the IT group

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R078

November 17, 1999
Project 791749

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

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

Dear Mr. Supple:

Pinnacle Environmental Solutions, a member of The IT Group (Pinnacle), is submitting the attached report which presents the results of the third 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

Dan Easter, R.G.
Project Geologist

Attachment: Quarterly Groundwater Monitoring Report, Third Quarter 1999

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

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Date: November 17, 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.: 791749

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

WORK PERFORMED THIS QUARTER (THIRD - 1999):

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

WORK PROPOSED FOR NEXT QUARTER (FOURTH - 1999):

1. Prepare and submit quarterly groundwater monitoring report for third quarter 1999.
2. Perform quarterly groundwater monitoring and sampling for fourth 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 (2nd 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:	7.6 feet
Groundwater Flow Direction and Gradient (Average):	0.03 ft/ft toward southwest

DISCUSSION:

- Because annual and semi-annual samples were collected during the third quarter 1999, they will not be collected during the fourth quarter 1999.

- 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
- Table 2 - Groundwater Flow Direction and Gradient
- 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)	Total Xylenes (ppb)	MTBE (ppb)	Dissolved Oxygen (ppm)	Purged/ Not Purged (P/NP)
MW-1	01/31/96	158.91	6.34	152.57	Not Sampled: Well Sampled Annually							
MW-1	04/10/96	158.91	5.82	153.09	Not Sampled: Well Sampled Annually							
MW-1	07/16/96	158.91	7.23	151.68	<50	<0.5	<0.5	<0.5	<0.5	340	NM	
MW-1	10/14/96	158.91	8.34	150.57	Not Sampled: Well Sampled Annually							
MW-1	03/27/97	158.91	6.37	152.54	Not Sampled: Well Sampled Annually							
MW-1	05/27/97	158.91	7.30	151.61	Not Sampled: Well Sampled Annually							
MW-1	08/12/97	158.91	8.22	150.69	<50	<0.5	<0.5	<0.5	<0.5	620	NM	
MW-1	11/17/97	158.91	7.98	150.93	Not Sampled: Well Sampled Annually							
MW-1	03/16/98	158.91	4.94	153.97	Not Sampled: Well Sampled Annually							
MW-1	05/12/98	158.91	5.28	153.63	Not Sampled: Well Sampled Annually							
MW-1	07/27/98	158.91	6.84	152.07	<500	<5	<5	<5	<5	580	0.6	P
MW-1	10/15/98	158.91	7.32	151.59	Not Sampled: Well Sampled Annually							
MW-1	02/18/99	158.91	6.28	152.63	Not Sampled: Well Sampled Annually							
MW-1	05/24/99	158.91	6.45	152.46	<50	<0.5	<0.5	<0.5	<0.5	1,300	2.0	NP
MW-1	08/27/99	158.91	7.86	151.05	<50	<0.5	<0.5	<0.5	<0.5	1,500	1.65	NP
MW-2	01/31/96	157.92	6.51	151.41	Not Sampled: Well Sampled Annually							
MW-2	04/10/96	157.92	6.94	150.98	Not Sampled: Well Sampled Annually							
MW-2	07/16/96	157.92	7.73	150.19	<50	1.2	<0.5	<0.5	<0.5	33	NM	
MW-2	10/14/96	157.92	8.35	149.57	Not Sampled: Well Sampled Annually							
MW-2	03/27/97	157.92	7.40	150.52	Not Sampled: Well Sampled Annually							
MW-2	05/27/97	157.92	7.82	150.10	Not Sampled: Well Sampled Annually							
MW-2	08/12/97	157.92	8.29	149.63	<50	<0.5	<0.5	<0.5	<0.5	23	NM	
MW-2	11/17/97	157.92	8.05	149.87	Not Sampled: Well Sampled Annually							
MW-2	03/16/98	157.92	6.45	151.47	Not Sampled: Well Sampled Annually							
MW-2	05/12/98	157.92	6.93	150.99	Not Sampled: Well Sampled Annually							
MW-2	07/27/98	157.92	7.39	150.53	<50	<0.5	<0.5	<0.5	<0.5	<3	0.85	NP
MW-2	10/15/98	157.92	7.67	150.25	Not Sampled: Well Sampled Annually							
MW-2	02/18/99	157.92	6.63	151.29	Not Sampled: Well Sampled Annually							

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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)	Total Xylenes (ppb)	MTBE (ppb)	Dissolved Oxygen (ppm)	Purged/ Not Purged (P/NP)
MW-2	05/24/99	157.92	7.43	150.49	<50	6.3	<0.5	0.7	<0.5	29	3.0	P
MW-2	08/27/99	157.92	8.22	149.70	<50	<0.5	<0.5	<0.5	<0.5	<3	0.95	NP
MW-3*	01/31/96	153.64	7.02	146.62	140	20	0.87	11	14	NA	NM	
MW-3*	04/10/96	153.64	7.82	145.82	84	2.4	<0.5	1.9	1.1	NA	NM	
MW-3*	07/16/96	153.64	6.80	146.84	<50	2.2	<0.5	<0.5	<0.5	<2.5	NM	
MW-3*	10/14/96	153.64	7.67	145.97	<50	1.2	<0.5	<0.5	0.81	2.9	NM	
MW-3*	03/27/97	153.64	7.62	146.02	<50	0.94	<0.5	0.9	0.63	<2.5	NM	
MW-3*	05/27/97	153.64	6.72	146.92	Not Sampled: Well Sampled Semiannually							
MW-3*	08/12/97	153.64	8.20	145.44	<50	<0.5	<0.5	<0.5	<0.5	<2.5	NM	
MW-3*	11/17/97	153.64	7.64	146.00	Not Sampled: Well Sampled Semiannually						12.0	
MW-3*	03/18/98	153.64	5.14	148.50	<50	<0.5	<0.5	<0.5	<0.5	<3	4.0	P
MW-3*	05/12/98	153.64	5.53	148.11	Not Sampled: Well Sampled Semiannually							
MW-3*	07/27/98	153.64	7.63	146.01	74	<0.5	<0.5	<0.5	<0.5	<3	1.7	NP
MW-3*	10/15/98	153.64	7.46	146.18	Not Sampled: Well Sampled Semiannually							
MW-3*	02/18/99	153.64	5.85	147.79	Not Sampled							
MW-3*	05/24/99	153.64	7.00	146.64	<50	<0.5	<0.5	<0.5	<0.5	4	6.0	NP
MW-3*	08/27/99	153.64	7.16	146.48	<50	<0.5	<0.5	<0.5	<0.5	<3	16.57	NP
MW-4	01/31/96	156.53	5.64	150.89	230	23	2.2	3.7	32	NA	NM	
MW-4	04/10/96	156.53	6.66	149.87	7,300	1,600	350	350	830	NA	NM	
MW-4	07/16/96	156.53	7.73	148.80	5,600	1,100	160	240	520	150	NM	
MW-4	10/14/96	156.53	8.55	147.98	4,500	860	72	160	340	<62	NM	
MW-4	03/27/97	156.53	7.15	149.38	25,000	5,200	760	850	2,600	<250	NM	
MW-4	05/27/97	156.53	7.75	148.78	Not Sampled: Well Sampled Semiannually							
MW-4	08/12/97	156.53	8.46	148.07	4,800	950	40	140	210	170	NM	
MW-4	11/17/97	156.53	8.24	148.29	Not Sampled: Well Sampled Semiannually							
MW-4	03/16/98	156.53	5.32	151.21	<50	<0.5	<0.5	<0.5	<0.5	<3	1.5	P
MW-4	05/12/98	156.53	6.38	150.15	Not Sampled: Well Sampled Semiannually							

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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)	Total Xylenes (ppb)	MTBE (ppb)	Dissolved Oxygen (ppm)	Purged/ Not Purged (P/NP)
MW-4	07/27/98	156.53	7.36	149.17	21,000	6,100	390	810	1,600	<300	0.5	NP
MW-4	10/15/98	156.53	8.30	148.23	Not Sampled: Well Sampled Semiannually							
MW-4	02/18/99	156.53	4.39	152.14	Not Sampled							
MW-4	05/24/99	156.53	7.45	149.08	18,000	5,600	350	410	1,300	<300	1.0	NP
MW-4	08/27/99	156.53	8.07	148.46	12,000	3,200	170	490	810	65	1.32	NP
MW-5	01/31/96	151.33	8.64	142.69	<50	<0.5	<0.5	<0.5	<0.5	NA	NM	
MW-5	04/10/96	151.33	N/A	--	<50	<0.5	<0.5	<0.5	<0.5	NA	NM	
MW-5	07/16/96	151.33	8.15	143.18	<50	0.79	1.3	<0.5	<0.5	<2.5	NM	
MW-5	10/14/96	151.33	7.92	143.41	<50	<0.5	<0.5	<0.5	<0.5	<2.5	NM	
MW-5	03/27/97	151.33	7.75	143.58	<50	<0.5	<0.5	<0.5	<0.5	<2.5	NM	
MW-5	05/27/97	151.33	8.16	143.17	<50	<0.5	<0.5	<0.5	<0.5	<2.5	NM	
MW-5	08/12/97	151.33	---------- Well Inaccessible ----------									
MW-5	11/17/97	151.33	8.75	142.58	<50	<0.5	<0.5	<0.5	<0.5	<2.5	4.0	NP
MW-5	03/16/98	151.33	6.90	144.43	<50	<0.5	<0.5	<0.5	<0.5	<3	1.5	P
MW-5	05/12/98	151.33	7.24	144.09	<50	<0.5	<0.5	<0.5	<0.5	<3	2.2	P
MW-5	07/27/98	151.33	7.91	143.42	<50	<0.5	<0.5	<0.5	<0.5	<3	1.3	P
MW-5	10/15/98	151.33	8.31	143.02	<50	<0.5	<0.5	<0.5	0.6	<3	3.0	P
MW-5	02/18/99	151.33	7.25	144.08	<50	<0.5	<0.5	<0.5	<0.5	<3	2.0	P
MW-5	05/24/99	151.33	7.52	143.81	<50	<0.5	<0.5	<0.5	<0.5	<3	2.0	NP
MW-5	08/27/99	151.33	8.31	143.02	<50	<0.5	<0.5	<0.5	<0.5	<3	2.28	P
MW-6	01/31/96	153.84	5.15	148.69	Not Sampled: Well Sampled Annually							
MW-6	04/10/96	153.84	4.58	149.26	Not Sampled: Well Sampled Annually							
MW-6	07/16/96	153.84	4.96	148.88	<50	<0.5	<0.5	<0.5	<0.5	150	NM	
MW-6	10/14/96	153.84	6.15	147.69	Not Sampled: Well Sampled Annually							
MW-6	03/27/97	153.84	4.40	149.44	Not Sampled: Well Sampled Annually							
MW-6	05/27/97	153.84	4.90	148.94	Not Sampled: Well Sampled Annually							
MW-6	08/12/97	153.84	5.43	148.41	<50	<0.5	<0.5	<0.5	<0.5	39	NM	

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)	Total Xylenes (ppb)	MTBE (ppb)	Dissolved Oxygen (ppm)	Purged/ Not Purged (P/NP)
MW-6	11/17/97	153.84	5.87	147.97	Not Sampled: Well Sampled Annually							
MW-6	03/16/98	153.84	4.52	149.32	Not Sampled: Well Sampled Annually							
MW-6	05/12/98	153.84	4.42	149.42	Not Sampled: Well Sampled Annually							
MW-6	07/27/98	153.84	4.75	149.09	<50	<0.5	<0.5	<0.5	<0.5	18	0.9	P
MW-6	10/15/98	153.84	5.75	148.09	Not Sampled: Well Sampled Annually							
MW-6	02/18/99	153.84	3.93	149.91	Not Sampled: Well Sampled Annually							
MW-6	05/24/99	153.84	4.32	149.52	<50	<0.5	<0.5	<0.5	<0.5	6	2.0	NP
MW-6	08/27/99	153.84	5.72	148.12	<50	<0.5	<0.5	<0.5	<0.5	8	1.02	NP

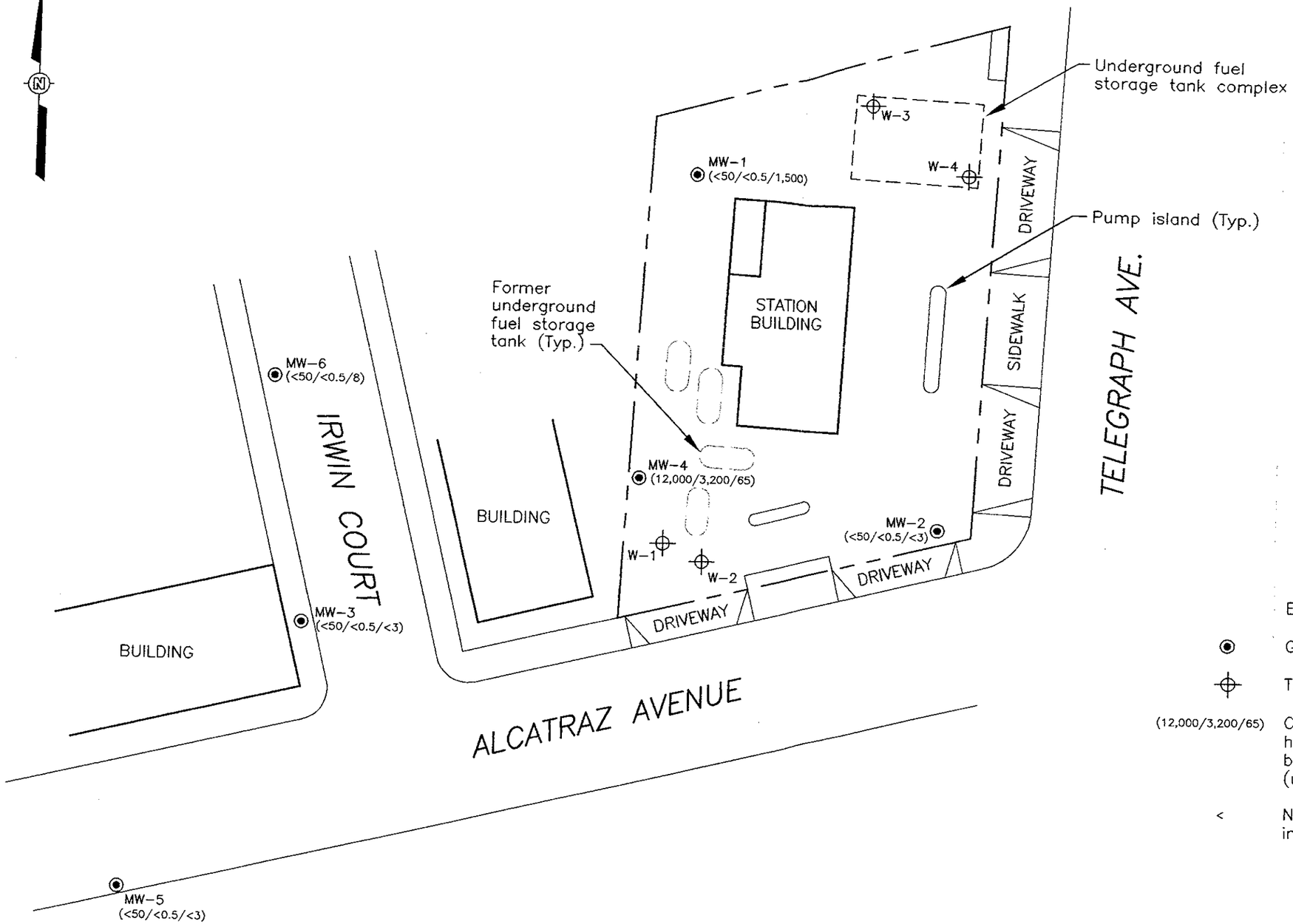
MSL = Mean sea level.
TOC = Top of casing.
TPPH = Total purgeable petroleum hydrocarbons by modified EPA method 8015
BTEX = Benzene, toluene, ethylbenzene, xylenes by EPA method 8020
MTBE = Methyl tert -Butyl Ether by EPA method 8020
ppb = Parts per billion.
ppm = Parts per million.
< = Less than laboratory 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.

Table 2
Groundwater Flow Direction and Gradient

ARCO Service Station 0374
6407 Telegraph Avenue, Oakland, California

Date Measured	Average Flow Direction	Average Hydraulic Gradient
01-31-96	Southwest	0.04
04-10-96	Southwest	0.04
07-16-96	Southwest	0.03
10-14-96	Southwest	0.03
03-27-97	Southwest	0.04
05-27-97	Southwest	0.03
08-12-97	Southwest	0.04
11-17-97	Southwest	0.03
03-16-98	Southwest	0.03
05-12-98	Southwest	0.04
07-27-98	Southwest	0.04
10-15-98	Southwest	0.02
02-18-99	Southwest	0.05
05-24-99	Southwest	0.03
08-27-99	**Southwest**	**0.03**

DRAWN BY	PROJECT NUMBER
K Black 10-15-99	791749



SCALE
0 30 60 FEET

ELEVATION

- ◉ Groundwater monitoring well
- ⊕ Tank pit groundwater monitoring well
- (12,000/3,200/65) Concentration of total petroleum hydrocarbons as gasoline (TPHG), benzene, and MTBE in groundwater (ug/L); samples collected 8/27/99
- < Not detected at or above the indicated laboratory detection limit

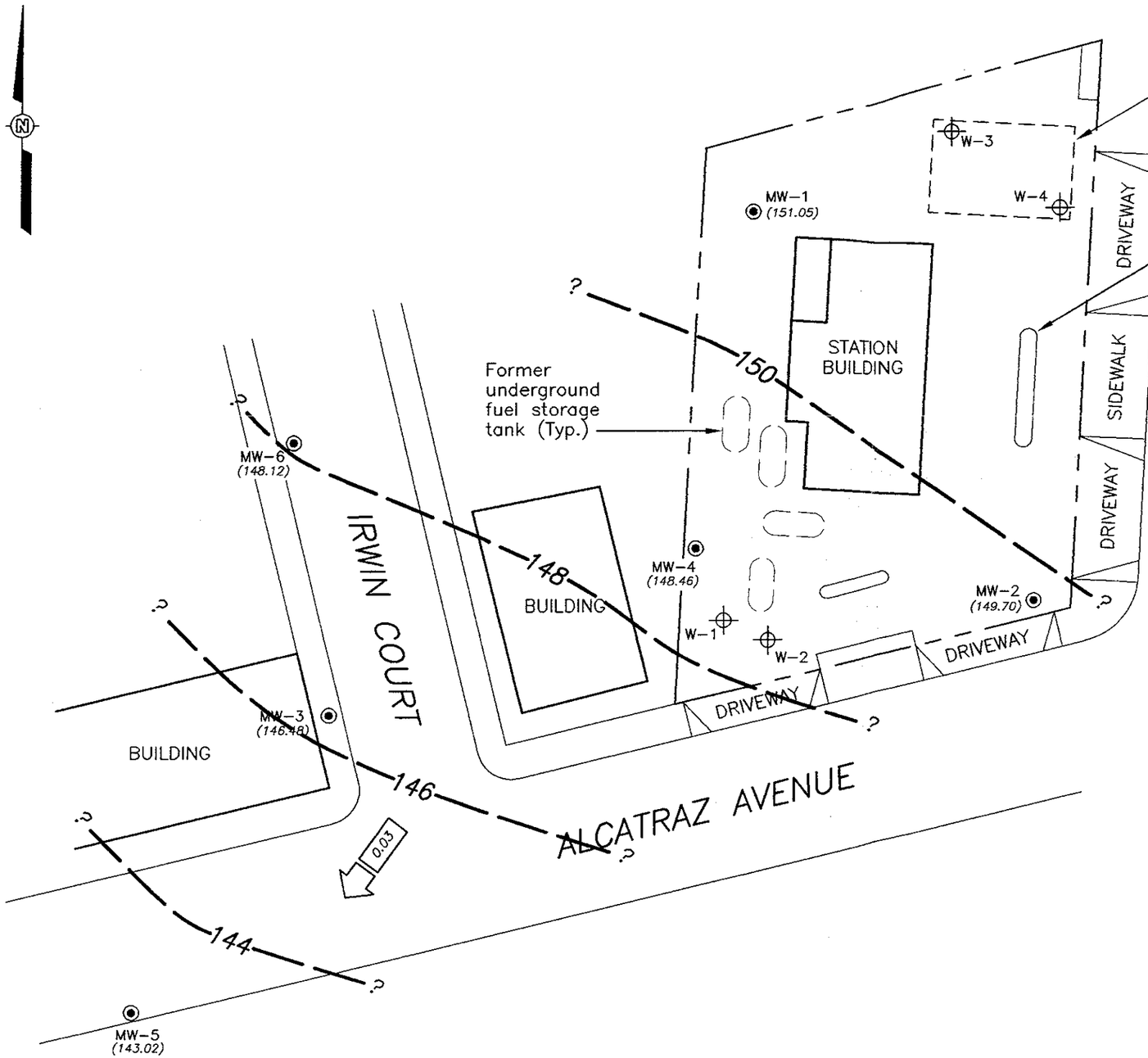
IT CORPORATION

ARCO PRODUCTS COMPANY
SERVICE STATION 374

FIGURE 1
GROUNDWATER ANALYTICAL SUMMARY
THIRD QUARTER 1999
6407 TELEGRAPH AVENUE
OAKLAND, CALIFORNIA

SANJOSE/CADD: N:\DWG\PINACL\374\374CHEM.DWG Fri, 15/Oct/99 06:23pm kblock

DRAWN BY	PROJECT NUMBER
K Black 10-15-99	791749



ELEVATION

- Groundwater monitoring well
- Tank pit groundwater monitoring well
- (149.70) Groundwater elevation (Ft.–MSL); measured 8/27/99
- Groundwater elevation contour (Ft.–MSL)
- Approximate direction of groundwater flow showing gradient

SCALE

0 30 60 FEET

IT CORPORATION

ARCO PRODUCTS COMPANY
SERVICE STATION 374

FIGURE 2
GROUNDWATER ELEVATION CONTOURS
THIRD QUARTER 1999
6407 TELEGRAPH AVENUE
OAKLAND, CALIFORNIA

SANJOSE/CADD: N:\cad\DWG\PINACL\374\374gwc.dwg Mon, 08/Nov/99 11:31am kblack

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 IT's San Jose or Sacramento office location for temporary storage. IT 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 IT 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 IT to an ARCO-approved laboratory by courier or taken directly to the laboratory by the environmental sampler. Sample shipments from IT 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

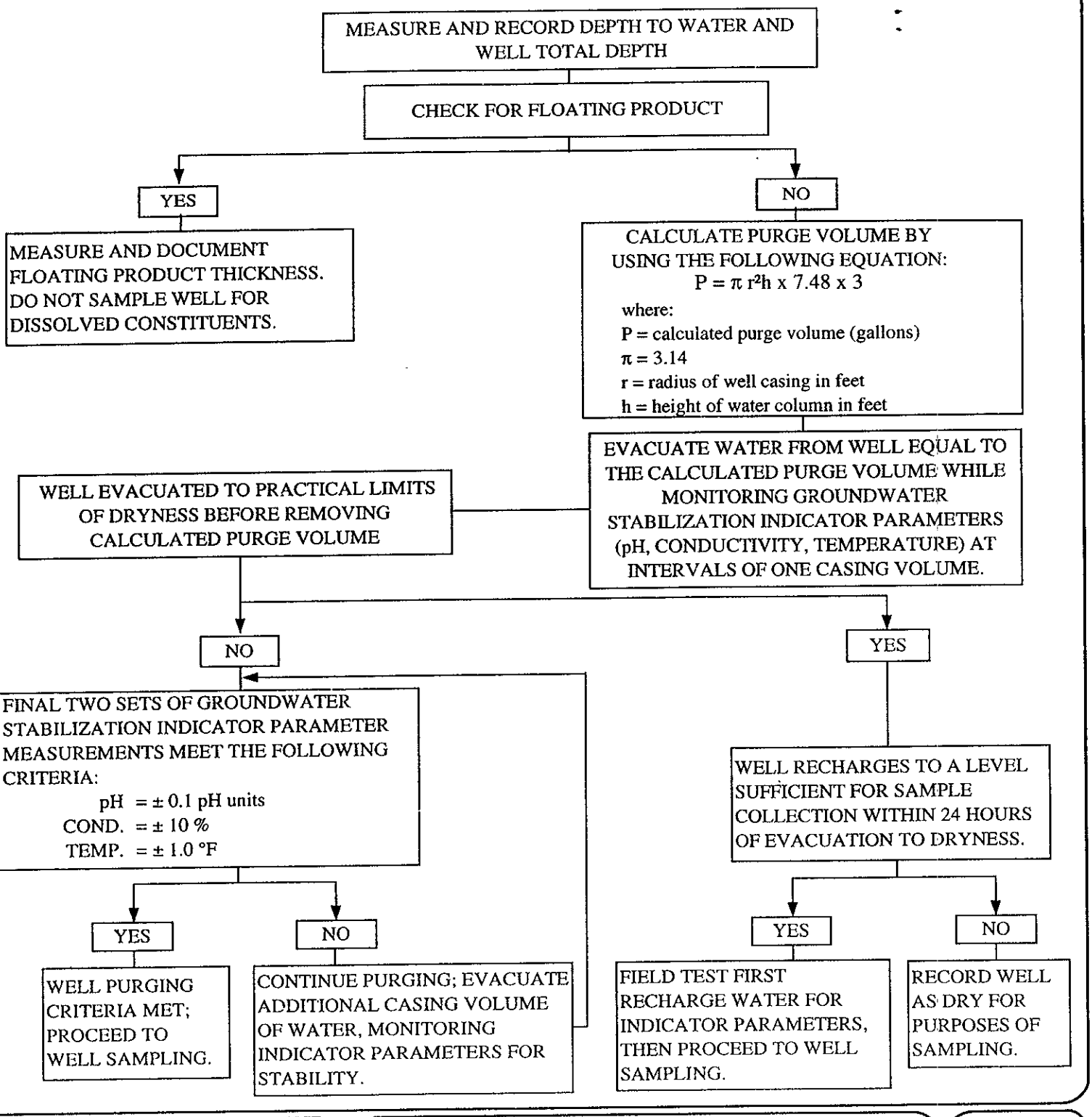
The ARCO chain-of-custody record initiated at the time of sampling contained, at a minimum, the sample designation (including the depth at which the sample was collected), sample type, analytical request, date of sampling, and the name of the sampler. The record sheet was signed, timed, and dated by 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 IT 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



MONITORING WELL PURGING PROTOCOL

FIGURE
A-1

WATER SAMPLE FIELD DATA SHEET

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 _____

FIGURE A-2

WATER SAMPLE FIELD DATA SHEET

IT - 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:

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

September 15, 1999

Service Request No.: S9902667

Mr. Glen Vanderveen
IT/EMCON
2201 Broadway, Suite 101
Oakland, CA 94612

RE: **TO#24118.00/RAT#8/374 OAKLAND**

Dear Mr. Vanderveen:

Enclosed are the results of the sample(s) submitted to our laboratory on August 31, 1999. All analyses were performed in accordance with our laboratory's quality assurance program. Results are intended to be considered in their entirety and apply to the sample(s) analyzed. Columbia Analytical Services is not responsible for use of less than the complete report. Signature of this CAS Analytical Report confirms that pages 2 through 14, following, have been thoroughly reviewed and approved for release.

Columbia Analytical Services is certified for environmental analyses by the California Department of Health Services (certificate number: 1496, expiration: January 31, 2001).

If you have any questions, please call me at (408) 748-9700.

Respectfully submitted,

Columbia Analytical Services, Inc.

Bernadette Troncales
Project Chemist

Greg Jordan
Laboratory Director

SEP 17 1999
BY:

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
Project: TO#24118.00/RAT#8/374 OAKLAND
Sample Matrix: Water

Service Request: S9902667
Date Collected: 8/27/99
Date Received: 8/31/99

BTEX, MTBE and TPH as Gasoline

Sample Name: MW-1(25)
Lab Code: S9902667-001
Test Notes:

Units: ug/L (ppb)
Basis: NA

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	9/10/99	ND	
Benzene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Toluene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	5	NA	9/10/99	1500	

Approved By: _____ Date: 09/15/99

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9902667
Project:	TO#24118.00/RAT#8/374 OAKLAND	**Date Collected:**	8/27/99
Sample Matrix:	Water	**Date Received:**	8/31/99

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-6(13)	Units:	ug/L (ppb)
Lab Code:	S9902667-002	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	9/10/99	ND	
Benzene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Toluene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	9/10/99	8	

Approved By: _____ Date: 09/15/99

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9902667
Project:	TO#24118.00/RAT#8/374 OAKLAND	**Date Collected:**	8/27/99
Sample Matrix:	Water	**Date Received:**	8/31/99

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-5(22)	Units:	ug/L (ppb)
Lab Code:	S9902667-003	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	9/10/99	ND	
Benzene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Toluene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	9/10/99	ND	

Approved By: _____ Date: 09/15/99

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9902667
Project:	TO#24118.00/RAT#8/374 OAKLAND	**Date Collected:**	8/27/99
Sample Matrix:	Water	**Date Received:**	8/31/99

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-2(25)	Units:	ug/L (ppb)
Lab Code:	S9902667-004	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	9/10/99	ND	
Benzene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Toluene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Methyl *tert* -Butyl Ether	EPA 5030	8020	3	1	NA	9/10/99	ND	

Approved By: _____ Date: 09/15/99

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9902667
Project:	TO#24118.00/RAT#8/374 OAKLAND	**Date Collected:**	8/27/99
Sample Matrix:	Water	**Date Received:**	8/31/99

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-3(25)	Units:	ug/L (ppb)
Lab Code:	S9902667-005	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	9/10/99	ND	
Benzene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Toluene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	9/10/99	ND	

Approved By: _____ Date: 09/15/99

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9902667
Project:	TO#24118.00/RAT#8/374 OAKLAND	**Date Collected:**	8/27/99
Sample Matrix:	Water	**Date Received:**	8/31/99

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-4(25)	Units:	ug/L (ppb)
Lab Code:	S9902667-006	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	20	NA	9/11/99	12000	
Benzene	EPA 5030	8020	0.5	20	NA	9/11/99	3200	
Toluene	EPA 5030	8020	0.5	20	NA	9/11/99	170	
Ethylbenzene	EPA 5030	8020	0.5	20	NA	9/11/99	490	
Xylenes, Total	EPA 5030	8020	0.5	20	NA	9/11/99	810	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	20	NA	9/11/99	65	

Approved By: _____ Date: 09/15/99

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9902667
Project:	TO#24118.00/RAT#8/374 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:	S990909-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	9/10/99	ND	
Benzene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Toluene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	9/10/99	ND	

Approved By: MT Date: 09/15/99

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9902667
Project:	TO#24118.00/RAT#8/374 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:	S990910-WB1	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	9/10/99	ND	
Benzene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Toluene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	9/10/99	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	9/10/99	ND	

Approved By: _____ Date: 09/15/99

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24118.00/RAT#8/374 OAKLAND
Sample Matrix: Water

Service Request: S9902667
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	Percent Recovery a,a,a-Trifluorotoluene
MW-1(25)	S9902667-001		93	102
MW-6(13)	S9902667-002		92	92
MW-5(22)	S9902667-003		91	83
MW-2(25)	S9902667-004		92	101
MW-3(25)	S9902667-005		93	94
MW-4(25)	S9902667-006		88	134
BATCH QC	S9902640-001MS		106	92
BATCH QC	S9902640-001DMS		108	91
BATCH QC	S9902640-002MS		82	131
BATCH QC	S9902640-002DMS		80	116
Method Blank	S990909-WB2		98	93
Method Blank	S990910-WB1		92	93

CAS Acceptance Limits: 69-116 72-139

Approved By: _____ Date: 09/15/99

SUR2/020397p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24118.00/RAT#8/374 OAKLAND
Sample Matrix: Water

Service Request: S9902667
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 9/10/99

Matrix Spike/Duplicate Matrix Spike Summary
BTE

Sample Name: BATCH QC
Lab Code: S9902640-001MS, S9902640-001DMS
Test Notes:

Units: ug/L (ppb)
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	CAS Acceptance Limits	Relative Percent Difference
Benzene	EPA 5030	8020	0.5	25	25	ND	26	24	104	96	75-135	8
Toluene	EPA 5030	8020	0.5	25	25	ND	24	22	96	88	73-136	9
Ethylbenzene	EPA 5030	8020	0.5	25	25	ND	25	23	100	92	69-142	8

Approved By: _____ Date: 09/15/99

DMS/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24118.00/RAT#8/374 OAKLAND
Sample Matrix: Water

Service Request: S9902667
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 9/10/99

Matrix Spike/Duplicate Matrix Spike Summary
TPH as Gasoline

Sample Name: BATCH QC
Lab Code: S9902640-002MS, S9902640-002DMS
Test Notes:

Units: ug/L (ppb)
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	CAS Acceptance Limits	Relative Percent Difference	Result Notes
Gasoline	EPA 5030	CA/LUFT	50	250	250	ND	204	225	82	90	75-135	10	

Approved By: _____ Date: 09/15/99

DMS/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: *ARCO Products Company*
Project: TO#24118.00/RAT#8/374 OAKLAND

Service Request: S9902667
Date Analyzed: 9/10/99

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	223	85-115	89	
Benzene	EPA 5030	8020	25	28	85-115	112	
Toluene	EPA 5030	8020	25	25	85-115	100	
Ethylbenzene	EPA 5030	8020	25	27	85-115	108	
Xylenes, Total	EPA 5030	8020	75	80	85-115	107	
Methyl *tert*-Butyl Ether	EPA 5030	8020	25	26	85-115	104	

Approved By: _____ Date: 09/15/99

ICV/032196

ARCO Products Company
Division of Atlantic/Richfield Company

Task Order No. 24118.00

S9902667 **Chain of Custody**

ARCO Facility no. 0374	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)437-9526 / Contract Number
Consultant name EMCON	Address (Consultant) 7201 Broadway #101 Oakland, CA 94612		

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 mod. #1 & 2 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-1	(25')	2	①	X		X	HCL	8/27/99	1255		X												
MW-6	(13')	2	②	X		X	HCL		1310		X												
MW-5	(22')	2	③	X		X	HCL		1331		X												
MW-2	(25')	2	④	X		X	HCL		1343		X												
MW-3	(25')	2	⑤	X		X	HCL		1352		X												
MW-4	(25')	2	⑥	X		X	HCL		1408		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

#791749

Lab Number

Turnaround Time.

Priority Rush 1 Business Day ☐

Rush 2 Business Days ☐

Expedited 5 Business Days ☐

Standard 10 Business Days ☒

Condition of sample: to cooler

Temperature received: DUE: 9/15/99 R11 D3

Relinquished by sampler	Date/Time 8/30/99 1400	Received by Joseph Machado CAS 8/31/99 845	
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 # : 792252 STATION ADDRESS : 6407 Telegraph Ave, Oakland, CA DATE : 8/27/99

ARCO STATION # : 0374 FIELD TECHNICIAN : B. Hendricks DAY : Friday

DTW Order	WELL ID	Well Box Seal Condition	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 DO = mg/L - °C
1	MW-1	ok	HEX	NO	ARCO	LWC	7.86	7.86	ND	—	26.8	1.65 / 19.4 °C
2	MW-6	ok	15/16"	YES	ARCO	LWC	5.72	5.72			14.7	1.02 / 20.4 °C
3	MW-5	ok	15/16"	YES	ARCO	LWC	8.31	8.31			23.0	2.28 / 21.4 °C
4	MW-2	ok	HEX	NO	ARCO	LWC	8.22	8.22			26.3	0.95 / 21.5 °C
5	MW-3	ok	HEX	NO	ARCO	LWC	7.16	7.16			26.8	16.57 / 20.0 °C
6	MW-4	ok	3/4"	NO	ARCO	LWC	8.07	8.07			26.6	1.32 / 19.5 °C

SURVEY POINTS ARE TOP OF WELL CASINGS

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97

EMCON

PROJECT NO: 792252 | SAMPLE ID: MW-1 (25')

PURGED BY: B. Hendricks | CLIENT NAME: ARCO #0374

SAMPLED BY: ↓ | LOCATION: Oakland, California

TYPE: Groundwater X | Surface Water ____ | Leachate ____ | Other ____

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

CASING ELEVATION (feet/MSL): N/A | VOLUME IN CASING (gal.): 12.3

DEPTH OF WELL (feet): 26.8 | CALCULATED PURGE (gal): 37.0

DEPTH OF WATER (feet): 7.86 | ACTUAL PURGE VOL. (gal.): 0

DATE PURGED: 8/27/99 | END PURGE: No purge

DATE SAMPLED: ↓ | SAMPLING TIME: 1258

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1257	—	6.79	1403	69.7	Clear	low

OTHER: Dissolved Oxygen= | ODOR: None | N/A (COBALT 0-100) | N/A (NTU 0-200)

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

PURGING EQUIPMENT

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

SAMPLING EQUIPMENT

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

WELL INTEGRITY: Good, universal | LOCK: Arco

REMARKS: DTW below top of screen, grab sample

pH, E.C., Temp Meter Calibration: Date 8/27/99 | Time 1250 | Meter Serial No 600341

E.C. 1000 1413 1416 1413 | pH 7 7.04 / 7.00 | pH 10 9.92 / 10.00 | pH 4 4.06 / 4.00

Temperature °F 74.7

SIGNATURE: BH | REVIEWED BY: [illegible] | PAGE 1 OF 6

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97

EMCON

PROJECT NO : 792252 | SAMPLE ID : MW-2 (25)

PURGED BY : B Hewitt | CLIENT NAME : ARCO #0374

SAMPLED BY : " | LOCATION : Oakland, California

TYPE. Groundwater X | Surface Water ____ | Leachate ____ | Other ____

CASING DIAMETER (inches). 2 ____ | 3 ____ | 4 X | 4.5 ____ | 6 ____ | Other ____

CASING ELEVATION (feet/MSL) : N/A | VOLUME IN CASING (gal) : 11.7

DEPTH OF WELL (feet) . 26.3 | CALCULATED PURGE (gal.) : 35.4

DEPTH OF WATER (feet) : 8.22 | ACTUAL PURGE VOL (gal.) : 0

DATE PURGED : 8/27/99 | END PURGE . No purge

DATE SAMPLED : " | SAMPLING TIME . 1343

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1342	—	7.07	590	70.9	clear	low

OTHER : Dissolved Oxygen= | ODOR : None | N/A (COBALT 0-100) | N/A (NTU 0-200)

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

PURGING EQUIPMENT

____ 2" Bladder Pump | ____ Bailer (Teflon)

____ Centrifugal Pump | ____ Bailer (PVC)

____ Submersible Pump | ____ Bailer (Stainless Steel)

____ Well WizardÔ | ____ Dedicated

Other ____

SAMPLING EQUIPMENT

____ 2" Bladder Pump | ____ Bailer (Teflon)

____ Bomb Sampler | ____ Bailer (Stainless Steel)

____ Dipper | ____ Submersible Pump

____ Well WizardÔ | ____ Dedicated

Other : Disposable Teflon Bailer

WELL INTEGRITY. Good | LOCK : Arco

REMARKS: DTW below top of screen, grab sample

pH, E.C , Temp. Meter Calibration Date : See MW-1 | Time ____ | Meter Serial No ____

E.C. 1000 ____ / ____ | pH 7 ____ / ____ | pH 10 ____ / ____ | pH 4 ____ / ____

Temperature °F ____

SIGNATURE. BH | REVIEWED BY. SA | PAGE 2 OF 6

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97

EMCON

PROJECT NO : 792252 — SAMPLE ID : MW-3 (25')

PURGED BY : B. Hendricks — CLIENT NAME : ARCO #0374

SAMPLED BY : " — LOCATION : Oakland, California

TYPE: Groundwater X Surface Water ____ Leachate ____ Other ____

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

CASING ELEVATION (feet/MSL) : N/A — VOLUME IN CASING (gal) : 12.8

DEPTH OF WELL (feet) : 26.8 — CALCULATED PURGE (gal.) : 38.5

DEPTH OF WATER (feet) : 7.16 — ACTUAL PURGE VOL. (gal.) : 6

DATE PURGED : 8/27/99 — END PURGE : No purge

DATE SAMPLED : " — SAMPLING TIME : 1352

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C (µmhos/cm @ 25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1351	—	7.97	782	69.0	clear	low

OTHER: Dissolved Oxygen= — ODOR none — N/A (COBALT 0-100) — N/A (NTU 0-200)

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

PURGING EQUIPMENT

____ 2" Bladder Pump — ____ Bailer (Teflon)

____ Centrifugal Pump — ____ Bailer (PVC)

____ Submersible Pump — ____ Bailer (Stainless Steel)

____ Well WizardÔ — ____ Dedicated

Other ____

SAMPLING EQUIPMENT

____ 2" Bladder Pump — ____ Bailer (Teflon)

____ Bomb Sampler — ____ Bailer (Stainless Steel)

____ Dipper — ____ Submersible Pump

____ Well WizardÔ — ____ Dedicated

Other: Disposable Teflon Bailer

WELL INTEGRITY: Good — LOCK: Arco

REMARKS: Drew below top of screen, grab sample

ORC socks have been installed in this well

pH, E C , Temp Meter Calibration Date See MW-1 — Time ____ — Meter Serial No . ____

E C 1000 ____ / ____ — pH 7 ____ / ____ — pH 10 ____ / ____ — pH 4 ____ / ____

Temperature °F ____

SIGNATURE: BH — REVIEWED BY: [illegible] — PAGE 3 OF 6

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97

EMCON

PROJECT NO: 792252 | SAMPLE ID: MW-4 (25')

PURGED BY: B. Hawkins | CLIENT NAME: ARCO #0374

SAMPLED BY: d | LOCATION: Oakland, California

TYPE: Groundwater X | Surface Water ____ | Leachate ____ | Other ____

CASING DIAMETER (inches): 2 ____ 3 ____ 4 X 4 5 ____ 6 ____ Other ____

CASING ELEVATION (feet/MSL): N/A | VOLUME IN CASING (gal.): 17.0

DEPTH OF WELL (feet): 26.6 | CALCULATED PURGE (gal.): 34.3

DEPTH OF WATER (feet): 8.07 | ACTUAL PURGE VOL. (gal): 0

DATE PURGED: 8/27/99 | END PURGE: no purge

DATE SAMPLED: d | SAMPLING TIME: 1408

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1406	—	7.09	1469	70.5	clear	low

OTHER: Dissolved Oxygen= | ODOR: Strong | N/A (COBALT 0-100) | N/A (NTU 0-200)

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

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: Disposable Teflon Bailer

WELL INTEGRITY: Good, 3/4" vault | LOCK: —

REMARKS: ____

pH, E.C., Temp Meter Calibration, Date: See MW-1 | Time: ____ | Meter Serial No: ____

E.C. 1000 ____ / ____ | pH 7 ____ / ____ | pH 10 ____ / ____ | pH 4 ____ / ____

Temperature °F: ____

SIGNATURE: BH | REVIEWED BY: [illegible] | PAGE 4 OF 6

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97

OWT

PROJECT NO: 192252 | SAMPLE ID: MW-5 (22')
PURGED BY: B. Hendricks | CLIENT NAME: Arco 374
SAMPLED BY: " | LOCATION: Oakland, CA

TYPE: Groundwater ✓ Surface Water ____ Leachate ____ Other ____

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

CASING ELEVATION (feet/MSL):	N/A	VOLUME IN CASING (gal.):	9.5
DEPTH OF WELL (feet):	23.0	CALCULATED PURGE (gal.):	28.8
DEPTH TO WATER (feet):	8.31	ACTUAL PURGE VOL. (gal.):	29.0

DATE PURGED: 8/27/96 | END PURGE: 1325
DATE SAMPLED: " | SAMPLING TIME: 1331

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1319	10.0	7.07	586	73.2	clear	low
1322	20.0	7.08	617	72.9	"	"
1325	29.0	7.16	624	72.6	"	"

OTHER: / ODOR: none / (COBALT 0-100) / (NTU 0-200)

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

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
____ 2" Bladder Pump	____ Bailer (Teflon)	____ 2" Bladder Pump	____ Bailer (Teflon)
____ Centrifugal Pump	____ Bailer (PVC)	____ Bomb Sampler	____ Bailer (Stainless Steel)
✓ Submersible Pump	____ Bailer (Stainless Steel)	____ Dipper	____ Submersible Pump
____ Well WizardÔ	____ Dedicated	____ Well WizardÔ	____ Dedicated
Other: ____		Other: Disp Bailer	

WELL INTEGRITY: Good LOCK: Arco

REMARKS: ____

pH, E.C., Temp. Meter Calibration: Date: See MW-1 Time: ____ Meter Serial No ____

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

Temperature °F ____

SIGNATURE: BA REVIEWED BY: TM PAGE 5 OF 6

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97

EMCON

PROJECT NO: 792252 | SAMPLE ID: MW-6 (13)

PURGED BY: B. Hawkins | CLIENT NAME: ARCO #0374

SAMPLED BY: L | LOCATION: Oakland, California

TYPE: Groundwater X | Surface Water ____ | Leachate ____ | Other ____

CASING DIAMETER (inches). 2 ____ 3 ____ 4 X 4 5 ____ 6 ____ Other ____

CASING ELEVATION (feet/MSL): N/A | VOLUME IN CASING (gal.): 5.8

DEPTH OF WELL (feet): 14.7 | CALCULATED PURGE (gal.): 17.6

DEPTH OF WATER (feet): 5.72 | ACTUAL PURGE VOL. (gal.): 0

DATE PURGED: 8/27/99 | END PURGE: no purge

DATE SAMPLED: L | SAMPLING TIME: 1310

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1309	—	7.12	589	73.0	clear	low

OTHER: Dissolved Oxygen= | ODOR: None | N/A (COBALT 0-100) | N/A (NTU 0-200)

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

PURGING EQUIPMENT

- ____ 2" Bladder Pump
- ____ Centrifugal Pump
- ____ Submersible Pump
- ____ Well Wizard©
- Other ____
- ____ Bailer (Teflon)
- ____ Bailer (PVC)
- ____ Bailer (Stainless Steel)
- ____ Dedicated

SAMPLING EQUIPMENT

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

WELL INTEGRITY: (Good) 15/16" | LOCK: Arco

REMARKS: DTW below top of screen, grab sample

pH, E.C., Temp. Meter Calibration Date: See MW-1 | Time ____ | Meter Serial No ____

E.C. 1000 ____/____ | pH 7 ____/____ | pH 10 ____/____ | pH 4 ____/____

Temperature °F ____

SIGNATURE: BH | REVIEWED BY: [illegible] | PAGE 6 OF 6

EMCON Associates - Field Services

1921 Ringwood Avenue

San Jose, California

1999

Historical Monitoring Well Data

ARCO 0374

#792252

						Gallons
						First 23.00
						Second 31.00
Well ID	Quarter	Date	Purge Volume (gallons)	Did well dry	Well Contained Product	**Third** 29.00
						Fourth 0.00
MW-1	First	02/18/99	0.00	NA	NO	
	Second	05/24/99	0.00	GRAB	NO	
	Third	08/27/99	0.00	GRAB	NO	
	Fourth					
MW-2	First	02/18/99	0.00	NA	NO	
	Second	05/24/99	31.00	NO	NO	
	Third	08/27/99	0.00	GRAB	NO	
	Fourth					
MW-3	First	02/18/99	0.00	NA	NO	
	Second	05/24/99	0.00	GRAB	NO	
	Third	08/27/99	0.00	GRAB	NO	
	Fourth					
MW-4	First	02/18/99	0.00	NA	NO	
	Second	05/24/99	0.00	GRAB	NO	
	Third	08/27/99	0.00	GRAB	NO	
	Fourth					
MW-5	First	02/18/99	23.00	YES	NO	
	Second	05/24/99	0.00	GRAB	NO	
	Third	08/27/99	29.00	NO	NO	
	Fourth					
MW-6	First	02/18/99	0.00	NA	NO	
	Second	05/24/99	0.00	GRAB	NO	
	Third	08/27/99	0.00	GRAB	NO	
	Fourth					
	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.

Chain of Custody

ARCO Facility no.	City (Facility)	Project manager (Consultant)		Laboratory Name
ARCO engineer	Telephone no. (ARCO)	Telephone no. (Consultant)	Fax no. (Consultant)	Contract Number
Consultant name	Address (Consultant)			

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 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 ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org/DHS ☐ Lead EPA 7420/7421 ☐			
				X		X					X												
				X							X												
				X							X												
											X												

Method of shipment

Special Detection Limit/reporting

Special QA/QC

Remarks

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	Date	Time	Received by		
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 Well 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

			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-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	N/A	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
	05/24/99		66.2	7.24	799	6.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
	07/26/99	**	ORC installed														
	08/27/99		69.0	7.97	782	16.57	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
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	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	07/27/98		70.5	6.34	1,434	0.5	N/A	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
	05/24/99		67.6	6.72	1,509	1.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	18,000	7,660
	07/26/99	**	ORC installed														
	08/27/99		70.5	7.09	1,469	1.32	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12,000	4,670

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	N/A	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	N/A	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	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
	05/24/99	66.7	6.70	591	2.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
	08/27/99	72.6	7.10	624	2.28	N/A	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	N/A	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
	05/24/99	65.5	6.62	713	2.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
	08/27/99	73.0	7.12	589	1.02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND

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.

Pinnacle