KAPREALIAN ENGINEERING
INCORPORATED

KEI-P89-0801.QR10
November 11, 1992

Unocal Corporation
2000 Crow Canyon Place, Suite 400
P.O. Box 5155
San Ramon, California 94583

Attention: Mr. Ed Ralston

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

Dear Mr. Ralston:

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, 1992, and as modified in KEI's quarterly reports (KEI-P89-0801.QR5) dated August 7, 1991, and (KEI-P89-0801.QR8) dated May 4, 1992. The wells are currently monitored and sampled on a quarterly basis, except for well MW1, which is no longer sampled. This report covers the work performed by KEI from August through October of 1992.

BACKGROUND

The subject site contains a Unocal service station facility. Two underground gasoline storage tanks, one waste oil tank, and the product piping were removed from the site in August of 1989 during tank replacement activities. The fuel tank pit was subsequently overexcavated to a depth of 17.5 feet below grade (the ground water depth at that time) in order to remove contaminated soil. Seven monitoring wells have been installed at the site.

A site description, detailed background information including a summary of all of the soil and ground water subsurface investigation/remediation work conducted to date, site hydrogeologic conditions, and tables that summarize all of the soil and ground water sample analytical results are presented in KEI's quarterly report (KEI-P89-0801.QR8) dated May 4, 1992.

RECENT FIELD ACTIVITIES

The seven monitoring wells (MW1 through MW7) were monitored and sampled once during the quarter, except for well MW1, which is no longer sampled. Well MW6 was not sampled this quarter since the well was dry on the sampling date. Prior to sampling, the wells

2401 Stanwell Drive, Suite 400
Concord, California 94520
Tel: 510.602.5100 Fax: 510.687.0602

were checked for depth to water and the presence of free product and sheen. No free product or sheen was noted in any of the wells during the quarter. The monitoring data collected by KEI this quarter for Unocal's wells are summarized in Table 1.

A joint monitoring and sampling program was conducted with the nearby Chevron service station on October 16, 1992. The monitoring data collected by Groundwater Technology, Inc. (GTI) for Chevron's monitoring wells are summarized in Table 2, and the ground water sample analytical results for Chevron's wells are summarized in Table 4.

Water samples were collected by KEI from all of Unocal's wells (except MW1 and MW6) on October 16, 1992. Prior to sampling, the wells were each purged of between 7 to 8 gallons of water by the use of a surface pump. The samples were then collected by the use of a clean Teflon bailer. The samples were decanted into clean VOA vials that were then sealed with Teflon-lined screw caps and stored in a cooler, on ice, until delivery to a state-certified laboratory.

HYDROLOGY

The measured depth to ground water at the Unocal site on October 16, 1992, ranged between 15.75 to 17.00 feet below grade. The water levels in all of the Unocal wells have shown net decreases ranging from 0.53 to 0.93 feet since July 7, 1992. Based on the joint monitoring water level data gathered on October 16, 1992, the ground water flow direction in the vicinity of the Unocal and Chevron sites appeared to be predominantly to the northwest, as shown on the attached Potentiometric Surface Map, Figure 1. The flow direction reported this quarter is relatively similar to the predominantly northwest flow direction reported in previous quarters. The average hydraulic gradient across the Unocal site on October 16, 1992, was approximately 0.004.

ANALYTICAL RESULTS

The ground water samples collected from Unocal's wells were analyzed at Sequoia Analytical Laboratory and were accompanied by properly executed Chain of Custody documentation. The samples were analyzed for total petroleum hydrocarbons (TPH) as gasoline by EPA method 5030/modified 8015, and benzene, toluene, xylenes, and ethylbenzene (BTX&E) by EPA method 8020. The sample from well MW5 was also analyzed for methyl tert butyl ether (MTBE) by EPA method 8020/modified.

The ground water sample analytical results for Unocal's wells are summarized in Table 3, and the ground water sample analytical results for Chevron's wells are summarized in Table 4. The concentrations of TPH as gasoline and benzene detected in the ground water samples collected this quarter from Unocal's and Chevron's wells are shown on the attached Figure 2. Copies of the laboratory analytical results and Chain of Custody documentation for the Unocal samples are attached to this report.

DISCUSSION AND RECOMMENDATIONS

Based on the analytical results for the ground water samples collected and evaluated to date from the Unocal site, and no evidence of free product or sheen in any of the Unocal wells, KEI recommends the continuation of the current quarterly ground water monitoring and sampling program, per KEI's proposal (KEI-P89-0801.P3) dated January 31, 1991, and as modified in KEI's quarterly reports (KEI-P89-0801.QR8) dated May 4, 1992, and (KEI-P89-0801.QR5) dated August 7, 1991. In addition, KEI recommends the continuation of the joint monitoring and sampling program with the nearby Chevron site.

Monitoring wells MW3 and MW7 continue to show non-detectable concentrations 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 concentrations of 300 ppb or greater in the 12 quarterly samples collected to date. As previously stated, these findings appear to indicate that off-site contamination has migrated onto the Unocal site. Based on the water level data gathered during the joint monitoring conducted on October 16, 1992, it appears that the Chevron site is located upgradient of the Unocal site.

As shown on Figure 2, elevated concentrations of petroleum hydrocarbons were detected in the recent ground water samples collected from the upgradient Chevron service station monitoring wells. Therefore, KEI recommends that a meeting be arranged between representatives from Unocal and Chevron (and their respective consultants) to discuss further subsurface investigation and remediation work that may be warranted for the respective sites.

DISTRIBUTION

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

LIMITATIONS

Environmental changes, either naturally-occurring or artificially-induced, may cause changes in ground water levels and flow paths, thereby changing 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 these 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.

If you have any questions regarding this report, please do not hesitate to call me at (510) 602-5100.

Sincerely,

Kaprealian Engineering, Inc.

Thomas J. Berkins
Senior Environmental Engineer

Jae Yang, P.E.

License No. 25337
Exp. Date 12/31/93

Timothy R. Ross
Project Manager

/bp

Attachments: Tables 1 through 4
Location Map
Potentiometric Surface Map - Figure 1
Concentrations of Petroleum Hydrocarbons - Figure 2
Laboratory Analyses
Chain of Custody documentation

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TABLE 1

SUMMARY OF GROUND WATER MONITORING
AND PURGING DATA

Well No.	Ground Water Elevation (feet)	Depth to Water (feet)	Product Thickness (feet)	Sheen	Water Purged (gallons)
(Monitored and Sampled on October 16, 1992)					
MW1*	503.88	17.00	0	No	0
MW2	503.73	16.44	0	No	7
MW3	504.12	15.79	0	No	7
MW4	504.34	15.78	0	No	8
MW5	503.88	16.70	0	No	8
MW6	WELL WAS DRY				
MW7	503.62	15.75	0	No	7

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.

** The elevations of the tops of the well covers have been surveyed relative to Mean Sea Level (MSL), per the City of Livermore Benchmark No. C-18-5 (elevation = 551.77 MSL).

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TABLE 2

SUMMARY OF MONITORING DATA
CHEVRON WELLS

Well	Well Case Elevation (feet above MSL)	Ground Water Elevation (feet)	Depth to Water (feet)
(Monitored and Sampled on October 16, 1992, by Groundwater Technology, Inc.)			
C-1	520.39	505.94	14.45
C-2	520.76	505.92	14.84
C-3	521.31	506.08	15.23
C-4	WELL DESTROYED		
C-5	520.82	505.97	14.85
C-6	519.62	505.67	13.95
C-7	520.30	505.88	14.42
C-8	519.74	505.17	14.57
C-9	519.72	505.74	13.98
C-10	520.41	504.90	15.51
C-11	520.04	504.25	15.79
C-12	519.82	504.70	15.12
C-13	522.24	506.37	15.87
C-14	520.08	505.70	14.38
C-15	522.41	506.16	16.25
C-16	519.68	504.76	14.92
C-17	520.82	505.06	15.76
C-18	518.96	504.58	14.38
C-19	520.99	504.99	16.00

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TABLE 3

SUMMARY OF LABORATORY ANALYSES
WATER ppb

DTW	Date	Sample Well #	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene	MTBE
16.44	10/16/92	MW2	--	290	2.3	ND	15	5.1	--
		MW3	--	ND	ND	ND	ND	ND	--
		MW4	--	200	2.1	ND	13	4.8	--
		MW5	--	180	7.8	1.1	6.4	17	2.0
		MW6	WELL WAS DRY						
		MW7	--	ND	ND	ND	ND	ND	--
15.67	7/07/92	MW2	--	44,000	160	1,100	17,000	1,000	--
		MW3	--	ND	ND	ND	ND	ND	--
		MW4	--	340	ND	2.2	2.4	2.4	--
		MW5	--	76	0.48	1.1	1.3	0.32	1.5
		MW6	--	ND	ND	ND	ND	ND	--
		MW7	--	ND	ND	ND	ND	ND	--
15.56	4/06/92	MW2	--	760	6.3	2.1	130	ND	--
		MW3	--	ND	ND	ND	ND	ND	--
		MW4	--	660	1.3	3.8	4.1	2.9	--
		MW5	--	240♦	ND	ND	ND	0.35	--
		MW6	--	ND	ND	ND	ND	ND	--
		MW7	--	ND	ND	ND	ND	ND	--
15.55	1/14/92	MW2	--	5,600	36	120	2,600	450	--
		MW3	--	ND	ND	ND	ND	ND	--
		MW4	--	1,500	4.2	7.1	9.2	18	--
		MW5	--	99	1.0	1.2	0.32	ND	--
		MW6	--	ND	ND	ND	ND	ND	--
		MW7	--	ND	ND	ND	ND	ND	--
16.78	10/14/91	MW2	--	11,000	79	130	4,700	660	--
		MW3	--	ND	ND	ND	ND	ND	--
		MW4	--	880	3.8	2.2	5.8	8.6	--
		MW5	--	660	55	4.4	66	50	--
		MW6	--	ND	ND	ND	ND	ND	--
		MW7	--	ND	ND	ND	ND	ND	--

TABLE 3 (Continued)

SUMMARY OF LABORATORY ANALYSES
WATER

Date	Sample Well #	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene	MTBE
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	--

TABLE 3 (Continued)

SUMMARY OF LABORATORY ANALYSES
WATER

Date	Sample Well #	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene	MTBE
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	--

♦ The laboratory reported that the sample "does not appear to contain gasoline," and that the low/medium boiling point hydrocarbons detected are "mostly due to unidentified peaks."

* 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 was not performed.

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

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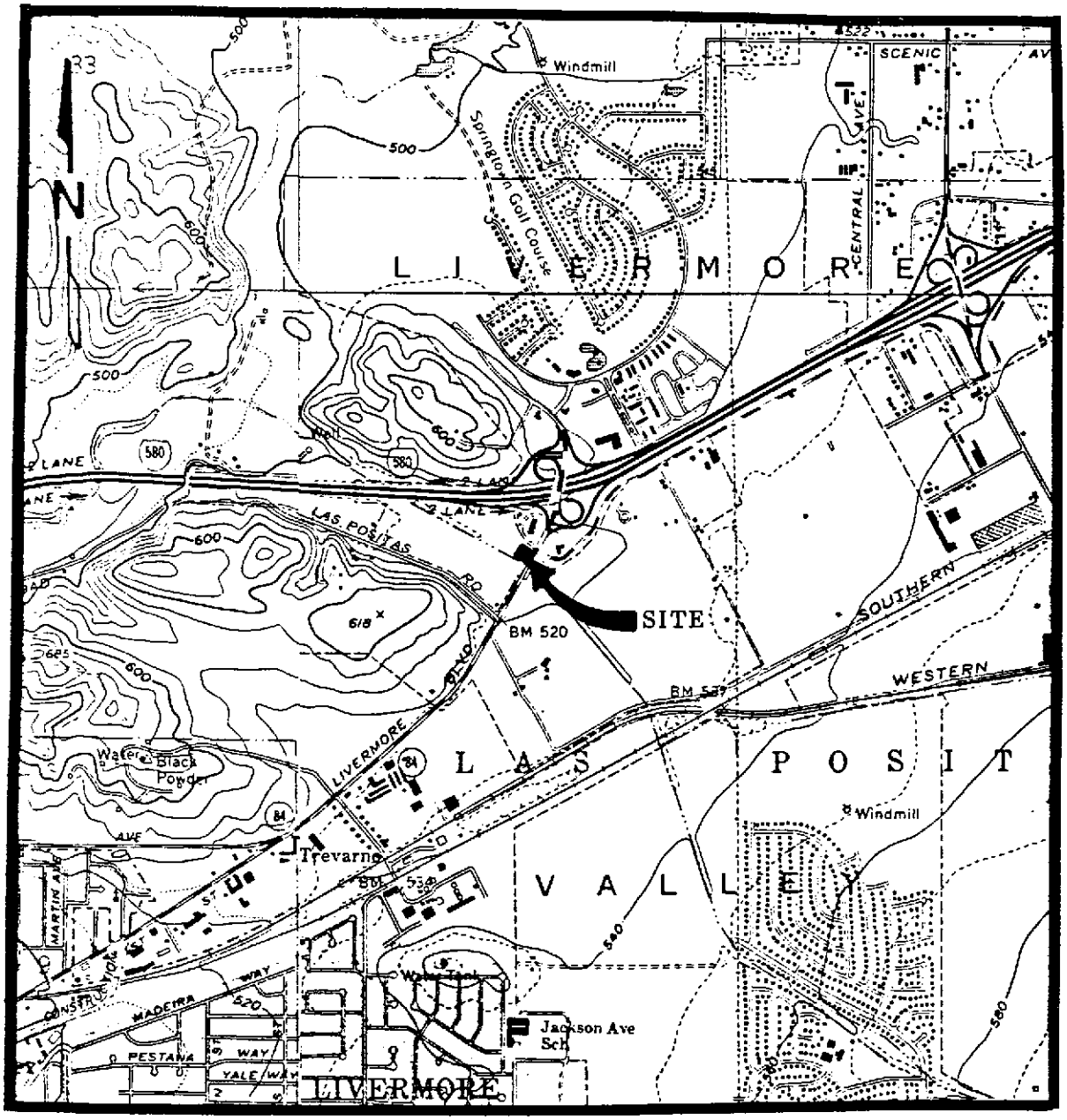
TABLE 4

SUMMARY OF LABORATORY ANALYSES
CHEVRON WELLS

Well #	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethylbenzene
(Sampled on October 16, 1992, by GTI)					
C-1	1,800	11	ND	55	32
C-2	2,000	ND	2.2	10	20
C-3	1,400	ND	ND	11	6.6
C-4	WELL DESTROYED				
C-5	ND	ND	ND	1.2	ND
C-6	570,000	ND	830	9,600	3,300
C-7	2,700	130	42	74	68
C-8	51	ND	ND	ND	ND
C-9	190,000	ND	730	2,000	960
C-10	ND	ND	ND	ND	ND
C-11	ND	ND	ND	ND	ND
C-12	ND	ND	ND	ND	ND
C-13	ND	ND	ND	ND	ND
C-14	NO SAMPLE - WELL WAS DRY AFTER INITIAL PURGING				
C-15	ND	ND	ND	ND	ND
C-16	140	11	ND	3.4	5.1
C-17	1,200,000	ND	4,800	6,600	3,900
C-18	ND	ND	ND	ND	ND

ND = Non-detectable.

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

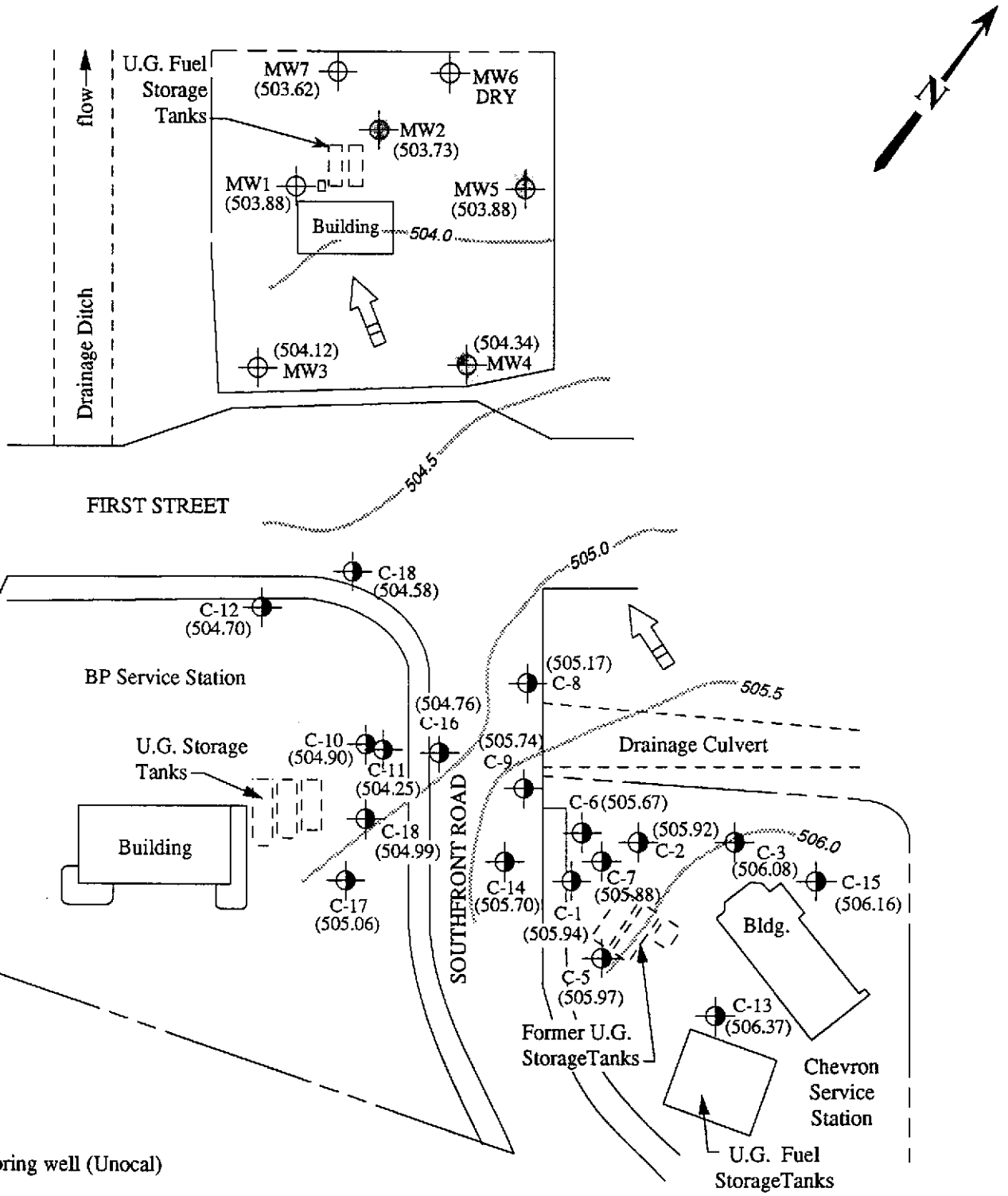


Base modified from 7.5 minute U.S.G.S. Livermore and Altamont Quadrangles (photorevised 1980 and 1981 respectively)

0 2000 4000

Approx. scale feet

KAPREALIAN ENGINEERING INCORPORATED	UNOCAL SERVICE STATION #6034 4700 FIRST STREET LIVERMORE, CA	LOCATION MAP



LEGEND

- Monitoring well (Unocal)
- Monitoring well (Chevron)
- ( ) Ground water elevation in feet above Mean Sea Level
- Direction of ground water flow
- Contours of ground water elevation

0 80 160

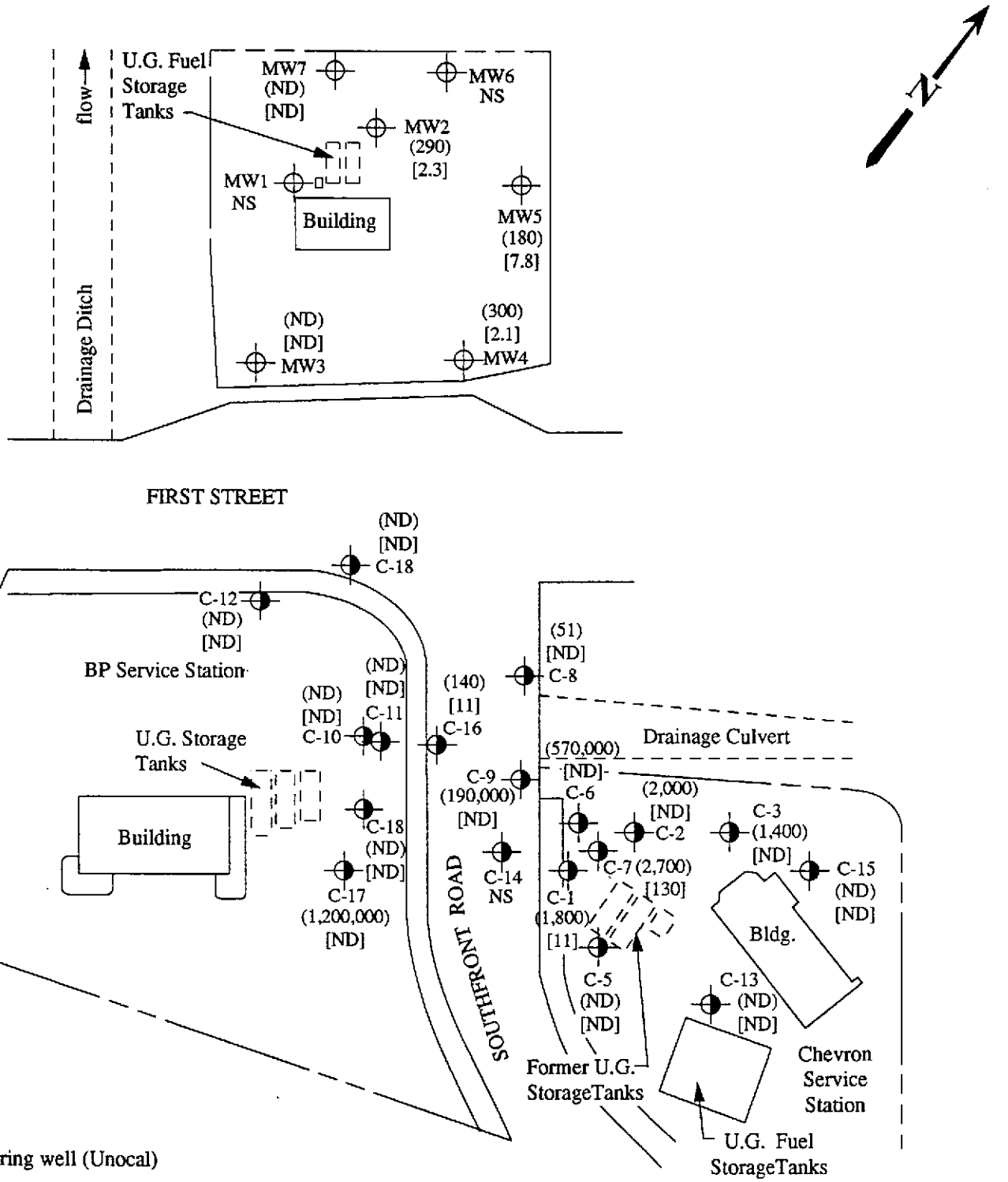
Approx. scale feet

POTENTIOMETRIC SURFACE MAP FOR THE OCTOBER 16, 1992 JOINT MONITORING EVENT

KAPREALIAN ENGINEERING INCORPORATED

UNOCAL SERVICE STATION # 6034
4700 FIRST STREET
LIVERMORE, CA

FIGURE 1



LEGEND

- Monitoring well (Unocal)
- Monitoring well (Chevron)
- ( ) Concentration of TPH as gasoline in ppb
- [ ] Concentration of benzene in ppb
- ND = Non-detectable
- NS = Not sampled

0 80 160

Approx. scale feet

PETROLEUM HYDROCARBON CONCENTRATIONS IN GROUND WATER ON OCTOBER 16, 1992

KAPREALIAN ENGINEERING INCORPORATED

UNOCAL SERVICE STATION # 6034
4700 FIRST STREET
LIVERMORE, CA

FIGURE **2**

SEQUOIA ANALYTICAL

1900 Bates Avenue • Suite LM • Concord, California 94520
(510) 686-9600 • FAX (510) 686-9689

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 4700 First St., Livermore	Sampled:	Oct 16, 1992
2401 Stanwell Drive, Suite 400	Sample Matrix:	Water	Received:	Oct 16, 1992
Concord, CA 94520	Analysis Method:	EPA 5030/8015/8020	Reported:	Oct 20, 1992
Attention: Mardo Kaprealian, P.E.	First Sample #:	210-0488		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit µg/L	Sample I.D. 210-0488 MW-2	Sample I.D. 210-0489 MW-3	Sample I.D. 210-0490 MW4	Sample I.D. 210-0491 MW-5	Sample I.D. 210-0492 MW-7	Sample I.D. Matrix Blank
Purgeable Hydrocarbons	50	290	N.D.	300	180	N.D.	
Benzene	0.5	2.3	N.D.	2.1	7.8	N.D.	
Toluene	0.5	N.D.	N.D.	N.D.	1.1	N.D.	
Ethyl Benzene	0.5	5.1	N.D.	4.8	17	N.D.	
Total Xylenes	0.5	15	N.D.	13	6.4	N.D.	
Chromatogram Pattern:		Gasoline	--	Gasoline	Gasoline	--	

Quality Control Data

Report Limit Multiplication Factor:	1.0	1.0	1.0	1.0	1.0	1.0
Date Analyzed:	10/16/92	10/16/92	10/16/92	10/16/92	10/16/92	10/16/92
Instrument Identification:	HP-5	HP-5	HP-5	HP-5	HP-5	HP-5
Surrogate Recovery, %: (QC Limits = 70-130%)	108	110	102	113	112	115

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

SEQUOIA ANALYTICAL

Scott A. Chieffo
Project Manager

SEQUOIA ANALYTICAL

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(510) 686-9600 • FAX (510) 686-9689

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 4700 First St., Livermore	Sampled:	Oct 16, 1992
2401 Stanwell Drive, Suite 400	Sample Descript:	Water	Received:	Oct 16, 1992
Concord, CA 94520	Analysis for:	MTBE (EPA 8020 - Modified)		
Attention: Mardo Kaprealian, P.E.	First Sample #:	210-0491	Analyzed:	Oct 16, 1992
			Reported:	Oct 20, 1992

LABORATORY ANALYSIS FOR: MTBE (EPA 8020 - Modified)

Sample Number	Sample Description	Detection Limit µg/L	Sample Result µg/L
210-0491	MW-5	0.60	2.0

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

SEQUOIA ANALYTICAL

Scott A. Chieffo
Project Manager

SEQUOIA ANALYTICAL

1900 Bates Avenue • Suite LM • Concord, California 94520
(510) 686-9600 • FAX (510) 686-9689

Kaprealian Engineering, Inc.
2401 Stanwell Drive, Suite 400
Concord, CA 94520
Attention: Mardo Kaprealian, P.E.

Client Project ID: Unocal, 4700 First St., Livermore
QC Sample Group: 2100448-492
Reported: Oct 20, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8015/8020	EPA 8015/8020	EPA 8015/8020	EPA 8015/8020
Analyst:	J.F.	J.F.	J.F.	J.F.
Reporting Units:	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Oct 16, 1992	Oct 16, 1992	Oct 16, 1992	Oct 16, 1992
QC Sample #:	Matrix Blank	Matrix Blank	Matrix Blank	Matrix Blank
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	20	20	20	60
Conc. Matrix Spike:	23	21	22	62
Matrix Spike % Recovery:	115	105	110	103
Conc. Matrix Spike Dup.:	18	22	23	66
Matrix Spike Duplicate % Recovery:	90	110	115	110
Relative % Difference:	2.4	4.6	4.4	6.2

Laboratory blank contained the following analytes: None Detected

SEQUOIA ANALYTICAL

Scott A. Chieffo
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

KAPREALIAN ENGINEERING
INCORPORATED

CHAIN OF CUSTODY

SAMPLER: JOE
WITNESSING AGENCY:
SITE NAME & ADDRESS: Unocal / Livermore
4700 First St.

ANALYSES REQUESTED: TBHG BTXE; MTBE

TURN AROUND TIME: Regular

SAMPLE ID NO.	DATE	TIME	SOIL	WATER	GRAB	COMP	NO. OF CONT.	SAMPLING LOCATION	TBHG BTXE	MTBE	REMARKS
MW-2	10/16/92	9:45 AM		✓	✓		2	MW	✓		2100488AB
MW-3	"			✓	✓		2	"	✓		489AB
MW-4	"			✓	✓		2	"	✓		490AB
MW-5	"			✓	✓		4	"	✓	✓	491AB
MW-7	"	1:30 PM		✓	✓		2	"	✓		492AB

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Joe Berman	10/16/92 4:25 PM	
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? Y
2. Will samples remain refrigerated until analyzed? Y
3. Did any samples received for analysis have head space? NO
4. Were samples in appropriate containers and properly packaged? Y

Signature | Title: P.S. | Date: 10/16/92

2401 Stanwell Drive, Suite 400
Concord, California 94520
Tel: 510.602.5100 Fax: 510.687.0602