PTI
ENVIRONMENTAL SERVICES

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November 7, 1996

Ms. Judith Aitkin
Ms. Elaine Atkinson
Washington State Department of Ecology
3190 160th Avenue SE
Bellevue, Washington 98008-5452

Subject: Field sampling for the Evergreen Park expansion project
PTI Contract CA5Q-05-01

Dear Ms. Aitkin and Ms. Atkinson:

On behalf of Failure Analysis Associates (Failure) and the City of Bremerton (the City), PTI Environmental Services (PTI) is pleased to submit the final work plan for an environmental investigation focused on properties surrounding Smith Cove in Bremerton, Washington (Figures 1 and 2). This version of the work plan should supplant an earlier version issued on September 17, 1996. Specifically, the upland portions of following properties will be addressed during this investigation:

- Evergreen Park (southern section)
- Brem-Air Disposal Company
- Lofthus
- Puget Power
- City of Bremerton (former Depot Building).

The Chevron property may be investigated at a later date. No sediment work will be conducted as part of this investigation. The City hopes to expedite the work on the uplands portions of the sites to accommodate park expansion construction. Therefore, the project team would like to separate the upland sources and potential sediment impacts into two operational units. The sediment operational unit may be investigated following remediation and source control within the upland operational unit.

PROJECT BACKGROUND

The following sections provide information regarding site description, existing site characterization, and data gaps.

Site Description

All of the subject properties are located within the vicinity of Smith's Cove (Figure 2). Complete information regarding historical and current operations for the subject properties is provided in *Draft Environmental Information to Support the Proposed Evergreen Park Expansion Project* (Failure 1996).

Historical documents indicate that the portions of the properties located between Sheldon Boulevard and Smith's Cove were filled between 1928 and 1947. The source, nature, and depth of the fill materials are unknown. Although no onsite investigations have been conducted in the underlying native material, the native soils are likely to be glacial till based on the general geology of the Bremerton area (USDA 1980) and on nearby well logs (Ecology 1995).

Smith's Cove is on Port Washington Narrows, a saline water body with moderate daily tidal fluctuations (i.e., 5–10 ft). Groundwater is shallow in the area at a depth of less than 10 ft below ground surface (BGS). Shallow groundwater gradients generally follow surface topography. Based on the topography at the subject site, local shallow groundwater would likely flow toward Smith's Cove. Groundwater in the subject area is believed to be saline and non-potable, with no beneficial use. Groundwater sampling will be performed to verify this assumption.

Existing Site Characterization

Available site characterization data for subject properties are summarized in Failure (1996) and PTI (1996). These data are briefly presented below:

- **Evergreen Park**—During construction of a storm sewer along the southern boundary of the park in 1994, soils contaminated with total petroleum hydrocarbons ([TPH] including diesel and heavy oil), metals, and asbestos were discovered. To date, 2,200 tons of impacted soil associated with the storm sewer excavation were disposed at the Kitsap County Landfill. No other site characterization or remedial actions have occurred in this area of the site.

  In 1996, PTI conducted a limited subsurface soil and groundwater investigation in the northeastern corner of the park (PTI 1996). Low concentrations of diesel and heavy oil were confirmed in site soils. No soil has been removed from this area of the park, which is currently awaiting a No Further Action determination by the Washington State Department of Ecology (Ecology) under the Independent Remedial Action Program.

- **Brem-Air**—In 1993, soil samples were collected during a limited subsurface investigation. TPH as diesel and heavy oil, petroleum solvents, volatile organic compounds (VOCs), and metals were confirmed in soils collected from the groundwater depth. No remedial actions have been conducted at this site. This site has not been ranked by Ecology under the Washington Ranking Method (WARM) process.
- **Lofthus**—A single surface water sample collected by Ecology in 1992 indicated the presence of TPH, oil and grease, and lead. No other characterization and no remediation has been conducted at the site. This site has been ranked as a 1 under the WARM process.
- **Puget Power**—No characterization has been conducted to date.
- **City of Bremerton (former Depot Building)**—No characterization has been conducted to date.

Historical sampling locations are presented in Figure 3.

Data Gaps

Based on the available information, the presence or absence of contamination has not been determined in some areas of the subject properties, and lateral and vertical extent of soil and groundwater contamination is undetermined. As indicated above, the City wishes to address soil and groundwater issues prior to resolving potential sediment concerns. Therefore, surface water, shoreline sediments, and cove sediments will not be addressed during this phase of the investigation.

Complete data gap summaries are presented in Failure (1996). Pertinent gaps are briefly presented below:

- **Evergreen Park**—Additional subsurface soil sampling is required in the storm sewer area and in the area between the storm sewer and the northern portion of the park. Groundwater screening is also required.
- **Brem-Air**—Additional subsurface soil sampling is required in areas associated with buried items and historical operations. Groundwater screening is also required.

- **Lofthus**—Subsurface soil sampling is required across the site, particularly in areas associated with former fueling and lumber yard operations. Groundwater screening is also required.
- **Puget Power**—Limited subsurface soil sampling is required in areas associated with former power-generating facilities. Groundwater screening is also required.
- **City of Bremerton (former Depot Building)**—Limited subsurface soil sampling is required in areas associated with former auto maintenance activities. Groundwater screening is also required.

PROPOSED SCOPE OF WORK

The following sections present the scope of work to address the data gaps identified in Failure (1996). It also includes information regarding quality assurance and quality control (QA/QC), field data reporting, equipment decontamination, and sample handling and shipping.

Sampling Objectives

In general, the primary goals of this investigation are to determine soil/fill stratigraphy, evaluate preliminary vertical and horizontal extent of contamination, and evaluate the potential impact of contaminated soils on groundwater. Therefore, the sampling objectives differ by site. These objectives are outlined below:

- **Evergreen Park**—Make a preliminary determination of the extent of TPH contamination near the storm sewer in the southeastern corner of the park. Determine if contamination is present between northeastern corner and sewer area. Screen groundwater conditions.
- **Brem-Air**—Better define extent of contamination associated with underground fuel tanks, onsite operations, and/or offsite sources. Screen groundwater conditions.
- **Lofthus**—Determine if contamination is present in site soils near suspected source areas (e.g., fuel tank supports, metals shop, former lumber yard). Attempt to determine sources of potential contamination. Screen groundwater conditions.
- **Puget Power**—Determine if contamination is present in site soils near potential source areas. Screen groundwater conditions.

- **City of Bremerton (former Depot Building)**—Determine if contamination is present in site soils. Screen groundwater conditions.

The locations of proposed sampling points are based on these objectives, as outlined in the following section.

Field Sampling and Analysis

The following scope of work was developed in consideration of previous characterizations and additional data gaps that remain. Field activities will consist of the following:

- Collection of subsurface soil samples at selected locations, with analyses of soil samples at selected depth intervals where field screening methods indicate potential contamination
- Collection of screening-level groundwater samples at selected locations, with analyses of groundwater samples at selected locations where field screening methods indicate potential groundwater contamination.

The sampling approach will consist of advancing boreholes in approximately 24 locations. Exact locations may be dependent on subsurface site conditions, and target soil sampling locations are shown in Figure 4. The sampling objectives for each station are presented in Table 1.

All samples will be collected by Strataprobe®, a method that advances a stainless-steel sample core into the ground to a specified depth using a truck-mounted hydraulic device. Although Strataprobe® is similar to the Geoprobe® system, Strataprobe® has more power to penetrate rocks, concrete, or other difficult subsurface materials. Samples will be collected by retrieving the sampling device, and no soil "cuttings" will be generated. This method minimizes disruption to paved and landscaped areas. The method is relatively rapid and does not require a large drill rig; therefore, disruption to the site operators/owners (at Brem-Air and Lofthus) and the City (at Evergreen Park) will be minimal. The use of this method assumes that subsurface material does not entirely consist of concrete, rock, or other solid material. If resistance is encountered, the Strataprobe® may be moved 2–3 ft from the original station to attempt sampling. Standard operating procedures for the Strataprobe® are included as Attachment A.

All excess soil and wash water will be contained, transferred to U.S. Department of Transportation-approved drums, and stored onsite. Removal of the drums will be the City's responsibility.

Soil Samples

All boreholes will be advanced to the depth at which groundwater is encountered (anticipated to be a maximum depth of 12 ft BGS) to better define subsurface conditions and the extent of contamination. Soil will be logged continuously and collected over 3-ft intervals. Soil samples will be field screened (e.g., using a combination of a sheen test, thin-layer chromatography [TLC], photoionization detector [PID], and/or odor and visual appearance) to evaluate the presence of gross contamination.

In addition to subsurface soil samples, one sediment sample will be collected from a ditch or drainage near the former tank supports on the Lofthus property. This station is identified as LF-03 on Figure 4. The sample will be collected from 0 to 6 in. BGS using stainless-steel spoons and will be field screened as described above.

Those soil samples with a positive field screening result (for a maximum of two soil samples per boring) will be submitted for WTPH-HCID, WTPH-D extended, or WPTH-G/BTEX analyses, as appropriate (see Table 2). In addition, 10 percent of those samples with negative results will also be submitted for analyses to confirm the reliability of the screening methods. Up to 40 samples that are positive for diesel and heavy oil under the HCID analysis will be analyzed using WTPH-D extended. Up to seven samples that are positive for gasoline under the HCID analyses will be analyzed using WTPH-G/BTEX. In addition to petroleum hydrocarbon analyses, up to 30 percent of selected samples may be submitted for VOCs, PAHs, PCBs, and metals using the methods specified in Table 2. All analytical determinations will be based on the location of the sample and historical operations that may have impacted site soil in that location.

In addition, two soil samples (one from the eastern border of Brem-Air and one from the western border of Lofthus) will be collected from the vadose zone and submitted for TPH fingerprinting analyses. This analysis will be completed to determine if different sources are responsible for potential contamination along boundaries between these two properties.

Groundwater Samples

Groundwater samples will be collected from approximately seven of the boreholes to screen for gross contamination. Water levels will be recorded in the field, and groundwater samples will be field screened by noting the presence of any unusual sheen or odor, and/or visual appearance. Samples will also be screened for the presence of TPH or PAHs using TLC. Groundwater samples will be monitored for conductivity, temperature, and pH. If a groundwater sample contains free product, the sample will not be submitted for analysis. If it is determined that groundwater contamination is present, monitoring wells may be installed at a later date to provide better quantification of contaminants.

Groundwater samples will be analyzed for diesel and heavy oil using WTPH-D extended and for gasoline and BTEX using WTPH-G/BTEX. In addition, up to two of these samples will be analyzed for PAHs, VOCs, and/or metals. Analytical determinations will be based on the location of the groundwater sample, historical operations that may have impacted the site in that location, and the results of soil samples collected from the same location.

Based on field screening results and an evaluation of suspected sources, up to 47 soil samples and 7 groundwater samples (not including field QA/QC samples) are proposed to be submitted for the analyses presented in Table 2. All field activities will be conducted under health and safety conditions stipulated in Attachment B.

QA/QC Sampling

Soil sample field duplicates and soil equipment rinsate blanks will be submitted as part of the field QA/QC for this project. Field duplicates will be analyzed to assess the variability of field collection techniques, which will provide an indication of the representativeness of the data set. One field duplicate will be submitted for every 20 samples analyzed.

Laboratory performance will be evaluated by comparing analytical data to pre-specified data quality objectives. The data quality objectives for this project are outlined in Table 2.

Field Data Reporting

The integrity of each sample from the time of collection to the point of data reporting will be maintained throughout the study. Proper recordkeeping and chain-of-custody procedures will be implemented to allow samples to be traced from collection to final disposition. All sampling activity will be documented in a dedicated field logbook and logged onto field data sheets, as appropriate. Field forms that will be used to document sampling activities include the following:

- **Field log form**—Each sample will be recorded on a field log form. The sample type, sample number, and sample tag number will also be recorded on the field log form.
- **Sample label and custody seal**—A sample label will be completed for each sample. Sample containers will be labeled at the time of sampling with the following information: sample number, site name, sampling date and time, sampling personnel, preservative (if appropriate), and tag number. A custody seal will be placed across the lid of the cooler prior to shipping.

- **Chain-of-custody record/sample analysis request form**—The sample and tag numbers of each sample container will be recorded on this form. The chain-of-custody record/sample analysis request form will also identify the sample collection date and time, the type of sample, the project, and the field team leader. For each sample tag, the form will identify the preservative or other sample pretreatment applied and the analyses to be conducted by referencing a list of specific analytes or the statement of work for the laboratory. The original form will be sent to the laboratory along with the sample and will be completed in triplicate, with one copy retained by the field team leader.

At the time of sampling, the sample number for each sample will be recorded in the field logbook. At the end of each day and prior to shipping or storage, chain-of-custody entries will be made for all samples. Finally, information on the labels will be checked against field logbook entries, and samples will be recounted.

The field team leader is responsible for properly completing all forms. Station and sample logs must be completed at the time the observations are made. Chain-of-custody/sample analysis request forms will be completed and signed before the end of each sampling day and before the samples are removed from the vessel or pass from the control of the field team leader. Chain-of-custody forms will be signed at each additional point of transfer of samples between the field and the laboratory and within the laboratory. Copies of all forms will be retained by the field team leader.

A bound field notebook will also be completed for this sampling event. Any changes in the sampling procedures described herein will be documented in the field notebook.

Sample Equipment Decontamination

Prior to collection of samples, all sampling equipment will be scrubbed with Alconox®, rinsed with acetone and hexane, and rinsed thoroughly with deionized water. The equipment will also be decontaminated between sample collection. The small volume of acetone and hexane rinsates will be collected into an open container and allowed to evaporate in a well ventilated area.

Sample Handling and Shipping

All sample containers will be provided by the laboratory and will be kept closed and in a cooler until use. As they are collected, samples will be fully labeled, recorded in the field notebook along with other pertinent collection data, and returned to coolers as soon as possible. Immediately after they are filled, all sample containers will be placed on ice in a cooler at 4°C. Handling of the samples while in the field will be minimized to the extent possible.

Chain-of-custody and sample analysis request forms will be completed and signed at the end of the day and shipped with the samples to the analytical laboratories. Samples will be shipped or sent by courier to the participating laboratories within 24 hours of sample collection. Soil and groundwater samples for all chemical analyses will be shipped on ice (4°C) to the testing laboratories and will be stored at 4°C until analysis and final disposition (i.e., until all selected analyses are completed) of the samples.

Samples shipped or sent by courier will be packed in bubble-wrap plastic to prevent breakage, and chain-of-custody seals will be placed across the cooler lids. Chain-of-custody forms will be enclosed in the coolers with the samples and will be signed at the laboratory upon receipt. A copy of the signed form will be returned to the field team leader and filed in the project file.

REPORTING

PTI will prepare a letter report summarizing field work, with corresponding data tables and figures. The report will document findings and identify potential remedial actions to occur.

SCHEDULE

The field investigation is expected to be conducted under an accelerated schedule so results of the investigation will be available for Ecology to review by January 1997. Field work is anticipated to take a total of 3 days using three PTI field crew members. Every effort will be made to follow the proposed scope based on site conditions encountered.

Key investigative milestones include the following:

- Field investigations will be conducted during the week of November 18, 1996
- Analytical data and field results will be available approximately 4 weeks after field investigations are completed
- QA/QC review of analytical data will be completed no later than 5 weeks after field investigations are completed
- The final report will be completed and submitted to Ecology by January 1997.

Our team looks forward to working with Ecology on this important project. Please feel free to call me, Greg Bawden, or Sherrill Nelligan Doran at (206) 643-9803 if you have any questions.

Sincerely,

Shawn R.T. Severn, Ph.D.
Principal Scientist

cc: Gene Sampley, Department of Public Works and Utilities
Jim Spencer, Department of Parks and Recreation
Admiral Roger Horne, Failure Analysis Associates

Attachments

REFERENCES

Ecology. 1995. Water Well Logs, copied November 1995. Washington State Department of Ecology.

Failure. 1996. Draft environmental information to support proposed evergreen park expansion project. Prepared for the City of Bremerton in conjunction with PTI Environmental Services. Failure Analysis Associates.

PTI. 1996. Personal communication (letter report from Shawn Severn to Admiral Horne, Failure Analysis Associates, Bremerton, WA, dated July 9, 1996, regarding results of sampling in northern portion of Evergreen Park). PTI Environmental Services, Bellevue, WA.

USDA. 1980. Soil survey of Kitsap County area, Washington. Soil Conservation Service, in cooperation with Washington State Department of Natural Resources and Washington State University Agricultural Research Center. U.S. Department of Agriculture.

Figures

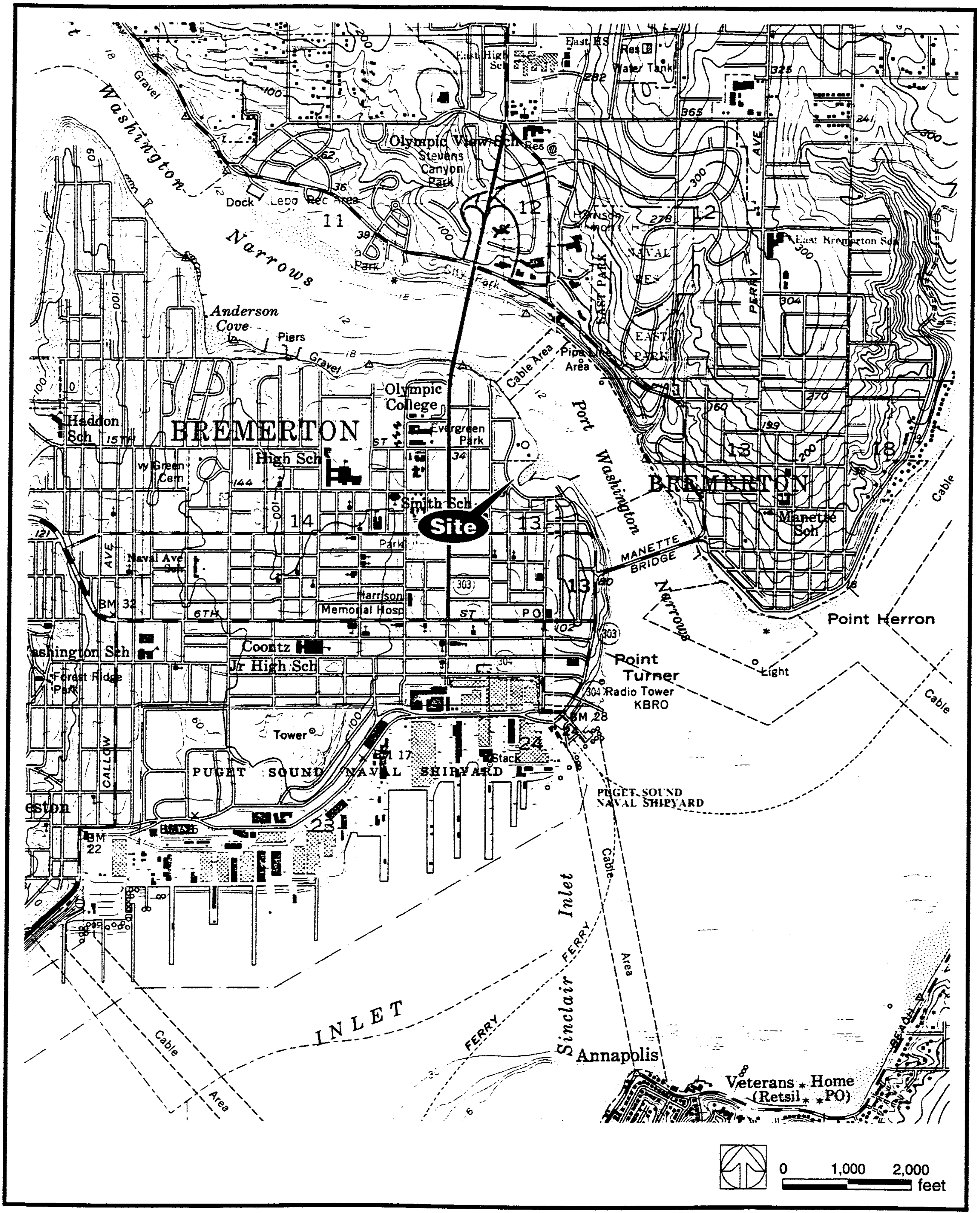

Figure 1. Site location map.

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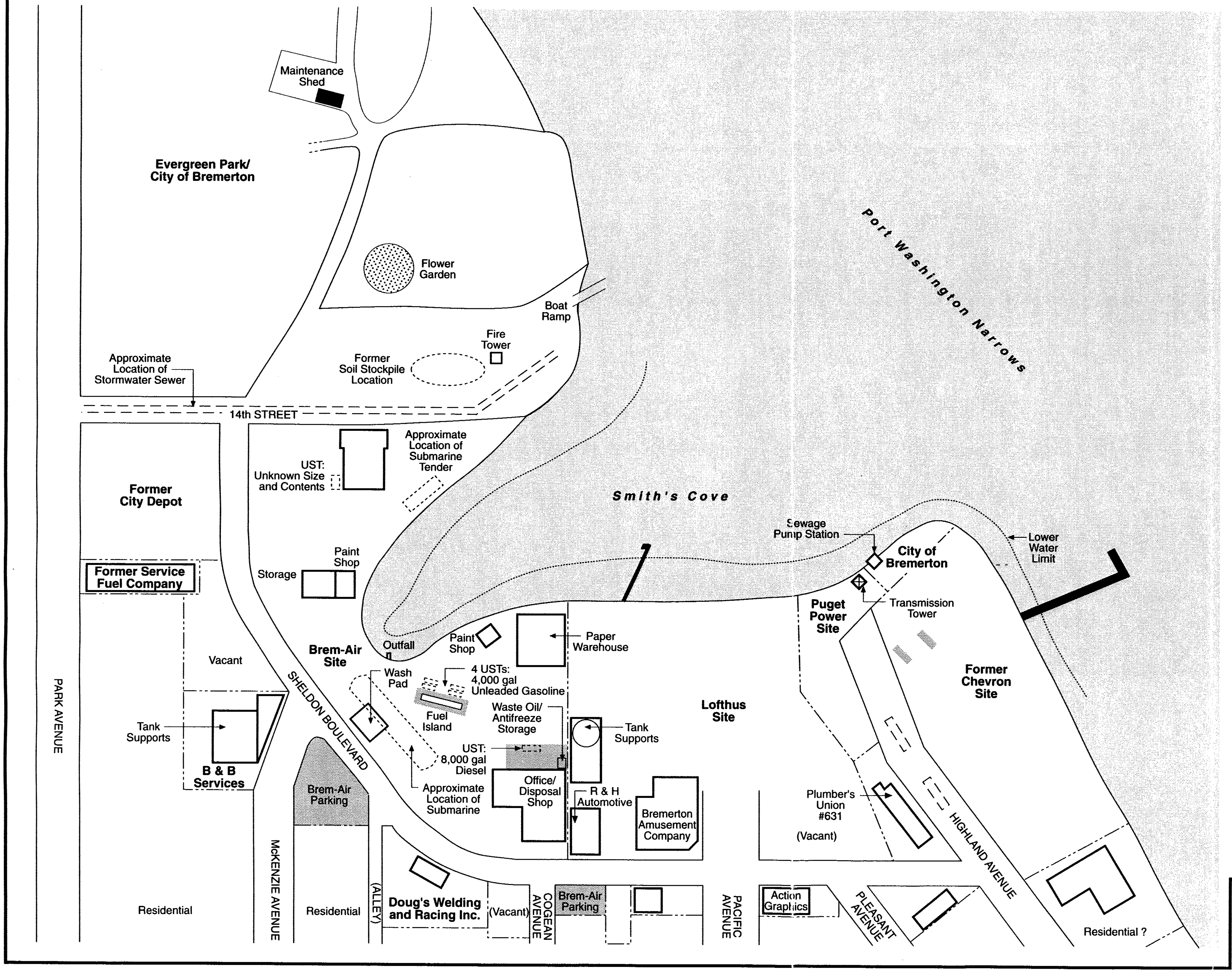

LEGEND

- - - - Extent of ownership, not necessarily individual parcels

Source: Street locations and property boundaries were taken from the 1991 Kitsap County Tax Assessors plat map. Site usage and ownership were complied from Kitsap County Tax Assessor records, aerial photographs, Sanborn Mapping and Geographical Information Service, and Woodward-Clyde August 1993 Phase I Environmental Site Assessment for Brem-Air.

Figure 2. Project area map.

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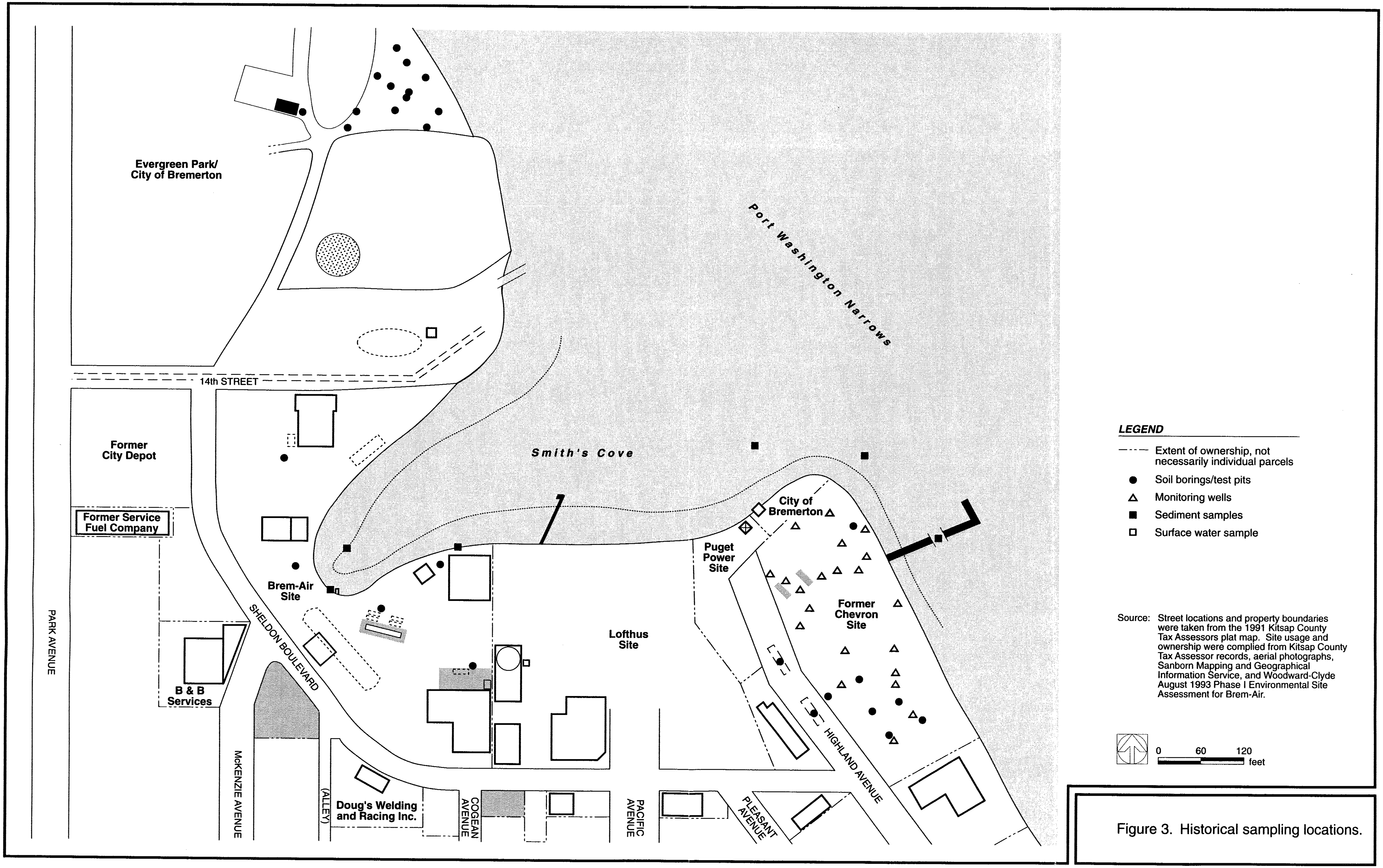
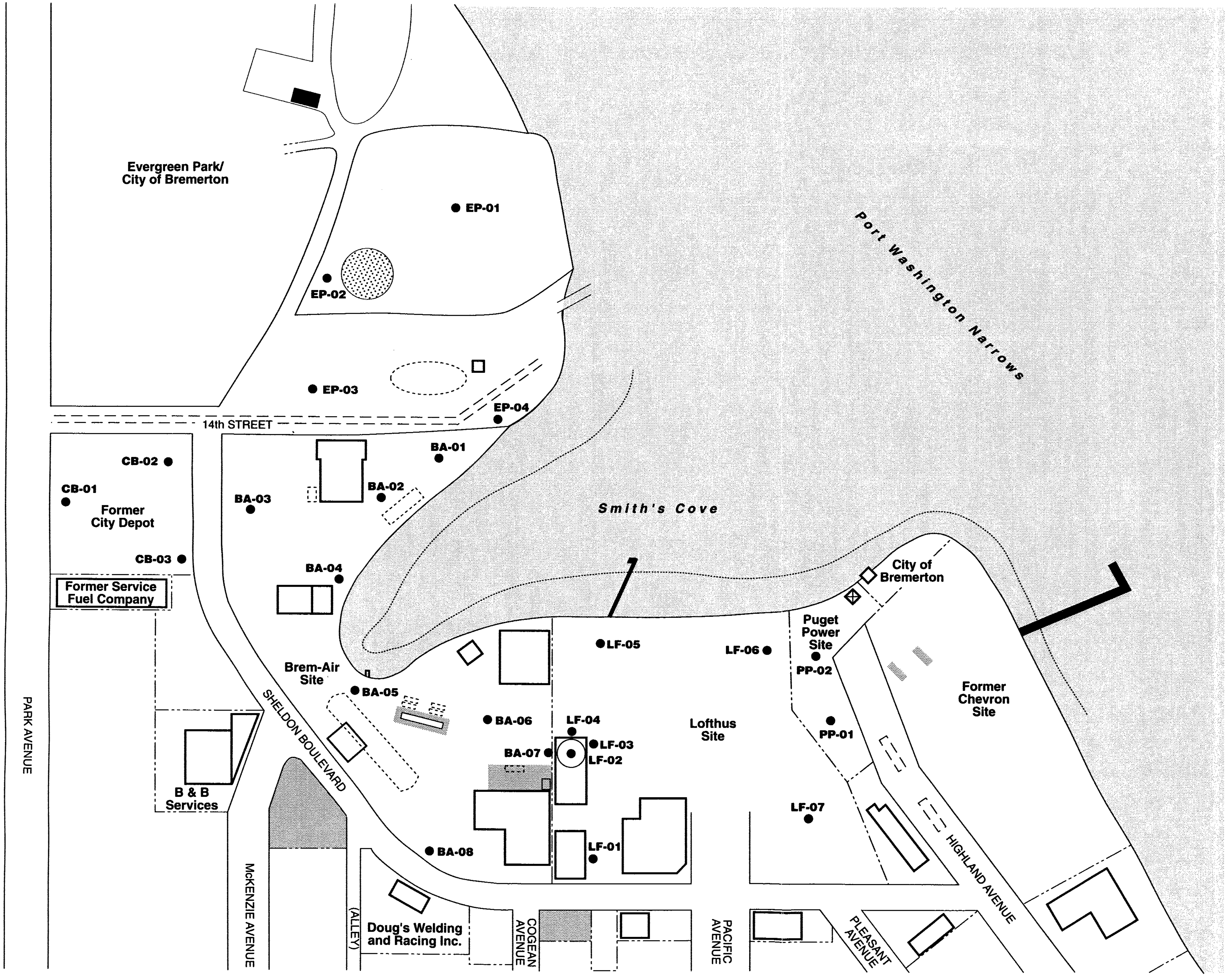


Source: Street locations and property boundaries were taken from the 1991 Kitsap County Tax Assessors plat map. Site usage and ownership were complied from Kitsap County Tax Assessor records, aerial photographs, Sanborn Mapping and Geographical Information Service, and Woodward-Clyde August 1993 Phase I Environmental Site Assessment for Brem-Air.

Figure 3. Historical sampling locations.



LEGEND

- - - - Extent of ownership, not necessarily individual parcels

● Sampling location

Source: Street locations and property boundaries were taken from the 1991 Kitsap County Tax Assessors plat map. Site usage and ownership were complied from Kitsap County Tax Assessor records, aerial photographs, Sanborn Mapping and Geographical Information Service, and Woodward-Clyde August 1993 Phase I Environmental Site Assessment for Brem-Air.

Figure 4. Proposed sampling locations.

Tables

TABLE 1. SUMMARY OF PROPOSED SAMPLING POINTS

Site	Sample ID	Sample Objectives
Evergreen Park- Southern Section	EP-01	Determine extent of potential contamination between northern and southern sections of park
	EP-02	Determine extent of potential contamination between northern and southern sections of park
	EP-03	Determine extent of potential contamination associated with storm sewer and former oil house
	EP-04	Determine extent of potential contamination associated with storm sewer
Brem-Air Disposal Co.	BA-01	Determine potential for contamination from trash burial area
	BA-02	Characterize northern border of site and determine potential for contamination from alleged buried submarine tender
	BA-03	Characterize northwest corner of site
	BA-04	Determine potential for contamination from paint shop and fill in gap between former boreholes B-1 and B-5
	BA-05	Determine potential for contamination from buried submarine and fill in gap between former boreholes B-5 and B-2
	BA-06	Determine potential for contamination and fill in gap between former boreholes B-2, B-3, B-4, and B-5
	BA-07	Determine source of potential contamination along eastern property line
	BA-08	Characterize southern border of site and bracket lowest concentrations
City of Bremerton- Former Auto Depo	CB-01	Characterize western portion of site and bracket lowest concentrations
	CB-02	Determine potential for contamination from former automotive repair operations
	CB-03	Determine potential for contamination from former fuel tank
Lofthus	LF-01	Determine potential for contamination from former sheet metals shop and current automotive repair operations
	LF-02	Determine potential for contamination near fuel tank supports
	LF-03	Determine potential for contamination in ditch that drains former fuel tank area
	LF-04	Determine source of potential contamination on western property line
	LF-05	Determine potential for contamination along shoreline
	LF-06	Determine potential for contamination from former fuel tank along eastern property line
	LF-07	Characterize southern border of site and bracket lowest concentrations
Puget Power	PP-01	Determine potential for contamination from former power generating facilities and offsite sources
	PP-02	Determine potential for contamination from former power generating facilities and offsite sources

TABLE 2. PROPOSED ANALYSES AND DATA QUALITY OBJECTIVES

Analysis	Method Reference	Analyte	Soil		Groundwater		Bias	Precision	Completeness
			Units	MRL	Units	MRL	(percent)	(RPD)	(percent)
TPH Identification[a]	WTPH-HCID	TPH-gasoline	mg/kg	20	mg/L	0.25	50-150	± 50	95
		TPH-diesel	mg/kg	50	mg/L	0.25	50-150	± 50	95
		TPH-heavy oil	mg/kg	100	mg/L	0.50	50-150	± 50	95
TPH Quantification[b]	WTPH-G/BTEX	TPH-gasoline	mg/kg	5	mg/L	0.25	50-150	± 50	95
		BTEX	mg/kg	0.05-0.1	mg/L	0.50	50-150	± 50	95
	WTPH-D extended (8015 modified)	TPH-diesel	mg/kg	25	mg/L	0.25	50-150	± 50	95
		TPH-heavy oil	mg/kg	100	mg/L	0.75	50-150	± 50	95
PAHs[c]	GC/MS SIM / EPA Method 8270	PAHs	µg/kg	10	µg/L	1.0	50-150	± 50	95
PCBs[c]	EPA Method 8080	PCBs	µg/kg	50	µg/L	1.0	50-150	± 50	95
VOCs[c]	EPA Method 8260	VOCs	µg/kg	5-10	µg/L	5.0-10	50-150	± 50	95
Metals[c]	EPA Method 6010	As, Cd, Cr, Pb	mg/kg	1	µg/L	4.0-5.0	75-125	± 35	95
	EPA Method 7471	Hg	mg/kg	0.5	µg/L	0.20	75-125	± 35	95

NOTE: Two soil samples will also be submitted for TPH "fingerprinting" using Friedman and Bruya techniques.

As - arsenic
BTEX - benzene, toluene, ethylbenzene, and xylenes
Cd - cadmium
Cr - chromium
Hg - mercury
MRL - method reporting limit
PAH - polycyclic aromatic hydrocarbon
Pb - lead
TPH - total petroleum hydrocarbon
VOC - volatile organic compound

[a] This analysis will be performed based on results of field screening.

[b] This analysis will be performed based on results of WTPH-HCID analyses.

[c] This analysis will be performed on selected samples based on the location of the sample and historical operations that may have impacted site soil and/or groundwater in that location.

[d] Approximately 20 percent of field-screened samples will be submitted for metals analysis.

Attachment A

Standard Operating Procedures

Note: SOPs 3 and 19 cited within.

STANDARD OPERATING PROCEDURE

INSTALLATION AND SAMPLING OF PROBE HOLES WITH STRATAPROBE SYSTEM

SOP 45

The Strataprobe system is a drilling instrument for installing shallow probe holes. The system can be used for soil gas sampling, soil sampling, or groundwater sampling applications. For groundwater sample collection, the system is composed of a direct push hydraulic unit mounted in a truck or van and a groundwater sampling package. The groundwater sampling package is composed of a 1-in. diameter mill-slotted well drive point(s) with expendable point holder, 1-in. diameter pipe extensions, expendable drive points, drive heads, pull caps, and a stainless-steel mini-bailer. If probing will take place through pavement or a 1-ft or less layer of hard material, a carbide tipped bit should be included. Copies of standard equipment specifications are included as Attachment 45-1.

PROCEDURE

1. Position the drill rig over the sampling station. Level the rig as necessary. Remove any surface material that would interfere with penetration of the probe. Decontaminate all pipes prior to probing as described in SOP 3.

2. Extend the drilling unit from the vehicle as described by the manufacturer's instructions. Attach a 3-ft section of slotted, 1-in. diameter pipe with expendable point to the probing mechanism and drive into the ground using the hydraulic option. Add sections of blank pipe as necessary. Activate the percussion option when pipe string can no longer be advanced using the hydraulic option.

3. Estimate depth to water (i.e., water table) by using the site potentiometric surface map. Continue installation of the pipe string until the tip of the slotted pipe approaches the water table. Insert an electrical water level measuring probe inside the pipe string to monitor for presence of water as described in SOP 19. Continue to install pipe string, and measure every 3 ft until water is detected. Drive the bottom of the slotted pipe approximately 3–5 ft below the water level in the pipe string.

4. Using a stainless-steel mini-bailer decontaminated in accordance with SOP 3, purge the well by removing three casing volumes (SOP 19) of water, and place in a suitable container for disposal. A new line will be attached to the bailer before this purging begins.

5. Using the mini-bailer, collect a 500-mL sample and pour into sample container.

6. Remove the pipe string from the hole as specified by the manufacturer's instructions. As the pipe string is removed, release the expendable well point from the bottom of the slotted pipe. Prepare a cement-bentonite grout by mixing American Petroleum Institute Class A or B or ASTM C-150 Type I or II neat cement, up to 3.75 lb of sodium bentonite per sack of cement, and 5.2 gal plus 0.7 gal/lb of bentonite of water. Mix the water and bentonite first, and then add the cement to the bentonite slurry. The mixture should have a mud weight of at least 14.1 lb/gal. As the pipe string is removed, pour the cement-bentonite slurry inside the pipe string. Ensure that the grout level in the pipe string is always above the bottom of the string. Continue to backfill the hole as the string is removed.

7. Clean and decontaminate all probing and sampling equipment in preparation for the next hole. Place probing equipment in a secure location free from contamination.

Attachment 45-1

Strataprobe Soil Probing Equipment Specifications

THE *STRATAPROBE*™ SYSTEM

DIRECT PUSH TECHNOLOGY
FOR SOIL, WATER, AND SOIL VAPOR SAMPLING

Overview

TEG Northwest's *STRATAPROBES* are a rugged, lightweight, hydraulic drive point system designed to perform sampling and monitoring services specific to the environmental industry. The *STRATAPROBE* carrier vehicle is a four wheel drive, one ton pickup truck with a reliable power take-off hydraulic system. One of the most versatile systems of its kind the *STRATAPROBE* can drive an assortment of sampling devices to 50 feet or more in most soil formations.

The direct push hydraulic unit consists of a rear-mounted, dual ram configuration mounted in conjunction with a hydraulic hammer that is capable of producing high-frequency impact energy. A 5,000 pound static reaction weight and 15,000 pound pullback capacity provide ample force to overcome most common geologic conditions. The low profile mast is only eleven feet high when fully extended and the framework of the machine is fully articulated to allow for a full range of positioning, including up to a 20 degree angle for boring underneath structures.

The *STRATAPROBE*'s low profile and articulated boom provide for easy access when sampling under canopies, adjacent to structures and inside buildings. Hand held portable equipment is also available where truck access is not possible.

Soil Sampling

The *STRATAPROBE* obtains discrete soil samples using a retractable piston sampler. The sampler consists of a standard split spoon with a piston assembly added to allow for discreet interval sampling. Upon reaching the desired depth, the piston is unlocked and the sampler advanced one foot into the soil as the piston retracts. Samples are collected in standard retainer sleeves made of stainless steel, brass, or clear acrylic. Samples are obtained at any interval specified by the workplan.

Groundwater Sampling

The *STRATAPROBE* provides for high quality groundwater sampling using a tool similar to a Hydropunch™ or via direct pumping to the surface. In areas of low hydraulic conductivity, extremely small sampling tubes can be implanted using the *STRATAPROBE* and sampled at a later date. The sampling tools are pushed directly into the aquifer in a shielded position. The sampling ports are then unsheathed to expose them to groundwater. Clean sample tubing or bailers are used to move the water sample to the surface.

Soil Vapor Sampling

The *STRATAPROBE* is the ideal tool for performing deep soil vapor surveys in difficult soil conditions. The drive probes are custom, high strength steel tubes with a uniform diameter machined the full length of the probe. The soil vapor collection system begins with a detachable tip held by the leading rod, which shields the sampling tube during the driving process. Vapor is collected through a continuous, inert 1/8" nylaflow tube connected to the surface. Once the desired sampling depth is reached the entire drive string is raised slightly opening a clear path for vapor. After sampling the probe can be pushed deeper for multiple depth vapor profiling.

Soil vapor is withdrawn from the nylaflow tubing using a small calibrated syringe connected via an on-off valve. The first three dead volumes of the sample tube are discarded to flush the tube and fill it with in-situ soil vapor. The next twenty cc's of gas are withdrawn in the syringe, plugged and immediately transferred to a mobile lab for analysis within minutes of collection. Additional soil vapor samples may be collected and stored in gas-tight containers as desired.

Vapor Wells

The *STRATAPROBE* provides a low cost alternative for installing multiple high quality vapor wells. Each individual well is installed by driving to the desired depth and placing a vapor inlet tip attached to an inert, continuous length of 1/8" nylaflow tubing down the hollow center of the rod. Clean silica sand is poured through the rod around the vapor tip and then a hydrated granular bentonite grout is used to seal the annular space of the borehole as the rod is withdrawn. Multiple wells can be placed in either a cluster or in the same borehole as specified by the workplan. Each well or cluster of wells will be completed at the top with sample fittings, labels and covers to the client's specifications.

Accessory Equipment

The *STRATAPROBE* sampling systems are fully equipped with the equipment necessary to operate unsupported in the field. Full provision has been made for power, water, decontamination of sampling equipment, and work site cleanup.

STRATAPROBE™

Soil Sampling Procedures

Soil samples may be obtained by using either of the following methods;

"OPEN BOREHOLE" CONTINUOUS CORING

A 36" long x 2.0" diameter coring tube is driven by the **STRATAPROBE™** drive rod to depths of 20 feet or more. Samples are collected in 36" long clear plastic liners. Once removed from the sampler, the sleeves are capped on each end for observation or transport to a mobile laboratory. The sleeves may also be cut to shorter lengths and capped for smaller sample sizes.

Sampling rates vary from 100' to 200' per day depending on soil conditions. Use of continuous corer allows for excellent observation of subsurface conditions. The corer also provides a clean hole for inserting water or vapor monitoring wells.

DISCRETE POINT SAMPLER

The **STRATAPROBE™** obtains discrete soil samples using retractable piston samplers up to 18" long and 2" in diameter. Upon reaching the desired sampling depth, the piston is unlocked and the sampler advanced into the soil to collect the sample. Samples are collected in standard retainer sleeves made of stainless steel, brass, or clear acrylic. Upon retrieval, the sleeves are removed, capped and transported to the laboratory.

Sampling rates vary from 4 to 6 five foot intervals per hour depending on soil conditions.

DECONTAMINATION

Decontamination procedures are selected based on soil conditions, type, and degree of contamination, and type of sampler used. In all cases, drive rods and samplers are wiped free of loose dirt and foreign material. Samplers, and rods if necessary, are either washed with a high temperature, high pressure wash system or put through a three step wash and rinse cycle which includes phosphate-free detergent and deionized water.

STRATAPROBE™

Groundwater Sampling Procedures

Groundwater may be obtained by using any of the three following methods;

PASSIVE SAMPLER

1) A **STRATAPROBE™** shielded screen point sampler is driven at least two feet below the water table. The outer drive casing is partially withdrawn, exposing a stainless steel screen. Groundwater is allowed to flow passively into the screen. Groundwater is then sampled using a ½ inch-diameter stainless steel bailer or pumped to the surface using a peristaltic pump.

PUMPED SAMPLING POINT

2) The **STRATAPROBE™** outer drive casing is partially withdrawn after placing ¼ inch OD Nylaflow tubing connected to a sampling tip down the hollow center. The tip and tubing are packed with pure #30 silica sand. Groundwater is then pumped up the tube to the surface from as deep as 25 feet using a peristaltic pump.

MINI-WELL

3) A temporary 3/4 or 1 inch ID piezometer PVC casing is installed, similar to a ground-water monitoring well. A sand pack and surface seal is completed using granular bentonite. The piezometer is developed by removing a minimum of 3 volumes of groundwater. A groundwater sample is obtained using either a ½ inch-diameter stainless steel bailer or a peristaltic pump.

Sampling Methods				
METHOD	*Replicate Samples*	*DTW Measurement*	*Quick*	*Easy Closure*
PASSIVE	*NO*	*NO*	*YES*	*YES*
SAMPLING POINT	*YES*	*NO*	*YES*	*YES*
MINI-WELL	*YES*	*YES*	*NO*	*NO*

STRATAPROBE™

Soil Vapor Sampling Procedures

Probe Construction

TEG's soil vapor probes are constructed of one inch diameter, steel, equipped with a hardened steel tip. Nominal lengths are 4, 5, or 6 feet, and additional lengths may be connected. An inert 1/8 inch polypropylene nylaflow tube runs down the center of the probe to sampling port.

Probe Insertion

The probe is driven into the ground by an electric rotary hammer or with TEG's *STRATAPROBE*™ system. Once inserted to the desired depth, the probe is retracted which opens the tip and exposes the vapor sampling port. This design prevents clogging of the sampling ports and cross-contamination from soils during insertion.

Soil Gas Sampling

Soil vapor is withdrawn from the nylaflow tubing using a 20 cc syringe connected via an on-off valve. The first 5 dead volumes of gas are discarded to flush the probe and fill it with in-situ soil vapor. The next 20 cc of gas are withdrawn in the syringe, plugged, and immediately transferred to the mobile lab for analysis within minutes of collection. Additional soil vapor samples may be collected and stored in gas-tight containers as desired.

Flushing & Decontamination Procedures

To minimize the potential for cross-contamination between sites, all external probe parts are cleaned of excess dirt and moisture prior to insertion. The internal nylaflow tubing and sampling ports are flushed with hundreds of cc's of ambient air between samples. If water, dirt, or any material is observed in the tubing, the tubing is replaced with fresh tubing. If concentrations greater than 100 ppmv are detected for any compound (except methane), the tubing is replaced.

Sampling syringes are opened and exposed to outside air on a clean surface to allow any volatiles to escape after each use. If concentrations greater than 100 ppmv are detected for any compound (except methane), the syringe is discarded.

Transfer of Samples to the Laboratory

The sample is transferred to the mobile laboratory for immediate analysis following the protocols discussed in the Analytical Methodology Section.

Attachment B

Health and Safety Plan

PTI
ENVIRONMENTAL SERVICES

Internal Memo

To: Greg Bawden

From: Sherrill Doran

Date: November 4, 1996

Subject: Addendum to Bremerton HASP

This memorandum will serve as an addendum to the health and safety plan (HASP) for the City of Bremerton, Evergreen Park Expansion project (CA5Q-0501). The most recent update to the plan was prepared in September 1996, and is contained in the work plan to perform characterization activities. The only change from the plan is the anticipated date of field work, which is currently scheduled for the week of November 18, 1996. Field personnel remain the same (Steve Barnett, Greg Bawden, Sherrill Doran, and Natasha Nimmo). All physical and chemical hazards remain the same.

PTI
ENVIRONMENTAL SERVICES

SITE SAFETY PLAN

Site Name Evergreen Park

Prepared by Sherrill Doran Date 9/16/96

Reviewed by Greg Bawden Date 9/17/96

INTRODUCTION

This site-specific health and safety plan establishes procedures and practices to protect employees of PTI Environmental Services (PTI) and its subcontractors from potential hazards posed by field activities on the subject properties. In this health and safety plan, measures are provided to minimize potential exposures, accidents, and physical injuries that may occur during daily onsite activities and adverse conditions. Contingency arrangements are also provided for emergency situations.

DISCLAIMER

PTI does not guarantee the health or safety of any person entering this site. Because of the potentially hazardous nature of this site and the activity 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 set forth herein will reduce, but not eliminate, the potential for injury and illness at this site. The health and safety guidelines in this plan were prepared specifically for this site and should not be used on any other site without prior evaluation by trained health and safety personnel.

SITE DESCRIPTION (use additional pages if necessary)

Site name: Evergreen Park, Brem-Air, Lofthus, Puget Power, Former City Depot (see figure)

Site location or address: Evergreen Park: No formal address, bounded by 14th Street to south and Port Washington Narrows to east

Brem-Air: 1221 and 513 Sheldon Blvd.

Lofthus: 1300, 1301 Pacific Ave.; 506, 510 Sheldon Blvd.

Puget Power: 1313 Highland Ave.

Former City Depot: 1333 Sheldon Blvd.

Owners/tenants: City of Bremerton, Brem-Air Disposal Co., Lofthus Co., Puget Power, City of Bremerton

Current site use: Recreational, light industrial, commercial

Past site use (if different): same

Designated hazardous waste site: yes (federal, state, other) state

Industrial facility _____ Spill _____ Other _____

Active X (Brem-Air, Evergreen Park) Inactive X (Lofthus, Puget Power, former City Depot)

Topography: Nearly flat with gentle slopes to north and east

Name of and distance to nearest surface water body: Smith's Cove, <0.25 mi

Surrounding land use/nearest population: Residential to north, west, south; commercial to south

Site access: Sheldon Blvd.

Nearest drinking water/sanitary facilities: Onsite

Nearest telephone (list number if possible): PTI Cell 660-0750

List utilities located (or to be located): Subsurface utilities will be located at least 24 hours prior to any subsurface sampling using private utility locating service, one-call public utility locating service, and City Utility Dept.

Site map attached: Yes

PROJECT PERSONNEL

	Name/Affiliation	Work Telephone	Home Telephone
Project Manager	Shawn Severn / PTI	(206) 643-9803	(206) 284-3472
Field team leader	Steve Barnett / PTI	(503) 636-4338	(206) 896-6056
	Greg Bawden / PTI	(206) 643-9803	(206) 788-0436
Site safety officer	Sherrill Doran / PTI	(206) 643-9803	(206) 828-0824
PTI field personnel	Sherrill Doran / PTI	(206) 643-9803	(206) 828-0824
	Natasha Nimmo / PTI	(206) 643-9803	(206) 236-7078
Facility contact	City: Jim Spencer	(360) 478-7252	
	Brem-Air:		
	Lofthus:		
Client contact (if different)	Admiral Horne	(360) 830-2211	same

WORK PROPOSED

Description of proposed work: Strataprobe® and/or hollow-stem auger soil and groundwater sampling to 12 ft BGS or to groundwater at 22 stations

Proposed work dates: Early October 1996 (three days of field work)

Subcontractors	Name	Task	Contact	Telephone
	TEG	Strataprobe® drilling	Michael Korosec	(360) 459-4670
	Cascade	Hollow-stem drilling	John Murnane	(206) 485-8908

If visual inspection, will personnel be entering or contacting potentially hazardous areas? Yes

If yes, describe: PTI personnel will be sampling in areas with petroleum and metals in soil and groundwater

HAZARD EVALUATION

Potentially hazardous chemicals known or suspected to be onsite (include preservatives and decontamination chemicals):

Substance	Maximum Concentration	Medium	OSHA PEL	OSHA STEL	Odor Threshold	IP(eV)	Carcinogen / Other Hazard
Evergreen Park							
TPH-diesel	870 mg/kg	soil	see	attached	TPH	worksheet	
TPH- heavy oil	1,200 mg/kg	soil	see	attached	TPH	worksheet	
SVOCs	1.0-72 mg/kg	soil	0.2-10 ppm	NA -15 ppm	NA - 0.84 ppm	NA - 8.12	C, P
VOCs/BTEX	ND-0.23 mg/kg	soil	1.0 - 1000 ppm	1.0-15 ppm	0.17 - 13 ppm	NA - 9.69	C
Asbestos	6.1%	soil	NA[1]	NA[1]	NA	NA	C
Brem-Air							
TPH-diesel	8,600 mg/kg	soil	see	attached	TPH	worksheet	
TPH- heavy oil	17,000 mg/kg	soil	see	attached	TPH	worksheet	
VOCs/BTEX	<1.0 - 1000 mg/kg	soil	1.0 - 1000 ppm	1.0-15 ppm	0.17 - 13 ppm	NA - 9.69	C
chromium	53 mg/kg	soil	0.5 ppm	NA	NA	NA	C
copper	57 mg/kg	soil	1.0 ppm	NA	NA	NA	
lead	144 mg/kg	soil	0.5 ppm	NA	NA	NA	P
Lofthus							
TPH	5.8 mg/l	SW	see	attached	TPH	worksheet	
oil & grease	13 mg/l	SW	NA	NA	NA	NA	
lead	241 ug/l	SW	0.5 ppm	NA	NA	NA	P
TLC Chemicals							
Methylene chloride	100 %	product	500 ppm[1] (OSHA) 50 ppm[1] (ACGIH)	2,000 ppm[1] (5-min max any 2 hrs)	150 ppm	11.32	C, P
Decon Chemicals							
Hexane	100%	product	50 ppm[1]	NA	130 ppm	10.18	Flammable
Acetone	100%	product	250 ppm[1]	NA	13-100	9.69	Flammable

Notes:				
--	- none established		PCB -	polychlorinated biphenyl
C	- carcinogen		PEL -	permissible exposure level
GW	- groundwater		SC -	suspected carcinogen
IP(eV)	- ionization potential		STEL -	short-term exposure level
N/A	- not applicable		SVOCs-	semivolatile organic compounds
NA	- not available		SW -	surface water
P	- poison		VOCs -	volatile organic compounds
			TLC -	thin-layer chromatography

1- NIOSH recommends exposure be limited to lowest feasible concentration.

	Known	**Possible**	**Unlikely**
Potential chemical exposure routes at the site:			
Inhalation	X (decon and TLC)	X	
Ingestion			X
Skin absorption		X	
Skin contact		X	
Eye contact		X	
Chemical characteristics:			
Corrosive			X
Ignitable		X	
Reactive			X
Volatile		X	
Radioactive			X
Explosive		X	
Biological agent			X
Particulates or fibers		X	

If known or likely, describe: ______________________________

Possible physical hazards present during site investigation activities:

	Yes	No	Proposed Safety Procedure
Uneven terrain/tripping	X		Exercise caution, keep work area neat
Heat stress		X	
Cold/hypothermia		X	
Drowning		X	
Falling objects	X		Wear hard hats near drill rig or other overhead hazards
Noise	X		Wear ear plugs if rotary air drilling is required
Excavations		X	
Scaffolding		X	
Heavy equipment	X		Stay clear from moving drill rigs and trucks moving on the Brem-Air site
Material handling	X		Lift properly, seek help if necessary
Compressed air equipment		X	
Confined spaces		X	
Other ________			

Note: If confined space entry is required, personnel must first obtain a confined space entry permit.

Potential physical hazards posed by proposed site activities:

Activity	Potential Hazard
Drilling	Uneven terrain, falling objects, noise, heavy equipment,
	material handling

PERSONAL PROTECTIVE EQUIPMENT

Based on the hazards identified above, the following personal protective equipment will be required for the following site activities (specify both an initial level of protection and a more protective level of protection in the event conditions should change):

	Level of Protection	
	Initial	Contingency
Drilling	MD	C or leave site
Soil sampling	MD	C or leave site
Groundwater sampling	MD	C or leave site
Surface water sampling		

	Level of Protection	
	Initial	**Contingency**
Sediment sampling		
Site inspection	D	MD
Sample handling	D	MD
Other activities (list)		
TLC Field Screening	MD	C or leave site

Each level of protection will incorporate the following equipment (specify type of coveralls, boots, gloves, respiratory cartridges or other protection, safety glasses, hard hat, and hearing protection):

Level D: Work clothes, steel-toed boots, work gloves, hard hat, coveralls, and safety glasses as required by field conditions.

Modified D: Same as D with the addition of coveralls, rain gear, or gray or blue Tyvek (i.e., something with low public visibility), and chemical resistant boots.

Level C: Same as MD with addition of air purifying respirator with combination organic vapor/HEPA cartridge

Note: Project personnel are not permitted to deviate from the specified levels of protection without the prior approval of the site safety officer or PTI corporate health and safety officer.

SAFETY EQUIPMENT

The following safety equipment will be onsite during the proposed field activities:

Air Monitoring (list items required for this project)

PID
Detector pump and tubes (benzene)

First Aid Kit (mandatory, list any additional items required for the site)

Sunscreen

Other (list the items required for this project)

Eyewash
Drinking water

SITE CONTROL

Describe how exclusion zones and contamination zones will be designed (attach sketch if possible):

The exclusion zone will consist of the area immediately surrounding the sample stations. The subject properties will be considered the contamination reduction zone, with a mobile decontamination station placed near the drill rig.

Describe controls to be used to prevent entry by unauthorized persons:

The area surrounding the drill rig will be marked with cones or survey tape to prevent other vehicles and unauthorized persons from coming within 25 ft of the drill rig.

AIR MONITORING

Air monitoring will be conducted when entering previously uncharacterized sites, when working in the vicinity of uncontaminated chemicals or spills, when opening containers and well casings, and prior to opening and entering confined spaces. Air monitoring must be conducted to identify potentially hazardous environments and determine reference or background concentrations. Air monitoring will be used to define exclusion zones. Air monitoring may also be conducted to evaluate the concentration of chemicals in samples.

The following equipment will be used to monitor air quality in the breathing zone during work activities:

Monitoring Instrument	Calibration Frequency	Parameters of Interest	Sampling Frequency
PID	Daily	VOCs	Continuously during sampling
Drager	NA	benzene	When PID detects VOCs >5 ppm

The following action levels have been established to determine the appropriate level of personal protection to be used during site investigation activities:

Instrument	Reading	Action[a]	Comments
PID	> 5 ppm	monitor for benzene	
Drager (benzene)	> 1 ppm	ventilate to reduce benzene concentrations to below 1 ppm, upgrade to Level C, or leave area	
PID (no benzene)	> 50 ppm	ventilate to reduce benzene concentrations to below 50 ppm, upgrade to Level C, or leave area	

[a] Examples: "upgrade to Level C" or "leave site."

DECONTAMINATION

To prevent the distribution of contaminants outside the exclusion zone or cross-contamination of samples, the following procedures will be used to decontaminate sampling equipment:

Wash with detergent and water, potable water rinse, acetone and hexane solvent rinse, distilled water rinse

To prevent the distribution of contaminants outside the exclusion zone and personal exposure to chemicals, vehicles will not be allowed inside the exclusion zone. If vehicles are required in the exclusion zone (e.g., drill rigs), the following procedures will be used to prevent contamination or decontaminate the vehicles:

Vehicles will not be exposed to contaminated soils. All sampling equipment will be cleaned prior to placing into field vehicles.

To minimize or prevent personal exposure to hazardous materials, all personnel working in the exclusion zone and contamination reduction zones will comply with the following decontamination procedures:

Wash mud from boots before entering vehicles or leaving site

Decontamination equipment required on site will include the following:

Alconox, hexane, acetone, brushes, buckets, potable water, deionized water, garbage bags, poly sheets, paper towels, 55-gal drums (if auger rig is necessary)

Decontamination wastewater and contaminated materials will be disposed of in the following manner:

Disposable clothing will be bagged for disposal as solid waste; small volumes of wash water will discharged appropriately; any waste generated from auger drilling will be contained in DOT-approved 55 gal drums and removed by the City.

The following personal hygiene practices will be used:

- Long hair will be secured away from the face so it does not interfere with any activities.
- All personnel leaving potentially contaminated areas will wash their hands and faces prior to entering any clean areas or eating areas.
- Personnel leaving potentially contaminated areas will shower (including washing hair) and change to clean clothing as soon as possible after leaving the site.
- No person will eat, drink, or chew gum or tobacco in potentially contaminated areas. Drink containers and drinking of replacement fluids for heat stress control will be permitted only in areas that are free from contamination. Smoking is prohibited in all areas of the site because of the potential for contaminating samples and for health and safety reasons.

SPILL CONTAINMENT

Provisions must be made for spill containment at any site where bulk liquids will be handled.

Will the proposed fieldwork include the handling of bulk liquids, oil, or chemicals (other than water)? Yes ______ No X

If yes, describe spill containment provisions for the site: ______

SHIPMENT OF RESTRICTED ARTICLES

Federal laws and international guidelines place restrictions on what materials may be shipped by passenger and cargo aircraft. In the course of this field investigation, the following items will be shipped to and from the site in the following manner:

Item	Hazardous Constituent	Quantity	Packaging	How Shipped
Samples	TPH, metals	20-30	glass jars to prevent breakage and placed into coolers	Federal Express
Calibration gas (name)	Isobutylene	1 canister	PID case	private vehicle
Other:	Acetone	< 1 L	glass bottles protected against breakage	private vehicle
	Hexane	< 1 L	glass bottles protected against breakage	private vehicle
	Methylene chloride	< 1 L	glass bottles protected against breakage	private vehicle

MEDICAL MONITORING

OSHA requires medical monitoring for personnel potentially exposed to chemical hazards in concentrations in excess of the PEL for more than 30 days per year and for personnel who must use respiratory protection for more than 30 days per year. PTI requires medical monitoring for all employees potentially exposed to chemical hazards.

Will personnel working at this site be enrolled in a medical monitoring program? Yes __X__ No ______

HEALTH AND SAFETY TRAINING

State and federal laws establish training requirements for workers at uncontrolled hazardous waste sites (including areas where accumulations of hazardous waste create a threat to the health and safety of an individual, the environment, or both).

PTI and subcontractor personnel will be required to complete the following training requirements:

Duties	No Special Training[a]	24-hour	40-hour	80-hour	Other
PTI Personnel					
Steve Barnett			X		CPR/First Aid, Supervisor
Greg Bawden			X		CPR/First Aid, Supervisor

Sherrill Doran			X		CPR/First Aid, Construction Safety, Supervisor
Natasha Nimmo			X		CPR/First Aid, Supervisor, Asbestos
Subcontractors					
TEG			X		
Cascade			X		

[a] Provide explanation or justification: ____________________

EMERGENCY INFORMATION

Local Resources	Name	Telephone	Notified Prior to Work (Yes/No)?
Fire	Bremerton	911 or (360)478-5380	No
Police	Bremerton	911 or (360)478-5220	No
Ambulance	Bremerton	911 or (360)478-5380	No
Hospital	Harrison Memorial	(360)377-3911	No
Site phone	PTI Cell 660-0750		

Directions to hospital: Take Park Avenue north and turn left on 17th St. Take Warren Ave. Right (Hwy 303) across bridge, and take right onto Campbell Way. Take a left on Wheaton and a right on Cherry. Follow to left and Harrison Memorial will be on the right-hand side.

Corporate Resources	Name	Work Telephone	Home Telephone
PTI health and safety officer	Greg Bawden	(206) 643-9803	(206) 788-0436
Medical consultant	Dr. Petrie	(206) 242-3651	NA

In case of serious injuries, death, or other emergency, the corporate health and safety officer must be notified immediately. To contact the corporate health and safety officer (or delegate), try calling Greg Bawden at the work and home numbers listed above. If no response, call the emergency pager (206) 996-1480. If no response, call Larry Marx at (206) 643-9803 or (206) 643-6019 or (206) 378-3252.

Other Resources	Agency Name/Location	Telephone
Local OSHA office	Washington Dept. Of Labor and Industries	(206) 281-5449
State OSHA equivalent		

DOCUMENTATION

	Attached	In File	Not Applicable
PTI site safety acknowledgment forms	X		
OSHA or equivalent state poster	X		
Site safety meeting minutes	X		
PTI accident/incident report form		X	
PTI heat stress monitoring form			X
PTI confined space entry permit			X
PTI confined space entry checklist			X
PTI air monitoring record	X		
PTI air sampling record	X		
PTI diving plan			X
Other: TPH Fact Sheet	X		

ATTACHMENTS

	Attached	In File	Not Applicable
Site map	X		
Work plan		X	
Material safety data sheets (hexane, acetone, methylene chloride)	X		
Hospital route	X		
Health and safety training records	X		
Heat stress standard operating procedure			X
Confined space entry information			X
Equipment standard operating procedures			
PID/Microtip	X		
Drager	X		
Other:			

Attachments

PTI
ENVIRONMENTAL SERVICES

SITE SAFETY PLAN CONSENT AGREEMENT

I have reviewed the site safety plan prepared by PTI Environmental, dated September 17, 1996, for the Evergreen Park Expansion project site fieldwork. I understand the purpose of the plan, and I consent to adhere to its policies, procedures, and guidelines while an employee of PTI or its subcontractors.

Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Provisions of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discriminatory action.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there

Proposed Penalty

The Act provides for mandatory penalties against employers of up to $1,000 for each serious violation and for optional penalties of up to $1,000 for each nonserious violation. Penalties of up to $1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to $10,000 for each such violation.

There are also provisions for criminal penalties. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of up to $250,000 (or $500,000 if the employer is a corporation), or by imprisonment for up to six months, or both. A second conviction of an employer doubles the possible term of imprisonment.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State Labor or Health department or a State university.

Posting Instructions

Employers in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or facsimile) in a conspicuous place where notices to employees are customarily posted.

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta	(404) 347-3573
Boston	(617) 565-7164
Chicago	(312) 353-2220
Dallas	(214) 767-4731
Denver	(303) 844-3061
Kansas City	(816) 426-5861
New York	(212) 337-2378
Philadelphia	(215) 596-1201
San Francisco	(415) 744-6670
Seattle	(206) 442-5930

Elizabeth Dole

Elizabeth Dole, Secretary of Labor

Washington, D.C.
1989 (Revised)
OSHA 2203

U.S. Department of Labor

Occupational Safety and Health Administration

PTI
ENVIRONMENTAL SERVICES

SITE SAFETY MEETING MINUTES

Site Name ______________________ Contract No. ____________

Meeting Location ______________________

Meeting Date ________ Time ________ Conducted By ____________

Pre-fieldwork Orientation ______ Weekly Site Meeting ______ Other ________

Subjects Discussed ______________________

Safety Officer Comments ______________________

Name and Signature of Participating Personnel (list company name if subcontractor)

Note: Attach additional pages if necessary. Send this form to the PTI corporate health and safety officer. Copies will be placed in the appropriate project files.

PTI
ENVIRONMENTAL SERVICES

AIR MONITORING RECORD

Project Title ______________________ Project No. ______________________

Site Specific Name/Location ______________________ Date ____________ Day ____________

Weather: Temp ____________ Wind Direction/Speed ________/________ Humidity ____________

	Instrument	S/N	Calibration date	Calibration gas/method	Calibration by
Organic vapors					
Particulates					
O_2					
H_2S					
Combustible gas					
Radiation					

Time	Location / Description	Organic vapor ppm	Particulates mg/m3	O_2 %	H_2S ppm	CG % LEL

Notes: ____

____

____

Data collected by ____
Print name Signature

PTI
ENVIRONMENTAL SERVICES

AIR SAMPLING RECORD

Project Title/Number ______________________________

Site Name/Location ______________________________

Date ______________________________

Meteorological Information

Temperature ______________________________

Wind Speed/Direction ______________________________

Humidity ______________________________

Barometric Pressure ______________________________

Sample Type

☐ Particulates
  ☐ Total ☐ Respirable
☐ Organic vapors — sorbent tube
  Sorbent type/size ______________
  Chemical ______________
☐ Organic vapors — whole air
  Container type/size ______________
  Chemical ______________
☐ Colorimetric tubes
  ☐ Dräger ☐ Sensidyne
  Chemicals ______________

Sample ID	Sample Location	Activities During Sample (e.g.,m drilling)	Pump ID	Rotometer Readings			Average Actual Flow Rate (liters/minute)	Sample Times			Volume Air Sampled			Analysis		
				Initial	Mid	Final		Begin	End	Total Minutes	# Strokes	Liters	m^3	ppm	mg/m^3	Colorimetric Tube Reading

Data collected by ______________________________ ______________________________
Print name *Signature*

Comments: 1,000 liters = 1 m^3

PTI Environmental Services - Bellevue

INTERNAL MEMO

TO: Steve Barnett, Paul Beeson, Mike Boyd. Pat Brady, Merina Chase, Steve Eberle, Howe Gates, Paul McBeth, Alan Soukup, and Nick Varnum

FROM: Greg Bawden

DATE: October 19, 1993

SUBJECT: TPH fact sheet

Enclosed is a copy of a newly revised fact sheet specifying health hazards for petroleum products and other contaminants found at many of our sites. This fact sheet can used when preparing short form health and safety plans.

Please let me know if you have any questions about the fact sheet.

EXPOSURE INFORMATION FOR PETROLEUM PRODUCT COMPONENTS
OSHA (29 CFR Part 1910.1000)

	8-hour TWA	Ceiling	IDLH	LEL (%)	Odor/Odor Threshold	Vapor Pressure	Route	Health Hazard Symptoms	Target Organs
Petroleum distillates (naptha)	400 mg/m[a] 100 ppm[b]	--[c]	10,000 ppm	1.1	Kerosene gasoline-like	<5 mm Hg (at 20°C)	Inhalation Absorption Ingestion Skin contact	Dizziness; headache; irritated eyes, nose, throat; dry cracked skin	Skin, eyes, respiratory system, CNS
Ethylene dibromide	20 ppm	30 ppm (15 min)	400 ppm	not combustible	Mild, sweet/ ~10 ppm	17.4 mm Hg (at 30°C)	Inhalation Absorption Ingestion Skin contact	Irritant to respiratory system; eye dermatitis; CNS depression; nausea and vomiting **CARCINOGEN**	Respiratory system, liver, kidneys, skin, eyes (corneal opacity)
Tetraethyl lead (as lead)	0.075 mg/m^3 (skin)	--[c]	40 mg/m^3	1.8	Musty pleasant, sweet odor	1 mm Hg (at 38.4°C)	Inhalation Absorption Ingestion Skin contact	Insomnia; lassitude; anxiety; hypotension; nausea; convulsions; eye irritant	CNS, kidneys, eyes
Benzene	1 ppm	5 ppm (10 min)	3,000 ppm	1.3	Aromatic solvent/ 5-12 ppm	100 mm Hg (at 26.1°C)	Inhalation Absorption Ingestion Skin contact	Irritated to eyes, nose, respiratory system; giddiness; headache; nausea; fatigue; dermatitis; bone marrow depression; abdominal pain **CARCINOGEN**	Blood, CNS, skin, bone marrow, eyes, respiratory system

EXPOSURE INFORMATION FOR PETROLEUM PRODUCT COMPONENTS (cont.)

	8-hour TWA	Ceiling	IDLH	LEL (%)	Odor/Odor Threshold	Vapor Pressure	Route	Health Hazard Symptoms	Target Organs
Other Recommendations for Benzene: NIOSH 8-hour TWA—0.1 ppm 15-minute ceiling—1 ppm									
Ethylbenzene	100 ppm	125 ppm	2,000 ppm	1.0	2.3 ppm	10 mm Hg (at 25.9°C)	Inhalation Ingestion Skin contact	Irritated eyes and mucus membranes; headache; dermatitis; narcosis; coma	Eyes, upper respiratory system, skin, CNS
Toluene	100 ppm	150 ppm	2,000 ppm	1.2	2.9	36.7 mm Hg (at 30°C)	Inhalation Ingestion Skin contact	Fatigue, weakness; confusion; euphoria; dizziness; headache; dilated pupils; lacrimation; nervousness; muscle fatigue; insomnia; paresthesia; dermatitis	CNS, liver, kidneys, skin
Xylene	100 ppm	150 ppm	1,000 ppm	1	1.1 ppm	6.72 mm Hg (at 21°C)	Inhalation Ingestion Skin contact Absorption	Dizziness; excitement; drowsiness; incoordination; staggering gait; irritated eyes, nose, and throat; corneal vacuolization; anorexia, nausea, and vomiting; abdominal pain; dermatitis	CNS, eyes, GI tract, blood, liver, kidneys, skin

EXPOSURE INFORMATION FOR PETROLEUM PRODUCT COMPONENTS (cont.)

	8-hour TWA	Ceiling	IDLH	LEL (%)	Odor/Odor Threshold	Vapor Pressure	Route	Health Hazard Symptoms	Target Organs
Gasoline	300 ppm	500 ppm (15 min)	--^{c}	1.3	Aromatic, volatile	95 mm Hg (at 20°C)	Inhalation Skin contact Absorption Ingestion	Eye irritant; pneumonitis if aspirated **SUSPECTED CARCINOGEN**	Respiratory system, eyes
PCBs	1 mg/m^3 (skin)	--^{c}	10 mg/m^3	unknown	Mild hydrocarbon odor	0.001 mm (at 20°C)	Inhalation Absorption Ingestion Skin contact	eye irritant, chlorane, liver damage **CARCINOGEN**	Skin, eyes, liver
Lead (as Pb), inorganic, metals	0.050 mg/m^3	--^{c}	700 mg/m^3	not combustible	N/A	~0 mm Hg (at 20°C)	Inhalation Ingestion Skin contact	Lassitude; insomnia; pallor; anorexia; abdominal pain; anemia; tremors; blood monitoring required	GI tract, CNS, blood, kidneys, gingival tissue

Other Recommendations for Lead:

<u>NIOSH</u>
0.100 mg/m^3 Pb TWA (ambient air)
<.060 mg/100 g blood Pb—workers

<u>EPA</u>
0.14 mg/m^3 RAL (24-hour)

	8-hour TWA	Ceiling	IDLH	LEL (%)	Odor/Odor Threshold	Vapor Pressure	Route	Health Hazard Symptoms	Target Organs
Refined Petroleum Solvents (Stoddard solvent)	100 ppm 525 mg/m^3	--^{c}	29,500 mg/m^3	Unknown	Kerosene-like odor/ 1–30 ppm	Unknown	Inhalation Skin contact Ingestion	Irritated eyes, nose, throat; dermatitis; nervous system effect; blood and urine monitoring required	Skin, eyes, respiratory system, CNS
Particulates		N/A	N/A	N/A	N/A	N/A	Inhalation		Respiratory system
Total Dust	10 mg/m^3								
Respirable	5 mg/m^3								

(footnotes on following page)

EXPOSURE INFORMATION FOR PETROLEUM PRODUCT COMPONENTS (cont.)

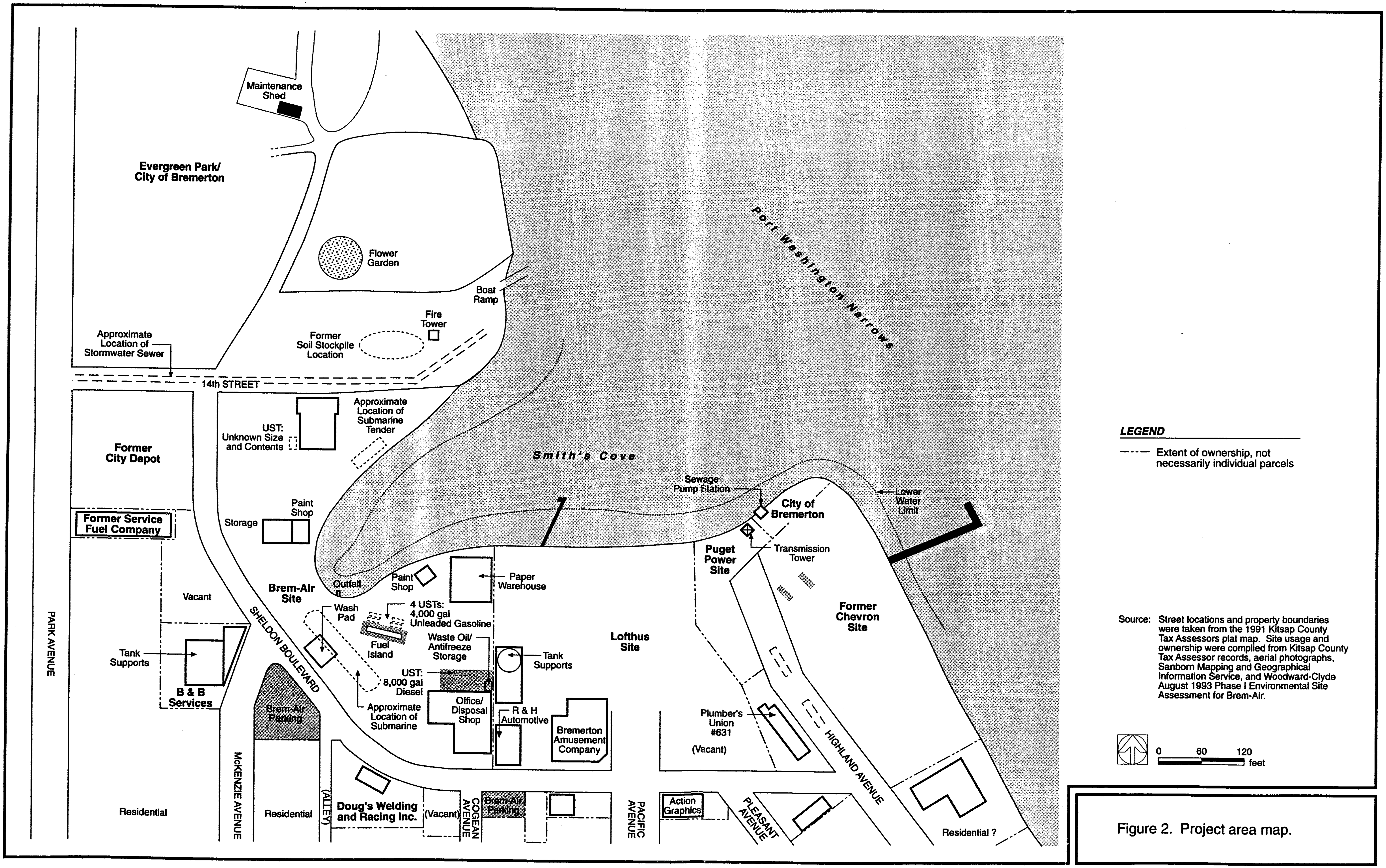
Note:

CFR	-	Code of Federal Regulations
CNS	-	central nervous system
EPA	-	U.S. Environmental Protection Agency
GI	-	gastrointestinal
IDLH	-	immediately dangerous to life and health
LEL	-	lower explosive limit
N/A	-	not applicable
NIOSH	-	National Institute of Occupational Safety and Health
OSHA	-	Occupational Safety and Health Administration
PCB	-	polychlorinated biphenyl
ppm	-	part per million of vapor or gas per million parts of contaminated air by volume at 25°C and 760 mm Hg pressure.
RAL	-	reference ambient level
TWA	-	time-weighted average

[a] mg/m^3 = milligrams of contaminant per cubic meter of contaminated air.

[b] Proposed Washington State standards.

[c] Not determined.



LEGEND

-·-·- Extent of ownership, not necessarily individual parcels

Source: Street locations and property boundaries were taken from the 1991 Kitsap County Tax Assessors plat map. Site usage and ownership were complied from Kitsap County Tax Assessor records, aerial photographs, Sanborn Mapping and Geographical Information Service, and Woodward-Clyde August 1993 Phase I Environmental Site Assessment for Brem-Air.

Figure 2. Project area map.

CA5O-05-01 09/16/96

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MANUFACTURER..............:

EM SCIENCE
A DIVISION OF EM INDUSTRIES
P.O. BOX 70
480 DEMOCRAT RD.
GIBBSTOWN, N.J. 08027

PREPARATION DATE.: 09/08/95
DATE MSDS PRINTED.: OCT 19, 1995

INFORMATION PHONE NUMBER.: 609-423-6300
HOURS: MON. TO FRI. 8:30-5
CHEMTREC EMERGENCY NUMBER: 800-424-9300
HOURS: 24 HRS A DAY

CATALOG NUMBER(S):
HX0295 HX0302

PRODUCT NAME.....:
HEXANE
SYNONYMS..........:
HEXANES
CHEMICAL FAMILY..:
ALIPHATIC HYDROCARBON
FORMULA...........:
C_6H_{14}

MOLECULAR WEIGHT.:
86.18

2. COMPOSITION / INFORMATION ON INGREDIENTS

COMPONENT	CAS #	APPR %
HEXANE	110-54-3	95-99%

ALSO CONTAINS METHYL PENTANES 0-5% CAS# UNKNOWN. MAY CONTAIN TRACE LEVELS BENZENE (0.0002%) CAS# 71-43-2.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
EXTREMELY FLAMMABLE LIQUID AND VAPOR.
HARMFUL IF INHALED OR SWALLOWED.
MAY CAUSE DAMAGE TO KIDNEYS, NERVES, AND RESPIRATORY SYSTEM.
IRRITATING TO SKIN, EYES AND MUCOUS MEMBRANES.

APPEARANCE..................:

CLEAR, COLORLESS LIQUID

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

SYMPTOMS OF EXPOSURE:
TOXIC BY INGESTION AND INHALATION.
VAPOR INHALATION CAUSES IRRITATION OF NASAL AND RESPIRATORY PASSAGES, HEADACHE, DIZZINESS, NAUSEA, CENTRAL NERVOUS SYSTEM DEPRESSION.
CHRONIC OVEREXPOSURE CAN CAUSE SEVERE NERVE DAMAGE.
CAUSES IRRITATION ON CONTACT WITH SKIN OR EYES.
MAY CAUSE DAMAGE TO KIDNEYS AND/OR LIVER.

MEDICAL COND. AGGRAVATED BY EXPOSURE:
KIDNEY, LIVER, RESPIRATORY AND CNS CONDITIONS

ROUTES OF ENTRY....................:
INHALATION, INGESTION OR SKIN CONTACT.

CARCINOGENICITY....................:
THE MATERIAL IS NOT LISTED (IARC, NTP, OSHA) AS CANCER CAUSING AGENT.

4. FIRST AID MEASURES

EMERGENCY FIRST AID:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
SKIN: IMMEDIATELY FLUSH THOROUGHLY WITH LARGE AMOUNTS OF WATER.
EYES: IMMEDIATELY FLUSH THOROUGHLY WITH WATER FOR AT LEAST 15 MINUTES.
INHALATION: REMOVE TO FRESH AIR; GIVE ARTIFICIAL RESPIRATION IF BREATHING HAS STOPPED.
INGESTION: DO NOT INDUCE VOMITING; GET IMMEDIATE MEDICAL ATTENTION.

5. FIRE FIGHTING MEASURES

FLASH POINT (F)...........: -7F (CC)
FLAMMABLE LIMITS LEL (%).: 1.20
FLAMMABLE LIMITS UEL (%).: 7.50
EXTINGUISHING MEDIA......:
FOAM, DRY CHEMICAL, OR CO2

FIRE FIGHTING PROCEDURES.:
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING.

FIRE & EXPLOSION HAZARDS.:
DANGEROUS FIRE AND EXPLOSIVE HAZARD.

VAPOR CAN TRAVEL DISTANCES TO IGNITION SOURCE AND FLASH BACK.

6. ACCIDENTAL RELEASE MEASURES

SPILL RESPONSE:
EVACUATE THE AREA OF ALL UNNECESSARY PERSONNEL.
WEAR SUITABLE PROTECTIVE EQUIPMENT LISTED UNDER EXPOSURE / PERSONAL PROTECTION.
ELIMINATE ANY IGNITION SOURCES UNTIL THE AREA IS DETERMINED TO BE FREE FROM EXPLOSION OR FIRE HAZARDS.
CONTAIN THE RELEASE AND ELIMINATE ITS SOURCE, IF THIS CAN BE DONE WITHOUT RISK.
TAKE UP AND CONTAINERIZE FOR PROPER DISPOSAL AS DESCRIBED UNDER DISPOSAL.
COMPLY WITH FEDERAL, STATE, AND LOCAL REGULATIONS ON REPORTING RELEASES. REFER TO REGULATORY INFORMATION FOR REPORTABLE QUANTITY AND OTHER REGULATORY DATA.
EM SCIENCE RECOMMENDS SPILL-X ABSORBENT AGENTS FOR VARIOUS TYPES OF SPILLS. ADDITIONAL INFORMATION ON THE SPILL-X PRODUCTS CAN BE PROVIDED THROUGH THE EM SCIENCE TECHNICAL SERVICE DEPARTMENT (609) 354-9200.
THE FOLLOWING EM SCIENCE SPILL-X ABSORBENT IS RECOMMENDED FOR THIS PRODUCT:

SX0863	SOLVENT SPILL TREATMENT KIT

7. HANDLING AND STORAGE

HANDLING & STORAGE:
KEEP CONTAINER CLOSED.
STORE IN A COOL, DRY AREA AWAY FROM IGNITION SOURCES AND OXIDIZERS.
DO NOT BREATH VAPOR OR MIST.
ELECTRICALLY GROUND ALL EQUIPMENT WHEN HANDLING THIS PRODUCT.
RETAINED RESIDUE MAY MAKE EMPTY CONTAINERS HAZARDOUS; USE CAUTION!
DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:

VENTILATION, RESPIRATORY PROTECTION, PROTECTIVE CLOTHING, EYE PROTECTION
RESPIRATORY PROTECTION: IF WORKPLACE EXPOSURE LIMIT(S) OF PRODUCT OR ANY COMPONENT IS EXCEEDED (SEE TLV/PEL), A NIOSH/MSHA APPROVED AIR SUPPLIED RESPIRATOR IS ADVISED IN ABSENCE OF PROPER ENVIRONMENTAL CONTROL. OSHA REGULATIONS ALSO PERMIT OTHER NIOSH/MSHA RESPIRATORS (NEGATIVE PRESSURE TYPE) UNDER SPECIFIED

CONDITIONS (SEE YOUR SAFETY EQUIPMENT SUPPLIER). ENGINEERING AND/OR ADMINISTRATIVE CONTROLS SHOULD BE IMPLEMENTED TO REDUCE EXPOSURE.
MATERIAL SHOULD BE HANDLED OR TRANSFERRED IN AN APPROVED FUME HOOD OR WITH ADEQUATE VENTILATION.
PROTECTIVE GLOVES SHOULD BE WORN TO PREVENT SKIN CONTACT (NITRILE OR EQUIVALENT)
SAFETY GLASSES WITH SIDE SHIELDS SHOULD BE WORN AT ALL TIMES.

WORK / HYGENIC PRACTICES:
WASH THOROUGHLY AFTER HANDLING.
DO NOT TAKE INTERNALLY.
EYE WASH AND SAFETY EQUIPMENT SHOULD BE READILY AVAILABLE.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
COMPONENT	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	SKIN
HEXANE	50	180					

ACGIH - TLV:

	TWA		STEL		CL		
COMPONENT	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	SKIN
HEXANE	50	176					

9. PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT (C 760 MMHG).: 65C
MELTING POINT (C)..........: -95C
SPECIFIC GRAVITY (H2O = 1).: 0.6603
VAPOR PRESSURE (MM HG).....: 125 20C
PERCENT VOLATILE BY VOL (%): 100%
VAPOR DENSITY (AIR = 1)....: 3.0
EVAPORATION RATE (BUAC = 1): 9.0
SOLUBILITY IN WATER (%)....: SLIGHT
APPEARANCE.................:
CLEAR, COLORLESS LIQUID

10. STABILITY AND REACTIVITY

STABILITY...............: YES

HAZARDOUS POLYMERIZATION:
DOES NOT OCCUR

HAZARDOUS DECOMPOSITION.:
COX

CONDITIONS TO AVOID.....:
HEAT; CONTACT WITH IGNITION SOURCES.

MATERIALS TO AVOID......:
( ) WATER
( ) ACIDS
( ) BASES
( ) CORROSIVES
(X) OXIDIZERS
( ) OTHER :

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA:

IHL-HMN TCLO: 5000 PPM/10M   ORL-RAT LD50: 28710 MG/KG

TOXICOLOGICAL FINDINGS:
TESTS ON LABORATORY ANIMALS INDICATE MATERIAL MAY PRODUCE ADVERSE MUTAGENIC AND REPRODUCTIVE EFFECTS.
CITED IN REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA WASTE NUMBERS: D001
TREATMENT:
INCINERATION, FUELS BLENDING OR RECYCLE. CONTACT YOUR LOCAL PERMITTED WASTE DISPOSAL SITE (TSD) FOR PERMISSIBLE TREATMENT SITES.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT PROPER SHIPPING NAME...:
HEXANE

DOT ID NUMBER..............:
UN1208

14. REGULATORY INFORMATION

TSCA STATEMENT ....:
THE CAS NUMBER OF THIS PRODUCT IS LISTED ON THE TSCA INVENTORY.

COMPONENT	SARA EHS (302)	SARA EHS TPQ (LBS)	CERCLA RQ (LBS)
HEXANE			5000

COMPONENT	OSHA FLOOR LIST	SARA 313	DEMINIMIS FOR SARA 313 (%)
HEXANE	Y	Y	1.0

15. OTHER INFORMATION

COMMENTS:
NONE

NFPA HAZARD RATINGS:
HEALTH : 1
FLAMMABILITY : 3
REACTIVITY : 0
SPECIAL HAZARDS :

REVISION HISTORY:
01/04/89 06/28/89 03/01/91 06/23/93 01/25/94 03/06/95

| = REVISED SECTION
N/A = NOT AVAILABLE
N/E = NONE ESTABLISHED

THE STATEMENTS CONTAINED HEREIN ARE OFFERED FOR INFORMATIONAL PURPOSES ONLY AND ARE BASED UPON TECHNICAL DATA THAT EM SCIENCE BELIEVES TO BE ACCURATE. IT IS INTENDED FOR USE ONLY BY PERSONS HAVING THE NECESSARY TECHNICAL SKILL AND AT THEIR OWN DESCRETION AND RISK. SINCE CONDITIONS AND MANNER OF USE ARE OUTSIDE OUR CONTROL, WE MAKE NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

"ISSUED BY VWR 01/15/96"

J.T.BAKER INC. 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865
MATERIAL SAFETY DATA SHEET
24-HOUR EMERGENCY TELEPHONE -- (908) 859-2151
CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (800) 424-8802

MALLINCKRODT BAKER,INC., 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME: ACETONE
COMMON SYNONYMS: DIMETHYL KETONE; 2-PROPANONE; DIMETHYL KETAL
CHEMICAL FAMILY: KETONES
FORMULA: $(CH_3)_2CO$
FORMULA WT.: 58.08
CAS NO.: 67-64-1
NIOSH/RTECS NO.: AL3150000
PRODUCT USE: LABORATORY REAGENT
PRODUCT CODES: 9004,9007,9009,9015,5580,9125,9125,A134,9002,9010,9008,9001 9006,5805,9254,9005,5356

PRECAUTIONARY LABELING

BAKER SAF-T-DATA* SYSTEM

HEALTH	-	1	SLIGHT
FLAMMABILITY	-	3	SEVERE (FLAMMABLE)
REACTIVITY	-	2	MODERATE
CONTACT	-	1	SLIGHT

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

U.S. PRECAUTIONARY LABELING

DANGER

EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. CAUSES IRRITATION. HARMFUL IF SWALLOWED OR INHALED.
KEEP AWAY FROM HEAT, SPARKS, FLAME. AVOID CONTACT WITH EYES, SKIN, CLOTHING AVOID BREATHING VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE, USE ALCOHOL FOAM, DRY CHEMICAL, CARBON DIOXIDE - WATER MAY BE INEFFECTIVE. IN CASE OF SPILL, SOAK UP WITH SAND OR EARTH. FLUSH SPILL AREA WITH WATER.

CONTINUED ON PAGE: 2

PRECAUTIONARY LABELING (CONTINUED)

INTERNATIONAL LABELING

HIGHLY FLAMMABLE.
KEEP CONTAINER IN A WELL-VENTILATED PLACE. KEEP AWAY FROM SOURCES OF IGNITI
- NO SMOKING. DO NOT BREATHE VAPOR. TAKE PRECAUTIONARY MEASURES AGAINST STAT
DISCHARGES.

SAF-T-DATA* STORAGE COLOR CODE: RED (FLAMMABLE)

SECTION II - COMPONENTS

COMPONENT	CAS NO.	WEIGHT %	OSHA/PEL	ACGIH/TL
ACETONE	67-64-1	99-100	1000 PPM	750 PPM

SECTION III - PHYSICAL DATA

BOILING POINT: 56 C (132 F) (AT 760 MM HG)

VAPOR PRESSURE (MMHG): 184 (20 C)

MELTING POINT: -95 C (-139 F) (AT 760 MM HG)

VAPOR DENSITY (AIR=1): 2.0

SPECIFIC GRAVITY: 0.79 (H_2O=1)

EVAPORATION RATE: 14.4 (BUTYL ACETATE = 1)

SOLUBILITY(H_2O): COMPLETE (100%)

% VOLATILES BY VOLUME: 100 (21 C)

PH: N/A

ODOR THRESHOLD (P.P.M.): 100

PHYSICAL STATE: LIQUID

COEFFICIENT WATER/OIL DISTRIBUTION: N/A

APPEARANCE & ODOR: CLEAR, COLORLESS LIQUID. SWEET ODOR.

CONTINUED ON PAGE: 3

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP): -18 C (-2 F) NFPA 704M RATING: 1-3-0

AUTOIGNITION TEMPERATURE: 464 C (869 F)

FLAMMABLE LIMITS: UPPER - 13.0 % LOWER - 2.2 %

FIRE EXTINQUISHING MEDIA
USE ALCOHOL FOAM, DRY CHEMICAL OR CARBON DIOXIDE. (WATER MAY BE INEFFECTIVE.)

SPECIAL FIRE-FIGHTING PROCEDURES
FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. US WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.

UNUSUAL FIRE & EXPLOSION HAZARDS
VAPORS MAY FLOW ALONG SURFACES TO DISTANT IGNITION SOURCES AND FLASH BAC CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE. CONTACT WITH STRONG OXIDIZERS MAY CAUSE FIRE. THIS MATERIAL MAY PRODUCE A FLOATING FIRE HAZARD.

TOXIC GASES PRODUCED
CARBON MONOXIDE, CARBON DIOXIDE

EXPLOSION DATA-SENSITIVITY TO MECHANICAL IMPACT
NONE IDENTIFIED.

EXPLOSION DATA-SENSITIVITY TO STATIC DISCHARGE
YES.

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE (TLV/TWA): 1780 MG/M3 (750 PPM)

SHORT-TERM EXPOSURE LIMIT (STEL): 2400 MG/M3 (1000 PPM)

PERMISSIBLE EXPOSURE LIMIT (PEL): 2380 MG/M3 (1000 PPM)

CONTINUED ON PAGE: 4

SECTION V - HEALTH HAZARD DATA (CONTINUED)

TOXICITY OF COMPONENTS

ORAL RAT LD50 FOR ACETONE	5800 MG/
ORAL MOUSE LD50 FOR ACETONE	3000 MG/
INTRAPERITONEAL MOUSE LD50 FOR ACETONE	1297 MG/
SKIN RABBIT LD50 FOR ACETONE	20 G/K

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

CARCINOGENICITY
NONE IDENTIFIED.

REPRODUCTIVE EFFECTS
NONE IDENTIFIED.

EFFECTS OF OVEREXPOSURE

INHALATION: IRRITATION OF NOSE AND THROAT, HEADACHE, NAUSEA, VOMITING, DIZZINESS, NARCOSIS, RESPIRATORY FAILURE, LO BLOOD PRESSURE, CENTRAL NERVOUS SYSTEM DEPRESSION, COM

SKIN CONTACT: IRRITATION, PROLONGED CONTACT MAY CAUSE DERMATITIS

EYE CONTACT: SEVERE IRRITATION, MAY CAUSE TEMPORARY CORNEAL DAMAGE

SKIN ABSORPTION: MAY OCCUR

INGESTION: HEADACHE, NAUSEA, VOMITING, DIZZINESS, GASTROINTESTINAL IRRITATION, CENTRAL NERVOUS SYSTEM DEPRESSION, UNCONSCIOUSNESS

CHRONIC EFFECTS: KIDNEY DAMAGE, LIVER DAMAGE

TARGET ORGANS
RESPIRATORY SYSTEM, LUNGS, EYES, SKIN, CENTRAL NERVOUS SYSTEM

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
CHRONIC RESPIRATORY DISEASE, SKIN DISORDERS, EYE DISORDERS

PRIMARY ROUTES OF ENTRY
INHALATION, INGESTION, EYE CONTACT, SKIN CONTACT

CONTINUED ON PAGE: 5

SECTION V - HEALTH HAZARD DATA (CONTINUED)

EMERGENCY AND FIRST AID PROCEDURES

INGESTION: CALL A PHYSICIAN. IF SWALLOWED, DO NOT INDUCE VOMITING. I CONSCIOUS, GIVE LARGE AMOUNTS OF WATER.

INHALATION: IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. PROMPT ACTION IS ESSENTIAL.

SKIN CONTACT: IN CASE OF CONTACT, FLUSH SKIN WITH WATER.

EYE CONTACT: IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES.

NOTES TO PHYSICIAN

ANY MATERIAL ASPIRATED DURING VOMITING MAY CAUSE LUNG INJURY. THEREFORE EMESIS SHOULD NOT BE INDUCED MECHANICALLY OR PHARMACOLOGICALLY. IF IT CONSIDERED NECESSARY TO EVACUATE THE SOMACH CONTENTS, THIS SHOULD BE D BY MEANS LEAST LIKELY TO CAUSE ASPIRATION (E.G., GASTRIC LAVAGE AFTER ENDOTRACHEAL INTUBATION).

SARA/TITLE III HAZARD CATEGORIES AND LISTS

ACUTE: YES CHRONIC: YES FLAMMABILITY: YES PRESSURE: NO REACTIVITY: NO

EXTREMELY HAZARDOUS SUBSTANCE: NO
CERCLA HAZARDOUS SUBSTANCE: YES CONTAINS ACETONE (RQ = 5000 LBS)
SARA 313 TOXIC CHEMICALS: NO
GENERIC CLASS: GENERIC CLASS REMOVED FROM CFR: 7/1/91
TSCA INVENTORY: YES

SECTION VI - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: HEAT, FLAME, OTHER SOURCES OF IGNITION

INCOMPATIBLES: STRONG OXIDIZING AGENTS, STRONG BASES, HALOGEN ACIDS AND HALOGEN COMPOUNDS, CAUSTICS, AMINES AND AMMONIA, CHLORINE AND CHLORINE COMPOUNDS, STRONG ACIDS, ESP. SULFURIC, NITRIC, HYDROCHLORIC

CONTINUED ON PAGE: 6

SECTION VI - REACTIVITY DATA (CONTINUED)

DECOMPOSITION PRODUCTS: CARBON MONOXIDE, CARBON DIOXIDE

SECTION VII - SPILL & DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE

WEAR SUITABLE PROTECTIVE CLOTHING. SHUT OFF IGNITION SOURCES; NO FLARES SMOKING, OR FLAMES IN AREA. STOP LEAK IF YOU CAN DO SO WITHOUT RISK. U WATER SPRAY TO REDUCE VAPORS. TAKE UP WITH SAND OR OTHER NON-COMBUSTIBL ABSORBENT MATERIAL AND PLACE INTO CONTAINER FOR LATER DISPOSAL. FLUSH AREA WITH WATER.

J. T. BAKER SOLUSORB(R) SOLVENT ADSORBENT IS RECOMMENDED FOR SPILLS OF THIS PRODUCT.

DISPOSAL PROCEDURE

DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: U002 (TOXIC WASTE)

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 5000 PPM, A CHEMICAL CARTRIDGE RESPIRATOR WITH ORGAN VAPOR CARTRIDGE IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS IS RECOMMENDED.

EYE/SKIN PROTECTION: SAFETY GOGGLES, BUTYL RUBBER GLOVES ARE RECOMMENDED.

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SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA* STORAGE COLOR CODE: RED (FLAMMABLE)

STORAGE REQUIREMENTS
KEEP CONTAINER TIGHTLY CLOSED. STORE IN A COOL, DRY, WELL-VENTILATED, FLAMMABLE LIQUID STORAGE AREA. ISOLATE FROM INCOMPATIBLE MATERIALS.

SPECIAL PRECAUTIONS
BOND AND GROUND CONTAINERS WHEN TRANSFERRING LIQUID.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME: ACETONE
HAZARD CLASS: 3
UN/NA: UN1090 REPORTABLE QUANTITY: 5000 LBS. PACKAGING GROUP: II
LABELS: 3 FLAMMABLE LIQUID
REGULATORY REFERENCES: 49CFR 172.101

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME: ACETONE
HAZARD CLASS: 3.1 I.M.O. PAGE: 3102
UN: UN1090 MARINE POLLUTANTS: NO PACKAGING GROUP: II
LABELS: 3 FLAMMABLE LIQUID
REGULATORY REFERENCES: 49CFR PART 176; IMDG CODE

AIR (I.C.A.O.)

PROPER SHIPPING NAME: ACETONE
HAZARD CLASS: 3
UN: UN1090 PACKAGING GROUP: II
LABELS: 3 FLAMMABLE LIQUID
REGULATORY REFERENCES: 49CFR PART 175; ICAO=== WE BELIEVE THE TRANSPORTATIO' DATA AND REFERENCES CONTAINED HEREIN TO BE FACTUAL A THE OPINION OF QUALIFIED EXPERTS. THE DATA IS MEANT A GUIDE TO THE OVERALL CLASSIFICATION OF THE PRODUCT AND IS NOT PACKAGE SIZE SPECIFIC, NOR SHOULD IT BE TAKEN AS A WARRANTY OR REPRESENTATION FOR WHICH THE COMPANY ASSUMES LEGAL RESPONSIBILITY.=== THE INFORMATION IS OFFERED SOLELY FOR YOUR CONSIDERATION, INVESTIGATION, AND VERIFICATION. ANY USE OF THE INFORMATION MUST BE DETERMINED BY THE USER TO BE IN

CONTINUED ON PAGE: 8

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION (CONTINUED)

ACCORDANCE WITH APPLICABLE FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS. SEE SHIPPER REQUIREMENTS 49CFR 171.2, CERTIFICATION 172.204, AND EMPLOYEE TRAINING CFR 173.1(B).

U.S. CUSTOMS HARMONIZATION NUMBER: 29141100008

NOTE: WHEN HANDLING LIQUID PRODUCTS, SECONDARY PROTECTIVE CONTAINERS MUST
USED FOR CARRYING.
-N/A = NOT APPLICABLE, OR NOT AVAILABLE;
N/E = NOT ESTABLISHED.-
THE INFORMATION IN THIS MATERIAL SAFETY DATA SHEET MEETS THE REQUIREMENTS OF THE UNITED STATES OCCUPATIONAL SAFETY AND HEALTH ACT AND REGULATIONS PROMULGATED THEREUNDER (29 CFR 1910.1200 ET. SEQ.) AND THE CANADIAN WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM. THIS DOCUMENT IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PERSON TRAINED IN, OR SUPERVISED BY A PERSON TRAINED IN, CHEMICAL HANDLING. THE USER IS RESPONSIBLE FOR DETERMINING THE PRECAUTIONS AND DANGERS OF THIS CHEMICAL FOR HIS OR HER PARTICULAR APPLICATION. DEPENDING ON USAGE, PROTECTIVE CLOTHING INCLUDING EYE AND FACE GUARDS AND RESPIRATORS MUST BE USED TO AVOID CONTACT WITH MATERIAL OR BREATHING CHEMICAL VAPORS/FUMES.
EXPOSURE TO THIS PRODUCT MAY HAVE SERIOUS ADVERSE HEALTH EFFECTS. THIS CHEMICAL MAY INTERACT WITH OTHER SUBSTANCES. SINCE THE POTENTIAL USES ARE SO VARIED, BAKER CANNOT WARN OF ALL OF THE POTENTIAL DANGERS OF USE OR INTERACTION WITH OTHER CHEMICALS OR MATERIALS. BAKER WARRANTS THAT THE CHEMICAL MEETS THE SPECIFICATIONS SET FORTH ON THE LABEL.
BAKER DISCLAIMS ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED WITH REGARD TO THE PRODUCT SUPPLIED HEREUNDER, ITS MERCHANTABILITY OR ITS FITNESS FOR A PARTICULAR PURPOSE.
THE USER SHOULD RECOGNIZE THAT THIS PRODUCT CAN CAUSE SEVERE INJURY AND EVEN DEATH, ESPECIALLY IF IMPROPERLY HANDLED OR THE KNOWN DANGERS OF USE ARE NOT HEEDED. READ ALL PRECAUTIONARY INFORMATION. AS NEW DOCUMENTED GENERAL SAFETY INFORMATION BECOMES AVAILABLE, BAKER WILL PERIODICALLY REVISE THIS MATERIAL SAFETY DATA SHEET.
NOTE: CHEMTREC, CANUTEC, AND NATIONAL RESPONSE CENTER EMERGENCY TELEPHONE NUMBERS ARE TO BE USED ONLY IN THE EVENT OF CHEMICAL EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT INVOLVING CHEMICALS. ALL NON-EMERGENCY QUESTIONS SHOULD BE DIRECTED TO CUSTOMER SERVICE (1-800-JTBAKER) FOR ASSISTANCE.

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* TRADEMARKS OF MALLINCKRODT BAKER, INC.

===

APPROVED BY QUALITY ASSURANCE DEPARTMENT.

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"ISSUED BY VWR 01/15/96"

J.T.BAKER(R) J.T. BAKER CHEMICAL CO. MATERIAL
222 RED SCHOOL LANE PHILLIPSBURG, N.J. 08865 SAFETY DAT
24-HOUR EMERGENCY TELEPHONE -- (201) 859-2151 SHEET

CHEMTREC # (800) 424-9300
NATIONAL RESPONSE CENTER # (800) 424-8802

MM420 -03 METHYLENE CHLORIDE PAGE:
EFFECTIVE: 10/24/87 ISSUED: 07/22/87

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME: METHYLENE CHLORIDE
FORMULA: CH2CL2
FORMULA WT: 84.93
CAS NO.: 75-09-2
NIOSH.RTECS NO.: PA8050000
COMMON SYNONYMS: DICHLOROMETHANE; METHYLENE DICHLORIDE; METHANE DICHLORIDE
PRODUCT CODES: 9324, 9341, 0480, 9330, 5378, 5531, 9315, 9329, 9264, 9128

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH-----CAUSES CANCER---3---SEVERE
FLAMMABILITY---------------1---SLIGHT
REACTIVITY-----------------1---SLIGHT
CONTACT--------------------2---MODERATE

LABORATORY PROTECTIVE EQUIPMENT
GOGGLES & SHIELD, LAB COAT & APRON, VENT HOOD, PROPER GLOVE

PRECAUTIONARY LABEL STATEMENTS

POISON! DANGER!
CAUSES IRRITATION
HARMFUL IF ABSORBED THROUGH SKIN
MAY BE FATAL IF SWALLOWED OR INHALED

NOTE: REPORTED AS CAUSING CANCER IN LABORATORY ANIMALS. EXERCISE DUE CARE.
AVOID CONTACT WITH EYES, SKIN, CLOTHING.
KEEP IN TIGHTLY CLOSED CONTAINER. WASH THOROUGHLY AFTER HANDLING.

SECTION II - HAZARDOUS COMPONENTS

COMPONENT	%	CAS N
METHYLENE CHLORIDE	90-100	75-09-

SECTION III - PHYSICAL DATA

BOILING POINT: 40 DEG.C (104 DEG.F) VAPOR PRESSURE(MM HG): 350

MELTING POINT: -95 DEG.C (-139 DEG.F) VAPOR DENSITY(AIR=1): 2.9

SPECIFIC GRAVITY: 1.32 EVAPORATION RATE: 27.5
(H2O=1) (BUTYL ACETATE=1)
SOLUBILITY(H2O): MODERATE (1 TO 10 %) % VOLATILES BY VOLUME: 100
PEARANCE & ODOR: COLORLESS,VOLATILE LIQUID WITH PENETRATING,ETHER-LIKE ODO

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

TOXIC GASES PRODUCED

HYDROGEN CHLORIDE, PHOSGENE, CARBON MONOXIDE, CARBON DIOXIDE

SECTION V - HEALTH HAZARD DATA

GIH DENOTES THAT THIS SUBSTANCE IS SUSPECT OF CARCINOGENIC POTENTIAL FOR MAN

.HRESHOLD LIMIT VALUE (TLV/TWA): 350 MG/M3 (100 PPM)
SHORT-TERM EXPOSURE LIMIT (STEL): 1740 MG/M3 (500 PPM)
PERMISSIBLE EXPOSURE LIMIT (PEL): MG/M3 (500 PPM)

TOXICITY: LD50 (ORAL-RAT) (MG/KG) - 2524
LD50 (IPR-MOUSE) (MG/KG) - 1500
LD50 (SCU-MOUSE) (MG/KG) - 6460
LC50 (INHAL-RAT-)(G/M3) - 88

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE

INHALATION AND INGESTION ARE HARMFUL AND MAY BE FATAL.
INHALATION MAY CAUSE HEADACHE, NAUSEA, VOMITING, DIZZINESS, NARCOSIS, SUFFOCATION, LOWER BLOOD PRESSURE, CENTRAL NERVOUS SYSTEM DEPRESSION.

CONTINUED ON PAGE: 3

SECTION V - HEALTH HAZARD DATA (CONTINUED)

INHALATION OF VAPORS MAY CAUSE SEVERE IRRITATION OF THE RESPIRATORY SYSTEM. LIQUID MAY BE IRRITATING TO SKIN AND EYES. PROLONGED SKIN CONTACT MAY RESULT IN DERMATITIS. EYE CONTACT MAY RESULT IN TEMPORARY CORNEAL DAMAGE. INGESTION MAY CAUSE NAUSEA, VOMITING, GASTROINTESTINAL IRRITATION, AND BURNS TO MOUTH AND THROAT.

RGET ORGANS

SKIN, CARDIOVASCULAR SYSTEM, CENTRAL NERVOUS SYSTEM, EYES

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

NONE IDENTIFIED

ROUTES OF ENTRY

INHALATION, INGESTION, SKIN CONTACT, EYE CONTACT

EMERGENCY AND FIRST AID PROCEDURES

CALL A PHYSICIAN.
IF SWALLOWED, 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 CONTACT, IMMEDIATELY FLUSH EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. FLUSH SKIN WITH WATER.
ACCEPTABLE MAXIMUM PEAK ABOVE THE ACCEPTANCE CEILING CONCENTRATION FOR AN 8 HOUR SHIFT = 2000 PPM FOR 5 MINUTES IN ANY 2 HOURS. (PEL) CEILING = 1000 PPM

SECTION VI - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR
CONDITIONS TO AVOID: HEAT, FLAME, OTHER SOURCES OF IGNITION, MOISTURE
DECOMPOSITION PRODUCTS: HYDROGEN CHLORIDE, PHOSGENE, CARBON MONOXIDE, CARBON DIOXIDE

SECTION VII - SPILL AND DISPOSAL PROCEDURES

EPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE

WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING. STOP LEAK IF YOU CAN DO SO WITHOUT RISK. USE WATER SPRAY TO REDUCE

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UN/NA	UN1593
LABELS	HARMFUL - STOW AWAY FROM FOOD STUFFS

(TM) AND (R) DESIGNATE TRADEMARKS.
N/A = NOT APPLICABLE OR NOT AVAILABLE

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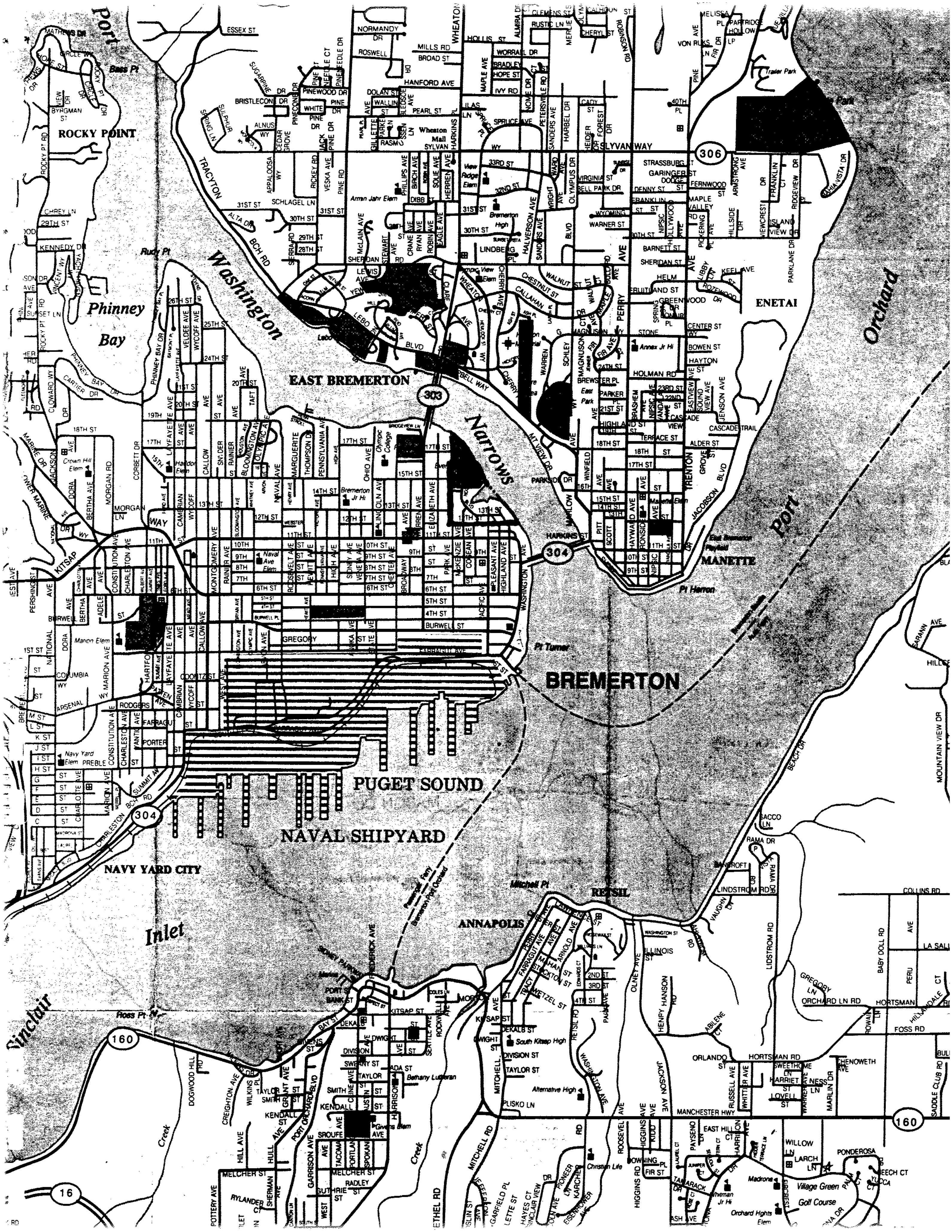
BREMERTON
EAST BREMERTON
PUGET SOUND
NAVAL SHIPYARD
NAVY YARD CITY
ROCKY POINT
ANNAPOLIS
RETSIL
MANETTE
ENETAI
Phinney Bay
Washington
Narrows
Port Orchard
Sinclair Inlet
Port
Creek
Bass Pt
Rudy Pt
Pt Herron
Pt Turner
Mitchell Pt
Ross Pt
Wheaton Mall
Bremerton High
Olympic College
Bremerton Jr Hi
Naval Ave Elem
Crown Hill Elem
Haddon Elem
Marion Elem
Navy Yard Elem
View Ridge Elem
Armin Jahr Elem
Olympic View Elem
Annex Jr Hi
Manette Elem
South Kitsap High
Alternative High
Givens Elem
Bethany Lutheran
Christian Life
Madrona
Whitman Jr Hi
Orchard Hghts Elem
Village Green Golf Course
Trailer Park
Bremerton-Port Orchard Passenger Ferry
303
304
306
160
16
SYLVAN WAY
WHEATON WY
KITSAP WAY
WASHINGTON AVE
BURWELL ST
GREGORY
FARRAGUT AVE
CHARLESTON BCH RD
TRACYTON BCH RD
SHERIDAN RD
CALLAHAN DR
MT VIEW DR
PERRY AVE
TRENTON AVE
JACOBSON BLVD
BEACH DR
MOUNTAIN VIEW DR
MANCHESTER HWY
MITCHELL RD
BETHEL RD
JACKSON AVE
OLNEY AVE
LIDSTROM RD
HORTSMAN RD
ROCKY PT RD
PHINNEY BAY DR
MARINE DR
NATIONAL AVE
MONTGOMERY AVE
PACIFIC AVE
WARREN AVE
ELIZABETH AVE
HIGHLAND AVE
PLEASANT AVE
SHORT PARK AVE

PTI's HEALTH & SAFETY TRAINING & MEDICAL STATUS

DATE: July 30, 1996

Name	40-Hour Training Course	Date	8-Hour Refresher	Supervisory Training	Fit Test	CPR	First Aid	Other Training	Date	Physical	Date	Status
BELLEVUE												
Barrick, R.				10/19/88						WIOMC*	Aug-87	INACTIVE
Bawden, G.	Haz Waste Certification		8/29/95	2/11/93	1/18/96	12/7/95	12/7/95	OSHA/WISHA Compliance	8/29/95	Virginia Mason*	May-96	ACTIVE
Bawden (cont)								Asbestos Worker	3/24/89			
Becker, S.	Haz Waste Certification	1/27/89	1/21/93	12/21/93	1/18/96					WIOMC*	Sep-91	ACTIVE
Bigham, G.				10/19/88		12/5/95						INACTIVE
Booth, P.	Haz Waste Certification	6/3/87	10/7/91	5/5/93	10/30/92	12/7/95	12/7/95			WIOMC*	Nov-95	ACTIVE
Boyce, C				4/30/96								
Bryant, M.	Haz Waste Certification	11/7/85		4/30/96	4/8/95	5/9/95		Excavation & Trenching	5/20/92			
Butcher, M.			8/29/95			12/5/95						
Doran S.	Haz Waste Certification	4/6/93	2/20/96	4/30/96	1/18/96	12/7/95	12/7/95			Virginia Mason*	Jan-96	ACTIVE
Gard, N.	Haz Waste Certification	6/4/91	8/29/95	4/30/96	1/18/96		12/7/95	Basic First Aid		Virginia Mason*	Sep-95	ACTIVE
Goode, D.	Haz Waste Certification	6/25/88	8/29/95		1/18/96	12/5/95				WIOMC*	Feb-93	ACTIVE
Hogue, C.	Haz Waste Certification	9/13/91	1/21/93	12/21/93	1/18/96					WIOMC*	Sep-91	ACTIVE
Jacobs, L.	Haz Waste Certification	6/3/87	8/29/95	12/21/93	12/3/93	10/19/94	10/19/94			WIOMC*	Aug-94	ACTIVE
Liegeois, A					1/18/96							
Marx, L.	Haz Waste Certification	10/1/82	10/11/88	10/19/88	5/13/91					WIOMC*	Sep-87	RESERVE
McCrone, L.	Haz Waste Certification	9/13/91	8/29/95	12/21/93	1/18/96	10/19/94	10/19/94			Virginia Mason	May-95	ACTIVE
Mellott, R.	Haz Waste Certification	3/25/94	8/29/95	4/30/96	9/6/94	12/7/95	12/7/95			WIOMC*	Aug-95	ACTIVE
Moore, M	Haz Waste Certification	12/15/93		4/30/96								
Nimmo, N	Haz Waste Certification	1/20/93	4/15/96	4/30/96	1/18/96		12/7/95	Asbestos Super Cont	9/16/95	Virginia Mason	Dec-95	ACTIVE
Nimmo (Cont)							Basic					
Pastorok, R.			8/29/95	6/30/93	7/21/93							INACTIVE
Sampson, J	Haz Waste Certification	5/25/91	4/25/96	1/0/00	5/30/96	1/1/00	x			Virginia Mason	Mar-96	ACTIVE
Sexton, J.	Haz Waste Certification	6/10/91	8/29/95	12/21/93	1/18/96	10/19/94	10/19/94			Virginia Mason	May-96	ACTIVE
Shields, W.				11/1/89	11/1/89	2/1/85	2/1/85			WIOMC*	Mar-90	INACTIVE
Yost, L.	Haz Waste Certification	11/4/89	9/1/94	5/5/93	6/16/93	6/22/93	5/16/92			WIOMC*	Dec-90	RESERVE

PTI's HEALTH & SAFETY TRAINING & MEDICAL STATUS

DATE: July 30, 1996

Name	40-Hour Training Course	Date	8-Hour Refresher	Supervisory Training	Fit Test	CPR	First Aid	Other Training	Date	Physical	Date	Status
LAKE OSWEGO												
Axelrod, R.	Haz Waste Certification	5/8/87	6/27/96	3/28/94	5/17/93	7/20/94	7/20/94			Thompson*	Nov-95	ACTIVE
Barnett, S.	Haz Waste Certification	2/28/92	7/11/95	3/28/94	7/19/94	7/20/94	7/20/94			Thompson*	Oct-95	ACTIVE
Boykin, C.	Haz Waste Certification	3/11/94	7/11/95		7/24/95	2/22/96	2/22/96			Thompson*	Feb-96	ACTIVE
Burden, A.	Haz Waste Certification	4/19/91	10/27/94		5/17/93	7/19/94	7/19/94			Thompson*	Sep-94	ACTIVE
Chapin, M.	Haz Waste Certification	1/22/88	10/27/94	10/20/93	7/19/94	2/18/91	2/18/91			Thompson*	Jun-94	ACTIVE
Chase, M.	Haz Waste Certification	9/13/91	7/11/95		5/17/93	3/31/92	3/31/92			Thompson*	Sep-94	ACTIVE
Jones, L.	Haz Waste Certification	11/18/88	7/11/95	3/28/94	5/17/93					Thompson*	Apr-94	ACTIVE
Livermore, D.	Haz Waste Certification	12/12/87	6/27/96	10/20/93	9/26/94	3/31/92	3/31/92			Thompson*	Nov-95	ACTIVE
Paul, J.	Haz Waste Certification	7/30/90	7/11/95	4/30/96	5/7/96	4/24/91	4/24/91			Thompson*	Oct-95	ACTIVE
Paul, (Cont.)	Chemical Waste Mgt	6/19/87										
Paul, (Cont.)	Radiation Safety & Nuclear Soil Gages	8/14/88	8/14/88									
Peek, D.	Haz Waste Certification	9/14/90	9/19/91							Thompson*	Aug-90	RESERVE
Schotthoefer,R	Haz Waste Certification	4/8/94	7/11/95		7/24/95	7/20/94	7/20/94			Thompson*	Apr-95	ACTIVE
Whitson, M.		6/9/05	7/11/95	10/20/93	7/24/95					Thompson*	Jul-94	ACTIVE
Whitson, (Cont).	Personal Protection & safety Training											

Name	40-Hour Training Course	Date	8-Hour Refresher	Supervisory Training	Fit Test	CPR	First Aid	Other Training	Date	Physical	Date	Status
BOSTON												
DiMauro, D.	Haz Waste Certification	4/14/95										ACTIVE
Hansen, L	Haz Waste Certification	9/22/95		3/20/96	1/16/96					Virginia Mason*	Nov-95	ACTIVE
Potocke, B	Haz Waste Certification	9/22/95	12/1/95		3/30/95			OSHA	3/2/94	Evalyne F. Theriault	Sep-95	ACTIVE
Smith, J.	Haz Waste Certification	11/4/94								B. Buehresm MD*	Feb-93	NON-HAZ
Weske, C.	Waste Certificat	35144	8/29/95	3/20/96				OSHA	8/29/95	Virginia Mason*	Nov-95	ACTIVE

Note: Physicals required annually, however, physicals may be delayed for up to 1 year (for a total of 2 years) for persons with no field activity since their last physical; first aid training valid for 3 years; CPR valid for 1 year; fit test valid for 1 year, 8-HR training for 1 year (can do supervisor training instead)

STATUS: ACTIVE-ready for site work (40 hour training, refresher course, fit test and physical up to date).

INACTIVE-needs training and baseline medical (not 40 hour trained).

RESERVE-could be activated for field work if necessary but will need updated training and medical within 30 days of being activated (40 hour trained, but other requirements not current). This category also includes personnel who are fully trained but are subject to other temporary restriction or limitation.

NON-HAZ-field support or lab, not cleared for field work at "uncontrolled hazardous waste site".

* Medical fit/unfit form available

**Possible field work limitations due to medical restrictions

STANDARD OPERATING PROCEDURE

OPERATION OF THE PHOTOVAC MICROTIP® HL-2000 PHOTOIONIZATION DETECTOR

SOP 402

PRINCIPLES OF OPERATION

The Photovac MicroTIP® HL-2000 (HL-2000) is a portable photoionization detector designed to perform field surveys of organic vapors at hazardous materials sites. Like other photoionization detectors, the HL-2000 uses a small pump to draw a continuous air sample into an ionization chamber, which is flooded with ultraviolet (UV) light. The UV light ionizes organic gases inside the chamber, which has two electrodes. An electric charge is applied across these electrodes, and one of them is connected to a current-measuring circuit (electrometer). When ions with positive and negative charges are formed, the negative ions travel to the positive electrode and the positive ions travel to the negative electrode. This exchange results in an electric current that the electrometer measures. The signal from the electrometer represents a composite of all ionizable compounds present with an ionization potential less than the electron voltage of the photoionization detector. A numerical value corresponding to the concentration of organic vapors is shown on the liquid crystal display. The instrument can be calibrated by exposing the instrument to a gas of a known concentration, then adjusting the instrument to indicate this known value.

The HL-2000 uses lead-acid batteries and can operate for up to 6 hours on a single charge. If longer operation is required, the battery pack can be easily exchanged for a second battery pack. The instrument has a range of 0–2,000 parts per million (ppm). Calibration is normally achieved using a mixture of 100 ppm isobutylene in air, but other compounds and concentrations can be substituted for specific applications. As equipped by the factory, the instrument uses a 10.6-electron volt (eV) lamp. Photovac also manufactures 9.5-eV and 11.7-eV lamps which can be used in this instrument.

All information is entered in the HL-2000 using a 16-key instrument panel. The basic functions of the keys are described briefly in this SOP. A more complete explanation of the instrument's capabilities, functions, and maintenance procedures is provided in the instrument operations manual. Copies of this manual are kept in the instrument case and in the PTI equipment files.

Underwriters Laboratories, Inc., has tested the HL-2000 and declared it safe for use in Class I, Division 2, Groups A, B, C, and D hazardous locations. This means that the instrument is approved for use near ignitable concentrations of flammable gases (including gasoline and hydrogen) present through the release, rupture, or leakage of gases from closed containers. For more information regarding the instrument rating for use in hazardous environments, refer to the National Fire Protection Association standards.

FUNCTIONS

On/Off

The on/off switch is the black switch located on the top of the handle, near the bottom of the keyboard. The instrument is turned on by pressing this switch and waiting for the instrument to warm up (approximately 3 min.). The instrument display will read "Warming Up Now, Please Wait."

Instrument Display and Keyboard

In normal monitoring mode, the instrument display will provide the following information:

- Instrument status (i.e., "ready") in the upper left corner
- Current detected concentration of organic vapors (in ppm) in the upper right corner
- The event number (a number assigned for data logging purposes) in the lower left corner
- The time and date in the lower right corner.

The display provides different information when in other modes, as described below. The operator can select the option shown on the display by pressing ENTER, or can scroll through the menu by pressing the up or down arrows until the desired selection is displayed. Numerical values are selected by pressing the corresponding number key.

Each key (in bold below) has several functions. The following is an overview of these functions:

- **BATT**—Pressing this key will display the current battery level. The normal operating voltage is 6–8.5 volts. When "LoBat" is displayed, the instrument has approximately 10 min. of battery remaining. When "Battery Pack is Critically Low" is displayed, the instrument will automatically shut off the lamp to prevent deep discharge of the battery and memory loss. The battery should be replaced or recharged immediately in this situation.

- **DISPLAY**—Pressing this key will change the numerical report of the current concentration of organic vapors to a bar graph. Pressing DISPLAY a second time will return the numerical display.
- **LIGHT**—Pressing this key will switch on a back light, allowing the display to be read in low light conditions. Pressing LIGHT a second time will switch the back light off. The back light should only be used when necessary because it causes the battery to discharge at a faster rate. Pressing this key also provides an indication of the UV lamp intensity.
- **AUDIO**—Pressing this key will allow the operator to select one of three audio modes: audio off, audio alarm, and continuous audio (use the up and down arrow keys to change selections). The audio signal can only be heard while using an optional headset.
- **PRINT**—Pressing this key begins the process of printing stored data at an external printer. The process requires specifying the range of data to be printed and establishing report formats. Consult the instrument operation manual for more information.
- **GRAPH**—Pressing this key begins the process of printing stored data at an external printer. Consult the instrument operation manual for more information.
- **PLAY**—Pressing this key plays back previously stored data on the visual display. One of two options can be selected: play back all data stored since the last playback or play back data from a specific monitoring "event" (data from a specific monitoring sequence can be stored using an event file or code, allowing for later retrieval). The operator may also select an option to play back the minimum, average, or maximum values recorded. Playback speed and direction must be specified. Organic vapor monitoring will continue during the playback mode. Consult the instrument operation manual for more information.
- **CAL**—Pressing this key places the instrument into calibration mode. The instrument must be calibrated to ensure that it is working properly and providing readings relevant to a known standard. A supply of "zero air," which contains no ionizable gases or vapors, is used to zero the instrument. Next, a gas containing a known concentration of photoionizable gas or vapor (typically a mixture of 100 ppm isobutylene in air), is used to set the sensitivity. See the *Calibration* section of this SOP or consult the instrument operation manual for more information.

- **ALARM**—Pressing this key displays the current alarm level setting and allows the operator to enter a new alarm setting. If the current alarm setting is satisfactory, press EXIT to return to the normal display. If a new alarm value is required, enter the new value using the number keys and then press ENTER.
- **SETUP**—Pressing this key will allows the operator to reset the time and date, select any previously stored calibration values, and select the instrument range.
- **MAX**—Pressing this key will display the maximum concentration encountered, as well as the time and date the concentration was encountered. The maximum value can be cleared by pressing any key and then CLEAR. The display will then read "Max Cleared."
- **EVENT**—Pressing this key will assign a numerical code to any particular sample or sample location the operator wants stored in the memory. This key also allows the operator to shut off the data logging function and delete stored events from the memory.
- **TUTOR**—Pressing this key will place the instrument in tutorial mode. By pressing the TUTOR key, and then pressing any other key on the instrument panel, the display will provide an explanation of the selected function key.
- **CLEAR**—Pressing this key will erase the last numerical entry. Use this key to delete an erroneous entry and then enter the desired value.
- **EXIT**—Pressing this key will cancel or terminate any selected function except DISPLAY. (Most functions exit automatically if no key is pressed for 15 seconds.)
- **ENTER**—Pressing this key will select the currently displayed function or menu choice.

CALIBRATION

The instrument can be calibrated with a variety of chemicals at a variety of concentrations. The normal procedure uses a commercially prepared mixture of 100 ppm isobutylene in air. To calibrate the instrument, follow these steps:

- Switch on the instrument in a clean environment (e.g., upwind of a chemical vapor source or in an air-conditioned office away from any organic vapor sources) and wait for the instrument to warm up.

- Evacuate any air from the sample bag (ideally made of Tedlar®) by opening the valve (turn counterclockwise) and compressing the bag.
- Connect the regulator to the calibration gas cylinder and the sample bag by using the supplied plastic tubing and hand tightening all fittings.
- Open the valves on the regulator (approximately one-half turn) and the sample bag, filling the bag with calibration gas.
- Shut the valves on the bag (turn clockwise) and the regulator, and disconnect the plastic tubing from the regulator.
- Press the CAL key once the instrument has warmed up.
- The instrument will display the currently entered response factor. Either press ENTER to confirm the current value or enter a new value using the number keys (the normal value is 1.0).
- After confirming or entering the response factor, the instrument display will read "Connect Zero Gas Then Press Enter." At this point, place the instrument in clean air or connect it to a source of clean air and press ENTER.
- The instrument display will read "Calibrating" for a brief moment; it will then read "Span Conc? ppm" and display the concentration of the previously used span gas.
- Press ENTER to confirm the span gas concentration shown or enter a new value using the number keys and then press ENTER.
- The display will read "Connect Span Gas Then Press Enter," at which point the operator must connect the sample bag to the instrument using the plastic tubing, open the valve on the sample bag (thus permitting span gas to flow to the instrument), and press ENTER.
- The instrument will switch to normal display mode when the calibration process is completed.

MAINTENANCE

The HL-2000 requires some routine maintenance, as summarized below.

The battery packs are lead-acid (unlike the TIP II which used nickel cadmium batteries) and thus do not require thorough charging and recharging to prevent "memory effect." The batteries require an 8-hour charge and must be charged using the charging source supplied by Photovac. If the instrument is to sit unused for an extended period of time, the battery packs should be charged for 8–16 hours every 6 months. Leaving the instrument for more than 3 days without a charged battery pack may result in the loss of stored data. Care should be exercised to always store the instrument with the batteries charged at the end of each field effort.

The particulate filter (a small metal cylinder), that is located in the inlet (the silver fitting at the tip of the instrument), should be in place during all normal use and should be replaced periodically. The manufacturer does not specify a time period or criteria for replacement. However, a reasonable guideline would be to replace the filter yearly (quarterly [or even monthly] in extremely dusty conditions) or when the instrument displays a value that is 10-percent greater without the filter in place than with the filter in place. Consult the instrument operation manual for filter replacement procedures.

Regular use of a photoionization detector will result in the accumulation of a film on the UV lamp. This accumulation will affect the sensitivity and accuracy of the instrument. To prevent erroneous results, the lamp should be cleaned after every 24 hours of use. However, lamp maintenance requires the disassembly of the detector cell and extreme caution is required to prevent damage to the detector. Complete procedures are provided in the instrument operation manual. A few key tips to reduce the potential for damaging the instrument are listed below:

- Clean the lamp indoors on a clean surface, using the proper tools (a small phillips head screwdriver, small needle-nose pliers, lens cleaning tissue, and methanol)
- Grasp the knurled white surface near the base of the detector cell firmly while unscrewing the top white disc, thus preventing the entire detector assembly from unscrewing from the circuit board
- DO NOT touch the fine wire mesh on the underside of the detector cell cover
- Do not lose the O-ring located at the inlet to the detector cell and the spring that sits inside the detector cell beneath the lamp
- Do not touch the flat surface of the lamp (this surface can be harmed by contact with water or oils).

If the instrument inadvertently draws water or other fluids into the inlet, immediate steps should be taken to prevent damage to the detector pump and lamp. These procedures include opening the detector cell to dry off the lamp and air drying the detector cell overnight. Consult the instrument operation manual for complete procedures.

As with all field instruments, precautions must be taken to prevent contamination of the instrument. The instrument should be kept in a clean environment or sealed in a plastic bag (with only the inlet hose protruding from the bag) to prevent the instrument from contacting mud, water, chemicals, or other contaminants.

WARNINGS

The following warnings should be heeded to prevent injury to the operator and damage to the instrument:

- The HL-2000 is not waterproof and should not be placed where it can draw in water, fall in water, be splashed with water, or be exposed to rainfall. If the instrument is exposed to rainfall, dry the exterior of the instrument as soon as possible.
- The instrument is not designed for constant use in flammable concentrations of gases, such as in a confined space containing flammable gases. No electrical connections should be made with the instrument when it is in potentially explosive environments (i.e., do not plug in the battery charger or printer cables when in a potentially explosive atmosphere).
- Data loss and battery damage may result if the instrument is stored for extended periods of time (as little as 3 days) with a discharged battery. Recharge the instrument after each project and top off the batteries every few months.
- The UV light generated by the lamp is harmful to the human eye. Although the lamp cannot be seen during normal operation, it may be visible during some maintenance chores. Care should be taken to avoid prolonged exposure to the UV light.
- Calibration gas is a nonflammable compressed gas that cannot be shipped by air without proper placards, notifications, and restricted article waybills.

STANDARD OPERATING PROCEDURE

OPERATION OF THE DRÄGER GAS DETECTOR TUBE KIT

SOP 405

PRINCIPALS OF OPERATION

The Dräger gas detector tube kit is a portable device used to take real-time measurements of selected chemical compounds in air. The kit uses a bellows pump to draw a known volume of air through a sorbent-filled glass tube. The volume of air to be drawn through the pump varies for each chemical sorbent tube. The volume of air is measured in number of pump strokes, with the number of required strokes indicated on the sorbent tube. The pump is hand powered (a battery-operated model is available) and has a counter to record the number of pump strokes. The sorbent-filled glass tubes are manufactured with sorbents specific to various chemical compounds. The sorbent material inside the tube reacts with gases present in the air and changes color during the sampling process to indicate the concentration of the gas present in the air. The concentration is indicated on a scale marked on the outside of the glass tube.

Dräger is the sole manufacturer of the bellows pump and tubes. Although other manufacturers make similar systems and detector tubes, the tubes and pumps are not interchangeable between brands.

Dräger publishes a catalog that lists available sorbent tubes and the concentration of gases detected by each tube. Vendors may also supply this information.

METHOD OF OPERATION

The Dräger detector tube kit is easy to operate. However, knowledge of the chemicals that may be present in the air is required to select the correct sorbent tube. The procedures presented below should be used to operate the Dräger detector tube:

- Select a detector tube that is appropriate for the gas and concentration of interest
- Check the expiration date for the box of detector tubes (this should be labeled on each box)

- Review the instructions that come with the box of detector tubes for special warnings or procedures specific to that detector tube (this may include the use of a two-stage detector tube or the breakage of a reagent ampule inside the detector tube)
- Break off the glass tips from each end of the detector tube using either the break-off eyelet on the front cover plate of the hand pump or a special break-off husk (available as an accessory)
- Reset the counter on the detector tube pump to zero by pressing the button
- Insert the detector tube firmly into the rubber grommet in the pump head with the arrow on the tube pointing toward the pump
- Hold the pump with the detector tube holding plate between the thumb and the index finger
- Compress the pump bellows completely with a squeezing motion and ensure that the total volume of the bellows has been expended
- Release the pump bellows and allow the chain that connects the two halves of the bellows to become taut, signifying that 100 cm^3 of air has been pulled through the detector tube
- Repeat the pumping action as many times as required by the instruction sheet for the detector tube
- Read the concentration of the gas in air by comparing the interface between the stained and unstained sorbents within the tube with the scale on the outside of the tube.

CALIBRATION

The detector tube kit does not require calibration. However, the operator should realize that inherent in the use of detector tubes is a margin of error and potential for interference by other gases. It is recommended that the operator consult the instruction sheets provided for each detector tube to evaluate these factors.

MAINTENANCE

Dräger detector tube kits require very little maintenance. As with all field equipment, the instrument must be kept free of dirt and liquids and be thoroughly cleaned in the event of unintentional contamination. The pump bellows may be tested for holes or leaks by fully compressing the bellows, inserting an unopened detector tube into the pump inlet, and releasing the bellows. The pump should remain completely compressed (under vacuum) for 10 minutes. If the bellows expand, then the pump should be inspected for leaks or damage. Common causes of air leaks are dirt in the inlet seal, a dirty exhaust valve, or a hole in the bellows. Consult the Dräger operation manual for more information regarding these repairs.

WARNINGS

Dräger detector tube kits provide valuable real-time measurements of gases in air. However, the following warnings should be considered when using the device:

- With few exceptions, the detector tubes are specific to individual gases and will not provide total organic vapor readings in atmospheres containing mixed contaminants (furthermore, the presence of other gases may interfere with the reaction with the contaminant of concern)
- The operator must select and use a detector tube that is appropriate for the chemical of concern (i.e., the tube identified by the manufacturer for use with the specific chemical at a specific range of concentrations)
- The kit will not provide accurate measurements of gases if the pump is not properly operated (i.e., fully compressed and released), if the tube is not properly inserted into the opening, or if the pump bellows leak or are damaged
- Detector tubes have a limited shelf life (usually 2 years). While tubes may be used after the shelf life has expired, the manufacturer does not guarantee results.