RESNA

Working To Restore Nature

3315 Almaden Expressway, Suite 34
San Jose, CA 95118
Phone: (408) 264-7723
Fax: (408) 264-2345

TRANSMITTAL

TO: Ms. Susan Hugo
Alameda County Health Care Services
Department of Environmental Health
80 Swan Way, Room 200
Oakland, California 94612

DATE: January 9, 1993
PROJECT NUMBER: 60000.09
SUBJECT: Environmental Work at ARCO Station 771, 899 Rincon Avenue Livermore, California.

FROM: Barbara Sieminski
TITLE: Assistant Project Geologist

WE ARE SENDING YOU:

COPIES	DATED	NO.	DESCRIPTION
1	1/7/93	60000.09	Environmental work at the above subject site.

THESE ARE TRANSMITTED as checked below:

[ ] For review and comment [ ] Approved as submitted [ ] Resubmit ___ copies for approval

[X] As requested [ ] Approved as noted [ ] Submit___ copies for distribution

[ ] For approval [ ] Return for corrections [ ] Return ___ corrected prints

[ ] For your files

REMARKS: cc: Mr. Michael Whelan, ARCO Products Company
Mr. Joel Coffman, RESNA Industries Inc.

Copies 1 to RESNA project file no. 60000.09

RESNA
Working To Restore Nature

January 7, 1993
0107shgo
60000.09

Ms. Susan Hugo
Alameda County Health Care Services Agency
Department of Environmental Health
80 Swan Way, Room 200
Oakland, California 94612

Subject: Environmental Work at ARCO Station 771, 899 Rincon Avenue, Livermore, California.

Dear Ms. Hugo:

On behalf of ARCO Products Company (ARCO), RESNA Industries, Inc. (RESNA) field personnel and RESNA subcontractors will be performing a portion of the offsite subsurface investigation at the subject site. This portion of work includes drilling and installing three offsite groundwater monitoring wells MW-8 through MW-10 located northeast, east, and southeast of the subject site, respectively, along Rincon Avenue, as shown on Plate 1, Proposed Boring/Monitoring Well Locations. The well locations were changed from locations proposed in Addendum Three to Work Plan (RESNA, March 5, 1992), because the owner of the property immediately adjacent to the ARCO site had refused to allow ARCO to install groundwater monitoring wells on his property. Your verbal approval for new well locations was received during the meeting held at your office on November 19, 1992. The work is scheduled to commence on January 14 and 15, 1992.

The work for this phase of investigation will be performed as proposed in the Addendum Three to Work Plan (RESNA, March 5, 1992) with the exception to completing the offsite groundwater monitoring wells as 2-inch-diameter wells instead of the originally proposed 4-inch-diameter wells. This change is within Tri-Regional guidelines which call for 2- or 4-inch diameter wells for monitoring purposes.

Field work will be performed in accordance with the RESNA Field Protocol in Appendix A of the Work Plan (RESNA, May 15, 1991), and safety guidelines established in the enclosed Site Safety Plan. To date, we have not received permission from land owners to install the offsite monitoring wells on their property and ARCO is still negotiating with the owners for access to install other wells.

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

Sincerely,
RESNA

Barbara Sieminski

Barbara Sieminski
Assistant Project Geologist

Joel Coffman

Joel Coffman
Project Geologist

Enclosure: Plate 1, Proposed Boring/Monitoring Well Locations
Site Safety Plan

cc: Mr. Michael Whelan, ARCO Products Company

60000.09S

SITE SAFETY PLAN
for
Arco Service Station 771
899 Rincon Avenue
Livermore, California

1.0 General

1.1 Background

RESNA Industries, Inc. (RESNA) has been retained by Arco Products Company (ARCO) to perform a site assessment/investigation at the Arco Service Station 771 located at 899 Rincon Avenue, Livermore, 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 January 14, 1993, with the duration estimated at approximately 1 week 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 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 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. 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
Arco Service Station 771
899 Rincon Avenue
Livermore, 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*
Diesel	—	—	————	5		

See notes on page 2 of 2.

TABLE 1
EXPOSURE LIMITS OF ANTICIPATED CHEMICAL CONTAMINANTS
Arco Service Station 771
899 Rincon Avenue
Livermore, 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

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.

3.3 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.

3.5 Confined Space Monitoring

OVM readings will be taken at the top, middle, and bottom of a vault, shed, or other confined space to ensure that vapors do not exceed acceptable levels.

If OVM readings exceed 100 ppm, a respirator with organic vapor cartridges must be worn by all site workers within any area where monitoring results exceed 100 ppm.

If OVM readings are between 100 ppm and 750 ppm, cartridges should be exchanged immediately if any odor is detected or when breathing becomes difficult. Because the warning properties of the contaminants are good, breakthrough detection will be noted at levels below the TLV.

If OVM readings exceed 750 ppm, personnel shall leave site immediately and contact the site safety officer of the Branch Safety Officer for further instructions.

The results of vapor monitoring should be recorded on the Results of Vapor Monitoring Form included within this Site Safety Plan (Appendix I).

All monitoring equipment shall be calibrated and maintained according to manufacture's recommendation. A calibration/maintenance form is included within this Site Safety Plan (Appendix J).

4.0 SITE CONTROL

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

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

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

5.0 WORK PRACTICES AND PERSONAL PROTECTIVE EQUIPMENT

5.1 Work Practices

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

Project activities will be conducted in accordance with the following minimum safety 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

- o Steel-toed chemical resistant boots (rubber, neoprene, or polyvinyl chloride [PVC])
- o Gloves (rubber, neoprene, PVC, or nitrile)
- o Orange or red safety vest (if equipment or motor vehicles are operating onsite or nearby)
- o Standard Tyvek coveralls (when required by Staff Geologist or Engineer)
- o 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 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:

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

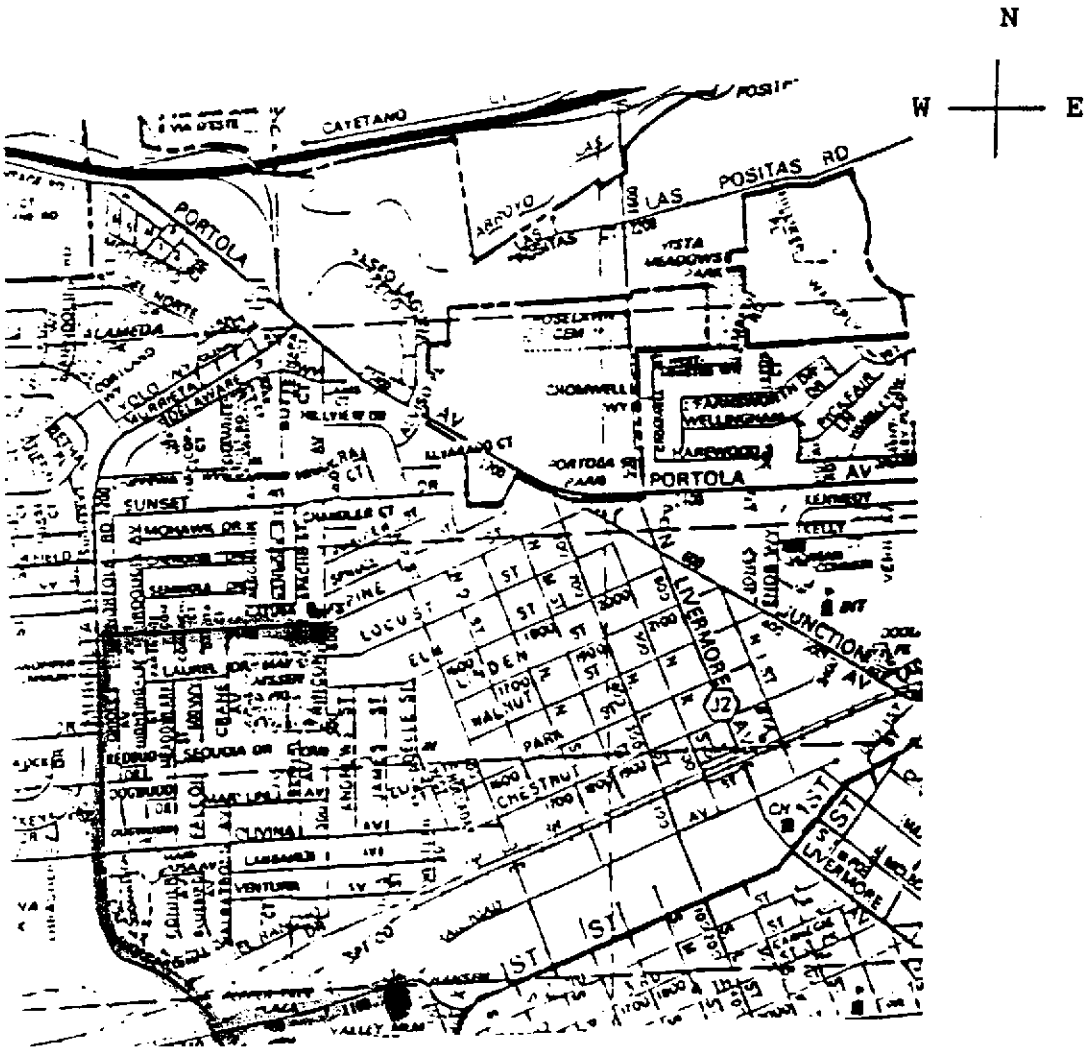
Ambulance 911

Valley Memorial Hospital ..... (510) 447-7000

1111 East Stanley Boulevard
Livermore, California

Directions to Hospital: Go west on Pine Street to Murrieta Boulevard. Go south on Murrieta Boulevard to East Stanley Boulevard; turn east. Valley Memorial Hospital will be on the right. Distance is approximately 2 miles.

Map:



Additional Contingency Telephone Numbers

Livermore Fire Department ..... (510) 373-5400

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: Joel Coffman / Resna

Health and Safety Coordinator: Marc A Brugge / RESNA

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
Name	Signature
Company	Date

ADDENDUMS

APPENDIX B

Site Safety Plan Amendment Sheet

APPENDIX C

Explanation of Hazard Evaluation Guidelines

Explanation of Hazard Evaluation Guidelines

Hazard: Airborne Contaminants

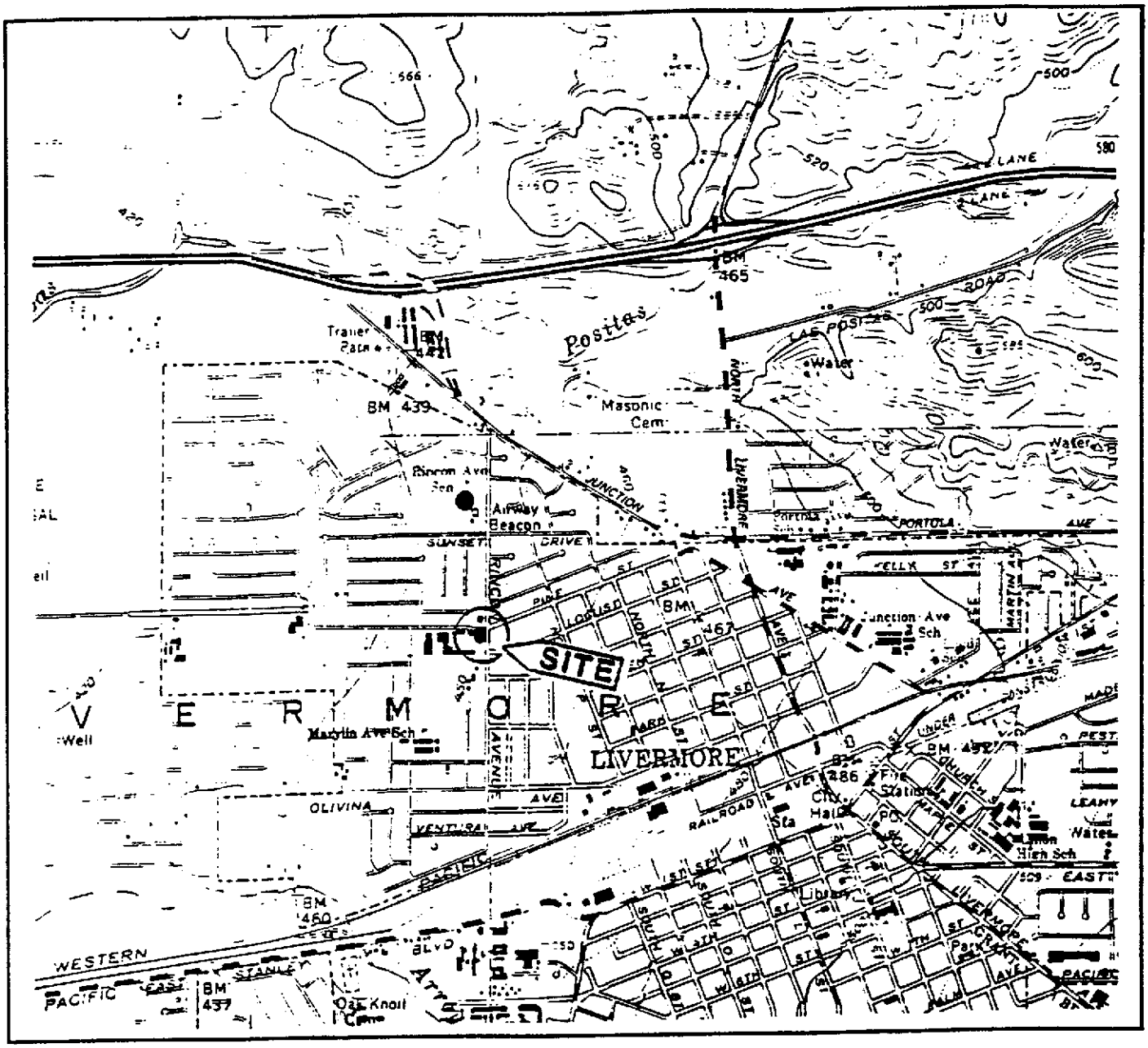
Guideline	Explanation
Threshold Limit Value Time-Weighted Average (TLV-TWA)	The time-weighted average concentration for a normal 8-hour work day and a 40-hour work week, to which nearly all workers may be repeatedly exposed without adverse effect.
Permissible Exposure Limit (PEL)	Time-weighted average 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.



Base: U.S. Geological Survey
7.5-Minute Quadrangle
Livermore, California
Photorevised 1980

N

LEGEND

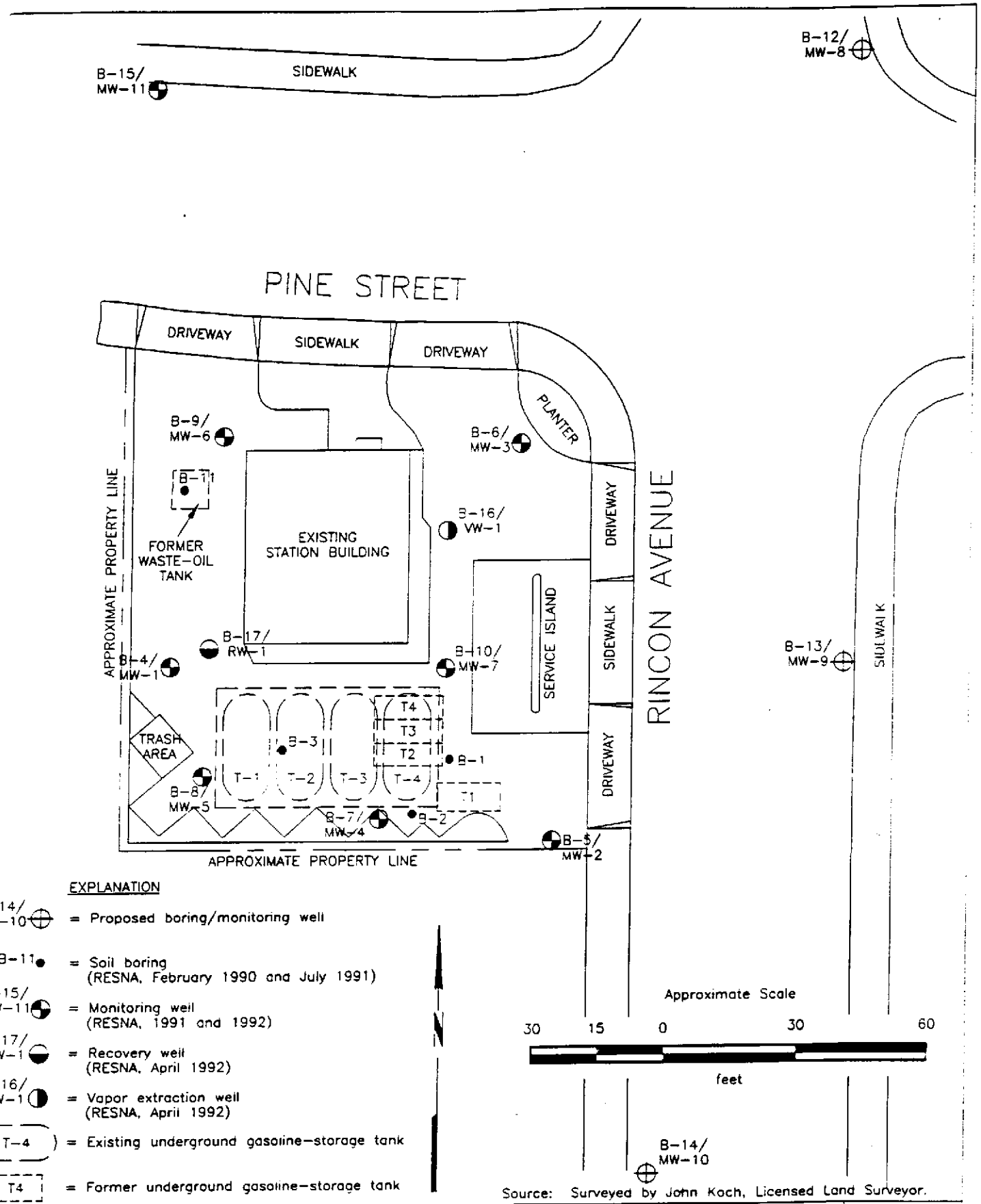
◉ = Site Location

Approximate Scale

2000 1000 0 2000 4000

feet

RESNA	**SITE VICINITY MAP** **ARCO Station 771** **899 Rincon Avenue** **Livermore, California**	**PLATE** **1**
PROJECT 60000.09		



EXPLANATION

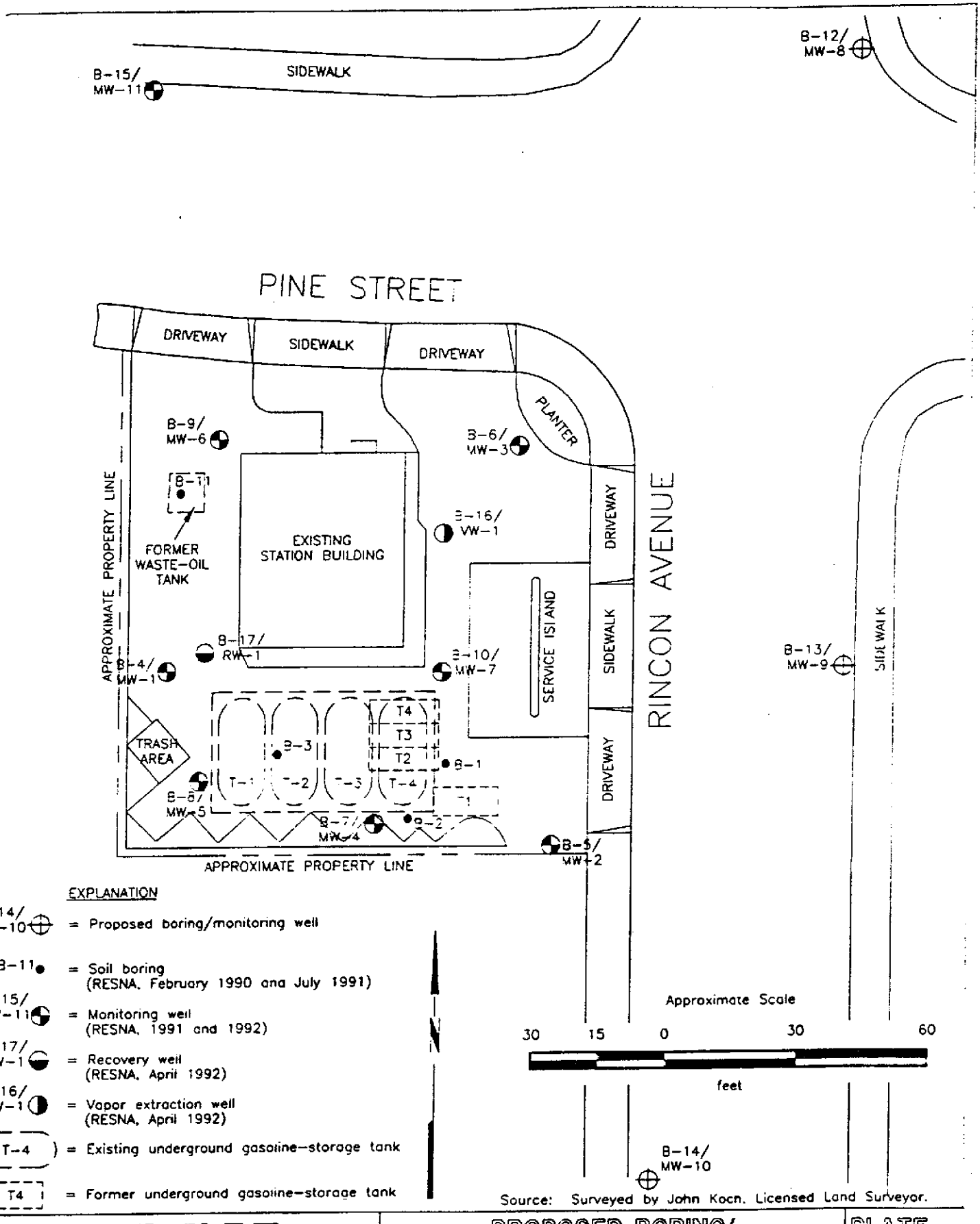
- B-14/MW-10 = Proposed boring/monitoring well
- B-11 = Soil boring (RESNA, February 1990 and July 1991)
- B-15/MW-11 = Monitoring well (RESNA, 1991 and 1992)
- B-17/RW-1 = Recovery well (RESNA, April 1992)
- B-16/VW-1 = Vapor extraction well (RESNA, April 1992)
- (T-4) = Existing underground gasoline-storage tank
- [T4] = Former underground gasoline-storage tank

RESNA
Working to Restore Nature

PROJECT 60000.09

PROPOSED BORING/
MONITORING WELL LOCATIONS
ARCO Station 771
399 Rincon Avenue
Livermore, California

PLATE
1



Source: Surveyed by John Kocn, Licensed Land Surveyor.

RESNA
Working to Restore Nature

PROJECT 60000.09

PROPOSED BORING/ MONITORING WELL LOCATIONS
ARCO Station 771
399 Rincon Avenue
Livermore, California

PLATE
2

APPENDIX E

Material Safety Data Sheets
(MSDS)

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

NFPA Rating
(Oral Toxicity): 2
Toxic Effect Levels:
Inhalation man LC_{LO} 900 ppm (for 1 h)
Inhalation mammal LC_{LO} 30,000 ppm for 8 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, OHS, 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 -12.6°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 -[illegible]°C (-45 to -36°F) (Closed cup)
Extinguisher Media: Dry chemical, carbon dioxide, foam.

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

Autoignition Temperature: 260-480°C (500-853°F)
NFPA Fire Hazard: 3
Special Fire Fighting Procedures: Firefighter 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 emit 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.

NO. 470

MATERIAL SAFETY DATA SHEET

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

GENIUM PUBLISHING CORP.

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 CAT.
Diesel Fuel Oil No. 2-D	>95	8-hr TWA 5mg/m^3* (mineral oil mist)
Complex mixture of paraffinic, olefinic, naphthenic 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 [illegible]

SECTION III. PHYSICAL DATA

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

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_x.

GENIUM PUBLISHING

SECTION VI. HEALTH HAZARD INFORMATION | TLV 5 mg/m^3 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

MOBIL OIL CORPORATION
ENVIRONMENTAL AFFAIRS AND TOXICOLOGY DEPT.
PRINCETON, N.J. 08540

PRODUCT IDENTIFICATION

DIESEL FUELS

HEALTH EMERGENCY TELEPHONE: (212)883-4411
TRANSPORT EMERGENCY TELEPHONE: (800)424-9300(CHEMTREC)

SUPPLIER: MOBIL OIL CORP.
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

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

SOLUBILITY IN WATER: NEGLIGIBLE

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

DIESEL FUEL

********** 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:
ABSORB 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

REVISED:

ENVIRONMENTAL AFFAIRS AND TOXICOLOGY DEPT.
MANAGER OF PRODUCT SAFETY INFORMATION, PHONE: 609-737-1696 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:

- If you see 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

EPA Rating	Oral human TD_{LO}	130 mg/kg
Acute Toxicity: 2	Inhalation human LC_{LO}	10,000 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-hr TWA
25 ppm, Ceiling
50 ppm, Peak 10 min in any 8 hr

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

ACGIH Recommended Limit(s): 10 ppm, 8-hr TLV-TWA
25 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 an 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: 30 C (170 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: 2
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.

DISCLAIMER: This document is based upon information obtained from numerous sources. Every reasonable effort has been made to provide reliable data and information; however, Envirologic Data cannot assume responsibility for the quality or validity of laboratory studies or other data reported in the literature or for the consequences of their use.

MATERIAL SAFETY DATA SHEET

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

GENIUM PUBLISHING CORP

No. 385

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

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 1977 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 LD50 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	Lower	Upper
59 F (15 C) closed cup	510 F (-32 C)	Volume %	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 degradation 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

Industrial Hygiene and Safety

[illegible]

GENIUM PUBLISHING

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, CAG, 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 (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 innalation of vapors, take the following steps:

- 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.
- Vapor: Ventilate area to keep vapor concentration below lower flammability limit.

Disposal Methods:

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

Eyes:
- Gently rinse eye immediately, using large amounts of water, for fifteen minutes, if possible, with eyelids held open.
- If possible, have person remove contact lenses if worn; never permit the eyes to be rubbed.
- Call the Pittsburgh Poison Information Center (1-412-681-6669).
- 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}	100 ppm
Inhalation man LC_{LO}	10,000 ppm (for 6
Oral rat LD_{50}	4,300 mg/kg
Inhalation rat LC_{50}	6,000 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/NIT, MAK, 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 (-13°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 solvents.
Appearance and Odor: Colorless or light colored aromatic liquid with an unrefrigerated 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): 17.2 to 32°C (63 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: 463 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 innalation 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.
≤1,000 ppm: Type C supplied-air respirator with full facepeice 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.

APPENDIX F

Safety Equipment Checklist

Groundwater Sampling

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

PERSONAL PROTECTION

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

✓ RESPIRATOR CARTRIDGE(S)

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

✓ COVERALLS

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

✓ GLOVES

X vinyl
___ neoprene
___ solvent (HNR)
___ acid
___ Viton
___ Silver she

✓ boots/rubbers
✓ safety goggles (H2O exposure)
___ safety glasses
___ hard hat
___ splash shield
✓ steel toe

MONITORING & SURVEILLANCE

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

MISCELLANEOUS

✓ 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 clea
✓ garbage bags
✓ drum/can
✓ visqueen sheeting
✓ hygienic soap
___ detergent

Job Task: Drilling

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 re

___ organic vapor
___ organic/HEPA (dust present)
___ acid/base
___ organic/acid
___ dust pre-filter
___ other

✓ COVERALLS

___ Tyvek
___ chem-tuff (major H_2O exposure)
___ chemrell
___ chem max (level A)
___ PV-tyvek
___ Saranex

✓ GLOVES

___ vinyl
___ neoprene
___ solvent (NBR)
___ acid
___ Viton
___ Silver shiel

___ boots/rubbers
___ safety goggles (H_2O exposure)
✓ safety glasses
✓ hard hat
___ splash shield
___ steel toed

MONITORING & SURVEILLANCE

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

MISCELLANEOUS

___ 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 clean
___ garbage bags
___ drum/can
✓ visqueen sheeting
✓ 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 <u>before</u> 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
	FID	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.