Bob Robles
Environmental Coordinator
(818) 505 2476

Texaco Refining
and Marketing Inc

May 18, 1992

Mr. Scott O. Seery
ALAMEDA COUNTY DEPARTMENT OF
ENVIRONMENTAL PROTECTION
80 Swan Way, Room 200
Oakland, CA 94621

SUBJECT: FORMER SERVICE STATION SITE
1127 Lincoln Avenue
Alameda, California

Dear Mr. Seery:

Enclosed for your review and comments is a copy of Addendum One To Work Plan dated May 12, 1992, for the proposed work at the above site. Texaco will proceed to obtain all necessary bids, permits and approvals to perform the work as outlined.

If you have any questions or wish to discuss this further, please call me at (818) 505 2476.

Very truly yours,

Bob Robles

RR:rr

pr

Enclosure

Mr.Leo Pagano
1104 Fountain Street
Alameda, California 94501

California Regional Water Quality Control Board
San Francisco Bay Region
Attention: Rich Hiett
2201 Webster Street, Suite 500
Oakland, California 94612

RRZielinski-Richmond

receptors and water wells; and preparing a report including a summary of previous work performed at the site, summaries of field procedures used during the investigation, the findings and interpretation of data, and conclusions.

Additionally, on March 3, 1992, RESNA performed a soil-vapor extraction test to evaluate the feasibility of this method for remediation of gasoline hydrocarbons in the shallow soil at the site.

Conclusions

From the subsurface investigation at the site RESNA concluded that diesel, oil and grease, and volatile and semi-volatile organic compounds do not appear to have impacted the shallow soil at the site.

Gasoline hydrocarbons have impacted shallow soils at the site in the vicinity of the former gasoline-storage tanks and former product pumps. The areas of highest concentrations of total petroleum hydrocarbons as gasoline (TPHg) in the soil are in the vicinity of the former 1,000-gallon gasoline-storage tanks, south of the former 4,000-gallon gasoline-storage tanks, and in the vicinity of the former product pumps, at depths of 5½ to 8½ feet. The lateral extent of gasoline hydrocarbons has been evaluated to nondetectable (1.0 parts per million [ppm]) in the western, northwestern, and extreme southeastern portions of the site.

The distribution of TPHg in the soil suggests that the former gasoline-storage tanks, and possibly the product lines, were sources of the hydrocarbon detected in the soil. The relatively high concentrations of gasoline hydrocarbons reported in soil samples collected from borings B-1 and B-5 along the eastern boundary of the site, and B-4 and B-10 upgradient of the tanks and product lines, suggest possible offsite sources of gasoline hydrocarbons in the soil at the site. This suggestion is supported by the presence of several underground gasoline-storage tank sites found during RESNA's area research. Movement of gasoline hydrocarbons in the shallow soil in the vicinity of the site may be facilitated by fluctuating ground-water levels in the vicinity of the site.

Diesel, volatile organic compounds (VOCs), and semi-VOCs do not appear to have impacted shallow groundwater at the site. While some hydrocarbons were detected by analysis of groundwater samples for diesel, these hydrocarbons are likely due to the presence of gasoline in the groundwater.

The groundwater at the site has been impacted by gasoline hydrocarbons, based on detectable levels of TPHg and the gasoline constituents benzene, toluene, ethylbenzene, and total xylenes (BTEX) reported in groundwater samples obtained from groundwater

monitoring wells MW-1, MW-2, and MW-3. The benzene concentrations reported in the groundwater samples obtained from these wells exceed the California State Department of Health Services maximum contaminant level for benzene (1 part per billion [ppb]) in drinking water. The presence of concentrations of gasoline hydrocarbons in the water samples collected from well MW-2 (upgradient of the former 1,000-gallon gasoline-storage tanks) exceeding the concentrations of gasoline hydrocarbons detected in the shallow soil sample from boring B-2/MW-2 suggests a possible offsite source of a portion of the gasoline hydrocarbons in the groundwater.

Recommendations

TASK 1: Research the work performed by Environmental Bio-Systems and any other previous work at the site to determine the extent of additional excavation and sampling which may have been performed at the locations of the former gasoline-storage tanks after the initial tank excavation, and whether any work was performed in the area of the product pipelines. Additionally, a file search for schematics of utility trenches in the area immediately surrounding the site will be performed to evaluate potential migratory pathways for possible offsite contamination. The necessity and locations of additional soil borings to delineate the extent of hydrocarbons in the soil should be evaluated after the results of this research are known.

TASK 2: After obtaining the necessary encroachment permits and well permits, drill five soil borings (B-12 through B-16) and construct groundwater monitoring wells (MW-4 through MW-8, respectively) in each boring to evaluate the extent of gasoline hydrocarbons in the soil and groundwater in the vicinity of the site (see Plate A, Proposed Soil Boring and Well Locations). B-12/MW-4 should be located onsite, southwest of MW-3 to evaluate the extent of gasoline hydrocarbons upgradient of MW-3, and to evaluate the possibility of an offsite source of gasoline hydrocarbons. B-13/MW-5 should be located onsite, northwest of the former 4,000-gallon gasoline-storage tanks to evaluate the extent of gasoline hydrocarbons in the groundwater north (downgradient) of MW-3. B-14/MW-6 should be located offsite, south-southwest of MW-2, ~~across~~ on Lincoln Avenue to evaluate the extent of gasoline hydrocarbons in the soil and groundwater upgradient of MW-2, and to evaluate the possibility of an offsite source of the gasoline hydrocarbons reported in MW-2. B-15/MW-7 should be located offsite, east of B-5, across Bay Street to evaluate the extent of gasoline hydrocarbons crossgradient to the site, and to evaluate the possibility of an offsite source of gasoline hydrocarbons. B-16/MW-8 should be located offsite, north or north-northeast of MW-1 to evaluate the extent

of gasoline hydrocarbons in the soil and groundwater downgradient of MW-1. The number and locations of these borings may be modified after completion of Task 1.

Develop the new groundwater monitoring wells, survey wellhead elevations, measure water levels, purge and sample all new and existing groundwater monitoring wells.

TASK 3: Perform laboratory analysis for TPHg and BTEX, using Environmental Protection Agency (EPA) Methods 5030/8015/8020/602, according to Alameda County Health Care Services Agency (ACHCSA) guidelines, for selected soil samples collected from borings B-12 through B-16, and for water samples obtained from ground-water monitoring wells MW-1 through MW-8.

TASK 4: Prepare a report of the proposed Subsurface Environmental Investigation including results, methods, and conclusions.

TASK 5: Evaluate the results and prepare a report which includes results, methods, and conclusions of the soil-vapor extraction test performed to evaluate the feasibility of this method for remediation of gasoline hydrocarbons in the shallow soil at the site.

TASK 6: Perform quarterly groundwater monitoring of groundwater monitoring wells at the site, including measuring depths-to-water, purging and sampling, and performing laboratory analysis of water samples for TPHg and BTEX, and prepare a report.

Work proposed in this addendum to Work Plan will be performed in accordance to the attached Field Protocol (Appendix A) and Site Safety Plan (Appendix B). A Preliminary Time Schedule (Plate B) to perform these tasks has been attached to this addendum. Subsequent addendums to the Work Plan will be prepared and submitted to regulatory agencies as necessary to describe future work.

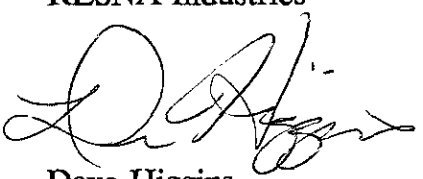
We recommend copies of this Addendum One to Work Plan be forwarded to the following:

Mr. Ariu Levi
Alameda County Health Care Services Agency
Department of Environmental Health
Hazardous Materials Program
80 Swan Way, Room 200
Oakland, California 94621

Mr. Rich Hiett
California Regional Water Quality Control Board
San Francisco Bay Region
2101 Webster Street, Suite 500
Oakland, California 94612

If you have any questions or comments regarding this addendum, please call us at (408) 264-7723.

Sincerely,
RESNA Industries



Dave Higgins
Project Geologist

Enclosures: References
Plate A, Proposed Boring/Monitoring Well Locations
Plate B, Preliminary Time Schedule
Appendix A, Field Protocol
Appendix B, Site Safety Plan

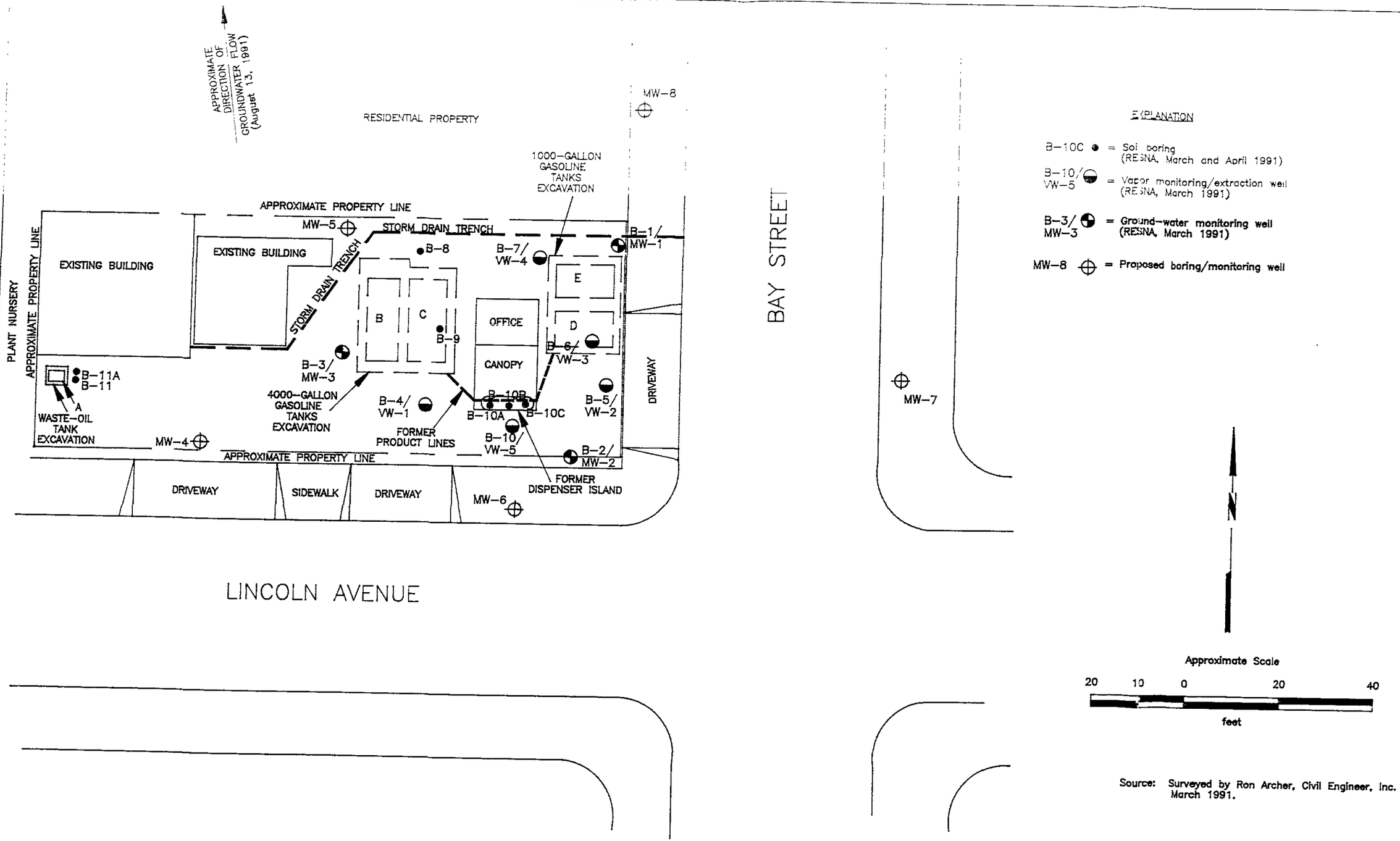
REFERENCES

Applied GeoSystems, May 7, 1991, Initial Subsurface Environmental Investigation at Former Bay Street Station, 1127 Lincoln Avenue, Alameda, California. AGS 61006.01

McLaren/Hart, November 29, 1990, Texaco-Alameda Site Safety and Health Plan, Project 88705-001.

McLaren/Hart, January 23, 1991, Work Plan for Phase I Investigation, Lewis Bay Street Service Station, Alameda, California, Project 88705-001.

RESNA Industries, Inc., September 24, 1991, Letter Report, Quarterly Groundwater Monitoring, Third Quarter 1991 at Former Texaco Station, 1127 Lincoln Avenue, Alameda, California. 61006.01



Source: Surveyed by Ron Archer, Civil Engineer, Inc. March 1991.

RESNA

PROJECT 61006.03A

PROPOSED BORING/MONITORING WELL LOCATIONS
Former Bay Street Texaco Station
1127 Lincoln Avenue
Alameda, California

PLATE
A

APPENDIX A

FIELD PROTOCOL

FIELD PROTOCOL

The following presents RESNA's protocol for a typical site investigation involving petroleum hydrocarbon-impacted soil and/or groundwater.

Site Safety Plan

The Site Safety Plan describes the safety requirements for the evaluation of petroleum hydrocarbons in soil, groundwater, and the vadose-zone at the site. The Site Safety Plan is applicable to personnel of RESNA and its subcontractors. RESNA personnel and subcontractors of RESNA scheduled to perform the work at the site are briefed on the contents of the Site Safety Plan before work begins. A copy of the Site Safety Plan is available for reference by appropriate parties during the work. A site Safety Officer is assigned to the project.

Sampling of Stockpiled Soil

One composite soil sample is collected for each 50 cubic yards of stockpiled soil, and for each individual stockpile composed of less than 50 cubic yards. Composite soil samples are obtained by first evaluating relatively high, average, and low areas of hydrocarbon concentration by digging approximately one to two feet into the stockpile and placing the intake probe of a field calibrated organic vapor meter (OVM) against the surface of the soil; and then collecting one sample from the "high" reading area, and three samples from the "average" areas. Samples are collected by removing the top one to two feet of soil, then driving laboratory-cleaned brass sleeves into the soil. The samples are sealed in the sleeves using aluminum foil, and plastic caps; labeled; and promptly placed in iced storage for transport to the laboratory, where compositing is performed.

Soil Borings

Prior to the drilling of borings and construction of monitoring wells, permits are acquired from the appropriate regulatory agency. In addition to the above-mentioned permits, encroachment permits from the City or State are acquired if drilling of borings offsite on City or State property is necessary. Copies of the permits are included in the appendix of the project report. Prior to drilling, Underground Services Alert is notified of our intent to drill, and known underground utility lines and structures are approximately marked.

The borings are drilled by a truck-mounted drill rig equipped with 8- or 10-inch-diameter, hollow-stem augers. The augers are steam-cleaned prior to drilling each boring to minimize

the possibility of cross-contamination. After drilling the borings, monitoring wells are constructed in the borings, or neat-cement grout with bentonite is used to backfill the borings to the ground surface.

Borings for groundwater monitoring wells are drilled to a depth of no more than 20 feet below the depth at which a saturated zone is first encountered, or a short distance into a stratum beneath the saturated zone which is of sufficient moisture and consistency to be judged as an aquitard by the field geologist, whichever is shallower. Drilling into a deeper aquifer below the shallowest aquifer is begun only after a conductor casing is properly installed and allowed to set, to seal the shallow aquifer.

Drill Cuttings

Drill cuttings subjectively evaluated as containing hydrocarbons at levels greater than 100 parts per million (ppm) are separated from those subjectively evaluated as containing hydrocarbons at levels less than 100 ppm. Evaluation is based either on subjective evidence of soil discoloration, or on measurements made using a field calibrated OVM. Readings are taken by placing a soil sample into a ziplock-type plastic bag and allowing volatilization to occur. The intake probe of the OVM is then inserted into the headspace created in the plastic bag immediately after opening it. The drill cuttings from the borings are placed in labeled 55-gallon drums approved by the Department of Transportation, or on plastic at the site, and covered with plastic. The cuttings remain the responsibility of the client.

Soil Sampling in Borings

Soil samples are collected at no greater than 5-foot intervals from the ground surface to the total depth of the borings. The soil samples are collected by advancing the boring to a point immediately above the sampling depth, and then driving a California-modified, split-spoon sampler containing brass sleeves through the hollow center of the auger into the soil. The sampler and brass sleeves are laboratory-cleaned, steam-cleaned, or washed thoroughly with Alconox® and water, prior to each use. The sampler is driven with a standard 140-pound hammer repeatedly dropped 30 inches. The number of blows to drive the sampler each successive six inches are counted and recorded to evaluate the relative consistency or density of the soil.

The samples selected for laboratory analysis are removed from the sampler and quickly sealed in their brass sleeves with aluminum foil, and plastic caps. The samples are then labeled, promptly placed in iced storage, and delivered to a laboratory certified by the State of California to perform the analyses requested.

One of the samples in brass sleeves not selected for laboratory analysis at each sampling interval is tested in the field using an OVM that is field calibrated at the beginning of each day it is used. This testing is performed by inserting the intake probe of the OVM into the headspace in the plastic bag containing the soil sample as described in the Drill Cuttings section above. The OVM readings are presented in Logs of Borings included in the project report.

Logging of Borings

A geologist is present to log the soil cuttings and samples using the Unified Soil Classification System. Samples not selected for chemical analysis, and the soil in the sampler shoe, are extruded in the field for inspection. Logs include texture, color, moisture, plasticity, consistency, relative density, and any other geologic characteristics noted. Logs also include subjective evidence for the presence of hydrocarbons, such as soil staining, and OVM readings.

Monitoring Well Construction

Monitoring wells are constructed in selected borings using clean 2- or 4-inch-diameter, thread-jointed, Schedule 40 polyvinyl chloride (PVC) casing. No chemical cements, glues, or solvents are used in well construction. Each casing bottom is sealed with a threaded end-plug, and each casing top with a locking plug. The screened portions of the wells are constructed of machine-slotted PVC casing with 0.020-inch-wide (typical) slots for initial site wells. Slot size for subsequent wells may be based on sieve analysis and/or well development data. The screened sections in groundwater monitoring wells are placed to allow monitoring during seasonal fluctuations of groundwater levels.

The annular space of each well is backfilled with a filter sand pack, or similar sorted sand, to approximately two feet above the top of the screened casing for initial site wells. The sand pack grain size for subsequent wells may be based on sieve analysis. A 1- to 2-foot-thick bentonite plug is placed above the sand as a seal against cement entering the filter pack. The remaining annulus is then backfilled with a slurry of water, neat cement, and bentonite to approximately one foot below the ground surface.

An aluminum utility box with a PVC apron is placed over each wellhead and set in concrete placed flush with the surrounding ground surface. Each wellhead cover has a seal to protect the monitoring well against surface-water infiltration and requires a special wrench to open. The design discourages vandalism and reduces the possibility of accidental disturbance of the well.

Groundwater Monitoring Well Development

The monitoring wells are developed by bailing or over-pumping and surge-block techniques. The wells are either bailed or pumped, allowed to recharge, and bailed or pumped again until the water removed from the wells is determined to be clear. Turbidity measurements (in NTUs) are recorded during well development and are used in evaluating well development. The development method used, initial turbidity measurement, volume of water removed, final turbidity measurement, and other pertinent field data and observations are recorded. The wells are allowed to equilibrate for at least 48 hours after development prior to sampling. Water generated by well development is stored in 17E Department of Transportation (DOT) 55-gallon drums on site, and remains the responsibility of the client.

Groundwater Sampling

The static water level in each well is measured to the nearest 0.01-foot using a Solinst® electric water-level sounder or oil/water interface probe (if the wells contain floating product) cleaned with Alconox® and water before use in each well. The liquid in the wells is examined for visual evidence of hydrocarbons by gently lowering approximately half the length of a Teflon® bailer (cleaned with Alconox® and water) past the air/water interface. The sample is then retrieved and inspected for floating product, sheen, emulsion, color, and clarity. If floating product is present in the well, the thickness of floating product is measured using an oil/water interface probe and is recorded to the nearest 0.01 foot. Floating product is removed from wells on site visits.

Wells which do not contain floating product are purged using a submersible pump. The pump, cables, and hoses are cleaned with Alconox® and water prior to use in each well. The wells are purged until withdrawal is of sufficient duration to result in stabilized Ph, temperature, and electrical conductivity of the water, as measured using portable meters calibrated to a standard buffer and conductivity standard. If the well becomes dewatered, the water level is allowed to recover to at least 80 percent of the initial water level. Prior to the collection of each groundwater sample, the Teflon® bailer is cleaned with Alconox® and rinsed with tap water and deionized water, and the latex gloves worn by the sampler changed. Hydrochloric acid is added to the sample vials as a preservative by RESNA personnel for the appropriate laboratory analyses. A sample method blank is collected by pouring distilled water into the bailer and then into sample vials. A sample of the formation water is then collected from the surface of the water in each of the wells using the Teflon® bailer. The water samples are then gently poured into laboratory-cleaned, 40-milliliter (ml) glass vials, 500 ml plastic bottles or 1-liter glass bottles (as required for specific laboratory analysis) and sealed with Teflon®-lined caps, and inspected for air bubbles to check for headspace, which would allow volatilization to occur. The samples are then labeled and promptly placed in iced storage. A field log of well evacuation

procedures and parameter monitoring is maintained. Water generated by the purging of wells is stored in 17E DOT 55-gallon drums, and floating product bailed from the wells is stored in double containment onsite; this water and product remains the responsibility of the client.

Sample Labeling and Handling

Sample containers are labeled in the field with the job number, sample location and depth, and date, and promptly placed in iced storage for transport to the laboratory. A Chain of Custody Record is initiated by the field geologist and updated throughout handling of the samples, and accompanies the samples to a laboratory certified by the State of California for the analyses requested. Samples are transported to the laboratory promptly to help ensure that recommended sample holding times are not exceeded.

APPENDIX B

SITE SAFETY PLAN

61006.03S

SITE SAFETY PLAN
SUBSURFACE ENVIRONMENTAL INVESTIGATION
at
Texaco/Alameda
1127 Lincoln Avenue
Alameda, California

1.0 General

1.1 Background

RESNA Industries, Inc. (RESNA) has been retained by Texaco Envirnometal Services (Texaco) to perform a site assessment/investigation at the Former Texaco Service Station, 1127 Lincoln Avenue in Alameda, California. Accordingly, this Site Safety Plan was prepared in conformance with RESNA's Health and Safety Program, and is intended to meet the requirements of 29 CFR 1910.120. As such, this Site Safety Plan addresses the activities associated with field operations conducted at this site. Compliance with the Site Safety Plan is required of all RESNA personnel, contractors, or a third party that enters the site. Field activities are planned to begin on March 10, 1992, with the duration estimated at approximately 5 days after the start date.

1.2 Purpose

This Site Safety Plan describes basic safety requirements for the subsurface environmental investigation. The provisions set forth in this Site Safety Plan apply to the employees of RESNA and its subcontractors working on this phase of the project.

This Site Safety Plan will address the expected potential chemical and physical hazards that may exist, or be encountered on the worksite for this project. Secondarily, the information contained herein will define the safety precautions necessary to respond to such hazards should they occur. If changes in site or working conditions occur as activities progress, addenda to this plan will be provided by RESNA.

1.3 Objective

The primary objective is to ensure the well-being of all field personnel and the community surrounding this gasoline service station. In order to accomplish this, project staff and approved subcontractors shall acknowledge and adhere to the policies and procedures established herein. Accordingly, all personnel assigned to this project shall read and sign the Agreement and Acknowledgement Statement (Appendix A) to certify that they have read, understood, and agreed to abide by its provisions.

1.4 Amendments

Any changes in the scope of this project and/or site conditions must be amended in writing on the Site Safety Plan Amendment Sheet (Appendix B) and approved by the Health and Safety Manager. The subcontractors may elect to modify these provisions, but only to upgrade or increase the safety requirements, and only with the concurrence of RESNA, as designated and accepted in writing.

1.5 Medical Monitoring Program

All RESNA field personnel and subcontractors engaged in project activities must participate in a medical surveillance program and must be cleared by the examining physician(s) to wear respiratory protection devices and protective clothing for working with hazardous materials. The applicable requirements of Title 8, Section 5216, of the California Administrative Code will be observed. The applicable requirements under 29 CFR 1910.120 of the Federal Administrative Code will also be observed.

1.6 Employee Training

All personnel working on this site, who may be potentially exposed to toxic substances or hazardous materials, must initially participate in a 40 hour training program (29 CFR 1910.120 [4]) designed towards the recognition, evaluation, and control of worksite hazards.

1.7 Tailgate Meetings

Job site tailgate meetings shall be conducted by the Site Safety Officer at the beginning of each shift for each job and whenever new employees arrive at the job site. For construction activities, tailgate meetings must be held at least once every ten working days. The initial site meeting shall include a discussion of site work plans, monitoring protective equipment, site rules, site hazards, and this site safety plan. In addition, fit-testing of respiratory protective devices will be conducted as part of the safety orientation meeting when the use of a respirator may be required.

2.0 Project Personnel

The RESNA personnel responsible for project safety are the Project Manager and the Staff Geologist or Engineer. The Project Manager will be responsible for implementing the project and obtaining any necessary personnel or resources for the completion of the project, for providing a copy of this Site Safety Plan to the Staff Geologist or Engineer,

and for advising the Staff Geologist or Engineer on health and safety matters. The Health and Safety Coordinator is responsible for the overall RESNA Health and Safety Program and may choose to audit the site for compliance and take appropriate action to correct deficiencies. The Project Manager and Staff Geologist or Engineer have the authority to audit site activities for compliance with the provisions of this Plan. They may suspend or modify work practices or dismiss subcontractors whose conduct does not meet the requirements specified in this Plan. All field personnel shall be responsible for acting in compliance with all safety procedures outlined in this site safety plan.

The Staff Geologist or Engineer is responsible for communicating the information contained in this Plan to the RESNA personnel assigned to the project and to the responsible representative of each subcontractor working for RESNA on the project.

The Staff Geologist or Engineer will also act as the Site Safety Officer. As such, the Staff Geologist or Engineer is responsible for addressing the following items:

- Implementing the Site Safety Plan, Company policy, and procedures
- Requiring and maintaining adequate safety supplies and equipment inventory onsite
- Conducting daily safety meetings and advising workers regarding hazards
- Site control, decontamination, and contamination-reduction procedures
- Reporting accidents or incidents

The Staff Geologist or Engineer has the authority to suspend work any time he or she finds that the provisions of the Plan are inadequate for worker safety. The Staff Geologist or Engineer will inform the Project Manager and the Health and Safety Coordinator promptly of deficiencies within the Plan or individuals or subcontractors whose conduct is not consistent with the requirements of this Plan.

3.0 Hazard Assessment

3.1 General

The major contaminants expected to be encountered on the project are gasoline and its hydrocarbon constituents, natural gas and propane. The anticipated contaminants and

their exposure standards are listed in Table 1. Potential effects of any exposure are dependant on several factors, such as: toxicity of substance, timeframe of exposure, concentration of substance producing exposure, general health of person exposed, and individual use of hazard reduction methods. It is not anticipated that the potential levels of exposure will reach the permissible exposure limits (PEL) or threshold limit values (TLV). Inhalation and dermal contact are the potential exposure pathways. Protective clothing will be mandatory for field personnel specified in this Plan. In addition, respiratory protective devices are required to be worn by each person onsite or to be within easy reach should irritating odors be detected or irritation of the respiratory tract occur.

TABLE 1
EXPOSURE LIMITS OF ANTICIPATED CHEMICAL CONTAMINANTS
Texaco/Alameda
1127 Lincoln Avenue
Alameda, California
(page 1 of 2)

Contaminant	PEL	EL	ED	CL	TWA	STEL
Benzene[1] [skin] & [carc]	1*	—	———	—	10*	5*
Ethylbenzene	100*	—	———	—	100*	125*
Toluene [skin]	100*	200*	10 min per 8 hours	500*	100*	150*
Xylene (o,m, & p isomers) [skin]	100*	200*	30 min per 8 hrs	300*	100*	150*
Gasoline[2]	300*	—	———	—	300*	500*
Propane[3]	1,000*	—	——	—	1,000*	—

See notes on page 2 of 2.

TABLE 1
EXPOSURE LIMITS OF ANTICIPATED CHEMICAL CONTAMINANTS
Texaco/Alameda
1127 Lincoln Avenue
Alameda, California
(page 2 of 2)

PEL	-	permissible exposure limit: 8 hour, time-weighted average, California Occupational Safety and Health Administration Standard (CAL-OSHA)
EL	-	excursion limit: maximum concentration of an airborne contaminant to which an employee may be exposed without regard to duration provided the 8 hour time-weighted average for PEL is not exceeded (CAL-OSHA)
ED	-	excursion duration: maximum time period permitted for an exposure above the excursion limit but not exceeding the ceiling limit (CAL-OSHA)
CL	-	ceiling limit: maximum concentration of airborne contaminant which employees may be exposed permitted (CAL-OSHA)
TWA	-	time-weighted average: 8 hour, [(same as threshold limit value (TLV)], American Conference of Governmental Industrial Hygienists (ACGIH)
STEL	-	short-term exposure limit: 15 minute time-weighted average (ACGIH)
#	-	milligrams of substance per cubic meter of air (mg/m^3)
*	-	parts of gas or vapor per million parts air
[carc]	-	substance identified as a suspected or confirmed carcinogen
[skin]	-	substance may be absorbed into the bloodstream through the skin, mucous membranes, or eyes
1	-	Federal OSHA benzene limits given for PEL and STEL; STEL has a 50 minute duration limit
2	-	Federal OSHA gasoline limit given for PEL; STEL is the same for FED-OSHA and ACGIH
3	-	Federal OSHA propane limit given for PEL

A brief description of the physical characteristics, incompatibilities, toxic effects, routes of entry, and target organs has been summarized from the NIOSH Pocket Guide to Chemical Hazards for the contaminants anticipated to be encountered. This information is used in onsite safety meetings to alert personnel to the hazards associated with the expected contaminants.

3.2 Hazardous Chemicals

3.2.1 Benzene

Benzene is a colorless, aromatic liquid. Benzene may create an explosion hazard. Benzene is incompatible with strong oxidizers, chlorine, and bromine with iron. Benzene is irritating to the eyes, nose, and respiratory system. Prolonged exposure may result in giddiness, headache, nausea, staggering gait, fatigue, bone marrow depression, or abdominal pain. Routes of entry include inhalation, absorption, ingestion, and skin or eye contact. The target organs are blood, the central nervous system (CNS), skin, bone marrow, eyes, and respiratory system. Benzene is carcinogenic.

3.2.2 Ethylbenzene

Ethylbenzene is a colorless, aromatic liquid. Ethylbenzene may create an explosion hazard. Ethylbenzene is incompatible with strong oxidizers. Ethylbenzene is irritating to the eyes and mucous membranes. Prolonged exposure may result in headache, dermatitis, narcosis, or coma. Routes of entry include inhalation, ingestion, and skin or eye contact. The target organs are the eyes, upper respiratory system, skin, and the CNS.

3.2.3 Toluene

Toluene is a colorless, aromatic liquid. Toluene may create an explosion hazard. Toluene is incompatible with strong oxidizers. Prolonged exposure may result in fatigue, confusion, euphoria, dizziness, headache, dilation of pupils, lacrimation, insomnia, dermatitis, or photophobia. Routes of entry are inhalation, absorption, ingestion, and skin or eye contact. The target organs are the CNS, liver, kidneys, and skin.

3.2.4 Xylene Isomers

Xylene is a colorless, aromatic liquid. Xylene may create an explosion hazard. Xylene is incompatible with strong oxidizers. Xylene is irritating to the eyes, nose, and throat. Prolonged exposure may result in dizziness, excitement, drowsiness, staggering gait, corneal vacuolization, vomiting, abdominal pain, or dermatitis. Routes of entry are inhalation, absorption, ingestion, and skin or eye contact. The target organs are the CNS, eyes, gastrointestinal tract, blood, liver, kidneys, and skin.

3.2.5 Gasoline

Gasoline is a complex mixture of hydrocarbons and additives. Chronic exposures or exposures to a high concentration of gasoline vapor may cause unconsciousness, coma, and possibly death from respiratory failure. Exposure to low concentrations of gasoline vapor may produce flushing of the face, slurred speech, and mental confusion.

3.2.6 Propane

Propane is a colorless gas, odorless when pure, though for most industrial uses a foul-smelling odorant is added. Propane is incompatible with strong oxidizers. Propane is an asphyxiant and being heavier than air, can displace air in confined spaces. It is explosive in concentrations of 2.2 to 9.5% by volume in air. Prolonged exposure can have narcotic effects, i.e. dizziness, disorientation or excitation. Target organs are the CNS. Liquid or

gaseous propane can cause frostbite upon exposure to skin. Routes of entry or exposure are by inhalation or by contact.

3.2.7 Natural Gas

Natural gas is a combination of gases typically consisting of approximately 85% methane, 9% ethane, 3% propane and 2% nitrogen. It is a colorless gas, odorless when pure, though for most industrial uses a foul-smelling odorant is added. Natural gas flammable, and explosive when heated and is incompatible with strong oxidizers. Incomplete combustion can produce carbon monoxide gas. Natural gas is an asphyxiant and being heavier than air, can displace air in confined spaces. It is explosive in concentrations of 5.53% to 14% by volume in air, and remains flammable at concentrations above 14% by volume in air. Prolonged exposure can have narcotic effects, i.e. dizziness, disorientation or excitation. Liquid or gaseous natural gas can cause frostbite upon exposure to skin. Routes of entry or exposure are by inhalation or by contact.

3.3 Initial Level of Protection

The minimum acceptable level of protection at this site is **Level D**, as described in the section entitled "Work Practices and Personal Protective Equipment".

3.4 Initial Air Monitoring

Potentially explosive and flammable atmospheres and the possibility of exposure to benzene, gasoline, and other organic vapors, as well as the potential for oxygen-enriched or oxygen-deficient atmospheres, represent the greatest potential hazard for safety and health at this site. Ongoing air monitoring will provide data to ensure that vapor concentrations are within acceptable ranges to provide adequate selection criteria for respiratory and dermal protection. The following monitoring procedures will be routinely undertaken.

Prior to the initiation of activity at the site, and periodically throughout site operations, ambient air level for toxic vapors, potentially explosive atmospheres, and oxygen deficiency will be determined utilizing a Organic Vapor Meter (OVM). Measurements will be taken at the start of each task and at anytime during the process when it is suspected that air concentrations have changed as suggested by appropriate warning properties, including odor threshold, irritation, employee stress, or as otherwise noted.

All monitoring equipment shall be calibrated and maintained according to manu recommendation. A calibration/maintenance form is included within this Site S (Appendix J).

4.0 SITE CONTROL

The site itself will normally be divided into three zones: the majority of the w conducted within the exclusion zone, with a limited area serving as the Support area for decontamination titled the Contamination Reduction Zone. In many si will be mobile, such as a site with many monitoring wells in which the work m one well to another.

Each of the areas where the borings will be drilled will be designated as Exclu Only essential personnel will be allowed into an Exclusion Zone. When it is p local topography allows, approximately 25 to 75 feet of space surrounding thos Zones will be designated as Contamination Reduction Zones.

Cones, wooden barricades, or a suitable alternative will be used to deny public these Contamination Reduction Zones. The general public will not be allowed work area under any conditions. If for any reason the safety of a member of t (e.g., motorist or pedestrian) may be endangered, work will cease until the situ remedied. Cones and warning signs will be used when necessary to redirect m pedestrians.

5.0 WORK PRACTICES AND PERSONAL PROTECTIVE EQUIPME

5.1 Work Practices

The Project Manager will call Underground Services Alert (USA) and the utiliti marked before any drilling is conducted onsite and the borings will be drilled at distances from the utilities. The client will also be advised to have a representa advise us in selecting locations of borings with respect to utilities or undergroun RESNA assumes no responsibility for utilities not so located. The first 5 feet w augured before any drilling equipment is operated.

Project activities will be conducted in accordance with the following minimum requirements:

- Eating, drinking, and smoking will be restricted to a designated area.

- Gross decontamination and removal of all personal protective equipment will be performed before leaving the site. Contaminated clothing will be removed and collected in a drum for disposal.

- Shaking or blowing dust or other materials off potentially contaminated clothing or equipment to remove dust or other materials is not permitted.

- The Staff Geologist will be responsible for taking steps to protect employees from physical hazards including

  * Falling objects, such as tools or equipment
  * Falls from elevations
  * Tripping over hoses, pipes, tools, or equipment
  * Slipping on wet or oily surfaces
  * Insufficient or faulty protective equipment
  * Insufficient or faulty equipment or tools

- All personnel will be required to wash hands and faces before eating, drinking, or smoking in the afore mentioned designated areas.

- Field personnel will be cautioned to inform each other of the nonvisual effects of the presence of toxics, such as

  * Headaches
  * Dizziness
  * Nausea
  * Blurred vision
  * Cramps
  * Irritation of eyes, skin, or respiratory tract
  * Changes in complexion or skin discoloration
  * Changes in apparent motor coordination
  * Changes in personality or demeanor
  * Excessive salivation or changes in pupillary response
  * Changes in speech ability or pattern

5.2 Personal Protective Equipment

Level D is the minimum acceptable level for this site. Field personnel and visitors are required to wear the following protective clothing and equipment, as a minimum, while in the work area at the site:

- Hard hat
- Safety glasses
- Steel-toed chemical resistant boots (rubber, neoprene, or polyvinyl chloride [PVC])
- Gloves (rubber, neoprene, PVC, or nitrile)
- Orange or red safety vest (if equipment or motor vehicles are operating onsite or nearby)
- Standard Tyvek coveralls (when required by Staff Geologist or Engineer)
- Respirator with organic vapor and acid gas cartridge (if lowest PEL or TLV is exceeded in the breathing zone or Staff Geologist or Engineer decides respirators should be worn)

5.3 Respiratory Protection Program

This section summarizes RESNA Respiratory Protection Program. RESNA's subcontractors must have company medical surveillance and respiratory protection programs including adequate training of their employees. Subcontractors must provide personal protective equipment as required in this Site Safety Plan for their employees. RESNA will attempt to verify worker training but does not assume the responsibility of the employer in any way. The following sections outline the RESNA Respiratory Protection Program.

Respirators are not issued to employees until the Company physician conducts a complete physical and decides the employee can 1) wear personal protective equipment and 2) wear a respirator. After the physician has issued written approval to RESNA, the Health and Safety Coordinator conducts the required training including these basic topics:

- Applicable OSHA regulations 1910.134 and 1910.120
- Nature of respiratory hazards to be encountered in the work environment and how to select proper respiratory equipment
- Use of respirators and proper fitting
- Functions and limitations of respirators

- Cleaning, disinfection, inspection, maintenance, and storage of respirators

5.3.1 Functions and Limitations of Respirators

Respirators are not intended for and may not be used in atmospheres which are, or may become, immediately dangerous to life or health (IDLH) or in atmospheres where the identity or concentration of the contaminant(s) is unknown. Respirators may not be used in atmospheres containing less than 19.5 percent oxygen.

Cartridges or canisters for respirators are selected and supplied to employees by the Health and Safety Coordinator or Branch Safety Officer. The failure to choose or use a respirator equipped with cartridges or filters suitable for the contaminant(s) in the atmosphere or likely to be released in the atmosphere may result in the respirator providing little or no protection against the contaminated atmosphere. The Site Safety Plan specifies the contaminant(s) to be encountered and type of cartridge or canister appropriate for personal protection.

Assuming that the respirator is properly fitted, in good condition, free from leaks, and has the proper cartridges for the contaminant(s) present, the length of time the respirator will provide protection also depends on the conditions of use.

The conditions of use include but are not limited to the following:

- The concentration of contaminant(s) in the atmosphere
- The temperature and humidity of the ambient atmosphere
- Any previous use of the cartridges and filters
- The elapsed time since the removal of the cartridges or filters from their protective packaging
- The emotional state of the wearer
- The level of physical activity of the wearer

Cartridges designed and specified to protect the wearer against airborne particles are not appropriate for protection against gases and vapors. Cartridges designed and specified for protection against specific gases and vapors are not appropriate for protection against airborne particles or other gases or vapors beyond the scope of that type of cartridge. Every

cartridge is labeled with specific instructions defining the use and limitations of that particular type of cartridge. If the label is missing or the type of cartridge is inappropriate then it may not be used under any circumstances; it will provide little or no protection to the wearer.

5.3.2 Danger Signals Indicating Possible Respirator Failure

If any of the danger signals in the following list are experienced while wearing a respirator, immediately return to a fresh air environment. The cartridges or filters may be inappropriate or used up or abnormal conditions may be creating vapor concentrations which are beyond the limits of the cartridges or filters. Danger is indicated when the individual subject to exposure:

- Smells or tastes chemicals, or if eyes, nose, or throat become irritated;
- Has difficulty breathing;
- Notices that the breathing air becomes uncomfortably warm;
- Experiences headaches, dizziness, cramps, nausea, or blurred vision;
- Experiences changes in complexion or skin discoloration;
- Experiences changes in motor coordination, personality, or demeanor;
- Experiences changes in speech ability or pattern;
- Experiences excessive salivation or changes in pupillary response.

5.3.3 Qualitative Respirator Fit Test

Qualitative fit testing of each respirator must be conducted before the respirator may be used to check that a good fit is still obtained. The following steps should be taken in qualitative fit test of the respirator.

1. Don the facepiece with cartridge or filters in place. Pull straps together and equally to avoid distorting the mask.
2. Adjust the facepiece. Do not overtighten it.

3. Negative Pressure Leak Check: Close off both inlet connections with palms of hands, inhale slowly, and hold breath momentarily. No leakage should be detected and the facepiece should be drawn slightly to the face.

4. Positive Pressure Leak Check: Close opening in the exhalation valve guard by placing palm of one hand over face of guard; exhale slowly maintaining slight positive pressure. No leakage should be detected between the face seal and the face.

5. Should any leakage be noted:

   a) Adjust the headstraps and facepiece slightly; recheck for leakage.

   b) Check condition of exhalation valve and seat. Check that both inlet gaskets are present and in proper condition.

   c) In the event the facepiece cannot be adjusted so there is no leakage, DO NOT ENTER THE AREA REQUIRING PROTECTION. Due to your particular facial features, a different style or size facepiece may be required to obtain a proper facial fit.

Note: Failure to perform a qualitative fit test of the respirator each time the respirator is donned may result in little or no respiratory protection.

5.3.4 Inspection, Cleaning, and Storage

The respirator should be inspected, cleaned, and properly stored after use each day. The following steps are the basic elements of each procedure:

A. Inspection

1. Examine faceseal for rips, tears, holes, deformation, or stiffness.

2. Examine facepiece plastic center shell for cracks, missing components, or damaged threads.

3. Examine harness for breaks, cuts, frays, tears, and missing or damaged hardware.

4. Examine inhalation and exhalation valves and valve seats for cuts, cracks, or foreign matter which may not allow the valve to close completely. Check that valves are properly installed and are not distorted.

5. Examine cartridges for signs of abuse or damage. Discard damaged items.

6. Any respirator malfunction or deficiencies noted must be reported to the Health and Safety Coordinator or Branch Safety Officer who will issue a new respirator or correct the deficiencies using only approved spare parts from the manufacturer of the specific model in need of repair. Spare parts from any other manufacturer may not be used under any conditions. Instructions in the manual provided by the manufacturer should be followed when the respirator needs repairing or replacing.

B. Cleaning

1. Unthread cartridges or filters.

2. Wash the facepiece after use, with warm water and a mild detergent.

3. Disinfect the facepiece if it was used by another person. The mask should routinely (once per month) be disinfected even if respirator is used solely by one individual. A hypochlorite solution may be used (i.e., 2 tablespoons chlorine bleach per gallon of water for an acceptable solution).

4. After cleaning and air-drying, check that the facepiece is not damaged and that components removed prior to cleaning have been installed properly.

C. Storage

1. Place the respirator in its storage box in a heat- sealed or resealable plastic bag. Store flat, with the facepiece and exhalation valve in an approximately normal position, to prevent the faceseal from taking a permanent "set."

2. Replacement components should be stored in sealed packages in a cool, clean, low-humidity location until ready for use.

The Health and Safety Coordinator or Branch Safety Officer will explain RESNA's Respiratory Protection Program to each new employee who must wear a respirator. The employee will be asked whether or not he or she understands the information provided. If

the Company physician has cleared the employee for respirator use and the Health and Safety Coordinator or Branch Safety Officer has checked the fit of the respirator then the employee will be issued a respirator. A written record is signed and dated by the employee and Health and Safety Coordinator or Branch Safety Officer and kept in the new employee's Safety Record.

6.0 AIR MONITORING PLAN

It is not anticipated that project personnel exposure will exceed the TLVs or PELs of the materials; however, proper personal protective equipment will be worn while working at the site. In addition, the work area will monitored using a direct-reading combustible gas analyzer or an organic vapor meter to detect the concentration of the volatile hydrocarbons in the ambient atmosphere.

If the lowest TLV or PEL is consistently being exceeded in the breathing zone, then a respirator must be worn. If the concentration exceeds 1,000 parts per million (ppm), the use of a respirator is inappropriate and personnel must withdraw from the site.

Gasoline has a flammable range from approximately 1.4 to 7.6 percent in air. One percent in air is equivalent to 10,000 ppm; thus the lower explosive limit (LEL) is 14,000 ppm. Normally explosive levels may be reached in tanks, pits, or other confined spaces. Any area suspected of containing potentially explosive levels of gasoline will be evaluated with an intrinsically safe or explosion-proof combustible gas indicator (CGI). Personnel response will be based on the following action levels from CGI readings:

-	Less than 10 percent of LEL*	then	Continue activities and monitoring
-	10 to 25 percent of LEL	then	Continue monitoring with extreme caution as higher levels are encountered
-	Greater than 25 percent of LEL	then	Explosion hazard. Cease activities and vacate area immediately

* CGI readings in percent of lower explosive limit

If an explosion potential is present onsite beyond 25 percent of the LEL then all RESNA' personnel and subcontractors must immediately withdraw from the site. The hazard potential will be evaluated by RESNA' management and a plan of action will be assessed.

7.0 DECONTAMINATION PROCEDURES

All drilling equipment and personal protective equipment leaving the contaminated site will undergo gross decontamination onsite. This gross decontamination will include washing contaminated equipment with a trisodium phosphate (TSP) solution. Steam-cleaning is an acceptable alternative.

8.0 EMERGENCY RESPONSE PROCEDURES

8.1 Lines of Authority

The Site Safety Officer is the primary authority for directing site operations under emergency conditions. All communications both on and off-site will be directed through the Health and Safety Manager.

In the event of a fire, explosion, or property damage, the nearest RESNA Branch and the Administrative Office will be immediately notified. If necessary, local fire or response agencies will be called.

In the event of an accident resulting in physical injury, first aid will be administered and the injured worker will be transported to the nearest hospital or emergency medical clinic for emergency treatment. A physician's attention is required regardless of the severity of the injury.

8.2 Overt Personnel Exposure

If overt personnel exposure occurs during the project, typical responses should include the following:

Skin or Eye Contact:	Wash and rinse affected area thoroughly with copious amounts of soap and water, then provide appropriate medical attention. Eyes and skin should be rinsed for a minimum of 15 minutes upon chemical contamination.

Inhalation:	Move to fresh air and, if necessary, decontaminate and transport to emergency hospital.
Ingestion:	Decontaminate and transport to emergency hospital.
Puncture Wound or Laceration:	Decontaminate and transport to emergency hospital.

EMERGENCY TELEPHONE NUMBERS

Fire and Police 911

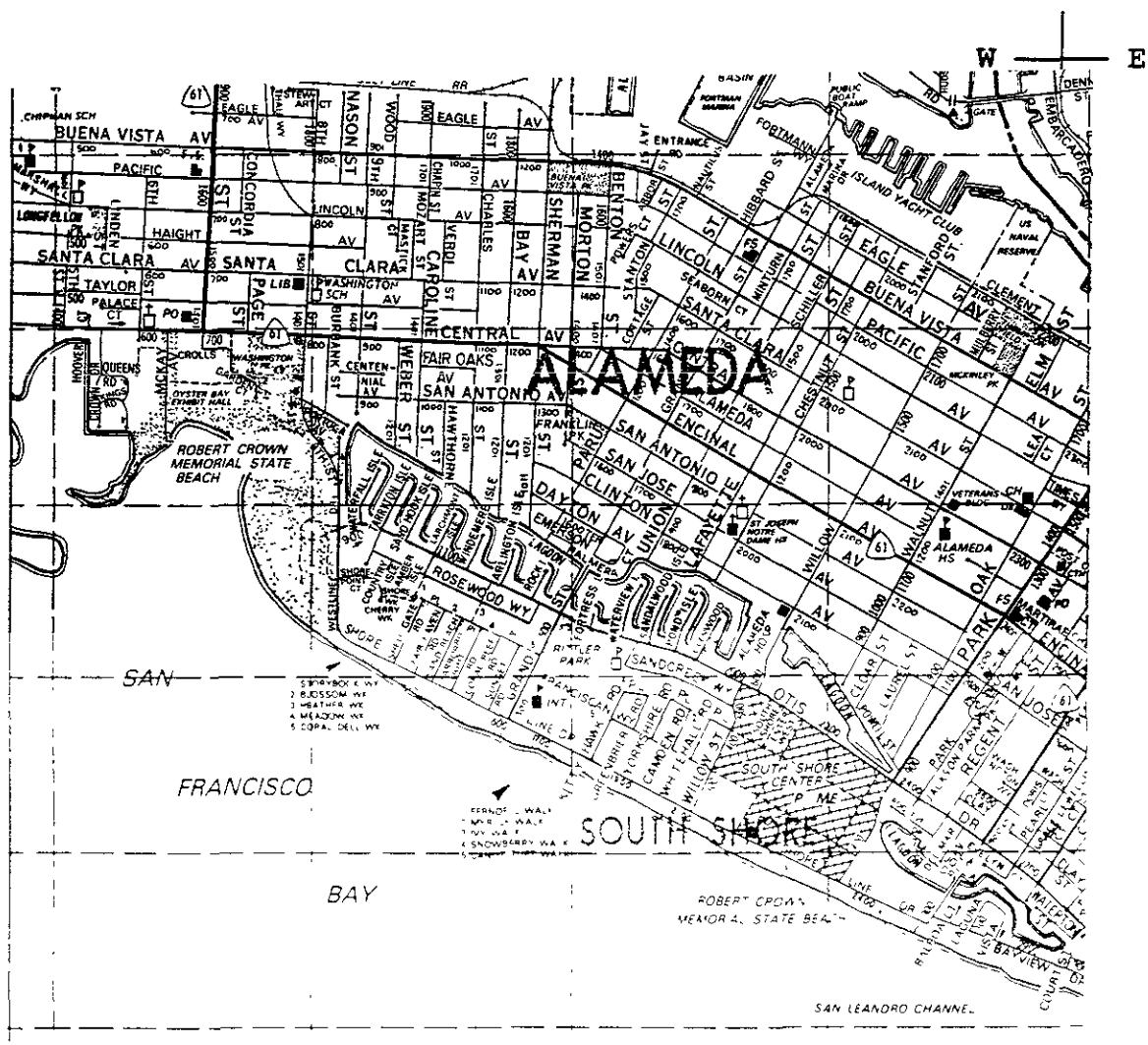
Ambulance 911

Alameda Hospital ..... (415) 523-4357

2070 Clinton Avenue
Alameda, California

Directions to Hospital: Go east on Lincoln Avenue to Willow Street, turn south (right). Go about 2 miles to Clinton Avenue. Alameda Hospital is on the right. Distance is approximately 4 miles.

Map:



Additional Contingency Telephone Numbers

Alameda Fire Department ..... (415) 748-4601

Poison Control Center ..... (800) 523-2222

RESNA, San Jose Branch ..... (408) 264-7723

RESNA, Administrative Office ..... (415) 291-9926

CHEMTREC ..... (800) 424-9300

Note: Only call CHEMTREC in an emergency. CHEMTREC stands for Chemical Transportation Emergency Center, a public service of the Chemical Manufacturer's Association. CHEMTREC can usually provide hazard information, warnings, and guidance when given the identification number or the name of the product and the nature of the problem. CHEMTREC can also contact the appropriate experts.

This Site Safety Plan has been reviewed by the following persons:

Project Manager:_____

Health and Safety Coordinator: _____

Amendments or modifications to this Plan may be written on a separate page and attached to this Plan. Any amendments or modifications must be reviewed and approved by the personnel named above.

Agreement and Acknowledgement Statement

Site Safety Plan Agreement

All RESNA project personnel and subcontractor personnel are required to sign the following agreement prior to conducting work at the site.

1. I have read and fully understand the Site Safety Plan and my individual responsibilities.

2. I agree to abide by the provisions of the Site Safety Plan.

Name	Signature
Company	Date
Name	Signature
Company	Date
Name	Signature
Company	Date
Name	Signature
Company	Date

ADDENDUMS

APPENDIX B

Site Safety Plan Amendment Sheet

Site Safety Plan Amendment Sheet

Project Name: _____

Project Number: _____

Location: _____

Changes in field activities or hazards:

Proposed Amendment:

Proposed by: _____ Date: _____

Approved by: _____ Date: _____

Declined by: _____ Date: _____

Amendment Number: _____

Amendment Effective Date: _____

APPENDIX C

Explanation of Hazard Evaluation Guidelines

Explanation of Hazard Evaluation Guidelines

Hazard: Airborne Contaminants

Guideline	Explanation
Threshold Limit Value Time-Weighted Average (TLV-TWA)	The time-weighted average concentration for a normal 8-hour work day and a 40-hour work week, to which nearly all workers may be repeatedly exposed without adverse effect.
Permissible Exposure Limit (PEL)	Time-weighted average concentration similar to (and in many cases derived from) TLV values.
Immediately Dangerous to Life or Health	"IDLH" or "Immediately dangerous to life or health" means any atmospheric condition that poses an immediate threat to life, or which is likely to result in acute or immediate severe health effects. This includes oxygen deficiency conditions.

Hazard: Explosion

Guideline	Explanation
Lower Explosive Limit (LEL)	The minimum concentration of vapor in air below which the propagation of a flame will not occur in the presence of an ignition source.
Upper Explosive Limit (UEL)	The maximum concentration of vapor in air above which propagation of a flame will not occur in the presence of an ignition source.

Hazard: Fire

Guideline	Explanation
Flash Point	The lowest temperature at which the vapor of a combustible liquid can be made to ignite momentarily in air.

APPENDIX D

Site Maps

APPENDIX E

Material Safety Data Sheets
(MSDS)

GASOLINE

MATERIAL SAFETY DATA SHEET

Prepared by Envirologic Data
Portland, ME (207) 773-3020
May 1985

EMERGENCY TELEPHONE NUMBER: Massachusetts Poison Information Center
Boston, MA 1-800-682-9211

SECTION I. IDENTIFICATION

Material Name: Gasoline
Synonyms: Petrol, motor spirits, benzin.
CAS No.: 8006-61-9
Molecular Formula: C_5H_{12} to C_9H_{20}

SECTION II. FIRST AID PROCEDURES AND EMERGENCY TREATMENT

In all cases of poisoning, follow standard procedures for poison management, first aid, and cardiopulmonary resuscitation. Whenever transporting a poisoned person to a hospital, bring the container, label, or other information concerning the product (without delaying transport) to assist medical personnel with diagnosis and treatment. Four different routes of exposure and their respective first aid/poison managements are outlined below:

Ingestion:

- Dilute the poison by offering and encouraging the person to drink one or two glassfuls of water or milk. Do not use carbonated fluids. Do not attempt to make the person vomit.
- Call the Massachusetts Poison Information Center (1-800-682-9211). If you cannot reach the Poison Information Center, call or take the person to the nearest hospital emergency department.
- Notify your supervisor or health and safety officer of this or any poison exposure.

Inhalation:

- Stop exposure by moving person from contaminated area to clean air area.
- Call the Massachusetts Poison Information Center (1-800-682-9211).
- Have someone call a rescue unit or medical professional.
- If necessary, transport person to an emergency medical facility promptly.

Skin:
- o Wash off skin immediately with a large amount of water; use soap if available.
- o Remove any contaminated clothing and rewash skin.
- o Call the Massachusetts Poison Information Center (1-800-682-9211).
- o Transport person to a medical facility as necessary.

Eyes:
- o Gently rinse eye immediately, using large amounts of water, for fifteen minutes, if possible, with eyelids held open.
- o If possible, have person remove contact lenses if worn; never permit the eyes to be rubbed.
- o Call the Massachusetts Poison Information Center (1-800-682-9211).
- o Transport person to an emergency medical facility promptly as necessary.

SECTION III. ACUTE TOXICITY

ELD Rating
(Oral Toxicity): 2
Toxic Effect Levels:
Inhalation man LC_{LO} 900 ppm (for 1 h)
Inhalation mammal LC_{LO} 30,000 ppm (for 5 min)
Signs and Symptoms
Ingestion: Burning of mouth, throat and stomach, inebriation, vomiting, dizziness, fever, drowsiness, confusion. Aspiration during vomiting may cause accumulation of fluid in the lungs, rapid breathing or death.
Inhalation: Burning of nose and throat, drowsiness, dizziness, nausea, numbness, headache, inebriation, central nervous system depression.
Skin: Itching, burning, irritation, blistering.
Eyes: Irritation.
Exposure Limits
OSHA Standard(s): None
NIOSH Recommended Limit(s): None
ACGIH Recommended Limit(s): 300 ppm, 8-h TLV-TWA
500 ppm, STEL

SECTION IV. LONG-TERM ORGANISM THREAT POTENTIAL

Carcinogenicity
IARC, NTP/NCI, CAG, RTECS: No indication of carcinogenic effects was found in standard references.
Mutagenicity
IARC, RTECS: No indication of mutagenic effects was found in standard references.
Teratogenicity
IARC, RTECS: No indication of teratogenic effects was found in standard references.

Reproductive Effects
IARC, RTECS: No indication of reproductive effects was found in standard references.

SECTION V. CHRONIC TOXICITY
Repeated or prolonged exposure may cause drying, dermatitis, and allergenic sensitivity.

SECTION VI. PHYSICAL DATA

Molecular weight: Not available
Boiling Point (at 760 mm Hg): 38-204°C (100-400°F)
Melting Point (at 760 mm Hg): Not available
Vapor Pressure (mm Hg) [at -12.5°C (9.32°F)]: 100
Vapor Density (Air=1): 3-4
Specific Gravity (water=1): 0.8
Percent Volatile by Volume: ~ 100
Evaporation Rate (butyl acetate =1): 1.1+
Solubility in Water: Insoluble
Solvent Solubility: Soluble in absolute alcohol, ether, chloroform, benzene.
Appearance and Odor: Clear volatile liquid with characteristic odor.

SECTION VII. FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used): -43 to -38°C (-45 to -36°F) (Closed cup)
Extinguisher Media: Dry chemical, carbon dioxide, foam.

Flammable Limits in Air, percent by vol.:	Lower	Upper
	1.4	7.6

Autoignition Temperature: 280-456°C (536-853°F)
NFPA Fire Hazard: 3
Special Fire Fighting Procedures: Firefighters should wear self-contained breathing apparatus with full facepiece operated in positive pressure mode and full protective clothing.
Unusual Fire and Explosion Hazards: HIGHLY FLAMMABLE. Fumes may travel great distances to source of ignition and flash back.

SECTION VIII. REACTIVITY DATA

Stability: Stable in closed containers at room temperature under normal storage conditions.
NFPA Reactivity: 0
Incompatibilities (Materials to Avoid): Strong oxidizing agents.
Hazardous Decomposition Products: When heated to decomposition may release toxic vapors and gases of hydrocarbons, carbon monoxide, and carbon dioxide.
Hazardous Polymerization: Does not occur.

SECTION IX. SPILL, LEAK OR DISPOSAL PROCEDURES

Actions To Take in Case of Spills or Leaks: Restrict from areas of spills or leaks persons not wearing protective equipment and clothing. Eliminate sources of ignition. Ventilate area. Inform supervisor or health and safety officer of any spill or leak. While protecting against eye and skin contact and inhalation of vapors, contain spill. Prevent leakage into confined spaces or sewer drains. Where feasible, absorb liquid with vermiculite, sand, or other non-combustible absorbent material. Collect in suitable container and cover.

Disposal Methods: Federal laws and regulations impose highly specific requirements for disposal of toxic and otherwise hazardous materials. Consult with your supervisor or health and safety officer regarding the proper, legal disposal procedures for this substance. Do not dispose of potentially toxic or otherwise hazardous substances without appropriate authorization. Prior to receiving institutional authorization, it may be necessary to store spilled materials. To do so safely, carefully label containers of materials, store in a cool, dry location, and maintain security of the storage area until official guidance is obtained.

SECTION X. SPECIAL PROTECTION INFORMATION

Respiratory Protection: Only NIOSH or MSHA approved equipment should be used.

>300 ppm: Organic vapor canister gas mask or supplied air or self-contained respirator with full facepiece.

Ventilation: Provide adequate explosion-proof general ventilation and local exhaust ventilation to meet TLV recommendations.

Protective Clothing or Equipment:

- To prevent repeated or prolonged skin contact with liquid chemicals, use impervious clothing, gloves, face shields (eight-inch minimum), splash-proof safety goggles, and other appropriate protective clothing.
- Place clothing contaminated with liquids in closed containers for storage until clothing can be discarded or decontaminated. If the clothing is to be laundered or otherwise cleaned to remove the chemical, the person(s) performing the operation should be informed of the chemical's hazardous properties and of ways to minimize exposure.
- A safety shower should be provided within the immediate work area for emergency use where liquids may contact the employee's body.
- An eyewash fountain should be provided within the immediate work area for emergency use where liquids may contact the employee's eyes.

SECTION XI. SPECIAL PROCEDURES AND PRECAUTIONS

Procedures and Precautions to be Taken in Handling and Storing: Store in closed containers in cool, dry, well-ventilated area away from heat,

sources of ignition, and oxidizing agents. Do not smoke in areas of handling and storage. Electrically bond and ground containers for transfers to prevent sparks.
Other Precautions: Wash hands before eating, smoking or using toilet facilities. Contact lenses should not be worn when working with this chemical.

MATERIAL SAFETY DATA SHEET

GENIUM PUBLISHING CORPORATION
1145 CATALYN STREET
SCHENECTADY, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP.

NO. 470

DIESEL FUEL OIL NO. 2-D

Date October 1981

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: DIESEL FUEL OIL NO. 2-D
DESCRIPTION: Mixture of petroleum hydrocarbons: a distillate oil of low sulfur content
OTHER DESIGNATIONS: ASTM D975, CAS # 068 476 346
MANUFACTURER: Available from many suppliers

SECTION II. INGREDIENTS AND HAZARDS	%	HAZARD DATA
Diesel Fuel Oil No. 2-D	>95	8-hr TWA 5mg/m^3* (mineral oil mist)
Complex mixture of paraffinic, olefinic, napathenic and aromatic hydrocarbons**	<0.5	
Sulfur content	<100 ppm	
Benzene***		

*Current OSHA standard and ACGIH (1981) TLV
**Diesel fuels tend to be low in aromatics and high in paraffinics. A min. Cetane No. of 40 is required (ASTM D613).
***A low benzene level reduces carcinogenic risk. Fuel oils can be exempted under the benzene standard (29 CFR 1910.1028)

SECTION III. PHYSICAL DATA

Boiling point range, deg F, ------- Ca 340-675
Solubility in water ---------- negligible
Viscosity at 40 C, cSt ---------- 1.9-4.1
Specific gravity (H_2O=1) ---- <0.86
Cloud point (wax), deg C --- Ca 0

Appearance and Odor: Clear, bright liquid with a mild petroleum odor.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air % by volume	LOWER	UPPER
125F min (PM)	>500F		0.6	7.5

Extinguishing Media: Dry chemical, carbon dioxide, foam, water spray. Use a water spray to cool fire exposed containers. Use a smothering technique for extinguishing fire of this combustible liquid. Do not use a forced water stream directly on oil fire as this will only scatter the fire. Material is a OSHA Class II combustible liquid. Firefighters should wear self-contained breathing apparatus and full protective clothing.

SECTION V. REACTIVITY DATA

This is a stable material in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization. Incompatible with strong oxidizing agents; heating greatly increases fire hazard. Thermal -oxidative degradation may yield various hydrocarbons and hydrocarbon derivatives (partial oxidation products), CO_2 and CO and SO_2.

SECTION VI. HEALTH HAZARD INFORMATION | TLV 5 mg/m³ oil (mist) (See Sect II)

Inhalation of excessive concentrations of vapor or mist can be irritating to the respiratory passages and can cause the following symptoms: headache, dizziness, nausea, vomiting, and loss of coordination. Prolonged or repeated skin contact may cause irritation of the hair follicles and block the sebaceous glands. This produces a rash of acne pimples and spots, usually on the arms and legs. (Good personal hygiene will prevent this).
Chemical pneumonitis may result when ingestion occurs and oil is aspirated in the lungs.

FIRST AID:

Eye Contact: Flush thoroughly with running water for 15 min. including under eyelids.
Skin Contact: Remove contaminated clothing. Wipe excess oil off with a dry cloth. Wash affected area well with soap and water.
Inhalation: Remove to fresh air. Restore and/or support breathing as required.
Ingestion: Do not induce vomiting.
Seek medical assistance for further treatment, observation and support.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel of leaks or spills. Remove sources of heat or ignition.
Provide adequate ventilation. Clean-up personnel to use protection against liquid contact and vapor or mist inhalation. Contain spill by diking. Small spills can be contained by using absorbants, such as rags, straw, polyurethane foam, activated carbon, and sand. Clean up spills promptly to reduce fire or vapor hazards.
DISPOSAL: May be disposed of by a licensed waste disposal company, or by controlled incineration or burial in an approved landfill.
Follow Federal, State and Local regulations. Report large oil spills.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide adequate ventilation where operating conditions (heating or spraying) may create excessive vapors or mists. Use explosion-proof equipment. Provide approved respiratory apparatus for nonroutine or emergency use. Use an approved filter & vapor respirator when vapor/mist concentrations are high. Wear protective rubber gloves and chemical safety glasses where contact with liquid or high mist conc. may occur. Additional suitable protective clothing may be required depending on working conditions. An eye-wash fountain and washing facilities to be readily available near handling and use areas.
Launder soiled or contaminated clothing before reuse (at least weekly laundering of work clothes is recommended).

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store in closed containers in a cool, dry, well-ventilated area away from sources of open flame, heat, strong oxidizing agents, and ignition. Protect containers from physical damage. Use non sparking tools and explosion-proof electrical equipment. Prevent static electric sparks.
Avoid prolonged skin contact and breathing of vapors or mists.
No smoking in areas of use. Follow good hygienic practice in the use of this material.
Do not wear oil contaminated clothing. Do not put oily rags into pockets. Wash exposed skin areas several times a day with soap and warm water when working with this material.

DOT Classification: COMBUSTIBLE [illegible]

DATA SOURCE(S) CODE: 1,6,7,12

APPROVALS: MIS CRD

Industrial Hygiene and Safety 10-12-81

MEDICAL REVIEW: 21 October 1981

DIESEL FUELS

SUPPLIER: MOBIL OIL CORP.
HEALTH EMERGENCY TELEPHONE: (212)883-4411
TRANSPORT EMERGENCY TELEPHONE: (800)424-9300(CHEMTREC)

CHEMICAL NAMES AND SYNONYMS:
HYDROCARBONS AND ADDITIVES

USE OR DESCRIPTION: FUEL OIL

TYPICAL CHEMICAL AND PHYSICAL PROPERTIES

(FOR ADDITIONAL INFORMATION PLEASE CONTACT YOUR LOCAL MARKETING OFFICE.)

APPEARANCE: CLEAR LIQUID

ODOR: HYDROCARBON

RELATIVE DENSITY: 15/4C
0.82-0.87

VISCOSITY: AT 100 F, SUS — AT 40 C, CST
31.0-40.0 — 1.3-4.1

BOILING RANGE: NO. 1 300-550F
NO. 2 350-700F

SOLUBILITY IN WATER: NEGLIGIBLE

FLASH POINT:F (C) (ASTH D-93)
NO. 1: 100(40) NO. 2: 125(52)

VAPOR PRESSURE:MM HG 20C
1.0

INGREDIENTS

HAZARDOUS INGREDIENTS	WT PCT (APPROX)	EXPOSURE LIMIT (TWA): MG/M3	PPM	EXPOSURE LIMIT SOURCE
PETROLEUM DISTILLATES	100	575	100	MOBIL RECOMMENDED

NOTE: EXPOSURE LIMITS SHOWN ARE FOR GUIDANCE ONLY. FOLLOW APPLICABLE REGULATIONS.

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: F(C) (ASTM D-93)
NO.1: 100(40) NO 2: 125(-52)

FLAMMABLE LIMITS:
LEL: NE UEL: NE

NFPA CODES:
HEALTH 0
FLAMMABILITY 2
REACTIVITY 0

EXTINGUISHING MEDIA:
CO2, FOAM, DRY CHEMICAL OR WATER FOG.

SPECIAL FIRE FIGHTING PROCEDURES:
FIREFIGHTERS MUST USE SELF-CONTAINED BREATHING APPARATUS.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
MATERIAL IS COMBUSTIBLE.

HEALTH HAZARD SUMMARY

THRESHOLD LIMIT VALUE (IF ESTABLISHED): NO TLV ESTABLISHED. MOBIL RECOMMENDS A TWA EXPOSURE LIMIT OF 100 PPM.

EFFECTS OF OVEREXPOSURE: SLIGHT SKIN IRRITATION. RESPIRATORY IRRITATION, DIZZINESS, NAUSEA, LOSS OF CONSCIOUSNESS. THIS PRODUCT MAY CONTAIN TRACE QUANTITIES OF POLYCYCLIC AROMATIC HYDROCARBONS (PCAH). UNDER CONDITIONS OF POOR PERSONAL HYGIENE AND PROLONGED, REPEATED CONTACT, SOME PCAH HAVE BEEN SUSPECTED AS A CAUSE OF SKIN CANCER IN HUMANS.

EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: FLUSH WITH WATER.

SKIN CONTACT: WASH CONTACT AREAS WITH SOAP AND WATER.

INHALATION: REMOVE FROM FURTHER EXPOSURE. IF UNCONSCIOUSNESS OCCURS, SEEK IMMEDIATE MEDICAL ASSISTANCE AND CALL A PHYSICIAN. IF BREATHING HAS STOPPED, USE MOUTH TO MOUTH RESUSCITATION.

INGESTION: DO NOT INDUCE VOMITING. ADMINISTER VEGETABLE OIL. GET MEDICAL ASSISTANCE. (NOTE TO PHYSICIAN: MATERIAL IF ASPIRATED INTO THE LUNGS MAY CAUSE CHEMICAL PNEUMONITIS. TREAT APPROPRIATELY)

REACTIVITY DATA

STABILITY: STABLE CONDITIONS TO AVOID: HEAT, SPARKS, FLAME AND BUILD UP OF STATIC ELECTRICITY.

INCOMPATIBILITY (MATERIALS TO AVOID): STRONG OXIDIZERS

HAZARDOUS DECOMPOSITION PRODUCTS: CARBON MONOXIDE (CO) FROM INCOMPLETE COMBUSTION.

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR CONDITIONS TO AVOID: NA

SPILL OR LEAK PROCEDURES

ENVIRONMENTAL IMPACT:

REPORT SPILLS AS REQUIRED TO APPROPRIATE AUTHORITIES. IN CASE OF ACCIDENT OR ROAD SPILL NOTIFY CHEMTREC (800) 424-9300. U.S. COAST GUARD REGULATIONS REQUIRE IMMEDIATE REPORTING OF SPILLS THAT COULD REACH ANY WATERWAY INCLUDING INTERMITTENT DRY CREEKS. COAST GUARD TOLL FREE NUMBER 800-424-8802.

PROCEDURES IF MATERIAL IS RELEASED OR SPILLED:

ADSORB ON FIRE RETARDANT TREATED SAWDUST, DIATOMACEOUS EARTH, ETC. SHOVEL UP AND DISPOSE OF AT AN APPROPRIATE WASTE DISPOSAL FACILITY IN ACCORDANCE WITH CURRENT APPLICABLE LAWS AND REGULATIONS, AND PRODUCT CHARACTERISTICS AT TIME OF DISPOSAL.

WASTE MANAGEMENT:

DISPOSE OF WASTE BY SUPERVISED INCINERATION IN COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.

SPECIAL PROTECTION INFORMATION

EYE PROTECTION: NO SPECIAL EQUIPMENT REQUIRED.

SKIN PROTECTION: IF PROLONGED OR REPEATED SKIN CONTACT IS LIKELY, OIL IMPERVIOUS GLOVES SHOULD BE WORN. GOOD PERSONAL HYGIENE PRACTICES SHOULD ALWAYS BE FOLLOWED.

RESPIRATORY PROTECTION: NO SPECIAL REQUIREMENTS UNDER ORDINARY CONDITIONS OF USE AND WITH ADEQUATE VENTILATION.

VENTILATION: VENTILATION DESIRABLE AND EQUIPMENT SHOULD BE EXPLOSION PROOF. USE IN WELL VENTILATED AREA.

OTHER: NA

SPECIAL PRECAUTIONS

STORED MATERIAL MUST BE LABELED AS: COMBUSTIBLE.

STORAGE: STORE IN A COOL AREA.

TOXICOLOGICAL DATA

ACUTE

ORAL TOXICITY: (RATS)

SLIGHTLY TOXIC (ESTIMATED) -- BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.

DERMAL TOXICITY: (RABBITS)

NONTOXIC (ESTIMATED) -- BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.

INHALATION TOXICITY: (RATS)

SLIGHTLY TOXIC (ESTIMATED) -- BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.

EYE IRRITATION: (RABBITS)

EXPECTED TO BE NON-IRRITATING -- BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.

SKIN IRRITATION: (RABBITS)

MAY CAUSE SLIGHT IRRITATION ON PROLONGED OR REPEATED CONTACT.

-- BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.

SUBACUTE AND MUTAGENICITY (SUMMARY)

NO INFORMATION AVAILABLE

CHRONIC OR SPECIALIZED (SUMMARY)

THIS PRODUCT MAY CONTAIN TRACE QUANTITIES OF POLYCYCLIC AROMATIC HYDROCARBONS, SOME OF WHICH HAVE BEEN SHOWN TO CAUSE SKIN CANCER IN LABORATORY ANIMALS AFTER PROLONGED, REPEATED SKIN CONTACT.

OTHER DATA

NA

ENVIRONMENTAL AFFAIRS AND TOXICOLOGY DEPT.
MANAGER OF PRODUCT SAFETY INFORMATION, PHONE: 609-737-5596

REVISED:
9/1/84

BENZENE

MATERIAL SAFETY DATA SHEET

Prepared by Envirologic Data
Portland, ME (207) 773-3020
September 1984

EMERGENCY TELEPHONE NUMBER: Massachusetts Poison Information Center
Boston, MA 1-800-682-9211

SECTION I. IDENTIFICATION

Material Name: Benzene
Synonyms: Benzol; phenyl hydride; cyclohexatriene
CAS No.: 71-43-2
Molecular Formula: C_6H_6

SECTION II. FIRST AID PROCEDURES AND EMERGENCY TREATMENT

In all cases of poisoning, follow standard procedures for poison management, first aid, and cardiopulmonary resuscitation. Whenever transporting a poisoned person to a hospital, bring the container, label, or other information concerning the product (without delaying transport) to assist medical personnel with diagnosis and treatment. Four different routes of exposure and their respective first aid/poison managements are outlined below:

Ingestion:

- Dilute the poison by offering and encouraging the person to drink one or two glassfuls of water or milk. Do not use carbonated fluids. Do not attempt to make the person vomit.
- Call the Massachusetts Poison Information Center (1-800-682-9211). If you cannot reach the Poison Information Center, call or take the person to the nearest hospital emergency department.
- Notify your supervisor or health and safety officer of this or any poison exposure.

Inhalation:
- o Stop exposure by moving person from contaminated area to clean air area.
- o Call the Massachusetts Poison Information Center (1-800-682-9211).
- o Have someone call a rescue unit or medical professional.
- o If necessary, transport person to an emergency medical facility promptly.

Skin:
- o If material is a powder, brush away using a cloth.
- o Wash off skin immediately with a large amount of water; use soap if available.
- o Remove any contaminated clothing and rewash skin.
- o Call the Massachusetts Poison Information Center (1-800-682-9211).
- o Transport person to a medical facility as necessary.

Eyes:
- o Gently rinse eye immediately, using large amounts of water, for fifteen minutes, if possible, with eyelids held open.
- o If possible, have person remove contact lenses if worn; never permit the eyes to be rubbed.
- o Call the Massachusetts Poison Information Center (1-800-682-9211).
- o Transport person to an emergency medical facility promptly as necessary.

SECTION III. ACUTE TOXICITY

ELD Rating (Oral Toxicity): 2

Oral human TD_{LO}	130 mg/kg
Inhalation human LC_{LO}	20,000 ppm for 5 min
Inhalation human TC_{LO}	100 ppm
Unknown* man LD_{LO}	194 mg/kg
Oral rat LD_{50}	4,894 mg/kg
Oral mouse LD_{50}	4,700 mg/kg

*Exposure route not reported

Signs and Symptoms

Ingestion: Irritation of mouth, throat, and stomach. See inhalation for other symptoms.

Inhalation: Lethargy, headaches, decreased cell counts, bronchitis, pneumonia, and collapse.

Skin: Irritation

Eyes: Irritation

Exposure Limits

OSHA Standard(s): 10 ppm, 8-h TWA
25 ppm, Ceiling
50 ppm, Peak 10 min in any 8 h

NIOSH Recommended Limit(s): 10 ppm, Ceiling in 1 h

ACGIH Recommended Limit(s): 10 ppm, 8-h TLV-TWA
15 ppm, STEL

SECTION IV. LONG-TERM ORGANISM THREAT POTENTIAL

Carcinogenicity
IARC: Limited evidence of carcinogenic effects in animals. Sufficient evidence of carcinogenic effects in humans.
NTP/NCI: NTP/NCI has reported carcinogenic effects.
CAG: CAG has reported carcinogenic effects.
RTECS: Carcinogenic by RTECs criteria based on cases of leukemia in humans and rats. Carcinogenic by RTECs criteria in mice.

Mutagenicity
IARC: Not mutagenic in bacteria, yeast, insects, or mouse lymphoma cells. Chromosomal anomalies in humans, rats, and mice were observed.
RTECS: Positive mutagenic responses in bacteria, mice, rats, and rabbits were observed. DNA damage and chromosomal breaks in humans were observed.

Teratogenicity
IARC: Tail abnormalities, cleft palate, and absence of the lower jaw were defects observed in mice. Brain and skeletal defects in rats were observed. Other studies did not show teratogenic effects.
RTECS: Abnormalities of the musculoskeletal system and other effects on the newborn were observed in rats and mice.

Reproductive Effects
IARC: Alteration of estrus cycles in rats was observed. Increased testicular weight and degeneration of the seminiferous tubules in rats, guinea pigs, and rabbits were observed. Fetotoxicity in rats and mice were observed.
RTECS: Fetotoxicity, post-implantation mortality, and extra embryonic structures in rats and mice were observed. Pre-implantation mortality, fetal death, and other fetal effects in mice were observed.

SECTION V. CHRONIC TOXICITY

Appetite loss, weight loss, fatigue, muscle weakness, headaches, dizziness, nervousness, irritability, anemia, irreversible blood changes, and damage to the heart and liver.

SECTION VI. PHYSICAL DATA

Molecular weight: 78.12
Boiling Point (at 760 mm Hg): 80°C (176°F)
Melting Point (at 760 mm Hg): 5.5°C (42°F)
Vapor Pressure (mm Hg) [at 20°C (68°F)]: 74.6
Vapor Density (Air=1): 2.77
Specific Gravity (water=1): 0.879
Percent Volatile By Volume: 100
Evaporation Rate (butyl acetate =1): 1
Solubility in water: Soluble
Solvent Solubility: Miscible with alcohol, chloroform, ether, carbon disulfide, carbon tetrachloride, glacial acetic acid, acetone, oils.
Appearance and Odor: Clear, colorless, flammable liquid with a odor threshold of 5 ppm.

SECTION VII. FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used): -11°C (12°F) (closed cup)
Extinguisher Media: Water fog, carbon dioxide, dry chemical, foam

	Lower	Upper
Flammable Limits in Air, percent by vol.:	1.3	7.1

Autoignition Temperature: 80°C (176°F)
NFPA Fire Hazard: 3
Special Fire Fighting Procedures: Use blanketing technique to smother fire. Water stream will scatter fire. Water spray may be used to cool fire-exposed containers. Firefighters should wear self-contained breathing apparatus and protective clothing.
Unusual Fire and Explosion Hazards: Explosive and flammable mixtures with air may be formed at room temperature. In a fire situation it is a severe explosion hazard. Vapors may flow a distance along surfaces to ignition sources and flash back.

SECTION VIII. REACTIVITY DATA

Stability: Stable under normal conditions of handling and storage.
NFPA Reactivity: 0
Incompatibilities (Materials to Avoid): Strong oxidizers such as ozone, permanganate, sulfuric or nitric acids, potassium peroxide, and sodium peroxide.
Hazardous Decomposition Products: Oxides of carbon and nitrogen
Hazardous Polymerization: Does not occur

SECTION IX. SPILL, LEAK OR DISPOSAL PROCEDURES

Actions To Take in Case of Spills or Leaks: Restrict from areas of spills or leaks persons not wearing protective equipment and clothing. Eliminate sources of ignition. Ventilate area. Inform supervisor or health and safety officer of any spill or leak. While protecting against eye and skin contact and inhalation of vapors, take the following steps:

- Solid: Shovel or sweep solid into suitable container, and cover.
- Liquid: Contain spill. Prevent leakage into confined spaces or sewer drains. Where feasible, absorb liquid with paper towels, vermiculite, sand, or other non-combustible absorbent material. Collect in suitable container and cover.
- Gas: Ventilate area to keep gas concentration below flammability limit. Stop the gas flow. If leak cannot be stopped, move container to safe place in open air and allow to empty.

Disposal Methods: Federal laws and regulations impose highly specific requirements for disposal of toxic and otherwise hazardous materials. Consult with your supervisor or health and safety officer regarding the proper, legal disposal procedures for this substance. Do not dispose of potentially toxic or otherwise hazardous substances without appropriate

authorization. Prior to receiving institutional authorization, it may be necessary to store spilled materials. To do so safely, carefully label containers of materials, store in a cool, dry location, and maintain security of the storage area until official guidance is obtained.

SECTION X. SPECIAL PROTECTION INFORMATION

Respiratory Protection: Only NIOSH or MSHA approved equipment should be used. Minimum respiratory equipment required for vapor:

≤50 ppm: For short periods, canister or cartridge type respirators with full facepiece.

For emergencies or when concentration is unknown, self-contained breathing apparatus should be used.

Ventilation: Provide general and local exhaust ventilation to comply with TLV requirements.

Protective Clothing or Equipment:

- To prevent repeated or prolonged skin contact with liquid and solid chemicals, use impervious clothing, gloves, face shields (eight-inch minimum), splash-proof safety goggles, and other appropriate protective clothing.
- Place clothing contaminated with liquids or solids in closed containers for storage until clothing can be discarded or decontaminated. If the clothing is to be laundered or otherwise cleaned to remove the chemical, the person(s) performing the operation should be informed of the chemical's hazardous properties and of ways to minimize exposure.
- A safety shower should be provided within the immediate work area for emergency use where liquids may contact the employee's body.
- An eyewash fountain should be provided within the immediate work area for emergency use where liquids or solids may contact the employee's eyes.

SECTION XI. SPECIAL PROCEDURES AND PRECAUTIONS

Procedures and Precautions to be Taken in Handling and Storing: Store in well-ventilated area away from oxidizing agents and sources of heat and ignition.

Other Precautions: Use extreme caution when handling this chemical. It has been shown to cause cancer in humans. Do not smoke in areas of use.

MATERIAL SAFETY DATA SHEET

GENIUM PUBLISHING CORP.
1115 CATALINE STREET
SCHENECTADY, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP

ETHYL BENZENE

Date August 1978

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: ETHYL BENZENE
OTHER DESIGNATIONS: Phenylethane, Ethylbenzol, $C_2H_5C_6H_5$, CAS# 000 100 41-
MANUFACTURER: Available from several suppliers.

SECTION II. INGREDIENTS AND HAZARDS	%	HAZARD DATA
Ethyl Benzene	ca 100	8-hr TWA 100 ppm*
*Current OSHA permissable exposure level. A Standard was proposed by OSHA in October 1973 which includes an action level of 50 ppm, and detailed requirements of monitoring, medical surveillance, employee training, etc., when exposure exceeds 50 ppm. It has not yet issued as a legal requirement		Human, inhalation TCLo 100 ppm for 8 hr (irritation) Rat, Oral LD_{50} 3500 mg/kg

SECTION III. PHYSICAL DATA

Boiling point at 1 atm, deg C	136	Specific gravity 20/4C	0.867
Vapor pressure at 25.9 C, mm Hg	10	Volatiles, %	ca 100
Vapor density (Air=1)	3.66	Evaporation rate (BuAc=1)	<1
Water solubility at 20 C Wt. %	0.015	Melting point, deg C	-95
		Molecular weight	106.16

Appearance & Odor: Clear, colorless liquid with an aromatic hydrocarbon odor.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air Volume %	LOWER	UPPER
59 F (15 C) (closed cup)	810 F (432 C)		1.0	6.7

Extinguishing media: Carbon dioxide, dry chemical or "alcohol" foam. A water spray may be ineffective to put out fire, but may be used to cool fire-exposed containers. A stream of water can spread fire of burning liquid.

This is a flammable liquid (OSHA Class IB) which can readily form explosive mixtures with air, especially when heated. Heavier-than-air vapors can flow along surfaces to reach distant ignition sources, and then flash back. Firefighters should use self-contained breathing equipment and eye protection to fight fires in enclosed places.

SECTION V. REACTIVITY DATA

This material is stable in storage in closed containers at room temperature. It does not polymerize.

This flammable material should be kept separated from oxidizing agents, strong acids and bases and ammonia. Thermal-oxidative decomposition can produce toxic products, including carbon monoxide.

SECTION VI. HEALTH HAZARD INFORMATION

TLV 100 ppm

Excessive exposure to vapors will irritate the eyes and mucous membranes of the upper respiratory tract. Sustained high levels can produce headache, depression of the central nervous system, narcosis and coma.

Liquid contact is irritating to the eyes and irritation and defatting to the skin, leading to dermatitis on prolonged or repeated exposures. Ingestion may lead to aspiration of liquid into the lungs small amounts of aspirated ethyl benzene cause extensive edema and hemorrhage of lung tissue. FIRST AID:

Eye contact: Wash eyes well with plenty of running water. Get medical help if irritation persists.

Skin contact: Wash exposed areas of skin. Promptly remove contaminated clothing.

Inhalation: Remove victim to fresh air. Restore breathing if necessary. Get medical help for serious exposure.

Ingestion: Get prompt medical help! (The danger of aspirating ethyl benzene into the lungs indicates medical direction before inducing vomiting.)

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Personnel involved in leak or spill control and clean-up must use protective equipment to avoid inhalation of vapors and contact with liquid. Eliminate ignition sources. Provide maximum explosion-proof ventilation.

Pick-up spilled material for recovery or disposal. Absorb with sand, etc. for disposal in a sanitary landfill or with paper towels or cloths for burning. Water can be used to flush liquid away from sensitive areas to special catch basins or ground, but not to sewer or surface water.

DISPOSAL: Scrap material can be burned in approved incinerators in accordance with Federal, State and local regulations.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide explosion-proof general and local exhaust ventilation to meet TLV requirements. Approved respirators must be available for non-routine or emergency use. A full face respirator with organic vapor cartridge can be used up to 1000 ppm; a gas mask with organic vapor canister can be used up to 5000 ppm; a self-contained respirator is needed for high and unknown concentrations of vapor.

Use impervious gloves and clothing and a face shield to prevent repeated or prolonged contact with the liquid. Where splashing is possible chemical goggles should be used. Clothing contaminated with ethyl benzene should be promptly removed and not reused until free of the contaminant.

Exposures above the action level, liquid contact, or working where fire and explosion hazards exist may require instituting employee training, medical surveillance, vapor concentration monitoring, record keeping, etc. when the proposed standard issues.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store this material in tightly closed containers in cool, well-ventilated areas, away from oxidizing agents, heat and sources of ignition. Use non-sparking tools around this material. Containers must be electrically bonded and grounded for transfers of liquid. Use safety cans for small amounts. No Smoking! where this material is stored or used.

Screen workers for history of kidney, liver, skin and lung problems which could give increased sensitivity and risk in ethyl benzene exposure.

Avoid breathing of vapors and contact with liquid. Do not ingest. Chronic properties are not fully known. Use with care.

DATA SOURCE(S) ... [illegible]

APPROVALS: MIS CRD

[illegible]

TOLUENE

MATERIAL SAFETY DATA SHEET

Prepared by Envirologic Data
Portland, ME (207) 773-3020
Revised September 1986

EMERGENCY TELEPHONE NUMBER: Pittsburgh Poison Information Center
Children's Hospital of Pittsburgh
Pittsburgh, PA (1-412--681-6669)

SECTION I. IDENTIFICATION

Material Name: Toluene
CAS No.: 108-88-3
Synonyms: Toluol; methylbenzene; methacide; phenylmethane; methylbenzol
Molecular Formula: $C_6H_5CH_3$

SECTION II. FIRST AID PROCEDURES AND EMERGENCY TREATMENT

In all cases of poisoning, follow standard procedures for poisoning, first aid, and cardiopulmonary resuscitation. Whenever transporting a poisoned person to a hospital, bring the container, label, or other information concerning the product (without delaying transport) to assist medical personnel with diagnosis and treatment. Four different routes of exposure and their respective first aid/poison managements are outlined below:

Ingestion:

- Dilute the poison by offering and encouraging the person to drink one or two glassfuls of water or milk. Do not use carbonated fluids. Do not attempt to make the person vomit.
- Call the Pittsburgh Poison Information Center (1-412-681-6669). If you cannot reach the Poison Information Center, call or take the person to the nearest hospital emergency department.
- Notify your supervisor or health and safety officer of this or any poison exposure.

Inhalation:

- Stop exposure by moving person from contaminated area to clean air area.

- o Call the Pittsburgh Poison Information Center (1-412-681-6669).
- o Have someone call a rescue unit or medical professional.
- o If necessary, transport person to an emergency medical facility promptly.

Skin:

- o Wash off skin immediately with a large amount of water; use soap if available.
- o Remove any contaminated clothing and rewash skin.
- o Call the Pittsburgh Poison Information Center (1-412-681-6669).
- o Transport person to a medical facility as necessary.

Eyes:

- o Gently rinse eye immediately, using large amounts of water, for fifteen minutes, if possible, with eyelids held open.
- o If possible, have person remove contact lenses if worn; never permit the eyes to be rubbed.
- o Call the Pittsburgh Poison Information Center (1-412-681-6669).
- o Transport person to an emergency medical facility promptly as necessary.

SECTION III. ACUTE TOXICITY

Exposure Routes: Primary routes of exposure are via inhalation of vapors and contact with liquid in skin and eyes.

Toxic Effect Levels:

Inhalation human TC_{LO}	200 ppm
Inhalation human TC_{LO}	100 ppm
Oral rat LD_{50}	5,000 mg/kg
Inhalation rat LC_{LO}	4,000 ppm (for 4 h)
Inhalation mouse LC_{50}	5,320 ppm (for 8 h)

Signs and Symptoms:

Ingestion: Irritation of the digestive tract; central nervous system depression, headache, dizziness, fatigue, muscular weakness, incoordination, collapse and coma.

Inhalation: Headache and slight drowsiness at 100 ppm, fatigue, nausea and itching skin at 100-200 ppm, anesthetic effects and respiratory tract and eye irritation above 200 ppm.

Skin: Irritation.

Eyes: Irritation, reversible corneal burns.

Exposure Limits:

OSHA standard(s):	200 ppm, 8-h TWA
	300 ppm, Ceiling
	500 ppm, Peak for 10 min
NIOSH recommended limit(s):	100 ppm, TWA
	200 ppm, Ceiling for 10 min
ACGIH recommended limit(s):	100 ppm, 8-h TLV-TWA
	150 ppm, STEL

SECTION IV. LONG-TERM ORGANISM THREAT POTENTIAL

Carcinogenicity

IARC, NTP, OAG, RTECS. No indication of carcinogenicity was found in standard references.

Mutagenicity
IARC: IARC Monographs have not reported mutagenic effects.
RTECS: Positive mutagenic reponses were observed in bacteria and in rat cells

Teratogenicity
IARC: IARC Monographs have not reported teratogenic effects.
RTECS: Developmental abnormalities in the musculoskeletal system of rats and in the craniofacial region of mice have been observed.

Reproductive Effects
IARC: IARC Monographs have not reported reproductive effects.
RTECS: Fetotoxicity was observed in rats and mice, and fetal death was observed in mice.

SECTION V. CHRONIC TOXICITY

Possible dermatitis, drying, and cracking of the skin may result from repeated or prolonged skin contact. Liver and kidney injury may occur after prolonged exposure.

SECTION VI. PHYSICAL DATA

Molecular weight: 92.1
Boiling Point (at 760 mm Hg): 110.6°C (231°F)
Melting Point (at 760 mm Hg): -95°C (-139°F)
Vapor Pressure (mm Hg) [at 20°C (68°F)]: 22
Vapor Density (Air=1): 3.14
Specific Gravity (water=1): 0.866
Percent Volatile By Volume: 100
Evaporation Rate (butyl acetate =1): 2.24
Solubility in Water: 0.05 g/100g of water, at 20°C (68°F)
Solvent Solubility: Soluble in acetone, miscible in absolute alcohol, ether, and chloroform.
Appearance and Odor: Water white liquid with a characteristic aromatic odor, whose recognition threshold (unfatigued) is 2-5 ppm (100 percent of test panel). Odor detection is unsatisfactory for safety because of fatigue.

SECTION VII. FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used): 4°C (40°F) (closed cup)
Extinguisher Media: CO_2, dry chemical, foam, water fog.

	Lower	Upper
Flammable Limits in Air, percent by vol.:	1.27	7.1

Autoignition Temperature: 480°C (896°F)
NFPA Fire Hazard: 3
Special Fire Fighting Procedures: Self-contained breathing apparatus and eye protection should be worn.
Unusual Fire and Explosion Hazards: At room temperature toluene emits vapors that can form flammable mixtures with air. When exposed to heat and flame it is a dangerous fire hazard and a moderate explosion

hazard. Vapors can flow along surfaces to distant ignition sources, then flash back.

SECTION VIII. REACTIVITY DATA

Stability: Stable under normal storage conditions and handling.
NFPA Reactivity: 0
Incompatibility (Materials to Avoid): Strong oxidizing agents, sparks or open flames. Nitric acid and toluene, especially when combined with sulfuric acid, will produce nitrated compounds which are dangerously explosive.
Hazardous Decomposition Products: Oxides of carbon and nitrogen.
Hazardous Polymerization: Does not occur.

SECTION IX. SPILL, LEAK OR DISPOSAL PROCEDURES

Actions To Take in Case of Spills or Leaks:
Restrict from areas of spills or leaks persons not wearing protective equipment and clothing. Eliminate sources of ignition. Ventilate area. Inform supervisor or health and safety officer of any spill or leak. While protecting against eye and skinn contact and inhalation of vapors, take the following steps:

- o Liquid: Contain spill. Prevent leakage into confined spaces or sewer drains. Where feasible, absorb liquid with vermiculite, sand, or other non-combustible absorbent material. Contaminated absorbent material should be stored away from sources of heat and ignition.
- o Vapor: Ventilate area to keep vapor concentration below lower flammability limit.

Disposal Methods:

- o Small quantities: dispose of absorbed material, i.e. vermiculite, dry sand, earth or a similar material in a secured sanitary landfill or atomize in a suitable combustion chamber.
- o Large quantities: dispose via a licensed waste disposal company. Follow federal, state and local regulations.

SECTION X. SPECIAL PROTECTION INFORMATION

Respiratory Protection: Only NIOSH or MSHA approved equipment should be used. Minimum respiratory protection required for vapor:
>200 and ≤500 ppm: Chemical cartridge respirator with organic vapor cartridge(s); or supplied air respirator; or self-contained breathing apparatus.
≤1000 ppm: Chemical cartridge respirator with full face-piece and organic vapor cartridge(s).
≤2000 ppm: Gas mask with chin-style or front- or back-mounted organic vapor canister; or supplied-air respirator with full facepiece, helmet or hood; or self-contained breathing apparatus with full facepiece.
>2000 ppm or entry and escape from unknown concentrations. Self contained breathing apparatus with full facepiece operated in

pressure demandor other positive pressure mode; or combination respirator which includes Type C supplied-air respirator with full facepiece operated in pressure-demand or other positive pressure mode and auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

Ventilation: Provide general dilution or local exhaust ventilation to comply with OSHA Standards. Ventilation fans and other electrical service must be nonsparking and explosion proof. Exhaust hoods should have >100 LFM face velocity and be designed to capture heavy vapors.

Protective Clothing or Equipment:

- To prevent repeated or prolonged skin contact with the liquid, use impervious clothing, gloves, face shields, (eight-inch minimum), splash-proof safety goggles, and other appropriate protective clothing.
- Place clothing contaminated with the liquid in closed containers for storage until it can be discarded or until provision is made for the removal of the chemical from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the chemical, the person performing the operation should be informed of the chemical's hazardous properties and ways to minimize exposure.
- A safety shower should be provided within the immediate work area for emergency use where liquid may contact the employees body.
- An eyewash fountain should be provided within the immediate work area for emergency use where the liquid may contact the employee's eyes.

SECTION XI. SPECIAL PROCEDURES AND PRECAUTIONS

Procedures and Precautions to be Taken in Handling and Storing: Store in cool, clean, well-ventilated area away from sources of heat and ignition and away from oxidizing agents. Use nonsparking tools and safety cans for handling small amounts. Use ground and bond metal containers for liquid transfers to prevent static sparks and protect containiers from physical damage.

Other Precautions: Do not wear contact lenses or smoke in areas of storage or use. Avoid contact with skin and eyes. Alcohol use may aggravate the narcotic and blood effects.

XYLENE

MATERIAL SAFETY DATA SHEET

Prepared by Envirologic Data
Portland, ME (207) 773-3020
Revised January 1986

EMERGENCY TELEPHONE NUMBER: Pittsburgh Poison Information Center
Children's Hospital of Pittsburgh
Pittsburgh, PA 1-412-681-6669

SECTION I. IDENTIFICATION

Material Name: Xylene
Synonyms: Dimethylbenzene: xylol
CAS No.: 1330-20-7
Molecular Formula: $C_6H_4(CH_3)_2$

SECTION II. FIRST AID PROCEDURES AND EMERGENCY TREATMENT

In all cases of poisoning, follow standard procedures for poison management, first aid, and cardiopulmonary resuscitation. Whenever transporting a poisoned person to a hospital, bring the container, label, or other information concerning the product (without delaying transport) to assist medical personnel with diagnosis and treatment. Four different routes of exposure and their respective first aid/poison managements are outlined below:

Ingestion:

- Dilute the poison by offering and encouraging the person to drink one or two glassfuls of water or milk. Do not use carbonated fluids. Do not attempt to make the person vomit.
- Call the Pittsburgh Poison Information Center (1-412-681-6669). If you cannot reach the Poison Information Center, call or take the person to the nearest hospital emergency department.
- Notify your supervisor or health and safety officer of this or any poison exposure.

Inhalation:

- Stop exposure by moving person from contaminated area to clean air area.
- Call the Pittsburgh Poison Information Center (1-412-681-6669).
- Have someone call a rescue unit or medical professional.
- If necessary, transport person to an emergency medical facility promptly.

Skin:
- o If material is a powder, brush away using a cloth.
- o Wash off skin immediately with a large amount of water: use soap if available.
- o Remove any contaminated clothing and rewash skin.
- o Call the Pittsburgh Poison Information Center (1-412-681-6669).
- o Transport person to a medical facility as necessary.

Eyes:
- o Gently rinse eye immediately, using large amounts of water, for fifteen minutes, if possible, with eyelids held open.
- o If possible, have person remove contact lenses if worn: never permit the eyes to be rubbed.
- o Call the Pittsburgh Poison Information Center (1-412-681-6669).
- o Transport person to an emergency medical facility promptly as necessary.

SECTION III. ACUTE TOXICITY

Exposure Routes: The primary routes of exposure are inhalation of vapor and direct skin or eye contact with the liquid.

Toxic Effect Levels:

Inhalation human TC_{LO}	200 ppm
Inhalation man LC_{LO}	10,000 ppm (for 6 h)
Oral rat LC_{50}	4,300 mg/kg
Inhalation rat LC_{50}	5,000 ppm (for 4 h)

Signs and Symptoms

Ingestion: Burning sensation in the mouth and throat. Other symptoms are the same as those for inhalation (see below), except that lung congestion will not usually develop.

Inhalation: Irritation of the eyes, nose, and throat. At concentrations above 200 ppm nausea, vomiting, abdominal pain, dizziness, staggering, drowsiness, severe breathing difficulties, and unconsciousness may occur. Vapor levels above 200 ppm may have an anesthetic effect.

Skin: Irritation and defatting.

Eyes: Irritation at concentrations of 200 ppm.

Exposure Limits.

OSHA Standard(s):	100 ppm, 8-h TWA (skin)*
NIOSH Recommended Limit(s):	100 ppm, 8-h TWA
	200 ppm, Ceiling (for 10 min)
ACGIH Recommended Limit(s):	100 ppm, 8-h TLV-TWA
	150 ppm, STEL

*Skin absorption may contribute to overall exposure.

SECTION IV. LONG-TERM ORGANISM THREAT POTENTIAL

Carcinogenicity

IARC, NTP, CA, MAG, RTECS: No indication of carcinogenic effects was found in standard references.

Mutagenicity
IARC: IARC Monographs have not reported mutagenic effects.
RTECS: Mutagenic response in yeast.
Teratogenicity
IARC: IARC Monographs have not reported teratogenic effects.
RTECS: Teratogenic effects in mice and rats.
Reproductive Effects
IARC: IARC Monographs have not reported reproductive effects.
RTECS: Reproductive effects in mice.

SECTION V. CHRONIC TOXICITY

Reversible damage to the kidneys and liver may occur from exposure to high concentrations.

SECTION VI. PHYSICAL DATA

Molecular weight: 106.2
Boiling Point (at 760 mm Hg): 144.4°C (292°F) (o)*
138.9°C (282°F) (m)*
138.3°C (281°F) (p)*
Melting Point (at 760 mm Hg): -25°C (-12°F) (o)
-48°C (-54°F) (m)
13°C (55°F) (p)
Vapor Pressure (mm Hg) [at 20°C (68°F)]: 7(o), 9(m), 9(p)
Vapor Density (Air=1): 3.7
Specific Gravity (water=1): 0.88(o), 0.86(m), 0.86(p), mixture about 0.86
Percent Volatile By Volume: ~ 100
Evaporation Rate (butyl acetate =1): 0.7 (o, m, p)
Solubility in Water: 0.00003 g/100 g of H_2O, at 20°C (68°F) (o, m, p).
Solvent Solubility: Miscible with absolute alcohol, ether, and other organic liquids.
Appearance and Odor: Colorless or light colored aromatic liquid with an unfatigued odor threshold of 0.3 ppm in air. Para-xylene may be a crystal at low temperatures.

*o = ortho isomer, m = meta isomer, p = para isomer

SECTION VII. FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used): 27.2 to 32°C (81 to 90°F) (closed cup)
Extinguisher Media: Foam, carbon dioxide, dry chemical.

	Lower	Upper
Flammable Limits in Air, percent by vol.:	1.0 to 1.1	6 to 7

Autoignition Temperature: 465 to 530°C (869 to 986°F)
NFPA Fire Hazard: 3
Special Fire Fighting Procedures: Firefighters should use self-contained breathing apparatus with a full facepiece operated in pressure-demand or positive-pressure mode.
Unusual Fire and Explosion Hazards: When exposed to heat or flame, xylene is a significant fire and explosion hazard. Vapors may travel a distance along surfaces to ignition sources and then flash back.

SECTION VIII. REACTIVITY DATA

Stability: Stable in closed containers at room temprature.
NFPA Reactivity: 0
Incompatibilities (Materials to Avoid): Can form explosive mixtures with air. Xylene should be kept away from sources of heat and ignition and strong oxidizing agents.
Hazardous Decomposition Products: Degradation in air due to heat may yield toxic vapors and gases, including carbon monoxide and oxides of nitrogen.
Hazardous Polymerization: Does not occur.

SECTION IX. SPILL, LEAK OR DISPOSAL PROCEDURES

Actions To Take in Case of Spills or Leaks: Restrict from areas of spills or leaks persons not wearing protective equipment and clothing. Eliminate sources of ignition. Ventilate area. Inform supervisor or health and safety officer of any spill or leak. While protecting against eye and skin contact and inhalation of vapors, take the following steps:

- Solid: Shovel or sweep solid into suitable container, and cover.
- Liquid: Contain spill. Prevent leakage into confined spaces or sewer drains. Where feasible, absorb liquid with paper towels, vermiculite, sand, or other non-combustible absorbent material. Collect in suitable container and cover.

Disposal Methods: Federal laws and regulations impose highly specific requirements for disposal of toxic and otherwise hazardous materials. Consult with your supervisor or health and safety officer regarding the proper, legal disposal procedures for this substance. Do not dispose of potentially toxic or otherwise hazardous substances without appropriate authorization. Prior to receiving institutional authorization, it may be necessary to store spilled materials. To do so safely, carefully label containers of materials, store in a cool, dry location, and maintain security of the storage area until official guidance is obtained.

SECTION X. SPECIAL PROTECTION INFORMATION

Respiratory Protection: Only NIOSH or MSHA approved equipment should be used. Minimum respiratory equipment required for vapor:

>100 and ≤1,000 ppm: Chemical cartridge respirator with full facepiece and organic vapor cartridge(s).
≤5,000 ppm: Gas mask with chin-style or front- or back-mounted organic vapor canister; or supplied-air respirator with full facepiece, helmet, or hood; or self-contained breathing apparatus with full facepiece.
≤10,000 ppm: Type C supplied-air respirator with full facepiece operated in pressure-demand or other positive pressure mode or with full facepiece, helmet or hood operated in continous-flow mode.

>10,000 ppm or entry and escape from unknown concentrations: Self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive pressure mode: or combination respirator including Type C supplied-air respirator with full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

Ventilation: Provide general and local exhaust ventilation to comply with OSHA standards. For exhaust hood, use >100 lfm face velocity.

Protective Clothing or Equipment:

- To prevent repeated or prolonged skin contact with liquid and solid chemicals, use impervious clothing, gloves, face shields (eight-inch minimum), splash-proof safety goggles, and other appropriate protective clothing.
- Place clothing contaminated with liquids or solids in closed containers for storage until clothing can be discarded or decontaminated. If the clothing is to be laundered or otherwise cleaned to remove the chemical, the person(s) performing the operation should be informed of the chemical's hazardous properties and of ways to minimize exposure.
- A safety shower should be provided within the immediate work area for emergency use where liquids may contact the employee's body.
- An eyewash fountain should be provided within the immediate work area for emergency use where liquids or solids may contact the employee's eyes.

SECTION XI. SPECIAL PROCEDURES AND PRECAUTIONS

Procedures and Precautions to be Taken in Handling and Storing: Store in a well-ventilated area in closed containers away from sources of heat and ignition and strong oxidizing agents. Protect containers from physical damage. Electrically ground metal containers when transferring liquid. Detached storage is preferable.

Other Precautions: Do not smoke in areas of use or storage. Wash hands before eating, smoking, or using toilet facilities.

0783X

APPENDIX F

Safety Equipment Checklist

Groundwater Sampling

SAFETY EQUIPMENT CHECKLIST
(Check equipment needed, indicated number needed at left)

PERSONAL PROTECTION

SCBA
___ air-line system
___ 5 min. bottle
✓ half-face respirator
___ full-face

X organic vapor
X (dust present) organic/HEPA
✓ RESPIRATOR CARTRIDGE(S)
___ acid/base ___ organic/acid ___ dust pre-filter ___ other

X tyvek (dust present)
___ chem-tuff
✓ COVERALLS
___ chemrell ___ chem-max (level A) ___ PV-tyvek ___ Saranex

X vinyl
___ neoprene
✓ GLOVES
___ solvent (NBR) ___ acid ___ Viton ___ Silver sh

boots/rubbers
✓ (No exposure) safety goggles
___ safety glasses ✓ hard hat ___ splash shield ___ steel to

MONITORING & SURVEILLANCE

✓ LEL/O2
___ OVA (FID)
✓ HNu (PID)
___ colorometric tubes
___ radiation meter
___ IH sampling pump
✓ (dust present) dust sampler
___ other

MISCELANEOUS

first aid kit
✓ fire extinguisher
✓ eye wash capacity
✓ drinking water
✓ barricades
escape pack
___ cascade system
✓ traffic cones
✓ reflective vest
___ spare air bottle

DECONTAMINATION EQUIPMENT

wash tub
✓ 5 gallon pail
✓ scrub brush
✓ water sprayer
✓ rinsate container
___ steam cl
garbage bags
✓ drum/can
✓ visqeen sheeting
✓ hygienic soap
___ detergent

Job task: Dr. Wing

SAFETY EQUIPMENT CHECKLIST
(Check equipment needed, indicated number needed at left)

PERSONAL PROTECTION

SCBA
___ air-line system ___ 5 min. bottle ✓ half-face respirator ___ full-face

___ ✓ RESPIRATOR CARTRIDGE(S)
___ organic vapor
X ___ organic/HEPA (dust present)
___ acid/base ___ organic/acid ___ dust pre-filter ___ other___

___ ✓ COVERALLS
___ tyvek
X ___ chem-tuff (major H_2O exposures)
___ chemrell ___ chem-max (level A) ___ PV-tyvek ___ Saranex

___ ✓ GLOVES
___ vinyl
___ neoprene ___ solvent (NBR) ___ acid ___ Viton ___ Silver sh
___ boots/rubbers
X ___ safety goggles (H_2O exposure)
X ___ safety glasses X ___ hard hat ___ splash shield X ___ steel toe

MONITORING & SURVEILLANCE
___ O2/LEL
___ OVA (FID) X ___ HNu (PID) ___ colorometric tubes ___ radiation meter
___ HI sampling pump X ___ dust sampler (dust present) ___ other___

MISCELANEOUS
X ___ first aid kit
X ___ fire extinguisher X ___ eye wash capacity X ___ drinking water X ___ barricades
___ escape pack
___ cascade system X ___ traffic cones X ___ reflective vest ___ spare air bottle

DECONTAMINATION EQUIPMENT
X ___ wash tub
X ___ 5 gallon pail X ___ scrub brush X ___ water sprayer X ___ rinsate container X ___ steam cle
X ___ garbage bags
X ___ drum/can X ___ visqeen sheeting X ___ hygienic soap ___ detergent

APPENDIX G

Accident Reporting Form

Accident/Incident (near miss) Report

Employee's Name:_____ D.O.B._____
Address:_____ D.O.H._____
_____ SS#_____
Job Title:_____ Supervisor's Name:_____
Office Location:_____
Location at Time of Incident:_____
Date/Time of Incident:_____

Describe clearly how the accident occurred:_____
_____
_____
_____

Was incident: Physical_____ Chemical_____
Parts of body affected_____ Exposure: Dermal_____
right left Inhalation_____
Ingestion_____

Witnesses: 1)_____ 2)_____

Conditions/acts contributing to this incident_____
_____
_____

Managers must complete this section:

Explain specifically the corrective action you have taken to prevent a recurrence:_____
_____
_____

Did injured go to doctor:_____ Where:_____
_____ When:_____
Did injured go to hospital:_____ Where:_____
_____ When:_____

Signatures:

_____	_____	_____
Employee	Reporting Manager	Health & Safety Manager
_____	_____	_____
Date	Date	Date

This form must be completed and returned to Health and Safety Manager within 5 working days.

APPENDIX H

OSHA Inspection Procedures

Applied GeoSystems is committed to providing a safe environment on all work sites. Every Applied GeoSystems employee represents the company and as such, will adhere to all regulations and company policies, and treat every OSHA inspector with respect for their authority.

Inspection Process:

1) Identify the inspector
   - Ask to see credentials
   - Write down the relevant information, including the inspector's name, agency affiliation, address, telephone number and the statutory authority under which the inspection is being conducted.
   - If inspection occurs at a project site, ask for written verification of the inspectors certification of completion of 40 hour hazardous materials training and health monitoring. Remember, **no one may venture out of the clean zone without proper certification.** Double check it with his/her office if in doubt.

2) **Notify** the Health and Safety Manager and Project Manager immediately: one or both must be present for the opening meeting and inspection.

3) Determine the scope of the inspection:
   - Ask the inspector what company activities are of interest and the reason for the inspection.
   - Discover what triggered the inspection
   - If complaints initiated the inspection, find out specifically what they are.

4) If the inspection occurs on site, carefully review the Site Safety Plan with the inspector before site entry.

5) Take notes on:
   - What is said.
   - What is seen.
   - Who spoke to whom.
   - What the issues are.
   - What recommendations and/or corrective actions were discussed/taken.
   - What the inspector actually inspected.
   - Any other activity/occurrence, even if minor (include where, when, who, and what) was observed

6) If the inspector asks for copies of anything, reassure him/her of our full intent to cooperate but remember your primary responsibility is to obtain clearance from the Project Manager, Health and Safety Manager, or other appropriate Manager.

7) When in doubt on any questions, **do not bluff an answer.** Ask the inspector to put the question in writing, addressed to company counsel. Never lie, even by omission; jail can be the penalty.

8) If the inspection occurs at the office, be sure the OSHA 200 logs are available for inspection. Always make sure the OSHA poster is visible and the Health and Safety Manager and/or appropriate Manager is present.

APPENDIX I

Vapor Monitoring Form

PROJECT NAME _____

PROJECT NUMBER _____

DATE OF SAMPLING _____

CONTAMINANTS _____

RESULTS OF VAPOR MONITORING

TIME	IONIZATION DETECTOR READING			EXPLOSIMETER READING		RADIATION MONITOR READING	LOCATION	PURPOSE	INITIALS
	PID	10.2eV PID	11.7eV PID	% LEL	% O_2	mR/hr			

APPENDIX J

Equipment Calibration Log

INSTRUMENT CALIBRATION LOG

DATE	INSTRUMENT	TEST GAS	ppm	READING	ADJUSTED?	SIGNATURE
					YES NO	
					YES NO	
					YES NO	
					YES NO	
					YES NO	
					YES NO	
					YES NO	
					YES NO	
					YES NO	
					YES NO	
					YES NO	
					YES NO	

PAGE _____

APPENDIX K

Construction Safety

Definitions -Excavation, Trenches, Earthwork

Bank- a mass of soil rising above a digging level.

Bell Hole- an additional excavation made into the sides or bottom of a trench to provide additional work space.

Belled Excavation- a part of a shaft or footing excavation, usually near the bottom and bell-shaped, that makes the cross-sectional area at that point larger than that above.

Benching- a method of excavation whereby the faces of an excavation or trench are widened progressively outward with respect to the bottom by a specific series of horizontal and vertical cuts to provide protection against the hazard of moving ground.

Braces for excavations- the horizontal members of the shoring system the ends of which bear against the uprights or stringers.

Earthwork- the process of excavating, moving, storing, placing, and working any type of earth materials.

Excavation- a man-made cavity or depression in the earth's surface, including its sides, walls, or faces formed by the removal of materials and producing unsupported earth conditions by reason of such removal. If installed forms or similar structures reduce the depth to width relationship, and excavation may become a trench.

Exploration shaft- a shaft created and used for the purpose of obtaining subsurface data.

Geotechnical Specialist (GTS)- a person registered by the State as a Certified Engineering Geologist, or a Registered Civil Engineer trained in soil mechanics, or an engineering geologist or civil engineer with a minimum of 3 years applicable experience working under the direct supervision of either a Certified Engineering Geologist or Registered Civil Engineer.

Hard Compact- all earth material not classified as running soil.

Hydraulic Shoring- a shoring system using hydraulic cylinders, planks, rails, plywood or steel beams to support the excavated wall of trenches.

Lagging- boards which are joined, side-by-side, lining and excavation.

Running Soil- earth material where the angle of repose is approximately zero, as in the case of soil in a nearly liquid state, or dry, unpacked sand which flows freely under slight pressure. Running material also includes loose or disturbed earth that can only be contained with solid sheeting.

Shaft- an excavation under the earth's surface in which the depth, is much greater than its cross-sectional dimensions such as those formed to serve as wells, cesspools, certain foundation footings, and under streets, railroads, buildings, etc.

Shore- a supporting member that resists a compressive force imposed by a load.

Shoring System- a temporary structure for the support of earth surfaces formed as a result of excavation work.

Sides, Walls, and Faces- the vertical or inclined earth surfaces formed as a result of excavation work.

Sloping- a method of excavation whereby the faces of an excavation or trench are laid back to provide protection from moving ground.

Spoil- the earth material that is removed in the formation of an excavation.

Stringers- the horizontal members of th shoring system whose sides bear against the uprights. Stringers are sometimes called whalers.

Strut- a structural member designed to resist forces in either tension or compression.

Trench- an excavation made below the surface of the ground. In general, the depth is greater than the width at the bottom, but the width of a trench at the bottom is not greater than 15 feet.

Trench Jack- screw or hydraulic type jacks used as cross bracing in a trench shoring system.

Trench Shield- a protective device which shields workers from the effect of ground movement and which can be moved along as work progresses.

Uprights- the vertical members of the shoring system.

Whaler- a structural member in a horizontal or nearly horizontal position used for stiffening or securing other components of concrete forms, excavation sheeting, or similar temporary structures.

EXCAVATION PROCEDURES
(also trenches, shafts and other earthwork)

1. Prior to beginning an excavation, the location of all underground utilities and other underground hazards shall be determined.

2. A hazard assessment shall be conducted by a qualified person to evaluate the potential exposure to employees who may work in or around the excavation.

3. The excavation shall also be inspected by a qualified person after each rain or other hazard increasing event to evaluate the potential hazard from slides or cave-ins.

4. Anytime an employee enters an excavation 5 feet or greater in depth, that employee must be protected by a system of shoring, sloping, benching, or alternative means addressed in #15 below. Excavations less than 5 feet deep with soft or unstable soils shall also be protected when hazardous ground movement may be expected.

5. When an employee enters an excavation 5 feet or deeper in depth, the employer is required to obtain the necessary excavation permit and/or notification procedures with Cal-OSHA.

6. Excavated materials shall be prevented from falling back into the excavation. Spoils should be placed no closer than 2 feet from the edge of the excavation.

7. Work which is conducted within the excavation should be under the direct supervision of a qualified person who is capable of modifying the shoring or sloping system.

8. A convenient and safe means of egress shall be provided for employees working within an excavation 4 feet deep or greater. This may consist of a stairway, ladder, or ramp located within 25 feet of lateral travel. If a ladder is utilized, it shall be placed on a substantial base and extend a minimum of 36 inches above the landing and secured against movement.

9. Any employee working in the vicinity of an excavator shall not be in a position where that employee might fall into or contact the moving parts of that excavator. These employees shall also be wearing a reflective vest.

10. An adequate means of water drainage shall be implemented to reduce the likelihood of run-off entering the excavation. This shall hold true during the rainy season. If the accumulation of water might pose a hazard to employees, the situation should be controlled prior to resumption of operations.

11. All shoring systems shall incorporate the soil specifications and conditions for that particular site. The installation of shoring systems shall be conducted such that the employee is properly protected from the potential of cave-ins. Additionally, the removal of the system shall follow the same requirement.

12. If the excavation exceeds 20 feet or if an alternative shoring, sloping, or benching system is utilized, a civil engineer currently registered in California shall prepare detailed plans showing the materials and methods to be utilized.

13. The detailed plans in #12 above, shall be available for inspection at the site.

14. Shoring shall be installed in accordance with Table 1-6 or as detailed in plans and specifications prepared by State registered civil engineer in accordance with the appropriate engineering criteria.

15. If protective shields (i.e. trench shields) are to be utilized for the protection of employees within an excavation, a civil engineer registered in California must prepare the necessary calculations and designs prior to the use of such equipment.

16. When sloping or benching are utilized in lieu of a shoring system, the slope shall be at least 3/4 horizontal to 1 vertical for excavations up to 8 feet, unless the instability of the soil requires a slope flatter than 3/4:1. For excavations greater than 8 but less than 12 feet, a slope of 1:1 shall be utilized.

APPENDIX L

Drilling Safety

PERSONAL PROTECTIVE EQUIPMENT

All workers at or near drilling operations require the use of personal protective equipment (PPE) to protect against injuries and potentially hazardous exposures. The following measures must be taken by workers at or near a drilling operation:

- PPE should (or must if company policy requires so) be worn at Level D drilling operations consisting or: hard hat (ANSI Z89.1 approved), steel toed and shank boots (ANSI Z41.1 approved), safety glasses (ANSI Z87.1 approved), close fitting gloves, close fitting clothing, and hearing protection (optional, but required in most cases due to high noise levels).

- PPE that must be worn during Level C, B, or A sites will include respiratory protection and chemical resistant clothing, gloves, and boots in addition to the equipment listed above. The specific requirements will be stated within the site specific site safety plan (SSP).

- Clothing worn at or around drilling operations must be close-fitting to prevent loose parts from catching on rotating or translating components of the drill rig. Rings and jewelry should not be worn because they may also get caught in drill-rig components.

- Drilling personnel must wear gloves to protect against cuts and abrasions that may occur while handling wires or cables. Gloves should also be worn to prevent contact with sharp edges and burrs on drill rods and other drilling or sampling tools.

HOUSEKEEPING DUTIES DURING DRILLING

The drill rig must be cleaned and properly maintained prior to the start of work operations. Tools used during drilling operations must be well lubricated. The on-site drilling supervisor is responsible for ensuring that the drill reg and the site are in proper order and ready for safe work conditions. He/she is responsible for ensuring that procedures are followed:

- All tools, materials, and supplies must be stored in a suitable location on the rig where they won't fall or hit workers during drilling operations.
- Tools, materials, or supplies should not be stored or transported within or on the mast (derrick) or the drill rig.
- All drilling materials such as pipe, drill rods, casing, augers, and similar drilling tools should be orderly stacked on racks or sills to prevent spreading, rolling or sliding.
- Driving hammers and other similar pieces of equipment must be placed at a safe location off the ground or be secured to prevent movement when not in use.
- All work areas, platforms, walkways, scaffolding and other access ways should be kept free of materials, debris, obstructions and substances such as ice, grease, or oil that could cause a surface to become slick or otherwise hazardous.
- Gasoline should not be stored in an approved storage container rated for gasoline.
- All controls, control linkages, warning and operational lights and lenses must be kept free from oil, grease, and/or ice.

MAINTENANCE SAFETY

Proper and routine maintenance of the drill rig well installation equipment allows for much safer drilling operations. The on-site drilling supervisor must ensure that his/her work crew adhere to the following proper maintenance procedures:

- The drill rig engine must be shut down prior to making repairs, adjustments, or lubrication. Precautions should be taken to prevent accidental starting of an engine during maintenance by removing or tagging the ignition key and following lockout/tagout procedures.

- The engine or the exhaust system of an engine should not be touched following its operation until the systems have had adequate time to cool.

- Prior to the performance of maintenance techniques, and when possible and appropriate, all pressure on the hydraulic systems, the drilling fluid systems and the air pressure systems of the rig should be released.

- Cutting or welding should not be performed on or near a fuel tank or other direct sources of flammable vapors.

- Gasoline or other volatile or flammable liquids must not be used as cleaning agents on or around the rig.

- All caps, filler plugs, protective pressure hose clamps, chains or cables should be replaced after maintenance has been conducted.

- Hook and heel jaws must be replaced when they become visible worn.

- All pipe wrenches must be kept clean and in good repair. If they are not cleaned frequently, the jaws could collect dust and grease and may cause slippage.

- When breaking tool joints on the ground or on a drilling platform, position hands such that fingers will not be smashed between the wrench handle and the ground or the platform. This precaution is necessary because the wrench could suddenly slip or the joint may suddenly let go.

SAFETY DURING OPERATIONS

The on-site supervisor must ensure that the area around the drill rig is cleared of all personnel, visitors, and obstructions. The on-site supervisor is responsible for ensuring that the drill rig and the site are improper order and ready for safe work conditions. He/she is responsible for ensuring that the following procedures are followed:

- Prior to the start-up of the rig, all employees and visitors on-site must "stand clear" immediately before and after the engine is started. All on-site personnel must be accounted for before starting the engine.

- Before starting a drill rig engine, check all gear boxes to ensure that they are in neutral, all hoist levers are disengaged, all hydraulic levers are in the correct positions and the cathead rope is not on the cathead.

- Prior to raising the mast, the location should be checked for overhead power lines. Additionally, all drill rig workers and others nearby on-site shall be clear from all areas immediately to the rear and the sides of the mast. All drill rig personnel and visitors should be informed that the mast is being raised prior to raising it.

- Before raising the mast and drilling is commenced, the drill rig must first be leveled and stabilized with leveling jacks and/or solid cribbing.

- Prior to the start of drilling operations, secure and/or lock the mast according to specific manufacturer's recommendations.

- Do not throw or drop tools from person to person.

- If it is necessary to drill within an enclosed area, make certain that exhaust fumes are properly ventilated.

- To reduce the chance of accidental falls fro slippery surfaces, all mud and grease form boots should be cleaned prior to mounting the drilling platform.

- Upon the completion of the drilling project, all boreholes should be covered, protected, or backfilled adequately.

- The drill rig must not be driven with the mast in the raised position.

OVERHEAD/BURIED UTILITIES

Before drilling on-site, it is necessary to contact the area utility locater to determine the location of all suspected utility lines on site. The use of a drill rig in the vicinity of electrical power lines, either overhead or buried, requires that special precautionary measures be taken by all involved in site work operations. Electricity can shock, burn, and cause death. It there are any questions concerning safety of drilling in the vicinity of power lines, contact the power company. They can provide expert advice at the drilling site as a public service and at no cost. For the safety of all working on-site, the following precautions must be adhered to:

- All located lines on-site should be noted and emphasized on all boring plans, location plans, and boring assignment plans.

- Consider all electrical wires to be alive and dangerous.

- Maintain at least 20 feet of clearance from overhead lines. The clearance can be reduced to 10 feet if the lines are padded. Do not attempt to raise the mast unless this distance is achieved. Additionally, do not attempt to move the rig until the mast is down.

- Insulate all the handles that are used to operate the rig. This should be done with rubber grips or heavy wrapping of electrical tape. This reduces the severity of the accident when gripping the controls.

CONTACT WITH ELECTRICITY

If a drill rig comes in contact with electrical wires, it may or may not be insulated from the ground by the tires or the carrier. If the human body simultaneously comes in contact with the drill rig and the ground, it will provide an conductor of the electricity to the ground. In this case, death or serious injury may result. If a rig or carrier comes in contact overhead or underground electrical lines, the following safety protocol should be adhered to:

- The victim in contact with the electrical lines must not attempt to touch any part of the equipment or attempt to enter or leave it. All other personnel on-site must be kept away from the rig.

- The victim in contact must not move or touch any part of the drill rig, particularly any metallic parts.

- Inform someone to call 9-1-1 and the local power company immediately.

- Under most circumstances, the operator and other personnel on the seat of the vehicle should remain seated and do not attempt to leave the vehicle. It it is determined that the drill rig should be vacated, then all personnel should jump clear and as far as possible from the rig. They should not step off, jump off, and should not hang on to the vehicle or any part of the rig while jumping.

- Rescuers should not attempt to touch any person who may be in contact with the electrical current.

- If the victim is not in contact with the electrical current and is unconscious, inform someone to contact 9-1-1 while a qualified persons begins CPR.

WIRE ROPE SAFETY

Rope which is worn or misused is one of the most potentially dangerous pieces of equipment on a drill rig. If a wire rope breaks, it is usually under the stress of a heavy load. As a result, it tends to "snap back" like a rubber band. To avoid this from occurring, the following precautionary measures should be taken:

- Inspect all wire ropes and fittings during use and at least once a week for wear, abrasion, broken wires, reduction in rope diameter, corrosion, damage from heat, improper reeving, jamming, crushing, kinking, core protrusion, and damage to lifting hardware. Wire ropes should be replaced when inspection indicates excessive damage.

- Manufactured end fittings and connections should be installed according to the manufacturer's instructions and loaded according to the manufacturer's specifications.

- When ball-bearing type hoisting swivels are used, swivel bearing should be inspected and lubricated daily to assure that the swivel freely rotates under load.

- When a rod slipping device is used to hoist drill rods, do not drill through or rotate drill rods through the slipping device, do not hoist more than 1 foot of the drill rod column with loose tool joints; do not make up, tighten or loosen tool joints while the rod column is being supported by a rod slipping device. If drill rods should slip back into the borehole, do not attempt to brake the fall of rods with your hands or by tensioning the slipping device.

- The number of parts of line on exploration drill rigs should never be increase without first consulting with the manufacturer of the drill rig.

- Each wire rope must be properly matched with each sheave.

- Use tool handling hoists for vertical lifting of tools only. Do not use tool handling hoist to pull on objects away form the drill rig. However, drills may be moved using the main hoist if the wire rope is spoiled through proper sheaves according to manufacturer's recommendations.

- When such tools or similar loads can not be raise with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill.

- When attempting to pull out a mired down vehicle or drill reg carrier, use a winch on the front or rear of the vehicle and stay as far away as possible from the wire rope. Do not attempt to use tool hoists to pull out a mired down vehicle or drill rig carrier.

- Minimize shock of a wire rope by applying loads smoothly and steadily.

- Avoid sudden loading in cold weather, and never use ropes which are frozen.

- Protect wire rope from sharp corners and edges.

- Replace worn sheaves, worn sheave bearings, and damaged safety latches on safety hooks before using.

- Never exceed the limit of the safe working load of equipment.

- Periodically inspect and t4est the clutches and brakes of hoists.

- Do not exceed the rated capacity of hooks, rings, links, swivels, shackles and other lifting aids.

- When handling wire ropes, always wear gloves.

- When installing a new wire rope, allow it to adjust by lifting a light load first.

- Do not carry out hoisting operations when the weather conditions may be hazardous to personnel.

- Do not leave suspended loads in the air when the hoist is unattended.

- Never hoist the load over the head, body, or feet of personnel.

- Never use a hoist to "ride" up the mast of a drill rig.

- Wires which are replaced should conform to the drill rig manufacturer's specifications.

USE OF CATHEAD & ROPE HOISTS

During the use of a cathead hoist the following safety procedures should be adhered to on-site:

- The cathead should be kept clean and free from rust, oil, and/or grease.
- The cathead must be periodically checked when the engine is not running for rope wear grooves. Rope grooves should not form to a depth greater than 1/8 inch.
- Use dry, clean, sound rope at all times.
- If the rope "grabs" the cathead and becomes tangled in the drum, all personnel should stand back and stay clear form the area.
- Protect the rope from contact with all chemicals, since deterioration of the rope can sometimes be visibly undetectable.
- Do not wrap any rope, wire rope, or cable on the drilling rig or from the cathead around a hand or around any other body part.
- Maintain a minimum clearance of 18 inches between the operating hand and the cathead drum when driving samplers, casing or other tools with the cathead and rope method.
- Do not use a rope which is longer than necessary or more ropes than are required to hoist a load.
- Do not leave a cathead unattended with the rope wrapped on the drum.
- Position all other hoist lines to prevent contact with the operating cathead rope.
- When using the cathead and rope for driving or back-driving, make certain that all threaded connections are tight and stay as far away as possible from the hammer impact point.
- The cathead operator must be able to operate the cathead standing on a level surface with good, firm footing conditions and without distraction or disturbance.

SAFE USE OF AUGERS

When continuous flight or hollow-stem augers are used during drilling procedures, the following safety protocol should be followed:

- Prior to starting an auger boring, the clutch or hydraulic rotation control should be disengaged, and the transmission should be in low gear.
- An adequate amount of pressure should be applied prior to rotation to seat the auger head below the ground surface.
- Stay clear of the auger while engaging the clutch or rotation control.
- Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about one foot or more below grade.
- If the auger head slides out of alignment, disengage the clutch or hydraulic rotation control and repeat the hole start8ing process.
- When securing the auger to the power coupling, use only the manufacturer's recommended methods.
- Use tool hoists whenever possible to handle auger sections.
- Never allow hands, fingers, feet, or other parts of the body to get below the auger sections and never reach behind or around a rotating auger.
- Long handled shovels should be used to move auger cuttings away from the auger.

ROTARY & CORE DRILLING SAFETY

Rotary drilling tools should be safety checked prior to drilling. A checklist should include:

- Lubricate all water swivels and hoisting plugs prior to use. Also, check for "frozen" bearings.
- Periodically check rod chucks jaws and replace when necessary.
- Check the capacities of hoists and sheaves against the anticipated weight to the drill rod string, and against other expected hoisting loads.