Pinnacle
ENVIRONMENTAL SOLUTIONS

a division of
EMCON

December 30, 1998
Project 20805-135.008

R077

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

Re: Quarterly Groundwater Monitoring Report and Remediation System Performance Evaluation Report, Third 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 third quarter 1998 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 quarterly 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

for G.V.

Valli Voruganti, P.E.
Project Engineer

Attachment: Quarterly Groundwater Monitoring Report, Third Quarter 1998

cc: Susan Hugo, ACHCSA

144-A Mayhew Way Walnut Creek, California 94596 (510) 977-9020

Date: December 30, 1998

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 /(925) 977-9020
Primary Agency/Regulatory ID No.:	ACHCSA /Susan Hugo

WORK PERFORMED THIS QUARTER (THIRD - 1998):

1. Prepared and submitted quarterly groundwater monitoring report for second quarter 1998.
2. Performed quarterly groundwater monitoring and sampling for third quarter 1998.
3. Operated air bubbling system to promote any natural biodegradation of petroleum hydrocarbons occurring in groundwater in the vicinity of the well. Started SVE system and ran for seven hours before the process blower failed to operate anymore.

WORK PROPOSED FOR NEXT QUARTER (FOURTH - 1998):

1. Prepare and submit quarterly groundwater monitoring report for second quarter 1998.
2. Perform quarterly groundwater monitoring and sampling for third quarter 1998.
3. Troubleshoot and repair SVE process blower.
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.
5. Continue to operate air bubbling system.

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:	16.2 feet
Groundwater Flow Direction and Gradient (Average):	0.02 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):	2,500 mg/m^3
Benzene Conc. End of Period (lab):	<8 mg/m^3
Flowrate End of Period:	NA
HC Destroyed This Period:	6 pounds (minimal since the SVE system was only on for 7 hours
HC Destroyed to Date:	1891.7 pounds
Utility Usage Electric (KWH):	1681 KWH
Operating Hours This Period:	7 hours
Percent Operational:	0.3%
Operating Hours to Date:	2711.7 hours
Unit Maintenance:	Routine monthly maintenance
Number of Auto Shut Downs:	0
Destruction Efficiency Permit Requirement:	95% or <1 lb./day TPH and <0.02 lb./day Benzene
Percent TPH Conversion:	98.8%
Average Stack Temperature:	NA
Average Source Flow:	95 scfm
Average Process Flow:	95 scfm
Average Source Vacuum:	8 inches of water

DISCUSSION:

Due to high water levels and a malfunctioning process blower, the SVE system operated for only seven hours. Influent TPHG and benzene concentrations in extracted vapor were 2,500 and <8 $mg/^3$, respectively. Effluent TPHG and benzene concentrations in treated vapor were 30 and <0.4 mg/m^3, respectively.

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	Oil & Grease SM 5520C	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	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	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-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	430	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	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	--	--	--

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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	Oil & Grease SM 5520C	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	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	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-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	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	--	--	--

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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	Oil & Grease SM 5520C	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	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	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-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	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								

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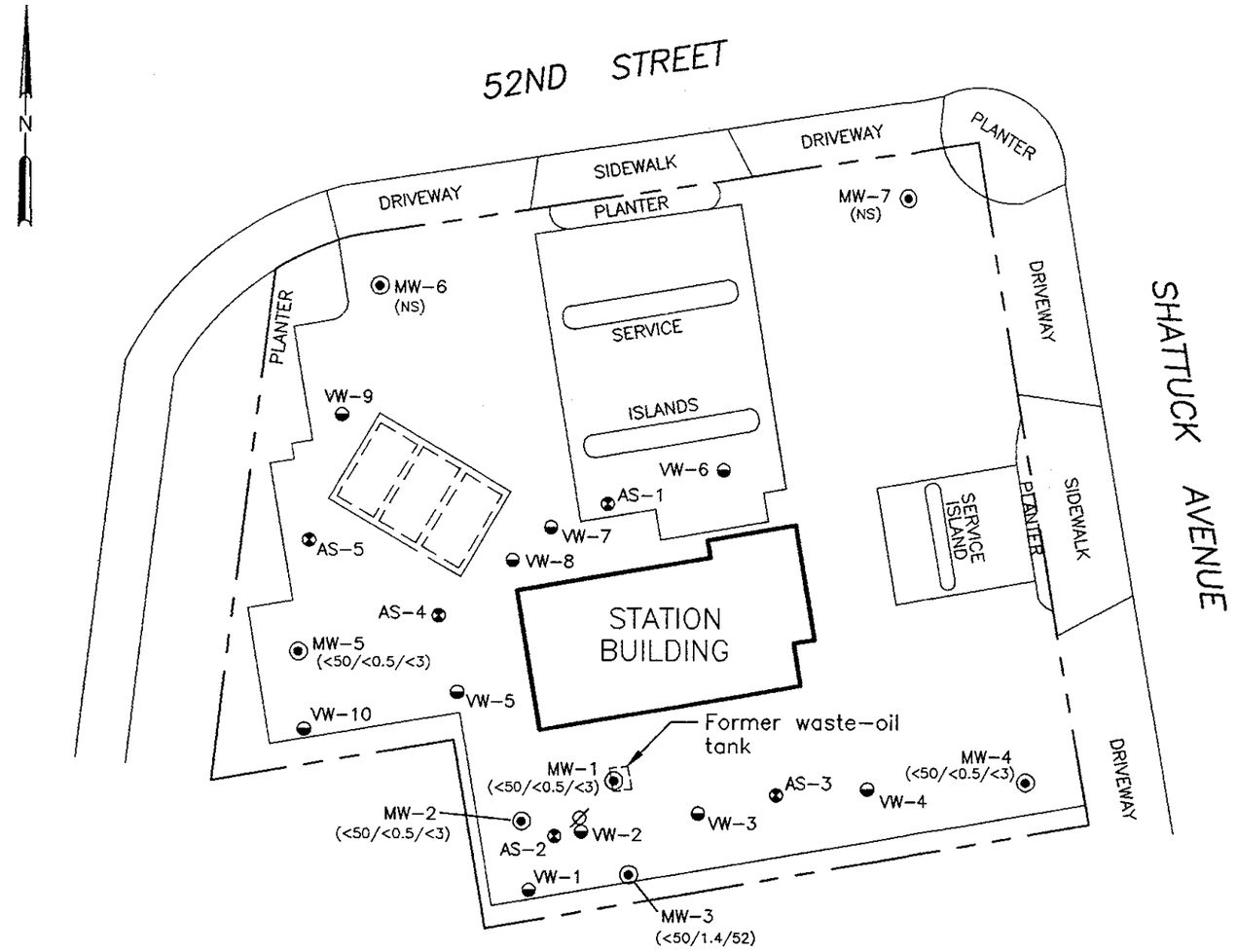
Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Groundwater Flow Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240	Oil & Grease SM 5520C	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	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	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								

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	Oil & Grease SM 5520C	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	mg/L

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
SM: standard method
mg/L: milligrams per liter
TRPH: total recoverable petroleum hydrocarbons
TPHD: total petroleum hydrocarbons as diesel, California DHS LUFT Method
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 Evaluation Report, ARCO Service Station 6148, Oakland, California,* (EMCON, March 4, 1996).



EXPLANATION

⊙	Groundwater monitoring well
◒	Vapor extraction well
⊗	Air-sparge well
⌀	Decommissioned well
⌐¬ L_J	Existing underground gasoline storage tanks
(<50/1.4/52)	Concentration of total petroleum hydrocarbons as gasoline (TPHG), benzene, and MTBE in groundwater (ug/L); samples collected 7/28/98
<	Not detected at or above the indicated laboratory detection limit
NS	Not sampled

0 30 60

SCALE IN FEET

Pinnacle

ENVIRONMENTAL SOLUTIONS
A DIVISION OF EMCON

DATE NOV. 1998
DWN KAB
APP
REV
PROJECT NO.
20805-135.008

FIGURE 1
ARCO PRODUCTS COMPANY
SERVICE STATION 6148, 5131 SHATTUCK AVE.
OAKLAND, CALIFORNIA
GROUNDWATER ANALYTICAL SUMMARY
THIRD QUARTER 1998

1" 1/2" 0" 1"

IMAGE Files: <No Images>
XREF Files: <No Xrefs>
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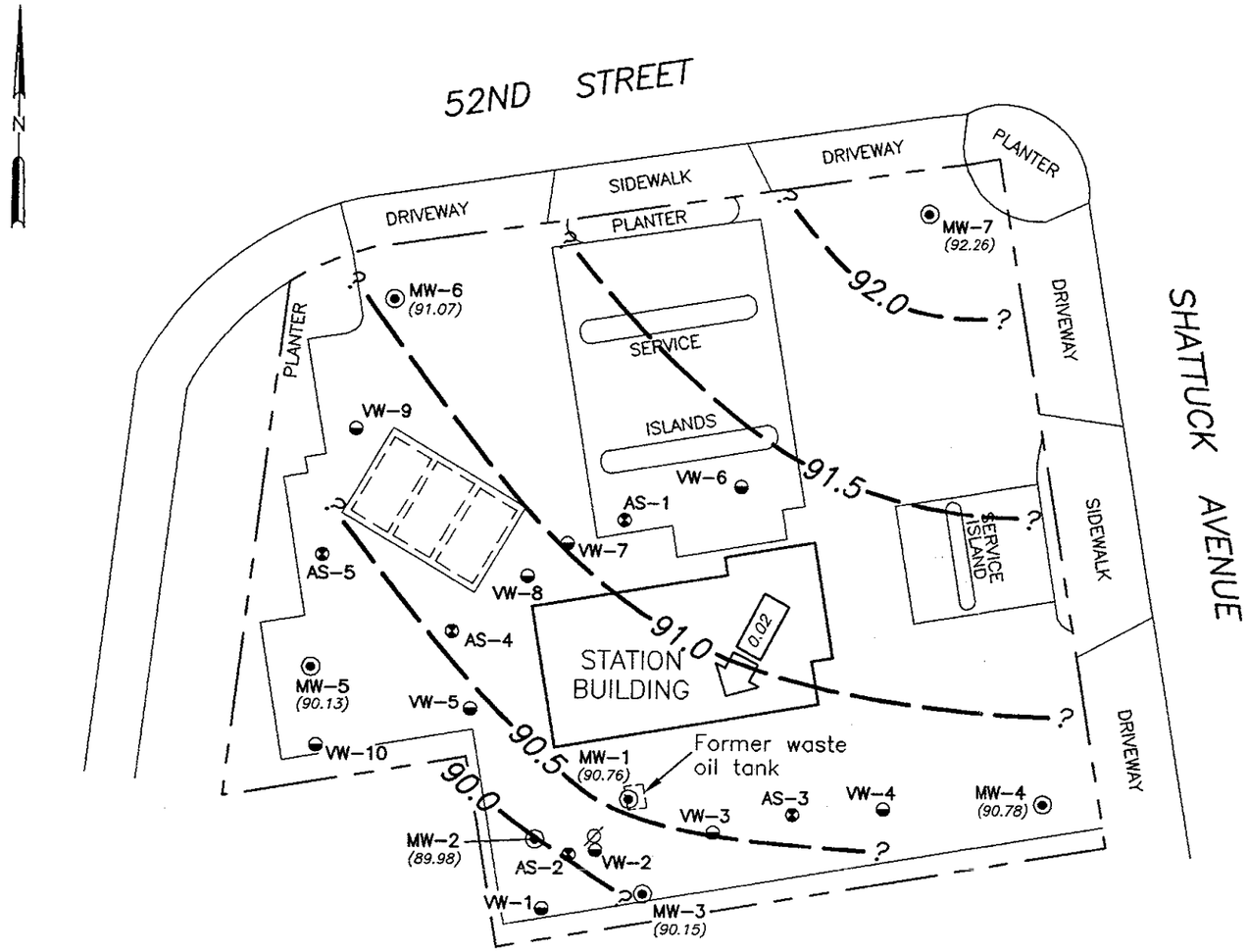
SANJOSE/CADD: N:\DWG\PINACL\6148\6148CHEM.DWG Mon, 30/Nov/98 01:24pm kblack



EXPLANATION

- Groundwater monitoring well
- Vapor extraction well
- Air–sparge well
- Ø Decommissioned well
- Existing underground gasoline storage tank
- (92.26) Groundwater elevation (Ft.–MSL) measured 7/28/98
- 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 NOV. 1998
DWN KAB
APP
REV
PROJECT NO.
20805–135.008

FIGURE 2
ARCO PRODUCTS COMPANY
SERVICE STATION 6148, 5131 SHATTUCK AVE.
OAKLAND, CALIFORNIA
GROUNDWATER ELEVATION CONTOURS
THIRD QUARTER 1998

1" 1/2" 0" 1"

IMAGE Files: <No Images>
XREF Files: <No Xrefs>
Dimscale: 30 Ltscale: 30 Psltscale: 0
SANJOSE/CADD: N:\DWG\PINACL\6148\6148GWC.DWG Thu, 10/Dec/98 01:20pm 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.

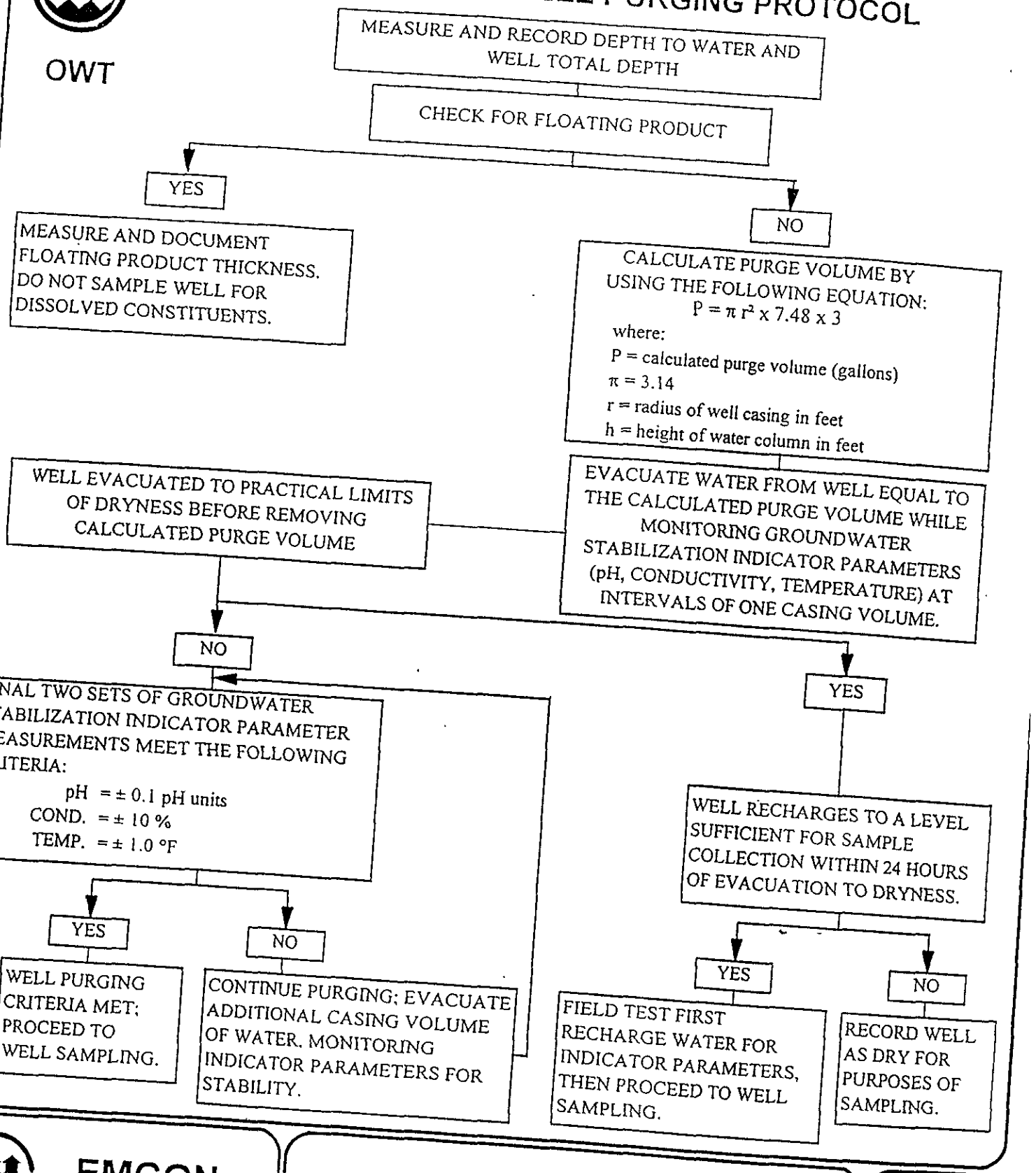
Groundwater Sampling and Analysis Request Form

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



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

August 13, 1998 Service Request No.: S9802014

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 July 31, 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 13, 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 T Cox for

Greg Anderson
Regional QA Coordinator

RECEIVED
AUG 17 1998
BY:

3334 Victor Court ▪ Santa Clara, CA 95054-2316 ▪ Telephone (408) 437-2400 ▪ Fax (408) 437-0356

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)

ACRONLST.DOC 7/14/95

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802014
Project:	20805-135.008/TO#22312.00/RAT8/6148 OAKLAND	**Date Collected:**	7/28/98
Sample Matrix:	Water	**Date Received:**	7/31/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-4(25)	Units:	ug/L (ppb)
Lab Code:	S9802014-001	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	8/8/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	8/8/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	8/8/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	8/8/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	8/8/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	8/8/98	ND	

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802014
Project:	20805-135.008/TO#22312.00/RAT8/6148 OAKLAND	**Date Collected:**	7/28/98
Sample Matrix:	Water	**Date Received:**	7/31/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-1(20)	Units:	ug/L (ppb)
Lab Code:	S9802014-002	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	8/8/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	8/8/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	8/8/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	8/8/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	8/8/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	8/8/98	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802014
Project:	20805-135.008/TO#22312.00/RAT8/6148 OAKLAND	**Date Collected:**	7/28/98
Sample Matrix:	Water	**Date Received:**	7/31/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-3(24)	Units:	ug/L (ppb)
Lab Code:	S9802014-003	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	8/8/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	8/8/98	1.4	
Toluene	EPA 5030	8020	0.5	1	NA	8/8/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	8/8/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	8/8/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	8/8/98	52	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802014
Project:	20805-135.008/TO#22312.00/RAT8/6148 OAKLAND	**Date Collected:**	7/28/98
Sample Matrix:	Water	**Date Received:**	7/31/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-2(24)	Units:	ug/L (ppb)
Lab Code:	S9802014-004	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	8/11/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	8/11/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	8/11/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	8/11/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	8/11/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	8/11/98	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802014
Project:	20805-135.008/TO#22312.00/RAT8/6148 OAKLAND	**Date Collected:**	7/28/98
Sample Matrix:	Water	**Date Received:**	7/31/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-5(23)	Units:	ug/L (ppb)
Lab Code:	S9802014-005	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	8/11/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	8/11/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	8/11/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	8/11/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	8/11/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	8/11/98	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802014
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:	S980807-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	8/7/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	8/7/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	8/7/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	8/7/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	8/7/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	8/7/98	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802014
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:	S980811-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	8/11/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	8/11/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	8/11/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	8/11/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	8/11/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	8/11/98	ND	

APPENDIX A

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-135.008/TO#22312.00/RAT8/6148 OAKLAND
Sample Matrix: Water

Service Request: S9802014
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: NA

Surrogate Recovery Summary
BTEX, MTBE and TPH as Gasoline

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

Units: PERCENT
Basis: NA

Sample Name	Lab Code	Test Notes	Percent Recovery	
			4-Bromofluorobenzene	a,a,a-Trifluorotoluene
MW-4(25)	S9802014-001		91	81
MW-1(20)	S9802014-002		100	86
MW-3(24)	S9802014-003		109	89
MW-2(24)	S9802014-004		105	89
MW-5(23)	S9802014-005		104	85
BATCH QC	S9802024-005MS		96	92
BATCH QC	S9802024-005DMS		97	91
Method Blank	S980807-WB1		100	97
Method Blank	S980811-WB1		103	87
CAS Acceptance Limits:			69-116	69-116

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO Products Company	**Service Request:**	S9802014
Project:	20805-135.008/TO#22312.00/RAT8/6148 OAKLAND	**Date Collected:**	NA
Sample Matrix	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	8/12/98

Matrix Spike/Duplicate Matrix Spike Summary
TPH as Gasoline

Sample Name:	BATCH QC	Units:	ug/L (ppb)
Lab Code:	S9802024-005MS, S9802024-005DMS	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	Result Notes
Gasoline	EPA 5030	CA/LUFT	50	250	250	ND	210	220	84	88	75-135	5	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-135.008/TO#22312.00/RAT8/6148 OAKLAND

Service Request: S9802014
Date Analyzed: 8/7/98

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

Sample Name: ICV
Lab Code: ICV1
Test Notes:

Units: ug/L (ppb)
Basis: NA

ICV Source:

Analyte	Prep Method	Analysis Method	True Value	Result	CAS Percent Recovery Acceptance Limits	Percent Recovery	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	250	240	90-110	96	
Benzene	EPA 5030	8020	25	25	85-115	100	
Toluene	EPA 5030	8020	25	25	85-115	100	
Ethylbenzene	EPA 5030	8020	25	23	85-115	92	
Xylenes, Total	EPA 5030	8020	75	73	85-115	97	
Methyl *tert*-Butyl Ether	EPA 5030	8020	25	22	85-115	88	

ARCO Products Company

Division of Atlantic/Richfield Company

Task Order No. 72312.00

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)437-9526
Consultant name EMCON	Address (Consultant) 1921 Ringwood Ave. San Jose, CA 95131		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 mg/kg 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-4(25')	1	2		X		X	HCL	7-28-98	1042		X												
MW-1(20')	2	2		X		X	HCL		1115		X												
MW-3(24')	3	2		X		X	HCL		1127		X												
MW-2(24')	4	2		X		X	HCL		1140		X												
MW-5(23')	5	2		X		X	HCL	↓	1203		X												

Condition of sample:

Temperature received:

	Date	Time			
Relinquished by sampler	7-30-98	1343	Received by	7/31/98	9:45 AM
Relinquished by	Date	Time	Received by		
Relinquished by	Date	Time	Received by laboratory	Date	Time

Method of shipment: Sampler will deliver

Special Detection Limit/reporting: Lowest Possible

Special QA/QC: As Normal

Remarks: RATS 2-40ml HCL VOAs #20805-135.008

Lab Number: 59802014

Turnaround Time:

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

4-13-98

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

Rev 10/93

APPENDIX C

FIELD DATA SHEETS

FIELD REPORT
DEPTH TO WATER / FLOATING PRODUCT SURVEY

PROJECT # : **21775-250.003** STATION ADDRESS : **5131 Shattuck Avenue, Oakland** DATE : **7/28/98**

ARCO STATION # : **6148** FIELD TECHNICIAN : **Patrick Jimison** 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	
1	MW-7	—	Hex 15/16	—	ARCO	LWC	14.79	14.79	N.D.	—	27.0		
2	MW-6	—	Hex 15/16	—	ARCO	LWC	14.06	14.06	N.D.	—	26.6		
3	MW-4	—	Hex 15/16	—	NONE	TC	15.93	15.93	N.D.	—	26.0	Has a hole in the well. D.O. = 0.3 Temp. = 21.0°C	G
4	MW-1	—	Hex 15/16	—	NONE	TC	17.04	17.04	N.D.	—	21.8	D.O. = 1.0 Temp. = 20.5 °C	G
5	MW-5	—	Hex 15/16	—	NONE	TC	16.47	16.47	N.D.	—	27.8	D.O. = 7.7 Temp = 20.0 °C	G
6	MW-2	—	Hex 15/16	—	NONE	TC	17.30	17.30	N.D.	—	25.6	DO = 5.7 Temp. = 20.0 °C	G
7	MW-3	—	Hex 15/16	—	NONE	TC	17.46	17.46	N.D.	—	25.6	DO = 0.4 Temp. = 20.0 °C	G

SURVEY POINTS ARE TOP OF WELL CASINGS

WATER SAMPLE FIELD DATA SHEET

Rev. 1/9

OWT

PROJECT NO: 21775-250.003 | SAMPLE ID: MW-1 (20')
PURGED BY: P. Jamison | CLIENT NAME: ARCO # 6148
SAMPLED BY: " | LOCATION: Shattuck Ave., Oakland

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

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

CASING ELEVATION (feet/MSL): —
DEPTH OF WELL (feet): 21.8
DEPTH TO WATER (feet): 17.04

VOLUME IN CASING (gal.): 3.2
CALCULATED PURGE (gal.): 9.6
ACTUAL PURGE VOL. (gal.): —

DATE PURGED: 7-28-98
DATE SAMPLED: "

END PURGE: No Purge
SAMPLING TIME: 1115

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1115	—	6.44	411	70.6	clear	low

OTHER: —
ODOR: None
COLOR (COBALT 0-100): —
TURBIDITY (NTU 0-200): —

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

PURGING EQUIPMENT

- ____ 2" Bladder Pump
- ____ Centrifugal Pump
- ____ Submersible Pump
- ____ Well Wizard©
- Other: —

- ____ Bailer (Teflon)
- ____ Bailer (PVC)
- ____ Bailer (Stainless Steel)
- ____ Dedicated

SAMPLING EQUIPMENT

- ____ 2" Bladder Pump
- ____ Bomb Sampler
- ____ Dipper
- ____ Well Wizard©
- Other: Disposable bailer

- ____ Bailer (Teflon)
- ____ Bailer (Stainless Steel)
- ____ Submersible Pump
- ____ Dedicated

WELL INTEGRITY: Good 1/8"
LOCK: —

REMARKS: OTW is below the top of the screen. Took Grab sample.

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 1 OF 5

WATER SAMPLE FIELD DATA SHEET

Rev. 1/9

OWT

PROJECT NO: 21775-250.003 | SAMPLE ID: MW-2 (24')
PURGED BY: P.J. Nixon | CLIENT NAME: ARCO # 6148
SAMPLED BY: ↓ | LOCATION: Shattuck Ave. Oakland

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

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

CASING ELEVATION (feet/MSL): —
DEPTH OF WELL (feet): 25.6
DEPTH TO WATER (feet): 17.30

VOLUME IN CASING (gal.): 5.5
CALCULATED PURGE (gal.): 16.5
ACTUAL PURGE VOL. (gal.): —

DATE PURGED: 7-28-98 | END PURGE: No Purge
DATE SAMPLED: ↓ | SAMPLING TIME: 1140

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1140	—	7.51	432	70.7	clear	low

OTHER: — | ODOR: None | — (COBALT 0-100) | — (NTU 0-200)

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

PURGING EQUIPMENT

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

SAMPLING EQUIPMENT

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

WELL INTEGRITY: Good 1¼" | LOCK: —

REMARKS: DTW was below the top of Screen. Took Grab Sample

well had a vapor hose in it.

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 2 OF 5

WATER SAMPLE FIELD DATA SHEET

Rev. 1.

OWT

PROJECT NO: 21775-250.003 | SAMPLE ID: MW-3 (24')
PURGED BY: P. Jamison | CLIENT NAME: ARCO #6148
SAMPLED BY: ↓ | LOCATION: Shattuck Ave. Oakland

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

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

CASING ELEVATION (feet/MSL): —
DEPTH OF WELL (feet): 25.6
DEPTH TO WATER (feet): 17.46
VOLUME IN CASING (gal.): 5.4
CALCULATED PURGE (gal.): 16.2
ACTUAL PURGE VOL. (gal.): —

DATE PURGED: 2-28-98
DATE SAMPLED: ↓
END PURGE: No Purge
SAMPLING TIME: 1127

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1127	~	6.46	555	71.7	clear	low

OTHER: ~ ODOR: Strong — —

(COBALT 0-100) (NTU 0-200)

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

PURGING EQUIPMENT

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

Other: ~

SAMPLING EQUIPMENT

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

Other: Disposable Bailer

WELL INTEGRITY: Good 15/16" LOCK: —

REMARKS: DTW was below the top of Screen. Took Grab Sample well had hose in it. (vapor hose (?))

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 3 OF 5

WATER SAMPLE FIELD DATA SHEET

Rev. 1/9

OWT

PROJECT NO: 21775-250.003 | SAMPLE ID: MW-4 (25')
PURGED BY: P. Jimison | CLIENT NAME: ARCO #6148
SAMPLED BY: ↓ | LOCATION: Shattuck Ave., Oakland

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

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

CASING ELEVATION (feet/MSL): —
DEPTH OF WELL (feet): 26.0
DEPTH TO WATER (feet): 15.93

VOLUME IN CASING (gal.): 6.6
CALCULATED PURGE (gal.): 19.8
ACTUAL PURGE VOL. (gal.): —

DATE PURGED: 7-28-98
DATE SAMPLED: ↓

END PURGE: No Purge
SAMPLING TIME: 1042

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1042	—	6.00	443	74.0	clear	low

OTHER: — ODOR: None

(COBALT 0-100) — (NTU 0-200) —

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

PURGING EQUIPMENT

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

Other: —

SAMPLING EQUIPMENT

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

Other: Disposable Bailer

WELL INTEGRITY: Good 15/16" | LOCK: —

REMARKS: The DTW was below the top of screen. Took Grab Sample.

Well has hose in it. (Vapor hose (?))

pH, E.C., Temp. Meter Calibration: Date: 7-28-98 | Time: 1023 | Meter Serial No.: —

E.C. 1000 1435 / 1413 | pH 7 7.01 / 7.00 | pH 10 10.04 / 10.00 | pH 4 4.01 / —

Temperature °F 74.6

SIGNATURE: [signature] | REVIEWED BY: [signature] | PAGE 4 OF 5

WATER SAMPLE FIELD DATA SHEET

Rev. 1.

OWT

PROJECT NO: 21775-250.003 | SAMPLE ID: MW-5 (23')

PURGED BY: P. Jimison | CLIENT NAME: ARCO # 6148

SAMPLED BY: L | LOCATION: Shattuck Ave. Oakland

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

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

CASING ELEVATION (feet/MSL): —

DEPTH OF WELL (feet): 24.8

DEPTH TO WATER (feet): 16.47

VOLUME IN CASING (gal.): 5.5

CALCULATED PURGE (gal.): 16.5

ACTUAL PURGE VOL. (gal.): —

DATE PURGED: 7-28-98 | END PURGE: No Purge

DATE SAMPLED: L | SAMPLING TIME: 1203

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1203	—	7.91	425	71.6	Clear	low

OTHER: — | ODOR: None | — | —

(COBALT 0-100) | (NTU 0-200)

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

PURGING EQUIPMENT

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

SAMPLING EQUIPMENT

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

WELL INTEGRITY: Good 15/15" | LOCK: —

REMARKS: Well is covered by Buy ~~[illegible]~~ behind vapor extraction system. DTW is below the top of the screen. Took Grab Samples.

Put a 0464 master (Brass) Lock on fence.

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

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

Temperature °F

SIGNATURE: [signature] | REVIEWED BY: [signature] | PAGE 5 OF 5

APPENDIX D

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

Columbia Analytical Services INC
An Employee-Owned Company

September 3, 1998 Service Request No.: S9802176

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 August 20, 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,

Steven L. Green
Project Chemist

for

Greg Anderson
Regional QA Coordinator

RECEIVED
SEP 0 8 1998
BY:

3334 Victor Court ▪ Santa Clara, CA 95054-2316 ▪ Telephone (408) 437-2400 ▪ Fax (408) 437-0356

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:**	S9802176
Project:	20805-135.008/TO#22672.00/RAT8/6148 OAKLAND	**Date Collected:**	8/20/98
Sample Matrix:	Air	**Date Received:**	8/20/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	I-1	Units:	mg/m3
Lab Code:	S9802176-001	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	8/21/98	<8	C1
Toluene	5030	8020	0.4	20	NA	8/21/98	<8	C1
Ethylbenzene	5030	8020	0.5	20	NA	8/21/98	<10	C1
Xylenes, Total	5030	8020	0.9	20	NA	8/21/98	<18	C1
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	12	20	NA	8/21/98	8900	
C6 - C12	5030	8015M	20	20	NA	8/21/98	2500	
TPH as Gasoline*	5030	8015M	20	20	NA	8/21/98	2500	

* 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.

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802176
Project:	20805-135.008/TO#22672.00/RAT8/6148 OAKLAND	**Date Collected:**	8/20/98
Sample Matrix:	Air	**Date Received:**	8/20/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	E-1	Units:	mg/m3
Lab Code:	S9802176-002	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	8/21/98	ND	
Toluene	5030	8020	0.4	1	NA	8/21/98	ND	
Ethylbenzene	5030	8020	0.5	1	NA	8/21/98	ND	
Xylenes, Total	5030	8020	0.9	1	NA	8/21/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	12	1	NA	8/21/98	88	
C6 - C12	5030	8015M	20	1	NA	8/21/98	30	
TPH as Gasoline*	5030	8015M	20	1	NA	8/21/98	30	

* 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:**	S9802176
Project:	20805-135.008/TO#22672.00/RAT8/6148 OAKLAND	**Date Collected:**	8/20/98
Sample Matrix:	Air	**Date Received:**	8/20/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	I-1	Units:	ppmV
Lab Code:	S9802176-001	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	8/21/98	<2	C1
Toluene	5030	8020	0.1	20	NA	8/21/98	<2	C1
Ethylbenzene	5030	8020	0.1	20	NA	8/21/98	<2	C1
Xylenes, Total	5030	8020	0.2	20	NA	8/21/98	<4	C1
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	5	20	NA	8/21/98	3800	
C6 - C12	5030	8015M	5	20	NA	8/21/98	610	
TPH as Gasoline*	5030	8015M	5	20	NA	8/21/98	610	

* 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:**	S9802176
Project:	20805-135.008/TO#22672.00/RAT8/6148 OAKLAND	**Date Collected:**	8/20/98
Sample Matrix:	Air	**Date Received:**	8/20/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	E-1	Units:	ppmV
Lab Code:	S9802176-002	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	8/21/98	ND	
Toluene	5030	8020	0.1	1	NA	8/21/98	ND	
Ethylbenzene	5030	8020	0.1	1	NA	8/21/98	ND	
Xylenes, Total	5030	8020	0.2	1	NA	8/21/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	5	1	NA	8/21/98	37	
C6 - C12	5030	8015M	5	1	NA	8/21/98	7	
TPH as Gasoline*	5030	8015M	5	1	NA	8/21/98	7	

* 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:**	S9802176
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:	S980821-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	8/21/98	ND	
Toluene	5030	8020	0.4	1	NA	8/21/98	ND	
Ethylbenzene	5030	8020	0.5	1	NA	8/21/98	ND	
Xylenes, Total	5030	8020	0.9	1	NA	8/21/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	12	1	NA	8/21/98	ND	
C6 - C12	5030	8015M	20	1	NA	8/21/98	ND	
TPH as Gasoline*	5030	8015M	20	1	NA	8/21/98	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:**	S9802176
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:	S980821-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	8/21/98	ND	
Toluene	5030	8020	0.1	1	NA	8/21/98	ND	
Ethylbenzene	5030	8020	0.1	1	NA	8/21/98	ND	
Xylenes, Total	5030	8020	0.2	1	NA	8/21/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	5	1	NA	8/21/98	ND	
C6 - C12	5030	8015M	5	1	NA	8/21/98	ND	
TPH as Gasoline*	5030	8015M	5	1	NA	8/21/98	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: S9802176
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 8/21/98

Duplicate Summary
BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
Lab Code: S9802176-001DUP
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	<8	<8	--	--	
Ethylbenzene	5030	8020	0.5	<10	<10	--	--	
Xylenes, Total	5030	8020	0.9	<18	<18	--	--	
Total Volatile Hydrocarbons								
C1 - C5	5030	8015M	12	8900	8400	8700	6	
C6 - C12	5030	8015M	20	2500	2400	2500	4	
TPH as Gasoline*	5030	8015M	20	2500	2400	2500	4	

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: S9802176
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 8/21/98

Duplicate Summary
BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
Lab Code: S9802176-001DUP
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	<2	<2	--	--	
Ethylbenzene	5030	8020	0.1	<2	<2	--	--	
Xylenes, Total	5030	8020	0.2	<4	<4	--	--	
Total Volatile Hydrocarbons								
C1 - C5	5030	8015M	5	3800	3500	3,700	8	
C6 - C12	5030	8015M	5	610	590	600	3	
TPH as Gasoline*	5030	8015M	5	610	590	600	3	

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: S9802176
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 8/21/98

Laboratory Control Sample Summary
TPH as Gasoline

Sample Name: Lab Control Sample
Lab Code: S980821-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
Gasoline	5030	8015M	200	180	90	60-140	

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: S9802176
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 8/21/98

Laboratory Control Sample Summary
TPH as Gasoline

Sample Name: Lab Control Sample
Lab Code: S980821-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	44	90	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: S9802176
Date Analyzed: 8/21/98

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	20	80	80-120
Toluene	5030	8020	25	20	80	80-120
Ethylbenzene	5030	8020	25	20	80	80-120
Xylenes, Total	5030	8020	75	61	81	80-120
Gasoline	5030	8015M	250	270	108	80-120

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 22672.00

Chain of Custody

ARCO Facility no. 6148	City (Facility) Oakland	Project manager (Consultant) Glen Vandeneem	Laboratory name
ARCO engineer Paul Supple	Telephone no. (ARCO)	Telephone no. (Consultant)	Fax no. (Consultant)
Consultant name EMCON	Address (Consultant)		Contract number

Method of shipment: Fed Ex

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 (yes)	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
I-1	1	1			AIR			8/20/98	1300		4											
E-1	2	1			AIR			8/20/98	1250		4											

Special detection Limit/reporting: PPMV

Special QA/QC

Remarks: 20805 135 008

RAT 8

Lab number: 59802176

Turnaround time

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

Condition of sample:

Temperature received:

	Date	Time	
Relinquished by sampler: Glen Vandeneem	8-20-98	1406	Received by: [illegible]
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
APC-3292 (2-91)

11/03