WORK PLAN
FOR SOIL AND GROUND WATER INVESTIGATION

at

Homestead Federal Savings Association Branch
3900 Piedmont Avenue
Oakland, California

Nov 15, 95

Prepared for:

TELACU/Carpenter
as Asset Management Contractor for
the Resolution Trust Corporation
2600 Michelson Drive, Suite 300
Irvine, California 92715

CAMBRIA
Environmental Technology, Inc.

WORK PLAN FOR SOIL AND GROUND WATER INVESTIGATION

at:

Homestead Federal Savings Association Branch
3900 Piedmont Avenue
Oakland, California

prepared by:

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November 15, 1995

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1 INTRODUCTION

Telacu/Carpenter of Irvine, California, a Resolution Trust Corporation (RTC) asset management contractor has retained PHR Environmental Consultants, Inc. (PHR) to provide project coordination and data analysis, and Cambria Environmental Technology, Inc. (*Cambria*) as a subcontractor to PHR, to complete a subsurface investigation at the site referenced above. The upcoming investigation will include drilling of soil borings, installation of ground water monitoring wells, execution of a hydraulic test and development of a remedial plan, and cost estimates. The following Draft Soil and Ground Water Investigation Workplan is limited to the duties, liabilities, obligations, and the statement of work as set forth in the RTC Scope of Work dated July 18, 1994.

1.1 Assessment Objectives

The objective of this expanded Phase II Environmental Assessment is to develop an estimate of the cost and time required to clean up the site to the target clean up levels specified by the regulatory agency having oversight authority for the site. Meeting this objective requires that the level and geographic extent of soil and ground water contamination exceeding target cleanup levels be estimated. The activities described in this workplan should allow us to accurately assess the vertical and horizontal extent of hydrocarbons in soil and ground water at the 3900 Piedmont Avenue, Oakland site. Although it is possible that the installed borings/wells will not completely bound/describe the impacted area, we should still be able to achieve the assessment objectives of reliably estimating site cleanup costs because the data collected can be analyzed/modeled in a manner that should fill in any gaps in the field investigation data set.

1.2 Background

A former Standard Oil (now Chevron) service station operated underground storage tanks (USTs) at the site until 1978, when the station was demolished and the tanks were apparently removed. Phase I and Phase II investigations conducted in 1993 determined that the former gasoline and waste oil USTs and the service station pump islands had released gasoline-range hydrocarbons and oil and grease to the subsurface. The investigations generally identified the locations of the former tanks (Figure 1). Based on these analytic results, the RTC (the owner of the property) requested that additional soil and ground water investigation be completed.

1.3 Assumptions and Limitations

The previous site investigations located the former tanks or piping, as well as all known potential nearby offsite sources. Based on this work, we have assumed that the former tanks/piping were located near the southwestern corner of the site and that these former structures were responsible for the hydrocarbons detected in the earlier Phase II assessment. We further assume that gasoline hydrocarbons, volatile organics and lead are the only compounds of concern and that no offsite sources are contributing hydrocarbons or other compounds to the site soils or groundwater. However, because of the uncertainty associated with all environmental investigations, we have designed this assessment to confirm the presumed location and nature of the contamination and to ensure that no previously unidentified offsite sources exist. Furthermore, the results of our recommended work plan will confirm that no other contaminants, tanks or other structures are present on the site.

2 DATA REVIEW/EVALUATION AND AGENCY REQUIREMENTS

This site is located in Northern Alameda County and is, therefore, within the jurisdiction of the Alameda County Department of Environmental Health (ACDEH). As the lead agency, the ACDEH will evaluate the investigation results and will work with the site consultant in developing cleanup standards for site remediation. The ACDEH

has not established their own guidelines, but rely instead on State Regulations (Title 23) and on existing and evolving procedures established by the Regional Water Quality Control Board - San Francisco Region (RWQCB). Directives established by Title 23, Article 11, Section 2725 require that all sites that have experienced unauthorized releases must undergo thorough site investigations to "assess the vertical and lateral extent of the unauthorized release". In addition, guidelines established by the three Northern California Regional Boards (the "Tri-regional Guidelines") stipulate procedures for installation of monitoring wells following tank removals or other indications of releases. In practice, these documents necessitate sampling ground water down gradient of the source area and beyond the leading edge of the hydrocarbon plume. We developed the investigation strategy presented below based on our review of the available data, and on our experience conducting subsurface investigations in Alameda County and negotiating clean-up criteria with ACDEH.

2.1 Conceptual Site Model

The site is located on the East Bay Plain adjacent to the foothills of the Diablo range. The subsurface stratigraphy in this part of the East Bay Plain typically consists of finely interbedded clays, silts and sands, with shallow ground water. The actual site stratigraphy, as interpreted by logs of previous soil borings, confirms this stratigraphy. The site soils consist of silty gravel fill to about three ft depth, and interbedded clayey sand, clayey gravel and silty sand to the total depth explored of 16.5 ft. The site stratigraphy is illustrated in Figure 2. Ground water depth was about 11 ft at the time of the November 1993 investigation. Based on the regional topographic gradient, ground water in the area probably flows southwest. Ground water depth in this area typically fluctuates about three to five ft due to seasonal changes and annual rain fall variation. This fluctuation probably created a hydrocarbon smear-zone up to five ft thick down gradient of the former USTs.

Based on the analytic results for soil and ground water presented in ESE's November 15, 1993 report and on the clayey soils encountered during the subsurface investigation, it appears that gasoline range volatile hydrocarbons in soil are restricted horizontally to the area surrounding boring FNBO-5, presumably located immediately southwest of the former tanks, and the area surrounding boring FNBO-7, located near the former service island (Figure 1). Total petroleum hydrocarbons as gasoline (TPH-g) and benzene were also detected in the ground water sample collected from boring FNBO-6, located adjacent to FNBO-5. This indicates that the release from the former USTs has impacted ground water in the vicinity of the former UST location. Since no additional ground water samples were collected, the horizontal extent of hydrocarbons in ground water cannot be completely assessed at this time. However, since only 7,800 ppb TPHg and 7.7 ppb benzene were detected in the ground water sample collected from boring FNBO-6, and since the subsurface stratigraphy consists of low hydraulic conductivity clayey soils, hydrocarbons in ground water should not extend more than thirty to fifty ft beyond the southwestern property line. In addition, due to the high dissolved oxygen concentrations found in most East Bay ground water, natural biodegradation bioattenuation is probably restricting hydrocarbon migration down gradient of the former tanks.

2.2 Data Sources and Summary of Data

Cambria selected the soil and ground water sampling points presented in Figure 1 based on analytic results for soil and ground water presented in a November 15, 1993 investigation report prepared by ESE, on the historic site information presented in the Augeas May 1993 Phase I report, on our conceptual assessment of the likely extent of site contamination and on our experience conducting numerous similar investigations in this area of Oakland. The analytic results for soil and ground water generated during previous investigations are summarized in Table 1.

2.3 Agency Target Cleanup Standards

Evolving policies at both the California Regional Water Quality Control Board - San Francisco Bay Region (WQCB-SFBR) and the ACDEH are allowing increased use of site specific considerations and risk assessment in establishing site cleanup standards. However, in the absence of these evolving policies, many nearby site remediations have used numerical ground water cleanup standards established by the ACDEH, working under the technical guidance of the WQCB-SFBR. Ground water in all regions within the jurisdiction of the ACDEH is considered to have beneficial use as potential municipal drinking water supply unless the aquifer beneath the site maintains a yield of less than 200 gallons per day and the Total Dissolved Solids (TDS) content of the water is greater than 3,000 ppm. If the aquifer is characterized as having a drinking water beneficial use, then the cleanup standards for the aquifer are California Department of Toxic Substances Control (DTSC) maximum contaminant levels (MCLs) for drinking water, which are 1 part per billion (ppb) for benzene, 680 ppb for ethylbenzene, 1,000 ppb for toluene (EPA MCL) and 1,750 ppb for xylenes.

Although the new ACDEH and WQCB-SFBR policies also incorporate risk considerations in establishing soil cleanup standards, many recent site remediations overseen by ACDEH have used "default" numerical soil cleanup standards. These ACDEH's "default" cleanup standards require that gasoline impacted soil be remediated to below detection limits for total petroleum hydrocarbons as gasoline (TPHg) and benzene, using typical industry detection limits of one ppm for TPHg and 0.05 ppm for benzene.

The ACDEH allows use of either the conservative default standards or use of flexible, risk-based decision criteria to establish cleanup standards for soil. They allow risk-based decisions because they recognize that all sites are different and that ground water usage, site stratigraphy, ground water depth and flow direction vary greatly between sites, resulting in varying risk to ground water resources and to human exposure and toxicity. Considerations they use in establishing soil cleanup standards include soil grain size and heterogeneity, ground water depth, infiltration, the presence or absence of vertical channeling and the mobility of the released compounds. Once additional soil and ground water analytic data is collected and the potential human exposure pathways are researched, appropriate soil cleanup levels can be negotiated with the ACDEH. The primary factor that they will consider in establishing the soil cleanup goals is the potential threat that the residual hydrocarbons present to ground water.

The ACDEH uses a similar risk-based approach in establishing ground water cleanup goals. They consider the site hydrogeology, the contaminant properties, the location of nearby human receptors and the projected future land use in evaluating the potential for human exposure to the released compounds. The results of the proposed soil and ground water investigation activities described below can be used as inputs to this risk-assessment process to determine the site specific cleanup goals for ground water. If a risk-based decision process is not used to determine site specific cleanup goals for this site, then the drinking water standards described above are likely to be used as ground water cleanup standards.

In addition to these risk-based approaches, the ACDEH also uses an alternative approach recently approved by the RWQCB - SFBR in regulating site cleanup. The new closure program, called the Non-Attainment Area (NAA) policy, is enjoying increased use among Bay Area regulatory agencies including the ACDEH. The program is based on the RWQCB's recognition that extensive cleanup efforts are not always necessary or cost-effective to protect the state's ground water resources. The RWQCB has established two categories of sites where case closure may be granted: I) sites with ground water and soil contamination that present limited risk to the

environment and human health, and II) sites where the approved remediation program has not resulted in compliance with state water quality objectives. The program allows the establishment of alternative compliance points such as property lines or the existing plume boundaries if all of the following criteria are met:

- Adequate characterization has fully defined the site stratigraphy and has demonstrated that the plume is not and will not migrate either horizontally or vertically,
- The source material (usually unsaturated soil beneath/adjacent to the source) has been removed,
- Available technologies will be unable to significantly improve ground water conditions, and
- An acceptable plan is submitted for containing and managing remaining risks posed by the residual contaminants in ground water.

Based on our familiarity with this program and on our preliminary understanding of the site conditions, the 3900 Piedmont Avenue site is a strong candidate for closure under this program.

2.4 Applicable Agency Guidelines, Rules and Procedures

A number of state statutes and state and federal regulatory agency guidelines will be used by the ACDEH in overseeing the assessment and cleanup of this site. The primary regulation used to encourage site assessment and remediation is CCR Title 23, Article 11. This state regulation requires abatement of unauthorized releases, thorough assessment of the extent of contamination from a release and implementation of a corrective action. The most common and easily applied state guidance document used to design ground water investigations is the Tri-Regional Guidelines discussed in Section 2.3 above. This document stipulates that, in situations where existing site data indicates that a release has occurred, at least one ground water monitoring well must be installed in the down gradient direction from the release point. The procedures to be followed in establishing risk-based cleanup goals for both soil and ground water are outlined in standards published by ASTM. Finally, the Non-Attainment Policy is described in a draft memorandum entitled "Implementation of Alternative Compliance Points for Ground Water Cleanup:" published in July 1994 by the RWQCB - SFBR.

2.5 Soil Gas Survey Results

As requested in a letter from Telacu Carpenter to PHR dated June 14, 1995, based on an Environmental Report Evaluation prepared by the RTC, the soil gas survey for this site was canceled. The survey was therefore not performed.

3 SAMPLE PLAN DESIGN

3.1 Data Quality Objectives

Data Quality Objectives are developed based on the level of uncertainty that the decision maker in an environmental assessment or remediation project is willing to accept. Data quality will affect the following factors that are important inputs to our remediation cost evaluation:

- Extent of soil and ground water contamination
- Soil properties, especially soil grain size and site stratigraphy,
- Aquifer properties.

Since contaminant distribution data developed from soil sampling is subject to considerable natural variability, the contaminant distribution assessment developed from the soil chemistry data will also involve considerable variability. We intend to reduce the variability as much as possible by maintaining strict QA/QC for all soil sample collection, storage and transport procedures. Our QA/QC procedures are discussed in detail in Section 4.2 below. The variability of ground water quality data developed from properly constructed, developed and sampled monitoring wells is considerably less than that for soil data. Therefore, the contaminant distribution calculations and the ground water remediation costs developed from the well data will be more accurate. Our strict QA/QC procedures for well installation, development and sampling will further increase the accuracy of these calculations.

Since soil properties affect remediation technology selection and the ease of contaminant removal, it is important to accurately characterize site stratigraphy and grain size and distribution during drilling of the soil borings. We will maximize the accuracy of our soil and ground water remediation cost estimates by locating the soil borings appropriately, by collecting and logging at least 1.5 ft of each 5 ft soil column encountered during drilling and by maintaining an accurate log of the soil properties. Our soil characterization procedures are described in Section 3.4 below.

The design and operation of ground water extraction and other remediation techniques are also affected by aquifer properties, and therefore the results of the proposed aquifer slug testing will influence our remediation cost estimates. However, our experience has shown that the results of these short term field tests provide only limited assistance in designing insitu remediation systems. Therefore, we intend to design and conduct the tests primarily to determine the spatial variability of aquifer properties.

3.2 Statistical Sampling Methodology

Geostatistical analysis will be performed to estimate the extent of released hydrocarbons in the subsurface. The existing data presented with the RFP documents as well as the new data generated by the activities described in this workplan will be used as inputs to this statistical analysis. The analysis will quantify the horizontal distribution and maximum and minimum variability of key indicator compounds such as TPHg and benzene.

The geostatistical analysis will assist in the development of variograms used to predict the expected hydrocarbon (and possibly other compound) concentrations at various areas at the site. Because hydrocarbon migration characteristics vary according to direction from the source area (ie. maximum migration usually occurs in the direction of the ground water flow direction) the variograms will represent hydrocarbon distribution in the southwest (down gradient), northeast (up gradient), northwest and southeast (both cross gradient) directions from the highest prior sampling results along Montell Street. Log transforms of all available chemical data will be used to develop the variograms.

The extent of hydrocarbon-impacted soils will be estimated using the following procedures:

- The site will be subdivided into three layers of 20-ft by 20-ft horizontal blocks. Three layers are appropriate for this site because the approximate 10 ft ground water depth creates three separate zones characterized by distinct hydrocarbon migration mechanisms. The shallow zone (0-4 ft depth) would contain compounds released by low-volume surface spills. The middle zone (4 to 8 ft depth) would contain vertically-distributed compounds resulting from more substantial releases. The deepest zone (8 to 12 ft depth) would show horizontally-distributed hydrocarbons emplaced by hydrocarbons migrating with ground water parallel to the local ground water

gradient. Based on the approximate 12,000 sq ft area of the site, the subdivision will create 90 blocks.

- Using the parameters derived from the variograms, kriging will be used to predict the hydrocarbon concentration in each of the 90 blocks, using a target 80% confidence level.

- The volume of hydrocarbon-impacted soil will then be estimated from the predicted concentrations. The values assigned to each of the 90 blocks will be contoured using isopleths for each of the three levels described above. The area of soil inside each isopleth will then be calculated to estimate the volume of soil needing treatment or disposal.

Since the confidence level of a predicted concentration decreases proportionally with the distance from the predicted value to the location of the nearest actual sample, the accuracy of the above-described modeling effort will be dependant on the placement of our proposed boring locations relative to the source areas. Therefore, it is possible that additional sampling may be needed after the modeling effort is complete to "fill in" areas with low confidence levels.

3.3 Sample Areas and Locations

Since the actual hydrocarbon source (the former tanks) is apparently covered by the existing building, we are able only to drill borings around the perimeter of the suspected source. Based on our experience and on the site layout, we recommend that 31 soil samples be analyzed for the upcoming investigation. One to two samples should be collected and analyzed from each of the 14 proposed borings and six proposed borings drilled for monitoring well installation (20 boreholes total). Our proposed boring locations are shown in Figure 1. We estimate that each boring will be drilled to at least 10 ft depth, and to two ft below the water table.

Our recommended ground water sampling plan is based on our professional judgement developed from conducting more than 300 UST assessments since 1986. In our experience, dissolved hydrocarbon plumes from older leaks rarely extend more than about 60 ft down gradient of the source, especially where concentrations in ground water at the source areas are relatively low and where oxygen levels in soil are probably high. Based on the available data for the subject site, we estimate that hydrocarbons in ground water extend no more than about 60 ft down gradient of boring FNBO-5 (the closest access we have to the apparent source) and no more than about 30 ft cross gradient from boring FNBO-5 (Figures 3 and 4). Based on this estimated distribution, we recommend the installation of six ground water monitoring wells to characterize the extent of dissolved hydrocarbons and to provide suitable measurement points for the aquifer slug testing described in Section 5 below. Our proposed monitoring well locations are shown in Figure 1.

Our recommended ground water sampling locations are based on a 60 ft maximum dissolved hydrocarbon migration and on a southwestward ground water flow direction. The well installation layout indicated on Figure 1 provides for the installation of two source area wells (MW-1 and MW-2), two cross gradient wells (MW-3 and 4), one down gradient plume boundary well (MW-5) and one up gradient well (MW-6). Assuming that our estimated hydrocarbon distribution and assumed ground water flow direction proves accurate, this layout should completely define the horizontal distribution of released hydrocarbons in a single investigation phase. Our recommendation for this number and location of wells is also based on the need for adequate spatial coverage for the aquifer slug tests described in Section 5 below.

3.4 Sampling Equipment and Procedures

Vertical and Horizontal Sample Locations

The vertical location of each soil sample is determined by measuring the distance from the middle of the soil sample tube to the end of the drive rod used to advance the split barrel sampler. Recorded sample elevations will be referenced to the surveyed onsite monument of record. The horizontal location of each boring will be measured in the field from an onsite permanent reference using a measuring wheel or tape measure.

Drilling and Sampling Methods

Soil Boring and Sampling: Soil borings will be drilled using hollow-stem augers or hydraulic push samplers. At least one and one-half ft of the soil column will be collected for every five ft of drilled depth. Additional soil samples will be collected near the water table and at lithologic changes. Samples will be collected using lined split-barrel or equivalent samplers driven into undisturbed sediments beyond the bottom of the borehole. Borings not completed as wells will be filled to the ground surface with cement grout poured or pumped through a tremie pipe.

Monitoring Well Installation: Ground water monitoring wells will be installed to monitor ground water quality and determine the ground water elevation, flow direction and gradient. Well depths and screen lengths will be based on the encountered ground water depth, occurrence of hydrocarbons or other compounds in the borehole and stratigraphy. Well screens will extend 10 to 15 ft below and 5 ft above the static water level at the time of drilling. However, the well screen will not extend into or through a clay layer that is at least three ft thick.

Well casing and screen will be 4 inch diameter, flush-threaded, Schedule 40 PVC. The screen slot size will depend on the sediments encountered, but slots are generally 0.010 or 0.020 inches wide. A rinsed and graded sand will occupy the annular space between the boring and the well screen to about one to two ft above the well screen. A two-ft-thick hydrated bentonite seal will separate the sand from the overlying sanitary surface seal composed of Portland type I,II cement.

Well-heads will be secured by locking well-caps inside traffic-rated vaults finished flush with the ground surface. The well top-of-casing elevation will be surveyed with respect to mean sea level and the well will be surveyed for horizontal location with respect to an onsite or nearby offsite landmark.

Well Development: The installed wells will be developed using a combination of ground water surging and extraction. Surging agitates the ground water and dislodges fine sediments from the sand pack. After about ten minutes of surging, ground water will be extracted from the well using bailing, pumping and/or reverse air-lifting through an eductor pipe to remove the sediments from the well. Surging and extraction will continue until at least ten well-casing volumes of ground water are extracted and the sediment volume in the ground water is negligible. This process usually will occur prior to installing the sanitary surface seal to ensure sand pack stabilization.

All equipment is steam-cleaned prior to use and air used for air-lifting is filtered to prevent oil entrained in the compressed air from entering the well. Wells that are developed using air-lift evacuation are not sampled until at least 24 hours after they are developed.

Ground Water Sampling: Three to four well-casing volumes of ground water will be purged prior to sampling. Purging will also continue until ground water pH, conductivity, and temperature have stabilized. Ground water

samples will be collected using bailers or pumps and are decanted into the appropriate containers supplied by the analytic laboratory.

Documentation of Field Activities

Cambria's field personnel will maintain a rigorous field log that documents all important aspects of the field work performed. The field log will, among other things, document equipment calibration and cleaning, document weather conditions, identify all field personnel, document the execution of QA/QC procedures and record the quantities of materials used during the sampling. It will also document the arrival and departure times of *Cambria*'s field personnel, subcontractors and other concerned personnel and record miscellaneous items needed for invoicing (mileage, truck usage, materials purchasing, etc.).

Soil Classification/Logging

All soil samples are classified according to the Unified Soil Classification System by a trained geologist or engineer working under the supervision of a California Registered Geologist (RG) or a Certified Engineering Geologist (CEG). The following soil properties are noted for each soil sample:

- Principal and secondary grain size category (i.e. sand, silt, clay or gravel)
- Approximate percentage of each grain size category
- Color
- Approximate water or product saturation percentage
- Observed odor and/or discoloration
- Other significant observations (i.e. cementation, presence of marker horizons, mineralogy)
- Estimated permeability

Equipment Decontamination

Drilling and sampling equipment is steam-cleaned prior to drilling and between borings to prevent cross-contamination. Sampling equipment is washed between samples with trisodium phosphate or an equivalent EPA-approved detergent.

Sample Preservation, Storage, Handling and Transport

Soil sampling tubes chosen for analysis will be trimmed of excess soil and capped with Teflon tape and plastic end caps. Soil samples will be labeled and stored at or below 4°C on either crushed or dry ice, depending upon local regulations. The samples will be transported under chain-of-custody to a State-certified analytic laboratory. Water sample containers will be preserved with dilute hydrochloric acid and will be labeled, placed in protective foam sleeves, stored on crushed ice at or below 4°C, and transported under chain-of-custody to the laboratory.

Duplicates and Blanks

Blind duplicate water samples will be collected for the monitoring well sampling program, at a rate of one blind sample for every 10 wells sampled. Laboratory-supplied trip blanks will be analyzed to check for cross-contamination caused by sample handling and transport. One trip blank will be analyzed for each sample container used during each sampling event. Two equipment blanks will be analyzed for each round of ground water sampling, since we anticipate the use of non-dedicated sampling equipment.

Waste Handling and Disposal

Soil cuttings from drilling activities will be stored onsite in drums. At least three individual soil samples will be collected from the drums for later compositing at the analytic laboratory. The composite sample will be analyzed for the same constituents analyzed in the borehole samples. Based on the composite analytic results, soil cuttings will be transported by licenced waste haulers and disposed in secure, licenced facilities designated by the client. Neither *Cambria* nor PHR will determine or recommend disposal procedures for wastes.

Ground water removed during well sampling and/or rinseate generated during decontamination procedures will be stored onsite in sealed 55 gallon drums. Each drum will be labeled with the drum number, date of generation, suspected contents, generator identification and consultant contact. Disposal of the water will be based on the analytic results for the well samples. The water will be either pumped out using a vacuum truck for transport to a licenced waste treatment/disposal facility or the individual drums will be picked up and transported to the waste facility where the drum contents will be removed and appropriately disposed.

4 SAMPLE ANALYSIS PLAN DESIGN

4.1 Target Analytes and Analytical Methods

We intend to analyze selected soil and ground water samples for the following compounds:

- TPHg by modified EPA Method 8015,
- Benzene, ethylbenzene, toluene and xylenes (BETX) by EPA Method 8020
- Volatile organics by EPA Method 8260
- Lead by EPA Method 7420
- and Total Recoverable Petroleum Hydrocarbons (TRPH) by EPA Method 418.1

We base this recommendation on the fact that only gasoline-range hydrocarbons and Oil and Grease were detected during the earlier sampling, and because only the above compounds are suspect at the site.

4.2 Laboratory Certification Documentation and QA/QC Procedures

Appropriate documentation of the State certification for NET Pacific of Santa Rosa, California, our chosen analytical subcontractor, will be provided as an appendix to our final report. Laboratory QA/QC will conform to EPA and California State procedures will include, at a minimum, calibration standard maintenance and method blank, matrix spike, matrix spike duplicate and laboratory control sample analyses. Reports of each of these procedures will be included as an appendix to our draft and final investigation reports.

4.3 Chemical Data Reporting

Our investigation report will include comprehensive data summary tables that present the results of all chemical analyses conducted, including the results of the field screening analyses and the laboratory analytic results. The data tables will identify the date and depth of sample collection, the analytic method used for the analysis, as well as other appropriate information such as the ground water depth at the time of sampling and the occurrence of unexpected compounds in the analytic chromatograms. Laboratory analytic reports and data tables from the aquifer testing will be presented as appendices to our report.

5 AQUIFER TEST PLAN

We propose to conduct the aquifer testing using a "slug test" procedure from three individual wells. Our procedures for this testing are as follows:

1) Measure water levels in all site wells before beginning the test.

2) Place pressure transducer at the bottom of the test well, recording the data produced on a data logger.

3) After establishing a reliable water level baseline, drop a weighted solid casing into the well to produce an instantaneous hydraulic head increase.

4) Monitor the water level declines using the pressure transducers. Data collection will occur approximately once every 30 seconds for the first five minutes of the test, once per minute for the next 15 minutes, and once every five minutes for the remainder of the test.

We propose to perform this procedure on wells MW-1, MW-2 and MW-5 to provide optimal onsite areal coverage. The above procedure will be repeated for each well.

6 DATA ANALYSIS PLAN

Following the execution of the field investigation and collection of soil and ground water samples, we will analyze the collected data to estimate, 1) the approximate quantity of soils contaminated above regulatory limits, 2) the extent of ground water contamination, and 3) aquifer characteristics including the actual ground water flow direction and velocity. This information will then be used to develop remediation cost estimates for both soil and ground water.

6.1 Data Analysis and Evaluation Methods and Procedures

We will measure the top-of-casing elevation of the installed wells and the water levels after the wells equilibrate following well development. We will then calculate the ground water flow direction and gradient.

Depending on the quality and variability of additional data collected during the field investigation, we will analyze the chemical data using either a geostatistical approach or an alternate method that uses contouring (most likely using geostatistical contouring software such as "Surfer") of soil chemistry data to estimate soil volumes.

If a geostatistical methodology is used, we intend to analyze the contaminant distribution data using variograms and kriging of key parameters. Several variograms will be developed to predict the distribution of hydrocarbons in soil parallel and perpendicular to the actual ground water flow direction. Key values from the variograms will then be used as inputs to a kriging analysis.

The collected data will be analyzed by computer generated contour plots illustrating the horizontal distribution of one or more key chemical parameters. Based on the available data, it is likely that we will use either TPHg or benzene data. The isopleth contour maps will illustrate the contaminant distribution at 5 ft depth and immediately above the water table. These isopleth contours will be used to generate the soil volume estimates.

The test data produced from the aquifer slug tests will be tabulated and then analyzed using either the Horslev or Bouwer-Rice method, both of which are appropriate for the analysis of data derived from tests of unconfined (water table) aquifers. As discussed in Section 3.1, the principal objective of the slug testing is to determine the spatial variability of hydraulic conductivity, the most important aquifer property for the purposes of site remediation.

6.2 Tables and Figures

The soil and ground water investigation report will include tabulated analytic results for all analysis performed and figures depicting the site layout, site stratigraphy, boring and well locations and isopleth contours for TPHg and benzene in both soil and ground water. Pump test data, laboratory analytic reports and QA/QC documentation and chain of custody documents will be presented as appendices.

7 REPORT FORMAT

We will prepare a final subsurface investigation/remediation cost estimate report that will contain:

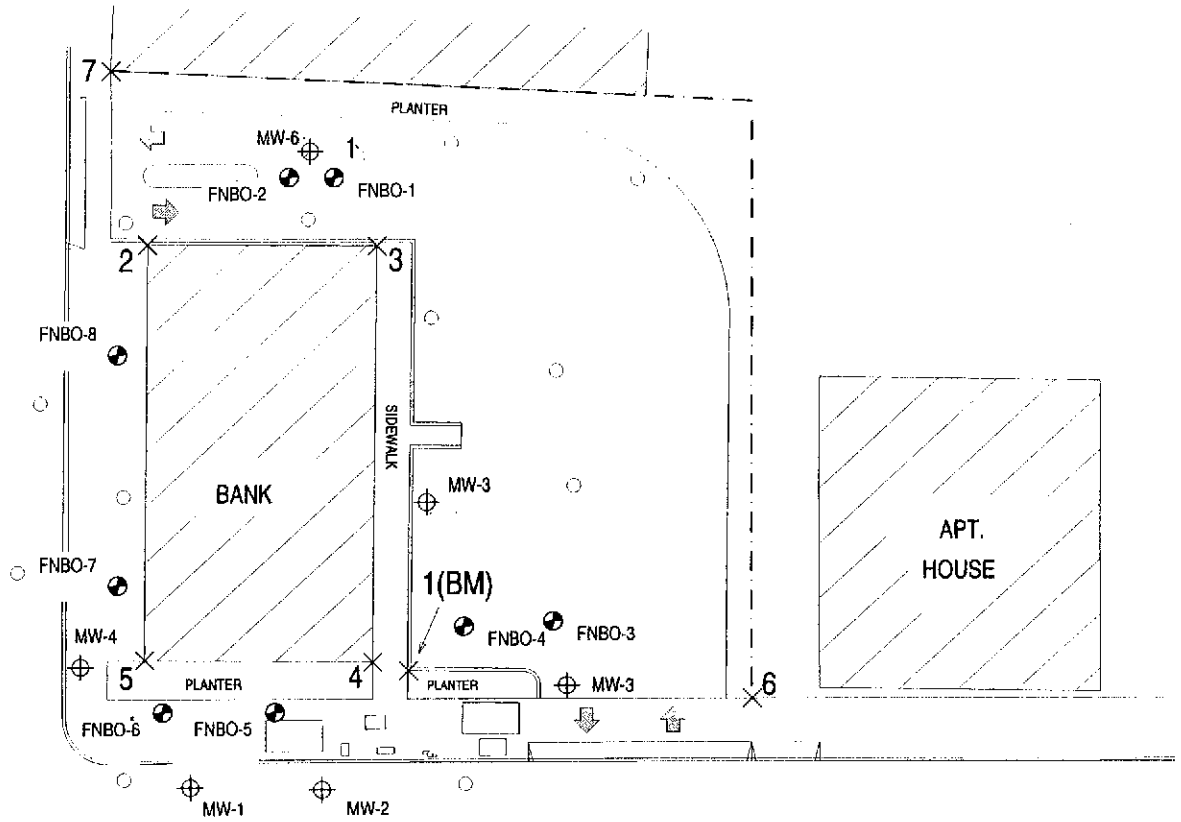
- Rationale for the soil boring and well locations,
- Descriptions of the boring and well installation and sampling methods,
- Descriptions of the hydraulic test procedures and results,
- Statistical data analysis procedures and results,
- Descriptions of our recommended remedial approach for site cleanup including a detailed discussions of probable agency soil and ground water cleanup goals,
- Detailed cost estimates for our recommended remedial approach including cost ranges for system installation and operation,
- Tabulated analytic results for both soil and ground water,
- Boring logs and well construction diagrams,
- Chain of custody documents and laboratory analytic reports,
- Quality Assurance and Control. All data will be evaluated to confirm compliance with RTC and industry standards.

8 SCHEDULE

We will begin the boring/well installation permitting process once we receive authorization from Telacu/Carpenter and the RTC. Since permits can generally be secured within one week of submittal, we should be able to begin the field investigation within two weeks of receipt of authorization. Two copies of the draft investigation report will be submitted to Telacu/Carpenter within 5 weeks following completion of the ground water sampling.

9 HEALTH AND SAFETY PLAN

Our site specific Health and Safety plan that includes hazard reduction procedures and routes to the nearest hospital with a trauma ward is included as Attachment A. The safety plan will be reviewed daily by all field personnel.



CAMBRIA
Environmental Technology, Inc.

EXPLANATION

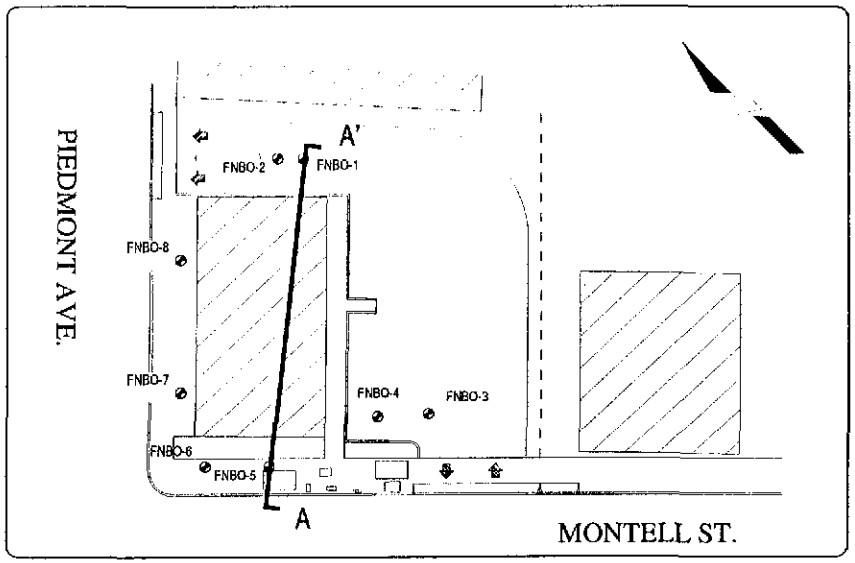
- FNBO-7 (350) — PREVIOUSLY DRILLED SOIL BORING (WITH TPHg CONCENTRATIONS - ppm)
- PROPOSED WELL
- PROPOSED SOIL BORING
- PROPERTY LINE
- 5 — SURVEY POINT AND IDENTIFICATION

Soil Boring and Monitoring Well Locations

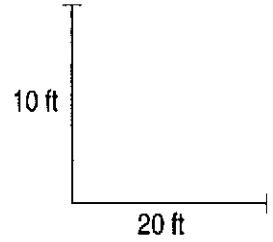
First Nationwide Bank
3900 Piedmont Avenue
Oakland, California

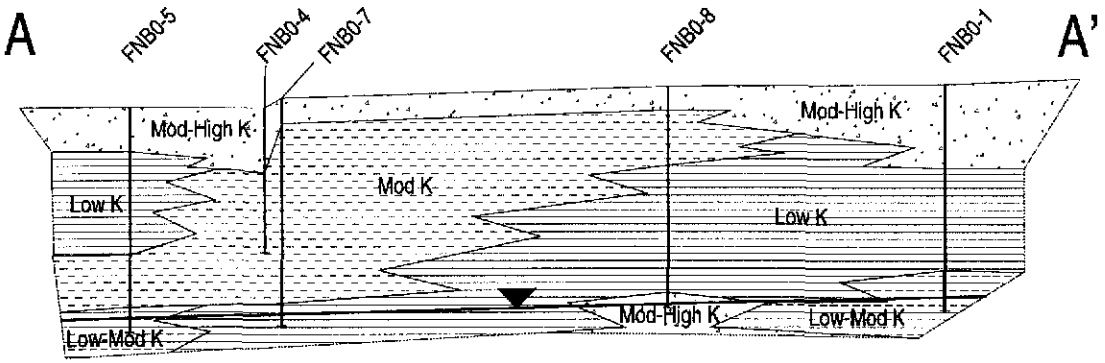
F:/PROJECT/PHR/PIED-R12

FIGURE
1



Cross-Section Location Map





CAMBRIA
Environmental Technology, Inc.

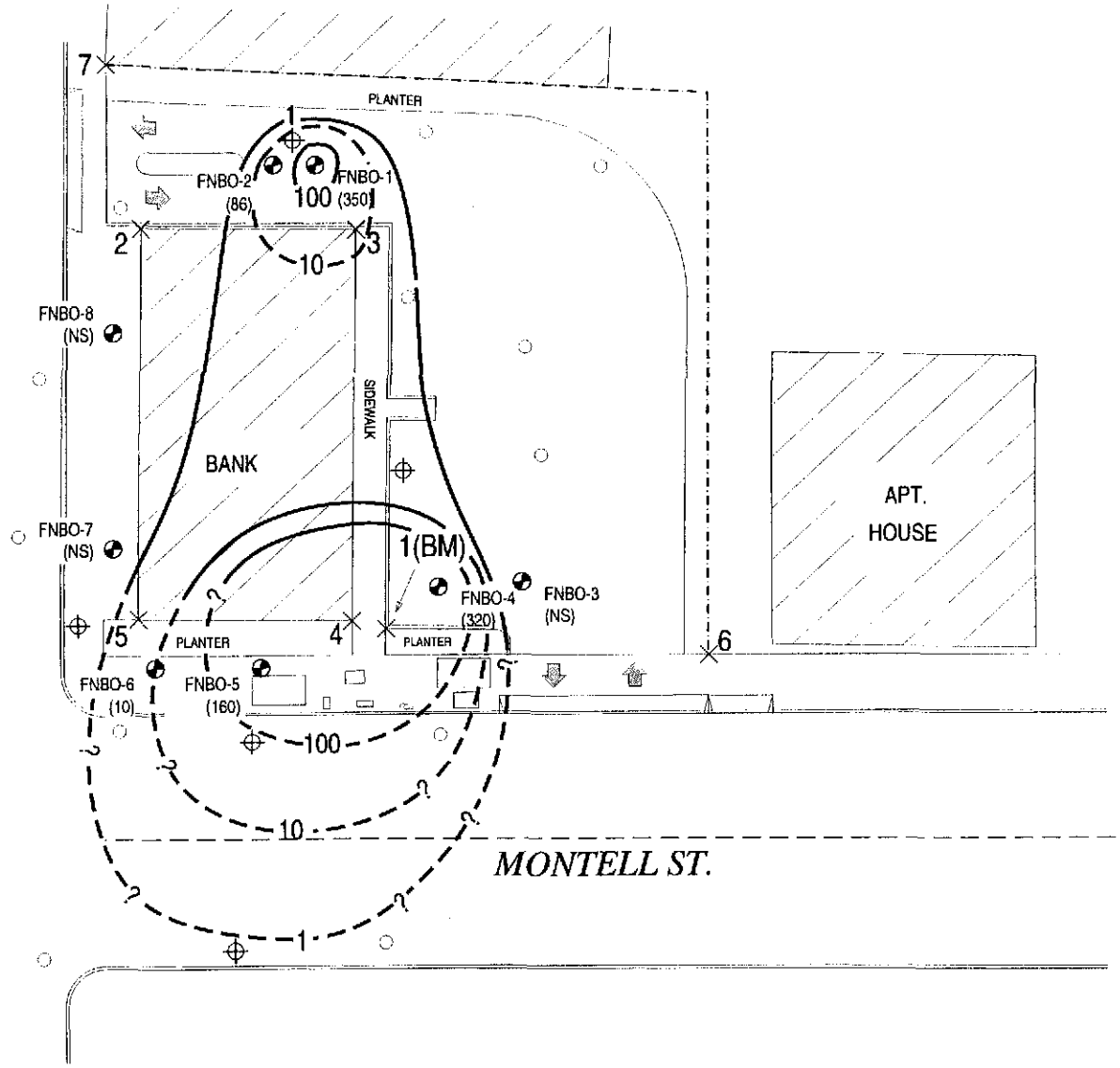
EXPLANATION

- Low permeability sediments
- Low to moderate permeability sediments
- Moderate permeability sediments
- Moderate to high permeability sediments

Cross-Section A-A'

3900 Piedmont Avenue
Oakland, California

FIGURE
2



BASE-MAP

CAMBRIA
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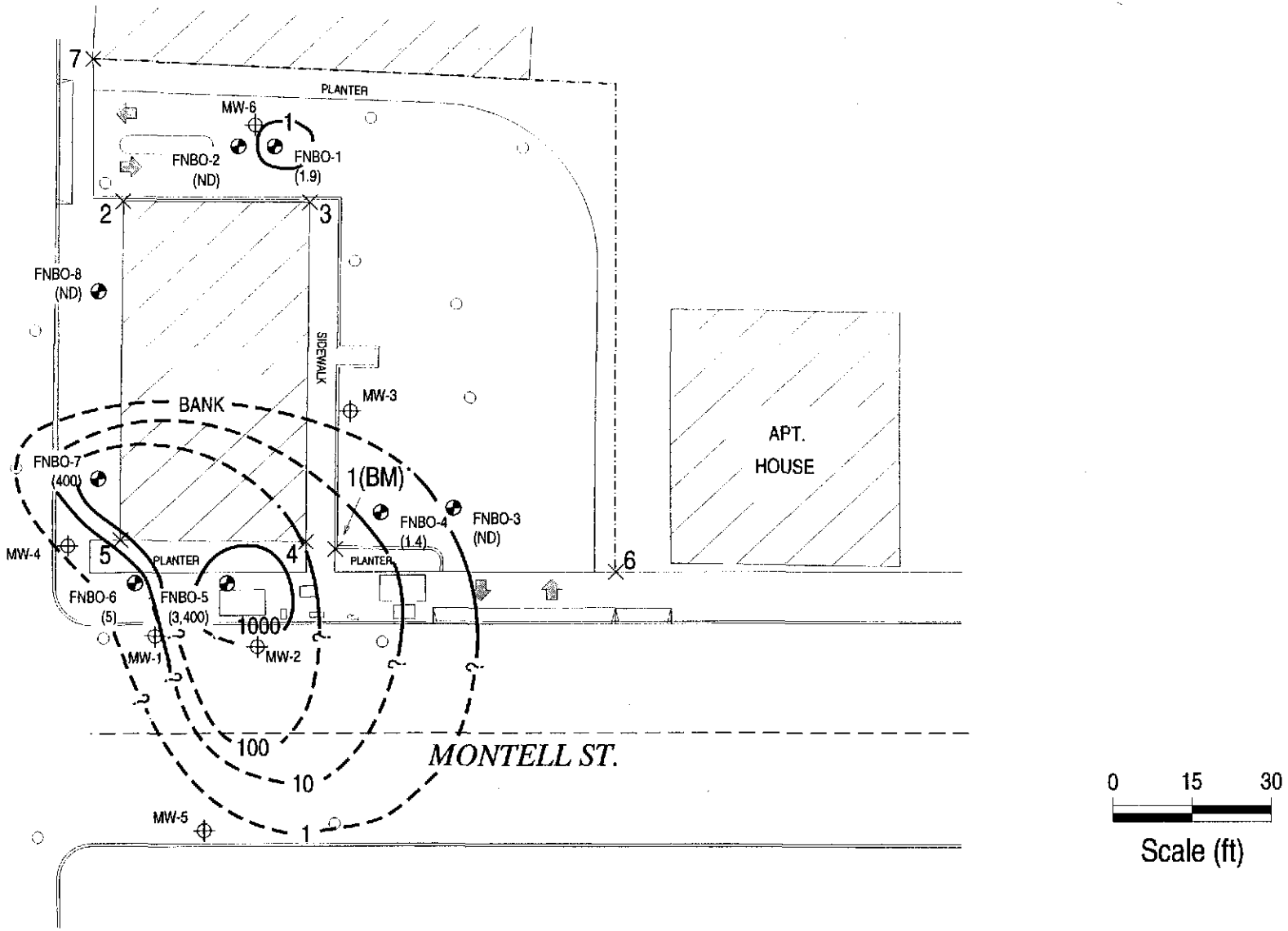
EXPLANATION

- FNBO-7 (350) — PREVIOUSLY DRILLED SOIL BORING (WITH TRPH CONCENTRATIONS - ppm)
- PROPOSED WELL
- PROPOSED SOIL BORING
- PROPERTY LINE
- 5 — SURVEY POINT AND IDENTIFICATION

Estimated Distribution of TRPH in Soil
Between 5 and 11 ft Depths
First Nationwide Bank
3900 Piedmont Avenue
Oakland, California F:/PROJECT/PHR/TRPH

FIGURE
3



CAMBRIA
Environmental Technology, Inc.

EXPLANATION

- FNBO-7 (350) — PREVIOUSLY DRILLED SOIL BORING (WITH TPHg CONCENTRATIONS - ppm)
- PROPOSED WELL
- PROPOSED SOIL BORING
- PROPERTY LINE
- 5 — SURVEY POINT AND IDENTIFICATION

Estimated Distribution of TPHg in Soil
Between 5 and 11 ft Depths
First Nationwide Bank
3900 Piedmont Avenue
Oakland, California

F:/PROJECT/PHR/PIED-R12

FIGURE
4

Table 1. Soil and Ground Water Analytic Data, Homestead Federal Savings, 3900 Piedmont Avenue, Oakland, California

Boring ID	Depth	Date Sampled	TRPH	VOCs	TPHg	TPHd	Benzene	Toluene	Ethylbenzene	Xylenes
							(Concentration in ppm, mg/kg or mg/l)			
Soil Samples										
FNBO-1	10.5	10/20/93	350	ND	1.9[a]	ND	ND	ND	ND	ND
FNBO-2	10	10/20/93	86	ND	ND	ND	ND	ND	ND	ND
FNBO-3	10.5	10/20/93	NA	NA	ND	ND	ND	ND	ND	ND
FNBO-4	6	10/20/93	320	ND	1.4	ND	ND	ND	ND	ND
FNBO-5	6	10/21/93	NA	NA	3,400	ND	ND	ND	19	7.5
FNBO-5	10	10/21/93	160	ND	15	ND	0.03	ND	0.31	0.12
FNBO-6	5.5	10/21/93	NA	NA	5.0[a]	ND	ND	ND	ND	ND
FNBO-6	10	10/21/93	10	ND	3.6[b]	ND	ND	ND	0.034	0.041
FNBO-7	6	10/21/93	NA	NA	350[b]	ND	ND	ND	ND	ND
FNBO-7	11	10/21/93	NA	NA	400[b]	ND	1.0	1.5	5.0	13
FNBO-8	11	10/21/93	NA	NA	ND	ND	ND	ND	ND	ND
Ground Water Sample										
FNBO-6		10/21/93	3	c	7.8	NA	0.0077	0.021	0.26	0.26

Table 1. Soil and Ground Water Analytic Data, Homestead Federal Savings, 3900 Piedmont Avenue, Oakland, California

Abbreviations

TRPH = Total recoverable petroleum hydrocarbons by EPA method 418.1
TPHg = Total petroleum hydrocarbons as gasoline by modified EPA Method 8260
TPHd = Total petroleum hydrocarbons as diesel by modified EPA Method 8260
VOCs = Volatile organic compounds by EPA method 8260
ND = No compounds detected above laboratory detection limit
NA = Not analyzed

Benzene by EPA Method 8260
Ethylbenzene by EPA Method 8260
Toluene by EPA Method 8260
Xylenes by EPA Method 8260

Notes:

All soil and ground water samples collected by Environmental Science and Engineering of Concord California

a = Quantified as light petroleum distillates.
b = Quantified as gasoline and light petroleum distillates
c = 0.03 ppm acetone and 0.035 ppm carbon disulfide detected Notes

CAMBRIA ENVIRONMENTAL TECHNOLOGY INC.

SITE SAFETY PLAN

Date: 6/28/95 Project Number: 53-187-03

A. SITE DESCRIPTION

Client: Telacu/Carpenter
Site Address: 3900 Piedmont Avenue
Site Use/Conditions: Bank
Area Land Use: [X] Residential [X] Commercial [ ] Industrial [ ] Agricultural [ ] Other
Topography: [X] Flat [ ] Hilly [ ] Open Excavation [ ] Paved [ ] Unpaved [ ] Other
Weather Conditions: clear

B. WORK TO BE PERFORMED Soil Borings and Monitoring Well Installation

C. ON SITE CONTROL

A safe perimeter has been established. The boundaries are defined by: [X] Tape [X] Cones [ ] fence [ ] Other
The Contamination Reduction Zone is designated as: Area adjacent to drill rig
The Support Zone is designated as: area adjacent to Cambria Vehicle

CHEMICAL HAZARD EVALUATION

Suspected or known concentrations of the following compounds are expected at the site:

Compound	Free Product (thickness)	Ambient Air Conc.	Soil Conc.	Water Conc.	TWA	IDLH
Gasoline	NA		350/3400 ppm	7,800ppb	NA	NA
Diesel	NA		NA	NA	NA	
Benzene	NA		1.0 ppm	7.7ppb	10ppmv	carcinogen
Acetone	NA		ND	30ppb	750ppmv	20,000 ppmv

[X] Applicable material safety data sheets (MSDS) are attached.
[ ] Vapor-phase concentrations may exceed 10% of the lower explosive limit (LEL).
[ ] Vapor-phase concentrations may exceed OSHA PEL or 8-hour TWA for the following compounds:

PHYSICAL HAZARD EVALUATION

[X] Underground utilities and or process lines have been identified. An underground line detector survey is [X], is not [ ] required.
[X] Personnel are aware of the safety hazards associated with lifting heavy objects, moving machinery and equipment, slipping, falling and operating or working near electrical equipment.
[ ] Confined space entry is [ ], is not [X] required. If required, a confined entry checklist is attached and proper confined space entry procedures will be followed.

AIR QUALITY MONITORING

	Instrument	Monitoring Intervals
[X]	PID	Hourly or at odor detection
[ ]	FID	
[X]	LEL Meter	
[X]	Colorimetric tubes	As needed

Substance	Concentration Ranges	Pump Strokes
benzene	1-25 ppm	50

PERSONAL PROTECTIVE EQUIPMENT

The required personal protective equipment level is: [ ] A, [ ] B, [ ] C, [X] D.

Specific protective equipment required: gloves steeltoed boots hardhat
Protective clothing required: longsleeved shirt and pants
Respiratory equipment required: half face mask
Cartridge type: organic vapor
This cartridge is expected to provide protection for 8 hrs
[X] All site personnel have been trained in the use of protective equipment

DECONTAMINATION PROCEDURES

Personnel and equipment shall be decontaminated as follows: [X] Wash and rinse all exposed skin and equipment.
[ ] Other: _____

HEAT STRESS MONITORING

The anticipated air temperature is 70 degrees F.
Adjusted air temperature [Tadj. Tair (fo) + (13 X % Sunshine)] is not expected to exceed 80 degrees F.

[ ] A Health Alert Warning (temperature over 95 degrees F) has been issued by the weather service.

[X] Workers are trained to recognize and treat heat stress symptoms. The site safety officer will monitor pulse and temperature of workers showing signs of heat stress. No person shall work with a temperature exceeding 100 degrees F.

[X] Drinking water is available at: Cambria Vehicle

EMERGENCY PROCEDURES

Injury: The Site Safety Officer and Project Team Leader should evaluate the injury and contact an ambulance and/or the designated medical facility as needed. An incident report form should be filed for any injury.

Fire/Explosion: All personnel should immediately move to a safe location away from threat of fire and/or explosion. Sound alarm if available and call fire department.

Emergency escape route and meeting place: Immediately across Piedmont Avenue

EMERGENCY MEDICAL FACILITIES

Hospital name and location: Kaiser Hospital, Howe and MacArthur
Hospital phone number: 596-1000
A map to the hospital is attached.
a first aid kit, eye wash and other emergency equipment is located in the Site Safety Officer's vehicle.

*Police Number:*911
Office Number:911

Fire Number:911
Client Number: 714-263-4559

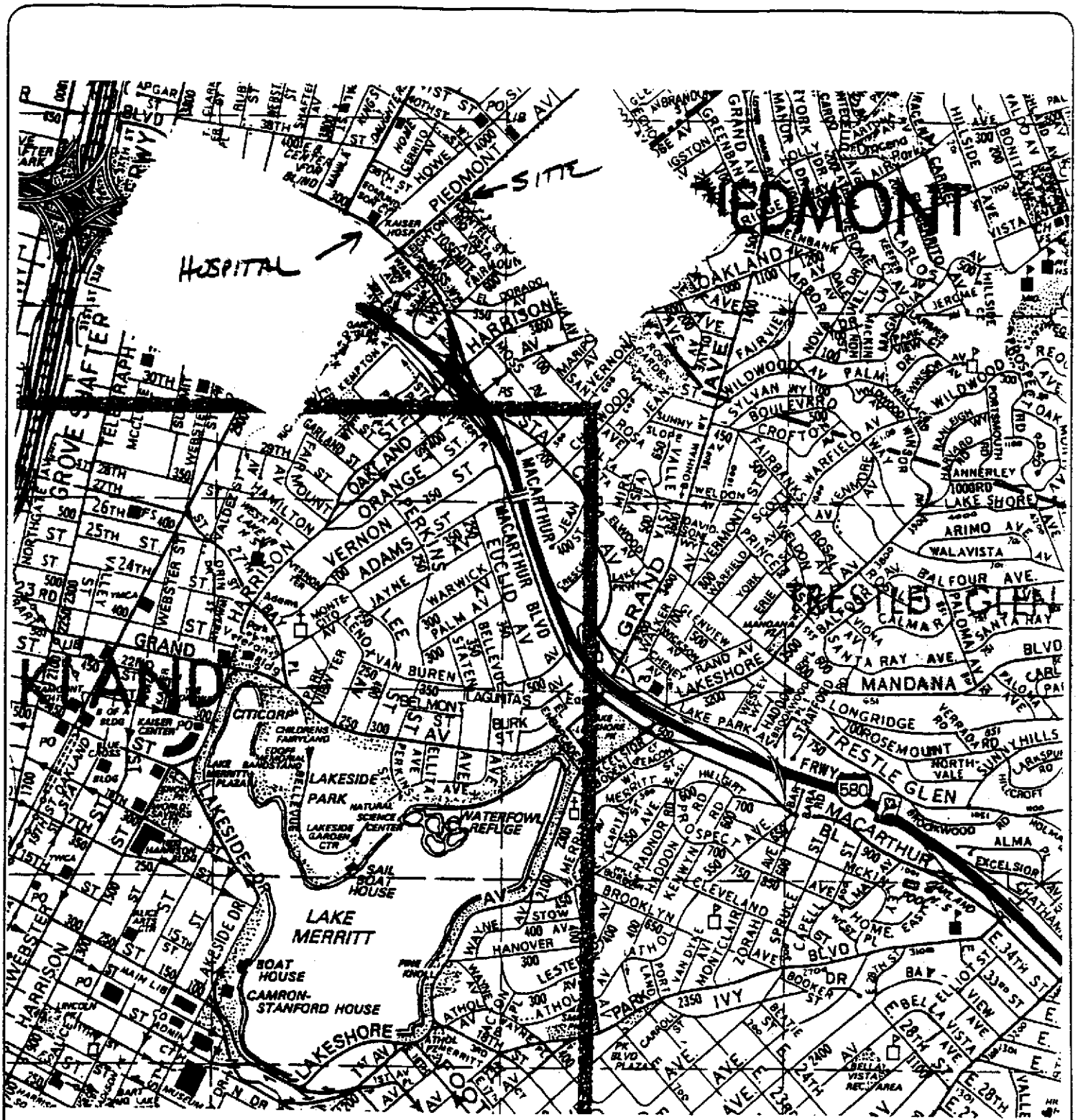
Any injury sustained while working are covered under Worker's Compensation insurance. Any injured Cambria employee should inform the medical care facility that this is a Worker's Compensation claim and that our insurance policy is _____. Copies of the doctor's report on the injury should be forwarded to our insurance carrier at Blue Shield. Cambria employees must notify N. Scott Macleod on the same day so that we can properly file this claim.

Any injured sub-contractor or sub-contractor employee will be covered under their employer's policy.

Emergency medical treatment due to chemical exposure to compounds anticipated to be at the site is presented on the attached MSDS forms.

All site workers have read the plan and are familiar with and will abide by its provisions.

	Name	Signature
Project Team Leader		
Site Safety Officer		
Field Team Leader		
Field Team Member		
Field Team Member		
Reviewed by Industrial Hygienist	Catherine S Lewis CIH	



CAMBRIA
Environmental Technology, Inc.

3900 Piedmont Ave
Homestead Federal Savings
Oakland, California

Hospital Location

FIGURE
1

GASOLINES: AUTOMOTIVE (<4.23g lead/gal)

GAT

Common Synonyms	Watery liquid	Colorless to pale brown or pink	Gasoline odor
Motor spirit Petrol	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness, headache, difficult breathing or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea or vomiting.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Disperse and flush

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures
3.2 Formula: (Mixture of hydrocarbons)
3.3 IMO/UN Designation: 3.1/1203
3.4 DOT ID No.: 1203
3.5 CAS Registry No.: Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless to brown
4.3 Odor: Gasoline

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective goggles, gloves.
5.2 Symptoms Following Exposure: Irritation of mucous membranes and stimulation followed by depression of central nervous system. Breathing of vapor may also cause dizziness, headache, and incoordination or, in more severe cases, anesthesia, coma, and respiratory arrest. If liquid enters lungs, it will cause severe irritation, coughing, gagging, pulmonary edema, and, later, signs of bronchopneumonia and pneumonitis. Swallowing may cause irregular heartbeat.
5.3 Treatment of Exposure: INHALATION: maintain respiration and administer oxygen; endorse bed rest if liquid is in lungs. INGESTION: do NOT induce vomiting; stomach should be lavaged (by doctor) if appreciable quantity is swallowed. EYES: wash with copious quantity of water. SKIN: wipe off and wash with soap and water.
5.4 Threshold Limit Value: 300 ppm
5.5 Short Term Inhalation Limits: 500 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{Lo} = 0.5 to 5 g/kg.
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If soaked on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.25 ppm
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: —36°F C.C.
6.2 Flammable Limits in Air: 1.4%-7.4%
6.3 Fire Extinguishing Agents: Foam, carbon dioxide, dry chemical
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: None
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 853°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 4 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 33

8. WATER POLLUTION

8.1 Aquatic Toxicity:
90 ppm/24 hr/juvenile American shad/TL_m/fresh water
91 mg/l/24 hr/juvenile American shad/TL_m/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 8%, 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Various octane ratings; military specifications
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-V-W

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations:
Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	0
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm:
140—390°F
= 60—199°C = 333—472°K
12.4 Freezing Point: Not pertinent
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity:
0.7321 at 20°C (liquid)
12.8 Liquid Surface Tension:
19-23 dynes/cm
= 0.019—0.023 N/m at 20°C
12.9 Liquid Water Interfacial Tension:
48-51 dynes/cm
= 0.048—0.051 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 3.4
12.11 Ratio of Specific Heats of Vapor (Gas): (est.) 1.054
12.12 Latent Heat of Vaporization:
130—150 Btu/lb = 71—81 cal/g
= 3.0 — 3.4 X 10^5 J/kg
12.13 Heat of Combustion: —18,720 Btu/lb
= —10,400 cal/g = 435.1 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 7.4 psia

NOTES

GAT GASOLINES: AUTOMOTIVE (<4.23g lead/gal)

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
45	46.270
50	46.130
55	46.000
60	45.850
65	45.710
70	45.560
75	45.400
80	45.240
85	45.080
90	44.910
95	44.750
100	44.570
105	44.390
110	44.210
115	44.030

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
10	.459
15	.462
20	.464
25	.467
30	.470
35	.472
40	.475
45	.478
50	.480
55	.483
60	.486
65	.488
70	.491
75	.494
80	.496
85	.499
90	.502
95	.504
100	.507
105	.510

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F (estimate)
40	.909
50	.900
60	.891
70	.883
80	.874
90	.865
100	.856
110	.847
120	.838
130	.829
140	.821
150	.812
160	.803
170	.794
180	.785
190	.776

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
46	.521
48	.514
50	.507
52	.500
54	.494
56	.487
58	.481
60	.475
62	.469
64	.463
66	.457
68	.451
70	.446
72	.440
74	.435
76	.430
78	.424
80	.419
82	.414
84	.410
86	.405
88	.400
90	.396
92	.391
94	.387
96	.382

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
	INSOLUBLE

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
	DATA NOT AVAILABLE

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
	NOT PERTINENT

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
	DATA NOT AVAILABLE

OILS, MISCELLANEOUS: MOTOR

OMT

Common Synonyms	Oily liquid	Yellow-brown	Lube oil odor
Crankcase oil Lubricating oil Transmission oil	Floats on water.		

Stop discharge if possible.
Call fire department.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Extinguish with dry chemical, foam or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures
3.2 Formula: Not applicable
3.3 IMO/UN Designation: 3.3/1270
3.4 DOT ID No.: 1270
3.5 CAS Registry No.: Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Yellow fluorescent
4.3 Odor: Characteristic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective gloves; goggles or face shield.
5.2 Symptoms Following Exposure: INGESTION: minimal gastrointestinal irritation; increased frequency of bowel passage may occur. ASPIRATION: pulmonary irritation is normally minimal but may become more severe several hours after exposure.
5.3 Treatment of Exposure: INGESTION: do NOT lavage or induce vomiting. ASPIRATION: treatment probably not required; delayed development of pulmonary irritation can be detected by serial chest x-rays. EYES: wash with copious amounts of water. SKIN: wipe off oil and wash with soap and water.
5.4 Threshold Limit Value: Data not available
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 1; LD_{50} = 5 to 15 g/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spread on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 275—600°F C.C.
6.2 Flammable Limits in Air: Data not available
6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 325—425°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 4 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 33

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Various viscosities
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Not listed
11.2 NFPA Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: Very high
12.4 Freezing Point: —29.0°F = —34.4°C = 238.8°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.84—0.96 at 15°C (liquid)
12.8 Liquid Surface Tension: 36-37.5 dynes/cm = 0.036—0.0375 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 33—54 dynes/cm = 0.033—0.054 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: —18,486 Btu/lb = —10,270 cal/g = —429.98 X 10^3 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.17 Heat of Fusion: Data not available
12.18 Limiting Value: Data not available
12.19 Reid Vapor Pressure: Data not available

NOTES

OMT

OILS, MISCELLANEOUS: MOTOR

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot (estimate)	Temperature (degrees F)	British thermal unit per pound-F (estimate)	Temperature (degrees F)	British thermal unit-inch per hour-square foot-F (estimate)	Temperature (degrees F)	Centipoise
50	52.430	50	.460	35	.920	100.42	275.000
52	52.430	52	.461	40	.919		
54	52.430	54	.462	45	.918		
56	52.430	56	.463	50	.917		
58	52.430	58	.464	55	.916		
60	52.430	60	.465	60	.915		
62	52.430	62	.466	65	.914		
64	52.430	64	.467	70	.913		
66	52.430	66	.468	75	.912		
68	52.430	68	.469	80	.911		
70	52.430	70	.470	85	.910		
72	52.430	72	.471	90	.909		
74	52.430	74	.472	95	.908		
76	52.430	76	.473	100	.907		
78	52.430	78	.474	105	.906		
80	52.430	80	.475	110	.905		
82	52.430	82	.476	115	.904		
84	52.430	84	.477	120	.903		
		86	.478				
		88	.479				
		90	.480				
		92	.481				
		94	.482				
		96	.483				
		98	.484				
		100	.485				

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch (estimate)	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	I	70	.042		N		N
	N	75	.049		O		O
	S	80	.057		T		T
	O	85	.065				
	L	90	.076		P		P
	U	95	.087		E		E
	B	100	.100		R		R
	L	105	.114		T		T
	E	110	.131		I		I
		115	.149		N		N
		120	.170		E		E
		125	.193		N		N
		130	.218		T		T
		135	.247				
		140	.279				
		145	.314				
		150	.352				
		155	.395				
		160	.443				
		165	.495				
		170	.552				
		175	.615				
		180	.683				
		185	.758				
		190	.841				
		195	.930				

BENZENE

BNZ

Common Synonyms	Watery liquid	Colorless	Gasoline-like odor
Benzol Benzole	Floats on water. Flammable, irritating vapor is produced. Freezing point is 42°F.		

Avoid contact with liquid and vapor. Keep people away.
Wear goggles and self-contained breathing apparatus.
Shut off ignition sources and call fire department.
Stop discharge if possible.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.

Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.
VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness.

Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.
LIQUID
Irritating to skin and eyes.
Harmful if swallowed.

Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-high flammability
Restrict access

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: C_6H_6
3.3 IMO/UN Designation: 3.2/1114
3.4 DOT ID No.: 1114
3.5 CAS Registry No.: 71-43-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Aromatic; rather pleasant aromatic odor; characteristic odor

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Hydrocarbon vapor canister, supplied air or a hose mask; hydrocarbon-insoluble rubber or plastic gloves; chemical goggles or face splash shield; hydrocarbon-insoluble apron such as neoprene.
5.2 Symptoms Following Exposure: Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possible death.
5.3 Treatment of Exposure: SKIN: flush with water followed by soap and water; remove contaminated clothing and wash skin. EYES: flush with plenty of water until irritation subsides. INHALATION: remove from exposure immediately. Call a physician. IF breathing is irregular or stopped, start resuscitation, administer oxygen.
5.4 Threshold Limit Value: 10 ppm
5.5 Short Term Inhalation Limit: 75 ppm for 30 min
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Leukemia
5.8 Vapor (Gas) Irritant Characteristics: If present in high concentrations, vapors may cause irritation of eyes or respiratory system. This effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 4.68 ppm
5.11 IDLH Value: 2,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 12°F C.C.
6.2 Flammable Limits in Air: 1.3%-7.9%
6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back
6.7 Ignition Temperature: 1087°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 6.0 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity:
5 ppm/6 hr/sunfish/saltwater/distilled water
20 ppm/24 hr/sunfish/TL_m/tap water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 1.2 lb/lb, 10 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity:
Industrial pure ____99+%
Thiophene-free ____99+%
Nitration ____99+%
Industrial 90% ____85+%
Reagent ____99+%
9.2 Storage Temperature: Open
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U-V-W

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	3
Water Pollution	
Human Toxicity	3
Aquatic Toxicity	1
Aesthetic Effect	3
Reactivity	
Other Chemicals	2
Water	1
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 78.11
12.3 Boiling Point at 1 atm: 176°F = 80.1°C = 353.3°K
12.4 Freezing Point: 42.0°F = 5.5°C = 278.7°K
12.5 Critical Temperature: 552.0°F = 289.9°C = 562.1°K
12.6 Critical Pressure: 710 psia = 48.3 atm = 4.89 MN/m²
12.7 Specific Gravity: 0.879 at 20°C (liquid)
12.8 Liquid Surface Tension: 28.9 dynes/cm = 0.0289 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 35.0 dynes/cm = 0.035 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 2.7
12.11 Ratio of Specific Heats of Vapor (Gas): 1.061
12.12 Latent Heat of Vaporization: 169 Btu/lb = 94.1 cal/g = 3.94 X 10⁵ J/kg
12.13 Heat of Combustion: −17,460 Btu/lb = −9698 cal/g = −406.0 X 10⁵ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 30.45 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 3.22 psia

NOTES

BNZ	BENZENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
55	55.330
60	55.140
65	54.960
70	54.770
75	54.580
80	54.400
85	54.210
90	54.030
95	53.840
100	53.660
105	53.470
110	53.290
115	53.100
120	52.920
125	52.730
130	52.540
135	52.360
140	52.170
145	51.990
150	51.800
155	51.620
160	51.430
165	51.250
170	51.060
175	50.870

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
45	.394
50	.396
55	.398
60	.400
65	.403
70	.405
75	.407
80	.409
85	.411
90	.414
95	.416
100	.418

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
75	.988
80	.981
85	.975
90	.969
95	.962
100	.956
105	.950
110	.944
115	.937
120	.931
125	.925
130	.919
135	.912
140	.906
145	.900
150	.893
155	.887
160	.881
165	.875
170	.868

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
55	.724
60	.693
65	.665
70	.638
75	.612
80	.588
85	.566
90	.544
95	.524
100	.505
105	.487
110	.470
115	.453
120	.438

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
77.02	.180

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
50	.881
60	1.171
70	1.535
80	1.989
90	2.547
100	3.227
110	4.049
120	5.033
130	6.201
140	7.577
150	9.187
160	11.060
170	13.220
180	15.700
190	18.520
200	21.740
210	25.360

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
50	.01258
60	.01639
70	.02109
80	.02681
90	.03371
100	.04196
110	.05172
120	.06317
130	.07652
140	.09194
150	.10960
160	.12980
170	.15270
180	.17850
190	.20750
200	.23970
210	.27560

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.204
25	.219
50	.234
75	.248
100	.261
125	.275
150	.288
175	.301
200	.313
225	.325
250	.337
275	.349
300	.360
325	.371
350	.381
375	.392
400	.402
425	.412
450	.421
475	.431
500	.440
525	.449
550	.457
575	.465
600	.474

ETHYLBENZENE

ETB

Common Synonyms	Liquid	Colorless	Sweet, gasoline-like odor
Phenylethane EB	Floats on water. Flammable, irritating vapor is produced.		

Avoid contact with liquid and vapor. Keep people away.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Shut off ignition sources and call fire department.
Stop discharge if possible.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic hydrocarbon
3.2 Formula: $C_6H_5CH_2CH_3$
3.3 IMO/UN Designation: 3.3/1175
3.4 DOT ID No.: 1175
3.5 CAS Registry No.: 100-41-4

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Self-contained breathing apparatus; safety goggles.
5.2 Symptoms Following Exposure: Inhalation may cause irritation of nose, dizziness, depression. Moderate irritation of eye with corneal injury possible. Irritates skin and may cause blisters.
5.3 Treatment of Exposure: INHALATION: if ill effects occur, remove victim to fresh air, keep him warm and quiet, and get medical help promptly; if breathing stops, give artificial respiration. INGESTION: induce vomiting only upon physician's approval; material in lung may cause chemical pneumonitis. SKIN AND EYES: promptly flush with plenty of water (15 min. for eyes) and get medical attention; remove and wash contaminated clothing before reuse.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 200 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg (rat)
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure.
5.10 Odor Threshold: 140 ppm
5.11 IDLH Value: 2,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 60°F C.C.; 59°F C.C.
6.2 Flammable Limits in Air: 1.0%-6.7%
6.3 Fire Extinguishing Agents: Foam (most effective), water fog, carbon dioxide or dry chemical.
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Irritating vapors are generated when heated.
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to the source of ignition and flash back.
6.7 Ignition Temperature: 865°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 5.8 mm/min.
6.10 Adiabatic Flame Temperature: Data Not Available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data Not Available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: 29 ppm/96 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 2.8% (theor.), 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research grade: 99.98%; pure grade: 99.5%; technical grade: 99.0%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	2
Liquid or Solid Irritant	2
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.17
12.3 Boiling Point at 1 atm: 277.2°F = 136.2°C = 409.4°K
12.4 Freezing Point: −138°F = −95°C = 178°K
12.5 Critical Temperature: 651.0°F = 343.9°C = 617.1°K
12.6 Critical Pressure: 523 psia = 35.6 atm = 3.61 MN/m²
12.7 Specific Gravity: 0.867 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.2 dynes/cm = 0.0292 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 35.48 dynes/cm = 0.03548 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.071
12.12 Latent Heat of Vaporization: 144 Btu/lb = 80.1 cal/g = 3.35 X 10^5 J/kg
12.13 Heat of Combustion: −17,780 Btu/lb = −9877 cal/g = −413.5 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data Not Available
12.26 Limiting Value: Data Not Available
12.27 Reid Vapor Pressure: 0.4 psia

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data Not Available
6.12 Flame Temperature: Data Not Available

ETB

ETHYLBENZENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
40	54.990
50	54.680
60	54.370
70	54.060
80	53.750
90	53.430
100	53.120
110	52.810
120	52.500
130	52.190
140	51.870
150	51.560
160	51.250
170	50.940
180	50.620
190	50.310
200	50.000
210	49.690

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
40	.402
50	.404
60	.407
70	.409
80	.412
90	.414
100	.417
110	.419
120	.421
130	.424
140	.426
150	.429
160	.431
170	.434
180	.436
190	.439
200	.441
210	.443

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
—90	1.065
—80	1.056
—70	1.047
—60	1.037
—50	1.028
—40	1.018
—30	1.009
—20	1.000
—10	.990
0	.981
10	.971
20	.962
30	.953
40	.943
50	.934
60	.924
70	.915
80	.906
90	.896
100	.887
110	.877
120	.868
130	.859
140	.849
150	.840
160	.830

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
40	.835
50	.774
60	.719
70	.670
80	.626
90	.586
100	.550
110	.518
120	.488
130	.461
140	.436
150	.414
160	.393
170	.374
180	.356
190	.340
200	.325
210	.311

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
68.02	.020

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
80	.202
100	.370
120	.644
140	1.071
160	1.713
180	2.643
200	3.953
220	5.747
240	8.147
260	11.290
280	15.320
300	20.410
320	26.730
340	34.460
360	43.800
380	54.950

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
80	.00370
100	.00654
120	.01099
140	.01767
160	.02734
180	.04087
200	.05926
220	.08363
240	.11520
260	.15510
280	.20490
300	.26570
320	.33910
340	.42620
360	.52850
380	.64720

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
—400	—.007
—350	.026
—300	.060
—250	.093
—200	.125
—150	.157
—100	.187
—50	.217
0	.246
50	.274
100	.301
150	.327
200	.353
250	.377
300	.401
350	.424
400	.446
450	.467
500	.487
550	.507
600	.525

ETHYLENE DICHLORIDE

EDC

Common Synonyms	Liquid	Colorless	Sweet odor
1, 2-Dichloroethane Ethylene chloride EDC Brocide Dutch liquid Glycol dichloride	Sinks in water. Flammable, irritating vapor is produced.		

Avoid contact with liquid and vapor. Keep people away.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Shut off ignition sources and call fire department.
Stop discharge if possible.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
POISONOUS GASES ARE PRODUCED IN FIRE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause nausea, dizziness or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Dangerous to aquatic life in high concentrations.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Isolate warning-high flammability
Disperse and flush

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Halogenated hydrocarbon
3.2 Formula: $ClCH_2CH_2Cl$
3.3 IMO/UN Designation: 3.2/1184
3.4 DOT ID No.: 1184
3.5 CAS Registry No.: 107-06-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Ethereal; chloroform-like; ether-like

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Clean, body-covering clothing and safety glasses with side shields. Respiratory protection: up to 50 ppm, none; 50 ppm to 2%, 1/2 hr or less, full face mask and canister; greater than 2%, self-contained breathing apparatus.

5.2 Symptoms Following Exposure: Inhalation of vapors causes nausea, drunkenness, depression. Contact of liquid with eyes may produce corneal injury. Prolonged contact with skin may cause a burn.

5.3 Treatment of Exposure: INHALATION: if victim is overcome, remove him to fresh air, keep him quiet and warm, and get medical attention immediately; if breathing stops, give artificial respiration. INGESTION: induce vomiting; call a physician; treat the symptoms. EYES: flush immediately with copious amounts of flowing water for at least 15 min. SKIN: remove clothing and wash skin thoroughly with soap and water; wash contaminated clothing before reuse.

5.4 Threshold Limit Value: 10 ppm

5.5 Short Term Inhalation Limits: 200 ppm for 5 min. during any 3-hour period.

5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg (rat)

5.7 Late Toxicity: Data not available

5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary

5.9 Liquid or Solid Irritant Characteristics: Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure

5.10 Odor Threshold: 100 ppm

5.11 IDLH Value: 1,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 60°F O.C.; 55°F C.C.
6.2 Flammable Limits in Air: 6.2%-15.6%
6.3 Fire Extinguishing Agents: Foam, carbon dioxide, dry chemical
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Toxic and irritating gases (hydrogen chloride, phosgene) are generated.
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 775°F
6.8 Electrical Hazard: Class I, group D
6.9 Burning Rate: 1.6 mm/min
6.10 Adiabatic Flame Temperature: Data Not Available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data Not Available
7.8 Reactivity Group: 36

8. WATER POLLUTION

8.1 Aquatic Toxicity:
150 ppm/*/pin perch/TL$_m$/salt water
*Time period not specified.
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0.002 lb/lb, 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Commercial
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-X

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations:
Flammable liquid

11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	2
Liquid or Solid Irritant	2
Poisons	3
Water Pollution	
Human Toxicity	3
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	1

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 98.96
12.3 Boiling Point at 1 atm: 182.7°F = 83.5°C = 356.7°K
12.4 Freezing Point: −32.5°F = −35.7°C = 237.5°K
12.5 Critical Temperature: 550°F = 288°C = 561°K
12.6 Critical Pressure: 735 psia = 50 atm = 5.1 MN/m²
12.7 Specific Gravity: 1.253 at 20°C (liquid)
12.8 Liquid Surface Tension: 32.2 dynes/cm = 0.0322 N/m at 20°C
12.9 Liquid Water Interfacial Tension: (est.) 30 dynes/cm = 0.03 N/m at 25°C
12.10 Vapor (Gas) Specific Gravity: 3.4
12.11 Ratio of Specific Heats of Vapor (Gas): 1.118
12.12 Latent Heat of Vaporization: 138 Btu/lb = 76.4 cal/g = 3.2×10^5 J/kg
12.13 Heat of Combustion: (est.) 3400 Btu/lb
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 21.12 cal/g
12.26 Limiting Value: Data Not Available
12.27 Reid Vapor Pressure: 2.7 psia

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data Not Available
6.12 Flame Temperature: Data Not Available

EDC

ETHYLENE DICHLORIDE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
35	79.879
40	79.629
45	79.379
50	79.129
55	78.879
60	78.620
65	78.370
70	78.120
75	77.860
80	77.599
85	77.349
90	77.089
95	76.830
100	76.570
105	76.309
110	76.049
115	75.790
120	75.520
125	75.259
130	74.990
135	74.730
140	74.459
145	74.190
150	73.919
155	73.660
160	73.379

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.283
10	.285
20	.288
30	.290
40	.293
50	.296
60	.298
70	.301
80	.303
90	.306
100	.309
110	.311
120	.314
130	.317
140	.319
150	.322
160	.324
170	.327

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
0	.990
10	.982
20	.974
30	.965
40	.957
50	.949
60	.941
70	.933
80	.924
90	.916
100	.908
110	.900
120	.892
130	.883
140	.875
150	.867
160	.859
170	.850

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
35	1.098
40	1.054
45	1.013
50	.975
55	.938
60	.904
65	.871
70	.840
75	.811
80	.784
85	.758
90	.733
95	.709
100	.687
105	.665
110	.645
115	.625
120	.607
125	.589
130	.573
135	.556
140	.541
145	.526
150	.512
155	.499
160	.486

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
68.02	.800

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
15	.231
20	.274
25	.323
30	.380
35	.445
40	.520
45	.606
50	.704
55	.816
60	.942
65	1.085
70	1.246
75	1.428
80	1.632
85	1.860
90	2.116
95	2.401
100	2.718

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
15	.00449
20	.00526
25	.00614
30	.00715
35	.00830
40	.00960
45	.01108
50	.01274
55	.01461
60	.01671
65	.01907
70	.02169
75	.02462
80	.02788
85	.03149
90	.03548
95	.03990
100	.04477

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.177
25	.182
50	.187
75	.191
100	.195
125	.200
150	.204
175	.208
200	.212
225	.217
250	.221
275	.225
300	.229
325	.232
350	.236
375	.240
400	.244
425	.247
450	.251
475	.254
500	.258
525	.261
550	.265
575	.268
600	.271

TOLUENE

TOL

Common Synonyms	Watery liquid	Colorless	Pleasant odor
Toluol Methylbenzene Methylbenzol	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: $C_6H_5CH_3$
3.3 IMO/UN Designation: 3.2/1294
3.4 DOT ID No.: 1294
3.5 CAS Registry No.: 108-88-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Pungent; aromatic, benzene-like; distinct, pleasant

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Air-supplied mask; goggles or face shield; plastic gloves.
5.2 Symptoms Following Exposure: Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration.
5.3 Treatment of Exposure: INHALATION: remove to fresh air, give artificial respiration and oxygen if needed; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 600 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: Kidney and liver damage may follow ingestion.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.17 ppm
5.11 IDLH Value: 2,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 40°F C.C.; 55°F O.C.
6.2 Flammable Limits in Air: 1.27%-7%
6.3 Fire Extinguishing Agents: Carbon dioxide or dry chemical for small fires, ordinary foam for large fires.
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 997°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.7 mm/min.
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: 1180 mg/l/96 hr/sunfish/TL$_m$/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0%, 5 days; 38% (theor), 8 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research, reagent, nitration-all 99.8 + %; industrial: contains 94 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 90/120: less pure than industrial.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 92.14
12.3 Boiling Point at 1 atm: 231.1°F = 110.6°C = 383.8°K
12.4 Freezing Point: —139°F = —95.0°C = 178.2°K
12.5 Critical Temperature: 605.4°F = 318.6°C = 591.8°K
12.6 Critical Pressure: 598.1 psia = 40.55 atm = 4.106 MN/m²
12.7 Specific Gravity: 0.867 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.0 dynes/cm = 0.0290 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m at 25°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.089
12.12 Latent Heat of Vaporization: 155 Btu/lb = 86.1 cal/g = 3.61 X 10⁵ J/kg
12.13 Heat of Combustion: —17,430 Btu/lb = —9686 cal/g = —405.5 X 10⁵ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 17.17 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 1.1 psia

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

TOL

TOLUENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
—30	57.180
—20	56.870
—10	56.550
0	56.240
10	55.930
20	55.620
30	55.310
40	54.990
50	54.680
60	54.370
70	54.060
80	53.750
90	53.430
100	53.120
110	52.810
120	52.500

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.396
5	.397
10	.399
15	.400
20	.402
25	.403
30	.404
35	.406
40	.407
45	.409
50	.410
55	.411
60	.413
65	.414
70	.415
75	.417
80	.418
85	.420
90	.421
95	.422
100	.424
105	.425
110	.427
115	.428
120	.429
125	.431

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
0	1.026
10	1.015
20	1.005
30	.994
40	.983
50	.972
60	.962
70	.951
80	.940
90	.929
100	.919
110	.908
120	.897
130	.886
140	.876
150	.865
160	.854
170	.843
180	.833
190	.822
200	.811
210	.800

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
0	1.024
5	.978
10	.935
15	.894
20	.857
25	.821
30	.788
35	.757
40	.727
45	.700
50	.673
55	.649
60	.625
65	.603
70	.582
75	.562
80	.544
85	.526
90	.509
95	.493
100	.477

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
68.02	.050

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
0	.038
10	.057
20	.084
30	.121
40	.172
50	.241
60	.331
70	.449
80	.600
90	.792
100	1.033
110	1.332
120	1.700
130	2.148
140	2.690
150	3.338
160	4.109
170	5.018
180	6.083
190	7.323
200	8.758
210	10.410

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
0	.00070
10	.00103
20	.00150
30	.00212
40	.00296
50	.00405
60	.00547
70	.00727
80	.00954
90	.01237
100	.01584
110	.02007
120	.02518
130	.03127
140	.03850
150	.04700
160	.05691
170	.06840
180	.08162
190	.09675
200	.11400
210	.13340

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.228
25	.241
50	.255
75	.268
100	.281
125	.294
150	.306
175	.319
200	.331
225	.343
250	.355
275	.367
300	.378
325	.389
350	.400
375	.411
400	.422
425	.432
450	.443
475	.453
500	.462
525	.472
550	.482
575	.491
600	.500

m-XYLENE

XLM

Common Synonyms	Watery liquid	Colorless	Sweet odor
1, 3-Dimethylbenzene Xylol	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose, and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Foaming to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-High flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: m-$C_6H_4(CH_3)_2$
3.3 IMO/UN Designation: 3.2/1307
3.4 DOT ID No.: 1307
3.5 CAS Registry No.: 108-38-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Like benzene; characteristic aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma; can be fatal. Kidney and liver damage can occur.
5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 300 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 g/kg
5.7 Late Toxicity: Kidney and liver damage.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.05 ppm
5.11 IDLH Value: 10,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 84°F C.C.
6.2 Flammable Limits in Air: 1.1%-6.4%
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 982°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.8 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity:
22 ppm/96 hr/bluegill/TL_/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days; 0% (theor.), 8 days
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research: 99.99%; Pure: 99.9%; Technical: 99.2%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.16
12.3 Boiling Point at 1 atm: 288.4°F = 131.9°C = 405.1°K
12.4 Freezing Point: −54.2°F = −47.9°C = 225.3°K
12.5 Critical Temperature: 650.8°F = 343.8°C = 617.0°K
12.6 Critical Pressure: 513.6 atm = 34.95 psia = 3.540 MN/m²
12.7 Specific Gravity: 0.864 at 20°C (liquid)
12.8 Liquid Surface Tension: 28.6 dynes/cm = 0.0286 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.4 dynes/cm = 0.0364 N/m at 30°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.071
12.12 Latent Heat of Vaporization: 147 Btu/lb = 81.9 cal/g = 3.43 X 10^5 J/kg
12.13 Heat of Combustion: −17,554 Btu/lb = −9752.4 cal/g = −408.31 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 26.01 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.34 psia

NOTES

XLM	m-XYLENE

12.17 SATURATED LIQUID DENSITY	
Temperature (degrees F)	Pounds per cubic foot
15	55.400
20	55.260
25	55.130
30	54.990
35	54.850
40	54.710
45	54.570
50	54.430
55	54.290
60	54.160
65	54.020
70	53.880
75	53.740
80	53.600
85	53.460
90	53.320
95	53.180
100	53.050

12.18 LIQUID HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
40	.387
50	.393
60	.398
70	.404
80	.410
90	.415
100	.421
110	.426
120	.432
130	.437
140	.443
150	.448
160	.454
170	.460
180	.465
190	.471
200	.476
210	.482

12.19 *LIQUID* THERMAL CONDUCTIVITY	
Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
35	.962
40	.953
45	.944
50	.935
55	.926
60	.917
65	.908
70	.899
75	.890
80	.881
85	.873
90	.864
95	.855
100	.846

12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Centipoise
15	.938
20	.898
25	.862
30	.827
35	.794
40	.764
45	.735
50	.708
55	.682
60	.658
65	.635
70	.613
75	.592
80	.572
85	.554

12.21 SOLUBILITY IN WATER	
Temperature (degrees F)	Pounds per 100 pounds of water
	I
	N
	S
	O
	L
	U
	B
	L
	E

12.22 SATURATED VAPOR PRESSURE	
Temperature (degrees F)	Pounds per square inch
60	.090
70	.127
80	.177
90	.242
100	.326
110	.434
120	.571
130	.743
140	.956
150	1.219
160	1.538
170	1.924
180	2.388
190	2.939
200	3.590
210	4.355
220	5.247
230	6.282
240	7.476
250	8.846
260	10.410

12.23 SATURATED VAPOR DENSITY	
Temperature (degrees F)	Pounds per cubic foot
60	.00172
70	.00238
80	.00324
90	.00435
100	.00577
110	.00754
120	.00975
130	.01247
140	.01577
150	.01977
160	.02455
170	.03023
180	.03691
190	.04473
200	.05382
210	.06431
220	.07635
230	.09009
240	.10570
250	.12330
260	.14310

12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
0	.247
25	.260
50	.273
75	.286
100	.299
125	.311
150	.324
175	.336
200	.348
225	.360
250	.371
275	.383
300	.394
325	.406
350	.417
375	.427
400	.438
425	.449
450	.459
475	.469
500	.479
525	.489
550	.499
575	.508
600	.517

o-XYLENE

XLO

Common Synonyms	Watery liquid	Colorless	Sweet odor
1, 2-Dimethylbenzene Xylol	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Foaming in streams.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: $o\text{-}C_6H_4(CH_3)_2$
3.3 IMO/UN Designation: 3.2/1307
3.4 DOT ID No.: 1307
3.5 CAS Registry No.: 95-47-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Benzene-like; characteristic aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma. Can be fatal. Kidney and liver damage can occur.
5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 300 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Kidney and liver damage.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.05 ppm
5.11 IDLH Value: 10,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 63°F C.C.; 75°F O.C.
6.2 Flammable Limits in Air: 1.1%-7.0%
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 865°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.8 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: >100 mg/l/96 hr/D. magna/TL$_m$/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days; 2.5% (theor.), 5 days
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research: 99.99%; Pure: 99.7%; Commercial: 95+%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No reaction
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water

Transportation: Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Class/Rating
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.16
12.3 Boiling Point at 1 atm: 291.9°F = 144.4°C = 417.6°K
12.4 Freezing Point: −13.3°F = −25.2°C = 248.0°K
12.5 Critical Temperature: 674.8°F = 357.1°C = 630.3°K
12.6 Critical Pressure: 541.5 atm = 36.84 psia = 3.732 MN/m²
12.7 Specific Gravity: 0.880 at 20°C (liquid)
12.8 Liquid Surface Tension: 30.53 dynes/cm = 0.03053 N/m at 15.5°C
12.9 Liquid Water Interfacial Tension: 36.06 dynes/cm = 0.03606 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.068
12.12 Latent Heat of Vaporization: 149 Btu/lb = 82.9 cal/g = 3.47 X 10⁴ J/kg
12.13 Heat of Combustion: −17,556 Btu/lb = −9754.7 cal/g = −408.41 X 10⁴ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 30.64 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.28 psia

NOTES

XLO

o-XYLENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
15	56.460
20	56.330
25	56.190
30	56.050
35	55.910
40	55.770
45	55.630
50	55.490
55	55.360
60	55.220
65	55.080
70	54.940
75	54.800
80	54.660
85	54.520
90	54.380
95	54.250
100	54.110

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
35	.389
40	.391
45	.394
50	.396
55	.398
60	.400
65	.402
70	.404
75	.406
80	.408
85	.411
90	.413
95	.415
100	.417

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
35	1.043
40	1.035
45	1.027
50	1.018
55	1.010
60	1.002
65	.993
70	.985
75	.977
80	.969
85	.960
90	.952
95	.944
100	.935

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
15	1.328
20	1.263
25	1.202
30	1.145
35	1.092
40	1.042
45	.995
50	.952
55	.911
60	.873
65	.836
70	.802
75	.770
80	.740
85	.712

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
	I
	N
	S
	O
	L
	U
	B
	L
	E

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
60	.071
70	.101
80	.141
90	.194
100	.263
110	.352
120	.465
130	.609
140	.787
150	1.007
160	1.277
170	1.605
180	1.999
190	2.469
200	3.028
210	3.686
220	4.456
230	5.352
240	6.389
250	7.581
260	8.947

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
60	.00135
70	.00188
80	.00258
90	.00349
100	.00464
110	.00611
120	.00794
130	.01021
140	.01298
150	.01634
160	.02038
170	.02520
180	.03090
190	.03759
200	.04539
210	.05443
220	.06484
230	.07674
240	.09030
250	.10560
260	.12290

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.261
25	.274
50	.287
75	.299
100	.311
125	.323
150	.335
175	.347
200	.358
225	.370
250	.381
275	.392
300	.403
325	.414
350	.424
375	.435
400	.445
425	.455
450	.465
475	.475
500	.485
525	.494
550	.504
575	.513
600	.522

p-XYLENE

XLP

Common Synonyms	Watery liquid	Colorless	Sweet odor
1, 4-Dimethylbenzene Xylol	Floats on water. Flammable, irritating vapor is produced. Freezing point = 56°F.		

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: $p\text{-}C_6H_4(CH_3)_2$
3.3 IMO/UN Designation: 3.2/1307
3.4 DOT ID No.: 1307
3.5 CAS Registry No.: 106-42-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Like benzene; characteristic aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma. Can be fatal. Kidney and liver damage can occur.
5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 300 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Kidney and liver damage.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.05 ppm
5.11 IDLH Value: 10,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 81°F C.C.
6.2 Flammable Limits in Air: 1.1%-6.6%
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 870°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.8 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 22

8. WATER POLLUTION

8.1 Aquatic Toxicity: 22 ppm/96 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0 lb/lb in 5 days
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research: 99.99%; Pure: 99.8%; Technical: 99.0%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.16
12.3 Boiling Point at 1 atm: 280.9°F = 138.3°C = 411.5°K
12.4 Freezing Point: 55.9°F = 13.3°C = 286.5°K
12.5 Critical Temperature: 649.4°F = 343.0°C = 616.2°K
12.6 Critical Pressure: 509.4 atm = 34.65 psia = 3.510 MN/m²
12.7 Specific Gravity: 0.861 at 20°C (liquid)
12.8 Liquid Surface Tension: 28.3 dynes/cm = 0.0283 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 37.5 dynes/cm = 0.0375 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.071
12.12 Latent Heat of Vaporization: 150 Btu/lb = 81 cal/g = 3.4 X 10⁵ J/kg
12.13 Heat of Combustion: −17,559 Btu/lb = −9754.7 cal/g = −408.41 X 10³ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 37.83 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.34 psia

NOTES

XLP

p-XYLENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
60	53.970
65	53.830
70	53.690
75	53.550
80	53.410
85	53.270
90	53.140
95	53.000
100	52.860
105	52.720
110	52.580
115	52.440
120	52.300

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
60	.412
70	.418
80	.424
90	.429
100	.435
110	.440
120	.446
130	.451
140	.457
150	.462
160	.468
170	.474
180	.479
190	.485
200	.490
210	.496
220	.501
230	.507
240	.512
250	.518
260	.524
270	.529
280	.535

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
60	.935
65	.928
70	.921
75	.914
80	.907
85	.900
90	.892
95	.885
100	.878

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
60	.678
65	.654
70	.631
75	.610
80	.590
85	.571
90	.552
95	.535
100	.519
105	.503
110	.488
115	.474
120	.460

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
	I
	N
	S
	O
	L
	U
	B
	L
	E

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
60	.096
70	.135
80	.187
90	.255
100	.343
110	.456
120	.599
130	.777
140	.998
150	1.270
160	1.600
170	1.998
180	2.475
190	3.041
200	3.710
210	4.493
220	5.407
230	6.465
240	7.683
250	9.080
260	10.670

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
60	.00183
70	.00252
80	.00343
90	.00459
100	.00607
110	.00792
120	.01022
130	.01303
140	.01646
150	.02059
160	.02553
170	.03138
180	.03826
190	.04629
200	.05561
210	.06636
220	.07867
230	.09270
240	.10860
250	.12650
260	.14670

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.246
25	.259
50	.272
75	.285
100	.297
125	.309
150	.321
175	.333
200	.345
225	.357
250	.368
275	.380
300	.391
325	.402
350	.413
375	.424
400	.435
425	.445
450	.456
475	.466
500	.476
525	.486
550	.496
575	.505
600	.515

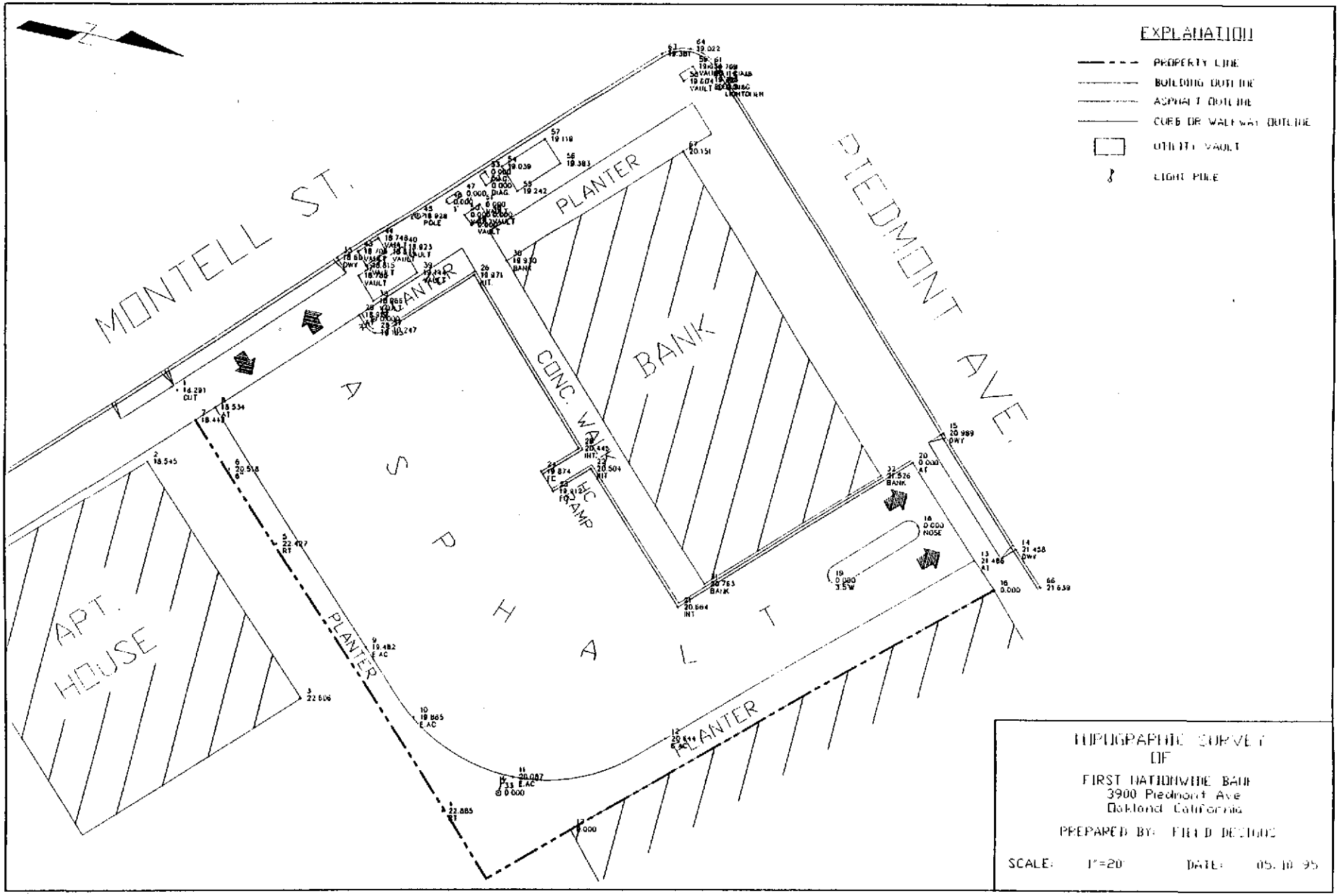
ATTACHMENT B

Site Base Map Survey Data

Attachment B

Survey Data for Site Base Map

SURVEY POINT	*NORTHING*	*EASTING*	*ELEVATION*
1. Monument of Record (BM)	1081.7278	4997.8444	100.00
2. Northern Building Corner	1048.3529	5067.1404	101.555
3. Eastern Building Corner	1029.7025	5037.1054	100.792
4. Southern Building Corner	1084.0937	5003.3624	99.959
5. Western Building Corner	1102.7670	5033.3345	100.180
6. Southern Property Corner	991.0622	4992.4024	102.914
7. Northern Property Corner	1028.8329	5086.2693	--


EXPLANATION
PROPERTY LINE
BUILDING OUTLINE
ASPHALT OUTLINE
CURB OR WALKWAY OUTLINE
UTILITY VAULT
LIGHT POLE
MONTELL ST.
PIEDMONT AVE.
PLANTER
CONC. WALK
BANK
ASPHALT
APT. HOUSE
PLANTER
PLANTER
TOPOGRAPHIC SURVEY
OF
FIRST NATIONWIDE BANK
3900 Piedmont Ave
Oakland California
PREPARED BY: FIELD SECTION
SCALE: 1"=20'
DATE: 05.10.95

59 1117.450 5035.033 19.636 VAULT
60 1115.140 5037.698 19.768 ELEC.DIAG.
61 1117.408 5037.632 19.704 ELEC.DIAG.
62 1113.841 5039.567 0.000 LIGHTOLIER
63 1119.625 5029.793 19.381
64 1120.459 5034.643 19.022
65 1116.140 5040.050 19.738
66 1029.258 5094.094 21.639
67 1102.767 5033.334 20.151