KAPREALIAN ENGINEERING, INC.
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KEI-P89-0801.R5
May 10, 1991

Unocal Corporation
2000 Crow Canyon Place, Suite 400
San Ramon, CA 94583

Attention: Mr. Ron Bock

RE: Continuing Ground Water Investigation at
Unocal Service Station #6034
4700 First Street
Livermore, California

Dear Mr. Bock:

This report presents the results of Kaprealian Engineering, Inc's. (KEI) soil and ground water investigation for the referenced site in accordance with KEI's proposal KEI-P89-0801.P3 dated January 31, 1991. The purpose of the investigation was to determine the degree and extent of ground water contamination at the site. The scope of the work performed by KEI consisted of the following:

Coordination with regulatory agencies.

Geologic logging of three borings for the installation of three monitoring wells.

Soil sampling.

Ground water monitoring, purging and sampling.

Laboratory analyses.

Data analysis, interpretation and report preparation.

SITE DESCRIPTION AND BACKGROUND

The subject site is presently used as a gasoline station. The subject site is situated on gently sloping, northwest trending topography, and is located adjacent to and northeast of the drainage channel for Arroyo Seco. In addition, the site is located approximately 9,000 feet northwest of the Lawrence Radiation Laboratory and the University of California. A Location Map, Site Plans and Site Vicinity Map are attached to this report. BP and Chevron Service Stations are located to the south and southeast of the Unocal site.

KEI's initial work at the site began on August 2, 1989, when KEI was asked to collect soil samples from beneath two 12,000 gallon fuel storage tanks and one waste oil tank during their replacement. The tanks were made of steel and no apparent holes or cracks were observed in the tanks. Six soil samples (designated as A1, A2, A3, B1, B2 and B3) were collected from beneath the fuel tanks at depths of 15 to 16 feet, and one soil sample, labeled WO1, was collected from beneath the waste oil tank at a depth of 8.5 feet. KEI returned to the site on August 7, 1989 in order to collect soil samples from the product pipe trenches. Seven soil samples, labeled P1 through P7, were collected from the pipe trench at depths ranging from 2.5 to 3.5 feet. Ground water was encountered in the fuel tank pit at a depth of 17.5 feet during subsequent excavation of contaminated soil from the location where sample A3 was collected. Locations of soil samples are shown on the attached Site Plan, Figure 2. One ground water sample, labeled W1, was collected from the excavated pit.

All samples were analyzed by Sequoia Analytical Laboratory in Redwood City, California for total petroleum hydrocarbons (TPH) as gasoline, and benzene, toluene, xylenes and ethylbenzene (BTX&E). In addition, the sample collected from beneath the waste oil tank was analyzed for TPH as diesel, total oil and grease (TOG) and EPA methods 8010 and 8270 compounds. Analytical results of the soil samples, collected from the fuel tank pit and pipe trenches, indicated levels of TPH as gasoline ranging from non-detectable to 9.6 ppm for all samples except for sample A3, which showed 390 ppm. However, the area below sample A3 was excavated to the depth of the water table. The soil sample collected from beneath the waste oil tank showed non-detectable levels of all constituents analyzed, except for TPH as diesel at 1.4 ppm. Analytical results of the water sample collected from the fuel tank pit showed 47,000 ppb of TPH as gasoline, and 260 ppb of benzene. Results of the soil analyses are summarized in Table 5, and the water sample in Table 6. Documentation of soil and water sample collection and analytical results are provided in KEI's report (KEI-J89-0801.R2) dated August 15, 1989. Based on the sample results, KEI recommended the installation of four monitoring wells.

On October 25 and 26, 1989, four two-inch diameter monitoring wells (designated as MW1, MW2, MW3 and MW4 on the attached Site Plan, Figure 1, and Site Vicinity Map, Figure 3) were installed at the site. The monitoring wells were drilled and completed to total depths ranging from 26 to 28.5 feet. Ground water was encountered at depths ranging from 14.5 to 17.5 feet beneath the surface during drilling. The wells were developed on November 3 and 9, 1989, and initially sampled on November 18, 1989. Water and selected soil samples were analyzed at Sequoia Analytical Laboratory in Redwood

City, California, for TPH as gasoline and BTX&E. In addition, soil and water samples collected from monitoring well MW1 were analyzed for TPH as diesel, EPA method 8010 compounds, and TOG.

Analytical results of the soil samples, collected from the borings, indicated levels of TPH as gasoline ranging from non-detectable to 3.0 ppm for all samples, except for samples MW2(5), MW2(17) and MW4(15), which showed levels of TPH as gasoline at concentrations of 23 ppm, 790 ppm and 56 ppm, respectively. TPH as diesel and EPA method 8010 results were non-detectable, and TOG was non-detectable in all samples.

Analytical results of the ground water samples, collected from monitoring wells MW1 and MW3, indicated non-detectable levels of TPH as gasoline. TPH as gasoline was detected in monitoring wells MW2 and MW4 at concentrations of 53,000 ppb and 990 ppb, respectively. Benzene was detected in monitoring wells MW2, MW3 and MW4 at concentrations of 540 ppb, 0.35 ppb and 9.8 ppb, respectively. In monitoring well MW1, TPH as diesel was detected at 400 ppb, TOG at 3.1 ppm, and EPA method 8010 constituents were non-detectable except for trichloroethene, which was detected at a concentration of 0.55 ppb. Analytical results of the soil samples are summarized in Table 4, and water samples in Table 2. Based on the analytical results, KEI recommended a monthly monitoring and quarterly sampling program. Documentation of the well installation and laboratory analyses are presented in KEI's report (KEI-J89-0801.R4) dated December 18, 1989. The monthly monitoring and quarterly sampling program began on January 4, 1990. The well covers of all wells have been surveyed to Mean Sea Level.

RECENT FIELD ACTIVITIES

On April 2, 1991, three two-inch diameter monitoring wells (designated as MW5, MW6 and MW7 on the attached Site Plan, Figure 1, and Site Vicinity Map, Figure 3) were installed at the site. The wells were drilled, constructed and completed in accordance with the guidelines of the Regional Water Quality Control Board (RWQCB), and California Well Standards per Bulletin 74-90.

The subsurface materials penetrated and details of the construction of the wells are described in the attached Boring Logs.

The three wells were drilled and completed to total depths ranging from 24 to 24.5 feet. Ground water was encountered at depths ranging from 15.5 to 16 feet beneath the surface during drilling. Soil samples were taken for laboratory analysis and for lithologic logging purposes at a maximum spacing of 5 foot intervals, and at or within the soil/ground water interface beginning at a depth of

approximately 4-1/2 feet below grade until ground water was encountered. Soil sampling conducted below the ground water table are for lithologic logging purposes only. The undisturbed soil samples were taken by driving a California-modified split-spoon sampler ahead of the drilling augers. The two-inch diameter brass liners holding the samples were sealed with aluminum foil, plastic caps and tape, and stored in a cooled ice chest for delivery to a certified laboratory. Each well casing was installed with a watertight cap and padlock. A round, watertight, flush-mounted well cover was cemented in place over each well casing.

The surface of each well cover was surveyed by Kier & Wright of Pleasanton, California to Mean Sea Level and to a vertical accuracy of 0.01 feet.

Wells MW5, MW6 and MW7, were developed on April 5, 1991. Prior to development, all wells were checked for depth to water table using an electronic sounder, presence of free product (using an interface probe or paste tape) and sheen. No free product or sheen was noted in any of the wells. After recording the monitoring data, wells MW5, MW6 and MW7 were purged with a surface pump of 50 to 55 gallons until the evacuated water was reasonably clear and free of suspended sediment. Monitoring and well development data are summarized in Table 1.

All wells were sampled on April 10, 1991. Prior to sampling, monitoring data were collected, the wells were purged of between 15 to 25 gallons (except well MW2 which was purged of 55 gallons), and water samples were then collected using a clean Teflon bailer. The samples were decanted into clean glass VOA vials, sealed with Teflon-lined screw caps, and labeled and stored on ice until delivery to a certified laboratory.

ANALYTICAL RESULTS

Water samples from all wells, and selected soil samples from borings of MW5 through MW7, were analyzed at Sequoia Analytical Laboratory in Concord, California. All samples analyzed were accompanied by properly executed Chain of Custody documentation. The samples were analyzed for TPH as gasoline by EPA method 5030 in conjunction with modified 8015, and BTX&E by EPA method 8020. In addition, the water sample collected from MW1 was analyzed for TPH as diesel using EPA method 3510 in conjunction with modified 8015, TOG by Standard Method 5520B&F, and chlorinated solvents using EPA method 8010.

Analytical results of the soil samples collected from the borings for monitoring wells MW5, MW6 and MW7 indicate non-detectable

levels of TPH as gasoline and benzene in all analyzed samples. Analytical results of the water samples collected from MW1, MW3, MW6 and MW7 indicate non-detectable levels of TPH as gasoline and BTX&E. In wells MW2, MW4 and MW5, levels of TPH as gasoline were 22,000 ppb, 950 ppb and 630 ppb, respectively, with benzene levels at 170 ppb, 0.84 ppb and 35 ppb, respectively. In monitoring well MW1, TPH as diesel, TOG and all EPA method 8010 constituents were non-detectable. Concentrations of TPH as gasoline and benzene detected in ground water are shown on the attached Site Plan, Figure 1a. Results of the soil analyses are summarized in Table 3, and water analyses in Table 2. Copies of the laboratory analyses and Chain of Custody documentation are attached to this report.

HYDROLOGY AND GEOLOGY

The water table stabilized in the monitoring wells at depths ranging from 15.27 to 16.70 feet below the surface. Ground water flow direction appeared to be toward the northwest on April 10, 1991, similar to the previous quarter, with a hydraulic gradient of approximately .006 (based on water level data collected from the monitoring wells prior to purging and sampling).

Review of the Fall 1990 Ground Water Level Report produced by the Alameda County Flood Control and Water Conservation District indicates that the subject site is located near the northeastern corner of the Mocho Subbasin (Macho 1), and near the boundary with the Spring Subbasin, where the regional ground water flow direction is toward the northwest.

Based on review of regional geologic maps (U.S. Geological Survey Open-File Report 80-533B "Preliminary Geologic Map of the Livermore Quadrangle, Alameda and Contra Costa Counties, California" by Thomas W. Dibblee, Jr., 1980), the subject site is inferred to be underlain by Quaternary-age alluvium. In addition, adjacent hillside areas northwest and southwest of the site are mapped as being underlain by the Livermore Gravel formation. The Livermore Gravel is typically composed of light redding-gray cobble-pebble gravel, pebbly sand, silt and clay.

The results of our previous subsurface study indicate that the subject site is underlain by Quaternary alluvium materials to the maximum depth explored (28.5 feet). These alluvium materials generally consist of a gravelly unit at the surface varying from about 5 to 7 feet thick. This upper gravel unit is underlain by a clay unit to depths below grade of about 11 to 12.5 feet. A second gravelly unit underlies the clay unit but varies significantly in thickness from about 6.5 to 8 feet thick in the vicinity of MW1 and MW2, and about 12.5 feet thick in the vicinity of MW3. This second

gravelly unit is inturn underlain by a second clay unit which locally contains sandy and gravelly lenses and extends from depths below grade of about 23.5 to 25 feet and extends to the maximum depths explored (26 to 28.5 feet).

The results of our recent subsurface study indicate that the site is underlain by fill materials which extend to depths below grade of about 4 to 5-3/4 feet at MW6 and MW7 and may extend to a depth of about 6-1/2 feet at MW5. The fill materials are inturn underlain by clay and/or silt materials to depths of about 12-1/4 feet at MW6, and to about 15 to 15-1/2 feet at MW5 and MW7. These fine-grained soils are inturn underlain by silty to clayey sand and gravel materials at MW5 and MW6 to depths below grade of about 16 to 18 feet. At MW5 and MW6, these coarse-grained soils are inturn underlain by clay and silt materials which extend to depths of about 17-1/2 feet at MW6, and to about 22-3/4 feet at MW5. Underlying the clay and silt soils at depths of about 22-3/4 feet at MW5, 17-1/2 feet at MW6, and 15 feet at MW7, is a zone of well graded gravel, which is about 4 to 7 feet thick at MW6 and MW7, and by clayey sand at MW5 which is about 1/2 foot thick. These coarse-grained soils are inturn underlain by clay materials at depths of about 21-1/2 to 23-1/4 feet which extend to the maximum depths explored (24 to 24-1/2 feet).

DISCUSSION AND RECOMMENDATIONS

Based on the analytical results, KEI recommends continuation of the monitoring and sampling program. Results of the monitoring program will be documented and evaluated after each monitoring and sampling event. Recommendations for altering or terminating the program will be made as needed.

The analytical results of the ground water samples collected to date from monitoring wells MW1 and MW3 (November, 1989 to April, 1991) reveal that levels of TPH as gasoline, benzene, and TPH as diesel have been non-detectable in five of six sampling events, including the two most recent samples collected. Therefore, based on the water quality data obtained to date, it appears that contamination from upgradient sources has not migrated onto the southwest corner of the Unocal site in the vicinity of monitoring well MW3. However, upgradient monitoring well MW4, located at the southeast corner of the Unocal site, has consistently shown TPH as gasoline levels greater than 900 ppb in all six samples collected to date, which would appear to support a conclusion of a local off-site source of contamination.

KEI coordinated a joint monitoring on December 24, 1990 at the BP and Chevron stations located to the south and southeast of the

Unocal station, across First Street. The ground water flow direction on that date appeared to be generally toward the northwest from the BP and Chevron stations toward the Unocal station, as shown on the attached Site Vicinity Map, Figure 3. The monitoring data (ground water surface elevation) for the Chevron monitoring wells is summarized in the attached Table 1a.

In addition to the above mentioned joint monitoring, KEI has also reviewed the most recent quarterly report (available for review by KEI) prepared for Chevron USA by Western Geologic Resources, Inc., dated June 12, 1990. Presently, there are 18 active monitoring wells (designated as C-1 through C-19 on the attached Site Vicinity Map, Figure 3) in the vicinity of the Chevron station. Chevron monitoring well C-4 was previously destroyed.

A review of the historical water quality data for Chevron's monitoring wells (C-2, C-3, C-6, C-7, C-8 and C-9), which are located directly upgradient of Unocal's monitoring well MW4, shows that "total fuel hydrocarbons" (TFH) were detected in ground water samples collected from these wells in 1988 at levels ranging from 2,100 ppb to 86,000 ppb. Based on analytical results from samples collected on January 1, 1990, the levels of contamination detected in each of the above mentioned Chevron wells had decreased significantly; however, "total petroleum hydrocarbons" (TPH) were still detected in each of the wells at levels ranging from 910 ppb to 5,600 ppb. The decreasing levels of petroleum hydrocarbons detected in Chevron's monitoring wells, coupled with the elevated levels of TPH as gasoline detected in Unocal's upgradient monitoring well MW4 and the general northwesterly ground water flow direction, suggests that upgradient contamination has migrated onto the Unocal site and may be contributing to contamination detected in Unocal's monitoring well MW2.

Therefore, KEI continues to recommend that a meeting be arranged between representatives of Chevron and Unocal Corporation to discuss further investigations and remediation at the respective sites.

DISTRIBUTION

Copies of this report should be sent to the Alameda County Health Care Services, and to the RWQCB, San Francisco Bay Region.

LIMITATIONS

Soil deposits and rock formations may vary in thickness, lithology, saturation, strength and other properties across any site. In addition, environmental changes, either naturally-occurring or artificially-induced, may cause changes in the extent and concentration of any contaminants. Our studies assume that the field and laboratory data are reasonably representative of the site as a whole, and assume that subsurface conditions are reasonably conducive to interpolation and extrapolation.

The results of this study are based on the data obtained from the field and laboratory analyses obtained from a state certified laboratory. We have analyzed this data using what we believe to be currently applicable engineering techniques and principles in the Northern California region. We make no warranty, either expressed or implied, regarding the above, including laboratory analyses, except that our services have been performed in accordance with generally accepted professional principles and practices existing for such work.

Should you have any questions regarding this report, please do not hesitate to call me at (707) 746-6915.

Sincerely,

Kaprealian Engineering, Inc.

Thomas J. Berkins
Senior Environmental Engineer

Don R. Braun
Certified Engineering Geologist

License No. 1310
Exp. Date 6/30/92

Timothy R. Ross
Project Manager

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Attachments: Tables 1 through 6
Location Map
Site Plans - Figures 1, 1a & 2
Site Vicinity Map - Figure 3
Boring Logs
Laboratory Results
Chain of Custody documentation

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TABLE 1

SUMMARY OF GROUND WATER MONITORING AND PURGING DATA

Well #	Ground Water Elevation (feet)	Depth to Water (feet)	Product Thickness	Sheen	Gallons Pumped
(Monitored and Sampled on April 10, 1991)					
MW1	504.18	16.70	0	None	15
MW2	503.96	16.21	0	None	55
MW3	504.57	15.34	0	None	15
MW4	504.85	15.27	0	None	25
MW5	504.28	16.30	0	None	15
MW6	503.74	15.60	0	None	15
MW7	503.76	15.61	0	None	15
(Monitored and Developed on April 5, 1991)					
MW1*	504.26	16.62	0	None	0
MW2*	504.05	16.12	0	None	0
MW3*	504.65	15.26	0	None	0
MW4*	504.99	15.13	0	None	0
MW5	504.24	16.34	0	None	50
MW6	503.82	15.52	0	None	55
MW7	503.83	15.54	0	None	55

Well #	Surface Elevation** (feet)
MW1	520.88
MW2	520.17
MW3	519.91
MW4	520.12
MW5	520.58
MW6	519.34
MW7	519.37

* Monitored only.

** Elevation of top of well covers surveyed to Mean Sea Level per City of Livermore Benchmark No. C-18-5.

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TABLE 1a

SUMMARY OF MONITORING DATA
(Chevron Monitoring Wells)

(Monitored on December 24, 1990)

Well No.	Ground Water Elevations (feet)
C-1	506.54
C-2	506.61
C-3	506.73
C-4 (DESTROYED)	
C-5	506.82
C-6	506.43
C-7	506.59
C-8	505.93
C-9	506.24
C-10	505.35
C-11	505.41
C-12	505.12
C-13	507.16
C-14	506.36
C-15	506.91
C-16	505.72
C-17	505.90
C-18	504.98
C-19	505.43

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TABLE 2

SUMMARY OF LABORATORY ANALYSES
WATER

Date	Sample Well #	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
4/10/91	MW1*	ND	ND	ND	ND	ND	ND
	MW2	--	22,000	170	190	6,200	490
	MW3	--	ND	ND	ND	ND	ND
	MW4	--	950	0.84	4.3	5.0	9.6
	MW5	--	630	35	14	30	47
	MW6	--	ND	ND	ND	ND	ND
	MW7	--	ND	ND	ND	ND	ND
12/24/90	MW1*	ND	ND	ND	ND	0.40	ND
	MW2	--	32,000	440	340	13,000	460
	MW3	--	ND	ND	ND	ND	ND
	MW4	--	1,400	ND	8.7	10	15
9/07/90	MW1*	ND	ND	ND	1.2	ND	ND
	MW2	--	ND	ND	1.5	ND	ND
	MW3	--	1,100	11	ND	16	6.6
	MW4	--	15,000	100	140	4,600	210
6/05/90	MW1*	ND	ND	ND	ND	ND	ND
	MW2	--	31,000	250	460	9,200	950
	MW3	--	ND	ND	ND	ND	ND
	MW4	--	1,400	1.2	4.7	12	24
3/08/90	MW1**	ND	ND	ND	ND	ND	ND
	MW2	--	26,000	230	410	2,100	1,300
	MW3	--	ND	ND	ND	ND	ND
	MW4	--	1,200	18	8.4	28	37
11/18/89	MW1***	400	ND	ND	ND	ND	ND
	MW2	--	53,000	540	500	22,000	130
	MW3	--	ND	0.35	ND	ND	ND
	MW4	--	990	9.8	10	4.7	7.1
Detection Limits		50	30	0.3	0.3	0.3	0.3

* TOG and all EPA method 8010 constituents were non-detectable.
** TOG showed 4.7 ppm. All EPA method 8010 compounds were non-detectable.
*** TOG showed 3.1 ppm, and all EPA method 8010 compounds were non-detectable, except trichloroethene at 0.55 ppb.
ND = Non-detectable.
-- Indicates analysis not performed.
Results in parts per billion (ppb), unless otherwise indicated.

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TABLE 3

SUMMARY OF LABORATORY ANALYSES
SOIL

Date	Sample Number	Depth (feet)	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
4/02/91	MW5(5)	5	ND	ND	0.0056	ND	ND
	MW5(10)	10	ND	ND	ND	ND	ND
	MW5(15.5)	15.5	ND	ND	ND	0.0060	ND
	MW6(5)	5	ND	ND	0.010	0.0086	ND
	MW6(10)	10	ND	ND	ND	0.017	ND
	MW6(15.5)	15.5	ND	ND	ND	0.058	ND
	MW7(5.5)	5.5	ND	ND	ND	ND	ND
	MW7(10)	10	ND	ND	0.0086	0.030	ND
	MW7(15)	15	ND	ND	0.0098	0.010	ND
Detection Limits			1.0	0.0050	0.0050	0.0050	0.0050

ND = Non-detectable.

Results in parts per million (ppm), unless otherwise indicated.

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TABLE 4

SUMMARY OF LABORATORY ANALYSES
SOIL

Date	Sample Number	Depth (feet)	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
10/25/89	MW1(5)*	5	ND	ND	ND	ND	ND
&	MW1(7)*	7	ND	ND	ND	ND	ND
10/26/89	MW1(10)*	10	ND	ND	ND	ND	ND
	MW1(12.5)*	12.5	ND	ND	ND	ND	ND
	MW1(15)*	15	ND	ND	ND	ND	ND
	MW1(17)*	17	ND	ND	ND	ND	ND
	MW2(5)	5	23	ND	ND	ND	ND
	MW2(10)	10	ND	ND	ND	ND	ND
	MW2(12.5)	12.5	ND	ND	ND	ND	ND
	MW2(15)	15	3.0	ND	ND	ND	ND
	MW2(17)	17	790	0.14	0.23	10	2.7
	MW3(5)	5	1.1	ND	ND	ND	ND
	MW3(10)	10	ND	ND	ND	ND	ND
	MW3(11.5)	11.5	ND	ND	ND	ND	ND
	MW3(14)	14	ND	ND	ND	ND	ND
	MW4(5)	5	1.9	ND	ND	ND	ND
	MW4(9.5	9.5	ND	ND	ND	ND	ND
	MW4(12)	12	ND	ND	ND	ND	ND
	MW4(15)	15	56	0.10	0.11	1.5	1.5
Detection Limits			1.0	0.05	0.1	0.1	0.1

* TPH as diesel and EPA method 8010 constituents were non-detectable. TOG was non-detectable.

ND = Non-detectable.

Results in parts per million (ppm), unless otherwise indicated.

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TABLE 5

SUMMARY OF LABORATORY ANALYSES
SOIL

Date	Sample	Depth (feet)	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
8/02/89	A1	15	--	2.1	ND	ND	0.21	ND
&	A2	15	--	1.6	ND	ND	ND	ND
8/07/89	A3	16	--	390	1.7	45	86	16
	B1	15	--	ND	ND	ND	0.10	ND
	B2	15	--	ND	ND	ND	ND	ND
	B3	15	--	2.3	ND	ND	0.30	0.12
	P1	3.5	--	9.6	ND	ND	0.94	0.16
	P2	3.5	--	ND	ND	ND	ND	ND
	P3	3.5	--	ND	ND	ND	ND	ND
	P4	3.5	--	ND	ND	ND	ND	ND
	P5	2.5	--	ND	ND	ND	ND	ND
	P6	2.5	--	ND	ND	ND	ND	ND
	P7	2.5	--	1.5	ND	ND	ND	ND
	WO1*	8.5	1.4	ND	ND	ND	ND	ND
Detection Limits			1.0	1.0	0.05	0.1	0.1	0.1

* TOG, all EPA method 8010 and 8270 constituents were non-detectable.

-- Indicates analysis not performed.

ND = Non-detectable.

Results in parts per million (ppm), unless otherwise indicated.

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TABLE 6

SUMMARY OF LABORATORY ANALYSES
WATER

Date	Sample	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethylbenzene
8/07/89	W1	47,000	260	840	9,400	830
Detection Limits		30	0.3	0.3	0.3	0.3

Results in parts per billion (ppb), unless otherwise indicated.

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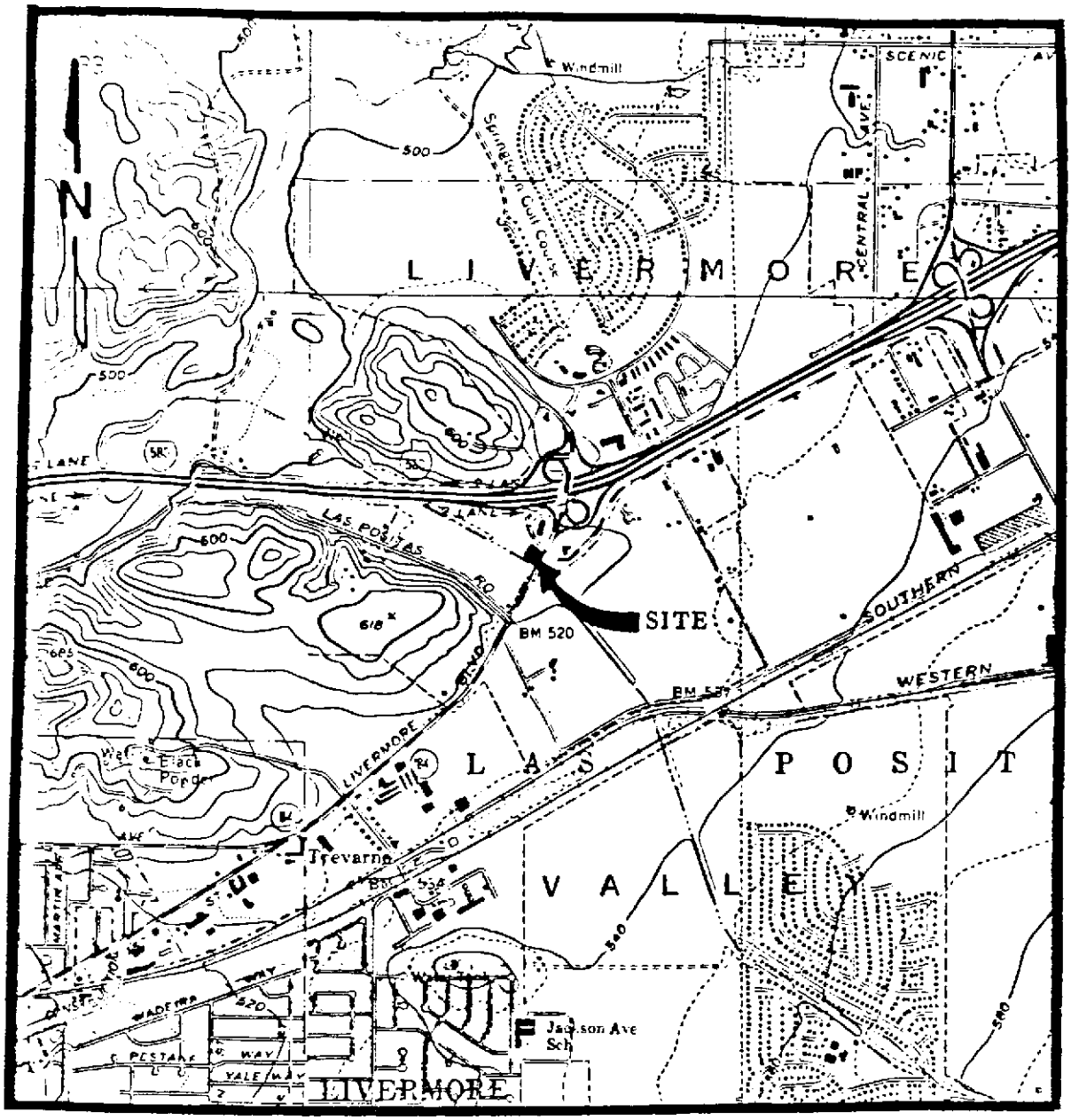

LOCATION MAP

Base from U.S.G.S. 7.5 minute Livermore Quadrangle
(photorevised 1980) and Altamont Quadrangle (photorevised 1981)

Unocal S/S #6034
4700 First Street
Livermore, CA

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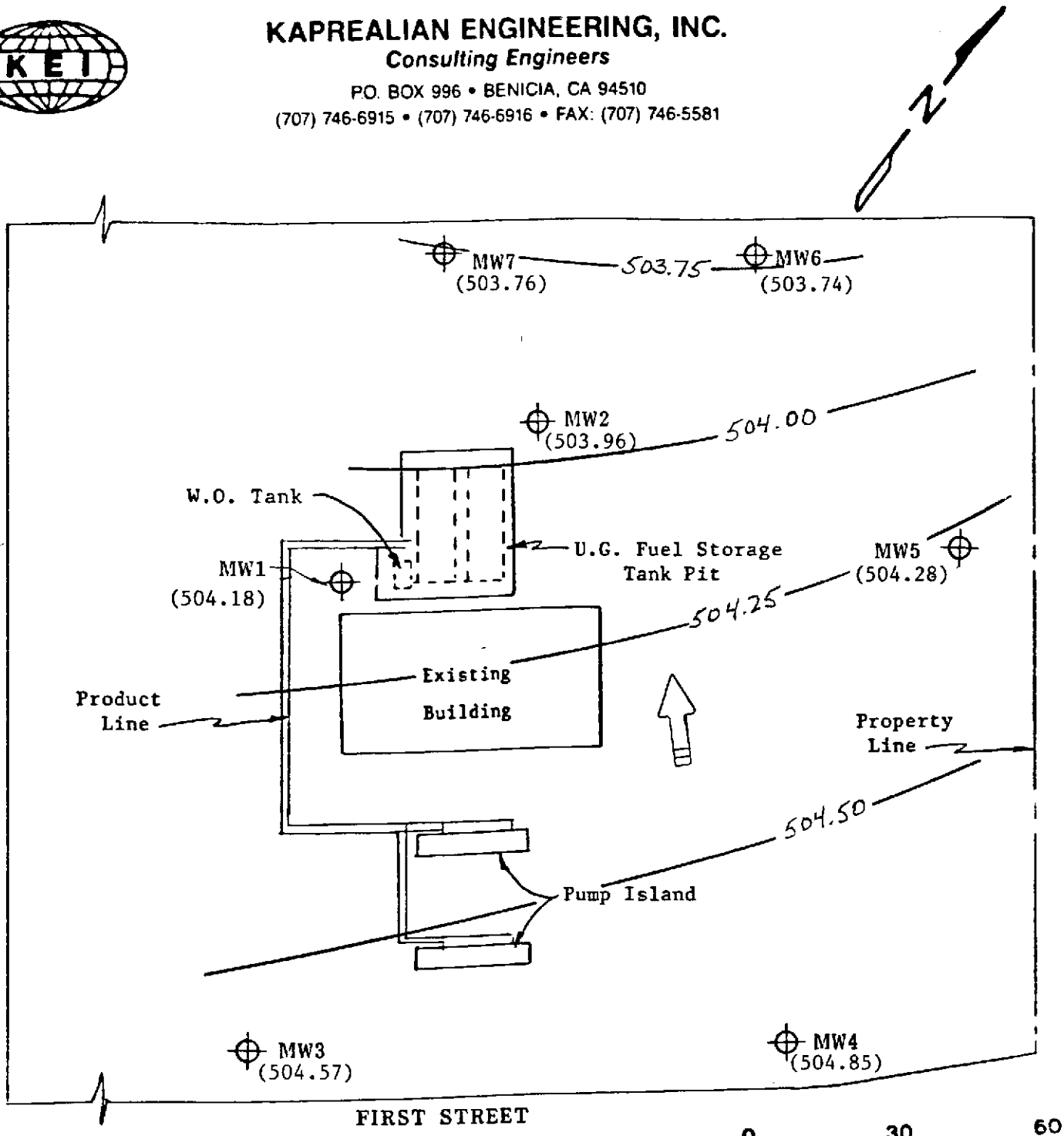

LEGEND

- ⊕ Monitoring Well
- ( ) Water Table Elevation in feet above Mean Sea Level on 4/10/91
- ——— Contour of equal elevation of ground water table
- ⇨ Direction of Ground Water Flow

SITE PLAN
Figure 1

Unocal S/S #6034
4700 First Street
Livermore, CA

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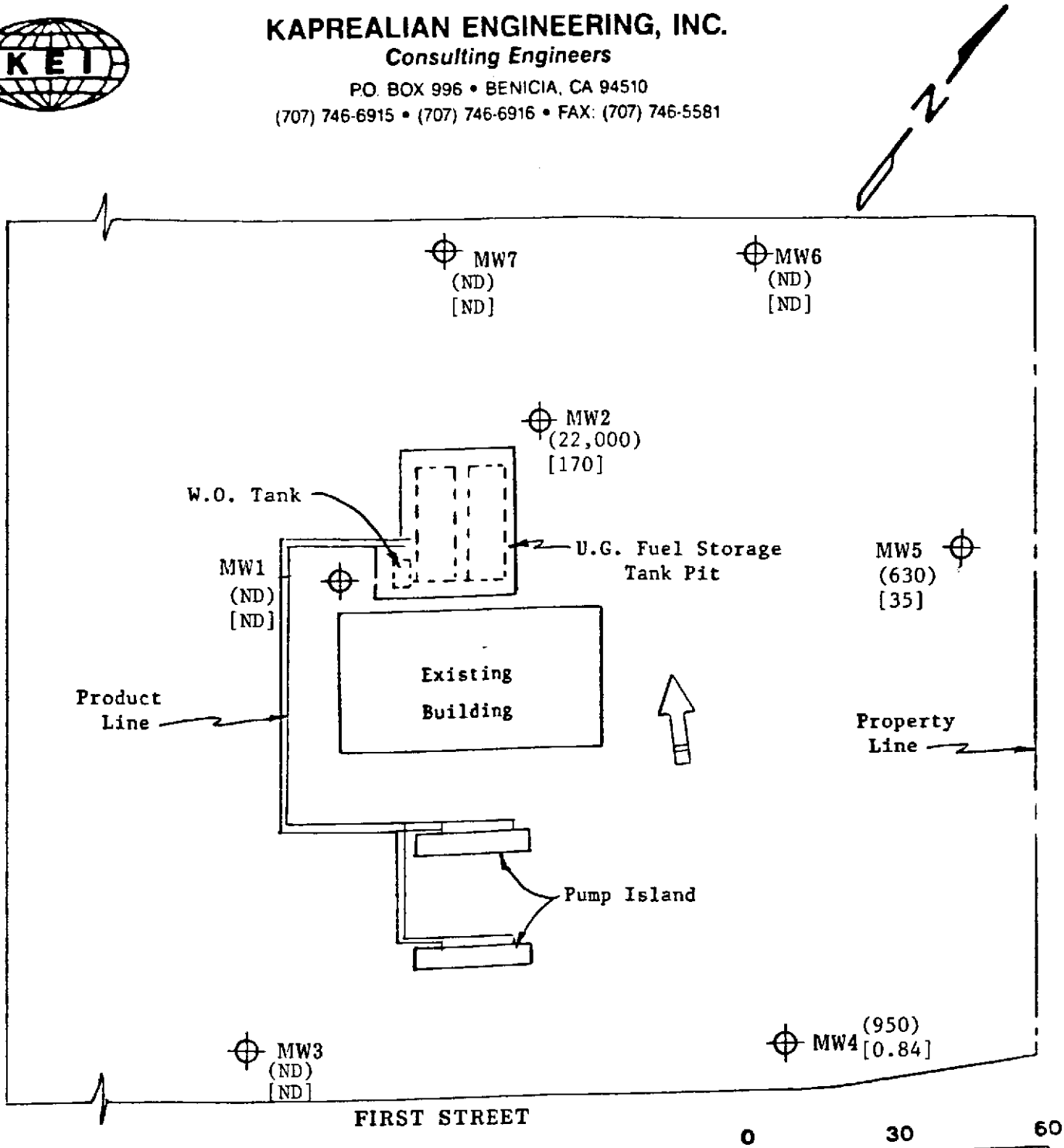


LEGEND

⊕ Monitoring Well

( ) Concentration of TPH as gasoline in ppb

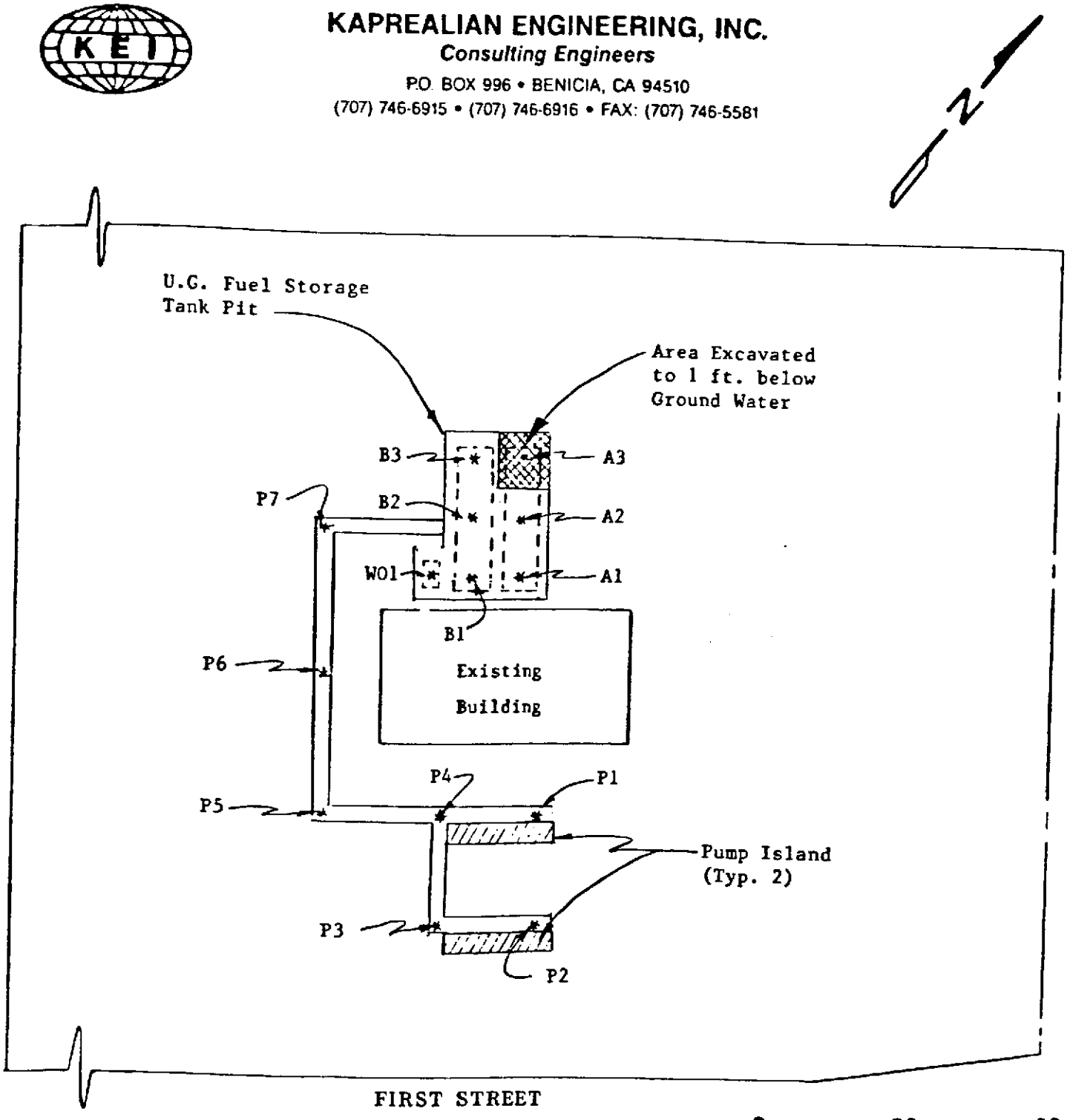
[ ] Concentration of benzene in ppb

⇨ Direction of Ground Water Flow

SITE PLAN
Figure 1a
April 10, 1991

Unocal S/S #6034
4700 First Street
Livermore, CA

KAPREALIAN ENGINEERING, INC.
Consulting Engineers
P.O. BOX 996 • BENICIA, CA 94510
(707) 746-6915 • (707) 746-6916 • FAX: (707) 746-5581



SITE PLAN
Figure 2

0 30 60
Approx. scale feet

LEGEND

* Sample Point Location

Unocal S/S #6034
4700 First Street
Livermore, CA

KAPREALIAN ENGINEERING, INC.
Consulting Engineers
P.O. BOX 996 • BENICIA, CA 94510
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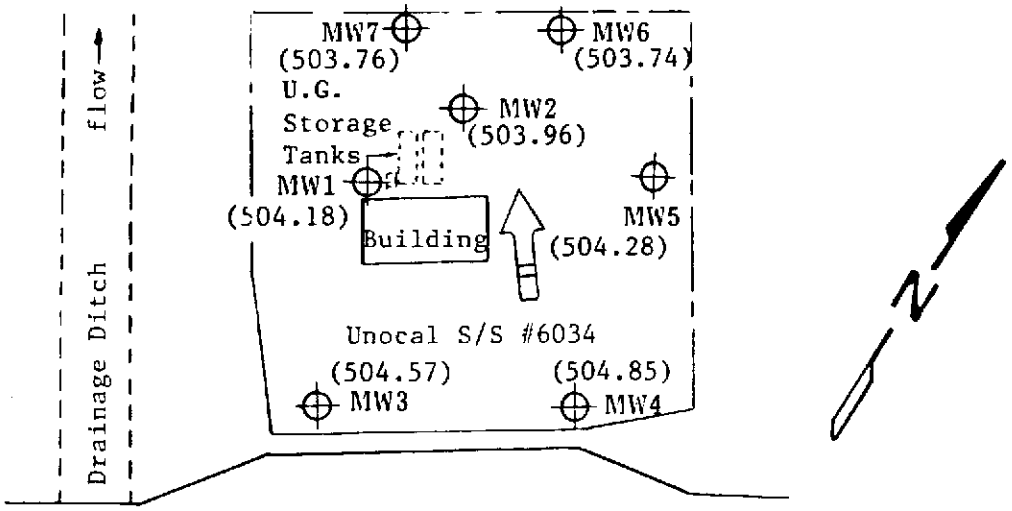
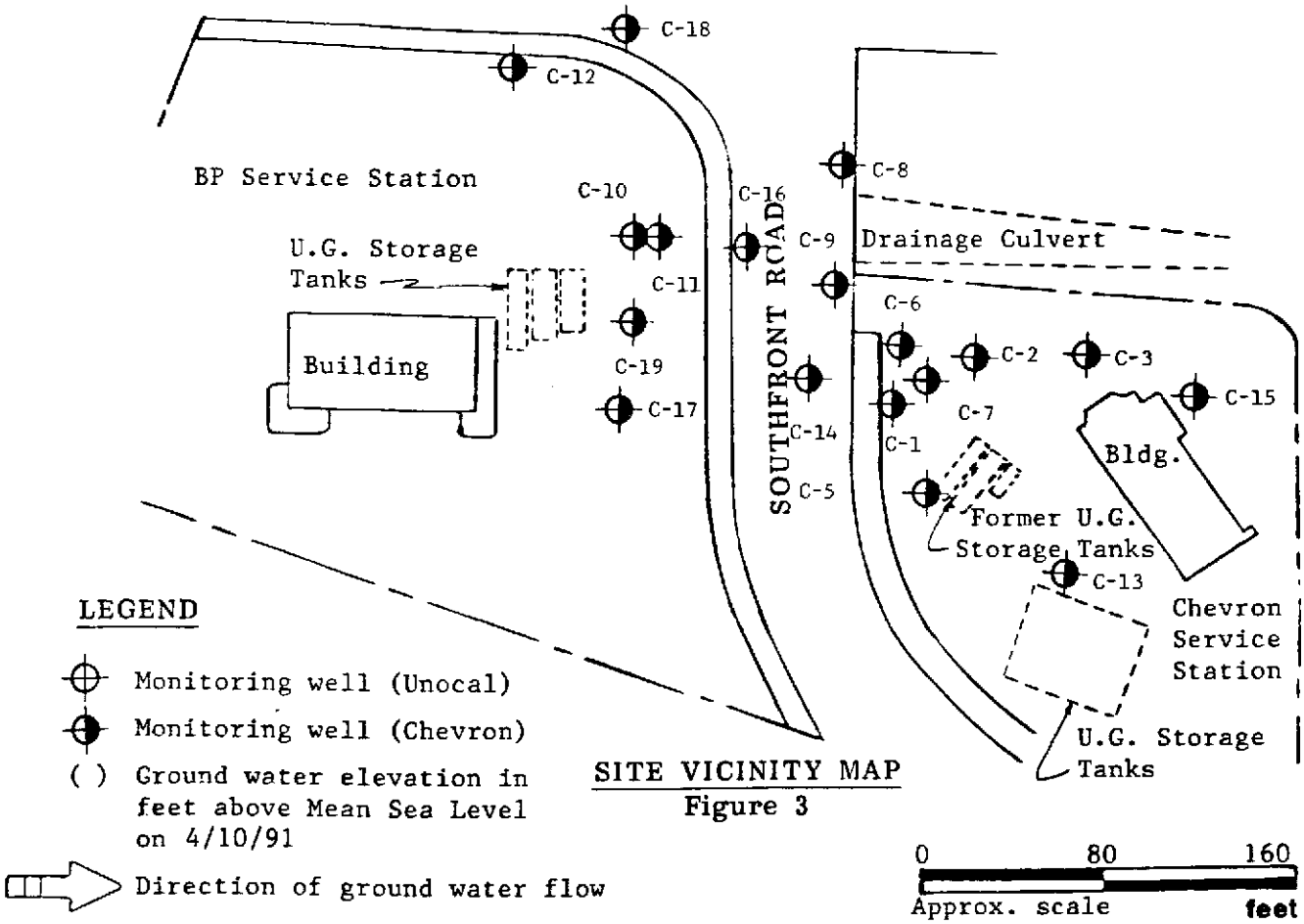




SITE VICINITY MAP
Figure 3

Note: ground water elevations for Chevron's wells are summarized in Table 1A

Unocal S/S #6034
4700 First Street
Livermore, CA

B O R I N G L O G

Project No. KEI-P89-0801	**Boring & Casing Diameter** 9" 2"	**Logged By** W.W.
Project Name Unocal 4700 First St. Liverm	**Well Cover Elevation**	**Date Drilled** 4/2/91
Boring No. MW5	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
		0		Asphalt pavement over sand and gravel.
14/28/12		5	ML to GM	Very gravelly clayey silt to silty gravel with clay, gravel composed of sandstone up to 6" diameter, trace fine-grained sand, moist, dense, dark grayish brown.
10/10/11		10	CH	Clay, with silt, trace coarse-grained sand, root holes common, trace highly weathered siltstone gravel to 3/4" diameter, moist, very stiff, very dark gray.
13/15/20	▽	15	ML/ MH	Clayey silt, trace fine-grained sand, several highly consolidated fine-grained silt or caliche (?) nodules to 1½" diameter (pale yellow), moist, very stiff, mottled with light yellowish brown, light yellowish brown, light olive brown and dark gray. Silt, with sand, trace clay, moist to very moist, very stiff, yellowish brown and light brownish gray mottled.
			SM	2" thick lens of subrounded gravel to 1/2" diameter at 15.4', underlain by sand, with silt, trace clay, sand is fine-grained, saturated, dense, yellowish brown.
3/4/6		20	CL/ CH	Sandy clay, trace silt, trace caliche, sand is fine-grained, moist to very moist, stiff, light olive gray.

BORING LOG

Project No. KEI-P89-0801	**Boring & Casing Diameter** 9" 2"	**Logged By** W.W.
Project Name Unocal 4700 First St. Liverm	**Well Cover Elevation**	**Date Drilled** 4/2/91
Boring No. MW5	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
			CL/ CH	Clay, trace sand, trace silt, trace gravel to 3/8" diameter, caliche common up to 1½" diameter.
2/2/3			SC	Clayey sand, light olive gray.
			CL	Clay, trace fine-grained sand, moist, firm, light olive gray.
		25		
		30		
		35		
		40		TOTAL DEPTH: 24'

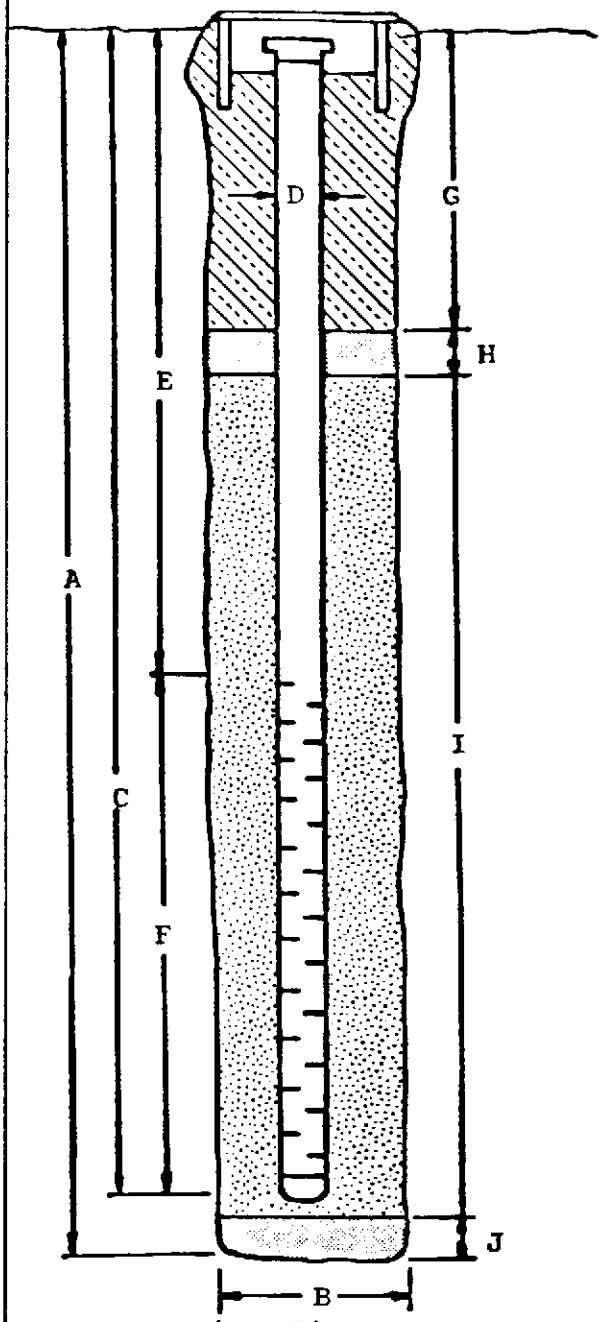
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal 4700 First St. Livermore BORING/WELL NO. MW5

PROJECT NUMBER: KEI-P89-0801

WELL PERMIT NO.: 91107

Flush-mounted Well Cover



A. Total Depth: 24'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 24'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375" ID = 2.067"

E. Depth to Perforations: 10'

F. Perforated Length: 14'

Screen length: 10-24' depth

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 6'

Seal Material: Neat Cement

H. Seal: 2'

Seal Material: Bentonite

I. Gravel Pack: 16'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: None

Seal Material: N/A

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.

B O R I N G L O G

Project No. KEI-P89-0801	**Boring & Casing Diameter** 9" 2"	**Logged By** W.W.
Project Name Unocal 4700 First St. Liverm	**Well Cover Elevation**	**Date Drilled** 4/2/91
Boring No. MW6	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
		0	ML	Lawn. Clayey silt with gravel to 3" diameter, trace sand, rootlets common, moist, stiff, dark grayish brown.
5/4/6		5	CL/CH	Clay, with silt, rootlets common, porous, moist, stiff, very dark grayish brown.
6/9/11		10		Clay, with coarse-grained sand, trace fine-grained sand and silt, trace highly weathered siltstone gravel to 3/4" diameter, trace caliche nodules to 1" diameter, moist, very stiff, light brownish gray and dark gray mottled.
			GC	Clayey gravel with sand and silt, trace rootlets, gravel to 3/4" diameter, moist, dense, grayish brown and greenish gray.
16/20/20	▽	15	GM	Silty gravel with sand, trace clay, subrounded gravel to 3/4" diameter, very moist, dense, greenish gray.
			ML	Silt, with clay, saturated, hard greenish gray.
9/12/14		20	GW	Sandy gravel, trace silt, well graded, subrounded gravel to 3/4" diameter, saturated, medium dense, dark gray.

BORING LOG

Project No.	Boring & Casing Diameter	Logged By
KEI-P89-0801	9" 2"	W.W.
Project Name Unocal 4700 First St. Liverm	**Well Cover Elevation**	**Date Drilled** 4/2/91
Boring No. MW6	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
			GW	Sandy gravel, as above.
4/6/7			CL/CH	Sandy clay, predominantly coarse-grained, very moist to saturated, stiff, light yellowish brown. Clay, with very fine-grained sand, very moist, stiff, light yellowish brown.
		25		
		30		
		35		
		40		TOTAL DEPTH: 24'

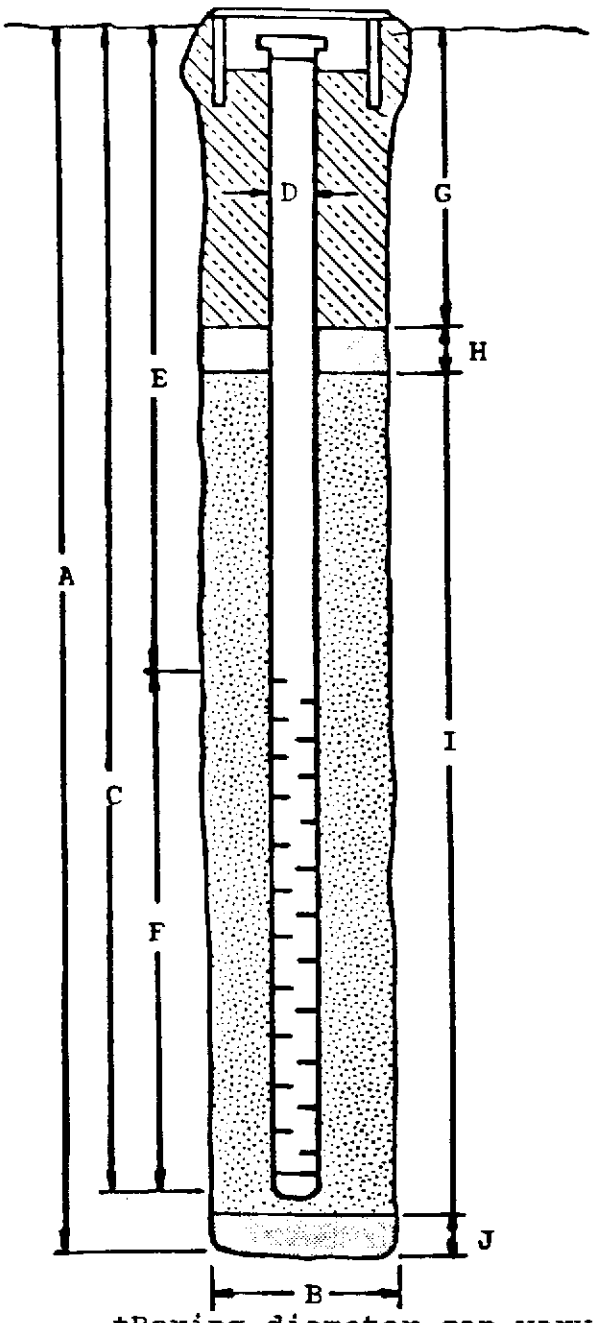
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal 4700 First St. Livermore BORING/WELL NO. MW6

PROJECT NUMBER: KEI-P89-0801

WELL PERMIT NO.: 91107

Flush-mounted Well Cover



A. Total Depth: 24'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 24'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375"
ID = 2.067"

E. Depth to Perforations: 10'

F. Perforated Length: 14'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 6'

Seal Material: Neat Cement

H. Seal: 2'

Seal Material: Bentonite

I. Gravel Pack: 16'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: None

Seal Material: N/A

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.

B O R I N G L O G

Project No. KEI-P89-0801	**Boring & Casing Diameter** 9" 2"	**Logged By** W.W.
Project Name Unocal 4700 First St. Liverm	**Well Cover Elevation**	**Date Drilled** 4/2/91
Boring No. MW7	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
		0	ML	Lawn - top soil. Silt, trace clay, with sand and gravel to 2" in diameter, moist, firm, dark grayish brown.
12/4/5		5		Sandy silt, trace clay, trace gravel to 3/4" diameter, moist to very moist, very stiff, dark grayish brown.
			CL/ CH	Clay, with silt, rootlets common, moist, stiff, gray and very dark gray mottled.
				Clay, trace very fine-grained sand, moist, stiff, very dark grayish brown.
6/7/8		10		Clay, trace silt and sand, caliche common with nodules to 3/4" diameter, trace root holes, moist, stiff, light gray and olive gray mottled.
				Clay, with silt, trace sand, very moist, hard, light olive gray.
16/21/30	▽	15	GW	Sandy gravel, trace clay, trace silt, sand and gravel well graded to 1¼" diameter, gravel is subangular, saturated below 15.4', dense to very dense, grayish brown.
				Well graded sand and gravel to 1¼" diameter, gravel is subangular to subrounded, trace clay and silt, saturated, dense, grayish brown.
7/25/		20		

BORING LOG

Project No.	Boring & Casing Diameter	Logged By
KEI-P89-0801	9" 2"	W.W.
Project Name Unocal 4700 First St. Liverm	**Well Cover Elevation**	**Date Drilled** 4/2/91
Boring No. MW7	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
/19			GW	Gravel, as above.
3/6/8			CL	Clay, with fine-grained and coarse-grained sand, common caliche nodules to 1/2" diameter, moist, stiff, pale yellow and light yellowish brown.
		25		
		30		
		35		
		40		TOTAL DEPTH: 24'

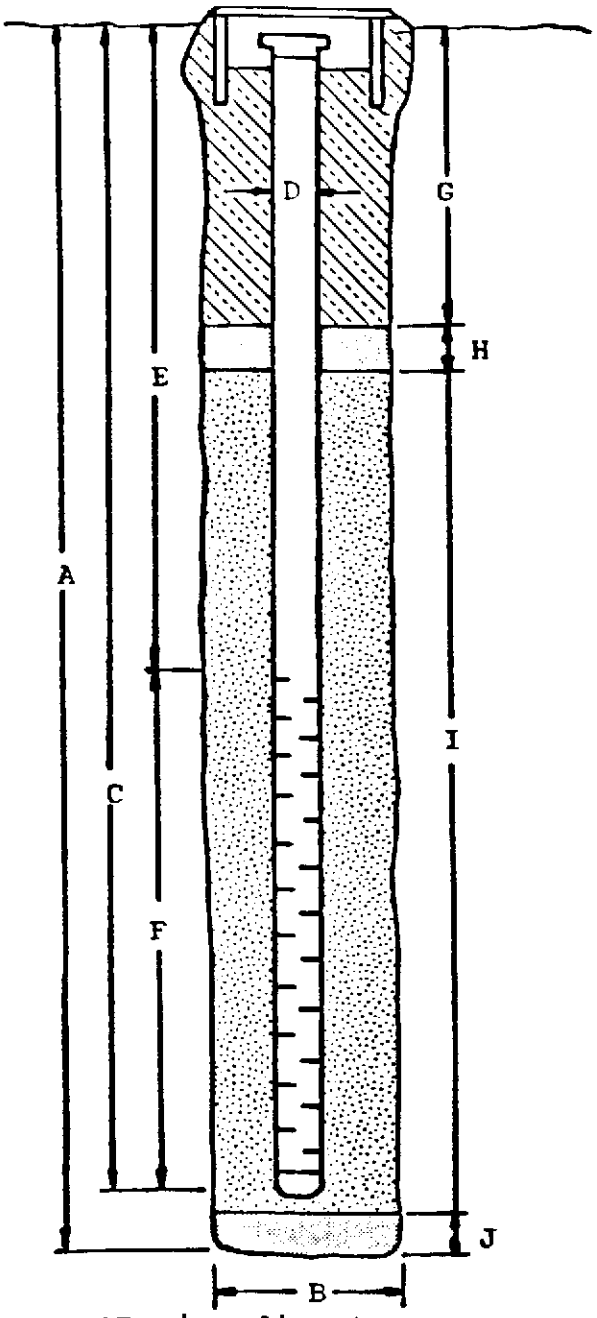
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal 4700 First St. Livermore BORING/WELL NO. MW7

PROJECT NUMBER: KEI-P89-0801

WELL PERMIT NO.: 91107

Flush-mounted Well Cover



A. Total Depth: 24.5'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 24'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375" ID = 2.067"

E. Depth to Perforations: 10'

F. Perforated Length: 14'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 6'

Seal Material: Neat Cement

H. Seal: 2'

Seal Material: Bentonite

I. Gravel Pack: 16.5'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: None

Seal Material: N/A

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.

SEQUOIA ANALYTICAL

1900 Bates Avenue • Suite LM • Concord, California 94520
(415) 686-9600 • FAX (415) 686-9689

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 4700 First St., Livermore	Sampled:	Apr 2, 1991
P.O. Box 996	Matrix Descript:	Soil	Received:	Apr 2, 1991
Benicia, CA 94510	Analysis Method:	EPA 5030/8015/8020	Analyzed:	4/12-4/15/91
Attention: Mardo Kaprealian, P.E.	First Sample #:	104-0106	Reported:	Apr 16, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
104-0106	MW5(5)	N.D.	N.D.	0.0056	N.D.	N.D.
104-0107	MW5(10)	N.D.	N.D.	N.D.	N.D.	N.D.
104-0108	MW5(15.5)	N.D.	N.D.	N.D.	N.D.	0.0060
104-0109	MW6(5)	N.D.	N.D.	0.010	N.D.	0.0086
104-0110	MW6(10)	N.D.	N.D.	N.D.	N.D.	0.017
104-0111	MW6(15.5)	N.D.	N.D.	N.D.	N.D.	0.058
104-0112	MW7(5.5)	N.D.	N.D.	N.D.	N.D.	N.D.
104-0113	MW7(10)	N.D.	N.D.	0.0086	N.D.	0.030
104-0114	MW7(15)	N.D.	N.D.	0.0098	N.D.	0.010
Detection Limits:		**1.0**	**0.0050**	**0.0050**	**0.0050**	**0.0050**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Belinda C. Vega
Laboratory Director

SEQUOIA ANALYTICAL

1900 Bates Avenue • Suite LM • Concord, California 94520
(415) 686-9600 • FAX (415) 686-9689

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 4700 First St., Livermore	Sampled: - - - - - -
P.O. Box 996	Sample Descript.:	Matrix Blank	Received: - - - - - -
Benicia, CA 94510	Analysis Method:	EPA 5030/8015/8020	Analyzed: Apr 12, 1991
Attention: Mardo Kaprealian, P.E.	Lab Number:	- - - - - -	Reported: Apr 16, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS WITH BTEX DISTINCTION (EPA 8015/8020)

Analyte	Detection Limit mg/kg (ppm)	Sample Results mg/kg (ppm)
Low to Medium Boiling Point Hydrocarbons	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes	**0.0050**	**0.016**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Belinda C. Vega
Laboratory Director

SEQUOIA ANALYTICAL

1900 Bates Avenue • Suite LM • Concord, California 94520
(415) 686-9600 • FAX (415) 686-9689

Kaprealian Engineering, Inc.
P.O. Box 996
Benicia, CA 94510
Attention: Mardo Kaprealian, P.E.

Client Project ID: Unocal, 4700 First St., Livermore
QC Sample Group: 1040106-14
Reported: Apr 16, 1991

QUALITY CONTROL DATA REPORT

SURROGATE

Method:	EPA8015/8020	EPA8015/8020	EPA8015/8020	EPA8015/8020	EPA8015/8020	EPA8015/8020	EPA8015/8020
Analyst:	E. Hamilton	E. Hamilton	E. Hamilton	E. Hamilton	E. Hamilton	E. Hamilton	E. Hamilton
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Apr 12, 1991	Apr 12, 1991	Apr 12, 1991	Apr 12, 1991	Apr 12, 1991	Apr 12, 1991	Apr 12, 1991
Sample #:	104-0106	104-0107	104-0108	104-0109	104-0110	104-0111	104-0112
Surrogate % Recovery:	93	93	100	93	100	100	97

SEQUOIA ANALYTICAL

Belinda C. Vega
Laboratory Director

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

SEQUOIA ANALYTICAL

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(415) 686-9600 • FAX (415) 686-9689

Kaprealian Engineering, Inc.
P.O. Box 996
Benicia, CA 94510
Attention: Mardo Kaprealian, P.E.

Client Project ID: Unocal, 4700 First St., Livermore
QC Sample Group: 1040106-14
Reported: Apr 16, 1991

QUALITY CONTROL DATA REPORT

SURROGATE

Method:	EPA8015/8020	EPA8015/8020	EPA8015/8020
Analyst:	E. Hamilton	E. Hamilton	E. Hamilton
Reporting Units:	mg/kg	mg/kg	mg/kg
Date Analyzed:	Apr 12, 1991	Apr 12, 1991	Apr 12, 1991
Sample #:	104-0013	104-0014	Blank
Surrogate % Recovery:	97	110	97

SEQUOIA ANALYTICAL

Belinda C. Vega
Laboratory Director

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

SEQUOIA ANALYTICAL

1900 Bates Avenue • Suite LM • Concord, California 94520
(415) 686-9600 • FAX (415) 686-9689

Kaprealian Engineering, Inc.
P.O. Box 996
Benicia, CA 94510
Attention: Mardo Kaprealian, P.E.

Client Project ID: Unocal, 4700 First St., Livermore
QC Sample Group: 1040106-114
Reported: Apr 16, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Method:	EPA8015/8020	EPA8015/8020	EPA8015/8020	EPA8015/8020
Analyst:	E. Hamilton	E. Hamilton	E. Hamilton	E. Hamilton
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Apr 12, 1991	Apr 12, 1991	Apr 12, 1991	Apr 12, 1991
QC Sample #:	Matrix	Matrix	Matrix	Matrix
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.50	0.50	0.50	1.5
Conc. Matrix Spike:	0.56	0.53	0.51	1.6
Matrix Spike % Recovery:	110	110	100	110
Conc. Matrix Spike Dup.:	0.63	0.55	0.50	1.5
Matrix Spike Duplicate % Recovery:	130	110	100	100
Relative % Difference:	12	3.7	2.0	6.5

SEQUOIA ANALYTICAL

Belinda C. Vega
Laboratory Director

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

KAPREALIAN ENGINEERING, INC.

CHAIN OF CUSTODY

SAMPLER: Gordie Weston

WITNESSING AGENCY:

SITE NAME & ADDRESS: Unocal - Livermore, 4700 First St.

ANALYSES REQUESTED: TPH-G/BTXE

TURN AROUND TIME: Regular

SAMPLE ID NO.	DATE	TIME	SOIL	WATER	GRAB	COMP	NO. OF CONT.	SAMPLING LOCATION	REMARKS
MW5-(5)	4/2/91		✓		✓		1	See Sample ID#	1040106
MW5-(10)	"		✓		✓		1		107
MW5-(15.5)	"		✓		✓		1		108
MW6-(5)	"		✓		✓		1		109
MW6-(10)	"		✓		✓		1		110
MW6-(15.5)	"		✓		✓		1		111
MW7-(5.5)	"		✓		✓		1		112
MW7-(10)	"		✓		✓		1		113
MW7-(15)	"		✓		✓		1		114

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Gordie Weston	4/2/91 17:00	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)

The following MUST BE completed by the laboratory accepting samples for analysis:

1. Have all samples received for analysis been stored in ice? ✓
2. Will samples remain refrigerated until analyzed? ✓
3. Did any samples received for analysis have head space? NO
4. Were samples in appropriate containers and properly packaged? ✓

Signature: [illegible] Title: SR Date: 4/2/91

SEQUOIA ANALYTICAL

1900 Bates Avenue • Suite LM • Concord, California 94520
(415) 686-9600 • FAX (415) 686-9689

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 4700 First St., Livermore	Sampled: Apr 10, 1991
P.O. Box 996	Matrix Descript:	Water	Received: Apr 11, 1991
Benicia, CA 94510	Analysis Method:	EPA 5030/8015/8020	Analyzed: 4/17-4/18/91
Attention: Mardo Kaprealian, P.E.	First Sample #:	104-0394 AB	Reported: Apr 24, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons µg/L (ppb)	Benzene µg/L (ppb)	Toluene µg/L (ppb)	Ethyl Benzene µg/L (ppb)	Xylenes µg/L (ppb)
104-0394 AB	MW-1	N.D.	N.D.	N.D.	N.D.	N.D.
104-0395 AB	MW-2	22,000	170	190	490	6,200
104-0396 AB	MW-3	N.D.	N.D.	N.D.	N.D.	N.D.
104-0397 AB	MW-4	950	0.84	4.3	9.6	5.0
104-0398 AB	MW-5	630	35	14	47	30
104-0399 AB	MW-6	N.D.	N.D.	N.D.	N.D.	N.D.
104-0400 AB	MW-7	N.D.	N.D.	N.D.	N.D.	N.D.
Detection Limits:		**30**	**0.30**	**0.30**	**0.30**	**0.30**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Julia R. Malerstein
Project Manager

SEQUOIA ANALYTICAL

1900 Bates Avenue • Suite LM • Concord, California 94520
(415) 686-9600 • FAX (415) 686-9689

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 4700 First St., Livermore	Sampled: - - - - - -
P.O. Box 996	Sample Descript.:	DI Blank	Received: - - - - - -
Benicia, CA 94510	Analysis Method:	EPA 5030/ 8015/8020	Analyzed: Apr 17, 1991
Attention: Mardo Kaprealian, P.E.	Lab Number:	- - - - - -	Reported: Apr 24, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS WITH BTEX DISTINCTION (EPA 8015/8020)

Analyte	Detection Limit µg/L (ppb)	Sample Results µg/L (ppb)
Low to Medium Boiling Point Hydrocarbons	30	N.D.
Benzene	0.30	N.D.
Toluene	0.30	N.D.
Ethyl Benzene	0.30	N.D.
Xylenes	0.30	N.D.

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Julia R. Malerstein
Project Manager

SEQUOIA ANALYTICAL

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(415) 686-9600 • FAX (415) 686-9689

Kaprealian Engineering, Inc.
P.O. Box 996
Benicia, CA 94510
Attention: Mardo Kaprealian, P.E.

Client Project ID: Unocal, 4700 First St., Livermore
QC Sample Group: 1040394-400

Reported: Apr 24, 1991

QUALITY CONTROL DATA REPORT

SURROGATE

Method:	EPA8015/8020	EPA8015/8020	EPA8015/8020	EPA8015/8020	EPA8015/8020
Analyst:	S.L./E.H.	S.L./E.H.	S.L./E.H.	S.L./E.H.	S.L./E.H.
Reporting Units:	ppb	ppb	ppb	ppb	ppb
Date Analyzed:	Apr 17, 1991	Apr 17, 1991	Apr 17, 1991	Apr 17, 1991	Apr 17, 1991
Sample #:	104-0394	104-0395	104-0396	104-0397	104-0398
Surrogate % Recovery:	90	84	96	130	95

SEQUOIA ANALYTICAL

Julia R. Malerstein
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

SEQUOIA ANALYTICAL

1900 Bates Avenue • Suite LM • Concord, California 94520
(415) 686-9600 • FAX (415) 686-9689

Kaprealian Engineering, Inc.
P.O. Box 996
Benicia, CA 94510
Attention: Mardo Kaprealian, P.E.

Client Project ID: Unocal, 4700 First St., Livermore
QC Sample Group: 1040394-400
Reported: Apr 24, 1991

QUALITY CONTROL DATA REPORT

SURROGATE

Method:	EPA8015/8020	EPA8015/8020	EPA8015/8020
Analyst:	S.L./E.H.	S.L./E.H.	S.L./E.H.
Reporting Units:	ppb	ppb	ppb
Date Analyzed:	Apr 17, 1991	Apr 17, 1991	Apr 17, 1991
Sample #:	104-0399	104-0400	Blank
Surrogate % Recovery:	90	91	110

SEQUOIA ANALYTICAL

Julia R. Malerstein
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

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Reported: Apr 24, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Method:	EPA8015/8020	EPA8015/8020	EPA8015/8020	EPA8015/8020
Analyst:	S.L./E.H.	S.L./E.H.	S.L./E.H.	S.L./E.H.
Reporting Units:	ppb	ppb	ppb	ppb
Date Analyzed:	Apr 17, 1991	Apr 17, 1991	Apr 17, 1991	Apr 17, 1991
QC Sample #:	104-0120	104-0120	104-0120	104-0120
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	20	20	20	60
Conc. Matrix Spike:	20	18	17	54
Matrix Spike % Recovery:	100	90	85	90
Conc. Matrix Spike Dup.:	24	22	21	62
Matrix Spike Duplicate % Recovery:	120	110	110	100
Relative % Difference:	18	20	4.9	14

SEQUOIA ANALYTICAL

Julia R. Malerstein
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 4700 First St., Livermore	Sampled:	Apr 10, 1991
P.O. Box 996	Matrix Descript:	Water	Received:	Apr 11, 1991
Benicia, CA 94510	Analysis Method:	EPA 3510/8015	Extracted:	Apr 15, 1991
Attention: Mardo Kaprealian, P.E.	First Sample #:	104-0394 C	Analyzed:	Apr 17, 1991
			Reported:	Apr 24, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

Sample Number	Sample Description	High B.P. Hydrocarbons µg/L (ppb)
104-0394 C	MW-1	N.D.

Detection Limits:	50

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Julia R. Malerstein
Project Manager

SEQUOIA ANALYTICAL

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Kaprealian Engineering, Inc.
P.O. Box 996
Benicia, CA 94510
Attention: Mardo Kaprealian, P.E.

Client Project ID: Unocal, 4700 First St., Livermore
QC Sample Group: 1040394-400
Reported: Apr 24, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Diesel
Method:	EPA 8015
Analyst:	K. Lee
Reporting Units:	µg/L
Date Analyzed:	Apr 17, 1991
QC Sample #:	BLK041591
Sample Conc.:	N.D.
Spike Conc. Added:	300
Conc. Matrix Spike:	170
Matrix Spike % Recovery:	57
Conc. Matrix Spike Dup.:	170
Matrix Spike Duplicate % Recovery:	57
Relative % Difference:	0

SEQUOIA ANALYTICAL

Julia R. Malerstein
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 4700 First St., Livermore	Sampled: - - - - - -
P.O. Box 996	Matrix Descript:	DI Blank	Received: - - - - - -
Benicia, CA 94510	Analysis Method:	EPA 3510/8015	Extracted: Apr 15, 1991
Attention: Mardo Kaprealian, P.E.	First Sample #:	- - - - - -	Analyzed: Apr 17, 1991
			Reported: Apr 24, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

Sample Number	Sample Description	High B.P. Hydrocarbons µg/L (ppb)
- - - - - -	DI Blank	N.D.

Detection Limits:	50

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Julia R. Malerstein
Project Manager

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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 4700 First St., Livermore	Sampled:	Apr 10, 1991
P.O. Box 996	Matrix Descript:	Water	Received:	Apr 11, 1991
Benicia, CA 94510	Analysis Method:	SM 5520 B&F (Gravimetric)	Extracted:	Apr 17, 1991
Attention: Mardo Kaprealian, P.E.	First Sample #:	104-0394 D	Analyzed:	Apr 23, 1991
			Reported:	Apr 24, 1991

TOTAL RECOVERABLE PETROLEUM OIL

Sample Number	Sample Description	Oil & Grease mg/L (ppm)
104-0394 D	MW-1	N.D.

Detection Limits:	5.0

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Julia R. Malerstein
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Kaprealian Engineering, Inc.
P.O. Box 996
Benicia, CA 94510
Attention: Mardo Kaprealian, P.E.

Client Project ID: Unocal, 4700 First St., Livermore
QC Sample Group: 1040394-400
Reported: Apr 24, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Oil & Grease
Method:	SM 5520 B&F
Analyst:	R. Halsne
Reporting Units:	mg/L
Date Analyzed:	Apr 23, 1991
QC Sample #:	Matrix Blank 041791M
Sample Conc.:	N.D.
Spike Conc. Added:	100
Conc. Matrix Spike:	96
Matrix Spike % Recovery:	96
Conc. Matrix Spike Dup.:	98
Matrix Spike Duplicate % Recovery:	98
Relative % Difference:	1.0

SEQUOIA ANALYTICAL

Julia R. Malerstein
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

SEQUOIA ANALYTICAL

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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 4700 First St., Livermore	Sampled:	Apr 10, 1991
P.O. Box 996	Sample Descript:	Water, MW-1	Received:	Apr 11, 1991
Benicia, CA 94510	Analysis Method:	EPA 5030/8010	Analyzed:	Apr 15, 1991
Attention: Mardo Kaprealian, P.E.	Lab Number:	104-0394 E-F	Reported:	Apr 24, 1991

HALOGENATED VOLATILE ORGANICS (EPA 8010)

Analyte	Detection Limit µg/L	Sample Results µg/L
Bromodichloromethane	1.0	N.D.
Bromoform	1.0	N.D.
Bromomethane	1.0	N.D.
Carbon tetrachloride	1.0	N.D.
Chlorobenzene	1.0	N.D.
Chloroethane	5.0	N.D.
2-Chloroethylvinyl ether	1.0	N.D.
Chloroform	0.50	N.D.
Chloromethane	0.50	N.D.
Dibromochloromethane	0.50	N.D.
1,2-Dichlorobenzene	2.0	N.D.
1,3-Dichlorobenzene	2.0	N.D.
1,4-Dichlorobenzene	2.0	N.D.
1,1-Dichloroethane	0.50	N.D.
1,2-Dichloroethane	0.50	N.D.
1,1-Dichloroethene	1.0	N.D.
cis-1,2-Dichloroethene	1.0	N.D.
trans-1,2-Dichloroethene	1.0	N.D.
1,2-Dichloropropane	0.50	N.D.
cis-1,3-Dichloropropene	5.0	N.D.
trans-1,3-Dichloropropene	5.0	N.D.
Methylene chloride	2.0	N.D.
1,1,2,2-Tetrachloroethane	0.50	N.D.
Tetrachloroethene	0.50	N.D.
1,1,1-Trichloroethane	0.50	N.D.
1,1,2-Trichloroethane	0.50	N.D.
Trichloroethene	0.50	N.D.
Trichlorofluoromethane	1.0	N.D.
Vinyl chloride	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

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Project Manager

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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 4700 First St., Livermore	Sampled: - - - - - -
P.O. Box 996	Sample Descript:	DI Blank	Received: - - - - - -
Benicia, CA 94510	Analysis Method:	EPA 5030/8010	Analyzed: Apr 15, 1991
Attention: Mardo Kaprealian, P.E.	Lab Number:	- - - - - -	Reported: Apr 24, 1991

HALOGENATED VOLATILE ORGANICS (EPA 8010)

Analyte	Detection Limit µg/L	Sample Results µg/L
Bromodichloromethane	1.0	N.D.
Bromoform	1.0	N.D.
Bromomethane	1.0	N.D.
Carbon tetrachloride	1.0	N.D.
Chlorobenzene	1.0	N.D.
Chloroethane	5.0	N.D.
2-Chloroethylvinyl ether	1.0	N.D.
Chloroform	0.50	N.D.
Chloromethane	0.50	N.D.
Dibromochloromethane	0.50	N.D.
1,2-Dichlorobenzene	2.0	N.D.
1,3-Dichlorobenzene	2.0	N.D.
1,4-Dichlorobenzene	2.0	N.D.
1,1-Dichloroethane	0.50	N.D.
1,2-Dichloroethane	0.50	N.D.
1,1-Dichloroethene	1.0	N.D.
cis-1,2-Dichloroethene	1.0	N.D.
trans-1,2-Dichloroethene	1.0	N.D.
1,2-Dichloropropane	0.50	N.D.
cis-1,3-Dichloropropene	5.0	N.D.
trans-1,3-Dichloropropene	5.0	N.D.
Methylene chloride	2.0	N.D.
1,1,2,2-Tetrachloroethane	0.50	N.D.
Tetrachloroethene	0.50	N.D.
1,1,1-Trichloroethane	0.50	N.D.
1,1,2-Trichloroethane	0.50	N.D.
Trichloroethene	0.50	N.D.
Trichlorofluoromethane	1.0	N.D.
Vinyl chloride	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

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Julia R. Malerstein
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Kaprealian Engineering, Inc.
P.O. Box 996
Benicia, CA 94510
Attention: Mardo Kaprealian, P.E.

Client Project ID:

QC Sample Group: 1040394-400

Reported: Apr 24, 1991

QUALITY CONTROL DATA REPORT

SURROGATE

Method:	EPA 8010	EPA 8010
Analyst:	EH	EH
Reporting Units:	ug/L	ug/L
Date Analyzed:	Apr 15, 1991	Apr 15, 1991
Sample #:	104-0394	Blank
Surrogate #1 % Recovery:	99	100
Surrogate #2 % Recovery:	95	96

SEQUOIA ANALYTICAL

Julia R. Malerstein
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

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Attention: Mardo Kaprealian, P.E.

Client Project ID: Unocal, 4700 First St., Livermore
QC Sample Group: 1040394-400
Reported: Apr 24, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	1,1-Dichloroethene	Trichloro-ethene	Chloro-benzene
Method:	EPA 8010	EPA 8010	EPA 8010
Analyst:	E. Hamilton	E. Hamilton	E. Hamilton
Reporting Units:	µg/L	µg/L	µg/L
Date Analyzed:	Apr 15, 1991	Apr 15, 1991	Apr 15, 1991
QC Sample #:	104-0321	104-0321	104-0321
Sample Conc.:	N.D.	N.D.	N.D.
Spike Conc. Added:	10	10	10
Conc. Matrix Spike:	8.1	9.5	10
Matrix Spike % Recovery:	81	95	100
Conc. Matrix Spike Dup.:	8.7	9.5	10
Matrix Spike Duplicate % Recovery:	87	95	100
Relative % Difference:	7.1	0	0

SEQUOIA ANALYTICAL

Julia R. Malerstein
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}}$	x 100
Relative % Difference:	$\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}}$	x 100

KAPREALIAN ENGINEERING, INC.

CHAIN OF CUSTODY

SAMPLER	SITE NAME & ADDRESS	TURN AROUND TIME:
Vartkes	Unocal / Livermore 4700 First street.	Regular.
WITNESSING AGENCY		[redacted]

ANALYSES REQUESTED: TPHG & BTXE, TPHD, TOG (5520 C&F), 8010

SAMPLE ID NO.	DATE	TIME	SOIL	WATER	GRAB	COMP	NO. OF CONT.	SAMPLING LOCATION	TPHG & BTXE	TPHD	TOG (5520 C&F)	8010				REMARKS
MW-1	4/10/91	11: A.M.		✓	✓		6	Monitoring Well	✓	✓	✓	✓	1040394 NF			VOA's Preserved in HCL.
MW-2	"			✓	✓		2	" "	✓					395 NS		
MW-3	"			✓	✓		2	" "	✓					396		
MW-4	"			✓	✓		2	" "	✓					397		
MW-5	"			✓	✓		2	" "	✓					398		
MW-6	"			✓	✓		2	" "	✓					399		
MW-7	"	4:15 P.M.		✓	✓		2	" "	✓					400		

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
W. Tachdjian	4/10/91 5:35 PM	K. Walters
K Well	4/11	[signature] Wimer

The following MUST BE completed by the laboratory accepting samples for analysis:

1. Have all samples received for analysis been stored in ice? ✓
2. Will samples remain refrigerated until analyzed? ✓
3. Did any samples received for analysis have head space? no
4. Were samples in appropriate containers and properly packaged? ✓

Signature	Title	Date
KW	SEK	4/10/91