C.S.C. LIC. NO. 300345 E.P.A. CAD 053841102
8301 W. COMMONWEALTH AVE. ■ BUENA PARK, CALIFORNIA 90621
(714) 826-0352

Project No. 86.255

January 26, 1988

Shell Oil Company
511 N. Brookhurst St.
Anaheim, CA

Attn: Carl Grimmer

Subject: Review of Venting Operations
Shell Station
230 MacArthur Blvd.
Oakland, CA

Gentlemen:

The attached report reviews the soil venting operations carried out at the above referenced Shell station from April 1987 through November 1987. Also included are results of soil sampling carried out before, during and after the venting period.

PREVIOUS INVESTIGATIONS

Initial investigation at this site was carried out on April 14, 1986 by EMCON Associates. Four exploratory borings were drilled in the vicinity of the tank zone to a maximum depth of 20.5 feet. Soil samples were analyzed for total hydrocarbons and BTX compounds. One sample was analyzed for total lead. Locations of the borings are shown on the Plot Plan, Figure 1 in Appendix A. Laboratory results, summarized in Table 4, Appendix B, indicated total hydrocarbon levels ranging from 1,200 to 5,700 mg/kg at depths ranging from 8 to 15 feet.

A soil gas survey was carried out at the site on December 2 - 3, 1986 to better define the extent of contamination. The survey was carried out by W.W. Irwin, Inc. using a Photovac portable gas chromatograph. Results of the survey, depicted in Figure 2, Appendix A, indicated very high concentrations of shallow soil vapors in the vicinity of the storage tank fills and near the pump island closest to MacArthur Blvd. Moderately high vapor concentrations were encountered beneath much of the remaining area

studied. No additional borings were made to verify the results of the soil gas survey.

SUBSURFACE CONDITIONS

Borings completed in the vicinity of the storage tank zone indicate the site is underlain by fine- to medium- grained silty sand and clayey silt. Much of the sand is probably fill material. The sand extends from the surface to depths ranging from 3 to 10 feet, depending on location. The clayey silt underlies the sand and extends to a depth of approximately 10 feet. Underlying the clay is a silty sand containing abundant gravel. Groundwater was encountered at a depth of approximately 13 feet.

INSTALLATION OF VENTING WELLS

Three vapor recovery wells were installed at the site on March 12, 1987, for venting with activated carbon. The wells were drilled with a 24 inch diameter bucket auger to a depth of 13 feet. A 4 inch diameter PVC casing was inserted into each boring. The casing contained slots measuring .020 inches in width, extending from the bottom to 3 feet below grade. The annular space was filled with No. 2 Monterey sand to a depth of 2 feet below grade. A bentonite seal measuring 6 inches in thickness was placed over the sand fill.

An activated carbon system was operated for a short period starting 4/07/87. The system was deemed ineffective because of immediate saturation of the carbon canisters. No meaningful reduction in hydrocarbon vapor concentration was achieved.

EFFECT OF VENTING ON VAPOR COMPOSITION

During the period of soil venting, samples of the well gas were obtained and immediately analyzed by gas chromatography. The Foxboro 128 OVA was used, together with a portable chart recorder. The G.C. column attached to the OVA was 24 inches in length by 1/8 inch outside diameter, and was packed with 10% OV-101 silicone stationary phase on Chromosorb W, HP 60/80 mesh support. All chromatograms were run with the column at ambient temperature.

Figure 5 in Appendix C shows a chromatogram of well vapors obtained during the second day of venting. As a reference, the elution times of four individual compounds on the same column are marked on the chromatogram. Figure 5 suggests that this sample of well gas contains a high fraction of low molecular weight (light) components; that is, in the C3 - C6 range. Chromatograms similar to that shown in Figure 5, also containing a high fraction of light components, were obtained each time we returned to the site after a long period of inactivity (one or two months with no venting).

Figure 6 in Appendix C shows a chromatogram of well vapors

obtained after 119 total hours venting. The vapor sample was taken at the end of six continuous hours of operation in the high mode. Figure 6 suggests that this sample of well gas contains a lower percentage of light components than the sample shown in Figure 5. Chromatograms similar to that in Figure 6 were consistently obtained at the end of long periods of venting.

Figure 7 in Appendix C shows a chromatogram of vapors given off by a sample of Shell leaded regular gasoline obtained from a dispenser at the same service station. This chromatogram contains peak groups that correspond to similar groups in the Figure 5 and Figure 6 chromatograms. However, some of the very low molecular weight compounds indicated in Figure 5 do not appear in Figure 7.

In summary, the well gas appears to contain some very light hydrocarbon compounds that are not apparent in a chromatogram of fresh gasoline vapors. Prolonged venting reduces the percentage of these very light compounds in the well gas. However, the light compounds reoccured after prolonged periods without venting.

FINAL SOIL BORINGS

On August 27, 1987, two soil borings were completed in the tank zone. Locations of the borings are shown on the Plot Plan, Figure 1 in Appendix A. The purpose of the borings was to obtain information on the degree of soil contamination remaining in the tank zone after the first time frame of operation. Soil samples were obtained at 2 foot intervals starting at a depth of 4 feet and ending at a depth of 14 feet.

Laboratory results are given in Table 5, Appendix B. The maximum hydrocarbon level, 1870 ppm TH, was encountered in boring B-1 at a depth of 8 feet. Lead levels as high as 65 mg/kg were also measured in samples from B-1. No significant contamination was found in samples from boring B-2.

Table 5 indicates that levels of benzene, toluene and ethylbenzene measured in the most highly contaminated soil samples were very low or non-detectable. This could be the result of the venting process, which should remove these more volatile components first. Xylene, a less volatile compound, is present in much higher concentrations in the contaminated samples.

SAMPLING AFTER TANK REMOVAL

Storage tank removal commenced on November 2, 1987, the day following the final period of venting. During the process of uncovering the tanks, composite soil samples were taken from the spoils pile by Kaprealian Engineering, Inc., and analyzed on-site for hydrocarbons in a mobile laboratory. Results of the spoils sampling, given in Table 6, Appendix B, show that total hydrocarbons in the composite samples ranged from 24 to 250 mg/kg.

After removal of the storage tanks, soil samples were taken from beneath each storage tank at a depth of 15 feet. Figure 1 in

Appendix A shows the sampling locations. Results of this sampling, given in Table 7, Appendix B, show that total hydrocarbons ranged from 9 to 480 mg/kg. It should be emphasized that maximum depth of the venting wells was 13 feet.

CONCLUSIONS

1. Soil venting reduced the vapor concentration in the well gas 90%, from about 40,000 to 4,000 ppmV. Had the venting process been continued beyond November 1, 1987, further reduction in the vapor level would undoubtedly have been achieved.

2. Laboratory analyses of soil samples taken before, during and after venting were not extensive enough to quantify the effect of venting on soil contamination. However, the borings done prior to venting showed localized soil contamination levels as high as 5700 mg/kg. The maximum contamination found during the tank removal process was 480 mg/kg. This suggests that overall soil contamination levels were reduced significantly by the venting process.

The opportunity to be of service is sincerely appreciated. If you have any questions regarding this report, please do not hesitate to call.

Very truly yours,

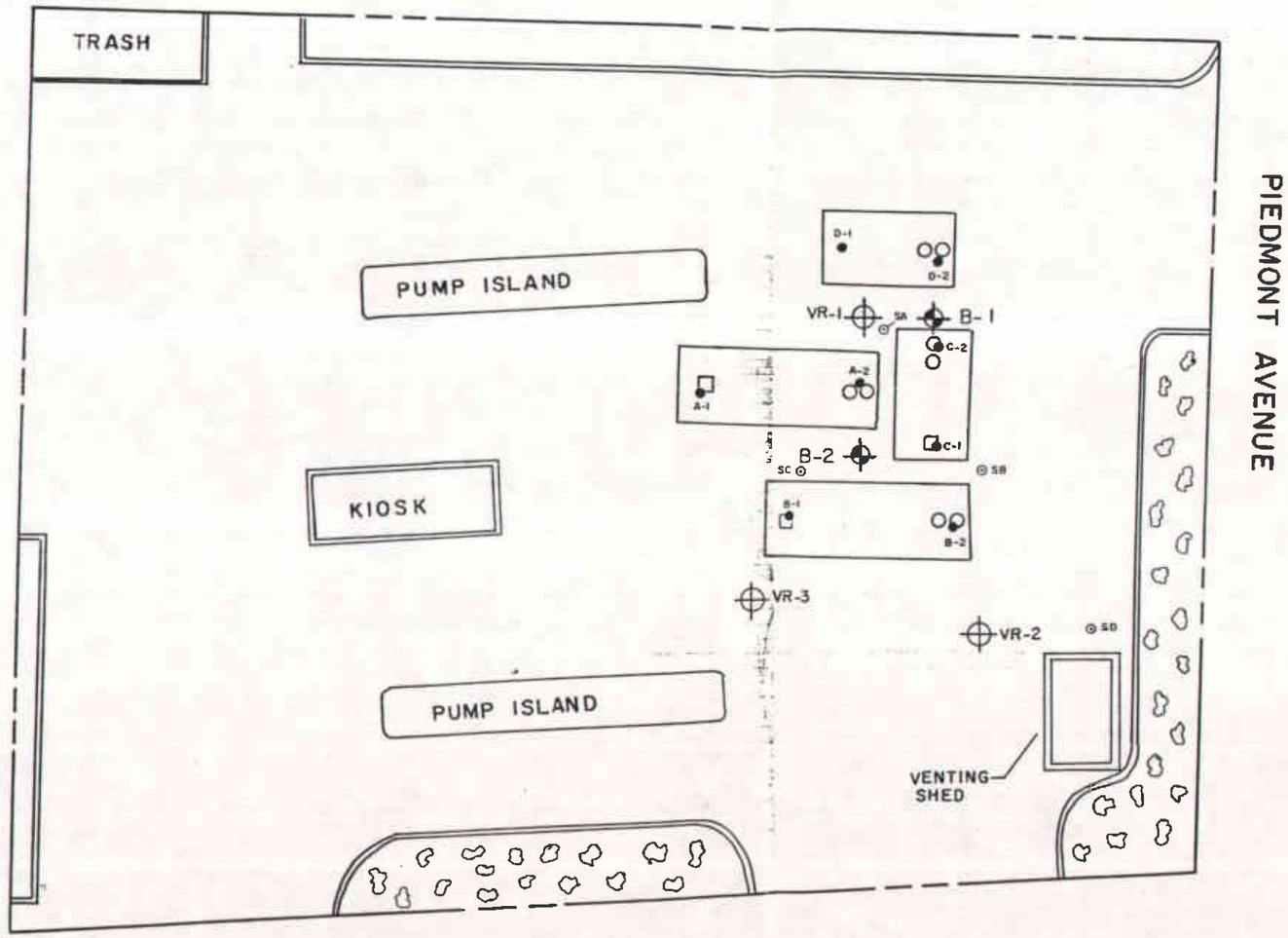
David E. Potts
Registered Chemical Engineer 4270

Shell Oil Company
Project No. 86.255

Appendix A

PLOT PLAN
SOIL VAPOR SURVEY

PLOT PLAN



KEY

VR-1 ⊕ SOIL VENTING WELL

B-1 ⊕ BORING 8-27-87

⊙ SA SOIL BORING 4-14-86

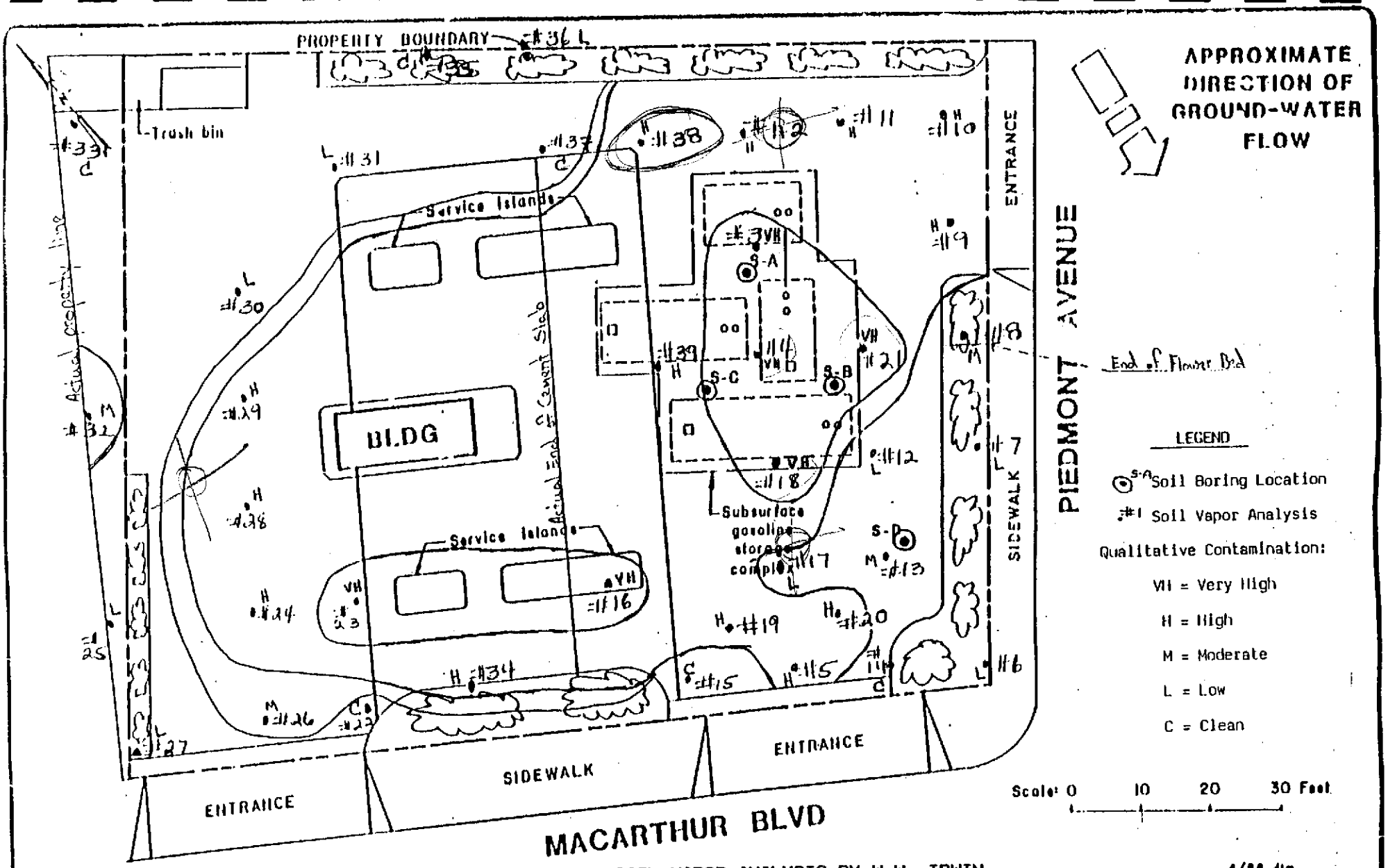
● D-1 SOIL SAMPLING 12-01-87

10 0 10 20 30

SCALE FEET

SHELL STATION
230 MACARTHUR BLVD
OAKLAND, CA.

PROJ. 86.255	FIGURE 1



SOIL VAPOR ANALYSIS BY W.W. IRWIN

4/88 dlm

EMCON Associates

GETTLER-RYAN INC.,
SUBSURFACE HYDROGEOLOGIC INVESTIGATION
SHELL STATION, 230 MACARTHUR BLVD
OAKLAND, CALIFORNIA

SITE PLAN

FIGURE 2

PROJECT NO. 800-41.01

Shell Oil Company
Project No. 86.255

Appendix B

RESULTS OF LABORATORY SAMPLING

Shell Oil Company
Project No. 86.255

Table 4 Laboratory Results of Soil Sampling
(EMCON Associates)

Boring	Depth Interval (ft)	Gasoline (ppm)	Lead (ppm)
S-A	4 to 5.5	17	NM
S-A	8.5 to 10	1200	NM
S-A	11 to 12.5	4300	NM
S-A	13.5 to 15	ND	NM
S-B	5 to 6.5	36	NM
S-B	8 to 9.5	78	NM
S-B	12 to 13	6.4	11.0
S-C	4 to 5.5	ND	NM
S-C	7 to 8.5	ND	NM
S-C	11 to 12.5	ND	NM
S-C	13.5 to 15	5700	NM
S-D	Composite 4 to 5 7 to 8.5 11 to 12.5 13.5 to 15	571	NM

Notes: ND not detected
NM not measured

TABLE 5

SOIL BORINGS 8-27-87

ASSOCIATED LABORATORIES
806 North Batavia - Orange, California 92668 - 714/771-6900

CLIENT
Wayne Perry Construction Co. (1365)
8301 West Commonwealth Avenue
Buena Park, CA 90621
Attn: Wayne Perry

LAB NO F37957-01
REPORTED 09/03/87

SAMPLE Soil
RECEIVED 08/28/87

IDENTIFICATION Shell Station - MacArthur/ Predmont
Job #86-255
As Submitted

BASED ON SAMPLE

	B-1 @ 4'	B-1 @ 6'	B-1 @ 8'	B-1 @ 10'
Total Hydrocarbons (8015) (mg/kg)	412	1,440	1,870	ND<10
Benzene (mg/kg)	ND< 0.05	ND< 0.05	ND< 0.05	ND< 0.05
Toluene (mg/kg)	ND< 0.05	ND< 0.05	4.3	ND< 0.05
Ethyl Benzene (mg/kg)	ND< 0.1	ND< 0.1	14	ND< 0.1
Total Xylene (8020) (mg/kg)	5.4	130	325	ND< 0.1
Lead (7421) (mg/kg)	65.9	26.4	14.3	ND< 5

ASSOCIATED LABORATORIES

Edward S. Behare, Ph.D.

ESB/ql

NOTE: Unless notified in writing, all samples will be discarded by appropriate disposal protocol 30 days from date reported.

RECEIVED
SEP 0 1987

TESTING & CONSULTING
Chemical
Microbiological
Environmental

TABLE 5 (continued)

ASSOCIATED LABORATORIES
806 North Batavia - Orange, California 92668 - 714/771-6900

CLIENT
Wayne Perry Construction Co. (1365)
8301 West Commonwealth Avenue
Buena Park, CA 90621
Attn: Wayne Perry

LAB NO F37957-02
REPORTED 09/03/87

SAMPLE Soil
RECEIVED 08/28/87

IDENTIFICATION Shell Station - MacArthur/ Predmont
Job #86-255

BASED ON SAMPLE As Submitted

	B-1 @ 12'	B-1 @ 14'	B-2 @ 5'	B-2 @ 6-7'
Total Hydrocarbons (8015) (mg/kg)	122	52	ND<10	ND<10
Benzene (mg/kg)	0.60	ND< 0.05	ND< 0.05	ND< 0.05
Toluene (mg/kg)	0.36	ND< 0.05	1.5	0.37
Ethyl Benzene (mg/kg)	0.38	ND< 0.1	5.7	0.55
Total Xylene (8020) (mg/kg)	0.33	ND< 0.1	ND< 0.1	ND< 0.1
Lead (7421) (mg/kg)	ND< 5	ND< 5	ND< 5	ND< 5

ASSOCIATED LABORATORIES

Edward S. Behare, Ph.D.

ESB/ql

NOTE: Unless notified in writing, all samples will be discarded by appropriate disposal protocol 30 days from date reported.

RECEIVED
SEP 3 1987

TESTING & CONSULTING
Chemical •
Microbiological •
Environmental •

TABLE 5 (continued)

ASSOCIATED LABORATORIES
806 North Batavia - Orange, California 92668 - 714/771-6900

CLIENT
Wayne Perry Construction Co. (1365)
8301 West Commonwealth Avenue
Buena Park, CA 90621
Attn: Wayne Perry

LAB NO F37957-03
REPORTED 09/03/87

SAMPLE Soil
RECEIVED 08/28/87

IDENTIFICATION Shell Station - MacArthur/ Predmont
Job #86-255

BASED ON SAMPLE As Submitted

	B-2 @ 8-9'	B-2 @ 10'	B-2 @ 12'
Total Hydrocarbons (8015) (mg/kg)	ND<10	ND<10	ND<10
Benzene (mg/kg)	0.5	ND< 0.05	ND< 0.05
Toluene (mg/kg)	0.4	ND< 0.05	ND< 0.05
Ethyl Benzene (mg/kg)	0.3	ND< 0.1	ND< 0.1
Total Xylene (8020) (mg/kg)	ND< 0.1	ND< 0.1	ND< 0.1
Lead (7421) (mg/kg)	ND< 5	ND< 5	ND< 5

ASSOCIATED LABORATORIES

Edward S. Behare, Ph.D.

ESB/ql

NOTE: Unless notified in writing, all samples will be discarded by appropriate disposal protocol 30 days from date reported.

RECEIVED
SEP 3 1987

TESTING & CONSULTING
Chemical •
Microbiological •
Environmental •

KEI-J87-111
December 1, 1987

TABLE 6

SUMMARY OF STOCKPILED SOIL SAMPLING

(all analyses in parts per million)

Sample #	Total Hydrocarbons	Benzene	Toluene	Xylene
Comp 1	24	0.2	<0.1	5.7
Comp 2	26	<0.1	0.2	12
Comp 3	150	1.8	1.9	36
Comp 4	8.4	0.1	0.1	2.8
Comp 5	250	1.8	9.3	52

KEI-J87-111
December 1, 1987

TABLE 7

SUMMARY OF LABORATORY ANALYSES

(all analyses are in parts per million)

Sample #	Depth	Total Hydrocarbon	Benzene	Toluene	Xylene
A1	15.0'	380	1.6	2.2	55
A2	15.0'	310	1.3	1.3	33
B1	15.0'	480	4.3	0.5	22
B2	15.0'	9.1	1.6	0.3	0.1
C1	15.0'	12	1.5	<0.1	1.1
C2	15.0'	170	4.1	<0.1	2.4
D1	15.0'	8.6	<0.1	<0.1	<0.1
D2	15.0'	44	<0.1	<0.1	5.3

Shell Oil Company
Project No. 86.255

Appendix C

WELL GAS CHROMATOGRAMS

FIGURE 5

TYPICAL GAS CHROMATOGRAM OF SOIL VAPORS

(Before soil venting)

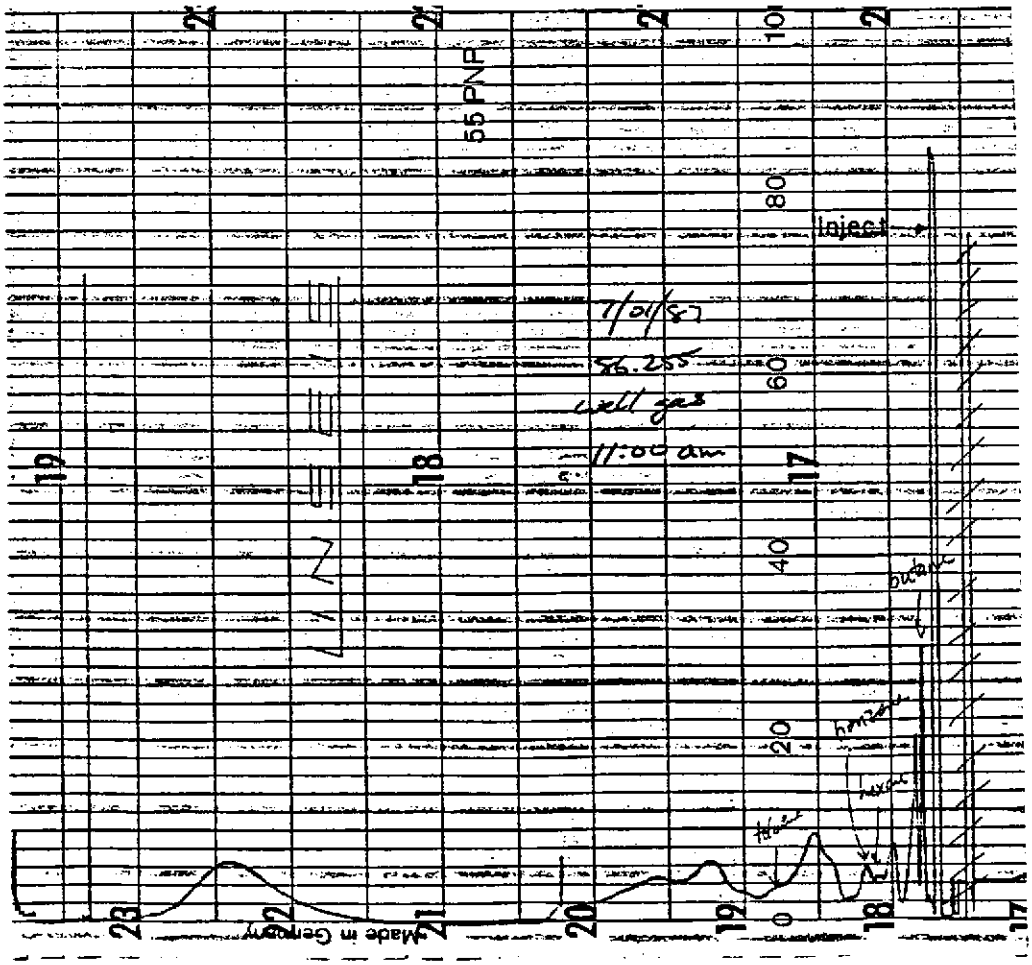


FIGURE 6

TYPICAL GAS CHROMATOGRAM OF SOIL VAPORS

(After soil venting)

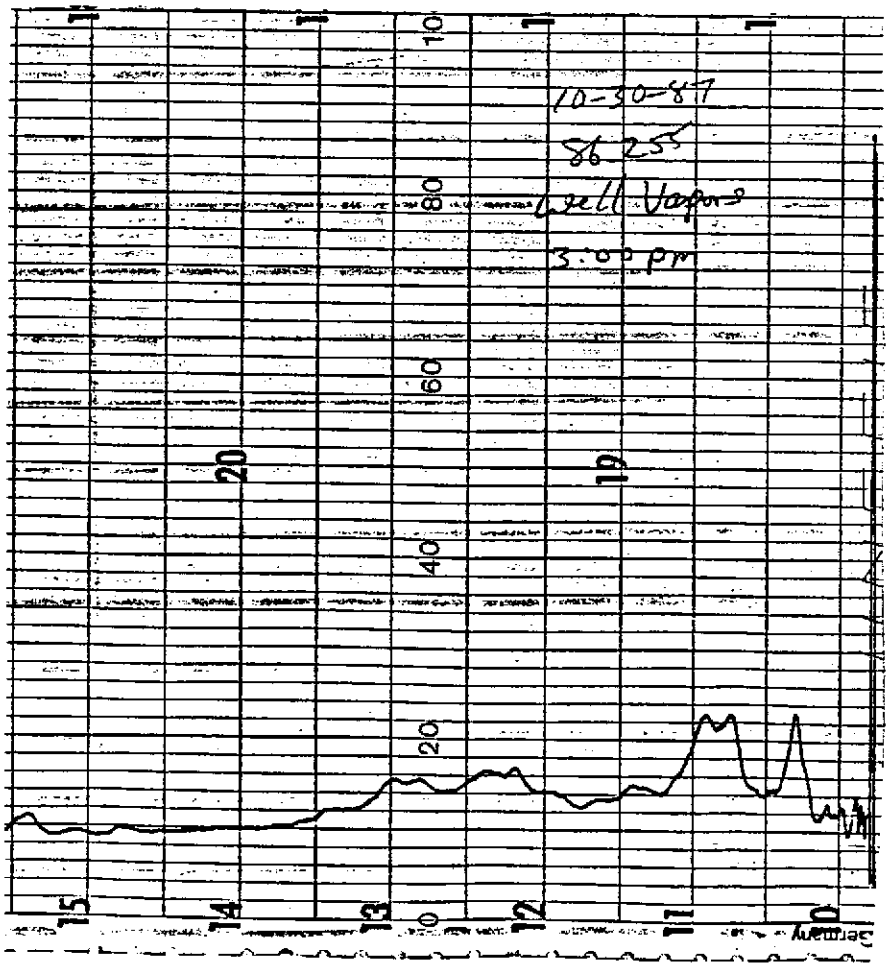


FIGURE 7

GAS CHROMATOGRAM OF GASOLINE VAPORS

(Shell leaded regular)