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KAPREALIAN ENGINEERING
INCORPORATED

June 7, 1993

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

1140

Attention: Mr. Barney Chan

RE: Unocal Service Station #2656
4251 E. 14th Street
Oakland, California

Dear Mr. Chan:

Per the request of Mr. Dave Camille of Unocal Corporation, enclosed please find our report dated May 24, 1993, for the above referenced site.

If you should have any questions, please feel free to call our office at (510) 602-5100.

Sincerely,

Kaprealian Engineering, Inc.

Judy A. Dewey

jad\82

Enclosure

cc: Dave Camille, Unocal Corporation

2401 Stanwell Drive, Suite 400
Concord, California 94520
Tel: 510 602 5100 Fax: 510.687.0602

KAPREALIAN ENGINEERING
INCORPORATED

KEI-P90-0102.R9
May 24, 1993

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

Attention: Mr. Dave Camille

RE: Vapor Extraction Test Well Installation
and Pilot Vapor Extraction Test Report
Unocal Service Station #2656
4251 E. 14th Street
Oakland, California

Dear Mr. Camille:

This report presents the results of Kaprealian Engineering, Inc's. (KEI) installation of three vapor extraction test wells and a subsequent pilot vapor extraction test in accordance with KEI's proposal (KEI-P90-0102.P7) dated February 16, 1993. The purpose of the vapor extraction test was to determine whether vapor extraction is a feasible and practical means of soil remediation at the subject 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 vapor extraction test wells

Soil sampling

Completion of a vapor extraction test

Air bag sampling

Laboratory analyses

Data analysis, interpretation, and report preparation

## SITE DESCRIPTION AND BACKGROUND

The subject site presently contains a Unocal service station facility. The site occupies the western corner of the intersection of East 14th Street and High Street in Oakland, California. In addition, the site is situated on generally southwest sloping topography, and is located approximately 2.1 miles northeast of the

2401 Stanwell Drive, Suite 400
Concord, California 94520
Tel: 510.602.5100 Fax: 510 687 0602

present shoreline of San Francisco Bay (southwest side of Alameda Island) and approximately 0.9 miles north of San Leandro Bay.

KEI's initial field work began on January 5, 1990, when one 280 gallon underground waste oil tank was removed from the site. Several holes of up to three square inches in size were observed in the tank. One soil sample, labeled WO1, was collected from beneath the tank at a depth of approximately 10 feet below grade. One additional sample, labeled WO1(11.5), was collected from a depth of about 11.5 feet below grade.

KEI returned to the site on January 26, 1990, in order to collect a duplicate tank bottom soil sample, as requested by the Alameda County Health Care Services Agency (ACHCS), and to evaluate the lateral extent of contamination in the vicinity of the waste oil tank pit. One sample, labeled WO1R, was collected from beneath the waste oil tank pit at a depth of 9 feet below grade. Four soil samples, labeled SWA, SWB(10), SWC(9), and SWD(10) were collected from the sidewalls of trenches (dug laterally from the original waste oil tank pit) at depths of approximately 9 feet below grade. KEI returned to the site on May 16 and 17, 1990, to observe further excavation of the area surrounding the waste oil tank pit. Soil was excavated to a depth of approximately 10 feet below grade. Two additional soil samples, labeled SWE and SWF, were collected from the excavation sidewalls at depths of approximately 8.5 feet below grade. Sample point locations are as shown on the attached Figure 6.

The samples were analyzed by Sequoia Analytical Laboratory in Redwood City, California. Soil samples WO1 and WO1(11.5) were analyzed for total petroleum hydrocarbons (TPH) as gasoline, benzene, toluene, xylenes, and ethylbenzene (BTX&E), TPH as diesel, EPA method 8010 compounds, total oil and grease (TOG), and the metals cadmium, chromium, lead, and zinc. Samples WO1R, SWA, SWB(10), SWC(9), SWD(10), SWE, and SWF were only analyzed for TPH as diesel and TOG.

Analytical results of soil samples WO1 and WO1(11.5), collected from beneath the waste oil tank, indicated non-detectable levels of TPH as gasoline, BTX&E, TPH as diesel, and TOG. Analytical results of soil sample WO1R, also collected from beneath the waste oil tank, showed non-detectable levels of TOG and 5.5 ppm of TPH as diesel. Analytical results of sidewall samples SWC(9) and SWE indicated non-detectable levels of both TPH as diesel and TOG. Analytical results of sidewall sample SWF showed levels of TPH as diesel at 2.3 ppm and TOG at 84 ppm. Analytical results of sidewall samples SWA, SWB(10), and SWD(10) indicated TPH as diesel ranging from 130 ppm to 200 ppm, with TOG ranging from 270 ppm to

2,900 ppm. The results of the soil analyses are summarized in Table 4.

To comply with the requirements of the regulatory agencies and based on the analytical results, KEI recommended the installation of three monitoring wells. Documentation of the tank removal protocol, sample collection techniques, and the analytical results of the soil samples from the waste oil tank excavation are summarized in KEI's report (KEI-J90-0102.R1) dated June 26, 1990.

On September 19 and 20, 1990, three two-inch diameter monitoring wells (designated as MW1, MW2, and MW3 on the attached Figure 1) were installed at the site. The monitoring wells were each drilled and completed to total depths of 51 feet below grade. Ground water was encountered at depths ranging from 39 to 39.75 feet beneath the surface during drilling. The wells were developed on September 25, 1990, and were initially sampled on October 2, 1990.

Water and selected soil samples were analyzed at Sequoia Analytical Laboratory in Concord, California, for TPH as gasoline, BTX&E, TPH as diesel, and TOG.

Analytical results of the soil samples collected from the borings of monitoring wells MW1, MW2, and MW3 showed non-detectable levels of TPH as gasoline, TPH as diesel, benzene, and TOG in all samples, except MW1(9), which showed 34 ppm of TPH as gasoline and 5.2 ppm of TPH as diesel. Analytical results of ground water samples collected from monitoring wells MW1, MW2, and MW3 on October 2, 1990, indicated non-detectable levels of TPH as gasoline, TPH as diesel, TOG, and BTX&E, except for a concentration of 0.84 ppb of toluene in MW1. The results of the soil analyses are summarized in Table 3, and the results of the water analyses are summarized in Table 6. Documentation of the well installation protocol, sample collection techniques, and the analytical results are presented in KEI's report (KEI-P90-0102.R3) dated November 15, 1990.

Based on the analytical results collected and evaluated through November of 1991 that showed consistently non-detectable levels of TPH as gasoline, TPH as diesel, BTX&E, and TOG for the preceding five quarters (except for 0.30 ppb xylenes and 0.84 ppb toluene in MW1 on February 22, 1991 and October 2, 1990, respectively), and a relatively consistent southwesterly ground water flow direction, KEI recommended reducing the monitoring frequency of the existing monitoring wells to quarterly and the sampling frequency to semi-annually. However, based on the southwesterly ground water flow direction, it appeared that none of the existing monitoring wells were located directly downgradient of the waste oil tank pit and the previously identified soil contamination in the vicinity of the

waste oil tank. Therefore, KEI recommended that one additional monitoring well be installed downgradient (southwest) of the waste oil tank in order to determine whether the ground water in this area had been impacted by hydrocarbon contamination.

On March 4, 1992, one additional two-inch diameter monitoring well (designated as MW4 on the attached Figure 1) was installed at the site. Monitoring well MW4 was drilled and completed to a total depth of 50 feet below grade. Ground water was encountered at a depth of 39 feet beneath the surface during drilling. All four wells (MW1 through MW4) were sampled on March 18, 1992.

Water samples from all wells (MW1, MW2, MW3, and MW4), and selected soil samples from the boring of MW4, were analyzed at Sequoia Analytical Laboratory in Concord, California, for TPH as gasoline and BTX&E. In addition, the soil samples collected from MW4 were also analyzed for TPH as diesel and for TOG. The water samples collected from all four wells were also analyzed for TPH as diesel and TOG.

Analytical results of the soil samples collected from boring MW4 indicated non-detectable levels of TPH as gasoline, BTX&E, TPH as diesel, and TOG in all analyzed samples. Analytical results of the water samples collected from all four wells indicated non-detectable levels of TPH as gasoline, BTX&E, TPH as diesel, and TOG. The results of the soil analyses are summarized in Table 3, and the results of the water analyses are summarized in Table 6. Documentation of well MW4 installation protocol, sample collection techniques, and the analytical results are presented in KEI's report (KEI-P90-0102.R4) dated April 27, 1992.

KEI's field work at the site continued on April 15, 1992, when one 10,000 gallon super unleaded gasoline storage tank and one 10,000 gallon regular unleaded gasoline storage tank were removed from the site. The tanks were made of steel and no apparent holes or cracks were observed in the regular unleaded tank. However, the super unleaded tank had four 1/4 square inch holes located on the side of the tank. Mr. Barney Chan of the ACHCS was present during tank removal and subsequent soil sampling. Mr. Antonio Edayan of the City of Oakland Fire Prevention Bureau was also present during tank removal.

Four soil samples, labeled A1, A2, B1, and B2, were collected from beneath the fuel tanks at depths ranging from 14.5 to 15 feet below grade. Two soil samples, labeled SW1(10) and SW1(12.5), were collected from the northwest sidewall of the fuel tank pit at depths of approximately 10 and 12.5 feet, respectively. Two additional soil samples, labeled SW1-14(10) and SW1-14(12.5), were

collected at a lateral distance of about 14 feet from sample point locations SW1(10) and SW1(12.5), respectively. One soil sample, labeled SW2(12.5), was collected from the northeast sidewall of the fuel tank pit at a depth of about 12.5 feet below grade. Samples were collected from bulk material excavated by backhoe. Sample point locations are as shown on the attached Figure 7.

KEI returned to the site on April 20, 1992, in order to collect soil samples from the product pipe trenches. Six soil samples, labeled P1 through P5 and P2 (5.5), were collected at depths ranging from 3.5 to 5.5 feet below grade. The samples were collected in the presence of Mr. Chan of the ACHCS. Pipe trench sample point locations are shown on the attached Figure 7.

KEI returned to the site on April 23, 1992, in order to observe additional soil excavation in the vicinity of sample points P1 and P2. Two soil samples, labeled P1(10) and P2(10), were collected from beneath sample point locations P1 and P2, respectively, at depths of about 10 feet below grade. Two additional soil samples, labeled SW1(P2) and SW2(P2), were collected from the southeast and northeast sidewalls of the product pipe trench adjacent to sample point location P2, at depths of about 5.5 feet below grade. Sample point locations are shown on the attached Figure 7.

On April 30, 1992, KEI collected three background soil samples, labeled BS1(10), BS2(10), and BS2(12.5), in order to characterize the vertical and lateral extent of soil contamination existing in a gravel layer between depths of 8 to 11.5 feet below grade at sample point locations SW1(10) and SW1-14(10). Sample point locations are shown on the attached Figure 7.

On May 4, 1992, an area (approximately 12 feet by 20 feet) adjacent to sample point location SW1(P2) was overexcavated to a depth of about 10 feet below grade. One soil sample, labeled P(B), was collected from the bottom of the excavation at a depth of about 10 feet below grade. Three soil samples, labeled SW(W), SW(E), and SW(S), were collected from the sidewalls of the new excavation at depths of approximately 5.5 feet below grade. The area of additional excavation and sample point locations are shown on the attached Figure 7.

All samples were analyzed by Sequoia Analytical Laboratory in Concord, California. All samples were analyzed for TPH as gasoline and BTX&E.

Analytical results of the soil samples collected from beneath the fuel tanks indicated non-detectable levels of TPH as gasoline and BTX&E. Soil samples collected from the sidewalls of the fuel tank

pit and the background soil samples collected at depths of about 12.5 feet below grade showed non-detectable levels of TPH as gasoline and BTX&E. However, soil samples SW1(10), SW1-14(10), and BS2(10), collected from the observed contaminated layer of gravel at depths of about 10 feet below grade, showed levels of TPH as gasoline at 1,800 ppm, 190 ppm, and 200 ppm, respectively.

Analytical results of the soil samples collected from the product pipe trenches indicated non-detectable levels of TPH as gasoline, except for samples P1 and P2, which showed 200 ppm and 440 ppm, respectively. Sample P2(5.5), collected from beneath sample point location P2 at a depth of about 5.5 feet below grade, showed 510 ppm of TPH as gasoline. Soil samples SW1(P2) and SW2(P2), collected from the sidewalls adjacent to sample point location P2, showed levels of TPH as gasoline at 520 ppm and non-detectable, respectively. However, after additional excavation, samples P1(10) and P2(10), collected from beneath sample point locations P1 and P2 at depths of about 10 feet below grade, showed non-detectable levels of TPH as gasoline and BTX&E. Samples SW(W), SW(E), and SW(S), collected from the sidewalls of the new excavation at depths of about 5.5 feet below grade, showed levels of TPH as gasoline at 45 ppm, 20 ppm, and 1.7 ppm, respectively. Sample P(B), collected from the bottom of the excavation, showed non-detectable levels of TPH as gasoline and BTX&E. The results of the soil analyses are summarized in Table 5.

Based on the analytical results of the final soil samples collected during excavation activities at the site, it appeared that the majority of the hydrocarbon-contaminated soil that existed in the vicinity of the pump island located next to High Street had been excavated and removed from the site. However, soil contamination appeared to remain in the northwest sidewall of the fuel tank pit [in the vicinity of sample point locations SW1(10), SW1-14(10), and BS2(10)]. Based on these results, KEI recommended (in KEI's work plan/proposal KEI-P90-0101.P5 dated May 27, 1992) the installation of subsurface piping to facilitate the possible use of vapor extraction as a remedial technique at the subject site. This subsurface piping was installed during the excavation activities at the site, and is configured as shown on the attached Figure 1.

However, before evaluating the use of vapor extraction as a remedial technique at the site, KEI recommended that two additional monitoring wells be installed at the site (KEI's report KEI-J90-0102.R5 dated August 20, 1992). These two wells were proposed in order to determine if ground water in the vicinity of the fuel tank pit and the southeasterly pump island had been impacted by hydrocarbon contamination. Documentation of the tank removal protocol, sample collection techniques, and the analytical results

of the soil samples collected from the tank excavation are also summarized in the same report.

On November 19, 1992, two additional two-inch diameter monitoring wells (designated as MW5 and MW6 on the attached Figure 1) were installed at the site. Monitoring wells MW5 and MW6 were drilled and completed to total depths of 49 and 50 feet below grade, respectively. The two new wells (MW5 and MW6) were developed on November 24, 1992, and all of the wells were sampled on December 4, 1992.

Water samples from all of the wells, and selected soil samples from the borings for MW5 and MW6, were analyzed at Sequoia Analytical Laboratory. The samples were analyzed for TPH as gasoline and BTX&E. In addition, water samples collected from the previously existing wells (MW1 through MW4) were analyzed for TPH as diesel and TOG.

The analytical results of the soil and ground water samples collected from monitoring wells MW5 and MW6 indicated predominantly non-detectable to very low concentrations of petroleum hydrocarbon contamination. The results of the soil analyses are summarized in Table 3, and the results of the water analyses are summarized in Table 6.

Based on the analytical results of the ground water samples collected through December of 1992, it appeared that the ground water beneath the site had not been significantly impacted by petroleum hydrocarbon contamination. Based on the analytical results of the soil samples collected through December 1992, (including soil samples collected during tank removal and excavation operations), it appeared that elevated levels of soil contamination are confined to a limited area in the northern portion of the site, adjacent to and west of the underground gasoline storage tanks. The vertical extent of contamination in this area appeared to be confined to a depth of 10 feet below grade, as shown in Table 5.

Therefore, KEI recommended the installation of three vapor extraction test wells in the northern portion of the site in order to conduct a vapor extraction test. KEI also proposed that the three vapor extraction test wells would be drilled and completed to depths of 10 to 11 feet below grade at the locations where three well box covers and associated vapor extraction piping had been previously installed.

RECENT FIELD ACTIVITIES - VAPOR EXTRACTION WELL INSTALLATION

On March 4, 1993, three two-inch diameter vapor extraction wells (designated as VE1 through VE3 on the attached Figure 1) were installed at the site. The wells were each drilled, constructed, and completed in accordance with the guidelines of the Regional Water Quality Control Board (RWQCB) and the 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 and Well Completion Diagrams, respectively, and are included in Appendix A.

The three wells were each drilled and completed to total depths ranging from 11 to 12.5 feet below grade. Ground water was not encountered during drilling. Soil samples were collected for laboratory analysis and for lithologic logging purposes at a maximum spacing of 1.5 foot intervals, at significant changes in lithology, and at obvious areas of contamination, beginning at a depth of approximately 3.5 to 4 feet below grade and continuing to the total depth drilled. The undisturbed soil samples were collected by driving a California-modified split-spoon sampler (lined with brass liners) ahead of the drilling augers. The two inch diameter brass liners holding the samples were then sealed with aluminum foil, plastic caps and tape, labeled, and stored in a cooler, on ice, until delivery to a state-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.

RECENT FIELD ACTIVITIES - VAPOR EXTRACTION TEST

A vapor extraction test was performed during the period April 26 through 30, 1993, using VE1 as the vapor extraction test well. The test system consisted of a vapor extraction well head attached to VE1, two-inch diameter flexible tubing, an internal combustion engine (ICE), and a propane tank. A diagram of the pilot test system is shown on the attached Figure 2.

The vacuum was applied by the use of the ICE, which is capable of applying a vacuum of up to approximately 16 inches of mercury ("Hg), or 218 inches of water. Hydrocarbon emissions were abated by ducting the extracted vapors through the ICE and associated catalytic converters.

Wells VE2, VE3, MW5, and MW6 were used as observation wells. Radial distances from VE1 to the observation wells ranged from approximately 13.5 to 74 feet. Observation wells VE2 and VE3 are

generally screened between 3.5 and 12 feet below grade, with pre-test unsaturated screen lengths of 8.5 and 7.5 feet, respectively. Observation wells MW5 and MW6 are generally screened between 29 and 49 feet below grade, with pre-test unsaturated screen lengths of 3.75 and 3.14 feet, respectively. Differential pressures at all of the observation wells were measured by the use of specially fitted well caps and magnahelic gauges, in order to determine the extent and effective influence of the applied vacuum. The magnahelic gauges are capable of measuring vacuum influence changes to an accuracy of 0.02 inches of water. Prior to beginning the test, vacuum influence measurements were taken at all of the observation wells in order to establish a base line for comparison of measurements taken during the test.

The applied vacuum, extraction air flow rate, and vacuum influence measurements were taken four times during the first hour of the test, twice during the second hour of the test, and on an hourly basis for the remainder of the test.

Influent and effluent air samples were collected in Tedlar bags by the use of a vacuum pump in order to determine the concentrations of constituents in the extracted air stream and to monitor the destruction efficiency of the abatement system. Air samples INF-1 through INF-5 were collected from the extracted air stream of VE1 before treatment. In order to ensure compliance with local air quality standards, air samples EFF-1 and EFF-5 were collected from the extracted air stream of the abatement equipment.

## ANALYTICAL RESULTS - VAPOR EXTRACTION WELL INSTALLATION

Selected soil samples from the borings of VE1 through VE3 were analyzed at Sequoia Analytical Laboratory. All samples analyzed were accompanied by properly executed Chain of Custody documentation. The samples were analyzed for TPH as gasoline by EPA method 5030/modified 8015, and for BTX&E by EPA method 8020. The results of the soil analyses are summarized in Table 3. Copies of the laboratory analytical results and the Chain of Custody documentation are attached to this report.

## RESULTS - PILOT VAPOR EXTRACTION TEST

The total duration of the test was 97 hours with an applied vacuum on well VE1 varying from approximately 4.3 to 17.3 inches of water. The vacuum was measured to be 10.4 inches of water immediately after system start-up. The extraction flow rate stabilized between 88.7 to 91.4 cubic feet per minute (CFM) after 6.75 hours of operation, and remained in this range until 79 hours of operation, at which time the RPM rate of the ICE was reduced. The flow rate

at that time dropped to 72.5 CFM, and remained constant until the termination of the test. The applied vacuum and extraction flow rates from VE1 are plotted versus time on the attached Figure 3. Field measurements of the applied vacuum and extraction flow rates are included in Appendix B.

Vacuum influence was measured in the observation wells immediately after system start-up. Measurements indicated no pressure changes in observation well VE3, and negative pressure influences of 0.01 inches of water for VE2, 0.16 inches of water for MW5, and 0.13 inches of water in MW6. Vacuum influence measurements in wells VE2 and VE3 were consistently at zero levels, with an occasional negative pressure influence of 0.01 inches of water. Influence measurements in wells MW5 and MW6 indicated positive differential pressures varying between 0.01 and 1.90 inches of water, except for a single measurement of a vacuum influence of 0.01 inches of water. The reason that a vacuum influence was not measured in the observation wells could be due to the highly permeable subsurface conditions, contributing to a relatively high flow rate, which did not permit a vacuum to establish and stabilize. Also, the referenced site is located adjacent to the San Francisco Bay and tidal effects and a fluctuating water table could have contributed to the fluctuating pressure influence measurements in wells MW5 and MW6. Vacuum influence data for all of the observation wells are plotted versus time on the attached Figure 4. Positive differential pressures are represented by negative magnehelic gauge readings and vacuum influence. Differential pressures are represented by negative gauge readings. Field measurements of vacuum influence for all of the observation wells are included in Appendix B.

ANALYTICAL RESULTS - PILOT VAPOR EXTRACTION TEST

Air sample analyses were conducted at Sequoia Analytical Laboratory and were accompanied by properly executed Chain of Custody documentation. The samples were analyzed for TPH as gasoline by EPA method 5030/modified 8015, and BTX&E by EPA method 8020.

The analytical results of the air samples collected from the extracted air stream of VE1 indicate concentrations of TPH as gasoline ranging from 6.8 micrograms per liter ($\mu$g/1) to 51 $\mu$g/1, and concentrations of benzene ranging from 0.077 $\mu$g/1 to 0.47 $\mu$g/1. The results of the air sample analyses for VE1 are summarized in Table 1, and the concentrations of TPH as gasoline are plotted versus time on the attached Figure 5. Copies of the laboratory analytical results and the Chain of Custody documentation are attached to this report.

Based on the ranges of flow rates measured in the field and the analytical results of the air samples, the system achieved a gasoline extraction rate ranging from approximately 0.0023 pounds per hour (lbs/hr) to 0.021 lbs/hr. The results of the gasoline extraction rate calculations are summarized in Table 2.

HYDROLOGY AND GEOLOGY

As previously noted, ground water was not encountered during drilling of the vapor extraction test wells. Based on water level data collected from the six existing monitoring wells at the site on March 4, 1993, the measured depth to ground water ranged between 32.21 and 33.88 feet below grade.

Based on review of regional geologic maps ("Flatland Deposits - Their Geology and Engineering Properties and their Importance to Comprehensive Planning" by E.J. Helley and K.R. Lajoie in U.S.G.S. Professional Paper 943, 1979), the subject site is underlain by Holocene-age alluvial deposits that are described as coarse-grained alluvium (Qhac), and that typically consist of unconsolidated, moderately sorted sand and silt.

Based on results of our subsurface studies, the site is underlain by fill materials to a depth of about 1 to 2.5 feet below grade, except in the vicinity of MW4, where fill materials are absent. The fill is in turn underlain by alluvium to the maximum depth explored (51 feet below grade). The alluvium underlying the site consists predominantly of clayey gravel, silty clay and clay, with interbeds of clayey silt and clayey sand.

The unsaturated zone beneath the site is approximately 32 feet thick and consists largely of silty clay and clayey gravel, with subordinate amounts of clayey silt and clayey sand. The first water bearing unit beneath the site (first aquifer) consists largely of clayey gravel, with clayey sand, silty clay, and clayey silt, in order of decreasing abundance.

The base of the unsaturated zone and the units immediately below the water table are characterized by gravel, silty sand, sandy silt, and lesser amounts of clay.

A particle size analysis (sieve and hydrometer) was previously performed on a soil sample collected from the saturated zone in well MW5 at a depth of 35 feet below grade, and on a composite sample collected from MW5 at a depth of 39 and 45 feet below grade. The results of the particle size analysis on the sample collected at a depth of 35 feet below grade indicate that the sample is composed of approximately 56% silt and clay, and 44% percent medium

and fine-grained sand. The sample is classified as sandy silt (ML). The composite sample collected at a depth of 39 and 45 feet below grade is composed of 67% sand and 33% gravel. Based on the sieve analysis results, this sample may be classified as gravelly sand (SW). However, the field description of this composite sample is sandy gravel or well graded sand and gravel (GW or GW-SW). The difference between the sieve analysis results (SW) and the field description (GW or GW-SW) is considered to be due to the difficulty in obtaining representative samples containing gravel, and the unit is considered to be composed predominantly of sandy gravel (GW).

## DISCUSSION AND RECOMMENDATIONS

As indicated in the background section of this report, one waste oil tank was removed from the site in January of 1990. The waste oil tank pit was subsequently overexcavated to remove contaminated soil. Two underground gasoline storage tanks and the associated product piping were removed from the site in April of 1992. The fuel tank pit and product pipe trenches were subsequently overexcavated in order to remove contaminated soil. Based on the analytical results of the final soil samples that were collected during excavation activities, it appeared that the majority of the hydrocarbon-contaminated soil that existed in the vicinity of the pump island located next to High Street was excavated and removed from the site. Soil contamination remained in the northwest sidewall of the fuel tank pit in the vicinity of the vapor extraction wells, VE1, VE2, and VE3.

The analytical results of the selected soil samples collected from the borings of the three vapor extraction wells indicated non-detectable levels of TPH as gasoline and benzene, except for samples VE1(10) and VE2(11.5), which showed 310 ppm and 68 ppm of TPH as gasoline, respectively, and except for VE1(5), which showed 0.037 ppm of benzene. The results of the soil analyses are summarized in Table 3.

As previously summarized in this report, the results of the vapor extraction test indicated concentrations of TPH as gasoline ranging from 6.8 µg/l to 51 µg/l in the extracted air stream of VE1. Furthermore, field measurements of relatively high air flow rates indicate permeable soil conditions. Calculations using the data obtained during the vapor extraction test indicate gasoline extraction rates ranging from 0.0023 lbs/hr to 0.021 lbs/hr. Based on these results, vapor extraction by the use of an ICE could be considered a possible means of remediation at the referenced site. However, based on the relatively low hydrocarbon extraction rates calculated from the data collected during the vapor extraction test, it appears that the majority of the hydrocarbon contamination

in the soil at the referenced site has been excavated and removed. Therefore, the installation and operation of a vapor extraction system at the subject site does not appear to be warranted. In addition, based on the preceding discussion and the analytical results of all of the samples collected and evaluated to date, KEI recommends that no additional work related to the removal of the underground fuel storage tanks be conducted unless required by the regulatory agencies.

Lastly, KEI recommends the continuation of the current ground water monitoring and sampling program. All six monitoring wells are monitored quarterly. Monitoring wells MW1 through MW4 are sampled semi-annually, and wells MW5 and MW6 are sampled quarterly.

DISTRIBUTION

Copies of this report should be sent to Mr. Barney Chan of the ACHCS, 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 us at (510) 602-5100.

Sincerely,

Kaprealian Engineering, Inc.

Thomas J. Berkins
Senior Environmental Engineer

Joel G. Greger, C.E.G.
Senior Engineering Geologist

License No. 1633
Exp. Date 6/30/94

Aram B. Kaloustian
Project Engineer

\bmp

Attachments: Tables 1 through 6
Location Map
Figures 1 through 7
Appendix A - Boring Logs
Appendix B - Vapor Extraction Test Field Measurements
Laboratory Analyses
Chain of Custody documentation

KEI-P90-0102.R9
May 24, 1993

TABLE 1

SUMMARY OF LABORATORY ANALYSES
AIR

| Date | Sample | Time | TPH as Gasoline | Benzene | Toluene | Xylenes | Ethyl-benzene |
|---|---|---|---|---|---|---|---|
| 4/30/93 | INF-5 | 13:00 | 13 | 0.10 | 0.22 | 1.2 | 0.26 |
| | EFF-5 | 13:00 | ND | 0.83 | 0.15 | 0.17 | ND |
| 4/29/92 | INF-4 | 13:00 | 6.8 | 0.077 | 0.08 | 0.57 | 0.10 |
| 4/28/93 | INF-3 | 13:45 | 17 | 0.10 | 0.20 | 1.2 | 0.26 |
| 4/27/93 | INF-2 | 13:00 | 39 | 0.18 | 0.51 | 2.7 | 0.59 |
| 4/26/93 | INF-1 | 13:00 | 51 | 0.47 | 0.84 | 4.5 | 0.87 |
| | EFF-1 | 13:00 | 5.8 | 0.80 | 0.10 | 0.67 | 0.089 |
| Detection Limits | | | 5.0 | 0.050 | 0.050 | 0.050 | 0.050 |

NOTE: All sample results are in µg/L.

DESTRUCTION EFFICIENCY

| Date | Sample Ratio | TPH as Gasoline | Benzene | Toluene | Xylenes | Ethyl-benzene |
|---|---|---|---|---|---|---|
| 4/30/93 | 1-(EFF-5/INF-5) | EFF=ND | N/A | 31.81% | 85.83% | EFF=ND |
| 4/26/93 | 1-(EFF-1/INF-1) | 88.63% | N/A | 88.10% | 85.11% | 89.77% |

KEI-P90-0102.R9
May 24, 1993

TABLE 2

SUMMARY OF EXTRACTION CALCULATIONS

| Date | Sample | Time | TPH as Gasoline (µg/l) | Flow Rate (CFM) | Hydrocarbon Extraction Rate (lbs/hr) |
|---|---|---|---|---|---|
| 4/30/93 | INF-5 | 13:00 | 13 | 72.7 | 0.0036 |
| 4/29/93 | INF-4 | 13:00 | 6.8 | 88.7 | 0.0023 |
| 4/28/93 | INF-3 | 13:45 | 17 | 89.6 | 0.0057 |
| 4/27/93 | INF-2 | 13:00 | 39 | 90.7 | 0.013 |
| 4/26/93 | INF-1 | 13:00 | 51 | 106.6 | 0.021 |

KEI-P90-0102.R9
May 24, 1993

TABLE 3

SUMMARY OF LABORATORY ANALYSES
SOIL

| Sample Number | TPH as Diesel | TPH as Gasoline | Benzene | Toluene | Xylenes | Ethyl-benzene | TOG |
|---|---|---|---|---|---|---|---|
| | | | **(Collected on September 20, 1990)** | | | | |
| MW1(5) | ND | ND | ND | 0.018 | ND | ND | ND |
| MW1(9) | 5.2 | 34 | ND | 0.17 | 0.56 | 0.086 | ND |
| MW1(15.5) | ND | ND | ND | 0.017 | ND | ND | ND |
| MW1(20) | ND | ND | ND | 0.028 | ND | ND | ND |
| MW1(30.5) | ND | ND | ND | ND | ND | ND | ND |
| MW1(39.5) | ND | ND | ND | 0.0060 | ND | ND | ND |
| MW2(5) | ND | ND | ND | 0.014 | 0.0070 | ND | ND |
| MW2(11) | ND | ND | ND | 0.017 | ND | ND | ND |
| MW2(15.5) | ND | ND | ND | 0.0060 | ND | ND | ND |
| MW2(20) | ND | ND | ND | 0.019 | ND | ND | ND |
| MW2(30) | ND | ND | ND | 0.0050 | ND | ND | ND |
| MW2(39.5) | ND | ND | ND | 0.010 | ND | ND | ND |
| MW3(5) | ND | ND | ND | 0.012 | ND | ND | ND |
| MW3(9.5) | ND | ND | ND | 0.029 | ND | ND | ND |
| MW3(15) | ND | ND | ND | 0.032 | ND | ND | ND |
| MW3(25) | ND | ND | ND | 0.0080 | ND | ND | ND |
| MW3(35) | ND | ND | ND | 0.013 | ND | ND | ND |
| MW3(39) | ND | ND | ND | 0.0060 | ND | ND | ND |
| | | | **(Collected on March 4, 1992)** | | | | |
| MW4(5) | ND | ND | ND | ND | ND | ND | ND |
| MW4(10) | ND | ND | ND | ND | ND | ND | ND |
| MW4(15.5) | ND | ND | ND | ND | ND | ND | ND |
| MW4(20) | ND | ND | ND | ND | ND | ND | ND |
| MW4(25) | ND | ND | ND | ND | ND | ND | ND |
| MW4(30) | ND | ND | ND | ND | ND | ND | ND |
| MW4(35.5) | ND | ND | ND | ND | ND | ND | ND |

TABLE 3 (Continued)

SUMMARY OF LABORATORY ANALYSES
SOIL

| Sample Number | TPH as Diesel | TPH as Gasoline | Benzene | Toluene | Xylenes | Ethyl-benzene | TOG |
|---|---|---|---|---|---|---|---|
| **(Collected on November 19, 1992)** | | | | | | | |
| MW5(5) | -- | ND | ND | ND | ND | ND | -- |
| MW5(10) | -- | ND | 0.0061 | 0.012 | 0.011 | ND | -- |
| MW5(15) | -- | ND | ND | ND | ND | ND | -- |
| MW5(20) | -- | ND | ND | 0.0060 | 0.0059 | ND | -- |
| MW5(25) | -- | ND | ND | ND | ND | ND | -- |
| MW5(30) | -- | ND | ND | ND | ND | ND | -- |
| MW5(35) | -- | ND | ND | ND | 0.0059 | ND | -- |
| MW6(4.5) | -- | ND | ND | ND | 0.0075 | ND | -- |
| MW6(9.5) | -- | ND | ND | ND | ND | ND | -- |
| MW6(15) | -- | ND | ND | ND | ND | ND | -- |
| MW6(20) | -- | ND | ND | ND | ND | ND | -- |
| MW6(25) | -- | ND | ND | ND | 0.0081 | ND | -- |
| MW6(29.5) | -- | ND | 0.0080 | 0.018 | 0.016 | ND | -- |
| MW6(34.5) | -- | ND | ND | ND | ND | ND | -- |
| **(Collected on April 8, 1993)** | | | | | | | |
| VE1(5) | -- | ND | 0.037 | 0.040 | 0.071 | 0.043 | -- |
| VE1(10) | -- | 310 | ND | 0.20 | 6.6 | 1.9 | -- |
| VE2(5) | -- | ND | ND | ND | ND | ND | -- |
| VE2(10) | -- | ND | ND | ND | ND | ND | -- |
| VE2(11.5) | -- | 68 | ND | 0.080 | 0.66 | 0.20 | -- |
| VE3(5) | -- | ND | ND | ND | ND | ND | -- |
| VE3(10) | -- | ND | ND | ND | ND | ND | -- |

**NOTE**: The soil samples were collected at the depths below grade indicated in the ( ) of the respective sample number.

ND = Non-detectable.

-- Indicates analysis was not performed.

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

KEI-P90-0102.R9
May 24, 1993

TABLE 4

SUMMARY OF LABORATORY ANALYSES
SOIL

(Collected on January 5 & 26, and May 17, 1990)

| Sample | Depth (feet) | TOG | TPH as Diesel | TPH as Gasoline | BTX&E | 8010 |
|---|---|---|---|---|---|---|
| WO1* | 10.0 | ND | ND | ND | ND | ND |
| WO1(11.5)** | 11.5 | ND | ND | ND | ND | ND |
| WO1R | 9.0 | ND | 5.5 | -- | -- | -- |
| SWA | 9.0 | 630 | 130 | -- | -- | -- |
| SWB(10) | 9.0 | 270 | 180 | -- | -- | -- |
| SWC(9) | 9.0 | ND | ND | -- | -- | -- |
| SWD(10) | 9.0 | 2,900 | 200 | -- | -- | -- |
| SWE | 8.5 | ND | ND | -- | -- | -- |
| SWF | 8.5 | 84 | 2.3 | -- | -- | -- |
| Detection Limits | | 1.0 | 1.0 | 1.0 | *** | *** |

* Metal concentrations were as follows: cadmium was non-detectable, chromium was 42 ppm, lead was 13 ppm, and zinc was 41 ppm.

** Metal concentrations were as follows: cadmium was non-detectable, chromium was non-detectable, lead was 6.5 ppm, and zinc was 41 ppm.

*** Refer to laboratory analyses for individual constituent detection limits.

ND = Non-detectable.

-- Indicates analysis was not performed.

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

KEI-P90-0102.R9
May 24, 1993

TABLE 5

SUMMARY OF LABORATORY ANALYSES
SOIL

| Date | Sample Number | Depth (feet) | TPH as Gasoline | Benzene | Toluene | Xylenes | Ethyl-benzene |
|---|---|---|---|---|---|---|---|
| 4/15/92 | A1 | 14.5 | ND | ND | ND | ND | ND |
| | A2 | 15.0 | ND | ND | ND | ND | ND |
| | B1 | 15.0 | ND | ND | ND | ND | ND |
| | B2 | 15.0 | ND | ND | ND | ND | ND |
| | SW1(10) | 10.0 | 1,800 | 5.7 | 110 | 240 | 41 |
| | SW1(12.5) | 12.5 | ND | ND | ND | ND | ND |
| | SW1-14(10) | 10.0 | 190 | 0.40 | 0.57 | 2.3 | 0.54 |
| | SW1-14(12.5) | 12.5 | ND | ND | ND | ND | ND |
| | SW2(12.5) | 12.5 | ND | ND | ND | ND | ND |
| 4/20/92 | P1 | 3.75 | 200 | 1.1 | 16 | 34 | 5.4 |
| | P2 | 3.5 | 440 | 0.95 | 1.0 | 3.9 | 1.9 |
| | P2(5.5) | 5.5 | 510 | 0.83 | 1.6 | 5.2 | 1.9 |
| | P3 | 4.0 | ND | ND | ND | ND | ND |
| | P4 | 3.75 | ND | ND | ND | ND | ND |
| | P5 | 3.5 | ND | ND | ND | 0.024 | ND |
| 4/23/92 | P1(10) | 10.0 | ND | ND | ND | ND | ND |
| | P2(10) | 10.0 | ND | ND | ND | ND | ND |
| | SW1(P2) | 5.5 | 520 | ND | 1.2 | 2.9 | 1.1 |
| | SW2(P2) | 5.5 | ND | ND | ND | ND | ND |
| 4/30/92 | BS1(10) | 10.0 | ND | ND | ND | ND | ND |
| | BS2(10) | 10.0 | 200 | ND | 0.31 | 2.2 | 0.48 |
| | BS2(12.5) | 12.5 | ND | ND | ND | ND | ND |
| 5/04/92 | P(B) | 10.0 | ND | ND | ND | ND | ND |
| | SW(W) | 5.5 | 45 | 0.051 | 0.48 | 0.31 | 0.16 |
| | SW(E) | 5.5 | 20 | 0.016 | 0.17 | 0.025 | 0.097 |
| | SW(S) | 5.5 | 1.7 | ND | ND | 0.025 | ND |
| Detection Limits | | | 1.0 | 0.0050 | 0.0050 | 0.0050 | 0.0050 |

ND = Non-detectable.

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

KEI-P90-0102.R9
May 24, 1993

TABLE 6

SUMMARY OF LABORATORY ANALYSES
WATER

| Date | Sample Number | TPH as Diesel | TPH as Gasoline | Benzene | Toluene | Xylenes | Ethyl-benzene |
|---|---|---|---|---|---|---|---|
| 3/04/93 | MW1 | SAMPLED SEMI-ANNUALLY | | | | | |
| | MW2 | SAMPLED SEMI-ANNUALLY | | | | | |
| | MW3 | SAMPLED SEMI-ANNUALLY | | | | | |
| | MW4 | SAMPLED SEMI-ANNUALLY | | | | | |
| | MW5* | ND | ND | ND | ND | ND | ND |
| | MW6* | ND | ND | ND | ND | ND | ND |
| 12/04/92 | MW1* | ND | ND | ND | ND | ND | ND |
| | MW2* | ND | ND | ND | 0.65 | 0.91 | ND |
| | MW3* | ND | ND | ND | ND | ND | ND |
| | MW4* | ND | ND | ND | ND | ND | ND |
| | MW5 | -- | ND | ND | ND | ND | ND |
| | MW6 | -- | ND | ND | ND | ND | ND |
| 9/24/92 | MW1* | ND | ND | ND | ND | ND | ND |
| | MW2* | ND | ND | ND | ND | ND | ND |
| | MW3* | ND | ND | ND | ND | ND | ND |
| | MW4* | ND | ND | ND | ND | ND | ND |
| 3/18/92 | MW1* | ND | ND | ND | ND | ND | ND |
| | MW2* | ND | ND | ND | ND | ND | ND |
| | MW3* | ND | ND | ND | ND | ND | ND |
| | MW4* | ND | ND | ND | ND | ND | ND |
| 11/21/91 | MW1* | ND | ND | ND | ND | ND | ND |
| | MW2* | ND | ND | ND | ND | ND | ND |
| | MW3* | ND | ND | ND | ND | ND | ND |
| 8/22/91 | MW1* | ND | ND | ND | ND | ND | ND |
| | MW2* | ND | ND | ND | ND | ND | ND |
| | MW3* | ND | ND | ND | ND | ND | ND |
| 5/22/91 | MW1* | ND | ND | ND | ND | ND | ND |
| | MW2* | ND | ND | ND | ND | ND | ND |
| | MW3* | ND | ND | ND | ND | ND | ND |
| 2/22/91 | MW1* | ND | ND | ND | ND | 0.30 | ND |
| | MW2* | ND | ND | ND | ND | ND | ND |
| | MW3* | ND | ND | ND | ND | ND | ND |
| | MWD** | ND | ND | ND | ND | ND | ND |

TABLE 6 (Continued)

SUMMARY OF LABORATORY ANALYSES
WATER

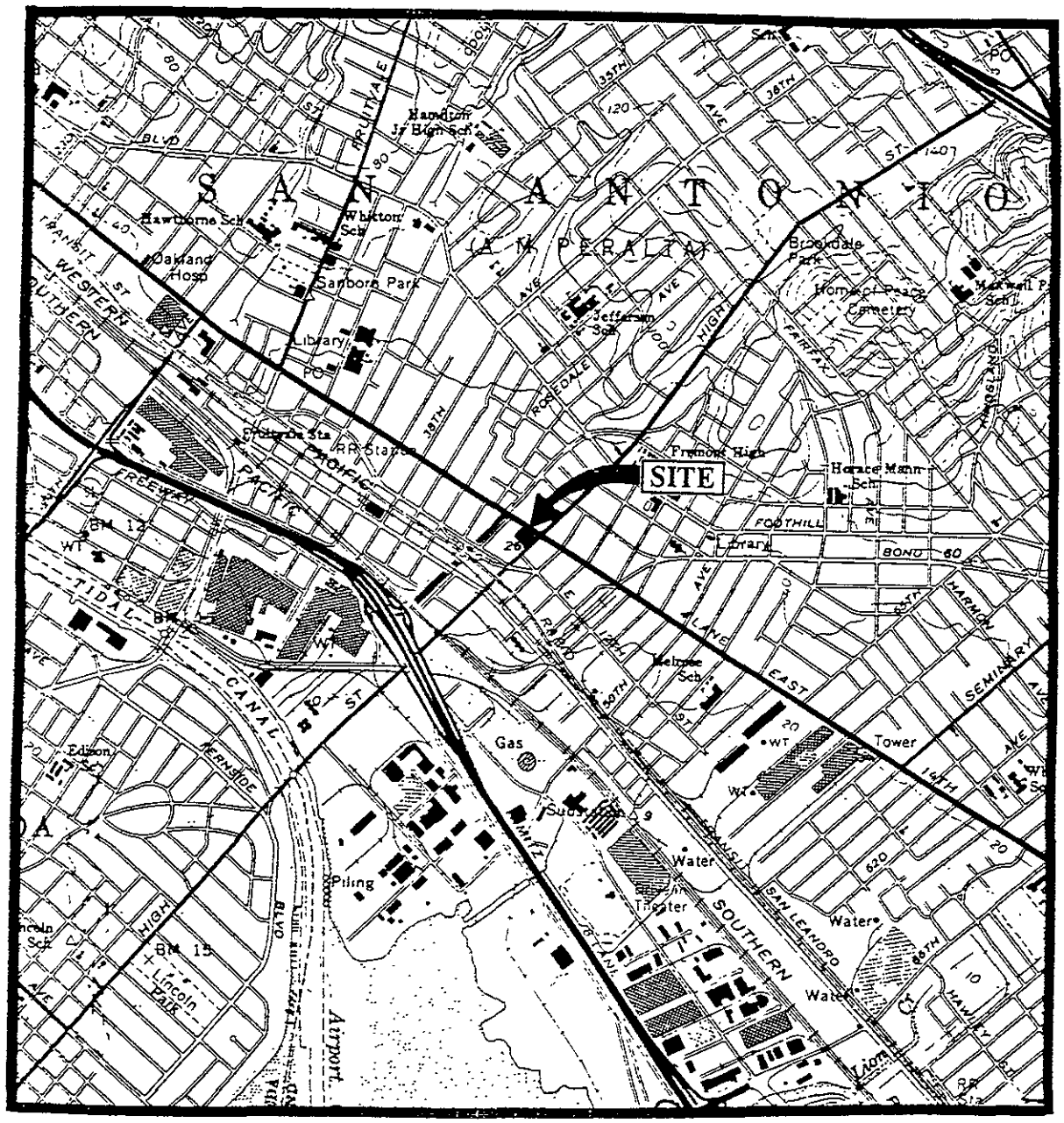
| Date | Sample Number | TPH as Diesel | TPH as Gasoline | Benzene | Toluene | Xylenes | Ethyl-benzene |
|---|---|---|---|---|---|---|---|
| 10/02/90 | MW1* | ND | ND | ND | 0.84 | ND | ND |
| | MW2* | ND | ND | ND | ND | ND | ND |
| | MW3* | ND | ND | ND | ND | ND | ND |

* TOG was non-detectable.

** Quality assurance duplicate water sample collected from monitoring well MW1. TOG was non-detectable.

ND = Non-detectable.

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

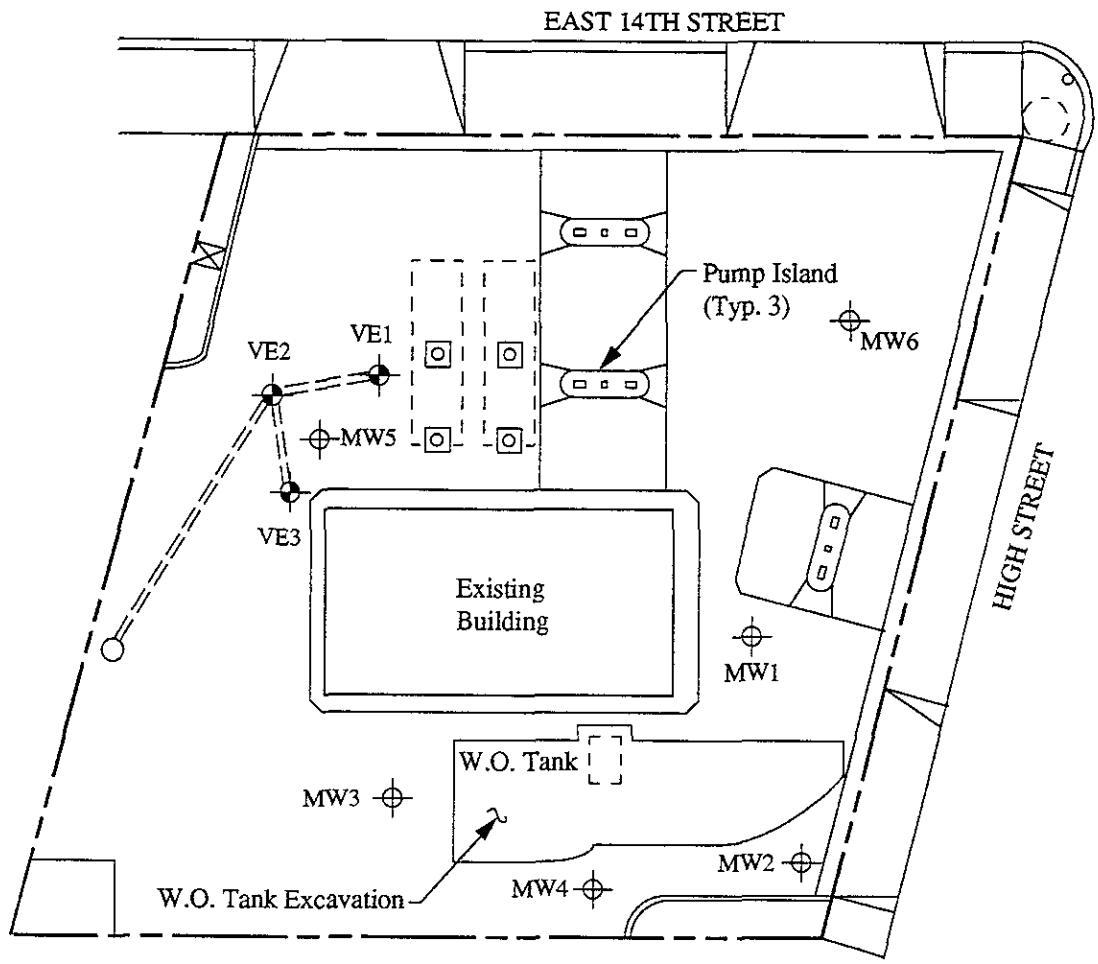



Base modified from 7.5 minute U.S.G.S. Oakland East Quadrangle
(photorevised 1980)

0 2000 4000

Approx. scale feet

| | | |
|---|---|---|
| KAPREALIAN ENGINEERING INCORPORATED | UNOCAL SERVICE STATION #2656<br>4251 EAST 14TH STREET<br>OAKLAND, CA LIFORNIA | LOCATION MAP |




LEGEND

- Monitoring well
- Vapor extraction well
- Vapor extraction subsurface conduit

0 30 60

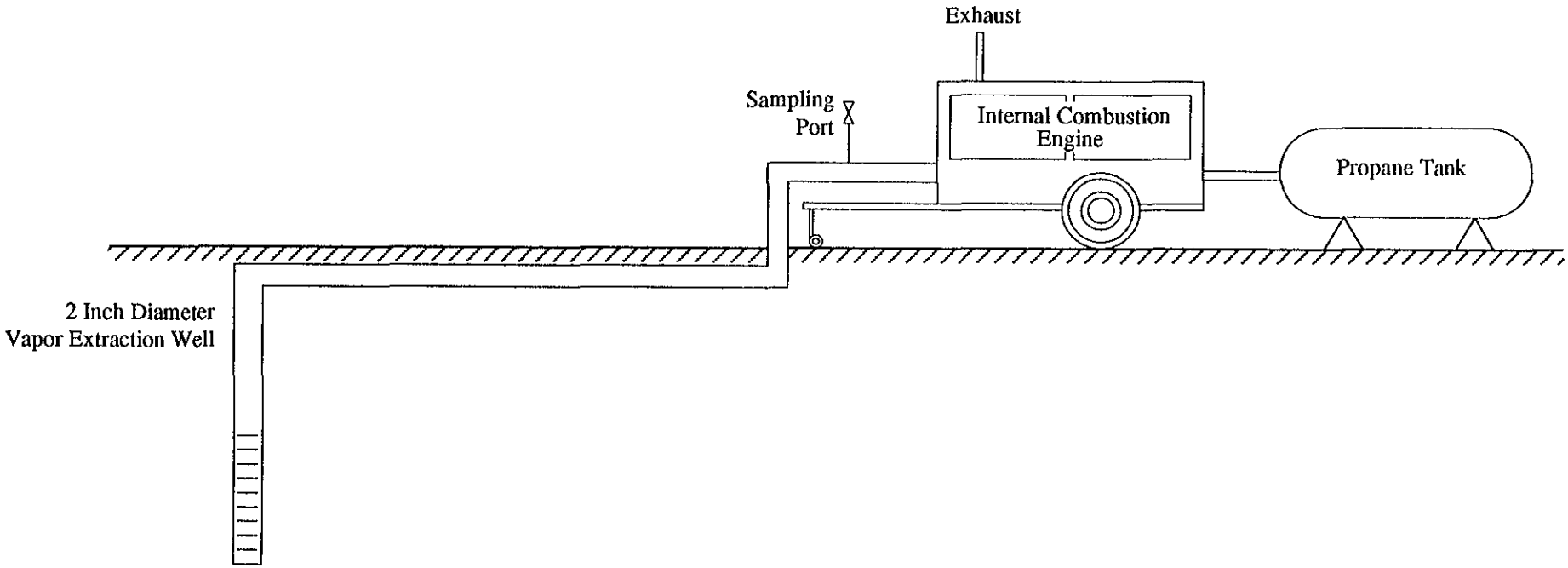
Approx. scale feet

**WELL LOCATION MAP**

KAPREALIAN ENGINEERING
INCORPORATED

**UNOCAL SERVICE STATION #2656**
**4251 EAST 14TH STREET**
**OAKLAND, CA LIFORNIA**

**FIGURE**
**1**



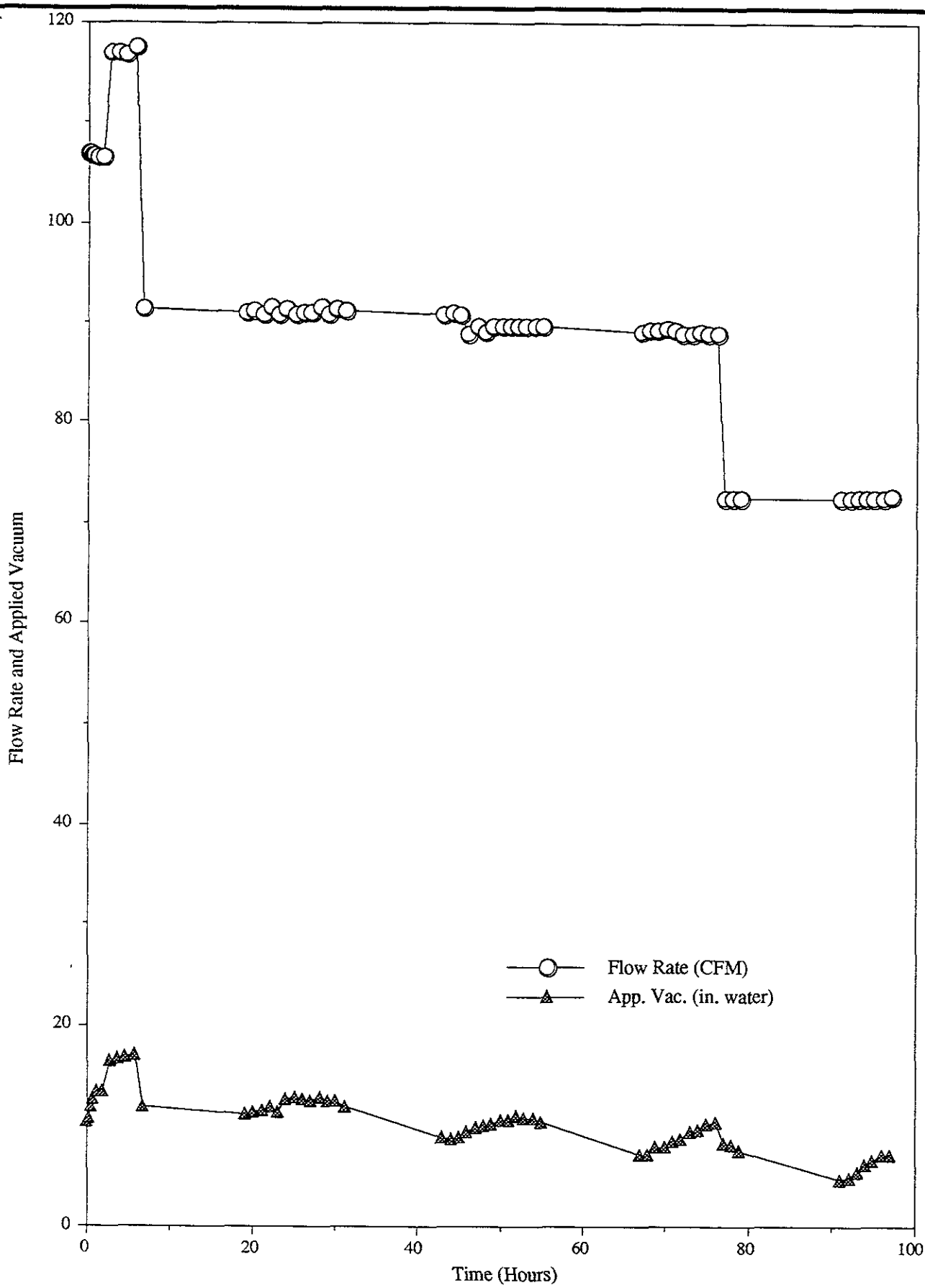

(NOT TO SCALE)

**PILOT VAPOR EXTRACTION TEST SYSTEM SCHEMATIC**

KAPREALIAN ENGINEERING INCORPORATED

**UNOCAL SERVICE STATION #2656**
**4251 EAST 14TH STREET**
**OAKLAND, CA**

FIGURE
**2**

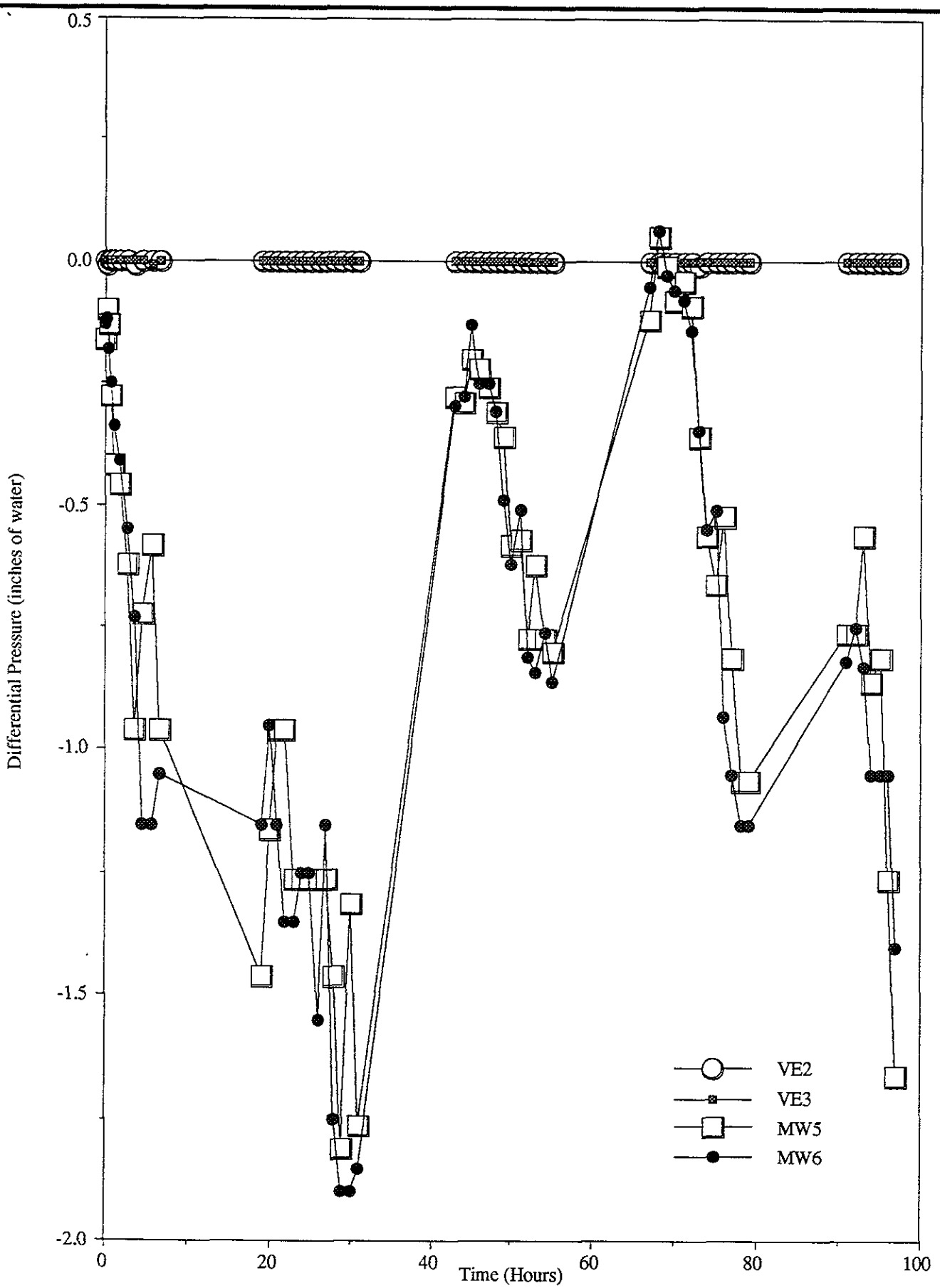



**APPLIED VACUUM AND FLOW RATE VERSUS TIME**

KAPREALIAN ENGINEERING
INCORPORATED

**UNOCAL SERVICE STATION #2656**
**4251 EAST 14TH STREET**
**OAKLAND, CALIFORNIA**

FIGURE
**3**

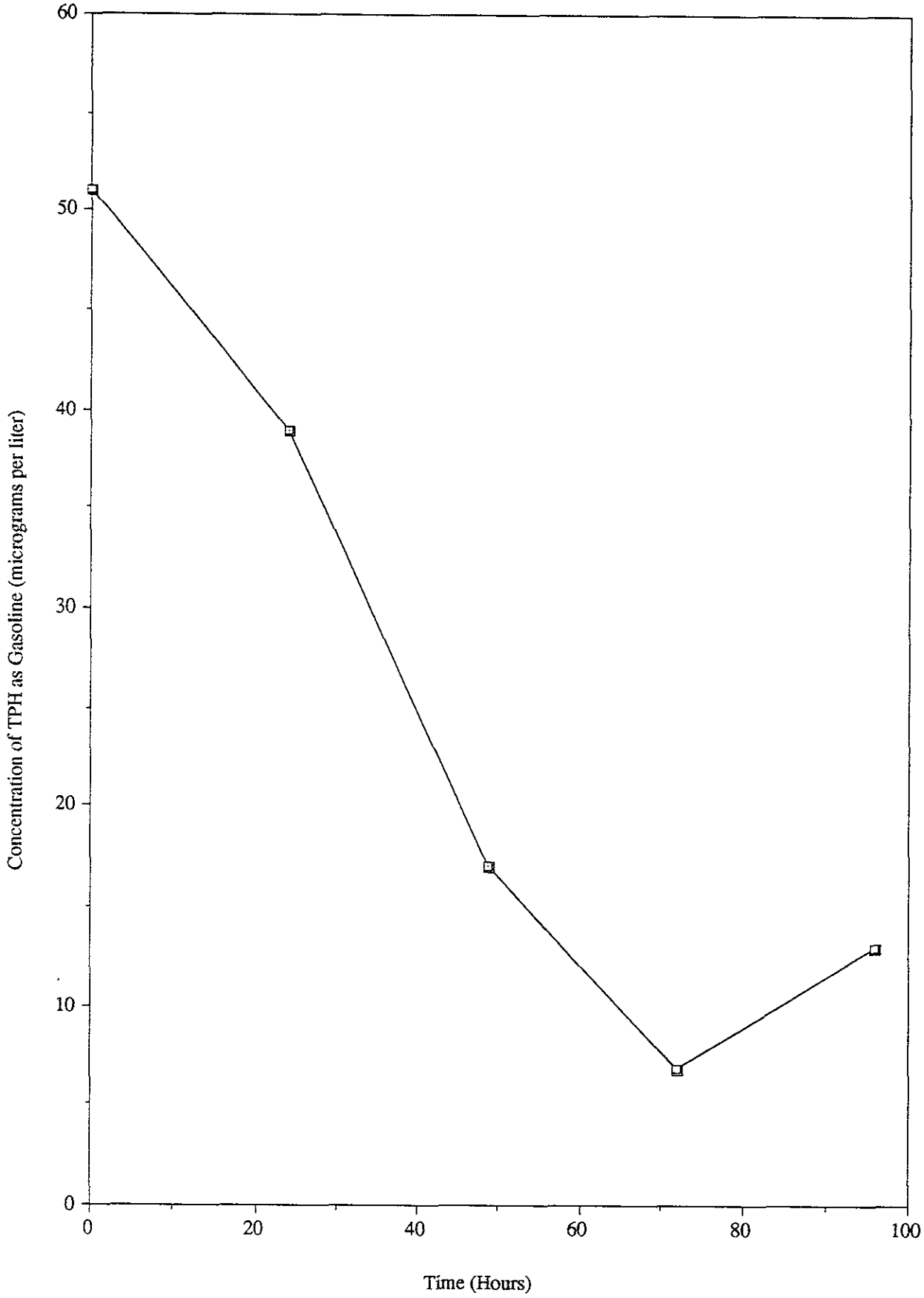



**DIFFERENTIAL PRESSURE MEASUREMENTS VERSUS TIME**

KAPREALIAN ENGINEERING
INCORPORATED

**UNOCAL SERVICE STATION #2656**
**4251 EAST 14TH STREET**
**OAKLAND, CALIFORNIA**

FIGURE
**4**

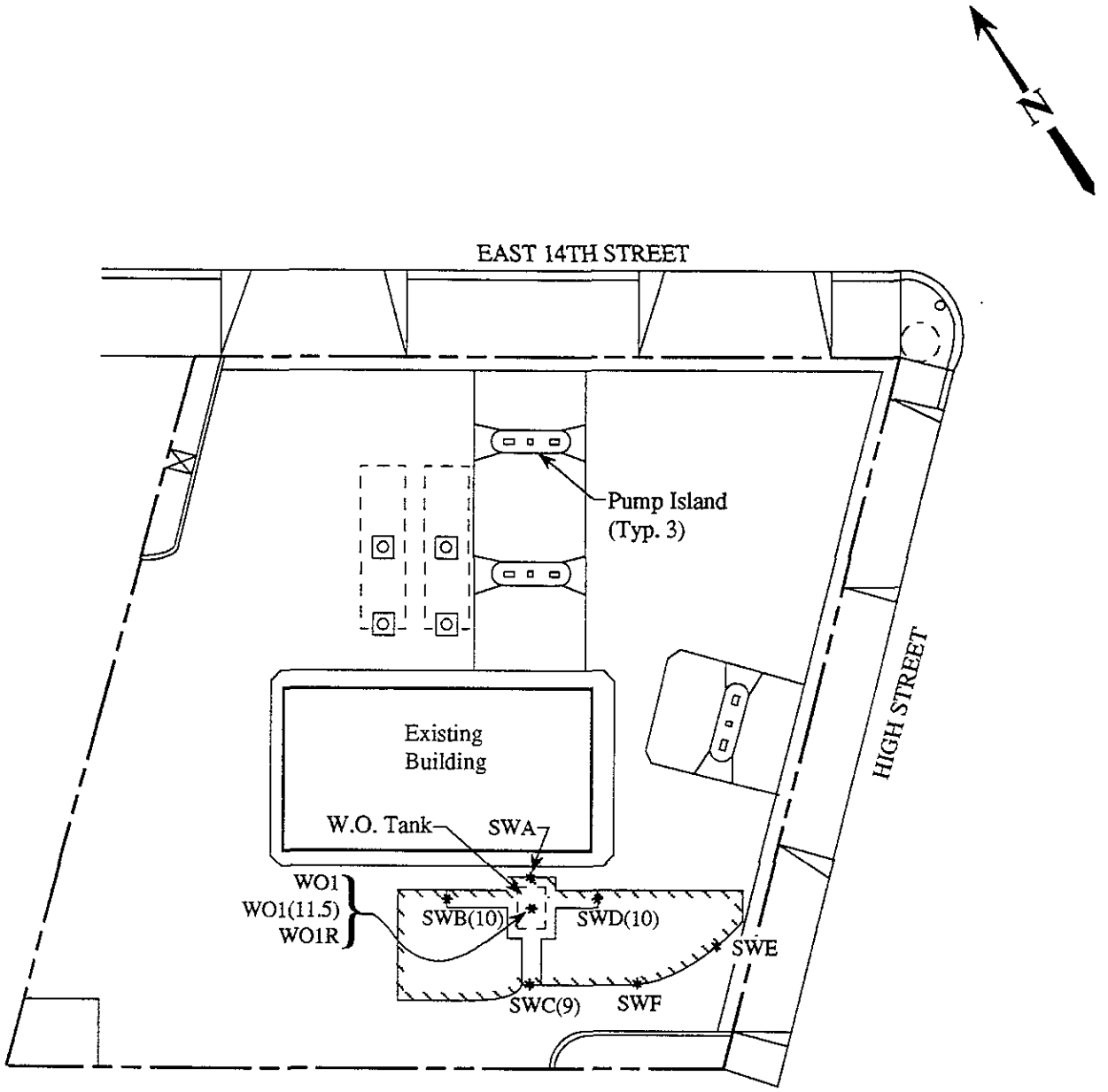



CONCENTRATIONS OF TPH AS GASOLINE EXTRACTED FROM VEI VERSUS TIME

KAPREALIAN ENGINEERING
INCORPORATED

UNOCAL SERVICE STATION #2656
4251 EAST 14TH STREET
OAKLAND, CALIFORNIA

FIGURE
5




LEGEND

* Sample Point Location

Area of Additional Excavation

0 30 60

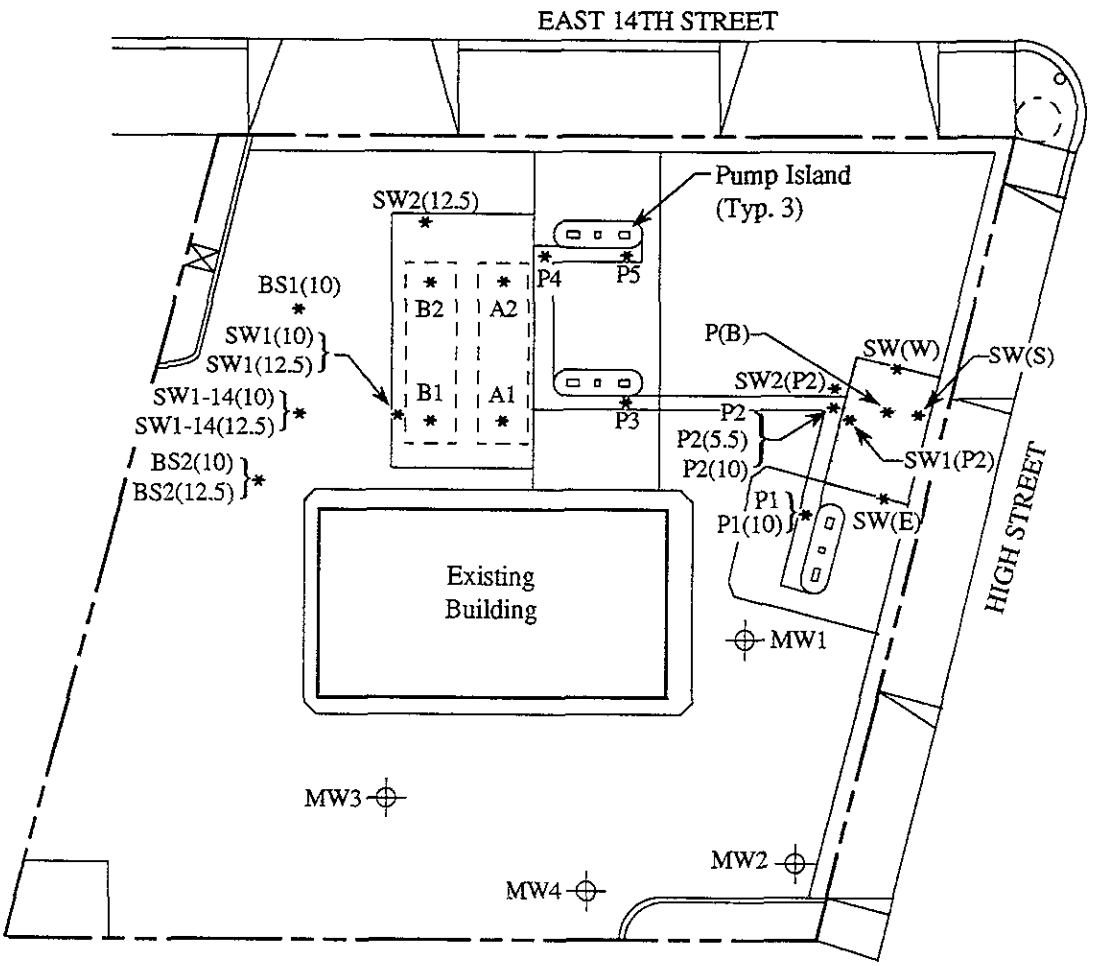
Approx. scale feet

**SOIL SAMPLE POINT LOCATION MAP**

KAPREALIAN ENGINEERING
INCORPORATED

**UNOCAL SERVICE STATION #2656**
**4251 EAST 14TH STREET**
**OAKLAND, CA**

FIGURE
**6**




LEGEND

- Monitoring well (existing)
- Sample point location
- Area of additional excavation

0 30 60

Approx. scale feet

**SOIL SAMPLE POINT LOCATION MAP**

KAPREALIAN ENGINEERING
INCORPORATED

**UNOCAL SERVICE STATION #2656**
**4251 EAST 14TH STREET**
**OAKLAND, CA**

FIGURE
**7**

# APPENDIX A

# BORING LOGS

KAPREALIAN ENGINEERING
INCORPORATED

| MAJOR DIVISIONS | | SYMBOLS | TYPICAL SOIL DESCRIPTIONS |
|---|---|---|---|
| GRAVELS (More than 1/2 of coarse fraction > No. 4 sieve size) | | GW | Well graded gravels or gravel - sand mixtures, little or no fines |
| | | GP | Poorly graded gravels or gravel - sand mixtures, little or no fines |
| | | GM | Silty gravels, gravel - sand - silt mixtures |
| | | GC | Clayey gravels, gravel - sand - clay mixtures |
| SANDS (More than 1/2 of coarse fraction < No. 4 sieve size) | | SW | Well graded sands or gravelly sands, little or no fines |
| | | SP | Poorly graded sands or gravelly sands, little or no fines |
| | | SM | Silty sands, sand - silt mixtures |
| | | SC | Clayey sands, sand - clay mixtures |
| SILTS & CLAYS LL < 50 | | ML | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity |
| | | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays |
| | | OL | Organic silts and organic silty clays of low plasticity |
| SILTS & CLAYS LL > 50 | | MH | Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts |
| | | CH | Inorganic clays of high plasticity, fat clays |
| | | OH | Organic clays of medium to high plasticity, organic silty clays, organic silts |
| HIGHLY ORGANIC SOILS | | Pt | Peat and other highly organic soils |
| DUAL (TRANSITION) SOILS | | | Soil characterisitics are transitional between the soil classifications listed above |

CLASSIFICATION CHART (Unified Soil Classification System)

# BORING LOG

| | | |
|---|---|---|
| **Project No.** KEI-P90-0102 | **Boring Diameter** 9" <br> **Casing Diameter** 2" | **Logged By** JGG <br> W.W. CEG 1633 |
| **Project Name** Unocal S/S #2656 <br> 4251 E. 14th Street, Oakland | **Well Cover Elevation** | **Date Drilled** 4/8/93 |
| **Boring No.** VE1 | **Drilling Method** Hollow-stem Auger | **Drilling Company** Great Sierra Exploration |

| O.V.M. (P.P.M.) | G.W. level | Penetration blows/6" | Depth (feet) Samples | Stratigraphy USCS | Description |
|---|---|---|---|---|---|
| | | | 0 | | Pea gravel (fill). |
| | | | | | Saturated - from rain? |
| | | | | ML | Clayey silt with sand, very stiff, moist, grayish brown (10YR 5/2), pores common, with iron oxide staining. |
| 0.0 | | 9/11/21 | 5 | | |
| 0.0 | | 9/13/20 | | GC | Clayey gravel, estimated at 35% sand, 15% clay, and trace silt, dense, moist, yellowish brown (10YR 5/4), gravel is subrounded to 3/4 inch in diameter. |
| 0.0 | | | | | Clayey gravel, as above. |
| | | 8/14/22 | 10 | | Clayey gravel with sand, estimated at 35% sand, 15% clay, and trace silt, dense, moist, greenish gray (5GY 5/1), gravel to 3/4 inch in diameter. |
| 355 | | | | CL | Clay, estimated at 10-20% fine-grained silt, 5% fine-grained sand, and trace gravel to 3/8 inch in diameter, hard, moist, pale brown (10YR 6/3) mottled with yellowish brown (10YR 5/4), trace caliche. |
| 0.2 | | 14/17/28 | | | |
| | | | | | TOTAL DEPTH 12.5' |
| | | | 15 | | |
| | | | 20 | | |

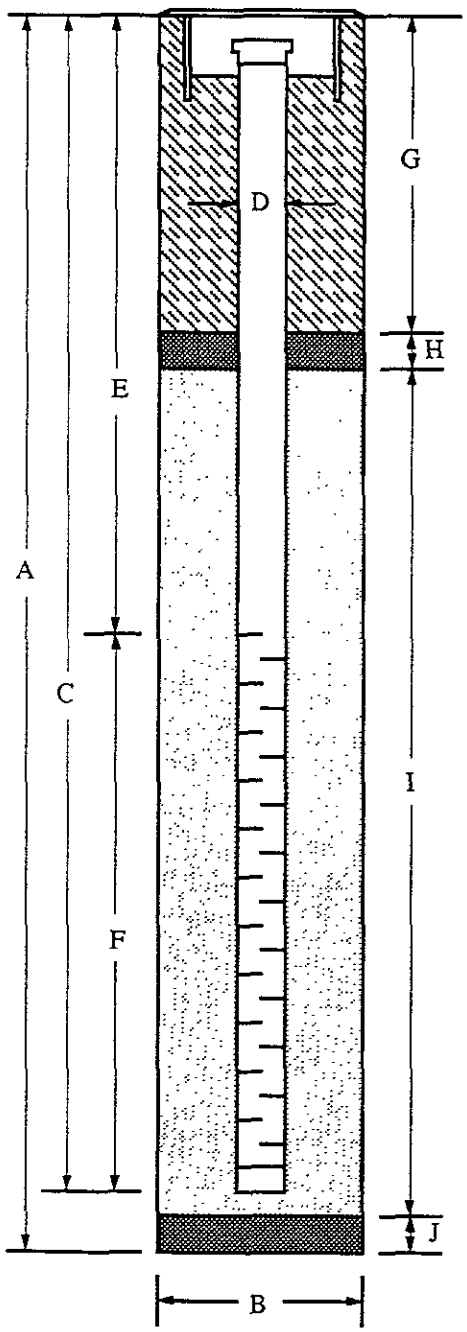
# WELL COMPLETION DIAGRAM

**PROJECT NAME:** Unocal #2656, 4251 E. 14th Street, Oakland **WELL NO.:** VE1

**PROJECT NUMBER:** KEI-P91-0102

**WELL PERMIT NO.:** 93140

Flush-mounted Well Cover




A. Total Depth : 12.5'

B. Boring Diameter: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 11.5'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375"

ID = 2.067"

E. Depth to Perforations: 3.5'

F. Perforated Length: 8.0'

Perforation Type: Machined Slot

Perforation Size: 0.010"

G. Surface Seal: 1.5'

Seal Material: Neat Cement

H. Seal: 1'

Seal Material: Bentonite

I. Filter Pack: 8.0'

Pack Material: Peagravel

Size: 3/8"

J. Bottom Seal: 1'

Seal Material: Bentonite

# BORING LOG

| | | |
|---|---|---|
| **Project No.** KEI-P90-0102 | **Boring Diameter** 9" <br> **Casing Diameter** 2" | **Logged By** W.W. JGG CEG 1633 |
| **Project Name** Unocal S/S #2656 <br> 4251 E. 14th Street, Oakland | **Well Cover Elevation** | **Date Drilled** 4/8/93 |
| **Boring No.** VE2 | **Drilling Method** Hollow-stem Auger | **Drilling Company** Great Sierra Exploration |

| O.V.M. (P.P.M.) | G.W. level | Penetration blows/6" | Depth (feet) Samples | Stratigraphy USCS | Description |
|---|---|---|---|---|---|
| | | | 0 | | Pea gravel (fill). |
| | | | | ML | Clayey silt with gravel, estimated at 15-20% gravel to 1/2 inch in diameter, 15% clay, and 5-10% sand, very stiff, moist, very dark gray (10YR 3/1). |
| 0.0 | | 4/6/11 | 5 | | |
| 0.0 | | 11/17/21 | | GC | Clayey gravel, estimated at 20-25% sand and 15-20% clay, medium dense, moist, yellowish brown (10YR 5/4), gravel is subrounded to 1 inch in diameter. |
| 0.0 | | 13/21/35 | 10 | | Clayey gravel, estimated at 30% sand and 15% clay, very dense, moist, yellowish brown (10YR 5/4), gravel to 1 inch in diameter. |
| 335 | | | | | Clayey gravel, estimated at 30% sand and 15% clay, dense, very moist, grayish green (5GY 5/1), gravel to 1-1/4 inches in diameter. |
| 0.0 | | 11/20 | | SC | Clayey sand, estimated at 40% clay and 5% gravel to 3/8 inch in diameter, dense, moist, yellowish brown (10YR 5/4). |
| | | | 15 | | TOTAL DEPTH 12' |
| | | | 20 | | |

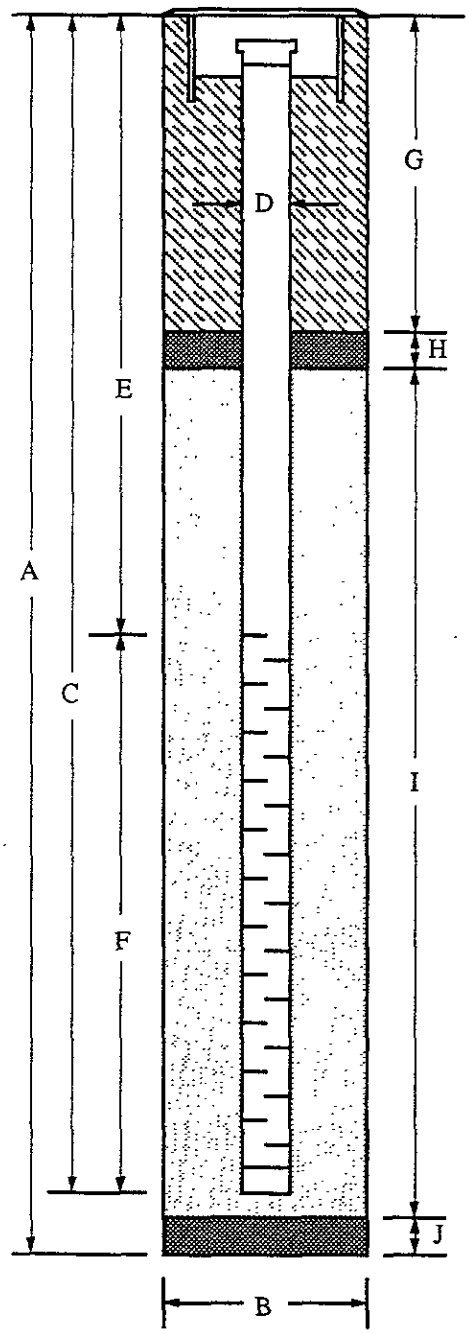
# WELL COMPLETION DIAGRAM

**PROJECT NAME:** Unocal #2656, 4251 E. 14th Street, Oakland **WELL NO.:** VE2

**PROJECT NUMBER:** KEI-P90-0102

**WELL PERMIT NO.:** 93140

Flush-mounted Well Cover




A. Total Depth : 12'

B. Boring Diameter: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 12'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375"

ID = 2.067"

E. Depth to Perforations: 3.5'

F. Perforated Length: 8.5'

Perforation Type: Machined Slot

Perforation Size: 0.010"

G. Surface Seal: 1.5'

Seal Material: Neat Cement

H. Seal: 1'

Seal Material: Bentonite

I. Filter Pack: 8.5'

Pack Material: Peagravel

Size: 3/8"

J. Bottom Seal: none

Seal Material: N/A

# BORING LOG

| | | |
|---|---|---|
| **Project No.** KEI-P90-0102 | **Boring Diameter** 9" / **Casing Diameter** 2" | **Logged By** W.W. |
| **Project Name** Unocal S/S #2656 4251 E. 14th Street, Oakland | **Well Cover Elevation** | **Date Drilled** 4/8/93 |
| **Boring No.** VE3 | **Drilling Method** Hollow-stem Auger | **Drilling Company** Great Sierra Exploration |

| O.V.M. (P.P.M.) | G.W. level | Penetration blows/6" | Depth (feet) Samples | Stratigraphy USCS | Description |
|---|---|---|---|---|---|
| | | | 0 | | Pre set 24 inch Kristy box. |
| | | | | | 3/4 inch river gravel (fill). (Excavated out during trenching and Kristy setting for VE system.) |
| 0.0 | | | 5 | GC | Clayey gravel with sand and silt, estimated at 15-20% clay, 15-20% sand, and 15% silt, very moist, grayish brown (2.5Y 5/2) changing to yellowish brown (10YR 5/4) below 5 feet, gravel is subrounded to 1-1/2 inches in diameter. |
| 0.0 | | | | | Clayey gravel, as above, except trace gravel to 4 inches in diameter, moist. |
| 0.0 | | | 10 | | Clayey gravel, estimated at 30-35% sand, 10-15% clay, and 5% silt, moist, yellowish brown (10YR 5/4), gravel is subrounded to 1 inch in diameter. |
| | | | | | TOTAL DEPTH 11' |
| | | | 15 | | |
| | | | 20 | | |

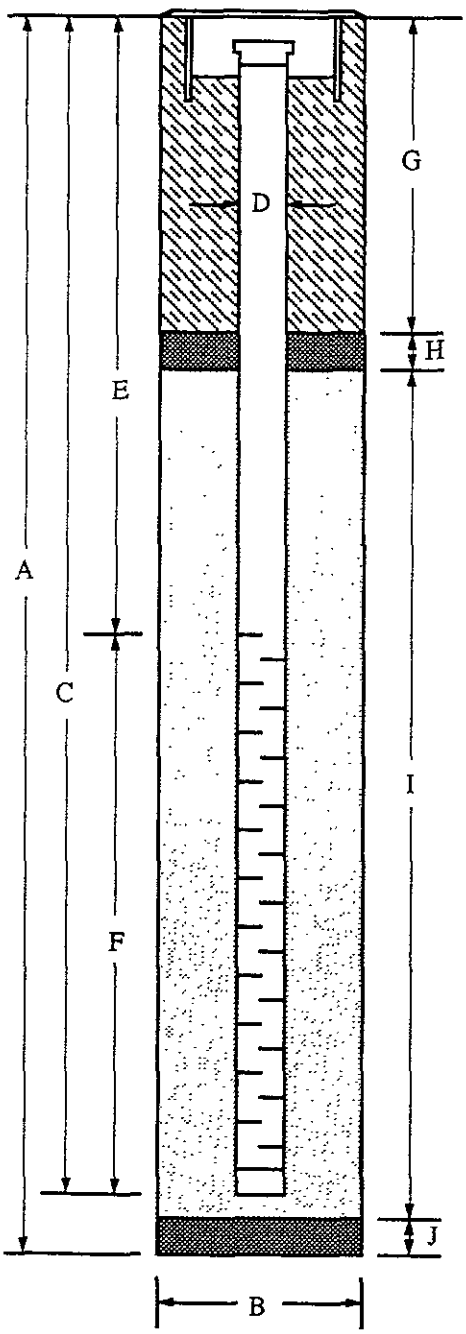
# WELL COMPLETION DIAGRAM

**PROJECT NAME:** Unocal #2656, 4251 E. 14th Street, Oakland **WELL NO.:** VE3

**PROJECT NUMBER:** KEI-P90-0102

**WELL PERMIT NO.:** 93140

Flush-mounted Well Cover




A. Total Depth : 11'

B. Boring Diameter: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 11'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375"

ID = 2.067"

E. Depth to Perforations: 3.5'

F. Perforated Length: 7.5'

Perforation Type: Machined Slot

Perforation Size: 0.010"

G. Surface Seal: 1.5'

Seal Material: Neat Cement

H. Seal: 1'

Seal Material: Bentonite

I. Filter Pack: 7.5'

Pack Material: Peagravel

Size: 3/8"

J. Bottom Seal: none

Seal Material: N/A

# APPENDIX B

# VAPOR EXTRACTION TEST FIELD MEASUREMENTS

Former Unocal S/S #2656
4251 E. 14th Street
Oakland, California


Vapor Extraction Well, VE1
Date: 4/26/93 to 4/30/93
Vapor Extraction Test Data

| Date | Field Time | Test Time | Vacuum Influence Data (inches of water) VE2 | VE3 | MW5 | MW6 |
|---|---|---|---|---|---|---|
| 4/26/93 | 12:00:00 | 0:00:00 | N/A | N/A | N/A | N/A |
| | 12:15:00 | 0:15:00 | 0.00 | 0.00 | -0.10 | -0.12 |
| | 12:30:00 | 0:30:00 | 0.00 | 0.00 | -0.13 | -0.18 |
| | 12:45:00 | 0:45:00 | 0.00 | 0.00 | -0.28 | -0.25 |
| | 13:15:00 | 1:15:00 | 0.00 | 0.00 | -0.42 | -0.34 |
| | 13:45:00 | 1:45:00 | 0.00 | 0.00 | -0.46 | -0.41 |
| | 14:45:00 | 2:45:00 | 0.00 | 0.00 | -0.62 | -0.55 |
| | 15:45:00 | 3:45:00 | -0.01 | 0.00 | -0.96 | -0.73 |
| | 16:45:00 | 4:45:00 | 0.00 | 0.00 | -0.72 | -1.15 |
| | 17:45:00 | 5:45:00 | 0.00 | -0.01 | -0.58 | -1.15 |
| | 18:45:00 | 6:45:00 | 0.00 | 0.00 | -0.96 | -1.05 |
| 4/27/93 | 7:00:00 | 19:00:00 | 0.00 | 0.00 | -1.46 | -1.15 |
| | 8:00:00 | 20:00:00 | 0.00 | 0.00 | -1.16 | -0.95 |
| | 9:00:00 | 21:00:00 | 0.00 | 0.00 | -0.96 | -1.15 |
| | 10:00:00 | 22:00:00 | 0.00 | 0.00 | -0.96 | -1.35 |
| | 11:00:00 | 23:00:00 | 0.00 | 0.00 | -1.26 | -1.35 |
| | 12:00:00 | 24:00:00 | 0.00 | 0.00 | -1.26 | -1.25 |
| | 13:00:00 | 25:00:00 | 0.00 | 0.00 | -1.26 | -1.25 |
| | 14:00:00 | 26:00:00 | 0.00 | 0.00 | -1.26 | -1.55 |
| | 15:00:00 | 27:00:00 | 0.00 | 0.00 | -1.26 | -1.15 |
| | 16:00:00 | 28:00:00 | 0.00 | 0.00 | -1.46 | -1.75 |
| | 17:00:00 | 29:00:00 | 0.00 | 0.00 | -1.81 | -1.90 |
| | 18:00:00 | 30:00:00 | 0.00 | 0.00 | -1.31 | -1.90 |
| | 19:00:00 | 31:00:00 | 0.00 | 0.00 | -1.76 | -1.85 |

Former Unocal S/S #2656
4251 E. 14th Street
Oakland, California


Vapor Extraction Well, VE1
Date: 4/26/93 to 4/30/93
Vapor Extraction Test Data

| Date | Field Time | Test Time | Vacuum Influence Data (inches of water) VE2 | VE3 | MW5 | MW6 |
|---|---|---|---|---|---|---|
| 4/28/93 | 7:00:00 | 43:00:00 | 0.00 | 0.00 | -0.28 | -0.30 |
| | 8:00:00 | 44:00:00 | 0.00 | 0.00 | -0.29 | -0.28 |
| | 9:00:00 | 45:00:00 | 0.00 | 0.00 | -0.20 | -0.13 |
| | 10:00:00 | 46:00:00 | 0.00 | 0.00 | -0.22 | -0.25 |
| | 11:00:00 | 47:00:00 | 0.00 | 0.00 | -0.26 | -0.25 |
| | 12:00:00 | 48:00:00 | 0.00 | 0.00 | -0.31 | -0.31 |
| | 13:00:00 | 49:00:00 | 0.00 | 0.00 | -0.36 | -0.49 |
| | 14:00:00 | 50:00:00 | 0.00 | 0.00 | -0.58 | -0.62 |
| | 15:00:00 | 51:00:00 | 0.00 | 0.00 | -0.57 | -0.51 |
| | 16:00:00 | 52:00:00 | 0.00 | 0.00 | -0.77 | -0.81 |
| | 17:00:00 | 53:00:00 | 0.00 | 0.00 | -0.62 | -0.84 |
| | 18:00:00 | 54:00:00 | 0.00 | 0.00 | -0.77 | -0.76 |
| | 19:00:00 | 55:00:00 | 0.00 | 0.00 | -0.80 | -0.86 |
| 4/29/93 | 7:00:00 | 67:00:00 | 0.00 | 0.00 | -0.12 | -0.05 |
| | 8:00:00 | 68:00:00 | 0.00 | 0.00 | 0.05 | 0.06 |
| | 9:00:00 | 69:00:00 | 0.00 | 0.00 | -0.01 | -0.03 |
| | 10:00:00 | 70:00:00 | 0.00 | 0.00 | -0.08 | -0.06 |
| | 11:00:00 | 71:00:00 | 0.00 | 0.00 | -0.04 | -0.08 |
| | 12:00:00 | 72:00:00 | 0.00 | 0.00 | -0.09 | -0.14 |
| | 13:00:00 | 73:00:00 | -0.01 | 0.00 | -0.36 | -0.35 |
| | 14:00:00 | 74:00:00 | 0.00 | 0.00 | -0.56 | -0.55 |
| | 15:00:00 | 75:00:00 | 0.00 | 0.00 | -0.66 | -0.51 |
| | 16:00:00 | 76:00:00 | 0.00 | 0.00 | -0.52 | -0.93 |
| | 17:00:00 | 77:00:00 | 0.00 | 0.00 | -0.81 | -1.05 |
| | 18:00:00 | 78:00:00 | 0.00 | 0.00 | -1.06 | -1.15 |
| | 19:00:00 | 79:00:00 | 0.00 | 0.00 | -1.06 | -1.15 |
| 4/30/93 | 7:00:00 | 91:00:00 | 0.00 | 0.00 | -0.76 | -0.82 |
| | 8:00:00 | 92:00:00 | 0.00 | 0.00 | -0.76 | -0.75 |
| | 9:00:00 | 93:00:00 | 0.00 | 0.00 | -0.56 | -0.83 |
| | 10:00:00 | 94:00:00 | 0.00 | 0.00 | -0.86 | -1.05 |
| | 11:00:00 | 95:00:00 | 0.00 | 0.00 | -0.81 | -1.05 |
| | 12:00:00 | 96:00:00 | 0.00 | 0.00 | -1.26 | -1.05 |
| | 13:00:00 | 97:00:00 | 0.00 | 0.00 | -1.66 | -1.40 |

# SEQUOIA ANALYTICAL

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


| | | | | | |
|---|---|---|---|---|---|
| Kaprealian Engineering, Inc. | Client Project ID: | Unocal #2656, 4251 E. 14th St., Oakland | Sampled: | Apr 26, 1993 |
| 2401 Stanwell Dr., Ste. 400 | Sample Matrix: | Air | Received: | Apr 27, 1993 |
| Concord, CA 94520 | Analysis Method: | EPA 5030/8015/8020 | Reported: | May 3, 1993 |
| Attention: Mardo Kaprealian, P.E. | First Sample #: | 304-1138 | | |

## TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

| Analyte | Reporting Limit µg/L | Sample I.D. 304-1138 Inf 1 | Sample I.D. 304-1139 Eff 1 | Sample I.D. Matrix Blank |
|---|---|---|---|---|
| Purgeable Hydrocarbons | 5.0 | 51 | 5.8 | |
| Benzene | 0.05 | 0.47 | 0.80 | |
| Toluene | 0.05 | 0.84 | 0.10 | |
| Ethyl Benzene | 0.05 | 0.87 | 0.089 | |
| Total Xylenes | 0.05 | 4.5 | 0.67 | |
| Chromatogram Pattern: | | Gasoline | Gasoline | |

**Quality Control Data**

| | | | |
|---|---|---|---|
| Report Limit Multiplication Factor: | 1.0 | 1.0 | 1.0 |
| Date Analyzed: | 4/28/93 | 4/28/93 | 4/28/93 |
| Instrument Identification: | HP-2 | HP-2 | HP-2 |
| Surrogate Recovery, %: (QC Limits = 70-130%) | 124 | 101 | 101 |

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

Client Project ID: Unocal #2656, 4251 E. 14th St., Oakland
Matrix: Water
QC Sample Group 3041138-39

Reported: May 3, 1993

## QUALITY CONTROL DATA REPORT

| ANALYTE | Benzene | Toluene | Ethyl-Benzene | Xylenes |
|---|---|---|---|---|
| **Method:** | EPA 8020 | EPA 8020 | EPA 8020 | EPA 8020 |
| **Analyst:** | J.F. | J.F. | J.F. | J.F. |
| **Conc. Spiked:** | 20 | 20 | 20 | 60 |
| **Units:** | µg/L | µg/L | µg/L | µg/L |
| **LCS Batch#:** | 1LCS042893 | 1LCS042893 | 1LCS042893 | 1LCS042893 |
| **Date Prepared:** | 4/28/93 | 4/28/93 | 4/28/93 | 4/28/93 |
| **Date Analyzed:** | 4/28/93 | 4/28/93 | 4/28/93 | 4/28/93 |
| **Instrument I.D.#:** | HP-2 | HP-2 | HP-2 | HP-2 |
| **LCS % Recovery:** | 102 | 100 | 100 | 106 |
| **Control Limits:** | 70-130% | 70-130% | 70-130% | 70-130% |
| **MS/MSD Batch #:** | 3041163 | 3041163 | 3041163 | 3041163 |
| **Date Prepared:** | 4/28/93 | 4/28/93 | 4/28/93 | 4/28/93 |
| **Date Analyzed:** | 4/28/93 | 4/28/93 | 4/28/93 | 4/28/93 |
| **Instrument I.D.#:** | HP-2 | HP-2 | HP-2 | HP-2 |
| **Matrix Spike % Recovery:** | 100 | 100 | 100 | 107 |
| **Matrix Spike Duplicate % Recovery:** | 105 | 100 | 100 | 108 |
| **Relative % Difference:** | 4.9 | 0.0 | 0.0 | 1.0 |

SEQUOIA ANALYTICAL

Scott A. Chiello
Project Manager

Please Note:

The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation and analytical methods employed for the samples. The LCS % recovery data is used for validation of sample batch results. Due to matrix effects, the QC limits for MS/MSD's are advisory only and are not used to accept or reject batch results.

KAPREALIAN ENGINEERING
INCORPORATED

# CHAIN OF CUSTODY

SAMPLER: C. Giddings
WITNESSING AGENCY:

SITE NAME & ADDRESS: Unocal #7656/Oakland
4751 E. 14th St.

ANALYSES REQUESTED: EPA 8010 | TPH/BTEX

TURN AROUND TIME: Regular

| SAMPLE ID NO. | DATE | TIME | SOIL | AIR / WATER | GRAB | COMP | NO. OF CONT. | SAMPLING LOCATION | EPA 8010 | TPH/BTEX | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inf 1 | 4/26/93 | 13:00 | | ✓ | | | | | ✓ | ✓ | 3041138 |
| Eff 1 | 4/26/93 | 13:00 | | ✓ | | | | | ✓ | ✓ | ↓ 1139 |
| | | | | | | | | | | | |
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| | | | | | | | | | | | |

| Relinquished by: (Signature) | Date/Time | Received by: (Signature) |
|---|---|---|
| [signature] | 4/26/93 16.50 | [signature] |
| Relinquished by: (Signature) [signature] | Date/Time 4/27/93 1100 | Received by: (Signature) [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? N/A
4. Were samples in appropriate containers and properly packaged? Y

EV — Signature
FS — Title
4/27/93 — Date

2401 Stanwell Drive, Suite 400
Concord, California 94520
Tel: 510 602 5100 Fax: 510 687 0602

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(510) 686-9600 • FAX (510) 686-9689

| | | | | | |
|---|---|---|---|---|---|
| Kaprealian Engineering, Inc. | Client Project ID: | Unocal #2656, 4251 E. 14th St., Oakland | Sampled: | 4/27-4/29/93 |
| 2401 Stanwell Dr., Ste. 400 | Sample Matrix: | Air | Received: | Apr 29, 1993 |
| Concord, CA 94520 | Analysis Method: | EPA 5030/8015/8020 | Reported: | May 4, 1993 |
| Attention: Mardo Kaprealian, P.E. | First Sample #: | 304-1284 | | |

## TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

| Analyte | Reporting Limit µg/L | Sample I.D. 304-1284 Inf. 2 | Sample I.D. 304-1285 Inf. 3 | Sample I.D. 304-1286 Inf. 4 | Sample I.D. Matrix Blank |
|---|---|---|---|---|---|
| Purgeable Hydrocarbons | 5.0 | 39 | 17 | 6.8 | |
| Benzene | 0.050 | 0.18 | 0.10 | 0.077 | |
| Toluene | 0.050 | 0.51 | 0.20 | 0.080 | |
| Ethyl Benzene | 0.050 | 0.59 | 0.26 | 0.10 | |
| Total Xylenes | 0.050 | 2.7 | 1.2 | 0.57 | |
| Chromatogram Pattern: | | Gasoline | Gasoline | Gasoline | |

**Quality Control Data**

| | | | | |
|---|---|---|---|---|
| Report Limit Multiplication Factor: | 1.0 | 1.0 | 1.0 | 1.0 |
| Date Analyzed: | 4/29/93 | 4/29/93 | 4/29/93 | 4/29/93 |
| Instrument Identification: | HP-2 | HP-2 | HP-2 | HP-2 |
| Surrogate Recovery, %: (QC Limits = 70-130%) | 111 | 109 | 99 | 99 |

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

Client Project ID: Unocal #2656, 4251 E. 14th St., Oakland
Matrix: Water
QC Sample Group 3041284-86

Reported: May 4, 1993

## QUALITY CONTROL DATA REPORT

| ANALYTE | Benzene | Toluene | Ethyl-Benzene | Xylenes |
|---|---|---|---|---|
| **Method:** | EPA 8020 | EPA 8020 | EPA 8020 | EPA 8020 |
| **Analyst:** | J.F. | J.F. | J.F. | J.F. |
| **Conc. Spiked:** | 20 | 20 | 20 | 60 |
| **Units:** | µg/L | µg/L | µg/L | µg/L |
| **LCS Batch#:** | 1LCS042993 | 1LCS042993 | 1LCS042993 | 1LCS042993 |
| **Date Prepared:** | 4/29/93 | 4/29/93 | 4/29/93 | 4/29/93 |
| **Date Analyzed:** | 4/29/93 | 4/29/93 | 4/29/93 | 4/29/93 |
| **Instrument I.D.#:** | HP-2 | HP-2 | HP-2 | HP-2 |
| **LCS % Recovery:** | 92 | 100 | 103 | 110 |
| **Control Limits:** | 70-130 | 70-130 | 70-130 | 70-130 |
| **MS/MSD Batch #:** | 3041201 | 3041201 | 3041201 | 3041201 |
| **Date Prepared:** | 4/29/93 | 4/29/93 | 4/29/93 | 4/29/93 |
| **Date Analyzed:** | 4/29/93 | 4/29/93 | 4/29/93 | 4/29/93 |
| **Instrument I.D.#:** | HP-2 | HP-2 | HP-2 | HP-2 |
| **Matrix Spike % Recovery:** | 95 | 105 | 105 | 115 |
| **Matrix Spike Duplicate % Recovery:** | 95 | 105 | 105 | 115 |
| **Relative % Difference:** | 0.0 | 0.0 | 0.0 | 0.0 |

SEQUOIA ANALYTICAL

Scott A. Chierici
Project Manager

Please Note:

The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation and analytical methods employed for the samples. The LCS % recovery data is used for validation of sample batch results. Due to matrix effects, the QC limits for MS/MSD's are advisory only and are not used to accept or reject batch results.

KAPREALIAN ENGINEERING
INCORPORATED

# CHAIN OF CUSTODY

SAMPLER: T. Giddings
WITNESSING AGENCY:
SITE NAME & ADDRESS: Unocal 2656 / Oakland
1351 E. 14th St

ANALYSES REQUESTED: TPH-G, BTEX

TURN AROUND TIME: Regular

| SAMPLE ID NO. | DATE | TIME | AIR / SOIL | WATER | GRAB | COMP | NO. OF CONT. | SAMPLING LOCATION | TPH-G | BTEX | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inf. 2 | 4/27 | 13:00 | ✓ | | | | | | ✓ | ✓ | 3041284 |
| Inf. 3 | 4/28 | 13:45 | ✓ | | | | | | ✓ | ✓ | 1285 |
| Inf. 4 | 4/29 | 13:00 | ✓ | | | | | | ✓ | ✓ | 1286 |
| | | | | | | | | | | | |
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| | | |
|---|---|---|
| Relinquished by: (Signature) | Date/Time 4/29 15:30 | Received by: (Signature) |
| 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? N/A
4. Were samples in appropriate containers and properly packaged? Y

Signature: SV  Title: FS  Date: 4/29/93

2401 Stanwell Drive, Suite 400
Concord, California 94520
Tel 510 602 5100 Fax 510 687 0602

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1900 Bates Avenue • Suite LM • Concord, California 94520
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| | | | | |
|---|---|---|---|---|
| Kaprealian Engineering, Inc. | Client Project ID: | Unocal #2656, 4251 E. 14th St., Oakland | Sampled: | Apr 30, 1993 |
| 2401 Stanwell Dr., Ste. 400 | Sample Matrix: | Air | Received: | Apr 30, 1993 |
| Concord, CA 94520 | Analysis Method: | EPA 5030/8015/8020 | Reported: | May 7, 1993 |
| Attention: Mardo Kaprealian, P.E. | First Sample #: | 304-1314 | | |

## TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

| Analyte | Reporting Limit µg/L | Sample I.D. 304-1314 Inf 5 | Sample I.D. 304-1315 Eff 5 | Sample I.D. Matrix Blank |
|---|---|---|---|---|
| Purgeable Hydrocarbons | 5.0 | 13 | N.D. | |
| Benzene | 0.050 | 0.10 | 0.83 | |
| Toluene | 0.050 | 0.22 | 0.15 | |
| Ethyl Benzene | 0.050 | 0.26 | N.D. | |
| Total Xylenes | 0.050 | 1.2 | 0.17 | |
| Chromatogram Pattern: | | Gasoline | -- | |

**Quality Control Data**

| | | | |
|---|---|---|---|
| Report Limit Multiplication Factor: | 1.0 | 1.0 | 1.0 |
| Date Analyzed: | 4/30/93 | 4/30/93 | 4/30/93 |
| Instrument Identification: | HP-5 | HP-5 | HP-5 |
| Surrogate Recovery, %: (QC Limits = 70-130%) | 109 | 106 | 106 |

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.
2401 Stanwell Dr., Ste. 400
Concord, CA 94520
Attention: Mardo Kaprealian, P.E.

Client Project ID: Unocal #2656, 4251 E. 14th St., Oakland
Matrix: Water
QC Sample Group 3041314-15

Reported: May 7, 1993

## QUALITY CONTROL DATA REPORT

| ANALYTE | Benzene | Toluene | Ethyl-Benzene | Xylenes |
|---|---|---|---|---|
| **Method:** | EPA 8020 | EPA 8020 | EPA 8020 | EPA 8020 |
| **Analyst:** | J.F. | J.F. | J.F. | J.F. |
| **Conc. Spiked:** | 20 | 20 | 20 | 60 |
| **Units:** | µg/L | µg/L | µg/L | µg/L |
| **LCS Batch#:** | 3LCS043093 | 3LCS043093 | 3LCS043093 | 3LCS043093 |
| **Date Prepared:** | 4/30/93 | 4/30/93 | 4/30/93 | 4/30/93 |
| **Date Analyzed:** | 4/30/93 | 4/30/93 | 4/30/93 | 4/30/93 |
| **Instrument I.D.#:** | HP-5 | HP-5 | HP-5 | HP-5 |
| **LCS % Recovery:** | 116 | 112 | 110 | 115 |
| **Control Limits:** | 70-130% | 70-130% | 70-130% | 70-130% |
| **MS/MSD Batch #:** | 3041235 | 3041235 | 3041235 | 3041235 |
| **Date Prepared:** | 4/30/93 | 4/30/93 | 4/30/93 | 4/30/93 |
| **Date Analyzed:** | 4/30/93 | 4/30/93 | 4/30/93 | 4/30/93 |
| **Instrument I.D.#:** | HP-5 | HP-5 | HP-5 | HP-5 |
| **Matrix Spike % Recovery:** | 120 | 120 | 115 | 122 |
| **Matrix Spike Duplicate % Recovery:** | 120 | 115 | 110 | 118 |
| **Relative % Difference:** | 0.0 | 4.2 | 4.4 | 3.3 |

SEQUOIA ANALYTICAL

Scott A. Chieffo
Project Manager

Please Note:

The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation and analytical methods employed for the samples. The LCS % recovery data is used for validation of sample batch results. Due to matrix effects, the QC limits for MS/MSD's are advisory only and are not used to accept or reject batch results.

KAPREALIAN ENGINEERING
INCORPORATED

# CHAIN OF CUSTODY

SAMPLER: T. Gibbings
WITNESSING AGENCY:
SITE NAME & ADDRESS: Unocal # 2656 / Oakland
4751 E. 14th St.

ANALYSES REQUESTED: TPH Gas (8015 Mod.) / BTEX (8020)

TURN AROUND TIME: Regular

| SAMPLE ID NO. | DATE | TIME | Air ~~Soil~~ | WATER | GRAB | COMP | NO. OF CONT. | SAMPLING LOCATION | TPH Gas (8015 Mod.) | BTEX (8020) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| INF 5 | 4/30/93 | 13:00 | ✓ | | | | | | ✓ | ✓ | 30413I4 |
| EFF 5 | " | 13:00 | ✓ | | | | | | ✓ | ✓ | 3041315 |
| | | | | | | | | | | | |
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| | | |
|---|---|---|
| Relinquished by: (Signature) | Date/Time 4/30/93 1715 ~~DST~~ | Received by: (Signature) |
| 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? 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

Signature — Analyst (Title) — 4/30/93 (Date)

2401 Stanwell Drive, Suite 400
Concord, California 94520
Tel: 510 602 5100 Fax 510 687 0602

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


| | | | | |
|---|---|---|---|---|
| Kaprealian Engineering, Inc. | Client Project ID: | Unocal #2656, E 14th St., Oakland | Sampled: | Apr 8, 1993 |
| 2401 Stanwell Dr., Ste. 400 | Sample Matrix: | Soil | Received: | Apr 8, 1993 |
| Concord, CA 94520 | Analysis Method: | EPA 5030/8015/8020 | Reported: | Apr 23, 1993 |
| Attention: Mardo Kaprealian, P.E. | First Sample #: | 304-0416 | | |

## TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

| Analyte | Reporting Limit mg/kg | Sample I.D. 304-0416 VE1-(5) | Sample I.D. 304-0417 VE1-(10) | Sample I.D. 304-0418 VE2-(5) | Sample I.D. 304-0419 VE2-(10) | Sample I.D. 304-0420 VE2-(11.5) | Sample I.D. 304-0421 VE3-(5) |
|---|---|---|---|---|---|---|---|
| Purgeable Hydrocarbons | 1.0 | N.D. | 310 | N.D. | N.D. | 68 | N.D. |
| Benzene | 0.005 | 0.037 | N.D. | N.D. | N.D. | N.D. | N.D. |
| Toluene | 0.005 | 0.040 | 0.20 | N.D. | N.D. | 0.080 | N.D. |
| Ethyl Benzene | 0.005 | 0.043 | 1.9 | N.D. | N.D. | 0.20 | N.D. |
| Total Xylenes | 0.005 | 0.071 | 6.6 | N.D. | N.D. | 0.66 | N.D. |
| Chromatogram Pattern: | | -- | Gasoline | -- | -- | Gasoline | -- |

**Quality Control Data**

| | | | | | | |
|---|---|---|---|---|---|---|
| Report Limit Multiplication Factor: | 1.0 | 5.0 | 1.0 | 1.0 | 2.0 | 1.0 |
| Date Analyzed: | 4/22/93 | 4/22/93 | 4/22/93 | 4/22/93 | 4/22/93 | 4/22/93 |
| Instrument Identification: | GCHP-1 | GCHP-1 | GCHP-1 | GCHP-1 | GCHP-1 | GCHP-1 |
| Surrogate Recovery, %: (QC Limits = 70-130%) | 117 | 73 | 115 | 118 | 70 | 119 |

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

| | | | | |
|---|---|---|---|---|
| Kaprealian Engineering, Inc. | Client Project ID: | Unocal #2656, E 14th St., Oakland | Sampled: | Apr 8, 1993 |
| 2401 Stanwell Dr., Ste. 400 | Sample Matrix: | Soil | Received: | Apr 8, 1993 |
| Concord, CA 94520 | Analysis Method: | EPA 5030/8015/8020 | Reported: | Apr 23, 1993 |
| Attention: Mardo Kaprealian, P.E. | First Sample #: | 304-0422 | | |

## TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

| Analyte | Reporting Limit mg/kg | Sample I.D. 304-0422 VE3-(10) | Sample I.D. Matrix Blank |
|---|---|---|---|
| Purgeable Hydrocarbons | 1.0 | N.D. | |
| Benzene | 0.005 | N.D. | |
| Toluene | 0.005 | N.D. | |
| Ethyl Benzene | 0.005 | N.D. | |
| Total Xylenes | 0.005 | N.D. | |
| Chromatogram Pattern: | | -- | |

**Quality Control Data**

| | | |
|---|---|---|
| Report Limit Multiplication Factor: | 1.0 | 1.0 |
| Date Analyzed: | 4/22/93 | 4/22/93 |
| Instrument Identification: | GCHP-1 | GCHP-1 |
| Surrogate Recovery, %: (QC Limits = 70-130%) | 114 | 114 |

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

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

Client Project ID: Unocal #2656, E 14th St., Oakland
QC Sample Group: 3040416-422
Reported: Apr 23, 1993

## QUALITY CONTROL DATA REPORT

| ANALYTE | Benzene | Toluene | Ethyl-Benzene | Xylenes |
|---|---|---|---|---|
| Method: | EPA 8015/8020 | EPA 8015/8020 | EPA 8015/8020 | EPA 8015/8020 |
| Analyst: | T.S.M. | T.S.M. | T.S.M. | T.S.M. |
| Reporting Units: | mg/kg | mg/kg | mg/kg | mg/kg |
| Date Analyzed: | Apr 22, 1993 | Apr 22, 1993 | Apr 22, 1993 | Apr 22, 1993 |
| QC Sample #: | 304-0577 | 304-0577 | 304-0577 | 304-0577 |
| **Sample Conc.:** | N.D. | N.D. | N.D. | N.D. |
| **Spike Conc. Added:** | 0.20 | 0.20 | 0.20 | 0.40 |
| **Conc. Matrix Spike:** | 0.19 | 0.19 | 0.20 | 0.39 |
| **Matrix Spike % Recovery:** | 95 | 95 | 100 | 98 |
| **Conc. Matrix Spike Dup.:** | 0.18 | 0.18 | 0.19 | 0.38 |
| **Matrix Spike Duplicate % Recovery:** | 90 | 90 | 95 | 95 |
| **Relative % Difference:** | 5.4 | 5.4 | 5.1 | 3.1 |

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: Wade Weston
WITNESSING AGENCY:

SITE NAME & ADDRESS: Unocal #2656
E. 14th St. Oakland

ANALYSES REQUESTED: TPH-g/BTXE

TURN AROUND TIME: Regular

| SAMPLE ID NO. | DATE | TIME | SOIL | WATER | GRAB | COMP | NO. OF CONT. | SAMPLING LOCATION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| VE1-(5) | 4/8/93 | | ✓ | | ✓ | | 1 | See Sample ID# | 3040 416 |
| VE1-(10) | " | | ✓ | | ✓ | | 1 | | 417 |
| VE2-(5) | " | | ✓ | | ✓ | | 1 | | 418 |
| VE2-(10) | " | | ✓ | | ✓ | | 1 | | 419 |
| VE2-(11.5) | " | | ✓ | | ✓ | | 1 | | 420 |
| VE3-(5) | " | | ✓ | | ✓ | | 1 | | 421 |
| VE3-(10) | " | | ✓ | | ✓ | | 1 | | 422 |

| | | |
|---|---|---|
| Relinquished by: (Signature) Wade Weston | Date/Time 4/8/93 2100 | Received by: (Signature) |
| 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? 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

Signature: [illegible] Title: Analyst Date: 4/8/93

2401 Stanwell Drive, Suite 400
Concord, California 94520
Tel. 510 602.5100 Fax: 510 687 0602