# Results of Ground Water Monitoring
# December 1995
# Unocal Service Station 1726
# Seattle, Washington

August 14, 1996

For

Unocal ERS - Western Region

GeoEngineers

15 YEARS

Consulting Engineers
and Geoscientists
Offices in Washington,
Oregon, and Alaska

August 14, 1996

Unocal ERS - Western Region
P.O. Box 76
Seattle, Washington 98111

Attention: Dr. Mark Brearley, R.G.

Results of Ground Water Monitoring
December 1995
Unocal Service Station 1726
Seattle, Washington
File No. 9161-278-04

## INTRODUCTION

This letter summarizes the results of ground water monitoring at and adjacent to the site of Unocal Service Station 1726 in Seattle, Washington. The site is located southwest of the intersection between West McGraw Street and 33rd Avenue West. Service Station 1726 is currently active.

The service station is identified as site number 008415 in Ecology's (Washington State Department of Ecology) registered UST (underground storage tank) program. The LUST (leaking underground storage tank) incident number for the site is 2078. The general layout of the service station is shown in Figure 1. Previous environmental studies conducted at the site are summarized in Attachment A.

## PURPOSE AND SCOPE

The purpose of our most recent site activities was to monitor ground water conditions in the on- and off-site monitoring wells. The specific scope of services completed for this phase of study includes:

1. Measure combustible vapor concentrations in the on- and off-site monitoring wells with a Bacharach TLV Sniffer calibrated to hexane.
2. Measure the depth to ground water, calculate the water table elevations in the monitoring wells, and interpret the shallow ground water flow direction.

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3. Obtain ground water samples from the on- and off-site wells for analysis of one or more of the following: BETX (benzene, ethylbenzene, toluene and xylenes) by EPA Method 8020, gasoline-range hydrocarbons by Ecology Method WTPH-G, diesel- and heavy oil-range hydrocarbons by Ecology Method WTPH-D extended, and HVOCs (halogenated volatile organic compounds) by EPA Method 8010.
4. Evaluate field and laboratory data with regard to current regulatory criteria.

## GROUND WATER MONITORING RESULTS

### DECEMBER 1995 FIELD MEASUREMENTS

A GeoEngineers representative measured the depth to the water table and combustible vapor concentrations in the monitoring well casings on December 19, 1995. Our field procedures are described in Attachment B. The depth to ground water in the monitoring well casings ranged from approximately 1.6 to 11.2 feet below ground surface. Based on our December 1995 measurements, the shallow ground water beneath the site appears to flow toward the east-northeast, which is consistent with our previous interpretations. Ground water contours based on our December 1995 measurements are shown in Figure 2. The ground water elevation data from monitoring well MW-3 were not used to develop ground water contours because the depth to ground water measured in this well was not consistent with the depths to water in the other monitoring wells. The water level anomaly in MW-3 is consistent with previous monitoring data.

Combustible vapor concentrations measured in the monitoring well casings ranged from 500 ppm (parts per million) (MW-2) to greater than 10,000 ppm (MW-1) on December 19. Free (floating) product was not encountered in the monitoring wells during this reporting period. Ground water elevations and combustible vapor concentrations are presented in Table 1.

### DECEMBER 1995 GROUND WATER QUALITY

Ground water samples were obtained from MW-1 through MW-6 on December 19, 1995. The ground water samples obtained from the on-site monitoring wells (MW-1 through MW-4) were submitted for laboratory analysis of gasoline-range hydrocarbons, BETX, and HVOCs. Ground water samples obtained from MW-1, MW-2 and MW-4 also were analyzed for diesel- and heavy oil-range hydrocarbons. Ground water samples obtained from the off-site monitoring wells (MW-5 and MW-6) were submitted for laboratory analysis of HVOCs. The chemical analytical results are summarized in Table 2 and Figure 3. The results of analysis for water samples obtained during previous monitoring events are included in Table 2 and Figure 4 for comparison. The laboratory reports and our evaluation of the laboratory's quality assurance procedures are included in Attachment C.

PCE (tetrachloroethene) was detected in the ground water samples obtained from MW-4 and MW-5 at concentrations greater than the MTCA Method A cleanup level of 5 $\mu$g/l (micrograms per liter). PCE was detected in the ground water samples obtained from MW-2 and MW-6 at

concentrations less than 5 µg/l. The compounds TCE (trichloroethene) and cis-1,2-DCE (cis-1,2-dichloroethene) were detected at concentrations less than applicable cleanup levels in the ground water sample obtained from MW-2. The MTCA Method A cleanup level for TCE is 5 µg/l. A Method A cleanup level has not been established for cis-1,2-DCE; however, the MTCA Method B single-constituent cleanup level for cis-1,2-DCE is 70 µg/l. The compound TCA (1,1,1-trichloroethane) was detected at a concentration less than the MTCA Method A cleanup level of 200 µg/l in the ground water sample obtained from MW-6. Other HVOCs were not detected in ground water samples obtained from the monitoring wells.

Benzene was detected at a concentration greater than the Method A cleanup level in the ground water sample obtained from MW-1. BETX constituents either were not detected or were detected at concentrations less than MTCA Method A cleanup levels in the ground water samples obtained from MW-2, MW-3 and MW-4 in December 1995.

Petroleum hydrocarbons (the sum of gasoline-, diesel- and heavy oil-range hydrocarbons) were detected at concentrations exceeding the MTCA Method A cleanup level in the ground water samples obtained from MW-1, MW-2 and MW-4. Gasoline-range hydrocarbons were not detected in the ground water sample obtained from MW-3.

## DISCUSSION

The results of our most recent ground water monitoring activities indicate that petroleum- and solvent-related ground water contamination continues to be present beneath the Unocal site. Chemical analytical results for ground water samples obtained from MW-1, MW-2 and MW-3 in December 1995 generally were consistent with previous monitoring at the site. The concentration of petroleum hydrocarbons (the sum of gasoline-, diesel- and heavy oil-range hydrocarbons) in the ground water sample obtained from MW-4 (8.44 mg/l) was greater than previous monitoring events.

The concentrations of PCE detected in the ground water samples obtained from off-site monitoring wells MW-5 and MW-6 and on-site monitoring well MW-4 in December 1995 decreased relative to the September 1995 results.

As discussed in our previous reports, it appears that the chlorinated compound originally released to the environment is PCE, based on our interpretation of ground water monitoring results. Other HVOCs detected at the site, TCE and cis-1,2-DCE, are breakdown products of PCE. TCA generally is not associated with degradation of PCE and was used in the past by the dry cleaning industry. TCA may have been released to the environment or may have been present at trace concentrations in the PCE that was released.

We reviewed a letter prepared by Kennedy/Jenks Consultants for Mr. Scott Shulz, the owner of Scott's Magnolia Cleaners. The letter, provided to us by Unocal, discussed the recent environmental investigation by Kennedy/Jenks within the Scott's Cleaners building. Soil samples were obtained from two soil borings and the base of an on-site sump. Extremely high

concentrations of PCE were detected in the sediment sample obtained from the sump, which is located upgradient from monitoring well MW-5. In our opinion, this study confirms the results of our ongoing ground water sampling, which indicate that the Scott's Cleaners site is the likely source of ground water contamination in off-site monitoring wells MW-5, MW-6 and on-site monitoring well MW-4.

## RECOMMENDATIONS

We recommend continued quarterly ground water monitoring and sampling at the site, including submitting ground water samples for analysis of BETX, gasoline-range hydrocarbons, HVOCs and/or diesel- and heavy oil-range hydrocarbons. We also recommend obtaining quarterly ground water samples from the off-site monitoring wells for analysis of HVOCs.

## LIMITATIONS

We have prepared this report for use by Unocal. This report may be made available to the property owner, Mr. Jeffrey Wishko, and to regulatory agencies. This report is not intended for use by others and the information contained herein is not applicable to other sites.

Our interpretation of subsurface conditions in this study is based on field observations and chemical analytical data from widely spaced explorations. It is always possible that areas contaminated with hydrocarbons or other regulated compounds exist in portions of the site that were not explored, sampled or analyzed.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in this area at the time this report was prepared. No warranty or other conditions, express or implied, should by understood.

Please contact us if you have questions regarding this submittal.

Yours very truly,

GeoEngineers, Inc.

Lisa J. Bona
Project Geologist

for JF
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Document ID: 0161278.GW

Attachments
Two copies submitted

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# TABLE 1 (Page 1 of 2)
# GROUND WATER ELEVATIONS AND COMBUSTIBLE VAPOR CONCENTRATIONS
UNOCAL SERVICE STATION 1726
SEATTLE, WASHINGTON

| Monitoring Well[1] | Date Measured | Casing Rim Elevation[2] (feet) | Ground Water Elevation[2] (feet) | Combustible Vapor Concentration[3] (ppm) |
|---|---|---|---|---|
| MW-1 | 03/24/94 | 101.43 | 97.20 | >10,000 |
| | 06/22/94 | | 96.81 | >10,000 |
| | 09/22/94 | | 96.33 | >10,000 |
| | 12/20/94 | | 97.38 | 2,000 |
| | 03/24/95 | | 97.11 | >10,000 |
| | 06/23/95 | | 96.67 | >10,000 |
| | 09/25/95 | | 96.55 | >10,000 |
| | **12/19/95** | | **97.61** | **>10,000** |
| MW-2 | 03/24/94 | 99.64 | 97.76 | <400 |
| | 06/22/94 | | 97.24 | <400 |
| | 09/22/94 | | 96.34 | <400 |
| | 12/20/94 | | 98.39 | <400 |
| | 03/24/95 | | 98.09 | <400 |
| | 06/23/95 | | 97.25 | <400 |
| | 09/25/95 | | 96.70 | <400 |
| | **12/19/95** | | **98.24** | **500** |
| MW-3 | 03/24/94 | 104.42 | 90.08 | <400 |
| | 06/22/94 | | 92.83 | <400 |
| | 09/22/94 | | 89.42 | <400 |
| | 12/20/94 | | 89.94 | <400 |
| | 03/24/95 | | 91.26 | <400 |
| | 06/23/95 | | 92.97 | <400 |
| | 09/25/95 | | 92.68 | <400 |
| | **12/19/95** | | **93.57** | **800** |
| MW-4 | 03/24/94 | 103.62 | 100.12 | <400 |
| | 06/22/94 | | 99.33 | <400 |
| | 09/22/94 | | 98.47 | <400 |
| | 12/20/94 | | 100.42 | <400 |
| | 03/24/95 | | 100.95 | <400 |
| | 06/23/95 | | 99.67 | <400 |
| | 09/25/95 | | 98.68 | <400 |
| | **12/19/95** | | **101.11** | **1,000** |
| MW-5 | 03/24/94 | 106.95 | 102.68 | <400 |
| | 06/22/94 | | 101.31 | <400 |
| | 09/22/94 | | 100.38 | <400 |
| | 12/20/94 | | 105.25 | <400 |
| | 03/24/95 | | 104.15 | <400 |
| | 06/23/95 | | 101.55 | <400 |
| | 09/25/95 | | 100.94 | <400 |
| | **12/19/95** | | **105.01** | **600** |

Notes appear on Page 2 of 2.

# TABLE 1 (Page 2 of 2)

| Monitoring Well[1] | Date Measured | Casing Rim Elevation[2] (feet) | Ground Water Elevation[2] (feet) | Combustible Vapor Concentration[3] (ppm) |
|---|---|---|---|---|
| MW-6 | 03/24/94 | 106.72 | 101.78 | <400 |
| | 06/22/94 | | 100.40 | <400 |
| | 09/22/94 | | 99.50 | <400 |
| | 12/20/94 | | 103.62 | <400 |
| | 03/24/95 | | 103.29 | <400 |
| | 06/23/95 | | 100.70 | <400 |
| | 09/25/95 | | 100.02 | <400 |
| | **12/19/95** | | **103.47** | **600** |

Notes:

[1]Approximate monitoring well locations are shown in Figures 2 and 3.

[2]Elevations are measured relative to the temporary benchmark shown in Figure 3. The benchmark is at an assumed elevation of 100.00 feet.

[3]Measured with a Bacharach TLV Sniffer calibrated to hexane. Field procedures are described in Attachment B.

ppm = parts per million

Bolding indicates measurement was obtained during the current reporting period.

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# TABLE 2 (Page 1 of 3)
# SUMMARY OF COMBUSTIBLE VAPOR CONCENTRATIONS AND GROUND WATER CHEMICAL ANALYTICAL DATA
## UNOCAL SERVICE STATION 1726
## SEATTLE, WASHINGTON

| Sample Source | Date Sampled | Well Casing Vapor Concentrations (ppm) | Volatile Aromatic Hydrocarbons[1] (EPA Method 8020) (µg/l) | | | | Gasoline-range Hydrocarbons (Ecology Method WTPH-G) (mg/l) | Diesel-range Hydrocarbons (Ecology Method WTPH-D) (mg/l) | Heavy Oil-range Hydrocarbons (Ecology Method WTPH-D ext) (mg/l) | Halogenated Volatile Organic Compounds[2] (EPA Method 8010) (µg/l) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | B | E | T | X | | | | PCE | TCE | DCE |
| MW-1 | 03/24/94 | >10,000[3] | 25 | 7.1[4] | 2.8 | 30 | 7.9 | 0.51 | <0.75 | <10 | <10 | <10 |
| Duplicate | 03/24/94 | -- | 25 | 34[4] | 2.6 | 40 | 9.3 | 0.39 | <0.75 | -- | -- | -- |
| | 06/22/94 | >10,000[3] | 41 | 5.5 | 0.79 | 6.2 | 0.88 | 0.28 | <0.75 | <1.0 | <1.0 | <1.0 |
| Duplicate | 06/22/94 | -- | 33 | 2.4 | <0.50 | 2.6 | 0.54 | <0.25 | <0.75 | -- | -- | -- |
| | 09/22/94 | >10,000 | 4.3 | 2.4 | <0.50 | 2.9 | 0.28 | 0.31 | 0.75 | <1.0 | <1.0 | <1.0 |
| | 12/20/94 | 2,000 | 28 | 26 | <0.50 | 24 | 4.3 | <0.25 | <0.75 | <1.0 | <1.0 | <1.0 |
| | 03/24/95 | >10,000[3] | 47 | 16 | 1.9 | 22 | 4.9 | 0.51 | <0.75 | <1.0 | <1.0 | <1.0 |
| | 06/23/95 | >10,000[3] | 47 | 17 | 3.0 | 17 | 4.5 | 0.61 | <0.75 | <1.0 | <1.0 | <1.0 |
| | 09/25/95 | >10,000[3] | 26 | 14 | 2.1 | 15 | 2.5 | 0.36 | <0.75 | <1.0 | <1.0 | <1.0 |
| | **12/19/95** | **>10,000[3]** | **24** | **18** | **1.8** | **19** | **3.5** | **1.0** | **0.98** | **<1.0** | **<1.0** | **<1.0** |
| MW-2 | 03/24/94 | <400[3] | 6.3 | 19 | <0.50 | 130 | 3.8 | <0.25 | <0.75 | <10 | <10 | <10 |
| | 06/22/94 | <400[3] | 2.4 | 6.7 | <0.50 | 41 | 1.1 | <0.25 | <0.75 | 1.8 | 2.7 | 3.6 |
| | 09/22/94 | <400[3] | 0.97 | 2.1 | <0.50 | 15 | 0.34 | <0.25 | <0.75 | 4.2 | 5.5 | 4.6 |
| | 12/20/94 | <400[3] | <0.50 | 0.73 | <0.50 | 5.0 | 0.12 | <0.25 | <0.75 | 2.8 | 2.9 | 2.9 |
| | 03/24/95 | <400[3] | 1.3 | 3.5 | <0.50 | 16 | 0.43 | 0.27 | <0.75 | 3.2 | 3.0 | 1.7 |
| | 06/23/95 | <400[3] | 0.91 | 1.9 | <0.50 | 8.9 | 0.28 | 0.35 | <0.75 | 4.1 | 3.2 | 2.7 |
| | 09/25/95 | <400[3] | 1.7 | 2.3 | <0.50 | 12 | 0.45 | 0.48 | 0.94 | 2.7 | 3.3 | 7.6 |
| | **12/19/95** | **500[3]** | **2.0** | **5.4** | **<0.50** | **24** | **0.9** | **1.2** | **1.3** | **2.5** | **2.2** | **4.0** |
| MW-3 | 03/24/94 | <400[3] | <0.50 | <0.50 | <0.50 | <1.0 | <0.05 | -- | -- | <1.0 | <1.0 | <1.0 |
| | 06/22/94 | <400[3] | <0.50 | <0.50 | <0.50 | <1.0 | <0.05 | -- | -- | <1.0 | <1.0 | <1.0 |
| | 09/22/94 | <400[3] | <0.50 | <0.50 | <0.50 | <1.0 | <0.05 | -- | -- | <1.0 | <1.0 | <1.0 |
| | 12/20/94 | <400[3] | <0.50 | <0.50 | <0.50 | <1.0 | <0.05 | -- | -- | <1.0 | <1.0 | <1.0 |
| | 03/24/95 | <400[3] | <0.50 | <0.50 | <0.50 | <1.0 | <0.05 | -- | -- | <1.0 | <1.0 | <1.0 |
| | 06/23/95 | <400[3] | <0.50 | <0.50 | <0.50 | <1.0 | <0.05 | -- | -- | <1.0 | <1.0 | <1.0 |
| | 09/25/95 | <400[3] | <0.50 | <0.50 | <0.50 | <1.0 | <0.05 | -- | -- | <1.0 | <1.0 | <1.0 |
| | **12/19/95** | **800[3]** | **<0.50** | **<0.50** | **<0.50** | **<1.0** | **<0.05** | -- | -- | **<1.0** | **<1.0** | **<1.0** |
| MTCA Method A Cleanup Levels | | | 5.0 | 30 | 40 | 20 | 1.0[5] | | | 5.0 | 5.0 | NA[6] |

Notes appear on Page 3 of 3

# TABLE 2 (Page 2 of 3)

| Sample Source | Date Sampled | Well Casing Vapor Concentrations (ppm) | Volatile Aromatic Hydrocarbons[1] (EPA Method 8020) (µg/l) | | | | Gasoline-range Hydrocarbons (Ecology Method WTPH-G) (mg/l) | Diesel-range Hydrocarbons (Ecology Method WTPH-D) (mg/l) | Heavy Oil-range Hydrocarbons (Ecology Method WTPH-D ext) (mg/l) | Halogenated Volatile Organic Compounds[2] (EPA Method 8010) (µg/l) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | B | E | T | X | | | | PCE | TCE | DCE |
| MW-4 | 03/24/94 | <400[3] | <0.50 | <0.50 | <0.50 | <1.0 | <0.05 | 0.37 | <0.75 | 79 | <1.0 | <1.0 |
| Duplicate | 03/24/94 | <400[3] | -- | -- | -- | -- | -- | -- | -- | 79 | <1.0 | <1.0 |
| | 06/22/94 | <400[3] | <0.50 | <0.50 | <0.50 | <1.0 | <0.05 | <0.25 | <0.75 | 100 | <1.0 | <1.0 |
| | 09/22/94 | <400[3] | <0.50 | <0.50 | <0.50 | <1.0 | 0.06 | <0.25 | <0.75 | 62 | <2.0 | <2.0 |
| | 12/20/94 | <400[3] | <0.50 | <0.50 | <0.50 | <1.0 | <0.05 | 0.44 | <0.75 | 41 | <1.0 | <1.0 |
| | 03/24/95 | <400[3] | <0.50 | <0.50 | <0.50 | <1.0 | 0.06[7] | 0.48 | 1.1 | 85 | <1.0 | <1.0 |
| | 06/23/95 | <400[3] | <0.50 | <0.50 | <0.50 | <1.0 | 0.10[7] | 0.31 | 0.91 | 190 | <1.0 | <1.0 |
| | 09/25/95 | <400[3] | <0.50 | <0.50 | <0.50 | <1.0 | 0.07[7] | <0.25 | <0.75 | 210 | <1.0 | <1.0 |
| | **12/19/95** | **1,000[3]** | **<0.50** | **<0.50** | **<0.50** | **<1.0** | **0.24** | **5.7** | **2.5** | **19** | **<1.0** | **<1.0** |
| MW-5 | 03/24/94 | <400 | -- | -- | -- | -- | -- | -- | -- | 250 | <1.0 | <1.0 |
| | 06/22/94 | <400 | -- | -- | -- | -- | -- | -- | -- | 170 | <1.0 | <1.0 |
| | 09/22/94 | <400 | -- | -- | -- | -- | -- | -- | -- | 280 | <10 | <10 |
| | 12/20/94 | <400 | -- | -- | -- | -- | -- | -- | -- | 18 | <1.0 | <1.0 |
| | 03/24/95 | <400 | -- | -- | -- | -- | -- | -- | -- | 33 | <1.0 | <1.0 |
| | 06/23/95 | <400 | -- | -- | -- | -- | -- | -- | -- | 150 | <1.0 | <1.0 |
| | 09/25/95 | <400 | -- | -- | -- | -- | -- | -- | -- | 250 | <1.0 | <1.0 |
| | **12/19/95** | **600[3]** | -- | -- | -- | -- | -- | -- | -- | **93** | **<1.0** | **<1.0** |
| MW-6 | 03/24/94 | <400 | -- | -- | -- | -- | -- | -- | -- | 6.2[8] | <1.0 | <1.0 |
| | 06/22/94 | <400 | -- | -- | -- | -- | -- | -- | -- | 7.9[9] | <1.0 | <1.0 |
| | 09/22/94 | <400 | -- | -- | -- | -- | -- | -- | -- | 3.3[10] | <1.0 | <1.0 |
| | 12/20/94 | <400 | -- | -- | -- | -- | -- | -- | -- | 3.3[11] | <1.0 | <1.0 |
| | 03/24/95 | <400 | -- | -- | -- | -- | -- | -- | -- | 4.2[12] | <1.0 | <1.0 |
| | 06/23/95 | <400 | -- | -- | -- | -- | -- | -- | -- | 8.9 | <1.0 | <1.0 |
| | 09/25/95 | <400 | -- | -- | -- | -- | -- | -- | -- | 17[13] | <1.0 | <1.0 |
| | **12/19/95** | **600** | -- | -- | -- | -- | -- | -- | -- | **2.6[12]** | **<1.0** | **<1.0** |
| MTCA Method A Cleanup Levels | | | 5.0 | 30 | 40 | 20 | | 1.0[5] | | 5.0 | 5.0 | NA[6] |

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# TABLE 2 (Page 3 of 3)

Notes:

[1]B = benzene, E = ethylbenzene, T = toluene, X = total xylenes

[2]See Attachment C for a complete list of analytes and detection limits. PCE = tetrachloroethene, TCE = trichloroethene, DCE = cis 1,2-dichloroethene.

[3]The combustible vapor measurement may not be representative of soil vapor concentrations because the ground water surface was at or above the screened interval of the well casing.

[4]Ethylbenzene values should be considered estimates because of variability of sample results.

[5]The MTCA Method A cleanup level for the sum of gasoline-, diesel- and heavy oil-range hydrocarbons is 1.0 mg/l when concentrations are quantified using gas chromatography methods.

[6]The MTCA Method B cleanup level for DCE is 80µg/l. The EPA drinking water MCL is 70µg/l.

[7]The laboratory report indicated that the gasoline-range hydrocarbons detected in this sample were a result of "an individual compound eluting in the volatile hydrocarbon range."

[8]1,1,1-trichloroethane also was detected in this sample at a concentration (2.4 µg/l) less than the MTCA Method A cleanup level of 200 µg/l.

[9]1,1,1-trichloroethane also was detected in this sample at a concentration (1.5 µg/l) less than the MTCA Method A cleanup level of 200 µg/l.

[10]1,1,1-trichloroethane also was detected in this sample at a concentration (5.6 µg/l) less than the MTCA Method A cleanup level of 200 µg/l.

[11]1,1,1-trichloroethane also was detected in this sample at a concentration (2.0 µg/l) less than the MTCA Method A cleanup level of 200 µg/l.

[12]1,1,1-trichloroethane also was detected in this sample at a concentration (1.0 µg/l) less than the MTCA Method A cleanup level of 200 µg/l.

[13]1,1,1-trichloroethane also was detected in this sample at a concentration (1.2 µg/l) less than the MTCA Method A cleanup level of 200 µg/l.

ppm = parts per million; µg/l = micrograms per liter; mg/l = milligrams per liter; NA = not applicable; "–" = not tested

Shading indicates a concentration at or greater than the MTCA Method A cleanup level.

Bolding indicates that sample was obtained during the current reporting period.

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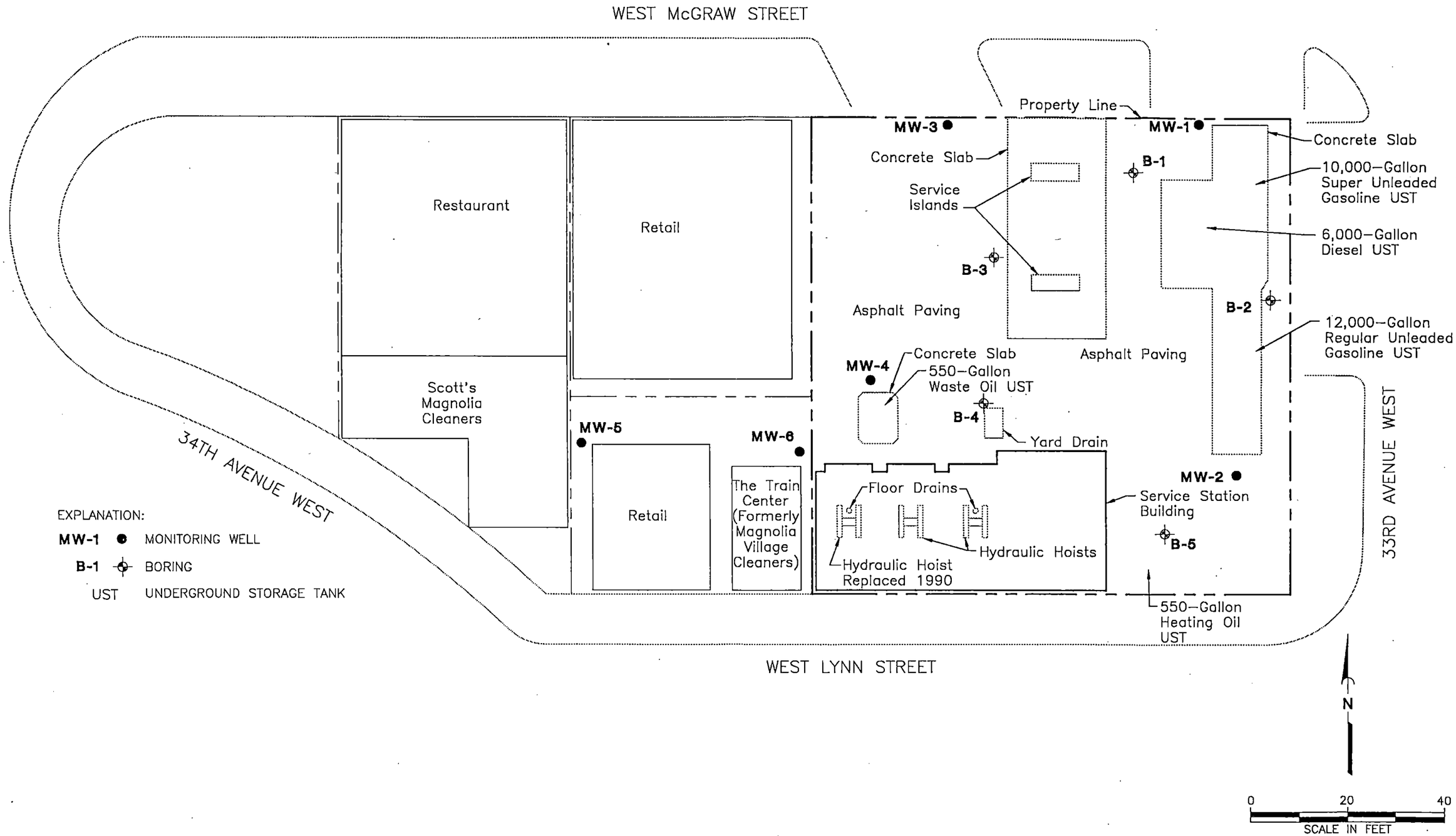


Note: 1. The locations of all features shown are approximate.

Reference: Drawing entitled "General Arrangement, Unocal Service Station 1726, Seattle, Washington," by Unocal, dated 10/17/85.

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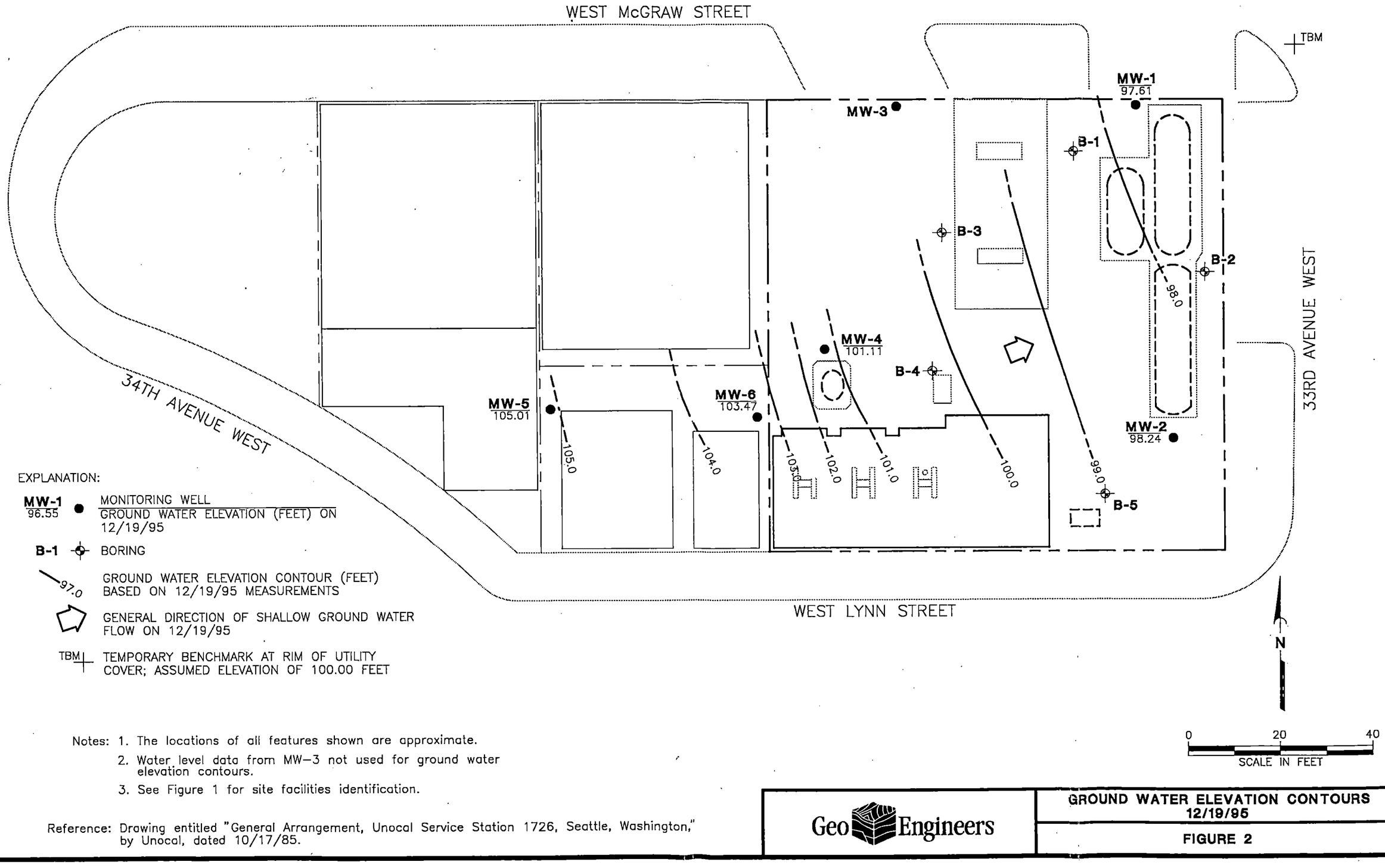
**SITE PLAN**

**FIGURE 1**

08/15/95 TNV:BDH D:\0161\278\0161278C.DWG




EXPLANATION:

- **MW-1** 96.55 ● — MONITORING WELL; GROUND WATER ELEVATION (FEET) ON 12/19/95
- **B-1** ⊕ — BORING
- 97.0 — GROUND WATER ELEVATION CONTOUR (FEET) BASED ON 12/19/95 MEASUREMENTS
- GENERAL DIRECTION OF SHALLOW GROUND WATER FLOW ON 12/19/95
- TBM ┼ — TEMPORARY BENCHMARK AT RIM OF UTILITY COVER; ASSUMED ELEVATION OF 100.00 FEET

Notes:
1. The locations of all features shown are approximate.
2. Water level data from MW-3 not used for ground water elevation contours.
3. See Figure 1 for site facilities identification.

Reference: Drawing entitled "General Arrangement, Unocal Service Station 1726, Seattle, Washington," by Unocal, dated 10/17/85.

Geo Engineers

**GROUND WATER ELEVATION CONTOURS 12/19/95**

**FIGURE 2**

01/12/96 LJB:BDH D:\0161\278\0161278A.DWG

| MW-3 | G | B | E | T | X | PCE | TCE | DCE |
|---|---|---|---|---|---|---|---|---|
| 03/24/94 | <0.05 | <0.5 | <0.5 | <0.5 | <1.0 | <1.0 | <1.0 | <1.0 |
| 06/22/94 | <0.05 | <0.5 | <0.5 | <0.5 | <1.0 | <1.0 | <1.0 | <1.0 |
| 09/22/94 | <0.05 | <0.5 | <0.5 | <0.5 | <1.0 | <1.0 | <1.0 | <1.0 |
| 12/20/94 | <0.05 | <0.5 | <0.5 | <0.5 | <1.0 | <1.0 | <1.0 | <1.0 |
| 03/24/95 | <0.05 | <0.5 | <0.5 | <0.5 | <1.0 | <1.0 | <1.0 | <1.0 |
| 06/23/95 | <0.05 | <0.5 | <0.5 | <0.5 | <1.0 | <1.0 | <1.0 | <1.0 |
| 09/25/95 | <0.05 | <0.5 | <0.5 | <0.5 | <1.0 | <1.0 | <1.0 | <1.0 |
| 12/19/95 | <0.05 | <0.5 | <0.5 | <0.5 | <1.0 | <1.0 | <1.0 | <1.0 |
| MTCA | 1.0 | 5.0 | 30.0 | 40.0 | 20.0 | 5.0 | 5.0 | NA |

| MW-1 | G | B | E | T | X | PCE | TCE | DCE |
|---|---|---|---|---|---|---|---|---|
| 03/24/94 | 7.9 | 25 | 7.1 | 2.8 | 30 | <10 | <10 | <10 |
| 06/22/94 | 0.88 | 41 | 5.5 | 0.79 | 6.2 | <1.0 | <1.0 | <1.0 |
| 09/22/94 | 0.28 | 4.3 | 2.4 | <0.5 | 2.9 | <1.0 | <1.0 | <1.0 |
| 12/20/94 | 4.3 | 28 | 26 | <0.5 | 24 | <1.0 | <1.0 | <1.0 |
| 03/24/95 | 4.9 | 47 | 16 | 1.9 | 22 | <1.0 | <1.0 | <1.0 |
| 06/23/95 | 4.5 | 47 | 17 | 3.0 | 17 | <1.0 | <1.0 | <1.0 |
| 09/25/95 | 2.5 | 26 | 14 | 2.1 | 15 | <1.0 | <1.0 | <1.0 |
| 12/19/95 | 3.5 | 24 | 18 | 1.8 | 19 | <1.0 | <1.0 | <1.0 |
| MTCA | 1.0 | 5.0 | 30.0 | 40.0 | 20.0 | 5.0 | 5.0 | NA |

| MW-5 | PCE | TCE | DCE |
|---|---|---|---|
| 03/24/94 | 250 | <1.0 | <1.0 |
| 06/22/94 | 170 | <1.0 | <1.0 |
| 09/22/94 | 280 | <10 | <10 |
| 12/20/94 | 18 | <1.0 | <1.0 |
| 03/24/95 | 33 | <1.0 | <1.0 |
| 06/23/95 | 150 | <1.0 | <1.0 |
| 09/25/95 | 250 | <1.0 | <1.0 |
| 12/19/95 | 93 | <1.0 | <1.0 |
| MTCA | 5.0 | 5.0 | NA |

| MW-6 | PCE | TCE | DCE |
|---|---|---|---|
| 03/24/94 | 6.2 | <1.0 | <1.0 |
| 06/22/94 | 7.9 | <1.0 | <1.0 |
| 09/22/94 | 3.3 | <1.0 | <1.0 |
| 12/20/94 | 3.3 | <1.0 | <1.0 |
| 03/24/95 | 4.2 | <1.0 | <1.0 |
| 06/23/95 | 8.9 | <1.0 | <1.0 |
| 09/26/95 | 17 | <1.0 | <1.0 |
| 12/19/95 | 2.6 | <1.0 | <1.0 |
| MTCA | 5.0 | 5.0 | NA |

WEST McGRAW STREET

34TH AVENUE WEST

33RD AVENUE WEST

WEST LYNN STREET

B-1

B-2

B-3

B-4

B-5

EXPLANATION:

- **MW-1** ● MONITORING WELL
- **B-1** ⊕ BORING
- GENERAL DIRECTION OF GROUND WATER FLOW ON 12/19/95
- G GASOLINE-RANGE HYDROCARBONS (mg/l)
- B BENZENE (µg/l)
- E ETHYLBENZENE (µg/l)
- T TOLUENE (µg/l)
- X XYLENES (µg/l)
- PCE TETRACHLOROETHENE (µg/l)
- TCE TRICHLOROETHENE (µg/l)
- DCE 1,2-DICHLOROETHENE (µg/l)
- NA NOT APPLICABLE
- MTCA MODEL TOXICS CONTROL ACT METHOD A GROUND WATER CLEANUP LEVELS

| MW-4 | G | B | E | T | X | PCE | TCE | DCE |
|---|---|---|---|---|---|---|---|---|
| 03/24/94 | <0.05 | <0.5 | <0.5 | <0.5 | <1.0 | 79 | <1.0 | <1.0 |
| 06/22/94 | <0.05 | <0.5 | <0.5 | <0.5 | <0.5 | 100 | <1.0 | <1.0 |
| 09/22/94 | 0.06 | <0.5 | <0.5 | <0.5 | <1.0 | 62 | <2.0 | <2.0 |
| 12/20/94 | <0.05 | <0.5 | <0.5 | <0.5 | <1.0 | 41 | <1.0 | <1.0 |
| 03/24/95 | 0.06 | <0.5 | <0.5 | <0.5 | <1.0 | 85 | <1.0 | <1.0 |
| 06/23/95 | 0.10 | <0.5 | <0.5 | <0.5 | <1.0 | 190 | <1.0 | <1.0 |
| 09/25/95 | 0.07 | <0.5 | <0.5 | <0.5 | <1.0 | 210 | <1.0 | <1.0 |
| 12/19/95 | 0.24 | <0.5 | <0.5 | <0.5 | <1.0 | 19 | <1.0 | <1.0 |
| MTCA | 1.0 | 5.0 | 30.0 | 40.0 | 20.0 | 5.0 | 5.0 | NA |

| MW-2 | G | B | E | T | X | PCE | TCE | DCE |
|---|---|---|---|---|---|---|---|---|
| 03/24/94 | 3.8 | 6.3 | 19 | <0.5 | 130 | <10 | <10 | <10 |
| 06/22/94 | 1.1 | 2.4 | 6.7 | <0.5 | 41 | 1.8 | 2.7 | 3.6 |
| 09/22/94 | 0.34 | 0.97 | 2.1 | <0.5 | 15 | 4.2 | 5.5 | 4.6 |
| 12/20/94 | 0.12 | <0.5 | 0.73 | <0.5 | 5.0 | 2.8 | 2.9 | 2.9 |
| 03/24/95 | 0.43 | 1.3 | 3.5 | <0.5 | 16 | 3.2 | 3.0 | 1.7 |
| 06/23/95 | 0.28 | 0.91 | 1.9 | <0.5 | 8.9 | 4.1 | 3.2 | 2.7 |
| 09/25/95 | 0.45 | 1.7 | 2.3 | <0.50 | 12 | 2.7 | 3.3 | 7.6 |
| 12/19/95 | 0.9 | 2.0 | 5.4 | <0.5 | 24 | 2.5 | 2.2 | 4.0 |
| MTCA | 1.0 | 5.0 | 30.0 | 40.0 | 20.0 | 5.0 | 5.0 | NA |

N

0 20 40

SCALE IN FEET

Notes: 1. The locations of all features shown are approximate.
2. See Figure 1 for site facilities identifications.

Reference: Drawing entitled "General Arrangement, Unocal Service Station 1726, Seattle, Washington," by Unocal, dated 10/17/85.

Geo Engineers

**SUMMARY OF GROUND WATER ANALYTICAL DATA**

**FIGURE 3**

01/12/96 LUB:BDH D:\0161\278\0161278B.DWG

ATTACHMENT A

## ATTACHMENT A

### PREVIOUS STUDIES

Astec Petroleum Services replaced the westernmost hydraulic hoist in the service station building in September 1990. A GeoEngineers representative visited the site following removal of the hoist to observe soil conditions in the excavation and to obtain soil samples for analytical testing. A 1/2-inch-diameter hole was observed in the casing for the hoist hydraulic ram. Laboratory analyses of three discrete soil samples obtained from the hoist excavation and of one composite sample obtained from the stockpile of excavated soil indicated that the concentrations of TPH (total petroleum hydrocarbons) exceeded the current MTCA (Model Toxics Control Act) Method A soil cleanup levels. The results of our services are presented in our report dated February 5, 1991.

GeoEngineers explored subsurface soil conditions in the vicinity of the USTs and fuel service islands at the site in June 1992 by completing nine borings (MW-1 through MW-4 and B-1 through B-5) at the approximate locations shown in Figure 2. Monitoring wells were constructed in borings MW-1 through MW-4 to evaluate ground water conditions. Gasoline-related contamination was detected in soil and ground water samples obtained from MW-1, and in one soil sample obtained from B-1. Solvent-related contamination was detected in a ground water sample obtained from MW-4. The results of our subsurface contamination study are presented in our report dated August 7, 1992.

We monitored test pit explorations in the vicinity of the hydraulic hoists in October 1993. Heavy oil-range contamination was detected in soil samples obtained from the test pit completed adjacent to the westernmost hydraulic hoist. The results of test pit explorations are summarized in our report dated December 17, 1993.

Ground water samples were obtained from MW-1 through MW-4 in September 1992 and October 1993. Solvent-related contamination was detected in ground water samples obtained from MW-2 and MW-4. Petroleum-related contamination was detected in ground water samples obtained from MW-1, MW-2 and MW-4 on one or both occasions. The results of our September 1992 monitoring activities are presented in our report dated November 12, 1992. The results of October 1993 monitoring activities are presented in our report dated December 17, 1993.

We concluded that the source of solvent-related contamination was likely off site, based on ground water flow direction and concentrations of contaminants detected in ground water samples. We installed two off-site (upgradient) monitoring wells (MW-5 and MW-6) and obtained ground water samples from all of the on- and off-site monitoring wells in March 1994. Solvent-related contamination was detected at high concentrations in the ground water samples obtained from the off-site monitoring wells. Petroleum-related compounds also were detected at

concentrations greater than MTCA Method A cleanup levels in ground water samples obtained from on-site monitoring wells MW-1 and MW-2. The results of our March 1994 activities are included in our report dated April 29, 1994.

Ground water samples were obtained from MW-1 through MW-6 on June 22, September 22, December 24, 1994 and March 24, June 23, and September 25, 1995. Solvent-related contamination was detected in ground water samples obtained from MW-2, MW-4, MW-5 and MW-6. Petroleum-related contamination was detected in ground water samples obtained from MW-1 and MW-2. Petroleum-related contamination was detected in the ground water sample obtained from MW-4 for the first time in March 1995. Monitoring wells MW-5 and MW-6 were installed off site to investigate the source of PCE contamination detected in ground water samples obtained from on-site well MW-4. PCE has been detected at concentrations greater than the MTCA Method A cleanup level in ground water samples obtained during this and previous monitoring events from MW-5, located adjacent to the former Scott's Magnolia Cleaners (Figure 2). Based on the results of this study and previous studies conducted at the site, the most likely source of PCE is the former Scott's Magnolia Cleaners. The results of our most recent monitoring activities are presented in our report dated October 31, 1995.

**ATTACHMENT B**

ATTACHMENT C

NORTH CREEK ANALYTICAL

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9405 S.W. Nimbus Avenue • Beaverton, OR 97008-7132 (503) 643-9200 • FAX 644-2202

| | | | |
|---|---|---|---|
| GeoEngineers, Inc. | Project Name: | UNOCAL Seattle, #1726 | |
| 8410 154th Avenue N.E. | Client Project : | #9161-278-R04 | |
| Redmond, WA 98052 | | | Received: Dec 20, 1995 |
| Attention: Laura Maffei | NCA Project #: | B512354 | Reported: Jan 4, 1996 |

## PROJECT SUMMARY PAGE

| Laboratory Sample Number | Sample Description | Sample Matrix | Date Sampled |
|---|---|---|---|
| B512354-01 | MW-1 | Water | 12/19/95 |
| B512354-02 | MW-2 | Water | 12/19/95 |
| B512354-03 | MW-3 | Water | 12/19/95 |
| B512354-04 | MW-4 | Water | 12/19/95 |
| B512354-05 | MW-5 | Water | 12/19/95 |
| B512354-06 | MW-6 | Water | 12/19/95 |

GeoEngineers

JAN 0 8 1996

Routing lcm

File

The results in this report apply to the samples analyzed in accordance with the chain of custody document.
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NORTH CREEK ANALYTICAL Inc.

Laura Dutton

Laura Dutton
Project Manager

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| | | | |
|---|---|---|---|
| GeoEngineers, Inc. | Client Project ID: | UNOCAL Seattle, #1726 | Sampled: Dec 19, 1995 |
| 8410 154th Avenue N.E. | Sample Matrix: | Water | Received: Dec 20, 1995 |
| Redmond, WA 98052 | Analysis Method: | WTPH-G | Analyzed: Dec 27-29, 1995 |
| Attention: Laura Maffei | First Sample #: | B512354-01 | Reported: Jan 4, 1996 |

## TOTAL PETROLEUM HYDROCARBONS-GASOLINE RANGE

| Sample Number | Sample Description | Sample Result µg/L (ppb) | Surrogate Recovery % |
|---|---|---|---|
| B512354-01 | MW-1 | 3,500 | S-2 |
| B512354-02 | MW-2 | 900 | S-2 |
| B512354-03 | MW-3 | N.D. | 96 |
| B512354-04 | MW-4 | 240 | 108 |
| BLK122795 | Method Blank | N.D. | 107 |

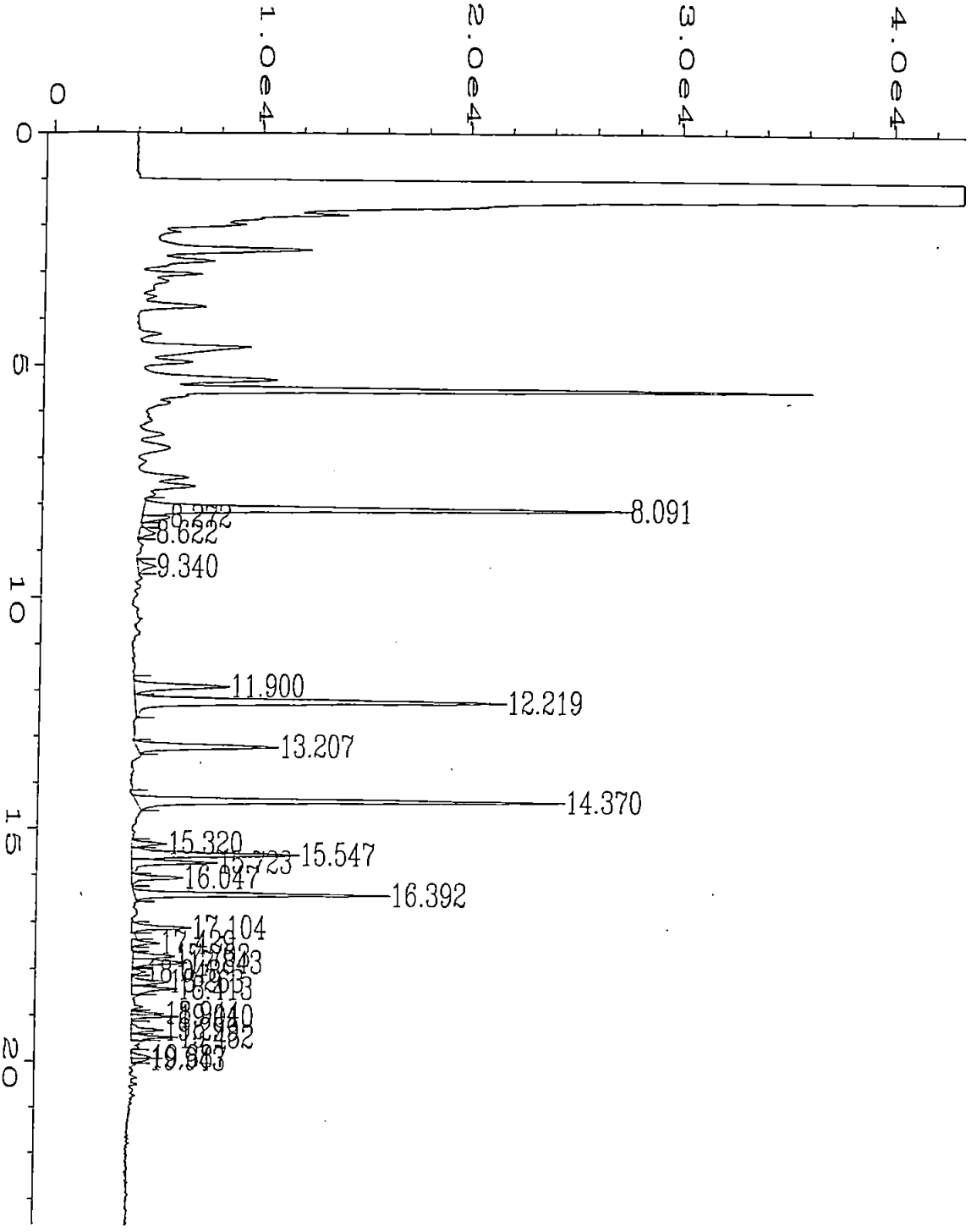
| | |
|---|---|
| **Reporting Limit:** | 50 |

4-Bromofluorobenzene surrogate recovery control limits are 50 - 150 %.
Volatile Total Petroleum Hydrocarbons are quantitated as Gasoline Range Organics (toluene - dodecane).
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc.

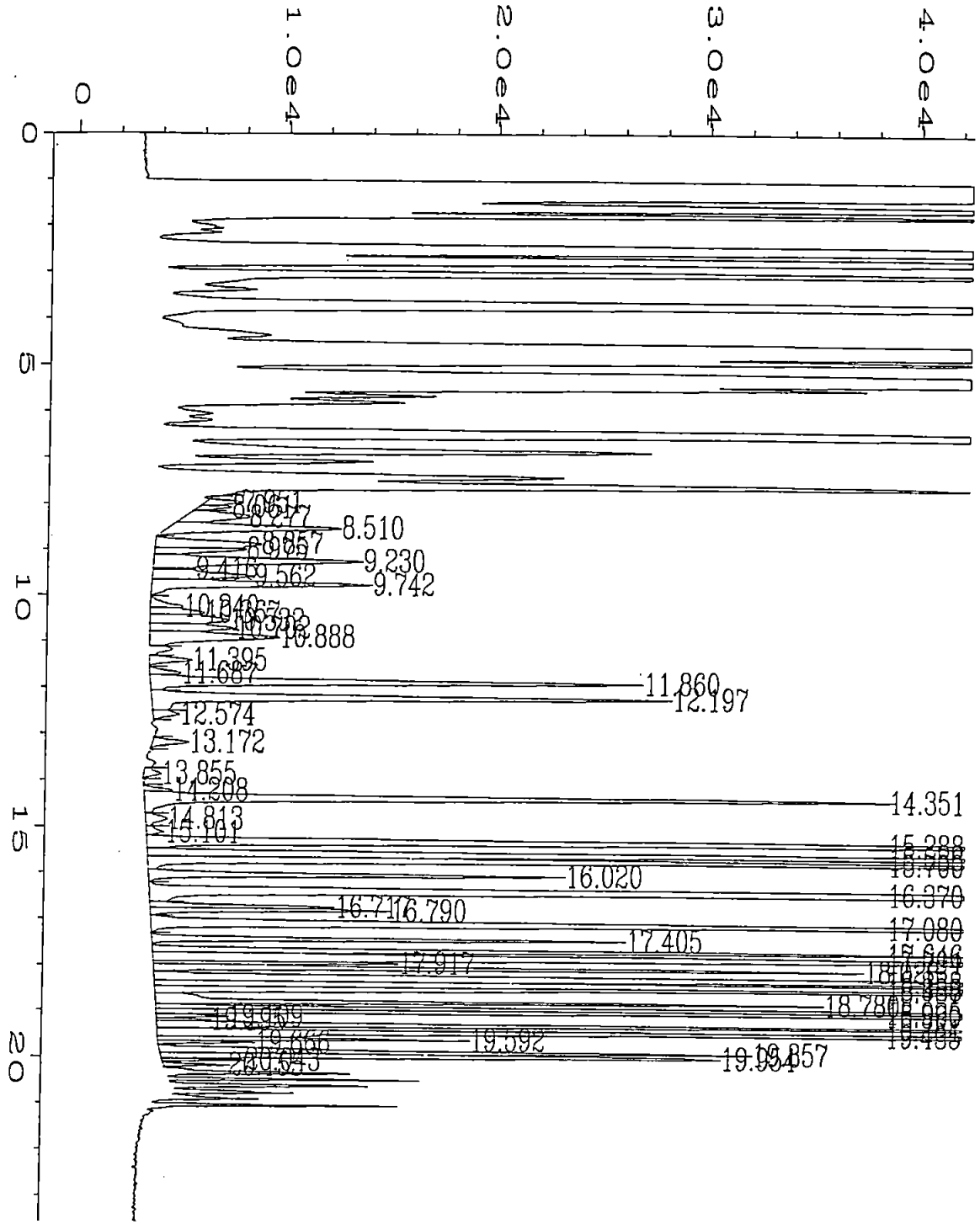
Laura Dutton
Project Manager

Please Note:
S-2 = The Surrogate Recovery for this sample cannot be accurately quantified due to interference from coeluting organic compounds present in the sample.



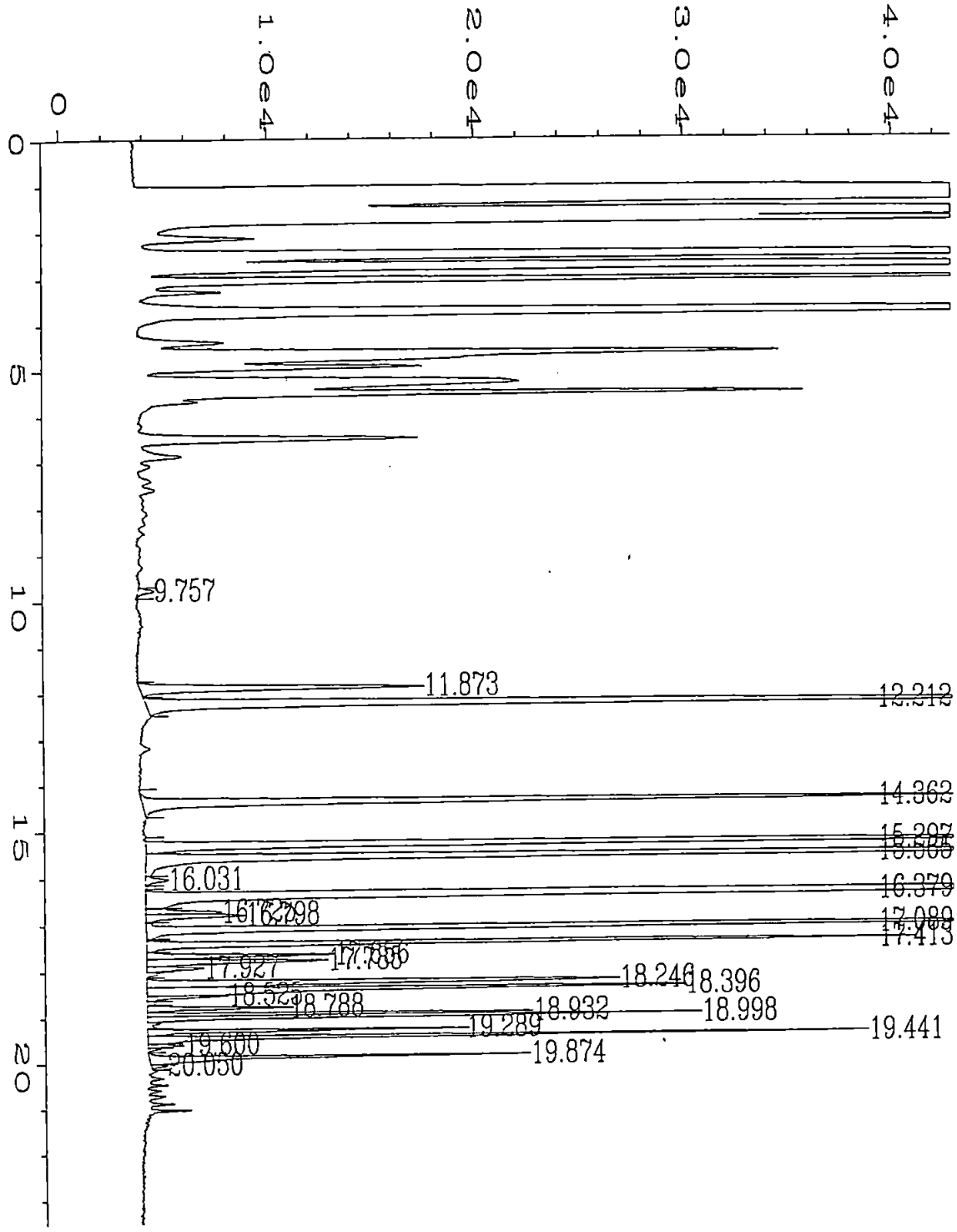

Data File Name : C:\HPCHEM\4\DATA\122795\002F0101.D
Operator :
Instrument : GC#4
Sample Name : gas std
Run Time Bar Code:
Acquired on : 27 Dec 95 07:53 AM
Report Created on: 27 Dec 95 08:17 AM
Sample Info : 500 ng v-10a

Page Number : 1
Vial Number : 2
Injection Number : 1
Sequence Line : 1
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH



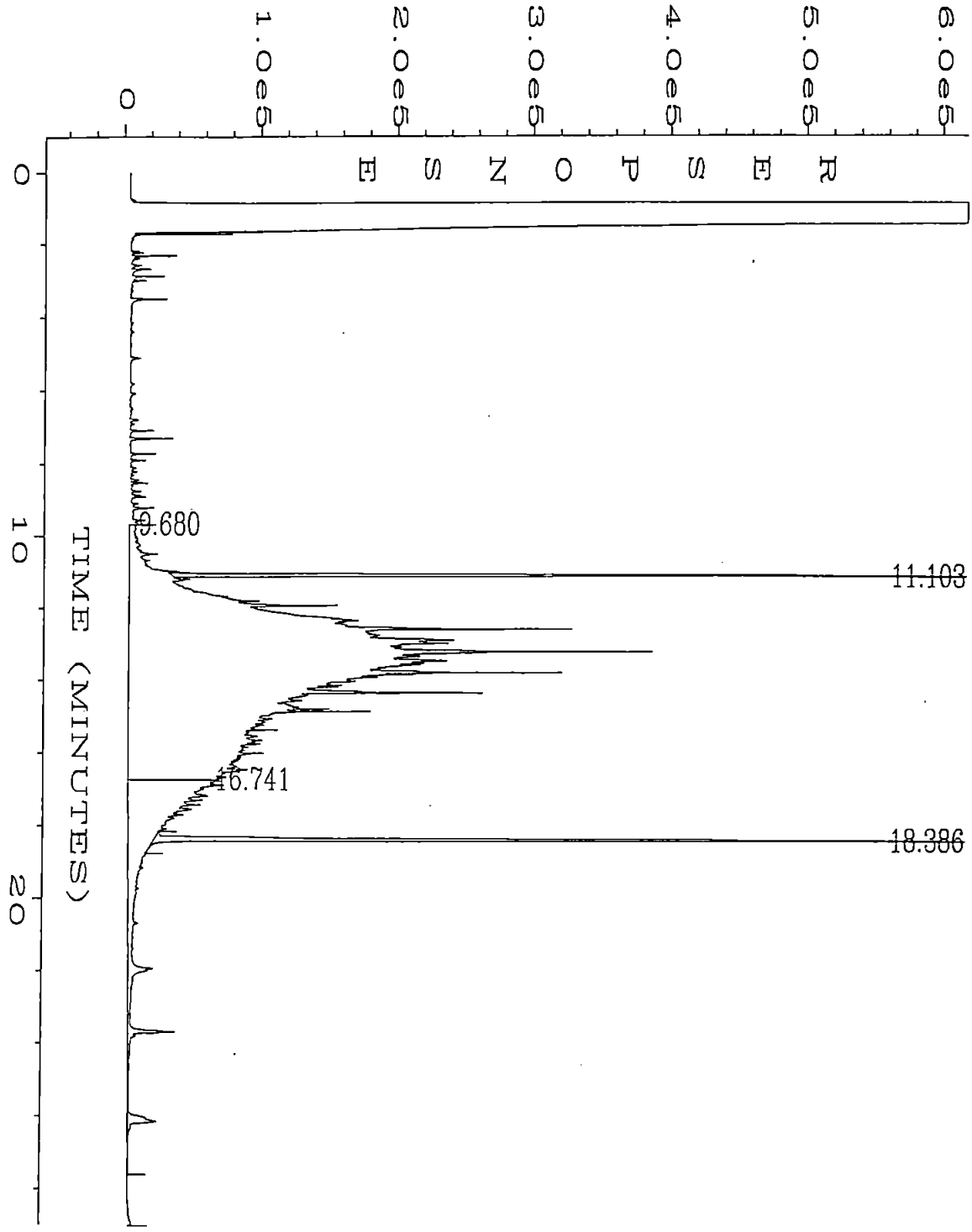

Data File Name : C:\HPCHEM\4\DATA\122895\036F1001.D
Operator :
Instrument : GC#4
Sample Name : b512354-01 r1
Run Time Bar Code:
Acquired on : 28 Dec 95 10:18 PM
Report Created on: 28 Dec 95 10:42 PM
Multiplier : 2
Sample Info : 2.5 ml

Page Number : 1
Vial Number : 36
Injection Number : 1
Sequence Line : 10
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH




Data File Name : C:\HPCHEM\4\DATA\122795\040F0501.D
Operator :
Instrument : GC#4
Sample Name : b512354-02
Run Time Bar Code:
Acquired on : 28 Dec 95 03:43 AM
Report Created on: 28 Dec 95 04:06 AM
Sample Info : 5 ml

Page Number : 1
Vial Number : 40
Injection Number : 1
Sequence Line : 5
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH




Data File Name : C:\HPCHEM\2\DATA\DEC28\037F2401.D
Operator : TF
Instrument : BOB
Sample Name : 512354-04W
Run Time Bar Code:
Acquired on : 29 Dec 95 10:21 AM
Report Created on: 29 Dec 95 10:58 AM

Page Number : 1
Vial Number : 37
Injection Number : 1
Sequence Line : 24
Instrument Method: TPHE.MTH
Analysis Method : TPHE.MTH

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GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052
Attention: Laura Maffei

Client Project ID: UNOCAL Seattle, #1726
Sample Matrix: Water
Analysis Method: WTPH-D
Units: mg/L (ppm)

Analyst: T. Fitzgibbon

Extracted: Dec 23, 1995
Analyzed: 12/29/95-1/4/96
Reported: Jan 4, 1996

# HYDROCARBON QUALITY CONTROL DATA REPORT

## ACCURACY ASSESSMENT
### Laboratory Control Sample

| | Diesel |
|---|---|
| Spike Conc. Added: | 2.04 |
| Spike Result: | 2.08 |
| % Recovery: | 102 |
| Upper Control Limit %: | 107 |
| Lower Control Limit %: | 69 |

## PRECISION ASSESSMENT
### Sample Duplicate

| | Diesel Range Organics |
|---|---|
| Sample Number: | B512396-03 |
| Original Result: | N.D. |
| Duplicate Result: | N.D. |
| Relative % Difference: | Relative Percent Difference values are not reported at sample concentration levels less than 10 times the Reporting Limit. |
| Maximum RPD: | 44 |

NORTH CREEK ANALYTICAL Inc.

Laura Dutton
Project Manager

$$\%\ \text{Recovery:} \quad \frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$$

$$\text{Relative \% Difference:} \quad \frac{\text{Original Result - Duplicate Result}}{(\text{Original Result + Duplicate Result}) / 2} \times 100$$

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| | | | | |
|---|---|---|---|---|
| GeoEngineers, Inc. | Client Project ID: | UNOCAL Seattle, #1726 | Sampled: | Dec 19, 1995 |
| 8410 154th Avenue N.E. | Sample Descript: | Water, MW-1 | Received: | Dec 20, 1995 |
| Redmond, WA 98052 | Analysis Method: | EPA 8010 | Analyzed: | Dec 29, 1995 |
| Attention: Laura Maffei | Sample Number: | B512354-01 | Reported: | Jan 4, 1996 |

## HALOGENATED VOLATILE ORGANICS

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

4-Bromofluorobenzene Surrogate Recovery, %: 92
Surrogate Recovery Control Limits are 63 - 148 %.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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Laura Dutton
Project Manager

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| | | | | |
|---|---|---|---|---|
| GeoEngineers, Inc. | Client Project ID: | UNOCAL Seattle, #1726 | Sampled: | Dec 19, 1995 |
| 8410 154th Avenue N.E. | Sample Descript: | Water, MW-2 | Received: | Dec 20, 1995 |
| Redmond, WA 98052 | Analysis Method: | EPA 8010 | Analyzed: | Dec 29, 1995 |
| Attention: Laura Maffei | Sample Number: | B512354-02 | Reported: | Jan 4, 1996 |

## HALOGENATED VOLATILE ORGANICS

| Analyte | Reporting Limit µg/L (ppb) | Sample Results µg/L (ppb) |
|---|---|---|
| Bromodichloromethane | 1.0 | N.D. |
| Bromoform | 1.0 | N.D. |
| Bromomethane | 1.0 | N.D. |
| Carbon tetrachloride | 1.0 | N.D. |
| Chlorobenzene | 1.0 | N.D. |
| Chloroethane | 1.0 | N.D. |
| Chloroform | 1.0 | N.D. |
| Chloromethane | 1.0 | N.D. |
| Dibromochloromethane | 1.0 | N.D. |
| 1,2-Dichlorobenzene | 1.0 | N.D. |
| 1,3-Dichlorobenzene | 1.0 | N.D. |
| 1,4-Dichlorobenzene | 1.0 | N.D. |
| 1,1-Dichloroethane | 1.0 | N.D. |
| 1,2-Dichloroethane | 0.50 | N.D. |
| 1,1-Dichloroethene | 1.0 | N.D. |
| **cis 1,2-Dichloroethene** | **1.0** | **4.0** |
| trans 1,2-Dichloroethene | 1.0 | N.D. |
| 1,2-Dichloropropane | 1.0 | N.D. |
| cis-1,3-Dichloropropene | 1.0 | N.D. |
| trans-1,3-Dichloropropene | 1.0 | N.D. |
| Methylene chloride | 5.0 | N.D. |
| 1,1,2,2-Tetrachloroethane | 1.0 | N.D. |
| **Tetrachloroethene** | **1.0** | **2.5** |
| 1,1,1-Trichloroethane | 1.0 | N.D. |
| 1,1,2-Trichloroethane | 1.0 | N.D. |
| **Trichloroethene** | **1.0** | **2.2** |
| Trichlorofluoromethane | 1.0 | N.D. |
| Vinyl chloride | 1.0 | N.D. |

4-Bromofluorobenzene Surrogate Recovery, %: 95
Surrogate Recovery Control Limits are 63 - 148 %.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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Project Manager

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9405 S.W. Nimbus Avenue • Beaverton, OR 97008-7132 (503) 643-9200 • FAX 644-2202

| | | | | |
|---|---|---|---|---|
| GeoEngineers, Inc. | Client Project ID: | UNOCAL Seattle, #1726 | Sampled: | Dec 19, 1995 |
| 8410 154th Avenue N.E. | Sample Descript: | Water, MW-3 | Received: | Dec 20, 1995 |
| Redmond, WA 98052 | Analysis Method: | EPA 8010 | Analyzed: | Dec 29, 1995 |
| Attention: Laura Maffei | Sample Number: | B512354-03 | Reported: | Jan 4, 1996 |

## HALOGENATED VOLATILE ORGANICS

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

4-Bromofluorobenzene Surrogate Recovery, %: 94
Surrogate Recovery Control Limits are 63 - 148 %.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc.

Laura Dutton
Project Manager

512354.GEO <10>

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| | | | | |
|---|---|---|---|---|
| GeoEngineers, Inc. | Client Project ID: | UNOCAL Seattle, #1726 | Sampled: | Dec 19, 1995 |
| 8410 154th Avenue N.E. | Sample Descript: | Water, MW-4 | Received: | Dec 20, 1995 |
| Redmond, WA 98052 | Analysis Method: | EPA 8010 | Analyzed: | Dec 29, 1995 |
| Attention: Laura Maffei | Sample Number: | B512354-04 | Reported: | Jan 4, 1996 |

## HALOGENATED VOLATILE ORGANICS

| Analyte | Reporting Limit µg/L (ppb) | Sample Results µg/L (ppb) |
|---|---|---|
| Bromodichloromethane | 1.0 | N.D. |
| Bromoform | 1.0 | N.D. |
| Bromomethane | 1.0 | N.D. |
| Carbon tetrachloride | 1.0 | N.D. |
| Chlorobenzene | 1.0 | N.D. |
| Chloroethane | 1.0 | N.D. |
| Chloroform | 1.0 | N.D. |
| Chloromethane | 1.0 | N.D. |
| Dibromochloromethane | 1.0 | N.D. |
| 1,2-Dichlorobenzene | 1.0 | N.D. |
| 1,3-Dichlorobenzene | 1.0 | N.D. |
| 1,4-Dichlorobenzene | 1.0 | N.D. |
| 1,1-Dichloroethane | 1.0 | N.D. |
| 1,2-Dichloroethane | 0.50 | N.D. |
| 1,1-Dichloroethene | 1.0 | N.D. |
| cis 1,2-Dichloroethene | 1.0 | N.D. |
| trans 1,2-Dichloroethene | 1.0 | N.D. |
| 1,2-Dichloropropane | 1.0 | N.D. |
| cis-1,3-Dichloropropene | 1.0 | N.D. |
| trans-1,3-Dichloropropene | 1.0 | N.D. |
| Methylene chloride | 5.0 | N.D. |
| 1,1,2,2-Tetrachloroethane | 1.0 | N.D. |
| **Tetrachloroethene** | **1.0** | **19** |
| 1,1,1-Trichloroethane | 1.0 | N.D. |
| 1,1,2-Trichloroethane | 1.0 | N.D. |
| Trichloroethene | 1.0 | N.D. |
| Trichlorofluoromethane | 1.0 | N.D. |
| Vinyl chloride | 1.0 | N.D. |

4-Bromofluorobenzene Surrogate Recovery, %: 90
Surrogate Recovery Control Limits are 63 - 148 %.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc.

Laura Dutton
Project Manager

512354.GEO <11>

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| | | | | |
|---|---|---|---|---|
| GeoEngineers, Inc. | Client Project ID: | UNOCAL Seattle, #1726 | Sampled: | Dec 19, 1995 |
| 8410 154th Avenue N.E. | Sample Descript: | Water, MW-5 | Received: | Dec 20, 1995 |
| Redmond, WA 98052 | Analysis Method: | EPA 8010 | Analyzed: | Dec 29, 1995 |
| Attention: Laura Maffei | Sample Number: | B512354-05 | Reported: | Jan 4, 1996 |

## HALOGENATED VOLATILE ORGANICS

| Analyte | Reporting Limit µg/L (ppb) | Sample Results µg/L (ppb) |
|---|---|---|
| Bromodichloromethane | 1.0 | N.D. |
| Bromoform | 1.0 | N.D. |
| Bromomethane | 1.0 | N.D. |
| Carbon tetrachloride | 1.0 | N.D. |
| Chlorobenzene | 1.0 | N.D. |
| Chloroethane | 1.0 | N.D. |
| Chloroform | 1.0 | N.D. |
| Chloromethane | 1.0 | N.D. |
| Dibromochloromethane | 1.0 | N.D. |
| 1,2-Dichlorobenzene | 1.0 | N.D. |
| 1,3-Dichlorobenzene | 1.0 | N.D. |
| 1,4-Dichlorobenzene | 1.0 | N.D. |
| 1,1-Dichloroethane | 1.0 | N.D. |
| 1,2-Dichloroethane | 0.50 | N.D. |
| 1,1-Dichloroethene | 1.0 | N.D. |
| cis 1,2-Dichloroethene | 1.0 | N.D. |
| trans 1,2-Dichloroethene | 1.0 | N.D. |
| 1,2-Dichloropropane | 1.0 | N.D. |
| cis-1,3-Dichloropropene | 1.0 | N.D. |
| trans-1,3-Dichloropropene | 1.0 | N.D. |
| Methylene chloride | 5.0 | N.D. |
| 1,1,2,2-Tetrachloroethane | 1.0 | N.D. |
| **Tetrachloroethene** | **1.0** | **93** |
| 1,1,1-Trichloroethane | 1.0 | N.D. |
| 1,1,2-Trichloroethane | 1.0 | N.D. |
| Trichloroethene | 1.0 | N.D. |
| Trichlorofluoromethane | 1.0 | N.D. |
| Vinyl chloride | 1.0 | N.D. |

4-Bromofluorobenzene Surrogate Recovery, %: 93
Surrogate Recovery Control Limits are 63 - 148 %.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc.

Laura Dutton
Project Manager

512354.GEO <12>

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| | | | | |
|---|---|---|---|---|
| GeoEngineers, Inc. | Client Project ID: | UNOCAL Seattle, #1726 | Sampled: | Dec 19, 1995 |
| 8410 154th Avenue N.E. | Sample Descript: | Water, MW-6 | Received: | Dec 20, 1995 |
| Redmond, WA 98052 | Analysis Method: | EPA 8010 | Analyzed: | Dec 29, 1995 |
| Attention: Laura Maffei | Sample Number: | B512354-06 | Reported: | Jan 4, 1996 |

## HALOGENATED VOLATILE ORGANICS

| Analyte | Reporting Limit µg/L (ppb) | Sample Results µg/L (ppb) |
|---|---|---|
| Bromodichloromethane | 1.0 | N.D. |
| Bromoform | 1.0 | N.D. |
| Bromomethane | 1.0 | N.D. |
| Carbon tetrachloride | 1.0 | N.D. |
| Chlorobenzene | 1.0 | N.D. |
| Chloroethane | 1.0 | N.D. |
| Chloroform | 1.0 | N.D. |
| Chloromethane | 1.0 | N.D. |
| Dibromochloromethane | 1.0 | N.D. |
| 1,2-Dichlorobenzene | 1.0 | N.D. |
| 1,3-Dichlorobenzene | 1.0 | N.D. |
| 1,4-Dichlorobenzene | 1.0 | N.D. |
| 1,1-Dichloroethane | 1.0 | N.D. |
| 1,2-Dichloroethane | 0.50 | N.D. |
| 1,1-Dichloroethene | 1.0 | N.D. |
| cis 1,2-Dichloroethene | 1.0 | N.D. |
| trans 1,2-Dichloroethene | 1.0 | N.D. |
| 1,2-Dichloropropane | 1.0 | N.D. |
| cis-1,3-Dichloropropene | 1.0 | N.D. |
| trans-1,3-Dichloropropene | 1.0 | N.D. |
| Methylene chloride | 5.0 | N.D. |
| 1,1,2,2-Tetrachloroethane | 1.0 | N.D. |
| **Tetrachloroethene** | **1.0** | **2.6** |
| **1,1,1-Trichloroethane** | **1.0** | **1.0** |
| 1,1,2-Trichloroethane | 1.0 | N.D. |
| Trichloroethene | 1.0 | N.D. |
| Trichlorofluoromethane | 1.0 | N.D. |
| Vinyl chloride | 1.0 | N.D. |

4-Bromofluorobenzene Surrogate Recovery, %: 97
Surrogate Recovery Control Limits are 63 - 148 %.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc.

Laura Dutton
Project Manager

512354.GEO <13>

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| | | | |
|---|---|---|---|
| GeoEngineers, Inc. | Client Project ID: | UNOCAL Seattle, #1726 | |
| 8410 154th Avenue N.E. | Sample Descript: | Method Blank | |
| Redmond, WA 98052 | Analysis Method: | EPA 8010 | Analyzed: Dec 28, 1995 |
| Attention: Laura Maffei | Sample Number: | BLK122895 | Reported: Jan 4, 1996 |

## HALOGENATED VOLATILE ORGANICS

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

4-Bromofluorobenzene Surrogate Recovery, %: 93
Surrogate Recovery Control Limits are 63 - 148 %.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc.

Laura Dutton
Project Manager

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| | | | |
|---|---|---|---|
| GeoEngineers, Inc. | Client Project ID: UNOCAL Seattle, #1726 | Analyst: | R. Hager |
| 8410 154th Avenue N.E. | Sample Matrix: Water | | |
| Redmond, WA 98052 | Analysis Method: EPA 8010 | | |
| Attention: Laura Maffei | Units: µg/L (ppb) | Analyzed: | Dec 29, 1995 |
| | QC Sample #: B512355-01 | Reported: | Jan 4, 1996 |

## MATRIX SPIKE QUALITY CONTROL DATA REPORT

| ANALYTE | 1,1-DCE | TCE | Chloro-Benzene |
|---|---|---|---|
| Sample Result: | N.D. | 4.3 | N.D. |
| Spike Conc. Added: | 10.0 | 10.0 | 10.0 |
| Spike Result: | 11.0 | 14.4 | 10.1 |
| Spike % Recovery: | 110% | 101% | 101% |
| Spike Dup. Result: | 11.7 | 15.8 | 10.1 |
| Spike Duplicate % Recovery: | 117% | 115% | 101% |
| Upper Control Limit %: | 144 | 130 | 127 |
| Lower Control Limit %: | 73 | 67 | 68 |
| Relative % Difference: | 6.0% | 9.3% | 0.0% |
| Maximum RPD: | 17 | 21 | 18 |

NORTH CREEK ANALYTICAL inc

Laura Dutton
Project Manager

| | | |
|---|---|---|
| % Recovery: | $\frac{\text{Spike Result - Sample Result}}{\text{Spike Conc. Added}}$ | x 100 |
| Relative % Difference: | $\frac{\text{Spike Result - Spike Dup. Result}}{\text{(Spike Result + Spike Dup. Result) / 2}}$ | x 100 |

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# UNOCAL CHAIN OF CUSTODY REPORT

**UNOCAL INFORMATION**

Facility Number: SS#1726
Site Address: 3301 W. McGraw St
City, State, ZIP: Seattle WA
Site Release Number:
Unocal Manager: Dr Mark Brearley
CERT INFO: (check one) o Evaluation o Remediation
o Detection o Demolition o Closure o Miscellaneous

**CONSULTANT INFORMATION**

Firm: GeoEngineers Project Number: 9161-278-R04
Address: 8410 154th Ave NE
Redmond WA 98052
Phone: (206) 861-6000 Fax: (206) 861-6050
Project Manager: Laura Maffei
Sample Collection by: Jim Jackson

**Chain of Custody Record #:**

Quality Assurance Data Level: [A] [X B]
A: Standard Summary
B: Standard + Chromatograms
Laboratory Turnaround Days: [X 10] [5] [3] [2] [1]

o Oregon o Washington Hydrocarbon Methods

| SAMPLE IDENTIFICATION | SAMPLING DATE / TIME | MATRIX (W,S,O) | # OF CONTAINERS | TPH-HCID | TPH-Gas | BTEX (EPA 8020 Mod.) | TPH-Gas + BTEX | TPH-Diesel | TPH-Diesel Extended | TPH-418.1 | Halogen. Volatiles (EPA 8010) | Aromatic Volatiles (EPA 8020) | Pesticides/PCBs or PCBs Only | GC/MS Volatiles (EPA 8240/8260) | GC/MS SemiVols. (EPA 8270) | PAHs by HPLC (EPA 8310) | Lead: Total or Dissolved | TCLP Metals (8) | NCA SAMPLE NUMBER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. MW-1 | 12/9/95/1315 | W | 4 | | | | X | | X | | X | | | | | | | | B512354-01 |
| 2. MW-2 | /1340 | | 4 | | | | X | | X | | X | | | | | | | | -02 |
| 3. MW-3 | /1410 | | 3 | | | | X | | | | X | | | | | | | | -03 |
| 4. MW-4 | /1440 | | 4 | | | | X | | X | | X | | | | | | | | -04 |
| 5. MW-5 | /1455 | | 1 | | | | | | | | X | X | | | | | | | -05 |
| 6. MW-6 | /1450 | | 1 | | | | | | | | X | | | | | | | | -06 |
| 7. | | | | | | | | | | | | | | | | | | | |
| 8. | | | | | | | | | | | | | | | | | | | |
| 9. | | | | | | | | | | | | | | | | | | | |
| 10. | | | | | | | | | | | | | | | | | | | |

| Relinquished by: | Firm: | Date & Time | Received by: | Firm: | Date & Time |
|---|---|---|---|---|---|
| 1. Jim Jackson | GEO | 0800/122095 | Lucinda McCoy | NCA | 12/20/95 1380 |
| 2. | | | Cust seal intact | | |
| 3. | | | | | |

**Final Report Approval**

Were all requested results provided? [yes] [no] Define
Were results within requested turnaround? [yes] [no] "No"
Final Approval Signature: on back

Firm: Date:

Page 1 of 1
Rev. 2.2, 11/94

Comments:

Distribution: White - Laboratory Yellow - Consultant Photocopy - Unocal

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