



ENVIRONMENTAL
PROTECTION

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March 6, 2000
Project 791637

3756
HWC'S

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

Re: Annual Groundwater Monitoring Report, Fourth Quarter 1999, for ARCO Service Station No. 0276, located at 10600 MacArthur Boulevard, Oakland, California

Dear Mr. Supple:

Pinnacle Environmental Solutions, a member of The IT Group (Pinnacle), is submitting the attached report which presents the results of the 1999 annual Tetrachloroethylene (PCE) monitoring at ARCO Products Company (ARCO) Service Station No. 0276, located at 10600 MacArthur Boulevard, Oakland, California. The annual monitoring event is conducted at the request of the Alameda County Health Care Services Agency (ACHCSA) to monitor PCE only. According to ACHCSA, the investigation and remediation associated with the underground storage tanks has been completed and is now closed.

Please call if you have questions.

Sincerely,

Pinnacle

Glen VanderVeen
Project Manager

Dan Easter, R.G. 5722
Project Geologist

Attachment: Annual Groundwater Monitoring Report, Fourth Quarter 1999

cc: Mr. Barney Chan, ACHCSA

Date: March 6, 2000**ARCO ANNUAL GROUNDWATER MONITORING REPORT**

Facility No.: 0276 Address: 10600 MacArthur Boulevard, Oakland, California
 ARCO Environmental Engineer: Paul Supple
 Consulting Co./Contact Person: Pinnacle Environmental Solutions/ Glen VanderVeen
 Consultant Project No.: 791637
 Primary Agency/Regulatory ID No.: ACHCSA

WORK PERFORMED THIS QUARTER (FOURTH - 1999):

1. Prepared and submitted quarterly status report for third quarter 1999.
2. Performed annual groundwater monitoring and sampling for fourth quarter 1999.

WORK PROPOSED FOR NEXT QUARTER (FIRST - 2000):

1. Prepare and submit annual groundwater monitoring report for fourth quarter 1999.
2. No environmental work is scheduled at the site during the first quarter 2000.

MONITORING:

Current Phase of Project: Closed
 Frequency of Groundwater Sampling: Annual (4th Quarter): MW-1, MW-3, MW-4, MW-5
 Frequency of Groundwater Monitoring: Annual
 Is Free Product (FP) Present On-Site: No
 FP Recovered this Quarter: None
 Cumulative FP Recovered to Date: 18.54 gallons, Wells MW-2 and MW-7.
 Bulk Soil Removed This Quarter: None
 Bulk Soil Removed to Date: 564 cubic yards of TPH-impacted soil
 Current Remediation Techniques: Complete
 Approximate Depth to Groundwater: 28.3 feet
 Groundwater Flow Direction and
 Gradient (Average): 0.19 ft/ft toward north-northwest

DISCUSSION:

- Per correspondence between ACHCSA, ARCO and Pinnacle, annual monitoring will be conducted at this site beginning with the fourth quarter 1999. Wells MW-1, MW-3, MW-4 and MW-5 will be sampled and analyzed for Tetrachloroethylene (PCE) by EPA Method 8010.
- The annual monitoring event is conducted at the request of the ACHCSA to monitor PCE only. According to ACHCSA, the investigation and remediation associated with the underground storage tanks has been completed and is now closed.
- Please refer to the *Fourth Quarter 1997 Monitoring Report, (EMCON, March 1998)*, for historical groundwater elevation and analytical data.

ATTACHMENTS:

- Table 1 - Groundwater Elevation and Analytical Data, Halogenated Volatile Organic Compounds
- 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
Halogenated Volatile Organic Compounds (EPA method 8010 or 8240)
1995-Present**

ARCO Service Station 276
10600 MacArthur Boulevard, Oakland, California

Well Number	Date Gauged	TOC Elevation (ft-MSL)	Depth to Water (feet)	FP Thickness (ft-MSL)	Groundwater Elevation (ft-MSL)	Date Sampled	Tetrachloro-ethene (PCE) µg/L	Trichloro-ethene (TCE) µg/L	trans-1,2-Dichloroethene µg/L	cis-1,2-Dichloroethene µg/L	Freon 12 µg/L	Dissolved Oxygen (mg/l)	Purged/Not Purged (P/NP)
MW-1	03-10-95	55.92	26.26	ND	29.66	03-10-95	170	<1	--	<1	--		
MW-1	06-05-95	55.92	25.71	ND	30.21	06-05-95	210	<5	--	<5	--		
MW-1	08-29-95	55.92	28.44	ND	27.48	08-29-95	130	<1	--	<1	--		
MW-1	11-16-95	55.92	30.85	ND	25.07	11-16-95	45	<1	--	<1	<1		
MW-1	02-28-96	55.92	24.99	ND	30.93	02-28-96	97	<1	<1	<1	--		
MW-1	05-28-96	55.92	24.92	ND	31.00	05-28-96	160	<5	<5	<5	--		
MW-1	08-19-96	55.92	28.04	ND	27.88	08-19-96	77	<1	<1	<1	--		
MW-1	11-21-96	55.92	30.19	ND	25.73	11-21-96	30	<1	<1	<1	--		
MW-1	03-26-97	55.92	24.90	ND	31.02	03-26-97	66	<1	<1	<1	--		
MW-1	05-20-97	55.92	26.99	ND	28.93	05-20-97	36	<0.5	<0.5	<0.5	--		
MW-1	08-18-97	55.92	29.98	ND	25.94	08-18-97	11	<0.5	<0.5	<0.5	--		
MW-1	11-17-97	55.92	31.72	ND	24.20	11-17-97	Not analyzed for Halogenated Volatile Organic Compounds						
MW-1	12-02-99	55.92	Not surveyed			12-02-99	Not surveyed: well was inaccessible						
MW-2	03-10-95	55.10	13.98	ND	41.12	03-11-95	<1	<1	--	<1	--		
MW-2	06-05-95	55.10	15.65	ND	39.45	06-05-95	<1	<1	--	<1	--		
MW-2	08-29-95	55.10	17.14	ND	37.96	08-29-95	<5	<5	--	<5	--		
MW-2	11-16-95	55.10	Not surveyed			11-16-95	Not surveyed: well was inaccessible						
MW-2	02-28-96	55.10	12.46	ND	42.64	02-28-96	<1	<1	<1	<1	--		
MW-2	05-28-96	55.10	15.23	ND	39.87	05-28-96	<1	<1	<1	<1	--		
MW-2	08-19-96	55.10	16.84	ND	38.26	08-21-96	<1	<1	<1	<1	--		
MW-2	11-21-96	55.10	15.44	ND	39.66	11-21-96	<1	<1	<1	<1	--		
MW-2	03-26-97	55.10	15.73	ND	39.37	03-26-97	<10 [^]	<10 [^]	<10 [^]	<10 [^]	--		
MW-2	05-20-97	55.10	16.07	ND	39.03	05-20-97	<1 [^]	<1 [^]	<1 [^]	<1 [^]	--		
MW-2	08-18-97	55.10	17.28	ND	37.82	08-18-97	<5 [^]	<5 [^]	<5 [^]	<5 [^]	--		
MW-2	11-17-97	55.10	16.75	ND	38.35	11-17-97	Not analyzed for Halogenated Volatile Organic Compounds						
MW-2	12-02-99	55.10	Not surveyed			12-02-99	Not sampled: not on sampling schedule						

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Well Number	Date Gauged	TOC Elevation (ft-MSL)	Depth to Water (feet)	FP Thickness (ft-MSL)	Groundwater Elevation (ft-MSL)	Date Sampled	Tetrachloro-ethene (PCE) µg/L	Trichloro-ethene (TCE) µg/L	trans-1,2-Dichloroethene µg/L	cis-1,2-Dichloroethene µg/L	Freon 12 µg/L	Dissolved Oxygen (mg/l)	Purged/Not Purged (P/NP)	
MW-3	03-10-95	56.55	26.74	ND	29.81	03-11-95	1700	<10	--	<10	--			
MW-3	06-05-95	56.55	26.34	ND	30.21	06-05-95	2500	<20	--	<20	--			
MW-3	08-29-95	56.55	29.15	ND	27.40	08-29-95	1600	<20	--	<20	--			
MW-3	11-16-95	56.55	31.50	ND	25.05	11-16-95	1100	<20	--	<20	<20			
MW-3	02-28-96	56.55	25.32	ND	31.23	02-28-96	1100	<10	<10	<10	--			
MW-3	05-28-96	56.55	25.46	ND	31.09	05-28-96	1700	<20	<20	<20	--			
MW-3	08-19-96	56.55	28.71	ND	27.84	08-19-96	1200	<20	<20	<20	--			
MW-3	11-21-96	56.55	30.85	ND	25.70	11-21-96	710	<20 [^]	<20 [^]	<20 [^]	--			
MW-3	03-26-97	56.55	25.36	ND	31.19	03-26-97	710	<40 [^]	<40 [^]	<40 [^]	--			
MW-3	05-20-97	56.55	27.61	ND	28.94	05-20-97	800	<25 [^]	<25 [^]	<25 [^]	--			
MW-3	08-18-97	56.55	30.62	ND	25.93	08-18-97	420	<5 [^]	<5 [^]	<5 [^]	--			
MW-3	11-17-97	56.55	32.40	ND	24.15	11-17-97	Not analyzed for Halogenated Volatile Organic Compounds							
MW-3	12-02-99	56.55	30.75	ND	25.80	12-02-99	210*	<0.5*	<0.5*	<0.5*	--	0.47	NP	
MW-4	03-10-95	55.98	26.22	ND	29.76	03-11-95	2600	<20	--	<20	--			
MW-4	06-05-95	55.98	25.79	ND	30.19	06-05-95	3100	<20	--	<20	--			
MW-4	08-29-95	55.98	28.56	ND	27.42	08-29-95	2900	<20	--	<20	--			
MW-4	11-16-95	55.98	31.00	ND	24.98	11-16-95	2100	<20	--	<20	<20			
MW-4	02-28-96	55.98	24.77	ND	31.21	02-28-96	2400	<20	<20	<20	--			
MW-4	05-28-96	55.98	24.91	ND	31.07	05-28-96	2700	<20	<20	<20	--			
MW-4	08-19-96	55.98	28.17	ND	27.81	08-19-96	2600	<20	<20	<20	--			
MW-4	11-21-96	55.98	30.30	ND	25.68	11-21-96	1100	<20 [^]	<20 [^]	<20 [^]	--			
MW-4	03-26-97	55.98	24.80	ND	31.18	03-26-97	1900	<40 [^]	<40 [^]	<40 [^]	--			
MW-4	05-20-97	55.98	27.03	ND	28.95	05-20-97	1600	<50 [^]	<50 [^]	<50 [^]	--			
MW-4	08-18-97	55.98	30.10	ND	25.88	08-18-97	600	<125 [^]	<125 [^]	--	--			
MW-4	11-17-97	55.98	31.84	ND	24.14	11-17-97	Not analyzed for Halogenated Volatile Organic Compounds							
MW-4	12-02-99	55.98	30.20	ND	25.78	12-02-99	320*	<0.5*	<0.5*	<0.5*	--	1.03	NP	

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MW-5	03-10-95	55.43	25.62	ND	29.81	03-10-95	270	<5	--	<5	--		
MW-5	06-05-95	55.43	25.30	ND	30.13	06-05-95	310	<5	--	<5	--		
MW-5	08-29-95	55.43	28.21	ND	27.22	08-29-95	240	<5	--	<5	--		
MW-5	11-16-95	55.43	30.63	ND	24.80	11-16-95	940	<5	--	<5	<5		
MW-5	02-28-96	55.43	24.07	ND	31.36	02-28-96	1100	<10	<10	<10	--		
MW-5	05-28-96	55.43	24.42	ND	31.01	05-28-96	360	<5	<5	<5	--		
MW-5	08-19-96	55.43	27.82	ND	27.61	08-21-96	150	<1	<1	2	--		
MW-5	11-21-96	55.43	29.92	ND	25.51	11-21-96	1900	<20 [^]	<20 [^]	<20 [^]	--		
MW-5	03-26-97	55.43	24.22	ND	31.21	03-26-97	270	<10 [^]	<10 [^]	<10 [^]	--		
MW-5	05-20-97	55.43	26.60	ND	28.83	05-20-97	290	<5 [^]	<5 [^]	<5 [^]	--		
MW-5	08-18-97	55.43	NR	ND	NR	08-18-97	--	--	--	--	--		
MW-5	11-17-97	55.43	Not surveyed			11-17-97	Not analyzed for Halogenated Volatile Organic Compounds						
MW-5	12-02-99	55.43	29.84	ND	25.59	12-02-99	46*	<0.5*	<0.5*	<0.5*	--	0.53	P
MW-6	03-10-95	61.21	31.54	ND	29.67	03-11-95	1300	<20	--	<20	--		
MW-6	06-05-95	61.21	31.15	ND	30.06	06-05-95	2000	<20	--	<20	--		
MW-6	08-29-95	61.21	34.03	ND	27.18	08-29-95	1300	<20	--	<20	--		
MW-6	11-16-95	61.21	36.40	ND	24.81	11-16-95	1300	<20	--	<20	<20		
MW-6	02-28-96	61.21	30.18	ND	31.03	02-28-96	960	<20	<20	<20	--		
MW-6	05-28-96	61.21	30.29	ND	30.92	05-28-96	970	<20	<20	<20	--		
MW-6	08-19-96	61.21	33.54	ND	27.67	08-19-96	820	<20	<20	<20	--		
MW-6	11-21-96	61.21	35.70	ND	25.51	11-21-96	680	<20 [^]	<20 [^]	<20 [^]	--		
MW-6	03-26-97	61.21	30.15	ND	31.06	03-26-97	830	<40 [^]	<40 [^]	<40 [^]	--		
MW-6	05-20-97	61.21	32.40	ND	28.81	05-20-97	270	<5 [^]	<5 [^]	<5 [^]	--		
MW-6	08-18-97	61.21	35.47	ND	25.74	08-18-97	420	<62.5 [^]	<62.5 [^]	--	--		
MW-6	11-17-97	61.21	37.25	ND	23.96	11-17-97	Not analyzed for Halogenated Volatile Organic Compounds						
MW-6	12-02-99	61.21	35.55	ND	25.66	12-02-99	Not sampled: not on sampling schedule						

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1995-Present**

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Well Number	Date Gauged	TOC Elevation (ft-MSL)	Depth to Water (feet)	FP Thickness (ft-MSL)	Groundwater Elevation (ft-MSL)	Date Sampled	Tetrachloro-ethene (PCE) $\mu\text{g/L}$	Trichloro-ethene (TCE) $\mu\text{g/L}$	trans-1,2-Dichloroethene $\mu\text{g/L}$	cis-1,2-Dichloroethene $\mu\text{g/L}$	Freon 12 $\mu\text{g/L}$	Dissolved Oxygen (mg/l)	Purged/Not Purged (P/NP)
MW-7	03-10-95	58.22	17.69	ND^^	40.53	03-11-95	Not sampled: floating product entered the well during purging						
MW-7	06-05-95	58.22	19.68	ND	38.54	06-05-95	<10	<10	--	<10	--		
MW-7	08-29-95	58.22	21.70	ND	36.52	08-29-95	<10	<10	--	<10	--		
MW-7	11-16-95	58.22	23.02	ND	35.20	11-16-95	<20	<20	--	<20	<20		
MW-7	02-28-96	58.22	16.54	ND	41.68	02-28-96	<10	<10	<10	<10	--		
MW-7	05-28-96	58.22	19.29	ND	38.93	05-28-96	<10	<10	<10	<10	--		
MW-7	08-19-96	58.22	21.84	ND	36.38	08-21-96	<1	<1	<1	<1	--		
MW-7	11-21-96	58.22	19.58	ND	38.64	11-21-96	<10^	<10^	<10^	<10^	--		
MW-7	03-26-97	58.22	19.67	ND	38.55	03-26-97	<20^	<20^	<20^	<20^	--		
MW-7	05-20-97	58.22	20.18	ND	38.04	05-20-97	<10^	<10^	<10^	<10^	--		
MW-7	08-18-97	58.22	22.21	ND	36.01	08-18-97	<10^	<10^	<10^	<10^	--		
MW-7	11-17-97	58.22	20.85	ND	37.37	11-17-97	Not analyzed for Halogenated Volatile Organic Compounds						
MW-7	12-02-99	58.22	20.92	ND	37.30	12-02-99	Not sampled: not on sampling schedule						
MW-8	03-10-95	53.65	23.60	ND	30.05	03-10-95	<1	<1	--	<1	--		
MW-8	06-05-95	53.65	23.48	ND	30.17	06-05-95	<1	<1	--	<1	--		
MW-8	08-29-95	53.65	26.44	ND	27.21	08-29-95	<1	<1	--	<1	--		
MW-8	11-16-95	53.65	28.90	ND	24.75	11-16-95	<1	<1	--	<1	<1		
MW-8	02-28-96	53.65	22.16	ND	31.49	02-28-96	3	<1	<1	<1	--		
MW-8	05-28-96	53.65	22.62	ND	31.03	05-28-96	<1	<1	<1	<1	--		
MW-8	08-19-96	53.65	26.70	ND	26.95	08-21-96	<1	<1	<1	<1	--		
MW-8	11-21-96	53.65	28.16	ND	25.49	11-21-96	7	<1	<1	<1	--		
MW-8	03-26-97	53.65	22.42	ND	31.23	03-26-97	<1	<1	<1	<1	--		
MW-8	05-20-97	53.65	24.84	ND	28.81	05-20-97	<0.5	<0.5	<0.5	<0.5	--		
MW-8	08-18-97	53.65	28.03	ND	25.62	08-18-97	<5	<5	<5	--	--		
MW-8	11-17-97	53.65	29.16	ND	24.49	11-17-97	Not analyzed for Halogenated Volatile Organic Compounds						
MW-8	12-02-99	53.65	28.07	ND	25.58	12-02-99	Not sampled: not on sampling schedule						

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RW-1	03-10-95	56.32	26.48	Sheen	29.84	03-10-95	260	<5	--	<5	--		
RW-1	06-05-95	56.32	26.20	ND	30.12	06-05-95	59	<1	--	<1	--		
RW-1	08-29-95	56.32	28.98	ND	27.34	08-29-95	570	<5	--	<5	--		
RW-1	11-16-95	56.32	31.34	ND	24.98	11-16-95	140	<1	--	<1	<1		
RW-1	02-28-96	56.32	25.12	ND	31.20	02-28-96	6	<1	<1	<1	--		
RW-1	05-28-96	56.32	25.26	ND	31.06	05-28-96	12	<1	<1	<1	--		
RW-1	08-19-96	56.32	28.51	ND	27.81	08-21-96	100	<1	<1	<1	--		
RW-1	11-21-96	56.32	30.65	ND	25.67	11-21-96	190	1	<1	<1	--		
RW-1	03-26-97	56.32	25.15	ND	31.17	03-26-97	6	<1	<1	<1	--		
RW-1	05-20-97	56.32	27.44	ND	28.88	05-20-97	5.3	<0.5	<0.5	<0.5	--		
RW-1	08-18-97	56.32	30.46	ND	25.86	08-18-97	46	<5	<5	--	--		
RW-1	11-17-97	56.32	32.16	ND	24.16	11-17-97	Not analyzed for Halogenated Volatile Organic Compounds						
RW-1	12-02-99	56.32	30.54	ND	25.78	12-02-99	Not sampled: not on sampling schedule						
WGR-3	03-10-95	NR	15.20	ND	NR	03-11-95	<1	<1	--	<1	--		
WGR-3	06-05-95	NR	19.25	ND	NR	06-05-95	<1	<1	--	<1	--		
WGR-3	08-29-95	NR	21.41	ND	NR	08-29-95	<1	<1	--	<1	--		
WGR-3	11-16-95	NR	22.50	ND	NR	11-16-95	<1	<1	--	<1	<1		
WGR-3	02-28-96	NR	14.90	ND	NR	02-28-96	<1	<1	<1	<1	--		
WGR-3	05-28-96	NR	18.33	ND	NR	05-28-96	<1	<1	<1	<1	--		
WGR-3	08-19-96	NR	21.38	ND	NR	08-19-96	<1	<1	<1	<1	--		
WGR-3	11-21-96	NR	18.70	ND	NR	11-21-96	<1	<1	<1	<1	--		
WGR-3	03-26-97	NR	18.98	ND	NR	03-26-97	<1	<1	<1	<1	--		
WGR-3	05-20-97	NR	19.70	ND	NR	05-20-97	<0.5	<0.5	<0.5	<0.5	--		
WGR-3	08-18-97	NR	21.81	ND	NR	08-18-97	<5	<5	<5	--	--		
WGR-3	11-17-97	NR	20.42	ND	NR	11-17-97	Not analyzed for Halogenated Volatile Organic Compounds						
WGR-3	12-02-99	NR	20.58	ND	NR	12-02-99	Not sampled: not on sampling schedule						

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1995-Present**

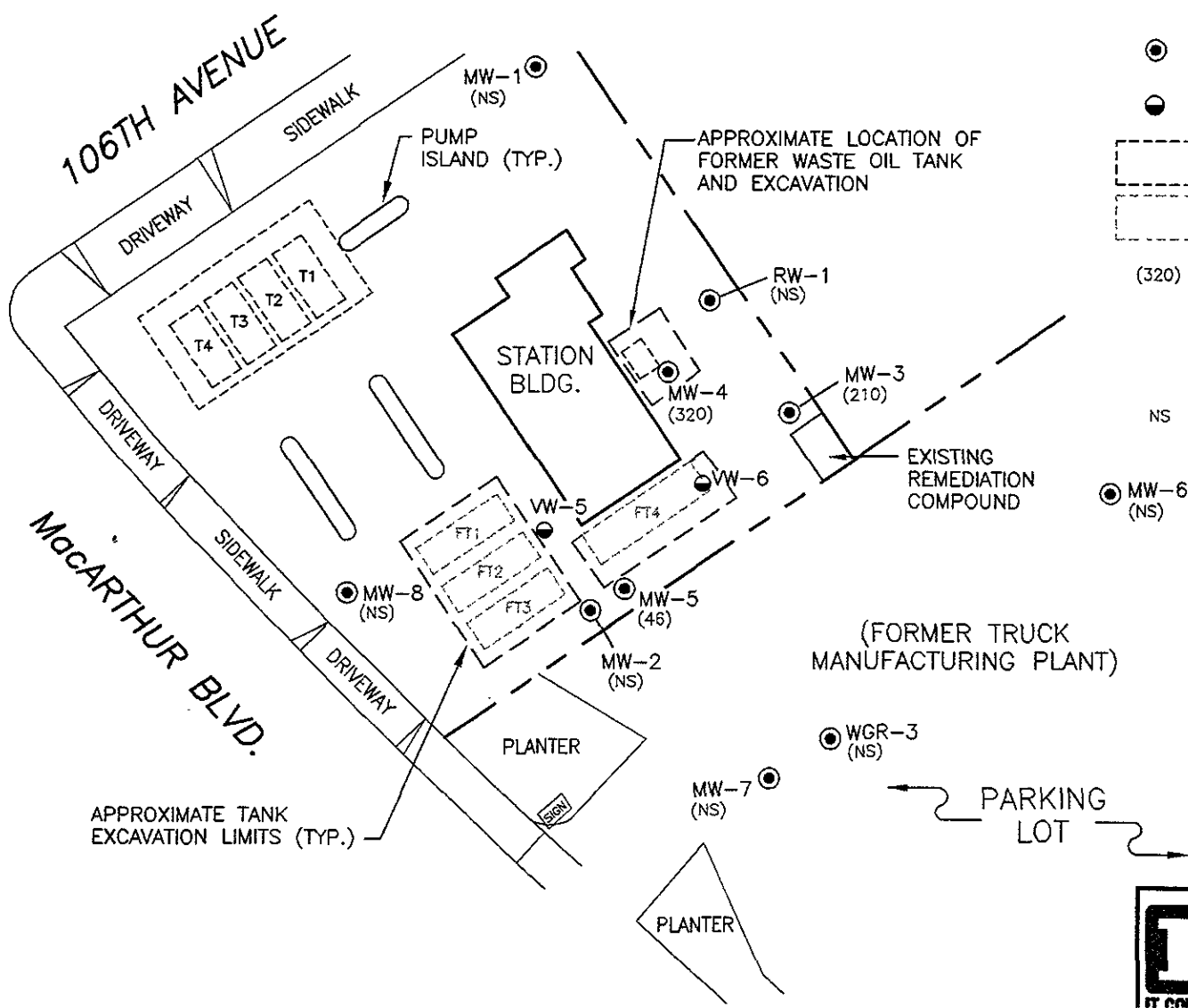
ARCO Service Station 276
10600 MacArthur Boulevard, Oakland, California

Well Number	Date Gauged	TOC Elevation (ft-MSL)	Depth to Water (feet)	FP Thickness (ft-MSL)	Groundwater Elevation (ft-MSL)	Date Sampled	Tetrachloro-ethene (PCE) $\mu\text{g/L}$	Trichloro-ethene (TCE) $\mu\text{g/L}$	trans-1,2-Dichloroethene $\mu\text{g/L}$	cis-1,2-Dichloroethene $\mu\text{g/L}$	Freon 12 $\mu\text{g/L}$	Dissolved Oxygen (mg/l)	Purged/Not Purged (P/NP)
<p>TOC: Top of Casing ft-MSL: elevation in feet, relative to mean sea level $\mu\text{g/L}$: micrograms per liter ND: none detected NR: not reported; data not available or not measurable - -: not analyzed or not applicable *: analyzed by EPA method 8021B ^: method reporting limit was raised due to: (1) high analyte concentration requiring sample dilution, or (2) matrix interference ^^: floating product entered the well during purging **: For previous historical groundwater elevation and analytical data please refer to <i>Fourth Quarter 1995 Groundwater Monitoring Results and Remediation System Performance Evaluation Report, Retail Service Station 10600 and 10700 MacArthur Boulevard, Oakland, California, (EMCON, March 22, 1996).</i></p>													

Table 2
Groundwater Flow Direction and Gradient

ARCO Service Station 0276
10600 MacArthur Boulevard, Oakland, California

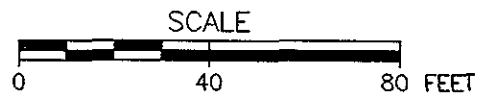
Date Measured	Average Flow Direction	Average Hydraulic Gradient
03-10-95	North-Northeast	0.003
06-05-95	Flat	Flat
08-29-95	Flat	Flat
11-16-95	Southwest	0.003
02-28-96	North-Northeast	0.004
05-28-96	Flat	Flat
08-19-96	Flat	Flat
11-21-96	Flat	Flat
03-26-97	Flat	Flat
05-20-97	Flat	Flat
08-18-97	Southwest	0.003
11-17-97	Northeast	0.003
12-02-99	North-Northwest	0.19



EXPLANATION

- ⊙ Groundwater monitoring well
- Vapor extraction well
- ⌞ Existing underground storage tank
- ⌞ Former underground storage tank
- (320) Concentration of tetrachloroethene (PCE) in groundwater (ug/L) by EPA Method 8021B; sampled 12/2/99
- NS Not sampled
- ⊙ MW-6 (NS)

Base map modified from RESNA, 1993

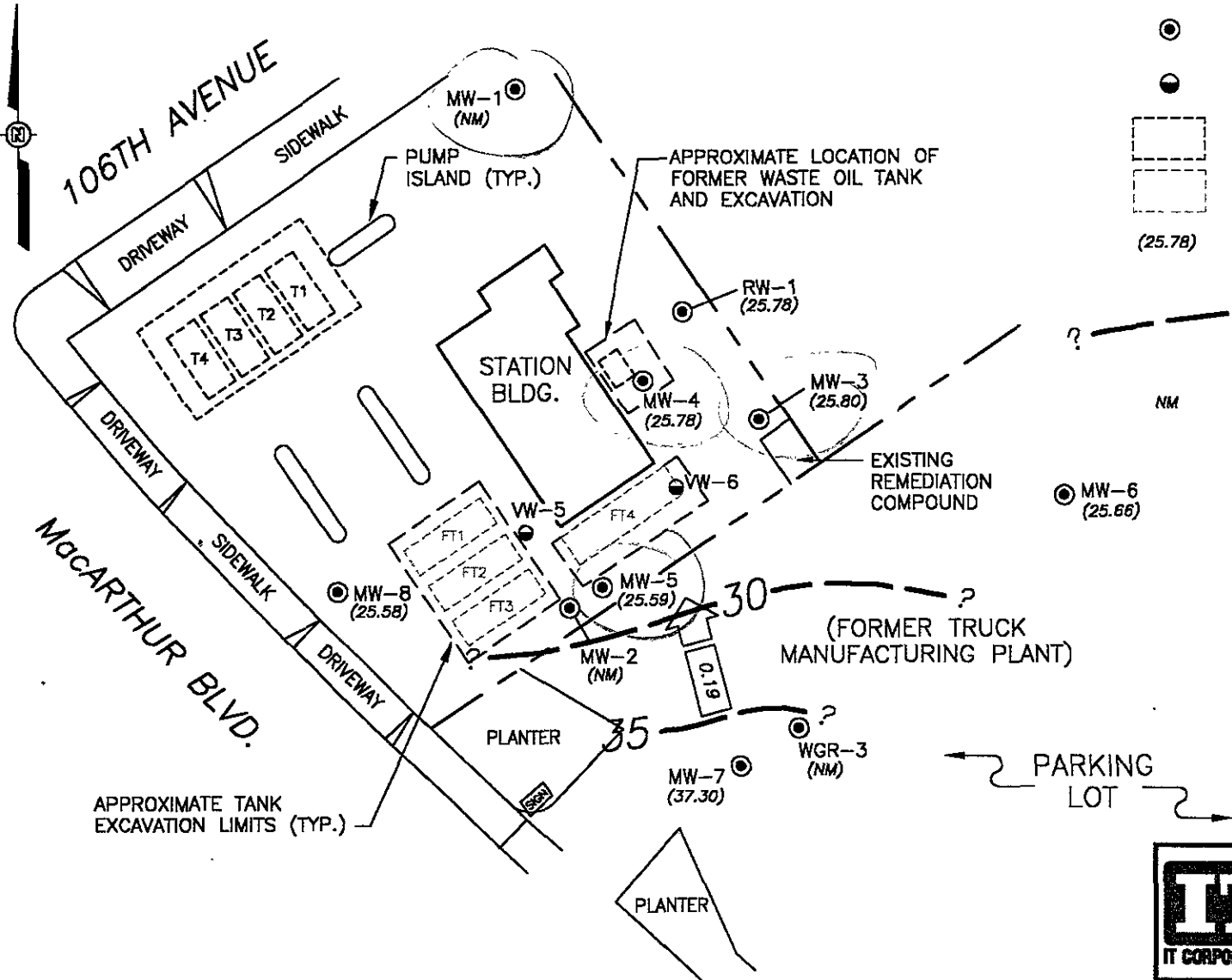


ARCO PRODUCTS COMPANY
SERVICE STATION 276

FIGURE 1
GROUNDWATER ANALYTICAL SUMMARY
FOURTH QUARTER 1999
10600 MACARTHUR BOULEVARD
OAKLAND, CALIFORNIA

EXPLANATION

- ⊙ Groundwater monitoring well
- Vapor extraction well
- ⎓ Existing underground storage tank
- ⎓ Former underground storage tank
- (25.78) Groundwater elevation (Ft.-MSL); measured 12/2/99
- ? Groundwater elevation contour (Ft.-MSL)
- NM Not measured



	ARCO PRODUCTS COMPANY SERVICE STATION 276
--	--

FIGURE 2
GROUNDWATER ELEVATION CONTOURS
FOURTH QUARTER 1999
10600 MACARTHUR BOULEVARD
OAKLAND, CALIFORNIA

Base map modified from RESNA, 1993

APPENDIX A
SAMPLING AND ANALYSIS PROCEDURES

APPENDIX A

SAMPLING AND ANALYSIS PROCEDURES

The sampling and analysis procedures for water quality monitoring programs are contained in this appendix. The procedures provided for consistent and reproducible sampling methods, proper application of analytical methods, and accurate and precise analytical results. Finally, these procedures provided guidelines so that the overall objectives of the monitoring program were achieved.

The following documents have been used as guidelines for developing these procedures:

- Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities, Environmental Protection Agency (EPA)-530/SW-611, August 1977
- Resource Conservation and Recovery Act (RCRA) Groundwater Monitoring Technical Enforcement Guidance Document, Office of Solid Waste and Emergency Response (OSWER) 9950.1, September 1986
- Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, 3rd edition, November 1986
- Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water, EPA-600/4-82-057, July 1982
- Methods for Organic Chemical Analysis of Water and Wastes, EPA-600/4-79-020, revised March 1983
- Leaking Underground Fuel Tank (LUFT) Field Manual, California State Water Resources Control Board, revised October 1989

Sample Collection

Sample collection procedures include equipment cleaning, water level and total well depth measurements, and well purging and sampling.

Equipment Cleaning

Before the sampling event was started, equipment that was used to sample groundwater was disassembled and cleaned with detergent water and then rinsed with deionized water. During field sampling, equipment surfaces that were placed in the well or came into contact with groundwater during field sampling were steam cleaned with deionized water before the next well was purged or sampled.

Water Level, Floating Hydrocarbon, and Total Well Depth Measurements

Before purging and sampling occurred, the depth to water, floating hydrocarbon thickness and total well depth were measured using an oil/water interface measuring system. The oil/water interface measuring system consists of a probe that emits a continuous audible tone when immersed in a nonconductive fluid, such as oil or gasoline and an intermittent tone when immersed in a conductive fluid, such as water. The floating hydrocarbon thickness and water level were measured by lowering the probe into the well. Liquid levels were recorded relative to the tone emitted at the groundwater surface. The sonic probe was decontaminated by being rinsed with deionized water or steam cleaned after each use. A bottom-filling, clear Teflon[®] bailer was used to verify floating hydrocarbon thickness measurements of less than 0.02 foot. Alternatively, an electric sounder and a bottom-filling Teflon bailer may have been used to record floating hydrocarbon thickness and depth to water.

The electric sounder is a transistorized instrument that uses a reel-mounted, two-conductor, coaxial cable that connects the control panel to the sensor. Cable markings are stamped at 1-foot intervals. The water level was measured by lowering the sensor into the monitoring well. A low-current circuit was completed when the sensor contacted the water, which served as an electrolyte. The current was amplified and fed into an indicator light and audible buzzer, signaling when water had been contacted. A sensitivity control compensated for highly saline or conductive water. The electric sounder was decontaminated by being rinsed with deionized water after each use. The bailer was lowered to a point just below the liquid level, retrieved, and observed for floating hydrocarbon.

Liquid measurements were recorded to the nearest 0.01 foot on the depth to water/floating product survey form. The groundwater elevation at each monitoring well was calculated by subtracting the measured depth to water from the surveyed elevation of the top of the well casing. (Every attempt was made to measure depth to water for all wells on the same day.) Total well depth was then measured by lowering the sensor to the bottom of the well. Total well depth, used to calculate purge volumes and to determine whether the well screen was partially obstructed by silt, was recorded to the nearest 0.1 foot on the depth to water/floating product survey form.

Well Purging

If the depth to groundwater was above the top of screens of the monitoring wells, then the wells were purged. Before sampling occurred, a polyvinyl chloride (PVC) bailer, centrifugal pump, low-flow submersible pump, or Teflon bailer was used to purge standing water in the casing and gravel pack from the monitoring well. Monitoring wells were purged according to the protocol presented in Figure A-1. In most monitoring wells, the amount of water purged before sampling was greater than or equal to three casing volumes. Some monitoring wells were expected to be evacuated to dryness after removing fewer than three casing volumes. These low-yield monitoring wells were allowed to recharge for up to 24 hours. Samples were obtained as soon as the monitoring wells recharged to a level sufficient for sample collection. If insufficient water recharged after 24 hours, the monitoring well was recorded as dry for the sampling event.

Groundwater purged from the monitoring wells was transported in a 500-gallon water trailer, 55-gallon drum, or a 325-gallon truck-mounted tank to IT's San Jose or Sacramento office location for temporary storage. IT 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 IT 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 IT to an ARCO-approved laboratory by courier or taken directly to the laboratory by the environmental sampler. Sample shipments from IT 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 IT with the analytical results.

Groundwater Sampling and Analysis Request Form

A groundwater sampling and analysis request form (see Figure A-3) was used to communicate to the environmental sampler the requirements of the monitoring event. At a minimum, the groundwater sampling and analysis request form included the following information:

- Date scheduled
- Site-specific instructions
- Specific analytical parameters
- Well number
- Well specifications (expected total depth, depth of water, and product thickness)

MONITORING WELL PURGING PROTOCOL

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 = ± 0.1 pH units
COND. = $\pm 10\%$
TEMP. = ± 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.

MONITORING WELL PURGING PROTOCOL

FIGURE

A-1

WATER SAMPLE FIELD DATA SHEET

PROJECT NO : _____
 PURGED BY : _____
 SAMPLED BY : _____

SAMPLE ID : _____
 CLIENT NAME : _____
 LOCATION : _____

TYPE: Groundwater _____ Surface Water _____ Leachate _____ Other _____

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

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

DATE PURGED : _____ END PURGE : _____
 DATE SAMPLED : _____ SAMPLING TIME : _____

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	TURBIDITY (visual/NTU)	TIME (2400 HR)
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

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

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

PURGING EQUIPMENT

SAMPLING EQUIPMENT

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

_____ 2" Bladder Pump _____ Bailer (Teflon)
 _____ Bomb Sampler _____ Bailer (Stainless Steel)
 _____ Dipper _____ Submersible Pump
 _____ Well Wizard™ _____ Dedicated

Other: _____

Other: _____

WELL INTEGRITY: _____ LOCK: _____

REMARKS: _____

pH, E.C., Temp. Meter Calibration: Date: _____ Time: _____ Meter Serial No.: _____
 E.C. 1000 _____ / _____ pH 7 _____ / _____ pH 10 _____ / _____ pH 4 _____ / _____
 Temperature °F _____

SIGNATURE: _____ REVIEWED BY: _____ PAGE _____ OF _____

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

PROJECT NAME :

SCHEDULED DATE :

SPECIAL INSTRUCTIONS / CONSIDERATIONS :

Project
Authorization: _____
EMCON Project No.: _____
OWT Project No.: _____
Task Code: _____
Originals To: _____
cc: _____

Well Lock Number (s)

CHECK BOX TO AUTHORIZE DATA ENTRY

Site Contact: _____
Name Phone #

Well Number or Source	Casing Diameter (inches)	Casing Length (feet)	Depth to Water (feet)	ANAYSES REQUESTED

Laboratory and Lab QC Istructions:



SAMPLING AND ANALYSIS REQUEST FORM

**FIGURE
A-3**

APPENDIX B

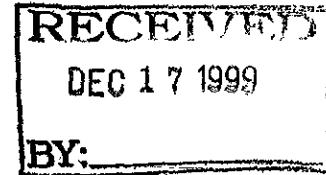
**CERTIFIED ANALYTICAL REPORTS,
AND CHAIN-OF-CUSTODY DOCUMENTATION**



December 13, 1999

Service Request No.: S9903827

Mr. Glen Vanderveen
IT/EMCON
2201 Broadway, Suite 101
Oakland, CA 94612



RE: TO#24118.00/RAT#8/276 OAKLAND

Dear Mr. Vanderveen:

Enclosed are the results of the sample(s) submitted to our laboratory on December 2, 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 11, 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: 2352, expiration: January 31, 2001).

If you have any questions, 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

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: TO#24118.00/RAT#8/276 OAKLAND
Sample Matrix: Water

Service Request: S9903827
Date Collected: 12/2/99
Date Received: 12/2/99

Halogenated Volatile Organic Compounds

Sample Name: MW-3(31)
Lab Code: S9903827-001
Test Notes:

Units: ug/L (ppb)
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Dichlorodifluoromethane (CFC 12)	EPA 5030	8021B	1	1	NA	12/6/99	ND	
Chloromethane	EPA 5030	8021B	1	1	NA	12/6/99	ND	
Vinyl Chloride	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Bromomethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Chloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Trichlorofluoromethane (CFC 11)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Trichlorotrifluoroethane (CFC 113)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Methylene Chloride	EPA 5030	8021B	5	1	NA	12/6/99	ND	
trans-1,2-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
cis-1,2-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1-Dichloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Chloroform	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1,1-Trichloroethane (TCA)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Carbon Tetrachloride	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,2-Dichloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Trichloroethene (TCE)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,2-Dichloropropane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Bromodichloromethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
2-Chloroethyl Vinyl Ether	EPA 5030	8021B	5	1	NA	12/6/99	ND	
trans-1,3-Dichloropropene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
cis-1,3-Dichloropropene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1,2-Trichloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Tetrachloroethene (PCE)	EPA 5030	8021B	0.5	10	NA	12/7/99	210	
Dibromochloromethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Chlorobenzene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Bromoform	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1,2,2-Tetrachloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,3-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/6/99	ND	
1,4-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/6/99	ND	
1,2-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/6/99	ND	

Approved By: _____

Handwritten signature

Date: _____

12/13/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: TO#24118.00/RAT#8/276 OAKLAND
Sample Matrix: Water

Service Request: S9903827
Date Collected: 12/2/99
Date Received: 12/2/99

Halogenated Volatile Organic Compounds

Sample Name: MW-4(31) Units: ug/L (ppb)
Lab Code: S9903827-002 Basis: NA
Test Notes:

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Dichlorodifluoromethane (CFC 12)	EPA 5030	8021B	1	1	NA	12/6/99	ND	
Chloromethane	EPA 5030	8021B	1	1	NA	12/6/99	ND	
Vinyl Chloride	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Bromomethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Chloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Trichlorofluoromethane (CFC 11)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Trichlorotrifluoroethane (CFC 113)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Methylene Chloride	EPA 5030	8021B	5	1	NA	12/6/99	ND	
trans-1,2-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
cis-1,2-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1-Dichloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Chloroform	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1,1-Trichloroethane (TCA)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Carbon Tetrachloride	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,2-Dichloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Trichloroethene (TCE)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,2-Dichloropropane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Bromodichloromethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
2-Chloroethyl Vinyl Ether	EPA 5030	8021B	5	1	NA	12/6/99	ND	
trans-1,3-Dichloropropene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
cis-1,3-Dichloropropene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1,2-Trichloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Tetrachloroethene (PCE)	EPA 5030	8021B	0.5	20	NA	12/7/99	320	
Dibromochloromethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Chlorobenzene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Bromoform	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1,2,2-Tetrachloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,3-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/6/99	ND	
1,4-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/6/99	ND	
1,2-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/6/99	ND	

Approved By: _____

MT

Date: _____

12/13/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: TO#24118.00/RAT#8/276 OAKLAND
Sample Matrix: Water

Service Request: S9903827
Date Collected: 12/2/99
Date Received: 12/2/99

Halogenated Volatile Organic Compounds

Sample Name: MW-5(46)
Lab Code: S9903827-003
Test Notes:

Units: ug/L (ppb)
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Dichlorodifluoromethane (CFC 12)	EPA 5030	8021B	1	1	NA	12/6/99	ND	
Chloromethane	EPA 5030	8021B	1	1	NA	12/6/99	ND	
Vinyl Chloride	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Bromomethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Chloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Trichlorofluoromethane (CFC 11)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Trichlorotrifluoroethane (CFC 113)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Methylene Chloride	EPA 5030	8021B	5	1	NA	12/6/99	ND	
trans-1,2-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
cis-1,2-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1-Dichloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Chloroform	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1,1-Trichloroethane (TCA)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Carbon Tetrachloride	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,2-Dichloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	10	
Trichloroethene (TCE)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,2-Dichloropropane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Bromodichloromethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
2-Chloroethyl Vinyl Ether	EPA 5030	8021B	5	1	NA	12/6/99	ND	
trans-1,3-Dichloropropene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
cis-1,3-Dichloropropene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1,2-Trichloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Tetrachloroethene (PCE)	EPA 5030	8021B	0.5	5	NA	12/7/99	46	
Dibromochloromethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Chlorobenzene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Bromoform	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1,2,2-Tetrachloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,3-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/6/99	ND	
1,4-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/6/99	ND	
1,2-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/6/99	ND	

Approved By: _____



Date: _____

12/13/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:
Project:
Sample Matrix:

ARCO Products Company
TO#24118.00/RAT#8/276 OAKLAND
Water

Service Request: S9903827
Date Collected: NA
Date Received: NA

Halogenated Volatile Organic Compounds

Sample Name: Method Blank(5A)
Lab Code: S991206-WB1
Test Notes:

Units: ug/L (ppb)
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Dichlorodifluoromethane (CFC 12)	EPA 5030	8021B	1	1	NA	12/6/99	ND	
Chloromethane	EPA 5030	8021B	1	1	NA	12/6/99	ND	
Vinyl Chloride	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Bromomethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Chloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Trichlorofluoromethane (CFC 11)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Trichlorotrifluoroethane (CFC 113)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Methylene Chloride	EPA 5030	8021B	5	1	NA	12/6/99	ND	
trans-1,2-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
cis-1,2-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1-Dichloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Chloroform	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1,1-Trichloroethane (TCA)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Carbon Tetrachloride	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,2-Dichloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Trichloroethene (TCE)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,2-Dichloropropane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Bromodichloromethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
2-Chloroethyl Vinyl Ether	EPA 5030	8021B	5	1	NA	12/6/99	ND	
trans-1,3-Dichloropropene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
cis-1,3-Dichloropropene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1,2-Trichloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Tetrachloroethene (PCE)	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Dibromochloromethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Chlorobenzene	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
Bromoform	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,1,2,2-Tetrachloroethane	EPA 5030	8021B	0.5	1	NA	12/6/99	ND	
1,3-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/6/99	ND	
1,4-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/6/99	ND	
1,2-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/6/99	ND	

Approved By: _____

AT

Date: _____

12/13/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: TO#24118.00/RAT#8/276 OAKLAND
Sample Matrix: Water

Service Request: S9903827
Date Collected: NA
Date Received: NA

Halogenated Volatile Organic Compounds

Sample Name: Method Blank(SA) Units: ug/L (ppb)
Lab Code: S991207-WB1 Basis: NA
Test Notes:

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Dichlorodifluoromethane (CFC 12)	EPA 5030	8021B	1	1	NA	12/7/99	ND	
Chloromethane	EPA 5030	8021B	1	1	NA	12/7/99	ND	
Vinyl Chloride	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Bromomethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Chloroethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Trichlorofluoromethane (CFC 11)	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,1-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Trichlorotrifluoroethane (CFC 113)	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Methylene Chloride	EPA 5030	8021B	5	1	NA	12/7/99	ND	
trans-1,2-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
cis-1,2-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,1-Dichloroethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Chloroform	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,1,1-Trichloroethane (TCA)	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Carbon Tetrachloride	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,2-Dichloroethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Trichloroethene (TCE)	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,2-Dichloropropane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Bromodichloromethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
2-Chloroethyl Vinyl Ether	EPA 5030	8021B	5	1	NA	12/7/99	ND	
trans-1,3-Dichloropropene	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
cis-1,3-Dichloropropene	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,1,2-Trichloroethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Tetrachloroethene (PCE)	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Dibromochloromethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Chlorobenzene	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Bromoform	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,1,2,2-Tetrachloroethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,3-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/7/99	ND	
1,4-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/7/99	ND	
1,2-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/7/99	ND	

Approved By: _____



Date: _____

12/13/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO Products Company	Service Request: S9903827
Project:	TO#24118.00/RAT#8/276 OAKLAND	Date Collected: NA
Sample Matrix:	Water	Date Received: NA

Halogenated Volatile Organic Compounds

Sample Name:	Method Blank(5A)	Units: ug/L (ppb)
Lab Code:	S991207-WB2	Basis: NA
Test Notes:		

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Dichlorodifluoromethane (CFC 12)	EPA 5030	8021B	1	1	NA	12/7/99	ND	
Chloromethane	EPA 5030	8021B	1	1	NA	12/7/99	ND	
Vinyl Chloride	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Bromomethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Chloroethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Trichlorofluoromethane (CFC 11)	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,1-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Trichlorotrifluoroethane (CFC 113)	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Methylene Chloride	EPA 5030	8021B	5	1	NA	12/7/99	ND	
trans-1,2-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
cis-1,2-Dichloroethene	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,1-Dichloroethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Chloroform	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,1,1-Trichloroethane (TCA)	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Carbon Tetrachloride	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,2-Dichloroethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Trichloroethene (TCE)	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,2-Dichloropropane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Bromodichloromethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
2-Chloroethyl Vinyl Ether	EPA 5030	8021B	5	1	NA	12/7/99	ND	
trans-1,3-Dichloropropene	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
cis-1,3-Dichloropropene	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,1,2-Trichloroethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Tetrachloroethene (PCE)	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Dibromochloromethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Chlorobenzene	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
Bromoform	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,1,2,2-Tetrachloroethane	EPA 5030	8021B	0.5	1	NA	12/7/99	ND	
1,3-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/7/99	ND	
1,4-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/7/99	ND	
1,2-Dichlorobenzene	EPA 5030	8021B	1	1	NA	12/7/99	ND	

Approved By: _____

PS

Date: _____

12/13/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24118.00/RAT#8/276 OAKLAND
Sample Matrix: Water

Service Request: S9903827
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: NA

Surrogate Recovery Summary
 Halogenated Volatile Organic Compounds

Prep Method: EPA 5030
Analysis Method: 8021B

Units: PERCENT
Basis: NA

Sample Name	Lab Code	Test Notes	Percent Recovery 4-Bromofluorobenzene
MW-3(31)	S9903827-001		124
MW-4(31)	S9903827-002		121
MW-5(46)	S9903827-003		113
Batch QC	S9903858-002MS		104
Batch QC	S9903858-002DMS		103
Method Blank(5A)	S991206-WB1		115
Method Blank(5A)	S991207-WB1		108
Method Blank(5A)	S991207-WB2		115
Lab Control Sample	S991207-LCS		103
Lab Control Sample	S991207-DLCS		102

CAS Acceptance Limits: 74-125

Approved By: _____

Handwritten signature

Date: _____

12/13/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
 Project: TO#24118.00/RAT#8/276 OAKLAND
 Sample Matrix: Water

Service Request: S9903827
 Date Collected: NA
 Date Received: NA
 Date Extracted: NA
 Date Analyzed: 12/8/99

Matrix Spike/Duplicate Matrix Spike Summary
 Halogenated Volatile Organic Compounds

Sample Name: Batch QC
 Lab Code: S9903858-002MS, S9903858-002DMS
 Test Notes:

Units: ug/L (ppb)
 Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Spike Level		Sample Result	Spike Result		Percent Recovery				Relative Percent Difference	Result Notes
				MS	DMS		MS	DMS	CAS Acceptance Limits		MS	DMS		
1,1-Dichloroethene	EPA 5030	8021B	0.5	10	10	ND	7.0	6.9	70	69	69-142	1		
Trichloroethene	EPA 5030	8021B	0.5	10	10	24	32	30	80	60	42-148	6		
Tetrachloroethene	EPA 5030	8021B	0.5	10	10	ND	9.8	9.6	98	96	80-136	2		

Approved By: _____



Date: _____

12/13/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: TO#24118.00/RAT#8/276 OAKLAND
LCS Matrix: Water

Service Request: S9903827
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 12/7/99

Laboratory Control Sample/Duplicate Laboratory Control Sample Summary
 Volatile Organic Compounds

Sample Name: Lab Control Sample Units: ug/L (ppb)
Lab Code: S991207-LCS S991207-DLCS Basis: NA
Test Notes:

Analyte	Prep Method	Analysis Method	True Value		Result		Percent Recovery				Result Notes
			LCS	DLCS	LCS	DLCS	CAS Acceptance Limits		Relative Percent Difference		
							LCS	DLCS			
1,1-Dichloroethene	EPA 5030	8021B	10	10	8.3	7.0	83	70	69-142	16	
Trichloroethene	EPA 5030	8021B	10	10	10	9.7	100	97	42-148	3	
Tetrachloroethene	EPA 5030	8021B	10	10	10	9.4	100	94	80-136	6	

Approved By: _____ *MT* _____ Date: 12/13/99

ARCO Facility no. 276	City (Facility) OAKLAND	Project manager (Consultant) Glenn VanderVeen
ARCO Engineer Paul Supple	Telephone no. (ARCO)	Telephone no. (Consultant) (408) 453-7300
Consultant name Emcon	Address (Consultant) 1921 Ringwood Ave. San Jose CA 95131	
		Fax no. (Consultant) (408) 437-9526

Laboratory name
CAS

Contract number

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015	TPH Modified 8015 Gas <input type="checkbox"/> Diesel <input type="checkbox"/>	Oil and Grease 413.1 <input type="checkbox"/> 413.2 <input type="checkbox"/>	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals <input type="checkbox"/> VOA <input type="checkbox"/>	Semi Metals <input type="checkbox"/> VOA <input type="checkbox"/>	CAM Metals EPA 6010/7000 TLC <input type="checkbox"/> STLC <input type="checkbox"/>	Lead Org./DHS <input type="checkbox"/> Lead EPA 7420/7421 <input type="checkbox"/>	Chlorine <input type="checkbox"/> 5010 <input type="checkbox"/>									
			Soil	Water	Other	Ice	Acid																								
mw-1 ()				X		X	HCL			NO samples taken																					
mw-3 (31')	4	①		X		X	HCL	12/2/99	0905																						
mw-4 (31')	4	②		X		X			0850																						
mw-5 (46')	4	③		X		X			1010																						

Method of shipment
Sampler will deliver

Special detection Limit/reporting
Lowest possible

Special QA/QC
As Normal

Remarks
**RA+8
4.40ml HCL
VOA'S**

Lab number
791636

Condition of sample:	Temperature received: Due: 12/16/99 RU/DB
Relinquished by sampler <i>[Signature]</i>	Date 12/2/99 Time 2:18
Relinquished by	Received by Brian Fuller Date 12/2/99 Time 2:18
Relinquished by	Received by laboratory
Date	Time

Turnaround time

Priority Rush 1 Business Day

Rush 2 Business Days

Expedited 5 Business Days

Standard 10 Business Days

APPENDIX C
FIELD DATA SHEETS

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

PROJECT # : 792201

STATION ADDRESS : 10600 MacArthur Blvd., Oakland

DATE : 12/2/99

ARCO STATION # : 276

FIELD TECHNICIAN : Manuel Gallegos

DAY : Thursday

DTW Order	WELL ID	Well Box Seal	Type Of Well Lid	Well Lid Secure	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	IL				LWC						Car parked on well
2	MW-8	OK	Vault	OK	none	SLIP	28.07	28.07			47.3	
3	RW-1	OK	Vault stop	OK	NA	SLIP	30.54	30.54			48.3	
4	WGR-3	OK	bivast	OK	ARCO	LWC	20.58	20.58			26.4	
5	MW-5	OK	OK	OK	ARCO	LWC	29.84	29.84			46.4	
6	MW-6	OK	15/16	XLO	ARCO	LWC	35.55	35.55			48.3	Well Box needs repairs.
7	MW-3	OK	3/4	OK	ARCO	LWC	30.75	30.75			38.3	
8	MW-4	OK	3/4	OK	ARCO	LWC	30.20	30.20			47.4	
10	MW-7	OK	15/15	OK	ARCO	LWC	20.92	20.92			20.92 37.8	
9	MW-2	OK	Vault	OK		LWC						Well Box Filled to top with Antifreeze + water. no water to be seen

SURVEY POINTS ARE TOP OF WELL CASINGS

RECEIVED
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BY: _____

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



OWT

PROJECT NO: 792201
 PURGED BY: M. Gallegos
 SAMPLED BY: ✓

SAMPLE ID: MW-1 ()
 CLIENT NAME: ARCO#276
 LOCATION: OAKLAND, CA.

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

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

DATE PURGED: 12-2-99 END PURGE: _____
 DATE SAMPLED: ✓ SAMPLING TIME: _____

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>car parked on top of well</u>						

OTHER: DO ODOR: _____ NR NR
(COBALT 0-100) (NTU 0-200)

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

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 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 _____	Other _____	Other _____

WELL INTEGRITY: OK LOCK: _____

REMARKS: all samples taken

pH, E.C., Temp Meter Calibration Date 12/2/99 Time _____ Meter Serial No 87M
 E.C. 1000 1000 pH 7 700 pH 10 1000 pH 4 400

Temperature °F _____
 SIGNATURE: [Signature] REVIEWED BY: [Signature] PAGE 1 OF 4

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



OWT

PROJECT NO: 792201
PURGED BY: M. Gallegos
SAMPLED BY: ↓

SAMPLE ID: MW-3 (31')
CLIENT NAME: ARCO#276
LOCATION: OAKLAND, CA.

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

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): AIR
DEPTH OF WELL (feet): 38.3 CALCULATED PURGE (gal.): _____
DEPTH OF WATER (feet): 30.75 ACTUAL PURGE VOL. (gal.): ↓

DATE PURGED: 12-2-99 END PURGE: _____
DATE SAMPLED: ↓ SAMPLING TIME: 0905

TIME (2400 HR)	VOLUME (gal)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>0905</u>	<u>GRAB</u>	<u>6.16</u>	<u>908</u>	<u>62.0</u>	<u>Clear</u>	<u>Clear</u>
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

OTHER: DO= 0.47 ODOR: none NR NR
(COBALT 0-100) (NTU 0-200)

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

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 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 _____	_____

WELL INTEGRITY: OK LOCK: ARCO

REMARKS: all samples taken

pH, E.C., Temp Meter Calibration Date 12/2/99 Time _____ Meter Serial No 87M
E.C. 1000 1000 pH 7 700 pH 10 1000 pH 4 400

Temperature °F _____
SIGNATURE: M. Gallegos REVIEWED BY: M. Gallegos PAGE 2 OF 4

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



OWT

PROJECT NO: 792201
PURGED BY: M. Gallegos
SAMPLED BY: ↓

SAMPLE ID: MW-4 (31')
CLIENT NAME: ARCO#276
LOCATION: OAKLAND, CA.

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

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): NR
DEPTH OF WELL (feet): 47.6 CALCULATED PURGE (gal.): _____
DEPTH OF WATER (feet): 30.20 ACTUAL PURGE VOL. (gal.): ↓

DATE PURGED: 12-2-99 END PURGE: _____
DATE SAMPLED: ↓ SAMPLING TIME: 0845-0850

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>0850</u>	<u>0.203</u>	<u>5.97</u>	<u>791</u>	<u>62.3</u>	<u>Clear</u>	<u>Clear</u>
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

OTHER: DO = 1.03 ODOR: None NR NR
(COBALT 0-100) (NTU 0-200)

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

PURGING EQUIPMENT

2" Bladder Pump Bailer (Teflon)
 Centrifugal Pump Bailer (PVC)
 Submersible Pump Bailer (Stainless Steel)
 Well Wizard[®] Dedicated
Other: _____

SAMPLING EQUIPMENT

2" Bladder Pump Bailer (Teflon)
 Bomb Sampler Bailer (Stainless Steel)
 Dipper Submersible Pump
 Well Wizard[®] Dedicated
Other: _____

WELL INTEGRITY: OK LOCK: ARCO

REMARKS: all samples taken

pH, E.C., Temp Meter Calibration. Date 12/2/99 Time 0840 Meter Serial No. 871M
E.C. 1000 1049, 1000 pH 7 702, 700 pH 10 1000, 1000 pH 4 400, 400
Temperature °F 61.2

SIGNATURE: [Signature] REVIEWED BY: [Signature] PAGE 3 OF 4

WATER SAMPLE FIELD DATA SHEET

Rev. 1/97



OWT

PROJECT NO: 792201
 PURGED BY: M. Gallegos
 SAMPLED BY: ↓

SAMPLE ID: MW-5 (46)
 CLIENT NAME: ARCO#276
 LOCATION: OAKLAND, CA.

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

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): 10.81
 DEPTH OF WELL (feet): 46.4 CALCULATED PURGE (gal.): 32.45
 DEPTH OF WATER (feet): 29.84 ACTUAL PURGE VOL. (gal.): 32.5

DATE PURGED: 12-2-99 END PURGE: 1004
 DATE SAMPLED: ↓ SAMPLING TIME: 1010

TIME (2400 HR)	VOLUME (gal)	pH (units)	EC (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>0957</u>	<u>11.0</u>	<u>6.14</u>	<u>945</u>	<u>64.5</u>	<u>clear</u>	<u>clear</u>
<u>1000</u>	<u>22.0</u>	<u>6.14</u>	<u>989</u>	<u>64.7</u>	<u>"</u>	<u>"</u>
<u>1004</u>	<u>32.5</u>	<u>6.15</u>	<u>991</u>	<u>64.7</u>	<u>"</u>	<u>"</u>

OTHER: DO = 0.53 ODOR: Slight NR NR
(COBALT 0-100) (NTU 0-200)
 FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
<input type="checkbox"/> 2" Bladder Pump	<input type="checkbox"/> Bailor (Teflon)	<input type="checkbox"/> 2" Bladder Pump	<input checked="" type="checkbox"/> Bailor (Teflon)
<input type="checkbox"/> Centrifugal Pump	<input type="checkbox"/> Bailor (PVC)	<input type="checkbox"/> Bomb Sampler	<input type="checkbox"/> Bailor (Stainless Steel)
<input checked="" type="checkbox"/> Submersible Pump	<input type="checkbox"/> Bailor (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 _____	

WELL INTEGRITY: OK LOCK: BSJ

REMARKS: all samples taken

pH, EC, Temp Meter Calibration: Date 12/2/99 Time _____ Meter Serial No 87M
 EC 100X 1 1000 pH 7 1 700 pH 10 1 1000 pH 4 1 400

Temperature F _____
 SIGNATURE: [Signature] REVIEWED BY: MSJ PAGE 4 OF 4

ARCO Facility no. <u>276</u>	City (Facility) <u>OAKLAND</u>	Project manager (Consultant) <u>Glenn VanderVeen</u>	Laboratory name <u>CAS</u>
ARCO engineer <u>Paul Supple</u>	Telephone no. (ARCO)	Telephone no. (Consultant) <u>(408) 453-7300</u>	Fax no. (Consultant) <u>(408) 437-9526</u>
Contract number		Consultant name <u>Emcon</u>	
Address (Consultant) <u>1921 Ringwood Ave. San Jose, CA 95131</u>		Method of shipment <u>Sampler will deliver</u>	

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX EPA 802	BTEX/TPH EPA 1602/8020/8015	TPH Modified 8015 Gas Diesel	Oil and Grease 413.1 413.2	TPH EPA 418.1/SN1503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals VOA VOA	Cadm Metals EPA 6010/7000 TTLC STLC	Lead Org./DHS Lead EPA 7420/7421	Chlorine SVOCs								
			Soil	Water	Other	Ice	Acid																						
<u>mw-1</u>				X		X	<u>HCL</u>			<u>NO samples taken</u>																			
<u>mw-3 (31')</u>	<u>41</u>			X		X	<u>HCL</u>	<u>12/2/99</u>	<u>0905</u>																				
<u>mw-4 (31')</u>	<u>41</u>			X		X	<u>HCL</u>		<u>0850</u>																				
<u>mw-5 (46')</u>	<u>41</u>			X		X	<u>HCL</u>		<u>1010</u>																				

Special detection Limit/reporting
Lowest possible

Special QA/QC
AS Normal

Remarks RAF 8
4.40mL HCL
VOA's

791636

Condition of sample:		Temperature received:	
Relinquished by sampler <u>[Signature]</u>	Date <u>12/2/99</u> Time <u>2:18</u>	Received by <u>Brian Fuell</u>	Date <u>12/2/99</u> Time <u>2:18</u>
Relinquished by	Date	Received by	Date
Relinquished by	Date	Received by laboratory	Date
			Time

Lab number	Turnaround time
	Priority Rush 1 Business Day <input type="checkbox"/>
	Rush 2 Business Days <input type="checkbox"/>
	Expedited 5 Business Days <input type="checkbox"/>
	Standard 10 Business Days <input checked="" type="checkbox"/>