



LOP3883

July 28, 1999  
Project 20805-134.006

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

Re: Semi-Annual Groundwater Monitoring Report, Second Quarter 1999, for ARCO Service Station No. 6113, Located at 785 East Stanley Boulevard, 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 1999 groundwater monitoring program at ARCO Products Company (ARCO) Service Station No. 6113, located at 785 East Stanley Boulevard, Livermore, California. 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: Semi-Annual Groundwater Monitoring Report, Second Quarter 1999

cc: Susan Hugo, Alameda County Health Care Services Agency  
Danielle Stefani, City of Livermore Fire Department

OAKS\ARCO\6113\QTRLY\6113Q299.DOC\uh:1



Date: July 28, 1999

## ARCO SEMI-ANNUAL GROUNDWATER MONITORING REPORT

Station No.: 6113 Address: 785 East Stanley Boulevard, Livermore, California  
Pinnacle Project No. 20805-134.006  
ARCO Environmental Engineer/Phone No.: Paul Supple / (925) 299-8891  
EMCON Project Manager/Phone No.: Glen VanderVeen / (510) 740-5807  
Primary Agency/Regulatory ID No.: ACHCSA / Susan Hugo

### WORK PERFORMED THIS QUARTER (SECOND - 1999):

1. Prepared and submitted status report for first quarter 1999.
2. Performed semi-annual groundwater monitoring and sampling for second quarter 1999.

### WORK PROPOSED FOR NEXT QUARTER (THIRD - 1999):

1. Prepare and submit semi-annual groundwater monitoring report for second quarter 1999.
2. No environmental work is scheduled at the site during the third quarter 1999.

### MONITORING:

Current Phase of Project: Semi-Annual Groundwater Monitoring  
Frequency of Sampling: Annual (4th Quarter): MW-1, MW-2, MW-3, MW-8, MW-9, MW-10  
Semi-Annual (2nd/4th Quarter): MW-4 through MW-7, MW-11, MW-12  
Frequency of Monitoring: Semi-Annual (groundwater)  
Is Floating Product (FP) Present On-site:  Yes  No  
Bulk Soil Removed to Date : 288 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: None  
Average Depth to Groundwater 17.1 feet  
Groundwater Flow Direction and Gradient (Average) 0.02 ft/ft toward north

### DISCUSSION:

- Since MW-9 was not sampled during the fourth quarter 1998 (scheduled for annual sampling), it will be sampled during the second and fourth quarters of 1999. Well MW-12 may have been paved over. If so, the well will be located, uncovered, and repaired as necessary.

### ATTACHMENTS:

- Table 1 - Historical Groundwater Elevation and Analytical Data
- Table 2 - Groundwater Flow Direction and Gradient
- 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 6113**  
**785 East Stanley Boulevard, Livermore, California**

Well Number	Date Gauged	Top of Casing Elevation (ft-MSL)	Depth to Water (feet)	Groundwater Elevation (ft-MSL)	Date Sampled	TPH					Purged/ Not Purged (P/NP)
						Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	
MW-1	03-23-95	457.04	14.12	442.92	03-23-95	Not sampled: well sampled annually, during the fourth quarter					
MW-1	05-31-95	457.04	14.45	442.59	05-31-95	Not sampled: well sampled annually, during the fourth quarter					
MW-1	08-31-95	457.04	17.12	439.92	08-31-95	Not sampled: well sampled annually, during the fourth quarter					
MW-1	11-28-95	457.04	16.34	440.70	11-28-95	<50	<0.5	<0.5	<0.5	<0.5	<3
MW-1	02-22-96	457.04	13.23	443.81	02-22-96	Not sampled: well sampled annually, during the fourth quarter					
MW-1	05-23-96	457.04	14.02	443.02	05-23-96	Not sampled: well sampled annually, during the fourth quarter					
MW-1	08-08-96	457.04	16.13	440.91	08-08-96	Not sampled: well sampled annually, during the fourth quarter					
MW-1	11-07-96	457.04	17.28	439.76	11-08-96	<50	<0.5	<0.5	<0.5	<0.5	<3
MW-1	03-27-97	457.04	14.91	442.13	03-28-97	Not sampled: well sampled annually, during the fourth quarter					
MW-1	05-19-97	457.04	16.47	440.57	05-19-97	Not sampled: well sampled annually, during the fourth quarter					
MW-1	05-18-98	457.04	14.69	442.35	05-18-98	Not sampled: well sampled annually, during the fourth quarter					
MW-1	11-02-98	457.04	25.94	431.10	11-02-98	<50	<0.5	<0.5	<0.5	<0.5	<3
MW-1	06-04-99	457.04	17.38	439.66	06-04-99	Not sampled: well sampled annually, during the fourth quarter					
MW-2	03-23-95	457.74	14.15	443.59	03-23-95	Not sampled: well sampled annually, during the fourth quarter					
MW-2	05-31-95	457.74	14.67	443.07	05-31-95	Not sampled: well sampled annually, during the fourth quarter					
MW-2	08-31-95	457.74	17.24	440.50	08-31-95	Not sampled: well sampled annually, during the fourth quarter					
MW-2	11-28-95	457.74	16.40	441.34	11-29-95	<50	<0.5	<0.5	<0.5	<0.5	<3
MW-2	02-22-96	457.74	13.55	444.19	02-22-96	Not sampled: well sampled annually, during the fourth quarter					
MW-2	05-23-96	457.74	14.29	443.45	05-23-96	Not sampled: well sampled annually, during the fourth quarter					
MW-2	08-08-96	457.74	16.19	441.55	08-08-96	Not sampled: well sampled annually, during the fourth quarter					
MW-2	11-07-96	457.74	17.50	440.24	11-07-96	65	0.6	7.4	2.1	12	5
MW-2	03-27-97	457.74	15.32	442.42	03-28-97	Not sampled: well sampled annually, during the fourth quarter					
MW-2	05-19-97	457.74	16.62	441.12	05-19-97	Not sampled: well sampled annually, during the fourth quarter					
MW-2	05-18-98	457.74	15.12	442.62	05-18-98	Not sampled: well sampled annually, during the fourth quarter					
MW-2	11-02-98	457.74	26.66	431.08	11-02-98	<50	<0.5	<0.5	<0.5	<0.5	<3
MW-2	06-04-99	457.74	17.74	440.00	06-04-99	Not sampled: well sampled annually, during the fourth quarter					

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

**ARCO Service Station 6113**  
**785 East Stanley Boulevard, Livermore, California**

Well Number	Date Gauged	Top of Casing	Depth to	Groundwater	Date Sampled	TPH			Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MTBE (µg/L)	Purged/ Not Purged (P/NP)
		Elevation (ft-MSL)	Water (feet)	Elevation (ft-MSL)		Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)				
MW-3	03-23-95	456.97	14.13	442.84	03-23-95	Not sampled: well sampled annually, during the fourth quarter						
MW-3	05-31-95	456.97	14.46	442.51	05-31-95	Not sampled: well sampled annually, during the fourth quarter						
MW-3	08-31-95	456.97	17.06	439.91	08-31-95	Not sampled: well sampled annually, during the fourth quarter						
MW-3	11-28-95	456.97	16.27	440.70	11-28-95	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-3	02-22-96	456.97	13.14	443.83	02-22-96	Not sampled: well sampled annually, during the fourth quarter						
MW-3	05-23-96	456.97	13.95	443.02	05-23-96	Not sampled: well sampled annually, during the fourth quarter						
MW-3	08-08-96	456.97	16.03	440.94	08-08-96	Not sampled: well sampled annually, during the fourth quarter						
MW-3	11-07-96	456.97	17.26	439.71	11-07-96	<50	<0.5	0.9	<0.5	1.5	<3	
MW-3	03-27-97	456.97	14.85	442.12	03-28-97	Not sampled: well sampled annually, during the fourth quarter						
MW-3	05-19-97	456.97	16.40	440.57	05-19-97	Not sampled: well sampled annually, during the fourth quarter						
MW-3	05-18-98	456.97	14.66	442.31	05-18-98	Not sampled: well sampled annually, during the fourth quarter						
MW-3	11-02-98	456.97	25.85	431.12	11-02-98	<1000	<10	<10	<10	<10	1700	
MW-3	06-04-99	456.97	17.35	439.62	06-04-99	Not sampled: well sampled annually, during the fourth quarter						
MW-4	03-23-95	456.55	15.39	441.16	03-23-95	210	2.1	0.6	0.8	2.1	--	
MW-4	05-31-95	456.55	15.32	441.23	05-31-95	190	1.6	<0.5	0.7	0.9	--	
MW-4	08-31-95	456.55	17.86	438.69	08-31-95	160	1.2	0.7	<0.5	<2	<3	
MW-4	11-28-95	456.55	17.18	439.37	11-29-95	150	0.7	<0.5	0.7	1.4	<3	
MW-4	02-22-96	456.55	14.80	441.75	02-22-96	100	<0.5	<0.5	<0.6	0.8	<3	
MW-4	05-23-96	456.55	14.43	442.12	05-23-96	86	<0.5	<0.5	<0.5	<0.7	<3	
MW-4	08-08-96	456.55	16.80	439.75	08-08-96	98	<0.5	<0.5	<0.5	1.3	<3	
MW-4	11-07-96	456.55	17.90	438.65	11-13-96	140	<0.5	<0.5	<0.9	1.3	<3	
MW-4	03-27-97	456.55	15.22	441.33	03-28-97	<50	1.1	<0.5	<0.5	1.6	<3	
MW-4	05-19-97	456.55	16.98	439.57	05-19-97	62	<0.5	<0.5	<0.5	0.6	<3	
MW-4	05-18-98	456.55	14.99	441.56	05-18-98	<50	<0.5	<0.5	<0.5	<0.5	64	
MW-4	11-02-98	456.55	25.29	431.26	11-02-98	74	<0.5	<0.5	<0.5	<0.5	96	
MW-4	06-04-99	456.55	17.95	438.60	06-04-99	100	<0.5	<0.5	<0.5	<0.5	38	P

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

**ARCO Service Station 6113**  
**785 East Stanley Boulevard, Livermore, California**

Well Number	Date Gauged	Top of Casing Elevation (ft-MSL)	Depth to Water (feet)	Groundwater		TPH			Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MTBE (µg/L)	Purged/Not Purged (P/NP)
				Elevation (ft-MSL)	Date Sampled	Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)				
MW-5	03-23-95	455.84	13.97	441.87	03-23-95	68	4.2	3.4	2.3	12	--	
MW-5	05-31-95	455.84	Not surveyed		05-31-95	Not sampled: well was inaccessible						
MW-5	08-31-95	455.84	Not surveyed		08-31-95	Not sampled: well was inaccessible						
MW-5	11-28-95	455.84	16.46	439.38	11-29-95	960	41	24	38	210	<5	
MW-5	02-22-96	455.84	13.34	442.50	02-22-96	Not sampled: well sampled semi-annually, during the second and fourth quarters						
MW-5	05-23-96	455.84	14.36	441.48	05-23-96	7100	440	180	270	1700	<50	
MW-5	08-08-96	455.84	16.38	439.46	08-08-96	Not sampled: well sampled semi-annually, during the second and fourth quarters						
MW-5	11-07-96	455.84	17.26	438.58	11-13-96	5600	230	86	210	1100	<80	
MW-5	03-27-97	455.84	15.95	439.89	03-28-97	Not sampled: well sampled semi-annually, during the second and fourth quarters						
MW-5	05-19-97	455.84	16.64	439.20	05-20-97	7600	480	140	400	1200	<40	
MW-5	05-18-98	455.84	14.75	441.09	05-18-98	990	46	13	45	180	4	
MW-5	11-02-98	455.84	27.83	428.01	11-02-98	14000	690	140	550	2200	100	
MW-5	06-04-99	455.84	17.47	438.37	06-04-99	8300	690	370	90	440	1400	P
MW-6	03-23-95	454.93	13.38	441.55	03-23-95	<50	1.5	<0.5	<0.5	0.9	--	
MW-6	05-31-95	454.93	13.96	440.97	05-31-95	<50	<0.5	<0.5	<0.5	<0.5	--	
MW-6	08-31-95	454.93	16.71	438.22	08-31-95	150	9	1.8	4	12	<3	
MW-6	11-28-95	454.93	15.65	439.28	11-29-95	<50	0.6	<0.5	<0.5	0.8	<3	
MW-6	02-22-96	454.93	12.53	442.40	02-22-96	<50	1.9	<0.5	0.8	2.1	<3	
MW-6	05-23-96	454.93	13.24	441.69	05-23-96	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-6	08-08-96	454.93	16.65	438.28	08-08-96	<50	0.5	<0.5	<0.5	0.5	<3	
MW-6	11-07-96	454.93	16.65	438.28	11-08-96	110	5.3	1.3	3.1	6.6	<3	
MW-6	03-27-97	454.93	14.25	440.68	03-28-97	<50	2.3	<0.5	0.9	3.5	4	
MW-6	05-19-97	454.93	15.87	439.06	05-20-97	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-6	05-18-98	454.93	14.00	440.93	05-18-98	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-6	11-02-98	454.93	24.95	429.98	11-02-98	<50	1.2	<0.5	<0.5	<0.5	3	
MW-6	06-04-99	454.93	16.68	438.25	06-04-99	310	41	3.8	11	19	33	P

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

**ARCO Service Station 6113**  
**785 East Stanley Boulevard, Livermore, California**

Well Number	Date Gauged	Top of Casing	Depth to	Groundwater		TPH			Ethyl-	Total	MTBE	Purged/ Not Purged (P/NP)
		Elevation (ft-MSL)	Water (feet)	Elevation (ft-MSL)	Date Sampled	Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	benzene (µg/L)	Xylenes (µg/L)		
MW-7	03-23-95	454.92	13.29	441.63	03-23-95	<50	<0.5	<0.5	<0.5	<0.5	--	
MW-7	05-31-95	454.92	13.72	441.20	05-31-95	<50	<0.5	<0.5	<0.5	<0.5	--	
MW-7	08-31-95	454.92	16.53	438.39	08-31-95	<50	<0.5	<0.5	<0.5	1.2	<3	
MW-7	11-28-95	454.92	15.50	439.42	11-29-95	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-7	02-22-96	454.92	12.30	442.62	02-22-96	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-7	05-23-96	454.92	13.02	441.90	05-23-96	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-7	08-08-96	454.92	Not surveyed		08-08-96	Not sampled: unable to locate well						
MW-7	11-07-96	454.92	16.50	438.42	11-08-96	<50	<0.5	<0.5	<0.5	0.8	<3	
MW-7	03-27-97	454.92	14.22	440.70	03-28-97	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-7	05-19-97	454.92	15.74	439.18	05-20-97	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-7	05-18-98	454.92	13.82	441.10	05-18-98	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-7	11-02-98	454.92	24.80	430.12	11-02-98	<50	<0.5	<0.5	<0.5	<0.5	4	
MW-7	06-04-99	454.92	16.55	438.37	06-04-99	<50	<0.5	<0.5	<0.5	<0.5	<3	P
MW-8	03-23-95	456.97	11.55	445.42	03-23-95	Not sampled: well sampled annually, during the fourth quarter						
MW-8	05-31-95	456.97	12.37	444.60	05-31-95	Not sampled: well sampled annually, during the fourth quarter						
MW-8	08-31-95	456.97	15.68	441.29	08-31-95	Not sampled: well sampled annually, during the fourth quarter						
MW-8	11-28-95	456.97	14.15	442.82	11-28-95	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-8	02-22-96	456.97	10.97	446.00	02-22-96	Not sampled: well sampled annually, during the fourth quarter						
MW-8	05-23-96	456.97	11.90	445.07	05-23-96	Not sampled: well sampled annually, during the fourth quarter						
MW-8	08-08-96	456.97	13.85	443.12	08-08-96	Not sampled: well sampled annually, during the fourth quarter						
MW-8	11-07-96	456.97	15.08	441.89	11-08-96	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-8	03-27-97	456.97	12.96	444.01	03-28-97	Not sampled: well sampled annually, during the fourth quarter						
MW-8	05-19-97	456.97	14.35	442.62	05-19-97	Not sampled: well sampled annually, during the fourth quarter						
MW-8	05-18-98	456.97	12.97	444.00	05-18-98	Not sampled: well sampled annually, during the fourth quarter						
MW-8	11-02-98	456.97	26.01	430.96	11-02-98	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-8	06-04-99	456.97	15.53	441.44	06-04-99	Not sampled: well sampled annually, during the fourth quarter						

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

**ARCO Service Station 6113**  
**785 East Stanley Boulevard, Livermore, California**

Well Number	Date Gauged	Top of Casing Elevation (ft-MSL)	Depth to Water (feet)	Groundwater		TPH					Purged/ Not Purged (P/NP)	
				Elevation (ft-MSL)	Date Sampled	Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)		MTBE (µg/L)
MW-9	03-23-95	456.18	13.18	443.00	03-23-95	Not sampled: well sampled annually, during the fourth quarter						
MW-9	05-31-95	456.18	12.66	443.52	05-31-95	Not sampled: well sampled annually, during the fourth quarter						
MW-9	08-31-95	456.18	14.40	441.78	08-31-95	Not sampled: well sampled annually, during the fourth quarter						
MW-9	11-28-95	456.18	14.26	441.92	11-29-95	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-9	02-22-96	456.18	12.05	444.13	02-22-96	Not sampled: well sampled annually, during the fourth quarter						
MW-9	05-23-96	456.18	12.07	444.11	05-23-96	Not sampled: well sampled annually, during the fourth quarter						
MW-9	08-08-96	456.18	14.12	442.06	08-08-96	Not sampled: well sampled annually, during the fourth quarter						
MW-9	11-07-96	456.18	15.42	440.76	11-08-96	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-9	03-27-97	456.18	13.01	443.17	03-28-97	Not sampled: well sampled annually, during the fourth quarter						
MW-9	05-19-97	456.18	14.60	441.58	05-19-97	Not sampled: well sampled annually, during the fourth quarter						
MW-9	05-18-98	456.18	12.60	443.58	05-18-98	Not sampled: well sampled annually, during the fourth quarter						
MW-9	11-02-98	456.18	25.08	431.10	11-02-98	Not sampled						
MW-9	06-04-99	456.18	15.87	440.31	06-04-99	<50	<0.5	<0.5	<0.5	<0.5	<3	P
MW-10	03-23-95	456.85	14.86	441.99	03-23-95	Not sampled: well sampled annually, during the fourth quarter						
MW-10	05-31-95	456.85	15.63	441.22	05-31-95	Not sampled: well sampled annually, during the fourth quarter						
MW-10	08-31-95	456.85	14.40	442.45	08-31-95	Not sampled: well sampled annually, during the fourth quarter						
MW-10	11-28-95	456.85	17.24	439.61	11-29-95	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-10	02-22-96	456.85	14.30	442.55	02-22-96	Not sampled: well sampled annually, during the fourth quarter						
MW-10	05-23-96	456.85	14.93	441.92	05-23-96	Not sampled: well sampled annually, during the fourth quarter						
MW-10	08-08-96	456.85	17.20	439.65	08-08-96	Not sampled: well sampled annually, during the fourth quarter						
MW-10	11-07-96	456.85	18.25	438.60	11-08-96	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-10	03-27-97	456.85	15.77	441.08	03-28-97	Not sampled: well sampled annually, during the fourth quarter						
MW-10	05-19-97	456.85	17.38	439.47	05-19-97	Not sampled: well sampled annually, during the fourth quarter						
MW-10	05-18-98	456.85	15.47	441.38	05-18-98	Not sampled: well sampled annually, during the fourth quarter						
MW-10	11-02-98	456.85	26.94	429.91	11-02-98	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-10	06-04-99	456.85	17.19	439.66	06-04-99	Not sampled: well sampled annually, during the fourth quarter						

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

**ARCO Service Station 6113**  
**785 East Stanley Boulevard, Livermore, California**

Well Number	Date Gauged	Top of Casing Elevation (ft-MSL)	Depth to Water (feet)	Groundwater		TPH					Purged/ Not Purged (P/NP)	
				Elevation (ft-MSL)	Date Sampled	Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)		MTBE (µg/L)
MW-11	03-23-95	455.07	17.34	437.73	03-23-95	Not sampled: well sampled semi-annually, during the second and fourth quarters						
MW-11	05-31-95	455.07	16.68	438.39	05-31-95	<50	<0.5	<0.5	<0.5	<0.5	--	
MW-11	08-31-95	455.07	20.20	434.87	08-31-95	Not sampled: well sampled semi-annually, during the second and fourth quarters						
MW-11	11-28-95	455.07	17.80	437.27	11-28-95	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-11	02-22-96	455.07	15.97	439.10	02-22-96	Not sampled: well sampled semi-annually, during the second and fourth quarters						
MW-11	05-23-96	455.07	15.50	439.57	05-23-96	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-11	08-08-96	455.07	17.77	437.30	08-08-96	Not sampled: well sampled semi-annually, during the second and fourth quarters						
MW-11	11-07-96	455.07	17.45	437.62	11-13-96	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-11	03-27-97	455.07	15.77	439.30	03-28-97	Not sampled: well sampled semi-annually, during the second and fourth quarters						
MW-11	05-19-97	455.07	16.80	438.27	05-19-97	<50	1.1	4.5	<0.5	2.2	<3	
MW-11	05-18-98	455.07	15.38	439.69	05-18-98	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-11	11-02-98	455.07	24.15	430.92	11-02-98	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-11	06-04-99	455.07	18.39	436.68	06-04-99	<50	<0.5	<0.5	<0.5	<0.5	<3	P
MW-12	03-23-95	455.04	15.54	439.50	03-23-95	Not sampled: well sampled semi-annually, during the second and fourth quarters						
MW-12	05-31-95	455.04	15.66	439.38	05-31-95	<50	<0.5	<0.5	<0.5	<0.5	--	
MW-12	08-31-95	455.04	18.23	436.81	08-31-95	Not sampled: well sampled semi-annually, during the second and fourth quarters						
MW-12	11-28-95	455.04	17.53	437.51	11-28-95	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-12	02-22-96	455.04	14.45	440.59	02-22-96	Not sampled: well sampled semi-annually, during the second and fourth quarters						
MW-12	05-23-96	455.04	14.88	440.16	05-23-96	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-12	08-08-96	455.04	17.30	437.74	08-08-96	Not sampled: well sampled semi-annually, during the second and fourth quarters						
MW-12	11-07-96	455.04	18.30	436.74	11-13-96	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-12	03-27-97	455.04	15.69	439.35	03-28-97	Not sampled: well sampled semi-annually, during the second and fourth quarters						
MW-12	05-19-97	455.04	17.41	437.63	05-19-97	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-12	05-18-98	455.04	15.21	439.83	05-18-98	<50	<0.5	<0.5	<0.5	<0.5	<3	
MW-12	11-02-98	455.04	Not surveyed		11-02-98	Not sampled: unable to locate well						
MW-12	06-04-99	455.04	Not surveyed		06-04-99	Not sampled: unable to locate well						



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

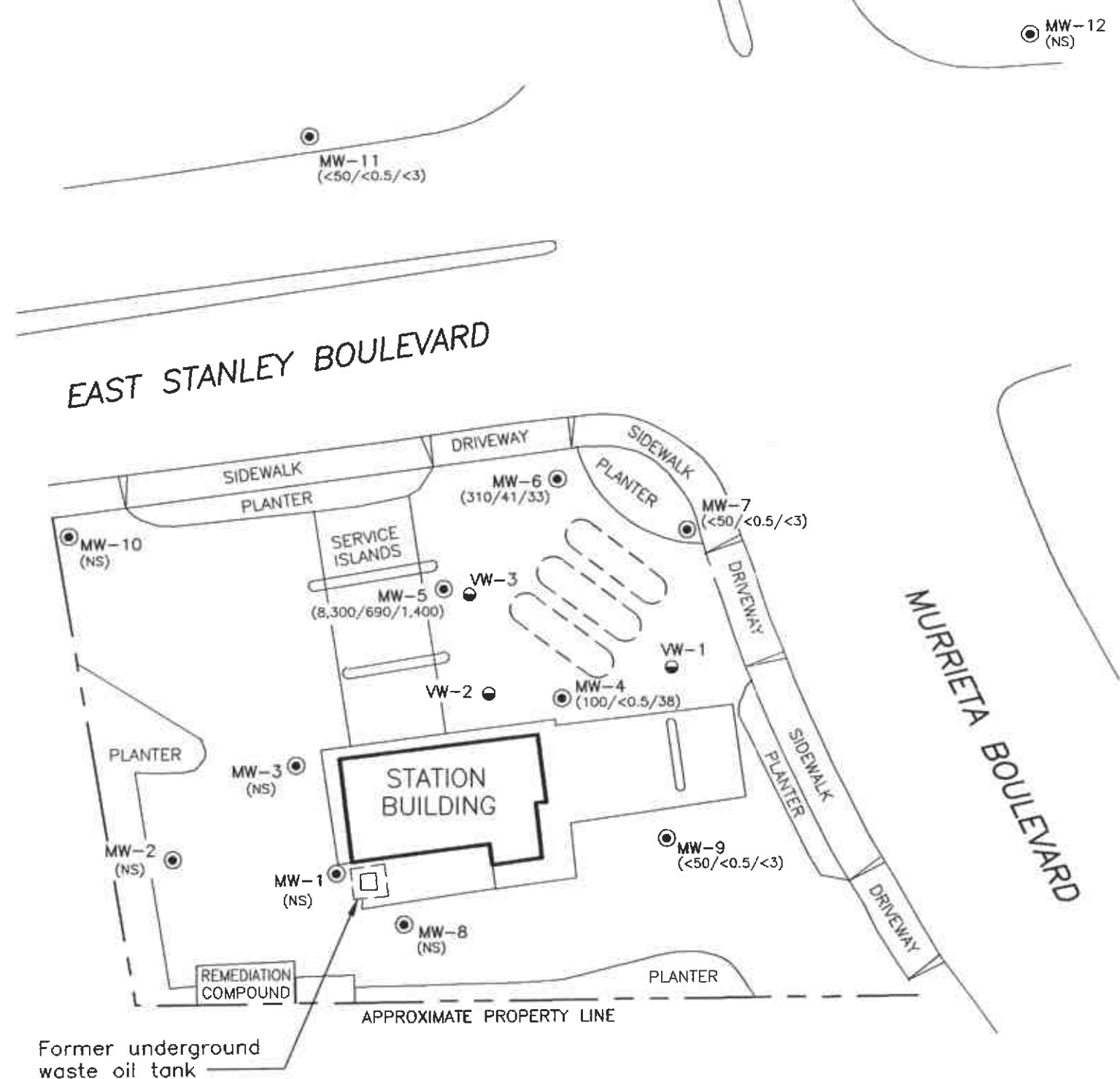
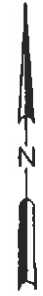
**ARCO Service Station 6113**  
**785 East Stanley Boulevard, Livermore, California**

Well Number	Date Gauged	Top of Casing Elevation (ft-MSL)	Depth to Water (feet)	Groundwater Elevation (ft-MSL)	Date Sampled	TPH			Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MTBE (µg/L)	Purged/ Not Purged (P/NP)
						Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)				
<p>TPH: Total petroleum hydrocarbons by modified EPA method 8015                      BTEX: Benzene, toluene, ethylbenzene, xylenes by EPA method 8020                      MTBE: Methyl tert-butyl ether by EPA method 8020                      ft-MSL: elevation in feet, relative to mean sea level                      µg/L: micrograms per liter                      mg/L: milligrams per liter                      &lt;: less than laboratory detection limit stated to the right                      *: For previous historical groundwater elevation and analytical data please refer to <i>Fourth Quarter 1995 Groundwater Monitoring Program Results, ARCO Service Station 6113, Livermore, California</i>, (EMCON, February 26, 1996).</p>												

**Table 2**  
**Groundwater Flow Direction and Gradient**

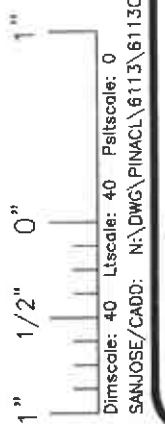
**ARCO Service Station 6113**  
**785 East Stanley Boulevard, Livermore, California**

<b>Date Measured</b>	<b>Average Flow Direction</b>	<b>Average Hydraulic Gradient</b>
03-23-95	Northwest	0.035
05-31-95	North-Northwest	0.028
08-31-95	North-Northwest	0.03
11-28-95	North-Northwest	0.025
02-22-96	North-Northwest	0.031
05-23-96	North-Northwest	0.025
08-08-96	North	0.019
11-07-96	North-Northeast	0.019
03-27-97	North-Northwest	0.021
05-19-97	North	0.019
05-18-98	North	0.02
11-02-98	North	0.02
<b>06-04-99</b>	<b>North</b>	<b>0.02</b>

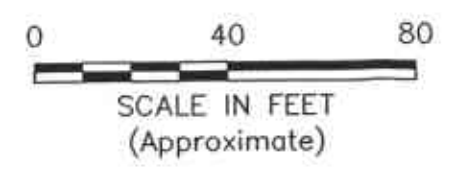
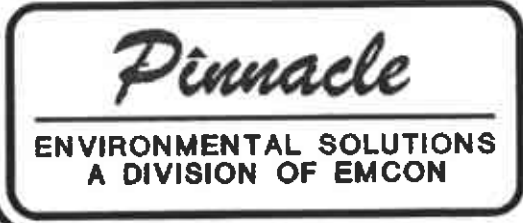


EXPLANATION	
⊙	Groundwater monitoring well
●	Vapor extraction well
⬭	Existing underground gasoline storage tank
(100/<0.5/38)	Concentration of total petroleum hydrocarbons as gasoline (TPHG), benzene, and MTBE in groundwater (ug/L); samples collected 6/4/99
<	Not detected at or above the indicated laboratory detection limit
NS	Not sampled

IMAGE Files: <No Images>  
 XREF Files: <No Xrefs>  
 Dimstyle: 40 Ltscale: 40 Plttscale: 0  
 SANJOSE/CADD: N:\DWG\PINACL\6113\6113CHEM.DWG Thu, 01/Jul/99 09:12am kblack

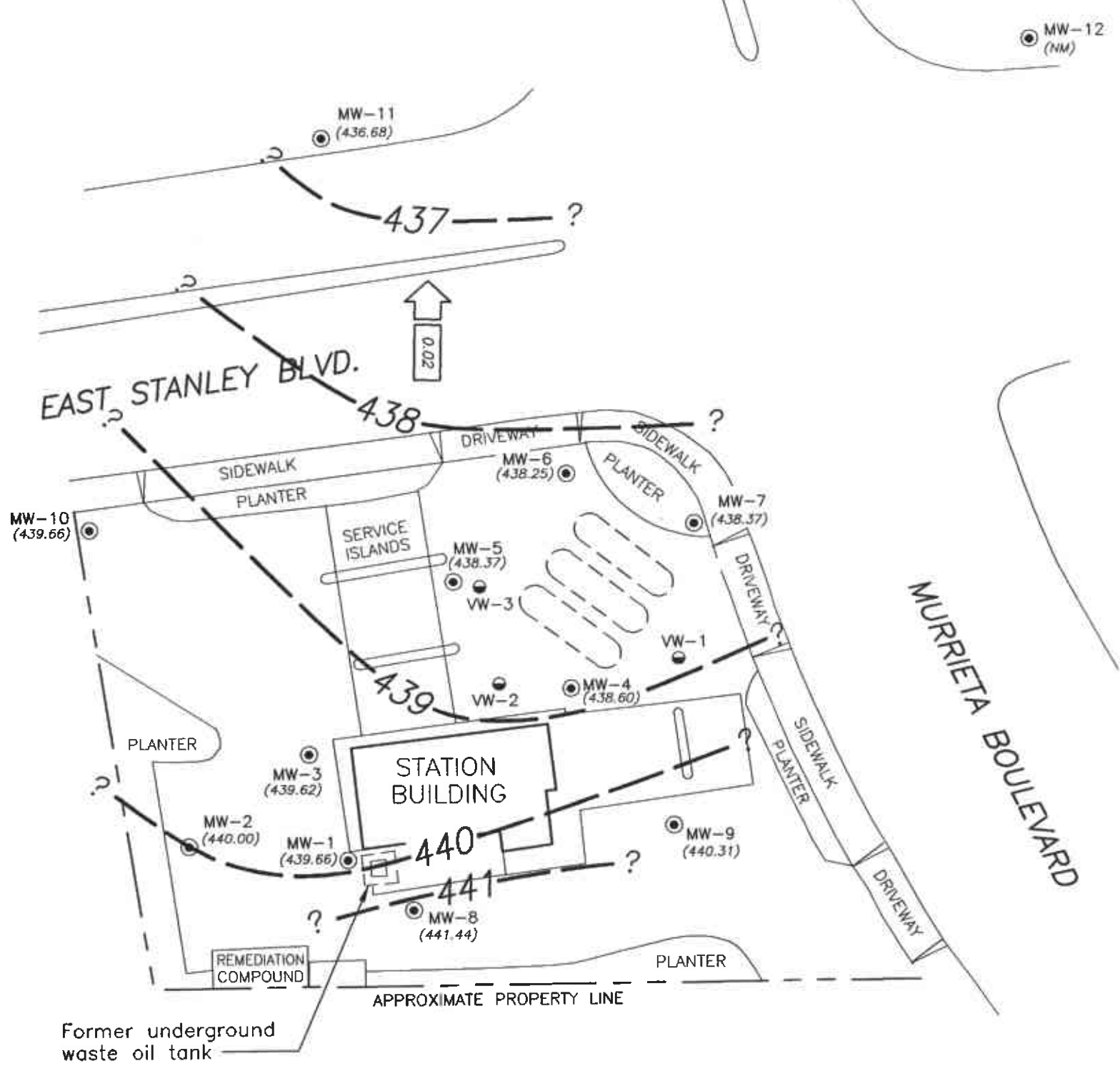
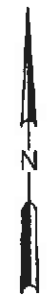


Base map modified from RESNA, 1994.



DATE	JUNE 1999
DWN	KAB
APP	
REV	
PROJECT NO.	20805-134.006

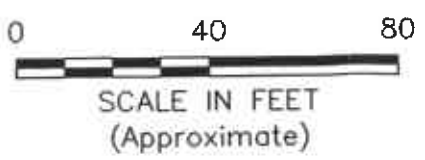
**FIGURE 1**  
 ARCO PRODUCTS COMPANY  
 SERVICE STATION 6113, 785 E. STANLEY BLVD.  
 LIVERMORE, CALIFORNIA  
**GROUNDWATER ANALYTICAL SUMMARY**  
**SECOND QUARTER 1999**



EXPLANATION	
⊙	Groundwater monitoring well
●	Vapor extraction well
⬭	Existing underground gasoline storage tank
(438.37)	Groundwater elevation (Ft.-MSL) measured 6/4/99
— ? —	Groundwater elevation contour (Ft.-MSL)
←	Approximate direction of groundwater flow showing gradient
NM	Not measured

IMAGE Files: <No Images>  
 XREF Files: <No Xrefs>  
 Dimacole: 40; Liscole: 40; Peltacole: 0  
 SANJOSE/CADD: N:\DWG\PINACL\6113\6113GWC.DWG Tue, 13/Jul/99 01:16pm kblack

Base map modified from RESNA, 1994.



DATE	JUNE 1999
DWN	KAB
APP	
REV	
PROJECT NO.	20805-134.006

**FIGURE 2**  
 ARCO PRODUCTS COMPANY  
 SERVICE STATION 6113, 785 E. STANLEY BLVD.  
 LIVERMORE, CALIFORNIA  
**GROUNDWATER ELEVATION CONTOURS**  
**SECOND QUARTER 1999**

**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<sup>®</sup> 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)



OWT

# MONITORING WELL PURGING PROTOCOL

MEASURE AND RECORD DEPTH TO WATER AND WELL TOTAL DEPTH

CHECK FOR FLOATING PRODUCT

YES

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

NO

CALCULATE PURGE VOLUME BY USING THE FOLLOWING EQUATION:

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

where:

P = calculated purge volume (gallons)

$\pi = 3.14$

r = radius of well casing in feet

h = height of water column in feet

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

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.

NO

YES

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

pH =  $\pm 0.1$  pH units

COND. =  $\pm 10$  %

TEMP. =  $\pm 1.0$  °F

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

YES

NO

YES

NO

WELL PURGING CRITERIA MET; PROCEED TO WELL SAMPLING.

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

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

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) : \_\_\_\_\_

<p style="text-align: center;"><u>PURGING EQUIPMENT</u></p> <p>_____ 2" Bladder Pump    _____ Bailer (Teflon)</p> <p>_____ Centrifugal Pump    _____ Bailer (PVC)</p> <p>_____ Submersible Pump    _____ Bailer (Stainless Steel)</p> <p>_____ Well Wizard™    _____ Dedicated</p> <p>Other: _____</p>	<p style="text-align: center;"><u>SAMPLING EQUIPMENT</u></p> <p>_____ 2" Bladder Pump    _____ Bailer (Teflon)</p> <p>_____ Bomb Sampler    _____ Bailer (Stainless Steel)</p> <p>_____ Dipper    _____ Submersible Pump</p> <p>_____ Well Wizard™    _____ Dedicated</p> <p>Other: _____</p>
--	---

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 \_\_\_\_\_



WATER SAMPLE FIELD DATA SHEET

FIGURE  
**A-2**



**OWT**

**EMCON - SACRAMENTO  
GROUNDWATER SAMPLING AND ANALYSIS REQUEST FORM**

PROJECT NAME :

SCHEDULED DATE :

SPECIAL INSTRUCTIONS / CONSIDERATIONS :

[Empty box for special instructions]

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:

[Empty box for laboratory and lab QC instructions]



**EMCON**

**SAMPLING AND ANALYSIS REQUEST FORM**

**FIGURE**

**A-3**

**APPENDIX B**

**CERTIFIED ANALYTICAL REPORTS,  
AND CHAIN-OF-CUSTODY DOCUMENTATION**



June 22, 1999

Service Request No.: S9901782

Mr. Glen Vanderveen  
EMCON-Pinnacle  
2201 Broadway, Suite 101  
Oakland, CA 94612

**RE: TO#24118.00/RAT8/6113 LIVERMORE**

Dear Mr. Vanderveen:

Enclosed are the results of the sample(s) submitted to our laboratory on June 10, 1999. All analyses were performed in accordance with our laboratory's quality assurance program. Results are intended to be considered in their entirety and apply to the sample(s) analyzed. Columbia Analytical Services is not responsible for use of less than the complete report. Signature of this CAS Analytical Report confirms that pages 2 through 12, following, have been thoroughly reviewed and approved for release.

Columbia Analytical Services is certified for environmental analyses by the California Department of Health Services (certificate number: 1496, expiration: January 31, 2001).

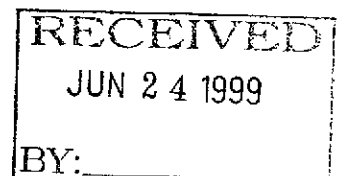
If you have any question, please call me at (408) 748-9700.

Respectfully submitted,

**Columbia Analytical Services, Inc.**

Bernadette Troncales  
Project Chemist

Greg Jordan  
Laboratory Director





**COLUMBIA ANALYTICAL SERVICES, Inc.**

**Acronyms**

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

**Client:** ARCO Products Company  
**Project:** TO#24118.00/RAT8/6113 LIVERMORE  
**Sample Matrix:** Water

**Service Request:** S9901782  
**Date Collected:** 6/4/99  
**Date Received:** 6/10/99

BTEX, MTBE and TPH as Gasoline

**Sample Name:** MW-7(66)  
**Lab Code:** S9901782-001  
**Test Notes:**

**Units:** ug/L (ppb)  
**Basis:** NA

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	6/11/99	ND	
Benzene	EPA 5030	8020	0.5	1	NA	6/11/99	ND	
Toluene	EPA 5030	8020	0.5	1	NA	6/11/99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	6/11/99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	6/11/99	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	6/11/99	ND	

Approved By: \_\_\_\_\_

*pt*

Date: \_\_\_\_\_

06/22/99



COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company  
Project: TO#24118.00/RAT8/6113 LIVERMORE  
Sample Matrix: Water

Service Request: S9901782  
Date Collected: 6/4/99  
Date Received: 6/10/99

BTEX, MTBE and TPH as Gasoline

Sample Name: MW-11(44)  
Lab Code: S9901782-003  
Test Notes:

Units: ug/L (ppb)  
Basis: NA

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	6/11//99	ND	
Benzene	EPA 5030	8020	0.5	1	NA	6/11//99	ND	
Toluene	EPA 5030	8020	0.5	1	NA	6/11//99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	6/11//99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	6/11//99	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	6/11//99	ND	

Approved By: \_\_\_\_\_



Date: \_\_\_\_\_

04/22/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company  
Project: TO#24118.00/RAT8/6113 LIVERMORE  
Sample Matrix: Water

Service Request: S9901782  
Date Collected: 6/4/99  
Date Received: 6/10/99

BTEX, MTBE and TPH as Gasoline

Sample Name: MW-6(65)  
Lab Code: S9901782-004  
Test Notes:

Units: ug/L (ppb)  
Basis: NA

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	6/11/99	310	
Benzene	EPA 5030	8020	0.5	1	NA	6/11/99	41	
Toluene	EPA 5030	8020	0.5	1	NA	6/11/99	3.8	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	6/11/99	11	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	6/11/99	19	
Methyl tert-Butyl Ether	EPA 5030	8020	3	1	NA	6/11/99	33	

Approved By: \_\_\_\_\_



Date: \_\_\_\_\_

06/22/99

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

**Client:** ARCO Products Company  
**Project:** TO#24118.00/RAT8/6113 LIVERMORE  
**Sample Matrix:** Water

**Service Request:** S9901782  
**Date Collected:** 6/4/99  
**Date Received:** 6/10/99

BTEX, MTBE and TPH as Gasoline

**Sample Name:** MW-4(25)  
**Lab Code:** S9901782-005  
**Test Notes:**

**Units:** ug/L (ppb)  
**Basis:** NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CALUFT	50	1	NA	6/11//99	100	G2
Benzene	EPA 5030	8020	0.5	1	NA	6/11//99	ND	
Toluene	EPA 5030	8020	0.5	1	NA	6/11//99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	6/11//99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	6/11//99	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	6/11//99	38	

G2      The sample contains a single non-fuel component and other hydrocarbons eluting in the gasoline range and quantitated as gasoline. The chromatogram does not match the typical gasoline fingerprint.

Approved By: \_\_\_\_\_ Date: 06/22/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company  
Project: TO#24118.00/RAT8/6113 LIVERMORE  
Sample Matrix: Water

Service Request: S9901782  
Date Collected: 6/4/99  
Date Received: 6/10/99

BTEX, MTBE and TPH as Gasoline

Sample Name: MW-5(61)  
Lab Code: S9901782-006  
Test Notes:

Units: ug/L (ppb)  
Basis: NA

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	6/11/99	8300	
Benzene	EPA 5030	8020	0.5	20	NA	6/11/99	690	
Toluene	EPA 5030	8020	0.5	20	NA	6/11/99	370	
Ethylbenzene	EPA 5030	8020	0.5	20	NA	6/11/99	90	
Xylenes, Total	EPA 5030	8020	0.5	20	NA	6/11/99	440	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	20	NA	6/11/99	1400	

Approved By: \_\_\_\_\_



Date: \_\_\_\_\_

06/22/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company  
Project: TO#24118.00/RAT8/6113 LIVERMORE  
Sample Matrix: Water

Service Request: S9901782  
Date Collected: NA  
Date Received: NA

BTEX, MTBE and TPH as Gasoline

Sample Name: Method Blank  
Lab Code: S990610-WB1  
Test Notes:

Units: ug/L (ppb)  
Basis: NA

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	6/10/99	ND	
Benzene	EPA 5030	8020	0.5	1	NA	6/10/99	ND	
Toluene	EPA 5030	8020	0.5	1	NA	6/10/99	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	6/10/99	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	6/10/99	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	6/10/99	ND	

Approved By: \_\_\_\_\_



Date: \_\_\_\_\_

06/22/99





**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

**Client:** ARCO Products Company  
**Project:** TO#24118.00/RAT8/6113 LIVERMORE  
**Sample Matrix:** Water

**Service Request:** S9901782  
**Date Collected:** NA  
**Date Received:** NA  
**Date Extracted:** NA  
**Date Analyzed:** 6/10/99

Matrix Spike/Duplicate Matrix Spike Summary  
 BTE

**Sample Name:** MW-5(61) Units: ug/L (ppb)  
**Lab Code:** S9901782-006MS, S9901782-006DMS Basis: NA  
**Test Notes:** A

Analyte	Prep Method	Analysis Method	MRL	Spike Level		Sample Result	Spike Result				Percent Recovery	
				MS	DMS		MS	DMS	MS	DMS	CAS	Relative
							MS	DMS	MS	DMS	Acceptance Limits	Percent Difference
Benzene	EPA 5030	8020	0.5	500	500	370	1100	1100	146	146	75-135	<1
Toluene	EPA 5030	8020	0.5	500	500	90	530	530	88	88	73-136	<1
Ethylbenzene	EPA 5030	8020	0.5	500	500	440	1000	990	112	110	69-142	1

A Recovery results for Benzene are outside of QC limits due to matrix interference.

Approved By: \_\_\_\_\_ Date: \_\_\_\_\_

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company  
 Project: TO#24118.00/RAT8/6113 LIVERMORE

Service Request: S9901782  
 Date Analyzed: 6/10/99

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		Result Notes
					Acceptance Limits	Percent Recovery	
TPH as Gasoline	EPA 5030	CA/LUFT	250	250	90-110	100	
Benzene	EPA 5030	8020	25	24	85-115	96	
Toluene	EPA 5030	8020	25	22	85-115	88	
Ethylbenzene	EPA 5030	8020	25	24	85-115	96	
Xylenes, Total	EPA 5030	8020	75	72	85-115	96	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	25	26	85-115	104	

Approved By: \_\_\_\_\_

*PT*

Date: \_\_\_\_\_

*06/22/99*

ICV/032196



**APPENDIX C**  
**FIELD DATA SHEETS**

**FIELD REPORT**  
**DEPTH TO WATER / FLOATING PRODUCT SURVEY**

PROJECT # : 21775-248.004

STATION ADDRESS : 785 East Stanley Blvd., Livermore

DATE : 6/4/99

ARCO STATION # : 6113

FIELD TECHNICIAN : JWharff

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-1	✓	✓	✓	ARCO	LWC	17.38	17.38	ND	ND	44.9	
2	MW-3				ARCO	LWC	17.55	17.35			39.0	
3	MW-7 <sup>x</sup>	✓	✓	✓	ARCO	LWC	16.55	16.55			67.7	
4	MW-8	✓	✓	✓	ARCO	LWC	15.53	15.53			66.6	
5	MW-9 <sup>x</sup>	✓	✓	✓	ARCO	LWC	15.87	15.87			68.0	
6	MW-10				ARCO	LWC	17.19	17.19			50.2	
7	MW-11 <sup>x</sup>	✓	✓	✓	ARCO	LWC	18.39	18.39			44.5	
<del>8</del>	<del>MW-12<sup>x</sup></del>				<del>ARCO</del>	<del>LWC</del>						→ Could not locate well
9	MW-2	✓	NO	✓	ARCO	LWC	17.74	17.74			38.6	bolts are broken / Replaced (BRASS) except lock (BRASS) 2404
10	MW-6 <sup>x</sup>	✓	✓	✓	ARCO	LWC	16.68	16.68			66.7	
11	MW-4 <sup>x</sup>	✓	✓	✓	ARCO	LWC	17.95	17.95			26.6	
12	MW-5 <sup>x</sup>	✓	NO	NO	None	Slip	17.47	17.47	↓	↓	67.6	large square van lt w/ no bolts

**SURVEY POINTS ARE TOP OF WELL CASINGS**

**RECEIVED**  
 JUN 28 1999  
 BY: \_\_\_\_\_

# WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



**OWT**

PROJECT NO: 21775-248.004  
20805-131.004  
 PURGED BY: Jwhorff  
 SAMPLED BY: ↓

SAMPLE ID: MW-4 (25)  
 CLIENT NAME: ARCO # 6113  
 LOCATION: LIVERMORE

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

CASING ELEVATION (feet/MSL):          VOLUME IN CASING (gal.): 6.0  
 DEPTH OF WELL (feet): 26.6 CALCULATED PURGE (gal.): 18.0  
 DEPTH TO WATER (feet): 17.95 ACTUAL PURGE VOL. (gal.): 18.0

DATE PURGED: 6/4/99 END PURGE: 1426  
 DATE SAMPLED: ↓ SAMPLING TIME: 1731

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1422</u>	<u>6.0</u>	<u>6.63</u>	<u>633</u>	<u>66.9</u>	<u>CLEAR</u>	<u>LOW</u>
<u>1424</u>	<u>12.0</u>	<u>6.55</u>	<u>635</u>	<u>66.3</u>	<u>↓</u>	<u>↓</u>
<u>1426</u>	<u>18.0</u>	<u>6.55</u>	<u>628</u>	<u>66.7</u>	<u>↓</u>	<u>↓</u>

OTHER: \_\_\_\_\_ ODOR: NOA \_\_\_\_\_  
(COBALT 0-100) (NTU 0-200)

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

PURGING EQUIPMENT	SAMPLING EQUIPMENT
<input type="checkbox"/> 2" Bladder Pump <input type="checkbox"/> Centrifugal Pump <input checked="" type="checkbox"/> Submersible Pump <input type="checkbox"/> Well Wizard <sup>®</sup> Other: _____	<input type="checkbox"/> 2" Bladder Pump <input checked="" type="checkbox"/> Bailer (Teflon) <input type="checkbox"/> Bomb Sampler <input type="checkbox"/> Dipper <input type="checkbox"/> Well Wizard <sup>®</sup> Other: <u>Dispo Bailer</u>

WELL INTEGRITY: Good 15/16 LOCK: OK

REMARKS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

pH, E.C., Temp. Meter Calibration: Date: \_\_\_\_\_ Time: SEE MW-7 Meter Serial No.: \_\_\_\_\_  
 E.C. 1000 / pH 7 / pH 10 / pH 4 /  
 Temperature °F \_\_\_\_\_

SIGNATURE: JW REVIEWED BY: [Signature] PAGE 1 OF 7

3-9-99  
fill  
scmp

# WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



**OWT**

PROJECT NO: 21775 - 248.004  
20805 - 134.004  
PURGED BY: JWherff  
SAMPLED BY: ↓

SAMPLE ID: MW-5 (61)  
CLIENT NAME: ARCO # 6113  
LOCATION: LIVERMORE

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

CASING ELEVATION (feet/MSL): — VOLUME IN CASING (gal.): 29.5  
DEPTH OF WELL (feet): 62.6 CALCULATED PURGE (gal.): 88.5  
DEPTH TO WATER (feet): 17.47 ACTUAL PURGE VOL. (gal.): 88.5

DATE PURGED: 6/4/99 END PURGE: 1507  
DATE SAMPLED: ↓ SAMPLING TIME: 1515

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1455</u>	<u>29.5</u>	<u>6.63</u>	<u>701</u>	<u>67.5</u>	<u>CLEAR</u>	<u>LOW</u>
<u>1501</u>	<u>59.0</u>	<u>6.87</u>	<u>698</u>	<u>66.9</u>	<u>↓</u>	<u>↓</u>
<u>1507</u>	<u>88.5</u>	<u>6.82</u>	<u>702</u>	<u>66.3</u>	<u>↓</u>	<u>↓</u>
_____	_____	_____	_____	_____	_____	_____

OTHER: — ODOR: STRONG  
(COBALT 0-100) (NTU 0-200)

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

### PURGING EQUIPMENT

### SAMPLING EQUIPMENT

<input type="checkbox"/> 2" Bladder Pump	<input type="checkbox"/> Bailer (Teflon)	<input type="checkbox"/> 2" Bladder Pump	<input type="checkbox"/> Bailer (Teflon)
<input type="checkbox"/> Centrifugal Pump	<input type="checkbox"/> Bailer (PVC)	<input type="checkbox"/> Bomb Sampler	<input type="checkbox"/> Bailer (Stainless Steel)
<input checked="" type="checkbox"/> Submersible Pump	<input type="checkbox"/> Bailer (Stainless Steel)	<input type="checkbox"/> Dipper	<input type="checkbox"/> Submersible Pump
<input type="checkbox"/> Well Wizard <sup>®</sup>	<input type="checkbox"/> Dedicated	<input type="checkbox"/> Well Wizard <sup>®</sup>	<input type="checkbox"/> Dedicated

Other: \_\_\_\_\_ Other: Dispo Bailer

WELL INTEGRITY: Good LOCK: OK

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

pH, E.C., Temp. Meter Calibration: Date: \_\_\_\_\_ Time: SEE mw-7 Meter Serial No.: \_\_\_\_\_  
E.C. 1000 / pH 7 / pH 10 / pH 4 /

Temperature °F \_\_\_\_\_  
SIGNATURE: JW REVIEWED BY: [Signature] PAGE 2 OF 7



# WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



**OWT**

PROJECT NO: 21775-248.004  
 PURGED BY: JWheff  
 SAMPLED BY: ↓

SAMPLE ID: mw-6 (65)  
 CLIENT NAME: ARCO # 6113  
 LOCATION: LIVERMORE

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

CASING ELEVATION (feet/MSL): — VOLUME IN CASING (gal.): 33.0  
 DEPTH OF WELL (feet): 66.7 CALCULATED PURGE (gal.): 99.0  
 DEPTH TO WATER (feet): 16.68 ACTUAL PURGE VOL. (gal.): 99.0

DATE PURGED: 6/4/99 END PURGE: 1402  
 DATE SAMPLED: ↓ SAMPLING TIME: 1410

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1351</u>	<u>33.0</u>	<u>6.89</u>	<u>681</u>	<u>68.0</u>	<u>CLEAR</u>	<u>LOW</u>
<u>1356</u>	<u>66.0</u>	<u>6.86</u>	<u>681</u>	<u>67.1</u>	<u>↓</u>	<u>↓</u>
<u>1402</u>	<u>99.0</u>	<u>6.87</u>	<u>682</u>	<u>66.7</u>	<u>↓</u>	<u>↓</u>

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

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

**PURGING EQUIPMENT**

**SAMPLING EQUIPMENT**

<input type="checkbox"/> 2" Bladder Pump	<input type="checkbox"/> Bailer (Teflon)	<input type="checkbox"/> 2" Bladder Pump	<input checked="" type="checkbox"/> Bailer (Teflon)
<input type="checkbox"/> Centrifugal Pump	<input type="checkbox"/> Bailer (PVC)	<input type="checkbox"/> Bomb Sampler	<input type="checkbox"/> Bailer (Stainless Steel)
<input checked="" type="checkbox"/> Submersible Pump	<input type="checkbox"/> Bailer (Stainless Steel)	<input type="checkbox"/> Dipper	<input type="checkbox"/> Submersible Pump
<input type="checkbox"/> Well Wizard <sup>®</sup>	<input type="checkbox"/> Dedicated	<input type="checkbox"/> Well Wizard <sup>®</sup>	<input type="checkbox"/> Dedicated

Other: \_\_\_\_\_ Other: \_\_\_\_\_

WELL INTEGRITY: Good 15/16 LOCK: ok

REMARKS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

pH, E.C., Temp. Meter Calibration: Date: SEE MW-7 Time: \_\_\_\_\_ Meter Serial No.: \_\_\_\_\_  
 E.C. 1000 / pH 7 / pH 10 / pH 4 /

Temperature °F \_\_\_\_\_  
 SIGNATURE: JW REVIEWED BY: [Signature] PAGE 3 OF 7

# WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



**OWT**

PROJECT NO: 21775-248.004  
20805-134.004  
 PURGED BY: JWhiff  
 SAMPLED BY: ↓

SAMPLE ID: mw-7 (60)  
 CLIENT NAME: ARCO # 6013  
 LOCATION: LIVERMORE

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

CASING ELEVATION (feet/MSL): - VOLUME IN CASING (gal.): 33.5  
 DEPTH OF WELL (feet): 67.7 CALCULATED PURGE (gal.): 100.5  
 DEPTH TO WATER (feet): 16.55 ACTUAL PURGE VOL. (gal.): 100.5

DATE PURGED: 6/4/99 END PURGE: 1132  
 DATE SAMPLED: ↓ SAMPLING TIME: 1140

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1119</u>	<u>33.5</u>	<u>5.92</u>	<u>638</u>	<u>68.4</u>	<u>CLEAR</u>	<u>LOW</u>
<u>1125</u>	<u>67.0</u>	<u>6.61</u>	<u>646</u>	<u>66.7</u>	↓	↓
<u>1132</u>	<u>100.5</u>	<u>6.90</u>	<u>647</u>	<u>66.2</u>	↓	↓

OTHER: \_\_\_\_\_ ODOR: none \_\_\_\_\_  
(COBALT 0-100) (NTU 0-200)

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

PURGING EQUIPMENT

SAMPLING EQUIPMENT

\_\_\_\_\_ 2" Bladder Pump \_\_\_\_\_ Bailer (Teflon)  
 \_\_\_\_\_ Centrifugal Pump \_\_\_\_\_ Bailer (PVC)  
 Submersible Pump \_\_\_\_\_ Bailer (Stainless Steel)  
 \_\_\_\_\_ Well Wizard<sup>®</sup> \_\_\_\_\_ Dedicated  
 Other: \_\_\_\_\_

\_\_\_\_\_ 2" Bladder Pump  Bailer (Teflon)  
 \_\_\_\_\_ Bomb Sampler \_\_\_\_\_ Bailer (Stainless Steel)  
 \_\_\_\_\_ Dipper \_\_\_\_\_ Submersible Pump  
 \_\_\_\_\_ Well Wizard<sup>®</sup> \_\_\_\_\_ Dedicated  
 Other: \_\_\_\_\_

WELL INTEGRITY: Good 15/16 LOCK: OK

REMARKS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

pH, E.C., Temp. Meter Calibration: Date: 6/4/99 Time: 1043 Meter Serial No.: 601125  
 E.C. #009 1419, 1413 pH7 7.15, 7.00 pH10 6.90, 10.00 pH4 6.01, 4.01  
 Temperature °F 67.7

SIGNATURE: Jal [Signature] REVIEWED BY: [Signature] PAGE 4 OF 7

# WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



**OWT**

PROJECT NO: 21775-248.004  
 PURGED BY: JWhurff  
 SAMPLED BY: ↓

SAMPLE ID: mw-9 (67)  
 CLIENT NAME: ARCO # 6113  
 LOCATION: LIVERMORE

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

CASING ELEVATION (feet/MSL): \_\_\_\_\_ VOLUME IN CASING (gal.): 34.0  
 DEPTH OF WELL (feet): 68.0 CALCULATED PURGE (gal.): 102.0  
 DEPTH TO WATER (feet): 15.87 ACTUAL PURGE VOL. (gal.): 102.0

DATE PURGED: 6/4/99 END PURGE: 1210  
 DATE SAMPLED: ↓ SAMPLING TIME: 1215

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1156</u>	<u>34.0</u>	<u>7.19</u>	<u>617</u>	<u>66.9</u>	<u>CLEAR</u>	<u>LOW</u>
<u>1203</u>	<u>68.0</u>	<u>6.87</u>	<u>613</u>	<u>66.0</u>	↓	↓
<u>1210</u>	<u>102.0</u>	<u>6.92</u>	<u>615</u>	<u>65.6</u>	↓	↓

OTHER: \_\_\_\_\_ ODOR: None \_\_\_\_\_  
(COBALT 0-100) (NTU 0-200)

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

**PURGING EQUIPMENT**

**SAMPLING EQUIPMENT**

\_\_\_\_\_ 2" Bladder Pump \_\_\_\_\_ Bailer (Teflon)  
 \_\_\_\_\_ Centrifugal Pump \_\_\_\_\_ Bailer (PVC)  
 Submersible Pump \_\_\_\_\_ Bailer (Stainless Steel)  
 \_\_\_\_\_ Well Wizard<sup>®</sup> \_\_\_\_\_ Dedicated  
 Other: \_\_\_\_\_

\_\_\_\_\_ 2" Bladder Pump  Bailer (Teflon)  
 \_\_\_\_\_ Bomb Sampler \_\_\_\_\_ Bailer (Stainless Steel)  
 \_\_\_\_\_ Dipper \_\_\_\_\_ Submersible Pump  
 \_\_\_\_\_ Well Wizard<sup>®</sup> \_\_\_\_\_ Dedicated  
 Other: \_\_\_\_\_

WELL INTEGRITY: Good 15/16 LOCK: OK

REMARKS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

pH, E.C., Temp. Meter Calibration: Date: \_\_\_\_\_ Time: SEA MW-7 Meter Serial No.: \_\_\_\_\_  
 E.C. 1000 \_\_\_\_\_ / pH 7 \_\_\_\_\_ / pH 10 \_\_\_\_\_ / pH 4 \_\_\_\_\_ /

Temperature °F \_\_\_\_\_  
 SIGNATURE: JW REVIEWED BY: [Signature] PAGE 5 OF 7

# WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



**OWT**

PROJECT NO: 21775-248.004  
20805-134.004  
 PURGED BY: JwherFF  
 SAMPLED BY: ↓

SAMPLE ID: mw-11 (44)  
 CLIENT NAME: ARCO # 6113  
 LOCATION: LIVERMORE

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

CASING ELEVATION (feet/MSL): \_\_\_\_\_ VOLUME IN CASING (gal.): 4.5  
 DEPTH OF WELL (feet): 44.5 CALCULATED PURGE (gal.): 13.5  
 DEPTH TO WATER (feet): 1839 ACTUAL PURGE VOL. (gal.): 5.0

DATE PURGED: 6/4/99 END PURGE: 1305  
 DATE SAMPLED: ↓ SAMPLING TIME: 1315

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1304</u>	<u>4.5</u>	<u>7.01</u>	<u>759</u>	<u>67.4</u>	<u>BROWN</u>	<u>HLLH</u>
<u>1315</u>	<u>—</u>	<u>6.91</u>	<u>703</u>	<u>68.5</u>	<u>11</u>	<u>10</u>

SAND

OTHER: \_\_\_\_\_ ODOR: MOD \_\_\_\_\_  
(COBALT 0-100) (NTU 0-200)

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

**PURGING EQUIPMENT**

**SAMPLING EQUIPMENT**

<input type="checkbox"/> 2" Bladder Pump	<input type="checkbox"/> Bailer (Teflon)	<input type="checkbox"/> 2" Bladder Pump	<input checked="" type="checkbox"/> Bailer (Teflon)
<input type="checkbox"/> Centrifugal Pump	<input type="checkbox"/> Bailer (PVC)	<input type="checkbox"/> Bomb Sampler	<input type="checkbox"/> Bailer (Stainless Steel)
<input checked="" type="checkbox"/> Submersible Pump	<input type="checkbox"/> Bailer (Stainless Steel)	<input type="checkbox"/> Dipper	<input type="checkbox"/> Submersible Pump
<input type="checkbox"/> Well Wizard <sup>®</sup>	<input type="checkbox"/> Dedicated	<input type="checkbox"/> Well Wizard <sup>®</sup>	<input type="checkbox"/> Dedicated

Other: \_\_\_\_\_ Other: \_\_\_\_\_

WELL INTEGRITY: Good 15/100 LOCK: OK

REMARKS: Slow recharge well dried @ 5.0 gallons  
DTW = 39.56  
Took sample @ 1315 DTW = ~~39~~ 23.81

pH, E.C., Temp. Meter Calibration: Date: \_\_\_\_\_ SEE mw-7 Time: \_\_\_\_\_ Meter Serial No.: \_\_\_\_\_  
 E.C. 1000 1 pH 7 1 pH 10 1 pH 4 1

Temperature °F \_\_\_\_\_  
 SIGNATURE: JW REVIEWED BY: [Signature] PAGE 6 OF 7



EMCON ASSOCIATES

# WATER SAMPLE FIELD DATA SHEET

PROJECT NO: 21775-748.004  
PURGED BY: \_\_\_\_\_  
SAMPLED BY: \_\_\_\_\_

SAMPLE ID: MW-17  
CLIENT NAME: ARCO # 0113  
LOCATION: Livermore, CA

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): \_\_\_\_\_ CALCULATED PURGE (gal.): \_\_\_\_\_  
DEPTH OF WELL (feet): \_\_\_\_\_ ACTUAL PURGE VOL. (gal.): \_\_\_\_\_

DATE PURGED: \_\_\_\_\_ Start (2400 Hr) \_\_\_\_\_ End (2400 Hr) \_\_\_\_\_  
DATE SAMPLED: \_\_\_\_\_ Start (2400 Hr) \_\_\_\_\_ End (2400 Hr) \_\_\_\_\_  
DTW<sup>(1)</sup>: \_\_\_\_\_

TIME <sup>(2)</sup> (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<i>No Sample Unable to Locate</i>						

D. O. (ppm): \_\_\_\_\_ ODOR: \_\_\_\_\_  
Field QC samples collected at this well: \_\_\_\_\_ Parameters field filtered at this well: \_\_\_\_\_  
(COBALT 0 - 500) (NTU 0 - 200 or 0 - 1000)

### PURGING EQUIPMENT

### SAMPLING EQUIPMENT

- |   |   |  |   |
|---|---|--|---|
| <input type="checkbox"/> 2" Bladder Pump  | <input type="checkbox"/> Bailer (Teflon®)         | <input type="checkbox"/> 2" Bladder Pump | <input type="checkbox"/> Bailer (Teflon®)         |
| <input type="checkbox"/> Centrifugal Pump | <input type="checkbox"/> Bailer (PVC)             | <input type="checkbox"/> DDL Sampler     | <input type="checkbox"/> Bailer (Stainless Steel) |
| <input type="checkbox"/> Submersible Pump | <input type="checkbox"/> Bailer (Stainless Steel) | <input type="checkbox"/> Dipper          | <input type="checkbox"/> Submersible Pump         |
| <input type="checkbox"/> Well Wizard™     | <input type="checkbox"/> Dedicated                | <input type="checkbox"/> Well Wizard™    | <input type="checkbox"/> Dedicated                |
| Other: _____                              | Other: _____                                      | Last well sampled w/above equip. _____   |   |
| Last well purged w/above equip. _____     |   | Last well purged w/above equip. _____    |   |

WELL INTEGRITY: \_\_\_\_\_ LOCK #: \_\_\_\_\_

REMARKS: \_\_\_\_\_

Well purge recovery for wells purged dry (Time/DTW) ( / / ) ( / / ) ( / / ) ( / / ) ( / / )

Meter Calibration: Date: \_\_\_\_\_ Time: \_\_\_\_\_ Meter Serial #: \_\_\_\_\_ Temperature °F: \_\_\_\_\_  
( EC 1000 \_\_\_\_\_ / \_\_\_\_\_ ) ( DI \_\_\_\_\_ ) ( pH 7 \_\_\_\_\_ / \_\_\_\_\_ ) ( pH 10 \_\_\_\_\_ / \_\_\_\_\_ ) ( pH 4 \_\_\_\_\_ / \_\_\_\_\_ )

Location of previous calibration: \_\_\_\_\_  
NOTES: (1) DTW before starting sampling, if well purged dry (2) Time at end of interval in which purge volume is measured

Signature: JW Reviewed By: JA Page 7 of 7

# ARCO Products Company

Division of Atlantic/Richfield Company

Task Order No. **74118.00**

# Chain of Custody

ARCO Facility no. <b>6113</b>	City (Facility) <b>Livermore</b>	Project manager (Consultant) <b>Glen VanderVeen</b>	Laboratory Name <b>CAS</b>
ARCO engineer <b>Paul Supple</b>	Telephone no. (ARCO)	Telephone no. (Consultant) <b>(408) 452-7200</b>	Contract Number
Consultant name <b>EMCON</b>		Address (Consultant) <b>2201 Broadway #101 Oakland, CA 94612</b>	

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH/x (g, #112) EPA 16020/20015	TPH Modified 8015 Gas <input type="checkbox"/> Diesel <input type="checkbox"/>	Oil and Grease 413.1 <input type="checkbox"/> 4132 <input type="checkbox"/>	TPH EPA 418.1/SM 503E	EPA 601/6010	EPA 624/6240	EPA 625/6270	TCIP Metals <input type="checkbox"/> VOAD <input type="checkbox"/> VOAD	CAM Metals EPA 60107000 TLC <input type="checkbox"/> STLC <input type="checkbox"/>	Lead <input type="checkbox"/> Org/MS <input type="checkbox"/>	Lead EPA 7420/7421 <input type="checkbox"/>	Method of shipment <b>Sampler will deliver</b>	
			Soil	Water	Other	Ice	Acid																
MW-7 (66)				X		X	HCL	6/4/99	1140		X												Special Detection Limit/reporting <b>Lowest Possible</b>
MW-9 (67)				X		X	HCL		1215		X												
MW-11 (44)				X		X	HCL		1315		X												Remarks <b>RAT &amp; 2-40ml HCL VORs</b>
<del>MW-12 (-)</del>				X		X	HCL				X												
MW-6 (65)				X		X	HCL		1410		X												Lab Number
MW-4 (25)				X		X	HCL		1431		X												
MW-5 (61)				X		X	HCL		1515		X												

Condition of sample:		Temperature received:	
Relinquished by sampler <i>[Signature]</i>	Date <b>6/9/99</b> Time <b>2:00</b>	Received by	
Relinquished by	Date	Received by	
Relinquished by	Date	Received by laboratory	Date
			Time