PROGRESS REPORT NO. 2
REMEDIAL ACTION CONSULTATION SERVICES
SUBSURFACE FUEL VAPOR EXTRACTION PROGRAM
SERVICE STATION 5353
SEATTLE, WASHINGTON
FOR
UNOCAL

GeoEngineers

Consulting Geotechnical
Engineers and Geologists

January 3, 1991

Unocal
P.O. Box 76
Seattle, Washington 98111

Attention: Mr. Gary Gunderson

We are submitting five copies of Progress Report No. 2 for our remedial action consultation services at the site of Unocal Station 5353 in Seattle, Washington. This progress report provides information for the time period between July 21, 1988 and December 7, 1990. Future progress reports will be issued to update the information presented in this report.

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

Yours very truly,

GeoEngineers, Inc.

Stephen C. Perrigo
Associate

KSK:SCP:db

File No. 0161-013-B04

cc: Washington State Department of Ecology
Northwest Regional Office
4350 - 150th Avenue N.E.
Redmond, Washington 98052
Attention: Annette Petrie

GeoEngineers, Inc.
2405 140th Ave. NE, Suite 105
Bellevue, WA 98005
Telephone (206) 746-5200
Fax. (206) 746-5068

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TABLE OF CONTENTS

List of Figures

APPENDIX A

APPENDIX B

APPENDIX C

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INTRODUCTION

This progress report summarizes ongoing site remediation efforts and monitoring activities at Unocal Service Station 5353 for the period of July 21, 1988 through December 7, 1990. The site is located northeast of the intersection between Mercer Street and Westlake Avenue in Seattle, Washington (Figure 1). Details of the site history, design, installation and operation of the VRS (vapor recovery system) are given in Progress Report No. 1 dated July 27, 1988. An Interim Status Report, dated October 3, 1988, summarized vapor recovery progress and proposed changes to the operation of the VRS.

Figure 1 shows the main features of the site and the locations of monitor wells and recovery wells discussed in this report. Field data collected during this reporting period are presented in Appendix A. Laboratory analytical data are presented in Appendices B and C.

VAPOR RECOVERY SYSTEM OPERATION

Earlier in this reporting period, a decision was made to continue operating the VRS using the thermal incinerator unit rather than switching the unit to a catalytic reactor as was previously planned. This decision was based on cost considerations and is discussed in our Interim Status Report dated October 3, 1988. The relatively low cost of supplementary fuel (natural gas) in this area makes the operation of the thermal incinerator more cost effective than changing to the catalytic reactor unit.

Approximately 869 days elapsed during this reporting period of July 21, 1988 through December 7, 1990. The VRS was operational for about 544 days during this same period. Nonoperational periods have consisted of

unscheduled and scheduled shutdowns. About 100 days of unscheduled shutdown time and 225 days of scheduled shutdown time elapsed during this reporting period.

Some difficulties with the operation of the VRS were encountered during the early portion of this reporting period. These difficulties forced the VRS to shut down operation automatically on numerous occasions (mainly from December 1988 through February 1989), for approximately 58 days of unscheduled down time. Troubleshooting the VRS and the vapor collection system by GeoEngineers and B & C Equipment representatives indicated that excess water entering the system (probably from condensation) was partially responsible for the problem. A new water trap was installed in October 1988 to collect additional condensation collecting in the system. Operational problems attributable to excess water in the system continued after the new water trap was installed, through February 1989. At this time, a larger water trap consisting of a 55-gallon drum was installed. We also determined that fine soil matter and grit from the interior of the piping system clogged the internal vanes on the flame arrestor. This problem was remedied in September 1988 by the installation of a filter screen near the flame arrester to capture the grit. Since these modifications were incorporated, the VRS maintained fairly continuous operation, provided that the water traps were checked frequently.

There continued to be occasional unscheduled shutdowns of the VRS during this reporting period because of the accumulation of water and other miscellaneous mechanical problems in the system. These shutdowns were of relatively short duration and accounted for 42 days of unscheduled shutdown time. GeoEngineers and B & C Equipment worked together to remedy these problems.

There were two intervals of scheduled shutdown time during this reporting period. These shutdowns occurred from February 2 to May 11, 1990 (98 days) and from August 2 through December 7, 1990 (127 days). The VRS remains inoperative at the time this report is issued. These scheduled shutdowns were implemented after routine system monitoring indicated that vapor concentrations in the VRS were reduced to the point where it was determined that hydrocarbon recovery was nominal.

Smoke tests were conducted across the surface of the site on August 2, 1988. These tests were conducted to determine the location of areas where ground vacuum was being reduced because of cracks in pavement and/or poorly sealed surface monuments. Two areas determined to have significant surface leakage were the vault located just south of the incinerator enclosure and the vault located near RW-7. These areas were subsequently sealed by B & C Equipment.

A sample of the waste condensate water was obtained from the 55-gallon water trap on March 31, 1989. This condensate sample was analyzed for total petroleum hydrocarbons (EPA Method 418.1) and purgeable aromatics (EPA Method 8020) in order to evaluate the appropriate method of water disposal. The laboratory report is presented in Appendix C.

MONITORING ACTIVITIES

GENERAL

The two types of monitoring activities at the site include: (1) monitoring of subsurface conditions, and (2) VRS performance monitoring. The time interval between monitoring activities varied from one week to four weeks during this reporting period. The intensity of monitoring decreased as the VRS operation and subsurface vapor concentrations became more predictable. Some inconsistencies in the frequency of monitoring are attributed to scheduled and unscheduled shutdowns of the VRS.

SUBSURFACE CONDITIONS

Ground Water Level Monitoring: Ground water levels were measured in the monitor wells and recovery wells at the site during the current reporting period on April 14, 1989, October 27, 1989, February 1, 1990, May 1, 1990, June 15, 1990 and December 7, 1990. Water table elevations measured from February 14, 1988 (prior to the initial start-up of the VRS) through the latest measurements on December 7, 1990 are presented in Table A-1 in Appendix A. Ground water level measurements were made using a fiberglass tape and water-finding paste.

The water table at the site typically occurs at a depth of about 10 feet below site grades. Ground water elevations as measured on December 7, 1990 (the latest full round of measurements) and referenced to

the Seattle datum ranged from 9.68 feet to 10.94 feet. The elevation of the water table appears to have fluctuated by about 0.6 to 1.6 feet since our initial 1988 measurements. Fluctuations in the ground water table elevations do not appear to be related to normal seasonal conditions.

Free Product Monitoring: Free product thicknesses were measured in the monitor wells and recovery wells at the site during the current reporting period on April 14, 1989, October 27, 1989, February 1, 1990, May 1, 1990, June 15, 1990 and December 7, 1990. Free product thicknesses measured from February 14, 1988 (previous to the initial start-up of the VRS) through the latest measurements on December 7, 1990 are presented in Table A-1 in Appendix A. Free product thickness measurements were made using a fiberglass tape and gasoline-finding paste or a water/product interface probe.

Since our initial measurements in 1988, measurable product has been detected in monitor wells MW-1, MW-2, MW-13, MW-17, MW-18, MW-19 and MW-24, and in recovery wells RW-4, RW-7, RW-10 and RW-28. The product thicknesses have varied from 0.01 feet to 0.66 feet. A trace of free product (detectable but not measurable) was found in monitor wells MW-3, MW-11 and MW-30, and in recovery wells RW-5, RW-8, RW-9 and RW-26, during our measurements.

A product sample was obtained from monitor well MW-2 on June 15, 1990 and from monitor well MW-19 on July 24, 1990. These product samples were submitted to the laboratory for fuel fingerprint analysis (EPA Method 8015, modified) to evaluate the type and relative age of the product. The laboratory reports are presented in Appendix C.

Soil Vapor Monitoring: Combustible vapor concentrations in all accessible monitor wells and recovery wells were measured on 28 occasions during this reporting period. Combustible vapor concentrations measured with field instrumentation prior to the current reporting period were erratic, probably because of the lack of oxygen in the subsurface environment. During this reporting period, the field instrumentation behaved more reliably, which we feel indicates the effectiveness of the vapor recovery system in drawing ambient air into the subsurface environment. Subsurface vapor concentrations measured from June 29, 1988

through the latest measurements on December 7, 1990 are presented in Table A-2 in Appendix A. Subsurface vapors were monitored in the well casings using a Bacharach TLV Sniffer calibrated to hexane.

Vapor samples were collected from selected monitor wells and recovery wells on several occasions throughout this reporting period. These vapor samples were submitted to the laboratory and analyzed for total volatile hydrocarbons and methane. The purpose of this analysis is to distinguish between fuel hydrocarbon vapors and methane gas.

Methane gas is present at high concentrations in the subsurface environment at this site. The presence of the methane gas is unrelated to the fuel leak or operation of the service station. The results of the vapor analyses on the samples obtained from May 16, 1988 (prior to the initial startup of the VRS) through July 24, 1990 are presented in Table A-3 in Appendix A. The laboratory reports for samples obtained during this reporting period are presented in Appendix B. The vapor samples were obtained by withdrawing vapors from the headspace in the well casings into stainless steel cylinders.

Periodic measurements of carbon dioxide concentrations also were made in selected wells, including monitor wells MW-3, MW-14, MW-17, MW-29 and MW-30. Subsurface carbon dioxide concentrations measured from August 9, 1988 through the latest measurements on July 24, 1990 are presented in Table A-3 in Appendix A. The percentage of carbon dioxide in vapor within the headspace in these well casings was measured using a Bacharach Fyrite Gas Analyzer.

Ground Water Sampling: Ground water samples were obtained from monitor wells MW-1 and MW-30 on October 19, 1988. Biological tests were performed on the water samples to determine aerobic plate counts over time. The purpose of this analysis was to determine the relative amount of biological activity in ground water. Plate counts were determined immediately after sample collection, after one day, after three days, and after seven days. These results are illustrated in Figure 2. The laboratory report is presented in Appendix C.

VAPOR RECOVERY SYSTEM PERFORMANCE MONITORING

The VRS was constructed with the capability to withdraw vapor from any combination of the four vapor recovery wells at the site. During the initial reporting period (Progress Report No. 1) the withdrawal mode was changed frequently in order to evaluate the relative efficiency of the different modes of operation. In order to evaluate efficiency of an operational mode, monitoring is required at each change in operation mode. The VRS was monitored on a less frequent basis during the current reporting period because the most preferred operational modes had been determined.

Monitoring the performance of the VRS involves measurement of several operational parameters including: (1) the total system flow rate measured in cubic feet per minute, (2) system vacuum expressed in inches of water column, (3) combustible vapor concentration in the extracted vapors using a Bacharach TLV Sniffer, (4) carbon dioxide concentration in the extracted vapors using a Bacharach Fyrite Gas Analyzer, (5) temperature of the extracted vapors, and (6) rate of consumption of supplementary fuel by the incinerator. Measurement of these parameters generally takes place each time the withdrawal mode is changed. Samples of extracted vapors are also collected from the system immediately before and after the withdrawal mode is changed. These vapors are analyzed for TVH (total volatile hydrocarbons) and methane. The laboratory reports for samples obtained during this reporting period are included in Appendix B. All of the VRS monitoring data collected since the startup of the system are summarized in Table A-4 in Appendix A.

Ground vacuum also is monitored to evaluate the performance of the VRS. Ground vacuum in all accessible monitor wells and recovery wells was measured on 22 occasions during this reporting period. Ground vacuum measured from June 29, 1988 through the latest measurements on July 24, 1990 are presented in Table A-5 in Appendix A. Ground vacuum measurements were made in the wells casings using a magnahelic gauge with a resolution of 0.005 inches water column.

DISCUSSION AND CONCLUSIONS

SUBSURFACE CONDITIONS

Ground Water and Free Product. The ground water level fluctuatations during this reporting period did not follow seasonal fluctuations that are typical of the Puget Sound Region. The ground water monitoring data indicate that the ground water levels are higher than would normally be expected in some of the wells located close to areas of vapor extraction. These anomalous variations in ground water levels are likely attributable to the effect of the subsurface vacuum. The vacuum effectively raises the water table locally in those areas of greatest vacuum. These ground water levels return to normal relative to nearby wells when operation of the VRS is terminated.

Artificial fluctuation of the ground water table probably has a beneficial effect on the removal of residual gasoline from the subsurface environment. Natural biodegradation of residual fuel hydrocarbons in the subsurface environment requires that (1) the hydrocarbons must be available to bacteria, and (2) oxygen, moisture and other nutrients must be available. The repeated rise and fall of ground water levels as induced by the cyclic operation of the VRS probably made the conditions for natural biodegradation more favorable.

At the onset of this monitoring period, measurable thicknesses of free product were present in five monitor wells, with a maximum thickness of 0.44 feet. At the end of this monitoring period, measurable thicknesses of free product were not observed in any of the monitor wells.

We obtained a product sample from two wells (MW-2 and MW-19) in June to evaluate the fuel type and degree of weathering. The fuel samples were analyzed by EPA Method 8015 (modified). The results of those analyses provided confirmation that the fuel type was gasoline and that the fuel was weathered. The chromatograms from the analyses show a distinct loss of the lighter phase of the gasoline. It is our opinion that the free product observed during this monitoring period can be attributed to historic releases rather than a recent, ongoing release.

Subsurface Hydrocarbon Vapors: Interpretation of subsurface hydrocarbon vapor data at this site has been hampered by the presence of

methane gas in the subsurface environment. Field measurements of vapors cannot distinguish between vapor types. The field monitoring instrument (a Bacharach TLV Sniffer) employs a sensor which is sensitive to methane and any other combustible vapor. We attempted to use a PID (photoionization detector) along with the TLV Sniffer instrumentation to assist in vapor discrimination. The PID is not sensitive to methane but is sensitive to other hydrocarbon vapors. Thus, in theory, it should be possible to determine the concentrations of methane versus other hydrocarbon vapors when using the instruments together. We found poor correlation of field data to actual laboratory data using this method, and as a result have discontinued attempts to distinguish vapor type using field instrumentation.

The VRS has been effective in reducing combustible vapor concentrations beneath the service station site during periods of active operation. When the system is turned off, the ground vapor concentration gradually return to relatively high levels. The VRS has not been effective in lowering combustible vapor concentrations in monitor wells located north of the site.

Subsurface vapor concentrations in areas unaffected by the VRS typically exceed the upper limit of the field monitoring instrument's range, which is 10,000 parts per million (this is one percent on a total volume basis, which corresponds to about 90 percent of the Lower Explosive Limit for gasoline). Vapor concentrations as measured by laboratory analysis have shown concentrations as high as 30 percent methane and 16 percent other TVH (total volatile hydrocarbons) expressed on a volume/volume basis. Twenty-two vapor samples have been collected from monitor wells for chemical analysis since the VRS operation began. The average methane concentration in these analyses has been 76,100 ppm (7.6%) and the average TVH concentration has been 15,700 ppm (1.6%).

There is significant ongoing methane production in the vicinity of the site. The location of the methane source is not readily apparent from our monitoring data; however, the methane appears to be ubiquitous across the site. Risks of fire, explosion and/or asphyxiation posed by methane gas are similar to those posed by gasoline vapors. We recommend that the Washington State Department of Ecology be made aware of the presence of methane in the vicinity of the site. The continued high concentrations of methane gas

indicate that there is a nearby, ongoing source of methane production. Sawdust fill was encountered in explorations completed in 1980 to characterize contamination in the vicinity of the site. The methane observed in the wells may be the result of decomposition of sawdust fill.

Despite the presence of methane vapors in the ground, the monitoring data clearly show reduced concentrations of gasoline vapors within the subsurface environment. This indicates that there is air exchange occurring within the zone of residual gasoline contamination. In addition to removing gasoline vapors through evaporation, this air exchange transports oxygen to the contaminated zone which helps stimulate natural biodegradation of the residual gasoline.

Indications of Biological Activity: Ground water samples were obtained from two monitor wells in October 1988 to evaluate the presence and activity of naturally occurring bacteria with an affinity to degrade gasoline. Counts of aerobic bacteria were evaluated initially and then at periodic intervals as each sample was mildly agitated (aerated). The testing showed a significant increase of 20 to 30 fold in bacterial populations over the seven-day test period. Figure 2 shows the increase in bacterial activity during this test. This testing indicates that, given sufficient oxygen, the naturally occurring bacteria at the site will increase their rate of destruction of residual gasoline.

We measured carbon dioxide concentrations in selected wells during this reporting period. Carbon dioxide is produced by bacterial decomposition of organic materials. The highest carbon dioxide concentrations were noted in wells MW-14 and MW-30, which are located northwest and northeast of the service station site, respectively. These high carbon dioxide measurements likely can be attributed to the same process that is producing the methane gas (which may be the decomposition of sawdust fill). In the absence of methane gas generation, elevated carbon dioxide concentrations could be attributed to biodegradation of the gasoline.

VRS SYSTEM PERFORMANCE

System Vacuum: System vacuum has been measured at the VRS system to evaluate the maximum potential vacuum applied to the ground at the withdrawal locations. A high system vacuum in conjunction with an adequate

flow rate indicates that the vapor recovery system is operating efficiently and affecting a large subsurface area. Low system vacuum may be attributed to short-circuiting of subsurface air flow paths to the ground surface with the resulting loss of vacuum.

The greatest system vacuum measurements were obtained when vapor withdrawal was from the southern vapor recovery wells (RW-4A and RW-5A). Significant declines in system vacuum were noted when withdrawal was from the entire system or when withdrawal was from the northern part of the site. This probably indicates that short-circuiting of vacuum occurred in the northern part of the system. Smoke testing to identify surface leaks identified several locations of significant air flow into the ground in the northern part of the system. These areas were repaired. It is our opinion that additional short-circuiting of vapor flow in the northern part of the system is occurring at the location where the gravel backfill of the collection trenches intersects the backfill of the sewer line and/or other buried utilities along Westlake Avenue.

Ground vacuum measurements clearly show that withdrawal from the southern part of the vapor recovery system induces measurable vacuums over a greater area than from the northern part of the VRS. Figure 3 shows a contour map of the maximum vapor concentration measured at each monitor well during the period of operation of the VRS. Maximum ground vacuums in excess of 10 inches water column were typical in the southern part of the system, while maximum vacuums in the northern part of the system never exceeded 1 inch of water column.

The maximum measurable extent of vacuum impact of the VRS is also shown in Figure 3. The VRS has been effective in vapor withdrawal beneath the service station property. Off-site influence to the west is likely limited by the presence of a deep sewer line and its backfill. The VRS impact to the south, across Mercer Street also may be affected by buried utilities. The data indicate limited impact of the VRS to the east and north of the site, in areas with known fuel-related hydrocarbon vapor concentrations.

Vapor Withdrawal: Vapor withdrawal efficiency has been calculated using monitoring information about flow rates and chemical composition of the effluent gas at the VRS. Table A-6 shows the estimated equivalent vapor

recovery for methane and gasoline for each individual period of system operation. Since the onset of operation of the system, we estimate that the equivalent of about 4,300 gallons of gasoline have been recovered in the withdrawn vapors. During the same period, about 120,800 cubic feet of methane gas have been recovered. Figure 4 shows the general trend in daily recovery rates during the period of operation of the system. Seasonal influence in vapor recovery rates are not apparent in the data. Some of the changing trends shown are caused by shifts in the operating mode of the VRS and withdrawal ports.

The most significant trend identified in the data shown in Figure 4 is the rate of decline of recovery rates with time. Initially, gasoline recovery rates for TVH declined from over 10 gallons per day to about 1 gallon per day over a period of about six months. During the next period of operation the system exhibited a greater rate of decline. During the final period of VRS operation, the average daily gasoline recovery rates declined from over 10 gallons per day to less than 0.01 gallons per day over a period of about three months.

The declining rates of recovery can be due to several reasons, including:

(1) increased inefficiency of the system due to desiccation of the soils and subsequent short-circuiting of air flow paths,

(2) reduced volume of available residual gasoline for recovery,

(3) depletion of residual hydrocarbon vapors in the subsurface.

We believe that the recent rapid declines in gasoline recovery rates during operation of the VRS are attributed to the latter two reasons. The rapid decline in recovery rates correlates closely with the disappearance of free product from monitor wells. The volume of air removed by the VRS represents a volume equivalent to about 600 exchanges of the available unsaturated pore space in the area of measured influence of the VRS. Therefore, it is likely that the area influenced by the VRS has effectively undergone several full "flushings" of its soil pore space.

FUTURE ACTIONS AND MONITORING

VAPOR RECOVERY SYSTEM OPERATION

The recent performance of the VRS gives valuable insight into the most effective mode of further operation of the system. We recommend that the system be operated in a "pulsed" mode with a sequence of two weeks on followed by two weeks off. Most air withdrawal should be from the southern part of the system, but periodically the northern part of the system should be purged to remove accumulated vapors.

The system efficiency should be observed closely during the periods of pulsed operations. After about three to six months, depending upon observed efficiencies, the system operation should be reevaluated.

PERFORMANCE MONITORING

Performance monitoring should continue in general accordance with past monitoring protocol. This includes measurements of water level and product thickness on a monthly basis, and measurement of ground vacuum and vapor concentrations in wells at each time the system configuration is changed. Periodic sampling and analysis of vapors from selected wells will support an understanding of the influence of methane on the cleanup activities.

Measurements of system vacuum, flow rate, combustible vapor concentration, carbon dioxide concentration, and fuel consumption should be made each time the VRS is turned on and off. Vapor samples also should be obtained to evaluate methane and TVH concentrations.

We also recommend the evaluation of additional field vapor monitoring techniques to differentiate methane from TVH.

FUTURE REPORTING

We will provide a progress report of system operation after completion of the recommended period of pulsed operation (three to six months, depending upon observed efficiencies under this mode of operation).

LIMITATIONS

We have prepared this report for use by Unocal in their evaluation of ongoing vapor recovery efforts at Station 5353 in Seattle, Washington. This report may be made available to potential buyers of the property and to

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regulatory agencies. The report is not intended for use by others and the information contained herein may not be applicable to other sites.

Our services have been executed 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.

Please call if you have questions concerning this progress report.

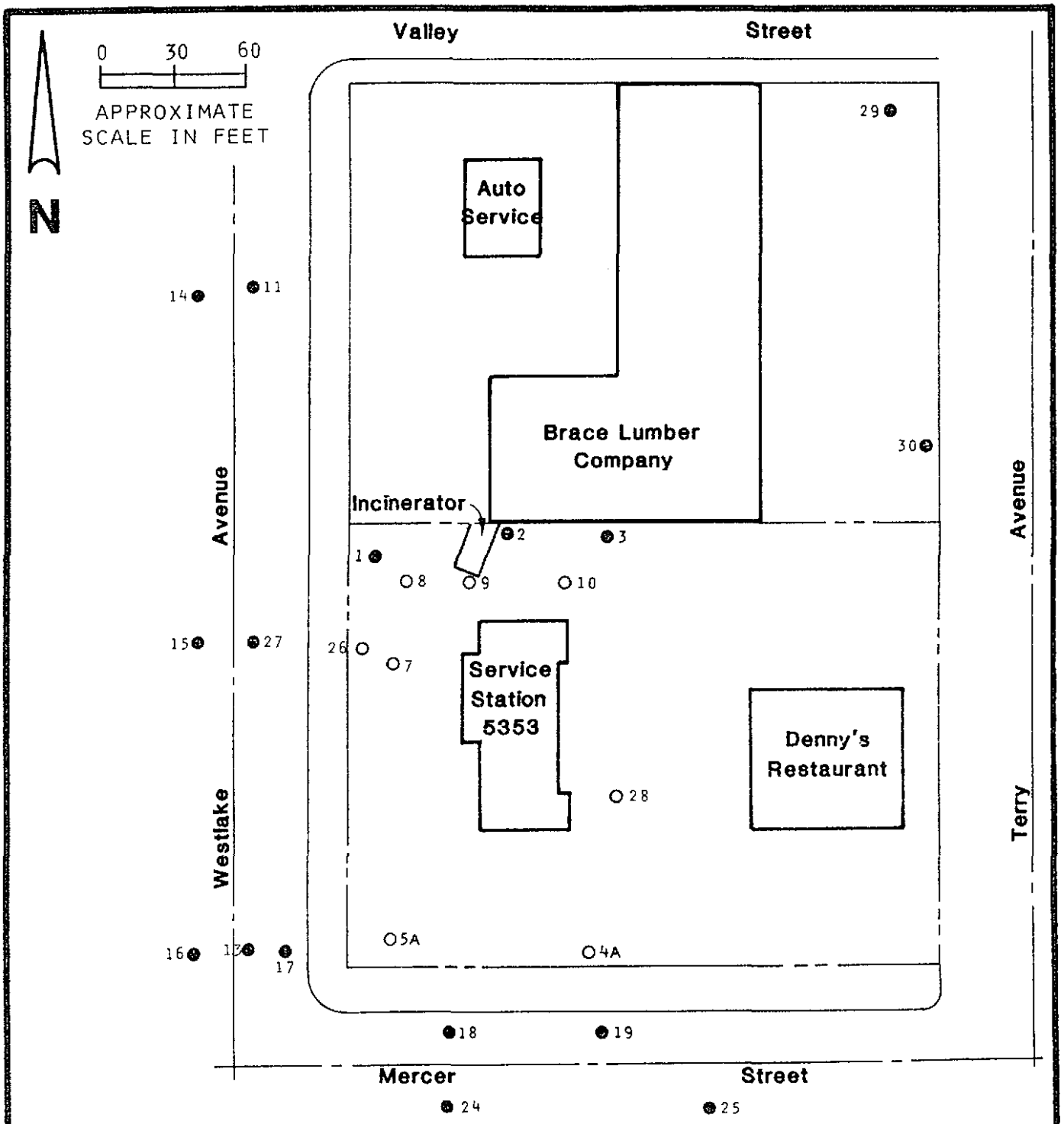
Respectfully submitted,

GeoEngineers, Inc.

Kathy S. Killman
Project Geologist

Stephen C. Perrigo
Associate

KSK:SCP:cs



EXPLANATION:

- ● MONITOR WELLS
- ○ RECOVERY WELLS WITH MANHOLE COVERS

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SITE PLAN

FIGURE 1

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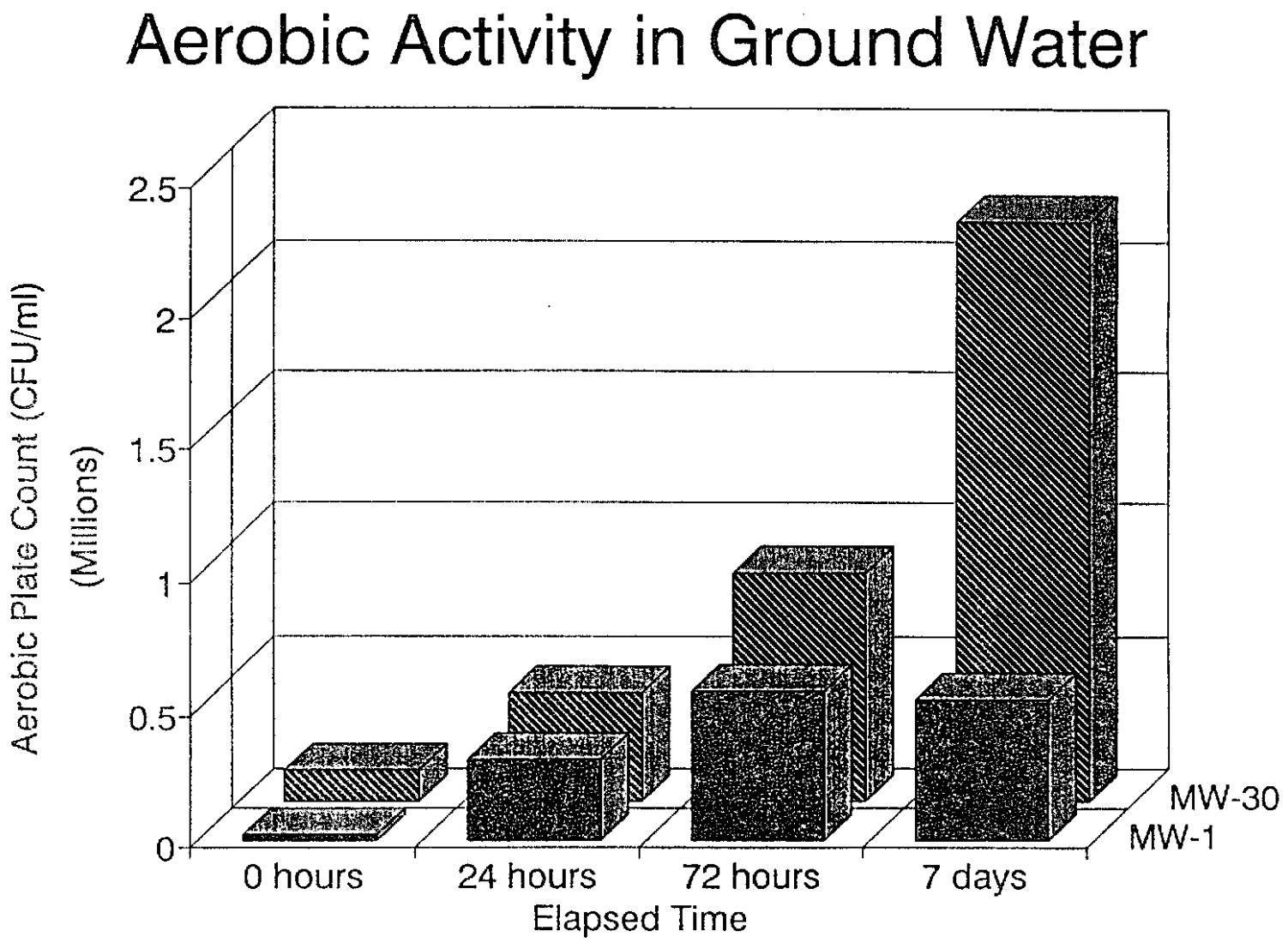
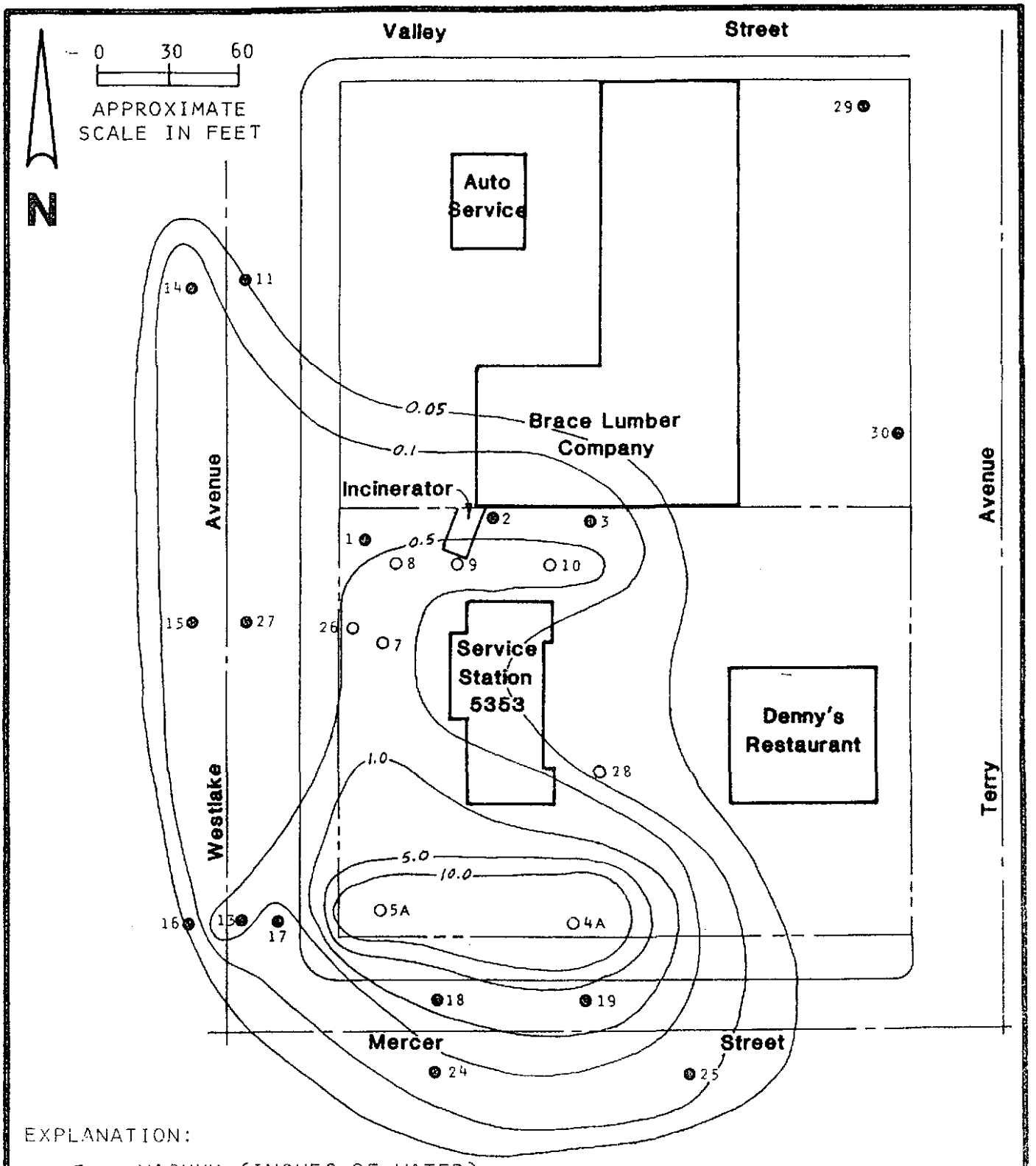
FIGURE 2

AEROBIC ACTIVITY IN GROUND WATER





EXPLANATION:

—5.0— VACUUM (INCHES OF WATER)

CONTOURS SHOWING MAXIMUM VACUUM MEASURED AT EACH MONITORING LOCATION 6/29/88 THROUGH 7/24/90

EXPLANATION:

● MONITOR WELLS

○ RECOVERY WELLS WITH MANHOLE COVERS

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MAXIMUM VACUUM OBSERVED

FIGURE 3

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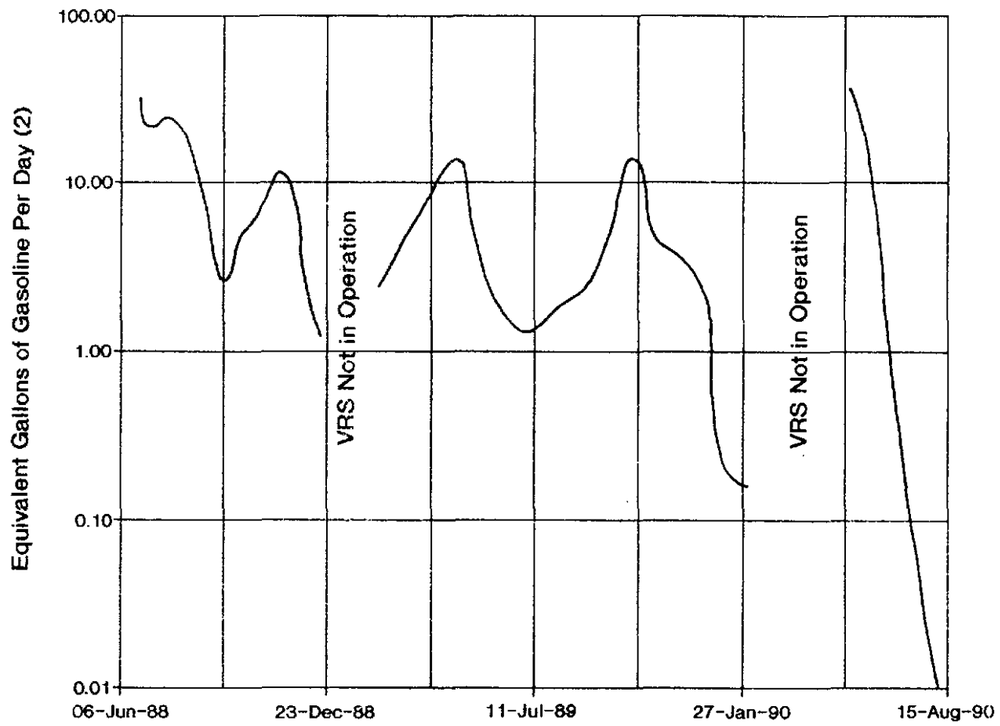

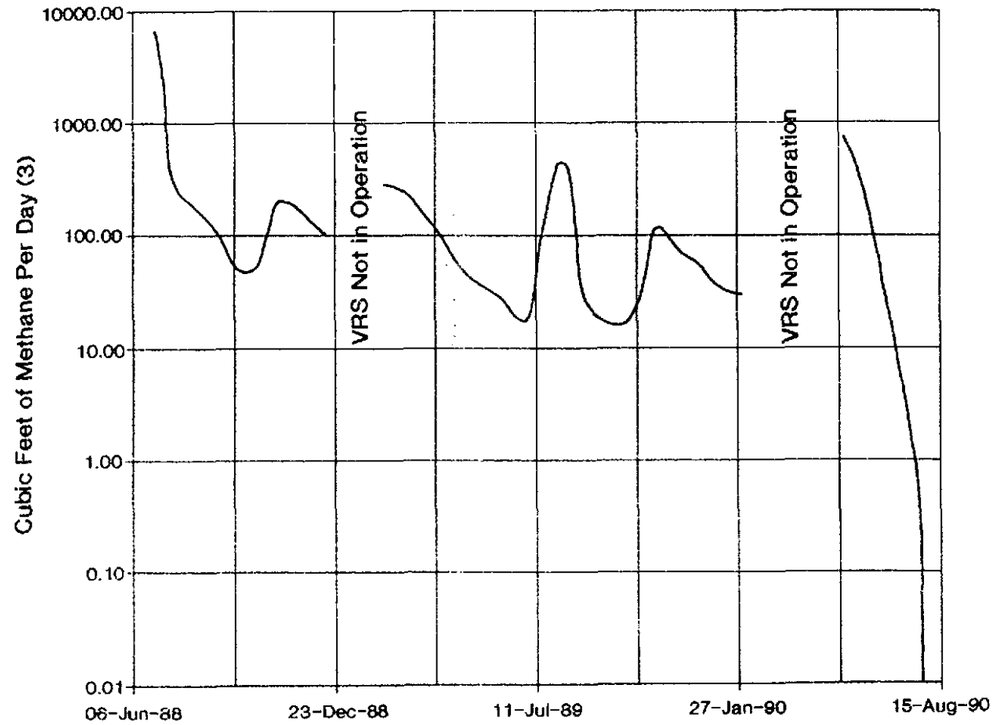

NOTES:
(1) THESE GRAPHS REPRESENT AVERAGE DAILY HYDROCARBON REMOVAL RATES SINCE THE SYSTEM BEGAN OPERATION. THE DATA HAS BEEN SMOOTHED TO AID IN INTERPRETATION.

(2) AVERAGE TVH WITHDRAWAL RATE IS BASED UPON AVERAGE TVH CONCENTRATIONS, FLOW RATE, AND AN APPROXIMATE CONVERSION FACTOR. TVH WITHDRAWAL IS EXPRESSED AS GALLONS OF LIQUID GASOLINE.

(3) AVERAGE METHANE WITHDRAWAL RATE IS BASED UPON AVERAGE METHANE CONCENTRATION AND FLOW RATE. METHANE WITHDRAWAL RATE IS EXPRESSED AS CUBIC FEET OF METHANE AT AMBIENT TEMPERATURE AND PRESSURE.

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AVERAGE DAILY WITHDRAWAL RATES FUEL HYDROCARBONS AND METHANE

FIGURE 4

APPENDIX A

TABLE A-1 (Page 1 of 2)
WATER AND PRODUCT LEVELS IN MONITOR AND RECOVERY WELLS

Well	Casing Rim Elevation(1)	02/14/88		05/15/88		07/20/88		04/14/89	
		Water Table Elevation	Product Thickness	Water Table Elevation	Product Thickness	Water Table Elevation	Product Thickness	Water Table Elevation	Product Thickness
MW-1	20.12	9.62*	0.22	10.06*	0.10	--	--	10.48	Trace
MW-2	20.07	--	--	--	--	--	--	10.18*	0.18
MW-3	19.38	9.61	Trace	10.02	0.00	--	--	10.34	Trace
MW-11	19.82	9.64	Trace	10.26	0.00	--	--	10.26	0.00
MW-13	21.73	9.86	0.00	10.30	0.00	--	--	10.63	0.00
MW-14	19.28	9.63	0.00	10.33	0.00	--	--	10.33	0.00
MW-15	20.48	9.86	0.00	10.30	0.00	--	--	10.52	0.00
MW-16	21.19	10.04	0.00	10.43	0.00	--	--	10.65	0.00
MW-17	21.28	9.77*	0.07	10.09*	0.04	--	--	10.53	0.00
MW-18	21.09	9.98	0.00	10.36*	0.06	--	--	10.89	0.00
MW-19	20.97	9.91*	0.23	10.25*	0.44	--	--	10.65*	0.57
MW-24	21.49	(2)	(2)	(2)	(2)	--	--	10.78	0.00
MW-25	21.16	10.52	0.00	10.75	0.00	--	--	11.59	0.00
MW-29	18.63	9.00	0.00	9.93	0.00	--	--	10.02	0.00
MW-30	18.86	8.91	Trace	9.69	0.00	10.52	Trace	9.72	0.00
RW-4A	21.28	9.50*	0.17	--	--	10.58	Trace	10.82	0.00
RW-5A	21.40	9.61	0.00	--	--	9.83	Trace	10.93	0.00
RW-7	20.66	9.38*	0.13	--	--	9.79	Trace	10.36	0.00
RW-8	19.92	9.31	0.00	--	--	9.74	Trace	--	--
RW-9	20.61	9.24	Trace	--	--	9.71	Trace	9.99	0.00
RW-10	20.59	9.29	0.00	--	--	9.88*	0.01	9.99	0.00
RW-26	20.72	9.42	0.00	--	--	9.68	Trace	10.11	0.00
RW-28	21.17	9.23*	0.09	--	--	--	--	9.98	0.00

Notes:
"--" signifies "no measurement taken"
(1) Elevations measured in feet and referenced to Seattle Datum
(2) Well was dry on date measured
* Water table elevation adjusted for presence of free product

TABLE A-1 (PAGE 2 OF 2)

Well	Casing Rim Elevation (1)	10/27/89		02/01/90		05/01/90		06/15/90		12/07/90	
		Water Table Elevation	Product Thickness	Water Table Elevation	Product Thickness	Water Table Elevation	Product Thickness	Water Table Elevation	Product Thickness	Water Table Elevation	Product Thickness
MW-1	20.12	10.14	0.00	--	--	10.30	0.00	--	--	10.44	0.00
MW-2	20.07	--	--	10.82	0.00	10.10*	0.14	10.34*	0.12	10.28	0.00
MW-3	19.38	10.08	0.00	--	--	10.25	0.00	--	--	10.39	0.00
MW-11	19.82	10.10	Trace	10.17	0.00	10.21	0.00	--	--	10.23	0.00
MW-13	21.73	10.39*	0.03	10.76	0.00	10.60	0.00	--	--	10.62	0.00
MW-14	19.28	10.12	0.00	10.13	0.00	10.29	0.00	--	--	10.24	0.00
MW-15	20.48	10.20	0.00	10.31	0.00	10.30	0.00	--	--	10.35	0.00
MW-16	21.19	10.39	0.00	10.59	0.00	10.60	0.00	--	--	10.61	0.00
MW-17	21.28	10.06	0.00	10.57	0.00	10.38	0.00	--	--	10.50	0.00
MW-18	21.09	10.26	0.00	10.67	Trace	10.48	0.00	--	--	10.73	0.00
MW-19	20.97	10.01	Trace	9.93	Trace	10.55*	0.43	10.65*	0.47	10.78	0.00
MW-24	21.49	(2)	(2)	(2)	(2)	10.66*	0.66	--	--	(2)	(2)
MW-25	21.16	11.60	0.00	(2)	(2)	(2)	(2)	--	--	(2)	(2)
MW-29	18.63	9.54	0.00	9.93	0.00	10.08	0.00	--	--	9.68	0.00
MW-30	18.86	9.28	0.00	9.78	0.00	9.73	0.00	--	--	--	--
RW-4A	21.28	10.20	0.00	10.32	0.00	10.16	0.00	--	--	10.31	0.00
RW-5A	21.40	9.94	0.00	10.76	0.00	10.17	0.00	--	--	10.94	0.00
RW-7	20.66	9.92	0.00	10.11	0.00	10.10	0.00	--	--	10.23	0.00
RW-8	19.92	9.84	0.00	10.03	0.00	10.00	0.00	--	--	10.15	0.00
RW-9	20.61	9.75	0.00	9.93	0.00	9.91	0.00	--	--	10.05	0.00
RW-10	20.59	9.73	0.00	9.92	0.00	9.89	0.00	--	--	10.04	0.00
RW-26	20.72	9.85	0.00	10.03	0.00	10.02	0.00	--	--	10.27	0.00
RW-28	21.17	10.10	0.00	9.87	0.00	9.87	0.00	--	--	9.80	0.00

Notes:
"--" signifies "no measurement taken"
(1) Elevations referenced to Seattle Datum
(2) Well was dry on date measured
* Water table elevation adjusted for presence of free product

TABLE A-2 (Page 1 of 3)
SUBSURFACE COMBUSTIBLE VAPOR MONITORING DATA

Well	Date											
	06/29/88	06/30/88	07/01/88	07/08/88	07/11/88	07/14/88	07/18/88	07/25/88	08/02/88	08/09/88	08/16/88	08/30/88
MW-1	---	<100	<100	NV	>10,000	300	5,400	---	<100	---	<100	---
MW-2	---	<100	<100	100	>10,000	<100	380	250	<100	<100	<100	<100
MW-3	---	>10,000	<100	660	<100	---	---	>10,000	<100	2,400	<100	>10,000
MW-11	---	1,600	<100	NV	>10,000	NV	>10,000	>10,000	>10,000	>10,000	2,800	>10,000
MW-13	NV	<100	<100	<100	>10,000	NV	<100	<100	<100	<100	400	<100
MW-14	NV	3,000	<100	<100	NV	>10,000	>10,000	>10,000	<100	<100	<100	>10,000
MW-15	NV	<100	<100	<100	NV	NV	<100	<100	<100	<100	<100	220
MW-16	NV	<100	<100	<100	NV	NV	<100	<100	<100	<100	190	1,200
MW-17	NV	<100	<100	NV	NV	NV	<100	<100	<100	<100	>10,000	<100
MW-18	NV	<100	<100	<100	NV	NV	<100	<100	<100	<100	<100	<100
MW-19	NV	<100	<100	<100	NV	NV	8,400	<100	2,600	<100	<100	>10,000
MW-24	NV	<100	<100	NV	NV	NV	<100	<100	<100	<100	500	<100
MW-25	NV	<100	<100	NV	>10,000	>10,000	<100	<100	>10,000	<100	>10,000	>10,000
MW-27	NV	<100	<100	<100	NV	NV	<100	<100	<100	<100	<100	1,800
MW-29	---	<100	NV	NV	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000
MW-30	---	<100	<100	NV	>10,000	---	9,700	>10,000	>10,000	>10,000	>10,000	>10,000
RW-4A	---	5,100	<100	---	4,900	7,100	3,800	<100	5,200	640	4,000	1,000
RW-5A	---	2,300	<100	---	<100	1,600	1,600	<100	---	<100	2,500	2,400
RW-7	---	<100	120	---	940	3,700	320	<100	1,800	180	2,200	340
RW-8	---	<100	<100	300	180	760	230	110	340	460	1,400	1,200
RW-9	---	<100	<100	<100	<100	400	<100	<100	1,200	100	3,300	5,200
RW-10	---	2,100	<100	740	310	180	400	140	<100	920	<100	1,900
RW-26	---	<100	220	---	1,200	<100	280	<100	<100	<100	110	210
RW-28	---	<100	<100	---	<100	100	<100	<100	<100	<100	110	<100

Vapor Collection System Operational Status

Northwest	O	-	-	-	-	O	-	-	O	-	O	-
Northeast	O	-	-	-	-	O	-	-	O	-	O	-
Southwest	O	O	O	O	-	O	O	O	O	O	O	O
Southeast	O	O	O	O	O	O	O	O	O	O	O	O

Notes:

Vapor concentrations were measured using a Bacharach TLV Sniffer calibrated to hexane.

Results are expressed as parts per million (vol/vol).

Most of the readings of <100 ppm are suspect. This is discussed in the text.

"NV" signifies that a measurement was taken but the value was not valid.

"<" signifies "less than"; ">" signifies "greater than"; "---" signifies "no reading taken"

Vapor collection system operational status shows the configuration of vapor withdrawal at the time the vapor readings were taken.

"O" signifies "Open" and "-" signifies "Closed"

TABLE A-2 (Page 2 of 3)

Well	Date											
	09/16/88	10/11/88	10/25/88	11/08/88	12/06/88	01/03/89	01/24/89	02/21/89	03/16/89	04/14/89	05/11/89	06/16/89
MW-1	600	<100	>10,000	<100	200	120	<100	<100	<100	<100	<100	100
MW-2	>10,000	<100	>10,000	1,300	---	>10,000	>10,000	>10,000	2,800	<100	<100	---
MW-3	---	<100	>10,000	<100	<100	>10,000	3,000	800	>10,000	>10,000	<100	>10,000
MW-11	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	6,000	7,400	>10,000	>10,000	>10,000
MW-13	>10,000	>10,000	>10,000	800	>10,000	2,200	120	>10,000	120	160	<100	120
MW-14	1,400	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000
MW-15	3,200	<100	4,600	<100	300	<100	2,400	<100	<100	160	<100	<100
MW-16	7,200	<100	>10,000	7,200	380	>10,000	>10,000	>10,000	3,200	560	100	<100
MW-17	>10,000	<100	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	300	>10,000
MW-18	>10,000	<100	180	<100	<100	>10,000	>10,000	>10,000	<100	<100	<100	<100
MW-19	>10,000	>10,000	>10,000	>10,000	<100	>10,000	>10,000	>10,000	>10,000	<100	>10,000	<100
MW-24	980	200	<100	<100	<100	1,400	>10,000	200	<100	<100	<100	<100
MW-25	>10,000	>10,000	>10,000	>10,000	>10,000	100	>10,000	160	5,000	>10,000	>10,000	<100
MW-27	200	140	<100	<100	<100	<100	220	600	<100	<100	<100	110
MW-29	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	2,000	>10,000
MW-30	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000
RW-4A	3,500	3,200	960	2,800	280	4,500	8,600	2,600	1,300	180	600	320
RW-5A	2,000	310	240	180	<100	220	240	4,000	1,200	280	620	520
RW-7	1,700	1,400	1,200	2,400	160	---	---	---	---	<100	<100	240
RW-8	2,000	1,200	2,000	2,400	330	200	220	4,200	720	160	<100	200
RW-9	2,000	1,400	560	1,900	1,200	220	280	2,800	440	<100	310	120
RW-10	1,000	220	4,800	<100	640	1,800	200	120	<100	100	<100	200
RW-26	540	160	290	200	200	200	230	380	120	<100	<100	120
RW-28	1,500	140	<100	<100	<100	<100	<100	<100	410	<100	<100	<100

Vapor Collection System Operational Status

Northwest	-	-	-	-	-	O	-	O	O	-	O	-
Northeast	-	O	-	O	-	O	-	O	O	-	O	-
Southwest	-	-	-	-	-	O	O	O	O	O	O	O
Southeast	-	O	O	O	O	O	O	O	O	O	O	O

Notes:

Vapor concentrations were measured using a Bacharach TLV Sniffer calibrated to hexane.

Results are expressed as parts per million (vol/vol)

Most of the readings of <100 ppm are suspect. This is discussed in the text.

"NV" signifies that a measurement was taken but the value was not valid.

"<" signifies "less than"; ">" signifies "greater than"; "---" signifies "no reading taken"

Vapor collection system operational status shows the configuration of vapor withdrawal at the time the vapor readings were taken.

"O" signifies "Open" and "-" signifies "Closed"

TABLE A-2 (page 3 of 3)

Well	Date										
	07/18/89	08/21/89	09/21/89	10/27/89	11/27/89	12/29/89	02/01/90	05/01/90	06/15/90	07/24/90	12/07/90
MW-1	110	---	4,000	<100	<100	100	---	270	100	<100	100
MW-2	8,000	---	---	>10,000	<100	---	6,000	>10,000	500	<100	>10,000
MW-3	>10,000	<100	<100	250	---	---	---	>10,000	200	<100	>10,000
MW-11	>10,000	>10,000	>10,000	>10,000	>10,000	1,200	>10,000	3,900	>10,000	>10,000	>10,000
MW-13	6,000	<100	<100	180	<100	100	<100	140	<100	200	>10,000
MW-14	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000
MW-15	1,300	<100	<100	200	200	160	>10,000	<100	<100	120	260
MW-16	>10,000	>10,000	1000	480	<100	3,300	140	220	<100	2,200	>10,000
MW-17	>10,000	1,100	<100	<100	>10,000	>10,000	>10,000	>10,000	<100	120	>10,000
MW-18	>10,000	<100	<100	<100	<100	<100	8,200	>10,000	<100	>10,000	>10,000
MW-19	>10,000	100	>10,000	<100	<100	400	300	>10,000	<100	>10,000	>10,000
MW-24	120	240	<100	<100	<100	<100	<100	>10,000	<100	200	>10,000
MW-25	<100	220	<100	<100	<100	<100	2,500	>10,000	<100	>10,000	>10,000
MW-27	100	100	<100	100	<100	<100	<100	<100	<100	<100	180
MW-29	>10,000	4,500	4,400	6,400	>10,000	>10,000	>10,000	>10,000	>10,000	>10,000	---
MW-30	>10,000	---	>10,000	>10,000	6,000	>10,000	>10,000	5,000	>10,000	>10,000	---
RW-4A	1,000	800	1,600	220	500	<100	500	6,200	300	1,500	8,000
RW-5A	360	---	500	<100	<100	<100	<100	100	150	130	<100
RW-7	440	160	300	180	500	160	720	140	<100	<100	920
RW-8	230	---	<100	130	440	9,600	510	120	120	<100	100
RW-9	200	340	180	350	300	400	380	160	<100	<100	120
RW-10	620	2,000	<100	140	<100	180	400	180	190	<100	430
RW-26	400	<100	<100	320	<100	160	<100	140	<100	<100	110
RW-28	180	<100	<100	<100	<100	<100	<100	<100	<100	<100	100

Vapor Collection System Operational Status

Northwest	-	-	O	-	-	-	-	-	-	-	-
Northeast	-	O	O	-	O	-	-	-	-	O	-
Southwest	-	-	O	-	-	-	-	-	O	-	-
Southeast	-	O	O	O	O	O	O	-	O	O	-

Notes:

Vapor concentrations were measured using a Bacharach TLV Sniffer calibrated to hexane.

Results are expressed as parts per million (vol/vol)

Most of the readings of <100 ppm are suspect. This is discussed in the text

"NV" signifies that a measurement was taken but the value was not valid.

"<" signifies "less than"; ">" signifies "greater than"; "---" signifies "no reading taken"

Vapor collection system operational status shows the configuration of vapor withdrawal at the time the vapor readings were taken.

"O" signifies "Open" and "-" signifies "Closed"

TABLE A-3 (Page 1 of 2)
ADDITIONAL TESTING OF VAPORS FROM SELECTED MONITOR WELLS

Well	Date	Field Measurement of Vapors		Laboratory Analyses of Vapors	
		TLV Reading (ppm) (1)	Carbon Dioxide (%) (2)	Methane (ppm) (3)	Total Volatile Hydrocarbons (ppm) (4)
MW-1	05/16/88	>10,000	---	36,000	12,000
	08/03/88	6,000	---	33	<10
MW-3	07/11/89	---	---	26,000	14,000
	07/18/89	>10,000	5.5	--	---
	05/01/90	>10,000	---	98,000	13,000
MW-14	07/18/89	>10,000	12.5	80,000	570
	10/27/89	>10,000	---	110,000	47,000
	02/01/90	>10,000	---	110,000	2,800
	05/01/90	>10,000	7.0	91,000	3,400
MW-17	05/16/88	>10,000	---	120,000	49,000
	08/03/88	<100		<10	<10
	07/18/89	>10,000	3.5	12,000	1,800
	02/01/90	>10,000	---	260,000	2,700
	05/01/90	>10,000	4.5	49,000	9,700
MW-19	10/27/89	<100	---	50	380
MW-29	05/16/88	>10,000	---	300,000	160,000
	08/03/88	>10,000	---	200,000	16,000
	08/09/88	>10,000	0.0	---	---
	08/16/88	>10,000	1.0	---	---
	08/30/88	>10,000	2.5	---	---
	09/16/88	>10,000	0.0	---	---
	10/11/88	>10,000	1.5	---	---
	10/25/88	>10,000	2.5	---	---
	11/08/88	>10,000	0.0	---	---
	12/06/88	>10,000	0.0	1,000	1,200
	01/03/89	>10,000	0.0	---	---
	02/21/89	>10,000	0.0	---	---
	03/16/89	>10,000	1.5	---	---

NOTES:

">" signifies "greater than"; "<" signifies "less than"

"ppm" signifies "parts per million"; "---" signifies "no measurement taken"

(1) Field measurements for TLV taken using a Bacharach TLV Sniffer calibrated to hexane

(2) Carbon dioxide measured using a Bacharach Fyrite Gas Analyzer

(3) Analyses for methane by GC/FID and expressed as ppm methane (vol/vol)

(4) Analyses for Total Volatile Hydrocarbons by GC/FID and expressed as ppm hexane (vol/vol)

TABLE A-3 (Page 2 of 2)

Well	Date	Field Measurement of Vapors		Laboratory Analyses of Vapors	
		TLV Reading (ppm) (1)	Carbon Dioxide (%) (2)	Methane (ppm) (3)	Total Volatile Hydrocarbons (ppm) (4)
MW-29 (con	05/11/89	2,000	1.0	---	---
	06/16/89	>10,000	2.0	---	---
	07/11/89	---	---	9,100	980
	07/18/89	>10,000	5.5	---	---
	08/21/89	4,500	0.0	---	---
	09/21/89	4,400	1.0	---	---
	11/27/89	>10,000	0.0	---	---
	12/29/89	>10,000	5.0	---	---
	02/01/90	>10,000	---	37,000	860
	05/01/90	>10,000	6.5	32,000	1,500
	07/24/90	>10,000	2.0	---	---
MW-30	08/09/88	>10,000	0.5	---	---
	08/16/88	>10,000	14.0	---	---
	08/30/88	>10,000	10.0	---	---
	09/16/88	>10,000	9.0	---	---
	10/11/88	>10,000	10.0	---	---
	10/25/88	>10,000	8.5	---	---
	11/08/88	>10,000	2.0	---	---
	01/03/89	>10,000	11.5	---	---
	02/21/89	>10,000	11.0	---	---
	03/16/89	>10,000	10.0	---	---
	05/11/89	>10,000	14.5	---	---
	06/16/89	>10,000	3.0	---	---
	07/18/89	>10,000	13.0	---	---
	09/21/89	>10,000	9.0	---	---
	10/27/89	>10,000	6.5	92,000	8,300
	11/27/89	6,000	0.0	---	---
	12/29/89	>10,000	13.0	---	---
	05/01/90	6,000	11.5	---	---
	07/24/90	>10,000	14.5	---	---
RW-4A	05/01/90	6,200	---	11,000	260

NOTES:

">" signifies "greater than", "<" signifies "less than"

"ppm" signifies "parts per million; "---" signifies "no measurement taken"

(1) Field measurements for TLV taken using a Bacharach TLV Sniffer calibrated to hexane

(2) Carbon dioxide measured using a Bacharach Fyrite Gas Analyzer

(3) Analyses for methane by GC/FID and expressed as ppm methane (vol/vol)

(4) Analyses for Total Volatile Hydrocarbons by GC/FID and expressed as ppm hexane (vol/vol)

TABLE A-4 (Page 1 of 3)
VAPOR RECOVERY SYSTEM OPERATION AND MONITORING DATA

Date	Time	Flow Rate (CFM)	Vapor Temperature (degrees F)	Vacuum (Inches)(1)	Fuel Use (CFM)(2)	System Configuration(3)				Sample Port A(4)			
						NW	NE	SW	SE	TLV Reading (ppm)(5)	% Carbon Dioxide(6)	TVH (ppm)(7)	Methane (ppm)(8)
06/24/88	1306	110	—	—	—	-	-	O	O	>10,000	—	600	110,000
06/24/88	1408	110	—	—	—	-	-	O	O	>10,000	—	520	110,000
06/28/88	1334	115	—	—	—	O	O	O	O	>10,000	—	6,500	75,000
06/28/88	1412	105	—	—	—	-	-	-	O	>10,000	—	1,400	110,000
06/28/88	1415	105	—	—	—	-	-	-	O	>10,000	—	1,800	95,000
06/28/88	1421	115	—	—	—	-	O	-	-	615	—	7,800	58,000
06/28/88	1429	110	—	—	—	O	-	-	-	700	—	5,400	43,000
06/28/88	1435	110	—	—	—	-	-	O	-	>10,000	—	450	17,000
06/28/88	1440	115	—	—	3.5	O	O	O	O	>10,000	—	—	—
06/29/88	1512	118	—	8.6	—	O	O	O	O	>10,000	—	760	8,600
06/29/88	1554	115	—	>10.0	—	-	-	O	O	>10,000	—	8,800	46,000
06/30/88	1535	115	—	—	—	-	-	O	O	—	—	15,000	63,000
07/01/88	1358	110	—	—	—	-	-	O	O	—	—	8,000	38,000
07/01/88	1418	110	—	—	—	-	O	-	O	—	—	410	4,900
07/05/88	1325	115	—	—	—	-	O	-	O	—	—	2,000	22,000
07/05/88	1330	—	—	—	—	O	O	O	O	—	—	—	—
07/06/88	0955	110	—	7.0	—	O	O	O	O	—	—	1,600	10,000
07/06/88	1010	105	—	16.0	—	-	-	-	O	—	—	5,900	55,000
07/06/88	1025	110	—	10.0	—	-	O	-	-	—	—	820	11,000
07/06/88	1100	110	—	11.0	—	O	-	-	-	—	—	1,200	5,900
07/06/88	1130	110	—	15.5	—	-	-	O	-	—	—	5,200	31,000
07/06/88	1130	110	—	15.5	—	-	-	O	O	—	—	—	—
07/08/88	1020	110	—	11.0	—	-	-	O	O	>10,000	—	1,700	16,000
07/08/88	1040	105	—	16.8	3.3	-	-	-	O	>10,000	—	2,200	25,000
07/12/88	0920	105	—	16.0	—	-	-	-	O	4,700	—	990	4,800
07/12/88	0940	115	—	7.5	3.3	O	O	O	O	2,000	—	490	930
07/15/88	1505	115	—	7.0	—	O	O	O	O	4,100	—	1,100	3,700
07/15/88	1525	112	—	10.5	2.9	-	-	O	O	>10,000	—	560	1,400
07/20/88	1550	110	—	10.5	3.0	-	-	O	O	4,700	—	9,000	1,500

Notes:
(1) Vacuum expressed as inches of water column
(2) Supplementary fuel consumption (cubic feet per minute)
(3) "-" = "Closed" and "O" = "Open"
(4) Sample Port A located on line between blower and burner units
(5) Measurement made with Bacharach TLV Sniffer calibrated to hexane
(6) Carbon dioxide measured using a Bacharach fyrite gas analyzer.
(7) Total Volatile Hydrocarbon analysis by GC/FID, expressed as ppm (vol/vol)
(8) Methane analysis by GC/FID, expressed as ppm (vol/vol)
"—" signifies "no reading taken"; ">" signifies "greater than"; "<" signifies "less than"

TABLE A-4 (Page 2 of 3)

Date	Time	Flow Rate (CFM)	Vapor Temperature (degrees F)	Vacuum (Inches)(1)	Fuel Use (CFM)(2)	System Configuration(3)				Sample Port A(4)			
						NW	NE	SW	SE	TLV Reading (ppm)(5)	% Carbon Dioxide(6)	TVH (ppm)(7)	Methane (ppm)(8)
07/27/88	0755	112	81	10.5	2.9	–	–	O	O	3,900	—	6,600	650
07/27/88	0810	115	—	7.5	2.9	O	O	O	O	1,100	—	5,200	250
08/02/88	0700	115	75	7.0	3.0	O	O	O	O	2,600	0.5	—	—
08/03/88	0910	115	78	7.2	3.0	O	O	O	O	2,400	1.0	1,500	1,200
08/03/88	1100	112	81	9.7	3.0	–	–	O	O	—	—	5,100	2,000
08/09/88	0710	110	76	10.5	1.5	–	–	O	O	2,700	1.5	2,800	4,600
08/09/88	0820	115	77	8.5	1.5	O	O	O	O	2,300	2.5	2,500	2,800
08/16/88	0713	115	74	8.5	1.5	O	O	O	O	3,200	1.0	450	1,000
08/16/88	1015	108	73	13.0	3.0	–	–	O	O	4,600	1.5	3,800	1,200
08/30/88	0735	110	74	11.0	3.25	–	–	O	O	2,500	1.0	870	460
08/30/88	0830	112	74	8.0	2.75	O	O	O	O	2,200	3.5	690	860
09/21/88	0820	85	72	5.0	5.3	O	O	O	O	2,200	—	210	250
09/23/88	1120	82	72	14.0	6.0	–	O	–	O	2,800	1.5	950	2,800
10/11/88	0713	40	84	13.0	6.0	–	O	–	O	2,000	0.5	4,400	6,100
10/11/88	0818	25	90	17.0	6.0	–	–	–	O	7,200	2.5	1,500	480
10/25/88	0815	105	59	—	6.5	–	–	–	O	2,000	0.5	1,400	730
10/25/88	0835	105	60	—	6.5	–	O	–	O	2,500	6.5	2,500	3,400
11/08/88	0710	110	62	—	7.0	–	O	–	O	2,000	1.0	2,100	320
11/08/88	0915	80	58	—	7.0	–	–	–	O	2,700	1.0	2,900	2,600
12/06/88	0715	100	<50	—	5.0	–	–	–	O	1,200	—	940	500
12/06/88	0920	100	<50	—	5.0	O	O	–	–	1,200	2.0	270	560
02/21/89	0700	110	<65	>30.0	2.5	O	O	O	O	3,100	0.5	340	3,000
03/16/89	0714	110	<50	>30.0	0.7	O	O	O	O	—	0.0	610	370
03/16/89	0920	105	<50	>30.0	0.7	–	–	O	O	—	0.0	1,000	1,400

Notes:

(1) Vacuum expressed as inches of water column

(2) Supplementary fuel consumption (cubic feet per minute)

(3) "–" = "Closed" and "O" = "Open"

(4) Sample Port A located on line between blower and burner units

(5) Measurement made with Bacharach TLV Sniffer calibrated to hexane

(6) Carbon dioxide measured using a Bacharach fyrite gas analyzer.

(7) Total Volatile Hydrocarbon analysis by GC/FID, expressed as ppm (vol/vol)

(8) Methane analysis by GC/FID, expressed as ppm (vol/vol)

"—" signifies "no reading taken"; ">" signifies "greater than"; "<" signifies "less than".

TABLE A-4 (Page 3 of 3)

Date	Time	Flow Rate (CFM)	Vapor Temperature (degrees F)	Vacuum (Inches)(1)	Fuel Use (CFM)(2)	System Configuration(3)				Sample Port A(4)			
						NW	NE	SW	SE	TLV Reading (ppm)(5)	% Carbon Dioxide(6)	TVH (ppm)(7)	Methane (ppm)(8)
04/14/89	0730	107	58	15.0	6.5	–	–	O	O	1,000	—	1,500	240
04/14/89	0748	110	58	5.0	6.5	O	O	O	O	500	—	3,300	220
05/11/89	0657	110	60	5.0	6.5	O	O	O	O	500	0.0	770	520
05/11/89	0808	105	60	16.0	6.5	–	–	O	O	920	0.0	510	180
06/16/89	0740	105	66	15.0	6.0	–	–	O	O	720	0.0	380	220
06/16/89	0817	110	66	5.0	6.0	O	O	O	O	500	2.5	140	170
07/06/89	0710	108	68	6.5	7.0	O	O	O	O	—	—	260	63
07/06/89	0735	110	68	6.5	7.0	–	O	–	–	570	—	190	150
07/18/89	0840	102	70	7.0	7.0	–	O	–	O	2,700	7.0	500	4,000
08/21/89	0935	110	70	8.0	7.0	–	O	–	O	540	1.5	—	—
08/21/89	1000	110	72	5.0	7.0	O	O	O	O	500	1.5	260	240
09/21/89	0755	110	68	5.0	7.0	O	O	O	O	500	1.0	370	<10
09/21/89	0845	102	68	>30.0	7.0	–	–	–	O	2,600	3.0	810	<10
10/27/89	0715	100	55	>30.0	7.0	–	–	–	O	420	0.5	3,600	210
10/27/89	0747	110	55	8.0	7.0	–	O	–	O	680	4.0	620	870
11/27/89	0815	110	52	0.5	7.0	–	O	–	O	620	0.0	—	—
12/06/89	0840	110	52	0.0	7.0	–	O	–	O	400	0.0	560	240
12/06/89	0900	100	52	0.0	7.0	–	–	–	O	1,000	0.0	690	740
12/29/89	0700	100	<50	>30.0	7.0	–	–	–	O	260	0.0	140	76
12/29/89	0800	110	<50	8.0	7.0	–	O	–	O	480	3.5	35	380
02/01/90	0730	110	<50	>30.0	7.0	–	–	–	O	480	—	16	<10
02/02/90	0800	Blower/Burner shutdown											
05/11/90	1100	Blower/Burner restarted											
05/11/90	1715	110	62	>30	7.0	–	–	O	O	8,800	2.0	—	—
05/14/90	1400	110	61	>30	7.0	–	–	O	O	1,600	1.0	—	—
06/15/90	0700	113	62	22	7.0	–	–	O	O	180	—	150	100
06/15/90	0800	113	62	20	7.0	–	O	–	O	150	—	90	100
07/24/90	0755	90	72	—	6.9	–	O	–	O	20	0.0	—	—
07/24/90	0810	85	—	—	6.9	O	O	O	O	20	0.0	—	—

Notes:

(1) Vacuum expressed as inches of water column

(2) Supplementary fuel consumption (cubic feet per minute)

(3) "–" = "Closed" and "O" = "Open"

(4) Sample Port A located on line between blower and burner units

(5) Measurement made with Bacharach TLV Sniffer calibrated to hexane

(6) Carbon dioxide measured using a Bacharach fyrite gas analyzer.

(7) Total Volatile Hydrocarbon analysis by GC/FID, expressed as ppm (vol/vol)

(8) Methane analysis by GC/FID, expressed as ppm (vol/vol)

"—" signifies "no reading taken"; ">" signifies "greater than"; "<" signifies "less than".

TABLE A-5 (Page 1 of 3)
GROUND VACUUM MONITORING DATA

Well	Date											
	06/29/88	06/30/88	07/01/88	07/08/88	07/11/88	07/14/88	07/18/88	07/25/88	08/02/88	08/09/88	08/16/88	08/30/88
MW-1	0.010	0.005	0.010	0.010	0.000	0.030	0.000	0.000	0.045	---	0.125	---
MW-2	0.065	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.050	0.000	0.190	0.000
MW-3	0.055	0.015	0.000	0.000	0.000	---	---	0.000	0.040	0.000	0.105	0.000
MW-11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MW-13	0.020	0.050	0.065	0.010	0.005	0.005	0.000	0.020	0.000	0.005	0.035	0.020
MW-14	0.015	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MW-15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MW-16	0.025	0.000	0.025	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.005
MW-17	0.075	0.250	0.050	0.050	0.025	0.010	0.025	0.060	0.000	0.010	0.055	0.100
MW-18	0.190	1.300	1.000	0.540	0.460	0.120	0.380	0.480	0.090	0.500	0.215	0.560
MW-19	0.200	0.880	1.000	0.740	0.720	0.130	0.800	0.370	0.050	0.200	0.130	0.430
MW-24	0.015	0.250	0.260	0.120	0.070	0.015	0.080	0.120	0.000	0.010	0.035	0.100
MW-25	0.050	0.045	0.120	0.025	0.000	0.000	0.075	0.000	0.000	0.000	0.000	0.000
MW-27	0.010	0.000	0.005	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.015	0.000
MW-29	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MW-30	0.000	0.000	0.000	0.000	0.000	---	0.000	0.000	0.000	0.000	0.000	0.000
RW-4A	---	8.800	9.400	7.400	>10.000	1.400	6.600	5.600	0.800	5.200	0.760	4.800
RW-5A	---	9.200	10.000	8.400	0.230	1.200	8.200	7.400	---	7.000	2.000	6.600
RW-7	---	0.030	0.010	0.005	0.000	0.029	0.000	0.000	0.250	0.010	0.590	0.010
RW-8	---	0.000	0.010	0.000	0.000	0.027	0.000	0.000	0.270	0.010	0.590	0.005
RW-9	---	0.025	0.010	0.000	0.000	0.027	0.000	0.000	0.300	0.010	0.590	0.000
RW-10	---	0.000	0.005	0.000	0.000	0.300	0.000	0.000	0.240	0.010	0.560	0.000
RW-26	---	0.000	0.000	0.002	0.000	0.270	0.000	0.000	0.240	0.015	0.500	0.010
RW-28	---	0.035	0.050	0.020	0.035	NV	0.010	0.020	0.000	0.015	0.000	0.010

Vapor Collection System Operational Status

Northwest	O	-	-	-	-	O	-	-	O	-	O	-
Northeast	O	-	-	-	-	O	-	-	O	-	O	-
Southwest	O	O	O	O	-	O	O	O	O	O	O	O
Southeast	O	O	O	O	O	O	O	O	O	O	O	O

Notes:

Measurements were made using magnahelic gauges with a resolution of 0.005 inches water column.

">" signifies "greater than".

"---" signifies "no reading taken".

"NV" signifies that a measurement was taken but the value was not valid.

Vapor collection system operational status shows the configuration of vapor withdrawal at the time the vacuum readings were taken.

"O" signifies "Open" and "-" signifies "Closed".

TABLE A-5 (Page 2 of 3)

Well	Date										
	10/11/88	10/25/88	11/08/88	12/06/88	02/21/89	03/16/89	04/14/89	05/11/89	06/16/89	08/21/89	09/21/89
MW-1	0.020	0.000	0.000	0.000	0.025	0.050	0.000	0.040	---	---	0.020
MW-2	0.030	0.000	0.140	---	0.150	0.000	0.000	0.075	---	---	---
MW-3	0.030	0.000	0.075	0.000	0.000	0.110	0.000	0.075	0.000	0.085	0.030
MW-11	0.000	0.000	0.000	0.000	0.000	0.050	0.000	0.000	0.000	0.000	0.000
MW-13	0.000	0.000	0.025	0.000	0.010	0.035	0.020	0.01	0.000	0.000	0.000
MW-14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	---	0.000	0.000	0.000
MW-15	0.000	0.000	0.000	0.000	0.000	0.020	0.000	0.01	0.000	0.010	0.000
MW-16	0.000	0.000	0.000	0.000	0.050	0.020	0.020	0.000	0.000	0.005	0.000
MW-17	0.015	0.000	0.055	0.000	0.050	0.050	0.000	0.150	0.000	0.000	0.010
MW-18	0.020	0.080	0.065	0.220	0.135	0.260	0.440	0.150	0.450	0.035	0.035
MW-19	0.045	0.000	0.220	1.200	0.160	0.170	0.470	0.085	0.300	0.045	0.060
MW-24	0.000	0.015	0.000	0.000	0.050	0.050	0.000	0.040	0.020	0.005	0.000
MW-25	0.000	0.000	0.000	0.000	0.020	0.050	0.000	0.010	0.000	0.000	0.000
MW-27	0.010	0.000	0.035	0.000	0.150	0.025	0.000	0.010	0.000	0.010	0.010
MW-29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MW-30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	---	0.000
RW-4A	0.620	4.000	2.400	>10.000	2.000	1.100	6.600	0.800	6.000	2.200	1.000
RW-5A	0.010	0.025	0.120	0.000	1.000	1.200	8.200	1.500	9.000	---	0.940
RW-7	0.140	0.000	0.720	0.015	--	--	0.010	0.700	0.010	0.540	0.510
RW-8	0.160	0.000	0.710	0.020	0.510	0.720	0.010	0.480	0.000	---	0.054
RW-9	0.190	0.000	0.780	0.015	0.550	0.760	0.015	0.460	0.000	0.620	0.540
RW-10	0.155	0.000	0.760	0.010	0.520	0.760	0.015	0.470	0.000	0.580	0.520
RW-26	0.130	0.000	0.700	0.000	0.500	0.720	0.020	0.440	0.000	0.500	0.450
RW-28	0.000	0.005	0.010	0.110	0.010	0.020	0.025	0.000	0.000	0.015	0.000

Vapor Collection System Operational Status

Northwest	-	-	-	-	O	O	-	O	-	-	O
Northeast	O	-	O	-	O	O	-	O	-	O	O
Southwest	-	-	-	-	O	O	O	O	O	-	O
Southeast	O	O	O	O	O	O	O	O	O	O	O

Notes:

Measurements were made using magnahelic gauges with a resolution of 0.005 inches water column.

">" signifies "greater than"

"---" signifies "no reading taken"

"NV" signifies that a measurement was taken but the value was not valid

Vapor collection system operational status shows the configuration of vapor withdrawal at the time the vacuum readings were taken.

"O" signifies "Open" and "-" signifies "Closed"

TABLE A-5 (page 3 of 3)

Well	Date					
	10/27/89	11/27/89	12/29/89	02/01/90	06/15/90	07/24/90
MW-1	0.020	0.000	0.000	---	0.000	0.000
MW-2	0.000	0.000	---	0.000	0.000	0.040
MW-3	0.050	0.000	---	---	0.000	0.010
MW-11	0.000	0.000	0.000	0.000	0.000	0.000
MW-13	0.000	0.000	0.000	0.000	0.000	0.000
MW-14	0.000	0.000	0.000	NV	0.000	0.000
MW-15	0.000	0.000	0.000	0.330	0.000	0.000
MW-16	0.000	0.000	0.000	0.030	0.000	0.000
MW-17	0.000	0.000	0.010	0.000	0.040	0.010
MW-18	0.036	0.000	0.410	0.000	0.250	0.000
MW-19	0.620	0.000	0.770	0.000	0.170	0.000
MW-24	0.002	0.000	0.110	0.060	0.250	0.000
MW-25	0.080	0.000	0.070	0.000	0.000	0.000
MW-27	0.000	0.000	0.000	0.020	0.000	0.000
MW-29	0.000	0.000	0.000	0.000	0.000	0.000
MW-30	0.000	0.000	0.000	0.000	0.000	0.000
RW-4A	3.200	2.400	>10.000	2.400	3.000	0.000
RW-5A	0.030	0.050	0.110	0.110	4.800	0.060
RW-7	0.460	0.440	0.000	0.720	0.010	0.030
RW-8	0.500	0.480	0.010	0.860	0.010	0.030
RW-9	0.520	0.580	0.000	0.740	0.010	0.050
RW-10	0.470	0.500	0.005	0.860	0.000	0.030
RW-26	0.420	0.400	0.000	0.660	0.010	0.040
RW-28	0.000	0.000	0.070	0.000	0.025	0.000

Vapor Collection System Operational Status

Northwest	-	-	-	-	-	-
Northeast	-	O	-	-	-	O
Southwest	-	-	-	-	O	-
Southeast	O	O	O	O	O	O

Notes:

Measurements were made using magnahelic gauges with a resolution of 0.005 inches water column.

">" signifies "greater than"

"---" signifies "no reading taken"

"NV" signifies that a measurement was taken but the value was not valid.

Vapor collection system operational status shows the configuration of vapor withdrawal at the time the vacuum readings were taken.

"O" signifies "Open" and "-" signifies "Closed".

TABLE A-6 (Page 1 of 2)
VOLUME OF RECOVERED PRODUCT

Start Date	Duration (Days)	Estimated Equivalent Total Recovery		Recovery System Configuration
		Gasoline (Gallons)	Methane (cubic feet)	
06/28/88	1.1	26.92	7696.07	All Open
06/29/88	1.0	78.76	8953.75	South
06/30/88	1.0	71.39	7782.18	South
07/01/88	4.0	31.15	8631.17	East
07/05/88	0.8	9.03	1400.70	All Open
07/06/88	2.0	44.81	7576.63	South
07/08/88	4.0	38.45	8917.65	Southeast
07/12/88	3.2	17.20	1243.54	All Open
07/15/88	5.0	158.78	1159.32	South
07/20/88	6.7	336.50	1151.25	South
07/27/88	7.0	157.49	846.07	All Open
08/03/88	5.9	150.02	3111.21	South
08/09/88	7.0	68.88	2202.48	All Open
08/16/88	13.9	205.53	1813.56	South
08/30/88	12.3	37.58	1020.18	All Open
09/16/88	2.6	2.30	49.65	All Open
09/19/88	0.3	0.27	6.76	All Open
09/20/88	1.0	0.86	23.63	All Open
09/22/88	1.9	19.85	167.16	East
09/27/88	1.3	24.12	263.04	East
09/28/88	1.0	6.62	97.96	East
09/29/88	2.5	36.39	724.87	East
10/03/88	0.1	1.92	44.84	East
10/04/88	0.1	0.89	21.00	East
10/05/88	5.6	48.84	1444.62	East
10/11/88	1.0	2.46	19.98	Southeast
10/12/88	0.1	0.44	3.75	Southeast
10/12/88	4.9	15.02	146.17	Southeast
10/17/88	2.7	9.21	108.17	Southeast
10/24/88	0.8	7.24	91.95	Southeast
10/25/88	10.0	144.79	3918.82	East
11/04/88	3.7	49.76	588.47	East
11/08/88	8.9	118.32	2560.87	Southeast
11/17/88	0.1	0.39	8.22	Southeast
11/17/88	4.2	49.31	1001.95	Southeast
11/21/88	0.5	4.10	80.60	Southeast
11/22/88	3.7	35.02	663.20	Southeast
11/28/88	3.9	30.57	524.73	Southeast
12/02/88	0.2	1.01	15.96	Southeast
12/03/88	2.8	16.77	245.12	Southeast
12/06/88	2.2	4.12	236.04	North
12/08/88	1.7	3.49	226.32	North
12/10/88	0.9	1.72	118.12	North
12/11/88	1.3	3.00	214.45	North
12/12/88	0.3	0.49	36.05	North
12/13/88	0.6	1.35	99.98	North
12/13/88	0.7	1.13	84.94	North
12/14/88	0.1	0.10	7.23	North

TABLE A-6 (Page 2 of 2)

Start Date	Duration (Days)	Estimated Equivalent Total Recovery		Recovery System Configuration
		Gasoline (Gallons)	Methane (cubic feet)	
12/16/88	0.8	1.97	151.55	North
12/20/88	5.8	10.15	826.65	North
01/13/89	0.1	0.10	8.50	North
01/18/89	0.1	0.10	8.51	North
01/24/89	0.1	0.08	6.57	North
02/07/89	0.1	0.06	5.30	All Open
02/10/89	3.6	5.75	495.24	All Open
02/14/89	1.0	5.40	473.33	All Open
02/20/89	0.7	4.12	364.40	All Open
02/21/89	23.0	104.39	6,022.64	All Open
03/16/89	1.1	6.73	228.10	South
03/17/89	2.9	18.46	569.39	South
03/20/89	3.9	20.33	531.00	South
03/24/89	16.9	115.18	1,644.35	South
04/10/89	3.8	34.95	188.13	South
04/14/89	27.0	350.90	1,583.76	All Open
05/11/89	24.1	66.69	711.39	South
06/05/89	10.8	24.66	357.50	South
06/16/89	5.2	5.29	123.99	All Open
06/26/89	9.8	13.66	150.71	All Open
07/06/89	4.2	5.82	322.16	Northeast
07/18/89	20.0	43.68	7,021.90	East
08/07/89	4.0	11.76	2,120.34	East
08/14/89	3.1	7.52	1,032.63	East
08/17/89	3.9	7.52	556.63	East
08/21/89	31.0	62.21	588.34	All Open
09/21/89	36.0	464.53	549.13	Southeast
10/27/89	14.3	55.42	1,634.69	East
11/20/89	4.0	16.54	369.03	East
11/24/89	11.8	42.60	672.05	East
12/06/89	23.0	55.27	1,414.97	Southeast
12/29/89	35.2	5.72	1,058.38	East
05/11/90	5.9	218.42	4,262.15	South
05/21/90	10.0	247.50	4,574.46	South
05/31/90	1.1	16.09	157.49	South
06/01/90	6.0	84.02	1,547.83	South
06/07/90	1.1	7.81	143.36	South
06/08/90	6.7	35.55	646.83	South
06/15/90	8.2	4.36	120.39	East
06/23/90	2.0	0.78	21.37	East
06/25/90	7.8	2.93	80.86	East
07/03/90	6.0	1.26	34.58	East
07/09/90	10.2	1.18	31.86	East
07/19/90	4.7	0.15	3.97	East
07/24/90	2.1	0.22	0.00	West
07/26/90	1.0	0.05	0.00	West
07/27/90	5.2	0.24	0.00	West
08/01/90	1.1	0.01	0.00	West
Totals	557.1	4,262.46	120,766.79	

A P P E N D I X B

CHEMICAL ANALYTICAL DATA FROM VAPOR SAMPLES

FARR, FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James K. Farr, Ph.D.
Andrew John Friedman
James E. Bruya, Ph.D.

3008 B - 16th West
Seattle, WA 98119
(206) 285-8282

July 28, 1988

GeoEngineers

AUG 09 1988

Routing scp

File

Steve Perrigo, Project Manager
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Steve:

Enclosed are the results of the analyses of samples submitted on July 27, 1988 from Project 0161-13-4.

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,

James K. Farr, Ph.D.

JKF

Enclosures

Date of Report: July 28, 1988
Date Submitted: July 27, 1988
Project: 0161-13-4

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

Sample #	Methane (ppm)
880727-1	650
880727-2	250
Quality Assurance	
Method Blank	<100
880727-2 (Replicate)	220

Date of Report: July 28, 1988
Date Submitted: July 27, 1988
Project: 0161-13-4

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

Sample #	Total Volatile Hydrocarbons (ppm)
880727-1	6,600
880727-2	5,200
Quality Assurance	
Method Blank	<10
880727-2 (Replicate)	5,100

FARR, FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James K. Farr, Ph.D.
Andrew John Friedman
James E. Bruya, Ph.D.

3008 B - 16th West
Seattle, WA 98119
(206) 285-8282

August 9, 1988

Steve Perrigo, Project Coordinator
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Steve:

Enclosed are the results of the analyses of samples submitted on August 3, 1988 from Project 0161-13-4.

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,

James E. Farr, in Bob's absence

Robert J. Wallace, Chemist

RJW

Enclosures

Date of Report: August 9, 1988
Date Submitted: August 3, 1988
Project: 0161-13-4

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

Sample #	Methane (ppm)
#1 air	1,200[a]
#2 air	200,000[a]
#3 air	33
#4 air	<10
#5 air	2,000[a]

Quality Assurance

Method Blank	<10
#3 (Replicate)	29

a - Value reported exceeded the calibration range established for the sample.

Date of Report: August 9, 1988
Date Submitted: August 3, 1988
Project: 0161-13-4

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

Sample #	Total Volatile Hydrocarbons as *n*-Hexane (ppm)
#1 air	1,500[a]
#2 air	16,000[a]
#3 air	<10
#4 air	<10
#5 air	5,100[a]
Quality Assurance	
Air Blank	<10
#5 (Replicate)	3,000[a]

a - Value reported exceeded the calibration range established for the sample.

FARR, FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James K. Farr, Ph.D.
Andrew John Friedman
James E. Bruya, Ph.D.

3008 B - 16th West
Seattle, WA 98119
(206) 285-8282

August 15, 1988

GeoEngineers

AUG 18 1988

Routing SCP

File

Steve Perrigo, Project Coordinator
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Steve:

Enclosed are the results of the analyses of samples submitted on August 9, 1988 from Project 0161-13-4.

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,

Robert J Wallace

Robert J. Wallace, Chemist

RJW

Enclosures

Date of Report: August 15, 1988
Date Submitted: August 9, 1988
Project: 0161-13-4

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

Sample #	Methane (ppm)
#1 air	2,000
#2 air	2,800
Quality Assurance	
Method Blank	<10
#1 (Replicate)	2,600

Date of Report: August 15, 1988
Date Submitted: August 9, 1988
Project: 0161-13-4

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

Sample #	Total Volatile Hydrocarbons (ppm)
#1 air	2,800
#2 air	2,500
Quality Assurance	
Method Blank	<10
#1 (Replicate)	1,700

FARR, FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James K. Farr, Ph.D.
Andrew John Friedman
James E. Bruya, Ph.D.

3008 B - 16th West
Seattle, WA 98119
(206) 285-8282

August 16, 1988

GeoEngineers

Steve Perrigo, Project Coordinator
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

AUG 19 1988

Routing SCP BJP

File

Dear Steve:

Enclosed are the results of the analyses of samples submitted on August 16, 1988 from Project 0161-13-4.

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,

James K. Farr

James K. Farr, Ph.D.

JKF

Enclosures

Date of Report: August 16, 1988
Date Submitted: August 16, 1988
Project: 0161-13-4

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

Sample #	Methane (ppm)
#1 air	1,000[a]
#2 air	1,200[a]
Quality Assurance	
Method Blank	<10
#1 (Replicate)	970[a]

a - Value reported exceeded the calibration range established for the sample.

Date of Report: August 16, 1988
Date Submitted: August 16, 1988
Project: 0161-13-4

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

Sample #	Total Volatile Hydrocarbons (ppm)
#1 air	450
#2 air	3,800[a]
Quality Assurance	
Method Blank	<10
#2 (Replicate)	3,900[a]

a - Value reported exceeded the calibration range established for the sample.

FARR, FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James K. Farr, Ph.D.
Andrew John Friedman
James E. Bruya, Ph.D.

3008 B - 16th West
Seattle, WA 98119
(206) 285-8282

September 2, 1988

GeoEngineers

SEP 9 1988

Routing SCP

File

Steve Perrigo, Project Coordinator
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Steve:

Enclosed are the results of the analyses of samples submitted on August 30, 1988 from Project 0161-13-4.

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,

Robert J. Wallace

Robert J. Wallace, Chemist

RJW

Enclosures

Date of Report: September 2, 1988
Date Submitted: August 30, 1988
Project: 0161-13-4

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

Sample #	Methane (ppm)
#1 air	460
#2 air	860
Quality Assurance	
Method Blank	<10
#1 (Replicate)	460

Date of Report: September 2, 1988
Date Submitted: August 30, 1988
Project: 0161-13-4

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

Sample #	Total Volatile Hydrocarbons (ppm)
#1 air	870
#2 air	690
Quality Assurance	
Method Blank	<10
#1 (Replicate)	1,200

FARR, FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James K. Farr, Ph.D.
Andrew John Friedman
James E. Bruya, Ph.D.

3008 B - 16th West
Seattle, WA 98119
(206) 285-8282

September 26, 1988

Steve Perrigo, Project Coordinator
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Steve:

Enclosed are the results of the analysis of the sample submitted on September 21, 1988 from Project 161-13-4.

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,

James E. Bruya, Ph.D.

JEB

Enclosures

Date of Report: September 26, 1988
Date Submitted: September 21, 1988
Project: 161-13-4

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

Sample #	Methane (ppm)
880921-1 air	250
Quality Assurance	
Method Blank	<1

Date of Report: September 26, 1988
Date Submitted: September 21, 1988
Project: 161-13-4

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

Sample #	Total Volatile Hydrocarbons (ppm)
880921-1 air	210
Quality Assurance	
Method Blank	<10

FARR, FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James K. Farr, Ph.D.
Andrew John Friedman
James E. Bruya, Ph.D.

3008 B - 16th West
Seattle, WA 98119
(206) 285-8282

September 26, 1988

GeoEngineers

SEP 27 1988

Routing SCP SP

File

Steve Perrigo, Project Coordinator
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Steve:

Enclosed are the results of the analysis of the sample submitted on September 23, 1988 from Project 161-13-4.

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,

Jim Bruya

James E. Bruya, Ph.D.

JEB

Enclosures

Date of Report: September 26, 1988
Date Submitted: September 23, 1988
Project: 161-13-4

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

Sample #	Methane (ppm)
880923-1 air	2,800[a]
Quality Assurance	
Method Blank	<1
880923-1 (Duplicate)	2,500[a]

a - Value reported exceeded the calibration range established for the sample.

Date of Report: September 26, 1988
Date Submitted: September 23, 1988
Project: 161-13-4

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

Sample #	Total Volatile Hydrocarbons (ppm)
880923-1 air	950[a]
Quality Assurance	
Method Blank	<10
880923-1 (Duplicate)	920[a]

a - Value reported exceeded the calibration range established for the sample.

FARR, FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James K. Farr, Ph.D.
Andrew John Friedman
James E. Bruya, Ph.D.

3008-B 16th West
Seattle, WA 98119
(206) 285-8282

October 13, 1988

GeoEngineers

Steve Perrigo, Project Coordinator
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

OCT 19 1988

Routing SCP

File

Dear Steve:

Enclosed are the results of the analyses of samples submitted on October 11, 1988 from Project 161-13-4.

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,

Robert J Wallace

Robert J. Wallace, Chemist

RJW

Enclosures

Date of Report: October 13, 1988
Date Submitted: October 11, 1988
Project: 161-13-4

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

Sample #	Methane (ppm)
881011-1	6100
881011-2	480
Quality Assurance	
Method Blank	<10
881011-2 (Duplicate)	530

Date of Report: October 13, 1988
Date Submitted: October 11, 1988
Project: 161-13-4

RESULTS OF ANALYSES OF ENVIRONMENTAL SAMPLES FOR TOTAL VOLATILE HYDROCARBONS (as *n*-HEXANE)

Sample #	Total Volatile Hydrocarbons (ppm)
881011-1	4400
881011-2	1500
Quality Assurance	
Method Blank	<10
881011-2 (Duplicate)	1700

FARR, FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James K. Farr, Ph.D.
Andrew John Friedman
James E. Bruya, Ph.D.

3008-B 16th West
Seattle, WA 98119
(206) 285-8282

October 27, 1988

Steve Perrigo, Project Manager
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Steve:

Enclosed are the results of the analyses of samples submitted on October 25, 1988 from Project 0161-13-4.

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,

Robert J. Wallace, Chemist

RJW

Enclosures

Date of Report: October 27, 1988
Date Submitted: October 25, 1988
Project: 0161-13-4

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

Sample #	Methane (ppm)
881025-1 gas	730[a]
881025-2 gas	3,400[a]
Quality Assurance	
Method Blank	<10
881025-2 (Replicate)	3,500[a]

[a] - Value reported exceeded the calibration range established for the sample.

Date of Report: October 27, 1988
Date Submitted: October 25, 1988
Project: 0161-13-4

RESULTS OF ANALYSES OF ENVIRONMENTAL SAMPLES FOR TOTAL VOLATILE HYDROCARBONS

Sample #	TVH (ppm)
881025-1	1,400[a]
881025-2	2,500[a]
Quality Assurance	
Method Blank	<10
881025-2 (Replicate)	2,500[a]

[a] - - Value reported exceeded the calibration range established for the sample.

FARR, FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James K. Farr, Ph.D.
Andrew John Friedman
James E. Bruya, Ph.D.

3008 B - 16th West
Seattle, WA 98119
(206) 285-8282

November 15, 1988

GeoEngineers

NOV 17 1988

Routing

File

Steve Perrigo, Project Coordinator
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Steve:

Enclosed are the results of the analyses of samples submitted on November 8, 1988 from Project 0161-13-4.

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,

Robert J. Wallace

Robert J. Wallace, Chemist

RJW

Enclosures

Date of Report: November 15, 1988
Date Submitted: November 8, 1988
Project: 0161-13-4

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

Sample #	Methane (ppm)
881108-1 gas	320
881108-2 gas	2,600
Quality Assurance	
Method Blank	<10
881108-1 (Replicate)	440

Date of Report: November 15, 1988
Date Submitted: November 8, 1988
Project: 0161-13-4

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

Sample #	(ppm)
881108-1 gas	2,100
881108-2 gas	2,900

Quality Assurance

Method Blank	<10
881108-1 (Replicate)	2,100

FARR, FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James K. Farr, Ph.D.
Andrew John Friedman
James E. Bruya, Ph.D.

3008-B 16th West
Seattle, WA 98119
(206) 285-8282

December 12, 1988

GeoEngineers

Steve Perrigo, Project Coordinator
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

DEC 14 1988

Routing SCP SSR

File

Dear Steve:

Enclosed are the results of the analyses of the air samples submitted on December 6, 1988 from Project 0161-13-4.

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,

Robert J Wallace

Robert J. Wallace, Chemist

RJW

Enclosures

Date of Report: December 12, 1988
Date Submitted: December 6, 1988
Project: 0161-13-4

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
881206-1	air	100	1,000
881206-2	air	20	500
881206-3	air	20	560
Quality Assurance			
Method Blank			<10
881206-3 (Replicate)			460

Date of Report: December 12, 1988
Date Submitted: December 6, 1988
Project: 0161-13-4

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

Sample #	Matrix	Dilution Factor	TVH (ppm)
881206-1	air	1	1,200
881206-2	air	1	940
881206-3	air	1	270
Quality Assurance			
Method Blank			<10
881206-3 (Replicate)			310

February 22, 1989

Steve Perrigo, Project Coordinator
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

GeoEngineers
FEB 27 1989
Routing SCP gf KSK
File

Dear Steve:

Enclosed are the results of the analyses of the air sample submitted on February 21, 1989 from Project 0161-13-4.

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,

Robert J Wallace

Robert J. Wallace, Chemist

RJW

Enclosures

Date of Report: February 22, 1989
Date Submitted: February 21, 1989
Project: 0161-13-4

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
890222-1	air	500	3,000

Quality Assurance

Method Blank	<10
890222-1 (Replicate)	3,600

Date of Report: February 22, 1989
Date Submitted: February 21, 1989
Project: 0161-13-4

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

Sample #	Matrix	Dilution Factor	TVH (ppm)
890222-1	air	1	840

Quality Assurance

Method Blank	<1
890222-1 (Replicate)	1,200

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Andrew John Friedman
James E. Bruya, Ph.D.
(206) 285-8282

3008-B 16th Avenue West
Seattle, WA 98119
FAX: (206) 283-5044

March 17, 1989

GeoEngineers

MAR 21 1989

Routing SCP

File

Steve Perrigo, Project Leader
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Mr. Perrigo:

Enclosed are the results of the analyses of samples submitted on March 16, 1989 from Project 161-13-4.

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,

Thomas M. Stapp, Chemist

BAO

Enclosures

Date of Report: March 17, 1989
Date Submitted: March 16, 1989
Project: 161-13-4

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
890316-1	Gas	20	370
890316-2	Gas	20	1400
Quality Assurance			
Method Blank		1	<10
890316-2(Replicate)		20	1300
890316-1(Duplicate)		20	440

Date of Report: March 17, 1989
Date Submitted: March 16, 1989
Project: 161-13-4

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

Sample #	Matrix	Dilution Factor	TVH (ppm)
890316-1	Gas	1	610
890316-2	Gas	1	1000
Quality Assurance			
Method Blank		1	<10
890316-2(Replicate)		1	1100

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Andrew John Friedman
James E. Bruya, Ph.D.
(206) 285-8282

3008-B 16th Avenue West
Seattle, WA 98119
FAX: (206) 283-5044

April 18, 1989

GeoEngineers

APR 21 1989

Routing ACP EP KSK

File 161-13-4

Steve Perrigo, Project Leader
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Steve:

Enclosed are the results of the analyses of samples submitted on April 14, 1989 from Project 161-13-4 Unocal.

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,

Thomas M. Stapp, Chemist

TMS/ddh

Enclosures

Date of Report: April 18, 1989
Date Submitted: April 14, 1989
Project: 161-13-4 Unocal

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

Sample #	Matrix	Dilution Factor	TVH (ppm)
890414-1	gas	100	1,500
890414-2	gas	100	3,300
Quality Assurance			
Method Blank		100	<1
890414-1 (Duplicate)		100	2,600

Date of Report: April 18, 1989
Date Submitted: April 14, 1989
Project: 161-13-4 Unocal

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
890414-1	gas	0	240
890414-2	gas	0	220
Quality Assurance			
Method Blank		0	<10
890414-1 (Duplicate)		0	230

GeoEngineers

MAY 16 1989

Routing SCP KPF IRSK

File

May 12, 1989

Steve Perrigo, Project Coordinator
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Steve:

Enclosed are the results of the analyses of the air samples submitted on May 11, 1989 from Project 0161-13-4.

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,

James K. Farr, Ph.D.

JKF/jkf

Enclosures

enviros

Corporation Scientists & Engineers (206) 455-2962 fax 451-8546
600 Skyline Tower 10900 NE 4th Street Bellevue, Washington 98004
Analytical Laboratory: 225 112th Avenue NE (206) 453-8174

Date of Report: May 12, 1989
Date Submitted: May 11, 1989
Project: 0161-13-4

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

Sample #	Dilution Factor	Methane (ppm)
890511-1	1	520
890511-2	1	180
Quality Assurance		
Method Blank		<10
890511-1 (Replicate)		510

enviros

Date of Report: May 12, 1989
Date Submitted: May 11, 1989
Project: 0161-13-4

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

Sample #	Dilution Factor	TVH (ppm)
890511-1	1	770
890511-2	1	510
Quality Assurance		
Method Blank		<10
890511-1 (Replicate)		730

enviros

June 16, 1989

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

Dear Kathy:

Enclosed are the results of the analyses of air samples submitted on June 16, 1989 from Project 0161-13-4.

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,

James F. Farr

James K. Farr, Ph.D.

JKF/cag

Enclosures

enviros

Corporation Scientists & Engineers (206) 455-2962 fax 451-8546
600 Skyline Tower 10900 NE 4th Street Bellevue, Washington 98004
Analytical Laboratory: 225 112th Avenue NE (206) 453-8174

Date of Report: June 16, 1989
Date Submitted: June 16, 1989
Project: 0161-13-4

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
61689-1	air	1:1	220
61689-2	air	1:1	170
Quality Assurance			
Method Blank			<10
61689-2 (Replicate)			170

enviros

Date of Report: June 16, 1989
Date Submitted: June 16, 1989
Project: 0161-13-4

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

Sample #	Matrix	Dilution Factor	TVH (ppm)
61689-1	air	1:1	380
61689-2	air	1:1	140
Quality Assurance			
Method Blank			<10
61689-2 (Replicate)			130

enviros

Enviros Corporation
600 Skyline Tower
10900 NE 4th St.
Bellevue, WA 98004
(206) 455-2962

Laboratory:
225 112th Ave NE
Bellevue, WA 98004
(206) 453-8174

Chain of Custody Record

PROJECT NAME: Unocal
PROJECT LOCATION: Westlake & Mercer
SAMPLED BY: JCK/ESA DATE: 6/16/89 SITE NUMBER: 161-13-4

Sample Number	Date/Time Sampled	Type of Samples	# of Containers	Analyses Required	Comments
6/16 89#1	6/6/89 8:00 AM	gas	1	TVH Methane	
6/16 89#2	"	gas	1	" "	

Relinquished by: (Signature) NAME: Ron Jensen FIRM: CET	Date: 6/16/89 Time: 12:53	Received by: (Signature) NAME: [illegible] FIRM: Enviros	Date: 6/16/89 Time: 12:53
Relinquished by: (Signature) NAME: FIRM:	Date: Time:	Received by: (Signature) NAME: FIRM: Enviros Corporation	Date: Time: Enviros' Client:

Additional Comments:

July 9, 1989

Steve Perrigo, Project Manager
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Steve:

Enclosed are the results of the analyses of samples submitted on July 6, 1989 from Project 0161-13-4.

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,

James K. Farr, Ph.D.

JKF

Enclosures

enviros

Date of Report: July 9, 1989
Date Submitted: July 6, 1989
Project: 0161-13-4

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
890706-1G	gas	1:1	63
890706-2G	gas	1:1	150
Quality Assurance			
Method Blank			<10
890706-1G (Replicate)			60

enviros

Date of Report: July 9, 1989
Date Submitted: July 6, 1989
Project: 0161-13-4

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

Sample #	Matrix	Dilution Factor	TVH (ppm)
890706-1G	gas	1:1	260
890706-2G	gas	1:1	190
Quality Assurance			
Method Blank			<10
890706-2G (Replicate)			210

enviros

GEOENGINEERS INC.
2405 - 140th AVE. N.E., SUITE 105
BELLEVUE, WASHINGTON 98005
206-746-5200

PROJECT LOC. Seattle
PROJECT NAME Ward
GEI FILE NO. 16-13-9

CHAIN OF CUSTODY RECORD

SAMPLED BY NLP DATE 7/6/89

SAMPLE No.	DATE SAMPLED	TIME SAMPLED	DEPTH OF SAMPLE	TYPE OF SAMPLE	FIELD FILTERED	PRESERVATIVE ADDED TO SAMPLE	ANALYSES TO BE CONDUCTED	NO. OF SAMPLE CONTAINERS	COMMENTS
983 890706-16	7/6/89	0715	—	Gas	—	—	TVH, CH4	1	
984 890706-17	7/6/89	0730	—	Gas	—	—	TVH, CH4	1	

RELINQUISHED BY (SIGNATURE) NAME / FIRM	DATE	TIME	RECEIVED BY (SIGNATURE) NAME / FIRM	DATE	TIME
Thomas Dorn / GeoEngineers			Bob Olszewski / Enviros	7-6-89	9:00am
RELINQUISHED BY (SIGNATURE) NAME / FIRM	DATE	TIME	RECEIVED BY (SIGNATURE) NAME / FIRM	DATE	TIME

ADDITIONAL COMMENTS:

Report to Steve Perrigo

GeoEngineers

JUL 14 1989

Routing DCP SEP KSK

File 0161-13-4

July 13, 1989

Steve Perrigo, Project Coordinator
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Steve:

Enclosed are the results of the analyses of air samples submitted on July 11, 1989 from Project 0161-13-4.

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,

Robert J. Wallace

Robert J. Wallace
Senior Environmental Chemist.

RJW

Enclosures

enviros

Corporation Scientists & Engineers (206) 455-2962 fax 451-8546
600 Skyline Tower 10900 NE 4th Street Bellevue, Washington 98004
Analytical Laboratory: 225 112th Avenue NE (206) 453-8174

Date of Report: July 13, 1989
Date Submitted: July 11, 1989
Project: 0161-13-4

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
890711-1	air	1	9,100
890711-2	air	100	26,000

Quality Assurance

Method Blank	<10
890711-2 (Replicate)	26,000

enviros

Date of Report: July 13, 1989
Date Submitted: July 11, 1989
Project: 0161-13-4

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

Sample #	Matrix	Dilution Factor	TVH (ppm)
890711-1	air	1	980
890711-2	air	100	14,000
Quality Assurance			
Method Blank			<10
890711-2 (Replicate)			9,700

enviros

GEOENGINEERS INC.
2405 - 140th AVE. N.E., SUITE 105
BELLEVUE, WASHINGTON 98005
206-746-5200

PROJECT LOC. Seattle
PROJECT NAME Unocal
GEI FILE NO. 161-13-9

CHAIN OF CUSTODY RECORD

SAMPLED BY NLP DATE 7/11/89

	SAMPLE No.	DATE SAMPLED	TIME SAMPLED	DEPTH OF SAMPLE	TYPE OF SAMPLE	FIELD FILTERED	PRESERVATIVE ADDED TO SAMPLE	ANALYSES TO BE CONDUCTED	NO. OF SAMPLE CONTAINERS	COMMENTS
533	890711-1	7/11/89	1515	—	Gas	—	—	TVH, CH_4	1	
534	890711-2	"	1520	—	"	—	—	TVH CH_4	1	

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME
NAME [signature] FIRM GeoEngineers	7/11/89	4:00 PM	NAME [signature] FIRM Enviros	7-11-89	4:06 pm
RELINQUISHED BY (SIGNATURE) NAME FIRM	DATE	TIME	RECEIVED BY (SIGNATURE) NAME FIRM	DATE	TIME

ADDITIONAL COMMENTS:

Report to Steve Perrigo

B - 57

GeoEngineers

AUG - 4 1989

Routing SCP SSP ICSK

File 0161-13-4

July 27, 1989

Mr. Steve Perrigo, Project Manager
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Steve:

Enclosed are the results of the analyses of samples submitted on July 18, 1989 from Project 0161-13-4.

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,

Bob Olsiewski

Bob Olsiewski, Environmental Chemist

Enclosures

enviros

Corporation Scientists & Engineers (206) 455-2962 fax 451-8546
600 Skyline Tower 10900 NE 4th Street Bellevue, Washington 98004
Analytical Laboratory: 225 112th Avenue NE (206) 453-8174

Date of Report: July 27, 1989
Date Submitted: July 18, 1989
Project: 0161-13-4

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
890718-1	Air	400	80,000
890718-2	Air	20	12,000
890718-3	Air	4	4,000
Quality Assurance			
Method Blank		1	<10
890718-1 (Duplicate)		400	79,000

enviros

Date of Report: July 27, 1989
Date Submitted: July 18, 1989
Project: 0161-13-4

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

Sample #	Dilution Factor	TVH (ppm)
890718-1	40	570
890718-2	40	1800
890718-3	40	500
Quality Assurance		
Method Blank	1	<10
890718-1 (Duplicate)	40	430

enviros

August 22, 1989

Cheryl Haines, Project Coordinator
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Cheryl:

Enclosed are the results of the analyses of the sample submitted on August 21, 1989 from Project 0161-13-4.

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,

Bob Olsiewski

Bob A. Olsiewski
Environmental Chemist

Enclosures

enviros

Corporation Scientists & Engineers (206) 455-2962 fax 451-8546
600 Skyline Tower 10900 NE 4th Street Bellevue, Washington 98004
Analytical Laboratory: 225 112th Avenue NE (206) 453-8174

Date of Report: August 22, 1989
Date Submitted: August 21, 1989
Project: 0161-13-4

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
2	Air	1	240
Quality Assurance			
Method Blank			<10
(Replicate) 2	Air	1	290

enviros

Date of Report: August 22, 1989
Date Submitted: August 21, 1989
Project: 0161-13-4

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

Sample #	Matrix	Dilution Factor	TVH (ppm)
2	Air	1	260
Quality Assurance			
Method Blank			<10
(Replicate) 2	Air	1	290

enviros

GEOENGINEERS INC.
2405 - 140th AVE. N.E., SUITE 105
BELLEVUE, WASHINGTON 98005
206-746-5200

PROJECT LOC. Seattle
PROJECT NAME Unocal
GEI FILE NO. 0161-13-4

CHAIN OF CUSTODY RECORD

SAMPLED BY Cheryl Hanna DATE 8/21/89

SAMPLE No.	DATE SAMPLED	TIME SAMPLED	DEPTH OF SAMPLE	TYPE OF SAMPLE	FIELD FILTERED	PRESERVATIVE ADDED TO SAMPLE	ANALYSES TO BE CONDUCTED	NO. OF SAMPLE CONTAINERS	COMMENTS
1	8/21/89			GAS	No	No	*Total Volatile Hydr. methane	1	
2	8/21/89			gas	NO	NO	*Total Volatile Hydr/methane	1	

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME
NAME [illegible] FIRM GeoEngineers	8/21/89	1030	NAME FIRM ENVIROS	8/21/89	10:30
RELINQUISHED BY (SIGNATURE) NAME FIRM	DATE	TIME	RECEIVED BY (SIGNATURE) NAME FIRM	DATE	TIME

ADDITIONAL COMMENTS:

* Total Volatile Hydrocarbons, methane analysis

Ea 1756

B - 64

GEI

October 24, 1989

Kathy Killman, Project Coordinator
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 September 21, 1989 from Project 0161-13-4.

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,

James K. Farr, Ph.D.

JKF

Enclosures

enviros

Corporation Scientists & Engineers (206) 455-2962 fax 451-8546
600 Skyline Tower 10900 NE 4th Street Bellevue, Washington 98004
Analytical Laboratory: 225 112th Avenue NE (206) 453-8174

Date of Report: October 24, 1989
Date Submitted: September 21, 1989
Project: 0161-13-4

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

Sample #	Matrix	Dilution Factor	TVH (ppm)	CH4 (ppm)
890921-1	Air	1	370	<10
890921-2	Air	1	810	<10
Quality Assurance				
Method Blank		1	<10	----
890921-2 (Replicate)	Air	1	1100a	----
890921-1 (Duplicate)	Air	1	440	----
Cont. Calib. @ 10 ppm		1	19	----

a - Value reported exceeded the calibration range established for the sample.

enviros

GEOENGINEER INC.
2405 - 140th AVE. N.E., SUITE 105
BELLEVUE, WASHINGTON 98005
206-746-5200

CHAIN OF CUSTODY RECORD

PROJECT LOC. Seattle
PROJECT NAME Unocal
GEI FILE NO. 161-13-4

SAMPLED BY NLP DATE 9/21/89

SAMPLE No.	DATE SAMPLED	TIME SAMPLED	DEPTH OF SAMPLE	TYPE OF SAMPLE	FIELD FILTERED	PRESERVATIVE ADDED TO SAMPLE	ANALYSES TO BE CONDUCTED	NO. OF SAMPLE CONTAINERS	COMMENTS
~~[illegible]~~									
890921-1	9/21/89	0755	—	Gas	—	—	TVH, CH_4	1	
890921-2	9/21/89	0845	—	Gas	—	—	TVH, CH_4	1	

RELINQUISHED BY (SIGNATURE) NAME / FIRM	DATE	TIME	RECEIVED BY (SIGNATURE) NAME / FIRM	DATE	TIME
[illegible] GeoEngineers	9/21/89	0915	Bob Olsewski Enviros	9-21-89	9:19am
RELINQUISHED BY (SIGNATURE) NAME / FIRM	DATE	TIME	RECEIVED BY (SIGNATURE) NAME / FIRM	DATE	TIME

ADDITIONAL COMMENTS:

Report to Kathy Killman

November 2, 1989

Kathy Kilman
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 October 27, 1989 from Project 161-13-04.

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,

James K. Farr, Ph.D.

JKF

Enclosures

enviros

Corporation Scientists & Engineers (206) 455-2962 fax 451-8546
600 Skyline Tower 10900 NE 4th Street Bellevue, Washington 98004
Analytical Laboratory: 225 112th Avenue NE (206) 453-8174

Date of Report: November 2, 1989
Date Submitted: October 27, 1989
Project: 161-13-04

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

Sample #	Matrix	Dilution Factor	TVH (ppm)
891027-1	Gas	1	3,600a
891027-2	Gas	1	620
891027-3	Gas	1	47,000a
891027-4	Gas	1	380
891027-5	Gas	1	8,300a
Quality Assurance			
Method Blank		1	<1

a - Value reported exceeded the calibration range established for the sample.

enviros

Date of Report: November 2, 1989
Date Submitted: October 27, 1989
Project: 161-13-04

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
891027-1	Gas	1	210
891027-2	Gas	1	870
891027-3	Gas	1	110,000a
891027-4	Gas	1	50
891027-5	Gas	1	92,000a
Quality Assurance			
Method Blank		1	<10

a - Value reported exceeded the calibration range established for the sample.

enviros

GEOENGINEERS INC.
2405 - 140th AVE. N.E., SUITE 105
BELLEVUE, WASHINGTON 98005
206-746-5200

PROJECT LOC. Seattle

PROJECT NAME _____

GEI FILE NO. 161-13-4

CHAIN OF CUSTODY RECORD

SAMPLED BY Norm P. DATE 10/27/89

SAMPLE No.	DATE SAMPLED	TIME SAMPLED	DEPTH OF SAMPLE	TYPE OF SAMPLE	FIELD FILTERED	PRESERVATIVE ADDED TO SAMPLE	ANALYSES TO BE CONDUCTED	NO. OF SAMPLE CONTAINERS	COMMENTS
891027-1	10/27/89		—	Geo	—	—	TVH, Oil	1	Lab Sample # 3274
891027-2	↓		↓	↓	↓	↓	↓	1	3275
891027-3								1	3276
891027-4								1	3277
891027-5	↓		↓	↓	↓	↓	↓	1	3278

RELINQUISHED BY (SIGNATURE) NAME / FIRM	DATE	TIME	RECEIVED BY (SIGNATURE) NAME / FIRM	DATE	TIME
[illegible] GEI	10/27/89	915			
RELINQUISHED BY (SIGNATURE) NAME / FIRM	DATE	TIME	RECEIVED BY (SIGNATURE) NAME / FIRM	DATE	TIME
			[illegible] Jan Jones	10/27/89	915

ADDITIONAL COMMENTS:

Report to Kathy Kilmer

December 18, 1989

Kathy Killman, Project Coordinator
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 December 6, 1989 from Project 0161-13-4 Unocal.

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,

Robert J Wallace

Robert J. Wallace
Senior Environmental Chemist.

RJW

Enclosures

enviros

Corporation Scientists & Engineers (206) 455-2962 fax 451-8546
600 Skyline Tower 10900 NE 4th Street Bellevue, Washington 98004
Analytical Laboratory: 225 112th Avenue NE (206) 453-8174

Date of Report: December 18, 1989
Date Submitted: December 6, 1989
Project: 0161-13-4 Unocal

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

Sample #	Matrix	Dilution Factor	TVH (ppm)
891206-1	Air	1	560
891206-2	Air	1	690
Quality Assurance			
Method Blank		1	<10
891206-2 (Replicate)		1	570

enviros

Date of Report: December 18, 1989
Date Submitted: December 6, 1989
Project: 0161-13-4 Unocal

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
891206-1	Air	1	240
891206-2	Air	1	740
Quality Assurance			
Method Blank		1	<10
891206-2 (Replicate)		1	815

enviros

January 16, 1990

Norman Puri, Project Coordinator
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Norman:

Enclosed are the results of the analyses of samples submitted on December 29, 1989 from Project 161-13-B04 Unocal.

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,

Bob Olsiewski

Bob A. Olsiewski
Environmental Chemist
RAO

Enclosures

enviros

Corporation Scientists & Engineers (206) 455-2962 fax 451-8546
600 Skyline Tower 10900 NE 4th Street Bellevue, Washington 98004
Analytical Laboratory: 225 112th Avenue NE (206) 453-8174

Date of Report: January 16, 1990
Date Submitted: December 29, 1989
Project: 161-13-B04 Unocal

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

Sample #	Matrix	Dilution Factor	TVH (ppm)
891229-1	Air	1	140
891229-2	Air	1	35
Quality Assurance			
Method Blank		1	<10
891229-2 (Replicate)	Air	1	46

enviros

Date of Report: January 16, 1990
Date Submitted: December 29, 1989
Project: 161-13-B04 Unocal

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
891229-1	Air	1	76
891229-2	Air	1	380
Quality Assurance			
Method Blank		1	<10
891229-2 (Replicate)	Air	1	380

enviros

GeoEngineers

FEB 14 1990

Routing NP USK

File

February 9, 1990

Norm Puri, Project Coordinator
GeoEngineers, Inc.
2405-140th Avenue N.E., Suite 105
Bellevue, WA 98005

Dear Norm:

Enclosed are the results of the analyses of samples submitted on ~~January~~ February 1, 1990 from Project 161-13-B04 Unocal.

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,

Jon J. Bagby
Chemist

JJB

Enclosures

enviros

Corporation Scientists & Engineers (206) 455-2962 fax 451-8546
600 Skyline Tower 10900 NE 4th Street Bellevue, Washington 98004
Analytical Laboratory: 225 112th Avenue NE (206) 453-8174

Date of Report: February 9, 1990
Date Submitted: January 1, 1990
Project: 161-13-B04 Unocal

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
14	Air	100	110,000
17	Air	100	260,000
19	Air	100	37,000
900201-1	Air	1	<10
Quality Assurance			
Air Blank		1	<10
Cont. Calib. @ 100 ppm		1	83

enviros

Date of Report: February 9, 1990
Date Submitted: January 1, 1990
Project: 161-13-B04 Unocal

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

Sample #	Matrix	Dilution Factor	TVH (ppm)
14	Air	1	2,800
17	Air	1	2,700
19	Air	1	860
900201-1	Air	1	16
Quality Assurance			
Air Blank		1	20
17 (Replicate)	Air	5	2,200
Cont. Calib. @ 100 ppm		1	94

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enviros

GeoEngineers

MAY - 9 1990

Routing KSR

May 7, 1990

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 May 1, 1990 from Project 161-13-B04 Mercer/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
Environmental Chemist
SJL

Enclosures

Enviros Analytical Services (206) 820-7575 fax 820-6337
12277 - 134th Court NE Suite 200 Redmond, Washington 98052

Date of Report: May 7, 1990
Date Submitted: May 1, 1990
Project: 161-13-B04 Mercer/Westlake

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
MW-3	Gas	100	98,000
MW-14	Gas	100	91,000
MW-17	Gas	100	49,000
MW-29	Gas	100	32,000
RW-4A	Gas	100	11,000
Quality Assurance			
Method Blank		100	<10
MW-3 (Replicate)		100	93,000
MW-17 (Replicate)		100	46,000
RW-4A (Replicate)		100	12,000
Cont. Calib. @ 500 ppm			440

enviros

Date of Report: May 7, 1990
Date Submitted: May 1, 1990
Project: 161-13-B04 Mercer/Westlake

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

Sample #	Matrix	Dilution Factor	TVH (ppm)
MW-3	Gas	100	13,000
MW-14	Gas	1	3,400
MW-17	Gas	1	9,700
MW-29	Gas	1	1,500
RW-4A	Gas	1	260

Quality Assurance

Lab Air	<10
MW-3 (Replicate)	18,000
MW-14 (Replicate)	3,000
RW-4A (Replicate)	240
Cont. Calib. @ 1,000 ppm	1,200

enviros

GEOENGINEERS INC.
2405 - 140th AVE. N.E., SUITE 105
BELLEVUE, WASHINGTON 98005
206-746-5200

PROJECT LOC. MERCER/WES
PROJECT NAME UNOCAL STA 5
GEI FILE NO. 161-13-60

CHAIN OF CUSTODY RECORD

SAMPLED BY CRW/NLP DATE MAY 1, 1990

SAMPLE No.	DATE SAMPLED	TIME SAMPLED	DEPTH OF SAMPLE	TYPE OF SAMPLE	FIELD FILTERED	PRESERVATIVE ADDED TO SAMPLE	ANALYSES TO BE CONDUCTED	NO. OF SAMPLE CONTAINERS	COMMENTS
MW-3	5-01-90	0720	—	VAPOR	—	—	TVH/METHANE	1	
MW-14	5-01-90	0640	—	VAPOR	—	—	TVH/METHANE	1	
MW-17	5-01-90	0620	—	VAPOR	—	—	TVH/METHANE	1	
MW-29	5-01-90	0800	—	VAPOR	—	—	TVH/METHANE	1	
RW-4A	5-01-90	0810	—	VAPOR	—	—	TVH/METHANE	1	

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME
NAME Carla R Woodworth FIRM GeoEngineers	5-01-90	1021	NAME FIRM ENVIRES	5/1/90	1021
RELINQUISHED BY (SIGNATURE) NAME FIRM	DATE	TIME	RECEIVED BY (SIGNATURE) NAME FIRM	DATE	TIME

ADDITIONAL COMMENTS: PROJECT MANAGER - KATHY KILLMAN

GEI 101

GeoEngineers

enviros

JUN 2 6 1990

Routing KSIC

File

June 21, 1990

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 June 15, 1990 from Project 161-13%-B04 Westlake/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
Environmental Chemist

SJL

Enclosures

Enviros Analytical Services (206) 820-7575 fax 820-6337
12277 - 134th Court NE Redmond, Washington 98052

Date of Report: June 21, 1990
Date Submitted: June 15, 1990
Project: 161-131-B04 Westlake/Mercer

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
900615-1	Air	1	100
900615-2	Air	1	100
Quality Assurance			
Method Blank		1	<10
900615-1 (Replicate)	Air	1	110
900615-2 (Replicate)	Air	1	110

enviros

Date of Report: June 21, 1990
Date Submitted: June 15, 1990
Project: 161-131-B04 Westlake/Mercer

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

Sample #	Matrix	Dilution Factor	TVH (ppm)
900615-1	Air	1	150
900615-2	Air	1	90
Quality Assurance			
Method Blank		1	<10
900615-1 (Replicate)	Air	1	160
900615-2 (Replicate)	Air	1	81

enviros

06-020

GEOENGINEERS INC.
2405 - 140th AVE. N.E., SUITE 105
BELLEVUE, WASHINGTON 98005
206-746-5200

CHAIN OF CUSTODY RECORD

PROJECT LOC. Seattle
PROJECT NAME Westlake/Mercer
GEI FILE NO. 61/13/B04

SAMPLED BY WSL, NLP DATE 6/15/90

SAMPLE No.	DATE SAMPLED	TIME SAMPLED	DEPTH OF SAMPLE	TYPE OF SAMPLE	FIELD FILTERED	PRESERVATIVE ADDED TO SAMPLE	ANALYSES TO BE CONDUCTED	NO. OF SAMPLE CONTAINERS	COMMENTS
900615-1	6/15/90	0700	—	vapor	—	—	TVH, CH_4	1	
900615-2	6/15/90	0810	—	vapor	—	—	TVH, CH_4	1	

RELINQUISHED BY (SIGNATURE) NAME / FIRM	DATE	TIME	RECEIVED BY (SIGNATURE) NAME / FIRM	DATE	TIME
W. Stephen Lewis / GeoEngineers	6/15/90		[signature] / ENVIRES	6/15/90	
RELINQUISHED BY (SIGNATURE) NAME / FIRM	DATE	TIME	RECEIVED BY (SIGNATURE) NAME / FIRM	DATE	TIME

ADDITIONAL COMMENTS: Results to Kathy Killman

B - 88

GEI 101-92

enviros

August 3, 1990

Kathy Kilman, 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 July 24, 1990 from Project 161-13-B9/Unocal, Seattle.

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,

Robert J Wallace

Robert J. Wallace
Senior Chemist

RJW:so

Enclosures

Enviros Analytical Services (206) 820-7575 fax 820-6337
12277 - 134th Court NE Redmond, Washington 98052

Date of Report: August 3, 1990
Date Submitted: July 24, 1990
Project: 161-13-B9/Unocal, Seattle

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

Sample #	Matrix	Dilution Factor	TVH (ppm)
900729-2	Air	1	24
Quality Assurance			
Method Blank	Air	1	<10
900729-2 (Replicate)	Air	1	25

enviros

Date of Report: August 3, 1990
Date Submitted: July 24, 1990
Project: 161-13-B9/Unocal, Seattle

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

Sample #	Matrix	Dilution Factor	Methane (ppm)
900729-2	Air	1	<10
Quality Assurance			
Method Blank		1	<10
900729-2 (Replicate)	Air	1	<10

enviros

GEOENGINEERS INC.
2405 - 140th AVE. N.E., SUITE 105
BELLEVUE, WASHINGTON 98005
206-746-5200

07-061

CHAIN OF CUSTODY RECORD

PROJECT LOC. Seattle
PROJECT NAME Uneeda
GEI FILE NO. 161-13-B9

SAMPLED BY NLP DATE 7/24/90

SAMPLE No.	DATE SAMPLED	TIME SAMPLED	DEPTH OF SAMPLE	TYPE OF SAMPLE	FIELD FILTERED	PRESERVATIVE ADDED TO SAMPLE	ANALYSES TO BE CONDUCTED	NO. OF SAMPLE CONTAINERS	COMMENTS
900724-2	7/24/90	—	—	Gas	—	—	TVH, CH_4	1	

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME
NAME [redacted] FIRM GeoEngineers	7/24/90		NAME Cynthia L. Klyver FIRM Enviros	7/24/90	12:20
RELINQUISHED BY (SIGNATURE) NAME FIRM	DATE	TIME	RECEIVED BY (SIGNATURE) NAME FIRM	DATE	TIME

ADDITIONAL COMMENTS:

1

B - 92

GEI 100-94

A P P E N D I X C

OTHER CHEMICAL ANALYTICAL DATA

am test inc.
14603 N.E. 87th St. • REDMOND, WASHINGTON 98052 • 206/885-1664

NOV 1 1988

Routing BCP

ANALYSIS REPORT

CLIENT: Geoengineers, Inc.

DATE RECEIVED: 10/19/88

REPORT TO: Steve Perrigo
2405 - 140th NE, Suite 105
Bellevue, WA 98005

DATE REPORTED: 10/28/88

Laboratory Sample Number	74101	74102
Client Identification	MW 30	MW 1
Aerobic Plate Count (CFU/ml) 0 Hours, 10/19	120,000.	20,500.
Aerobic Plate Count (CFU/ml) 24 Hours, 10/20	410,000.*	310,000.*
Aerobic Plate Count (CFU/ml) 72 Hours, 10/22	860,000.*	570,000.*
Aerobic Plate Count (CFU/ml) 7 Days, 10/26	2,200,000.	540,000.

* = Estimated Count - A count obtained from a plate having less than 30 or more than 300 colonies.

REPORTED BY Florence A. Giesy
Florence A. Giesy

FG/pb

Analytical Technologies, Inc. 560 Naches Avenue, S.W., Suite 101, Renton, WA 98055, (206) 228-8335

ATI I.D. # 8903-153

April 25, 1989

GeoEngineers, Inc.
2405 140th Ave. N.E.
Suite 105
Bellevue, WA 98005

Attention : Steve Perrigo

Project Number : 161-13-4

Project Name : Unocal

On March 31, 1989 Analytical Technologies, Inc. received one water sample for analyses. The sample was analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and the quality control data are enclosed.

Mary Silva
GC Chemist

Frederick W. Grothkopp
Technical Manager

FWG/hbb

Analytical Technologies, Inc.

ATI I.D. # 8903-153

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-4
PROJECT NAME : UNOCAL

ATI #	CLIENT DESCRIPTION	MATRIX	DATE SAMPLED
8903-153-1	WASTE WATER	WATER	03/31/89

----- 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 this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

ATI I.D. # 8903-153

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-4
PROJECT NAME : UNOCAL

ANALYSIS	TECHNIQUE	REFERENCE/METHOD
PURGEABLE AROMATICS	GC/PID	EPA 602
PETROLEUM HYDROCARBONS	IR	EPA 418.1

Analytical Technologies, Inc.

ATI I.D. # 8903-153

PURGEABLE AROMATICS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-13-4	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: N/A
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 04/04/89
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 602	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
CHLOROBENZENE	<0.5
1,3-DICHLOROBENZENE	<0.5
1,2-DICHLOROBENZENE	<0.5
1,4-DICHLOROBENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
META & PARA XYLENE	<0.5
ORTHO XYLENE	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	102

ATI I.D. # 8903-153-1

PURGEABLE AROMATICS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 03/31/89
PROJECT #	: 161-13-4	DATE RECEIVED	: 03/31/89
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: N/A
CLIENT I.D.	: WASTE WATER	DATE ANALYZED	: 04/04/89
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 602	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	1.2
CHLOROBENZENE	<0.5
1,3-DICHLOROBENZENE	<0.5
1,2-DICHLOROBENZENE	<0.5
1,4-DICHLOROBENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	2.4
META & PARA XYLENE	1.7
ORTHO XYLENE	0.7

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	105

Analytical Technologies, Inc.

ATI I.D. # 8903-153

PURGEABLE AROMATICS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D.	: 8903-147-4
PROJECT #	: 161-13-4	DATE ANALYZED	: 04/03/89
PROJECT NAME	: UNOCAL	SAMPLE MATRIX	: WATER
EPA METHOD	: 602	UNITS	: ug/L

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % REC	RPD
BENZENE	1.4	8.00	8.32	87	8.64	91	4
CHLOROBENZENE	<0.5	8.00	7.26	91	6.48	81	11
TOLUENE	<0.5	8.00	6.89	86	6.75	84	2
META & PARA XYLENE	<0.5	21.9	19.6	89	17.4	79	12

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

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

Analytical Technologies, Inc.

ATI I.D. # 8903-153

GENERAL CHEMISTRY RESULTS

CLIENT : GEOENGINEERS, INC. SAMPLE MATRIX : WATER
PROJECT # : 161-13-4
PROJECT NAME : UNOCAL

PARAMETER	UNITS	-1
PETROLEUM HYDROCARBONS	mg/L	0.77

Analytical Technologies, Inc.

ATI I.D. # 8903-153

GENERAL CHEMISTRY QUALITY CONTROL

CLIENT : GEOENGINEERS, INC. SAMPLE MATRIX : WATER
PROJECT # : 161-13-4
PROJECT NAME : UNOCAL

PARAMETER	UNITS	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED CONC	SPIKE ADDED	% REC
PETROLEUM HYDROCARBONS	mg/L	8904-007-1	<0.05	<0.05	0	4.05	5.14	79

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

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

Analytical **Technologies,** Inc.
San Diego ● Phoenix ● Seattle

Chain of Custody

DATE 3/31/89 PAGE 1 OF 1

PROJ. MGR. Steve Perino
COMPANY Geo-Engineers
ADDRESS 2405-140th Ave NE.
Bellevue, WA.

SAMPLERS (SIGNATURE) Kate Kuller (PHONE NO.) 746-5200

SAMPLE ID.	DATE	TIME	MATRIX	LAB ID.	BASE/NEU/ACID CMPDS. GC/MS/ 625/8270	VOLATILE CMPDS. GC/MS/ 624/8240	PESTICIDES/PCB 608/8080	POLYNUCLEAR AROMATIC 610/8310	PHENOLS, SUB PHENOLS 604/8040	HALOGENATED VOLATILES 601/8010	AROMATIC VOLATILES 602/8020	TOTAL ORGANIC CARBON 415/9060	TOTAL ORGANIC HALIDES 9020	PETROLEUM HYDROCARBONS (418)			PRIORITY POLLUTANT METALS (13)	CAM METALS (18) TTLC/STLC	EP TOX METALS (8)	SWDA-INORGANICS PRIMARY/SECONDARY	HAZARDOUS WASTE PROFILE				NUMBER OF CONTAINERS
Water Water	3/31/89	9:15	water	-1							X														2
"	"	"	"	-1										X											1

PROJECT INFORMATION
PROJECT: Unocal
PO NO. 101-13-4
SHIPPING ID. NO.
VIA:

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS	3
CHAIN OF CUSTODY SEALS	N
REC'D GOOD CONDITION/COLD	Y
CONFORMS TO RECORD	Y
LAB NO.	8903-153

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY 1.	RELINQUISHED BY 2.	RELINQUISHED BY 3.
Jon Kolaski		
(Signature) Jon Kolaski (Time)	(Signature) (Time)	(Signature) (Time)
(Printed Name) (Date)	(Printed Name) (Date)	(Printed Name) (Date)
(Company) Geo Engineers	(Company)	(Company)
RECEIVED BY 1.	**RECEIVED BY 2.**	**RECEIVED BY (LABORATORY) 3.**
		Jackie Lane 3:41
(Signature) (Time)	(Signature) (Time)	(Signature) (Time) Jackie Lane 3/31/89
(Printed Name) (Date)	(Printed Name) (Date)	(Printed Name)
(Company)	(Company)	ANALYTICAL TECHNOLOGIES, INC.

ATI LABORATORIES: SAN DIEGO (619) 458-9141 PHOENIX (602) 438-1530 DISTRIBUTION: WHITE, CANARY - ANALYTICAL TECHNOLOGIES, INC. ● PINK - ORIGINATOR

Analytical Technologies, Inc. 560 Naches Avenue, S.W., Suite 101, Renton, WA 98055, (206) 228-8335

ATI I.D. # 9006-114

GeoEngineers

JUL 6 1990

Routing

File

July 5, 1990

GeoEngineers, Inc.
2405-140th Avenue NE
Suite 105
Bellevue, WA 98005

Attention : Kathy Killman

Project Number : 161-13-B4

Project Name : Unocal

On June 15, 1990 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 the quality control data are enclosed.

Karen L. Mixon
Project Manager

Frederick W. Grothkopp
Technical Manager

FWG/tc

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-B4
PROJECT NAME : UNOCAL

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9006-114-1	MW-2	06/15/90	PRODUCT

----- TOTALS -----

MATRIX	# SAMPLES
PRODUCT	1

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-B4
PROJECT NAME : UNOCAL

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

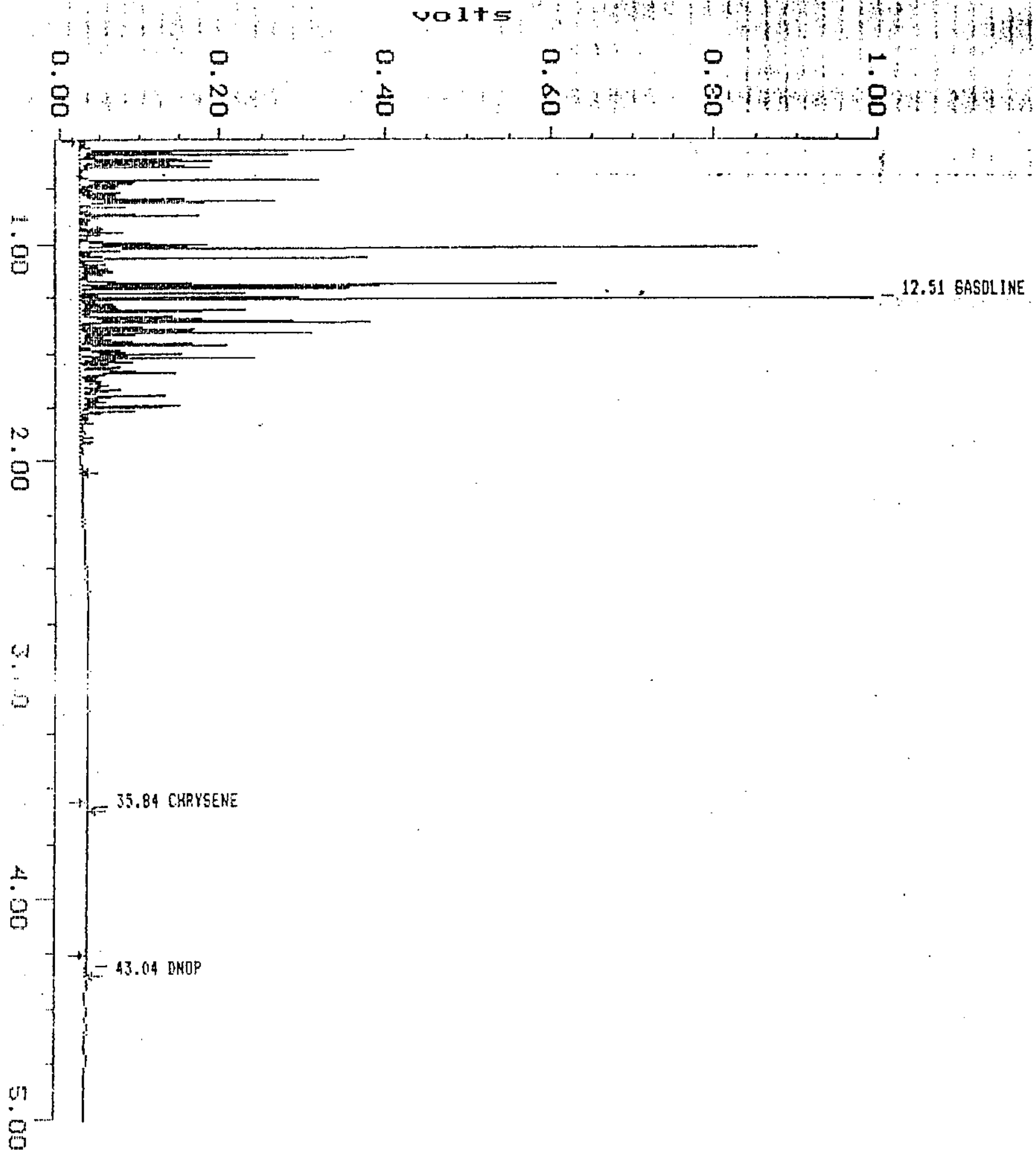
R = ATI - Renton
SD = ATI - San Diego
T = ATI - Tempe
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 06/15/90
PROJECT #	: 161-13-B4	DATE RECEIVED	: 06/15/90
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 06/26/90
CLIENT I.D.	: MW-2	DATE ANALYZED	: 06/27/90
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 20

COMPOUND	RESULT
FUEL HYDROCARBONS	1,900,000
HYDROCARBON RANGE	C6 - C16
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	DIESEL

Sample: 9006-114-1 R   Channel: FID REAR-B   Filename: OPR0202B
Acquired: 27-JUN-90 0:12   Method: M:\MAIDATA\PACK-R\FUEL625B   Operator: LAL
Dilution: 1 : 20.000
Comments: 8015 FUEL FINGEPRINT/ 3 ul INJECT ON PACKIE



Analytical Technologies, Inc. 9006-114
560 Naches Avenue SW, Suite 101 Renton, WA 98055

Chain of Custody

DATE 6/15/90 PAGE 1 OF 1

PROJECT MANAGER: Kathy K. Inman
COMPANY: GeoEngineers
ADDRESS: 2405 140th Ave NE Suite 105
Bellevue WA 98005
PHONE: 746-5200 SAMPLED BY: NLP

SAMPLE DISPOSAL INSTRUCTIONS

☒ ATI Disposal @ $5.00 each ☐ Return ☐ Pickup (will call)

LABORATORY NUMBER:

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 PAH/HH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	TCLP	Priority Pollutant Metals (13)	EPTOX Metals (8) Total	EP TOX Metals (8) EP EXT	NUMBER OF CONTAINERS
MW-2	6/15/90		Product	-1														X								1

PROJECT INFORMATION	SAMPLE RECEIPT	
PROJECT NUMBER: 161-13-B4	TOTAL NUMBER OF CONTAINERS	1
PROJECT NAME: Unocal	CHAIN OF CUSTODY SEALS Y/N/NA	NA
PURCHASE ORDER NUMBER:	INTACT? Y/N/NA	Y
VIA:	RECEIVED GOOD COND./COLD	y

TAT: ☐ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK ☒ 2 WKS (Normal)

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH DATA

SPECIAL INSTRUCTIONS:
8015 Fuel Fingerprint
product

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Norman Puri Time: 1015	Signature: Time:	Signature: Time:
Printed Name: Norman Puri Date: 6/15/90	Printed Name: Date:	Printed Name: Date:
Company: GeoEngineers	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: R. Nathewite Time: 1210	Signature: Time:	Signature: Time:
Printed Name: G. Lichtenstein Date: 6/15/90	Printed Name: Date:	Printed Name: Date:
Company: ATI / Renton	Company:	Analytical Technologies, Inc.

ATI [redacted] San [redacted] (619) [redacted] • [redacted] (602) [redacted] • [redacted] (206) [redacted] • [redacted] (907) [redacted] DISTRIBUTION: White - Canary - ANALYTICAL TECHNOLOGIES, INC. • Pink - ORIGINATOR

C - 16

Analytical Technologies, Inc. 560 Naches Avenue, S.W., Suite 101, Renton, WA 98055, (206) 228-8335

ATI I.D. # 9007-215

August 16, 1990

GeoEngineers, Inc.
2405 140th Ave. NE
Suite 105
Bellevue, WA 98005

Attention : Kathy Killman

Project Number : 161-13-B4

Project Name : Unocal

On July 25, 1990 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 the quality control data are enclosed.

Karen L. Mixon
Project Manager

Frederick W. Grothkopp
Technical Manager

FWG/hbb

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-13-B4
PROJECT NAME : UNOCAL

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9007-215-1	MW-19	07/24/90	PRODUCT

----- TOTALS -----

MATRIX	# SAMPLES
PRODUCT	1

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-B4
PROJECT NAME : UNOCAL

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

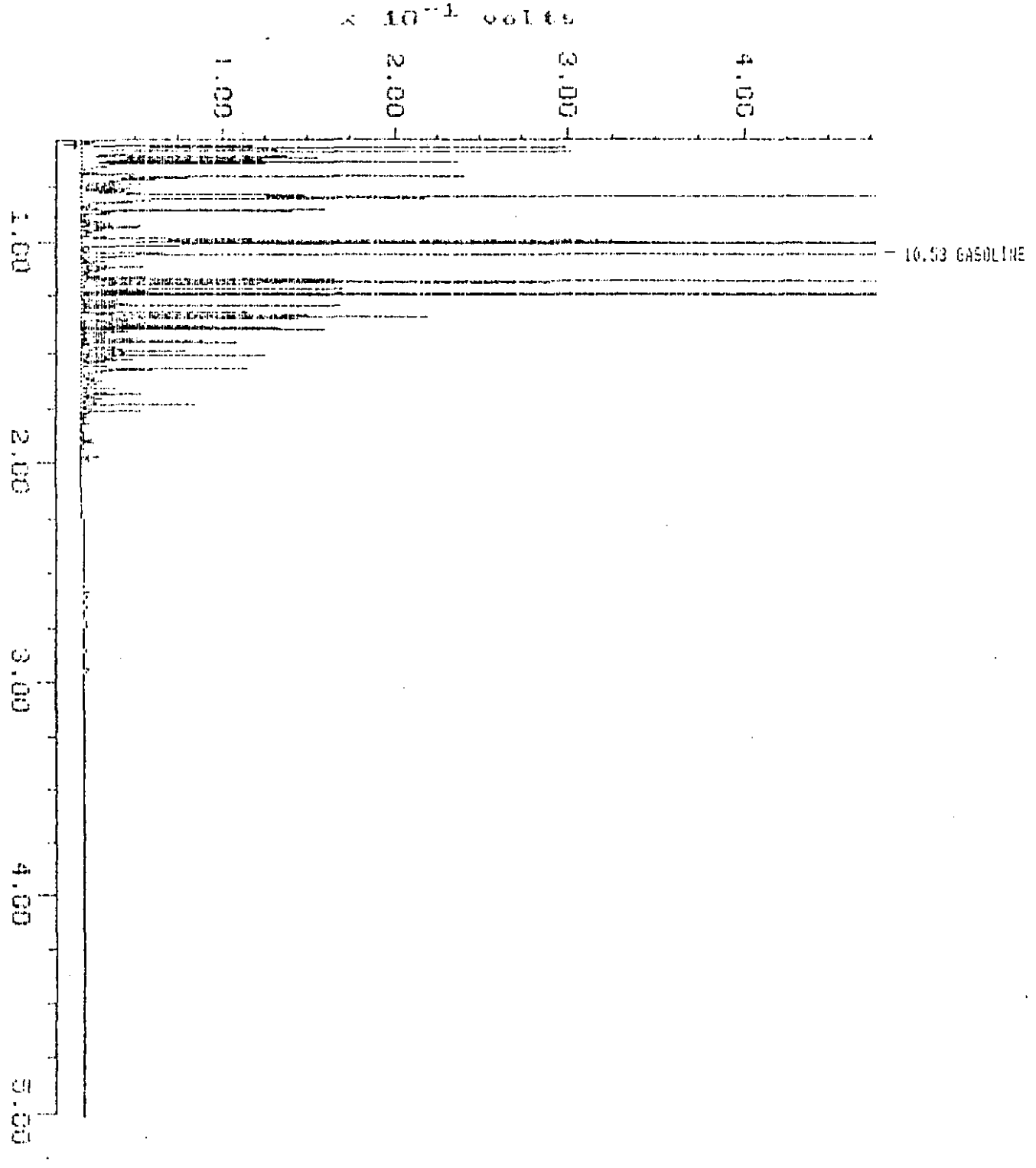
R = ATI - Renton
SD = ATI - San Diego
T = ATI - Tempe
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 07/24/90
PROJECT #	: 161-13-B4	DATE RECEIVED	: 07/25/90
PROJECT NAME	: UNOCAL	DATE EXTRACTED	: 08/07/90
CLIENT I.D.	: MW-19	DATE ANALYZED	: 08/07/90
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 20

COMPOUND	RESULT
FUEL HYDROCARBONS	1,600,000
HYDROCARBON RANGE	C6 - C14
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	DIESEL

Sample: 9607-215-1 FROD Channel: FID REAR-B Filename: 9FR0215?
Acquired: 07-AUG-96 22:12 Method: N:\MAXDATA\FREY-R\FUELSOS Operator: LAL
Comments: 8015 FUEL FINGERPRINT/ 3 ul INJECT ON FRONT



Analytical**Technologies**, Inc.
560 Naches Avenue SW, Suite 101 Renton, WA 98055

Chain of Custody

9007-215 DATE 7/29/90 PAGE 1 OF 1

PROJECT MANAGER: Kelly Killmon
COMPANY: GeoEngineers
ADDRESS: 2405 140th Ave NE Suite 105
Bellevue WA 98005
PHONE: 746-5200 SAMPLED BY: NLP

SAMPLE DISPOSAL INSTRUCTIONS

☑ ATI Disposal @ $5.00 each ☐ Return ☐ Pickup (will call)

LABORATORY NUMBER:

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 PAH/HH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified) *	TOC 9060	TOX 9020	% Moisture	TCLP	Priority Pollutant Metals (13)	EPTOX Metals (8) Total	EP TOX Metals (8) EP EXT	NUMBER OF CONTAINERS
MW-19	7/29/90		Product	-1														X								1

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJECT NUMBER: 161-13-B9		TOTAL NUMBER OF CONTAINERS	1
PROJECT NAME: Unocal		CHAIN OF CUSTODY SEALS Y/N/NA	N
PURCHASE ORDER NUMBER:		INTACT? Y/N/NA	NA
VIA: Courier		RECEIVED GOOD COND./COLD	Y/N
TAT: ☐ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK		☑ 2 WKS (Normal)	
PRIOR AUTHORIZATION IS REQUIRED FOR RUSH DATA			

SPECIAL INSTRUCTIONS:
* Analyze ~~only~~ only product portion of sample. Do not analyze water.

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Time: 1050	Signature: Time:	Signature: Time:
Printed Name: Norman Lin Date: 7/29/90	Printed Name: Date:	Printed Name: Date:
Company: GeoEngineers	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: Time:	Signature: Time:	Signature: Time: 1000
Printed Name: Date:	Printed Name: Date:	Printed Name: V. PENNICK Date: 7/25/90
Company:	Company:	Analytical Technologies, Inc.

ATI LABORATORIES: San Diego (619) 458-9141 • Phoenix (602) 438-1530 • Seattle (206) 228-8335 • Fort Collins (303) 490-1511 DISTRIBUTION: White, Canary - ANALYTICAL TECHNOLOGIES, INC. • Pink- ORIGINATOR