

RSI
REMEDIATION SERVICE, INT'L.

P.O. BOX 1601, OXNARD, CALIFORNIA 93032
(805) 644-5892 • FAX (805) 654-0720

August 3, 1990

Larry Seto
Hazardous Materials Specialist
Alameda County Health Care Services Agency
Hazardous Materials Program
80 Swan Way, Room 200
Oakland, California 94621

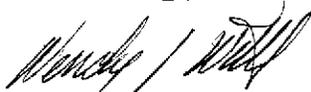
RE: Desert Petroleum station #796
2844 Mountain Boulevard
Oakland, CA

Dear Mr. Seto:

Enclosed is a copy of station #796's site assessment report for your review and comment. Four borings were advanced and sampled, and then completed as groundwater monitoring wells. Hydrocarbon contamination was found in both the soil and groundwater. However, it appears to be concentrated near the super-unleaded tank.

If you have any questions or concerns, please give me a call.

Sincerely,



Wendy J. Wittl
Senior Project Geologist

encl.

cc: Desert Petroleum, J. R.

RSI

REMEDIAION SERVICE, INT'L.

P.O. BOX 1601, OXNARD, CALIFORNIA 93032
(805) 644-5892 • FAX (805) 654-0720

Site Assessment Report
for
Desert Petroleum Station #796 (dba Arco)
2844 Mountain Boulevard
Oakland, California

prepared for
Desert Petroleum, Inc.
2060 Knoll Drive
Ventura, CA 93003

prepared by
RSI - Remediation Service, Int'l
P.O. Box 1601
Oxnard, CA 93032
(805) 644-5892

July 25, 1990

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1.0 INTRODUCTION

This report presents the data and findings of additional environmental assessment work completed at Desert Petroleum's station #796. This station operates under the Arco trade name and is located at 2844 Mountain Boulevard, Oakland, Alameda County, California (Figure 1). ~~Soil containing elevated levels~~ of hydrocarbons was discovered during the replacement of supply lines between the underground storage tanks and the pumps. Remediation Service, Int'l (RSI) has been retained to further delineate the gasoline contamination.

1.1 Site Description

The site is occupied by a retail gasoline outlet supplying regular, regular-unleaded and super-unleaded gasolines. The gasoline underground storage tanks have capacities of 3,000 gallons (super unleaded), 4,000 gallons (regular) and 10,000 gallons (regular unleaded). Surface improvements include a cashiers building, two pump islands and canopy (Figure 2).

1.2 Background Summary

Soil contamination was initially identified during replacement of the gasoline supply lines. Four soil samples were collected from beneath the previous supply lines in the vicinity of the fuel pumps, under the direction of Alameda County Health Care Services personnel. Laboratory analysis of the samples showed total petroleum hydrocarbon (TPH) concentrations ranging from 8 to 87 parts per million (ppm). An additional sample taken near the

edge of the super unleaded tank had a TPH concentration of 8,400 ppm.

The next phase of characterization was conducted by On-Site Technologies. Their excavation work started on July 7, 1989 and continued through August 18. Soil was removed from the south end of the super unleaded tank, creating a hole approximately ~~12 feet~~ in radius and 12 feet deep. All excavated dirt was stockpiled onsite in three separate locations. Soils uncovered by the excavation consisted of clays and gravelly clays. Groundwater flowed into the excavation and stabilized at 8.5 to 8.7 feet below grade.

Laboratory analyses of soil and water samples indicated a fairly confined plume of hydrocarbon contamination in the soil at the southern end of the super-unleaded tank. TPH concentrations for soil samples from the excavation ranged from 2 to 3,300 ppm. A groundwater sample obtained from the excavation contained a TPH concentration of 160 ppm.

2.0 SITE ASSESSMENT

2.1 Assessment Procedures

Under the supervision of an RSI geologist four soil borings, RS-1 through RS-4, were advanced and sampled on May 29 and 30, 1990 (Figure 2). Each boring was completed as a 4-inch PVC-cased groundwater monitoring well. During drilling operations soil

samples were collected every 5 feet, starting at 5 feet beneath ground surface (bgs) down to the total depth of each boring. These samples were used for laboratory analysis, field testing and soil description. The boring logs, a description of drilling and soil sampling operations and a well construction diagram are included in Appendix A. Table 1 presents well construction specifics.

All drilling was done by:

Kvilhaug Drilling

1109 Landini Lane

Concord, CA 94520

License Number 482390

Both soil and groundwater samples were transported to a California certified laboratory for analysis of benzene, toluene, ethyl benzene and total xylenes (BTXE) and total petroleum hydrocarbons (TPH) using EPA methods 8020 and 8015.

All samples were analyzed by:

Superior Analytical Laboratory, Inc.

1385 Fairfax Street, Suite D

San Francisco, CA 94124

Table 2 presents a summary of analytical results for soil samples and Table 3 gives a summary of analytical results for groundwater samples. The complete laboratory reports and chain of custody documents are included in Appendix C.

Groundwater was encountered during drilling in all borings. *depth?*

Upon completion of the wells, each well was developed by surging and bailing. All the wells went dry after a very short time. Approximately 25 gallons were recovered from RS-2 and RS-4, 35 gallons from RS-3 and 50 gallons from RS-1. After sufficient recharge into the wells, groundwater samples were collected. The primary purpose for well development is to ensure maximum groundwater flow into the well, with as little sediment as possible. At this site the adequacy of well development was severely limited by the very slow rate of groundwater recharge. Since the possible presence of a free product or dissolved phase was unknown, no additional water was added to the wells for development purposes.

2.2 Finding - Soil

The site is underlain by primarily fine-grained sediments to a depth of 25 feet. The two northwestern borings, RS-2 and RS-3; penetrated clay or silt layers with minor constituents of sand and/or gravel. The two southern borings, RS-1 and RS-4, have clay layers interbedded with silty or clayey sand beds. The proportion of sand layers to clay layers in these latter two borings is almost equal.

Three soil samples from each boring were selected for analyses, except for RS-3 which had only two samples chosen. Moderate concentrations of TPH were found in RS-1 at 10 feet (58 ppm) and in RS-2 at 5 feet (22 ppm) and 8 feet (240 ppm). Low levels of BTEX, below 1 ppm, were identified in all the other soil samples.

2.3 Findings - Groundwater

Groundwater occurs at very shallow depths at the site. Static water levels collected on May 30 ranged from 6 ft to 8.34 ft bgs (Table 4). A groundwater elevation map was contoured based on the May 30 measurements (Figure 3). The local gradient appears to be to the southwest, which is expected based on the topography.

Analytical results show that there are low to moderate levels of hydrocarbons in groundwater. The State standards for TPH and BTX maximum contaminant levels in drinking water were exceeded in RS-2. The analytical results from RS-1 were very similar, except xylenes were within standards. Only benzene exceeded the drinking water standards in RS-3 and RS-4; the other compounds were well below allowable drinking water concentrations.

3.0 CONCLUSIONS

The presence of hydrocarbons was identified both in the soil and in the groundwater in all four borings. The two borings, RS-1 and RS-2, nearest the suspected leak source (over spill from the super-unleaded tank), had the highest hydrocarbon concentrations. All three tanks were precision tested and determined to be "tight". The other two borings, RS-3 and RS-4, had very low concentrations in both the soil and groundwater. RS-3 is up-gradient of the tank and RS-4 is down-gradient of the suspected leak source. Significant soil contamination appears to be located near the super-unleaded tank. Even though groundwater

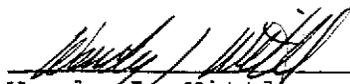
is found at 6 ft to 8 ft bgs, no free product was found and elevated dissolved phase concentrations also appear to be located near the super unleaded tank.

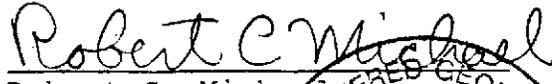
4.0 LIMITATIONS OF INVESTIGATIONS

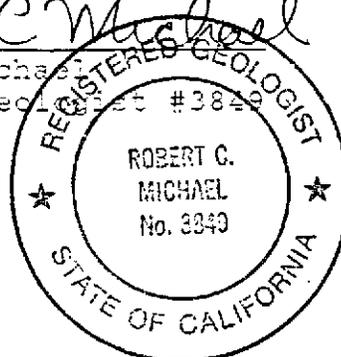
The discussion and recommendation presented in this report are based on the following:

1. The professional performance of the personnel who conducted the investigations.
2. The observations of the field personnel.
3. The results of laboratory analyses performed by a state certified laboratory.
4. Any referenced documents.
5. Our understanding of the regulations of the State of California; also, if applicable, other local regulations.

The services performed by Remediation Service Int'l have been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions in the State of California. Please note that contamination of soil and/or groundwater must be reported to the appropriate agencies in a timely manner. No other warranty, expressed or implied, is made.


Wendy J. Wittl
Senior Project Geologist

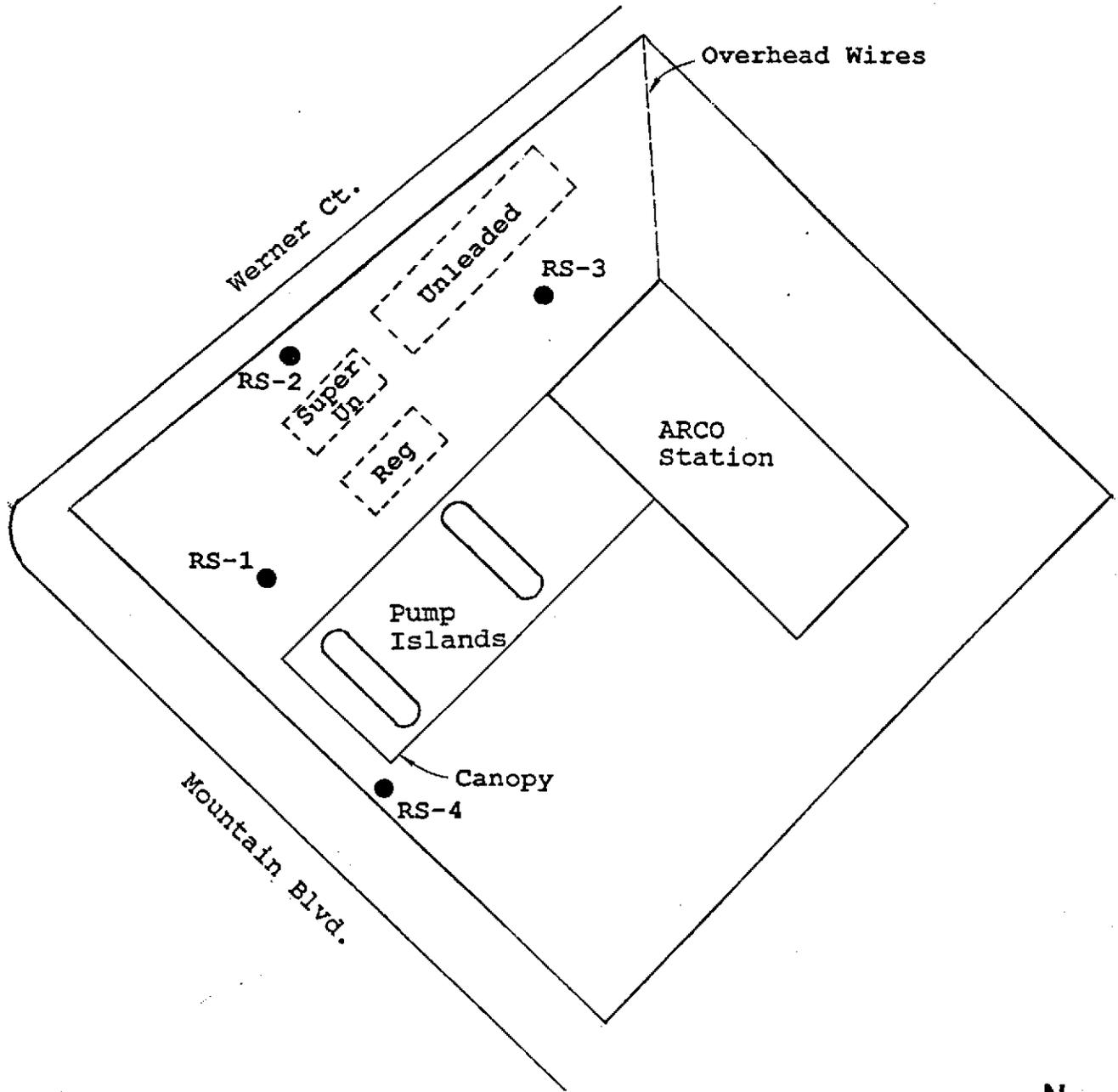

Robert C. Michael
Registered Geologist #3849



REGISTERED GEOLOGIST
★ ROBERT C. MICHAEL ★
No. 3349
STATE OF CALIFORNIA



Location Map
 Desert Petroleum
 Station #796
 2844 Mountain Blvd.
 Oakland, CA



Site Plan
 Desert Petroleum
 Station #796
 2844 Mountain Blvd.
 Oakland, CA

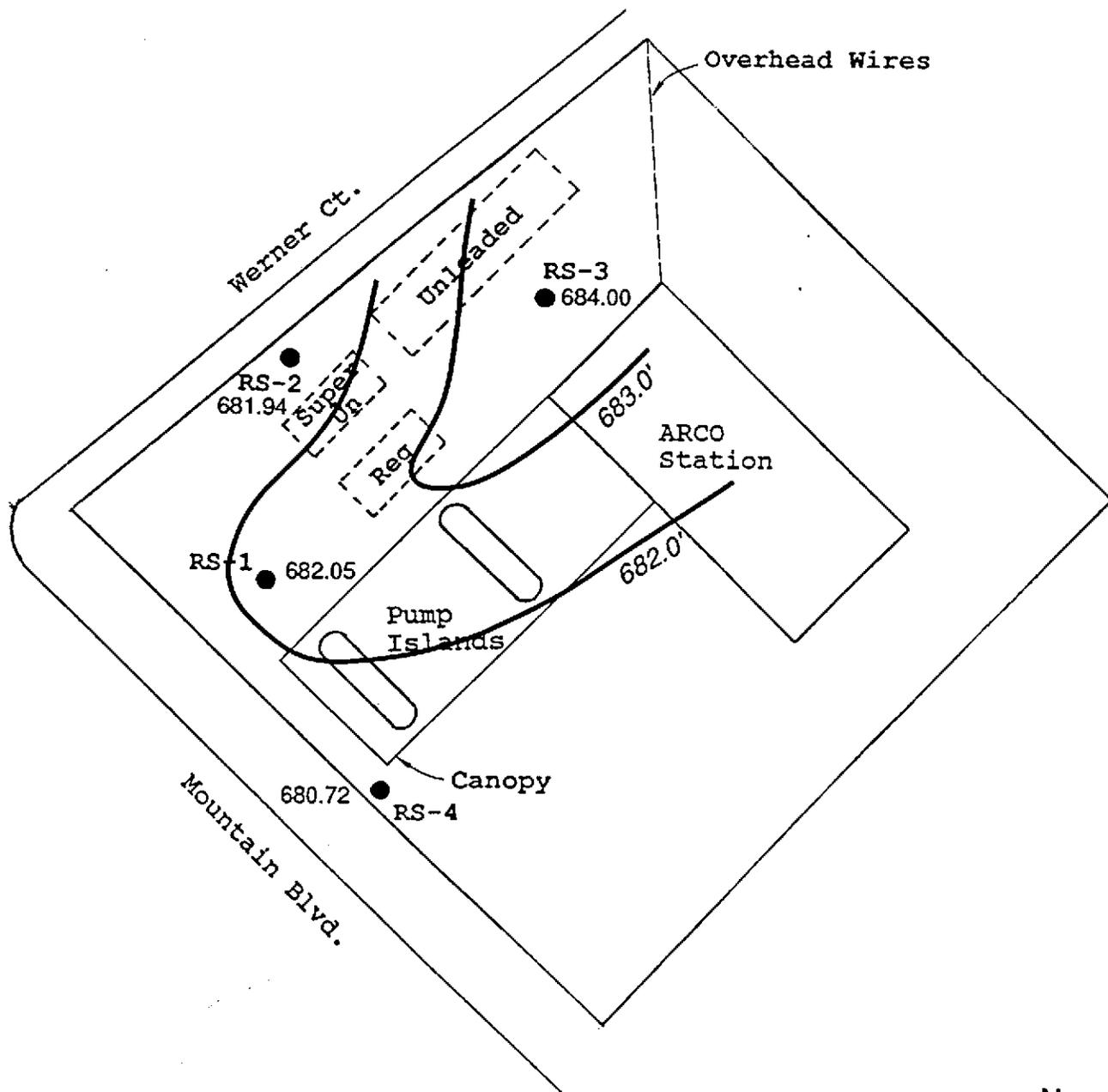


● Monitoring Well Location

Approximate Scale: 1" = 25'



FIGURE 2



GROUNDWATER ELEVATION MAP

5/30/90

Desert Petroleum
 Station #796
 2844 Mountain Blvd.
 Oakland, CA



● Monitoring Well Location

Approximate Scale: 1" = 25'



FIGURE 3

TABLE 2

Desert Petroleum Station #796

Summary of the Analytical Results for ~~Oil~~ (mg/kg)

Well I.D.	Depth (ft)	Benzene	Toluene	Xylenes	Ethyl Benzene	TPH
RS-1	5	0.59	0.53	0.76	0.085	9
RS-1	10	6.20	8.00	5.20	0.850	58
RS-1	28	0.004	0.003	ND	ND	ND <1
RS-2	5	1.10	0.85	2.50	0.26	22
RS-2	8	1.30	7.30	20.0	2.90	240
RS-2	25	0.059	0.08	0.068	ND	1
RS-3	5	0.084	0.014	0.030	0.004	ND <1
RS-3	25	0.004	0.009	0.020	ND	ND <1
RS-4	5	0.079	0.006	0.028	0.004	ND <1
RS-4	7	0.037	0.006	0.006	ND	ND <1
RS-4	25	0.006	0.007	0.006	ND	ND <1

TPH - Total Petroleum Hydrocarbons

ND not detected

TABLE 3

Desert Petroleum Station #796

Summary of Analytical Results for Groundwater (mg/l)

Well I.D.	Benzene	Toluene	Xylenes	Ethylbenzene	TPH
RS-1	0.37	0.42	0.32	0.04	2.7
RS-2	7.2	4.8	3.3	0.30	23.
RS-3	0.002	0.001	0.15	0.001	0.33
RS-4	0.009	0.011	0.049	0.009	0.44

TABLE 4

Desert Petroleum Station #796

Groundwater Data

All Measurements in Feet

Well I.D.	Depth To Groundwater	Wellhead Elevation	Groundwater Elevation
RS-1	7.20	689.25	682.05
RS-2	7.06	689.00	681.94
RS-3	6.00	690.00	684.00
RS-4	8.34	689.06	680.72

Elevation of RS-3 estimated based on U.S.G.S. topographical map of the area. Elevation of other wellheads referenced to R-3.

TABLE 1

DESERT PETROLEUM STATION #796

WELL CONSTRUCTION DATA

All Measurements in feet, unless otherwise noted.

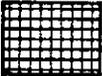
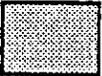
Well I.D.	RS-1	RS-2	RS-3	RS-4
DATE CONSTRUCTED	05/29/90	05/30/90	05/30/90	05/30/90
TYPE OF CASING	PVC	PVC	PVC	PVC
CASING DIAMETER	4 INCH	4 INCH	4 INCH	4 INCH
TOTAL DEPTH	31	25	25	25
BLANK CASING	0 - 5	0 - 5	0 - 5	0 - 5
SLOTTED CASING	5 - 30	5 - 25	5 - 25	5 - 25
SLOT SIZE	0.02 INCH	0.02 INCH	0.02 INCH	0.02 INCH
CEMENT	0 - 2	0 - 2	0 - 2	0 - 2
BENTONITE PLUG	2 - 4	2 - 4	2 - 4	2 - 4
FILTER PACK	4 - 31	4 - 25	4 - 25	4 - 25
TYPE OF PACK	#3 SAND	#3 SAND	#3 SAND	#3 SAND

LEGEND SHEET FOR BORING LOGS

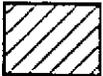
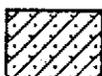
BORING LOG SYMBOLS

-  Modified California Sampler (blow count)
-  No Sample Recovered
-  First Water Encountered
-  Measured Water Level
-  Inferred Contact
-  Known Contact
-  Gradational Contact

MONITORING WELL SYMBOLS

-  Concrete Seal
-  Bentonite Seal
-  Sand Pack
-  Native Backfill
-  Slotted Section of Casing

LITHOLOGIES

- | | | | | | | | |
|---|-------------|---|--------------------------------|---|-----------------------------|---|-------------|
|  | CLAY |  | Silty CLAY |  | Sandy CLAY |  | SILT |
|  | Clayey SILT |  | Sandy SILT |  | SAND |  | Clayey SAND |
|  | Silty SAND |  | Gravels & Gravel-Sand Mixtures |  | All Silty or Clayey Gravels |  | Bedrock |
|  | Fill |  | Asphalt/Concrete | | | | |

DEFINITION OF TERMS USCS CLASSIFICATION FOR SOILS

PRIMARY DIVISIONS		SYM-BOLS	SECONDARY DIVISIONS
<p align="center">COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN NO.200 SIEVE SIZE</p>	<p align="center">GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO.4 SIEVE SIZE</p>	<p align="center">CLEAN GRAVELS (LESS THAN 5% FINES)</p>	<p>GW Well graded gravels, gravel-sand mixtures, little or no fines</p>
		<p align="center">GRAVELS WITH FINES</p>	<p>GP Poorly graded gravels or gravel-sand mixtures, little or no fines</p>
			<p>GM Silty gravels, gravel-sand-silt mixtures, non-plastic fines</p>
		<p align="center">SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO.4 SIEVE SIZE</p>	<p align="center">CLEAN SANDS (LESS THAN 5% FINES)</p>
	<p>SW Well graded sands, gravelly sands, little or no fines</p>		
	<p align="center">SANDS WITH FINES</p>		<p>SP Poorly graded sands, gravelly sands, little or no fines</p>
			<p>SM Silty sands, sand-silt mixtures, non-plastic fines</p>
	<p align="center">FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN NO.200 SIEVE SIZE</p>	<p align="center">SILTS AND CLAYS LIQUID LIMIT IS LESS THAN 50%</p>	<p>SC Clayey sands, sand-clay mixtures, plastic fines</p>
<p>ML Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity</p>			
<p>CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays</p>			
<p align="center">SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50%</p>		<p>OL Organic silts and organic silty clays of low plasticity</p>	
		<p>MH Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts</p>	
		<p>CH Inorganic clays of high plasticity, fat clays</p>	
		<p>OH Organic clays of medium to high plasticity, organic silts</p>	
<p align="center">HIGHLY ORGANIC SOILS</p>		<p>Pt Peat and other highly organic soils</p>	

DESERT PETROLEUM STATION #796

Oakland, CA

Date: 5/29/90

Time Started/Finished: 12:15/3:30

Sampling Method: Mod Cal

Rig Type: Mobile B-61 HSA

Drilling Contractor: Kvilhaug

MONITORING WELL: RS-1

Sheet 1 of 1

Logged By: BJM

Casing Size & Type: 4" PVC

Screen Size & Type: 4" PVC; 0.020" Slots

Filter Pack: #3 Sand

Traffic Cover Elevation:

Datum/Reference:

DEPTH (FEET)	SAMPLE INT.	PID ppm	BLOWS PER HALF FOOT	WELL DETAILS	USCS	SOIL DESCRIPTION AND NOTES
0						<u>SILTY CLAY</u> , BLACK.
5		90	5, 18, 40		CL	<u>SILTY CLAY</u> , BLACK TO GREENISH-GREY, STIFF, DAMP, MODERATE HYDROCARBON ODOR.
10		130	7, 14, 20		CL	<u>SILTY CLAY</u> , TAN AND GREENISH-GREY MOTTLED, STIFF, VERY DAMP TO WET, MODERATE HYDROCARBON ODOR.
15		2	12, 12, 12		SM	<u>SILTY SAND</u> WITH MINOR GRAVEL (<10%), TAN, VERY FINE-FINE GRAINED, SLIGHTLY STIFF, WET, NO HYDROCARBON ODOR.
20		5	15, 25, 25		SM	<u>SILTY SAND</u> AND GRAVEL, TAN-BROWN, FAIRLY STIFF, SAND IS FINE-COARSE GRAINED, POORLY SORTED, GRAVEL UP TO 1 1/2" DIAMETER, WET, NO HYDROCARBON ODOR.
25		<1	6, 12, 22		CL	<u>CLAY</u> WITH MINOR SAND (<5%), TAN, STIFF, DAMP, SAND IS VERY COARSE GRAINED, NO HYDROCARBON ODOR.
30		<1	8, 12, 30		SC	<u>CLAYEY SAND</u> AND GRAVEL, TAN, FAIRLY STIFF. SAND IS FINE-COARSE GRAINED, POORLY SORTED. GRAVEL UP TO 1/4" DIAMETER, VERY DAMP, NO HYDROCARBON ODOR.
35						TD AT 31 FEET. CSG AT 30 FEET.
40						
45						



DESERT PETROLEUM STATION #796

Oakland, CA

Date: 5/30/90

Time Started/Finished: 9:30/12:00

Sampling Method: Mod Cal

Rig Type: Mobile B-61 HSA

Drilling Contractor: Kvilhaug

MONITORING WELL: RS-2

Sheet 1 of 1

Logged By: BJM

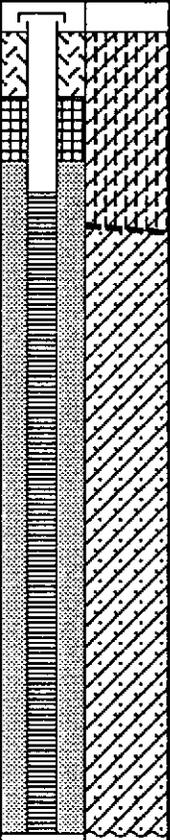
Casing Size & Type: 4" PVC

Screen Size & Type: 4" PVC; 0.020" Slots

Filter Pack: #3 Sand

Traffic Cover Elevation:

Datum/Reference:

DEPTH (FEET)	SAMPLE INT.	PID ppm	BLOWS PER HALF FOOT	WELL DETAILS	USCS	SOIL DESCRIPTION AND NOTES
0						<u>SILTY CLAY, BLACK.</u>
5		180	7, 19, 30		CL	<u>SILTY CLAY, DARK GREY-BLACK, STIFF, DAMP, SLIGHT HYDROCARBON ODOR.</u>
10		110	7, 15, 32		CL	<u>SANDY CLAY WITH MINOR GRAVEL (<math>\leq 5\%</math>), TAN AND GREY-GREEN MOTTLED, FAIRLY STIFF, VERY DAMP. SAND IS FINE GRAINED, STRONG HYDROCARBON ODOR.</u>
15		120	7, 15, 35		CL	<u>SANDY CLAY, AS ABOVE, SLIGHT HYDROCARBON ODOR.</u>
20		6	7, 18, 30		CL	<u>SANDY CLAY WITH MINOR GRAVEL (10-20%), TAN, FAIRLY STIFF, DAMP, SAND IS FINE-COARSE GRAINED, POORLY SORTED, GRAVEL TO 1/2" DIAMETER. NO HYDROCARBON ODOR.</u>
25		3	5, 15, 20		CL	<u>SANDY CLAY AND GRAVEL (<math>\leq 5\%</math>), AS ABOVE.</u>
30		<1	8, 12, 20		CL	<u>SANDY CLAY AND GRAVEL (<math>\leq 5\%</math>), AS ABOVE.</u>
35						TD AT 25 FEET. CSG AT 25 FEET.
40						
45						



DESERT PETROLEUM STATION #796

Oakland, CA

Date: 5/30/90

Time Started/Finished: 12:30/2:30

Sampling Method: Mod Cal

Rig Type: Mobile B-61 HSA

Drilling Contractor: Kvilhaug

MONITORING WELL: RS-3

Sheet 1 of 1

Logged By: BJM

Casing Size & Type: 4" PVC

Screen Size & Type: 4" PVC; 0.020" Slots

Filter Pack: #3 Sand

Traffic Cover Elevation:

Datum/Reference:

DEPTH (FEET)	SAMPLE INT.	PID ppm	BLOWS PER HALF FOOT	WELL DETAILS	USCS	SOIL DESCRIPTION AND NOTES
0						<u>CLAY</u> , BLACK, STIFF, DAMP, NO HYDROCARBON ODOR.
5	X	7	5, 13, 25		CL ML	<u>CLAYEY SILT</u> , TAN AND GREY MOTTLED, STIFF, DAMP, NO HYDROCARBON ODOR.
10	X	<1	5, 13, 17		CL	<u>SANDY CLAY</u> , TAN, FAIRLY STIFF, VERY DAMP, NO HYDROCARBON ODOR.
15	X	1	7, 12, 15		CL	<u>SANDY CLAY</u> WITH MINOR <u>GRAVEL</u> ($\leq 5\%$) WITH THIN INTERBEDDED (4" THICK) OF <u>CLAYEY SAND</u> . TAN, FAIRLY STIFF, WET . SAND IS FINE-COARSE GRAINED, POORLY SORTED. NO HYDROCARBON ODOR.
20	X	<1	6, 12, 16		CL	<u>SANDY CLAY</u> WITH MINOR <u>GRAVEL</u> ($\leq 5\%$), TAN, STIFF, VERY DAMP TO WET, NO HYDROCARBON ODOR.
25	X	<1	8, 15, 20		CL	<u>SANDY CLAY</u> , AS ABOVE. TD AT 25 FEET. CSG AT 25 FEET.
30						
35						
40						
45						

DESERT PETROLEUM STATION #796

Oakland, CA
 Date: 5/30/90
 Time Started/Finished: 3:00/6:00
 Sampling Method: Mod Cal
 Rig Type: Mobile B-61 HSA
 Drilling Contractor: Kvilhaug

MONITORING WELL: RS-4

Logged By: BJM
 Casing Size & Type: 4" PVC
 Screen Size & Type: 4" PVC; 0.020" Slots
 Filter Pack: #3 Sand
 Traffic Cover Elevation:
 Datum/Reference:

DEPTH (FEET)	SAMPLE INT.	PID ppm	BLOWS PER HALF FOOT	WELL DETAILS	USCS	SOIL DESCRIPTION AND NOTES
0						
5	X	15	7, 25, 40		SC	CLAYEY SAND WITH MINOR GRAVEL ($\leq 5\%$), GREENISH-GREY, FAIRLY STIFF, FINE GRAINED, DAMP, SLIGHT HYDROCARBON ODOR.
7.5	X	22	7, 15, 25		SC	CLAYEY SAND, TAN AND GREENISH-GREY MOTTLED, FAIRLY STIFF, FINE GRAINED, DAMP, SLIGHT HYDROCARBON ODOR.
10	X	161	6, 12, 15		CL	SANDY CLAY, TAN AND GREENISH-GREY MOTTLED, STIFF, DAMP, MODERATE HYDROCARBON ODOR.
15	X	<1	6, 12, 20		CL	SANDY SILTY CLAY, TAN, STIFF, VERY DAMP, NO HYDROCARBON ODOR.
20	X	<1	7, 9, 12		SC	CLAYEY SAND WITH MINOR GRAVEL ($\leq 5\%$), TAN, FINE GRAINED, FAIRLY STIFF, VERY DAMP, NO HYDROCARBON ODOR.
25	X	<1	7, 12, 30		CL	SANDY CLAY WITH MINOR GRAVEL ($\leq 5\%$), TAN, STIFF, DAMP, NO HYDROCARBON ODOR.
30						TD AT 25 FEET. CSG AT 25 FEET.
35						
40						
45						



DESCRIPTION OF BORING TECHNIQUES AND SAMPLING PROCEDURES

Under the supervision of a Remediation Service Int'l - (RSI) geologist, the soil borings are advanced using a truck mounted hollow-stem auger. Each auger flight is 5 feet in length with an inner diameter of 3.5 inches and an outer diameter of 8 inches. A pilot assembly, in conjunction with the auger head which is fitted with cutting blades, helps advance the auger through the soil and prevents solids from entering the hollow-stem portion of the auger. The hollow auger acts as a "temporary casing" preventing collapse of the borehole wall. Soil cuttings are carried up to the surface via the auger flights.

When the desired sample depth is reached, the drill bit and center plug are removed from the auger stem and replaced with a Modified California Split Spoon sampler. Usually, sampling is done at the end of each 5 foot auger flight. The sampler consists of an outer 12 to 18 inch long "split barrel" sampler in which a thin-walled set of rings is inserted. These rings are brass or stainless steel cylinders, each 2.0 to 3.25 inches in diameter and 3 to 6 inches long.

A 140 pound hammer is used to drive the sampler into the formation below the bottom of the auger flight, thereby filling all of the sampling rings with soil. This method allows for collection of an undisturbed soil sample, preventing introduction of overburden soil by the drilling process. The number of hammer blows (blows per foot, BPF) to advance the sampler a given distance is recorded on the boring log. This gives an indication of the amount of force required to recover the sample.

After retrieving and dismantling the sampler, all the thin tube rings are removed. The bottom ring is immediately sealed for laboratory analysis by covering both ends with teflon sheeting, plastic caps and securing the caps with tape. If some of the soil in the bottom ring has fallen out or appears to have been disturbed during the recovery operation, the second to last ring is used. This ring is labeled and placed in an ice chest for cold storage pending transportation to the laboratory. This packaging protocol is designed to prevent loss of volatiles from the soil sample, and to prevent any cross contamination. Standard chain of custody procedures are followed for all samples.

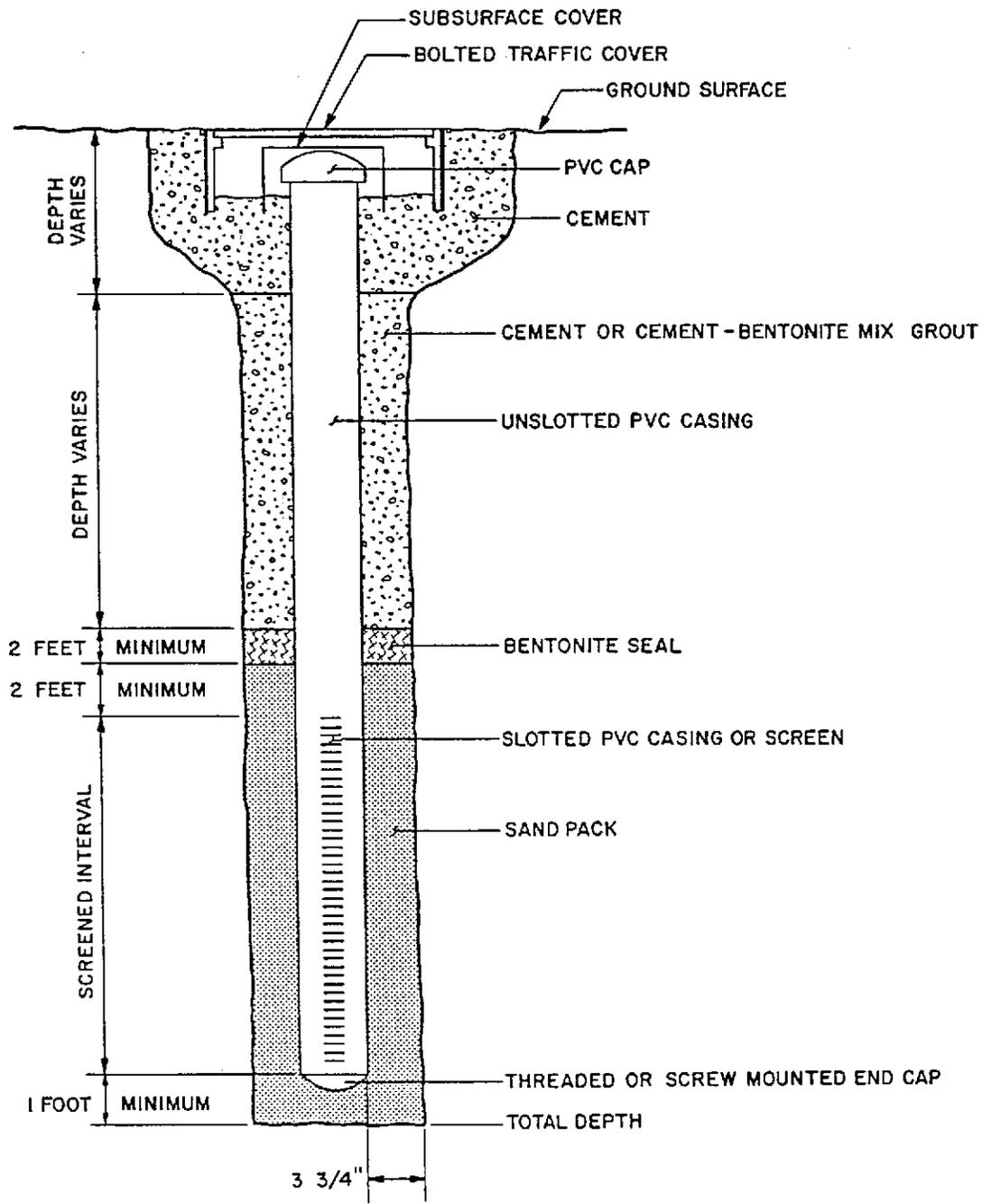
Soil from the second ring is used for field analysis of possible hydrocarbon contamination. The sample is placed in a Ziploc bag, sealed and allowed to volatilize for a HNU Photoionization Analyzer (PID) measurement. A head-space measurement is taken by breaking the seal just enough to insert the probe. The highest reading is recorded. However, if the reading stabilizes at a significantly different level, this also is noted. The PID has a detection range from 0.1 ppm to 2000 ppm for hydrocarbon vapors, when calibrated with a benzene standard.

Soils in the remaining rings are used for the field descriptions. The field data includes a written soils description, the Unified Soil Classification code, and any notable odors, staining or contamination. Also recorded are unusual drilling conditions, equipment malfunctions or other observations of field conditions for future reference. All data are included on the boring logs.

An alternative method to the use of brass rings is glass jars for sample collection. This method still utilizes the split spoon sampler, but no brass rings are inserted. Instead, soil from the base of the sampler is encapsulated in a glass jar. The jar is then treated in the same manner as soil samples in brass rings. The remaining soil in the sampler is used for field analysis and description.

To prevent any cross - contamination, the augers are steam cleaned prior to drilling each boring. The split spoon sampler is cleaned using a three step process commonly referred to as a "three bucket wash". This consist of first a trisodium phosphate wash, followed by a tap water rinse and finally a deionized water rinse. This process is completed between each sample run.

All cuttings and excess sample material recovered during the drilling operations are placed in 55 gallon DOT hazardous waste drums pending laboratory analysis results. Proper disposal is the client's responsibility.



NO SCALE
TYPICAL ONLY

TYPICAL MONITORING WELL
CONSTRUCTION

SAMPLING PROCEDURES FOR GROUNDWATER MONITORING WELLS

1. Top of casing or wellhead is surveyed and referenced to datum point.
2. Equipment is decontaminated using a three bucket wash. This consists of: (1) washing the equipment in water with trisodiumphosphate detergent; (2) rinsing with tap water; and, (3) rinsing with deionized water.
3. Depth to water, depth to free product (if present) and total depth of well is measured.
4. The well is bailed or pumped either until dry, or until 4 to 5 casing volumes of water have been removed. The water is discharged into a DOT hazardous waste drum which is labeled and left on site pending laboratory analysis of water sample.
5. After the well has recovered, a sample is taken using a teflon bailer and placed in a VOA vial such that no headspace is present. The vial is sealed, labeled, and cooled.
6. The field data sheet is completed with all pertinent information.
7. All the equipment is decontaminated using the 3-bucket wash.
8. The samples are transported to the laboratory as soon as possible following chain of custody procedures.
9. Wells are sampled from the cleanest to the most contaminated.
10. Site conditions are noted which may potentially contaminate the sample . . . any smoke, vapors from running engines, etc.

GROUNDWATER SAMPLE
FIELD LOG

PROJECT NAME DP 796
LOCATION OAKLAND
WELL NUMBER RS-1

SAMPLE:
WELL X
SURFACE WATER _____
SEEP _____
OTHER (DESCRIBE) _____

SAMPLER BYM
DATE OF SAMPLING 5/30/90
WEATHER CONDITIONS cloudy & cool
DEPTH TO FREE PRODUCT _____
DEPTH TO WATER 7.30
DATUM ELEVATION (msl) _____
GROUNDWATER ELEVATION (msl) _____
TOTAL WELL DEPTH 30'

WATER LEVEL MEASURING EQUIPMENT INT. PADBE
FREE PRODUCT LEVEL MEASURING EQUIPMENT "
EVACUATION EQUIPMENT PVC BAILER
GALLONS TO BE EVACUATED (4 casing vols.) 55
TIME OF EVACUATION START 11:15 FINISH 11:45
TOTAL GALLONS EVACUATED DRY @ 50

SAMPLING EQUIPMENT DISPOSABLE BAILER
SAMPLING TIME START _____ FINISH 6:00
SAMPLING RATE (ml/min.) _____
APPEARANCE OF SAMPLE CLEAR

FIELD OBSERVATIONS AND/OR PROBLEMS ENCOUNTERED _____

EQUIPMENT DECONTAMINATION 3 BUCKET WASH

SAMPLES HAND CARRIED/SHIPPED ON 6/1/90 AT 12:30
(date) (time)

VIA _____ TO SUPERIOR LAB
(carrier and shipper's number) laboratory

FOR ANALYSIS OF TPH (GAS), BTEX

GROUNDWATER SAMPLE
FIELD LOG

PROJECT NAME DP 716
LOCATION OAKLAND
WELL NUMBER 25-2

SAMPLE:
WELL X
SURFACE WATER _____
SEEP _____
OTHER (DESCRIBE) _____

SAMPLER BHM
DATE OF SAMPLING 5/31/90
WEATHER CONDITIONS SUNNY + COOL
DEPTH TO FREE PRODUCT _____
DEPTH TO WATER 11.60
DATUM ELEVATION (msl) _____
GROUNDWATER ELEVATION (msl) _____
TOTAL WELL DEPTH 25'

WATER LEVEL MEASURING EQUIPMENT Inst. PROBE
FREE PRODUCT LEVEL MEASURING EQUIPMENT _____
EVACUATION EQUIPMENT PVC BAILER
GALLONS TO BE EVACUATED (4 casing vols.) 46
TIME OF EVACUATION START 7:15 FINISH 7:45
TOTAL GALLONS EVACUATED DRY @ 25

SAMPLING EQUIPMENT DISPOSABLE BAILER
SAMPLING TIME START _____ FINISH 10:40
SAMPLING RATE (ml/min.) _____
APPEARANCE OF SAMPLE CLEAR

FIELD OBSERVATIONS AND/OR PROBLEMS ENCOUNTERED _____

EQUIPMENT DECONTAMINATION 3 BUCKET WASH

SAMPLES HAND CARRIED/SHIPPED ON 6/1/90 AT 12:30
(date) (time)

VIA _____ TO SUPERIOR LAB
(carrier and shipper's number) laboratory

FOR ANALYSIS OF TPH (CAS) BTEX

GROUNDWATER SAMPLE
FIELD LOG

PROJECT NAME DP 796
LOCATION OAKLAND
WELL NUMBER 25-3

SAMPLE:
WELL X
SURFACE WATER _____
SEEP _____
OTHER (DESCRIBE) _____

SAMPLER BJM
DATE OF SAMPLING 5/31/90
WEATHER CONDITIONS Cloudy + cool
DEPTH TO FREE PRODUCT _____
DEPTH TO WATER 6.00
DATUM ELEVATION (msl) _____
GROUNDWATER ELEVATION (msl) _____
TOTAL WELL DEPTH 25'

WATER LEVEL MEASURING EQUIPMENT Int. PADBE
FREE PRODUCT LEVEL MEASURING EQUIPMENT "
EVACUATION EQUIPMENT PVC Bailer
GALLONS TO BE EVACUATED (4 casing vols.) 50
TIME OF EVACUATION START 1:55 FINISH 2:15
TOTAL GALLONS EVACUATED Day @ 35

SAMPLING EQUIPMENT Disb. Bailer
SAMPLING TIME START _____ FINISH 10:50
SAMPLING RATE (ml/min.) _____
APPEARANCE OF SAMPLE Clear

FIELD OBSERVATIONS AND/OR PROBLEMS ENCOUNTERED _____

EQUIPMENT DECONTAMINATION 3 BUCKET WASH

SAMPLES HAND CARRIED/SHIPPED ON 6/1/90 AT 12:30
(date) (time)

VIA _____ TO Superior Labs
(carrier and shipper's number) laboratory

FOR ANALYSIS OF TPH (conts) BTEX

GROUNDWATER SAMPLE
FIELD LOG

PROJECT NAME DP 796
LOCATION OAKLAND
WELL NUMBER DS-4

SAMPLE:
WELL X
SURFACE WATER _____
SEEP _____
OTHER (DESCRIBE) _____

SAMPLER BPM
DATE OF SAMPLING 5/31/90
WEATHER CONDITIONS cloudy & cool
DEPTH TO FREE PRODUCT _____
DEPTH TO WATER 9.77
DATUM ELEVATION (msl) _____
GROUNDWATER ELEVATION (msl) _____
TOTAL WELL DEPTH 25'

WATER LEVEL MEASURING EQUIPMENT INT. PROBE
FREE PRODUCT LEVEL MEASURING EQUIPMENT "
EVACUATION EQUIPMENT PVC BAILER
GALLONS TO BE EVACUATED (4 casing vols.) 40
TIME OF EVACUATION START 8:25 FINISH 8:45
TOTAL GALLONS EVACUATED 24 @ 25

SAMPLING EQUIPMENT DISPOSABLE BAILER
SAMPLING TIME START _____ FINISH 10:30
SAMPLING RATE (ml/min.) _____
APPEARANCE OF SAMPLE CLEAR

FIELD OBSERVATIONS AND/OR PROBLEMS ENCOUNTERED _____

EQUIPMENT DECONTAMINATION 3 BUCKET WASH

SAMPLES HAND CARRIED/SHIPPED ON 6/1/90 AT 12:30
(date) (time)

VIA _____ TO SUPERIOR LAB
(carrier and shipper's number) laboratory

FOR ANALYSIS OF TPH (GAS) BTEX

SUPERIOR ANALYTICAL LABORATORY, INC.

1555 BURKE, UNIT I • SAN FRANCISCO, CA 94124 • PHONE (415) 647-2081

C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 52093
CLIENT: REMEDIATION SERVICE, INT'L
CLIENT JOB NO.: DP 796

DATE RECEIVED: 06/01/90
DATE REPORTED: 06/12/90

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 5030 and 8015

LAB #	Sample Identification	Concentration (mg/kg) Gasoline Range
1	RS-1 5'	9
2	RS-1 10'	58
5	RS-1 28'	ND<1
6	RS-2 5'	22
8	RS-2 8'	240
11	RS-2 25'	1
12	RS-3 5'	ND<1
16	RS-3 25'	ND<1
17	RS-4 5'	ND<1
18	RS-4 7'	ND<1
22	RS-4 25'	ND<1
		Concentration (ug/L)
23	RS-1	2700
24	RS-2	23000
25	RS-3	330
26	RS-4	440

mg/kg - parts per million (ppm)

ug/L - parts per billion (ppb)

Minimum Detection Limit for Gasoline in Soil: 1mg/kg

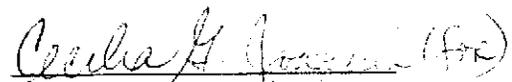
Minimum Detection Limit for Gasoline in Water: 50ug/L

QAQC Summary:

Daily Standard run at 2mg/L: RPD Gasoline = <15%

MS/MSD Average Recovery = 82%: Duplicate RPD = 4%

Richard Srna, Ph.D.


Laboratory Director

OUTSTANDING QUALITY AND SERVICE

SUPERIOR ANALYTICAL LABORATORY, INC.

1555 BURKE, UNIT I • SAN FRANCISCO, CA 94124 • PHONE (415) 647-2081

C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 52093
CLIENT: REMEDIATION SERVICE, INT'L
CLIENT JOB NO.: DP 796

DATE RECEIVED: 06/01/90
DATE REPORTED: 06/12/90

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/kg)			
		Benzene	Toluene	Ethyl Benzene	Xylenes
1	RS-1 5'	590	530	85	760
2	RS-1 10'	6200	8000	850	5200
5	RS-1 28'	4	3	ND<3	ND<3
6	RS-2 5'	1100	850	260	2500
8	RS-2 8'	1300	7300	2900	20000
11	RS-2 25'	59	80	ND<3	68
12	RS-3 5'	84	14	4	30
16	RS-3 25'	4	9	ND<3	20
17	RS-4 5'	79	6	4	28
18	RS-4 7'	37	6	ND<3	6
22	RS-4 25'	6	7	ND<3	6

		Concentration (ug/L)			
23	RS-1	370	420	40	320
24	RS-2	7200	4800	300	3300
25	RS-3	2	1	1	150
26	RS-4	9	11	9	49

ug/kg or ug/L - parts per billion (ppb)

Minimum Detection Limit in Soil: 3.0ug/kg

Minimum Detection Limit in Water: 0.3ug/L

QAQC Summary:

Daily Standard run at 20ug/L: RPD = <15%

MS/MSD Average Recovery = 95% : Duplicate RPD = <2%

Richard Srna, Ph.D.

Amelia G. Young (FSA)
Laboratory Director

OUTSTANDING QUALITY AND SERVICE

RSI

Chain of Custody Record

SA# 52093

Project No. _____	Superior Analytical Laboratory
Project Name <u>DP 796</u>	1555 Burke St. Unit 1
Samplers <u>Brian Messman</u>	San Francisco, CA 94124
P.O. No. _____	(415) 647-2081

Wendy With

Sample Number	Date	Time	Location	Matrix	Number of Containers	Sample Preservation	TPH as Gasoline		TPH as Diesel	Oil & Grease	B010	B240				
							RTXE									
RS-1	5/29/90		5'	SOIL		ICE	X	X								
RS-1	}		10'	}	}		X	X								
RS-1			15'												HOLD	
RS-1			25'													HOLD
RS-1			28'						X	X						
RS-2	5/30/90		5'				X	X								
RS-2	}		8'	}	}		X	X						HOLD Analyse		
RS-2			10'					X	X						Hold per BML/life	
RS-2			15'													HOLD
RS-2			20'													HOLD
RS-2	}		25'	}	}		X	X								
RS-3			5'					X	X							

Relinquished By (Signature)	Date/Time	Received By (Signature)	Date/Time	REMARKS:
<u>Brian Messman</u>	6/1/90 12:30	<u>Wendy With</u>	6/1/90 12:37	
2. _____		2. _____		
3. _____		3. _____		
4. _____		4. _____		

Chain of Custody Record

Project No. _____
 Project Name DP 796
 Samplers BRIAN MOSSMAN
 P.O. No. _____

Superior Analytical Laboratory
 1555 Burke St. Unit 1
 San Francisco, CA 94124
 (415) 647-2081

Sample Number	Date	Time	Location	Matrix	Number of Containers	Sample Preservation	TPH as Gasoline	RTXE	TPH as Diesel	Oil & Grease	8010	8240	
RS-3	5/30/90		10'	Soil		ICE							HOLD
RS-3			15'										HOLD
RS-3			20'										HOLD
RS-3			25'				X	X					
RS-4			5'				X	X					
RS-4			7'				X	X					
RS-4			10'				X	X					HOLD Analyzed
RS-4			15'										HOLD per BME/1/90
RS-4			20'										HOLD
RS-4			25'				X	X					

Relinquished By (Signature)	Date/Time	Received By (Signature)	Date/Time	REMARKS:
<u>Brian Mossman</u>	6/1/90 12:30	1. <u>[Signature]</u>		
2. _____		2. _____		
3. _____		3. _____		
4. _____		4. <u>[Signature]</u>	6/1/90 12:37	

