REPORT OF GEOTECHNICAL SERVICES
SUBSURFACE CONTAMINATION STUDY
BULK PLANT 0138
COUPEVILLE, WASHINGTON
FOR
UNOCAL



Consulting Geotechnical Engineers and Geologists

January 30, 1990

Unocal P.O. Box 76 Seattle, Washington 98111

Attention: Mr. Gary Gunderson

We are submitting five copies of our report of geotechnical services at Unocal Bulk Plant 0138 located in Coupeville, Washington. Our services were authorized verbally by Mr. Gunderson on August 31, 1989. Contractual terms for our services are described in the blanket contract number B1982A.

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

Yours very truly,

GeoEngineers, Inc.

orle Twellen

James A. Miller

Principal

JF: JAM: wd

cc: Ms. Elin Abramsen Washington Department of Ecology

> Mr. Harold Dill Public Works Supervisor Town of Coupeville P.O. Box 725 Coupeville, WA 98239

File No. 0161-205-B04

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REPORT OF GEOTECHNICAL SERVICES SUBSURFACE CONTAMINATION STUDY

BULK PLANT 0138

COUPEVILLE, WASHINGTON

FOR

UNOCAL

INTRODUCTION

The results of our subsurface contamination study at the site of Bulk Plant 0138 are presented in this report. The bulk plant is located southwest of the intersection between Coveland Street and Alexander Street. The site location is shown relative to surrounding physical features in Figure 1. A generalized site plan of the facility is shown in Figure 2.

GeoEngineers observed the removal of a semi-buried stove oil tank at this site in September 1989. The results of our activities during tank removal operations are presented in our report dated October 6, 1989.

The purpose of our services is to explore and evaluate potential subsurface petroleum-related contamination at the site. The scope of services completed for this study is listed below.

- Drill six exploratory borings at the site using hollow-stem auger drilling equipment.
- 2. Excavate three test pits using a rubber-tired backhoe.
- 3. Obtain soil samples from each boring and test pit. Conduct field screening on each sample for evidence of petroleum contamination using visual, water sheen and headspace vapor field screening methods.
- 4. Test at least one soil sample from each boring for the presence of total petroleum hydrocarbons (TPH by EPA Method 418.1) and for benzene, ethylbenzene, toluene and xylenes (BETX by EPA Method 8020). One soil sample was also tested for the presence of chlorinated solvent-related compounds (EPA Method 8010).
- 5. Test selected soil samples from two of the three test pits for the presence of TPH (EPA Method 418.1) and/or fuel hydrocarbons (gasoline and diesel by modified EPA Method 8015).

- 6. Obtain surficial soil samples from the drainage ditch and drum storage area for chemical analysis of TPH (EPA Method 418.1), BETX (EPA Method 8020) and/or chlorinated solvents (EPA Method 8010).
- Install a 2-inch-diameter PVC monitor well casing in each boring and protect each well casing within a flush-grade locking surface monument.
- 8. Develop the well screens by hand bailing.
- 9. Accurately measure the monitor well casing rim elevation and the depth to the water table in each well for determination of water table elevations and shallow ground water flow direction.
- 10. Sample the water table interface in each well casing for the potential presence of free (floating) hydrocarbons.
- 11. Obtain ground water samples from monitor wells for laboratory analysis of BETX (EPA Method 8020), TPH (EPA Method 418.1) and/or chlorinated solvents (EPA Method 8010).
- 12. Measure the air space in each well casing for hydrocarbon vapors using a Bacharach TLV Sniffer.
- 13. Evaluate the field and laboratory data with regard to existing regulatory concerns.

SITE CONDITIONS

GENERAL

Unocal Bulk Plant 0138 is located approximately 500 feet south of the shoreline of Penn Cove, within the Coupeville city limits. An active cardlock facility that is owned and operated by Stewart Corey, the Unocal bulk plant manager, is located immediately west of the site. The cardlock facility includes three underground diesel tanks and one underground gasoline tank. Residential property borders the bulk plant to the south and across Alexander Street to the east. A motel operates northwest of the site, across Coveland Street. The topography of the site generally slopes downward toward the north. The ground surface elevation of the site is approximately 100 feet above mean sea level.



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SITE HISTORY

We understand that Unocal constructed the bulk plant in 1927. Previous property use is unknown. Tank capacities, installation dates and removal dates are listed below:

STORAGE TANK DATA

Tank No.	Capacity (gallons)	Installation	Removal Date
2240	19,480	1927	Existing
2241	19,480	1927	Existing
2242	19,480	1927	Existing
3055	10,000	1982	Existing
3072	10,000	1986	Existing
H336	5,000	1961	1982
H548	6,000	Unknown	1982
H497	6,000	1965	1989

Based on an archived site plan provided to us by Unocal, the property included an easement to the town of Coupeville for a water well and associated piping. The easement location is shown in Figure 2. We were informed by Steward Corey, the bulk plant operator, that the well was abandoned sometime prior to 1960.

CURRENT CONDITIONS

Existing facilities at the site include an office/warehouse building with an attached loading platform; five aboveground product storage tanks; one underground heating oil tank; a truck unloading and loading area; a drum storage area; and pumps and piping. The five aboveground product storage tanks are enclosed within an earthen dike. A drainage ditch extends east to west between the aboveground tanks and the truck unloading/loading facilities, as shown in Figure 2.

Existing petroleum product lines at the site extend above ground from the product storage tanks to the truck unloaders and truck loading rack. Abandoned underground petroleum product lines formerly served the warehouse building. The location of the facilities are indicated in Figure 2.



SUBSURFACE SOIL CONDITIONS

Subsurface soil conditions beneath the bulk plant were explored by drilling six exploratory borings and excavating three test pits at the locations indicated in Figure 2. Details of the field exploration program, the boring logs and the test pit logs are presented in Appendix A.

The borings encountered glacial till beneath the asphaltic concrete to depths ranging between 16 and 28 feet in MW-2, MW-4, MW-5 and MW-6; and to the total depths explored in MW-1 and MW-3. Sand with variable amounts of silt was encountered beneath the glacial till in MW-2, MW-4, MW-5 and MW-6.

GROUND WATER CONDITIONS

Ground water conditions at the site were explored by constructing a monitor well in each boring. Construction details for the monitor wells are included in Appendix A.

We determined the water table depth and elevation in each well on November 22, 1989, two weeks after drilling was completed. The water table at the site was approximately 26 to 29 feet below ground surface at the time of our measurements. Perched ground water was measured at approximately 7 feet below ground surface in MW-3. Ground water was not encountered in MW-2. Water table elevations based on November 22, 1989 measurements are included in Figure 2. The general ground water flow direction beneath the site appears to be northeastward, toward Penn Cove.

SURFACE CONTAMINATION

Visual evidence of surface hydrocarbon contamination is present in the drum storage area and within the drainage ditch. Shallow subsurface soil samples were obtained in these stained areas and submitted for analytical testing. The results of these analyses are discussed in the subsurface contamination section of this report.

SUBSURFACE CONTAMINATION

Potential subsurface fuel-related contamination at the site was evaluated by:

 Conducting field screening on soil samples obtained from the borings and test pits for evidence of contamination using visual, water sheen and headspace vapor screening methods. Details of the field screening methods are included in Appendix A.

- 2. Measuring the air space in the monitor well casings for hydrocarbon vapors.
- 3. Sampling the water table interface in each ground water monitor well for the potential presence of free (floating) hydrocarbons.
- 4. Testing soil samples for TPH (modified EPA Method 418.1), for BETX (EPA Method 8020), for gasoline and diesel (EPA Method 8015) and/or for chlorinated solvents (EPA Method 8010).
- 5. Testing ground water samples for TPH (EPA Method 418.1), for BETX (EPA Method 8020) and/or for chlorinated solvents (EPA Method 8010).

The chemical analytical data are summarized in Tables 1 and 2. Field screening results for the soil samples obtained from the power borings are presented on the monitor well logs included in Appendix A. Table A-1 (Appendix A) summarizes field screening results on soil samples collected from the test pits. Laboratory reports for soil samples and water samples are included in Appendix B.

Headspace vapor field screening methods detected hydrocarbon vapor concentrations ranging between 160 to 7000 ppm in the soil samples tested from various depths in MW-2, MW-5 and TP-2. Moderate and heavy sheens were observed during the sheen screening tests on soil samples obtained from MW-4, MW-5 and TP-1. Either no sheen or a slight sheen were observed while testing the samples obtained from MW-1, MW-2, MW-3, MW-6, TP-2 and TP-3.

Selected soil samples from each boring were analyzed for the presence of TPH by EPA Method 418.1 and for BETX by EPA Method 8020. The soil sample from MW-1 was also analyzed for the presence of chlorinated hydrocarbons by EPA Method 8010. Analytical results are summarized in Table 1. Laboratory reports are included in Appendix B.

TPH concentrations ranging between 4.6 and 1500 ppm were reported in the soil samples analyzed from MW-1 through MW-6. A concentration of 32 ppb benzene was detected in the sample tested from 28 feet in MW-6. Relatively low concentrations of ethylbenzene, toluene and/or xylenes were reported in the soil samples tested from MW-1 and MW-5 (Table 1). Chlorinated hydrocarbons were not detected in the sample analyzed from MW-1.



Selected soil samples from TP-1 and TP-2 were submitted for laboratory analysis of TPH (EPA Method 418.1) and/or fuel hydrocarbons (modified EPA Method 8015). Concentrations of 12 ppm TPH and 6 ppm diesel were detected in the soil samples tested from TP-1 and TP-2, respectively (Table 1).

A composite soil sample (Composite 2) was obtained from the drainage ditch and submitted for laboratory analysis of TPH, BETX and chlorinated hydrocarbons. Concentrations of 97 ppm TPH, 0.074 ppm ethylbenzene and 3.4 ppm xylenes were detected in Composite 2; chlorinated hydrocarbons were not detected.

A shallow composite soil sample (Composite 1) was obtained from the drum storage area and tested for the presence of TPH. A concentration of 2500 ppm TPH was reported for this sample.

Free (floating) hydrocarbons were not found in any of the monitor wells; however, petroleum-like odor was noted on the ground water while obtaining samples from MW-4 and MW-5.

The concentrations of hydrocarbon vapors in the monitor well casings were measured with a Bacharach TLV Sniffer calibrated to hexane. Vapor concentrations ranging between 600 to greater than 10,000 ppm were measured in the six well casings. The hydrocarbon vapor concentrations measured in each well are listed in Table 1.

Benzene was detected at concentrations of 5.3 and 5.4 ppb in the ground water samples obtained on November 22, 1989 from MW-1 and MW-4, respectively. Low concentrations of toluene, ethylbenzene and/or xylenes were detected in the water samples obtained from MW-1, MW-3, MW-4 and MW-5. Low concentrations of TPH were detected in the ground water samples collected from MW-1, MW-2 and MW-3. A relatively high concentration of TPH (20 ppm) was detected in the ground water sample from MW-5. The analytical results are summarized in Table 2.

The ground water samples obtained on November 22, 1989 from MW-1 and MW-4 were also tested for the presence of solvent-related compounds. Concentrations of 1.0 and 20 ppb 1,2-dichloroethane (EDC) were detected in MW-1 and MW-4, respectively. EDC is a constituent of degreasers, paint, soaps and scouring compounds. The Washington State Department of Ecology (Ecology) has adopted 5 ppb as the maximum contaminant level (MCL) for EDC

in drinking water. Concentrations of 3.4 and 7.5 ppb 1,1,1-trichloroethane (1,1,1-TCA) were detected in MW-1 and MW-4, respectively. Trichloroethene (TCE) was detected at a concentration of 0.5 ppb in MW-4. The MCL for 1,1,1-TCA is 200 ppb and for TCE is 5 ppb. TCE and 1,1,1-TCA are used as solvents and degreasing agents. We informed Mr. Norm Peck of Ecology about these contaminant concentrations on January 16, 1990.

A ground water sample was obtained from MW-4 on January 16, 1990 and submitted for laboratory analysis of chlorinated hydrocarbons to verify contaminant concentrations reported in November 1989. A concentration of 23 ppb EDC was reported in the ground water sample obtained on January 16. Ground water samples were also obtained from MW-5 and MW-6 on January 16, 1990 to determine if solvent-related ground water contamination extends downgradient of MW-4; chlorinated hydrocarbon compounds were not detected in these two samples.

CONCLUSIONS

Our explorations detected the presence of subsurface soil and ground water contamination by petroleum- and solvent-related compounds at the site of Bulk Plant 0138. The concentrations of benzene detected in ground water from MW-1 and MW-4 are slightly greater than the current drinking water standard of 5 ppb. The concentration of EDC detected in the ground water from MW-4 exceeds the MCL of 5 ppb. The concentration of TPH in the water sample from MW-5 is greater than Ecology's cleanup guideline of 15 ppm.

The source of the solvent-related contamination found in the vicinity of MW-4 is unknown. Mr. Corey indicated to GeoEngineers that general purpose solvents have not been used in the vicinity of the loading rack during the time that he has operated the bulk plant. Mr. Corey has operated the bulk plant for 11 years.

We were informed by Mr. Harold Dill, Public Works Supervisor for the Town of Coupeville, that a municipal water supply well is located approximately one-half block north (downgradient) of the bulk plant. The well is used for backup supply purposes. Results of analytical testing of ground water samples obtained from Wells MW-5 and MW-6 on January 16, 1990

indicate that ground water contamination by solvent-related compounds does not extend downgradient of MW-4 and, therefore, does not pose a threat to the water supply well.

The high vapor concentrations detected in the well casings for MW-2 through MW-5 and the presence of benzene in ground water from MW-4 suggests the possibility that soil contaminated by gasoline is present in the vicinity of and downgradient from the loading/unloading rack. The gasoline contamination could extend beneath a portion of the warehouse building.

The source of benzene in ground water obtained from MW-1 may be a result of activities at Mr. Corey's cardlock facility. The cardlock is located west of the bulk plant, upgradient from MW-1.

RECOMMENDATIONS

We understand that Unocal intends to sell this bulk plant. We recommend that the loading/unloading rack and associated piping be demolished and removed when operations at the bulk plant are discontinued. We also recommend removing the underground heating oil tank located east of the warehouse building. As much contaminated soil as possible should be removed at the time of facility demolition. Because soil contamination in the northern portion of the bulk plant extends to depths of at least 23 feet, deep excavation will be required and shoring may be necessary.

We recommend treating the contaminated soils on site or on other Unocal property. As an alternative, it may be possible to legally dispose of contaminated soil at a sanitary landfill.

We recommend sampling ground water for laboratory analysis of BETX, TPH and chlorinated hydrocarbons at the end of the cleanup program. Several wells may be destroyed during excavation operations and will have to be replaced so that ground water can be sampled. Future sampling and analysis of ground water samples could necessitate additional remedial measures, such as ground water treatment.

LIMITATIONS

We have prepared this report for use by Unocal. This report can be made available to prospective buyers of the property and to regulatory agencies. The report is not intended for use by others and the information contained herein is not applicable to other sites.

Our interpretations of subsurface conditions are based on data from widely spaced boreholes and explorations at the site. It is possible that areas with undetected contamination exist in areas of the site that were not explored by drilling or by test pit explorations.

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

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Please call if you have questions concerning our report.

Respectfully submitted,

GeoEngineers, Inc.

Cheryl L. Haines

Cheryl L. Haines Geologist

James a Tuiller

James A. Miller Principal

CLH: JAM: cs

TABLE 1 SUMMARY OF HYDROCARBON VAPOR CONCENTRATIONS AND SOIL ANALYTICAL DATA

-									Hydrocarbon
				3			Fuel Hydrocarbons(c)	arbons(c)	Vapor
Sample	Sample	тРН(а)		BETX (ppm)(b)	pm)(b)		Gasoline	Diesel	Concentration(d)
Number	Depth(ft)	(mdd)	В	ш	F	×	(maa)	(mou)	(n) (n) (n) (n)
MW-1*	3	340	<0.025	<0.025	<0.025	0.16	LN LN	Inda'	- 1
MW-2	×	7.1	<0.025	<0.025	<0.025	<0.025	: 5	= =	00/
HW-3	м	12	<0.025	<0.025	<0.025	<0.025		ž 2	>10,000
7-MM	20.5	580	<0.025	<0.025	<0.025	<0.025	: 2	E 5	000,014
MW-5	23	1500	<0.13	1.3	<0.13	7 7		2 1	000,000
9-MH	28	4.6	0.032	<0.025	<0.025	\$0 US	2 5	Z :	000,001
TP-1	-	12	I.S.	IN	12	N	5 5	2 4	009
TP-2	3.5	HT	N	LN.	Z	×	, &	? <	
Composite 1	0.5	2500	N	1N	IN	- N	IN	, 5	
Composite 2*	0.5	26	<0.025	0.074	<0.025	3.4	. X	: X	-

Notes:

- (a) Analyzed by EPA Method 418.1 for Total Petroleum Hydrocarbons.
- (b) Analyzed by EPA Method 8020 for Benzene, Ethylbenzene, Toluene, and Tolal Xylenes.
- (c) Analyzed by modified EPA Method 8015 for Fuel Hydrocarbons.
- (d) Measurements obtained using a Bacharach TLV Sniffer calibrated to hexane (110 ppm = 1% LEL)
- *Also analyzed by EPA Method 8010 for Chiorinaled Hydrocarbons. Chlorinaled Hydrocarbons were not detected in this sample,
 - "ppm" indicates "parts per million"
- "<" indicates "less than"
- "NT" indicates "not tested"
- "ft" Indicates feet

TABLE 2 SUMMARY OF GROUND WATER ANALYTICAL DATA

		,		A41A7 4	11111	2000					
				1 – AA [A]	MVV-3	MW-4	-4	MW-5	-5	MW-6	9-
Analytes	Units	Standard	Source	11/22/89	11/22/89	11/22/89	1/16/90(a)	11/22/89	1/16/90/a)	11/22/80	1/16/00/21
Chlorinated Hydrocarbons									_	112203	1/10/30(d)
(EPA Method 8010)											
1,2-Dichloroethane	qdd	S	MCL	1.0	K	20	20	Þ	, ,	ŀ	(
1,1,1-Trichloroethane	qdd	200	MC	4 6	- LV	7 2	3 6	Z	50.2 0.0	Z :	<0.2
Trichloroethene	qdd	2	WC C	60%	Į.	C C	20.7	Z I	<0.2	- !	<0.5
						3	20.2	2	<0.2	Z	<0.2
(EPA Method 8020)											
	qdd	S	MCL	5.3	<0.5	4		- u		ŗ	
Ethylbenzene	qdd	700	700 Proposed MCL	1.5	9			0.00		<0.5 7	
	ddd	2,000	2,000 Proposed MCL	2.2	2.9			5 4		ζ.Ο. 	
Total Xylenes	qdd	10,000	Proposed MCL	8.4	1 4	5 5		0.0		\$0.5 0	
Total Petroleum Hydrocarbons						4		3		<0.05	
(EPA Method 418.1)	шфф	15	Ecology	0.14	0.50	0.21		20		2	
								20		<0.05	

Notes:

"ppb" Indicates "parts per billion"

"ppm" Indicates "parts per million"

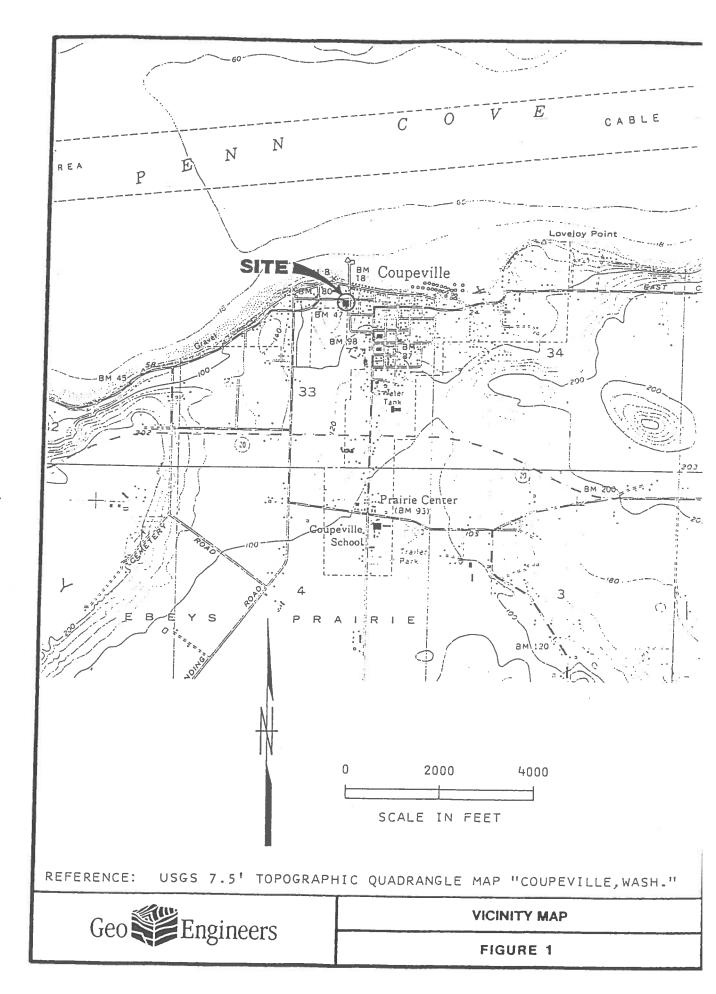
"NT" indicates "not tested"

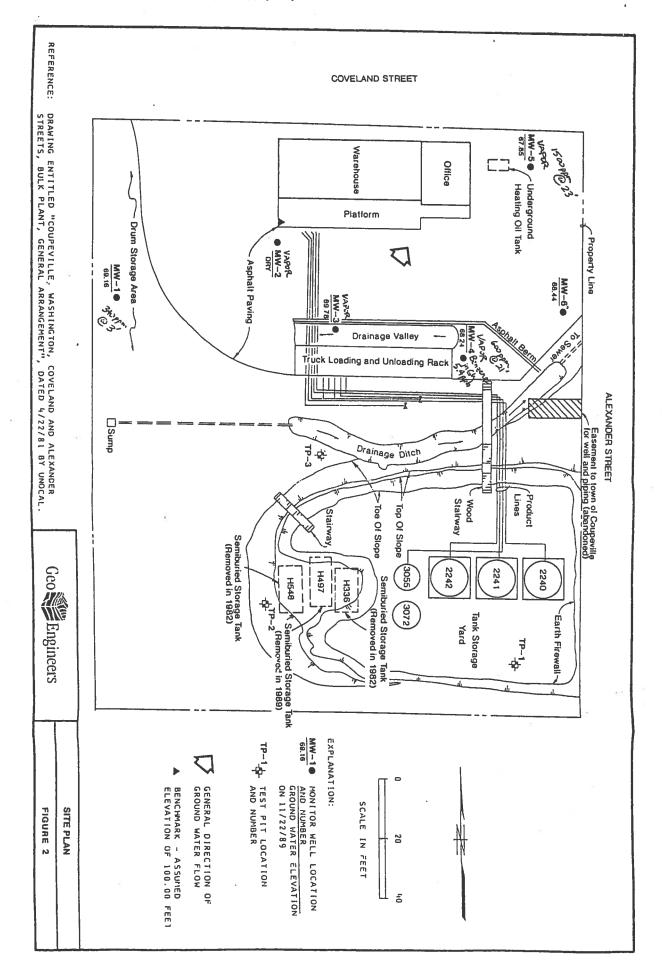
"<" Indicates "less than"

"MCL" Indicates "maximum contaminant level" "Ecology" indicates "Washington Department of Ecology"

(a) Ground water from MW-4 was resampled on 1/16/89 to verify concentrations of chlorinated solvents reported in the sample obtained on 11/22/89.

MW-5 and MW-6 were sampled on 1/16/90 to determine the downgradient extent of solvent-related contamination.





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APPENDIX A

FIELD EXPLORATIONS

DRILLING AND SOIL SAMPLING PROGRAM

Subsurface conditions at Bulk Plant 0138 were explored by drilling six borings and by excavating three test pits at the locations indicated in Figure 2. The borings were drilled between November 6 and 8, 1989 to depths of 17.0 to 39.0 feet using trailer-mounted hollow-stem auger drilling equipment owned and operated by GeoBoring and Development. The test pits were excavated on November 7, 1989 using a rubber-tired backhoe owned and operated by Krief Construction. The drilling and soil sampling equipment was cleaned with a hot-water pressure washer between each boring.

A hydrogeologist from our staff determined the boring and test pit locations, examined and classified the soils encountered, and prepared a detailed log of each boring and test pit. Soils encountered were classified visually in general accordance with ASTM D-2488-83, which is described in Figure A-1. An explanation of the boring log symbols is presented in Figure A-2. The boring logs are given in Figures A-3 through A-9. The test pit logs are presented in Appendix A.

Soil samples were obtained from each boring using a split-barrel sampler (1.5-inch ID). The sampler was driven 18 inches by a 140-pound weight falling a vertical distance of approximately 30 inches. The number of blows needed to advance the sampler the final 12 inches is indicated to the left of the corresponding sample notations on the boring logs.

Grab soils samples were obtained from the test pits every 2 feet. Sample depths are indicated on the test pit logs.

One soil sample from each boring was selected for chemical analysis of benzene, ethylbenzene, toluene, and xylenes (BETX); and total petroleum hydrocarbons (TPH). The soil sample from Boring MW-1 was also analyzed for chlorinated solvents. Soil samples were selected from two of the three test pits for chemical analysis of fuel hydrocarbons (gasoline and diesel) and total petroleum hydrocarbons. One composite shallow soil sample was obtained from the drum storage area for analysis of total petroleum hydrocarbons. One composite sample was collected from the drainage ditch for analysis of BETX, chlorinated solvents and TPH. Samples that were

tested are denoted in our boring logs with a "CA." Chain-of-custody procedures were followed in transporting the soil samples to the laboratory.

FIELD SCREENING OF SOIL SAMPLES

Soil samples were split into two portions. One portion of each sample was retained for soil classification and analytical testing. The second portion was tested in the field for petroleum-related contamination using (1) visual examination, (2) sheen testing, and (3) headspace vapor testing using a Bacharach TLV Sniffer calibrated to hexane. The results of headspace and sheen screening are including on the boring logs.

Visual screening consists of inspecting the soil for the presence of stains indicative of residual petroleum hydrocarbons. Visual screening is generally more effective in detecting the presence of heavier petroleum hydrocarbons such as motor oil, or when hydrocarbon concentrations are high. Sheen screening and headspace vapor screening are more sensitive methods which have been effective in detecting residual petroleum hydrocarbons at concentrations less than regulatory cleanup guidelines.

Sheen testing involves placing soil in water and observing the water surface for signs of sheen. Sheen classifications are as follows:

NS - No Sheen

SS - Slight Sheen

MS - Moderate Sheen

HS - Heavy Sheen

No visible sheen.

Light colorless film, spotty to globular; spread is irregular, not rapid; areas of no sheen remain; film dissipates rapidly.

Light to heavy film, may have some color or iridescence, globular to stringy; spread is irregular to flowing.

Heavy colorful film with iridescence; spread is rapid, and sheen flows off the sample; entire water surface may be covered with sheen.

Headspace vapor screening involves placing a soil sample in a plastic sample bag. Air is captured in the bag and the bag is shaken to expose the soil to the air trapped in the bag. The probe of a Bacharach TLV Sniffer is used to puncture the bag and the TLV Sniffer records the concentrations of combustible vapor in the sample headspace. The TLV Sniffer records concentrations in parts per million (ppm) and is calibrated to hexane. The instrument is designed to detect combustible hydrocarbons at concentration ranges between 100 ppm and 10,000 ppm.

Field screening results are site specific and vary with temperature, soil type, soil moisture content and type of contaminant.

MONITOR WELL CONSTRUCTION

Two-inch-diameter, Schedule 40 PVC pipe was installed in each boring at the completion of drilling. The lower portion of the PVC pipe is machine slotted (0.02-inch slot width) to allow entry of ground water, free floating product and hydrocarbon vapors into the well casing. Medium sand was placed in the borehole annulus surrounding the slotted portion of the PVC pipe. Monitor well construction is indicated in Figures A-3 through A-9.

The monitor wells were developed after drilling by removing water from the wells with a stainless steel bailer. We determined the elevations of the well casings to the nearest 0.01 foot with an engineer's level on November 8, 1989. An elevation datum of 100 feet was assumed on the southwest corner of the loading platform (Figure 2).

GROUND WATER ELEVATIONS

The depth to the ground water table relative to the monitor well casing rims was measured on November 22, 1989. The site measurements were made using a weighted fiberglass tape and water-finding paste. Ground water elevations were calculated by subtracting the water table depth from the casing rim elevations.

GROUND WATER SAMPLING PROGRAM

Ground water samples were collected from MW-1 and MW-3 through MW-6 by GeoEngineers on November 22, 1989. The water samples were collected with a teflon bailer after at least three well volumes of water were removed from each well casing. The water samples were transferred to septum vials and kept cool during transport to the testing laboratory. The bailer was

cleaned prior to each sampling attempt with a trisodium phosphate wash and a distilled water rinse.

HYDROCARBON VAPOR CONCENTRATIONS

Hydrocarbon vapor concentrations were measured in each monitor well casing on November 22, 1989. Vapor concentrations in parts per million (ppm) were measured with our Bacharach TLV Sniffer, which is calibrated to hexane. The field data are presented in Table 1 of this report.

CHEMICAL ANALYTICAL PROGRAM

Ten soil samples and five water samples were analyzed by Analytical Technologies, Inc. The samples were analyzed for petroleum hydrocarbons using freon extraction/infrared spectroscopy in accordance with EPA Method 418.1, and for BETX using gas chromatography/photoionization detection in accordance with EPA Method 8020. Two soil samples and two water samples were also analyzed for chlorinated solvents using gas chromatography/electrolytic conductivity in accordance with EPA Method 8010. Two soil samples were analyzed for gasoline and diesel using gas chromatography in accordance with EPA Method 8015, modified.

The analytical data are presented in Appendix B.



TABLE A-1 SUMMARY OF FIELD SCREENING RESULTS FOR TEST PITS

Test Pit	Date Sampled	Depth (feet)	Sheen(1)	TLV Headspace (ppm) (2)
TP-1	11/7/89	2	feet) Sheen(1) 2	<100
	11/7/89	4	, NS	<100
	11/7/89	6	NS	<100
	11/7/89	8	NS	<100
	11/7/89	10	NS	<100
	11/7/89	11	NS	<100
TP-2	11/7/89	2	SS	<100
	11/7/89	3.5	MS	160
	11/7/89	4	ss	<100
	11/7/89	6	ss	<100
	11/7/89	8	NS	200
	11/7/89	10	NS	<100
	11/7/89	12	NS	<100
TP-3	11/7/89	1	ss	<100
	11/7/89	2	NS	<100
	11/7/89	4	ss	<100
	11/7/89	6	NS	<100
	11/7/89	8	NS	<100
	11/7/89	10	ss	<100
	11/7/89	11	ss	<100

Notes:

- (1) "NS" signifies "no sheen"
 - "SS" signifies "slight sheen"
- "MS" signifies "moderate sheen"
- "HS" signifles "heavy sheen"
- (2) "ppm" signifies "parts per million"
 - "--" signifies "not tested"

SOIL CLASSIFICATION SYSTEM

!	MAJOR DIVISIONS		GROUP SYMBOL	GROUP NAME
COARSE	GRAVEL	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
GRAINED			GP	POORLY-GRADED GRAVEL
SOILS	MORE THAN 50% OF COARSE FRACTION	GRAVEL WITH FINES	GM	SILTY GRAVEL
MORE THAN 50%	RETAINED ON NO. 4 SIEVE		GC	CLAYEY GRAVEL
RETAINED ON NO. 200 SIEVE	SAND	CLEAN SAND	sw	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
	MORE THAN 50% OF COARSE FRACTION	SAND WITH FINES	SM	SILTY SAND
	PASSES NO. 4 SIEVE	***************************************	sc	CLAYEY SAND
FINE	SILT AND CLAY	INORGANIC	ML	SILT
GRAINED		INORGANIC	CL	CLAY
SOILS	LIQUID LIMIT LESS THAN 50	ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
MORE THAN 50%	SILT AND CLAY	1310.50.1310	мн	SILT OF HIGH PLASTICITY, ELASTIC SILT
PASSES NO. 200 SIEVE		INORGANIC	СН	CLAY OF HIGH PLASTICITY, FAT CLAY
	LIQUID LIMIT 50 OR MORE	ORGANIC	ОН	ORGANIC CLAY, ORGANIC SILT
ніс	SHLY ORGANIC SOILS	3	PT	PEAT

NOTES:

- Field classification is based on visual examination of soil in general accordance with ASTM D2488-83.
- Soil classification using laboratory tests is based on ASTM D2487-83.
- Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

- Dry Absence of moisture, dusty, dry to the touch
- Moist Damp, but no visible water
 - Wet Visible free water or saturated, usually soil is obtained from below water table

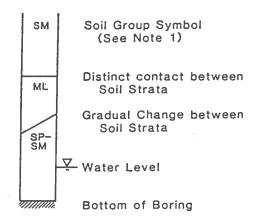


SOIL CLASSIFICATION SYSTEM

FIGURE A-1

- AL Atterberg limits
- CP Compaction
- CS Consolidation
- DS Direct shear
- GS Grain-size analysis
- HA Hydrometer analysis
- K Permeability
- M Moisture content
- MD Moisture and density
- SP Swelling pressure
- TX Triaxial compression
- UC Unconfined compression
- CA Chemical Analysis

SOIL GRAPH:



BLOW-COUNT/SAMPLE DATA:

Blows required to drive Dames & Moore sampler 12 inches or other indicated distances using 300 pound hammer falling 30 inches.

"P" indicates sampler pushed with weight of hammer or hydraulics of drill rig.



P 🔲

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Location of relatively undisturbed sample

Location of disturbed sample

Location of sampling attempt with no recovery

Location of sample attempt using Standard Penetration Test procedures

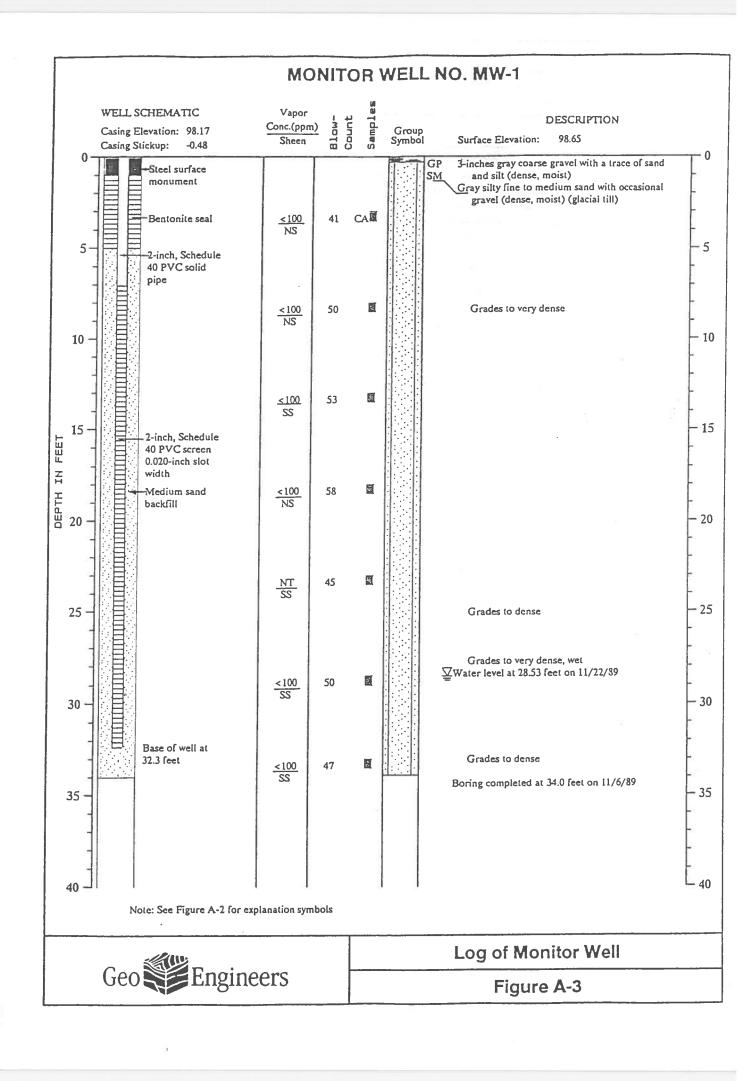
NOTES:

- 1. Soil classification system is summarized in Figure A-1.
- The reader must refer to the discussion in the report text as well as the exploration logs for a proper understanding of subsurface conditions.

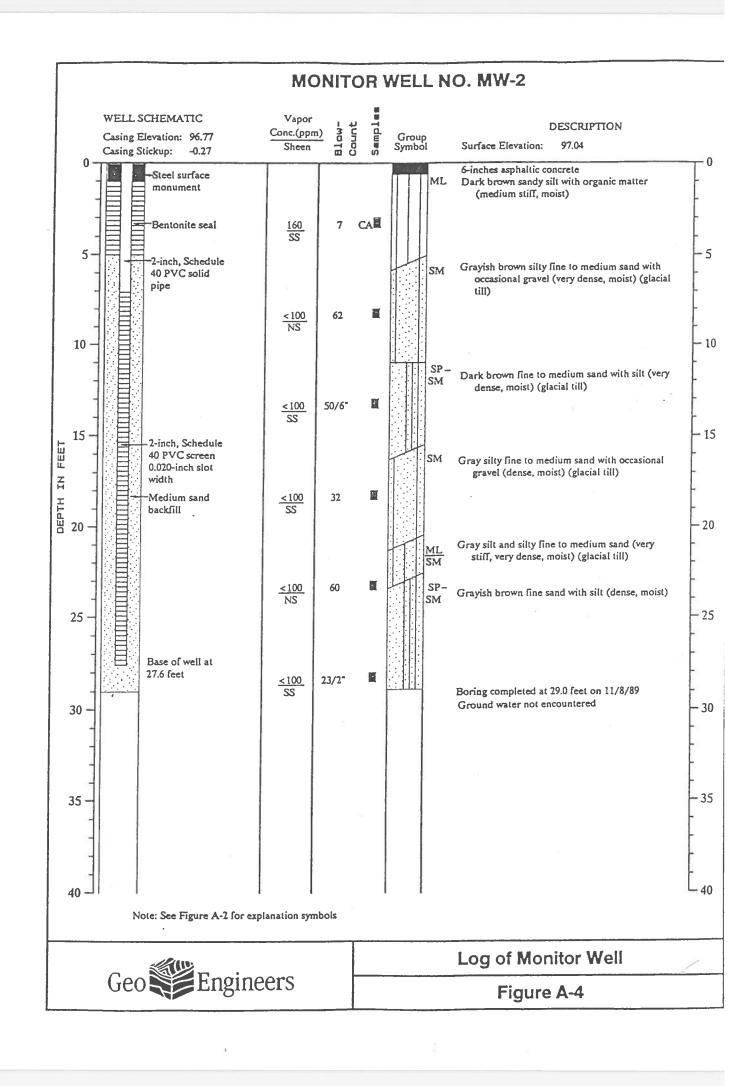


KEY TO BORING LOG SYMBOLS

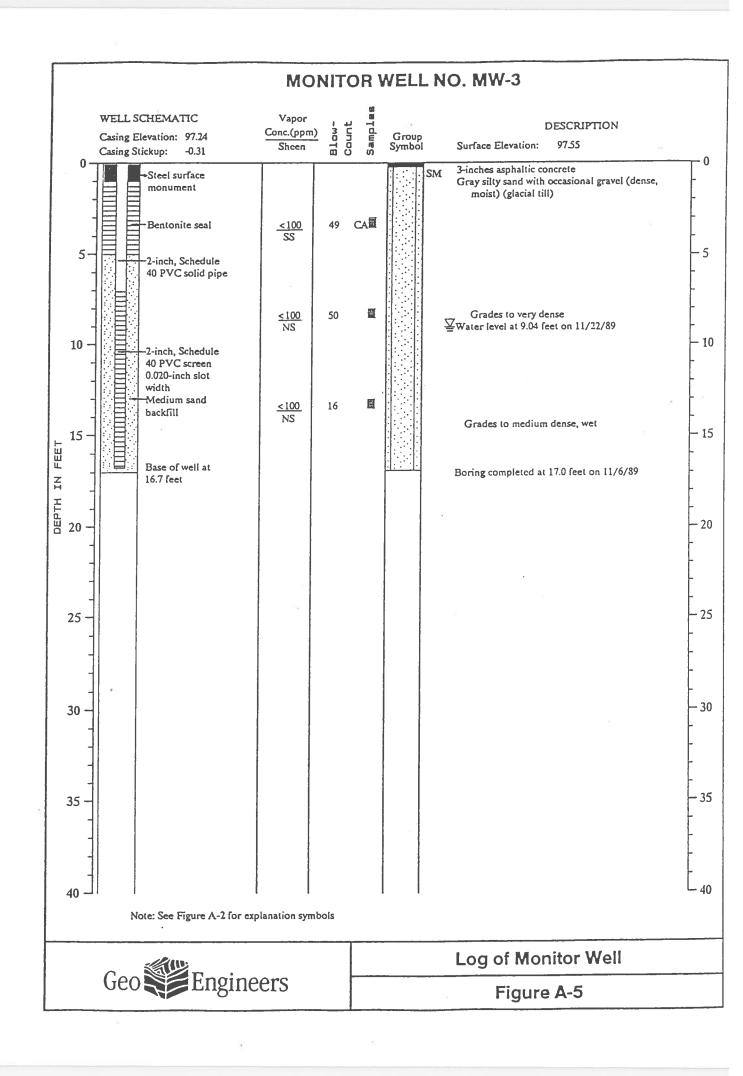
FIGURE A-2



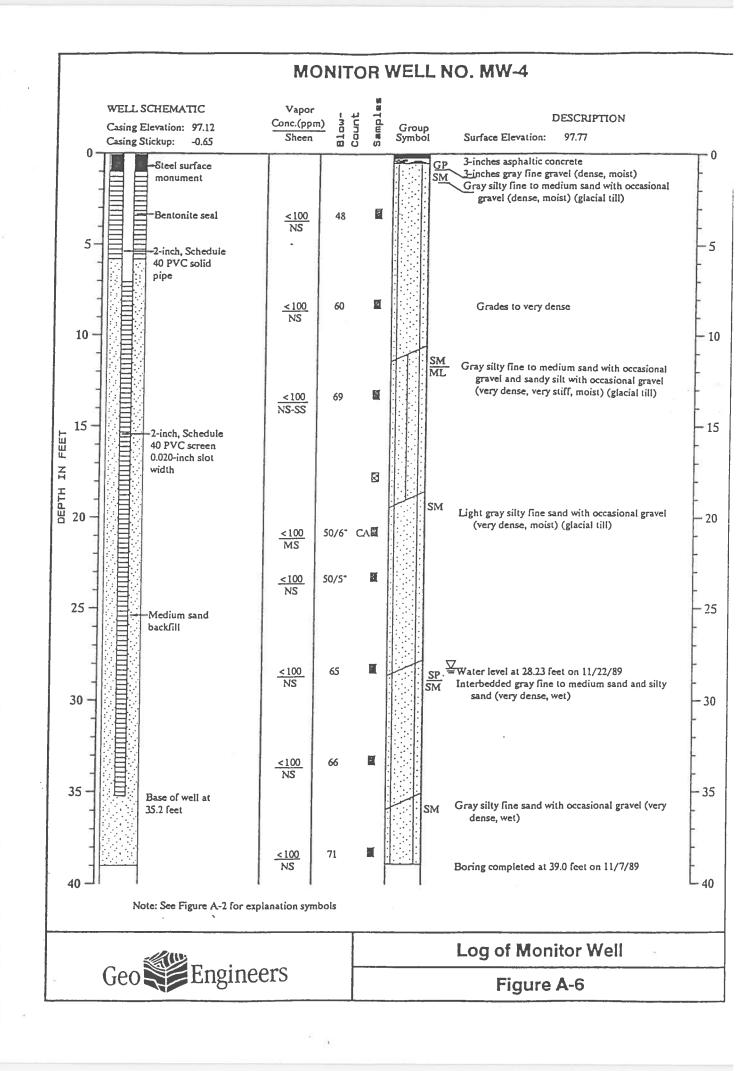
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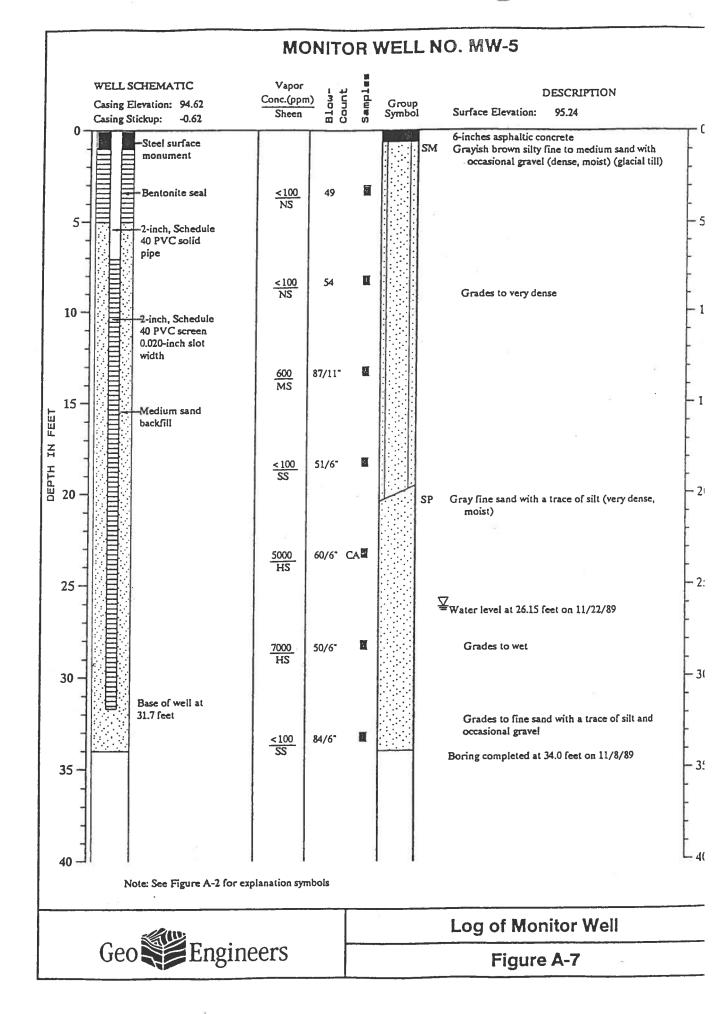


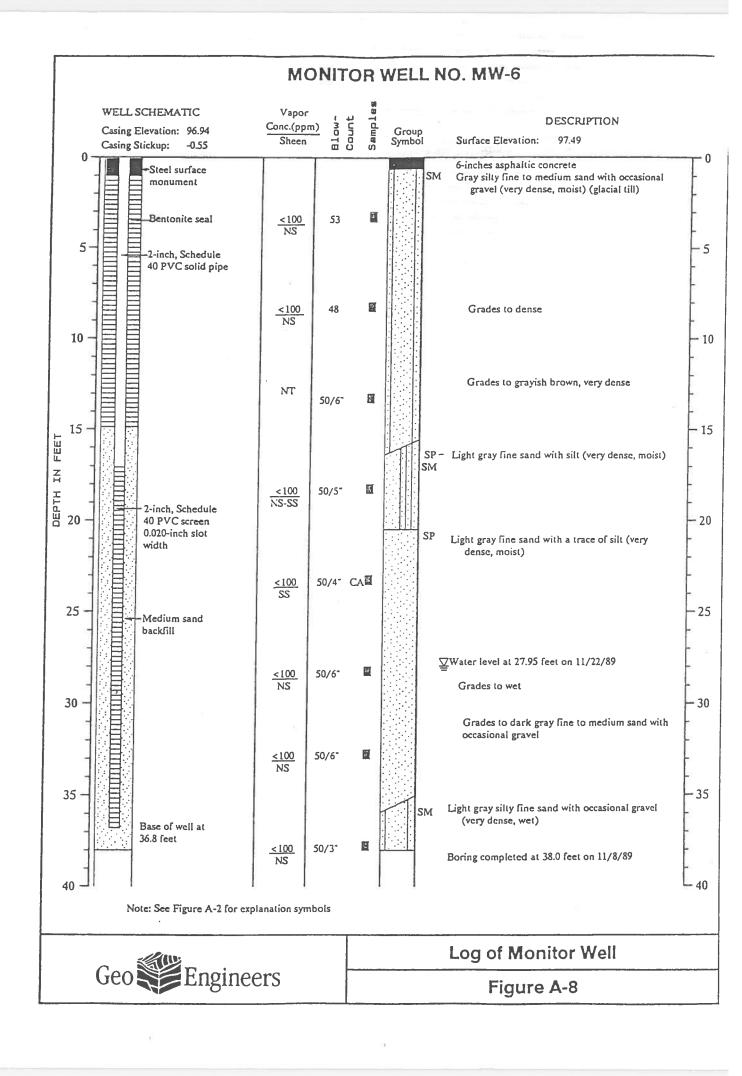
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11-211-2







161 CA B04

SM

TEST	PIT	7

APPROXIMATE ELEVATION: 103.4 FEET

0.0 - 9.5 SM 9.5 - 11.0

GRAYISH BROWN SILTY FINE TO MEDIUM SAND WITH GRAVEL AND OCCASIONAL COBBLES (VERY DENSE, MOIST) (GLACIAL TILL)

BROWN SILTY FINE SAND (DENSE, HOIST)

TEST PIT COMPLETED AT 11.0 FEET ON 11/07/89

NO GROUND WATER SEEPAGE OBSERVED

PETROLEUM-LIKE ODOR DETECTED BETWEEN 10.0 AND 11.0 FEET

BAG SAMPLES OBTAINED AT 2.0, 4.0, 6.0, 8.0, 10.0 AND 11.0 FEET SAMPLE FROM 11.0 FEET OBTAINED FOR CHEMICAL ANALYSIS

TEST PIT 2

APPROXIMATE ELEVATION: 104.6 FEET

0.0 - 3.0 SP-SH BROWN FINE TO MEDIUM SAND WITH SILT AND GRAVEL (DENSE, MOIST) (FILL)

3.0 - 3.8HL. DARK BROWN SANDY SILT WITH A TRACE OF ORGANIC MATTER (SOFT, MOIST) 3.8 ~ 5.0 SH

BROWN SILTY FINE SAND WITH A TRACE OF ORGANIC MATTER AND OCCASIONAL CRAVEL (HEDIUM DENSE, MOIST) 5.0 - 7.5 SP-SM BROWN FINE TO MEDIUM SAND WITH SILT AND OCCASIONAL GRAVEL (MEDIUM

DENSE, MOIST)

7.5 - 12.0 SM GRAYISH BROWN SILTY FINE TO MEDIUM SAND WITH OCCASIONAL GRAVEL (DENSE, HOIST) (GLACIAL TILL)

TEST PIT COMPLETED AT 12.0 FEET ON 11/7/89

NO GROUND WATER SEEPAGE OBSERVED

PETROLEUM-LIKE ODOR DETECTED AT 3.5 FEET

BAG SAMPLES OBTAINED AT 2.0, 3.5, 4.0, 6.0, 8.0, 10.0 AND 12.0 FEET

SAMPLE FROM 3.5 FEET OBTAINED FOR CHEMICAL ANALYSIS

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.



LOG OF TEST PIT

FIGURE A-9

DEPTH BELOW GROUND SURFACE (FEET)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		IEST PIT 3 APPROXIMATE ELEVATION: 99.9 FEET
0 - 1.5	MI.	DARK BROWN SANDY SILT WITH ORGANIC MATTER (SOFT, MOIST) (FILL)
1.5 - 3.5	SM ·	LIGHT BROWN SILTY FINE SAND WITH OCCASIONAL GRAVEL AND A TRACE OF ORGANIC MATTER (LOOSE, DRY) (FILL)
3.5 - 8.0	SM	GRAY SILTY FINE TO MEDIUM SAND WITH OCCASIONAL GRAVEL (VERY DENSE, MOIST)
8.0 - 11.0	ML	BROWN SANDY SILT (SOFT, MOIST)

BAG SAMPLES OBTAINED AT 1.0, 2.0, 4.0, 6.0, 8.0, 10.0 AND 11.0 FEET

TEST PIT COMPLETED AT 11.0 FEET ON 11/7/89

NO GROUND WATER SEEPAGE OBSERVED NO PETROLEUM ODOR DETECTED

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.



LOG OF TEST PIT

FIGURE A-10



NOV 2 9 1989 MAINT. & CONT.

November 28, 1989

Consulting Geotechnical Engineers and Geologists

Unocal P.O. Box 76 Seattle, Washington 98121

Attention: Mr. Gary Gunderson

Preliminary Results
Field Explorations
Subsurface Contamination Evaluation
Bulk Plant 0138
Coupeville, Washington
File No. 0161-205-B04

This summarizes the results of our recently completed field studies at the above-referenced bulk plant. Six monitor wells were installed to depths ranging between 17.0 to 39.0 feet. Three test pits were excavated to depths ranging from 11.0 to 12.0 feet. Two surficial soil samples were obtained for chemical analyses; one from the drum storage area and one from the drainage ditch. Final results and opinions will be provided following laboratory testing of soil and ground water samples.

General Subsurface Geology: Asphaltic concrete and/or gravel paving was encountered to a depth of approximately 0.5 feet in all of the borings and test pits. Native silty sand and sandy silt (glacial till) underlies the surficial paving. Borings MW-2, MW-4, MW-5 and MW-6 encountered sand with a variable silt content beneath the glacial till (below depths of approximately 16 to 28 feet). The borings did not encounter the base of the silty sand unit.

Field Screening Data: A slight petroleum-like odor and a low vapor concentration was detected in the soil sample collected from 3.0 feet in MW-2. A moderate sheen was detected in the soil sample collected at 20.5 feet in MW-4. A moderate sheen and vapor concentration were detected in the soil sample collected at 13.0 feet in MW-5. Heavy sheens and

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Unocal November 28, 1989 Page 2

relatively high vapor concentrations were detected in soil samples collected at 23.0 and 28.0 feet in MW-5. A low vapor concentration was detected in the soil sample collected at 3.5 feet in TP-2. All of the other soil samples obtained had no or slight sheens and the vapor concentrations were below the level of significance (<100 ppm).

Hydrocarbon Vapor Measurements: Hydrocarbon vapor concentrations were not measured in the monitor well casings during drilling operations. Vapor concentrations will be measured in the casings before completing our studies.

Water Table Depth: Ground water was encountered at depths of approximately 26 to 29 feet below the ground surface in MW-1, MW-4, MW-5 and MW-6. Perched ground water was encountered in MW-2 at approximately 10 feet below grade. Ground water was not measured in MW-3 during our drilling operations.

Floating Product or Sheen: Free (floating) product was not encountered during the drilling and excavation of the borings and test pits. A slight petroleum-like odor was noted in the water purged from MW-5 during development of the well screens immediately following drilling operations.

Comments: Boring MW-l is located on the northwestern side of the property in the drum storage area. Boring MW-2 is located southwest of the concrete platform, adjacent to the abandoned product lines. Boring MW-3 is located north of the loading rack. Boring MW-4 is located north of the truck unloaders. Boring MW-5 is located on the east side of the property, north of the drainage ditch. Boring MW-6 is located east of the heating oil tank.

Soil samples have been submitted to Analytical Technologies, Inc. for chemical analysis. Ground water samples will be obtained within two weeks after the completion of drilling operations.

Unocal November 28, 1989 Page 3

We will keep you informed of our findings as data are developed.

Yours very truly, GeoEngineers, Inc.

James A. Miller, P.E.

Principal

CLH: JAM: cs



October 6, 1989

Consulting Geotechnical Engineers and Geologists

Unocal P.O. Box 76 Seattle, Washington 98111

Attention: Mr. Gary Gunderson

Report of Remedial Actions Diesel Storage Tank Removal Bulk Plant 0138 Coupeville, Washington File No. 0161-205-B04

INTRODUCTION

A summary of our observations during the removal of a semi-buried diesel storage tank at Bulk Plant 0138 is presented in this report. The site is located southwest of the intersection between Coveland Street and Alexander Street in Coupeville, Washington as shown on the Vicinity Map (Figure 1). The general layout of the site is shown on the Site Plan, Figure 2. The portion of the facility which is the subject of this study is located in the southern section of the bulk plant site.

SOIL EXCAVATION AND SAMPLING

Quality Petroleum Construction removed one 6,000-gallon semi-buried diesel storage tank from the location shown in Figure 2. A representative of our staff was present to observe the tank removal activities on September 7, 1989. The northern portion of the excavation extended to a total depth of 0.5 foot. The bottom of the excavation sloped downward to a depth of 6.5 feet in the southern portion. Ground water was not encountered in the excavation. Soil that was removed during tank removal activities was stockpiled on both sides of the excavation.

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Unocal October 6, 1989 Page 2

GeoEngineers collected six soil samples (samples 1 through 6) from the limits of the excavation for chemical analyses. Soil sample locations are shown in Figure 2.

We conducted field screening on the soil samples for evidence of contamination using water sheen and volatile organics headspace field screening methods. Sheen testing involves immersing soil in water and observing the water surface for signs of sheen. Headspace vapor screening involves placing a soil sample in a plastic sample bag. Air is captured in the bag and the bag is shaken to expose the soil to the air trapped in the bag. The probe of a Bacharach TLV Sniffer is used to puncture the bag, the instrument withdraws the air from the bag, and the TLV Sniffer records the concentrations of combustible vapor in the air removed from the sample headspace.

The TLV Sniffer records vapor concentrations in parts per million (ppm) and is calibrated to hexane. The Sniffer is designed to quantify combustible gas concentrations in the range of 100 to 10,000 ppm. Field screening results are site specific. The results vary with temperature, soil type, type of contamination and soil moisture content.

A slight to moderate sheen was observed during field screening on samples 1 through 6. A slight sheen was also observed on a background sample obtained from a similar soil type collected from another portion of the site. Headspace field screening methods did not detect hydrocarbon vapor concentrations greater than 100 ppm in any of the soil samples. Field screening results are summarized in Table 1.

Soil samples 1 through 6 were submitted to Enviros Analytical Laboratory for analysis of total petroleum hydrocarbons (TPH) by EPA Method 418.1. Soil samples 2 and 5 were also analyzed for fuel hydrocarbons by modified EPA Method 8015. The results for these analyses are summarized in Table 1. Laboratory reports are attached.

The current Washington State Department of Ecology (Ecology) cleanup guidelines for petroleum-related contamination in soil is 200 ppm. The concentrations of petroleum compounds detected in the six soil samples are less than Ecology cleanup guidelines (Table 1).



Unocal October 6, 1989 Page 3

CONCLUSIONS

Based on the results of our chemical analyses, residual soil contamination in the floor and walls of the semi-buried diesel storage tank excavation is either nondetected or less than current Ecology cleanup guidelines.

LIMITATIONS

We have prepared this report for use by Unocal. This report can be made available to prospective buyers of the property and to regulatory agencies. The report is not intended for use by others and the information contained herein is not applicable to other sites.

Our interpretations of the soil conditions are based on field observations and chemical analytical data from soil samples obtained during the excavation of the semi-buried diesel tank. It is possible that contamination may exist in portions of the site which were not excavated or analyzed.

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

- 0 0 0 -

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

Yours very truly,

GeoEngineers, Inc.

James A. Miller, P.E.

amera huller

Principal

CLH: JAM: sd

Attachments

Two copies submitted

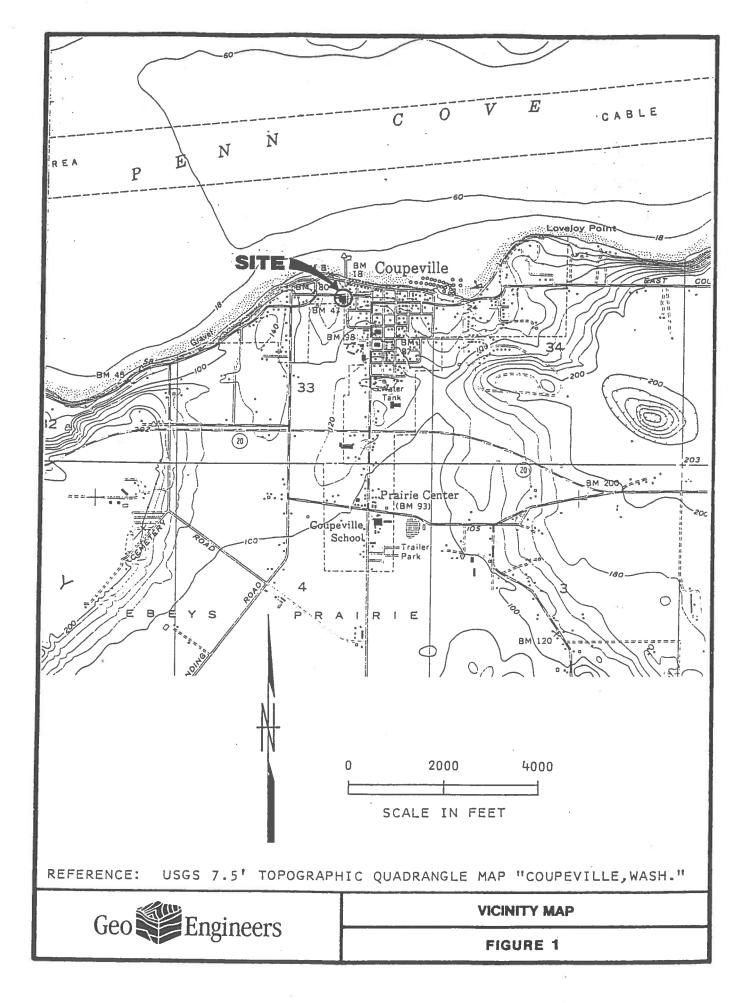
SUMMARY OF FIELD SCREENING AND SUBSURFACE SOIL CHEMISTRY TABLE 1

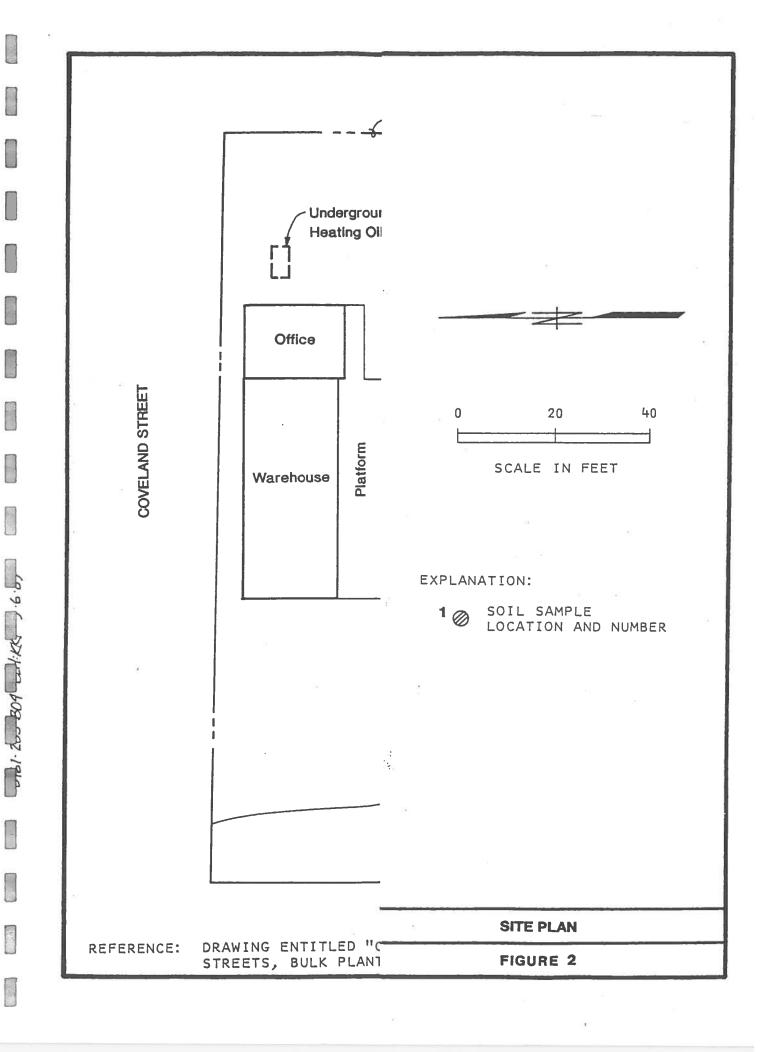
-									
	Sample	Location	East Wall	ž	Southeast Corner	West Wall	South Wall	Base South Side	Base North Side
	arbons (c)	Concentration Carbon Range	1		1	1	l	C20-C35	i I
	Fuel Hydrocarbons (c)	Concentration	1		80	į 1	!	82	1
	TPH(b)	(mdd)	21.2		<5.0	18.7	48.1	112	<5.0
ening	Sheen	Test	Slight to	Moderate	Slight to Moderate				
Field Screening	Headspace	Vapors(a)	<100		<100	V V	<100	<100	<100
	Sample	Depth (ft)	(Composite)		6	(Composite)	(Composite)	6.5	6.5
	Sample	Number	-		2	ო	4	2	9

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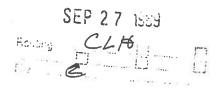
- (a) Headspace vapor screening was conducted using a Bacharach TLV Sniffer calibrated to hexane (ppm).
 - (b) Total petroleum hydrocarbons analyzed using EPA Method 418.1. (c) Fuel hydrocarbons analyzed using EPA Method 8015 (modified).
 - (d) The laboratory can not quantify carbon ranges below 10 ppm.
 - "ppm" signifles "parts per million"

 - "--" signifies "not tested" or "not reported"





Dealingman



September 12, 1989

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

Dear Cheryl:

Enclosed are the results of the analyses of samples submitted on September 7, 1989 from Project 0161-205-B04.

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

Sincerely,

James K. Farr, Ph.D.

JKF

Enclosures

Date of Report: September 12, 1989 Date Submitted: September 7, 1989

Project: 0161-205-B04

RESULTS OF ANALYSES OF ENVIRONMENTAL SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS BY IR (EPA METHOD 418.1)

Sample #	Total Petroleum <u>Hydrocarbons</u> (ppm)
	0.7. 0
890907-1	21.2
890907-2	<5.0
890907-3	18.7
890907-4	48.1
890907-5	112
890907-6	<5.0
<u>Ouality Assurance</u>	
Method Blank	<5.0

Date of Report: September 12, 1989
Date Submitted: September 7, 1989

Project: 0161-205-B04

RESULTS OF ANALYSES OF SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS (C7-C30) BY MODIFIED EPA METHOD 8015

Sample #	Matrix	Dil. Fac.	TPH (ppm)	RANGE (C7-C30)
890907-2	Soil	1	8	
890907-5	Soil	1	82	C20-C35*
Quality A	ssurance			
Method Bl	ank	1	<1	~ ~ ~ ~
890907-5 (Duplica	te)	1	140	C20-C35
890907-5 (Matrix Spiked @ Percent		1	60%	C7-C35
890907-5 (Matrix Spiked @	Spike Dupli 10 ppm	cate)		
	Recovery	1	64%	C7-C35

* - Oil

Bagainely wa GEI FILE NO. Q/6/-205-804 Moscal TIME 24 dan collons COMMENTS 82-4 DATE DATE 8015 (modified) (quel finger print, FROJECT NAME PROJECT LOC. NO: OF SAMPLE CONTAINERS 418.1 (testal Detaclum ta Jac S Lhanks N 3 RECEIVED BY AND BATURES NAME TO STATE OF STATE O RECEIVED BY (SIGNATURE NAME FIRM _______ ANALYSES TO BE CONDUCTED 418.1,8015 418.1.8015 ZANDS 418.1 418.1 1.814 7/20 24-40uros 000 GEOENGINEERS INC. 140th AVE. N.E. SUITE BELLEVUE, WASHINGTON 98005 206-746-5200 PRESERVATIVE ADDED TO SAMFLE Ecidax CHAIN OF CUSTODY RECORD -9/1/89 2 ; 2 1 CPA MethOC method results Withis DATE TIME TIME FIELD FILTERED Cocm 20 = 0 1 1 das , 68/1/6 DATE DATE CUSTOdy TYPE OF SAMPLE 301 20 11 1 0 1 1 allerbas DEPTH OF SAMPLE Gomo apmis analyse June 6.5 Lleat, ginsesa., dac. NAME ... Chest / Konse ന RELINGUISHED BY(SIGNATURE) NAME 9 SAMPLED (OATE) 450 58/4/6 58/1/6 9/1/89 58/1/6 91112 68/1/6 68/1/6 ADDITIONAL COMMENTS: Please png SAMFLED BY 77 Me BRTE SANFLED lease 0955 5007 þ 1207 h N 0 :581/67/890907-Z 1388 890807-1 13 1890501-5 1384 890907-3 SAMPLE 3-106068 NAME FIRM 890907-4 No. FIKゴ *