS, 1994: ANTIC TO BE (SUP
DAT)
Signs/Symptoms Of Overexp: SEE HEALTH HAZARDS.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: SKIN: EXPOSED SKIN AREAS SHOULD BE WASHED WITH
SOAP AND WATER. EYES: IF CONCRETE PASTE GETS INTO THE EYES, THEY SHOULD BE
IRRIGATED IMMEDIATELY AND REPEATEDLY WITH CLEAN WATER FOR AT LEAST 15
MINUTES. INHALATION: REMOVE TO FRESH AIR. SUPPORT BREATHING (GIVE OXYGEN OR
ARTIFICIAL RESPIRATION) (FP N). INGESTION: CALL MD IMMEDIATELY (FP N).

=====

Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: NONE SPECIFIED BY MANUFACTURER.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND
FEDERAL REGULATIONS (FP N).
Precautions-Handling/Storing: NONE SPECIFIED BY MANUFACTURER.
Other Precautions: NONE SPECIFIED BY MANUFACTURER.

=====

Control Measures

=====

Respiratory Protection: USE NIOSH APPROVED RESPIRATOR APPROPRIATE FOR
EXPOSURE OF CONCERN (FP N).
Ventilation: NONE SPECIFIED BY MANUFACTURER.
Protective Gloves: IMPERVIOUS GLOVES (FP N).
Eye Protection: ANSI APPRVD CHEM WORKERS GOGGLES (FP N).
Other Protective Equipment: EMERGENCY EYEWASH AND DELUGE SHOWER MEETING
ANSI DESIGN CRITERIA (FP N). WEAR PROTECTIVE CLOTHING AND BOOTS.

Work Hygienic Practices: AFTER WORK IS COMPLETED, WORKER SHOULD SHOWER
WITH SOAP AND WATER.
Suppl. Safety & Health Data: MATLS TO AVOID: SILICATE HYDRATES WHICH ARE
LUNG.

=====

Transportation Data

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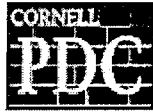
Disposal Data

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Label Data

=====

Label Required: YES
Technical Review Date: 07NOV97
Label Date: 07NOV97
Label Status: G
Common Name: READY MIXED CONCRETE
Chronic Hazard: YES
Signal Word: WARNING!
Acute Health Hazard-Slight: X
Contact Hazard-Moderate: X
Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: ACUTE: WET PORTLAND CEMENT CONCRETE IN A
PLASTIC STATE CAN DRY THE SKIN AND CAUSE ALKALI IRRITATION. CHRONIC: CANCER
HAZARD. CONTAINS SILICA, CRYSTALLINE-QUARTZ, WHICH IS LISTED AS A HUMAN
LUNG CARCINOGEN (FP N).
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: ARTESIA READY MIX CONCRETE INC
Label Street: 1000 SOUTH 19TH AVE
Label City: LEMOORE
Label State: CA
Label Country: US
Label Emergency Number: 209-686-1596



DOD Hazardous Material Information
DOD 6050.5-L
As of April 1997

This information prepared for Cornell University convenience only.

NO-LEADED GASOLINE

FSC: 9130

NIIN: 011352507

NSN: 9130011352507C

MANUFACTURERS CAGE: COLOR

PART NO INDICATOR: A

RT NUMBER TRADE NAME: NO-LEADED GASOLINE

Nuclear Water Data

NUCLEAR WATER FSC: GASO

NUCLEAR WATER NIIN: LINE, AUT

NUCLEAR WATER COG: OM

NUCLEAR WATER NOMENCLATURE: OTIVE

NUCLEAR WATER REMARKS: COLORADO R

Standard PMS Identification Data

SPIN FSC: EFIN

IN NIIN: ING COMPA

SPIN: NY

General Information

ITEM NAME: 5800 BRIGHTON BLVD

MANUFACTURERS NAME: COMMERCE CITY CO

 **MANUFACTURERS STREET: US80022 517-463-1164, CHEMTREC 800-4**

MANUFACTURERS P O BOX: 24-930

MANUFACTURERS CITY: 0303-295-4500

MANUFACTURERS STATE:

MANUFACTURERS COUNTRY:

MANUFACTURERS ZIP CODE:

MANUFACTURERS EMERG PH:

MANUFACTURERS INFO PH:

DISTRIBUTOR VENDOR 1:

DISTRIBUTOR VENDOR 1 CAGE:

DISTRIBUTOR VENDOR 2:

 **DISTRIBUTOR VENDOR 2 CAGE:**

DISTRIBUTOR VENDOR 3: D 001016SE 29JAN9130APR93KY M.N. MART

DISTRIBUTOR VENDOR 3 CAGE: IN

DISTRIBUTOR VENDOR 4:

DISTRIBUTOR VENDOR 4 CAGE:

SAFETY DATA ACTION CODE:

SAFETY FOCAL POINT:

RECORD NO FOR SAFETY ENTRY:

TOT SAFETY ENTRIES THIS STK:

STATUS:

DATE MSDS PREPARED:

 **SAFETY DATA REVIEW DATE:**

SUPPLY ITEM MANAGER:

MSDS PREPARERS NAME:

PREPARERS COMPANY:

PREPARERS ST OR P O BOX:

PREPARERS CITY: BQNGPVV-G-1690 LIMITED GD,

PREPARERS STATE: L

PREPARERS ZIP CODE: EADED F2

OTHER MSDS NUMBER:

MSDS SERIAL NUMBER: N/R

SPECIFICATION NUMBER: N/

SPEC TYPE GRADE CLASS: R SILVER, GREY

HAZARD CHARACTERISTIC CODE: OR C

UNIT OF ISSUE: LE

UNIT OF ISSUE CONTAINER QTY: AR LIQUID WIT

TYPE OF CONTAINER: H CHARACTERIS

NET UNIT WEIGHT: TIC GASOLIN

NRC STATE LICENSE NUMBER: E ODOR

NET EXPLOSIVE WEIGHT:

NET PROPELLANT WEIGHT AMMO: <100F

COAST GUARD AMMUNITION CODE: ,<3

Physical & Chemical Characteristics

APPEARANCE AND ODOR: 8C N/K 400-900MM 3-4 O.65-0.75 UNKNOWN <1 (ETHER=1)

BOILING POINT: INSOLU

MELTING POINT: BLE

VAPOR PRESSURE MM HG 70 F: 100

VAPOR DENSITY AIR 1:

SPECIFIC GRAVITY: N/R

DECOMPOSITION TEMPERATURE:

EVAPORATION RATE AND REF: UNKNOWN <-40

SOLUBILITY IN WATER: F,<-40C N/P 1.

PERCENT VOLATILES BY VOLUME: 3%

VISCOSITY: 6.0%

PH: USE

RADIOACTIVITY: CARBON DIOX

FORM RADIOACTIVE MATL: IDE, FOA

MAGNETISM MILLIGAUSS: M, OR

CORROSION RATE IPY: DRY CHE

AUTOIGNITION TEMPERATURE: MICAL.

Fire and Explosion Hazard Data

FLASH POINT: USE WATER FOG T

FLASH POINT METHOD: O COOL

LOWER EXPLOSIVE LIMIT: SRROUNDING

UPPER EXPLOSIVE LIMIT: CONTAINERS.

EXTINGUISHING MEDIA: WEAR FIRE FIGHTING PROTECTIVE EQUIPMENT AND A FULL FACED SELF
CONTAINED BREATHING APPARA

SPECIAL FIRE FIGHTING PROC: TUS. EVACUATE AREA. COOL FIRE EXPOSED CONTAINERS WITH
WATER SPRAY. CONTAINERS WILL EXPLODE IN FIRE. VAPORS HEAVIER THAN AIR AND MAY
TRAVEL A CONSIDERABLE D

UNUSUAL FIRE AND EXPL HAZRDS: ISTANCE TO SOURCE OF IGNITION AND FLASH BACK.
YESHIGH HEAT, OPEN FLAMES AND OTHER SOURCES OF IGNITION

Reactivity Data

STABILITY:

COND TO AVOID STABILITY: STRONG OXIDIZING AGENTS

MATERIALS TO AVOID: CARBON MONOXIDE, CARBON DIOXIDE AND OTHER HYDROCARBON
COMPOUNDS DURING COMBUSTION.

HAZARDOUS DECOMP PRODUCTS: NO NOT APPLICABLE

HAZARDOUS POLY OCCUR:

CONDITIONS TO AVOID POLY: ORAL LD50 (RAT) IS UNKNOWN YESYESYESACUTE-
INHALATION:IRRITATION OF UPPER RE

Health Hazard Data

LD50 LC50 MIXTURE: SPIRATORY TRACT, CENTRAL NERVOUS SYSTEM

ROUTE OF ENTRY INHALATION: DEP

ROUTE OF ENTRY SKIN: RES

ROUTE OF ENTRY INGESTION: SIO

HEALTH HAZ ACUTE AND CHRONIC: N. EYE:IRRITATION. SKIN: DEFATING, IRRITATION.
INGESTION:GI DISTURBANCES, CNS DEPRESSION. CHRONIC: DERMATITIS, PNEUMOTITIS,
POLYNEUROPATHY, PULMONARY EDEMA, AND KIDNEY DAMAGE. YES YES YES CONTAINS Benzene
[71-43-2] WHICH IS LISTED BY NTP AND IARC

CARCINOGENICITY NTP: AND REGUL

CARCINOGENICITY IARC: ATED BY OS

CARCINOGENICITY OSHA: HA AS A CA

EXPLANATION CARCINOGENICITY: RCINOGEN. COUGHING, DIFFICULTY IN BREATHING, NAUSEA,
VOMTING, FATIGUE, DIZZINESS, HEADACHES, UNCON

SIGNS SYMPTOMS OF OVEREXP: SCIOUSNESS, AND EYE IRRITATION, DRY SKIN. PERSONS WITH A
SKIN AND PULMONARY DISORDERS SHOULD USE CAUTION WHEN HANDLING OR USING TH

MED COND AGGRAVATED BY EXP: IS PRODUCT. SKIN: REMOVE CONTAMINATED CLOTHING.
WASH WITH SOAP AND WATER. GET MEDICAL ATTENTION IF I

EMERGENCY FIRST AID PROC: RRITATION PERSISTS. INHALATION:REMOVE TO FRESH AIR &
RESTORE BREATHING IF NECESSARY. GET MEDICAL ATTENTION. EYE:IMMEDIATELY FLUSH WITH
WATER FOR 15 MINUTES WHILE HOLDING EYELIDS OPEN. GET MEDICAL ATTENTION. INGESTION:
GET IMMEDIATE MEDICAL ATTENTION. DO NOT INDUCE VOMITING. NOTHING BY MOUTH IF
UNCONSCIOUS. REMOVE SOURCES OF IGNITION & WEAR PROTECTIVE EQUIPMENT. MINOR:
ABSORB MATERIAL WITH CLAY

Precautions for Safe Handling and Use

STEPS IF MATL RELEASED SPILL: , VERMICULITE, OR SIMILAR ABSORBENT MATERIAL. PLACE IN
DISPOSAL CONTAINERS. MAJOR: DIKE & CONTAIN SPILL. SHUT OFF LEAKS. REMOVE LIQUID BY
VACUUM OR ABSORBENT. NOT APPLICABLE WASTE MA

NEUTRALIZING AGENT: Y BE BURNED IN AN APPROVED INCINERATOR OR DISPOSED OF IN
ACCORDANCE WITH ALL APP

WASTE DISPOSAL METHOD: LICABLE LOCAL, STATE AND FEDERAL LAWS AND REGULATIONS. STORE IN A COOL, VENTILATED WORK AREA. KEEP CONTAINERS CLOSED WHEN NOT IN USE. FLAMMABLE

 **PRECAUTIONS HANDLING STORING:** LIQUID; EMPTY CONTAINERS CAN BE HAZARDOUS. THE SELECTION OF PERSONAL PROTECTIVE EQUIPMENT SHOULD BE MADE BY THE MATERIAL USER BASED

OTHER PRECAUTIONS: ON THE PARTICULAR CONDITIONS WHERE THE MATERIAL IS TO BE USED TOGETHER WITH INFORMATION CONTAINED IN THIS MSDS. USE NIOSH APPROVED RESPIRATOR. AIR-SUPPLIED OR FILTERING TYPE WITH ORGANIC VAPOR CARTRID

Control Measures

RESPIRATORY PROTECTION: GES ARE RECOMMENDED. LOCAL AND MECHANICAL EXHAUST RECOMMENDED. AVOID OPEN ELECTRICAL SOURCES NEAR PRODUCT VAP

VENTILATION: OR AREAS. NEOPRENE, NITRILE, OR POLYVINYL ALCOHOL USE CHEMICAL SAFETY GOGGLES & FACESHIELD EYE WASH

PROTECTIVE GLOVES: STATION & SAFETY SHOWER.

EYE PROTECTION:

 **OTHER PROTECTIVE EQUIPMENT:** DO NOT TAKE INTERNALLY. AVOID SKIN CONTACT. WASH IN AFTER USING PRODUCT. DO NOT EAT, D

WORK HYGIENIC PRACTICES: RINK OR SMOKE IN WORK AREA. NONE

SUPPL SAFETY HEALTH DATA:

Transportation Data

TRANSPORTATION ACTION CODE:

TRANSPORTATION FOCAL POINT:

TRANS DATA REVIEW DATE:

DOT PSN CODE:

DOT SYMBOL:

DOT PROPER SHIPPING NAME:

 **DOT CLASS:**

DOT ID NUMBER:

DOT PACK GROUP:

DOT LABEL:

DOT DOD EXEMPTION NUMBER:

 **O PSN CODE:**

IMO PROPER SHIPPING NAME:

IMO REG PAGE NUMBER:

IMO UN NUMBER:

IMO UN CLASS:

IMO SUBSID RISK LABEL:

IATA PSN CODE:

IATA UN ID NUMBER:

IATA PROPER SHIP NAME:

IATA UN CLASS:

IATA SUBSID RISK CLASS:

 **TA LABEL:**

AFI PSN CODE:

AFI SYMBOLS:

AFI PROP SHIPPING NAME:

AFI CLASS:

AFI ID NUMBER:

AFI PACK GROUP:

AFI LABEL:

AFI SPECIAL PROV:

AFI BASIC PAC REF:

MMAC CODE:

 **S SHIPPING NAME:**

ADDITIONAL TRANS DATA:

Disposal Data

DISPOSAL DATA ACTION CODE:

DISPOSAL DATA FOCAL POINT:

DISPOSAL DATA REVIEW DATE:

RECNUM FOR THIS DISP ENTR:

TOT DISP ENTRIES PER NSN:

LANDFILL BAN ITEM:

DISPOSAL SUPPLEMENTAL DAT:

EPAHAZWST 1ST CODE NEW:

EPAHAZWST 1ST NAME NEW:

EPAHAZWST 1ST CHAR NEW:

EPAACUTEHAZARD 1ST NEW:

EPAHAZWST 2ND CODE NEW:

EPAHAZWST 2ND NAME NEW:

EPAHAZWST 2ND CHAR NEW:

EPAACUTEHAZARD 2ND NEW:

EPAHAZWST 3RD CODE NEW:

EPAHAZWST 3RD NAME NEW: YES G NO-LEADED GASOLINE

EPAHAZWST 3RD CHAR NEW:

EPAACUTE 3RD HAZARD NEW:

Label Data

LABEL REQUIRED:

TECHNICAL REVIEW DATE: N/P

LABEL DATE:

MFR NUMBER:

LABEL STATUS: A

COMMON NAME: CUTE-INHALATION:IRRITATION OF UPPER RESPIRATORY TRACT, CENTR

CHRONIC HAZARD: AL

 **GNAL WORD:** NERVOUS

ACUTE HEALTH HAZARD NONE: S

ACUTE HEALTH HAZARD SLIGHT: Y

ACUTE HEALTH HAZARD MODERATE: S

ACUTE HEALTH HAZARD SEVERE: T

CONTACT HAZARD NONE: E

CONTACT HAZARD SLIGHT: M

CONTACT HAZARD MODERATE:

CONTACT HAZARD SEVERE: D

FIRE HAZARD NONE: E

FIRE HAZARD SLIGHT: P

 **RE HAZARD MODERATE:** R

FIRE HAZARD SEVERE: E

REACTIVITY HAZARD NONE: S

REACTIVITY HAZARD SLIGHT: S

REACTIVITY HAZARD MODERATE: I

REACTIVITY HAZARD SEVERE: O

SPECIAL HAZARD PRECAUTIONS: N. EYE:IRRITATION. SKIN: DEFATING, IRRITATION. INGESTION:GI DISTURBANCES, CNS DEPRESSION. CHRONIC: DERMATITIS, PNEUMOTITIS, POLYNEUROPATHY, PULMONARY EDEMA, AND KIDNEY DAMAGE. COUGHING, DIFFICULTY IN BREATHING, NAUSEA, VOMTING, FATIGUE, DIZZINESS, HEADACHES, UNCONSCIOUSNESS, AND EYE IRRITATION, DRY SKIN. COLORADO REFINING COMPANY 5800 BRIGHTON BLVD

PROTECT EYE:

PROTECT SKIN:

 **OTECT RESPIRATORY:**

LABEL NAME: COMMERCE CITY CO

LABEL STREET: 80022 US517-463-1164, CHEMTREC 800-4

LABEL P O BOX: 24-930

LABEL CITY: 0

 **BEL STATE:**

LABEL ZIP CODE:

LABEL COUNTRY:

LABEL EMERGENCY NUMBER:

YEAR PROCURED:

FIRE HAZARD SEVERE: E

REACTIVITY HAZARD NONE: S

REACTIVITY HAZARD SLIGHT: S

REACTIVITY HAZARD MODERATE: I

REACTIVITY HAZARD SEVERE: O

SPECIAL HAZARD PRECAUTIONS: N. EYE:IRRITATION. SKIN: DEFATING, IRRITATION.
GESTION:GI DISTURBANCES, CNS DEPRESSION. CHRONIC: DERMATITIS, PNEUMOTITIS,
 LYNEUROPATHY, PULMONARY EDEMA, AND KIDNEY DAMAGE. COUGHING, DIFFICULTY IN
BREATHING, NAUSEA, VOMTING, FATIGUE, DIZZINESS, HEADACHES, UNCONSCIOUSNESS, AND EYE
IRRITATION, DRY SKIN. COLORADO REFINING COMPANY 5800 BRIGHTON BLVD

PROTECT EYE:

PROTECT SKIN:

PROTECT RESPIRATORY:

LABEL NAME: COMMERCE CITY CO

LABEL STREET: 80022 US517-463-1164, CHEMTREC 800-4

LABEL P O BOX: 24-930

LABEL CITY: 0

LABEL STATE:

LABEL ZIP CODE:

 **BEL COUNTRY:**

LABEL EMERGENCY NUMBER:

YEAR PROCURED:

GOJO INDUSTRIES -- 0940 GOJO NATURAL ORANGE LOTION HAND CLEANER
MATERIAL SAFETY DATA SHEET
NSN: 685000F048618
Manufacturer's CAGE: 02905
Part No. Indicator: A
Part Number/Trade Name: 0940 GOJO NATURAL ORANGE LOTION HAND CLEANER

General Information

Company's Name: GOJO INDUSTRIES INC
Company's Street: 144 CUYAHOGA STREET
Company's P. O. Box: 991
Company's City: AKRON
Company's State: OH
Company's Country: US
Company's Zip Code: 44309-0991
Company's Emerg Ph #: 800-321-9647 EXT 242
Company's Info Ph #: 216-920-8100 EXT 352
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SE
Date MSDS Prepared: 13OCT92
Safety Data Review Date: 24JUN96
MSDS Preparer's Name: DONALD H SINER
Preparer's Company: GOJO INDUSTRIES INC
Preparer's St Or P. O. Box: 144 CUYAHOGA STREET
Preparer's City: AKRON
Preparer's State: OH
Preparer's Zip Code: 44309-0991
MSDS Serial Number: BZFSC

Ingredients/Identity Information

Proprietary: NO
Ingredient: -1-METHYL-4-(1-METHYLETHENYL)CYCLOHEXENE, CARVENE, CINENE, D-
LIMONENE (ANIMAL LIMITED EVIDENCE, NTP & IARC GROUP 3) *96-2*
Ingredient Sequence Number: 01
Percent: 7-15
NIOSH (RTECS) Number: GW6360000
CAS Number: 5989-27-5

Proprietary: NO
Ingredient: C12-18 ALKYL ALCOHOL ETHOXYLATE PROPOXYLATE
Ingredient Sequence Number: 02
Percent: 5-10
NIOSH (RTECS) Number: 1004311AF
CAS Number: 69227-21-0

Physical/Chemical Characteristics

Appearance And Odor: CREAMY OPAQUE VISCOUS GEL W/ORANGE FRAGRANCE
Boiling Point: 201F
Vapor Pressure (MM Hg/70 F): 15
Vapor Density (Air=1): 0.6
Specific Gravity: 1.02
Evaporation Rate And Ref: (WATER=1): 0.7
Solubility In Water: 80%
pH: (SUPP)

Fire and Explosion Hazard Data

Flash Point: >200F
Flash Point Method: PMCC
Extinguishing Media: WATER FOG, ALCOHOL FOAM, CO2, DRY CHEMICAL

Reactivity Data

Stability: YES
Hazardous Poly Occur: NO

Health Hazard Data

=====
Route Of Entry - Inhalation: NO
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: EYES: DIRECT CONTACT MAY CAUSE IRRITATION.
INGESTION: MAY CAUSE GASTRIC UPSET. SKIN: PROLONGED/REPEATED OVEREXPOSURE
Y CAUSE IRRITATION.

Carcinogenicity - NTP: YES
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: SEE INGREDIENTS.
Signs/Symptoms Of Overexp: IRRITATION, GASTRIC UPSET
Emergency/First Aid Proc: EYES: DON'T RUB. FLUSH THOROUGHLY W/WATER FOR 15
MINS. INGESTION: DRINK PLENTY OF MILK/WATER. OBTAIN MEDICAL ATTENTION IN
ALL CASES.

=====
Precautions for Safe Handling and Use
=====

Steps If Matl Released/Spill: CLEAN UP W/ABSORBENT MATERIAL. CONTAIN &
PICK UP WASTE MATERIALS. PUT IN A SEALED APPROVED CONTAINER. FLUSH AREA W/
WATER TO REDUCE SLIPPING HAZARDS.
Waste Disposal Method: DISPOSE OF IN ACCORDANCE W/LOCAL, STATE & FEDERAL
REGULATIONS.
Precautions-Handling/Storing: KEEP FROM FREEZING. AVOID EXCESSIVE HEAT.
KEEP OUT OF REACH OF CHILDREN.
Other Precautions: KEEP OUT OF EYES. DON'T TAKE INTERNALLY.

=====
Control Measures
=====

Respiratory Protection: NOT REQUIRED WHEN USED AS DIRECTED.
Protective Gloves: NOT REQUIRED WHEN USED AS DIRECTED.
Eye Protection: NOT REQUIRED WHEN USED AS DIRECTED.
Other Protective Equipment: NOT REQUIRED WHEN USED AS DIRECTED.

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Transportation Data
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Disposal Data
=====

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Label Data
=====

Label Required: YES
Label Status: G
Common Name: 0940 GOJO NATURAL ORANGE LOTION HAND CLEANER
Special Hazard Precautions: EYES: DIRECT CONTACT MAY CAUSE IRRITATION.
INGESTION: MAY CAUSE GASTRIC UPSET. SKIN: PROLONGED/REPEATED OVEREXPOSURE
MAY CAUSE IRRITATION. IRRITATION, GASTRIC UPSET
Label Name: GOJO INDUSTRIES INC
Label Street: 144 CUYAHOGA STREET
Label P.O. Box: 991
Label City: AKRON
Label State: OH
Label Zip Code: 44309-0991
Label Country: US
Label Emergency Number: 800-321-9647 EXT 242

HACH -- 14812 HYDROCHLORIC ACID STANDARD SOLUTION 0.10N
MATERIAL SAFETY DATA SHEET
NSN: 681000F025684
Manufacturer's CAGE: 4T252
Part No. Indicator: A
rt Number/Trade Name: 14812 HYDROCHLORIC ACID STANDARD SOLUTION 0.10N

General Information

Company's Name: HACH COMPANY
Company's Street: 100 DAYTON AVENUE
Company's P. O. Box: 907
Company's City: AMES
Company's State: IA
Company's Country: US
Company's Zip Code: 50010
Company's Emerg Ph #: 515-232-2533
Company's Info Ph #: 800-227-4224
Distributor/Vendor # 1: C C SCIENTIFIC PRODUCTS INC
Distributor/Vendor # 1 Cage: 5Z552
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SE
Date MSDS Prepared: 20APR90
Safety Data Review Date: 09DEC92
Preparer's Company: HACH COMPANY
Preparer's St Or P. O. Box: 100 DAYTON AVENUE
Preparer's City: AMES
Preparer's State: IA
Preparer's Zip Code: 50010
MSDS Serial Number: BPSNL

Ingredients/Identity Information

Proprietary: NO
Ingredient: HYDROCHLORIC ACID, HYDROGEN CHLORIDE, MURIATIC ACID
Ingredient Sequence Number: 01
Percent: <1%
NIOSH (RTECS) Number: MW4025000
CAS Number: 7647-01-0
OSHA PEL: 5 PPM
ACGIH TLV: C 11 MG/CUM
Other Recommended Limit: 7 PPM

Proprietary: NO
Ingredient: WATER
Ingredient Sequence Number: 02
Percent: BALANCE
NIOSH (RTECS) Number: ZC0110000
CAS Number: 7732-18-5

Physical/Chemical Characteristics

Appearance And Odor: CLEAR, COLORLESS LIQUID, SLIGHT ODOR.
Boiling Point: 100C
Specific Gravity: 0.994
pH: 1.1
Corrosion Rate (IPY): SEE SUPP

Fire and Explosion Hazard Data

Extinguishing Media: SAND
Unusual Fire And Expl Hazrds: CORROSIVE MATERIAL.

Reactivity Data

Stability: YES
Materials To Avoid: STRONG BASES
Hazardous Poly Occur: NO

Health Hazard Data

=====
Route Of Entry - Inhalation: NO
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: SKIN/EYES: IRRITATION & SLIGHTLY TOXIC.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NONE
Signs/Symptoms Of Overexp: SKIN/EYES: IRRITATION.
Emergency/First Aid Proc: EYES: IMMEDIATELY WASH W/WATER FOR 15 MINS.
SKIN: WASH W/SOAP & WATER. INGESTION: GIVE LARGE QUANTITIES OF WATER OR
MILK. OBTAIN MEDICAL ATTENTION IN ALL CASES.
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Precautions for Safe Handling and Use
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Steps If Matl Released/Spill: COVER CONTAMINATED SURFACE W/SODIUM
BICARBONATE/SODA ASH-SLAKED LIME MIXTURE (50-50). MIX/ADD WATER IF
NECESSARY TO FORM SLURRY. SCOOP UP SLURRY/WASH THE SITE W/SODA ASH
SOLUTION.
Waste Disposal Method: THE NEUTRALIZED SLURRY MAY CONTAIN SUFFICIENT HEAVY
METAL CONCENTRATION TO REQUIRE LANDFILLING OR TREATMENT AT AN EPA APPROVED
SITE. DISPOSE OF IN ACCORDANCE W/LOCAL, STATE, & FEDERAL REGULATIONS.
CORROSIVE MATERIAL. UN1789.
Precautions-Handling/Storing: STORE IN A COOL, DRY PLACE SEPARATE FROM
ACIDS & ALKALIES. AVOID CONTACT W/SKIN, EYES, & CLOTHING. DON'T BREATHE
CHEMICALS.
=====

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Control Measures
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Ventilation: ADEQUATE
Protective Gloves: DISPOSABLE
Eye Protection: SAFETY GLASSES
Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING.
Suppl. Safety & Health Data: CORROSION RATE: ALUMINUM: 0.2195 IN/YR;
EEL: CORROSIVE.
=====

=====
Transportation Data
=====

=====
Disposal Data
=====

=====
Label Data
=====

Label Required: YES
Technical Review Date: 09DEC92
Label Date: 19NOV92
Label Status: F
Common Name: 14812 HYDROCHLORIC ACID STANDARD SOLUTION 0.10N
Chronic Hazard: NO
Signal Word: CAUTION!
Acute Health Hazard-None: X
Contact Hazard-Slight: X
Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: SKIN/EYES: IRRITATION & SLIGHTLY TOXIC. TARGET
ORGANS: LIVER, KIDNEY, CENTRAL NERVOUS SYSTEM, & LUNGS.
Protect Eye: Y
Protect Skin: Y
Label Name: HACH COMPANY
Label Street: 100 DAYTON AVENUE
Label P.O. Box: 907
Label City: AMES
Label State: IA
Label Zip Code: 50010
Label Country: US
Label Emergency Number: 515-232-2533
Year Procured: UNK

SCOTT SPECIALTY GASES -- ISOBUTYLENE IN AIR - CALIBRATION GAS CYL
MATERIAL SAFETY DATA SHEET
NSN: 6665012148247
Manufacturer's CAGE: 51847
Part No. Indicator: A
Part Number/Trade Name: ISOBUTYLENE IN AIR

=====

General Information

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Item Name: CALIBRATION GAS CYL
Company's Name: SCOTT SPECIALTY GASES
Company's Street: ROUTE 611 NORTH
Company's City: PLUMSTEADVILLE
Company's State: PA
Company's Country: US
Company's Zip Code: 18949
Company's Emerg Ph #: 215-766-8861; 908-754-7700
Company's Info Ph #: 215-766-8861
Record No. For Safety Entry: 003
Tot Safety Entries This Stk#: 005
Status: SMJ
Date MSDS Prepared: 23APR92
Safety Data Review Date: 27SEP94
MSDS Serial Number: BVRGC
Hazard Characteristic Code: G3

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Ingredients/Identity Information

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Proprietary: NO
Ingredient: PROPENE, 2-METHYL-; (ISOBUTYLENE)
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: UD0890000
CAS Number: 115-11-7
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

=====

Proprietary: NO
Ingredient: AIR, REFRIGERATED LIQUID; AIR COMPRESSED (UN1002, DOT); AIR
REFRIGERATED LIQUID (CRYOGENIC LIQUID) (UN1003) (DOT)
Ingredient Sequence Number: 02
NIOSH (RTECS) Number: AX5271000
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

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Physical/Chemical Characteristics

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Appearance And Odor: COLORLESS GAS W/POSSIBLE SLIGHT OLEFINIC ODOR.
Boiling Point: -318F, -194C
Vapor Pressure (MM Hg/70 F): N/A
Vapor Density (Air=1): 1.2
Specific Gravity: 0.88 (H*20=1)
Evaporation Rate And Ref: NOT APPLICABLE
Solubility In Water: INSOLUBLE
Percent Volatiles By Volume: 100

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Fire and Explosion Hazard Data

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Flash Point: NONFLAMMABLE
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: USE WHAT IS APPROPRIATE FOR SURROUNDING FIRE.
Special Fire Fighting Proc: USE NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE
EQUIPMENT (FP N). USE WATER SPRAY TO KEEP FIRE EXPOSED CYLINDERS COOL.
Special Fire And Expl Hazrds: COMPRESSED AIR AT HIGH PRESSURES WILL
ACCELERATE THE BURNING OF FLAMMABLE MATERIALS.

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Reactivity Data

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Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: NONE.

Hazardous Decomp Products: NONE.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT

Health Hazard Data

50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: ACUTE:CONCENTRATION OF ISOBUTYLENE IS THIS MIXTURE SHOULD NOT PRESENT ANY SYMPTOMS OF TOXICITY. CHRONIC:NONE.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NOT RELEVANT
Signs/Symptoms Of Overexp: NONE SPECIFIED BY MANUFACTURER.
Med Cond Aggravated By Exp: NONE.
IMMEDIATELY FLUSH W/POTABLE WATER FOR A MINIMUM OF 15 MINUTES, SEEK ASSISTANCE FROM MD (FP N). SKIN:FLUSH W/COPIOUS AMOUNTS OF WATER. CALL MD (FP N). INHAL:IMMEDIATELY REMOVE VICTIM TO FRESH AIR. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUATE & VENTILATE AREA. REMOVE LEAKING CYLINDER TO EXHAUST HOOD OR SAFE OUTDOORS AREA IF THIS CAN BE DONE SAFELY.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: DISPOSAL MUST BE I/A/W FEDERAL, STATE & LOCAL REGULATIONS (FP N). RETURN CYLS TO SUPPLIER FOR PROPER DISP W/ANY VALVE OUTLET PLUGS/CAPS SECURED & VALVE PROT CAP IN PLACE. ALLOW GAS TO DISCHARGE AT SLOW RATE TO ATM IN UNCONFINED AREA/EXHST HOOD.
Precautions-Handling/Storing: STORE IN WELL VENTILATED AREAS ONLY. KEEP VALVE PROT CAP ON CYLS WHEN NOT IN USE & SECURE CYL WHEN USING TO PROT FROM COLLING.
Other Precautions: USE SUITABLE HAND TRUCK TO MOVE CYLS. PROT CYLS FROM PHYSICAL DMG. DO NOT DEFACE CYLS/LBLS. MOVE CYL W/ADEQ HAND TRUCK. CYL SHOULD BE REFILLED BY QUALIFIED PRODUCERS OF COMPRESSED GAS. SHIPMENT OF COMPRESSED GAS CYL WHICH HAS NOT (SUPDAT)

Control Measures

Respiratory Protection: USE NIOSH/MSHA APPROVED SCBA IN CASE OF EMERGENCY OR NON-ROUTINE USE.
Ventilation: PROVIDE ADEQUATE GENERAL & LOCAL EXHAUST VENTILATION.
Protective Gloves: RUBBER GLOVES.
Eye Protection: ANSI APPROVED CHEM WORKERS GOGGS (FP N).
Other Protective Equipment: WEAR SAFETY SHOES. A SAFETY SHOWER & EYEWASH STATION SHOULD BE READILY AVAILABLE.
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: OTHER PREC:BEEN FILLED BY OWNER OR WITH HIS WRITTEN CONSENT IS A VIOLATION OF FEDERAL LAW (49 CFR).

Transportation Data

Trans Data Review Date: 94269

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 27SEP94
Label Date: 26SEP94
Label Status: G
Common Name: ISOBUTYLENE IN AIR
Chronic Hazard: NO
Signal Word: NONE
Acute Health Hazard-None: X
Contact Hazard-None: X

Fire Hazard-None: X

Reactivity Hazard-None: X

Special Hazard Precautions: ACUTE:CONCENTRATION OF ISOBUTYLENE IS THIS MIXTURE SHOULD NOT PRESENT ANY SYMPTOMS OF TOXICITY. CHRONIC:NONE LISTED BY MANUFACTURER.

Protect Eye: Y

Protect Skin: Y

Protect Respiratory: Y

Label Name: SCOTT SPECIALTY GASES

Label Street: ROUTE 611 NORTH

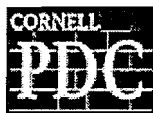
Label City: PLUMSTEADVILLE

Label State: PA

Label Zip Code: 18949

Label Country: US

Label Emergency Number: 215-766-8861; 908-754-7700



DOD Hazardous Material Information
DOD 6050.5-L
As of April 1997

This information prepared for Cornell University convenience only.

METHANOL REAGENT ACS

FSC: 6810

NIIN: 006878056

NSN: 68100068780566

MANUFACTURERS CAGE: 63415

PART NO INDICATOR: A

RT NUMBER TRADE NAME: METHANOL REAGENT ACS

Nuclear Water Data

NUCLEAR WATER FSC: METH

NUCLEAR WATER NIIN: ANOL, ACS

NUCLEAR WATER COG:

NUCLEAR WATER NOMENCLATURE:

NUCLEAR WATER REMARKS: SPECTRUM C

Standard PMS Identification Data

SPIN FSC: HEMI

SPIN NIIN: CAL MFG C

SPIN: ORP.

General Information

ITEM NAME: 14422 SOUTH SAN PEDRO STREET

MANUFACTURERS NAME: GARDENA CA

 **MANUFACTURERS STREET:** US90248-2027800-424-9300

MANUFACTURERS P O BOX:

MANUFACTURERS CITY: 213-516-8000 CHEM

MANUFACTURERS STATE: IC

MANUFACTURERS COUNTRY: AL

MANUFACTURERS ZIP CODE: COMMODITI

MANUFACTURERS EMERG PH: ES AGENCY 60777

MANUFACTURERS INFO PH:

DISTRIBUTOR VENDOR 1:

DISTRIBUTOR VENDOR 1 CAGE:

DISTRIBUTOR VENDOR 2:

 **DISTRIBUTOR VENDOR 2 CAGE:**

DISTRIBUTOR VENDOR 3: D 007011SE 01JUN9104DEC92CX C.A.EISEN

DISTRIBUTOR VENDOR 3 CAGE: HARD

DISTRIBUTOR VENDOR 4:

DISTRIBUTOR VENDOR 4 CAGE:

SAFETY DATA ACTION CODE:

SAFETY FOCAL POINT:

RECORD NO FOR SAFETY ENTRY:

TOT SAFETY ENTRIES THIS STK:

STATUS:

DATE MSDS PREPARED:

 **SAFETY DATA REVIEW DATE:**

SUPPLY ITEM MANAGER:

MSDS PREPARERS NAME:

PREPARERS COMPANY:

PREPARERS ST OR P O BOX:

PREPARERS CITY: BPKWR0-C-265

PREPARERS STATE:

PREPARERS ZIP CODE: F3

OTHER MSDS NUMBER: GL1.0 GAL. CAN

MSDS SERIAL NUMBER:

SPECIFICATION NUMBER: N/R

SPEC TYPE GRADE CLASS: N/R CLEAR COLOR L

HAZARD CHARACTERISTIC CODE: ESS L

UNIT OF ISSUE: IQ

UNIT OF ISSUE CONTAINER QTY: UID WITH A CH

TYPE OF CONTAINER: CHARACTERISTIC

NET UNIT WEIGHT: ALCOHOLIC O

NRC STATE LICENSE NUMBER: DOR.

NET EXPLOSIVE WEIGHT:

NET PROPELLANT WEIGHT AMMO: 149F,

COAST GUARD AMMUNITION CODE: 65C

Physical & Chemical Characteristics

APPEARANCE AND ODOR: -137F, -94C 97.25 1.11 0.79 4.6 (BUTYL ACETATE=1

BOILING POINT:) COMPLE

MELTING POINT: TE

VAPOR PRESSURE MM HG 70 F: N/R

VAPOR DENSITY AIR 1:

SPECIFIC GRAVITY: N/R

DECOMPOSITION TEMPERATURE:

EVAPORATION RATE AND REF: N/P 52.0

SOLUBILITY IN WATER: F,11.1C N/P 6

PERCENT VOLATILES BY VOLUME:

VISCOSITY: 36.0

PH: CAR

RADIOACTIVITY: BON DIOXIDE,

FORM RADIOACTIVE MATL: ALCOHOL

MAGNETISM MILLIGAUSS: FOAM

CORROSION RATE IPY: , DRY CH

AUTOIGNITION TEMPERATURE: EMICAL

Fire and Explosion Hazard Data

FLASH POINT: , HALON OR WATER

FLASH POINT METHOD: SPRAY

LOWER EXPLOSIVE LIMIT: .

UPPER EXPLOSIVE LIMIT:

EXTINGUISHING MEDIA: MOVE CONTAINERS FROM FIRE AREA IF POSSIBLE. DIKE FIRE CONTROL WATER FOR LATER DISPOSAL.

SPECIAL FIRE FIGHTING PROC: DO NOT SCATTER THIS MATERIAL. WITHDRAW IF RISING SOUND FROM VENTING. EXTINGUISH ONLY IF FLOW CAN BE STOPPED; USE WATER IN FLOODING AMOUNTS AS FOG, SOLID STREAM

UNUSUAL FIRE AND EXPL HAZARDS: AMS MAY NOT BE EFFECTIVE. APPLY FROM AS FAR A DISTANCE AS POSSIBLE. YES HIGH TEMPERATURES, SPARKS, AND OPEN FLAMES

Reactivity Data

STABILITY:

CONDITIONS TO AVOID STABILITY: ACETYL BROMIDE, ALKYLALUMINUM, ALUMINUM, LEAD
PERCHLORATE, MAGNESIUM, SULFURIC ACID, ZINC

MATERIALS TO AVOID: C. TOXIC OXIDES OF CARBON.

HAZARDOUS DECOMP PRODUCTS: NONE SPECIFIED BY MANUFACTURER.

HAZARDOUS POLY OCCUR:

CONDITIONS TO AVOID POLY: NONE SPECIFIED BY MANUFACTURER. YESYESYESINHALATION:
75,000 PPM DANGEROUS TO LIFE

Health Hazard Data

LD50 LC50 MIXTURE: E AND HEALTH. INGESTION: HEADACHE, TINNI

ROUTE OF ENTRY INHALATION: TUS

ROUTE OF ENTRY SKIN: , A

ROUTE OF ENTRY INGESTION: NOR

HEALTH HAZ ACUTE AND CHRONIC: EXIA, NARCOSIS, APATHY, DIMMED VISION, SHALLOW RESPIRATION, CEREBRAL AND PULMONARY EDEMA, LIVER AND KIDNEY DAMAGE, DEATH DUE TO RESPIRATORY FAILURE OR CIRCULATORY COLLAPSE. SKIN: LETHAL AMOUNTS MAY BE ABSORBED THROUGH INTACT SKIN. NO NO NO NONE SPECIFIED BY MANUFACTURER.

CARCINOGENICITY NTP:

CARCINOGENICITY IARC:

CARCINOGENICITY OSHA:

EXPLANATION CARCINOGENICITY: DEFATTING OF SKIN RESULTING IN ECZEMATOID DERMATITIS. EYE: IRRITATION, CORNEAL OPACITY.

SIGNS SYMPTOMS OF OVEREXP: INGESTION: SAME SYMPTOMS AS INHALATION LISTED IN HEALTH HAZARDS. PERSONS WITH CHRONIC RESPIRATORY, LIVER, KIDNEY, EYE, OR SKIN DISEASES.

MED COND AGGRAVATED BY EXP: INHALATION: REMOVE SUBJECT TO FRESH AIR. MAINTAIN BREATHING. GET MEDICAL HELP. EYE: FLUS

EMERGENCY FIRST AID PROC: H WITH COPIUS AMOUNTS OF WATER FOR 15 MINUTES. GET MEDICAL ATTENTION. SKIN: WASH WITH SOAP AND WATER. CALL A PHYSICIAN. INGESTION: IF INGESTION IS DISCOVERED WITHIN 2 HOURS, GIVE SYRUP OF IPECAC. LAVAGE THOROUGHLY WITH 2-4 GLASSES OF TAP WATER WITH SODIUM BICARBONATE (20G/LITER) ADDED. GET MEDICAL ATTENTION. SHUT OFF IGNITION SOURCES. USE WATER SPRAY TO REDUCE VAPORS. TAKE UP WITH SAND OR OTHER

Precautions for Safe Handling and Use

EPS IF MATL RELEASED SPILL: ABSORBENT MATERIAL AND PLACE INTO CONTAINER FOR LATER DISPOSAL. NO SMOKING, FLAMES, FLARES IN HAZARD AREA. SOIL SPILLS: DIG A PIT FOR CONTAINMENT. NONE SPECIFIED BY MANUFACTURER. DISPOSE

NEUTRALIZING AGENT: OF IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL LAWS AND REGULATIO

WASTE DISPOSAL METHOD: NS. NOTE: EMPTY CONTAINERS CAN HAVE RESIDUES. EPA HAZARDOUS WASTE # U154 STORE IN ACCORDANCE WITH 29 CFR 1910.106. STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

PRECAUTIONS HANDLING STORING: AVOID CONTACT WITH HEAT, SPARK, FLAMES OR OTHER IGNITION SOURCES. VAPORS MAY BE EXPLOSIVE

OTHER PRECAUTIONS: E. MATERIAL IS POISONOUS. AVOID INHALATION OF VAPORS OR CONTACT WITH SKIN. DO NOT ALLOW MATERIAL TO CONTAMINATE WATER SOURCES. BASED UPON CONTAMINATION LEVELS IN THE WORK PLACE.

Control Measures

RESPIRATORY PROTECTION: LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION.

VENTILATION: IMPERVIOUS SPLASH-PROOF CHEMICAL SAFETY GOGGLES EYE WASH

PROTECTIVE GLOVES: FOUNTAIN, QUICK DRENCH SHOWER.

EYE PROTECTION:

OTHER PROTECTIVE EQUIPMENT: WASH THOROUGHLY AFTER HANDLING AND BEFORE EATING. LAUNDRY CONTAMINATED CLOTHING BEFORE RE

WORK HYGIENIC PRACTICES: USE.

SUPPL SAFETY HEALTH DATA: D 92339JEZ METHANOL, OR METHYL ALCOHOL

Transportation Data

TRANSPORTATION ACTION CODE:

TRANSPORTATION FOCAL POINT:

TRANS DATA REVIEW DATE:

DOT PSN CODE:

DOT SYMBOL:

DOT PROPER SHIPPING NAME: 3 UN1230 II FLAMMABLE LIQUID, POISON N/R JQR METHYL ALC

DOT CLASS: OHOL

DOT ID NUMBER:

DOT PACK GROUP:

DOT LABEL:

DOT DOD EXEMPTION NUMBER:

IMO PSN CODE:

IMO PROPER SHIPPING NAME: SEE 3251 12303.2 TOXIC QHQ 1230METHANOL

IMO REG PAGE NUMBER:

IMO UN NUMBER:

IMO UN CLASS:

IMO SUBSID RISK LABEL:

IATA PSN CODE:

IATA UN ID NUMBER:

IATA PROPER SHIP NAME: 3 6.1 FLAMMABLE LIQUID * QHQ METHANOL OR METHYL ALCOHOL

IATA UN CLASS:

IATA SUBSID RISK CLASS:

IATA LABEL:

AFI PSN CODE:

AFI SYMBOLS:

AFI PROP SHIPPING NAME: 3 UN1230 II FLAMMABLE LIQUID, POISON

AFI CLASS:

AFI ID NUMBER:

AFI PACK GROUP: 7-7

AFI LABEL:

AFI SPECIAL PROV:

AFI BASIC PAC REF:

MMAC CODE:

N O S SHIPPING NAME:

ADDITIONAL TRANS DATA:

Disposal Data

DISPOSAL DATA ACTION CODE:

DISPOSAL DATA FOCAL POINT:

DISPOSAL DATA REVIEW DATE:

DISP CNUM FOR THIS DISP ENTR:

TOT DISP ENTRIES PER NSN:

LANDFILL BAN ITEM:

DISPOSAL SUPPLEMENTAL DAT:

EPAHAZWST 1ST CODE NEW:

EPAHAZWST 1ST NAME NEW:

EPAHAZWST 1ST CHAR NEW:

EPAACUTEHAZARD 1ST NEW:

EPAHAZWST 2ND CODE NEW:

EPAHAZWST 2ND NAME NEW:

EPAHAZWST 2ND CHAR NEW:

EPAACUTEHAZARD 2ND NEW:

EPAHAZWST 3RD CODE NEW:

EPAHAZWST 3RD NAME NEW: YES04DEC92 F METHANOL REAGENT ACS

EPAHAZWST 3RD CHAR NEW:

EPAACUTE 3RD HAZARD NEW:

Label Data

LABEL REQUIRED:

TECHNICAL REVIEW DATE: N/P

LABEL DATE: WARNING

MFR NUMBER: ! X X X X

LABEL STATUS: I

COMMON NAME: NHALATION: 25,000 PPM DANGEROUS TO LIFE AND HEALTH. INGESTIO

CHRONIC HAZARD: N:

SIGNAL WORD: HEADACHE

ACUTE HEALTH HAZARD NONE: ,

 **ACUTE HEALTH HAZARD SLIGHT:**

ACUTE HEALTH HAZARD MODERATE: T

ACUTE HEALTH HAZARD SEVERE: I

CONTACT HAZARD NONE: N

CONTACT HAZARD SLIGHT: N

CONTACT HAZARD MODERATE: I

CONTACT HAZARD SEVERE: T

FIRE HAZARD NONE: U

FIRE HAZARD SLIGHT: S

FIRE HAZARD MODERATE: ,

FIRE HAZARD SEVERE:

 **ACTIVITY HAZARD NONE: A**

REACTIVITY HAZARD SLIGHT: N

REACTIVITY HAZARD MODERATE: O

REACTIVITY HAZARD SEVERE: R

SPECIAL HAZARD PRECAUTIONS: EXIA, NARCOSIS, APATHY, DIMMED VISION, SHALLOW RESPIRATION, CEREBRAL AND PULMONARY EDEMA, LIVER AND KIDNEY DAMAGE, DEATH DUE TO RESPIRATORY FAILURE OR CIRCULATORY COLLAPSE. SKIN: LETHAL AMOUNTS MAY BE ABSORBED THROUGH INTACT SKIN. STORE IN ACCORDANCE WITH 29 CFR 1910.106. STORE AWAY FROM INCOMPATIBLE SUBSTANCES. YYYSPECTRUM CHEMICAL MFG CORP. 14422 SOUTH SAN PEDRO STREET

PROTECT EYE:

PROTECT SKIN:

PROTECT RESPIRATORY:

 **BEL NAME: GARDENA CA**

LABEL STREET: 90248-2027US800-424-9300

LABEL P O BOX:

LABEL CITY:

LABEL STATE:

 **LABEL ZIP CODE:**

LABEL COUNTRY:

LABEL EMERGENCY NUMBER:

YEAR PROCURED:

FIRE HAZARD SEVERE:

REACTIVITY HAZARD NONE: A

REACTIVITY HAZARD SLIGHT: N

REACTIVITY HAZARD MODERATE: O

REACTIVITY HAZARD SEVERE: R

SPECIAL HAZARD PRECAUTIONS: EXIA, NARCOSIS, APATHY, DIMMED VISION, SHALLOW RESPIRATION, CEREBRAL AND PULMONARY EDEMA, LIVER AND KIDNEY DAMAGE, DEATH DUE TO RESPIRATORY FAILURE OR CIRCULATORY COLLAPSE. SKIN: LETHAL AMOUNTS MAY BE ABSORBED THROUGH INTACT SKIN. STORE IN ACCORDANCE WITH 29 CFR 1910.106. STORE AWAY FROM  **COMPATIBLE SUBSTANCES. YYSPECTRUM CHEMICAL MFG CORP. 14422 SOUTH SAN PEDRO STREET**

PROTECT EYE:

PROTECT SKIN:

PROTECT RESPIRATORY:

LABEL NAME: GARDENA CA

LABEL STREET: 90248-2027US800-424-9300

LABEL P O BOX:

LABEL CITY:

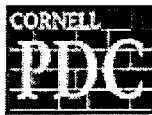
LABEL STATE:

LABEL ZIP CODE:

 **LABEL COUNTRY:**

LABEL EMERGENCY NUMBER:

YEAR PROCURED:



DOD Hazardous Material Information
DOD 6050.5-L
As of April 1997

This information prepared for Cornell University convenience only.

NITRIC ACID REAGENT

FSC: 6810

NIIN: 002709978

NSN: 68100027099786

MANUFACTURERS CAGE: 66378

PART NO INDICATOR: A

PART NUMBER TRADE NAME: NITRIC ACID REAGENT

Nuclear Water Data

NUCLEAR WATER FSC: NITR

NUCLEAR WATER NIIN: IC ACID R

NUCLEAR WATER COG: EA

NUCLEAR WATER NOMENCLATURE: GENT

NUCLEAR WATER REMARKS: WATER CHEM

Standard PMS Identification Data

SPIN FSC: ISTR

SPIN NIIN: Y, INC

SPIN:

General Information

ITEM NAME:

MANUFACTURERS NAME: 4273 ROANOKE VA

MANUFACTURERS STREET: US24015 703-989-0400

MANUFACTURERS P O BOX:

MANUFACTURERS CITY: 703-989-0400

MANUFACTURERS STATE:

MANUFACTURERS COUNTRY:

MANUFACTURERS ZIP CODE:

MANUFACTURERS EMERG PH:

MANUFACTURERS INFO PH:

DISTRIBUTOR VENDOR 1:

DISTRIBUTOR VENDOR 1 CAGE:

DISTRIBUTOR VENDOR 2:

DISTRIBUTOR VENDOR 2 CAGE:

DISTRIBUTOR VENDOR 3: D 009009SE 20DEC9104MAR96CX C. BRIAN

DISTRIBUTOR VENDOR 3 CAGE: KIDD

DISTRIBUTOR VENDOR 4:

DISTRIBUTOR VENDOR 4 CAGE:

SAFETY DATA ACTION CODE:

SAFETY FOCAL POINT:

RECORD NO FOR SAFETY ENTRY:

TOT SAFETY ENTRIES THIS STK:

STATUS:

DATE MSDS PREPARED:

SAFETY DATA REVIEW DATE:

SUPPLY ITEM MANAGER:

MSDS PREPARERS NAME:

PREPARERS COMPANY:

PREPARERS ST OR P O BOX:

PREPARERS CITY: BMQBMIL-W-15000 A CLASS

PREPARERS STATE:

PREPARERS ZIP CODE: C1

OTHER MSDS NUMBER: BT32 OZ BOTTLE UNKNOWN

MSDS SERIAL NUMBER:

SPECIFICATION NUMBER:

SPEC TYPE GRADE CLASS: CLEAR LIQUID

HAZARD CHARACTERISTIC CODE: , NIT

UNIT OF ISSUE: RO

UNIT OF ISSUE CONTAINER QTY: US OXIDE ODOR

TYPE OF CONTAINER:

NET UNIT WEIGHT:

NRC STATE LICENSE NUMBER:

NET EXPLOSIVE WEIGHT:

NET PROPELLANT WEIGHT AMMO: UNKNO

COAST GUARD AMMUNITION CODE: WN

Physical & Chemical Characteristics

APPEARANCE AND ODOR: UNKNOWN UNKNOWN UNKNOWN UNKNOWN UNKNOWN UNKNOWN

BOILING POINT: UNKNOW

MELTING POINT: N

VAPOR PRESSURE MM HG 70 F: N/K

VAPOR DENSITY AIR 1:

SPECIFIC GRAVITY: N/K

DECOMPOSITION TEMPERATURE:

EVAPORATION RATE AND REF: N/P UNKNOWN NONE

SOLUBILITY IN WATER: N/P N/

PERCENT VOLATILES BY VOLUME: R

VISCOSITY: N/R

PH: MED

RADIOACTIVITY: IA APPROPRIA

FORM RADIOACTIVE MATL: TE FOR S

MAGNETISM MILLIGAUSS: URROU

CORROSION RATE IPY: NDING FI

AUTOIGNITION TEMPERATURE: RE.

Fire and Explosion Hazard Data

FLASH POINT:

FLASH POINT METHOD:

LOWER EXPLOSIVE LIMIT:

UPPER EXPLOSIVE LIMIT:

EXTINGUISHING MEDIA: WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE GEAR.

SPECIAL FIRE FIGHTING PROC: NONE SPECIFIED BY MANUFACTURER.

UNUSUAL FIRE AND EXPL HAZRDS: YESNONE SPECIFIED BY MANUFACTURER.

Reactivity Data

STABILITY:

COND TO AVOID STABILITY: STRONG ALKALIS AND STRONG OXIDIZING AGENTS

MATERIALS TO AVOID: TOXIC FUMES OF OXIDES OF NITROGEN AND HYDROGEN NITRATE

HAZARDOUS DECOMP PRODUCTS: NO NONE SPECIFIED BY MANUFACTURER.

HAZARDOUS POLY OCCUR:

CONDITIONS TO AVOID POLY: ORAL LD50 (RAT) IS UNKNOWN NO YESYESACUTE: MAY IRRITATE SKIN, EYES, AND GI

Health Hazard Data

LD50 LC50 MIXTURE: TRACT. CHRONIC: NONE SPECIFIED BY MANUFA

ROUTE OF ENTRY INHALATION: CTU

ROUTE OF ENTRY SKIN: RER

ROUTE OF ENTRY INGESTION: .

HEALTH HAZ ACUTE AND CHRONIC: NO NO NO NO MATERIAL >1% IS LISTED AS A CARCINOGEN BY NTP, IARC, OR

CARCINOGENICITY NTP: OSHA.

CARCINOGENICITY IARC:

CARCINOGENICITY OSHA:

EXPLANATION CARCINOGENICITY: EYES: REDNESS, TEARING. SKIN: REDNESS, RASH, ITCHING. INGESTION: NAUSEA, VOMITNG.

SIGNS SYMPTOMS OF OVEREXP: NONE SPECIFIED BY MANUFACTURER.

ED COND AGGRAVATED BY EXP: INHALATION: REMOVE TO FRESH AIR. EYES: FLUSH WITH
ENTY OF WATER FOR 15 MINUTES. SEE DO

EMERGENCY FIRST AID PROC: CTOR. SKIN: FLUSH WITH WATER FOR SEVERAL MINUTES. REMOVE CONTAMINATED CLOTHES. WASH WITH SOAP AND WATER. INGESTION: DO NOT INDUCE VOMITING. GET IMMEDIATE MEDICAL CARE. CONTAIN SPILL. NEUTRALIZE. ABSORB WITH INERT MATERIAL. SCOOP UP AND PLACE IN A CONTAINER

Precautions for Safe Handling and Use

STEPS IF MATL RELEASED SPILL: FOR LATER DISPOSAL. 20% SODIUM BICARBONATE SOLUTION DISPOSE

NEUTRALIZING AGENT: OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS.

WASTE DISPOSAL METHOD: KEEP CONTAINER CLOSED WHEN NOT IN USE.

PRECAUTIONS HANDLING STORING: NONE SPECIFIED BY MANUFACTURER.

OTHER PRECAUTIONS: NONE NORMALLY REQUIRED.

Control Measures

RESPIRATORY PROTECTION: USE ADEQUATE MECHANICAL VENTILATION.

VENTILATION: NEOPREN AND PVC SAFETY GLASSES/CHEMICAL SPLASH GOGGLES CLOTHING

PROTECTIVE GLOVES: TO PREVENT REPEATED OR PROLONGED CONTACT

 **FACE PROTECTION:** T. EYE WASH STATION & SAFETY SHOWER.

OTHER PROTECTIVE EQUIPMENT: WASH HANDS AFTER USE AND BEFORE EATING, DRINKING, SMOKING. LAUNDRY CLOTHING BEFORE REUSE

WORK HYGIENIC PRACTICES: .

SUPPL SAFETY HEALTH DATA: D 92108KFD NITRIC ACID

Transportation Data

TRANSPORTATION ACTION CODE:

TRANSPORTATION FOCAL POINT:

TRANS DATA REVIEW DATE:

DOT PSN CODE:

DOT SYMBOL:

 **DOT PROPER SHIPPING NAME:** 8 UN2031 II CORROSIVE KPF NITRIC ACID

DOT CLASS: D

DOT ID NUMBER:

DOT PACK GROUP:

DOT LABEL:

DOT DOD EXEMPTION NUMBER:

IMO PSN CODE:

IMO PROPER SHIPPING NAME: 8195 20318 - RWI 2031 NITRIC ACID

IMO REG PAGE NUMBER:

IMO UN NUMBER:

IMO UN CLASS:

 **IMO SUBSID RISK LABEL:**

IATA PSN CODE:

IATA UN ID NUMBER:

IATA PROPER SHIP NAME: 8 CORROSIVE RWI T NITRIC ACID

IATA UN CLASS:

TA SUBSID RISK CLASS:

IATA LABEL:

AFI PSN CODE:

AFI SYMBOLS:

AFI PROP SHIPPING NAME: 8 UN2031 II CORROSIVE

AFI CLASS:

AFI ID NUMBER:

AFI PACK GROUP: 12-

AFI LABEL: 14

AFI SPECIAL PROV:

AFI BASIC PAC REF:

IAC CODE:

N O S SHIPPING NAME: NITRIC ACID SOLUTION: <8 % NITRIC ACID

ADDITIONAL TRANS DATA:

Disposal Data

DISPOSAL DATA ACTION CODE:

DISPOSAL DATA FOCAL POINT:

DISPOSAL DATA REVIEW DATE:

RECNUM FOR THIS DISP ENTR:

TOT DISP ENTRIES PER NSN:

LANDFILL BAN ITEM:

DISPOSAL SUPPLEMENTAL DAT:

EPAHAZWST 1ST CODE NEW:

EPAHAZWST 1ST NAME NEW:

EPAHAZWST 1ST CHAR NEW:

EPAACUTEHAZARD 1ST NEW:

HAZWST 2ND CODE NEW:

EPAHAZWST 2ND NAME NEW:

EPAHAZWST 2ND CHAR NEW:

EPAACUTEHAZARD 2ND NEW:

EPAHAZWST 3RD CODE NEW:

EPAHAZWST 3RD NAME NEW: YES17APR92 N/R G NITRIC ACID REAGENT

EPAHAZWST 3RD CHAR NEW:

EPAACUTE 3RD HAZARD NEW:

Label Data

LABEL REQUIRED:

TECHNICAL REVIEW DATE: NO

LABEL DATE: WARNING

MFR NUMBER: ! X X X X

LABEL STATUS: C

COMMON NAME: ORROSIVE. MAY IRRITATE SKIN, EYES, AND GI TRACT. KEEP CONTAI

CHRONIC HAZARD: NER

SIGNAL WORD: CLOSED

ACUTE HEALTH HAZARD NONE: W

ACUTE HEALTH HAZARD SLIGHT: H

ACUTE HEALTH HAZARD MODERATE: E

ACUTE HEALTH HAZARD SEVERE: N

CONTACT HAZARD NONE:

CONTACT HAZARD SLIGHT: N

CONTACT HAZARD MODERATE: O

CONTACT HAZARD SEVERE: T

FIRE HAZARD NONE:

RE HAZARD SLIGHT: I

FIRE HAZARD MODERATE: N

FIRE HAZARD SEVERE:

REACTIVITY HAZARD NONE: U

REACTIVITY HAZARD SLIGHT: S

REACTIVITY HAZARD MODERATE: E

REACTIVITY HAZARD SEVERE: .

SPECIAL HAZARD PRECAUTIONS: FIRST AID: INHALATION: REMOVE TO FRESH AIR. EYES: FLUSH WITH PLENTY OF WATER FOR 15 MINUTES. SEE DOCTOR. SKIN: FLUSH WITH WATER FOR SEVERAL MINUTES. REMOVE CONTAMINATED CLOTHES. WASH WITH SOAP AND WATER. INGESTION: DO NOT INDUCE VOMITING. GET IMMEDIATE MEDICAL CARE. YY WATER CHEMISTRY, INC

PROTECT EYE:

PROTECT SKIN:

PROTECT RESPIRATORY:

LABEL NAME: 4273 ROANOKE VA

LABEL STREET: 24015 US703-989-0400

LABEL P O BOX:

LABEL CITY: 1992

LABEL STATE:

LABEL ZIP CODE:

LABEL COUNTRY:

LABEL EMERGENCY NUMBER:

YEAR PROCURED:

RE HAZARD SEVERE:

REACTIVITY HAZARD NONE: U

REACTIVITY HAZARD SLIGHT: S

REACTIVITY HAZARD MODERATE: E

REACTIVITY HAZARD SEVERE: .

SPECIAL HAZARD PRECAUTIONS: FIRST AID: INHALATION: REMOVE TO FRESH AIR. EYES: FLUSH WITH PLENTY OF WATER FOR 15 MINUTES. SEE DOCTOR. SKIN: FLUSH WITH WATER FOR SEVERAL MINUTES. REMOVE CONTAMINATED CLOTHES. WASH WITH SOAP AND WATER. INGESTION: DO NOT INDUCE VOMITING. GET IMMEDIATE MEDICAL CARE. YY WATER CHEMISTRY, INC

PROTECT EYE:

PROTECT SKIN:

PROTECT RESPIRATORY:

LABEL NAME: 4273 ROANOKE VA

LABEL STREET: 24015 US703-989-0400

LABEL P O BOX:

LABEL CITY: 1992

LABEL STATE:

LABEL ZIP CODE:

LABEL COUNTRY:

LABEL EMERGENCY NUMBER:

YEAR PROCURED:



DOD Hazardous Material Information
DOD 6050.5-L
As of April 1997

This information prepared for Cornell University convenience only.

SODIUM HYDROXIDE REAGENT

FSC: 6665

NIIN: 012714027

NSN: 66650127140273

MANUFACTURERS CAGE: 34807

PART NO INDICATOR: A

RT NUMBER TRADE NAME: SODIUM HYDROXIDE REAGENT

Nuclear Water Data

NUCLEAR WATER FSC: REAG

NUCLEAR WATER NIIN: ENT SET,

NUCLEAR WATER COG: WA

NUCLEAR WATER NOMENCLATURE: TER TESTING

NUCLEAR WATER REMARKS: LAMOTTE CH

Standard PMS Identification Data

SPIN FSC: EMIC

SPIN NIIN: AL PRODUC

SPIN: TS CO

General Information

ITEM NAME: RT 213 N

MANUFACTURERS NAME: 329 CHESTERTOWN MD

 **MANUFACTURERS STREET: US21620 301-778-3100**

MANUFACTURERS P O BOX:

MANUFACTURERS CITY: 301-778-3100

MANUFACTURERS STATE:

MANUFACTURERS COUNTRY:

MANUFACTURERS ZIP CODE:

MANUFACTURERS EMERG PH:

MANUFACTURERS INFO PH:

DISTRIBUTOR VENDOR 1:

DISTRIBUTOR VENDOR 1 CAGE:

DISTRIBUTOR VENDOR 2:

 **DISTRIBUTOR VENDOR 2 CAGE:**

DISTRIBUTOR VENDOR 3: D 001005KE 19JUL9322FEB94CX

DISTRIBUTOR VENDOR 3 CAGE:

DISTRIBUTOR VENDOR 4:

DISTRIBUTOR VENDOR 4 CAGE:

SAFETY DATA ACTION CODE:

SAFETY FOCAL POINT:

RECORD NO FOR SAFETY ENTRY:

TOT SAFETY ENTRIES THIS STK:

STATUS:

DATE MSDS PREPARED:

 **SAFETY DATA REVIEW DATE:**

SUPPLY ITEM MANAGER:

MSDS PREPARERS NAME:

PREPARERS COMPANY:

PREPARERS ST OR P O BOX:

PREPARERS CITY: BSSCQ

PREPARERS STATE:

PREPARERS ZIP CODE: C4

OTHER MSDS NUMBER: KT1 KIT

MSDS SERIAL NUMBER:

SPECIFICATION NUMBER:

SPEC TYPE GRADE CLASS: CLEAR, COLOR

HAZARD CHARACTERISTIC CODE: LESS

UNIT OF ISSUE: LI

UNIT OF ISSUE CONTAINER QTY: QUID, NO ODOR

TYPE OF CONTAINER:

NET UNIT WEIGHT:

NRC STATE LICENSE NUMBER:

NET EXPLOSIVE WEIGHT:

NET PROPELLANT WEIGHT AMMO: UNKNO

COAST GUARD AMMUNITION CODE: WN

Physical & Chemical Characteristics

APPEARANCE AND ODOR: NOT GIVEN NOT GIVEN NOT GIVEN NOT GIVEN UNKNOWN NOT GIVEN

BOILING POINT: SOLUUB

MELTING POINT: LE

VAPOR PRESSURE MM HG 70 F: N/K

RELATIVE DENSITY AIR 1:

SPECIFIC GRAVITY: 12

DECOMPOSITION TEMPERATURE:

EVAPORATION RATE AND REF: N/P UNKNOWN N/K NONF

SOLUBILITY IN WATER: LAMMABLE N/P NO

PERCENT VOLATILES BY VOLUME: T GIVE

VISCOSITY: N NOT GIVEN

PH: NON

RADIOACTIVITY: FLAMMABLE. U

FORM RADIOACTIVE MATL: SE MEDIA

MAGNETISM MILLIGAUSS: SUIT

CORROSION RATE IPY: ABLE FOR

AUTOIGNITION TEMPERATURE: SURRO

Fire and Explosion Hazard Data

FLASH POINT: UNENDING FIRE.

FLASH POINT METHOD:

LOWER EXPLOSIVE LIMIT:

UPPER EXPLOSIVE LIMIT:

EXTINGUISHING MEDIA: NONFLAMMABLE. USE PROCEDURES SUITABLE FOR SURROUNDING FIRE.

SPECIAL FIRE FIGHTING PROC: NONE SPECIFIED BY MANUFACTURER.

UNUSUAL FIRE AND EXPL HAZRDS: YESNONE SPECIFIED BY MANUFACTURER.

Reactivity Data

STABILITY:

COND TO AVOID STABILITY: ACIDS, METALS

MATERIALS TO AVOID: NONE SPECIFIED BY MANUFACTURER.

HAZARDOUS DECOMP PRODUCTS: NO NONE. WILL NOT OCCUR.

HAZARDOUS POLY OCCUR:

CONDITIONS TO AVOID POLY: TLV 2 MG/M3 (SODIUM HYDROXIDE) NO YESNO CAUSES SEVERE EYE AND SKIN IRRITATION.

Health Hazard Data

LD50 LC50 MIXTURE: HARMFUL IF SWALLOWED.

ROUTE OF ENTRY INHALATION:

ROUTE OF ENTRY SKIN:

ROUTE OF ENTRY INGESTION:

HEALTH HAZ ACUTE AND CHRONIC: NO NO NO THIS COMPOUND CONTAINS NO INGREDIENTS AT CONCENTRATIONS OF

CARCINOGENICITY NTP: 0.1% OR G

CARCINOGENICITY IARC: REATER THA

CARCINOGENICITY OSHA: T ARE CARC

EXPLANATION CARCINOGENICITY: INOGENS OR SUSPECT CARCINOGENS. SEVERE EYE IRRITATION, SEVERE SKIN IRRITATION, GASTROINTESTINAL IRRITATION.

SIGNS SYMPTOMS OF OVEREXP: NONE SPECIFIED BY MANUFACTURER.

ED COND AGGRAVATED BY EXP: INHALATION: REMOVE FROM EXPOSURE. RESTORE BREATHING. KEEP WARM AND QUIET. GET MEDICAL AT

EMERGENCY FIRST AID PROC: TENTION. SKIN: WASH AFFECTED AREA THOROUGHLY WITH SOAP AND WATER. IF IRRITATION PERSISTS, GET MEDICAL ATTENTION. EYES: FLUSH WITH LARGE AMOUNTS OF WATER FOR 15 MINUTES. GET MEDICAL ATTENTION. INGESTION: DO NOT INDUCE VOMITING. RINSE MOUTH, DRINK A GLASS OF WATER. CONSULT A PHYSICIAN. CAREFULLY NEUTRALIZE WITH VINEGAR OR OTHER ACID. MOP UP AND FLUSH DOWN DRAIN WITH EXCESS

Precautions for Safe Handling and Use

STEPS IF MATL RELEASED SPILL: WATER IF PERMITTED BY LOCAL AUTHORITIES. VINEGAR, MILD ACIDS PREVENT

NEUTRALIZING AGENT: WASTE FROM CONTAMINATING SURROUNDING ENVIRONMENT. DISCARD ANY PRODUCT, RESIDUE,

WASTE DISPOSAL METHOD: DISPOSAL CONTAINER OR LINER IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REGULATIONS. AVOID CONTACT WITH SKIN. STORE AWAY FROM INCOMPATIBLES.

PRECAUTIONS HANDLING STORING: NONE SPECIFIED BY MANUFACTURER.

OTHER PRECAUTIONS: NOT NORMALLY REQUIRED.

Control Measures

RESPIRATORY PROTECTION: NORMAL

VENTILATION: RECOMMENDED RECOMMENDED LAB COAT

PROTECTIVE GLOVES:

EYE PROTECTION:

OTHER PROTECTIVE EQUIPMENT: WASH WITH SOAP AND WATER AFTER HANDLING PRODUCT AND BEFORE EATING DRINKING OR SMOKING.

WORK HYGIENIC PRACTICES: NONE SPECIFIED BY MANUFACTURER.

SUPPL SAFETY HEALTH DATA: D 94053ZZZ N/R NOT REGULATED BY THIS MODE OF TRANSPORTATION

Transportation Data

TRANSPORTATION ACTION CODE:

TRANSPORTATION FOCAL POINT:

TRANS DATA REVIEW DATE:

DOT PSN CODE:

DOT SYMBOL:

DOT PROPER SHIPPING NAME: N/R N/R N/R N/R ZZZ NOT REGULA

DOT CLASS: TED FOR T

DOT ID NUMBER: HIS MOD

DOT PACK GROUP: E OF TRA

DOT LABEL: NSPORTATION

DOT DOD EXEMPTION NUMBER:

IMO PSN CODE:

IMO PROPER SHIPPING NAME: N/R N/R N/R N/R ZZZ N/R NOT REGULATED BY THIS MODE OF TR

IMO REG PAGE NUMBER: ANSPORTAT

IMO UN NUMBER: ION

IMO UN CLASS:

IMO SUBSID RISK LABEL:

IATA PSN CODE:

 IATA UN ID NUMBER:

IATA PROPER SHIP NAME: N/R N/R N/R ZZZ NOT REGULATED BY THIS MODE OF TRANSPORT

IATA UN CLASS: ATIO

IATA SUBSID RISK CLASS: N

IATA LABEL:

AFI PSN CODE:

AFI SYMBOLS:

AFI PROP SHIPPING NAME: N/R N/R N/R N/R

AFI CLASS:

AFI ID NUMBER:

AFI PACK GROUP:

 I LABEL:

AFI SPECIAL PROV:

AFI BASIC PAC REF:

MMAC CODE:

N O S SHIPPING NAME: THIS IS PART A OF A 5-PART KIT.

ADDITIONAL TRANS DATA:

=====

Disposal Data

DISPOSAL DATA ACTION CODE:

DISPOSAL DATA FOCAL POINT:

DISPOSAL DATA REVIEW DATE:

 CNUM FOR THIS DISP ENTR:

TOT DISP ENTRIES PER NSN:

LANDFILL BAN ITEM:

DISPOSAL SUPPLEMENTAL DAT:

EPAHAZWST 1ST CODE NEW:

EPAHAZWST 1ST NAME NEW:

EPAHAZWST 1ST CHAR NEW:

EPAACUTEHAZARD 1ST NEW:

EPAHAZWST 2ND CODE NEW:

EPAHAZWST 2ND NAME NEW:

EPAHAZWST 2ND CHAR NEW:

EPAACUTEHAZARD 2ND NEW:

EPAHAZWST 3RD CODE NEW:

EPAHAZWST 3RD NAME NEW: YES22FEB94 NONE F SODIUM HYDROXIDE REAGENT

EPAHAZWST 3RD CHAR NEW:

EPAACUTE 3RD HAZARD NEW:

Label Data

LABEL REQUIRED:

TECHNICAL REVIEW DATE: NO

LABEL DATE: WARNING

MFR NUMBER: ! X X X X

LABEL STATUS: C

COMMON NAME: AUSES SEVERE EYE AND SKIN IRRITATION. HARMFUL IF SWALLOWED.

CHRONIC HAZARD: AVV

SIGNAL WORD: OID CONT

ACUTE HEALTH HAZARD NONE: A

ACUTE HEALTH HAZARD SLIGHT: C

ACUTE HEALTH HAZARD MODERATE: T

ACUTE HEALTH HAZARD SEVERE:

CONTACT HAZARD NONE: W

CONTACT HAZARD SLIGHT: I

 **CONTACT HAZARD MODERATE: T**

CONTACT HAZARD SEVERE: H

FIRE HAZARD NONE:

FIRE HAZARD SLIGHT: S

FIRE HAZARD MODERATE: K

FIRE HAZARD SEVERE: I

REACTIVITY HAZARD NONE: N

REACTIVITY HAZARD SLIGHT: .

REACTIVITY HAZARD MODERATE:

REACTIVITY HAZARD SEVERE: S

SPECIAL HAZARD PRECAUTIONS: TORE AWAY FROM INCOMPATIBLES. FIRST AID: INHALATION: REMOVE FROM EXPOSURE. RESTORE BREATHING. KEEP WARM AND QUIET. GET MEDICAL ATTENTION. SKIN: WASH AFFECTED AREA THOROUGHLY WITH SOAP AND WATER. IF IRRITATION PERSISTS, GET MEDICAL ATTENTION. EYES: FLUSH WITH LARGE AMOUNTS OF WATER FOR 15 MINUTES. GET MEDICAL ATTENTION. INGESTION: DO NOT INDUCE VOMITING. RINSE MOUTH, DRINK A GLASS OF WATER. CONSULT A PHYSICIAN. YY LAMOTTE CHEMICAL PRODUCTS CO RT 213 N

PROTECT EYE:

PROTECT SKIN:

PROTECT RESPIRATORY:

LABEL NAME: 329 CHESTERTOWN MD

LABEL STREET: 21620 US301-778-3100

LABEL P O BOX:

LABEL CITY:

LABEL STATE:

 **LABEL ZIP CODE:**

LABEL COUNTRY:

LABEL EMERGENCY NUMBER:

YEAR PROCURED:

FIRE HAZARD SEVERE: I

ACTIVITY HAZARD NONE: N

REACTIVITY HAZARD SLIGHT: .

REACTIVITY HAZARD MODERATE:

REACTIVITY HAZARD SEVERE: S

SPECIAL HAZARD PRECAUTIONS: TORE AWAY FROM INCOMPATIBLES. FIRST AID: INHALATION: REMOVE FROM EXPOSURE. RESTORE BREATHING. KEEP WARM AND QUIET. GET MEDICAL ATTENTION. SKIN: WASH AFFECTED AREA THOROUGHLY WITH SOAP AND WATER. IF IRRITATION PERSISTS, GET MEDICAL ATTENTION. EYES: FLUSH WITH LARGE AMOUNTS OF WATER FOR 15 MINUTES. GET MEDICAL ATTENTION. INGESTION: DO NOT INDUCE VOMITING. RINSE MOUTH, DRINK A GLASS OF WATER. CONSULT A PHYSICIAN. YY LAMOTTE CHEMICAL PRODUCTS CO RT 213 N

PROTECT EYE:

PROTECT SKIN:

PROTECT RESPIRATORY:

BEL NAME: 329 CHESTERTOWN MD

LABEL STREET: 21620 US301-778-3100

LABEL P O BOX:

LABEL CITY:

LABEL STATE:

LABEL ZIP CODE:

LABEL COUNTRY:

LABEL EMERGENCY NUMBER:

YEAR PROCURED:

Aldrich Chemical Co., Inc.
1001 West St. Paul
Milwaukee, WI 53233 USA
Phone: 414-273-3850

M A T E R I A L S A F E T Y D A T A S H E E T

SECTION 1. - - - - - CHEMICAL IDENTIFICATION- - - - -

CATALOG #: 519073
NAME: SODIUM PERMANGANATE, 40 WT. % SOLUTION
IN WATER

SECTION 2. - - - - - COMPOSITION/INFORMATION ON INGREDIENTS - - - - -

CAS #: 10101-50-5
MF: MNNAO4
EC NO: 233-251-1

SYNONYMS

PERMANGANATE DE SODIUM (FRENCH) *

SECTION 3. - - - - - HAZARDS IDENTIFICATION - - - - -

LABEL PRECAUTIONARY STATEMENTS

OXIDIZING
CORROSIVE
CONTACT WITH COMBUSTIBLE MATERIAL MAY CAUSE FIRE.
CAUSES BURNS.
HARMFUL BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.
TARGET ORGAN(S):

NERVES
BLOOD, KIDNEYS
LUNGS

KEEP AWAY FROM COMBUSTIBLE MATERIAL.
IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF
WATER AND SEEK MEDICAL ADVICE.
TAKE OFF IMMEDIATELY ALL CONTAMINATED CLOTHING.
WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE
PROTECTION.

SECTION 4. - - - - - FIRST-AID MEASURES- - - - -

IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS.
CALL A PHYSICIAN.
DO NOT INDUCE VOMITING.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL
RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IN CASE OF SKIN CONTACT, FLUSH WITH COPIOUS AMOUNTS OF WATER
FOR AT LEAST 15 MINUTES. REMOVE CONTAMINATED CLOTHING AND
SHOES. CALL A PHYSICIAN.
IN CASE OF CONTACT WITH EYES, FLUSH WITH COPIOUS AMOUNTS OF WATER
FOR AT LEAST 15 MINUTES. ASSURE ADEQUATE FLUSHING BY SEPARATING
THE EYELIDS WITH FINGERS. CALL A PHYSICIAN.

SECTION 5. - - - - - FIRE FIGHTING MEASURES - - - - -

EXTINGUISHING MEDIA

WATER SPRAY.

SPECIAL FIREFIGHTING PROCEDURES

WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO
PREVENT CONTACT WITH SKIN AND EYES.

UNUSUAL FIRE AND EXPLOSIONS HAZARDS

EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

SECTION 6. - - - - - ACCIDENTAL RELEASE MEASURES- - - - -

WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY
RUBBER GLOVES.
COVER WITH DRY LIME OR SODA ASH, PICK UP, KEEP IN A CLOSED CONTAINER
AND HOLD FOR WASTE DISPOSAL.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
EVACUATE AREA.

SHUT OFF ALL SOURCES OF IGNITION.

SECTION 7. - - - - - HANDLING AND STORAGE- - - - -

REFER TO SECTION 8.

SECTION 8. - - - - - EXPOSURE CONTROLS/PERSONAL PROTECTION- - - - -

SAFETY SHOWER AND EYE BATH.

USE ONLY IN A CHEMICAL FUME HOOD.

WASH CONTAMINATED CLOTHING BEFORE REUSE.

DISCARD CONTAMINATED SHOES.

WASH THOROUGHLY AFTER HANDLING.

DO NOT BREATHE VAPOR.

DO NOT GET IN EYES, ON SKIN, ON CLOTHING.

AVOID PROLONGED OR REPEATED EXPOSURE.

NIOSH/MSHA-APPROVED RESPIRATOR.

COMPATIBLE CHEMICAL-RESISTANT GLOVES.

CHEMICAL SAFETY GOGGLES.

FACESHIELD (8-INCH MINIMUM).

KEEP TIGHTLY CLOSED.

KEEP AWAY FROM COMBUSTIBLE MATERIALS, HEAT, SPARKS, AND OPEN FLAME.

STORE IN A COOL DRY PLACE.

SECTION 9. - - - - - PHYSICAL AND CHEMICAL PROPERTIES - - - - -

PHYSICAL PROPERTIES

BOILING POINT: 100 C

SPECIFIC GRAVITY: 1.000

SECTION 10. - - - - - -STABILITY AND REACTIVITY - - - - -

STABILITY

STABLE.

INCOMPATIBILITIES

STRONG REDUCING AGENTS

FINELY POWDERED METALS

STRONG ACIDS

ORGANIC MATERIALS

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS

CARBON MONOXIDE, CARBON DIOXIDE

HAZARDOUS POLYMERIZATION

WILL NOT OCCUR.

SECTION 11. - - - - - TOXICOLOGICAL INFORMATION - - - - -

ACUTE EFFECTS

CAUSES BURNS.

MAY BE HARMFUL IF ABSORBED THROUGH THE SKIN.

MATERIAL IS EXTREMELY DESTRUCTIVE TO THE TISSUE OF THE MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT.

MAY BE HARMFUL IF INHALED.

MAY BE HARMFUL IF SWALLOWED.

MEN EXPOSED TO MANGANESE DUSTS SHOWED A DECREASE IN FERTILITY.

CHRONIC MANGANESE POISONING PRIMARILY INVOLVES THE CENTRAL NERVOUS SYSTEM. EARLY SYMPTOMS INCLUDE LANGUOR, SLEEPINESS AND WEAKNESS IN THE LEGS. A STOLID MASK-LIKE APPEARANCE OF THE FACE, EMOTIONAL DISTURBANCES SUCH AS UNCONTROLLABLE LAUGHTER AND A SPASTIC GAIT WITH TENDENCY TO FALL IN WALKING ARE FINDINGS IN MORE ADVANCED CASES. HIGH INCIDENCE OF PNEUMONIA HAS BEEN FOUND IN WORKERS EXPOSED TO THE DUST OR FUME OF SOME MANGANESE COMPOUNDS.

MATERIAL IS EXTREMELY DESTRUCTIVE TO TISSUE OF THE MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT, EYES AND SKIN.

INHALATION MAY RESULT IN SPASM, INFLAMMATION AND EDEMA OF THE LARYNX AND BRONCHI, CHEMICAL PNEUMONITIS AND PULMONARY EDEMA.

SYMPTOMS OF EXPOSURE MAY INCLUDE BURNING SENSATION, COUGHING, WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA AND VOMITING.

CHRONIC EFFECTS

TARGET ORGAN(S):

NERVES

BLOOD

KIDNEYS

LUNGS

PERMANGANIC ACID, SODIUM SALT

ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR

COMPLETE INFORMATION.

SECTION 12. - - - - - ECOLOGICAL INFORMATION - - - - -

DATA NOT YET AVAILABLE.

SECTION 13. - - - - - DISPOSAL CONSIDERATIONS - - - - -

CONTACT A LICENSED PROFESSIONAL WASTE DISPOSAL SERVICE TO DISPOSE OF THIS MATERIAL.

DISSOLVE OR MIX THE MATERIAL WITH A COMBUSTIBLE SOLVENT AND BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER.

OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.

SECTION 14. - - - - - TRANSPORT INFORMATION - - - - -

CONTACT ALDRICH CHEMICAL COMPANY FOR TRANSPORTATION INFORMATION.

SECTION 15. - - - - - REGULATORY INFORMATION - - - - -

EUROPEAN INFORMATION

OXIDIZING

CORROSIVE

R 8

CONTACT WITH COMBUSTIBLE MATERIAL MAY CAUSE FIRE.

R 34

CAUSES BURNS.

R 20/21/22

HARMFUL BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.

S 17

KEEP AWAY FROM COMBUSTIBLE MATERIAL.

S 26

IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.

S 27

TAKE OFF IMMEDIATELY ALL CONTAMINATED CLOTHING.

S 36/37/39

WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE PROTECTION.

REVIEWS, STANDARDS, AND REGULATIONS

OEL=MAK

ACGIH TLV-TWA 0.2 MG(MN)/M3

DTLVS* TLV/BEI,1999

MSHA STANDARD-AIR:CL 5 MG(MN)/M3

DTLVS* 3,149,1971

OSHA PEL (GEN INDU):CL 5 MG(MN)/M3

CFRGBR 29,1910.1000,1994

OSHA PEL (CONSTRUC):CL 5 MG(MN)/M3

CFRGBR 29,1926.55,1994

OSHA PEL (SHIPYARD):CL 5 MG(MN)/M3

CFRGBR 29,1915.1000,1993

OSHA PEL (FED CONT):CL 5 MG(MN)/M3

CFRGBR 41,50-204.50,1994

OEL-AUSTRALIA: TWA 5 MG(MN)/M3, JAN1993

OEL-BELGIUM: TWA 5 MG(MN)/M3, JAN1993

OEL-DENMARK: TWA 2.5 MG(MN)/M3, JAN1999

OEL-FINLAND: TWA 0.5 MG(MN)/M3, JAN1999

OEL-HUNGARY: TWA 0.3 MG(MN)/M3, STEL 0.6 MG(MN)/M3, JAN1993

OEL-JAPAN: OEL 0.3 MG(MN)/M3, RESPIRABLE DUST, JAN1999

OEL-THE NETHERLANDS: MAC-TGG 1 MG(MN)/M3, MAC-K 3 MG(MN)/M3, JAN1999

OEL-POLAND: MAC(TWA) 0.3 MG(MN)/M3, MAC(C) 5 MG(MN)/M3, JAN1999

OEL-SWEDEN: NGV 1 MG(MN)/M3, KTV 2.5 MG(MN)/M3 (RESP. DUST), JAN1999

OEL-SWEDEN: NGV 2.5 MG(MN)/M3, KTV 5 MG(MN)/M3 (TOTAL DUST), JAN1999

OEL-UNITED KINGDOM: LTEL 5 MG(MN)/M3, JAN1993

OEL IN ARGENTINA, BULGARIA, COLOMBIA, JORDAN, KOREA CHECK ACGIH TLV;

OEL IN NEW ZEALAND, SINGAPORE, VIETNAM CHECK ACGIH TLV

NOES 1983: HZD X7187; NIS 2; TNF 26; NOS 2; TNE 45; TFE 3

EPA TSCA SECTION 8(B) CHEMICAL INVENTORY

U.S. INFORMATION

40.0% MANGANESE COMPOUNDS

THIS PRODUCT IS SUBJECT TO SARA SECTION 313 REPORTING REQUIREMENTS.

SECTION 16. - - - - - OTHER INFORMATION - - - - -

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BIOLAB -- AQUATECH SULFURIC ACID REAGENT
MATERIAL SAFETY DATA SHEET
NSN: 681000N053866
Manufacturer's CAGE: 54760
Part No. Indicator: A
Part Number/Trade Name: AQUATECH SULFURIC ACID REAGENT

=====

General Information

=====

Company's Name: BIOLAB
Company's P. O. Box: 1489
Company's City: DECATUR
Company's State: GA
Company's Country: US
Company's Zip Code: 30031
Company's Emerg Ph #: 404-378-1753
Company's Info Ph #: 404-378-1753
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 01JAN91
Safety Data Review Date: 25SEP95
MSDS Serial Number: BVVWS
Hazard Characteristic Code: N1

=====

Ingredients/Identity Information

=====

Proprietary: NO
Ingredient: SULFURIC ACID (SARA III)
Ingredient Sequence Number: 01
Percent: 0.8
NIOSH (RTECS) Number: WS5600000
CAS Number: 7664-93-9
OSHA PEL: 1 MG/M3
31H TLV: 1 MG/M3

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Physical/Chemical Characteristics

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Appearance And Odor: COLORLESS, ODORLESS LIQUID.
Solubility In Water: COMPLETE

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Fire and Explosion Hazard Data

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Flash Point: NOT APPLICABLE
Extinguishing Media: WATER.
Special Fire Fighting Proc: USE NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: DIRECT CONTACT W/METALS CAN GENERATE FLAMMABLE HYDROGEN GAS.

=====

Reactivity Data

=====

Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomp Products: CONTACT W/METALS CAN PRODUCE TOXIC & FLAMMABLE HYDROGEN GAS.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT

=====

Health Hazard Data

=====

LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: KNOWN NONE.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: SULFURIC ACID:IARC MONOGRAPHS ON EVAL OF

CARCIN RISK OF CHEMS TO MAN, VOL 54, PG 41, 1992:GRP 1. ANIMAL:PULM IRRIT.
Signs/Symptoms Of Overexp: NONE SPECIFIED BY MANUFACTURER.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: INHAL:REMOVE TO FRESH AIR. SUPPORT BREATHING
(GIVE O₂/ARTF RESP) (FP N). EYE:FLUSH W/WATER FOR AT LEAST 15 MINUTES.
OBTAIN MEDICAL ASSISTANCE IF SYMPTOMS PERSIST. SKIN:FLUSH W/BAKING SODA
(SODIUM BICARBONATE SOLUTION). INGEST:DO NOT INDUCE VOMITING. IF CONSCIOUS,
GIVE MILK OF MAGNESIA W/LARGE AMOUNTS OF WATER. FOLLOW W/MILK.

=====

Precautions for Safe Handling and Use

=====

Steps If Matl Released/Spill: ABSORB MATERIAL W/SUITABLE ABSORBENT.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: DISPOSE OF CONTAMINATED MATERIAL I/A/W CURRENT
LOCAL, STATE & FEDERAL LAWS & ORDINANCES.
Precautions-Handling/Storing: ENSURE THAT BOTTLE CAP IS TIGHTLY SEALED
AFTER USING. PROTECTION FROM EXTREME HEAT & FREEZING. KEEP OUT OF REACH OF
CHILDREN.
Other Precautions: NONE SPECIFIED BY MANUFACTURER.

=====

Control Measures

=====

Respiratory Protection: NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR
EXPOSURE OF CONCERN (FP N). NOT REQUIRED.
Ventilation: NOT REQUIRED.
Protective Gloves: IMPERVIOUS GLOVES (FP N).
Eye Protection: ANSI APPROVED CHEM WORKERS GOGGS (FP N).
Other Protective Equipment: NOT REQUIRED.
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.

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Transportation Data

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Trans Data Review Date: 94276

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Disposal Data

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Label Data

=====

Label Required: YES
Technical Review Date: 03OCT94
Label Date: 30SEP94
Label Status: G
Common Name: AQUATECH SULFURIC ACID REAGENT
Chronic Hazard: YES
Signal Word: CAUTION!
Acute Health Hazard-Slight: X
Contact Hazard-Slight: X
Fire Hazard-None: X
Reactivity Hazard-None: X
CANCER HAZARD. CONTAINS SULFURIC ACID, WHICH IS LISTED AS A CARCINOGEN (FP
N).
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: BIOLAB
Label P.O. Box: 1489
Label City: DECATUR
Label State: GA
Label Zip Code: 30031
Label Country: US
Label Emergency Number: 404-378-1753

Attachment E

Health and Safety Form Templates

The following Health and Safety Form templates are presented in this attachment. These forms will be utilized to demonstrate proper implementation and compliance with VHB's health and safety program.

- Site Entry and Exit Log
- Safety Meeting Form
- Safety Inspection List
- Incident Notification Form
- Medical Data Sheet
- Respiratory Certification Record

SITE ENTRY AND EXIT LOG

SITE: _____

Date/Time		Representing	Name	Date
In	Out			

SAFETY MEETING FORM

DATE HELD _____

Time _____

1. The safety meeting was held this date for the following personnel:

(CONTRACTOR) _____

(SUB-CONTRACTOR) _____

(FOM) _____

(OTHER) _____

2. Subjects discussed (note, delete, or add):

Accident trends/new hazards –

Individual protective equipment –

Back injury, safe lifting techniques –

Fire prevention –

Sanitation, first aid, waste disposal –

Tripping hazards –

Staging –

Equipment inspection & maintenance (zero defects) –

Hoisting equipment –

Ropes, hooks, chains, and slings –

Trucks, tractors, front-end loaders, scrapers, graders, gradall –

Electrical grounding, temporary wiring, GFCI –

Lockouts for safe clearance procedures: electrical, pressure moving parts –

Steep slopes –

Toxic materials: hazards, MSDS, respiratory, ventilation –

Other –

3. Forwarded _____

Prepared by _____

Signature _____

SAFETY INSPECTION LIST

Project Name/Number: _____ Date: _____

Superintendent's Name: _____ Title: _____

This safety inspection list is to be completed by the FOM and turned into the VHB Project Director with the week's paperwork. Any deficiencies found are to be corrected immediately.

1. Is the OSHA Safety and Health protection poster on the job? _____
2. Are emergency telephone numbers conspicuously posted? _____
3. Are first-aid kits and supplies on the job? _____
4. Are there first-aid trained personnel on the job? _____
5. Are warning signs and posters adequate? _____
6. Is there an adequate supply of personal protective gear available?
 - a. Hard Hats _____
 - b. Hearing Protection _____
 - c. Eye and Face Protection _____
 - d. Respiratory Protection _____
7. Are all personnel wearing the appropriate personal protective gear? _____
8. Is there an adequate slope or support provided for all trenches and excavations? _____
9. Is temporary electrical service grounded and is all other electrical equipment grounded? _____
10. Is the housekeeping adequate – are all aisles, passageways, and stairways clear of obstructions? _____
11. Are there any fire hazards on the job that could be eliminated? _____
12. Has heavy equipment been thoroughly inspected and is there a record of the inspections on file? _____

13. Is the job site fire protection adequate?
- a. Fire Extinguishers – have they been checked? _____
 - b. Available Water Hoses? _____
 - c. Barrels of Water with Buckets? _____
14. Is there adequate clearance between equipment or machinery and energized power lines? _____
15. Is the record of injuries and illnesses properly maintained and on file? _____
16. Are there job-site safety meetings held at least once a week? _____
17. Are all new employees indoctrinated with respect to their individual safety responsibilities? _____
18. Do my personal safety practices set a good example for all employees? _____
19. Misc.: _____
- _____
- _____
- _____

Signature_____
Date

INCIDENT NOTIFICATION FORM

TO: Vanasse Hangen Brustlin Consulting Engineers Project Manager

Date: _____

FROM: FOM and/or _____
(someone who has direct knowledge of the incident)

1. Contractor's Name: _____
2. Organization: _____
3. Telephone Number: _____
4. Location: _____
5. Reporter Name: _____
6. Name of Injured: _____ Birthdate: _____
7. Company Employing Injured: _____
8. Date of Incident: _____
9. Company Employing Injured: _____
10. Location of Incident: _____
11. Brief Summary of Incident (provide pertinent details including type of operation at time of incident):

12. Cause, if known: _____
13. Casualties, if any: _____

14. Details of Any Existing Chemical Hazards or Contamination:

15. Estimated Property Damage: _____

16. Affect on Contract Schedule: _____

17. Actions Taken by Contractor: _____

18. What Medical Help was Given: _____

19. Doctor and/or Hospital (if known): _____

20. When did Employee Return to Work: _____

21. Other Damages/Injuries Sustained (public or private):

22. Additional Information:

MEDICAL DATA SHEET

This Medical Data Sheet will be completed by all on-site personnel and will be kept in The Support Zone during site operations.

Project: _____

Name: _____

Address: _____

Home Telephone: Area Code () _____

Date of Birth: _____ Height: _____ Weight: _____

In case of Emergency, contact: _____
(name and relationship)

Address: _____

Telephone: Area Code () _____

Do you wear contact lenses? () Yes () No

Allergies: _____

List medication taken regularly: _____

Particular sensitivities: _____

Previous/recent illnesses or exposures to hazardous chemicals: _____

Name of Personal Physician: _____

Telephone: Area Code () _____

RESPIRATORY CERTIFICATION RECORD**RESPIRATORY PROTECTION PROGRAM
RECORD OF RESPIRATOR USE**

Name _____ Date _____

Social Security Number _____ Age _____

Location _____

Department _____ Supervisor _____

Area to be used in _____

Type of Respirator _____ Fitted By _____

Medical Approval Date _____

Medical Facility/Physician _____

Specific contaminants for which respiratory protection is necessary:

EMPLOYEE STATEMENT

I, an employee of _____ have received the above referenced respirator. I have been fitted and properly instructed on its uses and limitations. I, also, understand that it is my responsibility to properly clean, maintain and store my respirator in a clean area unless other arrangements have been made to assure maintenance and care of the respiratory protection.

Signature _____

Date _____

Appendix B

Quality Assurance Project Plan

Former Manufactured Gas Plants & Related Sites

New York

Prepared for: **KeySpan Corporation**
One MetroTech Center
Brooklyn, New York 11201-3850

Prepared by: **VHB/Vanasse Hangen Brustlin, Inc.**
54 Tuttle Place
Middletown, Connecticut 06457

April 2002

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Introduction

Purpose

The purpose of this generic Quality Assurance Project Plan (QAPP) is to document the type and quality of data needed for environmental decisions and to describe the methods for collecting and assessing those data. The generic QAPP has been designed to ensure high quality, valid data for use in investigation work conducted at a variety of sites formerly related to the manufacturing, storage, and/or transmission/regulation of gas. This document addresses common activities that may be performed at a site but does not describe site- or time-specific tasks. Sample numbers, types, matrices, locations, and frequencies will be identified in the site-specific work plan (sampling and analysis plan). If modifications to the procedures described herein are required for a site-specific investigation, detailed information regarding the changes and rationale for these changes will be provided in the site-specific work plan.

Related Resources

This generic QAPP has been prepared in accordance with New York State Department of Environmental Conservation (NYSDEC) and United States Environmental Protection Agency (EPA) guidance documents. Specific documents used in the creation of this generic QAPP or that complement this document with respect to environmental quality management include:

- *NYSDEC Analytical Services Protocol*, 10/95 Revisions;
- *Guidance for the Data Quality Objectives Process (QA/G-4)* (EPA 1994a);
- *EPA Guidance for Quality Assurance Project Plans (QA/G-5)* (EPA 1998);
- *EPA Requirements for Quality Assurance Project Plans (QA/R-5)* (EPA 1999a);
- *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods SW-846* (EPA 1997).

Program Description

Program Objective

The data generated from the sampling program will be used to determine the nature, extent, and source(s) of chemical constituents at a given site; prepare a human health and/or environmental risk/threat assessment; and, if necessary, identify, evaluate, and recommend a cost-effective, environmentally sound, long-term remedial action plan. The data will also be utilized to monitor for the health and safety of workers at the site as well as potential off-site receptors.

Site Description

The program to which this generic QAPP applies includes a variety of sites where former activities have the potential for the release of chemical constituents into the environment. These sites, include, but are not limited to, former manufactured gas plants (MGPs), gas storage sites, modern LP cracking facilities, gas transmission/regulation stations, *etc.*

A detailed site description will be included in the site-specific work plan.

Site History

A detailed site history will be included in the site-specific work plan. A general historical discussion of the manufactured gas process is provided below. (*Note: the following historical discussion is from *Manufactured Gas Plants, a New York Heritage* by The WD Burdick Company, 1996.*)

Former MGP sites are generally abandoned or reused properties that formerly housed a facility utilized for the production of gas distilled from coal. These facilities, also known as "gasworks" or "town gas," supplied gas to surrounding communities and industries for light, heat, and cooking. The first U.S. MGP opened in Baltimore, Maryland in 1817 and the first New York State MGP opened in 1825 in New York City.

The production of coal gas involved heating coal to drive off gas (primarily methane, hydrogen, and carbon dioxide), which was then condensed. By-products of condensation included tars and oils. Condensed gas was then scrubbed and purified to remove ammonia, sulfur, and other impurities.

During the 1870's, an alternative method of producing gas was developed. The "carbureted water-gas" or "blue water-gas" process involved the use of steam and hot coal to generate hydrogen and carbon dioxide that was then used to crack heavy oil into simpler gas.

Manufactured gas sales increased rapidly during the first half of the 1900's but came to a rapid end around 1950. The demise of the MGP industry was ushered by increased natural gas production and the development of interstate natural gas pipelines.

In general, the environmental legacy of MGPs includes the remnants of subsurface structures and facilities and the possible presence of tar and oil by-products in the surface and/or subsurface environment.

Sampling Program Design and Rationale

The following presents a general discussion of the sampling that may be conducted in support of a site investigation. Actual sample numbers, types, matrices, locations, and frequencies will be identified in the site-specific work plan

- Soil Vapor - Soil vapor samples may be collected to locate/confirm the source and extent of subsurface organic vapors on- and off-site. It may also be utilized on a preliminary basis to determine if the presence of subsurface vapors is potentially impacting surface receptors.
- Surface Soil - Surface soil samples may be collected on-site to determine the nature and extent of on- and/or off-site chemical analytes in surface soil.
- Sediment/Sludge - Sediment and sludge samples may be collected from dry wells, storm drainage systems, and/or wastewater disposal/sanitary systems located on the site, and surface water bodies on- and off-site. The purpose of these samples is to determine if the wells/systems are a source of site-related chemical constituents, and to determine if these constituents have impacted sediment from surface water bodies.
- Wastewater/Drainage Water - Wastewater and drainage water samples may be collected from dry wells and/or wastewater disposal/sanitary systems located on the site to determine if these wells/systems are a source of site-related chemical constituents.
- Storm Water - Storm water samples may be collected from catch basins and storm drains located on- and off-site to determine if the storm water system contains chemical analytes of concern.
- Surface Water - Surface water samples may be collected from surface water bodies on- and off-site to determine if impacts from site-related chemical constituents exist.
- Subsurface Soil - Subsurface soil samples may be collected during drilling of monitoring wells and borings, excavation of test pits, or by using direct push technology at probe locations. Subsurface soil samples may be collected to delineate the extent of on- and off-site chemical analytes of concern.
- Groundwater - Groundwater samples may be obtained from monitoring wells and/or at direct push probe/Hydropunch locations, which may be installed as part of the investigation, or from monitoring wells which were installed previously at and in the vicinity of the site. Groundwater samples will be collected to define the horizontal and vertical extent of chemical constituents in groundwater on- and off-site.
- Air - Ambient air samples may be collected on- and off-site, within buildings, and outdoors to identify potential health risks.

For a detailed discussion of the sampling program and selection of sample matrices and locations, see the site-specific work plan.

Analytical Parameters

Surface soil, subsurface soil and sediment samples collected at former MGP and other related sites will typically be analyzed for volatile organic compounds (VOCs) (specifically including benzene, toluene, ethylbenzene, and xylenes [BTEX]); semivolatile organic compounds (SVOCs) (specifically including polycyclic aromatic hydrocarbons [PAHs]); RCRA metals; and total cyanide. Polychlorinated biphenyls (PCBs) and pesticides may also be analyzed if the historical or current use of the property potentially suggests their presence.

Groundwater samples from direct-push sample locations will typically be analyzed for BTEX and PAHs, and monitoring well groundwater and surface water samples will typically be analyzed for VOCs, SVOCs, RCRA metals, total and free cyanide. Pesticides and PCBs may also be analyzed for as discussed above.

Ambient air and soil vapor samples will typically be analyzed for VOCs and naphthalene.

Additional chemical and Geotechnical parameters may be analyzed for on a site-specific basis and include, but are not limited to, total organic carbon, salinity, an expanded metals list (Target Analyte List).

Analytical methodologies will be consistent with the October 1995 edition of the NYSDEC *Analytical Services Protocol* (ASP) and will generally consist of non-Contract Laboratory Program (non-CLP) methods (e.g., 8260B for VOCs). When non-CLP methods are used, analytical procedures will be consistent with the latest update of *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846*, (currently Third Edition, Update III) (EPA 1997). Contract Required Quantitation Limits (CRQLs) for individual analytes will be consistent with Exhibit C of the NYSDEC ASP and will be assessed on a site-by-site basis for comparison with site-specific action levels. Action levels will generally be risk-based or federal/state promulgated matrix-specific limits. If ASP CRQLs are not low enough to meet a specific site's action levels, method detection limits (MDLs) may be used. MDLs for individual analytes will be the lower of those specified by the analytical method (in the ASP or SW-846) or those of the specific laboratory selected for a site. Specific laboratory-achievable MDLs for a given method will be provided in laboratory standard operating procedures (SOPs) prior to initiation of site activities.

Table 1 presents a summary of the parameters/sample fraction typically monitored for at former MGP and other related sites, together with the typical sample location, type of sample, sample matrix, type of sample container, method of sample preservation, holding time and analytical method.

Table 1
SUMMARY OF ANALYTICAL PARAMETERS

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Container Type/Size/No. ^a	Sample Preservation	Maximum Holding Time	Analytical Method
On-Site/Off-Site	Grab	Soil Vapor	BTEX and Naphthalene	Sorbent Tube/Tedlar® bag/ SUMMA® Canister	--	7 days from VTSR	10/95 NYSDEC ASP, Method 8021B or USEPA TO Methods (TO-1, TO-2, TO-15)
			Chlorinated Volatile Organics	Sorbent Tube/Tedlar® bag/ SUMMA® Canister	--	7 days from VTSR	10/95 NYSDEC ASP, Method 8260B or USEPA TO Methods (TO-1, TO-2, TO-15)
On-Site/Off-Site	Grab	Ambient Air	BTEX and Naphthalene	Sorbent Tube/Tedlar® bag/ SUMMA® Canister	--	7 days from VTSR	USEPA TO Methods (TO-1, TO-2, TO-15)
			Chlorinated Volatile Organics	Sorbent Tube/Tedlar® bag/ SUMMA® Canister	--	7 days from VTSR	USEPA TO Methods (TO-1, TO-2, TO-15)
			VOCs	Sorbent Tube/Tedlar® bag/ SUMMA® Canister	--	7 days from VTSR	USEPA TO Methods (TO-14A, TO- 15)
On-Site/Off-Site	Grab	Surface Soil	BTEX ^b	Glass, clear/40-ml/two 2000 class or equivalent	Cool to 4°C	10 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8021B
			Polycyclic Aromatic Hydrocarbons (PAHs)	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	10 days after VTSR for extraction, 40 days after extraction for analysis	10/95 NYSDEC ASP, Method 8270C
			Polychlorinated biphenyls (PCBs) ^c	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	10 days after VTSR for extraction, 40 days after extraction for analysis	10/95 NYSDEC ASP, Method 8082
			RCRA Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver)	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	26 days after VTSR for Hg analysis, 6 months for all other metals	10/95 NYSDEC ASP, Method 6010B/ 7471
			Total Cyanide	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	14 days after VTSR for analysis	10/95 NYSDEC ASP, Method 9010B
On-Site/Off-Site	Grab	Ash	Semivolatile Compounds	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	10 days after VTSR for extraction, 40 days after extraction for analysis	10/95 NYSDEC ASP, Method 8270C
	Grab	Ash	TAL Metals	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	26 days after VTSR for Hg analysis, 6 months for all other metals	10/95 NYSDEC ASP, Method 6010B/ 7471
	Grab	Ash	Total Cyanide	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	14 days after VTSR for analysis	10/95 NYSDEC ASP, Method 9010B

^a Verify number and type of containers with specific lab selected to perform the analyses.

^b If staining of the soil is present.

^c Samples collected in areas of transformers will be analyzed for PCBs.

Table 1 (continued)

SUMMARY OF ANALYTICAL PARAMETERS

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Container Type/Size/No. ^a	Sample Preservation	Maximum Holding Time	Analytical Method
On-Site/Off-Site	Grab	Subsurface Soil	BTEX	Glass, clear/40-ml/two 2000 class or equivalent	Cool to 4°C	10 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8021B
	Grab	Subsurface Soil	PAHs	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	10 days after VTSR for extraction, 40 days after extraction for analysis	10/95 NYSDEC ASP, Method 8270C
	Grab	Subsurface Soil	PCBs ^b	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	10 days after VTSR for extraction, 40 days after extraction for analysis	10/95 NYSDEC ASP, Method 8082
	Grab	Subsurface Soil	RCRA Metals	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	26 days after VTSR for Hg analysis, 6 months for all other metals	10/95 NYSDEC ASP, Method 6010B/7471
	Grab	Subsurface Soil	Total Cyanide	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	14 days after VTSR for analysis	10/95 NYSDEC ASP, Method 9010B
On-Site	Grab	Test Pit Soil	BTEX	Glass, clear/40-ml/two 2000 class or equivalent	Cool to 4°C	10 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8021B
	Grab	Test Pit Soil	PAHs	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	10 days after VTSR for extraction, 40 days after extraction for analysis	10/95 NYSDEC ASP, Method 8270C
	Grab	Test Pit Soil	RCRA Metals	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	26 days after VTSR for Hg analysis, 6 months for all other metals	10/95 NYSDEC ASP, Method 6010B/7471
	Grab	Test Pit Soil	Total Cyanide	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	14 days after VTSR for analysis	10/95 NYSDEC ASP, Method 9010B
Storm Water Runoff/Surface Water/Storm Drains/Dry Wells	Grab	Sediment	BTEX	Glass, clear/40-ml/two 2000 class or equivalent	Cool to 4°C	10 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8021B
	Grab	Sediment	Chlorinated Volatile Organics	Glass, clear/40-ml/two 2000 class or equivalent	Cool to 4°C	10 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8260B
	Grab	Sediment	PAHs	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	10 days after VTSR for extraction, 40 days after extraction for analysis	10/95 NYSDEC ASP, Method 8270C
	Grab	Sediment	RCRA Metals	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	26 days after VTSR for Hg analysis, 6 months after VTSR for analysis of all other metals	10/95 NYSDEC ASP, Method 6010B/7471
	Grab	Sediment	Total Cyanide	Glass, clear/8-oz./one 2000 class or equivalent	Cool to 4°C	14 days after VTSR for analysis	10/95 NYSDEC ASP, Method 9010B

^a Verify number and type of containers with specific lab selected to perform the analyses.

^b Samples collected in areas of transformers will be analyzed for PCBs.

Table 1 (continued)

SUMMARY OF ANALYTICAL PARAMETERS

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Container Type/Size/No. ^a	Sample Preservation	Maximum Holding Time	Analytical Method
Storm Drains/Dry Wells	Grab	Storm Water Runoff/ Surface Water	BTEX	Glass, clear/40-ml/three 2000 class or equivalent	Cool to 4°C	7 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8021B
	Grab	Storm Water Runoff/ Surface Water	Chlorinated Volatile Organics	Glass, clear/40-ml/three 2000 class or equivalent	Cool to 4°C	7 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8260B
	Grab	Storm Water Runoff/ Surface Water	PAHs	Glass, amber/1-L/two 2000 class or equivalent	Cool to 4°C	5 days after VTSR for extraction, 40 days after extraction for analysis	10/95 NYSDEC ASP, Method 8270C
	Grab	Storm Water Runoff/ Surface Water	RCRA Metals	Plastic/1-L/one 2000 class or equivalent	HNO ₃ to pH <2 Cool to 4°C	26 days after VTSR for Hg analysis, 6 months after VTSR for analysis of all other metals	10/95 NYSDEC ASP, Method 6010B/7471
	Grab	Storm Water Runoff/ Surface Water	Total Cyanide	Plastic/250 ml/one 2000 class or equivalent	NaOH to pH >12 Cool to 4°C	14 days after VTSR for analysis	10/95 NYSDEC ASP, Method 9010B
Monitoring Wells	Grab	Groundwater	BTEX	Glass, clear/40-ml/three 2000 class or equivalent	Cool to 4°C	7 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8021B
	Grab	Groundwater	Chlorinated Volatile Organics	Glass, clear/40-ml/three 2000 class or equivalent	Cool to 4°C	7 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8260B
	Grab	Groundwater	PAHs	Glass, amber/1-L/two 2000 class or equivalent	Cool to 4°C	5 days after VTSR for extraction, 40 days after extraction for analysis	10/95 NYSDEC ASP, Method 8270C
	Grab	Groundwater	Metals	Plastic/1-L/one 2000 class or equivalent	HNO ₃ to pH <2 Cool to 4°C	6 months after VTSR for analysis of others	10/95 NYSDEC ASP, Method 6010B/7470
	Grab	Groundwater	Total & Free Cyanide	Plastic/250-ml/one	NaOH to pH >12 Cool to 4°C	14 days after VTSR for analysis	10/95 NYSDEC ASP, Method 9010B and Method SM4500-CN1
	Grab	Groundwater	Salinity	Plastic/250-ml/one	Cool to 4°C	--	ASTM Method 210A
Groundwater Probe/Hydropunch Locations	Grab	Groundwater	BTEX	Glass, clear/40-ml/three 2000 class or equivalent	Cool to 4°C	7 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8021B
	Grab	Groundwater	Chlorinated Volatile Organics	Glass, clear/40-ml/three 2000 class or equivalent	Cool to 4°C	7 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8260B

^a Verify number and type of containers with specific lab selected to perform the analyses.

Table 1 (continued)

SUMMARY OF ANALYTICAL PARAMETERS

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Container Type/Size/No. ^a	Sample Preservation	Maximum Holding Time	Analytical Method
Groundwater Probe/Hydropunch Locations	Grab	Groundwater	PAHs	Glass, amber/1-L/two 2000 class or equivalent	Cool to 4°C	5 days after VTSR for extraction, 40 days after extraction for analysis	10/95 NYSDEC ASP, Method 8270C
	Grab	Groundwater	PCBs	Glass, amber/1-L/two 2000 class or equivalent	Cool to 4°C	14 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8082
Monitoring Wells	Grab	Groundwater	Volatile Organics	Glass, clear/40-ml/three 2000 class or equivalent	Cool to 4°C	7 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8260B
	Grab	Groundwater	Semivolatile Organics	Glass, amber/1-L/two 2000 class or equivalent	Cool to 4°C	5 days after VTSR for extraction, 40 days after extraction for analysis	10/95 NYSDEC ASP, Method 8270C
	Grab	Groundwater	Pesticides/PCBs	Glass, amber/1-L/two 2000 class or equivalent	Cool to 4°C	14 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8081A/8082
	Grab	Groundwater	TAL Metals	Plastic/1-L/two 2000 class or equivalent	HNO ₃ to pH <2 Cool to 4°C	26 days after VTSR for Hg analysis, 6 months for all others	10/95 NYSDEC ASP, 6010B/7470
	Grab	Groundwater	Total & Free Cyanide	Plastic/250-ml/one 2000 class or equivalent	NaOH to pH > 12 Cool to 4°C	14 days after VTSR for analysis	10/95 NYSDEC ASP, Method 9010B and Method SM4500-CNI
	Grab	Groundwater	Salinity	Plastic/250-ml/one 2000 class or equivalent	Cool to 4°C	---	ASTM Method 210A
Site/Study Area	Trip Blank	Water	BTEX	Glass, clear/40-ml/three 2000 class or equivalent	Cool to 4°C	7 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8021B
	Trip Blank	Water	Chlorinated Volatile Organics	Glass, clear/40-ml/three 2000 class or equivalent	Cool to 4°C	7 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8260B
	Trip Blank	Water	TCL Volatile Organics	Glass, clear/40-ml/three 2000 class or equivalent	Cool to 4°C	7 days after VTSR for analysis	10/95 NYSDEC ASP, Method 8260B
Site/Study Area	Blank	Ambient Air/Soil Vapor	BTEX/Naphthalene	Sorbent Tube/Tedlar® bag/ SUMMA® Canister	Cool to 4°C	7 days after VTSR for analysis	USEPA TO Methods (TO-1, TO-2, TO-15)

Sources: NYSDEC Analytical Services Protocol (ASP) October 1995 and USEPA 1999b.

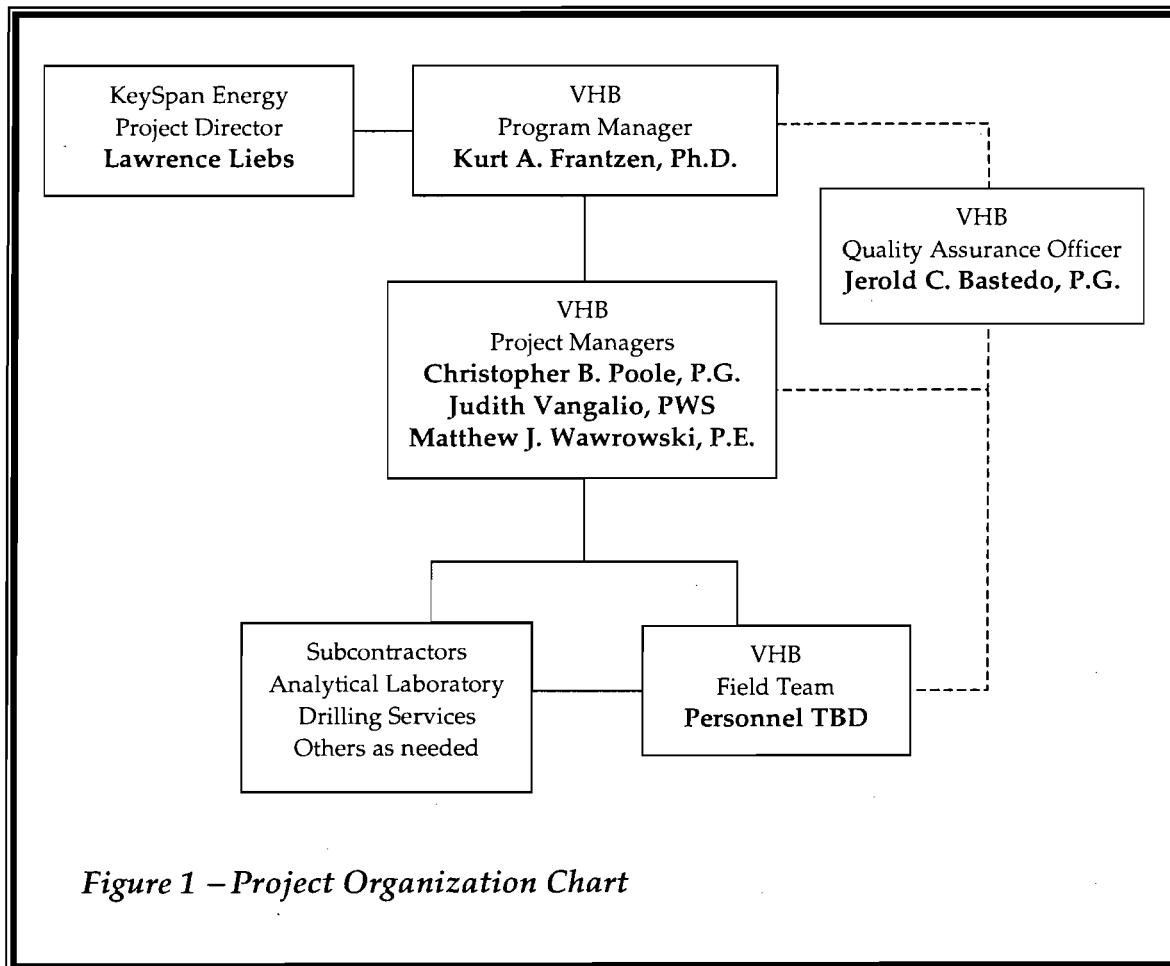
^a Verify number and type of containers with specific lab selected to perform the analyses.

Key: BTEX = benzene, toluene, ethylbenzene, and xylenes
 L = liter(s)
 ml = milliliters
 VTSR = Verified time of sample receipt at the laboratory

HNO₃ = Reagent-grade nitric acid
 NaOH = Reagent-grade sodium hydroxide
 TO = Toxic Organic compounds in air

Organization & Responsibility

Program organization is shown in Figure 1.



Training Requirements

At a minimum, all on-site personnel involved with sampling or oversight duties shall have received initial hazardous waste operations (HAZWOPER) training with annual refresher training as prescribed by *29 CFR 1910.120*. Certification of this training shall be provided to the project manager and/or site safety officer prior to initiation of field activities. In addition, at least one site worker shall be trained and certified in Standard First Aid and Adult CPR by the American Red Cross or equivalent. If shipping of hazardous materials to or from a site is required, personnel responsible for shipping shall be duly trained and certified in U.S. Department of Transportation (DOT) and/or International Air Transportation Association (IATA) shipping requirements as required by *49 CFR 172 Subpart H*.

The need for additional specialized training will be determined on a site-by-site basis and described in the site-specific work plan. Specialized training may be required if field-level analyses, geophysical surveys, wetland delineation, *etc.* are to be performed.

Quality Assurance Objectives & Requirements

Data quality requirements and assessments will be in accordance with the NYSDEC ASP, which includes method detection limits by analyte and sample matrix. When non-CLP methods are utilized (*e.g.*, 8260B, 8270C), data quality requirements will be those found in the latest update of SW-846, (currently Third Edition, Update III) (EPA 1997). Note that analyte-specific quantitation limits, accuracy, and precision estimates are determined by the laboratory performing the analysis and are contained in individual laboratory standard operating procedures (SOPs). Therefore, limits for these parameters are not specifically addressed in this generic QAPP but are available from the laboratory selected to perform the analyses. Individual laboratory SOPs and quality assurance (QA) requirements will conform to the quality assurance/quality control (QA/QC) requirements (Volume 10, Exhibit E) of the NYSDEC ASP. Additionally, selected laboratories will be NYS Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified for organic and inorganic analyses as well as NYSDOH CLP certified.

In general, the data collected at an individual site must be of sufficient quantity and quality to support decision making related to definition of the nature and extent of site-related chemical constituents and impacts of off-site contaminants, determination of potential human health and/or ecological risks/threats, and evaluation of engineering alternatives to mitigate these risks, if any.

Data Quality Objectives

Data quality objectives (DQOs) will be developed for individual sites to ensure that data collected will be of sufficient quality to support decision making as described above. DQOs help ensure the accountability of project staff to produce data of adequate quality for the intended use. DQOs are typically expressed through qualitative or quantitative statements of precision, accuracy, representativeness, comparability, and completeness (PARCC). Various levels of acceptable data quality will also be applied depending on the requirements and DQOs of a particular investigation. The levels of acceptable data that may be used include:

- Field screening. The use of portable instruments for the real-time measurement of organic vapors, dust, inorganic vapors (*e.g.*, hydrogen cyanide, hydrogen sulfide), explosive atmospheres, *etc.*, will be performed as applicable to optimize sampling locations, monitor health and safety, and screen for the presence of chemical constituents.
- Field analysis. Portable analytical instruments and mobile labs will generally not be used but may be required at an individual site to satisfy specific objectives.
- Laboratory analysis. This includes analysis of samples delivered to an appropriately certified laboratory by methods such as those discussed in Section 2.5. This will be the primary level of data quality used for site investigations to define the nature and extent of chemical analytes and in the assessment of human health and ecological risks.

Data Assessment

Data assessment procedures involve the application of PARCC parameters to determine whether QA objectives for the project have been met. PARCC parameters are expressed as overall performance goals typically related to indicator QC samples. PARCC parameters are applied as applicable throughout this generic QAPP. Definitions of PARCC parameters and assessment methods are provided below.

Precision

Precision is a measure of the variability or random error in measurements. Precision is indicated by the relative percent difference (RPD) between concentrations of individual analytes in duplicate samples. The overall precision is affected by variability in sampling (including sample heterogeneity) and lab analysis. Laboratory duplicate samples provide an indication of analytical precision while field duplicate samples provide an indication of the overall

precision. To this end, laboratory duplicates, including matrix spike duplicates (MSDs) and laboratory spike duplicates, will be analyzed at a rate that conforms to the general QA/QC requirements of the NYSDEC ASP or the specific analytical method, whichever is greater. Unless otherwise specified, this rate shall be one per sample delivery group (batch) or one per 20 field samples. Field duplicate samples shall be collected at the rate of one per ten original samples. See also Section 6.6 pertaining to matrix spike (MS), MSD, and field duplicates. Precision limits will be defined in individual laboratory SOPs. Typically, acceptable precision limits range from zero (no difference between duplicate control samples), and the historical mean relative percent difference between control and duplicate sample analyses is plus or minus three standard deviations (EPA 1997).

Accuracy

Accuracy is the degree of agreement of a measurement with an accepted reference standard. It is a measure of the total error of the system including both systematic (bias) and random errors. Traceable standards or laboratory-prepared solutions of surrogate compounds are spiked into each sample. The corrected percent recovery indicates the presence of bias due to sample or matrix interference. Accuracy limits will be defined in individual laboratory SOPs. Typically, acceptable accuracy limits are the historical mean recovery percentage of control sample analyses plus or minus three standard deviations (EPA 1997). Laboratory accuracy will also be assessed by laboratory control, matrix spike, and matrix spike blank samples analyzed at the rate defined by the analytical method or general QA/QC requirements of the NYSDEC ASP, whichever is greater.

Representativeness

Representativeness expresses the degree to which the sample data represent the actual conditions of a site. Representativeness is maximized by proper selection of sample locations and collection of a sufficient number of samples and can be assessed qualitatively. Representative samples will be collected as follows:

- Soil Vapor - Samples will be collected from decontaminated stainless steel or dedicated polyvinyl chloride (PVC) soil probes after the soil vapor has reached equilibrium. Samples will be collected using a personal sampling pump, polyethylene tubing (Teflon®-lined when sampling for semivolatiles), and dedicated gas-tight syringe, sorbent tube, or Tedlar® bag. Alternatively, pre-cleaned SUMMA® canisters may be used.
- Surface Soil - Samples will be collected at a depth of 0-2 inches (below sod or pavement when present) using a dedicated stainless-steel or polystyrene scoop, or sterile wooden tongue depressor.

- Sediment (Dry Well/Drainage System) - Samples will be collected from the center of the dry well, wastewater disposal/sanitary system, or catch basin and storm drain (if possible) after the drainage/storm water sample is obtained in order not to introduce sediment into the water column. Samples will be collected utilizing a decontaminated stainless steel or polyethylene long-handled scoop (if possible), or a soil probe or split-spoon sampler.
- Sediment (Surface Water) - Samples will be collected in the area of the surface water samples 0 to 6 inches below the sediment surface after the surface water sample is obtained in order not to introduce sediment into the water column. Samples will be collected with a decontaminated long-handled stainless steel or polyethylene scoop.
- Wastewater/Drainage Water - Samples will be collected from the center of the wastewater disposal/sanitary system (if possible) and at a depth of 6 inches below the surface of standing water (if possible) using a dedicated polyethylene bailer or decontaminated stainless-steel or polyethylene long-handled scoop. Sample portions for BTEX or other lighter-than-water portions will be collected at the surface.
- Storm Water - Samples will be collected from the center of the drainage system or storm drain (if possible) at a depth of 6 inches below the surface of standing water (if possible). Sample portions for BTEX or other lighter-than-water portions will be collected at the surface. Sample will be collected using a dedicated polyethylene bailer, decontaminated stainless steel or polyethylene scoop, or by directly filling appropriate laboratory containers.
- Surface Water - Samples will be collected from the center of the surface water body cross section (if possible) and at mid-depth or at a minimum of 6 inches below the surface of the water (if possible) in the vicinity of the surface drainage discharge point. Sample portions for BTEX or other lighter-than-water portions will be collected at the surface. Samples will be collected using a dedicated polyethylene bailer or scoop or by directly filling appropriate laboratory containers.
- Subsurface Soil (Test Pits) - Samples will be collected from the bucket of the backhoe using a dedicated stainless steel or polystyrene scoop, or sterile wooden tongue depressor.
- Subsurface Soil (Monitoring Well/Soil Boring) - Samples will be collected using a decontaminated steel split-spoon sampler during monitoring well or soil boring construction and transferred to appropriate laboratory containers using dedicated stainless steel or polystyrene scoops, or sterile wooden tongue depressors.
- Subsurface Soil (Probe) - Samples will be collected using a decontaminated steel soil-core sampler with dedicated acetate tube liner and transferred to appropriate laboratory containers using dedicated stainless steel or polystyrene scoops, or sterile wooden tongue depressors.
- Groundwater (Probe/Hydropunch) - Samples will be collected upon installation of the probe using dedicated polyethylene tubing equipped with a bottom check valve, a small diameter bailer, or a peristaltic pump.

- Groundwater (Monitoring Well) - Samples will be collected with a dedicated polyethylene or decontaminated stainless steel bailer after purging three to five well casing volumes (until field measurements for pH, conductivity, temperature and turbidity have stabilized, or until the well is purged dry) and the well has been allowed to recharge.
- Air - Samples will be collected using a dedicated sorbent tube or Tedlar® bag and low-flow sampling pump. Alternatively, pre-cleaned SUMMA® canisters may be used. Samples will be collected over a period of time selected to appropriately represent the conditions to be evaluated.

Comparability

Comparability expresses the confidence with which one set of data can be compared to another. Quantitatively, comparability can be assessed in terms of precision and accuracy between to sets of data. Qualitatively, data subject to strict QA/QC procedures will be deemed more reliable than data obtained without strict use of these procedures. All data will be presented in the units designated by the methods specified in the NYSDEC ASP or EPA SW-846. In addition, sample locations, collection procedures and analytical methods from earlier studies will be evaluated for comparability with current procedures/methods, as applicable.

Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected under typical conditions. The acceptability of 100% of the data is desired as a goal for this project. The acceptability of less than 100% complete data, meeting all laboratory QA/QC protocols/standards, will be evaluated on a case-by-case basis.

Detailed Sampling Procedures

Environmental samples will be collected as part of the site assessment. These may include groundwater, wastewater, storm water, surface water, sediment/sludge, subsurface soil, surface soil, soil vapor, and ambient air. Sample locations may consist of monitoring wells, dry wells, wastewater disposal/sanitary systems, soil probe locations, groundwater probe/Hydropunch locations, storm water drainage systems, surface water bodies, soil borings, surface soils, test pits, soil vapor points, and ambient air. Actual locations, sample quantities, and matrices will be described in the site-specific work plan.

General sampling approaches and equipment are described in this section. A summary of the general sampling program, including sample media, depths, equipment, rationale, and analytical parameters is provided in Table 2.

When taking soil samples, an attempt will be made to maintain sample integrity by preserving its physical form and chemical composition to as great an extent as possible. An appropriate sampling device (*i.e.*, decontaminated or dedicated equipment) will be utilized to transfer the sample into the sample container. Every effort will be made to ensure that the sample is a proper representation of the matrix from which it was collected. For all matrices, VOC aliquots will be transferred into the sample bottle as quickly as possible, with no mixing, to ensure that the volatile fraction is not lost.

Note that, in general, the use of polyethylene, polystyrene, stainless-steel, or Teflon® sampling equipment is acceptable assuming it has been certifiably decontaminated prior to use, either on site or by the manufacturer. Polyethylene is not recommended when sampling for semivolatile organics due to potential release of phthalate esters into the sample.

The materials involved in groundwater sampling are critical to the collection of high quality monitoring information, particularly where the analyses of volatile, pH sensitive, or reduced chemical constituents are of interest. The materials for bailers and pump parts will be Teflon®, stainless steel, PVC, and/or polyethylene.

There will be several steps taken after the transfer of the soil or water sample into the sample container that are necessary to properly complete collection activities. Once the sample is transferred into the appropriate container, the container will be capped and, if necessary, the outside of the container will be wiped with a clean paper towel (moistened with distilled/deionized water, if necessary).

The sample container will then be properly labeled. Appropriate information such as sample number, location, collection time, and sample description will be recorded in the field logbook. Associated paper work (*e.g.*, chain-of-custody forms) will then be completed and will stay with the sample. Samples will be packaged in a manner that will allow the appropriate storage temperature (4°C) to be maintained during shipment to the laboratory. Samples will be delivered to the laboratory within 48 hours of collection.

TABLE 2 SUMMARY OF SAMPLING PROGRAM

Environmental Media	Sample Location	Sample Point	Sample Depth	Equipment	Rationale	Sample Analyses (Source)
Soil Vapor	On-Site & Off-Site	Soil vapor survey point	3 feet below soil surface	Decontaminated or disposable soil vapor rods/tubing, sorbent tube/Tedlar® bag and personal sampling pump or SUMMA® canister	Determine soil vapor concentrations, aid location of other samples, and define potential impacts to surface receptors	VOCs and naphthalene (EPA Compendium of TO Methods or 10/95 NYSDEC ASP)
Surface Soil	On-Site & Off-Site	Biased to areas of potential contamination or sensitive receptors	0-2 inches below soil surface	Stainless steel or polystyrene scoop, or sterile wooden tongue depressor	Determine chemical concentrations and potential impacts to receptors	BTEX, PAHs, RCRA metals, total cyanide, PCBs (10/95 NYSDEC ASP)
Surface Soil	On-Site & Off-Site	Ash	0-2 inches below surface	Stainless steel or polystyrene scoop, or sterile wooden tongue depressor	Determine chemical concentrations and potential impacts to receptors	SVOCs, TAL metals (10/95 NYSDEC ASP)
Sediment/Sludge	On-Site & Off-Site	Dry well, catch basin, wastewater/sanitary system, storm drain, and surface water body	0-6 inches below sediment surface	Decontaminated long handle polyethylene scoop, sediment dredge, or split-spoon sampler	Determine chemical concentrations and potential impacts to receptors	BTEX, PAHs, RCRA metals, total cyanide, PCBs (10/95 NYSDEC ASP)
Wastewater	On-Site	Wastewater/Sanitary System	6 inches below water surface; at surface when sampling for BTEX	Decontaminated long handle polyethylene scoop or polyethylene/stainless steel bailer	Determine chemical concentrations	BTEX, PAH, RCRA metals, total cyanide, PCBs (10/95 NYSDEC ASP)
Drainage/Storm Water	On-Site & Off-Site	Dry well/catch basin/storm drain	6 inches below water surface; at surface when sampling for BTEX	Decontaminated long handle polyethylene scoop or polyethylene/stainless steel bailer	Determine chemical concentrations and potential impacts to receptors	BTEX, PAH, RCRA metals, total cyanide, PCBs (10/95 NYSDEC ASP)
Surface Water	On-Site & Off-Site	Surface water	6 inches below water surface; at surface when sampling for BTEX	Decontaminated long handle polyethylene scoop or dedicated polyethylene/stainless steel bailer	Determine chemical concentrations and potential impacts to receptors	BTEX, PAH, RCRA metals, total cyanide, PCBs (10/95 NYSDEC ASP)
Subsurface Soil	On-Site & Off-Site	Test Pits	Dependent on visual characteristics and organic vapor field screening	Decontaminated backhoe bucket, disposable polystyrene scoop, stainless steel spoon, or sterile wooden tongue depressor	Determine chemical concentrations and extent	BTEX, PAH, RCRA metals, total cyanide, PCBs (10/95 NYSDEC ASP)
Subsurface Soil	On-Site & Off-Site	Well borehole/soil boring	Dependent on visual characteristics and organic vapor field screening	Auger, decontaminated split spoon, and polystyrene scoop/ stainless steel spoon/ sterile wooden tongue depressor	Determine chemical concentrations and extent	BTEX, PAH, RCRA metals, total cyanide, PCBs (10/95 NYSDEC ASP)
Subsurface Soil	On-Site & Off-Site	Probe Location	Dependent on visual characteristics and organic vapor field screening	Decontaminated probe and dedicated acetate tube liner	Determine chemical concentrations and extent	BTEX, PAH, RCRA metals, total cyanide, PCBs (10/95 NYSDEC ASP)
Groundwater	On-Site & Off-Site	Groundwater Probe/ Hydropunch Location	At screened interval of probe	Disposable polyethylene tubing with bottom check valve, small diameter bailer, or peristaltic pump	Determine chemical concentrations and extent	BTEX and PAH (10/95 NYSDEC ASP)
Groundwater	On-Site & Off-Site	Monitoring well	At screened interval of well	Disposable polyethylene bailer, or pre-cleaned stainless steel bailer (after purge of three well volumes)	Determine chemical concentrations and extent	BTEX, PAH, RCRA metals, total cyanide or full TCL/TAL (10/95 NYSDEC ASP)
Air	On-Site & Off-Site	Ambient Air	Breathing Zone	Personal sampling pump and dedicated sorbent tube, Tedlar® bag or SUMMA® canister	Determine chemical concentrations in air and worker exposure	BTEX and naphthalene (EPA Compendium of TO Methods)
Air	On-Site & Off-Site	Drilling and sample locations	In the breathing zone and at point of sample collection	Photoionization and/or flame ionization detector	To screen for organic vapors in air	Total organic vapors

Sources: NYSDEC, October 1995, *Analytical Services Protocol*.EPA, 1999, *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*.

Key: BTEX = benzene, toluene, ethylbenzene, xylenes
PAH = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls

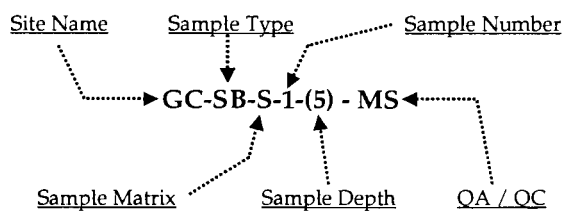
RCRA metals = arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver
TCL = Superfund Target Compound List volatiles, semivolatiles, pesticides, PCBs
TAL = Superfund Target Analyte List metals (23) and total cyanide

Sample Identification

All samples collected will be labeled with a sample identification code. The code will identify the site, sample location, matrix, and series number (for locations with more than one sample). Samples will be labeled according to the following system:

Site:	Site name (<i>e.g.</i> , Garden City "GC")
Sample Type:	Soil Boring or Probe "SB" Monitoring Well "MW" Dry Well "DW" Surface Soil "SS" Surface Water "SW" Sediment "SD" Groundwater Probe "GP" Test Pit "TP" Storm Drain "ST" Sanitary System Leaching Pool "LP" Sanitary System Septic Tank/Pit "SP" Soil Vapor/Gas Probe "SG" Ambient Air "AA" Runoff Water "RW" Runoff Sediment "RS"
Sample Matrix:	Soil "S" Sediment "SD" Sludge "SL" Groundwater "GW" Drainage Water/Storm Water "DW" Surface Water "SW" Wastewater "WW" Air "A" Soil Vapor/Gas "SG" Tap Water "TW"
Sample Number:	For circumstances where more than one sample of the same type and/or from the same location will be collected, a consecutive sample number will be assigned. When more than one sample is collected from a borehole in a sampling round at different depths, the depth will be indicated on the sample container and in the field logbook.
QA/QC:	Matrix Spike/Matrix Spike Duplicate "MS" Field Blank "FB" Trip Blank "TB"

Based upon the above sample identification procedures, an example of a sample label may be:



Sample Handling, Packaging, and Shipping

All samples will be placed in the appropriate containers as specified by the appropriate method in the NYSDEC ASP or EPA SW-846 (see Table 1). The holding time criteria identified in the ASP will be followed as specified in Table 1. The subcontracted laboratory will provide sample containers. These containers shall be acquired from a reliable source and prepared in a manner consistent with the bottle washing procedures of the NYSDEC ASP.

Sample preservation shall be performed in a manner consistent with the appropriate method in the NYSDEC ASP or EPA SW-846 and as summarized in Table 1. Reagent-grade preservatives shall be used. The pH of each preserved sample will be verified in the field prior to shipping and at the laboratory at the time of sample receipt or just prior to extraction, digestion, and/or analysis.

Prior to packaging any samples for shipment, the sample containers will be checked for proper identification and compared to the field logbook for accuracy. The samples will then be wrapped with a cushioning material and placed in a cooler (or laboratory shuttle) with a sufficient amount of bagged ice or "blue ice" packs in order to keep the samples at 4°C until arrival at the laboratory.

All necessary documentation required to accompany the sample during shipment will be placed in a sealed plastic bag and taped to the underside of the cooler lid. The cooler will then be sealed with packing tape, and custody seals will be placed in such a manner that opening of the cooler prior to arrival at the laboratory can be detected.

All samples will be shipped to ensure laboratory receipt within 48 hours of sample collection in accordance with NYSDEC requirements. The laboratory will be notified prior to the shipment of the samples.

Media-Specific Sampling Procedures

Soil Vapor

1. Refer to the appropriate USEPA Method for toxic organic (TO) compounds in air (USEPA 1999) and/or ASTM method (D5314-92e1).
2. Be certain that the sample location is noted on Location Sketch.
3. Calibrate personal sampling pump in accordance with manufacturer's specifications, if necessary.
4. Drive the decontaminated stainless steel probe into the ground to the desired depth in accordance with the procedures applicable to the specific probe type used (refer to manufacturer's specifications where applicable). Alternatively, drill a hole with a screw-type stainless steel auger to the desired depth. The hole diameter should be the same as that of the probe. Insert dedicated PVC probe into hole.
5. Connect new polyethylene tubing (Teflon®-lined when sampling for SVOCs) to the probe and the pump. Check all connections and turn on pump. Allow the pump to run until the soil vapor within the probe has reached equilibrium.
6. Collect a vapor sample using a gas tight syringe, sorbent tube, or Tedlar® bag in accordance with the appropriate EPA TO or ASTM method.
7. Shut off pump and disconnect tubing.
8. Record all sample information in the field logbook and on the chain of custody form.
9. Extract probe from the ground. If reusable, decontaminate according to the procedures in Section 6.4. If dedicated, dispose of in accordance with the procedures in Section 6.5.
10. Backfill probe hole with native soil or concrete.

Shallow Soil/Water

1. Be certain that the sample location is noted on Location Sketch.
2. Be certain that the sampling equipment, including the shovel or stainless steel scoop, is decontaminated utilizing the procedures outlined in Section 6.4.



1

* In order to establish the amount of time required for the soil vapor to reach equilibrium in the probe, the following approaches can be utilized:

- a. Once the personal sampling pump is turned on, collect a sample every 1 to 2 minutes and analyze on a portable gas chromatograph. Continue to collect samples until two consecutive samples yield comparable results. Do this at two or three locations in order to establish a pumping time.
- b. Instead of using a personal sampling pump, attach the tubing from the probe directly to a PID or FID. Once a steady reading is obtained, the system is considered to be in equilibrium. (Not recommended if low levels of volatile organic vapors are present [*i.e.*, <1 ppm].)
- c. Calculate the volume of air within the probe; divide by the pump flow rate to determine the time necessary to evacuate the probe; evacuate three to five volumes prior to collecting sample.

3. Remove laboratory precleaned sample containers from sample cooler, label container with indelible marker. Record all sample information in the field logbook and on the chain of custody form.
4. Dig/scoop out soil to desired depth (*i.e.*, 0 to 2 inches) and set aside.
5. If water is present, collect a water sample using a disposable scoop or fill the bottle directly by lowering into the water. Replace the container cover. If water is not present, sample the soil at the bottom of the excavation using a disposable scoop, place into the open sample containers and replace the container covers.
6. Backfill excavation with the removed soils that were set aside as the top layer.
7. If reusable, decontaminate the sampling equipment according to the procedures described in Section 6.4.
8. Dispose of dedicated sampling devices and disposable personal protective equipment (PPE) as described in Section 6.5.

Surface Soil

1. Be certain that the sample location is noted on Location Sketch.
2. Be certain that non-disposable sampling equipment has been decontaminated utilizing the procedures outlined in Section 6.4.
3. Remove laboratory precleaned sample container from sample cooler, label container with an indelible marker. Record all sample information in the field logbook and on the chain of custody form.
4. At the sample location, clear surface debris (*e.g.*, vegetation, rocks, twigs, *etc.*) or remove sod or pavement as applicable. Collect an adequate amount of soil from a depth of 0 to 2 inches using a decontaminated or disposable scoop and/or sterile wooden tongue depressor. Transfer the sample directly into the sample container.
5. Return the sample container to the cooler.
6. If reusable, decontaminate the sampling equipment according to the procedures described in Section 6.4.
7. Dispose of dedicated sampling devices and disposable PPE as described in Section 6.5.

Sediment

1. Be certain that the sample location is noted on Location Sketch.
2. Be certain that non-disposable sampling equipment has been decontaminated utilizing the procedures outlined in Section 6.4.
3. Remove laboratory precleaned sample containers from sample cooler, label container with an indelible marker. Record all sample information in the field logbook and on the chain of custody form.

4. Wear disposable gloves and boots or hip-waders if necessary to enter surface water bodies.
5. Insert scoop slowly at 0-6 inches into the sediment and remove sample. Sample sediment only after surface water samples have been taken to avoid introduction of sediment into the water.
6. If depth to sediment is greater than the reach of a long handled scoop, the sample may need to be collected utilizing a soil probe, split-spoon sampler, or sediment dredge.
7. With a sterile wooden tongue depressor and/or dedicated or decontaminated scoop, transfer the sample into the open sample container taking care not to spill sample on the outside of the container or overfill container and replace cover on the sample container.
8. Return sample container to sample cooler.
9. If necessary, decontaminate the sampling equipment according to the procedures outlined in Section 6.4.
10. Dispose of dedicated sampling devices and disposable PPE as described in Section 6.5.

Surface Water (Including Open Bodies, Drainage Water, Wastewater, Storm Water)

1. Be certain sample location is noted on Location Sketch.
2. Be certain that all non-disposable sampling equipment has been decontaminated utilizing the procedures outlined in Section 6.4.
3. Remove laboratory precleaned sample bottles from sample cooler, label container with an indelible marker. Record all sample information in the field logbook and on the chain of custody form.
4. Wear disposable gloves and boots or hip-waders if necessary to enter surface water bodies. Enter the water downstream of the sample location with minimal disturbance of the sediment.
5. Lower the scoop or bailer slowly into the water making sure that the sample is taken just below the surface of the water (or at the water/air interface if there is a sheen present) and raise the sample out of the water. Sample water before sediment to avoid introduction of sediment into the water.
6. Gently pour the sample into the sample container, taking care not to spill the sample on the outside of the container or overfill, and replace cover on the sample container. For volatile organic samples, make sure that there are no air bubbles in the sample vial after it has been capped. This is accomplished by filling the vial such that there is a meniscus on top. Carefully slide the cap, Teflon®-side down, onto the top of the vial and cap the vial. Check for bubbles by turning the vial upside down and tapping it lightly. If bubbles appear, reopen the vial, remove septum, and add more sample (or resample). Replace septum, recap, and check for bubbles. Continue until vial is bubble-free.

7. Return sample container to sample cooler. If the sample is obtained directly with a sample container, dry the exterior of the container before placing into cooler.
8. If reusable, decontaminate the sampling equipment according to the procedures outlined in Section 6.4.
9. Dispose of dedicated sampling devices and disposable PPE as described in Section 6.5.

Subsurface Soil (Test Pit)

Test pit excavation will be conducted using a backhoe or excavator operated by qualified personnel.

1. Be certain that the sample location is noted on Location Sketch.
2. Be certain that the sampling equipment, including the backhoe/excavator bucket, is decontaminated utilizing the procedures outlined in Section 6.4.
3. Remove laboratory precleaned sample containers from sample cooler, label container with an indelible marker. Record all sample information in the field logbook and on the chain of custody form.
4. Set aside soil from the top 2 feet (or less if chemicals are suspected to be present).
5. Lower the bucket into the test pit and remove soil/waste material.
6. Immediately upon retrieval of the soil/waste material, obtain an organic vapor measurement with a PID or FID.
7. Depending upon the organic vapor measurement, odors, and visual characteristics, obtain a soil sample from the backhoe bucket with a dedicated or decontaminated scoop and/or wooden tongue depressor. Place into the open sample containers and replace the container covers.
8. Record sample and test pit information, including a description of soil/waste with location, depth, and material sampled, on a test pit log form or in the site logbook.
9. Return the sample container to the cooler.
10. Backfill test pit using the soil removed during excavation. If soil/wastes were disposed off site or are not suitable to use as backfill, acquire certified clean fill (if the supplier does not perform testing, make prior arrangements to sample and analyze the fill). Compact fill with the backhoe bucket in lifts not to exceed 12 inches. Use the top 2 feet of soil that was set aside as the top layer.
11. If reusable, decontaminate the sampling equipment according to the procedures described in Section 6.4.
12. Dispose of dedicated sampling devices and disposable PPE as described in Section 6.5.

Subsurface Soil (Probe)

Sampling will be conducted using a direct push rig (*e.g.*, Geoprobe®) operated by qualified personnel.

1. Be certain that the sample location is noted on Location Sketch.
2. Be certain that the sampling equipment, including the sampling rods, is decontaminated utilizing the procedures outlined in Section 6.4.
3. Remove laboratory precleaned sample containers from sample cooler, label container with an indelible marker. Record all sample information in the field logbook and on the chain of custody form.
4. Equip the decontaminated probe with a dedicated acetate liner and drive to the desired sampling depth.
5. Retrieve the soil probe and immediately after opening it, obtain an organic vapor measurement with a FID or PID.
6. Remove a sample aliquot from the soil probe using a dedicated or decontaminated scoop and/or sterile wooden tongue depressor, place into the open sample container and replace the container cover.
7. Return the sample container to the cooler.
8. Decontaminate the probe and reusable sampling equipment according to the procedures described in Section 6.4.
9. Backfill the probe hole with clean native soil or grout consisting of Type I Portland cement with 3 – 5% bentonite by weight.
10. Dispose of dedicated sampling devices and disposable PPE as described in Section 6.5.

Subsurface Soil (Borehole, Split Spoon)

Drilling and sampling will be conducted using a drill rig equipped with hollow-stem augers and drive hammer that is operated by qualified personnel.

1. Be certain that the sample location is noted on Location Sketch.
2. Be certain that the sampling equipment (augers, split spoon) has been decontaminated utilizing the procedures outlined in Section 6.4.
3. Remove laboratory precleaned sample containers from sample cooler, label container with an indelible marker. Record all sample information in the field logbook and on the chain of custody form.

4. Drill into the soil to the desired depth and drive the split-spoon sampler ahead of the lead auger in accordance with ASTM procedures (ASTM D1586-99).
5. Retrieve the split spoon and immediately after opening obtain an organic vapor measurement with a PID or FID and fill out Boring Log Form.
6. Remove a sample aliquot from the split spoon using a dedicated or decontaminated scoop and/or sterile wooden tongue depressor, place into the open sample container and replace the container cover.
7. Return the sample container to the cooler.
8. Decontaminate the split spoon and reusable sampling equipment according to the procedures described in Section 6.4.
9. Backfill the borehole with clean native soil and/or a grout mixture consisting of Type I Portland cement with 3 - 5% bentonite by weight.
10. Dispose of dedicated sampling devices and disposable PPE as described in Section 6.5.

Groundwater (Probe, Hydropunch)

Sampling will be conducted using a direct push rig (*e.g.*, Geoprobe®) with a screen point sampler or standard drill rig equipped with a Hydropunch that is operated by qualified personnel.

1. Be certain sample location is noted on Location Sketch.
2. Be certain that the probe rods and sampling equipment have been decontaminated utilizing the procedures outlined in Section 6.4.
3. Remove the laboratory precleaned sample containers from sample cooler, label container with an indelible marker. Record all sample information in the field logbook and on the chain of custody form.
4. Drive the screen point sampler or Hydropunch to the desired depth and expose the screened portion of the tool.
5. Obtain a sample by using a decontaminated Hydropunch bailer, dedicated small-diameter bailer, dedicated polyethylene tubing equipped with a bottom check valve, or peristaltic pump equipped with dedicated polyethylene tubing. The use of stainless steel bailers or Teflon®-lined tubing is recommended when sampling for semivolatile organics due to the potential for release of phthalate esters from polyethylene.
6. Gently fill the sample container taking care not to spill on the outside of the container or overfill container and replace cover on the sample container. Samples for volatile organic analyses will have no air space in the sample vial prior to sealing (see Surface Water above).

7. After sample collection, obtain field measurements including pH, conductivity, temperature, and turbidity, or as specified in the site-specific work plan.
8. Return sample containers to sample cooler.
9. Decontaminate reusable sampling equipment according to the procedures described in Section 6.4.
10. Backfill the probe hole with clean native soil and/or a grout mixture consisting of Type I Portland cement with 3 - 5% bentonite by weight.
11. Dispose of dedicated sampling devices and disposable PPE as described in Section 6.5.

Groundwater (Monitoring Well)

1. Be certain sample location is noted on Location Sketch.
2. Be certain that the sampling equipment have been decontaminated utilizing the procedures outlined in Section 6.4.
3. Measure the depth of water using a decontaminated water level indicator and compute the volume of standing water in the well.
4. Remove three to five times the volume of standing water from the well until field measurements (e.g., pH, conductivity, temperature, and turbidity) stabilize, the well is dry, or two hours has passed since the inception of purging, whichever occurs first. Turbidity should be less than 50 NTU prior to collection of a sample for metals analysis. However, in fine-grained formations where turbidities remain above 50 NTU, filtering is not permitted. Rather, allow the suspended particles in the well water to settle out for a period up to, but not to exceed, 24 hours after sampling. Carefully collect a sample from the top of the water column, taking care not to disturb the material settled on the bottom of the well. Well purging may be accomplished with dedicated or decontaminated bailers constructed of polyethylene (not recommended when sampling for semivolatile organics), PVC, stainless steel, or Teflon®. Alternatively, low-flow pumping techniques may be used as described in *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures* (Puls and Barcelona 1996), *Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells* (EPA 1996), or equivalent guidelines.
5. Remove the laboratory precleaned sample containers from sample cooler, and label container with an indelible marker.
6. Obtain a sample by using a bailer or low-flow pumping techniques as described above.
7. Gently fill the sample containers taking care not to spill on the outside of the container or overfill container and replace the cover on the sample container. Samples for volatile organic analyses will have no air space in the sample vial prior to sealing (see Surface Water above).

8. Return sample container to sample cooler.
9. Record all sample information in the field logbook and on the chain of custody form.
10. Decontaminate reusable sampling equipment according to the procedures described in Section 6.4.
11. Dispose of dedicated sampling devices and disposable PPE as described in Section 6.5.

Ambient Air (Sorbent Tube)

1. Refer to the appropriate USEPA method (*e.g.*, TO-1 or TO-15) (EPA 1999b) and/or ASTM method (D6196-97).
2. Be certain sample location is noted on Location Sketch.
3. Set the flow rate[†] to the desired setting on the air pump.
4. Label sorbent tube and record all sample information in the field logbook and on the chain of custody form.
5. Connect the sorbent tube to the pump using polyethylene or Teflon®-lined tubing and set sorbent tube in breathing zone. (This can be accomplished by attaching the pump to a stake).
6. Turn on pump and monitor the pump flow rate at half-hour intervals during the duration of sampling.
7. Turn off pump and disconnect the sorbent tube and check the pump flow rate.
8. Cap sorbent tubes and/or place in shipping containers, as applicable, and place in cooler.
9. Dispose of dedicated sampling devices and disposable PPE as described in Section 6.5.

Ambient Air Sampling (Passivated/SUMMA® Canister)

Evacuated (subatmospheric pressure) air canisters may be used to collect grab samples of short duration or time-integrated samples over a period of hours using a flow-restrictive inlet. Pump-driven positive pressure samples may also be collected

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[†] Flow rate is determined using a calculation contained in the appropriate analytical method based on the constituents of concern at the site.

over time. Site-specific objectives and procedures will be included in the site-specific work plan.

1. Refer to the appropriate USEPA method (TO-14A or TO-15) (EPA 1999b) and/or ASTM method (D5466-95).
2. Be certain sample location is noted on Location Sketch.
3. Complete screening analysis using an organic vapor analyzer prior to placing canister.
4. Record ambient air temperatures in vicinity of canisters.
5. For time-integrated tests, calculate desired flow rate (see Method TO-14A).
6. For subatmospheric pressure canisters, connect practice canister to mass flow controller and mass flow meter. Adjust controller to desired rate, close practice canister valve, and reset timer to zero.
7. Attach certified clean canister to the flow controller and open canister and vacuum pressure gauge valves.
8. Record pressure data, close vacuum pressure valve and temperature. Record time and date.
9. After the sampling period, record maximum, minimum, and current temperature as well as current flow control reading.
10. Close canister valve, disconnect sampling line. Record final canister pressure. Turn sampler off.
11. Label canisters and place in manufacturer-supplied shipping containers.
10. Dispose of disposable sampling equipment and PPE as described in Section 6.5.

Decontamination Procedures

Whenever possible, all field sampling equipment should be sterile/disposable and dedicated to a particular sampling point. In instances where this is not possible, a field cleaning/decontamination procedure will be used in order to mitigate cross contamination between sample locations. A decontamination station/pad will be established for field activities, if necessary. This will be an area located away from the source of contamination so as not to adversely impact the decontamination procedure, but close enough to the sampling locations to keep equipment transport handling to a minimum after decontamination.

All non-disposable equipment will be decontaminated at appropriate intervals (*e.g.*, prior to initial use, prior to moving to a new sampling location, and prior to leaving the site). Different decontamination procedures for various types of sampling equipment are used. When using field decontamination, sampling should commence

in the area of the site with the lowest contamination, if known or probable, and proceed through to the areas of highest potential contamination.

Drilling/Probing Equipment

All equipment such as drill rigs and other mobile equipment will receive an initial cleaning prior to use at the site. The frequency of subsequent cleanings while on site will depend on how the equipment is actually used in relation to collecting environmental samples. After the initial decontamination, cleaning may be reduced to those areas that are in close proximity to materials being sampled. Drill rig/probe items such as augers, drill/probe rods and drill bits will be cleaned in between sample locations. Drill/probe rigs that are obviously leaking fuel, lubricants, or hydraulic oil, or that have loose, flaking paint, will not be used.

Drilling/probing equipment will be decontaminated in the following manner:

- Wash thoroughly with non-residual detergent (*e.g.*, Alconox®) and potable water using a brush to remove particulate matter or surface film if present.
- Pressure wash with hot potable water/steam.
- Once decontaminated, remove all items from the decontamination area.

All downhole/drilling items, such as split-spoon samplers, Shelby tubes, rock coring tools, or any other piece of equipment that will come in direct contact with a sample during drilling, will be decontaminated by pressure washing or by the procedure described below.

Sampling Equipment

Decontamination procedures for non-disposable, non-dedicated sampling equipment will be as follows:

- Wash thoroughly with non-residual detergent (*e.g.*, Alconox®) and potable water using a brush to remove particulate matter or surface film. Pressure washing will be utilized, if necessary, to remove oil and/or tar.
- Rinse with a 1:10 nitric acid solution when sampling for metals.
- Rinse with potable water.
- Rinse in a well-ventilated area with methanol (pesticide grade) and air dry.
- Rinse thoroughly with deionized or distilled water and air dry.
- Wrap completely in clean aluminum foil for storage. For small sampling items, such as scoops, decontamination will take place over a drum specifically used for this purpose.

Well Casing and Development Equipment

Field cleaning of well casings will consist of a manual scrubbing with a non-residual detergent solution to remove foreign material, followed by high-pressure hot water/steam cleaning. This procedure will be used on the inside and outside of casings/pipes to remove all traces of oil, grease, and tar, if present. Alternatively, This material will then be stored in such a manner so as to preserve it in this condition. Special attention to threaded joints will be necessary to remove cutting oil or weld burn residues, if necessary.

Materials and equipment that will be used for the purposes of well development will also be decontaminated by steam cleaning. An additional step will involve flushing the interior of any hose, pump, etc. with detergent solution followed by a potable water rinse prior to the development of the next well.

Control and Disposal of Investigation-Derived Waste

During construction and sampling of monitoring wells and soil borings, waste materials, soil, and water may be generated from drill cuttings, drilling fluids, decontamination water, development water, and purge water. All soil cuttings generated during the remedial investigation will be handled in a manner consistent with NYSDEC Technical and Administrative Guidance Memorandum (TAGM) No. 4032, *Disposal of Drill Cuttings*.

In the absence of organic vapor readings, all water generated during the investigation, including decontamination water, drill water and purge water, will be discharged on site, if possible, following testing. If it is not possible to discharge water on site, the next preferred option is discharge of the water to a municipal sewer system. Such discharge requires prior approval of the local publicly owned treatment works. The site-specific work plan will provide detailed information on the disposal of water generated during the investigation. Disposal of all investigation-derived wastes must be pre-approved by a KeySpan site representative since KeySpan will be considered the waste generator and will ultimately be responsible for its disposition.

DOT-approved 55-gallon drums and/or a pre-lined waste storage container (*i.e.*, roll-off) will be used for the containment of soil cuttings, water not otherwise disposed of, and similar wastes. PPE and disposable sampling equipment (*i.e.*, bailers, scoops, tongue depressors, tubing, *etc.*) that are likely to be contaminated based on visual observations, field screening, and previous analytical results will also be drummed. If this material is not suspected to be contaminated, it will be rendered unusable and double-bagged. Drums will be marked, labeled with a description of their contents, date, and the location from which the waste was derived and sealed. All drummed and bagged wastes will be stored on site in a secure area pending disposal.

Quality Control Samples

Various types of QC samples are used to check the cleanliness and effectiveness of field handling methods, assess sample matrix effects on analysis, and determine levels of background laboratory contamination.

Field QC Samples

Trip Blanks (Travel Blanks)

The primary purpose of a trip blank is to detect other sources of contamination that might potentially influence contaminant values reported in actual samples, both quantitatively and qualitatively. The following have been identified as potential sources of contamination:

- Laboratory reagent water;
- Sample containers;
- Cross contamination in shipment;
- Ambient air or contact with analytical instrumentation during preparation and analysis at the laboratory; and
- Laboratory reagents used in analytical procedures.

A trip blank will consist of a set of 40-ml sample vials filled at the laboratory with laboratory-demonstrated analyte-free water. Trip blanks will be handled, transported, and analyzed in the same manner as the samples acquired that day, except that the sample containers themselves are not opened in the field. Rather, these sample containers only travel with the sample cooler. The temperature of the trip blanks will be maintained at 4°C while on site and during shipment. Trip blanks will return to the laboratory with the same set of bottles they accompanied in the field.

The purpose of a trip blank is to control sample bottle preparation and blank water quality as well as sample handling. Thus, the trip blank will travel to the site with the empty sample bottles and back from the site with the collected samples in an effort to simulate sample handling conditions. Contaminated trip blanks may indicate inadequate bottle cleaning or blank water of questionable quality.

Trip blanks will be submitted only when collecting water samples for VOC analysis, including field blanks, at the rate of one per shipping cooler containing VOC sample portions. Trip blanks will be analyzed for VOCs only.

Equipment Rinsate Blanks

Rinsate blank samples are designed to demonstrate that non-dedicated sampling equipment has been properly prepared and cleaned before use and that cleaning

procedures between samples are sufficient to minimize cross-contamination. Rinsate blanks are prepared by passing analyte-free (deionized) water over sampling equipment and analyzing the samples for all applicable parameters. If previous analytical data is available, it may be possible to predict which areas or samples are likely to have the highest chemical concentrations. Unless other constraints apply, these samples should be taken last to avoid excessive contamination of sampling equipment.

Rinsate blanks shall be collected whenever non-dedicated equipment is used (*e.g.*, split spoons, bailers) at the rate of one per 20 samples per matrix.

Field Duplicates

Duplicates consist of two sets of field samples collected independently at a sampling location during a single sampling event. Field duplicates may be sent to the laboratory so that they are indistinguishable from other analytical samples. Duplicates are used to assess sample homogeneity as well as the consistency of the overall sampling and analytical system.

In accordance with the NYSDEC ASP, field duplicates will be collected at the rate of one per ten field samples per matrix.

Matrix Spikes/Matrix Spike Duplicates

The matrix spikes (MS) and matrix spike duplicates (MSD) are aliquots of a designated sample (water or soil) which are spiked in the laboratory with known quantities of specified compounds. These QC samples will be used to evaluate the matrix effect of the sample upon the analytical methodology, as well as to determine the overall precision of the analytical method used. The procedures and frequency regarding the MS/MSD samples are defined in the NYSDEC ASP. Sufficient sample volume shall be provided to the laboratory such that one MS/MSD set per 20 field samples per matrix can be analyzed.

Laboratory QC Samples

Laboratory QC samples include numerous spike and blank samples and calibration standards designed to assess several analytical precision and accuracy issues. Examples of internal laboratory QC samples include method blanks, matrix spike blanks, laboratory control samples, surrogate spikes, spike duplicates, initial and continuing calibration blanks, *etc.* The QC samples required and the frequency of analysis is defined by the individual method of analysis and will conform to the NYSDEC ASP or most recent update of SW-846. Laboratory QC issues will be addressed during data validation.

Field Management Documentation

Proper management and documentation of field activities is essential to ensure that all necessary work is conducted in accordance with the sampling plan and generic QAPP in an efficient and high quality manner. Field management procedures will include, at a minimum:

- Following proper chain-of-custody procedures to track a sample from collection through analysis;
- Noting when, how, and where samples are collected or split (if required);
- Preparing a location sketch;
- Completing chain-of-custody forms, and test pit, boring/drilling, and well construction logs;
- Maintaining a daily field logbook; and
- Recording daily equipment calibration information, field activities, and work plan changes.

Proper completion of field documentation is necessary to support the consequent actions that may result from the sample analysis. This documentation will provide legally defensible support that the samples were collected and handled properly.

Location Sketch

For each sampling point, a location sketch will be completed using permanent references and distances to the sampling point noted, if possible. When possible, the location sketch should be drawn in the field logbook.

Field Logbook

Field logbooks will be bound and have consecutively-numbered pages. The *Environmental Risk Management Field Logbook* which will be utilized during the performance of field programs at all KeySpan sites is attached to this generic QAPP in its entirety as Appendix A. All pertinent information regarding the site and sampling procedures will be documented in the field logbook. Notations will be made in logbook fashion, noting the time and date of all entries. Information recorded in this notebook will include, but not be limited to, the following:

The first page of the log will contain the following information:

- Project name and address
- Project number
- Project Manager, Site Safety Officer, and Team Members
- Dates of field activities
- Emergency contacts

Daily entries, will be made for the following information:

- Purpose of sampling
- Location of sampling point
- Number(s) and volume(s) of sample(s) taken
- Description of sampling point (including matrix) and sampling methodology
- Date and time of collection, arrival, and departure
- Collector's sample identification number(s)
- Analyses to be performed
- Sample distribution and method of storage and transportation
- References, such as sketches of the sampling site or photographs of sample collection
- Field observations, including results of field analyses (e.g., pH, temperature, specific conductance), water levels, drilling logs, and organic vapor and dust readings
- Photographic information
- Signature of personnel responsible for completing log entries
- Site visitors' and subcontractors' names, titles, and contact information
- Weather conditions
- Any remarks or additional pertinent information pertaining to sample collection or general site activities.

Each daily entry page will be dated and the person making the entries will sign the bottom of the page. If more than one person makes entries in the logbook, individual entries will be initialed and the person with primary responsibility for keeping the logbook will sign the bottom of the page.

Chain of Custody and Sample Identification Documentation

This section describes the procedures for sample chain of custody to be followed by VHB and laboratory personnel. The purpose of these procedures is to ensure that the integrity of the samples is maintained during their collection, transportation, storage, and analysis. The primary objective of chain-of-custody procedures is to provide an accurate written record that can be used to trace the possession and handling of a sample from the moment of its collection through its analysis.

A sample is considered to be in an individual's custody if any of the following conditions are met:

- It is in the individual's physical possession;
- It is in the individual's view after being in his or her physical possession;
- It is secured by the individual so that no one can tamper with it; or
- The individual puts it in a designated and identified secure area.

When unused sample bottles or samples are shipped or will not be in project staff's physical possession, shipping containers/boxes should be sealed with custody tape. Individual bottles may also be sealed with custody tape across the lid. Custody tape (seals) are preprinted, adhesive-backed seals designed to break if the seals are disturbed in order to indicate possible breaches in chain of custody.

In general, the laboratory selected to perform the analytical services provides chain-of-custody forms. At a minimum, the following information will be provided on these forms:

- Project name and address
- Project number
- Sample identification number
- Date and time of collection
- Sample location
- Sample type
- Analysis requested
- Number of containers and volume taken
- Remarks
- Type of waste
- Sampler(s) name(s) and signature(s)
- Spaces for relinquished by /received by signature and date/time.

Forms provided by the laboratory will be utilized. The chain-of-custody form will be filled out and signed by the person performing the sampling. The original of the form will travel with the sample and will be signed and dated each time the sample is relinquished to another party, until it reaches the laboratory or analysis is completed. The field sampler will keep one copy and a copy will be retained for the project file. A copy of the completed form will be returned by the laboratory with the analytical results.

The sample bottle will also be labeled with an indelible marker with a minimum of the following information:

- Sample number
- Analysis to be performed
- Date of collection
- Preservation techniques

A NYSDOH ELAP- and CLP-certified laboratory meeting the requirements for sample custody procedures, including cleaning and handling sample containers and analytical equipment, will be used to analyze samples collected during the investigation. The selected laboratory's SOPs will be made available upon request.

Split Samples

Whenever samples are being split with another party, a chain-of-custody form will be completed for each set of samples. The split sample set will be relinquished to the party accepting the split samples. The sampler will sign under "relinquished by" and the party accepting the split samples will sign under "received by." A copy of the split sample chain-of-custody record will be maintained in the project file.

Corrections to Documentation

No pages from field logbooks will be removed for any reason. If corrections to a field log book, sketch, or sampling form are necessary, they must be made by drawing a single line through the incorrect entry (so that the original entry can still be read) and writing the corrected entry alongside. All corrections must be initialed and dated by the person responsible for making the corrections.

Field Changes and Corrective Actions

Whenever there is a required or recommended investigation/sampling change or correction, the change, rationale for the change, and signatures of authorizing parties will be recorded in the field logbook. The Field Team Leader will make entries of this nature with the concurrence of the KeySpan on-site supervisor, VHB Project Manager, and NYSDEC Project Manager, if required.

Calibration Procedures & Preventive Maintenance

Equipment calibration and operating procedures, which will include provisions for documentation of frequency, conditions, standards, and records reflecting the calibration procedures, methods of usage, and repair history of the measurement system will be maintained. Calibration of field equipment will be performed daily in accordance with the manufacturer's specifications to ensure reliable operation of the equipment. Daily field calibration procedures and results will be recorded in the field logbook.

Calibration procedures and preventive maintenance for laboratory equipment, in accordance with the NYSDEC ASP, will be contained in the laboratory's SOPs, which will be available upon request.

Documentation, Data Reduction & Reporting

A NYSDOH ELAP- and CLP-certified laboratory meeting the New York State requirements for documentation, data reduction, and reporting will be used. All data will be cataloged according to sampling locations and sample identification nomenclature, as described above. All laboratory data packages provided by the laboratory will meet the requirements of a Category B deliverable as defined by the NYSDEC ASP.

Data Validation

As described above, summary documentation regarding data validation will be completed by the laboratory using NYSDEC forms contained in the NYSDEC ASP and submitted with the data package.

Data validation will be performed in order to define and document analytical data quality in accordance with NYSDEC requirements that investigation data must be of known and acceptable quality. The analytical and validation processes will be conducted in accordance with the NYSDEC ASP dated October 1995.

Because the NYSDEC ASP is based on the EPA CLP, EPA Functional Guidelines for Organic and Inorganic Data Review (EPA 1999c; 1994b) will assist in formulating SOPs for the data validation process. The data validation process will ensure that all analytical requirements specific to the site work plan, including this generic QAPP are followed. Procedures will address validation of routine analytical services results based on the NYSDEC Target Compound List for standard sample matrices.

The data validation process will provide an informed assessment of the laboratory's performance based upon contractual requirements and applicable analytical criteria. The report generated as a result of the data validation process will provide a base upon which the usefulness of the data can be evaluated by the end user of the analytical results. The overall level of effort and specific data validation procedure to be used will be for "100% validation."

During the review process, it will be determined whether the contractually required laboratory submittals for sample results are supported by sufficient back-up data and QA/QC results to enable the reviewer to conclusively determine the quality of data. Each data package will be checked for completeness and technical adequacy of the data. Upon completion of the review, the reviewers will develop a QA/QC data validation report for each analytical data package.

“Qualified” analytical results for any one field sample will be established and presented based on the results of specific quality control (QC) samples and procedures associated with its sample analysis group or batch. Precision and accuracy criteria (*i.e.*, QC acceptance limits) will be used in determining the need for qualifying data. Where the laboratory has reduced test data, the method of reduction will be described in the report. Reduction of laboratory measurements and laboratory reporting of analytical parameters will be verified in accordance with the procedures specified in the NYSDEC program documents for each analytical method (*i.e.*, recreate laboratory calculations and data reporting in accordance with the method specific procedure). The standard operating guideline manuals and any special analytical methodology required will specify documentation needs and technical criteria and will be taken into consideration in the validation process. Copies of the complete data package and the validation report, including the laboratory results data report sheets, with any qualifiers deemed appropriate by the data reviewer, and a supplementary field QC sample result summary statement, will be submitted to KeySpan.

The following is a description of the two-phased approach to data validation that will be used for the investigation. The first phase is called check-listing and the second phase is the analytical quality review, with the former being a subset of the latter.

- Check-listing - The data package will be checked for correct submission of the contract required deliverables, correct transcription from the raw data to the required deliverable summary forms and proper calculation of a number of parameters.
- Analytical Quality Review - The data package will be closely examined to recreate the analytical process and verify that proper and acceptable analytical techniques have been performed. Additionally, overall data quality and laboratory performance will be evaluated by applying the appropriate data quality criteria to the data to reflect conformance with the specified, accepted QA/QC standards and contractual requirements.

At the completion of the data validation, a Summary Data Validation/Usability Report will be prepared and submitted to KeySpan.

Performance & System Audits

Performance audits are a quantitative evaluation of the laboratory’s measurement systems. They generally consist of evaluation of the lab’s performance in analyzing performance evaluation samples and blind samples provided by regulating agencies. A NYSDOH ELAP- and CLP-certified laboratory, which has satisfactorily completed

performance audits and performance evaluation samples, will be used to perform sample analyses for all field investigations.

System audits are a qualitative on-site review and evaluation of the components and implementation of VHB's QA program. They may consist of field, laboratory, or office audits performed by qualified QA or technical staff. During field activities, the QA officer may accompany sampling personnel into the field, in particular in the initial phase of the field program, to verify that the site sampling program is being properly conducted, and to detect and define problems so that corrective action can be taken early in the field program. All findings will be documented and provided to the Field Team Leader and VHB Project Manager.

Corrective Action

The selected laboratory will meet the ASP requirements for corrective action protocols, including sample "clean up" to attempt to eliminate/mitigate matrix interference. The NYSDEC ASP includes both mandatory and optional sample cleanup and extraction methods. GPC cleanup is required for certain analyses and matrices in order to meet contract required detection limits. There are several optional cleanup and extraction methods noted in the ASP. These include florisil column cleanup, silica gel column cleanup, acid-base partition, steam distillation and sulfuric acid cleanup for PCB analysis.

High levels of matrix interference may be present in waste, soil, and sediment samples. This interference may prevent the achievement of ASP detection limits if no target compounds are found. In order to avoid unnecessary dilutions, the optional cleanup methods noted in the NYSDEC ASP will be required to be performed by the laboratory as necessary.

Corrective action will be required whenever a deficiency is identified in the laboratory or field operations. Laboratory corrective action procedures will be provided in the quality assurance manual provided by the laboratory selected to perform the analysis. Corrective action procedures for field activities will depend upon the nature of the system deficiency. Misidentification of samples and similar errors will require corrections to field documentation. Inappropriate decontamination procedures or the presence of analytes in field blanks may require additional decontamination, changes in the procedure, and/or resampling. Unauthorized changes to the sampling plan may also require resampling. These and similar deficiencies will be evaluated on a case-by-case basis by the field team leader, project manager, QA officer, and KeySpan representative. Documentation of deficiencies and the corrective actions applied thereto should be made in the field logbook, QA audit report, corrective action memorandum, and/or final site report, as appropriate.

References

- American Society For Testing And Materials (ASTM), 2000, *D1586-99 Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils*, West Conshohocken, PA.
- ASTM, 2000, *D5314-92e1 Standard Guide for Soil Gas Monitoring in the Vadose Zone*, West Conshohocken, PA.
- ASTM, 2000, *D5466-95 Determination of Volatile Organic Chemicals in Atmospheres (Canister Sampling Methodology)*, West Conshohocken, PA.
- ASTM, 2000, *D6196-97 Standard Practice for Selection of Sorbents and Pumped Sampling/Thermal Desorption Analysis Procedures for Volatile Organic Compounds in Air*, West Conshohocken, PA.
- New York State Department of Environmental Conservation (NYSDEC), October 1995, *Analytical Services Protocol*, Division of Water, Albany, NY 12233-3500.
- NYSDEC, 1989, Technical and Administrative Guidance Memorandum (TAGM) No. 4032, *Disposal of Drill Cuttings*, Division of Environmental Remediation, Albany, NY.
- Puls, Robert W. and Michael J. Barcelona, 1996a, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, EPA/540 S-94/504, U.S. EPA Superfund Technology Support Center for Ground Water, Ada, OK.
- United States Environmental Protection Agency (USEPA), 1999a, *EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5)*, Interim Final, Office of Research and Development, Washington, D.C.
- USEPA, 1999b, *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air – Second Edition*, EPA/625/R-96/010b, Center for Environmental Research Information, Cincinnati, OH.
- USEPA, 1999c, *Contract Laboratory Program, National Functional Guidelines for Organic Data Review*, EPA 540/R-99-008, Office of Emergency and Remedial Response.
- USEPA, 1998, *EPA Guidance for Quality Assurance Project Plans (QA/G-5)*, EPA/600/R-98/018, Office of Research and Development, Washington, D.C.
- USEPA, 1997, *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods SW-846*, Third Edition, Update III, Office of Solid Waste.

USEPA, 1996, *Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells*, Region I SOP # GW 0001, Revision 2.

USEPA, 1994a, *Guidance for the Data Quality Objectives Process (QA/G-4)*, EPA/600/R-96-055, Office of Research and Development, Washington, D.C.

USEPA, 1994b, *Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94-013, Office of Emergency and Remedial Response.

The WD Burdick Company, 1996, *Manufactured Gas Plants, a New York Heritage*, Skaneateles Falls, NY

Attachment A

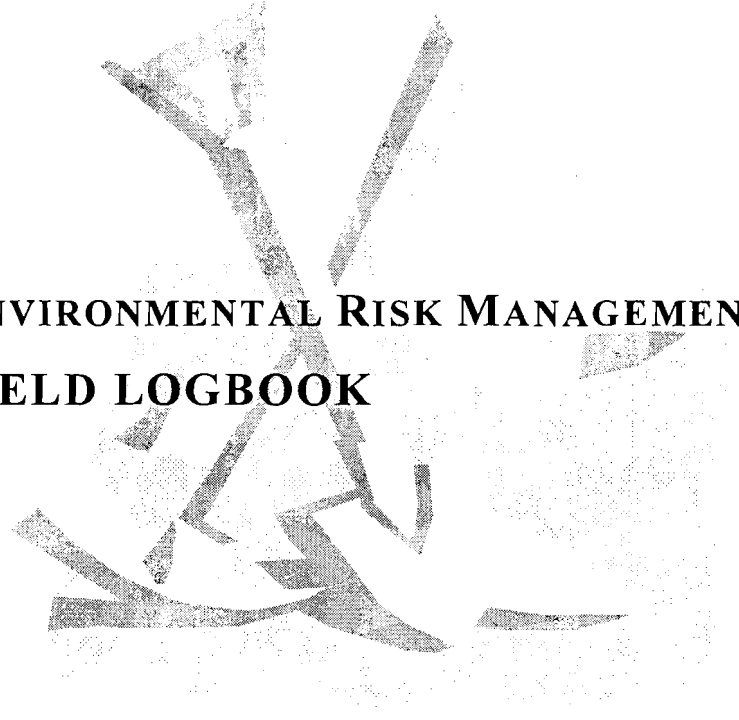
Environmental Risk Management Field Logbook

Transportation
Land Development
Environmental
Services



Vanasse Hangen Brustlin, Inc.

54 Tuttle Place
Middletown, Connecticut 06457
860 632-1500
FAX 860 632-7879



ENVIRONMENTAL RISK MANAGEMENT FIELD LOGBOOK

Site Name: _____

Client: _____

Project Number: _____

Dates of Field Activities: _____

CLIENT: _____

JOB NUMBER: _____

SITE NAME: _____

DRILLER: _____

LOCATION City/Town: _____

State: _____

PROJECT MANAGER: _____

FIELD TEAM LEADERS: _____

SITE SAFETY OFFICER (S): _____

TEAM MEMBERS: _____

JOB START / FINISH DATES: _____

BOOK _____ OF _____

VHB CORPORATE: 617-924-1770 FAX: 617-924-2286

VHB MIDDLETOWN, CT: 860-632-1500 FAX: 860-632-7879 or 860-632-8839

PROJECT LABORATORY: _____ FAX: _____

Laboratory Name: _____

FEDERAL EXPRESS TOLL FREE: 1-800-GO-FEDEX or 1-800-463-3339

Project / Client Contact(s)

Affiliation

Phone

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DRAWINGS / SKETCHES

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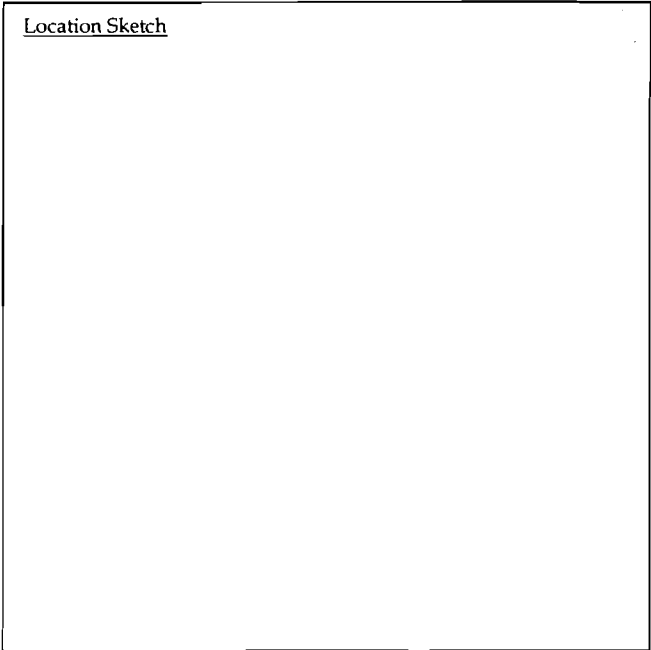
Well/Soil Boring Log

Client Name: _____

Site Name / Location: _____

Project No.: _____

Location Sketch



Comments/Notes:

WELL/ SOIL BORING LOG

Well/Boring ID: _____

Driller: _____

Well/Boring Depth: _____

Drill Rig: _____

Depth to Groundwater: _____

Technique: _____

VHB Representative: _____

Date: _____

Weather: _____

[illegible]

¹ See also separate well diagram containing well construction details.

Key: BGS = below ground surface
F/PID = flame/photoionization detector

HAS = hollow-stem auger
NA = not applicable

NR = no recovery
PPM = parts per million

Well/Soil Boring Log (cont.)

[illegible]

¹ See also separate well diagram containing well construction details.

Key: BGS = below ground surface
F/PID = flame/photoionization detector

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NA = not applicable

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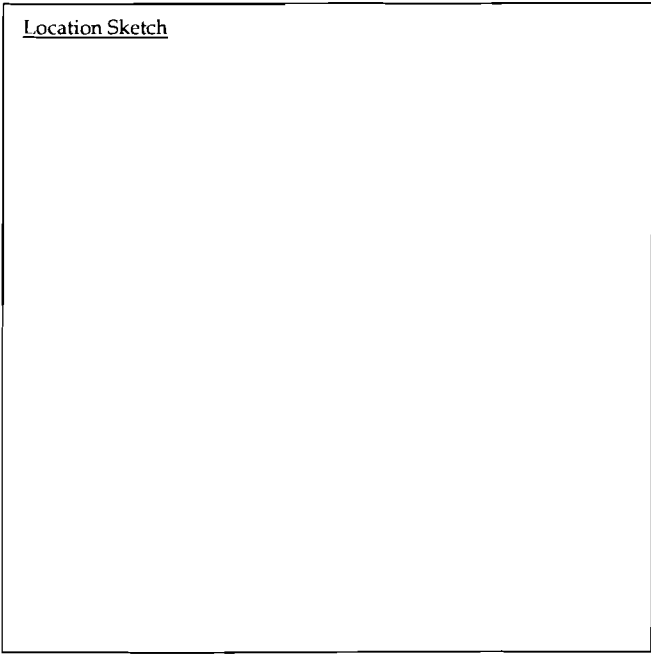
Well/Soil Boring Log

Client Name: _____

Site Name / Location: _____

Project No.: _____

Location Sketch



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Weather: _____

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[illegible]

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Final Development Water

Well Development – Water Quality Measurements

[illegible]

NTU = Nephelometric turbidity units
°F = degrees Fahrenheit

Well/Soil Boring Log

Client Name: _____

Site Name / Location: _____

Project No.: _____

Location Sketch

Comments/Notes:

Well/Boring ID: _____

Well/Boring Depth: _____

Depth to Groundwater: _____

VHB Representative: _____

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Well/Soil Boring Log (cont.)

[illegible]

¹ See also separate well diagram containing well construction details.

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BGS = below ground surface
F/PID = flame/photoionization detector

HAS = hollow-stem auger
NA = not applicable

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PPM = parts per million

Final Development Water

Well Development – Water Quality Measurements

[illegible]

TOIC = top of inner casing
□ S/cm = microSiemens per centimeter

Vol(s) = volume(s)
°C = degrees Celsius

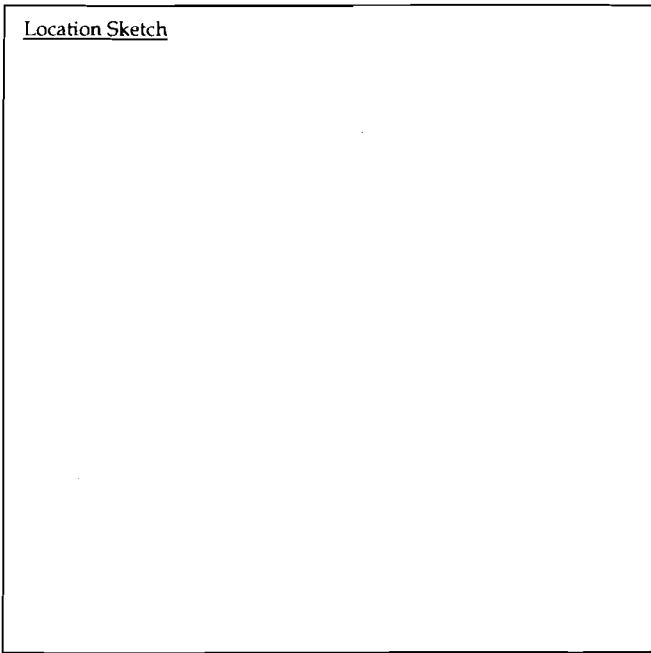
Well/Soil Boring Log

Client Name: _____

Site Name / Location: _____

Project No.: _____

Location Sketch



Comments/Notes:

WELL/ SOIL BORING LOG

Well/Boring ID: _____

Driller: _____

Well/Boring Depth: _____

Drill Rig: _____

Depth to Groundwater: _____

Technique: _____

VHB Representative: _____

Date: _____

Weather: _____

[illegible]

¹ See also separate well diagram containing well construction details.

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Well/Soil Boring Log (cont.)

[illegible]

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Location Sketch

Comments/Notes:

WELL/ SOIL BORING LOG

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[illegible]

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Well/Soil Boring Log (cont.)

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Well/Boring Depth: _____

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VHB Representative: _____

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[illegible]

¹ See also separate well diagram containing well construction details.

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WELL/ SOIL BORING LOG

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VHB Representative: _____

Date: _____

Weather: _____

[illegible]

¹ See also separate well diagram containing well construction details.

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Well/Soil Boring Log (cont.)

[illegible]

¹ See also separate well diagram containing well construction details.

Key:

BGS = below ground surface

F/PID = flame/photoionization detector

HAS = hollow-stem auger

NA = not applicable

NR = no recovery

PPM = parts per million

Well ID:		Date:	
Description of development technique:			
Developed by:			

Static water level (feet TOIC)	Total well depth (feet TOIC):	
Casing volume (gallons)	Color:	Clarity:

Ending water level (feet TOIC):	Total well depth (feet TOIC):	
Casing volume (gallons):	Color:	Clarity:

[illegible]

NTU = Nephelometric turbidity units
°F = degrees Fahrenheit

Well/Soil Boring Log

Client Name: _____

Site Name / Location: _____

Project No.: _____

Location Sketch

Comments/Notes:

Well/Boring ID: _____

Well/Boring Depth: _____

Depth to Groundwater: _____

VHB Representative: _____

[illegible]

Key:

NR = no recovery
PPM = parts per million

Well/Soil Boring Log (cont.)

[illegible]

¹ See also separate well diagram containing well construction details.

Key:

BGS = below ground surface

BGS = below ground surface
F/PID = flame/photoionization detector

HAS = hollow-stem auger

NA = not applicable

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PPM = parts per million

Final Development Water

Well Development – Water Quality Measurements

[illegible]

NTU = Nephelometric turbidity units
°F = degrees Fahrenheit

Well/Soil Boring Log

Client Name: _____

Site Name / Location: _____

Project No.: _____

Location Sketch

Comments/Notes:

Well/Boring ID:

Well/Boring Depth: _____

Depth to Groundwater: _____

VHB Representative: _____

¹ See also separate well diagram containing well construction details.

NR = no recovery
PPM = parts per million

Well/Soil Boring Log (cont.)

[illegible]

¹ See also separate well diagram containing well construction details.

Key: BGS = below ground surface
F/PID = flame/photoionization detector

HAS = hollow-stem auger
NA = not applicable

NR = no recovery
PPM = parts per million

Final Development Water

Ending water level (feet TOIC):	Total well depth (feet TOIC):	
Casing volume (gallons):	Color:	Clarity:

[illegible]

Val(s) = volume(s)
°C = degrees Celsius

NTU = Nephelometric turbidity units
°F = degrees Fahrenheit

Well/Soil Boring Log

Client Name: _____

Site Name / Location: _____

Project No.: _____

Location Sketch

Comments/Notes:

WELL/ SOIL BORING LOG

Well/Boring ID: _____

Driller: _____

Well/Boring Depth: _____

Drill Rig: _____

Depth to Groundwater: _____

Technique: _____

VHB Representative: _____

Date: _____

Weather: _____

[illegible]

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F/PID = flame/photoionization detector

HAS = hollow-stem auger
NA = not applicable

NR = no recovery
PPM = parts per million

Well/Soil Boring Log (cont.)

[illegible]

¹ See also separate well diagram containing well construction details.

Key:

BGS = below ground surface

BGS = below ground surface
F/PID = flame/photoionization detector

HAS = hollow-stem auger

NA = not applicable

NR = no recovery

PPM = parts per million

Final Development Water

Well Development – Water Quality Measurements

[illegible]

NTU = Nephelometric turbidity units
°F = degrees Fahrenheit

Geotechnical Reference Data

USEFUL CONVERSIONS

1 gallon	=	0.134 cubic feet	=	3.785 liters
1 cubic foot	=	7.482 gallons	=	28.32 liters
1 meter	=	3.281 feet	=	39.37 inches
1 inch	=	2.540 centimeters	=	0.0833 feet
1 kilometer	=	0.6214 miles	=	3,281 feet
1 kilogram	=	2.205 pounds	=	35.27 ounces
Density of water	=	8.54 pounds/gallon	=	1 kilogram/liter

VOLUME OF WATER IN CASING OR HOLE

Diameter of Casing/Hole	Gallons per Foot of Depth	Liters per Meter of Depth
1	0.041	0.509
2	0.163	1.142
NX (2.98)	0.362	4.49
3	0.367	4.56
HQ (3.78)	0.583	7.24
4	0.653	8.11
6	1.47	18.2
8	2.61	32.4
12	5.88	73.0
24	23.5	292

USEFUL RELATIONSHIPS

Volume of well casing or hole, in gallons:

$$V_c = 0.163 \cdot r^2 \cdot h$$

Annular volume, in gallons:

$$V_a = 0.0408 \cdot (d_b^2 - d_c^2) \cdot h$$

Where:

r = radius of casing/hole in inches

h = height of water or depth of casing/hole in feet

d_b = diameter of borehole in inches

d_c = outside diameter of casing in inches

ANNULAR VOLUME CHART (GALLONS/LINEAR FOOT)

Casing I.D.	Borehole Diameter				
	6 in.	8 in.	9 in.	11 in.	13 in.
1 in.	1.44	2.58	--	--	--
2 in.	1.31	2.46	3.16	--	--
4 in.	--	1.97	2.67	4.31	--
6 in.	--	1.15	1.85	3.49	5.45

SOIL DESCRIPTION CHECKLIST (BASED ON ASTM D2488)

1. Group Symbol/Name
2. Particle Size Distribution
3. Color (in moist condition)
4. Odor (only if organic or unusual, but not if contaminated)
5. Moisture: dry, moist, wet

Coarse Grained Portion

6. Particle Angularity: angular, subangular, subround, round
7. Particle Shape: flat, elongated, both
8. Hardness: *e.g.*, do coarse grains fracture when struck with hammer

Fine Grained Portion

9. Plasticity: nonplastic, low, medium, high
10. Dry strength: none, low, medium, high, very high
11. Dilatancy: none, slow, rapid
12. Toughness: low, medium, high
13. Consistency: very soft, soft, firm, hard, very hard

For Intact Samples

14. Structure: stratified, laminated, fissured, slickensided, lensed, homogeneous
15. Cementation: weak, moderate, strong
16. Name/geologic interpretation
17. Additional comments: *e.g.*, presence of roots, mineralization, difficulty drilling or excavating, density (penetration test)

GRAIN SIZE CHART

Phi	mm	Inches	U.S. Standard Sieve	Description (USCS)
8.23	300	11.8		Boulders
6.23	75	2.95		Cobbles
4.25	19	0.75		Coarse Gravel
2.25	4.75	0.19	No. 4	Fine Gravel
-1	2	.079	No. 10	Coarse Sand
1.23	0.425	.0167	No. 40	Medium Sand
3.74	0.075	.00295	No. 200	Fine Sand
	<0.075			Silt and Clay

MOISTURE CONDITION

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually below water table

SOIL CLASSIFICATION CHART^A

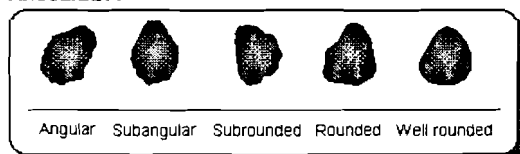
Major Divisions			Group Symbol ^C	Typical Names
Coarse-grained soils More than 50% retained on No. 200 sieve (0.075 mm)	Gravels (More than 50% retained on No. 4 sieve)	Clean gravels (little or no fines)	GW	Well-graded ^B gravels, gravel-sand mixtures, little or no fines
			GP	Poorly-graded ^B gravels, gravel-sand mixtures, little or no fines
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (More than 50% between No. 4 and 200 sieves)	Clean sands (little or no fines)	SW	Well-graded ^B sands, gravelly sands, little or no fines
			SP	Poorly-graded ^B sands, gravelly sands, little or no fines
		Sands with fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-grained soils More than 50% smaller than No. 200 sieve (0.075 mm)	Silts and clays (Liquid limit <50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	
		CL	Inorganic clays of low to medium plasticity gravelly clays, sandy clays, silty clays, lean clays	
		OL	Organic silts and organic silty clays of low plasticity	
	Silts and clays (Liquid limit >50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
		CH	Inorganic clays of high plasticity, fat clays	
		OH	Organic clays of medium to high plasticity, organic silts	
		Highly organic soils		PT

^A Based on Unified Soil Classification System and ASTM D2487, adapted from Holtz and Kovacs 1981.

^B "Well-graded" (or "poorly sorted") indicates a wide range in grain sizes, including all intermediate particle sizes. "Poorly-graded" (or "well sorted") indicates mostly one grain size or range of sizes with intermediate particle sizes missing.

^C Other qualifiers may be added to group symbol. For example, if gravels or fines contain 15-30% sand, add "with sand." If sands or fines contain 15-30% gravel, add "with gravel." If fines contain >30% gravel or sand, add "gravelly" or "sandy," whichever predominates. If soil contains cobbles or boulders, add "with cobbles" and/or "with boulders."

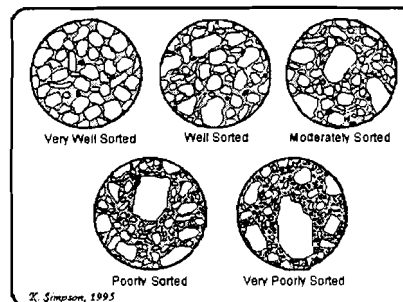
ANGULARITY



PARTICLE SHAPE

Description	Criteria
Flat	Particle width:thickness ratio >3
Elongated	Particle length:width ratio >3
Both	Meets both criteria

SORTING



PLASTICITY

Description	Criteria
Nonplastic	An 1/8" thread cannot be rolled at any water content.
Low	Thread can barely be rolled and lump cannot be formed when drier than the plastic limit.
Medium	Thread is easy to roll and little time is required to reach the plastic limit. Thread cannot be rerolled after reaching the plastic limit. Lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. Thread can be rerolled several times. Lump can be formed without crumbling when drier than the plastic limit.

DILATANCY

Description	Criteria
None	No visible change in the specimen.
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly when squeezed.
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly when squeezed.

CONSISTENCY

Description	Criteria
Very soft	Thumb will penetrate soil more than 1 inch.
Soft	Thumb will penetrate soil about 1 inch.
Firm	Thumb will indent soil about ¼ inch.
Hard	Thumb will not indent soil but readily indented with thumbnail.
Very hard	Thumbnail will not indent soil.

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

IDENTIFICATION OF FINE-GRAINED SOILS FROM MANUAL TESTS

Group Symbol	Dry Strength	Dilatancy	Toughness
ML	None to low	Slow to rapid	Low
CL	Medium to high	None to slow	Medium
MH	Low to medium	None to slow	Low to medium
CH	High to very high	None	High

DRY STRENGTH

Description	Criteria
None	Dry specimen crumbles into powder under handling pressure
Low	Dry specimen crumbles into powder with some finger pressure
Medium	Dry specimen breaks into pieces or crumbles with considerable finger pressure
High	Dry specimen cannot be broken with finger pressure but will break into pieces between thumb and hard surface
Very High	Dry specimen cannot be broken between thumb and hard surface

TOUGHNESS

Description	Criteria
Low	Only slight pressure is required to roll the thread near the plastic limit. The thread and lump are weak and soft.
Medium	Medium pressure is required to roll the thread near the plastic limit. The thread and lump have medium stiffness.
High	Considerable pressure is required to roll the thread near the plastic limit. The thread and lump have very high stiffness.

STRUCTURE

Description	Criteria
Stratified	Alternating layers of varying material or color with layers at least 6 mm thick.
Laminated	Alternating layers of varying material or color with layers less than 6 mm thick.
Fissured	Breaks along definite planes of fracture with little resistance
Slickensided	Fracture planes appear glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small, angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils.
Homogeneous	Same color and appearance throughout.

SOIL DENSITY FROM STANDARD PENETRATION TEST*

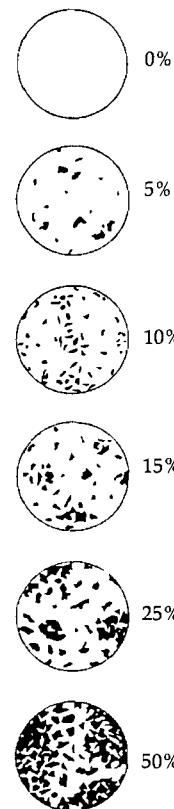
Granular Soils		Cohesive Soils	
N-value	Description	N-value	Description
0 - 10	Loose	0 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff

*ASTM D1586. N-value defined as blow count of 6 - 18 inch depth interval of sampler driven by 140-lb. hammer.

ROCK DESCRIPTIVE TERMS

Hardness	Soft	Scratched by fingernail	
	Medium Hard	Scratched easily by penknife	
	Hard	Difficult to scratch with a penknife	
	Very Hard	Cannot be scratched by penknife	
Weathering	Fresh	Rock is unstained. May be fractured, but discontinuities are not stained.	
	Slightly	Rock is unstained. Discontinuities show some staining on the surfaces of rocks, but discoloration does not penetrate rock mass.	
	Moderate	Discontinuity surfaces are stained. Discoloration may extend into rock along discontinuity surfaces.	
	High	Individual rock fragments are thoroughly stained and may be crumbly.	
	Severe	Rock appears to consist of gravel-sized fragments in a "soil" matrix. Individual fragments are thoroughly discolored and can be broken with fingers.	
Bedding Planes	Laminated	< .04 in.	< 1 mm
	Parting	0.04 in. - 0.24 in.	1 mm - 6 mm
	Banded	0.24 in. - 1 in.	6 mm - 30 mm
	Thin	1 in. - 4 in.	3 cm - 9.1 cm
	Medium	4 in. - 12 in.	9.1 cm - 30.5 cm
	Thick	12 in. - 36 in.	30.5 cm - 1 m
	Massive	> 36 in.	> 1 m
Fracture Spacing	Very close	< 2 in.	< 5.1 cm
	Close	2 in. - 1 ft.	5.1 cm - 30.5 cm
	Moderately close	1 ft. - 3 ft.	30.5 cm - 91.4 cm
	Wide	3 ft. - 10 ft.	91.4 cm - 3 m
	Very wide	> 10 ft.	> 3 m
Voids	Porous	Smaller than a pinhead. Their presence is indicated by the degree of absorbency.	
	Pitted	Pinhead size to a ¼ inch. If only thin walls separate the individual pits, the core may be described as honeycombed.	
	Vug	¼ inch to the diameter of the core. The upper limit will vary with core size.	
	Cavity	Larger than the diameter of the core.	
RQD	Very Poor	0 - 25%	<u>RQD - Rock Quality Designation</u>
	Poor	25 - 50%	Modified core recovery percentage calculated by dividing the sum of the lengths of core pieces 4 inches or larger by the total length of the run. RQD is a general estimate of the soundness of the rock and accounts for core loss, fracturing, weathering, etc. Use judgment to discern fractures caused by drilling and core recovery from <i>in-situ</i> fractures.
	Fair	50 - 75%	
	Good	75 - 90%	
	Excellent	90 - 100%	

PARTICLE PERCENT COMPOSITION ESTIMATE



REFERENCES

- American Society For Testing And Materials (ASTM), 2000, D2488-93e1 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), West Conshohocken, PA.
- ASTM, 2000, D2487-98 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System), West Conshohocken, PA.
- ASTM, 2000, D1586-99 Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils, West Conshohocken, PA.
- Compton, Robert R., 1985, Geology in the Field, John Wiley & Sons, Inc., New York, NY.
- Holtz Robert D. and William D. Kovacs, 1981, An Introduction to Geotechnical Engineering, Prentice-Hall, Inc., Englewood Cliffs, NY.

Appendix C

Calculations

Glenwood Area 1A

In-Situ Oxidation Calculations - Dissolved Phase

Part 1 - Area and Contaminant Mass

Length of Area to be Treated (ft)	300
Width of Area to be Treated (ft)	330
Depth of Aquifer to be Treated (ft)	20
Voids ratio (available space for water)	0.38

Dissolved Contaminant Mass (ppb)	PCE	220
Shallow:	TCE	22
	DCE	12
Total		254
Deep:	PCE	357
	TCE	39
	DCE	79
Total		475

Therefore, use deep gw values

Volume of soil and groundwater(cf)	1980000
Volume of groundwater (cf)	752400
Gallons of groundwater	5627952
Mass of Groundwater	46965259
Pounds of VOC/billion lb water	475
Pounds of VOC/site mass	22.3085

Part 2 - Oxidant Requirements

Stoichiometric Balance:

Moles of Sodium Permanganate per mole of VOCs	1.6
Molecular Weight of Sodium Permanganate g/mole	142

Molecular Weights of Contaminants:

Compound	Weight	% by volume	
TCE	131.4	0.08	10.512
PCE	165.9	0.75	124.425
DCE	98.95	0.17	16.8215

1 Must equal 1

Weight of VOC's (g)	151.7585
Weight of Oxidant (g)	227.2
Req'd Ratio	1.497115
Total Mass of Oxidant Required	33.3984

40% solution of Sodium Permanganate @ 4.6 lbs/gallon

Total Volume of 40% solution	7.260521
Inject at 4%, total volume	72.60521

Glenwood Area 1A

Bench Loadings for Groundwater - Area 1A

	total Volume req'd	Vol req'd per gallon	Vol. Req'd/Litre	Convert to ml.	Bench Test Volume (l)	Amount of oxidant req'd (ml)
40% solution of Sodium Permanganate @ 4.6 lbs/gallon						
<i>Total Volume of 40% solution</i>	9.851859	2.2173E-06	8.3815E-06	0.008381504	24.7	0.207023
<i>Inject at 4%, total volume</i>	98.51859	2.2173E-05	8.3815E-05	0.083815035	24.7	2.070231
<i>Inject at 1%, total volume</i>	394.0743	8.8693E-05	0.00033526	0.335260141	24.7	8.280925
<i>Inject @ .5</i>	788.1487	0.00017739	0.00067052	0.670520282	24.7	16.56185
<i>Inject @ .25</i>	1576.297	0.00035477	0.001341041	1.341040563	24.7	33.1237
<i>Inject @ .1%</i>	3940.743	0.00088693	0.003352601	3.352601408	24.7	82.80925

Bench Loadings for Soil/Groundwater

		Vol req'd per	Vol. Req'd/Sat. Litre	Convert to ml.	Bench Test Volume (l)	Amount of oxidant req'd (ml)
40% solution of Sodium Permanganate @ 4.6 lbs/gallon						
<i>Total Volume of 40% solution</i>	13.1746	6.6538E-06	1.31512E-05	0.013151181	2.5	0.032878
<i>Inject at 4%, total volume</i>	131.746	6.6538E-05	0.000131512	0.131511806	2.5	0.32878
<i>Inject at 1%, total volume</i>	526.984	0.00026615	0.000526047	0.526047223	2.5	1.315118
<i>Inject @ .5</i>	1053.968	0.00053231	0.001052094	1.052094445	2.5	2.630236
<i>Inject @ .25</i>	2107.936	0.00106461	0.002104189	2.104188891	2.5	5.260472
<i>Inject @ .1%</i>	5269.84	0.00266154	0.005260472	5.260472227	2.5	13.15118



Computations

AREA 1A

Project: GLENWOOD

Project # 06392.000

Location: GLENWOOD, NY

Sheet 1 of 3

Calculated by: M/V

Date: 2/5/02

Checked by:

Date:

Title CONTAMINANT MASS CALC'S.

PRELIM.

① AREA TO BE TREATED:

$$300' L \times 330' W \times 20' THICK = 1,980,000 \text{ cu. ft. H}_2\text{O}$$

- ASSUME POROSITY 30%

$$1,980,000 (.3) \times \frac{7.48 \text{ gal}}{\text{cu. ft.}} = \underline{\underline{4,443,120 \text{ GAL}}}$$

② DISSOLVED CONTAMINANT MASS:

GIVEN: SHALLOW
PCE 220 PPB
AVG. TCE 22 PPB
1,2 DCE 12 PPB

254

DEEPER
357 PPB
39 PPB
79 PPB

475 PPB

TOTAL VOC'S

$$4,443,120 \text{ GAL H}_2\text{O} \times 8.345 \text{ LB/gal} = 37,077,836 \text{ LBS}$$

$$\frac{X \text{ LBS VOC}}{37,077,836 \text{ LBS H}_2\text{O}} = \frac{475 \text{ LBS VOC}}{1,000,000,000 \text{ LBS H}_2\text{O}}$$

$$\underline{\underline{1,000,000,000 X = 17,611,972,100}}$$

$$1,000,000,000$$

$$\underline{\underline{X = 17.6 \text{ LBS}}}$$

Project: GLENWOOD

Project # AREA 1A

Location: GLENWOOD, NY Sheet 2 of 3

Calculated by: MJW

Date: 2/5/02

Checked by:

Date:

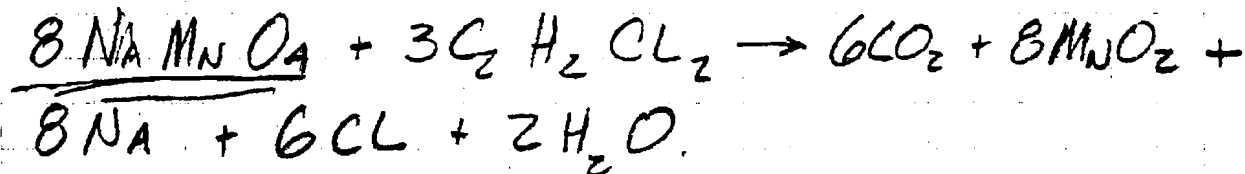
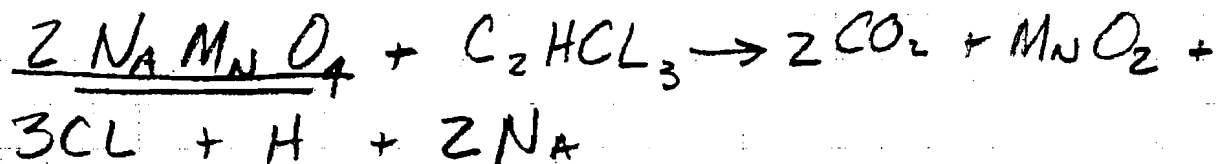
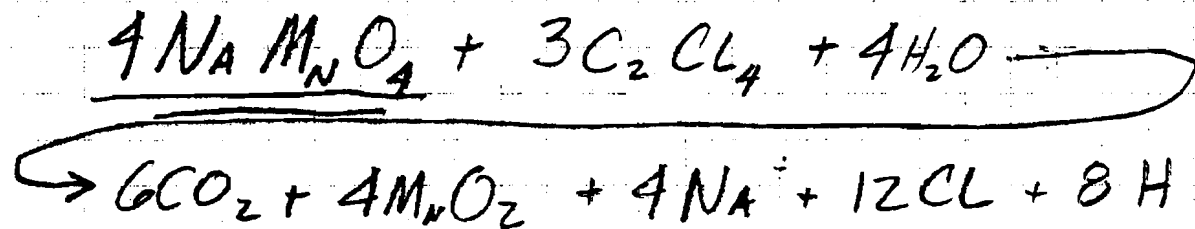
Title CONTAMINANT MASS CALC'S

(3) OXIDANT REQ'D.

- PCE (C_2Cl_4), TCE (C_2HCl_3), AND DCE ($C_2H_2Cl_2$)

ARE PRINCIPAL CONTAMINANTS @ 75, 8, 17 PERCENT TOTAL VOC'S RESPECTIVELY

- USING SODIUM PERMANGANATE ($NaMnO_4$) THE BALANCED REDUCTION IS AS FOLLOWS:



∴ 1.3 MOLE $NaMnO_4 / C_2Cl_4$, 2 MOLE $/ C_2HCl_3$, 1.6 MOLE $/ C_2H_2Cl_2$

$$1.3 \times .75 + 2 \times .08 + 1.6 \times .17 = .975 + .16 + .272$$

$$1.59 \rightarrow 1.6 \text{ MOLES}$$

Project: GLENWOOD, NY

Project # AREA 117

Location:

Sheet 3 of 3

Calculated by:

Date:

Checked by:

Date:

Title

(4) VOLUME OF OXIDANT

2.5 MOLES OF SOD. PERMANGANATE / MOLE OF VOC'S

$$\text{TCE} = 131.4 \text{ g/MOLE} \times .08 = 10.51$$

$$\text{PCE} = 165.9 \text{ g/MOLE} \times .75 = 124.43$$

$$\text{DCE} = 98.95 \text{ g/MOLE} \times .17 = 16.82$$

$$\text{TOTAL VOC'S} = 151.76 \text{ g/MOLE}$$

$$\text{NA MM O}_4 = 142 \text{ g/MOLE}$$

$$1 \text{ MOLE VOC'S } 151.76 \text{ g} / 1.6 \text{ MOLE @ } 142 \text{ g/MOLE}$$

$$\therefore 151.6 \text{ g VOC'S} = 227.2 \text{ g SOD. PERMANGANATE.}$$

$$227.2 / 151.6 = 1.5 \text{ TO } 1 \text{ OR } 1.5 \text{ LBS OF}$$

$$\text{SOD PER.} / 1 \text{ LB OF VOC'S}$$

$$17.6 \times 1.5 = 26.40 \approx 27 \text{ LBS}$$

$$40\% \text{ SOL. OF SOD. PERMANGANATE @ } 4.6 \text{ LBS/GALLON}$$

$$27 / 4.6 = 5.87 \approx 10 \text{ GAL}$$

$$\text{USING } 4\% \quad 10 \times 10 = 100 \text{ GALLONS}$$

Appendix D

Supplemental Site Investigation Figures



**54 Tuttle Place
Middletown, Connecticut 06457
860 632 1500 • FAX 860 632 7877**

LEGEND

- | | |
|---|-------------------------------|
|  | MONITORING WELL |
|  | SOIL BORING |
|  | SURFACE SOIL SAMPLE |
|  | GEOPROBE SAMPLE |
|  | SURFACE WATER/SEDIMENT SAMPLE |
|  | M.H. MANHOLE |
|  | DW DRYWELL |
|  | C.B. CATCHBASIN |
|  | O.F. OUTFLOW |

[illegible]

**Glenwood Landing
Gas Plant Site**
Glenwood Landing, New York



Investing Time

SITE COMPILATION AND SAMPLE LOCATION PLAN

1-2

Sheet	of
1	1

Project Number
06392-26

ctmldlar06392\cad\ev\glenwood\g\wood_ssp.dwg



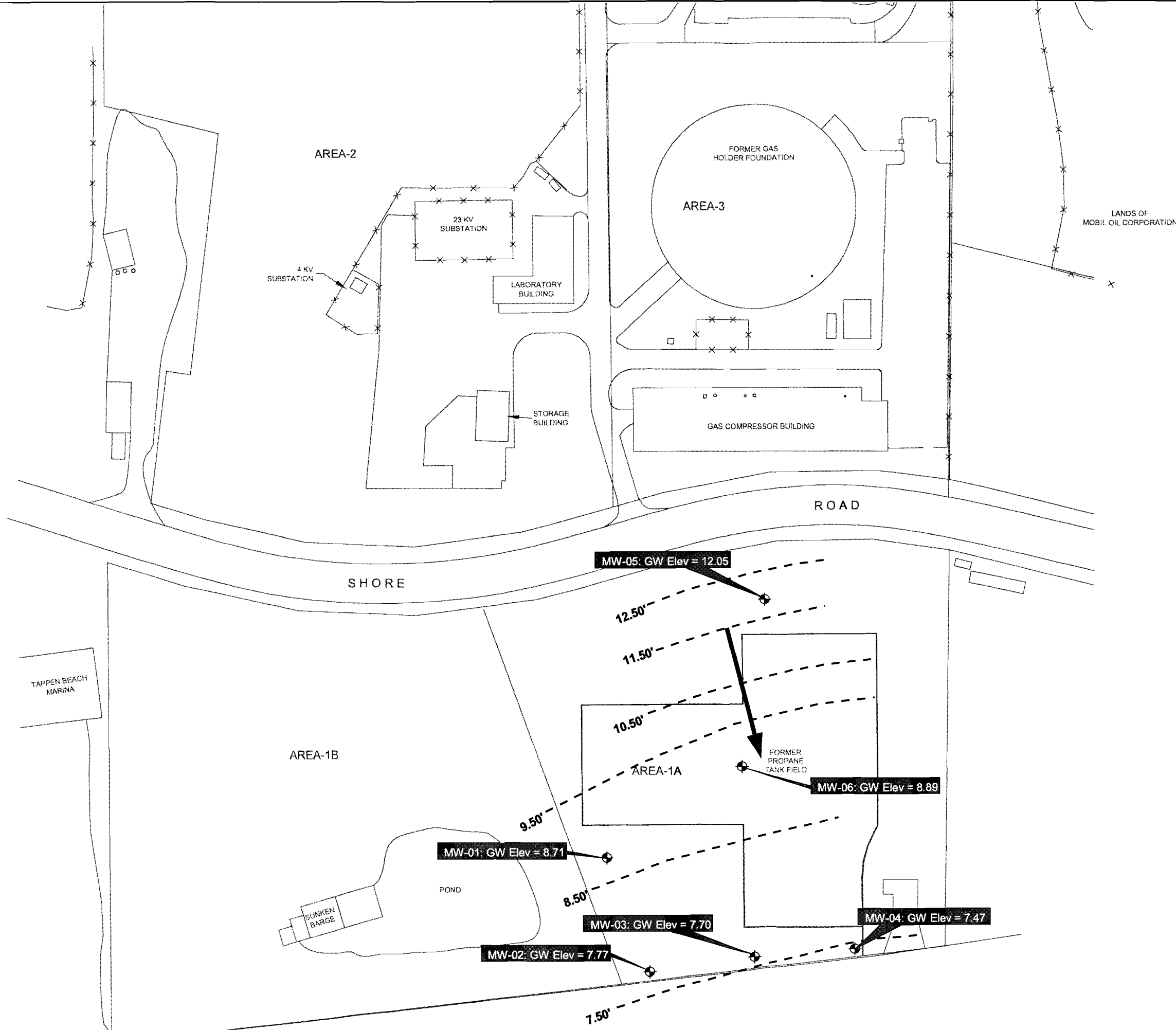
NOTES

1. 6-INCH LINES AROUND PERIMETER OF COMPRESSOR BLDG. ARE PERFORMED VITRIFIED CLAY PIPE.
2. 12-INCH PIPE VITRIFIED CLAY PIPE.
3. 24 & 36-INCH PIPE LOCATION AND SIZES PER ILLCO DWG. F-1337-6 DATED 5-23-49, LAST REVISED 4-30-73.

MAP REFERENCE

1. BASE MAP SOURCE: DRAWINGS AND AERIAL PHOTOGRAPHS BY LONG ISLAND LIGHTING COMPANY, AS MODIFIED BY IT CORPORATION.
2. ALL ELEVATIONS ARE BASED ON A PLANT DATUM.

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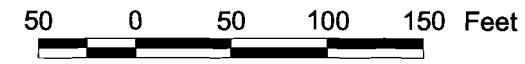
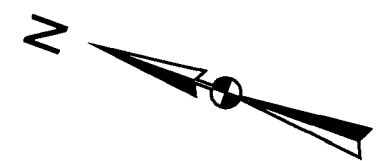


NOTE:
-Average Hydraulic Gradient (i) = 0.0108'/ft

LEGEND

- Monitoring Well
- 7.50' Inferred Groundwater Elevation Contour (MSL)
- Inferred Flow Direction

MONITORING WELL TABLE		
NUMBER	GRND ELEV.	TOP OF PIPE ELEV.
MW-1	16.24	19.76
MWD-1	14.23	18.11
MW-2	12.93	13.10
MWD-2	14.26	17.93
MW-3	15.40	18.81
MWD-3	16.74	20.43
MW-4	14.46	17.94
MW-5	16.78	19.78
MW-6	15.46	18.47



- MAP REFERENCE:
1. Base Map Source: Drawings and Aerial Photographs by Long Island Lighting Company, as Modified by IT Corporation
 2. All Elevations are Based on a Plant Datum

VHB Vanasse Hangen Brustlin, Inc.

PLAN PREPARED FOR **KEYSPAN** ENERGY

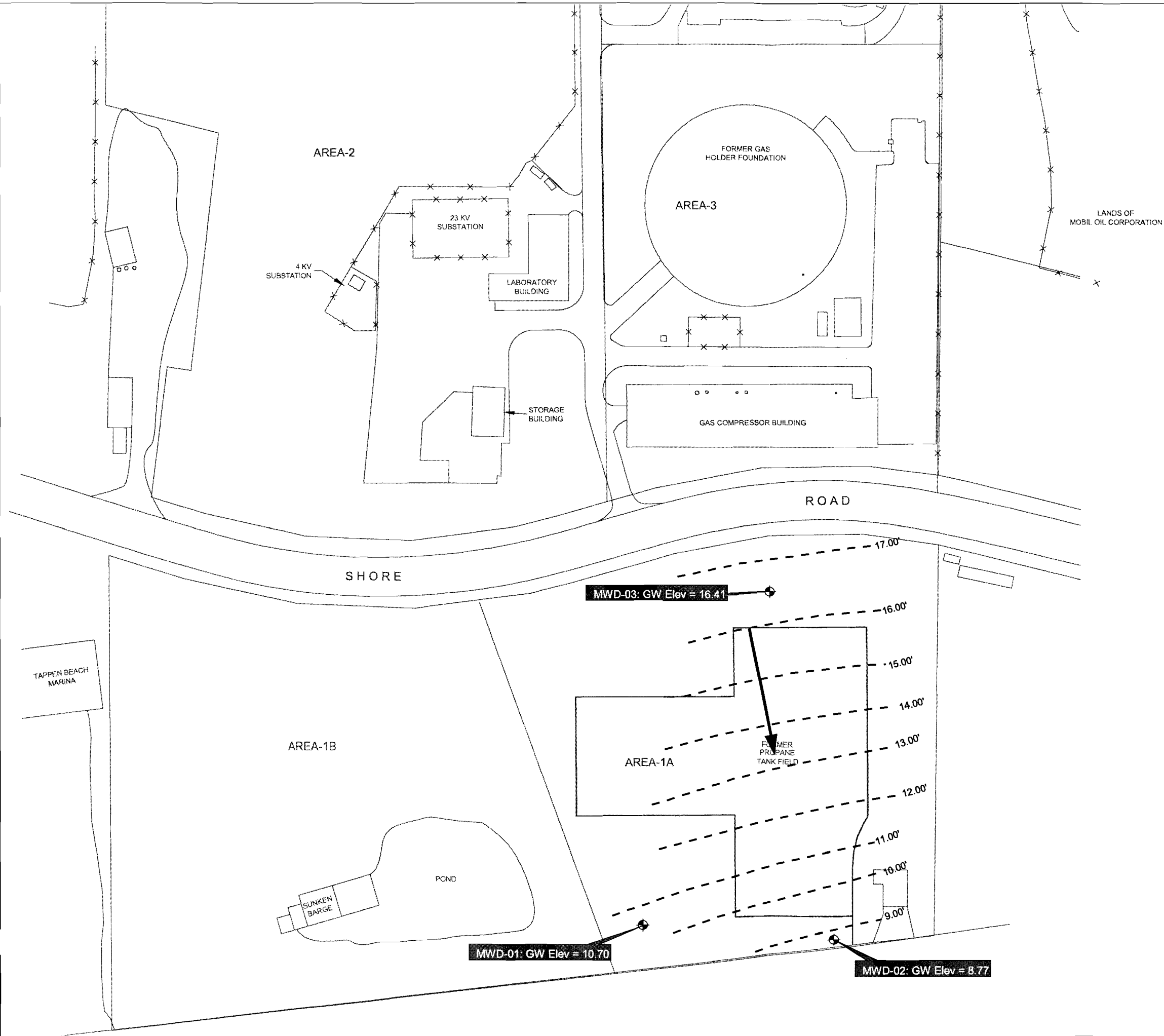
GLENWOOD LANDING GAS PLANT SITE
GLENWOOD LANDING, NEW YORK

GROUNDWATER MONITORING DATA
SHALLOW MONITORING WELLS
APRIL 27, 2001

SCALE = 1:1,200
DATE: JUNE 2001

FIGURE 2-1a

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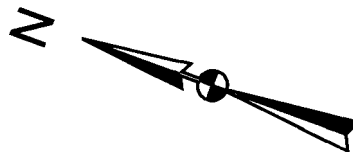
NOTE:
-Average Hydraulic Gradient (i) = 0.0184'/ft

LEGEND

- Monitoring Well
- 9.00' Inferred Groundwater Elevation Contour (MSL)
- Inferred Flow Direction

MONITORING WELL TABLE

NUMBER	GRND ELEV.	TOP OF PIPE ELEV.
MW-1	16.24	19.76
MWD-1	14.23	18.11
MW-2	12.93	13.10
MWD-2	14.26	17.93
MW-3	15.40	18.81
MWD-3	16.74	20.43
MW-4	14.46	17.94
MW-5	16.78	19.78
MW-6	15.46	18.47



50 0 50 100 150 Feet

MAP REFERENCE:

1. Base Map Source: Drawings and Aerial Photographs by Long Island Lighting Company, as Modified by IT Corporation
2. All Elevations are Based on a Plant Datum

VHB Vanasse Hangen Brustlin, Inc.

PLAN PREPARED FOR **KEYSPAN** ENERGY

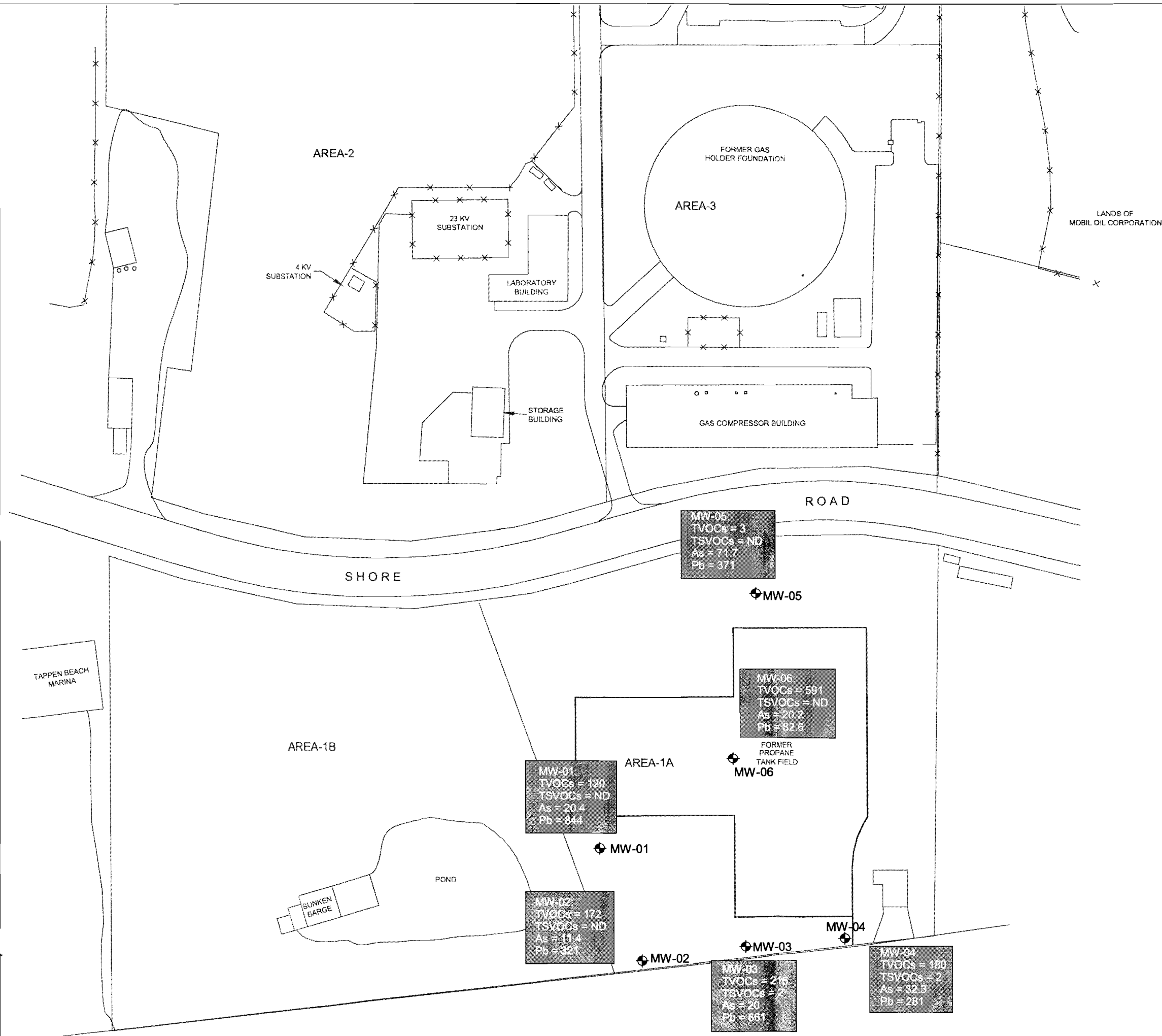
GLENWOOD LANDING GAS PLANT SITE
GLENWOOD LANDING, NEW YORK

GROUNDWATER MONITORING DATA
DEEP MONITORING WELLS
APRIL 27, 2001

SCALE = 1:1,200
DATE: JUNE 2001

FIGURE 2-1b

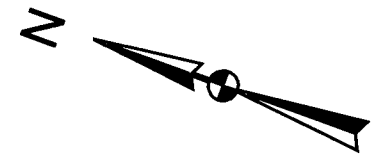
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NOTE:
-TVOCs = Total Volatile Organic Constituents (ug/l)
-TSVOCs = Total Semivolatile Organic Constituents (ug/l)
-As = Arsenic (ug/l)
-Pb = Lead (ug/l)
-ND = Not Detected at Quantitation Limits
- Results from samples collected April 25-27, 2001

LEGEND

Monitoring Well



50 0 50 100 150 Feet

MAP REFERENCE:

1. Base Map Source: Drawings and Aerial Photographs by Long Island Lighting Company, as Modified by IT Corporation
2. All Elevations are Based on a Plant Datum

VHB Vanasse Hangen Brustlin, Inc.

PLAN PREPARED FOR **KEYSPAN** ENERGY

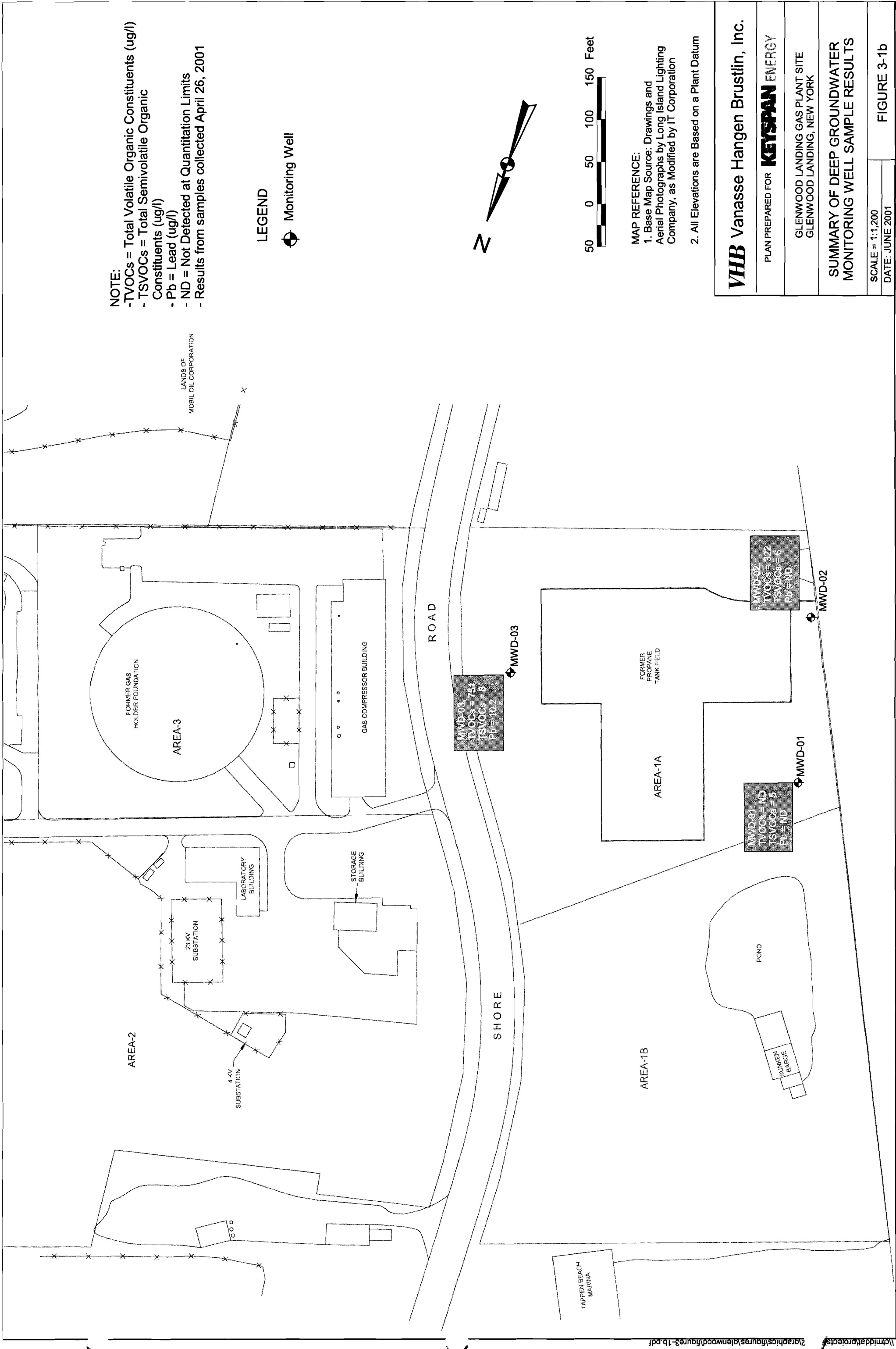
GLENWOOD LANDING GAS PLANT SITE
GLENWOOD LANDING, NEW YORK

SUMMARY OF SHALLOW GROUNDWATER MONITORING WELL SAMPLE RESULTS

SCALE = 1:1,200

DATE: JUNE 2001

FIGURE 3-1a



NOTE:
-TVOCs = Total Volatile Organic Constituents (ug/l)
-TSVOCs = Total Semivolatile Organic Constituents (ug/l)
-Pb = Lead (ug/l)
-ND = Not Detected at Quantitation Limits
-Results from samples collected April 26, 2001

LEGEND

Monitoring Well



MAP REFERENCE:

1. Base Map Source: Drawings and Aerial Photographs by Long Island Lighting Company, as Modified by IT Corporation
2. All Elevations are Based on a Plant Datum

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PLAN PREPARED FOR **KEYSPAN ENERGY**

GLENWOOD LANDING GAS PLANT SITE
GLENWOOD LANDING, NEW YORK

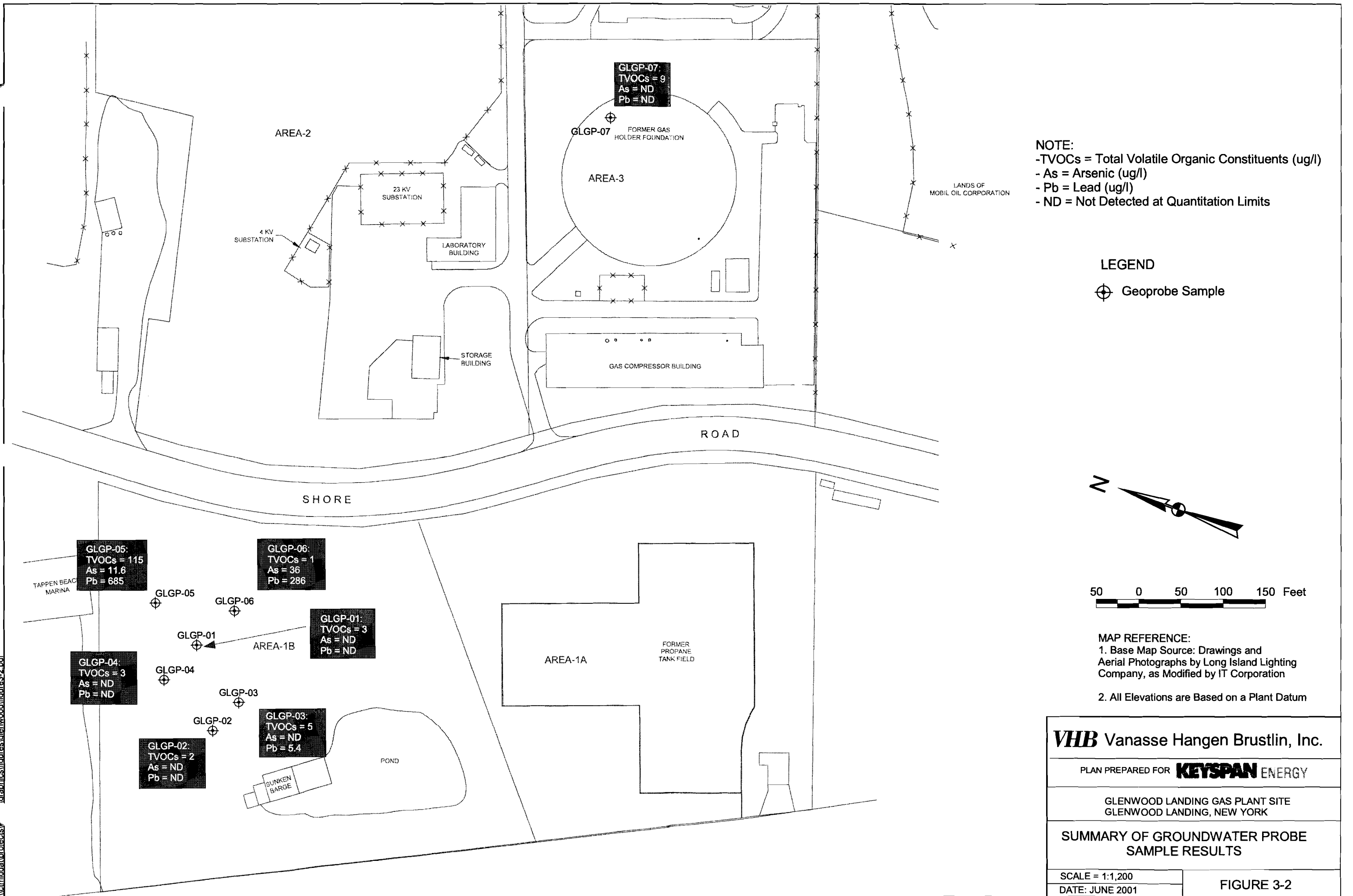
SUMMARY OF DEEP GROUNDWATER
MONITORING WELL SAMPLE RESULTS

SCALE = 1:1,200

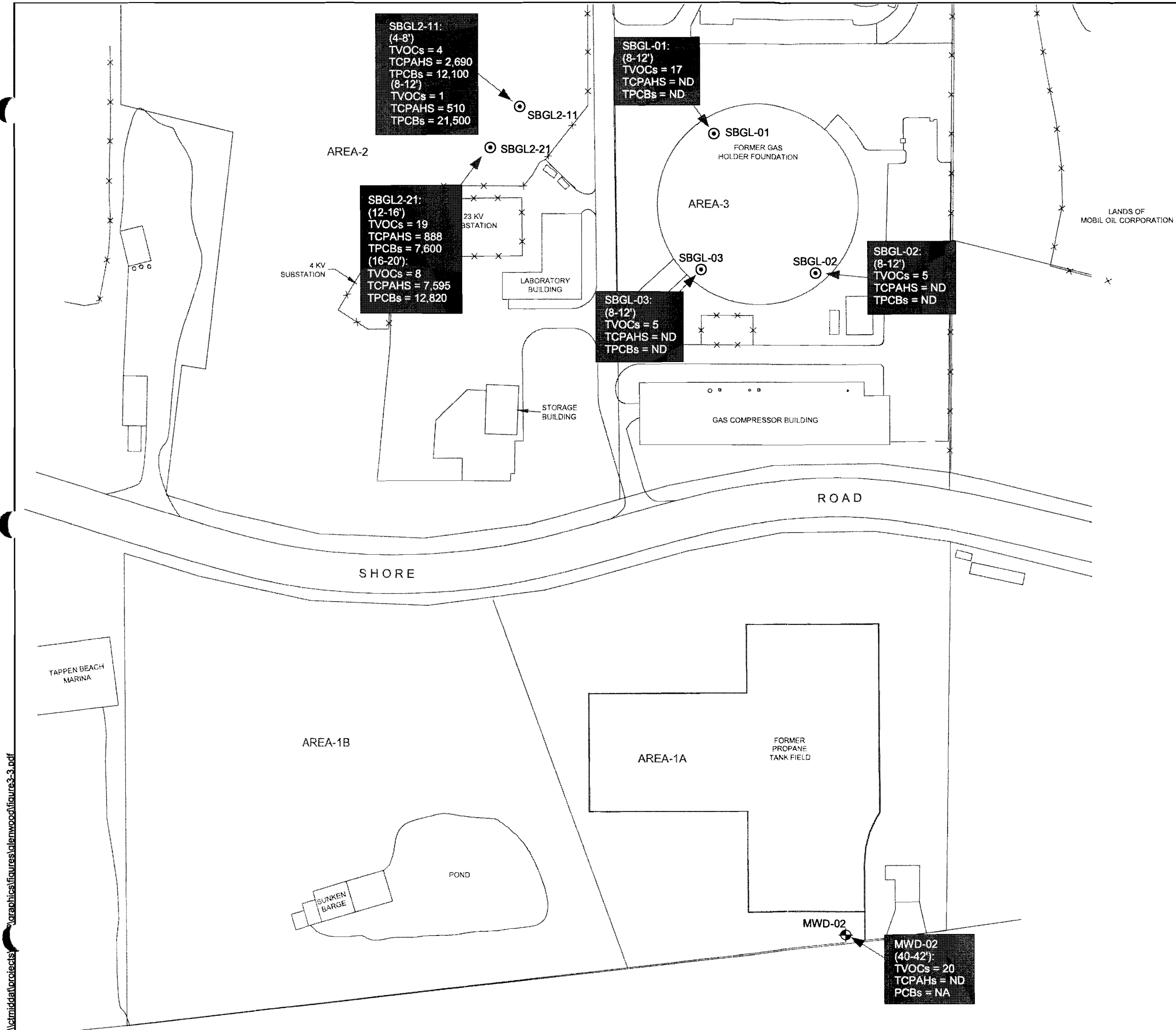
DATE: JUNE 2001

FIGURE 3-1b

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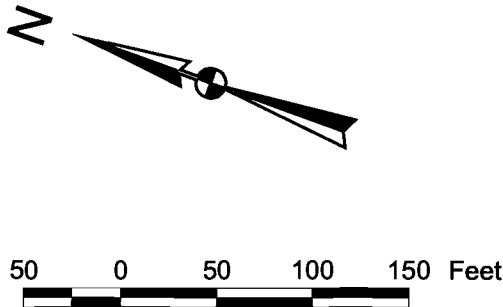


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NOTE:
-TVOCs = Total Volatile Organic Constituents (ug/kg)
-TCPAHS = Total Potentially Carcinogenic Polycyclic Aromatic Hydrocarbons (ug/kg)
- TPCBs = Total Polychlorinated Biphenyls (ug/kg)
- ND = Not Detected at Quantitation Limits
- NA = Not Applicable

LEGEND
⊙ Soil Boring
⊕ Monitoring Well



MAP REFERENCE:
1. Base Map Source: Drawings and Aerial Photographs by Long Island Lighting Company, as Modified by IT Corporation
2. All Elevations are Based on a Plant Datum

VHB Vanasse Hangen Brustlin, Inc.

PLAN PREPARED FOR **KEYSPAN** ENERGY

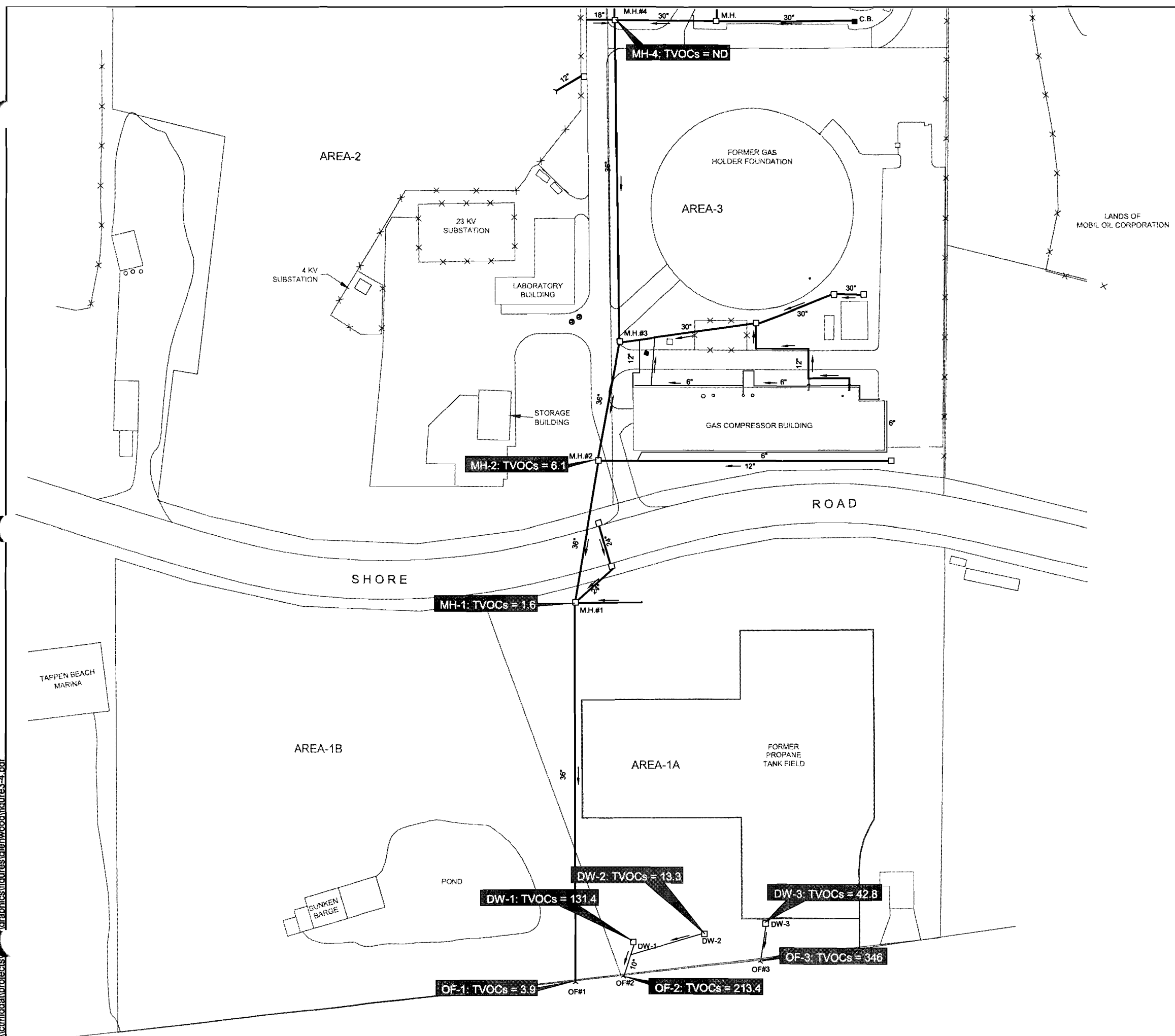
GLENWOOD LANDING GAS PLANT SITE
GLENWOOD LANDING, NEW YORK

**SUMMARY OF SUBSURFACE SOIL
SAMPLE RESULTS**

SCALE = 1:1,200
DATE: JUNE 2001

FIGURE 3-3

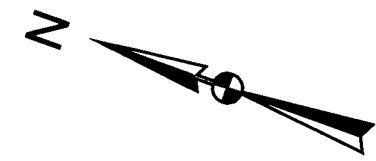
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NOTE:
-TVOCs = Total Volatile Organic
Constituents (ug/l)
- ND = Not Detected at Quantitation Limits

LEGEND

□ M.H. Manhole



50 0 50 100 150 Feet

- NOTES:
1. 6-inch lines around perimeter of compressor Bldg. are perforated vitrified clay pipe.
 2. 12-inch pipe vitrified clay pipe
 3. 24 & 36-inch pipe location and sizes per LILCO dwg. F-1337-6 dated 5-23-49, last revised 4-30-73.

MAP REFERENCE:

1. Base Map Source: Drawings and Aerial Photographs by Long Island Lighting Company, as Modified by IT Corporation
2. All Elevations are Based on a Plant Datum

VHB Vanasse Hangen Brustlin, Inc.

PLAN PREPARED FOR **KEYSPAN** ENERGY

GLENWOOD LANDING GAS PLANT SITE
GLENWOOD LANDING, NEW YORK

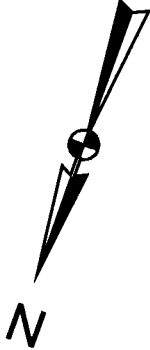
SUMMARY OF STORM SEWER
SAMPLE RESULTS

SCALE = 1:1,200
DATE: JUNE 2001

FIGURE 3-4

NOTE:
-TCPAHs = Total Potentially Carcinogenic
Polycyclic Aromatic Hydrocarbons (ug/kg)
- ND = Not Detected at Quantitation Limits

LEGEND
⊗ Surface Soil Sample



MAP REFERENCE:

- 1. Base Map Source: Drawings and Aerial Photographs by Long Island Lighting Company, as Modified by IT Corporation
- 2. All Elevations are Based on a Plant Datum

VHB Vanasse Hangen Brustlin, Inc.

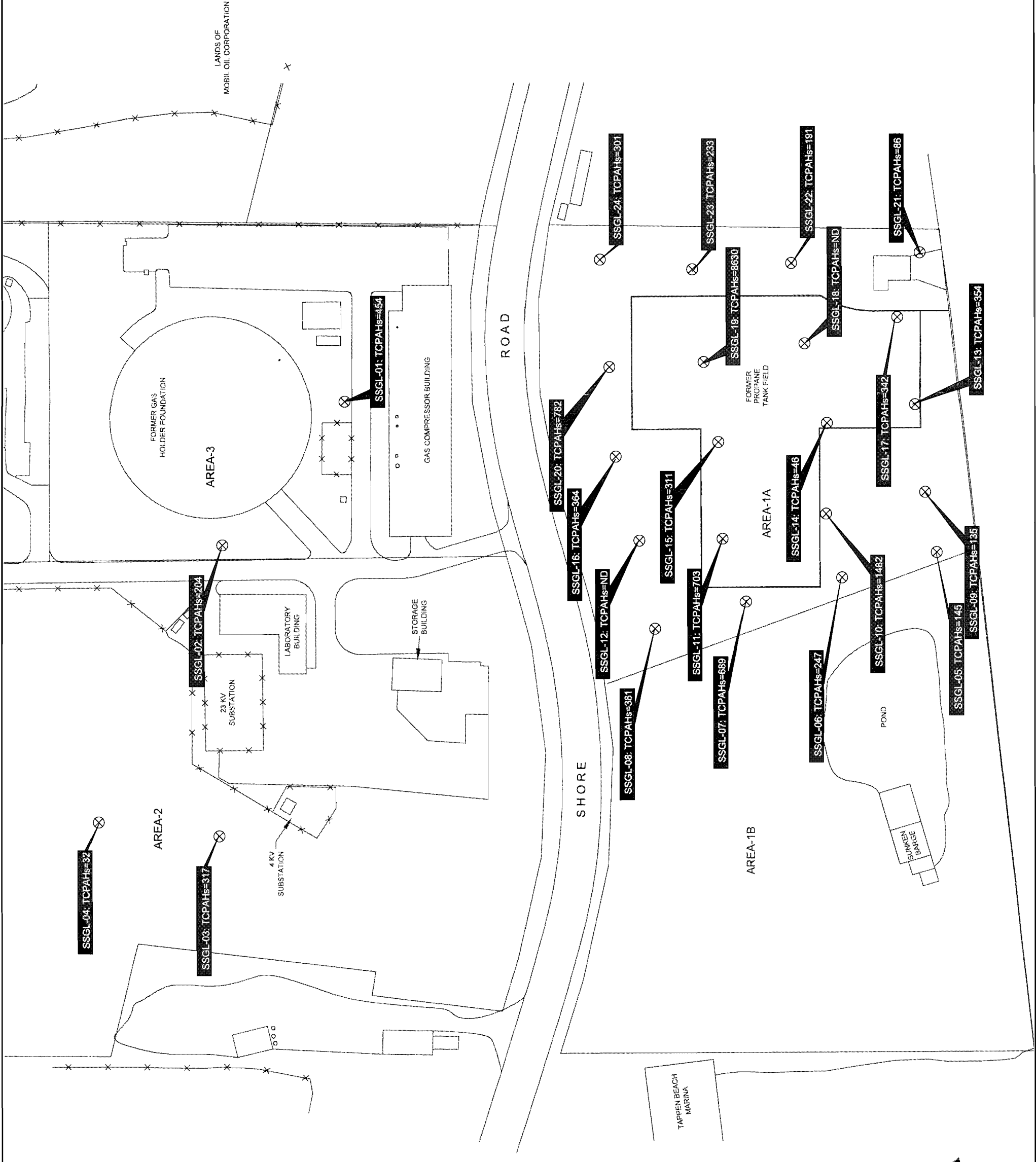
PLAN PREPARED FOR **KEYSPAN ENERGY**

GLENWOOD LANDING GAS PLANT SITE
GLENWOOD LANDING, NEW YORK

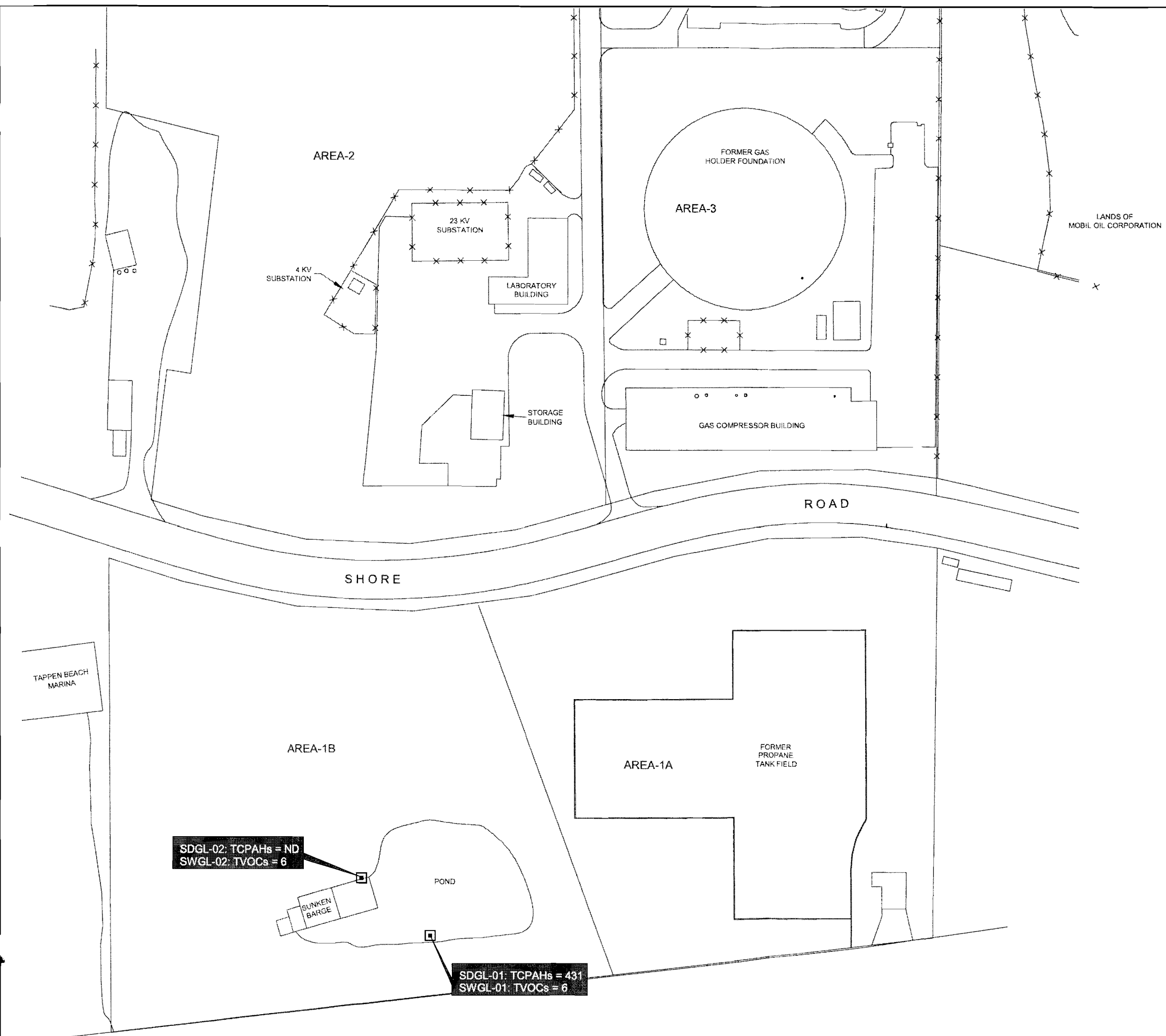
SUMMARY OF SURFACE SOIL
SAMPLE RESULTS

SCALE = 1:1,200
DATE: JUNE 2001

FIGURE 3-5

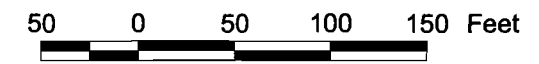
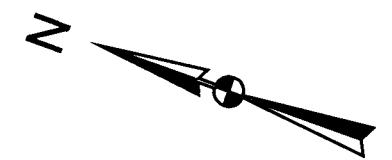


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NOTE:
-TVOCs = Total Volatile Organic
Constituents (ug/l)
-TCPAHs = Total Potentially Carcinogenic
Polycyclic Aromatic Hydrocarbons (ug/kg)
- ND = Not Detected at Quantitation Limits

LEGEND
□ Surface Water/Sediment Sample



MAP REFERENCE:
1. Base Map Source: Drawings and
Aerial Photographs by Long Island Lighting
Company, as Modified by IT Corporation

2. All Elevations are Based on a Plant Datum

VHB Vanasse Hangen Brustlin, Inc.

PLAN PREPARED FOR **KEYSPAN** ENERGY

GLENWOOD LANDING GAS PLANT SITE
GLENWOOD LANDING, NEW YORK

**SUMMARY OF SURFACE WATER AND
SEDIMENT SAMPLE RESULTS**

SCALE = 1:1,200
DATE: JUNE 2001

FIGURE 3-6



860 672 1500 (AUS 860 672 7879)



Proposed Remedial Action Objectives Areas 2 and 3 (mg/kg)	
Area 2	Area 3
1.0 0.5 0.1 0.05 0.01 0.005 0.001 0.0005 0.0001 0.00005 0.00001 0.000005 0.000001 0.0000005 0.0000001 0.00000005 0.00000001	1.0 0.5 0.1 0.05 0.01 0.005 0.001 0.0005 0.0001 0.00005 0.00001 0.000005 0.000001 0.0000005 0.0000001 0.00000005 0.00000001

Response actions should meet the designated values to a maximum depth of 8', or groundwater interface (whichever is less).

	MONITORING WELL
	SOIL BORING
	SURFACE SOIL SAMPLE
	GEOPROBE SAMPLE
	SURFACE WATER/SEDIMENT SAMPLE
	M.H. MANHOLE

[illegible]

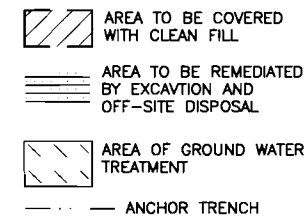
CONCEPTUAL REMEDIAL ACTION PLAN

51

1 1

06392-26

QW_REMEDIAL_ACTION_PLAN.dwg



1. 8-INCH LINES AROUND PERIMETER OF COMPRESSOR BLDG. ARE PERFORATED VITRIFIED CLAY PIPE.
2. 12-INCH PIPE VITRIFIED CLAY PIPE.

1. BASE MAP SOURCE: DRAWINGS AND AERIAL PHOTOGRAPHS BY LONG ISLAND LIGHTING COMPANY, AS MODIFIED BY IT CORPORATION.

2. ALL ELEVATIONS ARE BASED ON A PLANT DATUM.
3. 24 & 36-INCH PIPE LOCATION AND SIZES PER LILCO
DWG. F-1337-6 DATED 5-23-49, LAST REVISED 4-30-73.

CURRENT DATE: 6/12/01 by RCA
CWD FILE NAME: CWD_remediat_action_plan