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

August 7, 1991

Alameda County Health Care Services
80 Swan Way, Room 200
Oakland, CA 94621

Attention: Mr. Larry Seto

RE: Unocal Service Station #6034
4700 First Street
Livermore, California

Dear Mr. Seto:

Per the request of Mr. Rick Sisk of Unocal Corporation, enclosed please find our report dated August 7, 1991, for the above referenced site.

Should you have any questions, please feel free to call our office at (707) 746-6915.

Sincerely,

Kaprealian Engineering, Inc.

Judy A. Dewey

jad\82

Enclosure

cc: Rick Sisk, Unocal Corporation

91 MAY 6 PM 4:16

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KEI-P89-0801.QR5
August 7, 1991

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

Attention: Mr. Ron Bock

RE: Quarterly Report
Unocal Service Station #6034
4700 First Street
Livermore, California

Dear Mr. Bock:

This report presents the results of the most recent quarter of monitoring and sampling of the monitoring wells at the referenced site by Kaprealian Engineering, Inc. (KEI), per KEI's proposal KEI-P89-0801.P3 dated January 31, 1991. The wells are currently monitored monthly and sampled on a quarterly basis. This report covers the work performed by KEI from May through July, 1991.

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 trenches 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, EPA method 8010 results, and TOG were non-detectable in all soil samples collected from MW1.

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 (MSL).

Based on the levels of TPH as gasoline and benzene detected in well MW2 on December 24, 1990, KEI recommended the installation of three additional monitoring wells in KEI's fourth quarterly report (KEI-P89-0801.QR4) dated January 31, 1991.

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

Wells MW5, MW6 and MW7 were developed on April 5, 1991, and all wells were sampled on April 10, 1991. Water samples from all wells, and selected soil samples from borings of MW5 through MW7, were analyzed at Sequoia Analytical Laboratory in Concord, California, for TPH as gasoline and BTX&E. In addition, the water sample collected from MW1 was analyzed for TPH as diesel, TOG, and EPA method 8010 constituents.

Analytical results of the soil samples collected from the borings for monitoring wells MW5, MW6 and MW7 indicated non-detectable levels of TPH as gasoline and benzene in all analyzed samples. Analytical results of the water samples collected from monitoring wells MW1, MW3, MW6 and MW7 indicated non-detectable levels of TPH as gasoline and BTX&E. In wells MW2, MW4 and MW5, levels of TPH as gasoline were detected at 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. Results of the soil analyses are summarized in Table 3, and water analyses in Table 2. Documentation of the additional well installation, the last quarter of monitoring and sampling, and laboratory analyses are presented in KEI's report (KEI-P89-0801.R5) dated May 10, 1991. Based on the analytical results, KEI recommended continuation of the monthly monitoring and quarterly sampling program.

On January 24, 1991, KEI reviewed the most recent quarterly report (available for review by KEI) prepared for Chevron USA by Western Geologic Resources, Inc., dated June 12, 1990. At the time, there were 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, showed 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 previously 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, suggested that upgradient contamination has migrated onto the Unocal site and may be contributing to contamination detected in Unocal's monitoring well MW2.

RECENT FIELD ACTIVITIES

The seven wells (MW1 through MW7) were monitored three times and sampled once during the quarter. During monitoring, the wells were checked for depth to water and presence of free product and sheen. No free product or sheen was noted in any of the wells during the quarter. Well MW2 was purged of 55 gallons and well MW5 was purged of 25 to 35 gallons during each monthly monitoring event. Monitoring data are summarized in Table 1.

Water samples were collected from the wells on July 10, 1991. Prior to sampling, the wells were purged of between 15 and 55

gallons each using a Teflon bailer. Samples were then collected using a clean Teflon bailer. Samples were decanted into clean VOA vials and/or one-liter amber bottles, as appropriate, which were sealed with Teflon-lined screw caps and stored in a cooler on ice until delivery to a state certified laboratory.

HYDROLOGY AND GEOLOGY

Based on the water level data gathered during the quarter, ground water flow direction appeared to be toward the northwest on July 10, 1991, similar to the flow direction reported in previous quarters. The average hydraulic gradient at the site on July 10, 1991 was approximately 0.006. Water levels have fluctuated during the quarter, showing a net decrease of 0.01 to 0.04 feet in all wells since April 10, 1991, except for well MW6, which showed a net increase of 0.01 feet. The measured depth to ground water at the site on July 10, 1991 ranged between 15.30 and 16.73 feet.

KEI coordinated a joint monitoring on December 24, 1990 at the BP and Chevron stations located to the south and southeast, respectively, 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 (i.e. toward the Unocal station).

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 (Mocho 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).

ANALYTICAL RESULTS

Ground water samples were analyzed at Sequoia Analytical Laboratory in Concord, California, and were accompanied by properly executed Chain of Custody documentation. The samples were analyzed for TPH as gasoline using EPA method 5030 in conjunction with modified 8015, and BTX&E using EPA method 8020. In addition, the ground water sample collected from monitoring well MW1 was analyzed for TPH as diesel using EPA method 3510 in conjunction with modified 8015, TOG using Standard Method 5520B&F, and halogenated volatile organics using EPA method 8010.

Analytical results of ground water samples, collected from monitoring wells 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 detected at concentrations of 14,000 ppb, 830 ppb and 220 ppb, respectively, with benzene levels detected at concentrations of 70 ppb, 8.4 ppb and 5.1 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 during this

quarterly sampling are shown on the attached Site Plan, Figure 1a. Results of the analyses are summarized in Table 2. Copies of the laboratory analyses and Chain of Custody documentation are attached to this report.

DISCUSSION AND RECOMMENDATIONS

Based on the analytical results collected and evaluated to date and no evidence of free product or sheen in any of the wells, KEI recommends the continuation of the current monitoring and sampling program of the existing wells, per KEI's proposal (KEI-P89-0801.P3) dated January 31, 1991. However, based upon the fact that MW1 has shown non-detectable levels of TPH as gasoline and benzene for the past seven quarters, TPH as diesel for the past six quarters, and TOG for the past five quarters, KEI recommends that this well no longer be sampled. Well MW1 should continue to be monitored monthly in order to collect ground water elevation data.

Monitoring wells MW1, MW3, MW6 and MW7 continue to show non-detectable levels of TPH as gasoline and BTX&E; however, upgradient monitoring well MW4, located at the southeast corner of the Unocal site, has consistently shown TPH as gasoline levels greater than 800 ppb in all seven quarterly samples collected to date, which would appear to support a conclusion of a local off-site source of contamination.

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. Furthermore, additional joint monitoring and sampling of the wells at the Unocal, Chevron, and BP site should be conducted on a regular basis.

DISTRIBUTION

Copies of this report should be sent to the Alameda County Health Care Services Agency, the Alameda County Flood Control, 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

KEI-P89-0801.QR5
August 7, 1991

TABLE 1

SUMMARY OF GROUND WATER MONITORING
AND PURGING DATA

Well No.	Ground Water Elevation (feet)	Depth to Water (feet)	Product Thickness	Sheen	Water Bailed (gallons)
(Monitored and Sampled on July 10, 1991)					
MW1	504.15	16.73	0	No	15
MW2	503.95	16.22	0	No	55
MW3	504.54	15.37	0	No	15
MW4	504.82	15.30	0	No	25
MW5	504.24	16.34	0	No	35
MW6	503.75	15.59	0	No	15
MW7	503.75	15.62	0	No	15
(Monitored on June 10, 1991)					
MW1	504.22	16.66	0	No	0
MW2	504.02	16.15	0	No	55
MW3	504.60	15.31	0	No	0
MW4	504.80	15.32	0	No	0
MW5	504.28	16.30	0	No	25
MW6	503.79	15.55	0	No	0
MW7	503.81	15.56	0	No	0
(Monitored on May 13, 1991)					
MW1	504.31	16.57	0	No	0
MW2	504.05	16.12	0	No	55
MW3	504.52	15.39	0	No	0
MW4	504.88	15.24	0	No	0
MW5	504.37	16.21	0	No	35
MW6	504.01	15.33	0	No	0
MW7	504.01	15.36	0	No	0

TABLE 1 (Continued)

SUMMARY OF GROUND WATER MONITORING
AND PURGING DATA

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

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

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August 7, 1991

TABLE 2

SUMMARY OF LABORATORY ANALYSES
WATER

Date	Sample Well #	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
7/10/91	MW1*	ND	ND	ND	ND	ND	ND
	MW2	--	14,000	70	160	5,400	570
	MW3	--	ND	ND	ND	ND	ND
	MW4	--	830	8.4	19	7.2	7.7
	MW5	--	220	5.1	8.7	9.7	9.1
	MW6	--	ND	ND	ND	ND	ND
	MW7	--	ND	ND	ND	ND	ND
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

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TABLE 2 (Continued)

SUMMARY OF LABORATORY ANALYSES
WATER

Date	Sample Well #	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
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)	5.0	ND	ND	0.0056	ND	ND
	MW5(10)	10.0	ND	ND	ND	ND	ND
	MW5(15.5)	15.5	ND	ND	ND	0.0060	ND
	MW6(5)	5.0	ND	ND	0.010	0.0086	ND
	MW6(10)	10.0	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)	10.0	ND	ND	0.0086	0.030	ND
	MW7(15)	15.0	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)*	5.0	ND	ND	ND	ND	ND
&	MW1(7)*	7.0	ND	ND	ND	ND	ND
10/26/89	MW1(10)*	10.0	ND	ND	ND	ND	ND
	MW1(12.5)*	12.5	ND	ND	ND	ND	ND
	MW1(15)*	15.0	ND	ND	ND	ND	ND
	MW1(17)*	17.0	ND	ND	ND	ND	ND
	MW2(5)	5.0	23	ND	ND	ND	ND
	MW2(10)	10.0	ND	ND	ND	ND	ND
	MW2(12.5)	12.5	ND	ND	ND	ND	ND
	MW2(15)	15.0	3.0	ND	ND	ND	ND
	MW2(17)	17.0	790	0.14	0.23	10	2.7
	MW3(5)	5.0	1.1	ND	ND	ND	ND
	MW3(10)	10.0	ND	ND	ND	ND	ND
	MW3(11.5)	11.5	ND	ND	ND	ND	ND
	MW3(14)	14.0	ND	ND	ND	ND	ND
	MW4(5)	5.0	1.9	ND	ND	ND	ND
	MW4(9.5	9.5	ND	ND	ND	ND	ND
	MW4(12)	12.0	ND	ND	ND	ND	ND
	MW4(15)	15.0	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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August 7, 1991

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	15.0	--	2.1	ND	ND	0.21	ND
&	A2	15.0	--	1.6	ND	ND	ND	ND
8/07/89	A3	16.0	--	390	1.7	45	86	16
	B1	15.0	--	ND	ND	ND	0.10	ND
	B2	15.0	--	ND	ND	ND	ND	ND
	B3	15.0	--	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.

KAPREALIAN ENGINEERING, INC.
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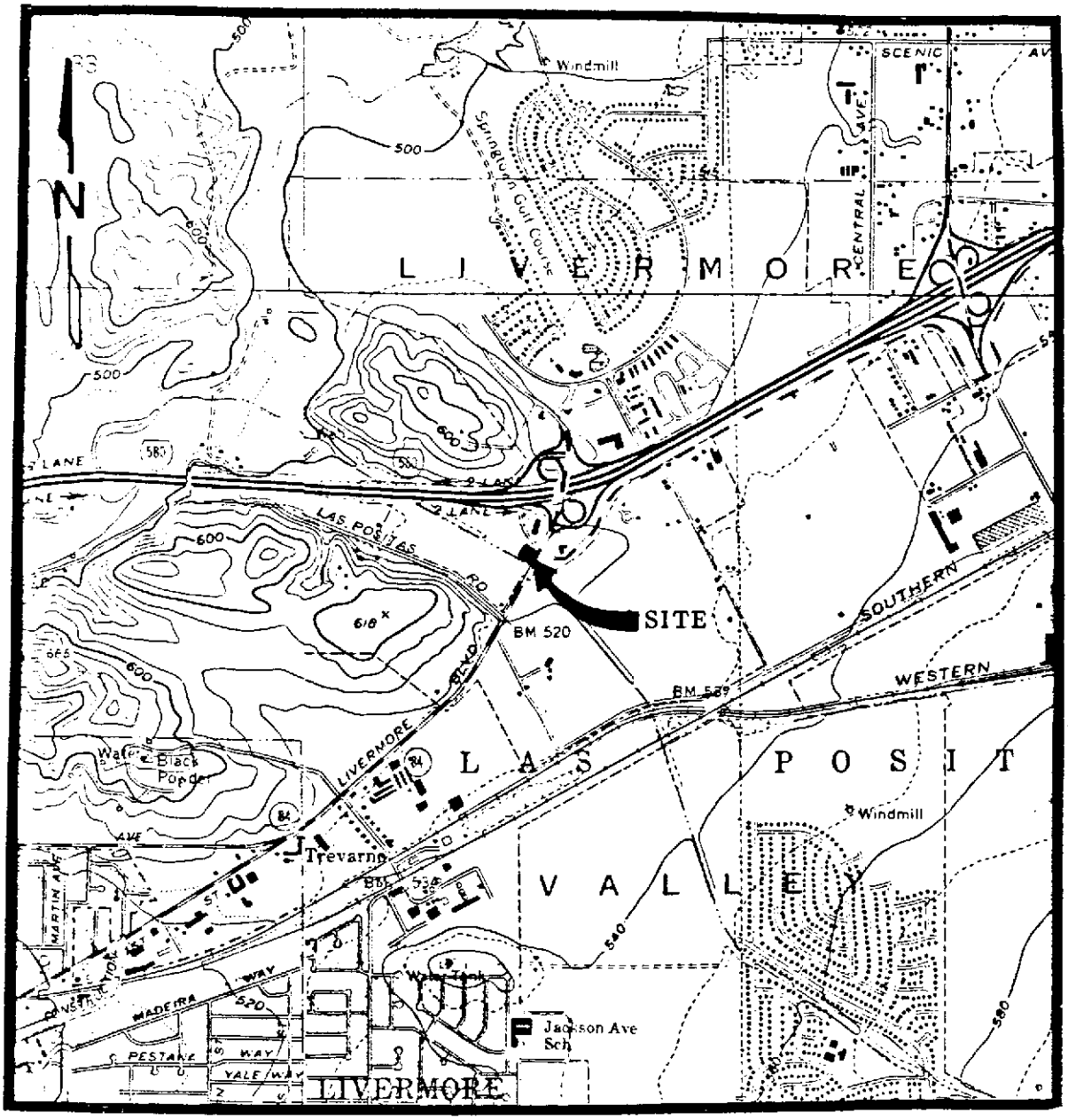
(707) 746-6915 • (707) 746-6916 • FAX: (707) 746-5581



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

KAPREALIAN ENGINEERING, INC.
Consulting Engineers
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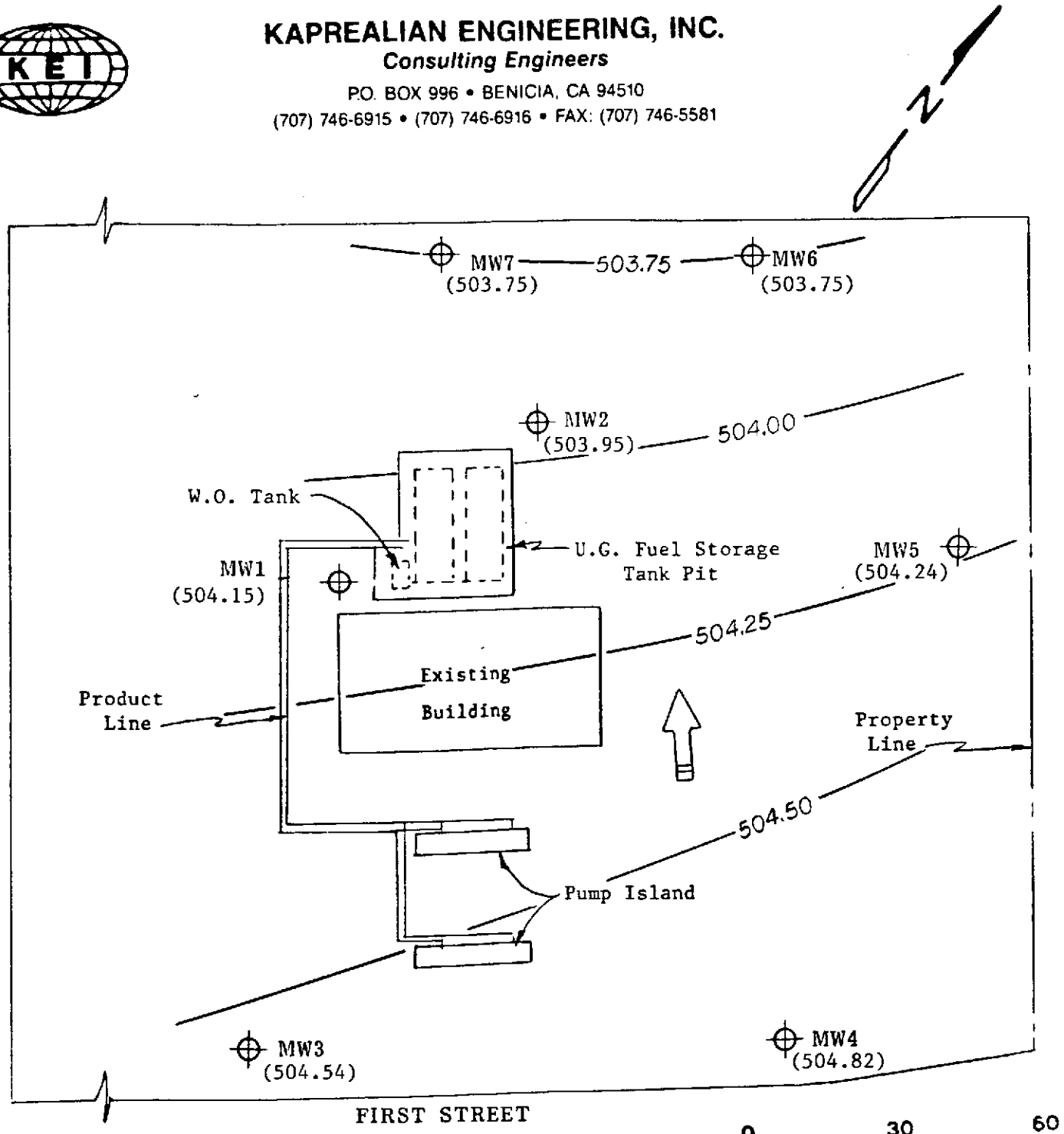

LEGEND

- ⊕ Monitoring Well
- ( ) Water Table Elevation in feet (MSL) on 7/10/91
- ——— 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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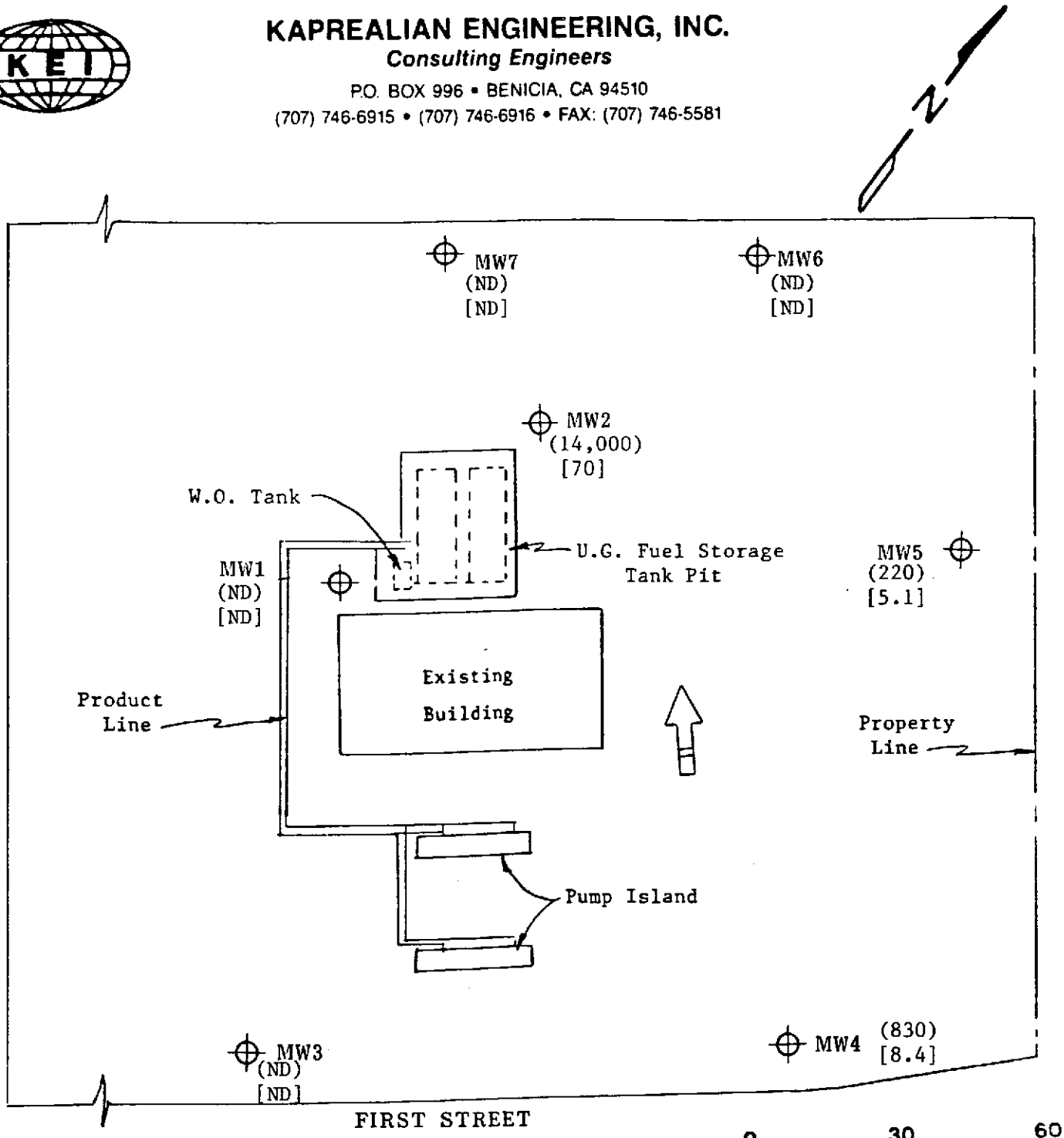

LEGEND

- ⊕ Monitoring Well
- ( ) Concentration of TPH as gasoline in ppb
- [ ] Concentration of benzene in ppb
- ⇨ Direction of ground water flow

SITE PLAN
Figure 1a
July 10, 1991

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

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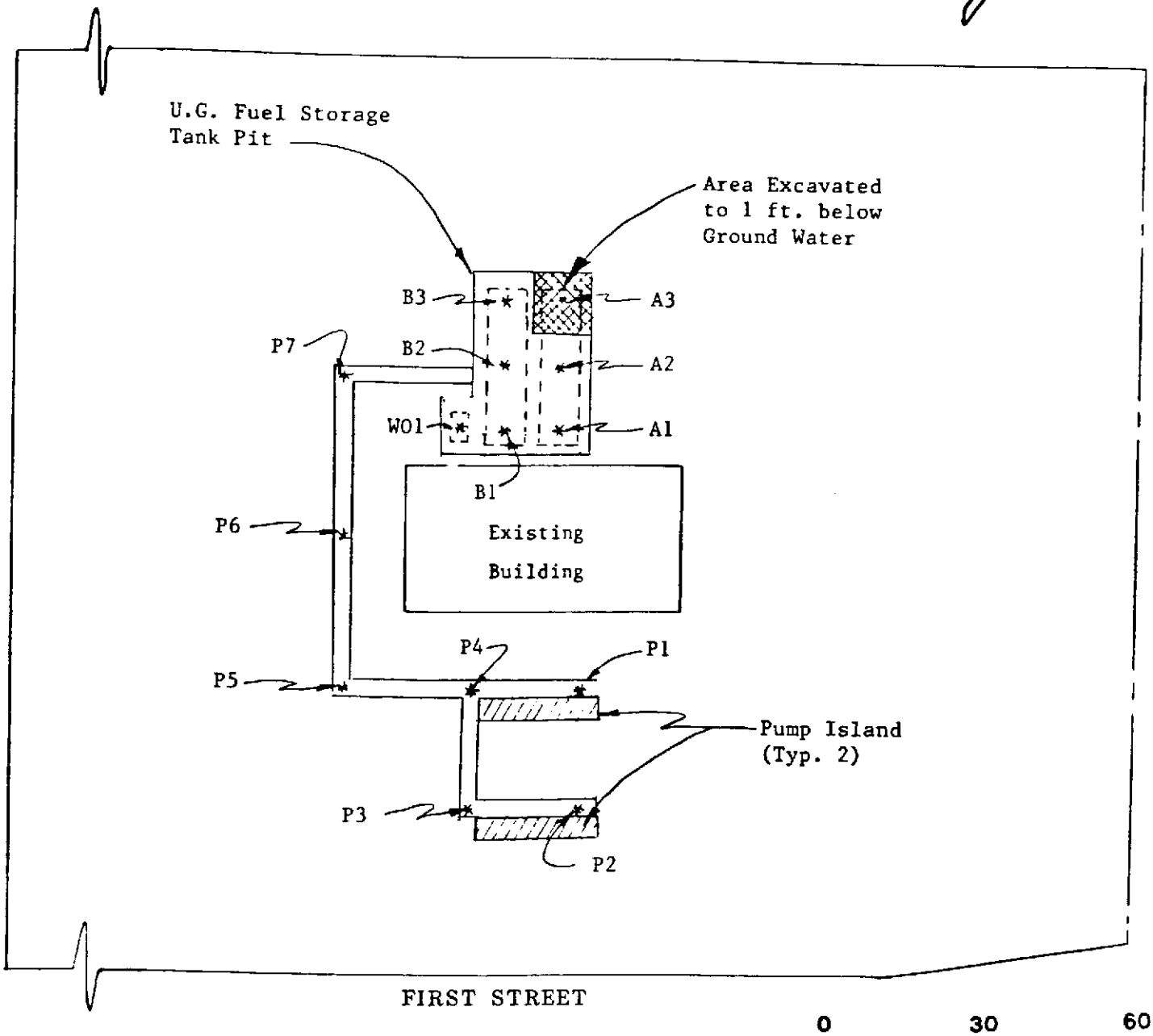

SITE PLAN
Figure 2

0 30 60
Approx. scale feet

LEGEND

* Sample Point Location

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

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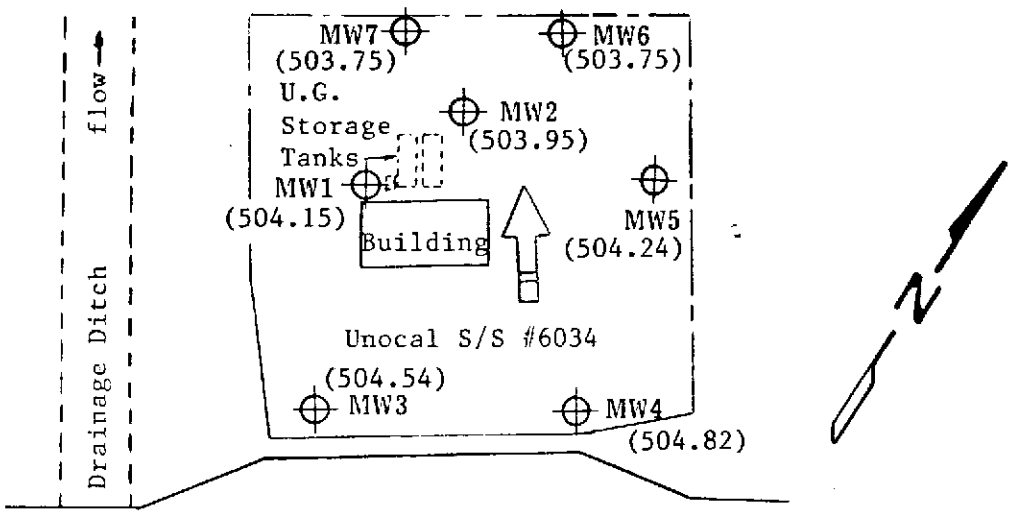
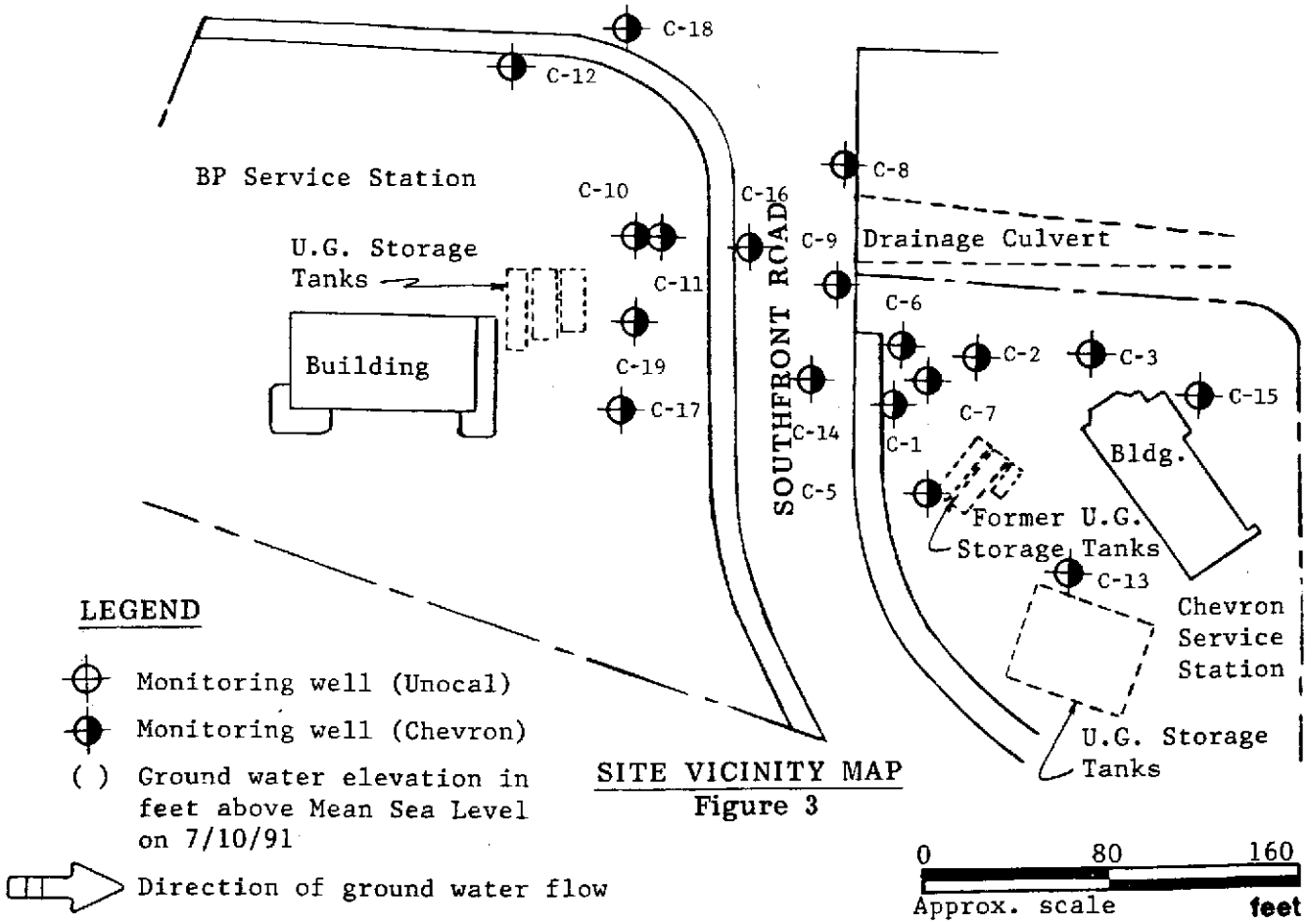


FIRST STREET



LEGEND

- Monitoring well (Unocal)
- Monitoring well (Chevron)
- ( ) Ground water elevation in feet above Mean Sea Level on 7/10/91
- Direction of ground water flow

SITE VICINITY MAP
Figure 3

0 80 160
Approx. scale feet

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

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:	Jul 10, 1991
P.O. Box 996	Matrix Descript:	Water	Received:	Jul 11, 1991
Benicia, CA 94510	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Jul 12, 1991
Attention: Mardo Kaprealian, P.E.	First Sample #:	107-0180 AB	Reported:	Jul 23, 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)
107-0180 AB	MW1	N.D.	N.D.	N.D.	N.D.	N.D.
107-0181 AB	MW2	14,000	70	160	570	5,400
107-0182 AB	MW3	N.D.	N.D.	N.D.	N.D.	N.D.
107-0183 AB	MW4	830	8.4	19	7.7	7.2
107-0184 AB	MW5	220	5.1	8.7	9.1	9.7
107-0185 AB	MW6	N.D.	N.D.	N.D.	N.D.	N.D.
107-0186 AB	MW7	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

Belinda C. Vega
Laboratory Director

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: 1070180-86
Reported: Jul 23, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Method:	EPA8015/8020	EPA8015/8020	EPA8015/8020	EPA8015/8020
Analyst:	R.H./J.F.	R.H./J.F.	R.H./J.F.	R.H./J.F.
Reporting Units:	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Jul 12, 1991	Jul 12, 1991	Jul 12, 1991	Jul 12, 1991
QC Sample #:	107-0124	107-0124	107-0124	107-0124
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	20	20	20	60
Conc. Matrix Spike:	20	19	20	62
Matrix Spike % Recovery:	100	95	100	100
Conc. Matrix Spike Dup.:	20	19	20	63
Matrix Spike Duplicate % Recovery:	100	95	100	110
Relative % Difference:	0	0	0	1.6

Laboratory blank contained the following analytes: None Detected

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

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Kaprealian Engineering, Inc. Client Project ID: Unocal, 4700 First St., Livermore
P.O. Box 996
Benicia, CA 94510
Attention: Mardo Kaprealian, P.E. QC Sample Group: 1070180-86 Reported: Jul 23, 1991

QUALITY CONTROL DATA REPORT

SURROGATE

Method:	EPA8015/8020	EPA8015/8020	EPA8015/8020	EPA8015/8020	EPA8015/8020	EPA8015/8020	EPA8015/8020
Analyst:	R.H./J.F.	R.H./J.F.	R.H./J.F.	R.H./J.F.	R.H./J.F.	R.H./J.F.	R.H./J.F.
Reporting Units:	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Jul 12, 1991	Jul 12, 1991	Jul 12, 1991	Jul 12, 1991	Jul 12, 1991	Jul 12, 1991	Jul 12, 1991
Sample #:	107-0180	107-0181	107-0182	107-0183	107-0184	107-0185	107-0186
Surrogate % Recovery:	90	100	90	100	110	89	85

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

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Benicia, CA 94510
Attention: Mardo Kaprealian, P.E.

Client Project ID: Unocal, 4700 First St., Livermore
QC Sample Group: 1070180-86
Reported: Jul 23, 1991

QUALITY CONTROL DATA REPORT

SURROGATE

Method:	EPA8015/8020
Analyst:	R.H./J.F.
Reporting Units:	µg/L
Date Analyzed:	Jul 12, 1991
Sample #:	Blank

Surrogate % Recovery:	94

SEQUOIA ANALYTICAL

Belinda C. Vega
Laboratory Director

$$\text{\% Recovery:} \quad \frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$$

$$\text{Relative \% Difference:} \quad \frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$$

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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 4700 First St., Livermore	Sampled:	Jul 10, 1991
P.O. Box 996	Matrix Descript:	Water, MW1	Received:	Jul 11, 1991
Benicia, CA 94510	Analysis Method:	EPA 3510/8015	Extracted:	Jul 15, 1991
Attention: Mardo Kaprealian, P.E.	First Sample #:	107-0180 C	Analyzed:	Jul 16, 1991
			Reported:	Jul 23, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

Sample Number	Sample Description	High B.P. Hydrocarbons µg/L (ppb)
107-0180 C	MW1	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

Belinda C. Vega
Laboratory Director

1070180.KEI <5>

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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: 107-0180
Reported: Jul 23, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Diesel
Method:	EPA 8015
Analyst:	JRM
Reporting Units:	µg/L
Date Analyzed:	Jul 16, 1991
QC Sample #:	BLK071591
Sample Conc.:	N.D.
Spike Conc. Added:	300
Conc. Matrix Spike:	280
Matrix Spike % Recovery:	93
Conc. Matrix Spike Dup.:	280
Matrix Spike Duplicate % Recovery:	93
Relative % Difference:	0

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

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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: 107-0180
Reported: Jul 23, 1991

QUALITY CONTROL DATA REPORT

SURROGATE

Method:	EPA 8015	EPA 8015
Analyst:	JRM	JRM
Reporting Units:	µg/L	µg/L
Date Analyzed:	Jul 16, 1991	Jul 16, 1991
Sample #:	107-0180	Blank
Surrogate % Recovery:	98	100

SEQUOIA ANALYTICAL

Belinda C. Vega
Laboratory Director

% 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

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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 4700 First St., Livermore	Sampled:	Jul 10, 1991
P.O. Box 996	Matrix Descript:	Water, MW1	Received:	Jul 11, 1991
Benicia, CA 94510	Analysis Method:	SM 5520 B&F (Gravimetric)	Extracted:	Jul 15, 1991
Attention: Mardo Kaprealian, P.E.	First Sample #:	107-0180 D	Analyzed:	Jul 16, 1991
			Reported:	Jul 23, 1991

TOTAL RECOVERABLE PETROLEUM OIL

Sample Number	Sample Description	Oil & Grease mg/L (ppm)
107-0180 D	MW1	N.D.

Detection Limits:	5.0

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

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Belinda C. Vega
Laboratory Director

1070180.KEI <8>

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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: 1070180-86
Reported: Jul 23, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Oil & Grease
Method:	SM 5520 B&F
Analyst:	D. Newcomb
Reporting Units:	mg/L
Date Analyzed:	Jul 16, 1991
QC Sample #:	Matix Blank 071591M
Sample Conc.:	N.D.
Spike Conc. Added:	100
Conc. Matrix Spike:	88
Matrix Spike % Recovery:	88
Conc. Matrix Spike Dup.:	82
Matrix Spike Duplicate % Recovery:	82
Relative % Difference:	7.0

Laboratory blank contained the following analytes: None Detected

SEQUOIA ANALYTICAL

Belinda C. Vega
Laboratory Director

% 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

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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 4700 First St., Livermore	Sampled:	Jul 10, 1991
P.O. Box 996	Sample Descript:	Water, MW1	Received:	Jul 11, 1991
Benicia, CA 94510	Analysis Method:	EPA 5030/8010	Analyzed:	Jul 15, 1991
Attention: Mardo Kaprealian, P.E.	Lab Number:	107-0180 EF	Reported:	Jul 23, 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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Belinda C. Vega
Laboratory Director

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

Client Project ID: Unocal, 4700 First St., Livermore
QC Sample Group: 107-0180
Reported: Jul 23, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	1,1-Dichloroethene	Trichloroethene	Chloro-benzene	Benzene	Toluene	Chloro-benzene (PID)
Method:	EPA 8010	EPA 8010	EPA 8010	EPA 8010	EPA 8010	EPA 8010
Analyst:	S. Le	S. Le	S. Le	S. Le	S. Le	S. Le
Reporting Units:	ppb	ppb	ppb	ppb	ppb	ppb
Date Analyzed:	Jul 15, 1991	Jul 15, 1991	Jul 15, 1991	Jul 15, 1991	Jul 15, 1991	Jul 15, 1991
QC Sample #:	107-0148	107-0148	107-0148	107-0148	107-0148	107-0148
Sample Conc.:	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	10	10	10	10	10	10
Conc. Matrix Spike:	7.9	9.3	11	9.4	8.4	9.0
Matrix Spike % Recovery:	79	93	110	94	84	90
Conc. Matrix Spike Dup.:	9.2	9.4	11	9.8	8.7	9.3
Matrix Spike Duplicate % Recovery:	92	94	110	98	87	93
Relative % Difference:	15	1.1	0	4.2	3.5	3.3

Laboratory blank contained the following analytes: None Detected

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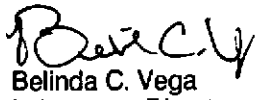

Belinda C. Vega
Laboratory Director

% 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

1070180.KEI <11>

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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: 107-0180
Reported: Jul 23, 1991

QUALITY CONTROL DATA REPORT

SURROGATE

Method:	EPA 8010	EPA 8010
Analyst:	S. Le	S. Le
Reporting Units:	ppb	ppb
Date Analyzed:	Jul 15, 1991	Jul 15, 1991
Sample #:	107-0180	Blank
Surrogate #1 % Recovery:	110	120
Surrogate #2 % Recovery:	100	100

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

WITNESSING AGENCY

SITE NAME & ADDRESS: Unocal / Livermore 4700 First st.

ANALYSES REQUESTED: TPH G, BTXE | 8010 | TOG (5520 B+F) | TPHD

TURN AROUND TIME: Regular

SAMPLE ID NO.	DATE	TIME	SOIL	WATER (2)	GRAB (2)	COMP	NO. OF CONT.	SAMPLING LOCATION	REMARKS
MW-1	7/10/91			✓	✓		6	MW	1070180 AF
MW-2	"			✓	✓		2	"	181 AB
MW-3	"	P.M 3:30		✓	✓		2	"	182
MW-4	"			✓	✓		2	"	183
MW-5	"			✓	✓		2	"	184
MW-6	"	P.M 1:15		✓	✓		2	"	185
MW-7	"			✓	✓		2	"	186

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	7/10/91 1735	[signature]
[signature]	7/12 8:05	[signature]
[signature]	7/12 10:00	[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? Yes
2. Will samples remain refrigerated until analyzed? Yes
3. Did any samples received for analysis have head space? No
4. Were samples in appropriate containers and properly packaged? Yes

BS — Signature | Login — Title | 7/10/91 — Date