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**REMEDIAL ACTION PLAN (RAP)  
SOIL EXCAVATION AND LONG-TERM MONITORING PROGRAM**

for

**OFFICE OF THE STATE ARCHITECT  
CALTRANS - HAYWARD MAINTENANCE STATION  
21195 CENTER STREET  
CASTRO VALLEY, CALIFORNIA**

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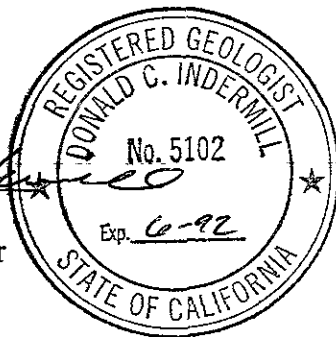
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Technical Reviewer



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## 1.0 INTRODUCTION

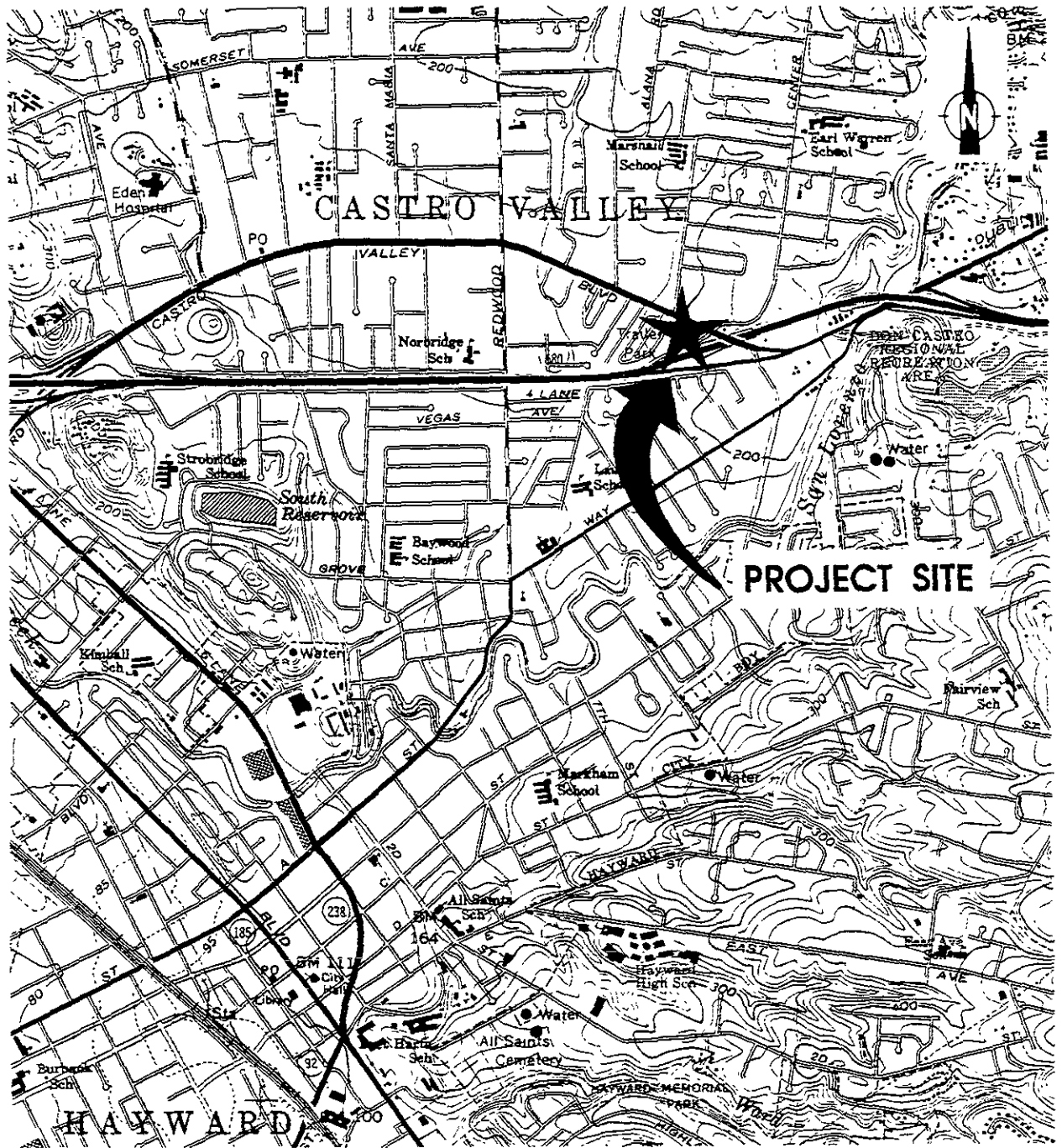
On behalf of the Office of the State Architect, Tetra Tech, Inc. has prepared the following remedial action plan for the implementation of corrective measures and long-term monitoring of identified petroleum-contaminated soil at the Caltrans - Hayward Maintenance Station, located at 21195 Center Street in the City of Castro Valley, California. Petroleum-contaminated soil had resulted from two on-site leaking underground fuel storage tanks (UST's). The remedial measures will consist of the excavation and off-site disposal and treatment of approximately 200 cubic yards of petroleum-contaminated soil. Due to the lack of groundwater data at the site, Tetra Tech also proposes to install three wells in order to monitor the presence or fluctuation of groundwater at the site and to evaluate groundwater quality through quarterly sampling.

## 2.0 SITE BACKGROUND

### 2.1 SITE LOCATION AND DESCRIPTION

The project site is the Caltrans Hayward Maintenance station, located at 21195 Center Street in the City of Castro Valley, California. A site location map showing the location of the site with respect to major roads and intersections is shown in Figure 1. The site is currently managed by the State of California. Both of the underground fuel tanks at the facility have been removed. The majority of the site is paved with asphalt or concrete, however the area where the previous tanks and dispenser island were removed is currently paved.

not



	<p>HAYWARD MAINT. STATION          CALTRANS          CASTRO VALLEY, CALIF.  <b>TETRA TECH, INC.</b>          PASADENA, CALIFORNIA</p>
<p><b>FIGURE 1</b>      <b>PROJECT SITE LOCATION</b></p>	

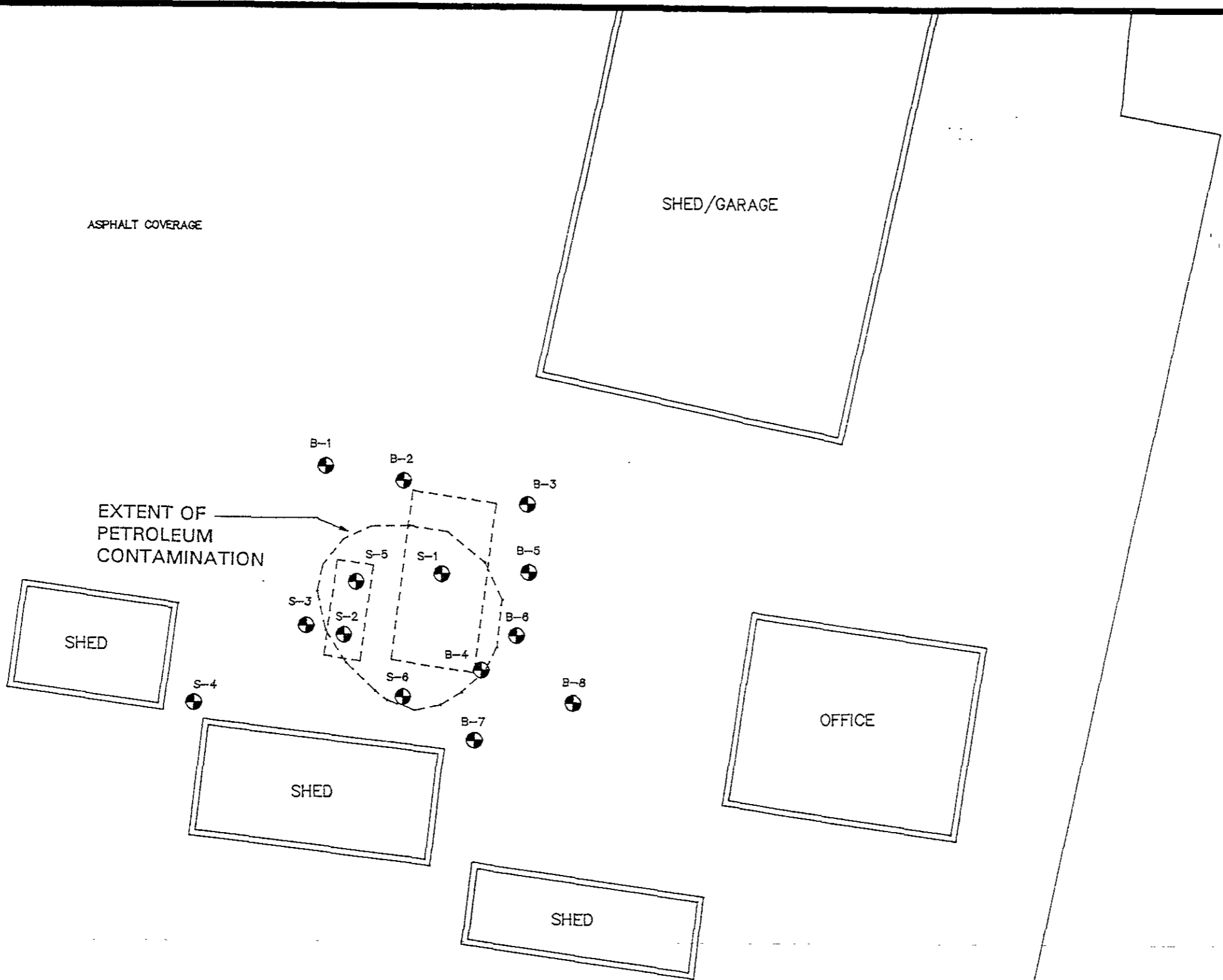
## 2.2 SITE HISTORY


Based on records provided by the Office of the State Architect (OSA), a 260 gallon diesel underground storage tank (UST) and a 1,000 gallon gasoline UST were removed from the Hayward Maintenance Station in January 1989. Following removal of the UST's, three soil samples were collected from the excavation floor for laboratory analyses. Analytical results indicated the presence of gasoline and diesel contamination in subsurface soils adjacent to both tanks.

In January of 1990, Geo/Resource Consultants Inc. performed a Preliminary Site Assessment (PSA) of the identified petroleum contamination at the Hayward Maintenance Station. The PSA, which consisted of completing six soil borings around the former tanks, indicated that the highest contamination was present around and beneath the former fuel dispensing island.

A Phase II site investigation was conducted in February <sup>1991</sup>1992 by Tetra Tech, Inc. to completely delineate the extent of petroleum contamination. The site investigation included the completion of eight additional soil borings around the perimeter of the reported contamination. Laboratory data indicated that the extent of soil contamination had been delineated.

As a result of the two investigations, the soil contamination appeared primarily to extend to the vertical depth of approximately 20 feet below ground surface. An isolated sample reported detectable contamination at the 30-foot depth interval in boring SB-1 (*located adjacent to the former dispenser island*). Laterally, the soil contamination is limited to the immediate vicinity of the former UST's and dispenser island. The lateral extent of soil contamination is presented in Figure 2.




**SITE REMEDIATION**  
**HAYWARD MAINT. STATION**  
**CALTRANS.**  
**CASTRO VALLEY, CALIF.**  
**TETRA TECH, INC.**  
 PASADENA, CALIFORNIA  
**FIGURE 2 SITE PLAN VIEW AND**  
**EXTENT OF CONTAMINATION**

### 2.3 SUBSURFACE CONDITIONS

Borings completed at the Hayward Maintenance Station indicate that the uppermost sediments consist of alluvial (*sands, silts and clays*) deposits. These deposits appear to be very poorly developed, irregular and discontinuous. A siltstone bedrock formation underlies the alluvial deposits at approximately 28 to 35 feet. The bedrock formation is speculated to contain fractures.

As reported by the Alameda County Flood Control and Water Conservation District, depth to groundwater in the vicinity has historically varied from 28 to 35 feet below ground surface (*bgs*). During Tetra Tech's boring program, damp soils were encountered from approximately 17 to 28 feet *bgs*. Although moisture was reported in some of the borings, groundwater was not encountered to the maximum logged depth of 51 feet.

### 3.0 PROPOSED SITE ACTIVITIES

#### 3.1 APPROACH

As shown in Figure 2, the area of gasoline and diesel contamination is confined to a circular-shaped area (*with a diameter of approximately 40 feet*) centered around the southeast corner of the former fuel dispensing island. The petroleum contamination is generally confined to the uppermost 20 feet. Based on the concentrations and extent of contamination, a two-phased remedial approach is proposed:

*PHASE I - LIMITED SOIL EXCAVATION*

*PHASE II - LONG-TERM MONITORING: CONSTRUCTION OF DRY WELLS*

Due to the relatively low volume of contaminated soil and the erratic soil horizons reported at the site, in-situ remedial alternatives would not appear to be effective at this site. Instead, a soil excavation program limited to the uppermost 20 feet is proposed. Excavation of this area will allow for the expedient and verifiable removal of the identified contaminants. Approximately 200 cubic yards of contaminated soil are estimated within the uppermost 20 feet of soil.

As discussed in Section 2.2, petroleum compounds in isolated samples have been detected to a depth of 30-35 feet bgs in the area of the former dispenser island. Laboratory results from both investigations reported isolated lenses of petroleum set between layers of non-detectable contamination. While these lenses of contamination may have the potential to impact groundwater in the future, Tetra Tech does not propose to excavate these materials. Rather, Tetra Tech recommends that a series of dry monitoring wells could be used to determine the presence of groundwater at the site and evaluate groundwater quality through quarterly sampling.



### 3.2 LIMITED SOIL EXCAVATION PROGRAM

As previously discussed, Tetra Tech proposes a limited excavation program to the uppermost 20 feet of contaminated soil. Based on laboratory data from the site investigations, approximately 200 yd<sup>3</sup> will be excavated during the program.

The actual soil excavation will continue until all perimeter soils with detectable TPH levels (characterized as gasoline or diesel) have been removed. In order to ensure that the soil excavation has removed all contaminated soil, on-site soil screening will be conducted. The extent of the excavation will be evaluated by soil consistency and color, augmented by on-site soil testing for volatile organic emissions. Both the excavated soil and the perimeter of the excavation will be screened using a Foxboro Model 128 GC organic vapor analyzer (OVA).

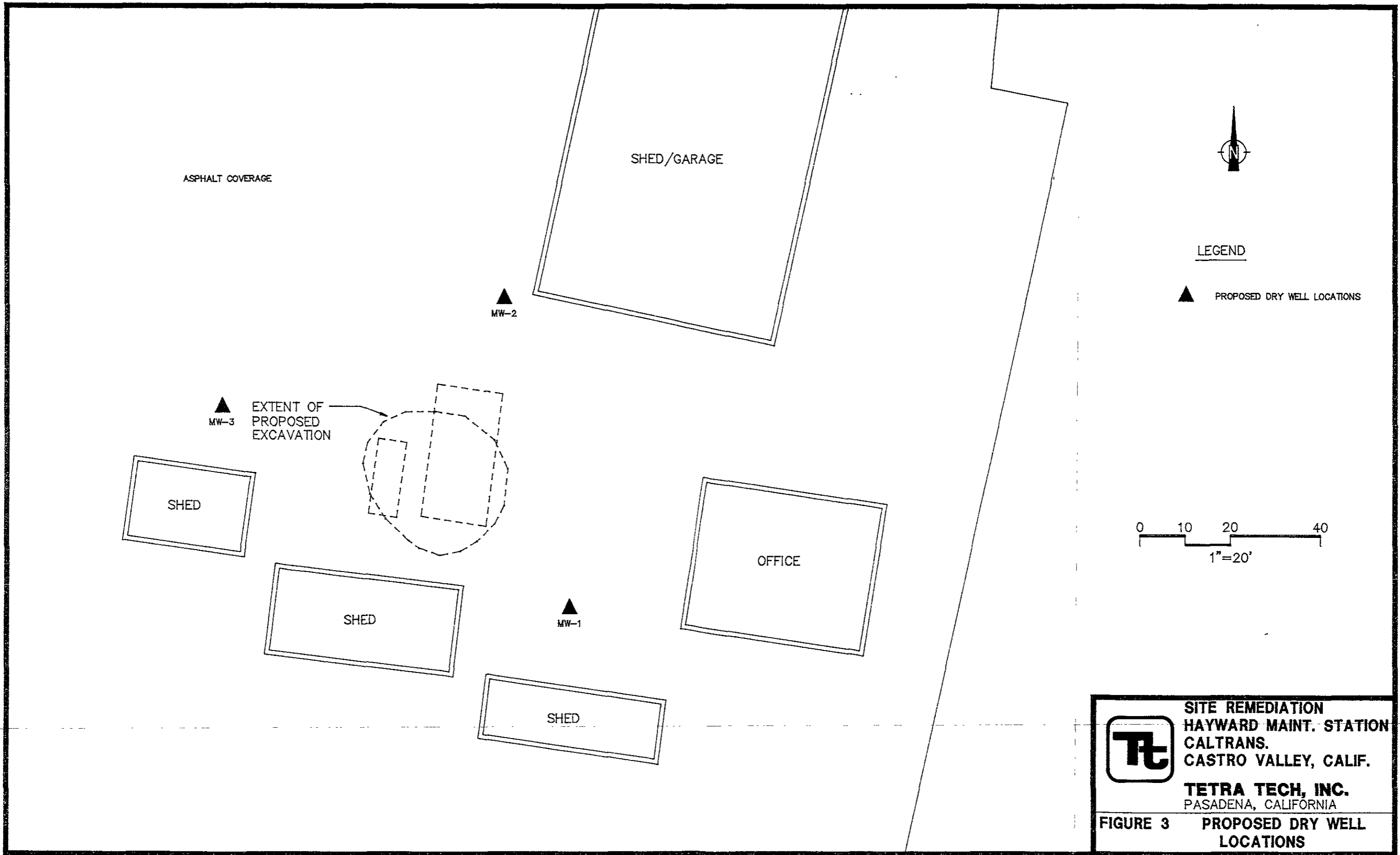
Once the soil excavation has been completed, representative soil samples will be collected from the perimeter of the excavation for laboratory analysis. Each soil sample collected will be analyzed for Total Petroleum Hydrocarbons (TPH) by EPA Method 8015M and Aromatic Volatile Organics by EPA Method 8020. A State Certified Mobile Laboratory will be provided on-site to perform clearance analyses that confirm that all contamination has been removed.

The excavated soil will be stockpiled and covered with polyethylene plastic sheeting to limit any uncontrolled emissions until the soil can be characterized for off-site disposal. Based on the anticipated contamination levels, Tetra Tech has made tentative arrangements for the disposal of the contaminated soil at R & G Environmental Services, Inc. in the City of San Jose (*a licensed soil treatment facility*). Prior to disposal, the soil will be profiled by the Toxicity Characteristic Leaching Procedure (TCLP) and the 96-hour fish bioassay for the presence of state and federally regulated hazardous wastes.

After the excavation has been completed, the area will be backfilled, compacted, and paved to match the existing coverage.

### **3.3 LONG-TERM MONITORING: CONSTRUCTION OF DRY MONITORING WELLS**

While the above-outlined excavation program is intended to remove the majority of the soil contamination, the deeper isolated lenses of contamination will be addressed in a long-term monitoring plan. Tetra Tech proposes to install three dry wells to monitor the presence of local groundwater and potential migration patterns of the contamination. These dry wells will allow for the detection of groundwater accumulation and, if necessary, allow for the future testing of the groundwater by quarterly sampling. The most probable locations of the monitoring wells are shown in Figure 3.



## Well Construction

Prior to well installation, well permits will be obtained from the Alameda County Health Care Services. The soil borings will be drilled with a truck-mounted rig with hollow stem auger. The borings will be extended to the reported depth of the bedrock formation (*approximately 35 feet*). Well casing will consist of 4-inch diameter flush threaded, schedule 40 PVC pipe, 0.020 slotted screen, and packed with #3 Monterey sand. The well will be constructed with screened PVC pipe at the 15 to 35 foot depth interval and blank PVC at the surface to 15 foot depth interval. The PVC <sup>20'</sup> screen and casing will be lowered into the hole and centralized. A sand filter media will be placed in the annulus from the bottom of the borehole to approximately 2 feet above the screened PVC portion of the well. A bentonite slurry will be used to fill the hole to approximately 10 feet below the ground surface. The remaining portion of the annulus will be filled with volclay grout and concrete and the well sealed with a locking well cover. Contaminated soil cuttings will be disposed of with the contaminated tank excavation soil to the disposal facility. Clean soil cuttings will be used as backfill material for the tank excavation.

## Well Development

In the event that groundwater is detected in the wells during drilling or during future monitoring, the wells will be developed in preparation for sampling. Development consists of mechanical surging and then bailing or pumping the wells. Well development usually requires removal of 3 to 4 well volumes or until an acceptable water clarity is achieved. All well development water will be stored in 55 gallon drums.

## Well Purging and Sampling

The wells will be left to settle and reach equilibrium for 72 hours, then purged before water samples are collected for analysis. Each well will be purged to assure that representative samples of the surrounding formation waters are collected. The well purging will consist of removing approximately 3 to 4 casing volumes of water from the well. During well purging, field parameters such as temperature, conductivity, and pH will be measured to determine when representative formation water is flowing into the well.

All work will be completed in accordance with criteria outlined in the San Francisco Bay Regional Water Quality Control Board (SFB-RWQCB), Tri-Regional Board Staff Recommendations for the Preliminary Evaluation and Investigation of Underground Tank Sites; and the State Water Resources Control Board, Leaking Underground Fuel Tank (LUFT) Manual. Prior to implementation, Tetra Tech's site remediation will be coordinated with SFB-RWQCB and the Alameda County Department of Environmental Health.

### 4.0 FIELD QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Field quality assurance/quality control QA/QC procedures include recording all samples in both the sampler's log book and the field geologist's boring logs; recording all samples on a chain of custody form that will accompany the samples to the laboratory; and several actions that will minimize cross-contamination:

- o soil augers will be steam cleaned prior to the start of each new boring;
- o the split-spoon sampler will be washed in a solution of TSP and clean tap water, rinsed in clean tap water and final rinsed in distilled water between each sample.
- o clean brass sleeves will be used for each sample.

In addition to a field notebook, which will be used to record the daily log of site activities, the following forms will be used to record the data generated in the field.

1. Inspector's Daily Record of Work Progress: This form will be used to record the names of project personnel on site, equipment on site, materials delivered to the site, items of work installed and a daily construction summary;
2. Request for Analysis: Each shipment of soil samples to the analytical laboratory will be accompanied by this form so that there will be no confusion regarding what analyses to be performed on each sample;
3. Chain of Custody Record: This form will also accompany each shipment of samples to the laboratory to insure accountability for the samples from the time of collection to the time they are analyzed;
4. Core Description Log: The field geologist will use this form to record soil types and other relevant data for each boring;
5. Tailgate Safety Meeting: This form is used to record all safety issues that are discussed by the Site Safety Officer with all personnel prior to work. These issues include hazards that may be encountered during work, preventive health and safety measures, and emergency hospital routes.

**TETRA TECH SITE SAFETY PLAN**

Site Name Caltrans-Hayward Maintenance Station

Project Number TC 8834-01

Original Site Safety Plan: Yes (X) No ( )

Revision Number \_\_\_\_\_

Plan Prepared by 

Phil Skorge,  
Site Health and Safety Officer

Date May 31, 1992

Plan Approved by 

Robert Prohaska,  
Corporate Health and Safety Officer

Date May 31, 1992

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ATTACHMENT A - TETRA TECH HEALTH AND SAFETY COMPLIANCE STATEMENT

ATTACHMENT B - DATA SHEETS FOR CONTAMINANTS



1.0 FACILITY BACKGROUND

1.1 SITE DESCRIPTION

Type: Spill ( ) Fire ( ) HW Site ( ) Industrial Facility ( )

Other: Maintenance Station

Physical Description: The Hayward Maintenance Station is located adjacent to the Castro Valley Boulevard exit of the 580 Freeway. The site consists of multiple office buildings, maintenance garages and sheds.

Location: 21195 Center Street in Castro Valley, California

Size: N/A

History: Maintenance yard and dispatching facility

Status: Active (X) Inactive ( )

Surrounding Population: Commercial/Residential

Surrounding Buildings/Homes: Adjacent to Hayward Maintenance Station  
Distance: \_\_\_\_\_

Have Nearby People Been Evacuated? Yes ( ) No ( ) Not applicable (X)

Evacuation Distance: N/A

Evacuation Initiated By: N/A

Topography: Level

Receiving Waters: N/A

Site Plan/Sketch completed (next page): Yes (X) No ( )

Background Material concerning site attached: Yes ( ) No ( ) Not Applicable ( )  
Not Available (X)

1.2 GOALS

Excavate petroleum-contaminated soil around former underground tanks. Install 3 dry wells to investigate potential groundwater conditions.

1.3 WASTES

Gasoline, Diesel Fuel

ASPHALT COVERAGE

SHED/GARAGE

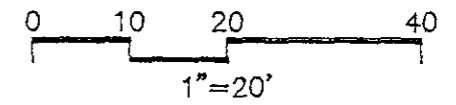
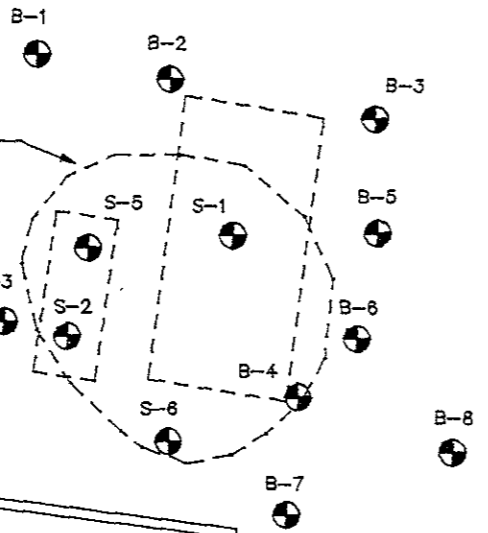
EXTENT OF PROPOSED EXCAVATION


SHED

SHED

SHED

OFFICE



 **SITE REMEDIATION**  
**HAYWARD MAINT. STATION**  
**CALTRANS.**  
**CASTRO VALLEY, CALIF.**

**TETRA TECH, INC.**  
PASADENA, CALIFORNIA

**FIGURE 2 SITE PLAN VIEW AND**  
**EXTENT OF CONTAMINATION**

2.0 KEY PERSONNEL AND RESPONSIBILITIES

Project Manager: Dan Batrack (818) 449-6400 - Directs project activities

Site Manager: Phil Skorge - Directs field activities

Site Safety Officer: Phil Skorge - Implements Safety Plan

Field Team Members: Ken Chapin - Project Scientist; Brad Bower - Technician

Federal Agency Reps: N/A

State Agency Reps: N/A

Local Agency Reps: Alameda County Health Care Services - (510) 271-4320

Contractor(s): West Hazmat Corp. - Drilling

CKY Environmental Services - Laboratory Analyses

Gagliasso Trucking - Soil Removal

R&G Environmental - Soil Treatment and Disposal

3.0 JOB HAZARD ANALYSIS

3.1 OVERALL HAZARD EVALUATION

Hazard Level: High ( ) Moderate ( ) Low (X) Unknown ( )

Hazard Type: Liquid ( ) Solid (X) Sludge ( ) Vapor/Gas (X)

Known or Suspected Hazardous Materials present on-site

(1) Gasoline

Characteristics of hazardous materials included above (complete for each chemical present):

Petroleum Hydrocarbons: This class of compounds causes irritation of the upper respiratory tract, and nervous system effects ranging from dizziness and headache to coma and respiratory arrest if inhaled in large quantities. Ingestion causes throat, lung and stomach irritation. Skin exposure causes a burning sensation.

Benzene, a component of gasoline can cause liver and kidney damage. Benzene can also affect the bone marrow resulting in blood cell changes.

Benzene has been identified as a carcinogen by the State of California.

3.2 JOB-SPECIFIC HAZARDS

Construction/drilling - hazards include trauma from drill rig/heavy equipment accidents during soil excavation and drilling; excavation of buried utility lines; and exposure to chemicals listed in Section 3.1 through ingestion, inhalation, or contact with contaminated soils. Hazards due to chemical exposures will be minimized through the use of PPE outlined in Section 6.0. The hazard due to contact with utilities will be reduced by determining the location of underground and overhead utilities prior to drilling.

The following additional hazards are expected on-site:

During drilling and sampling activities there will be a danger from vehicular traffic due to the fact that the site is an operating gas station.

Measures to minimize the effects of the additional hazards are:

The Site Safety Officer will place traffic cones or other barriers around the work area.

#### 4.0 HAZARD ASSESSMENT SUMMARY

Due to the nature of the site, the hazard from chemical exposure is considered to be minimal. Gasoline does contain minor amounts of benzene and if the gasoline storage tanks have leaked, there may be trace amounts of benzene in the soil. The principal hazard for this project will be from accidents involving trauma type injuries.

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5.0 AIR MONITORING PLAN

5.1 ACTION LEVELS FOR IMPLEMENTATION OF AIR MONITORING

<u>Level</u>	<u>Action Taken</u>
<u>0 ppm &amp; greater</u>	<u>Breathing zone (BZ) air monitoring with OVA at the location of each boring throughout drilling and sampling.</u>
<u>&gt;30 ppm in BZ</u>	<u>If breathing zone OVA readings exceed 30 ppm, the vapors in the breathing zone will be screened for benzene using Drager tubes capable of detecting 1 - 10 ppm in air.</u>

5.2 AIR MONITORING EQUIPMENT

Outline the specific equipment to be used, calibration method, frequency of monitoring, locations to be monitored, and analysis of samples (if applicable).

FLAME IONIZATION DETECTOR CALIBRATION

A Foxboro Analytical OVA-128 will be zeroed using hydrocarbon free air. The instrument gain (span) will be adjusted using hexane in air. Span gas cannot be used as oxygen is required to sustain the flame.

The instrument gain (span) will be adjusted to read the hexane level directly.

Drager pump kit CH304D and Drager aerosol tube No. 67-28561 (benzene). Monitoring will be conducted during initial pass into soil, periodically throughout drilling and upon extraction of the soil sampling head from each excavation. Excavated samples will also be analyzed prior to packaging for shipment to laboratory.

If air monitoring is not to be implemented for this site, explain why:

N/A

6.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

6.1 RATIONALE FOR SELECTION OF PPE

All site workers shall wear, at a minimum, coveralls or tyveks, steel-toed shoes or boots, safety glasses, hard hats, and hearing protection (Level D ensemble). Those site personnel in the work zone (within 10 feet of the drill rig) shall wear Level C PPE outlined in Section 6.2 if "level C" action levels prescribed in Section 6.3 (p. 14) are reached or exceeded. Persons outside the work zone will be required to wear a level D ensemble, including neoprene and viton gloves if handling soil, unless breathing zone readings exceed "level C" action levels set in Section 6.3, in which case, work zone PPE and upgrade criteria will apply to persons handling soil samples. In the event that persons inside the work zones are required to wear level C or greater respiratory protection, periodic monitoring at the downwind perimeter of the work zone will be performed to insure that downwind personnel breathing zone levels do not exceed those defined in Section 6.3. Upon reaching or exceeding specified "level B" action levels set in Section 6.3 in the breathing zone, all workers in the work zone shall upgrade respiratory protection to Level B (SCBA), close the excavation, and move out of the work zone until breathing zone vapor levels decrease below the action levels.

6.2 EQUIPMENT

Level of Protection: A ( ) B (X) C ( ) D ( )

Respiratory Protection: SCBA (X) Airline ( ) Air-Purifying ( )  
Dust Mask ( ) None ( )

If Air-Purifying: Canister ( ) Cartridge ( ) None ( )  
Half face ( ) Full face ( )

Canister/Cartridge Type N/A

Protective Clothing:

Suit Type Tyvek\* Boot Type Steel Toed

Glove Type(s) Neoprene+ Head Protection Type Hard Hat

Eye Protection Type Glasses/Goggles Other Protective Clothing \_\_\_\_\_

Hearing Protection Muff Type or Foam Inserts

Level of Protection A ( ) B ( ) C (X) D ( )

Respiratory Protection: SCBA ( ) Airline ( ) Air-Purifying (X)  
Dust Mask ( ) None ( )

If Air-Purifying: Canister ( ) Cartridge (X)  
Half Face ( ) Full Face (X)

Canister/Cartridge Type MSA "GMC-H" or equivalent

Protective Clothing:

Suite Type Tyvek\* Boot Type Steel Toed

Glove Type (s) Neoprene+ Head Protection Type Hard Hat

Eye Protection Type Glasses/Goggles Other Protective Clothing \_\_\_\_\_

Hearing Protection Muff Type or Foam Inserts

Level of Protection A ( ) B ( ) C ( ) D (X)

Respiratory Protection: SCBA ( ) Airline ( ) Air-Purifying ( )  
Dust Mask ( ) None (X)

If Air-Purifying: Canister ( ) Cartridge ( ) None (X)  
Half Face ( ) Full Face ( )



Canister/Cartridge Type N/A

Protective Clothing:

Suiter Type Coverall or Tyvek\*      Boot Type Steel Toed

Glove Type (s) Neoprene+      Head Protection Type Hard Hat

Eye Protection Type Glasses/Goggles    Other Protective Clothing     

Hearing Protection Muff Type or Foam Inserts

\*if high splash situation exists, upgrade to Saranek.

+persons handling soils or water samples will be required to wear neoprene inner gloves.

6.3 ACTION LEVELS

Action levels for upgrade and downgrade of respiratory protection/PPE.

<u>Level</u>	<u>Action Taken</u>
<u>All site workers</u>	<u>Level D PPE (those handling soil or water samples should wear modified level D specified in Section 6.2).</u>
<u>Work zone personnel where OVA breathing zone readings reach or exceed 30 ppm.</u>	<u>Level C PPE (equipment specified in Section 6.2).</u>
<u>OVA readings reach or exceed 1000 ppm in BZ</u>	<u>Upgrade respiratory protection to SCBA, close excavation, evacuate work zone.</u>

**Rationale for upgrade/downgrade matrix**

The decision to utilize Level C PPE is based on 1/10 of the PEL for petroleum hydrocarbons of 300 ppm. The decision to upgrade to Level B PPE at 1000 ppm of organic vapors is based on the rated removal capacity of 1000 ppm of organic vapors for the GMC-H cartridge.

Assuming a 1-2% benzene content in liquid gasoline, and an equivalent vapor partitioning, a 30 ppm total vapor action level should result in an exposure of less than half of 1 ppm, the OSHA PEL for benzene.

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## 7.0 WORK ZONES AND SECURITY MEASURES

The following general work zone and security guidelines will be implemented:

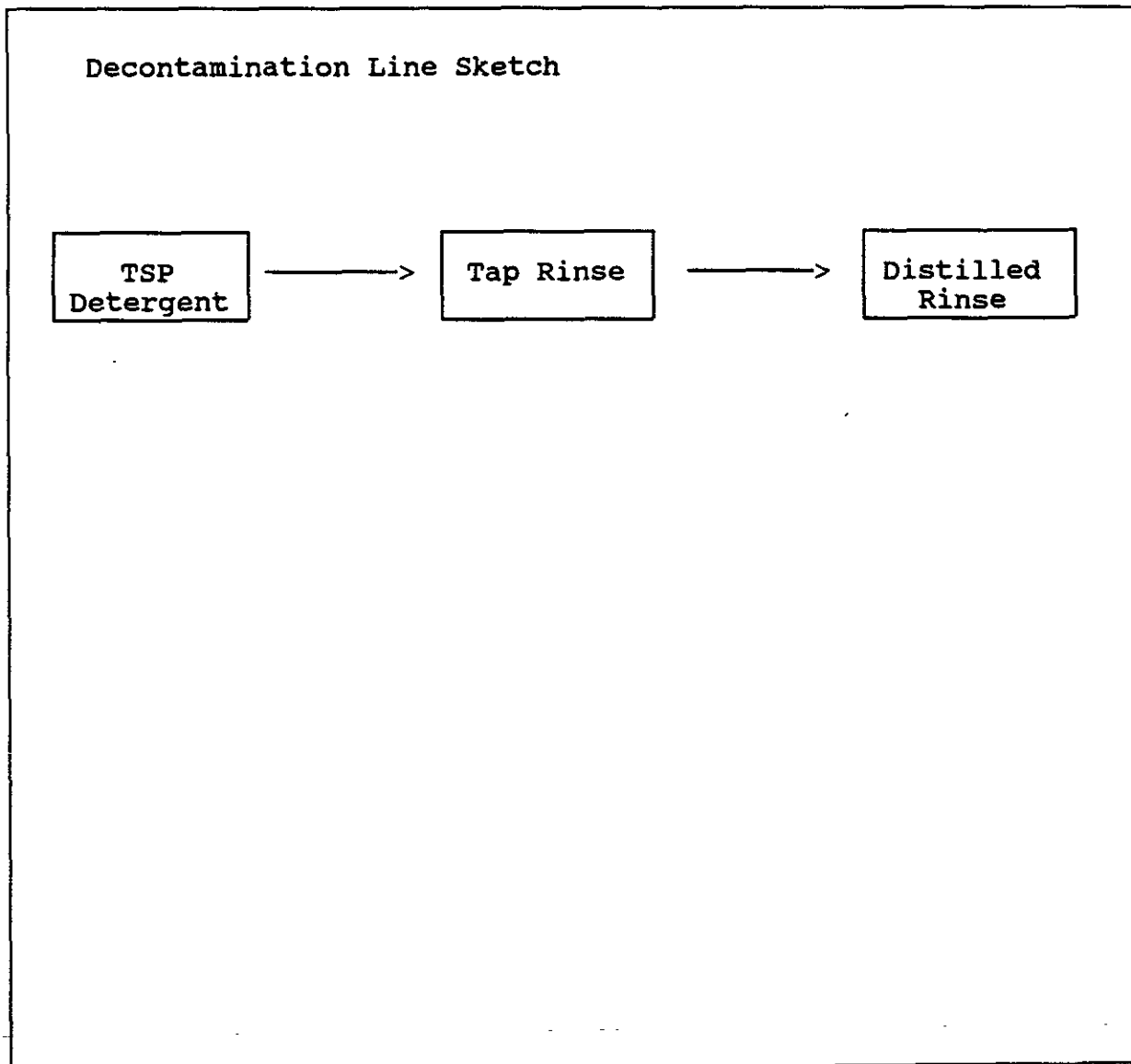
- Excavations shall be closed when drilling and sampling activities are not actually taking place.
- No excavation shall be left unattended. Excavations which must remain open will be fenced off and locked shut. Warning signs will be posted.
- Visitors will not enter the work zone unless they have attended a project safety briefing. Visitors who do not have business related to the project will be excluded from the site.
- The drill rig will not be moved until the boom has been completely lowered.
- The drill rig will not be placed within 20 feet of overhead electrical wires with the boom in the upright position.

List the requirements for moving between different zones and general site security measures, equipment and responsible personnel.

The work zone for this site shall consist of the area within 10 feet of an open excavation or heavy equipment. No equipment other than that needed to drill or sample soils should be placed in this area. Persons outside this area should place their equipment and themselves upwind of any activities, soil piles, or open excavation. Persons outside the work zone will be considered in the support/decontamination zone and are not required to comply with the respiratory protection requirements inside the work zone unless vapor and benzene levels outside the work zone exceed the action levels specified in Section 6.3. In such case, workers handling soils in the support zone will be required to comply with work zone PPE criteria. Persons handling soils and water samples outside of the work zone will be required to wear upgraded hand protection (neoprene outer gloves and viton inner gloves) regardless of vapor level readings. It is recommended that all site workers wear hearing protection when drill rig is in operation, regardless of their location.

8.0 DECONTAMINATION PROCEDURES

Personnel and equipment will be decontaminated separately. All equipment contaminated by site soils will be decontaminated using a water solution of TSP, then rinsed in tap water and finally rinsed in distilled water. All contaminated site equipment will be decontaminated both before and after site activities. All uncontaminated site equipment should be wiped with a wet towel at the close of site activities to remove dust.



Decontamination materials will be containerized labeled and left on-site in the custody of the client.

List the equipment which will be used in the decontamination procedure:

TSP

Distilled Water

Scrub Brushes

Towels

Plastic Buckets

## 9.0 GENERAL SAFE WORK PRACTICES

Tetra Tech, Inc. is responsible for the safety of all Tetra Tech employees on-site. Subcontractors are responsible to provide the required training and equipment to subcontractor employees. Each contractor shall provide all the equipment necessary to meet safe operating practices and procedures for their personnel on-site (this includes respirators, cartridges, steel toed boots, eye protection, tyvek suits, hearing protectors, and neoprene latex, and viton gloves) and be responsible for the safety of their workers. All general safety guidelines and procedures will conform to:

- o 29 CFR 1910.120.
- o Standard Operating Safety Guidelines (U.S.E.P.A., November 1984).

Tetra Tech will update versions of these safety guidelines and procedures if changes in the Operations Plan occur.

Tetra Tech will utilize a "three warning" system to enforce compliance with Health and Safety procedures as follows:

- First infraction - violator receives a verbal warning.
- Second infraction of same rule - violator receives a written warning.
- Third infraction of same rule - violator will be requested to leave the site.

The "three warning" system applies to the following safe work practices which will be implemented at the site for worker safety:

- o Eating, drinking, chewing gum or tobacco, and smoking will be allowed only in designated areas.
- o Wash facilities will be utilized by workers in the work areas before eating, drinking, or use of the toilet facilities.
- o All excavation/drilling work will comply with Title 8, Article G of the California Administrative Code.
- o Personnel at the site will use the "buddy system" when wearing any respiratory protective equipment. No one will be allowed to engage in drilling or sampling operations alone.
- o No facial hair which interferes with a satisfactory fit of the mask-to-face seal will be allowed. (no beards, large mustaches, or long sideburns).
- o All respiratory protection selection, use, and maintenance will meet the requirements of established procedures, recognized consensus standards (AIHA, ANSI, MSHA, and NIOSH), and will comply in all respects to the requirements set forth in 29 CFR 1910.134.
- o All site personnel will be required to wear hard hats, protective glasses and adequate hand protection when in the work zone.

## 10.0 COMMUNITY EXPOSURE CONTROL MEASURES

The perimeter surrounding both the work zone and the support zone will be clearly marked with barrier

cones and/or flagging tape. No smoking and keep out warnings will be posted at the perimeter.

As per California Proposition 65 requirements, a sign will be posted at the perimeter containing the following text.

Air monitoring will be performed as per AQMD rule 1199 requirements. Measurements of the air taken six inches from contaminated soils cannot exceed 50 ppm as measured using a PID. Should these levels be exceeded, controls will be implemented to reduce these levels. The measures include covering the exposed soil piles and excavation surfaces with plastic or barrier foam, and containerizing contaminated soil immediately.

Air monitoring will be performed at the downwind edge of this perimeter. Should measurements with either the FID or PID exceed 1 ppm at the perimeter, the perimeter line can be moved away from the operation or control measures will be implemented to minimize offsite migration. In the event that these measures are ineffective in reducing offsite migration, the operation will cease and the health and safety officer will be immediately notified.

11.0 EMERGENCY RESPONSE PLANS

Provide a list of site personnel certified in first aid and CPR:

Phil Skorge  
\_\_\_\_\_

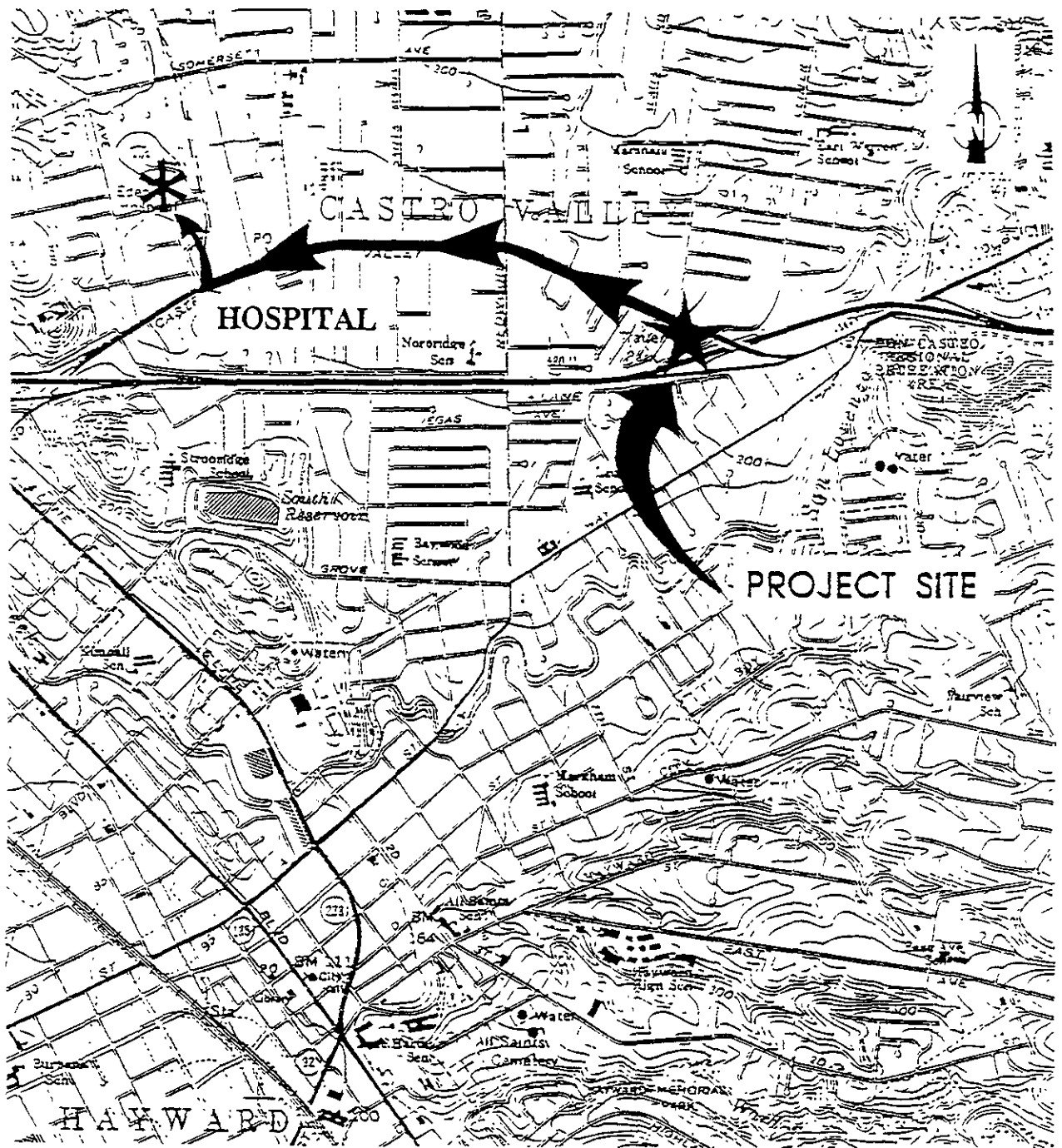
Relevant Phone Numbers:

<u>Person</u>	<u>Title</u>	<u>Phone #</u>
Dan Batrack	Project Manager	(818) 449-6400
	Fire	911
	Police	911
	Ambulance	911
	Poison control center	
	Site phone	(818) 384-2886
	Nearest off-site phone	
Dr. White	Medical advisor	(818) 355-3435
Mary Cooper	Client contact	(916) 323-5819
	U.S. EPA-Emergency Response Team	(201) 321-6660
	Chemtrec	(800) 424-9300
	Centers for Disease Control	(day) (404) 329-3311 (night) (404) 329-2888
	National Response Center	(800) 424-8802
	Superfund/RCRA Hotline	(800) 424-9346
	TSCA Hotline	(800) 424-9065
	National Pesticide Information Service	(800) 845-7633
	Bureau of Alcohol, Tobacco, and Firearms	(800) 424-9555
Eden Hospital		(510) 537-1234
Robert Prohaska	Tetra Tech Industrial Hygienist	(818) 449-6400

Include written and visual (next page) directions to the nearest hospital:

Go west on Castro Valley Boulevard approximately to Lake Chabot Road; Go north on Lake Chabot Road to Eden Medical Center: 20103 Lake Chabot Road





HAYWARD MAINT. STATION  
 CALTRANS  
 CASTRO VALLEY, CALIF.  
**TETRA TECH, INC.**  
 PASADENA, CALIFORNIA

FIGURE 1 Sketch of route to nearest hospital

## Emergency signals

The following communication signals will be utilized, if necessary, in case of emergency on-site.

<u>Gesture</u>		<u>Meaning</u>
Hand clutching throat	-	Out of air/can't breathe
Hands on top of head	-	Need assistance
Thumbs up	-	OK/I'm alright/I understand
Thumbs down	-	No/negative
Grip partner's wrists	-	Informing partner to leave area immediately

Emergency Decontamination - In an emergency, the primary concern is to prevent the loss of life or severe injury to site personnel. If immediate medical treatment is required to save a life, decontamination should be delayed until the victim is stabilized. If decontamination can be performed without interfering with essential life-saving techniques or first aid, or if a worker has been contaminated with an extremely toxic or corrosive material that could cause severe injury or loss of life, decontamination must be performed immediately. If an emergency due to heat-related illness develops, protective clothing should be removed from the victim as soon as possible to reduce heat injury. All emergency decontamination procedures must be supervised by the Site Safety Officer and the Field Team Leader.

## 12.0 TRAINING REQUIREMENTS

Prior to mobilization at the job site or at any time during site activities, if the Tetra Tech Project Manager requests, all contractors shall submit evidence that site workers have completed a 40-hour course in hazardous waste site operations training as specified in 29 CFR Part 1910.120, along with a letter from a physician stating that they have received a physical examination within one year and are physically capable of working on hazardous sites and wearing respiratory protection devices.

Prior to involvement in any field program, all personnel will attend a safety briefing. The briefing will include the nature of the wastes at the site, donning personnel protection equipment, decontamination procedures, respirator fit testing, and emergency procedures. Included in the initial briefing will be a review of:

- o Use of visual emergency signals.
- o The limitations and capabilities of the equipment.
- o Proper use and maintenance of the selected PPE.
- o The nature of the hazards and the consequences of not using the PPE.
- o Inspection, donning, checking, fitting, and using the PPE.
- o Provide individualized respirator fit testing to ensure proper fit.
- o The user's responsibility for decontamination, cleaning, maintenance, and repair (if any) of PPE.
- o Emergency procedures and self-rescue in the event of PPE failure.
- o The Site Safety Plan and the individual's responsibilities and duties in an emergency.

Daily, prior to commencement of operations, all personnel involved with the remedial investigations shall attend a short "tailgate" safety briefing which will cover:

- o Expected conditions at the site.
- o Daily activities.
- o Safety deficiencies previously observed.
- o Any changes in the emergency procedure.

Record of Training - Upon completion of the project safety briefing, all personnel will sign a statement indicating that they have read and understand and that they agree to abide by this project Health and Safety Plan. A record of attendance will be kept for all safety briefings. The Tetra Tech compliance agreement is included as attachment A.

### 13.0 MEDICAL SURVEILLANCE PROGRAM

Prior to assignment to any task requiring a level of personnel protection above Level D, personnel will submit, if requested by the Tetra Tech project manager, evidence that they have received and have passed a physical examination within the previous twelve months which incorporates the following:

- o An occupational and general physical history.
- o Complete physical examination which incorporates the head, torso, abdomen, limbs, and musculo-skeletal system.
- o Chest X-ray.
- o Pulmonary function test.
- o Audiometric exam for persons working around drill rigs.
- o Laboratory testing of blood and urine to include the following: C.B.C., albumin phosphatase, total bilirubin, SGOT, SGPT, cholesterol, total protein, albumin, globulin, A/G ratio, BUN, and creatinine
- o Vision test.
- o Electrocardiogram.

### 13.1 HEAT STRESS MONITORING

To aid in the prevention of heat stress, the following will be provided for personnel working at the site, if required:

- o Potable Water
  - Fresh Water
  - Potable water with 1% salt or commercial mix (such as Gatorade) will be within easy access to all workers.
- o Work Schedules
  - Work/rest regimens will be developed on recommendations by the Health & Safety Officer. The initial work schedule will consist of a 55-minute work regime followed by a 5-minute rest period. This work schedule will be modified as is necessary to conform with the heat stress monitoring criteria outlined below.

Personnel will be instructed to look for the following initial symptoms of heat stress:

- o Heat Exhaustion:
  - pale, clammy skin
  - profuse perspiration
  - tiredness, weakness
  - headache, perhaps cramps
  - nausea, dizziness (possible vomiting)
  - possible fainting
- o Heat Cramps:
  - cramping of muscles in legs and abdomen
- o Heat Stroke:
  - high body temperature
  - skin is characteristically hot, red, and dry (the sweating mechanism is blocked).

Heat stress monitoring will commence when the ambient temperature reaches 70 Degrees Fahrenheit if Tyvek or Saranex (level C) garments are in use. Otherwise, heat stress monitoring will commence at an ambient temperature of 85 degrees fahrenheit. The monitoring will consist of the following:

- o Heart rate (HR) will be measured by the radial pulse during 30 seconds as early as possible in the resting period. The heart rate at the beginning of the rest period should not exceed 110 beats per minute. If the HR is in excess of the above value, the next work period will be shortened by 33% while the length of the rest period stays the same. If the pulse rate is in excess of 110 beats per minute at the beginning of the next rest period, the following work cycle will be further shortened by 33%.
- o Workers will be asked to report any dizziness, faintness, cramps, or other symptoms of heat stress as discussed above.
- o Workers will also be questioned about any history of asthma, or if currently taking asthma medications. Persons taking asthma medications are typically more susceptible to heat stress reactions.

First aid for heat stress will include the following:

- o Heat Stress
  - exposed person will be removed from the work zone and placed in shade.
  - person will be required to rest in a recumbent position.
  - fluids will be administered (Gatorade).
  - workload will be reduced to a level which will prevent heat stress symptoms from recurring.
- o Heat Cramps and Heat Exhaustion

- same first aid procedures as described above except that exposed person will be requested to leave the site for the remainder of the day.

- o **Heat Stroke**

- exposed person will be placed in a shaded area and medical attention (Paramedics) will be sought immediately.

14.0 REFERENCES

California Site Mitigation Decision Tree. California Department of Health Services, Toxic Substances Control Division, Alternative Technology Policy Development Section, Sacramento, CA May 1986.

Casarett and Doull's Toxicology. Eds. Curtis Klaassen, et.al. Maacmillian Co., New York, 1986.

The Merck Index, 10th ed., Ed. M. Windholz, Merck & Co., Inc. Rahway, NJ, 1983.

Attachment A

HEALTH AND SAFETY COMPLIANCE STATEMENT

I, \_\_\_\_\_, have received and read a copy of the project Health and Safety Plan for the following site: \_\_\_\_\_.  
(TC #) 8380-09.

I understand that I am required to have read the aforementioned document and have received proper training under the Occupational Safety and Health Act (29 CFR, Part 1910.120) prior to conducting site activities at the site.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date



**Attachment B**

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

GAT

<p><b>Common Synonyms</b> Motor sport Petrol</p>	<p><b>Watery liquid</b> Colorless to pale brown or pink.  Floats on water. Flammable, irritating vapor is produced.</p>	<p><b>Gasoline odor</b></p>	
<p>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. Notify and remove discharged material. Notify local health and pollution control agencies.</p>			
<p><b>Fire</b></p>	<p><b>FLAMMABLE</b> 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.</p>		
<p><b>Exposure</b></p>	<p><b>CALL FOR MEDICAL AID</b> <b>VAPOR</b> 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. <b>LIQUID</b> Irritating to skin and eyes. If swallowed, will cause nausea or vomiting. Removes contaminated clothing and shoes. Flush affected areas with plenty of water. <b>IF IN EYES</b>, hold eyelids open and flush with plenty of water. <b>IF SWALLOWED</b> and victim is <b>CONSCIOUS</b>, have victim drink water or milk. <b>DO NOT INDUCE VOMITING.</b></p>		
<p><b>Water Pollution</b></p>	<p><b>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.</b> Fouling to shorelines. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>		
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability Evacuate area Decontaminate and flush</p>		<p><b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3</p>	
<p><b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures 3.2 Formula: (Mixture of hydrocarbons) 3.3 IMO/IUN Designation: 3.1/1203 3.4 DOT ID No.: 1203 3.5 CAS Registry No.: Data not available</p>		<p><b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless to brown 4.3 Odor: Gasoline</p>	
<p><b>5. HEALTH HAZARDS</b></p>			
<p>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 pneumonia. Swallowing may cause irregular heartbeat. 5.3 Treatment of Exposure: <b>INHALATION:</b> maintain respiration and administer oxygen; enforce bed rest if liquid is in lungs. <b>INGESTION:</b> do NOT induce vomiting; stomach should be lavaged (by doctor) if appreciable quantity is swallowed. <b>EYES:</b> wash with copious quantity of water. <b>SKIN:</b> wipe off and wash with soap and water. 5.4 Threshold Limit Value: 300 ppm 5.5 Short Term Inhalation Limit: 500 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 2; LD<sub>50</sub> = 0.5 to 5 g/kg. 5.7 Late Toxicity: None 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight stinging 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 stinging and reddening of the skin. 5.10 Odor Threshold: 0.25 ppm 5.11 IDLH Value: Data not available</p>			

<p><b>6. FIRE HAZARDS</b></p> <p>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: 653°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</p>	<p><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-T-U-V-W</p>
<p><b>7. CHEMICAL REACTIVITY</b></p> <p>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 Motor Fuels (Reactive to Product): Data not available 7.8 Reactivity Group: 35</p>	<p><b>II. HAZARD CLASSIFICATIONS</b></p> <p>11.1 Code of Federal Regulations: Flammable liquid 11.2 NAB 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</p> <p>11.3 NFPA Hazard Classification: Category Classification Health Hazard (Blue): ..... 1 Flammability (Red): ..... 3 Reactivity (Yellow): ..... 0</p>
<p><b>8. WATER POLLUTION</b></p> <p>8.1 Aquatic Toxicity: 90 ppm/24 hr/acute American shed/TL<sub>100</sub>/fresh water 91 mg/1/24 hr/acute American shed/TL<sub>100</sub>/salt water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 6%, 5 days 8.4 Food Chain Concentration Potential: None</p>	<p><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b></p> <p>12.1 Physical State at 16°C and 1 atm: Liquid 12.2 Molecular Weight: Not pertinent 12.3 Boiling Point at 1 atm: 140-380°F = 60-190°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 Intertacial 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): (rel.) 1.054 12.12 Latent Heat of Vaporization: 130-150 Btu/lb = 71-81 cal/g = 3.0 - 3.4 X 10<sup>4</sup> J/kg 12.13 Heat of Combustion: -18,720 Btu/lb = -10,400 cal/g = 435.1 X 10<sup>4</sup> 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 psi</p>
<p><b>9. SHIPPING INFORMATION</b></p> <p>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</p>	<p><b>NOTES</b></p>

# BENZENE

BNZ

<p><b>Common Synonyms</b> Benzol Benzole</p>		<p><b>Watery liquid</b></p>	<p><b>Colorless</b></p>	<p><b>Gasoline-like odor</b></p>
<p>Floets on water. Flammable, irritating vapor is produced. Freezing point is 42°F.</p>				
<p>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.</p>				
<p><b>Fire</b></p>		<p><b>FLAMMABLE</b> 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.</p>		
<p><b>Exposure</b></p>		<p><b>CALL FOR MEDICAL AID</b> <b>VAPOR</b> 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. <b>LIQUID</b> 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.</p>		
<p><b>Water Pollution</b></p>		<p><b>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS</b> May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>		
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability. Restrict access.</p>		<p><b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3</p>		
<p><b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Aromatic hydrocarbon 3.2 Formula: C<sub>6</sub>H<sub>6</sub> 3.3 IMDG/UN Designation: 3/2/1114 3.4 DOT ID No.: 1114 3.5 CAS Registry No.: 71-43-2</p>		<p><b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Aromatic; rather pleasant aromatic odor; characteristic odor</p>		
<p><b>5. HEALTH HAZARDS</b></p> <p>5.1 Personal Protective Equipment: Hydrocarbon vapor canister, supplied air or a hose mask, hydrocarbon-soluble rubber or plastic gloves, chemical goggles or face splash shield; hydrocarbon-soluble apron such as neoprene.</p> <p>5.2 Symptoms Following Exposure: Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possible death.</p> <p>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.</p> <p>5.4 Threshold Limit Value: 10 ppm</p> <p>5.5 Short Term Inhalation Limit: 75 ppm for 30 min</p> <p>5.6 Toxicity by Ingestion: Grade 3, LD<sub>50</sub> = 50 to 500 mg/kg</p> <p>5.7 Lethal Toxicity: Leukemia</p> <p>5.8 Vapor (Gas) Irritant Characteristics: If present in high concentrations, vapors may cause irritation of eyes or respiratory system. The effect is temporary.</p> <p>5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain may cause smearing and reddening of the skin.</p> <p>5.10 Odor Threshold: 4.69 ppm</p> <p>5.11 IDLH Value: 2,000 ppm</p>				

<p><b>6. FIRE HAZARDS</b></p> <p>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: 1057°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</p>		<p><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-T-U-V-W</p>																													
<p><b>7. CHEMICAL REACTIVITY</b></p> <p>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 Bases: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Motor Rate (Reactant to Product): Data not available 7.8 Reactivity Group: 32</p>		<p><b>11. HAZARD CLASSIFICATIONS</b></p> <p>11.1 Code of Federal Regulations: Flammable liquid 11.2 NFPA Hazard Rating for Bulk Water Transportation:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>3</td> </tr> <tr> <td>Health</td> <td>1</td> </tr> <tr> <td>Vapor Irritant</td> <td>1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>1</td> </tr> <tr> <td>Poison</td> <td>3</td> </tr> <tr> <td>Water Pollution</td> <td>3</td> </tr> <tr> <td>Human Toxicity</td> <td>3</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>1</td> </tr> <tr> <td>Aesthetic Effect</td> <td>3</td> </tr> </tbody> </table> <p>Reactivity: Other Chemicals: 2 Water: 1 Self Reaction: 0</p> <p>11.3 NFPA Hazard Classification:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>		Category	Rating	Fire	3	Health	1	Vapor Irritant	1	Liquid or Solid Irritant	1	Poison	3	Water Pollution	3	Human Toxicity	3	Aquatic Toxicity	1	Aesthetic Effect	3	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0
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Flammability (Red)	3																														
Reactivity (Yellow)	0																														
<p><b>8. WATER POLLUTION</b></p> <p>8.1 Aquatic Toxicity: 5 ppm/6 hr/minnow/lethal/dissolved water 20 ppm/24 hr/sunfish/TL<sub>50</sub>/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</p>		<p><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b></p> <p>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/m<sup>2</sup> 12.7 Specific Gravity: 0.679 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: 160 Btu/lb = 94.1 cal/g = 3.94 X 10<sup>4</sup> J/kg 12.13 Heat of Combustion: -17,460 Btu/lb = -9998 cal/g = -406.0 X 10<sup>4</sup> 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</p>																													
<p><b>9. SHIPPING INFORMATION</b></p> <p>9.1 Grades of Purity: Industrial pure ... 99+ % Theophene-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</p>		<p><b>NOTES</b></p>																													

# TOLUENE

TOL

<p><b>Common Synonyms</b></p> <p>Toluene Methylbenzene Toluol</p>	<p><b>Wettable liquid</b></p> <p>Colorless</p> <p>Refractive index</p>	<p>Flammable liquid. Flammable, irritating vapor is produced.</p>
<p>Slow discharge if possible. Keep people away. Shut off ignition sources and call fire department. Stay upwind and use water spray to break down vapor. Avoid contact with liquid and vapor. Soak and remove discharged remains. Notify local health and pollution control agencies.</p>		
<p><b>Fire</b></p>	<p><b>FLAMMABLE.</b> Flammable liquid vapor and may occur. Vapor may explode if ignited in an enclosed area. Water (fogging and salt-contaminated firefighting apparatus). Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Call exposed containers with water.</p>	
<p><b>Exposure</b></p>	<p><b>CALL FOR MEDICAL AID.</b></p> <p><b>VAPOR</b> 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.</p> <p><b>LIQUID</b> 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.</p>	
<p><b>Water Pollution</b></p>	<p>Dangerous to aquatic life in high concentrations. Floating in streams. May be dangerous if it enters water intakes. Notify local health and waste officials. Notify operators of nearby water intakes.</p>	
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability Evaluate area</p>		<p><b>2. LABEL</b></p> <p>2.1 Category: Flammable liquid 2.2 Class: 3</p>
<p><b>3. CHEMICAL DESIGNATIONS</b></p> <p>3.1 CG Compatibility Code: Aromatic Hydrocarbon 3.2 Formula: C<sub>7</sub>H<sub>8</sub> 3.3 MSD/UN Designation: 2.2/1204 3.4 DOT ID No.: 1204 3.5 CAS Registry No.: 108-88-3</p>		<p><b>4. OBSERVABLE CHARACTERISTICS</b></p> <p>4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Pungent, aromatic, benzene-like, distinct, pleasant</p>
<p><b>5. HEALTH HAZARDS</b></p>		
<p>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; acute distress, headache, weakness, respiratory arrest. Liquid irritates eyes and causes drying of skin. If absorbed, causes coughing, gagging, dizziness, and rapidly developing pulmonary edema. It irritates causes vomiting, greasy diarrhea, depressed respiration. 5.3 Treatment of Exposure: <b>INHALATION:</b> Remove to fresh air, give artificial respiration and oxygen if needed; call a doctor. <b>INGESTION:</b> Do NOT induce vomiting; call a doctor. <b>EYES:</b> Flush with water for at least 15 min. <b>SKIN:</b> Wash with soap and water. 5.4 Threshold Limit Value: 100 ppm 5.5 Short Term Exposure Limit: 600 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 2; LD<sub>50</sub> = 0.5 to 6 g/kg 5.7 Lethal Toxicity: Kidney and liver damage may follow ingestion. 5.8 Vapor (Basic Irritant Characteristic): Vapors cause a slight stinging of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid irritant Characteristic: Minimal hazard. If spilled on clothing and allowed to remain, may cause staining and reddening of the skin. 5.10 Odor Threshold: 0.17 ppm 5.11 IDLH Value: 2,000 ppm</p>		

<p><b>6. FIRE HAZARDS</b></p> <p>6.1 Flash Point: 40°F C.C., 55°F O.C. 6.2 Flammable Limits in Air: 1.27%-17% 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: 507°F 6.8 Self-Heating Class: Class I, Group 0 6.9 Burning Rate: 5.7 mm/min. 6.10 Adiabatic Flame Temperature: Data not available.</p> <p style="text-align: right;">(Continued)</p>	<p><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-T-U</p>																																				
<p><b>7. CHEMICAL REACTIVITY</b></p> <p>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 Corrosives: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Water Reactions (Reactive to): Products: Data not available 7.8 Reactivity Group: 32</p>	<p><b>11. HAZARD CLASSIFICATIONS</b></p> <p>11.1 Code of Federal Regulations: Flammable liquid 11.2 NFPA Hazard Rating for Bulk Water Transportation:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Category</th> <th style="text-align: center;">Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td style="text-align: center;">2</td> </tr> <tr> <td>Health</td> <td style="text-align: center;">1</td> </tr> <tr> <td>Vapor Irritant</td> <td style="text-align: center;">1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td style="text-align: center;">1</td> </tr> <tr> <td>Poison</td> <td style="text-align: center;">2</td> </tr> <tr> <td>Wear Pollution</td> <td style="text-align: center;">1</td> </tr> <tr> <td>Human Toxicity</td> <td style="text-align: center;">1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td style="text-align: center;">2</td> </tr> <tr> <td>Acute Effect</td> <td style="text-align: center;">2</td> </tr> <tr> <td>Reactivity</td> <td style="text-align: center;">1</td> </tr> <tr> <td>Other Chemical</td> <td style="text-align: center;">2</td> </tr> <tr> <td>Water</td> <td style="text-align: center;">0</td> </tr> <tr> <td>Sol. Reaction</td> <td style="text-align: center;">0</td> </tr> </tbody> </table> <p>11.3 NFPA Hazard Classifications:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Category</th> <th style="text-align: center;">Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td style="text-align: center;">2</td> </tr> <tr> <td>Flammability (Red)</td> <td style="text-align: center;">3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td style="text-align: center;">0</td> </tr> </tbody> </table>	Category	Rating	Fire	2	Health	1	Vapor Irritant	1	Liquid or Solid Irritant	1	Poison	2	Wear Pollution	1	Human Toxicity	1	Aquatic Toxicity	2	Acute Effect	2	Reactivity	1	Other Chemical	2	Water	0	Sol. Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0
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<p><b>8. WATER POLLUTION</b></p> <p>8.1 Acute Toxicity: 1100 mg/L/500 mg/L/1000 mg/L (fish water) 8.2 Waterborne Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 0%, 3 days; 30% (water, 8 days) 8.4 Feed Chain Concentration Potential: None</p>	<p><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b></p> <p>12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 92.14 12.3 Boiling Point at 1 atm: 110.6°C = 231.1°F = 110.6°C = 362.8°F 12.4 Freezing Point: -138°F = -95.0°C = 178.2°K 12.5 Critical Temperature: 606.4°F = 318.6°C = 591.6°K 12.6 Critical Pressure: 506.1 atm = 40.56 atm = 4100 lb/in<sup>2</sup> 12.7 Specific Gravity: 0.867 at 20°C (liquid) 12.8 Liquid Surface Tension: 28.0 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 (Basic) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): 1.089 12.12 Latent Heat of Vaporization: 156 Btu/lb = 66.1 cal/g = 3.81 x 10<sup>4</sup> J/kg 12.13 Heat of Combustion: -17,450 Btu/lb = -8000 cal/g = -405.5 x 10<sup>4</sup> J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.18 Heat of Fusion: 17.17 cal/g 12.20 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 1.1 atm</p>																																				
<p><b>9. SHIPPING INFORMATION</b></p> <p>9.1 Grade of Purity: Research, reagent, reagent-grade 99.5 + %, industrial, contains 84 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 99/120: less pure than reagent. 9.2 Storage Temperature Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting Open (from pressure) or pressure-relief</p>	<p><b>13. FIRE HAZARDS (Continued)</b></p> <p>6.11 Shock-Sensitive Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>																																				

<p>Common Synonyms 1,3-Dimethylbenzene Toluene</p>		<p>White liquid</p>	<p>Colorless</p>	<p>Sweet odor</p>
<p>Flammable, reacts with water. Flammable, irritating vapor is produced.</p>				
<p>Stop discharge if possible. Keep people away. Call fire department. Avoid contact with liquid and vapor. Wash and remove discharges material. Notify local health and pollution control agencies.</p>				
<p>Fire</p>	<p><b>FLAMMABLE</b> Flammable vapor may be formed. Vapor may explode if ignited in an enclosed area. Wear self-contained breathing apparatus. Extinguish with foam or chemical, or carbon dioxide. Wear may be ineffective on fire. Cool exposed containers with water.</p>			
<p>Exposure</p>	<p><b>CALL FOR MEDICAL AID.</b> <b>VAPOR</b> 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. <b>LIQUID</b> 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 eyes open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. <b>DO NOT INDUCE VOMITING.</b></p>			
<p>Water Pollution</p>	<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Floating to shores. May be dangerous if it enters water masses. Notify local health and waste officials. Notify operators of nearby water intakes.</p>			
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability Evacuate area Should be removed Chemical and physical treatment</p>		<p><b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3</p>		
<p><b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Aromatic hydrocarbon 3.2 Formula: <math>m-C_6H_4(CH_3)_2</math> 3.3 IBC/UN Designation: 3.2/1307 3.4 DOT ID No.: 1307 3.5 CAS Registry No.: 108-98-3</p>		<p><b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (at standard liquid) 4.2 Color: Colorless 4.3 Odor: Like benzene characteristic aromatic</p>		
<p><b>5. HEALTH HAZARDS</b></p>				
<p>5.1 Personal Protective Equipment: Approved respirator or air-supplied mask; goggles or face shield; plastic gloves and boots. 5.2 Symptoms Following Exposure: Vapor causes headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If repeated, causes nausea, vomiting, diarrhea, headache, and drowsiness can be fatal. Kidney and liver damage can occur. 5.3 Treatment of Exposure: <b>INHALATION</b> remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. <b>INJECTION</b> do NOT induce vomiting; call a doctor. <b>EYES</b> flush with water for at least 15 min. <b>SKIN</b> wipe off, wash with soap and water. 5.4 Threshold Limit Value: 100 ppm 5.5 Short Term Exposure Limit: 300 ppm for 30 min. 5.6 Toxicity by ingestion: Grade 2; LD<sub>50</sub> = 30 to 500 g/kg 5.7 Lethal Toxicity: Kidney and liver damage. 5.8 Vapor (flame) irritant Characteristics: Vapors cause a slight stinging 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 stinging and reddening of the skin. 5.10 Odor Threshold: 0.05 ppm 5.11 IDLH Value: 10,000 ppm</p>				

<p><b>6. FIRE HAZARDS</b></p> <p>6.1 Flash Point: 61°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 flow considerable distance to a source of ignition and flash back. 6.7 Ignition Temperature: 600°F 6.8 Exposed Hazard Class 1, Group D 6.9 Burning Rate: 3.8 mm/sec. 6.10 Adiabatic Flame Temperature: Data not available. 6.11 Self-Heating: Air to Fuel Ratio: Data not available. 6.12 Flame Temperature: Data not available.</p>		<p><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-T-4</p>	
<p><b>7. CHEMICAL REACTIVITY</b></p> <p>7.1 Reactivity with Water: No reaction. 7.2 Reactivity with Common Materials: No reaction. 7.3 Stability During Transport: Stable. 7.4 Reactivity Agents for Acids and Corrosives: Not pertinent. 7.5 Polymerizable: Not pertinent. 7.6 Initiator of Polymerization: Not pertinent. 7.7 Heavy Metals: Resistant to products: Data not available. 7.8 Reactivity Group: 2.</p>		<p><b>11. HAZARD CLASSIFICATIONS</b></p> <p>11.1 Code of Federal Regulations: Flammable liquid 11.2 NFPA Hazard Rating for Bulk Water Transportation: Category: Rating: Fire: _____ 3 Health: _____ 1 Vapor Irritant: _____ 1 Liquid or Solid Irritant: _____ 1 Poisons: _____ 2 Water Pollution: _____ 1 Human Toxicity: _____ 1 Aquatic Toxicity: _____ 3 Asphyxiant Effect: _____ 2 Reactivity: _____ 1 Other Chemicals: _____ 1 Waste: _____ 3 Self Reaction: _____ 0</p> <p>11.3 NFPA Hazard Classification: Category: Classification: Health Hazard (Blue): _____ 2 Flammability (Red): _____ 3 Reactivity (Yellow): _____ 0</p>	
<p><b>8. WATER POLLUTION</b></p> <p>8.1 Aquatic Toxicity: 22 ppm/96 hr (fish)/TL<sub>50</sub>/fresh water 8.2 Waterway Toxicity: Data not available. 8.3 Biological Oxygen Demand (BOD): 1 lb/lb, 5 days; 6% (over), 8 days 8.4 Food Chain Concentration Potential: Data not available.</p>		<p><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b></p> <p>12.1 Physical State at 18°C and 1 atm: Liquid 12.2 Molecular Weight: 106.16 12.3 Boiling Point at 1 atm: 206.4°F = 131.3°C = 405.1°K 12.4 Freezing Point: -54.2°F = -47.9°C = 225.2°K 12.5 Critical Temperature: 660.2°F = 343.8°C = 617.0°K 12.6 Critical Pressure: 512.8 atm = 34.96 atm = 3,540 mm/Hg 12.7 Specific Gravity: 0.86 at 20°C (liq) 12.8 Liquid Surface Tension: 28.6 dynes/cm = 0.0286 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 26.4 dynes/cm = 0.0264 N/m at 20°C 12.10 Vapor (flame) Specific Gravity: Not pertinent. 12.11 Ratio of Specific Heats of Vapor (liq): 1.071 12.12 Latent Heat of Vaporization: 147 Btu/lb = 61.9 cal/g = 3.45 x 10<sup>4</sup> J/kg 12.13 Heat of Combustion: -17,564 Btu/lb = -4752.4 cal/g = -408.31 x 10<sup>4</sup> J/kg 12.14 Heat of Decomposition: Not pertinent. 12.15 Heat of Solution: Not pertinent. 12.16 Heat of Polymerization: Not pertinent. 12.17 Heat of Fusion: 26.01 cal/g 12.18 Limiting Values: Data not available. 12.19 Real Vapor Pressure: 0.34 atm</p>	
<p><b>9. SHIPPING INFORMATION</b></p> <p>9.1 Grades of Purity: Flammable 98.50%; Pure 98.5%; Technical 98.2% 9.2 Storage Temperature: Ambient 9.3 Heat of Polymerization: No requirement 9.4 Venting: Open (flame arrester) or pressure-relief</p>		<p><b>NOTES</b></p>	