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Progress Report No. 3

Vapor Extraction System Monitoring

Unocal Service Station 5353

Seattle, Washington

October 1, 1993

For

Unocal CERT - Northern Region

October 1, 1993

Geotechnical,
Geoenvironmental and
Geologic Services

Unocal CERT - Northern Region
P.O. Box 76
Seattle, Washington 98111

Attention: Dr. Mark Brearley

We are submitting five copies of our "Progress Report No. 3, Vapor Extraction System Monitoring" for the site of Unocal Service Station 5353 in Seattle, Washington. This progress report summarizes VES-related monitoring activities conducted between December 8, 1990 and July 14, 1993. Future progress reports will be provided to Unocal to update the information presented in this report. Contractual terms for our services are described in blanket contract number B1982G.

We appreciate the opportunity to be of continued service to Unocal. Please call if you have questions regarding this report.

Yours very truly,

GeoEngineers, Inc.



Stephen C. Perrigo
Principal

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**PROGRESS REPORT NO. 3
VAPOR EXTRACTION SYSTEM MONITORING
UNOCAL SERVICE STATION 5353
SEATTLE, WASHINGTON
FOR
UNOCAL CERT - NORTHERN REGION**

INTRODUCTION

This report summarizes the results of GeoEngineers' VES (vapor extraction system) monitoring and related activities conducted at the site of Unocal Service Station 5353 from December 8, 1990 to July 14, 1993. The property owned by Unocal consists of the southern half of the city block bounded by West Mercer Street to the south, Westlake Avenue North to the west, Valley Street to the north and Terry Avenue North to the east. Unocal Service Station 5353 (600 Westlake Avenue North) and an adjacent Denny's restaurant (601 Terry Avenue North) are located on the Unocal property. The northern half of the city block described above is owned by the city of Seattle. The Ecology (Washington State Department of Ecology) UST (underground storage tank) site number is 008463. The site location is shown relative to surrounding physical features in Figure 1. The site location and the immediate vicinity are shown in Figure 2.

PREVIOUS STUDIES

Unocal Service Station 5353 is the site of an 80,000-gallon release of leaded premium gasoline that occurred in 1980. Site characterization and remediation activities completed at the site between 1980 and 1981 included drilling and installing 32 monitoring wells, and installing a free product recovery system. Over 40,000 gallons of free product were recovered between 1980 and 1983. The free product recovery system was taken out of operation in 1983 because of a decreasing recovery rate. A VES was installed at the site in 1988 to mitigate combustible vapors in the soil beneath the site and to reduce explosive potential. The VES design and installation details and monitoring data obtained during VES operation before December 8, 1990 are presented in the following reports: "Progress Report No. 1" dated July 12, 1988, "Interim Status Report" dated October 3, 1988 and "Progress Report No. 2" dated January 3, 1991.

GeoEngineers conducted additional subsurface explorations, including drilling and installation of 18 monitoring wells, from October 1991 to February 1992. The purpose of those supplemental explorations was to define the approximate extent and concentrations of residual petroleum contamination in soil and ground water in the vicinity of the site. The results of this study are presented in our "Supplemental Report of Geoenvironmental Services" dated July 7, 1992. The approximate locations of monitoring wells installed at the site in 1980 and additional monitoring wells installed in 1991 and 1992 are shown in Figure 3.

In October 1991, the city of Seattle requested that Unocal take steps to monitor combustible vapors in buildings, crawl spaces, vaults and other surface or subsurface structures on the city's property where vapors could potentially accumulate and result in health and safety hazards. Vapor monitoring of the city property occupying the northern half of the city block bounded by Mercer Street, Terry Avenue, Fairview Street and Westlake Avenue was implemented by GeoEngineers in October 1991. The results of monitoring from October 1991 to July 1992 are presented in our "Report of Geoenvironmental Services," dated December 2, 1992.

A site assessment, including tank removal activities and the installation of six monitoring wells, was performed at the city of Seattle property north of the Unocal site in early 1991. The assessment was completed by SCS (SCS Engineers) for the city of Seattle. The results of the SCS study, as summarized in their reports dated January 1991 and May 1991, indicate that petroleum-related soil and ground water contamination is present beneath the city of Seattle property. The approximate locations of the six monitoring wells installed by SCS are shown in Figure 3.

GeoEngineers performed aquifer testing at the site in February 1993. The results of these activities are summarized in our "Report of Hydrogeological Services" dated May 27, 1993.

SCOPE

The purpose of our services conducted during the current reporting period was to complete modifications of the VES and monitor operation of the VES. The specific scope of services completed during this reporting period is as follows.

1. Obtain the necessary permit to discontinue treatment of the effluent vapor stream, and coordinate disconnection of the thermal oxidizer from the VES.
2. Plan and coordinate the connection of four monitoring wells located on the city of Seattle property to the VES.
3. Periodically maintain and monitor the operation of the VES, as described in the "VES Operation and Monitoring" section of this report.
4. Observe Enviro (Enviros Inc.) obtaining a ground water sample from monitoring well MW-40. Submit a split of the sample for laboratory analysis of BETX (benzene, ethylbenzene, toluene and xylenes) by EPA Method 8020, gasoline-range hydrocarbons by Ecology Method WTPH-G, heavy oil-range hydrocarbons by Ecology Method WTPH-418.1 modified, and total and dissolved lead by EPA Method 7421.
5. Obtain two soil samples from stockpiled soil excavated during service station upgrading activities and submit the samples for chemical analysis.

VES MODIFICATIONS

VAPOR TREATMENT

VES emissions at the site were originally permitted by PSAPCA (Puget Sound Air Pollution Control Agency) by Notice of Construction 3088 issued June 27, 1988. The original Notice of

Construction permitted the use of a thermal oxidizer vapor treatment unit. A steady decline in hydrocarbon vapor concentrations in the pretreatment vapor stream has been observed over the course of VES operation. In a March 18, 1992 letter to PSAPCA, GeoEngineers requested approval to continue operating the VES without the thermal oxidizer, and vent vapors directly to the atmosphere. A copy of the request letter is provided in Appendix A. PSAPCA approved this request and issued Notice of Construction 4397 on April 2, 1992. The new Notice of Construction also is included in Appendix A. The new Notice of Construction allows an emission rate of up to 15 pounds of gasoline vapors per day.

The thermal oxidizer was disconnected on May 8, 1992 and remained off for the remainder of the reporting period. Gasoline vapor emissions, without treatment, were maintained at less than 15 pounds per day during this reporting period, as described in a later section of this report.

CONNECTION OF SEATTLE WELLS

Four additional wells (MW-32, MW-49, SMW-2S and SMW-5), located on city of Seattle property, were connected to the VES in January 1992 in an effort to reduce subsurface hydrocarbon vapor concentrations beneath the city of Seattle property. The wells were connected to the VES by B & C Equipment. The piping was valved so that vapors may be extracted from the western two wells (SMW-2S and SMW-5) or from the eastern two wells (MW-32 and MW-49). Piping was installed below-grade in parking or traffic areas and above-grade in other areas. The piping was sloped downward from the VES enclosure area to the wells to allow water condensing out of the vapor stream to drain back into the wells. The pipe trenches were backfilled with the soil excavated from the trenches, and resurfaced with concrete or asphalt pavement after installation.

The current layout of the VES, including these modifications, is shown in Figure 4.

VES OPERATION AND MONITORING

GENERAL

The VES was operated in a "pulsed" mode from December 8, 1990 to January 21, 1992. The pulsing cycle generally consisted of approximately two weeks on followed by approximately two weeks off. The on and off periods and the system operational configuration during these periods are summarized in Table 1. During this period, vapors generally were extracted from the southeastern and southwestern vapor collection areas on the Unocal site. The locations of the vapor collection areas are shown in Figure 4.

From January 21, 1992 to June 24, 1992 the VES essentially was operated continuously, with occasional shutdowns for maintenance. During this period, vapors generally were extracted from the southwestern and southeastern vapor collection areas on the Unocal site, and/or the western and eastern collection areas on the Seattle property (Table 1). Our observations indicated

that because of the high ground water levels in MW-32 and MW-49, vapors could not be extracted from the vapor collection areas on the Seattle property alone without entraining ground water in the vapor stream and damaging the system.

From June 24, 1992 to the end of this reporting period on July 14, 1993 the VES was operated continuously, extracting vapors from the northeastern, northwestern, southeastern and southwestern collection areas at the Unocal site and the eastern and western collection areas on the Seattle property (Table 1).

The current reporting period, December 8, 1990 through July 14, 1993, comprised 948 days. The VES operated for approximately 682 days of the reporting period. The VES did not operate, because of planned off-cycles or maintenance reasons, for the remaining portion of the reporting period.

VES monitoring was conducted on a regular basis during the current reporting period. The monitoring frequency, approximately twice monthly or monthly, depended on the operational configuration of the VES. VES monitoring activities included (1) measuring water levels, product thicknesses, combustible vapor concentrations, and ground vacuum in select monitoring and recovery wells, (2) obtaining vapor samples from the airspace of select monitoring wells for field measurement of carbon dioxide and for chemical analysis of methane and TVH (total volatile hydrocarbons), (3) measuring VES operational characteristics including flow rate, applied vacuum, vapor temperature and supplemental fuel use, and (4) obtaining vapor samples from the VES sample port for field measurement of combustible vapor concentration and carbon dioxide and for chemical analysis of methane and TVH. Not all of these activities were completed during each monitoring visit. Additionally, product samples were obtained from MW-2 and MW-19 for chemical analysis. Monitoring data, free product laboratory analytical data and estimated equivalent gasoline and methane recovery are summarized in Tables 2 through 10. Our field procedures for monitoring activities are described in Appendix B. Laboratory reports for product and vapor sample chemical analyses, and our review of the laboratory QA/QC (quality assurance/quality control) program are presented in Appendix C.

VES OPERATIONAL DATA

VES flow rates, vapor stream temperatures, applied vacuums, supplemental fuel use (for the period when the thermal oxidizer was in operation) and system operational configurations observed during monitoring events are presented in Table 2.

Flow Rate and Applied Vacuum Measurements

The flow rate ranged from 40 to 120 cfm (cubic feet per minute) during the reporting period, with a time-weighted average of about 85 cfm. Applied vacuum ranged from 1.2 to greater than 30 inches of water column. The applied vacuums are dependent on the VES operational configuration and are probably also dependent on soil moisture content, ground water levels and moisture content of the extracted vapors.

Combustible Vapor and Carbon Dioxide Measurements

The vapor stream extracted from the subsurface was characterized by obtaining field measurements of combustible vapor and carbon dioxide, and by obtaining vapor samples for chemical analysis of TVH and methane. Measurements and vapor samples obtained before the thermal oxidizer was disconnected on May 8, 1992 were obtained from the pre-treatment vapor stream. Measurements and vapor samples obtained after May 8, 1992 were obtained from the effluent vapor stream and are representative of the vapor stream emitted to the atmosphere.

The concentration of combustible vapors in the vapor stream generally decreased over the reporting period, with a temporary increase when four monitoring wells on the Seattle property were connected to the system. Generally, concentrations ranged up to 3,300 ppm (parts per million) during monitoring dates from December 8, 1990 to February 11, 1992, when vapors were generally extracted from the southwestern and southeastern vapor collection areas on the Unocal site. Concentration ranged up to 2,400 ppm during the monitoring dates from February 11, 1992 to June 24, 1992, when vapors generally were extracted from the southeastern and southwestern collection areas on the Unocal site and the eastern and western vapor collection areas on the Seattle property. Concentrations ranged up to 690 ppm during the monitoring dates from June 24, 1992 to July 14, 1993, when vapors were extracted from all vapor collection areas on the Unocal site and the Seattle property. The measurements of carbon dioxide concentration in the airstream ranged from 0 to 9.0 percent. Carbon dioxide measurements do not indicate a trend and do not appear to correlate with other measurements.

TVH and Methane Concentrations

Vapor samples obtained from the vapor stream on the dates indicated in Table 2 were analyzed for TVH and methane. Laboratory results are summarized in Table 2. Laboratory reports and our review of the laboratory QA/QC program are presented in Appendix C. During the period from December 8, 1990 to October 15, 1991 the laboratory reported TVH concentrations in parts per million on a volume-per-volume basis. After October 15, 1991 the laboratory reported TVH concentrations in milligrams per cubic meter. In Table 2, we have converted the values reported in milligrams per cubic meter to parts per million using the Ideal Gas Law and an assumed average molecular weight of 70 grams per mole, for the purpose of comparison to the older data. The unit of parts per million is used throughout the remainder of this report.

Concentrations of TVH and methane fluctuated widely in the vapor stream. In general, TVH decreased during the reporting period. During the period from December 8, 1990 to February 11, 1992, TVH concentrations ranged from 1,900 ppm to less than the laboratory detection level. The last six samples during this period had TVH concentrations at or less than the laboratory detection level. During the period from February 11, 1992 to June 24, 1992, TVH was not detected or was detected at the laboratory detection level when vapors were extracted from collection areas on the Unocal site; TVH concentrations ranged from 1,050 ppm to less than the laboratory detection level when vapors were extracted from collection areas on

the Seattle property. TVH was not detected during the period from June 24, 1992 to June 29, 1993. Methane concentrations ranged from 13,800 ppm to less than the laboratory detection level during the reporting period. A general trend toward lower average methane vapor concentrations was observed.

Approximate volumes of recovered gasoline vapors (converted to equivalent gallons) and methane were calculated for this reporting period using laboratory data, measured vapor flow rates and known durations of VES operational configurations. Calculated volumes of recovered gasoline and methane for the reporting period and cumulative totals for the life of the system through July 14, 1993 are presented in Table 3. The equivalent of approximately 465 gallons of gasoline and 62,722 cubic feet of methane have been recovered during this reporting period. The equivalent of approximately 4,727 gallons of gasoline and 183,489 cubic feet of methane have been recovered by the system from its initial start-up to July 14, 1993. Daily emissions of gasoline vapors to the atmosphere did not exceed the 15 pounds per day allowed by the PSAPCA permit during this reporting period.

In addition to reporting concentrations of TVH, the laboratory also reported concentrations of BETX for the vapor samples obtained from October 24, 1991 to March 13, 1992. The laboratory results were reported in milligrams per cubic meter. We converted the results to parts per million for consistency. Benzene concentrations ranged from less than the laboratory detection level to 7.8 ppm. Ethylbenzene concentrations ranged from less than the laboratory detection level to 2.8 ppm. Toluene concentrations ranged from less than the laboratory detection level to 12.7 ppm. Xylenes concentrations ranged from less than the laboratory detection level to 11.5 ppm. The laboratory reports are included in Appendix C.

MONITORING WELLS AND RECOVERY WELLS DATA

Ground Water and Free Product Measurements

Ground water levels were measured in the monitoring and recovery wells on the dates indicated in Table 4. The ground water elevations presented in Table 4 are referenced to the city of Seattle datum. The ground water elevations in the vicinity of the site ranged from about 7 to 13 feet, with the exception of MW-41, which is located significantly upgradient of the site. The general direction of ground water flow is toward the east and northeast, although considerable variation in flow direction has been observed in localized areas. This is consistent with past observations at this site. Ground water elevations in the monitoring wells did not always indicate a consistent ground water gradient. Ground water elevations measured in the monitoring wells installed in 1980 were usually more inconsistent than in the monitoring wells installed in 1991. This may be caused by variable screened intervals in the 1980 monitoring wells. Inferred ground water contours based on measurements obtained from the 1991 monitoring wells on April 30, 1993 are shown in Figure 5. The water levels in MW-32A and MW-46 appeared to be anomalous and were not used in calculating the contours.

The thickness of free product in monitoring wells was measured on the dates indicated in Table 4. Measurable free product was present during one or more monitoring events in MW-2,

MW-3, MW-11, MW-19, MW-35 and MW-45. A trace of free product has been observed in MW-18 and MW-37. Maximum measured free product thicknesses in the monitoring wells during this reporting period were as follows:

Monitoring Well Number	Date Measured	Maximum Free Product Thickness (feet)
MW-2	04/17/91	0.34
MW-3	07/14/93	0.01
MW-11	07/03/91	0.02
MW-18	12/16/91	Trace
MW-19	02/15/91	0.88
MW-35	11/04/91	0.02
MW-37	12/16/91	Trace
MW-45	11/04/91	0.01

During our most recent visit to the site (July 14, 1993) free product was present in monitoring wells MW-2 (0.06 feet), MW-3 (0.01 feet) and MW-19 (0.42 feet). Free product periodically was removed from the wells during the reporting period by hand-bailing.

Product samples were obtained from monitoring wells MW-2 (downgradient of the service station facilities) and MW-19 (upgradient of the service station facilities) on August 6, 1991 to evaluate whether the product present in monitoring well MW-2 was a remnant of the product leaked in 1980, or if it represented an ongoing leak. The samples were submitted for analysis of gasoline- and diesel-range hydrocarbons by modified EPA Method 8015. In addition, the samples were analyzed for BETX, TCLP (toxicity characteristic leaching procedure) metals, pH and flash point. The laboratory results are summarized in Table 5. A visual inspection of the samples, inspection of the chromatograms generated by the modified EPA Method 8015 test, comparisons of the BETX ratios and comparisons of the flash points of the two samples indicated that the product in both MW-2 and MW-19 was aged gasoline, although the product in MW-19 possibly was less aged than the product in MW-2. This suggests that the product present in both MW-2 and MW-19 are not the result of a recent or ongoing release.

Combustible Vapors

Recovery Wells. Combustible vapors were measured in the recovery wells on the dates indicated in Table 6. The results are presented in Table 6.

Combustible vapor concentrations in the recovery wells located on the Unocal site ranged from 200 ppm to 8,200 ppm at the beginning of this reporting period. Combustible vapor concentrations in these wells steadily decreased over the reporting period to concentrations ranging from less than 100 ppm to 220 ppm.

Combustible vapor concentrations in the recovery wells located on the Seattle property, measured immediately after the wells were connected to the VES, ranged from less than 100 ppm

to greater than 10,000 ppm. Combustible vapor concentrations in these wells were all greater than 10,000 ppm at the end of the current reporting period. The combustible vapor concentrations in recovery wells SMW-2S and SMW-5 generally either were very high or very low. This may be because the screened intervals in these wells do not extend significantly above the static water level, and under high applied vacuums the water levels in the wells rise above the top of the well screens and vapors cannot enter the wells.

Monitoring Wells. Combustible vapor concentrations were measured in selected monitoring wells on the dates indicated in Table 7. The results are presented in Table 7.

Only the monitoring wells installed in 1980 were present at the site at the beginning of this reporting period. Combustible vapor concentrations were greater than 10,000 ppm in more than half of the monitoring wells at that time. Combustible vapor concentrations in the remaining monitoring wells ranged from 120 ppm to 400 ppm. During the period when the VES was operated in "pulsed" mode (from December 8, 1990 to January 21, 1992) the concentrations of combustible vapors in the monitoring wells generally was much higher at the end of each two-week off period than at the end of each two-week on period.

Combustible vapor concentrations in the monitoring wells installed in 1991 and the two monitoring wells installed by SCS (SMW-1S and SMW-4) consistently have been greater than 10,000 ppm in more than half of the wells. The combustible vapor concentrations in the remaining wells have ranged from less than 100 ppm to 9,200 ppm. The combustible vapor concentrations in the 1991 monitoring wells located near the VES vapor collection areas were much lower than in the monitoring wells located farther away from the vapor collection areas, with the exception of monitoring well MW-32A, which has high concentrations of combustible vapors.

Combustible vapor concentrations in many of the monitoring wells (especially MW-14, MW-17, MW-32A, MW-35, MW-37, MW-42, MW-45 and MW-46) fluctuated widely, with no apparent correlation to the VES operational configuration. Also, the monitoring wells installed in 1980 generally have much lower combustible vapor concentrations than the monitoring wells installed in 1991 in the same areas. This is likely the result of localized biodegradation of hydrocarbons in the immediate vicinities of these older monitoring wells. This localized biodegradation would be stimulated by introduction of oxygen into the affected zone by the flow of fresh air into the monitoring well casings during routine monitoring activities. Combustible vapors measured in 1991 monitoring wells on June 29, 1993 are shown in Figure 6.

TVH and Methane Concentrations

Vapor samples were obtained from selected monitoring wells on the dates indicated in Table 8. The samples were submitted for laboratory analysis of TVH and methane. In addition, the laboratory provided BETX concentrations for the samples obtained on February 21, 1992. The laboratory results are summarized in Table 8. Laboratory reports and our review of the laboratory QA/QC program are presented in Appendix C.

Generally, the data show that vapors in MW-19 are predominantly fuel-related petroleum hydrocarbons. Vapors in the remaining wells tested (MW-11, MW-29 and MW-37) are predominantly methane vapors.

Ground Vacuum

Ground vacuum was measured in the recovery wells and in the monitoring wells on the dates indicated in Tables 9 and 10, respectively. The results are presented in Tables 9 and 10.

Vacuum in the recovery wells on the Unocal site ranged from 0 to 14 inches of water column. Vacuum in the recovery wells on the Seattle property ranged from 0 to 10 inches of water column. Vacuum in the recovery wells is dependent on the VES operational configuration, and is probably also dependent on soil moisture content, ground water levels and moisture content of the extracted vapors.

Vacuum in the monitoring wells ranged from 0 to 2.56 inches of water column. The vacuum in individual monitoring wells was not necessarily consistent between monitoring dates, even when the VES operational configuration during the two events being compared was the same. This inconsistency in the ground vacuum between monitoring dates could be dependent on soil moisture content, ground water levels and changing atmospheric pressure conditions. Ground vacuum in the monitoring wells generally decreased with distance from the vapor collection areas being operated at the time. Ground vacuum measured on June 29, 1993 and inferred vacuum contours based on this data are shown in Figure 7.

GROUND WATER SAMPLING

Enviros (Enviros Inc.) is providing environmental consulting services to the Seattle Commons Committee for their planned acquisition of properties in the area of the Unocal site. On March 25, 1993 Enviros obtained a ground water sample from monitoring well MW-40. GeoEngineers observed their sampling activities. At the time of sampling, Enviros provided GeoEngineers with a split of the sample. Enviros submitted the sample to NCA (North Creek Analytical) for analysis of BETX by EPA Method 8020, gasoline-range hydrocarbons by Ecology Method WTPH-G, heavy oil-range hydrocarbons by Ecology Method WTPH-418.1 modified, and total and dissolved lead by EPA Method 7421. GeoEngineers submitted the sample split to ATI (Analytical Technologies, Inc.) for the same analyses. Laboratory results for the sample split submitted to ATI are summarized in Table 11. The laboratory report and our review of the laboratory QA/QC program are presented in Appendix C.

SOIL STOCKPILE SAMPLING

A system to recover gasoline vapor emissions from the fueling dispensers during fueling operations was installed at the site by O'Sullivan (O'Sullivan Construction, Inc.) from March 22 to June 3, 1993. This system is not related to the subsurface VES currently operating at the site. GeoEngineers was not present during these installation activities. A stockpile of approximately

40 cubic yards of soil excavated from the vapor recovery piping trenches was temporarily stored on site. GeoEngineers obtained two discrete soil samples (SP-1 and SP-2) from the stockpile on April 30, 1993. The samples were analyzed for BETX by EPA Method 8020 and gasoline-range hydrocarbons by Ecology Method WTPH-G. BETX and gasoline-range hydrocarbons were not detected in the samples. The laboratory report and our review of the laboratory QA/QC program are presented in Appendix C. We understand that O'Sullivan disposed of the soil at Coal Creek Landfill.

CONCLUSIONS AND RECOMMENDATIONS

Small thicknesses of free product remain at isolated locations beneath the Unocal site and its immediate vicinity. We recommend installing passive product recovery devices in monitoring wells MW-2 and MW-3. Monitoring well MW-19 is less than 1.5 inches in diameter and is therefore not suitable for installation of a passive free product recovery device. GeoEngineers will continue to periodically hand-bail free product from MW-19. The fact that free product is not present in MW-37, several feet away from MW-19, indicates that the free product present in MW-19 is very localized.

The declining TVH and methane concentrations in vapor samples obtained from the effluent vapor stream indicate that the VES is successfully removing vapors from within its area of influence. The comparatively low combustible vapor concentrations in the recovery wells and on-site monitoring wells (with the exception of MW-32A) indicates that the VES is effective in removing vapors from the immediate vicinity of the Unocal site.

High concentrations of combustible vapors remain beneath the Seattle property and other surrounding properties. The extraction wells being used on the Seattle property apparently are not functioning efficiently, probably because the well screens do not extend far enough above the static water table.

The combustible vapor concentrations measured in the monitoring wells installed in 1980 appear to be inconsistent with the measurements obtained from the 1991 monitoring wells. This may be caused by localized biodegradation resulting in contaminant reduction in the immediate vicinity of these wells. We plan to discontinue use of the 1980 monitoring wells during routine monitoring; however, these wells may prove valuable for specific future monitoring efforts. The 1980 monitoring wells do not have locking caps or monuments because of the nonstandard sizes of the well casings. GeoEngineers is currently upgrading the caps on these wells.

We recommend that during future operation of the VES, we make monthly visits to the site to monitor the VES operational characteristics and perform routine maintenance. We recommend that measurements in the recovery and monitoring wells be reduced to a frequency of once per three months.

We recommend that six vapor samples be obtained from monitoring wells outside the apparent radius of influence of the system, and that two vapor samples be obtained from

monitoring wells near the center of the apparent radius of influence of the system. These samples will be submitted for laboratory analysis of TVH and methane to evaluate the relative proportions of gasoline compounds to methane.

LIMITATIONS

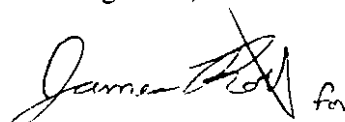
We have prepared this report for use by Unocal in their evaluation of ongoing vapor recovery efforts at Service Station 5353. This report may be made available to potential buyers of the property and to regulatory agencies. This report is not intended for use by others and the information contained herein may not be applicable to other sites.

Our services have been completed in accordance with generally accepted practices in this area at the time the report was prepared. No other conditions, express or implied, should be understood.

We appreciate the opportunity to be of service on this project. Please call if you have any questions regarding this report.

Respectfully submitted,

GeoEngineers, Inc.



Norman L. Puri, P.E.
Environmental Engineer



Stephen C. Perrigo
Principal

NLP:SCP:ems
Document ID: 0161013.PR3

TABLE 1
VAPOR EXTRACTION SYSTEM
OPERATIONAL CONFIGURATIONS

Operating Period		System Status (On/Off)	System Configuration ¹					
			Unocal				Seattle ²	
Start	End		NW	NE	SW	SE	W	E
12/08/90	01/16/91	Off	-	-	-	-	-	-
01/16/91	01/31/91	On	-	-	○	○	-	-
01/31/91	02/15/91	Off	-	-	-	-	-	-
02/15/91	03/04/91	On	-	-	-	○	-	-
03/04/91	03/18/91	Off	-	-	-	-	-	-
03/18/91	04/01/91	On	-	-	○	○	-	-
04/01/91	04/18/91	Off	-	-	-	-	-	-
04/18/91	05/01/91	On	-	-	-	○	-	-
05/01/91	05/20/91	Off	-	-	-	-	-	-
05/20/91	06/05/91	On	○	○	○	○	-	-
06/05/91	06/19/91	Off	-	-	-	-	-	-
06/19/91	07/03/91	On	-	-	○	○	-	-
07/03/91	07/16/91	Off	-	-	-	-	-	-
07/16/91	08/01/91	On	○	○	○	○	-	-
08/01/91	08/19/91	Off	-	-	-	-	-	-
08/19/91	08/29/91	On	-	-	○	○	-	-
08/29/91	09/16/91	Off	-	-	-	-	-	-
09/16/91	10/03/91	On	-	-	○	○	-	-
10/03/91	10/15/91	Off	-	-	-	-	-	-
10/15/91	10/31/91	On	-	-	○	○	-	-
10/31/91	11/15/91	Off	-	-	-	-	-	-
11/15/91	12/02/91	On	○	○	○	○	-	-
12/02/91	12/16/91	Off	-	-	-	-	-	-
12/16/91	12/30/91	On	-	-	○	○	-	-
12/30/91	01/21/92	Off	-	-	-	-	-	-
01/21/92	02/11/92	On	-	-	○	○	-	-
02/11/92	02/28/92	On	-	-	-	-	○	○
02/28/92	03/13/92	On	-	-	-	-	○	-
03/13/92	03/27/92	On	-	-	-	○	-	-
03/27/92	04/13/92	On	-	-	○	○	○	○
04/13/92	04/23/92	On	-	-	○	○	-	-
04/23/92	05/08/92	On	-	-	○	○	○	○
05/08/92	05/21/92	On	-	-	-	○	○	-
05/21/92	06/05/92	On	-	-	-	○	○	○
06/05/92	06/18/92	On	-	-	○	○	-	-
06/18/92	06/24/92	On	-	-	○	○	○	○
06/24/92	07/14/92	On	○	○	○	○	○	○

Notes:

¹ "-" = closed, "○" = open

²The city of Seattle wells were not connected to the system before January 31, 1992.

TABLE 2 (Page 1 of 3)
VAPOR EXTRACTION SYSTEM OPERATION AND MONITORING DATA

Date	Time	Flow Rate (cfm)	Vapor Temperature (°F)	Vacuum (inches) ¹	Fuel Use (cfm) ²	System Operational Configuration ^{3,4}						Effluent Vapor ⁵				
						Unocal				Seattle		Combustible Vapor Concentration ⁶ (ppm)	Carbon Dioxide ⁷ (%)	TVH (mg/m ³) ⁸	TVH (ppm) ⁹	Methane (ppm) ¹⁰
						NW	NE	SW	SE	W	E					
01/16/91	0945	-	-	3.0	6.5	-	-	O	O	-	-	3,300	4.5	--	600	1,800
01/31/91	0645	62	--	2.5	6.5	-	-	O	O	-	-	1,000	0.5	--	<20	100
02/15/91	0950	50	--	3.0	6.5	-	-	-	O	-	-	2,600	3.0	--	260	4,800
03/04/91	0745	100	50	>30	6.5	-	-	-	O	-	-	300	--	--	370	700
03/18/91	0930	95	--	>10	7.0	-	-	O	O	-	-	1,300	3.5	--	120	1,800
04/01/91	0715	90	--	4.0	7.0	-	-	O	O	-	-	180	0.0	--	--	--
04/18/91	0915	95	--	3.0	7.0	-	-	-	O	-	-	3,200	3.0	--	260	1,100
05/01/91	0742	100	58	3.0	7.0	-	-	-	O	-	-	120	0.0	--	135	40
05/20/91	0900	90	57	3.0	7.0	O	O	O	O	-	-	1,400	3.5	--	<5	<5
06/05/91	0646	95	60	3.0	8.0	O	O	O	O	-	-	200	0.0	--	680	57
06/19/91	0940	95	65	3.0	7.0	-	-	O	O	-	-	2,300	4.0	--	930	3,200
07/03/91	0719	105	72	3.0	6.5	-	-	O	O	-	-	<100	0.5	--	540	64
07/16/91	0912	105	63	3.5	7.0	O	O	O	O	-	-	1,800	9.0	--	1,000	860
08/01/91	0730	105	70	24	7.0	O	O	O	O	-	-	350	1.0	--	420	77
08/19/91	0915	95	65	3.0	7.0	-	-	O	O	-	-	2,800	0	--	1,200	4,200
08/29/91	0645	100	66	3.0	7.0	-	-	O	O	-	-	280	1.0	--	690	280
09/16/91	0650	-	--	--	--	-	-	O	O	-	-	--	--	--	1,900	5,000
10/03/91	0650	100	65	3.0	7.0	-	-	O	O	-	-	300	0.5	--	310	53
10/15/91	0930	100	58	3.0	7.0	-	-	O	O	-	-	3,000	0	--	200	1,900
10/31/91	0837	65	55	2.3	10.5	-	-	O	O	-	-	300	0	<500	<175	530
11/15/91	1000	105	<55	2.4	7.5	O	O	O	O	-	-	620	--	<1,000	<350	13,800
12/02/91	0733	110	54	2.4	7.0	O	O	O	O	-	-	200	--	<500	<175	365
12/16/91	0945	100	<55	2.5	7.0	-	-	O	O	-	-	--	--	<500	<175	5,250
12/30/91	0722	105	<55	2.6	7.5	-	-	O	O	-	-	350	--	<500	<175	725
02/11/92	--	90	<55	3	7.0	-	-	O	O	-	-	160	--	100	35	39
02/11/92	--	100	<55	>30	7.0	-	-	-	-	O	O	2,400	--	1,000	350	1,200
02/28/92	0715	40	80	2.9	6.5	-	-	-	-	O	-	1,200	--	3,000	1,050	640

Notes appear on page 3 of 3.

TABLE 2 (Page 2 of 3)

Date	Time	Flow Rate (cfm)	Vapor Temperature (°F)	Vacuum (inches) ¹	Fuel Use (cfm) ²	System Operational Configuration ^{3,4}						Effluent Vapor ⁵				
						Unocal				Seattle		Combustible Vapor Concentration ⁶ (ppm)	Carbon Dioxide ⁷ (%)	TVH (mg/m ³) ⁸	TVH (ppm) ⁹	Methane (ppm) ¹⁰
						NW	NE	SW	SE	W	E					
03/13/92	0730	55	74	11	6.5	-	-	-	O	-	-	140	-	<500	<175	460
03/27/92	--	103	56	12	6.5	-	-	O	O	O	O	1,400	-	-	-	-
04/13/92	0915	110	58	14	6.5	-	-	O	O	-	-	230	-	100	35	110
04/23/92	0700	114	<55	28	6.5	-	-	O	O	O	O	610	-	<500	<175	710
05/08/92	0800	111	62	30	0	-	-	O	O	O	O	<100	-	<500	<175	9
05/08/92	0930	111	<55	30	0	-	-	-	O	O	-	<100	-	<500	<175	13
05/21/92	0700	112	62	30	0	-	-	-	O	O	-	110	-	<500	<175	5
05/21/92	0845	112	63	28	0	-	-	-	O	O	O	560	-	-	-	-
06/05/92	0735	114	68	29	0	-	-	-	O	O	O	100	-	<500	<175	59
06/05/92	0800	117	69	11	0	-	-	O	O	-	-	110	-	<500	<175	18
06/18/92	0710	117	72	12	0	-	-	O	O	-	-	<100	-	<500	<175	21
06/18/92	0900	115	75	11	0	-	-	O	O	O	O	1,000	-	600	210	1,100
06/24/92	1100	--	88	4.0	0	O	O	O	O	O	O	690	-	<500	<175	190
07/02/92	0800	120	70	5.0	0	O	O	O	O	O	O	300	-	<500	<175	170
07/20/92	0738	--	71	5.0	0	O	O	O	O	O	O	280	-	<500	<175	300
07/31/92	0700	115	72	5.0	0	O	O	O	O	O	O	160	-	-	-	-
08/14/92	0800	118	72	5.0	0	O	O	O	O	O	O	380	-	-	-	-
08/26/92	0725	118	70	5.0	0	O	O	O	O	O	O	540	-	<500	<175	260
09/11/92	0715	118	66	6.7	0	O	O	O	O	O	O	240	-	<500	<175	190
10/12/92	0730	118	60	1.2	0	O	O	O	O	O	O	260	-	<500	<175	190
11/09/92	0730	120	<50	1.2	0	O	O	O	O	O	O	320	-	<500	<175	200
12/11/92	0740	118	<60	1.8	0	O	O	O	O	O	O	200	-	<500	<175	280
01/08/93	0800	118	<50	1.2	0	O	O	O	O	O	O	140	-	<500	<175	100
02/19/93	0816	120	<50	--	0	O	O	O	O	O	O	200	-	<500	<175	77
03/22/93	1430	120	<50	--	0	O	O	O	O	O	O	220	-	<500	<175	65
04/30/93	0730	0	--	0	0	O	O	O	O	O	O	<100	-	-	-	-
06/29/93	0807	120	62	24	0	O	O	O	O	O	O	<100	-	<500	<175	37

Notes appear on page 3 of 3.

TABLE 2 (Page 3 of 3)

Notes:

¹ Vacuum expressed as inches of water column.

² Supplementary fuel consumption for thermal oxidizer. The thermal oxidizer was disconnected on May 8, 1992.

³ "-" = closed; "O" = open

⁴ The city of Seattle wells were not connected to the system before January 31, 1992.

⁵ Measurements and samples were obtained from the vapor stream as it exited the subsurface, before treatment by the thermal oxidizer.

⁶ Measurement made with Bacharach TLV Sniffer calibrated to hexane.

⁷ Carbon dioxide measured using a Bacharach Fyrite gas analyzer.

⁸ Total volatile hydrocarbons analysis by GC/FID, expressed as mg/m³. All results before 10/30/91 were reported by the laboratory in ppm. All results after 10/30/91 were reported by the laboratory in mg/m³. GeoEngineers converted all values reported in mg/m³ to ppm using the Ideal Gas Law and an assumed average molecular weight of 70 grams per mole for the hydrocarbon vapors.

⁹ Total volatile hydrocarbons analysis by GC/FID, expressed as ppm.

¹⁰ Methane analysis by GC/FID, expressed as ppm.

cfm = cubic feet per minute

ppm = parts per million (volume basis)

mg/m³ = milligrams per cubic meter

"-" = no measurement taken

TABLE 3
VOLUMES OF RECOVERED GASOLINE AND METHANE

Operation Period Start Date	Operation Period Duration (days)	Estimated Equivalent Total Recovery	
		Gasoline (gallons)	Methane (cubic feet)
01/16/91	15	16	1,262
02/15/91	17	23	5,024
03/18/91	14	5	1,760
04/18/91	13	14	1,035
05/20/91	16	29	60
06/19/91	14	59	3,268
07/16/91	16	69	1,128
08/19/91	10	53	3,110
09/16/91	17	109	6,185
10/15/91	16	8	2,304
11/15/91	17	0	18,516
12/16/91	14	0	6,136
01/21/92	21	4	106
02/11/92	17	48	1,569
02/28/92	14	20	527
03/13/92	31	3	1,052
04/13/92	10	1	655
04/23/92	15	0	876
05/08/92	13	0	19
05/21/92	15	0	78
06/05/92	13	0	43
06/18/92	6	4	650
06/24/92	8	0	240
07/02/92	18	0	715
08/26/92	16	0	516
09/11/92	31	0	1,001
10/12/92	28	0	936
11/09/92	32	0	1,316
12/11/92	28	0	905
01/08/93	42	0	637
02/19/93	31	0	383
03/22/93	99	0	660
06/29/93	15	0	50
Total (01/16/91 - 07/14/93)	682	465	62,722
Previous Cumulative Total		4,263	120,767
TOTAL		4,728	183,489

TABLE 4 (Page 1 of 6)
WATER AND PRODUCT LEVELS IN MONITORING AND
RECOVERY WELLS

Well	Casing Rim Elevation ¹ (feet)	01/16/91		02/15/91		03/18/91	
		Water Elevation ¹ (feet)	Product Thickness (feet)	Water Elevation ¹ (feet)	Product Thickness (feet)	Water Elevation ¹ (feet)	Product Thickness (feet)
MW-1	20.12	10.37	--	10.37	--	10.16	--
MW-2	20.07	NM	NM	NM	NM	NM	NM
MW-3	19.38	10.33	--	10.35	--	NM	NM
MW-11	19.82	10.18	--	10.20	--	10.22	--
MW-13	21.73	10.63	--	10.61	--	10.61	--
MW-14	19.28	11.10	--	10.23	--	10.29	--
MW-15	20.48	10.22	--	10.36	--	10.48	--
MW-16	21.19	10.54	--	10.67	--	10.70	--
MW-17	21.28	10.43	--	10.55	--	10.58	--
MW-18	21.09	10.46	--	10.70	--	10.94	--
MW-19	20.97	10.60 ²	0.46	10.59 ²	0.88	10.67 ²	0.59
MW-24	21.49	10.62	--	10.73	--	10.75	--
MW-25	21.16	NM	NM	NM	NM	NM	NM
MW-27	20.71	10.04	--	10.15	--	10.25	--
MW-29	18.63	9.76	--	9.76	--	9.93	--
MW-32A ³	20.70	NM	NM	NM	NM	NM	NM
MW-33 ³	20.75	NM	NM	NM	NM	NM	NM
MW-34 ³	21.42	NM	NM	NM	NM	NM	NM
MW-35 ³	20.10	NM	NM	NM	NM	NM	NM
MW-36 ³	17.80	NM	NM	NM	NM	NM	NM
MW-37 ³	21.01	NM	NM	NM	NM	NM	NM
MW-38 ³	16.52	NM	NM	NM	NM	NM	NM
MW-39 ³	24.47	NM	NM	NM	NM	NM	NM
MW-40 ³	20.89	NM	NM	NM	NM	NM	NM
MW-41 ³	27.00	NM	NM	NM	NM	NM	NM
MW-42 ³	20.34	NM	NM	NM	NM	NM	NM
MW-43 ³	21.04	NM	NM	NM	NM	NM	NM
MW-44 ³	18.73	NM	NM	NM	NM	NM	NM
MW-45 ³	18.15	NM	NM	NM	NM	NM	NM
MW-46 ³	16.91	NM	NM	NM	NM	NM	NM
MW-47 ³	19.83	NM	NM	NM	NM	NM	NM
MW-48 ⁴	18.49	NM	NM	NM	NM	NM	NM
MW-49 ⁴	12.61	NM	NM	NM	NM	NM	NM
RW-4A	21.28	10.25	--	10.20	--	10.28	--
RW-5A	21.40	8.42	--	10.40	--	10.55	--
RW-7	20.66	10.19	--	10.16	--	10.09	--
RW-8	19.92	10.08	--	10.08	--	10.04	--
RW-9	20.61	9.99	--	9.98	--	9.96	--
RW-10	20.59	9.97	--	9.94	--	9.99	--
RW-26	20.72	10.10	--	10.09	--	10.29	--
RW-28	21.17	9.98	--	9.94	--	9.88	--

Notes appear on page 6 of 6.

TABLE 4 (Page 2 of 6)

Well	Casing Rim Elevation ¹ (feet)	04/17/91		05/20/91		06/19/91	
		Water Elevation ¹ (feet)	Product Thickness (feet)	Water Elevation ¹ (feet)	Product Thickness (feet)	Water Elevation ¹ (feet)	Product Thickness (feet)
MW-1	20.12	10.61	-	NM	NM	10.39	-
MW-2	20.07	10.51 ²	0.34	10.20 ²	0.19	10.31 ²	0.26
MW-3	19.38	10.75 ²	0.24	10.35	-	10.30	-
MW-11	19.82	10.28	-	10.19	-	10.31	-
MW-13	21.73	10.86	-	10.95	-	10.59	-
MW-14	19.28	10.35	-	10.26	-	10.32	-
MW-15	20.48	10.50	-	10.32	-	10.36	-
MW-16	21.19	10.77	-	10.62	-	10.60	-
MW-17	21.28	10.87	-	10.59	-	10.61	-
MW-18	21.09	11.12	-	10.78	-	10.68	-
MW-19	20.97	10.83 ²	0.79	10.66 ²	0.48	10.37 ²	0.23
MW-24	21.49	10.95	-	10.72	-	10.67	-
MW-25	21.16	NM	NM	NM	NM	NM	NM
MW-27	20.71	10.32	-	10.15	-	10.18	-
MW-29	18.63	10.20	-	NM	NM	NM	NM
MW-32A ³	20.70	NM	NM	NM	NM	NM	NM
MW-33 ³	20.75	NM	NM	NM	NM	NM	NM
MW-34 ³	21.42	NM	NM	NM	NM	NM	NM
MW-35 ³	20.10	NM	NM	NM	NM	NM	NM
MW-36 ³	17.80	NM	NM	NM	NM	NM	NM
MW-37 ³	21.01	NM	NM	NM	NM	NM	NM
MW-38 ³	16.52	NM	NM	NM	NM	NM	NM
MW-39 ³	24.47	NM	NM	NM	NM	NM	NM
MW-40 ³	20.89	NM	NM	NM	NM	NM	NM
MW-41 ³	27.00	NM	NM	NM	NM	NM	NM
MW-42 ³	20.34	NM	NM	NM	NM	NM	NM
MW-43 ³	21.04	NM	NM	NM	NM	NM	NM
MW-44 ³	18.73	NM	NM	NM	NM	NM	NM
MW-45 ³	18.15	NM	NM	NM	NM	NM	NM
MW-46 ³	16.91	NM	NM	NM	NM	NM	NM
MW-47 ³	19.83	NM	NM	NM	NM	NM	NM
MW-48 ⁴	18.49	NM	NM	NM	NM	NM	NM
MW-49 ⁴	12.61	NM	NM	NM	NM	NM	NM
RW-4A	21.28	10.53	-	NM	NM	10.26	-
RW-5A	21.40	10.78	-	NM	NM	11.29	-
RW-7	20.66	10.56	-	NM	NM	10.26	-
RW-8	19.92	10.30	-	NM	NM	10.07	-
RW-9	20.61	10.21	-	NM	NM	9.91	-
RW-10	20.59	10.21	-	NM	NM	9.98	-
RW-26	20.72	10.37	-	NM	NM	10.07	-
RW-28	21.17	10.22	-	NM	NM	9.90	-

Notes appear on page 6 of 6.

TABLE 4 (Page 3 of 6)

Well	Casing Rim Elevation ¹ (feet)	07/03/91		07/16/91		08/19/91	
		Water Elevation ¹ (feet)	Product Thickness (feet)	Water Elevation ¹ (feet)	Product Thickness (feet)	Water Elevation ¹ (feet)	Product Thickness (feet)
MW-1	20.12	NM	NM	NM	NM	10.16	-
MW-2	20.07	10.08 ²	0.16	10.04 ²	0.15	NM	NM
MW-3	19.38	NM	NM	10.15	Trace	NM	NM
MW-11	19.82	10.19 ²	0.02	10.17	-	10.22	-
MW-13	21.73	10.52	-	10.52	-	10.61	-
MW-14	19.28	10.24	-	10.17	-	10.29	-
MW-15	20.48	10.26	-	10.22	-	10.48	-
MW-16	21.19	10.51	-	10.47	-	10.70	-
MW-17	21.28	10.49	-	10.42	-	10.58	-
MW-18	21.09	10.58	-	Dry	-	10.94	-
MW-19	20.97	10.25 ²	0.01	10.52 ²	0.48	10.67 ²	0.59
MW-24	21.49	NM	NM	10.96	-	10.75	-
MW-25	21.16	NM	NM	Dry	-	Dry	-
MW-27	20.71	10.04	-	9.98	-	10.25	-
MW-29	18.63	NM	NM	NM	NM	9.93	-
MW-32A ³	20.70	NM	NM	NM	NM	NM	NM
MW-33 ³	20.75	NM	NM	NM	NM	NM	NM
MW-34 ³	21.42	NM	NM	NM	NM	NM	NM
MW-35 ³	20.10	NM	NM	NM	NM	NM	NM
MW-36 ³	17.80	NM	NM	NM	NM	NM	NM
MW-37 ³	21.01	NM	NM	NM	NM	NM	NM
MW-38 ³	16.52	NM	NM	NM	NM	NM	NM
MW-39 ³	24.47	NM	NM	NM	NM	NM	NM
MW-40 ³	20.89	NM	NM	NM	NM	NM	NM
MW-41 ³	27.00	NM	NM	NM	NM	NM	NM
MW-42 ³	20.34	NM	NM	NM	NM	NM	NM
MW-43 ³	21.04	NM	NM	NM	NM	NM	NM
MW-44 ³	18.73	NM	NM	NM	NM	NM	NM
MW-45 ³	18.15	NM	NM	NM	NM	NM	NM
MW-46 ³	16.91	NM	NM	NM	NM	NM	NM
MW-47 ³	19.83	NM	NM	NM	NM	NM	NM
MW-48 ⁴	18.49	NM	NM	NM	-	NM	-
MW-49 ⁴	12.61	NM	NM	NM	-	NM	-
RW-4A	21.28	NM	NM	10.10	-	10.28	-
RW-5A	21.40	NM	NM	10.59	-	10.55	-
RW-7	20.66	NM	NM	10.16	-	10.09	-
RW-8	19.92	NM	NM	9.92	-	10.04	-
RW-9	20.61	NM	NM	9.77	-	9.96	-
RW-10	20.59	NM	NM	9.76	-	9.99	-
RW-26	20.72	NM	NM	9.94	-	10.29	-
RW-28	21.17	NM	NM	9.73	-	9.88	-

Notes appear on page 6 of 6.

TABLE 4 (Page 4 of 6)

Well	Casing Rim Elevation ¹ (feet)	10/15/91		10/31/91		11/04/91	
		Water Elevation ¹ (feet)	Product Thickness (feet)	Water Elevation ¹ (feet)	Product Thickness (feet)	Water Elevation ¹ (feet)	Product Thickness (feet)
MW-1	20.12	10.12	-	NM	NM	NM	NM
MW-2	20.07	9.87	-	NM	NM	NM	NM
MW-3	19.38	NM	NM	NM	NM	NM	NM
MW-11	19.82	10.02	-	NM	NM	NM	NM
MW-13	21.73	10.53	-	NM	NM	NM	NM
MW-14	19.28	10.08	-	NM	NM	NM	NM
MW-15	20.48	10.28	-	NM	NM	NM	NM
MW-16	21.19	10.69	-	NM	NM	NM	NM
MW-17	21.28	10.33	-	NM	NM	NM	NM
MW-18	21.09	10.61	-	NM	NM	NM	NM
MW-19	20.97	10.20	-	NM	NM	NM	NM
MW-24	21.49	Dry	-	NM	NM	NM	NM
MW-25	21.16	Dry	-	NM	NM	NM	NM
MW-27	20.71	10.71	-	NM	NM	NM	NM
MW-29	18.63	9.43	-	NM	NM	NM	NM
MW-32A ³	20.70	NM	NM	9.50	-	9.67	-
MW-33 ³	20.75	NM	NM	9.65	-	9.82	-
MW-34 ³	21.42	NM	NM	9.96	-	9.98	-
MW-35 ³	20.10	NM	NM	9.46	-	9.64	0.02
MW-36 ³	17.80	NM	NM	8.03	-	8.22	-
MW-37 ³	21.01	NM	NM	10.15	-	10.31	-
MW-38 ³	16.52	NM	NM	7.79	-	7.98	-
MW-39 ³	24.47	NM	NM	10.82	-	11.11	-
MW-40 ³	20.89	NM	NM	9.81	-	10.11	-
MW-41 ³	27.00	NM	NM	16.01	-	15.32	-
MW-42 ³	20.34	NM	NM	10.32	-	10.52	-
MW-43 ³	21.04	NM	NM	10.09	-	10.26	-
MW-44 ³	18.73	NM	NM	9.73	-	10.18	-
MW-45 ³	18.15	NM	NM	9.21	-	9.33	0.01
MW-46 ³	16.91	NM	NM	7.98	-	8.21	-
MW-47 ³	19.83	NM	NM	9.23	-	9.21	-
MW-48 ⁴	18.49	NM	NM	NM	NM	NM	NM
MW-49 ⁴	12.61	NM	NM	NM	NM	NM	NM
RW-4A	21.28	9.98	-	NM	NM	NM	-
RW-5A	21.40	9.60	-	NM	NM	NM	-
RW-7	20.66	9.76	-	NM	NM	NM	-
RW-8	19.92	7.42	-	NM	NM	NM	-
RW-9	20.61	9.61	-	NM	NM	NM	-
RW-10	20.59	9.59	-	NM	NM	NM	-
RW-26	20.72	9.72	-	NM	NM	NM	-
RW-28	21.17	NM	NM	NM	NM	NM	-

Notes appear on page 6 of 6.

TABLE 4 (Page 5 of 6)

Well	Casing Rim Elevation ¹ (feet)	12/16/91		06/05/92		06/23/92	
		Water Elevation ¹ (feet)	Product Thickness (feet)	Water Elevation ¹ (feet)	Product Thickness (feet)	Water Elevation ¹ (feet)	Product Thickness (feet)
MW-1	20.12	NM	NM	NM	NM	NM	NM
MW-2	20.07	NM	NM	NM	NM	NM	NM
MW-3	19.38	NM	NM	NM	NM	NM	NM
MW-11	19.82	9.94	--	NM	NM	NM	NM
MW-13	21.73	10.87	--	NM	NM	NM	NM
MW-14	19.28	9.96	--	10.20	NM	NM	NM
MW-15	20.48	10.18	--	NM	NM	NM	NM
MW-16	21.19	10.04	--	NM	NM	NM	NM
MW-17	21.28	NM	NM	10.73	--	NM	NM
MW-18	21.09	10.45	Trace	NM	NM	NM	NM
MW-19	20.97	10.38 ²	0.84	NM	NM	NM	NM
MW-24	21.49	Dry	--	10.26	--	NM	NM
MW-25	21.16	NM	NM	NM	NM	NM	NM
MW-27	20.71	NM	NM	10.31	--	NM	NM
MW-29	18.63	NM	NM	NM	NM	NM	NM
MW-32A ³	20.70	9.96	--	9.93	--	10.04	--
MW-33 ³	20.75	NM	NM	9.84	--	10.02	--
MW-34 ³	21.42	10.16	--	10.32	--	10.36	--
MW-35 ³	20.10	NM	NM	9.95	--	10.02	--
MW-36 ³	17.80	7.80	--	NM	NM	9.52	--
MW-37 ³	21.01	10.61	Trace	10.51	--	9.26	--
MW-38 ³	16.52	7.12	--	NM	NM	9.28	--
MW-39 ³	24.47	10.79	--	NM	NM	11.12	--
MW-40 ³	20.89	10.18	--	10.29	--	9.56	--
MW-41 ³	27.00	14.99	--	15.60	--	16.52	--
MW-42 ³	20.34	10.46	--	10.91	--	10.83	--
MW-43 ³	21.04	10.30	--	10.45	--	10.46	--
MW-44 ³	18.73	9.69	--	10.24	--	10.34	--
MW-45 ³	18.15	NM	NM	9.77	--	9.35	--
MW-46 ³	16.91	8.00	--	9.51	--	9.38	--
MW-47 ³	19.83	NM	NM	9.39	--	9.40	--
MW-48 ⁴	18.49	NM	NM	NM	NM	9.65	--
MW-49 ⁴	12.61	NM	NM	NM	NM	NM	NM
RW-4A	21.28	NM	NM	11.50	--	NM	NM
RW-5A	21.40	NM	NM	10.28	--	NM	NM
RW-7	20.66	NM	NM	13.26	--	NM	NM
RW-8	19.92	NM	NM	NM	NM	NM	NM
RW-9	20.61	NM	NM	9.95	--	NM	NM
RW-10	20.59	NM	NM	9.92	--	NM	NM
RW-26	20.72	NM	NM	NM	NM	NM	NM
RW-28	21.17	NM	NM	9.87	--	NM	NM

Notes appear on page 6 of 6.

TABLE 4 (Page 6 of 6)

Well	Casing Rim Elevation ¹ (feet)	02/16/93		04/30/93		07/14/93	
		Water Elevation ¹ (feet)	Product Thickness (feet)	Water Elevation ¹ (feet)	Product Thickness (feet)	Water Elevation ¹ (feet)	Product Thickness (feet)
MW-1	20.12	NM	NM	10.48	--	NM	NM
MW-2	20.07	NM	NM	NM	NM	10.11 ²	0.06
MW-3	19.38	NM	NM	NM	NM	10.23 ²	0.01
MW-11	19.82	NM	NM	NM	NM	NM	NM
MW-13	21.73	NM	NM	NM	NM	NM	NM
MW-14	19.28	NM	NM	10.35	--	NM	NM
MW-15	20.48	NM	NM	NM	NM	NM	NM
MW-16	21.19	NM	NM	NM	NM	NM	NM
MW-17	21.28	NM	NM	11.55	--	NM	NM
MW-18	21.09	NM	NM	NM	NM	10.79	--
MW-19	20.97	NM	NM	NM	NM	11.03 ²	0.42
MW-24	21.49	NM	NM	10.81	--	NM	NM
MW-25	21.16	NM	NM	12.83	--	NM	NM
MW-27	20.71	NM	NM	11.94	--	NM	NM
MW-29	18.63	NM	NM	NM	NM	NM	NM
MW-32A ³	20.70	9.57	--	9.84	--	NM	NM
MW-33 ³	20.75	9.57	--	10.10	--	NM	NM
MW-34 ³	21.42	10.08	--	10.53	--	NM	NM
MW-35 ³	20.10	10.14	--	10.32	--	NM	NM
MW-36 ³	17.80	NM	NM	NM	NM	NM	NM
MW-37 ³	21.01	10.33	--	10.41	--	NM	NM
MW-38 ³	16.52	NM	NM	NM	NM	NM	NM
MW-39 ³	24.47	NM	NM	NM	NM	NM	NM
MW-40 ³	20.89	9.69	--	10.42	--	NM	NM
MW-41 ³	27.00	NM	NM	15.55	--	NM	NM
MW-42 ³	20.34	10.23	--	10.97	--	NM	NM
MW-43 ³	21.04	NM	NM	10.49	--	NM	NM
MW-44 ³	18.73	NM	NM	10.69	--	NM	NM
MW-45 ³	18.15	9.14	--	10.02	--	NM	NM
MW-46 ³	16.91	NM	NM	9.80	--	NM	NM
MW-47 ³	19.83	NM	NM	NM	NM	NM	NM
MW-48 ⁴	18.49	8.80	--	8.06	--	NM	NM
MW-49 ⁴	12.61	8.97	--	NM	NM	NM	NM
RW-4A	21.28	NM	--	NM	NM	NM	NM
RW-5A	21.40	NM	NM	NM	NM	NM	NM
RW-7	20.66	NM	NM	NM	NM	NM	NM
RW-8	19.92	NM	NM	NM	NM	NM	NM
RW-9	20.61	NM	NM	NM	NM	NM	NM
RW-10	20.59	NM	NM	NM	NM	NM	NM
RW-26	20.72	NM	NM	NM	NM	NM	NM
RW-28	21.17	NM	NM	NM	NM	NM	NM

Notes:

¹Elevations referenced to city of Seattle datum.²Water table elevations corrected for presence of free product. A specific gravity of 0.85 was assumed for the free product.³Monitoring wells MW-32A through MW-47 were installed in October 1991.⁴Monitoring wells MW-48 and MW-49 were installed in January 1992.

NM = not measured

"--" = none detected

TABLE 5
SUMMARY OF FREE PRODUCT CHEMICAL ANALYTICAL DATA
MW-2 AND MW-19

Monitoring Well Number	Date Sampled	BETX ¹ ($\mu\text{g/l}$)				TCLP Metals ² (mg/l)	pH ³	Flash Point ⁴ (°F)
		B	E	T	X			
MW-2 ⁵	08/06/91	380,000	7,400,000	8,500,000	70,000,000	0.049 barium ⁶ 0.27 lead	6.1	100
MW-19 ⁵	08/06/91	7,300,000	18,000,000	64,000,000	130,000,000	0.005 barium ⁶ 0.84 lead	6.2	78

Notes:

¹B = benzene, E = ethylbenzene, T = toluene, X = xylenes. Analyzed by EPA Method 8020.

²TCLP = toxicity characteristic leaching procedure. Analyzed by EPA Methods 1311, 6010 and 7470.

³Analyzed by EPA Method 9045.

⁴Analyzed by EPA Method 1010.

⁵Samples were also analyzed for gasoline- and diesel-range hydrocarbons by modified EPA Method 8015. An inspection of the chromatograms indicated that the product is aged gasoline. The chromatograms are included in Appendix C.

⁶Barium was also detected in the method blank at a concentration of 0.002 mg/l.

TABLE 6 (Page 1 of 5)
 SUBSURFACE COMBUSTIBLE VAPOR MONITORING DATA¹
 RECOVERY WELLS

Vapor Collection Area ²	Well Number	Date										
		01/16/91	01/31/91	02/15/91	03/04/91	03/18/91	04/01/91	04/17/91	05/01/91	05/20/91	06/05/91	06/19/91
Northwest	RW-7	540	100	200	<100	180	<100	<100	260	520	100	340
	RW-8	260	140	140	140	<100	140	<100	200	240	<100	260
	RW-9	360	100	160	320	420	<100	<100	220	380	<100	340
	RW-10	200	190	250	140	120	<100	140	300	680	160	1,200
	RW-26	280	120	240	<100	160	500	210	250	330	<100	480
Northeast	RW-28	240	<100	<100	<100	<100	<100	<100	<100	180	<100	100
Southwest	RW-5A	250	900	100	<100	<100	<100	<100	<100	200	<100	160
Southeast	RW-4A	8,200	220	630	120	1,400	<100	4,800	<100	7,400	100	480
Seattle West	SMW-2S ³	--	--	--	--	--	--	--	--	--	--	--
	SMW-5 ³	--	--	--	--	--	--	--	--	--	--	--
Seattle East	MW-32 ³	--	--	--	--	--	--	--	--	--	--	--
	MW-49 ³	--	--	--	--	--	--	--	--	--	--	--
VES Operational Configuration ⁴												
Northwest		-	-	-	-	-	-	-	-	0	0	-
Northeast		-	-	-	-	-	-	-	-	0	0	-
Southwest		0	0	-	-	0	0	-	-	0	0	0
Southeast		0	0	0	0	0	0	0	0	0	0	0
Seattle West		-	-	-	-	-	-	-	-	-	-	-
Seattle East		-	-	-	-	-	-	-	-	-	-	-

Notes appear on page 5 of 5.

TABLE 6 (Page 2 of 5)

Vapor Collection Area ²	Well Number	Date										
		07/03/91	07/16/91	08/01/91	08/19/91	08/29/91	10/03/91	10/15/91	10/31/91	11/15/91	12/02/91	12/16/91
Northwest	RW-7	<100	1,300	250	180	<100	100	380	160	180	300	<100
	RW-8	<100	800	300	<100	<100	100	380	180	160	<100	<100
	RW-9	<100	500	340	420	<100	350	3,200	160	220	120	100
	RW-10	<100	1,300	300	120	<100	<100	500	260	200	<100	<100
	RW-26	<100	420	200	160	<100	100	520	160	200	<100	<100
Northeast	RW-28	<100	270	<100	<100	100	<100	--	<100	<100	--	<100
Southwest	RW-5A	120	460	<100	<100	200	100	100	<100	180	--	<100
Southeast	RW-4A	<100	3,000	<100	1,400	100	120	2,400	<100	2,200	440	120
Seattle West	SMW-2S ³	--	--	--	--	--	--	--	--	--	--	--
	SMW-5 ³	--	--	--	--	--	--	--	--	--	--	--
Seattle East	MW-32 ³	--	--	--	--	--	--	--	--	--	--	--
	MW-49 ³	--	--	--	--	--	--	--	--	--	--	--
VES Operational Configuration ⁴												
Northwest		-	0	0	-	-	-	-	-	0	0	-
Northeast		-	0	0	-	-	-	-	-	0	0	-
Southwest		0	0	0	0	0	0	0	0	0	0	0
Southeast		0	0	0	0	0	0	0	0	0	0	0
Seattle West		-	-	-	-	-	-	-	-	-	-	-
Seattle East		-	-	-	-	-	-	-	-	-	-	-

Notes appear on page 5 of 5.

TABLE 6 (Page 3 of 5)

Vapor Collection Area ²	Well Number	Date										
		12/30/91	01/07/92	02/11/92	02/28/92	03/13/92	03/27/92	04/13/92	04/23/92	05/08/92	05/21/92	06/05/92
Northwest	RW-7	200	125	200	<100	<100	180	<100	<100	<100	2,100	120
	RW-8	<100	100	<100	<100	<100	140	<100	<100	<100	160	100
	RW-9	200	<100	<100	<100	<100	240	<100	<100	<100	120	<100
	RW-10	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
	RW-26	<100	125	<100	<100	<100	230	<100	<100	<100	160	-
Northeast	RW-28	<100	--	<100	<100	<100	<100	<100	<100	<100	<100	<100
Southwest	RW-5A	<100	120	180	<100	130	<100	<100	<100	<100	<100	<100
Southeast	RW-4A	800	120	760	300	130	<100	<100	<100	--	--	<100
Seattle West	SMW-2S ³	--	--	--	--	5,600	--	4,200	100	--	200	5,600
	SMW-5 ³	--	--	--	--	<100	<100	<100	--	<100	--	320
Seattle East	MW-32 ³	--	--	--	--	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000
	MW-49 ³	--	--	--	--	--	--	--	--	--	--	--
VES Operational Configuration ⁴												
Northwest		-	-	-	-	-	-	-	-	-	-	-
Northeast		-	-	-	-	-	-	-	-	-	-	-
Southwest		0	0	-	-	-	0	0	0	0	-	-
Southeast		0	0	-	-	0	0	0	0	0	0	0
Seattle West		-	-	0	0	-	0	-	0	0	0	0
Seattle East		-	-	0	-	-	0	-	0	0	-	0

Notes appear on page 5 of 5.

TABLE 6 (Page 4 of 5)

Vapor Collection Area ²	Well Number	Date										
		06/18/92	06/24/92	07/02/92	07/08/92	07/20/92	07/31/92	08/14/92	08/26/92	09/11/92	10/12/92	11/09/92
Northwest	RW-7	<100	--	<100	--	<100	<100	<100	140	<100	150	100
	RW-8	<100	--	<100	--	<100	<100	<100	<100	<100	<100	<100
	RW-9	<100	--	100	--	<100	<100	120	240	<100	100	<100
	RW-10	<100	--	<100	--	<100	<100	160	<100	<100	<100	<100
	RW-26	<100	--	<100	--	<100	<100	<100	100	<100	<100	<100
Northeast	RW-28	<100	--	<100	--	<100	<100	<100	<100	<100	<100	<100
Southwest	RW-5A	<100	--	<100	--	<100	<100	130	170	<100	100	<100
Southeast	RW-4A	<100	--	<100	--	<100	<100	280	100	<100	150	320
Seattle West	SMW-2S ³	1,800	6,700	--	110	5,600	<100	8,800	>10,000	4,300	<100	--
	SMW-5 ³	>10,000	<100	--	<100	<100	<100	<100	<100	<100	<100	--
Seattle East	MW-32 ³	800	<100	--	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	--
	MW-49 ³	>10,000	>10,000	--	>10,000	>10,000	>10,000	>10,000	>10,000	4,400	>10,000	--
VES Operational Configuration ⁴												
Northwest		.	0	0	0	0	0	0	0	0	0	0
Northeast		.	0	0	0	0	0	0	0	0	0	0
Southwest		0	0	0	0	0	0	0	0	0	0	0
Southeast		0	0	0	0	0	0	0	0	0	0	0
Seattle West		.	0	0	0	0	0	0	0	0	0	0
Seattle East		.	0	0	0	0	0	0	0	0	0	0

Notes appear on page 5 of 5.

TABLE 6 (Page 5 of 5)

Vapor Collection Area ²	Well Number	Date						
		12/11/92	01/08/93	02/19/93	03/22/93	04/30/93	06/29/93	07/14/93
Northwest	RW-7	<100	100	-	-	100	-	-
	RW-8	<100	<100	<100	<100	<100	<100	-
	RW-9	<100	100	100	<100	<100	<100	-
	RW-10	<100	<100	<100	<100	<100	<100	-
	RW-26	<100	<100	<100	-	160	<100	-
Northeast	RW-28	<100	-	<100	<100	-	<100	-
Southwest	RW-5A	<100	<100	120	-	<100	-	-
Southeast	RW-4A	280	220	160	-	220	-	-
Seattle West	SMW-2S ³	-	-	>10,000	>10,000	-	-	>10,000
	SMW-5 ³	-	-	>10,000	>10,000	-	>10,000	>10,000
Seattle East	MW-32 ³	-	-	>10,000	>10,000	>10,000	>10,000	-
	MW-49 ³	-	-	>10,000	>10,000	>10,000	>10,000	-
VES Operational Configuration ⁴								
Northwest		O	O	O	O	O	O	O
Northeast		O	O	O	O	O	O	O
Southwest		O	O	O	O	O	O	O
Southeast		O	O	O	O	O	O	O
Seattle West		O	O	O	O	O	O	O
Seattle East		O	O	O	O	O	O	O

Notes:

¹Vapor concentrations were measured using a Bacharach TLV Sniffer calibrated to hexane. Results are expressed in parts per million.

²Vapor collection areas are shown in Figure 4.

³Wells MW-32, MW-49, SMW-2S and SMW-5 were connected to the VES on February 11, 1992.

⁴VES operational configuration shows the configuration of vapor withdrawal at the time the concentrations were measured.

'O' = open; '-' = closed

'-' = not measured

TABLE 7 (Page 1 of 7)
 SUBSURFACE COMBUSTIBLE VAPOR MONITORING DATA¹
 MONITORING WELLS

Well Number	Date							
	01/16/91	01/31/91	02/15/91	03/04/91	03/18/91	04/01/91	04/17/91	05/01/91
MW-1	120	180	120	1,000	180	1,000	<100	140
MW-2	-	-	-	-	-	<100	>10,000	1,200
MW-3	>10,000	>10,000	>10,000	7,000	-	150	9,800	620
MW-11	>10,000	>10,000	2,000	>10,000	1,600	>10,000	>10,000	>10,000
MW-13	>10,000	<100	>10,000	<100	>10,000	>10,000	<100	200
MW-14	>10,000	>10,000	>10,000	>10,000	1,400	>10,000	180	<100
MW-15	400	<100	<100	8,400	800	<100	<100	<100
MW-16	>10,000	<100	1,300	<100	180	<100	<100	300
MW-17	>10,000	140	>10,000	9,000	>10,000	150	>10,000	<100
MW-18	>10,000	<100	>10,000	<100	>10,000	<100	<100	<100
MW-19	>10,000	<100	>10,000	<100	>10,000	<100	>10,000	<100
MW-24	>10,000	<100	120	<100	140	<100	<100	<100
MW-25	200	1,200	<100	-	200	1,100	<100	<100
MW-27	240	130	120	130	<100	<100	<100	140
MW-29	>10,000	>10,000	>10,000	>10,000	6,600	7,000	>10,000	5,200
MW-32A ²	-	-	-	-	-	-	-	-
MW-33 ²	-	-	-	-	-	-	-	-
MW-34 ²	-	-	-	-	-	-	-	-
MW-35 ²	-	-	-	-	-	-	-	-
MW-36	-	-	-	-	-	-	-	-
MW-37 ²	-	-	-	-	-	-	-	-
MW-38 ²	-	-	-	-	-	-	-	-
MW-39 ²	-	-	-	-	-	-	-	-
MW-40 ²	-	-	-	-	-	-	-	-
MW-41 ²	-	-	-	-	-	-	-	-
MW-42 ²	-	-	-	-	-	-	-	-
MW-43 ²	-	-	-	-	-	-	-	-
MW-44 ²	-	-	-	-	-	-	-	-
MW-45 ²	-	-	-	-	-	-	-	-
MW-46 ²	-	-	-	-	-	-	-	-
MW-47 ²	-	-	-	-	-	-	-	-
MW-48 ²	-	-	-	-	-	-	-	-
SMW-1S ³	-	-	-	-	-	-	-	-
SMW-4 ³	-	-	-	-	-	-	-	-
VES Operational Configuration ⁴								
Northwest	-	-	-	-	-	-	-	-
Northeast	-	-	-	-	-	-	-	-
Southwest	o	o	-	-	o	o	-	-
Southeast	o	o	o	o	o	o	o	o
Seattle West	-	-	-	-	-	-	-	-
Seattle East	-	-	-	-	-	-	-	-

Notes appear on page 7 of 7.

TABLE 7 (Page 2 of 7)

Well Number	Date							
	05/20/91	06/05/91	06/19/91	07/03/91	07/16/91	08/01/91	08/19/91	08/29/91
MW-1	-	-	<100	-	-	120	180	0
MW-2	>10,000	<100	>10,000	<100	>10,000	7,000	-	-
MW-3	>10,000	<100	>10,000	-	5,200	500	--	5,000
MW-11	>10,000	>10,000	>10,000	8,000	>10,000	2,000	1,600	<2,000
MW-13	1,600	<100	<100	<100	<100	100	>10,000	100
MW-14	>10,000	9,000	>10,000	<100	120	<100	1,400	>10,000
MW-15	<100	<100	<100	<100	160	<100	800	0
MW-16	120	<100	380	<100	>10,000	200	180	20
MW-17	880	<100	>10,000	<100	<100	<100	>10,000	100
MW-18	>10,000	<100	>10,000	<100	160	<100	>10,000	40
MW-19	>10,000	200	>10,000	<100	>10,000	5,000	>10,000	200
MW-24	280	<100	120	<100	1,900	<100	140	80
MW-25	<100	<100	<100	<100	700	<100	200	80
MW-27	180	<100	<100	<100	<100	120	80	40
MW-29	6,000	1,200	8,500	3,000	>10,000	3,000	6,600	3,000
MW-32A ²	-	-	-	-	-	-	-	-
MW-33 ²	-	-	-	-	-	-	-	-
MW-34 ²	-	-	-	-	-	-	-	-
MW-35 ²	-	-	-	-	-	-	-	-
MW-36	-	-	-	-	-	-	-	-
MW-37 ²	-	-	-	-	-	-	-	-
MW-38 ²	-	-	-	-	-	-	-	-
MW-39 ²	-	-	-	-	-	-	-	-
MW-40 ²	-	-	-	-	-	-	-	-
MW-41 ²	-	-	-	-	-	-	-	-
MW-42 ²	-	-	-	-	-	-	-	-
MW-43 ²	-	-	-	-	-	-	-	-
MW-44 ²	-	-	-	-	-	-	-	-
MW-45 ²	-	-	-	-	-	-	-	-
MW-46 ²	-	-	-	-	-	-	-	-
MW-47 ²	-	-	-	-	-	-	-	-
MW-48 ²	-	-	-	-	-	-	-	-
SMW-1S ³	-	-	-	-	-	-	-	-
SMW-4 ³	-	-	-	-	-	-	-	-
VES Operational Configuration⁴								
Northwest	0	0	-	-	0	0	-	-
Northeast	0	0	-	-	0	0	-	-
Southwest	0	0	0	0	0	0	0	0
Southeast	0	0	0	0	0	0	0	0
Seattle West	-	-	-	-	-	-	-	-
Seattle East	-	-	-	-	-	-	-	-

Notes appear on page 7 of 7.

TABLE 7 (Page 3 of 7)

Well Number	Date							
	10/03/91	10/15/91	10/31/91	11/15/91	12/02/91	12/16/91	12/30/91	01/07/92
MW-1	0	200	-	600	-	-	-	-
MW-2	10	-	-	-	-	-	-	-
MW-3	4,000	-	-	-	-	-	-	>10,000
MW-11	60	>10,000	<100	>10,000	>10,000	>10,000	-	<100
MW-13	0	>10,000	<100	110	<100	<100	-	>10,000
MW-14	0	>10,000	<100	>10,000	>10,000	>10,000	>10,000	<100
MW-15	0	6,400	<100	<100	<100	<100	-	160
MW-16	0	1,400	<100	100	<100	<100	-	1,200
MW-17	20	2,000	<100	140	180	-	<100	>10,000
MW-18	20	1,000	<100	>10,000	<100	>10,000	-	>10,000
MW-19	40	1,200	<100	>10,000	100	>10,000	-	<100
MW-24	0	280	<100	120	<100	100	<100	<100
MW-25	0	-	<100	<100	-	-	-	<100
MW-27	0	600	<100	<100	<100	<100	<100	-
MW-29	4,000	>10,000	-	>10,000	3,000	4,000	>10,000	7,500
MW-32A ²	-	-	>10,000	>10,000	<100	9,000	<100	300
MW-33 ²	-	-	4,000	2,200	<100	-	<100	200
MW-34 ²	-	-	<100	520	<100	1,800	<100	-
MW-35 ²	-	-	860	-	100	-	-	<100
MW-36	-	-	<100	>10,000	<100	100	-	>10,000
MW-37 ²	-	-	<100	>10,000	6,000	>10,000	<100	2,100
MW-38 ²	-	-	>10,000	>10,000	-	>10,000	-	7,100
MW-39 ²	-	-	>10,000	>10,000	>10,000	>10,000	-	8,000
MW-40 ²	-	-	>10,000	>10,000	>10,000	>10,000	7,600	>10,000
MW-41 ²	-	-	1,700	7,000	5,000	4,000	9,200	6,000
MW-42 ²	-	-	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000
MW-43 ²	-	-	8,200	>10,000	>10,000	>10,000	>10,000	>10,000
MW-44 ²	-	-	1,700	3,800	3,400	>10,000	>10,000	>10,000
MW-45 ²	-	-	>10,000	>10,000	>10,000	>10,000	>10,000	7,100
MW-46 ²	-	-	>10,000	>10,000	>10,000	6,000	>10,000	8,100
MW-47 ²	-	-	>10,000	>10,000	>10,000	>10,000	>10,000	7,100
MW-48 ²	-	-	-	-	-	-	-	-
SMW-1S ³	-	-	-	-	-	-	-	-
SMW-4 ³	-	-	-	-	-	-	-	-
VES Operational Configuration ⁴								
Northwest	-	-	-	0	0	-	-	-
Northeast	-	-	-	0	0	-	-	-
Southwest	0	0	0	0	0	0	0	0
Southeast	0	0	0	0	0	0	0	0
Seattle West	-	-	-	-	-	-	-	-
Seattle East	-	-	-	-	-	-	-	-

Notes appear on page 7 of 7.

TABLE 7 (Page 4 of 7)

Well Number	Date							
	02/11/92	02/28/92	03/13/92	03/27/92	04/13/92	04/23/92	05/08/92	05/21/92
MW-1	<100	-	-	-	-	-	-	-
MW-2	-	-	-	-	-	-	-	-
MW-3	-	-	-	-	-	-	-	-
MW-11	-	-	-	-	-	-	-	-
MW-13	-	-	-	-	-	-	-	-
MW-14	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	3,200
MW-15	-	-	-	-	-	-	-	-
MW-16	-	-	-	-	-	-	-	-
MW-17	<100	<100	<100	160	100	120	<100	<100
MW-18	<100	<100	-	-	-	-	-	-
MW-19	-	-	-	-	-	-	-	-
MW-24	<100	<100	<100	<100	<100	<100	<100	<100
MW-25	-	-	-	-	-	-	-	-
MW-27	<100	<100	-	<100	<100	<100	<100	<100
MW-29	>10,000	>10,000	<100	-	-	-	-	-
MW-32A ²	<100	<100	4,400	>10,000	<100	<100	1,200	7,800
MW-33 ²	<100	<100	<100	2,500	<100	<100	<100	220
MW-34 ²	<100	700	1,000	2,000	380	260	1,000	1,200
MW-35 ²	500	-	-	>10,000	4,200	100	440	-
MW-36	-	-	-	-	-	-	-	-
MW-37 ²	>10,000	>10,000	>10,000	<100	<100	<100	<100	<100
MW-38 ²	-	-	-	-	-	-	-	-
MW-39 ²	-	-	-	-	-	-	-	-
MW-40 ²	>10,000	-	>10,000	>10,000	>10,000	>10,000	2,400	>10,000
MW-41 ²	4,600	-	3,000	3,200	2,800	2,000	>10,000	3,600
MW-42 ²	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000
MW-43 ²	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000
MW-44 ²	>10,000	>10,000	-	>10,000	>10,000	>10,000	>10,000	>10,000
MW-45 ²	100	>10,000	>10,000	>10,000	>10,000	>10,000	1,400	>10,000
MW-46 ²	>10,000	9,000	>10,000	>10,000	>10,000	4,200	2,400	3,200
MW-47 ²	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000
MW-48 ²	-	-	-	-	-	-	-	-
SMW-1S ³	>10,000	>10,000	>10,000	-	-	-	-	-
SMW-4 ³	>10,000	-	>10,000	-	>10,000	>10,000	-	>10,000
VES Operational Configuration⁴								
Northwest	-	-	-	-	-	-	-	-
Northeast	-	-	-	-	-	-	-	-
Southwest	-	-	-	0	0	0	0	-
Southeast	-	-	0	0	0	0	0	0
Seattle West	0	0	-	0	-	0	0	-
Seattle East	0	-	-	0	-	0	0	0

Notes appear on page 7 of 7.

TABLE 7 (Page 5 of 7)

Well Number	Date							
	06/05/92	06/18/92	06/24/92	07/08/92	07/20/92	07/31/92	08/14/92	08/26/92
MW-1	-	<100	-	<100	<100	-	<100	100
MW-2	-	-	-	-	-	-	-	-
MW-3	-	-	-	-	-	-	-	-
MW-11	-	-	-	-	-	-	-	-
MW-13	-	-	-	-	-	-	-	-
MW-14	>10,000	2,200	-	>10,000	<100	>10,000	>10,000	4,200
MW-15	-	-	-	-	-	-	-	-
MW-16	-	-	-	-	-	-	-	-
MW-17	<100	<100	-	<100	100	<100	120	<100
MW-18	-	-	-	-	-	-	-	-
MW-19	-	-	-	-	<100	-	-	-
MW-24	<100	<100	-	<100	<100	<100	<100	<100
MW-25	-	-	-	-	-	-	-	-
MW-27	<100	<100	-	<100	<100	-	100	<100
MW-29	-	-	-	-	-	-	-	-
MW-32A ²	>10,000	<100	-	<100	<100	<100	<100	<100
MW-33 ²	3,400	<100	-	<100	-	<100	<100	<100
MW-34 ²	960	<100	-	250	3,600	<100	420	240
MW-35 ²	>10,000	<100	-	300	420	-	220	-
MW-36	-	-	-	-	-	-	-	-
MW-37 ²	<100	<100	-	8,000	>10,000	>10,000	>10,000	>10,000
MW-38 ²	-	-	-	-	-	-	-	-
MW-39 ²	-	-	-	-	-	-	-	-
MW-40 ²	>10,000	>10,000	-	>10,000	>10,000	>10,000	>10,000	>10,000
MW-41 ²	2,600	1,200	-	7,000	5,000	7,200	>10,000	<100
MW-42 ²	>10,000	>10,000	-	>10,000	>10,000	>10,000	>10,000	>10,000
MW-43 ²	>10,000	<100	-	>10,000	>10,000	>10,000	>10,000	>10,000
MW-44 ²	>10,000	>10,000	-	>10,000	>10,000	>10,000	>10,000	>10,000
MW-45 ²	>10,000	>10,000	-	>10,000	>10,000	>10,000	>10,000	>10,000
MW-46 ²	3,400	2,500	-	5,200	>10,000	>10,000	>10,000	>10,000
MW-47 ²	>10,000	>10,000	-	>10,000	>10,000	>10,000	>10,000	>10,000
MW-48 ²	-	-	-	-	-	-	-	-
SMW-1S ³	-	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000
SMW-4 ³	>10,000	>10,000	-	>10,000	>10,000	>10,000	>10,000	>10,000
VES Operational Configuration ⁴								
Northwest	-	-	0	0	0	0	0	0
Northeast	-	-	0	0	0	0	0	0
Southwest	-	0	0	0	0	0	0	0
Southeast	0	0	0	0	0	0	0	0
Seattle West	0	-	0	0	0	0	0	0
Seattle East	0	-	0	0	0	0	0	0

Notes appear on page 7 of 7.

TABLE 7 (Page 6 of 7)

Well Number	Date						
	09/11/92	10/12/92	11/09/92	12/11/92	01/08/93	02/19/93	03/02/93
MW-1	-	-	<100	<100	-	-	-
MW-2	-	-	-	-	-	<100	-
MW-3	-	-	-	-	-	-	-
MW-11	-	-	-	-	-	-	-
MW-13	-	-	-	-	-	-	-
MW-14	-	>10,000	>10,000	>10,000	>10,000	>10,000	-
MW-15	-	-	-	-	-	-	-
MW-16	-	-	-	-	-	-	-
MW-17	<100	<100	<100	<100	<100	<100	-
MW-18	-	-	-	-	-	-	-
MW-19	-	-	-	-	-	-	-
MW-24	<100	<100	200	<100	-	200	-
MW-25	-	-	-	-	-	-	-
MW-27	<100	<100	<100	220	<100	<100	-
MW-29	-	-	-	-	-	-	-
MW-32A ²	300	<100	<100	<100	<100	800	-
MW-33 ²	<100	<100	120	<100	<100	<100	-
MW-34 ²	100	<100	100	180	100	100	-
MW-35 ²	<100	-	<100	<100	150	2,000	-
MW-36	-	-	-	-	-	-	-
MW-37 ²	>10,000	>10,000	100	100	>10,000	>10,000	-
MW-38 ²	-	-	-	-	-	-	-
MW-39 ²	-	-	-	-	-	-	-
MW-40 ²	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	-
MW-41 ²	700	>10,000	>10,000	>10,000	2,100	3,000	-
MW-42 ²	>10,000	120	>10,000	>10,000	520	<100	-
MW-43 ²	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	8,000
MW-44 ²	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000
MW-45 ²	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	-
MW-46 ²	>10,000	>10,000	1,400	>10,000	>10,000	4,000	-
MW-47 ²	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000
MW-48 ²	-	-	-	-	-	>10,000	>10,000
SMW-1S ³	-	-	-	-	-	-	-
SMW-4 ³	>10,000	>10,000	-	-	-	-	-
VES Operational Configuration ⁴							
Northwest	○	○	○	○	○	○	○
Northeast	○	○	○	○	○	○	○
Southwest	○	○	○	○	○	○	○
Southeast	○	○	○	○	○	○	○
Seattle West	○	○	○	○	○	○	○
Seattle East	○	○	○	○	○	○	○

Notes appear on page 7 of 7.

TABLE 7 (Page 7 of 7)

Well Number	Date				
	03/04/93	03/22/93	04/30/93	06/29/93	07/14/93
MW-1	-	-	<100	<100	-
MW-2	-	<100	-	<100	>10,000
MW-3	-	-	-	<100	>10,000
MW-11	-	-	-	-	-
MW-13	-	-	-	-	-
MW-14	-	>10,000	>10,000	3,000	-
MW-15	-	-	-	-	-
MW-16	-	-	-	-	-
MW-17	-	900	>10,000	<100	-
MW-18	-	-	-	-	>10,000
MW-19	-	-	-	-	>10,000
MW-24	-	<100	<100	<100	-
MW-25	-	-	>10,000	-	-
MW-27	-	-	<100	<100	-
MW-29	-	-	-	-	-
MW-32A ²	-	<100	5,000	<100	-
MW-33 ²	-	<100	100	<100	-
MW-34 ²	-	<100	<100	<100	-
MW-35 ²	-	-	>10,000	<100	-
MW-36	-	-	-	-	-
MW-37 ²	>10,000	500	>10,000	<100	-
MW-38 ²	-	-	-	-	-
MW-39 ²	-	-	-	-	-
MW-40 ²	>10,000	>10,000	420	>10,000	-
MW-41 ²	-	1,700	3,000	3,000	-
MW-42 ²	-	>10,000	>10,000	>10,000	-
MW-43 ²	9,000	>10,000	>10,000	>10,000	-
MW-44 ²	>10,000	>10,000	>10,000	>10,000	-
MW-45 ²	-	>10,000	>10,000	>10,000	-
MW-46 ²	-	>10,000	220	<100	-
MW-47 ²	>10,000	>10,000	-	>10,000	-
MW-48 ²	>10,000	>10,000	>10,000	>10,000	-
SMW-1S ³	-	-	-	-	-
SMW-4 ³	-	-	-	-	-
VES Operational Configuration⁴					
Northwest	O	O	O	O	O
Northeast	O	O	O	O	O
Southwest	O	O	O	O	O
Southeast	O	O	O	O	O
Seattle West	O	O	O	O	O
Seattle East	O	O	O	O	O

Notes:

¹Vapor concentrations were measured using a Bacharach TLV Sniffer calibrated to hexane. Results are expressed in parts per million.

²Monitoring wells MW-32A through MW-48 were installed in October 1991 and January 1992.

³Monitoring wells SMW-15 and SMW-4 were installed in January 1991.

⁴VES operational configuration shows the configuration of vapor withdrawal at the time the vapor concentrations were measured. The city of Seattle wells were not connected to the system before January 31, 1992.

'O' = open; '-' = closed

'-' = not measured

TABLE 8
 ADDITIONAL TESTING OF VAPORS
 FROM SELECTED MONITORING WELLS

Well	Date	Combustible Vapor Concentration (ppm) ¹	Methane (ppm) ²	Total Volatile Hydrocarbons (ppm) ³
MW-2	05/20/91	>10,000	-	-
	06/19/91	>10,000	-	-
MW-3	08/29/91	5,000	-	-
MW-11	07/17/91	>10,000	34,000	7,200
MW-14	01/31/91	>10,000	-	-
MW-19	01/16/91	>10,000	-	-
	07/17/91	>10,000	48,000	124,000
MW-29	01/16/91	>10,000	-	-
	02/15/91	>10,000	-	-
	03/18/91	6,600	-	-
	04/01/91	7,000	-	-
	04/17/91	>10,000	2,100	260
	05/01/91	5,200	-	-
	05/20/91	6,000	-	-
	06/05/91	1,200	-	-
	06/19/91	8,500	-	-
	07/03/91	3,000	-	-
	07/16/91	>10,000	-	-
	08/01/91	3,000	-	-
	08/19/91	6,600	-	-
	10/03/91	4,000	-	-
	10/15/91	>10,000	-	-
10/31/91	-	-	-	
	02/21/92 ⁴	-	23,000	1,050
MW-37	02/21/92 ⁵	-	4,700	1,400
MW-47	05/08/92	-	28,000	-

Notes:

¹Field measurements for combustible vapor concentration taken using a Bacharach TLV Sniffer calibrated to hexane.

²Analysis for methane by GC/FID.

³Analysis for total volatile hydrocarbons by GC/FID converted to ppm assuming molecular weight of total volatile hydrocarbons is 69.5 grams per mole (U.S. EPA June 1989).

⁴The laboratory also provided BETX concentrations for this sample. Benzene (0.3 ppm) was detected. Ethylbenzene, toluene and xylenes were not detected.

⁵The laboratory also provided BETX concentrations for this sample. Benzene (4.4 ppm), ethylbenzene (1.6 ppm), toluene (15.9 ppm) and xylenes (6.9 ppm) were detected.

- = not measured

ppm = parts per million (volume basis)

TABLE 9 (Page 1 of 4)
GROUND VACUUM MONITORING DATA¹
RECOVERY WELLS

Vapor Collection Area ²	Well Number	Date									
		01/31/91	03/04/91	04/01/91	05/01/91	06/05/91	07/03/91	08/01/91	08/29/91	10/03/91	10/31/91
Northwest	RW-7	0.02	0.00	0.01	0.00	0.00	0.00	0.40	0.00	0.01	0.01
	RW-8	0.015	0.00	0.01	0.00	0.00	0.00	0.20	0.00	0.01	0.03
	RW-9	0.02	0.00	0.01	0.00	0.00	0.00	0.40	0.00	0.01	0.01
	RW-10	0.015	0.00	0.02	0.00	0.00	0.00	0.30	0.00	0.01	0.00
	RW-26	0.01	0.00	0.005	0.00	0.00	0.00	0.15	0.00	0.01	0.02
Northeast	RW-28	0.035	0.14	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.03
	RW-5A	4.20	0.24	5.00	0.08	2.20	7.00	1.40	8.00	4.4	8.00
	RW-4A	4.00	14.00	4.90	>10.00	0.00	6.00	0.90	4.00	3.4	8.00
Seattle West	SMW-2S	-	-	-	-	-	-	-	-	-	-
	SMW-5	-	-	-	-	-	-	-	-	-	-
Seattle East	MW-32	-	-	-	-	-	-	-	-	-	-
	MW-49	-	-	-	-	-	-	-	-	-	-
VES Operational Configuration ²											
Northwest		-	-	-	-	0	-	0	-	-	-
Northeast		-	-	-	-	0	-	0	-	-	-
Southwest		0	-	0	-	0	0	0	0	0	0
Southeast		0	0	0	0	0	0	0	0	0	0
Seattle West		-	-	-	-	-	-	-	-	-	-
Seattle East		-	-	-	-	-	-	-	-	-	-

Notes appear on page 4 of 4.

TABLE 9 (Page 2 of 4)

Vapor Collection Area ²	Well Number	Date									
		12/02/91	12/30/91	02/11/92	02/28/92	03/13/92	03/27/92	04/13/92	04/23/92	05/08/92	05/21/92
Northwest	RW-7	0.80	0.70	0.60	0.03	0.00	0.50	0.50	0.25	0.00	0.00
	RW-8	0.84	0.70	0.60	0.03	0.00	0.00	0.00	0.27	0.00	0.00
	RW-9	0.90	1.00	0.60	0.03	0.00	0.00	0.00	0.26	0.00	0.00
	RW-10	0.80	0.80	0.70	0.04	0.02	0.00	0.00	0.30	0.01	0.00
	RW-26	0.72	0.65	0.56	0.02	0.00	0.00	0.00	0.26	0.00	0.00
Northwest	RW-28	--	0.04	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.025
Southwest	RW-5A	--	0.50	0.42	0.00	0.00	0.00	0.60	0.04	0.04	0.45
Southwest	RW-4A	2.80	2.00	2.00	0.07	0.04	3.00	4.30	> 10.0	> 10.0	
Seattle West	SMW-2S	--	--	5.0	--	--	--	--	--	--	--
	SMW-5	--	--	5.6	--	--	--	--	--	--	--
Seattle East	MW-32	--	--	5.0	--	--	--	--	--	--	--
	MW-49	--	--	10.0	--	--	--	--	--	--	--
VES Operational Configuration ²											
Northwest		0	-	-	-	-	-	-	-	-	-
Northwest		0	-	-	-	-	-	-	-	-	-
Southwest		0	0	-	-	-	0	0	0	0	0
Southwest		0	0	-	-	0	0	0	0	0	0
Seattle West		-	-	0	0	-	0	0	0	0	0
Seattle East		-	-	0	-	-	0	0	0	0	0

Notes appear on page 4 of 4.

TABLE 9 (Page 3 of 4)

Vapor Collection Area ²	Well Number	Date											
		06/05/92	06/18/92	06/24/92	07/02/92	07/20/92	07/31/92	08/14/92	08/26/92	09/11/92	10/12/92		
Northwest	RW-7	0.00	0.36	--	0.40	0.45	0.38	0.40	0.40	0.42	0.40	0.42	0.40
	RW-8	0.00	0.32	--	0.20	0.51	0.42	0.42	0.44	0.40	0.44	0.40	0.44
	RW-9	0.00	0.30	--	0.40	0.52	0.43	0.44	0.44	0.42	0.44	0.42	0.46
	RW-10	0.00	0.34	--	0.40	0.52	0.46	0.46	0.43	0.46	0.43	0.46	0.48
	RW-26	--	0.32	--	0.40	0.40	0.42	0.38	0.45	0.36	0.45	0.36	0.36
Northeast	RW-28	0.025	0.02	--	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	RW-5A	0.05	0.04	--	1.50	1.80	1.60	1.80	1.80	1.60	1.80	1.60	0.90
Southwest	RW-4A	>10.0	4.60	--	1.10	1.30	1.10	1.00	1.00	1.00	1.00	0.90	1.60
	SMW-2S	--	9.80	4.50	4.50	4.40	1.40	4.60	1.90	3.00	1.90	3.00	2.40
Seattle West	SMW-5	--	<1.0	10.0	4.50	4.30	4.40	4.80	2.00	2.50	2.00	2.50	2.80
	MW-32	--	5.20	10.0	0.40	0.95	0.38	3.00	1.00	2.00	1.00	2.00	0.60
Seattle East	MW-49	--	5.20	0.50	0.60	--	0.40	3.00	1.00	0.60	1.00	0.60	2.00
	VES Operational Configuration ²												
Northwest		-	-	0	0	0	0	0	0	0	0	0	0
	Northeast	-	-	0	0	0	0	0	0	0	0	0	0
	Southwest	-	0	0	0	0	0	0	0	0	0	0	0
	Southeast	0	0	0	0	0	0	0	0	0	0	0	0
	Seattle West	0	-	0	0	0	0	0	0	0	0	0	0
Seattle East	0	-	0	0	0	0	0	0	0	0	0	0	

Notes appear on page 4 of 4.

TABLE 9 (Page 4 of 4)

Vapor Collection Area ²	Well Number	Date											
		11/09/92	12/11/92	01/08/93	02/19/93	03/22/93	04/30/93	06/29/93					
Northwest	RW-7	0.64	0.80	0.48	--	--	0.00	0.00	--	--	0.00	--	
	RW-8	0.68	0.79	0.54	0.43	0.30	0.00	0.00	0.30	0.00	0.00	0.41	
	RW-9	0.70	0.84	0.52	0.44	0.30	0.00	0.00	0.30	0.00	0.00	0.42	
	RW-10	0.74	0.78	0.54	0.46	0.40	0.00	0.00	0.40	0.00	0.00	0.42	
	RW-26	0.60	0.72	0.42	0.36	--	0.00	0.00	--	--	0.00	0.34	
Northwest	RW-28	0.01	0.00	--	0.00	0.10	0.00	0.00	0.10	0.00	0.00	--	
Southwest	RW-5A	0.76	0.80	0.52	0.20	--	0.00	0.00	--	0.00	0.00	--	
Southwest	RW-4A	1.80	0.20	2.00	1.80	--	0.00	0.00	--	0.00	0.00	--	
Seattle West	SMW-2S	--	--	--	0.10	0.10	--	--	0.10	--	--	--	
	SMW-5	--	--	--	0.20	0.00	--	--	0.00	--	--	0.01	
Seattle East	MW-32	--	--	--	0.00	0.00	--	--	0.00	0.00	0.00	0.00	
	MW-49	--	--	--	0.20	0.00	--	--	0.00	0.00	0.00	0.00	
VES Operational Configuration ²													
Northwest		0	0	0	0	0	0	0	0	0	0	0	0
Northwest		0	0	0	0	0	0	0	0	0	0	0	0
Southwest		0	0	0	0	0	0	0	0	0	0	0	0
Southwest		0	0	0	0	0	0	0	0	0	0	0	0
Seattle West		0	0	0	0	0	0	0	0	0	0	0	0
Seattle East		0	0	0	0	0	0	0	0	0	0	0	0

Notes:

¹ Measured using Magnehelic vacuum gauges. Results are expressed in inches of water column.

² VES operational configuration shows the configuration of vapor withdrawal at the time the vacuum was measured. '0' = open; '-' = closed. The city of Seattle wells were not connected to the system before January 31, 1992.

'--' = not measured

TABLE 10 (Page 1 of 6)
GROUND VACUUM MONITORING DATA¹
MONITORING WELLS

Well Number	Date						
	01/31/91	03/04/91	04/01/91	05/01/91	06/05/91	07/03/91	08/01/91
MW-1	0.00	0.00	0.00	0.01	0.00	0.00	0.01
MW-2	-	-	0.00	0.00	0.00	0.00	0.00
MW-3	0.00	-	0.00	0.00	0.00	0.00	0.00
MW-11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-13	0.02	0.00	0.01	0.00	0.00	0.00	0.00
MW-14	0.00	0.00	0.00	0.01	0.00	0.00	0.01
MW-15	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-16	0.01	0.00	0.00	0.00	0.00	0.00	0.00
MW-17	0.05	0.00	0.02	0.00	0.00	0.00	0.00
MW-18	0.32	0.48	0.04	0.34	0.00	0.00	0.35
MW-19	0.31	0.74	0.23	0.40	0.00	0.00	0.30
MW-24	0.08	0.12	0.41	0.04	0.00	0.00	0.02
MW-25	0.00	-	0.00	0.00	0.00	0.00	0.00
MW-27	0.025	0.00	0.01	0.01	0.00	0.00	0.01
MW-29	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-32A ²	-	-	-	-	-	-	-
MW-33 ²	-	-	-	-	-	-	-
MW-34 ²	-	-	-	-	-	-	-
MW-35 ²	-	-	-	-	-	-	-
MW-36 ²	-	-	-	-	-	-	-
MW-37 ²	-	-	-	-	-	-	-
MW-38 ²	-	-	-	-	-	-	-
MW-39 ²	-	-	-	-	-	-	-
MW-40 ²	-	-	-	-	-	-	-
MW-41 ²	-	-	-	-	-	-	-
MW-42 ²	-	-	-	-	-	-	-
MW-43 ²	-	-	-	-	-	-	-
MW-44 ²	-	-	-	-	-	-	-
MW-45 ²	-	-	-	-	-	-	-
MW-46 ²	-	-	-	-	-	-	-
MW-47 ²	-	-	-	-	-	-	-
MW-48 ²	-	-	-	-	-	-	-
SMW-1S ³	-	-	-	-	-	-	-
SMW-4 ³	-	-	-	-	-	-	-
Vapor Collection System Operational Status ⁴							
Northwest	-	-	-	-	○	-	○
Northeast	-	-	-	-	○	-	○
Southwest	○	-	○	-	○	○	○
Southeast	○	○	○	○	○	○	○
Seattle West	-	-	-	-	-	-	-
Seattle East	-	-	-	-	-	-	-

Notes appear on page 6 of 6.

TABLE 10 (Page 2 of 6)

Well Number	Date						
	08/29/91	10/03/91	10/31/91	12/02/91	12/30/91	02/11/92	02/28/92
MW-1	0.00	0.01	--	--	--	0.00	--
MW-2	--	0.00	--	--	--	--	--
MW-3	0.00	--	--	--	--	--	--
MW-11	0.00	0.00	0.00	0.00	--	--	--
MW-13	0.00	0.00	0.00	0.00	--	--	--
MW-14	0.00	0.03	0.00	0.01	0.00	0.00	0.00
MW-15	0.00	0.00	0.00	0.00	--	--	--
MW-16	0.00	0.00	0.04	0.00	--	--	--
MW-17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-18	0.01	0.40	0.065	0.00	--	0.04	0.00
MW-19	0.00	0.09	0.00	0.00	--	--	--
MW-24	0.10	0.00	0.00	0.00	0.00	0.00	0.00
MW-25	0.00	0.00	0.00	--	--	--	--
MW-27	0.00	0.00	0.03	0.01	0.03	0.00	0.00
MW-29	0.00	0.00	0.01	0.00	0.00	0.03	0.00
MW-32A ²	--	--	--	0.46	0.70	0.58	0.03
MW-33 ²	--	--	--	0.01	0.04	0.00	0.00
MW-34 ²	--	--	--	0.23	0.40	0.24	0.01
MW-35 ²	--	--	--	0.06	--	0.00	--
MW-36 ²	--	--	--	0.00	--	--	--
MW-37 ²	--	--	--	0.00	0.19	0.13	0.00
MW-38 ²	--	--	--	--	--	--	--
MW-39 ²	--	--	--	0.00	--	--	--
MW-40 ²	--	--	--	0.00	0.00	0.01	0.00
MW-41 ²	--	--	--	0.00	0.03	0.03	0.00
MW-42 ²	--	--	--	0.00	0.01	0.00	0.00
MW-43 ²	--	--	--	0.00	0.01	0.00	0.01
MW-44 ²	--	--	--	0.00	0.00	0.00	0.00
MW-45 ²	--	--	--	0.00	0.01	0.00	0.00
MW-46 ²	--	--	--	0.00	0.00	0.00	0.00
MW-47 ²	--	--	--	0.00	0.01	0.00	0.00
MW-48 ²	--	--	--	--	--	--	--
SMW-1S ³	--	--	--	--	--	--	--
SMW-4 ³	--	--	--	--	--	--	--
Vapor Collection System Operational Status⁴							
Northwest	-	-	-	○	-	-	-
Northeast	-	-	-	○	-	-	-
Southwest	○	○	○	○	○	-	-
Southeast	○	○	○	○	○	-	-
Seattle West	-	-	-	-	-	○	○
Seattle East	-	-	-	-	-	○	-

Notes appear on page 6 of 6.

TABLE 10 (Page 3 of 6)

Well Number	Date						
	03/13/92	03/27/92	04/13/92	04/23/92	05/08/92	05/21/92	06/05/92
MW-1	-	-	-	-	-	-	-
MW-2	-	-	-	-	-	-	-
MW-3	-	-	-	-	-	-	-
MW-11	-	-	-	-	-	-	-
MW-13	-	-	-	-	-	-	-
MW-14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-15	-	-	-	-	-	-	-
MW-16	-	-	-	-	-	-	-
MW-17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-18	-	-	-	-	-	-	-
MW-19	-	-	-	-	-	-	-
MW-24	0.00	0.00	0.00	0.02	0.05	0.05	0.05
MW-25	-	-	-	-	-	-	-
MW-27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-29	-	-	-	-	-	-	-
MW-32A ²	0.00	0.00	0.00	0.25	0.00	0.00	0.00
MW-33 ²	0.00	0.00	0.00	0.02	0.03	0.02	0.03
MW-34 ²	0.00	0.00	0.00	0.13	0.00	0.25	0.025
MW-35 ²	-	-	-	0.20	0.00	-	0.00
MW-36 ²	-	-	-	-	-	-	-
MW-37 ²	0.00	0.50	0.00	0.22	0.54	2.56	0.00
MW-38 ²	-	-	-	-	-	-	-
MW-39 ²	-	-	-	-	-	-	-
MW-40 ²	0.00	0.00	0.00	0.50	0.02	0.00	0.00
MW-41 ²	0.00	0.00	0.00	0.00	0.00	0.00	0.01
MW-42 ²	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-43 ²	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-44 ²	-	0.00	0.00	0.00	0.00	0.00	0.00
MW-45 ²	0.00	0.00	0.00	0.00	0.00	0.00	0.01
MW-46 ²	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-47 ²	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-48 ²	-	-	-	-	-	-	-
SMW-1S ³	-	-	-	-	-	-	-
SMW-4 ³	-	-	-	-	-	-	-
Vapor Collection System Operational Status ⁴							
Northwest	-	-	-	-	-	-	-
Northeast	-	-	-	-	-	-	-
Southwest	-	○	○	○	○	-	-
Southeast	○	○	○	○	○	○	○
Seattle West	-	○	-	○	○	○	○
Seattle East	-	○	-	○	○	-	○

Notes appear on page 6 of 6.

TABLE 10 (Page 4 of 6)

Well Number	Date						
	06/18/92	06/24/92	07/02/92	07/20/92	07/31/92	08/14/92	08/26/92
MW-1	0.03	-	0.00	0.00	-	0.03	0.03
MW-2	-	-	-	-	-	-	-
MW-3	-	-	-	-	-	-	-
MW-11	-	-	-	-	-	-	-
MW-13	-	-	-	-	-	-	-
MW-14	0.00	-	0.00	0.00	0.00	0.00	0.00
MW-15	-	-	-	-	-	-	-
MW-16	-	-	-	-	-	-	-
MW-17	0.00	-	0.00	0.02	0.00	0.00	0.00
MW-18	-	-	-	-	-	-	-
MW-19	-	-	-	0.01	-	-	-
MW-24	0.02	-	0.00	0.03	0.01	0.03	0.01
MW-25	-	-	-	-	-	-	-
MW-27	0.00	-	0.00	0.00	0.00	0.00	0.00
MW-29	-	-	-	-	-	-	-
MW-32A ²	0.31	-	0.20	0.49	0.40	0.40	0.38
MW-33 ²	0.01	-	0.00	-	0.01	0.00	0.00
MW-34 ²	0.18	-	0.10	0.35	0.27	0.28	0.28
MW-35 ²	0.24	-	0.10	0.38	-	0.28	-
MW-36 ²	-	-	-	-	-	-	-
MW-37 ²	0.25	-	0.00	0.15	0.10	0.10	0.07
MW-38 ²	-	-	-	-	-	-	-
MW-39 ²	-	-	-	-	-	-	-
MW-40 ²	0.00	-	0.00	0.00	0.00	0.00	0.00
MW-41 ²	0.00	-	0.00	0.02	0.07	0.00	0.00
MW-42 ²	0.00	-	0.00	0.00	0.00	0.00	0.00
MW-43 ²	0.00	-	0.00	0.00	0.00	0.00	0.00
MW-44 ²	0.00	-	0.00	0.00	0.00	0.00	0.00
MW-45 ²	0.00	-	0.00	0.00	0.01	0.00	0.01
MW-46 ²	0.00	-	0.00	0.00	0.00	0.00	0.00
MW-47 ²	0.00	-	0.00	0.00	0.00	0.00	0.00
MW-48 ²	-	-	-	-	-	-	-
SMW-1S ³	0.00	0.00	0.00	0.00	-	0.00	0.00
SMW-4 ³	0.00	-	0.00	0.00	-	0.00	0.00
Vapor Collection System Operational Status ⁴							
Northwest	-	○	○	○	○	○	○
Northeast	-	○	○	○	○	○	○
Southwest	○	○	○	○	○	○	○
Southeast	○	○	○	○	○	○	○
Seattle West	-	○	○	○	○	○	○
Seattle East	-	○	○	○	○	○	○

Notes appear on page 6 of 6.

TABLE 10 (Page 5 of 6)

Well Number	Date						
	09/11/92	10/12/92	11/09/92	12/11/92	01/08/93	02/19/93	03/22/93
MW-1	-	-	0.07	1.00	-	-	-
MW-2	-	-	-	-	-	-	0.20
MW-3	-	-	-	-	-	-	-
MW-11	-	-	-	-	-	-	-
MW-13	-	-	-	-	-	-	-
MW-14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-15	-	-	-	-	-	-	-
MW-16	-	-	-	-	-	-	-
MW-17	0.00	0.00	0.06	0.03	0.00	0.00	0.00
MW-18	-	-	-	-	-	-	-
MW-19	-	-	-	-	-	-	-
MW-24	0.01	0.01	0.04	0.01	-	0.00	0.00
MW-25	-	-	-	-	-	-	-
MW-27	0.00	0.00	0.01	0.00	0.00	0.00	-
MW-29	-	-	-	-	-	-	-
MW-32A ²	0.40	0.38	0.64	0.82	0.46	0.40	0.35
MW-33 ²	0.00	0.01	0.02	0.00	0.00	0.00	0.00
MW-34 ²	0.27	0.02	0.34	0.01	0.22	0.18	0.10
MW-35 ²	0.27	-	0.44	0.65	0.32	0.29	-
MW-36 ²	-	-	-	-	-	-	-
MW-37 ²	0.11	0.10	0.20	0.16	0.14	0.07	0.20
MW-38 ²	-	-	-	-	-	-	-
MW-39 ²	-	-	-	-	-	-	-
MW-40 ²	0.00	0.00	0.02	0.09	0.00	0.00	0.00
MW-41 ²	0.05	0.00	0.01	0.00	0.02	0.02	0.10
MW-42 ²	0.02	0.01	0.00	0.00	0.00	0.00	0.00
MW-43 ²	0.00	0.00	0.01	0.00	0.00	0.00	0.00
MW-44 ²	0.02	0.00	0.00	0.00	0.00	0.00	0.00
MW-45 ²	0.01	0.01	0.00	0.00	0.00	0.00	0.05
MW-46 ²	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-47 ²	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-48 ²	-	-	-	-	-	0.00	0.00
SMW-1S ³	-	-	-	-	-	-	-
SMW-4 ³	0.00	0.00	-	-	-	-	-
Vapor Collection System Operational Status⁴							
Northwest	○	○	○	○	○	○	○
Northeast	○	○	○	○	○	○	○
Southwest	○	○	○	○	○	○	○
Southeast	○	○	○	○	○	○	○
Seattle West	○	○	○	○	○	○	○
Seattle East	○	○	○	○	○	○	○

Notes appear on page 6 of 6.

TABLE 10 (Page 6 of 6)

Well Number	Date	
	04/30/93	06/29/93
MW-1	0.00	0.01
MW-2	-	0.03
MW-3	-	0.01
MW-11	-	-
MW-13	-	-
MW-14	0.00	0.00
MW-15	-	-
MW-16	-	-
MW-17	0.00	0.01
MW-18	-	-
MW-19	-	-
MW-24	0.00	0.01
MW-25	0.00	-
MW-27	0.00	0.01
MW-29	-	-
MW-32A ²	0.00	0.40
MW-33 ²	0.00	0.01
MW-34 ²	0.00	0.24
MW-35 ²	0.00	0.28
MW-36 ²	-	-
MW-37 ²	0.00	-
MW-38 ²	-	-
MW-39 ²	-	-
MW-40 ²	0.00	0.00
MW-41 ²	0.00	0.00
MW-42 ²	0.00	0.00
MW-43 ²	0.00	0.01
MW-44 ²	0.00	0.02
MW-45 ²	0.00	0.01
MW-46 ²	0.00	0.00
MW-47 ²	-	0.00
MW-48 ²	0.00	0.00
SMW-1S ³	-	-
SMW-4 ³	-	-
Vapor Collection System Operational Status⁴		
Northwest	O	O
Northeast	O	O
Southwest	O	O
Southeast	O	O
Seattle West	O	O
Seattle East	O	O

Notes:

- ¹ Measured using Magnehelic vacuum gauges. Results are expressed in inches of water column.
 - ² Monitoring wells MW-32A through MW-48 were installed in October 1991 and January 1992.
 - ³ Monitoring wells SMW-1S and SMW-4 were installed in January 1991.
 - ⁴ VES operational configuration shows the configuration of vapor withdrawal at the time the vacuum was measured.
The city of Seattle wells were not connected to the system before January 31, 1992.
- *- = not measured; *O = open; *C = closed

TABLE 11
GROUND WATER ANALYTICAL DATA
MW-40

Sample Number	Date Sampled	BETX ¹ (µg/l)				Gasoline-range Hydrocarbons ² (mg/l)	Heavy Oil-range Hydrocarbons ³ (mg/l)	Dissolved Lead ⁴ (mg/l)	Total Lead ⁴ (mg/l)
		B	E	T	X				
MW-40	03/25/93	32	4.0	1.3	1.4	0.87	<1	<0.0030	0.020
MTCA ⁵ Method A Ground Water Cleanup Level		5.0	30	40	20	1.0		0.005	0.005

Notes:

¹B = benzene, E = ethylbenzene, T = toluene, X = xylenes. Analyzed for BETX by EPA Method 8020.

²Analyzed by Ecology Method WTPH-G.

³Analyzed by Ecology Method WTPH-418.1 modified.

⁴Analyzed by EPA Method 7421.

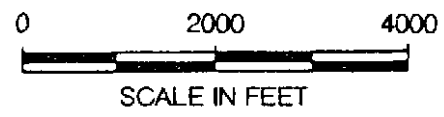
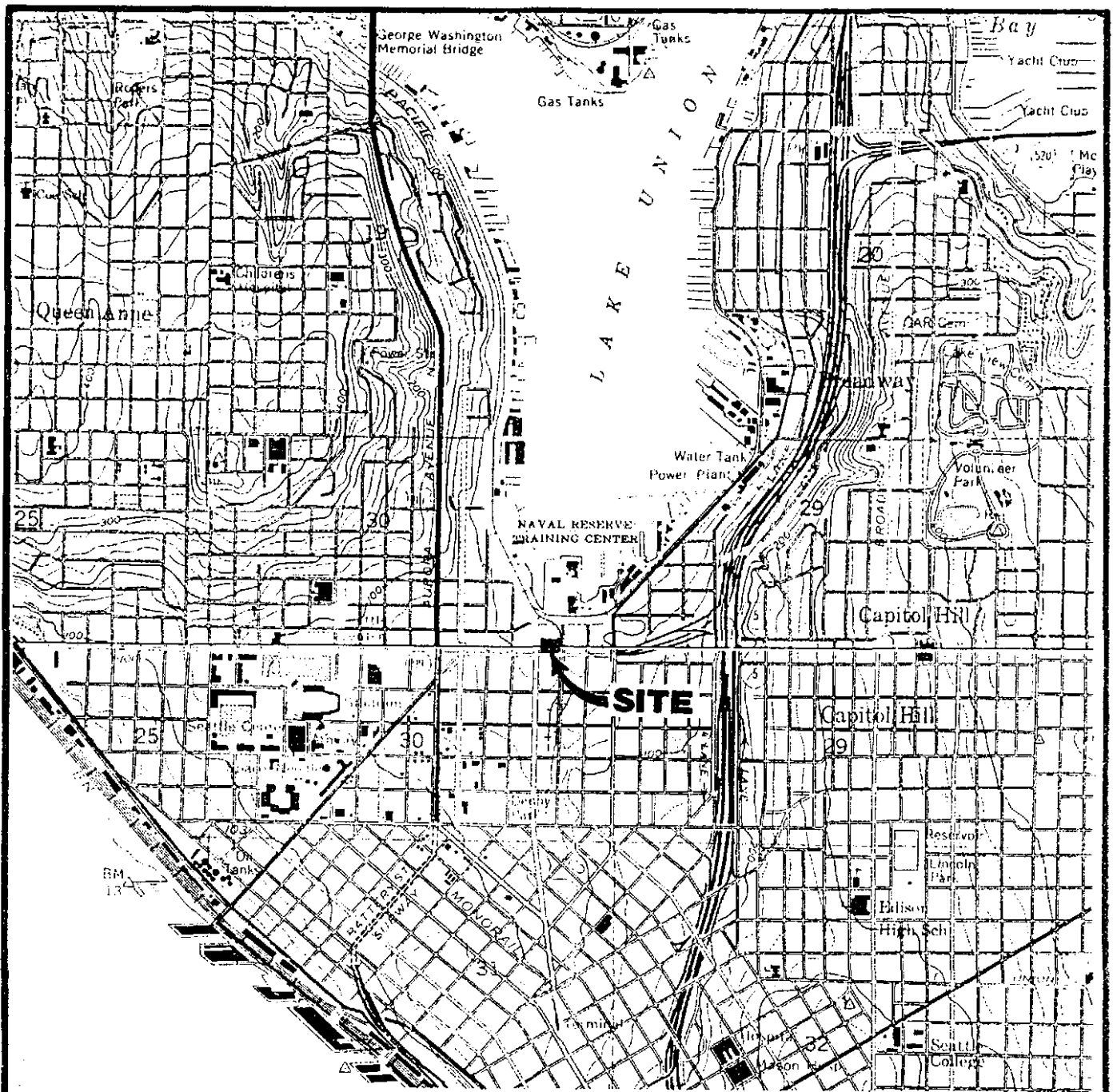
⁵MTCA = Model Toxics Control Act

µg/l = micrograms per liter

mg/l = milligrams per liter.

Shading indicates that analyte was detected at a concentration exceeding the MTCA Method A ground water cleanup level.

0161-013-ROA AMA:KKT 2/13/92

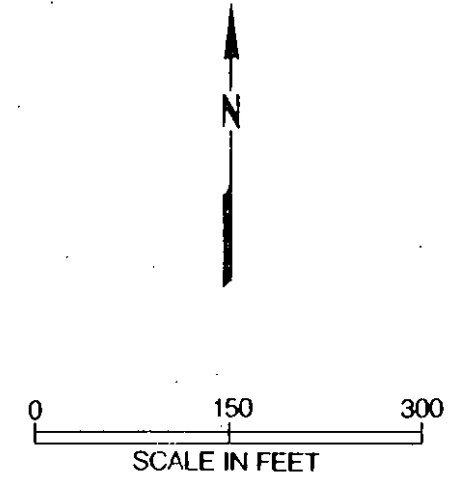
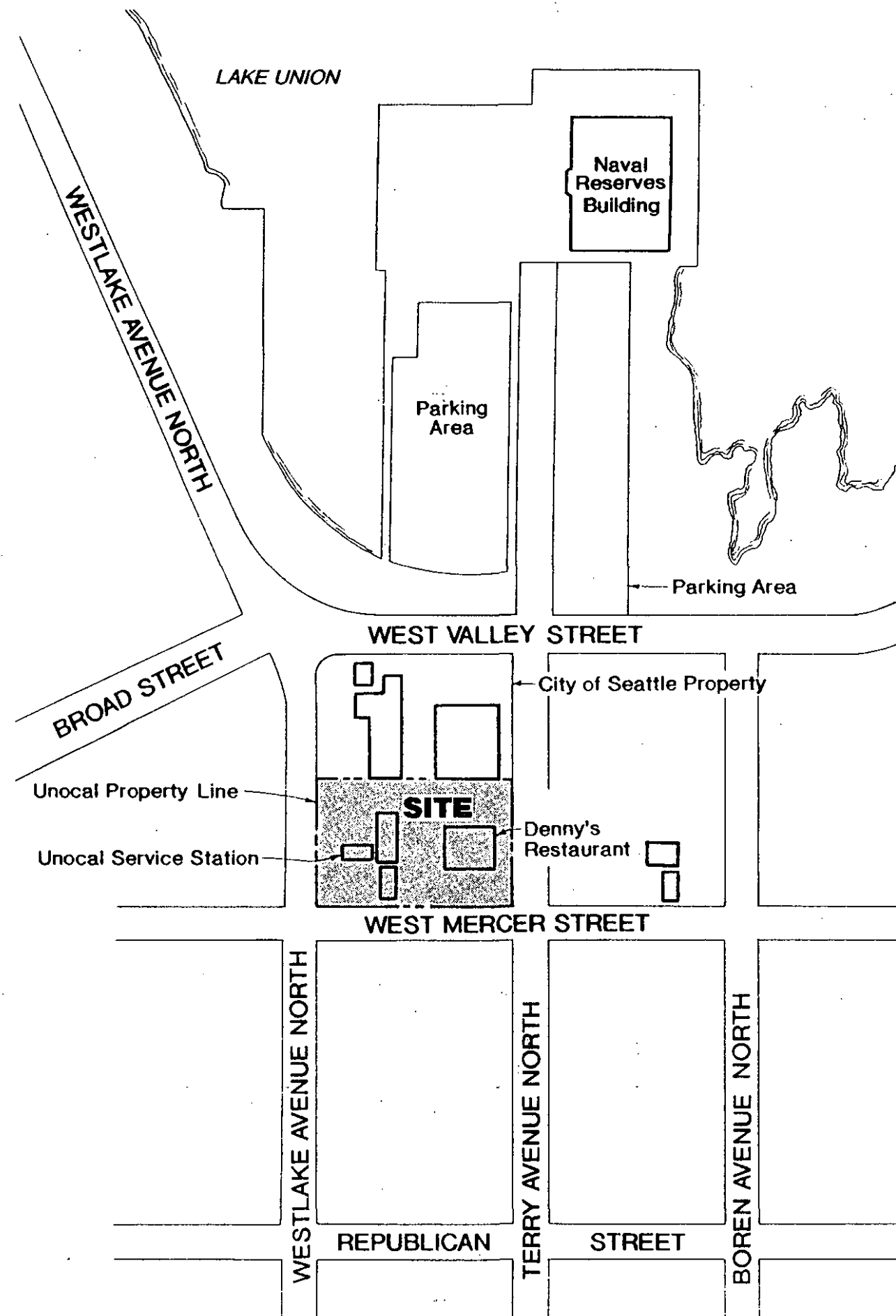


REFERENCE: USGS TOPOGRAPHIC QUADRANGLE MAPS "SEATTLE NORTH, WASH.,"
PHOTOREVISED 1968 AND "SEATTLE SOUTH, WASH.," PHOTOREVISED 1973.



VICINITY MAP

FIGURE 1



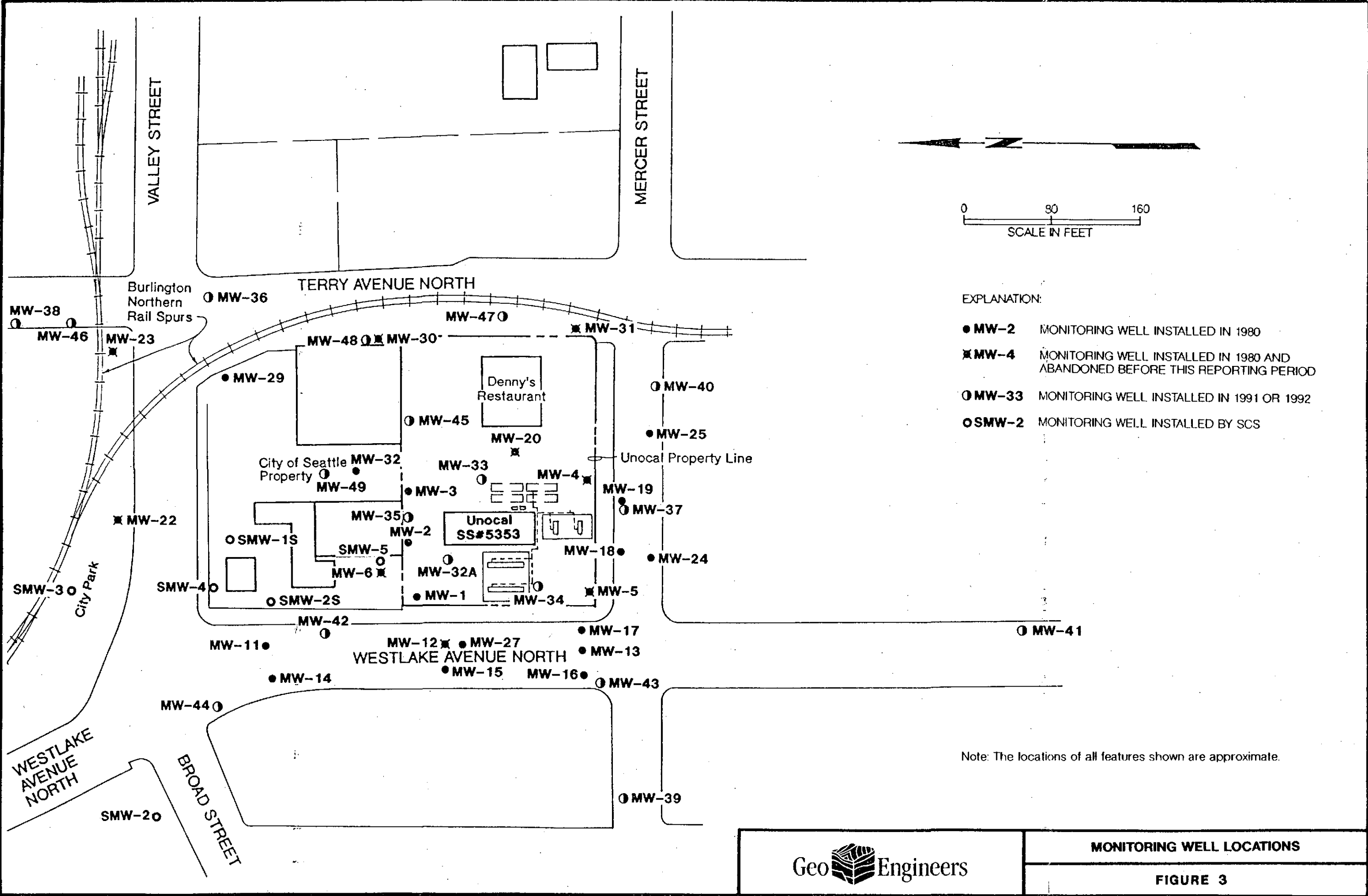
REFERENCE: CITY OF SEATTLE DEPARTMENT OF ENGINEERING, AERIAL PHOTOGRAPHY OF NE 1/4 OF THE SE 1/4 SEC. 30, T. 25, R.4, W.M.

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SITE AND IMMEDIATE VICINITY

FIGURE 2

0161-013-R63 NLP BDH 8/24/95(B)

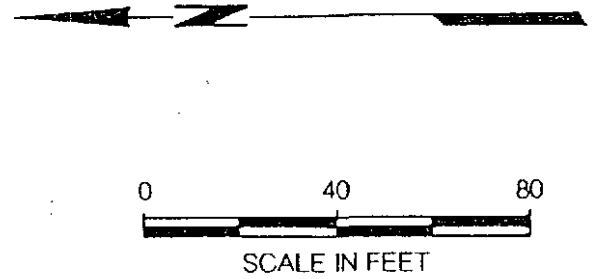
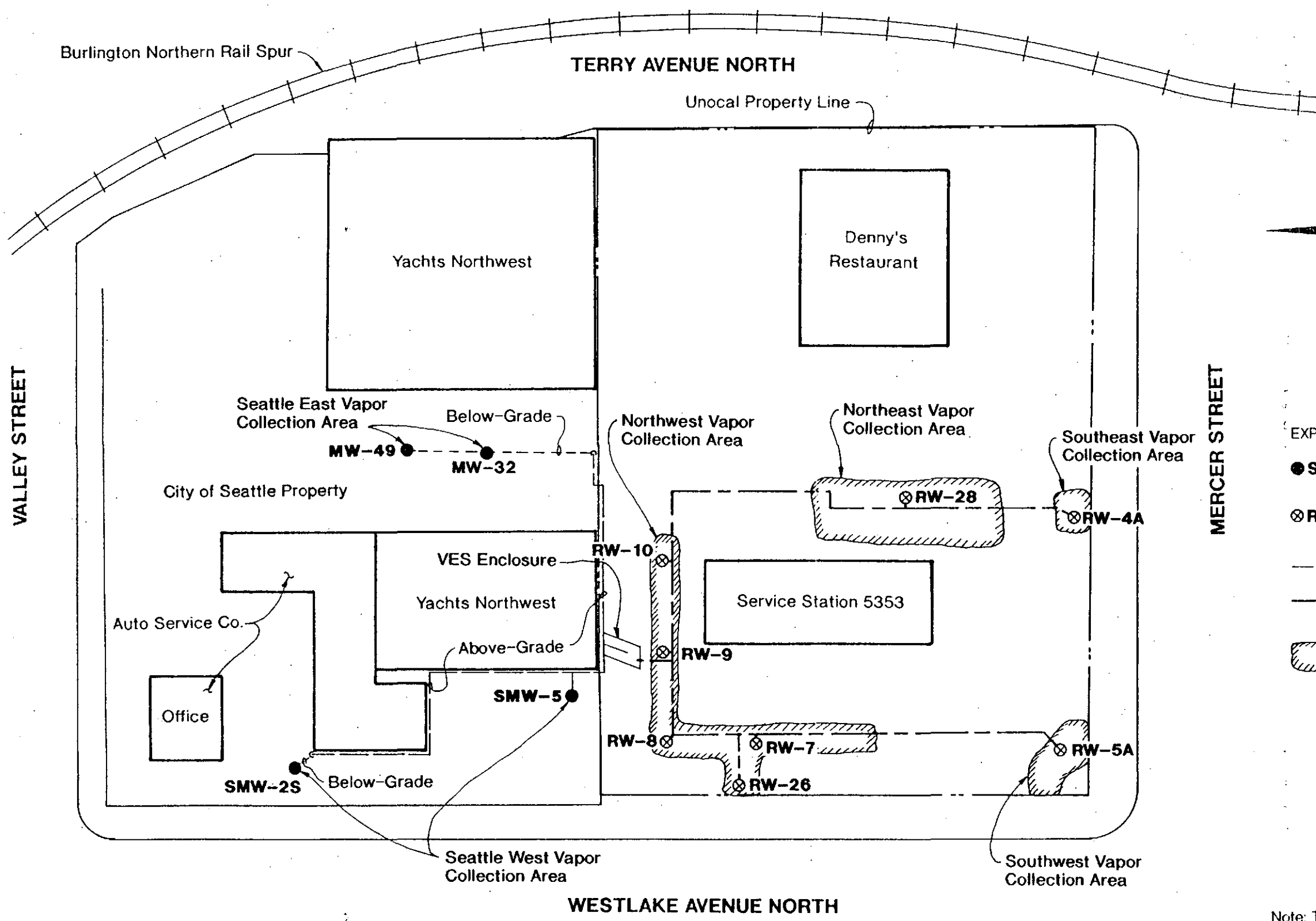


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MONITORING WELL LOCATIONS

FIGURE 3

0161-013-RO4 DEH:PMB 02-12-92 Rev. DEH:JLD 3/12/92 (A)



- EXPLANATION:
- **SMW-5** MONITORING WELL USED FOR VAPOR EXTRACTION
 - ⊗ **RW-4A** RECOVERY WELL USED FOR VAPOR EXTRACTION
 - 2" PVC VAPOR CONVEYANCE LINE
 - - - 3" GALVANIZED IRON VAPOR CONVEYANCE LINE
 - ▨ BACKFILLED EXCAVATION USED FOR VAPOR EXTRACTION

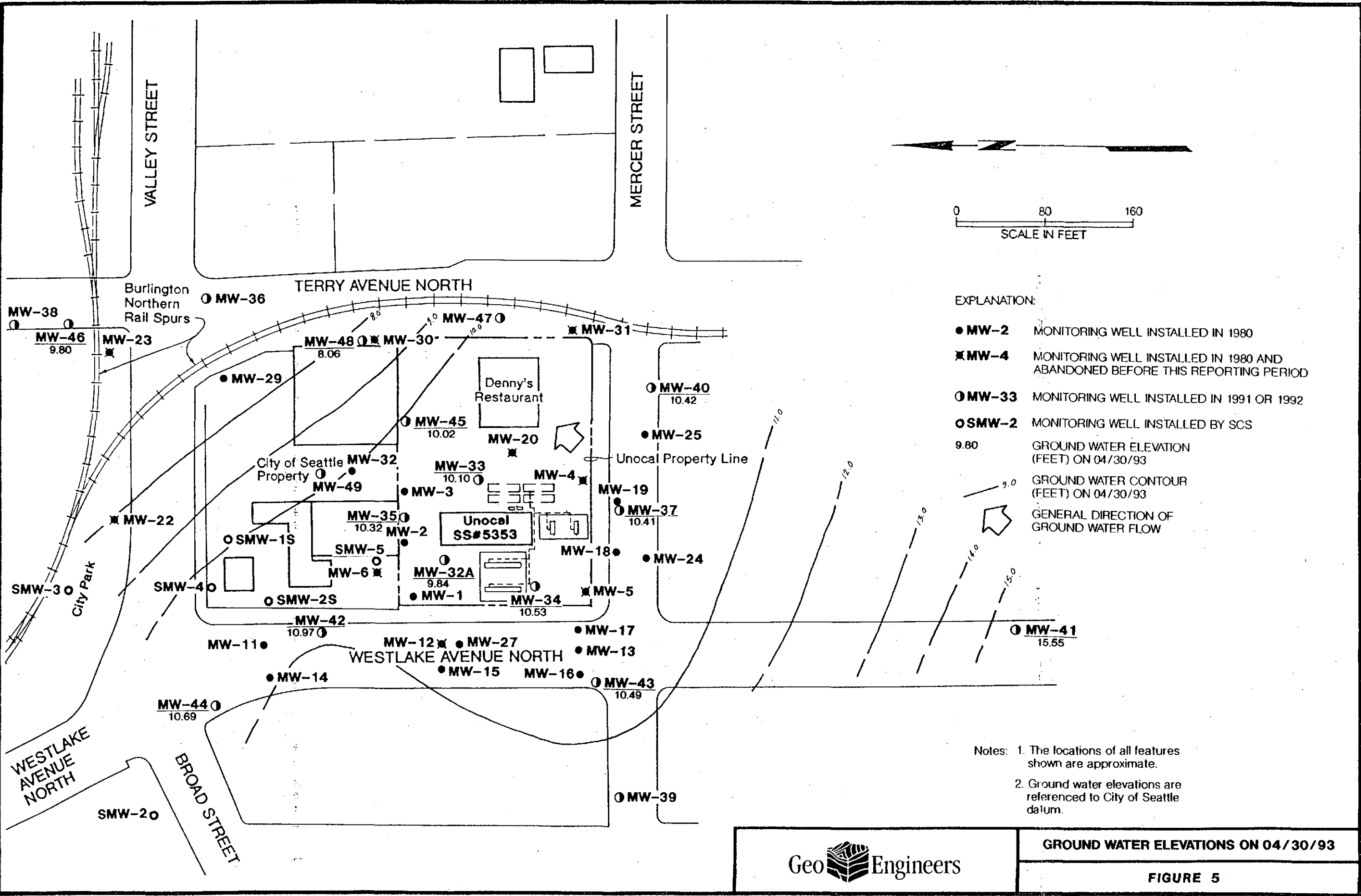
Note: The locations of all features shown are approximate.



VAPOR EXTRACTION SYSTEM LAYOUT

FIGURE 4

0161-013-R67 NLPBCH 8/24/95(2)



EXPLANATION:

- MW-2 MONITORING WELL INSTALLED IN 1980
- ✕ MW-4 MONITORING WELL INSTALLED IN 1980 AND ABANDONED BEFORE THIS REPORTING PERIOD
- MW-33 MONITORING WELL INSTALLED IN 1991 OR 1992
- SMW-2 MONITORING WELL INSTALLED BY SCS
- 9.80 GROUND WATER ELEVATION (FEET) ON 04/30/93
- 9.0 GROUND WATER CONTOUR (FEET) ON 04/30/93
- GENERAL DIRECTION OF GROUND WATER FLOW

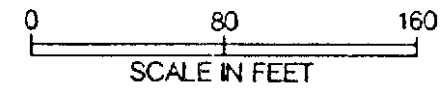
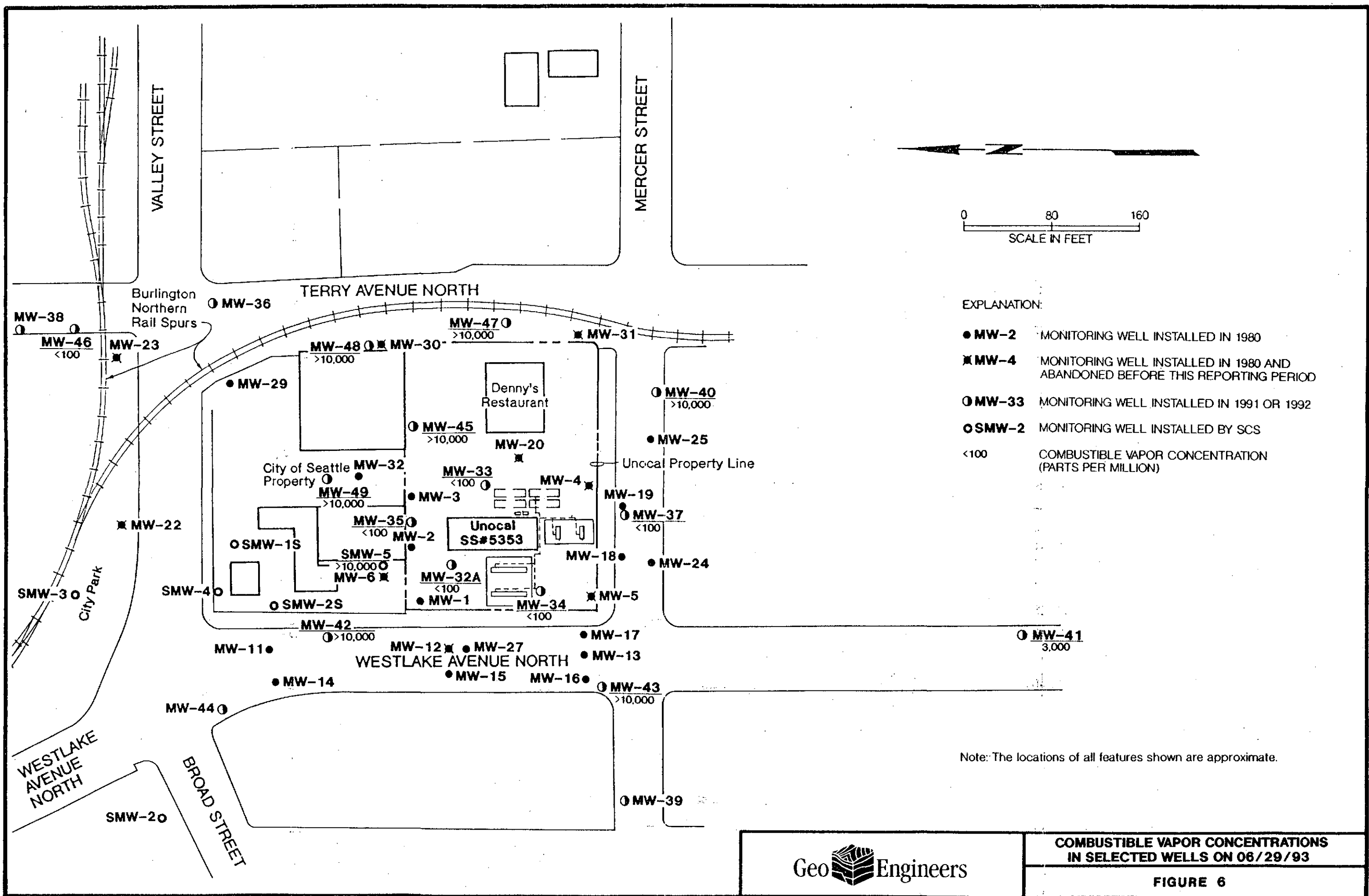
Notes: 1. The locations of all features shown are approximate.
 2. Ground water elevations are referenced to City of Seattle datum.



GROUND WATER ELEVATIONS ON 04/30/93

FIGURE 5

0161-013 R6.9 NLP BDH 8/24/93(B)



EXPLANATION:

- MW-2 MONITORING WELL INSTALLED IN 1980
- ✖ MW-4 MONITORING WELL INSTALLED IN 1980 AND ABANDONED BEFORE THIS REPORTING PERIOD
- MW-33 MONITORING WELL INSTALLED IN 1991 OR 1992
- SMW-2 MONITORING WELL INSTALLED BY SCS
- <100 COMBUSTIBLE VAPOR CONCENTRATION (PARTS PER MILLION)

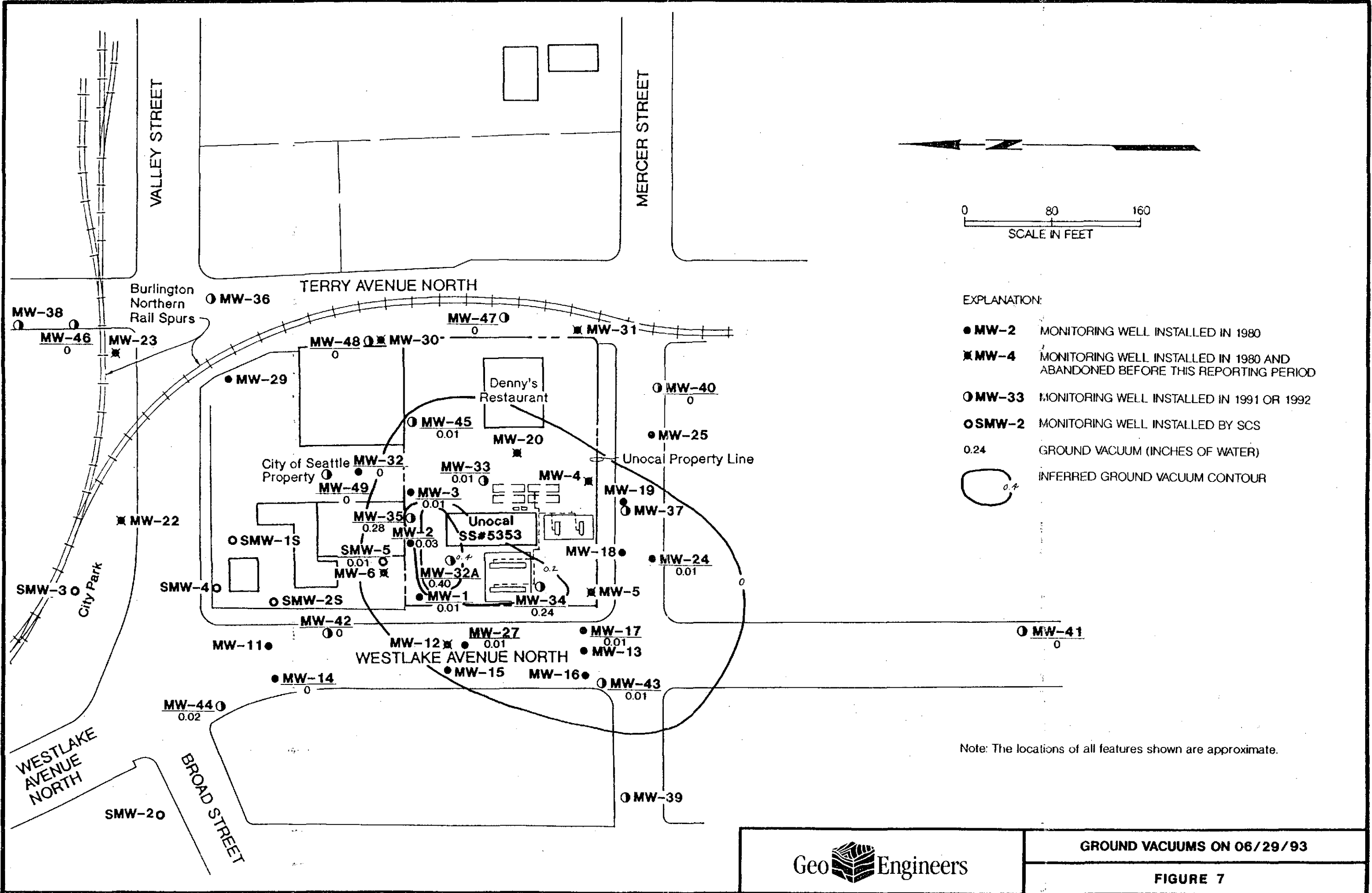
Note: The locations of all features shown are approximate.



COMBUSTIBLE VAPOR CONCENTRATIONS IN SELECTED WELLS ON 06/29/93

FIGURE 6

0161-013-R69 NLP:BDH 8/24/93(A)



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GROUND VACUUMS ON 06/29/93

FIGURE 7

APPENDIX A

March 18, 1992

Geotechnical,
Geoenvironmental and
Geologic Services

PSAPCA (Puget Sound Air Pollution Control Agency)
200 West Mercer Street, Room 205
Seattle, Washington 98119-3958

Attention: Mr. Harry Watters

Proposed VES Modification
Notice of Construction No. 3088
Unocal Service Station 5353
Seattle, Washington
File No. 0161-013-R69

GeoEngineers provides Unocal with environmental consulting services at the site of their Service Station 5353. The site is located at 600 Westlake Avenue North, northeast of the intersection of Mercer Street and Westlake Avenue North in Seattle, Washington. An in-situ VES (vapor extraction system) at the site has been operating since 1988 to control subsurface hydrocarbon vapors resulting from a subsurface spill of gasoline at the site. Recovered hydrocarbon vapors are currently destroyed with a thermal treatment unit. PSAPCA Notice of Construction Permit No. 3088 (June 27, 1988), and the fire department permit which were originally issued for the VES in 1988 are attached. A schematic of the VES is shown in Figure 1.

This letter proposes an alternative method of operation of the VES. We are proposing that thermal destruction of hydrocarbon vapors be terminated and that extracted vapors be vented directly to the atmosphere. We believe that this proposed action is consistent with PSAPCA guidelines and requirements. The remainder of this letter describes the rationale for this modification to the VES operation. In response to a telephone conversation with you on February 10, 1992, we are also providing a new application for approval of a revised Notice of Construction permit.

GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052
Telephone (206) 861-6000
Fax (206) 861-6050

Hydrocarbon vapor concentrations measured in the pretreatment VES vapor stream have steadily declined since the system was installed. Because of the reduced hydrocarbon vapor concentrations, the VES and vapor treatment unit are currently operated in alternating cycles of two-weeks "on" and two-weeks "off".

During the six month period, from May 1991 to October 1991, GeoEngineers obtained vapor samples from the VES immediately after starting operation of a two-week "on" cycle and immediately before stopping operation at the end of the cycle. Samples were obtained from the vapor stream before treatment, at a sample port shown in Figure 1. The samples were analyzed for TVH (total volatile hydrocarbons) and for methane gas using gas chromatography.

The analytical results for TVH and methane concentrations in all vapor samples obtained during the past six months are summarized in Table 1. Based on the TVH and methane concentrations reported by the laboratory and based on the corresponding measured VES flow rates, we have calculated the TVH and methane emission rate in lb/day (pounds per day) using an assumed TVH density of 0.126 pounds per cubic foot and an assumed methane density of 0.0416 pounds per cubic foot.

TVH emissions based on samples obtained at the beginning of "on" cycles were usually greater than 15 lb/day. The methane emissions ranged from <0.03 lb/day to 30.0 lb/day. Total vapor emissions obtained at the beginning of the "on" cycle ranged from <0.1 lb/day to 64.5 lb/day.

TVH emissions based on samples obtained at the end of "on" cycles ranged from <1 lb/day to 12.5 lb/day, and methane emissions ranged from <1 lb/day to 2.1 lb/day. The total vapor emissions, consisting of the sum total of TVH and methane emissions ranged from <1 lb/day to 14.2 lb/day.

At the end of "on" cycles, TVH concentrations ranged from <5 ppm to 690 ppm and methane concentrations ranged from <5 ppm to 530 ppm. Total concentrations of TVH and methane ranged from <5 ppm to 970 ppm. We believe the data obtained at the end of the two-week "on" cycles will be representative of the emissions that could be expected if the system were operated on a full-time basis.

Based on this data, we expect that if the VES were operated full-time with no thermal treatment, the daily emissions of TVH and methane would be less than 15 lb/day and the effluent TVH and methane concentration would be less than 1,500 ppm.

Therefore, we propose to cease operation of the vapor treatment unit and discharge the recovered hydrocarbon vapors directly to the atmosphere. If this proposal is accepted by PSAPCA, the VES will be operated continuously, and the hydrocarbon vapors will be vented to the atmosphere through a vertical exhaust stack. Our estimate of the maximum and average daily emission of TVH if the system is operated in this manner are attached. To ensure that the effluent TVH and methane concentration does not exceed 1,500 ppm, and the TVH and methane emission does not exceed 15 lb/day, GeoEngineers will sample the effluent stream and monitor

March 18, 1992

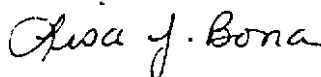
Page 3

the vapor flow rate once every two weeks for one month, and once every month subsequently. The thermal treatment unit will remain connected to the VES. In the event that the effluent TVH and methane concentration exceed 1,500 ppm, or the TVH and methane emission exceeds 15 lb/day, either the thermal incineration unit will be returned into use or the dilution valve will be adjusted.

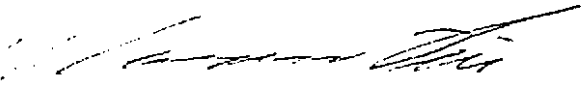
In summary, we request to use one soil venting system with a MD Pneumatics B-3200 Progressive Cavity blower at 85 cfm, controlled by a Hasstech VCP-100 Thermal Incinerator (vapor control processor) at 1200 cfm (600F) whenever the emission of total volatile hydrocarbons approaches 14.6 lb/day. We would appreciate PSAPCA's comments and approval to initiate this change in the operation of the VES. Please call if you have any questions about the enclosed information, or other aspects of this project.

Yours very truly,

GeoEngineers, Inc.



Lisa J. Bona
Staff Geologist



Norman L. Puri
Environmental Engineer

LJB:NLP:vvw
DOCUMENT ID: 0161013.PCA

Attachments

Two copies submitted

cc: Mr. Gary Gunderson
Unocal
P.O. Box 76
Seattle, WA 98111

File No. 0161-013-R69

EMISSIONS ESTIMATE

Assumptions

Maximum flow rate: 115 cfm

Maximum TVH vapor concentration
at a maximum flow rate: 700 ppm = 0.0007

Average flow rate: 100 cfm

Average TVH vapor concentration: 410 ppm = 0.00041

Average methane vapor
concentration: 149 ppm = 0.000149

Density of TVH vapor: 0.126 pcf (pounds per cubic foot)
(The vapor constituent of concern is gasoline. The vapor density of propane is substituted in these calculations as a reasonable equivalent to the vapor density of gasoline for determining the amount of TVH released from the exhaust stack.)

Density of methane vapor: 0.0416 pcf
Continuous operation of VES: 24 hours per day

Calculations

Maximum flow rate and TVH vapor concentration daily emission

- = maximum flow rate x maximum vapor concentration at maximum flow rate x density of vapor x conversion constant
- = 115 cfm x 0.0007 x 0.126 pcf x 1440 min/day
- = 14.6 lb/day

Average flow rate and TVH vapor concentration daily emission

- = average flow rate x average vapor concentration x density of vapor x conversion constant
- = 100 cfm x 0.00041 x 0.126 pcf x 1440 min/day
- = 7.4 lb/day

Average flow rate and methane concentration daily emission

- = average flow rate x average vapor concentration x density of vapor x conversion constant
- = 100 cfm x 0.000149 x 0.0416 pcf x 1440 min/day
- = 0.90 lb/day methane

Notice of Construction and Application for Approval

FORM P
SIDE 1

Be sure to complete items 39, 40, 41, & 43 before submitting Form P.

(AGENCY USE ONLY)

DATE _____ N/C NUMBER _____
REG. NO. _____ VAR. NO. _____
SIC. NO. _____ COS. NO. _____
GRID NO. _____ UTM _____

1. TYPE OF BUILDING (Check) <input type="checkbox"/> New <input checked="" type="checkbox"/> Existing		2. STATUS OF EQUIPMENT (Check) <input type="checkbox"/> New <input checked="" type="checkbox"/> Existing <input type="checkbox"/> Altered <input type="checkbox"/> Relocation		3. APPLICANT <i>Unocal</i>	
4. COMPANY (OR OWNER) NAME <i>Unocal</i>			8. APPLICANT ADDRESS <i>100 West Harrison Seattle WA 98119</i>		
6. COMPANY (OR OWNER) MAILING ADDRESS <i>100 West Harrison Seattle WA 98119</i>			5. INSTALLATION ADDRESS <i>600 Westlake Ave N</i>		
7. NATURE OF BUSINESS <i>Gasoline Marketer</i>			10. TYPE OF PROCESS <i>Soil Vapor Collection & Optional Destruction</i>		

EQUIPMENT (ENTER ONLY NEW EQUIPMENT OR CHANGES. ENTER NUMBER OF UNITS OF EQUIPMENT IN COLUMN 'NO. OF UNITS.' COMPLETE FORM 'S' FOR EACH ENTRY.)

11. NO. OF UNITS	SPACE HEATERS OR BOILERS (Complete Form S-A)	14. NO. OF UNITS	OVENS	15. NO. OF UNITS	MECHANICAL EQUIP.	16. NO. OF UNITS	MELTING FURNACES
(a) _____		(a) _____	CORE BAKING OVEN	(a) _____	AREAS	(a) _____	POT
12. NO. OF UNITS	INCINERATORS (Complete Form S-B)	(b) _____	PAINT BAKING	(b) _____	BULK CONVEYOR	(b) _____	REVERBERATORY
(a) _____		(c) _____	PLASTIC CURING	(c) _____	CLASSIFIER	(c) _____	ELECTRIC INDUC/RESIST
13. NO. OF UNITS	OTHER SYSTEMS	(d) _____	LITHO COATING OVEN	(d) _____	STORAGE BIN	(d) _____	CRUCIBLE
(a) _____		(e) _____	DRYER	(e) _____	BAGGING	(e) _____	CUPOLA
(b) _____	DEGREASING, SOLVENT	(f) _____	ROASTER	(f) _____	OUTSIDE BULK STORAGE	(f) _____	ELECTRIC ARC
(c) _____	ABRASIVE BLASTING	(g) _____	KILN	(g) _____	LOADING OR UNLOADING	(g) _____	SWEAT
(d) _____	OTHER - SYSTEM	(h) _____	HEAT-TREATING	(h) _____	BATCHING	(h) _____	OTHER METALLIC
		(i) _____	OTHER	(i) _____	MIXER (SOLIDS)	(i) _____	GLASS
		(j) _____		(j) _____	OTHER	(j) _____	OTHER NON METALLIC

17. NO. OF UNITS	GENERAL OPER. EQUIP.	17. NO. OF UNITS	GENERAL OPER. EQUIP.	17. NO. OF UNITS	GENERAL OPER. EQUIP.	18. NO. OF UNITS	OTHER EQUIPMENT
(a) _____	CHEMICAL MILLING	(1) _____	GALVANIZING	(k) _____	ASPHALT BLOWING	(a) _____	SPRAY PAINTING GUN
(b) _____	PLATING	(2) _____	IMPREGNATING	(l) _____	CHEMICAL COATING	(b) _____	SPRAY BOOTH OR ROOM
(c) _____	DIGESTER	(3) _____	MIXING OR FORMULATING	(m) _____	COFFEE ROASTER	(c) _____	FLOW COATING
(d) _____	DRY CLEANING	(4) _____	REACTOR	(n) _____	SAWS & PLANERS	(d) _____	FIBERGLASSING
(e) _____	FORMING OR MOLDING	(5) _____	STILL	(o) _____	STORAGE TANK	(e) _____	OTHER

CONTROL DEVICES (ENTER NUMBER OF UNITS OF EQUIPMENT IN SPACES IN COLUMNS. COMPLETE A FORM R FOR EACH ENTRY.)

19. NO. OF UNITS	CONTROL DEVICE	20. NO. OF UNITS	CONTROL DEVICE	21. NO. OF UNITS	CONTROL DEVICE	22. NO. OF UNITS	CONTROL DEVICE
(a) _____	SPRAY CURTAIN	(a) _____	AIR WASHER	(a) _____	AESORBER	(a) _____	DEMISTER
(b) _____	CYCLONE	(b) _____	WET COLLECTOR	(b) _____	ADSORBER	(b) _____	BAGHOUSE
(c) _____	MULTIPLE CYCLONE	(c) _____	VENTURI SCRUBBER	(c) _____	FILTER PADS	(c) _____	ELEC. PRECIPITATOR
(d) _____	INERTIAL COLL. - OTHER	(d) _____		(d) _____	AFTERBURNER	(d) _____	OTHER VCP

23. BASIC EQUIPMENT COST (Estimate)	24. CONTROL EQUIPMENT COST (Estimate)	25. DAILY HOURS <i>Continuous</i> FROM _____ AM to _____ PM	26. DAYS OF OPERATION (Circle): <i>(S) (M) (T) (W) (T) (F) (S)</i>
-------------------------------------	---------------------------------------	--	---

27. ESTIMATED STARTING DATE OF CONSTRUCTION: <i>Operating</i>	28. ESTIMATED COMPLETION DATE OF CONSTRUCTION:
--	--

29. RAW MATERIALS (List starting material used in process) AND FUELS (Type and amount)	ANNUAL AMT. Average flow rate UNITS	30. PRODUCTS (List End Products)	ANNUAL PROD. UNITS
<i>Total volatile hydrocarbons</i>	<i>2664 lbs.</i>	<i>same</i>	
<i>Methane vapors</i>	<i>324 lbs.</i>	<i>same</i>	
<i>Natural gas with incineration</i>	<i>optional</i>	<i>same</i>	

STACKS OR VENTS (LIST NUMBER, TYPE, AND SIZE OF VENT)

1. NO. UNITS	DESCRIPTION OF OPENING	32. HEIGHT ABOVE GRADE (FT.)	33. VOLUME EXHAUSTED (ACFM)	DIMENSIONS (INCHES)	
				34. LENGTH (OR DIAM)	35. WIDTH
1	STACKS	14	100	4"	
	FLUES				
	PROCESS OR GENERAL EXHAUST				
	PROCESS OR GENERAL VENTS				
	SKYLIGHT OR WINDOW				
	EXHAUST HOOD				
	OTHER				

FLOW DIAGRAM

36. FLOW DIAGRAM INSTRUCTIONS:

- (a) FLOW DIAGRAM MAY BE SCHEMATIC. ALL EQUIPMENT SHOULD BE SHOWN WITH EXISTING EQUIPMENT SO INDICATED.
- (b) SHOW FLOW DIAGRAM OF PROCESS STARTING WITH RAW MATERIALS USED AND ENDING WITH FINISHED PRODUCT.
- (c) IF MORE THAN ONE PROCESS IS INVOLVED TO MAKE FINISHED PRODUCT, SHOW EACH PROCESS AND WHERE THEY MERGE.
- (d) INDICATE ALL POINTS IN PROCESS WHERE GASEOUS OR PARTICULATE POLLUTANTS ARE EMITTED.
- (e) FLOW CHART CAN BE ATTACHED SEPARATELY IF NECESSARY. (DRAWINGS MAY BE SUBMITTED INSTEAD IF DESIRED).
- (f) SHOW PICKUP AND DISCHARGE POINTS FOR HANDLING OR CONVEYING EQUIPMENT.

Attached

37. LIST OF ATTACHMENTS AND ACCOMPANYING DATA OR COMMENTS:

Flow Diagram
 Form S
 Form R -
 PSAPCA Notice of Construction No 3088
 Emission Estimates with Cover Letter
 Table 4 (Vapor control processor)

38. CERTIFICATION:

I, THE UNDERSIGNED, DO HEREBY CERTIFY THAT THE INFORMATION CONTAINED IN THIS APPLICATION AND THE ACCOMPANYING FORMS, PLANS, AND SUPPLEMENTAL DATA DESCRIBED HEREIN IS, TO THE BEST OF MY KNOWLEDGE, ACCURATE AND COMPLETE.

39. SIGNATURE

Lisa J. Bona

40. DATE

3/13/92

41. TYPE OR PRINT NAME

Lisa J. Bona

42. TITLE

Staff Geologist

43. PHONE

861-6000

Notice of Construction and Application for Approval

*Note: Information required by Section 1a must be completed, for this form to be accepted for review.

FOR AIR POLLUTION CONTROL EQUIPMENT ONLY PLEASE CONSULT INSTRUCTION SHEETS BEFORE FORWARDING		FORM R		DATE <u>3/13/92</u> N/C F
a. COMPLETE THE SECTIONS INDICATED <input checked="" type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input checked="" type="checkbox"/> 5 <input checked="" type="checkbox"/> 6 <input type="checkbox"/> 7 <input checked="" type="checkbox"/> 8 <input type="checkbox"/> 9 <input checked="" type="checkbox"/> 10 <input type="checkbox"/> 11 <input checked="" type="checkbox"/> 12		b. COMPANY (OR OWNER) INSTALLATION ADDRESS 600 Westlake Ave N		
c. COMPANY (OR OWNER) NAME Unocal		e. APPLICANT Unocal		
f. PREPARED BY: (Name and Title) Lisa Bona Staff Geologist, Geoenvironmental		g. PREPARED BY: (Signature) Lisa J Bona for Unocal		h. PHONE 861-6000
a. AIR POLLUTION CONTROL EQUIPMENT DATA e. NUMBER OF UNITS 1		b. TYPE OF EQUIPMENT BAGHOUSE		c. MAKE AND MODEL Hasstech VCP-100
d. CAPACITY 100 SCFM		e. AUXILIARY EQUIPMENT Vapor Extraction System		f. DIMENSIONS (L x W x H) 3' x 4' x 16'
g. MATERIAL USED		h. SHAKING CYCLE (Auto or manual rapping or reverse air)		i. CONNECTED TO:
a. ELECTROSTATIC PRECIP. e. AREA (Sq Ft)		b. ELECTRODE SEPARATION (FT)		c. MEAN VELOCITY OF GAS (FPS)
d. VOLTAGE		e. COLL. ELECTRODE DIMENSIONS: W x L (Feet)		f. CONNECTED TO:
a. BURNER DATA e. NUMBER OF UNITS/IGNITION 1 / electric spark pilot		b. TYPE OF BURNER, FUEL Natural Gas		c. MAKE AND MODEL Hasstech VCP-100
d. TYPE OF VENT Open Pipe		e. CFM EXHAUSTED (Temp) 1200 (600°F)		f. RATING See Table 4
a. STACKS, VENTS e. NUMBER OF VENTS, MAT'L USED 1, Steel		b. TYPE OF FLOW (Spray, Bubler)		c. DIMENSIONS (L x H x W) 2 1/2' x 2 1/2' x 16'
d. TYPE OF FAN (Designate Blower)		e. CFM EXHAUSTED (Temp) 1200 (600°F)		f. CONNECTED TO: Thermal Processor
a. FAN DATA e. NUMBER OF FANS, MAT'L USED 0		b. TYPE OF CYCLONE <input type="checkbox"/> Common <input type="checkbox"/> Split Duct <input type="checkbox"/> Multicyclone		c. PACKING TYPE/SIZE
d. TYPE OF FAN (Designate Blower) See Form S		e. FLOW RATE (GPM)		f. MAKE UP (GPM)
a. CYCLONE DATA e. NUMBER OF UNITS, MAT'L USED		b. TYPE OF FAN (Designate Blower)		c. MOTOR DATA RPM _____ HP _____
d. TYPE OF CYCLONE <input type="checkbox"/> Common <input type="checkbox"/> Split Duct <input type="checkbox"/> Multicyclone		e. CFM EXHAUSTED (Temp @ SP)		f. CONNECTED TO:
a. COLLECTION DATA e. TYPES OF POLLUTANTS <input type="checkbox"/> Particulate <input checked="" type="checkbox"/> Gas <input type="checkbox"/> Other		b. TYPE OF CYCLONE <input type="checkbox"/> Common <input type="checkbox"/> Split Duct <input type="checkbox"/> Multicyclone		c. INLET AREA (Sq. Ft.)
d. DESCRIPTION OF COLLECTED MAT'L Total volatile hydrocarbons and methanol		e. BODY DIA. (INCH) OUTLET DIA. (INCH)		f. CONNECTED TO:
c. AMOUNT COLLECTED POUNDS/DAY av. 7.4 lb/day + 0.9 lb/day		g. BODY HEIGHT (INCH) EFFICIENCY		h. PARTICLE SIZE (MICRONS Average) N/A
f. COLLECTION EFFICIENCY > 95%		h. DISPOSITION OF COLLECTION WASTE N/A		
a. GAS FLOW e. PRESSURE DROP		b. ACTUAL CFM		c. TEMPERATURE (°F) IN: _____ OUT: _____
d. EFFICIENCY		e. INLET AND OUTLET POLLUTANT CONCENTRATIONS		
a. ADDITIONAL DATA <input checked="" type="checkbox"/> SUBMIT NARRATIVE DESCRIPTION OF PROCESS		b. <input checked="" type="checkbox"/> ATTACH BROCHURE		c. <input checked="" type="checkbox"/> ATTACH EMISSION ESTIMATE (show calculation)
d. <input type="checkbox"/> SUBMIT SOURCE TEST DATA		e. <input type="checkbox"/> SUBMIT MODELING DATA		f. <input checked="" type="checkbox"/> ATTACH A SCHEDULE OF EQUIPMENT WITH MAKE, MODEL CAPACITY
g. <input checked="" type="checkbox"/> Table 4		h. <input type="checkbox"/>		i. <input type="checkbox"/>

Notice of Construction and Application for Approval

*Note: Information required by Section 3a must be completed, for this form to be accepted for review.

FOR AIR POLLUTION CONTROL EQUIPMENT ONLY
PLEASE CONSULT INSTRUCTION SHEETS BEFORE FORWARDING

FORM R

DATE 3/13/92 N/C.R.

a. COMPLETE THE SECTIONS INDICATED 1 2 3 4 5 6 7 8 9 10 11 12

b. COMPANY (OR OWNER) INSTALLATION ADDRESS

600 Westlake Ave N

c. COMPANY (OR OWNER) NAME

Unocal

d. APPLICANT

Unocal

e. PREPARED BY: (Name and Title)

Lisa Bona, Staff Geologist, GeoEngineers

f. PREPARED BY: (Signature)

Lisa J. Bona for Unocal

g. PHONE

861-6000

1. AIR POLLUTION CONTROL EQUIPMENT DATA

b. TYPE OF EQUIPMENT

c. MAKE AND MODEL

d. DIMENSIONS (L x W x H)

e. NUMBER OF UNITS

f. CAPACITY

g. AUXILIARY EQUIPMENT

h. CONNECTED TO:

BAGHOUSE

b. NUMBER OF BAGS

c. SHAKING CYCLE (auto or manual tapping or reverse air)

d. CLOTH AREA

e. MATERIAL USED

f.

g. AIR TO CLOTH RATIO (ft³/min)

h. CONNECTED TO:

ELECTROSTATIC PRECIP.

b. ELECTRODE SEPARATION (FT)

c. COLL. ELECTRODE DIMENSIONS: W x L (Feet)

d. MEAN VELOCITY OF GAS (FPS)

e. AREA (Sq Ft)

f. VOLTAGE

g. COLL. ELECTRODE OR PLATE AREA (Sq Ft)

h. CONNECTED TO:

BURNER DATA

b. TYPE OF BURNER, FUEL

c. MAKE AND MODEL

d. RATING

e. NUMBER OF UNITS/IGNITION

f.

g. CFM EXHAUSTED (Temp)

h. CONNECTED TO:

STACKS, VENTS

b. TYPE OF VENT

Open Pipe

c. DIMENSIONS (L x H x W)

4" diam. x 14' h x h

d. DAMPERS

N/A

e. NUMBER OF VENTS, MAT'L USED

1, PVC

f.

g. CFM EXHAUSTED (Temp)

100 CFM @ 550 F

h. CONNECTED TO:

Vacuum Blower

SCRUBBER DATA

b. TYPE OF FLOW (Spray, Bubbler)

c. PACKING TYPE/SIZE

d. PRESSURE DROP (Inches of water)

e. COMPOSITION OF SOLUTION

f.

g. FLOW RATE (GPM)

h. MAKE UP (GPM)

FAN DATA

b. TYPE OF FAN (Designate Size)

See Forms

c. MAKE AND MODEL

d. MOTOR DATA

RPM

HP

e. NUMBER OF FANS, MAT'L USED

1

f.

g. CFM EXHAUSTED (Temp & SP)

h. CONNECTED TO:

CYCLONE DATA

b. TYPE OF CYCLONE

Common Split Duct Multistage

c. MAKE AND MODEL

d. INLET AREA Sq. Ft.

e. NUMBER OF UNITS, MAT'L USED

f. BODY DIA. (INCH) | OUTLET DIA. (INCH)

g. BODY HEIGHT (INCH) | EFFICIENCY

h. CONNECTED TO:

COLLECTION DATA

b. DESCRIPTION OF COLLECTED MAT'L
total volatile hydrocarbons and methane

c. AMOUNT COLLECTED POUNDS/DAY
average 7.4 lbs/day - 0.9 lbs/day

d. PARTICLE SIZE (MICRONS Average)

N/A

e. TYPES OF POLLUTANTS

Particulate Gas Odor

g. COLLECTION EFFICIENCY

> 95%

h. DISPOSITION OF COLLECTION WASTE

N/A

GAS FLOW

b. ACTUAL CFM

c. SCFM (Reg. Standard)

d. TEMPERATURE (°F)

IN: _____ OUT: _____

e. PRESSURE DROP

f. EFFICIENCY

g. INLET AND OUTLET POLLUTANT CONCENTRATIONS

h.

ADDITIONAL DATA

b. ATTACH BROCHURE

c. ATTACH PLANS/SPECS

d. ATTACH EMISSION ESTIMATE (show calculation)

e. SUBMIT NARRATIVE DESCRIPTION OF PROCESS

f. SUBMIT SOURCE TEST DATA

g. SUBMIT MODELING DATA

h. ATTACH A SCHEDULE OF EQUIPMENT WITH MAKE, MODEL CAPACITY

i. Table 4

j.

k.

l.

Blower
AS 1/13/92

Notice of Construction and Application for Approval

Note: Information required by Section 1a must be completed for this form to be accepted for review.

FOR BASIC PROCESS EQUIPMENT

FORM S

DATE 3/13/92 N/C =

PLEASE CONSULT INSTRUCTION SHEET BEFORE FORWARDING

a. COMPLETE THE SECTIONS INDICATED <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9 <input type="checkbox"/> 10 <input type="checkbox"/> 11 <input type="checkbox"/> 12		b. COMPANY (OR OWNER) INSTALLATION ADDRESS 6000 West Lake Ave N	
c. COMPANY (OR OWNER) NAME Unocal		d. APPLICANT Unocal	
e. PREPARED BY (Name and title) Lisa Bona, Staff Geologist, Gen Engineers		f. PREPARED BY (Signature) Lisa J Bona for Unocal	g. PHONE 861-6000
a. PROCESS EQUIPMENT DATA	b. Title Vapor Extraction System (Custom Designed)	c. Make and Model	d. Dimensions (LxWxH) 8' x 2 1/2' x 2'
e. No. of units; rated capacity 1 @ 2.8 Break HP	f. Auxiliary Equipment Flow rate instrumentation	g. Connected To Subsurface Collection Units	
a. BURNER DATA	b. Type of Burner, Fuel	c. Make and Model	d. Rated Capacity
e. No. of units; ignition method	f.	g. CFM Exhausted (Temperature) (°F)	h. Connected To
a. STACKS, VENTS AND EXHAUST OPENINGS	b. Type of Vent N/A	c. Dimensions	d.
e. No. of vents; Material of construction	f. (See Form R)	g. CFM Exhausted (Temperature) (°F)	h. Connected To
a. TANKS AND KETTLES	b. Type of Tank, Material	c. Dimensions (LxWxH) in inches	d. Surface Area (Sq. Ft.) <input type="checkbox"/> Closed <input type="checkbox"/> Open
e. No. of tanks; Material of construction	f.	g. Auxiliary Equipment	h. Connected To
a. FAN DATA	b. Type of Fan (Designate Speed) Progressive Centrif	c. Make and Model MID Pneumatics B-3200	d. Motor Data 1800 RPM 3
e. No. of fans; Material of construction 1, steel	f. @ 2750 Rpm	g. CFM Exhausted (Temperature) (°F) 85 ICFM 160°F	h. Connected To Subsurface Collection Units
a. OVENS AND FURNACES	b. Type of Oven or Furnace	c. Make and Model	d. Rated Capacity
e. No. of ovens; Material of construction	f.	g. CFM Exhausted (Temperature) (°F)	h. Connected To
a. OPERATIONAL DATA	b. Type of Operation <input type="checkbox"/> Batch <input checked="" type="checkbox"/> Continuous	c. Operating Schedule (Normal) N/A SHIFTS/DAY <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	d. Mode of Operations <input type="checkbox"/> Manual <input checked="" type="checkbox"/> Auto <input type="checkbox"/> Semi-Auto
e. Duration of Batch (hrs./Batch) Continuous	f.	g. Daily Number of Batches (Ave) N/A (Max)	h.
a. CONVEYOR DATA	b. Type of Conveyor (Pneumatic, Belt)	c. Make and Model	d. Capacity
e. Dimensions (LxWxH)	f.	g. No. of Pickups, No. of Discharge Pts.	h. Connected To
GAS FLOW	b. ACTUAL CFM	c. SCFM (Reg I Standard)	d. TEMPERATURE (°F) IN _____ OUT _____
e. PRESSURE DROP	f. EFFICIENCY	g. INLET AND OUTLET POLLUTANT CONCENTRATIONS	h.
a. ADDITIONAL DATA	b. <input type="checkbox"/> ATTACH BROCHURE	c. <input type="checkbox"/> ATTACH PLANS SPECS	d. <input checked="" type="checkbox"/> ATTACH EMISSION ESTIMATE (FROM CALCULATION)
e. <input checked="" type="checkbox"/> SUBMIT NARRATIVE DESCRIPTION OF PROCESS	f. <input type="checkbox"/> SUBMIT SOURCE TEST DATA	g. <input type="checkbox"/> SUBMIT MODELING DATA	h. <input type="checkbox"/> ATTACH A SCHEDULE OF EQUIPMENT WITH MAKE MODEL CAPACITY
i. <input checked="" type="checkbox"/> Table 4	j. <input type="checkbox"/>	k. <input type="checkbox"/>	l. <input checked="" type="checkbox"/> See Notice of Construction No.

TABLE 4

COMBUSTION UNITS

Optional
Vapor Control Processor (VCP)
Thermal Incinerator

OPERATIONAL DATA				
Number from flow diagram: <u>VCP (figure 1)</u>		Model Number (if available): <u>VCP-100</u>		
Name of device: <u>Vapor Control Processor</u>		Manufacturer: <u>Hasstech, Inc.</u>		
CHARACTERISTICS OF INPUT				
Waste Material*	Chemical Composition			
	Material	Min. Value Expected lb/hr	Ave. Value Expected lb/hr	Design Maximum lb/hr
	1. <u>Vent Gas</u>	<u>0.05</u>	<u>0.35</u>	<u>500</u>
	2. <u>(TVH + Methane)</u>			
	3.			
	4.			
5.				
Gross Heating Value of Waste Material (Wet basis if applicable)	Btu/lb <u>0</u>	Air Supplied for Waste Material	Minimum SCFM (70°F & 14.7 psia) <u>100</u>	Maximum SCFM (70°F & 14.7 psia) <u>110</u>
Waste Material or Contaminated Gas	Total Flow Rate lb/hr		Inlet Temperature °F	
	Minimum Expected <u>0.05</u>	Design Maximum <u>500</u>	Minimum Expected <u>50</u>	Design Maximum <u>90</u>
Fuel	Chemical Composition			
	Material	Min. Value Expected lb/hr	Ave. Value Expected lb/hr	Design Maximum lb/hr
	1. <u>Natural Gas</u>	<u>0</u>	<u>4.0</u>	<u>7.8</u>
	2.			
	3.			
4.				
Gross Heating Value of Fuel	Btu/lb <u>23,700</u>	Air Supplied for Fuel	Minimum SCFM (70°F & 14.7 psia) <u>107</u>	Maximum SCFM (70°F & 14.7 psia) <u>117</u>

* Describe how waste material is introduced into combustion unit on an attached sheet. Supply drawings, dimensioned and to scale to show clearly the design and operation of the unit.

(over)

TABLE 4
(continued)
COMBUSTION UNITS

CHARACTERISTICS OF OUTPUT				
Flue Gas Released	Chemical Composition			
	Material	Min. Value Expected lb/hr	Ave. Value Expected lb/hr	Design Maximum lb/hr
	1. Air	1460	3600	4000
	2. TVH	0.05	0.31	0.61 <small>PSA/CA Limit</small>
	3. Methane	0.01	0.04	NA
	4.			
5.				
Temperature at Stack Exit °F <u>600</u>	Total Flow Rate lb/hr		Velocity at Stack Exit ft/sec	
	Minimum Expected <u>1460</u>	Maximum Expected <u>4000</u>	Minimum Expected <u>3.5</u>	Maximum Expected <u>8</u>
COMBUSTION UNIT CHARACTERISTICS				
Chamber Volume from Drawing ft ³ <u>87.5</u>	Chamber Velocity at Average Chamber Temperature ft/sec <u>6.25</u>		Average Chamber Temperature °F <u>1000</u>	
Average Residence Time sec <u>2.3</u>	Exhaust Stack Height ft <u>14</u>		Exhaust Stack Diameter ft <u>2.5 ft. square</u>	
ADDITIONAL INFORMATION FOR CATALYTIC COMBUSTION UNITS				
Number and Type of Catalyst Elements <u>N/A</u>	Catalytic Bed Velocity ft/sec <u>N/A</u>		Max. Flow Rate per Catalytic Unit (Manufacturer's Specifications) Specify Units <u>N/A</u>	

on separate sheets as necessary providing a description of the combustion unit, including details regarding principle of operation and the basis for calculating its efficiency. Supply an assembly drawing, dimensioned and to scale, to show clearly design and operation of the equipment. If the device has bypasses, safety valves, etc., specify when such bypasses are to be used and under what conditions. Submit explanations on controls for temperature, air flow rates, fuel rates, and other operating variables.

1) see Attachment *
Refer also to NC3088



Puget Sound Air Pollution Control Agency

Notice of Construction No. 3088

HEREBY ISSUES AN ORDER OF APPROVAL TO CONSTRUCT, INSTALL, OR ESTABLISH

Date JUN 27 1988

One Vapor Removal System controlled by a King, Buck/Hasstech Multi-Mode Combustor Model MMC-5 with a Hasstech Vapor Control Processor Model VCP-100 and a Catalytic Reactor Model MMC-5-CAR.

APPLICANT

Mr. Leigh Carlson
Unocal

NAME

Same

NAME

3131 Elliott Ave.

STREET

OWNER

STREET

Seattle, WA 98101

CITY

STATE

ZIP

CITY

STATE

INSTALLATION ADDRESS

600 Westlake Ave. N., Seattle, WA 98101

STREET

CITY

STATE

THIS ORDER IS ISSUED SUBJECT TO THE FOLLOWING RESTRICTIONS AND CONDITIONS

Approval is hereby granted as provided in Article 6 of Regulation I of the Puget Sound Air Pollution Control Agency to the applicant to install, alter or establish the equipment, device or process described hereon at the INSTALLATION ADDRESS in accordance with the plans and specifications on file in the Engineering Division of PSAPCA.

Compliance with this ORDER and its conditions does not relieve the owner or operator from the responsibility of compliance with Regulations I or II, RCW 70.94, or any other emission control requirements, nor from the resulting liabilities and/or legal remedies for failure to comply.

This approval does not relieve the applicant or owner of any requirement of any other governmental agency.

GeoEngineers

RECEIVED

1988

MAINT. & CONT.

JUL 11 1988

Routing

File

[Signature]
Harry A. Watters
Reviewing Engineer

[Signature]
R. Dammkoehler
(Acting) Air Pollution Control Officer

NOTICE OF COMPLETION



WARNING:

Regulation I, Section 6.09(a), requires that the owner or applicant notify the Agency of the completion of the work covered by the application and when its operation will begin. This form is provided for your convenience to assist you in complying with the part of the Regulation.

APPLICANT or OWNER SECTION

Submitted to: Puget Sound Air Pollution Control Agency
Plan Review Section
200 West Mercer Street, Room 205
Seattle, Washington 98119-3958

Gentlemen:
The project described below was completed on _____ and will be in operation _____

Signature of Owner and/or Applicant

Title

Date

FOR AGENCY USE ONLY

Notice of Construction No. 3088

Project Description: One Vapor Removal System controlled by a King, Buck/Hasstech Multi-Mode Combustor Model MMC-5 with a Hasstech Vapor Control Processor Model VCP-100 and a Catalytic Reactor Model MMC-5-CAR

Conditions On Reverse Side

Applicant's Name Mr. Leigh Carlson, Unocal, 3131 Elliott Ave., Seattle, WA 98101

Address 600 Westlake ave. N., Seattle, Wa 98101

Inspector check

Engineer _____ and Inspector check

Follow-up _____ (Estimated Completion Date Plus 7)

Date Inspected _____ Inspector _____

REMARKS:

See Attachment

PERMIT

Date: 5-17-88

Permit No.: 5-15-89/NEW

SEATTLE FIRE DEPARTMENT

Station:

Occupancy File No.:

301 SECOND AVENUE SOUTH
SEATTLE, WASHINGTON 98104

Permit No.: 65652

Receipt No.: 132707

1989



Unocal
3131 Elliott Avenue
Seattle, WA 98121

Operation Address:
600 Westlake Ave N
Westlake Union Service Station
Phone Number:
623-8272

Serial No. 117653

TITLE: COMBUSTIBLE VAPOR INCINERATOR

CODE: 999

TYPE OF MATERIAL	U.N. NUMBERS	AMOUNT	LOCATION

Permission is hereby granted under the provisions of the Fire Code (Ord. 111001) to

install multimode combuster for vapor Incineration.

SEE ATTACHED CONDITIONS.

THIS PERMIT MUST BE POSTED IN A CONSPICUOUS PLACE

NOT TRANSFERABLE

Issued by: Capt. Davis : DF

CHIEF OF THE FIRE DEPARTMENT

1989	1990	1991	1992	1993
Serial No. 117653	Serial No.	Serial No.	Serial No.	Serial No.

KEY TO SYMBOLS

⊗ AIR FLOW VALVE

⊗ SAMPLE PORT/VALVE

(A) INSTRUMENTATION

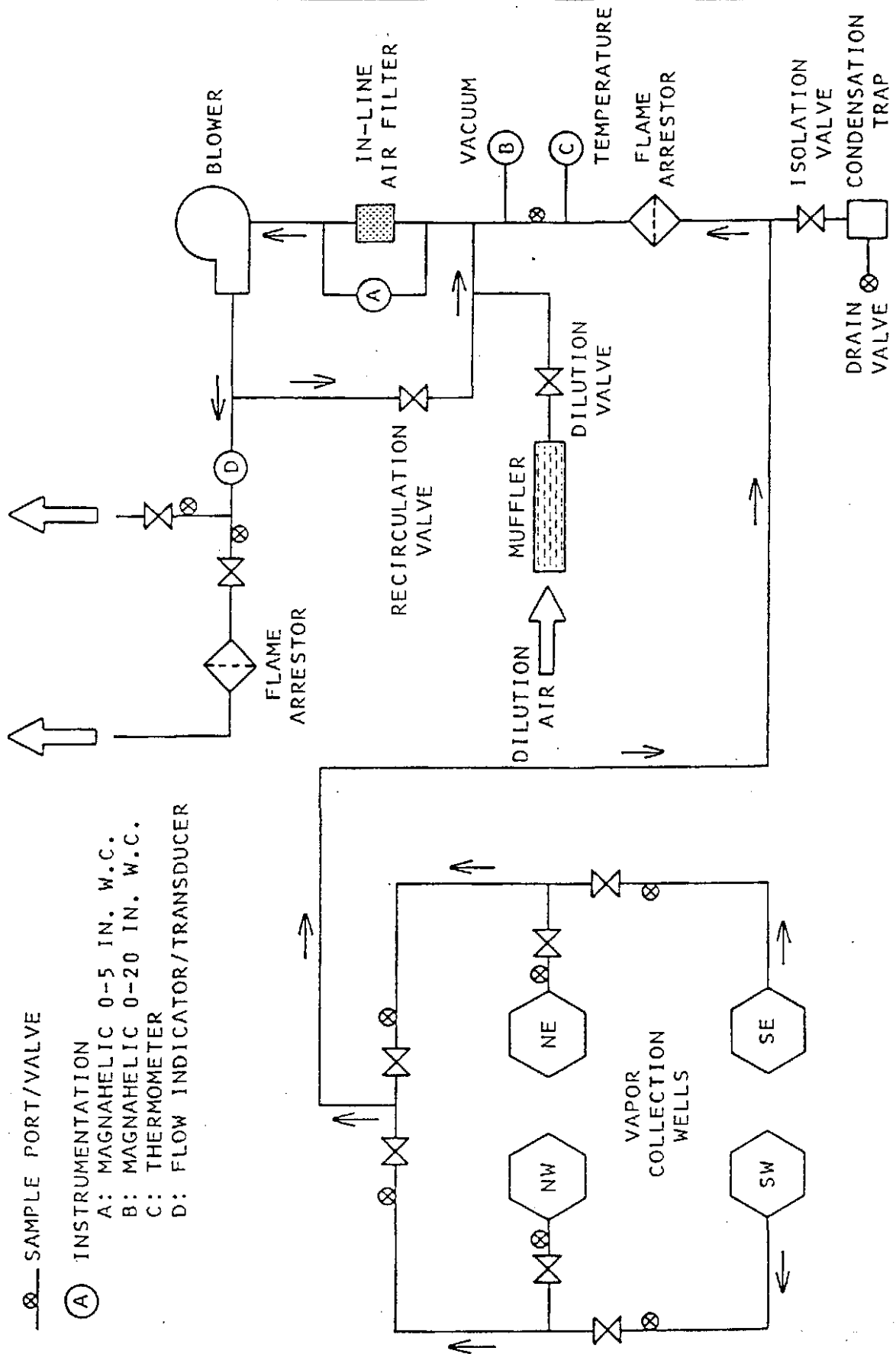
A: MAGNAHELIC 0-5 IN. W.C.

B: MAGNAHELIC 0-20 IN. W.C.

C: THERMOMETER

D: FLOW INDICATOR/TRANSDUCER

TO THERMAL
INCINERATION
UNIT [VCP] TO VENT STACK



TEST PROTOCOL
EFFICIENCY TEST
OF
HASSTECH MODEL VCP-100 INCINERATOR

1. OBJECTIVE This test protocol describes the method to be used for source testing the VCP-100 Incinerator.

2. EQUIPMENT DESCRIPTION The VCP-100 Incinerator is used to flare the VOC gases emitted from a soil venting system. The design is based upon the incinerators used for controlling emissions from Stage I and Stage II gasoline vapor recovery systems. The incinerator is a flare type burner with side screens which conceal the flame for aesthetic purposes. The burner head (and base of the flame) is approximately 22 inches above the base of the unit. The side panels extend to eight feet above the base and have a square opening three feet on a side. The normal flow rate is 100 cfm at a burner inlet pressure of 5" W.C. The flow rate is dependent upon the output of an auxiliary vapor pump. The normal flame height is 3-5 feet with a 12-15 inch diameter. Occasionally the flame height may reach 5-7 feet with a diameter of 15-18 inches or more.

3. SAMPLING LOCATION The sampling location should be 25-30 inches above the flame tips in order to avoid sampling products of incomplete combustion. The sampling point should be located approximately nine feet above the burner head.

4. SAMPLING PROCEDURE The center of the exhaust products shall be determined by traversing with a probe and measuring THC with a continuous reading analyzer such as a Beckman 400. This central position shall continue to be monitored while a second probe located in the same vicinity is used to collect samples for analysis.

5. THE EFFICIENCY DETERMINATION. Express all analytical results as ppm(w) of C₁. The THC control efficiency shall be determined as follows (1):

$$Effic = 1 - \frac{THC}{THC + CO + CO_2}$$

Footnote (1): For simplification it is assumed that ambient CO, CH₄, and CO₂ in the combustion air are low compared to hydrocarbons in the process gas to the VCP. This simplification tends to penalize the calculated burner efficiency.

King, Buck / Hasstech
5-3-88

Puget Sound Air Pollution Control Agency

HEREBY ISSUES AN ORDER OF APPROVAL
TO CONSTRUCT, INSTALL, OR ESTABLISH

Registration No. 17702

Notice of
Construction No. 4397

Date APR 02 1992

Modify Soil Venting System with a MD Pneumatics B-3200 Progressive Cavity Blower at 85 cfm, controlled by a Hasstech VCP-100 Thermal Incinerator at 1200 cfm (600F) (reference NC3088).

LISA J BONA/NORMAN L PURI

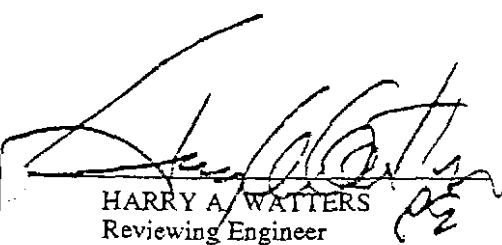
A P P L I C A N T	GEO ENGINEERS INC 8410 154TH AVE NE REDMOND WA 98052	O UNOCAL W PO BOX 76 N SEATTLE WA 98111 E R
---	--	---

INSTALLATION ADDRESS

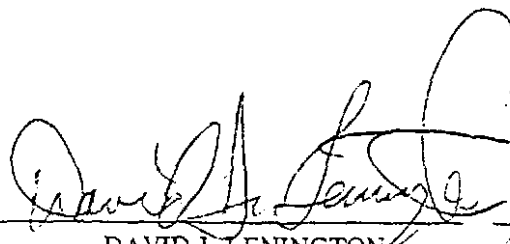
UNOCAL, 600 WESTLAKE AVE N, SEATTLE, WA, 98101


THIS ORDER IS ISSUED SUBJECT TO THE FOLLOWING RESTRICTIONS AND CONDITIONS

1. Approval is hereby granted as provided in Article 6 of Regulation I of the Puget Sound Air Pollution Control Agency to the applicant to install, alter or establish the equipment, device or process described hereon at the INSTALLATION ADDRESS in accordance with the plans and specifications on file in the Engineering Division of PSAPCA.
2. Compliance with this ORDER and its conditions does not relieve the owner or operator from the responsibility of compliance with Regulations I, II or III, RCW 70.94 or any other emission control requirements, nor from the resulting liabilities and/or legal remedies for failure to comply. Section 5.05(e) of Regulation I requires that the owner or operator must develop and implement an operation and maintenance (O&M) plan to assure continuous compliance with Regulations I, II, and III.
3. This approval does not relieve the applicant or owner of any requirement of any other governmental agency.


HARRY A. WATTERS
Reviewing Engineer

MEJ


DAVID J. LENINGTON
Reviewing Engineer


ANITA J. FRANKEL
Air Pollution Control Officer

APPENDIX B

APPENDIX B

MONITORING AND RECOVERY WELLS MEASUREMENTS AND SAMPLING GROUND WATER ELEVATIONS

Depths to the ground water table relative to the monitoring and recovery well casing rims and thicknesses of free product, where present, were measured on the dates indicated in Table 4. The measurements were made using a weighted fiberglass tape and water-sensitive paste. The fiberglass tape was cleaned with a TSP (trisodium phosphate) solution wash and a distilled water rinse prior to use in each well. Ground water elevations were calculated by subtracting the water table depths from the casing rim elevations.

GROUND WATER SAMPLING

A ground water sample was obtained from MW-40 by Enviros on March 24, 1993. Two sets of water samples were obtained. The water samples were transferred in the field to laboratory-prepared sample containers. GeoEngineers received one set for chemical analysis. The water samples were kept refrigerated during transport to the testing laboratory. Chain-of-custody procedures were followed in transferring the samples from Enviros and transporting the water samples to the testing laboratory. The laboratory data sheets and chain-of-custody records are provided in Appendix C.

PRODUCT SAMPLING

Product samples were obtained from monitoring wells MW-2 and MW-19 on August 1, 1991. The product samples were obtained with a 1/2-inch-diameter Teflon bailer and transferred in the field to laboratory-prepared sample containers. Chain-of-custody procedures were followed in transporting the product samples to the testing laboratory. The laboratory data sheets and chain-of-custody records are provided in Appendix C.

COMBUSTIBLE VAPOR CONCENTRATIONS

Combustible vapor concentrations were measured in accessible recovery and monitoring well casings on the dates indicated in Tables 6 and 7. A Bacharach TLV Sniffer calibrated to hexane was used to measure the combustible vapor concentrations in the well casings. A slip cap or an expandable plastic bladder was used to produce a temporary seal in the monitoring well casings when obtaining vapor concentrations. The lower threshold of significance for the TLV Sniffer in this application is 400 ppm (parts per million), equivalent to 4 percent of the LEL (lower explosive limit) of hexane.

VAPOR SAMPLING

Vapor samples were obtained from selected monitoring wells on the dates listed in Table 8. The vapor samples were collected in flow-through steel canisters in the following manner: (1) an expandable bladder was placed in the well casing to provide a seal and attached to the upstream

valve of the sample canister, (2) the downstream valve of the sample container was connected to a Bacharach TLV Sniffer that operated as a pump, and (3) the pump was allowed to draw vapors from the well casing into the canister, then the valves were closed. Chain-of-custody procedures were followed in transporting the vapor samples to the testing laboratory. The laboratory data sheets and chain-of-custody records are provided in Appendix C.

GROUND VACUUM

Ground vacuum was measured in the accessible monitoring and recovery well casings with a Magnehelic gauge with a resolution of 0.01 inches of water column. A slip cap or expandable plastic bladder enabled a tight fit around the monitoring well casings. Vacuum pressures were measured in the well casings while the on-site VES was operational. The ground vacuum data are presented in Tables 9 and 10.

VES MEASUREMENTS AND SAMPLING

MEASUREMENTS

The operating efficiency of the VES was monitored with manufactured meters permanently installed on the system. The meters include the following: (1) air flow meter, (2) vapor temperature meter, (3) vacuum pressure gauge, and (4) supplied fuel flow meter.

Combustible vapor and carbon dioxide gas concentrations were also obtained from the system using a Bacharach TLV Sniffer calibrated to hexane and a Bacharach Fyrite gas analyzer, respectively. The sample port for vapor measurement is located in the vapor conveyance line between the blower and the discharge stack/incinerator. The data are presented in Table 2.

VAPOR SAMPLING

Vapor samples were obtained from the sample port in the vapor conveyance line on the dates listed in Table 2. The vapor samples were collected in evacuated stainless steel containers by opening the valve in the sample port and allowing the vacuum in the canister to draw in the vapors. Chain-of-custody procedures were followed in transporting the vapor samples to the testing laboratory. The laboratory data sheets and chain-of-custody records are in Appendix C.

SOIL SAMPLING

Two discrete soil samples were obtained on April 30, 1993 from soil temporarily stockpiled on site. Soil samples were obtained with a trowel that was decontaminated with a TSP solution wash and a distilled water rinse before each sampling attempt. Each sample was placed in a glass container for chemical analysis. Chain-of-custody procedures were followed in transporting the soil samples to the testing laboratory. The laboratory data sheets and chain-of-custody records are provided in Appendix C.

APPENDIX C

APPENDIX C

CHEMICAL ANALYTICAL PROGRAM

ANALYTICAL METHODS

Chain-of-custody procedures were followed during transport of the vapor, water, product and soil samples to the analytical laboratories. The water, product and soil samples were held in cold storage pending extraction and/or analysis. The vapor samples were analyzed by either ASI (Analytical Services, Inc.) of Redmond, Washington, or ATI (Analytical Technologies, inc.) of Costa Mesa, California, or Pensacola, Florida. The water, product and soil samples were analyzed by ATI of Renton, Washington. One or more of the following analytical methods were used:

<u>Analyte</u>	<u>Matrix</u>	<u>Technique/Equipment</u>	<u>Method</u>
Methane	Vapor	Gas Chromatography/ Flame Ionization Detector	Nonstandard
BETX/TVH	Vapor	Gas Chromatography/ Photoionization Detector and Flame Ionization Detector	Nonstandard
BETX	Soil/ Water	Gas Chromatography/ Photoionization Detector	EPA 8020
Gasoline- range Hydrocarbons	Soil/ Water	Gas Chromatography/ Flame Ionization Detector	Ecology WTPH-G
Heavy Petroleum Hydrocarbons	Water	Infrared Spectrophotometry	Ecology WTPH-418.1 Modified
Oil & Grease	Water	Infrared Spectrophotometry	Ecology 413.2
Lead	Water	Atomic Absorption/ Graphite Furnace	EPA 7421

<u>Analyte</u>	<u>Matrix</u>	<u>Technique/Equipment</u>	<u>Method</u>
TCLP Metals	Product	Inductively Coupled Argon Plasma/Emission Spectroscopy and Cold Vapor/Atomic Absorption Spectroscopy	EPA 1311, 6010 and 7471
Flash Point	Product	Pensky-Martens	EPA 1010
pH	Product	Electrode	EPA 150.1 or 9045
Percent Solids	Soil	Gravimetric	CLP SOW ILM01.0

Analytical results and laboratory QA/QC (quality assurance/quality control) records are included in this appendix. The analytical results are also summarized in the text and Tables 2, 5, 8 and 11 of the report.

ANALYTICAL DATA REVIEW

Data Quality Goals

ATI and ASI maintain internal quality assurance programs as documented in their laboratory quality assurance manuals. ATI and ASI use a combination of blanks, surrogate percent recovery, duplicates, matrix spike recovery and matrix spike duplicate recovery to evaluate the validity of analytical results. ATI and ASI also use data quality goals for individual chemicals or groups of chemicals based on the long-term performance of the test methods. The data quality goals were supplied by the laboratories. Each group of samples was compared with the existing data quality goals for the laboratories and evaluated using data validation guidelines from the following documents: "Guidance Document for the Assessment of RCRA Environmental Data Quality" draft dated 1988; "National Functional Guidelines for Organic Data Review" draft dated 1991; and "Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses" dated 1988. The data quality review is presented below.

Data Quality Review

Surrogates. Surrogates were added to all soil, water and product samples prior to extraction and analysis for organic compounds, and BETX analysis of vapor samples, to monitor sample handling procedures, matrix effects and purging efficiency. Any surrogate recoveries that were outside the control limits are summarized below.

Matrix Spike/Matrix Spike Duplicates (MS/MSD). Matrix spikes and matrix spike duplicates were analyzed for some vapor samples obtained between October 31, 1991 and July 2, 1992. The MS/MSD data were provided in lieu of duplicate data. Blank spike/blank spike duplicate (BS/BSD) data were provided in lieu of duplicate data on most vapor samples obtained between December 30, 1991 and June 29, 1993. A reagent water sample was used during the MS/MSD or BS/BSD tests for QC of vapor analyses for the period between December 30, 1991 and March 24, 1993.

MS/MSD data were provided for most of the organic tests and some inorganic tests performed on the soil, product and water samples to monitor matrix effects. The laboratory also provided blank BS/BSD data for most of the analyses performed on the soil, product and water samples. Any MS/MSD or BS/BSD recoveries that were outside the control limits are summarized below.

Duplicates. Laboratory duplicates were analyzed on samples from other sets, for analyses performed on vapor samples between January 16, 1991 and October 31, 1991. Duplicates were analyzed during the inorganic tests and some of the hydrocarbons analyses on soil, product and water samples to monitor matrix effects on method reproducibility. Any relative percent differences (RPDs) that were outside the control limits are summarized below.

Holding Times. All samples were analyzed within the recommended holding times.

Blanks. Laboratory blanks were analyzed for contaminants that may have been introduced during sample analysis. The laboratory used a deionized water sample as the laboratory blank on vapor samples obtained between October 31, 1991 and March 24, 1993. A vapor blank was used for samples obtained on the other dates during the reporting period. Any contaminants that were detected in the blanks are listed below.

Data Quality Exceptions

The following is the list of nonconformances noted during the data quality review:

<u>Analyte/ Sample Number</u>	<u>Matrix</u>	<u>Data Quality Problem</u>	<u>Evaluation</u>
8015/ MW-2 MW-19	Product	Surrogate data not provided.	Concentrations of petroleum compounds not provided, only an interpretation of the chromatograms.

<u>Analyte/ Sample Number</u>	<u>Matrix</u>	<u>Data Quality Problem</u>	<u>Evaluation</u>
TCLP Metals/ MW-2 MW-19	Product	Barium detected in blank (0.002 mg/l).	Values in the field samples exceeded 10 times the concentration in the associated blank and are, therefore, not attributable to laboratory contamination.
TCLP Metals/ MW-2 MW-19	Product	Matrix spike recovery below control limits for mercury.	Acceptable method performance was demonstrated through blank spike recovery for mercury within control limits.
BETX/TPH/ 911031-1	Vapor	Duplicate RPD outside control limits.	QC sample was from another sample set. Matrix spike duplicate RPD was within control limits, demonstrating acceptable method performance.
TVH/ 9110116-1	Vapor	Blank data not reported.	Data should be qualified as estimated.

SUMMARY

The analytical results for this project were reviewed for conformance with the data quality goals. Several quality control problems were encountered with the quality control parameters provided and are listed above. Based on our review of the data quality problems, the following concentrations reported for the listed analytes are accepted for semiquantitative use: (1) TVH for vapor sample 9110116-1, obtained on January 16, 1991; (2) BETX/TPH for vapor sample 911031-1, obtained on October 31, 1991; and (3) mercury and barium for product samples MW-2 and MW-19, obtained on August 1, 6 and/or 29, 1991.

It is our opinion that the quality of chemical analytical data used to form conclusions in this report is acceptable based on our review of the ASI and ATI results and associated quality control parameters.



JAN 26 1991

KSC/K

161-13-869

January 24, 1991

Kathy Killman, Project Manager
GeoEngineers, Inc.
2405 140th Avenue N.E.
Suite 105
Bellevue, WA 98005

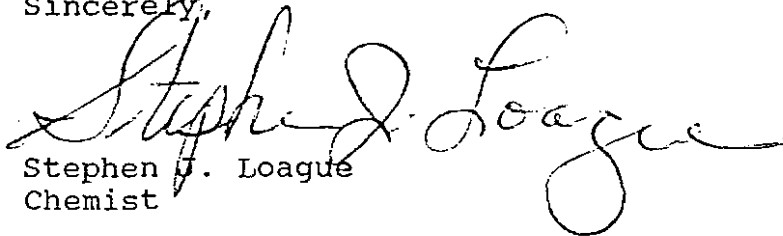
Dear Kathy:

Enclosed are the results of the analyses of samples submitted on January 16, 1991 from Project 161-13-B69/Unocal.

Please note we have formally changed our name to Analytical Services, Inc. Our new telephone number is (206) 820-4551.

We appreciate this opportunity to be of service to you on this project. If you have any questions regarding this material, or if you just want to discuss any aspect of your projects, please do not hesitate to contact me.

Sincerely,



Stephen J. Loague
Chemist

SJL:so

Enclosures

Analytical Services, Inc. (206) 820-4551 (fax) 820-6337
12277 134th Court NE Redmond, Washington 98052

Date of Report: January 24, 1991
Date Submitted: January 16, 1991
Project: 161-13-B69/Unocal

RESULTS OF ANALYSES OF ENVIROMENTAL
SAMPLES FOR METHANE BY GC/FID

<u>Sample #</u>	<u>Matrix</u>	<u>Dilution Factor</u>	<u>Methane (ppm)</u>
910116-1	Air	1	1,800
<u>Quality Assurance</u>			
Method Blank			<10
910115 VI (Original)	Air	1	110
910115 VI (Duplicate)	Air	1	150

Date of Report: January 24, 1991
Date Submitted: January 16, 1991
Project: 161-13-B69/Unocal

RESULTS OF ANALYSES OF ENVIRONMENTAL
SAMPLES FOR TOTAL VOLATILE
HYDROCARBONS AS N-HEXANE

<u>Sample #</u>	<u>Matrix</u>	<u>Dilution Factor</u>	<u>TVH (ppm)</u>
910116-1	Air	1	600

Quality Assurance

Method Blank

910115 VI (Original)	Air	1	170
910115 VI (Duplicate)	Air	1	200



GeoEngineers

FEB 22 1991

Routing
File

February 18, 1991

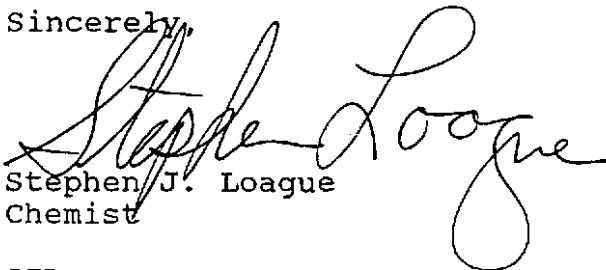
Kathy Killman
GeoEngineers, Inc.
2405 140th Avenue N.E.
Suite 105
Bellevue, WA 98005

Dear Kathy:

Enclosed are the results of the analyses of samples submitted on January 31, 1991 from Project 161-013-B14 UNOCAL Mercer and Westlake.

We appreciate this opportunity to be of service to you on this project. If you have any questions regarding this material, or if you just want to discuss any aspect of your projects, please do not hesitate to contact me.

Sincerely,



Stephen J. Loague
Chemist

SJL

Enclosures

Analytical Services, Inc. (206) 820-4551 (fax) 820-6337
12277 134th Court NE Redmond, Washington 98052



Date of Report: February 18, 1991
Date Submitted: January 31, 1991
Project: 161-013-B14 UNOCAL Mercer and Westlake

RESULTS OF ANALYSES OF ENVIROMENTAL
SAMPLES FOR METHANE BY GC/FID

<u>Sample #</u>	<u>Matrix</u>	<u>Dilution Factor</u>	<u>Methane (ppm)</u>
910131-1	air	1	100

Quality Assurance

Method Blank		1	<10
910131-1 (Duplicate)	air	1	70



Date of Report: February 18, 1991
Date Submitted: January 31, 1991
Project: 161-013-B14 UNOCAL Mercer and Westlake

RESULTS OF ANALYSES OF ENVIRONMENTAL
SAMPLES FOR TOTAL VOLATILE
HYDROCARBONS AS N-HEXANE
EXCLUDING METHANE

<u>Sample #</u>	<u>Matrix</u>	<u>Dilution Factor</u>	<u>TVH (ppm)</u>
910131-1	air	1	<20
<u>Quality Assurance</u>			
Method Blank		1	<20
910131-1 (Duplicate)	air	1	21



GeoEngineers

MAR 04 1991

Routing KSP
File

March 1, 1991

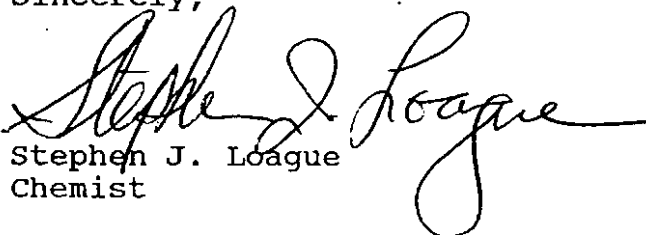
Kathy Killman
GeoEngineers, Inc.
8410 154th Avenue Northeast
Redmond, WA 98052

Dear Kathy:

Enclosed are the results of the analyses of samples submitted on February 18, 1991 from Project 161-13-B04 UNOCAL Westlake and Mercer.

We appreciate this opportunity to be of service to you on this project. If you have any questions regarding this material, or if you just want to discuss any aspect of your projects, please do not hesitate to contact me.

Sincerely,


Stephen J. Loague
Chemist

SJL

Enclosures

Analytical Services, Inc. (206) 820-4551 (fax) 820-6337
12277 134th Court NE Redmond, Washington 98052



Date of Report: March 1, 1991
Date Submitted: February 18, 1991
Project: 161-13-B04 UNOCAL Westlake and Mercer

**RESULTS OF ANALYSES OF ENVIROMENTAL
SAMPLES FOR METHANE BY GC/FID**

<u>Sample #</u>	<u>Matrix</u>	<u>Dilution Factor</u>	<u>Methane (ppm)</u>
910215-1	air	80	4800

Quality Assurance

Method Blank		1	<10
910215-1 (Duplicate)	air	80	4900



Date of Report: March 1, 1991
Date Submitted: February 18, 1991
Project: 161-13-B04 UNOCAL Westlake and Mercer

RESULTS OF ANALYSES OF ENVIRONMENTAL
SAMPLES FOR TOTAL VOLATILE
HYDROCARBONS AS N-HEXANE
(EXCLUDING METHANE)

<u>Sample #</u>	<u>Matrix</u>	<u>Dilution Factor</u>	<u>TVH (ppm)</u>
910215-1	air	1	260

Quality Assurance

Method Blank		1	<10
910215-1	air	1	270



GeoEngineers

MAR 14 1991

Routing

KSK MK

File 161-13-B04

March 12, 1991

Kathy Killman
GeoEngineers, Inc.
8410 154th Avenue Northeast
Redmond, WA 98052

Dear Kathy:

Enclosed are the results of the analyses of samples submitted on March 4, 1991 from Project 161-13-B04.

Please note we have changed the price of all our air sample analyses to \$125 per sample as of March 11, 1991.

We appreciate this opportunity to be of service to you on this project. If you have any questions regarding this material, or if you just want to discuss any aspect of your projects, please do not hesitate to contact me.

Sincerely,

Stephen J. League
Chemist

SJL

Enclosures

Analytical Services, Inc. (206) 820-4551 (fax) 820-6337
12277 134th Court NE Redmond, Washington 98052



Date of Report: March 12, 1991
Date Submitted: March 4, 1991
Project: 161-13-B04

RESULTS OF ANALYSES OF ENVIRONMENTAL
SAMPLES FOR TOTAL VOLATILE
HYDROCARBONS AS N-HEXANE
(EXCLUDING METHANE)

<u>Sample #</u>	<u>Matrix</u>	<u>Dilution Factor</u>	<u>TVH (ppm)</u>
910304-1	air	1	370

Quality Assurance

Method Blank			<10
910304-1 (Duplicate)	air	1	260



Date of Report: March 12, 1991
Date Submitted: March 4, 1991
Project: 161-13-B04

RESULTS OF ANALYSES OF ENVIROMENTAL
SAMPLES FOR METHANE BY GC/FID

<u>Sample #</u>	<u>Matrix</u>	<u>Dilution Factor</u>	<u>Methane (ppm)</u>
910304-1	air	1	700

Quality Assurance

Method Blank			<10
910304-1 (Duplicate)	air	1	730



GeoEngineers

MAR 28 1991

KSK
161-013-B04

March 27, 1991

Kathy Killman
GeoEngineers, Inc.
8410 154th Avenue Northeast
Redmond, WA 98052

Dear Kathy:

Enclosed are the results of the analyses of samples submitted on March 18, 1991 from Project 161-13-B04 UNOCAL Westlake and Mercer.

We appreciate this opportunity to be of service to you on this project. If you have any questions regarding this report, please feel free to call me.

Sincerely,

A handwritten signature in black ink that reads "Stephen J. Loague". The signature is written in a cursive style with a large, looping 'S' and 'L'.

Stephen J. Loague
Chemist

SJL

Enclosures

Analytical Services, Inc. (206) 820-4551 (fax) 820-6337
12277 134th Court NE Redmond, Washington 98052



Date of Report: March 27, 1991
Date Submitted: March 18, 1991
Project: 161-13-B04 UNOCAL Westlake and Mercer

RESULTS OF ANALYSES OF ENVIROMENTAL
SAMPLES FOR METHANE BY GC/FID

<u>Sample #</u>	<u>Matrix</u>	<u>Dilution Factor</u>	<u>Methane (ppm)</u>
910318-1	air	10	1800

Quality Assurance

Method Blank		1	<10
910318-1 (Duplicate)	air	10	1900



Date of Report: March 27, 1991
Date Submitted: March 18, 1991
Project: 161-13-B04 UNOCAL Westlake and Mercer

RESULTS OF ANALYSES OF ENVIRONMENTAL
SAMPLES FOR TOTAL VOLATILE
HYDROCARBONS AS N-HEXANE
(EXCLUDING METHANE)

<u>Sample #</u>	<u>Matrix</u>	<u>Dilution Factor</u>	<u>TVH (ppm)</u>
910318-1	air	1	120

Quality Assurance

Method Blank		1	<10
910318-1 (Duplicate)	air	1	130



ATI I.D. : 91109001

April 23, 1991

GeoEngineers

APR 26 1991

Geo Engineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052

Routine KSIC
File 161-13-B69

Project Name: Unocal/Westlake/Mercer
Project # : 161-13-B04

Attention: Kathy Killmon

Analytical Technologies, Inc. has received the following sample(s):

<u>Date Received</u>	<u>Quantity</u>	<u>Matrix</u>
April 19 1991	2	Air

The sample(s) were analyzed with EPA methodology or equivalent methods as specified in the enclosed analytical schedule. The symbol for "less than" indicates a value below the reportable detection limit. Please see the attached sheet for the sample cross reference table.

The results of these analyses and the quality control data are enclosed. If you have any questions please do not hesitate to call.

Jo-An Kittleson
Chemist

Leon Levan
Laboratory Manager



SAMPLE CROSS REFERENCE

Client : Geo Engineers, Inc.
Project# : 161-13-B04
Project Name : Unocal/Westlake/Mercer

Report Date: April 23, 1991
ATI I.D. # : 91109001

ATI #	Client Description	Matrix	Date Collected
1	910417-1	Air	17-APR-91
2	910418-1	Air	18-APR-91

---TOTALS---

<u>Matrix</u>	<u># Samples</u>
Air	2

ATI STANDARD DISPOSAL PRACTICE

The sample(s) from this project will be disposed of in fourteen (14) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.



ANALYTICAL SCHEDULE

Client : Geo Engineers, Inc.
Project # : 161-13-B04
Project Name : Unocal/Westlake/Mercer

ATI I.D. # : 91109001

Analysis	Technique/Description
METHANE	GC/FID
TOTAL VOLATILE HYDROCARBONS WITHOUT METHANE	GC/FID

GAS CHROMATOGRAPHY RESULTS

Client : Geo Engineers, Inc.
 Project # : 161-13-B04
 Project Name : Unocal/Westlake/Mercer

ATI I.D. #: 91109001

ATI #	Sample Client ID #	Matrix	Date Sampled	Date Received	Date Analyzed
1	910417-1	Air/Canister	17-APR-91	19-APR-91	22-APR-91
2	910418-1	Air/Canister	18-APR-91	19-APR-91	22-APR-91
	Method Blank	Air/Canister	NA	NA	22-APR-91

Parameter	Units	1	2	Method Blank
METHANE	PPM(V)	2100	1100	ND < 5
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	PPM(V)	260	260	ND < 5

* ND = Not Detected



GAS CHROMATOGRAPHY - QUALITY CONTROL

DUP/GC

Client : Geo Engineers, Inc.
Project # : 161-13-B04
Project Name : Unocal/Westlake/Mercer

ATI I.D. #: 91109001

Parameter	REF I.D.	UNITS	SAMPLE RESULT	DUP RESULT	RPD
METHANE	91109001-01	PPM(V)	1088	1086	0.18
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	91109001-01	PPM(V)	263	250	5.1

* RPD (Relative Percent Difference) = (Sample Result - Duplicate Result) * 100/average result



ATI I.D. : 91122001

May 8, 1991

GeoEngineers

Geo Engineers, Inc.
8410 154th Ave. N.E.
Redmond, WA 98052

MAY 16 1991

Routing *SK*
File

Project Name: Unocal/Westlake & Mercer
Project # : 0161-13-B04

Attention: Kathy Killman

Analytical Technologies, Inc. has received the following sample(s):

<u>Date Received</u>	<u>Quantity</u>	<u>Matrix</u>
May 2, 1991	1	Air

The sample(s) were analyzed with EPA methodology or equivalent methods as specified in the enclosed analytical schedule. The symbol for "less than" indicates a value below the reportable detection limit. Please see the attached sheet for the sample cross reference table.

The results of these analyses and the quality control data are enclosed. If you have any questions please do not hesitate to call.

Jo-An Kittleson
Chemist

Leon Levan
Laboratory Manager



SAMPLE CROSS REFERENCE

Client : Geo Engineers, Inc.
Project# : 0161-13-B04
Project Name : Unocal/Westlake & Mercer

Report Date: May 8, 1991
ATI I.D. # : 91122001

ATI #	Client Description	Matrix	Date Collected
1	910501-1	Air	01-MAY-91

--TOTALS--

<u>Matrix</u>	<u># Samples</u>
Air	1

ATI STANDARD DISPOSAL PRACTICE

The sample(s) from this project will be disposed of in fourteen (14) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.



ANALYTICAL SCHEDULE

Client : Geo Engineers, Inc.
Project # : 0161-13-B04
Project Name : Unocal/Westlake & Mercer

ATI I.D. # : 91122001

Analysis	Technique/Description
METHANE	GC/FID
TOTAL VOLATILE HYDROCARBONS WITHOUT METHANE	GC/FID

GAS CHROMATOGRAPHY RESULTS

 Client : Geo Engineers, Inc.
 Project # : 0161-13-B04
 Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91122001

ATI #	Sample Client ID #	Matrix	Date Sampled	Date Received	Date Analyzed
1	910501-1	Air/Canister	01-MAY-91	02-MAY-91	03-MAY-91
	Method Blank	Air/Tedlar	NA	NA	03-MAY-91
Parameter	Units	1	Method Blank		
METHANE	PPM(V)	40	ND < 5		
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	PPM(V)	135	ND < 5		

* ND=Not Detected



GAS CHROMATOGRAPHY - QUALITY CONTROL

DUP/GC

Client : Geo Engineers, Inc.
Project # : 0161-13-B04
Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91122001

Parameter	REF I.D.	UNITS	SAMPLE RESULT	DUP RESULT	RPD
METHANE	91122001-01	PPM(V)	40	42	5
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	91122001-01	PPM(V)	135	120	12

* RPD (Relative Percent Difference) = (Sample Result - Duplicate Result) * 100/average result



ATI I.D. : 91142001

May 24, 1991

GeoEngineers

Geo Engineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052

MAY 31 1991

Routing: *ESK*
File: 161-013-869

Project Name: Unocal/Westlake & Mercer
Project # : 161-13-B04

Attention: Kathy Killman

Analytical Technologies, Inc. has received the following sample(s):

<u>Date Received</u>	<u>Quantity</u>	<u>Matrix</u>
May 22, 1991	1	Air

The sample(s) were analyzed with EPA methodology or equivalent methods as specified in the enclosed analytical schedule. The symbol for "less than" indicates a value below the reportable detection limit. Please see the attached sheet for the sample cross reference table.

The results of these analyses and the quality control data are enclosed. If you have any questions please do not hesitate to call.

Jo-An Kittleson
Chemist

Leon Levan
Laboratory Manager

SAMPLE CROSS REFERENCE

Page 1

Client : Geo Engineers, Inc.
Project# : 161-13-B04
Project Name : Unocal/Westlake & Mercer

Report Date: May 24, 1991
ATI I.D. # : 91142001

ATI #	Client Description	Matrix	Date Collected
1	910520-1	Air	20-MAY-91

---TOTALS---

<u>Matrix</u>	<u># Samples</u>
Air	1

ATI STANDARD DISPOSAL PRACTICE

The sample(s) from this project will be disposed of in fourteen (14) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ANALYTICAL SCHEDULE

Page 2

Client : Geo Engineers, Inc.
Project # : 161-13-B04
Project Name : Unocal/Westlake & Mercer

ATI I.D. # : 91142001

Analysis	Technique/Description
METHANE	GC/FID
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	GC/FID

GAS CHROMATOGRAPHY RESULTS

 Client : Geo Engineers, Inc.
 Project # : 161-13-B04
 Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91142001

ATI #	Sample Client ID #	Matrix	Date Sampled	Date Received	Date Analyzed
1	910520-1	Air/Canister	20-MAY-91	22-MAY-91	23-MAY-91
	Method Blank	Air/Tedlar	NA	NA	23-MAY-91
Parameter	Units	1	Method Blank		
METHANE	PPM(V)	ND<5	ND<5		
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	PPM(V)	ND<5	ND<5		

* ND=Not Detected

GAS CHROMATOGRAPHY - QUALITY CONTROL

DUP/GC

Page 4

Client : Geo Engineers, Inc.
Project # : 161-13-B04
Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91142001

Parameter	REF I.D.	UNITS	SAMPLE RESULT	DUP RESULT	RPD
METHANE	91142001-01	PPM(V)	ND<5	ND<5	-
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	91142001-01	PPM(V)	ND<5	ND<5	-

* RPD (Relative Percent Difference) = (Sample Result - Duplicate Result) * 100/average result



ATI I.D. : 91157001

June 11, 1991

Geo Engineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052

JUN 14 1991
KSK

Project Name: Unocal/Westlake/Mercer
Project # : 161-13-B04

Attention: Kathy Killman

Analytical Technologies, Inc. has received the following sample(s):

<u>Date Received</u>	<u>Quantity</u>	<u>Matrix</u>
June 6 1991	1	Air

The sample(s) were analyzed with EPA methodology or equivalent methods as specified in the enclosed analytical schedule. The symbol for "less than" indicates a value below the reportable detection limit. Please see the attached sheet for the sample cross reference table.

The results of these analyses and the quality control data are enclosed. If you have any questions please do not hesitate to call.

Jo-An Kittleson
Chemist

Leon Levan
Laboratory Manager



SAMPLE CROSS REFERENCE

Client : Geo Engineers, Inc.
 Project# : 161-13-B04
 Project Name : Unocal/Westlake/Mercer

Report Date: June 11, 1991
 ATI I.D. # : 91157001

ATI #	Client Description	Matrix	Date Collected
1	910605-1	Air	05-JUN-91

---TOTALS---

<u>Matrix</u>	<u># Samples</u>
Air	1

ATI STANDARD DISPOSAL PRACTICE

The sample(s) from this project will be disposed of in fourteen (14) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.



ANALYTICAL SCHEDULE

Client : Geo Engineers, Inc.
Project # : 161-13-B04
Project Name : Unocal/Westlake/Mercer

ATI I.D. # : 91157001

Analysis	Technique/Description
METHANE	GC/FID
TOTAL VOLATILE HYDROCARBONS WITHOUT METHANE	GC/FID



GAS CHROMATOGRAPHY RESULTS

Client : Geo Engineers, Inc.
 Project # : 161-13-B04
 Project Name : Unocal/Westlake/Mercer

ATI I.D. #: 91157001

ATI #	Sample Client ID #	Matrix	Date Sampled	Date Received	Date Analyzed
1	910605-1	Air/Canister	05-JUN-91	06-JUN-91	10-JUN-91
	Method Blank	Air/Tedlar	NA	NA	10-JUN-91

Parameter	Units	1	Method Blank
METHANE	PPM(V)	57	ND <5
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	PPM(V)	680	ND <5

* ND=Not Detected



GAS CHROMATOGRAPHY - QUALITY CONTROL

DUP/GC

Page 4

Client : Geo Engineers, Inc.
Project # : 161-13-B04
Project Name : Unocal/Westlake/Mercer

ATI I.D. #: 91157001

Parameter	REF I.D.	UNITS	SAMPLE RESULT	DUP RESULT	RPD
METHANE	91157001-01	PPM(V)	57	58	1.7
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	91157001-01	PPM(V)	680	670	1.5

* RPD (Relative Percent Difference) = (Sample Result - Duplicate Result) * 100/average result



ATI I.D. : 91171002

June 24, 1991

Geo Engineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052

KS/KK
161-13

Project Name: Unocal/Westlake & Mercer
Project # : 161-13-B04

Attention: Kathy Killman

Analytical Technologies, Inc. has received the following sample(s):

<u>Date Received</u>	<u>Quantity</u>	<u>Matrix</u>
June 20, 1991	1	Air

The sample(s) were analyzed with EPA methodology or equivalent methods as specified in the enclosed analytical schedule. The symbol for "less than" indicates a value below the reportable detection limit. Please see the attached sheet for the sample cross reference table.

The results of these analyses and the quality control data are enclosed. If you have any questions please do not hesitate to call.

Jo-An Kittleson
Chemist

Leon Levan
Laboratory Manager

SAMPLE CROSS REFERENCE

Page 1

Client : Geo Engineers, Inc.
Project# : 161-13-B04
Project Name : Unocal/Westlake & Mercer

Report Date: June 24, 1991
ATI I.D. # : 91171002

ATI #	Client Description	Matrix	Date Collected
1	910619-1	Air	19-JUN-91

---TOTALS---

<u>Matrix</u>	<u># Samples</u>
Air	1

ATI STANDARD DISPOSAL PRACTICE

The sample(s) from this project will be disposed of in fourteen (14) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ANALYTICAL SCHEDULE

Client : Geo Engineers, Inc.
Project # : 161-13-B04
Project Name : Unocal/Westlake & Mercer

ATI I.D. # : 91171002

Analysis	Technique/Description
METHANE	GC/FID
TOTAL VOLATILE HYDROCARBONS WITHOUT METHANE	GC/FID

GAS CHROMATOGRAPHY RESULTS

 Client : Geo Engineers, Inc.
 Project # : 161-13-B04
 Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91171002

ATI #	Sample Client ID #	Matrix	Date Sampled	Date Received	Date Analyzed
1	910619-1	Air/Canister	19-JUN-91	20-JUN-91	21-JUN-91
	Method Blank	Air/Tedlar	NA	NA	20-JUN-91
Parameter	Units	1	Method Blank		
METHANE	PPM(V)	3200	ND < 5		
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	PPM(V)	930	ND < 5		

* ND=Not Detected



GAS CHROMATOGRAPHY - QUALITY CONTROL

DUP/GC

Client : Geo Engineers, Inc.
Project # : 161-13-B04
Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91171002

Parameter	REF I.D.	UNITS	SAMPLE RESULT	DUP RESULT	RPD
METHANE	91171002-01	PPM(V)	3200	3300	3.1
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	91171002-01	PPM(V)	930	900	3.3

* RPD (Relative Percent Difference) = (Sample Result - Duplicate Result) * 100/average result



ATI I.D. : 91189001

July 11, 1991

Geo Engineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052

GeoEngineers

JUL 25 1991

Project Name: Unocal/Westlake & Mercer
Project # : 0161-013-B04

Routing *KSK*
File

Attention: Kathy Killman

Analytical Technologies, Inc. has received the following sample(s):

<u>Date Received</u>	<u>Quantity</u>	<u>Matrix</u>
July 8, 1991	1	Air

The sample(s) were analyzed with EPA methodology or equivalent methods as specified in the enclosed analytical schedule. The symbol for "less than" indicates a value below the reportable detection limit. Please see the attached sheet for the sample cross reference table.

The results of these analyses and the quality control data are enclosed. If you have any questions please do not hesitate to call.

Jo-An Kittleson
Chemist

Leon Levan
Laboratory Manager

SAMPLE CROSS REFERENCE

Client : Geo Engineers, Inc.
Project# : 0161-013-B04
Project Name : Unocal/Westlake & Mercer

Report Date: July 11, 1991
ATI I.D. # : 91189001

ATI #	Client Description	Matrix	Date Collected
1	910703-1	Air	3-JUL-91

---TOTALS---

<u>Matrix</u>	<u># Samples</u>
Air	1

ANALYTICAL SCHEDULE

Page 2

Client : Geo Engineers, Inc.
Project # : 0161-013-B04
Project Name : Unocal/Westlake & Mercer

ATI I.D. # : 91189001

Analysis	Technique/Description
METHANE	GC/FID
TOTAL VOLATILE HYDROCARBONS WITHOUT METHANE	GC/FID

GAS CHROMATOGRAPHY RESULTS

 Client : Geo Engineers, Inc.
 Project # : 0161-013-B04
 Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91189001

ATI #	Sample Client ID #	Matrix	Date Sampled	Date Received	Date Analyzed
1	910703-1	Air/Canister	3-JUL-91	8-JUL-91	11-JUL-91
	Method Blank	Air/Tedlar	NA	NA	11-JUL-91

Parameter	Units	1	Method Blank
METHANE	PPM(V)	64	ND < 5
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	PPM(V)	540	ND < 5

* ND=Not Detected



GAS CHROMATOGRAPHY - QUALITY CONTROL

DUP/GC

Client : Geo Engineers, Inc.
Project # : 0161-013-B04
Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91189001

Parameter	REF I.D.	UNITS	SAMPLE RESULT	DUP RESULT	RPD
METHANE	91189001-01	PPM(V)	64	64	0
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	91189001-01	PPM(V)	540	460	16

* RPD (Relative Percent Difference) = (Sample Result - Duplicate Result) * 100/average result



Remit to Corporate Office:
 5550 Morehouse Drive
 San Diego, CA 92121-1709
 (619) 458-9141

INVOICE
 CM 40065

BILLED TO:

Geo Engineers, Inc.
 8410 154th Avenue N.E.
 Redmond, WA 98052

ACCESSION #: 91189001-01

DATE: July 11, 1991

CUSTOMER #: 342565

AUTHORIZED BY: Kathy Killman

P.O. #:

PROJECT NAME: Unocal/Westlake & Mercer

PROJECT #: 0161-013-B04

*** SAMPLES RECEIVED ON 7/8/91

TEST DESCRIPTION	QTY.	PRICE	SURCHARGE	TOTAL
METHANE TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	1	\$175.00	\$0.00	\$175.00
CANISTER LEASING	1	\$75.00	\$0.00	\$75.00
			10% DISCOUNT =	\$25.00
			REMIT -->	\$225.00

TERMS: Net 30 Days - 1½% Finance Charge on Balance Due over 30 days.



ATI I.D. : 91199002

July 22, 1991

Geo Engineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052

GeoEngineers

JUL 25 1991

Project Name: Unocal/Westlake & Mercer
Project # : 0161-013-B04

Routing *KSK*
File

Attention: Kathy Killman

Analytical Technologies, Inc. has received the following sample(s):

<u>Date Received</u>	<u>Quantity</u>	<u>Matrix</u>
July 18, 1991	3	Air

The sample(s) were analyzed with EPA methodology or equivalent methods as specified in the enclosed analytical schedule. The symbol for "less than" indicates a value below the reportable detection limit. Please see the attached sheet for the sample cross reference table.

The results of these analyses and the quality control data are enclosed. If you have any questions please do not hesitate to call.

Jo-An Kittleson
Chemist

Leon Levan
Laboratory Manager

SAMPLE CROSS REFERENCE

Client : Geo Engineers, Inc.
Project# : 0161-013-B04
Project Name : Unocal/Westlake & Mercer

Report Date: July 22, 1991
ATI I.D. # : 91199002

ATI #	Client Description	Matrix	Date Collected
1	910717-1	Air	17-JUL-91
2	910717-2	Air	17-JUL-91
3	910717-3	Air	17-JUL-91

---TOTALS---

<u>Matrix</u>	<u># Samples</u>
Air	3

ANALYTICAL SCHEDULE

Page 2

Client : Geo Engineers, Inc.
Project # : 0161-013-B04
Project Name : Unocal/Westlake & Mercer

ATI I.D. # : 91199002

Analysis	Technique/Description
METHANE	GC/FID
TOTAL VOLATILE HYDROCARBONS WITHOUT METHANE	GC/FID



GAS CHROMATOGRAPHY RESULTS

Client : Geo Engineers, Inc.
Project # : 0161-013-B04
Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91199002

ATI #	Sample Client ID #	Matrix	Date Sampled	Date Received	Date Analyzed
1	910717-1	Air/Canister	17-JUL-91	18-JUL-91	18-JUL-91
2	910717-2	Air/Canister	17-JUL-91	18-JUL-91	18-JUL-91
3	910717-3	Air/Canister	17-JUL-91	18-JUL-91	18-JUL-91
	Method Blank	Air/Tedlar	NA	NA	18-JUL-91

Parameter	Units	1	2	3	Method Blank
METHANE	PPM(V)	48000	34000	860	ND<5
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	PPM(V)	124000	7200	1000	ND<5

* ND=Not Detected

GAS CHROMATOGRAPHY - QUALITY CONTROL

DUP/GC

Page 4

Client : Geo Engineers, Inc.
Project # : 0161-013-B04
Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91199002

Parameter	REF I.D.	UNITS	SAMPLE RESULT	DUP RESULT	RPD
METHANE	91199002-03	PPM(V)	860	920	6.7
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	91199002-03	PPM(V)	1000	1000	0.0

* RPD (Relative Percent Difference) = (Sample Result - Duplicate Result) * 100/average result



Remit to Corporate Office:
 5550 Morehouse Drive
 San Diego, CA 92121-1709
 (619) 458-9141

INVOICE
 CM 40072

BILLED TO:

Geo Engineers, Inc.
 8410 154th Avenue N.E.
 Redmond, WA 98052

ACCESSION #: 91199002-01,02,03
DATE: July 22, 1991

CUSTOMER #: 342565

AUTHORIZED BY: Kathy Killman

P.O. #:

PROJECT NAME: Unocal/Westlake & Mercer
PROJECT #: 0161-013-B04

*** SAMPLES RECEIVED ON 7/18/91

TEST DESCRIPTION	QTY.	PRICE	SURCHARGE	TOTAL
METHANE TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	3	\$175.00	\$0.00	\$525.00
CANISTER LEASING	3	\$75.00	\$0.00	\$225.00
			10% DISCOUNT =	\$75.00
			REMIT -->	\$675.00

TERMS: Net 30 Days - 1½% Finance Charge on Balance Due over 30 days.



ATI I.D. : 91-218-001

August 12, 1991

GeoEngineers

Geo Engineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052

AUG 26 1991

Project Name: Unocal/Westlake & Mercer
Project # : 161-13-B69

Routing *KSK*
File

Attention: Kathy Killman

Analytical Technologies, Inc. has received the following sample(s):

<u>Date Received</u>	<u>Quantity</u>	<u>Matrix</u>
August 6, 1991	1	Air

The sample(s) were analyzed with EPA methodology or equivalent methods as specified in the enclosed analytical schedule. The symbol for "less than" indicates a value below the reportable detection limit. Please see the attached sheet for the sample cross reference table.

The results of these analyses and the quality control data are enclosed. If you have any questions please do not hesitate to call.

Jo-An Kittleson
Chemist

Leon Levan
Laboratory Manager



SAMPLE CROSS REFERENCE

Client : Geo Engineers, Inc.
Project# : 161-13-B69
Project Name : Unocal/Westlake & Mercer

Report Date: August 12, 1991
ATI I.D. # : 91-218-001

ATI #	Client Description	Matrix	Date Collected
1	910801-1	Air	01-AUG-91

---TOTALS---

<u>Matrix</u>	<u># Samples</u>
Air	1



ANALYTICAL SCHEDULE

Client : Geo Engineers, Inc.
Project # : 161-13-B69
Project Name : Unocal/Westlake & Mercer

ATI I.D. # : 91-218-001

Analysis	Technique/Description
METHANE	GC/FID
TOTAL VOLATILE HYDROCARBONS WITHOUT METHANE	GC/FID



GAS CHROMATOGRAPHY RESULTS

Client : Geo. Engineers, Inc.

Project # : 161-13-B69

Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91-218-001

ATI #	Sample Client ID #	Matrix	Date Sampled	Date Received	Date Analyzed
1	910801-1	Air/Canister	01-AUG-91	06-AUG-91	09-AUG-91
	Method Blank	Air/Tedlar	NA	NA	09-AUG-91

Parameter	Units	1	Method Blank
METHANE	PPM(V)	77	ND < 5
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	PPM(V)	420	ND < 5

* ND=Not Detected

* See Appendix for ppm(v) calculation formulas.



GAS CHROMATOGRAPHY - QUALITY CONTROL

DUP/GC

Client : Geo Engineers, Inc.
Project # : 161-13-B69
Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91-218-001

Parameter	REF I.D.	UNITS	SAMPLE RESULT	DUP RESULT	RPD
METHANE	91-218-001-01	PPM(V)	77	77	0
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	91-218-001-01	PPM(V)	420	380	10

* RPD (Relative Percent Difference) = (Sample Result - Duplicate Result) * 100/average result

APPENDIX
PPM(V) CALCULATION FORMULAS

The following condensed formula was used to calculate sample results in ppm(v).

$$\text{concentration ppm(v)} = \frac{(m)(10E3)(24.45)}{(V)(MW)}$$

where: m = mg of constituent detected in the air sample
 v = volume in liters of sample injected
 MW = molecular weight of constituent detected

The ppm(v) results are dependent on the molecular weight used in the above equation. To compare ppm(v) results that have different reference molecular weights the following relationship is used:

$$\text{ppm(v)} \propto 1/MW$$

Using this basic relationship the following equation can be derived:

$$\frac{\text{ppm(v)}_a}{\text{ppm(v)}_b} = \frac{MW_b}{MW_a}$$

The above equation can be used to compare the ppm(v) results of different constituents.

Notes:

1. The molecular weight of methane, 16 g/mole was used in calculating the TVH results in ppm(v).



Remit to Corporate Office:
 5550 Morehouse Drive
 San Diego, CA 92121-1709
 (619) 458-9141

INVOICE
 CM 40092

BILLED TO:
 Geo Engineers, Inc.
 8410 154th Avenue N.E.
 Redmond, WA 98052

ACCESSION #: 91-218-001
DATE: August 12, 1991

AUTHORIZED BY: Kathy Killman

CUSTOMER #: 342565

PROJECT NAME: Unocal/Westlake & Mercer
PROJECT #: 161-13-B69

P.O. #:

*** SAMPLES RECEIVED ON 8/6/91

TEST DESCRIPTION	QTY.	PRICE	SURCHARGE	TOTAL
METHANE TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	1	\$175.00	\$0.00	\$175.00
CANISTER LEASING	1	\$75.00	\$0.00	\$75.00
			10% DISCOUNT =	\$25.00
			REMIT -->	\$225.00

TERMS: Net 30 Days - 1½% Finance Charge on Balance Due over 30 days.

ATI I.D. # 9108-024

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 161-13-B69
 PROJECT NAME : UNOCAL WESTLAKE/MERCER

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9108-024-1	MW-2	08/01/91	PRODUCT
9108-024-2	MW-19	08/01/91	PRODUCT

----- TOTALS -----

MATRIX	# SAMPLES
PRODUCT	2

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 161-13-B69
 PROJECT NAME : UNOCAL WESTLAKE/MERCER

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
FUEL HYDROCARBONS	GC/FID	EPA 8015 MODIFIED	R
TCLP PREPARATION	-	EPA 1311	R
ARSENIC	ICAP	EPA 6010	R
BARIUM	ICAP	EPA 6010	R
CADMIUM	ICAP	EPA 6010	R
CHROMIUM	ICAP	EPA 6010	R
LEAD	ICAP	EPA 6010	R
MERCURY	AA/COLD VAPOR	EPA 7470	R
SELENIUM	ICAP	EPA 6010	R
SILVER	ICAP	EPA 6010	R
FLASH POINT	PENSKY-MARTENS	EPA 1010	SUB
PH	ELECTRODE	EPA 9045	R

R = ATI - Renton
 SD = ATI - San Diego
 PHX = ATI - Phoenix
 PNR = ATI - Pensacola
 FC = ATI - Fort Collins
 SUB = Subcontract

ATI I.D. # 9108-024

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-B69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL WESTLAKE/MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 08/06/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUND	RESULT
----------	--------

BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	111
--------------------	-----

ATI I.D. # 9108-024

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-B69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL WESTLAKE/MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 08/07/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	96
--------------------	----

ATI I.D. # 9108-024

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-B69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL WESTLAKE/MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 08/08/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	95
--------------------	----

ATI I.D. # 9108-024-1

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 08/01/91
PROJECT #	: 161-13-B69	DATE RECEIVED	: 08/02/91
PROJECT NAME	: UNOCAL WESTLAKE/MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-2	DATE ANALYZED	: 08/07/91
SAMPLE MATRIX	: PRODUCT	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 100,000

COMPOUND	RESULT
BENZENE	380,000
ETHYLBENZENE	7,400,000
TOLUENE	8,500,000
TOTAL XYLENES	70,000,000 D

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	110
--------------------	-----

D = Value from a 1,000,000 fold diluted analysis.

ATI I.D. # 9108-024-2

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 08/01/91
PROJECT #	: 161-13-B69	DATE RECEIVED	: 08/02/91
PROJECT NAME	: UNOCAL WESTLAKE/MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-19	DATE ANALYZED	: 08/07/91
SAMPLE MATRIX	: PRODUCT	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 100,000

COMPOUND	RESULT
BENZENE	7,300,000
ETHYLBENZENE	18,000,000 D
TOLUENE	64,000,000 D
TOTAL XYLENES	130,000,000 D

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	111
--------------------	-----

D = Value from a 10,000,000 fold diluted analysis.

ATI I.D. # 9108-024

 VOLATILE ORGANIC ANALYSIS
 QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9108-047-1
PROJECT #	: 161-13-B69	DATE EXTRACTED	: N/A
PROJECT NAME	: UNOCAL WESTLAKE/MERCER	DATE ANALYZED	: 08/06/91
EPA METHOD	: 8020 (BETX)	UNITS	: ug/L
SAMPLE MATRIX	: WATER		

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	0.7	20.0	20.7	100	19.3	93	7
TOLUENE	<0.5	20.0	20.4	102	19.1	96	7
TOTAL XYLENES	<0.5	40.0	40.6	102	39.0	98	4

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9108-024

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-B69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL WESTLAKE/MERCER	DATE EXTRACTED	: 08/06/91
CLIENT I.D.	: REAGENT BLANK/RINSE BLANK	DATE ANALYZED	: 08/06/91
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

-----	-----
COMPOUND	RESULT
-----	-----
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

ATI I.D. # 9108-024

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-B69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL WESTLAKE/MERCER	DATE EXTRACTED	: 08/06/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 08/06/91
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDRESULT

FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

ATI I.D. # 9108-024-1

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 08/01/91
PROJECT #	: 161-13-B69	DATE RECEIVED	: 08/02/91
PROJECT NAME	: UNOCAL WESTLAKE/MERCER	DATE EXTRACTED	: 08/06/91
CLIENT I.D.	: MW-2	DATE ANALYZED	: 08/07/91
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 4000

COMPOUNDRESULT

FUEL HYDROCARBONS	*
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	*
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

* Sample chromatogram indicates a gasoline-like contamination.



ATI I.D. # 9108-024-2

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 08/01/91
PROJECT #	: 161-13-B69	DATE RECEIVED	: 08/02/91
PROJECT NAME	: UNOCAL WESTLAKE/MERCER	DATE EXTRACTED	: 08/06/91
CLIENT I.D.	: MW-19	DATE ANALYZED	: 08/07/91
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 4000

COMPOUND	RESULT
FUEL HYDROCARBONS HYDROCARBON RANGE HYDROCARBON QUANTITATION USING	* C7 - C12 GASOLINE
FUEL HYDROCARBONS HYDROCARBON RANGE HYDROCARBON QUANTITATION USING	* C12 - C24 DIESEL

* Sample chromatogram indicates a gasoline-like contamination.

ATI I.D. # 9108-024

TCLP
METALS ANALYSIS

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 161-13-B69
 PROJECT NAME : UNOCAL WESTLAKE/MERCER

MATRIX : LEACHATE

ELEMENT	DATE PREPARED	DATE ANALYZED
ARSENIC	08/12/91	08/14/91
BARIUM	08/12/91	08/14/91
CADMIUM	08/12/91	08/20/91
CHROMIUM	08/12/91	08/14/91
LEAD	08/12/91	08/20/91
MERCURY	08/12/91	08/29/91
SELENIUM	08/12/91	08/14/91
SILVER	08/12/91	08/14/91

ATI I.D. # 9108-024

TCLP
METALS ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-B69
PROJECT NAME : UNOCAL WESTLAKE/MERCER

MATRIX : LEACHATE

UNITS : mg/L

ELEMENT	MW-2 -1	MW-19 -2	REAGENT BLANK
ARSENIC	<0.05	<0.05	<0.05
BARIUM	0.049	0.005	0.002
CADMIUM	<0.020 *	<0.004 *	<0.002
CHROMIUM	<0.006	<0.006	<0.006
LEAD	0.27	0.84	<0.02
MERCURY	<0.0004	<0.0004	<0.0002
SELENIUM	<0.05	<0.05	<0.05
SILVER	<0.003	<0.003	<0.003

* Higher detection limit due to matrix interference.

ATI I.D. # 9108-024

TCLP
METALS ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-B69
PROJECT NAME : UNOCAL WESTLAKE/MERCER

MATRIX : LEACHATE

UNITS : mg/L

ELEMENT	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
ARSENIC	9108-024-2	<0.05	<0.05	NC	1.02	1.00	102
BARIUM	9108-024-2	0.005	0.005	0	0.95	1.00	94
CADMIUM	9108-024-2	<0.004	<0.004	NC	0.86	1.00	86
CHROMIUM	9108-024-2	<0.006	<0.006	NC	0.99	1.00	99
LEAD	9108-024-2	0.84	0.92	9	1.61	1.00	77
MERCURY	9108-140-3	<0.0002	<0.0002	NC	0.0006	0.0010	60
MERCURY	BLANK SPIKE	N/A	N/A	N/A	0.0010	0.0010	100
SELENIUM	9108-024-2	<0.05	<0.05	NC	1.02	1.00	102
SILVER	9108-024-2	<0.003	<0.003	NC	0.91	1.00	91

NC = Not calculable.

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

ATI I.D. # 9108-024

GENERAL CHEMISTRY ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-B69
PROJECT NAME : UNOCAL WESTLAKE/MERCER

MATRIX : PRODUCT

PARAMETER	DATE PREPARED	DATE ANALYZED
FLASH POINT		08/07/91
PH	-	08/13/91

ATI I.D. # 9108-024

GENERAL CHEMISTRY ANALYSIS
DATA SUMMARYCLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-B69
PROJECT NAME : UNOCAL WESTLAKE/MERCER

MATRIX : PRODUCT

UNITS : °F

ATI I.D. #	CLIENT I.D.	FLASH POINT
9108-024-1	MW-2	100
9108-024-2	MW-19	78

ATI I.D. # 9108-024

GENERAL CHEMISTRY ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-B69
PROJECT NAME : UNOCAL WESTLAKE/MERCER

MATRIX : PRODUCT

UNITS : -

ATI I.D. #	CLIENT I.D.	PH
9108-024-1	MW-2	6.1
9108-024-2	MW-19	6.2

ATI I.D. # 9108-024

GENERAL CHEMISTRY ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-B69
PROJECT NAME : UNOCAL WESTLAKE/MERCER

MATRIX : PRODUCT

UNITS : -

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
PH	9108-126-1	6.46	6.41	1	N/A	N/A	N/A

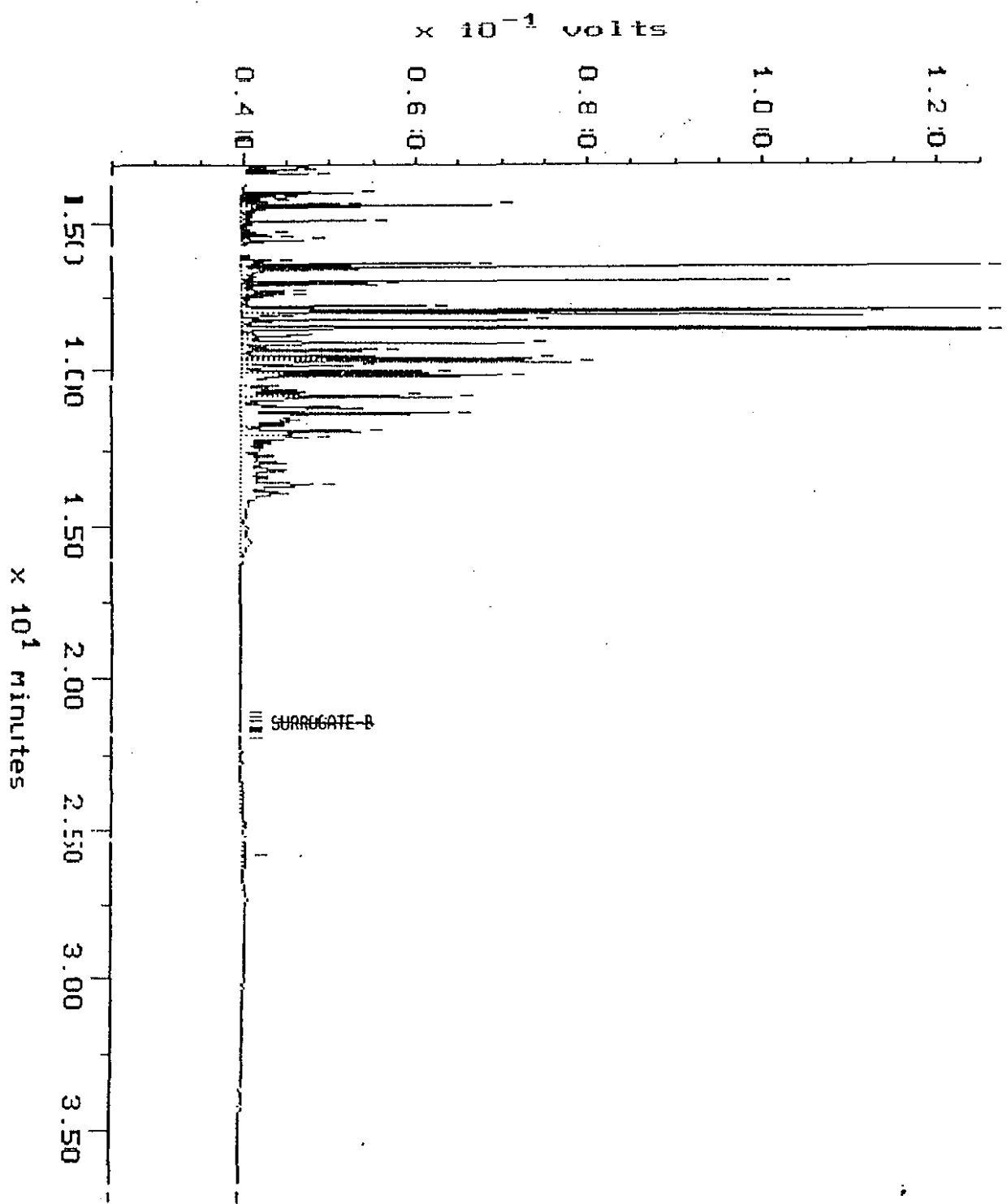
$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Sample: 9108-024-1 DIL
Acquired: 07-AUG-91 17:39
Inj Vol: 1.00

Channel: CLARENCE
Method: L:\BRO2\MAXDATA\SERGE-C\FUEL0807

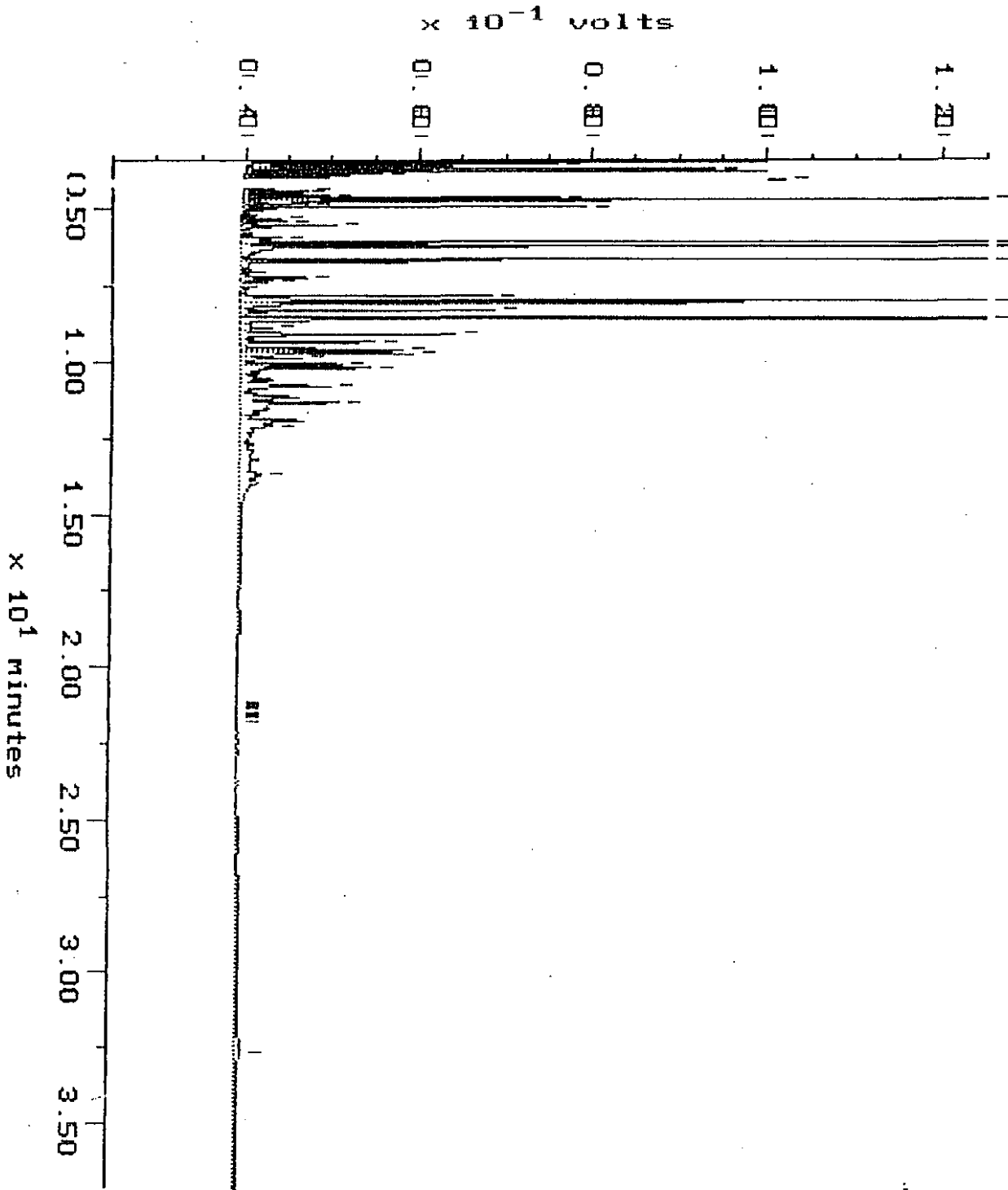
Filename: 0807SC04
Operator: BRD



Sample: 9108-024-2 DIL
Acquired: 07-AUG-91 16:49
Inj Vol: 1.00

Channel: CLARENCE
Method: L:\BRO2\MAXDATA\SERGE-C\FUEL0907

Filename: 0807SC03
Operator: BR0





Analytical Technologies, Inc.

560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335

PROJECT MANAGER: Kathy Killman
COMPANY: GroE Engineers
ADDRESS: 8410 154th Ave NE
Redmond WA case 2
PHONE: 861-6600 SAMPLED BY: [signature]

SAMPLE DISPOSAL INSTRUCTIONS

ATI Disposal @ \$5.00 each Return

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
MW-2	8/1/91		Water Product	1
MW-15	8/1/91		Water	2

Chain of Custody


LABORATORY NUMBER: 9108-0241

DATE 8/1/91 PAGE 1 OF 1

ANALYSIS REQUEST

ANALYSIS REQUEST	8010 Halogenated Volatiles	8020 Aromatic Volatiles	BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAHHH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	EP TOX Metals (8) EP EXT	Priority Pollutant Metals (13)	8080 Pesticide (4)	8240 ZH-EXT	8270	8150 Herbicides (2)	Metals (8)	NUMBER OF CONTAINERS	
	X	X												X										X	+	3
	X	X												X										X	+	3

PROJECT INFORMATION	SAMPLE RECEIPT	RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
PROJECT NUMBER: 161-13-1367	TOTAL NUMBER OF CONTAINERS: 0	Signature: [Signature]	Signature: [Signature]	Signature: [Signature]
PROJECT NAME: [unclear]	COC SEALS/INTACT? Y/N/NA: NA	Time: 1300	Time: [unclear]	Time: [unclear]
PURCHASE ORDER NUMBER:	RECEIVED GOOD COND./COLD: Y	Date: 8/1/91	Date: [unclear]	Date: [unclear]
ONGOING PROJECT? YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	RECEIVED VIA: Hand Del	Printed Name: William Park	Printed Name: [unclear]	Printed Name: [unclear]
PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS				
TAT: (NORMAL) <input type="checkbox"/> 2WKS (RUSH) <input type="checkbox"/> 24HR <input type="checkbox"/> 48 HRS <input checked="" type="checkbox"/> 72 HRS <input type="checkbox"/> 1 WK		Company: GroE-Engineers	Company: [unclear]	Company: [unclear]
GREATHER THAN 24 HR. NOTICE? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> (LAB USE ONLY)		RECEIVED BY: 1. [Signature]	RECEIVED BY: 2. [Signature]	RECEIVED BY: (LAB) 3. [Signature]
SPECIAL INSTRUCTIONS: MW-2 Test water/product mixture		Date: 8/6/91	Date: [unclear]	Date: [unclear]
Additional 5		Company: ATI	Company: [unclear]	Company: Analytical Technologies, Inc.



SPECTRA Laboratories, Inc.

2221 Ross Way • Tacoma, WA 98421 • (206) 272-4850

August 14, 1991

Analytical Technologies, Inc.
560 Naches Avenue S.W., Suite 101
Renton, WA 98055
Customer #82033

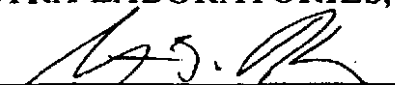
Project: 9108-024
P.O. #05797
Date Sampled: 8-1-91
Date Received: 8-6-91
Date Analyzed: 8-7-91

Attn: Donna McKinney

<u>Spectra #</u>	<u>ID:</u>	<u>Flash Point PMCC, Deg. F</u>
60577	9108-024-1 Product & H2O	100
60578	9108-024-2 Product	78

Flash Point P.M.C.C. by ASTM D-93

SPECTRA LABORATORIES, INC.



Steven G. Hibbs, Chemist



SAMPLE CROSS REFERENCE

Client : Geo Engineers
Project# : 161-13-B69
Project Name : Unocal/Westlake & Mercer

Report Date: September 6, 1991
ATI I.D. # : 91-238-001

ATI #	Client Description	Matrix	Date Collected
1	910811-1	Air	19-AUG-91

---TOTALS---

<u>Matrix</u>	<u># Samples</u>
Air	1



ANALYTICAL SCHEDULE

Client : Geo Engineers
Project # : 161-13-B69
Project Name : Unocal/Westlake & Mercer

ATI I.D. # : 91-238-001

Analysis

Technique/Description

METHANE

GC/FID

TOTAL VOLATILE HYDROCARBONS WITHOUT METHANE

GC/FID



GAS CHROMATOGRAPHY RESULTS

Client : Geo Engineers
Project # : 161-13-B69
Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91-238-001

ATI #	Sample Client ID #	Matrix	Date Sampled	Date Received	Date Analyzed
1	910811-1	Air/Canister	19-AUG-91	26-AUG-91	05-SEP-91
	Method Blank	Air/Tedlar	NA	NA	05-SEP-91

Parameter	Units	1	Method Blank
METHANE	PPM(V)	4200	ND < 5
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	PPM(V)	1200	ND < 5

* ND=Not Detected

* See Appendix for ppm(v) calculation formulas.



GAS CHROMATOGRAPHY - QUALITY CONTROL

DUP/GC

Page 4

Client : Geo Engineers

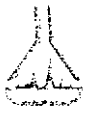
Project # : 161-13-B69

Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91-238-001

Parameter	REF I.D.	UNITS	SAMPLE RESULT	DUP RESULT	RPD
METHANE	91-246-001-01	PPM(V)	280	280	0
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	91-246-001-01	PPM(V)	690	670	3

* RPD (Relative Percent Difference) = (Sample Result - Duplicate Result) * 100/average result



Analytical Technologies, Inc.

ATI I.D. # 9108-295

September 3, 1991

GeoEngineers, Inc.
8410-154th Ave. N.E.
Redmond, WA 98052

Attention : Kathy Killman

Project Number : 161-13-B69

Project Name : Unocal Westlake Mercer

On August 29, 1991, Analytical Technologies, Inc., received one product sample for analysis. The sample was analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Bob A. Olsiewski
Project Manager

FWG/hal/cn

Frederick W. Grothkopp
Technical Manager

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-B69
PROJECT NAME : UNOCAL WESTLAKE MERCER

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9108-295-1	MW-19	08/29/91	PRODUCT

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	1

ATI STANDARD DISPOSAL PRACTICE

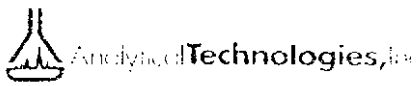
The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-B69
PROJECT NAME : UNOCAL WESTLAKE MERCER

ANALYSIS	TECHNIQUE	REFERENCE	LAB
FUEL HYDROCARBONS	GC/FID	EPA 8015 MODIFIED	R

- R = ATI - Renton
- SD = ATI - San Diego
- T = ATI - Tempe
- PNR = ATI - Pensacola
- FC = ATI - Fort Collins
- SUB = Subcontract

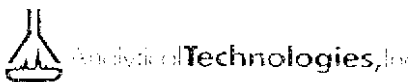


ATI I.D. # 9108-295

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-B69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL WESTLAKE MERCER	DATE EXTRACTED	: 08/29/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 08/29/91
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
EPA METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL



ATI I.D. # 9108-295-1

FUEL HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC.	DATE SAMPLED : 08/29/91
PROJECT # : 161-13-B69	DATE RECEIVED : 08/29/91
PROJECT NAME : UNOCAL WESTLAKE MERCER	DATE EXTRACTED : 08/29/91
CLIENT I.D. : MW-19	DATE ANALYZED : 08/29/91
SAMPLE MATRIX : PRODUCT	UNITS : mg/Kg
EPA METHOD : 8015 (MODIFIED)	DILUTION FACTOR : 2000

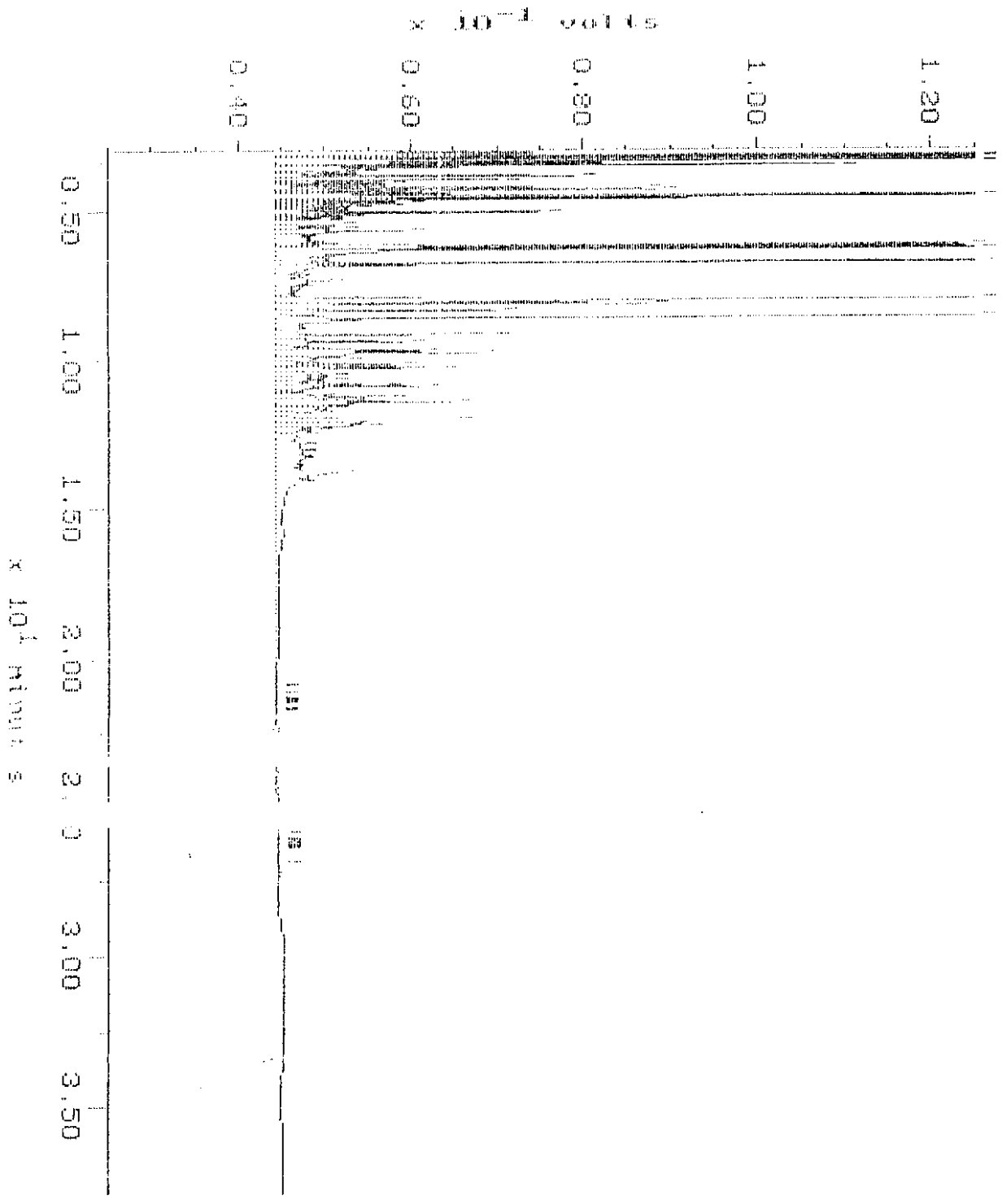
COMPOUND	RESULT
FUEL HYDROCARBONS	*
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	*
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

* - Sample chromatogram indicates gasoline-like petroleum hydrocarbons.

Sample: 9105-794 3 OIL
Acquired: 29-APR-91 02:15
Dilution: 1 : 2000.000

Channel: BERT
Method: L:\BROZ\MAXDATA\BERT\FUEL0829
Inj Vol: 1.00

Filename: 08298E08
Operator: PEA





560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335

Chain of Custody LABORATORY NUMBER:

PROJECT MANAGER: _____
 COMPANY: _____
 ADDRESS: _____
 PHONE: _____ SAMPLED BY: _____
 ATl Disposal @ \$5.00 each Return

ANALYSIS REQUEST			
SAMPLE ID	DATE	TIME	MATRIX LAB ID
8010 Halogenated Volatiles			
8020 Aromatic Volatiles			
BETX ONLY			
8240 GCMS Volatiles			
8270 GCMS BNA			
8310 HPLC PNA			
8080 Pesticides & PCB's			
PCB's ONLY			
8140 Phosphate Pesticides			
8150 Herbicides			
WDOE PAHHH (WAC 173)			
418.1 (TPH)			
413.2 Grease & Oil			
8015 (Modified)			
TOC 9060			
TOX 9020			
% Moisture			
EP TOX Metals (8) EP EXT			
Priority Pollutant Metals (13)			
8080 Pesticide (4)			
8240 ZH-EXT			
8270			
8150 Herbicides (2)			
Metals (8)			
NUMBER OF CONTAINERS			

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJECT NUMBER:		TOTAL NUMBER OF CONTAINERS	
PROJECT NAME:		COC SEALS/INTACT? Y/N/NA	
PURCHASE ORDER NUMBER:		RECEIVED GOOD COND./COLD	
ONGOING PROJECT? YES <input type="checkbox"/> NO <input type="checkbox"/>		RECEIVED VIA:	
PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS			
TAT: (NORMAL) <input type="checkbox"/> 2WKS (RUSH) <input type="checkbox"/> 24HR <input type="checkbox"/> 48 HRS <input type="checkbox"/> 72 HRS <input type="checkbox"/> 1 WK		(LAB USE ONLY)	
GREATHER THAN 24 HR. NOTICE? YES <input type="checkbox"/> NO <input type="checkbox"/>			
SPECIAL INSTRUCTIONS:			
RELINQUISHED BY: 1. Signature: _____ Time: _____		RECEIVED BY: 1. Signature: _____ Time: _____	
Printed Name: _____ Date: _____		Signature: _____ Date: _____	
Company: _____		Company: _____	
RELINQUISHED BY: 2. Signature: _____ Time: _____		RECEIVED BY: 2. Signature: _____ Time: _____	
Printed Name: _____ Date: _____		Signature: _____ Date: _____	
Company: _____		Company: _____	
RELINQUISHED BY: 3. Signature: _____ Time: _____		RECEIVED BY: 3. Signature: _____ Time: _____	
Printed Name: _____ Date: _____		Signature: _____ Date: _____	
Company: _____		Company: Analytical Technologies, Inc.	



GeoEngineers

ATI I.D. : 91-246-001

September 10, 1991

SEP 23 1991

Routing KSK
File

Geo Engineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052

Project Name: Unocal/Westlake & Mercer
Project # : 161-13-B69

Attention: Kathy Killman

Analytical Technologies, Inc. has received the following sample(s):

<u>Date Received</u>	<u>Quantity</u>	<u>Matrix</u>
September 3, 1991	1	Air

The sample(s) were analyzed with EPA methodology or equivalent methods as specified in the enclosed analytical schedule. The symbol for "less than" indicates a value below the reportable detection limit. Please see the attached sheet for the sample cross reference table.

The results of these analyses and the quality control data are enclosed. If you have any questions please do not hesitate to call.

Jo-An Kittleson
Chemist

Leon Levan
Laboratory Manager



SAMPLE CROSS REFERENCE

Client : Geo Engineers, Inc.
Project# : 161-13-B69
Project Name : Unocal/Westlake & Mercer

Report Date: September 10, 1991
ATI I.D. # : 91-246-001

ATI #	Client Description	Matrix	Date Collected
1	910829-1	Air	29-AUG-91

---TOTALS---

<u>Matrix</u>	<u># Samples</u>
Air	1



ANALYTICAL SCHEDULE

Client : Geo Engineers, Inc.
Project # : 161-13-B69
Project Name : Unocal/Westlake & Mercer

ATI I.D. # : 91-246-001

Analysis	Technique/Description
METHANE	GC/FID
TOTAL VOLATILE HYDROCARBONS WITHOUT METHANE	GC/FID



GAS CHROMATOGRAPHY RESULTS

Client : Geo Engineers, Inc.
Project # : 161-13-B69
Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91-246-001

ATI #	Sample Client ID #	Matrix	Date Sampled	Date Received	Date Analyzed
1	910829-1	Air/Canister	29-AUG-91	03-SEP-91	05-SEP-91
	Method Blank	Air/Tedlar	NA	NA	05-SEP-91

Parameter	Units	1	Method Blank
METHANE	PPM(V)	280	ND < 5
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE0	PPM(V)	690	ND < 5

* ND=Not Detected

* See Appendix for ppm(v) calculation formulas.



GAS CHROMATOGRAPHY - QUALITY CONTROL

DUP/GC

Page 4

Client : Geo Engineers, Inc.
Project # : 161-13-B69
Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91-246-001

Parameter	REF I.D.	UNITS	SAMPLE RESULT	DUP RESULT	RPD
METHANE	91-246-001-01	PPM(V)	280	280	0
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	91-246-001-01	PPM(V)	690	670	3

* RPD (Relative Percent Difference) = (Sample Result - Duplicate Result) * 100/average result



Remit to:
 Analytical Technologies, Inc.
 P.O. Box 662036
 Dallas, Texas 75266-2036

INVOICE
 CM 40124

Page 1

BILLED TO:

Geo Engineers, Inc.
 8410 154th Avenue N.E.
 Redmond, WA 98052

ACCESSION #: 91-246-001
DATE: September 10, 1991

CUSTOMER #: 340356

AUTHORIZED BY: Kathy Killman

P.O. #:

PROJECT NAME: Unocal/Westlake & Mercer
PROJECT #: 161-13-B69

SM#: 103

*** SAMPLES RECEIVED ON 9/3/91

TEST DESCRIPTION	QTY.	PRICE	SURCHARGE	TOTAL
METHANE TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	1	\$175.00	\$0.00	\$175.00
CANISTER LEASING	1	\$75.00	\$0.00	\$75.00
			10% DISCOUNT =	\$25.00
			REMIT —>	\$225.00

Please Note The
 New REMIT TO
 address

TERMS: Net 30 Days - 1½% Finance Charge on Balance Due over 30 days.



APPENDIX PPM(V) CALCULATION FORMULAS

The following condensed formula was used to calculate sample results in ppm(v).

$$\text{concentration ppm(v)} = \frac{(m)(10E3)(24.45)}{(V)(MW)}$$

where: m = mg of constituent detected in the air sample
 v = volume in liters of sample injected
 MW = molecular weight of constituent detected

The ppm(v) results are dependent on the molecular weight used in the above equation. To compare ppm(v) results that have different reference molecular weights the following relationship is used:

$$\text{ppm(v)} \propto 1/MW$$

Using this basic relationship the following equation can be derived:

$$\frac{\text{ppm(v)}_a}{\text{ppm(v)}_b} = \frac{MW_b}{MW_a}$$

The above equation can be used to compare the ppm(v) results of different constituents.

Notes:

1. The molecular weight of methane, 16 g/mole was used in calculating the TVH results in ppm(v).

* TVH=Total Volatile Hydrocarbons



ATI I.D. : 91-260-001

September 19, 1991

Geo Engineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052

Geo Engineers

SEP 27 1991

From: KSK
To:

Project Name: Unocal/Westlake & Mercer
Project # : 161-13-B69

Attention: Kathy Killman

Analytical Technologies, Inc. has received the following sample(s):

<u>Date Received</u>	<u>Quantity</u>	<u>Matrix</u>
September 17, 1991	1	Air

The sample(s) were analyzed with EPA methodology or equivalent methods as specified in the enclosed analytical schedule. The symbol for "less than" indicates a value below the reportable detection limit. Please see the attached sheet for the sample cross reference table.

The results of these analyses and the quality control data are enclosed. If you have any questions please do not hesitate to call.

Jo-An Kittleson
Chemist

Leon Levan
Laboratory Manager



SAMPLE CROSS REFERENCE

Client : Geo Engineers, Inc.
Project# : 161-13-B69
Project Name : Unocal/Westlake & Mercer

Report Date: September 19, 1991
ATI I.D. # : 91-260-001

ATI #	Client Description	Matrix	Date Collected
1	910916-1	Air	10-SEP-91

---TOTALS---

<u>Matrix</u>	<u># Samples</u>
Air	1



ANALYTICAL SCHEDULE

Client : Geo Engineers, Inc.
Project # : 161-13-B69
Project Name : Unocal/Westlake & Mercer

ATI I.D. # : 91-260-001

Analysis	Technique/Description
METHANE	GC/FID
TOTAL VOLATILE HYDROCARBONS WITHOUT METHANE	GC/FID



GAS CHROMATOGRAPHY RESULTS

Client : Geo Engineers, Inc.
Project # : 161-13-B69
Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91-260-001

ATI #	Sample Client ID #	Matrix	Date Sampled	Date Received	Date Analyzed
1	910916-1	Air/Tedlar	16-SEP-91	17-SEP-91	17-SEP-91

Parameter	Units	1	Method Blank
METHANE	PPM(V)	5000	ND < 5
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	PPM(V)	1900	ND < 5

* ND=Not Detected



GAS CHROMATOGRAPHY - QUALITY CONTROL

DUP/GC

Page 4

Client : Geo Engineers, Inc.
Project # : 161-13-B69
Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91-260-001

Parameter	REF I.D.	UNITS	SAMPLE RESULT	DUP RESULT	RPD
METHANE	91-260-001-01	PPM(V)	5000	5000	0
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	91-260-001-01	PPM(V)	1900	1800	5

* RPD (Relative Percent Difference) = (Sample Result - Duplicate Result) * 100/average result



Remit to:
 Analytical Technologies, Inc.
 P.O. Box 662036
 Dallas, Texas 75266-2036

INVOICE
 CM 40136

Page 1

BILLED TO:

Geo Engineers, Inc.
 8410 154th Avenue N.E.
 Redmond, WA 98052

ACCESSION #: 91-260-001
DATE: September 19, 1991

CUSTOMER #: 340356

AUTHORIZED BY: Kathy Killman

P.O. #:

PROJECT NAME: Unocal/Westlake & Mercer
PROJECT #: 161-13-B69

SM#: 103

*** SAMPLES RECEIVED ON 9/17/91

TEST DESCRIPTION	QTY.	PRICE	SURCHARGE	TOTAL
METHANE				
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	1	\$175.00	\$0.00	\$175.00
CANISTER LEASING	1	\$75.00	\$0.00	\$75.00
			10% DISCOUNT =	\$25.00
			REMIT -->	\$225.00

TERMS: Net 30 Days - 1½% Finance Charge on Balance Due over 30 days.



ATI I.D. : 91-281-004

October 14, 1991

GeoEngineers

OCT 24 1991

Geo Engineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052

Routing KSE
File

Project Name: Unocal/Westlake & Mercer
Project # : 161-13-B69

Attention: Kathy Killman

Analytical Technologies, Inc. has received the following sample(s):

<u>Date Received</u>	<u>Quantity</u>	<u>Matrix</u>
October 8, 1991	1	Air

The sample(s) were analyzed with EPA methodology or equivalent methods as specified in the enclosed analytical schedule. The symbol for "less than" indicates a value below the reportable detection limit. Please see the attached sheet for the sample cross reference table.

The results of these analyses and the quality control data are enclosed. If you have any questions please do not hesitate to call.

Jo-An Kittleson
Chemist

Leon Levan
Laboratory Manager



GAS CHROMATOGRAPHY - QUALITY CONTROL

DUP/GC

Page 4

Client : Geo Engineers, Inc.
Project # : 161-13-B69
Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91-281-004

Parameter	REF I.D.	UNITS	SAMPLE RESULT	DUP RESULT	RPD
METHANE	91-281-004-01	PPM(V)	53	58	7
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	91-281-004-01	PPM(V)	310	350	12

* RPD (Relative Percent Difference) = (Sample Result - Duplicate Result) * 100/average result



GAS CHROMATOGRAPHY RESULTS

Client : Geo Engineers, Inc.
Project # : 161-13-B69
Project Name : Unocal/Westlake & Mercer

ATI I.D. #: 91-281-004

ATI #	Sample Client ID #	Matrix	Date Sampled	Date Received	Date Analyzed
1	911003-1	Air/Canister	03-OCT-91	08-OCT-91	08-OCT-91
	Method Blank	Air/Tedlar	NA	NA	08-OCT-91
Parameter	Units	1	Method Blank		
METHANE	PPM(V)	53	ND < 5		
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	PPM(V)	310	ND < 5		

* ND=Not Detected

* See Appendix for ppm(v) calculation formulas.



ANALYTICAL SCHEDULE

Client : Geo Engineers, Inc.
Project # : 161-13-B69
Project Name : Unocal/Westlake & Mercer

ATI I.D. # : 91-281-004

Analysis	Technique/Description
METHANE	GC/FID
TOTAL VOLATILE HYDROCARBONS WITHOUT METHANE	GC/FID



SAMPLE CROSS REFERENCE

Client : Geo Engineers, Inc.
Project# : 161-13-B69
Project Name : Unocal/Westlake & Mercer

Report Date: October 14, 1991
ATI I.D. # : 91-281-004

ATI #	Client Description	Matrix	Date Collected
1	911003-1	Air	03-OCT-91

---TOTALS---

<u>Matrix</u>	<u># Samples</u>
Air	1



ATI I.D. : 91-290-001

GeoEngineers

October 30, 1991

NOV 04 1991

Routing *KSK*
File

Geo Engineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052

Project Name: Unocal - W. Lake Mercer
Project # : 161-13-B69

Attention: Kathy Killman

Analytical Technologies, Inc. has received the following sample(s):

<u>Date Received</u>	<u>Quantity</u>	<u>Matrix</u>
October 17, 1991	1	Air

The sample(s) were analyzed with EPA methodology or equivalent methods as specified in the enclosed analytical schedule. The symbol for "less than" indicates a value below the reportable detection limit. Please see the attached sheet for the sample cross reference table.

The results of these analyses and the quality control data are enclosed. If you have any questions please do not hesitate to call.

Jo-An Kittleson
Chemist

Leon Levan
Laboratory Manager



SAMPLE CROSS REFERENCE

Client : Geo Engineers, Inc.
Project# : 161-13-B69
Project Name : Unocal - W. Lake Mercer

Report Date: October 30, 1991
ATI I.D. # : 91-290-001

ATI #	Client Description	Matrix	Date Collected
1	910216-A	Air	15-OCT-91

--TOTALS--

<u>Matrix</u>	<u># Samples</u>
Air	1



ANALYTICAL SCHEDULE

Client : Geo Engineers, Inc.
Project # : 161-13-B69
Project Name : Unocal - W. Lake Mercer

ATI I.D. # : 91-290-001

Analysis

Technique/Description

METHANE (ASTM-D1946)

GC/FID

TOTAL VOLATILE HYDROCARBONS WITHOUT METHANE

GC/FID



GAS CHROMATOGRAPHY RESULTS

Client : Geo Engineers, Inc.
Project # : 161-13-B69
Project Name : Unocal - W. Lake Mercer

ATI I.D. #: 91-290-001

ATI #	Sample Client ID #	Matrix	Date Sampled	Date Received	Date Analyzed
1	910216-A	Air/Canister	15-OCT-91	17-OCT-91	18-OCT-91
	Method Blank	Air/Tedlar	NA	NA	18-OCT-91

Parameter	Units	1	Method Blank
METHANE	PPM(V)	1900	ND < 5
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	PPM(V)	200	ND < 5

* ND=Not Detected

* See Appendix for ppm(v) calculation formulas.



GAS CHROMATOGRAPHY - QUALITY CONTROL

DUP/GC

Client : Geo Engineers, Inc.
Project # : 161-13-B69
Project Name : Unocal - W. Lake Mercer

ATI I.D. #: 91-290-001

Parameter	REF I.D.	UNITS	SAMPLE RESULT	DUP RESULT	RPD
METHANE	91-290-001-01	PPM(V)	1900	2000	5
TOTAL VOLATILE HYDROCARBONS (WITHOUT METHANE)	91-290-001-01	PPM(V)	200	200	0

* RPD (Relative Percent Difference) = (Sample Result - Duplicate Result) * 100/average result



APPENDIX PPM(V) CALCULATION FORMULAS

The following condensed formula was used to calculate sample results in ppm(v).

$$\text{concentration ppm(v)} = \frac{(m)(10E3)(24.45)}{(V)(MW)}$$

where: m = mg of constituent detected in the air sample
 v = volume in liters of sample injected
 MW = molecular weight of constituent detected

The ppm(v) results are dependent on the molecular weight used in the above equation. To compare ppm(v) results that have different reference molecular weights the following relationship is used:

$$\text{ppm(v)} \propto 1/MW$$

Using this basic relationship the following equation can be derived:

$$\frac{\text{ppm(v)}_a}{\text{ppm(v)}_b} = \frac{MW_b}{MW_a}$$

The above equation can be used to compare the ppm(v) results of different constituents.

Notes:

1. The molecular weight of methane, 16 g/mole was used in calculating the TVH results in ppm(v).



NOV 30 1992

Routing

GEOENGINEERS
 8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 91-7928
 Order Number: P50245
 Received Date: 10/30/91
 Client: 07061
 Sampled By: DEH
 Sample Date: 10/24/91
 Sample Time: 1530

Project Number: 0161-13-R69
 Project Name: UNOCAL SS#5353
 Sample Site: N/S
 Sample Type: AIR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
7928-1	911024-1	METHANE	PPM	880	1.0

Comments: PPM = Parts Per Million, mg/l. MG/M3 = Milligrams Per Cubic Meter.
 Method Reference: Compendium of Methods for the Determination of Toxic Organic
 Compounds Ambient Air, SW-846, 3rd Ed., 11/86. BDL = Below Detection Limits.

Approved By : *[Signature]*
 page 1



Client: GEOENGINEERS

Lab I.D.#: 91-7928-1

Project Number: 0161-13-R69

Received Date: 10/30/91

Project Name: UNOCAL SS#5353

Sampled By: DEH

Sample Site: N/S

Sample Type: AIR

Sample ID.: 911024-1

Sample Date: 10/24/91 Time: 1530

AIR/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	BDL	1
ETHYL BENZENE	MG/M3	BDL	1
TOLUENE	MG/M3	BDL	5
XYLENES	MG/M3	BDL	2
TOTAL PETROLEUM HYDROCARBONS	MG/M3	BDL	500
BROMOFLUOROBENZENE *SURR*	% REC	96	
CHLOROBENZENE *SURR*	% REC	84	



Analytical Technologies, Inc.

GeoEngineers

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

DEC 03 1991

Routing: *NLP*
File

GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 91-8023
Order Number: P50383
Received Date: 11/04/91
Client: 07061
Sampled By: C.B.K.
Sample Date: 10/31/91
Sample Time: 0837

N/S = Not Submitted

Project Number: 161-13-K4
Project Name: UNOCAL - W. LAKE
Sample Site: N/S
Sample Type: AIR

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
8023-1	911031-1	METHANE	PPM	530	1.0

Comments: PPM = Parts Per Million, mg/l. MG/M3 = Milligrams Per Cubic Meter.
BDL = Below Detection Limits. Meth Ref: Compendium of Methods for the
Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Ed,
11/86 and Analysis Method Designed by Analytical Technologies, Inc.

Approved By: *John V. Hawkins*



Analytical Technologies, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

Client: GEOENGINEERS

Lab I.D.#: 91-8023-1

Received Date: 11/04/91

Sampled By: C.B.K.

Project Number: 161-13-K4

Project Name: UNOCAL - W. LAKE

Sample Site: N/S

Sample Type: AIR

Sample ID.: 911031-1

Sample Date: 10/31/91 Time: 0837

AIR/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	2	1
ETHYL BENZENE	MG/M3	BDL	1
TOLUENE	MG/M3	9	5
XYLENES	MG/M3	7	2
TOTAL PETROLEUM HYDROCARBONS	MG/M3	BDL	500
BROMOFLUOROBENZENE *SURR*	% REC	98	
CHLOROBENZENE *SURR*	% REC	98	

GEOENGINEERS

PROJECT: 161-13-K4

LAB ID: 91-8203

BATCH: CA-0065

LAB ID CLIENT ID ANALYSIS DATE

91-8023-1 911031-1 11-09-91
 MATRIX SPIKE
 MATRIX SPIKE DUP.

DI BLANK 11-09-91

PARAMETER	METHOD	DETECTION LIMIT	BLANK	MATRIX SPIKE		EXPECTED SPIKE	%REC. MATRIX SPIKE	%REC. CONTROL LIMITS	MAX RPD
				DUPLICATE RESULTS	RESULTS				
METHANE	*	1.0	BDL	5.51	5.19	6.30	87	50-150	6
							82		50

NOTES: PPM - Parts per Million, mg/l.
 BDL - Below Detection Limit
 Source for control limits is internal laboratory quality assurance program and the method reference.
 SAMPLE SPIKED AND DUPLICATED: 91-7928-1

REFERENCE: *Gas Chromatographic method employing direct injection on column with flame ionization detector (FID).



Analytical Technologies, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

CLIENT: GEOENGINEERS

PROJECT: 161-13-K4

LAB ID: 91-8023

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: II

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
91-8023-1	911031-1	10-31-91	11-21-91	N/A	11-26-91	EW0079	C



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0079

PARAMETERS

PARAMETERS	DETECTION LIMIT	BLANK A	BLANK B	BLANK C
		EXTRACTION DATE ANALYSIS DATE	RESULTS	RESULTS
		N/A 11-24-91	N/A 11-25-91	N/A 11-26-91
METHYL TERT-BUTYL ETHER	10 PPB	BDL	BDL	BDL
BENZENE	1 PPB	BDL	BDL	BDL
ETHYL BENZENE	1 PPB	BDL	BDL	BDL
TOLUENE	5 PPB	BDL	BDL	BDL
XYLENE	2 PPB	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	.5 PPM	BDL	BDL	BDL
BROMOFLUROBENZENE	*SURR* (50-150)	106	110	102
CHLOROBENZENE	*SURR* (50-150)	88	83	94

NOTE:

Units in PPB = ug/l, Units in PPM = mg/l

BDL = Below Detection limit.

Results reported are blank corrected.

Source for control limits is internal laboratory quality assurance program and the method reference.

N/S = NOT SUBMITTED

N/A = NOT APPLICABLE



WATER MATRIX SPIKE

BATCH NUMBER: EW0079

SAMPLE SPIKED: 91-8286-2

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	MS CONC	MS REC%#	REC LIMITS
BENZENE	50	BDL	50	100	50-150
TOLUENE	50	BDL	56	112	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	MSD CONC	MSD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	46	92	8	50	50-150
TOLUENE	50	BDL	56	112	0	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits

0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
MS	11-26-91	96 %	102%
MSD	11-26-91	104%	98 %

D = DILUTED OUT

NOTE: Units in ug/l = Parts Per Billion.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

QC LIMITS
 S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:



INDEPENDENT QC CHECK

BATCH NUMBER: EIC1114W

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	IQC CONC	IQC REC%#	REC LIMITS
BENZENE	50	BDL	54	108	50-150
TOLUENE	50	BDL	52	104	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 2 % recoveries out of limits

0 out of 2 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
IQC	11-14-91	96 %	97 %

D = DILUTED OUT

NOTE: Units in ug/l = Parts Per Billion.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

QC LIMITS
 S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:



METHOD DUPLICATE SAMPLE

BATCH NUMBER: 91EW079

SAMPLE NUMBER: 91-7982-2

PARAMETERS

	DETECTION LIMIT	SAMPLE RESULT	DUPLICATE RESULT	RPD
TOTAL PETROLEUM HYDROCARBONS	500 mg/m ³	2515	1600	44
BROMOFLUOROBENZENE	(50-150)	102	98	N/A
CHLOROBENZENE	(50-150)	92	96	N/A

NOTE:

TPH Results in mg/m³ (PPB).

RPD (Relative Percent Difference) =

sample result - duplicate *100/ combined results

N/A = Not Applicable.



SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: Geo Engineers

ATI Lab I.D.# 91-8023

PROJ NUMBER: 161-13-K4

1 911031-1

PROJ NAME: Unocal - W. Lake

2

Sampled by: C.B.K.

3

Sample Site: N/S

4

Sample Date: 10/31/91

5

Sample Time: 0837

6

Sample Type: (Air) Gas

7

RUSH: Y QC: N 0 1 3 4

8

Is there a chain of custody? Y N

9

Was the chain of custody signed? Y N

10

Were samples received cold? Y N

11

Were sample containers intact? Y N

12

Were samples preserved correctly? Y N

Were samples received in proper containers? Y N

Were samples received within holding time? Y N

Were air bubbles present in volatile bottles? N/A

Shipped by: Fed. Ec.

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ITS OFFICERS, AGENTS, EMPLOYEES OR SUCCESSORS, TO CLIENTS, ARISING OUT OF OR IN CONNECTION WITH THE SERVICES TO BE PROVIDED HEREIN, SHALL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICES. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF, NOT WITHSTANDING ANY PROVISION TO THE CONTRARY IN ANY CLIENT PURCHASE ORDER OR CONTRACT.

11/4/91

INSPECTED BY: Mike Nova

PM APPROVAL [Signature]

DATE INSPECTED: 11/4/91

DATE RECEIVED: _____



Analytical Technologies, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 91-8470
Order Number: P51039
Received Date: 11/19/91
Client: 07061
Sampled By: N.L.P.
Sample Date: 11/15/91
Sample Time: N/S

Project Number: 161-13-R69
Project Name: UNOCAL SS-5353
Sample Site: N/S
Sample Type: VAPOR (AIR)

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
70-1	911115-1	METHANE	PPM	13800	1

Comments: PPM = Parts Per Million, mg/l. MG/M3 = Milligrams per cubic meter.
Meth Refs: Compendium of Methods for the Determination of Toxic Organic
Compounds in Ambient Air, SW-846, 3rd Edition, November 1986 and
Analysis Method Designed by Analytical Technologies, Inc.

page 1 Approved By : John V Hawkins



Client: GEOENGINEERS

Lab I.D.#: 91-8470-1

Project Number: 161-13-R69

Received Date: 11/19/91

Project Name: UNOCAL SS-5353

Sampled By: N.L.P.

Sample Site: N/S

Sample Type: VAPOR (AIR)

Sample ID.: 911115-1

Sample Date: 11/15/91

Time: N/S

AIR/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	BDL	2
ETHYL BENZENE	MG/M3	BDL	2
TOLUENE	MG/M3	BDL	10
XYLENES	MG/M3	BDL	4
TOTAL PETROLEUM HYDROCARBONS	MG/M3	BDL	1000
BROMOFLUOROBENZENE *SURR*	% REC	100	
CHLOROBENZENE *SURR*	% REC	94	



Analytical Technologies, Inc.

11 EAST OLIVE ROAD
PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001

GEOENGINEERS

PROJECT: 161-13-R69

QC LEVEL II

LAB ID: 91-8470

BATCH: CA0069

ANALYSIS
DATE

LAB ID CLIENT ID

91-8470-1 911115-1

MATRIX SPIKE 12-10-91

MATRIX SPIKE DUP. 12-10-91

DI BLANK 12-10-91

C 1 155

<u>PARAMETER</u>	<u>METHOD</u>	<u>DETECTION LIMIT</u>	<u>BLANK</u>	MATRIX SPIKE <u>RESULTS</u>	MATRIX SPIKE <u>RESULTS</u>	EXPECTED <u>SPIKE</u>	%REC MATRIX <u>SPIKE</u>	%REC MATRIX <u>SPIKE DUP.</u>	% REC. CONTROL <u>LIMITS</u>	MAX RPD
METHANE	*	1	BDL	7.1	6.1	7.6	93	80	50-150	15 50

NOTES: PPM = Parts Per Million, mg/l.
BDL = Below Detection Limit
Source for control limits is internal laboratory quality assurance program and reference below.
SAMPLE SPIKED AND DUPLICATED - 91-8823-1.

REFERENCE: *Gas Chromatographic method employing direct injection on column with flame ionization detector (FID).



Analytical Technologies, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

CLIENT: GEOENGINEERS

PROJECT: 161-13-R69

LAB ID: 91-8470

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: II

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
91-8470-1	911115-1	11-15-91	11-19-91	N/A	11-26-91	EW0080	A



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0080

PARAMETERS	DETECTION LIMIT	BLANK A	BLANK B	BLANK C
		EXTRACTION DATE ANALYSIS DATE	RESULTS	RESULTS
		N/A 11-26-91	N/A 11-27-91	N/A N/A
METHYL TERT-BUTYL ETHER	10 PPB	BDL	BDL	BDL
BENZENE	1 PPB	BDL	BDL	BDL
METHYL BENZENE	1 PPB	BDL	BDL	BDL
TOLUENE	5 PPB	BDL	BDL	BDL
XYLENE	2 PPB	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	.5 PPM	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (50-150)	102	100	N/A
CHLOROBENZENE	*SURR* (50-150)	94	92	N/A

NOTE: Units in PPB = ug/l, Units in PPM = mg/l
 BDL = Below Detection limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



WATER MATRIX SPIKE

BATCH NUMBER: EW0080

SAMPLE SPIKED: 91-7948-2

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	MS CONC	MS REC%#	REC LIMITS
BENZENE	50	BDL	54	108	50-150
TOLUENE	50	BDL	60	120	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	MSD CONC	MSD REC%#	% RPD#	QC LIMITS RPD	REC
BENZENE	50	BDL	53	106	2	50	50-150
TOLUENE	50	BDL	59	118	2	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits

0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
MS	11-27-91	100%	98 %
MSD	11-27-91	100%	100%

D = DILUTED OUT

NOTE: Units in ug/l = Parts Per Billion.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

	QC LIMITS
S1 = BROMOFLUOROBENZENE	(50-150)
S2 = CHLOROBENZENE	(50-150)

COMMENTS:



INDEPENDENT QC CHECK

BATCH NUMBER: EIC1114W

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	IQC CONC	IQC REC%#	REC LIMITS
BENZENE	50	BDL	54	108	50-150
TOLUENE	50	BDL	52	104	50-150

Column to be used to flag recovery and RPD values with an asterisk

Values outside of QC limits

0 out of 2 % recoveries out of limits

0 out of 2 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
IQC	11-14-91	96 %	97 %

= DILUTED OUT

NOTE: Units in ug/l = Parts Per Billion.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

	QC LIMITS
S1 = BROMOFLUOROBENZENE	(50-150)
S2 = CHLOROBENZENE	(50-150)

COMMENTS:



SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: Geo Engineers

ATI Lab I.D.# 91-8470

PROJ NUMBER: 161-13-R69

1 91115-1

PROJ NAME: Unocal ss-5353

2 _____

Sampled by: NLP

3 _____

Sample Site: N/S

4 _____

Sample Date: 11/15/91

5 _____

Sample Time: N/S

6 _____

Sample Type: Vapor (Air)

7 _____

RUSH: Y N QC: N 0 1 2 3 4

8 _____

Is there a chain of custody? Y N

9 _____

Was the chain of custody signed? Y N

10 _____

Were samples received cold? Y N

11 _____

Were sample containers intact? Y N

12 _____

Were samples preserved correctly? Y N

Were samples received in proper containers? Y N

Were samples received within holding time? Y N

Were air bubbles present in volatile bottles? N/A

Shipped by: FED-EX
1331126560

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ITS OFFICERS, AGENTS, EMPLOYEES OR SUCCESSORS, TO CLIENTS, ARISING OUT OF OR IN CONNECTION WITH THE SERVICES TO BE PROVIDED HEREIN, SHALL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICES. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF, NOT WITHSTANDING ANY PROVISION TO THE CONTRARY IN ANY CLIENT PURCHASE ORDER OR CONTRACT.

PM APPROVAL JWH
11/19/91

INSPECTED BY: Timothy Dennis
DATE INSPECTED: 11/19/91
DATE RECEIVED: 11/19/91



SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEO Engineers

ATI Lab I.D.# 91-8470

PROJ NUMBER: 161-13-R69

1 91115-1

PROJ NAME: Unocal ss-5353

2 _____

Sampled by: NLP

3 _____

Sample Site: N/S

4 _____

Sample Date: 11/15/91

5 _____

Sample Time: N/S

6 _____

Sample Type: Vapor (Air)

7 _____

RUSH: Y N QC: N 0 1 2 3 4

8 _____

Is there a chain of custody? Y N

9 _____

Was the chain of custody signed? Y N

10 _____

Were samples received cold? Y N

11 _____

Were sample containers intact? Y N

12 _____

Were samples preserved correctly? Y N

Were samples received in proper containers? Y N

Were samples received within holding time? Y N

Were air bubbles present in volatile bottles? N/A

Shipped by: FED-EX
1331126560

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ITS OFFICERS, AGENTS, EMPLOYEES OR SUCCESSORS, TO CLIENTS, ARISING OUT OF OR IN CONNECTION WITH THE SERVICES TO BE PROVIDED HEREIN, SHALL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICES. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF, NOT WITHSTANDING ANY PROVISION TO THE CONTRARY IN ANY CLIENT PURCHASE ORDER OR CONTRACT.

11/19/91

INSPECTED BY: Timothy Dennis

PM APPROVAL JWH

DATE INSPECTED: 11/19/91

DATE RECEIVED: 11/19/91



Analytical Technologies, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 91-8825
Order Number: P51584
Received Date: 12/03/91
Client: 07061
Sampled By: N/S
Sample Date: 12/02/91
Sample Time: N/S

Project Number: 161-13-R69
Project Name: UNOCAL WESTLAKE-MERCER
Sample Site: N/S
Sample Type: VAPOR (AIR)

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
8825-1	911202	METHANE	PPM	365	1

Comments: PPM = Parts Per Million, mg/l. MG/M3 = Milligrams per cubic meter.
Meth Refs: Compendium of Methods for the Determination of Toxic Organic
Compounds in Ambient Air, SW-846, 3rd Edition, November 1986 and
Analysis Method Designed by Analytical Technologies, Inc.

Approved By : John V Hawkins
page 1



Analytical Technologies, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

Client: GEOENGINEERS

Lab I.D.#: 91-8825-1

Project Number: 161-13-R69

Received Date: 12/03/91

Project Name: UNOCAL WESTLAKE-MERCER

Sampled By: N/S

Sample Site: N/S

Sample Type: VAPOR (AIR)

Sample ID.: 911202

Sample Date: 12/02/91

Time: N/S

R/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	BDL	1
ETHYL BENZENE	MG/M3	6	1
TOLUENE	MG/M3	24	5
XYLENES	MG/M3	38	2
TOTAL PETROLEUM HYDROCARBONS	MG/M3	BDL	500
BROMOFLUOROBENZENE *SURR*	% REC	99	
CHLOROBENZENE *SURR*	% REC	91	

GEOENGINEERS

PROJECT: 161-13-R69

QC LEVEL II

LAB ID: 91-8825

BATCH: CA0069

<u>LAB ID</u>	<u>CLIENT ID</u>	<u>ANALYSIS DATE</u>
91-8825-1	911202	12-10-91
MATRIX SPIKE		12-10-91
MATRIX SPIKE DUP.		12-10-91
DI BLANK		12-10-91

<u>PARAMETER</u>	<u>METHOD</u>	<u>DETECTION LIMIT</u>	<u>MATRIX SPIKE RESULTS</u>	<u>MATRIX SPIKE RESULTS</u>	<u>EXPECTED SPIKE</u>	<u>%REC MATRIX SPIKE</u>	<u>%REC MATRIX SPIKE DUP.</u>	<u>% REC. CONTROL LIMITS</u>	<u>MAX RPD</u>
METHANE	*	1	7.1	6.1	7.6	93	80	50-150	15 50

NOTES: PPM = Parts Per Million, mg/l.
 BDL = Below Detection Limit
 Source for control limits is internal laboratory quality assurance program and reference below.
 SAMPLE SPIKED AND DUPLICATED - 91-8823-1.

REFERENCE: *Gas Chromatographic method employing direct injection on column with flame ionization detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 161-13-R69

LAB ID: 91-8825-1

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: II

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
91-8825-1-1	911202	12-02-91	12-03-91	N/A	12-04-91	EW0081	C



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0081

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		12-02-91	12-03-91	12-04-91
PARAMETERS	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
METHYL TERT-BUTYL ETHER	10 PPB	BDL	BDL	BDL
BENZENE	1 PPB	BDL	BDL	BDL
ETHYL BENZENE	1 PPB	BDL	BDL	BDL
TOLUENE	5 PPB	BDL	BDL	BDL
XYLENE	2 PPB	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	.5 PPM	BDL	BDL	BDL
BROMOFLUROBENZENE	*SURR* (50-150)	104	110	111
CHLOROBENZENE	*SURR* (50-150)	92	84	90

NOTE:

Units in PPB = ug/l, Units in PPM = mg/l

BDL = Below Detection limit.

Results reported are blank corrected.

Source for control limits is internal laboratory quality assurance program and the method reference.

N/S = NOT SUBMITTED

N/A = NOT APPLICABLE



WATER MATRIX SPIKE

BATCH NUMBER: EW0081

SAMPLE SPIKED: 91-8484-1

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	MS CONC	MS REC%#	REC LIMITS
BENZENE	50	BDL	49	98	50-150
TOLUENE	50	BDL	48	96	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	MSD CONC	MSD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	47	94	4	50	50-150
TOLUENE	50	BDL	45	90	6	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

Values outside of QC limits

0 out of 00 % recoveries out of limits

0 out of 00 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
MS	12-03-91	104%	94 %
MSD	12-03-91	115%	90 %

D = DILUTED OUT

NOTE: Units in ug/l = Parts Per Billion.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:



INDEPENDENT QC CHECK

BATCH NUMBER: EIC1114W

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	IQC CONC	IQC REC%#	REC LIMITS
BENZENE	50	BDL	54	108	50-150
TOLUENE	50	BDL	52	104	50-150

Column to be used to flag recovery and RPD values with an asterisk

Values outside of QC limits

0 out of 2 % recoveries out of limits

0 out of 2 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
IQC	11-14-91	96 %	97 %

= DILUTED OUT

NOTE: Units in ug/l = Parts Per Billion.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

QC LIMITS
 S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: Geo Engineers

ATI Lab ID # 91- 8825

	SAMPLE	DATE
PROJ NUMBER: <u>161-13-R69</u>	1 <u>911202</u>	<u>12/02/91</u>
PROJ NAME: <u>Unocal Westlake-Mercer</u>	2 _____	_____
	3 _____	_____
SAMPLED BY: <u>N/S</u>	4 _____	_____
SAMPLE SITE: <u>N/S</u>	5 _____	_____
	6 _____	_____
SAMPLE DATE: <u>12/02/91</u>	7 _____	_____
SAMPLE TIME: <u>N/S</u>	8 _____	_____
SAMPLE TYPE: <u>Vapor (Air)</u>	9 _____	_____
RUSH: Y <input checked="" type="radio"/> QC: N 0 1 <input checked="" type="radio"/> 3 4	10 _____	_____
Date Received: <u>12/03/91</u>	11 _____	_____
Is there a chain of custody? <input checked="" type="radio"/> N	12 _____	_____
Was chain of custody signed? <input checked="" type="radio"/> N	13 _____	_____
Were samples received cold? Y <input checked="" type="radio"/> N	14 _____	_____
Were samples received in proper containers? <input checked="" type="radio"/> N	15 _____	_____
Were samples preserved correctly? <input checked="" type="radio"/> N	16 _____	_____
Were air bubbles present in volatile bottles? Y <u>N/A</u> N	17 _____	_____
Were samples within holding time? <input checked="" type="radio"/> N	18 _____	_____
SHIPPED BY: <u>FED-EX</u>	19 _____	_____
<u>165 717 5656</u>	20 _____	_____

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL [Signature] 12/3/91 INSPECTED BY TD DATE INSPECTED/ 12/03/91
COPIES OF REPORT 1



Analytical Technologies, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 91-9337
Order Number: P52293
Received Date: 12/17/91
Client: 07061
Sampled By: W.A.P.
Sample Date: 12/16/91
Sample Time: N/S

Project Number: 161-13-R69
Project Name: UNOCAL WESTLAKE & MERCER
Sample Site: N/S
Sample Type: VAPOR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
9337-1	911216-1	METHANE	PPM	5250	2.0

Comments: PPM = Parts Per Million, mg/l. BDL = Below Detection Limits. Method Ref: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Ed., 11/86. Analysis Method Designed by Analytical Technologies, Inc.

Approved By : RL RL
page 1



Client: GEOENGINEERS

Lab I.D.#: 91-9337-1

Project Number: 161-13-R69

Received Date: 12/17/91

Project Name: UNOCAL WESTLAKE & MERCER

Sampled By: W.A.P.

Sample Site: N/S

Sample Type: VAPOR

Sample ID.: 911216-1

Sample Date: 12/16/91

Time: N/S

R/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	BDL	1
ETHYL BENZENE	MG/M3	BDL	1
TOLUENE	MG/M3	BDL	5
XYLENES	MG/M3	BDL	2
TOTAL PETROLEUM HYDROCARBONS	MG/M3	BDL	500
BROMOFLUOROBENZENE *SURR*	% REC	89	
CHLOROBENZENE *SURR*	% REC	92	



Analytical Technologies, Inc.

11 EAST OLIVE ROAD
PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001

GEOENGINEERS

PROJECT: 161-13-R69

QC LEVEL II

LAB ID: 91-9337

BATCH: CA0080

LAB ID CLIENT ID ANALYSIS DATE

91-9337-1 911216-1 01-08-92

MATRIX SPIKE

01-08-92

MATRIX SPIKE DUP.

01-08-92

DI BLANK

01-08-92

<u>PARAMETER</u>	<u>METHOD</u>	<u>DETECTION LIMIT</u>	<u>BLANK</u>	MATRIX SPIKE <u>RESULTS</u>	MATRIX SPIKE <u>EXPECTED SPIKE</u>	%REC MATRIX <u>SPIKE</u>	%REC CONTROL <u>LIMITS</u>	MAX RPD
METHANE	*	2	BDL	30.0	30.1	100	50-150	3 50
				29.2		97		

NOTES:

PPM - Parts Per Million, mg/l.

BDL - Below Detection Limit

Source for control limits is internal laboratory quality assurance

program and reference below.

SAMPLE SPIKED AND DUPLICATED - 91-9337-1.

REFERENCE: *Gas Chromatographic method employing direct injection on column with flame ionization detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 161-13-R69

LAB ID: 91-9337

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: II

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
91-9337-1	911216-1	12-16-91	12-17-91	N/A	12-18-91	EW0085	C



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0085

PARAMETERS

		BLANK A	BLANK B	BLANK C
	EXTRACTION DATE	N/A	N/A	N/A
	ANALYSIS DATE	12-16-91	12-17-91	12-18-91
	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
ETHYL TERT-BUTYL ETHER	10 PPB	BDL	BDL	BDL
BENZENE	1 PPB	BDL	BDL	BDL
ETHYL BENZENE	1 PPB	BDL	BDL	BDL
TOLUENE	5 PPB	BDL	BDL	BDL
XYLENE	2 PPB	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	.5 PPM	BDL	BDL	BDL
BROMOFLUROBENZENE	*SURR* (50-150)	110	106	101
CHLOROBENZENE	*SURR* (50-150)	85	91	90

NOTE:

Units in PPB = ug/l, Units in PPM = mg/l

BDL = Below Detection limit.

Results reported are blank corrected.

Source for control limits is internal laboratory quality assurance program and the method reference.

N/S = NOT SUBMITTED

N/A = NOT APPLICABLE



WATER MATRIX SPIKE

BATCH NUMBER: EW0085

SAMPLE SPIKED: 91-9311-3

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	MS CONC	MS REC%#	REC LIMITS
BENZENE	50	BDL	46	92	50-150
TOLUENE	50	BDL	45	90	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	MSD CONC	MSD REC%#	% RPD#	QC LIMITS RPD	REC
BENZENE	50	BDL	49	98	6	50	50-150
TOLUENE	50	BDL	48	96	6	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 00 % recoveries out of limits

0 out of 00 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
MS	12-18-91	100%	97%
MSD	12-18-91	89%	101%

D = DILUTED OUT

NOTE: Units in ug/l = Parts Per Billion.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

QC LIMITS
 S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:



INDEPENDENT QC CHECK

BATCH NUMBER: EIC1114W

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	IQC CONC	IQC REC%#	REC LIMITS
BENZENE	50	BDL	54	108	50-150
TOLUENE	50	BDL	52	104	50-150

* Column to be used to flag recovery and RPD values with an asterisk

Values outside of QC limits

0 out of 2 % recoveries out of limits

0 out of 2 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
IQC	11-14-91	96 %	97 %

= DILUTED OUT

NOTE: Units in ug/l = Parts Per Billion.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

	QC LIMITS
S1 = BROMOFLUOROBENZENE	(50-150)
S2 = CHLOROBENZENE	(50-150)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEOENGINEERS, INC. ATI Lab ID # 91-9337

	SAMPLE	DATE
PROJ NUMBER: <u>161-13-R69</u>	1 <u>911216-1</u>	<u>12-16-91</u>
PROJ NAME: <u>UNOCA1 Nestlake</u>	2 _____	_____
<u>+ Mercer</u>	3 _____	_____
SAMPLED BY: <u>WAP</u>	4 _____	_____
SAMPLE SITE: <u>N/S</u>	5 _____	_____
SAMPLE DATE: <u>12-16-91</u>	6 _____	_____
SAMPLE TIME: <u>N/S</u>	7 _____	_____
SAMPLE TYPE: <u>VAPOR</u>	8 _____	_____
RUSH: Y <input checked="" type="radio"/> N <input type="radio"/> QC: N 0 1 <input checked="" type="radio"/> 2 3 4	9 _____	_____
Date Received: <u>12-17-91</u>	10 _____	_____
Is there a chain of custody? <input checked="" type="radio"/> Y <input type="radio"/> N	11 _____	_____
Was chain of custody signed? <input checked="" type="radio"/> Y <input type="radio"/> N	12 _____	_____
Were samples received cold? Y <input checked="" type="radio"/> N <input type="radio"/>	13 _____	_____
Were samples received in proper containers? <input checked="" type="radio"/> Y <input type="radio"/> N	14 _____	_____
Were samples preserved correctly? <input checked="" type="radio"/> Y <input type="radio"/> N	15 _____	_____
Were air bubbles present in volatile bottles? <u>N/A</u> Y N	16 _____	_____
Were samples within holding time? <input checked="" type="radio"/> Y <input type="radio"/> N	17 _____	_____
SHIPPED BY: <u>FED EX</u>	18 _____	_____
<u>1657176312</u>	19 _____	_____
	20 _____	_____

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL [Signature] 12/17/91 INSPECTED BY [Signature] DATE INSPECTED/ 12-17-91
 # COPIES OF REPORT 1

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: Geo Engineers

ATI Lab ID # 91- 8825

PROJ NUMBER: 161-13-R69

SAMPLE	DATE
1	<u>911202</u>
2	
3	
4	
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7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

PROJ NAME: Unocal Westlake-Mercer

SAMPLED BY: N/S

SAMPLE SITE: N/S

SAMPLE DATE: 12/02/91

SAMPLE TIME: N/S

SAMPLE TYPE: Vapor (Air)

RUSH: Y QC: N 0 1 3 4

Date Received: 12/03/91

Is there a chain of custody? Y N

Was chain of custody signed? Y N

Were samples received cold? Y N

Were samples received in proper containers? Y N

Were samples preserved correctly? Y N

Were air bubbles present in volatile bottles? Y N/A N

Were samples within holding time? Y N

SHIPPED BY: FED-EX
165 717 5656

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS HEREOF.

CLIENT APPROVAL Jan 12/13/91

INSPECTED BY TD

DATE INSPECTED/ 12/03/91
COPIES OF REPORT 1

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEOENGINEERS, INC. ATI Lab ID # 91-9337

PROJ NUMBER: 161-13-R69
PROJ NAME: UNOCA/ Nestlake
+ Mercer
SAMPLED BY: WAP
SAMPLE SITE: N/S
SAMPLE DATE: 12-16-91
SAMPLE TIME: N/S
SAMPLE TYPE: VAPOR

SAMPLE	DATE
1	<u>911216-1</u> <u>12-16-91</u>
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
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15	
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20	

GeoEngineers

DEC 26 1991

Routing
File

RUSH: Y N QC: N 0 1 2 3 4
Date Received: 12-17-91
Is there a chain of custody? Y N
Was chain of custody signed? Y N
Were samples received cold? Y N
Were samples received in proper containers? Y N
Were samples preserved correctly? Y N
Were air bubbles present in volatile bottles? N/A Y N
Were samples within holding time? Y N
SHIPPED BY: FED EX
1657176312

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS HEREOF.

PM APPROVAL galt 12/17/91 INSPECTED BY COT DATE INSPECTED/ 12-17-91
COPIES OF REPORT 1



Analytical Technologies, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 91-9651
Order Number: P52755
Received Date: 12/31/91
Client: 07061
Sampled By: N/S
Sample Date: 12/30/91
Sample Time: N/S

N/S = Not Submitted

Project Number: 161-13-R69
Project Name: UNOCAL WESHAL & MERCER
Sample Site: N/S
Sample Type: VAPOR (AIR)

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
9651-1	911230-1	METHANE	PPM	725	2.0

GeoEngineers

JAN 20 1992

Routing *NLP*

File _____

Comments: PPM = Parts Per Million, mg/l. MG/M3 = Milligrams Per Cubic Meter.
Method Refs: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Edition, 11/86 and Analysis Method

page 1 Approved By : *[Signature]*



Analytical Technologies, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

Client: GEOENGINEERS

Lab I.D.#: 91-9651-1

Project Number: 161-13-R69

Received Date: 12/31/91

Project Name: UNOCAL WESHAL & MERCER

Sampled By: N/S

Sample Site: N/S

Sample Type: VAPOR (AIR)

Sample ID.: 911230-1

Sample Date: 12/30/91

Time: N/S

AIR/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	BDL	1
ETHYL BENZENE	MG/M3	BDL	1
TOLUENE	MG/M3	BDL	5
XYLENES	MG/M3	6	2
TOTAL PETROLEUM HYDROCARBONS	MG/M3	BDL	500
BROMOFLUOROBENZENE *SURR*	% REC	96	
CHLOROBENZENE *SURR*	% REC	99	



Analytical Technologies, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

CLIENT: GEOENGINEERS

PROJECT: 161-13-R69

LAB ID: 91-9651

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
91-9651-1	911230-1	12-30-91	12-31-91	N/A	01-09-92	EW0002	B



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0002

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		01-08-92	01-09-92	N/A
PARAMETERS	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
METHYL TERT-BUTYL ETHER	10 PPB	N/A	BDL	BDL
BENZENE	1 PPB	N/A	BDL	BDL
ETHYL BENZENE	1 PPB	N/A	BDL	BDL
TOLUENE	5 PPB	N/A	BDL	BDL
XYLENE	2 PPB	N/A	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	.5 PPM	BDL	BDL	BDL
BROMOFLUROBENZENE	*SURR* (50-150)	N/A	104	N/A
CHLOROBENZENE	*SURR* (50-150)	N/A	94	N/A

NOTE:

Units in PPB = ug/l, Units in PPM = mg/l

BDL = Below Detection limit.

Results reported are blank corrected.

Source for control limits is internal laboratory quality assurance program and the method reference.

N/S = NOT SUBMITTED

N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0002

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	50	100	50-150
TOLUENE	50	BDL	49	98	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	52	104	4	50	50-150
TOLUENE	50	BDL	52	104	6	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits

0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	01-09-92	98 %	102 %
SPD	01-09-92	104 %	96 %

D = DILUTED OUT

NOTE:

Units in ug/l = Parts Per Billion.

BDL = Below Detection Limit.

Results reported are blank corrected.

Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE

S2 = CHLOROBENZENE

QC LIMITS

(50-150)

(50-150)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: ATI^{mb} Geo Engineers

ATI Lab ID # 91-9651

	SAMPLE	DATE
PROJ NUMBER: <u>161-13-R69</u>	1 <u>911230-1</u>	<u>12/30</u>
PROJ NAME: <u>Unocal WestHal</u>	2 _____	_____
<u>+ Mercer</u>	3 _____	_____
SAMPLED BY: <u>NLS</u>	4 _____	_____
SAMPLE SITE: <u>NLS</u>	5 _____	_____
SAMPLE DATE: <u>12/30/91</u>	6 _____	_____
SAMPLE TIME: <u>NLS</u>	7 _____	_____
SAMPLE TYPE: <u>Vapor (Air)</u>	8 _____	_____
RUSH: Y <input checked="" type="radio"/> N <input type="radio"/> QC: N, 0 <input checked="" type="radio"/> 1 2 3 4	9 _____	_____
Date Received: <u>12/31/91</u>	10 _____	_____
Is there a chain of custody? <input checked="" type="radio"/> Y <input type="radio"/> N	11 _____	_____
Was chain of custody signed? <input checked="" type="radio"/> Y <input type="radio"/> N	12 _____	_____
Were samples received cold? <input checked="" type="radio"/> Y <input checked="" type="radio"/> N	13 _____	_____
Were samples received in proper containers? <input checked="" type="radio"/> Y <input type="radio"/> N	14 _____	_____
Were samples preserved correctly? <input checked="" type="radio"/> Y <input type="radio"/> N	15 _____	_____
Were air bubbles present in volatile bottles? Y <input checked="" type="radio"/> N <input type="radio"/>	16 _____	_____
Were samples within holding time? <input checked="" type="radio"/> Y <input type="radio"/> N	17 _____	_____
SHIPPED BY: <u>FedEx</u>	18 _____	_____
	19 _____	_____
	20 _____	_____

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL RR 12/31 INSPECTED BY mb DATE INSPECTED/ 12/31
 # COPIES OF REPORT 1



GeoEngineers

JUN 18 1997

Routing

WAP

File

GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 92-1134
Order Number: P54400
Received Date: 02/13/92
Client: 07061
Sampled By: W.A.P.
Sample Date: 02/11/92
Sample Time: N/S

N/S = Not Submitted

Project Number: 161-013-R69
Project Name: UNOCAL WESTLAKE & MERCER
Sample Site: N/S
Sample Type: AIR

ID	Sample ID	Parameter	Units	Results	Detection Limit
84-1	920211-1	METHANE	PPM	39	1
84-2	920211-2	METHANE	PPM	1200	1

Comments: MG/M3 = Milligrams Per Cubic Meter. PPM = Parts Per Million.
Method References: Analysis Method Designed by Analytical Technologies, Inc.,
and Compendium of Methods for the Determination of Toxic Organic Compounds in
Ambient Air, SW-846, 3rd Ed. 11/86. BDL = Below Detection Limits.
THIS IS A REVISED REPORT: JUNE 17, 1992.

Approved By : 
page 1



Client: GEOENGINEERS

Lab I.D.#: 92-1134-1

Project Number: 161-013-R69
Project Name: UNOCAL WESTLAKE & MERCER
Sample Site: N/S
Sample Type: AIR

Received Date: 02/13/92
Sampled By: W.A.P.

Sample ID.: 920211-1 Sample Date: 02/11/92 Time: N/S

AIR/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	BDL	0.2
ETHYL BENZENE	MG/M3	BDL	0.2
TOLUENE	MG/M3	BDL	0.9
XYLENES	MG/M3	3.2	0.4
TOTAL PETROLEUM HYDROCARBONS	MG/M3	100	90
BROMOFLUOROBENZENE *SURR*	% REC	91	
CHLOROBENZENE *SURR*	% REC	83	



Client: GEOENGINEERS

Lab I.D.#: 92-1134-2

Project Number: 161-013-R69

Received Date: 02/13/92

Project Name: UNOCAL WESTLAKE & MERCER

Sampled By: W.A.P.

Sample Site: N/S

Sample Type: AIR

Sample ID.: 920211-2

Sample Date: 02/11/92

Time: N/S

AIR/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	20	0.2
ETHYL BENZENE	MG/M3	6.6	0.2
TOLUENE	MG/M3	13	1
XYLENES	MG/M3	25	0.4
TOTAL PETROLEUM HYDROCARBONS	MG/M3	1000	100
BROMOFLUOROBENZENE *SURR*	% REC	83	
CHLOROBENZENE *SURR*	% REC	87	



Analytical Technologies, Inc.

11 EAST OLIVE ROAD PENSACOLA, FLORIDA 32514 PHONE (904) 474-1001

GEOENGINEERS

PROJECT: 161-013-R69

QC LEVEL I

LAB ID: 92-1134

BATCH: CA0089

ANALYSIS DATE

LAB ID CLIENT ID

92-1134-1 920211-1 02-26-92
92-1134-2 920211-2 02-26-92
SPIKE 02-26-92
SPIKE DUP. 02-26-92

C DI BLANK 02-26-92

Table with columns: PARAMETER, METHOD, DETECTION LIMIT, SPIKE RESULTS, BLANK, SPIKE DUPLICATE RESULTS, EXPECTED SPIKE, %REC SPIKE, %REC SPIKE DUP., % REC. CONTROL LIMITS, MAX RPD. Row 1: METHANE, *, 1, 730, BDL, 710, 1000, 73, 71, 50-150, 3, 50.

NOTES: PPM = Parts per Million. BDL = Below Detection Limit. Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: *Gas Chromatographic method employing direct injection on column with flame ionization detector (FID).



Analytical Technologies, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

CLIENT: GEOENGINEERS

PROJECT: 161-013-R69

LAB ID: 92-1134

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
92-1134-1	920211-1	02-11-92	02-13-92	N/A	02-20-92	EW0013	A
92-1134-2	920211-2	02-11-92	02-13-92	N/A	02-20-92	EW0013	A



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0013

PARAMETERS

		BLANK A	BLANK B	BLANK C
	EXTRACTION DATE	N/A	N/A	N/A
	ANALYSIS DATE	02-20-92	02-21-92	02-22-92
	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
ETHYL TERT-BUTYL ETHER	10 mg/m3	BDL	BDL	BDL
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUROBENZENE	*SURR* (50-150)	97	100	102
CHLOROBENZENE	*SURR* (50-150)	74	72	89

NOTE:

Units in mg/m3 = milligrams per cubic meter.

BDL = Below Detection limit.

Results reported are blank corrected.

Source for control limits is internal laboratory quality assurance program and the method reference.

N/S = NOT SUBMITTED

N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0013

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	40	80	50-150
TOLUENE	50	BDL	46	92	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	44	88	10	50	50-150
TOLUENE	50	BDL	47	94	2	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits
0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	02-20-92	103%	96 %
SPD	02-20-92	100%	94 %

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
BDL = Below Detection Limit.
Results reported are blank corrected.
Source for control limits is internal laboratory quality assurance program and method reference.

	QC LIMITS
S1 = BROMOFLUOROBENZENE	(50-150)
S2 = CHLOROBENZENE	(50-150)

COMMENTS:

SAMPLE, INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: Geo Engineers

ATI Lab ID # 92- 1134

PROJECT NUMBER: 161-013-R69
 PROJ NAME: Unocal Westlake
& Mercer
 SAMPLED BY: W.A.P.
 SAMPLE SITE: N/S
 SAMPLE DATE: 02/11/92
 SAMPLE TIME: N/S
 SAMPLE TYPE: Air

SAMPLE	DATE
1 <u>920211-1</u>	<u>02/11/92</u>
2 <u>920211-2</u>	<u>02/11/92</u>
3 _____	_____
4 _____	_____
5 _____	_____
6 _____	_____
7 _____	_____
8 _____	_____
9 _____	_____
10 _____	_____
11 _____	_____
12 _____	_____
13 _____	_____
14 _____	_____
15 _____	_____
16 _____	_____
17 _____	_____
18 _____	_____
19 _____	_____
20 _____	_____

QC: Y N QC: N 0 1 2 3 4
 Date Received: 2/13/92
 Is there a chain of custody? Y N
 Is chain of custody signed? Y N
 Were samples received cold? Y N
 Were samples received in proper containers? Y N
 Were samples preserved correctly? Y N
 Were air bubbles present in volatile bottles? Y N/A
 Were samples within holding time? Y N
 SHIPPED BY: Joe SX

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS HEREOF.

APPROVAL RR 2/13/92 INSPECTED BY 50 DATE INSPECTED 2/13/92
 # COPIES OF REPORT _____

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GeoEngineers

ATI Lab ID # 92- 1134

PROJ NUMBER: 161-013-R69
 PROJ NAME: Unocal Westlake
& Mercer

SAMPLED BY: W.A.P.

SAMPLE SITE: N/S

SAMPLE DATE: 02/11/92

SAMPLE TIME: N/S

SAMPLE TYPE: A/R

RUSH: Y N QC: N 0 1 2 3 4

Date Received: 2/13/92

Is there a chain of custody? Y N

Was chain of custody signed? Y N

Were samples received cold? Y N

Were samples received in proper containers? Y N

Were samples preserved correctly? Y N

Were air bubbles present in volatile bottles? Y N N/A

Were samples within holding time? Y N

SHIPPED BY: Joe Ex

SAMPLE	DATE
1 <u>920211-1</u>	<u>02/11/92</u>
2 <u>920211-2</u>	<u>02/11/92</u>
3 _____	_____
4 _____	_____
5 _____	_____
6 _____	_____
7 _____	_____
8 _____	_____
9 _____	_____
10 _____	_____
11 _____	_____
12 _____	_____
13 _____	_____
14 _____	_____
15 _____	_____
16 _____	_____
17 _____	_____
18 _____	_____
19 _____	_____
20 _____	_____

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS HEREOF.

PM APPROVAL PRZ/13/92 INSPECTED BY 50 DATE INSPECTED 2/13/92
 # COPIES OF REPORT _____



Client: GEOENGINEERS

Lab I.D.#: 92-1134-1

Project Number: 161-013-R69

Received Date: 02/13/92

Project Name: UNOCAL WESTLAKE & MERCER

Sampled By: W.A.P.

Sample Site: N/S

Sample Type: AIR

Sample ID.: 920211-1

Sample Date: 02/11/92 Time: N/S

IR/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	BDL	0.2
ETHYL BENZENE	MG/M3	BDL	0.2
TOLUENE	MG/M3	BDL	0.9
XYLENES	MG/M3	3.2	0.4
TOTAL PETROLEUM HYDROCARBONS	MG/M3	100	90
BROMOFLUOROBENZENE *SURR*	% REC	91	
CHLOROBENZENE *SURR*	% REC	83	



Client: GEOENGINEERS

Lab I.D.#: 92-1134-2

Project Number: 161-013-R69

Received Date: 02/13/92

Project Name: UNOCAL WESTLAKE & MERCER

Sampled By: W.A.P.

Sample Site: N/S

Sample Type: AIR

Sample ID.: 920211-2

Sample Date: 02/11/92

Time: N/S

AIR/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	20	0.2
ETHYL BENZENE	MG/M3	6.6	0.2
TOLUENE	MG/M3	13	1
XYLENES	MG/M3	25	0.4
TOTAL PETROLEUM HYDROCARBONS	MG/M3	1000	100
BROMOFLUOROBENZENE *SURR*	% REC	83	
CHLOROBENZENE *SURR*	% REC	87	



GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 92-1422
Order Number: P54805
Received Date: 02/24/92
Client: 07061
Sampled By: W.A.P.
Sample Date: 02/21/92
Sample Time: N/S

Project Number: 161-13-R69
Project Name: UNOCAL WESTLAKE & MERCER
Sample Site: N/S
Sample Type: VAPOR (AIR)

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
22-1	MW-29	METHANE	GM/M3	23000	1
22-2	MW-37	METHANE	GM/M3	4700	1

Comments: MG/M3 = Milligrams Per Cubic Meter. GM/M3 = Grams Per Cubic Meter.
Method Ref: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Ed. 11/86. Analysis Method Designed by Analytical Technologies, Inc. BDL = Below Detection Limits

Approved By : RL RL



Client: GEOENGINEERS

Lab I.D.#: 92-1422-1

Project Number: 161-13-R69

Received Date: 02/24/92

Project Name: UNOCAL WESTLAKE & MERCER

Sampled By: W.A.P.

Sample Site: N/S

Sample Type: VAPOR (AIR)

Sample ID.: MW-29

Sample Date: 02/21/92

Time: N/S

AIR/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	1	1
ETHYL BENZENE	MG/M3	BDL	1
TOLUENE	MG/M3	BDL	5
XYLENES	MG/M3	BDL	2
TOTAL PETROLEUM HYDROCARBONS	MG/M3	3000	500
BROMOFLUOROBENZENE *SURR*	% REC	104	
CHLOROBENZENE *SURR*	% REC	91	



Client: GEOENGINEERS

Lab I.D.#: 92-1422-2

Project Number: 161-13-R69

Received Date: 02/24/92

Project Name: UNOCAL WESTLAKE & MERCER

Sampled By: W.A.P.

Sample Site: N/S

Sample Type: VAPOR (AIR)

Sample ID.: MW-37

Sample Date: 02/21/92 Time: N/S

IR/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	14	1
ETHYL BENZENE	MG/M3	7	1
TOLUENE	MG/M3	60	5
XYLENES	MG/M3	30	2
TOTAL PETROLEUM HYDROCARBONS	MG/M3	4000	500
BROMOFLUOROBENZENE *SURR*	% REC	70	
CHLOROBENZENE *SURR*	% REC	98	



GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 92-1134
Order Number: P54400
Received Date: 02/13/92
Client: 07061
Sampled By: W.A.P.
Sample Date: 02/11/92
Sample Time: N/S

Project Number: 161-013-R69
Project Name: UNOCAL WESTLAKE & MERCER
Sample Site: N/S
Sample Type: AIR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
1134-1	920211-1	METHANE	GM/M3	39	1
1134-2	920211-2	METHANE	GM/M3	1200	1

City of Seattle wells only

Comments: MG/M3 = Milligrams Per Cubic Meter. GM/M3 = Grams Per Cubic Meter.
Method References: Analysis Method Designed by Analytical Technologies, Inc.,
and Compendium of Methods for the Determination of Toxic Organic Compounds in
Ambient Air, SW-846, 3rd Ed. 11/86. BDL = Below Detection Limits

Approved By : RL RL



GeoEngineers

JUN 18 1992

GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Routing WAP
 Lab I.D.#/File 92-1422
 Order Number: P54805
 Received Date: 02/24/92
 Client: 07061
 Sampled By: W.A.P.
 Sample Date: 02/21/92
 Sample Time: N/S

Project Number: 161-13-R69
 Project Name: UNOCAL WESTLAKE & MERCER
 Sample Site: N/S
 Sample Type: VAPOR (AIR)

N/S = Not Submitted

ID	Sample ID	Parameter	Units	Results	Detection Limit
2-1	MW-29	METHANE	PPM	23000	1
2-2	MW-37	METHANE	PPM	4700	1

Comments: MG/M3 = Milligrams Per Cubic Meter. PPM = Parts Per Million.
 Method Ref: Compendium of Methods for the Determination of Toxic Organic
 Compounds in Ambient Air, SW-846, 3rd Ed. 11/86. Analysis Method Designed by
 Analytical Technologies, Inc. BDL = Below Detection Limits.
 THIS IS A REVISED REPORT: JUNE 17, 1992.

Approved By : *Rh Rh*
 page 1



Client: GEOENGINEERS

Lab I.D.#: 92-1422-2

Project Number: 161-13-R69

Received Date: 02/24/92

Project Name: UNOCAL WESTLAKE & MERCER

Sampled By: W.A.P.

Sample Site: N/S

Sample Type: VAPOR (AIR)

Sample ID.: MW-37

Sample Date: 02/21/92

Time: N/S

AIR/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	14	1
ETHYL BENZENE	MG/M3	7	1
TOLUENE	MG/M3	60	5
XYLENES	MG/M3	30	2
TOTAL PETROLEUM HYDROCARBONS	MG/M3	4000	500
BROMOFLUOROBENZENE *SURR*	% REC	70	
CHLOROBENZENE *SURR*	% REC	98	



Client: GEOENGINEERS

Lab I.D.#: 92-1422-1

Project Number: 161-13-R69
 Project Name: UNOCAL WESTLAKE & MERCER

Received Date: 02/24/92

Sample Site: N/S
 Sample Type: VAPOR (AIR)

Sampled By: W.A.P.

Sample ID.: MW-29

Sample Date: 02/21/92 Time: N/S

IR/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	1	1
ETHYL BENZENE	MG/M3	BDL	1
TOLUENE	MG/M3	BDL	5
XYLENES	MG/M3	BDL	2
TOTAL PETROLEUM HYDROCARBONS	MG/M3	3000	500
BROMOFLUOROBENZENE *SURR*	% REC	104	
CHLOROBENZENE *SURR*	% REC	91	

GEOENGINEERS

PROJECT: 161-13-R69

QC LEVEL I

LAB ID: 92-1422

BATCH: CA0089

<u>LAB ID</u>	<u>CLIENT ID</u>	<u>ANALYSIS DATE</u>
92-1422-1	MW-29	02-26-92
92-1422-2	MW-37	02-26-92
SPIKE		02-26-92
SPIKE DUP.		02-26-92

DI BLANK

C 1 219

<u>PARAMETER</u>	<u>METHOD</u>	<u>DETECTION LIMIT</u>	<u>BLANK</u>	<u>SPIKE RESULTS</u>	<u>SPIKE DUPLICATE RESULTS</u>	<u>EXPECTED SPIKE</u>	<u>%REC SPIKE</u>	<u>%REC SPIKE DUP.</u>	<u>% REC. CONTROL LIMITS</u>	<u>MAX RPD</u>
METHANE	*	1	BDL	730	710	1000	73	71	50-150	3 50

NOTES: PPM = Parts per Million.
 BDL = Below Detection Limit
 Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: *Gas Chromatographic method employing direct injection on column with flame ionization detector (FID).



Analytical Technologies, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

CLIENT: GEOENGINEERS

PROJECT: 161-13-R69

LAB ID: 92-1422

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
92-1422-1	MW-29	02-21-92	02-24-92	N/A	02-25-92	EW0014	C
92-1422-2	MW-37	02-21-92	02-24-92	N/A	02-25-92	EW0014	C



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0014

PARAMETERS

		BLANK A	BLANK B	BLANK C
	EXTRACTION DATE	N/A	N/A	N/A
	ANALYSIS DATE	02-23-92	02-24-92	02-25-92
	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
ETHYL TERT-BUTYL ETHER	10 mg/m3	BDL	BDL	BDL
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUROBENZENE	*SURR* (50-150)	102	97	110
CHLOROBENZENE	*SURR* (50-150)	89	103	96

NOTE:

Units in mg/m3 = milligrams per cubic meter.

BDL = Below Detection limit.

Results reported are blank corrected.

Source for control limits is internal laboratory quality assurance program and the method reference.

N/S = NOT SUBMITTED

N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0014

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	49	98	50-150
TOLUENE	50	BDL	47	94	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	53	106	8	50	50-150
TOLUENE	50	BDL	50	100	6	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits

0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	02-23-92	96 %	100%
SPD	02-23-92	96 %	102%

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

QC LIMITS
 S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEO ENGINEERS, INC.

ATI Lab ID # 92- 1422

PROJ NUMBER: 161-13-R69

SAMPLE	DATE
1 <u>MW-29</u>	<u>02/21/92</u>
2 <u>MW-37</u>	<u>↓</u>
3 _____	_____
4 _____	_____
5 _____	_____
6 _____	_____
7 _____	_____
8 _____	_____
9 _____	_____
10 _____	_____
11 _____	_____
12 _____	_____
13 _____	_____
14 _____	_____
15 _____	_____
16 _____	_____
17 _____	_____
18 _____	_____
19 _____	_____
20 _____	_____

PROJ NAME: UNOCAL WESTLAKE

EMERCER

SAMPLED BY: W. A. P.

SAMPLE SITE: N/S

SAMPLE DATE: 02/21/92

SAMPLE TIME: N/S

SAMPLE TYPE: VAPOR (AIR)

RUSH: Y N QC: N 0 1 2 3 4

Date Received: 02/24/92

Is there a chain of custody? Y N

Was chain of custody signed? Y N

Were samples received cold? Y N

Were samples received in proper containers? Y N

Were samples preserved correctly? Y N

Were air bubbles present in volatile bottles? N/A Y N

Were samples within holding time? Y N

SHIPPED BY: WPS-0003 7643 131

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL 02/24/92 INSPECTED BY ROC DATE INSPECTED 02/24/92
COPIES OF REPORT 1

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEO ENGINEERS, INC.

ATI Lab ID # 92- 14122

PROJ NUMBER: 161-13-R69

SAMPLE	DATE
1	<u>MW-29</u> <u>02/21/92</u>
2	<u>MW-37</u> <u>↓</u>
3	<u>GeoEngineers</u>
4	<u>FEB 28 1992</u>
5	<u>Routing</u> <input checked="" type="checkbox"/> <u>File</u> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
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PROJ NAME: UNOCAL WESTLAKE
EMERCER

SAMPLED BY: W.A.P.

SAMPLE SITE: N/S

SAMPLE DATE: 02/21/92

SAMPLE TIME: N/S

SAMPLE TYPE: VAPOR (AIR)

RUSH: Y N QC: N 0 1 2 3 4

Date Received: 02/24/92

Is there a chain of custody? Y N

Was chain of custody signed? Y N

Were samples received cold? Y N

Were samples received in proper containers? Y N

Were samples preserved correctly? Y N

Were air bubbles present in volatile bottles? N/A Y N

Were samples within holding time? Y N

SHIPPED BY: UPS - 0003 7643 131

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL PR 2/24/92 INSPECTED BY RCC DATE INSPECTED 02/24/92
COPIES OF REPORT 1



Analytical Technologies, Inc.

560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335

92-1422

DATE 2/21/92 PAGE 1 OF 1

Chain of Custody LABORATORY NUMBER:

PROJECT MANAGER: <u>Norm Pelt</u> COMPANY: <u>GeoEngineers Inc.</u> ADDRESS: <u>840 154th Ave NE</u> <u>Redmond WA 98052</u> PHONE: <u>(206) 861-6000</u> SAMPLED BY: <u>WAF</u>				ANALYSIS REQUEST 8010 Halogenated Volatiles 8020 Aromatic Volatiles 8020 BETX ONLY 8240 GCMS Volatiles 8270 GCMS BNA 8310 HPLC PNA 8080 Pesticides & PCB's 8080 PCB's ONLY 8140 Phosphate Pesticides 8150 Herbicides WDOE PAH/MH (MAC 173) 418.1 (TPH) 413.2 Grease & Oil 8015 (Modified) TOC 9060 TOX 9020 % Moisture EP TOX Metals (8) EP EXT Priority Pollutant Metals (13) 8080 Pesticide (4) 8240 ZH-EXT 8270 8150 Herbicides (2) Metals (8) NUMBER OF CONTAINERS			
SAMPLE DISPOSAL INSTRUCTIONS <input type="checkbox"/> ATI Disposal @ \$5.00 each <input type="checkbox"/> Return				SAMPLE RECEIPT TOTAL NUMBER OF CONTAINERS COC SEALS/INTACT? Y/N/W/A RECEIVED GOOD COND./COLD RECEIVED VIA:			
SAMPLE ID	DATE	TIME	MATRIX	LAB ID	PROJECT INFORMATION PROJECT NUMBER: <u>161-13-1267</u> PROJECT NAME: <u>Geac & Westlake/Merice</u> PURCHASE ORDER NUMBER: ONGOING PROJECT? YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS TAT: (NORMAL) <input type="checkbox"/> 2WKS (RUSH) <input type="checkbox"/> 24HR <input type="checkbox"/> 48 HRS <input type="checkbox"/> 72 HRS <input type="checkbox"/> 1 WK GREATER THAN 24 HR. NOTICE? YES <input type="checkbox"/> NO <input type="checkbox"/> (LAB USE ONLY)		
<u>MW-29</u>	<u>2/21/92</u>		<u>Vapor</u>		RELINQUISHED BY: 1. Signature: <u>William Altek</u> Date: <u>2/21/92</u> RELINQUISHED BY: 2. Signature: _____ Date: _____ RELINQUISHED BY: 3. Signature: _____ Date: _____		
<u>MW-37</u>	<u>2/21/92</u>		<u>Vapor</u>		RECEIVED BY: 1. Signature: <u>William Altek</u> Date: <u>2/21/92</u> RECEIVED BY: 2. Signature: _____ Date: _____ RECEIVED BY: (LAB) 3. Signature: _____ Date: _____		
SPECIAL INSTRUCTIONS:				COMPANY: <u>ATI Renton</u> DISTRIBUTION: <u>White, Canary - ATI - Pink - ORIGINATOR</u>			



Analytical Technologies, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

Seattle wells on

GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 92-1596
Order Number: P55086
Received Date: 03/02/92
Client: 07061
Sampled By: W.A.P.
Sample Date: 02/28/92
Sample Time: N/S

Project Number: 161-13-R69
Project Name: UNOCAL WESTLAKE & MERCER
Sample Site: N/S
Sample Type: VAPOR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
96-1	920228-1	METHANE	PPM	640	0.5

GeoEngineers

MAR 12 1992

Routing *MLT*
File

Comments: MG/M3 = Milligrams Per Cubic Meter. PPM = Parts Per Million.
Method Refs: Compendium of Method the Determination of Toxic Organic Compounds
Ambient Air, SW-846, 3rd Ed., 11/86. Analysis Methods Designed by Analytical
Technologies, Inc. BDL = Below Detection Limits.

Approved By : *[Signature]*



Analytical Technologies, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

Client: GEOENGINEERS

Lab I.D.#: 92-1596-1

Project Number: 161-13-R69

Received Date: 03/02/92

Project Name: UNOCAL WESTLAKE & MERCER

Sampled By: W.A.P.

Sample Site: N/S

Sample Type: VAPOR

Sample ID.: 920228-1

Sample Date: 02/28/92

Time: N/S

AIR/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	25	1
ETHYL BENZENE	MG/M3	12	1
TOLUENE	MG/M3	48	5
XYLENES	MG/M3	50	2
TOTAL PETROLEUM HYDROCARBONS	MG/M3	3000	500
BROMOFLUOROBENZENE *SURR*	% REC	82	
CHLOROBENZENE *SURR*	% REC	95	



Analytical **Technologies**, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

Q U A L I T Y C O N T R O L
D A T A

GEOENGINEERS

PROJECT: 161-13-R69

QC LEVEL I

LAB ID: 92-1596

BATCH: CA0090

LAB ID	CLIENT ID	ANALYSIS DATE
92-1596-1	920228-1	03-02-92
SPIKE		03-02-92
SPIKE DUP.		03-02-92
DI BLANK		03-02-92

PARAMETER	METHOD	DETECTION LIMIT	BLANK	SPIKE RESULTS	SPIKE DUPLICATE RESULTS	EXPECTED SPIKE	%REC SPIKE	%REC SPIKE DUP.	% REC. CONTROL LIMITS	MAX RPD
METHANE	*	0.5	BDL	53	49	50	106	98	50-150	8 50

NOTES: PPM = Parts per Million.
 BDL = Below Detection Limit
 Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: *Gas Chromatographic method employing direct injection on column with flame ionization detector (FID).



Analytical Technologies, Inc.

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

CLIENT: GEOENGINEERS

PROJECT: 161-13-R69

LAB ID: 92-1596

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
92-1596-1	920228-1	02-28-92	03-02-92	N/A	03-02-92	EW0016	A



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0016

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		03-02-92	03-03-92	N/A
PARAMETERS	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
	METHYL TERT-BUTYL ETHER	10 mg/m3	BDL	BDL
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUROBENZENE	*SURR* (50-150)	100	90	N/A
CHLORO BENZENE	*SURR* (50-150)	88	96	N/A

NOTE:

Units in mg/m3 = milligrams per cubic meter.

BDL = Below Detection limit.

Results reported are blank corrected.

Source for control limits is internal laboratory quality assurance program and the method reference.

N/S = NOT SUBMITTED

N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0016

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	48	96	50-150
TOLUENE	50	BDL	49	98	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	46	92	4	50	50-150
TOLUENE	50	BDL	46	92	6	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

Values outside of QC limits

0 out of 4 % recoveries out of limits

0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	03-02-92	100%	99 %
SPD	03-02-92	96 %	98 %

= DILUTED OUT

NOTE: Units in mg/m³ = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE QC LIMITS (50-150)
 S2 = CHLOROBENZENE QC LIMITS (50-150)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEOENGINEERS, INC.

ATI Lab ID # 92- 1596

PROJ NUMBER: N/S 2/12 161-73-R69
 PROJ NAME: UNOCAL WESTLAKE & MERCER
 SAMPLED BY: N/S 2/12 W.A.P.
 SAMPLE SITE: N/S
 SAMPLE DATE: 2/28/92
 SAMPLE TIME: N/S
 SAMPLE TYPE: VAPOR

SAMPLE	DATE
1	<u>920228-1</u>
2	
3	
4	
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7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

RUSH: Y N QC: N 0 1 2 3 4
 Date Received: 3/2/92
 Is there a chain of custody? Y N
 Was chain of custody signed? Y N
 Were samples received cold? Y N
 Were samples received in proper containers? Y N
 Were samples preserved correctly? Y N
 Were air bubbles present in volatile bottles? N/A 2/12
 Y N
 Were samples within holding time? Y N

SHIPPED BY: FED EX
1331126624

OUT OF CONTROL EVENTS: 1331126624

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL [Signature] INSPECTED BY [Signature] DATE INSPECTED 3/2/92
 # COPIES OF REPORT 1

Chain of Custody LABORATORY NUMBER:

PROJECT MANAGER: Don Davis

COMPANY: Chlor-Alkali Services

ADDRESS: 1111 1st Ave NE

PHONE: 206-363-3355

SAMPLED BY: _____

AT1 Disposal @ \$5.00 each Return

SAMPLE DISPOSAL INSTRUCTIONS

ANALYSIS REQUEST		NUMBER OF CONTAINERS
8010 Halogenated Volatiles		
8020 Aromatic Volatiles		
8020 BETX ONLY		
8240 GCMS Volatiles		
8270 - GCMS BNA		
8310 HPLC PNA		
8080 Pesticides & PCB's		
8080 PCB's ONLY		
8140 Phosphate Pesticides		
8150 Herbicides		
WDOE PAH/H (WAC 173)		
418.1 (TPH)		
413.2 Grease & Oil		
8015 (Modified)		
TOC 9050		
TOX 9020		
% Moisture		
EP TOX Metals (8) EP EXT		
Priority Pollutant Metals (13)		
8080 Pesticide (4)		
8240 ZH-EXT		
8270		
8150 Herbicides (2)		
Metals (8)		

PROJECT INFORMATION

PROJECT NUMBER: 1111 1st Ave NE

PROJECT NAME: Chlor-Alkali Services

PURCHASE ORDER NUMBER: _____

ONGOING PROJECT? YES NO

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) 2WKS (RUSH) 24HR 48 HRS 72 HRS 1 WK

GREATHER THAN 24 HR. NOTICE? YES NO (LAB USE ONLY)

SPECIAL INSTRUCTIONS: _____

SAMPLE RECEIPT		RELINQUISHED BY:		RELINQUISHED BY:	
TOTAL NUMBER OF CONTAINERS	COC SEALS/INTACT? Y/N/NA	Signature:	Time:	Signature:	Time:
		<u>Don Davis</u>	<u>12/1/92</u>		
		<u>William White</u>	<u>2/1/93</u>		
		Company: <u>ATI</u>		Company: <u>ATI</u>	
		RECEIVED BY: <u>William White</u>	RECEIVED BY: (LAB) <u>3</u>		
		Signature: <u>William White</u>	Signature:		
		Date: <u>2/1/93</u>	Date:		
		Company: <u>ATI</u>	Company: <u>Analytical Technologies, Inc.</u>		

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEOENGINEERS, INC.

ATI Lab ID # 92- 1596a

	SAMPLE	DATE
PROJ NUMBER: <u>N/S 2/28/92 161-13-R69</u>	1 <u>920228-1</u>	<u>2/28/92</u>
PROJ NAME: <u>UNOCAL WELLSITE #</u>	2 _____	_____
<u>MERCER</u>	3 _____	_____
SAMPLED BY: <u>N/S 2/28/92 W.A.P.</u>	4 _____	_____
SAMPLE SITE: <u>N/S</u>	5 _____	_____
SAMPLE DATE: <u>2/28/92</u>	6 _____	_____
SAMPLE TIME: <u>N/S</u>	7 _____	_____
SAMPLE TYPE: <u>VAPOR</u>	8 _____	_____
RUSH: Y <input checked="" type="radio"/> N <input type="radio"/> QC: N 0 <input checked="" type="radio"/> 1 2 3 4	9 _____	_____
Date Received: <u>3/2/92</u>	10 _____	_____
Is there a chain of custody? <input checked="" type="radio"/> Y <input type="radio"/> N	11 _____	_____
Was chain of custody signed? <input checked="" type="radio"/> Y <input type="radio"/> N	12 _____	_____
Were samples received cold? <input checked="" type="radio"/> Y <input type="radio"/> N	13 _____	_____
Were samples received in proper containers? <input checked="" type="radio"/> Y <input type="radio"/> N	14 _____	_____
Were samples preserved correctly? <input checked="" type="radio"/> Y <input type="radio"/> N	15 _____	_____
Were air bubbles present in volatile bottles? <u>N/A 2/28/92</u> <input type="radio"/> Y <input checked="" type="radio"/> N	16 _____	_____
Were samples within holding time? <input checked="" type="radio"/> Y <input type="radio"/> N	17 _____	_____
SHIPPED BY: <u>FED EX</u>	18 _____	_____
<u>1331126624</u>	19 _____	_____
	20 _____	_____

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS HEREOF.

PM APPROVAL pk 2/28/92 INSPECTED BY af DATE INSPECTED 3/2/92
COPIES OF REPORT 1



GEOENGINEERS
 8410 154TH AVE N.E.
 REDMOND WA 98052-0000

Lab I.D.#: 92-2280
 Order Number: P56007
 Received Date: 03/24/92
 Client: 07061
 Sampled By: D. LOVROVICH
 Sample Date: 03/13/92
 Sample Time: 0730

Project Number: 161-13-R69
 Project Name: UNOCAL WESTLAKE & MERCER
 Sample Site: N/S
 Sample Type: AIR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
2280-1	920313-1	METHANE	PPM	460	1

GeoEngineers

MAR 31 1992

Routing NLP
 By: _____

Comments: PPM = Parts Per Million, by volume. MG/M3 = Milligrams Per Cubic Meter. Method Refs: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Ed., 11/86 and Analysis Method Designed by Analytical Technologies, Inc. BDL = Below Detection Limits.

Approved By : R. P. P.



Client: GEOENGINEERS

Lab I.D.#: 92-2280-1

Project Number: 161-13-R69

Received Date: 03/24/92

Project Name: UNOCAL WESTLAKE & MERCER

Sampled By: D. LOVROVICH

Sample Site: N/S

Sample Type: AIR

Sample ID.: 920313-1

Sample Date: 03/13/92

Time: 0730

IR/BETX&TPH

AIR BETX & TPH

Parameter	Units	Result	Detection Limit
BENZENE	MG/M3	BDL	1
ETHYL BENZENE	MG/M3	BDL	1
TOLUENE	MG/M3	BDL	5
XYLENES	MG/M3	BDL	2
TOTAL PETROLEUM HYDROCARBONS	MG/M3	BDL	500
BROMOFLUOROBENZENE *SURR*	% REC	97	
CHLOROBENZENE *SURR*	% REC	88	



Analytical Technologies, Inc.

11 EAST OLIVE ROAD
PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001

GEOENGINEERS

PROJECT: 161-13-R69

QC LEVEL I

LAB ID: 92-2280

BATCH: CA0092

ANALYSIS

<u>LAB ID</u>	<u>CLIENT ID</u>	<u>DATE</u>
92-2280-1	920313-1	03-25-92
SPIKE		03-23-92
SPIKE DUP.		03-23-92
DI BLANK		03-23-92
DI BLANK		03-25-92

<u>PARAMETER</u>	<u>METHOD</u>	<u>DETECTION LIMIT</u>	<u>BLANK</u>	<u>SPIKE</u>		<u>EXPECTED SPIKE</u>	<u>%REC SPIKE</u>	<u>%REC SPIKE DUP.</u>	<u>% REC. CONTROL LIMITS</u>	<u>RPD</u>	<u>MAX RPD</u>
				<u>RESULTS</u>	<u>DUPLICATE RESULTS</u>						
METHANE	*	1	BDL	50	72	50	100	144	50-150	36	50

NOTES: PPM = Parts per Million.
 BDL = Below Detection Limit
 Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: *Gas Chromatographic method employing direct injection on column with flame ionization detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 161-13-R69

LAB ID: 92-2280

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
92-2280-1	920313-1	03-13-92	03-24-92	N/A	03-25-92	EW0022	C



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0022

PARAMETERS

		BLANK A	BLANK B	BLANK C
	EXTRACTION DATE	N/A	N/A	N/A
	ANALYSIS DATE	03-23-92	03-24-92	03-25-92
	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
METHYL TERT-BUTYL ETHER	10 mg/m3	BDL	BDL	BDL
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUROBENZENE	*SURR* (50-150)	101	93	100
CHLORO BENZENE	*SURR* (50-150)	84	89	88

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0022

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	52	104	50-150
TOLUENE	50	BDL	51	102	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	50	100	4	50	50-150
TOLUENE	50	BDL	49	98	4	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits
 0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	03-23-92	102%	96 %
SPD	03-23-92	106%	95 %

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GeoEngineers Inc.

ATI Lab ID # 92- 2280

ROJ NUMBER:	SAMPLE	DATE
<u>1161-13-R69</u>	1 <u>920313-1</u>	<u>63/13/92</u>
ROJ NAME: <u>Unocal Westlake & Mercer</u>	2 _____	_____
SAMPLED BY: <u>D. Lovrovich</u>	3 _____	_____
SAMPLE SITE: <u>N/S</u>	4 _____	_____
SAMPLE DATE: <u>03/13/92</u> (see bottle for verification)	5 _____	_____
SAMPLE TIME: <u>0730</u>	6 _____	_____
SAMPLE TYPE: <u>0730 AIR</u> ^{CW 03/24/92}	7 _____	_____
USH: Y <input checked="" type="radio"/> N <input type="radio"/> QC: N 0 <input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4	8 _____	_____
Date Received: <u>03/24/92</u>	9 _____	_____
Is there a chain of custody? <input checked="" type="radio"/> Y <input type="radio"/> N	10 _____	_____
Is chain of custody signed? <input checked="" type="radio"/> Y <input type="radio"/> N	11 _____	_____
Were samples received cold? <input checked="" type="radio"/> Y <input type="radio"/> N ^{CW 03/24/92}	12 _____	_____
Were samples received in proper containers? <input checked="" type="radio"/> Y <input type="radio"/> N	13 _____	_____
Were samples preserved correctly? <input checked="" type="radio"/> Y <input type="radio"/> N	14 _____	_____
Were air bubbles present in volatile bottles? Y <input checked="" type="radio"/> N/A	15 _____	_____
Were samples within holding time? <input checked="" type="radio"/> Y <input type="radio"/> N	16 _____	_____
SHIPPED BY: <u>Fed Ex</u>	17 _____	_____
<u>1657175995</u>	18 _____	_____
OUT OF CONTROL EVENTS: _____	19 _____	_____
_____	20 _____	_____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

APPROVAL [Signature] INSPECTED BY [Signature] DATE INSPECTED 03/24/92



GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 92-3086
Order Number: P57060
Received Date: 04/16/92
Client: 07061
Sampled By: D.J.L.
Sample Date: 04/13/92
Sample Time: 1000

Project Number: 0161-013-R04
Project Name: UNOCAL WESTLAKE & MERCER
Sample Site: N/S
Sample Type: VAPOR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
86-1	920413-1	METHANE	PPM	110	1

Comments: PPM = Parts Per Million (by volume). MG/M3 = Milligrams Per Cubic Meter. Analysis Method Designed by Analytical Technologies, Inc.

page 1

Approved By :

RL RL



Client: GEOENGINEERS

Lab I.D.#: 92-3086-1

Project Number: 0161-013-R04

Received Date: 04/16/92

Project Name: UNOCAL WESTLAKE & MERCER

Sampled By: D.J.L.

Sample Site: N/S

Sample Type: VAPOR

Sample ID.: 920413-1

Sample Date: 04/13/92 Time: 1000

AIR/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	100 153 ppm	50



Q U A L I T Y C O N T R O L
D A T A

GEOENGINEERS

PROJECT: 0161-013-R04

QC LEVEL I

LAB ID: 92-3086 BATCH: CA102

ANALYSIS DATE

LAB ID CLIENT ID 920413-1 04-23-92

SPIKE 04-23-92
 SPIKE DUP.
 BLANK 04-23-92

PARAMETER	METHOD	DETECTION LIMIT	BLANK	SPIKE		EXPECTED SPIKE	% REC SPIKE	% REC SPIKE DUP.	% REC CONTROL LIMITS	MAX RPD
				RESULTS	RESULTS					
METHANE	*	1	BDL	74	77	75	99	103	50-150	4 50

NOTES: PPM - Parts Per Million
 BDL - Below Detection Limit
 Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: *Gas Chromatographic method employing direct injection on column with flame ionization detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 0161-013-R04

LAB ID: 92-3086

METHOD: Analysis Method Designed by Analytical Technologies, Inc.

LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
2-3086-1	920413-1	04-13-92	04-16-92	N/A	04-17-92	EW0029	B



METHOD INSTRUMENT BLANK.

BATCH NUMBER: EW0029

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		04-16-92	04-17-92	N/A
PARAMETERS	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
METHYL TERT-BUTYL ETHER	10 mg/m3	BDL	BDL	BDL
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (50-150)	99	96	N/A
CHLOROBENZENE	*SURR* (50-150)	72	69	N/A

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0029

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	48	96	50-150
TOLUENE	50	BDL	48	96	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	47	94	2	50	50-150
TOLUENE	50	BDL	46	92	4	50	50-150

* Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

1 out of 4 % recoveries out of limits
 1 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	04-16-92	104%	95 %
SPD	04-16-92	104%	94 %

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEO Engineers

ATI Lab ID # 92- 3086

PROJ NUMBER: 0161-013-204
 PROJ NAME: UNOCAL
WESTLAKE - MERCER
 SAMPLED BY: N/S - JP. D.J.L.
 SAMPLE SITE: N/S
 SAMPLE DATE: 04/13/92
 SAMPLE TIME: 1000
 SAMPLE TYPE: VAPOR
 RUSH: Y N QC: N 0 1 2 3 4
 Date Received: 04/16/92
 Is there a chain of custody? Y N
 Was chain of custody signed? Y N
 Were samples received cold? Y N
 Were samples received in proper containers? Y N
 Were samples preserved correctly? Y N
 Headspace in volatile bottles? N/A Y N
 Were samples within holding time? Y N
 SHIPPED BY: FED EX

SAMPLE	DATE
1 <u>920413-1</u>	<u>4/13/92</u>
2 _____	_____
3 _____	_____
4 _____	_____
5 _____	_____
6 _____	_____
7 _____	_____
8 _____	_____
9 _____	_____
10 _____	_____
11 _____	_____
12 _____	_____
13 _____	_____
14 _____	_____
15 _____	_____
16 _____	_____
17 _____	_____
18 _____	_____
19 _____	_____
20 _____	_____

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL [Signature] INSPECTED BY JP. DATE INSPECTED/ 4/16/92
 # COPIES OF REPORT 1

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEO Engineers

ATI Lab ID # 92-3086

PROJ NUMBER: 0161-013-204

SAMPLE DATE
1 920413-1 4/13/92

PROJ NAME: UNOCAL

2 GEO Engineers

WESTLAKE / MERCER

SAMPLED BY: N/S-IP D.J.L.

3 APR 27 1992

SAMPLE SITE: N/S

4 Holding MS U

SAMPLE DATE: 04/13/92

5 _____

SAMPLE TIME: 1000

6 _____

SAMPLE TYPE: VAPOR

7 _____

RUSH: Y N QC: N 0 1 2 3 4

Date Received: 04/16/92

8 _____

Is there a chain of custody? Y N

9 _____

Was chain of custody signed? Y N

10 _____

Were samples received cold? Y N

11 _____

Were samples received in proper containers? Y N

12 _____

Were samples preserved correctly? Y N

13 _____

Headspace in volatile bottles? N/A Y N

14 _____

Were samples within holding time? Y N

15 _____

SHIPPED BY: FED EX

16 _____

17 _____

18 _____

19 _____

20 _____

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL [Signature]

INSPECTED BY IP

DATE INSPECTED 4/16/92
COPIES OF REPORT 1



Analytical Technologies, Inc.

560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335

92-3086

DATE 4/15/92 PAGE 1 OF 1

Chain of Custody LABORATORY NUMBER:

PROJECT MANAGER: NORM PURI
 COMPANY: GEO ENGINEERS
 ADDRESS: 8410 154TH AVE. NE
REDMOND, WA 98052
 PHONE: (206) 861-6000 SAMPLED BY: DJL

SAMPLE DISPOSAL INSTRUCTIONS
 ATI Disposal @ \$5.00 each Return

ANALYSIS REQUEST		8010 Halogenated Volatiles	8020 Aromatic Volatiles	8020 BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	8080 PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAHHH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	EP TOX Metals (8) EP EXT	Priority Pollutant Metals (13)	8080 Pesticide (4)	8240 ZH-EXT	8270	8150 Herbicides (2)	Metals (8)	NUMBER OF CONTAINERS	
																											1

PROJECT INFORMATION

PROJECT NUMBER: 0161-013-204
 PROJECT NAME: UNOCAL WASTEWATER
 PURCHASE ORDER NUMBER:
 ONGOING PROJECT? YES NO

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS
 COC SEALS/INTACT? Y/N/NA
 RECEIVED GOOD COND./COLD
 RECEIVED VIA:

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) 2WKS (RUSH) 24HR 48 HRS 72 HRS 1 WK
 GREATER THAN 24 HR. NOTICE? YES NO (LAB USE ONLY)

SPECIAL INSTRUCTIONS:
FAX RESULTS TO NORM PURI / RETURN
EMPTY CANISTER TO GEO ENGINEERS

RELINQUISHED BY: 1

Signature: [Signature] Type: 10:00
 Printed Name: DAVE LOVROVICH Date: 4-15-92
 Company: G.E.I.

RECEIVED BY: 1

Signature: [Signature] Type: 0830
 Printed Name: J. Perez Date: 4/14/92
 Company: ATI

RELINQUISHED BY: 2

Signature: _____ Time: _____
 Printed Name: _____ Date: _____
 Company: _____

RECEIVED BY: 2

Signature: _____ Time: _____
 Printed Name: _____ Date: _____
 Company: Analytical Technologies, Inc.



Client: GEOENGINEERS

Lab I.D.#: 92-3552-1

Project Number: 0161-013-RO4
 Project Name: UNOCAL/WEST LAKE MERCER
 Sample Site: N/S
 Sample Type: AIR

Received Date: 05/01/92
 Sampled By: D.J.L.

Sample ID.: 920423-1 Sample Date: 04/23/92 Time: 0700

AIR/TVH TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500

GeoEngineers

MAY 11 1992

Routing NLP
 File



Q U A L I T Y C O N T R O L
D A T A



Analytical Technologies, Inc.

11 EAST OLIVE ROAD PHONE (904) 474-1001
PENSACOLA, FLORIDA 32514

GEOENGINEERS

PROJECT: 0161-013-R04

QC LEVEL II

LAB ID: 92-3552

BATCH: CA107

ANALYSIS DATE

LAB ID CLIENT ID

92-3552-1 920423-1 05-04-92

MS 05-04-92
MS DUP. 05-04-92

DI BLANK 05-04-92

PARAMETER	METHOD	DETECTION LIMIT	BLANK	MATRIX SPIKE		EXPECTED SPIKE	%REC. CONTROL LIMITS		MAX RPD	
				RESULTS	DUPLICATE RESULTS		MATRIX SPIKE	% REC. CONTROL LIMITS		
CARBON MONOXIDE	*	1	BDL	46	43	38	121	113	7	50

NOTES: PPM - Parts Per Million.
BDL - Below Detection Limit
Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: * Gas Chromatographic method employing injection on column with Flame Ionization Detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 0161-013-R04

METHOD: Gas Chromatographic Method designed by Analytical Technologies
employing Purge (PID) and Flame Ionization Detector (FID)

LEVEL: II

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
0161-3552-1	920423-1	04-23-92	05-01-92	N/A	05-04-92	EW0034	A



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0034

PARAMETERS

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		05-04-92	N/A	N/A
DETECTION LIMIT		RESULTS	RESULTS	RESULTS
ETHYL TERT-BUTYL ETHER	10 mg/m3	BDL	BDL	BDL
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (50-150)	95	N/A	N/A
CHLOROBENZENE	*SURR* (50-150)	70	N/A	N/A

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



WATER MATRIX SPIKE

BATCH NUMBER: EW0034

SAMPLE SPIKED: 3585-1

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	MS CONC	MS REC%#	REC LIMITS
BENZENE	50	BDL	44	88	50-150
TOLUENE	50	BDL	43	86	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	MSD CONC	MSD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	45	90	2	50	50-150
TOLUENE	50	BDL	44	88	2	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

) out of 00 % recoveries out of limits

) out of 00 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
MS	05-04-92	99 %	91 %
MSD	05-04-92	100%	91 %

) = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

QC LIMITS
 S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:



INDEPENDENT QC CHECK

BATCH NUMBER: EIC1114W

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	IQC CONC	IQC REC%#	REC LIMITS
BENZENE	50	BDL	54	108	50-150
TOLUENE	50	BDL	52	104	50-150

* Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 2 % recoveries out of limits

0 out of 2 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
IQC	11-14-91	96 %	97 %

) = DILUTED OUT

NOTE: Units in ug/l = Parts Per Billion.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROENZENE (50-150)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEO Engineers

ATI Lab ID # 92-3552

	SAMPLE	DATE
PROJ NUMBER: <u>0161-013-R04</u>	1 <u>920423-1</u>	<u>4-23-92</u>
PROJ NAME: <u>Unocal Westlake</u>	2 _____	_____
<u>mercer</u>	3 _____	_____
SAMPLED BY: <u>RF 5/1/92</u> <u>n/s D.J.L.</u>	4 _____	_____
SAMPLE SITE: <u>n/s</u>	5 _____	_____
SAMPLE DATE: <u>4-23-92</u>	6 _____	_____
SAMPLE TIME: <u>0700</u>	7 _____	_____
SAMPLE TYPE: <u>AIR</u>	8 _____	_____
RUSH: Y <input checked="" type="radio"/> N <input type="radio"/> QC: N 0 1 <input checked="" type="radio"/> 2 3 4	9 _____	_____
Date Received: <u>5/1/92</u>	10 _____	_____
Is there a chain of custody? <input checked="" type="radio"/> Y <input type="radio"/> N	11 _____	_____
Was chain of custody signed? <input checked="" type="radio"/> Y <input type="radio"/> N	12 _____	_____
Were samples received cold? Y <input type="radio"/> N <input checked="" type="radio"/>	13 _____	_____
Were samples received in proper containers? <input checked="" type="radio"/> Y <input type="radio"/> N	14 _____	_____
Were samples preserved correctly? <input checked="" type="radio"/> Y <input type="radio"/> N	15 _____	_____
Headspace in volatile bottles? Y <input type="radio"/> N <input checked="" type="radio"/>	16 _____	_____
Were samples within holding time? <input checked="" type="radio"/> Y <input type="radio"/> N	17 _____	_____
SHIPPED BY: <u>Fed EX</u>	18 _____	_____
<u>1854 068 854</u>	19 _____	_____
	20 _____	_____

OUT OF CONTROL EVENTS: Fax Results to norm PurI/
Return Empty canister to Geo Engineers

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL [Signature] 5/1/92 INSPECTED BY [Signature] DATE INSPECTED 5/1/92
COPIES OF REPORT 1



GEOENGINEERS
 8410 154TH AVE N.E.
 REDMOND WA 98052-0000


Lab I.D.#: 92-3552
 Order Number: P57732
 Received Date: 05/01/92
 Client: 07061
 Sampled By: D.J.L.
 Sample Date: 04/23/92
 Sample Time: 0700

Project Number: 0161-013-RO4
 Project Name: UNOCAL/WEST LAKE MERCER
 Sample Site: N/S
 Sample Type: AIR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
3552-1	920423-1	METHANE	PPM	710	1

Comments: MG/M3 = Milligrams Per Cubic Meter. PPM = Parts Per Million.
 Analysis Methods Designed by Analytical Technologies, Inc.
 BDL = Below Detection Limits.

Approved By : 
 page 1

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEO Engineers

ATI Lab ID # 92-3552

PROJ NUMBER: 0161-013-R04

SAMPLE	DATE
1 <u>920423-1</u>	<u>4-23-92</u>
2 _____	_____
3 _____	_____
4 _____	_____
5 _____	_____
6 _____	_____

PROJ NAME: Unocal / west lake

SAMPLED BY: mercer
2/5 5/1/92 DJL

SAMPLE SITE: n/s

SAMPLE DATE: 4-23-92

SAMPLE TIME: 0700

SAMPLE TYPE: AIR

RUSH: Y N QC: N 0 1 (2) 3 4

Date Received: 5/1/92

Is there a chain of custody? (Y) N

Was chain of custody signed? (Y) N

Were samples received cold? Y (N)

Were samples received in proper containers? (Y) N

Were samples preserved correctly? (Y) N

Headspace in volatile bottles? Y N/A

Were samples within holding time? (Y) N

SHIPPED BY: Fed EX
1854 086 854

GeoEngineers
MAY 07 1992
Routing _____
File _____

16 _____	_____
17 _____	_____
18 _____	_____
19 _____	_____
20 _____	_____

OUT OF CONTROL EVENTS: Fox Results to room PurI /
Return Empty Canister to Geo Engineers

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL [Signature] 5/1/92

INSPECTED BY [Signature]

DATE INSPECTED/ 5/1/92
COPIES OF REPORT _____



GeoEngineers

MAY 28 1992

GEOENGINEERS
8410 154TH AVE N.E.
REDMOND WA 98052-0000

Routing NLP
File

Lab I.D.#: 92-4012
Order Number: P58471
Received Date: 05/18/92
Client: 07061
Sampled By: D.J.L.
Sample Date: 05/08/92
Sample Time: AM

Project Number: 161-013-R04
Project Name: UNOCAL/WESTLAKE & MERCER
Sample Site: N/S
Sample Type: VAPORS (AIR)

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
4012-1	920508-1	METHANE	PPM	13	1
4012-2	920508-2	METHANE	PPM	9	1

Comments: MG/M3 = Milligrams Per Cubic Meter. PPM = Parts Per Million. Method Refs: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Edition, 11/86 and Analysis Method Designed by Analytical Technologies, Inc. BDL = Below Detection Limits.

Approved By : *John Williams*



Client: GEOENGINEERS
 Project Number: 161-013-R04
 Project Name: UNOCAL/WESTLAKE & MERCER
 Sample Site: N/S
 Sample Type: VAPORS (AIR)

Lab I.D.#: 92-4012-1
 Received Date: 05/18/92
 Sampled By: D.J.L.

Sample ID.: 920508-1 Sample Date: 05/08/92 Time: AM

AIR/TVH TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



Client: GEOENGINEERS

Lab I.D.#: 92-4012-2

Project Number: 161-013-R04

Received Date: 05/18/92

Project Name: UNOCAL/WESTLAKE & MERCER

Sampled By: D.J.L.

Sample Site: N/S

Sample Type: VAPORS (AIR)

Sample ID.: 920508-2

Sample Date: 05/08/92

Time: AM

AIR/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



Analytical Technologies, Inc.

11 EAST OLIVE ROAD
PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001

GEOENGINEERS

PROJECT: 161-013-R04 QC LEVEL I

LAB ID: 92-4012 BATCH: CA109

LAB ID	CLIENT ID	ANALYSIS DATE
92-4012-1	920508-1	05-19-92
92-4012-2	920508-2	05-19-92
SPIKE		05-19-92
SPIKE DUP.		05-19-92
DI BLANK		05-19-92

PARAMETER	METHOD	DETECTION LIMIT	BLANK	SPIKE RESULTS	DUPLICATE RESULTS	EXPECTED SPIKE	%REC SPIKE	%REG SPIKE DUP.	% REC. CONTROL LIMITS	MAX RPD
METHANE	*	1	BDL	25	29	25	100	116	50-150	15 50

NOTES: PPM - Parts Per Million.
 BDL - Below Detection Limit
 Source for control limits is internal laboratory quality assurance program and reference below.
 N/S - NOT SUBMITTED.

REFERENCE: *Gas Chromatographic method employing direct injection on column with Flame Ionization Detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 161-013-R04

LAB ID: 92-4012

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
92-4012-1	920508-1	05-08-92	05-18-92	N/A	05-21-92	EW0039	A
92-4012-2	920508-2	05-08-92	05-18-92	N/A	05-21-92	EW0039	A



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0039

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		05-21-92	05-22-92	N/A
PARAMETERS	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
METHYL TERT-BUTYL ETHER	10 mg/m3	BDL	BDL	BDL
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (50-150)	96	96	N/A
CHLOROBENZENE	*SURR* (50-150)	80	76	N/A

NOTE:

Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0039

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	44	88	50-150
TOLUENE	50	BDL	43	86	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	47	94	7	50	50-150
TOLUENE	50	BDL	46	92	7	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits
 0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	05-21-92	104%	92 %
SPD	05-21-92	102%	92 %

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: Geo Engineers

ATI Lab ID # 92- 4012

	SAMPLE	DATE
PROJ NUMBER: <u>161-013-R04</u>	1 <u>920508-1</u>	<u>5-8-92</u>
PROJ NAME: <u>UNOCAL/Watfak</u> <u>3 Mercer</u>	2 <u>920508-2</u>	<u>5-8-92</u>
SAMPLED BY: <u>DJL</u>	3 _____	_____
SAMPLE SITE: <u>MS</u>	4 _____	_____
SAMPLE DATE: <u>5/8/92</u>	5 _____	_____
SAMPLE TIME: <u>AM</u>	6 _____	_____
SAMPLE TYPE: <u>VAPORS (AIR)</u>	7 _____	_____
RUSH: Y <input checked="" type="radio"/> N <input type="radio"/> QC: N 0 <input checked="" type="radio"/> 1 2 3 4	8 _____	_____
Date Received: <u>5-18-92</u>	9 _____	_____
Is there a chain of custody? <input checked="" type="radio"/> Y <input type="radio"/> N	10 _____	_____
Was chain of custody signed? <input checked="" type="radio"/> Y <input type="radio"/> N	11 _____	_____
Were samples received cold? Y <input checked="" type="radio"/> N <input type="radio"/>	12 _____	_____
Were samples received in proper containers? <input checked="" type="radio"/> Y <input type="radio"/> N	13 _____	_____
Were samples preserved correctly? Y <input type="radio"/> N/A <input checked="" type="radio"/>	14 _____	_____
Headspace in volatile bottles? Y <input type="radio"/> N/A <input checked="" type="radio"/>	15 _____	_____
Were samples within holding time? <input checked="" type="radio"/> Y <input type="radio"/> N	16 _____	_____
SHIPPED BY: <u>UPS</u>	17 _____	_____
	18 _____	_____
	19 _____	_____
	20 _____	_____

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL RL INSPECTED BY Hue DATE INSPECTED/ 5-18-92
REPORTS 1



GEOENGINEERS
 8410 154TH AVE N.E.
 REDMOND WA 98052-0000

Lab I.D.#: 92-4013
 Order Number: P58470
 Received Date: 05/18/92
 Client: 07061
 Sampled By: R.T.K.
 Sample Date: 05/08/92
 Sample Time: 0700

Project Number: 161-013-R04
 Project Name: WESTLAKE & MERCER
 Sample Site: N/S
 Sample Type: AIR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
013-1	AT178	METHANE	PPM	28000	1

GeoEngineers

MAY 22 1992

Routing

File

NLP

Comments: PPM = Parts Per Million. Method Reference: Analysis Method Designed By Analytical Technologies, Inc.

Approved By : *Rh Rh*
 page 1 end of report



Analytical Technologies, Inc.

11 EAST OLIVE ROAD
PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001

GEOENGINEERS

PROJECT: 161-013-R04 QC LEVEL I

LAB ID: 92-4013 BATCH: CA109

ANALYSIS

LAB ID	CLIENT ID	ANALYSIS DATE
92-4013-1	AT178	05-19-92
SPIKE		05-19-92
SPIKE DUP.		05-19-92
DI BLANK		05-19-92

PARAMETER	METHOD	DETECTION LIMIT	BLANK	SPIKE RESULTS	SPIKE DUPLICATE	EXPECTED SPIKE	%REC SPIKE	%REC SPIKE DUP.	% REC. CONTROL LIMITS	MAX RPD
METHANE	*	1	BDL	25	29	25	100	116	50-150	15 50

NOTES: PPM - Parts Per Million.

BDL - Below Detection Limit

Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: *Gas Chromatographic method employing direct injection on column with Flame Ionization Detector (FID).

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: Geo Engineers

ATI Lab ID # 92- 40B

PROJ NUMBER: 161-013-R04

SAMPLE	DATE
1 <u>AT 178</u>	<u>5-8-92</u>
2	
3	
4	
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9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

PROJ NAME: Westlake &

Mercer

SAMPLED BY: RTK

SAMPLE SITE: MS

SAMPLE DATE: 5-8-92

SAMPLE TIME: 0700

SAMPLE TYPE: Air

RUSH: Y ^{HRC} N 0 1 2 3 4

Date Received: 5-18-92

Is there a chain of custody? Y N

Was chain of custody signed? Y N

Were samples received cold? Y N

Were samples received in proper containers? Y N

Were samples preserved correctly? Y ^{HRC} NA

Headspace in volatile bottles? Y NA

Were samples within holding time? Y N

SHIPPED BY: UPS

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL RP INSPECTED BY HRC DATE INSPECTED 5-18-92
REPORTS 1



GeoEngineers

JUN 15 1992

Routing
 File

GEO ENGINEERS
 7504 SW BRIDGEPORT RD.
 PORTLAND OR 97224-0000

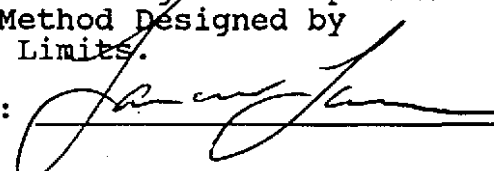
Lab I.D.#: 92-4421
 Order Number: P59053
 Received Date: 06/02/92
 Client: 07082
 Sampled By: DJL
 Sample Date: 05/21/92
 Sample Time: 0730

N/S = Not Submitted

Project Number: 161-013-R04
 Project Name: UNOCAL/WESTLAKE MERCER
 Sample Site: N/S
 Sample Type: VAPORS

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
421-1	920521-1	METHANE	PPM	5	1

Comments: PPM = Parts Per Million. MG/M3 = Milligrams Per Cubic Meter. Method Ref: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Ed, 11/86, and Analysis Method Designed by Analytical Technologies, Inc. BDL = Below Detection Limits.

Approved By : 
 page 1



GeoEngineers

JUN 15 1992

Routing
 File

Client: GEO ENGINEERS

Lab I.D.#: 92-4421-1
 Received Date: 06/02/92
 Sampled By: DJL

Project Number: 161-013-R04
 Project Name: UNOCAL/WESTLAKE MERCER
 Sample Site: N/S
 Sample Type: VAPORS

Sample ID.: 920521-1 Sample Date: 05/21/92 Time: 0730

R/TVH TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



CLIENT: GEO ENGINEERS

PROJECT: 161-013-R04

LAB ID: 92-4421

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
92-4421-1	920521-1	05-21-92	06-02-92	N/A	06-03-92	EW0041	C



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0041

PARAMETERS

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		06-01-92	N/A	06-03-92
DETECTION LIMIT		RESULTS	RESULTS	RESULTS
ETHYL TERT-BUTYL ETHER	10 mg/m3	BDL	BDL	BDL
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (50-150)	97	N/A	91
CHLOROBENZENE	*SURR* (50-150)	86	N/A	91

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0041

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC#	REC LIMITS
BENZENE	50	BDL	48	96	50-150
TOLUENE	50	BDL	52	104	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	46	92	4	50	50-150
TOLUENE	50	BDL	50	100	4	50	50-150

* Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits

0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	06-04-92	100%	100%
SPD	06-04-92	104%	100%

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS: Reagent spikes run (1) day after batch ended due to instrument breakdown.

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEO Engineers

ATI Lab ID # 92- 4421

PROJ NUMBER: 161-013-R04
 PROJ NAME: Unocal Westlake
mercer
 SAMPLED BY: DSL
 SAMPLE SITE: n/s
 SAMPLE DATE: 5-21-92
 SAMPLE TIME: Imports 07030
 SAMPLE TYPE: Imports
 RUSH: Y N QC: N 1 2 3 4
 Date Received: 5-2-92
 Is there a chain of custody? Y N
 Was chain of custody signed? Y N
 Are samples received cold? Y N
 Were samples received in proper containers? Y N
 Were samples preserved correctly? Y N
 Headspace in volatile bottles? Y N
 Were samples within holding time? Y N
 SHIPPED BY: UPS

SAMPLE	DATE
1 <u>920521-1</u>	<u>5-21-92</u>
2 _____	_____
3 _____	_____
4 _____	_____
5 _____	_____
6 _____	_____
7 _____	_____
8 _____	_____
9 _____	_____
10 _____	_____
11 _____	_____
12 _____	_____
13 _____	_____
14 _____	_____
15 _____	_____
16 _____	_____
17 _____	_____
18 _____	_____
19 _____	_____
20 _____	_____

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL PR INSPECTED BY RF DATE INSPECTED 6-2-92
 # REPORTS 1



GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 92-5014
Order Number: P59378
Received Date: 06/09/92
Client: 07061
Sampled By: D. LOUROUCH
Sample Date: 06/05/92
Sample Time: 0735

Project Number: 161-013-R04
Project Name: UNOCAL/WESTLAKE & MERCER
Sample Site: WESTLAKE & MERCER
Sample Type: VAPOR

N/S = Not Submitted

ID	Sample ID	Parameter	Units	Results	Detection Limit
4-1	920605-1	METHANE	PPM	59	1

Comments: PPM = Parts Per Million, by volume. MG/M3 = Milligrams Per Cubic Meter. Method Refs: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Edition, November 1986 and Analysis Method Designed by Analytical Technologies, Inc. BDL = Below Detection Limits.

Approved By : Mike Acran
page 1



Client: GEOENGINEERS

Lab I.D.#: 92-5014-1

Project Number: 161-013-R04

Received Date: 06/09/92

Project Name: UNOCAL/WESTLAKE & MERCER

Sampled By: D. LOUROUCH

Sample Site: WESTLAKE & MERCER

Sample Type: VAPOR

Sample ID.: 920605-1

Sample Date: 06/05/92

Time: 0735

IR/TVH TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



Q U A L I T Y C O N T R O L
D A T A



Analytical Technologies, Inc.

11 EAST OLIVE ROAD PHONE (904) 474-1001
PENSACOLA, FLORIDA 32514

GEOENGINEERS

PROJECT: 161-013-R04 QC LEVEL I
LAB ID: 92-5014 BATCH: CA116

LAB ID CLIENT ID ANALYSIS DATE
92-5014-1 920605-1 06-18-92
SPIKE 06-18-92
SPIKE DUP. 06-18-92
BLANK 06-18-92

<u>PARAMETER</u>	<u>METHOD</u>	<u>DETECTION LIMIT</u>	<u>BLANK</u>	<u>SPIKE</u>		<u>EXPECTED SPIKE</u>	<u>%REC SPIKE</u>	<u>%REC SPIKE DUP.</u>	<u>% REC. CONTROL LIMITS</u>	<u>MAX RPD</u>
				<u>RESULTS</u>	<u>RESULTS</u>					
METHANE	ATI/GC/FID	1	BDL	26	26	25	104	104	50-150	0 50

NOTES: PPM - Parts Per Million, by volume.
BDL - Below Detection Limit
Source for control limits is internal laboratory quality assurance program and reference below.
N/S - NOT SUBMITTED.

REFERENCE: ATI Gas Chromatographic method employing direct injection on column with Flame Ionization Detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 161-013-R04

LAB ID: 92-5014

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
92-5014-1	920605-1	06-05-92	06-09-92	N/A	06-18-92	EW0045	A



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0045

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		06-18-92	06-19-92	N/A
PARAMETERS	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
METHYL TERT-BUTYL ETHER	10 mg/m ³	BDL	BDL	BDL
BENZENE	1 mg/m ³	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m ³	BDL	BDL	BDL
TOLUENE	5 mg/m ³	BDL	BDL	BDL
XYLENE	2 mg/m ³	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m ³	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (50-150)	100	94	N/A
CHLOROBENZENE	*SURR* (50-150)	90	94	N/A

NOTE: Units in mg/m³ = milligrams per cubic meter.
 BDL = Below Detection limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



AGENT WATER SPIKE

BATCH NUMBER: EW0045

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	48	96	50-150
TOLUENE	50	BDL	50	100	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	48	96	0	50	50-150
TOLUENE	50	BDL	47	94	6	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

Values outside of QC limits

out of 4 % recoveries out of limits
 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	06-18-92	104%	100%
SPD	06-18-92	102%	100%

= DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE QC LIMITS (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: Geo Engineering

ATI Lab ID # 92- 5014

PROJ NUMBER: 161-013-RO4

SAMPLE	DATE
1 <u>920605-1</u>	<u>06/05/92</u>
2 _____	_____
3 _____	_____
4 _____	_____
5 _____	_____
6 _____	_____
7 _____	_____
8 _____	_____
9 _____	_____
10 _____	_____
11 _____	_____
12 _____	_____
13 _____	_____
14 _____	_____
15 _____	_____
16 _____	_____
17 _____	_____
18 _____	_____
19 _____	_____
20 _____	_____

PROJ NAME: UNOCAL/Westlake & Mercer

SAMPLED BY: D. Lounpuch

SAMPLE SITE: Westlake & Mercer

SAMPLE DATE: 06/05/92

SAMPLE TIME: 0735

SAMPLE TYPE: VAPOR

RUSH: Y N QC: N 0 1 2 3 4

Date Received: 06/09/92

Is there a chain of custody? Y N

Was chain of custody signed? Y N

Were samples received cold? Y N

Were samples received in proper containers? Y N

Were samples preserved correctly? Y N

Headspace in volatile bottles? Y N

Were samples within holding time? Y N

SHIPPED BY: UPS

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARD FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

APPROVAL PR
 TIME _____

INSPECTED BY JD
 TIME 1000

DATE INSPECTED 06/09/92
 # OF REPORTS 1



GEOENGINEERS
 8410 154TH AVE N.E.
 REDMOND WA 98052-0000

Lab I.D.#: 92-5013
 Order Number: P59379
 Received Date: 06/09/92
 Client: 07061
 Sampled By: D. LOUROUCH
 Sample Date: 06/05/92
 Sample Time: 0800

Project Number: 161-013-R04
 Project Name: UNOCAL/WESTLAKE & MERCER
 Sample Site: WESTLAKE & MERCER
 Sample Type: VAPOR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
1013-1	920605-2	METHANE	PPM	18	1

Comments: PPM = Parts Per Million, by volume. MG/M3 = Milligrams Per Cubic Meter. Method Refs: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Edition, November 1986 and Analysis Method Designed by Analytical Technologies, Inc. BDL = Below Detection Limits.

Approved By : Mike Loran
 page 1



Client: GEOENGINEERS

Lab I.D.#: 92-5013-1

Project Number: 161-013-R04

Received Date: 06/09/92

Project Name: UNOCAL/WESTLAKE & MERCER

Sampled By: D. LOUROUCH

Sample Site: WESTLAKE & MERCER

Sample Type: VAPOR

Sample ID.: 920605-2

Sample Date: 06/05/92

Time: 0800

R/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



GEOENGINEERS
8410 154TH AVE N.E.
REDMOND WA 98052-0000

Lab I.D.#: 92-5710
Order Number: P60299
Received Date: 06/30/92
Client: 07061
Sampled By: DJL
Sample Date: 06/18/92
Sample Time: AM

Project Number: 161-013-R04
Project Name: UNOCAL/WESTLAKE MERCER
Sample Site: WESTLAKE/MERCER
Sample Type: VAPOR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
5710-1	920618-1	METHANE	PPM	21	1
5710-2	920618-2	METHANE	PPM	1100	1

GeoEngineers

JUL 13 1992

Routing

File

NLP

Comments: PPM = Parts Per Million. MG/M3 = Milligrams per Cubic Meter.
Meth. Refs: Compendium of Methods for the Determination of Toxic
Organic Compounds in Ambient Air, SW-846, 3rd Ed 11/86 and ATI Gas
Chromatographic Method employing direct injection on column with flame
ionization detector (FID). BDL = Below Detection Limits.

page 1

Approved By : *Mike Loren*



Client: GEOENGINEERS

Lab I.D.#: 92-5710-1

Received Date: 06/30/92

Sampled By: DJL

Project Number: 161-013-R04

Project Name: UNOCAL/WESTLAKE MERCER

Sample Site: WESTLAKE/MERCER

Sample Type: VAPOR

Sample ID.: 920618-1

Sample Date: 06/18/92 Time: AM

IR/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



Client: GEOENGINEERS

Lab I.D.#: 92-5710-2

Project Number: 161-013-R04

Received Date: 06/30/92

Project Name: UNOCAL/WESTLAKE MERCER

Sampled By: DJL

Sample Site: WESTLAKE/MERCER

Sample Type: VAPOR

Sample ID.: 920618-2

Sample Date: 06/18/92 Time: AM

AIR/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	600	500



Q U A L I T Y C O N T R O L
D A T A

GEOENGINEERS

PROJECT: 161-013-R04 QC LEVEL I

LAB ID: 92-5710 BATCH: CAL21

LAB ID CLIENT ID ANALYSIS DATE

92-5710-1 920618-1 07-01-92
 92-5710-2 920618-2 07-01-92
 SPIKE 06-29-92
 SPIKE DUP. 06-29-92
 DI BLANK 06-29-92
 DI BLANK 07-01-92

PARAMETER	METHOD	DETECTION LIMIT	BLANK	SPIKE RESULTS	EXPECTED SPIKE	%REC SPIKE	%REC SPIKE DUP.	% REC. CONTROL LIMITS	MAX RPD
CARBON DIOXIDE	*	1	BDL	25	25	100	68	50-150	38 50

NOTES: PPM - Parts per Million.
 BDL - Below Detection Limit
 Source for control limits is internal laboratory quality assurance program and reference below.
 N/S - NOT SUBMITTED.

REFERENCE: *ATI/GC/FID - ATI Gas Chromatographic method employing direct injection on column with Flame Ionization Detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 161-013-R04

LAB ID: 92-5710

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
92-5710-1	920618-1	06-18-92	06-30-92	N/A	07-01-92	EW0048	C
92-5710-2	920618-2	06-18-92	06-30-92	N/A	06-30-92	EW0048	B



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0048

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		06-29-92	06-30-92	07-01-92
PARAMETERS	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
METHYL TERT-BUTYL ETHER	10 mg/m3	BDL	BDL	BDL
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (50-150)	106	102	94
CHLOROBENZENE	*SURR* (50-150)	92	92	90

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0048

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	51	102	50-150
TOLUENE	50	BDL	51	102	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	51	102	0	50	50-150
TOLUENE	50	BDL	51	102	0	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits

0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	06-29-92	106%	100%
SPD	06-29-92	108%	100%

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:



GEOENGINEERS
 8410 154TH AVE N.E.
 REDMOND WA 98052-0000

Lab I.D.#: 92-5832
 Order Number: P60428
 Received Date: 07/02/92
 Client: 07061
 Sampled By: RTK
 Sample Date: 06/24/92
 Sample Time: 1500

Project Number: 161-013-R04
 Project Name: WESTLAKE & MERCER
 Sample Site: SEATTLE
 Sample Type: AIR (SUMMA)

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
5832-1	ATO42	METHANE	PPM	190	1

Engineers

JUL 20 1992

Routing

File

Comments: MG/M3 = Milligrams Per Cubic Meter. PPM = Parts Per Million, by Volume. Meth. Refs: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Ed. 11/86 and ATI Gas Chromatographic method employing direct injection on column with flame ionization detector (FID).

page 1

Approved By :

Mike Aora



Client: GEOENGINEERS

Lab I.D.#: 92-5832-1

Project Number: 161-013-R04

Received Date: 07/02/92

Project Name: WESTLAKE & MERCER

Sampled By: RTK

Sample Site: SEATTLE

Sample Type: AIR (SUMMA)

Sample ID.: ATO42

Sample Date: 06/24/92 Time: 1500

IR/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



Analytical Technologies, Inc.

11 EAST OLIVE ROAD
PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001

GEOENGINEERS

PROJECT: 161-013-R04 QC LEVEL I
LAB ID: 92-5832 BATCH: CA125

<u>LAB ID</u>	<u>CLIENT ID</u>	<u>ANALYSIS DATE</u>
92-5832-1	AT042	07-06-92
SPIKE		07-06-92
SPIKE DUP.		07-06-92
DI BLANK		07-06-92

<u>PARAMETER</u>	<u>METHOD</u>	<u>DETECTION LIMIT</u>	<u>BLANK</u>	<u>SPIKE RESULTS</u>	<u>DUPLICATE RESULTS</u>	<u>EXPECTED SPIKE</u>	<u>%REC SPIKE</u>	<u>%REC CONTROL LIMITS</u>	<u>MAX RPD</u>
METHANE	*	1	BDL	24	23	25	96	50-150	4 50

NOTES:
 PPM - Parts Per Million.
 BDL - Below Detection Limit
 Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: *ATI/GC/FID - ATI Gas Chromatographic method employing direct injection on column with Flame Ionization Detector (FID).



CLIENT: GEOENGINEERS
PROJECT: 161-013-R04
LAB ID: 92-5832
METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of
Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986
QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
92-5832-1	ATO42	06-24-92	07-02-92	N/A	07-10-92	EW0051	A



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0051

PARAMETERS

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		07-10-92	N/A	N/A
DETECTION LIMIT		RESULTS	RESULTS	RESULTS
METHYL TERT-BUTYL ETHER	10 mg/m3	BDL	BDL	BDL
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (50-150)	94	N/A	N/A
CHLOROBENZENE	*SURR* (50-150)	90	N/A	N/A

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0051

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	51	102	50-150
TOLUENE	50	BDL	49	98	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	56	112	9	50	50-150
TOLUENE	50	BDL	48	96	2	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits
 0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	07-10-92	100%	98 %
SPD	07-10-92	98 %	98 %

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

QC LIMITS
 S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEO ENGINEERING

ATI Lab ID # 92-5832
 SAMPLE DATE

PROJ NUMBER: 161-013-R04

1 AT042 06/24/92

PROJ NAME: WEST LAKE & MERCER

2 _____

SAMPLED BY: RTK

3 _____

SAMPLE SITE: SEATTLE

4 _____

SAMPLE DATE: 06/24/92

5 _____

SAMPLE TIME: 1500

6 _____

SAMPLE TYPE: AIR (SUMMA)

7 _____

RUSH: Y N QC: N 0 1 2 3 4

8 _____

Date Received: 07/02/92

9 _____

Is there a chain of custody? Y N

10 _____

Was chain of custody signed? Y N

11 _____

Were samples received cold? Y N

12 _____

Were samples received in proper containers? Y N

13 _____

Were samples preserved correctly? Y N

14 _____

Headspace in volatile bottles? Y N NA

15 _____

Were samples within holding time? Y N

16 _____

SHIPPED BY: UPS

17 _____

18 _____

19 _____

20 _____

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL _____ INSPECTED BY ROG DATE INSPECTED 07/02/92
 # OF REPORTS 1



GEOENGINEERS
 8410 154TH AVE N.E.
 REDMOND WA 98052-0000

Lab I.D.#: 92-6084
 Order Number: P60776
 Received Date: 07/10/92
 Client: 07061
 Sampled By: RTK
 Sample Date: 07/02/92
 Sample Time: 0800

Project Number: 161-013-RO4
 Project Name: UNOCAL-WESTLAKE & MERCER
 Sample Site: SEATTLE
 Sample Type: AIR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
6084-1	920702-1	METHANE	PPM	170	1

GeoEngineers

JUL 27 1992

Routing WAT
 File

Comments: PPM = Parts Per Million, by volume. MG/M3 = Milligrams Per Cubic Meter. Method Refs: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Edition, November 1986 and ATI Gas Chromatographic method employing direct injection on column with flame ionization detector (FID). BDL = Below Detection Limits.

Approved By : Mike [Signature]



Client: GEOENGINEERS

Lab I.D.#: 92-6084-1
 Received Date: 07/10/92
 Sampled By: RTK

Project Number: 161-013-RO4
 Project Name: UNOCAL-WESTLAKE & MERCER
 Sample Site: SEATTLE
 Sample Type: AIR

Sample ID.: 920702-1 Sample Date: 07/02/92 Time: 0800

AIR/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



Q U A L I T Y C O N T R O L
D A T A



Analytical Technologies, Inc.

11 EAST OLIVE ROAD
PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001

GEOENGINEERS

PROJECT: 161-013-R04 QC LEVEL I
LAB ID: 92-6084 BATCH: CA127

LAB ID CLIENT ID ANALYSIS DATE
92-6084-1 920702-1 07-15-92
DS 07-15-92
DS DUP. 07-15-92
DI BLANK 07-15-92

C - 325

<u>PARAMETER</u>	<u>METHOD</u>	<u>DETECTION LIMIT</u>	<u>BLANK</u>	<u>MATRIX SPIKE</u>		<u>EXPECTED SPIKE</u>	<u>%REC SPIKE</u>	<u>%REC SPIKE DUP.</u>	<u>% REC. CONTROL LIMITS</u>	<u>MAX RPD</u>
				<u>RESULTS</u>	<u>RESULTS</u>					
METHANE	*	1	BDL	17	18	25	68	72	50-150	6 50

NOTES:
PPM - Parts Per Million, by volume.
BDL - Below Detection Limit
Source for control limits is internal laboratory quality assurance program and reference below.
N/S - NOT SUBMITTED.

REFERENCE: *ATI/GC/FID - Gas Chromatographic method employing direct injection on column with Flame Ionization Detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 161-013-RO4

LAB ID: 92-6084

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
92-6084-1	920702-1	07-02-92	07-10-92	N/A	07-14-92	EW0052	A



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0052

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		07-14-92	N/A	N/A
PARAMETERS	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
METHYL TERT-BUTYL ETHER	10 mg/m3	BDL	BDL	BDL
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (50-150)	100	N/A	N/A
CHLOROBENZENE	*SURR* (50-150)	94	N/A	N/A

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0052

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	49	98	50-150
TOLUENE	50	BDL	48	96	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS RPD	REC
BENZENE	50	BDL	49	98	0	50	50-150
TOLUENE	50	BDL	47	94	2	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits
 0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	07-14-92	92 %	102%
SPD	07-14-92	102%	100%

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

client: Geoengineers

ATI Lab ID # 92- 6084
 SAMPLE DATE

PROJ NUMBER: 161-013-R04

1 920702-1 07/02/92

PROJ NAME: Unocal-Westlake & Mercer

2 _____

SAMPLED BY: RTK

3 _____

SAMPLE SITE: Seattle

4 _____

SAMPLE DATE: 07/02/92

5 _____

SAMPLE TIME: 0800

6 _____

SAMPLE TYPE: AIR

7 _____

RUSH: Y N QC: N 0 1 2 3 4

8 _____

Date Received: 07/10/92

9 _____

Is there a chain of custody? Y N

10 _____

Was chain of custody signed? Y N

11 _____

Were samples received cold? Y N

12 _____

Were samples received in proper containers? Y N

13 _____

Were samples preserved correctly? Y N

14 _____

Headspace in volatile bottles? Y N

15 _____

Were samples within holding time? Y N

16 _____

SHIPPED BY: UPS

17 _____

18 _____

19 _____

20 _____

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES* IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL me-7/10/92 INSPECTED BY JP

DATE INSPECTED 07/10/92
 # OF REPORTS 1



ATI LAB. I.D. # 92-6084

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

PART 1 - Bottle Shipment Information

CLIENT: <u>Geo Engineers</u>										CLIENT PROJECT NUMBER: <u>161-013-R04</u>																						
PRESERVATIVE					PLASTIC CONTAINERS					GLASS CONTAINERS																						
SAMPLE CONTAINERS SHIPPED	QTY.	H ₂ O	HWG	HCl	2n ACETATE	H ₂ S ₂ O ₈	UNPRESERVED	H ₂ O ₂	4 oz.	8 oz.	16 oz.	32 oz.	1/2 gallon	1 gallon	VINYL-BAG	100-ML SPECIMEN CUP	120 ml (A)	120 ml (C)	1 liter (A)	1 liter (C)	40 ml Vial	4 oz. WTR	8 oz. WTR	16 oz. WTR	32 oz. WTR	DI Trip Blank	PL Same Can					
RELINQUISHED <u>Laura J</u>										TIME <u>12:20</u>		DATE <u>6-24-92</u>		RECEIVED					TIME		DATE											

PART 2 - Sample Information

PARAMETERS AND PRESERVATIVES

SAMPLE MATRIX

DW DRINKINGWATER OL OIL
 WW WASTEWATER AR AIR
 GW GROUNDWATER SL SLUDGE
 SW SURFACEWATER
 SO SOIL

SAMPLE I.D.	DATE	TIME	MATRIX	PARAMETERS AND PRESERVATIVES																				TOTAL	LAB USE ONLY
<u>920702-1</u>	<u>7-29-92</u>	<u>8:00</u>	<u>Air</u>	<u>TUV Methane</u>																				<u>1</u>	
TOTAL NUMBER OF BOTTLES/CONTAINERS																								<u>1</u>	
RELINQUISHED BY: <u>Randy Kenyon</u>				DATE	TIME	RECEIVED BY: <u>C. Perry</u>				DATE	TIME														
				<u>7/3/92</u>	<u>11:00</u>					<u>6/24/92</u>	<u>1100</u>														

CLIENT Geo Engineers
 ADDRESS 8410 154th Av NE
 CITY Redmond
 STATE WA ZIP 98052
 PHONE NO. 206 861 6200
 PROJECT MANAGER (person to receive data) William Park

PROJECT NUMBER 161-013-R04 REQUEST FAX DATA BY _____ (FAX #)
 PROJECT NAME Unsat - Wall Lake # Mercer REQUEST VERBAL RESULTS BY _____ (DATE)
 SAMPLED BY RTK NEED DATA PACKAGE BY _____ (DATE)
 SAMPLE SITE Seattle QUALITY CONTROL REPORTING LEVEL (circle one)
 PURCHASE ORDER NUMBER _____ NONE 1 2 3 4
 NEED _____ EXTRA COPIES OF REPORT

TURN AROUND TIMES (check one)		SPECIAL INSTRUCTIONS:
STANDARD - 14 TO 21 DAYS	<input checked="" type="checkbox"/>	
RUSH: (MUST BE APPROVED IN ADVANCE)	<input type="checkbox"/>	
0-48 HOURS - 2 x STD PRICE	<input type="checkbox"/>	
3-7 DAYS - 1.5 x STD PRICE	<input type="checkbox"/>	
TCLP - 1 WEEK RUSH - 1.5 x STD PRICE	<input type="checkbox"/>	



GEOENGINEERS
 8410 154TH AVE N.E.
 REDMOND WA 98052-0000

Lab I.D.#: 92-6563
 Order Number: P61501
 Received Date: 07/28/92
 Client: 07061
 Sampled By: DJL
 Sample Date: 07/20/92
 Sample Time: 0745

Project Number: 161-013-R69
 Project Name: UNOCAL/WESTLAKE-MERCER
 Sample Site: WESTLAKE-MERCER
 Sample Type: VAPOR (AIR)

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
6563-1	920720-1	METHANE	PPMV	300	1

GeoEngineers

AUG 10 1992

Routing MLP
 File _____

Comments: MG/M3 = Milligrams Per Cubic Meter. PPMV = Parts Per Million Per Volume. Method Ref: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Edition, November 1986 and ATI Gas Chromatographic method employing direct injection on column with Flame Ionization Detector (FID) BDL = Below Detection Limits.

Approved By : Mike Horan



Client: GEOENGINEERS

Lab I.D.#: 92-6563-1
Received Date: 07/28/92
Sampled By: DJL

Project Number: 161-013-R69
Project Name: UNOCAL/WESTLAKE-MERCER
Sample Site: WESTLAKE-MERCER
Sample Type: VAPOR (AIR)

Sample ID.: 920720-1 Sample Date: 07/20/92 Time: 0745

IR/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



Analytical Technologies, Inc.

11 EAST OLIVE ROAD
PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001

GEOENGINEERS

PROJECT: 161-013-R69

QC LEVEL I

LAB ID: 92-6563

BATCH: CA0130

LAB ID CLIENT ID ANALYSIS DATE

92-6563-1 920720-1 08-03-92

SPIKE 08-03-92
SPIKE DUP. 08-03-92

BLANK 08-03-92

PARAMETER	METHOD	DETECTION LIMIT	BLANK	SPIKE		EXPECTED SPIKE	% REC SPIKE	% REC SPIKE DUP.	% REC. CONTROL LIMITS	MAX RPD
				RESULTS	RESULTS					
METHANE	ATI/GC/FID	1	BDL	108	112	100	108	112	50-150	4 50

NOTES:
PPM = Parts Per Million, by volume.
BDL = Below Detection Limit
Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: ATI Gas Chromatographic method employing direct injection on column with Flame Ionization Detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 161-013-R69

LAB ID: 92-6563

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
92-6563-1	920720-1	07-20-92	07-28-92	N/A	07-30-92	EW0057	A



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0057

PARAMETERS

ETHYL TERT-BUTYL ETHER	10 mg/m3
BENZENE	1 mg/m3
ETHYL BENZENE	1 mg/m3
TOLUENE	5 mg/m3
XYLENE	2 mg/m3
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3
BROMOFLUOROBENZENE	*SURR* (50-150)
CHLOROBENZENE	*SURR* (50-150)

BLANK A BLANK B BLANK C

EXTRACTION DATE	N/A	N/A	N/A
ANALYSIS DATE	07-30-92	N/A	N/A
DETECTION LIMIT	RESULTS	RESULTS	RESULTS
	BDL	BDL	BDL
	BDL	BDL	BDL
	BDL	BDL	BDL
	BDL	BDL	BDL
	BDL	BDL	BDL
	BDL	BDL	BDL
	98	N/A	N/A
	84	N/A	N/A

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0057

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	73	146	50-150
TOLUENE	50	BDL	52	104	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	47	94	43	50	50-150
TOLUENE	50	BDL	50	100	4	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits
 0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	07-30-92	100%	96 %
SPD	07-30-92	100%	94 %

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

QC LIMITS
 S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GeoEngineers

ATI Lab ID # 92- 6563
 SAMPLE DATE

PROJ NUMBER: 161-013-R69

1 920720-1 07/20/92

PROJ NAME: UNOCAL/

2 _____

WESTLAKE-MERCER

3 _____

SAMPLED BY: DJL

4 _____

SAMPLE SITE: WESTLAKE/MERCER

5 _____

SAMPLE DATE: 7/20/92

6 _____

SAMPLE TIME: 0745

7 _____

SAMPLE TYPE: VAPOR (ART) (AIR)

8 _____

RUSH: Y N QC: N 0 1 2 3 4

9 _____

Date Received: 07/28/92

10 _____

Is there a chain of custody? Y N

11 _____

Was chain of custody signed? Y N

12 _____

Were samples received cold? Y N

13 _____

Were samples received in proper containers? Y N

14 _____

Were samples preserved correctly? Y N

15 _____

Headspace in volatile bottles? Y N/A

16 _____

Were samples within holding time? Y N

17 _____

SHIPPED BY: FED-EX

18 _____

19 _____

OUT OF CONTROL EVENTS: _____

ATI WILL PERFORM THE SERVICES* IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

APPROVAL _____ INSPECTED BY T.D. DATE INSPECTED 07/28/92
 # OF REPORTS 01



GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 92-7622
Order Number: P63014
Received Date: 09/03/92
Client: 07061
Sampled By: DJL
Sample Date: 08/26/92
Sample Time: 0800

Project Number: 161-013-R04
Project Name: UNOCAL/WESTLAKE MERCER
Sample Site: N/S
Sample Type: VAPOR (AIR)

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
7622-1	920826-1	METHANE	PPM	260	1

GeoEngineers

SEP 15 1992

Routing NLP
File _____

Comments: MG/M3 = Milligrams Per Cubic Meter. PPM = Parts Per Million by Volume.
Method Reference: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Ed, 11/86, and ATI Gas Chromatographic method employing direct injection on column with flame ionization detector (FID). BDL = Below Detection Limits.

Approved By : Mike Toran
page 1



Client: GEOENGINEERS

Lab I.D.#: 92-7622-1

Project Number: 161-013-R04
Project Name: UNOCAL/WESTLAKE MERCER
Sample Site: N/S
Sample Type: VAPOR (AIR)

Received Date: 09/03/92
Sampled By: DJL

Sample ID.: 920826-1 Sample Date: 08/26/92 Time: 0800

AIR/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



Q U A L I T Y C O N T R O L
D A T A

GeoEngineers

SEP 15 1992

Routing

MLP

File

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Analytical Technologies, Inc.

11 EAST OLIVE ROAD
PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001

GEOENGINEERS

PROJECT: 161-013-R04

QC LEVEL I

LAB ID: 92-7622

BATCH: CA0132

ANALYSIS
DATE

LAB ID CLIENT ID

92-7622-1 920826-1 09-08-92

SPIKE 09-08-92

SPIKE DUP. 09-08-92

BLANK 09-08-92

PARAMETER	METHOD	DETECTION LIMIT	BLANK	SPIKE		EXPECTED SPIKE	% REC SPIKE	% REC SPIKE DUP.	% REC. CONTROL LIMITS	MAX RPD
				RESULTS	RESULTS					
METHANE	ATI/GC/FID	1	BDL	98	98	100	98	98	50-150	0 50

NOTES: PPM = Parts Per Million, by volume.
BDL = Below Detection Limit
Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: ATI Gas Chromatographic method employing direct injection on column with Flame Ionization Detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 161-013-R04

LAB ID: 92-7622

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
92-7622-1	920826-1	08-26-92	09-03-92	N/A	09-04-92	EW0067	B



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0067

		BLANK A	BLANK B	BLANK C
PARAMETERS	EXTRACTION DATE	N/A	N/A	N/A
	ANALYSIS DATE	09-03-92	09-04-92	N/A
	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
METHYL TERT-BUTYL ETHER	10 mg/m3	BDL	BDL	BDL
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (50-150)	102	88	N/A
CHLOROBENZENE	*SURR* (50-150)	78	80	N/A

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0067

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	33	66	50-150
TOLUENE	50	BDL	48	96	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	44	88	29	50	50-150
TOLUENE	50	BDL	43	86	11	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits
 0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	09-03-92	100%	98 %
SPD	09-03-92	100%	92 %

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:



GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 92-8043
Order Number: P63659
Received Date: 09/21/92
Client: 07061
Sampled By: DJL
Sample Date: 09/11/92
Sample Time: 0800

Project Number: 161-013-R69
Project Name: UNOCAL/WESTLAKE & MERCER
Sample Site: WESTLAKE & MERCER
Sample Type: AIR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
8043-1	920911-1	METHANE	PPM	190	1

GeoEngineers

OCT 01 1992

Routing *NLP*
File

Comments: MG/M3 = Milligrams Per Cubic Meter. PPM = Parts Per Million (by volume). Method Ref: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Edition, November 1986. BDL = Below Detection Limits. ATI Gas Chromatographic method employing direct injection on column with flame ionization detector (FID).

Approved By : Mike Gora



Client: GEOENGINEERS

Lab I.D.#: 92-8043-1

Project Number: 161-013-R69

Received Date: 09/21/92

Project Name: UNOCAL/WESTLAKE & MERCER

Sampled By: DJL

Sample Site: WESTLAKE & MERCER

Sample Type: AIR

Sample ID.: 920911-1

Sample Date: 09/11/92 Time: 0800

AIR/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



Analytical Technologies, Inc.

11 EAST OLIVE ROAD
PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001

GEOENGINEERS

PROJECT: 161-013-R69

QC LEVEL I

LAB ID: 91-8043 BATCH: CA0141

LAB ID CLIENT ID ANALYSIS DATE

91-8043-1 920911-1 09-21-92

SPIKE 09-21-92
SPIKE DUP. 09-21-92

BLANK 09-21-92

C I 350

PARAMETER	METHOD	DETECTION LIMIT	BLANK	SPIKE RESULTS	SPIKE DUPLICATE RESULTS	EXPECTED SPIKE	% REC SPIKE	% REC SPIKE DUP.	% REC. CONTROL LIMITS	MAX RPD
METHANE	*	1	BDL	100	98	100	100	98	50-150	2 50

NOTES: PPM = Parts Per Million, by volume.
BDL = Below Detection Limit
Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: ATI Gas Chromatographic method employing direct injection on column with Flame Ionization Detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 161-013-R69

LAB ID: 92-8043

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
92-8043-1	920911-1	09-11-92	09-21-92	N/A	09-24-92	EW0073	A



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0073

PARAMETERS

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		09-24-92	N/A	N/A
DETECTION LIMIT		RESULTS	RESULTS	RESULTS
METHYL TERT-BUTYL ETHER	10 mg/m3	BDL	BDL	BDL
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (50-150)	98	N/A	N/A
CHLOROBENZENE	*SURR* (50-150)	86	N/A	N/A

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0073

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	45	90	50-150
TOLUENE	50	BDL	45	90	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	45	90	0	50	50-150
TOLUENE	50	BDL	44	88	2	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits
 0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	09-24-92	102%	96 %
SPD	09-24-92	102%	94 %

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

QC LIMITS
 S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEOENGINEERS

ATI Lab ID # 92- 8043

PROJ NUMBER: 161-013-R69

PROJ NAME: UNOCAL/WESTLAKE & MERCER

SAMPLED BY: DTL

SAMPLE SITE: WESTLAKE & MERCER

SAMPLE DATE: 09/10/92

SAMPLE TIME: 0800

SAMPLE TYPE: AIR

RUSH: Y N QC: N 0 1 2 3 4

Date Received: 09/21/92

Is there a chain of custody? Y N

Was chain of custody signed? Y N

Were samples received cold? Y N

Were samples received in proper containers? Y N

SHIPPED BY: FED EX UPS
09/21/92 WA 933-9ES

COOLER #: N/A

OUT OF CONTROL EVENTS: _____

SPECIAL INSTRUCTIONS: _____

SAMPLE	DATE
1 <u>920911-1</u>	<u>9/11/92</u>
2 _____	_____
3 _____	_____
4 _____	_____
5 _____	_____
6 _____	_____
7 _____	_____
8 _____	_____
9 _____	_____
10 _____	_____

Were samples preserved correctly? Y N

Headspace in volatile bottles? Y N/A

Were samples within holding time? Y N

Is there sufficient sample volume? Y N

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL _____ INSPECTED BY af DATE INSPECTED 9/21/92
OF REPORTS 1



PART 1 - Bottle Shipment Information

CLIENT: GEOENGINEERS	CLIENT PROJECT NUMBER:
-----------------------------	------------------------

SAMPLE CONTAINERS SHIPPED	PRESERVATIVE				PLASTIC CONTAINERS				GLASS CONTAINERS																			
	H ₂ SO ₄	HNO ₃	HCl	Zn ACETATE	H ₂ S-O ₂	UNPRESERVED	H ₂ O ₂	4 OZ.	8 OZ.	16 OZ.	32 OZ.	1/2 gallon	1 gallon	WHIT-PAK	100-ML SPECIMEN CUP	120 ml (A)	120 ml (C)	1 liter (A)	1 liter (C)	40 ml Vial	4 OZ. W/IN	8 OZ. W/IN	16 OZ. W/IN	32 OZ. W/IN	01 Trip Blank			
QTY.																												

AT001

RELINQUISHED BY: <i>J. New</i>	TIME: 1600	DATE: 9/8/92	RECEIVED	TIME	DATE
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PART 2 - Sample Information

PARAMETERS AND PRESERVATIVES

SAMPLE MATRIX
 DW DRINKINGWATER OL OIL
 WW WASTEWATER AR AIR
 GW GROUNDWATER SL SLUDGE
 SW SURFACEWATER
 SO SOIL

SAMPLE I.D.	DATE	TIME	MATRIX	1/4"	METHANE	TOTAL	LAB USE ONLY
920911-1	9/11/92	0800	AR	X	X	1	

TOTAL NUMBER OF BOTTLES/CONTAINERS 1

RELINQUISHED BY: <i>Dave Benavich</i>	DATE: 9/11/92	TIME: 1300	RECEIVED BY: <i>(Signature)</i>	DATE: 9/21/92	TIME: 0915
---------------------------------------	---------------	------------	---------------------------------	---------------	------------

CLIENT: GEO ENGINEERS PROJECT NUMBER: 161-D13-R69 REQUEST FAX DATA BY: 206-861-6050 (FAX #)

ADDRESS: 8110 154TH AVE. NE. PROJECT NAME: WASTAGE & MERCER REQUEST VERBAL RESULTS BY: _____ (DATE)

CITY: REDMOND, WA SAMPLED BY: D.J.L. NEED DATA PACKAGE BY: _____ (DATE)

STATE: WA ZIP: 98052 SAMPLE SITE: WASTAGE & MERCER QUALITY CONTROL REPORTING LEVEL (circle one)

PHONE NO.: 206-861-6000 PURCHASE ORDER NUMBER: _____ NONE 1 2 3 4

PROJECT MANAGER (person to receive data): _____ NEED _____ EXTRA COPIES OF REPORT

TURN AROUND TIMES (check one)

STANDARD - 14 TO 21 DAYS

RUSH: (MUST BE APPROVED IN ADVANCE)

0-48 HOURS - 2 x STD PRICE

3-7 DAYS - 1.5 x STD PRICE

TCLP - 1 WEEK RUSH - 1.5 x STD PRICE

SPECIAL INSTRUCTIONS:

FAX RESULTS TO NORM POKI
OF GEO ENGINEERS

C - 355



GEO ENGINEERS
8410 154TH AVE N.E.
REDMOND WA 98052-0000

Lab I.D.#: 92-8634
Order Number: P64461
Received Date: 10/13/92
Client: 07061
Sampled By: DJL
Sample Date: 10/12/92
Sample Time: 0800

Project Number: 161-013-R69
Project Name: UNOCAL/WESTLAKE & MERCER
Sample Site: WESTLAKE/MERCER
Sample Type: AIR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
634-1	921012-1	METHANE	PPM	190	1

Comments: MG/M3 = Milligrams Per Cubic Meter. PPM = Parts Per Million by volume.
Method Ref: Compendium of Methods for the Determination of Toxic Organic
Compounds in Ambient Air, SW-846, 3rd Ed, 11/86 and ATI Gas Chromatographic
method employing direct injection on column with flame ionization detector
(FID). BDL = Below Detection Limit.

Approved By : Mike Tava
page 1



Client: GEO ENGINEERS

Lab I.D.#: 92-8634-1
Received Date: 10/13/92
Sampled By: DJL

Project Number: 161-013-R69
Project Name: UNOCAL/WESTLAKE & MERCER
Sample Site: WESTLAKE/MERCER
Sample Type: AIR

Sample ID.: 921012-1 Sample Date: 10/12/92 Time: 0800

AIR/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



Analytical **Technologies, Inc.**

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

Q U A L I T Y C O N T R O L
D A T A



Analytical Technologies, Inc.

GEO ENGINEERS

11 EAST OLIVE ROAD
PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001

PROJECT: 161-013-R69

QC LEVEL: I

LAB ID: 92-8634

BATCH: CA147

LAB ID	CLIENT ID	ANALYSIS DATE
92-8634-1	921012-1	10-13-92
SPIKE		10-13-92
SPIKE DUP		10-13-92
DI BLANK		10-13-92

C	I	359	PARAMETER	METHOD	DETECTION LIMIT	BLANK	REAGENT SPIKE		EXPECTED SPIKE	% REC		CONTROL LIMITS	MAX RPD
							DUPLICATE RESULTS	RESULTS		REAGENT SPIKE	% REC		
			METHANE	*	1 PPM	BDL	100	100	100 PPM	100	100	50-150	0 50

NOTES: PPM = Parts Per Million, (by volume).
 BDL = Below Detection Limit
 Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: * ATI Gas Chromatographic method employing direct injection on column with Flame Ionization Detector (FID).



CLIENT: GEO ENGINEERS

PROJECT: 161-013-R69

LAB ID: 92-8634

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
92-8634-1	921012-1	10-12-92	10-13-92	N/A	10-19-92	EW0080	A



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0080

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		10-19-92	N/A	N/A
PARAMETERS	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
METHYL TERT-BUTYL ETHER	10 mg/m3	BDL	BDL	BDL
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (50-150)	94	N/A	N/A
CHLOROBENZENE	*SURR* (50-150)	84	N/A	N/A

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



EAGENT WATER SPIKE

ATCH NUMBER: EW0080

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	42	84	50-150
TOLUENE	50	BDL	42	84	50-150

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	39	78	7	50	50-150
TOLUENE	50	BDL	40	80	5	50	50-150

Column to be used to flag recovery and RPD values with an asterisk

Values outside of QC limits

0 out of 4 % recoveries out of limits

0 out of 4 surrogate recoveries out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	10-19-92	100%	92 %
SPD	10-19-92	100%	96 %

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

QC LIMITS
 S1 = BROMOFLUOROBENZENE (50-150)
 S2 = CHLOROBENZENE (50-150)

COMMENTS:

MG

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEO ENGINEERS

ATI Lab ID # 92-8634

PROJ NUMBER: 161-013-R69

SAMPLE	DATE
1	<u>921012-1</u> <u>10-12-92</u>
2	
3	
4	
5	
6	
7	
8	
9	
10	

PROJ NAME: UNOCAL/WESTLAKE

MERCER

SAMPLED BY: DSL

SAMPLE SITE: WESTLAKE /

MERCER

SAMPLE DATE: 10/12/92

SAMPLE TIME: 0800

SAMPLE TYPE: AIR

RUSH: Y QC: N 0 2 3 4

Date Received: 10/12/92 ^{13 TD: 10/13}

Is there a chain of custody? N

Was chain of custody signed? N

Were samples received cold? N

Were samples received in proper containers? N

SHIPPED BY: UPS

Were samples preserved correctly? N

Headspace in volatile bottles? Y N

Were samples within holding time? N

Is there sufficient sample volume? N

OUT OF CONTROL EVENTS: _____

SPECIAL INSTRUCTIONS: Fix results to Norm Puri

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL MG 10/13/92 INSPECTED BY RF DATE INSPECTED 10/13/92
OF REPORTS 1



GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 92-9631
Order Number: P65986
Received Date: 11/19/92
Client: 07061
Sampled By: DJL
Sample Date: 11/09/92
Sample Time: 0800

Project Number: 161-013-R69
Project Name: UNOCAL/WESTLAKE & MERCER
Sample Site: WESTLAKE & MERCER
Sample Type: AIR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
631-1	921109-1	METHANE	PPM	200	1

GeoEngineers

NOV 30 1992

Routing NLP
File

Comments: PPM = Parts Per Million (By Volume). MG/M3 = Milligrams Per Cubic Meter. Meth. Refs: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd., Ed. 11/86 and ATI Gas Chromatographic method employing direct injection on column with flame ionization detector (FID). BDL = Below Detection Limit.

Approved By : Peter Shuba
page 1



Client: GEOENGINEERS

Lab I.D.#: 92-9631-1

Received Date: 11/19/92

Sampled By: DJL

Project Number: 161-013-R69

Project Name: UNOCAL/WESTLAKE & MERCER

Sample Site: WESTLAKE & MERCER

Sample Type: AIR

Sample ID.: 921109-1

Sample Date: 11/09/92

Time: 0800

AIR/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



Q U A L I T Y C O N T R O L
D A T A

GEOENGINEERS

PROJECT: 161-013-R69

QC LEVEL: I

LAB ID: 92-9631

BATCH: CA152

LAB ID	CLIENT ID	ANALYSIS DATE
92-9631-1	921109-1	11-19-92
SPIKE		11-19-92
SPIKE DUP		11-19-92
DI BLANK		11-19-92

C 1 367	PARAMETER	METHOD	DETECTION LIMIT	BLANK	REAGENT SPIKE		EXPECTED SPIKE	% REC.		MAX RPD
					RESULTS	DUPLICATE RESULTS		REAGENT SPIKE	CONTROL LIMITS	
	METHANE	*	1 PPM	BDL	98 PPM	100 PPM	100	98	50-150	2 50

NOTES:
 PPM = Parts Per Million (by volume).
 BDL = Below Detection Limit
 Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: * ATI Gas Chromatographic method employing direct injection on column with Flame Ionization Detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 161-013-R69

LAB ID: 92-9631

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
92-9631-1	921109-1	11-09-92	11-19-92	N/A	11-20-92	EW0089	B



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0089

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		11-19-92	11-20-92	11-21-92
PARAMETERS	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
	BENZENE	1 mg/m3	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (81-109)	98	96	98
CHLOROBENZENE	*SURR* (70-105)	80	80	78

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0089

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	46	92	58-119
TOLUENE	50	BDL	44	88	69-112

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS RPD	REC
BENZENE	50	BDL	46	92	0	42	58-119
TOLUENE	50	BDL	45	90	2	23	69-112

* Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits
 0 out of 4 surrogate recoveries out of limits
 0 out of 2 RPDs out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	11-19-92	102%	92 %
SPD	11-19-92	102%	90 %

= DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Results reported are blank corrected.
 Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE (81-109)
 S2 = CHLOROBENZENE (70-105)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEOENGINEERS

ATI Lab ID # 92-9631

PROJ NUMBER: 161-013-R69

1 SAMPLE DATE
1 921109-1 11-09-92

PROJ NAME: UNOCAL/WESTLAKE

2 _____

MERCER

3 _____

SAMPLED BY: DJL

4 _____

SAMPLE SITE: WESTLAKE MERCER

5 _____

SAMPLE DATE: 11/9/92

6 _____

SAMPLE TIME: 0800

7 _____

SAMPLE TYPE: AIR

8 _____

RUSH: Y N QC: N 0 2 3 4

9 _____

Date Received: 11/19/92

10 _____

Is there a chain of custody? Y N

Were samples preserved correctly? Y N/A

Was chain of custody signed? Y N

Headspace in volatile bottles? Y N/A

Were samples received cold? Y N/A

Were samples received in proper containers? Y N

Were samples within holding time? Y N

SHIPPED BY: UPS

Is there sufficient sample volume? Y N/A

COOLER #: -

OUT OF CONTROL EVENTS: CANISTER ARRIVED UNLABELED - I LABELED ACCORDING TO C.O.C. Michael D Meyer 11/19/92

SPECIAL INSTRUCTIONS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL MD 11/19/92 INSPECTED BY MM DATE INSPECTED 11/19/92
OF REPORTS 1



ATI LAB. I.D.# 92-9631

11 EAST OLIVE ROAD PHONE (904) 474-1001
PENSACOLA, FLORIDA 32514

PART 1 - Bottle Shipment Information

CLIENT: <u>GEOENGINEERS</u>	CLIENT PROJECT NUMBER: <u>161-013-R69</u>
-----------------------------	---

SAMPLE CONTAINERS SHIPPED	PRESERVATIVE				PLASTIC CONTAINERS				GLASS CONTAINERS																				
	H ₂ SO ₄	HNO ₃	HCl	Zn ACETATE	MS.G.	UNPRESERVED	None	4 oz.	8 oz.	16 oz.	32 oz.	1/2 gallon	1 gallon	White-pkg	100-ML SPECMEN CUP	120 ml (A)	120 ml (C)	1 liter (A)	1 liter (C)	40 ml Vial	4 oz. W/M	8 oz. W/M	16 oz. W/M	32 oz. W/M	01 Trip Blank				
1																													ATD07

RELINQUISHED BY: <u>[Signature]</u>	TIME: <u>1630</u>	DATE: <u>11/15/92</u>	RECEIVED BY: _____	TIME: _____	DATE: _____
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PART 2 - Sample Information

PARAMETERS AND PRESERVATIVES

- SAMPLE MATRIX**
- DW DRINKINGWATER
 - WW WASTEWATER
 - GW GROUNDWATER
 - SW SURFACEWATER
 - SO SOIL
 - OL OIL
 - AR AIR
 - SL SLUDGE

SAMPLE I.D.	DATE	TIME	MATRIX	TUHH	METHANE	TOTAL	LAB USE ONLY
<u>921109-1</u>	<u>11/19/92</u>	<u>0800</u>	<u>AR</u>	<u>X</u>	<u>X</u>	<u>1</u>	

RELINQUISHED BY: <u>Dave L...</u>	DATE: <u>11/19/92</u>	TIME: <u>1300</u>	RECEIVED BY: <u>Michael D Meyer</u>	DATE: <u>11/19/92</u>	TIME: <u>0920</u>
-----------------------------------	-----------------------	-------------------	-------------------------------------	-----------------------	-------------------

CLIENT: <u>GEOENGINEERS</u>	PROJECT NUMBER: <u>161-013-R69</u>	REQUEST FAX DATA BY: <u>ASAP</u> (FAX #)
ADDRESS: <u>8910 150TH AVE NE</u>	PROJECT NAME: <u>UNRAY / WESTLAKE & MERCER</u>	REQUEST VERBAL RESULTS BY: _____ (DATE)
CITY: <u>REDMOND, WA</u>	SAMPLED BY: <u>D.J.L.</u>	NEED DATA PACKAGE BY: _____ (DATE)
STATE: <u>WA</u> ZIP: <u>98052</u>	SAMPLE SITE: <u>WESTLAKE & MERCER</u>	QUALITY CONTROL REPORTING LEVEL: (circle one)
PHONE NO. (904) <u>661-6000</u>	PURCHASE ORDER NUMBER: _____	NONE 1 2 3 4
PROJECT MANAGER (person to receive data): _____		NEED _____ EXTRA COPIES OF REPORT

<p>TURN AROUND TIMES (check one)</p> <p>STANDARD - 14 TO 21 DAYS <input checked="" type="checkbox"/></p> <p>RUSH: (MUST BE APPROVED IN ADVANCE)</p> <p>0-48 HOURS - 2 x STD PRICE <input type="checkbox"/></p> <p>3-7 DAYS - 1.5 x STD PRICE <input type="checkbox"/></p> <p>TCLP - 1 WEEK RUSH - 1.5 x STD PRICE <input type="checkbox"/></p>	<p>SPECIAL INSTRUCTIONS:</p> <p>FAX RESULTS TO NORM PURI OF GEOENGINEERS</p> <p>372</p>
---	--



GEO ENGINEERS
7504 S W BRIDGEPORT ROAD

PORTLAND OR 97224-0000

Lab I.D.#: 92-10591
Order Number: P67348
Received Date: 12/22/92
Client: 06055
Sampled By: DJL
Sample Date: 12/11/92
Sample Time: 0800

Project Number: 161-013-R69
Project Name: UNOCAL/WESTLAKE MERCER
Sample Site: WESTLAKE MERCER
Sample Type: VAPOR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
10591-1	921211-1	METHANE	PPM	280	2

GeoEngineers

JAN 04 1993

Routing
File

Comments: MG/M3 = Milligrams Per Cubic Meter. PPM = Parts Per Million (by volume). Meth. Refs: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Ed., 11/86 & ATI Gas Chromatographic method employing direct injection on column with Flame Ionization Detector (FID).

Approved By : Mike Yoro



Client: GEO ENGINEERS

Lab I.D.#: 92-10591-1

Project Number: 161-013-R69
Project Name: UNOCAL/WESTLAKE MERCER
Sample Site: WESTLAKE MERCER
Sample Type: VAPOR

Received Date: 12/22/92
Sampled By: DJL

Sample ID.: 921211-1

Sample Date: 12/11/92 Time: 0800

AIR/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



CLIENT: GEO ENGINEERS

PROJECT: 161-013-R69

LAB ID: 10591

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
10591-1	921211-1	12-11-92	12-22-92	N/A	12-23-92	EW0097	B



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0097

		BLANK A	BLANK B	BLANK C
PARAMETERS	EXTRACTION DATE	N/A	N/A	N/A
	ANALYSIS DATE	12-21-92	12-23-92	N/A
	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (81-109)	96	94	N/A
CHLOROBENZENE	*SURR* (70-105)	78	78	N/A

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0097

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	43	86	58-119
TOLUENE	50	BDL	43	86	69-112

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	36	72	18	42	58-119
TOLUENE	50	BDL	37	74	15	23	69-112

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits

0 out of 4 surrogate recoveries out of limits

0 out of 2 RPDs out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	12-21-92	104%	94 %
SPD	12-21-92	98 %	92 %

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE (81-109)
 S2 = CHLOROBENZENE (70-105)

COMMENTS:



Analytical Technologies, Inc.

GEO ENGINEERS

11 EAST OLIVE ROAD
PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001

PROJECT: 161-013-R69

QC LEVEL: I

LAB ID: 92-10591

BATCH: CA160

LAB ID	CLIENT ID	ANALYSIS DATE
92-10591-1	921211-1	12-23-92
SPIKE		12-23-92
SPIKE DUP		12-23-92
DI BLANK		12-23-92

C - 379

PARAMETER	METHOD	DETECTION LIMIT	REAGENT SPIKE RESULTS	REAGENT SPIKE DUPLICATE RESULTS	EXPECTED SPIKE	% REAGENT SPIKE	% REAGENT SPIKE DUP.	% REC. CONTROL LIMITS	MAX RPD
METHANE	*	1 PPM	BDL	100	100	100	100	50-150	0 50

NOTES: PPM = Parts Per Million, (by volume).

BDL = Below Detection Limit

Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: * ATI Gas Chromatographic method employing direct injection on column with Flame Ionization Detector (FID).

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

client: GEO ENGINEERS

ATI Lab ID # 92- 10591

PROJ NUMBER: 161-013-R69

SAMPLE DATE: 921211-1 DATE: 12/11/92

PROJ NAME: UNOCAL/WESTLAKE
MERCER

SAMPLED BY: DJL

SAMPLE SITE: WESTLAKE

SAMPLE DATE: MERCER
12/11/92

SAMPLE TIME: 0800

SAMPLE TYPE: VAPOR

RUSH: Y QC: N 0 2 3 4

Date Received: 12/22/92

Is there a chain of custody? Y N

Were samples preserved correctly? Y N

Was chain of custody signed? Y N

Headspace in volatile bottles? Y N N/A

Were samples received cold? Y N

Were samples received in proper containers? Y N

Were samples within holding time? Y N

SHIPPED BY: FED EX

Is there sufficient sample volume? Y N

COOLER #: _____

OUT OF CONTROL EVENTS: _____

SPECIAL INSTRUCTIONS: _____

V. POC
12/22/92

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL me 12/22/92 INSPECTED BY GF

DATE INSPECTED 12/22/92
OF REPORTS 1



GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 93-0459
Order Number: P68209
Received Date: 01/20/93
Client: 07061
Sampled By: D. LOVROVICH
Sample Date: 01/08/93
Sample Time: 0800

Project Number: 161-013-R69
Project Name: UNOCAL/WESTLAKE & MERCER
Sample Site: WESTLAKE & MERCER
Sample Type: VAPOR (AIR)

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
0459-1	930108-1	METHANE	PPM	100	1.0

GeoEngineers

JAN 26 1993

Routing ALP H B
File

Comments: PPM = Parts Per Million (by Volume). MG/M3 = Milligrams Per Cubic Meter. Method Refs: ATI Gas Chromatographic method employing direct injection on column with flame ionization detector (FID) and Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Edition, November 1986. BDL = Below Detection Limit.

page 1 Approved By : Linda Perjan



Client: GEOENGINEERS

Lab I.D.#: 93-0459-1

Project Number: 161-013-R69

Received Date: 01/20/93

Project Name: UNOCAL/WESTLAKE & MERCER

Sampled By: D. LOVROVICH

Sample Site: WESTLAKE & MERCER

Sample Type: VAPOR (AIR)

Sample ID.: 930108-1

Sample Date: 01/08/93

Time: 0800

AIR/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



Q U A L I T Y C O N T R O L
D A T A



Analytical Technologies, Inc.

11 EAST OLIVE ROAD
PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001

GEOENGINEERS

PROJECT: 161-013-R69

QC LEVEL: I

LAB ID: 93-0459

BATCH: CA165

LAB ID	CLIENT ID	ANALYSIS DATE
93-0459-1	930108-1	01-21-93
SPIKE		01-21-93
SPIKE DUP		01-21-93
DI BLANK		01-21-93

PARAMETER	METHOD	DETECTION LIMIT	BLANK	SPIKE RESULTS	DUPLICATE RESULTS	EXPECTED SPIKE	%REC SPIKE	%REC SPIKE DUP.	% REC. CONTROL LIMITS	MAX RPD
METHANE	*	1.0	BDL	99	99	100	99	99	50-150	0 50

NOTES: PPM = Parts Per Million (by volume).
 BDL = Below Detection Limit
 Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: * ATI Gas Chromatographic method employing direct injection on column with Flame Ionization Detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 161-013-R69

LAB ID: 93-0459

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
93-0459-1	930108-1	01-08-93	01-20-93	N/A	01-21-93	EW0005	A



ETHOD INSTRUMENT BLANK

BATCH NUMBER: EW0005

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		01-21-93	N/A	N/A
PARAMETERS	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (73-117)	96	N/A	N/A
CHLOROBENZENE	*SURR* (64-100)	82	N/A	N/A

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0005

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	53	106	70-107
TOLUENE	50	BDL	48	96	70-104

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS RPD	REC
BENZENE	50	BDL	53	106	0	24	70-107
TOLUENE	50	BDL	47	94	2	21	70-104

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

- 0 out of 4 % recoveries out of limits
- 0 out of 4 surrogate recoveries out of limits
- 0 out of 2 RPDs out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	01-21-93	100%	100%
SPD	01-21-93	98 %	100%

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE (73-117)
 S2 = CHLOROBENZENE (64-100)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GEO ENGINEERS

ATI Lab ID # 93- 0459

PROJ NUMBER: 161-013-R659

PROJ NAME: UNOCAL/WESTLAKE & MERCER

SAMPLED BY: D. LOUROVICH

SAMPLE SITE: WEST LAKE & MERCER

SAMPLE DATE: 01/08/93

SAMPLE TIME: 0800

SAMPLE TYPE: VAPOR (AIR)

RUSH: Y N QC: N 0 1 2 3 4

Date Received: 01/20/93

Is there a chain of custody? Y N

Was chain of custody signed? Y N

Were samples received cold? Y N

Were samples received in proper containers? Y N

SHIPPED BY: UPS

COOLER #: N/S

OUT OF CONTROL EVENTS: _____

SPECIAL INSTRUCTIONS: FAX RESULTS TO NORM PURI

SAMPLE	DATE
1 <u>930108-1</u>	<u>01/08/93</u>
2 _____	_____
3 _____	_____
4 _____	_____
5 _____	_____
6 _____	_____
7 _____	_____
8 _____	_____
9 _____	_____
10 _____	_____

Were samples preserved correctly? Y N

Headspace in volatile bottles? N/A

Were samples within holding time? Y N

Is there sufficient sample volume? Y N

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SA SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL LP 1/20/93 INSPECTED BY RJC DATE INSPECTED 01/20/93
OF REPORTS 1



ATI LAB. I.D. #

93-0459

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

PART 1 - Bottle Shipment Information

CLIENT: <u>Geo Engineers</u>	CLIENT PROJECT NUMBER:
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SAMPLE CONTAINERS SHIPPED	PRESERVATIVE				PLASTIC CONTAINERS				GLASS CONTAINERS				QTY.																	
	H2SO4	HNO3	HCl	Zn ACETATE	Na2S2O8	UNPRESERVED	NaOH	4 OZ.	8 OZ.	16 OZ.	32 OZ.	1/2 Gallon		1 Gallon	White-pack	100-ML SPECIMEN CUP	120 ml (A)	120 ml (B)	1 liter (A)	1 liter (B)	40 ml Vial	4 oz. W/W	8 oz. W/W	16 oz. W/W	32 oz. W/W	DI Trip Blank	GL Sample			
																													1	AT007

RELINQUISHED BY: <u>[Signature]</u>	TIME: <u>15:40</u>	DATE: <u>1/6/93</u>	RECEIVED	TIME	DATE
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PART 2 - Sample Information

PARAMETERS AND PRESERVATIVES

SAMPLE MATRIX

- DW DRINKING WATER
- WW WASTEWATER
- IW GROUNDWATER
- SW SURFACEWATER
- SO SOIL
- OL OIL
- AR AIR
- SL SLUDGE

SAMPLE I.D.	DATE	TIME	MATRIX	T.V.H.	METHANE	TOTAL	LAB USE ONLY
930108-1	1/8/93	0800	VAPOR				1

RELINQUISHED BY: <u>Dave Lovovich</u>	DATE: <u>1/8/93</u>	TIME: <u>0800</u>	RECEIVED BY: <u>Robt Experm</u>	DATE: <u>1/23/93</u>	TIME: <u>0430</u>
---------------------------------------	---------------------	-------------------	---------------------------------	----------------------	-------------------

CLIENT: <u>GEO ENGINEERS</u>	PROJECT NUMBER: <u>161-013-R19</u>	REQUEST FAX DATA BY: _____ (FAX #)
ADDRESS: <u>RD 154 1/2 AVE. NE</u>	PROJECT NAME: <u>WALC / WESTLAKE 3</u>	REQUEST VERBAL RESULTS BY: _____ (DATE)
CITY: <u>REDMOND, WA</u>	SAMPLED BY: <u>Dave Lovovich</u>	NEED DATA PACKAGE BY: _____ (DATE)
STATE: <u>WA</u> ZIP: <u>98052</u>	SAMPLE SITE: <u>WESTLAKE 3 MERCER</u>	QUALITY CONTROL REPORTING LEVEL (check one)
PHONE NO. (206) <u>861-6000</u>	PURCHASE ORDER NUMBER	NONE 1 2 3 4
PROJECT MANAGER (person to receive data): <u>NORM PURI</u>		NEED _____ EXTRA COPIES OF REPORT

<p>TURN AROUND TIMES (check one)</p> <p>STANDARD - 14 TO 21 DAYS <input checked="" type="checkbox"/></p> <p>RUSH: (MUST BE APPROVED IN ADVANCE)</p> <p>0-48 HOURS - 2 x STD PRICE <input type="checkbox"/></p> <p>3-7 DAYS - 1.5 x STD PRICE <input type="checkbox"/></p> <p>TCLP - 1 WEEK RUSH - 1.5 x STD PRICE <input type="checkbox"/></p>	<p>SPECIAL INSTRUCTIONS:</p> <p>FAX RESULTS TO NORM PURI OF GEO ENGINEERS</p> <p>C - 390</p>
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GeoEngineers

MAR 04 1993

Routing NLP

GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

File Lab I.D.#: 93-1384
Order Number: P69489
Received Date: 02/22/93
Client: 07061
Sampled By: LISA BONA
Sample Date: 02/19/93
Sample Time: 0816

Project Number: 0161-013-R69
Project Name: UNOCAL, W. LAKE/MERCER
Sample Site: W. LAKE/MERCER
Sample Type: VAPOR (AIR)

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
1384-1	930219-1	METHANE	PPM	77	1

Comments: MG/M3 = Milligrams Per Cubic Meter. PPM = Parts Per Million (by Volume). Method Refs: ATI Gas Chromatographic method for analysis of fixed gases employing direct injection on column with thermal conductivity detector (TCD) and flame ionization detector (FID) and Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Edition, 11/86. BDL = Below Detection Limit.

Approved By : Mike Foran



Client: GEOENGINEERS

Lab I.D.#: 93-1384-1
Received Date: 02/22/93
Sampled By: LISA BONA

Project Number: 0161-013-R69
Project Name: UNOCAL, W. LAKE/MERCER
Sample Site: W. LAKE/MERCER
Sample Type: VAPOR (AIR)

Sample ID.: 930219-1 Sample Date: 02/19/93 Time: 0816

AIR/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500

Analytical Technologies, Inc.

11 EAST OLIVE ROAD
PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001

GEOENGINEERS

PROJECT: 0161-013-R69

QC LEVEL: I

LAB ID: 93-1384

BATCH: CA174

LAB ID	CLIENT ID	ANALYSIS DATE
93-1384-1	930219-1	02-28-93
SPIKE		02-28-93
SPIKE DUP		02-28-93
DI BLANK		02-28-93

PARAMETER	METHOD	DET. LIMIT	BLANK	SPIKE RESULTS	SPIKE DUP RESULTS	SPIKE CONC.	% REC MS	% REC MSD	% REC LIMITS	RPD	MAX RPD
METHANE	*	1 PPM	BDL	99	100	100	99	100	50-150	1	50

NOTES: PPM = Parts Per Million (by volume).
BDL = Below Detection Limit

Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: ATI Gas Chromatographic method employing direct injection on column with Thermal Conductivity Detector (TCD) and Flame Ionization Detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 0161-013-R69

LAB ID: 93-1384

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
93-1384-1	930219-1	02-19-93	02-22-93	N/A	02-24-93	EW0015	A



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0015

PARAMETERS

		BLANK A	BLANK B	BLANK C
	EXTRACTION DATE	N/A	N/A	N/A
	ANALYSIS DATE	02-24-93	N/A	N/A
	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (73-117)	98	N/A	N/A
CHLOROBENZENE	*SURR* (64-100)	100	N/A	N/A

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0015

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	50	100	70-107
TOLUENE	50	BDL	48	96	70-104

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	50	100	0	24	70-107
TOLUENE	50	BDL	47	94	2	21	70-104

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits
 0 out of 4 surrogate recoveries out of limits
 0 out of 2 RPDs out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	02-24-93	102%	100 %
SPD	02-24-93	102%	98 %

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Source for control limits is internal laboratory quality assurance program and method reference.

QC LIMITS
 S1 = BROMOFLUOROBENZENE (73-117)
 S2 = CHLOROBENZENE (64-100)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: Geoengineers

ATI Lab ID # 93- 13084

PROJ NUMBER: 0161-013-R69

PROJ NAME: Unocal, W. Lake /
mercer

SAMPLED BY: Lisa Bona

SAMPLE SITE: w. Lake / mercer

SAMPLE DATE: 02/19/93

SAMPLE TIME: 0816

SAMPLE TYPE: vapor (Air)

RUSH: Y QC: N 0 2 3 4

Date Received: 02/22/93

Is there a chain of custody? N

Was chain of custody signed? N

Were samples received cold? Y

Were samples received in proper containers? N

SHIPPED BY: FED-EX 6173704795

COOLER #: N/S (BOX)

OUT OF CONTROL EVENTS: _____

SPECIAL INSTRUCTIONS: _____

SAMPLE	DATE
1 <u>93-010222</u> <u>930219-1</u>	<u>02/19/93</u>
2 _____	_____
3 _____	_____
4 _____	_____
5 _____	_____
6 _____	_____
7 _____	_____
8 _____	_____
9 _____	_____
10 _____	_____

Were samples preserved correctly? N

Headspace in volatile bottles? Y N/A

Were samples within holding time? N

Is there sufficient sample volume? N

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SAID SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL CP 2/22 INSPECTED BY T.D. DATE INSPECTED 02/22/93
OF REPORTS 01

CHAIN OF CUSTODY



Analytical Technologies, Inc.

ATI LAB. I.D.#

93-13874

11 EAST OLIVE ROAD

PHONE (904) 474-1001

PENSACOLA, FLORIDA 32514

PART 1 - Bottle Shipment Information

502/22/93

CLIENT: <u>GeoEngineers</u> <u>Unocal, Seattle (w. Lake/Mercer)</u>	CLIENT PROJECT NUMBER: <u>0161-013-R69</u>
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SAMPLE CONTAINERS SHIPPED	PRESERVATIVE				PLASTIC CONTAINERS						GLASS CONTAINERS															
	REST/L.S. Sample	HNO3	HCl	Zn ACETATE	MASSA	UNPRESERVED	MCON	4 oz.	8 oz.	16 oz.	32 oz.	1/2 gallon	1 gallon	White-pak	100-ML SPEECHER CUP	120 ml (A)	120 ml (B)	1 liter (A)	1 liter (B)	40 ml Vial	4 oz. W/M	8 oz. W/M	16 oz. W/M	32 oz. W/M	DI Trip Blank	
QTY.	1																									

ATQ168

RELINQUISHED BY: <u>C. Motica</u>	TIME <u>1330</u>	DATE <u>1-10-93</u>	RECEIVED	TIME	DATE
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PART 2 - Sample Information

PARAMETERS AND PRESERVATIVES

SAMPLE MATRIX

- DW DRINKINGWATER
- WW WASTEWATER
- GW GROUNDWATER
- SW SURFACEWATER
- SO SOIL
- OL OIL
- AR AIR
- SL SLUDGE

SAMPLE I.D.	DATE	TIME	MATRIX	TVH	Methane	TOTAL	LAB USE ONLY
930219-1	2/19/93	0816	vapor	X	X	1	
TOTAL NUMBER OF BOTTLES/CONTAINERS							1
RELINQUISHED BY: <u>Lisa J Bona, GEI</u>		DATE <u>2/19/93</u>	TIME <u>1000</u>	RECEIVED BY: <u>Timothy J Dennis</u>		DATE <u>2/22/93</u>	TIME <u>0835</u>

CLIENT GeoEngineers
 ADDRESS 8410 154th Ave NE
 CITY Redmond
 STATE WA ZIP 98052
 PHONE NO. 206) 861-6000
 PROJECT MANAGER (person to receive data)
Norm Puri

PROJECT NUMBER 0161-013-R69
 PROJECT NAME Unocal, W. Lake/Mercer
 SAMPLED BY Lisa Bona
 SAMPLE SITE W. Lake/Mercer
 PURCHASE ORDER NUMBER
0161-013-R69

REQUEST FAX DATA BY _____ (FAX #)
 REQUEST VERBAL RESULTS BY _____ (DATE)
 NEED DATA PACKAGE BY _____ (DATE)
 QUALITY CONTROL REPORTING LEVEL (circle one)
 NONE 1 2 3 4
 NEED _____ EXTRA COPIES OF REPORT

<p>TURN AROUND TIMES (check one)</p> <p>STANDARD - 14 TO 21 DAYS <input checked="" type="checkbox"/></p> <p>RUSH: (MUST BE APPROVED IN ADVANCE)</p> <p>0-48 HOURS - 2 x STD PRICE <input type="checkbox"/></p> <p>3-7 DAYS - 1.5 x STD PRICE <input type="checkbox"/></p> <p>TCLP - 1 WEEK RUSH - 1.5 x STD PRICE <input type="checkbox"/></p>	<p>SPECIAL INSTRUCTIONS:</p> <p>C - 400</p>
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Analytical **Technologies, Inc.**

560 Naches Avenue, S.W., Suite 101, Renton, WA 98055 (206) 228-8335
Karen L. Mixon, Laboratory Manager

ATI I.D. # 9303-269

April 14, 1993

GeoEngineers

APR 14 1993

GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond WA 98052

Routing *ALL*
File

Attention : Norm Puri

Project Number : 0161-013-R04

Project Name : Unocal - Westlake & Mercer

Dear Mr. Puri:

On March 23, 1993, Analytical Technologies, Inc. (ATI), received one sample for analysis. The sample was analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Sincerely,

Mary C. Silva
Mary C. Silva
Senior Project Manager

MCS/hal/ff

Enclosure

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WESTLAKE & MERCER

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9303-269-1	DRUM #1	03/22/93	WATER

----- TOTALS -----

MATRIX	# SAMPLES
WATER	1

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 0161-013-R04
 PROJECT NAME : UNOCAL - WESTLAKE & MERCER

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BTEX	GC/PID	EPA 8020	R
TCLP PREPARATION	-	EPA 1311	R
ARSENIC	ICAP	EPA 6010	R
BARIUM	ICAP	EPA 6010	R
CADMIUM	ICAP	EPA 6010	R
CHROMIUM	ICAP	EPA 6010	R
LEAD	ICAP	EPA 6010	R
MERCURY	AA/COLD VAPOR	EPA 7470	R
SELENIUM	ICAP	EPA 6010	R
SILVER	ICAP	EPA 6010	R
PH	ELECTRODE	EPA 150.1	R

R = ATI - Renton
 SD = ATI - San Diego
 PHX = ATI - Phoenix
 PNR = ATI - Pensacola
 FC = ATI - Fort Collins
 JB = Subcontract

VOLATILE ORGANIC ANALYSIS
 DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 03/26/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	98	76 - 120

ATI I.D. # 9303-269-1

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 03/22/93
PROJECT #	: 0161-013-R04	DATE RECEIVED	: 03/23/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: DRUM #1	DATE ANALYZED	: 03/27/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	0.6
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY

LIMITS

BROMOFLUOROBENZENE	98	76 - 120
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VOLATILE ORGANIC ANALYSIS
 QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9303-266-1
PROJECT #	: 0161-013-R04	DATE EXTRACTED	: N/A
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE ANALYZED	: 03/26/93
EPA METHOD	: 8020 (BETX)	UNITS	: ug/L
SAMPLE MATRIX	: WATER		

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.5	20.0	19.5	98	19.8	99	2
TOLUENE	<0.5	20.0	20.0	100	20.0	100	0
TOTAL XYLENES	0.660	40.0	38.9	96	40.1	99	3

CONTROL LIMITS	% REC.	RPD
BENZENE	77 - 112	20
TOLUENE	72 - 113	20
TOTAL XYLENES	80 - 110	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	98	98	76 - 120

VOLATILE ORGANIC ANALYSIS
 QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: BLANK SPIKE
PROJECT #	: 0161-013-R04	DATE EXTRACTED	: N/A
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE ANALYZED	: 03/26/93
EPA METHOD	: 8020 (BETX)	UNITS	: ug/L
SAMPLE MATRIX	: WATER		

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.5	20.0	19.6	98	N/A	N/A	N/A
TOLUENE	<0.5	20.0	19.9	100	N/A	N/A	N/A
TOTAL XYLENES	<0.5	40.0	39.3	98	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
BENZENE	80 - 111	20
TOLUENE	78 - 111	20
TOTAL XYLENES	80 - 114	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	99	N/A	76 - 120

TCLP METALS ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WESTLAKE & MERCER

MATRIX : LEACHATE

ELEMENT	DATE LEACHED	DATE DIGESTED	DATE ANALYZED
ARSENIC	03/25/93	03/27/93	03/28/93
BARIUM	03/25/93	03/27/93	03/28/93
CADMIUM	03/25/93	03/27/93	03/28/93
CHROMIUM	03/25/93	03/27/93	03/28/93
LEAD	03/25/93	03/27/93	03/28/93
MERCURY	03/25/93	03/25/93	03/26/93
SELENIUM	03/25/93	03/27/93	03/28/93
SILVER	03/25/93	03/27/93	03/28/93

ATI I.D. # 9303-269

TCLP METALS ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC. MATRIX : LEACHATE
 PROJECT # : 0161-013-R04
 PROJECT NAME : UNOCAL - WESTLAKE & MERCER UNITS : mg/L

ATI I.D. #	CLIENT I.D.	ARSENIC	BARIUM	CADMIUM
9303-269-1	DRUM #1	<0.050	0.18	<0.0050
TCLP BLANK	-	<0.050	<0.010	<0.0050
METHOD BLANK	-	<0.050	<0.010	<0.0050

ATI I.D. # 9303-269

TCLP METALS ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WESTLAKE & MERCER

MATRIX : LEACHATE
UNITS : mg/L

ATI I.D. #	CLIENT I.D.	CHROMIUM	LEAD	MERCURY
9303-269-1	DRUM #1	<0.010	<0.030	<0.00020
TCLP BLANK	-	<0.010	<0.030	<0.00020
METHOD BLANK	-	<0.010	<0.030	<0.00020

ATI I.D. # 9303-269

TCLP METALS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	MATRIX	: LEACHATE
PROJECT #	: 0161-013-R04		
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	UNITS	: mg/L

ATI I.D. #	CLIENT I.D.	SELENIUM	SILVER
9303-269-1	DRUM #1	<0.050	<0.0050
TCLP BLANK	-	<0.050	<0.0050
METHOD BLANK	-	<0.050	<0.0050

ATI I.D. # 9303-269

 TCLP METALS ANALYSIS
 QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC. MATRIX : LEACHATE
 PROJECT # : 0161-013-R04
 PROJECT NAME : UNOCAL - WESTLAKE & MERCER UNITS : mg/L

ELEMENT	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
ARSENIC	9303-303-12	<0.050	<0.050	NC	1.05	1.00	105
ARSENIC	BLANK SPIKE	<0.050	N/A	N/A	1.03	1.00	103
BARIUM	9303-303-12	0.12	0.11	9	1.02	1.00	90
BARIUM	BLANK SPIKE	<0.010	N/A	N/A	0.966	1.00	97
CADMIUM	9303-303-12	<0.0050	<0.0050	NC	0.918	1.00	92
CADMIUM	BLANK SPIKE	<0.0050	N/A	N/A	1.00	1.00	100
CHROMIUM	9303-303-12	0.011	0.012	9	0.878	1.00	87
CHROMIUM	BLANK SPIKE	<0.010	N/A	N/A	0.929	1.00	93
LEAD	9303-303-12	0.093	0.096	3	1.02	1.00	93
LEAD	BLANK SPIKE	<0.030	N/A	N/A	1.01	1.00	101
MERCURY	9303-269-1	<0.00020	<0.00020	NC	0.00083	0.00100	83
MERCURY	BLANK SPIKE	<0.00020	N/A	N/A	0.00085	0.00100	85
SELENIUM	9303-303-12	<0.050	<0.050	NC	1.07	1.00	107
SELENIUM	BLANK SPIKE	<0.050	N/A	N/A	0.995	1.00	100
SILVER	9303-303-12	<0.0050	<0.0050	NC	0.903	1.00	90
SILVER	BLANK SPIKE	<0.0050	N/A	N/A	0.971	1.00	97

NC = Not Calculable.

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

ATI I.D. # 9303-269

GENERAL CHEMISTRY ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WESTLAKE & MERCER

MATRIX : WATER

PARAMETER	DATE ANALYZED
-----------	---------------

PH	03/23/93
----	----------

ATI I.D. # 9303-269

GENERAL CHEMISTRY ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC. MATRIX : WATER
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WESTLAKE & MERCER UNITS : -

ATI I.D. #	CLIENT I.D.	PH
9303-269-1	DRUM #1	8.1



GEOENGINEERS
8410 154TH AVE N.E.

REDMOND WA 98052-0000

Lab I.D.#: 93-3175
Order Number: P70700
Received Date: 03/25/93
Client: 07061
Sampled By: M. THURBER
Sample Date: 03/24/93
Sample Time: 1439

Project Number: 161-013-R04
Project Name: WESTLAKE & MENO UNOCAL
Sample Site: WESTLAKE & MERCER SEATTLE
Sample Type: AIR

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
3175-1	VES	METHANE	PPM	65	1.0

GeoEngineers

APR 02 1993

Routing



File

Comments: MG/M3 = Milligrams Per Cubic Meter. PPM = Parts Per Million (by Volume). Method Refs: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW-846, 3rd Edition, November 1986 and ATI Gas Chromatographic method employing direct injection on column with flame ionization detector (FID). BDL = Below Detection Limit.

page 1

Approved By :

Cathy Papadimitriou



Client: GEOENGINEERS

Lab I.D.#: 93-3175-1
 Received Date: 03/25/93
 Sampled By: M. THURBER

Project Number: 161-013-R04
 Project Name: WESTLAKE & MENO UNOCAL
 Sample Site: WESTLAKE & MERCER SEATTLE
 Sample Type: AIR

Sample ID.: VES Sample Date: 03/24/93 Time: 1439

AIR/TVH

TOTAL VOLATILE HYDROCARBONS

Parameter	Units	Result	Detection Limit
TOTAL VOLATILE HYDROCARBONS	MG/M3	BDL	500



Q U A L I T Y C O N T R O L
D A T A



Analytical Technologies, Inc.

11 EAST OLIVE ROAD PHONE (904) 474-1001
PENSACOLA, FLORIDA 32514

GEOENGINEERS

PROJECT: 161-013-R04

QC LEVEL: I

LAB ID: 93-3175

BATCH: CA184

<u>LAB ID</u>	<u>CLIENT ID</u>	<u>ANALYSIS DATE</u>
93-3175-1	VES	03-28-93

SPIKE	03-28-93
SPIKE DUP	03-28-93

DI BLANK	03-28-93
DI BLANK	03-29-93

PARAMETER	METHOD	DET. LIMIT	BLANK	SPIKE RESULTS	SPIKE DUP RESULTS	SPIKE CONC.	% REC SPIKE	% REC SPIKE DUP	% REC LIMITS	RPD	MAX RPD
METHANE	*	1 PPM	BDL	78	89	100PPM	78	89	50-150	13	50

NOTES: PPM = Parts Per Million (by volume).

BDL = Below Detection Limit

Source for control limits is internal laboratory quality assurance program and reference below.

REFERENCE: *ATI Gas Chromatographic method for analysis of fixed gases employing direct injection on column with Thermal Conductivity Detector (TCD) and Flame Ionization Detector (FID).



CLIENT: GEOENGINEERS

PROJECT: 161-013-R04

LAB ID: 93-3175

METHOD: 5030 / 8020 / 8015 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, SW 846, 3rd Edition, November 1986

QC LEVEL: I

LAB ID:	CLIENT ID:	DATE SAMPLED	DATE RECEIVED	DATE EXTRACTED	DATE ANALYZED	QC BATCH	QC BLANK
93-3175-1	VES	03-24-93	03-25-93	N/A	03-30-93	EW0026	A



METHOD INSTRUMENT BLANK

BATCH NUMBER: EW0026

		BLANK A	BLANK B	BLANK C
EXTRACTION DATE		N/A	N/A	N/A
ANALYSIS DATE		03-30-93	N/A	N/A
PARAMETERS	DETECTION LIMIT	RESULTS	RESULTS	RESULTS
BENZENE	1 mg/m3	BDL	BDL	BDL
ETHYL BENZENE	1 mg/m3	BDL	BDL	BDL
TOLUENE	5 mg/m3	BDL	BDL	BDL
XYLENE	2 mg/m3	BDL	BDL	BDL
TOTAL PETROLEUM HYDROCARBONS	500 mg/m3	BDL	BDL	BDL
BROMOFLUOROBENZENE	*SURR* (62-125)	100	N/A	N/A
CHLOROBENZENE	*SURR* (90-112)	100	N/A	N/A

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection limit.
 Source for control limits is internal laboratory quality assurance program and the method reference.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE



REAGENT WATER SPIKE

BATCH NUMBER: EW0026

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPK CONC	SPK REC%#	REC LIMITS
BENZENE	50	BDL	52	104	70-107
TOLUENE	50	BDL	52	104	70-104

COMPOUNDS	SPIKE ADDED	SAMPLE CONC	SPD CONC	SPD REC%#	% RPD#	QC LIMITS	
						RPD	REC
BENZENE	50	BDL	50	100	4	24	70-107
TOLUENE	50	BDL	49	98	6	21	70-104

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

0 out of 4 % recoveries out of limits
 0 out of 4 surrogate recoveries out of limits
 0 out of 2 RPDs out of limits

ITEM ID:	ANALYSIS DATE	SURROGATE RECOVERY	
		S1	S2
SPK	03-30-93	100%	98 %
SPD	03-30-93	100%	98 %

D = DILUTED OUT

NOTE: Units in mg/m3 = milligrams per cubic meter.
 BDL = Below Detection Limit.
 Source for control limits is internal laboratory quality assurance program and method reference.

S1 = BROMOFLUOROBENZENE (62-125)
 S2 = CHLOROBENZENE (90-112)

COMMENTS:

SAMPLE INSPECTION AND IDENTIFICATION SHEET/OUT OF CONTROL EVENTS

Client: GeoEngineering

ATI Lab ID # 93- 3175

PROJ NUMBER: 161-013-R04

SAMPLE	DATE
1 <u>YES</u>	<u>03/24/93</u>
2	
3	
4	
5	
6	
7	
8	
9	
10	

PROJ NAME: Westlake & MEND

Unocal

SAMPLED BY: M. Thurber

SAMPLE SITE: Westlake & Mercer

Seattle

SAMPLE DATE: 03/24/93

SAMPLE TIME: 1439

SAMPLE TYPE: Air

RUSH: Y N QC: N 0 1 2 3 4

Date Received: 03/25/93

Is there a chain of custody? Y N

Were samples preserved correctly? Y N/A

Was chain of custody signed? Y N

Headspace in volatile bottles? Y N/S

Were samples received cold? Y N

Were samples received in proper containers? Y N

Were samples within holding time? Y N

SHIPPED BY: UPS

Is there sufficient sample volume? Y N

COOLER #: N/S

OUT OF CONTROL EVENTS: _____

SPECIAL INSTRUCTIONS: _____

ATI WILL PERFORM THE SERVICES IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS FOR THE INDUSTRY. THE TOTAL LIABILITY OF ATI, ANY AND ALL OFFICERS AND EMPLOYEES OR SUCCESSORS, TO CLIENTS FOR SERVICES PROVIDED, WILL NOT EXCEED THE INVOICE AMOUNT FOR SA SERVICE. CLIENT ACCEPTANCE OF A PROPOSAL RELEASES ATI FROM ANY LIABILITY IN EXCESS THEREOF.

PM APPROVAL LP 3/25/93 INSPECTED BY [Signature]

DATE INSPECTED 03/25/93
OF REPORTS 1



ATI I.D. # 9303-269

April 14, 1993

GeoEngineers

GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond WA 98052

APR 14 1993
Routing ALP
File

Attention : Norm Puri

Project Number : 0161-013-R04

Project Name : Unocal - Westlake & Mercer

Dear Mr. Puri:

On March 23, 1993, Analytical Technologies, Inc. (ATI), received one sample for analysis. The sample was analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Sincerely,

Mary C. Silva
Mary C. Silva
Senior Project Manager

MCS/hal/ff

Enclosure



SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WESTLAKE & MERCER

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9303-269-1	DRUM #1	03/22/93	WATER

----- TOTALS -----

MATRIX	# SAMPLES
WATER	1

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WESTLAKE & MERCER

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
TCLP PREPARATION	-	EPA 1311	R
ARSENIC	ICAP	EPA 6010	R
BARIUM	ICAP	EPA 6010	R
CADMIUM	ICAP	EPA 6010	R
CHROMIUM	ICAP	EPA 6010	R
LEAD	ICAP	EPA 6010	R
MERCURY	AA/COLD VAPOR	EPA 7470	R
SELENIUM	ICAP	EPA 6010	R
SILVER	ICAP	EPA 6010	R
PH	ELECTRODE	EPA 150.1	R

R = ATI - Renton
SD = ATI - San Diego
PHX = ATI - Phoenix
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

ATI I.D. # 9303-269

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 03/26/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

-----	-----
COMPOUND	RESULT
-----	-----
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY	LIMITS
BROMOFLUOROBENZENE	98 76 - 120

ATI I.D. # 9303-269-1

 VOLATILE ORGANIC ANALYSIS
 DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 03/22/93
PROJECT #	: 0161-013-R04	DATE RECEIVED	: 03/23/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: DRUM #1	DATE ANALYZED	: 03/27/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

-----	-----
COMPOUND	RESULT
-----	-----
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	0.6
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	98	76 - 120

ATI I.D. # 9303-269

VOLATILE ORGANIC ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.	SAMPLE I.D. # : 9303-266-1
PROJECT # : 0161-013-R04	DATE EXTRACTED : N/A
PROJECT NAME : UNOCAL - WESTLAKE & MERCER	DATE ANALYZED : 03/26/93
EPA METHOD : 8020 (BETX)	UNITS : ug/L
SAMPLE MATRIX : WATER	

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.5	20.0	19.5	98	19.8	99	2
TOLUENE	<0.5	20.0	20.0	100	20.0	100	0
TOTAL XYLENES	0.660	40.0	38.9	96	40.1	99	3

CONTROL LIMITS

	% REC.	RPD
BENZENE	77 - 112	20
TOLUENE	72 - 113	20
TOTAL XYLENES	80 - 110	20

SURROGATE RECOVERIES

	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	98	98	76 - 120

ATI I.D. # 9303-269

VOLATILE ORGANIC ANALYSIS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: BLANK SPIKE
PROJECT #	: 0161-013-R04	DATE EXTRACTED	: N/A
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE ANALYZED	: 03/26/93
EPA METHOD	: 8020 (BETX)	UNITS	: ug/L
SAMPLE MATRIX	: WATER		

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.5	20.0	19.6	98	N/A	N/A	N/A
TOLUENE	<0.5	20.0	19.9	100	N/A	N/A	N/A
TOTAL XYLENES	<0.5	40.0	39.3	98	N/A	N/A	N/A

CONTROL LIMITS

	% REC.	RPD
BENZENE	80 - 111	20
TOLUENE	78 - 111	20
TOTAL XYLENES	80 - 114	20

SURROGATE RECOVERIES

	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	99	N/A	76 - 120

TCLP METALS ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WESTLAKE & MERCER

MATRIX : LEACHATE

ELEMENT	DATE LEACHED	DATE DIGESTED	DATE ANALYZED
ARSENIC	03/25/93	03/27/93	03/28/93
BARIUM	03/25/93	03/27/93	03/28/93
CADMIUM	03/25/93	03/27/93	03/28/93
CHROMIUM	03/25/93	03/27/93	03/28/93
LEAD	03/25/93	03/27/93	03/28/93
MERCURY	03/25/93	03/25/93	03/26/93
SELENIUM	03/25/93	03/27/93	03/28/93
SILVER	03/25/93	03/27/93	03/28/93

ATI I.D. # 9303-269

TCLP METALS ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC. MATRIX : LEACHATE
 PROJECT # : 0161-013-R04
 PROJECT NAME : UNOCAL - WESTLAKE & MERCER UNITS : mg/L

ATI I.D. #	CLIENT I.D.	ARSENIC	BARIUM	CADMIUM
9303-269-1	DRUM #1	<0.050	0.18	<0.0050
TCLP BLANK	-	<0.050	<0.010	<0.0050
METHOD BLANK	-	<0.050	<0.010	<0.0050

ATI I.D. # 9303-269

TCLP METALS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	MATRIX : LEACHATE
PROJECT #	: 0161-013-R04	
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	UNITS : mg/L

ATI I.D. #	CLIENT I.D.	SELENIUM	SILVER
9303-269-1	DRUM #1	<0.050	<0.0050
TCLP BLANK	-	<0.050	<0.0050
METHOD BLANK	-	<0.050	<0.0050

ATI I.D. # 9303-269

GENERAL CHEMISTRY ANALYSIS

CLIENT : GEOENGINEERS, INC. MATRIX : WATER
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WESTLAKE & MERCER

PARAMETER DATE ANALYZED

PH 03/23/93



ATI I.D. # 9303-269

GENERAL CHEMISTRY ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC. MATRIX : WATER
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WESTLAKE & MERCER UNITS : -

ATI I.D. #	CLIENT I.D.	PH
9303-269-1	DRUM #1	8.1



ATI I.D. # 9304-021

April 23, 1993

GeoEngineers

GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond WA 98052

APR 26 1993

Routing NhP
File

Attention : Norm Puri

Project Number : 0161-013-R04

Project Name : Unocal - Westlake & Mercer

Dear Mr. Puri:

On April 2, 1993, Analytical Technologies, Inc. (ATI), received one sample for analysis. The sample was analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Sincerely,

Mary C. Silva
Mary C. Silva
Senior Project Manager

MCS/hal/ff

Enclosure



SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WESTLAKE & MERCER

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9304-021-1	MW-40	03/25/93	WATER

----- TOTALS -----

MATRIX	# SAMPLES
WATER	1

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.



ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WESTLAKE & MERCER

Table with 4 columns: ANALYSIS, TECHNIQUE, REFERENCE, LAB. Rows include BETX, TOTAL PETROLEUM HYDROCARBONS, PETROLEUM HYDROCARBONS, and LEAD.

R = ATI - Renton
SD = ATI - San Diego
PHX = ATI - Phoenix
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

ATI I.D. # 9304-021

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 04/02/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G - 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY

LIMITS

BROMOFLUOROBENZENE	99	76 - 120
TRIFLUOROTOLUENE	103	50 - 150

ATI I.D. # 9304-021-1

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 03/25/93
PROJECT #	: 0161-013-R04	DATE RECEIVED	: 04/02/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-40	DATE ANALYZED	: 04/03/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G - 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDSRESULTS

BENZENE	32
ETHYLBENZENE	4.0
TOLUENE	1.3
TOTAL XYLENES	1.4
 FUEL HYDROCARBONS	 870
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY

LIMITS

BROMOFLUOROBENZENE	113	76 - 120
TRIFLUOROTOLUENE	104	50 - 150



ATI I.D. # 9304-021

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC. SAMPLE I.D. # : 9304-015-15
 PROJECT # : 0161-013-R04 DATE EXTRACTED : N/A
 PROJECT NAME : UNOCAL - WESTLAKE & MERCER DATE ANALYZED : 04/13/93
 SAMPLE MATRIX : WATER UNITS : ug/L
 METHOD : WA DOE WTPH-G - 8020 (BETX)

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP.	DUP.	RPD
							SPIKED RESULT	% REC.	
GASOLINE	<100	<100	NC	N/A	N/A	N/A	N/A	N/A	N/A
CONTROL LIMITS						% REC.			RPD
GASOLINE						N/A			20
SURROGATE RECOVERIES				SAMPLE		SAMPLE DUP.		LIMITS	
TRIFLUOROTOLUENE				99		102			50 - 150

NC = Not Calculable.

ATI I.D. # 9304-21

 BETX - GASOLINE
 QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9304-006-2
PROJECT #	: 0161-013-R04	DATE EXTRACTED	: N/A
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE ANALYZED	: 04/02/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G - 8020 (BETX)		

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	6.73	N/A	N/A	20.0	28.3	108	27.4	103	3
TOLUENE	13.7	N/A	N/A	20.0	34.0	102	33.6	100	1
TOTAL XYLENES	6.68	N/A	N/A	60.0	67.5	101	65.8	99	3
GASOLINE	<100	<100	NC	1,000	1,010	101	996	100	1

CONTROL LIMITS

	% REC.	RPD
BENZENE	77 - 112	20
TOLUENE	72 - 113	20
TOTAL XYLENES	80 - 110	20
GASOLINE	58 - 127	20

SURROGATE RECOVERIES

	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	107	110	76 - 120
TRIFLUOROTOLUENE	105	105	50 - 150

NC = Not Calculable.

ATI I.D. # 9304-021

 BETX - GASOLINE
 QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: BLANK SPIKE
PROJECT #	: 0161-013-R04	DATE EXTRACTED	: N/A
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE ANALYZED	: 04/02/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G - 8020 (BETX)		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.5	20.0	20.4	102	N/A	N/A	N/A
TOLUENE	<0.5	20.0	19.8	99	N/A	N/A	N/A
TOTAL XYLENES	<0.5	40.0	39.4	99	N/A	N/A	N/A
GASOLINE	<100	1,000	972	97	N/A	N/A	N/A

CONTROL LIMITS

	% REC.	RPD
BENZENE	80 - 111	20
TOLUENE	78 - 111	20
TOTAL XYLENES	80 - 114	20
GASOLINE	75 - 120	20

SURROGATE RECOVERIES

	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	98	N/A	76 - 120
TRIFLUOROTOLUENE	105	N/A	50 - 150

ATI I.D. # 9304-021

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE EXTRACTED	: 04/06/93
PROJECT #	: 0161-013-R04	DATE ANALYZED	: 04/06/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	UNITS	: mg/L
METHOD	: WA DOE WTPH-418.1 MODIFIED	SAMPLE MATRIX	: WATER

ATI I.D. #	CLIENT I.D.	TOTAL PETROLEUM HYDROCARBONS
9304-021-1	MW-40	<1
METHOD BLANK	-	<1



TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC. SAMPLE I.D. # : BLANK SPIKE
 PROJECT # : 0161-013-R04 DATE EXTRACTED : 04/06/93
 PROJECT NAME : UNOCAL - WESTLAKE & MERCER DATE ANALYZED : 04/06/93
 METHOD : WA DOE WTPH-418.1 MODIFIED UNITS : mg/L
 SAMPLE MATRIX : WATER

COMPOUND	SAMPLE RESULT	SAMPLE DUP.		SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED		RPD
		RESULT	RPD				RESULT	%	
PETROLEUM HYDROCARBONS	<1	N/A	N/A	10	8.14	81	8.15	82	0

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9304-021

METALS ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WESTLAKE & MERCER

MATRIX : WATER

ELEMENT	DATE PREPARED	DATE ANALYZED
LEAD	04/14/93	04/15/93

ATI I.D. # 9304-021

METALS ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC. MATRIX : WATER
 PROJECT # : 0161-013-R04
 PROJECT NAME : UNOCAL - WESTLAKE & MERCER UNITS : mg/L

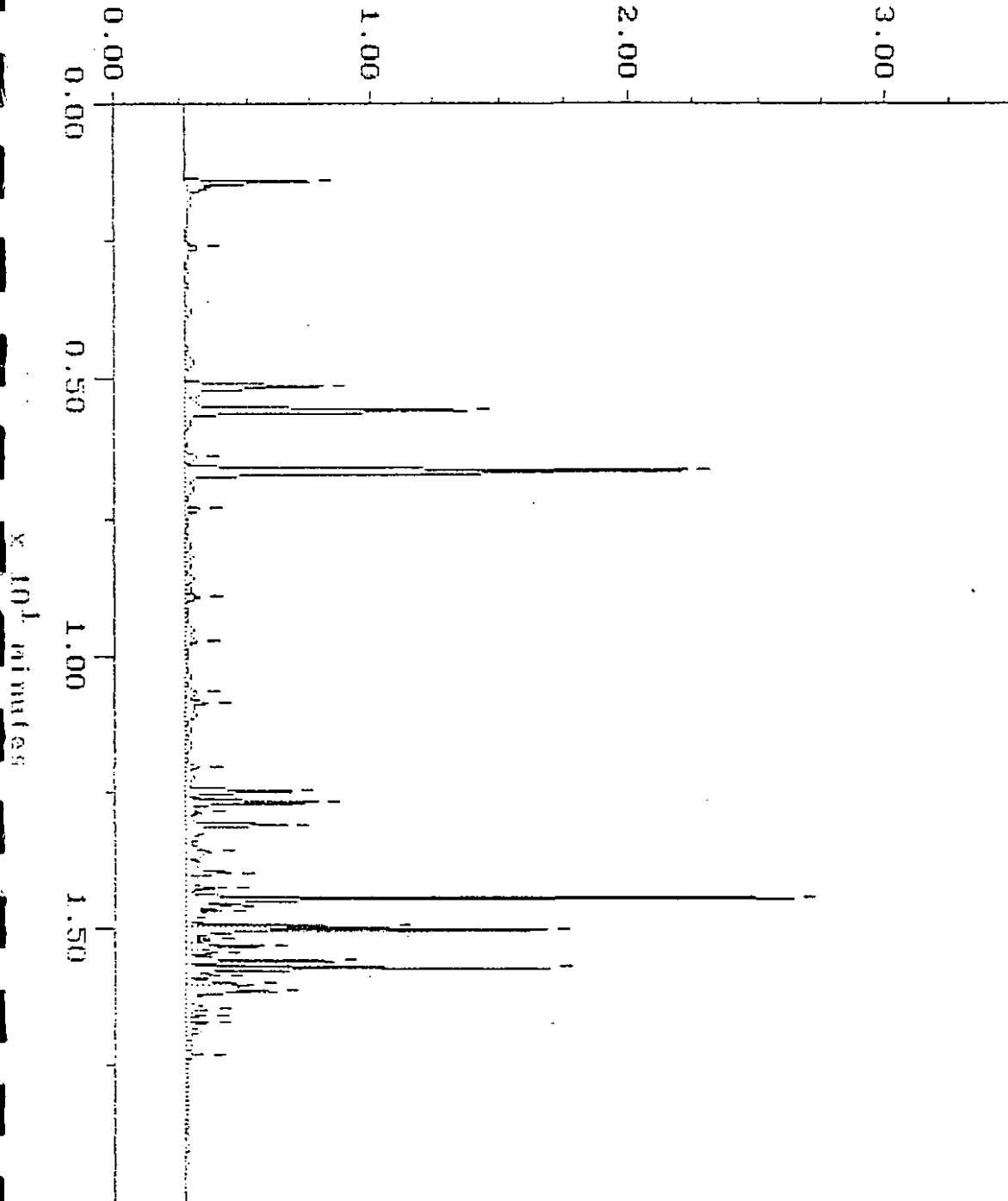
ATI I.D. #	CLIENT I.D.	TOTAL LEAD	DISSOLVED LEAD
9304-021-1	MW-40	0.020	<0.0030
METHOD BLANK	-	<0.0030	<0.0030

WA DOE WTPH-G

Sample: 9304-021-1 Channel: FID
Acquired: 03-APR-93 4:55 Method: F:\BRO2\MAXDATA\NPICARD\040293FC
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.

Filename: R4029P38
Operator: ATI

$\times 10^{-1}$ volts

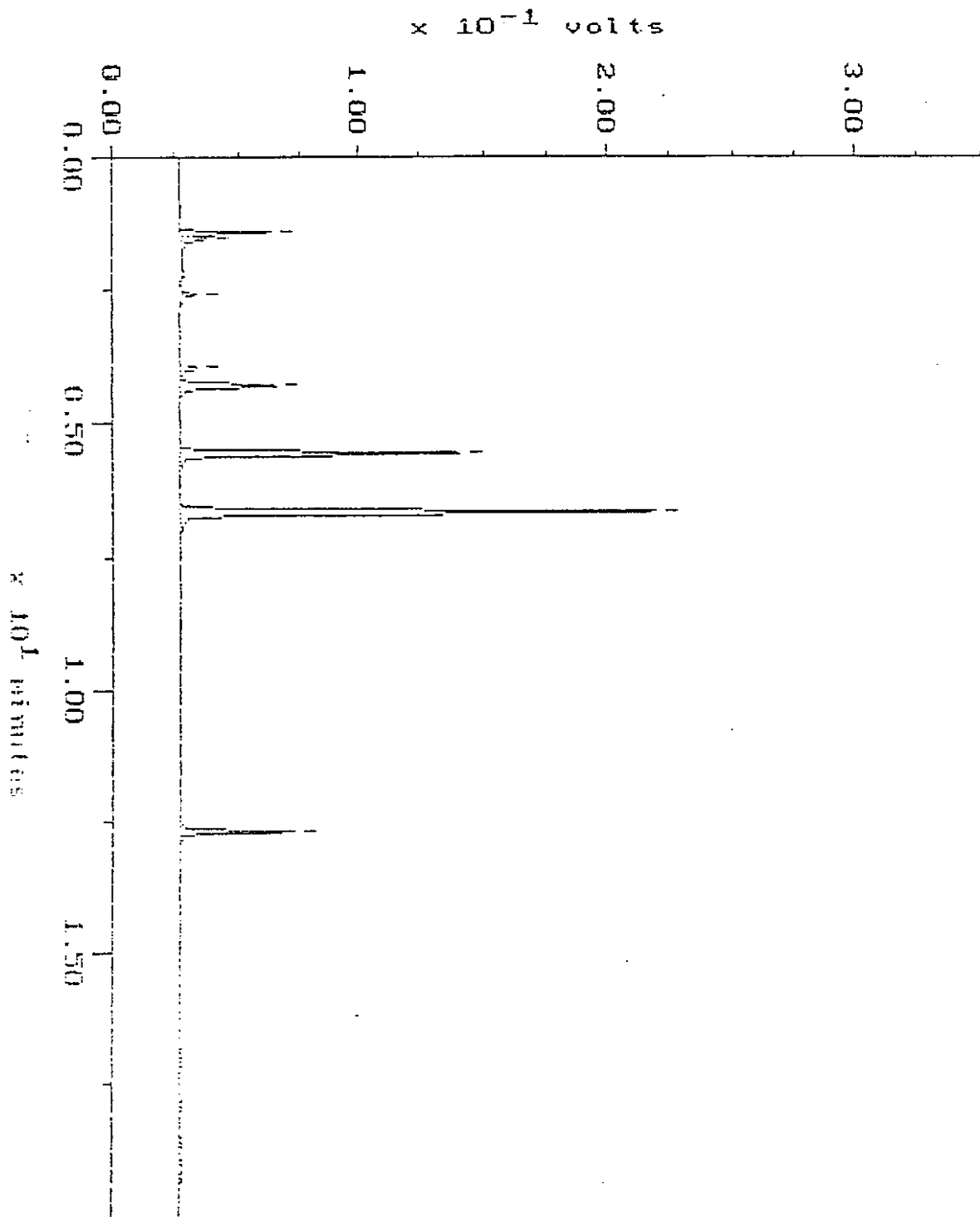


WA DOE WTPH-G

Blank

Sample: WRB 402 Channel: FID
Acquired: 02-APR-93 9:54 Method: F:\BRO2\MAXDATA\PICARD\040293PC
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.

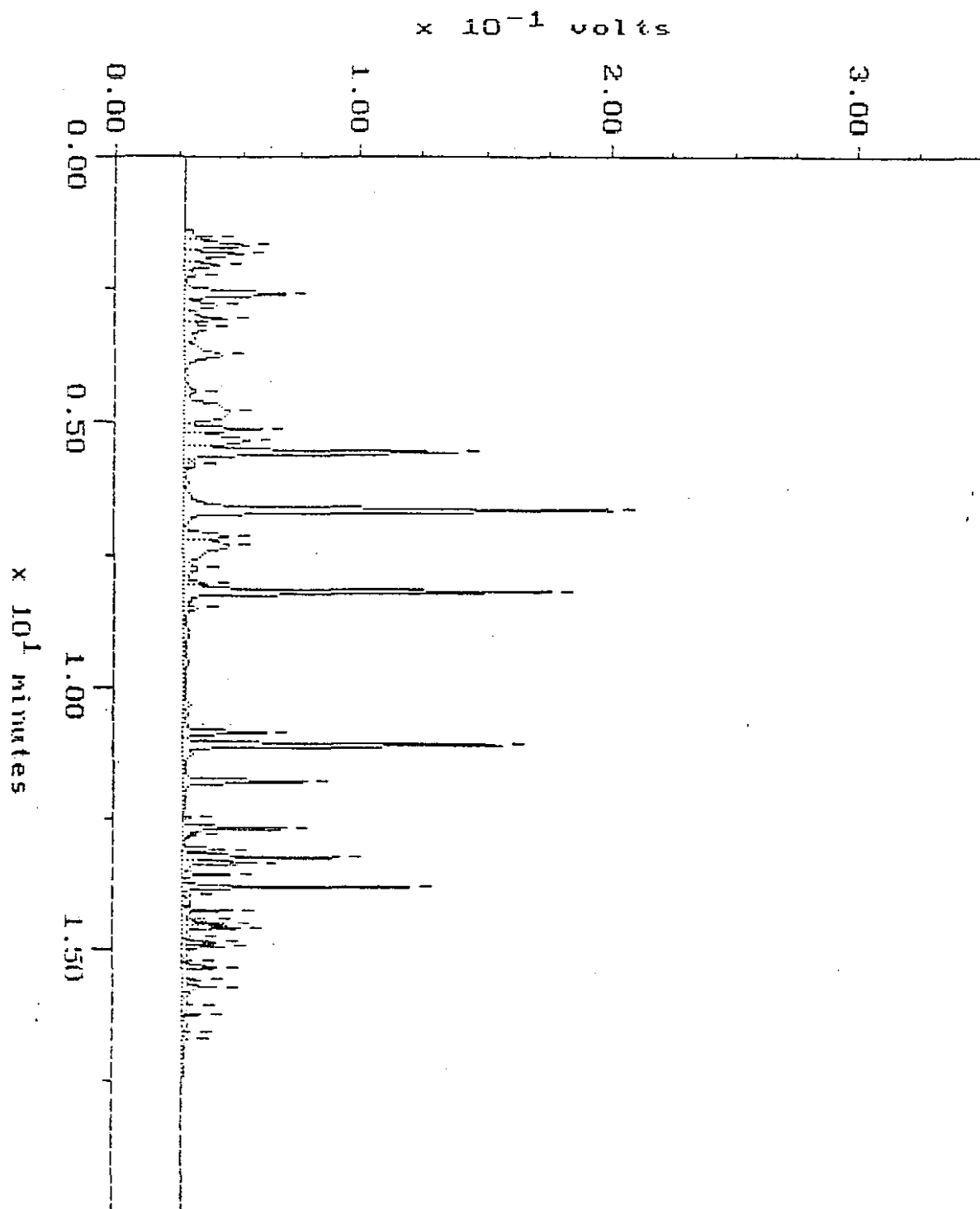
Filename: R4029P01
Operator: ATI



Continuing Calibration

Sample: STD-C G Channel: FID
Acquired: 02-APR-93 3:10 Method: F:\BRO2\MAXDATA\PICARD\040193PC
Comments: AFI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.

Filename: R4019P28
Operator: ATI





9304-021

GEI Project Name:

18939 120th Avenue N.E., Suite 101 • Bothell, WA 98011-2561
Phone (206) 481-9200 • FAX (206) 485-2999

CHAIN OF CUSTODY REPORT

Unosol, Westlake + Mercur
GET Project #

CLIENT: GEI (161-013-204)

ADDRESS: 3400 154th Ave NE
Redmond, WA 98052

PHONE: 861-6000 FAX: ~~861-3000~~

PROJECT NAME: Commons

PROJECT NUMBER: 921184, 03

SAMPLED BY: Chris Pitre (Enviros) (827-3299)

REPORT TO: Norm Puri, Geo Engineers

BILLING TO:

P.O. NUMBER:

NCA QUOTE #:

SAME DAY (2-8 HR.) RUSH (+150%)
NEXT DAY RUSH (+100%)
2 DAY RUSH (+80%)
3 DAY RUSH (+60%)
5 DAY RUSH (+40%)
10 DAY STANDARD (LIST PRICE)

ANALYSIS REQUESTED

BETA / WTPH X
WTPH - 401 X
Total Pb X
Dissolved Pb X

COMMENTS & PRESERVATIVES USED

1 l w/ H₂SO₄
1 l no pres.
1/2 l w/ HNO₃
3 vials w/ HCl

LABORATORY NUMBER

SAMPLE IDENTIFICATION:	SAMPLING DATE / TIME	MATRIX (W.S.O)	# OF CONTS
1 MW-40	93-3-25	W	6
2	10-11-20 AM		
3			
4			
5			
6			
7			
8			
9			
10			

RELINQUISHED BY: *Chris Pitre* DATE: 93-3-25
FIRM: Enviros TIME: 11:20 AM
RELINQUISHED BY: *Mark E* DATE: 4/2/93
FIRM: GEI TIME: 9:00

RECEIVED BY: *Mark E* DATE: 3/25/93
FIRM: GEI TIME: 11:23
RECEIVED BY: *Mark E* DATE: 4/2/93
FIRM: GEI TIME: 12:35

HAZARDOUS SAMPLES? NO YES; DESCRIBE ON BACK

CONTAINER CONDITION? GOOD VIOLATED

COOL (4°C)? YES NO

CUSTOMER INFORMATION: PAGE OF



Analytical **Technologies, Inc.**

560 Naches Avenue, S.W., Suite 101, Renton, WA 98055 (206) 228-8335

Karen L. Mixon, Laboratory Manager

GeoEngineers

MAY 24 1993

ATI I.D. # 9304-312

Routing *NLP*
File

May 21, 1993

GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond WA 98052

Attention : Norm Puri

Project Number : 0161-013-R69

Project Name : Unocal - Westlake & Mercer

Dear Mr. Puri:

On April 30, 1993, Analytical Technologies, Inc. (ATI), received three samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Sincerely,

Mary C. Silva
Mary C. Silva
Senior Project Manager

MCS/hal/dmc

Enclosure

ATI I.D. # 9304-312

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WESTLAKE & MERCER

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9304-312-1	SP-1	04/30/93	SOIL
9304-312-2	SP-2	04/30/93	SOIL
9304-312-3	DRUM-1	04/30/93	WATER

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	2
WATER	1

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ATI I.D. # 9304-312

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 0161-013-R69
 PROJECT NAME : UNOCAL - WESTLAKE & MERCER

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-G	R
OIL & GREASE	IR	EPA 413.2	R
MOISTURE	GRAVIMETRIC	CLP SOW ILM01.0	R

R = ATI - Renton
 SD = ATI - San Diego
 PHX = ATI - Phoenix
 PNR = ATI - Pensacola
 FC = ATI - Fort Collins
 SUB = Subcontract

ATI I.D. # 9304-312

 BETX - GASOLINE
 DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-013-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: 05/04/93
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 05/04/93
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G - 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

 COMPOUNDS

RESULTS

BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY

LIMITS

BROMOFLUOROBENZENE	98	52 - 116
TRIFLUOROTOLUENE	96	50 - 150

ATI I.D. # 9304-312-1

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/30/93
PROJECT #	: 161-013-R69	DATE RECEIVED	: 04/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: 05/04/93
CLIENT I.D.	: SP-1	DATE ANALYZED	: 05/05/93
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G - 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUNDS	RESULTS
-----------	---------

BENZENE	<0.026
ETHYLBENZENE	<0.026
TOLUENE	<0.026
TOTAL XYLENES	<0.026
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY

		LIMITS
BROMOFLUOROBENZENE	88	52 - 116
TRIFLUOROTOLUENE	79	50 - 150

ATI I.D. # 9304-312-2

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/30/93
PROJECT #	: 161-013-R69	DATE RECEIVED	: 04/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: 05/04/93
CLIENT I.D.	: SP-2	DATE ANALYZED	: 05/05/93
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G - 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUNDS	RESULTS
BENZENE	<0.027
ETHYLBENZENE	<0.027
TOLUENE	<0.027
TOTAL XYLENES	<0.027
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	66	52 - 116
TRIFLUOROTOLUENE	83	50 - 150

ATI I.D. # 9304-312

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
 PROJECT # : 161-013-R69
 PROJECT NAME : UNOCAL - WESTLAKE & MERCER
 SAMPLE MATRIX : SOIL
 METHOD : WA DOE WTPH-G - 8020 (BETX)

SAMPLE I.D. # : 9304-312-2
 DATE EXTRACTED : 05/04/93
 DATE ANALYZED : 05/05/93
 UNITS : mg/Kg

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP.	DUP.	RPD
							SPIKED RESULT	% REC.	
BENZENE	<0.0250	N/A	N/A	1.00	0.991	99	0.927	93	7
TOLUENE	<0.0250	N/A	N/A	1.00	1.05	105	0.955	96	9
TOTAL XYLENES	<0.0250	N/A	N/A	2.00	2.17	109	1.98	99	9
GASOLINE	<5	<5	NC	50.0	49.3	99	45.7	91	8

CONTROL LIMITS

	% REC.	RPD
BENZENE	35 - 113	20
TOLUENE	43 - 107	20
TOTAL XYLENES	46 - 114	20
GASOLINE	50 - 112	20

SURROGATE RECOVERIES

	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	101	91	52 - 116
TRIFLUOROTOLUENE	79	76	50 - 150

NC = Not Calculable.

ATI I.D. # 9304-312

 BETX - GASOLINE
 QUALITY CONTROL DATA

 CLIENT : GEOENGINEERS, INC.
 PROJECT # : 161-013-R69
 PROJECT NAME : UNOCAL - WESTLAKE & MERCER
 SAMPLE MATRIX : SOIL
 METHOD : WA DOE WTPH-G - 8020 (BETX)

 SAMPLE I.D. # : BLANK SPIKE
 DATE EXTRACTED : 05/04/93
 DATE ANALYZED : 05/04/93
 UNITS : mg/Kg

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.0250	1.00	0.957	96	N/A	N/A	N/A
TOLUENE	<0.0250	1.00	1.01	101	N/A	N/A	N/A
TOTAL XYLENES	<0.0250	2.00	2.04	102	N/A	N/A	N/A
GASOLINE	<5	50.0	49.9	100	N/A	N/A	N/A

CONTROL LIMITS

	% REC.	RPD
BENZENE	63 - 115	20
TOLUENE	75 - 110	20
TOTAL XYLENES	79 - 109	20
GASOLINE	80 - 119	20

SURROGATE RECOVERIES

	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	94	N/A	52 - 116
TRIFLUOROTOLUENE	89	N/A	50 - 150

ATI I.D. # 9304-312

OIL & GREASE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE EXTRACTED	: 05/03/93
PROJECT #	: 161-013-R69	DATE ANALYZED	: 05/03/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	UNITS	: mg/L
EPA METHOD	: 413.2	SAMPLE MATRIX	: WATER

ATI I.D. #	CLIENT I.D.	OIL & GREASE
------------	-------------	--------------

9304-312-3	DRUM-1	<1
METHOD BLANK	-	<1

ATI I.D. # 9304-312

 OIL & GREASE
 QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9304-307-6
PROJECT #	: 161-013-R69	DATE EXTRACTED	: 05/03/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE ANALYZED	: 05/03/93
EPA METHOD	: 413.2	UNITS	: mg/L
SAMPLE MATRIX	: WATER		

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
OIL & GREASE	<1	<1	NC	N/A	N/A	N/A	N/A	N/A	N/A

NC = Not Calculable.

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9304-312

OIL & GREASE
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9304-307-2
PROJECT #	: 161-013-R69	DATE EXTRACTED	: 05/03/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE ANALYZED	: 05/03/93
EPA METHOD	: 413.2	UNITS	: mg/L
SAMPLE MATRIX	: WATER		

COMPOUND	SAMPLE RESULT	SAMPLE DUP.		SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED		RPD
		RESULT	RPD				RESULT	%	
OIL & GREASE	<1	N/A	N/A	10	7.23	72	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9304-312

OIL & GREASE
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.	SAMPLE I.D. # : BLANK SPIKE
PROJECT # : 161-013-R69	DATE EXTRACTED : 05/03/93
PROJECT NAME : UNOCAL - WESTLAKE & MERCER	DATE ANALYZED : 05/03/93
EPA METHOD : 413.2	UNITS : mg/L
SAMPLE MATRIX : WATER	

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	%	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
OIL & GREASE	<1	N/A	N/A	10	7.48	75	N/A	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

ATI I.D. # 9304-312

GENERAL CHEMISTRY ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC. MATRIX : SOIL
PROJECT # : 161-013-R69
PROJECT NAME : UNOCAL - WESTLAKE & MERCER UNITS : %

ATI I.D. #	CLIENT I.D.	MOISTURE
9304-312-1	SP-1	5.2
9304-312-2	SP-2	6.0

ATI I.D. # 9304-312

GENERAL CHEMISTRY ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC. MATRIX : SOIL
 PROJECT # : 161-013-R69
 PROJECT NAME : UNOCAL - WESTLAKE & MERCER UNITS : %

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
MOISTURE	9305-021-1	6.9	5.8	17	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

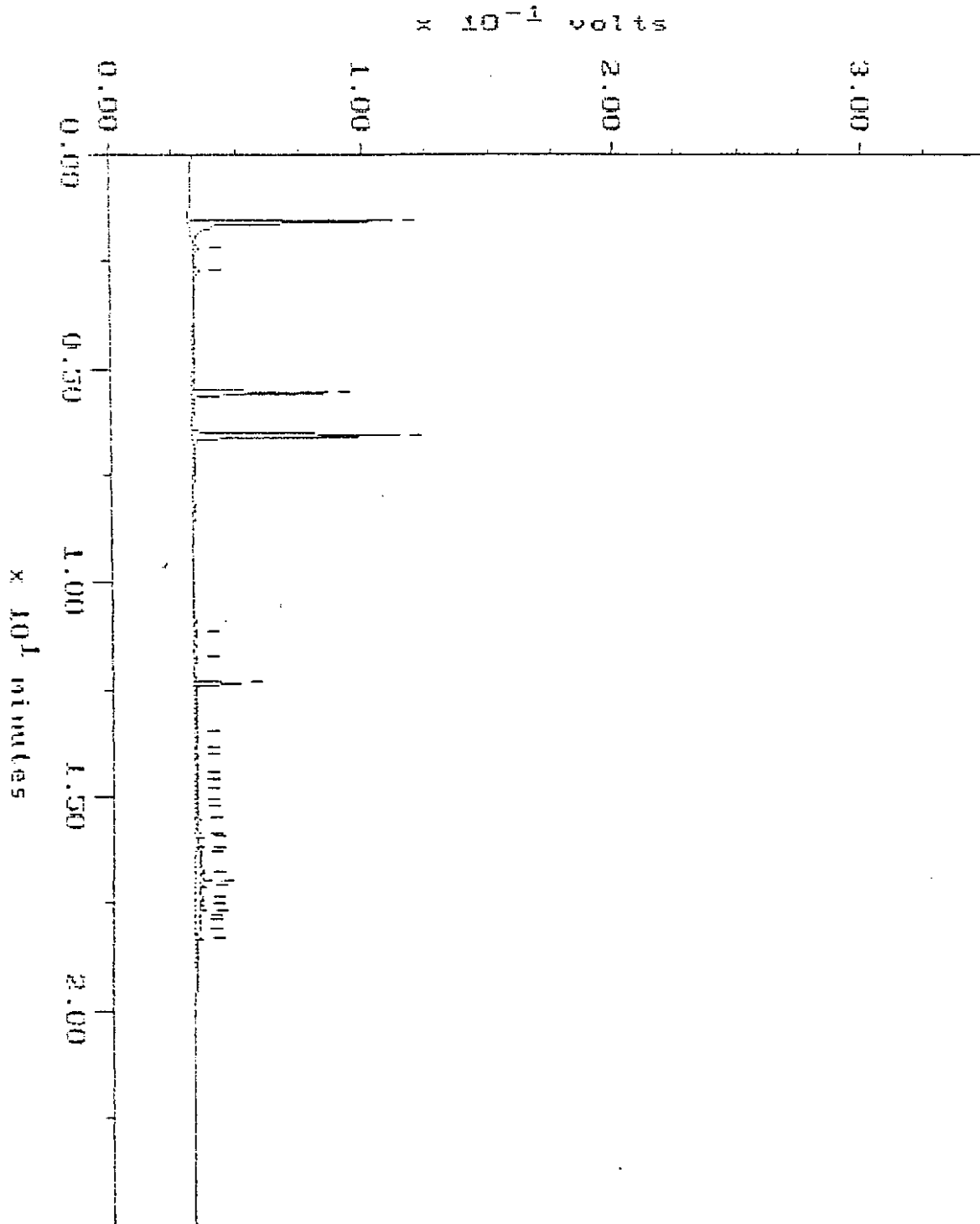
$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

WA DOE WTPH-G

Sample: 9304-312-1
Acquired: 05-MAY-93 2:42

Channel: JEROME-FID
Method: F:\NR02\MAXDATA\JEROME\050493JR

Filename: R5249J01
Operator:

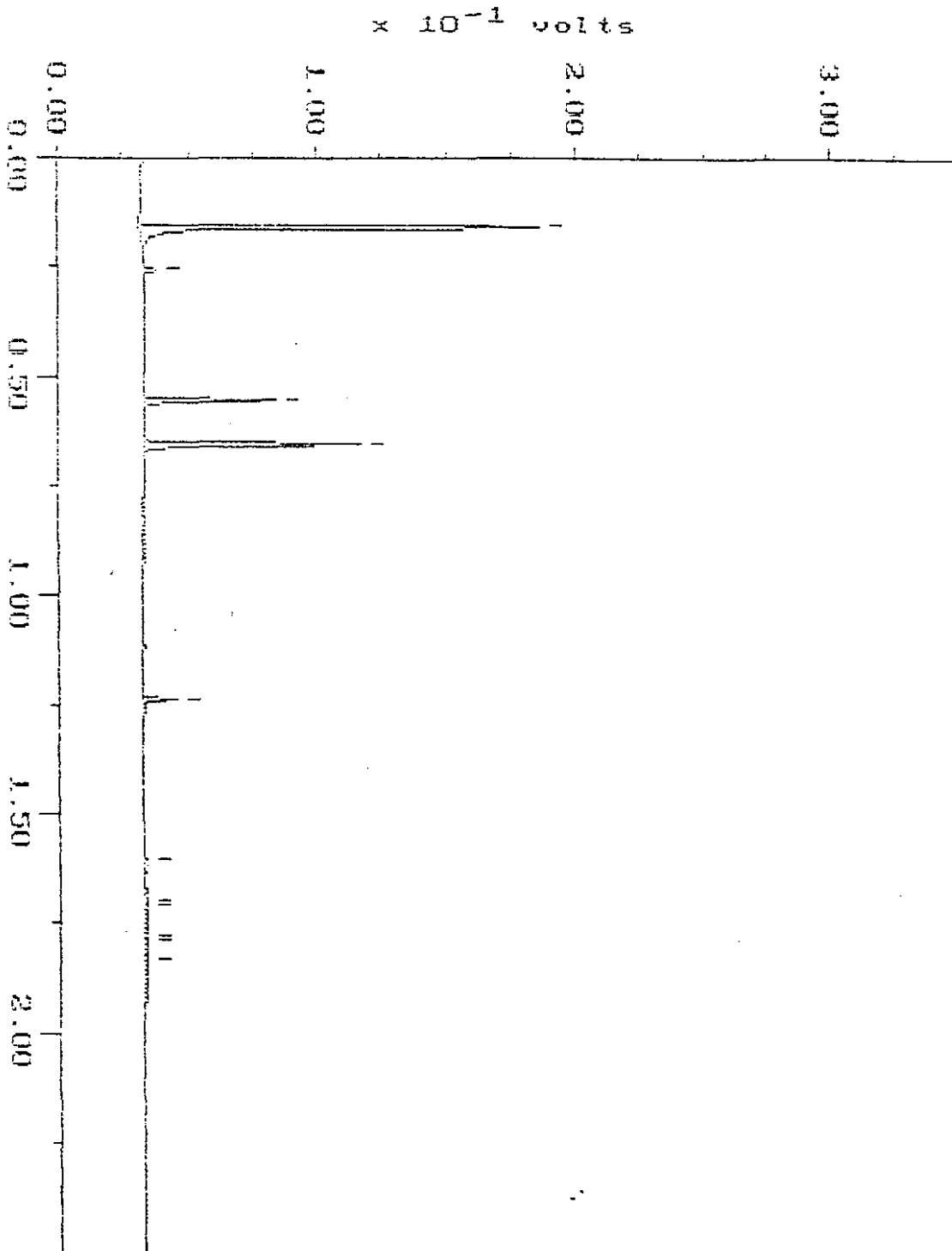


WA DOE WTPH-G

Sample: 9334-312-2
Acquired: 05-MAY-93 0:46

Channel: JEROME-FID
Method: F:\BRO2\MAXDATA\JEROME\050493JR

Filename: 850493J27
Operator:



Blank

WA DOE WTPH-G

Sample: SRS-3 5-4

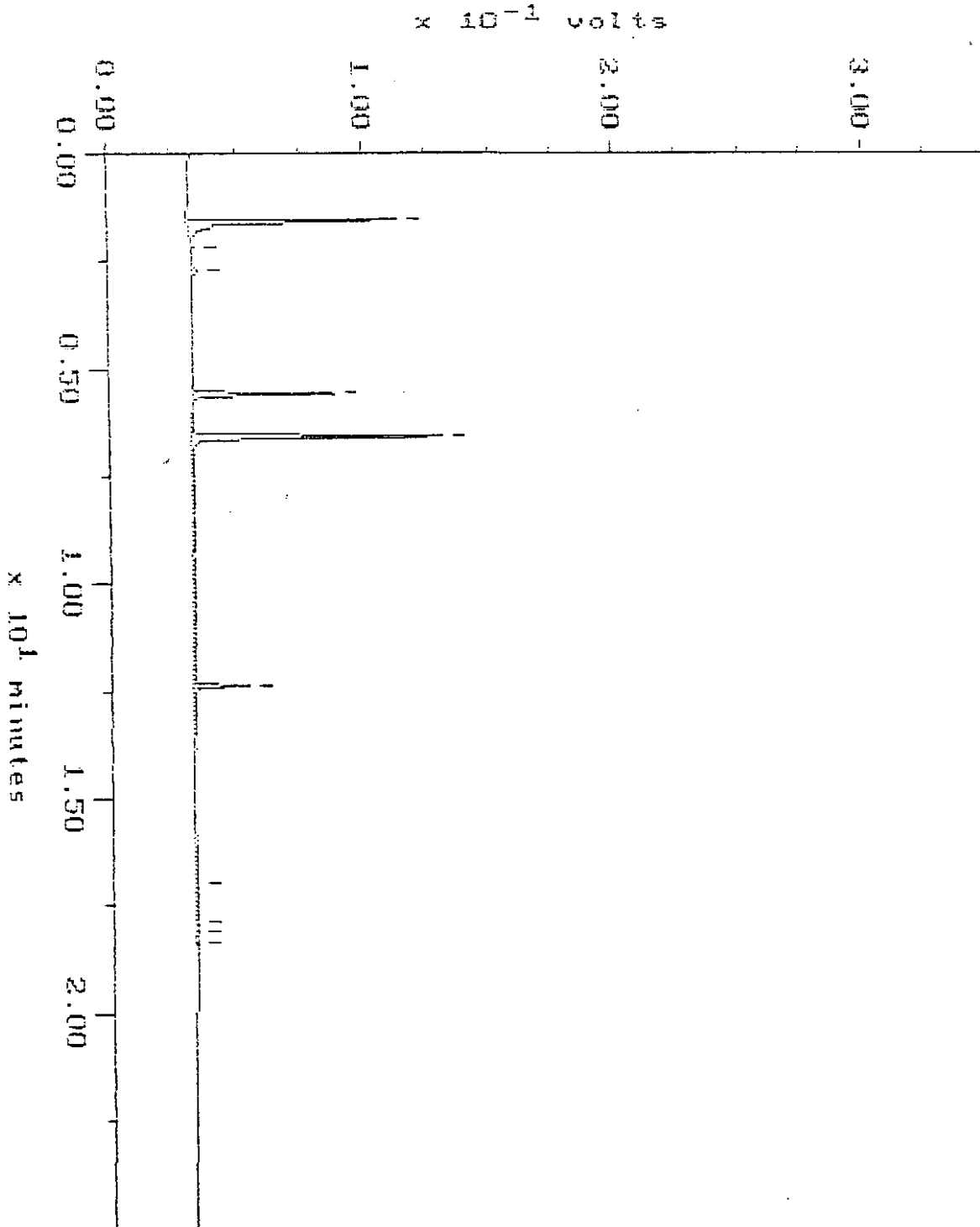
Channel: JEROME-FID

Filename: R5049J19

Acquired: 04-MAY-93 00:56

Method: F:\BRO2\MAXDATA\JEROME\050493JR

Operator:



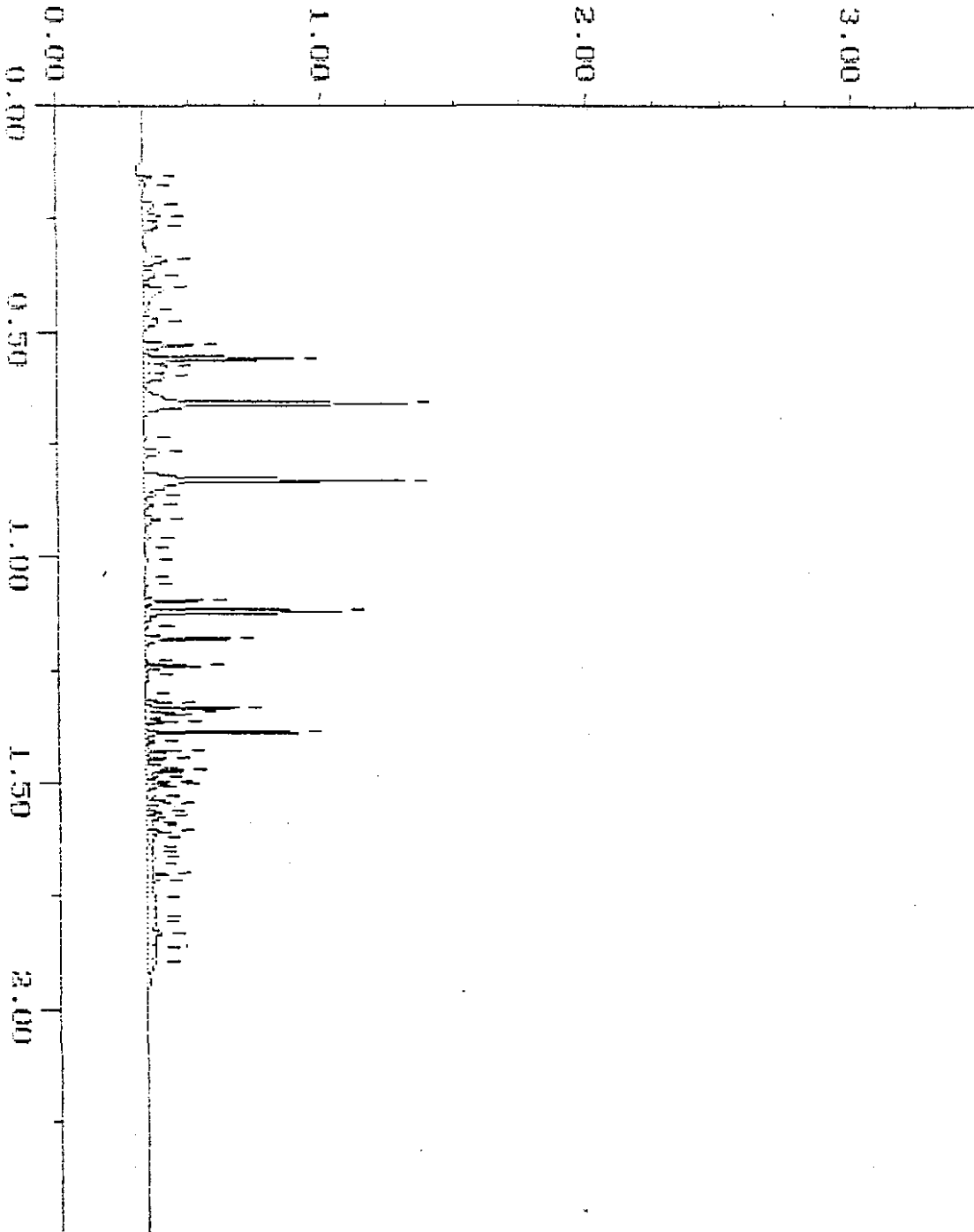
Continuing Calibration

Sample: STD-C 6
Acquired: 04-MAY-93 7:47

Channel: JEROME-FID
Method: F:\SRD2\MAXDATA\JEROME\050493JR

Filename: R5049J01
Operator:

$\times 10^{-1}$ volts





ATI ACCESSION # 9304-312

DATE: 4/30/93 Page 1 of 1

COMPANY: Geo Engineers
 REPORT TO: NORM FURI
 ADDRESS: 840 154TH AVE. N.E.
REDMOND, WA 98052
 PHONE: (206) 861-6000 FAX: (206) 84-6050
 PROJECT MANAGER: NORM FURI
 PROJECT NUMBER: 161-013-269
 PROJECT NAME: UNOCAL/WESTLAKE-MERLE

(U) will DISPOSE RETURN samples (circle one)

Sample ID	Date	Time	Matrix	Lab#
SP-1	4/30/93	0744	SOIL	1
SP-2		0744	↓	2
DRUM-1	↓	0730	↓	3

FUELS		ORGANIC COMPOUNDS						METALS		TCIP				OTHER				
TPH-HCID	WA/OR	8240 CCMS Volatiles	8010 Halogenated VOCs	8310 HPLC PAHs	8040 Phenols	8140 OP Pesticides	8150 OC Herbicides	Metals (Indicate below #)	Total Lead	Priority Pollutant Metals (13)	TAL Metals (23)	TCIP-Volatiles (ZHE-8240)	TCIP-Semivolatiles (8270)	TCIP-Pesticides (8080)	TCIP-Herbicides (8150)	TCIP-Metals (8 metals)	% Moisture (Please indicate)	Total # of Containers/sample
TPH-HCID	WA/OR	8240 CCMS Volatiles	8010 Halogenated VOCs	8310 HPLC PAHs	8040 Phenols	8140 OP Pesticides	8150 OC Herbicides	Metals (Indicate below #)	Total Lead	Priority Pollutant Metals (13)	TAL Metals (23)	TCIP-Volatiles (ZHE-8240)	TCIP-Semivolatiles (8270)	TCIP-Pesticides (8080)	TCIP-Herbicides (8150)	TCIP-Metals (8 metals)	% Moisture (Please indicate)	Total # of Containers/sample
TPH-HCID	WA/OR	8240 CCMS Volatiles	8010 Halogenated VOCs	8310 HPLC PAHs	8040 Phenols	8140 OP Pesticides	8150 OC Herbicides	Metals (Indicate below #)	Total Lead	Priority Pollutant Metals (13)	TAL Metals (23)	TCIP-Volatiles (ZHE-8240)	TCIP-Semivolatiles (8270)	TCIP-Pesticides (8080)	TCIP-Herbicides (8150)	TCIP-Metals (8 metals)	% Moisture (Please indicate)	Total # of Containers/sample

Turnaround Time	Sample Receipt	Relinquished By:	Relinquished By:	Relinquished By:
STANDARD TAT	TOTAL # CONTAINERS RECD	Date:	Date:	Date:
1 WEEK TAT	COC SEALS PRESENT	Time:	Time:	Time:
4 WORK DAY TAT	COC SEALS INTACT	Received By:	Received By:	Received By:
3 WORK DAY TAT	RECEIVED COLD	Date:	Date:	Date:
2 WORK DAY TAT	RECEIVED INTACT	Time:	Time:	Time:
24 HOUR TAT	RECEIVED VIA: <u>HANDY</u>			

Special Instructions:
FAX RESULTS TO NORM FURI

* Metals needed:
 Corporate Offices: 5550 Northhouse Drive, San Diego, CA 92121 (619) 458-9141



SIGNATURE PAGE

GeoEngineers

JUL 13 1993

Routing NLP
File

Reviewed by:

Costa Papadopoulos
JATI Project Manager

Client: GEO ENGINEERS
REDMOND, WASHINGTON

Project Name: UNOCAL, SEATTLE
Project Number: 161-013-RO4
Project Location: WES HALE
Accession Number: 306954

Project Manager: NORM PURI
Sampled By: MARK THURBER



"Method Report Summary"

Accession Number: 306954
Client: GEO ENGINEERS
Project Number: 161-013-RO4
Project Name: UNOCAL, SEATTLE
Project Location: WES HALE
Test: METHANE PLUS FIXED GASES

Client Sample Id:	Parameter:	Unit:	Result:
930629-1	METHANE	PPMV	37



Accession: 306954
 Client: GEO ENGINEERS
 Project Number: 161-013-RO4
 Project Name: UNOCAL, SEATTLE
 Project Location: WES HALE
 Test: METHANE PLUS FIXED GASES
 Analysis Method: ATI/GC/FID
 Extraction Method: N/A
 Matrix: AIR
 Qc Level: I

Lab Id: 001 Sample Date/Time: 29-JUN-93 0815
 Client Sample Id: 930629-1 Received Date: 01-JUL-93
 Batch: GEA224 Dilution Factor: 1 Extraction Date: N/A
 Blank: A Dry Weight %: N/A Analysis Date: 02-JUL-93

Parameter:	Units:	Results:	Rpt Lmts:	Q:
METHANE	PPMV	37	5	
ANALYST	INITIALS	RP		

Comments:



"QC Report"

Title: Air Blank
Batch: GEA224
Analysis Method: ATI/GC/FID
Extraction Method: N/A

Blank Id: A Date Analyzed: 02-JUL-93 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
METHANE	PPMV	ND	5

Comments:
ANALYST: ROB PEREZ



"QC Report"

Title: Air Reagent
 Batch: GEA224
 Analysis Method: ATI/GC/FID
 Extraction Method: N/A

RS Date Analyzed: 02-Jul-93
 RSD Date Analyzed: 02-Jul-93

RS Date Extracted: N/A
 RSD Date Extracted: N/A

Parameters:	Spike Added	Sample Conc	RS Conc	RS Rec%	RSD Conc	RSD Rec%	Rpd	Rec Lmts
METHANE	100	<5	100	100	110	110	10	50-150

Surrogates:

Comments:

Notes:
 PPMV = PARTS PER MILLION PER VOLUME. < = LESS THAN REPORTING LIMIT.
 * = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
 SOURCE FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCE METHOD.
 N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT



Common notation for Organic reporting

N/S = NOT SUBMITTED
N/A = NOT APPLICABLE
D = DILUTED OUT
MG/L = PARTS PER BILLION.
MG/KG = PARTS PER BILLION.
MG/KG = PARTS PER MILLION.
MG/L = PARTS PER MILLION.
L = LESS THAN DETECTION LIMIT.
O = VALUES OUTSIDE OF QUALITY CONTROL LIMITS
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM
AND REFERENCED METHOD.
ORGANIC SOILS ARE REPORTED ON A DRYWEIGHT BASIS.
ND = NOT DETECTED ABOVE REPORTING LIMIT.

JT = LISA THOMASON
CD = CHRISTY DRAPER
JP = JOE POPE
IP = INGRID PITTMAN
RP = ROB PEREZ
KR = SVETLANA RODKINA
GH = DARREL HALSELL

Accession: 306954
Client: GEO ENGINEERS
Project Number: 161-013-RO4
Project Name: UNOCAL, SEATTLE
Project Location: WES HALE
Test: TOTAL VOLATILE HYDROCARBONS IN CANISTER
Analysis Method: 5030/8020/8015 / SW 846, 3rd Edition, November 1986
Extraction Method: N/A
Matrix: AIR
Qc Level: I

Lab Id: 001 Sample Date/Time: 29-JUN-93 0815
Client Sample Id: 930629-1 Received Date: 01-JUL-93
Batch: CAB106 Dilution Factor: 1 Extraction Date: N/A
Blank: B Dry Weight %: N/A Analysis Date: 07-JUL-93

Parameter:	Units:	Results:	Rpt Lmts:	Q:
TOTAL VOLATILE HYDROCARBONS	MG/M3	ND	500	
ANALYST	INITIALS	RY		

Comments:

"QC Report"

Title: BAG/CAN BLANK
Batch: CAB106
Analysis Method: 5030/8020/8015 / SW 846, 3rd Edition, November 1986
Extraction Method: N/A

Blank Id: B Date Analyzed: 07-JUL-93 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
BENZENE	MG/M3	ND	1
ETHYL BENZENE	MG/M3	ND	1
TOLUENE	MG/M3	ND	5
XYLENES	MG/M3	ND	2
TOTAL PETROLEUM HYDROCARBON	MG/M3	ND	500
TRIFLUOROTOLUENE (PID)	%REC/SURR	94	70-130
TRIFLUOROTOLUENE (FID)	%REC/SURR	93	70-130
ANALYST	INITIALS	RY	

Comments:

"QC Report"

Title: BAG/CAN REAGENT
Batch: CAB106
Analysis Method: 5030/8020/8015 / SW 846, 3rd Edition, November 1986
Extraction Method: N/A

RS Date Analyzed: 06-JUL-93
RSD Date Analyzed: 06-JUL-93

RS Date Extracted: N/A
RSD Date Extracted: N/A

Parameters:	Spike Added	Sample Conc	RS Conc	RS Rec%	RSD Conc	RSD Rec%	Rpd	Rec Lmts
BENZENE	50	<1	47	94	47	94	0	11 82-120
TOLUENE	50	<5	51	102	51	102	0	14 77-125
Surrogates: TRIFLUOROTOLUENE (PID)				101		100		70-130

Comments:

Notes:
UNITS IN MG/M3 = MILLIGRAM PER CUBIC METER N/S = NOT SUBMITTED
< = LESS THAN REPORTING LIMIT
SOURCE FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND METHOD REFERENCE.
UNITS IN UG = MICROGRAMS. N/S = NOT SUBMITTED

Common notation for Organic reporting

N/S = NOT SUBMITTED
N/A = NOT APPLICABLE
D = DILUTED OUT
UG/L = PARTS PER BILLION.
UG/KG = PARTS PER BILLION.
MG/KG = PARTS PER MILLION.
MG/L = PARTS PER MILLION.
< = LESS THAN DETECTION LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM
AND REFERENCED METHOD.
ORGANIC SOILS ARE REPORTED ON A DRY WEIGHT BASIS.
** COMPOUNDS FLAGGED IN METHOD ARE NOT WITHIN THE FIVE POINT CURVE. THEY
ARE SEARCHED FOR QUALITATIVELY.
ND = NOT DETECTED ABOVE REPORTING LIMIT.

SR-SHELLEY REAMSMA
MLP-MELISSA POPE
TSH-TRICIA HOLSTON
LKD-LEIGH DUVALL
MM-MIKE MCKENZIE
KWS-KENDALL SMITH
RY-RON YOKUM
 '-KIMBERLY SMITH
 -GREG FOOTE
DF-DIANNA FOX
CEF-CLAIRE FORNSEL

PROJECT INFORMATION

Accession Number 308554 Due to Client 15 July 93 Bottle Order ID _____

Client Code GEDENG Office ID REDMOND PM CP

PO Number _____ Project Number 161-013-R04

Project Name UNOCAL, SEATTLE

Project Location WES HALE

Report To NORM PURI

Sampled By MARK THURBER

Comment Report Methane only

Requirement Code 1 Number of Report Copies 1

- Is there a Chain of Custody? Y N Are samples correctly preserved? Y N
- Was Chain of Custody signed? Y N Is there sufficient volume for analysis requested? Y N
- Were samples received cold? Y N Were samples received within holding time? Y N
- Were samples received in proper containers? Y N Were matrix spike bottles returned? Y N
- Is there headspace greater than 1/4" in diameter in volatile bottles? Y N

Date Received 1 July 93 Tracking Number N/S

Shipped By FEDEX Cooler Number N/S

Discount _____ %

INVOICE INFORMATION

Invoice Comment 1

Enter or Query Miscellaneous Charges? Y N

Out of Control events and inspection comments _____

ATI will perform the services in accordance with normal professional standards for the industry. The total liability of ATI, any and all officers and employees or successors, to clients for service provided, will not exceed the invoice amount for said service. Client acceptance of a proposal releases ATI from any liability in excess thereof.

PM Approval CP 7/1 Inspected By R. Frost Date Inspected 1 July 93 Logged By [Signature]

