CTTS, Inc.
toxic technology services

toxic technology services inc.

April 17, 1990
File No. 90-2

Ms. Pam Evans
Alameda County Health Care Agency
Hazardous Materials Division
80 Swan Way
Oakland, CA 94621

Subject: Transmittal of Work Plan for
19984 Meekland Road, Hayward, California

Dear Ms. Evans:

On behalf of Durham Transportation, CTTS, Inc. (Toxic Technology Services) is submitting for your review a work plan and health and safety plan for the above mentioned subject site.

Neither Durham Transportation nor Toxic Technology Services received a request from Alameda County to submit such a work plan, however it is in the best interest of an expedient and successful site remediation to solicit the insight of the agencies involved.

After your review of these documents, Toxic Technology Services will be glad to sent copies to the Water Quality Control Board and the Eden Fire District.

Durham Transportation is anxious to continue the investigation of the subject site and commence with a remediation program during the summer months. To this end, soil gas testing has been scheduled for April 30, 1990.

Please submit your comments to Toxic Technology Services by April 27, 1990. If you have questions regarding this matter, please call the undersigned at (415) 799-1140 or Mr. Jack Worthington - Durham Transportation, at (818) 571-7020.

P.O. Box 515 ● Rodeo, California 94572 ● (415) 799-1140

Thank you for your time and assistance concerning this matter. We look forward to working with you. If we do not hear from you by April 27, 1990, we will proceed according to the submitted plan.

Sincerely,

Lisa A. Polos

Lisa A. Polos, REA, CHMM
Senior Scientist
Toxic Technology Services
CTTS, Inc.

LAP/lap

Enclosures

cc: Jack Worthington - Durham Transportation
John Alt, CEG - Toxic Technology Services

toxic technology services inc.

April 6, 1990
File No. 90-2

Mr. Jack Worthington
Durham Transportation
P.O. Box 948
Rosemead, California 91770

Subject: Work Plan for
19984 Meekland Road, Hayward, California

Dear Mr. Worthington:

CTTS, Inc. (Toxic Technology Services) is pleased to present the work plan for the determination of the extent of the contamination on the Meekland Road site.

After your review and approval of this document, our firm will be happy to forward copies to the appropriate agencies.

Thank you for this opportunity to provide Durham Transportation with these environmental services.

Sincerely,

Lisa A. Polos, REA, CHMM
Senior Scientist
Toxic Technology Services
CTTS, Inc.

John N. Alt, CEG (#1136)
Consulting Geologist
Toxic Technology Services
CTTS, Inc.

WORK PLAN FOR THE EVALUATION OF EXTENT OF CONTAMINATION

19984 MEEKLAND ROAD
HAYWARD, CALIFORNIA

Prepared For

Mr. Jack Worthington
Durham Transportation
P.O. Box 948
Rosemead, California 91770

Prepared By

CTTS, Inc.
Toxic Technology Services
P.O. Box 515
Rodeo, California 94572

April 6, 1990
File No. 90-2

TABLE OF CONTENTS

INTRODUCTION

The following is the proposed workplan for the subsurface investigation and characterization of 19984 Meekland Road in the Hayward area of Alameda County, California. The current property owner is Durham Transportation located at 27577 (A) Industrial Blvd., Hayward, California.

Scope of Work

The purpose of this investigation is two fold; to assess the vertical and lateral extent of soil and groundwater contamination and to characterize the contamination with regards to constitents and concentration.

This investigation will result in the preparation of a remediation plan that will recommend appropriate, available technology at an economically reasonable cost.

Site History

The subject site is located at the northeast corner of the intersection of Meekland Avenue and Blossom Way in the unincorporated area of Alameda County near the City of Hayward (Plate 1).

According to Mr. Scott Owen of the Alameda County Public Works Department, the subject site was a service station and opened in 1946. Mr. Owen assumes that tanks 1, 2 and 4 (Plate 2) were installed in 1947 when the service station started operation. Tank 3 was installed in 1972.

In July, 1986, when the property was owned by Harbert Transportation, a subsurface investigation was conducted by Applied Geosystems of Fremont, California. The Applied Geosystems report is presented in its entirety under Appendix A.

Soil samples indicated that petroleum hydrocarbons were found at a level of over 200 ppm in B-1 and <1 ppm in B-2 (Plate 2). Groundwater was encountered at 24', and B-1 was converted into a monitoring well (MW-1). MW-1 had 42 ppm of gasoline and BTX values ranging from 5-6 ppm.

July '86

Durham Transportation took possession of the property in December, 1986.

In May 1988, precision tank tests using the Horner Ezy-Chek method were conducted on the gasoline tanks. Tanks 1 & 2 were found to be manifolded together above the tank top and the system appeared to be leaking. The test suggested that the leak was in the piping. Tank 3 tested tight.

Durham shut down the leaking system and pumped out the product. In April 1989, tanks 3 & 4 were shut down and the product was pumped out and removed. The site is now vacant.

In July 1989, CTTS, Inc. (Toxic Technology Services) was contracted to manage the removal of the four underground storage tanks at the subject site. The actual excavation and removal was conducted by Verl's Construction of San Leandro.

The on-site activities to date, are presented in a following section.

SITE DESCRIPTION

As mentioned, the subject site is located at the northeast corner of the intersection of Meekland Road and Blossom Way in the unincorporated area of Alameda County near the City of Hayward (Plate 1). The surrounding area is mainly residential, with commercial land use on the remaining three corners of Meekland and Blossom.

In September, 1989, the Alameda County Health Care Services Agency, Hazardous Materials Division conducted a records search on the subject site and the surrounding properties. The results are as follows:

19884 Meekland Road - Durham Transportation: Inspected on 3/3/88; interim permits issued for 4 tanks on 4/20/89; closure plans submitted to remove 4 tanks on 7/28/89; no major violations of the state law

50 Blossom Way: No record; Note: Ms. Polos of Toxic Technology Services spoke to the manager of the store which occupies this site. He indicated that underground tanks had been removed from this site over ten years. ago.

20009 Meekland Road - Hoang's Auto Care: Inspected on 3/3/88; no record of soil contamination; no major violations of the state law; Note: Chief Jim Ferdinand of the Eden Fire District indicated that this facility was pumping fuel until 1-2 years ago. He has no record of tank removal on the property, so it is possible that the tanks are still on-site.

20008 Meekland Road: No record

20332 Meekland Road: No record

20228 Meekland Road: No record

Chief Ferdinand indicated that for at least the past 16 years, the above three addresses did not have underground tanks on-site.

He also said that an earth-moving service formerly operated from 124 Blossom Way, but had no underground tanks, to the best of his knowledge. This site is adjacent to the southeast side of the subject site.

Hydrogeologic Setting

The subject site is underlain by generally fine-grained alluvial fan and flood plain deposits derived from the hills located approximately two miles east of the site. The deposits are late Quaternary in age and overlie rock of the Franciscan Assemblage at an unknown but probably great depth.

Three to four feet of fill generally overlies the Quaternary deposits at the site. The fill consists primarily of a clayey to sandy gravel.

The native deposits underlying the fill consist primarily of silty clay to clayey silt with minor and varying amounts of sand and gravel. Lenses of silty sand and gravel, approximately 3 to 4 inches thick, were encountered in the two borings. No other significant bedding or stratification of the units was observed to the depth explored (40 feet) and the deposits are considered to be homogeneous for hydrologic considerations.

The groundwater gradient at the site is essentially flat. The elevation of the groundwater was measured in the three monitoring wells on-site by surveying the elevation of the top of the casing and measuring the depth to groundwater using an electronic probe. The elevations are based on Alameda County benchmark BLO-MEEK located in the middle of the intersection of Blossom Way and Meekland Avenue. The depth to groundwater was measured on December 19, 1989, January 29, 1990 and March 23, 1990. The data are presented on Table 1. They indicate a very low westward to northwestward gradient. The elevations of groundwater in the three wells are within 0.1 foot and are about at the level of error in the measuring techniques. Therefore an exact gradient was not calculated.

The data also indicates that the groundwater table has risen 0.9 feet over the three month period that measurements have been taken.

TABLE 1
DEPTH TO GROUNDWATER

Monitoring Well	Elev. Top of Casing	12/19/89 Depth	12/19/89 Elev.	1/29/90 Depth	1/29/90 Elev.	3/23/90 Depth	3/23/90 Elev.
MW-1	55.13	29.07	26.06	28.73	26.35	28.22	26.91
MW-3	54.34	28.35	25.99	28.00	26.34	27.51	26.83
MW-4	54.61	28.59	26.02	28.18	26.43	27.71	26.90

Note: All measurements are in feet.

On-Site Investigation To Date

Tank removal took place, following state and local regulations, on August 11, 1989 under the supervision of Ms. Polos and Mr. John Alt, CEG and witnessed by representatives of the Eden Fire District. Product lines to the gasoline dispensers were excavated and removed on August 15, 1989.

Soil samples from the tank and pipe excavation were collected for analysis. The existing groundwater monitoring well (MW-1) was purged and sampled.

Analytical data from the soil samples taken in the pit excavation show significant gasoline, Benzene, Toluene, Ethylbenzene and Xylene contamination, particularly around tanks 1 and 2. Soil from the waste oil excavation contained low levels of Toluene and Xylene.

On November 28, 1989, two groundwater monitoring wells were installed (Plate 3). Prior to drilling, permits were obtained from Zone 7. On November 29, 1989, the wells were developed and sampled by Ms. Polos and Mr. Alt. Details on groundwater monitoring well installation and sampling are presented in a following section.

On December 12, 1989, HEW drilling abandoned, by pressure grouting, the existing, unregistered water well, located at the northeast end of the subject site, behind the washrack. As requested by Tom Peacock of the Alameda County Health Care Agency, Hazardous Materials Division, the well was purged and sampled prior to abandonment. All samples were analyzed by TMV/Norcal of Richmond, California. Prior to abandonment, a permit was obtained from Zone 7. Details on well abandonment are presented in a following section.

On the same day, two on-site sumps were located. One is located under the washrack. This structure is a concrete, two-stage sump and contains waste in both sections. There is a pipe, that could be a drain, under one of the metal covers associated with the sump. It is unknown where this pipe leads, but it is possible

that there is a tank or a broken pipe under the washrack causing a contamination problem.

The second sump, is located in the service station building and was piped to the waste oil tank, formerly located behind the building.

Table 2, presented at the end of this section, is a summary of positive analytical results from the soil and water samples collected.

Details of the above accounts can be found in Toxic Technology Services report to Durham Transportation, September 13, 1989 (File No. 89-6) and Toxic Technology Services report to Durham Transportation, January 31, 1990 (File No. 89-12).

On February 26, 1990, for safety considerations, Verl's Construction lined the pit excavations with plastic sheeting (Vis-queen) and filled it with the soil from the original excavations. The plastic was then brought around the soil, enveloping it, and secured with concrete blocks and tires. No new fill was put into the pits.

Trenches made during the pipe excavation were filled with the original soil which was non-detectable for gasoline hydrocarbons and BTEX.

On March 20, 1990, demolition of the service station building commenced.

On March 23, 1990, the sump under the washrack was sampled by Ms. Polos and Mr. Alt. Two samples were collected; one of the supernatant liquid and one of the bottom sludge. Analyses requested are:

- Polychlorinated Biphenyls (PCB's)
- Volatile Hydrocarbons by Method 8240
- Semi-volatile Hydrocarbons by Method 8270
- Total Petroleum Hydrocarbons, Gas and Diesel
- Total Petroleum Hydrocarbons as Oil and Grease
- Title 22 - 17 CAM Metals

After characterization data was reported, the contents of the sump will be disposed of in a proper manner.

Any contents in the waste oil sump located in the service station building will be pumped out and disposed of as a waste oil.

Also on March 23, 1990, the three groundwater monitoring wells were each purged of 5 gallons of water and samples collected. Samples will be analyzed for Total Petroleum Hydrocarbons as gasoline and BTEX. Water levels in each well were also recorded.

Analytical work is being conducted by TMA/Norcal in Richmond. Results are pending.

TABLE 2
ANALYTICAL SUMMARY

Monitoring Well 3 (MW-3) is located at the northwest corner of the subject site.

Soils

MCL
Benzene 7 ug/L

20.5':	Trichloroethene	200 ug/kg (ppb) ?
	Benzene	130 ug/kg
	Toluene	22 ug/kg
25.5'	Benzene	440 ug/kg
	Toluene	480 ug/kg
	Ethylbenzene	200 ug/kg
	Xylenes	930 ug/kg
	Gasoline	52 ug/g (ppm)
30.5'	Benzene	540 ug/kg
	Toluene	188 ug/kg
	Ethylbenzene	210 ug/kg
	Xylenes	400 ug/kg
	Gasoline	23 ug/g

Water

MW-3	Benzene	4600 ug/L (ppb)
	Toluene	1100 ug/L
	Ethylbenzene	680 ug/L
	Xylenes	1100 ug/L
	Gasoline	29 mg/L (ppm) >10
	1,2-Dichloroethane	36 ug/L .5/5(30) 10 MCL
	Total Lead	0.04 mg/L (ppm) 50/ 5(30, 100) = 40 ug/L

MW-4 is located at the southwest corner of the subject site.

Soils

15.5'	Benzene	20 ug/kg (ppb)
	Toluene	19 ug/kg
	Ethylbenzene	13 ug/kg
20.5'	Benzene	75 ug/kg
	Toluene	20 ug/kg
	Ethylbenzene	26 ug/kg
	Xylenes	15 ug/kg

Water

MW-4	Benzene	33 ug/L (ppb)
	Toluene	1.0 ug/L
	Ethylbenzene	1.3 ug/L
	Xylenes	5.2 ug/L
	Total Lead	0.012 mg/L (ppm)

ABW is the water well used for on-site operations and was abandoned.

Water

ABW	Benzene	200 ug/L (ppb)
	Toluene	18 ug/L
	Ethylbenzene	24 ug/L
	Xylenes	34 ug/L
	1,2-Dichloroethane	1.5 ug/L
	Gasoline	1.8 mg/L (ppm)

Groundwater Monitoring Well Installation and Sampling

On November 28, 1989, two groundwater monitoring wells, identified as MW-3 and MW-4, were installed at the subject site by HEW Drilling, Inc., using a CME 55 drill rig with hollow stem augers. Mr. John Alt, CEG and Ms. Lisa Polos supervised the installation. The locations of the wells are shown on Plate 3. Augers were steam cleaned prior to the drilling of the wells. A standard split barrel sampler with 2-5/8" OD and 2" ID was used for soil sampling. It had the capacity for obtaining an 18 inch sample using three six-inch long brass liners. Prior to obtaining each sample, the disassembled sampler and the brass liners were washed in a solution of TSP in water. Each piece was triple rinsed, with the final rinse being distilled water.

A boring log was prepared for each well. Copies of these logs are presented in Appendix B. Blow counts were recorded for each six inches of penetration of the sampler, and the time at which each sample was taken was noted on the field log. Soil samples were collected at five foot intervals during the drilling. The lower-most sample liner (next to the shoe) was retained for any required chemical analysis. The soil exposed in the ends of the tube was quickly noted, and the ends were then sealed with teflon tape and snug-filling plastic caps. The edges of the caps were sealed with plastic tape. The cap was labeled with the samples were placed in a chilled ice chest as they were collected, and selected soil samples were marked to be sent to TMA/Norcal, a State certified hazardous waste laboratory for analysis. The second and third samples were inspected and used for the sample description.

Two-inch (ID) Schedule 40 PVC pipe was used for the well casings. Each well was screened with slotted (0.020 inch openings) casings in the lower 15 feet of the well and capped at the bottom with a slip on cap. The 8-inch diameter borings were filled in the annular space between the casing and bore wall with clean #3 sand to a depth of approximately 2 feet above the top of the slotted casing. Above the sand-pack, at least two feet of bentonite pellets were used as a seal, and the remainder of the annulus was filled with cement grout. Monitoring Well Installation Reports with more detailed information on each of the well installations were recorded and are in the files.

The units encountered in the borings for monitoring wells MW-3 had no odor above a depth of 20 feet. The sample at 20 feet had a slight solvent odor. The sample was moist and was probably within the capillary fringe of the groundwater table. The sample at a depth of 25 feet had a very strong odor of gasoline. Below 25 feet, the samples were from the saturated zone and had a slight odor of gasoline. The sample at 25 feet is probably within the zone of groundwater fluctuation and the contamination in the soil was deposited during a period of a higher groundwater level.

The soil samples from MW-4 had a slight odor of gasoline from a depth of 20 feet to the bottom of the boring. A very slight odor was detected in the sample from a depth of 15 feet.

During the well installation, Mr. Tom Peacock of the Alameda County Health Care Services Agency, Hazardous Materials Division, visited the site. He requested that a water sample be collected from the well that was to be abandoned and submitted for chemical analysis.

On November 29, 1989, Mr. John Alt and Ms. Lisa Polos developed the wells by evacuating 15 gallons of water from each well by bailing prior to sampling. After the wells were developed, groundwater samples were collected using separate three-foot disposable bailers.

The first sample from each well was retrieved from the surface of the water, and the contents of the bailer were inspected to assess whether or not there was any floating product present. Groundwater from both wells had odor and sheen, but both were more noticeable in MW-3. Sample vials and jars, provided by the laboratory, were filled from the bailer.

MW-1, which was installed in 1986, was not sampled at this time, however, upon opening the well cap and checking the water level, a strong odor was detected.

On March 23, 1990, the three monitoring wells were purged and water samples were collected in the same manner as above. In MW-

1, odor and sheen were noted. MW-3 had odor but no noticeable sheen and MW-4 had no noticeable sheen and only a very slight odor.

Well Abandonment

A water well was located at the northeast corner of the building and connected to a holding water tank inside the building by a galvanized surface pipe. Attempts to activate the existing pump to sample the well were not successful.

Alameda County Public Works Department had no record of a well at the subject site prior to the 1986 installation of one monitoring well by Applied Geosystems. No data were available regarding the total depth, screened interval or condition of the unrecorded well. Because of the potential that the well could act as a conduit for downward migration of the near surface contamination, it was decided that the well should be grouted and abandoned.

The grouting was completed on December 12, 1989 by HEW Drilling, Inc.

The well head and surface piping was removed and the pump was then taken out of the well. The well was four inches in diameter with a PVC casing. The total depth of the well was measured at 67.9 feet to the ground surface. The top of the casing was approximately one foot below the ground surface.

The depth to standing water in the well was measured at 29.9 feet from the ground surface. The well was purged by bailing and a water sample collected. The initial bailer of water had no odor, sheen or product. After bailing approximately 2 gallons, a solvent odor was detected. The odor increased in intensity as more water was extracted from the well, however, the samples collected had no noticeable odor. The sample was shipped in a cooled ice chest to TMA/Norcal and analyzed for Volatile Halogenated Hydrocarbons, Total Petroleum Hydrocarbons as gasoline and Benzene, Toluene, Ethylbenzene and Xylenes (BTEX).

The well was pressured grouted using a tremie pipe starting from the bottom and continuing upward. The grout mix was one 90lb. sack of Lonestar Cement Type I & II per five gallons of water. A total of 22 sacks of cement were used to grout the well. The level of the cement grout was brought up to where it overflowed the top of the casing.

PROPOSED ADDITIONAL SITE CHARACTERIZATION

The following tasks are proposed to assess the extent of soil and groundwater contamination at and under the subject site:

Soil Contamination

In order to better assess the extent of the soil contamination on-site, the following tasks will be accomplished:

1. Soil Gas Survey: A soil gas survey will be conducted in order to outline plumes of contamination and "hot spots". In order to accomplish this, NET Laboratories, Pleasanton will be contracted to sample the soil at approximately a depth of 20 feet and provide on-site analysis.

   The subject site will be sampled in a grid fashion, as presented in Plate 4. Starting at the north corner of the site, sampling will commence 5 feet from the property lines. Samples will be taken approximately every 15 feet, testing for Total Petroleum Hydrocarbons as gasoline, BTEX and Volatile Halogenated Hydrocarbons.

   After that sampling set, samples will be taken every 25 feet over the rest of the site, testing for gasoline and BTEX only. This plan could change depending on the outcome of the on-site analysis. If "hot spots" are found, sampling will concentrate in that area in order to better define the plume of contamination. Sampling and testing will take approximately 3-4 days on-site.

   Zone 7 requires a permit for this work, but assesses no fee. However, they do request that each sampling hole be grouted. The grout mix will be one 90 pound sack of Lonestar Cement Type I & II per five gallons of water.

   The soil gas sampling probe is 1" in diameter and will be driven into the ground, therefore no sampling spoils will be generated.

   Using the data from the soil gas survey, a map of the site which details plumes of contamination will be prepared.

2. Approximately one week after the soil gas survey, trenching will be conducted in several locations.

   - Around the tank excavations: Starting 10 feet from each side of both the gasoline tank pit and the waste oil pit, trenches will be dug to a depth of approximately 17 feet. An organic vapor analyzer will be used for qualitative monitoring. If contamination is encountered, parallel trenches will be dug until there is no detectable odor, visual contamination or positive measurement above background from the meter. Soil samples will be collected for confirmation and analyzed for Total Petroleum Hydrocarbons as gasoline and BTEX.

- Around the sump: Using the same strategy as above, the soil around the sump located under the washrack will be trenched, sampled and at a minimum, analyzed for Total Petroleum Hydrocarbons as gasoline, BTEX and Volatile Halogenated Hydrocarbons.

- Deepen the bottom of the tank excavations: The soil that has been placed back in the excavations will be re-excavated, then using an extend-a-hoe, the bottom of the gasoline tank pit and the waste oil pit will be deepened until no visible contamination, odor or positive reading above background from the meter is encountered. If contamination persists, excavation will cease at 17 feet. As above, soil samples will be taken and analyzed for Total Petroleum Hydrocarbons as gasoline and BTEX.

- "Hot Spots": Using the data from the soil gas testing, any "hot spots" discovered will be trenched, sampled and at a minimum, analyzed for Total Petroleum Hydrocarbons and BTEX.

As soil is being excavated, it will be qualitatively screened with a portable organic vapor analyzer. Soils that give a positive reading will be separated from soils that do not. All spoil piles will have at least three random samples taken and analyzed for Total Petroleum Hydrocarbons as gasoline and BTEX. All spoils will be enveloped in plastic sheeting. All spoils will be stored on-site pending analysis. Soil piles that are non-detectable can be used for fill on-site. Soils that are contaminated will be held on-site pending the preparation and approval of a remediation plan.

To ensure safety, all trenches will be covered with plywood and taped off. The pit excavations will be blocked off with a chain link fence. "Open Trench" signs will be placed as needed. The entire site is already fenced off by a portable chain link fence and secured with a chain and padlock.

Groundwater Contamination

A minimum of two additional groundwater monitoring wells will be installed after the soil gas survey. The proposed placement of these wells is presented in Plate 4. These points will complete a well pattern that will help characterize the groundwater below the subject site.

The placement of any additional wells will be based on the outcome of the soil gas survey.

All additional wells will be installed in the manner described in

mention sampling and/or change in lithology previous contamination

the section of this plan entitled Groundwater Monitoring Well Installation and Sampling, except that new wells will be 4" in diameter in anticipation of using them for groundwater extraction during the remediation phase.

All drill cuttings and purged water from the installations, will be placed in 55 gallon drums and stored on-site, pending analysis. If possible, disposal of drum contents will be on-site in a manner consistent with the remediation plan.

Drilling activities will be performed by HEW Drilling of East Palo Alto.

SITE SAFETY PLAN

The site safety plan for the Meekland site is presented as a stand-alone document under Appendix C.

DEVELOPMENT OF REMEDIATION PLAN

After the completion of the above described tasks, a formal remediation plan will be drafted by CTTS, Inc. (Toxic Technology Services). This plan will be sent to the appropriate local and state agencies for review.

TIME SCHEDULE AND REPORTING

The anticipated time schedule for the above described tasks are as follows:

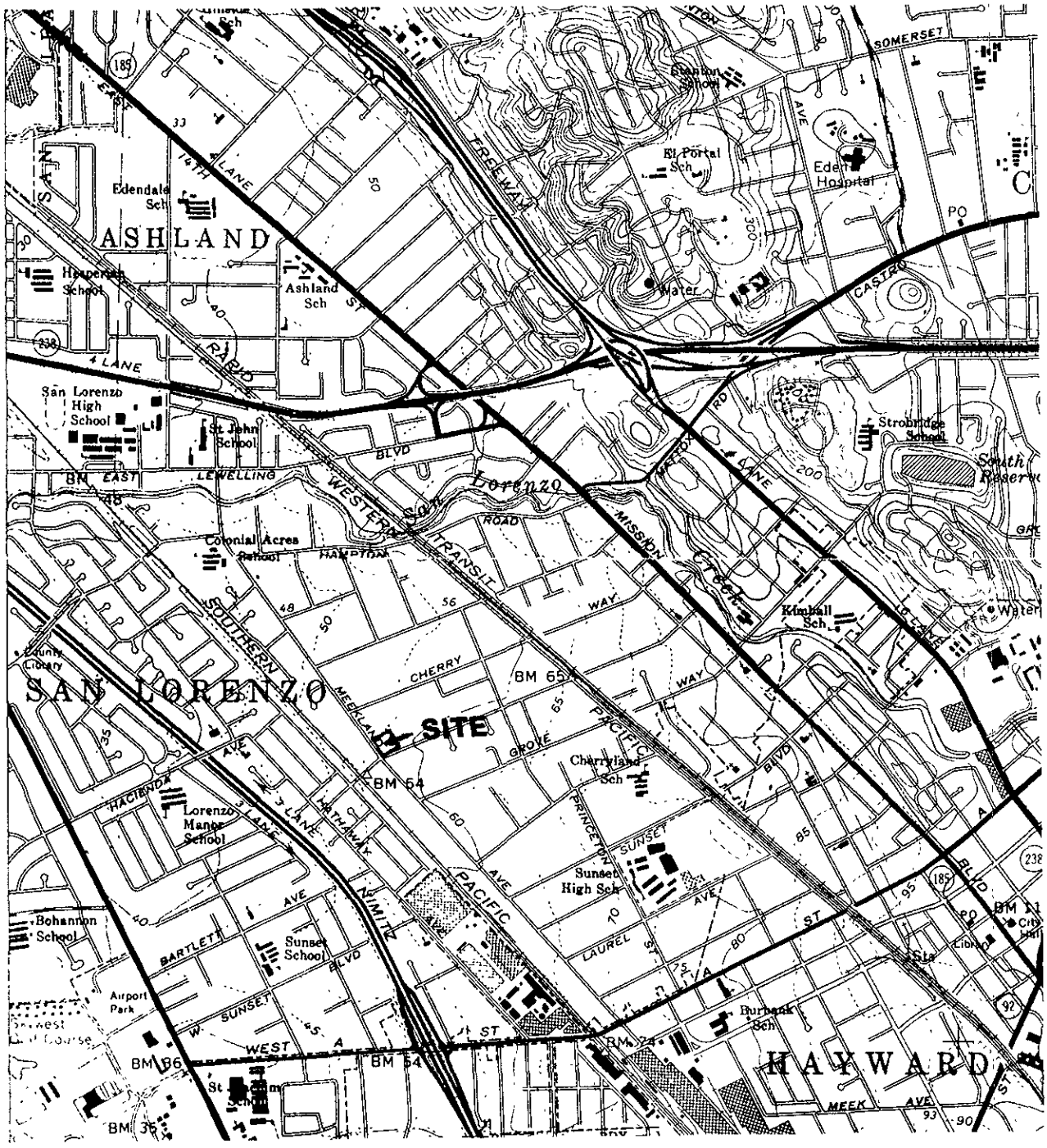
TASK	TENTATIVE DATE
Monitoring Well Depths and Elevations	Monthly
Monitoring Well Sampling and Analysis	Quarterly
Draining and Disposal of Sump Contents	Last week in April
Soil Gas Testing	April 30 - May 3
Trenching	May 14-16, 1990
Monitoring Well Installations	May 16-18, 1990
Well Development and Sampling	May 21, 1990
Draft Remediation Plan (Agency Submittal)	June 18, 1990

Monthly and quarterly monitoring programs will be maintained for a minimum of one year.

Monthly progress reports will be submitted, up to the time of preparation of the remediation plan, to the Alameda County investigator handling this case.

All reports and plans will be signed by Mr. John Alt, CEG (California #1136) and Lisa A. Polos, REA of Toxic Technology Services.

PLATES



1 0 1/2 MILES

1000 0 1000 2000 3000 FEET

PLATE	No. 1

SITE LOCATION MAP

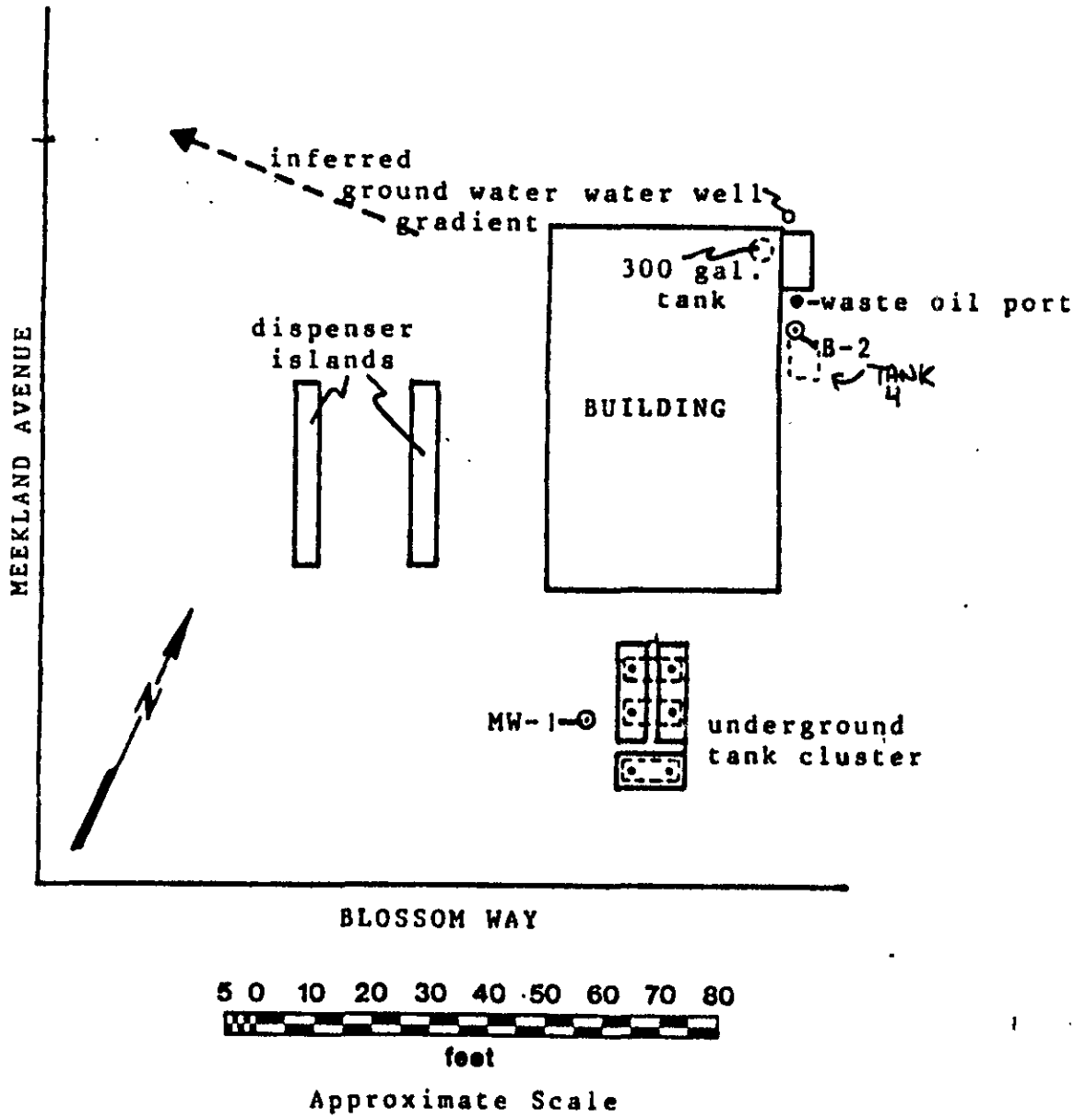


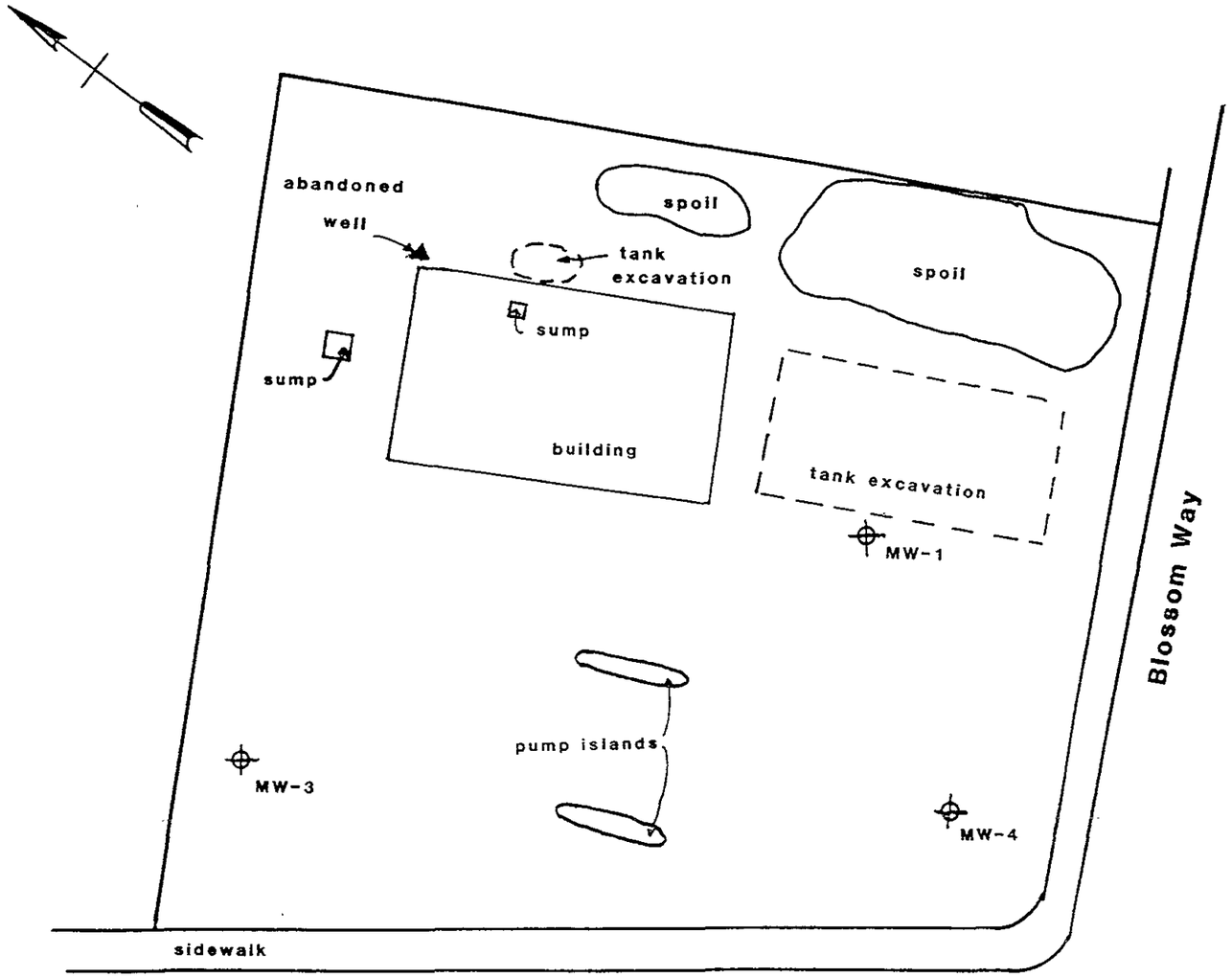
PLATE 2

Boring and Well Locations From 1986

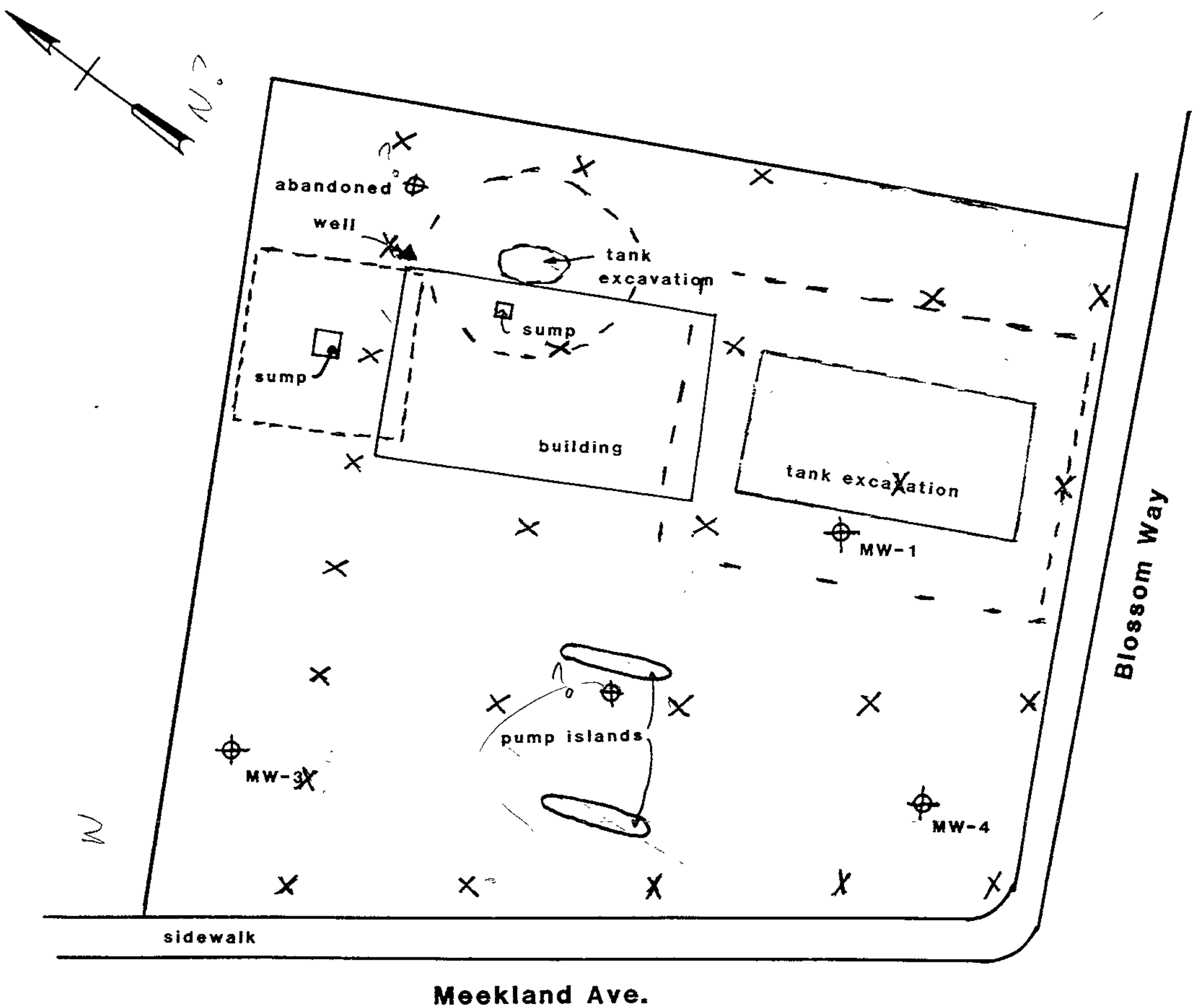
Site Location: 19984 Meekland Road, Hayward

Toxic Technology Services
P.O. Box 515
Rodeo, California 94572

Project #89-6
Durham Transportation
27577 (A) Industrial Blvd.
Hayward, CA 94545



SITE PLAN - DURHAM TRANSPORTION		
SCALE 1" = 20'	APPROVED BY	DRAWN BY
DATE JANUARY 1990		REVISED
CTTS, Inc.		DRAWING NUMBER 3



LEGEND

⊕ = PROPOSED MONITORING WELLS

X = PROPOSED SOIL GAS PROBES

– – – – = PROPOSED TRENCHES

"Install one mw within ? ft of the tank in the verified downgradient direction." pg 11

DURHAM TRANSPORTION		
SCALE 1" = 20'	APPROVED BY	DRAWN BY
DATE APRIL 1990		REVISED
EXPLORATION PLAN		
CTTS, Inc.		DRAWING NUMBER 4

APPENDICES

APPLIED GEOSYSTEMS REPORT OF 1986

Applied GeoSystems 43255 Mission Blvd. Suite B Fremont, CA 94539 (415) 651-1906

REPORT
SUBSURFACE ENVIRONMENTAL INVESTIGATION
TWO SOIL BORINGS
AND MONITORING WELL INSTALLATION
at
Harbert Transportation
19984 Meekland Avenue
Hayward, California

AGS Job No. 8660-1

Report prepared for

Harbert Transportation
Hayward, California

by

Glenn R. Dembroff
Project Geologist

Michael N. Clark
C.E.G. 1264

July 20, 1986

Applied GeoSystems 43255 Mission Blvd. Suite B Fremont, CA 94539 (415) 651-1906

REPORT
SUBSURFACE ENVIRONMENTAL INVESTIGATION
SOIL BORING AND MONITORING WELL INSTALLATION
at Harbert Transportation
Hayward, CA
for: Harbert Transportation

INTRODUCTION

The following report describes the work elements associated with two soil borings and installation of one monitoring well near the fuel storage tank cluster at Harbert Transportation located on 19984 Meekland Avenue, Hayward, California. The well was installed after the Groundwater Protection Ordinance Permit from the Alameda County Flood Control and Water Conservation District (ACFCWCD) was approved by Mr. Craig Mayfield. A copy of this permit is included in the Appendix of this report. Methods used in this project are in compliance with Guidelines for Addressing Fuel Leaks (California Regional Water Quality Control Board, San Francisco Bay Region, September 1985) and Groundwater Monitoring Guidelines (Alameda County Water District, May 1984).

SITE HISTORY

The Harbert Transportation site is located on the corner of Meekland Avenue and Blossom Way in Hayward, as shown on the Site Vicinity Map, Plate P-1. Three underground motor fuel storage tanks are buried in a single cluster at the site. One waste oil tank is buried in a cavity on the northern side of the property. A water well is located approximately 15 feet west of the waste oil tank. The water from this well is collected in a 300 gallon holding tank and it is our understanding that the water is used primarily for vehicle washing. We assume that the waste water used at the site is disposed of in the storm water runoff drain and sewer.

FIELD WORK

On June 30, 1986, a geologist from Applied GeoSystems was present at the station to observe the soil borings and well construction. Drilling began at 3:30 PM. The equipment used for the boring was a CME-55 truck-mounted drill rig with steam-cleaned hollow stem augers operated by Datum Exploration of Pittsburg, California. The borings were drilled with eight-inch O.D. augers. The total depth drilled in the boreholes was 41.5 feet for B-1/MW-1 and 23 feet in B-2. Ground water was encountered at 24 feet in MW-1. Boring B-1 was drilled at 41.5 feet to accomodate 15 feet of well

screen below the saturated zone. Boring B-2 was terminated at a total depth of 23 feet in order to sample the soil immediately above the saturated zone. No well was constructed in this boring. The locations of these two borings are shown on the Generalized Site Plan, Plate P-2.

Soil samples were collected from the boreholes with a modified California split spoon sampler. Descriptions of earth materials encountered in borings B-1 and B-2 are presented on the Boring Logs, Plates P-4 through P-6. Plate P-3 gives a summary of the Unified Soils Classification System used to identify the soils. The earth materials encountered at this site consist of silty clay material to a depth of approximately sixteen feet underlain by clay. The cuttings excavated from the borings were sealed in appropriately-lined D.O.T. 17 55-gallon drums left on the site and remain the responsibility of Harbert Transportation. Applied GeoSystems can make arrangements, with the authorization of Harbert Transportation, to schedule to have the drums transported by a licensed waste hauler to a Class I dump site.

SOIL SAMPLING PROCEDURE

Seven soil samples were collected and described from boring B-1 and four samples were collected and described from boring B-2 at the time of drilling. These samples, labeled as indicated on the Boring Logs, were collected at five-foot intervals from the ground surface to Total Depth. When soil samples were missed (i.e. were not retained in the sampler due to saturated and unconsolidated condition of the materials), the sampler was cleaned and placed in the boring with a sand catcher for resampling. Soil samples were collected by advancing the boring to a point immediately above the sampling depth, and then driving a modified California split spoon sampler into the soil through the hollow center of the auger. The sampler was driven 18 inches with a standard 140 pound hammer repeatedly dropped 30 inches. The number of blows to drive the sampler each successive six inches were counted and recorded.

The samples were removed from the sampler and immediately sealed in their brass sleeves with aluminum foil, plastic caps and air-tight tape, labeled, and placed in iced storage. The samples were delivered to Applied GeoSystems' laboratory for analytical testing. The Chain-of-Custody form for samples tested is included in the Appendix of this report.

MONITORING WELL CONSTRUCTION

A ground water monitoring well was constructed in the soil boring B-1. The well (MW-1) was completed with two-inch I.D. PVC casing. The casing consists of 0.020-inch machine-slotted PVC from the base of the borings to the twenty foot depth in MW-1. Blank casing completes the well from the twenty foot depth to the surface. Both ends of the casing were plugged with PVC caps.

The annular space of the well was backfilled with washed sand to approximately eighteen feet below surface grade. A one foot bentonite plug was placed above the sand as a seal against cement entering the sand pack. The remaining annulus was backfilled with neat cement to grade. Graphic representation of the well construction is shown on the right margin of the Boring Log.

A utility box was placed over the well head and cemented into place flush with the surrounding surface grade. The utility box has a water-tight seal to protect against surface water infiltration and requires a specially-designed key to reduce the possibility of well vandalism.

WATER SAMPLING PROCEDURE

Prior to development, a subjective water sample was collected by lowering a teflon bailer approximately halfway through the air/water interface. The sample was retrieved and inspected for the presence of floating product, product odor, sheen, and emulsion. No subjective evidence of floating product, sheen, or emulsion was detected. A moderate product odor was detected in the subjective sample.

The well was developed by pumping, swabbing, and air surging. A minimum of three well volumes were removed from the monitoring well by pumping prior to sampling. Following the purge period, and after well recovery of approximately one hour, the water sample was collected using a teflon bailer. The bailer was lowered through the air/water interface in order to retrieve a sample representative of the formation water.

The sample was transferred to a clean finger vial, made acidic by the addition of hydrochloric acid, immediately sealed with a teflon-lined cap, and placed in iced storage for transport to the analytical laboratory for testing.

Additionally, a water well sample was collected from the 300 gallon holding tank at the site. It is our understanding that this well water is currently being used as a non-potable water source. The sample was collected by filling the finger vials from a faucet plumbed to the holding tank after the tank was emptied and refilled. Preparation and transport procedures for this sample are the same as the monitoring well water sample. Chain-of-Custody forms for the soil and water samples are included in the Appendix of this report.

ANALYTICAL RESULTS

Two soil samples (S-20-MW1 and S-20-B2) were analyzed for total hydrocarbon using gas chromatography with flame-ionization detection (EPA Method 8020). Two water samples, one from the monitoring well (MW-1) and one from the water well at the site, were analyzed for purgeable aromatic hydrocarbons by EPA method 602 using gas chromatography with photo- and flame-ionization detection. The results of the chemical analyses are presented in Table 1 and in the Appendix of this report.

TABLE 1
RESULTS OF CHEMICAL ANALYSES
OF SOIL AND WATER SAMPLES
Harbert Transportation
Hayward, California

Material	Soil	Soil	Water	Water
Boring No.	B-1	B-2	MW1	-
Sample No.	S-20-B1	S-20-B2	W-28-MW1	W-Well
Depth	20 feet	20 feet	28 feet	-
Total Hydrocarbons	235.16	0.27	42.09	0.66
Benzene	--	--	5.52	0.03
Toluene	--	--	4.92	ND
Xylenes	--	--	6.07	0.01

Note: Results in parts-per-million (ppm)
ND: Non-detectable
Detection limits: 0.05 ppm (soil)
0.0005 ppm (water)

The soil samples taken from borings B-1 and B-2 show detectable levels of total hydrocarbons. The sample from boring B-2, drilled adjacent to the waste oil tank, shows low levels of contamination. The soil analyzed from boring B-1, adjacent to the tank cluster, shows higher levels of hydrocarbon contamination.

The water samples collected and analyzed also show detectable levels of hydrocarbon. The lab results for water collected from monitoring well MW-1 shows a more pronounced hydrocarbon influence than the water collected from the 300 gallon holding tank at the site.

CONCLUSIONS AND RECOMMENDATIONS

Although the soils from the two borings show detectable amounts of hydrocarbon contamination, no soil remediation is warranted at this time. We do feel, however, that hydrocarbon levels found in water samples collected from MW-1 may suggest a potential contamination problem. We recommend that the hydrocarbon level in the water of MW-1 be monitored monthly to assess possible changes in concentration. This information, in conjunction with inventory records, may be used to evaluate the possibility of a contaminant source. In order to monitor any future negative contamination trends, we recommend that the well be sampled monthly for subjective analysis for at least one year.

This work can be done by Applied GeoSystems. The subjective analyses would include examination of a sample collected with a laboratory-cleaned teflon bailer. The bailer would be used to

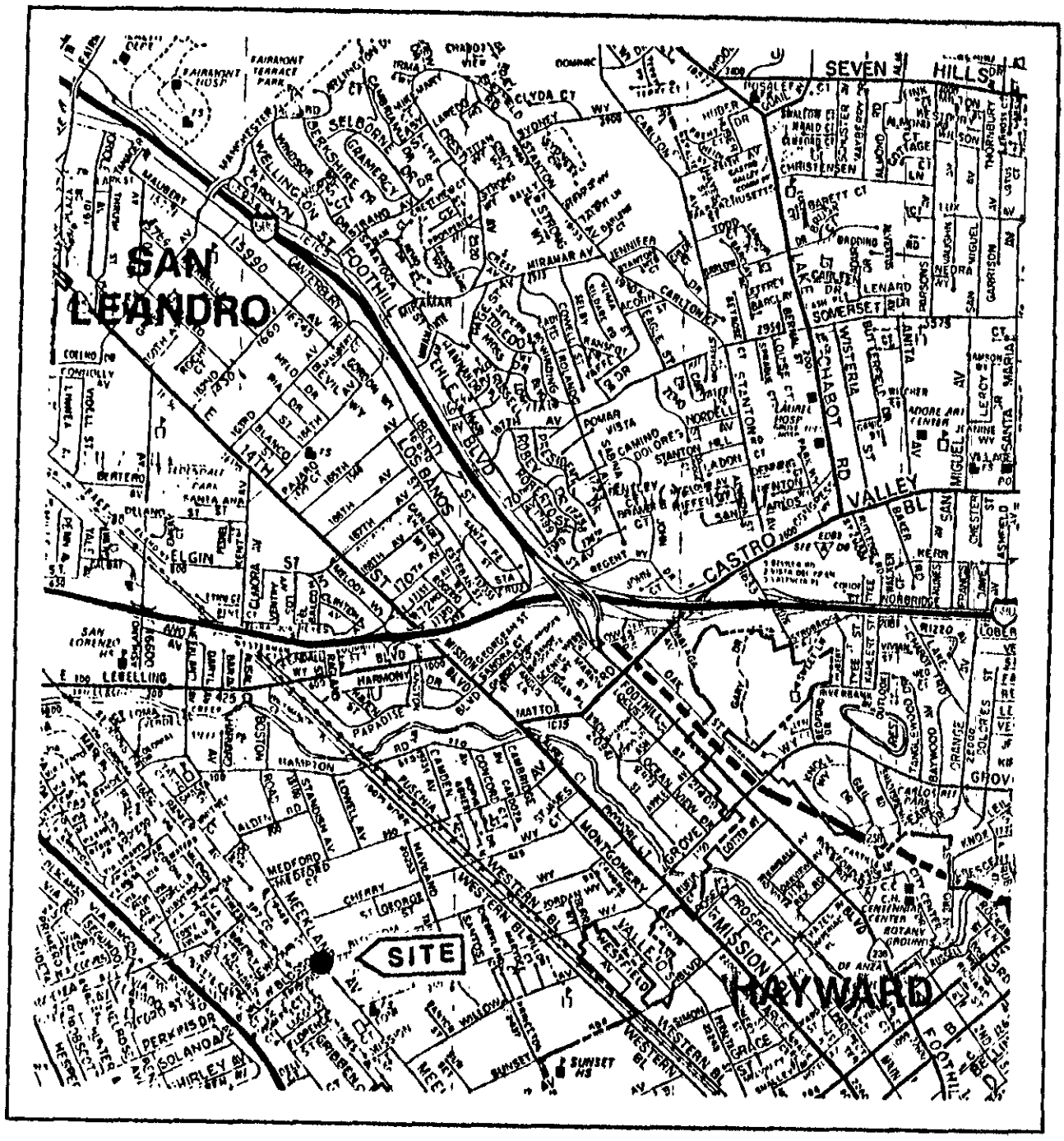
collect a relatively undisturbed water sample from the air/water interface in the well which would be examined for evidence of floating product, petroleum odor, sheen, and emulsion. In addition, every six months a water sample would be analyzed by EPA method 602 for total hydrocarbons and dissolved constituents. The well would be purged of approximately three to four well volumes prior to the collection of this semi-annual sample. The sample would be collected from below the air/water interface in the well in order to be representative of the formation water. The information obtained from the semi-annual sample should show a trend for the ground water quality at the site.

The source of the hydrocarbon contamination found in the soil borings and wells at the site may be from surface spillage, other limited source, or from off-site. The subjective analysis that we recommend should supply data that can be used to evaluate whether or not the source of product is still active.

The water sampled from the holding tank shows low levels of hydrocarbons. We recommend this water be analyzed every six months in order to monitor ground water quality. We recommend that this water remain a non-potable source.

LIMITATIONS

This report was prepared in accordance with generally accepted standards of environmental geological practice in California at the time this investigation was performed. It need be emphasized that evaluation of geologic conditions at the site, for the purpose of this investigation, are made from a limited number of observation points. Subsurface conditions may vary away from the data points available. Additional work, including further subsurface investigations, can reduce the inherent uncertainties associated with this type of investigation.



N

Approximate Scale

0 1/2 1

Miles

Source: Thomas Bros. Maps, Alameda County, 1985

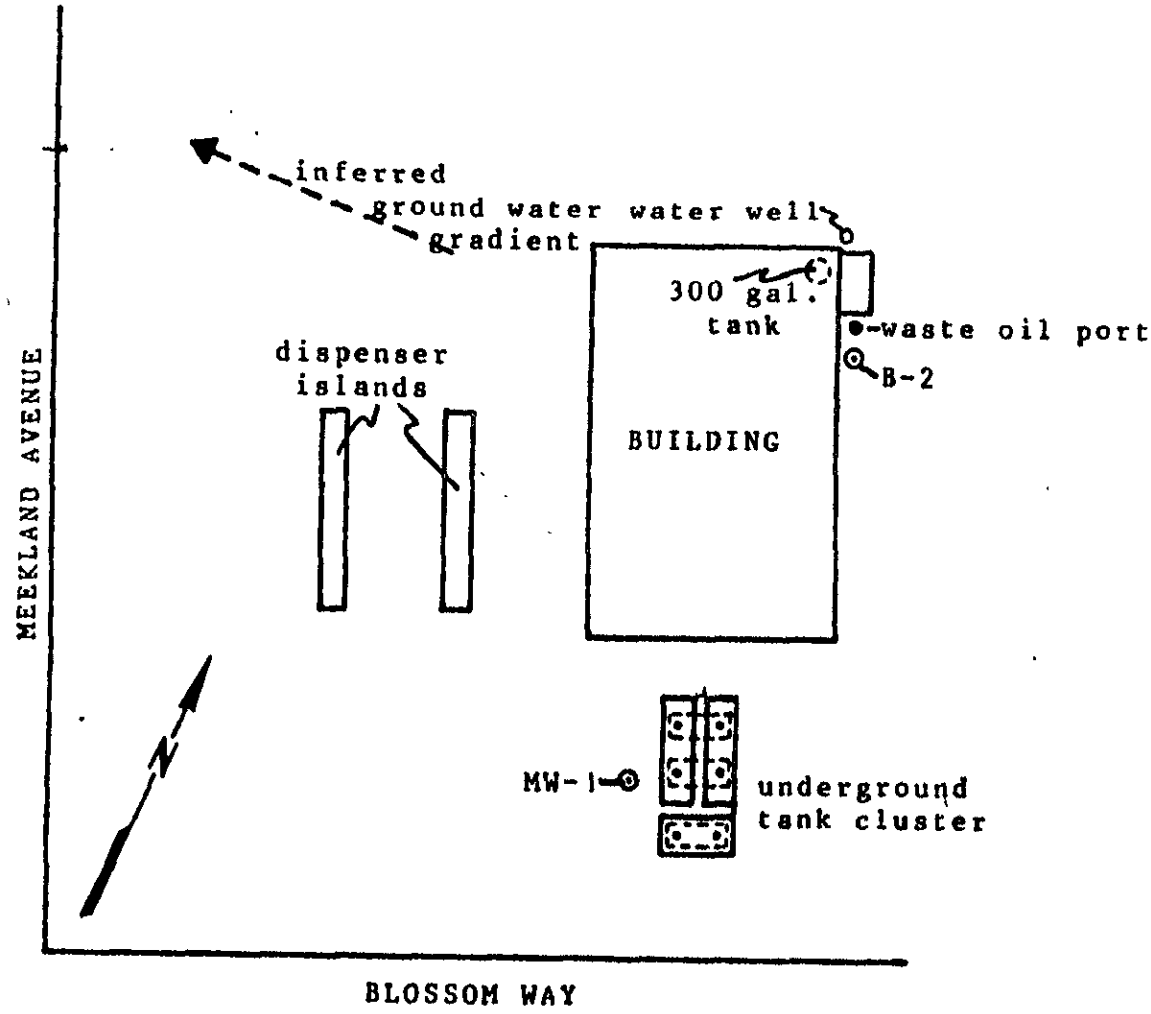
Applied GeoSystems

PROJECT NO. 8660-1

SITE VICINITY MAP
Harbert Transportation
Hayward, California

PLATE

P-1



5 0 10 20 30 40 50 60 70 80

feet

Approximate Scale

Applied GeoSystems

GENERALIZED SITE PLAN

Harbert Transportation
Hayward, California

PLATE

P-2

OJECT NO. 8660-1

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS (MORE THAN HALF IS LARGER THAN No. 200 SIEVE)	GRAVELS (MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE)	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVELS, GRAVEL - SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL - SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, POORLY GRADED GRAVEL - SAND - SILT MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL - SAND - CLAY MIXTURES
	SANDS (MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE)	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, POORLY GRADED SAND - SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND - CLAY MIXTURES
FINE GRAINED SOILS (MORE THAN HALF IS SMALLER THAN No. 200 SIEVE)	SILTS AND CLAYS (LIQUID LIMIT LESS THAN 50)		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (LIQUID LIMIT GREATER THAN 50)		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT AND OTHER HIGHLY ORGANIC SOILS

Depth through which sampler is driven

Relatively undisturbed sample (Calif. Modified Sampler)

Disturbed sample

Bag or grab sample

Ground water level observed in boring

I-2 Sample No.

Sand pack

Bentonite annular seal

Neat cement annular seal

PVC blank

Machine-slotted PVC

BLOW/FT. REPERSENTS THE NUMBER OF BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES TO DRIVE THE SAMPLER THROUGH THE LAST 12 INCHES OF AN 18 INCH PENETRATION.

LINES SEPARATING UNITS ON THE LOG REPRESENT APPROXIMATE BOUNDRIES ONLY. ACTUAL BOUNDRIES MAY BE GRADUAL. LOGS REPRESENT SUBSURFACE CONDITIONS AT THE BORING LOCATION AT THE TIME OF DRILLING ONLY.

Applied GeoSystems
Mission Blvd. Suite B Fremont, CA 94539 (415) 65[illegible]906

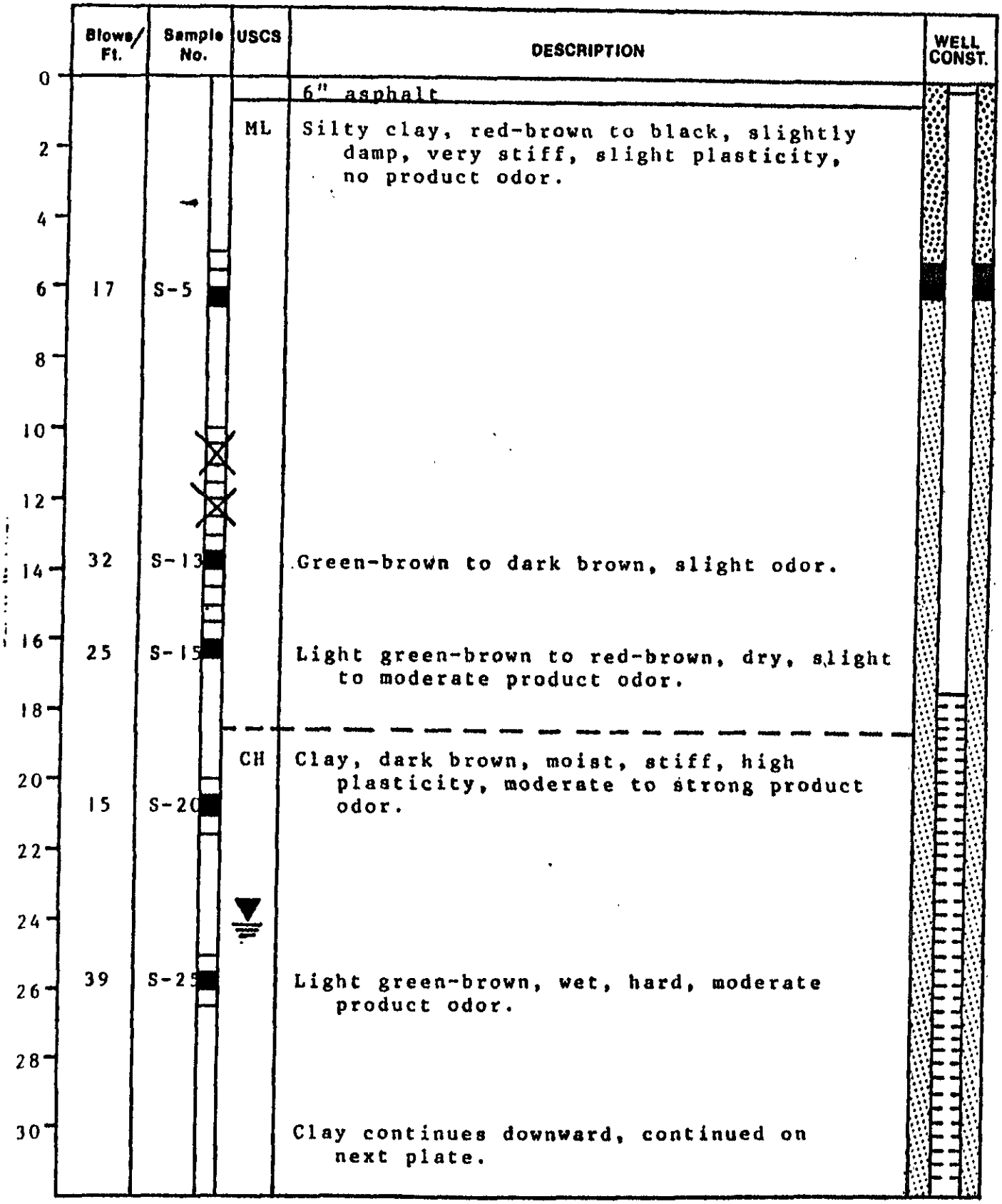
PCT NO. 8660-1

UNIFIED SOIL CLASSIFICATION SYSTEM AND SYMBOL KEY

Harbert Transportation
Hayward, California

PLATE

P-3



Applied GeoSystems

LOG OF BORING B1/MW-1

Harbert Transportation
Hayward, California

PLATE

P-4

PROJECT NO. 8660-1

Blows/ Ft.	Sample No.	USCS	DESCRIPTION	WELL CONST.
		CH	Clay, light green-brown, wet, hard, high plasticity, moderate product odor.	
18	S-30		Dark green-brown, very stiff.	
38	S-35		Red-brown, hard, slight product odor.	
				CAVED
			Total depth = 41.5 feet.	

30
32
34
36
38
40
42

Applied GeoSystems

LOG OF BORING B-1/MW-1

Harbert Transportation
Hayward, California

PLATE

P-5

PROJECT NO. 8660-1

Blows/ Ft.	Sample No.	USCS	DESCRIPTION	WELL CONST.
			6" asphalt	
		ML	Silty clay, slightly pebbly, dark brown, wet, very stiff, medium plasticity, no product odor.	
17	S-5			
19	S-10		Red-brown.	
13	S-15	CH	Clay, green-gray, wet, stiff, high plasticity, very slight product odor.	
		ML	Silty clay, red-brown, wet, stiff, medium plasticity, no product odor.	
11 29	S-20	CH	Clay, dark green-brown, wet, stiff, medium plasticity, no product odor.	
			Total depth = 23 feet.	

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LOG OF BORING B-2

Harbert Transportation
Hayward, California

PLATE

P-6

PROJECT NO. 8660-1

APPENDIX

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

5997 PARKSIDE DRIVE ♦ PLEASANTON, CALIFORNIA 94566 ♦ (415) 484-2600

GROUNDWATER PROTECTION ORDINANCE PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

CATION OF PROJECT 19984 MEEKLAND WY HAYWARD

ENT
n JACK WORTHINGTON
ress 93 JACKSON ST Phone (415) 889-7200
y HAYWARD CA Zip 94544

LICANT
e APPLIED GEOSYSTEMS *
43255 MISSION BLVD
ress SUITE B Phone (415) 651-1906
y FREMONT, CA Zip 94539

CRIPTION OF PROJECT
or Well Construction ✓ Geotechnical ___
hodic Protection ___ Well Destruction ___

POSED WATER WELL USE
stic ___ Industrial ___ Irrigation ___
icipal ___ Monitoring ✓ Other ___

POSED CONSTRUCTION
lling Method:
Rotary ___ Air Rotary ___ Auger ✓
le ___ Other ___

PROJECTS
Drill Hole Diameter 8 in. Depth 30 ft.
Casing Diameter 2 in. Number 1
Surface Seal Depth 8 ft.
Driller's License No. C57 1264

TECHNICAL PROJECTS
Number 1
Diameter 8 in. Maximum Depth 30 ft.

IMATED STARTING DATE JUNE 26, 1986
IMATED COMPLETION DATE JUNE 27, 1986

ereby agree to comply with all requirements of s permit and Alameda County Ordinance No. 73-68.

LICANT'S NATURE C. Robin Ross Date 6/4/86

FOR OFFICE USE

PERMIT NUMBER 86154
LOCATION NUMBER

Approved Craig A. Mayfield Date 13 Jun 86
Craig A. Mayfield

PERMIT CONDITIONS

Circled Permit Requirements Apply

(A) GENERAL
1. A permit application should be submitted so as to arrive at the Zone 7 office five days prior to proposed starting date.
2. Notify this office (443-9300) at least one day prior to starting work on permitted work and before placing well seals.
3. Submit to Zone 7 within 30 days after completion of permitted work the original Department of Water Resources Water Well Drillers Report or equivalent for well projects, or bore hole log and location sketch for geotechnical projects. Permitted work is completed when the last surface seal is placed or the last boring is completed.
4. Permit is void if project not begun within 90 days of approval date.

(B) WATER WELLS, INCLUDING PIEZOMETERS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie, or equivalent.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic, irrigation, and monitoring wells unless a lesser depth is specially approved.

C. GEOTECHNICAL. Backfill bore hole with compacted cuttings or heavy bentonite and upper two feet with compacted material.

D. CATHODIC. Fill hole above anode zone with concrete placed by tremie, or equivalent.

E. WELL DESTRUCTION. See attached.

* Applied Geosystems Representative: Mr. Robin Ross

1198

CHAIN OF CUSTODY RECORD

Applied GeoSystems

43255 Mission Blvd. Fremont, CA 94539 (415)651-

...LERS: *(Signature)* [signature]

...O:

...ITION:

No.

SHIPPING INFORMATION:

Shipper

Address

Date Shipped

Shipment Service

Airbill No. Cooler No.

...uished by: *(Signature)*	Received by: *(Signature)*	Date	Time
[signature]			
...uished by: *(Signature)* [signature]	Received by: *(Signature)*	Date	Time
...uished by: *(Signature)*	Received by: *(Signature)*	Date	Time
...uished by: *(Signature)*	Received for laboratory by*: *(Signature)* [signature]	Date 7-2-86	Time 8:00

...s laboratory should complete "Sample Condition Upon Receipt," section below, sign and return top copy to: APPLIED GEOSYSTEMS, 43255 MISSION BLVD., FREMONT, CA. 94539

...ple ...ber	Site/Sample Identification	Date Sampled	Analysis Requested	Sample Condition Upon Receipt
...-B1	8660-1	6/30/86	Total HC	iced
...o-B2	8660-1	6/30/86	Total HC	iced

Applied GeoSystems 43255 Mission Blvd. Suite B Fremont, CA 94539 (415) 651-1906

RECORD OF ANALYSIS

Applied GeoSystems
43255 Mission Blvd.
Fremont, CA. 94539

Date 7-7-86

Attention: Glenn R. Dembroff

Date Received: 7-2-86
Date Analyzed: 7-7-86

Laboratory# 8607-S17

Procedure:

The soil samples referenced on the attached Chain-of-Custody were analyzed for the presence and concentration of Benzene, Ethyl-Benzene, Toluene, and Xylenes (BETX) and for Total Hydrocarbons (THC) by EPA method 8020. The sample were concentrated on a Tekmar LSC-2 and ALS automatic sampler prior to injection into a 5890 Hewlett Packard gas chromatograph fitted with a Photo-Ionization detector (PID) and a Flame-Ionization detector (FID). The limit of detection for this method of analysis is 50 micrograms/kilogram (parts per billion = ppb).

The results are presented in the table below:

SAMPLE	SITE	TOTAL HYDROCARBONS
S-20-B1	8660-1	235.16
S-20-B2	8660-1	0.27

Results in milligrams/kilogram (parts per million = ppm).

Tia Tran
Chemist

CHAIN OF CUSTODY RECORD

Applied GeoSystems

43255 Mission Blvd. Fremont, CA 94539 (415) 65

MPLERS: *(Signature)* [signature]

ne:

TO:

Applied Geo Systems

ENTION: TIA TRAN

ne No.

SHIPPING INFORMATION:

Shipper

Address

Date Shipped

Shipment Service

Airbill No. Cooler No.

		Date	Time
nquished by: *(Signature)* [signature]	Received by: *(Signature)* [signature]	7-7-86	16:0
nquished by: *(Signature)* [signature]	Received by: *(Signature)*	Date	Time
nquished by: *(Signature)*	Received by: *(Signature)*	Date	Time
nquished by: *(Signature)*	Received for laboratory by*: *(Signature)*	Date	Time

ysis laboratory should complete "Sample Condition Upon Receipt," section below, sign and return top copy to: APPLIED GEOSYSTEMS, 43255 MISSION BLVD., FREMONT, CA. 94539

ample umber	Site/Sample Identification	Date Sampled	Analysis Requested	Sample Condition Upon Receipt
WELL	AGS-8660-1	7-7-86	THC + BTX	ICED
[illegible]	AGS-8660-1	7-7-86	THC + BTX	ICED

Applied GeoSystems 43255 Mission Blvd. Suite B Fremont, CA 94539 (415) 651-1906

RECORD OF ANALYSIS

Applied GeoSystems
43255 Mission Blvd.
Fremont, CA. 94539

Date 7-9-86

Attention: Glenn R. Dembroff

Date Received: 7-7-86
Date Analyzed: 7-8-86

Laboratory# 8607-W19

Procedure:

The water samples referenced on the attached Chain-of-Custody were analyzed for the presence and concentration of Benzene, Ethyl-Benzene, Toluene, and Xylenes (BETX) and for Total Hydrocarbons (THC) by EPA method 602. The sample were concentrated on a Tekmar LSC-2 and ALS automatic sampler prior to injection into a 5890 Hewlett Packard gas chromatograph fitted with a Photo-Ionization detector (PID) and a Flame -Ionization detector (FID). The limit of detection for this method of analysis is 0.5 micrograms/Liter (parts per billion = ppb).

The results are presented in the table below:

SAMPLE	SITE	BENZENE	ETHYL BENZENE	TOLUENE	TOTAL XYLENES	THC
W-Well	8660-1	0.03	0.005	ND	0.01	0.66
W-28-MW1	8660-1	5.52	1.37	4.92	6.07	42.09

Results in milligrams/Liter (parts per million = ppm).
ND=Non Detectable - Less than 0.0005 milligrams/Liter (ppm).

Tia Tran
Chemist

BORING LOGS

BORING LOCATION: Meekland and Blossom Ave		ELEVATION AND DATUM:	
DRILLING CONTRACTOR: HEW Drilling	DRILLER: Jeff	DATE STARTED: 11-28-89	DATE FINISHED: 11-28-89
DRILLING EQUIPMENT: CME 55		COMPLETION DEPTH (FT): 40	ROCK DEPTH (FT): -
DIAMETER OF BORING:		NO. OF UNDIST. SAMPLES: 7	CORE:
PURPOSE OF BORING: Monitoring Well		WATER FIRST DEPTH(FT): 34	COMPL.:
SAMPLING EQUIPMENT:		LOGGED BY: J. Alt	CHECKED BY:
COMMENTS:			

DEPTH (FEET)	DESCRIPTION	GRAPHIC LOG LITHOLOGY	SAMPLES NO.	SAMPLES TYPE	SAMPLES BLOW COUNT	SAMPLES DRILLING RATE/TIME	REMARKS
	Fill						
	dark brown clay, dry, adobe						
5					6		
					8		
	reddish brown fine sandy silt with some clay, dry				10		
	Tan sandy silt to silty sand. Thin lens of coarse sand at 11 ft.; dry, becoming moist at 15 ft.						
10					3		
					5		
					8		
15					2		
					4		
					6		
20					2		
	Gray clay, moist, mottled brown, moderately plastic				4		
					5		
25					4		
					7		
					10		
30							

Project Durham Site

Project No.

LOG OF BORING

B-3

DEPTH (FEET)	DESCRIPTION	GRAPHIC LOG LITHOLOGY	SAMPLES NO.	SAMPLES TYPE	SAMPLES BLOW COUNT	DRILLING RATE/TIME	REMARKS
30	Gray clay mottled brown, moist, moderately plastic.				4 4 5		
35	Brown clayey sand and gravel, grades downward to brown clayey silt.				5 7 11		
40	Bottom of boring No sample						
45							
50							
55							
60							
65							
70							

Project

Project No.

CONT. LOG OF BORING B-3

BORING LOCATION: Meekland and Blossom Ave		ELEVATION AND DATUM:	
DRILLING CONTRACTOR: HEW Drilling	DRILLER: Jeff	DATE STARTED: 11-28-89	DATE FINISHED: 11-28-89
DRILLING EQUIPMENT: CME 55		COMPLETION DEPTH (FT): 40	ROCK DEPTH (FT): -
DIAMETER OF BORING		NO. OF UNDIST. SAMPLES: 7	CORE
PURPOSE OF BORING: Monitoring Well		WATER DEPTH(FT): FIRST	COMPL.
SAMPLING EQUIPMENT		LOGGED BY: J. Alt	CHECKED BY:
COMMENTS			

DEPTH (FEET)	DESCRIPTION	GRAPHIC LOG LITHOLOGY	SAMPLES NO.	SAMPLES TYPE	SAMPLES BLOW COUNT	SAMPLES DRILLING RATE/ TIME	REMARKS
	Fill - Sand and Gravel						
5	Dark brown clay, dry				8 6 4		
	Tan silty clay, dry						
10	brown sandy gravel				5 6 9		
15	Gray clayey silt to silty clay, locally sandy				2 4 4		
20	Same as above moist				1 4 4		
25	Same as above with brown mottlings				4 5 6		
30							

Project: Durham Site Project No.	**LOG OF BORING** B-4	

DEPTH (FEET)	DESCRIPTION	GRAPHIC LOG LITHOLOGY	SAMPLES NO.	SAMPLES TYPE	SAMPLES BLOW COUNT	SAMPLES DRILLING RATE/ TIME	REMARKS
30	Gray clay, moist, mottled brown				4 7 13		
35	Brown silty clay, wet				6 7 9		
40	bottom of boring						
45							
50							
55							
60							
65							
70							

Project

Project No.

CONT. LOG OF BORING

B-4

HEALTH AND SAFETY PLAN

(see document attached)

CONTENTS

SECTION 1

INTRODUCTION

PURPOSE AND SCOPE

This Health and Safety Plan contains site-specific information regarding requirements and safety, emergency, and general procedures to be followed during the course of the site investigation program at the Durham Transportation site located at 19984 Meekland Road in the Hayward area of Alameda County, California. The purpose of this Plan is to ensure the health and safety of all personnel during the site investigation program.

The Health and Safety Plan was developed based on the following:

- The Occupational Health and Safety Administration regulations in 29 CFR parts 1910 and 1926, specifically part 1910.120 (Hazardous Waste Operations and Emergency Response;
- The Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October 1985; and
- The Standard Operating Safety Guides from the U.S. Environmental Protection Agency Office of Emergency and Remedial Response, November 1984.

This site-specific plan addresses:

- Site Setting
- Site History
- Prior Site Investigations
- Physical, Chemical, Mineral and Biological Hazards
- Site Control and Safe Work Practices
- Monitoring Equipment Requirements
- Personal Protective Equipment Requirements
- Material Handling and Decontamination Guidelines
- Medical Surveillance and Emergency Response Procedures
- General Health and Safety Requirements

PROJECT TEAM

Project Manager (PM)

Lisa A. Polos, REA will be designated as the Project Manager (PM) for the site investigation program. In this capacity, she will be responsible for overall project management.

Field Manager (FM)

John N. Alt, CEG will be designated as the Field Manager (FM) for the site investigation program. In this capacity, he will be responsible for overseeing the sampling program. He will be at the site to monitor job progress and overall health and safety compliance.

Health and Safety Officer (HSO)

Lisa A. Polos, REA will be designated as the Health and Safety Officer (HSO) for the site investigation program. In this capacity, she will be responsible for maintaining compliance to the Health and Safety Plan. She will report directly to the FM and will provide field personnel with site-specific training and field auditing of site health and safety practices. If serious violations are noted, she will recommend that field operations be shutdown until corrective action is taken.

Field Personnel

During excavation and sampling activities, CTTS, Inc. personnel will be on-site to identify sampling locations, collect soil samples, log soil conditions, complete chain-of-custody documentation and transport samples to the laboratory.

All field personnel will comply with all federal, state, and local safety codes, ordinances, and regulations in order to maintain safe working conditions at the job site. All personnel will also be responsible for reporting unsafe working conditions to the PM, FM, or HSO. All questions or inquiries must be addressed to the PM, FM and HSO immediately. Prompt reporting is critical so as to provide field personnel the proper information, first aid or other medical treatment as required.

SECTION 2

SITE INFORMATION

SITE LOCATION AND SETTING: The subject site is located at the northeast corner of the intersection of Meekland Road and Blossom Way in the unincorporated area of Alameda County near the City of Hayward, California (Plate 1). The surrounding area is mainly residential, with commercial land use on the remaining three corners of Meekland and Blossom.

SITE HISTORY:

Background: The Subject site was a service station and opened in 1946. It is assumed that tanks 1, 2, and 4 (Plate 2) were installed in 1947 when the service station started operation. Tank 3 was installed in 1972. Sometime later, the property was owned by Harbert Transportation. In December 1986, the property was purchased by Durham Transportation, the current owner.

Previous Investigations: In July 1986, a subsurface investigation was conducted by Applied Geosystems of Fremont, California. Soil samples indicated that petroleum hydrocarbons were found at a level of over 200 ppm in B-1 and <1 ppm in B-2 (Plate 2). Groundwater was encountered at 24' and B-1 was converted into a monitoring well (MW-1). MW-1 had 42 ppm of gasoline and Benzene values ranging from 5-6 ppm. In May 1988, precision tank tests were conducted on the gasoline tanks. Tanks 1 & 2 were found to be manifolded together above the tank top and the system appeared to be leaking. The test suggested that the leak was in the piping. Tank 3 tested tight. All four underground tanks were removed in August 1989 by CTTS, Inc. Analytical data from the soil samples taken in the pit excavation show significant gasoline, benzene, toluene, ethylbenzene and xylene contamination, particularly around tanks 1 & 2. Soil from the waste oil excavation contained low levels of toluene and xylene. In November 1989, two groundwater monitoring wells were installed (Plate 3). Soils from the monitoring well borings had no odor above a depth of 20 feet. Analytical results indicated the presence of gasoline and BTEX in both borings. Additionally, MW-3 had low levels volatile chlorinated hydrocarbons. Water from the wells contained the same constituents as the soil borings, with Benzene levels in MW-3 as high as 4.6 ppm. Full analytical data is available upon request.

Regulatory Actions To-Date: After submittal of the underground tank removal report in September 1989, Mr. Tom Peacock of the Alameda County Health Care Services Agency, Hazardous Materials Division requested that a State Fuel Leak Report be filled out and returned to the County. This was done by CTTS, Inc. On November 28, 1989, Mr. Tom Peacock arrived on-site during installation of the monitoring wells. He requested that the un-

registered on-site operations well be sampled before abandonment. This was done by CTTS, Inc. Aside from the above, there has been no other interaction with Alameda County, who is the lead agency for fuel site investigations.

SECTION 3

HAZARD ASSESSMENT

trench-collapse

PHYSICAL HAZARDS

Physical hazards involved in this project include exposure to temperatures high enough to precipitate heat stroke, heat stress, heat exhaustion and heat cramps. Other physical hazards may include: operations of heavy machinery, fire and explosion hazards and confined entry with a potential for asphyxiation.

CHEMICAL HAZARDS

According to preliminary site information, potential chemicals at the site include: petroleum hydrocarbons as gasoline, Benzene, Toluene, Ethylbenzene Xylenes and chlorinated solvents. Prolonged exposure to these products may produce irritation of the skin and mucous membranes, asphyxiation, central nervous system (CNS) damage or systemic toxicoses by targeting specific organs for damage.

Should drums, containers, liquids, unusual odors or other evidence of non-documented potentially hazardous materials be identified during the site investigation, activities shall cease, and the PM/HSO shall be notified immediately.

MINERAL HAZARDS

To the best of our knowledge, no mineral hazards have been found at this site as of the date of this document.

BIOLOGICAL HAZARDS

To the best of our knowledge, no biological hazards have been found at this site as of the date of this document.

SECTION 4

SITE INVESTIGATION ACTIVITIES

CTTS, Inc. has been retained to perform a site investigation program in areas determined to contain hydrocarbon contaminants. Project activities will consist of:

- Soil-Gas Testing
- Test Pit Excavations
- Monitoring Well Installations

BACKHOE OPERATIONS

Backhoe excavation operations that are to be performed as part of this site investigation program include test pits to evaluate the lateral and vertical extent of contamination based on results of the soil-gas testing.

No personnel shall enter a test pit which is deeper than their waist height. Required samples will be collected from the excavated material whenever possible. Backhoe test pits shall be covered with plywood and taped off. No partially excavated test pits shall remain uncovered at the end of the work day.

DRILLING OPERATIONS

Drilling operations to be performed as part of this subsurface hydrocarbon investigation include the installation of at least two additional groundwater monitoring wells and possibly some test borings.

If any drilling is not completed by the end of the work day, the boring shall be backfilled or covered with a plate of sufficient thickness and with sufficient bearing to prevent access to the hole.

SAMPLING AND DOCUMENTATION PROCEDURES

Sampling to be performed as part of the site investigation program include soil-gas, to be analyzed on-site, soil samples to be collected in brass liners, ends wrapped in teflon and sealed with a plastic cap and water samples to be collected in glass containers provided by the laboratory, that meet the specifications required by the EPA and that already contain the proper preservative. Soil and water samples will be identified with a sample number, labeled, placed on ice in a cooled ice chest and transported to TMA/Norcal or Western Environmental Laboratory under chain-of-custody procedures.

Sample labels and chain-of-custody forms will be appropriately completed by field personnel to ensure proper and accurate sample documentation, tracking and analysis in the laboratory.

PROJECT DURATION

It is anticipated that the period of the site investigation program will be approximately 50 days.

SECTION 5

SITE-SPECIFIC HEALTH AND SAFETY REQUIREMENTS

HEALTH AND SAFETY PLAN REVIEW

Twenty-nine (29) CFR Part 1910.120 requires organizations sponsoring hazardous materials investigations to draft a site-specific Health and Safety Plan. This Health and Safety Plan is to be explained in detail to all site employees and parties involved in the site investigation.

PERSONAL PROTECTION LEVELS

Due to the anticipated levels of contaminants at the site, Level D personal protective equipment (PPE) will be enforced throughout the duration of the field activities at the site. Should circumstances dictate that a higher level of personal protection is required, the PM, FM or HSO will stop field activities until further evaluation of the site has occurred. These decisions can only be made by the PM, FM or HSO. Periodic air monitoring will be performed to characterize the presence of potential atmospheric hazards during the duration of the field investigation.

Level D adequate? - gloves, resp. eye pro

EPA LEVEL D

Level D PPE consists of the following equipment and will be used as required:

Boots - Resp

- o Body Protection (Coveralls)
- o Foot Protection (Steel-toed boots or safety shoes) - necessary?
- o Eye Protection (Safety glasses)
- o Head Protection (Hard hat)

ENVIRONMENTAL MONITORING PROCEDURES

Under CFR 1910 and SARA Title III Section 1206 E, monitoring of ambient air in the work area is required to prevent inhalation of toxic gases and/or vapors.

The results of the monitoring will be recorded by CTTS, Inc. field personnel. An initial air quality monitoring program will include, but may not be limited to:

- o HNU Monitor (or equivalent)
- o Gas Tech combustible gas meter

Air quality monitoring equipment will be calibrated off-site prior to commencement of daily field investigation work. Results of daily calibrations will be recorded on instrument calibration forms. Background ambient air reading will also be recorded prior to daily work startup.

SITE CONTROL

Due to the size of the subject site, the entire site will become the work zone. An area near the gate of the site will contain metal drums for disposal of disposable protective equipment. A wash station will be in this area for decontamination of exposed skin. This will consist of washing with soap and water followed by a clean water rinse. Work boots and coveralls will be stored on-site in a locker or trailer.

All personnel entering the site must wear no less than the designated level of protective equipment. Access to the site will be only through the front gate located on Meekland Road. Site access will be controlled such that only approved visitors will be allowed in on-site. A daily sign in sheet will be maintained at the front gate.

REPORTING PROCEDURES

CTTS, Inc. field personnel will complete documentation logs throughout the duration of the project. These logs include the following:

- Equipment Use Form
- Daily Project Reports
- Monitoring Equipment Calibration Form
- Site Incident Report
- Equipment Billing Form

SECTION 6

EMERGENCY PROCEDURES

EMERGENCY TELEPHONE NUMBERS

St. Rose Hospital	(415) 782-6200
Emergency Medical, Police and Fire	911
Alameda County - HazMat	(415) 271-4320
National Response Center	1-800-424-8802
CTTS, Inc.	(415) 799-1140

COMMUNICATIONS

Public Telephones are available at the liquor store located at 50 Blossom Road and Pires Market located at 20008 Meekland Road. Both of these sites are located at the same intersection as the subject site.

IN CASE OF FIRE

In the event of a fire, the procedure is to :

- Maintain the safety of employees in the immediate vicinity of the fire, evacuating if necessary.
- If the fire is containable or immediately extinguishable, on-site personnel will respond and proceed to extinguish the fire using on-site fire control equipment.
- Call for assistance from the fire department (911).

IN CASE OF ACCIDENT OR INJURY

Depending on the severity of the injury, treatment may either be given at the site by trained personnel (additional assistance from an emergency medical technician may be required) or the victim may have to be transported to a hospital. A map showing the location of the nearest hospital (St. Rose) is provided in Plate 4.

HEAT MONITORING

Heat Stroke

Heat stroke is life-threatening. The condition occurs when the victim's temperature-controlling system stops working. The body temperature can rise high enough such that brain damage and death may occur if the body is not cooled quickly.

Symptoms: Hot, red skin, small pupils and very high body temperature; skin may be either wet or dry.

First Aid: Heat stroke is life-threatening. Call 911 and shade the victim. Cool the victim by wrapping wet towels around the body and fanning them. Care for shock while waiting for Emergency Response Personnel to arrive. Do not administer fluids or medications by mouth.

Heat Exhaustion

Heat exhaustion is less dangerous than heat stroke. This condition occurs when people exercise heavily, or work in a warm humid place where body fluids are lost through perspiration. Fluid loss causes blood flow to decrease in the vital organs, resulting in a form of shock. With heat exhaustion, perspiration does not evaporate as it should, possibly because of high humidity or too many layers of clothing. As a result, the body is not cooled efficiently.

Symptoms: Cool, pale, moist skin, dilated pupils, headache, nausea, dizziness and vomiting. Body temperature will be near normal.

First Aid: Shade the victim, and place on the back with feet up. Either remove or loosen victim's clothing. Cool by fanning and applying cold packs (putting a cloth between the pack and the victim's skin) or wet towels. Give the victim on-half glassful of water to drink every 15 minutes, if fully conscious and tolerable. These steps should bring improvement within one-half hour.

Heat Cramps

Heat cramps are muscular pains and spasms due to heavy exertion. They usually involve the abdominal muscles or legs. it is generally thought that the loss of water and salt from heavy perspiring causes the cramps.

Symptoms: Pains and/or spasms in the abdomen area or in the legs noticed while working in a hot environment.

First Aid: As with other heat emergencies, shade the victim. If the victim has no other injuries and can tolerate water, give one-half glassful every 15 minutes for one hour.

SECTION 7

GENERAL SAFETY REQUIREMENTS

UTILITIES REVIEW

Prior to commencement of any subsurface investigation work at the project site, the PM or his designate shall contact Underground Service Alert (USA) at 1-800-642-2444 or a utility-locating company to evaluate whether underground pipes, wire, cables, etc. are present, energized or charged. This includes:

- Water
- Storm and Sanitary Sewer
- Telephone
- Electric Power
- Natural Gas and/or Other High Pressure Fuel Lines
- Cable Television

PERSONAL SAFETY

- There shall be no intoxicating substances of any kind permitted on or near the job site (i.e. alcohol, illegal drugs, etc.). Under no circumstances will anyone known to be under the influence of intoxicating substances be allowed on the job site (violators are subject to dismissal).

- No firearms or other weapons shall be permitted on the job site (violators are subject to dismissal)

- Fighting, scuffling or horseplay is prohibited while on the job site (violators are subject to dismissal).

- All field personnel must follow all instructions from the PM, FM or HSO regarding the proper use of personal safety equipment.

- Decontamination of personnel and equipment shall be as outlined in this Health and Safety Plan.

- No worker shall handle excavated refuse or other material without wearing the proper protective gloves. No glove ... on page 13

- Contact with contaminated or suspected contaminated surfaces should be avoided, whenever possible. Do not kneel on the ground.

- No smoking will be allowed within the Work Zone.

- Good Housekeeping is essential and shall be maintained at the job site.

- No eating, drinking, gum chewing or chewing tobacco shall be allowed in the work area in order to decrease the probability of hand-to-mouth transfer and ingestion of material that could harm human health and safety.

- All personnel are responsible for practicing personal hygiene, such as washing hands, face and arms thoroughly prior to eating, drinking or rest room duties.

EVACUATION OF WORK AREA

The PM, FM or HSO are responsible for determining if conditions exist which require evacuation and will always assume worst-case until proven otherwise. Withdrawal to a safe up-wind location will be required if any of the following conditions occur:

- Potentially explosive levels of combustible gases, toxic gases, or volatile organic gases are detected (20 percent of the lower explosive limit (LEL) in the atmosphere).

- Potentially toxic levels of organic or inorganic vapors are detected in the Work Zone that exceed the capacity of the protective equipment.

- Wind blows contaminated dust particles to the point of interfering with the work crew.

- Occurrence of an accident. Field operations will resume after first aid and/or decontamination procedures have been administered.

- Equipment, including protective clothing, malfunctions.

EQUIPMENT SAFETY

- All equipment, (i.e., electrical and gas fueled) water lines, steam lines, and gas lines shall not be turned on or set in motion without carefully checking to assure that no person could be injured by such action and then should only be used by authorized personnel.

- Construction equipment shall be equipped with a vertical exhaust at least five feet above grade and/or with spark arrestors.

- Motors used in the excavation are shall be explosion proof.

- No welding shall be permitting within 50 feet of the excavation or work area.

- Startup and shutdown of equipment shall not be performed in areas of exposed refuse.

FIRE SAFETY

- Entrances to the job site must not be obstructed. In the event of an emergency, response vehicles must have a means of access to the site.

- There will be absolutely no smoking in the work area.

- The use of gasoline as a cleaning solvent is strictly forbidden.

- No burning, welding or other source of ignition shall be applied to any enclosed tank or vessel, even if there are some openings, until it has first been determined by the HSO that there is no possibility of explosion. Authorization for such work MUST be obtained from the PM, FM or HSO.

EXCAVATION SAFETY

- No field personnel shall enter underground vaults, tanks, silos, manholes excavation or any confined space until it has been determined that the air contains no flammable or toxic gases or vapors. This determination can only be made by the HSO. There must be at least 19.5 percent oxygen.

- No worker shall be allowed to work alone at any time in or immediately near an excavation and/or construction area.

- No excavation or drilled hole greater that 12 inches deep shall be left open overnight unless securely covered in an acceptable manner.

- Sloping/shoring of excavations. More detail

SECTION 8

TRAINING, CERTIFICATION AND MEDICAL MONITORING

TRAINING AND CERTIFICATION REQUIREMENTS

Under current OSHA regulations stated in CFR 29, Part 1910.120, all personnel engaged in site investigation activities that include exposure to hazardous wastes or substances must complete and be certified in 40 hours of Hazardous Materials/Health and Safety training, and a minimum of 24 hours of on-site supervised instruction is designed to provide personal knowledge and skills necessary to perform on-site activities and operations with minimal risk to themselves, on-site personnel and the environment.

All personnel are required to take an eight hour refresher course each year, re-emphasizing issues crucial to personal health and safety in a hazardous environment. Management and supervisory personnel are required to supplement the 40-Hour training with an Eight-Hour training course, emphasizing additional issues applicable to management.

Under 29 CFR Part 1900.120 (Hazardous Communication Standard), it is the responsibility of the management (employer) to provide to their personnel the Material Safety Data Sheets (or equal information) of all hazardous and/or possibly hazardous substances present, or likely to be present on the job site, and providing them proper chemical protective equipment. It is also the responsibility of management to extend this knowledge to anyone under their employ that has received prior clearance or authority to enter the site.

All site personnel, regardless of level or position, must present proof of appropriate training before being allowed on the job site. All contractor and subcontractor personnel who are assigned to the field program will be required to provide documentation which certifies their training.

For this specific site, the contamination is believed to be generally at a depth of 20' or greater, except for the gasoline pit, which has been lined and covered. Therefore, no direct exposure to hazardous substances is anticipated until trenching and drilling operations commence. At this time, all on-site personnel will be required to have proof of proper certification as described above.

MEDICAL MONITORING

All site personnel are required to be in a medical monitoring program. All other outside contractors are also required to

provide their on-site field personnel with a medical monitoring program.

The medical monitoring program required by 29 CFR Part 1910.120 must begin with a "baseline" physical examination. This primary information must be established prior to working in a hazardous environment. Monitoring of all field personnel must be performed on an annual basis. Medical monitoring must include but not be limited to a chest X-ray, a liver/kidney check and a complete health screen that includes testing for lead and zinc.

If an employee(s) has exceeded the respiratory limits, or in case of personal exposure exceeding the Permissible Exposure Limits, the HSO will alert the proper emergency response organization, document the incident exposure and an immediate medical examination of the exposed person(s) must be administered and followed up by periodic monitoring.

SECTION 9

ACKNOWLEDGEMENT OF HEALTH AND SAFETY PLAN REVIEW

Prior to conducting any field work at this site, all personnel must review this site-specific Health and Safety Plan. If any information presented is unclear, the Project Manger or Health and Safety Officer should be contacted for clarification. A copy of this Health and Safety Plan must be kept on-site for the duration of field activities.

"I have reviewed this attached Health and Safety Plan for the Durham Transportation site located at 19984 Meekland Road in Hayward, California. I have discussed any questions that I have regarding this Plan with the Project Manager or the Health and Safety Officer, and I understand all of the requirements."

Signature: _____
Company Name: _____
Date: _____

Signature: _____
Company Name: _____
Date: _____

Signature: _____
Company Name: _____
Date: _____

Signature: _____
Company Name: _____
Date: _____

Signature: _____
Company Name: _____
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Company Name: _____
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Company Name: _____
Date: _____

Signature: _____
Company Name: _____
Date: _____

PLATES

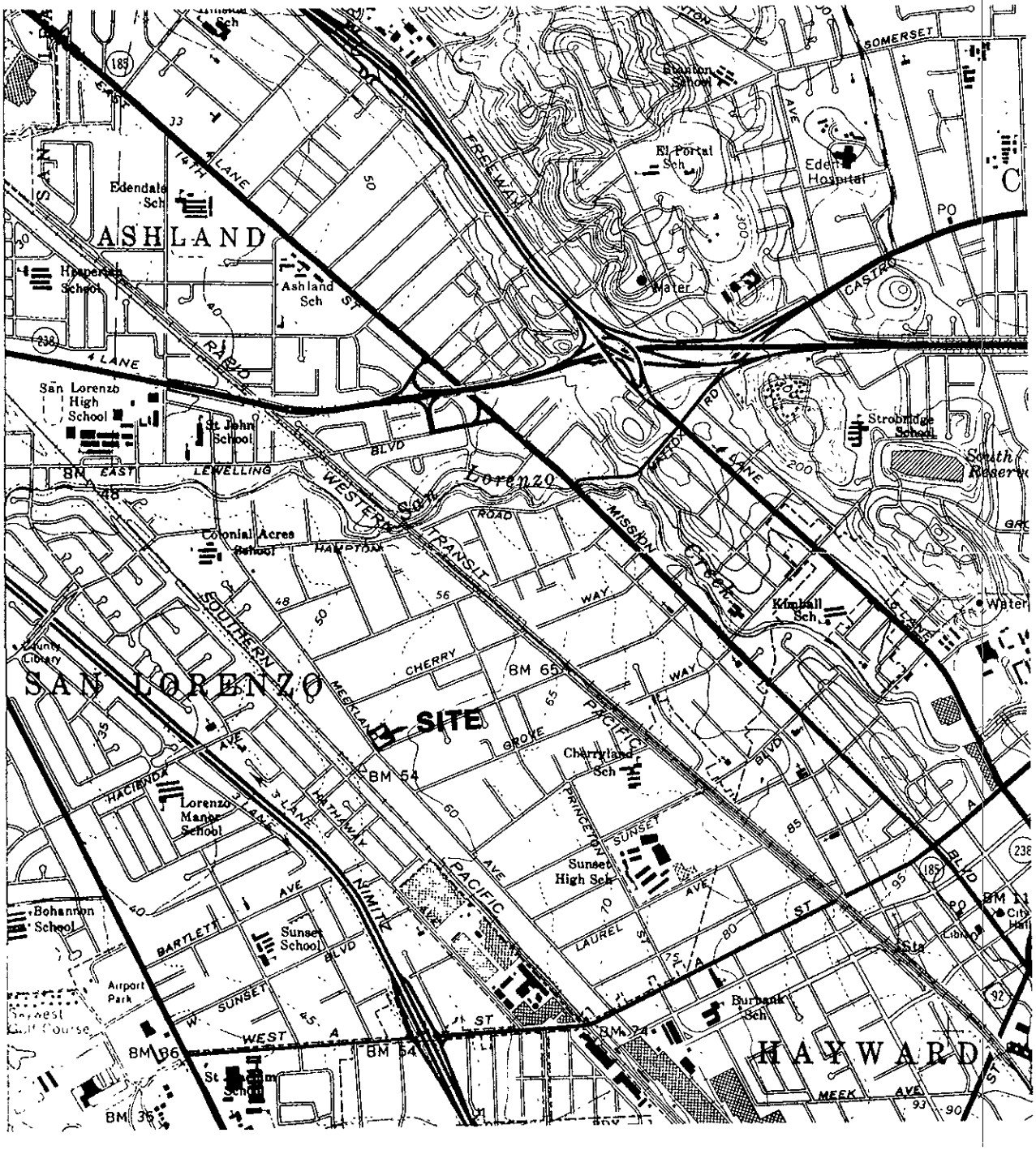


PLATE	No. 1
SITE LOCATION MAP	

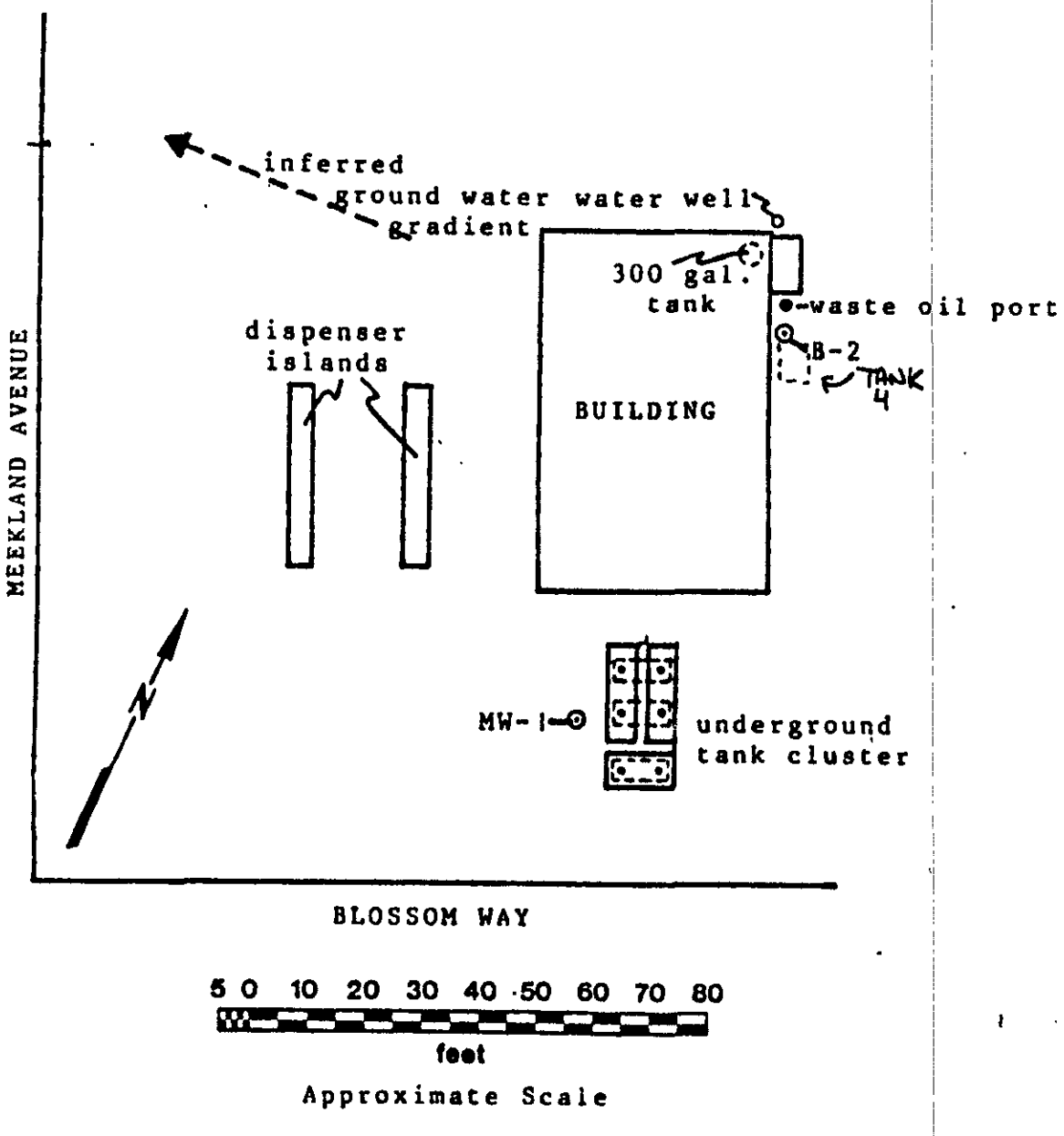


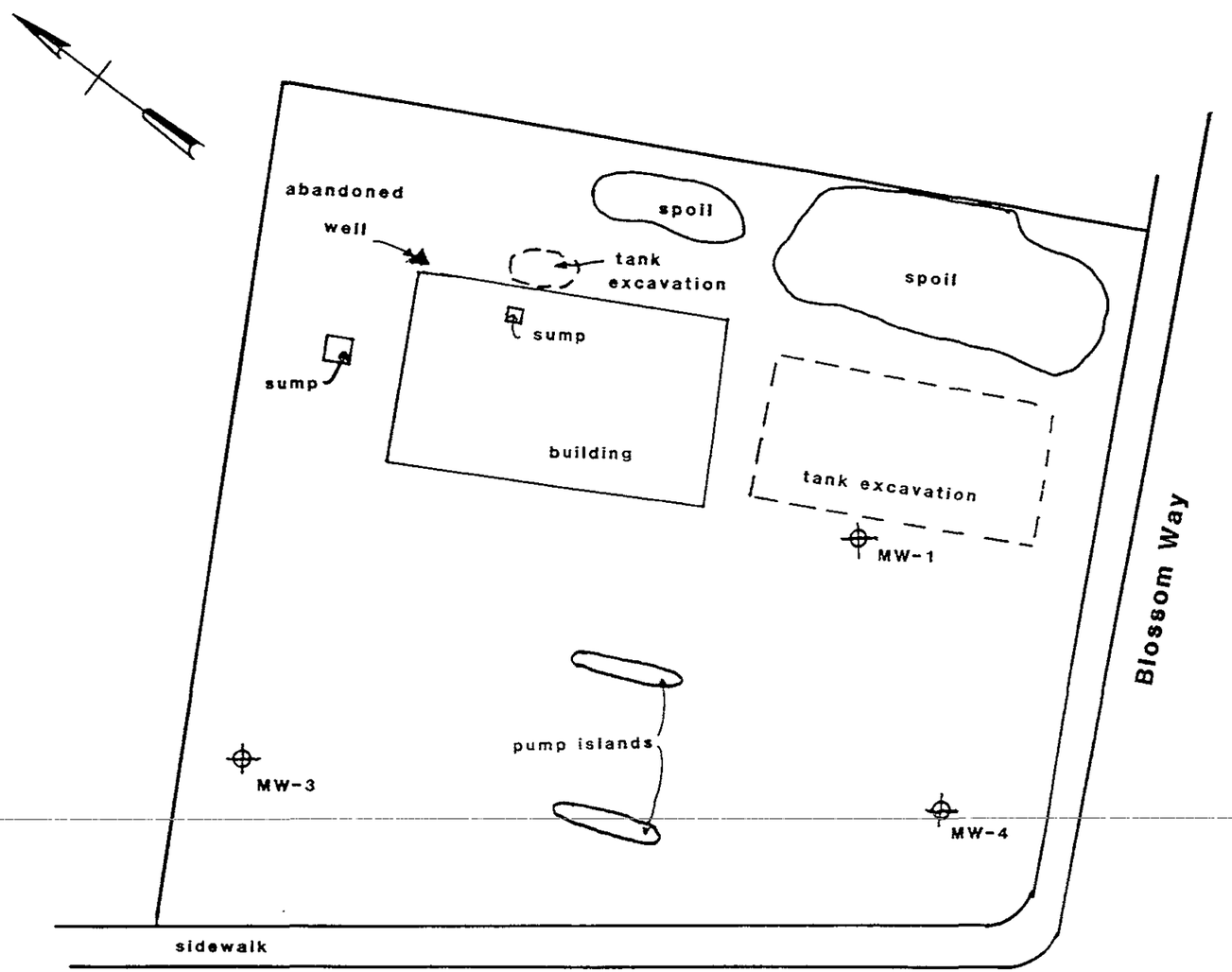
PLATE 2

Boring and Well Locations From 1986

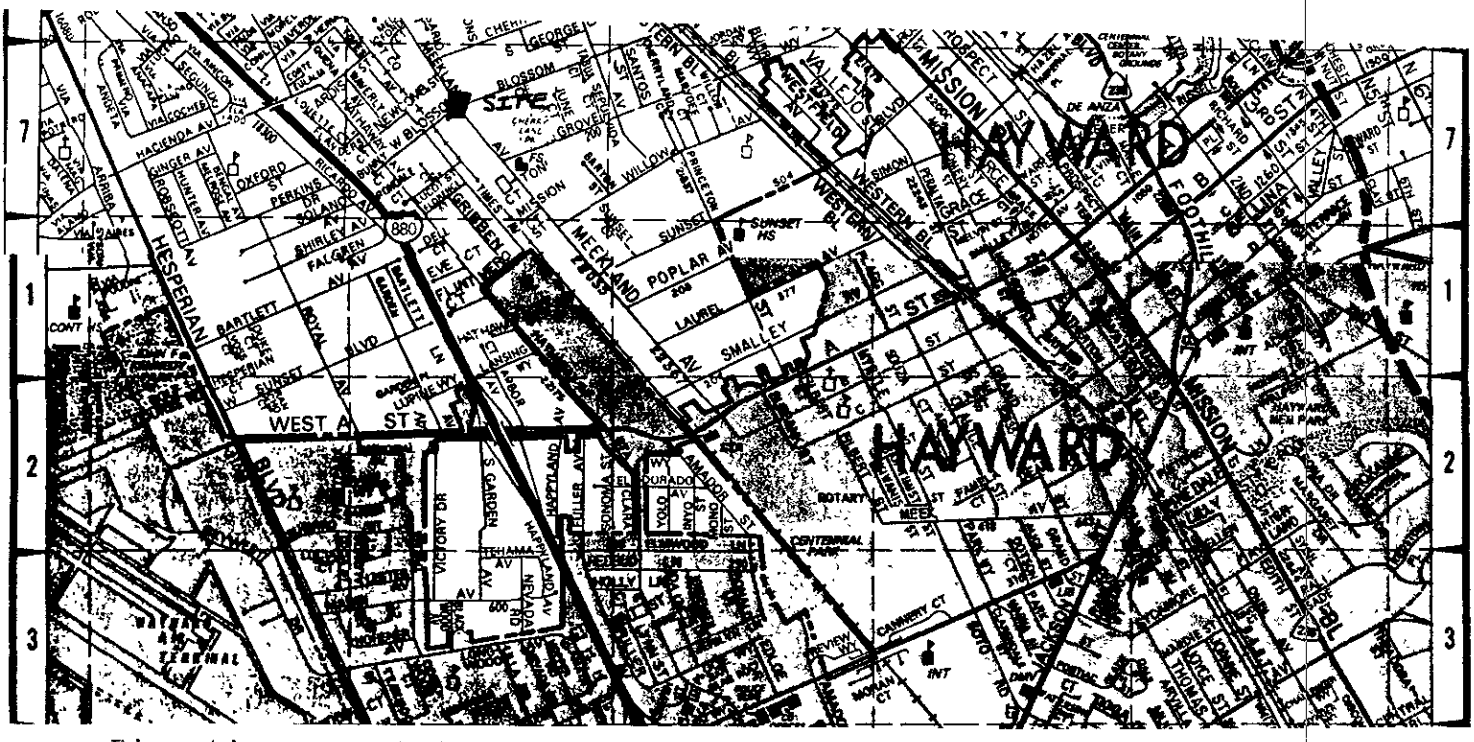
Site Location: 19984 Meekland Road, Hayward

Toxic Technology Services
P.O. Box 515
Rodeo, California 94572

Project #89-6
Durham Transportation
27577 (A) Industrial Blvd.
Hayward, CA 94545



SITE PLAN - DURHAM TRANSPORTION		
SCALE 1" = 20'	APPROVED BY	DRAWN BY
DATE JANUARY 1990		REVISED
CTTS, Inc.		DRAWING NUMBER 3



Directions: Take 880 South to W. Tennyson, turn right. Go to Calaroga, turn right.

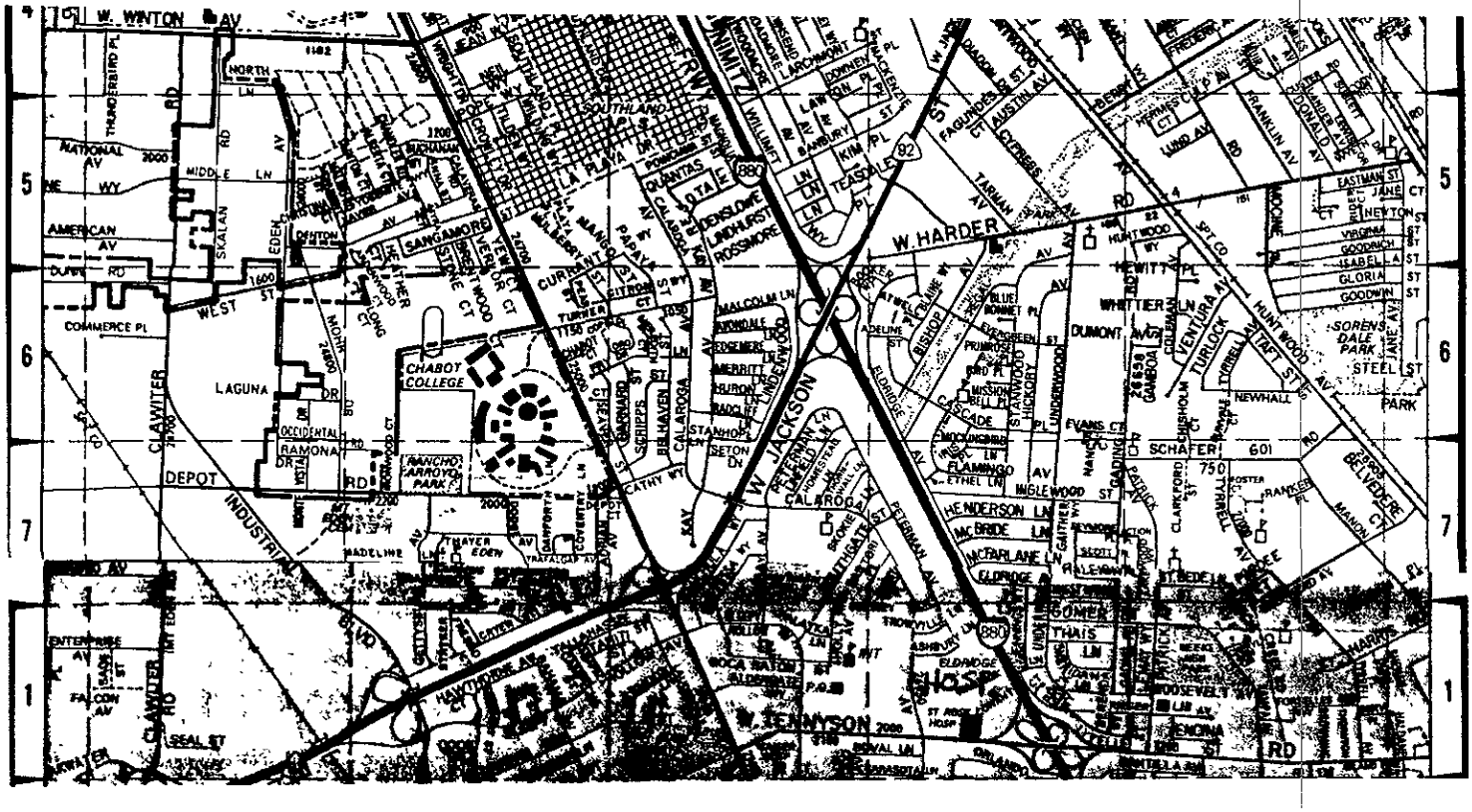


PLATE 4

ROUTE TO NEAREST HOSPITAL

Hospital Location: St. Rose, 27200 Calaroga Ave., Hayward

CTTS, Inc.
Toxic Technology Services
P.O. Box 515
Rodeo, California 94572

Project #90-2
Durham Transportation
27577 (A) Industrial Blvd.
Hayward, California 94545

APPENDIX A

ETHYLENE DICHLORIDE

EDC

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

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

Fire

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

Exposure

CALL FOR MEDICAL AID

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

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

Water Pollution

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

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

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Disperse and flush

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3 CHEMICAL DESIGNATIONS

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

4. OBSERVABLE CHARACTERISTICS

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

5. HEALTH HAZARDS

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

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

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

5.4 Threshold Limit Value: 10 ppm

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

5.6 Toxicity by Ingestion: Grade 2, LD_{50} = 0.8 to 5 g/kg (rat)

5.7 Late Toxicity: Data not available

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

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

5.10 Odor Threshold: 100 ppm

5.11 IDLH Value: 1,000 ppm

6. FIRE HAZARDS

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

(Continued)

7. CHEMICAL REACTIVITY

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

8. WATER POLLUTION

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

9. SHIPPING INFORMATION

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

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-X

11. HAZARD CLASSIFICATIONS

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

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

11.3 NFPA Hazard Classification:

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 98.96
12.3 Boiling Point at 1 atm: 182.3°F = 83.5°C = 356.7°K
12.4 Freezing Point: −32.3°F = −35.7°C = 237.5°K
12.5 Critical Temperature: 550°F = 288°C = 561°K
12.6 Critical Pressure: 735 psia = 50 atm = 5.1 MN/m²
12.7 Specific Gravity: 1.253 at 20°C (liquid)
12.8 Liquid Surface Tension: 32.2 dynes/cm = 0.0322 N/m at 20°C
12.9 Liquid Water Interfacial Tension: (est.) 30 dynes/cm = 0.03 N/m at 25°C
12.10 Vapor (Gas) Specific Gravity: 3.4
12.11 Ratio of Specific Heats of Vapor (Gas): 1.116
12.12 Latent Heat of Vaporization: 138 Btu/lb = 76.4 cal/g = 3.2×10^5 J/kg
12.13 Heat of Combustion: (est.) 3400 Btu/lb
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.35 Heat of Fusion: 21.12 cal/g
12.36 Limiting Value: Data Not Available
12.37 Reid Vapor Pressure: 2.7 psia

6. FIRE HAZARDS (Continued)

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

EDC ETHYLENE DICHLORIDE

12.17 SATURATED LIQUID DENSITY

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

12.18 LIQUID HEAT CAPACITY

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

12.19 LIQUID THERMAL CONDUCTIVITY

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

12.20 LIQUID VISCOSITY

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

12.21 SOLUBILITY IN WATER

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

12.22 SATURATED VAPOR PRESSURE

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

12.23 SATURATED VAPOR DENSITY

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

12.24 IDEAL GAS HEAT CAPACITY

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

TRICHLOROETHYLENE

TCL

Common Synonyms	Watery liquid	Colorless	Sweet odor
Trichloroethylene Trichlene, Algylen Chlorylen Gemalgene Trethylene Trichloran, Trilene	Sinks in water. Irritating vapor is produced		

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

Fire

Combustible.
POISONOUS GASES ARE PRODUCED IN FIRE.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, carbon dioxide, or foam.

Exposure

CALL FOR MEDICAL AID

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

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, difficult breathing, or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

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

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

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Should be removed.
Chemical and physical treatment.

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Halogenated hydrocarbon
3.2 Formula: $CHCl=CCl_2$
3.3 IMO/UN Designation: 9.0/1710
3.4 DOT ID No.: 1710
3.5 CAS Registry No.: 79-01-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Chloroform-like, ethereal

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Organic, vapor-acid gas canister, self-contained breathing apparatus for emergencies; neoprene or vinyl gloves, chemical safety goggles; face-shield; neoprene safety shoes; neoprene suit or apron for splash protection.

5.2 Symptoms Following Exposure: INHALATION symptoms range from irritation of the nose and throat to nausea, an attitude of irresponsibility, blurred vision, and finally disturbance of central nervous system resulting in cardiac failure. Chronic exposure may cause organic injury. INGESTION symptoms similar to inhalation. SKIN, defatting action can cause dermatitis. EYES, slightly irritating sensation and lachrymation.

5.3 Treatment of Exposure: Do NOT administer adrenalin or epinephrine; get medical attention for all cases of overexposure. INHALATION, remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. INGESTION: have victim drink water and induce vomiting; repeat three times; then give 1 tablespoon epsom salts in water. EYES, flush thoroughly with water. SKIN, wash thoroughly with soap and warm water.

5.4 Threshold Limit Value: 50 ppm
5.5 Short Term Inhalation Limits: 200 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3, LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard if spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold. 50 ppm
5.11 IDLH Value: 1,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 90°F C.C., practically nonflammable
6.2 Flammable Limits in Air: 8.0%-10.5%
6.3 Fire Extinguishing Agents: Water fog
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic and irritating gases are produced in fire situations.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 770°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

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

8. WATER POLLUTION

6.1 Aquatic Toxicity: 660 mg/l/40 hr/daphnia/kill/fresh water
6.2 Waterfowl Toxicity: Data not available
6.3 Biological Oxygen Demand (BOD): Data not available
6.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Technical; dry cleaning; degreasing; extraction
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-X-Y

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A

11.2 NAS Hazard Rating for Bulk Water Transportation:

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

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	1
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 131.39
12.3 Boiling Point at 1 atm: 189°F = 87°C = 360°K
12.4 Freezing Point: −123.5°F = −86.4°C = 186.8°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.46 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.3 dynes/cm = 0.0293 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 34.6 dynes/cm = 0.0346 N/m at 24°C
12.10 Vapor (Gas) Specific Gravity: 4.5
12.11 Ratio of Specific Heats of Vapor (Gas): 1.116
12.12 Latent Heat of Vaporization: 103 Btu/lb = 57.2 cal/g = 2.4×10^5 J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 2.5 psia

NOTES

TCL TRICHLOROETHYLENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
0	94.669
5	94.410
10	94.150
15	93.889
20	93.629
25	93.370
30	93.110
35	92.849
40	92.589
45	92.330
50	92.070
55	91.809
60	91.549
65	91.290
70	91.030
75	90.770
80	90.509
85	90.250
90	89.990
95	89.730
100	89.469
105	89.209
110	88.950
115	88.690
120	88.429
125	88.169

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.220
10	.221
20	.223
30	.225
40	.226
50	.228
60	.230
70	.231
80	.233
90	.235
100	.236
110	.238
120	.240
130	.241
140	.243
150	.245
160	.246
170	.248

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
NOT PERTINENT	

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
15	.800
20	.775
25	.750
30	.727
35	.705
40	.684
45	.664
50	.645
55	.627
60	.610
65	.593
70	.577
75	.562
80	.548
85	.534
90	.521
95	.508
100	.496
105	.485
110	.474
115	.463
120	.453

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
77.02	.110

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
40	.508
50	.678
60	.894
70	1.166
80	1.507
90	1.929
100	2.448
110	3.081
120	3.846
130	4.765
140	5.862
150	7.163
160	8.695
170	10.490
180	12.580
190	15.010
200	17.810
210	21.020

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
40	.01245
50	.01628
60	.02105
70	.02695
80	.03418
90	.04296
100	.05354
110	.06619
120	.08120
130	.09891
140	.11960
150	.14380
160	.17180
170	.20390
180	.24080
190	.28280
200	.33040
210	.38420

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.136
25	.139
50	.143
75	.146
100	.149
125	.152
150	.155
175	.157
200	.160
225	.162
250	.165
275	.167
300	.169
325	.172
350	.174
375	.176
400	.177
425	.179
450	.181
475	.182
500	.184
525	.185
550	.186
575	.187
600	.188

p-XYLENE

XLP

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

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

Fire

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

Exposure

CALL FOR MEDICAL AID.

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

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

Water Pollution

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

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

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

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

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

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

4. OBSERVABLE CHARACTERISTICS

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

5. HEALTH HAZARDS

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

6. FIRE HAZARDS

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

7. CHEMICAL REACTIVITY

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

8. WATER POLLUTION

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

9. SHIPPING INFORMATION

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

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

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

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

11.3 **NFPA Hazard Classification:**

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 106.16
12.3 **Boiling Point at 1 atm:** 280.9°F = 138.3°C = 411.5°K
12.4 **Freezing Point:** 55.9°F = 13.3°C = 286.5°K
12.5 **Critical Temperature:** 649.4°F = 343.0°C = 616.2°K
12.6 **Critical Pressure:** 509.4 atm = 34.66 psia = 3.510 MN/m²
12.7 **Specific Gravity:** 0.861 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 28.3 dynes/cm = 0.0283 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 37.8 dynes/cm = 0.0378 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.071
12.12 **Latent Heat of Vaporization:** 150 Btu/lb = 81 cal/g = 3.4 X 10⁵ J/kg
12.13 **Heat of Combustion:** −17,559 Btu/lb = −9754.7 cal/g = −408.41 X 10⁵ J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** 37.63 cal/g
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** 0.84 psia

NOTES

XLP	p-XYLENE

12.17 SATURATED LIQUID DENSITY

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

12.18 LIQUID HEAT CAPACITY

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

12.19 LIQUID THERMAL CONDUCTIVITY

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

12.20 LIQUID VISCOSITY

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

12.21 SOLUBILITY IN WATER

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

12.22 SATURATED VAPOR PRESSURE

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

12.23 SATURATED VAPOR DENSITY

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

12.24 IDEAL GAS HEAT CAPACITY

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

o-XYLENE

XLO

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

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

Fire

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

Exposure

CALL FOR MEDICAL AID

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

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

Water Pollution

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

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

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

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

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

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

4. OBSERVABLE CHARACTERISTICS

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

5. HEALTH HAZARDS

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

6. FIRE HAZARDS

6.1 Flash Point: 63°F C.C.; 75°F O.C.
6.2 Flammable Limits in Air: 1.1%-7.0%
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 869°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.8 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

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

8. WATER POLLUTION

8.1 Aquatic Toxicity: >100 mg/l/96 hr/D. magna/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0 lb/lb 5 days; 2.5% (theor.), 8 days
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

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

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

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

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

11.3 NFPA Hazard Classification:

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.16
12.3 Boiling Point at 1 atm: 291.9°F = 144.4°C = 417.6°K
12.4 Freezing Point: −13.3°F = −25.2°C = 248.0°K
12.5 Critical Temperature: 674.8°F = 357.1°C = 630.3°K
12.6 Critical Pressure: 541.5 atm = 36.84 psia = 3.732 MN/m²
12.7 Specific Gravity: 0.880 at 20°C (liquid)
12.8 Liquid Surface Tension: 30.53 dynes/cm = 0.03053 N/m at 15.6°C
12.9 Liquid Water Interfacial Tension: 36.06 dynes/cm = 0.03606 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.068
12.12 Latent Heat of Vaporization: 149 Btu/lb = 82.9 cal/g = 3.47 X 10^5 J/kg
12.13 Heat of Combustion: −17,558 Btu/lb = −9754.7 cal/g = −408.41 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 30.64 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.26 psia

NOTES

XLO	o-XYLENE

12.17 SATURATED LIQUID DENSITY

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

12.18 LIQUID HEAT CAPACITY

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

12.19 LIQUID THERMAL CONDUCTIVITY

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

12.20 LIQUID VISCOSITY

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

12.21 SOLUBILITY IN WATER

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

12.22 SATURATED VAPOR PRESSURE

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

12.23 SATURATED VAPOR DENSITY

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

12.24 IDEAL GAS HEAT CAPACITY

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

m-XYLENE

XLM

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

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

Fire

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

Exposure

CALL FOR MEDICAL AID.

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

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

Water Pollution

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

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

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

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

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3 CHEMICAL DESIGNATIONS

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

4. OBSERVABLE CHARACTERISTICS

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

5. HEALTH HAZARDS

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

6. FIRE HAZARDS

6.1 Flash Point: 84°F C.C.
6.2 Flammable Limits in Air: 1.1%-6.4%
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 986°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.8 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

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

8. WATER POLLUTION

8.1 Aquatic Toxicity: 22 ppm/96 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days; 0% (theor.), 6 days
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

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

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

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

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

11.3 NFPA Hazard Classification:

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.16
12.3 Boiling Point at 1 atm: 269.4°F = 131.9°C = 405.1°K
12.4 Freezing Point: −54.2°F = −47.9°C = 225.9°K
12.5 Critical Temperature: 650.8°F = 343.8°C = 617.0°K
12.6 Critical Pressure: 513.8 atm = 34.95 psia = 3.540 MN/m²
12.7 Specific Gravity: 0.864 at 20°C (liquid)
12.8 Liquid Surface Tension: 28.6 dynes/cm = 0.0286 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.4 dynes/cm = 0.0364 N/m at 30°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.071
12.12 Latent Heat of Vaporization: 147 Btu/lb = 81.9 cal/g = 3.43 X 10^5 J/kg
12.13 Heat of Combustion: −17,554 Btu/lb = −9752.4 cal/g = −408.31 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 26.01 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.34 psia

NOTES

XLM	m-XYLENE

12.17 SATURATED LIQUID DENSITY

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

12.18 LIQUID HEAT CAPACITY

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

12.19 LIQUID THERMAL CONDUCTIVITY

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

12.20 LIQUID VISCOSITY

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

12.21 SOLUBILITY IN WATER

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

12.22 SATURATED VAPOR PRESSURE

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

12.23 SATURATED VAPOR DENSITY

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

12.24 IDEAL GAS HEAT CAPACITY

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

TOLUENE

TOL

Common Synonyms
Toluol
Methylbenzene
Methylbenzol

Watery liquid | Colorless | Pleasant odor

Floats on water. Flammable, irritating vapor is produced.

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

Fire

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

Exposure

CALL FOR MEDICAL AID.

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

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

Water Pollution

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

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

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-high flammability.
Evacuate area.

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

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

4. OBSERVABLE CHARACTERISTICS

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

5. HEALTH HAZARDS

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

6. FIRE HAZARDS

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

(Continued)

7. CHEMICAL REACTIVITY

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

8. WATER POLLUTION

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

9. SHIPPING INFORMATION

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

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U

11. HAZARD CLASSIFICATIONS

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

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

11.3 NFPA Hazard Classification:

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 92.14
12.3 Boiling Point at 1 atm: 231.1°F = 110.6°C = 383.8°K
12.4 Freezing Point: -139°F = -95.0°C = 178.2°K
12.5 Critical Temperature: 605.4°F = 318.6°C = 591.8°K
12.6 Critical Pressure: 596.1 psia = 40.55 atm = 4.106 MN/m²
12.7 Specific Gravity: 0.867 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.0 dynes/cm = 0.0290 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m at 25°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.089
12.12 Latent Heat of Vaporization: 155 Btu/lb = 86.1 cal/g = 3.61×10^5 J/kg
12.13 Heat of Combustion: -17,430 Btu/lb = -9686 cal/g = -405.5×10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 17.17 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 1.1 psia

6. FIRE HAZARDS (Continued)

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

TOLUENE

TOL

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
—30	57.160
—20	56.870
—10	56.550
0	56.240
10	55.930
20	55.620
30	55.310
40	54.990
50	54.680
60	54.370
70	54.060
80	53.750
90	53.430
100	53.120
110	52.810
120	52.500

12.18 LIQUID HEAT CAPACITY

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

12.19 LIQUID THERMAL CONDUCTIVITY

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

12.20 LIQUID VISCOSITY

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

12.21 SOLUBILITY IN WATER

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

12.22 SATURATED VAPOR PRESSURE

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

12.23 SATURATED VAPOR DENSITY

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

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.226
25	.241
50	.255
75	.268
100	.281
125	.294
150	.306
175	.319
200	.331
225	.343
250	.355
275	.367
300	.378
325	.389
350	.400
375	.411
400	.422
425	.432
450	.443
475	.453
500	.462
525	.472
550	.482
575	.491
600	.500

GASOLINES: AUTOMOTIVE (<4.23g lead/gal)

GAT

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

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

Fire

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

Exposure

CALL FOR MEDICAL AID

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

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

Water Pollution

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

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

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning high flammability
Evacuate area
Disperse and flush

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Miscellaneous Hydrocarbon Mixtures
3.2 **Formula:** (Mixture of hydrocarbons)
3.3 **IMO/UN Designation:** 3 1/1203
3.4 **DOT ID No.:** 1203
3.5 **CAS Registry No.:** Data not available

4. OBSERVABLE CHARACTERISTICS

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

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Protective goggles, gloves
5.2 **Symptoms Following Exposure:** Irritation of mucous membranes and stimulation followed by depression of central nervous system. Breathing of vapor may also cause dizziness, headache, and incoordination or, in more severe cases, anesthesia, coma, and respiratory arrest. If liquid enters lungs, it will cause severe irritation, coughing, gagging, pulmonary edema, and, later, signs of bronchopneumonia and pneumonitis. Swallowing may cause irregular heartbeat.
5.3 **Treatment of Exposure:** INHALATION: maintain respiration and administer oxygen, enforce bed rest if liquid is in lungs. INGESTION: do NOT induce vomiting, stomach should be lavaged (by doctor) if appreciable quantity is swallowed. EYES: wash with copious quantity of water. SKIN: wipe off and wash with soap and water.
5.4 **Threshold Limit Value:** 300 ppm
5.5 **Short Term Inhalation Limits:** 500 ppm for 30 min
5.6 **Toxicity by Ingestion:** Grade 2, LD_{50} = 0.5 to 5 g/kg
5.7 **Late Toxicity:** None
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard if spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 0.25 ppm
5.11 **IDLH Value:** Data not available

6. FIRE HAZARDS

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

7. CHEMICAL REACTIVITY

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

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 90 ppm/24 hr/juvenile American shad/TL_m/fresh water; 91 mg/1/24 hr/juvenile American shad/TL_m/salt water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 8%, 5 days
8.4 **Food Chain Concentration Potential:** None

9. SHIPPING INFORMATION

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

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-V-W

11. HAZARD CLASSIFICATIONS

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

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

11.3 **NFPA Hazard Classification:**

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** Not pertinent
12.3 **Boiling Point at 1 atm:** 140—390°F = 60—199°C = 333—472°K
12.4 **Freezing Point:** Not pertinent
12.5 **Critical Temperature:** Not pertinent
12.6 **Critical Pressure:** Not pertinent
12.7 **Specific Gravity:** 0.7321 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 19-23 dynes/cm = 0.019—0.023 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 49-51 dynes/cm = 0.049—0.051 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** 3.4
12.11 **Ratio of Specific Heats of Vapor (Gas):** (est.) 1.054
12.12 **Latent Heat of Vaporization:** 130—150 Btu/lb = 71—81 cal/g = 3.0 — 3.4 X 10^5 J/kg
12.13 **Heat of Combustion:** —18,720 Btu/lb = —10,400 cal/g = 435.1 X 10^5 J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** Data not available
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** 7.4 psia

NOTES

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

12.17 SATURATED LIQUID DENSITY

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

12.18 LIQUID HEAT CAPACITY

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

12.19 LIQUID THERMAL CONDUCTIVITY

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

12.20 LIQUID VISCOSITY

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

12.21 SOLUBILITY IN WATER

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

12.22 SATURATED VAPOR PRESSURE

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

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
	NOT PERTINENT

12.24 IDEAL GAS HEAT CAPACITY

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

GASOLINES: POLYMER

GPL

Common Synonyms	Watery liquid	Colorless	Gasoline odor
	Floats on water. Flammable, irritating vapor is produced.		

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

Fire

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

Exposure

CALL FOR MEDICAL AID

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

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

Water Pollution

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Disperse and flush

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Miscellaneous Hydrocarbon Mixtures
3.2 **Formula:** Not pertinent
3.3 **IMO/UN Designation:** 3.2/1215
3.4 **DOT ID No.:** 1215
3.5 **CAS Registry No.:** Data not available

4. OBSERVABLE CHARACTERISTICS

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

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Protective goggles, gloves
5.2 **Symptoms Following Exposure:** INHALATION, causes irritation of upper respiratory tract, central nervous system stimulation followed by depression of varying degrees ranging from dizziness, headache, and incoordination to anesthesia, coma, and respiratory arrest, irregular heartbeat is dangerous complication. ASPIRATION causes severe lung irritation with coughing, gagging, dyspnea, substernal distress, and rapidly developing pulmonary edema, later, signs of bronchopneumonia and pneumonitis, acute onset of central nervous system excitement followed by depression. INGESTION causes irritation of mucous membranes of throat, esophagus, and stomach; stimulation followed by depression of central nervous system, irregular heartbeat.
5.3 **Treatment of Exposure:** Seek medical attention. INHALATION maintain respiration, give oxygen if needed. ASPIRATION enforce bed rest, administer oxygen. INGESTION do NOT induce vomiting, lavage carefully if appreciable quantity was ingested, guard against aspiration into lungs. EYES wash with copious quanity of water. SKIN wipe off and wash with soap and water.
5.4 **Threshold Limit Value:** 300 ppm
5.5 **Short Term Inhalation Limits:** 500 ppm for 30 min
5.6 **Toxicity by Ingestion:** Grade 2, LD_{50} = 0.5 to 5 g/kg
5.7 **Late Toxicity:** None
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard if spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 0.25 ppm
5.11 **IDLH Value:** Data not available

6. FIRE HAZARDS

6.1 **Flash Point:** 0-73°F C.C.
6.2 **Flammable Limits in Air:** 1.3%-7.1%
6.3 **Fire Extinguishing Agents:** Dry chemical, foam, carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective
6.5 **Special Hazards of Combustion Products:** None
6.6 **Behavior in Fire:** Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back
6.7 **Ignition Temperature:** Data not available
6.8 **Electrical Hazard:** Class I, group D
6.9 **Burning Rate:** 4 mm/min.
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

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

8. WATER POLLUTION

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

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Composition varies with range of distillation temperatures used. Contains mostly isohexane-isooctane
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-V-W

11. HAZARD CLASSIFICATIONS

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

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

11.3 **NFPA Hazard Classification:**

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** Not pertinent
12.3 **Boiling Point at 1 atm:** 58-275°F = 14—135°C = 287—408°K
12.4 **Freezing Point:** Not pertinent
12.5 **Critical Temperature:** Not pertinent
12.6 **Critical Pressure:** Not pertinent
12.7 **Specific Gravity:** 0.71-0.75 at 15°C (liquid)
12.8 **Liquid Surface Tension:** 19.23 dynes/cm = 0.019-0.023 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 49-51 dynes/cm = 0.049—0.051 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** 3.4
12.11 **Ratio of Specific Heats of Vapor (Gas):** Not pertinent
12.12 **Latent Heat of Vaporization:** 130—150 Btu/lb = 71—81 cal/g = 3.0—3.4 X 10^5 J/kg
12.13 **Heat of Combustion:** —18,720 Btu/lb = —10,400 cal/g = —435.4 X 10^5 J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** Data not available
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** Data not available

NOTES

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GASOLINES: POLYMER

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot (estimate)
35	45.040
40	44.880
45	44.730
50	44.570
55	44.410
60	44.260
65	44.100
70	43.950
75	43.790
80	43.630
85	43.480
90	43.320
95	43.160
100	43.010
105	42.850
110	42.700
115	42.540
120	42.380
125	42.230
130	42.070
135	41.920
140	41.760
145	41.600
150	41.450
155	41.290
160	41.140.

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
10	.459
15	.462
20	.464
25	.467
30	.470
35	.472
40	.475
45	.478
50	.480
55	.483
60	.486
65	.488
70	.491
75	.493
80	.496
85	.499
90	.501
95	.504
100	.507
105	.509

12.19 LIQUID THERMAL CONDUCTIVITY

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

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise (estimate)
35	.519
40	.501
45	.485
50	.469
55	.454
60	.440
65	.426
70	.414
75	.401
80	.390
85	.379
90	.368
95	.358
100	.348
105	.339
110	.330
115	.322
120	.314
125	.306
130	.299
135	.291
140	.285
145	.278
150	.272
155	.266
160	.260

12.21 SOLUBILITY IN WATER

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

12.22 SATURATED VAPOR PRESSURE

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

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
	NOT PERTINENT

12.24 IDEAL GAS HEAT CAPACITY

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

BENZENE

BNZ

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

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

Fire

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

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

Exposure

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

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

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

Water Pollution

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

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

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Restrict access

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

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

4. OBSERVABLE CHARACTERISTICS

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

5. HEALTH HAZARDS

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

6. FIRE HAZARDS

6.1 **Flash Point:** 12°F C.C.
6.2 **Flammable Limits in Air:** 1.3%-7.9%
6.3 **Fire Extinguishing Agents:** Dry chemical, foam, or carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective
6.5 **Special Hazards of Combustion Products:** Not pertinent
6.6 **Behavior in Fire:** Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back
6.7 **Ignition Temperature:** 1097°F
6.8 **Electrical Hazard:** Class I, Group D
6.9 **Burning Rate:** 6.0 mm/min
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

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

8. WATER POLLUTION

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

9. SHIPPING INFORMATION

9.1 **Grades of Purity:**
Industrial pure ..... 99+%
Thiophene-free ..... 99+%
Nitration ..... 99+%
Industrial 90% ..... 85+%
Reagent ..... 99+%
9.2 **Storage Temperature:** Open
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-V-W

11. HAZARD CLASSIFICATIONS

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

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

11.3 **NFPA Hazard Classification:**

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 78.11
12.3 **Boiling Point at 1 atm:** 176°F = 80.1°C = 353.3°K
12.4 **Freezing Point:** 42.0°F = 5.5°C = 278.7°K
12.5 **Critical Temperature:** 552.0°F = 288.9°C = 562.1°K
12.6 **Critical Pressure:** 710 psia = 48.3 atm = 4.89 MN/m²
12.7 **Specific Gravity:** 0.879 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 28.9 dynes/cm = 0.0289 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 35.0 dynes/cm = 0.035 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** 2.7
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.061
12.12 **Latent Heat of Vaporization:** 169 Btu/lb = 94.1 cal/g = 3.94 X 10⁵ J/kg
12.13 **Heat of Combustion:** −17,460 Btu/lb = −9698 cal/g = −406.0 X 10⁵ J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** 30.45 cal/g
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** 3.22 psia

NOTES

BNZ	BENZENE

12.17 SATURATED LIQUID DENSITY

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

12.18 LIQUID HEAT CAPACITY

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

12.19 LIQUID THERMAL CONDUCTIVITY

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

12.20 LIQUID VISCOSITY

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

12.21 SOLUBILITY IN WATER

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

12.22 SATURATED VAPOR PRESSURE

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

12.23 SATURATED VAPOR DENSITY

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

12.24 IDEAL GAS HEAT CAPACITY

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