



KAPREALIAN ENGINEERING
INCORPORATED

KEI-P91-1004.R3
March 26, 1992

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

Attention: Mr. Ron Bock

RE: Preliminary Ground Water Investigation at
Unocal Service Station #5043
449 Hegenberger Road
Oakland, California

Dear Mr. Bock:

This report presents the results of soil and ground water investigation for the referenced site, in accordance with Kaprealian Engineering, Inc's. (KEI) proposal KEI-P91-1004.P1 dated December 17, 1991. The purpose of the investigation was to determine the ground water flow direction, and to begin to determine the degree and extent of the subsurface soil and ground water contamination at the site. The scope of the work performed by KEI consisted of the following:

Coordination with regulatory agencies

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

Soil sampling

Ground water monitoring, purging, and sampling

Laboratory analyses

Data analysis and report preparation

SITE DESCRIPTION AND BACKGROUND

The subject site is presently used as a gasoline station. The site is characterized by gently sloping, west to west-southwest trending topography, and is located approximately 1,250 feet northeast of the existing drainage channel of San Leandro Creek.

KEI's initial field work was conducted on October 25, 1991, when four soil samples, labeled P1 through P4, were collected from the product pipe trenches (at depths of approximately 3 feet below grade) during an island modification project at the site. Sample point locations are as shown on the attached Site Plan, Figure 2.

In addition, two shallow borings were drilled to ground water (which was encountered at a depth of approximately 4 to 4.5 feet below grade) by the use of a hand auger. The product pipe trenches were subsequently excavated to the ground water depth.

All samples were analyzed by Sequoia Analytical Laboratory in Concord, California. All soil samples were analyzed for total petroleum hydrocarbons (TPH) as gasoline, benzene, toluene, xylenes, and ethylbenzene (BTX&E), and TPH as diesel.

The analytical results of the soil samples indicated a level of TPH as gasoline at 370 ppm for sample P4, while samples P1, P2, and P3 showed levels of TPH as gasoline at 3,200 ppm, 9,000 ppm, and 7,100 ppm, respectively. The analytical results further indicated levels of TPH as diesel at 420 ppm and 460 ppm for samples P1 and P4, respectively. Samples P2 and P3 indicated levels of TPH as diesel at 8,400 ppm and 1,100 ppm, respectively. 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 proposed the installation of three monitoring wells. Documentation of the sample collection techniques and the analytical results of the soil samples collected from the product pipe trenches are summarized in KEI's report (KEI-J91-1004.R1) dated December 17, 1991.

RECENT FIELD ACTIVITIES

On February 5, 1992, three two-inch diameter monitoring wells (designated as MW1, MW2, and MW3 on the attached Site Plan, Figure 1) were installed at the site. The wells were drilled, constructed, and completed in accordance with the guidelines of the Regional Water Quality Control Board (RWQCB), and 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.

The monitoring wells were drilled and completed to total depths ranging from 13.5 to 15 feet below grade. Ground water was encountered at depths ranging from approximately 3 to 5 feet beneath the surface during drilling. Soil samples were taken for laboratory analysis and lithologic logging purposes at a maximum interval of 5 feet, at significant changes in lithology, at obvious areas of contamination, and at the soil/ground water interface, beginning at a depth of approximately 2.5 to 3 feet below grade and continuing until ground water was encountered. Soil samples were obtained below the first encountered ground water at the depths indicated on the attached Boring Logs for lithologic logging

purposes only. The undisturbed soil samples were taken 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, placed in plastic zip-lock baggies, and stored in a cooled ice chest for 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.

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

The wells were developed on February 10, 1992. Prior to development, the wells were checked for depth to the water table (by the use of an electronic sounder) and the presence of free product (by the use of an interface probe or paste tape). No free product was noted in any of the wells. After recording the monitoring data, the wells were developed by the use of a surface pump (until the evacuated water was clear and free of suspended sediment). During development, the wells were each purged of 30 to 42 gallons. However, between 20 to 30 gallons of drinking quality water were added to each well to facilitate development (due to poor water recovery). Monitoring and well development data are summarized in Table 1.

The wells were sampled on February 18, 1992. Prior to sampling, monitoring data was collected and the wells were each purged of between 8 and 9 gallons. Prior to sampling, the wells were evaluated for the presence of free product and sheen. No free product or sheen was noted in any of the wells (except for well MW1, where a sheen was observed). Water samples were then collected by the use of a clean Teflon bailer that was rinsed with distilled water prior to sampling each well. The samples were decanted into clean glass VOA vials, sealed with Teflon-lined screw caps, labeled, and stored in a cooler, on ice, until delivery to a state-certified laboratory.

ANALYTICAL RESULTS

Water and selected soil samples were analyzed at Sequoia Analytical Laboratory in Concord, California. All samples were accompanied by properly executed Chain of Custody documentation. Soil and water samples were analyzed for TPH as gasoline by EPA method 5030 in conjunction with modified 8015, BTX&E by EPA method 8020, and TPH as diesel by EPA method 3550 (soil) and 3510 (water).

Analytical results of the soil samples collected from the boring for monitoring well MW3 indicated non-detectable levels of TPH as gasoline and BTX&E, except for 0.011 ppb of xylenes in sample MW3(3). Also, in MW3, all soil samples showed non-detectable levels of TPH as diesel, except for sample MW3(3), which showed a level of 49 ppm. All soil samples analyzed from MW1 and MW2 showed levels of TPH as gasoline ranging from 31 ppm to 14,000 ppm, levels of benzene ranging from 2.4 ppm to 160 ppm, and levels of TPH as diesel ranging from 29 ppm to 2,400 ppm.

Analytical results of the ground water samples collected from monitoring wells MW1, MW2, and MW3 indicated levels of TPH as gasoline ranging from 230 ppb to 150,000 ppb, benzene levels ranging from 4.8 ppb to 17,000 ppb, and levels of TPH as diesel ranging from 4,300 ppb to 13,000 ppb, except for MW3, which showed a non-detectable level of TPH as diesel. The concentrations of TPH as gasoline, benzene, and TPH as diesel detected in the initial ground water samples collected on February 18, 1992, are shown on the attached Site Plan, Figure 1a. The results of the soil analyses are summarized in Table 3, and the results of the water analyses are summarized in Table 2. Copies of the laboratory analyses and Chain of Custody documentation are attached to this report.

HYDROLOGY AND GEOLOGY

The water table stabilized in the monitoring wells at depths ranging from 2.36 to 3.10 feet below the surface. The ground water flow direction appeared to be toward the west on February 18, 1992, with a hydraulic gradient of approximately 0.024 (based on water level data collected from the three monitoring wells prior to purging).

Based on review of regional geologic maps (U.S. Geological Survey Professional Paper 943 "Flatland Deposits - Their Geology and Engineering Properties and their Importance to Comprehensive Planning" by E.J. Helley and K.R. Lajoie, 1979), the subject site is underlain by Holocene-age Bay Mud (Qhbm). The Bay Mud typically consists of unconsolidated, saturated clay and silty clay that is rich in organic material. The Bay Mud locally contains lenses and stringers of well-sorted silt, sand, and beds of peat.

The subsurface soils exposed in the pipe trench excavations consisted primarily of sandy silt (to a depth of about 4 feet below grade) that was underlain with "Bay Mud" to the full depth explored (approximately 5 feet below grade). Ground water was encountered at a depth of approximately 4 to 4.5 feet below grade.

The results of our recent subsurface study indicate that the site is underlain by artificial fill materials that extend to depths below grade of approximately 2 to 4 feet. The fill materials are underlain by a highly organic zone that is locally lensed with peat and that extends to depths of about 8 to 9 feet below grade. This highly organic layer is in turn underlain by silty clay soil materials to the maximum depths explored (13.5 to 15 feet below grade).

DISCUSSION AND RECOMMENDATIONS

Based on the analytical results collected to date, KEI recommends the implementation of a monitoring and sampling program of the existing monitoring wells. The wells should be monitored on a monthly basis, and should be purged and sampled on a quarterly basis. The proposed program should be conducted for a period of 12 months. The results of the monitoring program will be documented and evaluated after each monitoring and sampling event. Recommendations for altering or terminating the program will be made as warranted.

The extent of soil and ground water contamination at and in the vicinity of the site has not been defined. Elevated levels of soil and ground water contamination exist in the vicinity of the pump island. However, prior to recommending the installation of additional on-site monitoring wells, KEI recommends performing a quarter of monitoring and sampling of the existing wells. This quarter of the monitoring and sampling program is recommended in order to attempt to establish a consistent ground water flow direction at the site, and also to attempt to establish a relatively consistent contamination level in the existing wells. At the end of this quarter, after review of the monitoring and sampling data, KEI will make additional recommendations pertaining to the installation of additional on-site (or off-site) monitoring wells.

Lastly, KEI will evaluate the areas adjacent to the site in order to identify any potential sources of ground water contamination that may be contributing to the contamination at the Unocal site.

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

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 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 this data by the use of 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.

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Should 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



Don R. Braun
Certified Engineering Geologist

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



Timothy R. Ross
Project Manager

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Attachments: Tables 1 through 4
Location Map
Site Plans - Figures 1, 1a & 2
Boring Logs
Laboratory Results
Chain of Custody documentation

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TABLE 1

SUMMARY OF GROUND WATER MONITORING AND PURGING DATA

| <u>Well #</u> | <u>Ground Water Elevation (feet)</u> | <u>Depth to Water (feet)</u> | <u>Product Thickness</u> | <u>Sheen</u> | <u>Gallons Pumped</u> |
|---------------|--|--------------------------------------|------------------------------|--------------|---------------------------|
|---------------|--|--------------------------------------|------------------------------|--------------|---------------------------|

(Monitored and Sampled on February 18, 1992)

| | | | | | |
|-----|------|------|---|-----|---|
| MW1 | 5.42 | 2.36 | 0 | Yes | 8 |
| MW2 | 6.21 | 2.75 | 0 | No | 9 |
| MW3 | 4.57 | 3.10 | 0 | No | 8 |

(Monitored and Developed on February 10, 1992)

| | | | | | |
|-----|------|------|---|----|-----|
| MW1 | 5.00 | 2.78 | 0 | -- | 42* |
| MW2 | 5.76 | 3.20 | 0 | -- | 30* |
| MW3 | 3.39 | 4.28 | 0 | -- | 37* |

| <u>Well #</u> | <u>Surface Elevation** (feet)</u> |
|---------------|---------------------------------------|
| MW1 | 7.78 |
| MW2 | 8.96 |
| MW3 | 7.67 |

-- Sheen determination was not performed.

* During development of the wells, poor water recovery rates required the addition of drinking quality water to each well (30 gallons at MW1, 20 gallons at MW2, and 25 gallons at MW3). Water was obtained from an on-site source.

** Elevation of the tops of the well covers have been surveyed to MSL (per City of Oakland Benchmark #3880).

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TABLE 2
SUMMARY OF LABORATORY ANALYSES
WATER

| <u>Date</u> | <u>Sample Number</u> | <u>TPH as Diesel</u> | <u>TPH as Gasoline</u> | <u>Benzene</u> | <u>Toluene</u> | <u>Xylenes</u> | <u>Ethyl-benzene</u> |
|------------------|----------------------|----------------------|------------------------|----------------|----------------|----------------|----------------------|
| 2/18/92 | MW1 | 13,000 | 150,000 | 17,000 | 26,000 | 26,000 | 5,200 |
| | MW2 | 4,300 | 29,000 | 1,000 | 5,300 | 7,900 | 260 |
| | MW3 | ND | 230 | 4.8 | 22 | 33 | 1.8 |
| Detection Limits | | 50 | 30 | 0.30 | 0.30 | 0.30 | 0.30 |

ND = Non-detectable.

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

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TABLE 3
SUMMARY OF LABORATORY ANALYSES
SOIL

| <u>Date</u> | <u>Sample Number</u> | <u>Depth (feet)</u> | <u>TPH as Diesel</u> | <u>TPH as Gasoline</u> | <u>Benzene</u> | <u>Toluene</u> | <u>Xylenes</u> | <u>Ethyl-benzene</u> |
|------------------|----------------------|---------------------|----------------------|------------------------|----------------|----------------|----------------|----------------------|
| 2/05/92 | MW1(2.5) | 2.5 | 1,200 | 14,000 | 160 | 680 | 2,400 | 470 |
| | MW2(3.5) | 3.5 | 2,400 | 9,000 | 74 | 440 | 1,400 | 280 |
| | MW2(4.5) | 4.5 | 29 | 31 | 2.4 | 0.14 | 9.0 | 3.0 |
| | MW3(3) | 3.0 | 49 | ND | ND | ND | 0.011 | ND |
| | MW3(4.5) | 4.5 | ND | ND | ND | ND | ND | ND |
| Detection Limits | | | 1.0 | 1.0 | 0.0050 | 0.0050 | 0.0050 | 0.0050 |

ND = Non-detectable.

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

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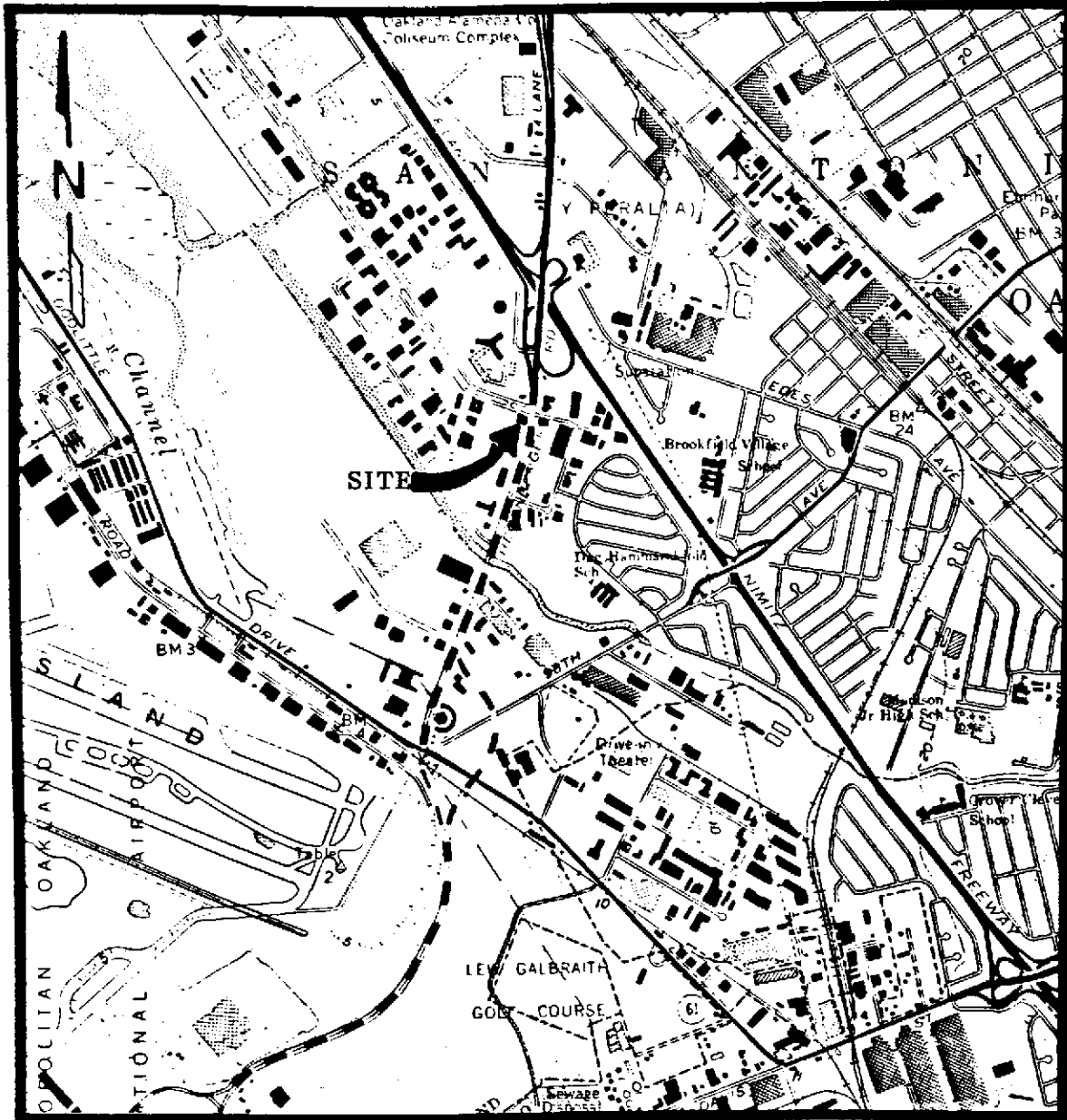
TABLE 4

SUMMARY OF LABORATORY ANALYSES

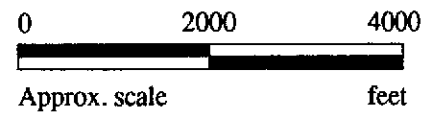
| <u>Date</u> | <u>Sample</u> | <u>Depth (feet)</u> | <u>TPH as Diesel</u> | <u>TPH as Gasoline</u> | <u>Benzene</u> | <u>Toluene</u> | <u>Xylenes</u> | <u>Ethyl- benzene</u> |
|---------------------|---------------|-------------------------|--------------------------|----------------------------|----------------|----------------|----------------|---------------------------|
| 10/25/91 | P1 | 3 | 420 | 3,200 | 33 | 120 | 540 | 110 |
| | P2 | 3 | 8,400 | 9,000 | 46 | 120 | 1,500 | 330 |
| | P3 | 3 | 1,100 | 7,100 | 48 | 410 | 1,200 | 220 |
| | P4 | 3 | 460 | 370 | 7.4 | 39 | 77 | 12 |
| Detection Limits | | | 1.0 | 1.0 | 0.0050 | 0.0050 | 0.0050 | 0.0050 |

ND = Non-detectable.

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



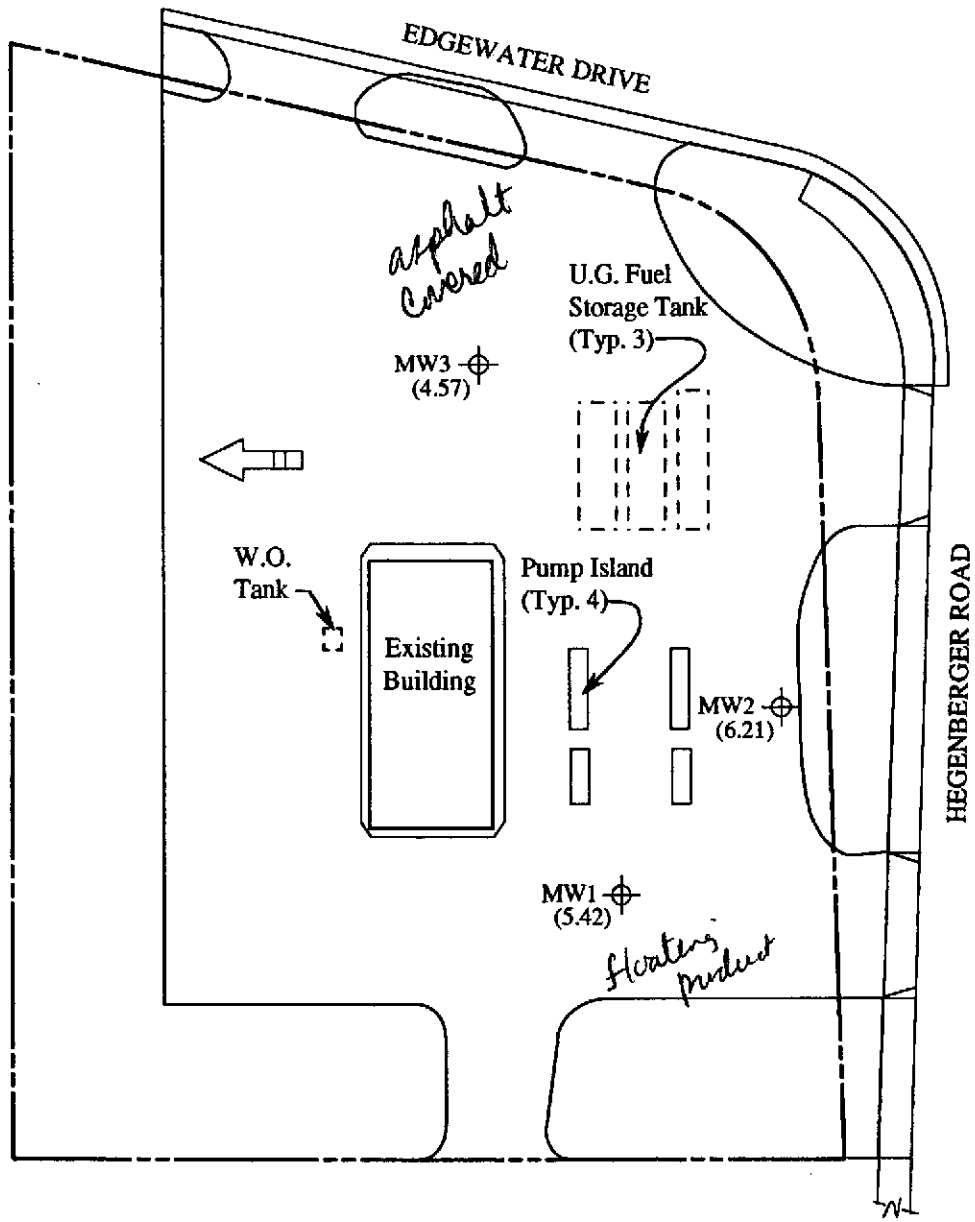
Base modified from 7.5 minute U.S.G.S. San Leandro Quadrangle
(photorevised 1980)



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

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449 HEGENBERGER ROAD
OAKLAND, CA**

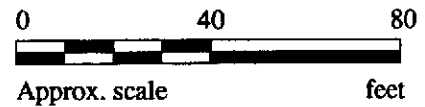
**LOCATION
MAP**



SITE PLAN

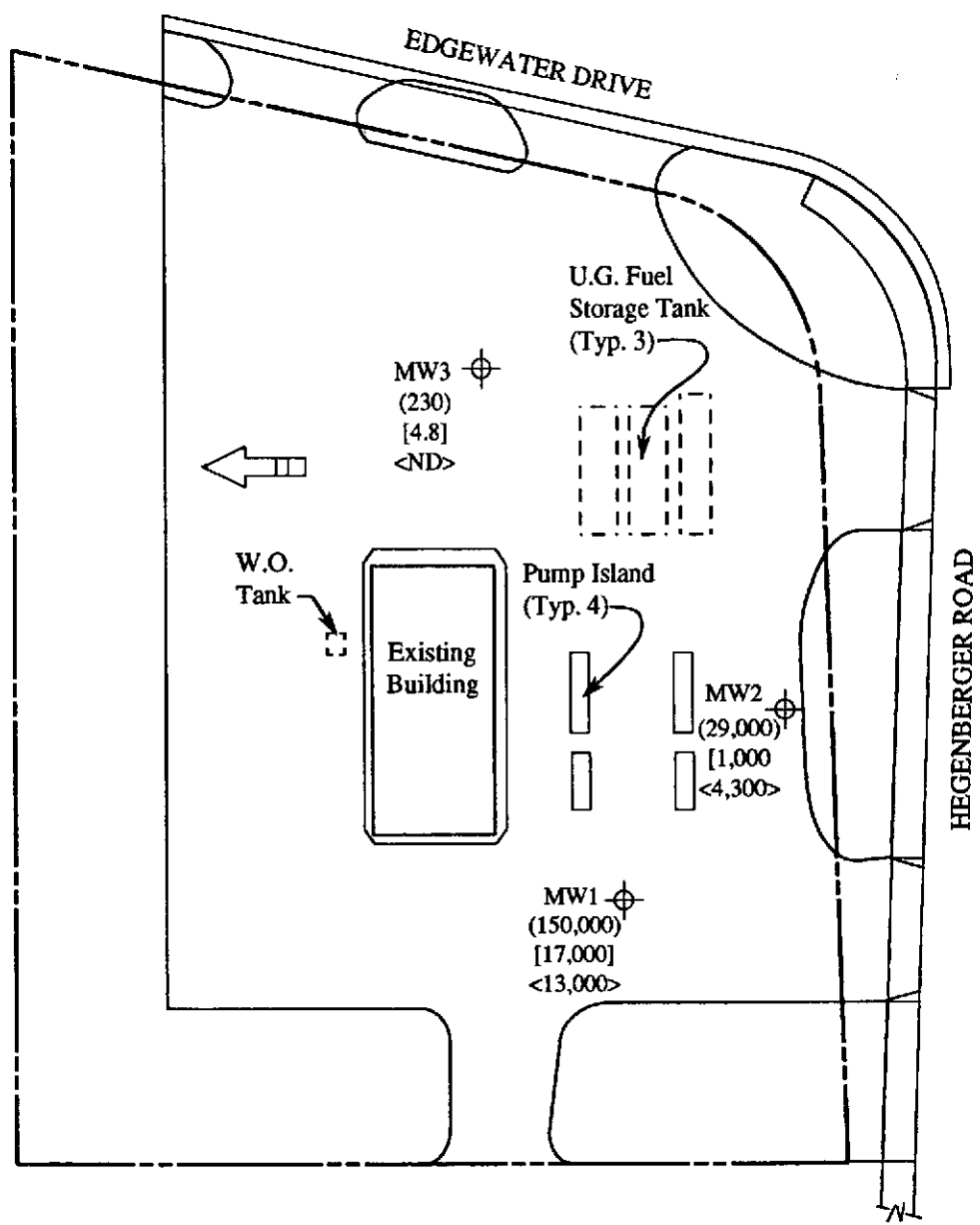
LEGEND

-  Monitoring well
-  Ground water elevation in feet above Mean Sea Level on 2/18/92
-  Direction of ground water flow



UNOCAL SERVICE STATION #5043
449 HEGENBERGER ROAD
OAKLAND, CA

FIGURE
1

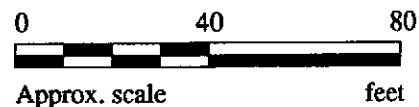


SITE PLAN

(Samples Collected on 2/18/92)

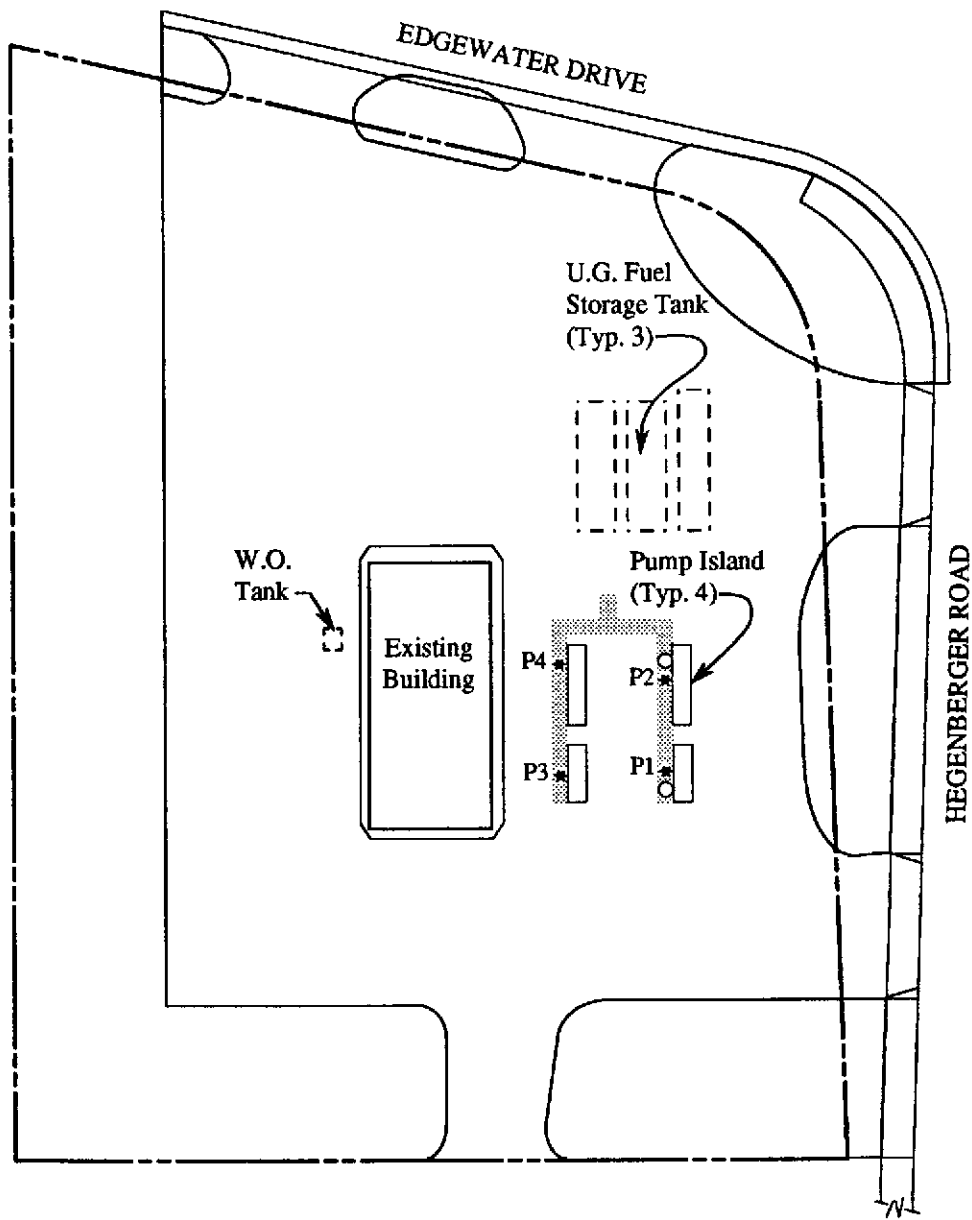
LEGEND

- ⊕ Monitoring Well
- () Concentrations of TPH as gasoline in ppb
- [] Concentrations of benzene in ppb
- < > Concentrations of TPH as diesel in ppb
- Direction of ground water flow
- ND = Non-detectable



**UNOCAL SERVICE STATION #5043
449 HEGENBERGER ROAD
OAKLAND, CA**

**FIGURE
1a**



SITE PLAN

LEGEND

- * Sample point location
- Hand augered boring location
- ▨ Area excavated to ground water (approx. 4 - 4.5 feet below grade)




**UNOCAL SERVICE STATION #5043
449 HEGENBERGER ROAD
OAKLAND, CA**

**FIGURE
2**

BORING LOG

| | | |
|--|---|--|
| Project No. KEI-P91-1004 | Boring & Casing Diameter 8" 2" | Logged By D.L. <i>DL</i> |
| Project Name Unocal Oakland, Hegenberger | Well Cover Elevation 7.78 feet | Date Drilled 2/5/91 |
| Boring No. MW1 | Drilling Method Hollow-stem Auger | Drilling Company West Hazmat |

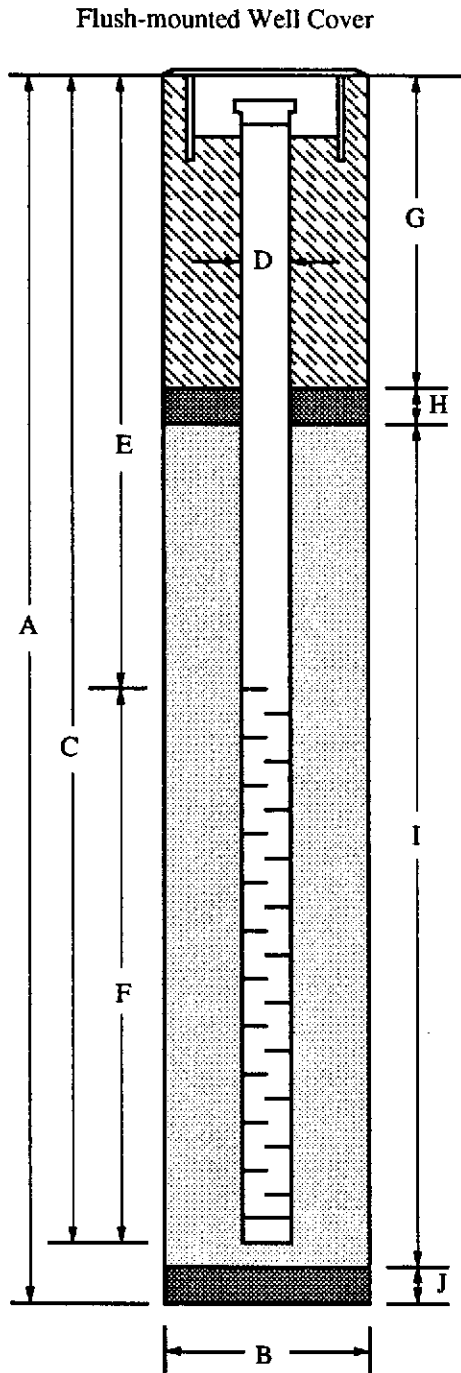
| Penetration blows/6" | G. W. level | Depth (feet) Samples | Strati- graphy USCS | Description |
|-------------------------|---|----------------------------|---------------------------|--|
| | | 0 | | Asphalt pavement over sand and gravel base. |
| | | | | Clay with silt, stiff, moist, olive gray, pocketed with poorly graded sand, medium-grained, dark greenish gray, moist: fill |
| 5/5/4 |  | 1 | SW | Well graded sand with gravel, loose, very moist to saturated, very dark greenish gray, fill? |
| 2 for 18" | | 5 | OL/ OH | Clayey silt, highly organic, very soft, wet, very dark greenish gray, with plant fibers and organic matter, lensed with peat: bay mud. |
| 2/4/6 | | 10 | CH | Silty clay, firm to stiff, very moist, black, with plant fibers and organic matter. |
| 6/10/13 | | 13.5 | CL | Sandy clay, stiff to very stiff, moist, olive gray and olive brown, mottled with root holes. |
| | | 15 | | TOTAL DEPTH: 13.5' |
| | | 20 | | |

WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - Oakland, Hegenberger WELL NO. MW1

PROJECT NUMBER: KEI-P91-1004

WELL PERMIT NO.: ACFD & WCD 92012




- A. Total Depth : 13.5'
- B. Boring Diameter*: 8"
Drilling Method: Hollow Stem Auger
- C. Casing Length: 13'
Material: Schedule 40 PVC
- D. Casing Diameter: OD = 2.375"
ID = 2.067"
- E. Depth to Perforations: 2'
- F. Perforated Length: 11'
Perforation Type: Machined Slot
Perforation Size: 0.010"
- G. Surface Seal: 1'
Seal Material: Neat Cement
- H. Seal: 0.5'
Seal Material: Bentonite
- I. Filter Pack: 12'
Pack Material: RMC Lonestar Sand
Size: #2/12
- J. Bottom Seal: none
Seal Material: N/A

* Boring diameter can vary from 7-1/4" to 8" depending on bit wear.

BORING LOG

| | | |
|--|---|--|
| Project No. KEI-P91-1004 | Boring & Casing Diameter 8" 2" | Logged By D.L. <i>DLB</i> |
| Project Name Unocal Oakland, Hegenberger | Well Cover Elevation 8.96 feet | Date Drilled 2/5/91 |
| Boring No. MW2 | Drilling Method Hollow-stem Auger | Drilling Company West Hazmat |

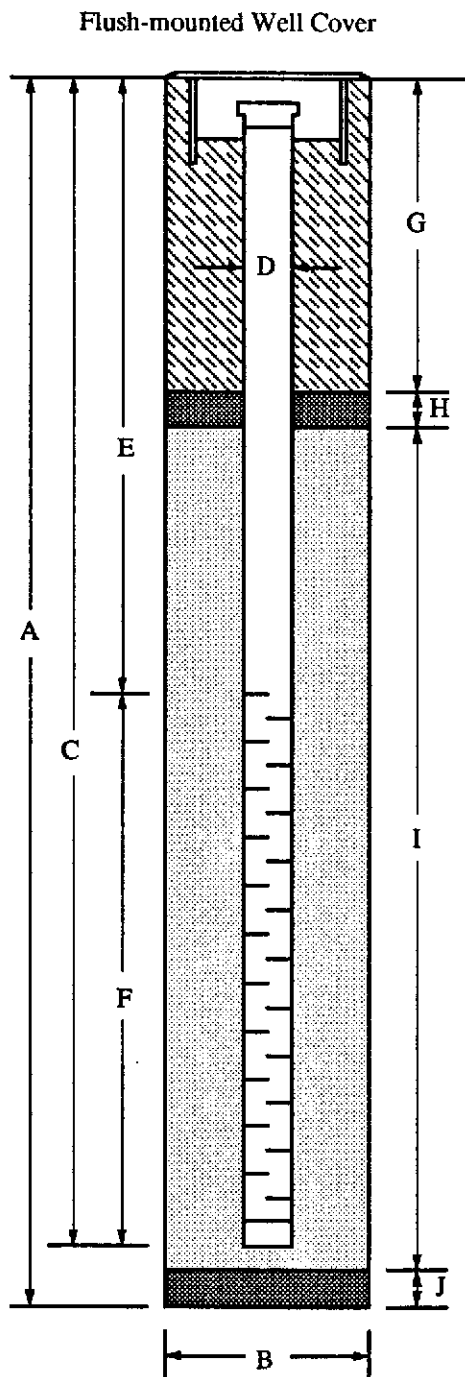
| Penetration blows/6" | G. W. level | Depth (feet) Samples | Strati- graphy USCS | Description |
|-------------------------|---|----------------------------|---------------------------|---|
| | | 0 | | Asphalt pavement over sand and gravel base. |
| | | | CH | Silty clay, stiff, moist, dark greenish gray, pocketed with silty sand and well graded sand, moist to very moist: fill |
| 11/6/3 | | | MH | Sandy silt, sand is very fine-grained, very soft, very moist to wet, dark greenish gray, lensed with very fine-grained sand. |
| 2 for 18" |  | 5 | OL/ OH | Very silty clay, very soft, very moist, black, with abundant plant fibers and organic matter: bay mud. |
| 4/6/8 | | 10 | CH | Silty clay, stiff, moist, black, with plant fibers and organic matter. |
| 8/9/9 | | | | Silty clay, trace fine-grained sand, very stiff, moist, olive gray and olive brown, mottled with root holes. |
| 3/7/12 | | 15 | CL | Sandy clay, estimated at 10 to 15% silt, sand is fine- to medium-grained, stiff to very stiff, moist, olive gray and olive brown mottled. |
| | | | | TOTAL DEPTH: 15' |
| | | 20 | | |

WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - Oakland, Hegenberger WELL NO. MW2

PROJECT NUMBER: KEI-P91-1004

WELL PERMIT NO.: ACFD & WCD 92012



- A. Total Depth : 15'
- B. Boring Diameter* : 8"
Drilling Method: Hollow Stem Auger
- C. Casing Length: 15'
Material: Schedule 40 PVC
- D. Casing Diameter: OD = 2.375"
ID = 2.067"
- E. Depth to Perforations: 3'
- F. Perforated Length: 12'
Perforation Type: Machined Slot
Perforation Size: 0.010"
- G. Surface Seal: 1'
Seal Material: Neat Cement
- H. Seal: 1'
Seal Material: Bentonite
- I. Filter Pack: 13'
Pack Material: RMC Lonestar Sand
Size: #2/12
- J. Bottom Seal: none
Seal Material: N/A

* Boring diameter can vary from 7-1/4" to 8" depending on bit wear.

BORING LOG

| | | |
|--|---|--|
| Project No. KEI-P91-1004 | Boring & Casing Diameter 8" 2" | Logged By D.L. |
| Project Name Unocal Oakland, Hegenberger | Well Cover Elevation 7.67 feet | Date Drilled 2/5/91 |
| Boring No. MW3 | Drilling Method Hollow-stem Auger | Drilling Company West Hazmat |

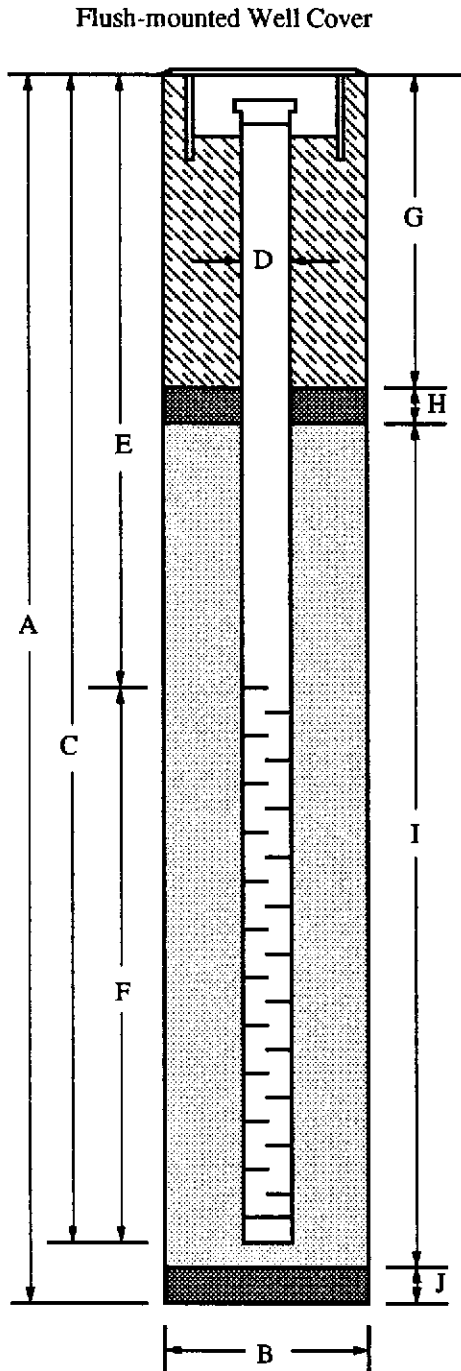
| Penetration blows/6" | G. W. level | Depth (feet) Samples | Strati- graphy USCS | Description |
|----------------------|-------------|-------------------------|---------------------------|--|
| | | 0 | | Asphalt pavement over sand and gravel base. |
| | | | SP | Poorly graded sand, trace silt, medium-grained, loose, very moist, dark greenish gray: fill? |
| 1/1/1 | | | ML | Sandy silt, sand is very fine-grained, very soft, very moist to wet, dark greenish gray with organic matter. |
| 2/2/2 | | 5 | MH | Clayey silt, very soft to soft, very moist to wet, dark greenish gray. |
| | | | OL | Peat, soft, wet, dark greenish gray, spongy feel.. |
| | | | OH | Silty clay, highly organic, firm, moist, black, with plant remains. |
| 3/4/5 | | 10 | CH | Silty clay, with an estimated 10 to 15% fine- to medium-grained sand content, firm to stiff, moist, dark greenish gray, with plant remains and organic matter. |
| 7/9/10 | | | | Silty clay, with an estimated 10 to 15% fine- to medium-grained sand content, stiff, to very stiff, moist, olive gray and olive brown, with root holes. |
| | | 15 | | TOTAL DEPTH: 14' |
| | | 20 | | |

WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - Oakland, Hegenberger WELL NO. MW3

PROJECT NUMBER: KEI-P91-1004

WELL PERMIT NO.: ACFD & WCD 92012



- A. Total Depth : 14'
- B. Boring Diameter*: 8"
Drilling Method: Hollow Stem Auger
- C. Casing Length: 14'
Material: Schedule 40 PVC
- D. Casing Diameter: OD = 2.375"
ID = 2.067"
- E. Depth to Perforations: 2'
- F. Perforated Length: 12'
Perforation Type: Machined Slot
Perforation Size: 0.010"
- G. Surface Seal: 1'
Seal Material: Neat Cement
- H. Seal: 0.5'
Seal Material: Bentonite
- I. Filter Pack: 12.5'
Pack Material: RMC Lonestar Sand
Size: #2/12
- J. Bottom Seal: none
Seal Material: N/A

* Boring diameter can vary from 7-1/4" to 8" depending on bit wear.

| MAJOR DIVISIONS | SYMBOLS | TYPICAL SOIL DESCRIPTIONS |
|--|---|--|
| <p style="text-align: center;"><u>GRAVELS</u></p> <p>(More than 1/2 of coarse fraction > No. 4 sieve size)</p> | 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 |
| <p style="text-align: center;"><u>SANDS</u></p> <p>(More than 1/2 of coarse fraction < No. 4 sieve size)</p> | 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 |
| <p style="text-align: center;"><u>SILTS & CLAYS</u></p> <p style="text-align: center;"><u>LL < 50</u></p> | 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 |
| <p style="text-align: center;"><u>SILTS & CLAYS</u></p> <p style="text-align: center;"><u>LL > 50</u></p> | 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 characteristics are transitional between the soil classifications listed above | |

CLASSIFICATION CHART (Unified Soil Classification System)



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| | | |
|-----------------------------------|---|------------------------|
| Kaprealian Engineering, Inc. | Client Project ID: Unocal, 449 Hegenberger Rd., Oakland | Sampled: Feb 18, 1992 |
| P.O. Box 996 | Matrix Descript: Water | Received: Feb 18, 1992 |
| Benicia, CA 94510 | Analysis Method: EPA 5030/8015/8020 | Analyzed: Feb 24, 1992 |
| Attention: Mardo Kaprealian, P.E. | First Sample #: 202-0617 | Reported: Mar 4, 1992 |

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

| Sample Number | Sample Description | Low/Medium B.P. | Benzene | Toluene | Ethyl | Xylenes |
|---------------|--------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | | Hydrocarbons | | | Benzene | |
| | | $\mu\text{g/L}$ (ppb) | $\mu\text{g/L}$ (ppb) | $\mu\text{g/L}$ (ppb) | $\mu\text{g/L}$ (ppb) | $\mu\text{g/L}$ (ppb) |
| 202-0617 | MW-1 | 150,000 | 17,000 | 26,000 | 5,200 | 26,000 |
| 202-0618 | MW-2 | 29,000 | 1,000 | 5,300 | 260 | 7,900 |
| 202-0619 | MW-3 | 230 | 4.8 | 22 | 1.8 | 33 |

| | | | | | |
|---------------------------------|-----------|-------------|-------------|-------------|-------------|
| Method Detection Limits: | 30 | 0.30 | 0.30 | 0.30 | 0.30 |
|---------------------------------|-----------|-------------|-------------|-------------|-------------|

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.

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Laboratory Director



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| | | |
|-----------------------------------|---|-------------------------|
| Kaprealian Engineering, Inc. | Client Project ID: Unocal, 449 Hegenberger Rd., Oakland | Sampled: Feb 18, 1992 |
| P.O. Box 996 | Matrix Descript: Water | Received: Feb 18, 1992 |
| Benicia, CA 94510 | Analysis Method: EPA 3510/8015 | Extracted: Feb 25, 1992 |
| Attention: Mardo Kaprealian, P.E. | First Sample #: 202-0617 | Analyzed: Mar 4, 1992 |
| | | Reported: Mar 4, 1992 |

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

| Sample Number | Sample Description | High B.P. Hydrocarbons $\mu\text{g/L}$ (ppb) |
|---------------|--------------------|--|
| 202-0617 | MW-1 | 13,000 |
| 202-0618 | MW-2 | 4,300 |
| 202-0619 | MW-3 | N.D. |

| | |
|---------------------------------|-----------|
| Method Detection Limits: | 50 |
|---------------------------------|-----------|

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.

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Laboratory Director

2020617.KEI <2>



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Kapreallan Engineering, Inc.
P.O. Box 996
Benicia, CA 94510

Client Project ID: Unocal, 449 Hegenberger Rd., Oakland

Attention: Mardo Kapreallan, P.E. QC Sample Group: 2020617-619

Reported: Mar 4, 1992

QUALITY CONTROL DATA REPORT

| ANALYTE | Benzene | Toluene | Ethyl-Benzene | Xylenes | Diesel |
|------------------------------------|---------------|---------------|---------------|---------------|--------------|
| Method: | EPA 8015/8020 | EPA 8015/8020 | EPA 8015/8020 | EPA 8015/8020 | EPA8015 |
| Analyst: | K.E. | K.E. | K.E. | K.E. | A. Tuzon |
| Reporting Units: | ug/L | ug/L | ug/L | ug/L | ug/L |
| Date Analyzed: | Feb 24, 1992 | Feb 24, 1992 | Feb 24, 1992 | Feb 24, 1992 | Feb 26, 1992 |
| QC Sample #: | Matrix Blank | Matrix Blank | Matrix Blank | Matrix Blank | Matrix Blank |
| Sample Conc.: | N.D. | N.D. | N.D. | N.D. | N.D. |
| Spike Conc. Added: | 20 | 20 | 20 | 60 | 300 |
| Conc. Matrix Spike: | 22 | 22 | 22 | 70 | 210 |
| Matrix Spike % Recovery: | 110 | 110 | 110 | 116 | 69 |
| Conc. Matrix Spike Dup.: | 22 | 22 | 22 | 70 | 230 |
| Matrix Spike Duplicate % Recovery: | 110 | 110 | 110 | 116 | 76 |
| Relative % Difference: | 0.0 | 0.0 | 0.0 | 0.0 | 10 |

Laboratory blank contained the following analytes: None Detected

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Laboratory Director

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



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Kaprealian Engineering, Inc.
P.O. Box 996
Benicia, CA 94510

Client Project ID: Unocal, 449 Hegenberger Rd., Oakland

Attention: Mardo Kaprealian, P.E. QC Sample Group: 2020617-619

Reported: Mar 4, 1992

QUALITY CONTROL DATA REPORT

SURROGATE

| | EPA | EPA | EPA | EPA | EPA8015 | EPA8015 | EPA8015 |
|------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Method: | 8015/8020 | 8015/8020 | 8015/8020 | 8015/8020 | EPA8015 | EPA8015 | EPA8015 |
| Analyst: | K.E. | K.E. | K.E. | K.E. | A. Tuzon | A. Tuzon | A. Tuzon |
| Reporting Units: | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Date Analyzed: | Feb 24, 1992 | Feb 24, 1992 | Feb 24, 1992 | Feb 24, 1992 | Feb 25, 1992 | Feb 25, 1992 | Feb 25, 1992 |
| Sample #: | 202-0617 | 202-0618 | 202-0619 | Blank | 202-0617 | 202-0618 | 202-0619 |

| | | | | | | | |
|--------------------------|----|----|----|----|-----|-----|-----|
| Surrogate % Recovery: | 88 | 87 | 96 | 88 | 140 | 140 | 120 |
|--------------------------|----|----|----|----|-----|-----|-----|

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Laboratory Director

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



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Kaprealian Engineering, Inc.

Client Project ID: Unocal, 449 Hegenberger Rd., Oakland

P.O. Box 996

Benicia, CA 94510

Attention: Mardo Kaprealian, P.E. QC Sample Group: 2020617-619

Reported: Mar 4, 1992

QUALITY CONTROL DATA REPORT

SURROGATE

Method: EPA8015
Analyst: A. Tuzon
Reporting Units: ug/L
Date Analyzed: Feb 26, 1992
Sample #: Blank

Surrogate
% Recovery: 120

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Laboratory Director

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



KAPREALIAN ENGINEERING, INC.

CHAIN OF CUSTODY

| SAMPLER <i>Vartkes</i> | | SITE NAME & ADDRESS <i>Unocal / Oakland</i> <i>449 Hegenberger Rd.</i> | | | | | ANALYSES REQUESTED | | | | TURN AROUND TIME: <i>Regular</i> | | |
|------------------------------|----------------|--|-------------------------------------|-------------------------------------|------|--|--------------------|------------|--------------|------------------------|-------------------------------------|--|---|
| WITNESSING AGENCY | | | | | | | TPHG:BTKE | TPHD | | | | | REMARKS <i>VDA's Preserved in HCl.</i> |
| SAMPLE ID NO. | DATE | TIME | SOIL | WATER | GRAB | COMP | | | NO. OF CONT. | SAMPLING LOCATION | | | |
| <i>MW-1</i> | <i>2/18/92</i> | <i>2:55 P.M.</i> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | | | | <i>3</i> | <i>Monitoring Well</i> | | | |
| <i>MW-2</i> | <i>"</i> | <i>3:45 P.M.</i> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | | | | <i>3</i> | <i>" "</i> | | | |
| <i>MW-3</i> | <i>"</i> | <i>4:20 P.M.</i> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | | <i>3</i> | <i>" "</i> | | | | | |
| Relinquished by: (Signature) | | Date/Time | | Received by: (Signature) | | <p>The following MUST BE completed by the laboratory accepting samples for analysis:</p> <p>1. Have all samples received for analysis been stored in ice? <u>YES</u></p> <p>2. Will samples remain refrigerated until analyzed? <u>YES</u></p> <p>3. Did any samples received for analysis have head space? <u>NO</u></p> <p>4. Were samples in appropriate containers and properly packaged? <u>YES</u></p> | | | | | | | |
| <i>W. Tachjian</i> | | <i>2/18/92</i> | | <i>A. Nagre</i> | | | | | | | | | |
| <i>MM</i> | | <i>2/19/92</i> | | <i>[Signature]</i> | | | | | | | | | |
| | | | | | | | | | | | | | |
| Relinquished by: (Signature) | | Date/Time | | Received by: (Signature) | | <p><i>A. Nagre</i> <i>Analyst</i> <i>2/18/92</i></p> <p style="text-align: center;">Signature Title Date</p> | | | | | | | |
| | | | | | | | | | | | | | |
| Relinquished by: (Signature) | | Date/Time | | Received by: (Signature) | | | | | | | | | |
| | | | | | | | | | | | | | |
| Relinquished by: (Signature) | | Date/Time | | Received by: (Signature) | | | | | | | | | |
| | | | | | | | | | | | | | |



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| | | |
|-----------------------------------|---|------------------------|
| Kaprealian Engineering, Inc. | Client Project ID: Unocal #5043/ 449 Hegenberger, Oakland | Sampled: Feb 5, 1992 |
| P.O. Box 996 | Matrix Descript: Soil | Received: Feb 6, 1992 |
| Benicia, CA 94510 | Analysis Method: EPA 5030/8015/8020 | Analyzed: Feb 7, 1992 |
| Attention: Mardo Kaprealian, P.E. | First Sample #: 202-0274 | Reported: Feb 24, 1992 |

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

| Sample Number | Sample Description | Low/Medium B.P. Hydrocarbons mg/kg (ppm) | Benzene mg/kg (ppm) | Toluene mg/kg (ppm) | Ethyl Benzene mg/kg (ppm) | Xylenes mg/kg (ppm) |
|---------------|--------------------|--|---------------------------|---------------------------|---------------------------------|---------------------------|
| 202-0274 | MW1 (2.5) | 14,000 | 160 | 680 | 470 | 2,400 |
| 202-0275 | MW2 (3.5) | 9,000 | 74 | 440 | 280 | 1,400 |
| 202-0276 | MW2 (4.5) | 31 | 2.4 | 0.14 | 3.0 | 9.0 |
| 202-0277 | MW3 (3) | N.D. | N.D. | N.D. | N.D. | 0.011 |
| 202-0278 | MW3 (4.5) | N.D. | N.D. | N.D. | N.D. | N.D. |

| | | | | | |
|---------------------------------|------------|---------------|---------------|---------------|---------------|
| Method Detection Limits: | 1.0 | 0.0050 | 0.0050 | 0.0050 | 0.0050 |
|---------------------------------|------------|---------------|---------------|---------------|---------------|

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.

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Belinda C. Vega
Laboratory Director

2020274.KEI <1>



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| | | |
|-----------------------------------|---|-------------------------|
| Kaprealian Engineering, Inc. | Client Project ID: Unocal #5043/ 449 Hegenberger, Oakland | Sampled: Feb 5, 1992 |
| P.O. Box 996 | Matrix Descript: Soil | Received: Feb 6, 1992 |
| Benicia, CA 94510 | Analysis Method: EPA 3550/8015 | Extracted: Feb 19, 1992 |
| Attention: Mardo Kaprealian, P.E. | First Sample #: 202-0274 | Analyzed: Feb 21, 1992 |
| | | Reported: Feb 24, 1992 |

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

| Sample Number | Sample Description | High B.P. Hydrocarbons mg/kg (ppm) |
|---------------|--------------------|--|
| 202-0274 | MW1 (2.5) | 1,200 |
| 202-0275 | MW2 (3.5) | 2,400 |
| 202-0276 | MW2 (4.5) | 29 |
| 202-0277 | MW3 (3) | 49 |
| 202-0278 | MW3 (4.5) | N.D. |

| | |
|---------------------------------|------------|
| Method Detection Limits: | 1.0 |
|---------------------------------|------------|

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.

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Laboratory Director

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| | | | |
|--|---|------------------|-----------|
| Kaprealian Engineering, Inc. P.O. Box 996 Benicia, CA 94510 Attention: Mardo Kaprealian, P.E. | Client Project ID: Unocal #5043/ 449 Hegenberger, Oakland | QC Sample Group: | Reported: |
|--|---|------------------|-----------|

QUALITY CONTROL DATA REPORT

| ANALYTE | Benzene | Toluene | Ethyl-Benzene | Xylenes | Diesel |
|------------------------------------|----------------|----------------|----------------|----------------|--------------|
| Method: | EPA 8015/8020 | EPA 8015/8020 | EPA 8015/8020 | EPA 8015/8020 | EPA8015 |
| Analyst: | K.E./K.N./J.F. | K.E./K.N./J.F. | K.E./K.N./J.F. | K.E./K.N./J.F. | A. Tuzon |
| Reporting Units: | mg/Kg | mg/Kg | mg/Kg | mg/Kg | mg/Kg |
| Date Analyzed: | Feb 7, 1992 | Feb 7, 1992 | Feb 7, 1992 | Feb 7, 1992 | Feb 21, 1992 |
| QC Sample #: | Matrix Blank | Matrix Blank | Matrix Blank | Matrix Blank | Matrix Blank |
| Sample Conc.: | N.D. | N.D. | N.D. | N.D. | N.D. |
| Spike Conc. Added: | 0.40 | 0.40 | 0.40 | 1.2 | 10 |
| Conc. Matrix Spike: | 0.49 | 0.50 | 0.50 | 1.6 | 9.5 |
| Matrix Spike % Recovery: | 122 | 125 | 125 | 133 | 95 |
| Conc. Matrix Spike Dup.: | 0.48 | 0.48 | 0.49 | 1.6 | 9.8 |
| Matrix Spike Duplicate % Recovery: | 120 | 120 | 122 | 133 | 98 |
| Relative % Difference: | 2.0 | 4.0 | 2.0 | 0.0 | 3.3 |

Laboratory blank contained the following analytes: None Detected

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



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| | | |
|--|--|------------------------|
| Kaprealian Engineering, Inc. P.O. Box 996 Benicia, CA 94510 Attention: Mardo Kaprealian, P.E. | Client Project ID: Unocal #5043/ 449 Hegenberger, Oakland QC Sample Group: 2020274-0278 | Reported: Feb 24, 1992 |
|--|--|------------------------|

QUALITY CONTROL DATA REPORT

SURROGATE

| | EPA | EPA | EPA | EPA | EPA | EPA |
|------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Method: | 8015/8020 | 8015/8020 | 8015/8020 | 8015/8020 | 8015/8020 | 8015/8020 |
| Analyst: | K.N. | K.N. | K.N. | K.N. | K.N. | K.N. |
| Reporting Units: | mg/Kg | mg/Kg | mg/Kg | mg/Kg | mg/Kg | mg/Kg |
| Date Analyzed: | Feb 7, 1992 | Feb 7, 1992 | Feb 7, 1992 | Feb 7, 1992 | Feb 7, 1992 | Feb 7, 1992 |
| Sample #: | 202-0274 | 202-0275 | 202-0276 | 202-0277 | 202-0278 | Blank |

| Surrogate | % Recovery: | 98 | 100 | 110 | 120 | 110 | 110 |
|-----------|-------------|----|-----|-----|-----|-----|-----|
|-----------|-------------|----|-----|-----|-----|-----|-----|

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Laboratory Director

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



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Kaprealian Engineering, Inc.
P.O. Box 996
Benicia, CA 94510

Client Project ID: Unocal #5043/ 449 Hegenberger, Oakland

Attention: Mardo Kaprealian, P.E. QC Sample Group: 2020274-0278

Reported: Feb 24, 1992

QUALITY CONTROL DATA REPORT

SURROGATE

| | | | | | | |
|------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Method: | EPA 8015 | EPA 8015 | EPA 8015 | EPA 8015 | EPA 8015 | EPA 8015 |
| Analyst: | A. Tuzon | A. Tuzon | A. Tuzon | A. Tuzon | A. Tuzon | A. Tuzon |
| Reporting Units: | mg/Kg | mg/Kg | mg/Kg | mg/Kg | mg/Kg | mg/Kg |
| Date Analyzed: | Feb 21, 1992 | Feb 21, 1992 | Feb 21, 1992 | Feb 21, 1992 | Feb 21, 1992 | Feb 21, 1992 |
| Sample #: | 202-0274 | 202-0275 | 202-0276 | 202-0277 | 202-0278 | Blank |

| | | | | | | |
|-------------|-----|-----|-----|-----|-----|-----|
| Surrogate | | | | | | |
| % Recovery: | 150 | 120 | 120 | 120 | 120 | 110 |

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Laboratory Director

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



KAPREALIAN ENGINEERING, INC.

CHAIN OF CUSTODY

| SAMPLER <i>Dyke</i> | | SITE NAME & ADDRESS UNICAL #5043/PAYLAND 449 HEGENBERGER | | | | | | ANALYSES REQUESTED | | | TURN AROUND TIME: REGULAR | |
|------------------------|--------|--|------|-------|------|------|--------------|--------------------|------|-------|------------------------------|---------|
| WITNESSING AGENCY | | | | | | | | | | | | |
| SAMPLE ID NO. | DATE | TIME | SOIL | WATER | GRAB | COMP | NO. OF CONT. | SAMPLING LOCATION | SOIL | WATER | DISS | REMARKS |
| MW1(2.5) | 2-5-92 | | X | | X | | 1 | SEE SAMPLE ID NO. | X | X | X | 2020274 |
| MW2(3.5) | 2-5-92 | | X | | X | | 1 | ↓ | X | X | X | 275 |
| MW2(4.5) | 2-5-92 | | X | | X | | 1 | ↓ | X | X | X | 276 |
| MW3(3) | 2-5-92 | | X | | X | | 1 | ↓ | X | X | X | 277 |
| MW3(4.5) | 2-5-92 | | X | | X | | 1 | ↓ | X | X | X | 278 |

Relinquished by: (Signature)

Date/Time

Received by: (Signature)

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

Relinquished by: (Signature)

Date/Time

Received by: (Signature)

1. Have all samples received for analysis been stored in ice?

Relinquished by: (Signature)

Date/Time

Received by: (Signature)

2. Will samples remain refrigerated until analyzed?

Relinquished by: (Signature)

Date/Time

Received by: (Signature)

3. Did any samples received for analysis have head space? N/A

4. Were samples in appropriate containers and properly packaged?

WVS

SAL

2/6

Signature

Title

Date