P2078

April 22, 1999
Project 20805-190.002

Mr. Paul Supple
ARCO Products Company
PO Box 6549
Moraga, California 94570

Re: Quarterly Groundwater Monitoring Report, First Quarter 1999, for ARCO Service Station No. 0374, located at 6407 Telegraph Avenue, Oakland, California

Dear Mr. Supple:

Pinnacle Environmental Solutions, a division of EMCON (Pinnacle), is submitting the attached report which presents the results of the first quarter 1999 groundwater monitoring program at ARCO Products Company (ARCO) Service Station No. 0374, located at 6407 Telegraph Avenue, Oakland, California. The monitoring program complies with the Regional Water Quality Control Board, San Francisco Bay Region, requirements regarding underground tank investigations.

LIMITATIONS

No monitoring event is thorough enough to describe all geologic and hydrogeologic conditions of interest at a given site. If conditions have not been identified during the monitoring event, results should not be construed as a guarantee of the absence of such conditions at the site, but rather as the product of the scope and limitations of work performed during the monitoring event.

Please call if you have questions.

Sincerely,

Pinnacle

Glen VanderVeen
Project Manager

Jay R. Johnson, R.G.
Senior Project Supervisor

Attachment: Quarterly Groundwater Monitoring Report, First Quarter 1999

cc: Ms. Susan Hugo, Alameda County Health Care Services Agency
Mr. John Kaiser, Regional Water Quality Control Board - S.F. Bay Region

Date: April 22, 1999

ARCO QUARTERLY GROUNDWATER MONITORING REPORT

Facility No.: 0374 Address: 6407 Telegraph Avenue, Oakland, California

ARCO Environmental Engineer: Paul Supple

Consulting Co./Contact Person: Pinnacle Environmental Solutions/Glen VanderVeen

Consultant Project No.: 20805-190.002

Primary Agency/Regulatory ID No.: Regional Water Quality Control Board - S.F. Bay Region

WORK PERFORMED THIS QUARTER (FIRST - 1999):

1. Prepared and submitted quarterly groundwater monitoring report for fourth quarter 1998.
2. Performed quarterly groundwater monitoring and sampling for first quarter 1999.
3. Continued intrinsic bioremediation enhancement at wells MW-3 and MW-4 using oxygen release compound socks.

WORK PROPOSED FOR NEXT QUARTER (SECOND - 1999):

1. Prepare and submit quarterly groundwater monitoring report for first quarter 1999.
2. Perform quarterly groundwater monitoring and sampling for second quarter 1999.
3. Continue intrinsic bioremediation enhancement at wells MW-3 and MW-4.

QUARTERLY MONITORING:

Current Phase of Project:	Monitoring/Remediation
Frequency of Groundwater Sampling:	Annual (3rd Quarter): MW-1, MW-2, MW-6 Semi-annual (2nd/4th Quarter): MW-3, MW-4 Quarterly: MW-5
Frequency of Groundwater Monitoring:	Quarterly
Is Free Product (FP) Present On-Site:	No
FP Recovered this Quarter:	None
Cumulative FP Recovered to Date:	None
Bulk Soil Removed This Quarter:	None
Bulk Soil Removed to Date:	None
Current Remediation Techniques:	Bioremediation enhancement
Average Depth to Groundwater:	5.7 feet
Groundwater Flow Direction and Gradient (Average):	0.05 ft/ft toward southwest

DISCUSSION:

- TPPH-g and benzene concentrations at downgradient perimeter Well MW-5 remained below detection limits this quarter.
- The occurrence of intrinsic bioremediation at the site was documented during third quarter 1996.
- Intrinsic bioremediation enhancement at the off-site wells MW-3 and MW-4 is in progress. Please refer to Attachment D for details.

ATTACHMENTS:

- Table 1 - Groundwater Elevation and Analytical Data
- Figure 1 - Groundwater Analytical Summary Map
- Figure 2 - Groundwater Elevation Contour Map
- Appendix A - Sampling and Analysis Procedures
- Appendix B - Certified Analytical Reports and Chain-of-Custody Documentation
- Appendix C - Field Data Sheets
- Appendix D - Remedial System Performance Summary

Table 1
Groundwater Elevation and Analytical Data
Total Purgeable Petroleum Hydrocarbons
(TPPH as Gasoline, BTEX Compounds, and MTBE)

ARCO Service Station 0374
6407 Telegraph Avenue, Oakland, California

Well Number	Date Gauged/ Sampled	Well Elevation (feet, MSL)	Depth to Water (feet, TOC)	Groundwater Elevation (feet, MSL)	TPPH as Gasoline (ppb)	Benzene (ppb)	Toluene (ppb)	Ethyl-benzene (ppb)	Xylenes (ppb)	MTBE (ppb)	Dissolved Oxygen (ppm)	Purged/ Not Purged (P/NP)
MW-1	01/31/96	158.91	6.34	152.57	---------- Well Sampled Annually ----------							
	04/10/96		5.82	153.09	---------- Well Sampled Annually ----------							
	07/16/96		7.23	151.68	<50	<0.5	<0.5	<0.5	<0.5	340	NM	
	10/14/96		8.34	150.57	---------- Well Sampled Annually ----------							
	03/27/97		6.37	152.54	---------- Well Sampled Annually ----------							
	05/27/97		7.30	151.61	---------- Well Sampled Annually ----------							
	08/12/97		8.22	150.69	<50	<0.5	<0.5	<0.5	<0.5	620	NM	
	11/17/97		7.98	150.93	---------- Well Sampled Annually ----------							
	03/16/98		4.94	153.97	---------- Well Sampled Annually ----------							
	05/12/98		5.28	153.63	---------- Well Sampled Annually ----------							
	07/27/98		6.84	152.07	<500	<5	<5	<5	<5	580	0.6	P
	10/15/98		7.32	151.59	---------- Well Sampled Annually ----------							
	02/18/99		6.28	152.63	---------- Well Sampled Annually ----------							
MW-2	01/31/96	157.92	6.51	151.41	---------- Well Sampled Annually ----------							
	04/10/96		6.94	150.98	---------- Well Sampled Annually ----------							
	07/16/96		7.73	150.19	<50	1.2	<0.5	<0.5	<0.5	33	NM	
	10/14/96		8.35	149.57	---------- Well Sampled Annually ----------							
	03/27/97		7.40	150.52	---------- Well Sampled Annually ----------							
	05/27/97		7.82	150.10	---------- Well Sampled Annually ----------							
	08/12/97		8.29	149.63	<50	<0.5	<0.5	<0.5	<0.5	23	NM	
	11/17/97		8.05	149.87	---------- Well Sampled Annually ----------							
	03/16/98		6.45	151.47	---------- Well Sampled Annually ----------							
	05/12/98		6.93	150.99	---------- Well Sampled Annually ----------							
	07/27/98		7.39	150.53	<50	<0.5	<0.5	<0.5	<0.5	<3	0.85	NP
	10/15/98		7.67	150.25	---------- Well Sampled Annually ----------							
	02/18/99		6.63	151.29	---------- Well Sampled Annually ----------							

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MW-3*	01/31/96	153.64	7.02	146.62	140	20	0.87	11	14	NA	NM	
	04/10/96		7.82	145.82	84	2.4	<0.5	1.9	1.1	NA	NM	
	07/16/96		6.80	146.84	<50	2.2	<0.5	<0.5	<0.5	<2.5	NM	
	10/14/96		7.67	145.97	<50	1.2	<0.5	<0.5	0.81	2.9	NM	
	03/27/97		7.62	146.02	<50	0.94	<0.5	0.9	0.63	<2.5	NM	
	05/27/97		6.72	146.92	---------- Well Sampled Semiannually ----------							
	08/12/97		8.20	145.44	<50	<0.5	<0.5	<0.5	<0.5	<2.5	NM	
	11/17/97		7.64	146.00	---------- Well Sampled Semiannually ----------						12.0	
	03/18/98		5.14	148.50	<50	<0.5	<0.5	<0.5	<0.5	<3	4.0	P
	05/12/98		5.53	148.11	---------- Well Sampled Semiannually ----------							
	07/27/98		7.63	146.01	74	<0.5	<0.5	<0.5	<0.5	<3	1.7	NP
	10/15/98		7.46	146.18	---------- Well Sampled Semiannually ----------							
	02/18/99		5.85	147.79	---------- Well Not Sampled ----------							
MW-4	01/31/96	156.53	5.64	150.89	230	23	2.2	3.7	32	NA	NM	
	04/10/96		6.66	149.87	7,300	1,600	350	350	830	NA	NM	
	07/16/96		7.73	148.80	5,600	1,100	160	240	520	150	NM	
	10/14/96		8.55	147.98	4,500	860	72	160	340	<62	NM	
	03/27/97		7.15	149.38	25,000	5,200	760	850	2,600	<250	NM	
	05/27/97		7.75	148.78	---------- Well Sampled Semiannually ----------							
	08/12/97		8.46	148.07	4,800	950	40	140	210	170	NM	
	11/17/97		8.24	148.29	---------- Well Sampled Semiannually ----------							
	03/16/98		5.32	151.21	<50	<0.5	<0.5	<0.5	<0.5	<3	1.5	P
	05/12/98		6.38	150.15	---------- Well Sampled Semiannually ----------							
	07/27/98		7.36	149.17	21,000	6,100	390	810	1,600	<300	0.5	NP
	10/15/98		8.30	148.23	---------- Well Sampled Semiannually ----------							
	02/18/99		4.39	152.14	---------- Well Not Sampled ----------							

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Well Number	Date Gauged/ Sampled	Well Elevation (feet, MSL)	Depth to Water (feet, TOC)	Groundwater Elevation (feet, MSL)	TPPH as Gasoline (ppb)	Benzene (ppb)	Toluene (ppb)	Ethyl-benzene (ppb)	Xylenes (ppb)	MTBE (ppb)	Dissolved Oxygen (ppm)	Purged/ Not Purged (P/NP)
MW-5	01/31/96	151.33	8.64	142.69	<50	<0.5	<0.5	<0.5	<0.5	NA	NM	
	04/10/96		N/A	--	<50	<0.5	<0.5	<0.5	<0.5	NA	NM	
	07/16/96		8.15	143.18	<50	0.79	1.3	<0.5	<0.5	<2.5	NM	
	10/14/96		7.92	143.41	<50	<0.5	<0.5	<0.5	<0.5	<2.5	NM	
	03/27/97		7.75	143.58	<50	<0.5	<0.5	<0.5	<0.5	<2.5	NM	
	05/27/97		8.16	143.17	<50	<0.5	<0.5	<0.5	<0.5	<2.5	NM	
	08/12/97		---------- Well Inaccessible ----------									
	11/17/97		8.75	142.58	<50	<0.5	<0.5	<0.5	<0.5	<2.5	4.0	NP
	03/16/98		6.90	144.43	<50	<0.5	<0.5	<0.5	<0.5	<3	1.5	P
	05/12/98		7.24	144.09	<50	<0.5	<0.5	<0.5	<0.5	<3	2.2	P
	07/27/98		7.91	143.42	<50	<0.5	<0.5	<0.5	<0.5	<3	1.3	P
	10/15/98		8.31	143.02	<50	<0.5	<0.5	<0.5	0.6	<3	3.0	P
	02/18/99		7.25	144.08	<50	<0.5	<0.5	<0.5	<0.5	<3	2.0	P
MW-6	01/31/96	153.84	5.15	148.69	---------- Well Sampled Annually ----------							
	04/10/96		4.58	149.26	---------- Well Sampled Annually ----------							
	07/16/96		4.96	148.88	<50	<0.5	<0.5	<0.5	<0.5	150	NM	
	10/14/96		6.15	147.69	---------- Well Sampled Annually ----------							
	03/27/97		4.40	149.44	---------- Well Sampled Annually ----------							
	05/27/97		4.90	148.94	---------- Well Sampled Annually ----------							
	08/12/97		5.43	148.41	<50	<0.5	<0.5	<0.5	<0.5	39	NM	
	11/17/97		5.87	147.97	---------- Well Sampled Annually ----------							
	03/16/98		4.52	149.32	---------- Well Sampled Annually ----------							
	05/12/98		4.42	149.42	---------- Well Sampled Annually ----------							
	07/27/98		4.75	149.09	<50	<0.5	<0.5	<0.5	<0.5	18	0.9	P
	10/15/98		5.75	148.09	---------- Well Sampled Annually ----------							
	02/18/99		3.93	149.91	---------- Well Sampled Annually ----------							

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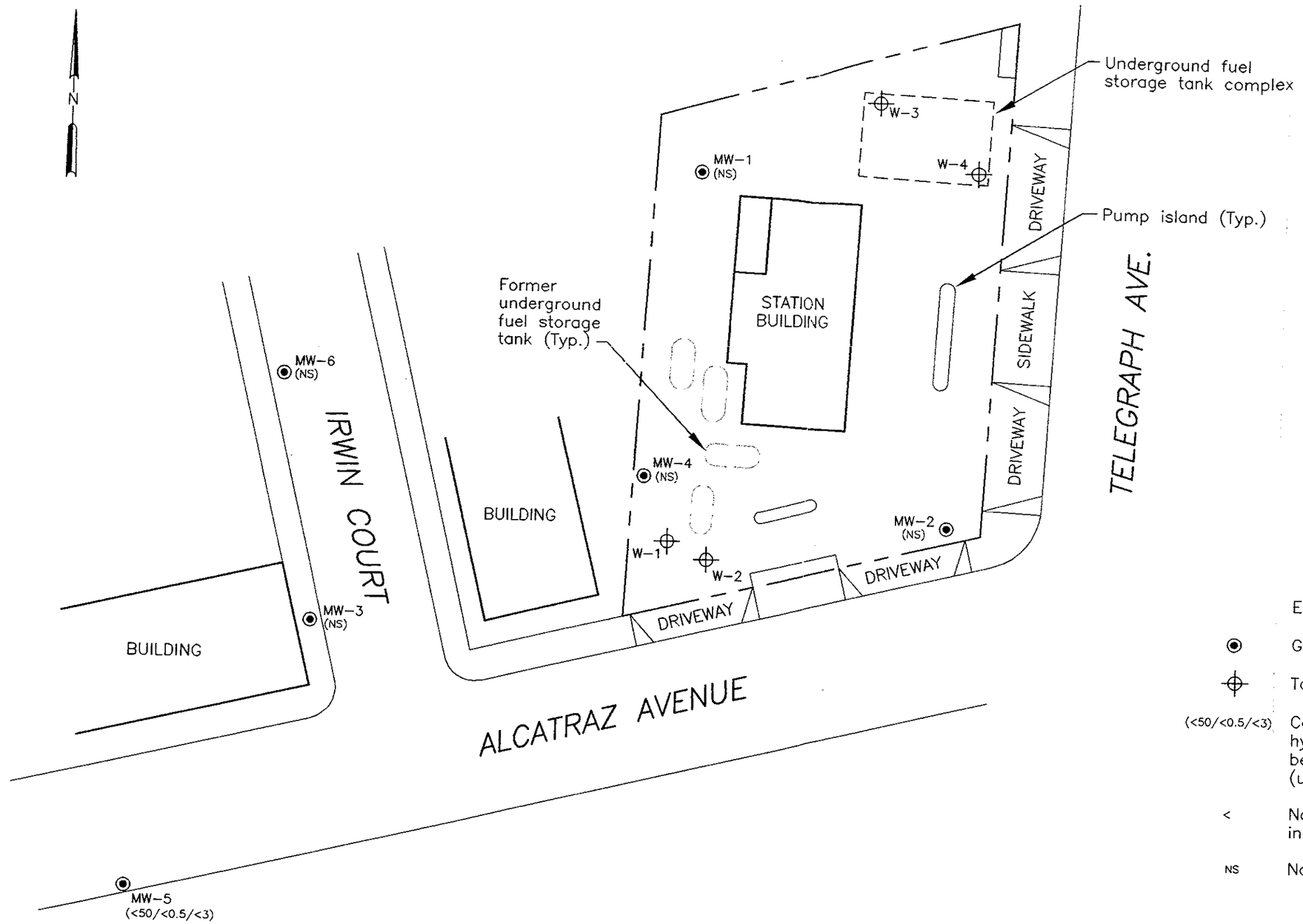
Well Number	Date Gauged/ Sampled	Well Elevation (feet, MSL)	Depth to Water (feet, TOC)	Groundwater Elevation (feet, MSL)	TPPH as Gasoline (ppb)	Benzene (ppb)	Toluene (ppb)	Ethyl-benzene (ppb)	Xylenes (ppb)	MTBE (ppb)	Dissolved Oxygen (ppm)	Purged/ Not Purged (P/NP)

MTBE = Methyl tert-butyl ether.
MSL = Mean sea level.
TOC = Top of casing.
ppb = Parts per billion.
ppm = Parts per million.
< = Less than laboratory detection limit stated to the right.
NA = Not analyzed.
NM = Not measured.
N/A = Not available.
* = ORCs installed in well beginning 11/14/95. Please refer to Appendix D for details.



ELEVATION

- ◉ Groundwater monitoring well
- ⊕ Tank pit groundwater monitoring well
- (<50/<0.5/<3) Concentration of total petroleum hydrocarbons as gasoline (TPHG), benzene, and MTBE in groundwater (ug/L); samples collected 2/18/99
- < Not detected at or above the indicated laboratory detection limit
- NS Not sampled

0 30 60
SCALE IN FEET

Pinnacle
ENVIRONMENTAL SOLUTIONS
A DIVISION OF EMCON

DATE MAR. 1999
DWN KAB
APP
REV 0
PROJECT NO.
20805-190.002

FIGURE 1
ARCO PRODUCTS COMPANY
SERVICE STATION 374, 6407 TELEGRAPH AVE.
OAKLAND, CALIFORNIA
GROUNDWATER ANALYTICAL SUMMARY
FIRST QUARTER 1999

IMAGE Files: <No images>
XREF Files: <No Xrefs>
SANJOSE/CADD: N:\DWG\PINACL\374\374CHEM.DWG Fri, 12/Mar/99 08:29am kblack
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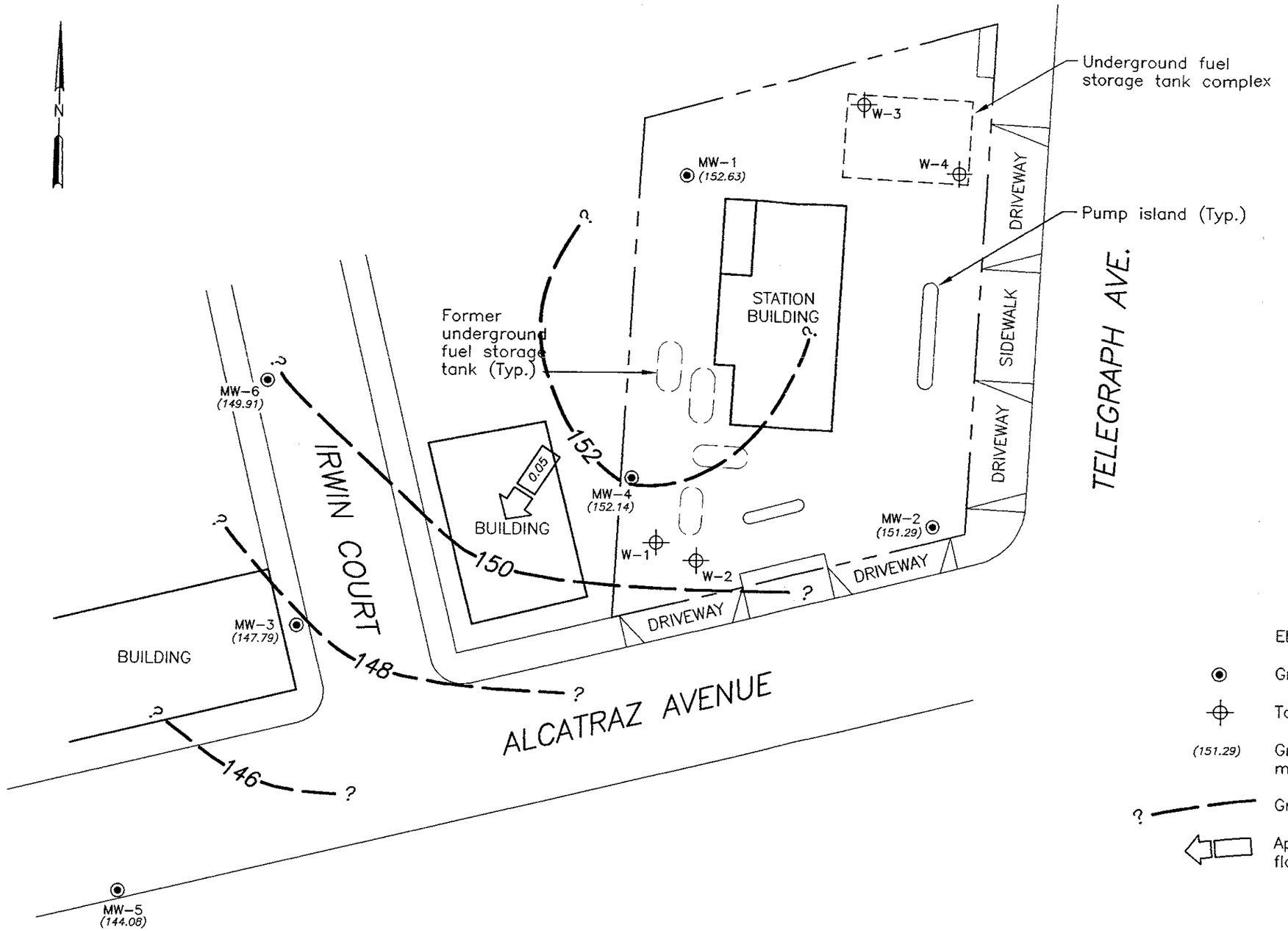
1" 1/2" 0" 1"



ELEVATION

- Groundwater monitoring well
- Tank pit groundwater monitoring well
- (151.29) Groundwater elevation (Ft.–MSL); measured 2/18/99
- Groundwater elevation contour (Ft.–MSL)
- Approximate direction of groundwater flow showing gradient

0 30 60

SCALE IN FEET

Pinnacle

ENVIRONMENTAL SOLUTIONS
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DATE MAR. 1999
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PROJECT NO.
20805-190.002

FIGURE 2
ARCO PRODUCTS COMPANY
SERVICE STATION 374, 6407 TELEGRAPH AVE.
OAKLAND, CALIFORNIA
GROUNDWATER ELEVATION CONTOURS
FIRST QUARTER 1999

ENVIRONMENTAL PROTECTION
99 MAR 23 PM 1:03

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XREF Files: <No Xrefs>
SANJOSE/CADD: N:\DWG\PINACL\374\374GWC.DWG Mon, 15/Mar/99 01:47pm kblack
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1" 1/2" 0" 1"

APPENDIX A

SAMPLING AND ANALYSIS PROCEDURES

APPENDIX A

SAMPLING AND ANALYSIS PROCEDURES

The sampling and analysis procedures for water quality monitoring programs are contained in this appendix. The procedures provided for consistent and reproducible sampling methods, proper application of analytical methods, and accurate and precise analytical results. Finally, these procedures provided guidelines so that the overall objectives of the monitoring program were achieved.

The following documents have been used as guidelines for developing these procedures:

- Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities, Environmental Protection Agency (EPA)-530/SW-611, August 1977
- Resource Conservation and Recovery Act (RCRA) Groundwater Monitoring Technical Enforcement Guidance Document, Office of Solid Waste and Emergency Response (OSWER) 9950.1, September 1986
- Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, 3rd edition, November 1986
- Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water, EPA-600/4-82-057, July 1982
- Methods for Organic Chemical Analysis of Water and Wastes, EPA-600/4-79-020, revised March 1983
- Leaking Underground Fuel Tank (LUFT) Field Manual, California State Water Resources Control Board, revised October 1989

Sample Collection

Sample collection procedures include equipment cleaning, water level and total well depth measurements, and well purging and sampling.

Equipment Cleaning

Before the sampling event was started, equipment that was used to sample groundwater was disassembled and cleaned with detergent water and then rinsed with deionized water. During field sampling, equipment surfaces that were placed in the well or came into contact with groundwater during field sampling were steam cleaned with deionized water before the next well was purged or sampled.

Water Level, Floating Hydrocarbon, and Total Well Depth Measurements

Before purging and sampling occurred, the depth to water, floating hydrocarbon thickness, and total well depth were measured using an oil/water interface measuring system. The oil/water interface measuring system consists of a probe that emits a continuous audible tone when immersed in a nonconductive fluid, such as oil or gasoline, and an intermittent tone when immersed in a conductive fluid, such as water. The floating hydrocarbon thickness and water level were measured by lowering the probe into the well. Liquid levels were recorded relative to the tone emitted at the groundwater surface. The sonic probe was decontaminated by being rinsed with deionized water or steam cleaned after each use. A bottom-filling, clear Teflon® bailer was used to verify floating hydrocarbon thickness measurements of less than 0.02 foot. Alternatively, an electric sounder and a bottom-filling Teflon bailer may have been used to record floating hydrocarbon thickness and depth to water.

The electric sounder is a transistorized instrument that uses a reel-mounted, two-conductor, coaxial cable that connects the control panel to the sensor. Cable markings are stamped at 1-foot intervals. The water level was measured by lowering the sensor into the monitoring well. A low-current circuit was completed when the sensor contacted the water, which served as an electrolyte. The current was amplified and fed into an indicator light and audible buzzer, signaling when water had been contacted. A sensitivity control compensated for highly saline or conductive water. The electric sounder was decontaminated by being rinsed with deionized water after each use. The bailer was lowered to a point just below the liquid level, retrieved, and observed for floating hydrocarbon.

Liquid measurements were recorded to the nearest 0.01 foot on the depth to water/floating product survey form. The groundwater elevation at each monitoring well was calculated by subtracting the measured depth to water from the surveyed elevation of the top of the well casing. (Every attempt was made to measure depth to water for all wells on the same day.) Total well depth was then measured by lowering the sensor to the bottom of the well. Total well depth, used to calculate purge volumes and to determine whether the well screen was partially obstructed by silt, was recorded to the nearest 0.1 foot on the depth to water/floating product survey form.

Well Purging

If the depth to groundwater was above the top of screens of the monitoring wells, then the wells were purged. Before sampling occurred, a polyvinyl chloride (PVC) bailer, centrifugal pump, low-flow submersible pump, or Teflon bailer was used to purge standing water in the casing and gravel pack from the monitoring well. Monitoring wells were purged according to the protocol presented in Figure A-1. In most monitoring wells, the amount of water purged before sampling was greater than or equal to three casing volumes. Some monitoring wells were expected to be evacuated to dryness after removing fewer than three casing volumes. These low-yield monitoring wells were allowed to recharge for up to 24 hours. Samples were obtained as soon as the monitoring wells recharged to a level sufficient for sample collection. If insufficient water recharged after 24 hours, the monitoring well was recorded as dry for the sampling event.

Groundwater purged from the monitoring wells was transported in a 500-gallon water trailer, 55-gallon drum, or a 325-gallon truck-mounted tank to EMCON's San Jose or Sacramento office location for temporary storage. EMCON arranged for transport and disposal of the purged groundwater through Integrated Waste Stream Management, Inc.

Field measurements of pH, specific conductance, and temperature were recorded in a waterproof field logbook. Figure A-2 shows an example of the water sample field data sheet on which field data are recorded. Field data sheets were reviewed for completeness by the sampling coordinator after the sampling event was completed.

The pH, specific conductance, and temperature meter were calibrated each day before field activities were begun. The calibration was checked once each day to verify meter performance. Field meter calibrations were recorded on the water sample field data sheet.

Well Sampling

A Teflon bailer was the only equipment acceptable for well sampling. When samples for volatile organic analysis were being collected, the flow of groundwater from the bailer was regulated to minimize turbulence and aeration. Glass bottles of at least 40-milliliters volume and fitted with Teflon-lined septa were used in sampling for volatile organics. These bottles were filled completely to prevent air from remaining in the bottle. A positive meniscus formed when the bottle was completely full. A convex Teflon septum was placed over the positive meniscus to eliminate air. After the bottle was capped, it was inverted and tapped to verify that it contained no air bubbles. The sample containers for other parameters were filled, filtered as required, and capped.

When required, dissolved concentrations of metals were determined using appropriate field filtration techniques. The sample was filtered by emptying the contents of the Teflon bailer into a pressure transfer vessel. A disposable 0.45-micron acrylic copolymer filter was threaded onto the transfer vessel at the discharge point, and the vessel was sealed. Pressure was applied to the vessel with a hand pump and the filtrate directed into the appropriate containers. Each filter was used once and discarded.

Sample Preservation and Handling

The following section specifies sample containers, preservation methods, and sample handling procedures.

Sample Containers and Preservation

Sample containers vary with each type of analytical parameter. Container types and materials were selected to be nonreactive with the particular analytical parameter tested.

Sample Handling

Sample containers were labeled immediately prior to sample collection. Samples were kept cool with cold packs until received by the laboratory. At the time of sampling, each sample was logged on an ARCO chain-of-custody record that accompanied the sample to the laboratory.

Samples that required overnight storage prior to shipping to the laboratory were kept cool (4° C) in a refrigerator. The refrigerator was kept in a warehouse, which was locked when not occupied by an EMCON employee. A sample/refrigerator log was kept to record the date and time that samples were placed into and removed from the refrigerator.

Samples were transferred from EMCON to an ARCO-approved laboratory by courier or taken directly to the laboratory by the environmental sampler. Sample shipments from EMCON to laboratories performing the selected analyses routinely occurred within 24 hours of sample collection.

Sample Documentation

The following procedures were used during sampling and analysis to provide chain-of-custody control during sample handling from collection through storage. Sample documentation included the use of the following:

- Water sample field data sheets to document sampling activities in the field
- Labels to identify individual samples
- Chain-of-custody record sheets for documenting possession and transfer of samples
- Laboratory analysis request sheets for documenting analyses to be performed

Field Logbook

In the field, the sampler recorded the following information on the water sample field data sheet (see Figure A-2) for each sample collected:

- Project number
- Client's name
- Location
- Name of sampler
- Date and time
- Well accessibility and integrity
- Pertinent well data (e.g., casing diameter, depth to water, well depth)
- Calculated and actual purge volumes
- Purging equipment used
- Sampling equipment used
- Appearance of each sample (e.g., color, turbidity, sediment)
- Results of field analyses (temperature, pH, specific conductance)
- General comments

The water sample field data sheet was signed by the sampler and reviewed by the sampling coordinator.

Labels

Sample labels contained the following information:

- Project number
- Sample number (i.e., well designation)
- Sample depth
- Sampler's initials
- Date and time of collection
- Type of preservation used (if any)

Sampling and Analysis Chain-of-Custody Record

The ARCO chain-of-custody record initiated at the time of sampling contained, at a minimum, the sample designation (including the depth at which the sample was collected), sample type, analytical request, date of sampling, and the name of the sampler. The record sheet was signed, timed, and dated by the sampler when transferring the samples. The number of custodians in the chain of possession was minimized. A copy of the ARCO chain-of-custody record was returned to EMCON with the analytical results.

Groundwater Sampling and Analysis Request Form

A groundwater sampling and analysis request form (see Figure A-3) was used to communicate to the environmental sampler the requirements of the monitoring event. At a minimum, the groundwater sampling and analysis request form included the following information:

- Date scheduled
- Site-specific instructions
- Specific analytical parameters
- Well number
- Well specifications (expected total depth, depth of water, and product thickness)

MONITORING WELL PURGING PROTOCOL

OWT

MEASURE AND RECORD DEPTH TO WATER AND WELL TOTAL DEPTH

CHECK FOR FLOATING PRODUCT

YES

MEASURE AND DOCUMENT FLOATING PRODUCT THICKNESS. DO NOT SAMPLE WELL FOR DISSOLVED CONSTITUENTS.

NO

CALCULATE PURGE VOLUME BY USING THE FOLLOWING EQUATION:

$P = \pi r^2 h \times 7.48 \times 3$

where:

P = calculated purge volume (gallons)

$\pi = 3.14$

r = radius of well casing in feet

h = height of water column in feet

EVACUATE WATER FROM WELL EQUAL TO THE CALCULATED PURGE VOLUME WHILE MONITORING GROUNDWATER STABILIZATION INDICATOR PARAMETERS (pH, CONDUCTIVITY, TEMPERATURE) AT INTERVALS OF ONE CASING VOLUME.

WELL EVACUATED TO PRACTICAL LIMITS OF DRYNESS BEFORE REMOVING CALCULATED PURGE VOLUME

NO

FINAL TWO SETS OF GROUNDWATER STABILIZATION INDICATOR PARAMETER MEASUREMENTS MEET THE FOLLOWING CRITERIA:

pH = ± 0.1 pH units

COND. = ± 10 %

TEMP. = ± 1.0 °F

YES

WELL PURGING CRITERIA MET; PROCEED TO WELL SAMPLING.

NO

CONTINUE PURGING; EVACUATE ADDITIONAL CASING VOLUME OF WATER, MONITORING INDICATOR PARAMETERS FOR STABILITY.

YES

WELL RECHARGES TO A LEVEL SUFFICIENT FOR SAMPLE COLLECTION WITHIN 24 HOURS OF EVACUATION TO DRYNESS.

YES

FIELD TEST FIRST RECHARGE WATER FOR INDICATOR PARAMETERS, THEN PROCEED TO WELL SAMPLING.

NO

RECORD WELL AS DRY FOR PURPOSES OF SAMPLING.

EMCON

MONITORING WELL PURGING PROTOCOL

FIGURE

A-1

WATER SAMPLE FIELD DATA SHEET

Rev. 5/96

OWT

PROJECT NO : _____ SAMPLE ID : _____

PURGED BY : _____ CLIENT NAME : _____

SAMPLED BY : _____ LOCATION : _____

TYPE: Groundwater _____ Surface Water _____ Leachate _____ Other _____

CASING DIAMETER (inches): 2 _____ 3 _____ 4 _____ 4.5 _____ 6 _____ Other _____

CASING ELEVATION (feet/MSL) : _____ VOLUME IN CASING (gal.) : _____

DEPTH OF WELL (feet) : _____ CALCULATED PURGE (gal.) : _____

DEPTH OF WATER (feet) : _____ ACTUAL PURGE VOL. (gal.) : _____

DATE PURGED : _____ END PURGE : _____

DATE SAMPLED : _____ SAMPLING TIME : _____

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	TURBIDITY (visual/NTU)	TIME (2400 HR)

OTHER: _____ ODOR: _____ (COBALT 0-100) (NTU 0-200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1) : _____

PURGING EQUIPMENT

_____ 2" Bladder Pump _____ Bailer (Teflon)

_____ Centrifugal Pump _____ Bailer (PVC)

_____ Submersible Pump _____ Bailer (Stainless Steel)

_____ Well Wizard™ _____ Dedicated

Other: _____

SAMPLING EQUIPMENT

_____ 2" Bladder Pump _____ Bailer (Teflon)

_____ Bomb Sampler _____ Bailer (Stainless Steel)

_____ *Dipper* _____ *Submersible Pump*

_____ Well Wizard™ _____ Dedicated

Other: _____

WELL INTEGRITY: _____ LOCK: _____

REMARKS: _____

pH, E.C , Temp Meter Calibration: Date: _____ Time: _____ Meter Serial No : _____

E.C. 1000 _____ / _____ pH 7 _____ / _____ pH 10 _____ / _____ pH 4 _____ / _____

Temperature °F _____

SIGNATURE: _____ REVIEWED BY: _____ PAGE _____ OF _____

EMCON

WATER SAMPLE FIELD DATA SHEET

FIGURE A-2

OWT

EMCON - SACRAMENTO
GROUNDWATER SAMPLING AND ANALYSIS REQUEST FORM

PROJECT NAME :

SCHEDULED DATE :

SPECIAL INSTRUCTIONS / CONSIDERATIONS :

Project Authorization: _____
EMCON Project No.: _____
OWT Project No.: _____
Task Code: _____
Originals To: _____
cc: _____

Well Lock Number (s)

[ ] CHECK BOX TO AUTHORIZE DATA ENTRY

Site Contact: _____ Name _____ Phone #

Well Number or Source	Casing Diameter (inches)	Casing Length (feet)	Depth to Water (feet)	ANAYSES REQUESTED

Laboratory and Lab QC Istructions:

EMCON

SAMPLING AND ANALYSIS REQUEST FORM

FIGURE
A-3

APPENDIX B

CERTIFIED ANALYTICAL REPORTS, AND CHAIN-OF-CUSTODY DOCUMENTATION

Columbia Analytical Services INC
An Employee-Owned Company

March 2, 1999

Service Request No.: S9900590

Mr. Glen Vanderveen
PINNACLE
144 A Mayhew Wy.
Walnut Creek, CA 94596

MAR 0 1999

RE: 20805-190.005/TO#24118.00/RAT8/374 Oakland

Dear Mr. Vanderveen:

The following pages contain analytical results for sample(s) received by the laboratory on February 19, 1999. Results of sample analyses are followed by Appendix A which contains sample custody documentation and quality assurance deliverables requested for this project. The work requested has been assigned the Service Request No. listed above. To help expedite our service, please refer to this number when contacting the laboratory.

Analytical results were produced by procedures consistent with Columbia Analytical Services' (CAS) Quality Assurance Manual (with any deviations noted). Signature of this CAS Analytical Report below confirms that pages 2 through 8, following, have been thoroughly reviewed and approved for release in accord with CAS Standard Operating Procedure ADM-DatRev3.

Please feel welcome to contact me should you have questions or further needs.

Sincerely,

Bernadette T. Cox
Project Chemist

Regional QA Coordinator

3334 Victor Court ▪ Santa Clara, CA 95054-2316 ▪ Telephone (408) 748-9700 ▪ Fax (408) 748-9860

COLUMBIA ANALYTICAL SERVICES, Inc.
Acronyms

A2LA	American Association for Laboratory Accreditation
ASTM	American Society for Testing and Materials
BOD	Biochemical Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CAM	California Assessment Metals
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
COD	Chemical Oxygen Demand
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DLCS	Duplicate Laboratory Control Sample
DMS	Duplicate Matrix Spike
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
IC	Ion Chromatography
ICB	Initial Calibration Blank sample
ICP	Inductively Coupled Plasma atomic emission spectrometry
ICV	Initial Calibration Verification sample
J	Estimated concentration. The value is less than the MRL, but greater than or equal to the MDL. If the value is equal to the MRL, the result is actually <MRL before rounding.
LCS	Laboratory Control Sample
LUFT	Leaking Underground Fuel Tank
M	Modified
MBAS	Methylene Blue Active Substances
MCL	Maximum Contaminant Level. The highest permissible concentration of a substance allowed in drinking water as established by the U. S. EPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
MS	Matrix Spike
MTBE	Methyl tert-Butyl Ether
NA	Not Applicable
NAN	Not Analyzed
NC	Not Calculated
NCASI	National Council of the paper industry for Air and Stream Improvement
ND	Not Detected at or above the method reporting/detection limit (MRL/MDL)
NIOSH	National Institute for Occupational Safety and Health
NTU	Nephelometric Turbidity Units
ppb	Parts Per Billion
ppm	Parts Per Million
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
SIM	Selected Ion Monitoring
SM	Standard Methods for the Examination of Water and Wastewater, 18th Ed., 1992
STLC	Solubility Threshold Limit Concentration
SW	Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Ed., 1986 and as amended by Updates I, II, IIA, and IIB.
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbons
tr	Trace level. The concentration of an analyte that is less than the PQL but greater than or equal to the MDL. If the value is equal to the PQL, the result is actually <PQL before rounding.
TRPH	Total Recoverable Petroleum Hydrocarbons
TSS	Total Suspended Solids
TTLC	Total Threshold Limit Concentration
VOA	Volatile Organic Analyte(s)

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9900590
Project:	20805-190.005/TO#24118.00/374 Oakland	**Date Collected:**	2/18/99
Sample Matrix:	Water	**Date Received:**	2/19/99

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-5(20)	Units:	ug/L (ppb)
Lab Code:	S9900590-001	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	2/22/99	ND	
Benzene	EPA 5030	8020	0.5	1	NA	2/22/99	ND	
Toluene	EPA 5030	8020	0.5	1	NA	2/22/99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	2/22/99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	2/22/99	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	2/22/99	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9900590
Project:	20805-190.005/TO#24118.00/374 Oakland	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA

BTEX, MTBE and TPH as Gasoline

Sample Name:	Method Blank	Units:	ug/L (ppb)
Lab Code:	S990222-WB2	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	2/22/99	ND	
Benzene	EPA 5030	8020	0.5	1	NA	2/22/99	ND	
Toluene	EPA 5030	8020	0.5	1	NA	2/22/99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	2/22/99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	2/22/99	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	2/22/99	ND	

APPENDIX A

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-190.005/TO#24118.00/374 Oakland
Sample Matrix: Water

Service Request: S9900590
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: NA

Surrogate Recovery Summary
BTEX, MTBE and TPH as Gasoline

Prep Method: EPA 5030
Analysis Method: 8020 CA/LUFT

Units: PERCENT
Basis: NA

Sample Name	Lab Code	Test Notes	Percent Recovery	
			4-Bromofluorobenzene	a,a,a-Trifluorotoluene
MW-5(20)	S9900590-001		103	93
Lab Control Sample	S990222-LCS		114	89
Lab Control Sample	S990222-DLCS		113	92
Method Blank	S990222-WB2		102	89
CAS Acceptance Limits:			69-116	69-116

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO Products Company	**Service Request:**	S9900590
Project:	20805-190.005/TO#24118.00/374 Oakland	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	2/22/99

Laboratory Control Sample/Duplicate Laboratory Control Sample Summary
BTE

Sample Name:	Lab Control Sample	Units:	ug/L (ppb)
Lab Code:	S990222-LCS, S990222-DLCS	Basis:	NA
Test Notes:			

				Spike Level		Sample	Spike Result		Percent Recovery		CAS	Relative
Analyte	**Prep Method**	**Analysis Method**	**MRL**	LCS	DLCS	**Result**	LCS	DLCS	LCS	DLCS	Acceptance Limits	**Percent Difference**
Benzene	EPA 5030	8020	0.5	25	25	ND	24	24	96	96	75-135	<1
Toluene	EPA 5030	8020	0.5	25	25	ND	23	22	92	88	73-136	4
Ethylbenzene	EPA 5030	8020	0.5	25	25	ND	22	23	88	92	69-142	4

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-190.005/TO#24118.00/374 Oakland

Service Request: S9900590
Date Analyzed: 2/22/99

Initial Calibration Verification (ICV) Summary
BTEX, MTBE and TPH as Gasoline

Sample Name: ICV
Lab Code: ICV1
Test Notes:

Units: ug/L (ppb)
Basis: NA

ICV Source:

Analyte	Prep Method	Analysis Method	True Value	Result	CAS Percent Recovery Acceptance Limits	Percent Recovery	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	250	250	90-110	100	
Benzene	EPA 5030	8020	25	24	85-115	96	
Toluene	EPA 5030	8020	25	23	85-115	92	
Ethylbenzene	EPA 5030	8020	25	23	85-115	92	
Xylenes, Total	EPA 5030	8020	75	73	85-115	97	
Methyl *tert*-Butyl Ether	EPA 5030	8020	25	23	85-115	92	

ICV/032196

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO Products Company	**Service Request:**	S9900590
Project:	20805-190.005/TO#24118.00/374 Oakland	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	2/22/99

Laboratory Control Sample Summary
BTE

Sample Name:	Lab Control Sample	Units:	ug/L (ppb)
Lab Code:	S990222-LCS	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Benzene	EPA 5030	8020	0.5	25	ND	24	96	75-135	
Toluene	EPA 5030	8020	0.5	25	ND	23	92	73-136	
Ethylbenzene	EPA 5030	8020	0.5	25	ND	22	88	69-142	

ARCO Products Company — Chain of Custody

Division of Atlantic/Richfield Company S9900590 Task Order No. 7418.00

ARCO Facility no. QF74	City (Facility) Oakland	Project manager (Consultant) Glen VanderVeen	Laboratory Name CAS
ARCO engineer Paul Supple	Telephone no. (ARCO)	Telephone no. (Consultant) (408)453-7300	Fax no. (Consultant) (408)437-9758
Consultant name EMCON	Address (Consultant) 144-A Mayhew Way, Walnut Creek, CA		Contract Number

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH including MTBE EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM 503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Semi Metals ☐ VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org/DHS ☐ Lead EPA 7420/7421 ☐			
MW-5	(20)	2	(1)	X		X	HCL	2/18/99	0945		X												

Method of shipment: Sampler will deliver

Special Detection Limit/reporting: Lowest Possible

Special QA/QC: As Normal

Remarks: RAT 8
2-40ml HCL VOAs
190
#20805-125 COC

Lab Number

Turnaround Time:
- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☒

Condition of sample:

Temperature received: Due: 3/5/99 R11/D3

Relinquished by sampler	Date 2/19/99	Time 1500	Received by ROBINS CAS 2/19/99 1500
Relinquished by	Date	Time	Received by
Relinquished by	Date	Time	Received by laboratory / Date / Time

Distribution: White Copy – Laboratory: Canary Copy – ARCO Environmental Engineering: Pink Copy – Consultant

APPENDIX C

FIELD DATA SHEETS

FIELD REPORT
DEPTH TO WATER / FLOATING PRODUCT SURVEY

PROJECT # : **21775-261.004** STATION ADDRESS : **6407 Telegraph Ave, Oakland, CA** DATE : **2/18/99**

ARCO STATION # : **374** FIELD TECHNICIAN : **Mike Ross/ Manuel Gallegos** DAY : **Thursday**

DTW Order	WELL ID	Well Box Seal	Type Of Well Lid	Gasket Present	Lock Number	Type Of Well Cap	FIRST DEPTH TO WATER (feet)	SECOND DEPTH TO WATER (feet)	DEPTH TO FLOATING PRODUCT (feet)	FLOATING PRODUCT THICKNESS (feet)	WELL TOTAL DEPTH (feet)	COMMENTS
1	MW-1	OK	HEX	NO	ARCO	LWC	6.28	6.28	NR	NR	27.8	UNDER PRESSURE/NO BLOCK IN LID
2	MW-6	OK	15/16"	YES	ARCO	LWC	3.93	3.93	NR	NR	14.6	UNDER PRESSURE / TOP OF CASING NOT MARKED
3	MW-5	OK	~~HEX~~	YES	ARCO	LWC	7.25	7.25	NR	NP	23.1	
4	MW-2	OK	HEX	NO	ARCO	LWC	6.63	6.63	NR	NR	26.3	
5	MW-3	OK	HEX	NO	ARCO	LWC	5.85	5.85	NR	NR	26.8	ORC SOCK IN WELL
6	MW-4	OK	3/4 ~~HEX~~	NO	VAULT ~~ARCO~~	LWC	4.39	4.39	NR	NR	27.0	

SURVEY POINTS ARE TOP OF WELL CASINGS

WATER SAMPLE FIELD DATA SHEET

Rev 1/97

OWT

PROJECT NO 21775-261,004 | SAMPLE ID MW-5 (20)
PURGED BY M. Ross | CLIENT NAME ARCO 0374
SAMPLED BY M. Ross | LOCATION Oakland, Ca

TYPE Groundwater ✓ Surface Water ____ Leachate ____ Other ____

CASING DIAMETER (inches) 2 ____ 3 ____ 4 ✓ 4 5 ____ 6 ____ Other ____
1.96

CASING ELEVATION (feet/MSL) NR
DEPTH OF WELL (feet) 23.1
DEPTH OF WATER (feet) 7.25

VOLUME IN CASING (gal) 10.35
CALCULATED PURGE (gal.) 31.06
ACTUAL PURGE VOL (gal) 23.0

DATE PURGED 2/18/99 | END PURGE 0936
DATE SAMPLED 2/18/99 | SAMPLING TIME 0945

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
0932	10.5	6.49	670	63.5	clr	clr
0935	22.0	6.68	617	64.6	clr	clr
0936	~~5~~ Dry @		23.0	Gallons		
0945	Recharge	6.98	616	63.4	clr	clr

OTHER: D.O. 2.0 mg/L ODOR ~~Strong~~ Slight NR (COBALT 0-100) NR (NTU 0-200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1) NR

PURGING EQUIPMENT

____ 2" Bladder Pump
✓ Centrifugal Pump
____ Submersible Pump
____ Well Wizard™
____ Bailer (Teflon)
____ Bailer (PVC)
____ Bailer (Stainless Steel)
____ Dedicated
Other: ____

SAMPLING EQUIPMENT

____ 2" Bladder Pump
____ Bomb Sampler
____ Dipper
____ Well Wizard™
✓ Bailer (Teflon)
____ Bailer (Stainless Steel)
____ Submersible Pump
____ Dedicated
Other: Disposable

WELL INTEGRITY: OK | LOCK. ARCO

REMARKS: ~~Purged~~

pH, E.C., Temp. Meter Calibration Date 2/18/99 | Time 0920 | Meter Serial No. 606235
E.C. 1000 1000 / 1077 | pH 7 700 / 6992 | pH 10 1000 / 1003 | pH 4 400 / 399
Temperature °F 61.1
SIGNATURE: [signature] | REVIEWED BY [signature] | PAGE 1 OF 1

EMCON Associates - Field Services

1921 Ringwood Avenue

San Jose, California

1999

Historical Monitoring Well Data

ARCO 0374

21775-261.004

Well ID	Quarter	Date	Purge Volume (gallons)	Did well dry	Well Contained Product	Gallons
						First 23.00
						Second 25.00
						Third 90.00
						Fourth 26.00
MW-1	First	02/18/99	0.00	NA	NO	
	Second	05/12/98	0.00	NA	NO	
	Third	07/27/98	40.50	NO	NO	
	Fourth	10/15/98	0.00	NA	NO	
MW-2	First	02/18/99	0.00	NA	NO	
	Second	05/12/98	0.00	NA	NO	
	Third	07/27/98	0.00	GRAB	NO	
	Fourth	10/15/98	0.00	NA	NO	
MW-3	First	02/18/99	0.00	NA	NO	
	Second	05/12/98	0.00	NA	NO	
	Third	07/27/98	0.00	GRAB	NO	
	Fourth	10/15/98	0.00	NA	NO	
MW-4	First	02/18/99	0.00	NA	NO	
	Second	05/12/98	0.00	NA	NO	
	Third	07/27/98	0.00	GRAB	NO	
	Fourth	10/15/98	0.00	NA	NO	
MW-5	First	02/18/99	23.00	YES	NO	
	Second	05/12/98	25.00	YES	NO	
	Third	07/27/98	30.00	YES	NO	
	Fourth	10/15/98	26.00	YES	NO	
MW-6	First	02/18/99	0.00	NA	NO	
	Second	05/12/98	0.00	NA	NO	
	Third	07/27/98	19.50	NO	NO	
	Fourth	10/15/98	0.00	NA	NO	
	First					
	Second					
	Third					
	Fourth					
	First					
	Second					
	Third					
	Fourth					
	First					
	Second					
	Third					
	Fourth					
	First					Steam water (gal)
	Second					
	Third					
	Fourth					

ARCO Products Company
Division of Atlantic/Richfield Company

Task Order No. 4115.CC

Chain of Custody

ARCO Facility no. C-74	City (Facility) Oakland	Project manager (Consultant) Glen VanderVeen	Laboratory Name CAS
ARCO engineer Paul Supple	Telephone no. (ARCO)	Telephone no. (Consultant) (405)457-7[illegible] / Fax no. (Consultant) (405)457-9[illegible]	Contract Number
Consultant name EMCON		Address (Consultant) 144 A Mayhew Way Walnut Creek, CA	

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH [illegible] EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM 503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals☐ VOA☐ Semi VOA☐	CAM Metals EPA 6010/7000 TTLC☐ STLC☐	Lead Org/DHS☐ Lead EPA 7420/7421☐			
MW-5	(6)	7		X		X	HCL	3/19/99	0945		X												

Method of shipment: Sampler will deliver

Special Detection Limit/reporting: Lowest Possible

Special QA/QC: As Normal

Remarks: RAT 8 - 40ml HCL VOAs [illegible] -[illegible]

Lab Number:

Turnaround Time:

- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☑

Condition of sample:

Temperature received:

Relinquished by sampler [illegible]	Date 3/19/99	Time 1500	Received by [illegible] CAS 3/19/99 1500		
Relinquished by	Date	Time	Received by		
Relinquished by	Date	Time	Received by laboratory	Date	Time

Distribution: White Copy – Laboratory: Canary Copy – ARCO Environmental Engineering: Pink Copy – Consultant

APPENDIX D

REMEDIAL SYSTEM PERFORMANCE SUMMARY

APPENDIX D

REMEDIAL SYSTEM PERFORMANCE SUMMARY

GWE System

Groundwater extraction (GWE) was conducted between December 21, 1993, and October 13, 1995. No evidence of additional plume migration has been observed since system deactivation. The GWE system was comprised of a pneumatic pump in Well W-2 and three 200-pound granular activated carbon vessels arranged in series to treat the extracted groundwater. Extracted and treated groundwater was discharged into the East Bay Municipal Utility District (EBMUD) Permit Account Number 502-85611. Based on verbal approval from the ACHCSA, indicating that GWE would no longer be required at the site, the EBMUD permit was relinquished on June 14, 1996. Overall, approximately 0.1 million gallons of groundwater were extracted and less than 0.05 gallon of benzene was removed.

Please refer to the *Second Quarter 1997 Groundwater Monitoring Report,* for historical GWE system performance and analytical data.

Intrinsic Bioremediation Evaluation

Intrinsic bioremediation indicator parameters (bioparameters) were monitored during the third quarter 1996 groundwater monitoring event. Groundwater samples from Wells MW-3, MW-4, and MW-5 were analyzed for total alkalinity, dissolved oxygen (DO), ferrous iron, nitrate, sulfate, methane, biological oxygen demand (BOD), chemical oxygen demand (COD), and carbon dioxide (CO_2). Intrinsic bioremediation evaluation data are presented in Table D-1.

It is generally accepted that depleted concentrations of electron acceptors (DO, nitrate, and sulfate), and elevated concentrations of bioremediation byproducts (CO_2, methane, and ferrous iron) within the hydrocarbon-impacted plume compared to background levels indicate that intrinsic bioremediation is occurring. Collected data follow a trend that indicates the occurrence of intrinsic bioremediation.

Bioremediation Enhancement Program

On November 14, 1995, at the request of ARCO, twelve oxygen releasing compound (ORC) socks manufactured by Regenesis Bioremediation Products, Inc. were installed below the groundwater surface in Well MW-3. ORC is a formulation of very fine, insoluble magnesium peroxide that releases oxygen at a slow, controlled rate when hydrated. ORC product literature was presented in PEG's fourth quarter 1995 report.

Data collected from Well MW-3 indicate that concentrations of TPPH-g and benzene have declined since ORC units were installed. On September 29, 1998 ORC socks were also installed in MW-4. ORC units are changed when dissolved oxygen data indicate that they have been depleted.

Conclusions

As indicated above, GWE at the site has been terminated with verbal approval from ACHCSA. Bioremediation enhancement program will continue.

Attachments: Table D-1 - Intrinsic Bioremediation Evaluation Data

Table D-1
Intrinsic Bioremediation Evaluation and Enhancement Data

ARCO Service Station 0374
6407 Telegraph Avenue, Oakland, California

Well	Date Sampled	Field Analyses: Groundwater Temperature (deg F)	pH (units)	Conductivity (µmhos)	D.O. (mg/L)	Ferrous Iron (mg/L)	Laboratory Analyses: Total Alkalinity (mg CaCO3/L)	B.O.D. (mg/L)	Carbon Dioxide (mg/L)	C.O.D. (mg/L)	Methane (%)	Nitrate as Nitrate (mg/L)	Nitrite as Nitrite (mg/L)	Sulfate (mg/L)	TPH as Gasoline (µg/L)	Total BTEX (µg/L)
MW-3	11/14/95 **	65.5*	6.76*	508*	7.17	N/A	NS	NS	NS	NS	NS	6.6	<1.0	NS	140	46
	06/06/96 **	66.2	7.38	700	12.28	N/A	NS	NS	NS	NS	NS	NS	NS	NS	84†	5.4†
	07/16/96	67.8	7.08	1,010	8.73	0.0	280	1.8	270	44	<0.020	<1.0	NS	78	<50	2.2
	01/21/97 **	59	N/A	N/A	11.15	0.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	08/12/97 **	74.4	6.65	600	6.7	1.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/17/97	N/A	N/A	N/A	12.0	0.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	03/16/98	68.5	7.75	806	4.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
	05/12/98	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	07/27/98	68.1	6.81	904	1.7	NM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	74	ND
	09/29/98 **	ORC installed														
	10/15/98	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	02/18/99	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW-4	07/16/96	69.5	6.72	1,370	3.20	4.20	420	NS	470	NS	0.11	<1.0	NS	18	5,600	2,020
	03/16/98	66.2	6.89	1,411	1.50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
	05/12/98	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	07/27/98	70.5	6.34	1434	0.5	NM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	21,000	8,900
	09/29/98 **	ORC installed														
	10/15/98	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	02/18/99	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table D-1
Intrinsic Bioremediation Evaluation and Enhancement Data

ARCO Service Station 0374
6407 Telegraph Avenue, Oakland, California

		Field Analyses					Laboratory Analyses									
Well	Date Sampled	Groundwater Temperature (deg F)	pH (units)	Conductivity (µmhos)	D.O. (mg/L)	Ferrous Iron (mg/L)	Total Alkalinity (mg CaCO3/L)	B.O.D. (mg/L)	Carbon Dioxide (mg/L)	C.O.D. (mg/L)	Methane (%)	Nitrate as Nitrate (mg/L)	Nitrite as Nitrite (mg/L)	Sulfate (mg/L)	TPH as Gasoline (µg/L)	Total BTEX (µg/L)
MW-5	07/16/96	70.4	6.85	690	6.80	0.0	170	NS	180	NS	<0.020	<1.0	NS	35	<50	1.1
	03/16/98	69.5	7.19	584	1.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
	05/12/98	65.9	7.04	619	2.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
	07/27/98	73.6	7.39	569	1.3	NM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
	10/15/98	65.8	6.88	626	3.0	NM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	0.6
	02/18/99	63.4	6.98	616	2.0	NM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
MW-6	06/06/96	N/A	N/A	N/A	3.47	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	03/16/98	N/A	N/A	N/A	N/A	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	05/12/98	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	07/27/98	70.3	6.67	638	0.9	NM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
	10/15/98	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	02/18/99	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

D.O. = Dissolved oxygen
B.O.D = Biochemical oxygen demand
C.O.D = Chemical oxygen demand
TPPH = Total purgeable petroleum hydrocarbons
BTEX = Benzene, toluene, ethylbenzene, and xylenes
deg F = Degrees Fahrenheit
µmhos = Micromhos
mg/L = Milligrams per liter

µg/L = Micrograms per liter
NM = not measured
NS = Not sampled
ND = Not detected
N/A = Not available
* Field measurements collected on November 2, 1995.
** ORC installed
† From April 10, 1996 groundwater monitoring event.