September 16, 1998
Project 20805-135.008

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

Re: Quarterly Groundwater Monitoring Report and Remediation System Performance Evaluation Report, First Quarter 1998, for ARCO Service Station No. 6148, located at 5131 Shattuck Avenue, Oakland, California

Dear Mr. Supple:

Pinnacle Environmental Solutions, a division of EMCON (Pinnacle), is submitting the attached report which presents the results of the first quarter 1998 groundwater monitoring program at ARCO Products Company (ARCO) Service Station No. 6148, located at 5131 Shattuck Avenue, Oakland, California (see Figure 1). Operation and performance data for the on-site soil-vapor extraction (SVE), air-sparge (AS), and air-bubbling remediation systems are also presented. The quarterly monitoring program complies with Alameda County Health Care Services Agency (ACHCSA) requirements regarding underground tank investigations.

LIMITATIONS

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

Please call if you have questions.

Sincerely,

Pinnacle

Glen VanderVeen
Project Manager

Valli Voruganti, P.E.
Project Engineer

Attachment: Quarterly Groundwater Monitoring Report, First Quarter 1998

cc: Susan Hugo, ACHCSA

September 16, 1998

ARCO QUARTERLY GROUNDWATER MONITORING REPORT

Station No.: 6148 Address: 5131 Shattuck Avenue, Oakland, California

Pinnacle Project No. 20805-135.008

ARCO Environmental Engineer/Phone No.: Paul Supple /(510) 299-8891

Pinnacle Project Manager/Phone No.: Glen VanderVeen /(925) 977-9020

Primary Agency/Regulatory ID No.: ACHCSA /Susan Hugo

WORK PERFORMED THIS QUARTER (First - 1998):

1. Prepared and submitted quarterly groundwater monitoring report for fourth quarter 1997.
2. Performed quarterly groundwater monitoring and sampling for first quarter 1998.
3. Started and attempted to operate soil-vapor extraction system (SVE).
4. Operated air bubbling system to enhance biodegredation.

WORK PROPOSED FOR NEXT QUARTER (Second - 1998):

1. Prepare and submit quarterly groundwater monitoring report for first quarter 1998.
2. Perform quarterly groundwater monitoring and sampling for second quarter 1998.
3. Restart soil-vapor extraction (SVE) and air-sparge systems if hydrocarbon concentrations in extracte soil vapor warrant.
4. Continue to operate air bubbling system.

QUARTERLY MONITORING:

Current Phase of Project	Quarterly Groundwater Monitoring and Operation and Maintenance of Remediation Systems The SVE system was started on 01/27/98. Due to low influent TPH concentrations, the system did not operate continuously during the first quarter 1998. The air-bubbling system operated during the quarter.
Frequency of Sampling	Annual (1st Quarter): MW-6, MW-7 Semi-Annual (1st/3rd Quarter): MW-4 Quarterly: MW-1, MW-2, MW-3, MW-5
Frequency of Monitoring	Quarterly (groundwater), Monthly (SVE, air-sparge, and air-bubbling)
Is Floating Product (FP) Present On site	☐ Yes ☒ No
Bulk Soil Removed to Date	560 cubic yards of TPH-impacted soil
Bulk Soil Removed This Quarter	None
Water Wells or Surface Waters within 2000 ft., impacted by site	None
Current Remediation Techniques	SVE, Air-Sparge, and Air-Bubbling Systems
Average Depth to Groundwater	12.1 ft.
Groundwater Gradient (Average)	0.012 toward south-southwest

SVE QUARTERLY OPERATION AND PERFORMANCE:

Equipment Inventory:	Therm Tech Model CATVAC-10E, Electric/Catalytic Oxidizer
Operating Mode:	Catalytic Oxidation
BAAQMD Permit #:	25126
TPH Conc. End of Period (lab):	NA (Not Available)
Benzene Conc. End of Period (lab):	NA
Flowrate End of Period:	NA
HC Destroyed This Period:	0.0 pounds
HC Destroyed to Date:	1885.6 pounds
Utility Usage Electric (KWH):	1178 KWH
Operating Hours This Period:	0.0 hours
Percent Operational:	0.0%
Operating Hours to Date:	2697.5 hours
Unit Maintenance:	Routine monthly maintenance
Number of Auto Shut Downs:	0
Destruction Efficiency Permit Requirement:	95% or <1 lb./day TPH and <0.02 lb./day Benzene
Percent TPH Conversion:	NA
Average Stack Temperature:	NA
Average Source Flow:	0.0 scfm
Average Process Flow:	0.0 scfm
Average Source Vacuum:	0 inches of water

ATTACHMENTS:

- Table 1 - Groundwater Monitoring Data, First Quarter 1998
- Table 2 - Historical Groundwater Elevation and Analytical Data, Petroleum Hydrocarbons and Their Constituents
- Table 3 - Soil-Vapor Extraction System Operation and Performance Data
- Table 4 - Soil-Vapor Extraction Well Data
- Table 5 - Air-Sparge and Air-Bubbling Systems Operation and Performance Data
- Figure 1 - Site Location
- Figure 2 - Groundwater Analytical Summary Map
- Figure 3 - Groundwater Elevation Contour Map
- Figure 4 - Soil-Vapor Extraction and Treatment System, Historical System Influent TVHG and Benzene Concentrations
- Figure 5 - Soil-Vapor Extraction and Treatment System, Historical Hydrocarbon Removal Rates
- Appendix A - Sampling and Analysis Procedures
- Appendix B - Certified Analytical Reports and Chain of Custody Documentation
- Appendix C - Field Data Sheets
- Appendix D - SVE System Monitoring Data Log Sheets
- Appendix E - Certified Analytical Reports and Chain of Custody Documentation for Soil-Vapor Extraction System

Table 1
Groundwater Monitoring Data
First Quarter 1998

ARCO Service Station 6148
5131 Shattuck Avenue, Oakland, California

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Groundwater Flow Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240	Oil & Grease SM 5520C	TRPH EPA 418.1	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	mg/L	mg/L	µg/L
MW-1	02-13-98	107.80	13.15	94.65	ND	SSW	0.012	02-13-98	<100^	8.4	<1^	<1^	14	130	--	--	--	--
MW-2	02-13-98	107.28	12.75	94.53	ND	SSW	0.012	02-13-98	220	9.5	3.9	3.7	48	84	--	--	--	--
MW-3	02-13-98	107.61	13.00	94.61	ND	SSW	0.012	02-13-98	<50	1.3	<0.5	<0.5	1	21	--	--	--	--
MW-4	02-13-98	106.71	13.05	93.66	ND	SSW	0.012	02-13-98	<50	1.3	0.7	<0.5	2.3	19	--	--	--	--
MW-5	02-13-98	106.60	12.21	94.39	ND	SSW	0.012	02-13-98	11,200	51	<10^	<10^	<10^	2000	--	--	--	--
MW-6	02-13-98	105.13	10.06	95.07	ND	SSW	0.012	02-13-98	<50	<0.5	<0.5	<0.5	<0.5	8	--	--	--	--
MW-7	02-13-98	107.05	10.80	96.25	ND	SSW	0.012	02-13-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--

ft-MSL: elevation in feet, relative to mean sea level
MWN: ground-water flow direction and gradient apply to the entire monitoring well network
ft/ft: foot per foot
TPHG: total petroleum hydrocarbons as gasoline, California DHS LUFT Method
µg/L: micrograms per liter
EPA: United States Environmental Protection Agency
MTBE: Methyl tert-butyl ether
SM: standard method
mg/L: milligrams per liter
TRPH: total recoverable petroleum hydrocarbons
TPHD: total petroleum hydrocarbons as diesel, California DHS LUFT Method
ND: none detected
SSW: south-southwest
^: The MRL was elevated due to high analyte concentration requiring sample dilution.
--: not analyzed or not applicable

Pinnacle

Table 2
Historical Groundwater Elevation and Analytical Data
Petroleum Hydrocarbons and Their Constituents
1995 - Present**

ARCO Service Station 6148
5131 Shattuck Avenue, Oakland, California

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Flow Groundwater Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240	Oil & Grease SM 5520C	TRPH EPA 418.1	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	mg/L	mg/L	µg/L
MW-1	03-20-95	108.03	15.75	92.28	ND	SW	0.02	03-20-95	830	140	5	41	110	--	--	--	--	--
MW-1	06-06-95	108.03	17.68	90.35	ND	SW	0.016	06-06-95	210	30	<0.5	7.3	16	--	--	--	--	--
MW-1	08-24-95	107.80	17.45	90.35	ND	SW	0.014	08-24-95	Not sampled: well was inaccessible due to construction									
MW-1	11-16-95	107.80	17.64	90.16	ND	SW	0.012	11-16-95	<50	5.6	<0.5	1.4	1.2	55	--	--	--	--
MW-1	02-27-96	107.80	15.21	92.59	ND	SW	0.016	02-27-96	1400	240	88	44	110	200	--	--	--	--
MW-1	05-15-96	107.80	17.53	90.27	ND	SW	0.015	05-15-96	Not sampled: well sampled semi-annually, during the first and third quarter									
MW-1	08-14-96	107.80	17.15	90.65	ND	SW	0.021	08-14-96	98	18	<0.5	1.9	1	45	--	--	--	--
MW-1	11-11-96	107.80	17.78	90.02	ND	SW	0.015	11-11-96	Not sampled: well sampled semi-annually, during the first and third quarter									
MW-1	03-25-97	107.80	17.68	90.12	ND	SSW	0.018	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--
MW-1	05-15-97	107.80	17.91	89.89	ND	SSW	0.014	05-15-97	Not sampled: well sampled semi-annually, during the first and third quarter									
MW-1	10-26-97	107.80	18.85	88.95	ND	SW	0.009	10-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--
MW-1	11-10-97	107.80	18.10	89.70	ND	SSW	0.014	11-10-97	<50	<0.5	<0.5	<0.5	<0.5	4	--	--	--	--
MW-1	02-13-98	107.80	13.15	94.65	ND	SSW	0.012	02-13-98	<100^	8.4	<1^	<1^	14	130	--	--	--	--
MW-2	03-20-95	107.43	15.50	91.93	ND#	SW	0.02	03-20-95	Not sampled: floating product entered well during purging									
MW-2	06-06-95	107.43	17.43	90.00	ND	SW	0.016	06-06-95	1200	60	21	35	140	--	--	--	--	--
MW-2	08-24-95	107.28	17.22	90.06	ND	SW	0.014	08-24-95	Not sampled: well was inaccessible due to construction									
MW-2	11-16-95	107.28	17.36	89.92	ND	SW	0.012	11-16-95	360	45	1.3	7.1	7.5	210	--	--	--	--
MW-2	02-27-96	107.28	14.82	92.46	ND	SW	0.016	02-27-96	8900	1400	980	150	550	940	--	--	--	--
MW-2	05-15-96	107.28	17.40	89.88	ND	SW	0.015	05-15-96	480	82	48	8	48	87	--	--	--	--
MW-2	08-14-96	107.28	17.00	90.28	ND	SW	0.021	08-14-96	130	22	4	2	9	120	--	--	--	--
MW-2	11-11-96	107.28	17.55	89.73	ND	SW	0.015	11-11-96	1200	150	120	21	160	110	--	--	--	--
MW-2	03-25-97	107.28	17.32	89.96	ND	SSW	0.018	03-25-97	670	23	58	13	120	28	--	--	--	--
MW-2	05-15-97	107.28	17.61	89.67	ND	SSW	0.014	05-15-97	<50	<0.5	<0.5	<0.5	<0.5	23	--	--	--	--
MW-2	10-26-97	107.28	18.43	88.85	ND	SW	0.009	10-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--
MW-2	11-10-97	107.28	17.84	89.44	ND	SSW	0.014	11-10-97	<100^	<1^	<1^	<1^	1	74	--	--	--	--
MW-2	02-13-98	107.28	12.75	94.53	ND	SSW	0.012	02-13-98	220	9.5	3.9	3.7	48	84	--	--	--	--

Table 2
Historical Groundwater Elevation and Analytical Data
Petroleum Hydrocarbons and Their Constituents
1995 - Present**

ARCO Service Station 6148
5131 Shattuck Avenue, Oakland, California

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Groundwater Flow Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240	Oil & Grease SM 5520C	TRPH EPA 418.1	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	mg/L	mg/L	µg/L
MW-3	03-20-95	107.77	15 60	92.17	ND	SW	0.02	03-20-95	29000	880	190	760	2000	--	--	--	16	--
MW-3	06-06-95	107.77	17.54	90.23	ND	SW	0.016	06-06-95	22000	450	54	380	1300	--	--	--	7.1	--
MW-3	08-24-95	107.61	17.42	90.19	ND	SW	0.014	08-24-95	Not sampled: well was inaccessible due to construction									
MW-3	11-16-95	107.61	17.58	90.03	ND	SW	0.012	11-16-95	13000	210	<20	320	1000	790	--	--	8.3	--
MW-3	02-27-96	107.61	15.03	92.58	ND	SW	0.016	02-27-96	9700	94	15	290	720	430	--	--	10	--
MW-3	05-15-96	107.61	17.35	90.26	ND	SW	0.015	05-15-96	5600	66	12	37	67	230	--	--	--	--
MW-3	08-14-96	107.61	17.10	90.51	ND	SW	0.021	08-14-96	830	17	<1*	8	7	110	--	--	--	--
MW-3	11-11-96	107.61	17.73	89.88	ND	SW	0.015	11-11-96	500	28	3	12	13	150	--	--	--	--
MW-3	03-25-97	107.61	17.99	89.62	ND	SSW	0.018	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	94	--	--	--	--
MW-3	05-15-97	107 61	17.84	89.77	ND	SSW	0.014	05-15-97	<50	<0.5	<0.5	<0.5	<0.5	65	--	--	--	--
MW-3	10-26-97	107.61	18.50	89.11	ND	SW	0.009	10-26-97	220	4	<1^	<1^	<1^	160	--	--	--	--
MW-3	11-10-97	107.61	18.00	89 61	ND	SSW	0.014	11-10-97	350	8	<2^	3	3	230	--	--	--	--
MW-3	02-13-98	107 61	13.00	94.61	ND	SSW	0.012	02-13-98	<50	1.3	<0.5	<0.5	1	21	--	--	--	--
MW-4	03-20-95	106.58	13.85	92.73	ND	SW	0.02	03-20-95	88	1	<0.5	<0.5	0.7	--	--	--	--	--
MW-4	06-06-95	106.58	15.70	90.88	ND	SW	0.016	06-06-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--
MW-4	08-24-95	106.71	15.86	90.85	ND	SW	0.014	08-24-95	Not sampled: well was inaccessible due to construction									
MW-4	11-16-95	106.71	16.10	90.61	ND	SW	0.012	11-16-95	<50	<0.5	<0.5	<0.5	<0.5	6	--	--	--	--
MW-4	02-27-96	106.71	13.72	92.99	ND	SW	0.016	02-27-96	<50	<0.5	<0.5	<0.5	<0.5	10	--	--	--	--
MW-4	05-15-96	106.71	15.90	90.81	ND	SW	0.015	05-15-96	Not sampled: well sampled semi-annually, during the first and third quarter									
MW-4	08-14-96	106.71	15.68	91.03	ND	SW	0.021	08-14-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--
MW-4	11-11-96	106.71	16.19	90.52	ND	SW	0.015	11-11-96	Not sampled: well sampled semi-annually, during the first and third quarter									
MW-4	03-25-97	106.71	16.10	90.61	ND	SSW	0.018	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--
MW-4	05-15-97	106.71	16.38	90.33	ND	SSW	0.014	05-15-97	Not sampled: well sampled semi-annually, during the first and third quarter									
MW-4	10-26-97	106.71	17.78	88.93	ND	SW	0.009	10-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--
MW-4	11-10-97	106.71	16.43	90.28	ND	SSW	0.014	11-10-97	Not sampled: well sampled semi-annually, during the first and third quarter									
MW-4	02-13-98	106.71	13.05	93.66	ND	SSW	0.012	02-13-98	<50	1.3	0.7	<0.5	2.3	19	--	--	--	--

Table 2
Historical Groundwater Elevation and Analytical Data
Petroleum Hydrocarbons and Their Constituents
1995 - Present**

ARCO Service Station 6148
5131 Shattuck Avenue, Oakland, California

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Groundwater Flow Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240	Oil & Grease SM 5520C	TRPH EPA 418.1	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	mg/L	mg/L	µg/L
MW-5	03-20-95	106.68	14.92	91.76	ND	SW	0.02	03-20-95	21000	6900	450	800	1300	--	--	--	--	--
MW-5	06-06-95	106.68	16.61	90.07	ND	SW	0.016	06-06-95	6500	1700	<20	120	69	--	--	--	--	--
MW-5	08-24-95	106.60	16.47	90.13	ND	SW	0.014	08-24-95	Not sampled: well was inaccessible due to construction									
MW-5	11-16-95	106.60	16.69	89.91	ND	SW	0.012	11-16-95	1800	470	<5	17	5	1000	--	--	--	--
MW-5	02-27-96	106.60	14.35	92.25	ND	SW	0.016	02-27-96	10000	1000	71	690	1000	440	450	--	--	--
MW-5	05-15-96	106.60	16.58	90.02	ND	SW	0.015	05-15-96	3400	350	6	72	20	220	--	--	--	--
MW-5	08-14-96	106.60	17.26	89.34	ND	SW	0.021	08-14-96	2100	130	2.7	47	4.7	220	--	--	--	--
MW-5	11-11-96	106.60	16.62	89.98	ND	SW	0.015	11-11-96	1200	31	1	8	2	130	--	--	--	--
MW-5	03-25-97	106.60	16.38	90.22	ND	SSW	0.018	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	5	--	--	--	--
MW-5	05-15-97	106.60	16.54	90 06	ND	SSW	0.014	05-15-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--
MW-5	10-26-97	106.60	17.60	89.00	ND	SW	0.009	10-26-97	<50	<0.5	<0.5	<0.5	<0.5	7	--	--	--	--
MW-5	11-10-97	106.60	16.78	89.82	ND	SSW	0.014	11-10-97	<50	<0.5	<0.5	<0.5	<0.5	24	--	--	--	--
MW-5	02-13-98	106.60	12.21	94.39	ND	SSW	0.012	02-13-98	11,200	51	<10^	<10^	<10^	2000	--	--	--	--
MW-6	03-20-95	105.16	12.13	93.03	ND	SW	0.02	03-20-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--
MW-6	06-06-95	105.16	13.95	91.21	ND	SW	0.016	06-06-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--
MW-6	08-24-95	105.13	14.07	91.06	ND	SW	0.014	08-24-95	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--
MW-6	11-16-95	105.13	14.34	90.79	ND	SW	0.012	11-16-95	<60	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--
MW-6	02-27-96	105.13	12.00	93.13	ND	SW	0.016	02-27-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--
MW-6	05-15-96	105.13	14.10	91.03	ND	SW	0.015	05-15-96	Not sampled: well sampled annually, during the first quarter									
MW-6	08-14-96	105.13	13.70	91.43	ND	SW	0.021	08-14-96	Not sampled: well sampled annually, during the first quarter									
MW-6	11-11-96	105.13	14.11	91.02	ND	SW	0.015	11-11-96	Not sampled: well sampled annually, during the first quarter									
MW-6	03-25-97	105.13	14.15	90.98	ND	SSW	0.018	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--
MW-6	05-15-97	105.13	14.44	90.69	ND	SSW	0.014	05-15-97	Not sampled: well sampled annually, during the first quarter									
MW-6	10-26-97	105.13	16.02	89.11	ND	SW	0.009	10-26-97	Not sampled: well sampled annually, during the first quarter									
MW-6	11-10-97	105.13	14.52	90.61	ND	SSW	0.014	11-10-97	Not sampled: well sampled annually, during the first quarter									
MW-6	02-13-98	105 13	10.06	95.07	ND	SSW	0.012	02-13-98	<50	<0.5	<0.5	<0.5	<0.5	8	--	--	--	--

Table 2
Historical Groundwater Elevation and Analytical Data
Petroleum Hydrocarbons and Their Constituents
1995 - Present**

ARCO Service Station 6148
5131 Shattuck Avenue, Oakland, California

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Groundwater Flow Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240	Oil & Grease SM 5520C	TRPH EPA 418.1	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	mg/L	mg/L	µg/L
MW-7	03-20-95	107.08	12.32	94.76	ND	SW	0.02	03-20-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--
MW-7	06-06-95	107.08	14.59	92.49	ND	SW	0.016	06-06-95	Not sampled: well sampled semi-annually, during the first and third quarters									
MW-7	08-24-95	107.05	14.64	92.41	ND	SW	0.014	08-24-95	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--
MW-7	11-16-95	107.05	15.30	91.75	ND	SW	0.012	11-16-95	Not sampled: well sampled semi-annually, during the first and third quarters									
MW-7	02-27-96	107.05	12.24	94.81	ND	SW	0.016	02-27-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--
MW-7	05-15-96	107.05	14.65	92.40	ND	SW	0.015	05-15-96	Not sampled: well sampled annually, during the first quarter									
MW-7	08-14-96	107.05	14.35	92.70	ND	SW	0.021	08-14-96	Not sampled: well sampled annually, during the first quarter									
MW-7	11-11-96	107.05	14.92	92.13	ND	SW	0.015	11-11-96	Not sampled: well sampled annually, during the first quarter									
MW-7	03-25-97	107.05	14.80	92.25	ND	SSW	0.018	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--
MW-7	05-15-97	107.05	15.27	91.78	ND	SSW	0.014	05-15-97	Not sampled: well sampled annually, during the first quarter									
MW-7	10-26-97	107.05	16.68	90.37	ND	SW	0.009	10-26-97	Not sampled: well sampled annually, during the first quarter									
MW-7	11-10-97	107.05	15.37	91.68	ND	SSW	0.014	11-10-97	Not sampled: well sampled annually, during the first quarter									
MW-7	02-13-98	107 05	10.80	96.25	ND	SSW	0.012	02-13-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--

Table 2
Historical Groundwater Elevation and Analytical Data
Petroleum Hydrocarbons and Their Constituents
1995 - Present**

ARCO Service Station 6148
5131 Shattuck Avenue, Oakland, California

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Groundwater Flow Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240	Oil & Grease SM 5520C	TRPH EPA 418.1	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	mg/L	mg/L	µg/L

ft-MSL: elevation in feet, relative to mean sea level
MWN: ground-water flow direction and gradient apply to the entire monitoring well network
ft/ft: foot per foot
TPHG: total petroleum hydrocarbons as gasoline, California DHS LUFT Method
µg/L: micrograms per liter
EPA: United States Environmental Protection Agency
MTBE: Methyl tert-butyl ether
SM: standard method
mg/L: milligrams per liter
TRPH: total recoverable petroleum hydrocarbons
TPHD: total petroleum hydrocarbons as diesel, California DHS LUFT Method
ND: none detected
SSW: south-southwest
#: floating product entered the well during purging
- -: not analyzed or not applicable
^: method reporting limit was raised due to: (1) high analyte concentration requiring sample dilution, or (2) matrix interference
**: For previous historical groundwater elevation and analytical data please refer to *Fourth Quarter 1995 Groundwater Monitoring Program Results and Remediation System Performance Evaluation Report, ARCO Service Station 6148, Oakland, California,* (EMCON, March 4, 1996).

Table 3
Soil-Vapor Extraction System
Operation and Performance Data

Facility Number: 6148
Location: 5131 Shattuck Avenue
Oakland, California

Consultant: Pinnacle Environmental Solutions
144-A Mayhew Way
Walnut Creek, CA 94596

Vapor Treatment Unit: ThermTech Model CATVAC-10E electric/ catalytic oxidizer

Start-Up Date: 09-27-95
Operation and Performance Data From: 09-27-95
To: 04-01-98

System was shut down on 10-3-96. Started up 01-27-98

Date Begin:	09-27-96	10-01-95	01-01-96	02-01-96	03-01-96
Date End:	10-01-95	01-01-96	02-01-96	03-01-96	04-01-96
Mode of Oxidation:	Cat-ox	Cat-ox	Cat-ox	Cat-ox	Cat-ox
Days of Operation:	3	11	16	7	11
Days of Downtime:	1	81	15	22	20
Average Vapor Concentrations (1)					
Well Field Influent: ppmv (2) as gasoline	3800	1200	670	230	320
mg/m3 (3) as gasoline	14000	4400	2790	830	1300
ppmv as benzene	81	19	NA (13)	0.6	1.6
mg/m3 as benzene	260	61	NA	2	5.2
System Influent: ppmv as gasoline	1800	600	415	230	320
mg/m3 as gasoline	6700	2200	1730	830	1300
ppmv as benzene	41	11	NA	0.6	1.6
mg/m3 as benzene	130	34	NA	2	5.2
System Effluent: ppmv as gasoline	52	30	3.8*	21	26
mg/m3 as gasoline	190	110	20	76	110
ppmv as benzene	1.1	0.5	NA	<0.1	<0.1
mg/m3 as benzene	3.5	1.5	NA	<0.5	<0.5
Average Well Field Flow Rate (4), scfm (5):	75.0	104.0	124.6	128.2	126.4
Average System Influent Flow Rate (4), scfm:	103.6	132.3	111.9	128.2	126.4
Average Destruction Efficiency (6), percent (7):	97.2	95.0	98.8	90.8	91.5
Average Emission Rates (8), pounds per day (9)					
Gasoline:	1.77	1.31	0.20	0.88	1.25
Benzene:	0.03	0.02	0.00	0.01	0.01
Operating Hours This Period:	74.9	255.3	381.7	157.2	253.0
Operating Hours To Date:	74.9	330.2	711.9	869.1	1122.2
Pounds/ Hour Removal Rate, as gasoline (10):	3.93	1.71	1.30	0.40	0.62
Pounds Removed This Period, as gasoline (11):	294.4	437.3	496.6	62.6	155.6
Pounds Removed To Date, as gasoline:	294.4	731.7	1228.3	1290.9	1446.5
Gallons Removed This Period, as gasoline (12):	47.5	70.5	80.1	10.1	25.1
Gallons Removed To Date, as gasoline:	47.5	118.0	198.1	208.2	233.3

Pinnacle

Table 3
Soil-Vapor Extraction System
Operation and Performance Data

Facility Number: 6148
Location: 5131 Shattuck Avenue
Oakland, California

Consultant: Pinnacle Environmental Solutions
144-A Mayhew Way
Walnut Creek, CA 94596

Vapor Treatment Unit: ThermTech Model CATVAC-10E electric/ catalytic oxidizer

Start-Up Date: 09-27-95
Operation and Performance Data From: 09-27-95
To: 04-01-98

System was shut down on 10-3-96. Started up 01-27-98

Date Begin:		04-01-96	05-01-96	06-01-96	07-01-96	08-01-96
Date End:		05-01-96	06-01-96	07-01-96	08-01-96	09-01-96
Mode of Oxidation:		Cat-ox	Cat-ox	Cat-ox	Cat-ox	Cat-ox
Days of Operation:		22	3	3	20	11
Days of Downtime:		8	28	27	11	20
Average Vapor Concentrations (1)						
Well Field Influent:	ppmv (2) as gasoline	190	160	180	170	170
	mg/m3 (3) as gasoline	760	650	740	690	710
	ppmv as benzene	0.9	0.6	<1	0.4	<1
	mg/m3 as benzene	3	2	<2.5	1.3	<2.5
System Influent:	ppmv as gasoline	190	160	180	170	170
	mg/m3 as gasoline	760	650	740	690	710
	ppmv as benzene	0.9	0.6	<1	0.4	<1
	mg/m3 as benzene	3	2	<2.5	1.3	<2.5
System Effluent:	ppmv as gasoline	10	10	<5	6	9
	mg/m3 as gasoline	41	39	<20	23	38
	ppmv as benzene	<0.2	<0.2	<0.2	<0.2	<0.2
	mg/m3 as benzene	<0.5	<0.5	<0.5	<0.5	<0.5
Average Well Field Flow Rate (4), scfm (5):		100.3	91.8	116.7	125.7	125.4
Average System Influent Flow Rate (4), scfm:		100.3	91.8	116.7	125.7	125.4
Average Destruction Efficiency (6), percent (7):		94.6	94.0	97.3	96.7	94.6
Average Emission Rates (8), pounds per day (9)						
Gasoline:		0.37	0.32	0.21	0.26	0.43
Benzene:		0.00	0.00	0.01	0.01	0.01
Operating Hours This Period:		532.5	72.9	83.7	478.9	255.2
Operating Hours To Date:		1654.6	1727.6	1811.3	2290.1	2545.3
Pounds/ Hour Removal Rate, as gasoline (10):		0.29	0.22	0.32	0.32	0.33
Pounds Removed This Period, as gasoline (11):		151.9	16.3	27.1	155.4	85.0
Pounds Removed To Date, as gasoline:		1598.4	1614.7	1641.8	1797.2	1882.2
Gallons Removed This Period, as gasoline (12):		24.5	2.6	4.4	25.1	13.7
Gallons Removed To Date, as gasoline:		257.8	260.5	264.8	289.9	303.6

Table 3
Soil-Vapor Extraction System
Operation and Performance Data

Facility Number: 6148
Location: 5131 Shattuck Avenue
Oakland, California

Consultant: Pinnacle Environmental Solutions
144-A Mayhew Way
Walnut Creek, CA 94596

Vapor Treatment Unit: ThermTech Model CATVAC-10E electric/ catalytic oxidizer

Start-Up Date: 09-27-95
Operation and Performance Data From: 09-27-95
To: 04-01-98

System was shut down on 10-3-96. Started up 01-27-98

Date Begin:		09-01-96	10-01-96	11-01-96	12-01-96	01-01-97
Date End:		10-01-96	11-01-96	12-01-96	01-01-97	04-01-97
Mode of Oxidation:		Cat-ox	Cat-ox	Cat-ox	Cat-ox	Cat-ox
Days of Operation:		6	0	0	0	0
Days of Downtime:		24	31	30	31	90
Average Vapor Concentrations (1)						
Well Field Influent:	ppmv (2) as gasoline	NA	450	NA	NA	NA
	mg/m3 (3) as gasoline	NA	1900	NA	NA	NA
	ppmv as benzene	NA	<1	NA	NA	NA
	mg/m3 as benzene	NA	<4	NA	NA	NA
System Influent:	ppmv as gasoline	NA	330	NA	NA	NA
	mg/m3 as gasoline	NA	1400	NA	NA	NA
	ppmv as benzene	NA	<1	NA	NA	NA
	mg/m3 as benzene	NA	<4	NA	NA	NA
System Effluent:	ppmv as gasoline	NA	20	NA	NA	NA
	mg/m3 as gasoline	NA	83	NA	NA	NA
	ppmv as benzene	NA	<0.1	NA	NA	NA
	mg/m3 as benzene	NA	<0.4	NA	NA	NA
Average Well Field Flow Rate (4), scfm (5):		125.2	63.7	0.0	91.8	0.0
Average System Influent Flow Rate (4), scfm:		125.2	63.3	0.0	81.9	0.0
Average Destruction Efficiency (6), percent (7):		NA	94.1	NA	NA	NA
Average Emission Rates (8), pounds per day (9)						
Gasoline:		NA	0.47	NA	NA	NA
Benzene:		NA	0.00	NA	NA	NA
Operating Hours This Period:		140.7	7.5	0.0	0.6	0.0
Operating Hours To Date:		2686.0	2693.5	2693.5	2694.1	2694.1
Pounds/ Hour Removal Rate, as gasoline (10):		0.00	0.45	0.00	0.00	0.00
Pounds Removed This Period, as gasoline (11):		0.0	3.4	0.0	0.0	0.0
Pounds Removed To Date, as gasoline:		1882.2	1885.6	1885.6	1885.6	1885.6
Gallons Removed This Period, as gasoline (12):		0.0	0.5	0.0	0.0	0.0
Gallons Removed To Date, as gasoline:		303.6	304.2	304.2	304.2	304.2

Pinnacle

Table 3
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Operation and Performance Data

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Consultant: Pinnacle Environmental Solutions
144-A Mayhew Way
Walnut Creek, CA 94596

Vapor Treatment Unit: ThermTech Model CATVAC-10E electric/ catalytic oxidizer

Start-Up Date: 09-27-95
Operation and Performance Data From: 09-27-95
To: 04-01-98

System was shut down on 10-3-96. Started up 01-27-98

Date Begin:		04-01-97	07-01-97	10-01-97	11-01-97
Date End:		07-01-97	10-01-97	11-01-97	12-01-97
Mode of Oxidation:		Cat-ox	Cat-ox	Cat-ox	Cat-ox
Days of Operation:		0	0	0	0
Days of Downtime:		91	92	31	30
Average Vapor Concentrations (1)					
Well Field Influent:	ppmv (2) as gasoline	NA	NA	680	NA
	mg/m3 (3) as gasoline	NA	NA	2800	NA
	ppmv as benzene	NA	NA	24	NA
	mg/m3 as benzene	NA	NA	78	NA
System Influent:	ppmv as gasoline	NA	NA	680	NA
	mg/m3 as gasoline	NA	NA	2800	NA
	ppmv as benzene	NA	NA	24	NA
	mg/m3 as benzene	NA	NA	78	NA
System Effluent:	ppmv as gasoline	NA	NA	61	NA
	mg/m3 as gasoline	NA	NA	250	NA
	ppmv as benzene	NA	NA	0.2	NA
	mg/m3 as benzene	NA	NA	0.5	NA
Average Well Field Flow Rate (4), scfm (5):		0.0	0.0	0.0	0.0
Average System Influent Flow Rate (4), scfm:		0.0	0.0	0.0	0.0
Average Destruction Efficiency (6), percent (7):		NA	NA	91.1	NA
Average Emission Rates (8), pounds per day (9)					
Gasoline:		NA	NA	0.00	NA
Benzene:		NA	NA	0.00	NA
Operating Hours This Period:		0.0	0.0	1.4	2.1
Operating Hours To Date:		2694.1	2694.1	2695.5	2697.5
Pounds/ Hour Removal Rate, as gasoline (10):		0.00	0.00	0.00	0.00
Pounds Removed This Period, as gasoline (11):		0.0	0.0	0.0	0.0
Pounds Removed To Date, as gasoline:		1885.6	1885.6	1885.6	1885.6
Gallons Removed This Period, as gasoline (12):		0.0	0.0	0.0	0.0
Gallons Removed To Date, as gasoline:		304.2	304.2	304.2	304.2

Table 3
Soil-Vapor Extraction System
Operation and Performance Data

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Oakland, California

Consultant: Pinnacle Environmental Solutions
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Walnut Creek, CA 94596

Vapor Treatment Unit: ThermTech Model CATVAC-10E electric/ catalytic oxidizer

Start-Up Date: 09-27-95
Operation and Performance Data From: 09-27-95
To: 04-01-98

System was shut down on 10-3-96. Started up 01-27-98

Date Begin:		12-01-97	01-01-98	02-01-98	03-01-98
Date End:		01-01-98	02-01-98	03-01-98	04-01-98
Mode of Oxidation:		Cat-ox	Cat-ox	Cat-ox	Cat-ox
Days of Operation:		0	0	0	9
Days of Downtime:		31	31	28	22
Average Vapor Concentrations (1)					
Well Field Influent:	ppmv (2) as gasoline .	NA	39	NA	NA
	mg/m3 (3) as gasoline	NA	160	NA	NA
	ppmv as benzene	NA	<.1	NA	NA
	mg/m3 as benzene	NA	<.4	NA	NA
System Influent:	ppmv as gasoline	NA	39	NA	NA
	mg/m3 as gasoline	NA	160	NA	NA
	ppmv as benzene	NA	<.1	NA	NA
	mg/m3 as benzene	NA	<.4	NA	NA
System Effluent:	ppmv as gasoline	NA	<5	NA	NA
	mg/m3 as gasoline	NA	<20	NA	NA
	ppmv as benzene	NA	<.1	NA	NA
	mg/m3 as benzene	NA	<.4	NA	NA
Average Well Field Flow Rate (4), scfm (5):		0.0	0.0	0.0	0.0
Average System Influent Flow Rate (4), scfm:		0.0	0.0	0.0	0.0
Average Destruction Efficiency (6), percent (7):		NA	87.5	NA	NA
Average Emission Rates (8), pounds per day (9)					
Gasoline:		NA	NA	NA	NA
Benzene:		NA	NA	NA	NA
Operating Hours This Period:		0.0	0.0	0.0	0.0
Operating Hours To Date:		2697.5	2697.5	2697.5	2697.5
Pounds/ Hour Removal Rate, as gasoline (10):		0.00	0.00	0.00	0.00
Pounds Removed This Period, as gasoline (11):		0.0	0.0	0.0	0.0
Pounds Removed To Date, as gasoline:		1885.6	1885.6	1885.6	1885.6
Gallons Removed This Period, as gasoline (12):		0.0	0.0	0.0	0.0
Gallons Removed To Date, as gasoline:		304.2	304.2	304.2	304.2

Table 3
Soil-Vapor Extraction System
Operation and Performance Data

Facility Number: 6148
Location: 5131 Shattuck Avenue
Oakland, California

Consultant: Pinnacle Environmental Solutions
144-A Mayhew Way
Walnut Creek, CA 94596

Vapor Treatment Unit: ThermTech Model CATVAC-10E electric/ catalytic oxidizer

Start-Up Date: 09-27-95
Operation and Performance Data From: 09-27-95
To: 04-01-98

System was shut down on 10-3-96. Started up 01-27-98

CURRENT REPORTING PERIOD:	01-01-98		to 04-01-98	
DAYS / HOURS IN PERIOD:		90	2160.0	
DAYS / HOURS OF OPERATION:		0	0.2	
DAYS / HOURS OF DOWN TIME:		90	2159.9	
PERCENT OPERATIONAL:			0.0	%
PERIOD POUNDS REMOVED:		0.0		
PERIOD GALLONS REMOVED:		0.0		
AVERAGE WELL FIELD FLOW RATE (scfm):			0.0	
AVERAGE SYSTEM INFLUENT FLOW RATE (scfm):			0.0	

1. Average concentrations are based on discrete sample results reported during the month; refer to Appendix B for discrete sample results. For the period of January 1, 1996 to February 1, 1996, laboratory analytical results were unavailable. The average concentrations were based on photoionization det (PID) field readings taken during the month of January 1996.
2. ppmv: parts per million by volume
3. mg/m3: milligrams per cubic meter
4. Average flow rates (time weighted average) are based on instantaneous flow rates recorded during the month; refer to Appendix B for instantaneous flow data.
5. scfm: flow in standard cubic feet per minute at one atmosphere and 70 degrees Fahrenheit
6. Average destruction efficiencies are calculated using monthly average concentrations; refer to Appendix B for instantaneous destruction efficiency data.
7. destruction efficiency, percent = ([system influent concentration (as gasoline in mg/m3) - system effluent concentration (as gasoline in mg/m3)] / system influent concentration (as gasoline in mg/m3)) x 100 percent
8. Average emission rates are calculated using monthly average concentrations and flow rates; refer to Appendix B for instantaneous emission rate data.
9. emission rates (pounds per day) = system effluent concentration (as gasoline or benzene in mg/m3) x system influent flow rate (scfm) x 0.02832 m3/ft3 x 1440 minutes/day x 1 pound/454,000 mg
10. pounds/ hour removal rate (as gasoline) = well field influent concentration (as gasoline in mg/m3) x well field influent flow rate (scfm) x 0.02832 m3/ft3 x 60 minutes/hour x 1 pound/454,000 mg
11. pounds removed this period (as gasoline) = pounds/ hour removal rate x hours of operation
12. gallons removed this period (as gasoline) = pounds removed this period (as gasoline) x 0.1613 gallons/pound of gasoline
13. not available

Table 4
Soil-Vapor Extraction Well Data

ARCO Service Station 6148
5131 Shattuck Avenue, Oakland, California

Date	Well Identification											
	VW-1			VW-2			VW-3			VW-4		
	Valve Position	TVHG ppmv	Vacuum Response in-H2O	Valve Position	TVHG ppmv	Vacuum Response in-H2O	Valve Position	TVHG ppmv	Vacuum Response in-H2O	Valve Position	TVHG ppmv	Vacuum Response in-H2O
For SVE monitoring well data prior to June 1, 1996, please refer to the second quarter 1996 groundwater monitoring report for this site.												
07-10-96	open	361 PID	8.0	open	302 PID	8.0	open	247 PID	8.0	closed	54 PID	0.0
08-05-96	open	NA	8.0	open	NA	7.0	open	NA	6.0	closed	NA	0.0
08-12-96	closed	NA	0.0	closed	NA	0.0	closed	NA	0.0	closed	NA	0.0
09-27-96	open (b)	NA	NA	open (b)	NA	NA	open	NA	NA	closed	NA	NA
09-30-96	open	200 FID	NA	open	220 FID	NA	open	800 FID	NA	open	>1000 FID	NA
10-03-96	open	NA	9.0	open	NA	10.0	open	NA	9.0	open	NA	10.0
12-04-96	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA
01-08-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed	NA	NA
02-04-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed	NA	NA
03-07-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
05-16-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed	NA	NA
07-22-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed	NA	NA
08-04-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed	NA	NA
08-26-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed	NA	NA
09-26-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed	NA	NA
10-17-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed	NA	NA
11-05-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
11-13-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed	NA	NA
12-15-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed	NA	NA
01-27-98	open(b)	NA	NA	open(b)	NA	NA	open(b)	NA	NA	open	NA	NA
02-10-98	open(b)	NA	NA	open(b)	NA	NA	open(b)	NA	NA	open	NA	NA
02-16-98	open(b)	NA	NA	open(b)	NA	NA	open(b)	NA	NA	open	NA	NA
03-23-98	open(b)	NA	NA	open(b)	NA	NA	open(b)	NA	NA	open	NA	NA

TVHG: concentration of total volatile hydrocarbons as gasoline
ppmv: parts per million by volume
in-H2O: inches of water
open: open to the system
open (b): open to the system and bubbling air at 1 scfm per well
passive: open to the atmosphere
closed: closed to the system and atmosphere
NA: not analyzed or not measured
FID: TVHG concentration was measured with a portable flame ionization detector
LAB: TVHG concentration was analyzed in the laboratory

Pinnacle

Table 4
Soil-Vapor Extraction Well Data

ARCO Service Station 6148
5131 Shattuck Avenue, Oakland, California

Date	Well Identification											
	VW-5			VW-6			VW-7			VW-8		
	Valve Position	TVHG ppmv	Vacuum Response in-H2O	Valve Position	TVHG ppmv	Vacuum Response in-H2O	Valve Position	TVHG ppmv	Vacuum Response in-H2O	Valve Position	TVHG ppmv	Vacuum Response in-H2O
For SVE monitoring well data prior to June 1, 1996, please refer to the second quarter 1996 groundwater monitoring report for this site.												
07-10-96	open	233 PID	8.0	open	371 PID	8.0	open	511 PID	8.0	open	113 PID	8.0
08-05-96	open	NA	8.0	open	NA	8.0	open	NA	6.0	open	NA	8.0
08-12-96	closed	NA	0.0	closed	NA	0.0	closed	NA	0.0	closed	NA	0.0
09-27-96	open	NA	NA	open (b)	NA	NA	open (b)	NA	NA	open	NA	NA
09-30-96	closed	48 FID	NA	closed	140 FID	NA	open	480 FID	NA	closed	120 FID	NA
10-03-96	closed	NA	NA	closed	NA	NA	open	NA	8.0	closed (b)	NA	0.0
12-04-96	closed	NA	NA	closed	NA	NA	closed (b)	NA	NA	closed	NA	NA
01-08-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
02-04-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
03-07-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
05-16-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
07-22-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
08-04-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
08-26-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
09-26-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
10-17-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
11-05-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
11-13-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
12-15-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
01-27-98	closed	NA	NA	closed	NA	NA	open	NA	NA	closed	NA	NA
02-10-98	closed	NA	NA	closed	NA	NA	open	NA	NA	closed	NA	NA
02-16-98	closed	NA	NA	closed	NA	NA	open	NA	NA	closed	NA	NA
03-23-98	closed	NA	NA	closed	NA	NA	open	NA	NA	closed	NA	NA

TVHG: concentration of total volatile hydrocarbons as gasoline
ppmv: parts per million by volume
in-H2O: inches of water
open: open to the system
open (b): open to the system and bubbling air at 1 scfm per well
passive: open to the atmosphere
closed: closed to the system and atmosphere
NA: not analyzed or not measured
FID: TVHG concentration was measured with a portable flame ionization detector
LAB: TVHG concentration was analyzed in the laboratory

Pinnacle

Table 4
Soil-Vapor Extraction Well Data

ARCO Service Station 6148
5131 Shattuck Avenue, Oakland, California

Date	Well Identification											
	VW-9			VW-10			MW-1			MW-5		
	Valve Position	TVHG ppmv	Vacuum Response in-H2O	Valve Position	TVHG ppmv	Vacuum Response in-H2O	Valve Position	TVHG ppmv	Vacuum Response in-H2O	Valve Position	TVHG ppmv	Vacuum Response in-H2O
For SVE monitoring well data prior to June 1, 1996, please refer to the second quarter 1996 groundwater monitoring report for this site.												
07-10-96	open	173 PID	8.0	closed	51 PID	0.0	closed	50 PID	0.0	closed	50 PID	0.0
08-05-96	open	NA	6.0	closed	NA	0.0	closed	NA	0.0	closed	NA	0.0
08-12-96	closed	NA	0.0	closed	NA	0.0	closed	NA	0.0	closed	NA	0.0
09-27-96	open (b)	NA	NA	closed	NA	NA	closed (b)	NA	NA	open (b)	NA	NA
09-30-96	open	600 FID	NA	open	>1000 FID	NA	closed	NA	NA	open	250 FID	NA
10-03-96	open	NA	9.0	open	NA	8.0	closed (b)	NA	0.0	open	NA	8.0
12-04-96	closed (b)	NA	NA	closed	NA	NA	closed	NA	NA	closed (b)	NA	NA
01-08-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA
02-04-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA
03-07-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
05-16-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA
07-22-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA
08-04-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA
08-26-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA
09-26-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA
10-17-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA
11-05-97	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
11-13-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA
12-15-97	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA	closed (b)	NA	NA
01-27-98	open(b)	NA	NA	open(b)	NA	NA	closed(b)	NA	NA	open(b)	NA	NA
02-10-98	open(b)	NA	NA	open(b)	NA	NA	closed(b)	NA	NA	open(b)	NA	NA
02-16-98	open(b)	NA	NA	open(b)	NA	NA	closed(b)	NA	NA	open(b)	NA	NA
03-23-98	open(b)	NA	NA	open(b)	NA	NA	closed(b)	NA	NA	open(b)	NA	NA

TVHG: concentration of total volatile hydrocarbons as gasoline
ppmv: parts per million by volume
in-H2O: inches of water
open: open to the system
open (b): open to the system and bubbling air at 1-2 scfm per well
passive: open to the atmosphere
closed: closed to the system and atmosphere
NA: not analyzed or not measured
FID: TVHG concentration was measured with a portable flame ionization detector
LAB: TVHG concentration was analyzed in the laboratory
PID: TVHG concentration was measured with a portable photoionization detector

Pinnacle

Table 5
Air-Sparge and Air-Bubbling Systems
Operation and Performance Data

Facility Number: 6148
Location: 5131 Shattuck Avenue
Oakland, California

Air-Sparge and Air-Bubbling Unit:
5 Hp Powerex Rotary Oilless Compressor

Consultant: EMCON
1921 Ringwood Avenue
San Jose, California

Air-Bubbling Start-Up Date: 03-19-96
Air-Sparge Start-Up Date: 06-07-96
Operation and Performance Data From: 03-19-96
To: 03-23-98

Date Begin:	03-19-96	03-19-96	04-02-96	05-08-96	05-16-96	06-07-96
Date End:		04-02-96	05-08-96	05-16-96	06-07-96	06-28-96
Air-Bubbling Well Status:						
	See Table 6 for the status of the 12 SVE/air-bubbling wells. Air is bubbled at an average flow rate of 1 scfm per well.					
MW-2	off	on	on	off	on	on
MW-3	off	on	on	off	on	on
MW-4	off	off	off	off	off	on
Air-Sparge Well Status:						
AS-1	off	off	off	off	off	on
AS-2	off	off	off	off	off	on
AS-3	off	off	off	off	off	on
AS-4	off	off	off	off	off	on
AS-5	off	off	off	off	off	on
Air-Bubbling Well Pressure (psig) (1):						
MW-1	--(4)	--	--	--	--	--
MW-2	--	2.5	2.5	--	2.5	--
MW-3	--	3.0	3.0	--	3.0	--
MW-4	--	--	--	--	--	--
MW-5	--	--	--	--	--	--
Air-Sparge Well Pressure (psig) (1):						
AS-1	--	--	--	--	--	--
AS-2	--	--	--	--	--	--
AS-3	--	--	--	--	--	--
AS-4	--	--	--	--	--	--
AS-5	--	--	--	--	--	--
Total Air-Sparge and Air-Bubbling Pressure (psig) (1):	--	20.0	20.0	0.0	20.0	20.0
Total Air-Sparge and Air-Bubbling Flow Rate (scfm) (2):	--	--	--	--	--	--
Dissolved Oxygen (ppm) (3):						
Air-Bubbling Wells:						
MW-1	--	--	--	--	--	--
MW-2	--	--	--	--	--	--
MW-3	--	--	--	--	--	--
MW-4	--	--	--	--	--	--
MW-5	--	--	--	--	--	--

Table 5
Air-Sparge and Air-Bubbling Systems
Operation and Performance Data

Facility Number: 6148
Location: 5131 Shattuck Avenue
Oakland, California

Air-Sparge and Air-Bubbling Unit:
5 Hp Powerex Rotary Oilless Compressor

Consultant: EMCON
1921 Ringwood Avenue
San Jose, California

Air-Bubbling Start-Up Date: 03-19-96
Air-Sparge Start-Up Date: 06-07-96
Operation and Performance Data From: 03-19-96
To: 03-23-98

Date Begin:	06-28-96	07-10-96	08-12-96	09-27-96	10-01-96	10-03-96
Date End:	07-10-96	08-12-96	09-27-96	10-01-96	10-03-96	10-07-96
Air-Bubbling Well Status:	See Table 6 for the status of the 12 SVE/air-bubbling wells. Air is bubbled at an average flow rate of 1 scfm per well.					
MW-2	on	on	off	on	on	on
MW-3	on	on	off	on	on	on
MW-4	on	on	off	on	on	on
Air-Sparge Well Status:						
AS-1	on	on	off	off	on	off
AS-2	on	on	off	off	on	off
AS-3	on	on	off	off	on	off
AS-4	on	on	off	off	on	off
AS-5	on	on	off	off	on	off
Air-Bubbling Well Pressure (psig) (1):						
MW-1	--	--	--	--	--	0.0
MW-2	4.0	5.0	0.0	2.6	2.0	0.0
MW-3	4.0	5.5	0.0	2.5	2.5	0.0
MW-4	4.0	5.5	0.0	4.1	3.5	0.0
MW-5	--	--	--	--	--	3.0
Air-Sparge Well Pressure (psig):						
AS-1	4.0	5.0	0.0	0.0	8.0	0.0
AS-2	3.0	5.5	0.0	0.0	4.0	0.0
AS-3	4.0	4.0	0.0	0.0	7.0	0.0
AS-4	3.0	4.5	0.0	0.0	4.0	0.0
AS-5	3.5	5.0	0.0	0.0	12.0	0.0
Total Air-Sparge and Air-Bubbling Pressure (psig):	20.0	30.0	0.0	40.0	32.0	50.0
Total Air-Sparge and Air-Bubbling Flow Rate (scfm) (2):	--	--	--	--	--	--
Dissolved Oxygen (ppm) (3):						
Air-Bubbling Wells:						
MW-1	--	--	--	--	--	--
MW-2	--	--	--	--	--	--
MW-3	--	--	--	--	--	--
MW-4	--	--	--	--	--	--
MW-5	--	--	--	--	--	--

Table 5
Air-Sparge and Air-Bubbling Systems
Operation and Performance Data

Facility Number: 6148
Location: 5131 Shattuck Avenue
Oakland, California

Air-Sparge and Air-Bubbling Unit:
5 Hp Powerex Rotary Oilless Compressor

Consultant: EMCON
1921 Ringwood Avenue
San Jose, California

Air-Bubbling Start-Up Date: 03-19-96
Air-Sparge Start-Up Date: 06-07-96
Operation and Performance Data From: 03-19-96
To: 03-23-98

Date Begin:	10-07-96	11-06-96	12-04-96	01-08-97	02-04-97	03-07-97
Date End:	11-06-96	12-04-96	01-08-97	02-04-97	03-07-97	04-01-97
Air-Bubbling Well Status:	See Table 6 for the status of the 12 SVE/air-bubbling wells. Air is bubbled at an average flow rate of 1 scfm per well.					
MW-2	on	on	on	on	on	on
MW-3	off	off	off	off	off	off
MW-4	off	off	off	off	off	off
Air-Sparge Well Status:						
AS-1	off	off	off	off	off	off
AS-2	off	off	off	off	off	off
AS-3	off	off	off	off	off	off
AS-4	off	off	off	off	off	off
AS-5	off	off	off	off	off	off
Air-Bubbling Well Pressure (psig) (1):						
MW-1	3.5	3.5	--	--	--	--
MW-2	3.0	3.0	--	3.5	3.5	--
MW-3	0.0	0.0	0.0	0.0	0.0	0.0
MW-4	0.0	0.0	0.0	0.0	0.0	0.0
MW-5	3.0	3.5	--	--	--	--
Air-Sparge Well Pressure (psig):						
AS-1	0.0	0.0	0.0	0.0	0.0	0.0
AS-2	0.0	0.0	0.0	0.0	0.0	0.0
AS-3	0.0	0.0	0.0	0.0	0.0	0.0
AS-4	0.0	0.0	0.0	0.0	0.0	0.0
AS-5	0.0	0.0	0.0	0.0	0.0	0.0
Total Air-Sparge and Air-Bubbling Pressure (psig):	50.0	0.0	60.0	--	--	--
Total Air-Sparge and Air-Bubbling Flow Rate (scfm) (2):	--	--	--	--	--	--
Dissolved Oxygen (ppm) (3):						
Air-Bubbling Wells:						
MW-1	--	--	--	--	--	--
MW-2	--	--	--	--	--	0.5
MW-3	--	--	--	--	--	0.5
MW-4	--	--	--	--	--	0.5
MW-5	--	--	--	--	--	--

Table 5
Air-Sparge and Air-Bubbling Systems
Operation and Performance Data

Facility Number: 6148
Location: 5131 Shattuck Avenue
Oakland, California

Air-Sparge and Air-Bubbling Unit:
5 Hp Powerex Rotary Oilless Compressor

Consultant: EMCON
1921 Ringwood Avenue
San Jose, California

Air-Bubbling Start-Up Date: 03-19-96
Air-Sparge Start-Up Date: 06-07-96
Operation and Performance Data From: 03-19-96
To: 03-23-98

Date Begin:	04-01-97	05-01-97	06-01-97	07-01-97	07-22-97	08-04-97
Date End:	05-01-97	06-01-97	07-01-97	07-22-97	08-04-97	08-26-97
Air-Bubbling Well Status:	See Table 6 for the status of the 12 SVE/air-bubbling wells. Air is bubbled at an average flow rate of 1 scfm per well.					
MW-2	off	on	on	on	on	on
MW-3	off	on	on	on	on	on
MW-4	off	on	on	on	on	on
Air-Sparge Well Status:						
AS-1	off	off	off	off	off	off
AS-2	off	off	off	off	off	off
AS-3	off	off	off	off	off	off
AS-4	off	off	off	off	off	off
AS-5	off	off	off	off	off	off
Air-Bubbling Well Pressure (psig) (1):						
MW-1	0.0	--	--	--	--	--
MW-2	0.0	--	--	--	--	--
MW-3	0.0	0.0	0.0	0.0	0.0	0.0
MW-4	0.0	0.0	0.0	0.0	0.0	0.0
MW-5	0.0	--	--	--	--	--
Air-Sparge Well Pressure (psig):						
AS-1	0.0	0.0	0.0	0.0	0.0	0.0
AS-2	0.0	0.0	0.0	0.0	0.0	0.0
AS-3	0.0	0.0	0.0	0.0	0.0	0.0
AS-4	0.0	0.0	0.0	0.0	0.0	0.0
AS-5	0.0	0.0	0.0	0.0	0.0	0.0
Total Air-Sparge and Air-Bubbling Pressure (psig):	0.0	20.0	--	10.0	10.0	10.0
Total Air-Sparge and Air-Bubbling Flow Rate (scfm) (2):	0.0	16.0	--	--	--	16.0
Dissolved Oxygen (ppm) (3):						
Air-Bubbling Wells:						
MW-1	--	--	--	--	--	--
MW-2	--	0.5	--	--	--	--
MW-3	--	0.5	--	--	--	--
MW-4	--	--	--	--	--	--
MW-5	--	1.5	--	--	--	--

Table 5
Air-Sparge and Air-Bubbling Systems
Operation and Performance Data

Facility Number: 6148
Location: 5131 Shattuck Avenue
Oakland, California

Air-Sparge and Air-Bubbling Unit:
5 Hp Powerex Rotary Oilless Compressor

Consultant: EMCON
1921 Ringwood Avenue
San Jose, California

Air-Bubbling Start-Up Date: 03-19-96
Air-Sparge Start-Up Date: 06-07-96
Operation and Performance Data From: 03-19-96
To: 03-23-98

Date Begin:	08-26-97	09-26-97	10-17-97	11-05-97	11-13-97
Date End:	09-26-97	10-17-97	11-05-97	11-13-97	12-15-97
Air-Bubbling Well Status:	See Table 6 for the status of the 12 SVE/air-bubbling wells. Air is bubbled at an average flow rate of 1 scfm per well.				
MW-2	on	on	on	on	on
MW-3	on	off	off	off	off
MW-4	on	off	off	off	off
Air-Sparge Well Status:					
AS-1	off	off	off	off	off
AS-2	off	off	off	off	off
AS-3	off	off	off	off	off
AS-4	off	off	off	off	off
AS-5	off	off	off	off	off
Air-Bubbling Well Pressure (psig) (1):					
MW-1	--	--	2.5	--	--
MW-2	--	--	2.0	--	--
MW-3	0.0	0.0	0.0	0.0	0.0
MW-4	0.0	0.0	0.0	0.0	0.0
MW-5	--	--	5.5	--	--
Air-Sparge Well Pressure (psig):					
AS-1	0.0	0.0	0.0	0.0	0.0
AS-2	0.0	0.0	0.0	0.0	0.0
AS-3	0.0	0.0	0.0	0.0	0.0
AS-4	0.0	0.0	0.0	0.0	0.0
AS-5	0.0	0.0	0.0	0.0	0.0
Total Air-Sparge and Air-Bubbling Pressure (psig):	10.0	10.0	10.0	10.0	10.0
Total Air-Sparge and Air-Bubbling Flow Rate (scfm) (2):	16.0	16.0	16.0	16.0	16.0
Dissolved Oxygen (ppm) (3):					
Air-Bubbling Wells:					
MW-1	--	--	--	--	--
MW-2	--	--	--	--	--
MW-3	--	--	--	--	--
MW-4	--	--	--	--	--
MW-5	--	--	--	--	--

Table 5
Air-Sparge and Air-Bubbling Systems
Operation and Performance Data

Facility Number: 6148
Location: 5131 Shattuck Avenue
Oakland, California

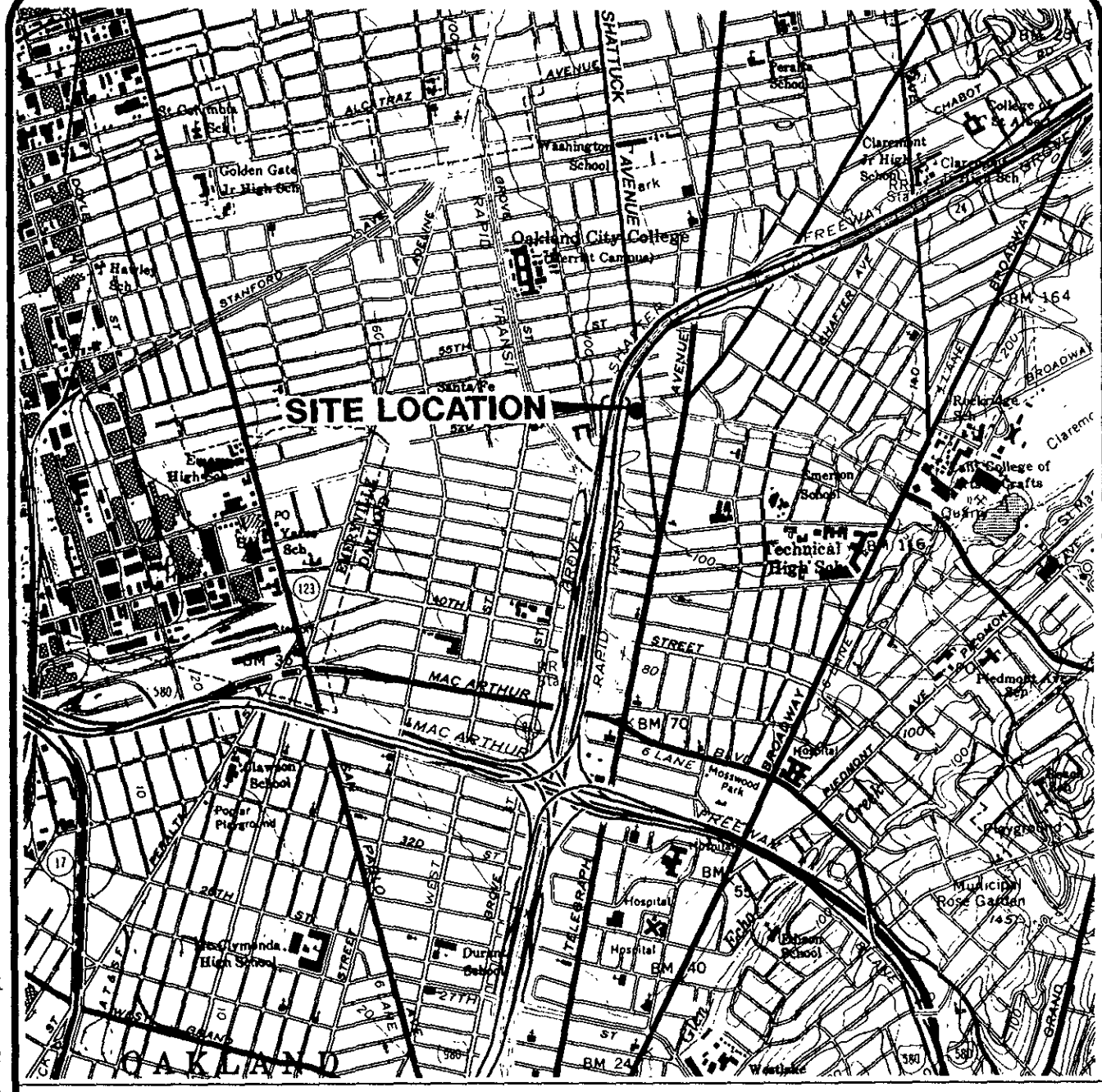
Air-Sparge and Air-Bubbling Unit:
5 Hp Powerex Rotary Oilless Compressor

Consultant: EMCON
1921 Ringwood Avenue
San Jose, California

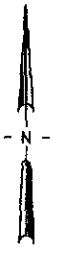
Air-Bubbling Start-Up Date: 03-19-96
Air-Sparge Start-Up Date: 06-07-96
Operation and Performance Data From: 03-19-96
To: 03-23-98

Date Begin:	12-15-97	01-27-98	02-10-98	02-16-98
Date End:	01-27-98	02-10-98	02-16-98	03-23-98
Air-Bubbling Well Status:	See Table 6 for the status of the 12 SVE/air-bubbling wells. Air is bubbled at an average flow rate of 2 scfm per well.			
MW-2	on	on	off	on
MW-3	off	off	off	off
MW-4	off	off	off	off
Air-Sparge Well Status:				
AS-1	off	off	off	off
AS-2	off	off	off	off
AS-3	off	off	off	off
AS-4	off	off	off	off
AS-5	off	off	off	off
Air-Bubbling Well Pressure (psig) (1):				
MW-1	--	2.0	0.0	0.0
MW-2	--	2.0	0.0	2.0
MW-3	0.0	0.0	0.0	0.0
MW-4	0.0	0.0	0.0	0.0
MW-5	--	2.0	0.0	2.0
Air-Sparge Well Pressure (psig):				
AS-1	0.0	0.0	0.0	0.0
AS-2	0.0	0.0	0.0	0.0
AS-3	0.0	0.0	0.0	0.0
AS-4	0.0	0.0	0.0	0.0
AS-5	0.0	0.0	0.0	0.0
Total Air-Sparge and Air-Bubbling Pressure (psig):	10.0	10.0	10.0	8.0
Total Air-Sparge and Air-Bubbling Flow Rate (scfm) (2):	16.0	16.0		
Dissolved Oxygen (ppm) (3):				
Air-Bubbling Wells:				
MW-1	--	--		
MW-2	--	--		
MW-3	--	--		
MW-4	--	--		
MW-5	--	--		

CURRENT REPORTING PERIOD:	01-01-98	to	03-23-98
DAYS / HOURS IN PERIOD:	81.0	1944	



Base map from USGS 7.5' Quad. Maps:
Oakland East and Oakland West, California.
Photorevised 1980.



0 2000 4000

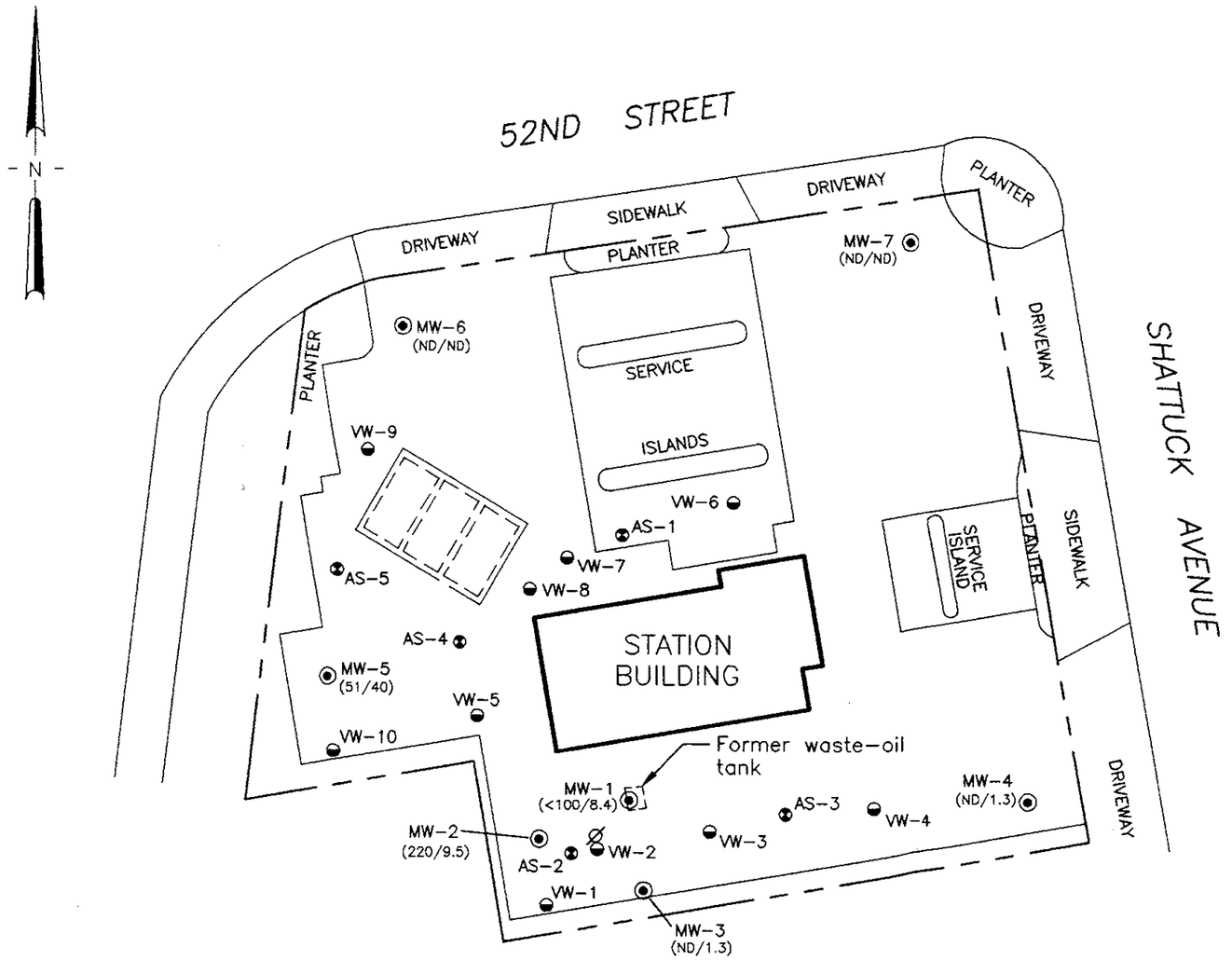
SCALE IN FEET

emcon

DATE	NOV. 1997
DWN	KAJ
APP	
REV	
PROJECT NO.	805-135.007

FIGURE 1
ARCO PRODUCTS COMPANY
SERVICE STATION 6148, 5131 SHATTUCK AVE.
OAKLAND, CALIFORNIA
QUARTERLY GROUNDWATER MONITORING
SITE LOCATION

EA-SANJOSE-CAD/DRAWINGS: I:\OZ002\SITELOC.dwg Xrefs: <NONE>
Scale: 1 = 1.00 DimScale: 1 = 1.00 Date: 3/12/97 Time: 5:19 PM Operator: KAJ



EXPLANATION

⊙	Groundwater monitoring well
◒	Vapor extraction well
⊗	Air-sparge well
⌀	Decommissioned well
⌐¬ ⌊⌋	Existing underground gasoline storage tanks
(220/9.5)	Concentration of total petroleum hydrocarbons, as gasoline (TPHG) and benzene in groundwater (ug/L); water samples were collected on 2/13/98
ND	Not detected at or above the method reporting limit for TPHG (50 ug/L) or benzene (0.5 ug/L)
<	Method reporting limit raised due to high analyte concentration requiring sample dilution or matrix interference

0 30 60

SCALE IN FEET

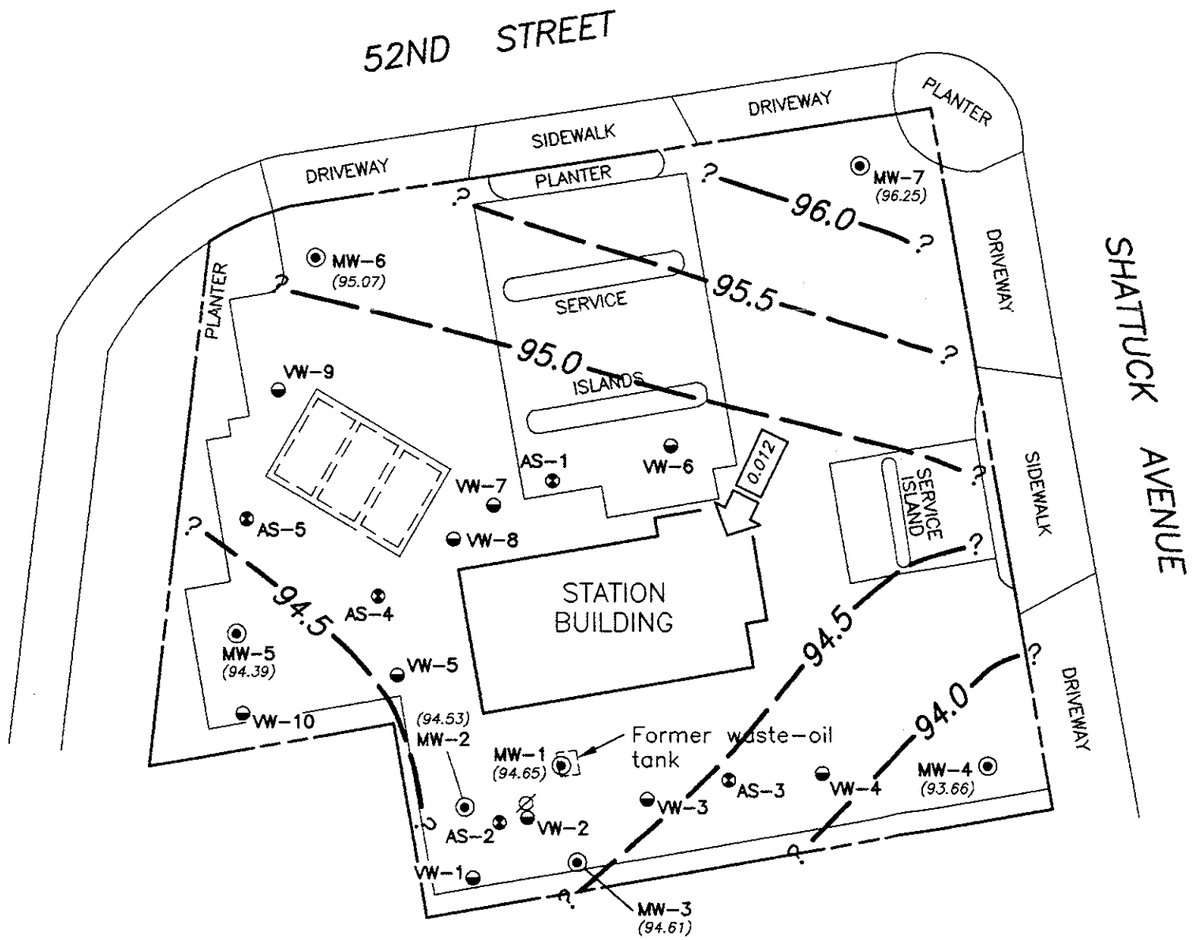
Pinnacle

ENVIRONMENTAL SOLUTIONS
A DIVISION OF EMCON

DATE MAY 1998
DWN KAJ
APP
REV
PROJECT NO.
805-135.007

FIGURE 2
ARCO PRODUCTS COMPANY
SERVICE STATION 6148, 5131 SHATTUCK AVE.
OAKLAND, CALIFORNIA
GROUNDWATER ANALYTICAL SUMMARY
1ST QUARTER 1998

SANJOSE/CAD: N:\805135\SJSITE.dwg Xrefs: <NONE>
Scale: 1 = 30.00 DimScale: 1 = 30.00 Date: 8/10/98 Time: 3:13 PM Operator: KBlack
1" 1/2" 0" 1"



EXPLANATION

- Groundwater monitoring well
- Vapor extraction well
- Air–sparge well
- Decommissioned well
- Existing underground gasoline storage tank
- (96.25) Groundwater elevation (Ft.–MSL) measured 2/13/98
- Groundwater elevation contour (Ft.–MSL)
- Approximate direction of groundwater flow showing gradient

0 30 60

APPROXIMATE SCALE IN FEET

Pinnacle

ENVIRONMENTAL SOLUTIONS
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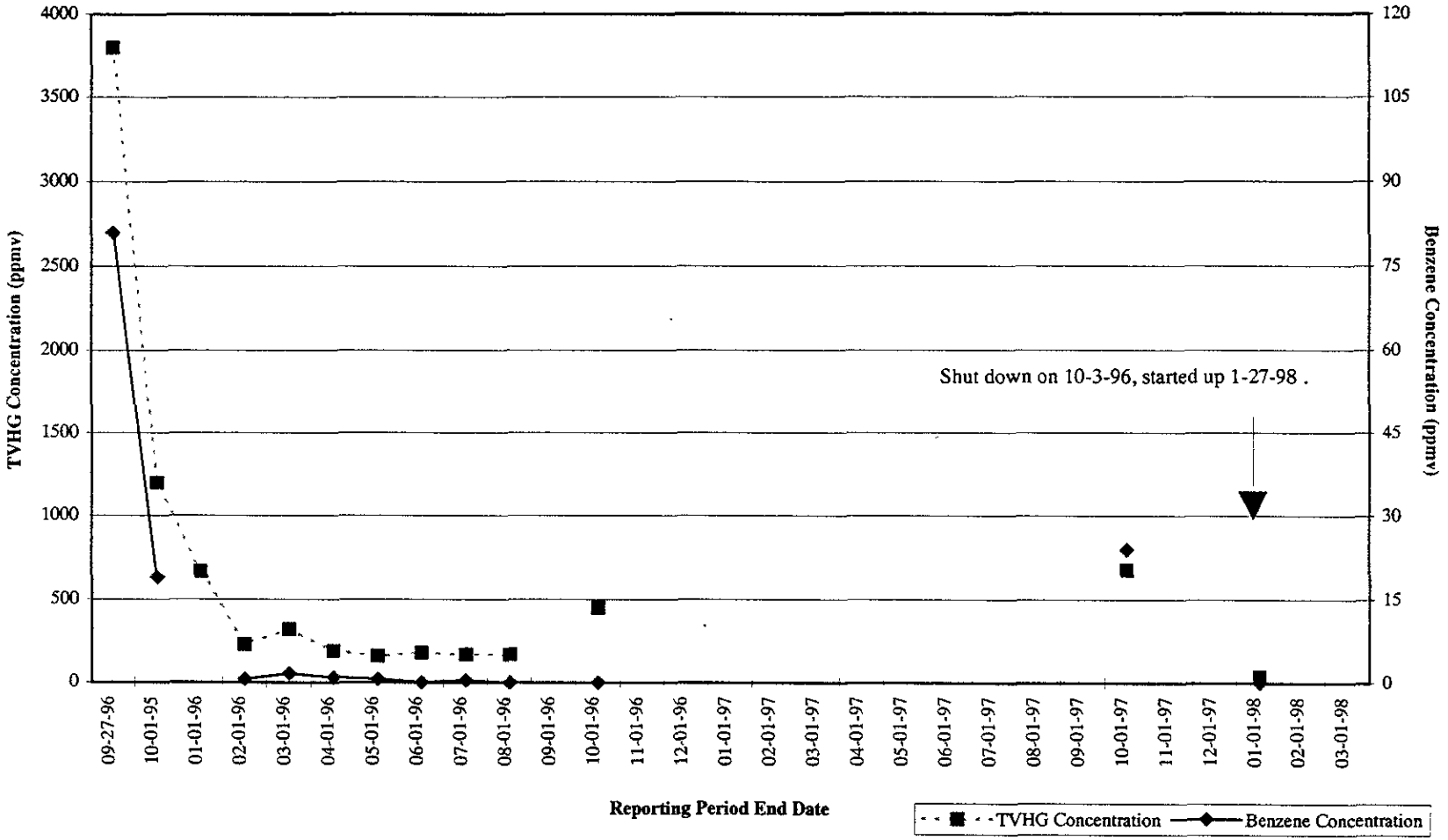
DATE MAY 1998
DWN KAJ
APP
REV
PROJECT NO.
805-135.007

FIGURE 3
ARCO PRODUCTS COMPANY
SERVICE STATION 6148, 5131 SHATTUCK AVE.
OAKLAND, CALIFORNIA
GROUNDWATER ELEVATION CONTOURS
1ST QUARTER 1998

SANJOSE/CADS: N:\805135\SJGWELEV.dwg Xrefs: <NONE>
Scale: 1 = 30.00 DimScale: 1 = 30.00 Date: 8/10/98 Time: 3:13 PM Operator: KBlack
1" 1/2" 0" 1"

Figure 4

ARCO Service Station 6148
Soil-Vapor Extraction and Treatment System
Historical Well Field Influent TVHG and Benzene Concentrations

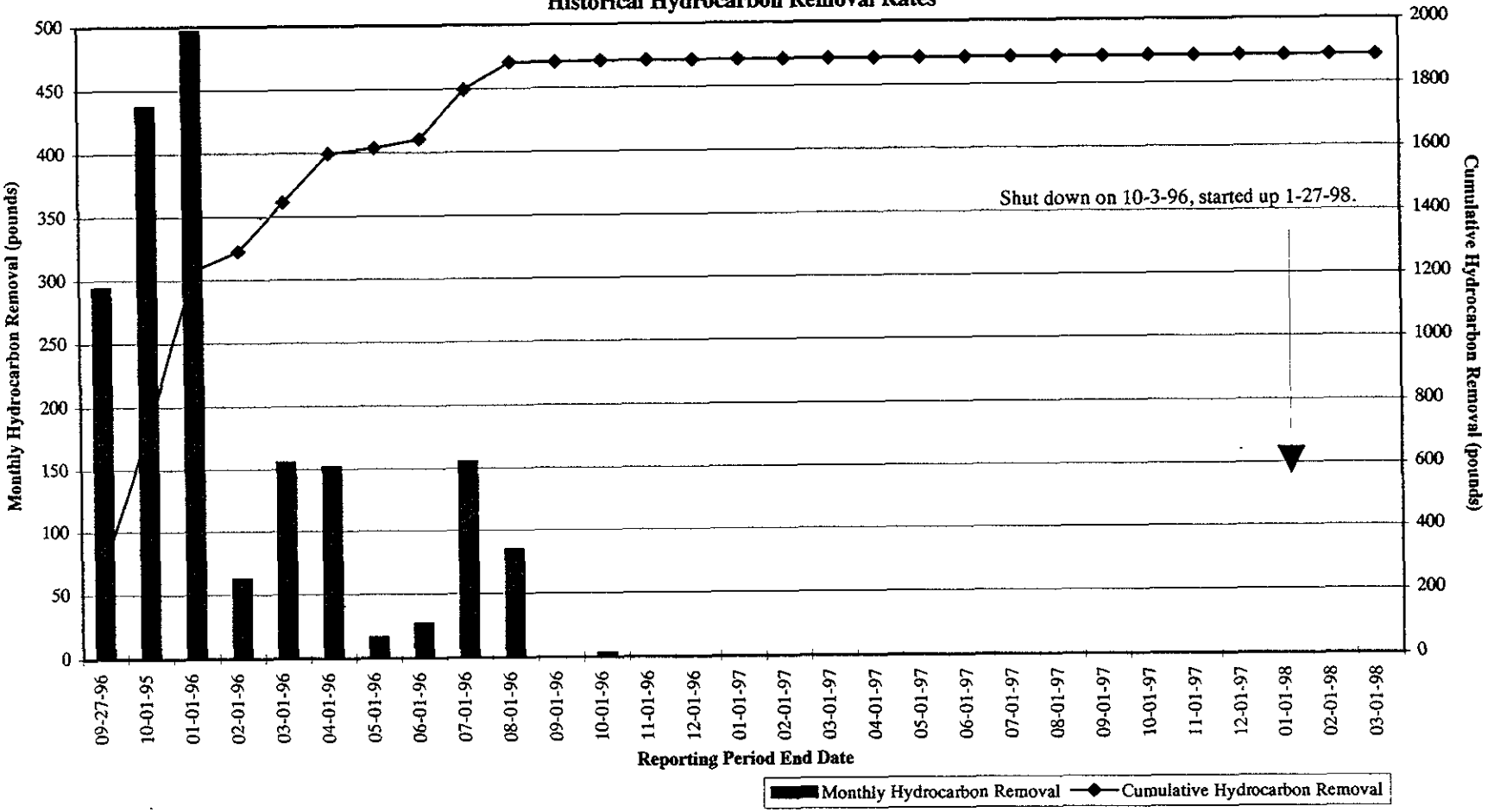


TVHG: total volatile hydrocarbons as gasoline
ppmv: parts per million by volume

esj/j:\qtr_rpts\6148\6148tdb.xls\SVE Model:imi
20805-135.007

Figure 5

ARCO Service Station 6148
Soil-Vapor Extraction and Treatment System
Historical Hydrocarbon Removal Rates



esj/j:\qtr_rpts\6148\6148tdb.xls\SVE Model:imi
20805-135.007

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:

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

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 REPORT AND CHAIN-OF-CUSTODY DOCUMENTATION

Columbia Analytical Services, Inc.

February 27, 1998 Service Request No.: S9800307

Gary Messerotes
EMCON
1921 Ringwood Avenue
San Jose, CA 95131

RE: 20805-135.007/TO#21133.00/6148 OAKLAND

Dear Mr. Messerotes:

The following pages contain analytical results for sample(s) received by the laboratory on February 13, 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 15, 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:**	S9800307
Project:	20805-135.007/TO#21133.00/6148 OAKLAND	**Date Collected:**	2/13/98
Sample Matrix:	Water	**Date Received:**	2/13/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-7(26)	Units:	ug/L (ppb)
Lab Code:	S9800307-001	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	2/15/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	2/15/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	2/15/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	2/15/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	2/15/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	2/15/98	ND	

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9800307
Project:	20805-135.007/TO#21133.00/6148 OAKLAND	**Date Collected:**	2/13/98
Sample Matrix:	Water	**Date Received:**	2/13/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-6(26)	Units:	ug/L (ppb)
Lab Code:	S9800307-002	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	2/15/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	2/15/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	2/15/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	2/15/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	2/15/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	2/15/98	8	

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9800307
Project:	20805-135.007/TO#21133.00/6148 OAKLAND	**Date Collected:**	2/13/98
Sample Matrix:	Water	**Date Received:**	2/13/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-4(14)	Units:	ug/L (ppb)
Lab Code:	S9800307-003	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	2/15/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	2/15/98	1.3	
Toluene	EPA 5030	8020	0.5	1	NA	2/15/98	0.7	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	2/15/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	2/15/98	2.3	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	2/15/98	19	

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9800307
Project:	20805-135.007/TO#21133.00/6148 OAKLAND	**Date Collected:**	2/13/98
Sample Matrix:	Water	**Date Received:**	2/13/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-1(14)	Units:	ug/L (ppb)
Lab Code:	S9800307-004	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	2	NA	2/18/98	<100	C1
Benzene	EPA 5030	8020	0.5	2	NA	2/18/98	8.4	
Toluene	EPA 5030	8020	0.5	2	NA	2/18/98	<1	C1
Ethylbenzene	EPA 5030	8020	0.5	2	NA	2/18/98	<1	C1
Xylenes, Total	EPA 5030	8020	0.5	2	NA	2/18/98	14	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	2	NA	2/18/98	130	

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

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9800307
Project:	20805-135.007/TO#21133.00/6148 OAKLAND	**Date Collected:**	2/13/98
Sample Matrix:	Water	**Date Received:**	2/13/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-3(14)	Units:	ug/L (ppb)
Lab Code:	S9800307-005	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	2/15/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	2/15/98	1.3	
Toluene	EPA 5030	8020	0.5	1	NA	2/15/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	2/15/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	2/15/98	1.0	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	2/15/98	21	

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9800307
Project:	20805-135.007/TO#21133.00/6148 OAKLAND	**Date Collected:**	2/13/98
Sample Matrix:	Water	**Date Received:**	2/13/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-2(14)	Units:	ug/L (ppb)
Lab Code:	S9800307-006	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	2/15/98	220	
Benzene	EPA 5030	8020	0.5	1	NA	2/15/98	9.5	
Toluene	EPA 5030	8020	0.5	1	NA	2/15/98	3.9	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	2/15/98	3.7	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	2/15/98	48	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	2/15/98	84	

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9800307
Project:	20805-135.007/TO#21133.00/6148 OAKLAND	**Date Collected:**	2/13/98
Sample Matrix:	Water	**Date Received:**	2/13/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-5(14)	Units:	ug/L (ppb)
Lab Code:	S9800307-007	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	2/18/98	1200	
Benzene	EPA 5030	8020	0.5	20	NA	2/18/98	51	
Toluene	EPA 5030	8020	0.5	20	NA	2/18/98	<10	C1
Ethylbenzene	EPA 5030	8020	0.5	20	NA	2/18/98	<10	C1
Xylenes, Total	EPA 5030	8020	0.5	20	NA	2/18/98	<10	C1
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	20	NA	2/18/98	2000	

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:**	S9800307
Project:	20805-135.007/TO#21133.00/6148 OAKLAND	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA

BTEX, MTBE and TPH as Gasoline

Sample Name:	Method Blank	Units:	ug/L (ppb)
Lab Code:	S980214-WB1	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	2/14/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	2/14/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	2/14/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	2/14/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	2/14/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	2/14/98	ND	

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9800307
Project:	20805-135.007/TO#21133.00/6148 OAKLAND	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA

BTEX, MTBE and TPH as Gasoline

Sample Name:	Method Blank	Units:	ug/L (ppb)
Lab Code:	S980217-WB1	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	2/17/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	2/17/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	2/17/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	2/17/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	2/17/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	2/17/98	ND	

1S22/020597p

APPENDIX A

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-135.007/TO#21133.00/6148 OAKLAND
Sample Matrix: Water

Service Request: S9800307
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
MW-7(26)	S9800307-001		87	93
MW-6(26)	S9800307-002		93	99
MW-4(14)	S9800307-003		95	88
MW-1(14)	S9800307-004		109	72
MW-3(14)	S9800307-005		92	90
MW-2(14)	S9800307-006		104	97
MW-5(14)	S9800307-007		98	82
BATCH QC	S9800310-001MS		103	113
BATCH QC	S9800310-001DMS		103	113
Method Blank	S980214-WB1		93	98
Method Blank	S980217-WB1		98	93
CAS Acceptance Limits:			69-116	69-116

SUR2/020397p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO Products Company	**Service Request:**	S9800307
Project:	20805-135.007/TO#21133.00/6148 OAKLAND	**Date Collected:**	NA
Sample Matrix	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	2/14/98

Matrix Spike/Duplicate Matrix Spike Summary
TPH as Gasoline

Sample Name:	BATCH QC	Units:	ug/L (ppb)
Lab Code:	S9800310-001MS, S9800310-001DMS	Basis:	NA
Test Notes:			

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

DMS/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-135.007/TO#21133.00/6148 OAKLAND

Service Request: S9800307
Date Analyzed: 2/14/98

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

Sample Name: ICV
Lab Code: ICV1
Test Notes:

Units: ug/L (ppb)
Basis: NA

ICV Source:

Analyte	Prep Method	Analysis Method	True Value	Result	CAS Percent Recovery Acceptance Limits	Percent Recovery	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	250	240	90-110	96	
Benzene	EPA 5030	8020	25	26	85-115	104	
Toluene	EPA 5030	8020	25	26	85-115	104	
Ethylbenzene	EPA 5030	8020	25	24	85-115	96	
Xylenes, Total	EPA 5030	8020	75	73	85-115	97	
Methyl *tert*-Butyl Ether	EPA 5030	8020	25	23	85-115	92	

ICV032196

TPH-VOA, F, PC

ARCO Products Company

Division of Atlantic/Richfield Company

Task Order No. 21133.00

Chain of Custody

ARCO Facility no. 6148	City (Facility) Oakland	Project manager (Consultant) Gary Messerates	Laboratory Name CAS
ARCO engineer Paul Supple	Telephone no. (ARCO)	Telephone no. (Consultant) (408) 453-7300	Fax no. (Consultant) (408) 437-9526
Consultant name FMCON	Address (Consultant) 1921 Ringwood Ave. San Jose, CA 95131		Contract Number

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH incl. MTBE EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM 503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Semi Metals ☐ VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org/DHS ☐ Lead EPA 7420/7421 ☐
MW-7(26)	1	2		X		X	HCL	2-13-58	11:15		X									
MW-6(26)	2	2		X		X	HCL		11:50		X									
MW-4(24)	3	2		X		X	HCL		12:10		X									
MW-1(24)	4	2		X		X	HCL		12:25		X									
MW-3(24)	5	2		X		X	HCL		12:40		X									
MW-2(24)	6	2		X		X	HCL		12:55		X									
MW-5(24)	7	2		X		X	HCL		13:15		X									

Method of shipment: Sampler will deliver

Special Detection Limit/reporting: Lowest Possible

Special QA/QC: As Normal

Remarks: 2-40ml HCL VOAs

#20805-135.00

Lab Number: 59800307

Turnaround Time:

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

Condition of sample:		Temperature received:	
Relinquished by sampler	Date 2-13-58 Time 14:45	Received by CAS 2/13/48 1600	
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

R11/01

APPENDIX C

FIELD DATA SHEETS

EMCON - Groundwater Sampling and Analysis Request Form

PROJECT NAME : **ARCO STATION 6148**
5131 Shattuck Avenue, Oakland

Sampling Project #: **21775-250.003**
Reporting Project #: **20805-135.007**

DATE REQUESTED : **13-Feb-98**

Project Manager: **Gary Messerotes**

Groundwater Monitoring Instructions	Treatment System Instructions
Quarterly Monitoring- Second Month Of The Quarter You will need a water trailer for purge water transport, and a 15/16" socket to access wells. **Get the key from the station manager to open the gate.** Perform a water level survey prior to sampling (See ARCO SOP). The survey points are tops of the well casings. Purge three (3) casing volumes. Well MW-2 may contain a skimmer, please note this on your field sheet. Sample all wells regardless of product per John Young's request. **Please use the Reporting Project Number (20805-135.007) on the chain-of-custody, sample containers, and analytical results.** Sample ID's on the Chain-Of-Custody and sample containers must include the depth at which the sample was collected [i.e. MW-1 (30)].	Active System. **Lisle Rath Pager# (888) 606-0933**

Site Contact: _____ Site Phone: **(510) 654-3461** Well Locks: **ARCO Key**

Well ID or Source	Casing Diameter (inches)	Casing Length (feet)	Top Of Screen (feet)	Analyses Requested
MW-7	4.0	27.0	14.0	**Depth To Water** **Total Depth** **Dissolved Oxygen** **TPHG** **BTEX** **MTBE by EPA 8020**
MW-6	4.0	26.6	14.0	
MW-4	4.0	26.0	13.0	
MW-1	4.0	25.7	11.5	
MW-3	4.0	25.9	10.0	
MW-2	4.0	25.8	12.0	
MW-5	4.0	25.0	12.0	

Above wells in indicated order

Laboratory Instructions:
Provide ARCO standard detection limits.
Please use the Reporting Project Number **(#20805-135.007)** on the CARs.

ND = None Detected IP = Intermitent Product

FIELD REPORT
DEPTH TO WATER / FLOATING PRODUCT SURVEY

PROJECT # : **21775-250.003** STATION ADDRESS : **5131 Shattuck Avenue, Oakland** DATE : **2/13/98**

ARCO STATION # : **6148** FIELD TECHNICIAN : **Chris Chaco** DAY : **Friday**

DTW Order	WELL ID	Well Box Seal	Well Lid Secure	Gasket Present	Lock Number	Type Of Well Cap	FIRST DEPTH TO WATER (feet)	SECOND DEPTH TO WATER (feet)	DEPTH TO FLOATING PRODUCT (feet)	FLOATING PRODUCT THICKNESS (feet)	WELL TOTAL DEPTH (feet)	COMMENTS
1	**MW-7**	OK	Y	Y	ARCO	LWC	10.80	10.8	ND	ND	27.0	
2	**MW-6**	OK	Y	Y	ARCO	LWC	10.06	10.06	ND	ND	26.0	
3	**MW-4**	OK	Y	Y	NA	Twist	13.05	13.05	ND	ND	26.1	
4	**MW-1**	OK	Y	Y	NA	Twist	13.15	13.15	ND	ND	25.5	
5	**MW-5**	OK	Y	Y	NA	Twist	~~24.8~~ 12.21	~~24.8~~ 12.21	ND	ND	24.8	
6	**MW-2**	OK	Y	Y	NA	Twist	12.75	12.75	ND	ND	25.6	
7	**MW-3**	OK	Y	Y	NA	Twist	13.0	13.0	ND	ND	25.6	

SURVEY POINTS ARE TOP OF WELL CASINGS

Rev. 3, 2/94

WATER SAMPLE FIELD DATA SHEET

EMCON ASSOCIATES

PROJECT NO: 21775.250.003 | SAMPLE ID: MW-1 (14)

PURGED BY: — | CLIENT NAME: ARCO 6148

SAMPLED BY: C. Cuico | LOCATION: Oakland

TYPE: Ground Water ✓ Surface Water ___ Treatment Effluent ___ Other ___

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

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

DEPTH TO WATER (feet): 13.15 | CALCULATED PURGE (gal.): N/A

DEPTH OF WELL (feet): 25.5 | ACTUAL PURGE VOL. (gal.): ___

DATE PURGED: — | Start (2400 Hr) — | End (2400 Hr) —

DATE SAMPLED: 2-13-98 | Start (2400 Hr) 12:25 | End (2400 Hr) ___

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
12:25	Grab	7.20	928.6	70.0	clr	0

D. O. (ppm): 0-1 | ODOR: None

(COBALT 0 - 500) | (NTU 0 - 200 or 0 - 1000)

Field QC samples collected at this well: MS/MSD

Parameters field filtered at this well: NA

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®)

___ DDL Sampler ___ Bailer (Stainless Steel)

___ Dipper ___ Submersible Pump

___ Well Wizard™ ___ Dedicated

Other: ___

WELL INTEGRITY: Good | LOCK #: NA

REMARKS: ___

Meter Calibration: Date: ___ Time: ___ Meter Serial #: ___ Temperature °F: ___

(EC 1000 ___ / ___) (DI ___) (pH 7 ___ / ___) (pH 10 ___ / ___) (pH 4 ___ / ___)

Location of previous calibration: ___

Signature: [signature] | Reviewed By: [signature] | Page 1 of 7

Rev. 3, 2/94

WATER SAMPLE FIELD DATA SHEET

EMCON ASSOCIATES

PROJECT NO: 2175.250.003 SAMPLE ID: MW-2 (14')

PURGED BY: — CLIENT NAME: ARCO 6148

SAMPLED BY: C. Chan LOCATION: Oakland

TYPE: Ground Water ✓ Surface Water ___ Treatment Effluent ___ Other ___

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

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

DEPTH TO WATER (feet): 12.75 CALCULATED PURGE (gal.): N/A

DEPTH OF WELL (feet): 25.6 ACTUAL PURGE VOL. (gal.): ___

DATE PURGED: — Start (2400 Hr) — End (2400 Hr) —

DATE SAMPLED: 2-13-98 Start (2400 Hr) 12:55 End (2400 Hr) —

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
12:55	Grab	6.91	998.1	70.1	clr	0

D. O. (ppm): 0-1 ODOR: NONE

(COBALT 0 - 500) (NTU 0 - 200 or 0 - 1000)

Field QC samples collected at this well: NA

Parameters field filtered at this well: NA

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®)

___ DDL Sampler ___ Bailer (Stainless Steel)

___ Dipper ___ Submersible Pump

___ Well Wizard™ ___ Dedicated

Other: ___

WELL INTEGRITY: Good LOCK #: NA

REMARKS: ___

Meter Calibration: Date: ___ Time: ___ Meter Serial #: ___ Temperature °F: ___

(EC 1000 ___ / ___) (DI ___) (pH 7 ___ / ___) (pH 10 ___ / ___) (pH 4 ___ / ___)

Location of previous calibration: ___

Signature: [signature] Reviewed By: [signature] Page 2 of 7

Rev. 3, 2/94

WATER SAMPLE FIELD DATA SHEET

EMCON ASSOCIATES

PROJECT NO: 21775.250.003 SAMPLE ID: MW-3 (14')

PURGED BY: — CLIENT NAME: ARCO 6148

SAMPLED BY: C. Chan LOCATION: Oakland

TYPE: Ground Water ~~(~~ Surface Water ___ Treatment Effluent ___ Other ___

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

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

DEPTH TO WATER (feet): 13.0 CALCULATED PURGE (gal.): NA

DEPTH OF WELL (feet): 25.6 ACTUAL PURGE VOL. (gal.): ___

DATE PURGED: — Start (2400 Hr) — End (2400 Hr) —

DATE SAMPLED: 2-13-98 Start (2400 Hr) 12:40 End (2400 Hr) —

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
12:40	Grab	6.78	1069	70.3	clr	0

D. O. (ppm): 0-1 ODOR: None — —

(COBALT 0 - 500) (NTU 0 - 200 or 0 - 1000)

Field QC samples collected at this well: ___

Parameters field filtered at this well: ___

PURGING EQUIPMENT

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

Other: ___

SAMPLING EQUIPMENT

- ___ 2" Bladder Pump
- ___ DDL Sampler
- ___ Dipper
- ___ Well Wizard™
- ___ Bailer (Teflon®)
- ___ Bailer (Stainless Steel)
- ___ Submersible Pump
- ___ Dedicated

Other: ___

WELL INTEGRITY: Good LOCK #: NA

REMARKS: ___

Meter Calibration: Date: ___ Time: ___ Meter Serial #: ___ Temperature °F: ___

(EC 1000 ___ / ___) (DI ___) (pH 7 ___ / ___) (pH 10 ___ / ___) (pH 4 ___ / ___)

Location of previous calibration: ___

Signature: ___ Reviewed By: ___ Page 3 of 7

Rev. 3, 2/94

WATER SAMPLE FIELD DATA SHEET

EMCON ASSOCIATES

PROJECT NO: 21775-250.003 SAMPLE ID: MW-4 (14)

PURGED BY: C. CLIENT NAME: ARCO 6148

SAMPLED BY: C. Chavez LOCATION: Oakland

TYPE: Ground Water ✓ Surface Water ___ Treatment Effluent ___ Other ___

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

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

DEPTH TO WATER (feet): 13.05 CALCULATED PURGE (gal.): N/A

DEPTH OF WELL (feet): 26.1 ACTUAL PURGE VOL. (gal.): ___

DATE PURGED: ___ Start (2400 Hr) ___ End (2400 Hr) ___

DATE SAMPLED: 2-13-98 Start (2400 Hr) 12:10 End (2400 Hr) ___

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
12:10	Grab	6.89	621.2	71.0	clr	mod

D. O. (ppm): 0-1 ODOR: None (COBALT 0 - 500) (NTU 0 - 200 or 0 - 1000)

Field QC samples collected at this well: ___

Parameters field filtered at this well: ___

PURGING EQUIPMENT

___ 2" Bladder Pump ___ Bailer (Teflon®)

___ Centrifugal Pump N/A ___ Bailer (PVC)

___ Submersible Pump ___ Bailer (Stainless Steel)

___ Well Wizard™ ___ Dedicated

Other: ___

SAMPLING EQUIPMENT

___ 2" Bladder Pump ✓ Bailer (Teflon®)

___ DDL Sampler ___ Bailer (Stainless Steel)

___ Dipper ___ Submersible Pump

___ Well Wizard™ ___ Dedicated

Other: ___

WELL INTEGRITY: Good LOCK #: N/A

REMARKS: ___

Meter Calibration: Date: ___ Time: ___ Meter Serial #: ___ Temperature °F: ___

(EC 1000 ___ / ___) (DI ___) (pH 7 ___ / ___) (pH 10 ___ / ___) (pH 4 ___ / ___)

Location of previous calibration: ___

Signature: [signature] Reviewed By: NA Page 4 of 7

Rev. 3, 2/94

WATER SAMPLE FIELD DATA SHEET

EMCON ASSOCIATES

PROJECT NO: 2177.B50.003 SAMPLE ID: MW-5 C14'

PURGED BY: _____ CLIENT NAME: ARCO . 6148

SAMPLED BY: C Chace LOCATION: Oakland

TYPE: Ground Water ✓ Surface Water ___ Treatment Effluent ___ Other ___

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

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

DEPTH TO WATER (feet): 12.21 CALCULATED PURGE (gal.): N/A

DEPTH OF WELL (feet): 24.8 ACTUAL PURGE VOL. (gal.): ___

DATE PURGED: ___ Start (2400 Hr) ___ End (2400 Hr) ___

DATE SAMPLED: 2-13-98 Start (2400 Hr) 13:15 End (2400 Hr) ___

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
13:13	Grab	7.22	557.2	67.6	clr	✓

D. O. (ppm): 0-1 ODOR: None

(COBALT 0 - 500) (NTU 0 - 200 or 0 - 1000)

Field QC samples collected at this well: ✓

Parameters field filtered at this well: ✓

PURGING EQUIPMENT

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

SAMPLING EQUIPMENT

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

WELL INTEGRITY: Good LOCK #: N/A

REMARKS: ___

Meter Calibration: Date: ___ Time: ___ Meter Serial #: ___ Temperature °F: ___

(EC 1000 ___ / ___) (DI ___) (pH 7 ___ / ___) (pH 10 ___ / ___) (pH 4 ___ / ___)

Location of previous calibration: ___

Signature: [signature] Reviewed By: [signature] Page 5 of 7

Rev. 3, 2/94

WATER SAMPLE FIELD DATA SHEET

EMCON ASSOCIATES

PROJECT NO: 21775-250.003 | SAMPLE ID: MW-6 (26)

PURGED BY: C Chaco | CLIENT NAME: ~~X~~ ARCO 6148

SAMPLED BY: ~~X~~ | LOCATION: Oakland

TYPE: Ground Water ✓ Surface Water ___ Treatment Effluent ___ Other ___

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

CASING ELEVATION (feet/MSL): ___ | VOLUME IN CASING (gal.): 10.80

DEPTH TO WATER (feet): 10.06 | CALCULATED PURGE (gal.): 32.41

DEPTH OF WELL (feet): 26.6 | ACTUAL PURGE VOL. (gal.): 33.0

DATE PURGED: 2-13-98 | Start (2400 Hr) 10:33 | End (2400 Hr) 11:41

DATE SAMPLED: 2-13-98 | Start (2400 Hr) 11:50 | End (2400 Hr) ___

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
10:35	11.0	7.42	449.5	69.7	BRN	Hvy
11:38	22.0	7.38	453.4	69.5	"	"
11:41	33.0	7.36	455.2	69.8	"	"

D. O. (ppm): 0-1 | ODOR: None | (COBALT 0 - 500) | (NTU 0 - 200 or 0 - 1000)

Field QC samples collected at this well: ___

Parameters field filtered at this well: ←

PURGING EQUIPMENT

___ 2" Bladder Pump
✓ Centrifugal Pump
___ Submersible Pump
___ Well Wizard™
___ Bailer (Teflon®)
___ Bailer (PVC)
___ Bailer (Stainless Steel)
___ Dedicated
Other: ___

SAMPLING EQUIPMENT

___ 2" Bladder Pump
___ DDL Sampler
___ Dipper
___ Well Wizard™
___ Bailer (Teflon®)
___ Bailer (Stainless Steel)
___ Submersible Pump
___ Dedicated
Other: ___

WELL INTEGRITY: Good | LOCK #: ARCO

REMARKS: ___

Meter Calibration: Date: ___ Time: ___ Meter Serial #: ___ Temperature °F: ___

(EC 1000 ___ / ___) (DI ___) (pH 7 ___ / ___) (pH 10 ___ / ___) (pH 4 ___ / ___)

Location of previous calibration: ___

Signature: [signature] Reviewed By: TA Page 6 of 7

Rev. 3, 2/94

WATER SAMPLE FIELD DATA SHEET

EMCON ASSOCIATES

PROJECT NO: 21775-250.003 SAMPLE ID: MW-7 (26)

PURGED BY: C. Chico CLIENT NAME: ARCO 6148

SAMPLED BY: ↓ LOCATION: Oakland

TYPE: Ground Water ✓ Surface Water ___ Treatment Effluent ___ Other ___

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

CASING ELEVATION (feet/MSL): ✓ VOLUME IN CASING (gal.): 10.58

DEPTH TO WATER (feet): 10.8 CALCULATED PURGE (gal.): 31.75

DEPTH OF WELL (feet): 27.0 ACTUAL PURGE VOL. (gal.): 32.0

DATE PURGED: 2-13-98 Start (2400 Hr) 10:58 End (2400 Hr) 11:08

DATE SAMPLED: 2-13-98 Start (2400 Hr) 11:15 End (2400 Hr) —

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
11:00	10	7.06	454.6	71.0	Brn	Hvy
11:04	21	7.09	458.3	70.5	"	"
11:08	32	7.13	462.1	70.1	"	"

D. O. (ppm): 0-1 ODOR: None

(COBALT 0 - 500) (NTU 0 - 200 or 0 - 1000)

Field QC samples collected at this well: ✓

Parameters field filtered at this well: —

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®)
___ DDL Sampler ___ Bailer (Stainless Steel)
___ Dipper ___ Submersible Pump
___ Well Wizard™ ___ Dedicated
Other: ___

WELL INTEGRITY: Good LOCK #: ARCO

REMARKS: ___

Meter Calibration: Date: 2-13-98 Time: 10:50 Meter Serial #: 56 Temperature °F: 67.3

(EC 1000 1035 / 1000) (DI ___) (pH 7 740 / 700) (pH 10 995 / 1000) (pH 4 ___ / ___)

Location of previous calibration: ___

Signature: [signature] Reviewed By: [signature] Page 7 of 7

EMCON Associates - Field Services | Historical Monitoring Well Data

1921 Ringwood Avenue | **1998** | ARCO 6148

San Jose, California | #21775-250.0003

Well ID	Quarter	Date	Purge Volume (gallons)	Did well dry	Well Contained Product	
						Gallons
						First 0.00
						Second 0.00
						Third 0.00
						Fourth 0.00
MW-1	First	02/13/98	GRAB	NA	NO	
	Second					
	Third	08/22/97	GRAB	NO	NO	
	Fourth	11/10/97	GRAB	NO	NO	
MW-2	First	02/13/98	GRAB	NA	NO	
	Second					
	Third	08/22/97	GRAB	NO	NO	
	Fourth	11/10/97	GRAB	NO	NO	
MW-3	First	02/13/98	GRAB	NA	NO	
	Second					
	Third	08/22/97	GRAB	NO	NO	
	Fourth	11/10/97	GRAB	NO	NO	
MW-4	First	02/13/98	GRAB	NA	NO	
	Second					
	Third	08/22/97	GRAB	NO	NO	
	Fourth	11/10/97	NA	NA	NO	
MW-5	First	02/13/98	GRAB	NA	NO	
	Second					
	Third	08/22/97	GRAB	NO	NO	
	Fourth	11/10/97	GRAB	NO	NO	
MW-6	First	02/13/98	33.00	NO	NO	
	Second					
	Third	08/22/97	NA	NA	NO	
	Fourth	11/10/97	NA	NA	NO	
MW-7	First	02/13/98	32.00	NO	NO	
	Second					
	Third	08/22/97	NA	NA	NO	
	Fourth	11/10/97	NA	NA	NO	
						Steam water (gal) _____

ARCO Products Company
Division of Atlantic/Richfield Company

Task Order No. 21133.00

Chain of Custody

ARCO Facility no. 6148	City (Facility) Oakland	Project manager (Consultant) Gary Messerotes	Laboratory Name CAS
ARCO engineer Paul Supple	Telephone no. (ARCO)	Telephone no. (Consultant) (408)453-7300 / Fax no. (Consultant) (408)437-9526	Contract Number
Consultant name EMCON	Address (Consultant) 1921 Ringwood Ave. San Jose, CA 95131		

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 Metals ☐ VOA ☐ Semi VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org/DHS ☐ Lead EPA 7420/7421 ☐			
MW-7(26)		2		X		X	HCL	2-13-98	11:15		X												
MW-6(26)		2		X		X	HCL	↓	11:50		X												
MW-4(14)		2		X		X	HCL	↓	12:10		X												
MW-1(14)		2		X		X	HCL	↓	12:25		X												
MW-3(14)		2		X		X	HCL	↓	12:40		X												
MW-2(14)		2		X		X	HCL	↓	12:55		X												
MW-5(14)		2		X		X	HCL	↓	13:15		X												

Method of shipment: Sampler will deliver

Special Detection Limit/reporting: Lowest Possible

Special QA/QC: As Normal

Remarks: 2-40ml HCL VOAs

#20805-125-[illegible]

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 [signature]	Date 2-13-98	Time 14:45	Received by [signature] 2/13/98 1500
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

SVE SYSTEM MONITORING DATA LOG SHEETS

ARCO 6148
SVE SYSTEM
MONITORING DATA

Reporting Period
01/01/98 00 00
02/01/98 00 00

Hours in Period 744
Days in Period 31 00

Operation + Down Hours 744
Operation + Down Days 31 00

	Field Monitoring Data							Laboratory Monitoring Data															
	Flow Rates		FID or PID Results					Well Field Influent				System Influent				System Effluent							
Reading Date & Time	Well Field Flow Rate	System Influent Flow Rate*	Well Field	System Influent	System Effluent	Destruction Efficiency	Laboratory Sample Time	Gasoline		Benzene		Gasoline		Benzene		Gasoline		Benzene		Destruction Efficiency	Gasoline Emission Rate	Benzene Emission Rate	Period Hours	Meter Hours	Hours of Operation	Days of Operation	Down Hours	Down Days
	scfm	scfm	ppm	ppm	ppm	%		ppmv	mg/m3	ppmv	mg/m3	ppmv	mg/m3	ppmv	mg/m3	ppmv	mg/m3	ppmv	mg/m3	%	lb/day	lb/day						
01/01/98 00 00																								2702 01				
01/27/98 10 35	0 0	0 0					10 35	39	160	< 1	< 4	39	160	< 1	< 4	<5	<20	< 1	< 4	87 5	0 00	NR	634 58	2702 01	0 00	0 00	634.6	26 44
02/01/98 00 00	0 0	0 0																					109 42	2702 01	0 00	0 00	109.4	4 56
Period Totals																							744		0 00	0 00	744	31 00
Period Averages	0 0	0 0																										

ARCO 6148
SVE SYSTEM
MONITORING DATA

Reporting Period
02/01/98 00 00
03/01/98 00 00

Hours in Period 672
Days in Period 28 00

Operation + Down Hours. 672
Operation + Down Days: 28 00

	Field Monitoring Data							Laboratory Monitoring Data													
	Flow Rates		FID or PID Results					Well Field Influent		System Influent		System Effluent									
Reading Date & Time	Well Field Flow Rate	System Influent Flow Rate*	Well Field	System Influent	System Effluent	Destruction Efficiency	Laboratory Sample Time	Gasoline	Benzene	Gasoline	Benzene	Gasoline	Benzene	Destruction Efficiency	Gasoline Emission Rate	Benzene Emission Rate	Period Hours	Meter Hours	Hours of Operation	Days of Operation	Down Hours	Down Days
	scfm	scfm	ppm	ppm	ppm	%		ppmv mg/m3	ppmv mg/m3	ppmv mg/m3	ppmv mg/m3	ppmv mg/m3	ppmv mg/m3	%	lb/day	lb/day						
02/01/98 00 00																		2702 01				
02/10/98 11 33	0 0	0.0															227 55	2704 73	2 72	0 11	224 8	9 37
02/16/98 10 38	0 0	0.0															143 08	2704 73	0 00	0 00	143.1	5 96
03/01/98 00 00																	301 37	2704 73	0.00	0 00	301.4	12.56
Period Totals																	672 00		2 72	0 11	669.28	27.89
Period Averages	0 0	0 0																				

ARCO 6148
SVE SYSTEM
MONITORING DATA

Reporting Period
03/01/98 00:00
04/01/98 00:00

Hours in Period: 744
Days in Period: 31 00

Operation + Down Hours: 744
Operation + Down Days: 31 00

	Field Monitoring Data							Laboratory Monitoring Data														
	Flow Rates		FID or PID Results					Well Field Influent		System Influent		System Effluent										
Reading Date & Time	Well Field Flow Rate	System Influent Flow Rate*	Well Field	System Influent	System Effluent	Destruction Efficiency	Laboratory Sample Time	Gasoline	Benzene	Gasoline	Benzene	Gasoline	Benzene	Destruction Efficiency	Gasoline Emission Rate	Benzene Emission Rate	Period Hours	Meter Hours	Hours of Operation	Days of Operation	Down Hours	Down Days
	scfm	scfm	ppm	ppm	ppm	%		ppmv mg/m3	ppmv mg/m3	ppmv mg/m3	ppmv mg/m3	ppmv mg/m3	ppmv mg/m3	%	lb/day	lb/day						
03/01/98 00 00																		2702.01				
03/23/98 11 15	0 0	0 0															539 25	2704 73	2 72	0 11	536 5	22 36
04/01/98 00.00	0 0	0 0															204 75	2906 76	202.03	8 42	2.7	0.11
Period Totals																	744 00		204.75	8.53	539 25	22 47
Period Averages	0.0	0 0																				

APPENDIX E

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

Columbia Analytical Services, Inc.

February 10, 1998 Service Request No.: S9800161

Valli Voruganti
EMCON
1921 Ringwood Avenue
San Jose, CA 95131

RE: 20805-135.007/TO#20830.00/6148 OAKLAND

Dear Ms. Voruganti:

The following pages contain analytical results for sample(s) received by the laboratory on January 27, 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

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:**	S9800161
Project:	20805-135.007/TO#20830.00/6148 OAKLAND	**Date Collected:**	1/27/98
Sample Matrix:	Air	**Date Received:**	1/27/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	I-1	Units:	mg/m3
Lab Code:	S9800161-001	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	1/28/98	ND	
Toluene	5030	8020	0.4	1	NA	1/28/98	2.5	
Ethylbenzene	5030	8020	0.5	1	NA	1/28/98	0.5	
Xylenes, Total	5030	8020	0.9	1	NA	1/28/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	12	1	NA	1/28/98	200	
C6 - C12	5030	8015M	20	1	NA	1/28/98	160	
TPH as Gasoline*	5030	8015M	20	1	NA	1/28/98	160	

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

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9800161
Project:	20805-135.007/TO#20830.00/6148 OAKLAND	**Date Collected:**	1/27/98
Sample Matrix:	Air	**Date Received:**	1/27/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	I-1	Units:	ppmV
Lab Code:	S9800161-001	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	1/28/98	ND	
Toluene	5030	8020	0.1	1	NA	1/28/98	0.7	
Ethylbenzene	5030	8020	0.1	1	NA	1/28/98	0.1	
Xylenes, Total	5030	8020	0.2	1	NA	1/28/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	5	1	NA	1/28/98	84	
C6 - C12	5030	8015M	5	1	NA	1/28/98	39	
TPH as Gasoline*	5030	8015M	5	1	NA	1/28/98	39	

* 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:**	S9800161
Project:	20805-135.007/TO#20830.00/6148 OAKLAND	**Date Collected:**	1/27/98
Sample Matrix:	Air	**Date Received:**	1/27/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	E-1	Units:	mg/m3
Lab Code:	S9800161-002	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	1/28/98	ND	
Toluene	5030	8020	0.4	1	NA	1/28/98	ND	
Ethylbenzene	5030	8020	0.5	1	NA	1/28/98	ND	
Xylenes, Total	5030	8020	0.9	1	NA	1/28/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	12	1	NA	1/28/98	ND	
C6 - C12	5030	8015M	20	1	NA	1/28/98	ND	
TPH as Gasoline*	5030	8015M	20	1	NA	1/28/98	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:**	S9800161
Project:	20805-135.007/TO#20830.00/6148 OAKLAND	**Date Collected:**	1/27/98
Sample Matrix:	Air	**Date Received:**	1/27/98

BTEX and Total Volatile Hydrocarbons

Sample Name:	E-1	Units:	ppmV
Lab Code:	S9800161-002	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	1/28/98	ND	
Toluene	5030	8020	0.1	1	NA	1/28/98	ND	
Ethylbenzene	5030	8020	0.1	1	NA	1/28/98	ND	
Xylenes, Total	5030	8020	0.2	1	NA	1/28/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	5	1	NA	1/28/98	ND	
C6 - C12	5030	8015M	5	1	NA	1/28/98	ND	
TPH as Gasoline*	5030	8015M	5	1	NA	1/28/98	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:**	S9800161
Project:	20805-135.007/TO#20830.00/6148 OAKLAND	**Date Collected:**	NA
Sample Matrix:	Air	**Date Received:**	NA

BTEX and Total Volatile Hydrocarbons

Sample Name:	Method Blank	Units:	mg/m3
Lab Code:	S980128-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	1/28/98	ND	
Toluene	5030	8020	0.4	1	NA	1/28/98	ND	
Ethylbenzene	5030	8020	0.5	1	NA	1/28/98	ND	
Xylenes, Total	5030	8020	0.9	1	NA	1/28/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	12	1	NA	1/28/98	ND	
C6 - C12	5030	8015M	20	1	NA	1/28/98	ND	
TPH as Gasoline*	5030	8015M	20	1	NA	1/28/98	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:**	S9800161
Project:	20805-135.007/TO#20830.00/6148 OAKLAND	**Date Collected:**	NA
Sample Matrix:	Air	**Date Received:**	NA

BTEX and Total Volatile Hydrocarbons

Sample Name:	Method Blank	Units:	ppmV
Lab Code:	S980128-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	1/28/98	ND	
Toluene	5030	8020	0.1	1	NA	1/28/98	ND	
Ethylbenzene	5030	8020	0.1	1	NA	1/28/98	ND	
Xylenes, Total	5030	8020	0.2	1	NA	1/28/98	ND	
Total Volatile Hydrocarbons:								
C1 - C5	5030	8015M	5	1	NA	1/28/98	ND	
C6 - C12	5030	8015M	5	1	NA	1/28/98	ND	
TPH as Gasoline*	5030	8015M	5	1	NA	1/28/98	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

APPENDIX A

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-135.007/TO#20830.00/6148 OAKLAND
Sample Matrix: Air

Service Request: S9800161
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 1/28/98

Duplicate Summary
BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
Lab Code: S9800161-001DUP
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	2.5	2.4	2.5	4	
Ethylbenzene	5030	8020	0.5	0.5	0.5	0.5	<1	
Xylenes, Total	5030	8020	0.9	ND	ND	--	--	
Total Volatile Hydrocarbons								
C1 - C5	5030	8015M	12	200	190	200	5	
C6 - C12	5030	8015M	20	160	150	160	6	
TPH as Gasoline*	5030	8015M	20	160	150	160	6	

DUP/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-135.007/TO#20830.00/6148 OAKLAND
Sample Matrix: Air

Service Request: S9800161
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 1/28/98

Duplicate Summary
BTEX and Total Volatile Hydrocarbons

Sample Name: I-1
Lab Code: S9800161-001DUP
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	--	--	--	--	
Toluene	5030	8020	0.1	0.7	0.6	0.7	14	
Ethylbenzene	5030	8020	0.1	0.1	0.1	0.1	<1	
Xylenes, Total	5030	8020	0.2	--	--	--	--	
Total Volatile Hydrocarbons								
C1 - C5	5030	8015M	5	84	80	82	5	
C6 - C12	5030	8015M	5	39	37	38	5	
TPH as Gasoline*	5030	8015M	5	39	37	38	5	

DUP/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO Products Company	**Service Request:**	S9800161
Project:	20805-135.007/TO#20830.00/6148 OAKLAND	**Date Collected:**	NA
LCS Matrix:	Air	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	1/28/98

Laboratory Control Sample Summary
TPH as Gasoline

Sample Name:	Lab Control Sample	**Units:**	mg/m3
Lab Code:	S980128-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	180	90	60-140	

LCS/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

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Project:	20805-135.007/TO#20830.00/6148 OAKLAND	**Date Collected:**	NA
LCS Matrix:	Air	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	1/28/98

Laboratory Control Sample Summary

Sample Name:	Lab Control Sample	Units:	ppmV
Lab Code:	S980128-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	44	90	60-140	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO Products Company	**Service Request:**	S9800161
Project:	20805-135.007/TO#20830.00/6148 OAKLAND	**Date Analyzed:**	1/28/98

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	24	96	80-120
Toluene	5030	8020	25	24	96	80-120
Ethylbenzene	5030	8020	25	23	92	80-120
Xylenes, Total	5030	8020	75	71	95	80-120
Gasoline	5030	8015M	250	260	104	80-120

ICV032196

ARCO Products Company
Division of Atlantic/Richfield Company

Task Order No. 20830.00

Chain of Custody

ARCO Facility no. 6148	City (Facility) Oakland	Project manager (Consultant) Vulli Vorugant.	Laboratory Name CAS
ARCO engineer D. Vorugant. Paul Supple	Telephone no. (ARCO)	Telephone no. (Consultant) 4084533730	Fax no. (Consultant)
Consultant name Emcon	Address (Consultant) 1921 Ringwood Ave SJ CA		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 EPA M602/8020/8015 gas	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	1			AIR			1/27	1145		X												
E-1	2	1			AIR			1/27	1130		X												

Special Detection Limit/reporting: Report in PPMV + mg/m3

Method of shipment: Tech

Special QA/QC

Remarks: ~~20805 0500~~ 20805 1350

Lab Number: S9800161

Turnaround Time:

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

DVE 2/9/98

BTEX

Condition of sample:

Temperature received:

Relinquished by sampler: Lisa Ratn	Date 1-27-98 Time 1340	Received by
Relinquished by	Date Time	Received by
Relinquished by	Date Time	Received by laboratory: Kay Loulin CAS Date 1/27/98 Time 1340

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