



ENVIRONMENTAL  
PROTECTION

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R072

October 21, 1999  
Project 791661

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

Re: Quarterly Groundwater Monitoring Results and Remediation System Performance  
Evaluation Report, Third Quarter 1999, for ARCO Service Station No. 2169, located at  
889 West Grand 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. 2169, located at 889 West Grand Avenue, Oakland, California. Operation and performance data for the site's interim soil-vapor extraction (SVE) and biosparging systems are also presented. The monitoring program complies with the Alameda County Health Care Services Agency (ACHCSA) 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

Dan Lescure  
Project Manager

Dan Easter, R.G.  
Project Geologist

Attachment: Quarterly Groundwater Monitoring Report, Third Quarter 1999

cc: Susan Hugo, ACHCSA

Date: October 21, 1999**ARCO QUARTERLY GROUNDWATER MONITORING REPORT**

Station No.: 2169 Address: 889 West Grand Avenue, Oakland, California  
 Pinnacle Project No. 791661  
 ARCO Environmental Engineer/Phone No.: Paul Supple / (925) 299-8891  
 Pinnacle Project Manager/Phone No.: Glen VanderVeen / (510) 740-5807  
 Primary Agency/Regulatory ID No.: ACHCSA

**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. Operated biosparging system.
4. Operated soil-vapor extraction (SVE) system.

**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 operation of SVE system if hydrocarbon removal rates warrant.
4. Continue with biosparging in wells AS-1 through AS-5 to enhance natural biodegradation.

**QUARTERLY MONITORING:**

Current Phase of Project: Quarterly Groundwater Monitoring and Operation and Maintenance of Remediation Systems

Frequency of Sampling: Annual (1st Quarter): A-3, A-4  
Semi-annual (1st/2nd Quarter): A-2, AR-1, AR-2  
Quarterly: A-1, A-5, A-6, ADR-1, ADR-2

Frequency of Monitoring: Quarterly (groundwater), Monthly (SVE and Biosparging)

Is Floating Product (FP) Present On-site:  Yes  No

Cumulative FP Recovered to Date : 4.8 gallons, Wells ADR-1 and ADR-2

FP Recovered This Quarter : None

Bulk Soil Removed to Date : 2,196 cubic yards of TPH-impacted soil

Bulk Soil Removed This Quarter : None

Water Wells or Surface Waters within 2000 ft., impacted by site: None

Current Remediation Techniques: SVE and Biosparging Systems

Average Depth to Groundwater: 11.1 feet

Groundwater Flow Direction and Gradient (Average): Variable

**SVE QUARTERLY OPERATION AND PERFORMANCE:**

Equipment Inventory:	Therm Tech Model VAC-25, 250 cfm, Thermal/Catalytic Oxidizer
Operating Mode:	Catalytic Oxidation
BAAQMD Permit #:	12119
TPH Conc. End of Period (lab):	71 ppmv
Benzene Conc. End of Period (lab):	0.2 ppmv
Flowrate End of Period:	176.6 scfm
HC Destroyed This Period:	63.5 pounds
HC Destroyed to Date:	8708.9 pounds
Utility Usage	
Electric (KWH):	Not available
Operating Hours This Period:	811.36 hours
Percent Operational:	36%
Operating Hours to Date:	8538.97 hours
Unit Maintenance:	Not applicable
Number of Auto Shut Downs:	0
Destruction Efficiency Permit Requirement:	98.5% (POC >2,000 ppmv); 97% (POC >200 ppmv); 90% (POC <200 ppmv); waived if outlet POC <1.0 lb/day & benzene <0.02 lb/day
Average Percent TPH Conversion:	Waived
Average Stack Temperature:	679°F
Average Source Flow:	50 scfm
Average Process Flow:	195.8 scfm
Average Source Vacuum:	44.7 inches of water

**ATTACHMENTS:**

- Table 1 - Historical Groundwater Elevation and Analytical Data, Petroleum Hydrocarbons and Their Constituents
- Table 2 - Groundwater Flow Direction and Gradient
- Table 3 - Operational Uptime Information for the SVE System
- Table 4 - Flow Rates and Analytical Results of Air Sample Analyses
- Table 5 - Extraction Rates, Emission Rates, Destruction Efficiency, and Mass Removed
- 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 - Certified Analytical Reports and Chain-of-Custody Documentation for SVE System

**Table 1**  
**Historical Groundwater Elevation and Analytical Data**  
**Petroleum Hydrocarbons and Their Constituents**  
**1995 - Present\*\*\***

**ARCO Service Station 2169**  
**889 West Grand Avenue, Oakland, CA**

Well Number	Date Gauged	TOC	Depth	FP	Groundwater	Date Sampled	TPH			Ethyl-	Total	MTBE	MTBE	TPH	Dissolved	Purged/
		Elevation (ft-MSL)	to Water (feet)	Thickness (feet)	Elevation (ft-MSL)		Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	benzene (µg/L)	Xylenes (µg/L)	8020 (µg/L)	8260 (µg/L)	Diesel (µg/L)	Oxygen (mg/L)	Not Purged (P/NP)
A-1	03-24-95	14.16	8.10	ND	6.06	03-24-95	1,200	230	39	34	66	--	--	160		
A-1	06-05-95	14.16	11.13	ND	3.03	06-05-95	1,500	310	27	36	76	--	--	710		
A-1	08-17-95	14.16	11.71	ND	2.45	08-18-95	1,600	470	35	48	110	120	--	240		
A-1	12-04-95	14.16	12.28	ND	1.88	12-04-95	1,200	240	17	25	56	--	120	--		
A-1	03-01-96	14.16	8.78	ND	5.38	03-13-96	1,300	300	74	29	73	100	--	--		
A-1	05-29-96	14.16	9.85	ND	4.31	05-29-96	Not sampled: well sampled semi-annually, during the first and third quarters									
A-1	08-29-96	14.16	11.08	ND	3.08	08-29-96	1,200	320	5.9	25	27	110	--	--		
A-1	11-21-96	14.16	10.54	ND	3.62	11-21-96	Not sampled: well sampled semi-annually, during the first and third quarters									
A-1	03-26-97	14.16	10.55	ND	3.61	03-26-97	<50	0.8	<0.5	<0.5	<0.5	64	--	--		
A-1	05-21-97	14.16	11.10	ND	3.06	05-21-97	Not sampled: well sampled semi-annually, during the first and third quarters									
A-1	08-08-97	14.16	11.32	ND	2.84	08-08-97	91	7	<0.5	0.5	3.9	<60	--	--		
A-1	11-18-97	14.16	3.46	ND	10.70	11-18-97	54	<0.5	<0.5	<0.5	0.6	27	--	--		
A-1	02-20-98	14.16	7.10	ND	7.06	02-23-98	590	160	22	15	28	70	--	--		
A-1	05-11-98	14.16	9.87	ND	4.29	05-11-98	280	26	<0.5	0.8	2.3	6	--	--		
A-1	07-30-98	14.16	10.73	ND	3.43	07-30-98	1,000	210	5	<5	38	<30	--	--		
A-1	10-08-98	14.16	11.15	ND	3.01	10-08-98	3,100	740	11	<10	24	<60	--	--		
A-1	02-18-99	14.16	8.00	ND	6.16	02-18-99	510	87	7.1	6.4	13	52	--	--		
A-1	05-26-99	14.16	10.60	ND	3.56	05-26-99	240	26	<0.5	1.2	6.2	34	--	--		
A-1	08-23-99	14.16	11.22	ND	2.94	08-23-99	79	3.9	0.6	<0.5	1.7	38	--	--	0.68	NP
A-2	03-24-95	14.55	8.64	ND	5.91	03-24-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--		
A-2	06-05-95	14.55	11.72	ND	2.83	06-05-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--		
A-2	08-17-95	14.55	12.35	ND	2.20	08-17-95	<50	<0.5	<0.5	<0.5	<0.5	12	--	--		
A-2	12-04-95	14.55	12.74	ND	1.81	12-04-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--		
A-2	03-01-96	14.55	9.34	ND	5.21	03-13-96	<50	<0.5	0.6	<0.5	1.3	<9	--	--		
A-2	05-29-96	14.55	10.40	ND	4.15	05-29-96	<50	<0.5	<0.5	<0.5	<0.5	<20	--	--		
A-2	08-29-96	14.55	11.50	ND	3.05	08-29-96	<50	<0.5	<0.5	<0.5	<0.5	<39	--	--		

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**1995 - Present\*\*\***

**ARCO Service Station 2169**  
**889 West Grand Avenue, Oakland, CA**

Well Number	Date Gauged	TOC	Depth	FP	Groundwater	Date Sampled	TPH			Ethyl-	Total	MTBE	MTBE	TPH	Dissolved	Purged/	
		Elevation (ft-MSL)	to Water (feet)	Thickness (feet)	Elevation (ft-MSL)		Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	benzene (µg/L)	Xylenes (µg/L)	8020 (µg/L)	8260 (µg/L)	Diesel (µg/L)	Oxygen (mg/L)	Not Purged (P/NP)	
A-2	11-21-96	14.55	11.06	ND	3.49	11-21-96	<50	<0.5	<0.5	<0.5	<0.5	<30	--	--			
A-2	03-26-97	14.55	11.12	ND	3.43	03-26-97	<50	<0.5	<0.5	<0.5	<0.5	<20	--	--			
A-2	05-21-97	14.55	11.58	ND	2.97	05-21-97	Not sampled: well sampled semi-annually, during the first and third quarters										
A-2	08-08-97	14.55	11.82	ND	2.73	08-08-97	<50	<0.5	<0.5	<0.5	<0.5	<20	--	--			
A-2	11-18-97	14.55	3.33	ND	11.22	11-18-97	Not sampled: well sampled semi-annually, during the first and third quarters										
A-2	02-20-98	14.55	7.68	ND	6.87	02-20-98	<50	<0.5	<0.5	<0.5	<0.5	17	--	--			
A-2	05-11-98	14.55	10.45	ND	4.10	05-11-98	Not sampled										
A-2	07-30-98	14.55	11.23	ND	3.32	07-30-98	Not sampled: well sampled semi-annually, during the first and second quarters										
A-2	10-08-98	14.55	11.62	ND	2.93	10-08-98	Not sampled: well sampled semi-annually, during the first and second quarters										
A-2	02-18-99	14.55	8.62	ND	5.93	02-18-99	93	<0.5	<0.5	<0.5	<1	26	--	--			
A-2	05-26-99	14.55	11.16	ND	3.39	05-26-99	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--			
A-2	08-23-99	14.55	11.69	ND	2.86	08-23-99	Not sampled: well sampled semi-annually, during the first and second quarters										0.59
A-3	03-24-95	15.75	8.83	ND	6.92	03-24-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--			
A-3	06-05-95	15.75	12.44	ND	3.31	06-05-95	Not sampled: well sampled annually										
A-3	08-17-95	15.75	13.04	ND	2.71	08-17-95	Not sampled: well sampled annually										
A-3	12-04-95	15.75	13.57	ND	2.18	12-04-95	Not sampled: well sampled annually										
A-3	03-01-96	15.75	9.90	ND	5.85	03-13-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--			
A-3	05-29-96	15.75	11.08	ND	4.67	05-29-96	Not sampled: well sampled annually										
A-3	08-29-96	15.75	12.38	ND	3.37	08-29-96	Not sampled: well sampled annually										
A-3	11-21-96	15.75	11.86	ND	3.89	11-21-96	Not sampled: well sampled annually										
A-3	03-26-97	15.75	11.81	ND	3.94	03-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--			
A-3	05-21-97	15.75	12.35	ND	3.40	05-21-97	Not sampled: well sampled annually										
A-3	08-08-97	15.75	12.62	ND	3.13	08-08-97	Not sampled: well sampled annually										
A-3	11-18-97	15.75	3.75	ND	12.00	11-18-97	Not sampled: well sampled annually										
A-3	02-20-98	15.75	8.06	ND	7.69	02-20-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--			
A-3	05-11-98	15.75	11.19	ND	4.56	05-11-98	Not sampled: well sampled annually										

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**1995 - Present\*\*\***

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**889 West Grand Avenue, Oakland, CA**

Well Number	Date Gauged	TOC	Depth	FP	Groundwater	Date Sampled	TPH				Total	MTBE	MTBE	TPH	Dissolved	Purged/
		Elevation (ft-MSL)	to Water (feet)	Thickness (feet)	Elevation (ft-MSL)		Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	ethyl-benzene (µg/L)	Xylenes (µg/L)	8020 (µg/L)	8260 (µg/L)	Diesel (µg/L)	Oxygen (mg/L)	Not Purged (P/NP)
A-3	07-30-98	15.75	12.05	ND	3.70	07-30-98	Not sampled: well sampled annually									
A-3	10-08-98	15.75	12.43	ND	3.32	10-08-98	Not sampled: well sampled annually									
A-3	02-18-99	15.75	9.05	ND	6.70	02-18-99	Not sampled: well sampled annually									
A-3	05-26-99	15.75	11.93	ND	3.82	05-26-99	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--		
A-3	08-23-99	15.75	12.57	ND	3.18	08-23-99	Not sampled: well sampled annually								0.88	
A-4	03-24-95	15.25	7.20	ND	8.05	03-24-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--		
A-4	06-05-95	15.25	11.70	ND	3.55	06-05-95	Not sampled: well sampled annually									
A-4	08-17-95	15.25	12.28	ND	2.97	08-17-95	Not sampled: well sampled annually									
A-4	12-04-95	15.25	12.63	ND	2.62	12-04-95	Not sampled: well sampled annually									
A-4	03-01-96	15.25	8.55	ND	6.70	03-13-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--		
A-4	05-29-96	15.25	10.32	ND	4.93	05-29-96	Not sampled: well sampled annually									
A-4	08-29-96	15.25	11.55	ND	3.70	08-29-96	Not sampled: well sampled annually									
A-4	11-21-96	15.25	10.83	ND	4.42	11-21-96	Not sampled: well sampled annually									
A-4	03-26-97	15.25	10.97	ND	4.28	03-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--		
A-4	05-21-97	15.25	11.51	ND	3.74	05-21-97	Not sampled: well sampled annually									
A-4	08-08-97	15.25	11.73	ND	3.52	08-08-97	Not sampled: well sampled annually									
A-4	11-18-97	15.25	4.37	ND	10.88	11-18-97	Not sampled: well sampled annually									
A-4	02-20-98	15.25	6.25	ND	9.00	02-20-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--		
A-4	05-11-98	15.25	10.33	ND	4.92	05-11-98	Not sampled: well sampled annually									
A-4	07-30-98	15.25	11.25	ND	4.00	07-30-98	Not sampled: well sampled annually									
A-4	10-08-98	15.25	11.62	ND	3.63	10-08-98	Not sampled: well sampled annually									
A-4	02-18-99	15.25	7.12	ND	8.13	02-18-99	Not sampled: well sampled annually									
A-4	05-26-99	15.25	11.12	ND	4.13	05-26-99	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--		
A-4	08-23-99	15.25	11.62	ND	3.63	08-23-99	Not sampled: well sampled annually								0.54	
A-5	03-24-95	13.51	7.40	ND	6.11	03-24-95	3,300	200	310	130	460	--	--	--		

**Table 1**  
**Historical Groundwater Elevation and Analytical Data**  
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**1995 - Present\*\*\***

**ARCO Service Station 2169**  
**889 West Grand Avenue, Oakland, CA**

Well Number	Date Gauged	TOC Elevation (ft-MSL)	Depth to Water (feet)	FP Thickness (feet)	Groundwater Elevation (ft-MSL)	Date Sampled	TPH Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MTBE 8020 (µg/L)	MTBE 8260 (µg/L)	TPH Diesel (µg/L)	Dissolved Oxygen (mg/L)	Purged/Not Purged (P/NP)
A-5	06-05-95	13.51	10.43	ND	3.08	06-05-95	57,000	2,700	4,600	1,500	6,800	--	--	--		
A-5	08-17-95	13.51	11.15	ND	2.36	08-18-95	34,000	1,600	2,700	1,100	5,100	<28	--	--		
A-5	12-04-95	13.51	11.42	ND	2.09	12-04-95	61	<0.5	<0.5	<0.5	<0.5	--	--	--		
A-5	03-01-96	13.51	8.11	ND	5.40	03-13-96	11,000	860	960	380	1,600	<100	--	--		
A-5	05-29-96	13.51	9.30	ND	4.21	05-29-96	19,000	1,600	1,900	880	3,300	<100	--	--		
A-5	08-29-96	13.51	10.60	ND	2.91	08-29-96	7,700	490	450	260	990	<30	--	--		
A-5	11-21-96	13.51	10.05	ND	3.46	11-21-96	8,000	450	550	340	1,100	<30	--	--		
A-5	03-26-97	13.51	9.87	ND	3.64	03-26-97	3,100	190	140	130	340	<30	--	--		
A-5	05-21-97	13.51	10.25	ND	3.26	05-21-97	16,000	1,500	900	700	2,700	<120	--	--		
A-5	08-08-97	13.51	10.42	ND	3.09	08-08-97	9,000	690	240	440	1,300	<30	--	--		
A-5	11-18-97	13.51	NR	NR	NR	11-18-97	Not sampled: well was inaccessible									
A-5	02-20-98	13.51	NR	NR	NR	02-20-98	Not sampled: well was inaccessible									
A-5	05-11-98	13.51	NR	NR	NR	05-11-98	Not sampled: well was inaccessible									
A-5	07-30-98	13.51	NR	NR	NR	07-30-98	Not sampled: well was inaccessible									
A-5	10-08-98	13.51	NR	NR	NR	10-08-98	Not sampled: well was inaccessible									
A-5	02-18-99	13.51	7.63	ND	5.88	02-18-99	<50	0.8	<0.5	<0.5	1.5	<10	--	--		
A-5	05-26-99	13.51	9.85	ND	3.66	05-26-99	1,700	240	41	110	330	<12	--	--		
A-5	08-23-99	13.51	10.60	ND	2.91	08-23-99	560	65	3	30	52	<6	--	--	0.73	NP
A-6	03-24-95	13.51	7.89	ND	5.62	03-24-95	120	<0.5	<1	<0.5	<1.5	--	--	--		
A-6	06-05-95	13.51	10.06	ND	3.45	06-05-95	160	<0.5	<0.6	<0.5	<0.5	--	--	--		
A-6	08-17-95	13.51	11.10	ND	2.41	08-18-95	530	<0.5	<0.5	<2.4	<4.2	6	--	--		
A-6	12-04-95	13.51	11.52	ND	1.99	12-04-95	28,000	1,600	1,800	880	3,600	--	--	--		
A-6	03-01-96	13.51	8.21	ND	5.30	03-13-96	1,400	<3	<15	<7	<10	<20	--	--		
A-6	05-29-96	13.51	9.25	ND	4.26	05-29-96	410	<2	<2	<2	<2	3	--	--		
A-6	08-29-96	13.51	10.52	ND	2.99	08-29-96	80	<0.5	<0.5	<0.5	<0.5	6	--	--		
A-6	11-21-96	13.51	10.54	ND	2.97	11-21-96	62	<0.5	<0.5	<0.5	<0.5	12	--	--		

**Table 1**  
**Historical Groundwater Elevation and Analytical Data**  
**Petroleum Hydrocarbons and Their Constituents**  
**1995 - Present\*\*\***

**ARCO Service Station 2169**  
**889 West Grand Avenue, Oakland, CA**

Well Number	Date Gauged	TOC	Depth	FP	Groundwater		TPH			Ethyl-	Total	MTBE	MTBE	TPH	Dissolved	Purged/
		Elevation (ft-MSL)	to Water (feet)	Thickness (feet)	Elevation (ft-MSL)	Date Sampled	Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	benzene (µg/L)	Xylenes (µg/L)	8020 (µg/L)	8260 (µg/L)	Diesel (µg/L)	Oxygen (mg/L)	Not Purged (P/NP)
A-6	03-26-97	13.51	9.93	ND	3.58	03-26-97	110	<0.5	0.8	1	1.4	15	--	--		
A-6	05-21-97	13.51	10.54	ND	2.97	05-21-97	600	0.6	0.6	<2	2.7	<3	--	--		
A-6	08-08-97	13.51	10.77	ND	2.74	08-08-97	850	<0.5	<0.5	6.1	<0.5	<4	--	--		
A-6	11-18-97	13.51	3.41	ND	10.10	11-18-97	690	<1	<1	3	2	7	--	--		
A-6	02-20-98	13.51	6.73	ND	6.78	02-20-98	60	<0.5	0.6	1.3	0.5	4	--	--		
A-6	05-11-98	13.51	9.26	ND	4.25	05-11-98	140	<0.5	0.7	0.6	<0.5	6	--	--		
A-6	07-30-98	13.51	10.12	ND	3.39	07-30-98	910	<2	<2	3	7	34	--	--		
A-6	10-08-98	13.51	10.53	ND	2.98	10-08-98	1,300	<2	4	3	4	21	--	--		
A-6	02-18-99	13.51	7.50	ND	6.01	02-18-99	150	<0.5	<0.5	1.4	1.7	35	--	--		
A-6	05-26-99	13.51	10.00	ND	3.51	05-26-99	100	<0.5	<0.5	<0.5	<0.5	17	--	--		
A-6	08-23-99	13.51	10.70	ND	2.81	08-23-99	98	0.6	<0.5	1.1	4.3	13	--	--	2.42	NP
AR-1	03-24-95	15.61	7.25	ND	8.36	03-24-95	270	14	0.6	2.5	2.1	--	--	130		
AR-1	06-05-95	15.61	11.37	ND	4.24	06-05-95	190	10	<0.5	0.8	0.5	--	--	580		
AR-1	08-17-95	15.61	12.40	ND	3.21	08-17-95	960	110	12	4.5	150	14	--	<50		
AR-1	12-04-95	15.61	12.90	ND	2.71	12-04-95	<50	1.5	<0.5	<0.5	0.8	--	--	--		
AR-1	03-01-96	15.61	8.19	ND	7.42	03-13-96	150	3.8	0.5	1.4	1.3	<3	--	--		
AR-1	05-29-96	15.61	10.41	ND	5.20	05-29-96	Not sampled: well sampled semi-annually, during the first and third quarters									
AR-1	08-29-96	15.61	12.12	ND	3.49	08-29-96	<50	<0.5	<0.5	<0.5	0.8	<3	--	--		
AR-1	11-21-96	15.61	11.52	ND	4.09	11-21-96	Not sampled: well sampled semi-annually, during the first and third quarters									
AR-1	03-26-97	15.61	11.33	ND	4.28	03-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--		
AR-1	05-21-97	15.61	12.02	ND	3.59	05-21-97	Not sampled: well sampled semi-annually, during the first and third quarters									
AR-1	08-08-97	15.61	12.31	ND	3.30	08-08-97	<50	0.7	<0.5	1	<0.5	<3	--	--		
AR-1	11-18-97	15.61	3.97	ND	11.64	11-18-97	Not sampled: well sampled semi-annually, during the first and third quarters									
AR-1	02-20-98	15.61	6.42	ND	9.19	02-23-98	<200	<2	<2	<2	<2	160	--	--		
AR-1	05-11-98	15.61	10.93	ND	4.68	05-11-98	<50	<0.5	<0.5	<0.5	<0.5	4	--	--		
AR-1	07-30-98	15.61	11.82	ND	3.79	07-30-98	<50	<0.5	<0.5	<0.5	<0.5	6	--	--		



**Table 1**  
**Historical Groundwater Elevation and Analytical Data**  
**Petroleum Hydrocarbons and Their Constituents**  
**1995 - Present\*\*\***

**ARCO Service Station 2169**  
**889 West Grand Avenue, Oakland, CA**

Well Number	Date Gauged	TOC	Depth	FP	Groundwater	Date Sampled	TPH			Ethyl-	Total	MTBE	MTBE	TPH	Dissolved	Purged/
		Elevation (ft-MSL)	to Water (feet)	Thickness (feet)	Elevation (ft-MSL)		Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	benzene (µg/L)	Xylenes (µg/L)	8020 (µg/L)	8260 (µg/L)	Diesel (µg/L)	Oxygen (mg/L)	Not Purged (P/NP)
AR-1	10-08-98	15.61	12.24	ND	3.37	10-08-98	<50	<0.5	<0.5	<0.5	<0.5	6	--	--		
AR-1	02-18-99	15.61	7.75	ND	7.86	02-18-99	<50	<0.5	<0.5	<0.5	<1.0	<10	--	--		
AR-1	05-26-99	15.61	11.62	ND	3.99	05-26-99	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--		
AR-1	08-23-99	15.61	9.32	ND	6.29	08-23-99	Not sampled: well sampled semi-annually, during the first and second quarters								NR	
AR-2	03-24-95	15.28	9.13	ND	6.15	03-24-95	<50	6.2	<0.5	<0.5	0.6	--	--	<50		
AR-2	06-05-95	15.28	12.09	ND	3.19	06-05-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	<50		
AR-2	08-17-95	15.28	12.78	ND	2.50	08-18-95	<50	<0.5	<0.5	<0.5	<0.5	4	--	<50		
AR-2	12-04-95	15.28	11.44	ND	3.84	12-13-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--		
AR-2	03-01-96	15.28	9.83	ND	5.45	03-13-96	190	26	2.6	3.3	13	200	--	--		
AR-2	05-29-96	15.28	10.97	ND	4.31	05-29-96	Not sampled: well sampled semi-annually, during the first and third quarters									
AR-2	08-29-96	15.28	12.20	ND	3.08	08-29-96	<50	<0.5	<0.5	<0.5	<0.5	95	--	--		
AR-2	11-21-96	15.28	11.57	ND	3.71	11-21-96	Not sampled: well sampled semi-annually, during the first and third quarters									
AR-2	03-26-97	15.28	11.60	ND	3.68	03-26-97	<50	<0.5	<0.5	<0.5	<0.5	9	--	--		
AR-2	05-21-97	15.28	12.12	ND	3.16	05-21-97	Not sampled: well sampled semi-annually, during the first and third quarters									
AR-2	08-08-97	15.28	12.35	ND	2.93	08-08-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--		
AR-2	11-18-97	15.28	3.48	ND	11.80	11-18-97	Not sampled: well sampled semi-annually, during the first and third quarters									
AR-2	02-20-98	15.28	8.00	ND	7.28	02-20-98	<50	<0.5	<0.5	<0.5	<0.5	43	--	--		
AR-2	05-11-98	15.28	10.97	ND	4.31	05-11-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--		
AR-2	07-30-98	15.28	11.76	ND	3.52	07-30-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--		
AR-2	10-08-98	15.28	12.17	ND	3.11	10-08-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--		
AR-2	02-18-99	15.28	9.17	ND	6.11	02-18-99	<50	<0.5	<0.5	<0.5	<1.0	<10	--	--		
AR-2	05-26-99	15.28	11.72	ND	3.56	05-26-99	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--		
AR-2	08-23-99	15.28	12.31	ND	2.97	08-23-99	Not sampled: well sampled semi-annually, during the first and second quarters								0.61	
ADR-1	03-24-95	13.95	8.04	0.01	** 5.92	03-24-95	Not sampled: well contained floating product									
ADR-1	06-05-95	13.95	11.02	ND	2.93	06-05-95	23,000	310	420	300	1,900	--	--	13,000		

**Table 1**  
**Historical Groundwater Elevation and Analytical Data**  
**Petroleum Hydrocarbons and Their Constituents**  
**1995 - Present\*\*\***

**ARCO Service Station 2169**  
**889 West Grand Avenue, Oakland, CA**

Well Number	Date Gauged	TOC	Depth	FP	Groundwater	Date Sampled	TPH			Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MTBE 8020 (µg/L)	MTBE 8260 (µg/L)	TPH Diesel (µg/L)	Dissolved Oxygen (mg/L)	Purged/Not Purged (P/NP)
		Elevation (ft-MSL)	to Water (feet)	Thickness (feet)	Elevation (ft-MSL)		Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)							
ADR-1	08-17-95	13.95	11.86	ND	2.09	08-18-95	4,400	150	120	95	620	120	--	4,500		
ADR-1	12-04-95	13.95	10.05	ND	3.90	12-13-95	8,800	100	130	120	990	--	--	--		
ADR-1	03-01-96	13.95	8.76	ND	5.19	03-13-96	89,000	370	1,000	840	8,100	<500	--	--		
ADR-1	05-29-96	13.95	9.74	ND	4.21	05-30-96	27,000	230	380	370	2,700	<100	--	--		
ADR-1	08-29-96	13.95	10.77	ND	3.18	08-29-96	5,300	190	58	76	470	85	--	--		
ADR-1	11-21-96	13.95	10.49	ND	3.46	11-21-96	1,900	82	21	32	270	110	--	--		
ADR-1	03-26-97	13.95	10.37	ND	3.58	03-26-97	1,300	260	6	39	27	95	--	--		
ADR-1	05-21-97	13.95	10.90	ND	3.05	05-21-97	2,100	300	18	37	200	79	--	--		
ADR-1	08-08-97	13.95	11.12	ND	2.83	08-08-97	3,900	620	49	110	470	<200	--	--		
ADR-1	11-18-97	13.95	3.47	ND	10.48	11-18-97	18,000	900	140	360	2,700	<60	--	--		
ADR-1	02-20-98	13.95	NR	NR	NR	02-20-98	Not sampled: well was inaccessible									
ADR-1	05-11-98	13.95	NR	NR	NR	05-11-98	Not sampled: well was inaccessible									
ADR-1	07-30-98	13.95	NR	NR	NR	07-30-98	Not sampled: well was inaccessible									
ADR-1	10-08-98	13.95	NR	NR	NR	10-08-98	Not sampled: well was inaccessible									
ADR-1	02-18-99	13.95	7.80	ND	6.15	02-18-99	200	4.4	<0.5	1.3	1.3	43	--	--		
ADR-1	05-26-99	13.95	10.40	ND	3.55	05-26-99	160	10	<0.5	1.7	1.8	43	--	--		
ADR-1	08-23-99	13.95	10.70	ND	3.25	08-23-99	7,400	310	16	210	970	18	--	--	0.37 NP	
ADR-2	03-24-95	14.64	8.41	>3.00*	NR*	03-24-95	Not sampled: well contained floating product									
ADR-2	06-05-95	14.64	11.45	>3.00*	NR*	06-05-95	Not sampled: well contained floating product									
ADR-2	08-17-95	14.64	12.10	0.03	** 2.56	08-17-95	Not sampled: well contained floating product									
ADR-2	12-04-95	14.64	10.93	0.03	** 3.73	12-13-95	Not sampled: well contained floating product									
ADR-2	03-01-96	14.64	8.74	ND	5.90	03-13-96	29,000	1,100	1,200	710	3,800	<500	--	--		
ADR-2	05-29-96	14.64	10.43	ND	4.21	05-29-96	33,000	510	500	470	2,300	120	--	--		
ADR-2	08-29-96	14.64	11.64	ND	3.00	08-29-96	8,000	230	180	150	730	53	--	--		
ADR-2	11-21-96	14.64	11.23	ND	3.41	11-21-96	15,000	630	440	390	2,100	75	--	--		
ADR-2	03-26-97	14.64	11.13	ND	3.51	03-26-97	6,100	320	23	180	400	32	--	--		

**Table 1**  
**Historical Groundwater Elevation and Analytical Data**  
**Petroleum Hydrocarbons and Their Constituents**  
**1995 - Present\*\*\***

**ARCO Service Station 2169**  
**889 West Grand Avenue, Oakland, CA**

Well Number	Date Gauged	TOC	Depth	FP	Groundwater	Date Sampled	TPH			Ethyl-	Total	MTBE	MTBE	TPH	Dissolved	Purged/
		Elevation (ft-MSL)	to Water (feet)	Thickness (feet)	Elevation (ft-MSL)		Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	benzene (µg/L)	Xylenes (µg/L)	8020 (µg/L)	8260 (µg/L)	Diesel (µg/L)	Oxygen (mg/L)	Not Purged (P/NP)
ADR-2	05-21-97	14.64	11.64	ND	3.00	05-21-97	6,100	380	22	210	320	<30	--	--		
ADR-2	08-08-97	14.64	11.85	ND	2.79	08-08-97	8,400	380	35	230	910	<30	--	--		
ADR-2	11-18-97	14.64	3.33	ND	11.31	11-18-97	11,000	230	29	300	1,200	<60	--	--		
ADR-2	02-20-98	14.64	7.67	ND	6.97	02-20-98	4,700	320	30	130	360	20	--	--		
ADR-2	05-11-98	14.64	10.47	ND	4.17	05-11-98	Not sampled									
ADR-2	07-30-98	14.64	NR	NR	NR	07-30-98	Not sampled: well was inaccessible									
ADR-2	10-08-98	14.64	11.67	ND	2.97	10-08-98	Not sampled									
ADR-2	02-18-99	14.64	NR	NR	NR	02-18-99	Not sampled: well inaccessible									
ADR-2	05-26-99	14.64	11.02	ND	3.62	05-26-99	5,900	670	5	340	104	16	--	--		
ADR-2	08-23-99	14.64	9.82	ND	4.82	08-23-99	9,100	570	12	410	1,000	28	--	--	0.50	NP

TOC: top of casing

ft-MSL: elevation in feet, relative to mean sea level

TPH: total petroleum hydrocarbons, California DHS LUFT Method

BTEX: benzene, toluene, ethylbenzene, xylenes by EPA method 8020

MTBE: Methyl tert-butyl ether

µg/L: micrograms per liter

mg/L: milligrams per liter

ND: none detected

NR: not reported; data not available or not measurable

--: not analyzed or not applicable

<: denotes concentration not present at or above laboratory detection limit stated to the right.

\*: well contained more than 3 feet of floating product; exact product thickness and groundwater elevation could not be measured

\*\* : [corrected elevation (Z')] = Z + (h \* 0.73) where: Z = measured elevation, h = floating product thickness, 0.73 = density ratio of oil to water

\*\*\*: For previous historical groundwater elevation data please refer to *Fourth Quarter 1995 Groundwater Monitoring Program Results and Remediation System Performance Evaluation Report, ARCO Service Station 2169, 889 West Grand Avenue, Oakland, California, (EMCON, March 4, 1996).*

**Table 2**  
**Groundwater Flow Direction and Gradient**

**ARCO Service Station 2169**  
**889 West Grand Avenue, Oakland, CA**

<b>Date Measured</b>	<b>Average Flow Direction</b>	<b>Average Hydraulic Gradient</b>
03-24-95	Northwest	0.009
06-05-95	Northwest	0.002
08-17-95	West	0.001
12-04-95	North-Northwest	0.002
03-01-96	Northwest	0.003
05-29-96	Northwest	0.002
08-29-96	West	0.002
11-21-96	West-Northwest	0.002
03-26-97	Northwest	0.002
05-21-97	North-Northwest	0.002
08-08-97	North-Northwest	0.002
11-18-97	North-Northwest	0.003
02-20-98	North	0.013
05-11-98	North	0.03
07-30-98	North	0.002
10-08-98	North-Northwest	0.002
02-18-99	Northwest	0.008
05-26-99	North-Northwest	0.003
<b>08-23-99</b>	<b>Variable</b>	<b>Variable</b>

**Table 3  
Soil Vapor Extraction System  
Operational Uptime Information (1998 - present)**

**Arco Service Station No. 2169  
889 West Grand Avenue, Oakland, California**

Site	Meter (hrs.)	Operation (hrs.)	Period Operation				Cumulative Operation			
			Total (days)	Uptime (days)	Downtime (days)	Uptime (%)	Total (days)	Uptime (days)	Downtime (days)	Uptime (%)
04/01/98 <sup>1</sup>	7365.55	6909.60					1399	287.9	1111.1	21%
04/15/98	7365.55	6909.60								
06/22/98	7365.78	6909.83	68	0.0	68.0	0%	1467	287.9	1179.1	20%
08/20/98	7365.78	6909.83	59	0.0	59.0	0%	1526	287.9	1238.1	19%
10/07/98	7366.69	6910.74	48	0.0	48.0	0%	1574	287.9	1286.1	18%
10/08/98	7392.07	6936.12	1	1	0	100%	1575	289.0	1286.0	18%
10/30/98	7752.82	7296.87	22	15.0	7.0	68%	1597	304.0	1293.0	19%
11/18/98	7755.18	7299.23	19	0.1	18.9	1%	1616	304.1	1311.9	19%
11/25/98	7869.69	7413.74	7	4.8	2.2	68%	1623	308.9	1314.1	19%
12/08/98	8182.76	7726.81	13	13.0	0.0	100%	1636	322.0	1314.0	20%
02/05/99	8183.26	7727.31	59	0.0	59.0	0%	1695	322.0	1373.0	19%
03/19/99	8183.56	7727.61	42	0.0	42.0	0%	1737	322.0	1415.0	19%
04/27/99	8183.56	7727.61	39	0.0	39.0	0%	1776	322.0	1454.0	18%
06/21/99	8183.88	7727.93	55	0.0	55.0	0%	1831	322.0	1509.0	18%
06/24/99	8260.48	7804.53	3	3	0	106%	1834	325.2	1508.8	18%
08/19/99	8260.48	7804.53	56	0	56	0%	1890	325.2	1564.8	17%
08/25/99	8360.47	7904.52	6	-4	2	69%	1896	329.4	1566.6	17%
09/08/99	8695.25	8239.3	14	14	0	100%	1910	343.3	1566.7	18%
09/09/99	8706.53	8250.58	1	0	1	47%	1911	343.8	1567.2	18%
09/21/99	8994.92	8538.97	12	12	0	100%	1923	355.8	1567.2	19%

<sup>1</sup> Operational data through 04/01/98 from First Quarter 1998 Quarterly Monitoring Report

**Table 4**  
**Soil Vapor Extraction System**  
**Flow Rates and Analytical Results of Air Samples (1998 - present)**

**Arco Service Station No. 2169**  
**889 West Grand Avenue, Oakland, California**

Date	Sample Location	Vacuum (in. H2O)	Velocity (fpm)	Flowrate <sup>1</sup> (scfm)	Analyses (ppmv)					
					TPHG	Benzene	Toulene	Ethylbenzene	Xylene	MTBE
10/08/98	Influent	21.2	750	35	190	<0.1	<0.1	<0.1	0.2	
	Effluent <sup>2</sup>		3600	274.2	<5	<0.1	<0.1	<0.1	<0.2	
11/18/98	Influent	21	900	42	83	<0.1	0.4	0.4	0.9	
	Effluent		3300	253.4	<5	<0.1	<0.1	<0.1	<0.2	
12/08/98	Influent	25	1100	51	12	<0.1	0.3	<0.1	0.2	<0.8
	Effluent		3100	238.0	6	<0.1	0.3	<0.1	0.2	<0.8
06/21/99	Influent	40	1000	44	20	0.1	0.1	<0.1	<0.2	<0.8
	Effluent		2500	192.0	<5	<0.1	<0.1	<0.1	<0.2	<0.8
08/19/99	Influent	39.2	800	35	180	6.9	0.9	0.15	0.32	5.5
	Effluent		2800	215.0	<2.4	0.05	<0.013	<0.012	0.03	0.13
09/08/99	Influent	50.2	1500	65	71	0.2	0.2	0.2	0.9	1.1
	Effluent		2300	176.6	<5	<0.1	<0.1	<0.1	<0.2	<0.8

<sup>1</sup> Influent Flow Rate, cfm = (Velocity, fpm)(Influent Pipe Area, sq. ft.)(406.8 in.H2O - Vacuum, in.H2O) / (406.8 in.H2O)

where Influent Pipe Diameter = 3"

Effluent Flow Rate, cfm = (Velocity, fpm)(Effluent Pipe Area, sq.ft.)(460° R + 77° F)/(460° R + Vapor Temp F)

where Effluent (after blower) Pipe Diameter = 4"

<sup>2</sup> Dilution air only

**Table 5**  
**Soil Vapor Extraction System**  
**Extraction Rates, Emission Rates, Destruction Efficiency, and Mass Removed**  
**(1998 - present)**

**Arco Service Station No. 2169**  
**889 West Grand Avenue, Oakland, California**

Date End	Extraction Rate from Wellfield <sup>1</sup>		Emission Rate to Atmosphere <sup>2</sup>		Destruction Efficiency <sup>3</sup>		Period Removal <sup>4</sup>		Cumulative Removal	
	TPHG (lbs/day)	Benzene (lbs/day)	TPHG (lbs/day)	Benzene (lbs/day)	TPHG (%)	Benzene (%)	TPHG (lbs)	Benzene (lbs)	TPHG (lbs)	Benzene (lbs)
04/01/98 <sup>5</sup>									8582.1	0
10/08/98	2.4351	0.0	<0.5037	<0.0079	Waived		39.5329	0	8621.6	0
11/18/98	1.2772	0.0	<0.4655	<0.0073	Waived		22.7538	0	8644.4	0
12/08/98	0.2233	0.0	0.5248	<0.0068	Waived		0.0104	0	8644.4	0
06/21/99	0.3251	0.0013	<0.3527	<0.0055	Waived		1.0376	0.0041	8645.4	0.0041
08/19/99	2.3459	0.0702	<0.1896	<0.0031	Waived		42.4964	1.2723	8687.9	1.2763
09/08/99	1.6830	0.0037	<0.3245	<0.0051	Waived		21.0150	0.0462	8708.9	1.3226

<sup>1</sup> Extraction Rate, lbs/day = (Influent Flow, cfm)(Influent conc., ppmv)(g/mole)(60 min/hr)(24 hr/day)(28.3 L/cf) / (10<sup>6</sup>)(24.45 moles/L)(453.6 g/lb)  
where TPHG = 100 g/mole and Benzene = 78.1 g/mole; Influent conc. = 0, if reported as non-detect

<sup>2</sup> Emission Rate, lbs/day = (Effluent Flow, cfm)(Effluent conc., ppmv)(g/mole)(60 min/hr)(24 hr/day)(28.3 L/cf) / (10<sup>6</sup>)(24.45 moles/L)(453.6 g/lb)  
where TPHG = 100 g/mole and Benzene = 78.1 g/mole; Effluent conc. = Method Reporting Limit, if reported as non-detect

<sup>3</sup> Destruction Efficiency, % = (Extraction Rate - Emission Rate)(100) / (Extraction Rate); "Waived" = if TPHG emissions <1.0 lbs/day and Benzene emissions <0.02 lbs/day

<sup>4</sup> Period Removal, lbs = (Extraction Rate)(Uptime)

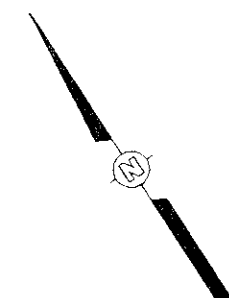
<sup>5</sup> Operational data through 4/1/98 from First Quarter 1998 Quarterly Monitoring Report

**APPENDIX A**  
**SAMPLING AND ANALYSIS PROCEDURES**



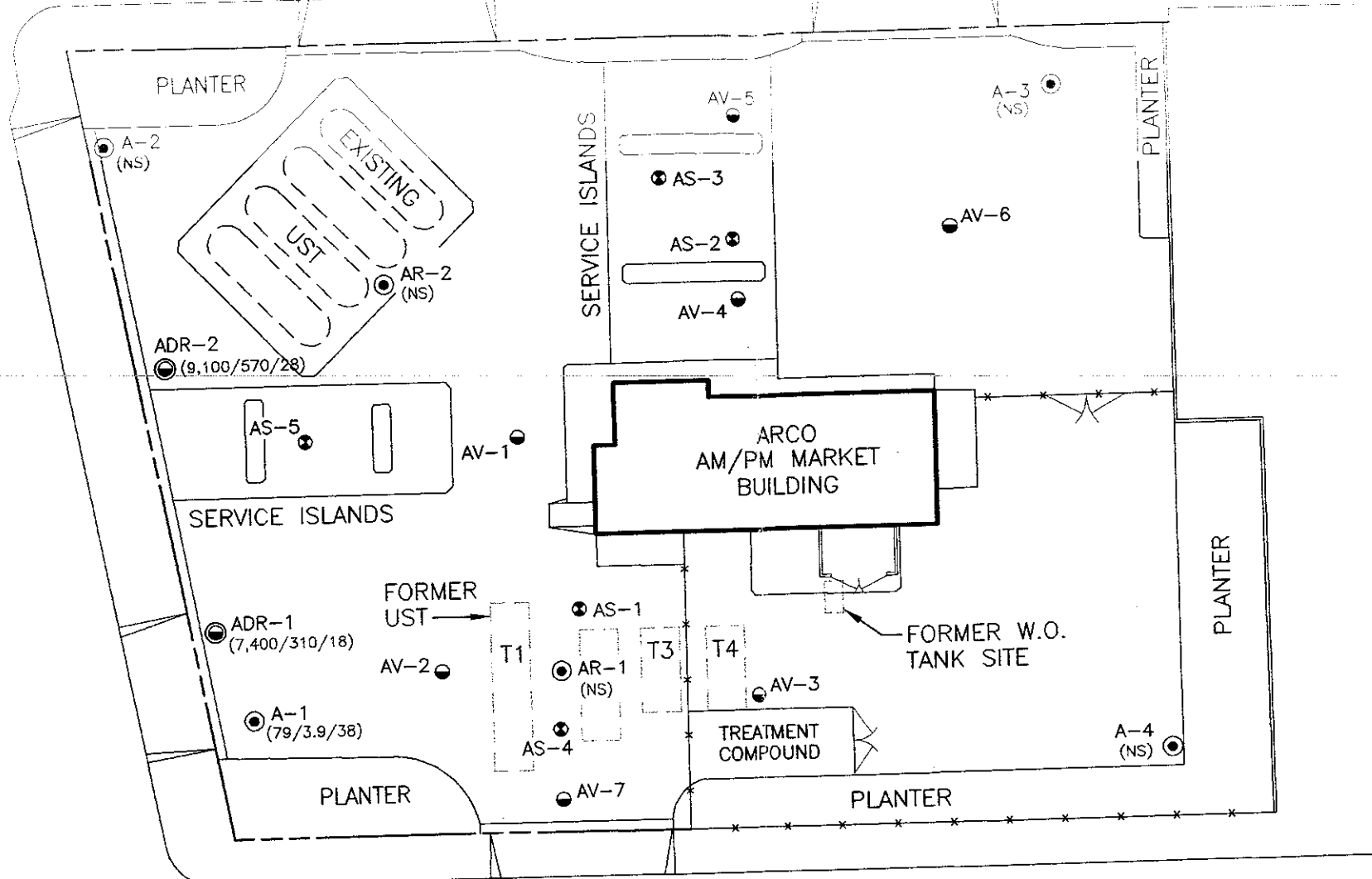
PROJECT NUMBER 791661  
 DRAWN BY K. Block 9-17-99

WEST GRAND AVENUE



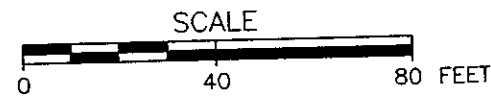
MARKET STREET

WEST GRAND SHOPPING CENTER



- EXPLANATION
- Groundwater monitoring well
  - Vapor extraction well
  - ⊙ Groundwater monitoring/vapor extraction well
  - ⊕ Air sparging well
  - (79/3.9/38) Concentration of total petroleum hydrocarbons as gasoline (TPHG), benzene, and MTBE in groundwater (ug/L); samples collected 8/23/99
  - < Not detected at or above the indicated laboratory detection limit
  - NS Not sampled

22nd STREET



A-5 (560/65/<6)

LAUNDRY FACILITY

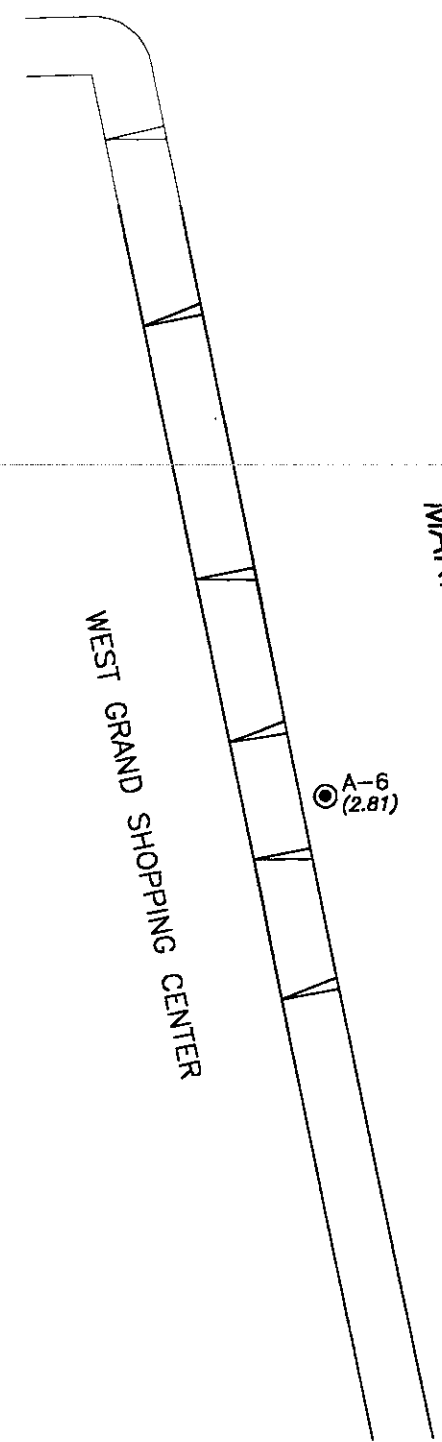
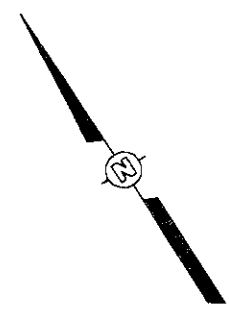


ARCO PRODUCTS COMPANY  
 SERVICE STATION 2169

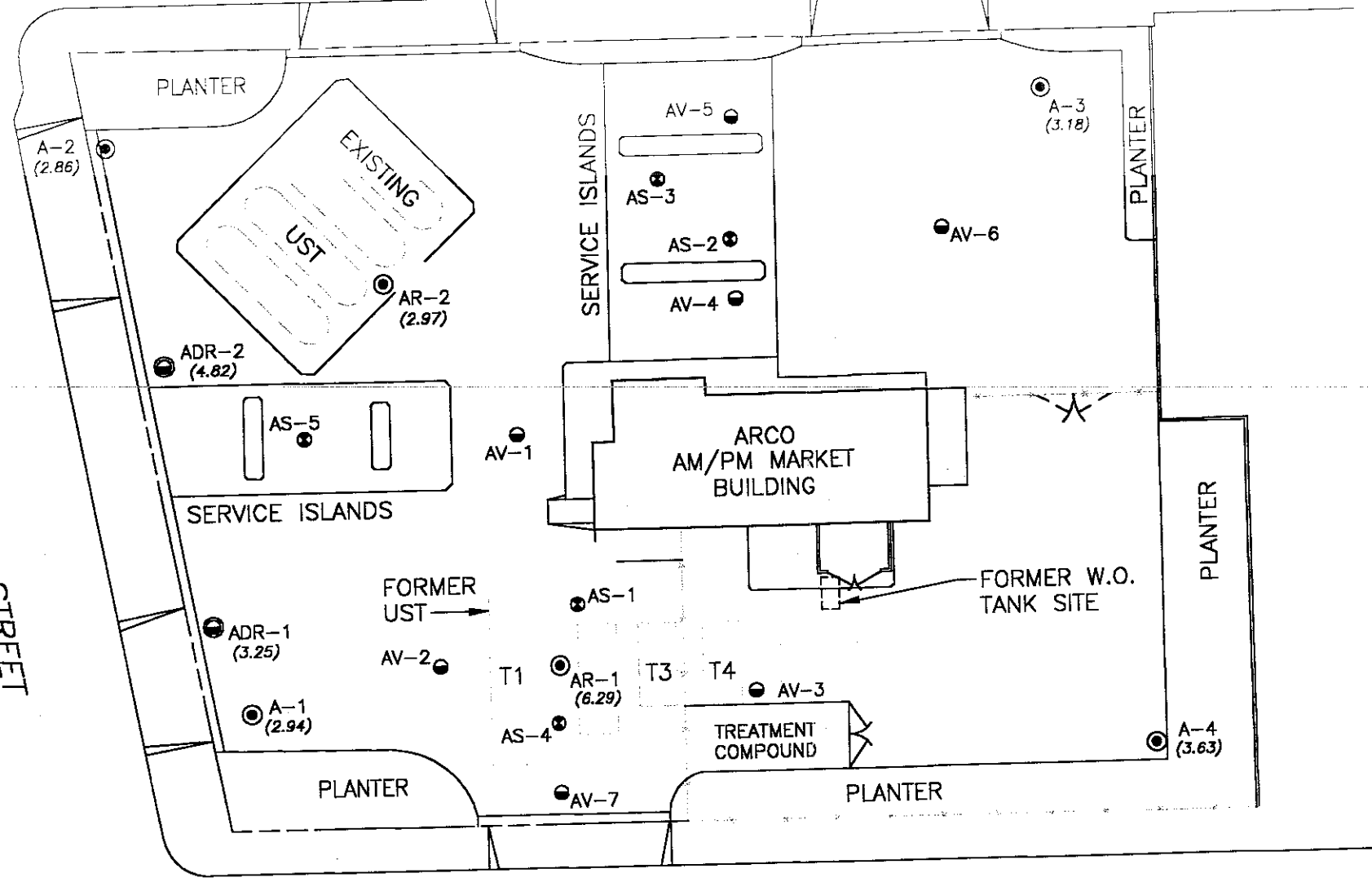
FIGURE 1  
 GROUNDWATER ANALYTICAL SUMMARY  
 THIRD QUARTER 1999  
 889 WEST GRAND AVENUE  
 OAKLAND, CALIFORNIA

PROJECT NUMBER 791661  
 DRAWN BY K Black 9-17-99

WEST GRAND AVENUE



MARKET STREET

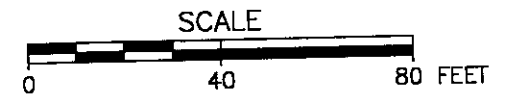


**EXPLANATION**

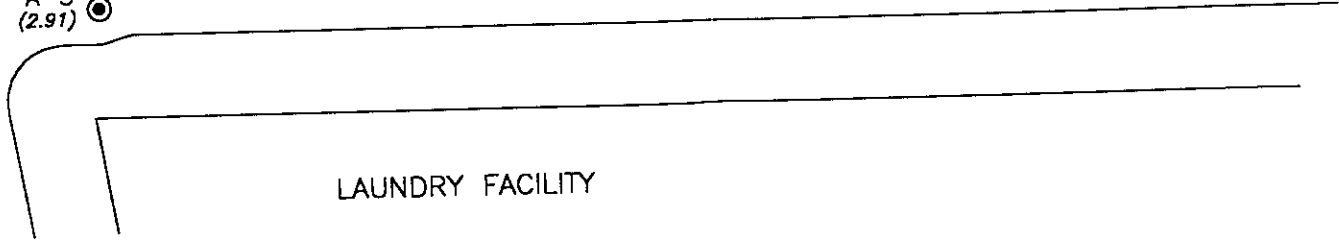
- ⊙ Groundwater monitoring well
- Vapor extraction well
- ⊙ Groundwater monitoring/vapor extraction well
- Air sparging well
- (3.63) Groundwater elevation (Ft.-MSL); measured 8/23/99

NOTE: Not contoured due to variable gradient

22nd STREET



A-5 (2.91)



LAUNDRY FACILITY

	ARCO PRODUCTS COMPANY SERVICE STATION 2169
	<b>FIGURE 2</b> GROUNDWATER ELEVATION DATA THIRD QUARTER 1999 889 WEST GRAND AVENUE OAKLAND, CALIFORNIA

## 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<sup>®</sup> 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

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

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

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.

NO

YES

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

pH =  $\pm 0.1$  pH units  
COND. =  $\pm 10$  %  
TEMP. =  $\pm 1.0$  °F

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

YES

NO

YES

NO

WELL PURGING CRITERIA MET; PROCEED TO WELL SAMPLING.

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

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

RECORD WELL AS DRY FOR PURPOSES OF SAMPLING.

MONITORING WELL PURGING PROTOCOL

FIGURE

A-1

# WATER SAMPLE FIELD DATA SHEET

PROJECT NO: \_\_\_\_\_  
 PURGED BY: \_\_\_\_\_  
 SAMPLED BY: \_\_\_\_\_

SAMPLE ID: \_\_\_\_\_  
 CLIENT NAME: \_\_\_\_\_  
 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**

**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 Wizard™	_____ Dedicated	_____ Well Wizard™	_____ Dedicated
Other: _____		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 \_\_\_\_\_

**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: \_\_\_\_\_

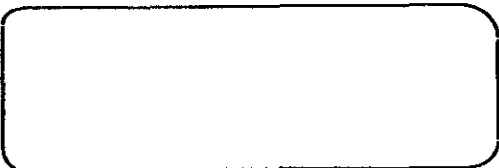
Well Lock Number (s)

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**



September 7, 1999

Service Request No.: S9902610

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

**RE: TO#24118.00/RAT8/2169 OAKLAND**

Dear Mr. Vanderveen:

Enclosed are the results of the sample(s) submitted to our laboratory on August 25, 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 13, 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).

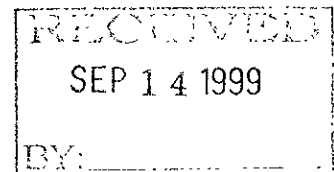
If you have any questions, please call me at (408) 748-9700.

Respectfully submitted,

Columbia Analytical Services, Inc.

Bernadette Troncales  
Project Chemist

Greg Jordan  
Laboratory Director



**COLUMBIA ANALYTICAL SERVICES, Inc.**

**Acronyms**

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









COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company  
Project: TO#24118.00/RAT8/2169 OAKLAND  
Sample Matrix: Water

Service Request: S9902610  
Date Collected: 8/23/99  
Date Received: 8/25/99

BTEX, MTBE and TPH as Gasoline

Sample Name: A-6(26)  
Lab Code: S9902610-004  
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	9/3/99	98	
Benzene	EPA 5030	8020	0.5	1	NA	9/3/99	0.6	
Toluene	EPA 5030	8020	0.5	1	NA	9/3/99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	9/3/99	1.1	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	9/3/99	4.3	
Methyl tert-Butyl Ether	EPA 5030	8020	3	1	NA	9/3/99	13	

Approved By: \_\_\_\_\_



Date: \_\_\_\_\_



COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company  
Project: TO#24118.00/RAT8/2169 OAKLAND  
Sample Matrix: Water

Service Request: S9902610  
Date Collected: 8/23/99  
Date Received: 8/25/99

BTEX, MTBE and TPH as Gasoline

Sample Name: A-1(22)  
Lab Code: S9902610-005  
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	9/3/99	79	
Benzene	EPA 5030	8020	0.5	1	NA	9/3/99	3.9	
Toluene	EPA 5030	8020	0.5	1	NA	9/3/99	0.6	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	9/3/99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	9/3/99	1.7	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	9/3/99	38	

Approved By: \_\_\_\_\_

*[Signature]*

Date: \_\_\_\_\_

09/08/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company  
 Project: TO#24118.00/RAT8/2169 OAKLAND  
 Sample Matrix: Water

Service Request: S9902610  
 Date Collected: NA  
 Date Received: NA

BTEX, MTBE and TPH as Gasoline

Sample Name: Method Blank  
 Lab Code: S990902-WB1  
 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	9/2/99	ND	
Benzene	EPA 5030	8020	0.5	1	NA	9/2/99	ND	
Toluene	EPA 5030	8020	0.5	1	NA	9/2/99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	9/2/99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	9/2/99	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	9/2/99	ND	

Approved By: \_\_\_\_\_

Date: \_\_\_\_\_

09/08/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company  
Project: TO#24118.00/RAT8/2169 OAKLAND  
Sample Matrix: Water

Service Request: S9902610  
Date Collected: NA  
Date Received: NA

BTEX, MTBE and TPH as Gasoline

Sample Name: Method Blank  
Lab Code: S990903-WB2  
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	9/3/99	ND	
Benzene	EPA 5030	8020	0.5	1	NA	9/3/99	ND	
Toluene	EPA 5030	8020	0.5	1	NA	9/3/99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	9/3/99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	9/3/99	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	9/3/99	ND	

Approved By: \_\_\_\_\_



Date: 09/08/99

**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

**Client:** ARCO Products Company  
**Project:** TO#24118.00/RAT8/2169 OAKLAND  
**Sample Matrix:** Water

**Service Request:** S9902610  
**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
A-5(23)	S9902610-001		94	141 S1
ADR-2(25)	S9902610-002		79	114
ADR-1(20)	S9902610-003		97	127
A-6(26)	S9902610-004		95	92
A-1(22)	S9902610-005		96	110
Batch QC	S9902693-001MS		98	103
Batch QC	S9902693-001DMS		100	101
Batch QC	S9902693-002MS		85	113
Batch QC	S9902693-002DMS		86	115
Method Blank	S990902-WB1		97	105
Method Blank	S990903-WB1			

CAS Acceptance Limits:            69-116                            72-139

S1                            Surrogate recovery out of control limits due to matrix interference.

Approved By: \_\_\_\_\_ *AT* \_\_\_\_\_ Date: 09/08/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

**Client:** ARCO Products Company  
**Project:** TO#24118.00/RAT8/2169 OAKLAND  
**Sample Matrix:** Water

**Service Request:** S9902610  
**Date Collected:** NA  
**Date Received:** NA  
**Date Extracted:** NA  
**Date Analyzed:** 9/2/99

Matrix Spike/Duplicate Matrix Spike Summary  
 BTE

**Sample Name:** Batch QC  
**Lab Code:** S9902693-001MS S9902693-001DMS  
**Test Notes:**

**Units:** ug/L (ppb)  
**Basis:** NA

Analyte	Prep Method	Analysis Method	MRL	Spike Level		Sample Result	Spike Result		Percent Recovery				
				MS	DMS		MS	DMS	CAS Acceptance		Relative Percent Difference		
				MS	DMS		MS	DMS	Limits				
Benzene	EPA 5030	8020	0.5	25	25	ND	27	27	108	108	75-135		<1
Toluene	EPA 5030	8020	0.5	25	25	ND	24	24	96	96	73-136		<1
Ethylbenzene	EPA 5030	8020	0.5	25	25	ND	26	26	104	104	69-142		<1

Approved By: \_\_\_\_\_



Date: \_\_\_\_\_

09/08/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company  
Project: TO#24118.00/RAT8/2169 OAKLAND  
Sample Matrix: Water

Service Request: S9902610  
Date Collected: NA  
Date Received: NA  
Date Extracted: NA  
Date Analyzed: 9/2/99


Matrix Spike/Duplicate Matrix Spike Summary  
TPH as Gasoline

Sample Name: Batch QC  
Lab Code: S9902693-002MS  
Test Notes:

S9902693-002DMS

Units: ug/L (ppb)  
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Spike Level		Sample Result	Spike Result				Percent Recovery		Result Notes
				MS	DMS		MS	DMS	MS	DMS	CAS Acceptance Limits	Relative Percent Difference	
Gasoline	EPA 5030	CA/LUFT	50	250	250	ND	240	240	96	96	75-135	<1	

Approved By:  Date: 09/08/99



COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

**Client:** ARCO Products Company  
**Project:** TO#24118.00/RAT8/2169 OAKLAND

**Service Request:** S9902610  
**Date Analyzed:** 9/2/99

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	Result Notes
					Percent Recovery Acceptance Limits		
TPH as Gasoline	EPA 5030	CA/LUFT	250	240	85-115	96	
Benzene	EPA 5030	8020	25	26	85-115	104	
Toluene	EPA 5030	8020	25	24	85-115	96	
Ethylbenzene	EPA 5030	8020	25	25	85-115	100	
Xylenes, Total	EPA 5030	8020	75	74	85-115	99	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	25	22	85-115	88	

Approved By:



Date:

09/08/99

ICV032196

# ARCO Products Company

Division of Atlantic/Richfield Company

S9902610

Task Order No.

74118.00

# Chain of Custody

ARCO Facility no. <b>2169</b>	City (Facility) <b>Oakland</b>	Project manager (Consultant) <b>Glen Vander Veen</b>	Laboratory Name <b>CAS</b>
ARCO engineer <b>Paul Supple</b>	Telephone no. (ARCO)	Telephone no. (Consultant) <b>(408) 453-7300</b>	Contract Number
Consultant name <b>EMCON</b>		Address (Consultant) <b>7201 Broadway #101 Oakland, CA 94612</b>	

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX 602EPA 8020	BTX/TPH EPA Method 8210/15	TPH Modified 8015 Gas <input type="checkbox"/> Diesel <input type="checkbox"/>	Oil and Grease 413.1 D 413.2 D	TPH EPA 418.1/SM 503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCUP Metals <input type="checkbox"/> VOAC VOAD	Semi Metals <input type="checkbox"/> VOAC VOAD	CAMP Metals EPA 6010/7000	TLLC <input type="checkbox"/> STLOC	Lead Orig/DHSD Lead EPA 7420/7421 C	Method of shipment <b>Sampler will deliver</b>	
			Soil	Water	Other	Ice	Acid																	
A-5 (23)	2	①	X			X	HCL	8/23/99	1345		X													Special Detection Limit/reporting <b>Lowest Possible</b>
ADR-2 (25)	2	②	X			X	HCL		1400		X													Special QA/QC <b>As Normal</b>
ADR-1 (20)	2	③	X			X	HCL		1410		X													Remarks <b>RAT 8 2-40ml HCL VOAs  # 791661</b>
A-6 (24)	2	④	X			X	HCL		1420		X													Lab Number
A-1 (22)	2	⑤	X			X	HCL	✓	1430		X													Turnaround Time: Priority Rush 1 Business Day <input type="checkbox"/> Rush 2 Business Days <input type="checkbox"/> Expedited 5 Business Days <input type="checkbox"/> Standard 10 Business Days <input checked="" type="checkbox"/>

Condition of sample		Temperature received: <b>Done: 9/9/99 R11/D3</b>	
Relinquished by <b>[Signature]</b>	Date <b>8/25/99</b>	Time <b>1455</b>	Received by <b>Joseph Pachado CAS</b>
Relinquished by	Date	Time	Received by
Relinquished by	Date	Time	Received by laboratory
	Date	Time	

**APPENDIX C**  
**FIELD DATA SHEETS**

**FIELD REPORT**  
**DEPTH TO WATER / FLOATING PRODUCT SURVEY**

PROJECT #: 792230 STATION ADDRESS: 899 West Grand Avenue, Oakland DATE: 8/23/99  
 ARCO STATION #: 2169 FIELD TECHNICIAN: D. Waters DAY: Monday

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
1	A-4	OK	VAULT	/	NONE	TEC	11.62	11.62	N.D.	-	27.8	0.54 m/l 19.7°C
2	A-3	OK	VAULT	/	NONE	TEC	12.97	12.97	N.D.	-	28.4	0.88 m/l 20.5°C
3	AR-2	OK	VAULT	/	NONE	TEC	12.51	12.51	N.D.	-	28.7	0.61 m/l 21.0°C
4	AR-1	OK	VAULT	/	NONE	TEC	4.28 m/l	4.28 m/l	N.D.	-	27.28	0.68 m/l 20.8°C
5	A-2	OK	VAULT	/	NONE	TEC	11.69	11.69	N.D.	-	24.6	0.55 m/l 20.9°C
6	A-5	OK	G-5	/	ARCO	LWC	10.60	10.60	N.R.	-	24.2	0.73 m/l 21.9°C
7	ADR-2	OK	VAULT	/	NONE	TEC	9.82	9.82	N.R.	-	24.1	0.50 m/l 22.1°C
8	ADR-1	OK	VAULT	/	NONE	TEC	10.70	10.70	N.D.	-	21.0	0.37 m/l 23.7°C
9	A-6	OK	G-5	/	ARCO	LWC	10.70	10.70	N.D.	-	27.0	2.42 m/l 22.5°C
10	A-1	OK	VAULT	/	NONE	TEC	11.22	11.22	N.D.	-	23.8	0.68 m/l 22.8°C

**SURVEY POINTS ARE TOP OF WELL CASINGS**

OK sock in A-6

**RECEIVED**  
 SEP 07 1999  
 BY: \_\_\_\_\_

# WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



**EMCON**

PROJECT NO 792230

SAMPLE ID A-1(2')

PURGED BY: DW Johnson

CLIENT NAME: ARCO #2169

SAMPLED BY: F

LOCATION Oakland, California

TYPE. Groundwater X Surface Water \_\_\_\_\_ Leachate \_\_\_\_\_ Other \_\_\_\_\_

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

CASING ELEVATION (feet/MSL): N/A VOLUME IN CASING (gal.): 8.5

DEPTH OF WELL (feet): 23.8 CALCULATED PURGE (gal.): 25.5

DEPTH OF WATER (feet): 11.22 ACTUAL PURGE VOL. (gal.): \_\_\_\_\_

DATE PURGED: \_\_\_\_\_ END PURGE: \_\_\_\_\_

DATE SAMPLED: 8/23/99 SAMPLING TIME: 1430

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1430</u>	<u>—</u>	<u>7.86</u>	<u>1328</u>	<u>71.6</u>	<u>Clear</u>	<u>Low</u>

OTHER: N/A ODOR: Strong N/A N/A  
(COBALT 0-100) (NTU 0-200)

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

PURGING EQUIPMENT

SAMPLING EQUIPMENT

2" Bladder Pump  ~~Bailer (Teflon)~~  
 Centrifugal Pump  ~~Bailer (PVC)~~  
 Submersible Pump  ~~Bailer (Stainless Steel)~~  
 Well Wizard  ~~Dedicated~~  
 Other: \_\_\_\_\_

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

WELL INTEGRITY: GOOD LOCK: NONE

REMARKS: \_\_\_\_\_  
 \_\_\_\_\_ SEE A-5 \_\_\_\_\_  
 \_\_\_\_\_

pH, E.C., Temp Meter Calibration Date: \_\_\_\_\_ Time: SEE A-5 Meter Serial No: \_\_\_\_\_

EC 1000 / pH 7 / pH 10 / pH 4 /

Temperature °F: \_\_\_\_\_

SIGNATURE: [Signature] REVIEWED BY: [Signature] PAGE 1 OF 5

# WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



**EMCON**

PROJECT NO: 792230  
 PURGED BY: Duplon  
 SAMPLED BY: J

SAMPLE ID: A-5 (23')  
 CLIENT NAME: ARCO #2169  
 LOCATION: Oakland, California

TYPE: Groundwater X Surface Water \_\_\_\_\_ Leachate \_\_\_\_\_ Other \_\_\_\_\_  
 CASING DIAMETER (inches): 2 X 3 \_\_\_\_\_ 4 \_\_\_\_\_ 4.5 \_\_\_\_\_ 6 \_\_\_\_\_ Other \_\_\_\_\_

CASING ELEVATION (feet/MSL): N/A VOLUME IN CASING (gal.): 2.5  
 DEPTH OF WELL (feet): 24.2 CALCULATED PURGE (gal.): 7.5  
 DEPTH OF WATER (feet): 10.60 ACTUAL PURGE VOL (gal.): \_\_\_\_\_

DATE PURGED: \_\_\_\_\_ END PURGE: \_\_\_\_\_  
 DATE SAMPLED: 8/23/89 SAMPLING TIME: 1315

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1315</u>	_____	<u>7.73</u>	<u>1019</u>	<u>68.8</u>	<u>689</u>	<u>1.2</u>
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

OTHER: N/A ODOR: Strong \_\_\_\_\_  
(COBALT 0-100) (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<sup>®</sup> \_\_\_\_\_ Dedicated  
 Other: \_\_\_\_\_

SAMPLING EQUIPMENT

\_\_\_\_\_ 2" Bladder Pump \_\_\_\_\_ Bailer (Teflon)  
 \_\_\_\_\_ Bomb Sampler \_\_\_\_\_ Bailer (Stainless Steel)  
 \_\_\_\_\_ Dipper \_\_\_\_\_ Submersible Pump  
 \_\_\_\_\_ Well Wizard<sup>®</sup> \_\_\_\_\_ Dedicated  
 Other: Disposable Teflon Bailer

WELL INTEGRITY: 6000 LOCK: OK

REMARKS: DTW is below top of screen taking  
6.450 sample

pH, E.C., Temp Meter Calibration Date: 8/23/89 Time: 1333 Meter Serial No. 232  
 E.C. 1000 1409, 1113 pH 7 6.91, 7.00 pH 10 9.17, 10.00 pH 4 3.94  
 Temperature °F 85.0

SIGNATURE: [Signature] REVIEWED BY: [Signature] PAGE 2 OF 5

# WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



**EMCON**

PROJECT NO: 792230  
PURGED BY: DUGHER  
SAMPLED BY: [Signature]

SAMPLE ID: A-6(26)  
CLIENT NAME: ARCO #2169  
LOCATION: Oakland, California

TYPE: Groundwater X Surface Water \_\_\_\_\_ Leachate \_\_\_\_\_ Other \_\_\_\_\_  
CASING DIAMETER (inches): 2 X 3 \_\_\_\_\_ 4 \_\_\_\_\_ 4.5 \_\_\_\_\_ 6 \_\_\_\_\_ Other \_\_\_\_\_

CASING ELEVATION (feet/MSL): N/A VOLUME IN CASING (gal.): 2.5  
DEPTH OF WELL (feet): 270 CALCULATED PURGE (gal.): 7.5  
DEPTH OF WATER (feet): 10.70 ACTUAL PURGE VOL. (gal.): \_\_\_\_\_

DATE PURGED: \_\_\_\_\_ END PURGE: \_\_\_\_\_  
DATE SAMPLED: 8/23/99 SAMPLING TIME: 1420

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C. (umhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1420</u>	<u>—</u>	<u>7.33</u>	<u>1115</u>	<u>70.4</u>	<u>600</u>	<u>4.8</u>

OTHER: N/A ODOR: M.L.D. N/A N/A  
(COBALT 0-100) (NTU 0-200)  
FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): N/A

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
<input type="checkbox"/> 2" Bladder Pump	<input checked="" type="checkbox"/> Bailer (Teflon)	<input type="checkbox"/> 2" Bladder Pump	<input checked="" type="checkbox"/> Bailer (Teflon)
<input type="checkbox"/> Centrifugal Pump	<input checked="" type="checkbox"/> Bailer (PVC)	<input type="checkbox"/> Bomb Sampler	<input checked="" type="checkbox"/> Bailer (Stainless Steel)
<input type="checkbox"/> Submersible Pump	<input checked="" type="checkbox"/> Bailer (Stainless Steel)	<input type="checkbox"/> Dipper	<input checked="" type="checkbox"/> Submersible Pump
<input type="checkbox"/> Well Wizard <sup>®</sup>	<input checked="" type="checkbox"/> Dedicated	<input checked="" type="checkbox"/> Well Wizard <sup>®</sup>	<input checked="" type="checkbox"/> Dedicated
Other: _____		Other: <u>Disposable Teflon Bailer</u>	

WELL INTEGRITY: GOOD LOCK: OK

REMARKS: SEE A-5

pH, E.C., Temp Meter Calibration: Date \_\_\_\_\_ Time SEE Meter Serial No. 5  
E.C. 1000 / pH 7 / pH 4 /  
Temperature °F \_\_\_\_\_  
SIGNATURE: [Signature] REVIEWED BY: [Signature] PAGE 3 OF 5

# WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



**EMCON**

PROJECT NO : 792230

SAMPLE ID : ADR-1 (2<sup>d</sup>)

PURGED BY : DW/Plm

CLIENT NAME : ARCO #2169

SAMPLED BY : F

LOCATION : Oakland, California

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.) : 7.0  
 DEPTH OF WELL (feet) : 21.0 CALCULATED PURGE (gal.) : 21.0  
 DEPTH OF WATER (feet) : 10.70 ACTUAL PURGE VOL. (gal.) : \_\_\_\_\_

DATE PURGED : \_\_\_\_\_ END PURGE : \_\_\_\_\_  
 DATE SAMPLED : 8/23/99 SAMPLING TIME : 1410

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1410</u>	<u>—</u>	<u>7.39</u>	<u>1432</u>	<u>74.1</u>	<u>6147</u>	<u>MODERATE</u>

OTHER: N/A ODOR: Strong N/A N/A  
(COBALT 0-100) (NTU 0-200)

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

PURGING EQUIPMENT

SAMPLING EQUIPMENT

2" Bladder Pump  Bailor (Teflon)  
 Centrifugal Pump  Bailor (PVC)  
 Submersible Pump  Bailor (Stainless Steel)  
 Well Wizard  Dedicated  
 Other: \_\_\_\_\_

2" Bladder Pump  Bailor (Teflon)  
 Bomb Sampler  Bailor (Stainless Steel)  
 Dipper  Submersible Pump  
 Well Wizard  Dedicated  
 Other: Disposable Teflon Bailor

WELL INTEGRITY: Good LOCK: None

REMARKS: \_\_\_\_\_  
 \_\_\_\_\_ SEE A-5 \_\_\_\_\_  
 \_\_\_\_\_

pH, E.C., Temp Meter Calibration Date: \_\_\_\_\_ Time: 5:56 Meter Serial No: A-5  
 E.C. 1000 / \_\_\_\_\_ pH 7 / \_\_\_\_\_ pH 10 / \_\_\_\_\_ pH 4 / \_\_\_\_\_

Temperature °F: \_\_\_\_\_ SIGNATURE: [Signature] REVIEWED BY: [Signature] PAGE 4 OF 5



# WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



**EMCON**

PROJECT NO: 792230  
PURGED BY: Dupless  
SAMPLED BY: [Signature]

SAMPLE ID: ADR-2 (25)  
CLIENT NAME: ARCO #2169  
LOCATION: Oakland, California

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.): 10.5  
DEPTH OF WELL (feet): 26.1 CALCULATED PURGE (gal.): 31.5  
DEPTH OF WATER (feet): 9.2 ACTUAL PURGE VOL (gal.):       

DATE PURGED:        END PURGE:         
DATE SAMPLED: 8/23/99 SAMPLING TIME: 1400

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1400</u>	<u>—</u>	<u>7.69</u>	<u>1260</u>	<u>71.0</u>	<u>600</u>	<u>157</u>

OTHER: N/A ODOR: Strong N/A N/A  
(COBALT 0-100) (NTU 0-200)

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

### PURGING EQUIPMENT

### SAMPLING EQUIPMENT

2" Bladder Pump  Bailer (Teflon)  
 Centrifugal Pump  Bailer (PVC)  
 Submersible Pump  Bailer (Stainless Steel)  
 Well Wizard<sup>®</sup>  Dedicated  
Other:       

2" Bladder Pump  Bailer (Teflon)  
 Bomb Sampler  Bailer (Stainless Steel)  
 Dipper  Submersible Pump  
 Well Wizard<sup>®</sup>  Dedicated  
Other: Disposable Teflon Bailer

WELL INTEGRITY: Good LOCK: None

REMARKS: SEE A-5

pH, E.C., Temp. Meter Calibration Date:        Time: SEE A-5 Meter Serial No:         
E.C. 1000: 1 pH 7: 1 pH 10:        pH 4:         
Temperature °F:         
SIGNATURE: [Signature] REVIEWED BY: [Signature] PAGE 5 OF 5

1921 Ringwood Avenue  
San Jose, California

1999

ARCO 2169  
792230

Well ID	Quarter	Date	Purge Volume (gallons)	Did well dry	Well Contained Product	Gallons			
						First	Second	Third	Fourth
A-1	First	02/18/99	18.00	NO	NO	70.50	0.00	0.00	0.00
	Second	05/26/99	0.00	GRAB	NO				
	Third	08/23/99	0.00	GRAB	NO				
	Fourth								
A-2	First	02/18/99	17.50	NO	NO				
	Second	05/26/99	0.00	GRAB	NO				
	Third	08/23/99	0.00	NA	NO				
	Fourth								
A-3	First	02/18/99	0.00	NA	NO				
	Second	05/26/99	0.00	GRAB	NO				
	Third	08/23/99	0.00	NA	NO				
	Fourth								
A-4	First	02/18/99	0.00	NA	NO				
	Second	05/26/99	0.00	GRAB	NO				
	Third	08/23/99	0.00	NA	NO				
	Fourth								
A-5	First	02/18/99	0.00	GRAB	NO				
	Second	05/26/99	0.00	GRAB	NO				
	Third	08/23/99	0.00	GRAB	NO				
	Fourth								
A-6	First	02/18/99	0.00	GRAB	NO				
	Second	05/26/99	0.00	GRAB	NO				
	Third	08/23/99	0.00	GRAB	NO				
	Fourth								
AR-1	First	02/18/99	35.00	YES	NO				
	Second	05/26/99	0.00	GRAB	NO				
	Third	08/23/99	0.00	NA	NO				
	Fourth								
AR-2	First	02/18/99	0.00	GRAB	NO				
	Second	05/26/99	0.00	GRAB	NO				
	Third	08/23/99	0.00	NA	NO				
	Fourth								
ADR-1	First	02/18/99	0.00	GRAB	NO				
	Second	05/26/99	0.00	GRAB	NO				
	Third	08/23/99	0.00	GRAB	NO				
	Fourth								
ADR-2	First	02/18/99	0.00	IW	IW	Steam water (gal) _____			
	Second	05/26/99	0.00	GRAB	NO				
	Third	08/23/99	0.00	GRAB	NO				
	Fourth								

# ARCO Products Company

Division of Atlantic/Richfield Company

# Chain of Custody

Task Order No. \_\_\_\_\_

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

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA 1602/8020/8015	TPH Modified 8015	Gas <input type="checkbox"/> Diesel <input type="checkbox"/>	Oil and Grease 413.1 <input type="checkbox"/> 413.2 <input type="checkbox"/>	TPH EPA 418.1/SM.503E	EPA 601/6010	EPA 624/6240	EPA 625/6270	TCUP Metals <input type="checkbox"/> VOAG <input type="checkbox"/> VOAG <input type="checkbox"/> <small>Sem</small>	CMM Metals EPA 60107/6000	TLLCO <input type="checkbox"/> STLLCO <input type="checkbox"/>	Lead <input type="checkbox"/> Org/DHSC <input type="checkbox"/>	Lead EPA 7420/742 <input type="checkbox"/>	Method of shipment
			Soil	Water	Other	Ice	Acid																	
				X		X				X														Special Detection Limit/reporting
				X		X				X														Special QA/QC
				X		X				X														Remarks
				X		X				X														Lab Number

Condition of sample:					Temperature received:					Expedited 5 Business Days <input type="checkbox"/>		
Relinquished by sampler				Date	Time	Received by					Rush 2 Business Days <input type="checkbox"/>	
Relinquished by				Date	Time	Received by					Expedited 10 Business Days <input type="checkbox"/>	
Relinquished by				Date	Time	Received by laboratory			Date		Time	

**APPENDIX D**

**CERTIFIED ANALYTICAL REPORTS,  
AND CHAIN-OF-CUSTODY DOCUMENTATION  
FOR SOIL-VAPOR EXTRACTION SYSTEM**



**Sequoia Analytical**

680 Chesapeake Drive  
404 N. Wiget Lane  
819 Sutter Avenue, Suite B  
1485 McDowell Blvd. North, Ste. D

Redwood City, CA 94063  
Walnut Creek, CA 94598  
Sacramento, CA 95834  
Petaluma, CA 94954

(650) 364-9600  
(925) 988-9600  
(916) 921-9600  
(707) 792-1865

FAX  
FAX (1)  
FAX (70)

**FACSIMILE TRANSMISSION**

To:

Name: Glenn Vanderveen  
Company: Pinnacle ITT  
Fax #: 1-510-663-3315

From:

**Dimple Sharma**

SEQUOIA ANALYTICAL, WALNUT CREEK  
Telephone: (925) 988-9600  
FAX: (925) 988-9673

Date: 8-23-99

10/2/98  
11/18/98  
12/2/98  
4/21/99

Number of Pages (including this page): 4

Comments:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

If you have any problems receiving this transmission, please call (925) 988-9600. Because access to receiving equipment is not under our control, Sequoia Analytical cannot be responsible for the confidentiality of electronically transmitted data.



# Sequoia Analytical

404 N. Wiget Lane  
Walnut Creek, CA 94598  
(925) 988-9600  
FAX (925) 988-9673

Pinnacle/IT  
2201 Broadway, Suite 101  
Oakland, CA 94612  
Attention: Glenn Vanderveen

Client Project ID: Arco # 2169, Oakland  
Sample Matrix: Air  
Analysis Method: EPA 5030/8015 Mod./8020  
First Sample #: W908393-01

Sampled: Aug 19, 1999  
Received: Aug 19, 1999  
Reported: Aug 23, 1999

QC Batch Number: GC082099 GC082099  
802002A 802002A

## TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit µg/L	Sample I.D. W908393-01 I-1	Sample I.D. 02 E-1
Purgeable Hydrocarbons	10	740	N.D.
Benzene	0.050	22	0.16
Toluene	0.050	3.4	N.D.
Ethyl Benzene	0.050	0.64	N.D.
Total Xylenes	0.050	1.4	0.13
MTBE	0.25	20	0.46

Chromatogram Pattern: Gasoline & Unidentified Hydrocarbons < C6

Quality Control Data		
Report Limit Multiplication Factor:	10	1.0
Date Analyzed:	8/20/99	8/20/99
Instrument Identification:	HP-2	HP-2
Surrogate Recovery, %: (QC Limits = 70-130%)	161*	81

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.  
Analytes reported as N.D. were not detected above the stated reporting limit.

SEQUOIA ANALYTICAL, #1271

*Dimple Sharma*  
Dimple Sharma  
Project Manager

Please Note:  
\*Surrogate recovery above upper control limit due to coelution.





# Sequoia Analytical

404 N. Wiget Lane  
Walnut Creek, CA 94598  
(925) 988-9600  
FAX (925) 988-9673

Pinnacle/IT  
2201 Broadway, Suite 101  
Oakland, CA 94612  
Attention: Glenn Vanderveen

Client Project ID: Arco # 2169, Oakland  
Sample Matrix: Air  
Analysis Method: EPA 5030/8015 Mod./8020  
First Sample #: W908393-01

Sampled: Aug 19, 1999  
Received: Aug 19, 1999  
Reported: Aug 23, 1999

QC Batch Number: GC082099 GC082099

802002A 802002A

## TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit PPMV	Sample I.D. W908393-01 I-1	Sample I.D. 02 E-1
Purgeable Hydrocarbons	2.4	180	N.D.
Benzene	0.016	6.9	0.050
Toluene	0.013	0.90	N.D.
Ethyl Benzene	0.012	0.15	N.D.
Total Xylenes	0.012	0.32	0.030
MTBE	0.069	5.5	0.13

Chromatogram Pattern: Gasoline & Unidentified Hydrocarbons < C6

Quality Control Data		
Report Limit Multiplication Factor:	10	1.0
Date Analyzed:	8/20/99	8/20/99
Instrument Identification:	HP-2	HP-2
Surrogate Recovery, %: (QC Limits = 70-130%)	161*	81

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard  
Analytes reported as N.D. were not detected above the stated reporting limit

SEQUOIA ANALYTICAL, #1271

*Dimple Sharma*  
Dimple Sharma  
Project Manager

Please Note:  
\*Surrogate recovery above upper control limit due to coelution.



**ARCO Products Company**

Division of AtlanticRichfield Company

Task Order No. **24070.00**

**W908393**

**Chain of Custody**

ARCO Facility no. <b>2169</b>	City (Facility) <b>Oakland</b>	Project manager (Consultant) <b>Glen VanderVeen</b>	Laboratory name <b>SEQUOIA</b>
ARCO engineer <b>Paul Supple</b>	Telephone no (ARCO)	Telephone no. (Consultant) <b>510 740 5807</b>	Contract number
Consultant name <b>Pinnacle/IT</b>	Address (Consultant) <b>2201 Broadway Suite 101 Oakland CA 94612</b>		
		Fax no. (Consultant) <b>510 663 3315</b>	

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX EPA 801/802	BTEX/TPH EPA 100/200/400/16	TPH Method B015 C04 <input type="checkbox"/> D04 <input type="checkbox"/>	Oil and Grease 413.1 <input type="checkbox"/> 413.2 <input type="checkbox"/>	TPH EPA 418.1/504/505	EPA 801/8010	EPA 804/8040	EPA 805/8050	TCP Mercury <input type="checkbox"/> VOA <input type="checkbox"/> VOA <input type="checkbox"/> Semi <input type="checkbox"/>	CML Metals EPA 8210/7000 TLC <input type="checkbox"/> STLC <input type="checkbox"/>	Lead Cu/Zn/Hg Lead EPA 7120/7121 <input type="checkbox"/>	Method of shipment	
			Soil	Water	Other	Ice	Acid															
<b>I-1</b>					<b>X</b>			<b>8/19/99</b>	<b>11:30</b>		<b>X</b>		<b>01</b>									Special detection Limit/reporting
<b>E1</b>					<b>X</b>			<b>8/19/99</b>	<b>11:20</b>		<b>X</b>		<b>02</b>									report in ppmv
																						Special QA/QC
																						Remarks
																						<b>IZAT 8</b>
																						Lab number
																						Turnaround time

Condition of sample:	Temperature received:	Priority Rush 1 Business Day <input type="checkbox"/>
Relinquished by sampler <b>Mark Chet...</b>	Date <b>8/17/99</b> Time <b>11:35</b>	Rush 2 Business Days <input checked="" type="checkbox"/>
Relinquished by	Date	Expedited 5 Business Days <input type="checkbox"/>
Relinquished by	Date	Standard 10 Business Days <input type="checkbox"/>
	Received by laboratory <b>[Signature]</b> (WC)	
	Date <b>8/19/99</b> Time <b>1:35</b>	





September 14, 1999

Service Request No.: S9902758

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

**RE: TO#24070.00/RAT8/2169 OAKLAND**

Dear Mr. Vanderveen:

Enclosed are the results of the sample(s) submitted to our laboratory on September 8, 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 13, following, have been thoroughly reviewed and approved for release.

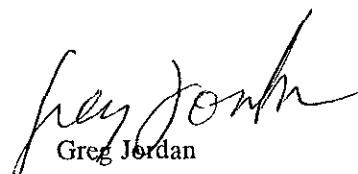
Columbia Analytical Services is certified for environmental analyses by the California Department of Health Services (certificate number: 1496, expiration: January 31, 2001).

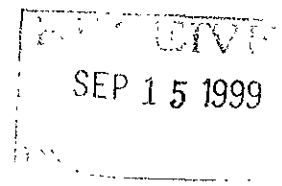
If you have any questions, please call me at (408) 748-9700.

Respectfully submitted,

Columbia Analytical Services, Inc.

  
Bernadette Troncales  
Project Chemist

  
Greg Jordan  
Laboratory Director



**COLUMBIA ANALYTICAL SERVICES, Inc.**

**Acronyms**

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

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

**Client:** ARCO Products Company  
**Project:** TO#24070.00/RAT8/2169 OAKLAND  
**Sample Matrix:** Air

**Service Request:** S9902758  
**Date Collected:** 9/8/99,  
**Date Received:** 9/8/99

BTEX and Total Volatile Hydrocarbons

**Sample Name:** I-1  
**Lab Code:** S9902758-001  
**Test Notes:**

**Units:** mg/m3  
**Basis:** NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8020	0.4	1	NA	9/9/99	0.5	
Toluene	NONE	8020	0.4	1	NA	9/9/99	0.6	
Ethylbenzene	NONE	8020	0.5	1	NA	9/9/99	1.0	
Xylenes, Total	NONE	8020	0.9	1	NA	9/9/99	3.7	
<b>Total Volatile Hydrocarbons:</b>								
C1 - C5	NONE	8015M	12	1	NA	9/9/99	150	
C6 - C12	NONE	8015M	20	1	NA	9/9/99	290	
TPH as Gasoline*	NONE	8015M	20	1	NA	9/9/99	290	
Methyl tert-Butyl Ether	NONE	8020	3	1	NA	9/9/99	4	

\* TPH as gasoline is defined as C6 (benzene) through C12 (dodecane) and uses a molecular weight of 100 to calculate the ppmv.

Approved By: \_\_\_\_\_ *PJT* Date: 09/14/99

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

**Client:** ARCO Products Company  
**Project:** TO#24070.00/RAT8/2169 OAKLAND  
**Sample Matrix:** Air

**Service Request:** S9902758  
**Date Collected:** 9/8/99  
**Date Received:** 9/8/99


BTEX and Total Volatile Hydrocarbons

**Sample Name:** I-1  
**Lab Code:** S9902758-001  
**Test Notes:**

**Units:** ppmV  
**Basis:** NA

<b>Analyte</b>	<b>Prep Method</b>	<b>Analysis Method</b>	<b>MRL</b>	<b>Dilution Factor</b>	<b>Date Extracted</b>	<b>Date Analyzed</b>	<b>Result</b>	<b>Result Notes</b>	
Benzene	NONE	8020	0.1	1	NA	9/9/99	0.2		
Toluene	NONE	8020	0.1	1	NA	9/9/99	0.2		
Ethylbenzene	NONE	8020	0.1	1	NA	9/9/99	0.2		
Xylenes, Total	NONE	8020	0.2	1	NA	9/9/99	0.9		
<b>Total Volatile Hydrocarbons:</b>							9/9/99		
C1 - C5	NONE	8015M	5	1	NA	9/9/99	63		
C6 - C12	NONE	8015M	5	1	NA	9/9/99	71		
TPH as Gasoline*	NONE	8015M	5	1	NA	9/9/99	71		
Methyl tert-Butyl Ether	NONE	8020	0.8	1	NA	9/9/99	1.1		

\* TPH as gasoline is defined as C6 (benzene) through C12 (dodecane) and uses a molecular weight of 100 to calculate the ppmv.

Approved By: \_\_\_\_\_  Date: 09/14/99

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

**Client:** ARCO Products Company  
**Project:** TO#24070.00/RAT8/2169 OAKLAND  
**Sample Matrix:** Air

**Service Request:** S9902758  
**Date Collected:** 9/8/99  
**Date Received:** 9/8/99

BTEX and Total Volatile Hydrocarbons

**Sample Name:** E-1  
**Lab Code:** S9902758-002  
**Test Notes:**

**Units:** mg/m3  
**Basis:** NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8020	0.4	1	NA	9/9/99	ND	
Toluene	NONE	8020	0.4	1	NA	9/9/99	ND	
Ethylbenzene	NONE	8020	0.5	1	NA	9/9/99	ND	
Xylenes, Total	NONE	8020	0.9	1	NA	9/9/99	ND	
<b>Total Volatile Hydrocarbons:</b>								
C1 - C5	NONE	8015M	12	1	NA	9/9/99	ND	
C6 - C12	NONE	8015M	20	1	NA	9/9/99	ND	
TPH as Gasoline*	NONE	8015M	20	1	NA	9/9/99	ND	
Methyl tert-Butyl Ether	NONE	8020	3	1	NA	9/9/99	ND	

\* TPH as gasoline is defined as C6 (benzene) through C12 (dodecane) and uses a molecular weight of 100 to calculate the ppmv.

Approved By: \_\_\_\_\_

Date: \_\_\_\_\_

09/14/99

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

**Client:** ARCO Products Company  
**Project:** TO#24070.00/RAT8/2169 OAKLAND  
**Sample Matrix:** Air

**Service Request:** S9902758  
**Date Collected:** 9/8/99  
**Date Received:** 9/8/99

**BTEX and Total Volatile Hydrocarbons**

**Sample Name:** E-1  
**Lab Code:** S9902758-002  
**Test Notes:**

**Units:** ppmV  
**Basis:** NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8020	0.1	1	NA	9/9/99	ND	
Toluene	NONE	8020	0.1	1	NA	9/9/99	ND	
Ethylbenzene	NONE	8020	0.1	1	NA	9/9/99	ND	
Xylenes, Total	NONE	8020	0.2	1	NA	9/9/99	ND	
<b>Total Volatile Hydrocarbons:</b>								
C1 - C5	NONE	8015M	5	1	NA	9/9/99	ND	
C6 - C12	NONE	8015M	5	1	NA	9/9/99	ND	
TPH as Gasoline*	NONE	8015M	5	1	NA	9/9/99	ND	
Methyl tert-Butyl Ether	NONE	8020	0.8	1	NA	9/9/99	ND	

\* TPH as gasoline is defined as C6 (benzene) through C12 (dodecane) and uses a molecular weight of 100 to calculate the ppmv.

Approved By: \_\_\_\_\_ *AT* \_\_\_\_\_ Date: 09/14/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company  
 Project: TO#24070.00/RAT8/2169 OAKLAND  
 Sample Matrix: Air

Service Request: S9902758  
 Date Collected: NA  
 Date Received: NA

BTEX and Total Volatile Hydrocarbons

Sample Name: Method Blank  
 Lab Code: S990909-VB1  
 Test Notes:

Units: mg/m3  
 Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8020	0.4	1	NA	9/9/99	ND	
Toluene	NONE	8020	0.4	1	NA	9/9/99	ND	
Ethylbenzene	NONE	8020	0.5	1	NA	9/9/99	ND	
Xylenes, Total	NONE	8020	0.9	1	NA	9/9/99	ND	
Total Volatile Hydrocarbons:								
C1 - C5	NONE	8015M	12	1	NA	9/9/99	ND	
C6 - C12	NONE	8015M	20	1	NA	9/9/99	ND	
TPH as Gasoline*	NONE	8015M	20	1	NA	9/9/99	ND	
Methyl tert-Butyl Ether	NONE	8020	3	1	NA	9/9/99	ND	

\* TPH as gasoline is defined as C6 (benzene) through C12 (dodecane) and uses a molecular weight of 100 to calculate the ppmv.

Approved By: \_\_\_\_\_

*HT*

Date: \_\_\_\_\_

*09/14/99*

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company  
Project: TO#24070.00/RAT8/2169 OAKLAND  
Sample Matrix: Air

Service Request: S9902758  
Date Collected: NA  
Date Received: NA

BTEX and Total Volatile Hydrocarbons

Sample Name: Method Blank  
Lab Code: S990909-VB1  
Test Notes:

Units: ppmV  
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8020	0.1	1	NA	9/9/99	ND	
Toluene	NONE	8020	0.1	1	NA	9/9/99	ND	
Ethylbenzene	NONE	8020	0.1	1	NA	9/9/99	ND	
Xylenes, Total	NONE	8020	0.2	1	NA	9/9/99	ND	
Total Volatile Hydrocarbons:								
C1 - C5	NONE	8015M	5	1	NA	9/9/99	ND	
C6 - C12	NONE	8015M	5	1	NA	9/9/99	ND	
TPH as Gasoline*	NONE	8015M	5	1	NA	9/9/99	ND	
Methyl tert-Butyl Ether	NONE	8020	1.4	1	NA	9/9/99	ND	

\* TPH as gasoline is defined as C6 (benzene) through C12 (dodecane) and uses a molecular weight of 100 to calculate the ppmv.

Approved By: \_\_\_\_\_

Date: \_\_\_\_\_



COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company  
 Project: TO#24070.00/RAT8/2169 OAKLAND  
 Sample Matrix: Air

Service Request: S9902758  
 Date Collected: 9/8/99  
 Date Received: 9/8/99  
 Date Extracted: NA  
 Date Analyzed: 9/9/99

Duplicate Summary  
 BTEX and Total Volatile Hydrocarbons

Sample Name: I-1  
 Lab Code: S9902758-001DUP  
 Test Notes:

Units: mg/m3  
 Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Benzene	NONE	8020	0.4	0.5	0.5	0.5	<1	
Toluene	NONE	8020	0.4	0.6	0.5	0.6	17	
Ethylbenzene	NONE	8020	1.0	1.0	0.8	0.9	11	
Xylenes, Total	NONE	8020	0.9	3.7	3.5	3.6	3	
Total Volatile Hydrocarbons								
C1 - C5	NONE	8015M	12	150	200	180	22	
C6 - C12	NONE	8015M	20	290	220	260	27	
TPH as Gasoline*	NONE	8015M	20	290	220	260	27	
Methyl tert-Butyl Ether	NONE	8020	3	4	4	4	<1	

Approved By: \_\_\_\_\_

*det*

Date: \_\_\_\_\_

*09/14/99*

**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

**Client:** ARCO Products Company  
**Project:** TO#24070.00/RAT8/2169 OAKLAND  
**Sample Matrix:** Air

**Service Request:** S9902758  
**Date Collected:** 9/8/99  
**Date Received:** 9/8/99  
**Date Extracted:** NA  
**Date Analyzed:** 9/9/99

Duplicate Summary  
 BTEX and Total Volatile Hydrocarbons

**Sample Name:** I-1  
**Lab Code:** S9902758-001DUP  
**Test Notes:**

**Units:** ppmV  
**Basis:** NA

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Benzene	NONE	8020	0.1	0.16	0.16	0.16	<1	
Toluene	NONE	8020	0.1	0.16	0.13	0.15	14	
Ethylbenzene	NONE	8020	0.1	0.23	0.18	0.21	15	
Xylenes, Total	NONE	8020	0.2	0.85	0.81	0.83	5	
Total Volatile Hydrocarbons								
C1 - C5	NONE	8015M	5	63	84	74	28	
C6 - C12	NONE	8015M	5	71	54	63	27	
TPH as Gasoline*	NONE	8015M	5	71	54	63	27	
Methyl tert-Butyl Ether	NONE	8020	0.8	1.1	1.1	1.1	<1	

Approved By: \_\_\_\_\_



Date: \_\_\_\_\_

09/14/99







