TPH constituents now detected in MW-4, where it was ND or very low before

CAMBRIA

July 31, 2001

Eva Chu
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, 2nd Floor
Alameda, California 94502

AUG 1 0 2001

Re: **Semi-Annual Groundwater Monitoring Report**
Second Quarter 2001
ARCO Service Station No. 6113
785 East Stanley Boulevard
Livermore, California
Cambria Project #438-1611

Dear Ms. Chu:

On behalf of ARCO, Cambria Environmental Technology, Inc. (Cambria) is submitting the attached report which presents the results of the second quarter 2001 groundwater monitoring program at 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.

Please call if you have any questions.

Sincerely,
Cambria Environmental Technology, Inc.

Ron Scheele, RG
Senior Project Manager

Attachment: Semi-Annual Groundwater Monitoring Report, Second Quarter 2001

cc: Ms. Danielle Stefani, City of Livermore Fire Department, 4550 East Ave, Livermore, CA 94550
Mr. Paul Supple, ARCO, PO Box 6549 Moraga, CA 94570

Oakland, CA
San Ramon, CA
Sonoma, CA

Cambria Environmental Technology, Inc.

1144 65th Street
Suite B
Oakland, CA 94608
Tel (510) 420-0700
Fax (510) 420-9170

CAMBRIA

Semi-Annual Groundwater Monitoring Report

Second Quarter 2001

Arco Service Station 6113
785 East Stanley Boulevard
Livermore, California
Cambria Project #438-1611

Prepared For:

Mr. Paul Supple
ARCO

July 31, 2001

Prepared By:
Cambria Environmental Technology, Inc.
1144 65th Street, Suite B
Oakland, California 94608

REGISTERED GEOLOGIST • RONALD A. SCHEELE • No. 6842 • STATE OF CALIFORNIA

Oakland, CA
San Ramon, CA
Sonoma, CA

Cambria Environmental Technology, Inc.

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Tel (510) 420-0700
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Written by:

Jason D. Olson
Staff Environmental Scientist

Ron Scheele, RG
Senior Project Manager

CAMBRIA

Date: July 31, 2001
Quarter: 2nd Quarter, 2001

ARCO SEMI-ANNUAL GROUNDWATER MONITORING REPORT

Station No.:	6113	Address:	785 East Stanley Boulevard, Livermore, California
ARCO Environmental Engineer:			Paul Supple
Consulting Co./Contact Person:			Cambria Environmental Technology Inc. / Ron Scheele, RG
Consultant Project No.:			438-1611
Primary Agency/Regulatory ID No.:			ACHCSA

WORK PERFORMED THIS QUARTER (SECOND - 2001):

1. Prepared and submitted quarterly status report for first quarter 2001.
2. Performed second quarter groundwater monitoring and sampling on May 2, 2001.
3. Submitted *Well Replacement Workplan* dated June 15, 2001.

WORK PROPOSED FOR NEXT QUARTER (THIRD - 2001):

1. Prepare and submit semi-annual groundwater monitoring report for second quarter 2001.
2. Install replacement well as outlined in Cambria's *Well Replacement Workplan*, pending agency approval.

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 Onetime event (4th Quarter): VW-1 through VW-4
Frequency of Monitoring:	Semi-Annual (groundwater)
Is Free Product (FP) Present On-site:	No
Bulk Soil Removed This Quarter :	None
Bulk Soil Removed to Date :	288 cubic yards of TPH impacted soil
Water Wells or Surface Waters, within 2001 ft., impacted by site:	None
Current Remediation Techniques:	Natural attenuation
Average Depth to Groundwater	22.85 feet
Groundwater Flow Direction and Gradient :	0.018 ft/ft toward Northeast

DISCUSSION:

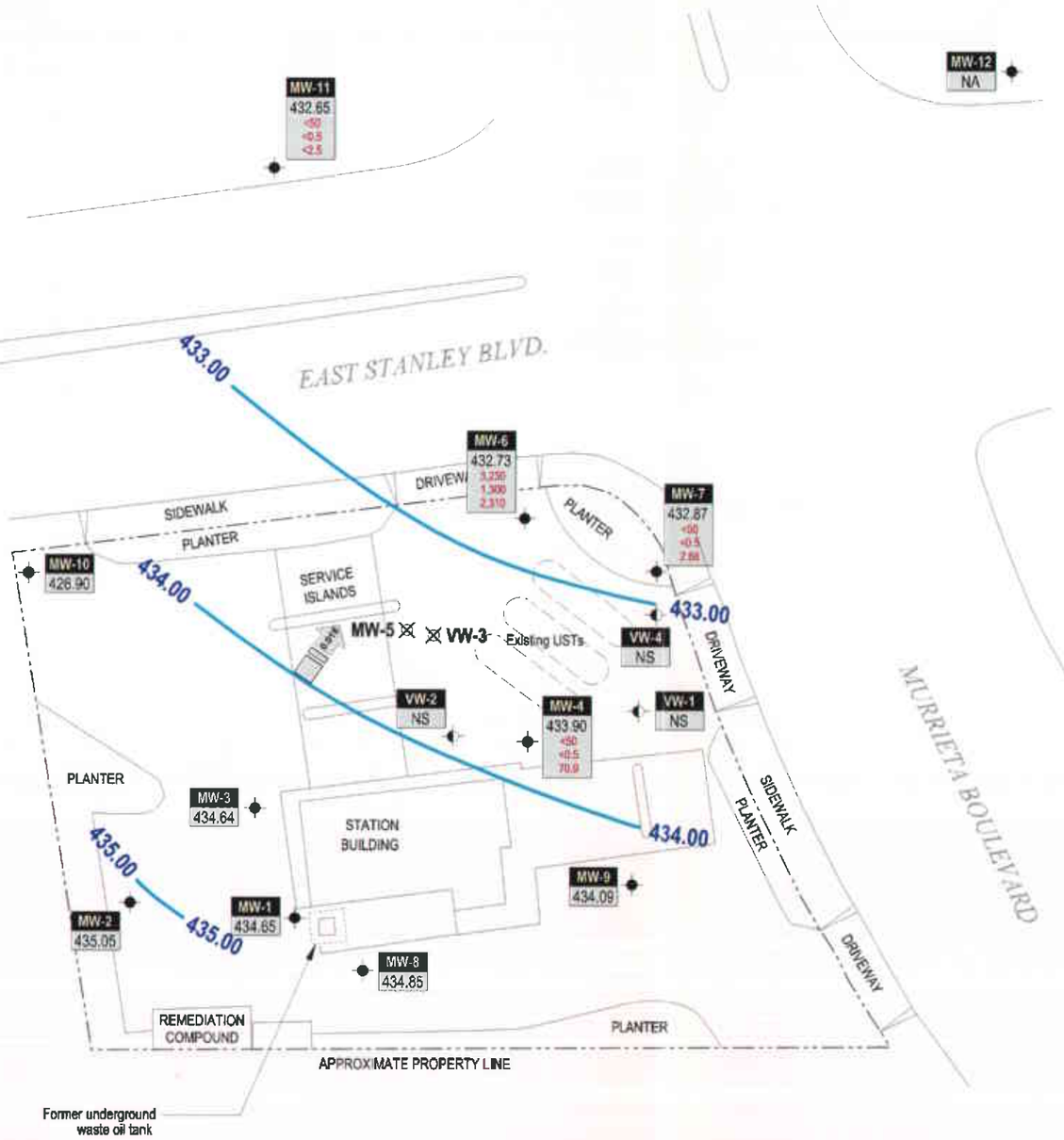
Based on field measurements collect on May 2, 2001, groundwater beneath the site flows towards the northeast, at a gradient of 0.018 ft/ft. This is consistent with the historic groundwater flow direction and gradient.

Hydrocarbon concentrations detected this quarter are consistent with the previous sampling event with the exception of well MW-6, which showed an increase in TPHg, benzene, and MTBE. The maximum TPHg, benzene, and MTBE concentrations were detected in well MW-6 at 3,230, 1,300, and 1,810 micrograms per liter (µg/L), respectively.

ATTACHMENTS:

- Figure 1 – Groundwater Elevation Contour and Analytical Summary Map
- Table 1 – Summary of Historical Groundwater Elevation and Analytical Data
- Appendix A – Field and Laboratory Procedures
- Appendix B – Certified Analytical Report, Chain-of-Custody Documentation
- Appendix C – Field Data Sheets

05/02/01



EXPLANATION

- MW-1 — Monitoring well location
- VW-1 — Vapor Extraction Well Location
- MW-5 — Abandoned Well Location
- Well ID / ELEV / TPHg / Benzene / MTBE — Well Designation; Groundwater Elevation; Concentration of total petroleum hydrocarbons as gasoline, benzene, and MTBE in groundwater in micrograms per liter (ug/l). Samples collected on 05/02/01
- NA — Well Not Accessible
- NS — Well Not Sampled
- 434.00 — Groundwater elevation contour
- 0.018 — Approximate groundwater flow direction and gradient

Groundwater Elevation Contour and Analytical Summary Map
May 2, 2001

CAMBRIA

ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

FIGURE
1

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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 Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MTBE 8021B (µg/L)	MTBE 8260 (µg/L)	Dissolved Oxygen (mg/L)	Purged/ Not Purged (P/NP)
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-1	11-11-99	457.04	18.63	438.41	11-11-99	<50	<0.5	<0.5	<0.5	<1	<3		1.03	P
MW-1	06-20-00	457.04	17.09	439.95	06-20-00	Not sampled: well sampled annually, during the fourth quarter							3.1	
MW-1	08-29-00	457.04	18.20	438.84	08-29-00	Not sampled: well sampled annually, during the fourth quarter							2.66	
MW-1	11-29-00	457.04	20.30	436.74	11-29-00	<50.0	<0.500	<0.500	<0.500	1.36	<2.50		0.71	P
MW-1	**05-02-01**	**457.04**	**22.39**	**434.65**	**05-02-01**	**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								

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1995 - Present*

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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 Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MTBE 8021B (µg/L)	MTBE 8260 (µg/L)	Dissolved Oxygen (mg/L)	Purged/ Not Purged (P/NP)
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								
MW-2	11-11-99	457.74	18.75	438.99	11-11-99	<50	<0.5	<0.5	<0.5	<1	<3		0.82	P
MW-2	06-20-00	457.74	17.21	440.53	06-20-00	Not sampled: well sampled annually, during the fourth quarter							2.6	
MW-2	08-29-00	457.74	18.25	439.49	08-29-00	Not sampled: well sampled annually, during the fourth quarter							2.65	
MW-2	11-29-00	457.74	20.69	437.05	11-29-00	<50.0	<0.500	0.581	0.827	4.38	<2.50		0.88	P
MW-2	**05-02-01**	**457.74**	**22.69**	**435.05**	**05-02-01**	**Not sampled: well sampled annually, during the fourth quarter**								
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	<1,000	<10	<10	<10	<10	1,700			
MW-3	06-04-99	456.97	17.35	439.62	06-04-99	Not sampled: well sampled annually, during the fourth quarter								
MW-3	11-11-99	456.97	18.58	438.39	11-11-99	<50	<0.5	<0.5	<0.5	<1	<3		0.79	P
MW-3	06-20-00	456.97	17.03	439.94	06-20-00	Not sampled: well sampled annually, during the fourth quarter							2.8	
MW-3	08-29-00	456.97	18.25	438.72	08-29-00	Not sampled: well sampled annually, during the fourth quarter							3.39	
MW-3	11-29-00	456.97	20.27	436.70	11-29-00	<50.0	<0.500	<0.500	1.08	3.34	<2.50		0.67	
MW-3	**05-02-01**	**456.97**	**22.33**	**434.64**	**05-02-01**	**Not sampled: well sampled annually, during the fourth quarter**								

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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 Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MTBE 8021B (µg/L)	MTBE 8260 (µg/L)	Dissolved Oxygen (mg/L)	Purged/ Not Purged (P/NP)
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		NR	P
MW-4	11-11-99	456.55	19.25	437.30	11-11-99	88	<0.5	<0.5	<0.5	<1	10		0.77	P
DUP 1	06-20-00	NR	NR	NR	06-20-00	<50.0	<0.500	<0.500	<0.500	<0.500	62.3		NR	
MW-4	06-20-00	456.55	17.79	438.76	06-20-00	<50.0	<0.500	<0.500	<0.500	<0.500	82.4		1.3	P
MW-4	08-29-00	456.55	18.90	437.65	08-29-00	56.0	<0.500	<0.500	<0.500	<0.500	47.9		0.97	P
MW-4	11-29-00	456.55	20.50	436.05	11-29-00	<50.0	<0.500	<0.500	<0.500	<0.500	9.88	10.4	0.59	P
MW-4	**05-02-01**	**456.55**	**22.65**	**433.90**	**05-02-01**	**<50.0**	**<0.500**	**<0.500**	**<0.500**	**<0.500**	**61.1**	**70.9**	**0.74**	**P**
DUP 1	**05-02-01**	**NR**	**NR**	**NR**	**05-02-01**	**<50.0**	**<0.500**	**<0.500**	**<0.500**	**<0.500**	**59.4**	**68.4**	**NR**	
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	7,100	440	180	270	1,700	<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	5,600	230	86	210	1,100	<80			

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1995 - Present*

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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 Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MTBE 8021B (µg/L)	MTBE 8260 (µg/L)	Dissolved Oxygen (mg/L)	Purged/ Not Purged (P/NP)
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	7,600	480	140	400	1,200	<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	14,000	690	140	550	2,200	100			
MW-5	06-04-99	455.84	17.47	438.37	06-04-99	8,300	690	370	90	440	1,400		NM	P
MW-5	11-11-99	455.84	18.80	437.04	11-11-99	18,000	900	190	1,100	3,200	72		0.86	P
MW-5	06-20-00	455.84	17.14	438.70	06-20-00	10,200	618	122	832	2,020	<50.0		1.6	P
MW-5	08-29-00	455.84	18.60	437.24	08-29-00	12,300	436	166	711	2,120	517		0.79	P
MW-5	11-29-00	455.84	20.57	435.27	11-29-00	26,000	491	149	1,090	3,810	671	<20.0	0.51	P
MW-5	**05-02-01**	--	--	--	**05-02-01**	**Well Abandoned**								
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		NM	P
MW-6	11-11-99	454.93	16.12	438.81	11-11-99	<50	0.5	<0.5	<0.5	<1	<3		0.92	P
MW-6	06-20-00	454.93	16.63	438.30	06-20-00	<50.0	<0.500	<0.500	<0.500	<0.500	17.3		1.9	P
DUP	08-29-00	- -	- -	- -	08-29-00	<50.0	<0.500	<0.500	<0.500	<0.500	<2.50		- -	- -
MW-6	08-29-00	454.93	17.91	437.02	08-29-00	<50.0	<0.500	0.551	<0.500	<0.500	<2.50		1.67	P
MW-6	11-29-00	454.93	20.30	434.63	11-29-00	<50.0	<0.500	<0.500	<0.500	1.03	<2.50		0.79	P
MW-6	**05-02-01**	**454.93**	**22.20**	**432.73**	**05-02-01**	**3,230**	**1,300**	**33.6**	**89.4**	**136**	**1,810**	**2,310**	**0.95**	**P**

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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 Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MTBE 8021B (µg/L)	MTBE 8260 (µg/L)	Dissolved Oxygen (mg/L)	Purged/ Not Purged (P/NP)
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		NM	P
MW-7	11-11-99	454.92	18.02	436.90	11-11-99	<50	<0.5	<0.5	<0.5	<1	<3		1.03	P
MW-7	06-20-00	454.92	16.50	438.42	06-20-00	<50.0	<0.500	<0.500	<0.500	<0.500	<2.50		1.3	P
MW-7	08-29-00	454.92	17.80	437.12	08-29-00	<50.0	<0.500	<0.500	<0.500	<0.500	<2.50		1.67	P
MW-7	11-29-00	454.92	19.61	435.31	11-29-00	<50.0	<0.500	<0.500	<0.500	<0.500	<2.50		0.51	P
MW-7	**05-02-01**	**454.92**	**22.05**	**432.87**	**05-02-01**	**<50.0**	**<0.500**	**<0.500**	**<0.500**	**<0.500**	**<2.50**	**2.66**	**0.9**	**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								

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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								
MW-8	11-11-99	456.97	16.67	440.30	11-11-99	<50	<0.5	<0.5	<0.5	<1	<3		1.01	P
MW-8	06-20-00	456.97	15.29	441.68	06-20-00	Not sampled: well sampled annually, during the fourth quarter							2.4	
MW-8	08-29-00	456.97	16.59	440.38	08-29-00	Not sampled: well sampled annually, during the fourth quarter							3.37	
MW-8	11-29-00	456.97	19.80	437.17	11-29-00	<50.0	<0.500	<0.500	<0.500	0.772	<2.50		1.35	P
MW-8	**05-02-01**	**456.97**	**22.12**	**434.85**	**05-02-01**	**Not sampled: well sampled annually, during the fourth quarter**								
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		NM	P
MW-9	11-11-99	456.18	17.02	439.16	11-11-99	<50	<0.5	<0.5	<0.5	<1	<3		0.96	P
MW-9	06-20-00	456.18	15.54	440.64	06-20-00	Not sampled: well sampled annually, during the fourth quarter							2.1	
MW-9	08-29-00	456.18	16.81	439.37	08-29-00	Not sampled: well sampled annually, during the fourth quarter							2.59	
MW-9	11-29-00	456.18	18.81	437.37	11-29-00	<50.0	<0.500	<0.500	<0.500	<0.500	<2.50		0.81	P
MW-9	**05-02-01**	**456.18**	**22.09**	**434.09**	**05-02-01**	**Not sampled: well sampled annually, during the fourth quarter**								

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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 Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MTBE 8021B (µg/L)	MTBE 8260 (µg/L)	Dissolved Oxygen (mg/L)	Purged/ Not Purged (P/NP)
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								
MW-10	11-11-99	456.85	19.35	437.50	11-11-99	<50	<0.5	<0.5	<0.5	<1	<3		0.68	P
MW-10	06-20-00	456.85	17.92	438.93	06-20-00	Not sampled: well sampled annually, during the fourth quarter							2.9	
MW-10	08-29-00	456.85	19.15	437.70	08-29-00	Not sampled: well sampled annually, during the fourth quarter							1.54	
MW-10	11-29-00	456.85	21.30	435.55	11-29-00	<50.0	<0.500	<0.500	<0.500	<0.500	<2.50		0.95	P
MW-10	**05-02-01**	**456.85**	**29.95**	**426.90**	**05-02-01**	**Not sampled: well sampled annually, during the fourth quarter**								
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								

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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		NM	P
MW-11	11-11-99	455.07	18.62	436.45	11-11-99	<50	<0.5	<0.5	<0.5	<1	<3		1.01	P
MW-11	06-20-00	455.07	17.82	437.25	06-20-00	<50.0	0.631	<0.500	<0.500	<0.500	<2.50		4.1	P
MW-11	08-29-00	455.07	19.50	435.57	08-29-00	Not sampled: well sampled semi-annually, during the second and fourth quarters								
MW-11	11-29-00	455.07	20.60	434.47	11-29-00	<50.0	<0.500	<0.500	<0.500	1.63	<2.50		0.97	P
MW-11	**05-02-01**	**455.07**	**22.42**	**432.65**	**05-02-01**	**<50.0**	**<0.500**	**<0.500**	**<0.500**	**<0.500**	**<2.50**		**1.04**	**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								
MW-12	11-11-99	455.04	Not surveyed		11-11-99	Not sampled: unable to locate well								
MW-12	06-20-00	455.04	Not surveyed		06-20-00	Not sampled: unable to locate well								
MW-12	08-29-00	455.04	Not surveyed		08-29-00	Not sampled: unable to locate well								
MW-12	11-29-00	455.04	Not surveyed		11-29-00	Not sampled: unable to locate well								
MW-12	**05-02-01**	**455.04**	**Not surveyed**		**05-02-01**	**Not sampled: unable to locate well**								

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VW-1	08-29-00	NR	17.40	NR	08-29-00	2,360	27.6	11.6	26.3	33.2	110		4.47	P
VW-1	11-29-00	NR	18.75	NR	11-29-00	<50.0	<0.500	<0.500	<0.500	<0.500	<2.50		0.46	P
VW-1	**05-02-01**	**NR**	**21.59**	**NR**	**05-02-01**	**Well not sampled**								
VW-2	08-29-00	NR	NR	NR	08-29-00	Well inaccessible								
VW-2	11-29-00	NR	NR	NR	11-29-00	Well inaccessible								
VW-2	**05-02-01**	**NR**	**NR**	**NR**	**05-02-01**	**Well not sampled**								
VW-3	08-29-00	NR	17.93	NR	08-29-00	25,400	3,540	10,600	1,280	43,000	44,700		NR	P
VW-3	11-29-00	NR	19.75	NR	11-29-00	54,200	9,450	1,870	2,350	9,400	12,300	15,100	0.47	P
VW-3	**05-02-01**	**NR**	**NR**	**NR**	**05-02-01**	**Well abandoned**								
VW-4	08-29-00	NR	NR	NR	08-29-00	Well inaccessible								
VW-4	11-29-00	NR	19.45	NR	11-29-00	37,500	4,510	206	2,100	9,030	6,770	7,880	0.42	P
DUP	11-29-00	NR	NR	NR	11-29-00	36,100	3,700	206	1,850	7,890	6,430	8,460		
VW-4	**05-02-01**	**NR**	**21.66**	**NR**	**05-02-01**	**Well not sampled**								

Notes:

NA: Not analyzed

NR: not reported; data not available or not measurable

TPH: Total petroleum hydrocarbons by modified EPA method 8015

BTEX: Benzene, toluene, ethylbenzene, total xylenes by EPA method 8021B. (EPA method 8020 prior to 11/11/99)

MTBE: Methyl tert-butyl ether by EPA method 8021B. (EPA method 8020 prior to 11/11/99). Any MTBE Detection by 8021B was confirmed by EPA method 8260 beginning Third Quarter 2000 (08-29-00 Resuls)

ft-MSL: elevation in feet, relative to mean sea level

µg/L: micrograms per liter

mg/L: milligrams per liter

<: less than laboratory detection limit stated to the right

*: For previous historical groundwater elevation and analytical data please refer to *Fourth Quarter 1995 Groundwater Monitoring Program Results, ARCO Service Station 6113, Livermore, California,* (EMCON, February 26, 1996).

Table 2
Groundwater Flow Direction and Gradient

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

Date Measured	Average Flow Direction	Average Hydraulic Gradient
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
06-04-99	North	0.02
11-11-99	North	0.03
06-20-00	North-Northeast	0.014
08-29-00	North-Northeast	0.013
11-29-00	North-Northwest	0.026
05-02-01	**Northeast**	**0.026**

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 tap water. During field sampling, equipment surfaces that were placed in the well or came into

contact with groundwater during field sampling were washed with detergent and double rinsed with tap 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 after each use. A bottom-filling, clear disposable 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 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, otherwise non-purge groundwater samples were collected. Before sampling occurred, a polyvinyl chloride (PVC) bailer, centrifugal pump, low-flow submersible pump, or disposable bailer was used to purge standing water in the casing and gravel pack from the monitoring well. 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 240-gallon truck-mounted tank to Integrated Waste Management's Milpitas storage facility for disposal.

Field measurements of pH, specific conductance, and temperature were recorded in a waterproof field logbook. 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 disposable 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 disposable 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 or ice 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.

Samples were transferred from Cambria to an ARCO-approved laboratory by courier or taken directly to the laboratory by the environmental sampler. Sample shipments from Cambria to laboratories performing the selected analyses routinely occurred within two to three days 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 Cambria 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)

APPENDIX B

CERTIFIED ANALYTICAL REPORTS AND CHAIN-OF-CUSTODY DOCUMENTATION

Sequoia
Analytical

885 Jarvis Drive
Morgan Hill, CA 95037
(408) 776-9600
FAX (408) 782-6308
www.sequoialabs.com

14 May, 2001

Jason Olson
Cambria - Emeryville
6262 Hollis St.
Emeryville, CA 94608

RE: Arco
Sequoia Report: MKE0112

Enclosed are the results of analyses for samples received by the laboratory on 05/03/01 13:06. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jeff Smyly
Project Manager

CA ELAP Certificate #1210

Sequoia Analytical

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Morgan Hill, CA 95037
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FAX (408) 782-6308
www.sequoialabs.com

Cambria - Emeryville	Project: Arco	
6262 Hollis St.	Project Number: Arco No.6113	**Reported:**
Emeryville CA, 94608	Project Manager: Jason Olson	05/14/01 12:09

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
MW-4	MKE0112-01	Water	05/02/01 12:45	05/03/01 13:06
MW-6	MKE0112-02	Water	05/02/01 11:00	05/03/01 13:06
MW-7	MKE0112-03	Water	05/02/01 12:00	05/03/01 13:06
MW-11	MKE0112-04	Water	05/02/01 09:35	05/03/01 13:06
DUP	MKE0112-05	Water	05/02/01 00:00	05/03/01 13:06

Sequoia Analytical - Morgan Hill

Jeff Smyly, Project Manager

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Sequoia Analytical

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Cambria - Emeryville	Project: Arco	
6262 Hollis St.	Project Number: Arco No.6113	**Reported:**
Emeryville CA, 94608	Project Manager: Jason Olson	05/14/01 12:09

Total Purgeable Hydrocarbons (C6-C12), BTEX and MTBE by DHS LUFT

Sequoia Analytical - Morgan Hill

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-4 (MKE0112-01) Water Sampled: 05/02/01 12:45 Received: 05/03/01 13:06									
Purgeable Hydrocarbons	ND	50.0	ug/l	1	1E07002	05/07/01	05/07/01	DHS LUFT	
Benzene	ND	0.500	"	"	"	"	"	"	
Toluene	ND	0.500	"	"	"	"	"	"	
Ethylbenzene	ND	0.500	"	"	"	"	"	"	
Xylenes (total)	ND	0.500	"	"	"	"	"	"	
Methyl tert-butyl ether	**61.1**	2.50	"	"	"	"	"	"	
Surrogate: a,a,a-Trifluorotoluene		*101 %*	*70-130*		"	"	"	"	
MW-6 (MKE0112-02) Water Sampled: 05/02/01 11:00 Received: 05/03/01 13:06									
Purgeable Hydrocarbons	**3230**	1000	ug/l	20	1E07002	05/07/01	05/07/01	DHS LUFT	P-01
Benzene	**1300**	10.0	"	"	"	"	"	"	
Toluene	**33.6**	10.0	"	"	"	"	"	"	
Ethylbenzene	**89.4**	10.0	"	"	"	"	"	"	
Xylenes (total)	**136**	10.0	"	"	"	"	"	"	
Methyl tert-butyl ether	**1810**	50.0	"	"	"	"	"	"	
Surrogate: a,a,a-Trifluorotoluene		*102 %*	*70-130*		"	"	"	"	
MW-7 (MKE0112-03) Water Sampled: 05/02/01 12:00 Received: 05/03/01 13:06									
Purgeable Hydrocarbons	ND	50.0	ug/l	1	1E07002	05/07/01	05/07/01	DHS LUFT	
Benzene	ND	0.500	"	"	"	"	"	"	
Toluene	ND	0.500	"	"	"	"	"	"	
Ethylbenzene	ND	0.500	"	"	"	"	"	"	
Xylenes (total)	ND	0.500	"	"	"	"	"	"	
Methyl tert-butyl ether	ND	2.50	"	"	"	"	"	"	
Surrogate: a,a,a-Trifluorotoluene		*99.6 %*	*70-130*		"	"	"	"	

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Sequoia Analytical

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Cambria - Emeryville	Project: Arco	
6262 Hollis St.	Project Number: Arco No.6113	**Reported:**
Emeryville CA, 94608	Project Manager: Jason Olson	05/14/01 12:09

Total Purgeable Hydrocarbons (C6-C12), BTEX and MTBE by DHS LUFT

Sequoia Analytical - Morgan Hill

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-11 (MKE0112-04) Water Sampled: 05/02/01 09:35 Received: 05/03/01 13:06									
Purgeable Hydrocarbons	ND	50.0	ug/l	1	1E07002	05/07/01	05/07/01	DHS LUFT	
Benzene	ND	0.500	"	"	"	"	"	"	
Toluene	ND	0.500	"	"	"	"	"	"	
Ethylbenzene	ND	0.500	"	"	"	"	"	"	
Xylenes (total)	ND	0.500	"	"	"	"	"	"	
Methyl tert-butyl ether	ND	2.50	"	"	"	"	"	"	
Surrogate: a,a,a-Trifluorotoluene		*101 %*	*70-130*		"	"	"	"	
DUP (MKE0112-05) Water Sampled: 05/02/01 00:00 Received: 05/03/01 13:06									
Purgeable Hydrocarbons	ND	50.0	ug/l	1	1E07002	05/07/01	05/07/01	DHS LUFT	
Benzene	ND	0.500	"	"	"	"	"	"	
Toluene	ND	0.500	"	"	"	"	"	"	
Ethylbenzene	ND	0.500	"	"	"	"	"	"	
Xylenes (total)	ND	0.500	"	"	"	"	"	"	
Methyl tert-butyl ether	**59.4**	2.50	"	"	"	"	"	"	
Surrogate: a,a,a-Trifluorotoluene		*102 %*	*70-130*		"	"	"	"	

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Cambria - Emeryville	Project: Arco	
6262 Hollis St.	Project Number: Arco No.6113	**Reported:**
Emeryville CA, 94608	Project Manager: Jason Olson	05/14/01 12:09

MTBE Confirmation by EPA Method 8260A

Sequoia Analytical - Morgan Hill

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-4 (MKE0112-01) Water Sampled: 05/02/01 12:45 Received: 05/03/01 13:06									
Methyl tert-butyl ether	**70.9**	5.00	ug/l	5	1E09018	05/09/01	05/09/01	EPA 8260A	
Surrogate: 1,2-Dichloroethane-d4		*87.9 %*	*70-130*		"	"	"	"	
MW-6 (MKE0112-02) Water Sampled: 05/02/01 11:00 Received: 05/03/01 13:06									
Methyl tert-butyl ether	**2310**	100	ug/l	100	1E09018	05/09/01	05/09/01	EPA 8260A	
Surrogate: 1,2-Dichloroethane-d4		*90.7 %*	*70-130*		"	"	"	"	
MW-7 (MKE0112-03) Water Sampled: 05/02/01 12:00 Received: 05/03/01 13:06									
Methyl tert-butyl ether	**2.66**	1.00	ug/l	1	1E09018	05/09/01	05/09/01	EPA 8260A	
Surrogate: 1,2-Dichloroethane-d4		*87.3 %*	*70-130*		"	"	"	"	
DUP (MKE0112-05) Water Sampled: 05/02/01 00:00 Received: 05/03/01 13:06									
Methyl tert-butyl ether	**68.4**	5.00	ug/l	5	1E09018	05/09/01	05/09/01	EPA 8260A	
Surrogate: 1,2-Dichloroethane-d4		*86.9 %*	*70-130*		"	"	"	"	

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Cambria - Emeryville	Project: Arco	
6262 Hollis St.	Project Number: Arco No.6113	**Reported:**
Emeryville CA, 94608	Project Manager: Jason Olson	05/14/01 12:09

Total Purgeable Hydrocarbons (C6-C12), BTEX and MTBE by DHS LUFT - Quality Control
Sequoia Analytical - Morgan Hill

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1E07002 - EPA 5030B [P/T]										
Blank (1E07002-BLK1)				Prepared & Analyzed: 05/07/01						
Purgeable Hydrocarbons	ND	50.0	ug/l							
Benzene	ND	0.500	"							
Toluene	ND	0.500	"							
Ethylbenzene	ND	0.500	"							
Xylenes (total)	ND	0.500	"							
Methyl tert-butyl ether	ND	2.50	"							
Surrogate: a,a,a-Trifluorotoluene	*9.98*		"	*10.0*		*99.8*	*70-130*			
LCS (1E07002-BS1)				Prepared & Analyzed: 05/07/01						
Purgeable Hydrocarbons	250	50.0	ug/l	250		100	70-130			
Surrogate: a,a,a-Trifluorotoluene	*10.3*		"	*10.0*		*103*	*70-130*			
Matrix Spike (1E07002-MS1)		**Source: MKE0112-03**		Prepared & Analyzed: 05/07/01						
Purgeable Hydrocarbons	243	50.0	ug/l	250	ND	97.2	60-140			
Surrogate: a,a,a-Trifluorotoluene	*12.1*		"	*10.0*		*121*	*70-130*			
Matrix Spike Dup (1E07002-MSD1)		**Source: MKE0112-03**		Prepared & Analyzed: 05/07/01						
Purgeable Hydrocarbons	220	50.0	ug/l	250	ND	88.0	60-140	9.94	25	
Surrogate: a,a,a-Trifluorotoluene	*10.4*		"	*10.0*		*104*	*70-130*			

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Cambria - Emeryville	Project: Arco	
6262 Hollis St.	Project Number: Arco No.6113	**Reported:**
Emeryville CA, 94608	Project Manager: Jason Olson	05/14/01 12:09

MTBE Confirmation by EPA Method 8260A - Quality Control
Sequoia Analytical - Morgan Hill

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1E09018 - EPA 5030B P/T										
Blank (1E09018-BLK1)				Prepared: 05/09/01 Analyzed: 05/10/01						
Methyl tert-butyl ether	ND	1.00	ug/l							
Surrogate: 1,2-Dichloroethane-d4	*8.39*		"	*10.0*		*83.9*	*70-130*			
LCS (1E09018-BS1)				Prepared: 05/09/01 Analyzed: 05/10/01						
Methyl tert-butyl ether	11.8	1.00	ug/l	10.0		118	70-130			
Surrogate: 1,2-Dichloroethane-d4	*8.67*		"	*10.0*		*86.7*	*70-130*			
Matrix Spike (1E09018-MS1)		**Source: MKE0161-01**		Prepared: 05/09/01 Analyzed: 05/10/01						
Methyl tert-butyl ether	442	10.0	ug/l	100	334	108	70-130			
Surrogate: 1,2-Dichloroethane-d4	*8.86*		"	*10.0*		*88.6*	*70-130*			
Matrix Spike Dup (1E09018-MSD1)		**Source: MKE0161-01**		Prepared: 05/09/01 Analyzed: 05/10/01						
Methyl tert-butyl ether	399	10.0	ug/l	100	334	65.0	70-130	10.2	25	Q-01
Surrogate: 1,2-Dichloroethane-d4	*8.63*		"	*10.0*		*86.3*	*70-130*			

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Cambria - Emeryville	Project: Arco	
6262 Hollis St.	Project Number: Arco No.6113	**Reported:**
Emeryville CA, 94608	Project Manager: Jason Olson	05/14/01 12:09

Notes and Definitions

P-01	Chromatogram Pattern: Gasoline C6-C12
Q-01	The spike recovery for this QC sample is outside of established control limits. Review of associated batch QC indicates the recovery for this analyte does not represent an out-of-control condition for the batch.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

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ARCO Products Company
Division of Atlantic-Richfield Company

Task Order No. 27198.00

Chain of Custody

ARCO Facility no. 6113	City (Facility) Livermore	Project manager (Consultant) Ron Scheele/Jason Olson	Laboratory name Sequoia
ARCO engineer Paul Supple	Telephone no. (ARCO) 925-299-3891	Telephone no. (Consultant) 510-450-1983	Fax no. (Consultant) 510-450-8295
Consultant name CAMBRIA ENV. TECH	Address (Consultant) 6262 Hollis St.		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/TPH9/MTBE EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM METALS EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐	confirm all MTBE by 8260
MW-4	01	4		X		X	X	5-2-01	12:45		X										X
MW-6	02	4		X		X	X	5-2-01	11:00		X										X
MW-7	03	4		X		X	X	5-2-01	12:00		X										X
MW-11	04	4		X		X	X	5-2-01	9:35		X										X
DUP	05	4		/		X	X	5-2-01			X										X

Special detection Limit/reporting: Report and Lo... Detection Lim...

Special QA/QC

Remarks: Confirm all MTBE by 8260

Lab number: MKE0112

Turnaround time

Priority Rush
1 Business Day

Rush
2 Business Days

Expedited
5 Business Days

Standard
10 Business Days

Condition of sample:

Temperature received:

	Date	Time	
Relinquished by sampler: S. Hill	5/3/01	1306	Received by: MH
Relinquished by	Date	Time	Received by
...ed by	Date	Time	Received by / Date / Time

...opy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant

APPENDIX C

FIELD DATA SHEETS

CAMBRIA

WELL DEPTH MEASUREMENTS

Well ID	Time	Top of Screen	DTB	DTP	DTW	DOP	Casing Dia	Comments
MW-1	8:30	29'	44		22.39		2"	
MW-2	8:35	28'	38		22.69		2"	
MW-3	8:40	28.5'	38.5'		22.33		2"	
MW-4	8:15		26.65		22.65		4"	
MW-5	—	43'	63'	well	abandoned		4"	
MW-6	8:50	48'	68'		22.20		4"	
MW-7	8:55	48'	68'		22.05		4"	
MW-8	8:25	47'	67'		22.12		4"	
MW-9	8:20	48'	68'		22.09		4"	
MW-10	8:45	32'	52'		29.95		4"	
MW-11	8:00	38'	45'		22.42		2"	
MW-12	—	18'	34.5'	not located			2"	
VW-1	8:05	25'	45'		21.59		4"	
VW-2	8:10	28'	49.5'					
VW-3	—	15.5"	23.5'	well	abandoned		4"	

Project Name: ARCO 6113

Project Number: 438-1611

Measured By: J. Hall

Date: 5-2-01

H:\ARCO\6113\Forms\ARCO_GW-DEPTH.WPD

CAMB..A

WELL DEPTH MEASUREMENTS

Well ID	Time	Top of Screen	DTB	DTP	DTW	DOP	Casing Dia	Comments
MW-4	9:00	17'	30.1'		21.66			
MW-5	DOES NOT EXIST							

Project Name: Arco 6113

Project Number: 438-1611

Measured By: [signature]

Date: 5-2-01

H:\ARCO\6113\Forms\ARCO_GW-DEPTH.WPD

CAMBRIA

WELL SAMPLING FORM

Project Name: **ARCO 6113**	Cambria Mgr: **Ron Scheele**	Well ID: MW-4
Project Number: **438 - 1611**	Date: 5-2-01	Well Yield:
Site Address: **785 E Stanley Blvd, Livermore**	Sampling Method: **Disposable bailer**	Well Diameter: 4" pvc
		Technician(s): SK
Initial Depth to Water: 22.65	Total Well Depth: 26.65	Water Column Height: 4
Volume/ft: 0.65	1 Casing Volume: 2.60	3 Casing Volumes: 7.80
Purge/No Purge:		
Purging Device: **Submersible Pump**	Did Well Dewater?: NO	Total Gallons Purged: 8
Start Purge Time: 12:30	Stop Purge Time: 12:39	Total Time: 9mins

1 Casing Volume = Water column height x Volume/ ft.

Well Diam.	Volume/ft (gallons)
2"	0.16
4"	0.65
6"	1.47

Time	Casing Volume	Temp. C	pH	Cond. uS	Comments
12:33	3	16.0	7.68	481	
12:37	6	15.7	7.79	469	
12:40	8	15.3	7.91	460	
					DO = 0.74 mg/L

Sample ID	Date	Time	Container Type	Preservative	Analytes	Analytic Method
MW-4	5-2-01	12:45	4 VOA	HCL	TPHg, BTEX, MTBE	8021B
DUP						

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WELL SAMPLING FORM

Project Name: **ARCO 6113**	Cambria Mgr: **Ron Scheele**	Well ID: MW-6
Project Number: **438 - 1611**	Date: 5-2-01	Well Yield:
Site Address: **785 E Stanley Blvd, Livermore**	Sampling Method: **Disposable bailer**	Well Diameter: 4" pvc
		Technician(s): SC
Initial Depth to Water: 22.20	Total Well Depth: 68.00	Water Column Height: 45.80
Volume/ft: 0.65	1 Casing Volume: ~~29.77~~ 29.77	3 Casing Volumes: 89.31
Purge/No Purge:		
Purging Device: **Submersible Pump**	Did Well Dewater?: NO	Total Gallons Purged: 90
Start Purge Time: 9:45	Stop Purge Time: 10:54	Total Time: 69 mins

1 Casing Volume = Water column height x Volume/ ft.

Well Diam.	Volume/ft (gallons)
2"	0.16
4"	0.65
6"	1.47

Time	Casing Volume	Temp. C	pH	Cond. uS	Comments
10:05	30	17.2	7.09	341	
10:30	60	14.4	7.03	548	
10:55	90	14.8	7.05	769	
					0.95 mg/L

Sample ID	Date	Time	Container Type	Preservative	Analytes	Analytic Method
MW-6	5-2-01	11:00	4 VOA	HCL	TPHg, BTEX, MTBE	8021B

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WELL SAMPLING FORM

Project Name: **ARCO 6113**	Cambria Mgr: **Ron Scheele**	Well ID: MW-7
Project Number: **438 - 1611**	Date: 5-2-01	Well Yield:
Site Address: **785 E Stanley Blvd, Livermore**	Sampling Method: **Disposable bailer**	Well Diameter: 4" pvc
		Technician(s): SG
Initial Depth to Water: 22.05	Total Well Depth: 68.00	Water Column Height: 45.95
Volume/ft: 0.65	1 Casing Volume: 29.87	3 Casing Volumes: 89.60
Purge/No Purge:		
Purging Device: **Submersible Pump**	Did Well Dewater?: NO	Total Gallons Purged: 90
Start Purge Time: 11:10	Stop Purge Time: 12:14	Total Time: 64 mins

1 Casing Volume = Water column height x Volume/ ft.

Well Diam.	Volume/ft (gallons)
2"	0.16
4"	0.65
6"	1.47

Time	Casing Volume	Temp. C	pH	Cond. uS	Comments
11:30	30	17.9	7.71	527	
11:50	60	16.1	7.27	521	
12:15	90	16.5	7.13	552	
					DO = 90 mg/L

Sample ID	Date	Time	Container Type	Preservative	Analytes	Analytic Method
MW-7	5-2-01	12:20	**4 VOA**	**HCL**	**TPHg, BTEX, MTBE**	**8021B**

CAMBRIA

WELL SAMPLING FORM

Project Name: **ARCO 6113**	Cambria Mgr: **Ron Scheele**	Well ID: MW-11
Project Number: **438 - 1611**	Date: 5-2-01	Well Yield:
Site Address: **785 E Stanley Blvd, Livermore**	Sampling Method: **Disposable bailer**	Well Diameter: 2" pvc
		Technician(s): SC
Initial Depth to Water: 22.42	Total Well Depth: 45.00	Water Column Height: 22.58
Volume/ft: 0.16	1 Casing Volume: 3.61	3 Casing Volumes: 10.83
Purge/No Purge:		
Purging Device: ~~Submersible Pump~~ disposable bailer	Did Well Dewater?: NO	Total Gallons Purged: 10
Start Purge Time: 9:00	Stop Purge Time: 9:29	Total Time: 29 mins

1 Casing Volume = Water column height x Volume/ ft.

Well Diam.	Volume/ft (gallons)
2"	0.16
4"	0.65
6"	1.47

Time	Casing Volume	Temp. C	pH	Cond. uS	Comments
9:10	3	16.3	8.23	600	
9:20	6	14.6	8.05	619	
9:30	10	15.1	8.09	612	
					DO = 1.04 mg/L

Sample ID	Date	Time	Container Type	Preservative	Analytes	Analytic Method
MW-11	5-2-01	9:35	**4 VOA**	**HCL**	**TPHg, BTEX, MTBE**	**8021B**