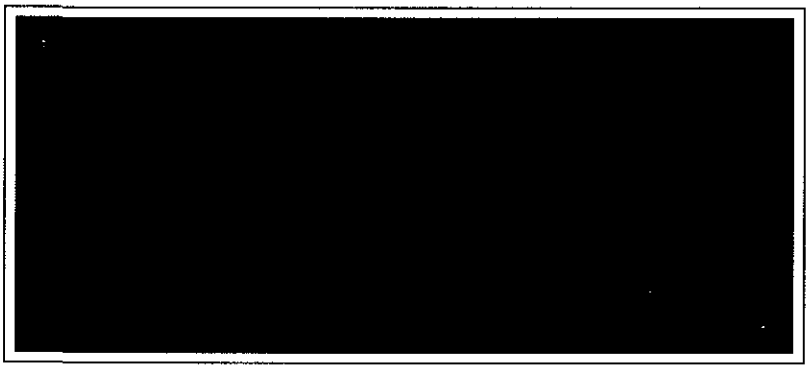

3-14-97

LAIDLAW
ENVIRONMENTAL
SERVICES

ADDITIONAL REMEDIATION WORKPLAN

OAKLAND FUELING AREA
1717 MIDDLE HARBOR ROAD
UPRR TOFC RAILYARD
OAKLAND, CALIFORNIA

PREPARED FOR:

UNION PACIFIC RAILROAD
ENVIRONMENTAL MANAGEMENT
1416 DODGE STREET, ROOM 930
OMAHA, NEBRASKA 68179

Prepared by:

USPCI/Laidlaw Consulting Services
5665 Flatiron Parkway
Boulder, Colorado 80301
Project No. 96199

March 14, 1997

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USPCI
A LAIDLAW COMPANY

Consulting Services

ENVIRONMENTAL
PROTECTION

97 MAR 17 PM 2:48

March 14, 1997

Ms. Jennifer Eberle
Alameda County
Department of Environmental Health Services
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

RE: *Additional Remediation Workplan*, Fueling Area, UPRR Oakland TOFC Railyard, 1717 Middle Harbor Road

Dear Ms. Eberle:

On behalf of Union Pacific Railroad (UPRR), Laidlaw Environmental Services has prepared the enclosed *Additional Remediation Workplan* for the Fueling Area at the Oakland trailer-on-flat-car (TOFC) facility.

If you have any questions or require additional information, please contact Harry Patterson of UPRR at (402) 271-4078 or Denton Mauldin at (303) 938-5539.

Sincerely,

Denton Mauldin, P.E.
Project Manager

Sam Marquis, R.G., P.G.
Project Hydrogeologist

cc: Harry Patterson, UPRR
Mark Gallup, Laidlaw

Enclosure
DM/tjh

5665 Flatiron Parkway Boulder, Colorado 80301-2800
Phone 303.938.5500 Fax 303.938.5520

1. INTRODUCTION

This workplan was prepared by USPCI, a Laidlaw company (Laidlaw) for Union Pacific Railroad (UPRR) as a response to a letter dated January 23, 1997, from Alameda County Department of Environmental Health Services. The purpose of this report is to document the proposed method of enhancing the recovery of light non-aqueous phase liquid (diesel) at the fueling area of the UPRR Oakland trailer-on-flat-car (TOFC) railyard at 1717 Middle Harbor Road in Oakland, California. The objective of this report is to obtain concurrence to proceed with the proposed activities.

The following sections of this report includes background information and the approach for expanding the existing diesel recovery system at the fueling area.

2. BACKGROUND INFORMATION

The fueling area is located in the northern portion of the UPRR Oakland TOFC Yard, which is adjacent to the Oakland Inner Harbor or Oakland Estuary (Figure 1). The area surrounding the site is used for heavy to light commerce. Residential areas are located approximately one-half mile north of the site and across the Oakland Estuary one-half mile south of the site.

2.1 PREVIOUS WORK

Previous investigations indicated the presence of diesel floating on the groundwater near the fueling area. A hydrocarbon recovery and groundwater treatment system (system) was installed to remove diesel on the groundwater near the fueling area and has been operating since May 1992.

The results from prior investigations and environmental engineering activities conducted by Laidlaw have been documented in previous reports. Background information about the site was presented in the report, *Hydrocarbon Investigation and Remediation Design*, dated June 10, 1991. The results of the hydrocarbon investigation and a conceptual design of the system were also presented in this report. The system design was outlined in the *Preliminary Design Report*, dated September 5, 1991. As-built information for the system has been presented in the *Hydrocarbon Recovery System, As-Built Construction Report*, dated July 20, 1992. Process changes to the system were presented in a letter from UPRR dated March 22, 1993 to the East Bay Municipal Utility District; this letter represented the permit renewal application.

2.2 MONITORING

The current activities at the site consist of sampling and maintenance of the system and conducting a groundwater monitoring program on the wells near the fueling area.

Samples are collected from the water stream of the system to assess the performance of the system and to compare discharge concentrations with limits established by the EBMUD. At varying frequencies, water samples are collected from sampling ports located before (influent), between (midfluent), and after (effluent) the two granular activated carbon vessels. The samples are analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) using EPA Method 8020 and total petroleum hydrocarbons as diesel (TPH-D) using EPA Method 8015 Modified.

System maintenance consists of changing particulate filters (typically weekly), backwashing the carbon, and checking the chlorine feed system. Operational readings (cumulative flow, hydrocarbon storage volume, and pressure drop across the particle filters) are collected during each site visit.

Groundwater monitoring activities consist of collecting fluid level measurements in the groundwater monitoring wells on a bi-monthly basis and collecting groundwater samples on a semi-annual basis. Fluid levels measurements are used to generate potentiometric surface maps. The potentiometric surface maps provide information about the groundwater gradient and the operation of the recovery wells. Groundwater samples are collected from wells in which diesel is absent. The samples are submitted to a state-certified laboratory and analyzed for BTEX and TPH-D. Diesel is first recovered by hand using disposable bailers from wells containing measurable amounts of diesel.

2.3 SYSTEM OPERATION

The recovery of diesel is accomplished by depressing the groundwater table with total-fluids pumps to recover diesel and water and creating a cone of depression surrounding the recovery wells. The recovery and treatment system consists of three recovery wells, a diesel/water separator, a recovered diesel storage tank, and an activated carbon treatment system. The recovered groundwater is treated and discharged to the sanitary sewer. The locations of the three recovery wells and the water treatment facility are indicated on Figure 2.

2.4 SYSTEM PERFORMANCE

Since start-up on May 12, 1992, until November 25, 1996, the system has recovered approximately 9,400 gallons of diesel and recovered and treated approximately five million gallons of groundwater. Combined pumping rates for the three well recovery system averages approximately two gallons per minute.

In a report entitled *Third Quarter 1994 Monitoring Report* and dated October 28, 1994, a capture zone analysis was performed to estimate the performance of the three recovery wells (ORW-1, ORW-2, and ORW-3). The results of the analysis indicated the need for additional data to fully establish the effectiveness of the recovery system. To obtain additional data, four piezometers were installed at the fueling area in May, 1995. The November 1996 diesel thickness plume, from the report entitled *The Semi-Annual Monitoring Report Hydrocarbon Recovery System*, and the result of the capture zone analysis are presented in Figure 3, "Results of the Pathline Simulation".

Figure 3 indicates the presence of diesel near the fueling area of the site. Results of the 1994 capture zone analysis indicate that diesel will be recovered from near the three operating recovery wells. The figure also indicates that three recovery wells may not effectively remove diesel downgradient of the gap between ORW-1 and ORW-2. Recovery of diesel could also be enhanced down- and side-gradient (south and east) of the currently operating hydrocarbon recovery system.

3. ADDITIONAL REMEDIATION WORKPLAN

To enhance the recovery of diesel in the fueling area, two phases of effort are proposed. The first phase will include the conversion of two wells into recovery wells and the second phase will include a capture zone analysis to evaluate the effectiveness of the enhanced system after the collection of additional operational information. The following sections present additional information about the two phases.

3.1 RECOVERY WELL CONVERSION

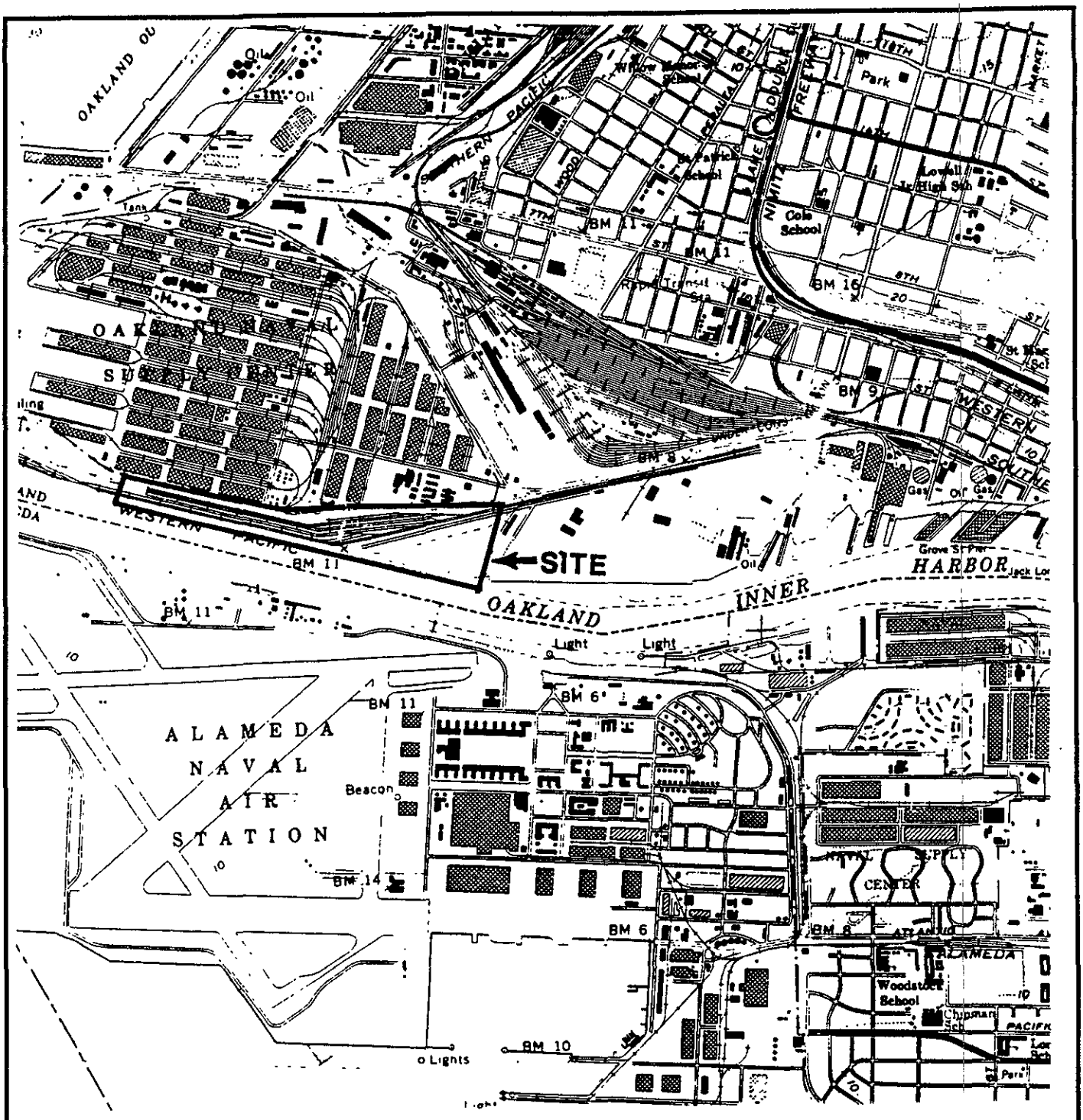
As indicated above, the recovery of diesel can be enhanced downgradient of the gap between ORW-1 and ORW-2, and to the south and east of ORW-1. To recover the diesel to the maximum extent practicable in these areas, the hydrocarbon recovery system will be expanded to include two existing groundwater wells (OP-4 and OMW-9).

Pneumatically operated total fluid recovery pumps will be installed in groundwater monitoring well OMW-9 and piezometer OP-4. The recovery of diesel will be accomplished by depressing the groundwater table with the total-fluids pumps to create a cone of depression. The cone of depression will increase the diesel capture area and the diesel collected in each well will be pumped with the recovered groundwater to the existing treatment system

3.2 CAPTURE ZONE ANALYSIS

After three quarters of operational data have been collected from the enhanced recovery system, a steady-state capture zone analysis for the five recovery well system will be performed to determine whether the capture zones are large enough to recover the entire diesel plume at the fueling area. A computer code, FLOWPATH Version 5, will be selected to perform screening level simulations. The model will be calibrated by comparing field measured (observed) hydraulic heads in the wells at the site with heads predicted for the same wells by FLOWPATH under steady-state flow conditions. Results of the capture zone analysis will be used to develop an understanding of: (1) the effectiveness of the five well recovery system, and (2) whether the system needs to be modified (additional recovery wells, adjusted flow rates, etc.) in order to address the full extent of the diesel plume.

FIGURES



LOCMAP

USPCI

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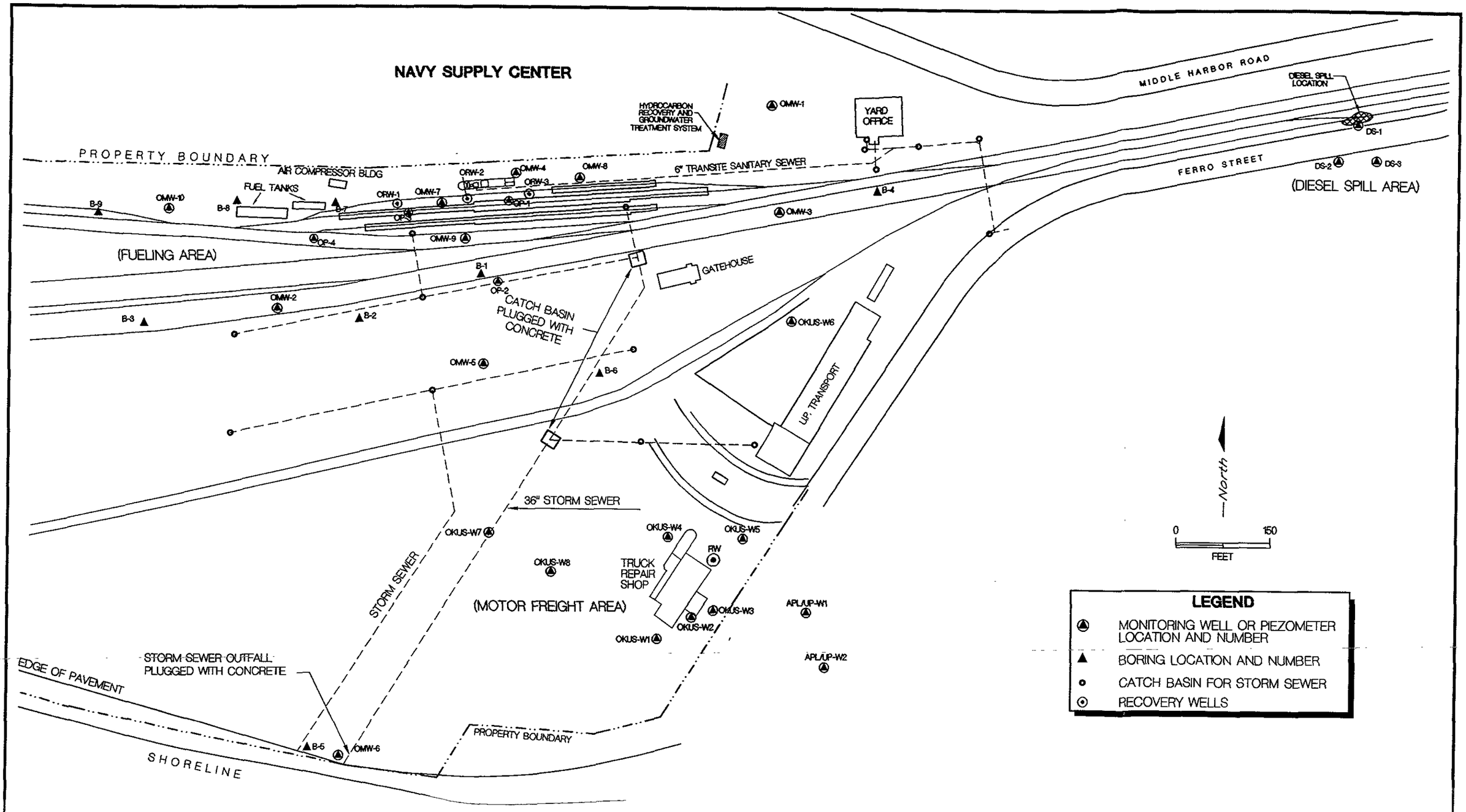
UPRR TOFC RAILYARD - OAKLAND, CALIFORNIA

FIGURE 1
SITE LOCATION MAP

SCALE	DATE
1" = 2000'	10/29/96



	BY	DATE
DRAWN	CJJ	10/24/96
CHECKED		
APPROVED		
APPROVED		
APPROVED		

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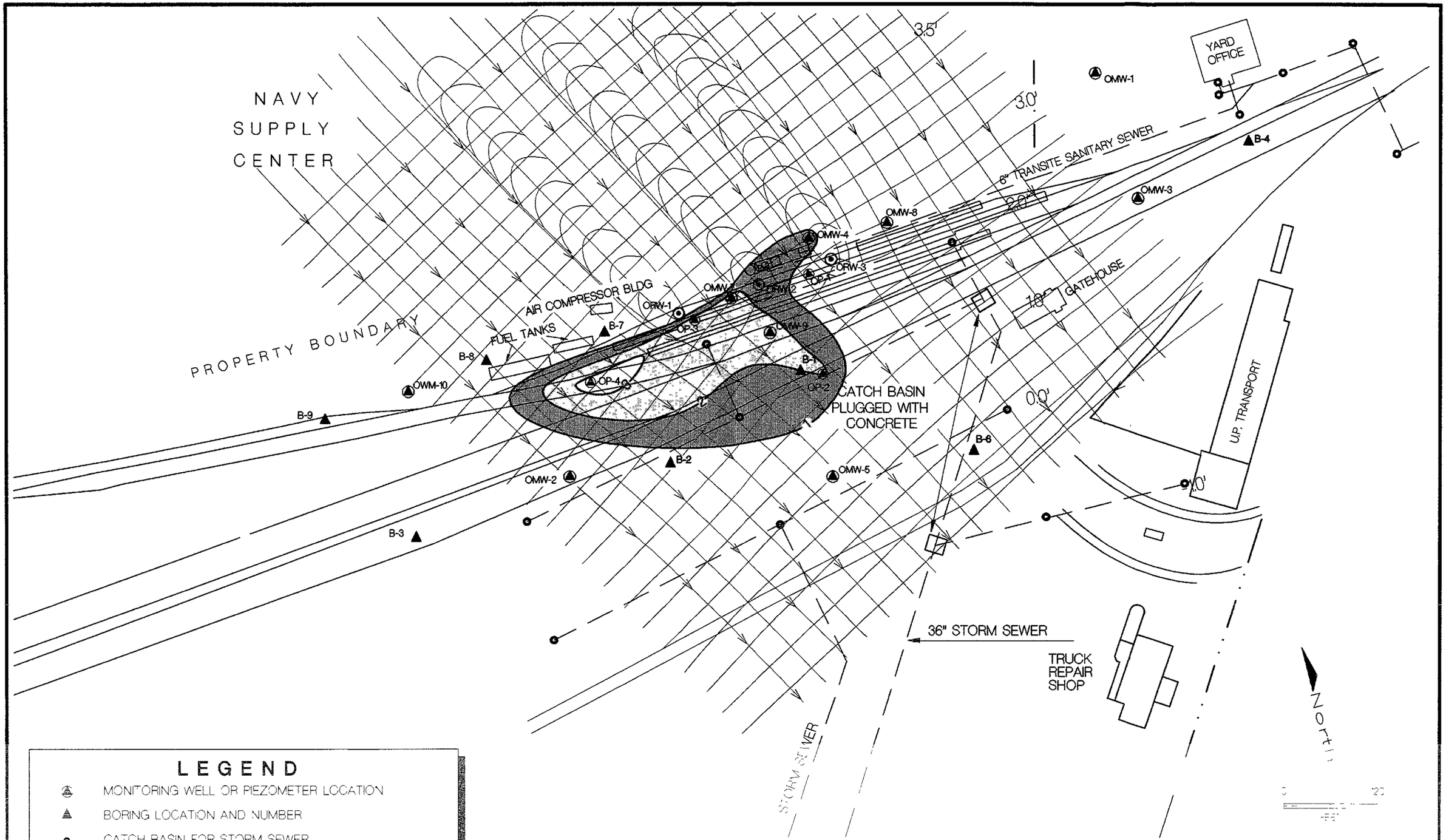
UPRR TOFC RAILYARD - OAKLAND, CALIFORNIA

FIGURE 2
SITE VICINITY MAP

SCALE: 1" = 150'

DWG. NO. 96120-861



LEGEND

- MONITORING WELL OR PIEZOMETER LOCATION
- BORING LOCATION AND NUMBER
- CATCH BASIN FOR STORM SEWER
- RECOVERY WELLS
- DIESEL THICKNESS IN FT (EXCLUDING ORW WELLS)

	BY	DATE
DRAWN	CJJ	2/27/97
CHECKED		
APPROVED		
APPROVED		
APPROVED		

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UPRR TOFC RAILYARD - OAKLAND, CALIFORNIA

FIGURE 3
RESULTS OF PATHLINE SIMULATION (10-94)

SCALE 1" = 120'

DWG NO 96199-78

NAVY
SUPPLY
CENTER

PROPERTY BOUNDARY

HYDROCARBON RECOVERY AND GROUNDWATER TREATMENT SYSTEM

OMW-1

YARD OFFICE

6" TRANSITE SANITARY SEWER

AIR COMPRESSOR BLDG

FUEL TANKS

B-9 OMW-10 B-8 B-7 ORW-1 OMW-7 ORW-2 OMW-4 ORW-3 OMW-8 OP-1 OP-3 OP-4 OMW-9 B-4 OMW-3

GATEHOUSE

B-1 OP-2 OMW-2 B-3 B-2

CATCH BASIN PLUGGED WITH CONCRETE

OMW-5 B-6

U.P. TRANSPORT

CROSSTIES LEFT OFF FOR CLARITY

36" STORM SEWER

STORM SEWER

TRUCK REPAIR SHOP

EDGE OF PAVEMENT

SHORELINE

STORM SEWER OUTFALL PLUGGED WITH CONCRETE

B-5 OMW-6

PROPERTY BOUNDARY

OAKLAND ESTUARY

LEGEND

- MONITORING WELL OR PIEZOMETER LOCATION AND NUMBER
- BORING LOCATION AND NUMBER
- CATCH BASIN FOR STORM SEWER
- RECOVERY WELLS
- SHUT OFF VALVE

North

0 150

FEET

BY	DATE
DRAWN CJW	2/27/96
CHECKED	
APPROVED	
APPROVED	
APPROVED	

USPCI
A LAIDLAW COMPANY

UPRR TOFC RAILYARD - OAKLAND CALIFORNIA

FIGURE 4
PROPOSED RECOVERY WELL CONVERSION

SCALE 1" = 150'

DWG NO 96199-79

APPENDIX - SITE HEALTH AND SAFETY PLAN

Site Health and Safety Plan
Groundwater Recovery and Treatment
System Operation and Maintenance
Union Pacific Railroad
Oakland, California

Prepared by
USPCI/Laidlaw
5665 Flatiron Parkway
Boulder, Colorado 80301
August 1992

Contents

1.0 Introduction

The personal health and safety of all individuals directly involved in the operation of the groundwater recovery and treatment system at the Union Pacific Railroad (UPRR) trailer on freight car (TOFC) railyard in Oakland, California, is of particular concern to USPCI/Laidlaw. Therefore, in accordance with health and safety policies and procedures and the requirements set forth by local, state, and federal laws, USPCI/Laidlaw has developed this Site Health and Safety Plan (SHSP).

This SHSP will be followed during remedial activities consisting of the collection of groundwater elevations from monitoring wells, collection of operational data from the recovery system, and performing routine maintenance of the treatment system. This plan also

- identifies the chemical and physical hazards unique to the project,
- details the controls used to minimize or eliminate the hazards,
- addresses the measures to be taken to protect personnel, the environment, property, and the general public, and
- details the operating procedures to be used under normal and emergency conditions.

Modification of the plan will be the responsibility of the USPCI/Laidlaw Project Manager. Substantial changes will be reviewed and approved by a member of USPCI/Laidlaw's Health and Safety Staff and UPRR. All on-site workers will be trained from this or any modified Site Health and Safety Plan.

This SHSP requires that all persons entering restricted areas on the site

- be fully aware of all potential hazards present;
- be trained as required by the standards for hazardous waste operations and other applicable standards;
- wear and use all prescribed personal protective equipment (PPE);
- read and acknowledge (by signature) this plan;
- be certified by a licensed physician to be physically capable of work at a hazardous waste site, without restrictions; and

2.0 Scope of Work

Union Pacific Railroad is in the railroad transportation business with 23,000 route miles. Operations at this facility consist of loading and unloading of trailers onto flatcars for rail transport. The facility also includes a small, inactive re-fueling rack for diesel locomotives.

The address of the site is 1717 Middle Harbor Road in Oakland, California. The majority of the work will be located near the yard office and the re-fueling area, which are located in the north eastern portion of the site.

A Site Map (see Figure 1) shows the site location. The UPRR Oakland TOFC Yard is located to the west of downtown Oakland, California in a heavy industrial area. The Oakland Inner Harbor borders the site on the south. The Oakland Naval Supply Center borders the site on the north. The land surface is flat with sparse vegetation.

The site can be accessed on public roads. These roads are generally paved asphalt in fair to reasonable condition.

2.1 Work Schedule/Security

Groundwater monitoring will be conducted on a monthly basis. Monitoring of the treatment system will be conducted on a weekly basis. A sign-in/sign-out sheet for USPCI/Laidlaw personnel and authorized visitors will be maintained in the control box of the treatment system.

2.2 General Scope of Work

The objectives of this project are to monitor groundwater elevations and contaminant concentrations, and to maintain the operation of the groundwater recovery and treatment system. Monitoring and operation of this project will last from 4 to 6 years.

2.3 Specific Tasks

The specific tasks will include:

1. Groundwater monitoring:
   a. groundwater elevations
   b. collection of groundwater samples

2. Treatment system monitoring
   a. record operational data
   b. check recovery pumps
   c. check bag filters

3.0 Personnel

USPCI/Laidlaw personnel required to complete the project will be

- One Project Manager Denton Mauldin
- One Project Supervisor/Health & Safety Officer: Pat Speiles
- One or two Maintenance Personnel: Mike Klein and to be named
- One Project Geologist Steve Brinkman

Other personnel will include

- Sampling crew
- Recovered Diesel Recyclers
- Carbon Delivery Drivers

3.1 Job Titles and Duties

The following describes the titles and responsibilities of USPCI/Laidlaw personnel present at the work site, or directly associated with the project.

3.1.1 Project Manager

The Project Manager will have overall responsibility for overseeing the project and will conduct site visits from time to time and be in close contact with the supervisor. He is also responsible for:

- interface with UPRR
- acquisition, dispersal, and maintenance of all supplies and equipment
- maintenance of project records
- maintaining communication, including communicating the hazards of the site, with all parties involved with the site
- ultimate responsibility for health and safety on the project.

3.1.2 Project Supervisor

This person will be responsible for all on-site activities including, but not limited to:

- project health and safety,
- project documentation,
- production/work schedules,
- equipment inspection, and
- protection of the environment from site operations.

The Project Supervisor will also assume the responsibilities of the Health and Safety Officer, responsible for the following

- completing addendums to the SHSP as necessary, and submitting these to corporate health and safety for review and approval,
- ensure that the SHSP is followed,
- ensure the availability and proper use of PPE,
- issue hot work or confined space entry permits, if necessary,
- monitor employees for heat stress and take steps to prevent heat stress, and
- ensure that all emergency procedures are followed

3.1.3 Maintenance Personnel

The duties of the maintenance personnel will be divided as follows.

- Collecting groundwater monitoring information.
- Supervising the operation of the treatment system.

3.1.4 Other personnel

These personnel will follow the requirements of this Site Health and Safety Plan.

4.0 Equipment

The equipment used to remediate this site will include:

- all equipment described in the **"Operation and Maintenance Manual"**
- personnel decontamination equipment
- emergency eye wash
- fire extinguisher
- first aid kit
- visqueen

5.0 Specific Hazards

The specific hazards and controls associated with each work task are detailed in the following table.

Hazards	Controls
General Hazard/All phases of Work	
Fire/Explosion	Make all workers aware of the fire and explosion hazards . Coordinate with UPRR to determine evacuation procedures. Instruct and familiarize personnel with UPRR's emergency procedures and alarm. Provide fire extinguishers. Designate no smoking areas. Monitor air with a Gastech 1214/13 when excavating near gas lines.
Heat Stress	Provide ample drinking water. Provide shaded work and rest areas. Take rest breaks as needed.
Bites (snakes, insects) Poisonous Plants	Visually inspect the work area to identify poisonous plants and look for snakes. Provide insect repellant.
Groundwater Monitoring	
Traffic	Monitor the entrance gate. Follow designated traffic patterns. Maintain safe speeds. When driving in railyard, turn on lights and flashers.

Hazards	Controls
System Operation and Maintenance	
Strikes and blows Cuts and abrasions Slips, trips, and falls Projectiles	Instruct workers on safe work practices. Wear personal protective equipment (PPE).
Material Handling	Use proper lifting techniques. Use forklift/buddy system when possible.
Electrical	Use ground fault circuit interrupters (GFCI). Ensure use of industrial and non-faulty wiring.
Noise	Require hearing protection to be worn while using power equipment.

6.0 Personal Protective Equipment

Zone	Task	PPE
Exclusion Zone	System Operation and Maintenance	Hard Hat Safety Glasses with side-shields Steel-toed, BATA polymax boots Saranex-coated tyvek coveralls will be worn when pulling pumps or removing sludge from oil/water separator Nitrile gloves Leather or cotton gloves
Contamination Reduction Zone	System Operation and Maintenance and Equipment decontamination	Hard Hat Safety Glasses with side-shields Steel-toed, BATA polymax boots Nitrile gloves Leather or cotton gloves
Support Zone	Groundwater Monitoring	Hard Hat Safety Glasses with side-shields Steel-toed, leather boots Surgical gloves, if sampling

7.0 Site Control Measures

The location of the site is indicated on Figure 1. Figure 2 indicates the location of the yard office, the recovery wells, and the equipment locations. The exclusion and contaminant reduction zones are located in the boxed-in area, which is labelled "equipment location".

7.1 Exclusion Zones

The area immediately surrounding the above-ground equipment of the recovery and treatment system and near the recovery wells during pump maintenance, will be the Exclusion Zones (EZs). The EZ near the above-ground equipment will be bordered by a six-foot high chain link fence. The fence will act as a barrier to inadvertent entry from the zone. The EZ for pump maintenance will be near the recovery well head. Visqueen shall be placed on the ballast prior to pulling the pump from the recovery well.

Only the following personnel may enter the EZ:

- personnel properly protected using the required PPE,
- personnel who have completed the required 40 hour training, and
- personnel that have been medically evaluated and found to be "medically fit".

All work with the diesel will be confined to these areas. Smoking, drinking and eating are prohibited in the EZs.

7.2 Contamination Reduction Zone

The Contamination Reduction Zone (CRZ) is located within the fenced area that surrounds the above-ground equipment.

Smoking and eating are prohibited in the CRZs. The yard office will used for heat stress relief and short break periods.

7.3 Support Zone

All areas outside the EZ and CRZ will be the Support Zones (SZs). These zones will be restricted UPRR and USPCI/Laidlaw authorized personnel.

8.0 Decontamination Procedures

8.1 Personnel Decontamination

Personnel that perform pump maintenance or handle diesel shall dispose of any PPE in the receptacles located in the southeast corner of the fenced in area. Personnel will be required to bathe at the end of each day to remove possible contaminants from the skin.

Wastes generated by the decontamination process will remain in the CRZ areas until proper disposal can be accomplished.

8.2 Equipment Decontamination

Equipment will remain outside of the EZs whenever possible. A water spicket, five gallon bucket, long-handled brush, and trisodium phosphate soap are provided in the fenced area for the decontamination of equipment.

9.0 Training

All USPCI/Laidlaw personnel and subcontractors will have completed a 40-hour health and safety training course that complies with 29 CFR 1910.120. Additionally, all personnel will have three days of documented supervised field training. Personnel will have completed an annual health and safety refresher course if required.

All supervisors will have completed an 8-hour supervisory health and safety course. All supervisors will have completed training in accordance with 29 CFR 1926 - OSHA Health and Safety Standards Excavation, Final Rule.

Contractors, subcontractors, clients, and any other persons present at the site are required to document the required training that is relevant to their activities.

A pre-job conference and daily site safety meetings will be held. Each day the Project Supervisor or his designate will review any changes or modifications to the Health and Safety Plan, describe the assigned tasks for the day, and identify their potential hazards. This meeting shall also be used to obtain feedback on health and safety conditions.

10.0 Medical Monitoring Requirements

All USPCI/Laidlaw personnel will be participants in the standard company medical surveillance program. This program includes pre-employment, annual, termination, and special project examinations. All subcontractors will participate in a medical surveillance program that includes, as a minimum, blood chemistries, blood work for PCBs and heavy metals, audiometric testing, and spirometry.

Copies of the medical certifications of all USPCI/Laidlaw and subcontractor personnel working on-site will be available on-site.

A close-out physical will be required for all on-site personnel.

11.0 Emergency and Spill Containment Plan

The purpose of the Emergency and Spill Containment Plans is to provide procedures for personnel to follow in the event of an emergency (fire, injury, spill, etc.) and to provide emergency response agencies with the necessary information to adequately react to any emergency situation. Prior to start of work on-site, the specific outside emergency agencies (i.e. hospital, fire department, police, etc.) will be contacted and supplied with the necessary information (contaminants, location of work, etc.) to adequately provide emergency services.

During the project, any on-site employee who has an illness or injury that causes him to miss more than one day of work will provide the Site Safety Officer with a written statement, signed by a physician, indicating the employee's fitness to return to work. A copy of this statement will be available to UPRR.

11.1 Emergency Plan

For purposes of this Plan, an emergency is defined as any fire, explosion, gaseous release, hazardous material spill, worker contamination, or worker injury. All personnel will be instructed on how to respond to any of the above situations, regardless of the severity. The on-site Project Supervisor will be the Site Safety Officer and will make all decisions relative to the situation. He will determine the need to contact UPRR and/or outside agencies for assistance in any emergency.

The following information will be summarized and posted:

- a list of response agencies/personnel and phone numbers, and
- detailed written instructions that describe the location and route to the nearest hospital.

11.1.1 General Emergency Response Procedures

Phone numbers of emergency response agencies/personnel will be posted. Personnel will be trained in initial emergency response procedures, including fire extinguisher use and evacuation procedures. General procedures to be followed in the case of an emergency are provided below.

1. In the case of injury, worker contamination, fire, spill, or other emergency, immediately stop operations and contact the Site Safety Officer. Workers will maintain a safe distance from the emergency (approximately 100 yards).

2. Report the exact nature of the emergency including type of injury, number of injuries, amount of spill, etc. to the emergency response agencies/personnel.

3. The Site Safety Officer will contact UPRR to coordinate further response actions, possibly including contacting outside agencies.

4. If an outside agency is notified to respond, a representative will be dispatched to the entrance gate to escort the emergency team to the appropriate work area.

5. Work will not resume until the Site Safety Officer has given approval.

11.1.2 Fire

Minor fires will be handled by personnel in the following manner.

1. For all fires, notify the Site Safety Officer immediately.

2. Use available fire extinguisher to control the fire.

3. If unable to control the fire, evacuate upwind and notify the Site Safety Officer of the extent of the fire.

4. The Site Safety Officer will notify UPRR and/or the appropriate fire department, as necessary.

11.1.3 Explosion

USPCI/Laidlaw will work closely with UPRR personnel to coordinate emergency procedures in the case of an explosion. At a minimum, all on-site personnel will be familiar with UPRR emergency procedures. This will include, but may not be limited to, recognition of the UPRR alarm and coordinated evacuation procedures.

11.1.4 Injury

The following procedures will be followed if a worker is injured:

1. Any injury will be reported to the Site Safety Officer.

2. Any injured worker will be immediately removed from the Exclusion Zone and transported to the yard office.

3. The Site Safety Officer or other qualified persons will provide first aid as necessary.

4. In the case of serious injury, the worker will not be removed unless a hazardous situation has been created in the fenced area. The Site Safety Officer or his assistant will direct further actions.

11.1 6 Post Emergency Actions

The Site Safety Officer will decide when site conditions are appropriate to resume work operations.

11.1.7 Equipment

Emergency equipment will include:

- emergency eye wash
- fire extinguisher
- first aid kit

11.2 Spill Containment Plan

To prevent on-site spills, the following procedures will be adopted.

Oil/Water Separator

The oil/water separator is equipped with a spill containment wall. In the event of a spill, a high level float will notify key maintenance personnel.

Equalization Tank

The level of liquid in the equalization tank in the fenced in area has a high level alarm to prevent spillage.

Pumps and Hoses

All hoses, connectors and pumps used to transfer liquids to the storage tanks will be checked periodically for leaks. Pumps, hoses, and other miscellaneous items used to transfer potentially contaminated liquid will remain in the EZ.

All spill material will be collected and pumped through the treatment system.

11.2.1 Solid Materials/Course of Action

In the event of any spill of solid materials on-site, the following procedures will be implemented.

1. Notify the Project Manager and UPRR immediately.

2. Control and containment will only be carried out by personnel wearing eye protection, hard hat, steel-toed/BATA polymax rubber boots, and nitrile gloves.

3. Keep unnecessary persons away, isolate hazardous areas, and deny entry.

4. Using shovels, the trac-hoe, or a loader, pick up the spilled material and load it into transfer boxes. Transport the material to the fenced in area or coordinate a storage location with the terminal manager.

5. Depending on the amount of spillage, store the material in a 55 gallon drum or cover stockpiled material with visqueen.

11.2.2 Liquid Materials/Course of Action

In the event of a spill of liquid material on-site, the following actions will be taken.

1. Eliminate the discharge if possible by patching the leak, closing the valve, pumping out the sump, or whatever appropriate action is required.

2. Contain the discharge by berming with sand bags or constructing and earthen berm around the spill area.

3. Test for contamination.

3. Remove or retrieve any contaminated discharged liquids, if possible, and transfer to the oil/water separator for treatment in the system.

11.2.3 Equipment

The following equipment and supplies will be kept on-site at all times during waste removal:

- transfer pumps
- oil adsorbent materials
- shovels

Equipment will be stored in the fenced in area.

12.0 Sign-Off

I acknowledge that I have read and understand this Site Health and Safety Plan and will comply with the requirements of the Plan.

NAME PRINTED	COMPANY	SIGNATURE	DATE

13.0 Emergency Phone Numbers and Route to Hospital

13.1 Phone Numbers

California Highway Patrol 3601 Telegraph Ave. Oakland, California	911 or (510) 464-1280
Oakland Fire Department Oakland, California	911 or (510) 238-3856
Ambulance Service	911 or (510) 874-8010
Summit Medical Center 450 30th St. at Telegraph Ave. Oakland, California	(510) 655-4000

13.2 Route to Hospital

Leave site and go south on Middle Harbor Road to 3rd Street (approx. 1/2 mile) and turn right. Proceed south on 3rd Street for 1/2 mile to Broadway and turn left (east). Proceed on Broadway for 1.5 miles to 30th Street and turn left (north). Peralta Hospital is one block down 30th Street, at the corner of 30th and Telegraph Avenue. The length of the route is approximately 2 miles and will take about 15 minutes.

14.0 Health Hazards/ Chemical Hazards Chart

14.1 Diesel Fuel Oil No. 2

Information pertaining to the health and chemical hazards of diesel fuel oil No. 2 are outlined in the material safety data sheet (MSDS), which is included in Attachment 1.

14.2 Benzene

Health and chemical hazards of benzene are presented in the chart below and the MSDS (Attachment 1).

Category	Explanation/Notation
Substance	Benzene
Anticipated Amount on-site	20 mg/l in groundwater
PEL	0.1 ppm
IDLH	3000 ppm
Symptoms of Exposure	Inhalation - Irrit eyes, nose, and resp Skin Adsorption - sys; gidd; head, nau, Ingestion - staggered gait; ftg, anor Skin or eye contact - lass; derm; bone marrow, depres; [carc]
Incompatibilities	Strong oxidizers, many fluorides and perchlorates, nitric acid
Unusual Properties	Class 1B Flammable Liquid
Flash Point	12 degrees F
Vapor Pressure	75 mm
Specific Gravity	0.88
Boiling Point	176 degrees F
Color	Colorless to light yellow
Target Organs/Toxicity	Blood, CNS, skin, bone marrow, eyes, resp sys.

14.3 Ethylbenzene

Health and chemical hazards of ethylbenzene are presented in the chart below and the MSDS (Attachment 1).

Category	Explanation/Notation
Substance	Ethylbenzene
Anticipated Amount on-site	10 mg/l in groundwater
PEL	100 ppm
IDLH	2000 ppm
Symptoms of Exposure	Inhalation - Irrit eyes, muc memb Ingestion - head; derm; narco, coma
Incompatibilities	Strong oxidizers
Unusual Properties	Class 1B Flammable Liquid
Flash Point	55 degrees F
Vapor Pressure	10 mm (79 degrees F)
Specific Gravity	0.87
Boiling Point	277 degrees F
Color	Colorless liquid with an aromatic odor
Target Organs/Toxicity	Eyes, upper resp sys, skin CNS

14.4 Toluene

Health and chemical hazards of toluene are presented in the chart below and the MSDS (Attachment 1).

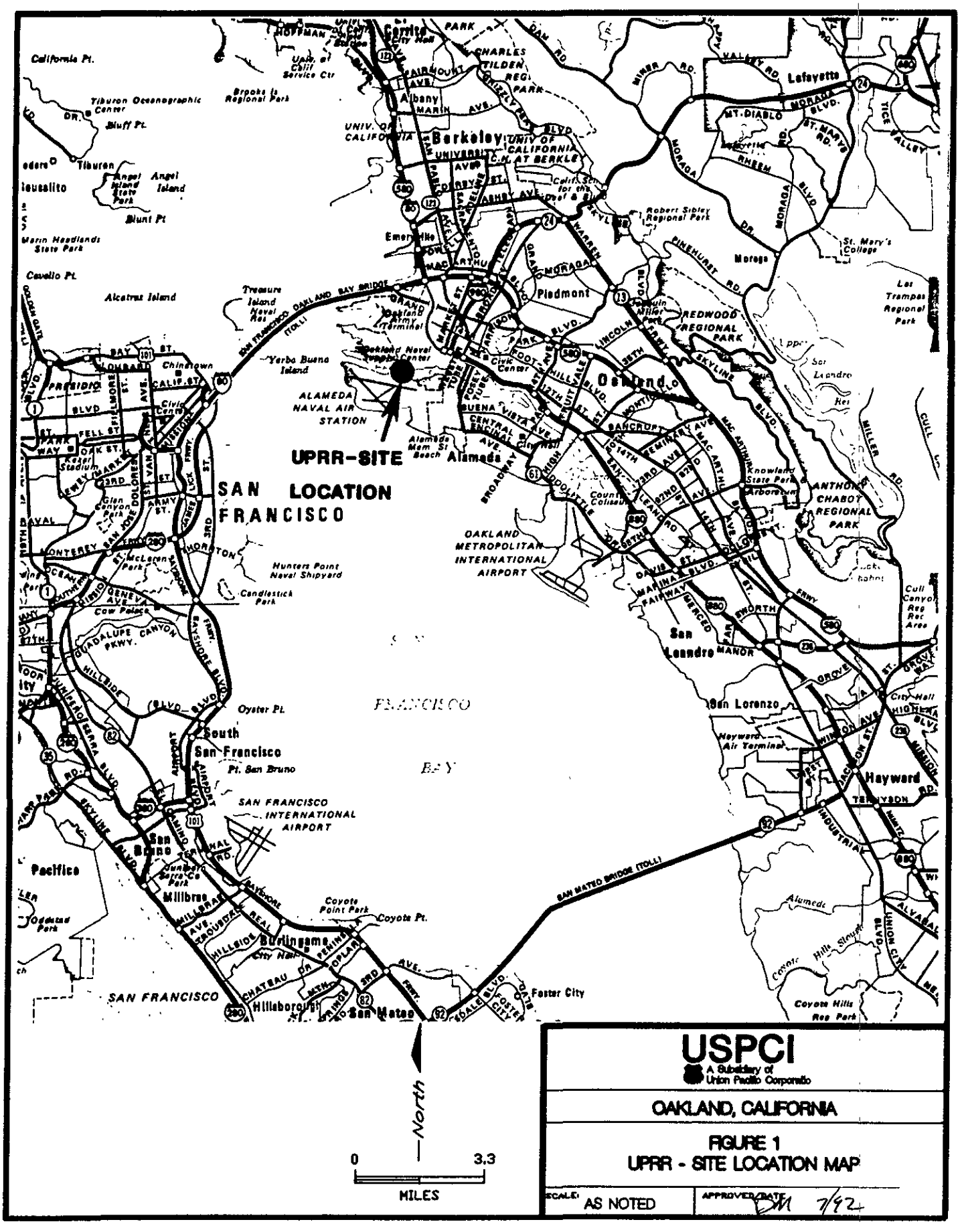
Category	Explanation/Notation
Substance	Toluene
Anticipated Amount on-site	10 mg/l in groundwater
PEL	100 ppm
IDLH	2000 ppm
Symptoms of Exposure	Inhalation - Ftg, weak; conf, euph, Skin adsorption - dizz, head; dilated pupils, Ingestion - lac; ner, musc ftg, insom Skin or eye contact - pares; derm
Incompatibilities	Strong oxidizers
Unusual Properties	Class 1B Flammable Liquid
Flash Point	40 degrees F
Vapor Pressure	20 mm (65 degrees F)
Specific Gravity	0.87
Boiling Point	232 degrees F
Color	Colorless liquid with a sweet pungent, benzene-like odor
Target Organs/Toxicity	Liver, kidneys, CNS, skin

14.5 Xylenes

Health and chemical hazards of xylenes are presented in the chart below and the MSDS (Attachment 1).

Category	Explanation/Notation
Substance	Xylenes
Anticipated Amount on-site	10 mg/l in groundwater
PEL	100 ppm
IDLH	1000 ppm
Symptoms of Exposure	Inhalation - Dizz, excitement, drow, Skin adsorption - inco, staggering gait Ingestion - irrit eyes, nose, throat; Skin or eye contact - corneal vacuolization; anor, nau, vomit, abdom pain; derm
Incompatibilities	Strong oxidizers
Unusual Properties	Class 1B, 1C Flammable Liquid
Flash Point	63-84 degrees F
Vapor Pressure	7-9 mm
Specific Gravity	0.87
Boiling Point	269-292 degrees F
Color	Colorless liquid with an aromatic odor
Target Organs/Toxicity	Liver, kidneys, CNS, skin, eyes GI tract, blood

Figures



USPCI
A Subsidiary of Union Pacific Corporation

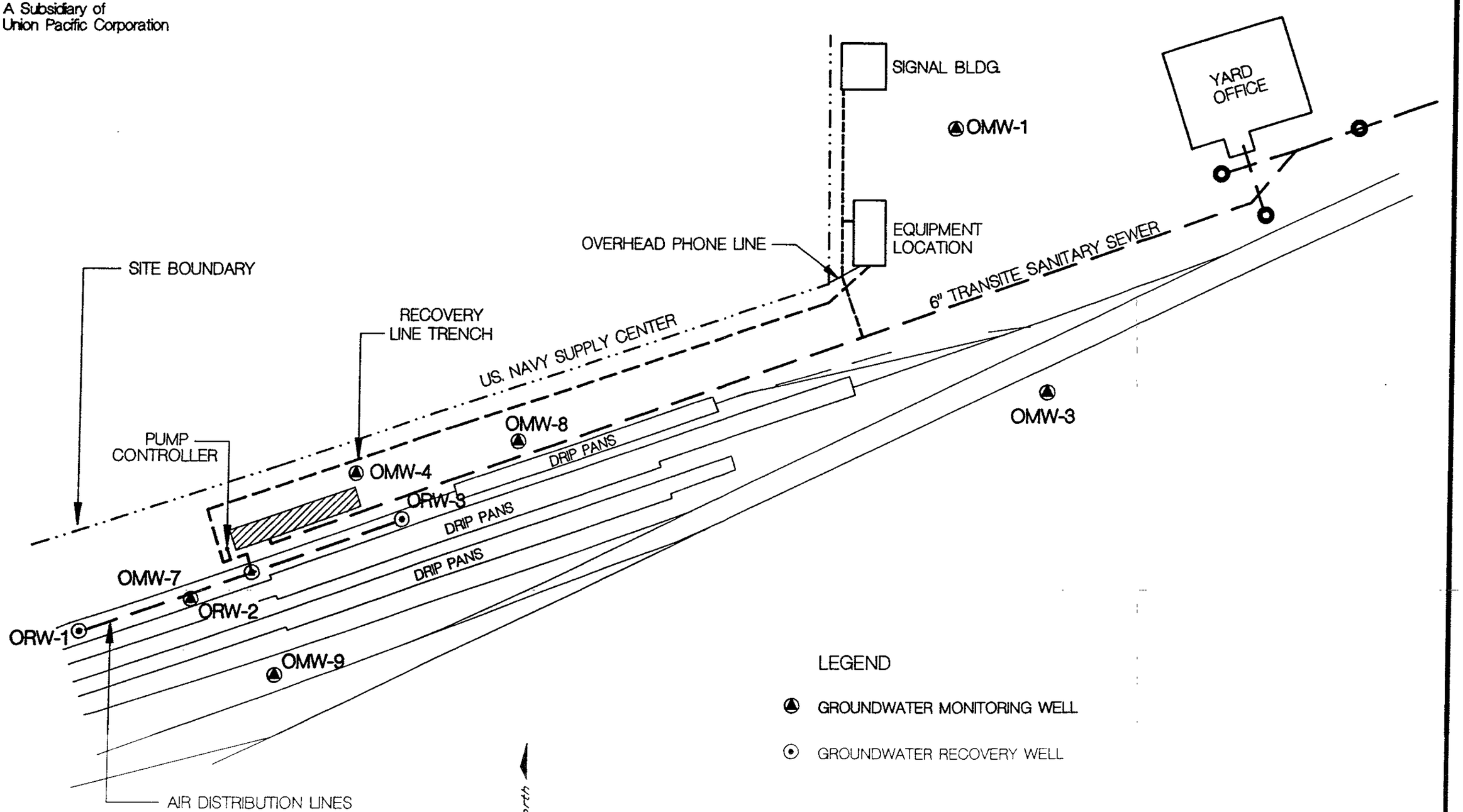
OAKLAND, CALIFORNIA

FIGURE 1
UPRR - SITE LOCATION MAP

SCALE: AS NOTED

APPROVED/DATE: 7/92

USPCI
A Subsidiary of
Union Pacific Corporation



LEGEND

- GROUNDWATER MONITORING WELL
- GROUNDWATER RECOVERY WELL

BY	DATE
JRH	7-92
DM	7/92
DM	7/92

USPCI
A Subsidiary of
Union Pacific Corporation

OAKLAND, CALIFORNIA

FIGURE 2
GROUNDWATER RECOVERY AND TREATMENT SYSTEM LOCATION

SCALE 1"=60' | DWG NO 96199-13

Attachment 1
MSDS Sheets

MATERIAL SAFETY DATA SHEET

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

GENIUM PUBLISHING CORP.

NO. 470

DIESEL FUEL OIL NO. 2-D

Date October 1981

SECTION I. MATERIAL IDENTIFICATION

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

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

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

SECTION III. PHYSICAL DATA

Boiling point range, deg F, -------	Ca 340-675	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	LOWER	UPPER
125F min (PM)	>500F	% by volume	0.6	7.5

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

SECTION V. REACTIVITY DATA

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

NO. 474

SECTION VI. HEALTH HAZARD INFORMATION

TLV 5 mg/m^3 (oil) (mist) (See Sect II)

Inhalation of excessive concentrations of fume 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). Heavy repeated application of #6 oil to rabbit skin gave severe skin changes & systemic toxicity: EPA(TOSCA)Document 8EHQ-0181-0377, Dec '80.

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 waterless cleanser. Then wash residue with soap and water. Caution: Hot liquid may cause minor burns; apply ice compresses.

Inhalation: Remove to fresh air. Restore and/or support breathing as required.

Ingestion: Do not induce vomiting. Contact physician.

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.

NOTE: Establish a plan to prevent/control spills where material used or handled.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide adequate ventilation where operating conditions (heating or spraying) may create excessive fumes or mists. Use explosion-proof equipment. Provide approved respiratory apparatus for nonroutine or emergency use. Use an approved filter & vapor respirator when fume/mist concentrations are high. Wear protective neoprene 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 eyewash 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). Minimize skin contact with No. 6 fuel oil.

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 LIQUID DOT I.D. No. UN1993

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

APPROVALS: MIS CRD J. M. [signature]

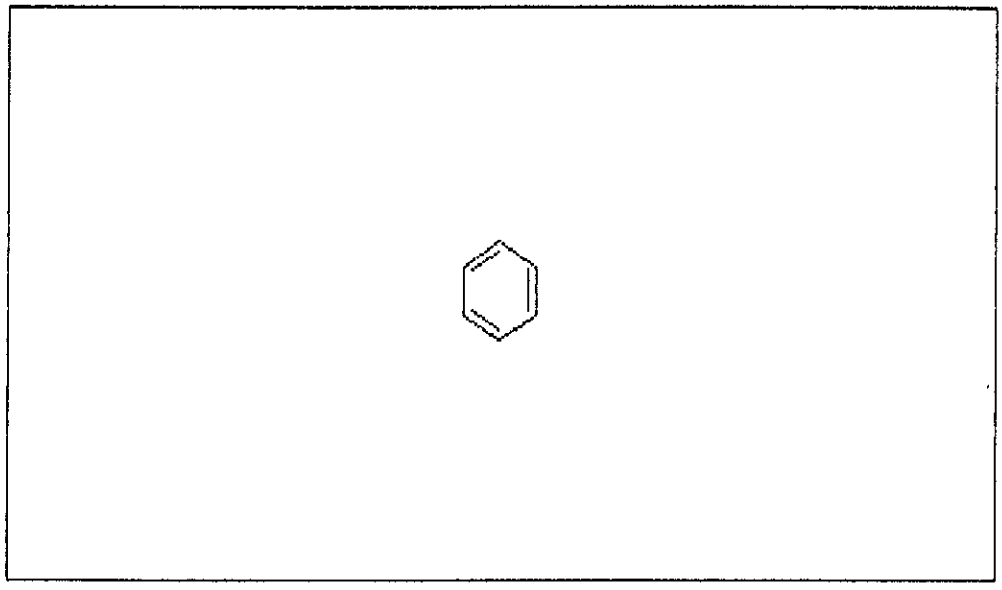
Industrial Hygiene and Safety [signature] 10-29-81

MEDICAL REVIEW: 14 November 1981

MATERIAL SAFETY DATA SHEET Valid 5/92- 7/92

Sigma-Aldrich Corporation
1001 West Saint Paul Ave. Milwaukee, WI 53233 USA

	Sigma	Aldrich
For Emergency Contact USA/Canada	800-325-5832	800-231-8327
Outside USA/Canada	314-771-5765	414-273-3850



IDENTIFICATION

PRODUCT #: 12552 NAME: BENZENE
CAS #: 71-43-2
MF: C6H6

SYNONYMS

(6)ANNULENE * BENZEEN (DUTCH) * BENZEN (POLISH) * BENZENE (ACGIH,DOT, OSHA) * BENZIN (OBS.) * BENZINE (OBS.) * BENZOL * BENZOL (DOT) * BENZOLE * BENZOLENE * BENZOLO (ITALIAN) * BICARBURET OF HYDROGEN * CARBON OIL * COAL NAPHTHA * CYCLOHEXATRIENE * FENZEN (CZECH) * MINERAL NAPHTHA * MOTOR BENZOL * NCI-C55276 * NITRATION BENZENE * PHENE * PHENYL HYDRIDE * PYROBENZOL * PYROBENZOLE * RCRA WASTE NUMBER U019 * UN 1114 (DOT) *

TOXICITY HAZARDS

RTECS NO: CY1400000
BENZENE

IRRITATION DATA

SKN-RBT 15 MG/24H OPEN MLD	AIHAAP 23,95,62
SKN-RBT 20 MG/24H MOD	85JCAE -,25,86
EYE-RBT 88 MG MOD	AMIHAB 14,387,56
EYE-RBT 2 MG/24H SEV	85JCAE -,25,86

TOXICITY DATA

IHL-HMN LCLO:2 PPH/5M	TABIA2 3,231,33.
ORL-MAN LDLO:50 MG/KG	YAKUD5 22,883,80
IHL-HMN LCLO:2000 PPM/5M	YAKUD5 22,883,80
IHL-HMN LCLO:65 MG/M3/5Y	ARGEAR 44,145,74
UNR-MAN LDLO:194 MG/KG	85DCAI 2,73,70
ORL-RAT LD50:930 MG/KG	TXAPA9 7,767,65
IHL-RAT LC50:10000 PPM/7H	28ZRAQ -,113,60
IPR-RAT LD50:2890 UG/KG	36YFAG -,302,77
ORL-MUS LD50:4700 MG/KG	HYSAAV 32(3),349,67
IHL-MUS LC50:9980 PPM	JIHTAB 25,366,43
IPR-MUS LD50:340 MG/KG	ANYAA9 243,104,75

REVIEWS, STANDARDS, AND REGULATIONS

ACGIH TLV-SUSPECTED CARCINOGEN 85INA8 5,50,86

ACGIH TLV-TWA 10 PPM 85INA8 5,50,86

IARC CANCER REVIEW:HUMAN LIMITED EVIDENCE IMEMDT 7,203,74

IARC CANCER REVIEW:ANIMAL SUFFICIENT EVIDENCE IMSUDL 7,120,87

IARC CANCER REVIEW:ANIMAL LIMITED EVIDENCE IMEMDT 29,93,82

IARC CANCER REVIEW:HUMAN SUFFICIENT EVIDENCE IMEMDT 29,93,82

IARC CANCER REVIEW:ANIMAL INADEQUATE EVIDENCE IMEMDT 7,203,74

IARC CANCER REVIEW:GROUP 1 IMSUDL 7,120,87

MSHA STANDARD:AIR-CL 25 PPM (80 MG/M3) (SKIN) DTLVS* 3,22,71

OSHA-CANCER HAZARD FEREAC 52,34460,87

NIOSH REL TO BENZENE-AIR:10H TWA 0.32 MG/M3;CL 3.2 MG/M3/15M MMWR** 37(S-7),5,88

NOHS 1974: HZD 09070; NIS 126; TNF 11184; NOS 106; TNE 147583

NOES 1983: HZD 09070; NIS 92; TNF 10054; NOS 117; TNE 272275; TFE 143066

ATSDR TOXICOLOGY PROFILE (NTIS** PB/89/209464/AS)

EPA GENETOX PROGRAM 1988, POSITIVE: CARCINOGENICITY-MOUSE/RAT

EPA GENETOX PROGRAM 1988, POSITIVE: IN VITRO CYTOGENETICS-HUMAN LYMPHOCYTE

EPA GENETOX PROGRAM 1988, POSITIVE: IN VIVO CYTOGENETICS-HUMAN LYMPHOCYTE

EPA GENETOX PROGRAM 1988, POSITIVE: MAMMALIAN MICRONUCLEUS; SPERM MORPHOLOGY-MOUSE

EPA GENETOX PROGRAM 1988, NEGATIVE: CELL TRANSFORM.-SA7/SHE; IN VITRO SCE-HUMAN LYMPHOCYTES

EPA GENETOX PROGRAM 1988, NEGATIVE: IN VITRO SCE-HUMAN

EPA TSCA CHEMICAL INVENTORY, JUNE 1990

EPA TSCA SECTION 8(E) STATUS REPORT 8EHQ-0680-0345;8EHQ-1277-0027; 8EHQ-0378-0112

EPA TSCA SECTION 8(E) STATUS REPORT 8EHQ-0978-0244;8EHQ-0379-0277

EPA TSCA SECTION 8(E) STATUS REPORT 8EHQ-0378-0112

ON EPA IRIS DATABASE

EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JANUARY 1992

NIOSH ANALYTICAL METHODS: SEE HYDROCARBONS, AROMATIC, 1501; HYDROCARBONS, BP 36-126 C, 1500;

NIOSH ANALYTICAL METHODS: SEE BENZENE BY PORTABLE GC, 3700

NIOSH ANALYTICAL METHODS: SEE HYDROCARBONS, AROMATIC 1501

NTP CARCINOGENESIS STUDIES (GAVAGE);CLEAR EVIDENCE:MOUSE,RAT NTPTR* NTP-TR-289,86

NTP SIXTH ANNUAL REPORT ON CARCINOGENS, 1991 : KNOWN TO BE CARCINOGENIC

OSHA ANALYTICAL METHOD #12

TARGET ORGAN DATA

PERIPHERAL NERVE AND SENSATION (SPASTIC PARALYSIS WITH/WITHOUT SENSORY CHANGE)
PERIPHERAL NERVE AND SENSATION (FLACCID PARALYSIS WITHOUT ANESTHESIA)
SENSE ORGANS AND SPECIAL SENSES (HEMORRHAGE)
SENSE ORGANS AND SPECIAL SENSES (TUMORS)
BEHAVIORAL (SOMNOLENCE)
BEHAVIORAL (TREMOR)
BEHAVIORAL (CONVULSIONS OR EFFECT ON SEIZURE THRESHOLD)
BEHAVIORAL (IRRITABILITY)
LUNGS, THORAX OR RESPIRATION (CHRONIC PULMONARY EDEMA OR CONGESTION)
LUNGS, THORAX OR RESPIRATION (TUMORS)
GASTROINTESTINAL (GASTRITIS)
GASTROINTESTINAL (NAUSEA OR VOMITING)
LIVER (OTHER CHANGES)
BLOOD (CHANGES IN CELL COUNT)
BLOOD (OTHER CHANGES)
BLOOD (LEUKEMIA)
BLOOD (LYMPHOMA INCLUDING HODGKIN'S DISEASE)
SKIN AND APPENDAGES (AFTER SYSTEMIC EXPOSURE: DERMATITIS, OTHER)
EFFECTS ON FERTILITY (PRE-IMPLANTATION MORTALITY)
EFFECTS ON FERTILITY (POST-IMPLANTATION MORTALITY)
EFFECTS ON FERTILITY (ABORTION)
EFFECTS ON EMBRYO OR FETUS (EXTRA EMBRYONIC STRUCTURES)
EFFECTS ON EMBRYO OR FETUS (CYTOLOGICAL CHANGES)
EFFECTS ON EMBRYO OR FETUS (FETOTOXICITY)
EFFECTS ON EMBRYO OR FETUS (FETAL DEATH)
EFFECTS ON EMBRYO OR FETUS (OTHER EFFECTS TO EMBYRO OR FETUS)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (MUSCULOSKELETAL SYSTEM)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (BLOOD AND LYMPHATIC SYSTEMS)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (OTHER DEVELOPMENTAL ABNORMALITIES)
EFFECTS ON NEWBORN (BIOCHEMICAL AND METABOLIC)
NUTRITIONAL AND GROSS METABOLIC (BODY TEMPERATURE INCREASE)
TUMORIGENIC (CARCINOGENIC BY RTECS CRITERIA)
TUMORIGENIC (NEOPLASTIC BY RTECS CRITERIA)
TUMORIGENIC (EQUIVOCAL TUMORIGENIC AGENT BY RTECS CRITERIA)
ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATION.

---------- HEALTH HAZARD DATA ----------

TLV AND SOURCE

FOR BENZENE:
ACGIH TLV-TWA: 10 PPM.
OSHA PEL: 8H TWA 1 PPM; STEL: 5 PPM (15 MIN.).

ACUTE EFFECTS

DANGER: CONTAINS BENZENE, CANCER HAZARD.
HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN.
MATERIAL IS IRRITATING TO MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT.
CAUSES SKIN IRRITATION.
CAUSES SEVERE EYE IRRITATION.
EXPOSURE CAN CAUSE:
NAUSEA, DIZZINESS AND HEADACHE
NARCOTIC EFFECT

CHRONIC EFFECTS

CARCINOGEN.
MAY ALTER GENETIC MATERIAL.

BLOOD EFFECTS
TARGET ORGAN(S):
BLOOD
BONE MARROW

FIRST AID

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS. CALL A PHYSICIAN.
REMOVE AND WASH CONTAMINATED CLOTHING PROMPTLY.

ADDITIONAL INFORMATION

INHALATION OF HIGH CONCENTRATIONS OF BENZENE MAY HAVE AN INITIAL STIMULATORY EFFECT ON THE CENTRAL NERVOUS SYSTEM CHARACTERIZED BY EXHILARATION, NERVOUS EXCITATION AND/OR GIDDINESS, DEPRESSION, DROWSINESS, OR FATIGUE. THE VICTIM MAY EXPERIENCE TIGHTNESS IN THE CHEST, BREATHLESSNESS AND LOSS OF CONSCIOUSNESS. TREMORS, CONVULSIONS AND DEATH DUE TO RESPIRATORY PARALYSIS OR CIRCULATORY COLLAPSE CAN OCCUR IN A FEW MINUTES TO SEVERAL HOURS FOLLOWING SEVERE EXPOSURES. ASPIRATION OF SMALL AMOUNTS OF LIQUID IMMEDIATELY CAUSES PULMONARY EDEMA AND HEMORRHAGE OF PULMONARY TISSUE. DIRECT SKIN CONTACT MAY CAUSE ERYTHEMA. REPEATED OR PROLONGED SKIN CONTACT MAY RESULT IN DRYING, SCALING DERMATITIS OR DEVELOPMENT OF SECONDARY SKIN INFECTIONS. THE CHIEF TARGET ORGAN IS THE HEMATOPOIETIC SYSTEM. BLEEDING FROM THE NOSE, GUMS OR MUCOUS MEMBRANES AND THE DEVELOPMENT OF PUPURIC SPOTS (SMALL BLISTERS), PANCYTOPENIA, LEUKOPENIA, THROMBOCYTOPENIA, APLASTIC ANEMIA AND LEUKEMIA MAY OCCUR AS THE CONDITION PROGESSES. THE BONE MARROW MAY APPEAR NORMAL, APLASTIC OR HYPERPLASTIC, AND MAY NOT CORRELATE WITH PERIPHERAL BLOOD-FORMING TISSUES. THE ONSET OF EFFECTS OF PROLONGED BENZENE EXPOSURE MAY BE DELAYED FOR MANY MONTHS OR YEARS AFTER THE ACTUAL EXPOSURE HAS CEASED.

---------- PHYSICAL DATA ----------

BOILING PT: 80.2 C
MELTING PT: 5.5 C
SPECIFIC GRAVITY: 0.874
VAPOR DENSITY: 2.77
VAPOR PRESSURE: 74.6 MM @ 20 C
166 MM @ 37.7 C

APPEARANCE AND ODOR

COLORLESS LIQUID

---------- FIRE AND EXPLOSION HAZARD DATA ----------

FLASHPOINT: 12 F BY:
AUTOIGNITION TEMPERATURE: 1043 F
LOWER EXPLOSION LEVEL: 1.3%
UPPER EXPLOSION LEVEL: 8%

EXTINGUISHING MEDIA

CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.
WATER MAY BE EFFECTIVE FOR COOLING, BUT MAY NOT EFFECT EXTINGUISHMENT.

SPECIAL FIREFIGHTING PROCEDURES

WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.
USE WATER SPRAY TO COOL FIRE-EXPOSED CONTAINERS.

UNUSUAL FIRE AND EXPLOSIONS HAZARDS

DANGER:

EXTREMELY FLAMMABLE.
VAPOR MAY TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION AND FLASH BACK.
CONTAINER EXPLOSION MAY OCCUR UNDER FIRE CONDITIONS.

---------- REACTIVITY DATA ----------

NCOMPATIBILITIES
OXIDIZING AGENTS
HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
TOXIC FUMES OF:
CARBON MONOXIDE, CARBON DIOXIDE

---------- SPILL OR LEAK PROCEDURES ----------

TEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
EVACUATE AREA.
SHUT OFF ALL SOURCES OF IGNITION.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
COVER WITH AN ACTIVATED CARBON ADSORBENT, TAKE UP AND PLACE IN CLOSED CONTAINERS. TRANSPORT OUTDOORS.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
ASTE DISPOSAL METHOD
BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL IS HIGHLY FLAMMABLE.
OBSERVE ALL FEDERAL, STATE, AND LOCAL LAWS.

--- PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE ---

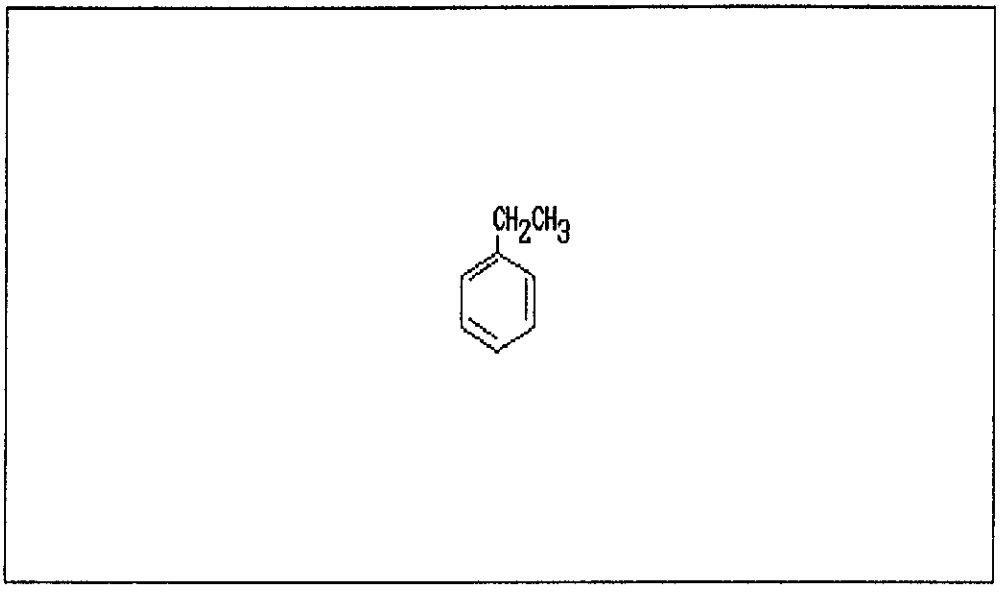
WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.
SAFETY SHOWER AND EYE BATH.
USE ONLY IN A CHEMICAL FUME HOOD.
USE NONSPARKING TOOLS.
DO NOT BREATHE VAPOR.
DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
AVOID PROLONGED OR REPEATED EXPOSURE.
WASH THOROUGHLY AFTER HANDLING.
CARCINOGEN.
SEVERE EYE IRRITANT.
MUTAGEN.
KEEP TIGHTLY CLOSED.
KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME.
STORE IN A COOL DRY PLACE.
MAY CAUSE CANCER.
MAY CAUSE HERITABLE GENETIC DAMAGE.
HARMFUL BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.
IRRITATING TO EYES, RESPIRATORY SYSTEM AND SKIN.
KEEP AWAY FROM SOURCES OF IGNITION. NO SMOKING.
IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE (SHOW THE LABEL WHERE POSSIBLE).
TAKE OFF IMMEDIATELY ALL CONTAMINATED CLOTHING.
WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE PROTECTION.
TARGET ORGAN(S):
BLOOD
BONE MARROW
EGULATORY INFORMATION
THIS PRODUCT IS SUBJECT TO SARA SECTION 313 REPORTING REQUIREMENTS.
E ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO BE

ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. SIGMA ALDRICH SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

MATERIAL SAFETY DATA SHEET Valid 5/92- 7/92

Sigma-Aldrich Corporation
1001 West Saint Paul Ave. Milwaukee, WI 53233 USA

	Sigma	Aldrich
For Emergency Contact USA/Canada	800-325-5832	800-231-8327
Outside USA/Canada	314-771-5765	414-273-3850



---------- IDENTIFICATION ----------

PRODUCT #: E3883 NAME: ETHYLBENZENE

CAS #: 100-41-4

MF: C8H10

SYNONYMS

AETHYLBENZOL (GERMAN) * EB * ETHYLBENZEEN (DUTCH) * ETHYL BENZENE * ETHYL BENZENE (ACGIH,DOT,OSHA) * ETHYLBENZOL * ETILBENZENE (ITALIAN) * ETYLOBENZEN (POLISH) * NCI-C56393 * PHENYLETHANE * UN 1175 (DOT) *

---------- TOXICITY HAZARDS ----------

RTECS NO: DA0700000

BENZENE, ETHYL-

IRRITATION DATA

SKN-RBT 15 MG/24H OPEN MLD	AIHAAP 23,95,62
EYE-RBT 500 MG SEV	AJOPAA 29,1363,46

TOXICITY DATA

ORL-RAT LD50:3500 MG/KG	AMIHAB 14,387,56
IPR-MUS LD50:2272 MG/KG	ARTODN 58,106,85
SKN-RBT LD50:17800 MG/KG	FCTXAV 13,803,75

REVIEWS, STANDARDS, AND REGULATIONS

ACGIH TLV-TWA 100 PPM; STEL 125 PPM 85INA8 5,244,86

MSHA STANDARD-AIR:TWA 100 PPM (435 MG/M3) DTLVS* 3,104,71
OSHA PEL:8H TWA 100 PPM (435 MG/M3) FEREAC 54,2923,89
OSHA PEL FINAL:8H TWA 100 PPM (435 MG/M3);STEL 125 PPM (545 MG/M3) FEREAC 54,2923,89
NOHS 1974: HZD 31830; NIS 64; TNF 7190; NOS 55; TNE 57442
NOES 1983: HZD 31830; NIS 126; TNF 17633; NOS 92; TNE 201833; TFE 34405
EPA GENETOX PROGRAM 1988, NEGATIVE: CELL TRANSFORM.-SA7/SHE
EPA TSCA CHEMICAL INVENTORY, JUNE 1990
EPA TSCA 8(A) PRELIMINARY ASSESSMENT INFORMATION, FINAL RULE FEREAC 47,26992,82
EPA TSCA SECTION 8(E) STATUS REPORT 8EHQ-0680-0345;8EHQ-1080-0368
ON EPA IRIS DATABASE
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JANUARY 1992
NIOSH ANALYTICAL METHODS: SEE HYDROCARBONS, AROMATIC, 1501
NTP CARCINOGENESIS STUDIES;ON TEST (TWO YEAR STUDIES), OCTOBER 1991
NTP CARCINOGENESIS STUDIES;TEST COMPLETED (POST PEER REVIEW), OCTOBER 1991

TARGET ORGAN DATA
SENSE ORGANS AND SPECIAL SENSES (OTHER EYE EFFECTS)
BEHAVIORAL (SLEEP)
LUNGS, THORAX OR RESPIRATION (OTHER CHANGES)
EFFECTS ON FERTILITY (FEMALE FERTILITY INDEX)
EFFECTS ON FERTILITY (LITTER SIZE)
EFFECTS ON FERTILITY (ABORTION)
EFFECTS ON EMBRYO OR FETUS (FETOTOXICITY)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (MUSCULOSKELETAL SYSTEM)
ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATION.

---------- HEALTH HAZARD DATA ----------

ACUTE EFFECTS
MAY BE HARMFUL BY INHALATION, INGESTION, OR SKIN ABSORPTION.
CAUSES SEVERE EYE IRRITATION.
MATERIAL IS IRRITATING TO MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT.
CAUSES SKIN IRRITATION.
CAN CAUSE CNS DEPRESSION.
EXPOSURE CAN CAUSE:
NAUSEA, HEADACHE AND VOMITING

FIRST AID
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.
IF INHALED, REMOVE TO FRESH AIR.
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS.
CALL A PHYSICIAN.
WASH CONTAMINATED CLOTHING BEFORE REUSE.

---------- PHYSICAL DATA ----------

BOILING PT: 136 C
MELTING PT: -95 C
SPECIFIC GRAVITY: 0.867
VAPOR DENSITY: 3.7
VAPOR PRESSURE: 10 MM @ 20 C
19 MM @ 37.7 C

APPEARANCE AND ODOR
COLORLESS LIQUID

---------- FIRE AND EXPLOSION HAZARD DATA ----------

FLASHPOINT: 72 F BY:
AUTOIGNITION TEMPERATURE: 810 F
LOWER EXPLOSION LEVEL: 1%
UPPER EXPLOSION LEVEL: 6.7%

XTINGUISHING MEDIA

CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.
WATER MAY BE EFFECTIVE FOR COOLING, BUT MAY NOT EFFECT EXTINGUISHMENT.

PECIAL FIREFIGHTING PROCEDURES

WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.
USE WATER SPRAY TO COOL FIRE-EXPOSED CONTAINERS.
WARNING:
FLAMMABLE LIQUID.

NUSUAL FIRE AND EXPLOSIONS HAZARDS

VAPOR MAY TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION AND FLASH BACK.
CONTAINER EXPLOSION MAY OCCUR UNDER FIRE CONDITIONS.

---------- REACTIVITY DATA ----------

NCOMPATIBILITIES

OXIDIZING AGENTS

AZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS

TOXIC FUMES OF:
CARBON MONOXIDE, CARBON DIOXIDE

---------- SPILL OR LEAK PROCEDURES ----------

EPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

EVACUATE AREA.
SHUT OFF ALL SOURCES OF IGNITION.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
USE NONSPARKING TOOLS.
COVER WITH AN ACTIVATED CARBON ADSORBENT, TAKE UP AND PLACE IN CLOSED CONTAINERS. TRANSPORT OUTDOORS.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

WASTE DISPOSAL METHOD

BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL IS HIGHLY FLAMMABLE.
OBSERVE ALL FEDERAL, STATE, AND LOCAL LAWS.

--- PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE ---

CHEMICAL SAFETY GOGGLES.
SAFETY SHOWER AND EYE BATH.
RUBBER GLOVES.
NIOSH/MSHA-APPROVED RESPIRATOR.
MECHANICAL EXHAUST REQUIRED.
DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
DO NOT BREATHE VAPOR.
WASH THOROUGHLY AFTER HANDLING.
SEVERE EYE IRRITANT.
KEEP TIGHTLY CLOSED.
KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME.
STORE IN A COOL DRY PLACE.
IRRITATING TO EYES, RESPIRATORY SYSTEM AND SKIN.
RISK OF SERIOUS DAMAGE TO EYES.
KEEP AWAY FROM SOURCES OF IGNITION. NO SMOKING.
IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF

WATER AND SEEK MEDICAL ADVICE.
WEAR SUITABLE PROTECTIVE CLOTHING.
TARGET ORGAN(S):
CENTRAL NERVOUS SYSTEM

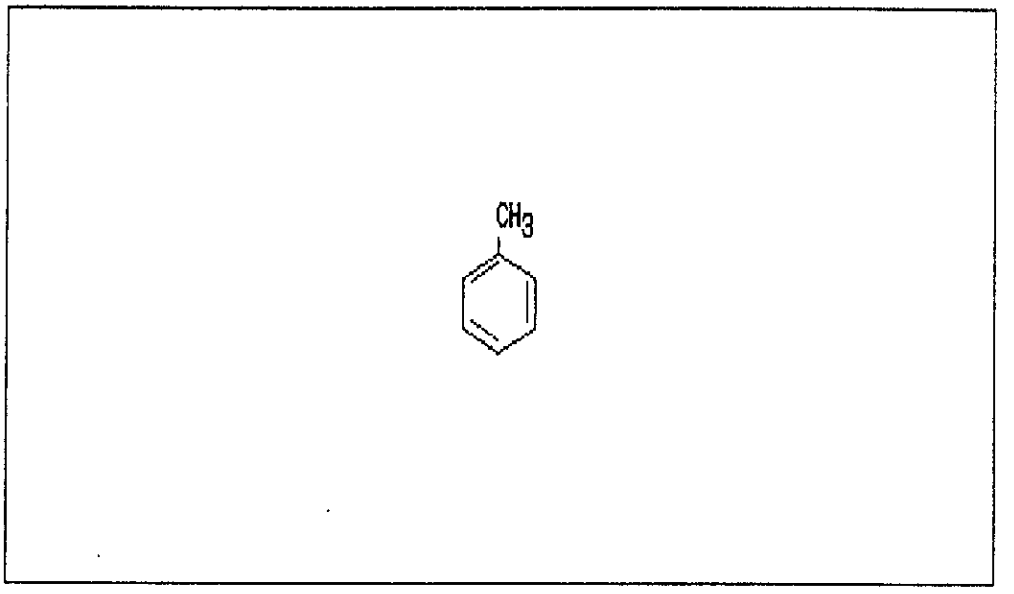
REGULATORY INFORMATION

THIS PRODUCT IS SUBJECT TO SARA SECTION 313 REPORTING REQUIREMENTS.

MATERIAL SAFETY DATA SHEET Valid 5/92- 7/92

igma-Aldrich Corporation
1001 West Saint Paul Ave. Milwaukee, WI 53233 USA

	Sigma	Aldrich
For Emergency Contact USA/Canada	800-325-5832	800-231-8327
Outside USA/Canada	314-771-5765	414-273-3850



IDENTIFICATION

PRODUCT #: 89681 NAME: TOLUENE
CAS #: 108-88-3

NONYMS
ANTISAL 1A * BENZENE, METHYL- * METHACIDE * METHANE, PHENYL- * METHYLBENZENE * METHYLBENZOL * NCI-C07272 * PHENYLMETHANE * RCRA WASTE NUMBER U220 * TOLUEEN (DUTCH) * TOLUEN (CZECH) * TOLUENE (ACGIH, DOT,OSHA) * TOLUENO (SPANISH) * TOLUOL * TOLUOL (DOT) * TOLUOLO (ITALIAN) * TOLU-SOL * UN 1294 (DOT) *

TOXICITY HAZARDS

ECS NO: XS5250000
TOLUENE
IRRITATION DATA

EYE-HMN 300 PPM	JIHTAB 25,282,43
SKN-RBT 435 MG MLD	UCDS** 7/23/70
SKN-RBT 500 MG MOD	FCTOD7 20,563,82
SKN-RBT 20 MG/24H MOD	85JCAE -,29,86
EYE-RBT 870 UG MLD	UCDS** 7/23/70
EYE-RBT 2 MG/24H SEV	85JCAE -,29,86
EYE-RBT 100 MG/30S RINSE MLD	FCTOD7 20,573,82

TOXICITY DATA

ORL-HMN LDLO:50 MG/KG	YAKUD5 22,883,80
ORL-RAT LD50:636 MG/KG	NRTXDN 2,567,81
IHL-RAT LC50:>26700 PPM/1H	NRTXDN 2,567,81
IPR-RAT LD50:1332 MG/KG	ENVRAL 40,411,86
IVN-RAT LD50:1960 MG/KG	MELAAD 54,486,63
UNR-RAT LD50:6900 MG/KG	GISAAA 45(12),64,80
IHL-MUS LC50:400 PPM/24H	NRTXDN 2,567,81
IPR-MUS LD50:59 MG/KG	NRTXDN 2,567,81
SCU-MUS LD50:2250 MG/KG	NRTXDN 8,237,87
UNR-MUS LD50:2000 MG/KG	GISAAA 45(12),64,80
SKN-RBT LD50:12124 MG/KG	AIHAAP 30,470,69
IPR-GPG LD50:500 MG/KG	NRTXDN 2,567,81

REVIEWS, STANDARDS, AND REGULATIONS

ACGIH TLV-TWA 100 PPM; STEL 150 PPM 85INA8 5,578,86
IARC CANCER REVIEW:ANIMAL INADEQUATE EVIDENCE IMEMDT 47,79,89
IARC CANCER REVIEW:HUMAN INADEQUATE EVIDENCE IMEMDT 47,79,89
IARC CANCER REVIEW:GROUP 3 IMEMDT 47,79,89
MSHA STANDARD-AIR:TWA 100 PPM (375 MG/M3) (SKIN) DTLWS* 3,29,73
OSHA PEL:8H TWA 200 PPM;CL 300;PK 500/10M FEREAC 54,2923,89
OSHA PEL FINAL:8H TWA 100 PPM (375 MG/M3);STEL 150 PPM (560 MG/M3) FEREAC 54,2923,89
NIOSH REL TO TOLUENE-AIR:10H TWA 100 PPM/8H;CL 200 PPM/10M MMWR** 37(S-7),26,88
NOHS 1974: HZD 73300; NIS 412; TNF 125516; NOS 206; TNE 1589482
NOES 1983: HZD 73300; NIS 399; TNF 128510; NOS 232; TNE 2015881; TFE 391255
ATSDR TOXICOLOGY PROFILE (NTIS** PB/90/198904/AS)
EPA GENETOX PROGRAM 1988, NEGATIVE: CELL TRANSFORM.-SA7/SHE; IN VITRO SCE-HUMAN
EPA GENETOX PROGRAM 1988, NEGATIVE: SPERM MORPHOLOGY-MOUSE
EPA GENETOX PROGRAM 1988, INCONCLUSIVE: E COLI POLA WITHOUT S9
EPA TSCA CHEMICAL INVENTORY, JUNE 1990
EPA TSCA 8(A) PRELIMINARY ASSESSMENT INFORMATION, FINAL RULE FEREAC 47,26992,82
EPA TSCA SECTION 8(E) STATUS REPORT 8EHQ-0680-0345;8EHQ-1080-0368; 8EHQ-0278-0079 P
ON EPA IRIS DATABASE
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JANUARY 1992
NIOSH ANALYTICAL METHODS: SEE HYDROCARBONS, AROMATIC, 1501; HYDROCARBONS, BP 36-126 C, 1500;
NIOSH ANALYTICAL METHODS: SEE TOLUENE, 4000; 2-BUTANONE, ETHANOL, AND TOLUENE IN BLOOD, 8002
NIOSH ANALYTICAL METHODS: SEE HYDROCARBONS, BP 36-126 DEGREE C 1500
NIOSH ANALYTICAL METHODS: SEE HYDROCARBONS, AROMATIC 1501
NTP CARCINOGENESIS STUDIES (INHALATION);NO EVIDENCE:RAT,MOUSE NTPTR* NTP-TR-371,90

TARGET ORGAN DATA

BRAIN AND COVERINGS (RECORDINGS FROM SPECIFIC AREAS OF CNS)
AUTONOMIC NERVOUS SYSTEM (OTHER: PARASYMPATHOMIMETIC)
BEHAVIORAL (GENERAL ANESTHETIC)
BEHAVIORAL (SOMNOLENCE)
BEHAVIORAL (HALLUCINATIONS, DISTORTED PERCEPTIONS)
BEHAVIORAL (CONVULSIONS OR EFFECT ON SEIZURE THRESHOLD)
BEHAVIORAL (CHANGE IN MOTOR ACTIVITY)
BEHAVIORAL (MUSCLE CONTRACTION OR SPASTICITY)

BEHAVIORAL (ANTIPSYCHOTIC)
BEHAVIORAL (IRRITABILITY)
BEHAVIORAL (CHANGE IN PSYCHOPHYSIOLOGICAL TESTS)
LUNGS, THORAX OR RESPIRATION (OTHER CHANGES)
BLOOD (CHANGES IN BONE MARROW NOT INCLUDED IN ABOVE)
PATERNAL EFFECTS (TESTES, EPIDIDYMIS, SPERM DUCT)
EFFECTS ON FERTILITY (ABORTION)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (MUSCULOSKELETAL SYSTEM)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (UROGENITAL SYSTEM)
EFFECTS ON NEWBORN (BIOCHEMICAL AND METABOLIC)
ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS)
DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATION.

---------- HEALTH HAZARD DATA ----------

ACUTE EFFECTS

HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN.
CAUSES SEVERE IRRITATION.
HIGH CONCENTRATIONS ARE EXTREMELY DESTRUCTIVE TO TISSUES OF THE MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT, EYES AND SKIN.
SYMPTOMS OF EXPOSURE MAY INCLUDE BURNING SENSATION, COUGHING, WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA AND VOMITING.
EXPOSURE CAN CAUSE:
LUNG IRRITATION, CHEST PAIN AND EDEMA WHICH MAY BE FATAL.

CHRONIC EFFECTS

MAY CAUSE NERVOUS SYSTEM DISTURBANCES.
INHALATION STUDIES ON TOLUENE HAVE DEMONSTRATED THE DEVELOPMENT OF INFLAMMATORY AND ULCEROUS LESIONS OF THE PENIS, PREPUCE AND SCROTUM IN ANIMALS.
TARGET ORGAN(S):
BRAIN
LIVER
KIDNEYS
BLADDER

FIRST AID

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS.
CALL A PHYSICIAN.
WASH CONTAMINATED CLOTHING BEFORE REUSE.

ADDITIONAL INFORMATION

EXPOSURE TO AND/OR CONSUMPTION OF ALCOHOL MAY INCREASE TOXIC EFFECTS.

---------- PHYSICAL DATA ----------

BOILING PT: 110.8 C
MELTING PT: -93 C
SPECIFIC GRAVITY: 0.865
VAPOR DENSITY: 3.2
VAPOR PRESSURE: 22 MM @ 20 C
26 MM @ 25 C

APPEARANCE AND ODOR

COLORLESS LIQUID

---------- FIRE AND EXPLOSION HAZARD DATA ----------

FLASHPOINT: 40 F BY:

AUTOIGNITION TEMPERATURE: 997 F
LOWER EXPLOSION LEVEL: 1%
UPPER EXPLOSION LEVEL: 7%

EXTINGUISHING MEDIA

CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.
WATER MAY BE EFFECTIVE FOR COOLING, BUT MAY NOT EFFECT EXTINGUISHMENT.

SPECIAL FIREFIGHTING PROCEDURES

WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.
USE WATER SPRAY TO COOL FIRE-EXPOSED CONTAINERS.

UNUSUAL FIRE AND EXPLOSIONS HAZARDS

DANGER:
EXTREMELY FLAMMABLE.
VAPOR MAY TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION AND FLASH BACK.
CONTAINER EXPLOSION MAY OCCUR UNDER FIRE CONDITIONS.

---------- REACTIVITY DATA ----------

INCOMPATIBILITIES

OXIDIZING AGENTS

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS

TOXIC FUMES OF:
CARBON MONOXIDE, CARBON DIOXIDE

---------- SPILL OR LEAK PROCEDURES ----------

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

EVACUATE AREA.
SHUT OFF ALL SOURCES OF IGNITION.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
COVER WITH AN ACTIVATED CARBON ADSORBENT, TAKE UP AND PLACE IN CLOSED CONTAINERS. TRANSPORT OUTDOORS.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

WASTE DISPOSAL METHOD

BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL IS HIGHLY FLAMMABLE.
OBSERVE ALL FEDERAL, STATE, AND LOCAL LAWS.

--- PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE ---

WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.
SAFETY SHOWER AND EYE BATH.
USE ONLY IN A CHEMICAL FUME HOOD.
DO NOT BREATHE VAPOR.
DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
AVOID PROLONGED OR REPEATED EXPOSURE.
READILY ABSORBED THROUGH SKIN.
WASH THOROUGHLY AFTER HANDLING.
TOXIC.
SEVERE IRRITANT.
KEEP TIGHTLY CLOSED.
KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME.
STORE UNDER NITROGEN.
STORE IN A COOL DRY PLACE.
TOXIC BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.
KEEP AWAY FROM SOURCES OF IGNITION. NO SMOKING.
IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE (SHOW THE LABEL WHERE POSSIBLE).

IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.
AFTER CONTACT WITH SKIN, WASH IMMEDIATELY WITH PLENTY OF WATER.
WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE PROTECTION.
CAUSES SEVERE IRRITATION.
TARGET ORGAN(S):
LIVER, KIDNEYS

EGULATORY INFORMATION

THIS PRODUCT IS SUBJECT TO SARA SECTION 313 REPORTING REQUIREMENTS.

--------- ADDITIONAL PRECAUTIONS AND COMMENTS ---------

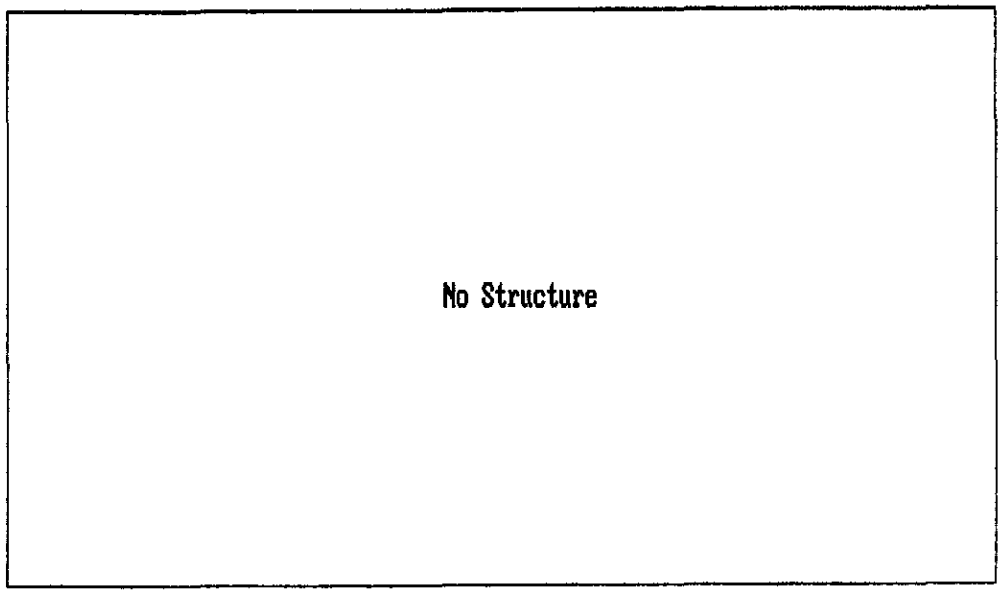
DDITIONAL INFORMATION

IRON OR FERRIC CHLORIDE CATALYZES A VIGOROUS EXOTHERMIC REACTION BETWEEN TOLUENE AND SULFUR DICHLORIDE. REF: CHEM. ENG. NEWS, P.2, AUGUST 8, 1988.

MATERIAL SAFETY DATA SHEET Valid 5/92- 7/92

Sigma-Aldrich Corporation
1001 West Saint Paul Ave. Milwaukee, WI 53233 USA

		Sigma	Aldrich
For Emergency	Contact USA/Canada	800-325-5832	800-231-8327
	Outside USA/Canada	314-771-5765	414-273-3850



IDENTIFICATION

PRODUCT #: Z6880 NAME: XYLENE
CAS #: 1330-20-7

SYNONYMS

BENZENE, DIMETHYL- * DIMETHYLBENZENE * DIMETHYLBENZENE (OSHA) * KSYLEN (POLISH) * METHYL TOLUENE * NCI-C55232 * RCRA WASTE NUMBER U239 * UN 1307 (DOT) * VIOLET 3 * XILOLI (ITALIAN) * XYLENE (ACGIH, DOT,OSHA) * XYLENEN (DUTCH) * XYLOL * XYLOL (DOT) * XYLOLE (GERMAN) *

TOXICITY HAZARDS

RTECS NO: ZE2100000
XYLENE

IRRITATION DATA

EYE-HMN 200 PPM	JIHTAB 25,282,43
SKN-RBT 100% MOD	AMIHAB 14,387,56
SKN-RBT 500 MG/24H MOD	28ZPAK -,24,72
EYE-RBT 87 MG MLD	AMIHAB 14,387,56
EYE-RBT 5 MG/24H SEV	28ZPAK -,24,72

TOXICITY DATA

ORL-HMN LDLO:50 MG/KG	YAKUD5 22,883,80
IHL-MAN LCLO:10000 PPM/6H	BMJOAE 3,442,70

ORL-RAT LD50:4300 MG/KG AMIHAB 14,387,56
IHL-RAT LC50:5000 PPM/4H NPIRI* 1,123,74
IPR-RAT LD50:2459 MG/KG ENVRAL 40,411,86
SCU-RAT LD50:1700 MG/KG NPIRI* 1,123,74
IPR-MUS LD50:1548 MG/KG AGGHAR 18,109,60

EVIEWS, STANDARDS, AND REGULATIONS

ACGIH TLV-TWA 100 PPM; STEL 150 PPM 85INA8 5,637,86
IARC CANCER REVIEW:ANIMAL INADEQUATE EVIDENCE IMEMDT 47,125,89
IARC CANCER REVIEW:HUMAN INADEQUATE EVIDENCE IMEMDT 47,125,89
IARC CANCER REVIEW:GROUP 3 IMEMDT 47,125,89
EPA FIFRA 1988 PESTICIDE SUBJECT TO REGISTRATION OR RE-REGISTRATION FEREAC 54,30848,89
OSHA PEL:8H TWA 100 PPM (435 MG/M3) FEREAC 54,2923,89
OSHA PEL FINAL:8H TWA 100 PPM (435 MG/M3);STEL 150 PPM (655 MG/M3) FEREAC 54,2923,89
NIOSH REL TO XYLENE-AIR:10H TWA 100 PPM;CL 200 PPM/10M MMWR** 37(2-7), 29,88
NOHS 1974: HZD 76720; NIS 367; TNF 99920; NOS 193; TNE 1016020
NOES 1983: HZD 76720; NIS 401; TNF 139914; NOS 230; TNE 2145039; TFE 408656
EPA GENETOX PROGRAM 1988, NEGATIVE: IN VITRO SCE-HUMAN LYMPHOCYTES; IN VITRO SCE-HUMAN
EPA TSCA CHEMICAL INVENTORY, JUNE 1990
EPA TSCA 8(A) PRELIMINARY ASSESSMENT INFORMATION, FINAL RULE FEREAC 47,26992,82
ON EPA IRIS DATABASE
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JANUARY 1992
NTP CARCINOGENESIS STUDIES (GAVAGE);NO EVIDENCE:MOUSE, RAT NTPTR* NTP-TR-327,1986
NIOSH ANALYTICAL METHODS: SEE HYDROCARBONS, AROMATIC, 1501

TARGET ORGAN DATA

PERIPHERAL NERVE AND SENSATION (FLACCID PARALYSIS WITHOUT ANESTHESIA)
SENSE ORGANS AND SPECIAL SENSES (OTHER OLFACTION EFFECTS)
SENSE ORGANS AND SPECIAL SENSES (CONJUNCTIVA IRRITATION)
BEHAVIORAL (CONVULSIONS OR EFFECT ON SEIZURE THRESHOLD)
BEHAVIORAL (IRRITABILITY)
LUNGS, THORAX OR RESPIRATION (OTHER CHANGES)
LIVER (FATTY LIVER DEGENERATION)
EFFECTS ON FERTILITY (POST-IMPLANTATION MORTALITY)
EFFECTS ON FERTILITY (ABORTION)
EFFECTS ON EMBRYO OR FETUS (FETOTOXICITY)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (CRANIOFACIAL)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (MUSCULOSKELETAL SYSTEM)
BIOCHEMICAL EFFECTS (OTHER TRANSFERASES)
ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATION.

---------- HEALTH HAZARD DATA ----------

ACUTE EFFECTS

HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN.
VAPOR OR MIST IS IRRITATING TO THE EYES, MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT.
EXPOSURE CAN CAUSE:
NARCOTIC EFFECT
LUNG IRRITATION, CHEST PAIN AND EDEMA WHICH MAY BE FATAL.
CNS DEPRESSION
DERMATITIS

GASTROINTESTINAL DISTURBANCES

CHRONIC EFFECTS

DAMAGE TO THE LIVER

DAMAGE TO THE KIDNEYS

BLOOD EFFECTS

OVEREXPOSURE MAY CAUSE REPRODUCTIVE DISORDER(S) BASED ON TESTS WITH LABORATORY ANIMALS.

FIRST AID

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.

IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS. CALL A PHYSICIAN.

WASH CONTAMINATED CLOTHING BEFORE REUSE.

---------- PHYSICAL DATA ----------

BOILING PT: 137 C TO 144 C

SPECIFIC GRAVITY: 0.860

VAPOR DENSITY: 3.7

VAPOR PRESSURE: 18 MM @ 37.7 C

APPEARANCE AND ODOR

COLORLESS LIQUID

---------- FIRE AND EXPLOSION HAZARD DATA ----------

FLASHPOINT: 85 F BY:

AUTOIGNITION TEMPERATURE: 867 F

LOWER EXPLOSION LEVEL: 1.1%

UPPER EXPLOSION LEVEL: 7%

EXTINGUISHING MEDIA

CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.

WATER MAY BE EFFECTIVE FOR COOLING, BUT MAY NOT EFFECT EXTINGUISHMENT.

SPECIAL FIREFIGHTING PROCEDURES

WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.

FLAMMABLE.

USE WATER SPRAY TO COOL FIRE-EXPOSED CONTAINERS.

UNUSUAL FIRE AND EXPLOSIONS HAZARDS

VAPOR MAY TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION AND FLASH BACK.

CONTAINER EXPLOSION MAY OCCUR UNDER FIRE CONDITIONS.

FORMS EXPLOSIVE MIXTURES IN AIR.

---------- REACTIVITY DATA ----------

INCOMPATIBILITIES

OXIDIZING AGENTS

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS

TOXIC FUMES OF:

CARBON MONOXIDE, CARBON DIOXIDE

---------- SPILL OR LEAK PROCEDURES ----------

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

EVACUATE AREA.

SHUT OFF ALL SOURCES OF IGNITION.

WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.

COVER WITH AN ACTIVATED CARBON ADSORBENT, TAKE UP AND PLACE IN CLOSED CONTAINERS. TRANSPORT OUTDOORS.

VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

WASTE DISPOSAL METHOD

BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL IS HIGHLY FLAMMABLE.

OBSERVE ALL FEDERAL, STATE, AND LOCAL LAWS.

--- PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE ---

WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.

MECHANICAL EXHAUST REQUIRED.

SAFETY SHOWER AND EYE BATH.

USE NONSPARKING TOOLS.

DO NOT BREATHE VAPOR.

AVOID CONTACT WITH EYES, SKIN AND CLOTHING.

WASH THOROUGHLY AFTER HANDLING.

IRRITANT.

REPRODUCTIVE HAZARD.

KEEP TIGHTLY CLOSED.

KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME.

STORE IN A COOL DRY PLACE.

HARMFUL BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.

IRRITATING TO EYES, RESPIRATORY SYSTEM AND SKIN.

POSSIBLE RISK OF IRREVERSIBLE EFFECTS.

KEEP AWAY FROM SOURCES OF IGNITION. NO SMOKING.

IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.

IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE (SHOW THE LABEL WHERE POSSIBLE).

WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE PROTECTION.

REPRODUCTIVE HAZARD.

REGULATORY INFORMATION

THIS PRODUCT IS SUBJECT TO SARA SECTION 313 REPORTING REQUIREMENTS.