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Draft Report

Subsurface Gas Investigation Metro Rail Orange Line Western Extension

Prepared for

Parsons Brinckerhoff Quade & Douglas, Inc.
Orange, California

July 1992

PE362.01

Engineering-Science, Inc.
Design ■ Research ■ Planning
199 South Los Robles Avenue ■ P.O. Box 7056 ■ Pasadena, California 91101

ES ENGINEERING-SCIENCE

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SECTION 1

INTRODUCTION

This subsurface gas investigation is an extension of previous investigations and studies conducted to characterize subsurface gases along candidate alignments for the Metro Rail Project. The focus of this investigation is the Western Extension of the Orange Line Metro Rail Route, as shown on Figure 1. Data from this investigation supplements existing data from previous investigations along Wilshire Boulevard from Western to Crenshaw, along Crenshaw Boulevard from Wilshire to Pico, and along Pico from Crenshaw to San Vincente Boulevard.

The investigation included drilling holes for six new probes, soil sampling and logging, installation of six new probes, gas monitoring, measurement of water levels, and gas sampling and analysis.

1.1 BACKGROUND AND AUTHORIZATION

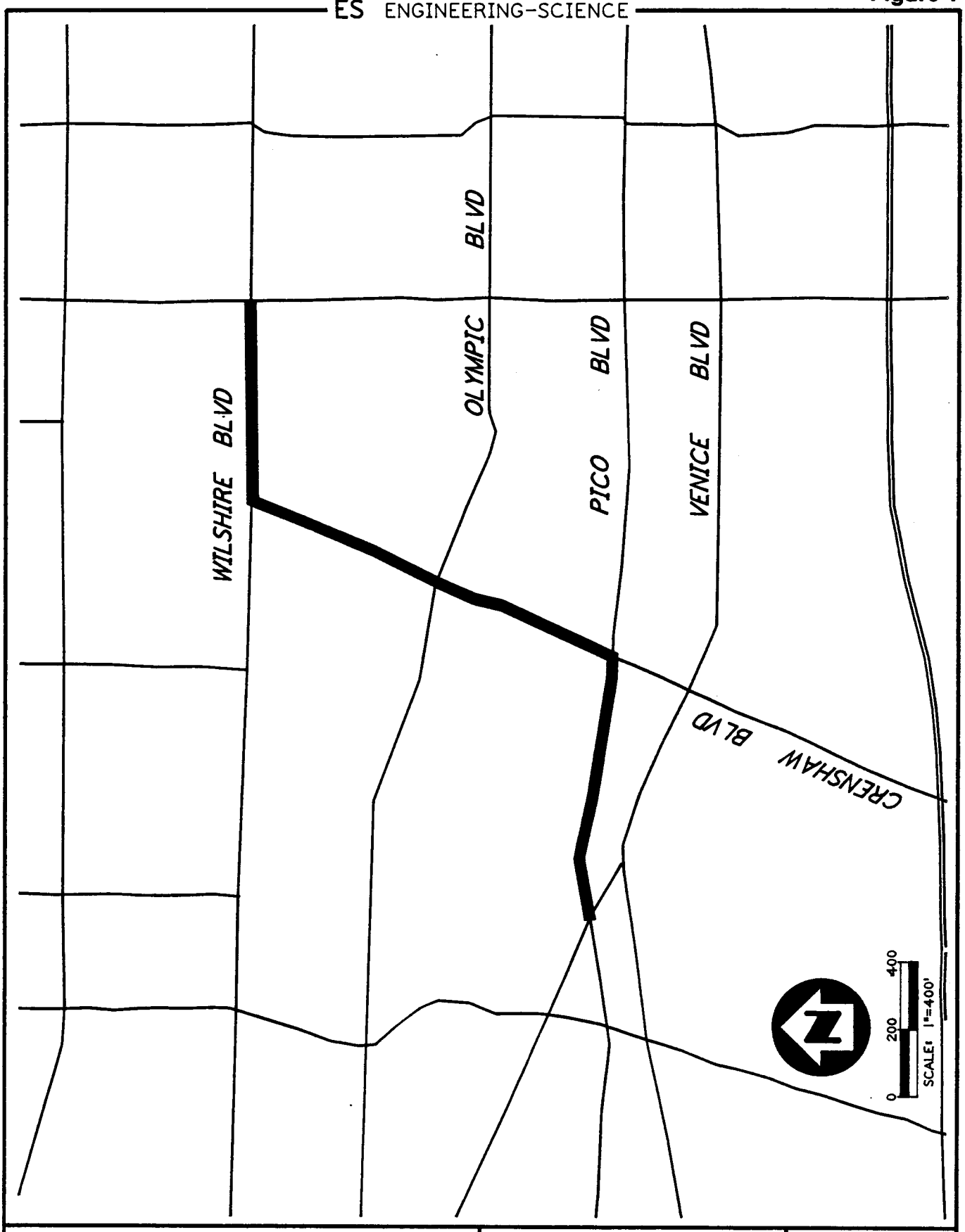
The background for the study of alternate alignments and their subsurface gas investigations along these alignments was described in the Core Study, Subsurface Conditions Report by Engineering-Science, April 1986, and is not repeated in this report.

In April of 1992, ES was retained by Parsons Brinckerhoff to conduct a subsurface gas investigation along the Western Extension of the Orange Line Metro Rail Route. A copy of the Health and Safety Plan for this investigation is in Appendix A.

2.1 OBJECTIVE OF THE INVESTIGATION

The objective of the investigation was to evaluate the subsurface gas conditions along the Western Extension of the Orange Line Metro Rail Route. This entailed the installation of six gas monitoring probes along the proposed route, and subsequent monitoring and sampling of these newly installed probes as well as existing probes installed in 1983 and 1986 along this alignment. Two monitoring rounds were implemented. Gas samples were taken from three of the six new probes in which gases were collected for laboratory analysis of the hydrogen sulfide, carbon monoxide, fixed gases, natural gases, and aromatic volatile organic compounds.

Figure 1



ENGINEERING-SCIENCE	METRO RAIL PROJECT ORANGE LINE WESTERN EXTENSION	

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SECTION 2

PROBE INSTALLATION AND MONITORING

This section describes probe location criteria, boring activities, soil sampling, probe design and installation, and probe monitoring.

2.1 PROBE LOCATIONS

New and existing probes are located approximately 1,000 feet apart along the candidate alignment. A map of the six new probes and the relevant probes installed in 1983 and 1986 is presented as Figure 2. Probe numbers, shallow and deep probe depths, and depth to groundwater during drilling are listed in Table 1. Individual probe location drawings for the six new probes are given in Appendix B. To identify and reduce the possible interference with subsurface structures and utilities, these drawings were made from photostatic copies of City of Los Angeles subsurface maps. Probe locations were selected to clear underground utilities and other substructures and to minimize disruptions to traffic flow and access to buildings. All probe locations were reviewed by the appropriate agencies and utilities for interference with underground structures.

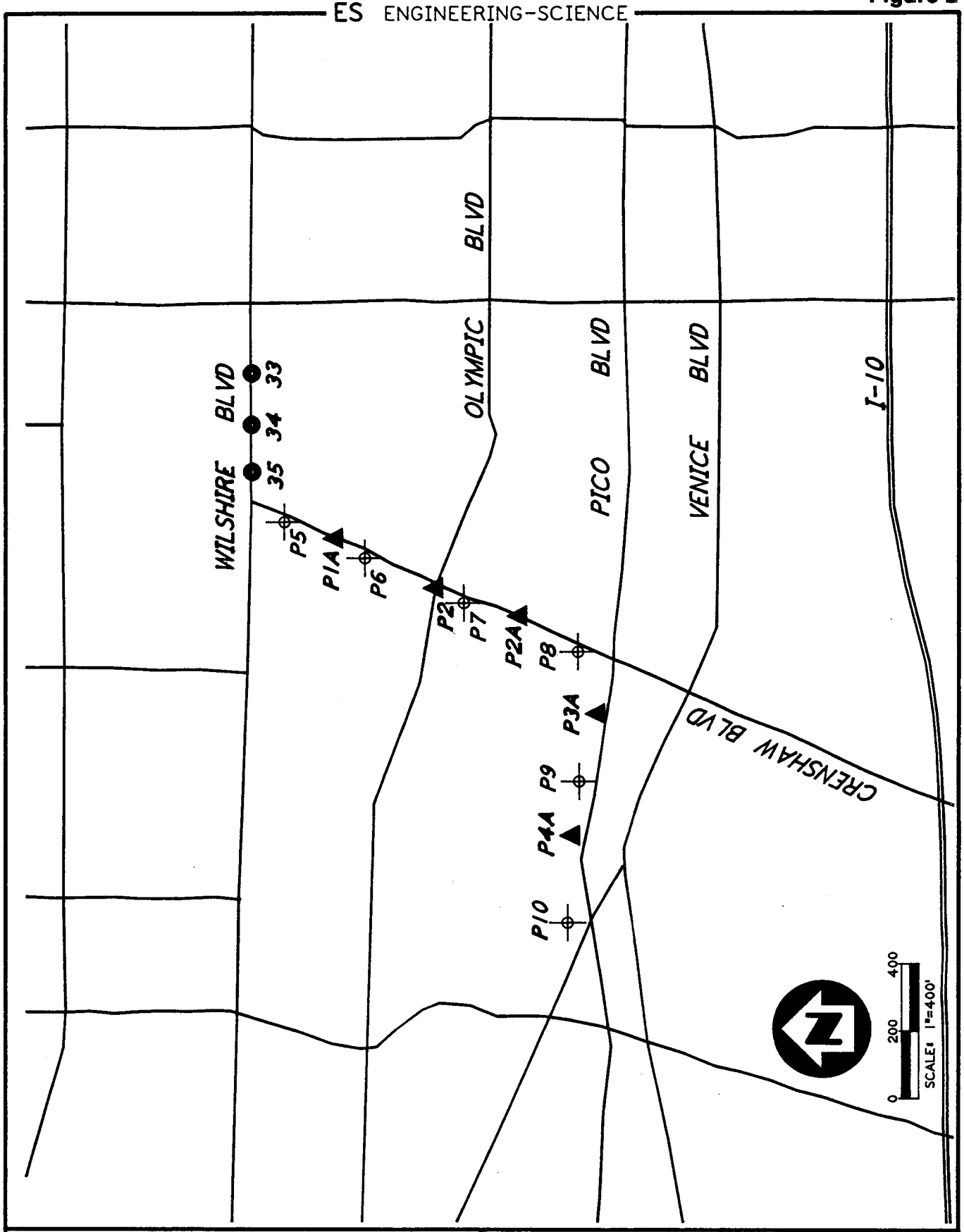
Appropriate permits were obtained from both the City of Los Angeles and the County of Los Angeles Department of Health Services prior to the start of drilling operations. Copies of these permits can be found in Appendix C.

2.2 SOIL BORINGS

Prior to drilling at each probe location, a hand auger boring was advanced to approximately a five foot depth to explore for subsurface utility lines not otherwise identified on the City of Los Angeles substructure maps. At probes located in street pavement with asphalt surfacing, it was necessary to core through the surface pavement to prevent the possibility of being delayed should concrete paving be present beneath the asphalt surface.

All borings were drilled with a truck-mounted Central Mine Equipment (CME) Model 75 drill rig. An eight-inch diameter boring was drilled at each location to an approximate total depth of 60 to 99 feet below the ground surface with hollow stem auger equipment. Soil boring depths were determined by using tunnel alignment and depth drawings provided by Parsons Brinckerhoff. Samples of subsurface geologic formations and soil were obtained at five foot intervals with an eighteen-inch long, two and one-half-inch inside diameter split spoon sampler. The soil and rock samples were logged by an ES geologist in accordance with the Unified Soil Classification System.

Figure 2



ENGINEERING-SCIENCE	METRO RAIL PROJECT ORANGE LINE PROBE LOCATIONS	DATE INSTALLED ● 1983 ▲ 1986 ⊕ 1992

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TABLE 1

METRO RAIL ORANGE LINE - WESTERN EXTENSION
PROBE LOCATIONS AND DEPTHS

Probe Number	Location	Depth *		GW Depth During Drilling
		Deep Probe	Shallow Probe	
P-5	Crenshaw & Eighth St.	77	32	36
P-6	Crenshaw & Ninth St.	77	32	36
P-7	Crenshaw & Country Club Dr.	57	16	20
P-8	Crenshaw & Pico Bl.	93	70	74
P-9	Pico & Queen Anne Place	95	66	70
P-10	San Vincente & Keniston Ave.	56	32	N/E
33	Wilshire & Gramercy Dr.	70	20	21
34	Wilshire & Van Ness Ave.	60	24	30
35	Wilshire & Irvine Bl.	65	30	35
P1A	Crenshaw & Eighth St.	59	28	32
P2	Crenshaw & Olympic Bl.	60	12	16
P2A	Opposite 1140 Crenshaw Bl.	59	30	35
P3A	Pico & Windsor Bl.	66	33	N/E
P4A	Pico & Mullen Ave.	60	22	28

* = Depth in feet below finish grade

N/E = Not Encountered

Soil boring logs can be found in Appendix D. Methane gas, oxygen, and hydrogen sulfide concentrations were measured at five foot intervals during drilling operations. The drill cuttings, split spoon samples, drillers breathing zone, and the top of the borehole were monitored with an MSA-361 Gas Detector and a MicroTip Photoionization Detector to ensure safety of the field personnel.

Soil cuttings generated during drilling were contained in DOT-approved 55-gallon drums and stored in a central location pending soil analytical results. Laboratory results indicated that the soils were not hazardous. All drums have been removed from the temporary storage facility under a Non-Hazardous Waste Manifest to an appropriate disposal facility.

2.3 PROBE DESIGN

A typical probe construction and a probe head assembly are illustrated in Figures 3 and 4, respectively.

Each monitoring location includes a deep and a shallow gas monitoring probe. The deep probe was installed at the anticipated rail depth plus ten feet. The second probe was installed at approximately one-half the deep probe length, or four feet above the water table as encountered during drilling. Gas probes are constructed of one-inch diameter Schedule 40 PVC flush-threaded pipe. Screened intervals are constructed of one-inch outside diameter Schedule 40 PVC pipe with .020-inch slots. The five foot screened interval is set in a #3 Monterey Sand filter pack extending two to three feet above and below the screened interval. An expansive bentonite pellet seal extends two feet above the top of the filter pack. Bentonite chips extend from the bottom bentonite seal to a second bentonite pellet seal above the water table. The second vadose gas monitoring probe is constructed on top of the upper bentonite pellet seal in a manner similar to the deep probe.

Probe head assemblies consist of a one-inch diameter, Schedule 80 PVC gate valve fitted on top of the one-inch casing. The top of the ball valve is fitted with a threaded plug. The probe head assembly is covered with a traffic vault mounted flush with the ground surface.

2.4 PROBE FIELD INSTALLATION

Probe installation began with probe P-6 on May 27, 1992. Probe locations can be found in Figure 2. In all, seven borings were drilled and six probes were installed. The initial boring for probe P-7 was abandoned after hitting thick concrete at three feet below ground surface (bgs). The new location for P-7 was moved to the south side of Country Club Drive (see Appendix B). No drilling was initiated at this new location until all underground utilities were identified.

Probes P-7, P-9, and P-10 were drilled and installed using Level B respiratory protection (air-line supplied oxygen with full-face respirators). Probes P-5, P-6, and P-8 were drilled and installed using Level D respiratory protection. See the Project Health and Safety Plan (Appendix A) for a description of site action levels.

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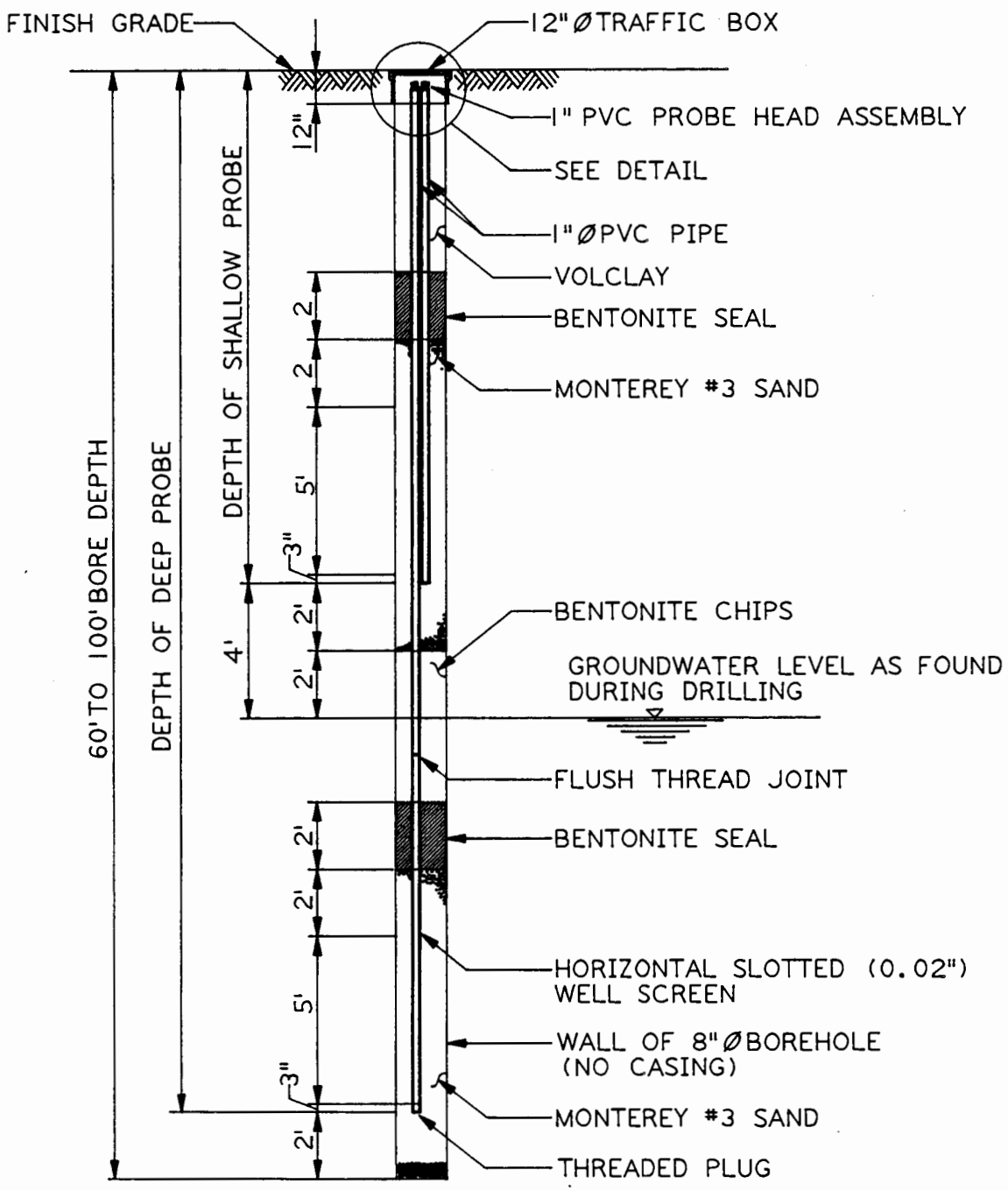

ENGINEERING-SCIENCE	TYPICAL GAS PROBE CONSTRUCTION DIAGRAM	

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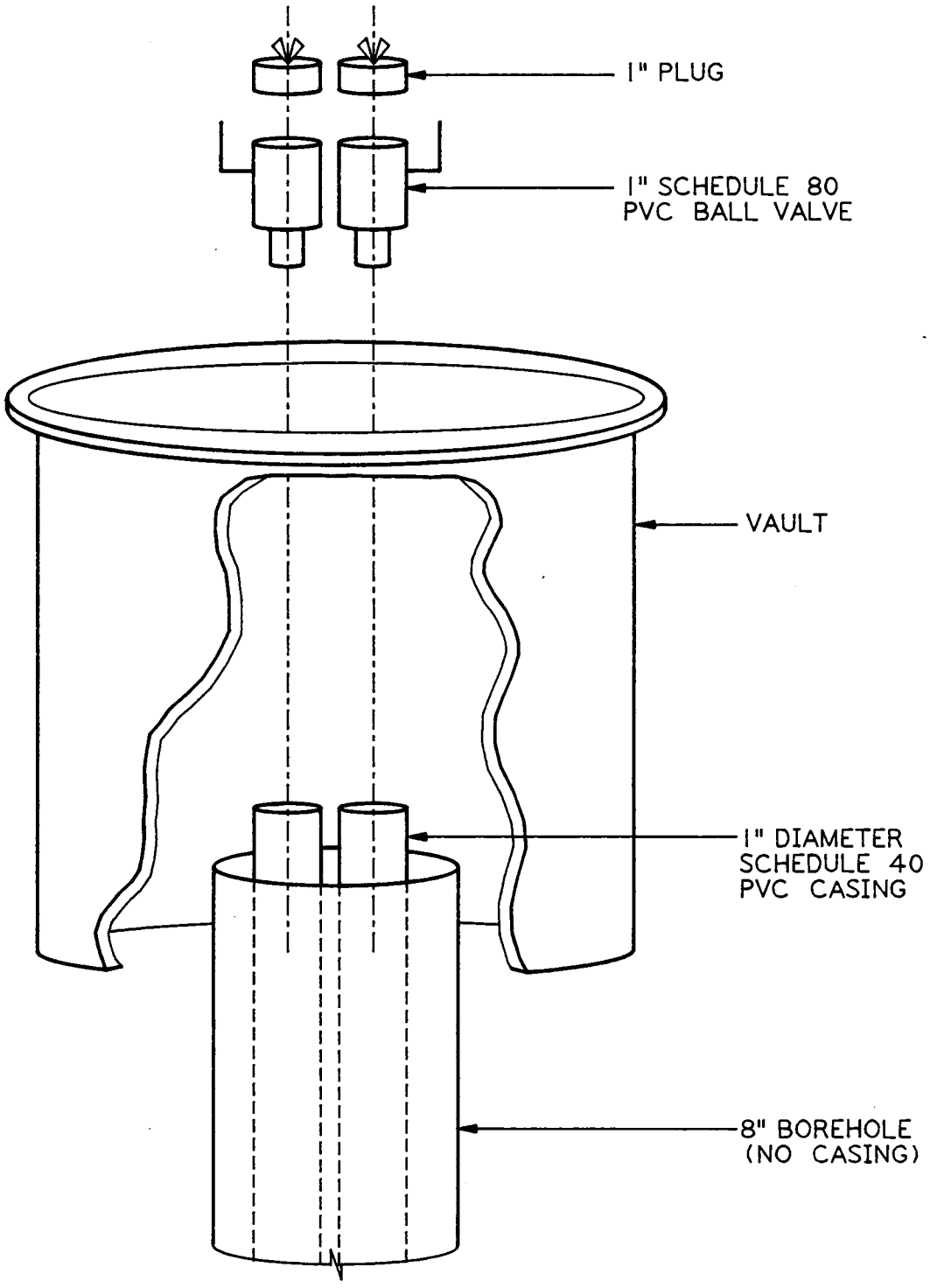
Figure 4



ENGINEERING-SCIENCE	**DETAILED PROBE HEAD ASSEMBLY DIAGRAM**	

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2.5 PROBE MONITORING

Two monitoring rounds were conducted in this study. The first monitoring round was conducted on June 10, 1992, approximately one week after completion of the probe installation. Only the six new probes were monitored during the first round. During the second round, conducted on June 23, 1992 (13 days after the first round), all the probes in the study area (eight existing and six new) were monitored. The gas pressure, combustible gas, hydrogen sulfide, and oxygen were measured by opening the plug above the gate valve and inserting a rubber cork. The rubber cork has a hole in its center to accommodate the Tygon tube with a snug fit. The gas pressure was measured in inches of water column at each probe head with a Magnehelic pressure gauge. Concentrations of combustible gas in percent of lower explosion limit (LEL), hydrogen sulfide in parts per million (ppm), and oxygen in percent of total gas were measured with a portable MSA-361 Gas Detector. Groundwater level was measured by lowering the Solinst probe through the opening in the gate valve when it is opened completely. The field monitoring data is included in Section 3. Water levels were measured to the nearest one-hundredth foot, in depth below finish grade (top of traffic box).

2.6 GAS SAMPLE ANALYSIS

Gas samples from P-6, P-7, and P-10 were obtained during the second monitoring round, following measurement of gas concentrations by the MSA Gas Detector. The three probes for laboratory analysis were selected based on highest combustible gas concentrations found in the first round. The gas samples were withdrawn by an Aerovironment pulse pump and contained within 4 mil thickness, 1 liter Tedlar bags. The three gas samples were delivered under chain of custody procedures to Enseco Air Toxic Laboratory, a State of California Certified Laboratory located in El Monte, California. The selected gas samples were analyzed in the laboratory by gas chromatograph and mass spectrometer (GC-MS) for hydrogen sulfide, carbon monoxide, Fixed Gas Analysis (oxygen, nitrogen, carbon dioxide, and methane), Natural Gas (ethane, propane, i-butane, n-butane, neo-pentane, i-pentane, n-pentane, hexanes, heptanes, and octanes), and BTEX (benzene, toluene, ethyl-benzene, and total xylenes).

SECTION 3

RESULTS

3.1 FIELD SCREENING DURING PROBE INSTALLATION

Monitoring of soils during drilling and probe installation detected high levels of hydrogen sulfide at three locations (Probes P-7, P-9, and P-10). As a result, probes P-7, P-9, and P-10 were installed by personnel using air-line respirators. Hydrogen sulfide levels ranged from 0 to 32 ppm in the breathing zone during probe installations. Lower concentrations of methane were also detected. Levels ranged from 0 to 0.35% by volume in air during probe installation. This is well below the lower explosive limit (LEL) for methane (5% by volume in air).

Water levels recorded during drilling and probe installation were utilized for determining the shallow probe depths. Water levels encountered during hollow stem auger drilling in materials of low hydraulic conductivity can be misleading due to the slow recharge of groundwater into the borehole. For this reason, probes were not installed until water table levels appeared to have stabilized. Groundwater depths during drilling are summarized in Table 1.

3.2 PROBE MONITORING RESULTS

Probe monitoring results can be found in Tables 2, 3, and 4. Table 2 summarizes the results from the first round of field monitoring on June 10, 1992. Only the six new probes were monitored during this round. Probes P-7 (deep), P-9 (deep), and P-10 (deep) all showed levels of hydrogen sulfide above the Immediately Dangerous to Life or Health (IDLH) threshold. All six probe locations had either the deep and/or shallow probes with methane concentrations above the LEL. Pressures ranged from 0 to 2.1 inches of water during the first round of monitoring.

Table 3 illustrates the results of the second round of field monitoring conducted on June 23, 1992. All 14 probes (6 new, 8 old) were monitored during Round 2. Results for the six new probes were similar to Round 1. Probes P-7 (deep), P-9 (deep), and P-10 (deep) again showed concentrations well above the IDLH threshold for hydrogen sulfide. All six locations had either the deep and/or shallow probes with methane levels above the LEL. Pressures ranged from 0 to 5.0 inches of water. Much lower concentrations and pressures were found in the eight older probes. Only probe P-2 (deep) was detected to have methane (9% of LEL). The other probes did not indicate the presence of hydrogen sulfide, methane, or pressure. Probes 33 and 35 were not found and may have been paved over.

TABLE 2

METRO RAIL ORANGE LINE ROUND ONE MONITORING
JUNE 10, 1992

Probe Number	Pressure (inches of H_20)[1]	H_2S (ppm)	LEL (% LEL)[2,3,4]	Oxygen (% in air)
P-5 (shallow)	0	0	0	18.4
P-5 (deep)	0	0	Over	14.1
P-6 (shallow)	0	0	0	19.9
P-6 (deep)	+0.15	0	Over	10.7
P-7 (shallow)	0	1	Over	8.5
P-7 (deep)	+2.1	769	Over	3.6
P-8 (shallow)	0	0	Over	20.1
P-8 (deep)	0	0	2	17.7
P-9 (shallow)	0	0	Over	19.4
P-9 (deep)	+1.9	743	Over	8.3
P-10 (shallow)	0	0	Over	20.2
p-10 (deep)	+1.8	740	Over	9.6

[1] +2.1 = Indicates Positive Pressure

[2] LEL = Lower Explosive Limit for Methane

[3] Over = Indicates over LEL for Methane

[4] LEL of Methane = 5% by Volume in Air

TABLE 3

METRO RAIL ORANGE LINE ROUND 2 MONITORING
JUNE 23, 1992

Probe Number	Pressure (inches of H_20)	H_2S (ppm)	LEL (% LEL)	Oxygen (% in air)	Depth to GW (ft bgs)	Comments
P-5 (shallow)	0	0	10	17.2	NA	Positive pressure
P-5 (deep)	+5.0	3	Over	17.8	48.8	in deep probe
P-6 (shallow)	0	0	0	20.8	NA	
P-6 (deep)	0	0	Over	14.1	67.74	
P-7 (shallow)	0	0	Over	1.8	NA	Positive pressure and
P-7 (deep)	+2.8	698	Over	11.9	NM	H_2S in deep probe
P-8 (shallow)	+0.25	0	Over	3.9	NA	Positive pressure
P-8 (deep)	+0.3	2	76	19.5	80.98	in both probes
P-9 (shallow)	+0.2	0	Over	3.9	NA	Positive pressure in both
P-9 (deep)	+3.0	743	Over	11.2	NM	probes; H_2S in deep probe
P-10 (shallow)	0	0	Over	20.8	NA	H_2S in deep probe
P-10 (deep)	+2.3	754	Over	NM	NM	
33 (shallow)	NM	NM	NM	NM	NM	Not found; possibly
33 (deep)	NM	NM	NM	NM	NM	paved over
34 (shallow)	NM	NM	NM	NM	NA	Probe heads missing
34 (deep)	NM	NM	NM	NM	25.66	
35 (shallow)	NM	NM	NM	NM	NM	Not found; possibly
35 (deep)	NM	NM	NM	NM	NM	paved over
P1A (shallow)	0	0	0	18.1	NA	Top of shallow probe
P1A (deep)	0	0	0	19.5	35.63	head broken
P2 (shallow)	0	0	0	5.7	NA	Probe requires
P2 (deep)	0	0	9	18.6	54.66	maintenance
P2A (shallow)	0	0	0	17.9	NA	Probe requires
P2A (deep)	0	0	0	20.8	NM	maintenance
P3A (shallow)	0	0	0	14.7	NA	Probe requires
P3A (deep)	0	0	0	10.0	Dry	maintenance
P4A (shallow)	0	0	0	16.7	NA	Probe requires
P4A (deep)	0	0	0	20.8	22.58	maintenance

GW = Groundwater
BGS = Below Ground Surface
LEL = Lower Explosive Limit for Methane
Over = Indicates over LEL for Methane
+2.8 = Indicates Positive Pressure
NA = Not Applicable
NM = Not Measured
LEL of Methane = 5% by Volume in Air

Laboratory analytical results of gas samples collected from P-6 (deep), P-7 (deep), and P-10 (deep) are summarized in Table 4. The concentrations of oxygen and nitrogen ranged from 0.9 to 9.3% (v/v) and 4.4 to 45.6% (v/v), respectively. Carbon dioxide levels ranged from 1.1 to 6.0% (v/v), whereas methane concentrations ranged from 43.7 to 91.3% (v/v). Ethane (ND to 0.6%), propane (ND to 0.09%), hexanes (ND to 0.07%), and heptanes (ND to 0.25%) were the only natural gasses detected. Benzene (ND to 6.9 ppm), toluene (0.26 to 2.0 ppm), ethyl benzene (ND to 2.7 ppm), and total xylenes (0.12 to 0.57 ppm) were also detected. Carbon monoxide concentration remained below 100 ppm in all three samples. Hydrogen sulfide sample concentrations were highly variable and ranged from 0.39 to 3,300 ppm. Copies of the laboratory analytical results can be found in Appendix E.

A compilation of the highest historical monitoring data along the Western Extension of the Orange Line Metro Rail alignment can be found in Table 5. This table indicates that methane concentrations have ranged from 0 to 91.3% (v/v) throughout the subject alignment. In addition, hydrogen sulfide concentrations and pressure have ranged from 0 to 3,300 ppm and 0 to 5 inches of water, respectively. Supplemental historical monitoring data for the eight older probes are located in Appendix F.

TABLE 4

METRO RAIL ORANGE LINE
PROBE GAS SAMPLE ANALYTICAL RESULTS

Analytical Parameters	P-6 (deep)	P-7 (deep)	P-10 (deep)
Fixed Gas Analysis *			
Oxygen	9.3	1.0	0.9
Nitrogen	45.6	4.6	4.4
Carbon Dioxide	1.1	2.9	6.0
Methane	43.7	91.3	88.0
Natural Gas Analysis *			
Ethane	<0.1	<0.1	0.6
Propane	<0.01	<0.01	0.09
i-Butane	<0.01	<0.01	<0.01
n-Butane	<0.01	<0.01	<0.01
neo-Pentane	<0.01	<0.01	<0.01
i-Pentane	<0.01	<0.01	<0.01
n-Pentane	<0.01	<0.01	<0.01
Hexanes	0.07	0.03	<0.01
Heptanes	0.25	0.14	<0.01
Octanes and Higher Molecular Weight Hydrocarbons	<0.01	<0.01	<0.01
BTEX Analysis **			
Benzene	<0.080	6.9	0.48
Toluene	0.74	0.26	2.0
Ethyl Benzene	<0.020	0.62	2.7
Total Xylenes	0.12	0.35	0.57
Hydrogen Sulfide **	0.39	280	3,300
Carbon Monoxide **	<100	<100	<100

* Results are presented in % by volume in air (% v/v)

** Results are presented in ppm (v/v)

TABLE 5
METRO RAIL ORANGE LINE HIGHEST HISTORICAL MONITORING DATA ALONG SUBJECT ALIGNMENT

Probe Number	Date Sampled	Methane (% by vol)	Date Sampled	H_2S (ppm)	Date Measured	Presure (inches (of H_2O)
P-5 (shallow)	6/23/92	0.5	6/23/92	0	6/23/92	0
P-5 (deep)	6/23/92	>5.0	6/23/92	3	6/23/92	5.0
P-6 (shallow)	6/23/92	0	6/23/92	0	6/23/92	0
P-6 (deep)	6/23/92	43.7	6/23/92	0.39	6/10/92	0.15
P-7 (shallow)	6/23/92	>5.0	6/10/92	1	6/23/92	0
P-7 (deep)	6/23/92	91.3	6/10/92	769	6/23/92	2.8
P-8 (shallow)	6/23/92	>5.0	6/23/92	0	6/23/92	0.25
P-8 (deep)	6/23/92	3.8	6/23/92	2	6/23/92	0.3
P-9 (shallow)	6/23/92	>5.0	6/23/92	0	6/23/92	0.2
P-9 (deep)	6/23/92	>5.0	6/23/92	743	6/23/92	3.0
P-10 (shallow)	6/23/92	>5.0	6/23/92	0	6/23/92	0
p-10 (deep)	6/23/92	88.0	6/23/92	3,300	6/23/92	2.3
33 (shallow)	10/5/83	1.75	10/5/93	0	4/23/85	0.2
33 (deep)	3/12/85	0.35	---	N/D	4/23/85	2.4
34 (shallow)	9/1/83	0.02	---	N/D	3/27/86	0
34 (deep)	3/12/85	0.22	---	N/D	3/27/86	0
35 (shallow)	3/12/85	0.14	---	N/D	3/12/85	0.5
35 (deep)	9/1/92	0.08	---	N/D	3/12/85	0.5
P1A (shallow)	3/19/91	0.01	6/23/92	0	8/22/91	0.25
P1A (deep)	3/19/91	0.01	6/23/92	0	6/23/92	0
P2 (shallow)	3/25/86	0.01	6/23/92	0	6/23/92	0
P2 (deep)	8/22/91	4.5	6/23/92	0	3/19/91	5
P2A (shallow)	3/25/86	0.01	6/23/92	0	6/23/92	0
P2A (deep)	6/23/92	0	6/23/92	0	6/23/92	0
P3A (shallow)	6/23/92	0	6/23/92	0	6/23/92	0
P3A (deep)	6/23/92	0	6/23/92	0	8/22/91	0.05
P4A (shallow)	6/23/92	0	6/23/92	0	4/9/86	4.4
P4A (deep)	6/23/92	0	6/23/92	0	4/9/86	3.6

1. N/D = No Data Available
2. Field measurements in % LEL for methane have been converted to % by volume in air.
3. If Highest historical reading = 0, most recent data was used.

SECTION 4

DATA SUMMARY

The results of the June 10 and June 23, 1992 gas monitoring events are summarized in Tables 2, 3, and 4 in Section 3 of this report. High levels of methane and hydrogen sulfide were found throughout the Western Extension of the Metro Rail Orange Line Alignment.

METHANE

Probes P-5 (deep), P-6 (deep), P-7 (shallow/deep), P-8 (deep), P-9 (shallow/deep), and P-10 (shallow/deep) all showed methane levels above the lower explosive limit (LEL) of 5% by volume in air during field monitoring. In addition, gas samples taken from P-6 (deep), P-7 (deep), and P-10 (deep) showed methane concentrations of 43.7, 91.3, and 88.0 percent by volume, respectively. These values are well above the LEL for methane.

HYDROGEN SULFIDE

High levels of hydrogen sulfide were also found throughout the Western Extension of the Metro Rail Orange Line Alignment. Significant levels of hydrogen sulfide were found at P-7 (deep), P-9 (deep), and P-10 (deep). Levels ranged from 698 ppm to 769 ppm hydrogen sulfide during field instrument monitoring during Rounds 1 and 2 for these probes. These levels are well above the IDLH for H_2S. Other locations showed lower levels for hydrogen sulfide (see Tables 3 and 4). Gas samples showed a high variance of hydrogen sulfide concentrations throughout the alignment, with P-6 at 0.39 ppm H_2S, P-7 at 280 ppm H_2S, and P-10 at 3,300 ppm H_2S.

PRESSURE

Positive pressures ranging from 1.8 to 5.0 inches of water were found at probe locations P-5 (deep), P-7 (deep), P-9 (deep), and P-10 (deep). Lower levels of positive pressure were found in probes P-6 (deep), P-8 (shallow/deep), and P-9 (shallow). With the exception of probe P-5 (deep), all other probes showing elevated levels of positive pressure also exhibited high levels of hydrogen sulfide.

OXYGEN

The levels of oxygen found in the probes through the Western Extension of the Metro Rail Orange Line Alignment were highly variable. Oxygen levels ranged from 0.9% by volume in air in P-10 (deep) to 20.8% in many of the other probes. Gas

samples taken from P-6 (deep), P-7 (deep), and P-10 (deep) do appear to show a trend in which lower levels of oxygen are associated with elevated levels of methane.

Table 6 shows a summary of the range of values found for the relevant parameters measured during the project.

TABLE 6

METRO RAIL ORANGE LINE - WESTERN EXTENSION PARAMETER RANGES

Parameter (units)	Range	Comments
Methane (% v/v)	0 - 91.3	6 out of 14 probe locations show readings above the LEL throughout the alignment.
Hydrogen Sulfide (ppm)	0 - 3,300	3 out of 14 probe locations show readings above the IDLH* for Hydrogen Sulfide. Additional locations showed a presence of H_2S.
Pressure (inches of water)	0 - 5	5 out of 14 probe locations indicate positive pressure at this time.
Oxygen (% v/v)	0.9 - 20.8	Highly Variable

* IDLH = Immediately Dangerous to Life or Health. Equals 300 ppm for H_2S.

SECTION 5

CONCLUSIONS AND RECOMMENDATIONS

The information provided in this study will assist Parsons Brinckerhoff in designing the subway structures to resist the methane and hydrogen sulfide along the Western Extension of the Metro Rail Orange Line Alignment.

Field and laboratory data indicate that soils in the Western Extension of the Metro Rail Orange Line Alignment, south of Wilshire Boulevard, contain high levels of methane and hydrogen sulfide. Six out of the 14 probe locations monitored showed methane readings above the LEL (5% v/v) within the soils long the alignment. Three out of 14 probe locations monitored indicated hydrogen sulfide readings above the IDLH (300 ppm) within the soils along the alignment. Oxygen levels as low as 0.9% v/v in gas samples taken from soils along the alignment indicate oxygen deficient environments.

Based upon the data collected during this study, as well as data from previous reports on the area, Engineering-Science makes the following recommendations:

- Special health and safety provisions must be implemented to address the high hydrogen sulfide and methane concentrations as well as an oxygen deficient environment.
- Tunnel design should include appropriate measures to prevent seepage of gas into the tunnel.
- Appropriate safety systems should be in place in case unexpected excursions of gas into the tunnel occur.
- Although the pressures observed were all less than 12 inches of water, designers should assume that the soil is saturated with hydrogen sulfide/methane and implement proper design measures to address this issue.

In addition to the recommendations listed above, maintenance and/or repair is advised for probes 34, P1A, P2, P2A, P3A, and P4A. These probes were installed in 1983 and 1986 and appear to be in poor condition due to lack of maintenance. Many of these probes have corroded tubing and/or missing probe heads that could potentially lead to a release of methane or hydrogen sulfide into the atmosphere. It should also be noted that probes 33 and 35 on Wilshire Boulevard appear to have been paved over. ES recommends that these probes be located and repaired.

SECTION 6

REFERENCE

1. Compilation of Monitoring Data on Gas Probes Along Proposed Metro Rail Alignments, Metro Rail Project, Volumes I and II: Engineering-Science, Inc., October 1991.
2. NIOSH Pocket Guide to Chemical Hazards: U.S. Department of Health and Human Services, June 1990.
3. Report on Subsurface Gas Investigation, Southern California Rapid Transit District, Metro Rail Project, Phase II Alignment: Engineering-Science, Inc., February 1990.
4. Core Study, Subsurface Conditions Report, An Evaluation of Methane Gas Potential Along Candidate Alignments of L.A. Metro Rail Project: Engineering-Science, Inc., April 1986.
5. Report of Subsurface Gas Investigation, Southern California Rapid Transit District, Metro Rail Project: Engineering-Science, Inc., May 1985.

APPENDIX A

APPENDIX A

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN
FOR INSTALLATION OF GAS PROBES
ALONG WESTERN EXTENSION OF METRO RAIL
ORANGE LINE, WEST LOS ANGELES

PARSONS BRINCKERHOFF
Orange, California

Prepared By:

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199 South Los Robles Avenue
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Reviewed and Approved By:

	Name	Date
Project Manager		5-26-92
Office H & S Representative		5/26/92
Corporate H & S Representative		22 May 92

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SECTION 1

PURPOSE AND POLICY

The purpose of this plan is to provide a document which will establish personnel protection standards and mandatory safety practices on the field work for installation of gas probes along the western extension of Metro Rail Orange Line alignment in West Los Angeles. The western extension includes portions of Crenshaw, Pico, and San Vincente Boulevards. The plan will also provide for contingencies that may arise during field investigations and operations. The provisions of this plan are mandatory for all onsite investigations. All ES and subcontract personnel shall abide by this plan. Any supplemental plans used by subcontractors shall conform to this plan as a minimum. All personnel who engage in field investigation activities shall be familiar with this plan and comply with its requirements.

A site description and scope of work summary for the project are provided in Section 2. Section 3 presents the project team organization, personnel responsibilities, and lines of authority. Site-specific training and medical monitoring requirements are contained in Section 4. Section 5 presents a safety and health risk analysis. Section 6 contains the site emergency response plan, a list of emergency contacts and a map showing the route from the facility to the nearest hospital. Site-specific requirements for levels of protection are included in Section 7, and air monitoring procedures are provided in Section 8. Site control measures, including designation of site work zones, is contained in Section 9, while Section 10 provides detailed site-specific decontamination procedures. Appendix A contains a Plan Acceptance form, SCBA and Air Purifying respirator logs, a Tailgate Safety Meeting form, a Personal Acknowledgement form, and an accident report form. Appendix B contains a Material Safety Data Sheet for hydrogen sulfide and Hesis Medical Guidelines for hydrogen sulfide. Standard operating guidelines for hazardous waste site investigations are contained in ES' Corporate Health and Safety Manual, which is incorporated by reference into this Health and Safety Plan.

SECTION 2

SITE DESCRIPTION AND SCOPE OF WORK

2.1 BACKGROUND

Site Name: Metro Rail Orange Line Gas Probes along portions of Crenshaw, Pico, and San Vincente Boulevards

Site Contact: Jim Crowley (714) 973-4880

Proposed Date(s) of Work: May 27-28-29 and June 1-2-3, 1992

Overall Hazard is:

High: if H_2S is encountered

Moderate: X

Low: _____

Unknown: _____

2.2 SITE HISTORY AND DESCRIPTION

Several gas probes were installed in 1986 at an approximately 2,000 foot spacing along the proposed Metro Rail alignments along Crenshaw, Pico, and San Vincente Boulevards in West Los Angeles. Since the time of their installation, these existing probes have been monitored for combustible gas (methane) and hydrogen sulfide.

2.3 SCOPE OF WORK

The current scope of work includes drilling and installation of gas probes at six additional locations along portions of Crenshaw, Pico, and San Vincente Boulevards in West Los Angeles. Two probes, one shallow (approximately 5 feet above the groundwater table) and one deep (10 feet below the rail elevation) will be installed at each of the six locations. The new probes will be monitored twice. Monitoring of the new probes only will be conducted during the first round scheduled one week after installation. The monitoring of the new and old probes in the second round will be conducted 10 to 15 days after the first round. Selected gas samples will also be collected for chemical analyses in the laboratory.

SECTION 3

PROJECT TEAM ORGANIZATION

The project team assigned to the Metro Rail Orange Line Gas Probe Installation Project, their responsibilities, and lines of authority are outlined below.

Name	Task Assigned
John Jackson	Project Manager, Field Health and Safety Officer
Mohammad Zaidi	Field Task Manager, Alternate Field Health & Safety Officer
John Stellar	Technical Director
QA/QC Director	Randy Griffith
Mary J. Loshak	Health and Safety Officer
Phil Storrs	Corporate Health and Safety Officer

The project manager, Mr. Jackson, will report to Mr. John Stellar, Technical Director, who will be responsible for overall conduct of the project. Ms. Mary Loshak is the health and safety officer and will be responsible for updating and revising the project health and safety plan, as necessary. Ms. Loshak will also be responsible for ensuring that field team members have the necessary hazardous waste site training and will coordinate the staff medical monitoring program.

John Jackson has been designated as the site health and safety officer. As site health and safety officer, he will be responsible for ensuring that the day-to-day project activities are preformed in strict conformance with the project health and safety plan. The health and safety officer has the authority to stop work on the site if actions or conditions are judged unsafe or not in conformance with the health and safety plan.

All field team members and subcontractors are responsible for reading and conforming to the project health and safety plan. No employee shall perform a project activity that he or she believes may endanger his or her health and safety or the health and safety of others.

SECTION 4

SITE-SPECIFIC EMPLOYEE TRAINING AND MEDICAL MONITORING REQUIREMENTS

The ES corporate health and safety manual, incorporated by reference, presents general requirements for ES employee training and medical monitoring. All field team members will have the 40-hour OSHA training as specified in 29 CFR 1910.120 and a current 8-hour annual refresher course. All field team members will be on appropriate and current medical monitoring programs. Listed below are additional health and safety training and medical monitoring requirements for this project.

4.1 ADDITIONAL SAFETY TRAINING REQUIREMENTS

All ES personnel engaged in site supervisory positions will have completed the 8-hour OSHA supervisory training as specified in 29 CFR 1910.120(e). Additional training will be provided for ES personnel involved in Level B (SCBA) respiratory protection.

4.2 ADDITIONAL MEDICAL MONITORING REQUIREMENTS

None

SECTION 5

SAFETY AND HEALTH RISK ANALYSIS

5.1 CHEMICAL HAZARDS

The chemicals of primary concern at the Metro Rail Orange Line Gas Probe Installation Project will be methane and hydrogen sulfide. If other compounds are discovered at this site, the health and safety plan shall be amended, pertinent information about the compounds shall be provided in Table 5.1, and an appropriate risk analysis of the compound's hazards shall be communicated to the on-site employees. The vapor properties of these chemicals are summarized in Table 5.1.

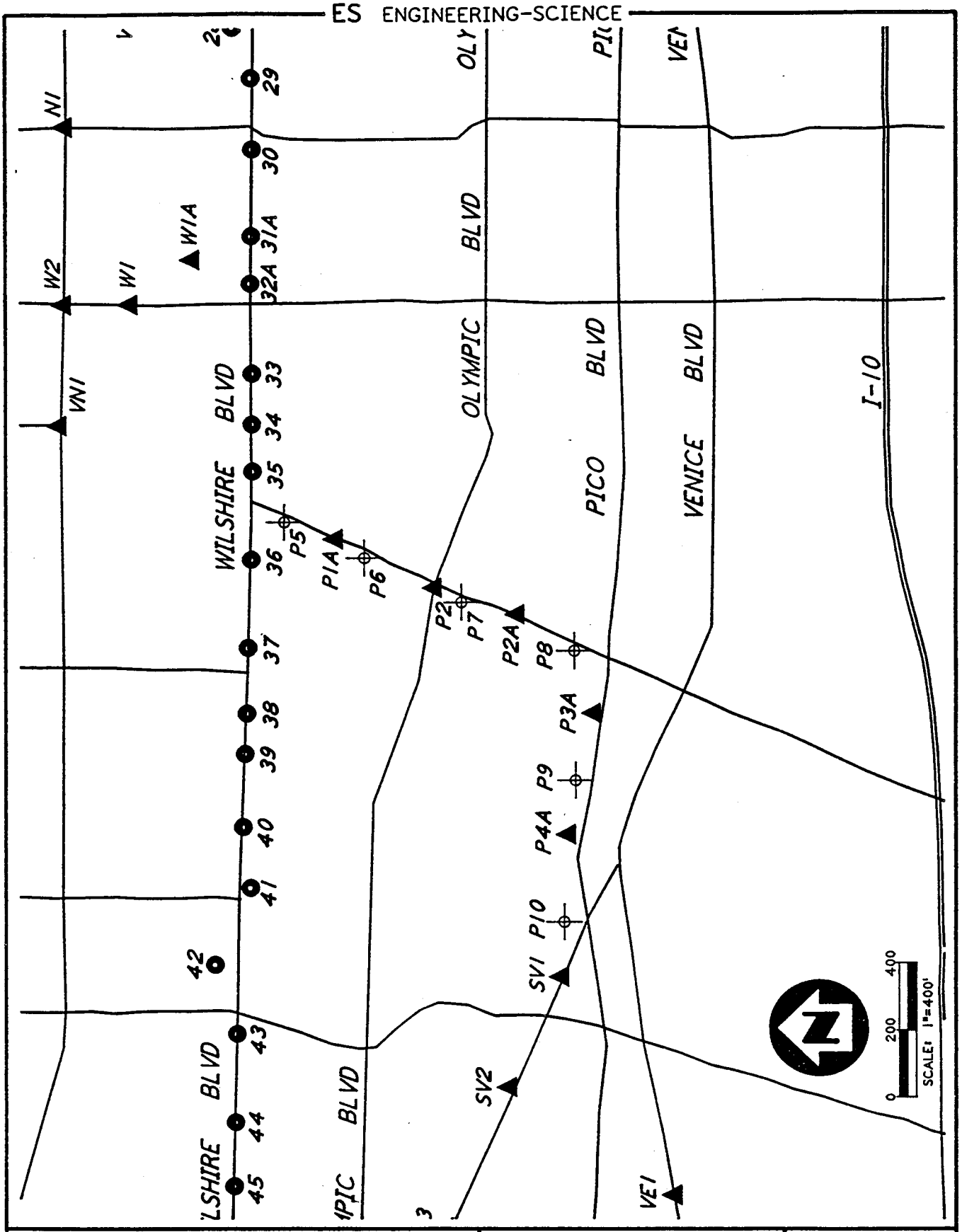
5.2 PHYSICAL HAZARDS

Explosion: Methane vapors can be highly explosive. Methane has a flash point of approximately 60°C.

Hydrogen Sulfide is a chemical asphyxiant. Due to the properties of this compound, air purifying respirators cannot be worn. Level B respiratory protection (Self Contained Breathing Apparatus) will be used at locations where hydrogen sulfide is encountered. Hydrogen sulfide is expected to be encountered at new locations P-10 and P-7 situated near the existing H_2S probe SV-1 (see attached Probe Location Map).

Construction Hazards

Employees must implement safe work practices in accordance with OSHA regulations while working on-site. In addition to the hazardous substances and environments present on-site, other physical hazards may exist during the excavation and testing process, including risk of injury while working in or around excavation pits and heavy equipment. Work areas should be kept clear of stockpiled materials. In areas with unstable soil, if workers are required to enter the excavation, excavation walls should be shored or samples should be collected by a remote system. A registered professional engineer must certify that the excavation shoring has been properly constructed to OSHA standards. Work area's should be barricaded to protect both public and field personnel.



ENGINEERING-SCIENCE	M R T C METRO-RAIL PROJECT METHANE GAS PROBE LOCATIONS	PROBES 5, 6, 7, 8, 9 and 10

CADD FILE: \METRO\GP4A.DGN

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TABLE 5.1

HEALTH AND PHYSICAL HAZARD AND RECOGNITION QUALITIES[1/] OF SITE CONTAMINANTS

Compound	PEL[2/] (ppm)	TLV[3/] (ppm)	IDLH[4/] (ppm)	Warning Conc.[5/] (ppm)	Ionization Potential (ev)	Comments
Hydrogen Sulfide	10	10	300	0.0047	10.46	Colorless gas with a strong odor of rotten eggs.
Methane	--	--	--	200	--	Odorless gas; flammable and explosive.

1/ Information summarized from Sax, 1979, *Dangerous Properties of Industrial Materials*, Fifth Edition; OSHA regulations contained in 29 CFR 1910.1000; EPA. 1983. *Response Safety Decision-Making Workshop* manual; ACGIH. 1989-90 *Threshold Limit Values*; and NIOSH/OSHA 1985. *Pocket Guide to Chemical Hazards*.

2/ PEL: Permissible Exposure Limit expressed as ppm unless otherwise indicated. OSHA limit as found in 29 CFR 1910.1000.

3/ TLV: Threshold Limit Value expressed as ppm unless otherwise indicated. From Plunkett, E.R., *Handbook of Industrial Toxicology*, 1976; or ACGIH 1989-90.

4/ IDLH: Immediately dangerous to life or health. Expressed as ppm unless otherwise indicated.

5/ Warning concentration is the odor threshold of the substance. Different sources listed different warning concentrations. When a range is given, use the highest concentration.

SECTION 6

EMERGENCY RESPONSE PLAN

All hazardous waste site activities present a degree of risk to on-site personnel. During routine operations, risk is minimized by establishing good work practices, staying alert, and using proper personal protective equipment. Unpredictable events such as physical injury, chemical exposure, or fire may occur and must be anticipated. Employees are encouraged to participate in Red Cross first aid and CPR courses in order to more effectively handle physical and medical emergencies that may arise in the field.

6.1 GUIDELINES FOR PRE-EMERGENCY PLANNING, AND TRAINING

Employees must read the site health and safety plan, and must familiarize themselves with the information in this chapter. Before project initiation, the field team should review the health and safety plan and the emergency response plan. Employees will be required to have a copy of the emergency contacts and phone numbers immediately accessible on-site and to know the route to the nearest emergency medical services.

6.2 EMERGENCY RECOGNITION AND PREVENTION

Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on-site.
- A condition is discovered that suggests the existence of a situation more hazardous than anticipated.
- Concentrations of organic vapors exceed 10 ppm above background air concentrations (based on PEL for hydrogen sulfide).
- Concentrations of combustible vapors exceed 10 percent of the lower explosive limit (LEL).

Some ways of preventing emergency situations are listed below.

- Entry team members should remain close together to assist each other during emergencies.
- During continual operations, on-site workers act as safety backup to each other. Off-site personnel provide emergency assistance.

- All field crew members should make use of their senses (all senses) to alert themselves to potentially dangerous situations which they should avoid, e.g., presence of strong and irritating or nauseating odors.
- Personnel should practice unfamiliar operations before doing the actual procedure in the field.
- Field crew members shall be familiar with the physical characteristics of investigations, including:
  - Wind direction in relation to contamination zones
  - Accessibility to associates, equipment, and vehicles
  - Communications
  - Hot zone (areas of known or suspected contamination)
  - Site access
  - Nearest water sources
- Personnel and equipment in the work area enclosure should be minimized, consistent with effective site operations.
- Work areas for various operational activities must be established.

In the event that any member of the field crew experiences any adverse effects or symptoms of exposure while on the scene, or organic vapors and combustible vapors exceed the action limits, the entire field crew will immediately halt work and act according to the instructions provided by the site safety officer.

The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated will result in the evacuation of the field team and reevaluation of the hazard and the level of protection required.

In the event an accident occurs, the field supervisor is to complete an Accident Report Form. Followup action should be taken to correct the situation that caused the accident.

General emergency procedures, and specific procedures for handling personal injury and chemical exposure, are described in the following sections.

6.3 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATION PROCEDURES DURING EMERGENCY

When an emergency occurs, decisive action is required. Rapidly made choices may have far-reaching, long-term consequences. Delays of minutes can create life-threatening situations. Personnel must be ready to respond to emergency situations immediately. All personnel should know their own responsibilities during an emergency, know who is in charge during an emergency, and the extent of their authority. This section outlines personnel roles, lines of authority, and communication procedures during emergencies.

In the event of an emergency situation at the site, the site health and safety officer will assume total control and will be responsible for on-site decision making. This individual has the authority to resolve all disputes about health and safety requirements and precautions. He will also be responsible for coordinating all activities until emergency response teams (ambulance, fire department, etc.) arrive on-site.

The site health and safety officer will ensure that the necessary ES personnel and agencies are contacted as soon as possible after the emergency occurs. All on-site personnel must know the location of the nearest phone and the location of the emergency phone number list.

6.4 EVACUATION ROUTES AND PROCEDURES, SAFE DISTANCES, AND PLACES OF REFUGE

In the event of emergency conditions, employees will evacuate the area as instructed, transport injured personnel, or take other measures to mitigate the situation. Evacuation routes and safe distances shall be decided upon and posted by the project manager before initiating work.

6.5 DECONTAMINATION OF PERSONNEL DURING AN EMERGENCY

Procedures for leaving a contaminated area must be planned and implemented prior to going on-site. Work areas and decontamination procedures must be established based on expected site conditions. If a member of the field crew is exposed to chemicals, the emergency procedures outlined below should be followed:

- Another team member (buddy) should remove the individual from the immediate area of contamination.
- Precautions should be taken to avoid exposure of other individuals to the chemical.
- If the chemical is on the individual's clothing, the clothing should be removed if it is safe to do so.
- Administer first aid and transport the victim to the nearest medical facility, if necessary.

If uninjured employees are required to evacuate a contaminated area in an emergency situation, emergency decontamination procedures should be followed. At a minimum these would involve moving into a safe area and removing protective equipment. Care should be taken to minimize contamination of the safe area and personnel. Contaminated clothing should be placed in plastic garbage bags or other suitable containers. Employees should wash or shower as soon as possible.

6.6 EMERGENCY SITE SECURITY AND CONTROL

For this project, the project manager (or designated representative) must know who is on site and who is in the work area. In an emergency situation, only necessary rescue and response personnel should be allowed into the exclusion zone.

6.7 PROCEDURES FOR EMERGENCY MEDICAL TREATMENT AND FIRST AID

6.7.1 Chemical Exposure

In the event of chemical exposure (skin contact, inhalation, ingestion) the following procedures should be implemented:

- Another team member (buddy) should remove the individual from the immediate area of contamination.
- Precautions should be taken to avoid exposure of other individuals to the chemical.
- If the chemical is on the individual's clothing, the clothing should be removed if it is safe to do so.
- If the chemical has contacted the skin, the skin should be washed with copious amounts of water, preferably under a shower.
- In case of eye contact, an emergency eye wash should be used. Eyes should be washed for at least 15 minutes.
- If necessary, the victim should be transported to the nearest hospital or medical center. If necessary, an ambulance should be called to transport the victim.

6.7.2 Personal Injury

In the event of personal injury:

- Field team members trained in first aid can administer treatment to an injured worker.
- The victim should be transported to the nearest hospital or medical center. If necessary, an ambulance should be called to transport the victim.
- The project manager is responsible for the completion of an Accident Report Form.

6.7.3 Fire or Explosion

In the event of fire or explosion, personnel will evacuate the area immediately and administer necessary first aid to injured employees. Personnel will proceed to a safe area and phone the emergency support services. Upon contacting the emergency support services, state your name, nature of the hazard (fire, high combustible vapor levels), the location of the incident, and whether there were any physical injuries requiring an ambulance. Do not hang up until emergency support services has all of the additional information they may require.

6.7.4 Emergency Contact

In the event of any situation or unplanned occurrence requiring assistance, the appropriate contact(s) should be made from the list below. For emergency situations, telephone or radio contact should be made with the site point of contact or site emergency personnel who will then contact the appropriate response teams.

Contingency Contacts	Phone Number
Nearest phone located at the work site	La Brea and San Vincente
Fire Department/Police	911
Cedar Sinai Hospital	(310) 855-5000
Midway Hospital	(213) 932-5104 (Emergency Room)
	(213) 938-3161 (Switchboard)

6.7.5 Medical Emergency

Route to the hospital:

Go 1/2 to one mile north on San Vincente Boulevard. Midway Hospital is located on the north side of San Vincente Boulevard.

LOCATION MAP TO MIDWAY HOSPITAL

SECTION 7

LEVELS OF PROTECTION AND PERSONAL PROTECTIVE EQUIPMENT REQUIRED FOR SITE ACTIVITIES

7.1 PERSONAL PROTECTIVE EQUIPMENT

The personal protection level prescribed for the Metro Rail Orange Line Gas Probe Installation project is Level D (no respiratory or chemical protective clothing) with a contingency for the use of Level B. Unless certain compounds are ruled out through use of appropriate combustible gas and hydrogen sulfide monitoring techniques using an MSA-361 Gas Detector, Level B respiratory protection (air-line respirator using the cascade system) will be worn. Level C respiratory protection (air purifying respirator) cannot be used on this project due to the poor warning properties (high odor thresholds) of hydrogen sulfide. This requirement is based upon the expected risk of exposure to chemical contaminants known to be present on the site. Monitoring for hydrogen sulfide must be conducted in the worker breathing zone.

Ambient air monitoring of organic gases/vapors (by the MSA-361 Gas Detector) will be used to select the appropriate level of personal protection. The flow chart presented in Figure 7.1 will be used to select respiratory protection. If concentrations of hydrogen sulfide meet or exceed 10 ppm in the breathing zone, the field team must evacuate the area until hydrogen sulfide concentrations drop below the PEL or until Level B respiratory protection is operational.

The following personnel protective ensemble is required only when handling contaminated samples or equipment.

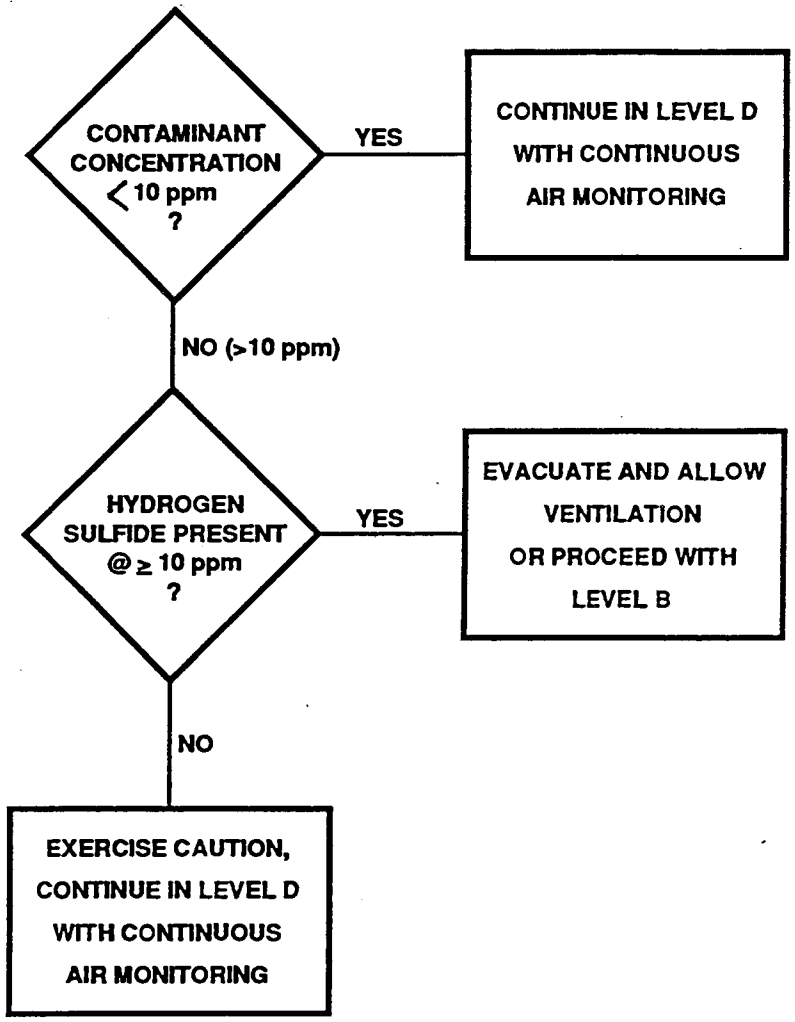
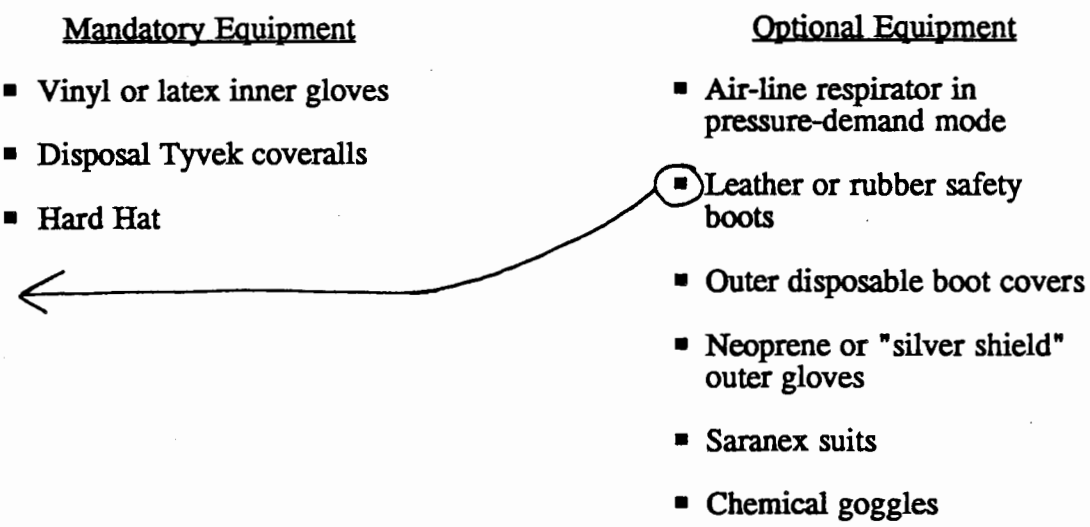


Figure 7.1
Decision Diagram
Site Actoin Levels



7.2 EQUIPMENT NEEDS

Each field team shall have the following items readily available:

- Copy of site health and safety plan including a separate list of emergency contacts
- First aid kit
- Eye wash bottle
- Paper towels
- Duct tape
- Water
- Plastic garbage bags

7.3 HEAT STRESS

Adverse weather conditions are important considerations in planning and conducting site operations. Hot or cold weather can cause physical discomfort, loss of efficiency, and personal injury. Of particular importance is heat stress resulting when protective clothing decreases natural body ventilation. Heat stress can occur even when temperatures are moderate. One or more of the following recommendations will help reduce heat stress:

- Provide plenty of liquids. To replace body fluids (water and electrolytes) lost due to sweating, use a 0.1 percent salt water solution, more heavily salted foods, or commercial mixes. The commercial mixes may be preferable for those employees on a low-sodium diet.
- Provide cooling devices, if necessary, to aid natural body ventilation. These devices, however, add weight, and their use should be balanced against worker efficiency.

- Provide cooling devices, if necessary, to aid natural body ventilation. These devices, however, add weight, and their use should be balanced against worker efficiency.
- Long cotton underwear acts as a wick to help absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.
- Install mobile showers and/or hose-down facilities to reduce body temperature and to cool protective clothing.
- In extremely hot weather, conduct non-emergency response operations in the early morning or evening.
- Ensure that adequate shelter is available to protect personnel against heat, cold, rain, snow, or other adverse weather conditions which decrease physical efficiency and increase the probability of accidents.
- In hot weather, rotate workers wearing protective clothing.
- Good hygienic standards must be maintained by frequent change of clothing and daily showering. Clothing should be permitted to dry during rest periods. Workers who notice skin problems should immediately consult medical personnel.

7.3.1 Effects of Heat Stress

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur. They can range from mild reactions such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement to death. Specific first aid treatment for mild cases of heat stress is provided in the American Red Cross first aid book. This book should be readily available for reference in the field. Medical help must be obtained for the more serious cases of heat stress.

7.3.2 Heat-Related Problems

Heat-related problems include:

- Heat rash: Caused by continuous exposure to heat and humid air and aggravated by chafing clothes. Decreases ability to tolerate heat as well as being a nuisance.
- Heat cramps: Caused by profuse perspiration with inadequate fluid intake and chemical replacement, especially salts. Signs include muscle spasm and pain in the extremities and abdomen.
- Heat exhaustion: Caused by increased stress on various organs to meet increased demands to cool the body. Signs include shallow breathing; pale, cool, moist skin; profuse sweating; and dizziness and lassitude.
- Heat stroke: The most severe form of heat stress. Body must be cooled immediately to prevent severe injury and/or death. Signs include red, hot, dry skin; no perspiration; nausea; dizziness and confusion; strong, rapid pulse; and possibly coma. Medical help must be obtained immediately.

TABLE 7.1

SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING FOR FIT AND ACCLIMATIZED WORKERS[a]

Adjusted Temperature[b]	Normal Work Ensemble[c]	Impermeable Ensemble
90°F or above (32°C)	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 60 minutes of work
82.5° - 87.5°F (23.1° - 30.8°C)	After each 90 minutes of work	After each 90 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

a For work levels of 250 kilocalories/hr.

b Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent of time the sun is not covered by clouds that are thick enough to produce a shadow (100 percent sunshine - no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows).

c A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and trousers.

7.3.3 Heat Stress Monitoring

Monitoring of personnel wearing impervious clothing will begin when the ambient temperature is 70°F or above. Table 7.1 presents the suggested frequency for such monitoring. Monitoring frequency will increase as the ambient temperature increases or as slow recovery rates are observed. Heat-stress monitoring will be performed by a person with a current first-aid certification, who is trained to recognize heat-stress symptoms. For monitoring the body's recuperative abilities from excess heat, one or more of the techniques listed below will be used. Other methods for determining heat-stress monitoring, such as the wet bulb globe temperature (WBGT) index from American Conference of Governmental Industrial Hygienist (ACGIH) TLV Booklet may be used.

To monitor the worker, measure:

- Heart rate: Count the radial pulse during a 30-second period as early as possible during the rest period.
  - If the heart rate exceeds 110 beats per minute at the beginning of the rest period, the next work cycle will be shortened by one-third and the rest period will remain the same.
  - If the heart rate still exceeds 110 beats per minute at the next rest period, the following work cycle will be reduced by one third.
- Oral temperature: Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).
  - If oral temperature exceeds 99.6°F (37.6°C), the next work cycle will be reduced by one-third without changing the rest period.
  - If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, the following cycle will be reduced by one-third.
  - No worker will be permitted to wear a semipermeable or impermeable garment when oral temperature exceeds 100.6°F (38.1°C).

7.4 COLD EXPOSURE

Persons working outdoors in temperatures at or below freezing may suffer from cold exposure. During prolonged outdoor periods with inadequate clothing, effects of cold exposure may even occur at temperatures well above freezing. Cold exposure may cause severe injury by freezing exposed body surfaces (frostbite) or result in profound generalized cooling, possibly causing death. Areas of the body which have high surface area-to-volume ratios such as fingers, toes, and ears are the most susceptible to frostbite.

Local injury resulting from cold is included in the generic term frostbite. There are several degrees of damage. Frostbite of the extremities can be categorized into:

- Frost nip or incipient frostbite: characterized by suddenly blanching or whitening of skin.

- Superficial frostbite: skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- Deep frostbite: tissues are cold, pale, and solid; extremely serious injury.

Systematic hypothermia is caused by exposure to freezing or rapidly dropping temperature. Its symptoms are usually exhibited in five stages: (1) shivering; (2) apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95°F; (3) unconsciousness, glassy stare, slow pulse, and slow respiratory rate; (4) freezing of the extremities; and (5) death.

SECTION 8

FREQUENCY AND TYPES OF AIR MONITORING

Air monitoring will be used to identify and quantify airborne levels of hazardous substances. Periodic monitoring is required during some on-site activities. Only activities which may encounter airborne contamination (i.e., drilling, installation, etc.), require air monitoring.

Initial air monitoring will be provided by ES. Engineering-Science will also perform personal monitoring during the site activities. The ES health and safety officer will periodically confirm air monitoring data and review calibration and record keeping procedures.

Type of Equipment	Minimum Calibration Frequency	Parameter(s) to be Measured	Minimum Sampling Frequency	Sampling Locations
MSA-361	1/day	Hydrogen Sulfide Combustible Gas	4/hour	Breathing Zone Well Head
OVA/MicroTip	1/day	Volatile Organic Compounds	4/hour	Breathing Zone, Well Head, and Soil sample headspace

During onsite operations at the work area, the explosimeter should be used to measure the percentage of the LEL. The hydrogen sulfide meter should be used to measure ambient air concentrations in the worker breathing zone.

SECTION 9

SITE CONTROL MEASURES

The following site control measures shall be followed to minimize potential contamination of workers, protect the public from potential site hazards, and control access to the sites. Site control involves the physical arrangement and control of the operation zones and the methods for removing contaminants from workers and equipment. The first aspect, site organization, is discussed in this section. The second aspect, decontamination, is considered in the next section.

9.1 SITE ORGANIZATION-OPERATION ZONES

Any time respirators are worn, the following operation zones shall be established on the site or around the tanks.

1. Exclusion Zone (Contamination Zone)
2. Contamination Reduction Zone
3. Support Zone

If protective clothing, such as gloves and/or Tyvek suits are worn but respirators are not worn (Level D-modified), the field crew shall establish a decontamination area to avoid spreading contaminants off-site. The field team leader and/or site safety officer shall be responsible for establishing the size and distance between zones at the site or around the site feature. Considerable judgement is required to ensure safe working distances for each zone are balanced against practical work considerations.

9.1.1 Exclusion Zone (Contamination Zone)

The exclusion zone constitutes the place where active investigation or cleanup operations take place. Within the exclusion zone, prescribed levels of protection must be worn by all personnel. The hotline, or exclusion zone boundary, is initially established based upon the presence of actual wastes or apparent spilled material, or through air monitoring, and is placed around all physical indicators of hazardous substances (i.e., drums, tanks, ponds, liquid runoff, defoliated areas). The hotline may be readjusted based upon subsequent observations and measurements. This boundary should be physically secure and posted or well-defined by physical and geographic boundaries.

Under some circumstances, the exclusion zone may be subdivided into zones based upon environmental measurements or expected on-site work conditions.

9.1.2 Contamination Reduction Zone

Between the exclusion zone and the support zone is the contamination reduction zone. This zone provides an area to prevent or reduce the transfer of hazardous materials which may have been picked up by personnel or equipment leaving the exclusion area. All decontamination activities occur in this area. The organization of the contamination reduction zone, and the control or decontamination operations, are described in the next section, Decontamination.

9.1.3 Support Zone

The support zone is the outermost area of the site and is considered a non-contaminated or clean area. The support zone contains the command post for field operations, first aid stations, and other investigation and cleanup support. Normal work clothes are appropriate apparel within this zone; potentially contaminated personnel clothing, equipment, etc., are not permitted in it.

9.2 SITE SECURITY

Site security will be enforced by the site health and safety officer who will ensure that only authorized personnel are allowed in the work area and that personnel have the required level of personal protective equipment.

Site security is necessary to prevent exposure of unauthorized, unprotected individuals in the work area.

9.3 SITE COMMUNICATION

Internal site communication is necessary to alert field team members in the exclusion zone and contamination reduction zone of emergency conditions, to convey safety information, and to communicate changes or clarification in the work to be performed. For internal site communication, the field team members will use prearranged hand signals (and responses). Radios and/or compressed air horns may also be used for communication.

9.4 SAFE WORK PRACTICES

To ensure a strong safety awareness program during the characterization, personnel shall have adequate training, this health and safety plan must be communicated to the employees, and standing work orders developed and communicated to the employees. Sample standing orders for personnel entering the exclusion zone are as follows:

- No smoking, eating, drinking
- No matches/lighters in zone
- No personal vehicles allowed in the exclusion zone or contamination reduction zone
- Check in/check out at access control points
- Use buddy system
- Wear appropriate personal protective equipment

- Avoid walking through puddles, stained soil
- Discovery of unusual or unexpected conditions will result in immediate evaluation and reassessment of site conditions and health and safety practices
- Conduct safety briefings prior to on-site work
- Conduct daily/weekly safety meetings as necessary
- Take precautions to reduce injuries from heavy equipment and other tools

The following guidelines will be followed while working on-site:

- Heavy Equipment - Only qualified operators will be allowed to operate heavy equipment. Subcontractors will be required to use the safe work guidelines included in the OSHA General Industry (29 CFR 1910) and Construction Industry (29 CFR 1926) Standards.
- Trench Shoring - Any trenches for human entry that are more than 5 feet deep will be shored or have the sides laid back in accordance with 29 CFR 1926 Subpart P. All trenching and shoring will be inspected on a daily basis by the site health and safety officer.
- Power Lines - When operating heavy equipment, such as drilling rigs, near power lines, workers will take care to ensure that the boom or rigging always maintains a safe distance from power lines (20 ft minimum). Any underground utility lines must also be located, and appropriate measures taken before any excavation work or drilling is done.
- Swing Radius - All swing equipment, such as cranes or backhoes, will have the swing radius guarded to prevent workers from being struck by the rotating machinery.
- Electrical Equipment - All electrical equipment will be properly grounded and class-approved for the location.
- Machine Guarding - All machinery on-site will be properly guarded to prevent contact with rotating shafts, blades, or gears.
- Flammable Materials - When work involves flammable materials, adequate ventilating and control of all ignition sources will be maintained. This may include:
  - Nonsparking tools
  - Explosion-proof equipment (intrinsically safe)
  - Class-approved electrical equipment
  - Grounding and bonding of static electricity sources
  - No smoking or open lights
  - No welding

SECTION 10

SITE SPECIFIC DECONTAMINATION PROCEDURES

10.1 PERSONNEL DECONTAMINATION PROCEDURES

An exclusion zone, contamination reduction zone, and support zone shall be established whenever field personnel are using Level C or Level B respiratory protection. Defined access and egress points will be established and personnel will enter and exit only through these points.

A guideline for personnel decontamination is presented in Figure 10.1. This procedure may be modified somewhat by the site health and safety officer if necessary. The decontamination station will include provisions for collecting disposable protective equipment (such as garbage bags); washing boots, gloves, Saranex or vinyl rainsuits (if used), and field instruments and tools; and washing hands, face, and other exposed body parts. On-site personnel will shower upon return to their hotel or homes at the end of the work day. Refuse from decontamination will be left at the facility for disposal. At no time shall contaminated or potentially contaminated personnel, clothing, or equipment be placed or transported in personal vehicles, company vehicles, or rental vehicles.

Decontamination equipment will include:

- Plastic buckets and pails
- Scrub brushes and long-handle brushes
- Detergent
- Containers of water
- Paper towels
- Plastic garbage bags
- Distilled water

10.2 DECONTAMINATION OF EQUIPMENT

Decontamination of drilling rigs will be conducted at a location on-site, if possible, where the rinseate can be collected. High-pressure steam cleaning of drilling rigs will be necessary before the beginning the drilling operation, between borehole locations, and before the drill rig leaves the project site. All sampling equipment will be decontaminated before use between samples and between sampling locations.

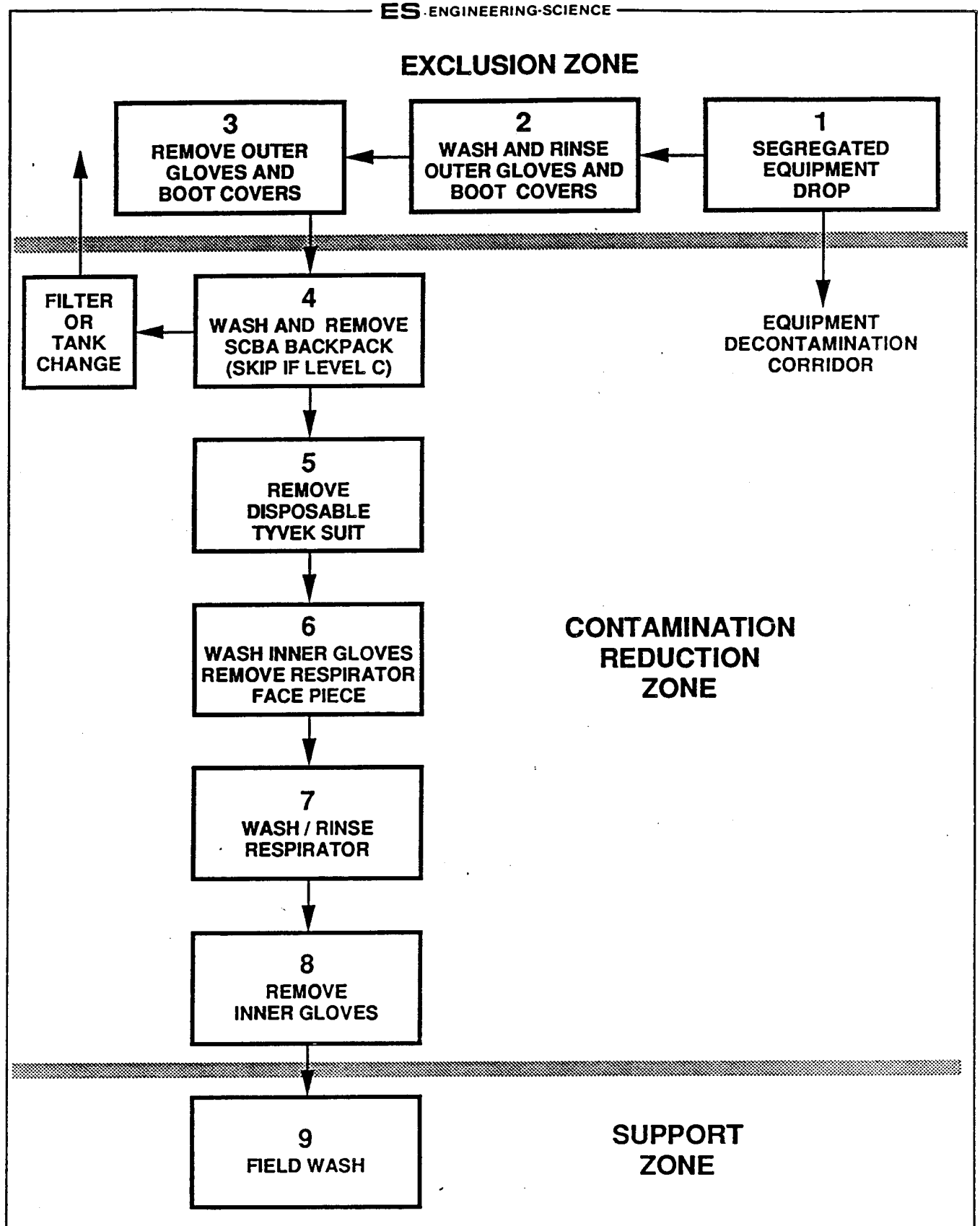


Figure 10.1
Decontamination Station Layout
For Level B or C Protection

211-1034/FX

Sampling equipment should be thoroughly washed with detergent followed by clean water rinse, solvent (methanol) rinse, and a distilled water rinse. Adequate time will be allowed for solvent evaporation.

SECTION 11

AIR MONITORING EQUIPMENT AND CALIBRATION PROCEDURES

11.1 MSA-361 GAS DETECTOR

An MSA-361 Gas Detector will be used for measuring oxygen and combustible gas and hydrogen sulfide levels during field operations.

The detector will be calibrated every morning before starting the field operations and the date and time of calibration will be recorded in a field note book.

Oxygen calibration is performed by adjusting the oxygen potentiometer until the instrument reads 20.9 percent.

11.2 CENTURY ORGANIC VAPOR ANALYZER (OVA)

A Century OVA/MicroTip will be used for measuring volatile organic compounds emitted from the top of the borehole soil samples during drilling. The OVA will be calibrated every morning with Hexane and proper records will be maintained in a field note book.

APPENDIX A

PLAN ACCEPTANCE FORM, SCBA AND RESPIRATOR LOGS, TAILGATE SAFETY MEETING FORM, PERSONAL ACKNOWLEDGEMENT FORM, AND ACCIDENT REPORT FORM

PLAN ACCEPTANCE FORM

PROJECT HEALTH AND SAFETY PLAN

Instructions: This form is to be completed by each person to work on the subject project work site and returned to the safety manager.

I have read and agree to abide by the contents of the Health and Safety Plan for the following project:

Parsons Brinckerhoff Gas Probes Installation Project

_____

_____
Signed

_____
Date

RETURN TO:

Office Health and
Safety Representative
Engineering-Science, Inc.
199 South Los Robles Avenue
Pasadena, CA 91101

SCBA

RESPIRATOR LOG

SITE:

LOCATION:

DATES OF INVESTIGATION:

User	Date of Use	SCBA#	Satisfactory (Yes/No)	Check-Out Initials	Date Cleaned

SCBA Performance Comments:

Project H&S Officer
or
ES Project Manager

Date

Return to Office Health and Safety Representative
at the completion of field activities.

AIR PURIFYING RESPIRATOR LOG

SITE:

LOCATION:

DATES OF INVESTIGATION:

User	Date of Use	Cleaned and Inspected Prior To Use (Initials)	Cartridges Changed Prior to Use (Yes, No, N/A)	Total Hours on Cartridge

Project H&S Officer
or
ES Project Manager

Date

Return to the Office Health and Safety Representative
at the Completion of field activities.

ACCIDENT REPORT FORM

Project: _____

EMPLOYER

1. Name _____

2. Mail Address _____
(No. and Street) (City or Town) (State)

3. Location, if different from mail address _____

_____

INJURED OR ILL EMPLOYEE

4. Name _____ Social Security Number_
(First) (Middle) (Last)

5. Home address _____
(No. and Street) (City or Town) (State)

6. Age _____ 7. Sex: Male_____Female_____(Check one)

8. Occupation _____
(Specific job title, not the specific activity he was performing at time of injury)

9. Department _____
(Enter name of department in which injured persons is employed, even though he may have been temporarily working in another department at the time of injury)

THE ACCIDENT OR EXPOSURE TO OCCUPATIONAL ILLNESS

10. Place of accident or exposure__
(No. and Street) (City or Town) (State)

ACCIDENT REPORT FORM
(Continued)

11. Was place of accident or exposure on employer's premises? (Yes/No)

12. What was the employee doing when injured?_____
(Be specific - If he was using tools or equipment or handling material, name and tell what he was doing.)

13. How did the accident occur? _____
(Describe fully the events which resulted in the injury or occupational illness. Tell what happened and how. Name any objects or substances involved. Give details on all factors which led to accident. Use separate sheet for additional space.)

14. Time of accident:_____

15. WITNESSES TO _____ (Name) _____ (Affiliation) _____ (Phone No.)

ACCIDENT _____ (Name) _____ (Affiliation) _____ (Phone No.)

_____ (Name) _____ (Affiliation) _____ (Phone No.)

OCCUPATIONAL INJURY OR OCCUPATIONAL ILLNESS

16. Describe the injury or illness in detail and indicate the part of body affected. _____

17. Name the object or substance which directly injured the employee. (For example, the machine or thing or struck against or which struck him; the vapor or poison he inhaled or swallowed; the chemical or radiation which irritated his skin; or in cases of strains, hernias, etc., the thing he was lifting, pulling, etc.

_____

_____

ACCIDENT REPORT FORM
(Continued)

18. Date of injury or initial diagnosis of occupational illness_____
(Date)

19. Did employee die?_ (Yes or No)

OTHER

20. Name and address of physician _____

21. If hospitalized, name and address of hospital _____

_____

Date of report _____ Prepared by _____

Official position _____

DAILY HEALTH AND SAFETY REPORT

Name _____ Project Name _____
Date _____ Project Number _____

1) Have all field team members reviewed the site H&S Plan? Yes ___ No ___
If not, explain why and corrective actions taken:_____
_____

2) Are Plan Acceptance Forms on file for all field team members?
Yes ___ No ___
(If not, obtain form and forward to Office H&S Representative.)

3) Is at least one copy of the site H&S Plan present on-site for employee review?
Yes ___ No ___
(If not, obtain copy immediately and inform employees of its location.)

4) Are all field team members on current and appropriate medical monitoring and have they had the required 40-hour/8-hour training within the past year?
Yes ___ No ___
If not, explain why and corrective actions taken: _____
_____

5) Have all field team members received on-site H&S training? Yes ___ No ___

If yes, describe frequency: Initial ____ Daily ____ Weekly ____
(If not, perform required training before allowing employee(s) to continue working on-site).

6) Provide the following information:

Task	Employee Name (by Task)	Level of Respiratory Protection (for each employee)	Comments

7) Was heat stress monitoring performed today? Yes ___ No ___
If yes, was it documented? _____
If no, explain:_____

8) Was personal air monitoring conducted today? Yes ___ No ___
If yes, describe:_____
_____
If no, explain ;_____
_____

9) Describe other air monitoring procedures used today: _____
_____
_____

10) Were site work zones established today? Yes ___ No ___
If not, explain: _____
_____

11) Describe personal decontamination procedures used today:_____
_____
_____
_____

12) Did any accidents occur today? Yes ___ No ___
If yes, describe: _____
_____

13) Comments: _____
_____
_____
_____
_____

Return this report to the Office Health and Safety Representative.

SITE SPECIFIC TRAINING RECORD

Project:_____
Project No.:_____
Date:_____
Trainer:_____

On this date, the following individuals were provided site-specific training in accordance with OSHA regulations contained in 29CFR1910.120(e):

Name (Print)	Employee No.	Employee Signature

Forward this form to:

Office Health and Safety Representative
Engineering-Science, Inc.
199 South Los Robles Avenue
Pasadena, CA 91101

APPENDIX B

MSDS FOR HYDROGEN SULFIDE

Material Safety Data Sheet

Prepared According to the OSHA Hazard Communication Standard (29 CFR 1910.1200).
(Formerly Called MATERIAL INFORMATION BULLETIN)

Chevron

HYDROGEN SULFIDE H_2S

DANGER! POISON
EXTREMELY FLAMMABLE
MAY BE HARMFUL OR FATAL IF INHALED
MAY CAUSE EYE IRRITATION

TYPICAL COMPOSITION

Hydrogen sulfide	100%

EXPOSURE STANDARD

The Federal OSHA exposure standard is a ceiling value of 20 ppm which may be exceeded up to 50 ppm for no more than 10 minutes in any 8-hour period in which no other measurable exposure occurs. The ACGIH TLV (1985-86) is 10 ppm for an 8-hour Time Weighted Average (TWA) and 15 ppm for a Short Terms Exposure Limit (STEL).

PHYSIOLOGICAL & HEALTH EFFECTS	EMERGENCY & FIRST AID PROCEDURES
Eyes	
Eye contact with hydrogen sulfide gas may cause painful irritation. Eye irritation may be indicative of exposure above the applicable standards.	Flush eyes immediately with fresh water for at least 15 minutes while holding the eyelids open. See a doctor.
Skin	
Not expected to be a skin irritant. However, dermatitis may occur following chronic exposure.	Wash thoroughly with soap and water following skin contact. Launder contaminated clothing.
Inhalation	
Irritating and highly toxic if inhaled. See Additional Health Data.	DO NOT ATTEMPT RESCUE WITHOUT ADEQUATE RESPIRATORY PROTECTION. If there are signs or symptoms as described in this bulletin due to breathing this material, move the person to fresh air. If breathing has stopped, apply artificial respiration. SEE A DOCTOR IMMEDIATELY - Prompt action is essential.
Ingestion	
Material is a gas and cannot be swallowed in the usual sense.	Since this material is not expected to be an acute ingestion problem, no first aid procedures are required.

DDITIONAL HEALTH DATA
See following pages

SPECIAL PROTECTIVE INFORMATION
ye Protection: Vapor-tight chemical afety goggles must be worn if there is likelihood of exposure. Approved full-face espiratory protection will provide eye rotection.
Skin Protection: No special skin rotection is necessary.
espiratory Protection: Wear approved respiratory protection such as a self-contained breathing apparatus or an air-upplying respirator unless ventilation is dequate to keep airborne concentrations below the ACGIH TLV. See Note in Special recautions Section.
entilation: Use adequate ventilation to keep the airborne concentrations of this aterial below the ACGIH TLV.

IRE PROTECTION
This material presents an extreme fire azard. Gas forms mixtures with air which an catch fire and burn with explosive violence. Invisible mixture spreads easily nd can be set on fire by many sources uch as pilot lights, welding equipment, and electrical motors and switches.
lash Point: NDAExtremely flammable gas.
utoignition Temp.: 558°F
lammability Limits: 4.3%-45.5
Extinguishing Media: Stop gas flow. Use ater for cooling.
pecial Fire Fighting Procedures: For fires involving this material, do not nter any enclosed or confined fire space ithout proper protective equipment, ncluding self-contained breathing pparatus. See Hazardous Decomposition oducts. Read the entire bulletin.

SPECIAL PRECAUTIONS
eep container closed. Keep away from eat, sparks and open flame. Store in cool area away from strong acids.

ote: H_2S gas deadens the sense of smell. o not depend upon odor to estimate its concentration.

) NOT ATTEMPT RESCUE WITHOUT WEARING PPROVED SELF-CONTAINED BREATHING PPARATUS OR SUPPLIED AIR RESPIRATOR.

ENVIRONMENTAL PROTECTION
Environmental Impact: Some areas have ambient air standards limiting the quantity of H_2S which can be vented to the atmosphere. These standards should be reviewed to confirm that they are not exceeded.
Precautions if Material is Released or Spilled: If this material is released into a work area, evacuate the area immediately. Persons entering the contaminated area to correct the problem and determine whether it is safe to resume normal activities must comply with all instructions in Special Protective Information.
Waste Disposal Methods: One method is absorptions of the gas (e.g., into a caustic scrubber). Other methods are available, such as burning, but may present additional problems.

REACTIVITY DATA
Stability (Thermal, Light, etc.): Stable
Incompatibility (Materials to Avoid): May react with strong oxidizing materials and a wide variety of chemicals. Forms explosive mixtures with air.
Hazardous Decomposition Products: Normal combustions forms sulfur dioxide and water.
Hazardous Polymerization: Will not occur.

PHYSICAL PROPERTIES
Solubility: Soluble in water, alcohol, and petroleum fractions.
Appearance (Color, Odor, etc.): Colorless gas with rotten egg odor. Faint but readily perceptible odor at less than 1 ppm. See Note in Special Precautions Section.
Boiling Point: -79.5°F
Melting Point: -117°F
Specific Gravity: n/a
Vapor Pressure: 20 atm. @ 78°F
Vapor Density (Air=1): 1.189
Percent Volatile (Volume %): n/a
Evaporation: n/a
Molecular Weight: 34

n/a = Not Applicable
NDA = No Data Available

bove information is based on data of which we are aware and is believed to be correct as of the date hereof. Since the information contained n may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is ished upon the condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

Material Safety Data Sheet

HYDROGEN SULFIDE H_2S

ADDITIONAL HEALTH DATA

The main hazard from H_2S is from inhalation overexposure. Because of the rapid occurrence of olfactory fatigue, odor is an unreliable indicator of concentration. Inhalation of H_2S at airborne levels of approximately 50-70 ppm may result in irritation of the eyes and respiratory tract mucosa. Overexposure to higher concentrations may produce signs and symptoms of headache, dizziness, nausea, vomiting, coughing and a sensation of dryness and pain of the nose, throat and chest. An atmosphere containing 1000-2000 ppm H_2S may be immediately hazardous to life. Prolonged or frequently repeated exposure to H_2S may result in chronic health effects characterized by local irritation of the eyes, respiratory tract and skin. Small amounts of H_2S can be absorbed through the skin, but absorption is too slow to result in poisoning.

Note to Physician: For severe hydrogen sulfide poisoning, successful treatment has involved initial inhalation of amyl nitrite pearls for 15 to 30 seconds of each minute until 10 ml of a 3% solution of sodium nitrite can be administered intravenously at 2.5 to 5 ml per minute. The nitrite-induced methemoglobin is thought to bind the toxic hydrosulfide ion.

SECTION 6. HEALTH HAZARD INFORMATION

Hydrogen sulfide is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: High concentrations (500-1000 ppm) of this material can cause systemic poisoning symptomized by respiratory paralysis, and unconsciousness, followed by death. Exposures of 50 to 500 ppm are characterized by respiratory irritation (coughing, difficulty in breathing). Eye and upper respiratory tract (URT) irritation start around 20 ppm; the severity increases with the duration and intensity of exposure. The sense of smell can be paralyzed immediately by exposure to 200 ppm. Collapse quickly followed by coma and possibly death can occur after breathing only a small amount at >1000 ppm.

Medical Conditions Aggravated by Long-Term Exposure: None reported. **Target Organs:** Eyes, respiratory system.

Primary Entry: Skin contact, inhalation. **Acute Effects:** Eye and URT irritation, dizziness, headache, and nausea.

Chronic Effects: None reported.

FIRST AID

Eyes: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes.

Skin: Treat for possible frostbite damage (cryogenic injury) if liquid hydrogen sulfide touches skin. Treat also for corrosive, acidic burns from either the gas or liquid. **Inhalation:** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Rescuers must use good judgment to minimize their own personal risk. **Ingestion:** Unlikely.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: *Treat any hydrogen sulfide gas leak as an emergency.* Preplan for gas leaks and make these preparations known to all relevant personnel. Notify safety personnel, evacuate all nonessential personnel, provide maximum explosion-proof ventilation, and eliminate all sources of ignition immediately. Try to stop the flow of gas; use a water spray to protect personnel attempting to do this. Cleanup personnel require a complete set of protective clothing, including an SCBA.

Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z)

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste, No. U135

CERCLA Hazardous Substance, Reportable Quantity: 100 lbs (45.4 kg)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Follow the eye- and face-protection guidelines in 29 CFR 1910.133. **Respirator:** Wear a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow the respirator guidelines in 29 CFR 1910.134. For emergency or nonroutine use (e.g., cleaning reactor vessels or storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres.

Other: Wear impervious gloves; boots; aprons; and clean, impervious, body-covering clothing to prevent any possibility of hydrogen sulfide's contact with skin. All clothing must be flame resistant. **Ventilation:** Install and operate general and local ventilation systems powerful enough to maintain airborne levels of hydrogen sulfide below the exposure limit cited in section 2. Make all ventilation systems of maximum explosion-proof design (e.g., nonsparking, electrically grounded and bonded, etc.)

Safety Stations: Make eyewash stations, washing facilities, and safety showers available in use and handling areas.

Contaminated Equipment: Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do *not* wear contact lenses in any work area. **Other:** All piping and equipment used with this gas must be pressure checked and leak tight.

Comments: Practice good personal hygiene; always wash thoroughly after using this material. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store hydrogen sulfide in a cool, dry, well-ventilated area away from oxidizing agents, sources of heat or ignition, any flammable/explosive materials, cylinders containing oxygen, and incompatible chemicals (see sect. 5). Use outside or detached storage. Store cylinders upright and secure them tightly. **Special Handling/Storage:** Hydrogen sulfide is shipped and stored as a pressurized gas in cylinders or tank cars. Protect them against physical damage and regularly inspect them for cracks, leaks, or faulty valves. Electrically ground and bond all containers used in shipping or transferring operations to prevent static sparks. Do not drag or slide cylinders; move them in a carefully supervised manner with a suitable hand truck. Do not smoke in any use or storage area. Shade containers from radiant heat and direct sunlight. **Engineering Controls:** Make all engineering systems (ventilation, production, etc.) of maximum explosion-proof design. Hydrogen sulfide must be used in closed engineering systems because of its explosibility (see sect. 4). Evacuate and purge all lines with an inert gas such as nitrogen (N_2) before and after using hydrogen sulfide. **Comments:** Perform all operations with hydrogen sulfide carefully to prevent accidental ignition. Keep the valve-protection cap in place until immediately before use. Insert a check valve or trap into the transferral line to prevent a dangerous backflow into the original container. Use pressure-reducing regulators when connecting a cylinder to a lower-pressure piping system. Obtain detailed handling, shipping, and storage information from your supplier. A trained chemist or safety specialist familiar with the physical and chemical properties of this material should be present during all work operations.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Hydrogen Sulfide
DOT ID No. UN1053
DOT Label: Flammable Gas and Poison
DOT CLass: Flammable Gas
IMO Class: 2.1
IMO Label: Flammable Gas and Poison Gas

References: 1, 2, 12, 73, 84-94, 100, 103.

Judgments as to the suitability of information herein for purchaser's purposes are necessarily purchaser's responsibility. Therefore, although reasonable care has been taken in the preparation of such information, Genium Publishing Corp. extends no warranties, makes no representations and assumes no responsibility as to the accuracy or suitability of such information for application to purchaser's intended purposes or for consequences of its use.

Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: MJ Hardies, MD

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES
DEPARTMENT OF INDUSTRIAL RELATIONS CAL/OSHA

HESIS

2151 Berkeley Way
Berkeley, California 94704
Call Collect (415) 540-3014

MEDICAL GUIDELINES

HAZARD EVALUATION SYSTEM AND INFORMATION SERVICE

HYDROGEN SULFIDE

SOURCES:

H_2S is a by-product of many industrial processes. Hazardous levels may be found in petroleum refineries, tanneries, mines and wherever there is decay of organic matter; especially sewers.

MECHANISM OF TOXICITY:

H_2S is a gas and exposure is by inhalation. Like cyanide, H_2S inhibits the cytochrome oxidase system. It also causes direct damage to CNS cells. It is an irritant of the eyes and respiratory tract at low concentrations; at high concentrations it rapidly causes respiratory paralysis and death. The offensive "rotten egg" odor is unreliable as a warning signal because of rapid olfactory fatigue, and "tolerance" with chronic exposure.

CLINICAL PRESENTATION:

The principle manifestation at low levels is irritation, with rhinitis, conjunctivitis and bronchitis; at higher levels, headache, nausea, dizziness and pulmonary edema occur. Concentrations above 500 ppm can cause immediate loss of consciousness and respiratory paralysis. Inhalation of 1,000 ppm can cause coma after a single breath and can be rapidly fatal. There are no characteristic laboratory or pathologic findings.

TREATMENT:

Remove from exposure, with care that rescue workers do not enter contaminated areas without respiratory protection, as multiple fatalities may result. Administer artificial respiration with O_2 if respiration is depressed. If exposure is severe, hospitalize and observe for 72 hours for delayed onset of pulmonary edema.

Amyl nitrite or sodium nitrite (see guidelines on cyanide) has been advocated because resulting methemoglobin binds with the toxic HS^- anion and forms sulfmethemoglobin, thus removing sulfide from the blood and preventing tissue binding.

1) Break capsule of amyl nitrite under nose while IV is being started (relatively ineffective);

NIOSH

POCKET GUIDE TO

CHEMICAL HAZARDS

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health

CDC
CENTERS FOR DISEASE CONTROL

Chemical name, structure/formula, and RTECS Nos., and DOT ID and guide Nos.	Synonyms, trade names, and conversion factors	Exposure limits (TWA unless noted otherwise)	IDLH	Physical description	Chemical and physical properties		Incompatibilities and reactivities	Measurement method (See Table 1)
					MW, BP, SOL, FI.P, IP, Sp.Gr, flammability	VP, FRZ UEL, LEL		
gen selenide Se)	Selenium dihydride, Selenium hydride	NIOSH/OSHA 0.05 ppm (0.2 mg/m³)	2 ppm	Colorless gas with an odor resembling decayed horse radish.	MW: 81.0 BP: -42°F Sol(73°F): 0.9% FI.P: NA (Gas) IP: 9.88 eV	VP: >1 atm FRZ: -87°F UEL: ? LEL: ?	Strong oxidizers, acids, water, halogenated hydrocarbons	None available
3-07-5 050000								
18	1 ppm = 3.37 mg/m³				Flammable Gas			
rogen sulfide	Hydrosulfuric acid, Sewer gas, Sulfuretted hydrogen	NIOSH C 10 ppm (15 mg/m³) [10-min] OSHA 10 ppm (14 mg/m³) ST 15 ppm (21 mg/m³)	300 ppm	Colorless gas with a strong odor of rotten eggs. [Note: Sense of smell becomes rapidly fatigued & can NOT be relied upon to warn of the continuous presence of H_2S. Shipped as a liquefied compressed gas.]	MW: 34.1 BP: -77°F Sol: 0.4% FI.P: NA (Gas) IP: 10.46 eV	VP: >1 atm FRZ: -122°F UEL: 44.0% LEL: 4.0%	Strong oxidizers, strong nitric acid, metals	Dry tube/ Mol-sieve; Thermal desorp; GC/FID; II(6) [P&CAM #296]
06-4 25000								
13	1 ppm = 1.42 mg/m³				Flammable Gas			
quinone $C_6(OH)_2$	1,4-Benzenediol; Dihydroxybenzene; 1,4-Dihydroxybenzene; Quinol	NIOSH C 2 mg/m³ [15-min] OSHA 2 mg/m³	Unknown	Light tan, light gray, or colorless crystals.	MW: 110.1 BP: 545°F Sol: 7% FI.P: 329°F (Molten) IP: 7.95 eV	VP: 0.00001 mm MLT: 338°F UEL: ? LEL: ?	Strong oxidizers, alkalis	Filter; CH_3COOH; HPLC/UVD; III [#5004]
-31-9 00000								
2 53					Sp.Gr: 1.33 Combustible Solid, dust cloud may explode if ignited in an enclosed area.			
	Iodine crystals, Molecular iodine	NIOSH/OSHA C 0.1 ppm (1 mg/m³)	10 ppm	Violet solid with a sharp, characteristic odor.	MW: 253.8 BP: 365°F Sol: 0.01% FI.P: NA IP: 9.31 eV	VP(77°F): 0.3 mm MLT: 236°F UEL: NA LEL: NA	Ammonia, acetylene, acetaldehyde, powdered aluminum, active metals, liquid chlorine	Char*; Na_2CO_3; IC; III [#6005]
3-56-2 575000								
					Sp.Gr: 4.93 Noncombustible	Solid		

Personal protection and sanitation (See Table 3)	Recommendations for respirator selection — maximum concentration for use (MUC) (See Table 4)	Health hazards				
		Route	Symptoms (See Table 5)	First aid (See Table 6)		Target organs (See Table 5)
Clothing: N.R. Goggles: N.R. Wash: N.R. Change: N.R. Remove: N.R.	NIOSH/OSHA 0.5 ppm: SA/SCBA 1.25 ppm: SA:CF* 2 ppm: SCBAF/SAF §: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFS[4]/SCBAE	Inh Con	Irrit eyes, nose, throat; nau, vomit, diarr; metallic taste, garlic breath; dizz, lass, ftg; in animals: pneuitis, liver damage	Breath:	Resp support	Resp sys, eyes
Clothing: Prevent skin freezing Goggles: Reason prob Wash: N.R. Change: N.R. Remove: Immed wet (flamm)	NIOSH/OSHA 100 ppm: SA*/SCBA* 250 ppm: SA:CF* 300 ppm: SCBAF/SAF §: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFS/SCBAE	Inh Ing Con	Apnea, coma, convuls; irrit eyes: conj, pain, lac, photo, corneal vesic; irrit resp sys; dizz; head; ftg, irrity; insom; GI dist	Eye: Skin: Breath:	Irr immed Water flush immed Resp support	Resp sys, eyes
Clothing: Repeat Goggles: Any poss >7%/Reason prob <7% Wash: Prompt contam Change: After work if reason prob contam Remove: Prompt non-imperv contam Provide: >7%: Eyewash	NIOSH/OSHA 50 mg/m³: PAPRD[c] 100 mg/m³: HiEF/SCBAF/SAF/ PAPRTHiE[c]/SAT:CF[c] 200 mg/m³: SAF:PD,PP §: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: HiEF/SCBAE	Inh Ing Con	Irrit eyes: conj; kera; CNS excitement; colored urine, nau, dizz, suffocation, rapid breath; musc twitch, delirium; collapse	Eye: Skin: Breath: Swallow:	Irr immed (15 min) Water flush Fresh air Medical attention immed	Eyes, resp sys, skin, CNS
Clothing: Any poss >7%/Repeat <7% Goggles: Any poss >7%/Reason prob <7% Wash: Immed contam >7%/ Prompt contam <7% Change: N.R. Remove: Immed non-imperv contam >7%/Prompt non-imperv wet <7% Provide: 7%: Eyewash, quick drench	NIOSH/OSHA 1 ppm: SA*/SCBA* 2.5 ppm: SA:CF* 5 ppm: SCBAF/SAF 10 ppm: SAF:PD,PP §: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFAGHiE/SCBAE	Inh Ing Con	Irrit eyes, nose; lac; head; tight chest; skin burns, rash; cutaneous hypersensitivity	Eye: Skin: Breath: Swallow:	Irr immed Soap wash immed Resp support Medical attention immed	Resp sys, eyes, skin, CNS, CVS

Iodine

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Requirements of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discrimination.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory penalties against employers of up to $1,000 for each serious violation and for optional penalties of up to $1,000 for each nonserious violation. Penalties of up to $1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to $10,000 for each such violation.

Criminal penalties are also provided for in the Act. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of not more than $10,000, or by imprisonment for not more than six months, or by both. Conviction of an employer after a first conviction doubles these maximum penalties.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

Such voluntary action should initially focus on the identification and elimination of hazards that could cause death, injury, or illness to employees and supervisors. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free consultative assistance, without citation or penalty, is available to employers, on request, through OSHA supported programs in most State departments of labor or health.

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, Georgia
Boston, Massachusetts
Chicago, Illinois
Dallas, Texas
Denver, Colorado
Kansas City, Missouri
New York, New York
Philadelphia, Pennsylvania
San Francisco, California
Seattle, Washington

Telephone numbers for these offices, and additional area office locations, are listed in the telephone directory under the United States Department of Labor in the United States Government listing.

Washington, D.C.
1985
OSHA 2203

William E. Brock, Secretary of Labor

U.S. Department of Labor
Occupational Safety and Health Administration

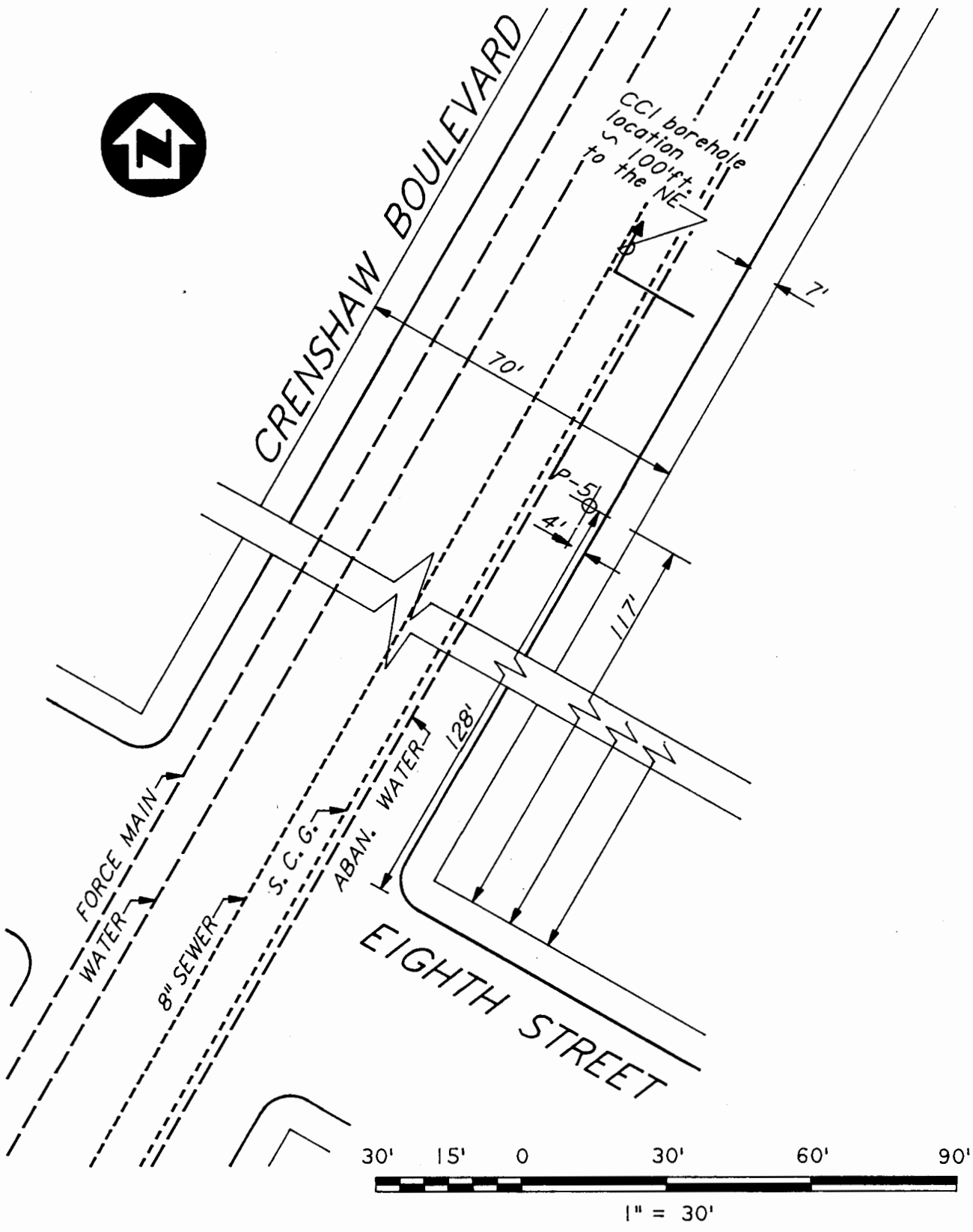
Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or a facsimile) in a conspicuous place where notices to employees are customarily posted.

APPENDIX B

APPENDIX B

PROBE LOCATION DRAWINGS

ES ENGINEERING-SCIENCE

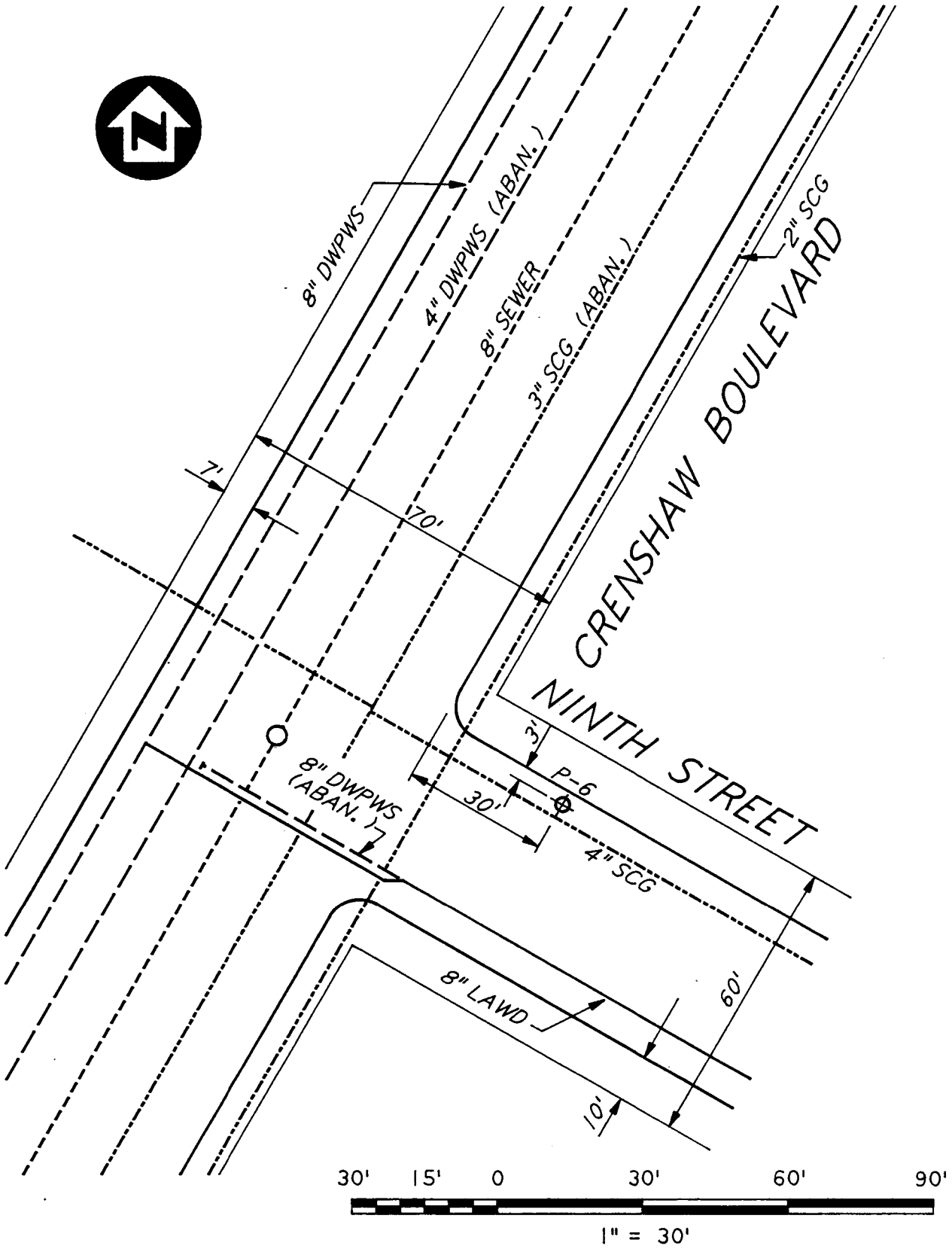


ENGINEERING-SCIENCE	METRO RAIL PROJECT ORANGE LINE PROBE LOCATIONS	PROBE P-5

CADD FILE: \METRO\GP2A.DGN

D: 07-07-92 R: 02
LF

ES ENGINEERING-SCIENCE

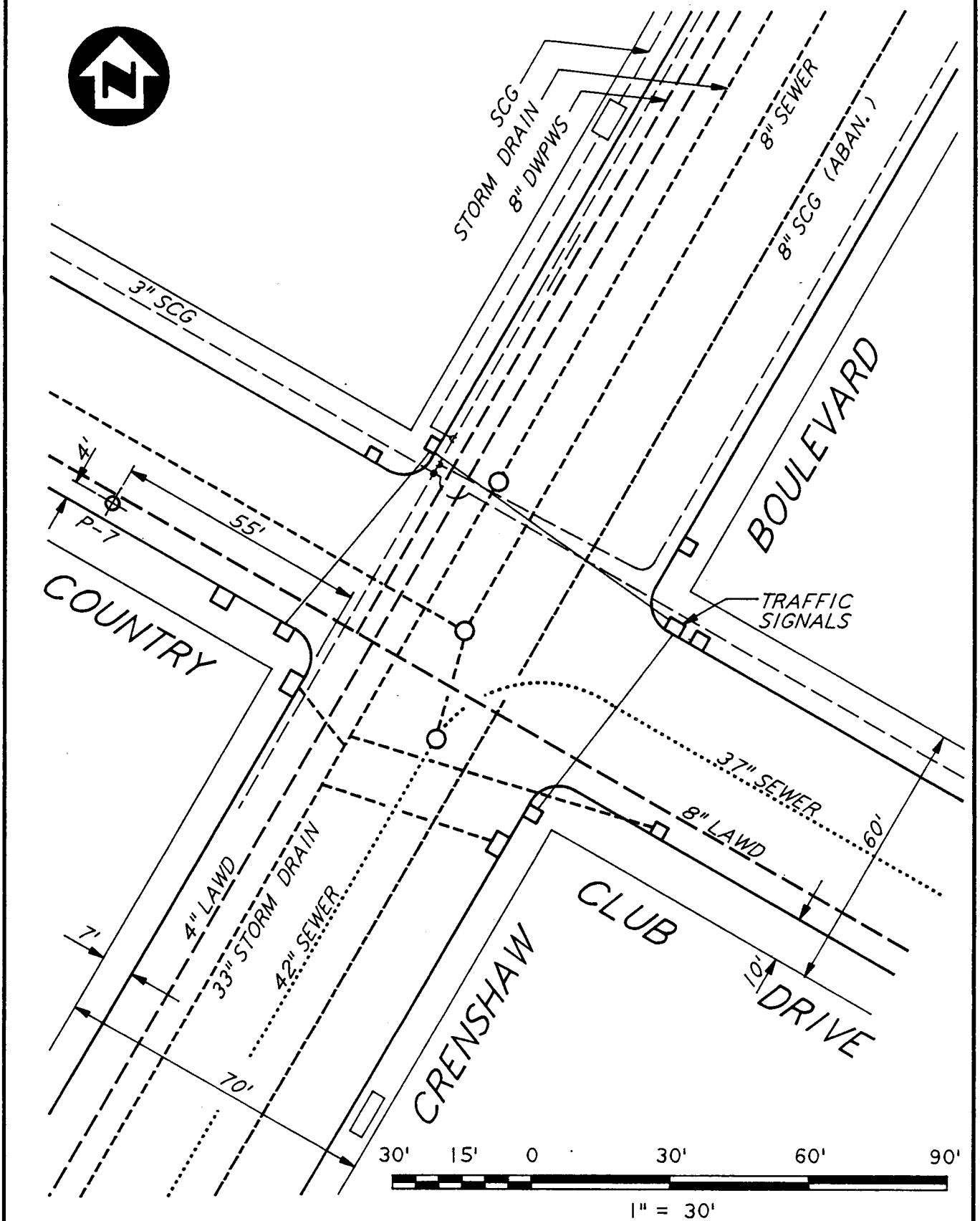


ENGINEERING-SCIENCE	METRO RAIL PROJECT ORANGE LINE PROBE LOCATIONS	PROBE P-6

CADD FILE: S:\METRO\GP7A.DGN

D:07-07-92 R:02
LF

ES ENGINEERING-SCIENCE

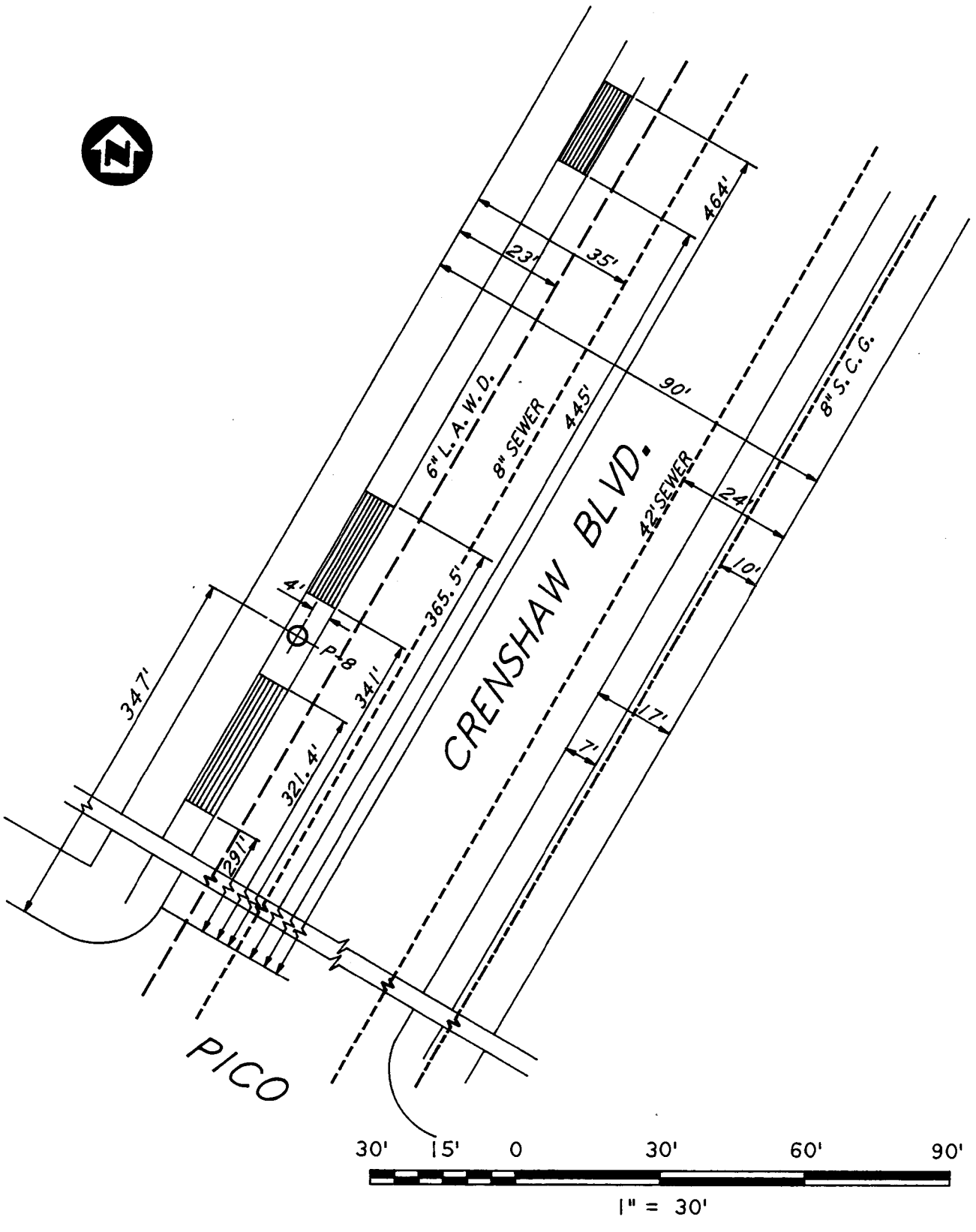


ENGINEERING-SCIENCE	METRO RAIL PROJECT ORANGE LINE PROBE LOCATIONS	PROBE P-7

CADD FILE: S:\METRO\GP3A.DGN

D:07-07-92 R:02
LF

ES ENGINEERING-SCIENCE

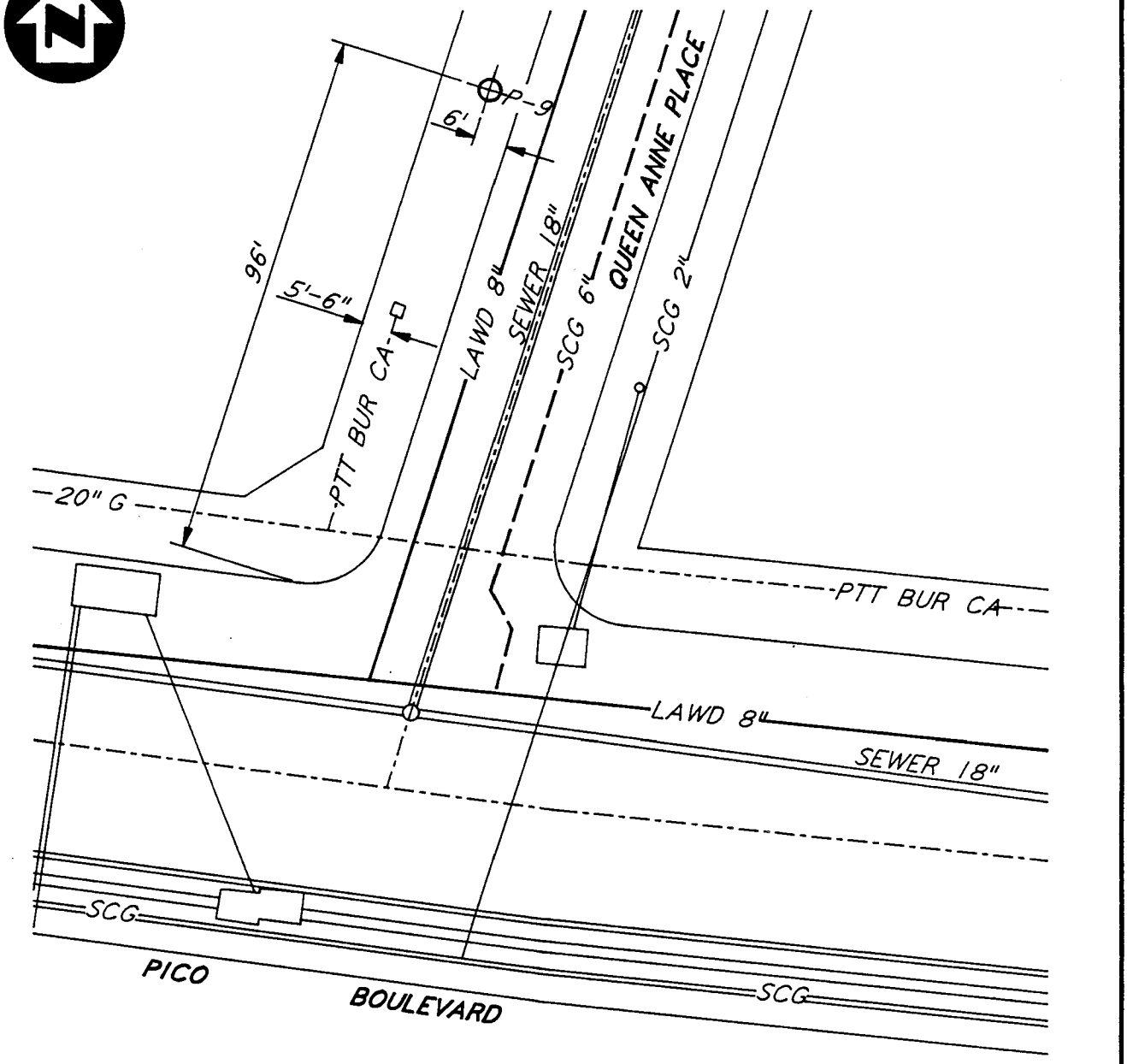


ENGINEERING-SCIENCE	METRO RAIL PROJECT ORANGE LINE PROBE LOCATIONS	PROBE P-8

CADD FILE: \METRO\GP1A.DGN

D: 05/06/92 R: 01

ES ENGINEERING-SCIENCE



30' 15' 0 30' 60' 90'

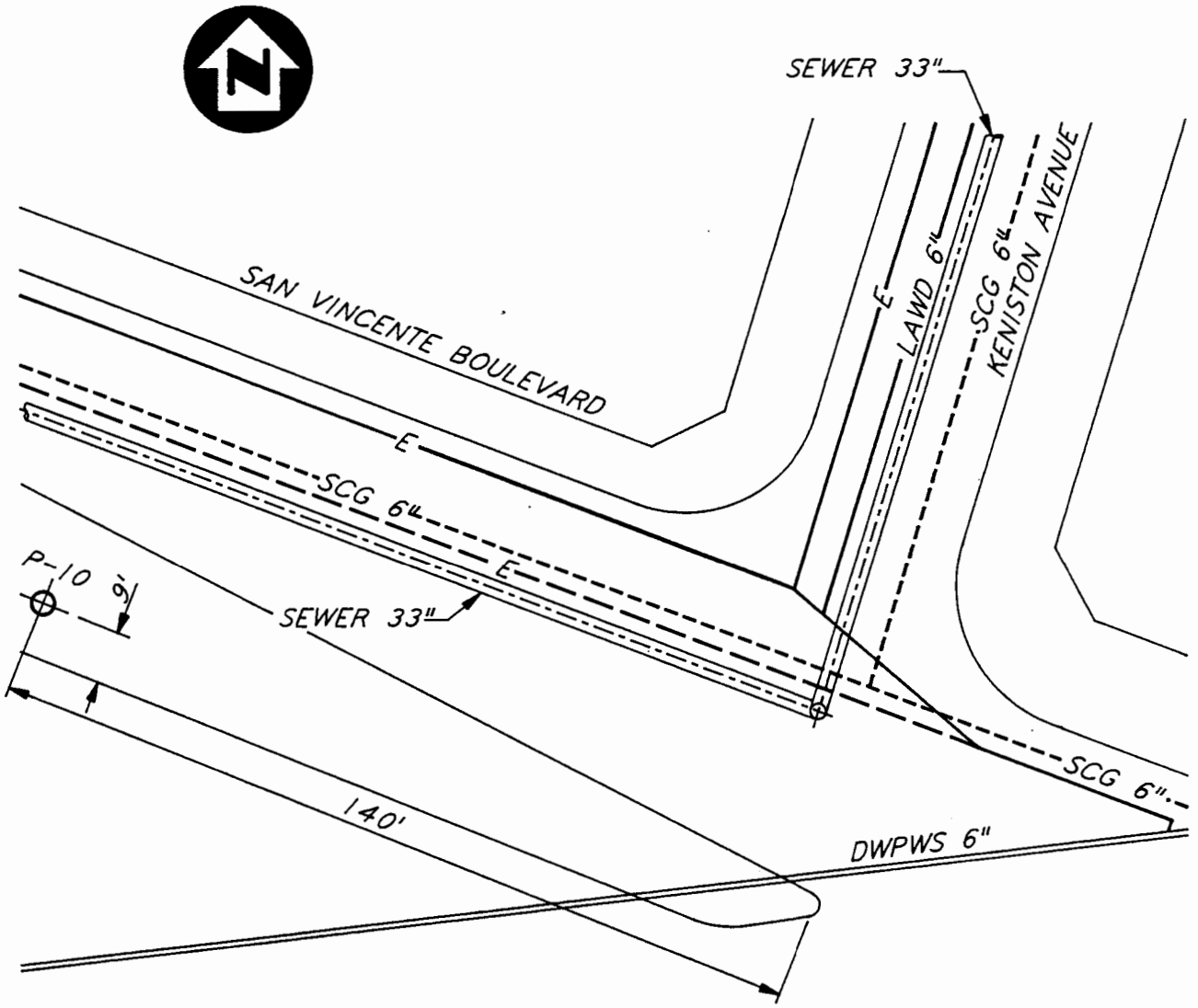
1" = 30'

ENGINEERING-SCIENCE	METRO RAIL PROJECT ORANGE LINE PROBE LOCATIONS	PROBE P-9

CADD FILE: \METRO\GP6A.DGN

D: 05-06-92 R: 01

ES ENGINEERING-SCIENCE



30' 15' 0 30' 60' 90'

1" = 30'

ENGINEERING-SCIENCE	METRO RAIL PROJECT ORANGE LINE PROBE LOCATIONS	PROBE P-10

CADD FILE: \METRO\GP5A.DGN

D: 07-07-92 R: 02
LF

APPENDIX C

APPENDIX C

DRILLING PERMITS

APPLICATION FOR WELL PERMIT

ENVIRONMENTAL HEALTH 2525 Corporate Place Monterey Park, Ca 91754
COUNTY OF LOS ANGELES DEPARTMENT OF HEALTH SERVICES

DATE: 5-4-92

DESCRIPTION

TYPE OF PERMIT (CHECK)

- [X] NEW WELL CONSTRUCTION
- [ ] RECONSTRUCTION OR RENOVATION
- [ ] DESTRUCTION

TYPE OF WELL

- [ ] PRIVATE DOMESTIC
- [ ] PUBLIC DOMESTIC
- [ ] IRRIGATION
- [X] OBSERVATION/MONITORING
- [ ] CATHODIC
- [ ] INDUSTRIAL
- [ ] GRAVEL PACK
- [ ] TEST

TYPE OF CASING: two 1-inch diameter schedule 40 PVC nested in an 8-inch diameter borehole

METHOD OF SEALING OF CASING: please see probe diagram

METHOD OF DESTRUCTION: N/A

LOCATION

ADDRESS (NUMBER, STREET, AND NEAREST INTERSECTION): 700 Crenshaw Blvd.

CITY: Los Angeles

DIAGRAM (SHOW PROPERTY LINES, STREET, ADDRESS, WELL SITE, SEWERS, AND PRIVATE SEWAGE DISPOSAL SYSTEMS ALONG WITH LABELS AND DIMENSIONS)

Please see attached site map and probe diagram

Probes includes P5, P6, P7, P8, P9 and P10.

APPLICANT

NAME OF WELL DRILLER (PRINT): West HazMat

TRADE NAME:

BUSINESS ADDRESS: 1016 E. Katella Ave., Anaheim, CA 92805 CITY

NAME OF WELL OWNER (PRINT): MRTC

MAILING ADDRESS: 548 South Spring Street

CITY: Los Angeles 90013

I hereby agree to comply in every respect with all regulations of the County Preventive/Public Health Services and with all ordinances and laws of the County of Los Angeles and of the State of California pertaining to well construction, reconstruction and destruction. Upon completion of well and within ten days thereafter, I will furnish the County Preventive/Public Health Services with a complete log of the well, giving date drilled, depth of well, all perforations in casing, and any other data deemed necessary by such County Preventive/Public Health Services.

RG 3812

Applicant's Signature

DISPOSITION OF APPLICATION: (For Sanitarians Use Only)

- [X] APPROVED
- [ ] DENIED
- [ ] APPROVED WITH CONDITIONS

If denied or approved with conditions, report reason or conditions here:

DATE:

SANITARIAN:

DATE: 5/6/92

SECTION CHIEF: Robert P. Craig

When signed by Section Chief, this application is a permit.

76A668
H-13 (Rev. 3/91)

APPLICANT

Please Return All Copies

City of Los Angeles
Dept. of Public Works
Bureau of Engineering
78-3.068 (R 4/89)

PRINT OR TYPE

1. Engineering
2. Permittee
3. Permittee/Contr. Adm.
4. Contract Adm.

CLASS "A" APPLICATION / PERMIT

For the Construction of Curbs, Driveways, Sidewalks and other Structures in Public Streets

APPLICANT/PERMITTEE: RSC

ADDRESS: 818 W. 7th Street

CITY: Los Angeles | ZIP CODE: 90017 | TELEPHONE: 213 244-6231

I Hereby agree to observe all requirements of the Municipal Code of the City of Los Angeles, all amendments thereto, and any special requirements made a part of this permit.

X [signature] DATE 5/19/92

RECEIPT NUMBER: No Fee

GIVE TO LA INSPECTOR

NOTE: Dimensions may be obtained from City Records—Plan No. _____

PERMIT NO. A 9205-54

WRITTEN BY	VALIDATION TIME	FRONTAGE STREET	INTERSECTING STREET
	Curb face to front edge of walk	FT. IN.	FT. IN.
	Width of sidewalk	FT. IN.	FT. IN.
	Back edge of walk to property line	FT. IN.	FT. IN.
	Curb face to property line	FT. IN.	FT. IN.
	Height of Curb face (Subject to field check)	FT. IN.	FT. IN.

IF TREE REMOVAL IS NECESSARY, THIS PERMIT IS VOID UNLESS A TREE REMOVAL PERMIT IS ISSUED BY THE BUREAU OF STREET MAINTENANCE.

WORK DESCRIPTION OR REMARKS ☒ NEW ☐ REPAIR ☐ RESURFACING

STD. PLAN NO.

8 soil borings, 6 monitoring wells, 6 vapor wells.
Backfill soil borings with slurry. wells to be caped per sketch.
X change inspection to E1900027
Wells not to be located in sidewalk or gutter.

JOB ADDRESS: Crenshaw & Pico bl.

INSPECTOR'S REPORT

WORK DONE BY

ADDRESS

CONCRETE BUNKER | SOURCE OF BITUMINOUS PAVEMENTS

CONCRETE MIX | DELIVERY TICKET NO. | KIND OF BITUMINOUS MATERIAL

DATE	CURB LIN. FT.	GUTTER SQ. FT.	DRIVEWAY SQ. FT.	6-INCH SIDEWALK SQ. FT.	PAVEMENT TYPE	PAVEMENT SQ. FT.	ROOF DRAINS
TOTAL WORK INSTALLED							
COVERED BY PERMIT							

JOB COMPLETED (DATE) | INSPECTOR

REMARKS

THIS PERMIT EXPIRES IN 180 DAYS

ITEM		QUANTITY	UNIT	RATE	FEE
CONC. CURB			LIN. FT.		$
CONC. GUTTER			SQ. FT.		
CONC. DRIVEWAY			SQ. FT.		
CONC. SIDEWALK			SQ. FT.		
SUBTOTAL					

ITEM	QUANTITY	RATE	D.O.T. PROJECT NO.	TOTAL D.O.T. FEE
Pkg. Mtr. Removal		Ea.		$

Case No.	DRIVEWAYS		
W =			
Y =		BASIC FEE	
X =			
a =		SURCHARGE	
T =			No Fee
SKETCH ATTACHED _____		TOTAL FEE	$

JOB ADDRESS: Crenshaw & Pico bl.

PERMIT NUMBER A- 9205054

USE TYPEWRITER OR BALL POINT PEN — PRESS FIRMLY — PRINT ONLY

DISTRIBUTION: 1. WHITE — ISSUING OFFICE 2. GREEN — PERMITTEE 3. PINK — CONTRACT ADMIN. 4. BLUE — ACCOUNTING 5. YELLOW — STREET MAINTENANCE

P.S.: wells not to be located in sidewalk or Gutter area

City of Los Angeles
Dept. of Public Works
Bureau of Engineering
78-3.052 (R9-89)

APPLICATION/PERMIT FOR EXCAVATIONS

SEE REVERSE SIDE FOR SPECIAL REQUIREMENTS

IN OR ADJACENT TO PUBLIC STREETS
UNDER CHAPTER 6, ARTICLE 2, LOS ANGELES MUNICIPAL CODE

THIS PERMIT NOT VALID UNLESS REGISTER VALIDATED OR RECEIPT SHOWN

JOB ADDRESS: VICINITY OF Crenshaw Blvd. & Pico bl.

PROPERTY OWNER/CONTRACTOR/AGENT FOR: RCC

MAIL ADDRESS: 818 W. 7th street

CITY OR TOWN: Los Angeles

ZIP CODE: 90017

TELEPHONE: 213-244-6231

PURPOSE OF EXCAVATION: (8) soil borings, (6) wells, 6 vapor wells

WORK ORDER NO.	LIAB. INS. C.A. NO.	INSURANCE EXPIRES
E1900027	057675	11-1-92
"A" PERMIT NO.	SURETY BOND C.A. NO.	MISC. RECEIPT NO.
	EXEMPT	PER
ARE STREETS NOW BEING IMPROVED? ☐ YES ☐ NO	WAIVER REC. NO.	MISC. CASH BOND NO.
	ARTICLE 3.2 of the	
PLAT FILED? ☐ YES ☐ NO	REPORT NO.	
	Master Cooperative agreement.	

RECEIPT NO.: NO FEE

MUST CALL FOR INSPECTION 485-3002 24 hr. before Start of Excavation

STATE D.I.S. PERMIT NO.

NOTICE TO PERMITTEE

PERMIT MUST BE ON JOB AT ALL TIMES.

THIS PERMIT EXPIRES 6 MONTHS FROM ISSUANCE UNLESS WORK HAS COMMENCED. (LAMC 62.02)

KEEP SIDEWALKS AND GUTTERS CLEAR.

NOTIFY FIRE AND POLICE DEPT. 48 HOURS BEFORE STARTING WORK WHICH BLOCKS ANY STREET.

INSPECTION IS REQUIRED
See Instructions 8 and 9 on back

I hereby agree to observe all requirements of the Municipal Code of the City of Los Angeles, all amendments thereto, and any special requirements made part of this permit.

x M F Merrick

PRINT NAME: M.F MERRICK

JOB ADDRESS: Vicinity of Crenshaw & Pico bl.

EXCAVATION SIZE AND TYPE

CONC. CURB	At $	LIN. FT.	$	
CONC. WALK	At $	LIN. FT.	$	
CONC. GUTTER	At $	LIN. FT.	$	
PAVEMENT	At $	LIN. FT.	$	
DIRT	At $	LIN. FT.	$	
ROCK & OIL	At $	LIN. FT.	$	
TOTAL SPECIAL DEPOSIT			$	
SPECIAL INSPECTION ____ HOURS ____ DAYS AT ____ PER HOUR DAY				
TESTING RELATIVE COMPACTION	AT	EA.		
STANDARD DENSITY	AT	EA.		
PLAN CHECK				
TOTAL SPEC. INSP., etc.				
TOTAL AMOUNT			$ NO FEE	

Per Article 3.2

BY: R. Jang (BUREAU OF ENGINEERING) DATE: 5-19-92

STREETS AFFECTED

SPECIAL INSPECTION NO.	SPECIAL DEPOSIT PERMIT NO.
E	E 92 50 077

JOB ADDRESS

PERMIT NO. E

APPENDIX D

SOIL BORING LOGS

DRILLING RECORD

BORING ID: P-5	DRILLING STARTED: 9:30 05-28-92
LOCATION: Crenshaw, North of 8th Street	DRILLING COMPLETED: 05-28-92
PROJECT NO: PE362	DRILLING METHOD: 8" Hollow Stem Auger
DRILLER: West Hazmat	SAMPLING METHOD: Split Spoon
LOGGER: M. Zaidi	STATIC WATER LEVEL: = 36'
GEOLOGIST: M. Zaidi	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW L.S.		SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE I.D.	SAMPLE DESCRIPTION	NOTES
						Background = 3 ppm HS = Head Space
5		17-18-22	100%		CL, Sandy (10%) and Gravelly (10%) Clay, medium gray, sl. moist, gravel is granule sized, medium hard.	HS = 10.9 ppm
10		10-11-19	100%		ML, Clayey Silt, green, almost dry, medium hard.	HS = 5.5 ppm
15		9-10-15	100%	P-5-15	ML, Clayey Silt, green at the top and grades down to khaki/brown/rust mottled, almost dry, medium hard.	HS = 6.7 ppm
20		11-27-32	100%		SP, Sand, f.g., grayish green, friable, sl moist.	HS = 8.0 ppm
25		12-14-23	100%		SP, Sand, c.g., green, friable, sl. moist.	HS = 6.3 ppm
30		9-17-18	100%		ML, Sand, f.g., silty, grades downward to clayey silt, medium moist.	HS = 6.8 ppm
35		16-27-32	100%		SP, Sand, grayish green, v.c.g., minor silt (= 5%), friable, sand wet and fluid at 36 ft. bgs.	HS = 5.7 ppm
40		13-19-25	100%		SP, Sand, grayish green, v,.c.g., sl. silty (= 5%), as @ 35'.	HS = 6.7 ppm
45		8-13-15	100%		SC, Sand, (50%, grayish green, f.g., moist, silty (20%), clayey (30%), med. plasticity.	HS = 6.3 ppm
50		8-17-22	100%		ML, Sand, v.f.g., green, friable, moist.	HS = 5.5 ppm
55		15-21-22	100%		ML, Silt, green, sl. moist, friable.	HS = 2.8 ppm

DRILLING RECORD

DEPTH IN FEET BELOW L.S.		SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE I.D.	SAMPLE DESCRIPTION	NOTES
60		11-12-14	100%		CL, Silty (=15%) Clay, greenish dark gray, brittle to slightly plastic, slightly moist, medium hard.	HS = 4.5 ppm
65		10-19-37	100%		SP, Sand, c.g., grayish green, wet, friable.	HS = 4.1 ppm
70		29-50/4"	60%		SP, Sand, m.g., med. to dk. gray, friable, saturated with indigenous petroleum (a reservoir rock).	HS = 6.6 ppm
75		50/6"	33%		SP, Sand, f.g. to m.g., med. to dk. gray, friable, wet with water and some petroleum.	HS = 4.5 ppm
81		50/5"	30%		SP, Sand, m.g., as @ 75'.	HS = 0 ppm
					Total Depth = 81' bgs	

DRILLING RECORD

BORING ID: P-6	DRILLING STARTED: 8:35 05-27-92
LOCATION: 9th Street at Crenshaw	DRILLING COMPLETED: 05-27-92
PROJECT NO: PE362	DRILLING METHOD: 8" Hollow Stem Auger
DRILLER: West Hazmat	SAMPLING METHOD: Split Spoon
LOGGER: M. Zaidi	STATIC WATER LEVEL: 36'
GEOLOGIST: M. Zaidi	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW L.S.		SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE I.D.	SAMPLE DESCRIPTION	NOTES
						HS = Head Space
5		3-6-10	100%		CL, khaki-brown, silty (= 30%), dry.	HS = 6 ppm
10		9-12-14	100%		ML, clayey silt, lt. khaki-brown, sl plastic, sl. moist, friable.	HS = 6 ppm
15		14-31-50/5"	90%	P-6-15	SC, Sand, v.f.g., white, silty probably lime, minor gravel (sl. larger than v.c.), silt (30%), clay (20%). SP, grayish white, c.g. to m.g., friable, perched water at 19'.	HS = 5 ppm
20		5-10-10	100%		SM, Sand, brown, silty (20%), clayey (5%), sl. moist.	HS = 7 ppm
25		9-10-14	100%		SM, Sand, f.g. to v.f.g., green, medium moist, sl. silty.	HS = 7 ppm
30		10-18-31	100%		SP, Sand, f.g. to m.g., green, medium moist. Fine and m.g., sand interbedded (=1' thick). Fine sand bed shows cross bedding.	HS = 8 ppm
35		13-19-30	100%		SP, Sand, c.g., green, wet, perched water at 36' bgs.	HS = 7 ppm
40		10-15-50/5"	90%		CL, Silty Clay, green, clay (= 60%), hard, almost dry.	HS = 7 ppm
45		18-30-35	100%		ML, Clayey Silt, green, silt (= 60%), hard, almost dry, some white mottles.	HS = 7 ppm
50		7-12-20	100%		ML, Silty, f.g., dark green, moist.	HS = 7 ppm

DRILLING RECORD

DEPTH IN FEET BELOW L.S.		SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE I.D.	SAMPLE DESCRIPTION	NOTES
55		50/5"	30%		ML, Sand, f.g., dk. green, moist, sl. silty (5-10%).	HS = 6 ppm
60		29-50/5"	60%		CL, Clay, d. green, silty (= 20%), interbedded with silt, dry, hard.	HS = 7 ppm
65		50/4"	30%		SP, Sand, green, c.g. to m.g., moist, v. sl. silty (= 5%).	HS = 8 ppm
70		25-36-41	100%		SP, Sand, grayish dk. brown, m.g. to c.g., saturated with petroleum hydrocarbons (indigenous reservoir rock), v. sl. petroleum odor.	HS = 108 ppm
75		15-50/5"	60%		SP, as at 70'	HS = 37 ppm
81		15-16-17	100%		SP, as at 70' and 75'. Bottom one foot v.c.g. sand, with = upto 10% fine gravel.	HS = 68 ppm
					Total Depth = 81' bgs	

DRILLING RECORD

BORING ID: P-7	DRILLING STARTED: 06-04-92
LOCATION: S. side of County Club Dr., W. of Crenshaw	DRILLING COMPLETED: 06-04-92
PROJECT NO: PE362	DRILLING METHOD: 8" Hollow Stem Auger
DRILLER: West Hazmat	SAMPLING METHOD: Split Spoon
LOGGER: M. Zaidi	STATIC WATER LEVEL: = 20'
GEOLOGIST: M. Zaidi	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW L.S.		SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE I.D.	SAMPLE DESCRIPTION	NOTES
					Asphalt = 1", Concrete = 8"	Background = 0 ppm HS = Headspace
5		6-10-11	100%		CL, Clay, brown, sl. silty (10%) and gravelly (2%), sl. mois, med. hard, med. plasticity.	HS = 0 ppm
10		7-9-12	100%		Cl, Clay, brown, as @ 5'	HS = 0 ppm
15		9-16-20	100%	P-7-15	ML, Silt, brown, clayey (= 30%), moist, med. plasticity, sl. soft. Sleeves are wet so close to GW (= 18-19' bgs).	HS = 0 ppm
20		16-20-24	100%		GW, Gravel, sand (30% v.c.g. to c.g.), granules (55%), wet, poorly sorted, 15% gravel up to 1" diameter. Sampler and samples wet; definate groundwater.	HS = 0 ppm
25		29-50/6"	66%		GW, Gravel, sandy (= 40% v.c.g., c.g., and m.g.), granules (50%), wet, poorly sorted, 10% gravel up to 1" diameter.	HS = 1.2 ppm
30		15-50/6"	66%		Cl, Clay, silty (= 30%), grayish green, sl. moist, med. hard, med. plasticity.	HS = 2.6 ppm
35		50/6"	33%		CL, Clay, grayish green, moist, med. hard, high plasticity, sl. silty (5-10%), interbedded with silt and v.f.g. sand (1-2" beds).	HS = 2.9 ppm
40		50/6"	33%		CL, Clay, grayish green, moist, med. soft, high plasticity, vaguely laminated.	HS = 5.7 ppm
45		23-50/6"	66%		CL, Clay, grayish green, sl. moist, hard, high plasticity.	HS = 2.4 ppm
50		5-50/4"	55%		SP, Sand, med. gray, f.g., v. well sorted, friable, moist to sl. wet.	HS = 11.2 ppm

DRILLING RECORD

DEPTH IN FEET BELOW L.S.		SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE I.D.	SAMPLE DESCRIPTION	NOTES
55		50/6"	33%		SW, Sand, med. greenish gray, poorly sorted, v.c.g. to f.g., minor granules (5-10%), wet, friable. Encountered H2S (72 ppm) at 55' bgs at the top of the hole.	HS = 7.6 ppm
61		50/6"	33%		SP, Sand, med. gray, m.g., wet, friable, v. well sorted.	HS = 0 ppm
					Total Depth = 61' bgs	

DRILLING RECORD

BORING ID: P-8	DRILLING STARTED: 06-03-92
LOCATION: Crenshaw, approx. 400 N. of Pico	DRILLING COMPLETED: 06-03-92
PROJECT NO: PE362	DRILLING METHOD: 8" Hollow Stem Auger
DRILLER: West Hazmat	SAMPLING METHOD: Split Spoon
LOGGER: M. Zaidi	STATIC WATER LEVEL: 74' bgs
GEOLOGIST: M. Zaidi	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW L.S.		SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE I.D.	SAMPLE DESCRIPTION	NOTES
						Background = 0 ppm HS = Head Space
5		10-17-13	100%		CL, Clay, silty (= 40%), rusty-brown, with limonite spots and elongated dark gray irregular patches of organic materials, dry, hard.	HS = 0 ppm
10		13-17-22	100%		SC, Sand, c.g. to silty, greenish-brown, clay (= 25%), moist, soft, sl. plastic, sand very poorly sorted.	HS = 0 ppm
15		12-15-17	100%	P-8-15	SC, as at 10'	HS = 0 ppm
20		17-21-23	100%		ML, Sand, khaki-brown, v.f.g., well sorted, sl. moist, friable.	HS = 0 ppm
25		10-14-19	100%		ML, Silt, khaki-brown, cross laminated, dark gray (organic material or mica-rich) and khaki laminate, sl. plastic, sl. moist.	HS = 0 ppm
30		18-22-23	100%		ML, Silt, khadi-brown, sl. clayey (= 15%), sl. moist, sl. plastic, micaceous.	HS = 0 ppm
35		16-20-23	100%		ML, Silt, khaki-brown, sl. clayey (= 10%), sl. moist, interbedded with khaki-brown silty clay (= 20%), CL. CL is sl. moist to almost dry, hard, med. plastic, rare granules.	HS = 0 ppm
40		14-24-31	100%		ML, Silt, khaki-brown, sl. clayey (= 10%), almost dry.	HS = 0 ppm
45		18-23-27	100%		ML, Silt, khaki-brown, laminated with alternative limonite, rich and greenish khaki laminae, sl. moist, sl. clayey (= 15%).	HS = 0 ppm
50		24-31-34	100%		ML, Silt, khaki-brown, sl clayey (= 10%), sl. moist.	HS = 0 ppm
55		50/4"	30%		SM, Sand, med. gray, f.g., friable, sl. moist, med. sorfte, sl. silty (= 10%).	HS = 0 ppm

DRILLING RECORD

DEPTH IN FEET BELOW L.S.		SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE I.D.	SAMPLE DESCRIPTION	NOTES
60		14-29-41	100%		SP, Sand, med. gray, f.g., micaceous, well sorted, sl. moist, friable.	HS = 0 ppm
65		10-27-31	100%		SM, Sand, f.g., grayish green, silty (= 25%), moist, sl. cohesive, rare granules.	HS = 0 ppm
70		---	100%		ML, Sand to Silt, f.g., intervedded clayey silt, f.g. and c.g., sand laminae grayish green, clayey (= 15), sl. moist to almost dry, med. hard.	HS = 0 ppm
74		---	---		Groundwater detected after drilling to Total Depth.	
75		29-37-42	100%		ML, Silt, grayish green, clayey (= 25%) sl. plastic, moist.	HS = 0 ppm
80		12-22-30	100%		SM, Sand, f.g., grayish green, silty (= 30%), very moist, soft, poorly sorted.	HS = 0 ppm
85		6-10-16	100%		CL, Clay, grayish green, sl. moist, highly plastic, medium hard. Sampler partly wet so possible perched groundwater at 84'.	HS = 0 ppm
90		6-12-18	100%		CL, Clay, grayish green, sl. moist, med. plasticity, sl. silty (= 15%), med. hard.	HS = 0 ppm
95		50/6"	33%		SM, Sand, grayish green, moist, silty (= 20%), f.g. to m.g.	HS = 0 ppm
					Total Depth = 97' bgs	

DRILLING RECORD

BORING ID: P-9	DRILLING STARTED: 06-01-92
LOCATION: Queen Anne Place at Pico	DRILLING COMPLETED: 06-01-92
PROJECT NO: PE362	DRILLING METHOD: 8" Hollow Stem Auger
DRILLER: West Hazmat	SAMPLING METHOD: Split Spoon
LOGGER: M. Zaidi	STATIC WATER LEVEL: = 70'
GEOLOGIST: M. Zaidi	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW L.S.		SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE I.D.	SAMPLE DESCRIPTION	NOTES
						HS = Headspace
5		21-23-25	100%		ML, rusty-brown, dry, med. hard, clayey (= 10%).	HS = 2.2 ppm
10		50/5"	30%		SP, Sand, rusty-brown, friable, sl. moist, m.g., well sorted, minor granules (i.e., v.c. sand).	HS = 2.7 ppm
15		50/4"	25%	P-9-15	SP, Sand, khaki-brown, m.g., well sorted, sl. moist, friable.	HS = 2.6 ppm
20		20-25-27	100%		SP, Sand, khaki-gray, m.g., well sorted, sl. moist, friable	HS = 2.5 ppm
25		14-22-28	100%		SC, Sand, khaki-gray, f.g. to m.g., friable, sl. clayey (= 5-10%), dry to sl. moist, interbedded with khaki-gray silty clay.	HS = 1.6 ppm
30		13-15-19	100%		ML, Sand, f.g., khaki-gray, sl. moist, friable to sl. silty, interbedded with brown, hard, dry silty clay with rusty brown mottles.	HS = 2.3 ppm
35		50/6"	35%		CL, Clay, grayish light brown, hard, silty (= 45%), sl. moist, brittle.	HS = 2.0 ppm
40		50/4"	25%		CL, Clay, greenish gray, silty (= 30%), hard, sl. moist, rare small rusty mottles, med. plasticity.	HS = 2.3 ppm
45		50/6"	33%		ML, Silt to v.f.g. Sand, green, dry to v. sl. moist, friable to clumpy.	HS = 2.2 ppm
50		27-50/5"	60%		ML, Silt, green, dry to v. low moisture, med. hard.	HS = 1.6 ppm
55		25-50/5"	60%		SP, Sand, grayish green, f.g., sl. moist, friable, v. well sorted.	HS = 2.2 ppm

DRILLING RECORD

DEPTH IN FEET BELOW L.S.		SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE I.D.	SAMPLE DESCRIPTION	NOTES
60		28-31-32	100%		SP, Sand, grayish green, c.g., sl. moist, friable, minor gravel and granules (= 5%), interbedded with grayish green silty clay.	HS = 1.4 ppm
65		35-50/5"	60%		SP, Sand, grayish green, c.g., moist, friable, very well sorted, micaceous.	HS = 2.0 ppm
70		50/6"	33%		SP, Sand, grayish green, c.g., wet, groundwater encountered between 68 to 70', friable, v. well sorted, micaceous.	HS = 0.9 ppm
75		50/6"	33%		SW, Sand, grayish green, c.g. to v.c.g., rare pebbles, wet, med. sorting, friable. Rare interbeds or lenses of silty clay.	HS = 0.5 ppm
80		50/5"	30%		ML, Silt, grayish green, hard, sl. moist.	HS = 0.8 ppm
85		38-50/6"	66%		ML, Silt, grayish green, hard, moist.	HS = 0.7 ppm
90		50/5"	30%		ML, Silt, grayish green, hard, moist, clayey.	
95		50/3"	20%		SP, Sand, m.g., grayish green, friable, moist.	HS = 4.6 ppm
99		---	100%		SP, Sand, c.g., greenish, m.g., friable, wet.	HS = 2.0 ppm
					Total Depth = 99' bgs	

DRILLING RECORD

BORING ID: P-10	DRILLING STARTED: 06-02-92
LOCATION: San Vincente near Keniston	DRILLING COMPLETED: 06-02-92
PROJECT NO: PE362	DRILLING METHOD: 8" Hollow Stem Auger
DRILLER: West Hazmat	SAMPLING METHOD: Split Spoon
LOGGER: M. Zaidi	STATIC WATER LEVEL: Not Encountered
GEOLOGIST: M. Zaidi	WATER LEVEL DATE:
SIGNATURE:	WATER LEVEL DATUM:

DEPTH IN FEET BELOW L.S.		SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE I.D.	SAMPLE DESCRIPTION	NOTES
						Background = 0 ppm HS = Head Space
5		5-9-17	100%		ML, Sand, f.g. to v.f.g., grayish green, silty (20%) and clayey (= 30%), med. plasticity, moist.	HS = 0 ppm
10		9-13-14	100%		SP, Sand, grayish green, v.c.g. to c.g., friable, moist.	HS = 0 ppm
15		5-6-9	100%	P-10-15	SC, Sand, brownish-dark gray, c.g. to clay (= up to 30%), poorly sorted, medium plasticity, moist. Clay is brownish black.	HS = 0 ppm
20		9-11-13	100%		SP, Sand, v.c.g. to c.g., lt. gray, friable, very well sorted, sl. moist.	HS = 0 ppm
25		15-17-20	100%		CL, grayish green, silty (= 30%), med. plasticity, med. hard, sl. moist.	HS = 0 ppm
30		13-19-23	100%		CL, Clay, grayish green, silty (= 35-40%), sl. hard, med. plasticity, sl. moist.	HS = 0 ppm
35		10-12-15	100%		ML, Silt, grayish green, med. hard, sl. moist, sl. clayey (= 5-10%).	HS = 0 ppm
40		16-20-25	100%		ML, Silt, grayish green, hard, almost dry, clayey (= 5-10%).	HS = 0 ppm
45		---	100%		SP, Sand, med. gray, f.g. to m.g., micaceous, friable, moist, well sorted.	HS = 0 ppm
50		50/6"	33%		SP, Sand, f.g., med. gray, micaceous, friable, moist, v. well sorted.	HS = 0 ppm
55		50/6"	33%		SW, Sand, granules to fine grained, dk. gray, moist, friable, rare rounded 1-1/2" diameter gravel, v. poorly sorted.	HS = 0 ppm

DRILLING RECORD

DEPTH IN FEET BELOW L.S.		SAMPLER BLOWS	PERCENT RECOVERY	SAMPLE I.D.	SAMPLE DESCRIPTION	NOTES
60		28-31-32	100%		SP, Sand, med. gray, f.g., friable, v. well sorted, moist. Total Depth = 60' Groundwater not encountered to total depth.	HS = 1.4 ppm

APPENDIX E

APPENDIX E

LABORATORY ANALYTICAL RESULTS

Enseco
A Corning Company

Enseco - Air Toxics Laboratory
18501 East Gale Avenue, Suite 130
City of Industry, CA 91748-1321
(818) 965-1006 • FAX (818) 965-1003

July 10, 1992

ENGINEERING-SCIENCE, INC.
199 S. Los Robles Avenue
Pasadena, CA 91101
ATTN: MR. JOHN JACKSON

ANALYSIS NO.: A9217603-001/003
ANALYSES: BTXE (ARB-ADDL004), Natural Gas (ASTM-D1945), Fixed Gas (ASTM-D1946), Hydrogen Sulfide (CARB 16)
DATE SAMPLED: 06/23/92
DATE SAMPLE REC'D: 06/24/92

PROJECT: PARSONS BRINCKERHOFF

Enclosed with this letter is the report on the chemical and physical analyses on the samples from ANALYSIS NO: A9217603-001/003 as shown above.

The samples were received by Enseco Air Toxics Laboratory, intact and with the chain-of-custody record attached.

Please note that ND means not detected at the reporting limits expressed.

The preliminary results were faxed to Mr. John Jackson on July 8 & 9, 1992.

Maurita M. Lorenzo
REVIEWED

APPROVED

The Report Cover Letter is an integral part of this report.

This report pertains only to the samples investigated and does not necessarily apply to other apparently identical or similar materials. This report is submitted for the exclusive use of the client to whom it is addressed. Any reproduction of this report or use of this Laboratory's name for advertising or publicity purposes without authorization is prohibited.

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18501 East Gale Avenue, Suite 130
City of Industry, CA 91748-1321
(818) 965-1006 • FAX (818) 965-1003

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A Corning Company

LABORATORY REPORT

ENGINEERING-SCIENCE, INC.
199 S. Los Robles Avenue
Pasadena, CA 91101
ATTN: MR. JOHN JACKSON

Sample ID: P-10 (DEEP)

ANALYSIS NO.: A9217603-001
ANALYSES: BTXE (ARB-ADDL004)
DATE SAMPLED: 06/23/92
DATE SAMPLE REC'D: 06/24/92
DATE ANALYZED: 06/26/92
SAMPLE TYPE: Air

BTXE ANALYSIS

Compounds	Results ppm(vol/vol)	Reporting Limits
Benzene	0.48	0.020
Toluene	2.0	0.020
Ethyl Benzene	2.7	0.020
Total Xylenes	0.57	0.040

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Enseco - Air Toxics Laboratory
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City of Industry, CA 91748-1321
(818) 965-1006 • FAX (818) 965-1003

LABORATORY REPORT

ENGINEERING-SCIENCE, INC.
199 S. Los Robles Avenue
Pasadena, CA 91101
ATTN: MR. JOHN JACKSON

Sample ID: P-7 (DEEP)

ANALYSIS NO.: A9217603-002
ANALYSES: BTXE (ARB-ADDL004)
DATE SAMPLED: 06/23/92
DATE SAMPLE REC'D: 06/24/92
DATE ANALYZED: 06/26/92
SAMPLE TYPE: Air

BTXE ANALYSIS

Compounds	Results ppm(vol/vol)	Reporting Limits
Benzene	6.9	0.040
Toluene	0.26	0.040
Ethyl Benzene	0.62	0.040
Total Xylenes	0.35	0.080

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18501 East Gale Avenue, Suite 130
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LABORATORY REPORT

ENGINEERING-SCIENCE, INC.
199 S. Los Robles Avenue
Pasadena, CA 91101
ATTN: MR. JOHN JACKSON

Sample ID: P-6 (DEEP)

ANALYSIS NO.: A9217603-003
ANALYSES: BTXE (ARB-ADDL004)
DATE SAMPLED: 06/23/92
DATE SAMPLE REC'D: 06/24/92
DATE ANALYZED: 06/26/92
SAMPLE TYPE: Air

BTXE ANALYSIS

Compounds	Results ppm(vol/vol)	Reporting Limits
Benzene	ND	0.080
Toluene	0.74	0.020
Ethyl Benzene	ND	0.020
Total Xylenes	0.12	0.040

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LABORATORY REPORT

ENGINEERING-SCIENCE, INC.
199 S. Los Robles Avenue
Pasadena, CA 91101
ATTN: MR. JOHN JACKSON

ANALYSIS NO.: A9217603
ANALYSES: BTXE (ARB-ADDL004)
DATE SAMPLED: 06/23/92
DATE SAMPLE REC'D: 06/24/92
DATE ANALYZED: 06/26/92
SAMPLE TYPE: Air

BTXE ANALYSIS
Blank Summary

Compounds	Results ppm(vol/vol)	Reporting Limits
Benzene	ND	0.02
Toluene	ND	0.02
Ethyl Benzene	ND	0.02
Total Xylenes	ND	0.04

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LABORATORY REPORT

ENGINEERING-SCIENCE, INC.
199 S. Los Robles Avenue
Pasadena, CA 91101
ATTN: MR. JOHN JACKSON

Sample ID: P-10 (DEEP)

ANALYSIS NO.: A9217603-001
ANALYSES: Natural Gas (ASTM-D1945)
DATE SAMPLED: 06/23/92
DATE SAMPLE REC'D: 06/24/92
DATE ANALYZED: 06/25/92, 06/26/92
SAMPLE TYPE: Air

Natural Gas - (ASTM-D1945)

Compounds	Results % (vol/vol)
Carbon Dioxide	6.0
Oxygen	0.9
Nitrogen	4.4
Methane	88.0
Ethane	0.6
Propane	0.09
i-Butane	ND (0.01)
n-Butane	ND (0.01)
neo-Pentane	ND (0.01)
i-Pentane	ND (0.01)
n-Pentane	ND (0.01)
Hexanes	ND (0.01)
Heptanes	ND (0.01)
Octanes and Higher Molecular Weight Hydrocarbons	ND (0.01)
Total	100.0
BTU/Cubic ft.	901.7
Specific Gravity (air = 1.00)	0.6390

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LABORATORY REPORT

ENGINEERING-SCIENCE, INC.
199 S. Los Robles Avenue
Pasadena, CA 91101
ATTN: MR. JOHN JACKSON

Sample ID: P-7 (DEEP)

ANALYSIS NO.: A9217603-002
ANALYSES: Natural Gas (ASTM-D1945)
DATE SAMPLED: 06/23/92
DATE SAMPLE REC'D: 06/24/92
DATE ANALYZED: 06/25/92, 06/26/92
SAMPLE TYPE: Air

Natural Gas - (ASTM-D1945)

Compounds	Results % (vol/vol)
Carbon Dioxide	2.9
Oxygen	1.0
Nitrogen	4.6
Methane	91.3
Ethane	ND (0.1)
Propane	ND (0.01)
i-Butane	ND (0.01)
n-Butane	ND (0.01)
neo-Pentane	ND (0.01)
i-Pentane	ND (0.01)
n-Pentane	ND (0.01)
Hexanes	0.03
Heptanes	0.14
Octanes and Higher Molecular Weight Hydrocarbons	ND (0.01)
Total	100.0
BTU/Cubic ft.	931.0
Specific Gravity (air = 1.00)	0.6113

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LABORATORY REPORT

ENGINEERING-SCIENCE, INC.
199 S. Los Robles Avenue
Pasadena, CA 91101
ATTN: MR. JOHN JACKSON

Sample ID: P-6 (DEEP)

ANALYSIS NO.: A9217603-003
ANALYSES: Natural Gas (ASTM-D1945)
DATE SAMPLED: 06/23/92
DATE SAMPLE REC'D: 06/24/92
DATE ANALYZED: 06/25/92, 06/26/92
SAMPLE TYPE: Air

Natural Gas - (ASTM-D1945)

Compounds	Results % (vol/vol)
Carbon Dioxide	1.1
Oxygen	9.3
Nitrogen	45.6
Methane	43.7
Ethane	ND (0.1)
Propane	ND (0.01)
i-Butane	ND (0.01)
n-Butane	ND (0.01)
neo-Pentane	ND (0.01)
i-Pentane	ND (0.01)
n-Pentane	ND (0.01)
Hexanes	0.07
Heptanes	0.25
Octanes and Higher Molecular Weight Hydrocarbons	ND (0.01)
Total	100.0
BTU/Cubic ft.	458.8
Specific Gravity (air = 1.00)	0.8131

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LABORATORY REPORT

ENGINEERING-SCIENCE, INC.
199 S. Los Robles Avenue
Pasadena, CA 91101
ATTN: MR. JOHN JACKSON

Sample ID: P-10 (DEEP)

ANALYSIS NO.: A9217603-001
ANALYSES: Fixed Gas (ASTM-D1946)
DATE SAMPLED: 06/23/92
DATE SAMPLE REC'D: 06/24/92
DATE ANALYZED: 06/26/92
SAMPLE TYPE: Air

Fixed Gas (ASTM-D1946)

Compounds	Results	Units	Reporting Limits
Carbon Monoxide	ND	ppm (vol/vol)	100

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LABORATORY REPORT

ENGINEERING-SCIENCE, INC.
199 S. Los Robles Avenue
Pasadena, CA 91101
ATTN: MR. JOHN JACKSON

Sample ID: P-7 (DEEP)

ANALYSIS NO.: A9217603-002
ANALYSES: Fixed Gas (ASTM-D1946)
DATE SAMPLED: 06/23/92
DATE SAMPLE REC'D: 06/24/92
DATE ANALYZED: 06/26/92
SAMPLE TYPE: Air

Fixed Gas (ASTM-D1946)

Compounds	Results	Units	Reporting Limits
Carbon Monoxide	ND	ppm (vol/vol)	100

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(818) 965-1006 • FAX (818) 965-1003

Enseco
A Corning Company

LABORATORY REPORT

ENGINEERING-SCIENCE, INC.
199 S. Los Robles Avenue
Pasadena, CA 91101
ATTN: MR. JOHN JACKSON

Sample ID: P-6 (DEEP)

ANALYSIS NO.: A9217603-003
ANALYSES: Fixed Gas (ASTM-D1946)
DATE SAMPLED: 06/23/92
DATE SAMPLE REC'D: 06/24/92
DATE ANALYZED: 06/26/92
SAMPLE TYPE: Air

Fixed Gas (ASTM-D1946)

Compounds	Results	Units	Reporting Limits
Carbon Monoxide	ND	ppm (vol/vol)	100

The Report Cover Letter is an integral part of this report.
This report pertains only to the samples investigated and does not necessarily apply to other apparently identical or similar materials. This report is submitted for the exclusive use of the client to whom it is addressed. Any reproduction of this report or use of this Laboratory's name for advertising or publicity purposes without authorization is prohibited.

Enseco - Air Toxics Laboratory
18501 East Gale Avenue, Suite 130
City of Industry, CA 91748-1321
(818) 965-1006 • FAX (818) 965-1003

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LABORATORY REPORT

ENGINEERING-SCIENCE, INC.
199 S. Los Robles Avenue
Pasadena, CA 91101
ATTN: MR. JOHN JACKSON

ANALYSIS NO.: A9217603
ANALYSES: Fixed Gas (ASTM-D1946)
DATE SAMPLED: 06/23/92
DATE SAMPLE REC'D: 06/24/92
DATE ANALYZED: 06/26/92
SAMPLE TYPE: Air

Fixed Gas (ASTM-D1946)
Blank Summary

Compounds	Results	Units	Reporting Limits
Carbon Monoxide	ND	ppm (vol/vol)	100

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LABORATORY REPORT

ENGINEERING-SCIENCE, INC.
199 S. Los Robles Avenue
Pasadena, CA 91101
ATTN: MR. JOHN JACKSON

ANALYSIS NO.: A9217603-001/003
ANALYSES: Hydrogen Sulfide (CARB 16)
DATE SAMPLED: 06/23/92
DATE SAMPLE REC'D: 06/24/92
DATE ANALYZED: 06/25/92, 06/26/92
SAMPLE TYPE: Air

Hydrogen Sulfide (CARB 16)

Sample Identification	Results ppm (vol/vol)	Reporting Limits
P-10 (DEEP)	3,300	100
P-7 (DEEP)	280	10
P-6 (DEEP)	0.39	0.20

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LABORATORY REPORT

ENGINEERING-SCIENCE, INC.
199 S. Los Robles Avenue
Pasadena, CA 91101
ATTN: MR. JOHN JACKSON

ANALYSIS NO.: A9217603
ANALYSES: Hydrogen Sulfide (CARB 16)
DATE SAMPLED: 06/23/92
DATE SAMPLE REC'D: 06/24/92
DATE ANALYZED: 06/25/92, 06/26/92
SAMPLE TYPE: Air

CARB 16
Blank Summary

Compound	Results ppm (vol/vo)	Reporting Limits
Hydrogen Sulfide	ND	0.2

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Enseco
A Corning Company

☐ 7440 Lincoln Way, Garden Grove, CA 92641, (714) 898-6370
☐ 2810 Bunsen Ave., Unit A Ventura, CA 93003, (805) 650-0546
☐ 2325 Skyway Dr., Unit K, Santa Maria, CA 93455, (805) 922-2776
☐ 9537 Telstar Ave., Unit 118, El Monte, CA 91731, (818) 442-8400
☐ Mobile Labs, (800) ENSECO-8

CHAIN OF CUSTODY RECORD

Date 6-24-92 Page 1 of 1

Lab Number A9217603-001/003

CLIENT ENGINEERING-SCIENCE

ADDRESS 199 S. LOS ROBLES AVE
PASADENA, CA 91101

PROJECT NAME
PARSONS BRINCKERHOFF

CONTRACT / PURCHASE ORDER / QUOTE #
PE362.01

PROJECT MANAGER
JOHN JACKSON

PHONE NUMBER
(818) 585-6207

SITE CONTACT
J. JACKSON

ANALYSES

Sample No. / Identification	Date	Time	Lab Sample Number	SAMPLE TYPE LIQ.	AIR	SOLID	No. of Containers	Natural Gases	Fixed Gases	BTEX	H_2S				Sample Condition/ REMARKS
P-10 (DEEP)	6/23/92	1112			✓		2	✓	✓	✓	✓				BE AWARE
P-7 (DEEP)	6/23/92	1143			✓		2	✓	✓	✓	✓				OF HIGH
P-6 (DEEP)	6/23/92	1210			✓		2	✓	✓	✓	✓				H_2S AND
															METHANE
															IN ALL
															SAMPLES

SAMPLERS: (Signature) John A. Jackson / M22

Relinquished by: (Signature)	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Received by: (Signature)	Date	Time

The delivery of samples and the signature on this chain of custody form constitutes authorization to perform the analyses specified above under the Enseco Terms and Conditions, unless a contract or purchase order has been executed and is cited above.

Relinquished by: (Signature)	Date	Time	Received for Laboratory by:	Date RECEIVED	Time	Date ACCEPTED	Time
X John A. Jackson	6/24/92	1435		6/24/92	14:35		

Method of Shipment:

Special Instructions:
ANALYSIS AS PER FAX TRANSMISSION ON
5/21/92

SAMPLE DISPOSITION:
1. Storage time requested: _____ days
(Samples will be stored for 30 days without additional charges; thereafter storage charges will be billed at the published rates.)
2. Sample to be returned to client: Y N
(Enseco will dispose of unreturned samples at no extra charge. Disposal will be by incineration wherever possible; otherwise, as appropriate, according to legal requirements.)

ENS—1145

DISTRIBUTION: White with report, Yellow to Enseco, Pink to Courier, Gold to Sample Control

APPENDIX F

APPENDIX F

SUPPLEMENTAL HISTORICAL MONITORING DATA

PROBE #	DATE OF MEASUREMENT	PRESSURE (in inches of water) S/D	% OXYGEN S/D	COMBUSTIBLE GAS (% LEL) S/D	HYDROGEN SULFIDE (ppm) S/D	WATER LEVEL (feet below probe head) S/D	REMARKS
33	08/15/91	NA	NA	NA	NA	NA	Paved over.
	04/23/85	0.2/2.4	2/13	15/3		-/19.3	
	04/16/85	0/-4.7	2/20	12/0.5			
	03/12/85	0/1.4	3/13	16/7			
	03/05/85	-6.3/0	20/21	0/0		20/20	
	10/05/83	0/-0.5	5/18	35/0	0/-		
	09/01/83	0/0	13/19	10/0.3			
	08/26/83	0/0	19/11	16/0.3			
34	08/15/91	NA	NA	NA	NA	16.68/19.9	Casings open, no probe heads.
	03/27/86	0/0	21/20	0/2.5		16.16/17.41	
	03/12/85	0/0	21/19	0/4.5			
	03/05/85	0/0	21/21	0/0		19/20	
	10/05/83	0/0	20/20	0.2/0.2			
	09/01/83		19/19	0.3/0.7			
	08/16/83		19/20	0/0			
35	08/15/91	NA	NA	NA	NA	NA	Paved Over
	03/27/86	0/0	14/19	0.5/T		Dry/37.33	
	04/23/85	0.3/0	8/19	0.8/0.3		-/38	
	04/16/85	0/0	12/18	1/0.7			
	03/12/85	0.5/0.5	16/21	2.7/0			
	03/05/85	0/0	21/21	0/0		31/39	No water
	10/05/83	0/0	10/20	2.2/0.5			
	09/01/83	-0.2/0	16/19	0.3/1.6			
	08/16/83		20/20	0/0.5			

PROBE #	DATE OF MEASUREMENT	PRESSURE (in inches of water) S/D	% OXYGEN S/D	COMBUSTIBLE GAS (% LEL) S/D	HYDROGEN SULFIDE (ppm) S/D	WATER LEVEL (feet below probe head) S/D	REMARKS
P1A	08/22/91	+0.25/0	15/21	0/0	0/0	Dry/37.24	Clamp on deep probe tube was open. Condensation in Tygon tube on shallow probe. Deep probe head is lower and its tube has black tape
	03/19/91			0.2/0.2			Instrument used = MSA Model 361
	04/09/86		20/20	T/0		Dry/34.08	
	03/25/86	0/0	20/21	0/0		Dry/34.16	
	03/11/86			0			
P2	08/22/91	0/0	4/13	0/90	0/0	Dry/54.88	Deep probe head has black on its tube. Condensation in Tygon tube on deep probe head.
	03/19/91	0/5		0/0.6			
	03/25/86	0/0	8/21	0.2/0.6		8.0/54.25	
	03/08/86			Max 30-100% by volume			
P2A	08/22/91	0/0	18/22	0/0	0/0	Dry/35.3	Two probe head of equal height. Deep probe head has black tape on its tube.
	04/06/86	0/0	11/20	T/T		Dry/32.9	
	03/25/86	0/−0.3	5/20	0.2/0		Dry/33.08	
	03/13/86			0			

PROBE #	DATE OF MEASUREMENT	PRESSURE (in inches of water) S/D	% OXYGEN S/D	COMBUSTIBLE GAS (% LEL) S/D	HYDROGEN SULFIDE (ppm) S/D	WATER LEVEL (feet below probe head) S/D	REMARKS
P3A	08/22/91	0/+0.05	17/21.5	0/0	0/0	Dry/Dry	Two probe heads of equal height. Deep probe head has black tape on its tube.
	03/19/91	0/0		0			Tygon tubes torn.
	04/09/86	0/0	14/21			Dry/Dry	
	03/25/86	0/0	11/0.5	0/T		Dry/Dry	
	03/13/86			0			
P4A	08/22/91	0/0	12/21	0/0	0/0	Dry/51.08	Deep probe head is lower and has black tape on its tube.
	03/19/91						Standing water made sampling impossible.
	04/09/86	4.4/3.6	13/20	0/0		18/40.5	Instrument used = MSA Model 361
	03/25/86	0.4/0	17/18	0/0		18.7/40.83	
	03/13/86			0			