Progress Report No. 5
Vapor Extraction System Monitoring
Unocal Service Station 5353
Seattle, Washington

July 6, 1995

For

Unocal CERT - Northern Region

GeoEngineers

July 6, 1995

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

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

Attention: Dr. Mark Brearley, R.G.

We are submitting two copies of "Progress Report No. 5, Vapor Extraction System Monitoring" for the site of Unocal Service Station 5353 in Seattle, Washington. This progress report summarizes VES-related monitoring activities conducted from March 10, 1994 to June 6, 1995. Future progress reports will be provided to Unocal to update the information presented in this report. Contractual terms for our services are described in blanket agreement number CTB1982G.

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

Yours very truly,

GeoEngineers, Inc.

James A. Miller, P.E.
Principal

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CONTENTS

TABLES

CONTENTS (continued)

FIGURES

APPENDICES

PROGRESS REPORT NO. 5
VAPOR EXTRACTION SYSTEM MONITORING
UNOCAL SERVICE STATION 5353
SEATTLE, WASHINGTON
FOR
UNOCAL CERT - NORTHERN REGION

INTRODUCTION

This report summarizes the results of GeoEngineers' VES (vapor extraction system) monitoring and maintenance activities conducted at the site of Unocal Service Station 5353 from March 10, 1994 through June 6, 1995. The property owned by Unocal consists of the southern half of the city block bounded by Mercer Street to the south, Westlake Avenue North to the west, Valley Street to the north and Terry Avenue North to the east. Unocal Service Station 5353 (600 Westlake Avenue North) and an adjacent Denny's restaurant (601 Terry Avenue North) are located on the Unocal property. The northern half of the city block described above is owned by the city of Seattle. The Ecology (Washington State Department of Ecology) UST (underground storage tank) site number is 008463. The site location is shown relative to surrounding physical features in Figure 1. The site location and the immediate vicinity are shown in Figure 2.

PREVIOUS STUDIES

Unocal Service Station 5353 is the site of an 80,000-gallon release of leaded premium gasoline that occurred in 1980. Site characterization and remediation activities completed at the site between 1980 and 1981 included drilling and installing 32 monitoring wells, and installing a free product recovery system. Over 40,000 gallons of free product were recovered between 1980 and 1983. The free product recovery system was taken out of operation in 1983 because of a decreasing recovery rate. A VES was installed at the site in 1988 to mitigate combustible vapors in the soil beneath the site and to reduce explosive potential. The VES design and installation details, and monitoring data obtained during VES operation before July 15, 1993 are presented in the following reports: "Progress Report No. 1" dated July 12, 1988; "Interim Status Report" dated October 3, 1988; "Progress Report No. 2" dated January 3, 1991; "Progress Report No. 3" dated October 1, 1993; and "Progress Report No. 4" dated June 15, 1994.

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

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

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

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

The results of soil and ground water sampling activities completed during this reporting period will be summarized in a separate report to Unocal.

VES OPERATION AND MONITORING

GENERAL

The system operated continuously from the beginning of this reporting period (March 10, 1994) to November 23, 1994. The system was turned off on November 23 for repairs. The blower was replaced with a similar blower obtained from Unocal's surplus equipment. Except for a short down period from approximately May 10 through May 25 when the blower temporarily malfunctioned, the system operated continuously from January 30, 1995 through the end of this reporting period. The on and off periods and the system operational configuration during these periods are summarized in Table 1. During this reporting period, vapors were extracted from the northeastern, northwestern, southeastern and southwestern collection areas at the Unocal site, and from the eastern and western collection areas on the Seattle property. The locations of the vapor collection areas are shown in Figure 4.

The current reporting period, March 10, 1994 through June 6, 1995, comprised 453 days. The VES operated for approximately 370 days of the reporting period.

The VES monitoring frequency during the current reporting period, approximately every two to three months when the system was operating, depended on the operational configuration of the VES. VES monitoring activities included (1) measuring combustible vapor concentrations and ground vacuum in selected monitoring and recovery wells, (2) measuring VES operational characteristics including flow rate, applied vacuum and vapor temperature, and (3) obtaining

vapor samples from the VES sample port for field measurement of combustible vapor concentration and for chemical analysis of methane and TVH (total volatile hydrocarbons). Not all of these activities were completed during each monitoring visit. Monitoring data are summarized in Tables 2 through 8. Our field procedures for monitoring activities are described in Appendix A. Laboratory reports for vapor sample chemical analyses and our review of the laboratory QA/QC (quality assurance/quality control) program are presented in Appendix B.

VES MAINTENANCE

The blower motor assembly began to malfunction in November 1994. The blower motor was removed on November 23 and sent to a machine shop for repair. The blower continued to malfunction after the rebuilt motor was reinstalled. The blower subsequently was replaced with a positive displacement blower from Unocal's surplus equipment. The replacement blower was somewhat smaller than the original blower. The system vacuums and flow rates measured during site visits after the new blower was installed were significantly lower than those measured while the original blower was operating effectively.

VES OPERATIONAL DATA

VES flow rates, vapor stream temperatures, applied vacuums and system operational configurations observed during this reporting period are presented in Table 2. Data for the preceding reporting period are included for comparison.

Flow Rate and Applied Vacuum Measurements

The flow rate was approximately 115 cfm (cubic feet per minute) during the portion of the reporting period from March 10 to November 23, 1994. Since January 30, 1995 when the new blower was installed, the flow rate ranged from 72 to 76 cfm. The time-weighted average flow rate during this reporting period was about 103 cfm. The applied vacuum ranged from 30 to 33 inches of water column during the portion of this reporting period from March 10 to November 23, 1994. The applied vacuum ranged from 7 to 15 inches after January 30, 1995. Applied vacuum is dependent on soil moisture content, ground water levels and moisture content of the extracted vapors. The applied vacuum after January 30 also was affected by the lower power of the new blower.

Combustible Vapor Measurements

The vapor stream extracted from the subsurface was characterized by obtaining field measurements of combustible vapor concentrations and by obtaining vapor samples for chemical analysis of TVH and methane. Field measurements and vapor samples were obtained from the effluent vapor stream and are representative of the vapor stream emitted to the atmosphere. The concentration of combustible vapors in the vapor stream ranged from less than 100 ppm (parts per million) to approximately 500 ppm during this reporting period.

TVH and Methane Concentrations

Vapor samples obtained from the effluent stream on the dates indicated in Table 2 were submitted for laboratory analysis of TVH and methane. TVH and methane are quantified using non-standardized testing methods. On three sampling dates during this reporting period, the laboratory misinterpreted the request for the TVH test on the chain of custody, and tested the samples for either volatile organic compounds by EPA Method 8240 or BETX (benzene, ethylbenzene, toluene and xylenes) by EPA Method 8020. Several verbal and written communications were made with the laboratory during this period before the laboratory understood the testing method that was being requested. Laboratory results are summarized in Table 2. Laboratory reports and our review of the laboratory QA/QC program are presented in Appendix B.

Methane, TVH and other analytes were not detected in the vapor samples obtained during this reporting period.

The volumes of gasoline and methane vapor removed by the VES were not calculated because the TVH and methane concentrations were less than laboratory detection limits. The cumulative totals of gasoline and methane for the life of the system are presented in Table 3. The equivalent of approximately 4,728 gallons of gasoline and 193,944 cubic feet of methane were recovered by the system from its initial start-up to June 6, 1995. Daily emissions of gasoline vapors to the atmosphere during this reporting period did not exceed the 15 pounds per day allowed by the PSAPCA permit.

MONITORING WELLS AND RECOVERY WELLS DATA

Ground Water Measurements

Ground water levels were measured in selected monitoring wells on April 7, 1994; July 14 and 15, 1994; September 22, 1994; October 25 and 26, 1994; February 3, 1995; April 18, 1995; and June 6, 1995, as summarized in Table 4. The ground water elevations presented in Table 4 are referenced to the city of Seattle datum. The ground water elevations in the vicinity of the site ranged from 9.36 to 11.54 feet in April 1994 (seasonal high water level period) and from 8.40 to 10.40 feet in October 1994 (seasonal low water level period), with the exception of MW-41, which is located significantly upgradient of the site. The general direction of ground water flow is toward the east and northeast. Significant localized variations in the ground water flow direction exist in the vicinity of the site, probably caused by the presence of underground utility corridors. The overall apparent ground water flow direction is consistent with past observations at this site. Inferred ground water contours based on measurements obtained from selected wells on September 22, 1994 are shown in Figure 5.

Free Product

Free product thicknesses were measured in selected monitoring wells on April 7, 1994; July 14 and 15, 1994; September 22, 1994; October 25 and 26, 1994; February 3, 1995; April 18, 1995; and June 6, 1995, as summarized in Table 4. Free product was measured only in MW-37, at thicknesses ranging from a trace (less than 0.01 foot) to 0.25 foot during this reporting period.

Combustible Vapors

Recovery Wells. Combustible vapors were measured in the recovery wells on July 15 and September 22, 1994; and on February 3 and April 18, 1995. The results are presented in Table 5.

Combustible vapor concentrations in the recovery wells located on the Unocal site ranged from less than 100 ppm to 4,000 ppm during this reporting period, with the exception of a concentration of greater than 10,000 ppm in RW-28 on February 3, 1995.

Combustible vapor concentrations in the recovery wells SMW-2S and SMW-5, located on city of Seattle property, were less than or equal to 100 ppm during this reporting period. Combustible vapor concentrations in recovery wells MW-32 and MW-49, located on city of Seattle property, were greater than 10,000 ppm on July 15, 1994. Combustible vapor concentrations were not measured in MW-32 and MW-49 on other occasions because the water levels in these two wells typically are near the ground surface, submerging the well screens.

Monitoring Wells. Combustible vapor concentrations were measured in selected monitoring wells on July 15 and September 22, 1994; and on February 3, 1995; April 18, 1995; and June 6, 1995. The results are presented in Table 6.

Combustible vapor concentrations in monitoring wells MW-32A through MW-35 ranged from less than 100 ppm to 1,100 ppm, with the exception of a measurement of greater than 10,000 ppm in MW-32A on April 18, 1995. Monitoring wells MW-32A through MW-35 are located in the immediate vicinity of the vapor collection areas. Combustible vapor concentrations in the remaining wells ranged from 3,700 to greater than 10,000 ppm, with the exception of several much lower measurements during the February and April 1995 monitoring events (Table 6). Combustible vapor concentrations measured in selected monitoring wells on July 15, 1994 are shown in Figure 6.

Ground Vacuum

Recovery Wells. The ground vacuum was measured in the recovery wells on July 15 and September 22, 1994; and on February 3 and April 18, 1995. Vacuums measured in the recovery wells on the Unocal site ranged from 0 to 2.0 inches of water column during this reporting period. The ground vacuums were much lower during the February and April 1995 monitoring

events. This probably was a result of the less powerful blower used for the VES, and more water condensing in the conveyance piping than during the drier months of the year. Vacuum in the recovery wells on city of Seattle property ranged from 0 to 6.4 inches of water column.

Monitoring Wells. Vacuums in the monitoring wells ranged from 0 to 0.30 inches of water column when measured during the July and September 1994, and February 1995 monitoring events. No measurable vacuums were observed in over half of the monitoring wells during these events. No measurable vacuums were observed in the monitoring wells during the April 1995 monitoring event. Ground vacuums measured during the July 1994 monitoring event are shown in Figure 7.

CONCLUSIONS AND RECOMMENDATIONS

The low TVH and methane concentrations in vapor samples obtained from the effluent vapor stream, and the comparatively low combustible vapor concentrations in the recovery wells and on-site monitoring wells indicate that the VES has been effective in removing vapors from the immediate vicinity of the Unocal site. However, high concentrations of combustible vapors remain beneath the city of Seattle property and other surrounding properties.

Although TVH and methane concentrations in the effluent stream remain low, we recommend continuing to operate the VES. The VES introduces oxygen into the subsurface which enhances natural biodegradation of the nonvolatile hydrocarbons which are not removed by the VES.

We recommend that Unocal evaluate the cost effectiveness of replacing the existing blower at the site. Several Rotron DR707 blowers are available in Unocal's surplus equipment. The Rotron DR707 would be capable of exerting a much higher ground vacuum, resulting in a higher effluent flow rate than the current blower. The DR707 blowers which are available are wired for three phase power, however, and only single phase power is available at the site, to the best of our knowledge. A phase converter would have to be installed in conjunction with a DR707 blower.

We recommend quarterly monitoring of VES operational characteristics. We also recommend that measurements in the recovery and monitoring wells continue to be taken on a quarterly basis.

LIMITATIONS

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

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

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

Respectfully submitted,

GeoEngineers, Inc.

Dana Carlisle, P.E.
Senior Engineer

James A. Miller, P.E.
Principal

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TABLE 1
VAPOR EXTRACTION SYSTEM
OPERATIONAL CONFIGURATIONS

Operating Period		System Status	System Configuration[1]					
			Unocal				Seattle	
Start	End	(On/Off)	NW	NE	SW	SE	W	E
07/15/93	11/15/93	On	O	O	O	O	O	O
11/15/93	01/05/94	Off	–	–	–	–	–	–
01/06/94	02/15/94	On	O	O	O	O	O	O
02/15/94	02/25/94	Off	–	–	–	–	–	–
02/25/94	03/10/94	On	O	O	O	O	O	O
03/10/94	**11/23/94**	**On**	**O**	**O**	**O**	**O**	**O**	**O**
11/23/94	**01/30/95**	**Off**	**–**	**–**	**–**	**–**	**–**	**–**
01/30/95	**05/10/95 (est.)**	**On**	**O**	**O**	**O**	**O**	**O**	**O**
05/10/95 (est.)	**05/25/95**	**Off**	**–**	**–**	**–**	**–**	**–**	**–**
05/25/95	**06/06/95**	**On**	**O**	**O**	**O**	**O**	**O**	**O**

Notes:

[1] "–" = Closed, "O" = Open

Bolding indicates operational configurations during the current reporting period.

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TABLE 2
VAPOR EXTRACTION SYSTEM OPERATION AND MONITORING DATA

Date	Time	Flow Rate (cfm)	Vapor Temperature (°F)	Vacuum[1] (inches)	System Operational Configuration[2]						Effluent Vapor[3]			
					Unocal				Seattle		Combustible Vapor Concentration[4] (ppm)	TVH[5] (mg/m^3)	TVH[6] (ppm)	Methane[7] (ppm)
					NW	NE	SW	SE	W	E				
08/03/93	0800	118	70	27	O	O	O	O	O	O	<100	<500	<175	47
09/15/93	0900	120	66	32	O	O	O	O	O	O	<100	<500	<175	21
10/15/93	0600	120	60	34	O	O	O	O	O	O	120	<500	<175	80
01/06/94	0700	120	--	34	O	O	O	O	O	O	520	<500	<175	1,200
03/09/94	0700	115	60	34	O	O	O	O	O	O	<100	<500	<175	<500
04/28/94	**1000**	**115**	**<50**	**31**	**O**	**O**	**O**	**O**	**O**	**O**	**190**	**<500**	**<175**	**<500**
07/15/94	**0630**	**115**	**70**	**30**	**O**	**O**	**O**	**O**	**O**	**O**	**190**	**--[8]**	**--**	**<500**
09/22/94	**0730**	**115**	**67**	**33**	**O**	**O**	**O**	**O**	**O**	**O**	**500**	**--[8]**	**--**	**<500**
02/03/95[9]	**0700**	**76**	**<50**	**12**	**O**	**O**	**O**	**O**	**O**	**O**	**400**	**--[10]**	**--**	**<500**
03/01/95	**0936**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**<500**	**<175**	**<500**
04/18/95	**0730**	**75**	**50**	**15**	**O**	**O**	**O**	**O**	**O**	**O**	**<100**	**<500**	**<175**	**<500**
06/05/95	**1245**	**72**	**68**	**7**	**O**	**O**	**O**	**O**	**O**	**O**	**<100**	**<500**	**<175**	**<500**

Notes:

[1]Vacuum expressed as inches of water column.

[2]"O" = open.

[3]Measurements and samples were obtained from the vapor stream as it exited the subsurface.

[4]Measurement made with Bacharach TLV Sniffer calibrated to hexane.

[5]Total volatile hydrocarbons analysis by GC/FID, expressed as mg/m^3.

[6]Total volatile hydrocarbons analysis by GC/FID, expressed as ppm. GeoEngineers converted all values reported in mg/m^3 to ppm using the Ideal Gas Law and an assumed average molecular weight of 70 grams per mole for the hydrocarbon vapors.

[7]Methane analysis by GC/FID, expressed as ppm.

[8]Samples were analyzed for VOCs (volatile organic compounds) by EPA Method 8240. VOCs were not detected.

[9]The VES blower was replaced on 01/30/95, accounting for the lower system flow rates and vacuums.

[10]Sample was analyzed for BETX (benzene, ethylbenzene, toluene and xylenes) by EPA Method 8020. BETX compounds were not detected.

cfm = cubic feet per minute

ppm = parts per million

mg/m^3 = milligrams per cubic meter

"--" = no measurement taken

Bolding indicates operation and monitoring data during the current reporting period.

TABLE 3
VOLUMES OF RECOVERED GASOLINE AND METHANE

Operation Period Start Date	Operation Period Duration (days)	Estimated Equivalent Total Recovery	
		Gasoline (gallons)	Methane (cubic feet)
07/14/93	21	0[1]	109
08/03/93	43	0[1]	251
09/15/93	30	0[1]	261
10/15/93	31	0[1]	322
01/06/94	40	0[1]	8,294
02/25/94	12	0[1]	1,218
03/10/94	**259**	**0[1]**	**0[1]**
01/30/95	**99**	**0[1]**	**0[1]**
05/25/95	**12**	**0[1]**	**0[1]**
Total (03/10/94 - 06/06/95)	370	0[1]	0[1]
Previous Cumulative Total		4,728	193,944
TOTAL		4,728	193,944

Notes:

[1]Volumes of recovered gasoline and methane cannot be calculated because vapor sample concentrations were less than laboratory detection levels.

Bolding indicates information for the current reporting period.

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TABLE 4 (Page 1 of 2)
WATER AND PRODUCT LEVELS IN MONITORING AND RECOVERY WELLS

Well	Casing Rim Elevation[1] (feet)	04/07/94[2]		07/14/94 and 07/15/94[3]		09/22/94		10/25/94 and 10/26/94		02/03/95		04/18/95		06/06/95	
		Water Elevation[1] (feet)	Product Thickness (feet)	Water Elevation[1] (feet)	Product Thickness (feet)	Water Elevation[1] (feet)	Product Thickness (feet)	Water Elevation[1] (feet)	Product Thickness (feet)	Water Elevation[1] (feet)	Product Thickness (feet)	Water Elevation[1] (feet)	Product Thickness (feet)	Water Elevation[1] (feet)	Product Thickness (feet)
MW-32A	20.70	10.05	--	9.98	--	9.30	--	9.24	--	9.64	--	9.70	--	NM	NM
MW-33	20.75	10.15	--	NM	NM	9.73	--	NM	NM	9.74	--	9.81	--	NM	NM
MW-34	21.42	10.54	--	10.64	--	10.16	--	9.64	--	10.18	--	10.14	--	9.97	--
MW-35	20.10	10.19	--	9.97	--	NM	NM	9.23	--	9.79	--	9.56	--	9.60	--
MW-36	17.80	NM	NM	9.82	--	8.78	--	8.48	--	8.56	--	9.83	--	10.12	--
MW-37	21.01	10.59	0.08[4]	NM	0.25	10.08	--	NM	0.17	9.99	Trace	9.97	--	9.42	0.01
MW-38	16.52	NM	NM	NM	NM	8.11	--	NM	NM	7.90	--	9.25	--	NM	NM
MW-39	24.47	NM	NM	NM	NM	11.04	--	NM	NM	11.10	--	11.25	--	NM	NM
MW-40	20.89	11.54	--	10.21	--	10.11	--	9.67	--	9.93	--	10.08	--	9.94	--
MW-41	27.00	NM	NM	16.19	--	16.18	--	13.31	--	12.36	--	12.21	--	12.18	--
MW-42	20.34	10.96	--	11.06	--	10.59	--	10.40	--	10.68	--	11.01	--	10.99	--
MW-43	21.04	NM	NM	10.34	--	10.17	--	9.70	--	10.00	--	9.93	--	9.84	--
MW-44	18.73	NM	NM	10.38	--	10.27	--	8.92	--	10.36	--	10.82	--	10.62	--
MW-45	18.15	9.93	--	9.76	--	9.33	--	9.05	--	9.41	--	9.77	--	9.86	--
MW-46	16.91	NM	NM	9.76	--	8.66	--	8.40	--	8.62	--	9.67	--	10.01	--
MW-47	19.83	9.36	--	9.32	--	9.14	--	8.81	--	9.16	--	9.15	--	9.13	--
MW-48	18.49	NM	NM	NM	NM	9.22	--	NM	NM	9.20	--	9.71	--	NM	NM
MW-49	12.61	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
RW-4A	21.28	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
RW-5A	21.40	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
RW-7	20.66	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
RW-8	19.92	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
RW-9	20.61	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
RW-10	20.59	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
RW-26	20.72	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
RW-28	21.17	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM

Notes appear on page 2 of 2.

TABLE 4 (Page 2 of 2)

Notes:

[1]Elevations referenced to city of Seattle datum.

[2]Previously reported in our "Report of Geoenvironmental Services" dated June 10, 1994.

[3]Previously reported in our "Status Report and Results of Ground Water Monitoring" dated May 17, 1995.

[4]Water table elevations corrected for presence of free product. A specific gravity of 0.85 was assumed for the free product.

NM = not measured

"--" = none detected

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TABLE 5
SUBSURFACE COMBUSTIBLE VAPOR MONITORING DATA[1]
RECOVERY WELLS

Vapor Collection Area[2]	Well Number	Date			
		07/15/94	09/22/94	02/03/95	04/18/95
Northwest	RW-7	<100	<100	<100	<100
	RW-8	<100	<100	<100	<100
	RW-9	<100	<100	<100	<100
	RW-10	<100	<100	<100	<100
	RW-26	<100	<100	<100	<100
Northeast	RW-28	<100	<100	>10,000	<100
Southwest	RW-5A	<100	600	100	<100
Southeast	RW-4A	1,100	3,000	4,000	<100
Seattle West	SMW-2S	--	<100	<100	<100
	SMW-5	--	100	<100	<100
Seattle East	MW-32	>10,000	--[3]	--[3]	--[3]
	MW-49	>10,000	--[3]	--[3]	--[3]
VES Operational Configuration[4]					
Northwest		O	O	O	O
Northeast		O	O	O	O
Southwest		O	O	O	O
Southeast		O	O	O	O
Seattle West		O	O	O	O
Seattle East		O	O	O	O

Notes:

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

[2]Vapor collection areas are shown in Figure 4.

[3]Measurements were not obtained from MW-32 and MW-49 during this monitoring period because water levels typically are near the ground surface in these wells, submerging the well screens.

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

'O' = open

'--' = not measured

Document ID: 161013M5.WK1

TABLE 6
SUBSURFACE COMBUSTIBLE VAPOR MONITORING DATA[1]
MONITORING WELLS

Well Number	Date				
	07/15/94	09/22/94	02/03/95	04/18/95	06/06/95
MW-32A	<100	<100	<100	>10,000	–
MW-33	<100	–	<100	<100	–
MW-34	1,100	<100	220	<100	240
MW-35	<100	<100	<100	180	700
MW-36	4,000	>10,000	600	<100	300
MW-37	>10,000	>10,000	<100	>10,000	>10,000
MW-38	>10,000	>10,000	>10,000	>10,000	–
MW-39	>10,000	>10,000	>10,000	<100	–
MW-40	>10,000	>10,000	>10,000	>10,000	–
MW-41	3,700	>10,000	8,000	3,000	6,000
MW-42	>10,000	>10,000	>10,000	>10,000	>10,000
MW-43	>10,000	>10,000	>10,000	>10,000	4,200
MW-44	>10,000	>10,000	<100	450	200
MW-45	>10,000	>10,000	>10,000	>10,000	>10,000
MW-46	>10,000	>10,000	400	1,000	>10,000
MW-47	>10,000	>10,000	>10,000	>10,000	600
MW-48	>10,000	>10,000	>10,000	>10,000	–
SMW-4	–	>10,000	>10,000	<100	–
VES Operational Configuration[2]					
Northwest	O	O	O	O	O
Northeast	O	O	O	O	O
Southwest	O	O	O	O	O
Southeast	O	O	O	O	O
Seattle West	O	O	O	O	O
Seattle East	O	O	O	O	O

Notes:

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

[2]VES operational configuration shows the configuration of vapor withdrawal at the time the vapor concentrations were measured.

"O" = open

"–" = not measured

Document ID: 161013M6.WK1

TABLE 7
GROUND VACUUM MONITORING DATA[1]
RECOVERY WELLS

Vapor Collection Area[2]	Well Number	Date			
		07/15/94	09/22/94	02/03/95	04/18/95
Northwest	RW-7	0.27	0.32	0.05	0
	RW-8	0.31	0.31	0.08	0
	RW-9	0.35	0.33	0.08	0
	RW-10	0.34	0.32	0.08	0
	RW-26	0.33	0.29	0	0
Northeast	RW-28	0	0	0	0
Southwest	RW-5A	1.8	2.0	0	0
Southeast	RW-4A	1.1	0.71	0.40	0
Seattle West	SMW-2S	--	6.2	0.40	0.04
	SMW-5	--	6.2	0.44	0.05
Seattle East	MW-32	0	--[3]	--[3]	--[3]
	MW-49	0.3	--[3]	--[3]	--[3]
VES Operational Configuration[4]					
Northwest		O	O	O	O
Northeast		O	O	O	O
Southwest		O	O	O	O
Southeast		O	O	O	O
Seattle West		O	O	O	O
Seattle East		O	O	O	O

Notes:

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

[2]Vapor collection areas are shown in Figure 4.

[3]Measurements were not obtained from MW-32 and MW-49 during this monitoring period because water levels typically are near the ground surface in these wells, submerging the well screens.

[4]VES operational configuration shows the configuration of vapor withdrawal at the time the vacuum was measured.

'O' = open

'--' = not measured

Document ID: 161013M7.WK1

TABLE 8
GROUND VACUUM MONITORING DATA[1]
MONITORING WELLS

Well Number	Date			
	07/15/94	09/22/94	02/03/95	04/18/95
MW-32A	0.29	0.30	0.07	0
MW-33	0.01	–	0	0
MW-34	0.28	0.18	0.02	0
MW-35	0.20	0	0.04	0
MW-36	0	0	0	0
MW-37	0.08	0.1	0	0
MW-38	0	0	0	0
MW-39	–	0	0	0
MW-40	0.005	0	0	0
MW-41	0.02	0	0	0
MW-42	0	0	0	0
MW-43	0	0	0	0
MW-44	0	0	0	0
MW-45	0	0	0.005	0
MW-46	0	0	0	0
MW-47	0	0	0	0
MW-48	0	0	0	0
SMW-4	--	0	0	0
VES Operational Configuration[2]				
Northwest	O	O	O	O
Northeast	O	O	O	O
Southwest	O	O	O	O
Southeast	O	O	O	O
Seattle West	O	O	O	O
Seattle East	O	O	O	O

Notes:

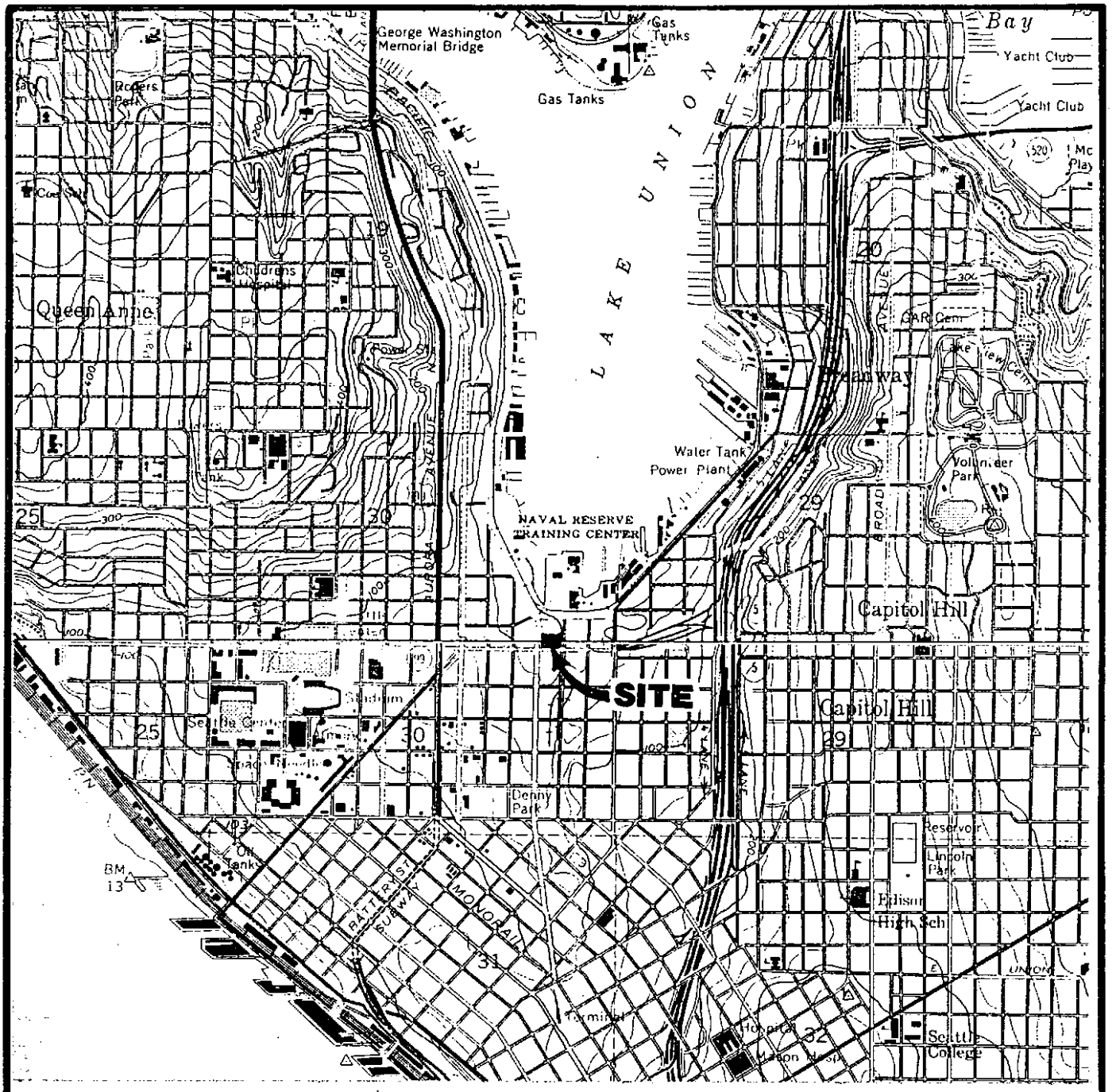
[1]Measured using Magnehelic vacuum gauges. Results are expressed in inches of water column.

[2]VES operational configuration shows the configuration of vapor withdrawal at the time the vacuum was measured.

'O' = open

'–' = not measured

Document ID: 161013M8.WK1



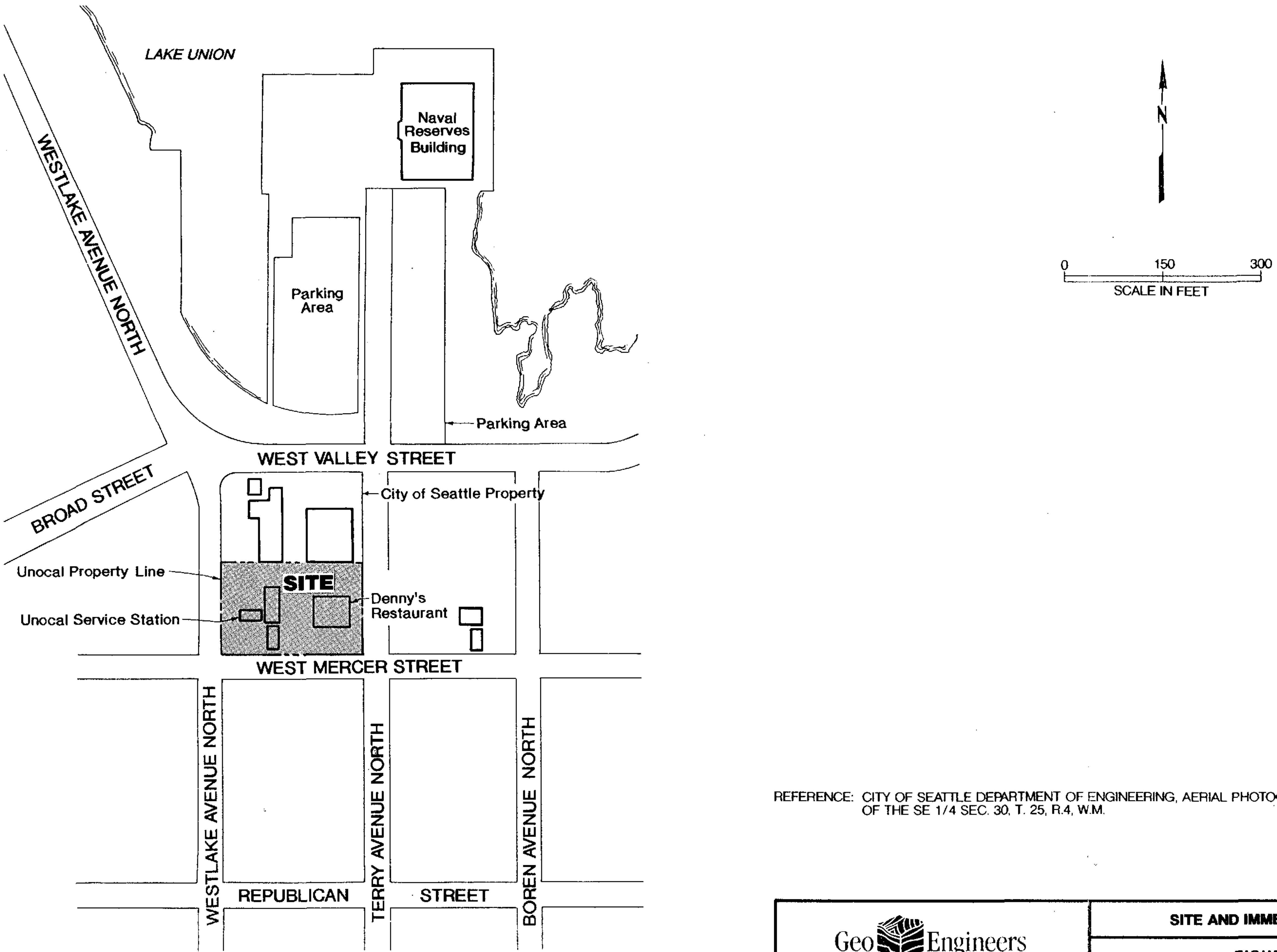
REFERENCE: USGS TOPOGRAPHIC QUADRANGLE MAPS "SEATTLE NORTH, WASH.," PHOTOREVISED 1968 AND "SEATTLE SOUTH, WASH.," PHOTOREVISED 1973.

GeoEngineers

VICINITY MAP

FIGURE 1

0161-013-R04 AMA:KKT 2/13/92



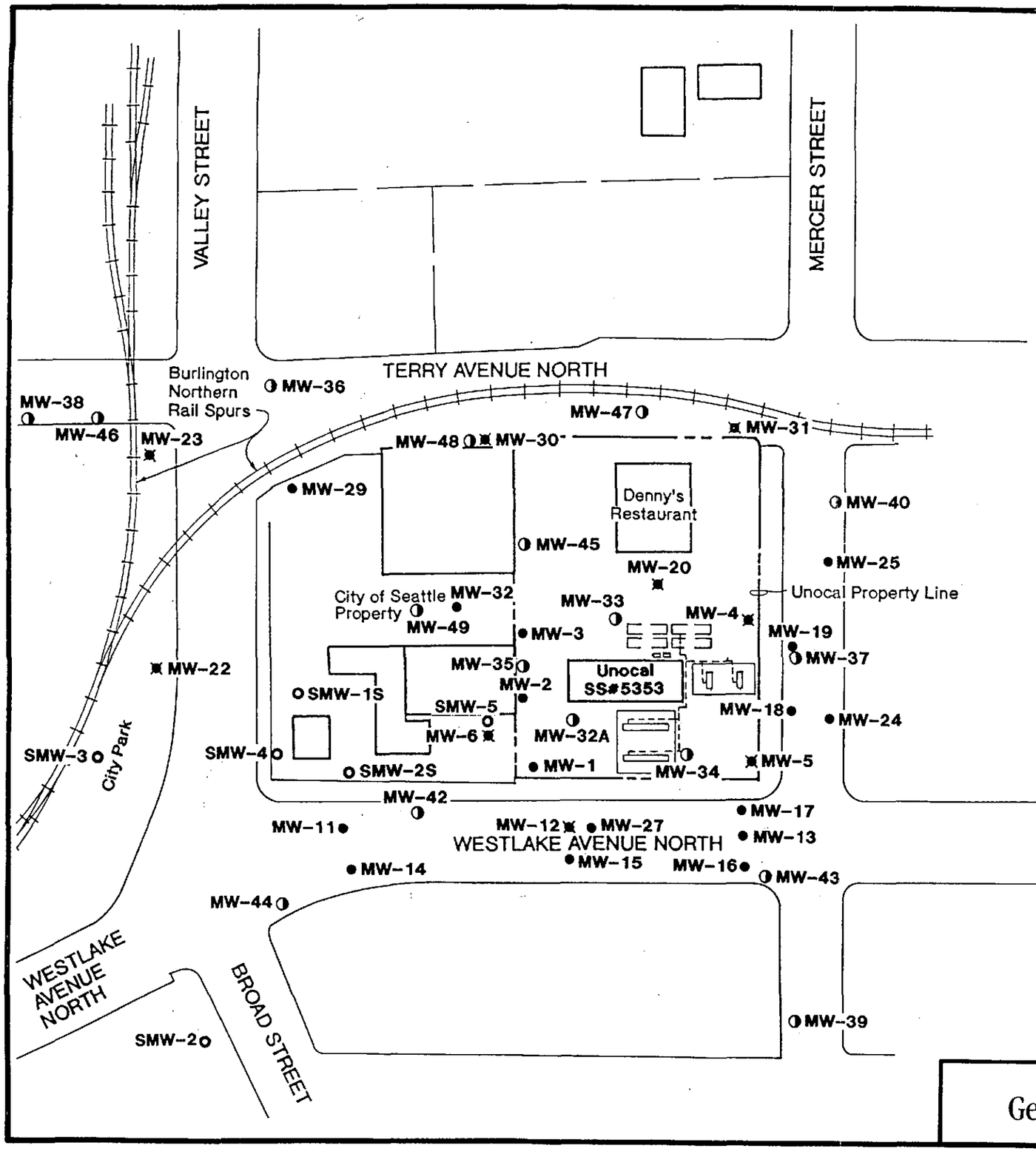
REFERENCE: CITY OF SEATTLE DEPARTMENT OF ENGINEERING, AERIAL PHOTOGRAPHY OF NE 1/4 OF THE SE 1/4 SEC. 30, T. 25, R.4, W.M.

GeoEngineers

SITE AND IMMEDIATE VICINITY

FIGURE 2

10-1-93



EXPLANATION:

- ● MW-2 MONITORING WELL INSTALLED IN 1980
- ✕ MW-4 MONITORING WELL INSTALLED IN 1980 AND ABANDONED BEFORE THIS REPORTING PERIOD
- ◑ MW-33 MONITORING WELL INSTALLED IN 1991 OR 1992
- ○ SMW-2 MONITORING WELL INSTALLED BY SCS

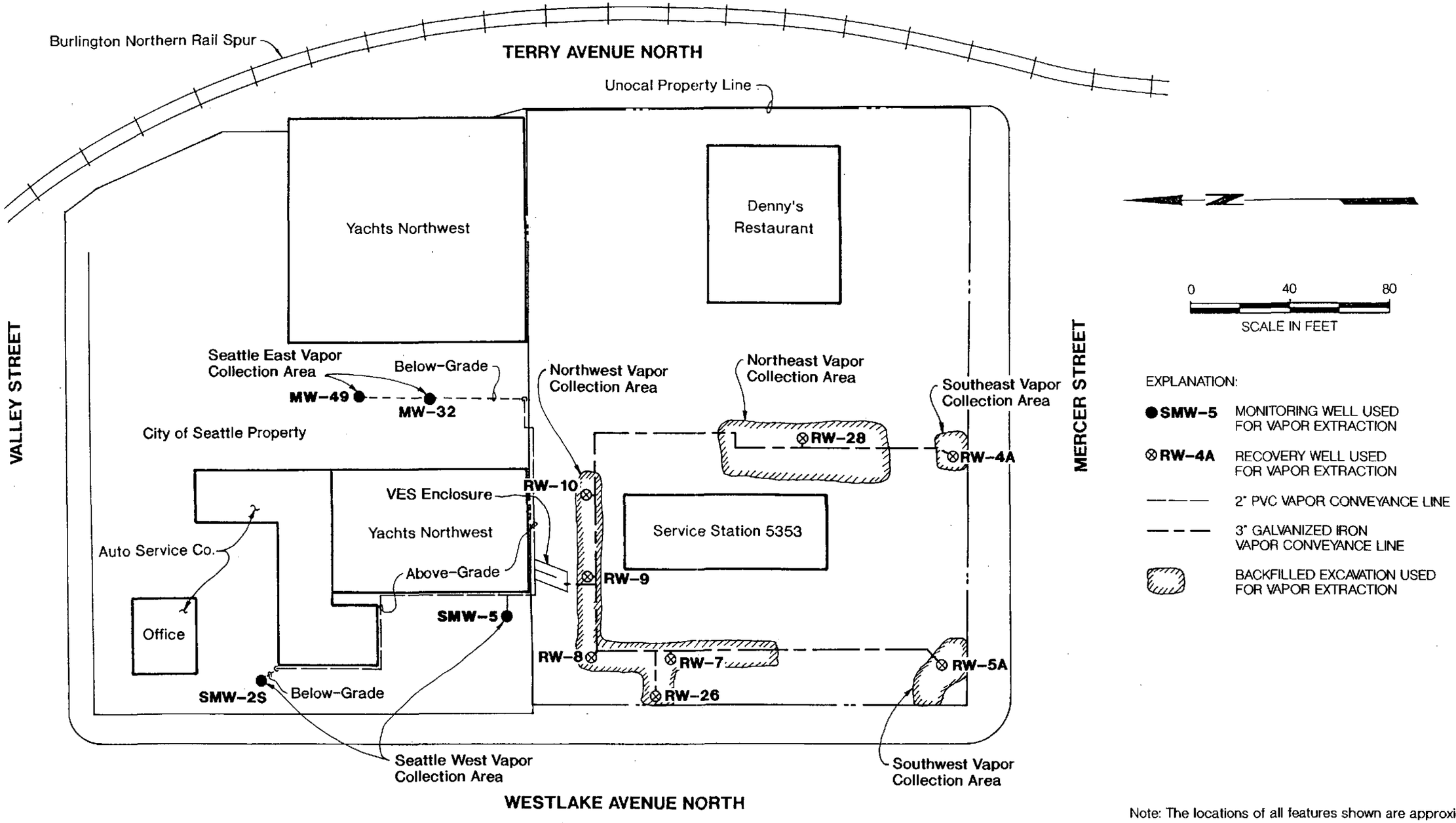
Note: The locations of all features shown are approximate.

Geo Engineers

MONITORING WELL LOCATIONS

FIGURE 3

10-1-93
0161-013-R69 NLP/BDH 8/24/93(B)



Note: The locations of all features shown are approximate.

0161.013.R04 DEH:PMB 02-12-92 Rev: DFH:LJD 3/3/92 (3)

10-1-93

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VAPOR EXTRACTION SYSTEM LAYOUT

FIGURE 4

EXPLANATION:

- **MW-2** ● MONITORING WELL INSTALLED IN 1980
- **MW-33** ◑ MONITORING WELL INSTALLED IN 1991 OR 1992
- **SMW-2S** ⊗ MONITORING WELL INSTALLED BY SCS
- 8.11 GROUND WATER ELEVATION (FEET) ON 09/22/94
- 9.5 GROUND WATER CONTOUR (FEET) ON 09/22/94
- GENERAL DIRECTION OF GROUND WATER FLOW ON 09/22/94

N

0 80 160
SCALE IN FEET

VALLEY STREET

MERCER STREET

TERRY AVENUE NORTH

Unocal Property Line

MW-38 8.11

MW-46 8.66

MW-36 8.78

MW-47 9.14

MW-48 9.22

MW-29

MW-45 9.33

MW-32

MW-49

MW-3

MW-33 9.73

MW-35

MW-2

SMW-1S

SMW-5

MW-32A 9.30

MW-1

MW-34 10.16

SMW-4

SMW-2S

SMW-3

City Park

MW-42 10.59

MW-11

MW-27

MW-17

MW-13

MW-15

MW-14

MW-16

MW-43 10.17

MW-44 10.27

WESTLAKE AVENUE NORTH

BROAD STREET

SMW-2

Denny's Restaurant

City of Seattle Property

Unocal SS-5353

MW-40 10.11

MW-19

MW-37 10.08

MW-18

MW-24

MW-41 16.18

MW-39 11.04

9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0

Note: The locations of all features shown are approximate.

0161013R04:061395

0161013E.DWG

NLP:BDH

Geo Engineers

GROUND WATER ELEVATIONS ON 09/22/94

FIGURE 5

EXPLANATION:

MW-2 ● MONITORING WELL INSTALLED IN 1980

MW-33 ◑ MONITORING WELL INSTALLED IN 1991 OR 1992

SMW-2S ⊗ MONITORING WELL INSTALLED BY SCS

<100 COMBUSTIBLE VAPOR CONCENTRATION (PARTS PER MILLION)

N

0 80 160

SCALE IN FEET

VALLEY STREET

MERCER STREET

TERRY AVENUE NORTH

Unocal Property Line

MW-38 >10,000

MW-46 >10,000

MW-36 4,000

MW-47 >10,000

MW-48 >10,000

MW-29

Denny's Restaurant

MW-40 >10,000

MW-45 >10,000

City of Seattle Property

MW-32

MW-49

MW-3

MW-33 <100

MW-19

MW-35 <100

Unocal SS-5353

MW-37 >10,000

MW-2

SMW-1S

SMW-5

MW-18

MW-24

MW-32A <100

SMW-3

SMW-4

SMW-2S

MW-1

MW-34 1,100

City Park

MW-42 >10,000

MW-17

MW-11

MW-27

MW-41 3,700

MW-13

WESTLAKE AVENUE NORTH

MW-14

MW-15

MW-16

MW-44 >10,000

MW-43 >10,000

WESTLAKE AVENUE NORTH

BROAD STREET

MW-39 >10,000

SMW-2

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

2. Combustible vapor concentrations were measured with a Bacharach TLV sniffer calibrated to hexane.

Geo Engineers

COMBUSTIBLE VAPOR CONCENTRATIONS IN SELECTED WELLS ON 07/15/94

FIGURE 6

0161013R04:061395

0161013F.DWG

NLP:BDH

EXPLANATION:

MW-2 ● MONITORING WELL INSTALLED IN 1980

MW-33 ◑ MONITORING WELL INSTALLED IN 1991 OR 1992

SMW-2S ⊗ MONITORING WELL INSTALLED BY SCS

0.28 GROUND VACUUM ON 07/15/94

N

0 80 160

SCALE IN FEET

VALLEY STREET

MERCER STREET

TERRY AVENUE NORTH

Unocal Property Line

MW-38 0

MW-46 0

MW-36 0

MW-47 0

MW-48 0

MW-29

MW-45 0

Denny's Restaurant

MW-40 0.005

City of Seattle Property

MW-32

MW-49

MW-3

MW-33 0.01

MW-19

MW-35 0.20

Unocal SS-5353

MW-37 0.08

MW-2

SMW-1S

MW-18

MW-24

SMW-5

MW-32A 0.29

SMW-3

SMW-4

SMW-2S

MW-1

MW-34 0.28

City Park

MW-17

MW-42 0

MW-11

MW-27

MW-41 0.02

WESTLAKE AVENUE NORTH

MW-13

MW-15

MW-14

MW-16

MW-44 0

MW-43 0

WESTLAKE AVENUE NORTH

BROAD STREET

MW-39

SMW-2

Note: The locations of all features shown are approximate.

Geo Engineers

GROUND VACUUMS ON 07/15/94

FIGURE 7

NLP:BDH 01610136.DWG 0161013R04:061395

APPENDIX A

APPENDIX A

MONITORING AND RECOVERY WELLS MEASUREMENTS AND SAMPLING

GROUND WATER ELEVATIONS

Depths to the ground water table relative to the monitoring well casing rims were measured on the dates indicated in Table 4. The measurements were made using an electric water level indicator. The water level indicator was cleaned with a Liquinox solution wash and a distilled water rinse prior to use in each well. Ground water elevations were calculated by subtracting the water table depths from the casing rim elevations. The ground water elevations are summarized in Table 4.

FREE PRODUCT THICKNESSES

Free product thicknesses were measured in selected in monitoring wells on the dates indicated in Table 4. The measurements were made using an electric product probe.

COMBUSTIBLE VAPOR CONCENTRATIONS

Combustible vapor concentrations were measured in selected recovery and monitoring well casings on the dates indicated in Tables 5 and 6. A Bacharach TLV Sniffer calibrated to hexane was used to measure the combustible vapor concentrations in the well casings. A slip cap was used to produce a temporary seal in the monitoring well casings when obtaining vapor concentrations. The lower threshold of significance for the TLV Sniffer in this application is 100 ppm (parts per million), equivalent to 1 percent of the LEL (lower explosive limit) of hexane.

GROUND VACUUM

Ground vacuum was measured in the accessible monitoring and recovery well casings on the dates indicated in Tables 7 and 8. The measurements were made with a Magnehelic gauge with a resolution of 0.01 inches of water column. A slip cap enabled a tight fit around the monitoring well casings. Vacuum pressures were measured in the well casings while the on-site VES was operating.

VES MEASUREMENTS AND SAMPLING

MEASUREMENTS

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

Combustible vapor concentrations also were obtained from the system using a Bacharach TLV Sniffer calibrated to hexane. The sample port for vapor measurement and sampling is located in the vapor conveyance line between the blower and the discharge stack.

VAPOR SAMPLING

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

APPENDIX B

APPENDIX B

CHEMICAL ANALYTICAL PROGRAM

ANALYTICAL METHODS

Chain-of-custody procedures were followed during the transport of the field samples to the analytical laboratory. The analytical results, analytical methods reference and laboratory QA/QC (quality assurance/quality control) records are included in this appendix. The analytical results are also summarized in the text and tables of this report.

ANALYTICAL DATA REVIEW

The laboratory maintains an internal quality assurance program as documented in its laboratory quality assurance manual. The laboratory uses a combination of blanks, surrogate recoveries, duplicates, matrix spike recoveries, matrix spike duplicate recoveries, blank spike recoveries and blank spike duplicate recoveries to evaluate the validity of the analytical results. The laboratory also uses data quality goals for individual chemicals or groups of chemicals based on the long-term performance of the test methods. The data quality goals were included in the laboratory reports. The laboratory compared each group of samples with the existing data quality goals and noted any exceptions in the laboratory report. The laboratory QA/QC and data quality exceptions documented by the laboratory were reviewed by GeoEngineers using the applicable data validation guidelines from the following documents: "Guidance Document for the Assessment of RCRA Environmental Data Quality" draft dated 1988; "National Functional Guidelines for Organic Data Review" draft dated 1991; and "Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses" dated 1988.

ANALYTICAL DATA REVIEW SUMMARY

No significant data quality exceptions were noted in the laboratory report or during our review. Based on our data quality review, it is our opinion that the analytical data are of acceptable quality for their intended use.

Analytical**Technologies,**Inc. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

SIGNATURE PAGE

Reviewed by: _____
ATI Project Manager

Client:	GEO ENGINEERS REDMOND, WASHINGTON
Project Name:	UNOCAL SEATTLE
Project Number:	0161-013-R69T11.03
Project Location:	N/S
Accession Number:	405027
Project Manager:	NORM PURI
Sampled By:	N/S

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Analysis Report

Analysis: METHANE

Accession:	405027
Client:	GEO ENGINEERS
Project Number:	0161-013-R69T11.03
Project Name:	UNOCAL SEATTLE
Project Location:	N/S
Department:	SEMI-VOLATILE FUELS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"FINAL REPORT FORMAT - SINGLE"

Accession:	405027
Client:	GEO ENGINEERS
Project Number:	0161-013-R69T11.03
Project Name:	UNOCAL SEATTLE
Project Location:	N/S
Test:	METHANE
Analysis Method:	ASTM D1946
Extraction Method:	N/A
Matrix:	AIR
QC Level:	N

Lab Id:	001		Sample Date/Time:	28-APR-94 1010
Client Sample Id:	940428-1		Received Date:	02-MAY-94
Batch: SPA055			Extraction Date:	N/A
Blank: A	Dry Weight %:	N/A	Analysis Date:	03-MAY-94

Parameter:	Units:	Results:	Rpt Lmts:	Q:
METHANE	%	ND	0.05	
ANALYST	INITIALS	KW		

Comments:

Common notation for Organic reporting

I/S = NOT SUBMITTED
I/A = NOT APPLICABLE
) = DILUTED OUT
JG = MICROGRAMS
JG/L = PARTS PER BILLION.
JG/KG = PARTS PER BILLION.
1G/M3 = MILLIGRAM PER CUBIC METER.
PPMV = PART PER MILLION BY VOLUME.
1G/KG = PARTS PER MILLION.
1G/L = PARTS PER MILLION.
< = LESS THAN DETECTION LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS

SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

ORGANIC SOILS ARE REPORTED ON A DRYWEIGHT BASIS.

ND = NOT DETECTED ABOVE REPORTING LIMIT.

RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

ATI/GC/FID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME IONIZATION DETECTOR (FID).

ATI/GC/FIX
ATI GAS CHROMATOGRAPHIC METHOD FOR ANALYSIS OF FIXED GASES EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD) AND FLAME IONIZATION DETECTOR (FID).

ATI/GC/FPD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME PHOTOMETRIC DETECTOR (FPD) IN SULFUR-SPECIFIC MODE.

ATI/GC/PID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH PHOTOIONIZATION DETECTOR (PID).

ATI/GC/TCD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD).

LJT = LISA THOMASON
CD = CHRISTY DRAPER
IP = INGRID PITTMAN
RP = ROB PEREZ
SKR = SVETLANA RODKINA
DGH = DARREL HALSELL
KW = KAREN WADSWORTH
PB = PAMELA BREWTON
MV = MONIQUE VERHEYDEN
SW = STEVE WILHITE
DC = DAVID CELESTIAL

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Analysis Report

Analysis: TOTAL VOLATILE HYDROCARBONS IN CANISTER

Accession:	405027
Client:	GEO ENGINEERS
Project Number:	0161-013-R69T11.03
Project Name:	UNOCAL SEATTLE
Project Location:	N/S
Department:	GC/VOA

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Accession: 405027
Client: GEO ENGINEERS
Project Number: 0161-013-R69T11.03
Project Name: UNOCAL SEATTLE
Project Location: N/S
Test: TOTAL VOLATILE HYDROCARBONS IN CANISTER
Analysis Method: 5030/8020/8015 / SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
Extraction Method: N/A
Matrix: AIR
QC Level: I

Lab Id: 001
Client Sample Id: 940428-1
Sample Date/Time: 28-APR-94 1010
Received Date: 02-MAY-94

Batch: ETB087
Blank: A
Dry Weight %: N/A
Extraction Date: N/A
Analysis Date: 03-MAY-94

Parameter:	Units:	Results:	Rpt Lmts:	Q:
TOTAL VOLATILE HYDROCARBONS	MG/M3	ND	500	
ANALYST	INITIALS	JP		

Comments:

ANALYTICAL TECHNOLOGIES, INC. 11 EAST OLIVE ROAD PENSACOLA, FLORIDA 32514

QUALITY CONTROL REPORT

ANALYSIS: METHANE

ACCESSION:	405027
CLIENT:	GEO ENGINEERS
PROJECT NUMBER:	0161-013-R69T11.03
PROJECT NAME:	UNOCAL SEATTLE
PROJECT LOCATION:	N/S
DEPARTMENT:	SEMI-VOLATILE FUELS

NITROGEN BLANK ANALYSIS

DATE: 5-3-94

METHOD: ASTM D1946

BATCH: SPA055

COMPOUND	UNITS	REPORTING LIMIT	RESULT
METHANE	VOL. %	0.05	ND

CHECK STANDARD (POST-RUN)

DATE: 5-3-94

METHOD: ASTM D1946

BATCH: SPA055

COMPOUND	RF (IC)	RF (PS)	%D	QC LIMITS
METHANE	1.97 E-5	1.99 E-5	1.0	15

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Quality Control Report

Analysis: TOTAL VOLATILE HYDROCARBONS IN CANISTER

Accession:	405027
Client:	GEO ENGINEERS
Project Number:	0161-013-R69T11.03
Project Name:	UNOCAL SEATTLE
Project Location:	N/S
Department:	GC/VOA

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Date 04-May-94

"QC Report"

Title: Bag/Can Blank
Batch: ETB087
Analysis Method: 5030/8020/8015 / SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
Extraction Method: N/A

Blank Id: A Date Analyzed: 03-MAY-94 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
BENZENE	MG/M3	ND	1
ETHYL BENZENE	MG/M3	ND	1
TOLUENE	MG/M3	ND	5
XYLENES	MG/M3	ND	2
TOTAL PETROLEUM HYDROCARBON	MG/M3	ND	500
TRIFLUOROTOLUENE (PID)	%REC/SURR	96	70-130
TRIFLUOROTOLUENE (FID)	%REC/SURR	108	70-130
ANALYST	INITIALS	JA	

Comments:

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"QC Report"

Title: Bag/Can Reagent
Batch: ETB087
Analysis Method: 5030/8020/8015 / SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
Extraction Method: N/A

RS Date Analyzed: 03-MAY-94
RSD Date Analyzed: 03-MAY-94

RS Date Extracted: N/A
RSD Date Extracted: N/A

Parameters:	Spike Added	Sample Conc	RS Conc	RS %Rec	RSD Conc	RSD %Rec	RPD	RPD Lmts	Rec Lmts
BENZENE	50	<1	51	102	48	96	6	11	82-120
TOLUENE	50	<5	48	96	47	94	2	14	77-125
Surrogates:									
TRIFLUOROTOLUENE (PID)				106		95			70-130

Comments:

Notes:
UNITS IN MG/M3 = MILLIGRAM PER CUBIC METER N/S = NOT SUBMITTED
< = LESS THAN REPORTING LIMIT
SOURCE FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND METHOD REFERENCE.
UNITS IN UG = MICROGRAMS. N/S = NOT SUBMITTED

Common notation for Organic reporting

/S = NOT SUBMITTED
/A = NOT APPLICABLE
= DILUTED OUT
UG/L = PARTS PER BILLION.
UG/KG = PARTS PER BILLION.
G/KG = PARTS PER MILLION.
G/L = PARTS PER MILLION.
< = LESS THAN DETECTION LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS
OURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM
ND REFERENCED METHOD.
RGANIC SOILS ARE REPORTED ON A DRY WEIGHT BASIS.
** COMPOUNDS FLAGGED IN METHOD ARE NOT WITHIN THE FIVE POINT CURVE. THEY
RE SEARCHED FOR QUALITATIVELY.
D = NOT DETECTED ABOVE REPORTING LIMIT.

SR-SHELLEY REAMSMA
MLP-MELISSA POPE
SH-TRICIA HOLSTON
KD-LEIGH DUVALL
M-MIKE MCKENZIE
KWS-KENDALL SMITH
KS-KIMBERLY SMITH
F-GREG FOOTE
C-NICOLE CALL
JP-JOSEPH POPE
JA-JENNIFER ALEXANDER
B-HEATHER BIANCALANA
M-PENNY A. MALOUIN
W-MARIE CLAUDIA WALTON
SB-SHARON BRADDOCK

PROJECT SAMPLE INSPECTION FORM

Accession #: 405027 Date received: 5/2/94

1.	Was there a Chain of Custody?	(YES)	NO	7.	Are samples correctly preserved for analysis required?	(YES)	NO
2.	Was Chain of Custody properly relinquished?	(YES)	NO	8.	Is there sufficient volume for analysis requested?	(YES)	NO
3.	Were samples received cold? (At 4° or on ice)	(YES)	NO	9.	Were samples received within holding time?	(YES)	NO
4.	Were all containers properly labeled and identified?	(YES)	NO	10.	Was there headspace greater than ¼" in diameter in volatile bottles?	YES	NO (N/A)
5.	Were samples received in proper containers for analysis requested?	(YES)	NO	11.	If sent, were matrix spike bottles returned?	YES	NO (N/A)
6.	Were all sample containers received intact?	(YES)	NO				

Tracking Number: 2570 2497 380 Shipped By: UPS

Cooler Number: N/S

Out of Control Events and Inspection Comments:

Inspected By: SF Date: 5/2/94 Logged By: SF Date: 5/2/94

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

DATE: 7/28/94 Page 1 of 1 ATI ACCESSION # 405027

COMPANY: GEOENGINEERS, INC
REPORT TO: Norm Puri
ADDRESS: 8410 154TH AVE NE
REDMOND, WA 98052
PHONE: (206) 861-6000 FAX: (206) 861-6050
PROJECT MANAGER: Norm Puri
PROJECT NUMBER: 0161-013-R6 T11.03
PROJECT NAME: Lowell-Seattle

ATI will DISPOSE / RETURN samples (circle one)

Sample ID	Date	Time	Matrix	LabID	FUELS: TPH-HCID WA/OR	FUELS: BETX/TPH-G combo WA/OR	FUELS: BETX (by 8020) WA/OR	FUELS: TPH-G WA/OR	FUELS: TPH-D WA/OR	FUELS: 8015 modified	FUELS: 418.1 WA/OR	FUELS: 413.2	FUELS: AK-GRO	FUELS: AK-DRO	ORGANIC COMPOUNDS: 8240 GCMS Volatiles	ORGANIC COMPOUNDS: 8270 GCMS Semivolatiles	ORGANIC COMPOUNDS: 8080 Pesticides/PCBs	ORGANIC COMPOUNDS: PCB only (by 8080) STD/lo level	ORGANIC COMPOUNDS: 8010 Halogenated VOCs	ORGANIC COMPOUNDS: 8020 Aromatic VOCs	ORGANIC COMPOUNDS: 8310 HPLC PAHs	ORGANIC COMPOUNDS: 8040 Phenols	ORGANIC COMPOUNDS: 8140 OP Pesticides	ORGANIC COMPOUNDS: 8150 OC Herbicides	METALS: Metals (Indicate below *)	METALS: Total Lead	METALS: Priority Pollutant Metals (13)	METALS: TAL Metals (23)	TCLP: TCLP-Volatiles (ZHE-8240)	TCLP: TCLP-Semivolatiles (8270)	TCLP: TCLP-Pesticides (8080)	TCLP: TCLP-Herbicides (8150)	TCLP: TCLP-Metals (8 metals)	OTHER: % Moisture (please indicate)	OTHER: Total Volatile Hydrocarbons	OTHER: Methane	OTHER:	OTHER:	Total # of Containers/sample
940428-1	07/28/94	10:10																																X	X				

Turnaround Time

STANDARD TAT	X
1 WEEK TAT	
4 WORK DAY TAT	
3 WORK DAY TAT	
2 WORK DAY TAT	
24 HOUR TAT	

Sample Receipt

TOTAL # CONTAINERS RECVD	
COC SEALS PRESENT?	
COC SEALS INTACT?	
RECEIVED COLD?	
RECEIVED INTACT?	
RECEIVED VIA:	

Special Instructions:
No BETX with TVH

* Metals needed:

Relinquished By:	Relinquished By:	Relinquished By:
Date: 7/28/94	Date:	Date:
Time: 14:45	Time:	Time:
Received By:	Received By:	Received By:
Date: 5/3/94	Date:	Date:
Time: 08:40	Time:	Time:

SIGNATURE PAGE

Reviewed by: Cathy Papadakis
ATI Project Manager

Client:	GEO ENGINEERS REDMOND, WASHINGTON
Project Name:	UNOCAL SS-5353
Project Number:	0161-013-R69
Project Location:	WESTLAKE & MERCER
Accession Number:	407482
Project Manager:	NORM PURI
Sampled By:	NLP

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Analysis Report

Analysis: METHANE

Accession:	407482
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL SS-5353
Project Location:	WESTLAKE & MERCER
Department:	SEMI-VOLATILE FUELS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"FINAL REPORT FORMAT - SINGLE"

Accession:	407482
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL SS-5353
Project Location:	WESTLAKE & MERCER
Test:	METHANE
Analysis Method:	ASTM D1946
Extraction Method:	N/A
Matrix:	AIR
QC Level:	N

Lab Id:	001		Sample Date/Time:	15-JUL-94	0630
Client Sample Id:	940715-1		Received Date:	19-JUL-94	
Batch: SPA083			Extraction Date:	N/A	
Blank: A	Dry Weight %:	N/A	Analysis Date:	23-JUL-94	

Parameter:	Units:	Results:	Rpt Lmts:	Q:
METHANE	%	ND	0.05	
ANALYST	INITIALS	KW		

Comments:

Common notation for Organic reporting

/S = NOT SUBMITTED
/A = NOT APPLICABLE
) = DILUTED OUT
JG = MICROGRAMS
G/L = PARTS PER BILLION.
G/KG = PARTS PER BILLION.
IG/M3 = MILLIGRAM PER CUBIC METER.
PPMV = PART PER MILLION BY VOLUME.
IG/KG = PARTS PER MILLION.
G/L = PARTS PER MILLION.
= LESS THAN DETECTION LIMIT.
= VALUES OUTSIDE OF QUALITY CONTROL LIMITS

OURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM
ND REFERENCED METHOD.

RGANIC SOILS ARE REPORTED ON A DRYWEIGHT BASIS.

) = NOT DETECTED ABOVE REPORTING LIMIT.

PT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

PD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

TI/GC/FID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME IONIZATION DETECTOR (FID).

TI/GC/FIX
ATI GAS CHROMATOGRAPHIC METHOD FOR ANALYSIS OF FIXED GASES EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD) AND FLAME IONIZATION DETECTOR (FID).

TI/GC/FPD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME PHOTOMETRIC DETECTOR (FPD) IN SULFUR-SPECIFIC MODE.

TI/GC/PID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH PHOTOIONIZATION DETECTOR (PID).

TI/GC/TCD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD).

T = LISA THOMASON
= CHRISTY DRAPER
KR = SVETLANA RODKINA
GH = DARREL HALSELL
= KAREN WADSWORTH
= PAMELA BREWTON
V = MONIQUE VERHEYDEN
W = STEVE WILHITE

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Analysis Report

Analysis: VOLATILE METHOD 8240 BAG/CAN

Accession:	407482
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL SS-5353
Project Location:	WESTLAKE & MERCER
Department:	ORGANIC/MS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"FINAL REPORT FORMAT - SINGLE"

Accession: 407482
Client: GEO ENGINEERS
Project Number: 0161-013-R69
Project Name: UNOCAL SS-5353
Project Location: WESTLAKE & MERCER
Test: VOLATILE METHOD 8240 BAG/CAN
Analysis Method: 8240 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992
Extraction Method: N/A
Matrix: AIR
QC Level: I

Lab Id: 001
Client Sample Id: 940715-1

Sample Date/Time: 15-JUL-94 0630
Received Date: 19-JUL-94

Batch: MAB089
Blank: C

Dry Weight %: N/A

Extraction Date: N/A
Analysis Date: 27-JUL-94

Parameter:	Units:	Results:	Rpt Lmts:	Q:
ACETONE	MG/M3	ND	0.2	
ACROLEIN	MG/M3	ND	2	
ACRYLONITRILE	MG/M3	ND	2	
BROMODICHLOROMETHANE	MG/M3	ND	0.06	
BROMOFORM	MG/M3	ND	0.06	
BROMOMETHANE	MG/M3	ND	0.06	
2-BUTANONE (MEK)	MG/M3	ND	0.2	
CARBON DISULFIDE	MG/M3	ND	0.06	
CARBON TETRACHLORIDE	MG/M3	ND	0.06	
CHLOROBENZENE	MG/M3	ND	0.06	
CHLOROETHANE	MG/M3	ND	0.06	
2-CHLOROETHYLVINYL ETHER	MG/M3	ND	0.06	
CHLOROFORM	MG/M3	ND	0.06	
CHLOROMETHANE	MG/M3	ND	0.06	
CHLORODIBROMOMETHANE	MG/M3	ND	0.06	
DIBROMOMETHANE	MG/M3	ND	0.06	
DICHLORODIFLUOROMETHANE	MG/M3	ND	0.06	
1,1-DICHLOROETHANE	MG/M3	ND	0.06	
1,2-DICHLOROETHANE	MG/M3	ND	0.06	
1,1-DICHLOROETHENE	MG/M3	ND	0.06	
TRANS 1,2-DICHLOROETHYLENE	MG/M3	ND	0.06	
CIS 1,2 DICHLOROETHYLENE	MG/M3	ND	0.06	
1,2-DICHLOROPROPANE	MG/M3	ND	0.06	
CIS-1,3-DICHLOROPROPENE	MG/M3	ND	0.06	
TRANS-1,3-DICHLOROPROPENE	MG/M3	ND	0.06	
1,4-DICHLORO-2-BUTENE	MG/M3	ND	0.06	
ETHYL METHACRYLATE	MG/M3	ND	0.06	
2-HEXANONE	MG/M3	ND	0.2	
IODOMETHANE	MG/M3	ND	0.06	
METHYLENE CHLORIDE	MG/M3	ND	0.1	
4-METHYL-2-PENTANONE	MG/M3	ND	0.2	
STYRENE	MG/M3	ND	0.06	
1,1,2,2-TETRACHLOROETHANE	MG/M3	ND	0.06	
TETRACHLOROETHENE	MG/M3	ND	0.06	
1,1,1-TRICHLOROETHANE	MG/M3	ND	0.06	
1,1,2-TRICHLOROETHANE	MG/M3	ND	0.06	
TRICHLOROETHENE	MG/M3	ND	0.06	
TRICHLOROFLUOROMETHANE	MG/M3	ND	0.06	
1,2,3 TRICHLOROPROPANE	MG/M3	ND	0.06	

"FINAL REPORT FORMAT - SINGLE"

Accession:	407482
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL SS-5353
Project Location:	WESTLAKE & MERCER
Test:	VOLATILE METHOD 8240 BAG/CAN
Analysis Method:	8240 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992
Extraction Method:	N/A
Matrix:	AIR
QC Level:	I

Lab Id: 001 Sample Date/Time: 15-JUL-94 0630
Client Sample Id: 940715-1 Received Date: 19-JUL-94

Parameter:	Units:	Results:	Rpt Lmts:	Q:
VINYL ACETATE	MG/M3	ND	0.06	
VINYL CHLORIDE	MG/M3	ND	0.06	
BROMOFLUOROBENZENE	%REC/SURR	102	82-118	
1,2-DICHLOROETHANE-D4	%REC/SURR	114	78-122	
TOLUENE-D8	%REC/SURR	104	81-127	
ANALYST	INITIALS	LL		

Comments:

ANALYTICAL TECHNOLOGIES, INC. 11 EAST OLIVE ROAD PENSACOLA, FLORIDA 32514

QUALITY CONTROL REPORT

ANALYSIS: METHANE

ACCESSION:	407482
CLIENT:	GEO ENGINEERS
PROJECT NUMBER:	0161-013-R69
PROJECT NAME:	UNOCAL SS-5353
PROJECT LOCATION:	WESTLAKE & MERCER
DEPARTMENT:	SEMI-VOLATILE FUELS

NITROGEN BLANK ANALYSIS

DATE: 7/23/94

METHOD: ASTM D1946

BATCH: SPA083

COMPOUND	UNITS	REPORTING LIMIT	RESULT
METHANE	VOL.%	0.05	ND

INITIAL CALIBRATION

DATE: 7/23/94

METHOD: ASTM D1946

BATCH: SPA083

COMPOUND	RF 1	RF 2	RF 3	RF 4	RF 5	AVG RF	SD	%RSD
METHANE	1.95 E-5	1.98 E-5	3.00 E-5			2.31 E-5	5.98 E-6	26

CHECK STANDARD (POST-RUN)

DATE: 7/23/94

METHOD: ASTM D1946

BATCH: SPA083

COMPOUND	RF (IC)	RF (PS)	%D	QC LIMITS
METHANE	2.31 E-5	1.95 E-5	15	N/A

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Quality Control Report

Analysis: VOLATILE METHOD 8240 BAG/CAN

Accession:	407482
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL SS-5353
Project Location:	WESTLAKE & MERCER
Department:	ORGANIC/MS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Date 03-Aug-94

"QC Report"

Title: Bag/Can Blank
Batch: MAB089
Analysis Method: 8240 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992
Extraction Method: N/A

Blank Id: C Date Analyzed: 27-JUL-94 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
ACETONE	MG/M3	ND	0.1
ACROLEIN	MG/M3	ND	1
ACRYLONITRILE	MG/M3	ND	1
BENZENE	MG/M3	ND	0.03
BROMODICHLOROMETHANE	MG/M3	ND	0.03
BROMOFORM	MG/M3	ND	0.03
BROMOMETHANE	MG/M3	ND	0.03
2-BUTANONE (MEK)	MG/M3	ND	0.1
CARBON DISULFIDE	MG/M3	ND	0.03
CARBON TETRACHLORIDE	MG/M3	ND	0.03
CHLOROBENZENE	MG/M3	ND	0.03
CHLOROETHANE	MG/M3	ND	0.03
2-CHLOROETHYLVINYL ETHER	MG/M3	ND	0.03
CHLOROFORM	MG/M3	ND	0.03
CHLOROMETHANE	MG/M3	ND	0.03
CHLORODIBROMOMETHANE	MG/M3	ND	0.03
DIBROMOMETHANE	MG/M3	ND	0.03
DICHLORODIFLUOROMETHANE	MG/M3	ND	0.03
1,1-DICHLOROETHANE	MG/M3	ND	0.03
1,2-DICHLOROETHANE	MG/M3	ND	0.03
1,1-DICHLOROETHENE	MG/M3	ND	0.03
TRANS 1,2-DICHLOROETHYLENE	MG/M3	ND	0.03
CIS 1,2 DICHLOROETHYLENE	MG/M3	ND	0.03
1,2-DICHLOROPROPANE	MG/M3	ND	0.03
CIS-1,3-DICHLOROPROPENE	MG/M3	ND	0.03
TRANS-1,3-DICHLOROPROPENE	MG/M3	ND	0.03
1,4-DICHLORO-2-BUTENE	MG/M3	ND	0.03
ETHYL BENZENE	MG/M3	ND	0.03
ETHYL METHACRYLATE	MG/M3	ND	0.03
2-HEXANONE	MG/M3	ND	0.1
IODOMETHANE	MG/M3	ND	0.03
METHYLENE CHLORIDE	MG/M3	ND	0.07
4-METHYL-2-PENTANONE	MG/M3	ND	0.1
STYRENE	MG/M3	ND	0.03
1,1,2,2-TETRACHLOROETHANE	MG/M3	ND	0.03
TETRACHLOROETHENE	MG/M3	ND	0.03
TOLUENE	MG/M3	ND	0.03
1,1,1-TRICHLOROETHANE	MG/M3	ND	0.03
1,1,2-TRICHLOROETHANE	MG/M3	ND	0.03
TRICHLOROETHENE	MG/M3	ND	0.03
TRICHLOROFLUOROMETHANE	MG/M3	ND	0.03
1,2,3 TRICHLOROPROPANE	MG/M3	ND	0.03
VINYL ACETATE	MG/M3	ND	0.03
VINYL CHLORIDE	MG/M3	ND	0.03
TOTAL XYLENES	MG/M3	ND	0.03
BROMOFLUOROBENZENE	%REC/SURR	101	82-118

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"QC Report"

Title: Bag/Can Blank
Batch: MAB089
Analysis Method: 8240 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992
Extraction Method: N/A

Parameters:	Units:	Results:	Reporting Limits:
1,2-DICHLOROETHANE-D4	%REC/SURR	105	78-122
TOLUENE-D8	%REC/SURR	104	81-127
ANALYST	INITIALS	LL	

Comments:

"QC Report"

Title: Bag/Can Reagent
Batch: MAB089
Analysis Method: 8240 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992
Extraction Method: N/A

RS Date Analyzed: 26-JUL-94
RSD Date Analyzed: 26-JUL-94

RS Date Extracted: N/A
RSD Date Extracted: N/A

Parameters:	Spike Added	Sample Conc	RS Conc	RS %Rec	RSD Conc	RSD %Rec	RPD	RPD Lmts	Rec Lmts
1,1-DICHLOROETHENE	2.0	<0.03	1.9	95	2.0	100	5	20	61-145
TRICHLOROETHENE	2.0	<0.03	2.0	100	2.0	100	0	20	71-120
BENZENE	2.0	<0.03	2.2	110	2.2	110	0	20	76-127
TOLUENE	2.0	<0.03	2.0	100	2.1	105	5	20	76-125
CHLOROBENZENE	2.0	<0.03	2.1	105	2.2	110	5	20	75-130
Surrogates:									
1,2-DICHLOROETHANE-D4				101		101			78-122
TOLUENE-D8				99		98			81-127
BROMOFLUOROBENZENE				104		103			82-118

Comments:

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
MG/M3 = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

Common notation for Organic reporting

N/S = NOT SUBMITTED
N/A = NOT APPLICABLE
D = DILUTED OUT
UG/L = PARTS PER BILLION.
UG/KG = PARTS PER BILLION.
MG/KG = PARTS PER MILLION.
MG/L = PARTS PER MILLION.
MG/M3 = MILLIGRAMS PER CUBIC METER.
NG = NANOGRAMS.
UG = MICROGRAMS.
PPBV = PARTS PER BILLION/VOLUME.
< = LESS THAN DETECTION LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS
J = THE REPORTED VALUE IS EITHER LESS THAN THE REPORTING LIMIT BUT GREATER THAN ZERO, OR QUANTITATED AS A TIC; THEREFORE, IT IS ESTIMATED.
JJ = REPORTED VALUE IS ESTIMATED DUE TO MATRIX INTERFERENCE.
ND = NOT DETECTED ABOVE REPORT LIMIT.
RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.
RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

ORGANIC SOILS ARE REPORTED ON A DRY WEIGHT BASIS.

DUE TO THE NATURE OF THE SAMPLE MATRIX, MATRIX SPIKE/MATRIX SPIKE DUPLICATE ANALYSIS CANNOT BE PERFORMED FOR AIR ANALYSIS.

LP = LEVERNE PETERSON	RW = RITA WINGO
DWB = DAVID BOWERS	LD = LARRY DILMORE
DB = DENNIS BESON	DC = DAVID CELESTIAL
LL = LANCE LARSON	RB = RAFAEL BARRAZA
JA = JENNIFER ALEXANDER	

Analytical Technologies, Inc.

PROJECT SAMPLE INSPECTION FORM

Accession #: 407482 Date received: 7/19/94

1.	Was there a Chain of Custody?	(YES)	NO	7.	Are samples correctly preserved for analysis required?	(YES)	NO	
2.	Was Chain of Custody properly relinquished?	(YES)	NO	8.	Is there sufficient volume for analysis requested?	(YES)	NO	
3.	Were samples received cold? (At 4° or on ice)	(YES)	NO	9.	Were samples received within holding time?	(YES)	NO	
4.	Were all containers properly labeled and identified?	(YES)	NO	10.	Was there headspace greater than ¼" in diameter in volatile bottles?	YES	NO	(N/A)
5.	Were samples received in proper containers for analysis requested?	(YES)	NO	11.	If sent, were matrix spike bottles returned?	YES	NO	(N/A)
6.	Were all sample containers received intact?	(YES)	NO					

Tracking Number: 933-0ES Shipped By: UPS

Cooler Number: N/S

Out of Control Events and Inspection Comments:

Received on 7/19 but not logged in until 7/21/94.

Inspected By: SF Date: 7/21/94 Logged By: SF Date: 7/21/94

SF

CHAIN OF CUSTODY

ATI LAB. I.D. # 407482

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

PART 1 — Bottle Shipment Information

CLIENT:	CLIENT PROJECT NUMBER:
Geo Engineering	

SAMPLE CONTAINERS SHIPPED

QTY.	PRESERVATIVE: H_2SO_4	HNO3	HC1	Zn ACETATE	$Na_2S_2O_3$	UNPRESERVED	NaOH	PLASTIC CONTAINERS: 4 oz.	8 oz.	16 oz.	32 oz.	½ gallon	1 gallon	Whirl-pak	100-ML SPECIMEN CUP	GLASS CONTAINERS: 120 ml (A)	120 ml (C)	1 liter (A)	1 liter (C)	40 ml Vial	4 oz. wm	8 oz. wm	16 oz. wm	32 oz. wm	DI Trip Blank	6.0 Summa Canister
1																										AT060

RELINQUISHED	TIME	DATE	RECEIVED	TIME	DATE
[signature]	0830	7-06-94			

PART 2 — Sample Information

SAMPLE MATRIX

DW DRINKINGWATER
WW WASTEWATER
GW GROUNDWATER
SW SURFACEWATER
SO SOIL
OL OIL
AR AIR
SL SLUDGE

PARAMETERS AND PRESERVATIVES

SAMPLE I.D.	DATE	TIME	MATRIX	Total Volatile Hydrocarbons (as BETX)	Methane								TOTAL	LAB USE ONLY
940715-1	7/15/94	0630	Air	X	X									

TOTAL NUMBER OF BOTTLES/CONTAINERS

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME
[signature]	7/15/94	0700	Suzanne R. Fox	7/19/94	1000

CLIENT GeoEngineering PROJECT NUMBER 0161-011-069

Analytical Technologies, Inc. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

SIGNATURE PAGE

Reviewed by: _____
ATI Project Manager

Client: GEO ENGINEERS
REDMOND, WASHINGTON

Project Name: UNOCAL STATION 5353
Project Number: 0161-013-R69
Project Location: WESTLAKE
Accession Number: 409820

Project Manager: NORM L. PURI
Sampled By: ALLAN W. MILLS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Analysis Report

Analysis: METHANE

Accession:	409820
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL STATION 5353
Project Location:	WESTLAKE
Department:	SEMI-VOLATILE FUELS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"FINAL REPORT FORMAT - SINGLE"

Accession:	409820
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL STATION 5353
Project Location:	WESTLAKE
Test:	METHANE
Analysis Method:	ASTM D1946
Extraction Method:	N/A
Matrix:	AIR
QC Level:	N

Lab Id:	001		Sample Date/Time:	22-SEP-94 0734
Client Sample Id:	940922-1		Received Date:	26-SEP-94
Batch: SPA095			Extraction Date:	N/A
Blank: A	Dry Weight %:	N/A	Analysis Date:	30-SEP-94

Parameter:	Units:	Results:	Rpt Lmts:	Q:
METHANE	%	ND	0.05	
ANALYST	INITIALS	KW		

Comments:

Common notation for Organic reporting

/S = NOT SUBMITTED
/A = NOT APPLICABLE
= DILUTED OUT
= MICROGRAMS
G/L = PARTS PER BILLION.
G/KG = PARTS PER BILLION.
G/M3 = MILLIGRAM PER CUBIC METER.
PMV = PART PER MILLION BY VOLUME.
G/KG = PARTS PER MILLION.
G/L = PARTS PER MILLION.
= LESS THAN DETECTION LIMIT.
= VALUES OUTSIDE OF QUALITY CONTROL LIMITS

URCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM
D REFERENCED METHOD.

RGANIC SOILS ARE REPORTED ON A DRYWEIGHT BASIS.

= NOT DETECTED ABOVE REPORTING LIMIT.

PT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

D = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

TI/GC/FID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME IONIZATION DETECTOR (FID).

TI/GC/FIX
ATI GAS CHROMATOGRAPHIC METHOD FOR ANALYSIS OF FIXED GASES EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD) AND FLAME IONIZATION DETECTOR (FID).

TI/GC/FPD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME PHOTOMETRIC DETECTOR (FPD) IN SULFUR-SPECIFIC MODE.

TI/GC/PID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH PHOTOIONIZATION DETECTOR (PID).

I/GC/TCD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD).

T = LISA THOMASON
KR = SVETLANA RODKINA
GH = DARREL HALSELL
= KAREN WADSWORTH
= MONIQUE VERHEYDEN
= ROBERT PEREZ
LK = KERRY KUST
W = STEVE WILHITE
P = JACKIE PRICE
F = STEVE FILOROMO

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Analysis Report

Analysis: VOLATILE METHOD 8240 BAG/CAN

Accession:	409820
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL STATION 5353
Project Location:	WESTLAKE
Department:	ORGANIC/MS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"FINAL REPORT FORMAT - SINGLE"

Accession:	409820
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL STATION 5353
Project Location:	WESTLAKE
Test:	VOLATILE METHOD 8240 BAG/CAN
Analysis Method:	8240 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992
Extraction Method:	N/A
Matrix:	AIR
QC Level:	I

Lab Id:	001	Sample Date/Time:	22-SEP-94 0734
Client Sample Id:	940922-1	Received Date:	26-SEP-94
Batch: MAB115		Extraction Date:	N/A
Blank: B	Dry Weight %: N/A	Analysis Date:	06-OCT-94

Parameter:	Units:	Results:	Rpt Lmts:	Q:
ACETONE	MG/M3	ND	0.1	
ACROLEIN	MG/M3	ND	1	
ACRYLONITRILE	MG/M3	ND	1	
BROMODICHLOROMETHANE	MG/M3	ND	0.03	
BROMOFORM	MG/M3	ND	0.03	
BROMOMETHANE	MG/M3	ND	0.03	
2-BUTANONE (MEK)	MG/M3	ND	0.1	
CARBON DISULFIDE	MG/M3	ND	0.03	
CARBON TETRACHLORIDE	MG/M3	ND	0.03	
CHLOROBENZENE	MG/M3	ND	0.03	
CHLOROETHANE	MG/M3	ND	0.03	
2-CHLOROETHYLVINYL ETHER	MG/M3	ND	0.03	
CHLOROFORM	MG/M3	ND	0.03	
CHLOROMETHANE	MG/M3	ND	0.03	
CHLORODIBROMOMETHANE	MG/M3	ND	0.03	
DIBROMOMETHANE	MG/M3	ND	0.03	
DICHLORODIFLUOROMETHANE	MG/M3	ND	0.03	
1,1-DICHLOROETHANE	MG/M3	ND	0.03	
1,2-DICHLOROETHANE	MG/M3	ND	0.03	
1,1-DICHLOROETHENE	MG/M3	ND	0.03	
TRANS 1,2-DICHLOROETHYLENE	MG/M3	ND	0.03	
CIS 1,2 DICHLOROETHYLENE	MG/M3	ND	0.03	
1,2-DICHLOROPROPANE	MG/M3	ND	0.03	
CIS-1,3-DICHLOROPROPENE	MG/M3	ND	0.03	
TRANS-1,3-DICHLOROPROPENE	MG/M3	ND	0.03	
1,4-DICHLORO-2-BUTENE	MG/M3	ND	0.03	
ETHYL METHACRYLATE	MG/M3	ND	0.03	
2-HEXANONE	MG/M3	ND	0.1	
IODOMETHANE	MG/M3	ND	0.03	
METHYLENE CHLORIDE	MG/M3	ND	0.07	
4-METHYL-2-PENTANONE	MG/M3	ND	0.1	
STYRENE	MG/M3	ND	0.03	
1,1,2,2-TETRACHLOROETHANE	MG/M3	ND	0.03	
TETRACHLOROETHENE	MG/M3	ND	0.03	
1,1,1-TRICHLOROETHANE	MG/M3	ND	0.03	
1,1,2-TRICHLOROETHANE	MG/M3	ND	0.03	
TRICHLOROETHENE	MG/M3	ND	0.03	
TRICHLOROFLUOROMETHANE	MG/M3	ND	0.03	
1,2,3 TRICHLOROPROPANE	MG/M3	ND	0.03	

"FINAL REPORT FORMAT - SINGLE"

Accession:	409820
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL STATION 5353
Project Location:	WESTLAKE
Test:	VOLATILE METHOD 8240 BAG/CAN
Analysis Method:	8240 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992
Extraction Method:	N/A
Matrix:	AIR
QC Level:	I

Lab Id: 001 Sample Date/Time: 22-SEP-94 0734
Client Sample Id: 940922-1 Received Date: 26-SEP-94

Parameter:	Units:	Results:	Rpt Lmts:	Q:
VINYL ACETATE	MG/M3	ND	0.03	
VINYL CHLORIDE	MG/M3	ND	0.03	
BROMOFLUOROBENZENE	%REC/SURR	103	82-118	
1,2-DICHLOROETHANE-D4	%REC/SURR	109	78-122	
TOLUENE-D8	%REC/SURR	96	81-127	
ANALYST	INITIALS	LL		

Comments:

NITROGEN BLANK ANALYSIS

DATE: SEPT-30-94

METHOD: ASTM D1946

BATCH: SPA095

COMPOUND	UNITS	REPORTING LIMIT	RESULT
METHANE	VOL.%	0.05	ND

INITIAL CALIBRATION

DATE: JUL-23-94

METHOD: ASTM D1946

BATCH: SPA095

COMPOUND	RF 1	RF 2	RF 3	RF 4	RF 5	AVG RF	SD	%RSD
METHANE	1.95 E-5	1.98 E-5	1.95 E-5			1.96E-5	1.73 E-5	0.88

CONTINUING CALIBRATION

DATE: SEPT-30-94

METHOD: ASTM D1946

BATCH: SPA095

COMPOUND	RF (IC)	RF (CC)	%D	QC LIMITS
METHANE	1.96E-5	1.97E-5	0.51	20

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.

CHECK STANDARD (POST-RUN)

DATE: SEPT-30-94

METHOD: ASTM D1946

BATCH: SPA095

COMPOUND	RF (IC)	RF (PS)	%D	QC LIMITS
METHANE	1.97E-5	1.96E-5	0.51	20

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Quality Control Report

Analysis: VOLATILE METHOD 8240 BAG/CAN

Accession:	409820
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL STATION 5353
Project Location:	WESTLAKE
Department:	ORGANIC/MS

"QC Report"

Title: Bag/Can Blank
Batch: MAB115
Analysis Method: 8240 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992
Extraction Method: N/A

Blank Id: B Date Analyzed: 06-OCT-94 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
ACETONE	MG/M3	ND	0.1
ACROLEIN	MG/M3	ND	1
ACRYLONITRILE	MG/M3	ND	1
BENZENE	MG/M3	ND	0.03
BROMODICHLOROMETHANE	MG/M3	ND	0.03
BROMOFORM	MG/M3	ND	0.03
BROMOMETHANE	MG/M3	ND	0.03
2-BUTANONE (MEK)	MG/M3	ND	0.1
CARBON DISULFIDE	MG/M3	ND	0.03
CARBON TETRACHLORIDE	MG/M3	ND	0.03
CHLOROBENZENE	MG/M3	ND	0.03
CHLOROETHANE	MG/M3	ND	0.03
2-CHLOROETHYLVINYL ETHER	MG/M3	ND	0.03
CHLOROFORM	MG/M3	ND	0.03
CHLOROMETHANE	MG/M3	ND	0.03
CHLORODIBROMOMETHANE	MG/M3	ND	0.03
DIBROMOMETHANE	MG/M3	ND	0.03
DICHLORODIFLUOROMETHANE	MG/M3	ND	0.03
1,1-DICHLOROETHANE	MG/M3	ND	0.03
1,2-DICHLOROETHANE	MG/M3	ND	0.03
1,1-DICHLOROETHENE	MG/M3	ND	0.03
TRANS 1,2-DICHLOROETHYLENE	MG/M3	ND	0.03
CIS 1,2 DICHLOROETHYLENE	MG/M3	ND	0.03
1,2-DICHLOROPROPANE	MG/M3	ND	0.03
CIS-1,3-DICHLOROPROPENE	MG/M3	ND	0.03
TRANS-1,3-DICHLOROPROPENE	MG/M3	ND	0.03
1,4-DICHLORO-2-BUTENE	MG/M3	ND	0.03
ETHYL BENZENE	MG/M3	ND	0.03
ETHYL METHACRYLATE	MG/M3	ND	0.03
2-HEXANONE	MG/M3	ND	0.1
IODOMETHANE	MG/M3	ND	0.03
METHYLENE CHLORIDE	MG/M3	ND	0.07
4-METHYL-2-PENTANONE	MG/M3	ND	0.1
STYRENE	MG/M3	ND	0.03
1,1,2,2-TETRACHLOROETHANE	MG/M3	ND	0.03
TETRACHLOROETHENE	MG/M3	ND	0.03
TOLUENE	MG/M3	ND	0.03
1,1,1-TRICHLOROETHANE	MG/M3	ND	0.03
1,1,2-TRICHLOROETHANE	MG/M3	ND	0.03
TRICHLOROETHENE	MG/M3	ND	0.03
TRICHLOROFLUOROMETHANE	MG/M3	ND	0.03
1,2,3 TRICHLOROPROPANE	MG/M3	ND	0.03
VINYL ACETATE	MG/M3	ND	0.03
VINYL CHLORIDE	MG/M3	ND	0.03
TOTAL XYLENES	MG/M3	ND	0.03
BROMOFLUOROBENZENE	%REC/SURR	103	82-118

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"QC Report"

Title: Bag/Can Blank
Batch: MAB115
Analysis Method: 8240 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992
Extraction Method: N/A

Parameters:	Units:	Results:	Reporting Limits:
1,2-DICHLOROETHANE-D4	%REC/SURR	102	78-122
TOLUENE-D8	%REC/SURR	97	81-127
ANALYST	INITIALS	LL	

Comments:

"QC Report"

itle: Bag/Can Reagent
atch: MAB115
nalysis Method: 8240 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992
xtraction Method: N/A

RS Date Analyzed: 05-OCT-94
RSD Date Analyzed: 05-OCT-94

RS Date Extracted: N/A
RSD Date Extracted: N/A

arameters:	Spike Added	Sample Conc	RS Conc	RS %Rec	RSD Conc	RSD %Rec	RPD	RPD Lmts	Rec Lmts
,1-DICHLOROETHENE	2.0	<0.03	1.9	95	1.9	95	0	20	61-145
RICHLOROETHENE	2.0	<0.03	1.9	95	1.9	95	0	20	71-120
ENZENE	2.0	<0.03	2.0	100	2.1	105	5	20	76-127
OLUENE	2.0	<0.03	2.0	100	2.1	105	5	20	76-125
HLOROBENZENE	2.0	<0.03	2.1	105	2.1	105	0	20	75-130
urrogates:									
,2-DICHLOROETHANE-D4				108		109			78-122
OLUENE-D8				105		106			81-127
ROMOFLUOROBENZENE				98		98			82-118

omments:

otes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
MG/M3 = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

Common notation for Organic reporting

N/S = NOT SUBMITTED
N/A = NOT APPLICABLE
D = DILUTED OUT
UG/L = PARTS PER BILLION.
UG/KG = PARTS PER BILLION.
MG/KG = PARTS PER MILLION.
MG/L = PARTS PER MILLION.
MG/M3 = MILLIGRAMS PER CUBIC METER.
NG = NANOGRAMS.
UG = MICROGRAMS.
PPBV = PARTS PER BILLION/VOLUME.
< = LESS THAN DETECTION LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS
J = THE REPORTED VALUE IS EITHER LESS THAN THE REPORTING LIMIT BUT GREATER THAN ZERO, OR QUANTITATED AS A TIC; THEREFORE, IT IS ESTIMATED.
JJ = REPORTED VALUE IS ESTIMATED DUE TO MATRIX INTERFERENCE.
ND = NOT DETECTED ABOVE REPORT LIMIT.
RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.
RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

ORGANIC SOILS ARE REPORTED ON A DRY WEIGHT BASIS.

DUE TO THE NATURE OF THE SAMPLE MATRIX, MATRIX SPIKE/MATRIX SPIKE DUPLICATE ANALYSIS CANNOT BE PERFORMED FOR AIR ANALYSIS.

LP = LEVERNE PETERSON	RW = RITA WINGO
DWB = DAVID BOWERS	LD = LARRY DILMORE
DB = DENNIS BESON	LL = LANCE LARSON
RB = RAFAEL BARRAZA	JA = JENNIFER ALEXANDER
PL = PAUL LESCHENSKY	

Analytical Technologies, Inc.

PROJECT SAMPLE INSPECTION FORM

Accession #: 409820 Date received: 9/26/94

1.	Was there a Chain of Custody?	(YES)	NO	7.	Are samples correctly preserved for analysis required?	(YES)	NO	N/A
2.	Was Chain of Custody properly relinquished?	(YES)	NO	8.	Is there sufficient volume for analysis requested?	(YES)	NO	
3.	Were samples received cold? (At 4° or on ice)	YES	NO (N/A)	9.	Were samples received within holding time?	(YES)	NO	
4.	Were all containers properly labeled and identified?	(YES)	NO	10.	Was there headspace greater than ¼" in diameter in volatile bottles?	YES	NO	(N/A)
5.	Were samples received in proper containers for analysis requested?	(YES)	NO	11.	If sent, were matrix spike bottles returned?	YES	NO	(N/A)
6.	Were all sample containers received intact?	(YES)	NO					

Tracking Number: N/A Shipped By: UPS

Cooler Number: N/A

Out of Control Events and Inspection Comments:

Inspected By: SF Date: 9/27/94 Logged By: SF Date: 9/27/94

Analytical**Technologies,**Inc.
11 East Olive Road • Pensacola, Florida 32514 • (904) 474-1001

CHAIN OF CUSTODY

PART 1 - Bottle Shipment Information ATI ACCESSION #: 4D9820

CLIENT: GEO ENGINEERS | CLIENT PROJECT NUMBER: 8161-013-R69

QUANTITY OF SAMPLE CONTAINERS SHIPPED	PRESERVATIVE							PLASTIC CONTAINERS							GLASS CONTAINERS									NOTES
	H_2SO_4	HNO3	HCL	Zn Acetate	$Na_2S_2O_3$	Unpreserved	NaOH	8 oz.	16 oz.	32 oz.	½ gallon	1 gallon	Whirl-pak	100-ML Cup	120 ml (A)	1 liter (A)	1 liter (C)	40 ml Vial	4 oz. wm	8 oz. wm	16 oz. wm	32 oz. wm	D.I. Trip Blank	
1																		✓			✓			6 L Summa Can with ATO35

Relinquished By:	Time	Date	Received By:	Time	Date
J. G. Wilson	1542	16 Sept 94			

PART 2 - Sample/Project Information

PARAMETERS AND PRESERVATIVES REQUESTED

SAMPLE MATRIX CODES

DW DRINKING WATER — AI AIR — SW SURFACE WATER
WW WASTEWATER — SO SOIL — SL SLUDGE
GW GROUNDWATER — OI OIL — ST STORMWATER

SAMPLE I.D.	SAMPLE DATE	SAMPLE TIME	MATRIX	TVH	CH4	TOTAL # OF BOTTLES
940922-1	9/22/94	0734	AI	X	X	1

Total Number of Bottles/Containers:

Relinquished By	Date	Time	Received By	Date	Time
William W. Mills	9/22/94	0925	[illegible]	9/22/94	0932

Client GEO ENGINEERS, INC			Purchase Order Number
Address 8410 154TH AVE NE			Project Number 8161-013-R69
City REDMOND	State WA	Zip 98052	Project Name [illegible] STATION 5353
Phone Number (206) 861-6000	Fax Number (206) 861-6050		Project Location
Project Manager [illegible]			Sampled By

TURNAROUND TIMES	check below	SPECIAL INSTRUCTIONS
Standard - 14-21 days		[illegible]
RUSH (must be approved in advance)		
- 48 hours - 2x standard price		
-7 days - 1.5x standard price		
TCLP - 1 week rush 1.5x standard price		
QC Level none I II III IV (circle one)		Copies of report needed B-52

FORM # 12694 — METRO PRINTING, INC., HUNTSVILLE, ALABAMA 35801 WHITE — LAB CANARY — REPORT PINK — CLIENT

SIGNATURE PAGE

Reviewed by: _____
ATI Project Manager

Client: GEO ENGINEERS
REDMOND, WASHINGTON

Project Name: UNOCAL SS-5353
Project Number: 161-013-R69
Project Location: WESTLAKE E MERCER
Accession Number: 502294

Project Manager: NORM PURI
Sampled By: AWM

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Analysis Report

Analysis: METHANE PLUS FIXED GASES

Accession:	502294
Client:	GEO ENGINEERS
Project Number:	161-013-R69
Project Name:	UNOCAL SS-5353
Project Location:	WESTLAKE E MERCER
Department:	SEMI-VOLATILE FUELS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"FINAL REPORT FORMAT - SINGLE"

Accession:	502294
Client:	GEO ENGINEERS
Project Number:	161-013-R69
Project Name:	UNOCAL SS-5353
Project Location:	WESTLAKE E MERCER
Test:	METHANE PLUS FIXED GASES
Analysis Method:	ASTM D1946
Extraction Method:	N/A
Matrix:	AIR
QC Level:	N

Lab Id:	001		Sample Date/Time:	03-FEB-95 0730
Client Sample Id:	950203-1		Received Date:	07-FEB-95
Batch: SPA003			Extraction Date:	N/A
Blank: A	Dry Weight %:	N/A	Analysis Date:	08-FEB-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
CARBON MONOXIDE	%	ND	0.05	
CARBON DIOXIDE	%	0.44	0.05	
METHANE	%	ND	0.05	
NITROGEN	%	75	0.05	
OXYGEN	%	22	0.05	
ANALYST	INITIALS	KW		

Comments:

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"Method Report Summary"

Accession Number: 502294
Client: GEO ENGINEERS
Project Number: 161-013-R69
Project Name: UNOCAL SS-5353
Project Location: WESTLAKE E MERCER
Test: METHANE PLUS FIXED GASES

Client Sample Id:	Parameter:	Unit:	Result:
950203-1	CARBON DIOXIDE	%	0.44
	NITROGEN	%	75
	OXYGEN	%	22

Common notation for Organic reporting

]/S = NOT SUBMITTED
]/A = NOT APPLICABLE
) = DILUTED OUT
]G = MICROGRAMS
]G/L = PARTS PER BILLION.
]G/KG = PARTS PER BILLION.
1G/M3 = MILLIGRAM PER CUBIC METER.
?PMV = PART PER MILLION BY VOLUME.
1G/KG = PARTS PER MILLION.
1G/L = PARTS PER MILLION.
< = LESS THAN DETECTION LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS

SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

ORGANIC SOILS ARE REPORTED ON A DRYWEIGHT BASIS.

ND = NOT DETECTED ABOVE REPORTING LIMIT.

RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

ATI/GC/FID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME IONIZATION DETECTOR (FID).

ATI/GC/FIX
ATI GAS CHROMATOGRAPHIC METHOD FOR ANALYSIS OF FIXED GASES EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD) AND FLAME IONIZATION DETECTOR (FID).

ATI/GC/FPD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME PHOTOMETRIC DETECTOR (FPD) IN SULFUR-SPECIFIC MODE.

ATI/GC/PID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH PHOTOIONIZATION DETECTOR (PID).

ATI/GC/TCD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD).

JT = LISA THOMASON
GH = DARREL HALSELL
LH = TARA HELTON
W = KAREN WADSWORTH
V = MONIQUE VERHEYDEN
W = STEVE WILHITE
MP = JACKIE PRICE
JF = STEVE FILOROMO
L = PAUL LESCHENSKY
W = ROBERT WOLFE
V = BEN VAUGHN
S = KENDALL SMITH

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Analysis Report

Analysis: BETX FOR AIR IN CANISTER

Accession:	502294
Client:	GEO ENGINEERS
Project Number:	161-013-R69
Project Name:	UNOCAL SS-5353
Project Location:	WESTLAKE E MERCER
Department:	GC/VOA

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"FINAL REPORT FORMAT - SINGLE"

Accession:	502294
Client:	GEO ENGINEERS
Project Number:	161-013-R69
Project Name:	UNOCAL SS-5353
Project Location:	WESTLAKE E MERCER
Test:	BETX FOR AIR IN CANISTER
Analysis Method:	8020 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method:	N/A
Matrix:	AIR
QC Level:	I

Lab Id:	001	Sample Date/Time:	03-FEB-95 0730
Client Sample Id:	950203-1	Received Date:	07-FEB-95
Batch: CAB033		Extraction Date:	N/A
Blank: B	Dry Weight %: N/A	Analysis Date:	15-FEB-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BENZENE	MG/M3	ND	1	
ETHYL BENZENE	MG/M3	ND	1	
TOLUENE	MG/M3	ND	5	
XYLENES (TOTAL)	MG/M3	ND	2	
TRIFLUOROTOLUENE	%REC/SURR	90	63-135	
ANALYST	INITIALS	KKS		

Comments:

NITROGEN BLANK ANALYSIS

DATE: 08-FEB-95

METHOD: ASTM D1946

BATCH: SPA003

COMPOUND	UNITS	REPORTING LIMIT	RESULT
CARBON MONOXIDE	%	0.05	ND
CARBON DIOXIDE	%	0.05	ND
NITROGEN	%	0.05	ND
OXYGEN	%	0.05	ND

CONTINUING CALIBRATION

DATE: 08-FEB-95

METHOD: ASTM D1946

BATCH: SPA003

COMPOUND	RF (IC)	RF (CC)	%D	QC LIMITS
CARBON MONOXIDE	1.76E-5	1.79E-5	0.02	20
CARBON DIOXIDE	1.34E-5	1.29E-5	0.04	20
METHANE	1.95E-5	1.96E-5	0.01	20
NITROGEN	1.75E-5	1.75E-5	0.00	20
OXYGEN	1.87E-5	1.95E-5	0.04	20

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.

CHECK STANDARD (POST-RUN)

DATE: 08-FEB-95

METHOD: ASTM D1946

BATCH: SPA003

COMPOUND	RF (CC)	RF (PS)	%D	QC LIMITS
CARBON MONOXIDE	1.79E-5	1.79E-5	0.00	15
CARBON DIOXIDE	1.29E-5	1.34E-5	0.04	15
METHANE	1.96E-5	1.97E-5	0.01	15
NITROGEN	1.75E-5	1.74E-5	0.01	15
OXYGEN	1.95E-5	1.96E-5	0.01	15

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Quality Control Report

Analysis: BETX FOR AIR IN CANISTER

Accession:	502294
Client:	GEO ENGINEERS
Project Number:	161-013-R69
Project Name:	UNOCAL SS-5353
Project Location:	WESTLAKE E MERCER
Department:	GC/VOA

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Date 17-Feb-95

"QC Report"

Title: Bag/Can Blank
Batch: CAB033
Analysis Method: 8020 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A

Blank Id: B Date Analyzed: 15-FEB-95 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
BENZENE	MG/M3	ND	1
ETHYL BENZENE	MG/M3	ND	1
TOLUENE	MG/M3	ND	5
XYLENES	MG/M3	ND	2
TOTAL PETROLEUM HYDROCARBON	MG/M3	ND	100
TRIFLUOROTOLUENE (PID)	%REC/SURR	110	63-135
TRIFLUOROTOLUENE (FID)	%REC/SURR	110	63-135
ANALYST	INITIALS	GF	

Comments:

"QC Report"

Title: Bag/Can Reagent
Batch: CAB033
Analysis Method: 8020 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A

RS Date Analyzed: 14-FEB-95
RSD Date Analyzed: 14-FEB-95

RS Date Extracted: N/A
RSD Date Extracted: N/A

Parameters:	Spike Added	Sample Conc	RS Conc	RS %Rec	RSD Conc	RSD %Rec	RPD	RPD Lmts	Rec Lmts
BENZENE	50	<1	52	104	53	106	2	18	71-138
TOLUENE	50	<2	52	104	53	106	2	17	75-130
Surrogates:									
TRIFLUOROTOLUENE (PID)				96		99			63-135

Comments:

Notes:
UNITS IN MG/M3 = MILLIGRAM PER CUBIC METER N/S = NOT SUBMITTED
< = LESS THAN REPORTING LIMIT
SOURCE FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND METHOD REFERENCE.
UNITS IN UG = MICROGRAMS. N/S = NOT SUBMITTED

Common notation for Organic reporting

'S = NOT SUBMITTED
'A = NOT APPLICABLE
= DILUTED OUT
'G/L = PARTS PER BILLION.
G/KG = PARTS PER BILLION.
/KG = PARTS PER MILLION.
/L = PARTS PER MILLION.
= LESS THAN DETECTION LIMIT.
= VALUES OUTSIDE OF QUALITY CONTROL LIMITS
URCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM
D REFERENCED METHOD.
RGANIC SOILS ARE REPORTED ON A DRY WEIGHT BASIS.
* COMPOUNDS FLAGGED IN METHOD ARE NOT WITHIN THE FIVE POINT CURVE. THEY
RE SEARCHED FOR QUALITATIVELY.
= NOT DETECTED ABOVE REPORTING LIMIT.

R-SHELLEY REAMSMA
C-DAVID CELESTIAL
D-LEIGH DUVALL
-MIKE MCKENZIE
S-KENDALL SMITH
KS-KIMBERLY SMITH
-GREG FOOTE
-NICOLE CALL
-JENNIFER ALEXANDER
M-PENNY MALOUIN
CW-MARIE CLAUDIA WALTON
-SHARON BRADDOCK
KAROLE FERGUSON
-SCOTT CLARK
M-AMANDA MCCRAY

Analytical Technologies, Inc.

PROJECT SAMPLE INSPECTION FORM

Accession #: 502294 Date received: 07-FEB-95

1.	Was there a Chain of Custody?	(YES)	NO		7.	Are samples correctly preserved for analysis required?	(YES)	NO
2.	Was Chain of Custody properly relinquished?	(YES)	NO		8.	Is there sufficient volume for analysis requested?	(YES)	NO
3.	Were samples received cold? (At 4° or on ice)	(YES)	NO	N/A	9.	Were samples received within holding time?	(YES)	NO
4.	Were all containers properly labeled and identified?	(YES)	NO		10.	Was there headspace greater than ¼" in diameter in volatile bottles?	YES	NO (N/A)
5.	Were samples received in proper containers for analysis requested?	(YES)	NO		11.	If sent, were matrix spike bottles returned?	YES	NO (N/A)
6.	Were all sample containers received intact?	(YES)	NO					

Tracking Number: 5028019350 Shipped By: UPS

Cooler Number: N/A

Out of Control Events and Inspection Comments:

Inspected By: [signature] Date: 2/7/95 Logged By: [signature] Date: 2/4/95

Analytical**Technologies,** Inc. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

SIGNATURE PAGE

Reviewed by: _____
ATI Project Manager

Client:	GEO ENGINEERS REDMOND, WASHINGTON
Project Name:	UNOCAL WESTLAKE & MERCER
Project Number:	0161-013-R69
Project Location:	SEATTLE, WA
Accession Number:	503505
Project Manager:	NORM PURI
Sampled By:	ALLAN W. MILLS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Analysis Report

Analysis: METHANE

Accession:	503505
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL WESTLAKE & MERCER
Project Location:	SEATTLE, WA
Department:	SEMI-VOLATILE FUELS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"FINAL REPORT FORMAT - SINGLE"

Accession:	503505
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL WESTLAKE & MERCER
Project Location:	SEATTLE, WA
Test:	METHANE
Analysis Method:	ASTM D1946
Extraction Method:	N/A
Matrix:	AIR
QC Level:	N

Lab Id:	001		Sample Date/Time:	01-MAR-95 0936
Client Sample Id:	950301A		Received Date:	13-MAR-95
Batch: SPA010			Extraction Date:	N/A
Blank: A	Dry Weight %:	N/A	Analysis Date:	17-MAR-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
METHANE	PPMV	ND	500	
ANALYST	INITIALS	KW		

Comments:

Common notation for Organic reporting

N/S = NOT SUBMITTED
N/A = NOT APPLICABLE
D = DILUTED OUT
UG = MICROGRAMS
UG/L = PARTS PER BILLION.
UG/KG = PARTS PER BILLION.
MG/M3 = MILLIGRAM PER CUBIC METER.
PPMV = PART PER MILLION BY VOLUME.
MG/KG = PARTS PER MILLION.
MG/L = PARTS PER MILLION.
< = LESS THAN DETECTION LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS

SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

ORGANIC SOILS ARE REPORTED ON A DRYWEIGHT BASIS.

ND = NOT DETECTED ABOVE REPORTING LIMIT.

RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

ATI/GC/FID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME IONIZATION DETECTOR (FID).

ATI/GC/FIX
ATI GAS CHROMATOGRAPHIC METHOD FOR ANALYSIS OF FIXED GASES EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD) AND FLAME IONIZATION DETECTOR (FID).

ATI/GC/FPD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME PHOTOMETRIC DETECTOR (FPD) IN SULFUR-SPECIFIC MODE.

ATI/GC/PID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH PHOTOIONIZATION DETECTOR (PID).

ATI/GC/TCD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD).

LJT = LISA THOMASON
DGH = DARREL HALSELL
TLH = TARA HELTON
KW = KAREN WADSWORTH
MV = MONIQUE VERHEYDEN
SW = STEVE WILHITE
JMP = JACKIE PRICE
SJF = STEVE FILOROMO
PL = PAUL LESCHENSKY
RW = ROBERT WOLFE
BV = BEN VAUGHN
KS = KENDALL SMITH
NC = NICOLE CALL
LKD = LEIGH DUVALL

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Analysis Report

Analysis: TOTAL VOLATILE HYDROCARBONS IN CANISTER

Accession:	503505
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL WESTLAKE & MERCER
Project Location:	SEATTLE, WA
Department:	SEMI-VOLATILE FUELS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"FINAL REPORT FORMAT - SINGLE"

Accession:	503505
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL WESTLAKE & MERCER
Project Location:	SEATTLE, WA
Test:	TOTAL VOLATILE HYDROCARBONS IN CANISTER
Analysis Method:	ATI/GC/FID
Extraction Method:	N/A
Matrix:	AIR
QC Level:	B

Lab Id:	001		Sample Date/Time:	01-MAR-95 0936
Client Sample Id:	950301A		Received Date:	13-MAR-95
Batch: GEA028			Extraction Date:	N/A
Blank: A	Dry Weight %:	N/A	Analysis Date:	24-MAR-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
TOTAL VOLATILE HYDROCARBONS	MG/M3	ND	500	
ANALYST	INITIALS	KW		

Comments:

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, FL 32514 (904) 474-1001

Quality Control Report

Analysis: METHANE PLUS FIXED GASES

Accession:	503505
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL WESTLAKE & MERCER
Project Location:	SEATTLE, WA
Department:	SEMI-VOLATILE FUELS

NITROGEN BLANK ANALYSIS

DATE: 17-MAR-95

METHOD: ASTM D1946

BATCH: SPA010

COMPOUND	UNITS	REPORTING LIMIT	RESULT
METHANE	PPMV	500	ND

INITIAL CALIBRATION

DATE: 25-JAN-95

METHOD: ASTM D1946

BATCH: SPA010

COMPOUND	RF 1	RF 2	RF 3	RF 4	RF 5	AVG RF	SD	%RSD
CARBON MONOXIDE	1.76 E-5	1.77 E-5	1.76 E-5			1.76E-5	5.80 E-8	0.33
CARBON DIOXIDE	1.32 E-5	1.34 E-5	1.35 E-5			1.34E-5	1.53 E-7	1.1
METHANE	1.94 E-5	1.95 E-5	1.95 E-5			1.95E-5	5.80 E-8	0.30
NITROGEN	1.72 E-5	1.89 E-5	1.65 E-5			1.75E-5	1.23 E-6	7.0
OXYGEN	1.92 E-5	1.82 E-5	1.88 E-5			1.87E-5	5.03 E-7	2.7

CONTINUING CALIBRATION

DATE: 17-MAR-95

METHOD: ASTM D1946

BATCH: SPA010

COMPOUND	RF (IC)	RF (CC)	%D	QC LIMITS
CARBON MONOXIDE	1.76E-5	1.76E-5	0.0	20
CARBON DIOXIDE	1.34E-5	1.30E-5	3.0	20
METHANE	1.95E-5	1.94E-5	0.51	20
NITROGEN	1.75E-5	1.69E-5	3.4	20
OXYGEN	1.87E-5	1.92E-5	2.7	20

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.

DUPLICATE SAMPLE ANALYSIS

DATE: 17-MAR-95

METHOD: ASTM D1946

LAB SAMPLE #: 503610-1

BATCH: SPA010

COMPOUND	SAMPLE RESULT	DUPLICATE RESULT	%RPD	QC LIMITS
CARBON DIOXIDE	0.128	0.125	2.4	15
OXYGEN	22.1	22.1	0	15

ALL RESULTS REPORTED IN %.

ND = NOT DETECTED
NC = NOT CALCULABLE

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.

CHECK STANDARD (POST-RUN)

DATE: 17-MAR-95

METHOD: ASTM D1946

BATCH: SPA010

COMPOUND	RF (IC)	RF (PS)	%D	QC LIMITS
CARBON MONOXIDE	1.76E-5	1.78E-5	1.1	15
CARBON DIOXIDE	1.30E-5	1.32E-5	1.5	15
METHANE	1.94E-5	1.96E-5	1.0	15
NITROGEN	1.69E-5	1.69E-5	0.0	15
OXYGEN	1.92E-5	1.96E-5	2.1	15

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Quality Control Report

Analysis: TOTAL VOLATILE HYDROCARBONS IN CANISTER

Accession:	503505
Client:	GEO ENGINEERS
Project Number:	0161-013-R69
Project Name:	UNOCAL WESTLAKE & MERCER
Project Location:	SEATTLE, WA
Department:	SEMI-VOLATILE FUELS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Date 27-Mar-95

"QC Report"

Title: Air Blank
Batch: GEA028
Analysis Method: ATI/GC/FID
Extraction Method: N/A

Blank Id: A Date Analyzed: 24-MAR-95 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
TOTAL VOLATILE HYDROCARBON	MG/M3	ND	500

Comments:
ANALYST: KW

Common notation for Organic reporting

/S = NOT SUBMITTED
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) = DILUTED OUT
IG = MICROGRAMS
G/L = PARTS PER BILLION.
G/KG = PARTS PER BILLION.
IG/M3 = MILLIGRAM PER CUBIC METER.
PMV = PART PER MILLION BY VOLUME.
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D = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

TI/GC/FID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME IONIZATION DETECTOR (FID).

I/GC/FIX
ATI GAS CHROMATOGRAPHIC METHOD FOR ANALYSIS OF FIXED GASES EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD) AND FLAME IONIZATION DETECTOR (FID).

TI/GC/FPD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME PHOTOMETRIC DETECTOR (FPD) IN SULFUR-SPECIFIC MODE.

I/GC/PID
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I/GC/TCD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD).

T = LISA THOMASON
H = DARREL HALSELL
LH = TARA HELTON
W = KAREN WADSWORTH
= MONIQUE VERHEYDEN
= STEVE WILHITE
MP = JACKIE PRICE
JF = STEVE FILOROMO
= PAUL LESCHENSKY
= ROBERT WOLFE
= BEN VAUGHN
S = KENDALL SMITH
C = NICOLE CALL
D = LEIGH DUVALL

AnalyticalTechnologies,Inc.
11 East Olive Road • Pensacola, Florida 32514 • (904) 474-1001

CHAIN OF CUSTODY

PART 1 - Bottle Shipment Information

ATI ACCESSION #: 503505

CLIENT: GEO ENGINEERS, INC **CLIENT PROJECT NUMBER:** 0161-013-R69

QUANTITY OF SAMPLE CONTAINERS SHIPPED	PRESERVATIVE: H_2SO_4	HNO3	HCL	Zn Acetate	$Na_2S_2O_3$	Unpreserved	NaOH	PLASTIC CONTAINERS: 8 oz.	16 oz.	32 oz.	½ gallon	1 gallon	Whirl-pak	100-ML Cup	GLASS CONTAINERS: 120 ml (A)	1 liter (A)	1 liter (C)	40 ml Vial	4 oz. wm	8 oz. wm	16 oz. wm	32 oz. wm	D.I. Trip Blank	NOTES
1																								6 L CANISTER ATO51

Relinquished By:	Time	Date	Received By:	Time	Date
Hanna R. [illegible]	1630	22FB95	Allan W. [illegible]	0838	3/1/95

PART 2 - Sample/Project Information

SAMPLE MATRIX CODES

DW DRINKING WATER AI AIR SW SURFACE WATER
WW WASTEWATER SO SOIL SL SLUDGE
GW GROUNDWATER OI OIL ST STORMWATER

PARAMETERS AND PRESERVATIVES REQUESTED

SAMPLE I.D.	SAMPLE DATE	SAMPLE TIME	MATRIX	M.II[illegible]	TVH, C-Cn by GC-FID												TOTAL # OF BOTTLES
950301A	3/1/95	09:36	AI	√	/											1	1

Total Number of Bottles/Containers: 1

Relinquished By	Date	Time	Received By	Date	Time
Allan W. [illegible]			Rolf Esperman	3/13/95	1030

Client: GEO ENGINEERS, INC	Purchase Order Number: N/A
Address: 8410 154 AVE N.E	Project Number: 0161-013-R69
City: REDMOND State: WA Zip: 98052	Project Name: UNOCAL WESTLAKE & MERCER
Phone Number: (206) 861-6000 Fax Number: (206) 861-6050	Project Location: SEATTLE, WA
Project Manager: NORM PURI	Sampled By: ALLAN W. MILLS

TURNAROUND TIMES	check below	SPECIAL INSTRUCTIONS
Standard - 14-21 days	✓	SEE ATTACHED MEMO
RUSH (must be approved in advance)		
48 hours - 2x standard price		
5-7 days - 1.5x standard price		
TCLP - 1 week rush 1.5x standard price		
QC Level none I II III IV (circle one)		Copies of report needed: 1

FORM # 12694 — METRO PRINTING, INC., HUNTSVILLE, ALABAMA 35801 WHITE — LAB CANARY — REPORT PINK — CLIENT

Analytical Technologies, Inc. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

SIGNATURE PAGE

Reviewed by: _____
ATI Project Manager

Client:	GEO ENGINEERS REDMOND, WASHINGTON
Project Name:	N/S
Project Number:	0161-013-R04
Project Location:	SEATTLE, WA
Accession Number:	504663
Project Manager:	NORM PURI
Sampled By:	NLP/AWM

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Analysis Report

Analysis: METHANE

Accession:	504663
Client:	GEO ENGINEERS
Project Number:	0161-013-R04
Project Name:	N/S
Project Location:	SEATTLE, WA
Department:	SEMI-VOLATILE FUELS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"FINAL REPORT FORMAT - SINGLE"

Accession:	504663
Client:	GEO ENGINEERS
Project Number:	0161-013-R04
Project Name:	N/S
Project Location:	SEATTLE, WA
Test:	METHANE
Analysis Method:	ASTM D1946
Extraction Method:	N/A
Matrix:	AIR
QC Level:	N

Lab Id:	001		Sample Date/Time:	18-APR-95 0734
Client Sample Id:	950418-01		Received Date:	20-APR-95
Batch: SPA015			Extraction Date:	N/A
Blank: A	Dry Weight %:	N/A	Analysis Date:	21-APR-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
METHANE	PPMV	ND	500	
ANALYST	INITIALS	KW		

Comments:

Common notation for Organic reporting

/S = NOT SUBMITTED
/A = NOT APPLICABLE
= DILUTED OUT
G = MICROGRAMS
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G/KG = PARTS PER BILLION.
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= VALUES OUTSIDE OF QUALITY CONTROL LIMITS

OURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM
ND REFERENCED METHOD.

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PD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

TI/GC/FID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME IONIZATION DETECTOR (FID).

TI/GC/FIX
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TI/GC/TCD
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JT = LISA THOMASON
GH = DARREL HALSELL
LH = TARA HELTON
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V = MONIQUE VERHEYDEN
W = STEVE WILHITE
MP = JACKIE PRICE
JF = STEVE FILOROMO
L = PAUL LESCHENSKY
W = ROBERT WOLFE
V = BEN VAUGHN
S = KENDALL SMITH
C = NICOLE CALL
KD = LEIGH DUVALL

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, FL 32514 (904) 474-1001

Quality Control Report

Analysis: METHANE PLUS FIXED GASES

Accession:	504663
Client:	GEO ENGINEERS
Project Number:	0161-013-R04
Project Name:	N/S
Project Location:	SEATTLE, WA
Department:	SEMI-VOLATILE FUELS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Analysis Report

Analysis: TOTAL VOLATILE HYDROCARBONS IN CANISTER

Accession:	504663
Client:	GEO ENGINEERS
Project Number:	0161-013-R04
Project Name:	N/S
Project Location:	SEATTLE, WA
Department:	SEMI-VOLATILE FUELS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"FINAL REPORT FORMAT - SINGLE"

Accession:	504663
Client:	GEO ENGINEERS
Project Number:	0161-013-R04
Project Name:	N/S
Project Location:	SEATTLE, WA
Test:	TOTAL VOLATILE HYDROCARBONS IN CANISTER
Analysis Method:	ATI/GC/FID
Extraction Method:	N/A
Matrix:	AIR
QC Level:	B

Lab Id:	001		Sample Date/Time:	18-APR-95 0734
Client Sample Id:	950418-01		Received Date:	20-APR-95
Batch: GEA038			Extraction Date:	N/A
Blank: B	Dry Weight %:	N/A	Analysis Date:	26-APR-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
TOTAL VOLATILE HYDROCARBONS	MG/M3	ND	500	
ANALYST	INITIALS	KW		

Comments:

NITROGEN BLANK ANALYSIS

DATE: 21-APR-95

METHOD: ASTM D1946

BATCH: SPA015

COMPOUND	UNITS	REPORTING LIMIT	RESULT
METHANE	PPMV	500	ND

INITIAL CALIBRATION

DATE: 25-JAN-95

METHOD: ASTM D1946

BATCH: SPA015

COMPOUND	RF 1	RF 2	RF 3	RF 4	RF 5	AVG RF	SD	%RSD
CARBON MONOXIDE	1.76 E-5	1.77 E-5	1.76 E-5			1.76E-5	5.80 E-8	0.33
CARBON DIOXIDE	1.32 E-5	1.34 E-5	1.35 E-5			1.34E-5	1.53 E-7	1.1
METHANE	1.94 E-5	1.95 E-5	1.95 E-5			1.95E-5	5.80 E-8	0.30
NITROGEN	1.72 E-5	1.89 E-5	1.65 E-5			1.75E-5	1.23 E-6	7.0
OXYGEN	1.92 E-5	1.82 E-5	1.88 E-5			1.87E-5	5.03 E-7	2.7

CONTINUING CALIBRATION

DATE: 21-APR-95

METHOD: ASTM D1946

BATCH: SPA015

COMPOUND	RF (IC)	RF (CC)	%D	QC LIMITS
METHANE	1.95E-5	1.94E-5	0.5	20

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.

CHECK STANDARD (POST-RUN)

DATE: 21-APR-95

METHOD: ASTM D1946

BATCH: SPA015

COMPOUND	RF (IC)	RF (PS)	%D	QC LIMITS
METHANE	1.94E-5	1.94E-5	0.0	15

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Quality Control Report

Analysis: TOTAL VOLATILE HYDROCARBONS IN CANISTER

Accession:	504663
Client:	GEO ENGINEERS
Project Number:	0161-013-R04
Project Name:	N/S
Project Location:	SEATTLE, WA
Department:	SEMI-VOLATILE FUELS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"QC Report"

Title: Air Blank
Batch: GEA038
Analysis Method: ATI/GC/FID
Extraction Method: N/A

Blank Id: B Date Analyzed: 26-APR-95 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
TOTAL VOLATILE HYDROCARBONS	MG/M3	ND	500

Comments:
ANALYST: KW

Common notation for Organic reporting

/S = NOT SUBMITTED
/A = NOT APPLICABLE
= DILUTED OUT
3 = MICROGRAMS
3/L = PARTS PER BILLION.
3/KG = PARTS PER BILLION.
3/M3 = MILLIGRAM PER CUBIC METER.
PMV = PART PER MILLION BY VOLUME.
3/KG = PARTS PER MILLION.
3/L = PARTS PER MILLION.
= LESS THAN DETECTION LIMIT.
= VALUES OUTSIDE OF QUALITY CONTROL LIMITS

OURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM
ND REFERENCED METHOD.

RGANIC SOILS ARE REPORTED ON A DRYWEIGHT BASIS.

D = NOT DETECTED ABOVE REPORTING LIMIT.

PT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

PD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

TI/GC/FID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME IONIZATION DETECTOR (FID).

TI/GC/FIX
ATI GAS CHROMATOGRAPHIC METHOD FOR ANALYSIS OF FIXED GASES EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD) AND FLAME IONIZATION DETECTOR (FID).

TI/GC/FPD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME PHOTOMETRIC DETECTOR (FPD) IN SULFUR-SPECIFIC MODE.

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TI/GC/TCD
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JT = LISA THOMASON
GH = DARREL HALSELL
LH = TARA HELTON
W = KAREN WADSWORTH
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W = STEVE WILHITE
JF = STEVE FILOROMO
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V = BEN VAUGHN
S = KENDALL SMITH

AnalyticalTechnologies,Inc.
11 East Olive Road • Pensacola, Florida 32514 • (904) 474-1001

CHAIN OF CUSTODY

PART 1 - Bottle Shipment Information

ATI ACCESSION #: 504663

CLIENT: GEO ENGINEERS — CLIENT PROJECT NUMBER: 0161-013-R04

QUANTITY OF SAMPLE CONTAINERS SHIPPED	PRESERVATIVE: H_2SO_4	HNO3	HCL	Zn Acetate	$Na_2S_2O_3$	Unpreserved	NaOH	PLASTIC CONTAINERS: 8 oz.	16 oz.	32 oz.	½ gallon	1 gallon	Whirl-pak	100-ML Cup	GLASS CONTAINERS: 120 ml (A)	1 liter (A)	1 liter (C)	40 ml Vial	4 oz. wm	8 oz. wm	16 oz. wm	32 oz. wm	D.I. Trip Blank	NOTES
1																								6 L CANISTER AT 103

Relinquished By:	Time	Date	Received By:	Time	Date
(signature)	1630	11AP95			

PART 2 - Sample/Project Information

SAMPLE MATRIX CODES

DW DRINKING WATER — AI AIR — SW SURFACE WATER
WW WASTEWATER — SO SOIL — SL SLUDGE
GW GROUNDWATER — OI OIL — ST STORMWATER

PARAMETERS AND PRESERVATIVES REQUESTED

SAMPLE I.D.	SAMPLE DATE	SAMPLE TIME	MATRIX	TVH By GC-FID	[redacted]	Methane	TOTAL # OF BOTTLES
950418-01	4/18/95	0734	AI	X	[redacted]	X	1

Total Number of Bottles/Containers:

Relinquished By	Date	Time	Received By	Date	Time
(signature) Allan W. Mills	4/18/95	12:00	(signature)	4/20/95	0945

Client: GEO ENGINEERS, INC.	Purchase Order Number
Address: 8410 154th AVE N.E	Project Number: 0161-013-R04
City: REDMOND — State: WA — Zip: 98052	Project Name
Phone Number: (206) 861-6000 — Fax Number: (206) 861-6050	Project Location: SEATTLE
Project Manager: NORM PUR.	Sampled By: NLP/AWM

TURNAROUND TIMES	check below	SPECIAL INSTRUCTIONS
Standard - 14-21 days		TOTAL VOLITILE HYDROCARBONS [redacted]
RUSH (must be approved in advance)		BY GAS CHROMATOGRAPH, FLAME IONIZATION
24 - 48 hours - 2x standard price		DETECTOR C7 - C-14
5-7 days - 1.5x standard price		
TCLP - 1 week rush 1.5x standard price		
QC Level none I II III IV (circle one)		Copies of Report Needed ____

FORM # 12694 — METRO PRINTING, INC., HUNTSVILLE, ALABAMA 35801 — WHITE — LAB — CANARY — REPORT — PINK — CLIENT

Analytical**Technologies,**Inc. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

SIGNATURE PAGE

Reviewed by: _____
ATI Project Manager

Client:	GEO ENGINEERS REDMOND, WASHINGTON
Project Name:	UNOCAL SS-5353
Project Number:	0161-013-R04
Project Location:	SEATTLE, WA
Accession Number:	506435
Project Manager:	NORM PURI
Sampled By:	N.L.P.

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Analysis Report

Analysis: TOTAL VOLATILE HYDROCARBONS IN CANISTER

Accession:	506435
Client:	GEO ENGINEERS
Project Number:	0161-013-R04
Project Name:	UNOCAL SS-5353
Project Location:	SEATTLE, WA
Department:	SEMI-VOLATILE FUELS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"FINAL REPORT FORMAT - SINGLE"

Accession:	506435
Client:	GEO ENGINEERS
Project Number:	0161-013-R04
Project Name:	UNOCAL SS-5353
Project Location:	SEATTLE, WA
Test:	TOTAL VOLATILE HYDROCARBONS IN CANISTER
Analysis Method:	ATI/GC/FID
Extraction Method:	N/A
Matrix:	AIR
QC Level:	B

Lab Id:	001		Sample Date/Time:	05-JUN-95 1245
Client Sample Id:	950605-1		Received Date:	13-JUN-95
Batch: GEA063			Extraction Date:	N/A
Blank: A	Dry Weight %:	N/A	Analysis Date:	27-JUN-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
TOTAL VOLATILE HYDROCARBONS	MG/M3	ND	500	
ANALYST	INITIALS	KS		

Comments:

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Analysis Report

Analysis: METHANE

Accession:	506435
Client:	GEO ENGINEERS
Project Number:	0161-013-R04
Project Name:	UNOCAL SS-5353
Project Location:	SEATTLE, WA
Department:	SEMI-VOLATILE FUELS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"FINAL REPORT FORMAT - SINGLE"

Accession:	506435
Client:	GEO ENGINEERS
Project Number:	0161-013-R04
Project Name:	UNOCAL SS-5353
Project Location:	SEATTLE, WA
Test:	METHANE
Analysis Method:	ASTM D1946
Extraction Method:	N/A
Matrix:	AIR
QC Level:	N

Lab Id:	001		Sample Date/Time:	05-JUN-95 1245
Client Sample Id:	950605-1		Received Date:	13-JUN-95
Batch: SPA025			Extraction Date:	N/A
Blank: A	Dry Weight %:	N/A	Analysis Date:	24-JUN-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
METHANE	PPMV	ND	500	
ANALYST	INITIALS	KW		

Comments:

Common notation for Organic reporting

S = NOT SUBMITTED
A = NOT APPLICABLE
) = DILUTED OUT
IG = MICROGRAMS
/L = PARTS PER BILLION.
/KG = PARTS PER BILLION.
IG/M3 = MILLIGRAM PER CUBIC METER.
PMV = PART PER MILLION BY VOLUME.
/KG = PARTS PER MILLION.
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= MONIQUE VERHEYDEN
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= ROBERT WOLFE
= BEN VAUGHN
= KENDALL SMITH

Analytical Technologies, Inc.
11 East Olive Road • Pensacola, Florida 32514 • (904) 474-1001

CHAIN OF CUSTODY

PART 1 - Bottle Shipment Information ATI ACCESSION #: 506435

CLIENT:	CLIENT PROJECT NUMBER:

QUANTITY OF SAMPLE CONTAINERS SHIPPED	PRESERVATIVE							PLASTIC CONTAINERS							GLASS CONTAINERS									NOTES
	H_2SO_4	HNO3	HCL	Zn Acetate	$Na_2S_2O_3$	Unpreserved	NaOH	8 oz.	16 oz.	32 oz.	½ gallon	1 gallon	Whirl-pak	100-ML Cup	120 ml (A)	1 liter (A)	1 liter (C)	40 ml Vial	4 oz. wm	8 oz. wm	16 oz. wm	32 oz. wm	O.I. Trip Blank	
1	Sum					Glass																		AT 015

Relinquished By:	Time	Date	Received By:	Time	Date
Rita G. Yun	1450	5.22.95			

PART 2 - Sample/Project Information

PARAMETERS AND PREVERVATIVES REQUESTED

SAMPLE MATRIX CODES

DW	DRINKING WATER	AI	AIR	SW	SURFACE WATER
WW	WASTEWATER	SO	SOIL	SL	SLUDGE
GW	GROUNDWATER	OI	OIL	ST	STORMWATER

SAMPLE I.D.	SAMPLE DATE	SAMPLE TIME	MATRIX	Total Volatile Hydrocarbons C7-C14 by GC-FID	BTEX by Method	TOTAL # OF BOTTLES
950605-1	6/5/95	1345	Vapor	X	X	1 / 1

Total Number of Bottles/Containers: 1

Relinquished By	Date	Time	Received By	Date	Time
	6/5/95	1400	Robert Eby	6/6/95	0915

Client GeoEngineers			Purchase Order Number
Address 8410 154th Ave NE			Project Number 0161-013-R04
City Woodinville	State WA	Zip 98052	Project Name Unocal 55-5352
Phone Number (206) 861-6000	Fax Number (206) 861-6050		Project Location Seattle
Project Manager Akhtar Puri			Sampled By NLP

TURNAROUND TIMES	check below	SPECIAL INSTRUCTIONS
Standard - 14-21 days	X	Total volatile hydrocarbons C7-C14 by GC-FID, no BETX distinction necessary.
RUSH (must be approved in advance)		
<- 48 hours - 2x standard price		
3-7 days - 1.5x standard price		
TCLP - 1 week rush 1.5x standard price		
QC Level none I II III IV (circle one)		Copies of report needed 1

FORM # 12694 — METRO PRINTING, INC., HUNTSVILLE, ALABAMA 35801

WHITE — LAB CANARY — REPORT PINK — CLIENT

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

Quality Control Report

Analysis: TOTAL VOLATILE HYDROCARBONS IN CANISTER

Accession:	506435
Client:	GEO ENGINEERS
Project Number:	0161-013-R04
Project Name:	UNOCAL SS-5353
Project Location:	SEATTLE, WA
Department:	SEMI-VOLATILE FUELS

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, Florida 32514 (904) 474-1001

"QC Report"

Title: Air Blank
Batch: GEA063
Analysis Method: ATI/GC/FID
Extraction Method: N/A

Blank Id: A Date Analyzed: 27-JUN-95 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
TOTAL VOLATILE HYDROCARBONS	MG/M3	ND	500

Comments:
ANALYST: KS

Common notation for Organic reporting

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/A = NOT APPLICABLE
) = DILUTED OUT
IG = MICROGRAMS
G/L = PARTS PER BILLION.
G/KG = PARTS PER BILLION.
MG/M3 = MILLIGRAM PER CUBIC METER.
PPMV = PART PER MILLION BY VOLUME.
G/KG = PARTS PER MILLION.
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= LESS THAN DETECTION LIMIT.
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ND REFERENCED METHOD.

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RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

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ATI/GC/FID
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TI/GC/FIX
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TT = LISA THOMASON
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N = ROBERT WOLFE
V = BEN VAUGHN
S = KENDALL SMITH

ANALYTICAL TECHNOLOGIES, INC. 11 East Olive Road Pensacola, FL 32514 (904) 474-1001

Quality Control Report

Analysis: METHANE PLUS FIXED GASES

Accession:	506435
Client:	GEO ENGINEERS
Project Number:	0161-013-R04
Project Name:	UNOCAL SS-5353
Project Location:	SEATTLE, WA
Department:	SEMI-VOLATILE FUELS

NITROGEN BLANK ANALYSIS

DATE: 24-JUN-95

METHOD: ASTM D1946

BATCH: SPA025

COMPOUND	UNITS	REPORTING LIMIT	RESULT
CARBON MONOXIDE	PPMV	500	ND
CARBON DIOXIDE	PPMV	500	ND
METHANE	PPMV	500	ND
OXYGEN	PPMV	500	ND

INITIAL CALIBRATION

DATE: 25-JAN-95

METHOD: ASTM D1946

BATCH: SPA025

COMPOUND	RF 1	RF 2	RF 3	RF 4	RF 5	AVG RF	SD	%RSD
CARBON MONOXIDE	1.76 E-5	1.77 E-5	1.76 E-5			1.76E-5	5.80 E-8	0.33
CARBON DIOXIDE	1.32 E-5	1.34 E-5	1.35 E-5			1.34E-5	1.53 E-7	1.1
METHANE	1.94 E-5	1.95 E-5	1.95 E-5			1.95E-5	5.80 E-8	0.30
OXYGEN	1.92 E-5	1.82 E-5	1.88 E-5			1.87E-5	5.03 E-7	2.7

CONTINUING CALIBRATION

DATE: 24-JUN-95

METHOD: ASTM D1946

BATCH: SPA025

COMPOUND	RF (IC)	RF (CC)	%D	QC LIMITS
CARBON MONOXIDE	1.76E-5	1.74E-5	1.1	20
CARBON DIOXIDE	1.34E-5	1.26E-5	6.0	20
METHANE	1.95E-5	1.92E-5	1.5	20
NITROGEN	1.75E-5	1.70E-5	2.9	20
OXYGEN	1.87E-5	1.92E-5	2.7	20

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.

DUPLICATE SAMPLE ANALYSIS

DATE: 24-JUN-95

METHOD: ASTM D1946

LAB SAMPLE #: 506459-1

BATCH: SPA025

COMPOUND	SAMPLE RESULT	DUPLICATE RESULT	%RPD	QC LIMITS
CARBON DIOXIDE	1600	1640	2.5	15
NITROGEN	760000	756000	0.5	15
OXYGEN	236000	236000	0.0	15

ALL RESULTS REPORTED IN %.

ND = NOT DETECTED
NC = NOT CALCULABLE

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.

CHECK STANDARD (POST-RUN)

DATE: 24-JUN-95

METHOD: ASTM D1946

BATCH: SPA025

COMPOUND	RF (IC)	RF (PS)	%D	QC LIMITS
CARBON MONOXIDE	1.74E-5	1.73E-5	0.6	15
CARBON DIOXIDE	1.26E-5	1.26E-5	0.0	15
METHANE	1.92E-5	1.92E-5	0.0	15
NITROGEN	1.70E-5	1.71E-5	0.6	15
OXYGEN	1.92E-5	1.92E-5	0.0	15

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.