9077

April 2, 1999
Project 20805-135.008

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

Re: Quarterly Groundwater Monitoring Report, Fourth Quarter 1998, for ARCO Service Station No. 6148, located at 5131 Shattuck Avenue, Oakland, California

Dear Mr. Supple:

Pinnacle Environmental Solutions, a division of EMCON (Pinnacle), is submitting the attached report which presents the results of the fourth quarter 1998 groundwater monitoring program at ARCO Products Company (ARCO) Service Station No. 6148, located at 5131 Shattuck Avenue, Oakland, California. The monitoring program complies with Alameda County Health Care Services Agency (ACHCSA) requirements regarding underground tank investigations.

LIMITATIONS

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

Please call if you have questions.

Sincerely,

Pinnacle

Glen VanderVeen
Project Manager

Valli Voruganti, P.E.
Project Engineer

Attachment: Quarterly Groundwater Monitoring Report, Fourth Quarter 1998

cc: Susan Hugo, ACHCSA

Date: April 2, 1999

ARCO QUARTERLY GROUNDWATER MONITORING REPORT

Station No.: 6148 Address:	5131 Shattuck Avenue, Oakland, California
Pinnacle Project No.	20805-135.008
ARCO Environmental Engineer/Phone No.:	Paul Supple /(925) 299-8891
Pinnacle Project Manager/Phone No.:	Glen VanderVeen /(510) 740-5807
Primary Agency/Regulatory ID No.:	ACHCSA /Susan Hugo

WORK PERFORMED THIS QUARTER (FOURTH - 1998):

1. Prepared and submitted quarterly groundwater monitoring report for third quarter 1998.
2. Performed quarterly groundwater monitoring and sampling for fourth quarter 1998.
3. Troubleshooted SVE process blower failure and air compressor electrical problems.

WORK PROPOSED FOR NEXT QUARTER (FIRST - 1999):

1. Prepare and submit quarterly groundwater monitoring report for fourth quarter 1998.
2. Perform quarterly groundwater monitoring and sampling for first quarter 1999.
3. Repair SVE process blower and air compressor electrical.
4. Restart soil-vapor extraction (SVE) and air-sparge systems if hydrocarbon concentrations in extracted soil vapor warrant or water levels decrease at the site.

QUARTERLY MONITORING:

Current Phase of Project:	Quarterly Groundwater Monitoring and Operation and Maintenance of Remediation Systems Due to a malfunctioning process blower, the SVE system operated for only seven hours during the third quarter 1998. The air-bubbling system operated during the quarter.
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:	16.8 feet
Groundwater Flow Direction and Gradient (Average):	0.01 ft/ft toward southwest

DISCUSSION:

Due to a malfunctioning process blower, the SVE system had not operated continuously since the second quarter 1998. The system was restarted on November 10, 1998 for sample collection and system inspection. It was determined upon inspection that the telemetry system which records temperature continuously was malfunctioning, and the process blower continued to malfunction.

Analytical results for influent vapor samples collected on November 10, 1998 were reported as 3,400 micrograms per cubic meter (mg/m^3) of TPHG, and <8 mg/m^3 of Benzene. Analytical results for effluent vapor samples collected on November 10, 1998 were reported as 81 mg/m^3 of TPHG, and 0.4 mg/m^3 of Benzene.

The system would not operate continuously due to the malfunctioning process blower, and would not be in compliance with the Bay Area Air Quality Management District's requirements due to the malfunctioning telemetry system. Therefore, the system was non-operational for the fourth quarter 1998, with exception of the three hours of operation for sample collection and system inspection.

Currently the problems with the telemetry system and the process blower are being investigated and will be repaired as soon as possible. Operational information will be updated after the system is repaired. Refer to the Third Quarter 1998 Report for historical operational information.

ATTACHMENTS:

- Table 1 - Historical Groundwater Elevation and Analytical Data, Petroleum Hydrocarbons and Their Constituents
- Figure 1 - Groundwater Analytical Summary Map
- Figure 2 - Groundwater Elevation Contour Map
- Appendix A - Sampling and Analysis Procedures
- Appendix B - Certified Analytical Reports and Chain-of-Custody Documentation
- Appendix C - Field Data Sheets
- Appendix D - Certified Analytical Reports and Chain-of-Custody Documentation for Soil-Vapor Extraction System

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 Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Groundwater Flow Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240	TRPH EPA 418 1
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
MW-1	03-20-95	108.03	15.75	92.28	ND	SW	0.02	03-20-95	830	140	5	41	110	--	--	--
MW-1	06-06-95	108.03	17.68	90.35	ND	SW	0.016	06-06-95	210	30	<0.5	7.3	16	--	--	--
MW-1	08-24-95	107.80	17.45	90.35	ND	SW	0.014	08-24-95	Not sampled: well was inaccessible due to construction							
MW-1	11-16-95	107.80	17.64	90.16	ND	SW	0.012	11-16-95	<50	5.6	<0.5	1 4	1.2	55	--	--
MW-1	02-27-96	107.80	15.21	92.59	ND	SW	0.016	02-27-96	1400	240	88	44	110	200	--	--
MW-1	05-15-96	107.80	17.53	90.27	ND	SW	0.015	05-15-96	Not sampled: well sampled semi-annually, during the first and third quarter							
MW-1	08-14-96	107.80	17.15	90.65	ND	SW	0.021	08-14-96	98	18	<0.5	1.9	1	45	--	--
MW-1	11-11-96	107.80	17.78	90.02	ND	SW	0.015	11-11-96	Not sampled: well sampled semi-annually, during the first and third quarter							
MW-1	03-25-97	107.80	17.68	90.12	ND	SSW	0.018	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
MW-1	05-15-97	107.80	17.91	89.89	ND	SSW	0.014	05-15-97	Not sampled: well sampled semi-annually, during the first and third quarter							
MW-1	10-26-97	107.80	18.85	88.95	ND	SW	0.009	10-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
MW-1	11-10-97	107 80	18.10	89.70	ND	SSW	0.014	11-10-97	<50	<0.5	<0.5	<0.5	<0.5	4	--	--
MW-1	02-13-98	107 80	13 15	94 65	ND	SSW	0.012	02-13-98	<100	8.4	<1	<1	14	130	--	--
MW-1	05-12-98	107 80	12.30	95.50	ND	SW	0.02	05-12-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
MW-1	07-28-98	107.80	17.04	90.76	ND	SW	0.02	07-28-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
MW-1	10-28-98	107.80	18.10	89.70	ND	SW	0.01	10-28-98	<50	<0.5	<0.5	<0.5	<0 5	<3	--	--
MW-2	03-20-95	107.43	15.50	91.93	ND#	SW	0.02	03-20-95	Not sampled, floating product entered well during purging							
MW-2	06-06-95	107 43	17 43	90.00	ND	SW	0.016	06-06-95	1200	60	21	35	140	--	--	--
MW-2	08-24-95	107.28	17.22	90.06	ND	SW	0.014	08-24-95	Not sampled: well was inaccessible due to construction							
MW-2	11-16-95	107.28	17.36	89.92	ND	SW	0.012	11-16-95	360	45	1.3	7.1	7.5	210	--	--
MW-2	02-27-96	107.28	14 82	92.46	ND	SW	0.016	02-27-96	8900	1400	980	150	550	940	--	--
MW-2	05-15-96	107.28	17 40	89 88	ND	SW	0 015	05-15-96	480	82	48	8	48	87	--	--
MW-2	08-14-96	107 28	17.00	90.28	ND	SW	0 021	08-14-96	130	22	4	2	9	120	--	--
MW-2	11-11-96	107.28	17.55	89.73	ND	SW	0.015	11-11-96	1200	150	120	21	160	110	--	--
MW-2	03-25-97	107.28	17.32	89.96	ND	SSW	0.018	03-25-97	670	23	58	13	120	28	--	--
MW-2	05-15-97	107.28	17.61	89.67	ND	SSW	0.014	05-15-97	<50	<0.5	<0.5	<0.5	<0 5	23	--	--
MW-2	10-26-97	107.28	18 43	88.85	ND	SW	0.009	10-26-97	<50	<0.5	<0.5	<0 5	<0.5	<3	--	--
MW-2	11-10-97	107.28	17 84	89.44	ND	SSW	0.014	11-10-97	<100	<1	<1	<1	1	74	--	--
MW-2	02-13-98	107.28	12.75	94.53	ND	SSW	0.012	02-13-98	220	9.5	3 9	3.7	48	84	--	--
MW-2	05-12-98	107 28	17 02	90 26	ND	SW	0.02	05-12-98	3900	210	280	86	910	35	--	--
MW-2	07-28-98	107.28	17.30	89 98	ND	SW	0.02	07-28-98	<50	<0.5	<0 5	<0.5	<0 5	<3	--	--
MW-2	10-28-98	107.28	17.80	89.48	ND	SW	0.01	10-28-98	170	17	<0.5	1 7	5 0	24	--	--

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 Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Groundwater Flow Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240	TRPH EPA 418.1
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
MW-3	03-20-95	107.77	15.60	92.17	ND	SW	0.02	03-20-95	29000	880	190	760	2000	--	--	16
MW-3	06-06-95	107 77	17.54	90.23	ND	SW	0.016	06-06-95	22000	450	54	380	1300	--	--	7.1
MW-3	08-24-95	107.61	17.42	90.19	ND	SW	0 014	08-24-95	Not sampled: well was inaccessible due to construction							
MW-3	11-16-95	107.61	17 58	90.03	ND	SW	0.012	11-16-95	13000	210	<20	320	1000	790	--	8.3
MW-3	02-27-96	107 61	15.03	92.58	ND	SW	0.016	02-27-96	9700	94	15	290	720	430	--	10
MW-3	05-15-96	107.61	17.35	90.26	ND	SW	0.015	05-15-96	5600	66	12	37	67	230	--	--
MW-3	08-14-96	107.61	17 10	90.51	ND	SW	0.021	08-14-96	830	17	<1*	8	7	110	--	--
MW-3	11-11-96	107.61	17.73	89.88	ND	SW	0.015	11-11-96	500	28	3	12	13	150	--	--
MW-3	03-25-97	107.61	17.99	89 62	ND	SSW	0.018	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	94	--	--
MW-3	05-15-97	107.61	17.84	89.77	ND	SSW	0.014	05-15-97	<50	<0 5	<0.5	<0.5	<0.5	65	--	--
MW-3	10-26-97	107 61	18.50	89 11	ND	SW	0.009	10-26-97	220	4	<1	<1	<1	160	--	--
MW-3	11-10-97	107.61	18.00	89.61	ND	SSW	0.014	11-10-97	350	8	<2	3	3	230	--	--
MW-3	02-13-98	107.61	13 00	94.61	ND	SSW	0.012	02-13-98	<50	1 3	<0.5	<0.5	1	21	--	--
MW-3	05-12-98	107.61	17.20	90.41	ND	SW	0.02	05-12-98	120	<0.5	<0 5	<0.5	<0 9	71	--	--
MW-3	07-28-98	107.61	17.46	90.15	ND	SW	0.02	07-28-98	<50	1.4	<0.5	<0 5	<0 5	52	--	--
MW-3	10-28-98	107.61	18.00	89.61	ND	SW	0.01	10-28-98	170	<0.5	<0.5	<0.5	0.7	35	--	--
MW-4	03-20-95	106.58	13.85	92 73	ND	SW	0.02	03-20-95	88	1	<0 5	<0 5	0 7	--	--	--
MW-4	06-06-95	106.58	15.70	90.88	ND	SW	0.016	06-06-95	<50	<0 5	<0.5	<0.5	<0.5	--	--	--
MW-4	08-24-95	106.71	15 86	90.85	ND	SW	0.014	08-24-95	Not sampled: well was inaccessible due to construction							
MW-4	11-16-95	106.71	16.10	90.61	ND	SW	0 012	11-16-95	<50	<0.5	<0 5	<0.5	<0.5	6	--	--
MW-4	02-27-96	106.71	13.72	92.99	ND	SW	0.016	02-27-96	<50	<0 5	<0.5	<0.5	<0 5	10	--	--
MW-4	05-15-96	106.71	15 90	90.81	ND	SW	0.015	05-15-96	Not sampled, well sampled semi-annually, during the first and third quarter							
MW-4	08-14-96	106 71	15.68	91.03	ND	SW	0.021	08-14-96	<50	<0.5	<0 5	<0 5	<0 5	<3	--	--
MW-4	11-11-96	106.71	16.19	90.52	ND	SW	0.015	11-11-96	Not sampled: well sampled semi-annually, during the first and third quarter							
MW-4	03-25-97	106.71	16.10	90.61	ND	SSW	0.018	03-25-97	<50	<0 5	<0.5	<0.5	<0.5	<3	--	--
MW-4	05-15-97	106 71	16.38	90.33	ND	SSW	0.014	05-15-97	Not sampled: well sampled semi-annually, during the first and third quarter							
MW-4	10-26-97	106 71	17.78	88 93	ND	SW	0.009	10-26-97	<50	<0.5	<0 5	<0 5	<0.5	<3	--	--
MW-4	11-10-97	106.71	16.43	90.28	ND	SSW	0.014	11-10-97	Not sampled: well sampled semi-annually, during the first and third quarter							
MW-4	02-13-98	106.71	13.05	93.66	ND	SSW	0 012	02-13-98	<50	1.3	0.7	<0.5	2.3	19	--	--
MW-4	05-12-98	106.71	15.69	91.02	ND	SW	0.02	05-12-98	Not sampled: well sampled semi-annually, during the first and third quarter							
MW-4	07-28-98	106.71	15.93	90.78	ND	SW	0.02	07-28-98	<50	<0 5	<0.5	<0 5	<0.5	<3	--	--
MW-4	10-28-98	106 71	16.40	90 31	ND	SW	0.01	10-28-98	Not sampled: well sampled semi-annually, during the first and third 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

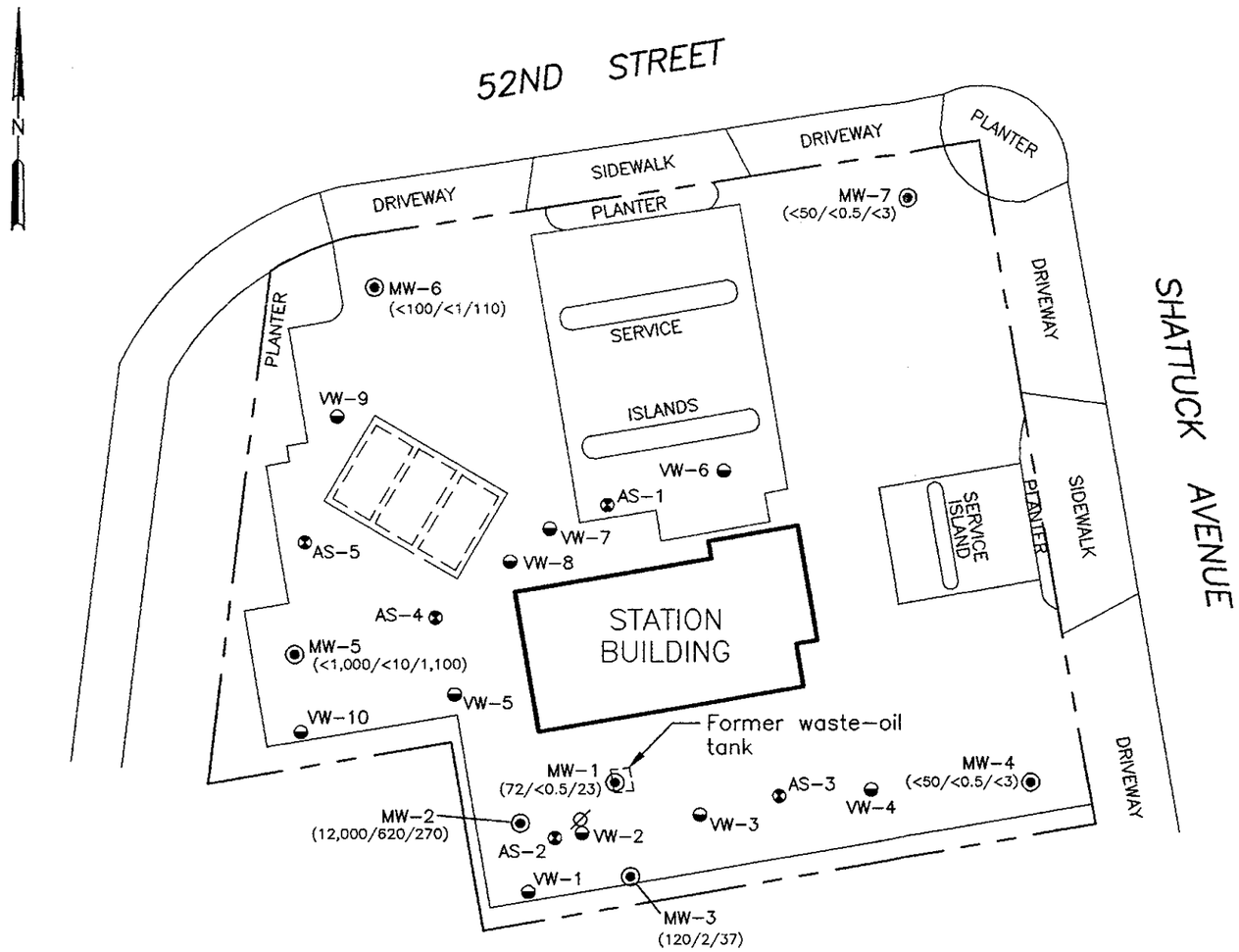
Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Groundwater Flow Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240	TRPH EPA 418.1
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
MW-5	03-20-95	106.68	14.92	91.76	ND	SW	0.02	03-20-95	21000	6900	450	800	1300	--	--	--
MW-5	06-06-95	106.68	16.61	90.07	ND	SW	0.016	06-06-95	6500	1700	<20	120	69	--	--	--
MW-5	08-24-95	106.60	16.47	90.13	ND	SW	0.014	08-24-95	Not sampled: well was inaccessible due to construction							
MW-5	11-16-95	106.60	16.69	89.91	ND	SW	0.012	11-16-95	1800	470	<5	17	5	1000	--	--
MW-5	02-27-96	106.60	14.35	92.25	ND	SW	0.016	02-27-96	10000	1000	71	690	1000	440	450	--
MW-5	05-15-96	106.60	16.58	90.02	ND	SW	0.015	05-15-96	3400	350	6	72	20	220	--	--
MW-5	08-14-96	106.60	17.26	89.34	ND	SW	0.021	08-14-96	2100	130	2.7	47	4.7	220	--	--
MW-5	11-11-96	106.60	16.62	89.98	ND	SW	0.015	11-11-96	1200	31	1	8	2	130	--	--
MW-5	03-25-97	106.60	16.38	90.22	ND	SSW	0.018	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	5	--	--
MW-5	05-15-97	106.60	16.54	90.06	ND	SSW	0.014	05-15-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
MW-5	10-26-97	106.60	17.60	89.00	ND	SW	0.009	10-26-97	<50	<0.5	<0.5	<0.5	<0.5	7	--	--
MW-5	11-10-97	106.60	16.78	89.82	ND	SSW	0.014	11-10-97	<50	<0.5	<0.5	<0.5	<0.5	24	--	--
MW-5	02-13-98	106.60	12.21	94.39	ND	SSW	0.012	02-13-98	11200	51	<10	<10	<10	2000	--	--
MW-5	05-12-98	106.60	NR	NR	ND	SW	0.02	05-12-98	Not sampled: well inaccessible							
MW-5	07-28-98	106.60	16.47	90.13	ND	SW	0.02	07-28-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
MW-5	10-28-98	106.60	16.80	89.80	ND	SW	0.01	10-28-98	<50	0.8	<0.5	<0.5	<0.5	99	--	--
MW-6	03-20-95	105.16	12.13	93.03	ND	SW	0.02	03-20-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
MW-6	06-06-95	105.16	13.95	91.21	ND	SW	0.016	06-06-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
MW-6	08-24-95	105.13	14.07	91.06	ND	SW	0.014	08-24-95	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
MW-6	11-16-95	105.13	14.34	90.79	ND	SW	0.012	11-16-95	<60	<0.5	<0.5	<0.5	<0.5	--	--	--
MW-6	02-27-96	105.13	12.00	93.13	ND	SW	0.016	02-27-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
MW-6	05-15-96	105.13	14.10	91.03	ND	SW	0.015	05-15-96	Not sampled: well sampled annually, during the first quarter							
MW-6	08-14-96	105.13	13.70	91.43	ND	SW	0.021	08-14-96	Not sampled: well sampled annually, during the first quarter							
MW-6	11-11-96	105.13	14.11	91.02	ND	SW	0.015	11-11-96	Not sampled: well sampled annually, during the first quarter							
MW-6	03-25-97	105.13	14.15	90.98	ND	SSW	0.018	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
MW-6	05-15-97	105.13	14.44	90.69	ND	SSW	0.014	05-15-97	Not sampled: well sampled annually, during the first quarter							
MW-6	10-26-97	105.13	16.02	89.11	ND	SW	0.009	10-26-97	Not sampled: well sampled annually, during the first quarter							
MW-6	11-10-97	105.13	14.52	90.61	ND	SSW	0.014	11-10-97	Not sampled well sampled annually, during the first quarter							
MW-6	02-13-98	105.13	10.06	95.07	ND	SSW	0.012	02-13-98	<50	<0.5	<0.5	<0.5	<0.5	8	--	--
MW-6	05-12-98	105.13	13.75	91.38	ND	SW	0.02	05-12-98	Not sampled: well sampled annually, during the first quarter							
MW-6	07-28-98	105.13	14.06	91.07	ND	SW	0.02	07-28-98	Not sampled: well sampled annually, during the first quarter							
MW-6	10-28-98	105.13	14.71	90.42	ND	SW	0.01	10-28-98	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 Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Groundwater Flow Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240	TRPH EPA 418.1
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
MW-7	03-20-95	107.08	12.32	94.76	ND	SW	0.02	03-20-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
MW-7	06-06-95	107.08	14.59	92.49	ND	SW	0.016	06-06-95	Not sampled: well sampled semi-annually, during the first and third quarters							
MW-7	08-24-95	107.05	14.64	92.41	ND	SW	0.014	08-24-95	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
MW-7	11-16-95	107.05	15.30	91.75	ND	SW	0.012	11-16-95	Not sampled: well sampled semi-annually, during the first and third quarters							
MW-7	02-27-96	107.05	12.24	94.81	ND	SW	0.016	02-27-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
MW-7	05-15-96	107.05	14.65	92.40	ND	SW	0.015	05-15-96	Not sampled: well sampled annually, during the first quarter							
MW-7	08-14-96	107.05	14.35	92.70	ND	SW	0.021	08-14-96	Not sampled: well sampled annually, during the first quarter							
MW-7	11-11-96	107.05	14.92	92.13	ND	SW	0.015	11-11-96	Not sampled: well sampled annually, during the first quarter							
MW-7	03-25-97	107.05	14.80	92.25	ND	SSW	0.018	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
MW-7	05-15-97	107.05	15.27	91.78	ND	SSW	0.014	05-15-97	Not sampled: well sampled annually, during the first quarter							
MW-7	10-26-97	107.05	16.68	90.37	ND	SW	0.009	10-26-97	Not sampled: well sampled annually, during the first quarter							
MW-7	11-10-97	107.05	15.37	91.68	ND	SSW	0.014	11-10-97	Not sampled: well sampled annually, during the first quarter							
MW-7	02-13-98	107.05	10.80	96.25	ND	SSW	0.012	02-13-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
MW-7	05-12-98	107.05	14.32	92.73	ND	SW	0.02	05-12-98	Not sampled: well sampled annually, during the first quarter							
MW-7	07-28-98	107.05	14.79	92.26	ND	SW	0.02	07-28-98	Not sampled: well sampled annually, during the first quarter							
MW-7	10-28-98	107.05	15.57	91.48	ND	SW	0.01	10-28-98	Not sampled: well sampled annually, during the first quarter							

ft-MSL: elevation in feet, relative to mean sea level
MWN: ground-water flow direction and gradient apply to the entire monitoring well network
ft/ft: foot per foot
TPHG: total petroleum hydrocarbons as gasoline, California DHS LUFT Method
µg/L: micrograms per liter
EPA: United States Environmental Protection Agency
MTBE: Methyl tert-butyl ether
mg/L: milligrams per liter
TRPH: total recoverable petroleum hydrocarbons
NR: not reported; data not available
ND: none detected
SW: Southwest
#: floating product entered the well during purging
- -: not analyzed or not applicable
**: For previous historical groundwater elevation and analytical data please refer to *Fourth Quarter 1995 Groundwater Monitoring Program Results and Remediation System Performance Eval Report, ARCO Service Station 6148, Oakland, California,* (EMCON, March 4, 1996).



EXPLANATION

⊙	Groundwater monitoring well
◒	Vapor extraction well
⊗	Air-sparge well
⌀	Decommissioned well
┌ ─ ┐ └ ─ ┘	Existing underground gasoline storage tanks
(72/<0.5/23)	Concentration of total petroleum hydrocarbons as gasoline (TPHG), benzene, and MTBE in groundwater (ug/L); samples collected 2/12/99
<	Not detected at or above the indicated laboratory detection limit

0 30 60

SCALE IN FEET

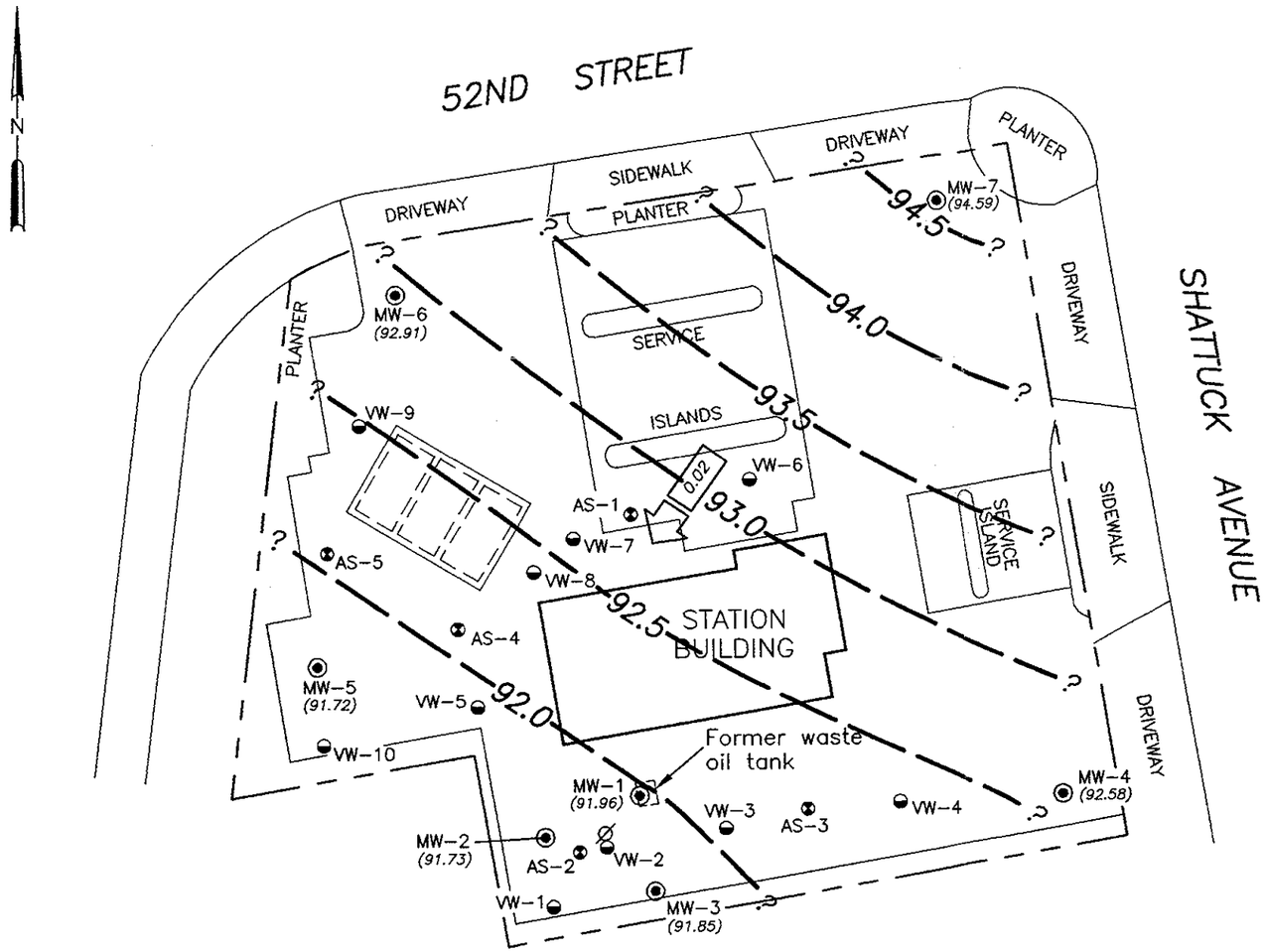
IMAGE Files: <No Images>
XREF Files: <No Xrefs>
SANJOSE/CADD: N:\DWG\PINACL\6148\6148CHEM.DWG Mon, 05/Apr/99 02:24pm kblack
Dimscale: 30 Ltscale: 30 Psltscale: 0

1" 1/2" 0" 1"

Pinnacle
ENVIRONMENTAL SOLUTIONS
A DIVISION OF EMCON

DATE APR. 1999
DWN KAB
APP
REV
PROJECT NO.
20805-135.009

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



EXPLANATION

- Groundwater monitoring well
- Vapor extraction well
- Air-sparge well
- Decommissioned well
- Existing underground gasoline storage tank
- (94.59) Groundwater elevation (Ft.-MSL) measured 2/12/99
- Groundwater elevation contour (Ft.-MSL)
- Approximate direction of groundwater flow showing gradient

0 30 60

APPROXIMATE SCALE IN FEET

Pinnacle

ENVIRONMENTAL SOLUTIONS
A DIVISION OF EMCON

DATE APR. 1999
DWN KAB
APP
REV
PROJECT NO.
20805-135.009

FIGURE 2
ARCO PRODUCTS COMPANY
SERVICE STATION 6148, 5131 SHATTUCK AVE.
OAKLAND, CALIFORNIA
GROUNDWATER ELEVATION CONTOURS
FIRST QUARTER 1999

1" 1/2" 0" 1"
IMAGE Files: <No Images>
Dimscale: 30 Ltscale: 30 Psltscale: 0 XREF Files: <No Xrefs>
SANJOSE/CADD: N:\DWG\PINACL\6148\6148GWC.DWG Thu, 08/Apr/99 12:22pm kblack

APPENDIX A

SAMPLING AND ANALYSIS PROCEDURES

APPENDIX A

SAMPLING AND ANALYSIS PROCEDURES

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

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

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

Sample Collection

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

Equipment Cleaning

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

Water Level, Floating Hydrocarbon, and Total Well Depth Measurements

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

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

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

Well Purging

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

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

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

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

Well Sampling

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

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

Sample Preservation and Handling

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

Sample Containers and Preservation

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

Sample Handling

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

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

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

Sample Documentation

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

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

Field Logbook

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

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

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

Labels

Sample labels contained the following information:

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

Sampling and Analysis Chain-of-Custody Record

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

Groundwater Sampling and Analysis Request Form

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

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

MONITORING WELL PURGING PROTOCOL

OWT

MEASURE AND RECORD DEPTH TO WATER AND WELL TOTAL DEPTH

CHECK FOR FLOATING PRODUCT

YES

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

NO

CALCULATE PURGE VOLUME BY USING THE FOLLOWING EQUATION:

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

where:

P = calculated purge volume (gallons)

$\pi = 3.14$

r = radius of well casing in feet

h = height of water column in feet

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

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

NO

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

pH = ± 0.1 pH units

COND. = ± 10 %

TEMP. = ± 1.0 °F

YES

WELL PURGING CRITERIA MET; PROCEED TO WELL SAMPLING.

NO

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

YES

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

YES

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

NO

RECORD WELL AS DRY FOR PURPOSES OF SAMPLING.

EMCON

MONITORING WELL PURGING PROTOCOL

FIGURE

A-1

WATER SAMPLE FIELD DATA SHEET

Rev. 5/96

OWT

PROJECT NO : _____ SAMPLE ID : _____

PURGED BY : _____ CLIENT NAME : _____

SAMPLED BY : _____ LOCATION : _____

TYPE: Groundwater _____ Surface Water _____ Leachate _____ Other _____

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

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

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

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

DATE PURGED : _____ END PURGE : _____

DATE SAMPLED : _____ SAMPLING TIME : _____

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

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

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

PURGING EQUIPMENT

_____ 2" Bladder Pump _____ Bailer (Teflon)

_____ Centrifugal Pump _____ Bailer (PVC)

_____ Submersible Pump _____ Bailer (Stainless Steel)

_____ Well Wizard™ _____ Dedicated

Other. _____

SAMPLING EQUIPMENT

_____ 2" Bladder Pump _____ Bailer (Teflon)

_____ Bomb Sampler _____ Bailer (Stainless Steel)

_____ Dipper _____ Submersible Pump

_____ Well Wizard™ _____ Dedicated

Other: _____

WELL INTEGRITY: _____ LOCK: _____

REMARKS: _____

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

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

Temperature °F _____

SIGNATURE: _____ REVIEWED BY: _____ PAGE _____ OF _____

EMCON

WATER SAMPLE FIELD DATA SHEET

FIGURE A-2

OWT

EMCON - SACRAMENTO
GROUNDWATER SAMPLING AND ANALYSIS REQUEST FORM

PROJECT NAME :

SCHEDULED DATE :

SPECIAL INSTRUCTIONS / CONSIDERATIONS :

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

Well Lock Number (s)

[ ] CHECK BOX TO AUTHORIZE DATA ENTRY

Site Contact: _____ Name _____ Phone #

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

Laboratory and Lab QC Istructions:

EMCON

SAMPLING AND ANALYSIS REQUEST FORM

FIGURE
A-3

APPENDIX B

CERTIFIED ANALYTICAL REPORTS, AND CHAIN-OF-CUSTODY DOCUMENTATION

Columbia Analytical Services INC.
An Employee-Owned Company

RECEIVED
NOV 1 2 1998
BY: am

November 10, 1998 Service Request No.: S9802900

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

RE: 20805-135.008/TO#22312.00/RAT8/6148 OAKLAND

Dear Mr. Vanderveen:

The following pages contain analytical results for sample(s) received by the laboratory on October 28, 1998. Results of sample analyses are followed by Appendix A which contains sample custody documentation and quality assurance deliverables requested for this project. The work requested has been assigned the Service Request No. listed above. To help expedite our service, please refer to this number when contacting the laboratory.

Analytical results were produced by procedures consistent with Columbia Analytical Services' (CAS) Quality Assurance Manual (with any deviations noted). Signature of this CAS Analytical Report below confirms that pages 2 through 12, following, have been thoroughly reviewed and approved for release in accord with CAS Standard Operating Procedure ADM-DatRev3.

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

Sincerely,

Steven L. Green
Project Chemist

Bernadette J. Cox for

Greg Anderson
Regional QA Coordinator

COLUMBIA ANALYTICAL SERVICES, Inc.

Acronyms

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802900
Project:	20805-135 008/TO#22312.00/RAT8/6148 OAKLAND	**Date Collected:**	10/28/98
Sample Matrix:	Water	**Date Received:**	10/28/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-1(19)	Units:	ug/L (ppb)
Lab Code:	S9802900-001	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	10/31/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	10/31/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	10/31/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	10/31/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	10/31/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	10/31/98	ND	

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802900
Project:	20805-135.008/TO#22312.00/RAT8/6148 OAKLAND	**Date Collected:**	10/28/98
Sample Matrix:	Water	**Date Received:**	10/28/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-3(19)	Units:	ug/L (ppb)
Lab Code:	S9802900-002	Basis:	NA
Test Notes.			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	10/29/98	170	
Benzene	EPA 5030	8020	0.5	1	NA	10/29/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	10/29/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	10/29/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	10/29/98	0.7	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	10/29/98	35	

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802900
Project:	20805-135.008/TO#22312.00/RAT8/6148 OAKLAND	**Date Collected:**	10/28/98
Sample Matrix:	Water	**Date Received:**	10/28/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-2(18)	Units:	ug/L (ppb)
Lab Code:	S9802900-003	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	10/29/98	170	
Benzene	EPA 5030	8020	0.5	1	NA	10/29/98	17	
Toluene	EPA 5030	8020	0.5	1	NA	10/29/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	10/29/98	1.7	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	10/29/98	5.0	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	10/29/98	24	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802900
Project:	20805-135 008/TO#223 12.00/RAT8/6148 OAKLAND	**Date Collected:**	10/28/98
Sample Matrix:	Water	**Date Received:**	10/28/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-5(17)	Units:	ug/L (ppb)
Lab Code:	S9802900-004	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	10/29/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	10/29/98	0.8	
Toluene	EPA 5030	8020	0.5	1	NA	10/29/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	10/29/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	10/29/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	10/29/98	99	

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802900
Project:	20805-135.008/TO#22312.00/RAT8/6148 OAKLAND	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA

BTEX, MTBE and TPH as Gasoline

Sample Name:	Method Blank	Units:	ug/L (ppb)
Lab Code:	S981031-WB1	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	10/31/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	10/31/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	10/31/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	10/31/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	10/31/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	10/31/98	ND	

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802900
Project:	20805-135.008/TO#22312.00/RAT8/6148 OAKLAND	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA

BTEX, MTBE and TPH as Gasoline

Sample Name:	Method Blank	Units:	ug/L (ppb)
Lab Code:	S981029-WB1	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	10/29/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	10/29/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	10/29/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	10/29/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	10/29/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	10/29/98	ND	

1S22/020197p

APPENDIX A

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO Products Company	**Service Request:**	S9802900
Project:	20805-135.008/TO#22312.00/RAT8/6148 OAKLAND	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	NA

Surrogate Recovery Summary
BTEX, MTBE and TPH as Gasoline

Prep Method:	EPA 5030	Units:	PERCENT
Analysis Method	8020 CA/LUFT	Basis:	NA

Sample Name	Lab Code	Test Notes	Percent Recovery	
			4-Bromofluorobenzene	a,a,a-Trifluorotoluene
MW-1(19)	S9802900-001		98	87
MW-3(19)	S9802900-002		100	110
MW-2(18)	S9802900-003		109	106
MW-5(17)	S9802900-004		105	103
MW-1(19)	S9802900-001MS		105	80
MW-1(19)	S9802900-001DMS		105	89
Method Blank	S981031-WB1		99	94
Method Blank	S981029-WB1		99	98
CAS Acceptance Limits:			69-116	69-116

SUR2/020397p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO Products Company	**Service Request:**	S9802900
Project:	20805-135.008/TO#22312.00/RAT8/6148 OAKLAND	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	11/1/98

Matrix Spike/Duplicate Matrix Spike Summary
BTE

Sample Name:	MW-1(19)	Units:	ug/L (ppb)
Lab Code:	S9802900-001MS, S9802900-001DMS	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	CAS Acceptance Limits	Relative Percent Difference
Benzene	EPA 5030	8020	0.5	25	25	ND	28	28	112	112	75-135	<1
Toluene	EPA 5030	8020	0.5	25	25	ND	28	27	112	108	73-136	4
Ethylbenzene	EPA 5030	8020	0.5	25	25	ND	28	28	112	112	69-142	<1

DMS/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO Products Company	**Service Request:**	S9802900
Project:	20805-135.008/TO#22312.00/RAT8/6148 OAKLAND	**Date Analyzed:**	10/31/98

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

Sample Name:	ICV	Units:	ug/L (ppb)
Lab Code:	ICV1	Basis:	NA
Test Notes:			

ICV Source:

Analyte	Prep Method	Analysis Method	True Value	Result	CAS Percent Recovery Acceptance Limits	Percent Recovery	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	250	250	90-110	100	
Benzene	EPA 5030	8020	25	27	85-115	108	
Toluene	EPA 5030	8020	25	27	85-115	108	
Ethylbenzene	EPA 5030	8020	25	28	85-115	112	
Xylenes, Total	EPA 5030	8020	75	83	85-115	111	
Methyl *tert*-Butyl Ether	EPA 5030	8020	25	24	85-115	96	

ICV/032196

ARCO Products Company — Chain of Custody

Division of Atlantic/Richfield Company — 5980 2900 — Task Order No. 22312.CC

ARCO Facility no 6148	City (Facility) Oakland	Project manager (Consultant) Glen VanderVeen	Laboratory Name CAS
ARCO engineer Paul Supple	Telephone no (ARCO)	Telephone no (Consultant) (408)453-7300	Fax no. (Consultant) (408)437-9526
Consultant name EMCON	Address (Consultant) 144-A Mayhew Way Walnut Creek, CA 94596		Contract Number

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH, MTBE EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM 503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Semi Metals ☐ VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org/DHS ☐ Lead EPA 7420/7421 ☐			
MW-1	(19)	2	(1)	X		X	HCL	10/28/98	1100		X												
MW-3	(19)	2	(2)	X		X	HCL	↓	1115		X												
MW-2	(18)	2	(3)	X		X	HCL		1135		X												
MW-5	(17)	2	(4)	X		X	HCL	↓	1150		X												

Method of shipment: Sampler will deliver

Special Detection Limit/reporting: Lowest Possible

Special QA/QC: As Normal

Remarks: RAT 9

2-40ml HCL VOAs

#20805-135.008

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: 11/11/98 R11/D3

	Date	Time			
Relinquished by sampler	10/28/98		Received by Joseph Machado CAS	10/28/98	1400
Relinquished by	Date	Time	Received by		
Relinquished by	Date	Time	Received by laboratory	Date	Time

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

APPENDIX C

FIELD DATA SHEETS

FIELD REPORT
DEPTH TO WATER / FLOATING PRODUCT SURVEY

PROJECT # : **21775-250.003** STATION ADDRESS : **5131 Shattuck Avenue, Oakland** DATE : **10/28/98**

ARCO STATION # : **6148** FIELD TECHNICIAN : **Manuel Gallegos** DAY : **Wednesday**

DTW Order	WELL ID	Well Box Seal	Type Of Well Lid	Gasket Present	Lock Number	Type Of Well Cap	FIRST DEPTH TO WATER (feet)	SECOND DEPTH TO WATER (feet)	DEPTH TO FLOATING PRODUCT (feet)	FLOATING PRODUCT THICKNESS (feet)	WELL TOTAL DEPTH (feet)	COMMENTS
1	MW-7	OK	15/16"	YES	ARCO	LWC	15.57	15.57	ND	ND	27.0	
2	MW-6	OK	15/16"	YES	ARCO	LWC	14.71	14.71	ND	ND	26.6	
3	MW-4	OK	15/16"	YES	NONE	TC	16.40	16.40	ND	ND	26.1	
4	MW-1	OK	15/16"	YES	NONE	TC	18.10	18.10	ND	ND	25.5	
5	MW-5	OK	15/16"	YES	NONE	TC	16.80	16.80	ND	ND	24.8	
6	MW-2	OK	15/16"	YES	NONE	TC	17.80	17.80	ND	ND	25.6	
7	MW-3	OK	15/16"	YES	NONE	TC	18.00	18.00	ND	ND	25.6	

SURVEY POINTS ARE TOP OF WELL CASINGS

WATER SAMPLE FIELD DATA SHEET

Rev 1/97

OWT

PROJECT NO 21775-250.003
PURGED BY M. Gallegos
SAMPLED BY ↓

SAMPLE ID MW-1 (191)
CLIENT NAME ARCO # 6148
LOCATION OAKLAND, CA.

TYPE Groundwater X Surface Water ____ Leachate ____ Other ____

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

CASING ELEVATION (feet/MSL) NR
DEPTH OF WELL (feet) 25.5
DEPTH OF WATER (feet) 18.10

VOLUME IN CASING (gal) NR
CALCULATED PURGE (gal) ____
ACTUAL PURGE VOL (gal) ↓

DATE PURGED 10-28-98
DATE SAMPLED ↓

END PURGE ____
SAMPLING TIME 1100

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1100	GRAB	5.64	426	72.9	Clear	Clear

OTHER DO = 1

ODOR none

NR (COBALT 0-100)

NR (NTU 0-200)

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

PURGING EQUIPMENT

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

SAMPLING EQUIPMENT

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

WELL INTEGRITY: ok

LOCK: Hondo

REMARKS: all samples taken

pH, E C, Temp Meter Calibration Date 10/28/98 Time 1055 Meter Serial No 87M

EC 1000 988/1000 pH 7 6.97/700 pH 10 997/1000 pH 4 405/400

Temperature °F 66.4

SIGNATURE Manuel L. Gallegos REVIEWED BY NA PAGE 1 OF 4

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97

OWT

PROJECT NO : 20805-135.008 SAMPLE ID : MW-2 (18')

PURGED BY : M. Gallegos CLIENT NAME : ARCO #6148

SAMPLED BY : ↓ LOCATION : OAKLAND, CA.

TYPE: Groundwater X Surface Water ____ Leachate ____ Other ____

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

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

DEPTH OF WELL (feet) : 25.4 CALCULATED PURGE (gal.) : ↓

DEPTH OF WATER (feet) : 17.80 ACTUAL PURGE VOL. (gal.) : ↓

DATE PURGED : 10-28-98 END PURGE : ____

DATE SAMPLED : ↓ SAMPLING TIME : 1135

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1135	GRAB	6.51	436	72.0		

OTHER: DO = 1.5 ODOR: None. NR (COBALT 0-100) NR (NTU 0-200)

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

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
____ 2" Bladder Pump	____ Bailer (Teflon)	____ 2" Bladder Pump	X 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: O/K LOCK: Mark

REMARKS: All samples taken

pH, E.C , Temp Meter Calibration Date 10/28/98 Time. ____ Meter Serial No 877M

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

Temperature °F

SIGNATURE: [signature] REVIEWED BY: GB PAGE 2 OF 4

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97

OWT

PROJECT NO : 2175-250-003 | SAMPLE ID : MW-3 (19')
PURGED BY : M. Gallegos | CLIENT NAME : ARCO # 6148
SAMPLED BY : ↓ | LOCATION : OAKLAND, CA.

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

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

CASING ELEVATION (feet/MSL) : NR | VOLUME IN CASING (gal.) : NR
DEPTH OF WELL (feet) : 25.6 | CALCULATED PURGE (gal) . ↓
DEPTH OF WATER (feet) : 18.00 | ACTUAL PURGE VOL. (gal.) : ↓

DATE PURGED : 10-28-98 | END PURGE —
DATE SAMPLED : ↓ | SAMPLING TIME : 1115

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1115	GRAB	6.17	545	72.9	Clear	Clear

OTHER: DO=1 | ODOR: Strong | NR (COBALT 0-100) | NR (NTU 0-200)

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

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
____ 2" Bladder Pump	____ Bailer (Teflon)	____ 2" Bladder Pump	X 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: OK | LOCK: Non-C.

REMARKS: all samples taken

pH, E.C , Temp Meter Calibration Date: 10/28/98 | Time: ____ | Meter Serial No ____

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

Temperature °F ____

SIGNATURE: [signature] | REVIEWED BY: TA | PAGE 3 OF 4

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97

OWT

PROJECT NO : 21775-250-003 | SAMPLE ID : MW-5(17')
PURGED BY : M. Gallegos | CLIENT NAME : ARCO# 6148
SAMPLED BY : ✓ | LOCATION : OAKLAND, CA.

TYPE: Groundwater 1 | Surface Water ____ | Leachate ____ | Other ____
CASING DIAMETER (inches): 2 ____ | 3 ____ | 4 X | 4.5 ____ | 6 ____ | Other ____

CASING ELEVATION (feet/MSL) : NR | VOLUME IN CASING (gal) : NR
DEPTH OF WELL (feet) : 24.8 | CALCULATED PURGE (gal.) : ____
DEPTH OF WATER (feet) : 16.80 | ACTUAL PURGE VOL (gal.) : ____

DATE PURGED : 10-- | END PURGE : ____
DATE SAMPLED : 10-28-98 | SAMPLING TIME : 1150

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1150	GRAB	6.55	491	69.9	clear	clear

OTHER: DO = 1 | ODOR: Moderate | COLOR (COBALT 0-100): NR | TURBIDITY (NTU 0-200): NR

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

PURGING EQUIPMENT

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

SAMPLING EQUIPMENT

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

WELL INTEGRITY: OK | LOCK: Nuts

REMARKS: all samples taken

pH, E C , Temp Meter Calibration: Date: 10/28/98 | Time ____ | Meter Serial No : SM
E C 1000 ____ / ____ | pH 7 ____ / ____ | pH 10 ____ / ____ | pH 4 ____ / ____
Temperature °F ____

SIGNATURE: [signature] | REVIEWED BY: JA | PAGE 4 OF 4

EMCON Associates - Field Services | Historical Monitoring Well Data

1921 Ringwood Avenue | 1998 | ARCO 6148

San Jose, California | #21775-250.0003

Well ID	Quarter	Date	Purge Volume (gallons)	Did well dry	Well Contained Product	
						Gallons
						First 65.00
						Second 0.00
						Third 0.00
						Fourth 0.00
MW-1	First	02/13/98	0.00	GRAB	NO	
	Second	05/12/98	0.00	GRAB	NO	
	Third	07/28/98	0.00	GRAB	NO	
	Fourth	10/28/98	0.00	GRAB	NO	
MW-2	First	02/13/98	0.00	GRAB	NO	
	Second	05/12/98	0.00	GRAB	NO	
	Third	07/28/98	0.00	GRAB	NO	
	Fourth	10/28/98	0.00	GRAB	NO	
MW-3	First	02/13/98	0.00	GRAB	NO	
	Second	05/12/98	0.00	GRAB	NO	
	Third	07/28/98	0.00	GRAB	NO	
	Fourth	10/28/98	0.00	GRAB	NO	
MW-4	First	02/13/98	0.00	GRAB	NO	
	Second	05/12/98	0.00	NA	NO	
	Third	07/28/98	0.00	GRAB	NO	
	Fourth	10/28/98	0.00	NA	NO	
MW-5	First	02/13/98	0.00	GRAB	NO	
	Second	05/12/98	0.00	NA	NO	
	Third	07/28/98	0.00	GRAB	NO	
	Fourth	10/28/98	0.00	GRAB	NO	
MW-6	First	02/13/98	33.00	NO	NO	
	Second	05/12/98	0.00	NA	NO	
	Third	07/28/98	0.00	NA	NO	
	Fourth	10/28/98	0.00	NA	NO	
MW-7	First	02/13/98	32.00	NO	NO	
	Second	05/12/98	0.00	NA	NO	
	Third	07/28/98	0.00	NA	NO	
	Fourth	10/28/98	0.00	NA	NO	
						Steam water (gal) _____

ARCO Products Company
Division of Atlantic/Richfield Company

Task Order No. 22312.00

Chain of Custody

ARCO Facility no. 6148	City (Facility) Oakland	Project manager (Consultant) Glen Vanderveen	Laboratory Name CAS
ARCO engineer Paul Supple	Telephone no. (ARCO)	Telephone no. (Consultant) (408) 453-7300	Fax no. (Consultant) (408) 437-9776
Consultant name EMCON	Address (Consultant) 44-A Hayden Way Walnut Creek, CA 94596		Contract Number

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH Gas/TPH Diesel EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM 503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Semi Metals ☐ VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org/DHS ☐ Lead EPA 7420/7421 ☐			
MW-1	(19)	2		X		X	HCl	12-6-91	1100		X												
MW-3	(20)	2		X		X	HCl		1115		X												
MW-2	(18)	2		X		X	HCl		1125		X												
MW-5	(17)	2		X		X	HCl		1150		X												

Method of shipment: Sampler will deliver

Special Detection Limit/reporting: Lowest Possible

Special QA/QC: As Normal

Remarks: RAT 9
2-40ml HCl VOAs

H20865-135.008

Lab Number

Turnaround Time:

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

Condition of sample:		Temperature received:	
Relinquished by sampler	Date 12/6/91 Time	Received by	
Relinquished by	Date Time	Received by	
Relinquished by	Date Time	Received by laboratory	Date Time

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

APPENDIX D

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

Columbia Analytical Services INC
An Employee-Owned Company

November 25, 1998 Service Request No.: S9803066

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

RE: 20805-135.008/TO#22672.00/RAT8/6148 OAKLAND

Dear Mr. Vanderveen:

The following pages contain analytical results for sample(s) received by the laboratory on November 10, 1998. Results of sample analyses are followed by Appendix A which contains sample custody documentation and quality assurance deliverables requested for this project. The work requested has been assigned the Service Request No. listed above. To help expedite our service, please refer to this number when contacting the laboratory.

Analytical results were produced by procedures consistent with Columbia Analytical Services' (CAS) Quality Assurance Manual (with any deviations noted). Signature of this CAS Analytical Report below confirms that pages 2 through 14, following, have been thoroughly reviewed and approved for release in accord with CAS Standard Operating Procedure ADM-DatRev3.

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

Sincerely,

Bernadette A Cox for Greg Anderson for

Steven L. Green
Project Chemist

Greg Anderson
Regional QA Coordinator

COLUMBIA ANALYTICAL SERVICES, Inc.
Acronyms

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9803066
Project:	20805-135.008/TO#22672.00/RAT8/6148 OAKLAND	**Date Collected:**	11/10/98
Sample Matrix:	Air	**Date Received:**	11/10/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	I-1	Units:	mg/m3
Lab Code:	S9803066-001	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	5030	8020	0.4	20	NA	11/12/98	<8	C1
Toluene	5030	8020	0.4	20	NA	11/12/98	51	
Ethylbenzene	5030	8020	0.5	20	NA	11/12/98	<10	C1
Xylenes, Total	5030	8020	0.9	20	NA	11/12/98	<18	C1
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	12	20	NA	11/12/98	10000	
C6 - C12	5030	8015M	20	20	NA	11/12/98	3400	
TPH as Gasoline*	5030	8015M	20	20	NA	11/12/98	3400	

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

C1 The MRL was elevated due to high analyte concentration requiring sample dilution.

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9803066
Project:	20805-135.008/TO#22672.00/RAT8/6148 OAKLAND	**Date Collected:**	11/10/98
Sample Matrix:	Air	**Date Received:**	11/10/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	I-1	Units:	ppmV
Lab Code:	S9803066-001	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	5030	8020	0.1	20	NA	11/12/98	<2	C1
Toluene	5030	8020	0.1	20	NA	11/12/98	14	
Ethylbenzene	5030	8020	0.1	20	NA	11/12/98	<2	C1
Xylenes, Total	5030	8020	0.2	20	NA	11/12/98	<4	C1
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	5	20	NA	11/12/98	420	
C6 - C12	5030	8015M	5	20	NA	11/12/98	830	
TPH as Gasoline*	5030	8015M	5	20	NA	11/12/98	830	

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

C1 The MRL was elevated due to high analyte concentration requiring sample dilution.

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9803066
Project:	20805-135.008/TO#22672.00/RAT8/6148 OAKLAND	**Date Collected:**	11/10/98
Sample Matrix:	Air	**Date Received:**	11/10/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	E-1	Units:	mg/m3
Lab Code:	S9803066-002	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	5030	8020	0.4	1	NA	11/12/98	ND	
Toluene	5030	8020	0.4	1	NA	11/12/98	0.9	
Ethylbenzene	5030	8020	0.5	1	NA	11/12/98	ND	
Xylenes, Total	5030	8020	0.9	1	NA	11/12/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	12	1	NA	11/12/98	250	
C6 - C12	5030	8015M	20	1	NA	11/12/98	81	
TPH as Gasoline*	5030	8015M	20	1	NA	11/12/98	81	

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9803066
Project:	20805-135.008/TO#22672.00/RAT8/6148 OAKLAND	**Date Collected:**	11/10/98
Sample Matrix:	Air	**Date Received:**	11/10/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	E-1	Units:	ppmV
Lab Code:	S9803066-002	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	5030	8020	0.1	1	NA	11/12/98	ND	
Toluene	5030	8020	0.1	1	NA	11/12/98	0.2	
Ethylbenzene	5030	8020	0.1	1	NA	11/12/98	ND	
Xylenes, Total	5030	8020	0.2	1	NA	11/12/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	5	1	NA	11/12/98	110	
C6 - C12	5030	8015M	5	1	NA	11/12/98	20	
TPH as Gasoline*	5030	8015M	5	1	NA	11/12/98	20	

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9803066
Project:	20805-135.008/TO#22672.00/RAT8/6148 OAKLAND	**Date Collected:**	NA
Sample Matrix:	Air	**Date Received:**	NA

BTEX and Total Volatile Hydrocarbons

Sample Name:	Method Blank	Units:	mg/m3
Lab Code:	S981112-VB1	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	5030	8020	0.4	1	NA	11/12/98	ND	
Toluene	5030	8020	0.4	1	NA	11/12/98	ND	
Ethylbenzene	5030	8020	0.5	1	NA	11/12/98	ND	
Xylenes, Total	5030	8020	0.9	1	NA	11/12/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	12	1	NA	11/12/98	ND	
C6 - C12	5030	8015M	20	1	NA	11/12/98	ND	
TPH as Gasoline*	5030	8015M	20	1	NA	11/12/98	ND	

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9803066
Project:	20805-135.008/TO#22672.00/RAT8/6148 OAKLAND	**Date Collected:**	NA
Sample Matrix:	Air	**Date Received:**	NA

BTEX and Total Volatile Hydrocarbons

Sample Name:	Method Blank	Units:	ppmV
Lab Code:	S981112-VB1	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	5030	8020	0.1	1	NA	11/12/98	ND	
Toluene	5030	8020	0.1	1	NA	11/12/98	ND	
Ethylbenzene	5030	8020	0.1	1	NA	11/12/98	ND	
Xylenes, Total	5030	8020	0.2	1	NA	11/12/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	5	1	NA	11/12/98	ND	
C6 - C12	5030	8015M	5	1	NA	11/12/98	ND	
TPH as Gasoline*	5030	8015M	5	1	NA	11/12/98	ND	

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

APPENDIX A

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-135.008/TO#22672.00/RAT8/6148 OAKLAND
Sample Matrix: Air

Service Request: S9803066
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 11/12/98

Duplicate Summary
BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
Lab Code: S9803066-001DUP
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	5030	8020	0.4	<8	<8	--	--	
Toluene	5030	8020	0.4	51	47	49	4	
Ethylbenzene	5030	8020	0.5	<10	<10	--	--	
Xylenes, Total	5030	8020	0.9	<18	<18	--	--	
Total Volatile Hydrocarbons								
C1 - C5	5030	8015M	12	10000	9600	9800	2	
C6 - C12	5030	8015M	20	3400	3200	3300	6	
TPH as Gasoline*	5030	8015M	20	3400	3200	3300	6	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-135.008/TO#22672.00/RAT8/6148 OAKLAND
Sample Matrix: Air

Service Request: S9803066
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 11/12/98

Duplicate Summary
BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
Lab Code: S9803066-001DUP
Test Notes:

Units: ppmV
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Benzene	5030	8020	0.1	<2	<2	--	--	
Toluene	5030	8020	0.1	14	12	13	8	
Ethylbenzene	5030	8020	0.1	<2	<2	--	--	
Xylenes, Total	5030	8020	0.2	<4	<4	--	--	
Total Volatile Hydrocarbons								
C1 - C5	5030	8015M	5	4200	4000	4,100	5	
C6 - C12	5030	8015M	5	830	780	810	6	
TPH as Gasoline*	5030	8015M	5	830	780	810	6	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO Products Company	**Service Request:**	S9803066
Project:	20805-135.008/TO#22672.00/RAT8/6148 OAKLAND	**Date Collected:**	NA
LCS Matrix:	Air	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	11/12/98

Laboratory Control Sample Summary
TPH as Gasoline

Sample Name:	Lab Control Sample	Units:	mg/m3
Lab Code:	S981112-LCS	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Gasoline	5030	8015M	200	200	100	60-140	

LCS/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-135.008/TO#22672.00/RAT8/6148 OAKLAND
LCS Matrix: Air

Service Request: S9803066
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 11/12/98

Laboratory Control Sample Summary
TPH as Gasoline

Sample Name: Lab Control Sample
Lab Code: S981112-LCS
Test Notes:

Units: ppmV
Basis: NA

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Gasoline	5030	8015M	49	49	100	60-140	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-135.008/TO#22672.00/RAT8/6148 OAKLAND

Service Request: S9803066
Date Analyzed: 11/12/98

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

Sample Name: ICV
Lab Code: ICV1
Test Notes:

Units: mg/m3
Basis: NA

ICV Source:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Acceptance Limits
Benzene	5030	8020	25	24	96	80-120
Toluene	5030	8020	25	24	96	80-120
Ethylbenzene	5030	8020	25	24	96	80-120
Xylenes, Total	5030	8020	75	72	96	80-120
Gasoline	5030	8015M	250	220	88	80-120

ARCO Products Company — Chain of Custody

Division of Atlantic/Richfield Company

S9803066 Task Order No. 22672.00

ARCO Facility no. 6148	City (Facility) Oakland	Project manager (Consultant) Glen vanderveen	Laboratory Name CAS
ARCO engineer Paul Supple	Telephone no. (ARCO)	Telephone no. (Consultant)	Fax no (Consultant) / Contract Number
Consultant name Emcon	Address (Consultant)		

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM 503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Semi Metals ☐ VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org/DHS ☐ Lead EPA 7420/7421 ☐			
E-1		1			AIR	(1)		11/10/98	1140		X												
E-1		1			AIR	(2)		↓	1130		X												

Method of shipment: Tech

Special Detection Limit/reporting: PPMV

Special QA/QC

Remarks: 20805 135008 RATS

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: 11/24/98

	Date	Time		Date	Time
Relinquished by sampler: Lisa Routh	11-10-98	1405	Received by: Joseph Machado CAS	11/10/98	1405
Relinquished by			Received by		
Relinquished by			Received by laboratory		

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