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RO77

LOP 36 286

March 14, 2000
Project 791673

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

Re: Quarterly Groundwater Monitoring Results and SVE Remediation System
Performance Evaluation Report, Fourth Quarter 1999, for ARCO Service Station
No. 6148, located at 5131 Shattuck 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 fourth quarter 1999 groundwater monitoring Program at ARCO Products Company (ARCO) Service Station No. 6148, located at 5131 Shattuck Avenue, Oakland, California. Operation and performance data for the on-site soil-vapor extraction (SVE), air-sparge (AS), and air-bubbling remediation systems are also presented. The monitoring program complies with Alameda County Health Care Services Agency (ACHCSA) requirements regarding underground tank investigations.

Please call if you have questions.

Sincerely,

Pinnacle

Dan Lescure
Project Manager

Dan Easter, R.G. 5722
Project Geologist

Attachment: Quarterly Groundwater Monitoring Report, Fourth Quarter 1999

cc: Susan Hugo, ACHCSA

Date: March 14, 2000**ARCO QUARTERLY GROUNDWATER MONITORING REPORT**

Station No.: 6148 Address: 5131 Shattuck Avenue, Oakland, California
Pinnacle Project No. 791673
ARCO Environmental Engineer/Phone No.: Paul Supple /(925) 299-8891
Pinnacle Project Manager/Phone No.: Dan Lescure /(510) 740-5804
Primary Agency/Regulatory ID No.: ACHCSA /Susan Hugo

WORK PERFORMED THIS QUARTER (FOURTH - 1999):

1. Prepared and submitted quarterly remediation system performance evaluation report for third quarter 1999.
2. Performed quarterly groundwater monitoring and sampling for fourth quarter 1999.
3. Investigated continued operational failure of SVE system.
4. Bubbled air into well MW-2 and MW-3 to introduce dissolved oxygen into the groundwater, thereby enhancing biodegradation of petroleum hydrocarbons in groundwater in the vicinity of the well.
5. Procured BAAQMD permit renewal.

WORK PROPOSED FOR NEXT QUARTER (FIRST - 2000):

1. Prepare and submit quarterly groundwater monitoring report for fourth quarter 1999.
2. Perform quarterly groundwater monitoring and sampling for first quarter 2000.
3. Continue investigation of the SVE system operational failure and repair as necessary.
4. Restart soil-vapor extraction (SVE) and air-sparge systems if hydrocarbon removal rates in extracted soil vapor warrant.
5. Continue bubbling air into well MW-2, MW-3 and others as applicable.

QUARTERLY MONITORING:

Current Phase of Project: Quarterly Groundwater Monitoring and Operation and Maintenance of Remediation Systems
Due to various control faults, the SVE system was non-operational during the fourth quarter 1999.

Frequency of Sampling: Annual (1st Quarter): MW-6, MW-7
Semi-Annual (1st/3rd Quarter): MW-4
Quarterly: MW-1, MW-2, MW-3, MW-5

Frequency of Monitoring: Quarterly (groundwater),
Monthly (SVE, air-sparge, and air-bubbling)

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

Bulk Soil Removed to Date : 560 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, Air-Sparge, and Air-Bubbling Systems

Average Depth to Groundwater: 15.8 feet

Groundwater Flow Direction and Gradient (Average): 0.01 ft/ft toward southwest

SVE QUARTERLY OPERATION AND PERFORMANCE:

Equipment Inventory:	Therm Tech Model CATVAC-10E, Electric/Catalytic Oxidizer
Operating Mode:	Catalytic Oxidation
BAAQMD Permit #:	25126
TPH Conc. End of Period (lab):	24 ppmv
Benzene Conc. End of Period (lab):	20.1 ppmv
Flowrate End of Period:	64.4 cfm
HC Destroyed This Period:	1.41 pounds
HC Destroyed to Date:	1893.6 pounds
Utility Usage	
Electric (kWh):	Not available
Operating Hours This Period:	14 hours
Percent Operational:	0.5%
Operating Hours to Date:	2730.71 hours
Unit Maintenance:	Routine monthly maintenance
Number of Auto Shut Downs:	0
Destruction Efficiency Permit Requirement:	95% (POC >1000 ppmv); 90% (POC <1000 ppmv); waived (<1.0 lb./day TPH and <0.02 lb./day benzene)
Percent TPH Conversion:	Waived
Average Stack Temperature:	577.5°F
Average Source Flow:	57.7 cfm
Average Process Flow:	69.4 cfm
Average Source Vacuum:	8.7 inches of H ₂ O

DISCUSSION:

- The SVE system would not operate continuously due to various control faults. The system was non-operational for the fourth quarter 1999. Currently the problem with the SVE system is being investigated and will be repaired as soon as possible.

ATTACHMENTS:

- Table 1 - Historical Groundwater Elevation and Analytical Data, Petroleum Hydrocarbons and Their Constituents
- Table 2 - Groundwater Flow Direction and Gradient
- Table 3 - SVE Operational Uptime Information
- Table 4 - SVE Flow Rates and Analytical Results of Air Samples
- Table 5 - SVE 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

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

ARCO Service Station 6148
5131 Shattuck Avenue, Oakland, California

Well Number	Date Gauged/ Sampled	Top of Casing Elevation (ft-MSL)	Depth to Water (feet)	FP Thickness (feet)	Groundwater Elevation (ft-MSL)	TPH					Total Xylenes (µg/L)	MTBE (µg/L)	TRPH (mg/L)	Dissolved Oxygen (mg/L)	Purged/ Not Purged (P/NP)
						Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl- benzene (µg/L)						
MW-1	03-20-95	108.03	15.75	ND	92.28	830	140	5	41	110	--	--			
MW-1	06-06-95	108.03	17.68	ND	90.35	210	30	<0.5	7.3	16	--	--			
MW-1	08-24-95	107.80	17.45	ND	90.35	Not sampled: well was inaccessible due to construction									
MW-1	11-16-95	107.80	17.64	ND	90.16	<50	5.6	<0.5	1.4	1.2	55	--			
MW-1	02-27-96	107.80	15.21	ND	92.59	1,400	240	88	44	110	200	--			
MW-1	05-15-96	107.80	17.53	ND	90.27	Not sampled: well sampled semi-annually, during the first and third quarter									
MW-1	08-14-96	107.80	17.15	ND	90.65	98	18	<0.5	1.9	1	45	--			
MW-1	11-11-96	107.80	17.78	ND	90.02	Not sampled: well sampled semi-annually, during the first and third quarter									
MW-1	03-25-97	107.80	17.68	ND	90.12	<50	<0.5	<0.5	<0.5	<0.5	<3	--			
MW-1	05-15-97	107.80	17.91	ND	89.89	Not sampled: well sampled semi-annually, during the first and third quarter									
MW-1	10-26-97	107.80	18.85	ND	88.95	<50	<0.5	<0.5	<0.5	<0.5	<3	--			
MW-1	11-10-97	107.80	18.10	ND	89.70	<50	<0.5	<0.5	<0.5	<0.5	4	--			
MW-1	02-13-98	107.80	13.15	ND	94.65	<100	8.4	<1	<1	14	130	--			
MW-1	05-12-98	107.80	12.30	ND	95.50	<50	<0.5	<0.5	<0.5	<0.5	<3	--			
MW-1	07-28-98	107.80	17.04	ND	90.76	<50	<0.5	<0.5	<0.5	<0.5	<3	--			
MW-1	10-28-98	107.80	18.10	ND	89.70	<50	<0.5	<0.5	<0.5	<0.5	<3	--			
MW-1	02-12-99	107.80	15.84	ND	91.96	72	<0.5	<0.5	<0.5	<0.5	23	--			
MW-1	06-03-99	107.80	17.62	ND	90.18	890	33	1.5	12	2.8	250	--	1.44	NP	
MW-1	10-26-99	107.80	16.92	ND	90.88	<50	<0.5	<0.5	<0.5	<1	9	--	9.58	NP	
MW-2	03-20-95	107.43	15.50	ND#	91.93	Not sampled: floating product entered well during purging									
MW-2	06-06-95	107.43	17.43	ND	90.00	1,200	60	21	35	140	--	--			
MW-2	08-24-95	107.28	17.22	ND	90.06	Not sampled: well was inaccessible due to construction									
MW-2	11-16-95	107.28	17.36	ND	89.92	360	45	1.3	7.1	7.5	210	--			
MW-2	02-27-96	107.28	14.82	ND	92.46	8,900	1,400	980	150	550	940	--			
MW-2	05-15-96	107.28	17.40	ND	89.88	480	82	48	8	48	87	--			
MW-2	08-14-96	107.28	17.00	ND	90.28	130	22	4	2	9	120	--			

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Well Number	Date Gauged/ Sampled	Top of Casing Elevation (ft-MSL)	Depth to Water (feet)	FP Thickness (feet)	Groundwater Elevation (ft-MSL)	TPH			Ethyl- benzene (µg/L)	Total Xylenes (µg/L)	MTBE (µg/L)	TRPH (mg/L)	Dissolved Oxygen (mg/L)	Purged/ Not Purged (P/NP)
						Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)						
MW-2	11-11-96	107.28	17.55	ND	89.73	1,200	150	120	21	160	110	--		
MW-2	03-25-97	107.28	17.32	ND	89.96	670	23	58	13	120	28	--		
MW-2	05-15-97	107.28	17.61	ND	89.67	<50	<0.5	<0.5	<0.5	<0.5	23	--		
MW-2	10-26-97	107.28	18.43	ND	88.85	<50	<0.5	<0.5	<0.5	<0.5	<3	--		
MW-2	11-10-97	107.28	17.84	ND	89.44	<100	<1	<1	<1	1	74	--		
MW-2	02-13-98	107.28	12.75	ND	94.53	220	9.5	3.9	3.7	48	84	--		
MW-2	05-12-98	107.28	17.02	ND	90.26	3,900	210	280	86	910	35	--		
MW-2	07-28-98	107.28	17.30	ND	89.98	<50	<0.5	<0.5	<0.5	<0.5	<3	--		
MW-2	10-28-98	107.28	17.80	ND	89.48	170	17	<0.5	1.7	5.0	24	--		
MW-2	02-12-99	107.28	15.55	ND	91.73	12,000	620	95	490	2,200	270	--		
MW-2	06-03-99	107.28	17.31	ND	89.97	<50	<0.5	<0.5	<0.5	1.1	8	--	2.53	NP
MW-2	10-26-99	107.28	16.58	ND	90.70	<50	1.0	<0.5	<0.5	3	<3	--	8.17	NP
MW-3	03-20-95	107.77	15.60	ND	92.17	29,000	880	190	760	2,000	--	16		
MW-3	06-06-95	107.77	17.54	ND	90.23	22,000	450	54	380	1,300	--	7.1		
MW-3	08-24-95	107.61	17.42	ND	90.19	Not sampled: well was inaccessible due to construction								
MW-3	11-16-95	107.61	17.58	ND	90.03	13,000	210	<20	320	1,000	790	8.3		
MW-3	02-27-96	107.61	15.03	ND	92.58	9,700	94	15	290	720	430	10		
MW-3	05-15-96	107.61	17.35	ND	90.26	5,600	66	12	37	67	230	--		
MW-3	08-14-96	107.61	17.10	ND	90.51	830	17	<1*	8	7	110	--		
MW-3	11-11-96	107.61	17.73	ND	89.88	500	28	3	12	13	150	--		
MW-3	03-25-97	107.61	17.99	ND	89.62	<50	<0.5	<0.5	<0.5	<0.5	94	--		
MW-3	05-15-97	107.61	17.84	ND	89.77	<50	<0.5	<0.5	<0.5	<0.5	65	--		
MW-3	10-26-97	107.61	18.50	ND	89.11	220	4	<1	<1	<1	160	--		
MW-3	11-10-97	107.61	18.00	ND	89.61	350	8	<2	3	3	230	--		
MW-3	02-13-98	107.61	13.00	ND	94.61	<50	1.3	<0.5	<0.5	1	21	--		
MW-3	05-12-98	107.61	17.20	ND	90.41	120	<0.5	<0.5	<0.5	<0.9	71	--		

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MW-3	07-28-98	107.61	17.46	ND	90.15	<50	1.4	<0.5	<0.5	<0.5	52	--				
MW-3	10-28-98	107.61	18.00	ND	89.61	170	<0.5	<0.5	<0.5	0.7	35	--				
MW-3	02-12-99	107.61	15.76	ND	91.85	120	2.0	0.6	<0.5	1.3	37	--				
MW-3	06-03-99	107.61	Well inaccessible: Surveyed well VW-1 as an alternative -----													
MW-3	10-26-99	107.61	16.69	ND	90.92	630	14	0.7	13	2	38	--	1.24	NP		
MW-4	03-20-95	106.58	13.85	ND	92.73	88	1	<0.5	<0.5	0.7	--	--				
MW-4	06-06-95	106.58	15.70	ND	90.88	<50	<0.5	<0.5	<0.5	<0.5	--	--				
MW-4	08-24-95	106.71	15.86	ND	90.85	Not sampled: well was inaccessible due to construction										
MW-4	11-16-95	106.71	16.10	ND	90.61	<50	<0.5	<0.5	<0.5	<0.5	6	--				
MW-4	02-27-96	106.71	13.72	ND	92.99	<50	<0.5	<0.5	<0.5	<0.5	10	--				
MW-4	05-15-96	106.71	15.90	ND	90.81	Not sampled: well sampled semi-annually, during the first and third quarter										
MW-4	08-14-96	106.71	15.68	ND	91.03	<50	<0.5	<0.5	<0.5	<0.5	<3	--				
MW-4	11-11-96	106.71	16.19	ND	90.52	Not sampled: well sampled semi-annually, during the first and third quarter										
MW-4	03-25-97	106.71	16.10	ND	90.61	<50	<0.5	<0.5	<0.5	<0.5	<3	--				
MW-4	05-15-97	106.71	16.38	ND	90.33	Not sampled: well sampled semi-annually, during the first and third quarter										
MW-4	10-26-97	106.71	17.78	ND	88.93	<50	<0.5	<0.5	<0.5	<0.5	<3	--				
MW-4	11-10-97	106.71	16.43	ND	90.28	Not sampled: well sampled semi-annually, during the first and third quarter										
MW-4	02-13-98	106.71	13.05	ND	93.66	<50	1.3	0.7	<0.5	2.3	19	--				
MW-4	05-12-98	106.71	15.69	ND	91.02	Not sampled: well sampled semi-annually, during the first and third quarter										
MW-4	07-28-98	106.71	15.93	ND	90.78	<50	<0.5	<0.5	<0.5	<0.5	<3	--				
MW-4	10-28-98	106.71	16.40	ND	90.31	Not sampled: well sampled semi-annually, during the first and third quarter										
MW-4	02-12-99	106.71	14.13	ND	92.58	<50	<0.5	<0.5	<0.5	<0.5	<3	--				
MW-4	06-03-99	106.71	16.00	ND	90.71	Not sampled: well sampled semi-annually, during the first and third quarter										
MW-4	10-26-99	106.71	15.76	ND	90.95	Not sampled: well sampled semi-annually, during the first and third qtr.									1.72	
MW-5	03-20-95	106.68	14.92	ND	91.76	21,000	6,900	450	800	1,300	--	--				

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MW-5	06-06-95	106.68	16.61	ND	90.07	6,500	1,700	<20	120	69	--	--		
MW-5	08-24-95	106.60	16.47	ND	90.13	Not sampled: well was inaccessible due to construction								
MW-5	11-16-95	106.60	16.69	ND	89.91	1,800	470	<5	17	5	1,000	--		
MW-5	02-27-96	106.60	14.35	ND	92.25	10,000	1,000	71	690	1,000	440/450*	--		
MW-5	05-15-96	106.60	16.58	ND	90.02	3,400	350	6	72	20	220	--		
MW-5	08-14-96	106.60	17.26	ND	89.34	2,100	130	2.7	47	4.7	220	--		
MW-5	11-11-96	106.60	16.62	ND	89.98	1,200	31	1	8	2	130	--		
MW-5	03-25-97	106.60	16.38	ND	90.22	<50	<0.5	<0.5	<0.5	<0.5	5	--		
MW-5	05-15-97	106.60	16.54	ND	90.06	<50	<0.5	<0.5	<0.5	<0.5	<3	--		
MW-5	10-26-97	106.60	17.60	ND	89.00	<50	<0.5	<0.5	<0.5	<0.5	7	--		
MW-5	11-10-97	106.60	16.78	ND	89.82	<50	<0.5	<0.5	<0.5	<0.5	24	--		
MW-5	02-13-98	106.60	12.21	ND	94.39	11,200	51	<10	<10	<10	2,000	--		
MW-5	05-12-98	106.60	NR	ND	NR	Not sampled: well inaccessible								
MW-5	07-28-98	106.60	16.47	ND	90.13	<50	<0.5	<0.5	<0.5	<0.5	<3	--		
MW-5	10-28-98	106.60	16.80	ND	89.80	<50	0.8	<0.5	<0.5	<0.5	99	--		
MW-5	02-12-99	106.60	14.88	ND	91.72	<1,000	<10	<10	<10	<10	1,100	--		
MW-5	06-03-99	106.60	16.65	ND	89.95	290	10	<0.5	<0.5	0.6	200	--	2.45	NP
MW-5	10-26-99	106.60	16.10	ND	90.50	<50	<0.5	<0.5	<0.5	<1	11	--	NM	NP
MW-6	03-20-95	105.16	12.13	ND	93.03	<50	<0.5	<0.5	<0.5	<0.5	--	--		
MW-6	06-06-95	105.16	13.95	ND	91.21	<50	<0.5	<0.5	<0.5	<0.5	--	--		
MW-6	08-24-95	105.13	14.07	ND	91.06	<50	<0.5	<0.5	<0.5	<0.5	<3	--		
MW-6	11-16-95	105.13	14.34	ND	90.79	<60	<0.5	<0.5	<0.5	<0.5	--	--		
MW-6	02-27-96	105.13	12.00	ND	93.13	<50	<0.5	<0.5	<0.5	<0.5	<3	--		
MW-6	05-15-96	105.13	14.10	ND	91.03	Not sampled: well sampled annually, during the first quarter								
MW-6	08-14-96	105.13	13.70	ND	91.43	Not sampled: well sampled annually, during the first quarter								
MW-6	11-11-96	105.13	14.11	ND	91.02	Not sampled: well sampled annually, during the first quarter								

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Well Number	Date Gauged/ Sampled	Top of Casing Elevation (ft-MSL)	Depth to Water (feet)	FP Thickness (feet)	Groundwater Elevation (ft-MSL)	TPH						Dissolved Oxygen (mg/L)	Purged/ Not Purged (P/NP)
						Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl- benzene (µg/L)	Total Xylenes (µg/L)	MTBE (µg/L)		
MW-6	03-25-97	105.13	14.15	ND	90.98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	
MW-6	05-15-97	105.13	14.44	ND	90.69	Not sampled: well sampled annually, during the first quarter							
MW-6	10-26-97	105.13	16.02	ND	89.11	Not sampled: well sampled annually, during the first quarter							
MW-6	11-10-97	105.13	14.52	ND	90.61	Not sampled: well sampled annually, during the first quarter							
MW-6	02-13-98	105.13	10.06	ND	95.07	<50	<0.5	<0.5	<0.5	<0.5	8	--	
MW-6	05-12-98	105.13	13.75	ND	91.38	Not sampled: well sampled annually, during the first quarter							
MW-6	07-28-98	105.13	14.06	ND	91.07	Not sampled: well sampled annually, during the first quarter							
MW-6	10-28-98	105.13	14.71	ND	90.42	Not sampled: well sampled annually, during the first quarter							
MW-6	02-12-99	105.13	12.22	ND	92.91	<100	<1	<1	<1	<1	110	--	
MW-6	06-03-99	105.13	13.95	ND	91.18	Not sampled: well sampled annually, during the first quarter							
MW-6	10-26-99	105.13	14.06	ND	91.07	Not sampled: well sampled annually, during the first quarter							3.94
MW-7	03-20-95	107.08	12.32	ND	94.76	<50	<0.5	<0.5	<0.5	<0.5	--	--	
MW-7	06-06-95	107.08	14.59	ND	92.49	Not sampled: well sampled semi-annually, during the first and third quarters							
MW-7	08-24-95	107.05	14.64	ND	92.41	<50	<0.5	<0.5	<0.5	<0.5	<3	--	
MW-7	11-16-95	107.05	15.30	ND	91.75	Not sampled: well sampled semi-annually, during the first and third quarters							
MW-7	02-27-96	107.05	12.24	ND	94.81	<50	<0.5	<0.5	<0.5	<0.5	<3	--	
MW-7	05-15-96	107.05	14.65	ND	92.40	Not sampled: well sampled annually, during the first quarter							
MW-7	08-14-96	107.05	14.35	ND	92.70	Not sampled: well sampled annually, during the first quarter							
MW-7	11-11-96	107.05	14.92	ND	92.13	Not sampled: well sampled annually, during the first quarter							
MW-7	03-25-97	107.05	14.80	ND	92.25	<50	<0.5	<0.5	<0.5	<0.5	<3	--	
MW-7	05-15-97	107.05	15.27	ND	91.78	Not sampled: well sampled annually, during the first quarter							
MW-7	10-26-97	107.05	16.68	ND	90.37	Not sampled: well sampled annually, during the first quarter							
MW-7	11-10-97	107.05	15.37	ND	91.68	Not sampled: well sampled annually, during the first quarter							
MW-7	02-13-98	107.05	10.80	ND	96.25	<50	<0.5	<0.5	<0.5	<0.5	<3	--	
MW-7	05-12-98	107.05	14.32	ND	92.73	Not sampled: well sampled annually, during the first quarter							
MW-7	07-28-98	107.05	14.79	ND	92.26	Not sampled: well sampled annually, during the first quarter							

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

**ARCO Service Station 6148
5131 Shattuck Avenue, Oakland, California**

Well Number	Date Gauged/ Sampled	Top of Casing Elevation (ft-MSL)	Depth to Water (feet)	FP Thickness (feet)	Groundwater Elevation (ft-MSL)	TPH Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl- benzene (µg/L)	Total Xylenes (µg/L)	MTBE (µg/L)	TRPH (mg/L)	Dissolved Oxygen (mg/L)	Purged/ Not Purged (P/NP)
MW-7	10-28-98	107.05	15.57	ND	91.48	Not sampled: well sampled annually, during the first quarter								
MW-7	02-12-99	107.05	12.46	ND	94.59	<50	<0.5	<0.5	<0.5	<0.5	<3	--		
MW-7	06-03-99	107.05	14.53	ND	92.52	Not sampled: well sampled annually, during the first quarter								
MW-7	10-26-99	107.05	14.74	ND	92.31	Not sampled: well sampled annually, during the first quarter								
VW-1	06-03-99	NR	17.51	ND	NR	420	2.3	0.6	2.0	2.2	74	--	1.28	P

ft-MSL: elevation in feet, relative to mean sea level
 TPH: total petroleum hydrocarbons as gasoline, California DHS LUFT Method
 BTEX: Benzene, toluene, ethylbenzene, total xylenes by EPA method 8021B. (EPA method 8020 prior to 10/26/99)
 MTBE: Methyl tert-butyl ether by EPA method 8021B (EPA method 8020 prior to 10/26/99).
 TRPH: total recoverable petroleum hydrocarbons
 µg/L: micrograms per liter
 mg/L: milligrams per liter
 NR: not reported; data not available
 ND: none detected
 #: floating product entered the well during purging
 --: not analyzed or not applicable
 *: confirmed by EPA 8240
 **: For previous historical groundwater elevation and analytical data please refer to *Fourth Quarter 1995 Groundwater Monitoring Program Results and Remediation System Performance Evaluation Report, ARCO Service Station 6148, Oakland, California, (EMCON, March 4, 1996).*

Table 2
Groundwater Flow Direction and Gradient

ARCO Service Station 6148
5131 Shattuck Avenue, Oakland, California

Date Measured	Average Flow Direction	Average Hydraulic Gradient
03-20-95	Southwest	0.02
06-06-95	Southwest	0.016
08-24-95	Southwest	0.014
11-16-95	Southwest	0.012
02-27-96	Southwest	0.016
05-15-96	Southwest	0.015
08-14-96	Southwest	0.021
11-11-96	Southwest	0.015
03-25-97	South-Southwest	0.018
05-15-97	South-Southwest	0.014
10-26-97	Southwest	0.009
11-10-97	South-Southwest	0.014
02-13-98	South-Southwest	0.012
05-12-98	Southwest	0.02
07-28-98	Southwest	0.02
10-28-98	Southwest	0.01
02-12-99	Southwest	0.02
06-03-99	Southwest	0.02
10-26-99	Southwest	0.01

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

**Arco Service Station No. 6148
5131 Shattuck Avenue, Oakland, California**

Date	Meter (hrs.)	Operation ¹ (hrs.)	Period Operation				Cumulative Operation			
			Total (days)	Uptime (days)	Downtime (days)	Uptime (%)	Total (days)	Uptime (days)	Downtime (days)	Uptime (%)
01/01/98		2697.50					827	112.4	714.6	14%
01/27/98	2702.01	2697.50	26	0.0	26.0	0%	853	112.4	740.6	13%
02/10/98	2704.73	2700.22	14	0.1	13.9	1%	867	112.5	754.5	13%
02/16/98	2704.73	2700.22	6	0.0	6.0	0%	873	112.5	760.5	13%
03/23/98	2704.73	2700.22	35	0.0	35.0	0%	908	112.5	795.5	12%
05/06/98	2704.73	2700.22	44	0.0	44.0	0%	952	112.5	839.5	12%
05/13/98	2704.73	2700.22	7	0.0	7.0	0%	959	112.5	846.5	12%
06/22/98	2704.73	2700.22	40	0.0	40.0	0%	999	112.5	886.5	11%
08/20/98	2704.73	2700.22	59	0.0	59.0	0%	1058	112.5	945.5	11%
08/27/98	2707.40	2702.89	7	0.1	6.9	2%	1065	112.6	952.4	11%
09/01/98	2709.55	2705.04	5	0.1	4.9	2%	1070	112.7	957.3	11%
09/02/98	2711.93	2707.42	1	0.1	0.9	10%	1071	112.8	958.2	11%
11/10/98	2712.40	2707.89	69	0.0	69.0	0%	1140	112.8	1027.2	10%
12/18/98	2714.81	2710.3	38	0.1	37.9	0%	1178	112.9	1065.1	10%
01/15/99	2714.18	2709.67	28	0.0	28.0	0%	1206	112.9	1093.1	9%
04/27/99	2717.29	2712.78	102	0.1	101.9	0%	1308	113.0	1195.0	9%
05/26/99	2717.29	2712.78	29	0.0	29.0	0%	1337	113.0	1224.0	8%
07/30/99	2718.05	2713.54	65	0.0	65.0	0%	1402	113.1	1288.9	8%
08/11/99	2718.05	2713.54	12	0.0	12.0	0%	1414	113.1	1300.9	8%
08/25/99	2718.05	2713.54	14	0.0	14.0	0%	1428	113.1	1314.9	8%
09/09/99	2718.45	2713.94	15	0.0	15.0	0%	1443	113.1	1329.9	8%
09/21/99	2720.63	2716.12	12	0.1	11.9	1%	1455	113.2	1341.8	8%
10/06/99	2723.11	2718.6	15	0.1	14.9	1%	1470	113.3	1356.7	8%
10/20/99	2725.62	2721.11	14	0.1	13.9	1%	1484	113.4	1370.6	8%
11/03/99	2728.21	2723.7	14	0.1	13.9	1%	1498	113.5	1384.5	8%
11/18/99	2730.66	2726.15	15	0.1	14.9	1%	1513	113.6	1399.4	8%
12/02/99	2732.80	2728.29	14	0.1	13.9	1%	1527	113.7	1413.3	7%
12/16/99	2735.22	2730.71	14	0.1	13.9	1%	1541	113.8	1427.2	7%

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

**Arco Service Station No. 6148
5131 Shattuck Avenue, Oakland, California**

Date	Meter (hrs.)	Operation ¹ (hrs.)	Period Operation				Cumulative Operation			
			Total (days)	Uptime (days)	Downtime (days)	Uptime (%)	Total (days)	Uptime (days)	Downtime (days)	Uptime (%)
01/06/00	2735.22	2730.71	21	0.0	21.0	0%	1562	113.8	1448.2	7%

¹ Operational data through 01/01/98 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. 6148
5131 Shattuck Avenue, Oakland, California

Date	Sample Location	Vacuum (in. H2O)	Velocity (fpm)	Flowrate ¹ (scfm)	Analyses (ppmv)					
					TPHG	Benzene	Toulene	Ethylbenzene	Xylene	MTBE
01/27/98	Influent	21	1100	51	39	<0.1	0.7	0.1	<0.2	
	Effluent ²		1100	83.1	<5	<0.1	<0.1	<0.1	<0.2	
08/20/98	Influent	10	1100	53	610	<2	<2	<2	<4	
	Effluent		1100	83.1	7	<0.1	<0.1	<0.1	<0.2	
11/10/98	Influent	Not Recorded			830	<2	14	<2	<4	
	Effluent	Not Recorded			20	<0.1	0.2	<0.1	<0.2	
01/15/99	Influent	21.8	1500	70	340	3	5	<2	<4	44
	Effluent		900	63.9	15	<0.1	0.3	<0.1	0.2	<0.8
09/09/99	Influent	10	1400	67	140	0.3	1	0.2	0.5	6.3
	Effluent		975	69.2	<5	<0.1	<0.1	<0.1	<0.2	<0.8
10/06/99	Influent	8	1400	67	220	<0.5	1.4	0.65	3	11
	Effluent		975	69.2	7.1	<0.1	<0.1	<0.1	<0.2	<0.8
11/03/99	Influent	8	1200	58	44	0.3	3.1	0.1	0.6	21
	Effluent		1050	74.5	<5	<0.1	<0.1	<0.1	<0.2	<0.8
12/02/99	Influent	10	1000	48	24	<0.1	0.1	<0.1	<0.2	<0.8
	Effluent		900	64.4	<5	<0.1	<0.1	<0.1	<0.2	<0.8

¹ 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"

² Dilution air only

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

Arco Service Station No. 6148
5131 Shattuck Avenue, Oakland, California

Date End	Extraction Rate from Wellfield ¹		Emission Rate to Atmosphere ²		Destruction Efficiency ³		Period Removal ⁴		Cumulative Removal	
	TPHG (lbs/day)	Benzene (lbs/day)	TPHG (lbs/day)	Benzene (lbs/day)	TPHG (%)	Benzene (%)	TPHG (lbs)	Benzene (lbs)	TPHG (lbs)	Benzene (lbs)
01/01/98 ⁵									1885.6	0
01/28/98	0.7335	0	<0.1527	<0.0024	Waived		0.0831	0.0000	1885.7	0.0000
08/20/98	11.7994	0	<0.2137	<0.0024	Waived		4.956	0.0000	1890.6	0.0000
11/10/98	Not Calculated		Not Calculated		Not Calculated		Not Calculated		Not Calculated	
01/15/99	8.702	0.0768	0.3520	<0.0018	Waived		1.175	0.0104	1891.8	0.0104
09/09/99	3.447	0.0074	<0.1271	<0.0020	Waived		0.3705	0.0008	1892.2	0.0112
10/06/99	5.443	0	0.1805	<0.0020	Waived		1.132	0.0000	1893.3	0.0112
11/03/99	0.933	0.0064	<0.1369	<0.0021	Waived		0.1960	0.0013	1893.5	0.0125
12/02/99	0.422	0	<0.1182	<0.0018	Waived		0.0802	0.0000	1893.6	0.0125

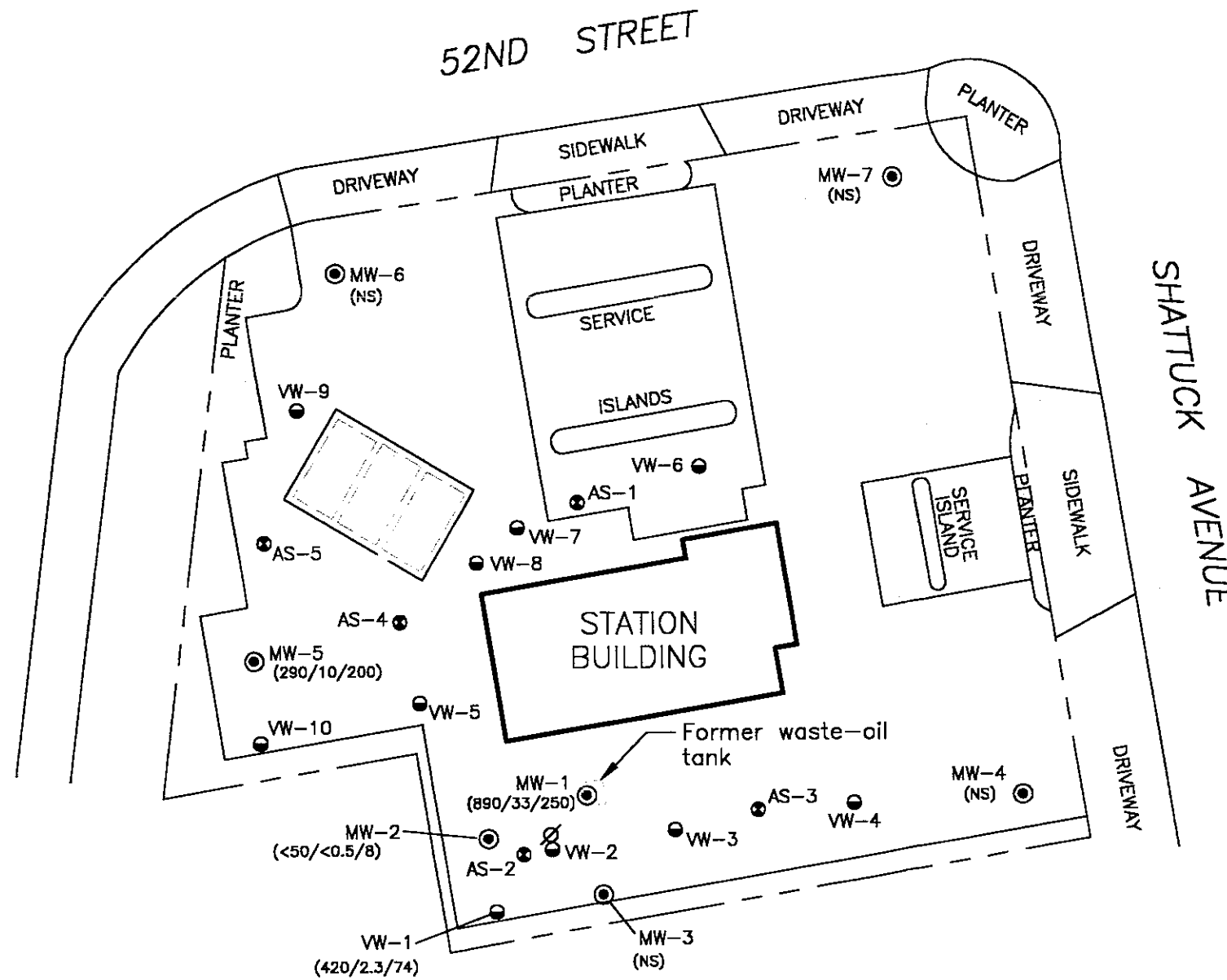
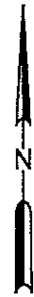
¹ Extraction Rate, lbs/day = (Influent Flow, cfm)(Influent conc., ppmv)(g/mole)(60 min/hr)(24 hr/day)(28.3 L/cf) / (10⁶)(24.45 moles/L)(453.6 g/lb)
where TPHG = 100 g/mole and Benzene = 78.1 g/mole; Influent conc. = 0, if reported as non-detect

² Emission Rate, lbs/day = (Effluent Flow, cfm)(Effluent conc., ppmv)(g/mole)(60 min/hr)(24 hr/day)(28.3 L/cf) / (10⁶)(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

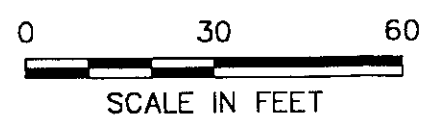
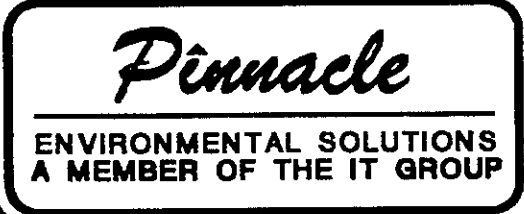
³ Destruction Efficiency, % = (Extraction Rate - Emission Rate)(100) / (Extraction Rate); "Waived" = if TPHG emissions <1.0 lbs/day and Benzene emissions <0.02 lbs/day

⁴ Period Removal, lbs = (Extraction Rate)(Uptime)

⁵ Operational data through 1/1/98 from First Quarter 1998 Quarterly Monitoring Report



EXPLANATION	
⊙	Groundwater monitoring well
●	Vapor extraction well
⊕	Air-sparge well
∅	Decommissioned well
---	Existing underground gasoline storage tanks
(290/10/200)	Concentration of total petroleum hydrocarbons as gasoline (TPHG), benzene, and MTBE in groundwater (ug/L); samples collected 6/3/99
<	Not detected at or above the indicated laboratory detection limit
NS	Not sampled



JUNE 1999
 KAB
 PROJECT NO.
 791673

FIGURE 1
 ARCO PRODUCTS COMPANY
 SERVICE STATION 6148, 5131 SHATTUCK AVE.
 OAKLAND, CALIFORNIA
GROUNDWATER ANALYTICAL SUMMARY
SECOND QUARTER 1999

APPENDIX A
SAMPLING AND ANALYSIS PROCEDURES

APPENDIX A

SAMPLING AND ANALYSIS PROCEDURES

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

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

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

Sample Collection

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

Equipment Cleaning

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

Water Level, Floating Hydrocarbon, and Total Well Depth Measurements

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

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

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

Well Purging

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

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

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

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

Well Sampling

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

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

Sample Preservation and Handling

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

Sample Containers and Preservation

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

Sample Handling

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

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

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

Sample Documentation

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

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

Field Logbook

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

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

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

Labels

Sample labels contained the following information:

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

Sampling and Analysis Chain-of-Custody Record

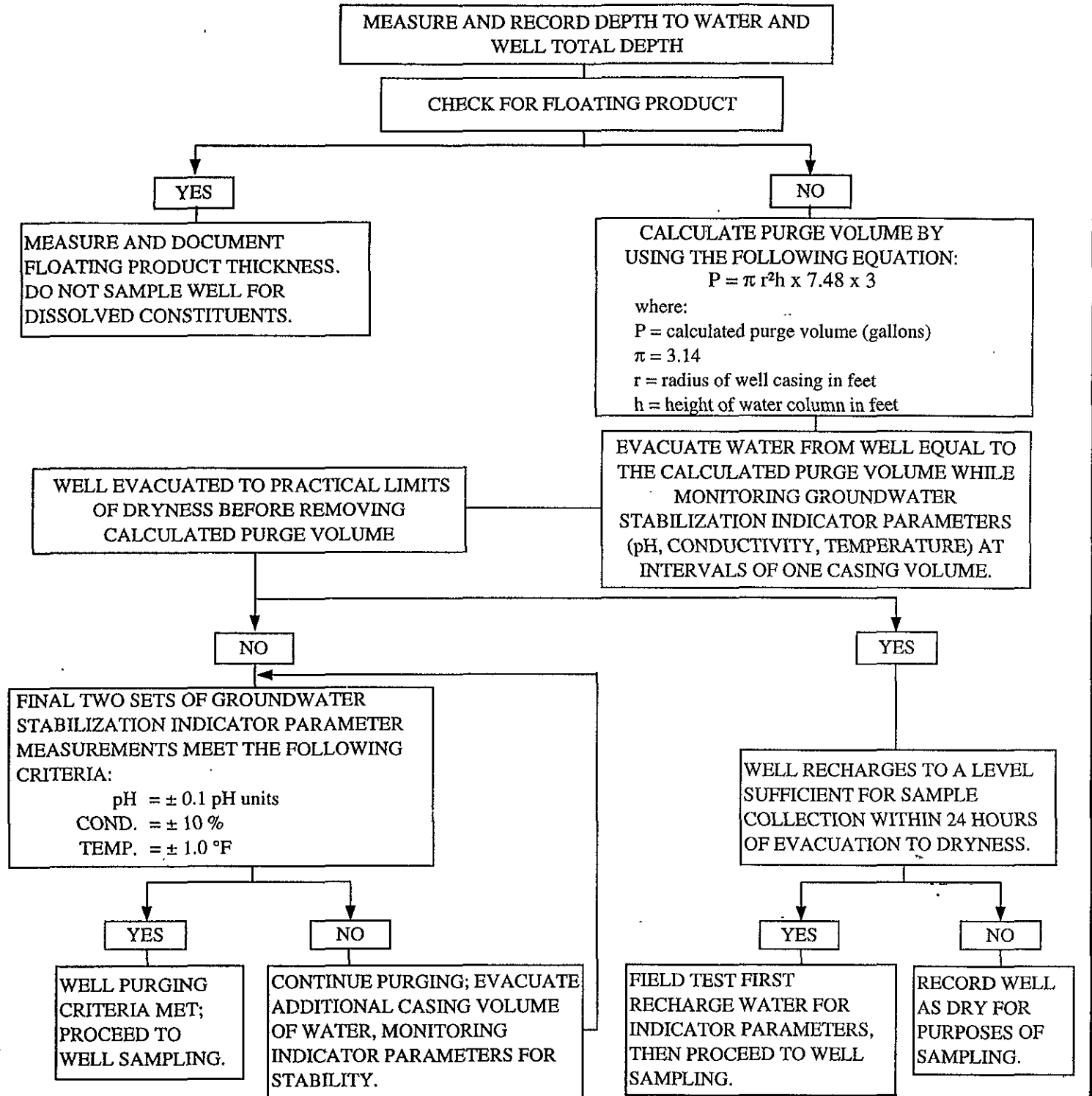
The ARCO chain-of-custody record initiated at the time of sampling contained, at a minimum, the sample designation (including the depth at which the sample was collected), sample type, analytical request, date of sampling, and the name of the sampler. The record sheet was signed, timed, and dated by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

Groundwater Sampling and Analysis Request Form

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

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

MONITORING WELL PURGING PROTOCOL



MONITORING WELL PURGING PROTOCOL

FIGURE
A-1

WATER SAMPLE FIELD DATA SHEET

PROJECT NO : _____ SAMPLE ID : _____
 PURGED BY : _____ CLIENT NAME : _____
 SAMPLED BY : _____ LOCATION : _____

TYPE: Groundwater _____ Surface Water _____ Leachate _____ Other _____

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

CASING ELEVATION (feet/MSL) : _____ VOLUME IN CASING (gal.) : _____
 DEPTH OF WELL (feet) : _____ CALCULATED PURGE (gal.) : _____
 DEPTH OF WATER (feet) : _____ ACTUAL PURGE VOL. (gal.) : _____

DATE PURGED : _____ END PURGE : _____
 DATE SAMPLED : _____ SAMPLING TIME : _____

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. ($\mu\text{mhos/cm@25}^\circ\text{C}$)	TEMPERATURE ($^\circ\text{F}$)	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 $^\circ\text{F}$ _____

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**



November 8, 1999

Service Request No.: S9903318

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

RE: TO#24118.00/RAT8/6148 OAKLAND

Dear Mr. Vanderveen:

Enclosed are the results of the sample(s) submitted to our laboratory on October 28, 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 10, 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: 2352, expiration: January 31, 2001).

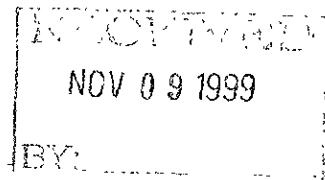
If you have any questions, please call me at (408) 748-9700.

Respectfully submitted,

Columbia Analytical Services, Inc.

Bernadette Troncales
Project Chemist

Greg Jordan
Laboratory Director



COLUMBIA ANALYTICAL SERVICES, Inc.

Acronyms

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: TO#24118.00/RAT8/6148 OAKLAND
Sample Matrix: Water

Service Request: S9903318
Date Collected: 10/26/99
Date Received: 10/28/99

BTEX, MTBE and TPH as Gasoline

Sample Name: MW-1(24)
Lab Code: S9903318-001
Test Notes:

Units: ug/L (ppb)
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	11/6/99	ND	
Benzene	EPA 5030	8021B	0.5	1	NA	11/6/99	ND	
Toluene	EPA 5030	8021B	0.5	1	NA	11/6/99	ND	
Ethylbenzene	EPA 5030	8021B	0.5	1	NA	11/6/99	ND	
Xylenes, Total	EPA 5030	8021B	1	1	NA	11/6/99	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8021B	3	1	NA	11/6/99	9	

Approved By: _____

CHS

Date: _____

11/08/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: TO#24118.00/RAT8/6148 OAKLAND
Sample Matrix: Water

Service Request: S9903318
Date Collected: 10/26/99
Date Received: 10/28/99

BTEX, MTBE and TPH as Gasoline

Sample Name: MW-3(24)
Lab Code: S9903318-002
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	11/6/99	630	
Benzene	EPA 5030	8021B	0.5	1	NA	11/6/99	14	
Toluene	EPA 5030	8021B	0.5	1	NA	11/6/99	0.7	
Ethylbenzene	EPA 5030	8021B	0.5	1	NA	11/6/99	13	
Xylenes, Total	EPA 5030	8021B	1	1	NA	11/6/99	2	
Methyl tert -Butyl Ether	EPA 5030	8021B	3	1	NA	11/6/99	38	

Approved By: _____



Date: _____

11/08/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: TO#24118.00/RAT8/6148 OAKLAND
Sample Matrix: Water

Service Request: S9903318
Date Collected: 10/26/99
Date Received: 10/28/99

BTEX, MTBE and TPH as Gasoline

Sample Name: MW-5(24)
Lab Code: S9903318-004
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	11/06/99	ND	
Benzene	EPA 5030	8021B	0.5	1	NA	11/06/99	ND	
Toluene	EPA 5030	8021B	0.5	1	NA	11/06/99	ND	
Ethylbenzene	EPA 5030	8021B	0.5	1	NA	11/06/99	ND	
Xylenes, Total	EPA 5030	8021B	1	1	NA	11/06/99	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8021B	3	1	NA	11/06/99	11	

Approved By: _____

MT

Date: _____

11/08/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: TO#24118.00/RAT8/6148 OAKLAND
Sample Matrix: Water

Service Request: S9903318
Date Collected: NA
Date Received: NA

BTEX, MTBE and TPH as Gasoline

Sample Name: Method Blank
Lab Code: S991106-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	11/06/99	ND	
Benzene	EPA 5030	8021B	0.5	1	NA	11/06/99	ND	
Toluene	EPA 5030	8021B	0.5	1	NA	11/06/99	ND	
Ethylbenzene	EPA 5030	8021B	0.5	1	NA	11/06/99	ND	
Xylenes, Total	EPA 5030	8021B	1	1	NA	11/06/99	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8021B	3	1	NA	11/06/99	ND	

Approved By: _____



Date: _____

11/08/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24118.00/RAT8/6148 OAKLAND
Sample Matrix: Water

Service Request: S9903318
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: 8021B CA/LUFT

Units: PERCENT
Basis: NA

Sample Name	Lab Code	Test Notes	Percent Recovery	
			4-Bromofluorobenzene	a,a,a-Trifluorotoluene
MW-1(24)	S9903318-001		92	103
MW-3(24)	S9903318-002		89	126
MW-2(24)	S9903318-003		93	100
MW-5(24)	S9903318-004		90	104
Lab Control Sample	S991106-LCS		95	107
Dup Lab Control Sample	S991106-DLCS		95	117
Method Blank	S991106-WB1		93	97

CAS Acceptance Limits: 69-116 72-139

Approved By: _____  _____ Date: 11/08/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24118.00/RAT8/6148 OAKLAND
LCS Matrix: Water


Service Request: S9903318
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 11/06/99

Laboratory Control Sample/Duplicate Laboratory Control Sample Summary
 BTEX and TPH as Gasoline

Sample Name: Dup Lab Control Sample Units: ug/L (ppb)
Lab Code: S991106-LCS, S991106-DLCS Basis: NA
Test Notes:

Percent Recovery

Analyte	Prep Method	Analysis Method	True Value		Result		Percent Recovery		CAS Acceptance Limits	Relative Percent Difference	Result Notes
			LCS	DLCS	LCS	DLCS	LCS	DLCS			
Benzene	EPA 5030	8021B	25	25	28	25	112	100	75-135	11	
Toluene	EPA 5030	8021B	25	25	26	24	104	96	73-136	8	
Ethylbenzene	EPA 5030	8021B	25	25	27	25	108	100	69-142	8	
Gasoline	EPA 5030	CA/LUFT	250	250	240	250	96	100	75-135	4	

Approved By: _____  Date: 11/08/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24118.00/RAT8/6148 OAKLAND

Service Request: S9903318
Date Analyzed: 11/06/99

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	8021B	25	28	85-115	112	
Toluene	EPA 5030	8021B	25	26	85-115	104	
Ethylbenzene	EPA 5030	8021B	25	27	85-115	108	
Xylenes, Total	EPA 5030	8021B	75	81	85-115	108	
Methyl tert -Butyl Ether	EPA 5030	8021B	25	24	85-115	96	

Approved By: _____



Date: _____

11/08/99

ICV/032196

ARCO Facility no. **6148** City (Facility) **Oakland** Project manager (Consultant) **Glen VanderVeen**
 ARCO engineer **Paul Supple** Telephone no. (ARCO) Telephone no. (Consultant) **(408) 453-7300** Fax no. (Consultant) **(408) 437-9526**
 Consultant name **EMCON** Address (Consultant) **2201 Broadway #101 Oakland, CA 94612**

Laboratory name
CAS
 Contract number

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX EPA 8020	BTEX/TPH Inc./C/M/G/S EPA 8020/8021/8015	TPH Modified 8015 Gas Diesel	Oil and Grease 413.1 413.2	TPH EPA 418.1/SM503E	EPA 801/8010	EPA 824/8240	EPA 825/8270	TCLP Metals VOA VOA	Semi Metals VOA VOA	CAM Metals EPA 601/07000 TLCL STLC	Lead Org./DHS Lead EPA 7420/7421
			Soil	Water	Other	Ice	Acid														
MW-1 (24)	2	①	X			X	HCL	10/26/99	1350		X										
MW-3 (24)	2	②	X			X	HCL		1415		X										
MW-2 (24)	2	③	X			X	HCL		1405		X										
MW-5 (24)	2	④	X			X	HCL		1500		X										

Method of shipment
Sampler will deliver

Special detection Limit/reporting
Lowest Possible

Special QA/QC
As Normal

Remarks
**RAT 8
2-40ml HCL
VOAs

791673**

Turnaround time
 Priority Rush 1 Business Day
 Rush 2 Business Days
 Expedited 5 Business Days
 Standard 10 Business Days

Condition of sample: **via cooler** Temperature received: **Due: 11/11/99 RU/D3-C**
 Relinquished by sampler **via cooler** Date **10/27/99** Time **15:00** Received by **Joseph Pachado CAS 738** Date **10/28/99**
 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 #: 792242

STATION ADDRESS: 5131 Shattuck Avenue, Oakland

DATE: 10/16/99

ARCO STATION #: 6148

FIELD TECHNICIAN: DWafford

DAY: Tuesday

DTW Order	WELL ID	Well Box Seal	Type Of Well Lid	Gasket Present	Lock Number	Type Of Well Cap	FIRST DEPTH TO WATER (feet)	SECOND DEPTH TO WATER (feet)	DEPTH TO FLOATING PRODUCT (feet)	FLOATING PRODUCT THICKNESS (feet)	WELL TOTAL DEPTH (feet)	COMMENTS	
												DO	TEMP
1	MW-7	ok	15/16"	YES	ARCO	LWC	14.74	14.74	N.D.	—	270	1.97 mg/L	27.1 °C
2	MW-6	ok	15/16"	YES	ARCO	LWC	14.06	14.06	N.D.	—	266	2.94 mg/L	27.2 °C
3	MW-4	ok	15/16"	YES	NONE	TC	15.76	15.76	N.D.	—	260	1.72 mg/L	27.5 °C
4	MW-1	ok	15/16"	YES	NONE	TC	16.92	16.92	N.D.	—	257	9.58 mg/L	25.8 °C
5	MW-5	ok	15/16"	YES	NONE	TC	16.10	16.10	N.D.	—	259		
6	MW-2	ok	15/16"	YES	NONE	TC	16.58	16.58	N.D.	—	258	8.17 mg/L	25.5 °C
7	MW-3	ok	15/16"	YES	NONE	TC	16.69	16.69	N.D.	—	250	1.24 mg/L	25.6 °C

SURVEY POINTS ARE TOP OF WELL CASINGS

RECEIVED
JAN 12 2000
RV: _____

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



EMCON

PROJECT NO: 792242
 PURGED BY: Dwight
 SAMPLED BY: [Signature]

SAMPLE ID: MW-1 (2V)
 CLIENT NAME: ARCO #6148
 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.): 6.0
 DEPTH OF WELL (feet): 25.7 CALCULATED PURGE (gal.): 18.0
 DEPTH OF WATER (feet): 16.2 ACTUAL PURGE VOL. (gal.): —

DATE PURGED: — END PURGE: —
 DATE SAMPLED: 10/26/99 SAMPLING TIME: 1350

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C. (µmhos/cm @ 25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1350</u>	<u>—</u>	<u>6.56</u>	<u>425.0</u>	<u>69.7</u>	<u>609</u>	<u>modest</u>

OTHER: Dissolved Oxygen= ODOR: NONE 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 type="checkbox"/> Bailer (Teflon)	<input type="checkbox"/> 2" Bladder Pump	<input type="checkbox"/> Bailer (Teflon)
<input type="checkbox"/> Centrifugal Pump	<input type="checkbox"/> Bailer (PVC)	<input type="checkbox"/> Bomb Sampler	<input type="checkbox"/> Bailer (Stainless Steel)
<input type="checkbox"/> Submersible Pump	<input type="checkbox"/> Bailer (Stainless Steel)	<input type="checkbox"/> Dipper	<input type="checkbox"/> Submersible Pump
<input type="checkbox"/> Well Wizard [®]	<input type="checkbox"/> Dedicated	<input type="checkbox"/> Well Wizard [®]	<input type="checkbox"/> Dedicated
Other: <u> </u>		Other: <u>Disposable Teflon Bailer</u>	

WELL INTEGRITY: GOOD LOCK: NONE

REMARKS: DTW is below top of screen
Taking 3rd sample

pH, E.C., Temp. Meter Calibration: Date: 10/26/99 Time: 1135 Meter Serial No.: 232
 E.C. 1000 149 / 1403 pH 7 6.68 / 7.20 pH 10 9.75 / 10.00 pH 4 3.98 / —
 Temperature °F 65.2

SIGNATURE: [Signature] REVIEWED BY: [Signature] PAGE 1 OF 4

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



EMCON

PROJECT NO: 792242

SAMPLE ID: MW-2 (24')

PURGED BY: D. Wolfson

CLIENT NAME: ARCO #6148

SAMPLED BY: [Signature]

LOCATION: Oakland, California

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

CASING ELEVATION (feet/MSL): N/A VOLUME IN CASING (gal.): 6.0
DEPTH OF WELL (feet): 25.8 CALCULATED PURGE (gal.): 18.0
DEPTH OF WATER (feet): 16.58 ACTUAL PURGE VOL. (gal.): _____

DATE PURGED: _____ END PURGE: _____
DATE SAMPLED: 10/26/99 SAMPLING TIME: 1415

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1415</u>	<u>—</u>	<u>6.37</u>	<u>266.0</u>	<u>69.3</u>	<u>Grey</u>	<u>modest</u>

OTHER: Dissolved Oxygen= _____ ODOR: NONE _____ 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 MW-1 _____

pH, E.C., Temp. Meter Calibration: Date: 10/26/99 Time: 5:55 Meter Serial No.: _____
E.C. 1000 _____ pH 7 _____ pH 10 _____ pH 4 _____

Temperature °F _____
SIGNATURE: [Signature] REVIEWED BY: [Signature] PAGE 2 OF 4

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



PROJECT NO: 792242
 PURGED BY: DW/ghs
 SAMPLED BY: f

SAMPLE ID: MW-3 (24')
 CLIENT NAME: ARCO #6148
 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.): 5.5
 DEPTH OF WELL (feet): 25.0 CALCULATED PURGE (gal.): 16.5
 DEPTH OF WATER (feet): 14.69 ACTUAL PURGE VOL. (gal.): _____

DATE PURGED: _____ END PURGE: _____
 DATE SAMPLED: 10/26/95 SAMPLING TIME: 1405

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1405</u>	<u>—</u>	<u>6.95</u>	<u>767.0</u>	<u>68.9</u>	<u>6.9</u>	<u>moderate</u>

OTHER: Dissolved Oxygen= ODOR: 517HA 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 type="checkbox"/> Bailer (Teflon)	<input type="checkbox"/> 2" Bladder Pump	<input type="checkbox"/> Bailer (Teflon)
<input type="checkbox"/> Centrifugal Pump	<input type="checkbox"/> Bailer (PVC)	<input type="checkbox"/> Bomb Sampler	<input type="checkbox"/> Bailer (Stainless Steel)
<input type="checkbox"/> Submersible Pump	<input type="checkbox"/> Bailer (Stainless Steel)	<input type="checkbox"/> Dipper	<input type="checkbox"/> Submersible Pump
<input type="checkbox"/> Well Wizard [®]	<input type="checkbox"/> Dedicated	<input type="checkbox"/> Well Wizard [®]	<input type="checkbox"/> Dedicated
Other: _____		Other: <u>Disposable Teflon Bailer</u>	

WELL INTEGRITY: Good LOCK: none

REMARKS: _____
 _____ SEE MW-1 _____

pH, E.C., Temp. Meter Calibration: Date: _____ Time: SEE MW-1 Meter Serial No.: _____
 E.C. 1000 _____ pH 7 _____ pH 10 _____ pH 4 _____

Temperature °F _____
 SIGNATURE: [Signature] REVIEWED BY: [Signature] PAGE 3 OF 4

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



EMCON

PROJECT NO: 792242
 PURGED BY: Dwobrn
 SAMPLED BY: J

SAMPLE ID: MW-5 (2y)
 CLIENT NAME: ARCO #6148
 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.): 6.5
 DEPTH OF WELL (feet): 25.9 CALCULATED PURGE (gal.): 19.5
 DEPTH OF WATER (feet): 16.10 ACTUAL PURGE VOL. (gal.): _____

DATE PURGED: _____ END PURGE: _____
 DATE SAMPLED: 10/26/99 SAMPLING TIME: 1500

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1500</u>	—	<u>6.72</u>	<u>415.0</u>	<u>68.0</u>	<u>Brown</u>	<u>14H</u>

OTHER: Dissolved Oxygen= ODOR: NONE 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 type="checkbox"/> Bailor (Teflon)	<input type="checkbox"/> 2" Bladder Pump	<input type="checkbox"/> Bailor (Teflon)
<input type="checkbox"/> Centrifugal Pump	<input type="checkbox"/> Bailor (PVC)	<input type="checkbox"/> Bomb Sampler	<input type="checkbox"/> Bailor (Stainless Steel)
<input type="checkbox"/> Submersible Pump	<input type="checkbox"/> Bailor (Stainless Steel)	<input type="checkbox"/> Dipper	<input type="checkbox"/> Submersible Pump
<input type="checkbox"/> Well Wizard [®]	<input type="checkbox"/> Dedicated	<input type="checkbox"/> Well Wizard [®]	<input type="checkbox"/> Dedicated
Other: _____		Other: <u>Disposable Teflon Bailor</u>	

WELL INTEGRITY: BAD - VINES NEED TO BE LOCKED

REMARKS: Clogged
SEE MW-1

pH, E.C., Temp. Meter Calibration: Date: 10/26/99 Time: _____ Meter Serial No.: _____
 E.C. 1000 _____ pH 7 _____ SEE MW-1 pH 4 _____
 Temperature °F _____
 SIGNATURE: [Signature] REVIEWED BY: [Signature] PAGE 4 OF 4

APPENDIX D

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



October 13, 1999

Service Request No.: S9903110

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

RE: TO#24094.00/RAT8/6148 OAKLAND

Dear Mr. Vanderveen:

Enclosed are the results of the sample(s) submitted to our laboratory on October 6, 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).

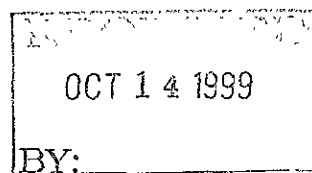
If you have any questions, please call me at (408) 748-9700.

Respectfully submitted,

Columbia Analytical Services, Inc.

Bernadette Troncales
Project Chemist

Greg Jordan
Laboratory Director



COLUMBIA ANALYTICAL SERVICES, Inc.

Acronyms

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND
Sample Matrix: Air

Service Request: S9903110
Date Collected: 10/06/99
Date Received: 10/06/99

BTEX and Total Volatile Hydrocarbons

Sample Name: E-1 Units: mg/m3
Lab Code: S9903110-002 Basis: NA
Test Notes:

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8021B	0.4	1	NA	10/06/99	ND	
Toluene	NONE	8021B	0.4	1	NA	10/06/99	ND	
Ethylbenzene	NONE	8021B	0.5	1	NA	10/06/99	ND	
Xylenes, Total	NONE	8021B	0.9	1	NA	10/06/99	ND	
Total Volatile Hydrocarbons:								
C1 - C5	NONE	8015M	12	1	NA	10/06/99	84	
C6 - C12	NONE	8015M	20	1	NA	10/06/99	29	
TPH as Gasoline*	NONE	8015M	20	1	NA	10/06/99	29	
Methyl tert-Butyl Ether	NONE	8021B	3	1	NA	10/06/99	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: 10/13/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND
Sample Matrix: Air

Service Request: S9903110
Date Collected: NA
Date Received: NA

BTEX and Total Volatile Hydrocarbons

Sample Name: Method Blank
Lab Code: S991006-VB1
Test Notes:

Units: ppmV
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8021B	0.1	1	NA	10/06/99	ND	
Toluene	NONE	8021B	0.1	1	NA	10/06/99	ND	
Ethylbenzene	NONE	8021B	0.1	1	NA	10/06/99	ND	
Xylenes, Total	NONE	8021B	0.2	1	NA	10/06/99	ND	
Total Volatile Hydrocarbons:								
C1 - C5	NONE	8015M	5	1	NA	10/06/99	ND	
C6 - C12	NONE	8015M	5	1	NA	10/06/99	ND	
TPH as Gasoline*	NONE	8015M	5	1	NA	10/06/99	ND	
Methyl tert-Butyl Ether	NONE	8021B	1.4	1	NA	10/06/99	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: _____ *[Signature]* Date: 10/13/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
 Project: TO#24094.00/RAT8/6148 OAKLAND
 Sample Matrix: Air

Service Request: S9903110
 Date Collected: 10/06/99
 Date Received: 10/06/99
 Date Extracted: NA
 Date Analyzed: 10/06/99

Duplicate Summary
 BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
 Lab Code: S9903054-001DUP
 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	8021B	0.4	7.1	7.1	7.1	<1	
Toluene	NONE	8021B	0.4	45	44	45	2	
Ethylbenzene	NONE	8021B	0.5	5.1	4.5	4.8	13	
Xylenes, Total	NONE	8021B	0.9	24	26	25	8	
Total Volatile Hydrocarbons								
C1 - C5	NONE	8015M	12	1740	1780	1760	2	
C6 - C12	NONE	8015M	20	960	890	925	8	
TPH as Gasoline*	NONE	8015M	20	960	890	925	8	
Methyl tert-Butyl Ether	NONE	8021B	3	44	45	45	2	

Approved By: _____

BT

Date: _____

10/13/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND
Sample Matrix: Air

Service Request: S9903110
Date Collected: 10/06/99
Date Received: 10/06/99
Date Extracted: NA
Date Analyzed: 10/06/99

Duplicate Summary
 BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
Lab Code: S9903054-001DUP
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	8021B	0.1	2.2	2.2	2	<1	
Toluene	NONE	8021B	0.1	12	12	12	<1	
Ethylbenzene	NONE	8021B	0.1	1.2	1.0	1.1	18	
Xylenes, Total	NONE	8021B	0.2	5.5	6.0	5.8	9	
Total Volatile Hydrocarbons								
C1 - C5	NONE	8015M	5	733	750	742	2	
C6 - C12	NONE	8015M	5	234	218	226	8	
TPH as Gasoline*	NONE	8015M	5	234	218	226	8	
Methyl tert-Butyl Ether	NONE	8021B	0.8	12	13	13	8	

Approved By: _____  Date: 10/13/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND
LCS Matrix: Air

Service Request: S9903110
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 10/06/99

Laboratory Control Sample Summary
BTEX and TPH as Gasoline

Sample Name: Lab Control Sample
Lab Code: S991006-LCS
Test Notes:

Units: mg/m3
Basis: NA

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Benzene	NONE	8021B	24	25	104	60-140	
Toluene	NONE	8021B	24	24	100	60-140	
Ethylbenzene	NONE	8021B	24	25	104	60-140	
Gasoline	NONE	8015M	210	213	101	60-140	

Approved By: _____



Date: _____

10/13/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND
LCS Matrix: Air

Service Request: S9903110
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 10/06/99

Laboratory Control Sample Summary
BTEX and TPH as Gasoline

Sample Name: Lab Control Sample
Lab Code: S991006-LCS
Test Notes:

Units: ppmV
Basis: NA

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Benzene	NONE	8021B	7.5	7.8	104	60-140	
Toluene	NONE	8021B	6.4	6.4	100	60-140	
Ethylbenzene	NONE	8021B	5.5	5.8	105	60-140	
Gasoline	NONE	8015M	210	52	25	60-140	

Approved By: _____



Date: _____

10/13/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND

Service Request: S9903110
Date Analyzed: 10/06/99

Initial Calibration Verification (ICV) Summary
BTEX and Total Volatile Hydrocarbons

Sample Name: ICV Units: mg/m3
Lab Code: ICV1 Basis: NA
Test Notes:

ICV Source:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Result Notes
Benzene	NONE	8021B	25	26	104	
Toluene	NONE	8021B	25	25	100	
Ethylbenzene	NONE	8021B	25	26	104	
Xylenes, Total	NONE	8021B	75	77	103	
Gasoline	NONE	8015M	250	241	96	
Methyl tert-Butyl Ether	NONE	8021B	25	25	100	

Approved By: _____



Date: _____

10/13/99

ICV/032196

ARCO Facility no. 6148	City (Facility) Oakland CA	Project manager (Consultant) Glen Vanderweert
ARCO engineer Paul Supple	Telephone no. (ARCO)	Telephone no. (Consultant)
Consultant name Emcon IT		Fax no. (Consultant)
Address (Consultant) 59903110		

Laboratory name **CAS**

Contract number

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX EPA 802/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/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals <input type="checkbox"/> VOA <input type="checkbox"/> VOA <input type="checkbox"/>	Semi Metals <input type="checkbox"/> VOA <input type="checkbox"/>	CAM Metals EPA 6010/7000 TTL <input type="checkbox"/> STL <input type="checkbox"/>	Lead Org./DHS <input type="checkbox"/> Lead EPA 7420/7421 <input type="checkbox"/>	
			Soil	Water	Other	Ice	Acid															
F1		1	(1)		AR			10/6/99	1200		X											
F1		1	(2)		AR			10/6/99	1210		X											

Method of shipment **TRUCK**

Special detection Limit/reporting **PPMV**

Special QA/QC

Remarks **20805**
135009

Lab number

Turnaround time

Priority Rush 1 Business Day

Rush 2 Business Days

Expedited 5 Business Days

Standard 10 Business Days

Condition of sample:		Temperature received: Due: 10/7/99	
Relinquished by sampler Lube Rev	Date 10-6-99	Time 1410	Received by Joseph Hatched CAS 10/6/99 1410
Relinquished by	Date	Time	Received by
Relinquished by	Date	Time	Received by laboratory
			Date
			Time



November 4, 1999

Service Request No.: S9903412

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

RE: TO#24051.00/RAT8/6148 Oakland

Dear Mr. Vanderveen:

Enclosed are the results of the sample(s) submitted to our laboratory on November 3, 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 12, 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: 2352, expiration: January 31, 2001).

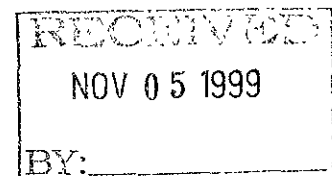
If you have any questions, please call me at (408) 748-9700.

Respectfully submitted,

Columbia Analytical Services, Inc.

Bernadette Troncales
Project Chemist

Greg Jordan
Laboratory Director



COLUMBIA ANALYTICAL SERVICES, Inc.

Acronyms

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: TO#24051.00/RAT8/6148 Oakland
Sample Matrix: Air

Service Request: S9903412
Date Collected: 11/3/99
Date Received: 11/3/99

BTEX and Total Volatile Hydrocarbons

Sample Name: E-1
Lab Code: S9903412-002
Test Notes:

Units: mg/m3
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8021B	0.4	1	NA	11/4/99	ND	
Toluene	NONE	8021B	0.4	1	NA	11/4/99	ND	
Ethylbenzene	NONE	8021B	0.5	1	NA	11/4/99	ND	
Xylenes, Total	NONE	8021B	0.9	1	NA	11/4/99	ND	
Total Volatile Hydrocarbons:								
C1 - C5	NONE	8015M	12	1	NA	11/4/99	ND	
C6 - C12	NONE	8015M	20	1	NA	11/4/99	ND	
TPH as Gasoline*	NONE	8015M	20	1	NA	11/4/99	ND	
Methyl tert-Butyl Ether	NONE	8021B	3	1	NA	11/4/99	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: 11/04/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24051.00/RAT8/6148 Oakland
Sample Matrix: Air

Service Request: S9903412
Date Collected: 11/3/99
Date Received: 11/3/99
Date Extracted: NA
Date Analyzed: 11/4/99

Duplicate Summary
 BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
Lab Code: s9903412-001DUP
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	8021B	0.4	0.9	0.9	0.9	<1	
Toluene	NONE	8021B	0.4	12	12	12	<1	
Ethylbenzene	NONE	8021B	0.5	0.6	0.6	0.6	<1	
Xylenes, Total	NONE	8021B	0.9	2.7	2.7	2.7	<1	
Total Volatile Hydrocarbons								
C1 - C5	NONE	8015M	12	480	480	480	<1	
C6 - C12	NONE	8015M	20	180	180	180	<1	
TPH as Gasoline*	NONE	8015M	20	180	180	180	<1	
Methyl tert-Butyl Ether	NONE	8021B	3	78	91	85	15	

Approved By: _____

[Signature]

Date: _____

11/6/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24051.00/RAT8/6148 Oakland
Sample Matrix: Air


Service Request: S9903412
Date Collected: 11/3/99
Date Received: 11/3/99
Date Extracted: NA
Date Analyzed: 11/4/99

Duplicate Summary
 BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
Lab Code: s9903412-001DUP
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	8021B	0.1	0.28	0.28	0.28	<1	
Toluene	NONE	8021B	0.1	3.2	3.2	3.2	<1	
Ethylbenzenc	NONE	8021B	0.1	0.14	0.14	0.14	<1	
Xylenes, Total	NONE	8021B	0.2	0.62	0.62	0.62	<1	
Total Volatile Hydrocarbons								
C1 - C5	NONE	8015M	5	202	202	202	<1	
C6 - C12	NONE	8015M	5	44	44	44	<1	
TPH as Gasoline*	NONE	8015M	5	44	44	44	<1	
Methyl tert-Butyl Ether	NONE	8021B	0.8	22	25	24	13	

Approved By: _____  Date: 11/04/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24051.00/RAT8/6148 Oakland
LCS Matrix: Air

Service Request: S9903412
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 11/4/99

Laboratory Control Sample Summary
 BTEX and TPH as Gasoline

Sample Name: Lab Control Sample
Lab Code: S991104-LCS
Test Notes:

Units: mg/m3
Basis: NA

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS	Result Notes
						Percent Recovery Acceptance Limits	
Benzene	NONE	8021B	24	23	96	60-140	
Toluene	NONE	8021B	24	22	92	60-140	
Ethylbenzene	NONE	8021B	24	23	96	60-140	
Gasoline	NONE	8015M	210	210	100	60-140	

Approved By: _____

MS

Date: _____

11/04/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24051.00/RAT8/6148 Oakland
LCS Matrix: Air


Service Request: S9903412
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 11/4/99

Laboratory Control Sample Summary
 BTEX and TPH as Gasoline

Sample Name: Lab Control Sample
Lab Code: S991104-LCS
Test Notes:

Units: ppmV
Basis: NA

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS	Result Notes
						Percent Recovery Acceptance Limits	
Benzene	NONE	8021B	7.5	7.2	96	60-140	
Toluene	NONE	8021B	6.4	5.8	91	60-140	
Ethylbenzene	NONE	8021B	5.5	5.3	96	60-140	
Gasoline	NONE	8015M	51	51	100	60-140	

Approved By: _____  Date: 11/04/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24051.00/RAT8/6148 Oakland

Service Request: S9903412
Date Analyzed: 11/4/99

Initial Calibration Verification (ICV) Summary
BTEX and Total Volatile Hydrocarbons

Sample Name: ICV Units: mg/m3
Lab Code: ICV1 Basis: NA
Test Notes:

ICV Source:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Result Notes
Benzene	NONE	8021B	25	27	108	
Toluene	NONE	8021B	25	26	104	
Ethylbenzene	NONE	8021B	25	26	104	
Xylenes, Total	NONE	8021B	75	81	108	
Gasoline	NONE	8015M	250	250	100	
Methyl tert-Butyl Ether	NONE	8021B	25	24	96	

Approved By: _____



Date: _____

11/04/99



November 5, 1999

Service Request No.: S9903440

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

RE: TO#24094.00/RAT8/6148 OAKLAND

Dear Mr. Vanderveen:

Enclosed are the results of the sample(s) submitted to our laboratory on November 4, 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: 2352, expiration: January 31, 2001).

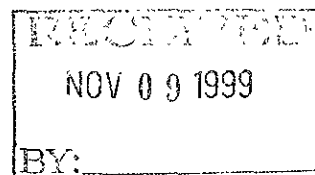
If you have any questions, please call me at (408) 748-9700.

Respectfully submitted,

Columbia Analytical Services, Inc.

Bernadette Troncales
Project Chemist

Greg Jordan
Laboratory Director



COLUMBIA ANALYTICAL SERVICES, Inc.

Acronyms

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

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND
Sample Matrix: Air

Service Request: S9903440
Date Collected: 11/4/99
Date Received: 11/4/99
Date Extracted: NA
Date Analyzed: 11/4/99

Duplicate Summary
 BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
Lab Code: S9903412-001DUP
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	8021B	0.4	0.9	0.9	0.9	<1	
Toluene	NONE	8021B	0.4	12	12	12	<1	
Ethylbenzene	NONE	8021B	0.5	0.6	0.6	0.6	<1	
Xylenes, Total	NONE	8021B	0.9	2.7	2.7	2.7	<1	
Total Volatile Hydrocarbons								
C1 - C5	NONE	8015M	12	480	480	480	<1	
C6 - C12	NONE	8015M	20	180	180	180	<1	
TPH as Gasoline*	NONE	8015M	20	180	180	180	<1	
Methyl tert-Butyl Ether	NONE	8021B	3	78	91	85	15	

Approved By: _____  Date: 11/05/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
 Project: TO#24094.00/RAT8/6148 OAKLAND
 Sample Matrix: Air

Service Request: S9903440
 Date Collected: 11/4/99
 Date Received: 11/4/99
 Date Extracted: NA
 Date Analyzed: 11/4/99

Duplicate Summary
 BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
 Lab Code: S9903412-001DUP
 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	8021B	0.1	0.28	0.28	0.28	<1	
Toluene	NONE	8021B	0.1	3.2	3.2	3.2	<1	
Ethylbenzene	NONE	8021B	0.1	0.14	0.14	0.14	<1	
Xylenes, Total	NONE	8021B	0.2	0.62	0.62	0.62	<1	
Total Volatile Hydrocarbons								
C1 - C5	NONE	8015M	5	202	202	202	<1	
C6 - C12	NONE	8015M	5	44	44	44	<1	
TPH as Gasoline*	NONE	8015M	5	44	44	44	<1	
Methyl tert-Butyl Ether	NONE	8021B	0.8	22	25	24	13	

Approved By: _____

Handwritten signature

Date: _____

Handwritten date: 11/05/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND
LCS Matrix: Air

Service Request: S9903440
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 11/4/99

Laboratory Control Sample Summary
 BTEX and TPH as Gasoline

Sample Name: Lab Control Sample
Lab Code: S991104-LCS
Test Notes:

Units: mg/m3
Basis: NA

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS	Result Notes
						Percent Recovery Acceptance Limits	
Benzene	NONE	8021B	24	23	96	60-140	
Toluene	NONE	8021B	24	22	92	60-140	
Ethylbenzene	NONE	8021B	24	23	96	60-140	
Gasoline	NONE	8015M	210	210	100	60-140	

Approved By: _____

[Handwritten Signature]

Date: _____

11/05/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND

Service Request: S9903440
Date Analyzed: 11/4/99

Initial Calibration Verification (ICV) Summary
BTEX and Total Volatile Hydrocarbons

Sample Name: ICV Units: mg/m3
Lab Code: ICV1 Basis: NA
Test Notes:

ICV Source:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Result Notes
Benzene	NONE	8021B	25	27	108	
Toluene	NONE	8021B	25	26	104	
Ethylbenzene	NONE	8021B	25	26	104	
Xylenes, Total	NONE	8021B	75	81	108	
Gasoline	NONE	8015M	250	250	100	
Methyl tert-Butyl Ether	NONE	8021B	25	24	96	

Approved By: _____



Date: _____

11/05/99

ICV/032196

ARCO Facility no. 6148	City (Facility) Oakland	Project manager (Consultant) Glen Vanderveen
ARCO engineer Paul Supple	Telephone no. (ARCO)	Telephone no. (Consultant)
Consultant name EMCON IT	Address (Consultant)	

Laboratory name **CAS**

Contract number

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA 8020/8020/8015	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/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TC/PC Metals <input type="checkbox"/> VOA <input type="checkbox"/> VOA <input type="checkbox"/>	Semi Metals <input type="checkbox"/> VOA <input type="checkbox"/> VOA <input type="checkbox"/>	CMM Metals EPA 601/07/000 TLC <input type="checkbox"/> STLC <input type="checkbox"/>	Lead Org./DHS <input type="checkbox"/> Lead EPA 7420/7421 <input type="checkbox"/>	
			Soil	Water	Other	Ice	Acid															
I-1	①	1			AR			11/4/99	1240		X											
E-1	②	1			AA			11/4/99	1230		X											

Method of shipment **Truck**

Special detection Limit/reporting **PPMV**

Special QA/QC

Remarks **20805
047
030**

Lab number

Turnaround time

Priority Rush 1 Business Day

Rush 2 Business Days

Expedited 5 Business Days

Standard 10 Business Days

Condition of sample:	Temperature received: Due: 11/5/99
Relinquished by sampler Gene P...	Date: 11-4-99 Time: 1506
Relinquished by	Received by Joseph Pacheco CAS Date: 11/4/99 Time: 1506
Relinquished by	Received by laboratory Date Time



December 3, 1999

Service Request No.: S9903823

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

RE: TO#24094.00/RAT8/6148 OAKLAND

Dear Mr. Vanderveen:


Enclosed are the results of the sample(s) submitted to our laboratory on December 2, 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 15, following, have been thoroughly reviewed and approved for release.

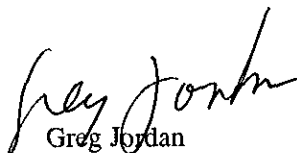
Columbia Analytical Services is certified for environmental analyses by the California Department of Health Services (certificate number: 2352, expiration: January 31, 2001).

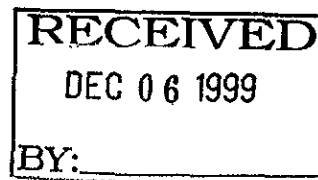
If you have any questions, please call me at (408) 748-9700.

Respectfully submitted,

Columbia Analytical Services, Inc.


Bernadette Troncales
Project Chemist


Greg Jordan
Laboratory Director



COLUMBIA ANALYTICAL SERVICES, Inc.

Acronyms

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND
Sample Matrix: Air

Service Request: S9903823
Date Collected: 12/2/99
Date Received: 12/2/99


BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
Lab Code: S9903823-001
Test Notes:

Units: mg/m3
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8021B	0.4	1	NA	12/2/99	ND	
Toluene	NONE	8021B	0.4	1	NA	12/2/99	0.5	
Ethylbenzene	NONE	8021B	0.5	1	NA	12/2/99	ND	
Xylenes, Total	NONE	8021B	0.9	1	NA	12/2/99	ND	
Total Volatile Hydrocarbons:								
C1 - C5	NONE	8015M	12	1	NA	12/2/99	70	
C6 - C12	NONE	8015M	20	1	NA	12/2/99	58	
TPH as Gasoline*	NONE	8015M	20	1	NA	12/2/99	58	
Methyl tert-Butyl Ether	NONE	8021B	3	1	NA	12/2/99	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: 12-3-99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND
Sample Matrix: Air

Service Request: S9903823
Date Collected: 12/2/99
Date Received: 12/2/99

BTEX and Total Volatile Hydrocarbons

Sample Name: I-1 Units: ppmV
Lab Code: S9903823-001 Basis: NA
Test Notes:

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8021B	0.1	1	NA	12/2/99	ND	
Toluene	NONE	8021B	0.1	1	NA	12/2/99	0.1	
Ethylbenzene	NONE	8021B	0.1	1	NA	12/2/99	ND	
Xylenes, Total	NONE	8021B	0.2	1	NA	12/2/99	ND	
Total Volatile Hydrocarbons:								
C1 - C5	NONE	8015M	5	1	NA	12/2/99	30	
C6 - C12	NONE	8015M	5	1	NA	12/2/99	24	
TPH as Gasoline*	NONE	8015M	5	1	NA	12/2/99	24	
Methyl tert-Butyl Ether	NONE	8021B	0.8	1	NA	12/2/99	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: *Revi JF* Date: 12-3-99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND
Sample Matrix: Air

Service Request: S9903823
Date Collected: 12/2/99
Date Received: 12/2/99
Date Extracted: NA
Date Analyzed: 12/3/99

Duplicate Summary
 BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
 Lab Code: S9903823-001DUP
 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	8021B	0.4	ND	ND	--	--	
Toluene	NONE	8021B	0.4	0.5	0.6	0.55	18	
Ethylbenzene	NONE	8021B	0.5	ND	ND	--	--	
Xylenes, Total	NONE	8021B	0.9	ND	ND	--	--	
Total Volatile Hydrocarbons								
C1 - C5	NONE	8015M	12	70	76	73	8.2	
C6 - C12	NONE	8015M	20	58	73	65.5	23	
TPH as Gasoline*	NONE	8015M	20	58	73	65.5	23	
Methyl tert-Butyl Ether	NONE	8021B	3	ND	ND	--	--	

Approved By: _____



Date: _____

12-3-99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND
Sample Matrix: Air

Service Request: S9903823
Date Collected: 12/2/99
Date Received: 12/2/99
Date Extracted: NA
Date Analyzed: 12/3/99

Duplicate Summary
 BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
 Lab Code: S9903823-001DUP
 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	8021B	0.1	ND	ND	--	--	
Toluene	NONE	8021B	0.1	0.1	0.2	0.15	67	
Ethylbenzene	NONE	8021B	0.1	ND	ND	--	--	
Xylenes, Total	NONE	8021B	0.2	ND	ND	--	--	
Total Volatile Hydrocarbons								
C1 - C5	NONE	8015M	5	30	32	31	6.4	
C6 - C12	NONE	8015M	5	24	18	21	29	
TPH as Gasoline*	NONE	8015M	5	24	18	21	29	
Methyl tert-Butyl Ether	NONE	8021B	0.8	ND	ND	--	--	

Approved By: _____

Reri ZR

Date: _____

12-3-99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND
LCS Matrix: Air


Service Request: S9903823
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 12/2/99

Laboratory Control Sample Summary
BTEX and TPH as Gasoline

Sample Name: Lab Control Sample
Lab Code: S991202-LCS
Test Notes:

Units: mg/m3
Basis: NA

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Benzene	NONE	8021B	24	23	96	60-140	
Toluene	NONE	8021B	24	22	92	60-140	
Ethylbenzene	NONE	8021B	24	23	96	60-140	
Gasoline	NONE	8015M	210	210	100	60-140	

Approved By:  Date: 12-3-99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND
LCS Matrix: Air

Service Request: S9903823
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 12/2/99

Laboratory Control Sample Summary
BTEX and TPH as Gasoline

Sample Name: Lab Control Sample
Lab Code: S991202-LCS
Test Notes:

Units: ppmV
Basis: NA

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Benzene	NONE	8021B	7.5	7.2	96	60-140	
Toluene	NONE	8021B	6.4	5.8	91	60-140	
Ethylbenzene	NONE	8021B	5.5	5.3	96	60-140	
Gasoline	NONE	8015M	51	51	100	60-140	

Approved By: _____

Date: 12-3-99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24094.00/RAT8/6148 OAKLAND

Service Request: S9903823
Date Analyzed: 12/2/99

Initial Calibration Verification (ICV) Summary
BTEX and Total Volatile Hydrocarbons

Sample Name: ICV Units: mg/m3
Lab Code: ICV1 Basis: NA
Test Notes:

ICV Source:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Result Notes
Benzene	NONE	8021B	25	25	100	
Toluene	NONE	8021B	25	24	96	
Ethylbenzene	NONE	8021B	25	24	96	
Xylenes, Total	NONE	8021B	75	72	96	
Gasoline	NONE	8015M	250	260	104	
Methyl tert-Butyl Ether	NONE	8021B	25	24	96	

Approved By: _____



Date: _____

12-3-99

ICV/032196

