FINAL REPORT
SITE CHARACTERIZATION
LAGUNA OAKS SITE
PLEASANTON, CALIFORNIA
FOR HOME SAVINGS CORP.

D&M JOB NO. 14943-062-015
JULY 31, 1992

DAMES & MOORE

LOS ANGELES, CALIFORNIA

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1.0 INTRODUCTION

Presented in this report are the results of Dames & Moore's soil and groundwater investigation beneath the Laguna Oaks site in Pleasanton, California (Figure 1). The study was conducted to delineate subsurface contamination beneath the site in the vicinity of a former onsite Underground Storage Tank (UST) containing gasoline (Figure 2). The UST was removed from the site in June 1989. Visual inspection of the tank and underlying soils indicated the tank contents had leaked into the subsurface. Subsequently three borings were drilled in the vicinity of the UST and completed as shallow monitoring wells. Initial sampling of the monitoring wells indicated low levels of volatile hydrocarbons in the groundwater beneath the site. Subsequent monitoring revealed the presence of tetrachloroethylene (PCE) in the groundwater beneath the site. The present investigation has focused on delineating the source and extent of the PCE in the subsurface in order to facilitate remedial activities and site closure.

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this investigation was to delineate the source and extent of PCE in the subsurface. In addition, the information collected on subsurface conditions beneath the site will be incorporated into remedial technology selection and design. Our scope of services included the following tasks:

- A geophysical survey to delineate subsurface utilities suspected of being a source for the PCE concentrations found in the groundwater;
- Trenching and soil sampling at potential source areas identified during the geophysical survey.
- Drilling and sampling of four borings for subsurface stratigraphy and chemical analysis in the suspected source area;
- Drilling and sampling of three additional borings completed as groundwater monitoring wells for subsurface stratigraphy;
- Surveying the monitoring wells for elevation by a licensed surveyor;

- Development and sampling of monitoring wells following installation;
- Development and sampling of the previously existing monitoring wells;
- Collection of water level measurements in each well;
- Chemical testing of selected soil and groundwater samples for PCE and petroleum hydrocarbons (BTEX);
- Preparation of interim reports on results of the geophysical survey, trenching, soil chemistry results from borings, and water quality results from the monitoring well sampling program;
- Preparation of this report summarizing our findings, conclusions, and recommendations from our investigation.

3.0 SITE HISTORY

The history of activities at the Laguna Oaks site is presented in the following subsections. The activities have been divided into three categories: (1) dairy operations (1919 to 1969), (2) activities related to environmental investigations conducted by Berlogar Consultants, and (3) activities related to environmental investigations conducted by Dames & Moore. A time line of site activities is shown in Figure 3.

3.1 DAIRY OPERATIONS

The Meadowlark Dairy began operations at the Laguna Oaks site in 1919 and continued until 1969. The dairy was originally owned by Walter Briggs and managed by Robert Dana. Buildings, fences, and/or irrigation systems were apparently constructed on the site by the early 1920s. Review of aerial photographs from 1939 to 1973 and a USGS 1961 topographic map shows a total of 11 buildings related to the dairy on the site during that time.

Industrial chemicals used at the former dairy included weed killers and cleaning detergents. The cleaning detergents reportedly used were supplied by Morgan-Gallacher, Inc., of Cudahy, California, and included "MSR," a corrosive containing phosphoric acid, and "Shur-

San," a sanitizing compound containing 10 percent chlorine. Reportedly, these products were used in relatively small quantities and diluted with water prior to use (Berlogar, 1990).

According to Berlogar Consultants (Field notes, May 17, 1989) Mr. Bruce Takens, a former owner of the diary, stated that a 300-gallon UST was installed sometime in the 1950s (Figure 2). The UST was filled with regular gasoline to be used for farm machinery. An inventory kept until 1978 showed no obvious leaks. From 1978 to 1980 there were some problems with the inventory which Mr. Takens indicated may have been an indication of a leak. Barrels of oil were also stored above ground in the vicinity of the gasoline pump. Mr. Takens reported the tank was pumped dry in 1980.

Although the dairy closed in 1969, cattle grazing continued on the site until 1987. Currently, one of the original adobe structures buildings and a trailer are located on the site.

3.2 ENVIRONMENTAL INVESTIGATIONS - BERLOGAR CONSULTANTS

3.2.1 UST Removal/Soil and Groundwater Investigation

In June 1989, Berlogar Geotechnical Consultants was retained by the former owner, the DeSilva Group, Inc., to remove the onsite UST. During excavation, petroleum hydrocarbons were detected in the soil beneath the tank. Berlogar recommended the installation of three groundwater monitoring wells to delineate the subsurface extent of the petroleum hydrocarbons. These wells, MW-1, MW-2 and MW-3, were installed in September 1989 (Figure 2). Concentrations of petroleum hydrocarbons (speciated as oil and grease fraction) were detected in soil samples obtained from MW-1. Petroleum hydrocarbons within the diesel fraction range were detected in groundwater samples from MW-2 and MW-3. In addition, concentrations of benzene and toluene were detected in groundwater samples from MW-1. Quarterly groundwater monitoring was initiated in March 1990 by Dames & Moore (see section 3.3.1).

3.2.2 Pesticide and Herbicide Testing

In June 1989 Berlogar Consultants conducted an investigation for pesticides and herbicides at the Laguna Oaks site. On June 20, 1989, Berlogar obtained a total of 18 near-surface soil samples at the site. Low concentrations of the pesticides 4,4-DDE, 4,4-DDT, and Dieldrin were detected in the samples analyzed. Berlogar Consultants recommended no further action regarding pesticide and herbicide concentrations at the site.

3.2.3 Geotechnical Investigation

In August 1989 Berlogar initiated a geotechnical investigation of the site for the future owner, Ahmanson Developments. The purpose of the study was to gather information on the nature, distribution, and characteristics of the earth materials and groundwater at the site, and to prepare specific recommendations for use in project design and construction. Berlogar's report (January 11, 1990) presented conclusions and recommendations for development that addressed expansive materials, collapsible soils, stability of cut slopes, and settlement problems.

3.2.4 Environmental Site Assessment

In December 1989, Ahmanson Developments assumed ownership of the site. In January 1990 Berlogar presented an environmental site assessment report to Ahmanson Developments. The report consisted of a site survey that included information obtained from interviews with pervious occupants, and a review of historical maps, documents, and information obtained from government agencies.

3.3 ENVIRONMENTAL INVESTIGATIONS - DAMES & MOORE

3.3.1 Quarterly Groundwater Monitoring

In November 1989 Dames & Moore began discussions with the DeSilva Group concerning closure of the site. In December 1989, after Ahmanson Developments had assumed site ownership, Dames & Moore drafted a letter to the Regional Water Quality Control Board (RWQCB) requesting site closure based on the Berlogar test data which showed low concentrations of petroleum hydrocarbons as gasoline and diesel, and benzene and toluene. The RWQCB responded by indicating that groundwater from four consecutive quarters in the on-site monitoring wells must be below the detection limit of 0.5 μg/kg for total petroleum hydrocarbons to qualify for site closure.

In March 1990 Dames & Moore began quarterly monitoring for petroleum hydrocarbons and volatile organics at the site. During the first quarter of groundwater sampling, tetrachloroethylene (PCE), a previously undetected (and untested) constituent, was detected. It was also detected in subsequent sampling efforts in July 1990, October 1990, May 1991, and September 1991 (Table 1).

3.3.2 Soil Gas Survey

In November 1990, Dames & Moore conducted a soil gas survey for organic vapors in the subsurface. The purpose of the survey was to further delineate the extent of the PCE in the subsurface. The concentrations of organic vapors detected in the subsurface are shown in Figure 4.

3.3.3 Grading Operations

A pocket of odorous material was discovered during grading operations in June 1991. The material was discovered approximately 17 feet below the original grade along the proposed

realignment of Foothill Road (Figure 2). Subsequent sampling of the soils indicated that the soil contained petroleum hydrocarbons in the diesel range. On November 27, 1991, 42 cubic yards of hydrocarbon-impacted soils was excavated and stockpiled on plastic sheets and covered in a area along Foothill Road.

3.3.4 Initial Remedial Recommendations

In a September 1991 proposal, Dames & Moore presented initial recommendations for remediation of PCE and petroleum hydrocarbon concentrations in the subsurface beneath the site. A vapor injection/extraction system was proposed for the removal of PCE. Subsequent pilot tests in October 1991 indicated vapor extraction was not a viable remedial procedure at the site.

3.3.5 Regional Board Meeting

Dames & Moore presented a scope of services refocusing the investigative work at the Laguna Oaks site in February 1992. The scope of services included initiating landfarming activities for the 42 yards of hydrocarbon-impacted soil, developing a site history, and meeting with the Regional Water Quality Board (RWQCB) to summarize the investigative results at the site and to discuss RWQCB requirements for site closure. Mr. Michael Gemmell of Dames & Moore met with RWQCB representatives Lester Feldman and John Jang on April 28, 1992.

The RWQCB indicated at least one of the following conditions must be met for the RWQCB to issue site closure:

(1) Identification of an upgradient source for the PCE contamination found beneath the Laguna Oaks site;

(2) If the total dissolved solids (TDS) concentration were above 3000 ug/l and the groundwater at the site is isolated from other waters of the state;

(3) If the groundwater were declared a degraded resource such that the costs of cleanup would exceed the benefits;

(4) Perform a remedial investigation to delineate the extent of contamination followed by site remediation to action levels or levels subsequently approved by the RWQCB.

3.3.6 Present Status

Subsequent to the meeting with the RWQCB, Dames & Moore proposed the scope of services listed in section 2.0. The scope of services addressed the investigative step listed in option 4 above.

4.0 REGIONAL GEOLOGY AND HYDROGEOLOGY

4.1 REGIONAL GEOLOGY

The site is located on the western edge of Livermore Valley. Livermore Valley is an alluvial basin surrounded by low-lying hills on all sides. The valley is approximately 100 square miles in area and is bounded on the east by the Diablo portion of the California Coastal range, on the north the Black Hills of the Diablo Range, on the south by a series of southeastward trending ridges and hills, and on the west by the Oakland hills which separate the valley from San Francisco Bay.

Tertiary, Cretaceous, and Jurassic-age marine sedimentary rocks form the hills surrounding the valley and also the basement floor beneath the alluvial sediments of the valley floor. The basin stratigraphy consists of approximately 500 to 1000 feet of unconsolidated alluvium, underlain by the gravels of the Livermore Formation, up to 4000 feet thick, and over 10,000 feet of sandstone, shale, and conglomerate beneath the Livermore Formation.

4.2 REGIONAL HYDROGEOLOGY

The site lies on the boundary of the Castle and Bernal subbasins on the west side of Livermore Valley. The subbasins are separated by the Calaveras Fault. The principal water-bearing formations in the Livermore Valley are the gravels of the Livermore Formation and the overlying Quaternary alluvium. In the main portion of the Bernal subbasin the water-bearing alluvial sediments are up to 400 feet thick but thin to only a few tens of feet thick closer to the hills in the vicinity of the Laguna Oaks site.

In the site vicinity, the gravels of the Livermore Formation are the primary water-producing formation. Groundwater flows east from the Castle subbasin into the Bernal subbasin, and from there continues east into the main portion of the Livermore valley. Regional groundwater contours beneath the site show the depth to water at approximately 120 feet bgs in the vicinity of the site (Reference: Livermore Valley and Sunol Valley Groundwater Basin Characteristics, December 1987, Figure 7). Groundwater in the Livermore Valley is used for municipal, domestic, and agricultural purposes.

5.0 METHODS OF INVESTIGATION

The methods of investigation for evaluating the extent of PCE in the subsurface include trenching in the areas identified during the geophysical survey as areas of potential underground utilities, drilling and sampling of soil borings, and the drilling, sampling and installation of groundwater monitoring wells. These methods are described in detail in the following subsections.

5.1 EXPLORATORY TRENCHING

Trenching operations were performed using a backhoe operated by Tom Daniels Excavating Co. and directed by a Dames & Moore geologist. Visual inspection of excavated areas was performed to evaluate the possible presence of PCE. In selecting sample locations special emphasis was given to joints and breaks in the piping uncovered during trenching

operations. In addition, soil samples were screened for laboratory analysis by the use of an organic vapor monitor (OVM). The locations of the trenches are shown on Figure 4.

Selected soil samples were analyzed for PCE by EPA Method 8010 at an onsite mobile laboratory operated by CKY Laboratories. The soil samples were obtained with a stainless steel trowel and transferred to laboratory supplied glassware following collection. The trowel was decontaminated between sampling events using a trisodium phosphate and water solution and distilled water rinse. Soil samples above 5 feet were obtained using the stainless steel trowel. Soil samples below 5 feet were obtained from the bucket of the backhoe. Upon collection, each sample was labeled, logged on chain-of-custody forms, and submitted to the mobile laboratory for analysis. A total of 15 soil samples were submitted to the laboratory for analysis of PCE.

5.2 SOIL BORINGS

Soil borings (SB-1, SB-2, SB-3, and SB-4) were drilled in the immediate vicinity of the former UST (Figure 2). Prior to drilling, a permit was obtained from the Alameda County Zone 7 Water Agency (see Appendix A for copy of permit).

The borings were drilled using a hydraulic drive truck-mounted drill rig equipped with 8-inch diameter hollow stem augers. In soil borings SB-1, SB-2, SB-3, SB-4, and DMMW-4 soil samples were collected continuously through the hollow stem of the auger using a split spoon sampler. In monitoring wells DMMW-5 and 6, the samples were collected every 5 feet. The split spoon sampler was driven 18 inches (or until refusal) with a standard 30-inch drop of a 140-pound hammer. Immediately after the split spoon was opened soil was taken from the split spoon with a stainless steel trowel, and put into the laboratory-supplied glassware.

Sample selection was based on soil stratigraphy and organic vapor readings. A headspace analysis was used to screen for organic vapors by taking a grab soil sample from the split spoon sampler and sealing it in a plastic bag. The sample was allowed to sit for at least 10 minutes before the headspace reading was taken.

Following collection, a sample label was affixed to each glass container and contained the following information: boring number, sample number, depth, date, collector name, owner, sample location, and the time of collection. Sealed and labeled samples were cooled in the field in ice chests containing ice. Chain-of-custody records were maintained during the sampling program (Appendix B).

All drilling and soil sampling was conducted under the technical supervision of a Dames & Moore geologist. The Dames & Moore geologist maintained a detailed log of the subsurface materials encountered, and organic vapor readings. The organic vapor monitoring was performed as part of Dames & Moore's Health and Safety Plan (Appendix C) as well as for sample screening. Soils were classified in accordance with the Unified Soil Classification System. All down-hole drilling equipment was steam cleaned prior to drilling each boring. Prior to soil sampling, samplers were washed in a dilute trisodium phosphate solution, rinsed in fresh and distilled water. Logs of Borings are included in Appendix D.

5.3 MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING

Three borings were completed as monitoring wells. Following installation, the three new wells along with the three previously existing wells were developed prior to water quality sampling.

The wells were developed by a licensed drilling company, Kvilhaug Drilling of Concord, California, and then surveyed by Martin M. Ron Associates, Inc. of San Francisco, California. At least three casing volumes were purged prior to sampling with the exception of MW-1 (2.5 casing volumes) because of a very slow rate of recharge. The 4-inch wells (DMMW-4, DMMW-5, and DMMW-6) were surged and then pumped to purge the wells. The 2-inch wells (MW-1, MW-2, and MW-3) surged and then bailed to complete purging. Field measurements of pH, conductivity, and temperature were made during development and sampling of the wells to establish stable conditions prior to sampling. Following development, water samples were obtained from each of the monitoring wells with a dedicated polyethylene bailer. To reduce

agitation and minimize volatilization of dissolved organic vapors, a bottom emptying device was used on each of the bailers to transfer the water sample to the sample container.

A total of 7 water samples (6 monitoring wells and 1 duplicate for QA/QC) were analyzed for PCE (EPA Method 8010) and BTEX (benzene, toluene, ethylbenzene, xylene, EPA Method 8020) by CKY Laboratories of Pleasanton, California. A copy of the laboratory reports is presented in Appendix B.

6.0 SITE CONDITIONS

The soils at the Laguna Oaks site generally consist of fine grained silty sands to sandy silts from ground surface to the top of the saturated zone, 25 to 35 feet below ground surface (bgs). Occasional interbeds of clay and gravel occur within the silty sand and sandy silt units. A greenish-clay clayey sand to clayey silt is present at and below the water table throughout the site with the exception of SB-4 where it is absent. Generally below the water table, the soils are finer grained than soils in the unsaturated zone and consist primarily of clayey sands, clayey silts, and clays. Isolated semi-saturated to saturated pockets of moisture are present above the water table. These pockets appear at 12 to 17 feet bgs in SB-3, at 29 to 39 feet bgs in DM-4, and 11 to 15 feet bgs in DM-5. Cross sections of the site geology are presented on Figures 6 and 7, and the boring logs are presented in Appendix D.

The two borings drilled (SB2 and SB3) and the monitoring wells installed during this investigation indicate that there is a perched water zone from 20 to 25 feet thick. Groundwater flows to the northeast across the site (Figure 7) at a gradient of approximately .04 ft/ft (4 feet of head change for every 100 feet of horizontal distance traveled). This is considered a steep gradient and is indicative of flow conditions in low permeability saturated zones.

7.0 RESULTS OF INVESTIGATION

Soil samples collected from the trenches and soil borings were analyzed for PCE concentrations by EPA method 8010. Sample T-5 taken from beneath a pipeline (Figure 4) had concentrations of 28 ug/kg of PCE. No other soil samples from trenches or soil borings had detectable concentrations of PCE.

Groundwater samples from existing wells and wells installed during this investigation were analyzed for PCE. In addition, water samples were analyzed for BTEX to assess the possibility of residual concentrations from the gasoline in the former UST. Concentrations of PCE were detected in MW-2 and MW-3 at 98 and 610 ug/l, respectively (Table 3). No other groundwater samples had detectable concentrations of PCE or BTEX.

8.0 CONCLUSIONS

Review of results from the present investigation and previous investigations at the Laguna Oaks site indicate:

- Petroleum hydrocarbon concentrations (in terms of BTEX concentrations) in groundwater associated with the former UST are below the limit of detection;
- PCE concentrations appear to have entered the subsurface in the vicinity of the sample taken at T-5 beneath the pipeline;
- The PCE does not appear to have spread laterally in the unsaturated zone as it moved downward toward the saturated zone;
- PCE has apparently moved through the unsaturated zone below T-5 and has reached the groundwater in the vicinity of MW-3;
- The PCE concentrations have been restricted to a small area laterally and vertically in the uppermost saturated zone. Their longitudinal extent in the saturated zone is bounded by downgradient monitoring wells DMMW-5 and

DMMW-6. The vertical extent is restricted to the perched zone beneath the site which, based on two borings (SB1 and SB2) and the monitoring wells, appears to be approximately 25 feet thick.

The current investigation appears to confirm the earlier soil gas survey conducted by Dames & Moore in December 1990. The concentrations of the soil gas vapors were below detection limit in probes installed in the vicinity of DMMW-5 and 6 mirroring the groundwater sampling results obtained from those wells during this investigation.

9.0 LIMITATIONS

This report summarizes observations of soil and water sampling and performance of four soil borings and three well installations. It has been prepared for the sole use of Home Savings. The oversight of the subsurface investigation and sampling were conducted in accordance with the terms, conditions, and limitations set forth in the Consulting Services Agreement between Home Savings and Dames & Moore. The investigation methods were in accordance with generally accepted geologic and hydrogeologic site investigation practices. No other warranty, expressed or implied, is made as the professional opinions presented herein.

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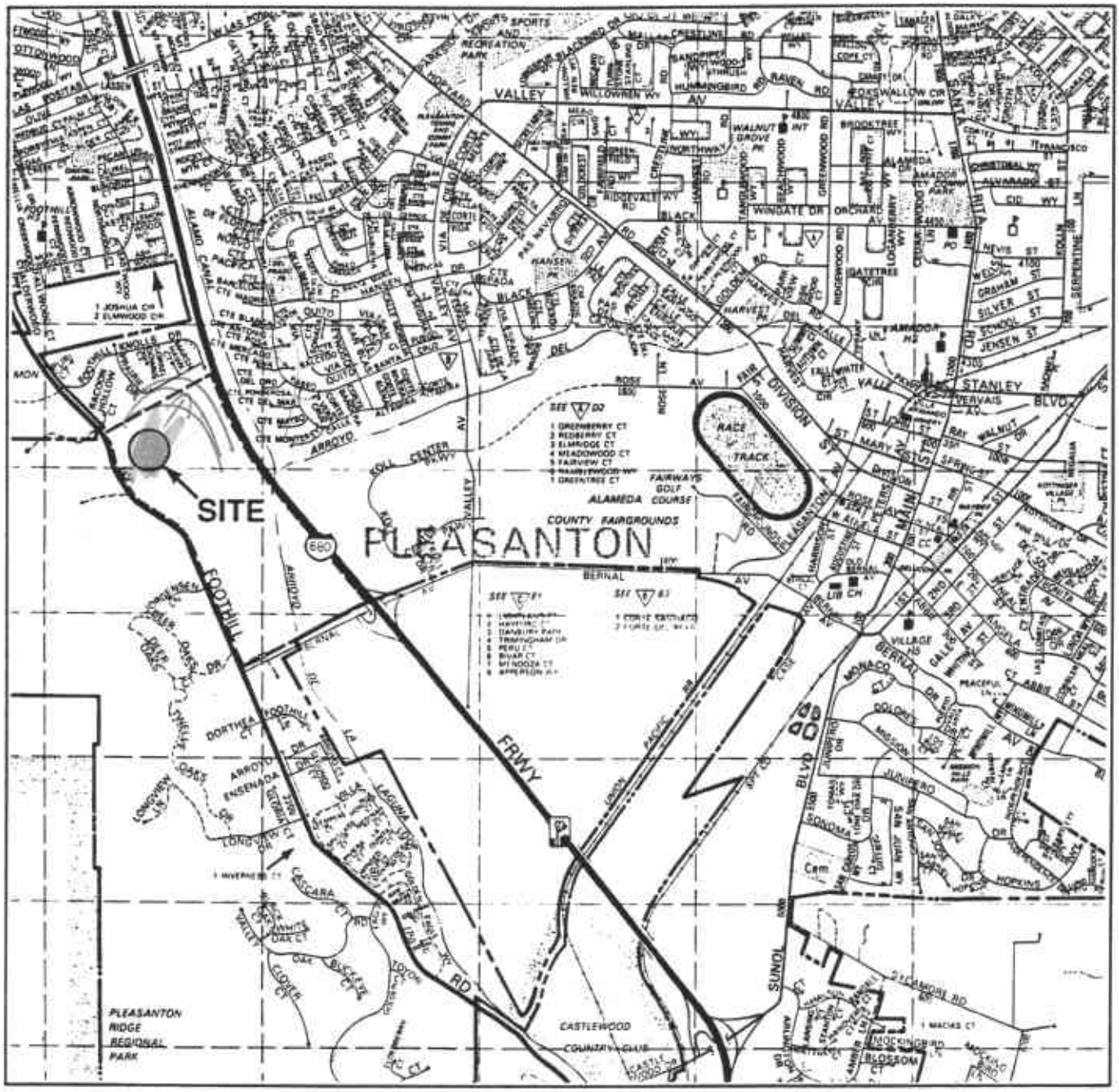

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0 1

Scale in Miles

N

SITE VICINITY MAP

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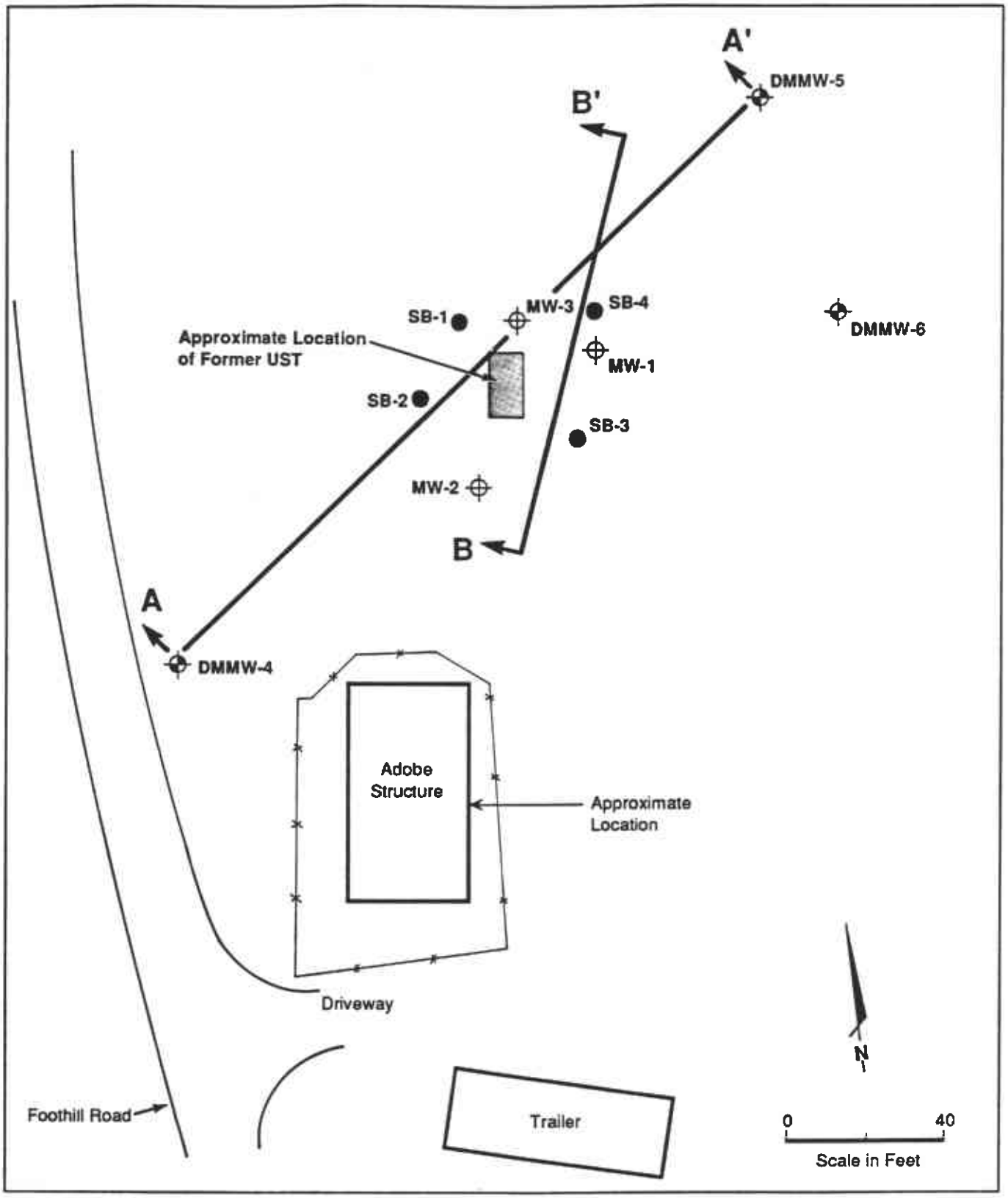
FIGURE 1



KEY

● SB-2	Dames & Moore Soil Boring
⊕ MW-2	Existing Monitoring Well
⊕ DMMW-4	Dames & Moore Monitoring Well

Note: Monitoring Wells Surveyed by Martin M. Ron Associates, Inc.

SITE PLOT PLAN

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FIGURE 2

SITE ACTIVITIES	1910	1930	1950	1970	1990	1989 J F M A M J J A S O N D	1990 J F M A M J J A S O N D	1991 J F M A M J J A S O N D	1992 J F M A
I DAIRY OPERATIONS									
Begin Operations	●								
On-Site Water Well Installation	●								
Underground Tank Installed			●						
Stopped Dairy Operations				●					
Stopped Using Tank					●				
On-Site Water Well Destroyed					●				
II ENVIRONMENTAL INVESTIGATIONS									
A. Berlogar Consultants									
Removed Underground Tank						●			
Gasoline Contamination Found in Soils Beneath Underground Tank						●			
Pesticide & Herbicide Testing						●			
Geotechnical Investigation						●			
Soil/Groundwater Investigation in Vicinity of Underground Tank Leak						●			
Environmental Site Assessment						●			
B. Ahmanson Developments									
Assumed Site Ownership							●		
C. Dames & Moore									
Regulated Site Closure with Regional Water Board							●		
Begin Quarterly Groundwater Monitoring								●	
Soil Gas Survey								●	
Grading Operations - (Discovered and Excavated 42 Cubic Yards of Soil)								Discovered ●	Excavated ●
Initial Remedial Recommendations									●
Vapor Extraction System Pilot Test									●
Revised Recommendations									●
Review of Site History									●

TIME LINE OF SITE ACTIVITIES

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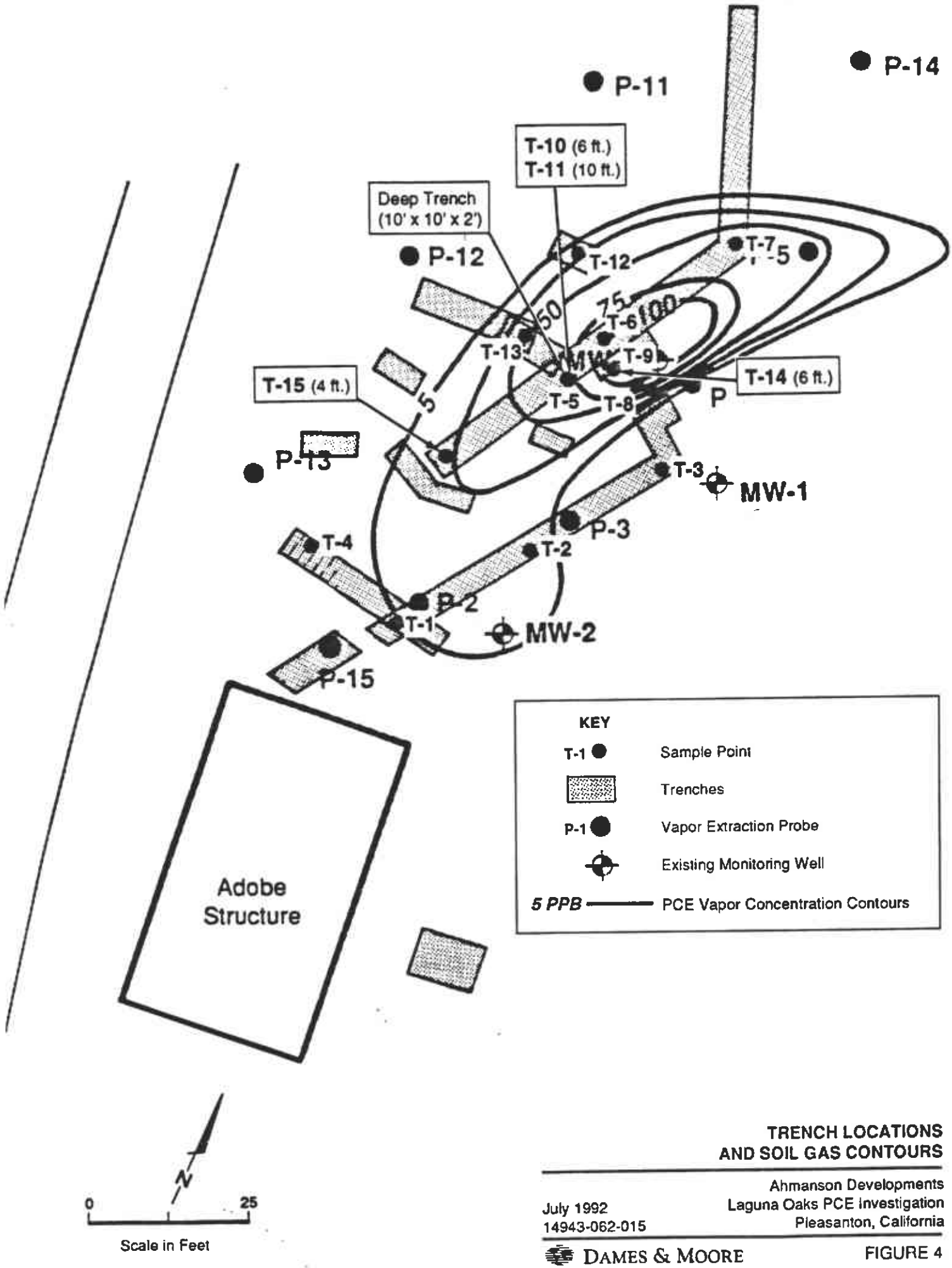
FIGURE 3



TRENCH LOCATIONS AND SOIL GAS CONTOURS

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FIGURE 4

A

Southwest

A'

Northeast

DMW-4 SB-2 SB-1 MW-3 SB-4 DMW-5

Ground Surface

Sand, Silt and Clay, Little Gravel and Occasional Cobbles

Silty Clay to Clayey Silt with Occasional Layers of Sand and Silt

Vadose Zone

Saturated Zone

ELEVATION (Feet)

0 10 20 30 40 50 60 70

KEY

SB-1 ← Soil Boring Identification

Stratigraphic Column, Refer to Unified Soil Classification Chart for Description of Units

MW-1 ← Indicates Monitoring Well (installed by Berlogger Geotechnical Consultants)

DMW-3 ← Indicates Dames & Moore Monitoring Well

Monitoring Well Screen Interval

Approximate Depth to Surface of Groundwater

Lithologic Contact (dashed where inferred)

NOTE:
Groundwater surface is based on depth to water encountered during drilling. See soil boring logs, Appendix D for a description of soils

GENERALIZED CROSS SECTION A - A'

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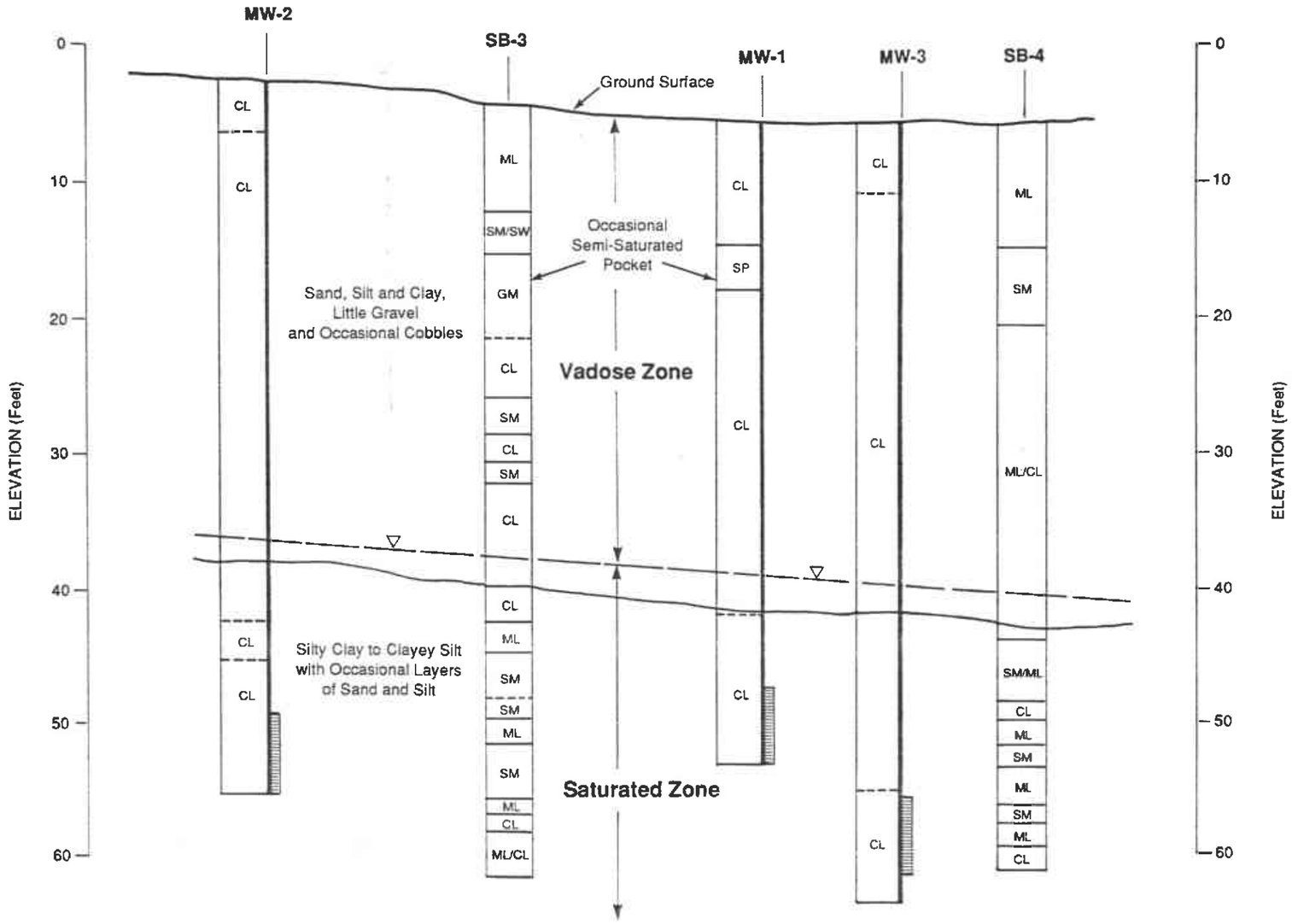
FIGURE 5

B

South

B'

North



KEY

SB-1 ← Soil Boring Identification

CL / ML / CL ← Stratigraphic Column, Refer to Unified Soil Classification Chart for Description of Units

MW-1 ← Indicates Monitoring Well (Installed by Berlogger Geotechnical Consultants)

DMW-3 ← Indicates Dames & Moore Monitoring Well

Monitoring Well Screen Interval

Approximate Depth to Surface of Groundwater

Lithologic Contact (dashed where inferred)

NOTE:
Groundwater surface is based on depth to water encountered during drilling. See soil boring logs, Appendix D for a description of soils.

GENERALIZED CROSS SECTION B - B'

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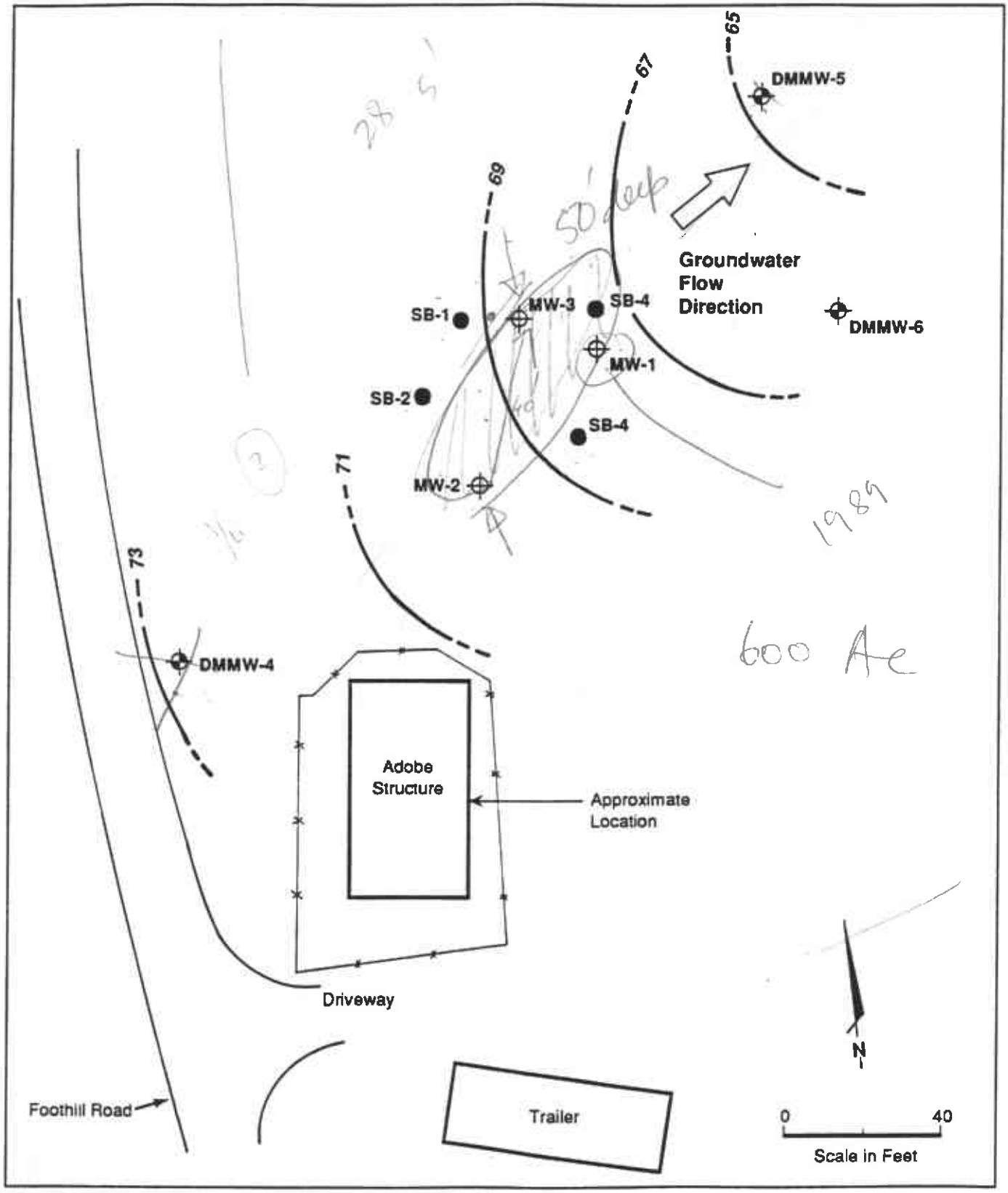
FIGURE 6

→ no ~~north~~ HRA →NO

→ Continue



KEY

● SB-2	Dames & Moore Soil Boring
⊕ MW-2	Existing Monitoring Well
⊕ DMMW-4	Dames & Moore Monitoring Well

Note: Monitoring Wells Surveyed by Martin M. Ron Associates, Inc.

GROUNDWATER ELEVATION CONTOUR MAP

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FIGURE 7

TABLE 1

ANALYTICAL TEST RESULTS FOR QUARTERLY GROUNDWATER MONITORING - LAGUNA OAKS SITE - PLEASONTON, CALIFORNIA

(Concentrations in parts per billion)

350 ppb

	CONSTITUENT											
Sample Location	TPH as Gasoline	Detection Limit	Benzene	Detection Limit	Toluene	Detection Limit	Ethyl-benzene	Detection Limit	Xylene	Detection Limit	Tetrachloro-ethylene	Detection Limit
FIRST QUARTER: MARCH 1990												
MW-1	ND	5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	NT	
MW-2	ND	50	ND	0.5	ND	0.5	ND	0.5	ND	0.5	NT*	
MW-3	ND	50	ND	0.5	ND	0.5	ND	0.5	ND	0.5	NT*	
SECOND QUARTER: JULY 1990												
MW-1	ND	25	ND	0.5	ND	0.5	ND	0.5	ND	0.5	NT	0.5
MW-2	ND	25	ND	0.5	ND	0.5	ND	0.5	ND	0.5	13	0.5
MW-3	ND	25	ND	0.5	ND	0.5	ND	0.5	ND	0.5	95	0.5
THIRD QUARTER: OCTOBER 1990												
MW-1	ND	25	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5
MW-2	ND	25	ND	0.5	ND	0.5	ND	0.5	ND	0.5	8.3	0.5
MW-3	60	25	ND	0.5	ND	0.5	1	0.5	ND	0.5	110	2.5
FOURTH QUARTER: MAY 1991												
MW-1	ND	50	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5
MW-2	ND	50	ND	0.5	ND	0.5	ND	0.5	ND	0.5	38	0.5
MW-3	90	50	ND	0.5	ND	0.5	ND	0.5	ND	0.5	370	10
SEPTEMBER 1991												
MW-1	ND	50	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5
MW-2	ND	50	ND	0.5	ND	0.5	ND	0.5	ND	0.5	25	0.5
MW-3	110	50	ND	0.5	ND	0.5	ND	0.5	ND	0.5	350	5

NT: Not Tested
ND: Not Detected
*: Results of the TPH as Gasoline showed a peak identified as Tetrachloroethylene.

gs:\soils\am\laguna.rpt

?

98 MW 2

July 1992 610 MW 3

TABLE 2

ANALYTICAL RESULTS OF PCE ANALYSIS OF SOIL SAMPLES
LAGUNA OAKS SITE
PLEASANTON, CALIFORNIA

Depth	SB-1	SB-2	SB-3	SB-4
9	ND	ND	-	-
15	ND	-	-	-
16	-	-	ND	-
24.5	-	-	ND	-
27.5	ND	-	-	-
30.5	-	ND	-	-
33	ND	-	-	-
34	ND	-	-	-
35	-	-	-	ND
37.5	-	ND	-	-
44	ND	-	-	-
47.5	-	ND	-	-
53.5	-	-	ND	-
58	-	ND	-	-
Detection Limit	0.001 mg/kg	0.001 mg/kg	0.001 mg/kg	0.001 mg/kg

Notes:

ND = Not detected above laboratory report limits

\- = No laboratory analyses performed

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TABLE 3

ANALYTICAL TEST RESULTS OF GROUNDWATER SAMPLING
LAGUNA OAKS SITE
PLEASANTON, CALIFORNIA
(Concentrations in micrograms per liter)

Test Method (compound)	Sample Source								
	MW-1	MW-2	MW-3	DMMW-4	DMMW-5	MW-7 (DMMW-5 duplicate)	DMMW-6	Trip Blank	Field Blank
EPA 8010 (PCE)	ND	0.098	0.610	ND	ND	ND	ND	ND	ND
EPA 8020 (BTEX)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Detection Limit	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

Explanation:

ND = Not detected above laboratory reporting limits
MW = Monitoring well

Notes:

Water samples were collected on July 8, 9, and 10, 1992.
Laboratory analyses performed on July 10, 1992 and July 13, 1992.

gs:\soils\am\laguna.rpt

APPENDIX A

BORING AND WELL PERMITS

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
5997 PARKSIDE DRIVE • PLEASANTON, CALIFORNIA 94588 • (510) 484-2600

23 June 1992

Dames & Moore
2101 Webster Street
Oakland, CA 94612

Gentlemen:

Enclosed is drilling permit 92314 for a monitoring well construction project at Foothill Road and Bernal Avenue in Pleasanton for Ahmanson Developments.

Please note that permit condition A-2 requires that a well construction report be submitted after completion of the work. The report should include drilling and completion logs, location sketch, and permit number.

If you have any questions, please contact Wyman Hong or me at 484-2600.

Very truly yours,

Craig A. Mayfield

Craig A. Mayfield
Water Resources Engineer

WH:mm
Enc.

ZONE 7 WATER AGENCY

5997 PARKSIDE DRIVE PLEASANTON, CALIFORNIA 94588 VOICE (510) 484-2600
FAX (510) 462-3914

DRILLING PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

ATION OF PROJECT FOOTHILL Rd. 1/2 mi of BERNAL, PLEASANTON, CA (OLD MEADOWLARK DAIRY SITE)

ENT
me AHMANSON DEVELOPMENTS
ress 1390 WILLOW PASS Phone 676-2323
CONCORD Zip 94520

LICANT
DAMES & MOORE
ess 2101 WEBSTER ST. Phone (510) 839-3400
OAKLAND Zip 94612

E OF PROJECT
Construction
Cathodic Protection ___
Water Supply ___
Monitoring X
Geotechnical Investigation ENVIRONMENTAL
General
Contamination X
Well Destruction ___

POSED WATER SUPPLY WELL USE
estic ___ Industrial ___ Other ___
icipal ___ Irrigation ___

LLING METHOD:
Rotary ___ Air Rotary ___ Auger HOLLOW STEM
___ Other - RUIL HAMMER

LER'S LICENSE NO. 485-390

L PROJECTS
Drill Hole Diameter 8 in. Maximum
~~Casing Diameter~~ 4 in. Depth 60 ft.
Surface Seal Depth 10 ft. Number 3
/Bentonite/Cement grout below

OTECHNICAL PROJECTS
Number of Borings 1 Maximum
Hole Diameter 8 in. Depth 60 ft.

IMATED STARTING DATE 6/23/92
IMATED COMPLETION DATE 7/2/92

eby agree to comply with all requirements of this permit and Alameda nty Ordinance No. 73-68.

LICANT'S NATURE Peter Davis Date 6/19/92
PETER DAVIS

FOR OFFICE USE

PERMIT NUMBER 92314
LOCATION NUMBER

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. Submit to Zone 7 within 60 days after completion of permitted work the original Department of Water Resources Water Well Drillers Report or equivalent for well Projects, or drilling logs and location sketch for geotechnical projects.
3. 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.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic and irrigation wells unless a lesser depth is specially approved. Minimum seal depth for monitoring wells is the maximum depth practicable or 20 feet.

C. GEOTECHNICAL. Backfill bore hole with compacted cuttings or heavy bentonite and upper two feet with compacted material. In areas of known or suspected contamination, tremied cement grout shall be used in place of compacted cuttings.

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

E. WELL DESTRUCTION. See attached.

Approved Wyman Hong Date 19 Jun 92
Wyman Hong

31992

APPENDIX B

LABORATORY REPORTS AND CHAIN OF CUSTODY

C K Y incorporated
Environmental Services

Date: 07/13/92
N9207-10

Dames & Moore
2101 Webster St., Suite 300
Oakland, CA 94612

Attn: Ms. Luke Anderson

Subject: Laboratory Report
Project: Ahmanson

Enclosed is the laboratory report for samples received on 07/10/92. The samples were received in coolers with ice and intact; the chain-of-custody forms were properly filled out. The data reported includes:

Method	No. of Analysis
EPA 8010	3 Water
EPA 8020	3 Water

The results are summarized on the following pages.

Please feel free to call if you have any questions concerning these results.

Sincerely,

Danny Hoang
Laboratory Director

3942 Valley Avenue, Suite F, Pleasanton, CA 94566 • Telephone 510-846-3188 • Fax: 510-846-1236

EPA METHOD 8010/PCE

CLIENT:	Dames & Moore	**DATE REC'D:**	07/10/92
PROJECT:	Ahmanson	**DATE EXTRACTED:**	N/A
CONTROL NO:	N9207-10	**DATE ANALYZED:**	07/10/92
MATRIX:	Water		

SAMPLE ID:	CONTROL NO:	RESULTS (ug/L)	DET. LIMIT (ug/L)	% SURRO RECOVERY
DMMW6	N9207-10-1	ND	1.0	108
MW1	N9207-10-2	ND	1.0	78
FB/TB	N9207-10-3	ND	1.0	100

EPA METHOD - 8020
BTEX

CLIENT:	Dames & Moore	**DATE REC'D:**	07/10/92
PROJECT:	Ahmanson	**DATE ANALYZED:**	07/10/92
CONTROL NO:	N9207-10	**MATRIX TYPE:**	Soil

		RESULTS (ug/L)				% SURRO
SAMPLE ID:	CONTROL NO:	Benz	Tol	Et Benz	Xyls	RECOVERY
DMMW6	N9207-10-1	ND	ND	ND	ND	108
MW1	N9207-10-2	ND	ND	ND	ND	78
FB/TB	N9207-10-3	ND	ND	ND	ND	100
DETECTION LIMIT		1	1	1	1	

QUALITY CONTROL DATA

CLIENT: Dames & Moore
PROJECT: Ahmanson
CONTROL NO: N9207-10

METHOD EPA 8010
MATRIX: Water

SAMPLE ID: N9207-10-1

COMPOUND	SAMPLE RESULTS (ug/L)	AMOUNT SPIKED (ug/L)	% REC.	DUP. % REC.	RPD
PCE	ND	100	125	110	13

QUALITY CONTROL DATA

CLIENT: Dames & Moore
PROJECT: Ahmanson
CONTROL NO: N9207-10

METHOD EPA 8020
MATRIX: Soil

SAMPLE ID: N9207-10-1

COMPOUND	SAMPLE RESULTS (ug/L)	AMOUNT SPIKED (ug/L)	% REC.	DUP. % REC.	RPD
Benzene	ND	20	110	110	0
Toluene	ND	20	110	100	0
Ethyl Benzene	ND	20	110	110	0
Xylene	ND	40	113	115	2

CHAIN-OF-CUSTODY RECORD

WHITE COPY - Original (Accompanies Samples) YELLOW COPY - Collector PINK COPY - Project Manager

	Boring or Well Number	Sample Number	Depth	Time	Sample Type	Container Type	VOA 601/8010 PCE	VOA 602/8020	VOA 624/8240	Semi Vol 625/8270	TPH 418.1	TPH 8015 (M)	TITLE 22 METALS	WET Test	PNA 610/8100	PEST/PCBs 8080	HEX CHROME	ORGANIC LEAD	TCLP	pH	ASBESTOS					FIELD NOTES:	Total Number Of Containers	Laboratory Note Number
1	DMMW6	DMMW6	14'	10:55	GRAB WATER	VOA's	X	X																		New well, flowing, gradient fm. "dirty" well	3	
2	MW1	MW1	55'	11:35	↓	↓	X	X																		maybe "dirty"	3	
3	FD/TB	FB/TB	NA	11:50	↓	↓	X	X																		Field Blank / Trip Blank	3	

W920710

RELINQUISHED BY: (Signature) DATE/TIME RECEIVED BY: (Signature)
Peter Davis 7/10/92 13:20

RELINQUISHED BY: (Signature) DATE/TIME RECEIVED BY: (Signature)
07/10/92 13:20

RELINQUISHED BY: (Signature) DATE/TIME RECEIVED BY: (Signature)

LABORATORY NOTES:

48 Hour Turnaround, Please!!

ANALYTICAL LABORATORY: CKY

LABORATORY CONTACT: Danny Hoang, Harry Hudson

D&M CONTACT: LUKE ANDERSON PHONE: 839-3600

JOB NO.: 14943-062-015 SHEET 1 OF 1

PROJECT Ahmanson PCE

LOCATION Laguna Oaks, Pleasanton

COLLECTOR PETER DAVIS DATE OF COLLECTION 7/10/92

DAMES & MOORE
221 MAIN STREET, SUITE 600
SAN FRANCISCO, CALIFORNIA 94105-1907
(415) 896-5858 FAX (415) 882-9261

2101 WEBSTER
OAK 94612

C K Y incorporated
Environmental Services

Date: 07/09/92
N9207-09

Dames & Moore
2101 Webster St., Suite 300
Oakland, CA 94612

Attn: Mr. Luke Anderson

Subject: Laboratory Report
Project: Ahmanson

Enclosed is the laboratory report for samples received on 07/09/92. The samples were received in coolers with ice and intact; the chain-of-custody forms were properly filled out. The data reported includes:

Method	No. of Analysis
EPA 8010	3 Water
EPA 8020	3 Water

The results are summarized on the following pages.

Please feel free to call if you have any questions concerning these results.

Sincerely,

Danny Hoang
Laboratory Director

3942 Valley Avenue, Suite F, Pleasanton, CA 94566 • Telephone 510-846-3188 • Fax: 510-846-1236

EPA METHOD 8010/PCE

CLIENT:	Dames & Moore	**DATE REC'D:**	07/09/92
PROJECT:	Ahmanson	**DATE EXTRACTED:**	N/A
CONTROL NO:	N9207-09	**DATE ANALYZED:**	07/09/92
MATRIX:	Water		

SAMPLE ID:	CONTROL NO:	RESULTS (ug/L)	DET. LIMIT (ug/L)	% SURRO RECOVERY
MW7	N9207-09-1	ND	1	98
MW5	N9207-09-2	ND	1	108
FB/TB	N9207-09-3	ND	1	90

EPA METHOD - 8020
BTEX

CLIENT:	Dames & Moore	**DATE REC'D:**	07/09/92
PROJECT:	Ahmanson	**DATE ANALYZED:**	07/09/92
CONTROL NO:	N9207-09	**MATRIX TYPE:**	Water

		RESULTS (ug/L)				% SURRO
SAMPLE ID:	CONTROL NO:	Benz	Tol	Et Benz	Xyls	RECOVERY
MW7	N9207-09-1	ND	ND	ND	ND	98
MW5	N9207-09-2	ND	ND	ND	ND	108
FB/TB	N9207-09-3	ND	ND	ND	ND	90
DETECTION LIMIT		1	1	1	1	

QUALITY CONTROL DATA

CLIENT: Dames & Moore
PROJECT: Ahmanson
CONTROL NO: N9207-09

METHOD EPA 8020
MATRIX: Water

SAMPLE ID: N9207-09-1

COMPOUND	SAMPLE RESULTS (ug/L)	AMOUNT SPIKED (ug/L)	% REC.	DUP. % REC.	RPD
Benzene	ND	20	105	90	15
Toluene	ND	20	110	85	25
Ethyl Benzene	ND	20	105	90	15
Xylene	ND	40	112	93	19

QUALITY CONTROL DATA

CLIENT: Dames & Moore
PROJECT: Ahmanson
CONTROL NO: N9207-09

METHOD EPA 8010
MATRIX: Water

SAMPLE ID: N9207-08-3

COMPOUND	SAMPLE RESULTS (ug/L)	AMOUNT SPIKED (ug/L)	% REC.	DUP. % REC.	RPD
PCE	ND	100	82	94	14

C. AIN-OF-CUSTODY RECORD

WHITE [PY] - Original (Accompanies Samples) YELLOW COPY - Collector PINK COPY [Pro]ject Manager

	Boring or Well Number	Sample Number	Depth	Time	Sample Type	Container Type	VOA 601/8010 (RE)	VOA 602/8020	VOA 624/8240	Semi Vol 625/8270	TPH 418.1	TPH 8015 (M)	TITLE 22 METALS	WET Test	PNA 610/8100	PEST/PCBs 8080	HEX CHROME	ORGANIC LEAD	TCLP	pH	ASBESTOS	.	.	.	.	.	FIELD NOTES:	Total Number Of Containers	Laboratory Note Number
1	MW7	MW7	20'	8:30	GRAB H2O	VOA'S	X	X																			{ NEW WELLS, DOWN	3	
2	MW5	MW5	17'	10:10	"	VOA'S	X	X																			} GRADIENT fm. dirty well	3	
3	FB/TB	FB/TB	NA	11:30	"	VOA'S	X	X																			Field Blank / Trip Blank	3	

N9207-09

MW7 (DUPLICATE FROM DMMW-5)

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
Peter Davis	7/9/92 15:50	[signature]
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)

LABORATORY NOTES:

48 HOUR TURNAROUND, PLEASE !!

ANALYTICAL LABORATORY: CKY

LABORATORY CONTACT: M. HUDSON, O. HOANG

D&M CONTACT: LUKE ANDERSON PHONE: 839-3600

DAMES & MOORE

221 MAIN STREET, SUITE 600
SAN FRANCISCO, CALIFORNIA 94105-1907
(415) 896-5858 FAX (415) 882-9261

2101 WEBSTER
OAK, 94612

JOB NO.: 14943-062-015 SHEET 1 OF 1

PROJECT Ahmanson PCE

LOCATION Laguna Oaks, Pleasanton

COLLECTOR PETER DAVIS DATE OF COLLECTION 7/9/92

C K Y incorporated
Environmental Services

Date: 07/09/92
N9207-08

Dames & Moore
2101 Webster St, Suite 300
Oakland, CA 94612

Attn: Mr. Luke Anderson

Subject: Laboratory Report
Project: Ahmanson

Enclosed is the laboratory report for samples received on 07/09/92. The samples were received in coolers with ice and intact; the chain-of-custody forms were properly filled out. The data reported includes:

Method	No. of Analysis
EPA 8010	4 Water
EPA 8020	4 Water

The results are summarized on the following pages.

Please feel free to call if you have any questions concerning these results.

Sincerely,

Danny Hoang
Laboratory Director

3942 Valley Avenue, Suite F, Pleasanton, CA 94566 • Telephone 510-846-3188 • Fax: 510-846-1236

EPA METHOD 8010/PCE

CLIENT:	Dames & Moore	**DATE REC'D:**	07/09/92
PROJECT:	Ahmanson	**DATE EXTRACTED:**	N/A
CONTROL NO:	N9207-08	**DATE ANALYZED:**	07/09/92
MATRIX:	Water		

SAMPLE ID:	CONTROL NO:	RESULTS (ug/L)	DET. LIMIT (ug/L)	% SURRO RECOVERY
MW2	N9207-08-1	98	1	122
MW3	N9207-08-2	610	1	84
DMMW 4	N9207-08-3	ND	1	96
FB/TB	N9207-08-4	ND	1	100

EPA METHOD - 8020
BTEX

CLIENT:	Dames & Moore	**DATE REC'D:**	07/08/92
PROJECT:	Ahmanson	**DATE ANALYZED:**	07/09/92
CONTROL NO:	N9207-08	**MATRIX TYPE:**	Water

		RESULTS (ug/L)				% SURRO
SAMPLE ID:	CONTROL NO:	Benz	Tol	Et Benz	Xyls	RECOVERY
MW2	N9207-08-1	ND	ND	ND	ND	122
MW3	N9207-08-2	ND	ND	ND	ND	84
DMMW 4	N9207-08-3	ND	ND	ND	ND	96
FB/TB	N9207-08-4	ND	ND	ND	ND	100
DETECTION LIMIT		1	1	1	1	

QUALITY CONTROL DATA

CLIENT: Dames & Moore
PROJECT: Ahmanson
CONTROL NO: N9207-08

METHOD EPA 8020
MATRIX: Water

SAMPLE ID: N9207-08-3

COMPOUND	SAMPLE RESULTS (ug/L)	AMOUNT SPIKED (ug/L)	% REC.	DUP. % REC.	RPD
Benzene	ND	20	105	90	15
Toluene	ND	20	100	85	25
Ethyl Benzene	ND	20	105	90	15
Xylene	ND	40	112	93	19

QUALITY CONTROL DATA

CLIENT: Dames & Moore
PROJECT: Ahmanson
CONTROL NO: N9207-08

METHOD EPA 8010
MATRIX: Water

SAMPLE ID: N9207-08-3

COMPOUND	SAMPLE RESULTS (ug/L)	AMOUNT SPIKED (ug/L)	% REC.	DUP. % REC.	RPD
PCE	ND	100	82	94	14

C. AIN-OF-CUSTODY RECORD

WHIT. PY - Original (Accompanies Samples) YELLOW COPY - Collector PINK COP'. oject Manager

	Boring or Well Number	Sample Number	Depth	Time	Sample Type	Container Type	VOA 601/8010 PCE	VOA 602/8020	VOA 624/8240	Semi Vol 625/8270	TPH 418.1	TPH 8015 (M)	TITLE 22 METALS	WET Test	PNA 610/8100	PEST/PCBs 8080	HEX CHROME	ORGANIC LEAD	TCLP	pH	ASBESTOS					FIELD NOTES:	Total Number Of Containers	Laboratory Note Number
1	MW2	MW2	40'	11:15	GW/DI H2O	VOA	X	X																		probably "dirty"	3	
2	MW3	MW3	47'	12:57	"	"	X	X																		probably "dirty"	3	
3	DUMW4	DUMW4	47'	1:10	"	"	X	X																		new well	3	
4	FB/TB	FB/TB	NA	3:45	"	"	X	X																		Field Blank/Trip Blank	3	

N9207-08

RELINQUISHED BY: (Signature) Peter Davis DATE/TIME 7/8/92 8:30 RECEIVED BY: (Signature) 7/9/92

RELINQUISHED BY: (Signature) DATE/TIME RECEIVED BY: (Signature)

RELINQUISHED BY: (Signature) DATE/TIME RECEIVED BY: (Signature)

LABORATORY NOTES:

48 Hr. TURNAROUND, PLEASE.

ANALYTICAL LABORATORY: CLY

LABORATORY CONTACT: Harry Hudson, Danny Hoang

D&M CONTACT: LUKE ANDERSON PHONE: 839-3600

DAMES & MOORE

2101 WEBSTER
OAK 94612

221 MAIN STREET, SUITE 600
SAN FRANCISCO, CALIFORNIA 94105-1907
(415) 896-5858 FAX (415) 882-9261

JOB NO.: 14943-062-015 SHEET 1 OF 1

PROJECT Alhamsan PCE

LOCATION Laguna Oaks, Pleasanton

COLLECTOR PETER DAVIS DATE OF COLLECTION 7/8/92

C K Y incorporated
Environmental Services

Date: 06/30/92
N9206-21

Dames & Moore
2101 Webster St., Suite 300
Oakland, CA 94612

Attn: Mr. Luke Anderson

Subject: Laboratory Report
Project: Ahmanson

Enclosed is the laboratory report for samples received on 06/25/92. The samples were received in coolers with ice and intact; the chain-of-custody forms were properly filled out. The data reported includes:

Method	No. of Analysis
EPA 8010	3 Soil

The results are summarized on the following pages.

Please feel free to call if you have any questions concerning these results.

Sincerely,

Danny Hoang
Laboratory Director

3942 Valley Avenue, Suite F, Pleasanton, CA 94566 • Telephone 510-846-3188 • Fax: 510-846-1236

EPA METHOD 8010/PCE
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/25/92
PROJECT:	Ahmanson	**DATE EXTRACTED:**	N/A
CONTROL NO:	N9206-21	**DATE ANALYZED:**	06/26/92
MATRIX:	Soil		

SAMPLE ID:	CONTROL NO:	RESULTS (ug/kg)	DET. LIMIT (ug/kg)	% SURRO RECOVERY
SB3-5-16	N9206-21-5	ND	1	75
SB3-8-24.5	N9206-21-8	ND	1	80
SB3-18-53.5	N9206-21-18	ND	1	72

QUALITY CONTROL DATA

CLIENT: Dames & More
PROJECT: Ahmanson
CONTROL NO: N9206-21

METHOD EPA 8010
MATRIX: Soil

SAMPLE ID: N9206-26-6

COMPOUND	SAMPLE RESULTS (ug/kg)	AMOUNT SPIKED (ug/kg)	% REC.	DUP. % REC.	RPD
PCE	ND	1	70	100	35

CHAIN-OF-CUSTODY RECORD

WHITE COPY - Original (Accompanies Samples) YELLOW COPY - Collector PINK COPY - Project Manager

N9206-21

	Boring or Well Number	Sample Number	Depth	Time	Sample Type	Container Type	VOA 601/8010	VOA 602/8020	VOA 624/8240	Semi Vol 625/8270	TPH 418.1	TPH 8015 (M)	TITLE 22 METALS	WET Test	PNA 610/8100	PEST/PCBs 8080	HEX CHROME	ORGANIC LEAD	TCLP	pH	ASBESTOS	FIELD NOTES:	Total Number Of Containers	Laboratory Note Number
1	SB3	1	6½		GRAB	4 oz Glass																HOLD	1	
2	SB3	2	7½		Soil																			
3	SB3	3	10																					
4	SB3	4	11½																					
5	SB3	5	16				X																	
6	SB3	6	18½																			HOLD		
7	SB3	7	22																			"		
8	SB3	8	24½				X																	
9	SB3	9	25																			HOLD		
10	SB3	10	28																					
11	SB3	11	30½																					
12	SB3	12	35																					
13	SB3	13	38½																					
14	SB3	14	41																					
15	SB3	15	46																					
16	SB3	16	47½																					
17	SB3	17	52																					
18	SB3	18	57½				X																	
19	SB3	19	59																			HOLD SB3-59	1	

RELINQUISHED BY: (Signature) [illegible] DATE/TIME RECEIVED BY: (Signature)

RELINQUISHED BY: (Signature) [illegible] DATE/TIME 6/25/92 16:45 RECEIVED BY: (Signature)

RELINQUISHED BY: (Signature) [illegible] DATE/TIME 6/25/92 16:45 RECEIVED BY: (Signature)

ANALYTICAL LABORATORY: CKY

LABORATORY CONTACT: Harry Hudson

D&M CONTACT: [illegible] PHONE: 536-3600

LABORATORY NOTES:

X 48 Hour TAT. Please refer to samples by entire sequence of numbers. e.g "SB3-9-21".

JOB NO.: 14943-067-015 SHEET 1 OF 2

PROJECT: Abrahamsen PCE

LOCATION: [illegible]

COLLECTOR: [illegible] DATE OF COLLECTION: [illegible]

DAMES & MOORE
221 MAIN STREET, SUITE 600
SAN FRANCISCO, CALIFORNIA 94105-1907
(415) 896-5858 FAX (415) 882-9261

C K Y incorporated
Environmental Services

Date: 06/30/92
N9206-17

Dames & Moore
2101 Webster St., Suite 300
Oakland, CA 94612

Attn: Mr. Luke Anderson

Subject: Laboratory Report
Project: Ahmanson

Enclosed is the laboratory report for samples received on 06/24/92. The samples were received in coolers with ice and intact; the chain-of-custody forms were properly filled out. The data reported includes:

Method	No. of Analysis
EPA 8010	5 Soil

The results are summarized on the following pages.

Please feel free to call if you have any questions concerning these results.

Sincerely,

Danny Hoang
Laboratory Director

3942 Valley Avenue, Suite F, Pleasanton, CA 94566 • Telephone 510-846-3188 • Fax: 510-846-1236

EPA METHOD 8010/PCE
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/24/92
PROJECT:	Ahmanson	**DATE EXTRACTED:**	N/A
CONTROL NO:	N9206-17	**DATE ANALYZED:**	06/25/92
MATRIX:	Soil		

SAMPLE ID:	CONTROL NO:	RESULTS (ug/kg)	DET. LIMIT (ug/kg)	% SURRO RECOVERY
SB2-3-9	N9206-17-3	ND	1	86
SB2-14-30.5	N9206-17-14	ND	1	80
SB2-18-37.5	N9206-17-18	ND	1	85
SB2-23-47.5	N9206-17-23	ND	1	74
SB2-26-58	N9206-17-26	ND	1	84

QUALITY CONTROL DATA

CLIENT: Dames & More
PROJECT: Ahmanson
CONTROL NO: N9206-17

METHOD EPA 8010
MATRIX: Soil

SAMPLE ID: N9206-14-2

COMPOUND	SAMPLE RESULTS (ug/kg)	AMOUNT SPIKED (ug/kg)	% REC.	DUP. % REC.	RPD
PCE	ND	2	80	100	22

CHAIN-OF-CUSTODY RECORD

WHITE COPY - Original (Accompanies Samples) YELLOW COPY - Collector PINK COPY - Project Manager

ANALYSES

#	Boring or Well Number	Sample Number	Depth	Time	Sample Type	Container Type	VOA 601/8010	VOA 602/8020	VOA 624/8240	Semi Vol 625/8270	TPH 418.1	TPH 8015 (M)	TITLE 22 METALS	WET Test	PNA 610/8100	PEST/PCBs 8080	HEX CHROME	ORGANIC LEAD	TCLP	pH	ASBESTOS					8010-L	FIELD NOTES:	Total Number Of Containers	Laboratory Note Number
1	SB2	1	6'		SOIL	4 oz Glass																					HOLD	1	
2	SB2	2	7½'		SOIL																								
3	SB2	3	9'																							X			
4	SB2	4	10'																							[illegible]	HOLD		
5	SB2	5	12'																								HOLD		
6	SB2	6	13½'																										
7	SB2	7	16'																										
8	SB2	8	18½'																										
9	SB2	9	20'																										
10	SB2	10	21½'																										
11	SB2	11	23½'																										
12	SB2	12	27'																										
13	SB2	13	29'																										
14	SB2	14	30½'																							X			
15	SB2	15	32'																								HOLD		
16	SB2	16	33½'																										
17	SB2	17	35½'																										
18	SB2	18	37½'																							X			

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
[illegible signature]	6/24/92 16:07	[illegible signature]
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)

LABORATORY NOTES:

Please refer to samples by entire number, e.g. "SB2-3-9'"

48 hr. Turnaround please.

ANALYTICAL LABORATORY: CKY

LABORATORY CONTACT: Harry Hudson

D&M CONTACT: [illegible] PHONE: 579-7600

DAMES & MOORE
221 MAIN STREET, SUITE 600
SAN FRANCISCO, CALIFORNIA 94105-1907
(415) 896-5858 FAX (415) 882-9261

JOB NO.: 14993-062-015 SHEET 1 OF 2

PROJECT [illegible] PCE

LOCATION [illegible]

COLLECTOR [illegible] DATE OF COLLECTION [illegible]

CLIENT: Dames & More
PROJECT: Ahmanson
CONTROL NO: N9206-26

METHOD EPA 8010
MATRIX: Soil

SAMPLE ID: N9206-26-6

COMPOUND	SAMPLE RESULTS (ug/kg)	AMOUNT SPIKED (ug/kg)	% REC.	DUP. % REC.	RPD
PCE	ND	1	70	100	35

CHAIN-OF-CUSTODY RECORD

WHITE COPY - Original (Accompanies Samples) YELLOW COPY - Collector PINK COPY - Project Manager

Boring or Well Number	Sample Number	Depth	Time	Sample Type	Container Type: NM206-22	ANALYSES: VOA 601/8010	VOA 602/8020	VOA 624/8240	Semi Vol 625/8270	TPH 418.1	TPH 8015 (M)	TITLE 22 METALS	WET Test	PNA 610/8100	PEST/PCBs 8080	HEX CHROME	ORGANIC LEAD	TCLP	pH	ASBESTOS	FIELD NOTES:	Total Number Of Containers	Laboratory Note Number
SB4	1	5½'		GRAB SOIL	4 oz GLASS																HOLD	1	
SB4	2	8½'																					
SB4	3	12'																					
SB4	4	24½'																					
SB4	5	29½'																					
SB4	6	35'				X																	
SB4	7	36½'																			HOLD		
SB4	8																						
SB4	9	45'																					
SB4	10	52'																					
SB4	11	55'																					
SB4	12	55½'																					
SB4	13	59½'																					
SB4	14	61'																					
SB4	15	62½'		↓	↓																↓	↓	
BH																							

RELINQUISHED BY: (Signature) DATE/TIME RECEIVED BY: (Signature)
Kelly Hudson 6/26/92 16:40

RELINQUISHED BY: (Signature) DATE/TIME RECEIVED BY: (Signature)

RELINQUISHED BY: (Signature) DATE/TIME RECEIVED BY: (Signature)
6/26/92

ANALYTICAL LABORATORY: CKY

LABORATORY CONTACT: Kelly Hudson

D&M CONTACT: LUKE ANDERSON PHONE:

LABORATORY NOTES:

15 hr. turn

please refer to samples by entire sequence of numbers, e.g. "SB4-6-35"

JOB NO.: 14613-062.015 SHEET 1 OF 1

PROJECT Alameda Site

LOCATION Alameda, California

COLLECTOR [illegible] DATE OF COLLECTION [illegible]

DAMES & MOORE
221 MAIN STREET, SUITE 600
SAN FRANCISCO, CALIFORNIA 94105-1907
(415) 896-5858 FAX (415) 882-9261

C K Y incorporated
Environmental Services

Date: 06/29/92
N9206-14

Dames & Moore
2101 Webster St., # 300
Oakland, CA 94612

Attn: Mr. Luke Anderson

Subject: Laboratory Report
Project: Ahmanson

Enclosed is the laboratory report for samples received on 06/23/92. The samples were received in coolers with ice and intact; the chain-of-custody forms were properly filled out. The data reported includes:

Method	No. of Analysis
EPA 8010	6 Soil

The results are summarized on the following pages.

Please feel free to call if you have any questions concerning these results.

Sincerely,

Danny Hoang
Laboratory Director

3942 Valley Avenue, Suite F, Pleasanton, CA 94566 • Telephone 510-846-3188 • Fax: 510-846-1236

EPA METHOD 8010/PCE

CLIENT:	Dames & Moore	**DATE REC'D:**	06/23/92
PROJECT:	Ahmanson	**DATE EXTRACTED:**	N/A
CONTROL NO:	N9206-14	**DATE ANALYZED:**	06/24/92
MATRIX:	Soil		

SAMPLE ID:	CONTROL NO:	RESULTS (ug/kg)	DET. LIMIT (ug/kg)	% SURRO RECOVERY
SB1-2-9	N9206-14-2	ND	1	106
SB1-6-15	N9206-14-6	ND	1	100
SB1-13-27.5	N9206-14-13	ND	1	121
SB1-14-33	N9206-14-14	ND	1	80
SB1-15-34	N9206-14-15	ND	1	72
SB1-20-44	N9206-14-20	ND	1	85

QUALITY CONTROL DATA

CLIENT: Dames & Moore
PROJECT: Ahmanson
CONTROL NO: N9206-14

METHOD EPA 8010
MATRIX: Soil

SAMPLE ID: N9206-14-2

COMPOUND	SAMPLE RESULTS (ug/kg)	AMOUNT SPIKED (ug/kg)	% REC.	DUP. % REC.	RPD
PCE	ND	2	80	100	22

CHAIN OF CUSTODY RECORD
REQUEST FOR ANALYSIS

DATE: 6/23

PAGE 1 OF 2

CKY Incorporated
Environmental Services
3942 Valley Avenue, Suite F
Pleasanton, CA 94566
Tel: 510-846-2188
Fax: 510-846-1234

CLIENT NAME: DAMES & MOORE
ADDRESS: 6101 WEBSTER
OAK 94612
PHONE NO. (510) 339-3600 FAX NO.
PROJECT NAME: AHMANSON
SEND REPORT TO: LUKE ANDERSON

SAMPLER NAME/SIGNATURE: PETER DAVIS / Peter Davis

TURN AROUND TIME
NORMAL ☐
RUSH ☒

SAMPLE NUMBER	SAMPLING DATE/TIME	PRESERVATIVE	CONTAINER SIZE/TYPE	SAMPLE DESCRIPTION: WATER	SOIL	OTHER	ANALYSES REQUIRED: 418.1	M8015,	8010/601	8020/602	8080/608	8240/624	8270/625	CAM Metals
SB1-1-7'	6/22	ICE	Glass jar		grab soil									
SB1-2-9'									X					
SB1-3-10'														
SB1-4-12'														
SB1-5-13'														
SB1-6-15'									X					
SB1-7-16½'														
SB1-8-17½'														
SB1-9-21'														
SB2-10-22'														
SB1-11-24'														
SB1-12-27'														
SB1-13-27½'									X					
SB1-14-33'									X					

COMMENTS: Please refer to Samples by entire # e.g. "SB-1-3-10"
HOLD SAMPLES Pending Project Manager's input.

Relinquished by: (Signature)	Date:	Received by: (Signature)	Date:	Relinquished by: (Signature)	Date:	Received by: (Signature)	Date:
Peter Davis	6/23/92		6/23/92				
Company: Dames & Moore	Time: 11 am	Company:	Time: 15 pm	Company:	Time:	Company:	Time:

Storage/Disposal of Samples: Sample will be stored at CKY for 30 days at no charge and at $10/sample/month thereafter. Disposal of sample by the Laboratory will be charged at $10/sample.

CHAIN OF CUSTODY RECORD
REQUEST FOR ANALYSIS

DATE: 6/23/92

PAGE 1 OF 2

CKY Incorporated
Environmental Services
5942 Valley Avenue, Suite P
Pleasanton, CA 94566
Tel: 510-846-3188
Fax: 510-846-1236

CLIENT NAME: Davis Moore

ADDRESS: 2101 Webster

PHONE NO.: FAX NO.:

PROJECT NAME: Anderson

SEND REPORT TO: Luke Anderson

SAMPLER NAME/SIGNATURE: Peter Davis / Peter Davis

TURN AROUND TIME
NORMAL ☐
RUSH ☐

ANALYSES REQUIRED

SAMPLE NUMBER	SAMPLING DATE/TIME	PRESERVATIVE	CONTAINER SIZE/TYPE	SAMPLE DESCRIPTION: WATER	SOIL	OTHER	418.1	M8015	8010/601/602	8020/602	8080/608	8240/624	8270/625	CAM Metals
SB1-15-31'	6/23	ICE	Glass jars		soil				X					
SB1-16-37'														
SB1-17-39'														
SB1-18-41'														
SB1-19-43'														
SB1-20-44'									X					

COMMENTS: HOLD SAMPLES

Relinquished by: (Signature)	Date:	Received by: (Signature)	Date:	Relinquished by: (Signature)	Date:	Received by: (Signature)	Date:
Peter Davis	6/23/92		6/23/92				
Company: Davis Moore	Time:	Company: CKY	Time:	Company:	Time:	Company:	Time:

Storage/Disposal of Samples: Sample will be stored at CKY for 30 days at no charge and at $10/sample/month thereafter. Disposal of sample by the Laboratory will be charged at $10/sample.

C K Y incorporated
Environmental Services

Date: 06/12/92
N9206-05

Dames & Moore
2101 Webster Street #300
Oakland, CA 94612

Attn: Mr. Luke Anderson

Subject: Laboratory Report
Project: Ahmanson PCE

Enclosed is the laboratory report for samples received on 06/10/92. The chain-of-custody forms were properly filled out. The data reported includes:

Method	No. of Analysis
EPA 8010	15 Soil

The results are summarized on seventeen pages.

Please feel free to call if you have any questions concerning these results.

Sincerely,

Danny Hoang
Laboratory Director

3942 Valley Avenue, Suite F, Pleasanton, CA 94566 • Telephone 510-846-3188 • Fax: 510-846-1236

EPA METHOD 8010
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/10/92
PROJECT:	Ahmanson PCE	**DATE ANALYZED:**	06/10/92
SAMPLE ID:	T1-2	**MATRIX TYPE:**	Soil
CONTROL NO:	N9206-05-1		

PARAMETERS (8010)	RESULTS (ug/kg)	DETECTION LIMIT (ug/kg)
Dichlorodifluoromethane	ND	20
Chloromethane	ND	20
Vinyl Chloride	ND	20
Bromomethane	ND	20
Chloroethane	ND	20
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND	5
cis-1,2-Dichloroethene	ND	5
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
2-Chloroethylvinylether	ND	5
Trans-1,3-Dichloropropene	ND	5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
1,1,1,2-Tetrachloroethane	ND	5
Dibromochloromethane	ND	5
Ethylene Dibromide	ND	5
Chlorobenzene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Chlorotoluene	ND	5
M-Dichlorobenzene	ND	5
P-Dichlorobenzene	ND	5
Benzylchloride	ND	5
O-Dichlorobenzene	ND	5
% Surrogate Recovery:	88	

EPA METHOD 8010
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/10/92
PROJECT:	Ahmanson PCE	**DATE ANALYZED:**	06/10/92
SAMPLE ID:	T2-1	**MATRIX TYPE:**	Soil
CONTROL NO:	N9206-05-2		

PARAMETERS (8010)	RESULTS (ug/kg)	DETECTION LIMIT (ug/kg)
Dichlorodifluoromethane	ND	20
Chloromethane	ND	20
Vinyl Chloride	ND	20
Bromomethane	ND	20
Chloroethane	ND	20
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND	5
cis-1,2-Dichloroethene	ND	5
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
2-Chloroethylvinylether	ND	5
Trans-1,3-Dichloropropene	ND	5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
1,1,1,2-Tetrachloroethane	ND	5
Dibromochloromethane	ND	5
Ethylene Dibromide	ND	5
Chlorobenzene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Chlorotoluene	ND	5
M-Dichlorobenzene	ND	5
P-Dichlorobenzene	ND	5
Benzylchloride	ND	5
O-Dichlorobenzene	ND	5
% Surrogate Recovery:	96	

EPA METHOD 8010
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/10/92
PROJECT:	Ahmanson PCE	**DATE ANALYZED:**	06/10/92
SAMPLE ID:	T3-1	**MATRIX TYPE:**	Soil
CONTROL NO:	N9206-05-3		

PARAMETERS (8010)	RESULTS (ug/kg)	DETECTION LIMIT (ug/kg)
Dichlorodifluoromethane	ND	20
Chloromethane	ND	20
Vinyl Chloride	ND	20
Bromomethane	ND	20
Chloroethane	ND	20
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND	5
cis-1,2-Dichloroethene	ND	5
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
2-Chloroethylvinylether	ND	5
Trans-1,3-Dichloropropene	ND	5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
1,1,1,2-Tetrachloroethane	ND	5
Dibromochloromethane	ND	5
Ethylene Dibromide	ND	5
Chlorobenzene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Chlorotoluene	ND	5
M-Dichlorobenzene	ND	5
P-Dichlorobenzene	ND	5
Benzylchloride	ND	5
O-Dichlorobenzene	ND	5
% Surrogate Recovery:	84	

EPA METHOD 8010
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/10/92
PROJECT:	Ahmanson PCE	**DATE ANALYZED:**	06/10/92
SAMPLE ID:	T4-1	**MATRIX TYPE:**	Soil
CONTROL NO:	N9206-05-4		

PARAMETERS (8010)	RESULTS (ug/kg)	DETECTION LIMIT (ug/kg)
Dichlorodifluoromethane	ND	20
Chloromethane	ND	20
Vinyl Chloride	ND	20
Bromomethane	ND	20
Chloroethane	ND	20
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND	5
cis-1,2-Dichloroethene	ND	5
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
2-Chloroethylvinylether	ND	5
Trans-1,3-Dichloropropene	ND	5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
1,1,1,2-Tetrachloroethane	ND	5
Dibromochloromethane	ND	5
Ethylene Dibromide	ND	5
Chlorobenzene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Chlorotoluene	ND	5
M-Dichlorobenzene	ND	5
P-Dichlorobenzene	ND	5
Benzylchloride	ND	5
O-Dichlorobenzene	ND	5
% Surrogate Recovery:	90	

EPA METHOD 8010
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/10/92
PROJECT:	Ahmanson PCE	**DATE ANALYZED:**	06/10/92
SAMPLE ID:	T5-2	**MATRIX TYPE:**	Soil
CONTROL NO:	N9206-05-5		

PARAMETERS (8010)	RESULTS (ug/kg)	DETECTION LIMIT (ug/kg)
Dichlorodifluoromethane	ND	20
Chloromethane	ND	20
Vinyl Chloride	ND	20
Bromomethane	ND	20
Chloroethane	ND	20
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND	5
cis-1,2-Dichloroethene	ND	5
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
2-Chloroethylvinylether	ND	5
Trans-1,3-Dichloropropene	ND	5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	¥ 28	5
1,1,1,2-Tetrachloroethane	ND	5
Dibromochloromethane	ND	5
Ethylene Dibromide	ND	5
Chlorobenzene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Chlorotoluene	ND	5
M-Dichlorobenzene	ND	5
P-Dichlorobenzene	ND	5
Benzylchloride	ND	5
O-Dichlorobenzene	ND	5
% Surrogate Recovery:	92	

EPA METHOD 8010
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/10/92
PROJECT:	Ahmanson PCE	**DATE ANALYZED:**	06/10/92
SAMPLE ID:	T6-1	**MATRIX TYPE:**	Soil
CONTROL NO:	N9206-05-6		

PARAMETERS (8010)	RESULTS (ug/kg)	DETECTION LIMIT (ug/kg)
Dichlorodifluoromethane	ND	20
Chloromethane	ND	20
Vinyl Chloride	ND	20
Bromomethane	ND	20
Chloroethane	ND	20
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND	5
cis-1,2-Dichloroethene	ND	5
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
2-Chloroethylvinylether	ND	5
Trans-1,3-Dichloropropene	ND	5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
1,1,1,2-Tetrachloroethane	ND	5
Dibromochloromethane	ND	5
Ethylene Dibromide	ND	5
Chlorobenzene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Chlorotoluene	ND	5
M-Dichlorobenzene	ND	5
P-Dichlorobenzene	ND	5
Benzylchloride	ND	5
O-Dichlorobenzene	ND	5
% Surrogate Recovery:	87	

EPA METHOD 8010
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/10/92
PROJECT:	Ahmanson PCE	**DATE ANALYZED:**	06/10/92
SAMPLE ID:	T7-1	**MATRIX TYPE:**	Soil
CONTROL NO:	N9206-05-7		

PARAMETERS (8010)	RESULTS (ug/kg)	DETECTION LIMIT (ug/kg)
Dichlorodifluoromethane	ND	20
Chloromethane	ND	20
Vinyl Chloride	ND	20
Bromomethane	ND	20
Chloroethane	ND	20
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND	5
cis-1,2-Dichloroethene	ND	5
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
2-Chloroethylvinylether	ND	5
Trans-1,3-Dichloropropene	ND	5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
1,1,1,2-Tetrachloroethane	ND	5
Dibromochloromethane	ND	5
Ethylene Dibromide	ND	5
Chlorobenzene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Chlorotoluene	ND	5
M-Dichlorobenzene	ND	5
P-Dichlorobenzene	ND	5
Benzylchloride	ND	5
O-Dichlorobenzene	ND	5
% Surrogate Recovery	80	

EPA METHOD 8010
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/10/92
PROJECT:	Ahmanson PCE	**DATE ANALYZED:**	06/10/92
SAMPLE ID:	T8-3	**MATRIX TYPE:**	Soil
CONTROL NO:	N9206-05-8		

PARAMETERS (8010)	RESULTS (ug/kg)	DETECTION LIMIT (ug/kg)
Dichlorodifluoromethane	ND	20
Chloromethane	ND	20
Vinyl Chloride	ND	20
Bromomethane	ND	20
Chloroethane	ND	20
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND	5
cis-1,2-Dichloroethene	ND	5
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
2-Chloroethylvinylether	ND	5
Trans-1,3-Dichloropropene	ND	5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
1,1,1,2-Tetrachloroethane	ND	5
Dibromochloromethane	ND	5
Ethylene Dibromide	ND	5
Chlorobenzene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Chlorotoluene	ND	5
M-Dichlorobenzene	ND	5
P-Dichlorobenzene	ND	5
Benzylchloride	ND	5
O-Dichlorobenzene	ND	5
% Surrogate Recovery:	79	

EPA METHOD 8010
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/10/92
PROJECT:	Ahmanson PCE	**DATE ANALYZED:**	06/10/92
SAMPLE ID:	T9-3	**MATRIX TYPE:**	Soil
CONTROL NO:	N9206-05-9		

PARAMETERS (8010)	RESULTS (ug/kg)	DETECTION LIMIT (ug/kg)
Dichlorodifluoromethane	ND	20
Chloromethane	ND	20
Vinyl Chloride	ND	20
Bromomethane	ND	20
Chloroethane	ND	20
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND	5
cis-1,2-Dichloroethene	ND	5
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
2-Chloroethylvinylether	ND	5
Trans-1,3-Dichloropropene	ND	5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
1,1,1,2-Tetrachloroethane	ND	5
Dibromochloromethane	ND	5
Ethylene Dibromide	ND	5
Chlorobenzene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Chlorotoluene	ND	5
M-Dichlorobenzene	ND	5
P-Dichlorobenzene	ND	5
Benzylchloride	ND	5
O-Dichlorobenzene	ND	5
% Surrogate Recovery:	92	

EPA METHOD 8010
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/10/92
PROJECT:	Ahmanson PCE	**DATE ANALYZED:**	06/10/92
SAMPLE ID:	T10-6	**MATRIX TYPE:**	Soil
CONTROL NO:	N9206-05-10		

PARAMETERS (8010)	RESULTS (ug/kg)	DETECTION LIMIT (ug/kg)
Dichlorodifluoromethane	ND	20
Chloromethane	ND	20
Vinyl Chloride	ND	20
Bromomethane	ND	20
Chloroethane	ND	20
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND	5
cis-1,2-Dichloroethene	ND	5
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
2-Chloroethylvinylether	ND	5
Trans-1,3-Dichloropropene	ND	5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
1,1,1,2-Tetrachloroethane	ND	5
Dibromochloromethane	ND	5
Ethylene Dibromide	ND	5
Chlorobenzene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Chlorotoluene	ND	5
M-Dichlorobenzene	ND	5
P-Dichlorobenzene	ND	5
Benzylchloride	ND	5
O-Dichlorobenzene	ND	5
% Surrogate Recovery:	99	

EPA METHOD 8010
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/10/92
PROJECT:	Ahmanson PCE	**DATE ANALYZED:**	06/10/92
SAMPLE ID:	T11-10	**MATRIX TYPE:**	Soil
CONTROL NO:	N9206-05-11		

PARAMETERS (8010)	RESULTS (ug/kg)	DETECTION LIMIT (ug/kg)
Dichlorodifluoromethane	ND	20
Chloromethane	ND	20
Vinyl Chloride	ND	20
Bromomethane	ND	20
Chloroethane	ND	20
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND	5
cis-1,2-Dichloroethene	ND	5
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
2-Chloroethylvinylether	ND	5
Trans-1,3-Dichloropropene	ND	5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
1,1,1,2-Tetrachloroethane	ND	5
Dibromochloromethane	ND	5
Ethylene Dibromide	ND	5
Chlorobenzene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Chlorotoluene	ND	5
M-Dichlorobenzene	ND	5
P-Dichlorobenzene	ND	5
Benzylchloride	ND	5
O-Dichlorobenzene	ND	5
% Surrogate Recovery:	77	

EPA METHOD 8010
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/10/92
PROJECT:	Ahmanson PCE	**DATE ANALYZED:**	06/10/92
SAMPLE ID:	T12-3	**MATRIX TYPE:**	Soil
CONTROL NO:	N9206-05-12		

PARAMETERS (8010)	RESULTS (ug/kg)	DETECTION LIMIT (ug/kg)
Dichlorodifluoromethane	ND	20
Chloromethane	ND	20
Vinyl Chloride	ND	20
Bromomethane	ND	20
Chloroethane	ND	20
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND	5
cis-1,2-Dichloroethene	ND	5
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
2-Chloroethylvinylether	ND	5
Trans-1,3-Dichloropropene	ND	5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
1,1,1,2-Tetrachloroethane	ND	5
Dibromochloromethane	ND	5
Ethylene Dibromide	ND	5
Chlorobenzene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Chlorotoluene	ND	5
M-Dichlorobenzene	ND	5
P-Dichlorobenzene	ND	5
Benzylchloride	ND	5
O-Dichlorobenzene	ND	5
% Surrogate Recovery:	86	

EPA METHOD 8010
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/10/92
PROJECT:	Ahmanson PCE	**DATE ANALYZED:**	06/10/92
SAMPLE ID:	T13-5	**MATRIX TYPE:**	Soil
CONTROL NO:	N9206-05-13		

PARAMETERS (8010)	RESULTS (ug/kg)	DETECTION LIMIT (ug/kg)
Dichlorodifluoromethane	ND	20
Chloromethane	ND	20
Vinyl Chloride	ND	20
Bromomethane	ND	20
Chloroethane	ND	20
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND	5
cis-1,2-Dichloroethene	ND	5
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
2-Chloroethylvinylether	ND	5
Trans-1,3-Dichloropropene	ND	5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
1,1,1,2-Tetrachloroethane	ND	5
Dibromochloromethane	ND	5
Ethylene Dibromide	ND	5
Chlorobenzene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Chlorotoluene	ND	5
M-Dichlorobenzene	ND	5
P-Dichlorobenzene	ND	5
Benzylchloride	ND	5
O-Dichlorobenzene	ND	5
% Surrogate Recovery:	72	

EPA METHOD 8010
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/10/92
PROJECT:	Ahmanson PCE	**DATE ANALYZED:**	06/10/92
SAMPLE ID:	T14-6	**MATRIX TYPE:**	Soil
CONTROL NO:	N9206-05-14		

PARAMETERS (8010)	RESULTS (ug/kg)	DETECTION LIMIT (ug/kg)
Dichlorodifluoromethane	ND	20
Chloromethane	ND	20
Vinyl Chloride	ND	20
Bromomethane	ND	20
Chloroethane	ND	20
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND	5
cis-1,2-Dichloroethene	ND	5
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
2-Chloroethylvinylether	ND	5
Trans-1,3-Dichloropropene	ND	5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
1,1,1,2-Tetrachloroethane	ND	5
Dibromochloromethane	ND	5
Ethylene Dibromide	ND	5
Chlorobenzene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Chlorotoluene	ND	5
M-Dichlorobenzene	ND	5
P-Dichlorobenzene	ND	5
Benzylchloride	ND	5
O-Dichlorobenzene	ND	5
% Surrogate Recovery:	81	

EPA METHOD 8010
HALOGENATED VOLATILE ORGANICS

CLIENT:	Dames & Moore	**DATE REC'D:**	06/10/92
PROJECT:	Ahmanson PCE	**DATE ANALYZED:**	06/10/92
SAMPLE ID:	T15-4	**MATRIX TYPE:**	Soil
CONTROL NO:	N9206-05-15		

PARAMETERS (8010)	RESULTS (ug/kg)	DETECTION LIMIT (ug/kg)
Dichlorodifluoromethane	ND	20
Chloromethane	ND	20
Vinyl Chloride	ND	20
Bromomethane	ND	20
Chloroethane	ND	20
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND	5
cis-1,2-Dichloroethene	ND	5
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
2-Chloroethylvinylether	ND	5
Trans-1,3-Dichloropropene	ND	5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
1,1,1,2-Tetrachloroethane	ND	5
Dibromochloromethane	ND	5
Ethylene Dibromide	ND	5
Chlorobenzene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Chlorotoluene	ND	5
M-Dichlorobenzene	ND	5
P-Dichlorobenzene	ND	5
Benzylchloride	ND	5
O-Dichlorobenzene	ND	5
% Surrogate Recovery:	89	

QUALITY CONTROL DATA

CLIENT: Dames & Moore
PROJECT: Ahmanson PCE
CONTROL NO: N9206-05

METHOD EPA 8010
MATRIX: Soil

SAMPLE ID: N9206-05-8

COMPOUND	SAMPLE RESULTS (ug/kg)	AMOUNT SPIKED (ug/kg)	% REC.	DUP. % REC.	RPD
1,1 DCE	ND	10	79	82	3
TCE	ND	10	81	89	8
PCE	ND	10	74	81	7
Benzene	ND	10	87	92	5

QUALITY CONTROL DATA

CLIENT: Dames & Moore
PROJECT: Ahmanson PCE
CONTROL NO: N9206-05

METHOD EPA 8010
MATRIX: Soil

SAMPLE ID: N9206-05-15

COMPOUND	SAMPLE RESULTS (ug/kg)	AMOUNT SPIKED (ug/kg)	% REC.	DUP. % REC.	RPD
1,1 DCE	ND	10	82	82	0
TCE	ND	10	82	84	2
PCE	ND	10	79	81	2
Benzene	ND	10	89	90	1

CHAIN OF CUSTODY RECORD
REQUEST FOR ANALYSIS

CLIENT NAME: James + Moore
ADDRESS: 2101 WEBSTER St.
OAKLAND 94612
PHONE NO. 839-3600 FAX NO. 839-4461
PROJECT NAME: AHMANSON PCE
SEND REPORT TO: LUKE ANDERSON

DATE: 06/10/92
PAGE 1 OF 1

N9206-05

CKY Incorporated
Environmental Services
3412 Valley Avenue, Suite F
Pleasanton, CA 94566
Tel: 415-846-3188
Fax: 415-846-3188

SAMPLER NAME/SIGNATURE

TURN AROUND TIME
ASAP/LE ☒
NORMAL ☐
RUSH ☐

	SAMPLE NUMBER	SAMPLING DATE/TIME	PRESERVATIVE	CONTAINER SIZE/TYPE	SAMPLE DESCRIPTION: WATER	SOIL	OTHER	ANALYSES REQUIRED: 418.1	M8015	8010/601 (PCE)	8020/602	8080/608	8240/624	8270/625	CAM Metals
1	T1 - 2'	06/10/92 0407	Ø	Glass Jar		✓				✓					
2	T2 - 1'														
3	T3 - 1'														
4	T4 - 1'														
5	T5 - 2'														
6	T6 - 1'														
7	T7 - 1'														
8	T8 - 3'														
9	T9 - 3'														
10	T10 - 6'														
11	T11 - 10'														
12	T12 - 3'														
13	T13 - 5'														
14	T14 - 6'														
15	T15 - 4'														

COMMENTS:

Relinquished by: (Signature)	Date:	Received by: (Signature)	Date:	Relinquished by: (Signature)	Date:	Received by: (Signature)	Date:
Pete Dacre	6/10/92		6/10/92				
Company: Damest Moore	Time: 5:00	Company: CKY	Time: 5:00	Company:	Time:	Company:	Time:

Storage/Disposal of Samples: Sample will be stored at CKY for 30 days at no charge and at $10/sample/month thereafter. Disposal of sample by the Laboratory will be charged at $10/sample.

APPENDIX C

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN
PCE DELINEATION AND REMEDIATION ALTERNATIVE SELECTION
LAGUNA OAKS SITE
PLEASANTON, CALIFORNIA

LAGUNA.H64

Job No.: 14943-060-043
Prepared by: Trish Bondurant
Date: June 3, 1992

HEALTH AND SAFETY PLAN
PCE DELINEATION AND REMEDIATION ALTERNATIVE SELECTION
LAGUNA OAKS SITE
PLEASANTON, CALIFORNIA

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GLOSSARY OF TERMS, ACRONYMS, AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
analyzer	refers to the field instrument described in Section 6.1
atm	atmosphere
°C	centigrade
Carcinogen	A substance that can cause cancer
cc	cubic centimeter
CGI	Combustible Gas Indicator
CNS	Central Nervous System
DHSM	Division Health and Safety Manager
Ev	Electron volts
EPA	U.S. Environmental Protection Agency
°F	fahrenheit
GM	General Manager
HSP	Health and Safety Plan
kg	kilogram
LEL	Lower Explosive Limit
Lpm	liter per minute
MSDS	Material Safety Data Sheet
m	meter
mg	milligram
mg/M^3	milligram per cubic meter
ml	milliliter
mm	millimeter

GLOSSARY OF TERMS, ACRONYMS, AND ABBREVIATIONS

ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
OBZ	Operator's Breathing Zone
OEL	Occupational Exposure Limit
OSC	Office Safety Coordinator
OSHA	Occupational Safety and Health Administration
OVA	Organic Vapor Analyzer (Foxboro-Century)
PEL	Permissible Exposure Limit
PID	Photoionization Detector
PM	Project Manager
ppb	parts per billion
ppm	parts per million
REL	Recommended Exposure Limit
SSO	Site Safety Officer
SSR	Subcontractor's Safety Representative
STEL	Short Term Exposure Limit
TLV	Threshold Limit Value
UEL	Upper Explosive Limit
VOC	Volatile Organic Compound

HEALTH AND SAFETY PLAN
PCE DELINEATION AND REMEDIAL ALTERNATIVE SELECTION
LAGUNA OAKS SITE
PLEASANTON, CALIFORNIA

1.0 SUMMARY

Dames & Moore was retained in December 1989 to characterize site conditions which were necessary to facilitate site closure at the Laguna Oaks site. The site had known soil and groundwater contamination in the vicinity of an underground storage tank (UST) formerly located at the site. Dames & Moore has conducted site characterization/remedial activities at the site including quarterly groundwater monitoring for hydrocarbons and chlorinated solvents, excavating and stockpiling hydrocarbon-impacted soils found during grading activities along the Foothill rerouting corridor, and conducting a soil gas survey to further delineate the extent of tetrachloroethylene (PCE) at the site.

The purpose of the study is to more fully characterize the presence and distribution of PCE and volatile organic compounds in the subsurface beneath the site. The data will be used to select a remedial alternative. The scope of services for characterization and remediation selection will include drilling five borings in the vicinity of MW-3 to assess the potential source of contamination.

Results of the geophysical survey conducted on June 3, 1992 indicated the presence of a pipeline/leach line or other underground linear structure in the vicinity of the three monitoring wells. Further investigation of this structure will be initiated before drilling activities commence. To investigate this object, a trench will be excavated to evaluate if it is the potential source of PCE contamination. The pipe is expected to be approximately 5-foot deep and 50 to 70 feet long.

During excavation, soil samples will be collected and analyzed. Contaminated soil will be stockpiled along the side of the excavation and covered with a plastic liner.

Skin contact with potentially contaminated soil or water will be minimized by wearing personal protective clothing (as described in Section 7.0). Inhalation of vapors during drilling and trenching activities, groundwater monitoring well installation activities, and soil and water sampling will be minimized by air monitoring, engineering controls, and the use of respiratory protection if action levels (see 6.1) are exceeded. Ingestion of contaminated

materials will be minimized by good personal hygiene during decontamination (i.e., thoroughly washing face and hands with soap and water before eating or drinking).

A Organic Vapor Analyzer (OVA) or equivalent will be used to monitor for organic vapors. The analyzer will be used on a regular basis, typically every five to ten minutes, to monitor in the immediate vicinity of the work area. If readings exceed an average of 10 ppm for more than one minute, monitoring in the operator's breathing zone (OBZ) of the person working nearest the boringor trench will start immediately, and personnel will don protective clothing as described in Section 7.0. Additional exposure monitoring and personal protective equipment criteria are found in Sections 6.0 and 7.0, respectively.

2.0 APPLICABILITY

The purpose of this plan, which was developed specifically for operations at the Laguna Oaks Site located in Pleasanton, California is to assign responsibilities, establish personal protection standards and mandatory safety procedures, and provide for contingencies that may arise while operations are being conducted at the site. This plan complies with, but does not replace, Federal Health and Safety Regulations as set forth in 29 CFR 1910 and 1926, California Health and Safety Regulations as set forth in Title 8, California Code of Regulations, and guidance established by the California Department of Health Services. This plan is to be used by Dames & Moore personnel as a supplement to such rules, regulations, and guidance.

The provisions of the plan are mandatory for all onsite Dames & Moore employees engaged in hazardous material management activities associated with this project which may involve health and safety hazards.

Changing and/or unanticipated site conditions may require modification of this site safety plan in order to maintain a safe and healthful work environment. Any proposed changes to this plan should be reviewed with the Dames & Moore Division Health and Safety Manager, or his designee, prior to their implementation. If this is not feasible, the site/project manager may modify the plan and record all changes in the field log book; under no circumstances will modifications to this plan conflict with Federal, state, or local health and safety regulations.

Dames & Moore is providing a copy of this Health and Safety Plan to each site subcontractor in order to fulfill its obligation under 29 CFR 1910.120(b)(15) to inform subcontractors of site hazards. Each Dames & Moore subcontractor is to provide a Health & Safety Plan that addresses the activities of its employees relative to this project.

3.0 FACILITY BACKGROUND/WORK PLAN

3.1 SITE HISTORY

Dames & Moore was retained in December 1989 to characterize site conditions which were necessary to facilitate site closure at the Laguna Oaks site in Pleasanton, California. The site had known soil and groundwater contamination in the vicinity of an underground storage tank (UST) formerly located at the site. During grading activities at the site, hydrocarbon-impacted soils were found along the Foothill rerouting. Dames & Moore has conducted site characterization/remedial activities at the site including quarterly groundwater monitoring for hydrocarbons and chlorinated solvents, excavating and stockpiling hydrocarbon-impacted soils found during grading activities along the Foothill rerouting corridor, and conducting a soil gas survey to further delineate the extent of tetrachloroethylene (PCE) at the site.

3.2 PURPOSE AND SCOPE OF WORK

The purpose of the study is to more fully characterize the presence and distribution of PCE and volatile organic compounds in the subsurface beneath the site. The data will be used to select a remedial alternative. The scope of services for characterization and remediation selection will include the following:

- Identify uncertainties in the available site characterization data to guide the development of a field investigation. This will include review of pertinent sections of the previous report including water quality monitoring, a soil gas survey, and other pertinent information;

- Perform a drilling program to install additional soil borings and groundwater monitoring wells to further characterize subsurface conditions beneath the site;

- Use data obtained from field studies to characterize the nature and extent of subsurface contamination beneath the site in order to use as input into the remedial action plan; and

- Select a remedial alternative for site cleanup.

The drilling program will be performed to further characterize the lateral and vertical extent of subsurface contamination at the site. The program will include soil borings for the purpose of delineating the source of PCE in the soil, and installing groundwater monitoring wells to delineate the lateral and vertical extent of the PCE in the groundwater. The drilling program is based on the assumption that the PCE contamination is limited to one water-bearing zone about 30 to 70 feet deep.

Based on the results of previous soil gas and water quality monitoring the PCE source appears to be centered in the vicinity of MW-3. Soil gas concentrations and concentrations in the groundwater are highest in that area. Dames & Moore will drill five soil borings to a depth of 50 feet. An additional three soil borings will be drilled in the event that the source is not found in the subsurface beneath MW-3. Soil samples will be screened in the field with an organic vapor analyzer (OVA) in order to select samples for laboratory testing for PCE concentrations.

Results of the geophysical survey conducted on June 3, 1992 indicated the presence of a pipeline/leach line or other underground linear structure in the vicinity of the three monitoring wells. Further investigation of this structure will be initiated before drilling activities commence. To investigate this object, a trench will be excavated to evaluate if it is the potential source of PCE contamination. The pipe is expected to be approximately 5-foot deep and 50 to 70 feet long.

During excavation, soil samples will be collected and analyzed. Contaminated soil will be stockpiled along the side of the excavation and covered with a plastic liner.

4.0 RESPONSIBILITIES

Dames & Moore will have site safety and health oversight and coordination responsibilities for Dames & Moore personnel; each subcontractor will be held accountable for the safe and healthful performance of work by each of their employees, subcontractor, or support personnel who may enter the site.

The provisions of this health and safety plan along with the applicable regulations issued by governmental entities will be strictly adhered to by Dames & Moore.

4.1 PROJECT MANAGER (Dames & Moore)

The Project Manager (PM) shall direct onsite operations. The PM may delegate all or part of these duties to a properly-qualified Dames & Moore employee who is designated as the Site Manager. At the site the PM, assisted by the Site Safety Officer (SSO), has primary responsibility for:

1. Seeing that appropriate personal protective equipment and monitoring equipment is available and properly utilized by all onsite Dames & Moore (D&M) personnel;

2. Establishing that D&M personnel are aware of the provisions of this plan, are instructed in the work practices necessary to ensure safety, and are familiar with planned procedures for dealing with emergencies;

3. Establishing that all D&M onsite personnel have completed a minimum of 40 hours of health and safety training and have appropriate medical clearance as required by 29 CFR 1910.120, and have been fit tested for the appropriate respirators;

4. Seeing that D&M personnel are aware of the potential hazards associated with site operations;

5. Monitoring the safety performance of all D&M personnel to see that the required work practices are employed;

6. Correcting any D&M work practices or conditions that may result in injury or exposure to hazardous substances;

7. Preparing any accident/incident reports for D&M activities (see Section 13.0);

8. Seeing to the completion of Plan Acceptance forms by Dames & Moore personnel (See Attachments);

9. Halting D&M site operations, if necessary, in the event of an emergency or to correct unsafe work practices; and

10. Reviewing and approving this project health and safety plan.

4.2 SITE SAFETY OFFICER (Dames & Moore)

The Site Safety Officer's (SSO) duties may be carried out by the PM or other Dames & Moore site manager. The SSO, unless specifically directed by this HSP, does not offer or otherwise provide health and safety guidance to any subcontractor unless there is an imminent endangerment to personnel, in which case guidance is to be directed to the SSR only. The SSO:

1. Implements project Health and Safety Plans, and reports any deviations from the anticipated conditions described in the plan to the PM, and, if necessary, the DHSM.

2. Determines that monitoring equipment is used properly by D&M personnel and is calibrated in accordance with manufacturer's instructions or other standards, and that results are properly recorded and filed. (See Attachments for Daily Calibration Check Sheet).

3. Checks with the OSC or DHSM to see that assigned D&M personnel have current Fit-For-Duty medical and training authorizations.

4. Assumes any other duties as directed by the PM or DHSM.

5. Identifies all D&M personnel with special medical problems (e.g., allergies, perforated eardrum, etc.).

6. Conducts daily safety meetings and completes the Site Safety Briefing Report (see Attachments).

7. Provides ongoing review of the protection level needs as project work is performed, and informs the PM of the need to upgrade/downgrade protection levels as appropriate.

8. Sees that decontamination procedures listed in Section 10.0 are followed by D&M personnel.

9. Establishes monitoring of D&M personnel and records results of exposure evaluations.

10. Halting D&M site operations, if necessary, in the event of an emergency or to correct unsafe work practices.

11. Reviews and approves this project health and safety plan.

4.3 WESTERN DIVISION HEALTH AND SAFETY MANAGER (Dames & Moore)

The Western Division Health and Safety Manager (DHSM) shall:

1. Determine the need for periodic audits of the operation to evaluate compliance with this plan.

2. Provide health and safety support as requested by the SSO and PM.

4.4 PROJECT PERSONNEL (Dames & Moore)

Project personnel involved in onsite investigations and operations are responsible for:

1. Taking all reasonable precautions to prevent injury to themselves and to their fellow employees.

2. Performing only those tasks that they believe they can do safely, and immediately reporting any accidents and/or unsafe conditions to the SSO or PM.

3. Implementing the procedures set forth in the Health and Safety Plan, and reporting any deviations from the procedures described in the Plan to the SSO or PM for action.

4. Notifying the PM and SSO of any special medical problems (i.e., allergies) and seeing that all onsite D&M personnel are aware of any such problems.

5. Reviews project health and safety plan and signs acceptance form.

4.5 SUBCONTRACTOR'S SAFETY REPRESENTATIVE

Each subcontractor is requested to designate a Subcontractor's Safety Representative (SSR), who is the subcontractor supervisor. The SSR is responsible for the safe and healthful performance of work by his work force and subcontractors. During the subcontractor's activities onsite, the SSR will perform continuing work area inspections, and conduct safety meetings and safety orientations for all new employees. The SSR will attend periodic safety meeting with the SSO. The SSR will also investigate accidents and overexposures involving subcontractor personnel.

5.0 JOB HAZARD ANALYSIS

Previous investigations indicate that tetrachloroethylene (PCE) is the constituent of concern during drilling and excavation activities. Other contaminants have been found onsite and could potentially be found during this investigation. Those contaminants include; diesel, total petroleum hydrocarbons, benzene, toluene, ethyl benzene, and xylene.

Physical hazards at this work site include those associated with:

- o heat stress;
- o slip-trip-fall type of accidents;
- o back injuries due to improper lifting;
- o being caught in or struck by moving equipment;
- o electrocution or explosion hazards associated with drilling and excavation activities, such as contact with overhead or underground power lines or pipelines.

5.1 HEAT STRESS RECOGNITION AND CONTROL

The wearing of Personal Protective Equipment (PPE) can place a hazardous waste worker at considerable risk of developing heat stress. This can result in health effects ranging from transient heat fatigue to serious illness or death. Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, work load, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses at hazardous waste sites, regular monitoring and other preventive precautions are vital.

Heat stress monitoring should commence when personnel are wearing PPE, including Tyvek-type coveralls, and the ambient temperature exceeds 70°F. If standard work garments (cotton coveralls) are worn, monitoring should commence at 85°F. Heat stress monitoring and control guidance can be found in the Attachments.

5.2 CHEMICAL HAZARDS

From an occupational health standpoint, given that any potential exposure to site personnel will be only for a short period of time (intermittent for several days), the levels of contaminants detected by previous site investigations should not represent a significant concern. However, the site is

still under investigation, so the potential for exposure to elevated levels of these contaminants may exist. Overviews of the hazards associated with exposure to the chemicals found onsite to date are presented below in terms of the following types of occupational exposure limits:

PEL - Permissible Exposure Limit
C - Ceiling
TLV - Threshold Limit Value
TLV-STEL - Short Term Exposure Limit

OSHA Permissible Exposure Limits (PELs) and ACGIH Threshold Limit Values (TLVs), time weighted averages (TWAs) are defined as concentrations for an 8-hour work day, 40-hour work week to which almost all workers can be repeatedly exposed without suffering adverse health effects.

Short Term Exposure Limit (STEL) is defined as the concentration to which workers can be exposed for short time periods without irritation, tissue damage, or narcosis sufficient to likely cause impairment of self-rescue or precipitate accidental injury. The STEL is a 15-minute time-weighted average that should not be exceeded at any time during the work day.

A ceiling value (c) is a concentration that should not be exceeded at any time in any work day.

Perchloroethylene (Tetrachloroethylene; PCE; Perc)

PEL = 25 ppm TLV = 50 ppm TLV/STEL = 200 ppm

PCE is a central nervous system depressant, with symptoms such as headache, nausea, dizziness and fatigue appearing at concentrations above 200 ppm. Eye and mucous membrane irritation can occur with exposures above 100 ppm. There is potential for liver injury with chronic exposure to higher concentrations. PCE is considered to be a probable human carcinogen, and is known to the State of California to cause cancer under the criteria of Proposition 65. Its mean odor threshold of 47 ppm gives it marginal warning properties. PCE's ionization potential is 9.32 eV.

Diesel Fuel (Fuel Oil)

Diesel fuel is mildly toxic by ingestion. When inhaled, many of the constituents function as central nervous system depressants, with characteristic symptoms (headaches, nausea, dizziness, incoordination, and vomiting). Diesel fuel has been shown to be a strong skin irritant.

Few chronic inhalation or ingestion studies of the toxic effects of diesel vapors/fuels are available. Skin painting studies of experimental animals suggest the potential for weak tumor-producing activity.

Because diesel fuel is a complex mixture of varying proportions of hydrocarbons, a mean odor threshold has not been determined.

Benzene

PEL = 1 ppm PEL/STEL = 5 ppm TLV = 10 ppm (0.1 ppm pending)

Benzene is a central nervous system depressant. Symptoms include headache, nausea, tremors, and fatigue, but these typically do not occur until exposure concentrations are in excess of 150 ppm. There is significant evidence that chronic exposures are carcinogenic causing a progressively malignant disease of the blood-forming organs (leukemia). Benzene is known to the State of California to cause cancer under the criteria of Proposition 65. Benzene is poorly absorbed through intact skin, but contact with liquid benzene may cause blistering and dermatitis. Benzene vapors can cause transient eye irritation. The mean air odor threshold for benzene is 34 ppm, which yields unsatisfactory warning properties. Benzene's ionization potential (IP) is 9.25 eV.

Toluene

PEL/TLV = 100 ppm STEL = 150 ppm

Toluene is a central nervous system depressant. Symptoms include headache, nausea, dizziness and fatigue, but such symptoms typically do not occur at exposures below 200 ppm. Repeated and prolonged contact with liquid toluene may cause drying of the skin and dermatitis. Mild, transitory eye irritation may be experienced with exposure to vapors above 200 ppm. Toluene is not considered carcinogenic. ACGIH has proposed to

lower the TLV to 50 ppm. Toluene's mean odor threshold is 3 ppm, which gives it good warning properties. Toluene's ionization potential (IP) is 8.82 eV, and its vapor pressure is 22 mm Hg.

Ethyl Benzene

PEL/TLV = 100 ppm

Ethyl benzene is an eye and mucous membrane irritant at levels well above the TLV. Liquid ethyl benzene is a significant skin irritant, and can cause defatting and blistering with repeated exposures. Vapor can cause transitory eye irritation at concentrations above 200 ppm. Ethyl benzene is not considered carcinogenic. The mean odor threshold is 0.5 ppm, which gives it good warning properties. Ethyl benzene's ionization potential is 8.76 Ev, and its vapor pressure is 10 torr.

Xylene (o-, m-, p-isomers)

PEL/TLV = 100 ppm STEL = 150 ppm

Xylene is an eye, nose and throat irritant at concentrations nearing 200 ppm. At higher concentrations, it is a central nervous system depressant, with symptoms including nausea, fatigue, and headaches. Liquid xylene acts on the skin as an irritant and can cause dermatitis. Exposure to vapor can cause eye irritation. Xylene is not considered carcinogenic. Xylene's mean odor threshold is 1 ppm, which gives it good warning properties. The ionization potential for the Xylene isomers are 8.56, 8.56, and 8.44 Ev, respectively, and the vapor pressures range from 7 to 9 mm Hg.

The following potential exposures may exist at the site:

- Skin contact with contaminated materials (soil, water);
- Inhalation of vapors or particulates; and
- Ingestion of contaminated materials, especially if poor personal hygiene is practiced.

Skin contact with potentially contaminated soil or water will be minimized by the use of personal protective clothing (as described in Section 7.0). Inhalation of vapors or particulates during the drilling process, or during soil or water sampling will be minimized by air monitoring and the use of engineering controls and respiratory protection if action levels (see 6.1) are exceeded. Ingestion of contaminated materials will be minimized by the use of appropriate personal hygiene procedures during decontamination (i.e., thoroughly washing face and hands with soap and water after leaving the work area and prior to eating or drinking).

5.3 NOISE HAZARDS

The primary noise hazard at this site is from the drilling and excavation equipment. Previous surveys indicate that such equipment may produce continuous and impact noise at or above the action level of 85 dBA. All D&M personnel within 25 feet of operating equipment shall wear hearing protective devices (either muffs or plugs). Personnel will wash their hands with soap and water prior to inserting ear plugs to avoid initiating ear infections.

5.4 HAZARD COMMUNICATION

Materials which are considered hazardous materials under the OSHA Hazard Communication Standard may be used during this project for decontamination or equipment calibration purposes. In accordance with the Dames & Moore Hazard Communication Program, the MSDSs for the hazardous materials listed below are included in the attachments. The SSO will make copies of these MSDSs available to any subcontractors (i.e. excavators) on this project.

- TSP or Alconox (decontamination)
- Methane (calibration)

5.5 HEAVY EQUIPMENT

Operation of heavy equipment in drilling, excavating or other activities presents potential physical hazards to personnel. The following precautions should be observed whenever heavy equipment is in use:

- Personal protective equipment (PPE) such as steel-toed shoes, safety glasses or goggles, and hard hats should be worn whenever such equipment is present.

- Personnel should at all times be aware of the location and operation of heavy equipment, and take precautions to avoid getting in the way of its operation. Never assume that the equipment operator sees you; make eye contact and use hand signals to inform the operator of your intent.

- Traffic safety vests are required for D&M personnel working near mobile heavy equipment, such as backhoes and other excavators.

- Never walk directly in back of, or to the side of, heavy equipment without the operator's knowledge.

- When an equipment operator must operate in tight quarters, the equipment subcontractor should provide a person to assist in guiding the operator's movements.

- Keep all non-essential personnel out of the work area.

- All heavy equipment that is used in the exclusion zone should remain in that zone until its task is completed. The equipment subcontractor should completely decontaminate such equipment in the designated equipment decontamination area as required.

5.6 EXCAVATION SAFETY

Site personnel are prohibited from entering any trench or excavation that is deeper than five feet on the site that is not shored, sloped or benched in accordance with Cal-OSHA regulations at 8 CCR 1541. A copy of this regulation is provided in Attachment L. For personnel to enter an excavation that is deeper than five feet, the following must be accomplished:

- Excavation protection (benching, sloping or shoring) must be provided in accordance with 8 CCR 1541.

- The Dames & Moore Cal-OSHA Trenching and Excavation Permit must be activated from the Sacramento Cal-OSHA District Office.

- All other applicable aspects of the Cal-OSHA Trenching and Excavation regulations at 8 CCR 1541 and 1542 must be followed.

6.0 EXPOSURE MONITORING PLAN

Heat stress, noise, and chemical exposures may be encountered at this site. Heat stress monitoring and prevention is addressed in Section 5.1. Noise levels will not be monitored; D&M personnel will wear hearing protection as described in Section 5.3.

6.1 CHEMICAL EXPOSURE MONITORING

The field instrumentation described in this subsection has been specifically selected for the contaminants that may be reasonably anticipated to be encountered during the course of this project. Selection factors include anticipated airborne concentrations, potential interferences, ionization potentials, instrument sensitivity, and occupational exposure limits. The action levels described below are established with the expectation that these specific instruments will be used. DO NOT SUBSTITUTE INSTRUMENTS WITHOUT THE CONSENT OF THE HSP PREPARER OR THE DHSM.

A Organic Vapor Analyzer (OVA) will be used to monitor for hydrocarbon vapors. The analyzer will be used on a regular basis, typically every five to ten minutes, to monitor in the immediate vicinity of the borehole, groundwater monitoring well, trench, and cuttings adjacent to the borehole. If readings exceed an average of 10 ppm for more than one minute, monitoring in the operator's breathing zone (OBZ) of the person working nearest the boring,trench or groundwater monitoring well will start immediately, and personnel will don protective clothing as described in Section 7.0.

An OBZ reading above 10 ppm for more than one minute will require the use of half-face respirators with organic vapor cartridges. An OBZ reading above 50 ppm for more than one minute will require the use of full-face respirators with organic vapor cartridges. If the OVA reads more than 200 ppm instantaneously (>5 seconds) or 100 ppm for more than one minute, work will stop, and workers will move upwind while the vapors dissipate; if elevated levels remain for more than five minutes, the boring or trench will be covered with clean soil, plastic sheeting, or foam, and the DHSM, HSP Preparer or PM will be contacted for further guidance.

A summary of the response criteria is presented below.

(OBZ - Operator's Breathing Zone)

Analyzer Reading*	Location	Time Period	Action
< 10 ppm	Borehole/ monitoring well/ trench/ work area	----------	Continue periodic monitoring.
> 10 ppm	Borehole/ monitoring well/ trench/ work area	>1 minute	Monitor OBZ; don protective clothing as described in 7.0; establish work zones described in 8.1.
< 10 ppm	OBZ	----------	No respirators required.
> 10 ppm	OBZ	>1 minute	Half-face respirators with organic vapor cartridges; establish decon area as described in 9.0.
> 50 ppm	OBZ	>1 minute	Full-face respirators with organic vapor cartridges.
> 100 ppm OR > 200 ppm	OBZ OBZ	>1 minute instantaneous	Stop work; move upwind while vapors dissipate. If elevated levels remain, cover boring or trench and evacuate upwind and notify DHSM or PM.

* above background readings

6.2 BACKGROUND READINGS

All direct-reading instrument readings will be evaluated relative to background readings, not "meter zero". Prior to the start of work at each shift, and whenever there is a significant shift in wind direction, instrument readings will be obtained upwind of the site work zone in order to determine the level of "background" readings from local vehicle traffic, emissions from nearby operations unrelated to the site, etc. Site readings will be evaluated against these background readings (i.e., if an action level is listed as 20 ppm, it is evaluated as 20 ppm above background).

6.3 DATA LOGGING

All exposure monitoring data, including background readings, will be logged in the field log book. The results of daily instrument calibrations can either be logged on the form provided in the Attachments or in the field log book. All monitoring instruments will be calibrated, in accordance with the manufacturer's instructions or the guidance found in the Attachments, prior to the start of each shift. Calibration should also be performed when inconsistent or erratic readings are obtained. If an instrument cannot be calibrated to specification, or becomes otherwise inoperable, all invasive site work (i.e., excavating) will cease until the instrument is appropriately repaired or replaced; the PM, DHSM or HSP Preparer should be contacted for further guidance.

6.4 DUST CONTROL

If drilling operations generate sustained visible dust, a water mist will be applied to reduce dust generation. If the mist is not effective in reducing dust generation, personnel will don respirators (half-face or full-face as appropriate for analyzer readings) with combination organic vapor-HEPA cartridges (such as MSA's GMC-H cartridges).

The sand and portland cement which may be used in groundwater monitoring well construction may contain free silica (quartz). Airborne exposure to silica dust may occur during handling of these materials. Half-face respirators with HEPA cartridges should be worn for those sand handling operations where there is a reasonable possibility for exposure to sustained airborne dust from the pouring and mixing of dry sand and portland cement.

7.0 PERSONAL PROTECTIVE EQUIPMENT

Minimum Protective Equipment for Site Personnel:

- Hardhat
- Safety glasses
- Steel-toed boots

Work/Exclusion Zone Requirements:

- Hardhat
- Eye protection (face shield or safety glasses)
- Chemical-resistant steel-toed boots
- Ear protection in vicinity of heavy equipment
- Cotton coveralls (optional)

If analyzer reading greater than 10 ppm above background in work area for more than one minute, add:

- Tyvek coveralls
- Nitrile gloves
- Surgical latex or vinyl gloves (inner)

If analyzer reading greater than 10 ppm above background in OBZ for more than one minute, add:

- Half-face respirator with organic vapor cartridges

If analyzer reading greater than 50 ppm above background in OBZ for more than one minute, add:

- Full-face respirator with organic vapor cartridges

If potential for liquid contact (i.e., well development and sampling):

- Use poly-coated Tyvek coveralls in place of uncoated Tyvek

7.1 LIMITATIONS OF PROTECTIVE CLOTHING

The protective equipment ensembles selected for this project are anticipated to provide protection against the types and concentrations of hazardous materials that may potentially be encountered during field operations. However, no protective garment, glove or boot is resistant to all chemicals at any concentration; in fact, chemicals may continue to permeate or degrade a garment even after the source of contamination is removed.

In order to obtain optimum usage from PPE, the following procedures are to be followed by all Dames & Moore personnel:

- When using disposable coveralls, don a clean, new garment after each rest break or at the beginning of each shift;
- Inspect all clothing, gloves and boots both prior to and during use for:
  - Imperfect seams
  - Non-uniform coatings
  - Tears
  - Poorly functioning closures
- Inspect reusable garments, boots and gloves both prior to and during use for:
  - Visible signs of chemical permeation such as swelling, discoloration, stiffness or brittleness
  - Cracks or any signs of puncture or abrasion

Any reusable garments exhibiting any such characteristics will be discarded.

7.2 DURATION OF WORK TASKS

The duration of work tasks in which personnel use PPE ensembles that include chemical protective clothing (including uncoated Tyvek) will be established by the SSO. Variables to be considered include ambient temperature and other weather conditions, the capacity of individual personnel to work in the

required level of PPE in heat and cold, and the limitations of specific PPE ensembles. The minimum rest breaks are as follows:

- Fifteen minutes midway between shift startup and lunch
- Lunch break (30 to 60 minutes)
- Fifteen minutes midway between lunch and shift end

Rest breaks are to be taken in the support zone or other clean area after personnel have completed the decontamination process, including soap and water wash of hands and face. Additional rest breaks will be scheduled according to heat stress monitoring protocols as described in the Attachments.

8.0 SITE CONTROL

8.1 GENERAL

Barricades and barricade tape should be used to delineate a work zone for safety purposes around the work area. The barriers should be set in a 25 foot radius (as practical) around the work area to provide sufficient maneuvering space for personnel and equipment. A short piece of barricade tape can be affixed to a secure upright to serve as a wind-direction tell-tale. A five foot opening in the barricades at the support zone (upwind of the work area) will serve as the personnel and equipment entry and exit point. The personnel decontamination station will be established at this point if formal decontamination procedures are required (see 9.0). All entry to and exit from the work area will be made at this opening in order to control potential sources of contamination and leave contaminated soil and debris in the work area.

The PM or SSO will determine an upwind evacuation area prior to each shift, and all personnel will be notified of its location. A horn or other signalling device will be used to signal an evacuation in the event of an emergency. Three blasts of the horn will be the signal to immediately stop work and proceed to the evacuation area.

The SSO will see that all site visitors sign the visitors' log and that all Dames & Moore personnel who enter the work zone do so only after presenting evidence of both their participation in a medical surveillance program and completion of health and safety training programs that fulfill the requirements of this plan.

The SSO will provide site hazard and emergency action information to all site visitors before they enter the site; this can be done by providing a copy of this SSP to the visitor.

8.2 WORK ZONES

If OVA readings exceed the first criteria in Section 6.1, requiring the use of chemical protective equipment, work zones must be established as described below. This criteria is 10 ppm above background for more than one minute in the work area.

o Exclusion Zone - a 25 foot (as practical) circle around the work area will be defined before work starts. The encircled area will constitute the "Exclusion Zone". This zone is where potentially hazardous contaminants and physical hazards to the workers will be contained. Full personal protection will be required in this area. Plastic sheeting (visqueen) and/or tarps may be used as necessary to control cuttings spilled to the ground during drilling operations. The size of the Exclusion Zone may be altered to accommodate site conditions and to ensure contaminant containment.

o Contamination Reduction Zone (CRZ) - a corridor leading from the Exclusion Zone will be defined, and will lead from the work area to a break area. All decontamination activities will occur in the CRZ. A waste container will be placed at the end of the corridor so contaminated disposal equipment can be placed inside and covered. Surface/soil contamination in this area should be controlled using plastic sheeting. No Dames & Moore personnel will be permitted into the Contamination Reduction Zone or Exclusion Zone unless they are in full compliance with the requirements of this Plan.

o Support Zone - a Support Zone, the outermost part of the site, must be defined for each field activity. Support equipment is located in this uncontaminated or clean area. Normal work clothes are appropriate within this zone. The location of this zone depends on factors such as accessibility, wind direction (upwind of work area), and resources (i.e., roads, shelter, utilities).

9.0 DECONTAMINATION PROCEDURES

If the OVA readings indicate respirator use (10 ppm over background in the OBZ for more than one minute), the following steps will be followed whenever personnel leave the exclusion zone/work area:

1. Remove all equipment, sample containers, and notes to the CRZ. Obtain decontamination solutions and decon the shovels, auger flights, etc. by brushing them under a water rinse. A high-pressure steam cleaner may also be used for decon. All waste and spent decon solutions will be properly contained.

2. Scrub boots and gloves with a stiff bristle brush and water. Washtubs and chairs will be provided.

3. Remove outer gloves (and boot covers, if used).

4. Remove Tyvek coverall; discard in provided container.

5. Remove hardhat and eye protection.

6. Remove respirator.

7. Remove inner gloves.

8. Wash hands and face.

The decontamination area will be covered with plastic sheeting which will be replaced when torn or heavily soiled, and at the end of each shift. A schematic of a "Minimum Layout of Personnel Decontamination Station" is provided in the Attachments for reference.

Each worker will be responsible for cleaning, sanitizing and storing their own respirator in accordance with manufacturer's guidance (i.e., washing in warm water and detergent or sanitizing solution, air drying, and storing in a plastic storage bag; see Attachments). Cartridges will be changed as soon as breakthrough occurs (detection of organic vapor odor while wearing the respirator) and at the end of each shift. Respirators will be kept in storage bags or boxes when not in use.

All spent decontamination fluids (rinse waters, etc.) shall be handled as directed by the PM and in accordance with relevant regulations.

9.1 SANITATION

Potable water will be made available at the site, either from a pressurized source or commercially-available bottled water. Drinking cups will be supplied so personnel will neither drink directly from the source of water nor have to share drinking cups. Sources of non-potable water shall be clearly labeled as such.

Unless toilet facilities are available on site or transportation is readily available to transport personnel to nearby (within five minutes) toilet facilities, portable toilet facilities, such as chemical toilets, will be provided on site.

Washing facilities will be provided on site, and will be located in the decontamination area or the support area. Soap, clean water, wash basins and single-use towels will be available for personnel use.

9.2 DECONTAMINATION-MEDICAL EMERGENCIES

In the event of physical injury or other serious medical concerns, immediate first-aid is to be administered in lieu of further decontamination efforts.

See Emergency Decontamination chart for a decision tree for emergency decontamination.

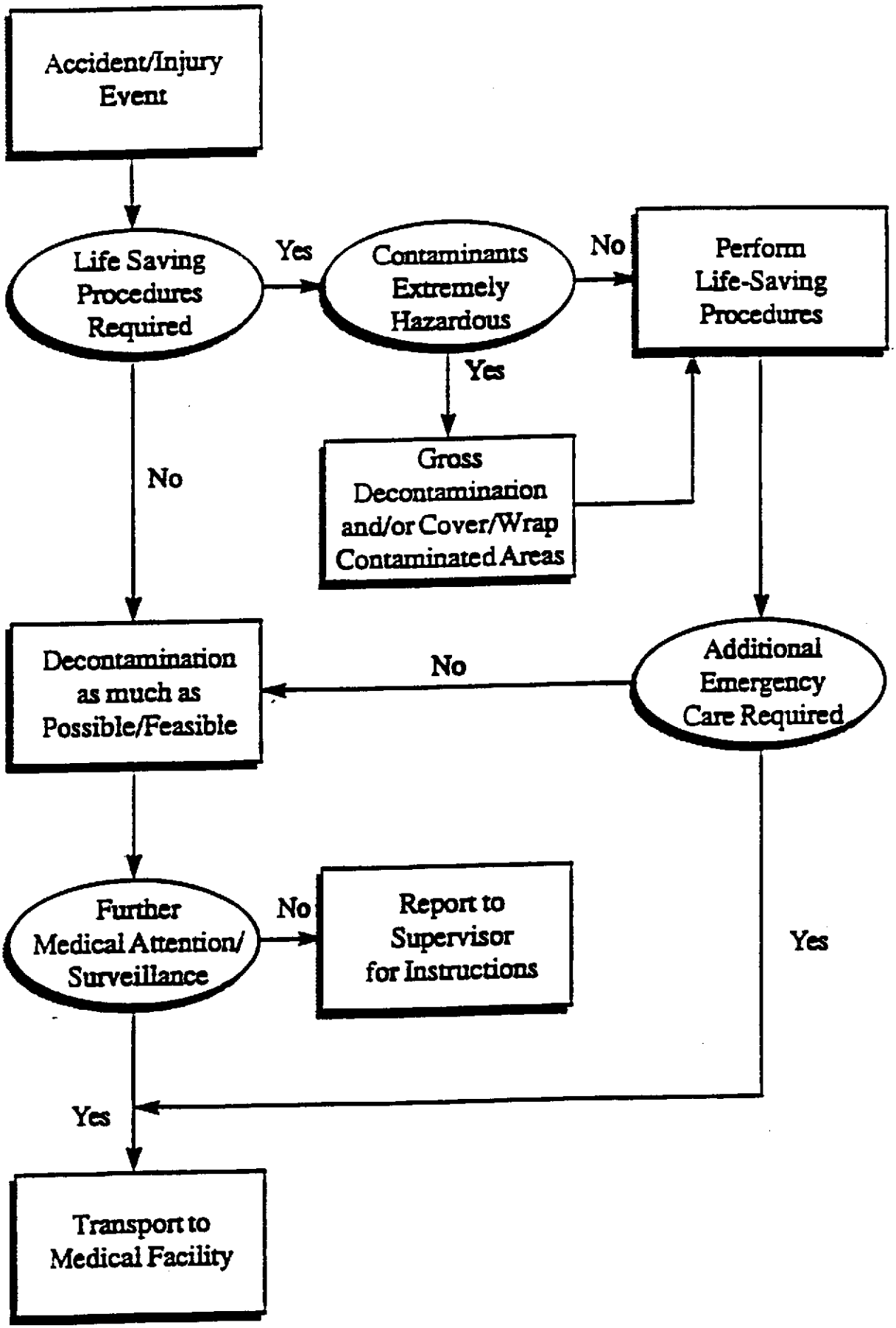
9.3 DECONTAMINATION OF TOOLS

When all work activities have been completed, contaminated tools used by D&M personnel will be either completely decontaminated or properly disposed as hazardous waste.

It is expected that all tools will be constructed of non-porous, non-absorbent materials. This will aid the decontamination process. Any tool, or part of a tool, which is made of a porous/absorbent material will be discarded and disposed of as a hazardous waste if it cannot be properly decontaminated.

Tools will be placed on a decontamination pad or into a bucket and thoroughly washed using a soap solution and brushing, followed by a fresh water rinse. All visible particles are to be removed before the tool is considered clean.

At the direction of the DHSM, the SSO may periodically take swipe samples from decontaminated tools for analysis to evaluate the effectiveness of this program.



Emergency Decontamination

10.0 SAFE WORK PRACTICES

10.1 GENERAL

1. Eating, drinking, chewing gum or tobacco, and smoking are prohibited in the contaminated or potentially contaminated area or where the possibility for the transfer of contamination exists.

2. All personnel will enter designated work areas only through the contamination reduction zone (CRZ). All personnel leaving an exclusion/work zone must exit through the CRZ and pass through the decontamination station as described in 9.0.

3. Personnel will wash their hands and face thoroughly with soap and water prior to eating, drinking or smoking.

4. Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling on the ground, leaning or sitting on equipment or ground. Do not place monitoring equipment on potentially contaminated surfaces (i.e., ground, etc.).

5. All field crew members should make use of their senses to alert them to potentially dangerous situations in which they should not become involved (i.e., presence of strong, irritating or nauseating odors).

6. Only those vehicles and equipment required to complete work tasks should be permitted within the exclusion/work zone (excavators and similar items). All non-essential vehicles should remain within the support zone.

7. Containers, such as drums, will be moved only with the proper equipment and will be secured to prevent dropping or loss of control during transport.

8. Field survey instruments, such as OVAs and HNus, will be covered with plastic or similar covering to minimize the potential for contamination.

9. No matches or lighters will be permitted in the work area/exclusion zone or contamination reduction zone.

10. Contaminated protective equipment, such as respirators, hoses, boots and disposable protective clothing, will not be removed from the work area/exclusion zone or decontamination area until it has been cleaned, or properly packaged and labeled.

11. Prevent, to the extent possible, spillages. In the event that a spillage occurs, contain liquid if possible.

12. Prevent splashing of the contaminated materials.

13. Field crew members shall be familiar with the physical characteristics of investigations, including:

    - o Wind direction in relation to contaminated area;
    - o Accessibility to equipment and vehicles;
    - o Communications;
    - o Hot zone (areas of known or suspected contamination);
    - o Site access; and
    - o Nearest water sources.

14. The number of personnel and equipment in the contaminated area should be minimized but only to the extent consistent with workforce requirements of safe site operations.

15. All wastes generated during Dames & Moore and/or subcontractor activities at the site will be disposed of as directed by the PM.

16. All personal protective equipment will be used as specified and required.

17. The buddy system will be used at all times when performing sampling for hazardous material when the first action level criteria has been exceeded or when working in remote areas.

18. Personnel are to immediately notify the SSO or Site Manager if any indications potential explosions, or unusual conditions are observed.

10.2 SAMPLING PRACTICES

For all sampling activities, the following standard safety procedures shall be employed:

1. All sampling equipment should be cleaned before proceeding to the site.

2. At the sampling site, sampling equipment should be cleaned after each use.

3. Work in "cleaner" areas should be conducted first where practical.

4. All unauthorized personnel will remain outside exclusion zones at all times.

10.3 HEALTH AND SAFETY EQUIPMENT LIST

Hardhats
Safety glasses
Ear plugs or muffs
Tyvek and polycoated Tyvek coveralls
Chemical resistant steel-toed boots
Work gloves *
Nitrile gloves
Surgical vinyl inner gloves
Plastic sheeting (visqueen)
55 gal 17-H drums (for contaminated solids) and 17-E drums (for liquids)*
Drum liners
Barricade tape and barricades
Wash tubs and scrub brushes
Decon solution (i.e., TSP)
Folding chairs *
5 or 10 gal portable eyewash *
Respirator sanitizing equipment *
First Aid kit
Drinking water

Gatorade or similar drink
Type ABC fire extinguishers
Half-face and full-face respirators (NIOSH/MSHA approved)
Organic vapor cartridges
Organic Vapor Analyzer (OVA) and calibration kit
Garden sprayer
Compressed gas horn *
Duct tape

* optional

11.0 EMERGENCY RESPONSE PLAN

It is Dames & Moore's policy to evacuate personnel from areas involved in hazardous material emergencies and to summon outside assistance from agencies with personnel trained to deal with the specific emergency. This section outlines the procedures to be followed by Dames & Moore personnel in the event of a site emergency. These procedures are to be reviewed during the onsite safety briefings conducted by the SSO.

In the event of a fire or medical emergency, the following numbers can be called for assistance:

Fire:	911
Ambulance:	911
Hospital:	Valley Memorial Hospital 1111 E. Stanley Boulevard Livermore, California (510) 447-7000
Police:	911

From the site turn left on Foothill then turn left of Sunol Boulevard, right on First Street, and right on Stanley. The hospital is located at 1111 E. Stanley Blvd.

Paramedics should be summoned in the event of a serious injury; they will arrange to transport the victim to the nearest appropriate facility. A first aid kit will be available at the site for use in case of minor injuries. If direct contact with contaminants occurs, affected skin areas should be washed immediately with soap and water.

In the event of serious trauma or unknown chemical exposure, the employee should be stabilized by one group of employees while the emergency phone number list is consulted and an ambulance immediately requested.

Workers with suspected back or neck injuries are NOT to be moved until professional emergency assistance arrives.

At least one person at the site will have current certification in First Aid and CPR.

11.1 PLACES OF REFUGE

In the event of a site emergency requiring evacuation, all personnel will evacuate to a pre-designated area located in the support zone, a safe distance from the exclusion zone boundary ("hot lines"). The SSO will designate the assembly area prior to the start of work.

11.2 FIRE

Type ABC fire extinguishers will be available onsite to contain and extinguish small fires. The local fire department should be summoned (911) in the event of any fire on site.

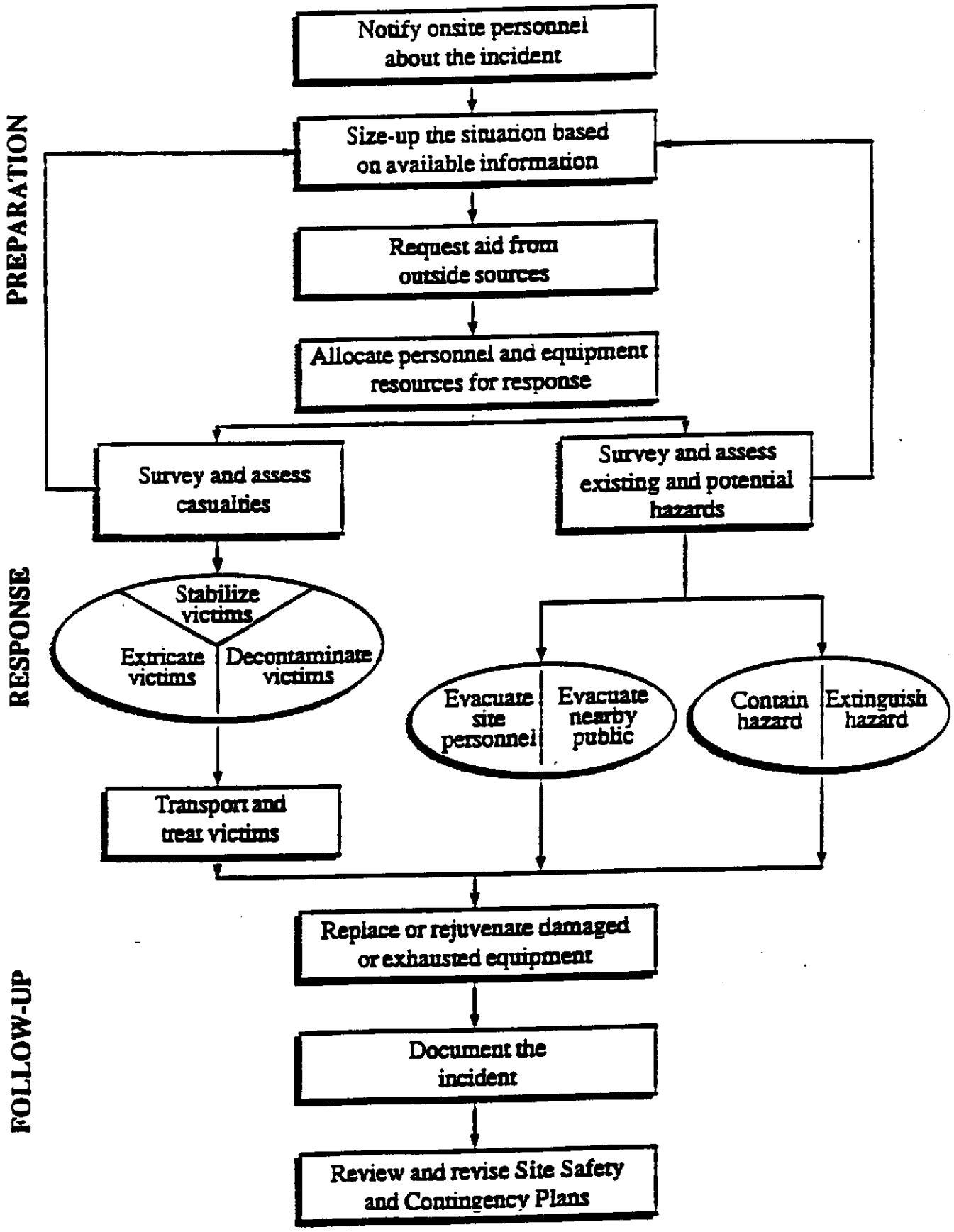
11.3 INCIDENT REPORT

In the event of an injury or illness, work is to be stopped until the SSO and the DHSM (John Danby-Sacramento) have determined the cause of the incident and have taken the appropriate action. Any injury or illness, regardless of severity, is to be reported on the accident report form (see Attachments).

11.4 OPERATION SHUTDOWN

Under certain extreme hazardous situations the onsite geologist, SSO or SSR may request that site operations be temporarily suspended while the underlying hazard is corrected or controlled. During operation shutdown, all personnel will be required to stand upwind to prevent exposure to fugitive emissions. The SSO will have ultimate authority for operations shutdown and restart.

Emergency Response Procedures



12.0 TRAINING AND MEDICAL SURVEILLANCE

All Dames & Moore site personnel will have met the requirements of 29 CFR 1910.120 (e), including:

- Forty hours or initial off-site training or its recognized equivalent;
- Eight hours of annual refresher training for all personnel;
- Eight hours of supervisor training for personnel serving as Site Safety Officers;
- Three days of work activity under the supervision of a trained and experienced supervisor.

All Dames & Moore site personnel are participating in medical surveillance programs that meet the requirements of 29 CFR 1910.120(f). The PM will maintain current copies of training certificates and statements of medical program participation for all site personnel.

In addition, all Dames & Moore site personnel will review this HSP and sign a copy of the safety plan compliance agreement, which is found in the Attachments. The PM will maintain these agreements at the site, and forward them to the DHSM at the conclusion of the operation.

Prior to the start of operations at the site, the SSO will conduct a site safety briefing, which will include all personnel involved in site operations. At this meeting, the SSO will discuss:

- Contents of this HSP;
- Types of hazards at the site and means for minimizing exposure to them;
- The type of monitoring that will be performed;
- Action levels for upgrade and downgrade of personal protective equipment;
- Personal protective equipment that will be used;

- o Decontamination protocol;
- o Site control measures, including safe operating practices and communication;
- o Location and use of emergency equipment; and
- o Evacuation signals and procedures.

Subsequent site safety briefings will be conducted prior to each shift to review pertinent safety issues, discuss any problems, and outline safety aspects of the shift's tasks.

For each briefing, the SSO will complete a Site Safety Briefing form (see Attachments) and submit each on a regular basis to the DHSM.

13.0 RECORDKEEPING

The PM and SSO are responsible for site recordkeeping. Prior to the start of work, they will review this plan; if there are no changes to be made, they will sign the approval form and forward a copy to the DHSM.

All D&M personnel will review the HSP and sign the plan acceptance form in Attachment A; copies of these forms will be forwarded to the DHSM.

The SSO will conduct a Site Safety Briefing in accordance with Section 12 prior to each shift and have all attendees sign the form in Attachment E; copies will be forwarded to the DHSM.

Any accident or exposure incident will be investigated and the form in Attachment C will be completed and forwarded to the office administrative manager and the DHSM.

All instrument readings and calibrations, PPE use and changes, health and safety-related issues, and deviations from or problems with this HSP will be recorded in the Field Log. These portions of the Log will be transmitted to the DHSM for review at the completion of field operations.

ATTACHMENT A

SAFETY PLAN COMPLIANCE AGREEMENT

ATTACHMENT A

SAFETY PLAN COMPLIANCE AGREEMENT

FOR

PCE DELINEATION AND REMEDIAL ALTERNATIVE SELECTION

LAGUNA OAKS SITE

PLEASANTON, CALIFORNIA

LUKE ANDERSON

I, PETER DAVIS, have received a copy of the Health and Safety Plan for the Project. I have reviewed the plan, understand it, and agree to comply with all of its provisions. I understand that I could be prohibited from working on the project for violating any of the health and safety requirements specified in the plan.

SIGNED: Peter Davis 6/22/92
(Signature) (Date)

7/2/92

Firm: Dames & Moore

LAGUNA2.H66

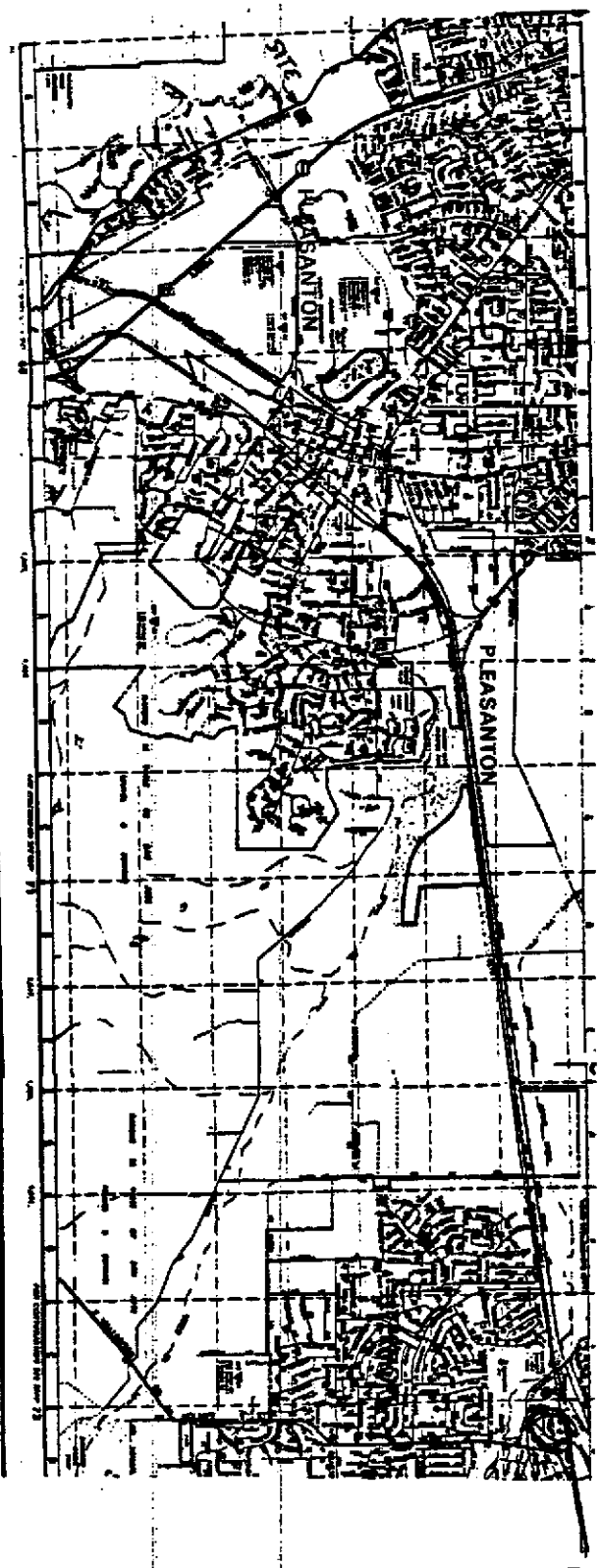
left on FOOTHILL -

Left on SUNOL -

Right on FIRST -

Right on STANLEY -

Valley Memorial Hosp.



ATTACHMENT C

ACCIDENT REPORT FORM

DAMES & MOORE

ACCIDENT/EXPOSURE REPORT

EMPLOYEE NAME _____ DATE OF BIRTH _____

HOME ADDRESS _____ PHONE NO. _____

SEX: MALE____ FEMALE____ JOB TITLE _____ SOCIAL SECURITY NO. _____

OFFICE NO. _____ OFFICE LOCATION _____ DATE OF HIRE _____

HOURS USUALLY WORKED: HOURS PER DAY _____ HOURS PER WEEK _____ TOTAL HOURS WEEKLY _____

WHERE DID ACCIDENT OR EXPOSURE OCCUR? (INCLUDE ADDRESS) _____

_____

COUNTY _____ ON EMPLOYER'S PREMISES? YES_____ NO_____

WHAT WAS EMPLOYEE DOING WHEN INJURED? (BE SPECIFIC) _____

_____

HOW DID THE ACCIDENT OR EXPOSURE OCCUR? (DESCRIBE FULLY) _____

_____

_____

_____

WHAT STEPS COULD BE TAKEN TO PREVENT SUCH AN OCCURRENCE? _____

_____

_____

OBJECT OR SUBSTANCE THAT DIRECTLY INJURED EMPLOYEE _____

_____

DESCRIBE THE INJURY OR ILLNESS _____ PART OF BODY AFFECTED _____

NAME AND ADDRESS OF PHYSICIAN _____

IF HOSPITALIZED, NAME AND ADDRESS OF HOSPITAL _____

DATE OF INJURY/ILLNESS _____ TIME OF DAY _____ LOSS OF ONE OR MORE DAY OF WORK? YES/NO_____

IF YES-DATE LAST WORKED _____

HAS EMPLOYEE RETURNED TO WORK?_____ IF YES-DATE RETURNED_____ DID EMPLOYEE DIE?_____ IF YES-DATE_____

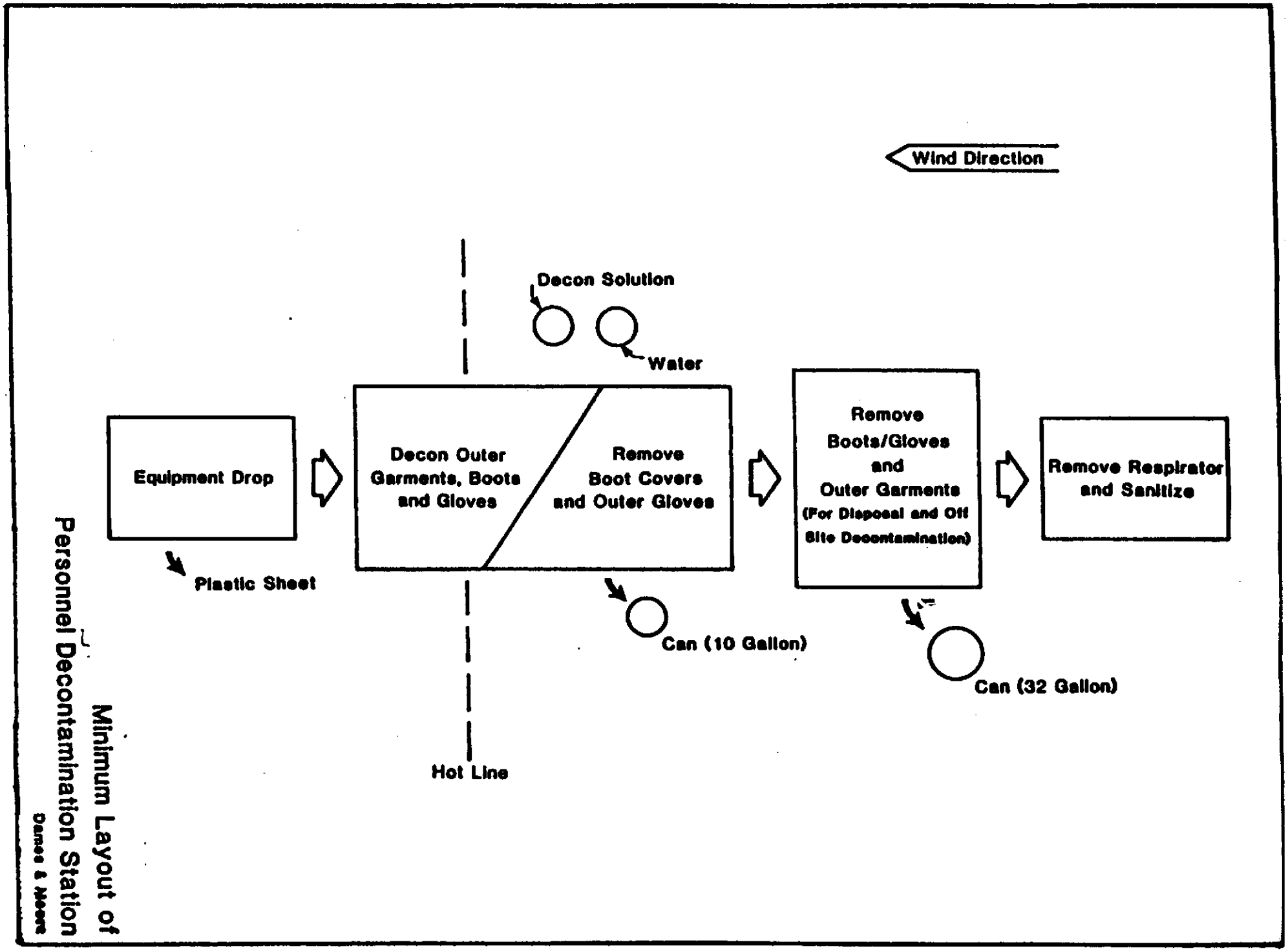
COMPLETED BY (PRINT) _____ SIGNATURE _____

TITLE _____ DATE _____

An accident/exposure report must be completed by the supervisor or site safety officer immediately upon learning of the incident. The completed report must be immediately transmitted to the office administrative manager and the Division Health and Safety Manager.

ATTACHMENT D

PERSONNEL DECONTAMINATION STATION LAYOUT



Minimum Layout of Personnel Decontamination Station

Dames & Moore

ATTACHMENT E

SITE SAFETY BRIEFINGS

SITE SAFETY BRIEFINGS

Job Name Ahmanson Number 14993-062-015
Date 6/23/92 Start Time 7:10 Completed 9:16
Site Location Pleasanton
Type of Work (General) Soil Borings (Environmental)

****

SAFETY ISSUES

Tasks (this shift) DRILL - SAMPLE SOIL

Protective Clothing/Equipment hard hats, eye protection, work boots, gloves - (Level "C" Gear available if needed)

Chemical Hazards PCE - BTEX

Physical Hazards DRILL RIG, HEAT STRESS,

Control Methods OVM to monitor OBZ Good Hygiene, - drillers to monitor their own physical condition re: heat stress.

Special Equipment/Techniques OVM

Nearest Phone Cellular w/ vehicle
Hospital Name/Address Valley, E. Stanley, Livermore
Special Topics (incidents, actions taken, etc.)
Hospital route (verbal)

****

ATTENDEES

Print Name	Sign Name
PETER DAVIS	Peter Davis
Rod Fuelein	Rodney P. Fuelein
GEORGE H JOHNSON	George H Johnson

Meeting conducted by: PETER DAVIS

BRIEFING.FRM

ATTACHMENT F

COLD STRESS AND HEAT STRESS GUIDANCE

COLD STRESS AND HEAT STRESS MONITORING AND CONTROL

Signs, Symptoms and First Aid

Heat rash (prickly heat) may result from continuous exposure to heat or humid air. It appears as red papules (elevated skin lesion), usually in areas where the clothing is restrictive, and gives rise to a prickly sensation, particularly as sweating increases. It occurs in skin that is persistently wetted by unevaporated sweat. The papules may become infected unless treated.

First Aid for Heat Rash - to prevent heat rash: shower after work, dry off thoroughly, and put on clean, dry underwear and clothes. Try to stay in a cool place after work. If, in spite of this, you develop heat rash, see your physician.

Heat Cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:

- muscle spasms
- pain in the hands, feet and abdomen

First Aid for Heat Cramps - leave the work area, and rest in a cool, shaded place. Drink one or two glasses of electrolyte replacement drink, and try to gently massage the cramped muscle. Once the spasms disappear, you may return to work; taking adequate breaks and drinking electrolyte replacement drink should prevent the cramps from returning.

Heat exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:

- pale, cool, moist skin
- heavy sweating
- dizziness
- nausea
- fainting

The key here is that the victim is still sweating, so the cooling system is still working; it's just under severe stress. The body core temperature should still be near normal. It is important to recognize and treat these symptoms as soon as possible, as the transition from heat exhaustion to the very hazardous heat stroke can be quite rapid.

First Aid for Heat Exhaustion - leave the work area immediately, go through decon and remove all chemical protective clothing. Rest in a cool, shaded place and open your clothing to allow air circulation; lay flat except when taking fluids. Drink plenty of cooled electrolyte replacement drinks. Your work is over for the day; do not attempt to return. Medical assistance should be summoned.

Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms are:

- red, hot, usually dry skin
- lack of or reduced perspiration
- nausea
- dizziness and confusion
- strong, rapid pulse
- coma

First Aid for Heat Stress - THIS IS A MEDICAL EMERGENCY! SUMMON MEDICAL ASSISTANCE IMMEDIATELY! Remove the victim from the work area, perform a gross decon, and remove all PPE. Have the victim lie down in a cool, shady area. Attempt to bring the victim's temperature down by increasing air movement (electric fan) or placing wetted sheets or towels on them. Place an ice bag on the victim's head. The victim must not be sent home or left unattended without a physician's specific order.

Heat Stress Prevention

The best approach to avoiding heat-related illnesses is through preventative heat stress management. The site manager and site safety officer are responsible for implementing this program.

Rest areas - a relatively cool, shaded area must be provided for breaks when ambient temperatures exceed 70°F and workers are wearing chemical protective clothing (including uncoated Tyvek), or if temperatures exceed 85°F and workers are wearing "Level D" coveralls or work clothes. A car or van is an oven, not a rest area. The rest area should be *located in the support zone adjacent to the contamination reduction zone*, situated so that part of it is in the decon area so workers can take breaks without going through full decon. If shade is not available, build some: use a plastic "dining canopy", which can be obtained at sporting goods stores. This same type of canopy can be set up to shade personnel performing hand augering in hot weather.

Liquids - encourage employees to drink cool electrolyte replacement drinks, such as Gatorade, Squench or Quik-kick (drink), frequently. Plain water is ok, but replacement drinks are preferred. OSHA prohibits a "community cup"; use paper cups. Have workers drink 16 ounces of drink before beginning work, such as in the morning and after lunch. At each break, workers should take 8-16 ounces of drink. Don't wait until you are thirsty to drink.

Discourage the use of alcohol during non-working hours, and discourage the intake of coffee during work hours, as these make heat stress control more difficult.

Acclimatization - this is the process by which your body "gets used to" hot work environments. This is achieved by slowly increasing workloads. Start at 50 percent capacity on day one, and increase by 10 percent per day; on day six, you'll be at 100 percent. You don't loose acclimatization over a

weekend, but it'll start to decrease after three to four days. If you don't do hot work for a week, it is gone. You don't have to do full shift hot work to achieve or retain acclimatization; a minimum of 100 minutes of continuous hot work exposure per day is adequate.

Auxiliary Cooling - auxiliary cooling is usually obtained by providing workers with a specially-designed vest, which is worn under the protective clothing, but over any underclothing. These vests typically provide cooling via one of two methods: the use of ice or other frozen media, or the use of a vortex cooler. Each method has its advantages and disadvantages.

The frozen media vest requires a means for freezing the media, and the media (usually water or "blue ice") will melt, requiring replacement. It is reported that frozen media vest usually cool only areas immediately adjacent to the media itself.

The vortex cooler tends to cool more uniformly. Instead of frozen media, this vest uses the expansion of compressed air to cool the wearer. The drawback is the compressed air requirement, but this is negated when the wearer is already using an airline respirator supplied by a compressor. A vortex cooler should not be supplied from air cylinders, as this will draw down the cylinders rapidly.

Auxiliary cooling should be considered when the following conditions exist:

- Ambient temperature over 80°F
- Workers wearing impermeable garments (PE Tyvek, Saranex, Chemrel, etc.)
- It is desirable to have long workshifts with minimum interruption

When the above conditions exist, and work is performed in direct sunlight, auxiliary cooling is mandatory.

Heat Stress Monitoring

For field operations that are part of ongoing site work activities in hot weather, the following procedures shall be used to monitor the body's physiological response to heat, and to monitor the work cycle of each site worker. There are two phases to this monitoring: initial work/rest cycle determination, and physiological monitoring. The initial work/rest cycle is used to estimate how long the first work shifts of the day should be. Heart rate monitoring of each worker will establish the length of the successive work periods. This monitoring should commence when ambient (not adjusted) temperatures exceed:

- 70°F for personnel wearing chemical protective clothing, including Tyvek coveralls
- 85°F for personnel wearing normal work clothes

DETERMINATION OF THE INITIAL WORK/REST CYCLES

Measure the air temperature with a standard thermometer with the bulb shielded from radiant heat; this yields T (actual). Estimate the fraction of sunshine by judging what percent time the sun is not shielded by clouds that are thick enough to produce a shadow. 100 percent sunshine - no cloud cover = 1.0; 50 percent sunshine - 50 percent cloud cover = 0.5; 0 percent sunshine - full cloud cover = 0.0.

Plug these variables into the following equation to determine the adjusted temperature:

T (adjusted) = T (actual) + (13 x fraction sunshine)

Use the chart below to determine the length of the first work shift. At the first break, initiate the heart rate monitoring as described in the next section.

INITIAL WORK/MONITORING CYCLES

ADJUSTED TEMPERATURE	NORMAL WORK CLOTHES	PROTECTIVE CLOTHING
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-30.8°)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

Heart Rate Monitoring

Heart rate (HR) should be measured by radial pulse for 30 seconds as early as possible in the resting period, preferably immediately after decon has been completed. The HR at the beginning of the rest period should not exceed 110 beats/minute. If the HR is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the pulse rate still exceeds 110 beats/minute at the beginning of the next rest period, the following work period should be further shortened by 33 percent, while the length of the rest period stays the same.

Cold Stress

Exposure to cold working conditions can result in cold stress (hypothermia) and/or injury (frostbite) to hands, feet, and head. Hypothermia can result when the core body temperature drops below 36°C (96.8°F) Lower body temperature will very likely result in dizziness, drowsiness, disorientation, slurred speech, or loss of consciousness, with possible fatal consequences. Pain in the extremities may be the first warning of danger to cold stress. Shivering develops when the body temperature has fallen to 35°C (95°)F.

Hypothermia can be brought on by exposure to cold air, immersion in cold water, or a combination of both. Wind chill factor, the cooling power of moving air, is a critical factor in cold stress. The following table is an equivalent chill (ec) temperature chart relating actual air temperature to ec temperature at various wind speeds.

Adequate insulating clothing must be worn by workers if work is performed in ec temperatures below 4°C (40°F). At ec temperatures of 2°C (35.6°F or less), workers whose clothing becomes wet should be immediately provided with a change of clothing and if necessary, treated for hypothermia. Treatment includes warming the victim with skin-to-skin contact, or by providing warm blankets or other coverings, and drinking warm liquids. Skin exposure should not be permitted at ec temperatures of -32°C (-25°F) or below.

If fine work is to be performed with bare hands for more than 10 to 20 minutes at ec temperatures below 16°C (60°F), provisions should be made for keeping the workers' hands warm. If ec temperatures fall below 40°F and fine manual dexterity is not required, then gloves should be worn. Metal handles of tools should be covered with insulating material at air temperatures below -1°C (30°F).

ATTACHMENT G

DAILY INSTRUMENT CALIBRATION CHECK SHEET

DAMES & MOORE

HEALTH & SAFETY PROGRAM
DAILY INSTRUMENT CALIBRATION CHECK SHEET

Project Name Ahmanson Instrument 580B OVM + HNU #51983

Job Number 14943-062-015 Serial # Rental

Isobutylene

DATE	INSTRUMENT	BATTERY CHECK OK?	ZERO ADJUST OK?	CALIBRATION GAS (PPM)	READING (PPM)	CALIBRATED BY	COMMENTS
6/23	OVM 580 B	✓	✓	100	99.7	P.D.	
6/24	"	✓	✓	100	99.9	P.D.	
6/25	"	✓	✓	100	99.7	P.D.	
6/26	"	✓	✓	100	99.8	P.D.	
6/29	"	✓	✓	100	99.7	P.D.	
6/30	HNU	✓	✓	57	52	P.D.	
7/1	HNU	✓	✓	57	52	P.D.	
7/7	OVM 580A	✓	✓	100	103.2	P.D.	
7/8	"	✓	✓	100	102.5	P.D.	
7/9	"	✓	✓	100	103.1	P.D.	LOW BATT.
7/10	"	✓	✓	100	103.3	P.D.	

ATTACHMENT H

FOXBORO OVA OPERATION INSTRUCTIONS

FOXBORO OVA OPERATING INSTRUCTIONS

A. Move the INSTR switch to ON and allow five minutes to warm up.

B. Battery Check: Move INSTR/BATT Test Switch to the BATT position and ensure battery is charged by reading the indication on the readout meter.

C. Move the CALIBRATE Switch to X10 and adjust the meter reading to zero with the CALIBRATE ADJUST (zero) Knob.

D. Ensure the PUMP Switch is ON and observe the SAMPLE FLOW RATE Indicator. Indication should be approximately two units.

E. Open H2 TANK VALVE one (1) turn and observe the reading on the H2 TANK PRESSURE Indicator. (Approximately 150 psi of pressure is needed for each hour of operation.)

F. Open H2 SUPPLY VALVE 1/2 to 1 turn and observe the reading on the H2 SUPPLY PRESSURE Indicator.

CAUTION

Do not leave H2 SUPPLY VALVE open when the pump is not running, as this will allow hydrogen to accumulate in the detector chamber.

G. Confirm that meter is still reading zero (readjust if required).

H. Depress ignite button. There will be a slight "pop" as the hydrogen ignites and the meter pointer will move upscale of zero. Immediately after ignition, release the igniter button. Do not depress igniter button for more than six seconds. If burner does not ignite, let instrument run for several minutes and try again. After ignition, the meter pointer will indicate the background concentration. This background level is nulled out using the CALIBRATE ADJUST (zero) Knob.

I. Move instrument to an area which is representative of the "lowest ambient background concentration" (cleanest air) to be surveyed. Move the CALIBRATE Switch to X1 and adjust the meter to read 1 ppm with the CALIBRATE ADJUST (zero) Knob.

FOXBORO OVA FIELD CALIBRATION PROCEDURE

1. Start up OVA according to factory procedure; warm it up for ten minutes prior to calibration.

2. Fill a small (2 liter) Tedlar bag with 100 ppm Methane/balance air calibration gas.

3. Set the calibrate switch to X10.

4. Sample the gas from the Tedlar bag. Use the "gas select" potentiometer to adjust the reading on the readout scale to near 100 (10 x 10). The reading should stabilize in 20 to 30 seconds.

5. Lock the knob on the gas select potentiometer; the OVA is now ready to use.

SHUTDOWN PROCEDURE

The following procedure should be followed for shutdown of the instrument:

1. Close H2 SUPPLY VALVE.
2. Close H2 TANK VALVE.
3. Move the INSTR Switch to OFF.
4. Wait five seconds and move PUMP Switch to OFF. INSTRUMENT IS NOW IN A SHUTDOWN CONFIGURATION.

FOXBORO.HSP

ATTACHMENT I

MATERIAL SAFETY DATA SHEETS

MATERIAL SAFETY DATA SHEET

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

GENIUM PUBLISHING CORP.

NO. 43

TRISODIUM PHOSPHATE DODECAHYDRATE

Date November 1978

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: TRISODIUM PHOSPHATE DODECAHYDRATE
DESCRIPTION: Crystallizes from water as $Na_3PO_4.12H_2O$ and can exist as several hydrate forms, depending on processing, and as the anhydrous salt.
OTHER DESIGNATIONS: TSP, Trisodium Orthophosphate, Sodium Phosphate, Tribasic, Teriary Sodium Phosphate, GE Material D4K1, ASTM D538, CAS# 007 601 549
MANUFACTURER: Available from several suppliers, including FMC Corporation, Monsanto Co., Stauffer Chemical Co., and Olin Corp.

SECTION II. INGREDIENTS AND HAZARDS	%	HAZARD DATA
Trisodium Phosphate (as $Na_3PO_4.12H_2O$)	>97	No TLV established*
		($Na_3PO_4.12H_2O$) Rat, Oral LD_{50} 7400 mg/kg

*Under OSHA inert dust limits it can be assumed that airborne particulate, not otherwise controlled, is limited to a maximum of 5 mg/kg of respirable dust; however, this level may not be adequate to prevent irritation with this material.

SECTION III. PHYSICAL DATA

Boiling point ---------- -11 H_2O at 100 C (decomposes)
Melting point, deg C -- >73.3 (dec)
Solubility, g/100g H_2O:
at 0 C ---------- 1.5
at 15 C ---------- 28.3
at 70 C ---------- 157

Specific gravity (20/4 C) ------- 1.62
pH of 1% water solution at 25 C - ca 12
Molecular weight ---------- 380.1

Appearance & Odor: White or colorless crystalline solid (also as powder flake, granules, etc.). No odor.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	LOWER	UPPER
None	None	None		

Extinguishing Media: Use that which is appropriate to the surrounding fire; this material is non-combustible.
In a fire situation at high temperature phosphates can emit highly toxic phosphorus oxide fumes. Firefighters should use self-contained breathing apparatus.

SECTION V. REACTIVITY DATA

This material is a stable alkaline solid at room temperature. It does not undergo hazardous polymerization.
It is incompatible with acidic materials.

GENIUM PUBLISHING

SECTION VI. HEALTH HAZARD INFORMATION

TLV None established (See Sect II)

This alkaline material will cause irritation to the respiratory tract if inhaled as a dust or as a solution mist. Prolonged or repeated skin contact will irritate the skin. Eye contact will irritate and can damage the eyes (alkaline attack). This material is low in toxicity by ingestion, but its alkaline nature will irritate, injure the digestive tract. (Trisodium phosphate is used as a food additive; but it must be reduced in alkalinity before being taken into the body.)

FIRST AID:

Eye contact: Promptly flush with plenty of water for 15 minutes. Get medical help.

Skin contact: Wash well with soap and water; rinse well with water. If irritation persists, get medical help.

Inhalation: Remove to fresh air. Get medical help if irritation persists.

Ingestion: Give 1-2 glasses of water or milk to drink to dilute; then give fruit juice or diluted vinegar to drink. Do not induce vomiting! Immediately contact a physician.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

For large spills, notify safety personnel. Clean-up personnel should use protection against contact or inhalation of dust or mist. Scoop up spill for recovery or disposal and place in a container with a lid. Flush residues to the sewer with plenty of water.

DISPOSAL: Scrap material can be used for neutralizing acidic wastes, or it can be buried in an approved manner in an approved landfill. Small amounts can be flushed to the sewer if regulations permit., Follow Federal, State and local regulations for disposal.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide general ventilation to the workplace; if dusting conditions occur, local exhaust ventilation will be needed and a NIOSH approved dust respirator may be required.

The use of rubber or plastic gloves and chemical safety glasses with side shields is recommended for handling this material. An apron may also be desirable to prevent contact with clothing, especially where solutions are involved.

Provide eyewash station near to the workplace where this material is used; a safety shower may also be needed where large amounts of solution are prepared or used.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store this material in tightly sealed containers in a clean, dry, ventilated area. Prevent physical damage to containers.

Avoid contact with the body and inhalation of dust.

Note that anhydrous trisodium phosphate and lower hydrates are more alkaline <u>on a weight basis</u> than $Na_3PO_4.12H_2O$.

APPROVALS: MIS, CRD	J. M. Dorsey
Industrial Hygiene and Safety	
Corporate Medical Staff	Jorge F. Martinez MD

DATA SOURCE(S) CODE: 1,2,4-7,12,15

Material Safety Data Sheets Collection:

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Sheet No. 440
Methane

Issued: 7/80 Revision: A, 8/89

Section 1. Material Identification

29

Methane Description: Widely distributed in nature, methane comprises 0.00022% by volume of the earth's atmosphere. American natural gas is mostly methane (85%). At temperatures greater than 2012 °F (1100 °C), pure carbon combines with pure hydrogen to form methane. Above 2732 °F (1500 °C), the amount of methane produced increases with temperature. Obtained from sodium acetate and sodium hydroxide or from aluminum carbide and water. Commercially prepared from natural gas or by fermentation of cellulose and sewage sludge. Constituent of illuminating and cooking gas. Used in the manufacture of hydrogen, hydrogen cyanide, ammonia, acetylene, formaldehyde, and many other organics.
Other Designations: Fire damp; marsh gas; methyl hydride: CH_4; CAS No. 0074-82-8.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers Guide* (Genium ref. 73) for a suppliers list.

R 1
I -
S -
K 4

NFPA

HMIS
H 1
F 4
R 0
PPG*
* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Methane, ca 100%*

OSHA PEL	ACGIH TLV, 1988-89	NIOSH REL	Toxicity Data†
None established	None established	None established	Not listed

* Check with your supplier to determine the exact composition of the purchased methane. Possible contaminants are ethane (C_2H_6), propane (C_3H_8), butane (C_4H_{10}), higher molecular weight alkanes, carbon dioxide (CO_2), nitrogen (N_2), and oxygen(O_2).
† Monitor NIOSH, *RTECS* (PA1490000), for future toxicity data.

Section 3. Physical Data

Boiling Point: -259 °F (161.6 °C)
Vapor Density (Air = 1): 0.544 at 32 °F (0 °C)
Molecular Weight: 16 g/mol
Water Solubility: Slight*
Melting Point: -296.5 °F (-182.5 °C)

Appearance and Odor: A colorless, odorless, tasteless, extremely flammable gas. Commercial methane's trace amounts of a suitable mercaptan compound give it natural gas's familiar rotten egg smell.

*Soluble in alcohol and ether.

Section 4. Fire and Explosion Data

Flash Point: -213 °F (-136.11 °C) | **Autoignition Temperature:** 999 °F (537 °C) | **LEL:** 5% v/v* | **UEL:** 15% v/v*

Extinguishing Media: Methane's extreme flammability, extensive explosibility range, and very low flash point represent dangerous fire and explosion risks. *Treat any fire situation involving rapidly escaping and burning methane gas as an emergency.* Extinguish methane fires by shutting off the source of the gas. Use water sprays to cool fire-exposed containers and to protect the personnel attempting to seal the source of the escaping gas.
Unusual Fire or Explosion Hazards: Methane gas is very flammable with an extensive explosibility range. The best fire-fighting technique may be simply to let the burning gas escape from the pressurized cylinder, tank car, or pipelines. Never extinguish the burning gas without first locating and sealing its source. Otherwise, the still leaking gas could explosively re-ignite without warning and cause more damage than if it burned itself out.
Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

* The loudest methane-air explosions occur when 1 volume of methane is mixed with 10 volumes of air (or 2 volumes of oxygen). **Warning:** Air with more than 14% by volume methane burns *noiselessly*. Methane burns with a pale, faintly luminous, not always easily detected flame.

Section 5. Reactivity Data

Stability/Polymerization: Methane is stable at room temperature in closed, pressurized containers during routine operations. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Genium reference 84 reports that methane can react violently with bromine pentafluoride, chlorine, chlorine dioxide, nitrogen trifluoride, liquid oxygen, and oxygen difluoride.
Conditions to Avoid: Never expose methane to ignition sources such as open flame, lighted cigarettes or pipes, uninsulated heating elements, or electrical or mechanical sparks. Prevent any accidental or uncontrollably rapid release of methane gas from high-pressure cylinders, tank cars, or pipelines.
Hazardous Products of Decomposition: Thermal oxidative degradation of methane can produce carbon dioxide and toxic carbon monoxide (CO).

Section 6. Health Hazard Data

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists methane as a carcinogen. **Summary of Risks:** As a simple asphyxiant, methane does not cause significant physiological responses, but it can displace the minimum required atmospheric oxygen level. Significant displacement results in an oxygen-deficient atmosphere with no adequate warning properties. Asphyxiation can occur especially in confined, poorly ventilated, undisturbed spaces infrequently entered by workers. Frostbite (cryogenic damage) can result from contact with liquid methane's extremely low temperature. **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Target Organs:** None reported. **Primary Entry:** Inhalation. **Acute Effects:** The initial symptoms of simple asphyxiant gases's effects are rapid respiration and air hunger, diminished mental alertness, and impaired muscular coordination. Continuing lack of oxygen causes faulty judgement, depression of all sensations, rapid fatigue, emotional instability, nausea, vomiting, prostration, unconsciousness, and finally, convulsions, coma, and death. **Chronic Effects:** None reported.

FIRST AID

Skin: (Liquid methane): Promptly flush the affected area with lots of tepid/lukewarm water to reduce freezing of tissues. Never apply direct heat to frostbitten areas. Loosely apply dry, bulky dressings to protect the area from further injury. Get treatment from qualified medical personnel. **Inhalation:** Rescuers must consider their own safety when entering confined, poorly ventilated, oxygen-deficient areas. Self-contained breathing equipment must be readily available. Rescuers must use nonsparking tools and equipment: e.g., floodlights lowered into any incident area must be electrically grounded and bonded, shatter-resistant, and sparkproof. **After first aid, get appropriate in-plant, paramedic, or community medical attention and support for inhalation exposures in oxygen-deficient atmospheres.** Seek prompt medical assistance for further observation and treatment.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: *Design and practice a methane spill control and countermeasure plan (SCCP).* When a leak occurs, notify safety personnel, eliminate heat and ignition sources, evacuate unnecessary personnel, provide maximum explosion-proof ventilation, and implement the SCCP. Use only nonsparking tools and equipment. Locate and seal the source of the leaking gas. Use water sprays to protect the personnel attempting this shutoff. Large methane releases can result in spectacular explosions. If attempts to shut off the leaking gas are unsuccessful, evacuate the likely explosion area. **Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations. Remove leaking or defective cylinders to a safe, outside, posted, discharge location. Let the methane gas discharge at a moderate rate. When it is empty, return the cylinder to the supplier after it is properly tagged, labelled, or stenciled MT (empty) or defective.

OSHA Designations
Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

EPA Designations
RCRA Hazardous Waste (40 CFR 261.33): Not listed
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). **Gloves:** To prevent skin contact, workers handling liquid methane should wear appropriate insulating gloves, safety glasses, and splash aprons, as required by the particular work conditions. **Respirator:** Wear a NIOSH-approved respirator if necessary. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres; use self-contained breathing equipment there. **Ventilation:** Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the 5% v/v LEL (Sec. 4). Local exhaust ventilation is preferred since it prevents methane dispersion into the work area by eliminating it at its source (Genium ref. 103). Give special attention to proper ventilation of enclosed areas. **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, washing facilities, fire extinguishers, and oxygen bottles for emergency first-aid. **Contaminated Equipment:** Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment. **Other:** If appropriate, consider installing automatic sensing equipment that warns workers of oxygen-deficient atmospheres or of potentially explosive air-gas mixtures. All engineering systems in any methane gas storage, handling, or processing area must be explosion-proof so they have no spark potential or hot spots. Pressurized systems must use only approved valves, manifolds, flanges, and flame arrestors. **Comments:** Methane gas presents dangerous fire, explosion, and reactivity risks. Regularly inspect and service all the piping systems which transport methane gas in production and storage areas. Before use, thoroughly test methane lines with nitrogen gas for leaking, especially in enclosed areas.

Section 9. Special Precautions and Comments

Storage Requirements: Store methane in closed, pressurized cylinders, tank cars, pipelines, or other containers in a cool, dry, well-ventilated, fireproof area away from heat and ignition sources and incompatible chemicals (Sec. 5). Protect these containers from physical damage and heat. Shield them from direct sunlight. **Special Handling/Storage:** Electrically ground and bond all containers, tanks, cylinders, tank cars and pipelines used in methane shipping, receiving, or transferring operations. Never smoke in any work area where the possibility of exposure to methane gas (fire hazard) exits. Recommended storage containers include steel.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Methane
DOT Hazard Class: Flammable gas
DOT ID No.: UN1971
DOT Label: Flammable gas
DOT Packaging Requirements: 49 CFR 173.302
DOT Packaging Exceptions: 49 CFR 173.306

IMO Shipping Name: Methane, compressed
IMO Hazard Class: 2.1
IMO Label: Flammable gas

MSDS Collection **References:** 1, 6, 7, 84-94, 100, 116, 117, 119, 120, 122
Prepared by: PJ Igoe, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Hardies, MD

ATTACHMENT J

RESPIRATOR INSPECTION PROCEDURES

RESPIRATOR INSPECTION PROCEDURES

Air-purifying respirators should be checked as follows before and after each use:

1. Examine the facepiece for:

   - o Excessive dirt;
   - o Cracks, tears, holes, or physical distortion of shape from improper storage;
   - o Inflexibility of rubber facepiece (stretch and knead to restore flexibility);
   - o Cracked or badly scratched lenses in full facepieces;
   - o Incorrectly mounted full facepiece lenses, or broken or missing mounting clips;
   - o Cracked or broken air-purifying element holder(s), badly worn threads, or missing gasket(s) if required.

2. Examine the head straps or head harness for:

   - o Breaks;
   - o Loss of elasticity;
   - o Broken or malfunctioning buckles and attachments;
   - o Excessively worn serrations on head harness, which might permit slippage (full facepieces only).

3. Examine the inhalation and exhalation valves for the following after removing its cover:

   - o Foreign material, such as detergent residue, dust particles, or human hair under the valve seat;
   - o Cracks, tears, or distortion in the valve material;
   - o Improper insertion of the valve body in the facepiece;
   - o Cracks, breaks, or chips in the valve body, particularly in the sealing surface;
   - o Missing or defective valve cover;
   - o Improper installation of the valve in the valve body;

4. Examine the air-purifying element for:

   - o Incorrect cartridge, canister, or filter for the hazard;
   - o Incorrect installation, loose connections, missing or worn gasket, or cross threading in the holder;
   - o Expired shelf-life date on the cartridge or canister;
   - o Cracks or dents in the outside case of the filter, cartridge or canister, indicated by the absence of sealing material, tape, foil, etc., over the inlet.

5. If the device has a corrugated breathing tube. examine it for:

- o Broken or missing end connectors:
- o Missing or loose hose clamps;
- o Deterioration, determined by stretching the tube and looking for cracks.

QUALITATIVE FIT TEST PROCEDURES

An employee shall be allowed to use only the specific make(s) and model(s) of air purifying respirators for which the person has obtained a satisfactory fit verified through fit testing procedures. An employee is not permitted to use any respirator not previously fit tested or if the results of the fit test indicated that the person was unable to obtain a satisfactory fit.

The following negative and positive pressure tests should be used each time a respirator is donned to check the face to face-seal fit.

- o Negative Pressure Sealing Checks For Tightly Fitting Air Purifying Respirators

  The wearer performs this test after donning an air purifying respirator. The test consists of closing off the inlets of the cartridge(s), canister or filters by covering them with the palm(s) of the hand(s) so that air cannot pass, inhaling gently, and holding one's breath for at least ten seconds. If a facepiece collapses slightly and no inward leakage of air into the facepiece is detected, it can be reasonably assumed that the fit of the respirator to the wearer is satisfactory.

  This is used only as a gross determination of fit when the respirator is to be worn in relatively toxic atmospheres. None the less, this test shall be used each time prior to entering a toxic atmosphere.

- o Positive Pressure Seal Check for Air Purifying Respirators with Inhalation and Exhalation Valves

  This test is very much like the negative pressure sealing check, above and is conducted by closing off the exhalation valve and exhaling gently. The fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece for at least 10 seconds without detecting any outward leakage of air between the sealing surface of the facepiece and the wearer's face.

  This test is also used only as a gross determination of fit when the respirator is to be worn in relatively toxic atmospheres. This test shall be used each time prior to entering a toxic atmosphere.

ATTACHMENT K

INJURY AND ILLNESS PREVENTION PROGRAM

DAMES & MOORE

Firmwide

Health and Safety

Program and Procedure Manual

Procedure No.: HS 330

Date: July 1, 1991

Supercedes:

Approved: Gary R. Krieger M
GARY R. KRIEGER

Subject: INJURY AND ILLNESS PREVENTION PROGRAM (California): INTRODUCTION

Dames & Moore believes that everyone benefits from a safe and healthy work environment. The Firm is committed to maintaining an injury and illness free workplace and to complying with applicable laws and regulations governing workplace safety. To achieve this goal, Dames & Moore has adapted this Injury and Illness Prevention Program (IIPP). This IIPP implements the provisions of the California Senate Bill 198, Statutes of 1989, Chapter 1369, Labor Code 6401.7, and the accompanying General Industry Safety Order at Title 8, California Code of Regulations, Section 3203 (8 CCR 3203) in all California Dames & Moore offices.

The following sections of the procedure describe how Dames & Moore is implementing its Illness and Injury Prevention Program (IIPP) in California Dames & Moore offices. The purpose of the Program is to reduce the incidence of workplace injuries and illnesses. The IIPP will complement the Firmwide Health and Safety Program that is in place throughout Dames & Moore. Dames & Moore has established, and is implementing and maintaining this written program to address, as a minimum, the seven main elements described below to comply with the provisions of 8 CCR 3203. The standard requires that the IIPP:

1. Designate persons with responsibility for implementing the Program;

2. Adopt procedures that will see that employees comply with safe and healthy work practices;

3. Establish employee/employer health and safety committees, in addition to other methods, to provide a means to communicate with employees on occupational health and safety matters;

4. Identify and evaluate work place hazards;

5. Investigate occurrences of occupational injury or illness;

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Firmwide

Health and Safety

Program and Procedure Manual

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GARY R. KRIEGER

Subject: INJURY AND ILLNESS PREVENTION PROGRAM (California): PROGRAM IMPLEMENTATION

To effectively implement the Injury and Illness Prevention Program (IIPP), Dames & Moore has determined that, in California:

- All office locations will have a Program in place which meets the requirements of this Procedure;
- Copies of this Procedure will be available for review at all offices;
- All field operations will have available a document summarizing the IIPP and its provisions;
- Offices having sufficient numbers of employees to form employee/employer health and safety committees will appoint such committees;
- Management will see that employees receive training appropriate to their training classification;
- Periodic inspections will be conducted at office and field sites;
- Injuries or illnesses of an occupational nature will be properly reported for investigation.

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GARY R. KRIEGER

Subject: INJURY AND ILLNESS PREVENTION PROGRAM (California): PROGRAM RESPONSIBILITIES

All employees are expected to work conscientiously to implement and maintain the IIPP. The Western Division Health and Safety Manager (WDHSM) is responsible for the overall development, implementation, and maintenance of the IIPP in California locations. The WDHSM is John G. Danby, CIH, who is located in the Sacramento office. The WDHSM, or his designee, will:

- Maintain the master IIPP document;
- Update the IIPP as new regulations and regulatory interpretations related to the Program are promulgated;
- Provide guidance on the formation of health and safety committees;
- Participate in the health and safety committee as a technical resource to resolve health and safety issues;
- Advise senior management on health and safety policy issues;
- Review employee suggestions or complaints related to occupational health and safety issues;
- Conduct periodic inspections of office locations and field activities;
- Provide guidance and training to employees as appropriate for their anticipated hazard potential;
- Establish a system for maintaining the records of inspection, hazard abatement, and training;

The Managing-Principal-in-Charge (MPIC) or Group Leader (GL) for each office location in California will:

- Direct the formation of a health and safety committee at office locations with sufficient members in accordance with Procedure HS 320.

- See that the committee meets at least quarterly;
- Participate in scheduled committee meetings;
- See that written documentation of committee business is maintained and distributed to effected employees and the WDHSM;
- Meet periodically with the WDHSM to evaluate program effectiveness.

The Administrative Manager for each location will:

- Assist the WDHSM and MPIC as necessary to implement the Program;
- See that materials relative to employee safety suggestion/complaint submittal are maintained in a central location known to employees;
- Maintain the confidentiality of completed employee submittal forms and forward them in a timely fashion to the WDHSM for his tracking and evaluation;
- Post responses to employee submittals in a central location in the office;
- Participate as a member of the committee;
- Work with Office 165 to resolve office-related health and safety issues in a timely fashion.

Supervisors are responsible to see that employees know and abide by the firm's health and safety policies and procedures. They are expected to do everything within their control to provide a safe workplace for their employees. Their duties include:

- Make employees available to attend committee meetings;
- Assign all employees to appropriate training classification(s);
- See that employees receive training appropriate to their training classification;
- See that each employee is able to and understands how to complete each assigned task safely;
- Take appropriate disciplinary action when employees engage in unsafe behavior;

- See that health and safety materials and equipment as required/recommended by Office 165 staff are readily available and properly used by employees;
- Directing employees to wear protective equipment as required;
- Evaluating employees' safety performance on a regular basis;
- Investigating accidents to discover cause(s) and identify corrective action to prevent future occurrences.

Health and Safety Committee members will:

- Participate in health and safety committee meetings;
- Submit to the committee's consideration new business items brought to their attention by any employee;
- Participate, as necessary, in the resolution of health and safety issues;
- Assist with periodic office inspections;
- Review the results of the investigations of incidents or accidents when deemed appropriate by the committee;
- Verify corrective actions taken by Dames & Moore when requested to do so by Cal-OSHA.

DAMES & MOORE

Firmwide

Health and Safety

Program and Procedure Manual

Procedure No.: HS 330.3

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Supercedes:

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GARY R. KRIEGER

Subject: INJURY AND ILLNESS PREVENTION PROGRAM (California): COMPLIANCE WITH PROPER WORK PRACTICES

Management is responsible to see that the firm's health and safety policies and procedures are clearly communicated and understood by all employees. Managers and supervisors are expected to enforce the rules fairly and uniformly.

All employees are responsible for utilizing safe work practices, for following all directives, policies and procedures, and for assisting in maintaining a safe work environment.

- As part of employees' annual performance reviews, the employee will be evaluated on his performance with safe work practices. The following specific health and safety factors will be evaluated:
  - Considers health and safety issues in proposal and project planning;
  - Effectively implements health and safety requirements in all activities;
  - Directs subordinates to comply with health and safety procedures.
- Employees who make a significant contribution to the maintenance of a safe workplace, as determined by the WDHSM, MPIC or Group Leader, will receive a written acknowledgement which will be maintained in the employee's personnel file.
- Increasing disciplinary actions will be utilized to encourage compliance with health and safety procedures and policies. It is the supervisor's responsibility to document reported and observed unsafe or unhealthy work practices. Guidance for applying disciplinary actions can be provided by the Administrative Manager. The Dames & Moore Employee Handbook, Section 3.3.1, states

"Although the firm may terminate employment without prior warning it will attempt to give employees with work performance problems fair warning prior to terminating them for unsatisfactory performance, wherever this is reasonable and appropriate in the judgement of firm management. In such circumstances, employees should receive verbal counseling and, where appropriate, a written warning that their work performance is below standard and their job is in jeopardy, in order to provide them with a reasonable opportunity to correct any performance deficiencies."

DAMES & MOORE

Firmwide

Health and Safety

Program and Procedure Manual

Procedure No.: HS 330.4

Date: July 1, 1991

Supercedes:

Approved: Gary R. Krieger

GARY R. KRIEGER

Subject: INJURY AND ILLNESS PREVENTION PROGRAM (California): COMMUNICATION WITH EMPLOYEES

The IIPP establishes means by which the Firm can communicate with employees on health and safety matters, and includes provisions which encourage employees to notify Dames & Moore about workplace hazards without fear of reprisal. The following system of communication is designed to facilitate a continuous flow of safety and health information between management and staff in a form that is readily understandable:

- Implementation and maintenance of employer/employee health and safety committees as described in Procedure HS 320. Information regarding the committee activities will be distributed to all employees at that committee's location;

- From time to time, the Firm will post or otherwise distribute written safety notifications. Employees should check bulletin boards regularly for such postings. Safety-related memos and documents are to be read promptly. Questions about the meaning or implementation of such information should be directed to supervisors;

- Employees will be provided with copies of the Dames & Moore Health and Safety Handbook, which contains general health and safety guidelines. Employees are encouraged to review the Dames & Moore Firmwide Health and Safety Manual for detailed health and safety procedures.

- Copies of the IIPP will be distributed to all California-based employees, and the WDHSM will coordinate seminars for employees regarding IIPP implementation;

- New California-based employees will be introduced to the IIPP through the new employee orientation process as implemented by office Administrative Managers. Additional information will be promulgated to employees through the completion of the steps outlined in the New Employee Health and Safety Checklist (see Procedure HS 110.2);

- The WDHSM or his designee will present program overviews and status updates to management as part of internal training programs and meetings.

- All employees are encouraged to inform their supervisor, the WDHSM, or Office 165 personnel of any matter which the employee perceives to be a workplace hazard and/or potential workplace hazard. Employees are also encouraged to make safety suggestions and safety training suggestions. If any employee so wishes, he may make such notification anonymously.

  Each California office location will have a designated area on the location's bulletin board, or equivalent, conspicuous place, where a summary of the IIPP will be posted, along with forms employees can use to report a hazardous condition. The form, Form HS 330.4a, is provided on the next page. Employees who wish to make an anonymous notification are to submit the hazardous condition report directly to the Western Division Health and Safety Manager (John Danby - SAC) for review and investigation as necessary. Results of investigations or suggestions will be promulgated as deemed appropriate by the WDHSM.

- NO EMPLOYEE WILL BE RETALIATED AGAINST FOR REPORTING HAZARDS OR POTENTIAL HAZARDS OR FOR MAKING SUGGESTIONS RELATED TO SAFETY.

DAMES & MOORE

Firmwide

Health and Safety

Program and Procedure Manual

Procedure No.: HS 330.5

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GARY R. KRIEGER

Subject: INJURY AND ILLNESS PREVENTION PROGRAM (California): HAZARD IDENTIFICATION AND EVALUATION

Dames & Moore uses the following methods to identify and evaluate work place hazards:

Identification of Hazards

- The WDHSM, or his designee, will review applicable General Industry Safety Orders (Cal-OSHA), federal OSHA regulations, and consensus standards published by the American National Standards Institute (ANSI), American Conference of Governmental Industrial Hygienists (ACGIH), National Fire Protection Association (NFPA), and the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), for comparison to Dames & Moore operations. As appropriate, relevant standards will be provided to Dames & Moore's health and safety professionals to be included in procedure development and revision, as well as in the evaluation of workplace health and safety issues. The WDHSM will also see that relevant regulatory issues, including newly promulgated standards, are placed on Health and Safety Committee meeting agendas for discussion.

- For activities relative to hazardous waste operations, a site-specific health and safety plan is prepared for the work site that addresses physical and chemical hazards. Provisions are included in the plan for exposure monitoring to airborne contaminants, heat stress, and other hazards, as appropriate to site conditions and anticipated activities. Additional information regarding health and safety plans is found in Procedure HS 240.

- Periodic audits of field activities are made by members of Office 165. An employee complaint on a specific work activity will initiate an immediate audit of that activity; such an audit will be charged either to the job or to the project manager's overhead. A checklist of items is evaluated at the job site with the goal of correcting any noted deficiencies in the field. A summary of the audit findings is prepared

and distributed to project management and appropriate supervision. Procedure HS 280 provides complete information on the field audit function.

- Office audits are conducted at least twice per year to evaluate the offices for hazardous conditions and determine compliance with administrational aspects of hazardous waste operation activities in accordance with Procedure HS 280.

- Each location's Administrative Manager is responsible for follow-up and correction of facility items (repairs, poor housekeeping, security concerns, etc.) that may present a health or safety hazard. A member of Office 165 can be contacted for guidance and recommendations on non-routine items.

- Health and Safety Committees will aid in identifying potential hazard items that may require investigation and follow-up by a health and safety professional. As most Dames & Moore employees receive training on health and safety issues that are relevant to their particular jobs, they have the basic tools with which to note health and safety hazards, and report these hazards through the methods provided in this procedure.

DAMES & MOORE

Firmwide

Health and Safety

Program and Procedure Manual

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Subject: INJURY AND ILLNESS PREVENTION PROGRAM (California): INVESTIGATION OF OCCUPATIONAL INJURY AND ILLNESS

It is imperative that employees report all injuries or illnesses that may be job-related to their supervisor. Supervisors are responsible for proper investigation and reporting of the incident in accordance with Procedure HS 210.2. A complete discussion of injury and illness reporting, investigation, and recordkeeping is found at Procedure HS 210 in this manual.

DAMES & MOORE

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Program and Procedure Manual

Procedure No.: HS 330.7

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Subject: INJURY AND ILLNESS PREVENTION PROGRAM (California): METHODS TO CORRECT UNSAFE OR UNHEALTHY CONDITIONS

Unsafe or unhealthy conditions will be corrected as promptly as possible based on the severity of the hazard. Hazards can generally be classified as general, serious, or imminently hazardous. An imminent hazard is a hazard that is likely to cause serious bodily harm or death. Imminent hazards will necessitate the removal of effected employees until the hazard has been abated or controlled to present a less hazardous condition.

Prevention of Unsafe or Unhealthy Conditions

By the implementation of proper training, advanced planning, and resolution of issues by responsible management or a health and safety professional, most unsafe or unhealthy conditions can be abated or minimized.

Correction of Hazardous Conditions

o Field Activities

At any site, an employee may contact a member of Office 165 if he is concerned that a health or safety problem may exist. The primary contact is the Western Division Health and Safety Manager, John Danby, who is located in the Sacramento office; other health and safety professionals in Office 165 can also provide support. Issues can often be resolved by providing the employee appropriate guidance.

In field activities at hazardous waste-related sites, the site-specific health and safety plan contains discrete action levels that require specific action to be taken by the PM, SSO, and other site personnel.

The SSO or PM may stop operations at any time if he believes that a unsafe or unhealthy condition exists or may be developing.

o Office Activities

The MPIC or GL at each office location is responsible for the working conditions at that location and seeing that facility items get prompt repair as required, and that good housekeeping is maintained in the work areas.

Office audits will be conducted to identify items needing attention.

Employees will maintain their work areas in good condition and refrain from activities that could endanger themselves or other personnel such as working with chemicals or samples in unauthorized areas, storage of samples in refrigerators or other communal areas, and creating trip hazards by the use of electrical cords.

o Laboratories

Laboratories operated by Dames & Moore will conduct their work as described by their Chemical Hygiene Plan. Appropriate procedures, equipment, and facilities will be utilized. Deficiencies in this areas will be corrected promptly. Laboratory hygiene plans are addressed in procedure HS 250.

DAMES & MOORE

Firmwide

Health and Safety

Program and Procedure Manual

Procedure No.: HS 330.8

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GARY R. KRIEGER

Subject: INJURY AND ILLNESS PREVENTION PROGRAM (California): TRAINING AND INSTRUCTIONS

Dames & Moore provides several types of training programs to employees as part of the health and safety program. Employees are assigned to training categories by their supervisor, then must complete any required training prior to their initial assignment under that classification. Procedure HS 110.1 provides additional detail on training classifications.

Training Programs

o Class 1 and Class 1-T

Class 1 and 1-T employees receive 40 hours of off-site instruction in accordance with the requirements of 8 CCR 5192 "Hazardous Waste Operations and Emergency Response" by a provider approved by Office 165. Office 165 maintains current information on available classes. The training is to be completed prior to the assignment of field work. Upon completion of the course, a certificate is issued by the provider. The employee retains the original and a copy is forwarded to the Office 165 files in Sacramento, and to the local Office Safety Coordinator. The SAC office will provide a wallet card with training documentation upon receipt of the certificates.

Required eight-hour annual Refresher training and the Supervisor's course for Class 1 employees is conducted by Office 165. Class 1-T employees do not receive the Supervisor's course. Certificates are also issued to the participants of these courses.

o Class 2

Class 2 employees receive a one-time six-hour Risk Awareness course conducted by Office 165. The topics of the course are detailed in procedure HS 110.3.6. Employees who have documentation of a previously completed 40-hour or 24-hour Hazardous Waste Operations and Emergency Response course are exempted from the Risk Awareness course.

o Class M

Managers of technical employees will attend a four-hour health and safety course for managers. The course will serve to focus on responsibilities that managers need to be aware of in today's business environment.

o Class C

Class C personnel are those who are frequently involved in construction activities, including drilling and excavation work. This four hour course will address construction safety issues that are not covered in "HAZWOPER"-type courses, and are to be taken in addition to such courses.

o Class O

Class O employees are persons whose normal work activities are conducted in the office. All office personnel who are not otherwise classified will receive a Hazard Communication Standard overview as well as guidance on preventing office-related injuries; prevention of disorders related to the use of video display terminals will also be discussed.

o Class A

Class A employees are individuals who participate in asbestos-related activities. Such individuals will maintain current certification in AHERA courses through recognized course providers.

o Class L

Class L employees are those who perform their duties in laboratories that are regulated under the OSHA Chemical Hygiene Standard. All such personnel will receive training addressing the contents of that laboratory's Chemical Hygiene Plan.

The master database and files for all health and training programs is maintained in the Sacramento office; Patty Stauss is the contact person. Local Office Safety Coordinators are also to maintain health and safety files for personnel in that office.

DAMES & MOORE

Firmwide

Health and Safety

Program and Procedure Manual

Procedure No.: HS 330.9

Date: July 1, 1991

Supercedes:

Approved: Gary R. Krieger M

GARY R. KRIEGER

Subject: INJURY AND ILLNESS PREVENTION PROGRAM: RECORDKEEPING

The IIPP standard requires that records be kept of the steps taken in establishing and maintaining the Program.

o Injury and Illness Prevention Program Records

Each supervisor will maintain an updated copy of the Dames & Moore Injury and Illness Prevention Program. The WDHSM will retain the following records on file for at least three (3) years.

- Master copy of the IIPP (Procedure HS 330)
- Documents that verify that the Firm has maintained on-going two way communication with employees, such as: memos to employees on health and safety issues; new employee orientation sessions; and employee suggestions and WDHSM response.
- All records of workplace investigations and inspections.
- Records of employee health and safety training.

o Cal/OSHA Injury and Illness Records

Recordkeeping is addressed in Procedure HS 210.

ATTACHMENT L

CAL/OSHA TRENCHING AND SHORING REGULATIONS

Article 6. Excavations

§ 1539. Permits.

For regulations relating to Permits for excavations and trenches, refer to the California Code of Regulations Title 8, Chapter 3.2, Article 2, Section 341 of the California Occupational Safety and Health Regulations (Cal/OSHA).

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

HISTORY

1. New section filed 6-21-72; effective thirtieth day thereafter (Register 72, No. 26).
2. Repealer and new section filed 8-1-74 as an emergency; effective upon filing (Register 74, No. 31).
3. Certificate of Compliance filed 11-22-74 (Register 74, No. 48).
4. Certificate of Compliance refiled 11-27-74 (Register 74, No. 48).
5. Repealer and new section filed 11-29-74; effective thirtieth day thereafter (Register 74, No. 48).
6. Amendment of article heading and section filed 8-26-91; operative 9-25-91 (Register 92, No. 13).

§ 1540. Excavations.

(a) Scope and application. This article applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

(b) Definitions applicable to this article.

Accepted engineering practices means those requirements which are compatible with standards of practice required by a registered professional engineer.

Aluminum hydraulic shoring. A pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such system is designed specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell-bottom pier hole. A type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

Benching (Benching system). A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in. The separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Crossbraces. The horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation. Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Faces or sides. The vertical or inclined earth surfaces formed as a result of excavation work.

Failure. The breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous atmosphere. An atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kickout. The accidental release or failure of a cross brace.

Protective system. A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp. An inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered professional engineer. A person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

Sheeting. The members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system). A structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with Section 1541.1(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring (Shoring system). A structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sides. See "Faces."

Sloping (Sloping system). A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away form the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable rock. Natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Structural ramp. A ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

Support system. A structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Tabulated data. Tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Trench (Trench excavation). A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet. If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet or less, (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Trench box. See "Shield."

Trench shield. See "Shield."

Uprights. The vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called "sheeting."

Wales. Horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

HISTORY

1. Repealer and new section filed 8-23-82; effective thirtieth day thereafter (Register 82, No. 35). For prior history, see Register 75, No. 21.
2. Amendment of subsection (b)(3) filed 11-18-83; effective thirtieth day thereafter (Register 83, No. 47).
3. Amendment of subsections (b)(2) and (b)(3) filed 5-1-87; operative 5-31-87 (Register 87, No. 19).
4. Repealer and new section filed 8-26-91; operative 9-25-91 (Register 92, No. 13).

§ 1541. General Requirements.

(a) Surface encumbrances. All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

(b) Underground installations.

(1) The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

(2) All Regional Notification Centers as defined by Government Code Section 4216(a) in the area involved and all known owners of underground facilities in the area who are not members of a Notification Center shall be advised of the proposed work at least 2 working days prior to the start of any digging or excavation work. EXCEPTION: Emergency repair work to underground facilities.

(3) When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means.

(4) While the excavation is open, underground installations shall be protected, supported, or removed as necessary to safeguard employees.

(c) Access and egress.

(1) Structural ramps.

(A) Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

(B) Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement.

(C) Structural members used for ramps and runways shall be of uniform thickness.

(D) Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.

(E) Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments to the top surface to prevent slipping.

(2) Means of egress from trench excavations.

A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet or more in depth so as to require no more than 25 feet of lateral travel for employees.

(d) Exposure to vehicular traffic. Employees exposed to public vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

(e) Exposure to falling loads. No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with Section 1591(e), to provide adequate protection for the operator during loading and unloading operations.

(f) Warning system for mobile equipment. When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

(g) Hazardous atmospheres.

(1) Testing and controls. In addition to the requirements set forth in the Construction Safety Orders and the General Industry Safety Orders to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements shall apply:

(A) Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than 4 feet in depth.

(B) Adequate precautions shall be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation.

(C) Adequate precaution shall be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.

(D) When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

(2) Emergency rescue equipment.

(A) Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.

(B) Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, shall wear a harness with a lifeline securely attached to it. The lifeline shall be separate from any line used to handle materials, and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.

(h) Protection from hazards associated with water accumulation.

(1) Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

(2) If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

(3) If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person and compliance with Sections 1540(h)(1) and (h)(2).

(i) Stability of adjacent structures.

(1) Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

(2) Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:

(A) A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or

(B) The excavation is in stable rock; or

(C) A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

(3) Sidewalks, pavements and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

(j) Protection of employees from loose rock or soil.

(1) Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

(2) Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

(k) Inspection.

(1) Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rain storm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

(2) Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

(l) Fall protection.

(1) Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guardrails shall be provided.

(2) Adequate barrier physical protection shall be provided at all remotely located excavations. All wells, pits, shafts, etc., shall be barricaded or covered. Upon completion of exploration and other similar operations, temporary wells, pits, shafts, etc., shall be backfilled.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code; and Section 4216, Government Code.

HISTORY

1. Repealer and new section filed 8-23-82; effective thirtieth day thereafter (Register 82, No. 35). For prior history, see Registers 75, No. 21; 74, No. 35; and 74 No. 17.
2. Repealer and new section filed 8-26-91; operative 9-25-91 (Register 92, No 13).

§ 1541.1. Requirements for Protective Systems.

(a) Protection of employees in excavations.

(1) Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with Section 1541.1(b) or (c) except when:

(A) Excavations are made entirely in stable rock; or

(B) Excavations are less than 5 feet in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

(2) Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

(b) Design of sloping and benching systems. The slopes and configurations of sloping and benching systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of Section 1541.1(b)(1); or, in the alternative, Section 1541.1(b)(2); or, in the alternative, Section 1541.1(b)(3); or, in the alternative, Section 1541.1(b)(4), as follows:

(1) Option (1) —Allowable configurations and slopes.

(A) Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.

(B) Slopes specified in Section 1541.1(b)(1)(a) shall be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this article.

(2) Option (2) —Determination of slopes and configurations using Appendices A and B. Maximum allowable slopes, and allowable configurations for sloping and benching systems, shall be determined in accordance with the conditions and requirements set forth in Appendices A and B to this article.

(3) Option (3) —Designs using other tabulated data.

(A) Designs of sloping or benching systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(B) The tabulated data shall be in written form and shall include all of the following:

1. Identification of the parameters that affect the selection of a sloping or benching system drawn from such data:

2. Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;

3. Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

4. At least one copy of the tabulated data which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Division upon request.

(4) Option (4) —Design by a registered professional engineer.

(A) Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under Section 1541.1(b) shall be approved by a registered professional engineer.

(B) Designs shall be in written form and shall include at least the following:

1. The magnitude of the slopes that were determined to be safe for the particular project;

2. The configurations that were determined to be safe for the particular project;

3. The identity of the registered professional engineer approving the design.

(C) At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy shall be made available to the Division upon request.

(c) Design of support systems, shield systems, and other protective systems. Designs of support systems, shield systems, and other protective systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of Section 1541.1(c)(1); or, in the alternative, Section 1541.1(c)(2); or, in the alternative, Section 1541.1(c)(3); or, in the alternative, Section 1541.1(c)(4) as follows:

(1) Option (1) —Designs using Appendices A, C and D. Designs for timber shoring in trenches shall be determined in accordance with the conditions and requirements set forth in Appendices A and C to this article. Designs for aluminum hydraulic shoring shall be in accordance with Section 1541.1(c)(2), but if manufacturer's tabulated data cannot be utilized, designs shall be in accordance with Appendix D.

(2) Option (2) —Designs Using Manufacturer's Tabulated Data.

(A) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

(B) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.

(C) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall be made available to the Division upon request.

(3) Option (3) —Designs using other tabulated data.

(A) Designs of support systems, shield systems, or other protective systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(B) The tabulated data shall be in written form and include all of the following:

1. Identification of the parameters that affect the selection of a protective system drawn from such data;

2. Identification of the limits of use of the data;

3. Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(C) At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Division upon request.

(4) Option (4) —Design by a registered professional engineer.

(A) Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2, or Option 3, above, shall be approved by a registered professional engineer.

(B) Designs shall be in written form and shall include the following:

1. A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and

2. The identity of the registered professional engineer approving the design.

(C) At least one copy of the design shall be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design shall be made available to the Division upon request.

(d) Materials and equipment.

(1) Materials and equipment used for protective systems shall be free from damage or defects that might impair their proper function.

(2) Manufactured materials and equipment used for protective systems shall be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.

(3) When material or equipment that is used for protective systems is damaged, a competent person shall examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service, and shall be evaluated and approved by a registered professional engineer before being returned to service.

(e) Installation and removal of supports.

(1) General.

(A) Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

(B) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(C) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(D) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(E) Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(F) Backfilling shall progress together with the removal of support systems from excavations.

(2) Additional requirements for support systems for trench excavations.

(A) Excavation of material to a level no greater than 2 feet below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(B) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) Sloping and benching systems. Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) Shield systems.

(1) General.

(A) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(B) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(C) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(D) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(2) Additional requirement for shield systems used in trench excavations. Excavations of earth material to a level not greater than 2 feet below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

HISTORY

1. New section including Appendices A-F filed 8-26-91; operative 9-25-91 (Register 92, No. 13).

Appendix A

Soil Classification

(a) Scope and application.

(1) Scope. This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

(2) Application. This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in Section 1541.1(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with Appendix C to this article, and when aluminum hydraulic shoring is designed in accordance with Appendix D. This appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in Section 1541.1(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) Definitions.

Cemented soil. A soil in which the particles are held together by a chemical agent, such a calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil. Clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical side slopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil. Soil that does not exhibit visible signs of moisture content.

Fissured. A soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil. Gravel, sand, or silt (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Layered system. Two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil. A condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic. A property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil. A soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

Soil classification system. A method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the characteristics of the deposits and the environmental conditions of exposure.

Stable rock. Natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Submerged soil. Soil which is underwater or is free seeping.

Type A soil. Cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

(1) The soil is fissured; or

(2) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or

(3) The soil has been previously disturbed; or

(4) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or

(5) The material is subject to other factors that would require it to be classified as a less stable material.

Type B soil:

(1) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf but less than 1.5 tsf; or

(2) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.

(3) Previously disturbed soils except those which would otherwise be classed as Type C soil.

(4) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or

(5) Dry rock that is not stable; or

(6) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C soil:

(1) Cohesive soil with an unconfined compressive strength of 0.5 tsf or less; or

(2) Granular soils including gravel, sand, and loamy sand; or

(3) Submerged soil or soil from which water is freely seeping; or

(4) Submerged rock that is not stable, or

(5) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Unconfined compressive strength. The load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil. Soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) Requirements.

(1) Classification of soil and rock deposits. Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(2) Basis of classification. The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in paragraph (d) below, or in other approved methods of soil classification and testing such as those adopted by the American Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

(3) Visual and manual analyses. The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(4) Layered systems. In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(5) Reclassification. If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) Acceptable visual and manual tests.

(1) Visual tests. Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(A) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(B) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breads up easily and does not stay in clumps is granular.

(C) Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(D) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(E) Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(F) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(G) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(2) Manual tests. Manual analysis of soil samples in conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(A) Plasticity. Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as 1/8-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch length of 1/8-inch thread can be held on one end without tearing, the soil is cohesive.

(B) Dry strength. If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breads into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(C) Thumb penetration. The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences (rain, flooding), the classification of the soil must be changed accordingly.

(D) Other strength tests. Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

(E) Drying test. The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick and six inches in diameter until it is thoroughly dry:

1. If the sample develops cracks as it dries, significant fissures are indicated.

2. Samples that dry without cracking are to be broken by hand. If considerable force is necessary to bread a sample, the soil has significant cohesive material content. The soil can be classified as an unfissured cohesive material and the unconfined compressive strength should be determined.

3. If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

Note: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

Appendix B

Sloping and Benching

(a) Scope and application. This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in Section 1541.1(b).

(b) Definitions.

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) Requirements.

(1) Soil classification. Soil and rock deposits shall be classified in accordance with Appendix A to Section 1541.1.

(2) Maximum allowable slope. The maximum allowable slope for a soil or rock deposit shall be determined from Table B–1 of this appendix.

(3) Actual slope.

(A) The actual slope shall not be steeper than the maximum allowable slope.

(B) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least 1/2 horizontal to one vertical (1/2H:1V) less steep than the maximum allowable slope.

(C) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with Section 1541.1(i).

(4) Configurations. Configurations of sloping and benching systems shall be in accordance with Figure B–1.

TABLE B–1
MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES [1] (H:V) FOR EXCAVATIONS LESS THAN 20 FEET DEEP [3]
STABLE ROCK	VERTICAL (90°)
TYPE A [2]	3/4:1 (53°)
TYPE B	1:1 (45°)
TYPE C	1½:1 (34°)

NOTES:

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.

2. A short-term maximum allowable slope of 1/2H:1V (63 degrees) is allowed in excavations in Type A soil that are 12 feet or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet in depth shall be 3/4H:1V (53 degrees).

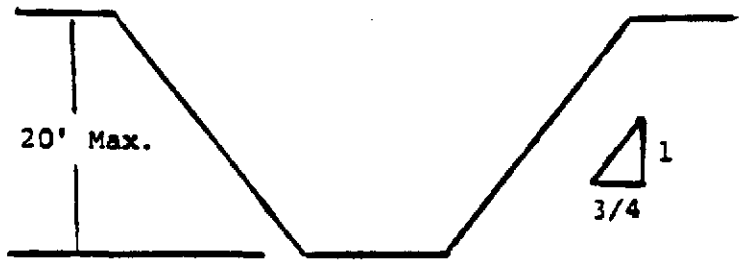
3. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

FIGURE B–1
SLOPE CONFIGURATIONS

(All slopes stated below are in the horizontal to vertical ratio)

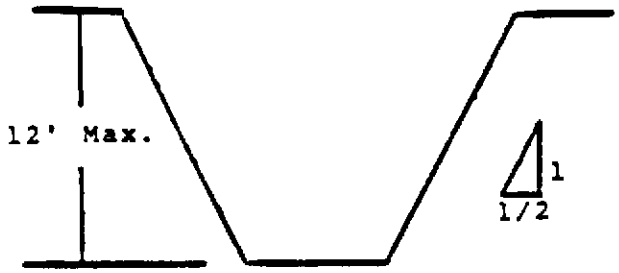
B – 1.1 Excavations made in Type A soil.

1. All simple slope excavations 20 feet or less in depth shall gave a maximum allowable slope of 3/4:1.



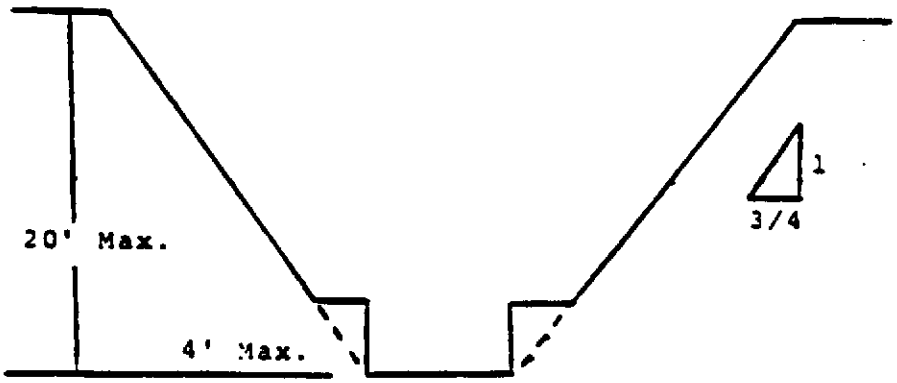
Simple Slope – General

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of 1/2:1.

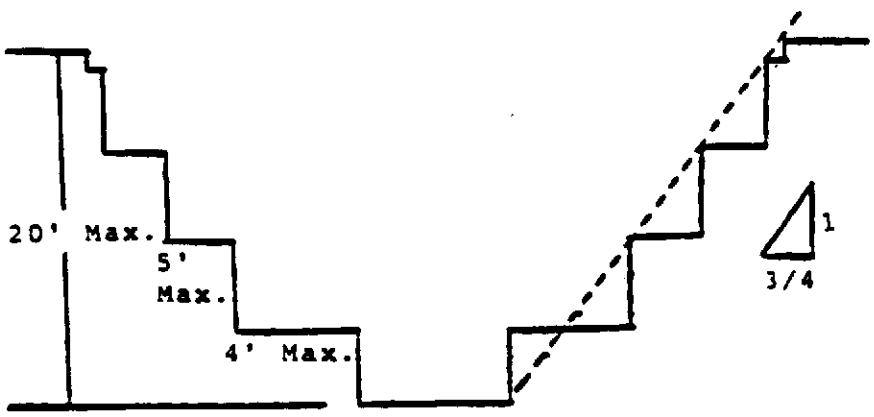


Simple Slope – Short Term

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 3/4 to 1 and maximum bench dimensions as follows:

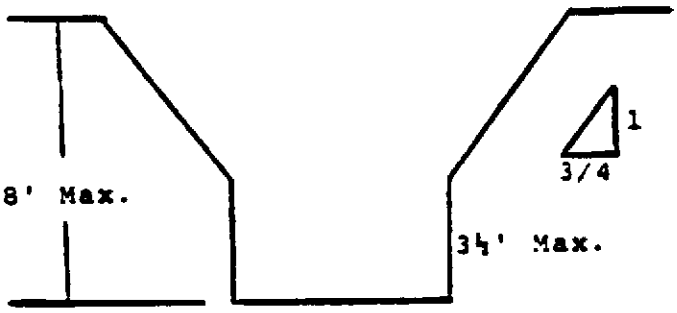


Simple Bench



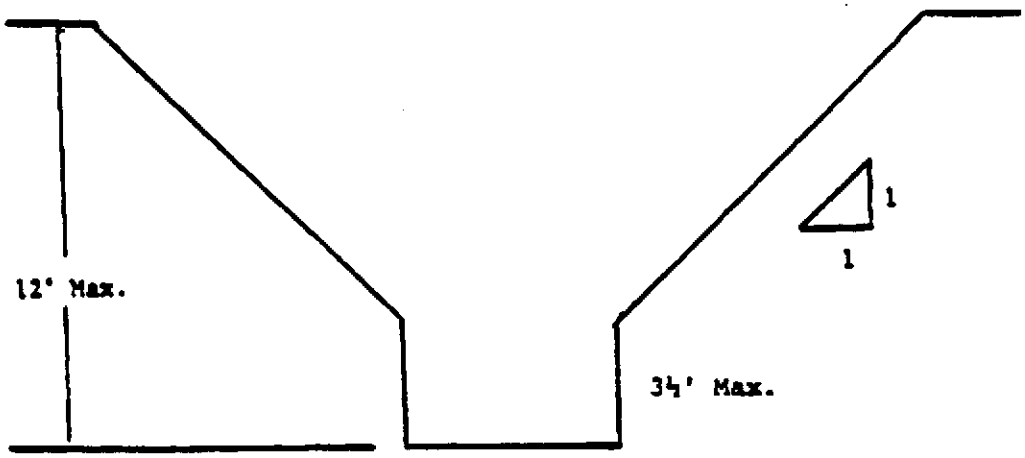
Multiple Bench

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side 3 1/2 feet.



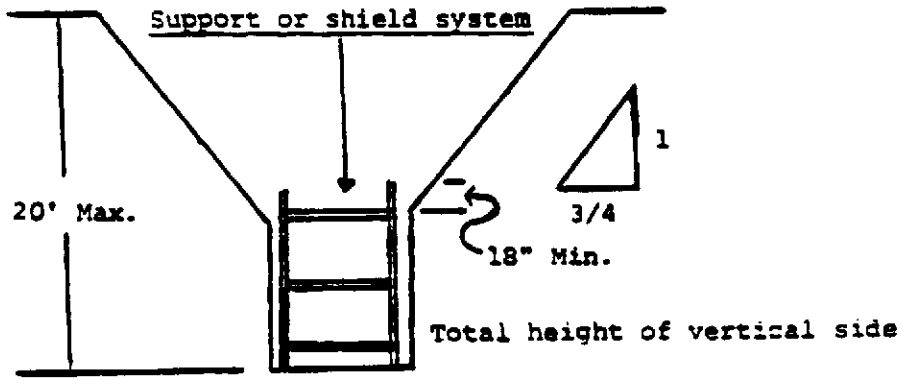
Unsupported Vertically Sided Lower Portion – Maximum 8 Feet in Depth

All excavations more than 8 feet but not more than 12 feet in depth with unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3 1/2 feet.



Unsupported Vertically Sided Lower Portion – Maximum 12 Feet in Depth

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of 3/4:1. The support or shield system must extend at least 18 inches above the top of the vertical side.

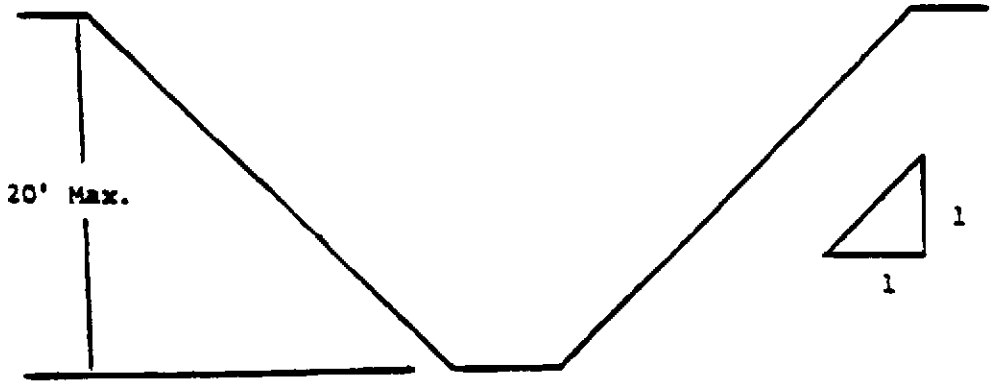


Supported or Shielded Vertically Sided Lower Portion

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under 1541.1(b).

B – 1.2 Excavations Made in Type B Soil

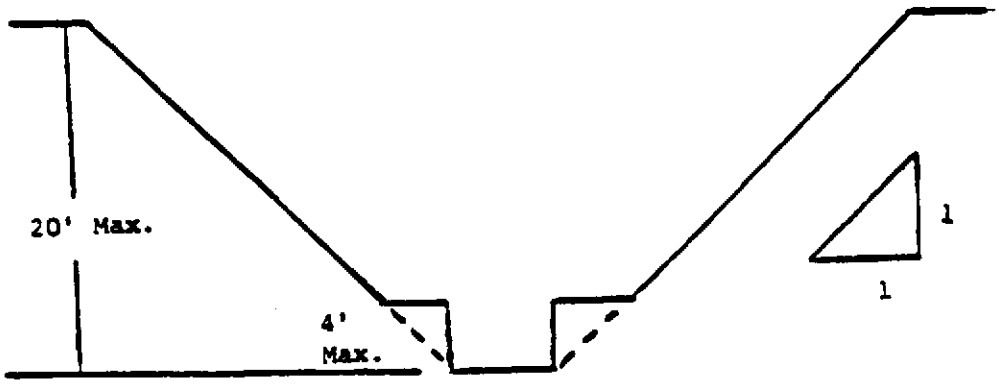
1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.



Simple Slope

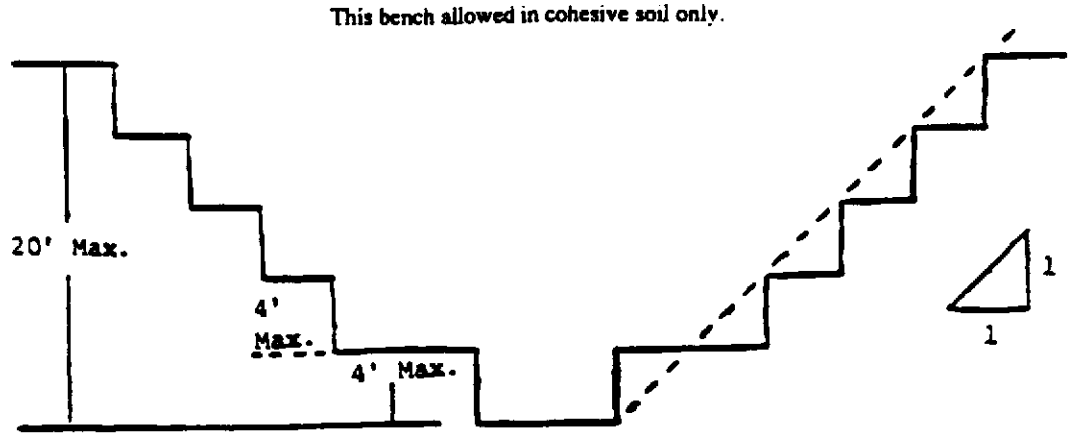
2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:

This bench allowed in cohesive soil only.



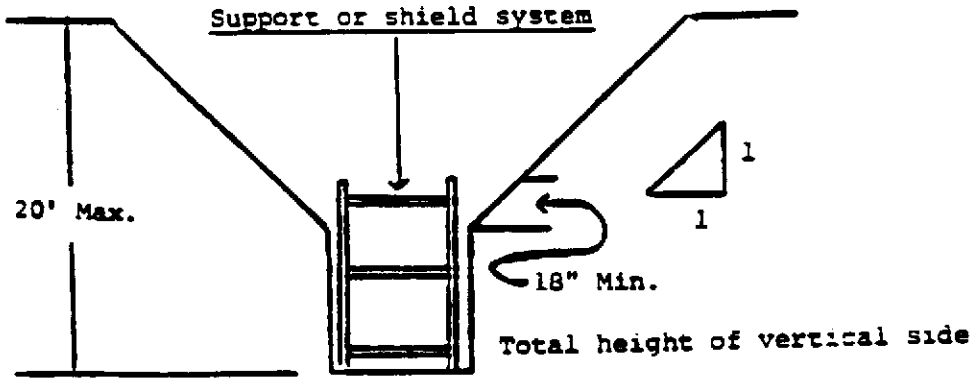
Single Bench

This bench allowed in cohesive soil only.



Multiple Bench

3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

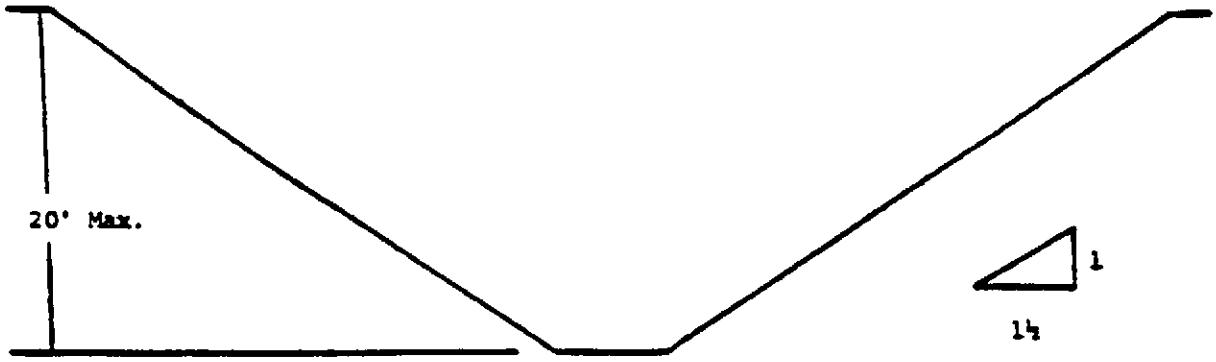


Vertically Sided Lower Portion

4. All other sloped excavations shall be in accordance with the other options permitted in 1541.1(b).

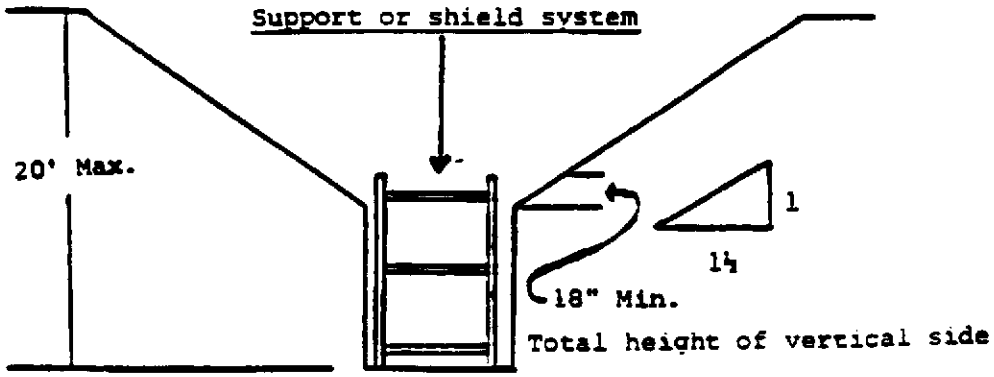
B – 1.3 Excavations Made in Type C Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1 1/2:1.



Simple Slope

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1 1/2:1.

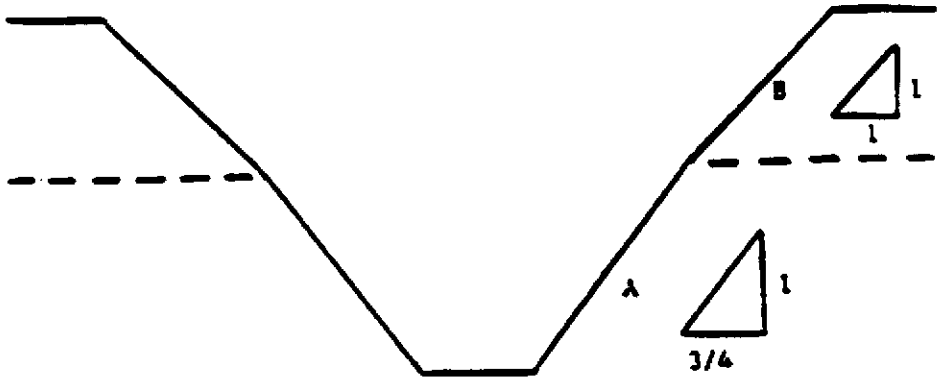


Vertically Sided Lower Portion

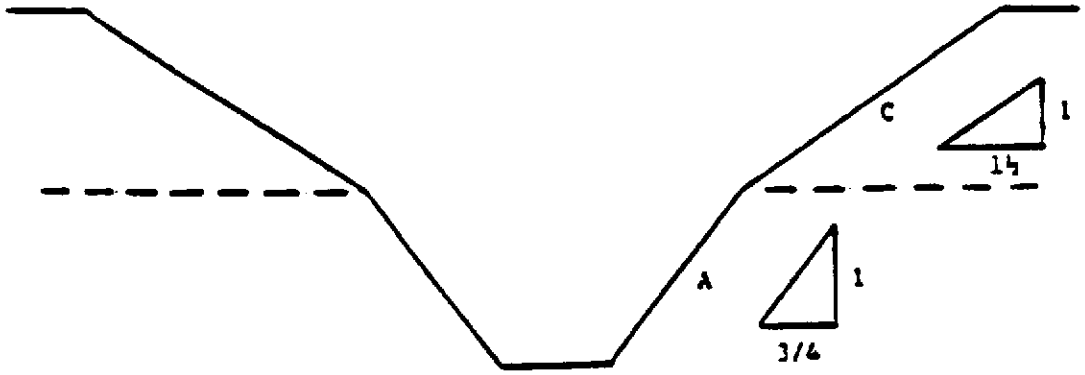
3. All other sloped excavations shall be in accordance with the other options permitted in 1541.1(b).

B - 1.4 Excavations Made in Layered Soil

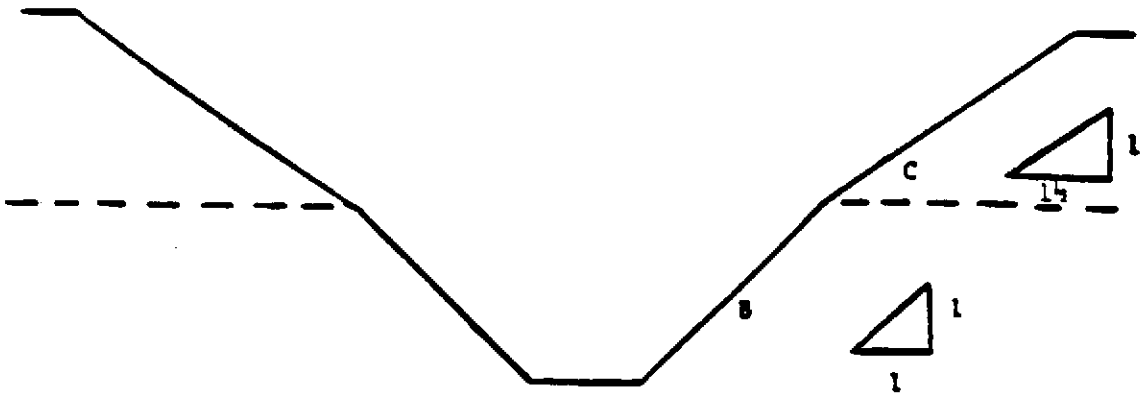
1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below:



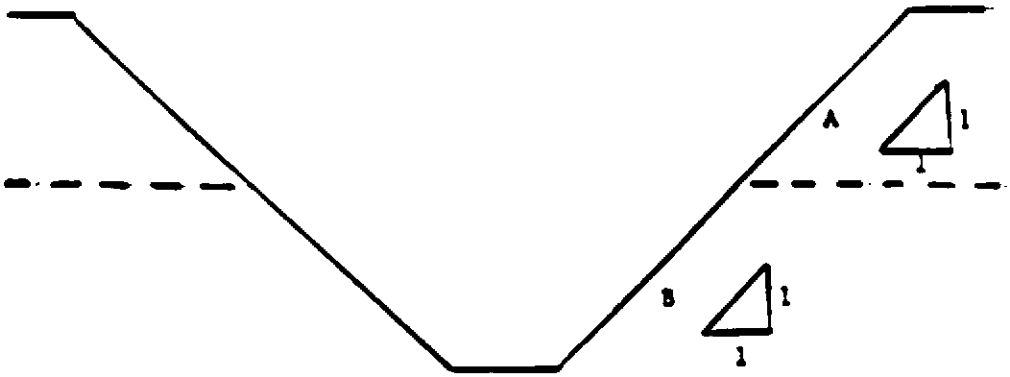
B OVER A



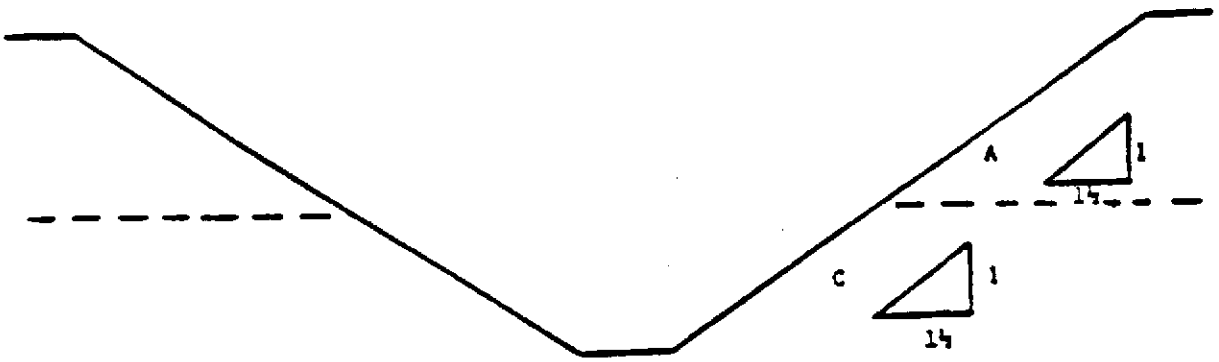
C OVER A



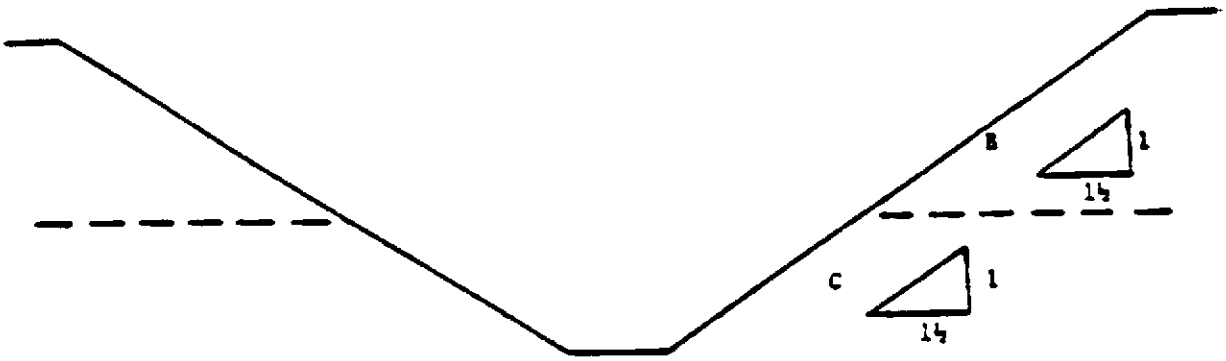
C OVER B



A OVER B



A OVER C



B OVER C

2. All other sloped excavations shall be in accordance with the other options permitted in 1541.1(b).

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

Appendix C

Timber Shoring for Trenches

(a) Scope. This appendix contains information that can be used when timber shoring is provided as a method of protection from cave-ins in trenches that do not exceed 20 feet in depth. This appendix must be used when design of timber shoring protective systems is to be performed in accordance with Section 1541.1(c)(1). Other timber shoring configurations; other systems of support such as hydraulic and pneumatic systems; and other protective systems such as sloping, benching, shielding, and freezing systems must be designed in accordance with the requirements set forth in Section 1541.1(b) and 1541.1(c).

(b) Soil Classification. In order to use the data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in Article 6.

(c) Presentation of Information.

Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables C-1.1, C-1.2 and C-1.3, and Tables C-2.1, C-2.2 and C-2.3 following Section (g) of Appendix C. Each table presents the minimum sizes of timber members to use in a shoring system, and each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. The data are arranged to allow the user the flexibility to select from among several acceptable configurations of members based on varying the horizontal spacing of the crossbraces. Stable rock is exempt from shoring requirements and therefore, no data are presented for this condition.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in Section (d) of this appendix, and on the tables themselves.

(3) Information explaining the use of the tabular data is presented in Section (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in Section (f) of this appendix.

(5) Miscellaneous notations regarding Tables C-1.1 through C-1.3 and Tables C-2.1 through C-2.3 are presented in Section (g) of this appendix.

(d) Basis and limitations of the data.

(1) Dimensions of timber members.

(A) The sizes of the timber members listed in Tables C-1.1 through C-1.3 are taken from the National Bureau of Standards (NBS) report, "Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations." In addition, where NBS did not recommend specific sizes of members, member sizes are based on an analysis of the sizes required for use by existing codes and on empirical practice.

(B) The required dimensions of the members listed in Tables C-1.1 through C-1.3 refer to actual dimensions and not nominal dimensions of the timber. Employers wanting to use nominal size shoring are directed to Tables C-2.1 through C-2.3, or have this choice under Section 1541.1(c)(3).

(2) Limitation of application.

(A) It is not intended that the timber shoring specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be designed as specified in Section 1541.1(c).

(B) When any of the following conditions are present, the members specified in the tables are not considered adequate. Either an alternate timber shoring system must be designed or another type of protective system designed in accordance with Section 1541.1.

1. When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two-foot soil surcharge. The term "adjacent" as used here means the area within a horizontal distance from the edge of the trench equal to the depth of the trench.

2. When vertical loads imposed on crossbraces exceed a 240-pound gravity load distributed on a one-foot section of the center of the crossbrace.

3. When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

4. When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) Use of Tables. The members of the shoring system that are to be selected using this information are the crossbraces, the uprights, and the wales, where wales are required. Minimum sizes of members are specified for use in different types of soil. There are six tables of information, two for each soil type. The soil type must first be determined in accordance with the soil classification system described in Appendix A. Using the appropriate table, the selection of the size and spacing of the members is then made. The selection is based on the depth and width of the trench where the members are to be installed and, in most instances, the selection is also based on the horizontal spacing of the crossbraces. Instances where a choice of horizontal spacing of crossbracing is available, the horizontal spacing of the crossbraces must be chosen by the user before the size of any member can be determined. When the soil type, the width and depth of the trench, and the horizontal spacing of the crossbraces, the size and vertical spacing of the crossbraces are known, the size and vertical spacing of the crossbraces, the size and vertical spacing of the wales, and the size and horizontal spacing of the uprights can be read from the appropriate table.

(f) Examples to Illustrate the Use of Tables C-1.1 through C-1.3.

(1) Example 1.

A trench dug in Type A soil is 13 feet deep and five feet wide. From Table C-1.1, four acceptable arrangements of timber can be used.

Arrangement #1

Space 4X4 crossbraces at six feet horizontally and four feet vertically. Wales are not required.

Space 3X8 uprights at six feet horizontally. This arrangement is commonly called "skip shoring."

Arrangement #2

Space 4X6 crossbraces at eight feet horizontally and four feet vertically.

Space 8X8 wales at four feet vertically.

Space 2X6 uprights at four feet horizontally.

Arrangement #3

Space 6X6 crossbraces at 10 feet horizontally and four feet vertically.

Space 8X10 wales at four feet vertically.

Space 2X6 uprights at five feet horizontally.

Arrangement #4

Space 6X6 crossbraces at 12 feet horizontally and four feet vertically.

Space 10X10 wales at four feet vertically.

Space 3X8 uprights at six feet horizontally.

(2) Example 2.

A trench dug in Type B soil is 13 feet deep and five feet wide. From Table C-1.2 three acceptable arrangements of members are listed.

Arrangement #1

Space 6X6 crossbraces at six feet horizontally and five feet vertically.

Space 8X8 wales at five feet vertically.

Space 2X6 uprights at two feet horizontally.

Arrangement #2

Space 6X8 crossbraces at eight feet horizontally and five feet vertically.

Space 10X10 wales at five feet vertically.

Space 2X6 uprights at two feet horizontally.

Arrangement #3

Space 8X8 crossbraces at 10 feet horizontally and five feet vertically.

Space 10X12 wales at five feet vertically.

Space 2X6 uprights at two feet vertically.

(3) Example 3.

A trench dug in Type C soil is 13 feet deep and five feet wide.

From Table C–1.3 two acceptable arrangements of members can be used.

Arrangement #1

Space 8X8 crossbraces at six feet horizontally and five feet vertically.

Space 10X12 wales at five feet vertically.

Position 2X6 uprights as closely together as possible.

If water must be retained use special tongue and groove uprights to form tight sheeting.

Arrangement #2

Space 8X10 crossbraces at eight feet horizontally and five feet vertically.

Space 12X12 wales at five feet vertically.

Position 2X6 uprights in a close sheeting configuration unless water pressure must be resisted. Tight sheeting must be used where water must be retained.

(4) Example 4.

A trench dug in Type C soil is 20 feet deep and 11 feet wide. The size and spacing of members for the section of trench that is over 15 feet in depth is determined using Table C–1.3. Only one arrangement of members is provided.

Space 8X10 crossbraces at six feet horizontally and five feet vertically.

Space 12X12 wales at five feet vertically.

Use 3X6 tightsheeting.

Use of Tables C–2.1 through C–2.3 would follow the same procedures.

(g) Notes for all Tables.

1. Members sizes at spacings other than indicated are to be determined as specified in Section 1541.1(c), "Design of Protective Systems."

2. When conditions are saturated or submerged use Tight Sheeting. Tight Sheeting refers to the use of specially–edged timber planks (e.g., tongue and groove) at least three inches thick, steel sheet piling, or similar construction that when driven or placed in position provide a tight wall to resist the lateral pressure of water and to prevent the loss of backfill material. Close Sheeting refers to the placement of planks side–by–side allowing as little space as possible between them.

3. All spacing indicated is measured center to center.

4.. Wales to be installed with greater dimension horizontal.

5. If the vertical distance from the center of the lowest crossbrace to the bottom of the trench exceeds two and one–half feet, uprights shall be firmly embedded or a mudsill shall be used. Where uprights are embedded, the vertical distance from the center of the lowest crossbrace to the bottom of the trench shall not exceed 36 inches. When mudsills are used, the vertical distance shall not exceed 42 inches. Mudsills are wales that are installed at the toe of the trench side.

6. Trench jacks may be used in lieu of or in combination with timber crossbraces.

7. Placement of crossbraces. When the vertical spacing of crossbraces is four feet, place the top crossbrace no more than two feet below the top of the trench. When the vertical spacing of crossbraces is five feet, place the top crossbrace no more than 2.5 feet below the top of the trench.

TABLE C-1.1

TIMBER TRENCH SHORING — MINIMUM TIMBER REQUIREMENTS*
SOIL TYPE A P_a = 25 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **														
	CROSS BRACES						WALES		UPRIGHTS						
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				2X6	
	UP TO 8	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---					2X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			2X6		
	UP TO 12	4X6	4X6	6X6	6X6	6X6	4	8X8	4				2X6	
10 TO 15	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				3X8	
	UP TO 8	4X6	4X6	6X6	6X6	6X6	4	8X8	4		2X6			
	UP TO 10	6X6	6X6	6X6	6X8	6X8	4	8X10	4			2X6		
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	10X10	4				3X8	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X8	6X8	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X8	6X8	4	8X8	4	3X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X10	4	8X10	4	3X6				
	UP TO 12	8X8	8X8	8X8	8X8	8X10	4	10X10	4	3X6				
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may by substituted for wood.

TABLE C–1.2

TIMBER TRENCH SHORING — MINIMUM TIMBER REQUIREMENTS*
SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3		
5 TO 10	UP TO 6	4X6	4X6	6X6	6X6	6X6	5	6X8	5			2X6		
	UP TO 8	6X6	6X6	6X6	6X8	6X8	5	8X10	5			2X6		
	UP TO 10	6X6	6X6	6X6	6X8	6X8	5	10X10	5			2X6		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5		2X6			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5		2X6			
	UP TO 10	8X8	8X8	8X8	8X8	8X10	5	10X12	5		2X6			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	3X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	3X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may by substituted for wood.

TABLE C-1.3

TIMBER TRENCH SHORING — MINIMUM TIMBER REQUIREMENTS*
SOIL TYPE C $P_a = 80 X + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**									
	CROSS BRACES								UPRIGHTS	
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) (See Note 2)
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE
5 TO 10	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	2X6
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6
	See Note 1									
10 TO 15	UP TO 6	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6
	UP TO 8	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6
	See Note 1									
	See Note 1									
15 TO 20	UP TO 6	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6
	See Note 1									
	See Note 1									
	See Note 1									
OVER 20	SEE NOTE 1									

* Mixed Oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.1

TIMBER TRENCH SHORING — MINIMUM TIMBER REQUIREMENTS*
SOIL TYPE A P_a = 25 X + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **												
	CROSS BRACES						WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)				VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15			CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X6	4X4	4X4	4X4	4X6	4	Not Req'd	Not Req'd				4X6	
	UP TO 8	4X4	4X4	4X4	4X6	4X6	4	Not Req'd	Not Req'd					4X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			4X6		
	UP TO 12	4X6	4X6	4X6	6X6	6X6	4	8X8	4				4X6	
10 TO 15	UP TO 6	4X4	4X4	4X6	6X8	6X6	4	Not Req'd	Not Req'd				4X10	
	UP TO 8	4X6	4X6	4X6	6X6	6X6	4	6X8	4		4X6			
	UP TO 10	6X6	6X6	6X6	6X6	6X6	4	8X8	4			4X8		
	UP TO 12	6X6	6X6	6X6	6X6	6X6	4	8X10	4		4X6		4X10	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X6	6X6	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X6	6X6	4	8X8	4	3X6	4X12			
	UP TO 10	6X6	6X6	6X6	6X6	6X8	4	8X10	4	3X6				
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	8X12	4	3X6	4X12			
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.2

TIMBER TRENCH SHORING — MINIMUM TIMBER REQUIREMENTS*
SOIL TYPE B P_a = 45 X H 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (NOM) AND SPACING OF MEMBERS **												
	CROSS BRACES						WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3	4	6
5 TO 10	UP TO 6	4X6	4X6	4X6	6X6	6X6	5	6X8	5			3X12 4X8		6X12
	UP TO 8	4X6	4X6	6X6	6X6	6X6	5	8X8	5		3X8		4X8	
	UP TO 10	4X6	4X6	6X6	6X6	6X8	5	8X10	5			4X8		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5	3X6	4X10			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5	3X6	4X10			
	UP TO 10	6X8	6X8	8X8	8X8	8X8	5	10X12	5	3X6	4X10			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	6X8	8X8	5	8X10	5	4X6				
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X12	5	4X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.3

TIMBER TRENCH SHORING — MINIMUM TIMBER REQUIREMENTS*
SOIL TYPE C $P_a = 25 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **												
	CROSS BRACES						WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)				VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE				
5 TO 10	UP TO 6	6X6	6X6	6X6	6X6	8X8	5	8X8	5	3X6				
	UP TO 8	6X6	6X6	6X6	6X8	8X8	5	10X10	5	3X6				
	UP TO 10	6X6	6X6	8X8	8X8	8X8	5	10X12	5	3X6				
	See Note 1													
10 TO 15	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	10X10	5	4X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6				
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8X8	8X8	8X8	8X10	8X10	5	10X12	5	4X6				
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

Note: Authority cited: Section 142.3, Labor Code. References: Section 142.3, Labor code.

Appendix D

Aluminum Hydraulic Shoring for Trenches

(a) Scope. This appendix contains information that can be used when aluminum hydraulic shoring is provided as a method of protection against cave-ins in trenches that do not exceed 20 feet in depth. This appendix must be used when design of the aluminum hydraulic protective system cannot be performed in accordance with Section 1541.1(c)(2).

(b) Soil Classification. In order to use data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in Appendix A of this Article.

(c) Presentation of Information. Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables D-1.1, D-1.2, D-1.3 and D-1.4. Each table presents the maximum vertical and horizontal spacings that may be used with various aluminum member sizes and various hydraulic cylinder sizes. Each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. Tables D-1.1 and D-1.2 are for vertical shores in Types A and B soil. Tables D-1.3 and D-1.4 are for horizontal waler systems in Types B and C soil.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in Section (d) of this appendix.

(3) Information explaining the use of the tabular data is presented in Section (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in Section (f) of this appendix.

(5) Miscellaneous notations (footnotes) regarding Table D-1.1 through D-1.4 are presented in Section (g) of this appendix.

(6) Figures, illustrating typical installations of hydraulic shoring, are included just prior to the Tables. The illustrations page is entitled "Aluminum Hydraulic Shoring: Typical Installations."

(d) Basis and limitations of the data.

(1) Vertical shore rails and horizontal wales are those that meet the Section Modulus requirements in the D-1 Tables. Aluminum material is 6061-T6 or material of equivalent strength and properties.

(2) Hydraulic cylinders specifications.

(A) 2-inch cylinders shall be a minimum 2-inch inside diameter with a minimum safe working capacity of no less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(B) 3-inch cylinders shall be minimum 3-inch inside diameter with a safe working capacity of not less than 30,000 pounds axial compressive load at extensions as recommended by product manufacturer.

(3) Limitation of application.

(A) It is not intended that the aluminum hydraulic specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be otherwise designed as specified in Section 1541.1(c).

(B) When any of the following conditions are present, the members specified in the Tables are no considered adequate. In this case, an alternative aluminum hydraulic shoring system or other type of protective system must be designed in accordance with Section 1541.1.

1. When vertical loads imposed on crossbraces exceed a 100 pound gravity load distributed on a one foot section of the center of the hydraulic cylinder.

2. When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

3. When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the slope portion.

(e) Use of Tables D-1.1, D-1.2, D-1.3 and D-1.4. The members of the shoring system that are to be selected using this information are the hydraulic cylinders, and either the vertical shores or the horizontal wales. When a waler system is used the vertical timber sheeting to be used is also selected from these tables. The Tables D-1.1 and D-1.2 for vertical shores are used in Type A and B soils that do not require sheeting. Type B soils that may require sheeting, and Type C soils that always require sheeting, are found in the horizontal wale Tables D-1.3 and D-1.4. The soil type must first be determined in accordance with the soil classification system described in Appendix A to Section 1541.1. Using the appropriate table, the selection of the size and spacing of the members is made. The selection is based on the depth and width of the trench where the members are to be installed. In these tables the vertical spacing is held constant at four feet on center. The tables show the maximum horizontal spacing of cylinders allowed for each size of wale in the waler system tables, and in the vertical shore tables, the hydraulic cylinder horizontal spacing is the same as the vertical shore spacing.

(f) Example to Illustrate the Use of the Tables:

(1) Example 1.

A trench dug in Type A soil is 6 feet deep and 3 feet wide. From Table D-1.1: Find vertical shores and 2 inch diameter cylinders spaced 8 feet on center (o.c.) horizontally and 4 feet on center (o.c.) vertically. (See Figures 1 & 3 for typical installations.)

(2) Example 2:

A trench is dug in Type B soil that does not require sheeting, 13 feet deep and 5 feet wide. From Table D-1.2: Find vertical shores and 2 inch diameter cylinders spaced 6.5 feet o.c. horizontally and 4 feet o.c. vertically. (See Figures 1 & 3 for typical installations.)

(3) Example 3:

A trench is dug in Type B soil that does not require sheeting, but does experience some minor raveling of the trench face. The trench is 16 feet deep and 9 feet wide. From Table D-1.2: Find vertical shores and 2 inch diameter cylinder (with special oversleeves as designated by footnote #2) spaced 5.5 feet o.c. horizontally and 4 feet o.c. vertically. Plywood (per footnote (g)(7) to the D-1 Table) should be used behind the shores. (See Figures 2 & 3 for typical installations.)

(4) Example 4:

A trench is dug in previously disturbed Type B soil, with characteristics of a Type C soil, and will require sheeting. The trench is 18 feet deep and 12 feet wide. 8 foot horizontal spacing between cylinders is desired for working space. From Table D-1.3: Find horizontal wale with a section modulus of 14.0 spaced at 4 feet o.c. vertically and 3 inch diameter cylinder spaced at 9 feet maximum o.c. horizontally, 3 x 12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(5) Example 5:

A trench is dug in Type C soil, 9 feet deep and 4 feet wide. Horizontal cylinder spacing in excess of 6 feet is desired for working space. From Table D-1.4: Find horizontal wale with a section modulus of 7.0 and 2 inch diameter cylinders spaced at 6.5 feet o.c. horizontally. Or, find horizontal wale with a 14.0 section modulus and 3 inch diameter cylinder spaced at 10 feet o.c. horizontally. Both wales are spaced 4 feet o.c. vertically, 3x12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(g) Footnotes, and general notes, for Tables D-1.1, D-1.2, D-1.3, and D-1.4.

(1) For applications other than those listed in the tables, refer to Section 1541.1(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to Section 1541.1(c)(2) and 1541.1(c)(3).

(2) 2-inch diameter cylinders, at this width, shall have structural steel tube (3.5 x 3.5 x 0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

(3) Hydraulic cylinders capacities.

(A) 2–inch cylinders shall be a minimum 2–inch inside diameter with a safe working capacity of not less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(B) 3–inch cylinders shall be a minimum 3–inch inside diameter with a safe work capacity of not less than 30,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(4) All spacing indicated is measured center to center.

(5) Vertical shoring rails shall have a minimum section modulus of 0.40 inch.

(6) When vertical shores are used, there must be a minimum of three shores spaced equally, horizontally, in a group.

(7) Plywood shall be 1.125 inches thick of wood or 0.75 inch thick, 14 ply, arctic white birch (Finland form). Please note that plywood is not intended as a structural member, but only for prevention of local raveling (sloughing of the trench face) between shores.

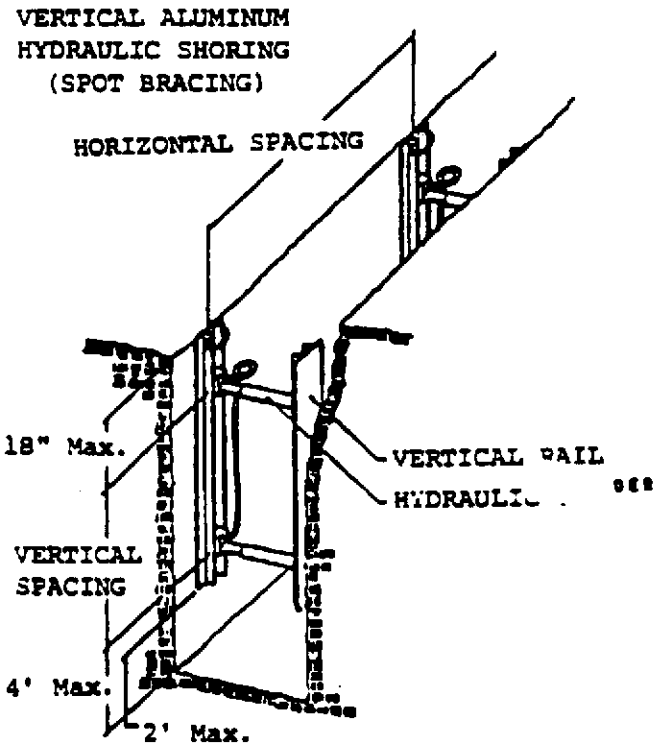
(8) See Appendix C for timber specifications.

(9) Wales are calculated for simple span conditions.

(10) See Appendix D, Section (d), for basis and limitations of the data.

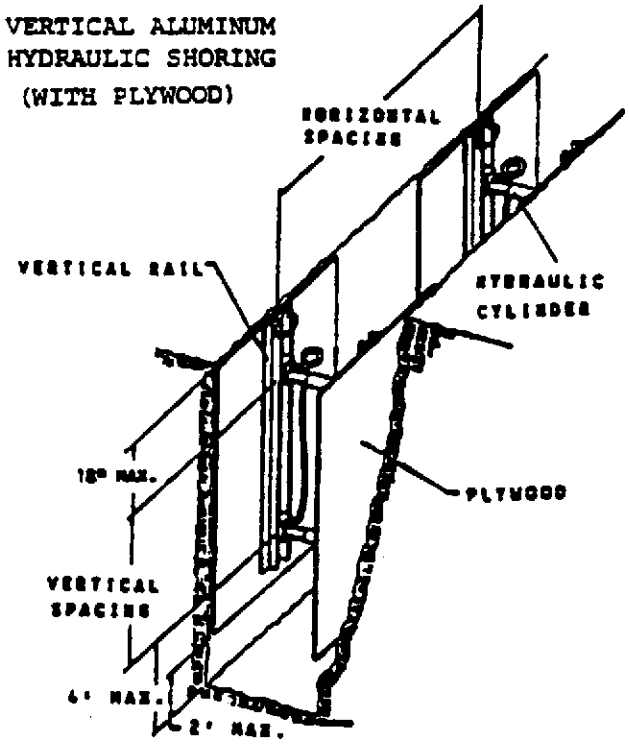
ALUMINUM HYDRAULIC SHORING
TYPICAL INSTALLATIONS

FIGURE NO. 1



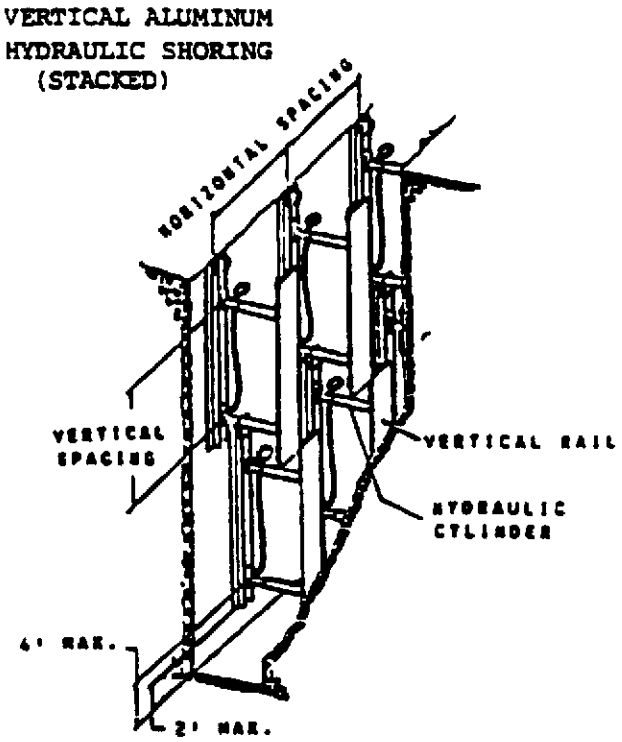
ALUMINUM HYDRAULIC SHORING
TYPICAL INSTALLATIONS

FIGURE NO. 2



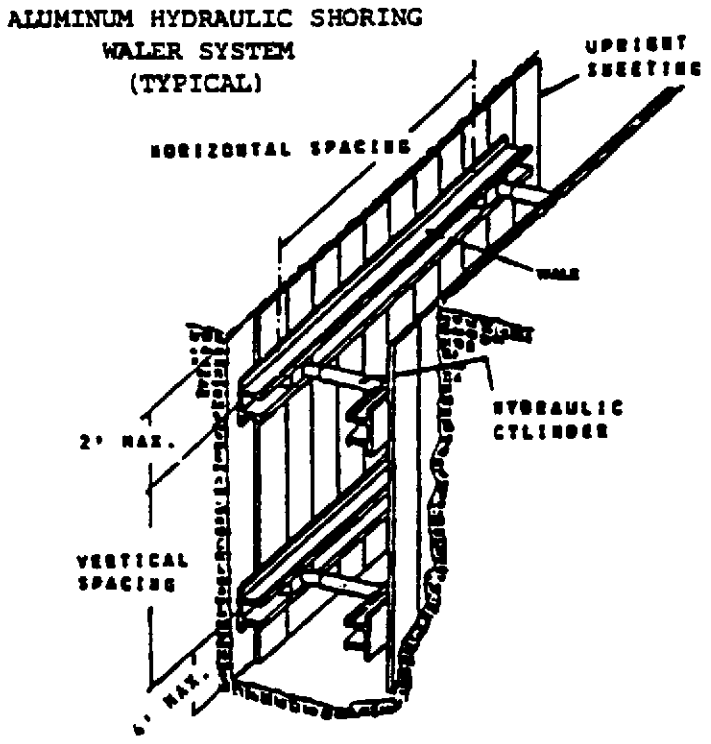
ALUMINUM HYDRAULIC SHORING
TYPICAL INSTALLATIONS

FIGURE NO. 3



ALUMINUM HYDRAULIC SHORING
TYPICAL INSTALLATIONS

FIGURE NO. 4



Note: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

TABLE D – 1.1

ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE A

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	8				
OVER 15 UP TO 20	7				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

TABLE D - 1.2

ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	6.5				
OVER 15 UP TO 20	5.5				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

TABLE D - 1.3

ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS**		
			WIDTH OF TRENCH (FEET)						MAX. HORIZ SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	SECTION MODULUS* (IN³)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT	3 FT
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	8.0	2 IN	8.0	2 IN NOTE(2)	8.0	3 IN	—	—	3x12
		7.0	9.0	2 IN	9.0	2 IN NOTE(2)	9.0	3 IN			
		14.0	12.0	3 IN	12.0	3 IN	12.0	3 IN			
OVER 10 UP TO 15	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	—	3x12	—
		7.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 15 UP TO 20	4	3.5	5.5	2 IN	5.5	2 IN NOTE(2)	5.5	3 IN	3x12	—	—
		7.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
		14.0	9.0	3 IN	9.0	3 IN	9.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, Item (g) (1)
Notes (2): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

**Douglas fir or equivalent with a bending strength not less than 1500 psi.

TABLE D-1.4

ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE C

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS[4]		
			WIDTH OF TRENCH (FEET)						MAX. HORIZ SPACING (ON CENTER)		
			UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15				
	VERTICAL SPACING (FEET)	SECTION MODULUS (IN³) *	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	SOLID SHEET	2 FT	3 FT
OVER 5 UP TO 10	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	3x12	—	—
		7.0	6.5	2 IN	6.5	2 IN NOTE(2)	6.5	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 10 UP TO 15	4	3.5	4.0	2 IN	4.0	2 IN NOTE(2)	4.0	3 IN	3x12	—	—
		7.0	5.5	3 IN	5.5	3 IN	5.5	3 IN			
		14.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
OVER 15 UP TO 20	4	3.5	3.5	2 IN	3.5	2 IN NOTE(2)	3.5	3 IN	3x12	—	—
		7.0	5.0	3 IN	5.0	3 IN	5.0	3 IN			
		14.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, Item (g) (1)
Notes (2): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

**Douglas fir or equivalent with a bending strength not less than 1500 psi.

Appendix E to Section 1541.1
Alternatives to Timber Shoring

Figure 1. Aluminum Hydraulic Shoring

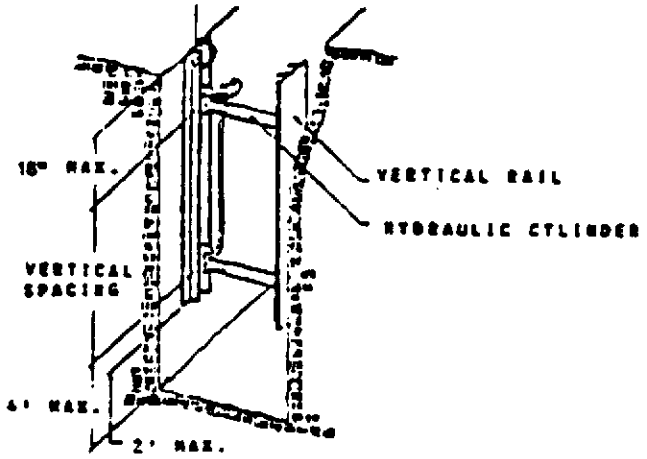
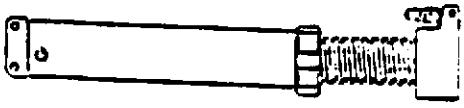


Figure 2. Pneumatic/hydraulic Shoring



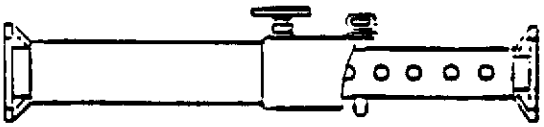


Figure 3. Trench Jacks (Screw Jacks)

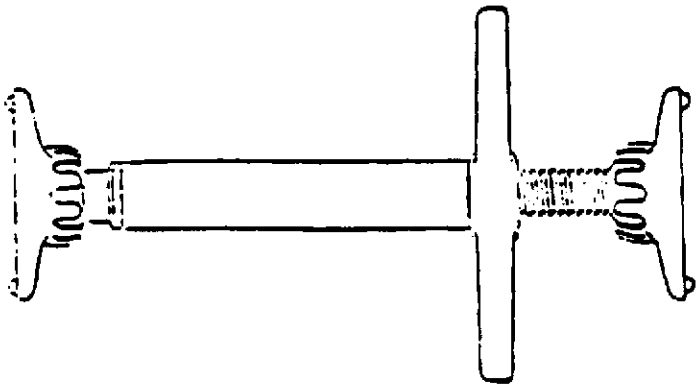
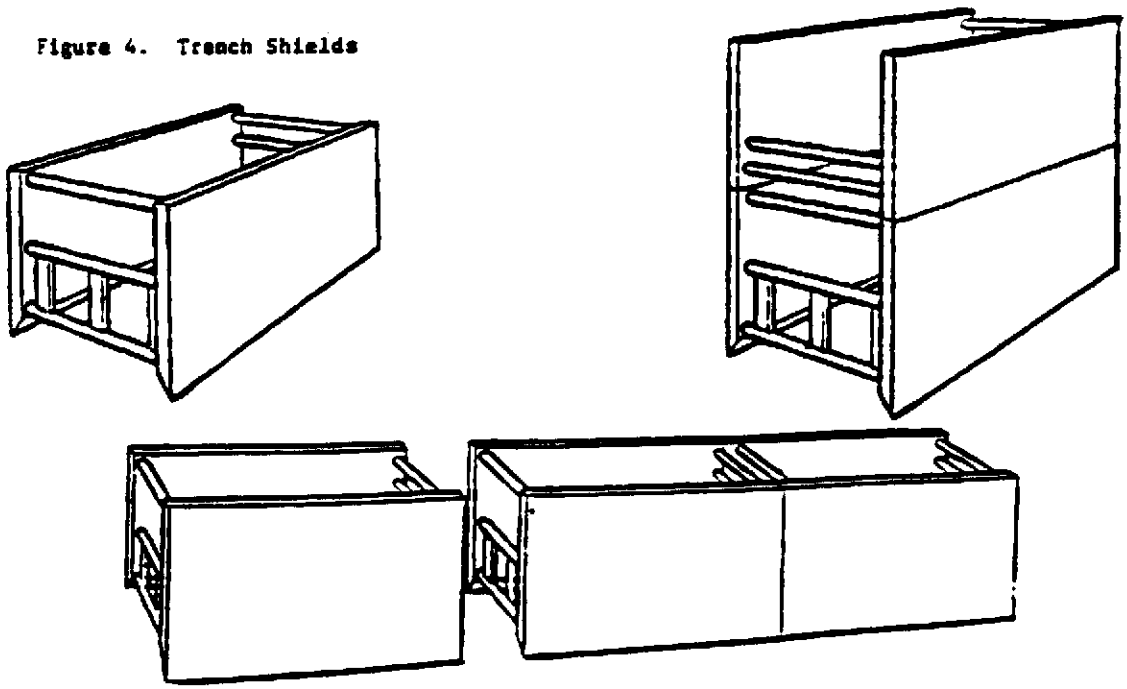


Figure 4. Trench Shields



NOTE: Authority Cited: Section 142.3, Labor Code. Reference 142.3, Labor Code.

Appendix F to Section 1541.1
Selection of Protective Systems

The following figures are a graphic summary of the requirements contained in Article 6 for excavations 20 feet or less in depth. Protective systems for use in excavations more than 20 feet in depth must be designed by a registered professional engineer in accordance Section 1541.1(b) and (c).

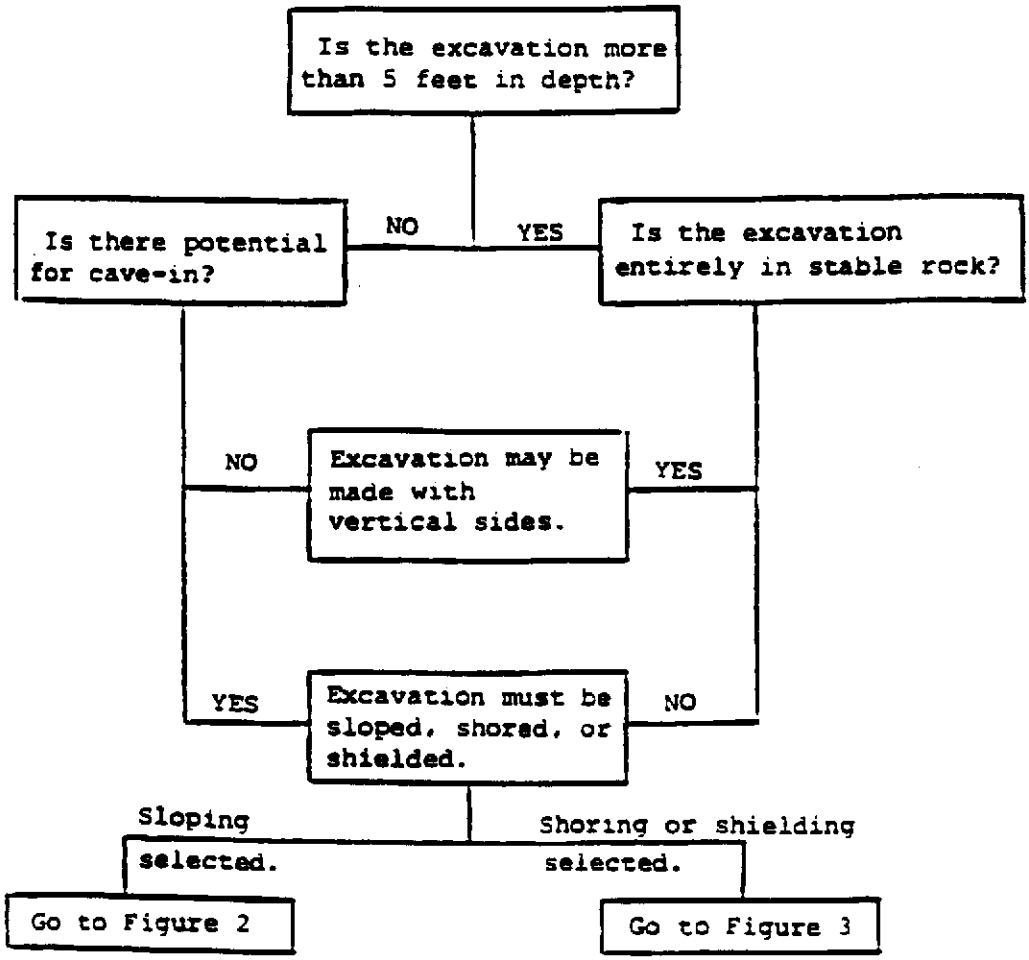


FIGURE 1 - PRELIMINARY DECISIONS

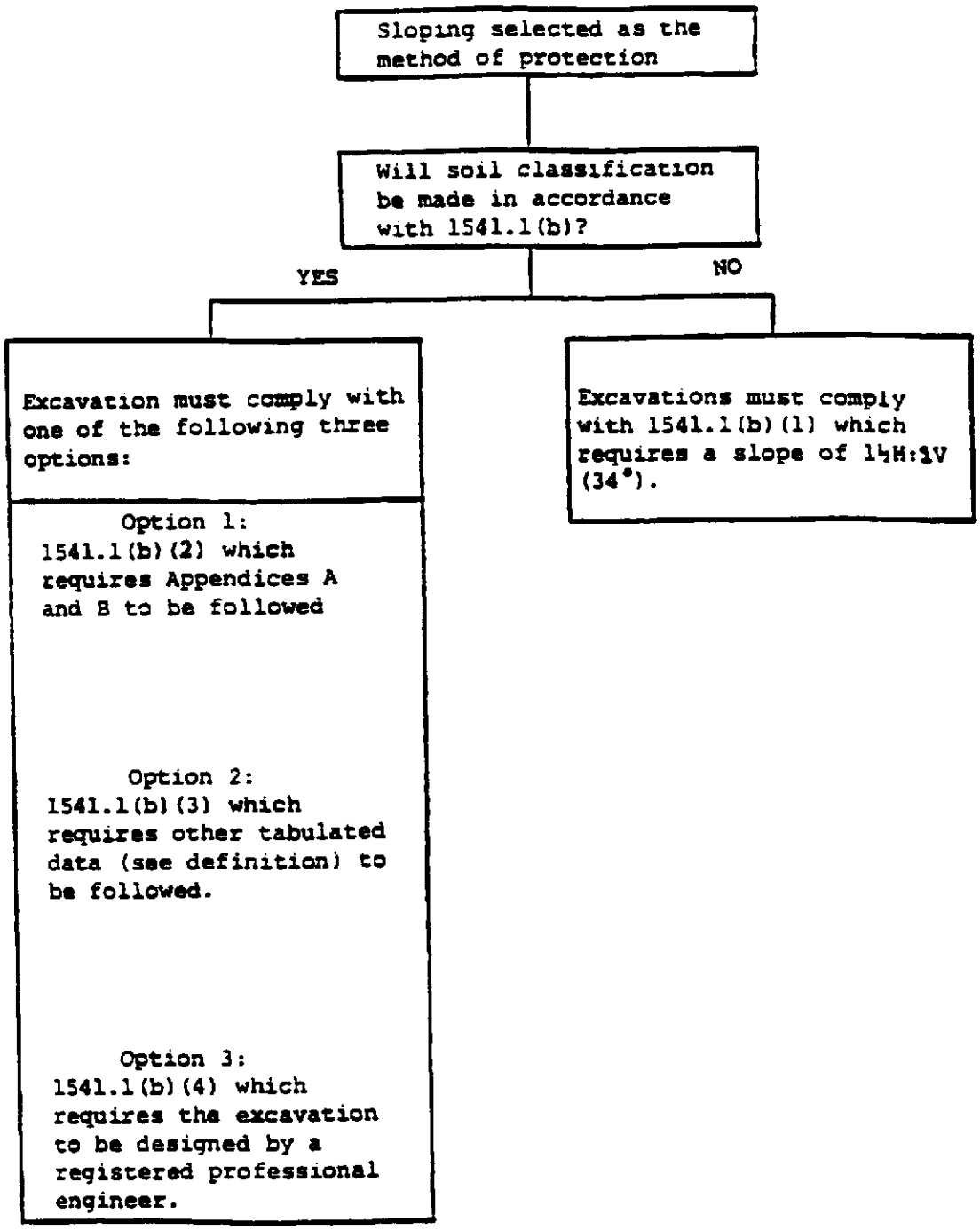


FIGURE 2 – SLOPING OPTIONS

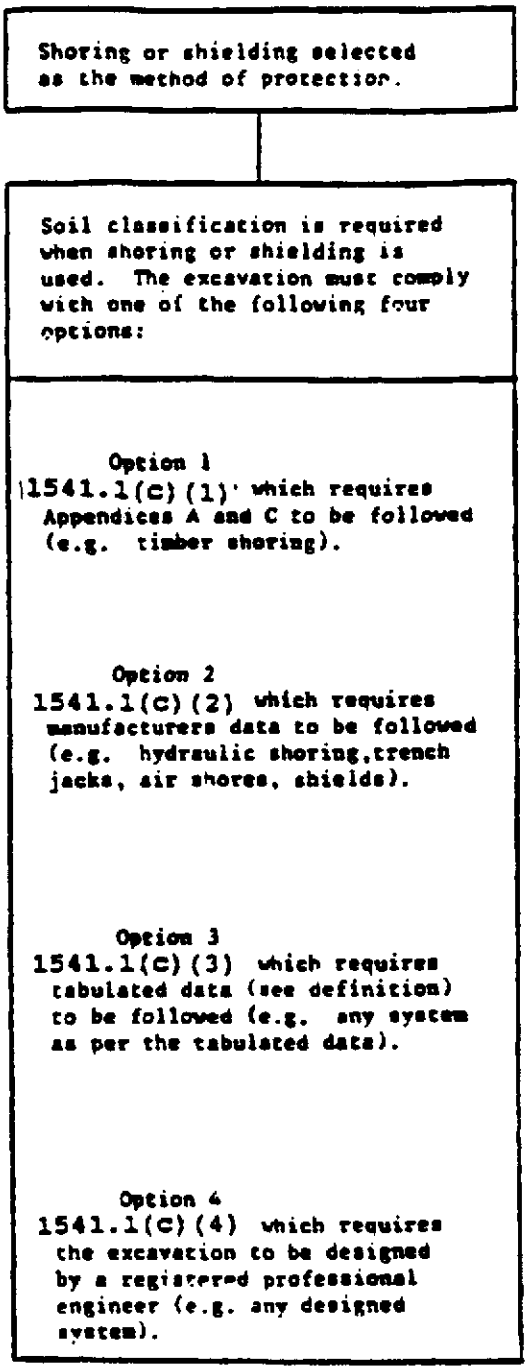


FIGURE 3 – SHORING AND SHIELDING OPTIONS

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

APPENDIX D

BORING LOGS, WELL CONSTRUCTION AND UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION CHART

SYMBOL	LETTER	DESCRIPTION	MAJOR DIVISIONS			
	GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	CLEAN GRAVELS (LITTLE OR NO FINES)	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO.4 SIEVE SIZE	FOR VISUAL CLASSIFICATION, THE 1/4" SIZE MAY BE USED AS EQUIVALENT TO THE NO.4 SIEVE SIZE	COARSE-GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN NO.200 SIEVE SIZE
	GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES				
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)			
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES				
	SW	WELL-GRADED SAND OR GRAVELLY SANDS, LITTLE OR NO FINES	CLEAN SANDS (LITTLE OR NO FINES)	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO.4 SIEVE SIZE		
	SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES				
	SM	SILTY SANDS, SAND-SILT MIXTURES	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)			
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES				
	ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	SILTS & CLAYS LIQUID LIMIT LESS THAN 50			FINE-GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN NO.200 SIEVE SIZE THE NO.200 U.S. STANDARD SIEVE IS ABOUT THE SMALLEST PARTICLE VISIBLE TO THE NAKED EYE
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS				
	OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY				
	MH	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY	SILTS & CLAYS LIQUID LIMIT GREATER THAN 50			
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS				
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS				
	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	HIGHLY ORGANIC SOILS			

KEY TO SAMPLES

- ■ INDICATES SAMPLE RECOVERY
- □ INDICATES NO RECOVERY IN SAMPLE

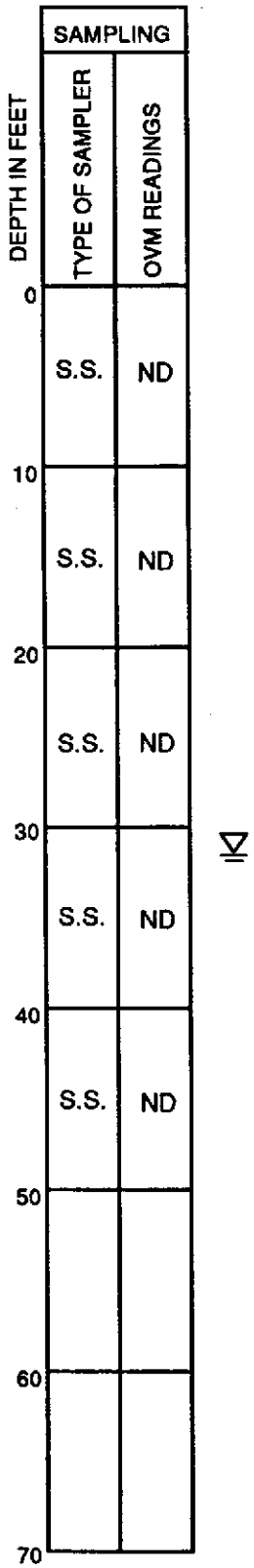
TYPES OF SOIL SAMPLERS

- U - DAMES & MOORE TYPE "U" SAMPLER
- P - PISTON-TUBE SAMPLER 3" DIAMETER
- MC- MODIFIED CALIFORNIA SAMPLER
- A - HAND AUGER

SOIL CLASSIFICATION CHART AND KEY TO SAMPLING

Dames & Moore

SOIL BORING SB1



SYMBOLS	DESCRIPTION
ML	BROWN SANDY SILT, with little fine to coarse sand.
CL	MOTTLED GRAY BROWN SILTY CLAY with some fine sand, little fine gravel, with occassional sandy layers (Water Encountered at 33.5 feet)
SM	GREENISH GRAY CLAYEY FINE SAND with little fine to coarse gravel
CL	BROWN CLAY with little coarse to fine sand, trace coarse to fine gravel
SM	GREENISH GREY CLAYEY FINE SAND with little coarse to medium sand trace fine gravel

NOTES:

1. Boring completed at a depth of 45.0 feet on 6/23/92.
2. Boring log indicates interpreted subsurface conditions only at the location and the time the boring was drilled.
3. For an explanation of terms used see the Soils Classification Chart, Plate D-8.
4. The soil boring was sampled continuously with a standard split spoon (S.S.)

LOG OF BORING

Dames & Moore

SOIL BORING SB2

DEPTH IN FEET	SAMPLING: TYPE OF SAMPLER	SAMPLING: OVM READINGS	SYMBOLS	DESCRIPTION
0	S.S.	ND	SM	BROWN CLAYEY FINE SAND with some coarse sand and fine gravel
10	S.S.	ND	CL	BROWN SILTY CLAY with some fine sand and fine gravel with occasional silty clay, some fine sand and fine gravel layers
20	S.S.	ND	CL	BROWN SANDY SILTY CLAY with a little fine gravel, occasional layers of brown silty sand with some fine and coarse gravel
30	S.S.	ND		Grades greenish gray with occasional pockets of fine sand @ 33.5 feet ▽
40	S.S.	ND		(Water encountered at 33.5 feet)
50	S.S.	ND	ML	DARK GRAY CLAYEY FINE SAND with some coarse to fine gravel
60	S.S.	ND	ML	BROWN CLAYEY FINE SAND with trace fine grave to fine sandy clay, with occasional silty clay and clayey silt layer
70				

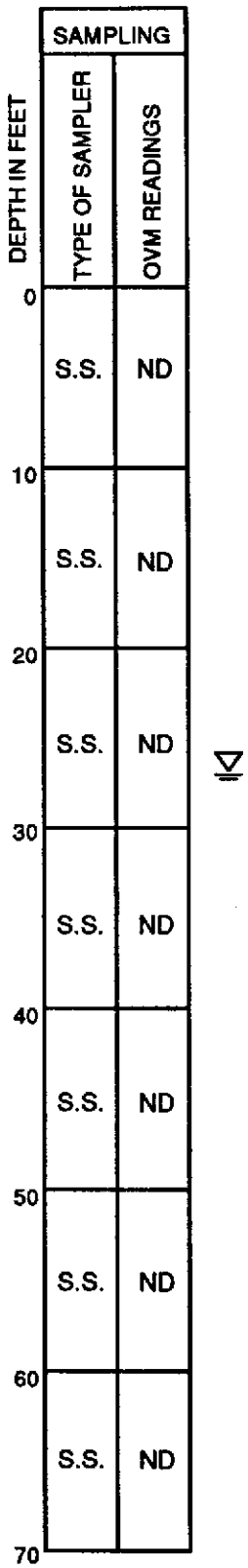
NOTES:

1. Boring completed at a depth of 62.5 feet on 6/23/92.
2. Boring log indicates interpreted subsurface conditions only at the location and the time the boring was drilled.
3. For an explanation of terms used see the Soils Classification Chart, Plate D-8.
4. The soil boring was sampled continuously with a standard split spoon (S.S.)

LOG OF BORING

Dames & Moore

SOIL BORING SB3



SYMBOLS	DESCRIPTION
ML	LIGHT BROWN SILT, with some fine sand, trace coarse sand, fine gravel
SM/SW	BROWN FINE SAND, with some fine gravel, little silt (moist)
GM	BROWN SILTY FINE GRAVEL, and coarse to fine sand (occasional semi-saturated and saturated pockets were encountered 12 to 17 ft.)
SM	BROWN SILTY FINE SAND, with some fine gravel, trace clay, coarse gravel Very moist material encountered at 25 feet
CL	CLAY with some fine sand trace fine gravel
ML/CL	GREENISH GRAY SILT with some clay, fine to coarse sand, fine gravel (moist) with occasional layers of silty sand
ML/CL	BROWN CLAYEY SILT with trace coarse to fine sand, trace fine gravel
	Grades with occasional pockets of fine sand

NOTES:

1. Boring completed at a depth of 59.5 feet on 6/25/92.
2. Boring log indicates interpreted subsurface conditions only at the location and the time the boring was drilled.
3. For an explanation of terms used see the Soils Classification Chart, Plate D-8.
4. The soil boring was sampled continuously with a standard split spoon (S.S.)

LOG OF BORING

Dames & Moore

SOIL BORING SB4

DEPTH IN FEET	SAMPLING: TYPE OF SAMPLER	SAMPLING: OVM READINGS
0	S.S.	ND
10	S.S.	ND
20	S.S.	ND
30	S.S.	ND
40	S.S.	ND
50	S.S.	ND
60	S.S.	ND
70		

▽

SYMBOLS	DESCRIPTION
ML	REDDISH BROWN SANDY SILT with trace fine gravel and clay
SM	BROWN SILTY FINE SAND with a little coarse to fine gravel, trace coarse to medium sand
SM/ML	BROWNISH YELLOW SILTY COARSE TO FINE SAND with trace clay, trace coarse to fine gravel, with occasional layers of clayey silt to sandy silt (Water encountered at 36.5 feet)

NOTES:

1. Boring completed at a depth of 53 feet on 6/25/92.
2. Boring log indicates interpreted subsurface conditions only at the location and the time the boring was drilled.
3. For an explanation of terms used see the Soils Classification Chart, Plate D-8.
4. The soil boring was sampled continuously with a standard split spoon (S.S.)

LOG OF BORING

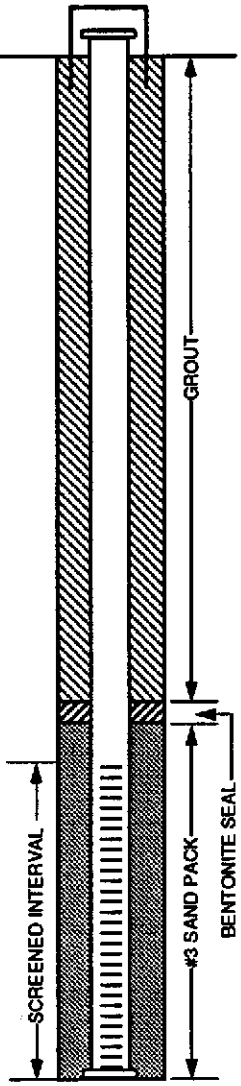
Dames & Moore

MONITORING WELL DMW4

Elevation: 400.64 feet

DEPTH IN FEET	SAMPLING: TYPE OF SAMPLER	SAMPLING: OVM READINGS
0	S.S.	ND
10	S.S.	ND
20	S.S.	ND
30	S.S.	ND
40	S.S.	ND
50	S.S.	ND
60		
70		

SAMPLES	SYMBOLS	DESCRIPTION
	SM	YELLOWISH-RED SILTY FINE SAND, little coarse to medium sand, fine gravel, occasional boulders
	ML	YELLOWISH-RED SILT with some clay, fine sand, little fine gravel and coaarse to medium sand. (Groundwater encountered at approximately 26 feet) (Semi-saturated and saturated pockets were encountered from 29 to 39 ft.)
	SW	YELLOWISH-REDCLAYEY COARSE TO FINE SAND, with a little fine gravel
	SW/CL	Grades with more clay
	CL	GREENISH GREY CLAY, with some fine sand, trace fine gravel



NOTES:

1. Boring completed at a depth of 55.5 feet on 6/29/92, monitoring well installed on 6/30/92)
2. 4-inch PVC observation well installed to a depth of 55.0 feet; screened interval from 38.0 to 55.0 feet.
3. Boring log indicates interpreted subsurface conditions only at the location and the time the boring was drilled.
4. For an explanation of terms used see the Soils Classification Chart, Plate D-8.
5. The soil boring was generally sampled at 5 foot intervals with a standard split spoon (S.S.)
6. Last waterwell measurement was taken on 7/17/92, at a depth of 28.14 measured from the top of the well monument.

LOG OF BORING

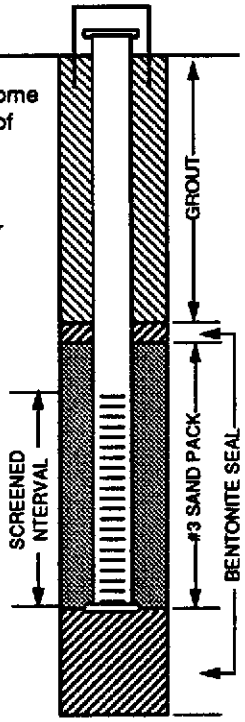
Dames & Moore

MONITORING WELL DMW5

Elevation: 375.87 feet

DEPTH IN FEET	SAMPLING: TYPE OF SAMPLER	SAMPLING: OVM READINGS
0	S.S.	ND
10	S.S.	ND
20	S.S.	ND
30	S.S.	ND
40	S.S.	ND
50		
60		
70		

SAMPLES	SYMBOLS	DESCRIPTION
	SM	REDDISH BROWN SILTY COARSE TO FINE SAND, with some fine gravel, trace coarse gravel, clay, with occasional layers of silty clay and fine sandy silt
	ML	
	CL	(Semi-saturated and saturated pockets were encountered for 11 to 15 ft.)
	SM	
	GM	
	CL	
	SM	
	GM	
	CL	
	SM	
	ML	
	SM	
	ML	
	GM	
	SM	



NOTES:

1. Boring completed at a depth of 35.5 feet on 6/30/92, monitoring well installed on 7/1/92
2. 4-inch PVC observation well installed to a depth of 35.5 feet; screened interval from 18.0 to 30.0 feet.
3. Boring log indicates interpreted subsurface conditions only at the location and the time the boring was drilled.
4. For an explanation of terms used see the Soils Classification Chart, Plate D-8.
5. The soil boring was generally continously sampled with a standard split spoon (S.S.)
6. Last waterwell measurement was taken on 7/17/92, at a depth of 11.18 from the top of the well monument.

LOG OF BORING

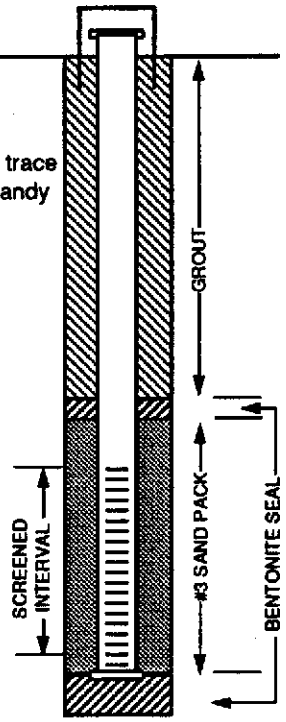
Dames & Moore

MONITORING WELL DMW6

Elevation 376.37

DEPTH IN FEET	SAMPLING: TYPE OF SAMPLER	SAMPLING: OVM READINGS
0	S.S.	ND
10	S.S.	ND
20	S.S.	ND
30	S.S.	ND
40		
50		
60		
70		

SAMPLES	SYMBOLS	DESCRIPTION
	SM	YELLOW BROWN SILTY FINE SAND with some fine gravel trace coarse gravel, clay and occassional layers of silty clay and sandy silt.
	ML	
	SM	
	ML	
	SM	
	ML/CL	
	SM	GREY CLAYEY SILT with some fine sand, trace coarse to medium sand, trace fine gravel (moist)
	ML/CL	
	GW	(Water encountered at 24.0 feet)
ML		
	GW	
	ML	
	ML/CL	



NOTES:

1. Boring completed at a depth of 36.0 feet on 7/1/92, monitoring well installed on 7/1/92
2. 4-inch PVC observation well installed to a depth of 34 feet; screened interval from 22.0 to 34.0 feet.
3. Boring log indicates interpreted subsurface conditions only at the location and the time the boring was drilled.
4. For an explanation of terms used see the Soils Classification Chart, Plate D-8.
5. The soil boring was generally sampled at 5 foot intervals with a standard split spoon (S.S.)
6. Last waterwell measurement was taken on 7/17/92, at a depth of 10.98 from the top of the well monument.

LOG OF BORING

Dames & Moore