Pinnacle
ENVIRONMENTAL SOLUTIONS

a division of EMCON

LOP 3193

March 26, 1999
Project 20805-129.005

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

Re: Quarterly Groundwater Monitoring Results and Remediation System Performance Evaluation Report, Fourth Quarter 1998, for ARCO Service Station No. 2169, located at 889 West Grand 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. 2169, located at 889 West Grand Avenue, Oakland, California. Operation and performance data for the interim soil-vapor extraction (SVE), air-sparge (AS) and air-bubbling systems at the site are also presented. The monitoring program complies with the Alameda County Health Care Services Agency (ACHCSA) requirements regarding underground tank investigations.

LIMITATIONS

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

Please call if you have questions.

Sincerely,

Pinnacle

Glen VanderVeen
Project Manager

Valli Voruganti, P.E.
Project Engineer

Attachment: Quarterly Groundwater Monitoring Report, Fourth Quarter 1998

cc: Susan Hugo, ACHCSA

Date: March 26, 1999

ARCO QUARTERLY GROUNDWATER MONITORING REPORT

Station No.:	2169	Address:	889 West Grand Avenue, Oakland, California
		Pinnacle Project No.	20805-129.005
		ARCO Environmental Engineer/Phone No.:	Paul Supple /(925) 299-8891
		Pinnacle Project Manager/Phone No.:	Glen VanderVeen /(510) 740-5807
		Primary Agency/Regulatory ID No.:	ACHCSA

WORK PERFORMED THIS QUARTER (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. Completed repairs and restarted air bubbling system and soil vapor extraction (SVE) system.
4. Shut down SVE system due to low hydrocarbon concentrations in extracted vapor.

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. Restart soil-vapor extraction (SVE) system, if influent vapor concentrations warrant.
4. Continue with air bubbling to enhance natural biodegredation.

QUARTERLY MONITORING:

Current Phase of Project:	Quarterly Groundwater Monitoring and Operation and Maintenance of Remediation Systems
Frequency of Sampling:	Annual (1st Quarter): A-3, A-4 Semi-annual (1st/2nd Quarter): A-2, AR-1, AR-2 Quarterly: A-1, A-5, A-6, ADR-1, ADR-2
Frequency of Monitoring:	Quarterly (groundwater), Monthly (SVE and Air-Sparge)
Is Floating Product (FP) Present On-site:	☐ Yes ☒ No
Cumulative FP Recovered to Date :	4.8 gallons, Wells ADR-1 and ADR-2
FP Recovered This Quarter :	None
Bulk Soil Removed to Date :	2,196 cubic yards of TPH-impacted soil
Bulk Soil Removed This Quarter :	None
Water Wells or Surface Waters within 2000 ft., impacted by site:	None
Current Remediation Techniques:	SVE, Air-Sparge and Air-Bubbling Systems
Average Depth to Groundwater:	11.7 feet
Groundwater Flow Direction and Gradient (Average):	0.002 ft/ft toward north-northwest

SVE QUARTERLY OPERATION AND PERFORMANCE:

Equipment Inventory:	Therm Tech Model VAC-25, 250 cfm, Thermal/Catalytic Oxidizer
Operating Mode:	Catalytic Oxidation
BAAQMD Permit #:	12119
TPH Conc. End of Period (lab):	12 ppmv
Benzene Conc. End of Period (lab):	<0.1 ppmv
Flowrate End of Period:	51 cfm
HC Destroyed This Period:	0.2339 pounds
HC Destroyed to Date:	8582.3 pounds
Utility Usage Electric (KWH):	Not available
Operating Hours This Period:	816.07 hours
Percent Operational:	55%
Operating Hours to Date:	7726.81 hours
Unit Maintenance:	Repairs to AS & SVE systems
Number of Auto Shut Downs:	0
Destruction Efficiency Permit Requirement:	90%
Average Percent TPH Conversion:	NA
Average Stack Temperature:	684 °F
Average Source Flow:	43 cfm
Average Process Flow:	255.2 cfm
Average Source Vacuum:	22.4 inches of water

DISCUSSION:

- The SVE system was shut off on 12/08/98 due to low influent concentrations. Total emissions from operation are less than one pound per day POC, and benzene emissions are less than 0.02 pounds per day.

ATTACHMENTS:

- Table 1 - Historical Groundwater Elevation and Analytical Data, Petroleum Hydrocarbons and Their Constituents
- Table 2 - Soil Vapor Extraction System, Operational Uptime Information
- Table 3 - Soil Vapor Extraction System, Flow Rates and Analytical Results of Air Samples
- Table 4 - Soil Vapor Extraction System, Extraction Rates, Emission Rates, Destruction Efficiency, and Mass Removed
- Figure 1 - Groundwater Analytical Summary Map
- Figure 2 - Groundwater Elevation Contour Map
- Appendix A - Sampling and Analysis Procedures
- Appendix B - Certified Analytical Reports and Chain-of-Custody Documentation
- Appendix C - Field Data Sheets
- Appendix D - Certified Analytical Reports and Chain-of-Custody Documentation for Soil-Vapor Extraction System

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

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

Well 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	TPHD LUFT Method
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
A-1	03-24-95	14.16	8.10	6.06	ND	NW	0.009	03-24-95	1200	230	39	34	66	--	--	160
A-1	06-05-95	14.16	11.13	3.03	ND	NW	0.002	06-05-95	1500	310	27	36	76	--	--	710
A-1	08-17-95	14.16	11.71	2.45	ND	W	0.001	08-18-95	1600	470	35	48	110	120	--	240
A-1	12-04-95	14.16	12.28	1.88	ND	NNW	0.002	12-04-95	1200	240	17	25	56	--	120	--
A-1	03-01-96	14.16	8.78	5.38	ND	NW	0.003	03-13-96	1300	300	74	29	73	100	--	--
A-1	05-29-96	14.16	9 85	4.31	ND	NW	0.002	05-29-96	Not sampled: well sampled semi-annually, during the first and third quarters							
A-1	08-29-96	14.16	11.08	3.08	ND	W	0 002	08-29-96	1200	320	5.9	25	27	110	--	--
A-1	11-21-96	14.16	10.54	3.62	ND	WNW	0.002	11-21-96	Not sampled: well sampled semi-annually, during the first and third quarters							
A-1	03-26-97	14.16	10.55	3.61	ND	NW	0.002	03-26-97	<50	0.8	<0.5	<0.5	<0.5	64	--	--
A-1	05-21-97	14.16	11.10	3 06	ND	NNW	0.002	05-21-97	Not sampled: well sampled semi-annually, during the first and third quarters							
A-1	08-08-97	14.16	11.32	2.84	ND	NNW	0.002	08-08-97	91	7	<0.5	0.5	3.9	<60	--	--
A-1	11-18-97	14.16	3.46	10.70	ND	NNW	0.003	11-18-97	54	<0.5	<0.5	<0.5	0.6	27	--	--
A-1	02-20-98	14.16	7.10	7.06	ND	N	0.013	02-23-98	590	160	22	15	28	70	--	--
A-1	05-11-98	14.16	9.87	4.29	ND	N	0.03	05-11-98	280	26	<0.5	0.8	2 3	6	--	--
A-1	07-30-98	14.16	10 73	3.43	ND	N	0.002	07-30-98	1000	210	5	<5	38	<30	--	--
A-1	10-08-98	14.16	11.15	3.01	ND	NNW	0.002	10-08-98	3100	740	11	<10	24	<60	--	--
A-2	03-24-95	14.55	8.64	5.91	ND	NW	0.009	03-24-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-2	06-05-95	14.55	11.72	2.83	ND	NW	0 002	06-05-95	<50	<0.5	<0.5	<0 5	<0.5	--	--	--
A-2	08-17-95	14 55	12.35	2.20	ND	W	0.001	08-17-95	<50	<0.5	<0.5	<0 5	<0 5	12	--	--
A-2	12-04-95	14.55	12 74	1.81	ND	NNW	0.002	12-04-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-2	03-01-96	14.55	9.34	5.21	ND	NW	0.003	03-13-96	<50	<0.5	0 6	<0.5	1 3	<9	--	--
A-2	05-29-96	14.55	10.40	4.15	ND	NW	0.002	05-29-96	<50	<0.5	<0.5	<0.5	<0.5	<20	--	--
A-2	08-29-96	14.55	11 50	3.05	ND	W	0 002	08-29-96	<50	<0 5	<0.5	<0.5	<0.5	<39	--	--
A-2	11-21-96	14 55	11.06	3.49	ND	WNW	0.002	11-21-96	<50	<0.5	<0.5	<0 5	<0 5	<30	--	--
A-2	03-26-97	14.55	11.12	3.43	ND	NW	0.002	03-26-97	<50	<0.5	<0.5	<0.5	<0.5	<20	--	--
A-2	05-21-97	14.55	11.58	2.97	ND	NNW	0.002	05-21-97	Not sampled: well sampled semi-annually, during the first and third quarters							
A-2	08-08-97	14.55	11.82	2.73	ND	NNW	0.002	08-08-97	<50	<0.5	<0.5	<0.5	<0.5	<20	--	--
A-2	11-18-97	14.55	3.33	11.22	ND	NNW	0.003	11-18-97	Not sampled: well sampled semi-annually, during the first and third quarters							
A-2	02-20-98	14.55	7.68	6.87	ND	N	0.013	02-20-98	<50	<0.5	<0.5	<0.5	<0.5	17	--	--
A-2	05-11-98	14.55	10 45	4.10	NR	N	0.03	05-11-98	Not sampled							
A-2	07-30-98	14.55	11.23	3 32	NR	N	0 002	07-30-98	Not sampled: well sampled semi-annually, during the first and second quarters							
A-2	10-08-98	14.55	11.62	2.93	NR	NNW	0.002	10-08-98	Not sampled: well sampled semi-annually, during the first and second quarters							

Pinnacle

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

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

Well 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	TPHD LUFT Method
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
A-3	03-24-95	15.75	8.83	6.92	ND	NW	0.009	03-24-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-3	06-05-95	15.75	12.44	3.31	ND	NW	0.002	06-05-95	Not sampled: well sampled annually, during the first quarter							
A-3	08-17-95	15.75	13.04	2.71	ND	W	0.001	08-17-95	Not sampled: well sampled annually, during the first quarter							
A-3	12-04-95	15.75	13.57	2.18	ND	NNW	0.002	12-04-95	Not sampled: well sampled annually, during the first quarter							
A-3	03-01-96	15.75	9.90	5.85	ND	NW	0.003	03-13-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
A-3	05-29-96	15.75	11.08	4.67	ND	NW	0.002	05-29-96	Not sampled: well sampled annually, during the first quarter							
A-3	08-29-96	15.75	12.38	3.37	ND	W	0.002	08-29-96	Not sampled: well sampled annually, during the first quarter							
A-3	11-21-96	15.75	11.86	3.89	ND	WNW	0.002	11-21-96	Not sampled: well sampled annually, during the first quarter							
A-3	03-26-97	15.75	11.81	3.94	ND	NW	0.002	03-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
A-3	05-21-97	15.75	12.35	3.40	ND	NNW	0.002	05-21-97	Not sampled: well sampled annually, during the first quarter							
A-3	08-08-97	15.75	12.62	3.13	ND	NNW	0.002	08-08-97	Not sampled: well sampled annually, during the first quarter							
A-3	11-18-97	15.75	3.75	12.00	ND	NNW	0.003	11-18-97	Not sampled: well sampled annually, during the first quarter							
A-3	02-20-98	15.75	8.06	7.69	ND	N	0.013	02-20-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
A-3	05-11-98	15.75	11.19	4.56	NR	N	0.03	05-11-98	Not sampled: well sampled annually, during the first quarter							
A-3	07-30-98	15.75	12.05	3.70	NR	N	0.002	07-30-98	Not sampled: well sampled annually, during the first quarter							
A-3	10-08-98	15.75	12.43	3.32	NR	NNW	0.002	10-08-98	Not sampled: well sampled annually, during the first quarter							
A-4	03-24-95	15.25	7.20	8.05	ND	NW	0.009	03-24-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-4	06-05-95	15.25	11.70	3.55	ND	NW	0.002	06-05-95	Not sampled: well sampled annually, during the first quarter							
A-4	08-17-95	15.25	12.28	2.97	ND	W	0.001	08-17-95	Not sampled: well sampled annually, during the first quarter							
A-4	12-04-95	15.25	12.63	2.62	ND	NNW	0.002	12-04-95	Not sampled: well sampled annually, during the first quarter							
A-4	03-01-96	15.25	8.55	6.70	ND	NW	0.003	03-13-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
A-4	05-29-96	15.25	10.32	4.93	ND	NW	0.002	05-29-96	Not sampled: well sampled annually, during the first quarter							
A-4	08-29-96	15.25	11.55	3.70	ND	W	0.002	08-29-96	Not sampled: well sampled annually, during the first quarter							
A-4	11-21-96	15.25	10.83	4.42	ND	WNW	0.002	11-21-96	Not sampled: well sampled annually, during the first quarter							
A-4	03-26-97	15.25	10.97	4.28	ND	NW	0.002	03-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
A-4	05-21-97	15.25	11.51	3.74	ND	NNW	0.002	05-21-97	Not sampled: well sampled annually, during the first quarter							
A-4	08-08-97	15.25	11.73	3.52	ND	NNW	0.002	08-08-97	Not sampled: well sampled annually, during the first quarter							
A-4	11-18-97	15.25	4.37	10.88	ND	NNW	0.003	11-18-97	Not sampled: well sampled annually, during the first quarter							
A-4	02-20-98	15.25	6.25	9.00	ND	N	0.013	02-20-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
A-4	05-11-98	15.25	10.33	4.92	NR	N	0.03	05-11-98	Not sampled: well sampled annually, during the first quarter							
A-4	07-30-98	15.25	11.25	4.00	NR	N	0.002	07-30-98	Not sampled: well sampled annually, during the first quarter							
A-4	10-08-98	15.25	11.62	3.63	NR	NNW	0.002	10-08-98	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 2169
889 West Grand Avenue, Oakland, CA

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	TPHD LUFT Method
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
A-5	03-24-95	13.51	7.40	6.11	ND	NW	0.009	03-24-95	3300	200	310	130	460	--	--	--
A-5	06-05-95	13.51	10.43	3.08	ND	NW	0.002	06-05-95	57000	2700	4600	1500	6800	--	--	--
A-5	08-17-95	13.51	11.15	2.36	ND	W	0.001	08-18-95	34000	1600	2700	1100	5100	<28	--	--
A-5	12-04-95	13.51	11.42	2.09	ND	NNW	0.002	12-04-95	61	<0.5	<0.5	<0.5	<0.5	--	--	--
A-5	03-01-96	13.51	8.11	5.40	ND	NW	0.003	03-13-96	11000	860	960	380	1600	<100	--	--
A-5	05-29-96	13.51	9.30	4.21	ND	NW	0.002	05-29-96	19000	1600	1900	880	3300	<100	--	--
A-5	08-29-96	13.51	10.60	2.91	ND	W	0.002	08-29-96	7700	490	450	260	990	<30	--	--
A-5	11-21-96	13.51	10.05	3.46	ND	WNW	0.002	11-21-96	8000	450	550	340	1100	<30	--	--
A-5	03-26-97	13.51	9.87	3.64	ND	NW	0.002	03-26-97	3100	190	140	130	340	<30	--	--
A-5	05-21-97	13.51	10.25	3.26	ND	NNW	0.002	05-21-97	16000	1500	900	700	2700	<120	--	--
A-5	08-08-97	13.51	10.42	3.09	ND	NNW	0.002	08-08-97	9000	690	240	440	1300	<30	--	--
A-5	11-18-97	13.51	NR	NR	NR	NNW	0.003	11-18-97	Not sampled: well was inaccessible							
A-5	02-20-98	13.51	NR	NR	NR	N	0.013	02-20-98	Not sampled: well was inaccessible							
A-5	05-11-98	13.51	NR	NR	NR	N	0.03	05-11-98	Not sampled: well was inaccessible							
A-5	07-30-98	13.51	NR	NR	NR	N	0.002	07-30-98	Not sampled: well was inaccessible							
A-5	10-08-98	13.51	NR	NR	NR	NNW	0.002	10-08-98	Not sampled: well was inaccessible							
A-6	03-24-95	13.51	7.89	5.62	ND	NW	0.009	03-24-95	120	<0.5	<1	<0.5	<1.5	--	--	--
A-6	06-05-95	13.51	10.06	3.45	ND	NW	0.002	06-05-95	160	<0.5	<0.6	<0.5	<0.5	--	--	--
A-6	08-17-95	13.51	11.10	2.41	ND	W	0.001	08-18-95	530	<0.5	<0.5	<2.4	<4.2	6	--	--
A-6	12-04-95	13.51	11.52	1.99	ND	NNW	0.002	12-04-95	28000	1600	1800	880	3600	--	--	--
A-6	03-01-96	13.51	8.21	5.30	ND	NW	0.003	03-13-96	1400	<3	<15	<7	<10	<20	--	--
A-6	05-29-96	13.51	9.25	4.26	ND	NW	0.002	05-29-96	410	<2	<2	<2	<2	3	--	--
A-6	08-29-96	13.51	10.52	2.99	ND	W	0.002	08-29-96	80	<0.5	<0.5	<0.5	<0.5	6	--	--
A-6	11-21-96	13.51	10.54	2.97	ND	WNW	0.002	11-21-96	62	<0.5	<0.5	<0.5	<0.5	12	--	--
A-6	03-26-97	13.51	9.93	3.58	ND	NW	0.002	03-26-97	110	<0.5	0.8	1	1.4	15	--	--
A-6	05-21-97	13.51	10.54	2.97	ND	NNW	0.002	05-21-97	600	0.6	0.6	<2	2.7	<3	--	--
A-6	08-08-97	13.51	10.77	2.74	ND	NNW	0.002	08-08-97	850	<0.5	<0.5	6.1	<0.5	<4	--	--
A-6	11-18-97	13.51	3.41	10.10	ND	NNW	0.003	11-18-97	690	<1	<1	3	2	7	--	--
A-6	02-20-98	13.51	6.73	6.78	ND	N	0.013	02-20-98	60	<0.5	0.6	1.3	0.5	4	--	--
A-6	05-11-98	13.51	9.26	4.25	ND	N	0.03	05-11-98	140	<0.5	0.7	0.6	<0.5	6	--	--
A-6	07-30-98	13.51	10.12	3.39	ND	N	0.002	07-30-98	910	<2	<2	3	7	34	--	--
A-6	10-08-98	13.51	10.53	2.98	ND	NNW	0.002	10-08-98	1300	<2	4	3	4	21	--	--

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

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

Well 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	TPHD LUFT Method
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
AR-1	03-24-95	15.61	7.25	8.36	ND	NW	0.009	03-24-95	270	14	0.6	2.5	2.1	--	--	130
AR-1	06-05-95	15.61	11.37	4.24	ND	NW	0.002	06-05-95	190	10	<0.5	0.8	0.5	--	--	580
AR-1	08-17-95	15 61	12.40	3.21	ND	W	0.001	08-17-95	960	110	12	4.5	150	14	--	<50
AR-1	12-04-95	15 61	12.90	2.71	ND	NNW	0.002	12-04-95	<50	1.5	<0.5	<0.5	0 8	--	--	--
AR-1	03-01-96	15.61	8.19	7.42	ND	NW	0.003	03-13-96	150	3 8	0.5	1 4	1.3	<3	--	--
AR-1	05-29-96	15.61	10.41	5.20	ND	NW	0.002	05-29-96	Not sampled: well sampled semi-annually, during the first and third quarters							
AR-1	08-29-96	15.61	12.12	3.49	ND	W	0.002	08-29-96	<50	<0.5	<0.5	<0.5	0.8	<3	--	--
AR-1	11-21-96	15.61	11.52	4.09	ND	WNW	0.002	11-21-96	Not sampled: well sampled semi-annually, during the first and third quarters							
AR-1	03-26-97	15 61	11.33	4.28	ND	NW	0.002	03-26-97	<50	<0.5	<0.5	<0.5	<0 5	<3	--	--
AR-1	05-21-97	15.61	12.02	3.59	ND	NNW	0.002	05-21-97	Not sampled: well sampled semi-annually, during the first and third quarters							
AR-1	08-08-97	15.61	12.31	3.30	ND	NNW	0.002	08-08-97	<50	0.7	<0.5	1	<0.5	<3	--	--
AR-1	11-18-97	15.61	3.97	11.64	ND	NNW	0.003	11-18-97	Not sampled: well sampled semi-annually, during the first and third quarters							
AR-1	02-20-98	15 61	6 42	9.19	ND	N	0.013	02-23-98	<200	<2	<2	<2	<2	160	--	--
AR-1	05-11-98	15.61	10 93	4.68	ND	N	0.03	05-11-98	<50	<0.5	<0.5	<0.5	<0 5	4	--	--
AR-1	07-30-98	15.61	11.82	3.79	ND	N	0.002	07-30-98	<50	<0 5	<0.5	<0.5	<0.5	6	--	--
AR-1	10-08-98	15 61	12.24	3.37	ND	NNW	0.002	10-08-98	<50	<0.5	<0.5	<0.5	<0.5	6	--	--
AR-2	03-24-95	15.28	9.13	6.15	ND	NW	0.009	03-24-95	<50	6.2	<0.5	<0.5	0 6	--	--	<50
AR-2	06-05-95	15.28	12.09	3.19	ND	NW	0.002	06-05-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	<50
AR-2	08-17-95	15.28	12.78	2.50	ND	W	0.001	08-18-95	<50	<0.5	<0.5	<0.5	<0.5	4	--	<50
AR-2	12-04-95	15.28	11.44	3.84	ND	NNW	0.002	12-13-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
AR-2	03-01-96	15.28	9 83	5.45	ND	NW	0.003	03-13-96	190	26	2.6	3.3	13	200	--	--
AR-2	05-29-96	15.28	10.97	4.31	ND	NW	0.002	05-29-96	Not sampled: well sampled semi-annually, during the first and third quarters							
AR-2	08-29-96	15.28	12.20	3.08	ND	W	0.002	08-29-96	<50	<0.5	<0.5	<0.5	<0.5	95	--	--
AR-2	11-21-96	15.28	11 57	3.71	ND	WNW	0.002	11-21-96	Not sampled: well sampled semi-annually, during the first and third quarters							
AR-2	03-26-97	15.28	11.60	3.68	ND	NW	0.002	03-26-97	<50	<0.5	<0.5	<0.5	<0.5	9	--	--
AR-2	05-21-97	15.28	12.12	3.16	ND	NNW	0.002	05-21-97	Not sampled: well sampled semi-annually, during the first and third quarters							
AR-2	08-08-97	15 28	12.35	2.93	ND	NNW	0.002	08-08-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
AR-2	11-18-97	15.28	3.48	11.80	ND	NNW	0.003	11-18-97	Not sampled: well sampled semi-annually, during the first and third quarters							
AR-2	02-20-98	15.28	8.00	7.28	ND	N	0.013	02-20-98	<50	<0.5	<0.5	<0.5	<0.5	43	--	--
AR-2	05-11-98	15 28	10.97	4.31	ND	N	0 03	05-11-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
AR-2	07-30-98	15.28	11.76	3.52	ND	N	0.002	07-30-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
AR-2	10-08-98	15.28	12.17	3.11	ND	NNW	0.002	10-08-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--

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

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

Well 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	TPHD LUFT Method
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
ADR-1	03-24-95	13.95	8.04	** 5.92	0.01	NW	0.009	03-24-95	Not sampled: well contained floating product							
ADR-1	06-05-95	13.95	11.02	2.93	ND	NW	0.002	06-05-95	23000	310	420	300	1900	--	--	13000
ADR-1	08-17-95	13.95	11.86	2.09	ND	W	0.001	08-18-95	4400	150	120	95	620	120	--	4500
ADR-1	12-04-95	13.95	10.05	3 90	ND	NNW	0.002	12-13-95	8800	100	130	120	990	--	--	--
ADR-1	03-01-96	13.95	8.76	5.19	ND	NW	0.003	03-13-96	89000	370	1000	840	8100	<500	--	--
ADR-1	05-29-96	13.95	9.74	4.21	ND	NW	0.002	05-30-96	27000	230	380	370	2700	<100	--	--
ADR-1	08-29-96	13.95	10.77	3.18	ND	W	0.002	08-29-96	5300	190	58	76	470	85	--	--
ADR-1	11-21-96	13.95	10.49	3.46	ND	WNW	0.002	11-21-96	1900	82	21	32	270	110	--	--
ADR-1	03-26-97	13.95	10.37	3.58	ND	NW	0.002	03-26-97	1300	260	6	39	27	95	--	--
ADR-1	05-21-97	13.95	10.90	3.05	ND	NNW	0 002	05-21-97	2100	300	18	37	200	79	--	--
ADR-1	08-08-97	13.95	11.12	2.83	ND	NNW	0.002	08-08-97	3900	620	49	110	470	<200	--	--
ADR-1	11-18-97	13.95	3.47	10.48	NR	NNW	0.003	11-18-97	18000	900	140	360	2700	<60	--	--
ADR-1	02-20-98	13.95	NR	NR	NR	N	0.013	02-20-98	Not sampled: well was inaccessible							
ADR-1	05-11-98	13.95	NR	NR	NR	N	0.03	05-11-98	Not sampled: well was inaccessible							
ADR-1	07-30-98	13 95	NR	NR	NR	N	0.002	07-30-98	Not sampled: well was inaccessible							
ADR-1	10-08-98	13.95	NR	NR	NR	NNW	0.002	10-08-98	Not sampled: well was inaccessible							
ADR-2	03-24-95	14.64	8.41	NR*	>3.00*	NR*	NR*	03-24-95	Not sampled: well contained floating product							
ADR-2	06-05-95	14.64	11 45	NR*	>3 00*	NR*	NR*	06-05-95	Not sampled: well contained floating product							
ADR-2	08-17-95	14.64	12.10	** 2.56	0 03	W	0.001	08-17-95	Not sampled: well contained floating product							
ADR-2	12-04-95	14.64	10.93	** 3.73	0.03	NNW	0.002	12-13-95	Not sampled: well contained floating product							
ADR-2	03-01-96	14.64	8.74	5.90	ND	NW	0.003	03-13-96	29000	1100	1200	710	3800	<500	--	--
ADR-2	05-29-96	14.64	10.43	4.21	ND	NW	0.002	05-29-96	33000	510	500	470	2300	120	--	--
ADR-2	08-29-96	14.64	11.64	3.00	ND	W	0.002	08-29-96	8000	230	180	150	730	53	--	--
ADR-2	11-21-96	14.64	11.23	3.41	ND	WNW	0.002	11-21-96	15000	630	440	390	2100	75	--	--
ADR-2	03-26-97	14.64	11.13	3.51	ND	NW	0.002	03-26-97	6100	320	23	180	400	32	--	--
ADR-2	05-21-97	14.64	11.64	3.00	ND	NNW	0.002	05-21-97	6100	380	22	210	320	<30	--	--
ADR-2	08-08-97	14.64	11 85	2.79	ND	NNW	0.002	08-08-97	8400	380	35	230	910	<30	--	--
ADR-2	11-18-97	14.64	3.33	11 31	ND	NNW	0.003	11-18-97	11000	230	29	300	1200	<60	--	--
ADR-2	02-20-98	14.64	7.67	6.97	ND	N	0.013	02-20-98	4700	320	30	130	360	20	--	--
ADR-2	05-11-98	14.64	10.47	4 17	NR	N	0.03	05-11-98	Not sampled							
ADR-2	07-30-98	14.64	NR	NR	NR	N	0.002	07-30-98	Not sampled: well was inaccessible							
ADR-2	10-08-98	14.64	11.67	2.97	NR	NNW	0.002	10-08-98	Not sampled							

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

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

Well 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	TPHD LUFT Method
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L

ft-MSL: elevation in feet, relative to mean sea level
MWN: groundwater 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
TPHD: total petroleum hydrocarbons as diesel, California DHS LUFT Method
ND: none detected
NR: not reported; data not available or not measurable
NNW: North-Northwest
^^: sample contains components eluting in the diesel range, quantified as diesel; chromatogram does not match the typical diesel fingerprint
- -: not analyzed or not applicable
*: well contained more than 3 feet of floating product; exact product thickness and groundwater elevation could not be measured
**: [corrected elevation (Z')] = Z + (h * 0.73) where: Z = measured elevation, h = floating product thickness, 0.73 = density ratio of oil to water
***: For previous historical groundwater elevation data please refer to *Fourth Quarter 1995 Groundwater Monitoring Program Results and Remediation System Performance Evaluation Report, ARCO Service Station 2169, 889 West Grand Avenue, Oakland, California, (EMCON, March 4, 1996).*

Table 2
Soil Vapor Extraction System (1998)
Operational Uptime Information

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

Site	Meter (hrs.)	Operation (hrs.)	Period Operation				Cumulative Operation			
			Total (days)	Uptime (days)	Downtime (days)	Uptime (%)	Total (days)	Uptime (days)	Downtime (days)	Uptime (%)
4/01/98[1]	7365.55	6909.60					1399	287.9	1111.1	21%
04/15/98	7365.55	6909.60								
06/22/98	7365.78	6909.83	68	0.0	68.0	0%	1467	287.9	1179.1	20%
08/20/98	7365.78	6909.83	59	0.0	59.0	0%	1526	287.9	1238.1	19%
10/07/98	7366.69	6910.74	48	0.0	48.0	0%	1574	287.9	1286.1	18%
10/08/98	7392.07	6936.12	1	1.1	-0.1	106%	1575	289.0	1286.0	18%
10/30/98	7752.82	7296.87	22	15.0	7.0	68%	1597	304.0	1293.0	19%
11/18/98	7755.18	7299.23	19	0.1	18.9	1%	1616	304.1	1311.9	19%
11/25/98	7869.69	7413.74	7	4.8	2.2	68%	1623	308.9	1314.1	19%
12/08/98	8182.76	7726.81	13	13.0	0.0	100%	1636	322.0	1314.0	20%

[1] Operational data through 04/01/98 from First Quarter 1998 Quarterly Monitoring Report

Table 3
Soil Vapor Extraction System (1998)
Flow Rates and Analytical Results of Air Samples

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

Date	Sample Location	Vacuum (in. H20)	Velocity (fpm)	Flowrate[1] (scfm)	Analyses (ppmv)					
					TPHG	Benzene	Toulene	Ethylbenzene	Xylene	MTBE
10/8/98	Influent	21.2	750	35	190	<0.1	<0.1	<0.1	0.2	
	Effluent[2]		3600	274.2	<5	<0.1	<0.1	<0.1	<0.2	
11/18/98	Influent	21	900	42	83	<0.1	0.4	0.4	0.9	
	Effluent		3300	253.4	<5	<0.1	<0.1	<0.1	<0.2	
12/8/98	Influent	25	1100	51	12	<0.1	0.3	<0.1	0.2	<0.8
	Effluent		3100	238.0	6	<0.1	0.3	<0.1	0.2	<0.8

[1] Influent Flow Rate, cfm = (Velocity, fpm)(Influent Pipe Area, sq. ft.)(406.8 in.H20 - Vacuum, in.H20) / (406.8 in.H20)
where Influent Pipe Diameter = 3"
Effluent Flow Rate, cfm = (Velocity, fpm)(Effluent Pipe Area, sq.ft.)[(460° R + 77° F)/(460° R + Vapor Temp F)]
where Effluent (after blower) Pipe Diameter = 4"

[2] Dilution air only

NR = Not Recorded. Parameters were not recorded because of minimal operation time due to noise complaint. System was started only to collect samples.

Table 4
Soil Vapor Extraction System (1998)
Extraction Rates, Emission Rates, Destruction Efficiency, and Mass Removed

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

Date End	Extraction Rate from Wellfield[1]		Emission Rate to Atmosphere[2]		Destruction Efficiency[3]		Period Removal[4]		Cumulative Removal	
	TPHG (lbs/day)	Benzene (lbs/day)	TPHG (lbs/day)	Benzene (lbs/day)	TPHG (%)	Benzene (%)	TPHG (lbs)	Benzene (lbs)	TPHG (lbs)	Benzene (lbs)
4/01/98[5]									8582.1	0
10/08/98	0.1015	0.0	0.0210	<0.0003	79%	NC	0.1073	0	8582.2	0
11/18/98	0.0532	0.0	<0.0194	<0.0003	NC	NC	0.0052	0	8582.2	0
12/08/98	0.0093	0.0	<0.0219	<0.0003	NC	NC	0.1214	0	8582.3	0

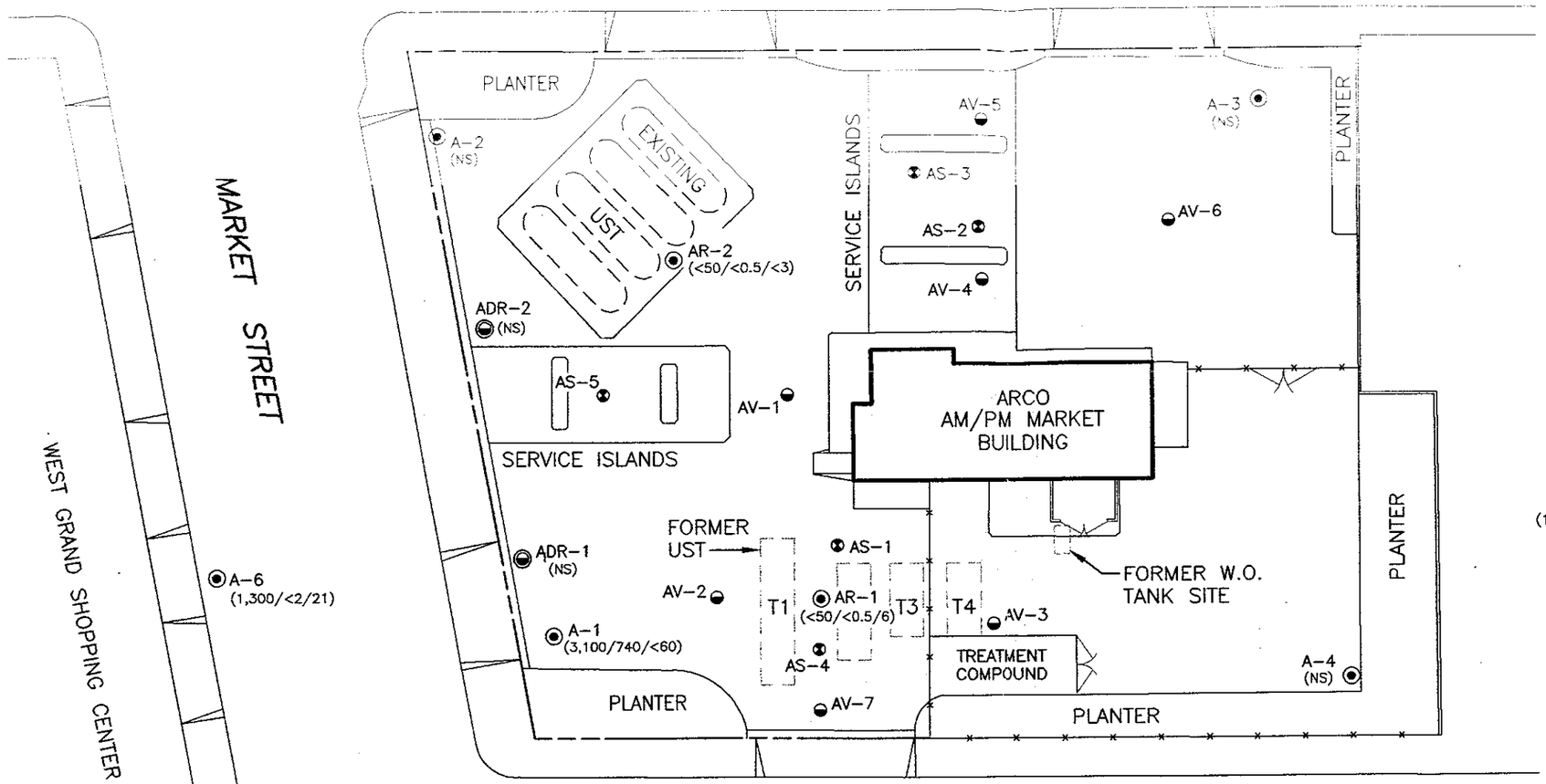
[1] Extraction Rate, lbs/day = (Influent Flow, cfm)(Influent conc., ppmv)(g/mole)(60 min/hr)(28.3 L/cf) / (10^6)(24.45 moles/L)(453.6 g/lb)
where TPHG = 100 g/mole and Benzene = 78.1 g/mole; Influent conc. = 0, if reported as non-detect

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

[3] Destruction Efficiency, % = (Extraction Rate - Emission Rate)(100) / (Extraction Rate); NC = Not Calculated due to non-detectable effluent concentration

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

[5] Operational data through 4/1/98 from First Quarter 1998 Quarterly Monitoring Report



N

EXPLANATION

- ◉ Groundwater monitoring well
- ◒ Vapor extraction well
- ◉ Groundwater monitoring/vapor extraction well
- ⊗ Air sparging well
- (1,300/<2/21) Concentration of total petroleum hydrocarbons as gasoline (TPHG), benzene, and MTBE in groundwater (ug/L); samples collected 10/8/98
- < Not detected at or above the indicated laboratory detection limit
- NS Not sampled

0 40 80

SCALE IN FEET

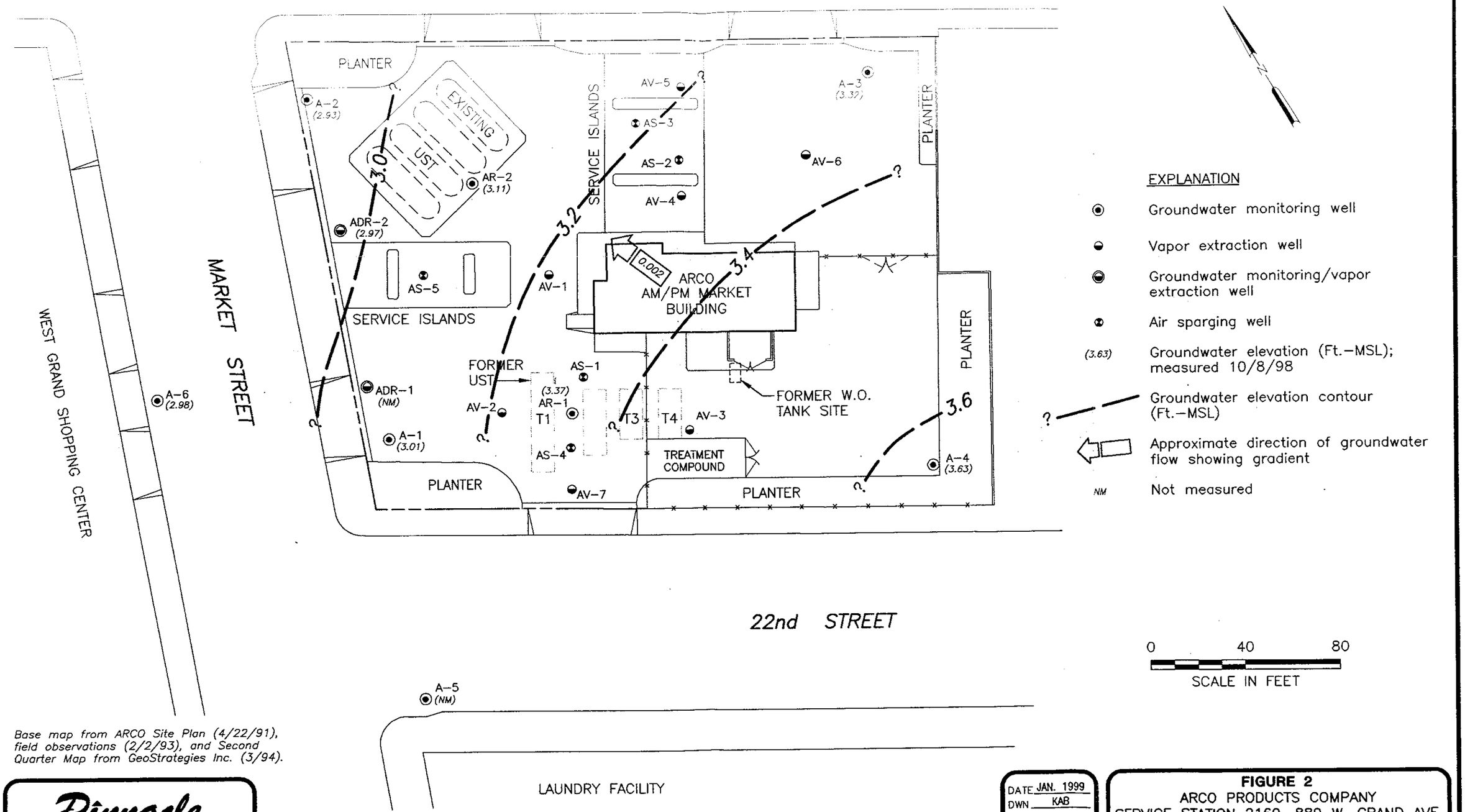
Pinnacle

ENVIRONMENTAL SOLUTIONS
A DIVISION OF EMCON

DATE JAN. 1999
DWN KAB
APP
REV 0
PROJECT NO.
20805-129.005

FIGURE 1
ARCO PRODUCTS COMPANY
SERVICE STATION 2169, 889 W. GRAND AVE.
OAKLAND, CALIFORNIA
GROUNDWATER ANALYTICAL SUMMARY
FOURTH QUARTER 1998

IMAGE Files: <No Images>
XREF Files: <No Xrefs>
Dimscale: 40 Ltscale: 40 Psltscale: 0
SANJOSE/CADD: N:\DWG\PINACL\2169\2169CHEM.DWG Tue, 26/Jan/99 03:50pm kblack



Base map from ARCO Site Plan (4/22/91), field observations (2/2/93), and Second Quarter Map from GeoStrategies Inc. (3/94).

Pinnacle
ENVIRONMENTAL SOLUTIONS A DIVISION OF EMCON

DATE JAN. 1999
DWN KAB
APP
REV 0
PROJECT NO. 20805-129.005

FIGURE 2
ARCO PRODUCTS COMPANY
SERVICE STATION 2169, 889 W. GRAND AVE.
OAKLAND, CALIFORNIA
GROUNDWATER ELEVATION CONTOURS
FOURTH QUARTER 1998

IMAGE Files: <No Images> XREF Files: <No Xrefs>
Dimscale: 40 Ltscale: 40 Psltscale: 0
SANJOSE/CADD: N:\DWG\PINACL\2169\2169GWC.DWG Wed, 03/Feb/99 11:03am kblack
1" 1/2" 0" 1"

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

October 21, 1998 Service Request No.: S9802676

RECEIVED
OCT 22 1998
BY: am

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

RE: 20805-129.005/TO#22312.00/RAT8/2169 OAKLAND

Dear Mr. Vanderveen:

The following pages contain analytical results for sample(s) received by the laboratory on October 8, 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 T. 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:**	S9802676
Project:	20805-129.005/TO#22312.00/RAT8/2169 OAKLAND	**Date Collected:**	10/8/98
Sample Matrix:	Water	**Date Received:**	10/8/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	AR-2(14)	Units:	ug/L (ppb)
Lab Code:	S9802676-001	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	10/21/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	10/21/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	10/21/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	10/21/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	10/21/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	10/21/98	ND	

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802676
Project:	20805-129.005/TO#22312.00/RAT8/2169 OAKLAND	**Date Collected:**	10/8/98
Sample Matrix:	Water	**Date Received:**	10/8/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	AR-1(14)	Units:	ug/L (ppb)
Lab Code:	S9802676-002	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	10/21/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	10/21/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	10/21/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	10/21/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	10/21/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	10/21/98	6	

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802676
Project:	20805-129.005/TO#22312.00/RAT8/2169 OAKLAND	**Date Collected:**	10/8/98
Sample Matrix:	Water	**Date Received:**	10/8/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	AR-6(14)	Units:	ug/L (ppb)
Lab Code:	S9802676-003	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	4	NA	10/21/98	1300	
Benzene	EPA 5030	8020	0.5	4	NA	10/21/98	<2	C1
Toluene	EPA 5030	8020	0.5	4	NA	10/21/98	4	
Ethylbenzene	EPA 5030	8020	0.5	4	NA	10/21/98	3	
Xylenes, Total	EPA 5030	8020	0.5	4	NA	10/21/98	4	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	4	NA	10/21/98	21	

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:**	S9802676
Project:	20805-129.005/TO#22312.00/RAT8/2169 OAKLAND	**Date Collected:**	10/8/98
Sample Matrix:	Water	**Date Received:**	10/8/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	A-1(14)	Units:	ug/L (ppb)
Lab Code:	S9802676-004	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	20	NA	10/21/98	3100	
Benzene	EPA 5030	8020	0.5	20	NA	10/21/98	740	
Toluene	EPA 5030	8020	0.5	20	NA	10/21/98	11	
Ethylbenzene	EPA 5030	8020	0.5	20	NA	10/21/98	<10	C1
Xylenes, Total	EPA 5030	8020	0.5	20	NA	10/21/98	24	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	20	NA	10/21/98	<60	C1

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:**	S9802676
Project:	20805-129.005/TO#22312.00/RAT8/2169 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:	S981020-WB2	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	10/20/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	10/20/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	10/20/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	10/20/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	10/20/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	10/20/98	ND	

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9802676
Project:	20805-129.005/TO#22312.00/RAT8/2169 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:	S981021-WB2	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	10/21/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	10/21/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	10/21/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	10/21/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	10/21/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	10/21/98	ND	

IS22/020597p

APPENDIX A

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-129.005/TO#22312.00/RAT8/2169 OAKLAND
Sample Matrix: Water

Service Request: S9802676
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: NA

Surrogate Recovery Summary
BTEX, MTBE and TPH as Gasoline

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

Units: PERCENT
Basis: NA

Sample Name	Lab Code	Test Notes	Percent Recovery 4-Bromofluorobenzene	Percent Recovery a,a,a-Trifluorotoluene
AR-2(14)	S9802676-001		102	96
AR-1(14)	S9802676-002		103	85
AR-6(14)	S9802676-003		99	89
A-1(14)	S9802676-004		101	90
AR-2(14)	S9802676-001MS		99	104
AR-2(14)	S9802676-001DMS		100	102
Method Blank	S981020-WB2		103	89
Method Blank	S981021-WB2		105	90
CAS Acceptance Limits:			69-116	69-116

SUR2/020397p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-129.005/TO#22312.00/RAT8/2169 OAKLAND
Sample Matrix Water

Service Request: S9802676
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 10/21/98

Matrix Spike/Duplicate Matrix Spike Summary
TPH as Gasoline

Sample Name: AR-2(14)
Lab Code: S9802676-001MS, S9802676-001DMS
Test Notes:

Units: ug/L (ppb)
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	CAS Acceptance Limits	Relative Percent Difference	Result Notes
Gasoline	EPA 5030	CA/LUFT	50	250	250	ND	270	270	108	108	75-135	<1	

DMS/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: *ARCO Products Company* **Service Request:** S9802676
Project: 20805-129.005/TO#22312.00/RAT8/2169 OAKLAND **Date Analyzed:** 10/20/98

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	270	90-110	108	
Benzene	EPA 5030	8020	25	26	85-115	104	
Toluene	EPA 5030	8020	25	26	85-115	104	
Ethylbenzene	EPA 5030	8020	25	27	85-115	108	
Xylenes, Total	EPA 5030	8020	75	80	85-115	107	
Methyl *tert*-Butyl Ether	EPA 5030	8020	25	25	85-115	100	

ICV/032196

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-129.005/TO#22312.00/RAT8/2169 OAKLAND
Sample Matrix: Water

Service Request: S9802676
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 10/20/98

Matrix Spike Summary
TPH as Gasoline

Sample Name: AR-2(14)
Lab Code: S9802676-001MS
Test Notes:

Units: ug/L (ppb)
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Gasoline	EPA 5030	CA/LUFT	50	250	ND	270	108	75-135	

MS/020597p

ARCO Products Company
Division of Atlantic/Richfield Company

Task Order No. 22312.00 S9802676

Chain of Custody

ARCO Facility no. 2169	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)437-9576
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 mix. w/ 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 ☐
AR-2(14)	①	2		X		X	HCl	10/8/98	1015		X									
AR-1(14)	②	2		X		X	HCl		0950		X									
A-5(14)		2		X		X	HCl				X	→ Unable to Sample →								
A-6(14)	③	2		X		X	HCl		1105		X									
A-1(14)	④	2		X		X	HCl	↓	1125		X									

Method of shipment: Sampler will deliver

Special Detection Limit/reporting: Lowest Possible

Special QA/QC: As Normal

Remarks: RAT 8
2 - 40ml HCL VOAs

#20805-129.005

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:

	Date	Time		Date	Time
Relinquished by sampler	10/8/98	1250	Received by P. Bins CAS	10/9/98	1250
Relinquished by			Received by		
Relinquished by			Received by laboratory		

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

Due: 10/22/98 R11D3

APPENDIX C

FIELD DATA SHEETS

FIELD REPORT
DEPTH TO WATER / FLOATING PRODUCT SURVEY

PROJECT # : **21775-235.003** STATION ADDRESS : **899 West Grand Avenue, Oakland** DATE : **10/8/98**

ARCO STATION # : **2169** FIELD TECHNICIAN : **Mike Ross** DAY : **Thursday**

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	A-4	OK	VAULT	NO	NONE	TEC	11.62	11.62	ND	ND	27.7	
2	A-3	OK	VAULT	NO	NONE	TEC	12.43	12.43	ND	ND	28.4	
3	AR-2	OK	VAULT	NO	NONE	TEC	12.17	12.17	ND	ND	29.6	
4	AR-1	OK	VAULT	NO	NONE	TEC	12.24	12.24	ND	ND	27.7	
5	A-2	OK	VAULT	NO	NONE	TEC	11.62	11.62	ND	ND	24.6	
6	A-5	IW	G-5	IW	ARCO	LWC	IW	IW	IW	IW	IW	ORP Sock Stuck in well
7	ADR-2	OK	VAULT	NO	NONE	TEC	11.67	11.67	ND	ND	26.1	
8	ADR-1	OK	VAULT	~~NO~~	NONE	TEC	IW	IW	~~ND~~	~~ND~~	IW	Unable to Get Screen out of well box CLA
9	A-6	OK	G-5	NO	ARCO	LWC	10.53	10.53	ND	ND	27.0	
10	A-1	OK	VAULT	NO	NONE	TEC	11.15	11.15	ND	ND	23.8	

SURVEY POINTS ARE TOP OF WELL CASINGS

WATER SAMPLE FIELD DATA SHEET

Rev 1/97

OWT

PROJECT NO 21275-235.003 | SAMPLE ID A-1 (14)
PURGED BY NR | CLIENT NAME ARCO 2169
SAMPLED BY M. Ross | LOCATION Oakland, Ca.

TYPE Groundwater ✓ Surface Water ____ Leachate ____ Other ____

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

CASING ELEVATION (feet/MSL)	NR	VOLUME IN CASING (gal.)	NR
DEPTH OF WELL (feet)	23.8	CALCULATED PURGE (gal.)	NR
DEPTH OF WATER (feet)	11.15	ACTUAL PURGE VOL (gal.)	NR

DATE PURGED NR | END PURGE NR
DATE SAMPLED 10/8/98 | SAMPLING TIME 1125

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E C (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1125	GRAB	6.95	1060	73.1	clr	clr

OTHER: D.O. 1.5 mg/L ODOR Slight | 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: NR

SAMPLING EQUIPMENT

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

LOCK: None - TEC

WELL INTEGRITY: OK

REMARKS: GRAB Sample Taken within Channel Below Top of Well Screens

pH, E.C., Temp. Meter Calibration: Date 10/8/98 Time 0945 Meter Serial No 600232

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

Temperature °F ____

SIGNATURE: [signature] See AR-1 REVIEWED BY: NR PAGE 1 OF 5

WATER SAMPLE FIELD DATA SHEET

Rev 1/97

OWT

PROJECT NO 21775-235.003 | SAMPLE ID A-5( )
PURGED BY NR | CLIENT NAME ARCO 2169
SAMPLED BY M. Ross | LOCATION Oakland, Ca.

TYPE Groundwater ✓ Surface Water ___ Leachate ___ Other ___

CASING DIAMETER (inches) 2 ✓ 3 ___ 4 ___ 4 5 ___ 6 ___ Other ___

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

DATE PURGED NR | END PURGE NR
DATE SAMPLED 10/8/98 | SAMPLING TIME NR

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
	No Samples	Taken -	ORP Sock		STUCK	
		in	well			

OTHER D.O. NR mg/L ODOR: NR | 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 ___ Bailer (Teflon)
___ Centrifugal Pump ___ Bailer (PVC)
___ Submersible Pump ___ Bailer (Stainless Steel)
___ Well Wizard™ ___ Dedicated
Other NR

SAMPLING EQUIPMENT

___ 2" Bladder Pump ✓ Bailer (Teflon)
___ Bomb Sampler ___ Bailer (Stainless Steel)
___ Dipper ___ Submersible Pump
___ Well Wizard™ ___ Dedicated
Other Disposable

WELL INTEGRITY: OK | LOCK. ARCO

REMARKS: No Sampling Done Bc well - ORP Sock STUCK in well cannot Get IT out of well.

pH, E C, Temp Meter Calibration Date 10/7/98 | Time 0945 | Meter Serial No 600232
E C 1000 ___ / ___ | pH 7 ___ / ___ | pH 10 ___ / ___ | pH 4 ___ / ___
Temperature °F ___ See AR-1

SIGNATURE: [signature] | REVIEWED BY [signature] | PAGE 2 OF 5

WATER SAMPLE FIELD DATA SHEET

Rev 1/97

OWT

PROJECT NO 21775-235.003 | SAMPLE ID A-6(14)
PURGED BY NR | CLIENT NAME ARCO 2169
SAMPLED BY M. Ross | LOCATION Oakland, Ca.

TYPE Groundwater ✓ Surface Water ____ Leachate ____ Other ____

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

CASING ELEVATION (feet/MSL)	NR	VOLUME IN CASING (gal.)	NR
DEPTH OF WELL (feet)	27.0	CALCULATED PURGE (gal.)	NR
DEPTH OF WATER (feet)	10.53	ACTUAL PURGE VOL (gal.)	NR

DATE PURGED NR | END PURGE NR
DATE SAMPLED 10/8/98 | SAMPLING TIME 1105

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1105	GRAB	6.99	932	71.8	clr	clr

OTHER: D.O. 1.5 mg/L ODOR slight | 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 NR

SAMPLING EQUIPMENT

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

WELL INTEGRITY: OK | LOCK: ARCO

REMARKS:

Grab Sample taken water column Below Top of well Screens.

pH, E.C., Temp Meter Calibration: Date 10/8/98 Time 0945 Meter Serial No 600232
EC 1000 ____ / ____ pH 7 ____ / ____ pH 10 ____ / ____ pH 4 ____ / ____
Temperature °F ____ See AR-1

SIGNATURE: Mike Ross REVIEWED BY ____ PAGE 3 OF 5

WATER SAMPLE FIELD DATA SHEET

Rev 1/97

OWT

PROJECT NO 21775-235.003
PURGED BY M. Ross
SAMPLED BY M. Ross

SAMPLE ID AR-1(14)
CLIENT NAME ARCO 2169
LOCATION Oakland, Ca.

TYPE Groundwater ✓ Surface Water ____ Leachate ____ Other ____

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

CASING ELEVATION (feet/MSL) NR
DEPTH OF WELL (feet) 27.7
DEPTH OF WATER (feet) 12.24

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

DATE PURGED: 10/8/98
DATE SAMPLED 10/8/98

END PURGE ND
SAMPLING TIME 0950

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
0950	GRAB	6.73	454	67.8	clr	clr

OTHER: D.O. 1.5 mg/L 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: NR

SAMPLING EQUIPMENT

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

WELL INTEGRITY: OK

LOCK: None-TEC

REMARKS:
GRAB Sample taken - Water Column Below Top of Screens.

pH, E C., Temp. Meter Calibration: Date 10/8/98 Time 0945 Meter Serial No 600232
E C. 1000 996 / 1000 pH 7 699 / 700 pH 10 999 / 1000 pH 4 402 / 400
Temperature °F 67.3
SIGNATURE Mike Ross REVIEWED BY ____ PAGE 4 OF 5

WATER SAMPLE FIELD DATA SHEET

Rev 1/97

OWT

PROJECT NO 21775-235.003 | SAMPLE ID AR-2(14)
PURGED BY NR | CLIENT NAME ARCO 2169
SAMPLED BY M. Ross | LOCATION Oakland, Ca.

TYPE Groundwater ✓ Surface Water ____ Leachate ____ Other ____

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

CASING ELEVATION (feet/MSL)	NR	VOLUME IN CASING (gal)	NR
DEPTH OF WELL (feet)	28.6	CALCULATED PURGE (gal.)	NR
DEPTH OF WATER (feet)	12.17	ACTUAL PURGE VOL (gal)	NR

DATE PURGED: NR | END PURGE NR
DATE SAMPLED 10/8/98 | SAMPLING TIME 1015

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1015	GRAB	8.22	913	71.1	clr	clr

OTHER: D.O. 1.5 mg/L ODOR None | 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: NR

SAMPLING EQUIPMENT

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

WELL INTEGRITY: OK | LOCK: None-TEC

REMARKS: GRAB Sample Taken - Water Column Below Top of Screens.

pH, E.C, Temp Meter Calibration Date 10/8/98 | Time 0945 | Meter Serial No. 600232
E.C. 1000 ____ | pH 7 ____ | pH 10 ____ | pH 4 ____
Temperature °F ____ See AR-1

SIGNATURE: Mike Ross | REVIEWED BY: ____ | PAGE 5 OF 5

EMCON Associates - Field Services | Historical Monitoring Well Data

1921 Ringwood Avenue | 1998 | ARCO 2169

San Jose, California | 21775-235.003

Well ID	Quarter	Date	Purge Volume (gallons)	Did well dry	Well Contained Product	
						Gallons
						First 252.00
						Second 0.00
						***Third* 0.00**
						Fourth 0.00
A-1	First	02/23/98	19.00	NO	NO	
	Second	05/11/98	0.00	GRAB	NO	
	Third	07/30/98	0.00	GRAB	NO	
	Fourth	10/09/98	0.00	GRAB	NO	
A-2	First	02/23/98	49.00	NO	NO	
	Second	05/11/98	0.00	NA	NO	
	Third	07/30/98	0.00	NA	NO	
	Fourth	10/09/98	0.00	NA	NO	
A-3	First	02/23/98	23.00	NO	NO	
	Second	05/11/98	0.00	NA	NO	
	Third	07/30/98	0.00	NA	NO	
	Fourth	10/09/98	0.00	NA	NO	
A-4	First	02/23/98	24.00	NO	NO	
	Second	05/11/98	0.00	NA	NO	
	Third	07/30/98	0.00	NA	NO	
	Fourth	10/09/98	0.00	NA	NO	
A-5	First	02/23/98	0.00	IW	IW	
	Second	05/11/98	0.00	IW	IW	
	Third	07/30/98	0.00	IW	IW	
	Fourth	10/09/98	0.00	IW	IW	
A-6	First	02/23/98	0.00	GRAB	NO	
	Second	05/11/98	0.00	GRAB	NO	
	Third	07/30/98	0.00	GRAB	NO	
	Fourth	10/09/98	0.00	GRAB	NO	
AR-1	First	02/23/98	96.00	NO	NO	
	Second	05/11/98	0.00	NA	NO	
	Third	07/30/98	0.00	GRAB	NO	
	Fourth	10/09/98	0.00	GRAB	NO	
AR-2	First	02/23/98	41.00	NO	NO	
	Second	05/11/98	0.00	GRAB	NO	
	Third	07/30/98	0.00	GRAB	NO	
	Fourth	10/09/98	0.00	GRAB	NO	
ADR-1	First	02/23/98	0.00	NA	NO	
	Second	05/11/98	0.00	GRAB	NO	
	Third	07/30/98	0.00	NA	NO	
	Fourth	10/09/98	0.00	NA	NO	
ADR-2	First	02/23/98	0.00	GRAB	NO	Steam water (gal) _____
	Second	05/11/98	0.00	NA	NO	
	Third	07/30/98	0.00	NA	NO	
	Fourth	10/09/98	0.00	NA	NO	

ARCO Products Company
Division of Atlantic/Richfield Company

Task Order No. 22312.00

Chain of Custody

ARCO Facility no. 2169	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) 427-9526
Consultant name EMCON		Address (Consultant) 144-A Mayhew Way Walnut Creek, CA 94596	Contract Number

Method of shipment: Sampler will deliver

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 MBE	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 ☐			
AR-2(14)	2			X		X	HCL	10/6/98	1015		X												
AR-1(14)	2			X		X	HCL		0950		X												
A-5(-)	2			X		X	HCL				X	→	→	Unable to Sample	→	→	→	→	→	→	→	→	→
A-6(14)	2			X		X	HCL		1105		X												
A-1(14)	2			X		X	HCL	↓	1125		X												

Special Detection Limit/reporting: Lowest Possible

Special QA/QC: As Normal

Remarks: RAT 9
2 - 40ml HCL VOAs

#20805-179.COC

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 10/8/98 Time 1230	Received by [signature] BINS CAS	10/6/98 1350
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

October 21, 1998 Service Request No.: S9802678

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

RE: 20805-009.005/TO#20821.00/2169 OAKLAND

Dear Mr. Vanderveen:

The following pages contain analytical results for sample(s) received by the laboratory on October 8, 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 8, 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

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:**	L9803404
Project:	20805-009.005/TO#20821.00/2169 OAKLAND	**Date Collected:**	10/8/98
Sample Matrix:	Air	**Date Received:**	10/8/98
		Date Extracted:	NA
		Date Analyzed:	10/9/98

BTEX and Total Volatile Hydrocarbons
EPA Methods 8021B/Modified 8015

Sample Name: I-1
Lab Code: L9803404-001

	MRLs		Results	
	mg/m3	uL/L (ppmv)	mg/m3	uL/L (ppmv)
Benzene	0.4	0.1	ND	ND
Toluene	0.4	0.1	ND	ND
Ethylbenzene	0.5	0.1	ND	ND
Xylenes, Total	0.9	0.2	0.9	0.2
Total Volatile Hydrocarbons:				
C1 - C5	12	5	1600	680
C6 - C12*	20	5	810	190

* TVH as gasoline is defined as C6 (benzene) through C12 (dodecane) and uses a molecular weight of 100 to calculate the mg/m3.

LCS/102194

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	L9803404
Project:	20805-009.005/TO#20821.00/2169 OAKLAND	**Date Collected:**	10/8/98
Sample Matrix:	Air	**Date Received:**	10/8/98
		Date Extracted:	NA
		Date Analyzed:	10/9/98

BTEX and Total Volatile Hydrocarbons
EPA Methods 8021B/Modified 8015

Sample Name: E-1
Lab Code: L9803404-002

	MRLs		Results	
	mg/m3	uL/L (ppmv)	mg/m3	uL/L (ppmv)
Benzene	0.4	0.1	ND	ND
Toluene	0.4	0.1	ND	ND
Ethylbenzene	0.5	0.1	ND	ND
Xylenes, Total	0.9	0.2	ND	ND
Total Volatile Hydrocarbons:				
C1 - C5	12	5	ND	ND
C6 - C12*	20	5	ND	ND

* TVH as gasoline is defined as C6 (benzene) through C12 (dodecane) and uses a molecular weight of 100 to calculate the mg/m3.

LCS/102194

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	L9803404
Project:		**Date Collected:**	NA
Sample Matrix:	Air	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	10/9/98

BTEX and Total Volatile Hydrocarbons
EPA Methods 8021B/Modified 8015

Sample Name: Method Blank
Lab Code: L981009-MB

	MRLs		Results	
	mg/m3	uL/L (ppmv)	mg/m3	uL/L (ppmv)
Benzene	0.4	0.1	ND	ND
Toluene	0.4	0.1	ND	ND
Ethylbenzene	0.5	0.1	ND	ND
Xylenes, Total	0.9	0.2	ND	ND
Total Volatile Hydrocarbons:				
C1 - C5	12	5	ND	ND
C6 - C12*	20	5	ND	ND

* TVH as gasoline is defined as C6 (benzene) through C12 (dodecane) and uses a molecular weight of 100 to calculate the mg/m3.

LCS/102194

APPENDIX A

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-009.005/TO#20821.00/2169 OAKLAND
Sample Matrix: Air

Service Request: L9803404
Date Collected: 10/8/98
Date Received: 10/8/98
Date Extracted: NA
Date Analyzed: 10/9/98

Duplicate Summary
BTEX and Total Volatile Hydrocarbons
EPA Methods 8021B/Modified 8015
Units: uL/L (ppmv)

Sample Name: I-1
Lab Code: L9803404-001DUP

Analyte	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Benzene	0.1	ND	ND	ND	NA
Toluene	0.1	ND	ND	ND	NA
Ethylbenzene	0.1	ND	ND	ND	NA
Total Xylenes	0.2	0.202	0.204	0.203	<1
Total Volatile Hydrocarbon:					
C1-C5	5	680	668	674	2
C6-C12*	5	194	190	192	2

* TVH as gasoline is defined as C6 (Benzene) through C12 (Dodecane).

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO Products Company	**Service Request:**	L9803404
Project:	20805-009.005/TO#20821.00/2169 OAKLAND	**Date Collected:**	NA
LCS Matrix:	Air	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	10/9/98

Laboratory Control Sample Summary
BTEX and Total Volatile Hydrocarbons
EPA Methods 8021B/Modified 8015
Units: uL/L (ppmv)

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Benzene	10.0	9.56	96	60-140
Toluene	10.0	10.3	103	60-140
Ethylbenzene	10.0	11.0	110	60-140
TVH as Gasoline	710	697	98	60-140

LCS/121594

ARCO Products Company — Chain of Custody

Division of Atlantic/Richfield Company

S9802678 Task Order No. 20821.00 ?

ARCO Facility no. 2169	City (Facility) Oakland	Project manager (Consultant) V. Voruganti	Laboratory Name
ARCO engineer Paul Supple	Telephone no. (ARCO)	Telephone no. (Consultant)	Fax no. (Consultant)	Contract Number
Consultant name Emcom	Address (Consultant) Emcom		

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 ☐			
I-1	(1)				AIR			10/8/98	1310		4												
E-1	(2)				AIR			10/8/98	1300		4												

Method of shipment: Tech

Special Detection Limit/reporting

Special QA/QC: ppmv & mg/m3

Remarks: RATS

20805009005

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 10/8/98 Time 1415	Received by Joseph Machado CAS	10/8/98 14:15
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

Due: 10/22/98

Columbia Analytical Services INC.
An Employee-Owned Company

December 4, 1998 Service Request No.: S9803159

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

RE: 20805-129.004/TO#20821.00/RAT8/2169 OAKLAND

Dear Mr. Vanderveen:

The following pages contain analytical results for sample(s) received by the laboratory on November 18, 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

Greg Anderson
Regional QA Coordinator

RECEIVED
DEC 07 1998
BY:

2324 Victor Court • Santa Clara, CA 95054-2316 • Telephone (408) 437-2400 • Fax (408) 437-9356

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:**	S9803159
Project:	20805-129.004/TO#20821.00/RAT8/2169 OAKLAND	**Date Collected:**	11/18/98
Sample Matrix:	Air	**Date Received:**	11/18/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	I-1	Units:	mg/m3
Lab Code:	S9803159-001	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	5030	8020	0.4	1	NA	11/18/98	ND	
Toluene	5030	8020	0.4	1	NA	11/18/98	1.4	
Ethylbenzene	5030	8020	0.5	1	NA	11/18/98	1.6	
Xylenes, Total	5030	8020	0.9	1	NA	11/18/98	3.7	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	12	1	NA	11/18/98	310	
C6 - C12	5030	8015M	20	1	NA	11/18/98	340	
TPH as Gasoline*	5030	8015M	20	1	NA	11/18/98	340	

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

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9803159
Project:	20805-129.004/TO#20821.00/RAT8/2169 OAKLAND	**Date Collected:**	11/18/98
Sample Matrix:	Air	**Date Received:**	11/18/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	I-1	Units:	ppmV
Lab Code:	S9803159-001	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	5030	8020	0.1	1	NA	11/18/98	ND	
Toluene	5030	8020	0.1	1	NA	11/18/98	0.4	
Ethylbenzene	5030	8020	0.1	1	NA	11/18/98	0.4	
Xylenes, Total	5030	8020	0.2	1	NA	11/18/98	0.9	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	5	1	NA	11/18/98	130	
C6 - C12	5030	8015M	5	1	NA	11/18/98	83	
TPH as Gasoline*	5030	8015M	5	1	NA	11/18/98	83	

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

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9803159
Project:	20805-129.004/TO#20821.00/RAT8/2169 OAKLAND	**Date Collected:**	11/18/98
Sample Matrix:	Air	**Date Received:**	11/18/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	E-1	Units:	mg/m3
Lab Code:	S9803159-002	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	11/18/98	ND	
Toluene	5030	8020	0.4	1	NA	11/18/98	ND	
Ethylbenzene	5030	8020	0.5	1	NA	11/18/98	ND	
Xylenes, Total	5030	8020	0.9	1	NA	11/18/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	12	1	NA	11/18/98	ND	
C6 - C12	5030	8015M	20	1	NA	11/18/98	ND	
TPH as Gasoline*	5030	8015M	20	1	NA	11/18/98	ND	

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

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9803159
Project:	20805-129.004/TO#20821.00/RAT8/2169 OAKLAND	**Date Collected:**	11/18/98
Sample Matrix:	Air	**Date Received:**	11/18/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	E-1	Units:	ppmV
Lab Code:	S9803159-002	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	11/18/98	ND	
Toluene	5030	8020	0.1	1	NA	11/18/98	ND	
Ethylbenzene	5030	8020	0.1	1	NA	11/18/98	ND	
Xylenes, Total	5030	8020	0.2	1	NA	11/18/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	5	1	NA	11/18/98	ND	
C6 - C12	5030	8015M	5	1	NA	11/18/98	ND	
TPH as Gasoline*	5030	8015M	5	1	NA	11/18/98	ND	

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

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9803159
Project:	20805-129.004/TO#20821.00/RAT8/2169 OAKLAND	**Date Collected:**	NA
Sample Matrix:	Air	**Date Received:**	NA

BTEX and Total Volatile Hydrocarbons

Sample Name:	Method Blank	Units:	mg/m3
Lab Code:	S981118-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	11/18/98	ND	
Toluene	5030	8020	0.4	1	NA	11/18/98	ND	
Ethylbenzene	5030	8020	0.5	1	NA	11/18/98	ND	
Xylenes, Total	5030	8020	0.9	1	NA	11/18/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	12	1	NA	11/18/98	ND	
C6 - C12	5030	8015M	20	1	NA	11/18/98	ND	
TPH as Gasoline*	5030	8015M	20	1	NA	11/18/98	ND	

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

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9803159
Project:	20805-129.004/TO#20821.00/RAT8/2169 OAKLAND	**Date Collected:**	NA
Sample Matrix:	Air	**Date Received:**	NA

BTEX and Total Volatile Hydrocarbons

Sample Name:	Method Blank	Units:	ppmV
Lab Code:	S981118-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	11/18/98	ND	
Toluene	5030	8020	0.1	1	NA	11/18/98	ND	
Ethylbenzene	5030	8020	0.1	1	NA	11/18/98	ND	
Xylenes, Total	5030	8020	0.2	1	NA	11/18/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	5	1	NA	11/18/98	ND	
C6 - C12	5030	8015M	5	1	NA	11/18/98	ND	
TPH as Gasoline*	5030	8015M	5	1	NA	11/18/98	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: 20805-129.004/TO#20821.00/RAT8/2169 OAKLAND
Sample Matrix: Air

Service Request: S9803159
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 11/18/98

Duplicate Summary
BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
Lab Code: S9803159-001DUP
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	ND	ND	--	--	
Toluene	5030	8020	0.4	1.4	1.5	1.5	6	
Ethylbenzene	5030	8020	0.5	1.6	1.7	1.7	6	
Xylenes, Total	5030	8020	0.9	3.7	4.0	3.7	8	
Total Volatile Hydrocarbons								
C1 - C5	5030	8015M	12	310	320	320	3	
C6 - C12	5030	8015M	20	340	350	350	3	
TPH as Gasoline*	5030	8015M	20	340	350	350	3	

DUP/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-129.004/TO#20821.00/RAT8/2169 OAKLAND
Sample Matrix: Air

Service Request: S9803159
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 11/18/98

Duplicate Summary
BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
Lab Code: S9803159-001DUP
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	ND	ND	--	--	
Toluene	5030	8020	0.1	0.4	0.4	0.4	<1	
Ethylbenzene	5030	8020	0.1	0.4	0.4	0 4	<1	
Xylenes, Total	5030	8020	0.2	0 9	0.9	0.9	<1	
Total Volatile Hydrocarbons								
C1 - C5	5030	8015M	5	130	130	130	<1	
C6 - C12	5030	8015M	5	83	86	85	4	
TPH as Gasoline*	5030	8015M	5	83	86	85	4	

DUP/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO Products Company	**Service Request:**	S9803159
Project:	20805-129 004/TO#20821.00/RAT8/2169 OAKLAND	**Date Collected:**	NA
LCS Matrix:	Air	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	11/18/98

Laboratory Control Sample Summary
TPH as Gasoline

Sample Name:	Lab Control Sample	Units:	mg/m3
Lab Code:	S981118-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	230	115	60-140	

LCS/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO Products Company	**Service Request:**	S9803159
Project:	20805-129.004/TO#20821.00/RAT8/2169 OAKLAND	**Date Collected:**	NA
LCS Matrix:	Air	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	11/18/98

Laboratory Control Sample Summary
TPH as Gasoline

Sample Name:	Lab Control Sample	Units:	ppmV
Lab Code:	S981118-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	49	56	114	60-140	

LCS/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO Products Company	**Service Request:**	S9803159
Project:	20805-129.004/TO#20821.00/RAT8/2169 OAKLAND	**Date Analyzed:**	11/18/98

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

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

Test Notes:

ICV Source:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Acceptance Limits
Benzene	5030	8020	25	28	112	80-120
Toluene	5030	8020	25	29	116	80-120
Ethylbenzene	5030	8020	25	29	116	80-120
Xylenes, Total	5030	8020	75	86	115	80-120
Gasoline	5030	8015M	250	230	92	80-120

ICV/032196

ARCO Products Company
Division of Atlantic/Richfield Company

59803159 Task Order No. 20821.00

Chain of Custody

ARCO Facility no. 2169	City (Facility) Oakland	Project manager (Consultant) Glen Vanderveen	Laboratory Name CAS
ARCO engineer Paul Supple	Telephone no. (ARCO)	Telephone no. (Consultant)	Fax no. (Consultant)
Consultant name Emcon	Address (Consultant)		Contract Number

Method of shipment: Tech

Special Detection Limit/reporting: PPMV

Special QA/QC

Remarks: 20805 129004

Lab 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 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)	1			AIR			11/18/98	1130		X									
E-1	(2)	1			↓			↓	1115		X									

Condition of sample:

Temperature received:

Relinquished by sampler: Lisa Rubin	Date 11/18/98	Time 1412	Received by: Joseph MacFarlane CAS 11/18/98 1442
Relinquished by	Date	Time	Received by: Due: 12/4/98
Relinquished by	Date	Time	Received by laboratory / Date / Time

Turnaround Time:

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

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

Columbia Analytical Services INC.
An Employee-Owned Company

December 23, 1998 Service Request No.: S9803450

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

RE: 20805-129.005/TO#22312.00/RAT8/2169 OAKLAND

Dear Mr. Vanderveen:

The following pages contain analytical results for sample(s) received by the laboratory on December 8, 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

Greg Anderson
Regional QA Coordinator

RECEIVED
DEC 28 1998
BY:

3334 Victor Court ▪ Santa Clara, CA 95054-2316 ▪ Telephone (408) 748-9700 ▪ Fax (408) 748-9860

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:**	S9803450
Project:	20805-129.005/TO#22312.00/RAT8/2169 OAKLAND	**Date Collected:**	12/8/98
Sample Matrix:	Air	**Date Received:**	12/8/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	I-1	Units:	mg/m3
Lab Code:	S9803450-001	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8020	0.4	1	NA	12/9/98	ND	
Toluene	NONE	8020	0.4	1	NA	12/9/98	1.1	
Ethylbenzene	NONE	8020	0.5	1	NA	12/9/98	ND	
Xylenes, Total	NONE	8020	0.9	1	NA	12/9/98	1.0	
Total Volatile Hydrocarbons:								
C1 - C5	NONE	8020	12	1	NA	12/9/98	14	
C6 - C12	NONE	8020	20	1	NA	12/9/98	50	
TPH as Gasoline*	NONE	8015M	20	1	NA	12/9/98	50	
Methyl tert-Butyl Ether	NONE	8020	3	1	NA	12/9/98	ND	

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

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9803450
Project:	20805-129.005/TO#22312.00/RAT8/2169 OAKLAND	**Date Collected:**	12/8/98
Sample Matrix:	Air	**Date Received:**	12/8/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	I-1	Units:	ppmV
Lab Code:	S9803450-001	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8020	0.1	1	NA	12/9/98	ND	
Toluene	NONE	8020	0.1	1	NA	12/9/98	0.3	
Ethylbenzene	NONE	8020	0.1	1	NA	12/9/98	ND	
Xylenes, Total	NONE	8020	0.2	1	NA	12/9/98	0.2	
Total Volatile Hydrocarbons:								
C1 - C5	NONE	8020	5	1	NA	12/9/98	6	
C6 - C12	NONE	8020	5	1	NA	12/9/98	12	
TPH as Gasoline*	NONE	8015M	5	1	NA	12/9/98	12	
Methyl tert-Butyl Ether	NONE	8020	0.8	1	NA	12/9/98	ND	

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

1522/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9803450
Project:	20805-129.005/TO#22312.00/RAT8/2169 OAKLAND	**Date Collected:**	12/8/98
Sample Matrix:	Air	**Date Received:**	12/8/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	E-1	Units:	mg/m3
Lab Code:	S9803450-002	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8020	0.4	1	NA	12/9/98	ND	
Toluene	NONE	8020	0.4	1	NA	12/9/98	1.1	
Ethylbenzene	NONE	8020	0.5	1	NA	12/9/98	ND	
Xylenes, Total	NONE	8020	0.9	1	NA	12/9/98	0.9	
Total Volatile Hydrocarbons:								
C1 - C5	NONE	8020	12	1	NA	12/9/98	ND	
C6 - C12	NONE	8020	20	1	NA	12/9/98	26	
TPH as Gasoline*	NONE	8015M	20	1	NA	12/9/98	26	
Methyl tert-Butyl Ether	NONE	8020	3	1	NA	12/9/98	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:**	S9803450
Project:	20805-129.005/TO#22312.00/RAT8/2169 OAKLAND	**Date Collected:**	12/8/98
Sample Matrix:	Air	**Date Received:**	12/8/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	E-1	Units:	ppmV
Lab Code:	S9803450-002	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8020	0.1	1	NA	12/9/98	ND	
Toluene	NONE	8020	0.1	1	NA	12/9/98	0.3	
Ethylbenzene	NONE	8020	0.1	1	NA	12/9/98	ND	
Xylenes, Total	NONE	8020	0.2	1	NA	12/9/98	0.2	
Total Volatile Hydrocarbons:								
C1 - C5	NONE	8020	5	1	NA	12/9/98	ND	
C6 - C12	NONE	8020	5	1	NA	12/9/98	6	
TPH as Gasoline*	NONE	8015M	5	1	NA	12/9/98	6	
Methyl tert-Butyl Ether	NONE	8020	0.8	1	NA	12/9/98	ND	

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

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9803450
Project:	20805-129.005/TO#22312.00/RAT8/2169 OAKLAND	**Date Collected:**	NA
Sample Matrix:	Air	**Date Received:**	NA

BTEX and Total Volatile Hydrocarbons

Sample Name:	Method Blank	Units:	mg/m3
Lab Code:	S981209-VB1	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8020	0.4	1	NA	12/9/98	ND	
Toluene	NONE	8020	0.4	1	NA	12/9/98	ND	
Ethylbenzene	NONE	8020	0.5	1	NA	12/9/98	ND	
Xylenes, Total	NONE	8020	0.9	1	NA	12/9/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	NONE	8020	12	1	NA	12/9/98	ND	
C6 - C12	NONE	8020	20	1	NA	12/9/98	ND	
TPH as Gasoline*	NONE	8015M	20	1	NA	12/9/98	ND	
Methyl tert-Butyl Ether	NONE	8020	3	1	NA	12/9/98	ND	

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

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9803450
Project:	20805-129.005/TO#22312.00/RAT8/2169 OAKLAND	**Date Collected:**	NA
Sample Matrix:	Air	**Date Received:**	NA

BTEX and Total Volatile Hydrocarbons

Sample Name:	Method Blank	Units:	ppmV
Lab Code:	S981209-VB1	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Benzene	NONE	8020	0.1	1	NA	12/9/98	ND	
Toluene	NONE	8020	0.1	1	NA	12/9/98	ND	
Ethylbenzene	NONE	8020	0.1	1	NA	12/9/98	ND	
Xylenes, Total	NONE	8020	0.2	1	NA	12/9/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	NONE	8020	5	1	NA	12/9/98	ND	
C6 - C12	NONE	8020	5	1	NA	12/9/98	ND	
TPH as Gasoline*	NONE	8015M	5	1	NA	12/9/98	ND	
Methyl tert-Butyl Ether	NONE	8020	1.4	1	NA	12/9/98	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: 20805-129.005/TO#22312.00/RAT8/2169 OAKLAND
Sample Matrix: Air

Service Request: S9803450
Date Collected: 12/8/98
Date Received: 12/8/98
Date Extracted: NA
Date Analyzed: 12/9/98

Duplicate Summary
BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
Lab Code: S9803450-001DUP
Test Notes:

Units: ppmV
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Benzene	NONE	8020	0.1	ND	ND	--	--	
Toluene	NONE	8020	0.1	0.3	0.3	0.3	<1	
Ethylbenzene	NONE	8020	0.1	ND	ND	--	--	
Xylenes, Total	NONE	8020	0.2	0.2	0.3	0.3	33	
Total Volatile Hydrocarbons								
C1 - C5	NONE	8015M	5	6	5	6	17	
C6 - C12	NONE	8015M	5	12	12	12	<1	
TPH as Gasoline*	NONE	8015M	5	12	12	12	<1	
Methyl tert-Butyl Ether	NONE	8020	0.8	ND	ND	--	--	

DUP/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-129.005/TO#22312.00/RAT8/2169 OAKLAND
Sample Matrix: Air

Service Request: S9803450
Date Collected: 12/8/98
Date Received: 12/8/98
Date Extracted: NA
Date Analyzed: 12/9/98

Duplicate Summary
BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
Lab Code: S9803450-001DUP
Test Notes:

Units: mg/m3
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Benzene	NONE	8020	0.4	ND	ND	--	--	
Toluene	NONE	8020	0.4	1.1	1.1	1.1	<1	
Ethylbenzene	NONE	8020	0.5	ND	ND	--	--	
Xylenes, Total	NONE	8020	0.9	1.0	1.1	1.1	9	
Total Volatile Hydrocarbons								
C1 - C5	NONE	8020	12	14	13	14	7	
C6 - C12	NONE	8020	20	50	51	51	2	
TPH as Gasoline*	NONE	8020	20	50	51	51	2	
Methyl tert-Butyl Ether	NONE	8020	3	ND	ND	--	--	

DUP/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-129.005/TO#22312.00/RAT8/2169 OAKLAND

Service Request: S9803450
Date Analyzed: 12/9/98

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	Result Notes
Benzene	NONE	8020	25	27	108	
Toluene	NONE	8020	25	27	108	
Ethylbenzene	NONE	8020	25	27	108	
Xylenes, Total	NONE	8020	75	81	108	
Gasoline	NONE	8015M	250	210	84	
Methyl tert-Butyl Ether	NONE	8020	25	26	104	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-129.005/TO#22312.00/RAT8/2169 OAKLAND
LCS Matrix: Air

Service Request:
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 12/9/98

Laboratory Control Sample Summary
BTEX and TPH as Gasoline

Sample Name: Lab Control Sample
Lab Code: S981209-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	NONE	8015M	210	180	86	60-140	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-129.005/TO#22312.00/RAT8/2169 OAKLAND
LCS Matrix: Air

Service Request:
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 12/9/98

Laboratory Control Sample Summary
BTEX and TPH as Gasoline

Sample Name: Lab Control Sample
Lab Code: S981209-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	NONE	8015M	49	44	90	60-140	

ARCO Products Company ◆ 5980 3450 **Task Order No.** 22636.00 — **Chain of Custody**

Division of AtlanticRichfieldCompany

ARCO Facility no. 2169	City (Facility) Oakland	Project manager (Consultant) Glen Vanderveen	Laboratory name CAS
ARCO engineer Paul Supple	Telephone no. (ARCO)	Telephone no. (Consultant) 925 551 7534	Fax no. (Consultant)	Contract number
Consultant name Emcon	Address (Consultant) 1921 Ringwood		Method of shipment Tech

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/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			12/8/98	1140		X											
E-1	②	1			AIR			12/8/98	1130		X											

Special detection Limit/reporting: PPMV

Special QA/QC

Remarks: 20505 129 005 RAT 8

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: Glen Vanderveen	Date 12/8/98 Time 505 PM	Received by: P. Blair CAS	Date 12/8/98 Time 1708
Relinquished by	Date Time	Received by: Due: 12/22/98	
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)