REVISED AND MODIFIED WORK PLAN FOR THE REMOVAL OF UNDERGROUND STORAGE TANKS AND INSTALLATION OF GROUNDWATER MONITORING WELLS

Aug 19, 1991

PHASE I
SITE CHARACTERIZATION PROGRAM

HARRISON STREET GARAGE
1432 HARRISON STREET
OAKLAND, CALIFORNIA 94612

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August 19, 1991

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August 19, 1991
File No. 0390044.02

Mr. Paul Smith
Alameda County Health Care Services
Division of Hazardous Materials
Department of Environmental Health
80 Swan Way, Room 200
Oakland, California 94621

Subject: Modified Work Plan for
Removal of Underground Storage Tanks
and Preliminary Site Investigation
Harrison Street Garage
1432 Harrison Street
Oakland, California 94612

Dear Mr. Smith:

Pursuant Alameda County Health Care Services' (ACHCS) letter dated July 12, 1991, SCS Engineers (SCS) is submitting this revised and modified work plan, including the appended Underground Tank Closure Plan, Health and Safety Plan, and other supporting documentation, for the 1) proposed removal of four abandoned underground storage tanks (USTs), three hydraulic lifts and associated facilities, and 2) initial installation of groundwater monitoring wells at the Harrison Street Garage, 1432 Harrison Street, Oakland California. The supporting documentation includes: copies of tank removal contractors' insurance certificates, plot plan, and a deposit check for $1000 (as per 1991 Alameda County deposit fee schedule) to cover the cost of County review and administration.

In this revised work plan SCS has made an attempt to address all issues outlined in ACHCS' letter, by incorporating the required changes in the work plan. The investigation and subsequent analysis outlined in this work plan will be conducted in accordance with the guidelines of Tri-Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites dated August 10, 1991 (Tri-Regional Recommendations).

Following ACHCS' concern regarding the concentration of benzene in the gasoline tanks on the Harrison Street, SCS collected liquid samples from the tanks in your presence and analyzed for benzene by EPA Protocol 8240. The results of the analysis indicated a benzene concentration of 1.8 percent which is a normal percentage for gasoline. Based on these results, it is SCS' opinion that our existing safety procedures are adequate for the underground storage tanks removal and preliminary site investigation. SCS proposes no revision to the Health and Safety plan outlined in our work plan dated June 6, 1991.

The tasks to be completed as part of this work plan constitute Phase I of the site characterization and assessment program for this site. After completing all the tasks outlined in this phase a detailed report describing SCS' findings, evaluation, and recommendation will be submitted along with a work plan for Phase II of site characterization/remediation program.

This work plan will be implemented immediately following the County's approval. If there are any questions, please contact any of the undersigned at (415) 829-0661.

Sincerely,

Nels R. Johnson, P.E.
Senior Project Engineer
SCS Engineers

John P. Cummings, Ph.D., R.E.A., R.E.P.
Office Director
SCS Engineers

Thomas D. Gilmore
Staff Geologist
SCS Engineers

Prabhu N. Ravandur
Staff Engineer
SCS Engineers

NRJ/JPC/TDG/PNR:egh

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SECTION 1
PROJECT DESCRIPTION

This modified work plan, including the appended Underground Tank Closure Plan and supporting documentation (Appendices A, B, C, D, and E), outlines the proposed field operations and associated analytical test services to be provided by SCS Engineers (SCS) for the proposed removal of abandoned underground storage tanks (USTs) and associated facilities, including hydraulic lifts, at the Harrison Street Garage, 1432 Harrison Street, Oakland, California. Alameda County issued the original Cleanup Order to the property owners on September 24, 1990. This modified work plan is being submitted pursuant to a recent agreement between Alameda County, SCS Engineers, and attorneys representing the property owners and District Attorney's office, dated April 26, 1991, to excavate and remove the existing tanks and associated facilities prior to the implementation of a more detailed site characterization and assessment program involving the drilling and installation of soil borings and monitoring wells and collection of representative soil and groundwater samples. The tasks to be completed as part of this work plan constitute Phase I of the site characterization and assessment program for this site. Following is a brief background and description of the site, including tank locations and conditions, investigative and remedial actions which have been performed to date, and current plans to remove the tanks, including sample collection procedures and proposed analytical tests to be conducted.

SECTION 2
SITE DESCRIPTION AND HISTORY

The subject site is located in downtown Oakland and is bordered by Harrison Street on the west and Alice Street on the east, between 14th and 15th Streets (Figure 1). Lake Merritt is located approximately one-quarter mile east of the subject site. Figure 2 presents a site plan that outlines the building perimeter, adjacent streets, and suspected locations of both on-site and off-site USTs.

A garage facility utilized for parking automobiles and light trucks currently exists on the site, and essentially consists of two directly adjoining buildings. The first is the principal entrance to the parking garage at 1432 Harrison Street. This single-story building contains a partial mezzanine and is constructed of timber and masonry. The second is a multi-story garage that is on the Alice Street portion of the property and is constructed of reinforced concrete. Historical aerial photographs date construction of the buildings back some forty to fifty years.

Results of Previous Investigations

Previous investigations by others indicate that the soil is contaminated beneath the site and that such contamination includes measurable quantities of gasoline and diesel fuels, benzene, toluene, ethylbenzene, and xylenes (BTEX) aromatic constituents, and PCBs. The reported analytical results (Table 1) are based on analyses of selected soil samples collected during the drilling of 6 exploratory borings by Subsurface Consultants in October 1990. The Subsurface Consultants' report also indicates that subsurface materials consist primarily of dense, fine-grained sands containing varying amounts of clay and silt. Published geologic maps indicate that these sediments are part of the Merritt Sand Formation. Groundwater was encountered by Subsurface Consultants during the drilling at depths ranging from 23 to 25 feet below the Harrison Street grade. Information regarding groundwater flow direction is not available; however, it is presumed to flow eastward toward Lake Merritt.

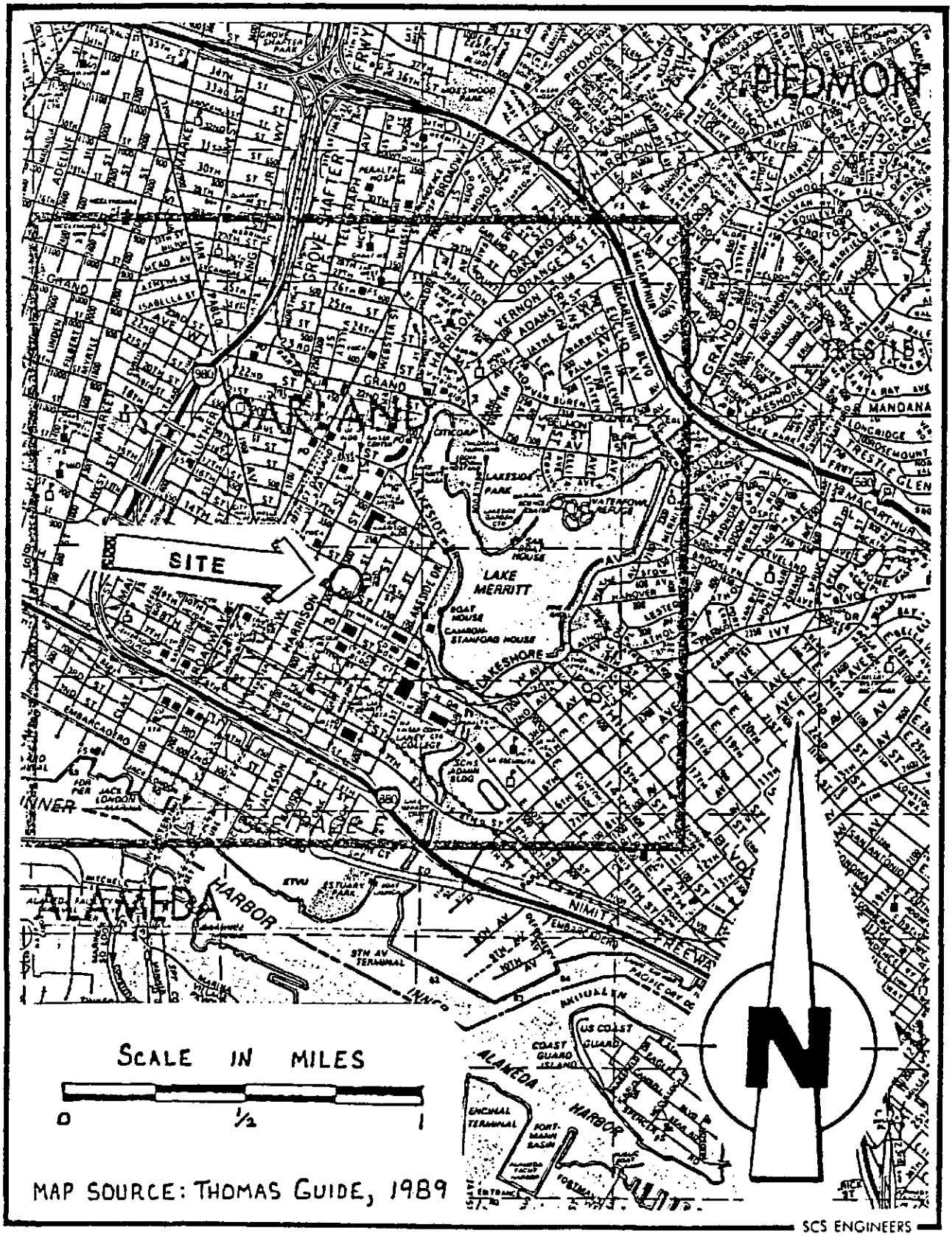


FIGURE 1: Vicinity Map Showing the Location of Subject Site

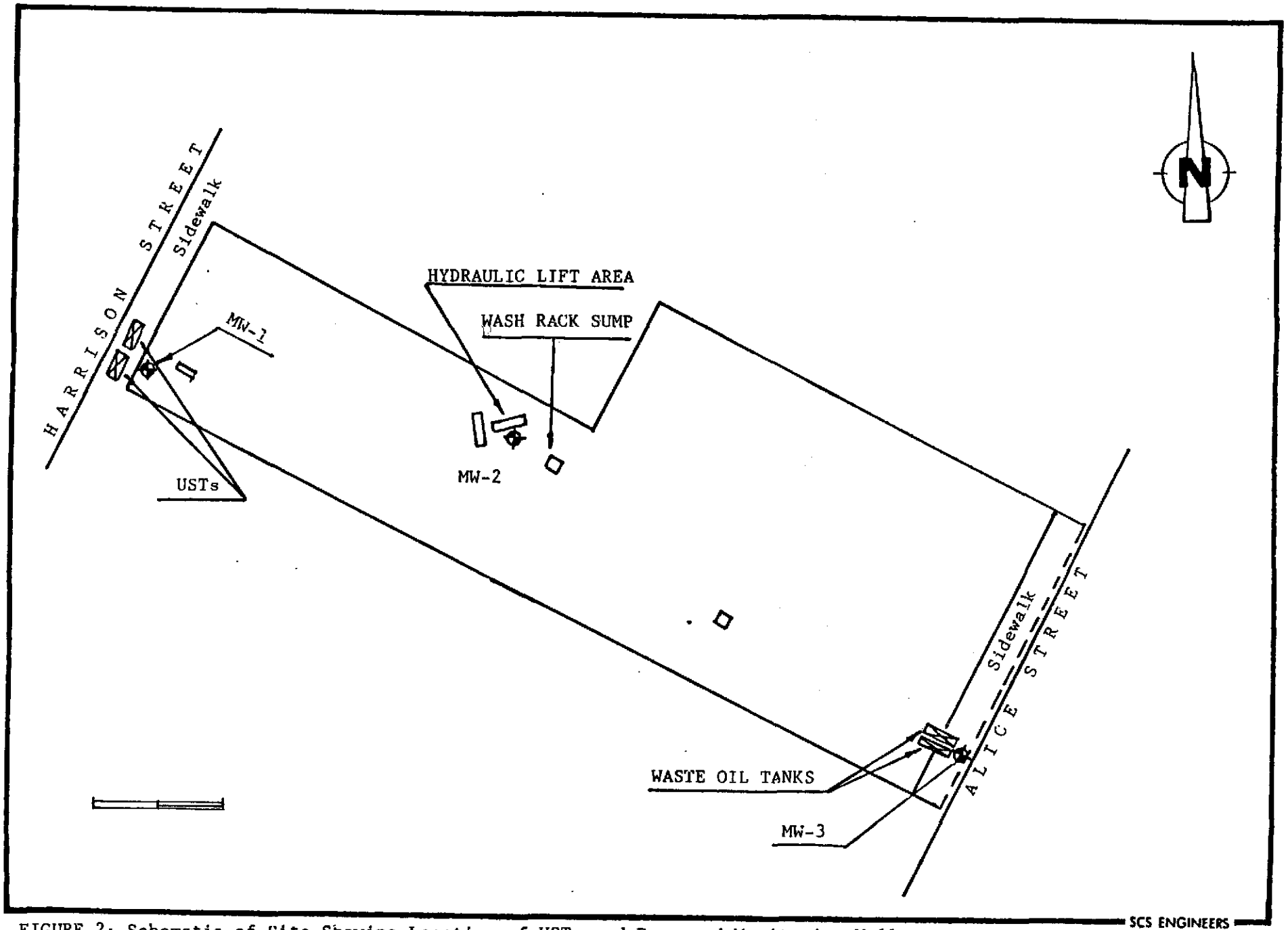


FIGURE 2: Schematic of Site Showing Location of USTs and Proposed Monitoring Wells

TABLE 1. CONTAMINANT CONCENTRATIONS IN SOIL
(Results of Subsurface Consultants October 1990 Investigation)

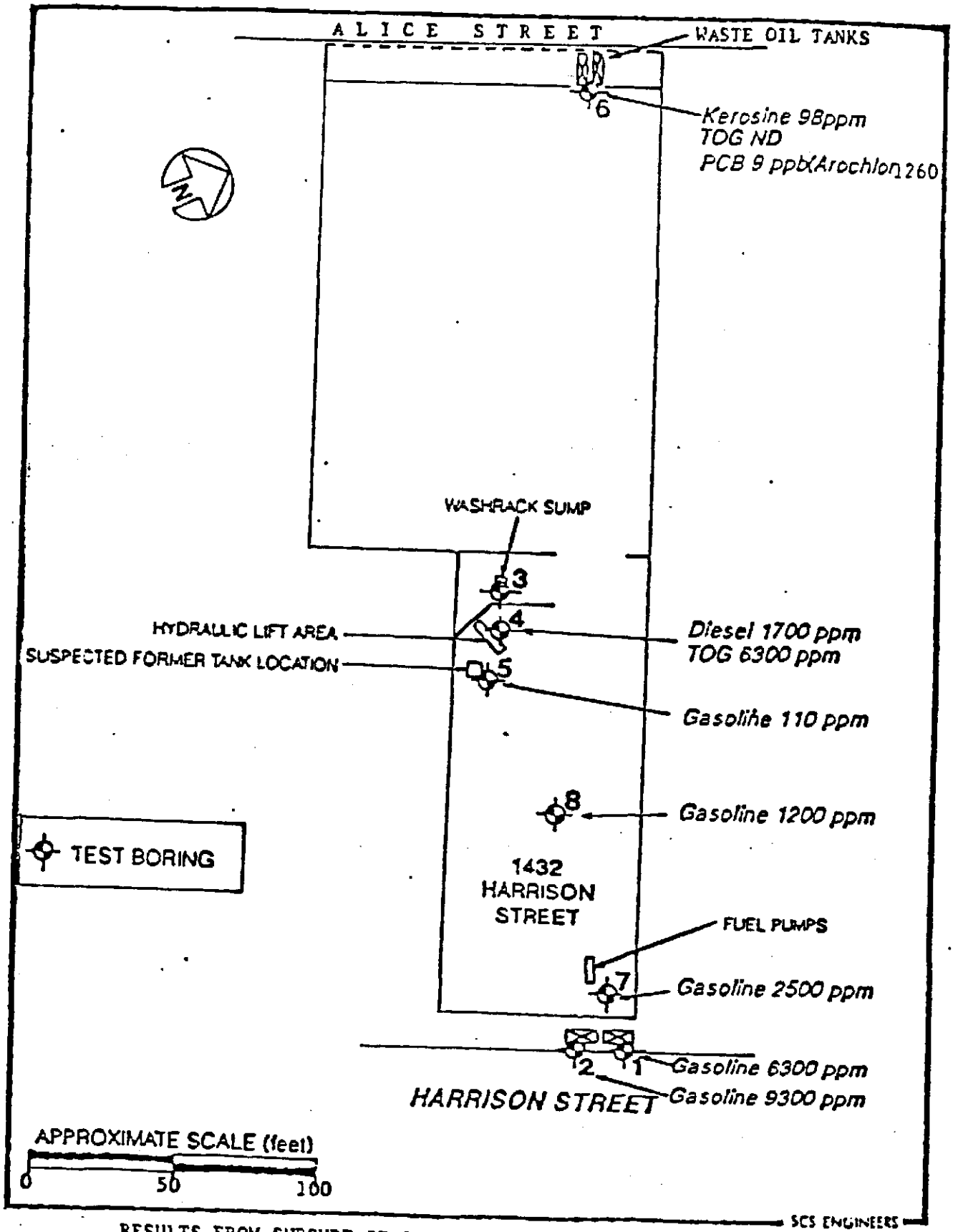
Boring No. & Depth (ft)	TVH[1] (ppm)	B[2] (ppb)	T[3] (ppb)	X[4] (ppb)	X[5] (ppb)	TOG[6] (ppm)	TKH[7] (ppm) Keros./Diesel	OTHER 8010/Sol Pb/PCBs ---/(ppm)/(ppb)
B1 @ 20	6,300	99,000	490,000	610,000	110,000	---[8]	---/---	---/---/---
B2 @ 18.5	9,300	98,000	900,000	1,100,000	190,000	---	---/---	---/0.21/---
B3 (in sump)	---	---	---	---	---	---	---/---	---/---/---
B4 @ 10	---	---	---	---	---	6,300	ND[9]/1,700	---/---/---
B5 @ 22.5	110	24	210	1,300	69	---	---/---	---/---/---
B6 @ 9	---	ND	ND	ND	ND	ND	98/ND	ND/0.06/9 (Arochlor 1260)
B6 @ 9.5	---	---	---	---	---	ND	140/ND	---/---/---

1 Total Volatile Hydrocarbons, mg/kg = ppm
2 Benzene, ug/kg = ppb
3 Toluene
4 Xylene
5 Ethylbenzene
6 Total Oil & Grease
7 Total Extractable Hydrocarbons (as kerosene and diesel)
8 --- = Not tested for
9 ND = Not detected

TABLE 1. CONTAMINANT CONCENTRATIONS IN SOIL (CONT'D)
(Results of Subsurface Consultants October 1990 Investigation)

Boring No. & Depth (ft)	TVH[1] (ppm)	B[2] (ppb)	T[3] (ppb)	X[4] (ppb)	X[5] (ppb)	TOG[6] (ppm)	TKH[7] (ppm) Keros./Diesel	OTHER 8010/Sol Pb/PCBs ---/(ppm)/(ppb)
B7 @ 13	ND	ND	ND	ND	ND			
B7 @ 20	2,500	3,500	34,000	130,000	33,000	---	---/---	---/0.07/---
B8 @ 22.5	1,200	2,300	38,000	89,000	18,000	---	---/---	---/---/---

1 Total Volatile Hydrocarbons, mg/kg = ppm
2 Benzene, ug/kg = ppb
3 Toluene
4 Xylene
5 Ethylbenzene
6 Total Oil & Grease
7 Total Extractable Hydrocarbons (as kerosene and diesel)
8 --- = Not tested for
9 ND = Not detected



RESULTS FROM SUBSURFACE CONSULTANTS

Suspected sources of contamination may include either on-site and/or off-site USTs. The lateral and vertical extent of contamination has not yet been defined. A previous geophysical investigation by J. R. Associates completed in August 1990 disclosed the presence of several USTs and associated facilities within the boundaries of the subject site. A description of these tanks and a summary of investigative and remedial actions which have been performed to date are presented below.

Waste Oil Tanks

Two waste oil tanks are located beneath the basement floor of the multi-story parking structure along Alice Street. Figure 3 shows the tanks and associated piping and vent lines in the area. The date of installation of these tanks is unknown. No records have been located which have documented the capacity or composition of these tanks. However, it is believed that each tank has an approximately 1000-gallon capacity and is of steel construction. On October 27, 1990, Falcon Energy drained the contents of both tanks by removing a combined total of 1300-gallons of waste oil from them.

Gasoline Tanks

Two gasoline tanks are located near the western property boundary beneath the Harrison Street sidewalk in front of the entrance to the garage. Permits issued to a former long-term tenant of the garage, Douglas Motor Services, show that these tanks each have 1000-gallon capacities, are of steel construction, and were installed in 1975 and 1982, respectively. On October 27, 1990, Falcon Energy removed most gasoline (total less than 200 gallons) from the tanks. The condition of these two tanks is unknown, although a sample collected from one was discolored by rust. The recovered gasoline and waste oil was accepted and utilized by a recycling contractor.

It should be noted that there is evidence of two other abandoned-in-place USTs a few feet west of the above-described gasoline tanks, beneath the Harrison Street sidewalk of the adjacent property. These tanks and property are owned and operated by other parties.

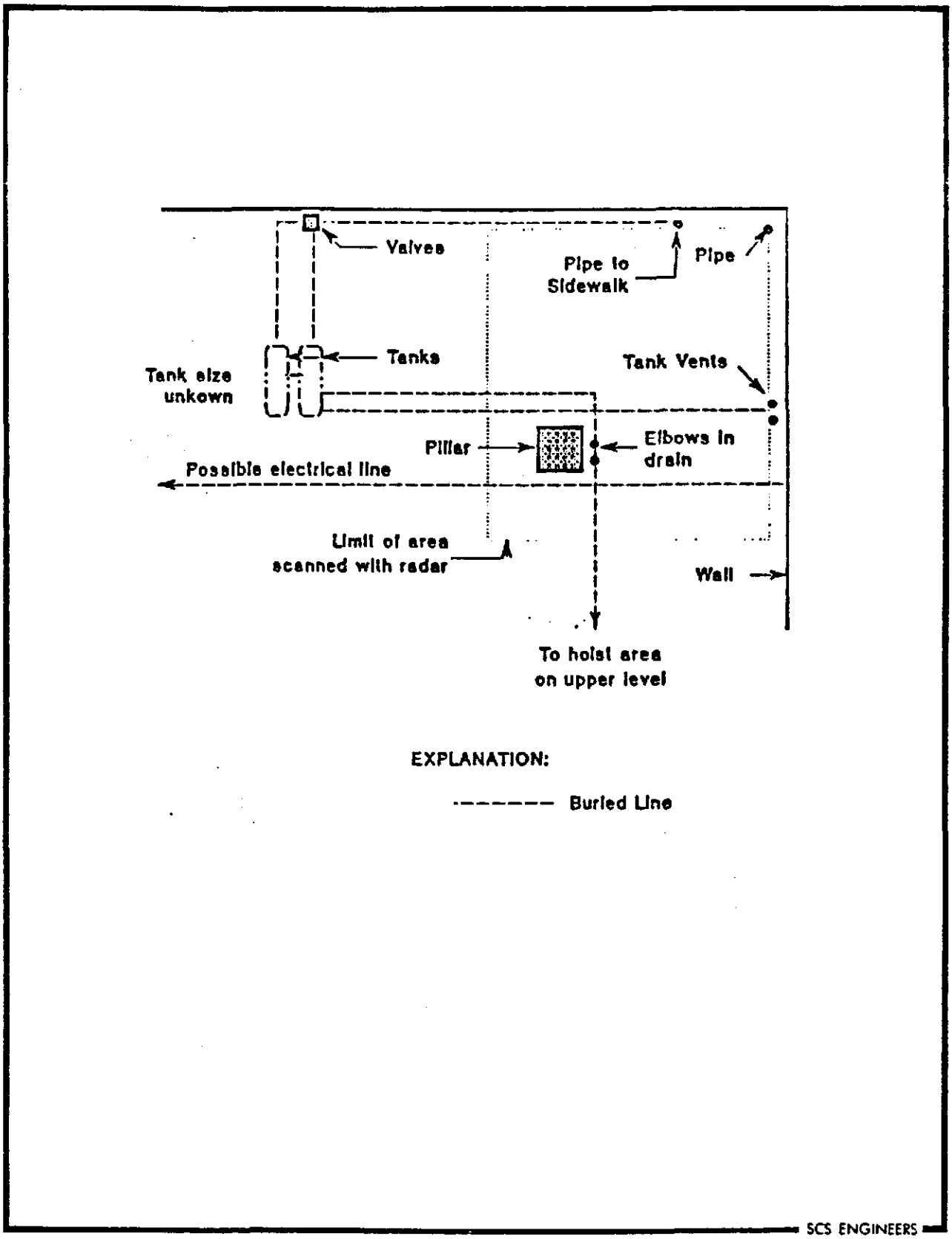


FIGURE 3: Detailed Site Plan of Alice Street Basement Garage, Showing Tank and Associated Piping Locations based on Geophysical Survey

Hydraulic Lift Area

The recent J. R. Associates geophysical investigation also identified a probable underground fluid reservoir located near the hydraulic lift area as well as three hydraulic lift rams inside the Harrison Street parking garage. Figure 4 shows the hydraulic lifts and associated piping in the area; the area of the Ground Penetrating Radar (GPR) anomaly marks the suspected location of the underground fluid reservoir.

There is no available record to indicate that integrity testing has ever been performed on any of the above-described tanks. The tanks are suspected to be the principal source(s) of the site's contamination. However, the time(s) of occurrence and total quantity of product(s) lost cannot be estimated at this time.

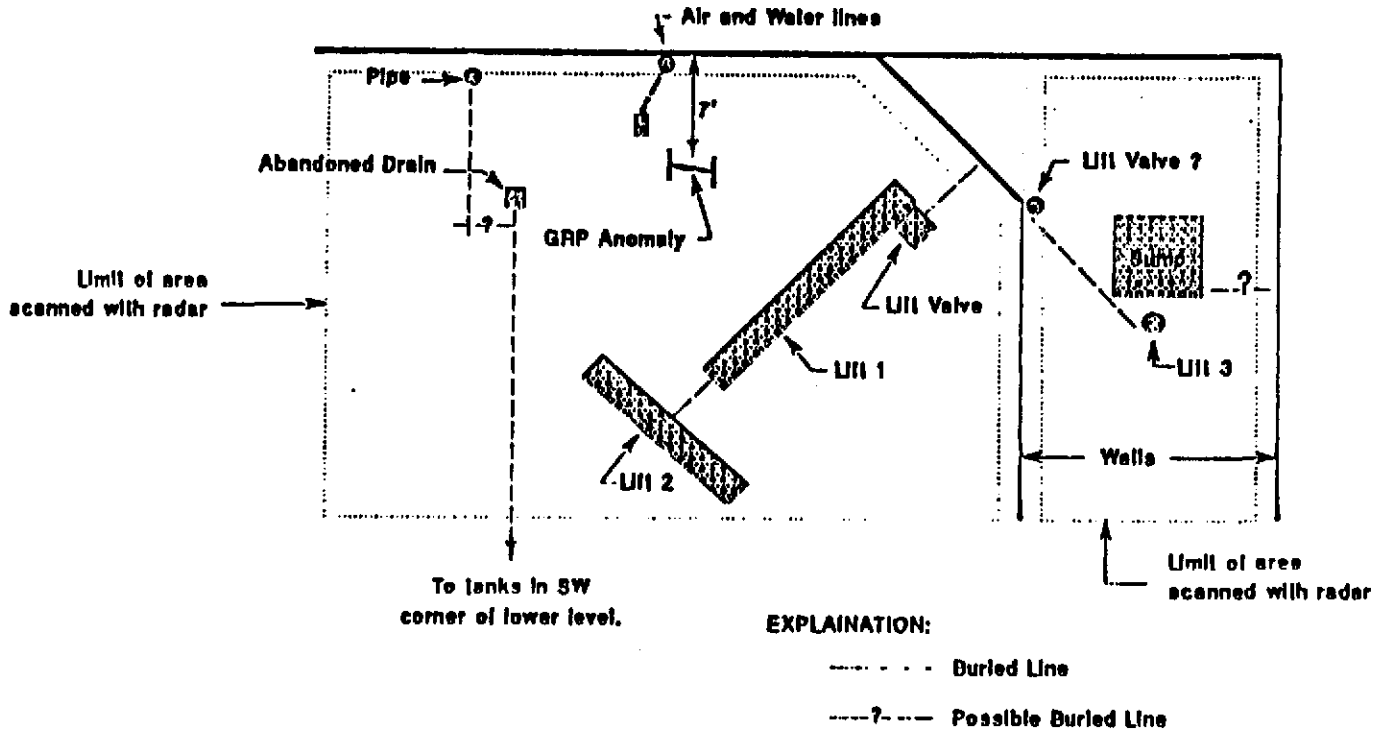


FIGURE 4: Detailed Site Plan of Hydraulic Lift Area in upper Harrison Street Garage, Showing Lift and associated Piping and Suspected Underground Fluid Reservoir (GPR anomaly) areas

SECTION 3

PROJECT ORGANIZATION AND FUNCTIONAL RESPONSIBILITIES

LIST OF PROJECT PERSONNEL

SCS Engineers

Dr. John P. Cummings, Project Director and Health and Safety Officer
Mr. David E. Ross, P.E., Technical Advisor And Quality Assurance Officer
Mr. Nels R. Johnson, P.E., Project Manager
Mr. Jack N. Alt, Certified Engineering Geologist
Mr. J. Don McClenagan, Field Manager
Mr. Thomas D. Gilmore, Field Geologist
Ms. Adi Constantinescu, Field Geologist
Mr. Prabhu N. Ravandur, Field Engineer

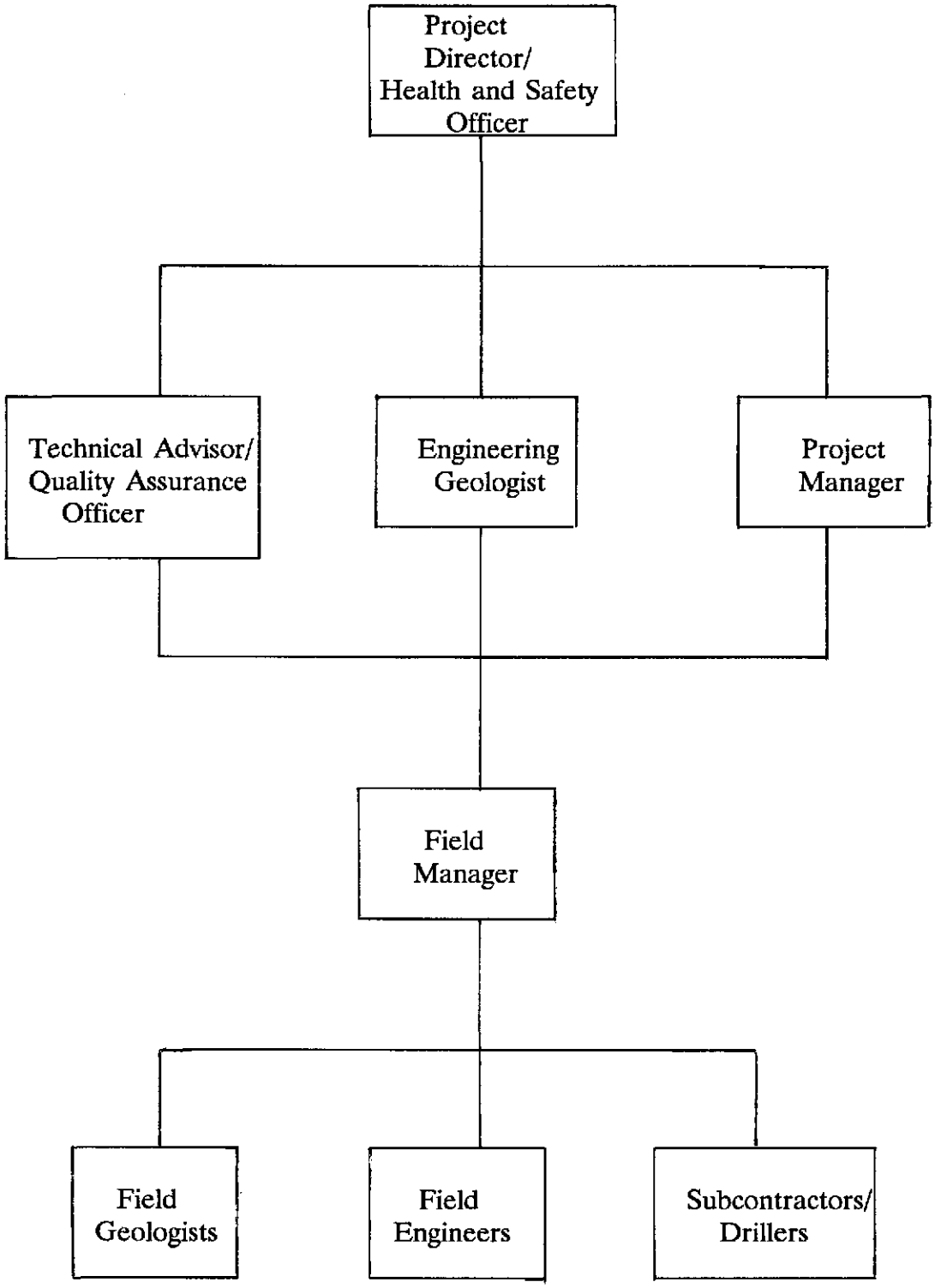
Subcontractors

SCS Field Services
J R Associates
HEW Drilling Company
Hogate Exploration
Bay Area Exploration

Contract Analytical Laboratory

SCS Analytical Laboratory
2860 Walnut Avenue
Long Beach, California 90806

SCS ENGINEERS ORGANIZATIONAL STRUCTURE



FUNCTIONAL RESPONSIBILITIES

Project Director/Health and Safety Officer

The Project Director (PD) will be responsible for overall project management and supervision. In this capacity, he will also closely coordinate with USACE Project Managers in order to assure satisfactory, accurate, and timely completion of all field operations, interpretation of laboratory analytical results, establishment of and compliance with quality-assurance procedures, and other characterization activities as required. For this project, the PD also will serve as the Health and Safety Officer (HSO). In this capacity, his responsibilities will include development, implementation, and updating of the Health and Safety Plan, including assessing, and interpreting the results of site monitoring and evaluation of health hazards, with specific application to determination of appropriate corrective actions or changes in required Personal Protective Equipment (PPE) that may be mandated by changes in site working conditions or environment.

Technical Advisor/Quality Assurance Officer

The Technical Advisor (TA) will provide technical support and expertise to the project as required by specific site conditions or problems that may be encountered during the course of either field operations or interpretation of analytical results. Such conditions may include, but are not limited to, discovery of unusual and/or complex combinations of contaminants, characterization or assessment of complex or interactive contaminant plumes or migration patterns, or interpretation of ambiguous laboratory results. For this project, the TA also will serve as the Quality Assurance Officer (QAO). Because the TA/QAO is affiliated with the Long Beach Office of SCS Engineers, his QA responsibilities are separate and independent from the Dublin Office-based project management, although he will report directly to the Project Director. In this capacity, the QAO will assess, initiate, carry out, and review corrective actions required to maintain adequate quality-assurance procedures for the field collection and laboratory analysis of samples interpretation of results, and chemical characterization of the site.

Project Manager

The Project Manager (PM) will be responsible for the day-to-day management of all operations associated with the site characterization program. In this capacity, he will be responsible for conducting and coordinating smooth and timely completion of the field operations, ensuring adequacy and completeness of the sampling and monitoring program and resulting characterization, and resolving any unanticipated problems or difficulties that may occur during the daily operations. In addition, the PM will be responsible for maintaining compliance with the Health and Safety Plan and will audit site health and safety practices, decontamination, and environmental monitoring activities.

Field Manager

The Field Manager (FM) will be responsible for overseeing daily activities of the sampling and monitoring program. He will also monitor job progress and overall Health and Safety Plan compliance.

Field Geologists/Engineers

During drilling, well installation, water-level measurement, and sample collection activities, field geologists and/or engineers will identify sampling locations and depths, collect and preserve soil samples, log soil conditions, measure water depths, collect and preserve representative groundwater samples, complete Chain-of-Custody documentation, and ship samples to the laboratory.

SECTION 4
FIELD ACTIVITIES

INTRODUCTION

The planned field activities for this first phase of the contamination characterization program include removal and disposal of the USTs and hydraulic lifts, collection of soil samples from all excavated tank pits, collection of sludge and water samples from the wash rack sump area, basement collection drain and capped pipe in the basement, installation of a total of three groundwater monitoring wells, (one adjoining the gas UST, one adjoining the waste oil UST and one adjoining the hydraulic lifts), well development and collection of representative groundwater samples.

The field methodology and laboratory analytical procedures to be used in the collection, analysis, and interpretation of chemical data for this contamination characterization program and their basis are outlined and described below. The purpose of the planned operations is to: 1) remove probable sources of contamination presently on-site, 2) identify contaminants in both soil and groundwater, 3) characterize the lateral and vertical extent of contamination, 4) identify concentration levels, and 5) identify the probable direction of movement (if any) of soil and /or groundwater contamination at the Harrison Street Garage.

Installation of groundwater monitoring wells will permit the collection and analysis of representative groundwater samples surrounding the tank and lift sites in order to define the nature, extent, and concentration of contamination and to discern the probable source and direction of movement of the contamination. Periodic measurement of groundwater levels in the wells will provide information concerning site-specific hydrologic conditions and temporal changes in water levels, which will in turn permit establishment of a groundwater gradient and probable direction of flow. Similarly, soil samples collected at the time of monitoring well installation and from additional, strategically located soil borings (to be drilled during a subsequent phase of site characterization) will permit

characterization of the nature, probable source, extent, and concentration levels of any potential soil contamination in the designated areas.

Completion of the above elements is expected to permit initial characterization and assessment of the nature and extent of any soil and/or groundwater contamination present at the three individual sites being investigated. Interpretation and integration of analytical test results will permit: (1) qualitative and quantitative determination of whether chemical releases to the environment have occurred, (2) identification of probable sources and extent of contamination, (3) identification of chemical constituents and concentration levels of any contamination present, which will in turn indicate the appropriate method of disposal and/or remediation, and (4) determination of whether additional or more detailed characterization of any individual site may be required.

All field operations will be conducted and analytical test results determined so as to fully comply with all applicable federal, state, and local regulations governing underground storage tanks. The field procedures described below have been developed and will be implemented so as to meet the minimum standards or requirements outlined in the State Water Resources Control Board's (SWRCB) LUFT Field Manual (dated May 1988, and revised in part April 5, 1989) and the Tri-Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites (dated 10 August, 1990). The results of this characterization investigation will provide the basis for addressing the next phase of cleanup operations.

The sampling and analytical procedures presented in this plan will ensure that characterization of all contaminants suspected to be present is complete; consistent and reproducible sampling methods are used; proper analytical methods are applied; analytical results are accurate, precise, and complete; and the overall objectives of the contamination characterization and monitoring program are achieved. These procedures will be performed in accordance with the Tri-Regional Board Staff Recommendations document (10 August, 1990). The analyses to be performed on discrete samples collected from each

suspected source area are summarized in tabular form as Table 2. The full complement of analytical tests specified for each suspected source area (Table 2) will be performed during the initial soil sampling round associated with the tank and lift removals and the monitor well installations, including the initial groundwater samples. If certain constituents or classes of constituents are "not-detected" during the initial round, then, as previously agreed to (May and July 1991) and in concurrence with the County and RWQCB, subsequent analyses may be limited to only those constituents or methods which initially produced detectable concentrations. Such a program may result in substantial savings in both time and money, to the client, without sacrificing adequacy of cleanup, and is in keeping with the cost-reduction purpose stated in Appendix A, Page A-1, of the Tri-Regional Board Recommendations: "We do not believe that the best interest of the tank owner is served by prolonging the investigation and subsequent cleanup. Both inflation and changing laws and regulations will escalate costs to the tank owner. Also, the ability to construct on property or to transfer ownership will be severely restricted, usually by the lending institution, not the regulating agency."

The remainder of this work plan consists of sections that describe in detail the various elements of the Phase I Site Characterization Program, including: Tank and lift removal, installation of monitoring wells, procedures for soil sample collection, groundwater level measurement and groundwater sample collection. In addition, documentation of Chain-of-Custody, analytical services, and quality assurance procedures are described.

LOCATION OF UNDERGROUND UTILITIES

Prior to the beginning of any field drilling or tank removal operations, Underground Service Alert (U.S. Alert) will be contacted in order to locate any underground utilities present near the proposed investigative areas around each former tank site. In addition, a geophysical survey utilizing ground penetrating radar may also be conducted to locate the same. Such utilities will include, but may not be limited to:

- Water
- Storm and Sanitary Sewer

TABLE 2

LABORATORY ANALYSIS SUMMARY
FOR COLLECTED SOIL AND WATER SAMPLES

Location	TPH-G[1]	TPH-D[2]	BTEX[3]	O.L.[4]	O&G[5]	ClH[6]	PCB's[7]	PPM[8]
Gasoline Tanks (MW-1)	X	X	X	X	X	X	X	X
Hydraulic Lift (MW-2)		X	X		X			
Waste Oil Tanks (Basement MW-3)	X	X	X		X	X	X	X
Wash Rack Sump	X	X	X		X	X		X
Collection Drain & Capped Pipe (Basement)	X	X	X		X	X		X

1. Total Petroleum Hydrocarbon as GAS (EPA 8015 Mod)
2. Total Petroleum Hydrocarbon as Diesel (EPA 8015 Mod)
3. Benzene, Toluene, Ethylbenzene, Xylene (EPA 8240)
4. Organic Lead (DOHS MIBK Method)
5. Oil & Grease (EPA 413.1)
6. Chlorinated Hydrocarbons (EPA 8240)
7. Polychlorinated Biphenyls (EPA 8080)
8. Priority Metals (Pb, Ni, 2N, Cr, Cd)

- Electric Power Lines
- Telephone
- Natural Gas and other High-pressure Fuel Lines
- Cable Television
- Other Facilities, such as Steam, Vacuum, or Compressed Air Lines
- Underground Storage Tanks and Associated Vent Lines or Dispenser Facilities

Precise field location of existing utility lines (or other unanticipated field conditions) may dictate the need to slightly modify proposed field locations of borings in order to avoid potential damage to the existing lines. SCS Engineers will contact the County for its approval of any such locational changes prior to the initiation of actual field work at those locations.

Identification of buried pipes or drain lines in the basement and their respective outlets or sewer hookups is of concern. The destination of discharge originated from the drains in the basement is not certain. As-built drawings for the building and city public sewers will be examined from City files, if available. If adequate records are not available, a pipe-locating service or geophysical survey will be employed in order to determine the probable routes and destinations of the basement drain lines.

COLLECTION OF SAMPLES FROM WASH RACK SUMP AND COLLECTION DRAIN AREAS

Liquid and/or sludge samples will be collected for analysis from three possible contamination source areas, including 1) the wash rack sump area in the Harrison Street garage 2) the collection drain in the Alice Street Basement and 3) the capped pipe also in the Alice Street basement. Analysis of these samples will permit identification of the contents of these areas, which currently are unknown, and will provide the basis for further drilling and sampling during a subsequent phase of characterization.

Liquid and/or sludge samples, if available, will be collected from the wash rack sump and/or adjoining lift ram. A preliminary field reconnaissance indicated that no water was

present in the sump area, although water was present in the adjoining lift ram. There is a sufficient amount of sludge or other solid residue present in the immediate sump area to collect a representative sample for analysis. Sludge will be collected using either a stainless steel or disposable plastic scoop and retained in a wide-mouth jar with a non-reactive screw-top. Representative water samples will be collected from the ram next to the sump using a disposable bailer. No water from the ram will be purged prior to sampling, as it is unknown how much product is available. The initial sample collected will be examined for the presence of floating, free product, which, if observed, will be measured and described, and any other distinguishing characteristics will be noted. A minimum of two 1-liter bottles and four 40-ml VOA vials will be collected. Samples will be sealed following collection, labeled, kept in cold storage (4^0C), and transported with Chain-of-Custody documentation to a certified testing laboratory for analysis. The analyses to be performed are specified in Table 2.

Liquid samples also will be collected from the basement collection drain and capped pipe. Based on preliminary field reconnaissance, both these sources appear to contain only liquids. If a disposable bailer cannot be inserted into either opening, or if insufficient material is available, a hand-operated siphon pump with removable hoses will be used for sample collection; clean hose lines will be installed in order to avoid cross-contamination of samples between the drain and pipe sources. A minimum of two 1-liter bottles and four 40-ml VOA vials will be collected from each source, provided sufficient material is available to sample. The analytical tests to be performed on these samples are specified in Table 2.

TANK AND LIFT REMOVALS

The two gasoline USTs beneath the Harrison Street sidewalk, the two waste oil USTs in the Alice Street basement, and the three hydraulic lifts and possible associated hydraulic fluid reservoir, and any associated product piping or vent lines that are exposed all will be removed and disposed of by a State-licensed hazardous materials contractor, after first being properly cleaned, vented, degassed, and inerted. Manifests (to be appended to the

tank removal report) will document proper treatment, storage, and disposal of all tanks, associated piping, and rinsate solutions.

It is anticipated that all excavation spoils will be retained on-site until disposition can be determined. Stockpiled soil will be covered over and underneath with visqueen material as required to keep contaminants contained. The open excavations will be barricaded and/or covered until disposition of the spoils can be determined (i.e., used as backfill or hauled off-site).

Collection of Soil Samples

Following excavation and removal of the tanks or lifts from each area, representative soil samples will be collected from each site and submitted to a State-certified analytical laboratory for testing. Two soil samples will be collected from beneath the ends of each tank or lift area. These samples shall be taken from native materials not to exceed 2 feet below the bottom of each end of the tank. Discrete soil samples also will be collected from beneath each hydraulic lift ram and fluid reservoir. Groundwater is not expected to be encountered in the excavation pit, however if present soil samples will be collected from the pit walls near the tank ends at the soil/groundwater interface. A water sample will also be collected from the excavation pit, where it is present.

Soil samples will also be collected at an interval of 20 feet for associated product piping that has been present as determined to be a conduit for hazardous materials. These samples will be collected and analyzed for the same constituents as the pertinent UST regardless of their disposition.

Additional soil samples will be collected from the excavation spoils piles. SCS Engineers proposes to collect two samples for every 50 cubic yards of soil removed. The samples will be discrete or discrete and composited by the laboratory (no field compositing). Additional analyses may be required, such as Title 22 and CAM 17 metals dependant on the disposal facility and its requirements for acceptance. The two gasoline tanks and the

two waste oil tanks should comprise one excavation each, and therefore, number of samples will be determined based on the volume of the soil removed. Same procedure will be followed regarding the number of samples in the removal of hydraulic lifts and associated reservoir. Since the exact physical size of the tanks is not known at this time, it is difficult to specify the extent of excavation at the site. However, based on the available details of the tank and their location, it is estimated that the preliminary excavation at the basement would be 14 ft x 14 ft x 12 ft and that on the Harrison Street would be 12 ft x 10 ft x 8 ft.

Soil samples will be collected and retained in clean brass sleeves, the ends sealed with teflon tape, capped with plastic end caps, sealed tightly with tape, labeled, and kept in cold storage (4°C) for transport to a State-certified laboratory. During sampling, samples may be screened in the field using both visual inspection and a portable organic vapor meter.

INSTALLATION OF GROUNDWATER MONITORING WELLS

Following removal of the tanks and lifts, a total of 3 groundwater monitoring wells will be installed, one adjacent to gasoline UST, waste oil USTs and hydraulic lifts. Installation of the initial 3 wells is expected not only to permit determination of a verified downgradient groundwater flow direction and to measure water levels, but also to meet the "within 10 feet (of a former tank site)" requirement specified by the Tri-Regional Recommendations (revised August 10, 1990, Page 11). Figure 2 shows the proposed locations of the monitoring wells, each in the presumed downgradiant (i.e., eastward) groundwater flow direction from the presumed source areas, which include: (1) the gasoline tanks (2) waste oil tanks and (3) hydraulic lift areas. Each well also will be used for sampling and monitoring during the next phase of the more detailed site characterization and assessment program.

Placement Rationale

The proposed wells are designed and will be sited so as to (1) permit computation of a verified downgradient groundwater flow direction, (2) measure water levels, and (3) optimally investigate the nature and levels of contamination both at known and suspected sources of contamination. A verified downgradient direction has not yet been established for this site; however, it is provisionally assumed to subparallel the local topographic slope. Consequently, and based on an assumed easterly direction of groundwater flow, contaminants which could move from their source are expected to migrate in a generally easterly direction toward Lake Merritt.

Drilling and Installation of Wells

The proposed groundwater monitoring wells will be installed using a hollow-stem auger drilling rig. Because of the height and clearance constraints imposed by the ceilings and access ways within the existing parking structure, a small skid-or trailer-mounted rig will be utilized inside the basement. The wells near the Harrison Street garage entrance and hydraulic lift areas will be installed using a conventional truck-mounted drilling rig.

The well installation will be coordinated by a field geologist, under the supervision of a State-registered Certified Engineering Geologist (CEG). The borings will be logged in the field by the field geologist, and soils encountered will be classified using the Unified Soil Classification System (Figure 5). Well logs for each boring showing lithologies encountered, depth to groundwater, and well construction details will be included in the final written report. A sample field boring log is shown in Appendix D.

The proposed borings will be approximately 6 inches in diameter. Borings will be drilled to a total depth of approximately 35 feet below the Harrison Street grade, or at least 10 feet below the groundwater surface. A previous subsurface investigation conducted at this site in October 1990 by Subsurface Consultants, encountered groundwater at an average depth of 23 to 25 feet below the Harrison Street grade. The augers will be steam-cleaned on site at the completion of each boring. Waste water and sludge from the steam cleaning

UNIFIED SOIL CLASSIFICATION SYSTEM

GENERAL SOIL CATEGORIES			SYMBOLS	TYPICAL SOIL TYPES
COARSE GRAINED SOILS More than half is larger than No. 200 sieve	GRAVEL More than half coarse fraction is larger than No. 4 sieve size	Clean Gravel with little or no fines	GW	Well Graded Gravel, Gravel-Sand Mixtures
			GP	Poorly Graded Gravel, Gravel-Sand Mixtures
		Gravel with more than 12% fines	GM	Silty Gravel, Poorly Graded Gravel-Sand-Silt Mixtures
			GC	Clayey Gravel, Poorly Graded Gravel-Sand-Clay Mixtures
	SAND More than half coarse fraction is smaller than No. 4 sieve size	Clean sand with little or no fines	SW	Well Graded Sand, Gravelly Sand
			SP	Poorly Graded Sand, Gravelly Sand
		Sand with more than 12% fines	SM	Silty Sand, Poorly Graded Sand-Silt Mixtures
			SC	Clayey Sand, Poorly Graded Sand-Clay Mixtures
FINE GRAINED SOILS More than half is smaller than No. 200 sieve	SILT AND CLAY Liquid Limit Less than 50%		ML	Inorganic Silt and Very Fine Sand, Rock Flour, Silty or Clayey Fine Sand, or Clayey Silt with Slight Plasticity
			CL	Inorganic Clay of Low to Medium Plasticity, Gravelly Clay, Sandy Clay, Silty Clay, Lean Clay
			OL	Organic Clay and Organic Silty Clay of Low Plasticity
	SILT AND CLAY Liquid Limit Greater than 50%		MH	Inorganic Silt, Micaceous or Diatomaceous Fine Sandy or Silty Soils, Elastic Silt
			CH	Inorganic Clay of High Plasticity, Fat Clay
			OH	Organic Clay of Medium to High Plasticity, Organic Silt
HIGHLY ORGANIC SOILS			PT	Peat and Other Highly Organic Soils

FIGURE 5: Unified Soil Classification System Chart

and excavation spoils from drilling will be collected and transferred to 55-gallon drums for temporary storage on-site. The waste water and spoils will be analyzed and the results will dictate the final disposition.

Soil samples will be collected from each boring at a minimum interval of every 5 feet, and at the soil/groundwater interface (if encountered), with a Modified California split-spoon sampler. Samples will be retained in brass sleeves, examined, sealed with teflon, capped with plastic end caps, tightly wrapped with tape, labeled, and kept in cold storage (4°C) for transport to a chemical testing laboratory certified by the California Department of Health Services. Samples submitted for analysis of heavy metal constituents will be retained in glass jars with non-reactive lids. Samples will be screened in the field using a photo-ionization detector type organic vapor meter (OVM). Protocol for sample labeling is as follows: All samples will include identification of project name or number, date and time of sampling, drill hole or monitoring well number, sample number, sample depth, and requested analyses.

Well Construction

Typical well construction details for the installation of groundwater monitoring wells are shown in Figure 6. Each monitoring well will be constructed in the borehole using flush-mounted, threaded PVC well casing. As proposed, wells located inside the building will be two inches in diameter. Factory-slotted screen with 0.020-inch slots will be placed into the aquifer, with solid PVC pipe installed above. The perforated zone of the casing will be installed from about 5 feet above the groundwater surface to the total depth of the well, such that perforated casing extends at least 10 feet below the groundwater surface.

A perforated zone of this nature should accommodate anticipated seasonal water-level fluctuations at the site. A flush-mounted, threaded end cap will be placed on the bottom of the perforated section. Couplings between the casing sections will be flush-set, threaded pipe with no glued connections. All casings will be steam-cleaned prior to installation.

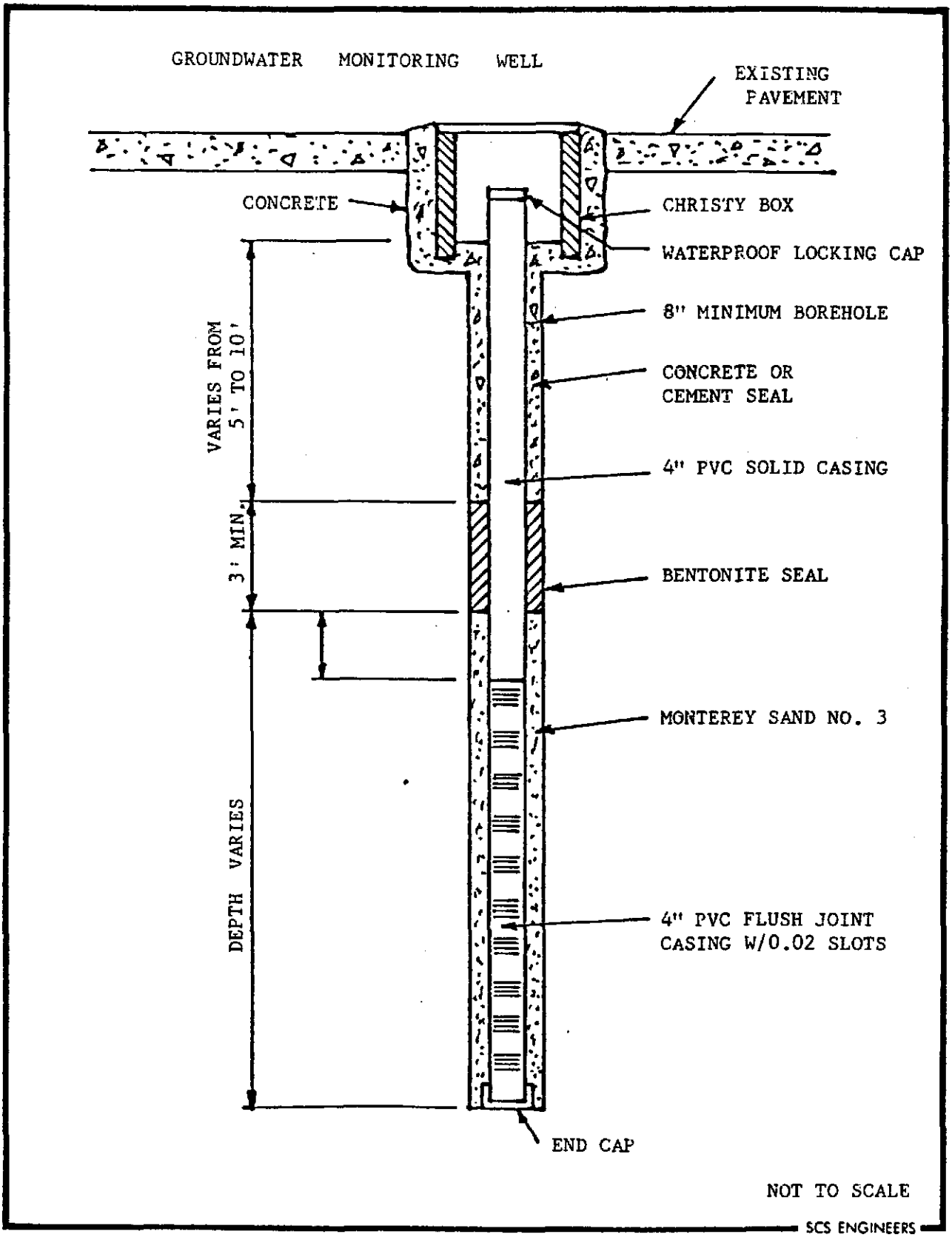


FIGURE 6: Typical Well Construction Details for the Installation of Groundwater Monitoring Wells

The well casing will be set inside the hollow augers prior to their removal in order to prevent caving of the hole prior to installation of the casing. The annular space surrounding the well screen will be filled with a filter pack, such as Monterey Sand No. 3, to a level at least 2 feet above the top of the screened interval and then capped with a bentonite seal approximately 3 feet thick. The sand will be poured slowly into the annular space between the PVC pipe and the augers. This procedure will be interrupted periodically in order to measure the depth to the top of the sand with a weighted tape. The remaining annular space above the bentonite seal will be filled with a cement/grout mixture to a level about 1 foot below grade. The top of the well will be cemented and set with a locking monument well cover. The concrete surface seal will be sloped away from the well casing at the ground surface in order to promote good drainage and prevent infiltration. The top or surface portion of the well casing will be fitted with a lockable, expandable rubber plug in order to reduce or minimize unwarranted intrusion into the casing.

A reference point on each monitoring well casing will be marked with an indelible marker and then surveyed by SCS Engineers in order to establish elevations that will be used for depth-to-water measurements and gradient calculations. The leveling survey will measure elevations to the nearest 0.01 foot and all elevations will be referred to an established benchmark or other fixed local control point of known elevation.

Well Development

Each monitoring well will be developed in order to increase its specific capacity, prevent sanding, maximize well life, and collect representative samples of the groundwater. Well development generally repairs any damage done to the native materials by the drilling operations, restores natural hydraulic properties to the adjacent soils, and improves hydraulic properties near the borehole so that water flows more freely into the well.

The wells will be developed by removing or flushing the finer material from both the local native materials and the sand filter pack surrounding the wells. This procedure will

consist first of bailing the well and then pumping or bailing the well until it produces clean water, i.e., water containing minimal amounts of suspended solids. All of the groundwater produced or removed during the well development operations will be stored temporarily on-site in approved 55-gallon drums, which will be labeled as to their contents. Subsequent testing of the purged groundwater will indicate its final disposition.

New disposable bailers will be used for all well purging and sampling activities. The use of dedicated bailers for each well will assure sample cleanliness and avoid potential for cross-contamination. Should any reusable equipment, such as pumps, be employed, all equipment will be decontaminated both prior to and subsequent to its use in each well. Decontamination will consist of steam cleaning and/or washing of equipment using trisodium phosphate soap, tap water rinse, and distilled water rinse.

Water Level Measurement

Prior to any groundwater sampling, static water-level measurements in each monitoring well will be taken using an electronic water-level indicator. Water-level measurements will be made within seven days of the initial well installation and thereafter monthly by a field geologist or engineer and the readings will be measured to the nearest 0.01 foot from the marked reference point on the top of the well casing. The monitoring wells will be sampled for soluble constituents only after completion of the water-level measurements. Water levels will be converted to elevations with respect to mean sea level (MSL), or another fixed local control point, and monthly groundwater elevation contour maps then will be constructed from the water level data.

Sealed wells should always be uncapped and left open for several minutes prior to water-level measurement in order to allow ambient groundwater levels to equilibrate. The water level will be measured by lowering the electrode and cable slowly into the well casing. The water level indicator will be turned on and the buzzer tested before lowering the cable into the well. Water levels will be reported in feet below a measured reference point, usually a mark on the top of the well casing. The point on the sounder cable

where the water level indicator will register maximum deflection will be held against the reference point and marked. The distance from the mark to the nearest footage tab will be measured using a pocket tape calibrated in hundredths of feet. Water level measurements will be repeated two or more times in order to assure accuracy of the water level measurement.

All water levels will be recorded on prepared forms of the type shown in Appendix D. The recorded data will include the depth to water, in feet below the reference point, the time and date of the measurement, and the calculated water level, depth or elevation, with respect to a fixed control point. Water level measurements will be reported to the nearest 0.01 foot.

Notes of any activity or condition which may affect the water level measurements will be made during the water level measuring. Such activities may include changes in local atmospheric conditions, pumping from nearby wells, drilling and/or testing operations.

Collection of Groundwater Samples

The following sections contain a detailed description of the equipment, well purging and sampling techniques, and methods of sample handling to be utilized in the monthly collection of representative groundwater samples for the water quality monitoring program. Initial groundwater samples will be collected, following accepted water-level measurement and well development procedures, within seven days of the initial well installation.

The depth to static water level first will be measured and recorded, as described in the section "Groundwater Level Measurements," before purging and sampling of each monitoring well begins. Next, a clear disposable bailer will be lowered into each well following water-level measurement, but prior to purging, in order to sample the upper surface of the groundwater. Any free product observed floating on the groundwater will be measured in the bailer, and its color, odor, turbidity, or other distinguishing characteristics will be noted and described.

Following free product sampling, each monitoring well will be purged of three to four well-volumes of water using disposable bailers or a submersible pump. Well purging permits a representative sample of groundwater to be obtained directly from the aquifer, rather than from water which had been standing in the well. Because the well casing diameter, total well depth, and groundwater level will be known or can be calculated for each well, an accurate estimate of well volume can be made in the field in order to estimate and measure the purge volume required to be evacuated from each well prior to sampling. If the well does not recharge fast enough to permit removing three well-casing volumes, the well will be pumped or bailed dry, and sampled as soon as sufficient recharge has occurred. Again, notations will be made as to any color, odor, turbidity, or other distinguishing characteristics in the water being purged from the well. Groundwater removed from wells prior to sample collection will be contained temporarily on-site in approved 55-gallon drums, which will be clearly labeled to identify contents as "Possibly Hazardous" and source. Subsequent testing results will dictate its final disposition.

After completion of the minimum bailing time required to adequately purge the well, the purging water level, well discharge rate, temperature, specific conductance, and pH again will be measured and recorded on the field data sheet. A typical data sheet is shown in Appendix D. The time when the purging began, the duration of purging, and the date of the sampling also will be noted on the data sheet. If a pump is used for purging of wells, it will be decontaminated both prior to and subsequent to its use in each monitoring well. Decontamination will consist of washing of equipment with trisodium phosphate soap, tap water rinse, and distilled water rinse.

Representative groundwater samples will be collected monthly using a disposable acrylic bailer and contained in pre-cleaned 40 ml VOA vials with teflon-coated septa or 1-liter amber jars, depending on the analysis to be performed. The type of containers, preservation, and maximum holding times permitted prior to analysis for both soil and groundwater samples will conform to EPA standards. Samples will be acidified for preservation when required by EPA protocol. The general procedure for sample collection

is as follows. Sample containers will not be pre-rinsed with sample, and will be filled slowly just to overflowing so that a convex meniscus remains over the opening of the container. Samples to be analyzed for volatiles will be collected first, allowing no head space and with as little disturbance of the water as possible. The container will then be carefully sealed with the teflon-lined cap. All efforts will be made to minimize volatilization of the samples, particularly by minimizing sample exposure to the atmosphere through collection as soon after completion of well purging or recharge as practicable and by ensuring that all air is expelled from sample containers. If air bubbles are present following sealing of sample containers, the sample should be poured out and resampled. Duplicate groundwater samples will be routinely collected.

Sealed sample containers then will be labeled with a sample tag, using similar protocol to that described above for soil samples. Labels will include: project name or number, date and time of sample collection, monitoring well number, sample number, name of person collecting the sample, and requested analyses.

Sample Handling

All samples for all analyses will be refrigerated from the time of field collection until the time the samples are analyzed in the laboratory. Samples obtained from sources or sample points known or suspected to contain high concentrations of volatile contaminants will be segregated from the other samples during handling and shipment. Samples containing high concentrations of volatile organic compounds will be shipped in separate containers to minimize potential cross contamination with other samples during shipping. Trip and field blanks (see Section 6) will be included with each container of samples shipped to the laboratory. At the end of each field day, the samples will be carefully packaged to preclude damage or breakage and sealed with tape for secure transportation to the selected laboratory. All sample shipments will be sent via an overnight carrier such as Federal Express with the proper Chain-of-Custody forms clearly documenting the sample identification, time and date of collection, and analyses to be performed. An example of the Chain-of-Custody form is included in Appendix D. A more detailed

description of Chain-of-Custody documentation is outlined in Section 5. Samples will be scheduled to arrive at the analytical lab within 24 hours after acquisition.

All soil and groundwater samples from the monitoring wells will be analyzed for the constituents listed in Table 2.

SECTION 5
DOCUMENTATION OF CHAIN OF CUSTODY

To ensure the integrity of samples from time of collection to reporting of analytical results, documentation of Chain-of-Custody is required. Custody documentation will permit tracing of the possession and handling of samples from the time of collection in the field through laboratory analysis and final disposition. The components of the custody procedure include: sample labels, field log, and Chain-of-Custody document containing analysis request. Sample field logs and Chain-of-Custody documents are included in Appendix D.

Sample labels will be attached to all sample containers in order to prevent misidentification of samples. Labels will be filled out and attached to sample containers at the time of sample collection. Protocol for sample labeling is discussed under the appropriate (i.e., soil or groundwater) sampling procedures outlined in Section 4, Field Activities.

Sample seals will be attached to the sample caps in order to detect possible contamination or unauthorized tampering of the samples during transfer. Gummed labels or tape are recommended. The seal will be attached in a manner that requires breaking of the seal in order to open the sample container.

A field sampling log will be maintained to record observations and information obtained during sampling. The field log will include:

- Location of sample point.
- Sample identification.
- Number and volume of samples taken.
- Description of sample point and sample methods.
- Date and time of collection.
- Field observations.
- Field measurements (e.g. pH, temperature, specific conductance).
- Names(s) and signature(s) of persons(s) collecting the sample.

The Chain-of-Custody document will accompany all samples delivered to the laboratory and will include sample identification, date sampled, and analyses requested. Any instructions for special handling, storage, or disposition of the samples also will be included on the request form.

The sample transmittal documents will include the shipping receipts to document sample transport, and sample Chain-of-Custody form. The acknowledgement of receipt will include date of sample receipt, identification of samples received, condition of samples as received, and signature of receiving laboratory representative on the same Chain-of-Custody form.

Copies of all documents relating to sample custody will be permanently retained by SCS Engineers and will be appended to written reports summarizing analytical test results.

SECTION 6
ANALYTICAL SERVICES AND QUALITY ASSURANCE PROCEDURES

ANALYTICAL SERVICES

A chemical testing laboratory certified by the State of California Department of Health Services will be retained to analyze all soil and water samples collected as part of the Site Characterization Program. The "Certificates of Approval" of the laboratory and Statement of Qualification of the personnel are presented in Appendix E. The primary laboratory to be used is:

SCS Analytical Laboratory
2860 Walnut Avenue
Long Beach, California 90806

The minimum verification laboratory analyses to be performed on each sample will depend on the contaminants known or suspected to be present in each study area and will be in accordance with the "Tri-Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites". A tabular summary of the laboratory analyses proposed for each individual source area specifying analyte(s) sought and EPA test method is included as Table 2. All sample analyses for organic compounds will be completed within 14 days of sample collection, or as otherwise required by EPA regulations. If contaminants other than those that are suspected to be present in any given study area or sample are discovered, or can be inferred to be present, then other EPA- designated analyses also will be performed, as required. Laboratory reports will include sample identification, date sampled, date received, date analyzed, and analytical results. Copies of the analytical test results and a sample location map then will be forwarded to the County upon receipt by SCS.

Internal laboratory QA/QC tests or assessments will be included with all reported test results. A written presentation and critical evaluation of laboratory quality assurance data

will be included in site characterization program progress reports. For further explanation of the primary laboratory's QA/QC procedures, refer to the SCS Analytical Laboratory Quality Assurance Quality Control Manual. This manual is available upon request.

QUALITY ASSURANCE PROCEDURES

The quality assurance measures outlined below will be taken in order to ensure and confirm the integrity and reliability of the analytical laboratory data generated during the Site Characterization Program.

Field Quality Assurance

As a part of the field quality assurance program of the contract, trip and field blanks will accompany all groundwater samples submitted for laboratory analyses. The trip blank will consist of a container of organic-free reagent water that is kept with the field sample containers from the time the samples are originally collected in the field until they are delivered to the laboratory. The purpose of trip blanks is to determine whether samples are being contaminated during transit or sample collection. Trip blanks pertain only to analyses for volatile organic compounds; therefore, the containers must contain no headspace. Only one trip blank is needed for one day's sampling and shall satisfy trip blank requirements for both soil and groundwater materials for that day if all volatile samples are shipped in the same cooler.

The field or rinsate blank will be collected at the sample site using ultrapure water which first has been poured directly into the acrylic bailer and then bottled under the same field conditions as the representative groundwater samples. Disposable bailers are expected to be the primary sampling tool, eliminating the need for equipment decontamination and potential cross-contamination of either field samples or sampling equipment. Should any other reusable sampling equipment be employed, the rinsate blank will consist of reagent water which has been collected from the final rinse of the sampling equipment following decontamination. This will permit detection of whether sampling equipment is causing cross-contamination of samples.

Laboratory Quality Assurance

Duplicate soil and groundwater samples will be simultaneously collected from each well using the same procedures as for collection of the original samples, as outlined in Section 4. The duplicate will be analyzed in the event that the original sample has been tampered with, broken, or otherwise rendered unusable. Duplicate samples also may be used for occasional internal QA/QC purposes in order to provide field originated checks on the quality and accuracy of laboratory analytical procedures. For these purposes, the identity of the samples will be held blind to the analysts and laboratory personnel until the chemical analyses have been completed.

APPENDIX A

ALAMEDA COUNTY
UNDERGROUND TANK CLOSURE PLAN

ALAMEDA COUNTY HEALTH CARE SERVICES AGENCY
DEPARTMENT OF ENVIRONMENTAL HEALTH
HAZARDOUS MATERIALS DIVISION
80 SWAN WAY, ROOM 200
OAKLAND, CA 94621
PHONE NO. 415/271-4320

Project Specialist (print) _____

UNDERGROUND TANK CLOSURE PLAN
*** * * Complete according to attached instructions * * ***

1. **Business Name** All Right Parking

   Business Owner Same

2. **Site Address** 1432 Harrison Street

   City Oakland **Zip** 94612 **Phone** _____

3. **Mailing Address** _____

   City _____ **Zip** _____ **Phone** _____

4. **Land Owner** Alvin H. Bacharach, Barbara J. Borsuk

   Address 383 Diablo Rd., Ste. 100 **City, State** Danville, CA **Zip** 94526

5. **Generator name under which tank will be manifested** _____

   Barbara J. Borsuk

   EPA I.D. No. under which tank will be manifested CAC 000598840

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6. Contractor Falcon Energy Associates

Address P.O. Box 1257

City Stockton, 95201 Phone 209-463-7108

License Type A General Engineering ID# 584524

7. Consultant SCS Engineers

Address 6761 Sierra Court, Suite "D"

City Dublin, CA Phone 415-829-0661

8. Contact Person for Investigation

Name Nels R. Johnson Title Senior Project Engineer

Phone 415-829-0661

9. Number of tanks being closed under this plan 4

Length of piping being removed under this plan Unknown

Total number of tanks at facility 4

10. State Registered Hazardous Waste Transporters/Facilities (see instructions).

** Underground tanks are hazardous waste and must be handled ** as hazardous waste

a) Product/Residual Sludge/Rinsate Transporter

Name Falcon Energy Associates EPA I.D. No. CAD 982526857

Hauler License No. 2463 License Exp. Date June 1991

Address P.O. Box 1257

City Stockton, State CA Zip 95201-1257

b) Product/Residual Sludge/Rinsate Disposal Site

Name The Kiesel Company EPA I.D. No. MOT 300011160

Address 4801 Fyler Avenue

City St. Louis State MO Zip 63116

c) Tank and Piping Transporter

Name Falcon Energy Associates EPA I.D. No. CAD 982526857

Hauler License No. 2463 License Exp. Date June 1991

Address P.O. Box 1257

City Stockton, State CA Zip 95201-1257

d) Tank and Piping Disposal Site

Name Erickson Inc. EPA I.D. No. CAD 009466392

Address 255 Parr Boulevard

City Richmond, State CA Zip 94801

11. Experienced Sample Collector

Name Don Mc Clenagan

Company SCS Engineers

Address 6761 Sierra Court, Suite "D"

City Dublin, State CA Zip 94568 Phone 829-0661

12. Laboratory

Name SCS Analytical Laboratory

Address 2860 Walnut Avenue

City Long Beach, State CA Zip 90806

State Certification No. _____

13. Have tanks or pipes leaked in the past? Yes [ ] No [ ]

If yes, describe. Unknown

14. Describe methods to be used for rendering tank inert

One hour prior to scheduled removal of tank, inert tank with dry ice at the rate of 20 lb per 1000 gal capacity with Fire/Health Inspector on-site, test tank with LEL/Oxygen meter.

Before tanks are pumped out and inerted, all associated piping must be flushed out into the tanks. All accessible associated piping must then be removed. Inaccessible piping must be plugged.

The Bay Area Air Quality Management District (771-6000), along with local Fire and Building Departments, must also be contacted for tank removal permits. Fire departments typically require the use of explosion proof combustible gas meters to verify tank inertness. It is the contractor's responsibility to bring a working combustible gas meter on site to verify tank inertness.

15. Tank History and Sampling Information

Gasoline Tanks

Tank		Material to be sampled (tank contents, soil, groundwater, etc.)	Location and Depth of Samples
Capacity	Use History (see instructions)		
1000 gal	Installed in 1975 contained gasoline last used - unknown	Soil/groundwater, if encountered	One at each end of tank from native materials at base of pit, not to exceed 2 ft below tank.
1000 gal	Installed in 1982 contained gasoline last used - unknown	Soil/groundwater, if encountered	One at each end of tank from native materials at base of pit, not to exceed 2 ft below tank.

One soil sample must be collected for every 20 feet of piping that is removed. A ground water sample must be collected should any ground water be present in the excavation.

Excavated/Stockpiled Soil	
Stockpiled Soil Volume (Estimated)	Sampling Plan
Unknown	See Modified Work Plan

Stockpiled soil must be placed on bermed plastic and must be completely covered by plastic sheeting.

16. Chemical methods and associated detection limits to be used for analyzing samples

The Tri-Regional Board recommended minimum verification analyses and practical quantitation reporting limits should be followed. See attached Table 2.

Gasoline Tanks

Contaminant Sought	EPA, DHS, or Other Sample Preparation Method Number	EPA, DHS, or Other Analysis Method Number	Method Detection Limit
TPH Gasoline		EPA 8015 G	Soil/Water 10 ppm/0.5 ppm
TPH Diesel		EPA 8015 D	10 ppm/0.05ppm
BTEX		EPA 8020	10 ppm/0.05 ppm
Oil and Grease		413.1	5 ppb/1 ppb
Total Lead		AA spectroscopy	0.2 ppm/5 ppb

17. Submit Site Health and Safety Plan (See Instructions)

14. Describe methods to be used for rendering tank inert

Before tanks are pumped out and inerted, all associated piping must be flushed out into the tanks. All accessible associated piping must then be removed. Inaccessible piping must be plugged.

The Bay Area Air Quality Management District (771-6000), along with local Fire and Building Departments, must also be contacted for tank removal permits. Fire departments typically require the use of explosion proof combustible gas meters to verify tank inertness. It is the contractor's responsibility to bring a working combustible gas meter on site to verify tank inertness.

15. Tank History and Sampling Information

Waste Oil Tanks

Tank		Material to be sampled (tank contents, soil, groundwater, etc.)	Location and Depth of Samples
Capacity	Use History (see instructions)		
Approximately 1000 gal	Installation: Unknown contained waste oil last used: Unknown	Soil/groundwater, if encountered	One at each end of tank from native materials at base of pit, not to exceed 2 ft below tank.
Approximately 1000 gal	Installation: Unknown contained waste oil last used: Unknown	Soil/groundwater, if encountered	One at each end of tank from native materials at base of pit, not to exceed 2 ft below tank.

One soil sample must be collected for every 20 feet of piping that is removed. A ground water sample must be collected should any ground water be present in the excavation.

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Excavated/Stockpiled Soil	
Stockpiled Soil Volume (Estimated)	Sampling Plan
Unknown	See Modified Work Plan

Stockpiled soil must be placed on bermed plastic and must be completely covered by plastic sheeting.

16. Chemical methods and associated detection limits to be used for analyzing samples

The Tri-Regional Board recommended minimum verification analyses and practical quantitation reporting limits should be followed. See attached Table 2.

Waste Oil Tanks

Contaminant Sought	EPA, DHS, or Other Sample Preparation Method Number	EPA, DHS, or Other Analysis Method Number	Method Detection Limit
			Soil/Water
TPH Diesel		EPA 8015D	10 ppm/0.05 ppm
TPH Gasoline		EPA 8015G	10 ppm/0.5 ppm
BTEX		EPA 8020	5 ppb/1 ppb
Total Lead		AA Spectroscopy	0.2 ppm/5 ppb
Oil & Grease		413.1	10 ppm/0.5 ppm
Cl Hc		8240	
PCB's			

17. Submit Site Health and Safety Plan (See Instructions)

14. Describe methods to be used for rendering tank inert

_____

_____

_____

Before tanks are pumped out and inerted, all associated piping must be flushed out into the tanks. All accessible associated piping must then be removed. Inaccessible piping must be plugged.

The Bay Area Air Quality Management District (771-6000), along with local Fire and Building Departments, must also be contacted for tank removal permits. Fire departments typically require the use of explosion proof combustible gas meters to verify tank inertness. It is the contractor's responsibility to bring a working combustible gas meter on site to verify tank inertness.

15. Tank History and Sampling Information

Hydraulic Lifts

Tank		Material to be sampled (tank contents, soil, groundwater, etc.)	Location and Depth of Samples
Capacity	Use History (see instructions)		
1. Unknown capacity		Soil/groundwater, if encountered	
2. Unknown capacity	Installation of lifts and reservoir is unknown.		
3. Possible third UST capacity unknown	The tanks possibly contained hydraulic fluid. The date of service discontinuation is unknown.		One at each end of tank/lift from native materials at base of pit, not to exceed 2 ft below tank/lift.

One soil sample must be collected for every 20 feet of piping that is removed. A ground water sample must be collected should any ground water be present in the excavation.

Excavated/Stockpiled Soil	
Stockpiled Soil Volume (Estimated)	Sampling Plan
Unknown	See Modified Work Plan

Stockpiled soil must be placed on bermed plastic and must be completely covered by plastic sheeting.

16. Chemical methods and associated detection limits to be used for analyzing samples

The Tri-Regional Board recommended minimum verification analyses and practical quantitation reporting limits should be followed. See attached Table 2.

Hydraulic Lifts

Contaminant Sought	EPA, DHS, or Other Sample Preparation Method Number	EPA, DHS, or Other Analysis Method Number	Method Detection Limit
			Soil/Water
TPH Diesel		EPA 8015 D	10 ppm/0.05 ppm
BTEX		EPA 8020	5 ppb/1 ppb
Oil & Grease		413.1	10 ppm/0.5 ppm

17. Submit Site Health and Safety Plan (See Instructions)

18. Submit Worker's Compensation Certificate copy

Name of Insurer Daugherty & Company, 2495 W. March Lane, Stockton

19. Submit Plot Plan (See Instructions)

20. Enclose Deposit (See Instructions)

21. **Report any leaks or contamination to this office within 5 days of discovery.** The report shall be made on an Underground Storage Tank Unauthorized Leak/Contamination Site Report form. (see Instructions)

22. Submit a closure report to this office within 60 days of the tank removal. This report must contain all the information listed in item 22 of the instructions.

I declare that to the best of my knowledge and belief the statements and information provided above are correct and true.

I understand that information in addition to that provided above may be needed in order to obtain an approval from the Department of Environmental Health and that no work is to begin on this project until this plan is approved.

I understand that any changes in design, materials or equipment will void this plan if prior approval is not obtained.

I understand that all work performed during this project will be done in compliance with all applicable OSHA (Occupational Safety and Health Administration) requirements concerning personnel health and safety. I understand that site and worker safety are solely the responsibility of the property owner or his agent and that this responsibility is not shared nor assumed by the County of Alameda.

Once I have received my stamped, accepted closure plan, I will contact the project Hazardous Materials Specialist at least three working days in advance of site work to schedule the required inspections.

Signature of Contractor

Name (please type) John P. Cummings, Office Director, SCS Engineers

Signature [signature]

Date 6/5/91

Signature of Site Owner or Operator

Name (please type) Alvin H. Bacharach, Barbara Borsuk

Signature Alvin H. Bacharach

Date 8-19-91

Barbara Borsuk
8/19/91

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APPENDIX B

SITE HEALTH AND SAFETY PLAN

EMPLOYEE HEALTH AND SAFETY PLAN, POLICIES, AND PROCEDURES FOR THE CLOSURE OF UNDERGROUND HAZARDOUS WASTE TANKS AND OTHER STANDARD FIELD OPERATIONS

SCS Engineers
6761 Sierra Court, Suite D
Dublin, California 94568
(415) 829-0661

CONTENTS

SECTION 1
INTRODUCTION

General Overview

The following Employee Health and Safety Plan, Policies, Procedures, and Practices have been established for field operations conducted by SCS Engineers, or their subcontractors, involving the removal and closure of underground hazardous waste storage tanks or soil and groundwater contamination assessment and remediation activities in Alameda County. This plan includes both job site activities, including tank removal, excavations, well installation and collection of soil and groundwater samples, and remediation activities, and off-site activities, including trucking and disposal operations, emergency response, and cleanup activities.

Intent

The intent of SCS Engineers Health and Safety Policies and Procedures is to:

1) Provide all employees and other individuals involved in both on-site and off-site activities with the safest possible work environment and to minimize or eliminate exposure to any hazardous substances or conditions.
2) Comply with the requirements of CFR Section 1900-1910 of the Code of Federal Regulations, and applicable OSHA and Cal OSHA standards.

Authority and Responsibilities

SCS has primary responsibility for the health and safety of their employees during the work outlined in the work plan. Each SCS subcontractor will be responsible for the safe and healthful performance of work by each of its employees or support personnel who may enter the site.

All subcontractors retained by SCS are required to ensure that all their employees, visitors, subcontractors, and suppliers/vendors, while on the work site and in the conduct of this investigation, comply with the provisions of this Health and Safety Plan and the minimum standards set forth under the Federal Occupational Safety and Health Act (OSHA). Any specific operation, machine, or process not covered will be governed by other applicable General Safety Orders of the OSHA, Cal/OSHA. The Subcontractor is required to know the safety regulations which apply to the operation.

SECTION 2
SAFETY RULES, PROCEDURES, AND POLICIES

General

- Employees must immediately notify the Health and Safety Officer, their Supervisor, or any other officer, of any unsafe working condition or equipment.

- A supervisor or his designate must always be present when hazardous materials are handled. No hazardous materials may be transferred or pumped, hoses disconnected/connected/drained, barrels handled, or any similar operation in any manner alone. Use the "Buddy" system - at least two people always must be present.

- Access to safety showers and fire extinguishers must be kept clear at all times.

- Smoking is not permitted on any job site unless specific smoking areas are provided and so marked.

- Any spill must be reported to a supervisor and cleaned up immediately. This includes small spills and spillage on drum transfer. Drum leaks shall be reported to a supervisor and over-packed.

Protective Clothing

Protective clothing is necessary to protect employees from hazardous products, spills, cleanup, soil contamination, and similar operations within the environment. SCS Engineers will provide appropriate protective clothing for various job assignments, at no cost, as required.

Protective clothing includes, but is not limited to:

1) Boots or protective shoes, depending on the job function.
2) Shirts, pants, or aprons sufficient to allow daily changes of clothes.
3) Class A, B, C, or D level personal protection equipment (PPE), as required.
4) Gloves appropriate for the materials handled or work environment.
5) Hard hats are required for all job site personnel.

Employees are required to:

1) Wear the designated protective clothing when instructed.
2) Maintain cleanliness of PPE.
3) Advise their supervisor of defects, loss, or damage to PPE.

Respirators

Company responsibility:

Whenever it has been determined that an airborne health hazard exists or may exist, SCS Engineers will provide and maintain the appropriate-level respirator.

Employee responsibility:

1) Use the appropriate respirator in accordance with the instructions and hazards determined for each particular work area, job site application, or job function.

2) Report any malfunction of the respirator to immediate supervisor.

3) Inspect the respirator prior to use for visible defects or damage.

4) Clean the respirator and periodically replace filters, as needed.

5) As preventative maintenance, store respirator in proper container or use plastic-lock bag.

Eye Protection

Safety glasses with side shields, goggles, or face shields will be provided to any employee who wants or is required to use them for any aspect or operation associated with removal, closure, sampling, or other site activities related to tank removals or other field operations.

In addition, individuals performing or working near the following operations will be required to use the indicated eye protection:

1) Welding, brazing, or metal flame cutting: welder's goggles with intensity filters.
2) Drumming: splash-proof goggles or face shield.
3) Pumping: face shield.

Personnel and Equipment Decontamination

Decontamination of equipment and personnel is necessary to confine the contaminants to the site and to preclude migration elsewhere. Upon leaving the work area, all major equipment, tools, and materials will be cleaned to remove grease, oil, or encrusted dirt.

Decontamination procedures are discussed in more depth below. Personnel decontamination will involve washing of hands and face with soap and water after removal of protective gear and prior to eating. Boots, respirators, gloves, and hard hats will be washed in a soap and water wash. Tyvek will be placed in a plastic bag for disposal.

Equipment Decontamination:

All major reusable equipment and other tools for boring activities will be decontaminated prior to leaving the work area. Cleaning will normally consist of scrubbing to remove encrusted materials, followed by a soap-and-water wash and potable water rinse using a high-pressure, low-volume water spray or steam cleaning unit. Containers of detergent solutions for cleaning tools, boots, and gloves will also be available.

A drill rig decontamination area will be established where the rig will be cleaned before it is moved out of the work area.

Personnel responsible for steam cleaning will use appropriate personal protective equipment.

Personnel Decontamination:

Decontamination of personnel will be performed within the designated decontamination zone. Decontamination will consist primarily of soap-and-water washing and water rinse

of exterior protective gear to remove contaminants, followed by removal of gear. Disposable coveralls will be removed by turning the clothing inside out. A general sequence of doffing procedures is outlined below. The extent of required washing, or modifications to the sequence, may be specified by the Site Health and Safety Officer as appropriate.

The minimum steps in decontamination will be as follows:

- Wash work gloves and boots;
- Rinse respirator; and
- Wash hands and face.

Contaminated protective clothing will be properly disposed. Provisions for emergency decontamination will be available as designated by the Site Health and Safety Officer at the drilling site. Clean water will be provided to rinse work gloves and boots.

Eating, Drinking, and Smoking:

Eating, drinking, or smoking will not be allowed in the work area and decontamination zone. Potable water will be available in areas just outside the work area.

SECTION 3

CHEMICAL ABUSE/IMPAIRMENT

As employees may be working near or with hazardous or dangerous materials and conditions, and operating or working near heavy equipment, it is imperative that employees not be impaired or under the influence of ANY chemical which reduces their effectiveness in reacting to a dangerous condition. Therefore, SCS Engineers, in order to protect all employees who depend on each other, establishes the following abuse/impairment policy:

- Chemical abuse/impairment is defined as use of alcohol, medication, drugs, or other chemical substances without a doctor's permission which alters, impairs, or changes the physical and mental condition of the employee.

- Consumption of any alcoholic beverage in any quantity at any job site is absolutely prohibited. Any person observed consuming alcoholic beverages during the work day, regardless of the hour or day, will be immediately fired.

- Any employee reporting to work at any location under the influence of alcohol, smelling of alcohol, or if alcoholic containers are found in any equipment, will be immediately fired.

- Any employee found to be using any other illegal drug at any time on any job site will be immediately fired.

- Any employee taking medication under a doctor's care or who has purchased over the counter medication must advise his supervisor.

- All employees are encouraged not to smoke. SCS Engineers will discuss any legitimate request of any employee to quit smoking and help place them in a program, if sponsored by the Company's health care provider. Employees are encouraged to participate in these medically supervised programs.

SECTION 4

SCS ENGINEERS HEALTH AND SAFETY PLAN

Scope

The SCS Engineers Health and Safety Plan outlined below is intended both to provide and ensure adequate safeguards to all personnel who may be exposed to hazardous materials or conditions during the normal course of their work conducting closure and other associated site operations and activities related to underground storage tank removal and other field operations. The scope of this plan does not include unexpected or unusual occurrences.

Composition of Typical Products Handled

Most products encountered in routine tank removal and closure operations and associated soil and groundwater contamination assessment and mitigation/remediation investigations are organic compounds that commonly include, but are not limited to:

A) diesel fuel

B) gasoline

   1) leaded
   2) unleaded

C) waste oil and grease

D) kerosene

E) hydraulic lift fluid

F) tank and pipe rinsate

   1) 99 percent water
   2) 1 percent detergents and trace elements

G) possible inorganic heavy metals, such as lead or zinc

H) polychlorinated biphenyls (PCBs)

Contaminated Soils

Results of laboratory soils analyses typically take two weeks or more to complete after tank removal. Treatment of soils, contamination procedures, and site remediation are separate processes which are covered by additional safety procedures not included in this list.

Assessment of Health and Safety Hazards

Initial site operations typically encompass only removal of cleaned tanks and product piping. Therefore, level D personal protective equipment (PPE) is the normal required level of protection at this stage of site operations.

Fire and Explosion:

Two fire extinguishers with a minimum class rating of 20 BC shall be kept within at least 50 feet of the removal operation at all times during work operations. Open flames or other ignition sources are not permitted anywhere within the area of operations. NO SMOKING signs will be posted in proximity to the work site. The use of welding or other electrical-spark producing equipment is specifically prohibited in the vicinity of a contaminated site or tank containing product residue. If such operations are determined to be necessary, approval of the Health and Safety Officer or other appropriate supervisor is required and the tank must previously have been rendered inert. The local fire district also should be notified in order to determine whether a fire inspector/observer should be present. Care always should be taken not to severely impact, crush, or puncture the tank prior to inerting, especially when it is known or suspected to contain volatile or potentially explosive compounds or gases.

Other Physical Hazards:

SCS Engineers routinely encourages fencing of all tank removal and excavation sites for the duration of work operations, if existing plant fencing and security is not present or adequate. If our clients refuse, a waiver must be signed wherein the client excludes SCS Engineers from any liability or responsibility contained therein owing to the lack of fencing. Normally, barricades and caution tape are used to restrict access to the area

of work operations, and may be used to secure a site overnight if no deep excavations or other hazards are present. If deep excavations must be left open unattended, then steel trench plates or plywood should be used to completely and securely cover the excavation. Work operations that can be completed during the same day and remain under the direct supervision of the Project Manager may be exempted from the fencing requirement, with the prior approval of the Health and Safety Officer.

It is expected that the work operations involving excavation, waste oil tank removals, and collection of soil samples in the Alice Street basement will be conducted in an area of both restricted access and limited air circulation. Consequently, the additional measures outlined below will be taken in order to ensure that safe and healthful working conditions are maintained. Ear protection will be worn by all employees and subcontractors at all times when work is in progress in this area. Dust masks and/or full-face respirators also will be available at all times for protection from dust and potential airborne contaminants stirred up during excavation and tank removal. At least 2 high-volume fans will be placed at existing grates in the basement ceiling/Alice Street sidewalk - one intake, one exhaust - to provide both fresh air to and air circulation within the basement area of work operations. Exhaust from stationary drilling and/or excavating equipment involved in the tank removal operations will be vented directly to the outside via closed lines. Only those vehicles or equipment directly required or involved in the removal operations will be permitted in the basement area of operations. Vehicles and other equipment shall be shut off when not in use. Equipment operators will need to exercise particular caution at all times when working in this area, both because of the low vertical clearance and the presence of overhead electrical lines near the excavation area.

No deep excavations are expected for this project. All soil sampling will be completed with mechanical equipment from the surface outside the excavation. No site personnel are allowed to enter any excavation deeper than 4 feet. Deeper excavations must be shored or braced, or must be performed using special excavation procedures following appropriate OSHA and Cal OSHA standards for stepping and/or sloping sidewalls.

If underground utilities are known or suspected to be located within or near the area of the planned excavation, U.S. Alert will be contacted in advance of the work operations to precisely locate and label the lines and/or associated facilities. Any site personnel working or excavating near operating utility lines of any kind (i.e., electrical, gas, water/sewer, etc.) should always exercise extreme caution and should immediately notify the Project Manager or other supervisor if any damage, leakage, or other problem is observed.

Chemical and Other Health Hazards:
The major chemicals suspected to be present are listed above. Material Safety Data Sheets (MSDS) are presented in Appendix A.

Airborne contaminants at the site could exceed currently recognized health limits for waste oil, gasoline, benzene, toluene, and xylene. Benzene is a suspect carcinogen which is regulated by Cal/OSHA and OSHA. Air purifying respirators are not approved for worker protection against benzene.

An organic vapor meter OVM will be routinely used to monitor the breathing zone for volatile organic compounds during excavation and other field activities. Respirators will be required if readings at any time exceed 300 ppm over background. Workers may continue work in respirators until concentrations reach 500 ppm. At that point, personnel will use airline respirators to continue work or evacuate the work zone until levels dissipate.

Contact with contaminated waste materials and soils would be expected to irritate the skin, with prolonged exposure leading to the development of skin lesions. For this reason direct skin contact with drilling soils will be avoided by wearing protective
gloves. Protective gloves and safety goggles will be required in areas where waste materials and contaminated soil are handled.

Organization and Responsibilities

Project Manager:

A project-specific Senior Project Manager or Project Engineer or Scientist, or his/her designee, is specifically responsible for all aspects of daily operations and for each specific site operation regarding tank removals, soil/groundwater sampling, or well installations. This Project Manager is responsible for the project through its successful completion, and all questions or problems associated with the projects should be directed to him/her. The Project Manager also is responsible for daily safety briefings and updates or site-specific changes to work crews and subcontractors prior to the start of work operations. Any designee shall report directly to the Project Manager.

Site Health and Safety Officer:

The Project Manager is authorized to act as the Site Health and Safety Officer. The office Health and Safety Officer may appoint a designee to act as Health and Safety Officer for a specific job and he/she shall report directly to the Project Manager.

The Safety Officer is specifically given authority to take the following actions:

- Require specific health and safety precautions prior to site entry by subcontractors, their personnel, visitors, SCS personnel or any other job site participants. This includes hard hats, any appropriate eye, ear, or foot protection, respirators, or any other safety equipment that the site Safety Officer deems necessary.

- Require any worker, including subcontractor personnel, to obtain immediate medical attention.

- Deny access to the site or any portion thereof when imminent health and safety risk exists.

- Order the immediate evacuation of workers, including subcontractor personnel, from any area of the site when, in the Safety Officer's professional judgement, conditions warrant such action. This includes shutting the site down.

Emergency Actions

If any emergency involving actual or suspected personnel injury or adverse chemical exposure occurs, the Safety officer shall take the following steps:

1) Remove the exposed or injured person(s) from the immediate area of danger.

2) Render first aid, if necessary. Decontaminate the victim's outer clothing only after critical first aid has been administered.

3) Obtain paramedic services or ambulance services. Transport the victim(s) to the closest local hospital for proper medical care. This procedure IS TO BE FOLLOWED even if no visible injuries are apparent.

4) Other personnel shall be evacuated to a safe distance until it has been determined by the site Safety Officer or other emergency response personnel that a safe site exists to resume work. If any doubt or questions exist, further appropriate advice shall be sought.

5) At the first opportunity, the Safety Officer shall contact the Project Manager and provide details, including a written report, of the conditions leading to and response to the suspected incident and procedures taken to prevent any subsequent recurrence.

6) A written report of the incident shall be prepared by the Safety Officer and the Project Manager within twenty-four (24) hours following the incident. There are NO EXCEPTIONS.

Site Shut-Down:

The Safety Officer shall shut any job site down and evacuate all site personnel to safe distance, if any of the following conditions occur:

a) Extremely strong odors

b) Excavation conditions which are unsafe, including but not limited to dirt slippage and slumping, excessive moisture, exposed or damaged utilities, and other similar observances.

c) Instability of any equipment or structure.

d) In any of these events, or similar occurrences, in the judgement of the Safety Officer, work will stop at the site until a modified work plan is prepared and approved by the Project Manager and regulatory agencies as necessary.

Emergency Response and Containment:

The Safety Officer is authorized to implement appropriate emergency response in accordance with the SCS Engineers EMR procedure plan either to protect worker health and safety or to contain accidental spills so as to minimize further environmental damage. The Safety Officer is further authorized to utilize the closest available local EMR facilities when required by his judgement.

If no undue risk is present, site personnel may attempt to contain a spill using whatever safe means are available, prevent additional spillage, and prevent spill migration into any storm drains, sewers, or natural drainage and waterways.

Available On-Site Safety Equipment:

Fire extinguishers, first aid kits, water, level D suits and PPE, head protection, eye protection, and gloves are to be available at each site at all times during work operations.

APPENDIX A1

MATERIAL SAFETY DATA SHEETS

GASOLINES: AUTOMOTIVE (<4.23g lead/gal)

GAT

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

Stop discharge if possible. Keep people away.
Shut off ignition sources and call for 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 apart 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.
Floating 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 causing gasping, 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, enforce 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_{50} = 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 spilled 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: 30

8. WATER POLLUTION

8.1 Aquatic Toxicity:
96 ppm/24 hr/Juvenile American shad/TL_m/fresh water
97 mg/l/24 hr/Juvenile American shad/TL_m/salt water
8.3 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—0.072 N/m at 20°C
12.9 Liquid Water Interfacial Tension:
49.91 dynes/cm
= 0.049—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:
150—180 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
12.21 Heat of Fusion: Data not available
12.36 Limiting Value: Data not available
12.37 Reid Vapor Pressure: 7.4 psia

NOTES

BENZENE

BNZ

Common Synonyms
Benzol
Benzole

Watery liquid Colorless Gasoline like odor

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 leak if you can do it without risk.
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 enters water intakes.

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

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Keep 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, sensation, 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 Limits: 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. 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: 4.68 ppm
5.11 IDLH Value: 3,000 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: 1097°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 6.6 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/minnow/fathead/distilled water
20 ppm/24 hr/sunfish/TL_m/tap water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 1.7 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 hazard	1
Liquid or Solid hazard	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: 0.8787 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): 1.081
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 = −9699 cal/g = −406.0 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: 30.45 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 3.22 psia

NOTES

TOLUENE

TOL

Common Synonyms
Toluol
Methylbenzene
Methylbenzol

Watery liquid Colorless Pleasant odor

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.
Floating 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)
Keep oncoming 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_7H_8; $C_6H_5CH_3$
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 rapid, 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: 500 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, 20°C (Theor.), 0 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research, reagent, mixture of 99.8 + %; industrial contains 94 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons, 80/120; 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: 596.1 psia = 40.57 atm = 4.109 MN/m²
12.7 Specific Gravity: 0.867 at 20°C (liquid)
12.8 Liquid Surface Tension: 28.0 dynes/cm = 0.0280 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.036 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 × 10⁵ J/kg
12.13 Heat of Combustion: −17,430 Btu/lb = −9686 cal/g = −405.5 × 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

m-XYLENE

XLM

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

Side: Disconnect 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.
Floating is dangerous.
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
Shield as 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: $mC_6H_4(CH_3)_2$
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: 865°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.2 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: 27 ppm/96 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days, 0% (theor.), 0 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: 284.4°F = 139.9°C = 413.1°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: 28.8 dynes/cm = 0.0288 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.4 dynes/cm = 0.0364 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: 147 Btu/lb = 81.9 cal/g = 3.43 X 10⁵ J/kg
12.13 Heat of Combustion: −17,554 Btu/lb = −9752.4 cal/g = −408.31 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: 26.01 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.24 psia

NOTES

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.
Floating is dangerous.
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-$C_6H_4(CH_3)_2$
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 rapid, 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 applied on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.07 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: 5.9 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/C magna/TL_m fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0.8 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	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: 291.8°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: 30.52 dynes/cm = 0.03052 N/m at 15.6°C
12.9 Liquid Water Interfacial Tension: 36.00 dynes/cm = 0.03600 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.088
12.12 Latent Heat of Vaporization: 148 Btu/lb = 82.6 cal/g = 3.47 X 10^5 J/kg
12.13 Heat of Combustion: −17,516 Btu/lb = −9734.7 cal/g = −406.61 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: 36.84 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.26 psia

NOTES

p-XYLENE

XLP

Common Synonyms	Watery liquid	Colorless	Sweet odor
1,4-Dimethylbenzene Xylol	Floats on water. Flammable, irritating vapor is produced. Freezing point is 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)
Initial 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 DOT 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: 2.8 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_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 Available: 95.99%: 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 Hazard	1
Liquid or Solid Hazard	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: 292.8°F = 138.2°C = 411.4°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: 508.4 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 = 3.4×10^5 J/kg
12.13 Heat of Combustion: −17,550 Btu/lb = −9754.7 cal/g = −408.41 $\times 10^5$ 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: 21.63 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.24 psia

NOTES

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.
Dike, dilute 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 shorelines.
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: $C_6H_5C_2H_5$
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 is lung irritant and 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 whitening 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 O.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: 860°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 5.2 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: 25 ppm/96 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 2.6% (theor.), 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research grade: 99.96% 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 Inhalant	2
Liquid or Solid Irritant	3
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: −139°F = −95°C = 178°K
12.5 Critical Temperature: 651.0°F = 343.9°C = 617.1°K
12.6 Critical Pressure: 527 psia = 35.8 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: 35.42 dynes/cm = 0.03542 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 = 3.35×10^5 J/kg
12.13 Heat of Combustion: −17,790 Btu/lb = −9877 cal/g = -413.5×10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.17 Heat of Fusion: Data Not Available
12.18 Limiting Value: Data Not Available
12.19 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

KEROSENE

KRS

Common Synonyms	Water	Corrosive	Fuel oil odor
Burning oil Kerosine Range oil Fuel oil No. 1 Jet Fuel JP-1	Floats on water.		

Site sketch (if possible)
Call fire dept. if needed
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

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)
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 DOT Compatibility Class: Miscellaneous Hydrocarbon Mixtures
3.2 Formula: C_nH_{2n+2}
3.3 IMO/UN Designation: 3.3/1223
3.4 DOT ID No.: 1223
3.5 CAS Registry No.: 8008-20-6

4. OBSERVABLE CHARACTERISTICS

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

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective gloves, goggles or face shield.
5.2 Symptoms Following Exposure: Vapor causes slight irritation of eyes and nose. Liquid irritates stomach, if taken into lungs causes coughing, dizziness, and rapidly developing pulmonary edema.
5.3 Treatment of Exposure: ASPIRATION: artificial respiration, administer oxygen, call a doctor. INGESTION: do NOT induce vomiting, call a doctor. EYES: wash with plenty of water. SKIN: wipe off and wash with soap and water.
5.4 Threshold Limit Value: 200 ppm
5.5 Short Term Inhalation Limits: 2530 mg/m³ for 60 min.
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 spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 1 ppm
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 100°F (min) C.C.
6.2 Flammable Limits in Air: 0.7%-5%
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: Not pertinent
6.7 Ignition Temperature: 444°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: 2190 ppm/24 hr/Bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 55%, 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Light hydrocarbon available 100%
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:
Combustible liquid
11.3 NAS Hazard Rating for Bulk Water Transportation:

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

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	2
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:
392-509°F
= 200—265°C = 473—538°K
12.4 Freezing Point:
—50°F = —45.6°C = 227.6°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity:
0.80 at 15°C (liquid)
12.8 Liquid Surface Tension:
23-32 dynes/cm
= 0.023-0.032 N/m at 20°C
12.9 Liquid-Water Interfacial Tension:
47-49 dynes/cm = 0.047-0.049 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:
110 Btu/lb = 60 cal/g =
2.5 X 10⁵ J/kg
12.13 Heat of Combustion: —18,540 Btu/lb = —10,300 cal/g = —431.2 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
12.17 Heat of Fusion: Data not available
12.18 Limiting Value: Data not available
12.19 Reid Vapor Pressure: 0.1 psia

NOTES

OILS, FUEL: 1-D

OOD

Common Synonyms Diesel oil (light)	Oily liquid Floats on water.	Yellow-brown	Lules in fuel oil odor

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	Dangerous to aquatic life in high concentrations. Floating is objectionable. 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: Light brown
4.3 Odor: Characteristic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective gloves; goggles or face shield.
5.2 Symptoms Following Exposure: INHALATION causes headache and slight giddiness. INGESTION causes nausea, vomiting and cramping, depression of central nervous system ranging from mild headache to unconsciousness, coma, and death, pulmonary irritation secondary to inhalation of solvent, signs of kidney and liver damage may be delayed. ASPIRATION causes severe lung irritation with coughing, gagging, dyspnea, substernal distress, and rapidly developing pulmonary edema, later, signs of bronchopneumonia and pneumonitis, acute onset of central nervous system excitement followed by depression.
5.3 Treatment of Exposure: INGESTION: do NOT induce vomiting; seek medical attention. ASPIRATION: enforce bed rest; administer oxygen. EYES: wash with copious quantity of water. SKIN: remove solvent by wiping and wash with soap and water.
5.4 Threshold Limit Value: No single value applicable.
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 1; LD_{50} = 5-15 g/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Slight smarting of 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 skin.
5.10 Odor Threshold: 0.7 ppm
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 100°F C.C.
6.2 Flammable Limits in Air: 1.3%-6%
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: 350—625°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 Water Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 30

8. WATER POLLUTION

8.1 Aquatic Toxicity: 204 mg/l/24 hr/juvenile American shad/TL_m/salt water
8.2 Waterfowl Toxicity: 2C mg/kg LD_{50} (mallard)
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Diesel fuel 1-D (ASTM)
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: Combustible liquid
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	2
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: 360—640°F = 183—293°C = 456—566°K
12.4 Freezing Point: —30°F = —34°C = 240°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.81—0.85 at 15°C (liquid)
12.8 Liquid Surface Tension: 23—32 dynes/cm = 0.023—0.032 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 47—48 dynes/cm = 0.047—0.048 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: 110 Btu/lb = 60 cal/g = 2.5 X 10^5 J/kg
12.13 Heat of Combustion: —18,540 Btu/lb = —10,300 cal/g = —431.24 X 10^4 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.26 Heat of Fusion: Data not available
12.36 Limiting Value: Data not available
12.37 Reid Vapor Pressure: Data not available

NOTES

OILS, FUEL: 2-D

OTD

Common Synonyms	Dry liquid	Yellow-brown	Lube or fuel oil odor
Diesel oil, medium	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, 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 to dilute.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Floating to shorelines.
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: Light brown
4.3 Odor: Characteristic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective gloves, goggles or face shield.
5.2 Symptoms Following Exposure: INGESTION causes nausea, vomiting, and cramping; depression of central nervous system ranging from mild headache to anesthesia, coma, and death; pulmonary irritation secondary to exhalation of solvent; signs of kidney and liver damage may be delayed; ASPIRATION causes severe lung irritation with coughing, gagging, dyspnea, substernal distress, and rapid) developing pulmonary edema, later, signs of bronchopneumonia and pneumonitis; acute onset of central nervous system involvement followed by depression.
5.3 Treatment of Exposure: INGESTION: do NOT induce vomiting; ASPIRATION: unless dead remove; administer oxygen, seek medical attention. EYES: wash with copious quantity of water. SKIN: remove solvent by wiping and wash with soap and water.
5.4 Threshold Limit Value: No single TLV applicable.
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 1, LD_{50} = 5-15 g/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Slight smarting of 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 skin.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 125°F C.C.
6.2 Flammable Limits in Air: 1.3%-6.0%
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: 490—545°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:
204 mg n-Zd in freshwater, American shad TL_m/salt water
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: Diesel fuel 2-D (ASTM)
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: Combustible liquid
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	2
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:
540—640°F = 282—338°C = 555—611°K
12.4 Freezing Point:
0°F = -18°C = 255°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity:
0.87—0.9C at 20°C (liquid)
12.8 Liquid Surface Tension: Data not available
12.9 Liquid Water Interfacial Tension: Data not available
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: -18,440 Btu/lb = -10,900 cal/g = -#52.17 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
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

POLYCHLORINATED BIPHENYL

PCB

Common Synonyms	Oily liquid to solid powder	Light yellow liquid, or white powder	Wood odor
PCB Chlorinated biphenyl Aroclor Halogenated waxes Polychlorodiphenyls	Sinks in water.		

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

Fire

Combustible.
Extinguish with water, foam, dry chemical, or carbon dioxide.

Exposure

CALL FOR MEDICAL AID.

LIQUID OR SOLID
Irritating to skin and eyes.
Skin: Promptly wash with plenty of water.
If in EYES, hold eyelids open and flush with plenty of water.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if 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 to water contaminant.
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: Not listed
3.2 Formula: $C_{12}H_{10-n}Cl_n$
3.3 IMO/UN Designation: Not listed
3.4 DOT ID No.: 2315
3.5 CAS Registry No.: 1336-36-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid or solid
4.2 Color: Pale yellow (liquid), colorless (solid)
4.3 Odor: Practically odorless

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Gloves and protective garments.
5.2 Symptoms Following Exposure: Acne from skin contact.
5.3 Treatment of Exposure: SKIN: wash with soap and water.
5.4 Threshold Limit Value: 0.5 to 1.0 mg/m³
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 2, oral rat LD_{50} = 3980 mg/kg
5.7 Late Toxicity: Causes chromosomal abnormalities in rats, birth defects in birds
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause severe irritation of eyes and throat and severe eye and lung injury. They cannot be tolerated even at low concentrations.
5.9 Liquid or Solid Irritant Characteristics: Contact with skin may cause irritation.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: 5 to 10 mg/m³

6. FIRE HAZARDS

6.1 Flash Point: > 200°F
6.2 Flammable Limits in Air: Data not available
6.3 Fire Extinguishing Agents: Water, foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Irritating gases are generated in fires.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: Data not available
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Data not available
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 Inhibition of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
0.278 ppm/96 hr/bluegill/TL_m/fresh water
0.005 ppm/336-1080 hr/goldfish/TL_m/salt water
8.2 Waterfowl Toxicity: LD_{50} 2000 ppm (mallard duck)
8.3 Biological Oxygen Demand (BOD): Very low
8.4 Food Chain Concentration Potential: High

9. SHIPPING INFORMATION

9.1 Grades of Purity: 11 grades (some liquid, some solids) which differ primarily in their chlorine content (20%-60% by weight)
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-E
11.2 NAS 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: Solid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: Very high
12.4 Freezing Point: Not pertinent
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.3—1.8 at 20°C (liquid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
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: Not pertinent
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

APPENDIX A2

SITE SPEACIFIC EMERGENCY INFORMATION

SITE SPECIFIC

EMERGENCY INFORMATION

Job Site: Harrison Street Garage
1432 Harrison Street
Oakland, California 94612

Contact Person: John P. Cummings; Office Director/Site Health & Safety Officer
SCS Engineers
(415) 829-0661

Nels R. Johnson; Project Manager
SCS Engineers
(415) 829-0661

Emergency Phone Numbers: Dial 911, report location, nature of injury or accident, and assistance required.

Fire Protection/Paramedics: Dial 911

Poison Control Center/San Francisco: 1-800-523-2222
or 415-476-6600

National Response Center (NRC): For toxic chemical and oil spills
1-800-424-8802

Hospitals/Emergency Services (Figure 1):

Nearest: Peralta Hospital
450 30th Street
Oakland, California
415-451-4900

Other Hospitals in Area:

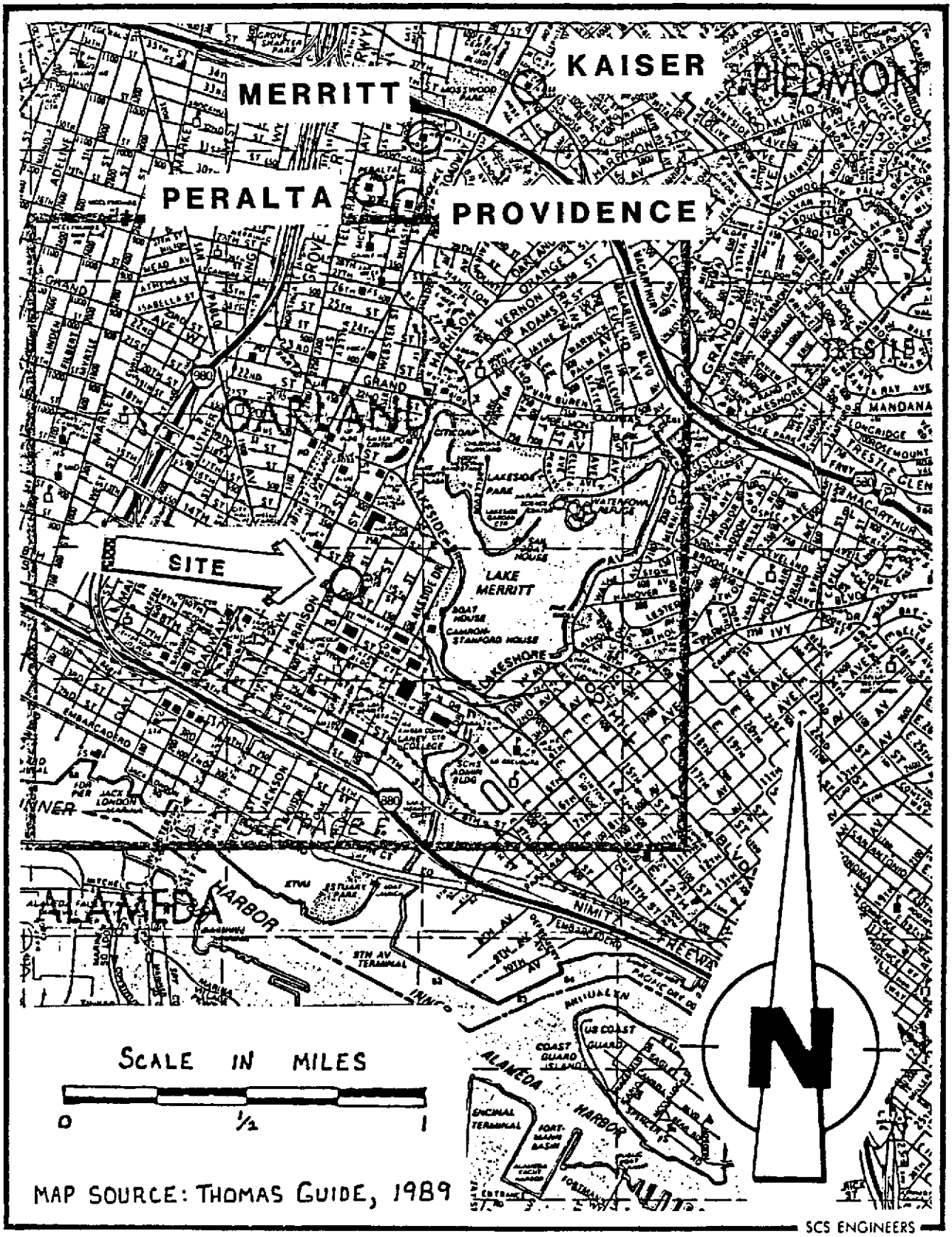
Providence Hospital
3100 Summit Street
Oakland, California
415-835-4500

Kaiser-Permanente Medical Center
280 W. MacArthur Boulevard
Oakland, California
415-596-1000

Merritt Hospital
Hawthorne and Webster Streets
Oakland, California
415-655-4000

Telephones are available in offices on the site and a cellular phone also will be present. A job site safety meeting will be held daily with the crew, including subcontractors, prior to starting excavation. NO SMOKING signs will be posted in proximity to the work site(s). Two fire extinguishes with a minimum class rating of 20BC shall be kept within at least 50 feet of the removal operation at all times during work operations. There shall be no ignition sources allowed within the area while removal operations are in progress. A first aid kit shall be present on site during all removal operations.

A copy of this notice shall be conspicuously posted in the area adjacent to removal operations, along with a copy of the fire department permit.



LOCATIONS OF OAKLAND HOSPITALS NEAR HARRISON STREET GARAGE
1432 Harrison Street, Oakland, California

APPENDIX A3

SIGNATURE SHEET

SIGNATURE SHEET

All employees of SCS Engineers, its subcontractors, or other agents must certify by signing this document that they have completed the appropriate OSHA-approved training and that they have read and will comply with this Site Health and Safety Plan.

Signature/Company	Date
Signature/Company	Date
Signature/Company	Date
Signature/Company	Date
Signature/Company	Date
Signature/Company	Date
Signature/Company	Date
Signature/Company	Date
Signature/Company	Date
Signature/Company	Date
Signature/Company	Date

APPENDIX C

TANK REMOVAL CONTRACTOR'S WORKMAN'S COMPENSATION INSURANCE CERTIFICATES

CERTIFICATE OF INSURANCE 12/31/90

This certificate is issued as a matter of information only and confers no rights upon the certificate holder. This certificate does not amend, extend or alter the coverage afforded by the policies listed below.

PRODUCER

Daugherty & Company
2495 West March Lane
Stockton CA 95207

INSURED

Falcon Energy Associates
P. O. Box 1257
Stockton CA 95201

COMPANIES
Letter A Pacific Compensation Ins. Co.
Letter B
Letter C
Letter D
Letter E

"LIMITS AT POLICY INCEPTION"

This is to certify that policies of insurance listed below have been issued to the insured named above for the policy period indicated. Notwithstanding any requirement, term or condition of any contract or other document with respect to which this certificate may be issued or may pertain, the insurance afforded by the policies described herein is subject to all the terms, exclusions and conditions of such policies. Limits shown may have been reduced by paid claims.

COVERAGES

Co Ltr	Type of Insurance	Policy #	Policy Effective	Policy Expiration	All Limits in Thousands	
	GENERAL LIABILITY					
	( ) Commercial GL				Gnl Aggregate	
	( ) ( )Claims Made				Prd-CompOp Agg	
	( )Occurrence				Pers & Adv Inj	
	( ) Owners & Contr				Each Occur	
	( )				Fire Damage	
	( )				Medical Exp	
	AUTOMOBILE LIABILITY					
	( ) Any Auto				CSL	
	( ) All Owned				B.I./Person	
	( ) Scheduled				B.I./Accident	
	( ) Hired				P.D.	
	( ) Non-Owned					
	( ) Garage Liab					
	EXCESS LIABILITY					
	( ) Umbrella Form				Each Occur	Aggregate
	( ) O.T. Umbrella					
	WORKERS COMPENSATION					
A	W.C.	WP012191	11/30/90	11/30/91	STATUTORY	
	Employers Liab.				Each Accident	$1,000
					Disease/Pol	$1,000
					Disease/Emp	$1,000
	OTHER					

DESCRIPTION OF Operations/Locations/Vehicles/Restrictions/Special Items

RE: As their interest may appear.

CANCELLATION: Should any of the above described policies be cancelled before the expiration date thereof, the issuing company will endeavor to mail ten days written notice to the certificate holder named below but failure to mail such notice shall impose no obligation or liability of any kind upon the company, its agents or representatives.

NAME and ADDRESS of CERTIFICATE HOLDER

SITE ADDRESS
1432 Harrison Street
Oakland CA 94612

VHO

R. S. Daugherty Jr.
Authorized Representative

ACORD. CERTIFICATE OF INSURANCE

ISSUE DATE (MM/DD/YY) REV 1588 12/12/90

PRODUCER

Corroon & Black of Missouri, Inc.
8112 Maryland Avenue
St. Louis, Missouri 63105-3721

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

COMPANIES AFFORDING COVERAGE

COMPANY LETTER A: Gotham Insurance Company

COMPANY LETTER B: Ocean Marine Indemnity

COMPANY LETTER C:

COMPANY LETTER D:

COMPANY LETTER E:

INSURED

Kiesel Enterprises, Inc. etal
Falcon Energy Associates
4801 Fyler Avenue
St. Louis, Missouri 63116

COVERAGES

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

CO LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS	
	GENERAL LIABILITY				GENERAL AGGREGATE	$ 2,000,000
	X COMMERCIAL GENERAL LIABILITY				PRODUCTS-COMP/OP AGG.	$ 1,000,000
A	CLAIMS MADE X OCCUR.	MMO-35827	12/01/90	12/01/91	PERSONAL & ADV. INJURY	$ 1,000,000
	OWNER'S & CONTRACTOR'S PROT.				EACH OCCURRENCE	$ 1,000,000
	X Coverage includes sudden and accidental pollution, subject to 72 hours as defined in policy.				FIRE DAMAGE (Any one fire)	$ 50,000
					MED. EXPENSE (Any one person)	$ 5,000
	AUTOMOBILE LIABILITY				COMBINED SINGLE LIMIT	$
	ANY AUTO				BODILY INJURY (Per person)	$
	ALL OWNED AUTOS				BODILY INJURY (Per accident)	$
	SCHEDULED AUTOS				PROPERTY DAMAGE	$
	HIRED AUTOS					
	NON-OWNED AUTOS					
	GARAGE LIABILITY					
	EXCESS LIABILITY				EACH OCCURRENCE	$ 5,000,000
B	UMBRELLA FORM	GCM 13974	12/01/90	12/01/91	AGGREGATE	$ 5,000,000
	X OTHER THAN UMBRELLA FORM					
	WORKER'S COMPENSATION AND EMPLOYERS' LIABILITY				STATUTORY LIMITS	
					EACH ACCIDENT	$
					DISEASE—POLICY LIMIT	$
					DISEASE—EACH EMPLOYEE	$
	OTHER					

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/SPECIAL ITEMS

CERTIFICATE HOLDER

SITE ADDRESS
1432 Harrison Street
Oakland, CA 94612

2/2'd

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING COMPANY WILL ENDEAVOR TO MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO MAIL SUCH NOTICE SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE COMPANY, ITS AGENTS OR REPRESENTATIVES.

AUTHORIZED REPRESENTATIVE

Timothy J. Davis

ACORD

ISSUE DATE (MM/DD/YY): 12/12/90

PRODUCER

Charles L. Crane Agency
100 South Fourth Street
St. Louis

MO 000069102

INSURED

FALCON ENERGY INC
P.O. BOX 1257

STOCKTON
CA 952010000

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

COMPANIES AFFORDING COVERAGES

COMPANY LETTER A	The Continental Ins. Companies
COMPANY LETTER B	KEMPER
COMPANY LETTER C	PACIFIC EMPLOYERS INSURANCE CO
COMPANY LETTER D	
COMPANY LETTER E	

THIS IS TO CERTIFY THAT POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED, NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS, AND CONDITIONS OF SUCH POLICIES.

CO LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	ALL LIMITS IN THOUSANDS
	GENERAL LIABILITY ☐ COMMERCIAL GENERAL LIABILITY ☐ CLAIMS MADE ☐ OCCURRENCE ☐ OWNER'S & CONTRACTORS PROTECTIVE				GENERAL AGGREGATE $ PRODUCTS-COMP/OPS AGGREGATE $ PERSONAL & ADVERTISING INJURY $ EACH OCCURRENCE $ FIRE DAMAGE (ANY ONE FIRE) $ MEDICAL EXPENSE (ANY ONE PERSON) $
A	AUTOMOBILE LIABILITY X ANY AUTO X ALL OWNED AUTOS X SCHEDULED AUTOS X HIRED AUTOS X NON-OWNED AUTOS ☐ GARAGE LIABILITY	81CLP05188785	9/18/90	9/18/91	CSL $1,200, BODILY INJURY (PER PERSON) $ BODILY INJURY (PER ACCIDENT) $ PROPERTY DAMAGE $
C	EXCESS LIABILITY X OTHER THAN UMBRELLA FORM	XMO033611	12/01/90	12/01/91	EACH OCCURRENCE $4,000, AGGREGATE 4,000,
	WORKERS' COMPENSATION AND EMPLOYERS' LIABILITY				STATUTORY $ (EACH ACCIDENT) $ (DISEASE-POLICY LIMIT) $ (DISEASE-EACH EMPLOYEE)
B	OTHER CONT. EQUIP	3AT58756400	9/30/90	9/30/91	PER FORM

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES XXXXXXXXX SPECIAL ITEMS

SITE ADDRESS

1432 Harrison Street
Oakland, CA 94612

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING COMPANY WILL ENDEAVOR TO MAIL 010 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER, NAMED TO THE LEFT, BUT FAILURE TO MAIL SUCH NOTICE SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE COMPANY, ITS AGENTS OR REPRESENTATIVES.

AUTHORIZED REPRESENTATIVE

BY

DAILY FIELD REPORT

PROJECT _____ PROJECT NO. _____ DATE _____

LOCATION _____ CLIENT _____

CONTRACTOR _____ SUPERINTENDENT _____

WEATHER CONDITIONS _____

TRAVEL TIME _____ MILEAGE _____ FIELDTIME _____

EQUIPMENT USED _____

_____

TIME	

ENGINEER/GEOLOGIST/INSPECTOR _____

REVIEWED BY _____ SHEET ____ OF ____

SCS ENGINEERS

BORING LOG

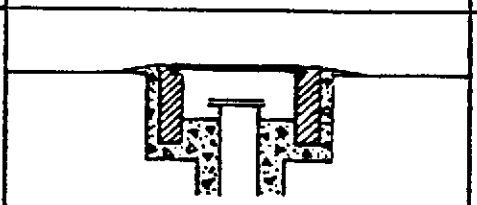
Project _____ Hole/Well # _____

Location _____ Diameter of Drill Hole _____

Job # _____ Total Depth of Hole _____

Geologist/Engineer _____ Date Started _____

Drill Agency _____ Date Completed _____

DEPTH IN FEET	WELL CONSTRUCTION DETAIL	N-VALUE	SAMPLE	GRAPHIC SYMBOL	DESCRIPTION
					

GROUNDWATER SAMPLING DATA SHEET

Well No.:_____ Monthly/Quarterly/Annual/Other (circle one) Sample

Explain "Other" Sample:_____

Sampling Date:_____ Time:_____ Weather:_____

Sampler Name:_____ Company:_____ Title:_____

Sample No.:_____

Type of Sampler/Pump Used:_____

Groundwater Surface Elevation (ft.):_____

Sample Depth:_____

Describe Well Purging Before Sampling:_____

_____

time pump on:_____ time pump off:_____

Type, Volume, Details of Sample Containers:_____

_____

Field Preservation of Samples (if any) - Describe:_____

_____

Analytical Lab Sent To, How Packaged and Shipped, Date/Time:_____

_____

_____

Describe Analytical Testing Requested:_____

_____

Analytical Results To Be Sent To:_____

_____

_____

Field Parameters: Spec. Conductance (umhos/cm)_____ pH_____

Temperature_____

Other Field Conditions:_____

File No.:_____ Reviewed By:_____

cc:_____

Remarks:_____

_____

_____

CHAIN OF CUSTODY RECORD REQUEST FOR ANALYSIS

COMPANY NAME :	CARRIER :	TURNAROUND TIME REQUIRED : ☐ NORMAL ☐ 5-DAY ☐ 3-DAY ☐ 24-HOUR ☐ IMMEDIATE ATTENTION
ADDRESS :	SHIPMENT DATE :	
PHONE NUMBER :	SHIPPING NUMBER :	
P.O. NUMBER :	NUMBER OF SAMPLES : PAGE OF	
PROJECT NAME :		
PROJECT ADDRESS :		
PROJECT NUMBER :		
SAMPLER NAME AND SIGNATURE :		
REPORTS TO BE SENT TO :		

SAMPLE I.D. NUMBER	SAMPLE DESCRIPTION	SAMPLE MATRIX	SAMPLE PRESERVATIVE(S)	CONTAINER SIZE / TYPE	DATE / TIME COLLECTED	FIELD TEMP.	FIELD pH	FIELD EC	SPECIAL PROGRAM REQUIREMENTS OR EPA - SOP & QAM REF	ANALYSES REQUIRED	LAB ONLY SAMPLE CONDITION UPON RECEIPT

SPECIAL INSTRUCTIONS / COMMENTS :

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

APPENDIX E

STATEMENT OF QUALIFICATIONS
SCS ANALYTICAL LABORATORY
2860 WALNUT AVENUE
LONG BEACH, CALIFORNIA 90806

JUL 22 1991

2860 WALNUT AVENUE
LONG BEACH, CALIFORNIA 90806
(213) 595-9324
FAX (213) 595-6709

STATEMENT OF QUALIFICATIONS

SCS Analytical Laboratory
2860 Walnut Avenue
Long Beach, CA 90806

(213) 595-9324

Laboratory Director: Lam V. Ho

July 1991

Table of Contents

SCS ANALYTICAL LABORATORY

CERTIFICATION AND QUALIFICATIONS

Introduction

SCS Engineers was founded in 1970 to provide comprehensive engineering services with an emphasis on environmental quality control systems. The firm is committed to excellence in professional services to public and private clients. The SCS Analytical Laboratory was started in 1975 to provide analytical support to the firm's engineering. Over the years since its inception, the laboratory has grown to provide analytical services to numerous private and governmental, local and national clients.

Certifications

SCS Analytical Laboratory, operating as a separate office of the SCS Engineers corporation, is certified by both California and New York states for testing solid/hazardous wastes, wastewaters, and potable waters. Copies of our certifications and related documentation are presented in Appendix A.

Affiliations

Laboratory personnel are members of the following organizations:

* American Chemical Society
* Association of Hazardous Materials Professionals
* Association of Analytical Chemists
* American Water Works Association
* Soil Science Society of America
* National Registry of Environmental Professionals

Personnel Summary:

Total Staff..... 17, which include:

PhD (Soil Chemistry)..... 1
MS (Chemistry)..... 3
MS (Biochemistry)..... 1
MS (Physics)..... 1
BS (Chemistry)..... 6
BS (Other disciplines)..... 2

Please refer to Appendix B for resumes of our key personnel.

FACILITY AND LAB INSTRUMENTATION

SCS Analytical Laboratory is conveniently located in Signal Hill, California. The Facility occupies a 7,000 square feet building and houses numerous modern lab instruments. Some of our major lab instrumentation are listed below:

Organic Analyses

2 **GC/MS** * Gas Chromatograph/Mass Spectrometers, HP 5890 coupled with HP MSD 5070 and HP 1000 computer system for analysis of volatile, base-neutral/acid extractable organic compounds.

8 **Gas Chromatograph** * which include, HP 5890A-II, Varian 3600, and 3400. The GC are equipped with auto samplers, integrators/computerized data acquisition and the following detectors: Hall, PID, FID, ECD, TCD and FPD.

1 **Infrared Spectrophotometer** * Perkin Elmer 1320 for analysis of Total Petroleum Hydrocarbons and Oil and Grease.

Metals and Other Inorganic Analyses

1 **Inductively Coupled Plasma Spectrophotometer** * Thermo-Jarrell Ash AtomScan 25 equipped with auto sampler and IBM PC computer and software control package.

2 **Atomic Absorption Spectrophotometer** * Varian SpectrAA-400Z flameless analysis, SpectrAA-20ABQ for flame AA, and VGA-76 Automatic Vapor Generation Accessory for mercury analysis by cold vapor technique.

1 **Ion Chromatograph** * Dionex 4500i for analysis of anionic parameters such as nitrate, nitrite, chlorides, fluoride, sulfate, etc.

QUALITY ASSURANCE/QUALITY CONTROL SUMMARY

SCS Analytical Laboratory strictly adheres to proper EPA protocols and enforces a strong quality assurance program. A QA/QC manual is available for in-house reference and for clients' inspection. The manual, reviewed and revised annually, addresses all applicable EPA or Department of Health Services requirements. Typical QA/QC procedures include:

- Analysis of blank and appropriate standards with each sample set.
- Ten percent of samples from each matrix are spiked in duplicate.
- Samples are checked for known concentration and are analyzed with each sample group.
- Use of control charts to identify QA/QC difficulties.

LABORATORY EXPERIENCE

SCS is a leader in both small- and large-scale solid waste and water contamination studies. Many of our projects have required unique sampling and analytical capabilities. Shown below are brief highlights of projects which demonstrate our analytical capabilities.

- For the SERRF project (a mass burn facility) in Long Beach, California, the SCS Laboratory analyzed ash samples for moisture, loss of ignition, free lime, ammonium salts, and total extractable heavy metals (EP toxicity extraction and California STLC extraction).

- For several major East Coast cities, commercial, institutional, and residential refuse samples were analyzed for higher heating value (BTU content), proximate and ultimate content, heavy metals, polynuclear aromatics, phenolics, and selected other constituents.

- The SCS Lab recently completed a leaching simulation study of arsenic from gold mine spoils and soils. The results were used to predict arsenic retention in the underlying soil matrix and to estimate kinetics and potential for ultimate vertical arsenic migration.

- The SCS Lab routinely supports many geotechnical/hydrogeological firms in assessing surfaces, subsurface, and groundwater contamination projects resulting from above/underground storage tanks. Analyses typically include 418.1's, EPA 8010, 8015, and 8020's.

- For the California University system, over 1,100 transformer oil samples were analyzed for PCB content. EPA sampling and analytical protocols were used through-out. Individual PCB isomers were identified.

- As a subcontractor to the Tanners Council of America, the SCS Analytical Laboratory completed a 5-year demonstration project assess the environmental effects of the sludges, plant and soil samples were analyzed for selected hazardous waste constituents.

- Investigation of toxic discharges from Washington state apple packers,. Monitoring wells were placed and over 30 ground water samples were drawn for analysis. EPA methods for sampling and analysis were closely followed, and the fate and degradation of diphenylamine (DPA), sodium orthophenylphenate (SOPP), benomyl, and thiabendazole (TBZ) were studied.

- In a project for the U.S. Navy, a 20 surface impoundment were investigated utilizing California Waste Extraction Test (WET) procedures. Samples of sediment and water were analyzed for the presence of hazardous waste including the explosives TNT, RXD, and HMX. Recommendations were issued relative to specific parameters for hazardous waste monitoring, where applicable.

APPENDIX A

Certificates of Approval

ENVIRONMENTAL LABORATORY ACCREDITATION/REGISTRATION
List of Approved Fields of Testing and Analytes

SCS Analytical Laboratory
2860 Walnut Avenue
Long Beach, CA 90805

PHONE: (213) 595-9324
COUNTY: Los Angeles

LABORATORY CATEGORY: Commercial
CERTIFICATE NUMBER: 0156

Y = CERTIFIED; N = NOT CERTIFIED

1.0 Microbiology of Drinking Water and Wastewater ----------(-------)
1.1 Total Coliforms by Multiple Tube Fermentation -----N
1.2 Fecal Coliforms by Multiple Tube Fermentation -----N
1.3 Total Coliforms by Membrane Filter ----------N
1.4 Fecal Coliforms by Membrane Filter ----------N
1.5 Total coliforms by Membrane Filter ----------N
1.6 Total Coliforms by MMO-MUG Drinking Water Only--N
1.7 Fecal Coliforms by MMO-MUG Drinking Water Only--N

2.0 Inorganic Chemistry and Physical Properties of Drinking Water excluding Toxic Chemical Elements ----------(04-12-90)
2.1 Alkalinity ----------Y
2.2 Calcium ----------Y
2.3 Chloride ----------Y
2.4 Corrosivity ----------Y
2.5 Fluoride ----------Y
2.6 Hardness ----------Y
2.7 Magnesium ----------Y
2.8 MBAS ----------Y
2.9 Nitrate ----------Y
2.10 Nitrite ----------Y
2.11 Sodium ----------Y
2.12 Sulfate ----------Y
2.13 Total Filterable residue and Conductivity ------Y
2.14 Iron (Colorimetric Only) ----------N
2.15 Manganese (Colorimetric Only) ----------N

3.0 Analysis of Toxic Chemical Elements in Drinking Water ----------(04-12-90)
3.1 Arsenic ----------Y
3.2 Barium ----------Y
3.3 Cadmium ----------Y
3.4 Chromium, total ----------Y
3.5 Copper ----------Y
3.6 Iron ----------Y
3.7 Lead ----------Y
3.8 Manganese ----------Y
3.9 Mercury ----------Y
3.10 Selenium ----------Y
3.11 Silver ----------Y
3.12 Zinc ----------Y
3.13 Aluminum ----------N
3.14 Asbestos ----------N

4.0 Organic Chemistry of Drinking Water (measurement by GC/MS combination) ----------(04-12-90)
4.1 Volatile Organics ----------Y
4.2 Trihalomethanes ----------Y
4.3 Acid and Base/Neutral Compounds ----------Y

5.0 Organic Chemistry of Drinking Water (excluding measurements by GC/MS combination) ----------(04-12-90)
5.1 Total Trihalomethanes ----------Y
5.2 Chlorinated pesticides ----------Y
5.3 Chlorophenoxy herbicides ----------Y
5.4 Halogenated Volatiles ----------Y
5.5 Aromatic Volatiles ----------Y
5.6 EDB and DBCP ----------Y
5.7 Polychlorinated Biphenyls ----------Y
5.8 Carbamates ----------N
5.9 Nitrogen/Phosphorus Pesticides ----------N

6.0 Radiochemistry ----------(-------)
6.1 Gross alpha and beta and counting error ----------N
6.2 Total Radium ----------N
6.3 Radium 226 ----------N
6.4 Uranium ----------N
6.5 Radon 222 ----------N
6.6 Radioactive Cesium ----------N
6.7 Iodine 131 ----------N
6.8 Radioactive Strontium ----------N
6.9 Tritium ----------N
6.10 Gamma emitting Isotopes ----------N
6.11 Gross Alpha by Co-precipitation ----------N

7.0 Shellfish Sanitation ----------(-------)
7.1 Shellfish meat Microbiology ----------N
7.2 Paralytic Shellfish Poison ----------N

8.0 Aquatic Toxicity Bioassays ----------(-------)
8.1 All Fresh Water: Static,Static/Renewal and Continuous Flow Bioassays; and
Estuarine/Marine: Static, Static/Renewal, and Continuous Flow Bioassays ----------N
8.2 Hazardous wastes Section 66696 (a) (4) ----------N

9.0 Physical Properties Testing of Hazardous Waste ----------(02-05-87)
9.1 Ignitability (Flashpoint determination Section 66702) ----------Y

9.2 Corrosivity - pH determination ---------- Y
9.3 Corrosivity - Corrosivity towards steel (Section 66708) ---------- Y
9.4 Reactivity (Section 66705) ---------- Y

10.0 Inorganic Chemistry and Toxic Chemical Elements of Hazardous Waste
10.1 Antimony ---------- 6010(04-03-90) ---------- 7040(08-24-88) 7041(04-03-90) ---------- Y
10.2 Arsenic ---------- 7060(08-24-88) ---------- Y
10.3 Barium ---------- 6010(04-03-90) ---------- 7080(08-24-88) 7081(04-03-90) ---------- Y
10.4 Beryllium ---------- 6010(04-03-90) ---------- 7090(08-24-88) 7091(04-03-90) ---------- Y
10.5 Cadmium ---------- 6010(04-03-90) ---------- 7130(08-24-88) 7131(04-03-90) ---------- Y
10.6 Chromium, total ---------- 6010(04-03-90) ---------- 7190(08-24-88) 7191(04-03-90) ---------- Y
10.7 Cobalt ---------- 6010(04-03-90) ---------- 7200(08-24-88) 7201(04-03-90) ---------- Y
10.8 Copper ---------- 6010(04-03-90) ---------- 7210(08-24-88) 7211(04-03-90) ---------- Y
10.9 Lead ---------- 6010(04-03-90) ---------- 7420(08-24-88) 7421(04-03-90) ---------- Y
10.10 Mercury ---------- 7470(04-03-90) ---------- Y
10.11 Molybdenum ---------- 6010(04-03-90) ---------- 7480(08-24-88) 7481(04-03-90) ---------- Y
10.12 Nickel ---------- 6010(04-03-90) ---------- 7520(08-24-88) 7521(04-03-90) ---------- Y
10.13 Selenium ---------- 7740(08-24-88) ---------- Y
10.14 Silver ---------- 6010(04-03-90) ---------- 7760(08-24-88) 7761(04-03-90) ---------- Y
10.15 Thallium ---------- 6010(04-03-90) ---------- 7840(08-24-88) 7841(04-03-90) ---------- Y
10.16 Vanadium ---------- 6010(04-03-90) ---------- 7910(04-03-88) 7911(08-24-88) ---------- Y
10.17 Zinc ---------- 6010(04-03-90) ---------- 7950(08-24-88) ---------- Y
10.18 Chromium (VI) ---------- 7196(08-24-88) ---------- Y
10.19 Cyanide ---------- 9010(08-24-88) ---------- Y
10.20 Fluoride ---------- 340.2(09-01-89) ---------- Y
10.21 Sulfide ---------- 9030(09-01-89) ---------- Y
10.22 Total Organic Lead ---------- (08-24-88) ---------- Y

11.0 Extraction Tests of Hazardous Waste ---------- (08-24-88)
11.1 Section 66700 ---------- Y 11.3 Toxicity Characteristic Leaching Procedure (TCLP) ---- Y
11.2 Extraction Procedure Toxicity ---------- N

12.0 Organic Chemistry of Hazardous Waste (measurement by GC/MS combination)
12.1 Volatile compounds ---------- 8240(09-01-89) ---------- Y
12.2 Semivolatile compounds ---------- 8270(04-03-90) ---------- Y

13.0 Organic Chemistry of Hazardous Waste (excluding measurements by GC/MS combination)
13.1 Halogenated Volatiles ---------- 8010(04-03-90) ---------- Y
13.2 Non-Halogenated Volatiles ---------- 8015(04-03-90) ---------- Y
13.3 Aromatic Volatiles ---------- 8020(03-17-87) ---------- Y
13.4 Acrolein, Acrylonitrile, Acetonitrile ---------- 8030(03-17-87) ---------- Y
13.5 Phenols ---------- 8040(04-03-90) ---------- Y
13.6 Phthalate Esters ---------- 8060(06-13-88) ---------- Y
13.7 Organochlorine Pesticides ---------- 8080(03-17-87) ---------- Y
13.8 Polychlorinated Biphenyls (PCBs) ---------- 8080(09-01-89) ---------- Y
13.9 Nitroaromatics and Cyclic Ketones ---------- 8090(04-03-90) ---------- Y
13.10 Polynuclear Aromatic Hydrocarbons ---------- 8100(04-03-90) ---------- Y
13.11 Chlorinated Hydrocarbons ---------- 8120(04-03-90) ---------- Y
13.12 Organophosporus Pesticides ---------- 8140(04-03-90) ---------- Y
13.13 Chlorinated Herbicides ---------- 8150(04-03-90) ---------- Y
13.14 Carbamates ---------- Y
13.15 Total Petroleum Hydrocarbons ---------- (09-01-89) ---------- Y

14.0 Bulk Asbestos Analysis ---------- (---------)
14.1 Section 66699 (1% or greater asbestos concentrations) ---------- N

15.0 Substances Regulated Under the California Safe Drinking Water and Toxic Enforcement Act (Proposition 65) and Not Included in Other Listed Groups. ---------- N

16.0 Wastewater Inorganic Chemistry, Nutrients and Demand ---------- (04-12-90)

16.1 Acidity ---------- Y
16.2 Alkalinity ---------- Y
16.3 Ammonia ---------- Y
16.4 Biochemical Oxygen Demand ---------- Y
16.5 Boron ---------- Y
16.6 Bromide ---------- Y
16.7 Calcium ---------- Y
16.8 cBOD ---------- Y
16.9 Chemical Oxygen Demand ---------- Y
16.10 Chloride ---------- Y
16.11 Chlorine Residual, total ---------- N
16.12 Cyanide ---------- Y
16.13 Cyanide amenable to Chlorination ---------- N
16.14 Fluoride ---------- Y
16.15 Hardness ---------- Y
16.16 Kjeldahl Nitrogen ---------- Y
16.17 Magnesium ---------- Y
16.18 Nitrate ---------- Y
16.19 Nitrite ---------- Y
16.20 Oil and Grease ---------- Y
16.21 Organic Carbon ---------- Y
16.22 Oxygen, dissolved ---------- Y
16.23 pH ---------- Y
16.24 Phenols ---------- Y
16.25 Phosphate, ortho- ---------- Y
16.26 Phosphorus, total ---------- Y
16.27 Potassium ---------- Y
16.28 Residue, Total ---------- Y
16.29 Residue, Filterable (TDS) ---------- Y
16.30 Residue, Nonfilterable (TSS) ---------- Y
16.31 Residue, Settleable (SS) ---------- Y
16.32 Residue, Volatile ---------- Y
16.33 Silica ---------- Y
16.34 Sodium ---------- Y
16.35 Specific Conductance ---------- Y
16.36 Sulfate ---------- Y
16.37 Sulfide (includes total and soluble) ---------- Y
16.38 Sulfite ---------- Y
16.39 Surfactants (MBAS) ---------- Y
16.40 Tannin and Lignin ---------- Y
16.41 Turbidity ---------- Y

17.0 Toxic Chemical Elements in Wastewater ---------- (04-12-90)

17.1 Aluminum ---------- Y
17.2 Antimony ---------- Y
17.3 Arsenic ---------- Y
17.4 Barium ---------- Y
17.5 Beryllium ---------- Y
17.6 Cadmium ---------- Y
17.7 Chromium (VI) ---------- Y
17.8 Chromium, total ---------- Y
17.9 Cobalt ---------- Y
17.10 Copper ---------- Y
17.11 Gold ---------- N
17.12 Iridium ---------- N
17.13 Iron ---------- Y
17.14 Lead ---------- Y
17.15 Manganese ---------- Y
17.16 Mercury ---------- Y
17.17 Molybdenum ---------- Y
17.18 Nickel ---------- Y
17.19 Osmium ---------- N
17.20 Palladium ---------- N
17.21 Platinum ---------- N
17.22 Rhodium ---------- N
17.23 Ruthenium ---------- N
17.24 Selenium ---------- Y
17.25 Silver ---------- Y
17.26 Strontium ---------- N
17.27 Thallium ---------- N
17.28 Tin ---------- N
17.29 Titanium ---------- Y
17.30 Vanadium ---------- Y
17.31 Zinc ---------- Y

18.0 Organic Chemistry of Wastewater (measurements by GC/MS combination) ---------- (04-12-90)

18.1 Volatile Organics ---------- Y
18.2 Acid and Base/Neutral compounds ---------- Y

19.0 Organic Chemistry of Wastewater (excluding measurements by GC/MS combination) ---------- (04-03-90)

19.1 Halogenated Volatiles ---------- Y
19.2 Aromatic Volatiles ---------- Y
19.3 Acrolein, Acrylonitrile, Acetonitrile ---------- Y
19.4 Phenols ---------- Y
19.5 Benzidine ---------- Y
19.6 Phthalate Esters ---------- Y
19.7 Nitrosoamines ---------- Y
19.8 Organochlorine Pesticides ---------- Y
19.9 Polychlorinated Biphenyls ---------- Y
19.10 Nitroaromatics and Cyclic Ketones ---------- Y
19.11 Polynuclear Aromatics ---------- Y
19.12 Haloethers ---------- Y
19.13 Carbamates ---------- N

This laboratory is also certified for additional hazardous material test categories under Certificate No. _____.

This laboratory is also certified for additional drinking water test categories under Certificate No. ____.

NEW YORK STATE DEPARTMENT OF HEALTH

DAVID AXELROD, M. D. *COMMISSIONER*

Expires 12:01 AM April 1, 1992
ISSUED June 7, 1991

INTERIM CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

Lab ID No.: 11243

Director: DR. LAM HO
Lab Name: SCS ANALYTICAL LABORATORY
Address : 2860 WALNUT AVE
LONG BEACH CA 90806

is hereby APPROVED as an Environmental Laboratory for the category

ENVIRONMENTAL ANALYSES NON POTABLE WATER

All approved subcategories and/or analytes are listed below:

Chlor. Hydrocarbon Pesticides :
- 4,4'-DDD
- 4,4'-DDE
- 4,4'-DDT
- alpha-BHC
- Aldrin
- beta-BHC
- Chlordane Total
- delta-BHC
- Dieldrin
- Endrin aldehyde
- Endrin
- Endosulfan I
- Endosulfan II
- Endosulfan sulfate
- Heptachlor
- Heptachlor epoxide
- Lindane
- Methoxychlor
- Toxaphene

Wastewater Miscellaneous :
- Boron, Total
- Cyanide, Total
- Phenols
- Oil & Grease Total Recoverable
- Hydrogen Ion (pH)
- Specific Conductance
- Sulfide (as S)

Polychlorinated Biphenyls (ALL)
Purgeable Aromatics (ALL)

Wastewater Metals III :
- Cobalt, Total
- Molybdenum, Total
- Thallium, Total

Haloethers (ALL)
Wastewater Metals II (ALL)
Nitroaromatics and Isophorone (ALL)
Nutrient (ALL)
Phthalate Esters (ALL)
Purgeable Halocarbons (ALL)

Demand :
- Biochemical Oxygen Demand

Chlorophenoxy Acid Pesticides (ALL)
Chlorinated Hydrocarbons (ALL)
Wastewater Metals I (ALL)
Mineral (ALL)
Nitrosoamines (ALL)
Polynuclear Aromatics (ALL)
Priority Pollutant Phenols (ALL)
Residue (ALL)

Herbert W. Dickerman

Serial No.: 08677

Herbert W. Dickerman, M.D., Ph.D., Director
Wadsworth Center for Laboratories and Research

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Must be conspicuously posted. Valid certificate has a red serial number.

DOH-3317 (11/90)

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LONG BEACH CA 90806

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ENVIRONMENTAL ANALYSES/ POTABLE WATER

All approved subcategories and/or analytes are listed below:

Drinking Water Non-Metals :
Alkalinity
Calcium Hardness
Chloride
Fluoride, Total
Nitrate (as N)
Hydrogen Ion (pH)
Solids, Total Dissolved
Sulfate (as SO4)

Drinking Water Metals (ALL)

Volatile Aromatics (ALL)

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Lab Name: SCS ANALYTICAL LABORATORY
Address : 2860 WALNUT AVE
LONG BEACH CA 90806

is hereby APPROVED as an Environmental Laboratory for the category

ENVIRONMENTAL ANALYSES/SOLID AND HAZARDOUS WASTE

All approved subcategories and/or analytes are listed below:

Characteristic Testing :
- Corrosivity
- Ignitability
- Toxicity

Miscellaneous :
- Cyanide, Total
- Hydrogen Ion (pH)
- Sulfide (as S)

Chlorophenoxy Acid Pesticides (ALL)
Chlorinated Hydrocarbons (ALL)
Metals I (ALL)
Nitroaromatics Isophorone (ALL)
Priority Pollutant Phenols (ALL)

Chlor. Hydrocarbon Pesticides (ALL)
Haloethers (ALL)
Metals II (ALL)
Polynuclear Arom. Hydrocarbon (ALL)
Purgeable Aromatics (ALL)

Polychlorinated Biphenyls (ALL)
Purgeable Halocarbons (ALL)
Phthalate Esters (ALL)

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DOH-3317 (11/90)

APPENDIX B

Resumes of Key Personnel

LAM V. HO, Ph.D., LABORATORY DIRECTOR

Education

B.S. - Polytechnique Institute (Thu Duc, Vietnam), 1967, Soil Chemistry

Ph.D. - University of Florida, 1976, Soil Chemistry

Professional Licenses

Registered Environmental Professional (by the National Registry of Environmental Professionals)

Affiliations

Association of Analytical Chemists
American Chemical Society
American Water Works Association
Soil Science Society of America

Professional Experience

Dr. Ho brings to SCS 20 years of experience in the environmental monitoring field which includes over 12 years of managing environmental laboratories. Dr. Ho has extensive knowledge in both organic and inorganic analyses, and is very familiar with all quality assurance/quality control (QA/QC) procedures.

Prior to joining SCS, Dr. Ho served as the Division/Laboratory Director for the Environmental and Industrial Division of Brookside Laboratories. Under his directorship, Brookside Laboratories attained several state certifications (California, New York, and Ohio) for hazardous waste testing and potable water analysis.

Analytical projects managed by Dr. Ho include the following:

- Chemical characterization of industrial wastes (to determine if waste is hazardous).
- Ground and surface water monitoring (for remedial action and/or regulatory compliance).
- NPDES monitoring (for remedial action and/or regulatory compliance).
- Municipal sewage sludge monitoring (for appropriate waste management).

LAM V. HO, Ph.D. (continued)

Dr. Ho's other relevant professional activities include the following:

- Organized and served as instructor for numerous technical seminars dealing with environmental sampling/testing.
- Spearheaded efforts to purchase state-of-the-art laboratory instrumentation (e.g., GC/MS, GC, AA, TOC analyzer, TOX analyzer).
- Assisted consultants and clients in developing appropriate monitoring plans and in understanding analytical findings.

Dr. Ho authored several important in-house documents, including:

- QA/QC manual to be used as a guideline and daily reference for all laboratory personnel.
- Laboratory waste management plan to prevent improper discharge of hazardous laboratory waste and to minimize waste generation.
- Reference manual documenting federal, state, and local regulatory requirements; common monitoring parameters for 34 selected industries; sample collection procedures; analytical procedures; and data interpretation.

Dr. Ho has published many reports and articles addressing hazardous waste management environmental monitoring issues.

DAVID C. SINCERBEAUX, LABORATORY MANAGER

Education

B.S. - California State University - Northridge, 1984, Chemistry

Affiliations

American Chemical Society

Professional Experience

As Laboratory Manager, Mr. Sincerbeaux has acquired equipment and quality personnel that have been forged into an effective team providing quality service to its many clients. He is experienced with most EPA and ASTM methods of analysis, particularly those dealing with organic compounds. He was instrumental in gaining California State Certification as a hazardous waste testing laboratory.

Major projects in which Mr. Sincerbeaux has participated include:

- Quantification of PCBs in Transformer oil for the California State University system.
- Characterization of pesticides at several different California and Arizona sites.
- Identification of hazardous compounds for both the U.S. Navy and numerous southern California redevelopment agencies.
- Analysis of landfill gas and ambient air samples from sites throughout the United States and Canada.

Mr. Sincerbeaux's experience in the trace analyses of gas samples by EPA and California state methods has helped to make the SCS Laboratory a leader in this field.

LOREE KENYON, QA/QC MANAGER, HEALTH AND SAFETY OFFICER

Education

B.A. - Williams College, Williamstown, Massachusetts, 1984, Chemistry

M.S. - University of California, Berkeley, California, 1985, Chemistry

Professional Experience

As QA/QC Manager, Ms. Kenyon oversees the laboratory's quality assurance program. Her responsibilities include ensuring that proper quality control is maintained for all analyses performed in the laboratory and directing corrective action as required. She is responsible for updating control charts quarterly to define limits for reporting of quality control data and for revising the quality control/quality assurance manual as needed.

As Health and Safety Officer, Ms. Kenyon has written a Laboratory Health and Safety Plan and provided training to all lab employees in lab safety. She performs monthly safety inspections, investigates work-related accidents, and trains all new employees in all aspects of lab safety.

Prior to her employment at SCS Analytical Laboratory, Ms. Kenyon had extensive experience analyzing volatile and semivolatile organics by GC/MS. She also served as Organics Manager at a new laboratory and was instrumental in setting up an Organics department at that lab.

DAVID R. MIKESELL, ORGANIC SECTION MANAGER

Education

B.S. - University of California, Irvine, California, 1986, Chemistry

Professional Experience

Mr. Mikesell brings to SCS Analytical Laboratory much experience in organic analysis. He is knowledgeable in the analysis of soils, sludges, and waters for both volatiles and extractables by GC/MS. In addition, he has analyzed petroleum products, landfill gases, and contaminants in manufactured products by GC and GC/MS.

Mr. Mikesell is also experience in the analysis of organic and inorganic constituents of waters, soils, and wastes by GC, IR, AA, ICAP and classical wet chemistry. He is well versed in the EPA methods of identification of herbicides, pesticides, and volatile compounds, and characterization of landfill gas. He is also experienced in the use of atomic absorption spectroscopy to characterize metals in soils and water matrices. His background in instrumental analysis also includes IR and UV/VIS spectrometry, NMR, and Neutron Activation Analysis.

Mr. Mikesell was instrumental in obtaining the SCS Analytical Laboratory's California State Hazardous Waste certification for EPA methods 8240, 8270, 8020, and 8030.

Projects in which Mr. Mikesell has been involved include:

- Identification of hazardous compounds for both the U.S. Navy and numerous southern California redevelopment agencies.
- Characterization of landfill condensate samples.
- Identification of potential chemical hazards for the California National Guard.
- Identification of organic contaminants in cryo-engines for Hughes Aircraft.

HARJI KALTHIA, CHEMIST

Education

B.S. - Sir P.P. Institute of Technology (India), 1966, Chemistry

M.S. - Youngstown State University, Youngstown, Ohio, 1970, Organic Chemistry

Professional Experience

Mr. Kalthia brings to SCS Analytical Laboratory 20 years of experience in analytical chemistry, especially in the instrumental analysis field.

Prior to joining SCS, Mr. Kalthia was an analytical chemist for Wyeth Laboratory (Evanston, Illinois) for eight years, GC specialist/organic chemist for Mead Compuchem (Cary, Illinois) for two years, and GC/MS chemist for the Illinois EPA (Springfield, Illinois) for seven years.

Analytical techniques that Mr. Kalthia is most familiar with include: Gas chromatography/mass spectroscopy, UV/IR spectrophotometry, atomic absorption spectroscopy, and x-ray difractometry.

Presently, Mr. Kalthia serves as a GC/MS spectroscopist for SCS Analytical Laboratory. He is responsible for analyzing volatile and semivolatile organic pollutants in various types of samples, including industrial wastes, sludges, contaminated soils, waste water and ground water. He also takes part in the method development for the analysis of organic compounds in complicated matrices.