Pinnacle
ENVIRONMENTAL SOLUTIONS

a division of
EMCON

LOP 3873

November 13, 1998
Project 20805-122.005

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

Re: Quarterly Groundwater Monitoring Report and Remediation System Performance Evaluation Report, Second Quarter 1998, for ARCO Service Station No. 0771, located at 899 Rincon Avenue, Livermore, California

Dear Mr. Supple:

Pinnacle Environmental Solutions, a division of EMCON (Pinnacle), is submitting the attached report which presents the results of the second quarter 1998 groundwater monitoring program at ARCO Products Company (ARCO) Service Station No. 0771, located at 899 Rincon Avenue, Livermore, California. Operation and performance data for the site's interim soil-vapor extraction (SVE) and air-bubbling systems are also presented. The monitoring program complies with the Alameda County Health Care Services Agency (ACHCSA) requirements regarding underground tank investigations.

LIMITATIONS

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

Please call if you have questions.

Sincerely,

Pinnacle

Glen VanderVeen
Project Manager

Jay R. Johnson, R.G.
Senior Project Supervisor

Attachment: Quarterly Groundwater Monitoring Report, Second Quarter 1998

cc: Susan Hugo, ACHCSA
Danielle Stefani, LFD

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November 13, 1998

ARCO QUARTERLY GROUNDWATER MONITORING REPORT

Station No.: 771 Address: 899 Rincon Avenue, Livermore, California
Pinnacle Project No.: 20805-122.005
ARCO Environmental Engineer/Phone No.: Paul Supple /(925) 299-8891
Pinnacle Project Manager/Phone No.: Glen VanderVeen /(925) 977-9020
Primary Agency/Regulatory ID No.: ACHCSA /Susan Hugo

WORK PERFORMED THIS QUARTER (SECOND - 1998):

1. Prepared and submitted quarterly groundwater monitoring report for first quarter 1998.
2. Performed quarterly groundwater monitoring and sampling for second quarter 1998.
3. Operated air-bubbling system.

WORK PROPOSED FOR NEXT QUARTER (THIRD - 1998):

1. Prepare and submit quarterly groundwater monitoring report for second quarter 1998.
2. Perform quarterly groundwater monitoring and sampling for third quarter 1998.
3. Continue operating air-bubbling system.

QUARTERLY MONITORING:

Current Phase of Project:	Quarterly Groundwater Monitoring and Operation and Maintenance of Remediation Systems Soil Vapor Extraction (SVE) system was shut down on 10-10-95 due to low hydrocarbon concentrations in extracted vapor. Air bubbling system pulses hourly at 1 to 2 scfm per well in wells VW-1, MW-1, MW-2, MW-4, MW-5, MW-7, and RW-1.
Frequency of Sampling:	Annual (1st Quarter): MW-4, MW-7, MW-9, MW-10, RW-1 Semi-Annual (1st/3rd Quarter): MW-8, MW-11 Quarterly: MW-1, MW-2, MW-3, MW-5, MW-6 Monthly (SVE)
Frequency of Monitoring:	Quarterly (groundwater), Monthly (SVE and air-bubbling systems)
Is Floating Product (FP) Present On-site:	☐ Yes ☒ No
Cumulative FP Recovered to Date :	3.06 gallons, Wells MW-1, MW-2, and MW-5
FP Recovered This Quarter :	None (FP was last recovered in 1992.)
Bulk Soil Removed to Date :	1,700 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:	Air-Bubbling System
Average Depth to Groundwater:	22.3 feet
Groundwater Flow Direction and Gradient (Average):	0.03 ft/ft toward northwest

SVE QUARTERLY OPERATION AND PERFORMANCE:

Equipment Inventory:	King Buck, 200 cfm, Model MMC-6A/E, Catalytic Oxidizer SVE system was shut down on 10-10-95 due to high groundwater
Operating Mode:	not operating
BAAQMD Permit #:	9051
TPH Conc. End of Period (lab):	NA (Not Applicable)
Benzene Conc. End of Period (lab):	NA
Flowrate End of Period:	NA
HC Destroyed This Period:	0.0 pounds
HC Destroyed to Date:	56.9 pounds
Utility Usage This Period	
Electric (KWH):	Not Reported
Gas (Therms):	NA
Operating Hours This Period:	0.0 hours
Percent Operational:	0.0%
Operating Hours to Date:	1737.5 hours
Unit Maintenance:	Routine maintenance of air-bubbling system.
Number of Auto Shut Downs:	0
Destruction Efficiency Permit Requirement:	90%
Percent TPH Conversion:	NA
Average Stack Temperature:	NA
Average Source Flow:	0.0 scfm
Average Process Flow:	0.0 scfm
Average Source Vacuum:	0.0 inches of water

ATTACHMENTS:

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

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

ARCO Service Station 771
899 Rincon Avenue, Livermore, 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	TPHD LUFT Method	TOG SM 5520F	TOG SM 5520C	TOG EPA 413.2	TRPH EPA 418.1
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L
MW-1	03-20-95	451.73	24.50	427.23	ND	NW	0.03	03-20-95	90000	1800	1100	1000	5600	--	--	--	--	--	--	--
MW-1	06-02-95	451.73	25.60	426.13	ND	NNW	0.014	06-03-95	81000	2000	1400	990	4600	--	--	--	--	--	--	--
MW-1	08-23-95	451.73	29.04	422.69	ND	NNW	0.03	08-23-95	44000	2400	1900	670	3800	<300	--	--	--	--	--	--
MW-1	12-04-95	451.73	31.31	420.42	ND	NNW	0.03	12-04-95	22000	870	660	390	2200	--	100	--	--	--	--	--
MW-1	02-20-96	451.73	22.26	429.47	ND	NW	0.016	02-20-96	21000	1500	1200	650	3500	<300	--	--	--	--	--	--
MW-1	05-15-96	451.73	23.42	428.31	ND	NW	0.024	05-15-96	36000	3000	2500	960	5700	<250	--	--	--	--	--	--
MW-1	08-13-96	451.73	26.83	424.90	ND	NNW	0.03	08-13-96	19000	730	580	450	2500	<200	--	--	--	--	--	--
MW-1	11-13-96	451.73	31.05	420.68	ND	NNW	0.031	11-13-96	6600	47	16	74	160	<30	--	--	--	--	--	--
MW-1	03-26-97	451.73	26.29	425.44	ND	NNW	0.044	03-27-97	1900	100	55	37	200	<30	--	--	--	--	--	--
MW-1	05-15-97	451.73	28.65	423.08	ND	NNW	0.031	05-15-97	16000	490	250	250	1100	<120	--	--	--	--	--	--
MW-1	08-26-97	451.73	31.53	420.20	ND	NNW	0.042	08-26-97	190	6.7	3	6.3	25	<3	--	--	--	--	--	--
MW-1	11-05-97	451.73	33.93	417.80	ND	NNW	0.03	11-05-97	63	0.5	<0.5	0.8	2.4	29	--	--	--	--	--	--
MW-1	02-18-98	451.73	20.46	431.27	ND	NW	0.01	02-18-98	23000	1500	610	550	3000	<120	--	--	--	--	--	--
MW-1	05-20-98	451.73	23.84	427.89	ND	NW	0.03	05-21-98	50000	4400	1900	1400	80000	<300	--	--	--	--	--	--
MW-2	03-20-95	449.49	20.27	429.22	ND	NW	0.03	03-20-95	54000	2600	1600	1200	7600	--	--	--	--	--	--	--
MW-2	06-02-95	449.49	22.32	427.17	ND	NNW	0.014	06-03-95	37000	2200	800	980	4800	--	--	--	--	--	--	--
MW-2	08-23-95	449.49	25.69	423.80	ND	NNW	0.03	08-23-95	65000	1100	310	840	3000	<500	--	--	--	--	--	--
MW-2	12-04-95	449.49	28.52	420.97	ND	NNW	0.03	12-04-95	19000	680	150	410	1600	--	--	--	--	--	--	--
MW-2	02-20-96	449.49	19.00	430.49	ND	NW	0.016	02-20-96	22000	1200	240	590	2200	<300	--	--	--	--	--	--
MW-2	05-15-96	449.49	20.03	429.46	ND	NW	0.024	05-15-96	25000	1200	240	610	2100	<300	--	--	--	--	--	--
MW-2	08-13-96	449.49	24.44	425.05	ND	NNW	0.03	08-13-96	19000	640	110	420	1200	<300	--	--	--	--	--	--
MW-2	11-13-96	449.49	28.42	421.07	ND	NNW	0.031	11-13-96	15000	260	52	220	640	<200	--	--	--	--	--	--
MW-2	03-26-97	449.49	22.98	426.51	ND	NNW	0.044	03-27-97	17000	580	120	360	980	<120	--	--	--	--	--	--
MW-2	05-15-97	449.49	25.40	424.09	ND	NNW	0.031	05-15-97	18000	420	63	340	730	<120	--	--	--	--	--	--
MW-2	08-26-97	449.49	28.38	421.11	ND	NNW	0.042	08-26-97	5300	210	26	140	270	<120	--	--	--	--	--	--
MW-2	11-05-97	449.49	31.93	417.56	ND	NNW	0.03	11-05-97	560	42	2.6	7	9	<40	--	--	--	--	--	--
MW-2	02-18-98	449.49	16.87	432.62	ND	NW	0.01	02-18-98	18000	710	120	480	1100	130	--	--	--	--	--	--
MW-2	05-20-98	449.49	20.29	429.20	ND	NW	0.03	05-21-98	16000	480	72	440	1100	<120	--	--	--	--	--	--

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		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L
MW-3	03-20-95	450.28	22.19	428.09	ND	NW	0.03	03-20-95	94	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--
MW-3	06-02-95	450.28	23.28	427.00	ND	NNW	0.014	06-02-95	72	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--
MW-3	08-23-95	450.28	26.55	423.73	ND	NNW	0.03	08-23-95	98	<0.5	<0.5	<0.6	0.5	<3	--	--	--	--	--	--
MW-3	12-04-95	450.28	29.52	420.76	ND	NNW	0.03	12-04-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--
MW-3	02-20-96	450.28	19.83	430.45	ND	NW	0.016	02-20-96	130	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-3	05-15-96	450.28	21.03	429.25	ND	NW	0.024	05-15-96	120	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--
MW-3	08-13-96	450.28	25.67	424.61	ND	NNW	0.03	08-13-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-3	11-13-96	450.28	21.57	428.71	ND	NNW	0.031	11-13-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-3	03-26-97	450.28	24.15	426.13	ND	NNW	0.044	03-26-97	<50	1.1	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-3	05-15-97	450.28	26.85	423.43	ND	NNW	0.031	05-15-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-3	08-26-97	450.28	30.07	420.21	ND	NNW	0.042	08-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-3	11-05-97	450.28	32.46	417.82	ND	NNW	0.03	11-05-97	<50	<0.5	0.7	<0.5	<0.5	<3	--	--	--	--	--	--
MW-3	02-18-98	450.28	17.82	432.46	ND	NW	0.01	02-18-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-3	05-20-98	450.28	21.41	428.87	ND	NW	0.03	05-21-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-4	03-20-95	451.09	22.68	428.41	ND	NW	0.03	03-20-95	12000	1000	100	450	700	--	--	--	--	--	--	--
MW-4	06-02-95	451.09	24.41	426.68	ND	NNW	0.014	06-02-95	9000	850	56	380	430	--	--	--	--	--	--	--
MW-4	08-23-95	451.09	27.72	423.37	ND	NNW	0.03	08-23-95	5300	400	25	240	170	<100	--	--	--	--	--	--
MW-4	12-04-95	451.09	29.85	421.24	ND	NNW	0.03	12-04-95	6700	100	<10	90	38	--	--	--	--	--	--	--
MW-4	02-20-96	451.09	21.16	429.93	ND	NW	0.016	02-20-96	7000	360	22	180	160	<70	--	--	--	--	--	--
MW-4	05-15-96	451.09	22.18	428.91	ND	NW	0.024	05-15-96	Not sampled: well sampled annually, during the first quarter											
MW-4	08-13-96	451.09	26.20	424.89	ND	NNW	0.03	08-13-96	Not sampled: well sampled annually, during the first quarter											
MW-4	11-13-96	451.09	29.72	421.37	ND	NNW	0.031	11-13-96	Not sampled: well sampled annually, during the first quarter											
MW-4	03-26-97	451.09	21.86	429.23	ND	NNW	0.044	03-27-97	8900	390	33	200	250	<70	--	--	--	--	--	--
MW-4	05-15-97	451.09	26.92	424.17	ND	NNW	0.031	05-15-97	Not sampled: well sampled annually, during the first quarter											
MW-4	08-26-97	451.09	29.30	421.79	ND	NNW	0.042	08-26-97	Not sampled: well sampled annually, during the first quarter											
MW-4	11-05-97	451.09	32.14	418.95	ND	NNW	0.03	11-05-97	Not sampled: well sampled annually, during the first quarter											
MW-4	02-18-98	451.09	19.30	431.79	ND	NW	0.01	02-18-98	5300	220	19	160	130	120	--	--	--	--	--	--
MW-4	05-20-98	451.09	22.40	428.69	ND	NW	0.03	05-21-98	Not sampled: well sampled annually, during the first quarter											

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		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L
MW-5	03-20-95	451.40	23.20	428.20	ND	NW	0.03	03-20-95	26000	1300	180	890	2900	--	--	--	--	--	--	--
MW-5	06-02-95	451.40	24.80	426.60	ND	NNW	0.014	06-02-95	39000	940	160	740	1900	--	--	--	--	--	--	--
MW-5	08-23-95	451.40	28.10	423.30	ND	NNW	0.03	08-23-95	14000	490	74	250	890	<300	--	--	--	--	--	--
MW-5	12-04-95	451.40	29.83	421.57	ND	NNW	0.03	12-04-95	7600	230	13	61	80	--	--	--	--	--	--	--
MW-5	02-20-96	451.40	21.63	429.77	ND	NW	0.016	02-20-96	4300	220	12	45	130	<50	--	--	--	--	--	--
MW-5	05-15-96	451.40	22.87	428.53	ND	NW	0.024	05-15-96	2200	380	17	58	84	<40	--	--	--	--	--	--
MW-5	08-13-96	451.40	26.48	424.92	ND	NNW	0.03	08-13-96	1700	150	16	24	35	47	--	--	--	--	--	--
MW-5	11-13-96	451.40	29.68	421.72	ND	NNW	0.031	11-13-96	850	150	11	19	37	66	--	--	--	--	--	--
MW-5	03-26-97	451.40	25.14	426.26	ND	NNW	0.044	03-26-97	2400	440	21	79	210	68	--	--	--	--	--	--
MW-5	05-15-97	451.40	27.38	424.02	ND	NNW	0.031	05-15-97	3900	510	19	140	240	48	--	--	--	--	--	--
MW-5	08-26-97	451.40	29.89	421.51	ND	NNW	0.042	08-26-97	76	4.9	<0.5	1.5	2	9	--	--	--	--	--	--
MW-5	11-05-97	451.40	32.57	418.83	ND	NNW	0.03	11-05-97	63	0.8	<0.5	<0.5	1.2	34	--	--	--	--	--	--
MW-5	02-18-98	451.40	19.99	431.41	ND	NW	0.01	02-18-98	6200	630	70	320	640	320	--	--	--	--	--	--
MW-5	05-20-98	451.40	23.21	428.19	ND	NW	0.03	05-21-98	2300	340	21	110	140	62	--	--	--	--	--	--
MW-6	03-20-95	451.37	25.19	426.18	ND	NW	0.03	03-20-95	2600	210	87	82	140	--	--	2000	--	--	--	1.7
MW-6	06-02-95	451.37	25.75	425.62	ND	NNW	0.014	06-02-95	1600	55	7.9	40	26	--	--	1200	--	--	--	1
MW-6	08-23-95	451.37	29.53	421.84	ND	NNW	0.03	08-23-95	1400	42	2.5	36	13	<20	--	530	--	--	--	1.6
MW-6	12-04-95	451.37	32.28	419.09	ND	NNW	0.03	12-04-95	2500	52	5.8	59	13	--	--	1100	--	--	--	1.5
MW-6	02-20-96	451.37	22.27	429.10	ND	NW	0.016	02-20-96	2500	120	16	73	12	<30	--	--	--	--	--	1.8
MW-6	05-15-96	451.37	23.86	427.51	ND	NW	0.024	05-15-96	2000	71	6.4	47	25	<15	--	--	--	--	--	--
MW-6	08-13-96	451.37	28.55	422.82	ND	NNW	0.03	08-13-96	3800	91	8.2	69	25	<20	--	--	--	--	--	--
MW-6	11-13-96	451.37	32.04	419.33	ND	NNW	0.031	11-13-96	1900	55	3.3	55	8.5	16	--	--	--	--	--	--
MW-6	03-26-97	451.37	26.84	424.53	ND	NNW	0.044	03-26-97	1800	51	5	32	15	<30	--	--	--	--	--	--
MW-6	05-15-97	451.37	29.58	421.79	ND	NNW	0.031	05-15-97	2400	46	3	29	9	<12	--	--	--	--	--	--
MW-6	08-26-97	451.37	32.67	418.70	ND	NNW	0.042	08-26-97	1400	61	6	33	10	<12	--	--	--	--	--	--
MW-6	11-05-97	451.37	34.62	416.75	ND	NNW	0.03	11-05-97	690	29	2.7	18	3.4	9	--	--	--	--	--	--
MW-6	02-18-98	451.37	20.09	431.28	ND	NW	0.01	02-18-98	1800	74	5	24	12	19	--	--	--	--	--	--
MW-6	05-20-98	451.37	24.05	427.32	ND	NW	0.03	05-21-98	1900	280	4	31	16	9	--	--	--	--	--	--

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		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L
MW-7	03-20-95	450.33	22.07	428.26	ND	NW	0.03	03-20-95	31000	2300	400	620	2900	--	--	--	--	--	--	--
MW-7	06-02-95	450.33	23.42	426.91	ND	NNW	0.014	06-03-95	40000	1400	280	610	2400	--	--	--	--	--	--	--
MW-7	08-23-95	450.33	27.13	423.20	ND	NNW	0.03	08-23-95	25000	1400	200	600	1600	350	--	--	--	--	--	--
MW-7	12-04-95	450.33	29.45	420.88	ND	NNW	0.03	12-04-95	23000	1100	74	490	720	--	--	--	--	--	--	--
MW-7	02-20-96	450.33	20.25	430.08	ND	NW	0.016	02-20-96	39000	1200	140	640	1800	<400	--	--	--	--	--	--
MW-7	05-15-96	450.33	21.38	428.95	ND	NW	0.024	05-15-96	Not sampled: well sampled annually, during the first quarter											
MW-7	08-13-96	450.33	25.52	424.81	ND	NNW	0.03	08-13-96	Not sampled: well sampled annually, during the first quarter											
MW-7	11-13-96	450.33	29.38	420.95	ND	NNW	0.031	11-13-96	Not sampled: well sampled annually, during the first quarter											
MW-7	03-26-97	450.33	24.36	425.97	ND	NNW	0.044	03-27-97	35000	1100	180	460	1700	<300	--	--	--	--	--	--
MW-7	05-15-97	450.33	26.90	423.43	ND	NNW	0.031	05-15-97	Not sampled: well sampled annually, during the first quarter											
MW-7	08-26-97	450.33	30.21	420.12	ND	NNW	0.042	08-26-97	Not sampled: well sampled annually, during the first quarter											
MW-7	11-05-97	450.33	32.49	417.84	ND	NNW	0.03	11-05-97	Not sampled: well sampled annually, during the first quarter											
MW-7	02-18-98	450.33	18.10	432.23	ND	NW	0.01	02-18-98	19000	1100	120	460	1700	240	--	--	--	--	--	--
MW-7	05-20-98	450.33	21.68	428.65	ND	NW	0.03	05-21-98	Not sampled: well sampled annually, during the first quarter											
MW-8	03-20-95	449.43	24.75	424.68	ND	NW	0.03	03-20-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--
MW-8	06-02-95	449.43	24.95	424.48	ND	NNW	0.014	06-02-95	Not sampled: well sampled semi-annually, during the first and third quarters											
MW-8	08-23-95	449.43	30.94	418.49	ND	NNW	0.03	08-23-95	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-8	12-04-95	449.43	31.99	417.44	ND	NNW	0.03	12-04-95	Not sampled: well sampled semi-annually, during the first and third quarters											
MW-8	02-20-96	449.43	21.13	428.30	ND	NW	0.016	02-20-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-8	05-15-96	449.43	21.96	427.47	ND	NW	0.024	05-15-96	Not sampled: well sampled semi-annually, during the first and third quarters											
MW-8	08-13-96	449.43	30.20	419.23	ND	NNW	0.03	08-13-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-8	11-13-96	449.43	33.24	416.19	ND	NNW	0.031	11-13-96	Not sampled: well sampled semi-annually, during the first and third quarters											
MW-8	03-26-97	449.43	26.85	422.58	ND	NNW	0.044	03-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-8	05-15-97	449.43	29.69	419.74	ND	NNW	0.031	05-15-97	Not sampled: well sampled semi-annually, during the first and third quarters											
MW-8	08-26-97	449.43	34.00	415.43	ND	NNW	0.042	08-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-8	11-05-97	449.43	35.94	413.49	ND	NNW	0.03	11-05-97	Not sampled: well sampled semi-annually, during the first and third quarters											
MW-8	02-18-98	449.43	18.18	431.25	ND	NW	0.01	02-18-98	<50	0.6	0.6	<0.5	1.1	<3	--	--	--	--	--	--
MW-8	05-20-98	449.43	22.85	426.58	ND	NW	0.03	05-21-98	Not sampled: well sampled semi-annually, during the first and third quarters											

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Historical Groundwater Elevation and Analytical Data
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1995 - Present*

ARCO Service Station 771
899 Rincon Avenue, Livermore, 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	TPHD LUFT Method	TOG SM 5520F	TOG SM 5520C	TOG EPA 413.2	TRPH EPA 418.1
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L
MW-9	03-20-95	449.21	19.11	430.10	ND	NW	0.03	03-20-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--
MW-9	06-02-95	449.21	21.23	427.98	ND	NNW	0.014	06-02-95	Not sampled: well sampled semi-annually, during the first and third quarters											
MW-9	08-23-95	449.21	24.33	424.88	ND	NNW	0.03	08-23-95	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-9	12-04-95	449.21	27.90	421.31	ND	NNW	0.03	12-04-95	Not sampled: well sampled semi-annually, during the first and third quarters											
MW-9	02-20-96	449.21	17.86	431.35	ND	NW	0.016	02-20-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-9	05-15-96	449.21	18.69	430.52	ND	NW	0.024	05-15-96	Not sampled: well sampled annually, during the first quarter											
MW-9	08-13-96	449.21	24.17	425.04	ND	NNW	0.03	08-13-96	Not sampled: well sampled annually, during the first quarter											
MW-9	11-13-96	449.21	28.01	421.20	ND	NNW	0.031	11-13-96	Not sampled: well sampled annually, during the first quarter											
MW-9	03-26-97	449.21	22.58	426.63	ND	NNW	0.044	03-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-9	05-15-97	449.21	25.12	424.09	ND	NNW	0.031	05-15-97	Not sampled: well sampled annually, during the first quarter											
MW-9	08-26-97	449.21	28.28	420.93	ND	NNW	0.042	08-26-97	Not sampled: well sampled annually, during the first quarter											
MW-9	11-05-97	449.21	31.18	418.03	ND	NNW	0.03	11-05-97	Not sampled: well sampled annually, during the first quarter											
MW-9	02-18-98	449.21	16.03	433.18	ND	NW	0.01	02-18-98	<50	0.6	0.5	<0.5	1	<3	--	--	--	--	--	--
MW-9	05-20-98	449.21	19.31	429.90	ND	NW	0.03	05-21-98	Not sampled: well sampled annually, during the first quarter											
MW-10	03-20-95	449.22	20.96	428.26	ND	NW	0.03	03-20-95	Not sampled: well sampled annually, during the third quarter											
MW-10	06-02-95	449.22	22.15	427.07	ND	NNW	0.014	06-02-95	Not sampled: well sampled annually, during the third quarter											
MW-10	08-23-95	449.22	24.47	424.75	ND	NNW	0.03	08-23-95	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-10	12-04-95	449.22	26.97	422.25	ND	NNW	0.03	12-04-95	Not sampled: well sampled annually, during the third quarter											
MW-10	02-20-96	449.22	18.40	430.82	ND	NW	0.016	02-20-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-10	05-15-96	449.22 Not surveyed: vehicle was parked on well						05-15-96	Not sampled: well sampled annually, during the first quarter											
MW-10	08-13-96	449.22	23.70	425.52	ND	NNW	0.03	08-13-96	Not sampled: well sampled annually, during the first quarter											
MW-10	11-13-96	449.22	27.15	422.07	ND	NNW	0.031	11-13-96	Not sampled: well sampled annually, during the first quarter											
MW-10	03-26-97	449.22	22.23	426.99	ND	NNW	0.044	03-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-10	05-15-97	449.22	24.57	424.65	ND	NNW	0.031	05-15-97	Not sampled: well sampled annually, during the first quarter											
MW-10	08-26-97	449.22	27.62	421.60	ND	NNW	0.042	08-26-97	Not sampled: well sampled annually, during the first quarter											
MW-10	11-05-97	449.22	30.79	418.43	ND	NNW	0.03	11-05-97	Not sampled: well sampled annually, during the first quarter											
MW-10	02-18-98	449.22	NM	NM	ND	NW	0.01	02-18-98	Not sampled: car parked on well						--	--	--	--	--	--
MW-10	05-20-98	449.22	NM	NM	ND	NW	0.03	05-21-98	Not sampled: well sampled annually, during the first quarter											

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1995 - Present*

ARCO Service Station 771
899 Rincon Avenue, Livermore, 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	TPHD LUFT Method	TOG SM 5520F	TOG SM 5520C	TOG EPA 413.2	TRPH EPA 418.1
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L
MW-11	03-20-95	448.02	25.02	423.00	ND	NW	0.03	03-20-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--
MW-11	06-02-95	448.02	23.82	424.20	ND	NNW	0.014	06-02-95	Not sampled: well sampled semi-annually, during the first and third quarters											
MW-11	08-23-95	448.02	30.15	417.87	ND	NNW	0.03	08-23-95	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-11	12-04-95	448.02	31.63	416.39	ND	NNW	0.03	12-04-95	Not sampled: well sampled semi-annually, during the first and third quarters											
MW-11	02-20-96	448.02	20.94	427.08	ND	NW	0.016	02-20-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-11	05-15-96	448.02	23.03	424.99	ND	NW	0.024	05-15-96	Not sampled: well sampled semi-annually, during the first and third quarters											
MW-11	08-13-96	448.02	29.19	418.83	ND	NNW	0.03	08-13-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-11	11-13-96	448.02	31.96	416.06	ND	NNW	0.031	11-13-96	Not sampled: well sampled semi-annually, during the first and third quarters											
MW-11	03-26-97	448.02	26.61	421.41	ND	NNW	0.044	03-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-11	05-15-97	448.02	29.39	418.63	ND	NNW	0.031	05-15-97	Not sampled: well sampled semi-annually, during the first and third quarters											
MW-11	08-26-97	448.02	33.47	414.55	ND	NNW	0.042	08-26-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	--	--	--
MW-11	11-05-97	448.02	35.12	412.90	ND	NNW	0.03	11-05-97	Not sampled: well sampled semi-annually, during the first and third quarters											
MW-11	02-18-98	448.02	18.03	429.99	ND	NW	0.01	02-18-98	<50	<0.5	<0.5	<0.5	1	<3	--	--	--	--	--	--
MW-11	05-20-98	448.02	23.00	425.02	ND	NW	0.03	05-21-98	Not sampled: well sampled semi-annually, during the first and third quarters											
RW-1	03-20-95	451.67	23.76	427.91	ND	NW	0.03	03-20-95	15000	1000	140	310	950	--	--	--	--	--	--	--
RW-1	06-02-95	451.67	25.12	426.55	ND	NNW	0.014	06-02-95	12000	1300	280	420	1100	--	--	--	--	--	--	--
RW-1	08-23-95	451.67	28.80	422.87	ND	NNW	0.03	08-23-95	8200	520	190	240	610	<50	--	--	--	--	--	--
RW-1	12-04-95	451.67	31.15	420.52	ND	NNW	0.03	12-04-95	2600	140	59	83	210	--	--	--	--	--	--	--
RW-1	02-20-96	451.67	21.45	430.22	ND	NW	0.016	02-20-96	6300	410	160.0	180	650	<40	--	--	--	--	--	--
RW-1	05-15-96	451.67	22.97	428.70	ND	NW	0.024	05-15-96	Not sampled: well sampled annually, during the first quarter											
RW-1	08-13-96	451.67	24.74	426.93	ND	NNW	0.03	08-13-96	Not sampled: well sampled annually, during the first quarter											
RW-1	11-13-96	451.67	30.69	420.98	ND	NNW	0.031	11-13-96	Not sampled: well sampled annually, during the first quarter											
RW-1	03-26-97	451.67	25.69	425.98	ND	NNW	0.044	03-26-97	500	57	3	6.4	18	54	--	--	--	--	--	--
RW-1	05-15-97	451.67	28.19	423.48	ND	NNW	0.031	05-15-97	Not sampled: well sampled annually, during the first quarter											
RW-1	08-26-97	451.67	31.21	420.46	ND	NNW	0.042	08-26-97	Not sampled: well sampled annually, during the first quarter											
RW-1	11-05-97	451.67	33.67	418.00	ND	NNW	0.03	11-05-97	Not sampled: well sampled annually, during the first quarter											
RW-1	02-18-98	451.67	20.14	431.53	ND	NW	0.01	02-18-98	9400	200	70	190	710	<60	--	--	--	--	--	--
RW-1	05-20-98	451.67	23.43	428.24	ND	NW	0.03	05-21-98	Not sampled: well sampled annually, during the first quarter											

Table 1
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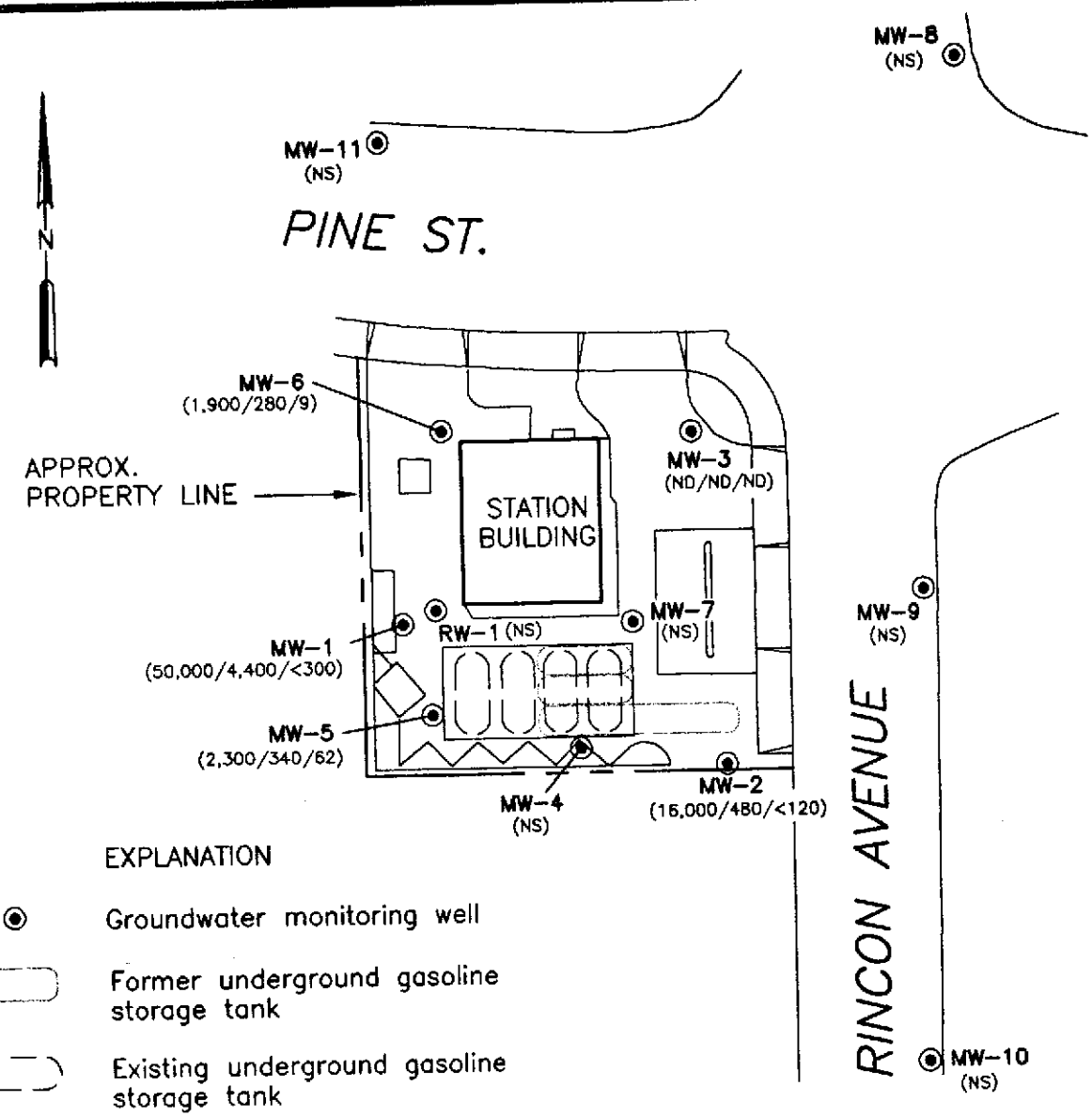
Petroleum Hydrocarbons and Their Constituents
1995 - Present*

ARCO Service Station 771
899 Rincon Avenue, Livermore, 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	TPHD LUFT Method	TOG SM 5520F	TOG SM 5520C	TOG EPA 413.2	TRPH EPA 418.1
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L

ft-MSL: elevation in feet, relative to mean sea level
MWN: ground-water flow direction and gradient apply to the entire monitoring well network
ft/ft: foot per foot
TPHG: total petroleum hydrocarbons as gasoline, California DHS LUFT Method
µg/L: micrograms per liter
EPA: United States Environmental Protection Agency
MTBE: Methyl tert-butyl ether
TOG: total oil and grease
mg/L: milligrams per liter
SM: standard method
TRPH: total recoverable petroleum hydrocarbons
NR: not reported; data not available
ND: none detected
NM: not measured; car parked on well
NW: northwest
- -: not analyzed or not applicable
*: For previous historical groundwater elevation and analytical data please refer to *Fourth Quarter 1995 Groundwater Monitoring Program Results and Remediation System Performance Evaluation Report, ARCO Service Station 771, Livermore, California*, (EMCON, March 1, 1996).

Pinnacle



EXPLANATION

- ◉ Groundwater monitoring well
- Former underground gasoline storage tank
- Existing underground gasoline storage tank
- (1,900/280/9) Concentration of total petroleum hydrocarbons as gasoline (TPHG), benzene, and MTBE in groundwater (ug/L); samples collected 5/20/98
- ND Not detected at or above the method reporting limit for TPHG (50 ug/L), benzene (0.5 ug/L), or MTBE (3 ug/L)
- < Method reporting limit raised due to high analyte concentration requiring sample dilution or matrix interference
- NS Not sampled

0 50 100

SCALE IN FEET
(Approximate)

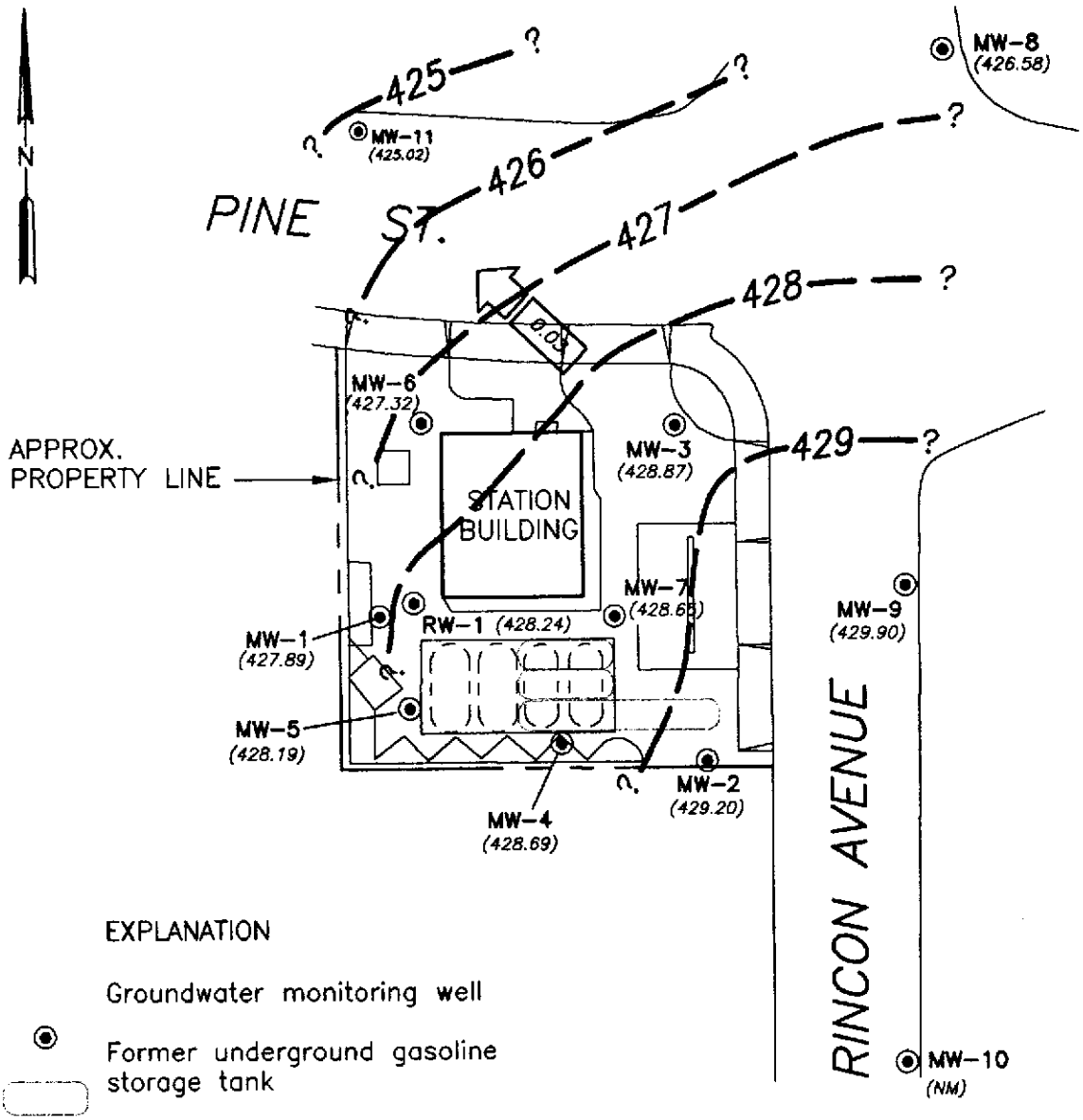
IMAGE Files: <No Images>
XREF Files: <No Xrefs>
Dimscale: 50 Ltscale: 50 Psltscale: 0
SANJOSE/CADD: N:\DWG\PINACL\771\771CHEM.DWG Wed, 30/Sep/98 04:34pm kblack

1" 1/2" 0" 1"

Pinnacle
ENVIRONMENTAL SOLUTIONS
A DIVISION OF EMCON

DATE SEPT. 1998
DWN KAB
APP
REV 0
PROJECT NO.
20805-122.005

FIGURE 1
ARCO PRODUCTS COMPANY
SERVICE STATION 771, 899 RINCON AVE.
LIVERMORE, CALIFORNIA
GROUNDWATER ANALYTICAL SUMMARY
SECOND QUARTER 1998



EXPLANATION

- Groundwater monitoring well
- Former underground gasoline storage tank
- Existing underground gasoline storage tank
- (428.19) Groundwater elevation (Ft.–MSL); measured 5/20/98
- Groundwater elevation contour (Ft.–MSL)
- Approximate direction of groundwater flow showing gradient
- NM Not measured

0 50 100

SCALE IN FEET
(Approximate)

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ENVIRONMENTAL SOLUTIONS
A DIVISION OF EMCON

DATE SEPT. 1998
DWN KAB
APP
REV 0
PROJECT NO.
20805-122.005

FIGURE 2
ARCO PRODUCTS COMPANY
SERVICE STATION 771, 899 RINCON AVE.
LIVERMORE, CALIFORNIA
GROUNDWATER ELEVATION CONTOURS
SECOND QUARTER 1998

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 REPORTS, AND CHAIN OF CUSTODY DOCUMENTATION

Columbia Analytical Services inc.

June 5, 1998 Service Request No.: S9801278

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

RE: 20805-122.004/TO#22312.00/RAT8/771 LIVERMORE

Dear Mr. Vanderveen:

The following pages contain analytical results for sample(s) received by the laboratory on May 21, 1998. Results of sample analyses are followed by Appendix A which contains sample custody documentation and quality assurance deliverables requested for this project. The work requested has been assigned the Service Request No. listed above. To help expedite our service, please refer to this number when contacting the laboratory.

Analytical results were produced by procedures consistent with Columbia Analytical Services' (CAS) Quality Assurance Manual (with any deviations noted). Signature of this CAS Analytical Report below confirms that pages 2 through 13, following, have been thoroughly reviewed and approved for release in accord with CAS Standard Operating Procedure ADM-DatRev3.

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

Sincerely,

Bernadette T. Cox for

Steven L. Green
Project Chemist

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:**	S9801278
Project:	20805-122.004/TO#22312.00/RAT8/771 LIVERMORE	**Date Collected:**	5/20/98
Sample Matrix:	Water	**Date Received:**	5/21/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-1(32)	Units:	ug/L (ppb)
Lab Code:	S9801278-001	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	100	NA	5/26/98	50000	
Benzene	EPA 5030	8020	0.5	100	NA	5/26/98	4400	
Toluene	EPA 5030	8020	0.5	100	NA	5/26/98	1900	
Ethylbenzene	EPA 5030	8020	0.5	100	NA	5/26/98	1400	
Xylenes, Total	EPA 5030	8020	0.5	100	NA	5/26/98	80000	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	100	NA	5/26/98	<300	C1

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

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9801278
Project:	20805-122.004/TO#22312.00/RAT8/771 LIVERMORE	**Date Collected:**	5/20/98
Sample Matrix:	Water	**Date Received:**	5/21/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-2(28)	Units:	ug/L (ppb)
Lab Code:	S9801278-002	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	40	NA	5/24/98	16000	
Benzene	EPA 5030	8020	0.5	40	NA	5/24/98	480	
Toluene	EPA 5030	8020	0.5	40	NA	5/24/98	72	
Ethylbenzene	EPA 5030	8020	0.5	40	NA	5/24/98	440	
Xylenes, Total	EPA 5030	8020	0.5	40	NA	5/24/98	1100	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	40	NA	5/24/98	<120	C1

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

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9801278
Project:	20805-122.004/TO#22312.00/RAT8/771 LIVERMORE	**Date Collected:**	5/20/98
Sample Matrix:	Water	**Date Received:**	5/21/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-3(34)	Units:	ug/L (ppb)
Lab Code:	S9801278-003	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	5/24/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	5/24/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	5/24/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	5/24/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	5/24/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	5/24/98	ND	

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	9801278
Project:	20805-122.004/TO#22312.00/RAT8/771 LIVERMORE	**Date Collected:**	5/20/98
Sample Matrix:	Water	**Date Received:**	5/21/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-5(36)	Units:	ug/L (ppb)
Lab Code:	S9801278-004	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	10	NA	5/26/98	2300	
Benzene	EPA 5030	8020	0.5	10	NA	5/26/98	340	
Toluene	EPA 5030	8020	0.5	10	NA	5/26/98	21	
Ethylbenzene	EPA 5030	8020	0.5	10	NA	5/26/98	110	
Xylenes, Total	EPA 5030	8020	0.5	10	NA	5/26/98	140	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	10	NA	5/26/98	62	

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9801278
Project:	20805-122.004/TO#22312.00/RAT8/771 LIVERMORE	**Date Collected:**	5/20/98
Sample Matrix:	Water	**Date Received:**	5/21/98

BTEX, MTBE and TPH as Gasoline

Sample Name:	MW-6(39)	Units:	ug/L (ppb)
Lab Code:	S9801278-005	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	2	NA	5/26/98	1900	
Benzene	EPA 5030	8020	0.5	2	NA	5/26/98	280	
Toluene	EPA 5030	8020	0.5	2	NA	5/26/98	4	
Ethylbenzene	EPA 5030	8020	0.5	2	NA	5/26/98	31	
Xylenes, Total	EPA 5030	8020	0.5	2	NA	5/26/98	16	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	2	NA	5/26/98	9	

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9801278
Project:	20805-122.004/TO#22312.00/RAT8/771 LIVERMORE	**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:	S980523-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	5/23/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	5/23/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	5/23/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	5/23/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	5/23/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	5/23/98	ND	

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	**Service Request:**	S9801278
Project:	20805-122.004/TO#22312.00/RAT8/771 LIVERMORE	**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:	S980526-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	5/26/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	5/26/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	5/26/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	5/26/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	5/26/98	ND	
Methyl *tert*-Butyl Ether	EPA 5030	8020	3	1	NA	5/26/98	ND	

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO Products Company	**Service Request:**	S9801278
Project:	20805-122.004/TO#22312.00/RAT8/771 LIVERMORE	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	NA

Surrogate Recovery Summary
BTEX, MTBE and TPH as Gasoline

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

Sample Name	Lab Code	Test Notes	Percent Recovery	
			4-Bromofluorobenzene	a,a,a-Trifluorotoluene
MW-1(32)	S9801278-001		106	102
MW-2(28)	S9801278-002		98	108
MW-3(34)	S9801278-003		100	100
MW-5(36)	S9801278-004		105	101
MW-6(39)	S9801278-005		88	108 B1
MW-3(34)	S9801278-003MS		98	108
MW-3(34)	S9801278-003DMS		96	107
Method Blank	S980523-WB1		100	112
Method Blank	S980526-WB1		100	105
	CAS Acceptance Limits:		69-116	69-116

B1 The surrogate used for this sample was 4-Bromofluorobenzene.

SUR2/020397p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-122.004/TO#22312.00/RAT8/771 LIVERMORE
Sample Matrix Water

Service Request: S9801278
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 5/24/98

Matrix Spike/Duplicate Matrix Spike Summary
TPH as Gasoline

Sample Name: MW-3(34)
Lab Code: S9801278-003MS, S9801278-003DMS
Test Notes:

Units: ug/L (ppb)
Basis: NA

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

DMS/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 20805-122.004/TO#22312.00/RAT8/771 LIVERMORE

Service Request: 89801278
Date Analyzed: 5/23/98

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	270	90-110	108	
Benzene	EPA 5030	8020	25	23	85-115	92	
Toluene	EPA 5030	8020	25	23	85-115	92	
Ethylbenzene	EPA 5030	8020	25	23	85-115	92	
Xylenes, Total	EPA 5030	8020	75	70	85-115	93	
Methyl *tert*-Butyl Ether	EPA 5030	8020	25	24	85-115	96	

ICV032196

ARCO Products Company

Division of Atlantic/Richfield Company

Task Order No. 22312.00

Chain of Custody

ARCO Facility no. 0771	City (Facility) Livermore	Project manager (Consultant) Glen Vanderveen	Laboratory Name CAS
ARCO engineer Paul Vanderveen	Telephone no. (ARCO)	Telephone no. (Consultant) (408)453-7300	Fax no. (Consultant) (408)437-9526
Consultant name EMCON	Address (Consultant) 1921 Ringwood Ave. San Jose, CA 95131		Contract Number

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH 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-1(32)	1	2		X		X	HCl	5/20/98	1435		X									
MW-2(28)	2	2		X		X	HCl	5/20/98	1305		X									
MW-3(34)	3	2		X		X	HCl	5/20/98	1225		X									
MW-5(36)	4	2		X		X	HCl	5/20/98	1520		X									
MW-6(37)	5	2		X		X	HCl	5/20/98	1355		X									

Laboratory Name: CAS

Contract Number:

Method of shipment: Sampler will deliver

Special Detection Limit/reporting: Lowest Possible

Special QA/QC: As Normal

Remarks: 2-40ml HCl VOAs RAT 6

20805-122.004

Lab Number: 59801278

Turnaround Time:

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

Dec 6-4-98

Condition of sample:

Temperature received:

	Date	Time		Date	Time
Relinquished by sampler	5/21/98	1315	Received by	5/21/98	1320
Relinquished by			Received by		
Relinquished by			Received by laboratory		

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

11102

APPENDIX C

FIELD DATA SHEETS

OWT - Groundwater Sampling and Analysis Request Form

PROJECT NAME : **ARCO STATION 771**
899 Rincon Avenue, Livermore

Sampling Project #: **21775-213.003**
Reporting Project #: **20805-122.004**

DATE REQUESTED : **20-May-98**

Project Manager: **Glen Vanderveen**

Groundwater Monitoring Instructions	Treatment System Instructions
Quarterly Monitoring- Second Month Of The Quarter You will need a water trailer for purge water transport. Some wells are under 3' diameter lids. **Bring a 3/4" socket to access these wells. All bolts must be replaced after well has been accessed. Bring air gun attachment and blow out any debris that may prevent this.** Perform a water level survey prior to sampling (See ARCO SOP). The survey points are the tops of the welll casings. Purge three (3) casing volumes. Sample all wells regardless of product per John Young's request. **Please use the Reporting Project Number (#20805-122.004) on the chain-of-custody, sample containers, and analytical results.** Sample ID's on the chain-of-custody, and the sample containers must include the depth at which the sample was collected [i.e. MW-1(30)].	There is a treatment system at this site. The SVE system has been shut down, but the air bubbling system is still active. Lisle operates this unit. Lisle Rath Pager # (888) 606-0933

Site Contact: **Jerry Shields** Site Phone: **(510) 447- 1329** Well Locks: **ARCO Key**

Well ID or Source	Casing Diameter (inches)	Casing Length (feet)	Top Of Screen (feet)	Analyses Requested
MW-10	2.0	36.1		
MW-9	2.0	40.2	29.5	
MW-11	2.0	38.6		**Depth to Water**
MW-8	2.0	41.7	27.5	
MW-4	4.0	41.1	26.0	**Depth to Floating Product**
MW-7	4.0	39.7	30.0	
RW-1	6.0	39.7	25.0	**Floating Product Thickness**
MW-3	4.0	39.6		
MW-2	4.0	37.9	30.0	**Total Depth**
MW-6	4.0	43.3		
MW-1	4.0	40.6	32.0	**Well Integrity**
MW-5	4.0	40.2	31.5	
Above wells in indicated order				
MW-3				
MW-2				**Dissolved Oxygen**
MW-6		(See Above)		**TPH- Gasoline**
MW-1				**BTEX**
MW-5				**MTBE by EPA 8020**
Above wells in indicated order				(Fill 2- 40ml HCL VOAs)

Laboratory Instructions: Provide lowest detection limits possible.
Please use the EMCON Reporting Project Number **(#20805-122.004)** on the CAR.

ND = None Detected IP = Intermitent Product

FIELD REPORT
DEPTH TO WATER / FLOATING PRODUCT SURVEY

PROJECT # : 21775-213.003 STATION ADDRESS : 899 Rincon Avenue, Livermore DATE : 20-May-98

ARCO STATION # : 771 FIELD TECHNICIAN : Mike Ross DAY : Wednesday

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-10	IW	IW	YES	ARCO	LWC	IW	IW	IW	IW	IW	
2	MW-9	OK	Yes	NO		LWC	19.31	19.31	NO	NO	39.1	
3	MW-11	OK	NO	YES		LWC	23.00	23.00	NO	NO	38.6	UNDER PRESSURE
4	MW-8	OK	YES	NO		LWC	22.85	22.85	NO	NO	41.6	NEEDS NEW WELL BOX
5	MW-4	OK	NO	NO	NONE	LWC	22.40	22.40	NO	NO	41.3	NO BOLTS IN LID
6	MW-7	OK	NO	NO	NONE	SLIP	21.68	21.68	NO	NO	39.7	NO BOLTS IN LID
7	RW-1	OK	NO	YES	NONE	SLIP	23.43	23.43	NO	NO	39.8	NO BOLTS IN LID
8	MW-3	OK	YES	YES		LWC	21.41	21.41	NO	NO	39.6	
9	MW-2	OK	NO	NO	NONE	LWC	20.29	20.29	NO	NO	34.2	NO BOLTS IN LID
10	MW-6	OK	YES	YES	NONE	LWC	24.05	24.05	NO	NO	43.2	
11	MW-1	OK	YES	NO	NONE	LWC	23.89	23.89	NO	NO	36.7	
12	MW-5	OK	NO	NO	NONE	SLIP	23.21	23.21	NO	NO	40.2	NO BOLTS IN LID
13	VW-1	OK	NO	NO	NONE	LWC	21.83	21.83	NO	NO	28.4	NO BOLTS IN LID

SURVEY POINTS ARE TOP OF WELL CASINGS

WATER SAMPLE FIELD DATA SHEET

Rev 1/97

OWT

PROJECT NO 21775-213.003 | SAMPLE ID MW-1 (32)
PURGED BY M. Ross | CLIENT NAME ARCO 721
SAMPLED BY M. Ross | LOCATION Livermore, Ca

TYPE Groundwater ✓ Surface Water ____ Leachate ____ Other ____
CASING DIAMETER (inches) 2 ____ 3 ____ 4 ✓ 4.5 ____ 6 ____ Other ____

CASING ELEVATION (feet/MSL)	NR	VOLUME IN CASING (gal.)	8.34
DEPTH OF WELL (feet)	36.7	CALCULATED PURGE (gal.)	25.04
DEPTH OF WATER (feet)	23.92	ACTUAL PURGE VOL. (gal.)	25.5

DATE PURGED 5/20/98 | END PURGE 1427
DATE SAMPLED 5/20/98 | SAMPLING TIME 1435

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1415	8.5	7.22	879	69.5	clr	clr
1419	17.0	7.19	742	71.7	clr	clr
1427	25.5	7.15	820	71.2	clr	clr

OTHER: D.O. 0.5 mg/L ODOR: Slight NR (COBALT 0-100) NR (NTU 0-200)

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

PURGING EQUIPMENT

____ 2" Bladder Pump ____ 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: Disposable

WELL INTEGRITY: OK LOCK: ARCO

REMARKS: ____

pH, E.C., Temp. Meter Calibration: Date 5/20/98 Time: 1145 Meter Serial No.: 600112
E.C. 1000 ____ / ____ pH 7 ____ / ____ pH 10 ____ / ____ pH 4 ____ / ____
Temperature °F See MW-3
SIGNATURE: Mike Ross REVIEWED BY: MA PAGE 1 OF 5

WATER SAMPLE FIELD DATA SHEET

Rev 1/97

OWT

PROJECT NO 21775-213.003 SAMPLE ID MW-2(28)
PURGED BY M. Ross CLIENT NAME ARCO 771
SAMPLED BY M. Ross LOCATION Livermore Ca

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

CASING ELEVATION (feet/MSL)	NR	VOLUME IN CASING (gal.)	9.0
DEPTH OF WELL (feet)	34.2	CALCULATED PURGE (gal.)	27.02
DEPTH OF WATER (feet)	20.31	ACTUAL PURGE VOL. (gal.)	27.5

DATE PURGED 5/20/98 END PURGE 1256
DATE SAMPLED 5/20/98 SAMPLING TIME 1305

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1247	9.5	6.97	944	70.4	clr	clr
1251	18.5	6.99	928	72.0	clr	clr
1256	27.5	7.04	926	71.8	clr	clr

OTHER: D.O. 0.7 mg/L ODOR: Strong COLOR: NR (COBALT 0-100) TURBIDITY: NR (NTU 0-200)

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

PURGING EQUIPMENT

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

SAMPLING EQUIPMENT

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

WELL INTEGRITY: OK LOCK: Arco

REMARKS:

pH, E.C., Temp. Meter Calibration: Date 5/20/98 Time 1145 Meter Serial No. 600112
E.C. 1000 ____ / ____ pH 7 ____ / ____ pH 10 ____ / ____ pH 4 ____ / ____
Temperature °F ____

See MW-3

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

WATER SAMPLE FIELD DATA SHEET

Rev 1/97

OWT

PROJECT NO 21775-213.003 | SAMPLE ID MW-3(34)
PURGED BY M. Ross | CLIENT NAME ARCO 771
SAMPLED BY M. Ross | LOCATION Livermore, Ca

TYPE Groundwater ✓ Surface Water ____ Leachate ____ Other ____

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

CASING ELEVATION (feet/MSL)	NR	VOLUME IN CASING (gal.)	11.88
DEPTH OF WELL (feet)	39.6	CALCULATED PURGE (gal.)	~~8.91~~ 35.62
DEPTH OF WATER (feet)	21.41	ACTUAL PURGE VOL. (gal.)	36.0

DATE PURGED: 5/20/98 | END PURGE: 1218
DATE SAMPLED: 5/20/98 | SAMPLING TIME: 1225

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1206	12.0	6.97	1039	67.3	clr	clr
1212	24.0	7.30	1007	68.8	clr	clr
1218	36.0	7.26	974	69.5	clr	clr

OTHER: D.O. 2.0 mg/L ODOR: None | NR (COBALT 0-100) | NR (NTU 0-200)

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

PURGING EQUIPMENT

____ 2" Bladder Pump | ____ 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: Disposable

WELL INTEGRITY: OK | LOCK: ARCO

REMARKS: ____

pH, E.C., Temp. Meter Calibration: Date: 5/20/98 Time: 1145 Meter Serial No: 600112
E.C. 1000 1023 | 1000 pH 7 7.09 | 7.00 pH 10 10.13 | 10.00 pH 4 4.05 | 4.00
Temperature °F 71.4
SIGNATURE: [signature] REVIEWED BY: MA PAGE 3 OF 5

WATER SAMPLE FIELD DATA SHEET

Rev 1/97

OWT

PROJECT NO 21775-213,003 | SAMPLE ID MW-5 (36)
PURGED BY M. Ross | CLIENT NAME ARCO 771
SAMPLED BY M. Ross | LOCATION Livermore, Ca

TYPE Groundwater ✓ Surface Water ____ Leachate ____ Other ____

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

CASING ELEVATION (feet/MSL)	NR	VOLUME IN CASING (gal.)	11.11
DEPTH OF WELL (feet)	40.2	CALCULATED PURGE (gal.)	33.33
DEPTH OF WATER (feet)	23.19	ACTUAL PURGE VOL. (gal.)	33.5

DATE PURGED: 5/20/98 | END PURGE: 1509
DATE SAMPLED: 5/20/98 | SAMPLING TIME: 1520

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1456	11.5	8.14	780	70.9	clr	clr
1501	22.5	7.35	1006	70.3	clr	clr
1509	33.5	7.43	1030	69.6	clr	clr

OTHER: D.O. 0.5 mg/L ODOR: None

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

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

PURGING EQUIPMENT

____ 2" Bladder Pump ____ 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: Disposable

WELL INTEGRITY: OK LOCK: ARCO

REMARKS: ____

pH, E.C., Temp. Meter Calibration: Date: 5/20/98 Time: 1145 Meter Serial No.: 60012

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

Temperature °F See MW-3

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WATER SAMPLE FIELD DATA SHEET

Rev 1/97

OWT

PROJECT NO 21775-213.003 | SAMPLE ID MW-6(39)
PURGED BY M. Ross | CLIENT NAME ARCO 771
SAMPLED BY M. Ross | LOCATION Livermore, Ca

TYPE Groundwater ✓ Surface Water ____ Leachate ____ Other ____

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

CASING ELEVATION (feet/MSL)	NR	VOLUME IN CASING (gal.)	12.45
DEPTH OF WELL (feet)	43.2	CALCULATED PURGE (gal.)	37.35
DEPTH OF WATER (feet)	24.14	ACTUAL PURGE VOL. (gal.)	37.5

DATE PURGED: 5/20/98 | END PURGE: 1347
DATE SAMPLED: 5/20/98 | SAMPLING TIME: 1355

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C. (µmhos/cm@25°c)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1335	12.5	7.02	971	71.5	clr	clr
1341	25.0	7.14	948	72.0	clr	clr
1347	37.5	~~7.18~~ 7.06	989	71.8	clr	clr

OTHER: D.O. 0.6 mg/L ODOR: Slight

COLOR (COBALT 0-100)	TURBIDITY (NTU 0-200)
NR	NR

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

PURGING EQUIPMENT

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

SAMPLING EQUIPMENT

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

WELL INTEGRITY: OK | LOCK: ARCO

REMARKS: ____

pH, E.C., Temp. Meter Calibration: Date: 5/20/98 Time 1145 Meter Serial No.: 600162

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

Temperature °F ____ See MW-3

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ARCO Products Company
Division of Atlantic Richfield Company

Task Order No. [illegible] 12 [illegible]

Chain of [illegible]

ARCO Facility no. 0771 | City (Facility) Livermore | [illegible] Glen Vanderveen

ARCO engineer Paul Vanderveen | Telephone no. (ARCO) | [illegible] no. (Consultant) (408) 452-7300 | Fax no. (Consultant) (408) 437-9526

Consultant name EMCON | Address (Consultant) [illegible] 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	[illegible]	[illegible]	[illegible]	[illegible]	EPA 418.1/SM 503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals VOA VOC	CAM Metals EPA 6010/7000 TTLC STLC	Lead Org./DHS Lead EPA 7420/7421			
MW-1 [illegible]	[illegible]	[illegible]		X		X	HCL	[illegible]	[illegible]														
MW-[illegible]		2		[illegible]		X	HCL	[illegible]	[illegible]														
MW-3 [illegible]		2		[illegible]		X	HCL	[illegible]	[illegible]														
MW-[illegible]		2		[illegible]		X	HCL	[illegible]	[illegible]														
MW-[illegible]		2		[illegible]		X	HCL	[illegible]	135[illegible]														

Condition of sample: [illegible]

Relinquished by sampler: [illegible] | [illegible] | [illegible] 5/[illegible] | 1350

Relinquished by: | Date

Relinquished by: | Date | Date

Distribution: White Copy – Laboratory; Canary Copy – ARCO Environmental Engine[illegible]