



EMCON

1921 Ringwood Avenue • San Jose, California 95131-1721 • (408) 453-7300 • Fax (408) 437-9526

Date December 13, 1996
Project 20805-129.003

To:

Ms. Susan Hugo
Alameda County Health Care Services Agency
Department of Environmental Health
1131 Harborbay Parkway, Suite 250
Alameda, California 94502-6577

We are enclosing:

Copies	Description
<u>1</u>	<u>Third quarter 1996 groundwater monitoring results and</u>
<u> </u>	<u>remediation system performance evaluation report,</u>
<u> </u>	<u>ARCO Service Station 2169, Oakland, California</u>
<u> </u>	<u> </u>

For your:	<u> X </u>	Use	Sent by:	<u> X </u>	Regular Mail
	<u> </u>	Approval		<u> </u>	Standard Air
	<u> </u>	Review		<u> </u>	Courier
	<u> </u>	Information		<u> </u>	Other:

Comments:

The enclosed groundwater monitoring and performance evaluation report is being sent to you per the request of ARCO Products Company. Please call if you have questions or comments.


John C. Young
Project Manager

cc: Kevin Graves, RWQCB - SFBR
Paul Supple - ARCO Products Company
File





Date:

December 12, 1996

Re: ARCO Station #

2169 • 889 West Grand Avenue • Oakland, CA
Third Quarter 1996 Groundwater Monitoring Results and
Remediation System Performance Evaluation Report

"I declare, that to the best of my knowledge at the present time, that the information and/or recommendations contained in the attached proposal or report are true and correct."

Submitted by:

A handwritten signature in black ink that reads "Paul Supple". The signature is written in a cursive, flowing style.

Paul Supple
Environmental Engineer



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1921 Ringwood Avenue • San Jose, California 95131-1721 • (408) 453-7300 • Fax (408) 437-9526

December 12, 1996
Project 20805-129.003

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

Re: Third quarter 1996 groundwater monitoring program results and remediation system performance evaluation report, ARCO service station 2169, Oakland, California

Dear Mr. Supple:

This letter presents the results of the third quarter 1996 groundwater monitoring program at ARCO Products Company (ARCO) service station 2169, 889 West Grand Avenue, Oakland, California (Figure 1). Operation and performance data for the interim soil-vapor extraction (SVE) and air-sparge (AS) remediation systems at the site are also presented. The quarterly monitoring program complies with Alameda County Health Care Services Agency (ACHCSA) requirements regarding underground tank investigations. Pertinent site features, including the locations of existing on-site monitoring and vapor extraction wells are shown in Figure 2.

LIMITATIONS

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

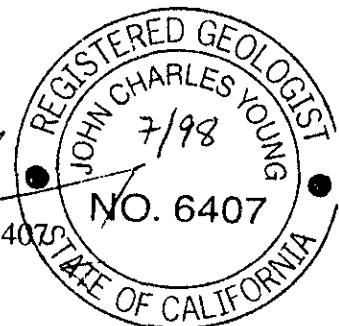
Please call if you have questions.

Sincerely,

EMCON

Krishnaveni M.
Krishnaveni Meka
Staff Engineer

John C. Young
John C. Young, R.G. 6407
Project Manager



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ARCO QUARTERLY REPORT

Station No.: 2169 Address: 889 West Grand Avenue, Oakland, California
 EMCON Project No. 20805-129.003
 ARCO Environmental Engineer/Phone No.: Paul Supple /(510) 299-8891
 EMCON Project Manager/Phone No.: John C. Young /(408) 453-7300
 Primary Agency/Regulatory ID No.: ACHCSA /Susan Hugo
 Reporting Period: July 1, 1996 to October 1, 1996

WORK PERFORMED THIS QUARTER (Third- 1996):

1. Conducted quarterly groundwater monitoring and sampling for third quarter 1996.
2. Prepared and submitted quarterly report for second quarter 1996.
3. Installed oxygen releasing compounds (ORCs) into groundwater monitoring wells A-5 and A-6 to further stimulate natural biodegradation.
4. Operated SVE and air-sparge systems.

WORK PROPOSED FOR NEXT QUARTER (Fourth- 1996):

1. Perform quarterly groundwater monitoring and sampling for fourth quarter 1996.
2. Prepare and submit quarterly report for third quarter 1996.
3. Continue operating SVE and air-sparge systems.
4. Groundwater monitoring well A-2 will be sampled semi-annually during the first and third quarter of the year.

QUARTERLY MONITORING:

Current Phase of Project: Quarterly Groundwater Monitoring and Operation and Maintenance of Remediation Systems

Frequency of Sampling: Quarterly (groundwater), Monthly (SVE and Air-Sparge)

Frequency of Monitoring: Quarterly (groundwater), Monthly (SVE and Air-Sparge)

Is Floating Product (FP) Present On-site: Yes No

Cumulative FP Recovered to Date : 4.8 gallons, Wells ADR-1 and ADR-2

FP Recovered This Quarter : None

Bulk Soil Removed to Date : 2,196 cubic yards of TPH-impacted soil

Bulk Soil Removed This Quarter : None

Water Wells or Surface Waters
 within 2000 ft., impacted by site: None

Current Remediation Techniques: SVE and Air-Sparge Systems

Approximate Depth to Groundwater: 10.77 feet

Groundwater Gradient (Average): 0.002 ft/ft toward west (consistent with past events)

SVE QUARTERLY OPERATION AND PERFORMANCE:

Equipment Inventory: Therm Tech Model VAC-25, 250 cfm, Thermal/Catalytic Oxidizer

Operating Mode: Catalytic Oxidation

BAAQMD Permit #: 12119

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TPH Conc. End of Period (lab):	770 ppmv
Benzene Conc. End of Period (lab):	2.4 ppmv
Flowrate End of Period:	128.6 scfm
HC Destroyed This Period:	388.3 pounds
HC Destroyed to Date:	7676.2 pounds
Utility Usage	
Electric (KWH):	7504
Gas (Therms):	673
Operating Hours This Period:	617.2 hours
Percent Operational:	28.0% System was down for quarterly monitoring, power interruptions, and other maintenance issues.
Operating Hours to Date:	4860.6 hours
Unit Maintenance:	Installed rebuilt blower motor on August 2, 1996.
Number of Auto Shut Downs:	1
Destruction Efficiency Permit Requirement:	90%
Percent TPH Conversion:	98.3%
Stack Temperature:	681°F (9-23-96)
Source Flow:	122.4 scfm (9-23-96)
Process Flow:	191.3 scfm (9-23-96)
Source Vacuum:	50 inches of water (9-23-96)

ATTACHED:

- Table 1 - Groundwater Monitoring Data, Third Quarter 1996
- Table 2 - Historical Groundwater Elevation and Analytical Data, Petroleum Hydrocarbons and Their Constituents
- Table 3 - Approximate Cumulative Floating Product Recovery Data
- Table 4 - Soil Vapor Extraction System Operation and Performance Data
- Table 5 - Soil-Vapor Extraction Well Data
- Table 6 - Air-Sparge System Operation and Performance Data
- Figure 1 - Site Location
- Figure 2 - Site Plan
- Figure 3 - Groundwater Data, Third Quarter 1996
- Figure 4 - Historical SVE System Influent TVHG and Benzene Concentrations
- Figure 5 - Historical SVE System Hydrocarbon Removal Rates
- Appendix A - Field Data Sheets, Third Quarter 1996 Groundwater Monitoring Event
- Appendix B - Analytical Results and Chain of Custody Documentation, Third Quarter 1996 Groundwater Monitoring Event
- Appendix C - SVE System Monitoring Data Log Sheets
- Appendix D - Field Data Sheets, Operation and Maintenance Visits, Third Quarter 1996
- Appendix E - Analytical Results and Chain-of-Custody Documentation for Soil-Vapor Extraction System, Third Quarter 1996

cc: Susan Hugo, ACHCSA
Kevin Graves, RWQCB-SFBR

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Table 1
Groundwater Monitoring Data
Third Quarter 1996

ARCO Service Station 2169
889 West Grand Avenue, Oakland, CA

Date: 11-26-96

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Groundwater Flow Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240	TPHD LUFT Method
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
A-1	08-29-96	14.16	11.08	3.08	ND	W	0.002	08-29-96	1200	320	59	25	27	110	--	--
A-2	08-29-96	14.55	11.50	3.05	ND	W	0.002	08-29-96	<50	<0.5	<0.5	<0.5	<0.5	<39#	--	--
A-3	08-29-96	15.75	12.38	3.37	ND	W	0.002	08-29-96	Not sampled: not scheduled for chemical analysis							
A-4	08-29-96	15.25	11.55	3.70	ND	W	0.002	08-29-96	Not sampled: not scheduled for chemical analysis							
A-5	08-29-96	13.51	10.60	2.91	ND	W	0.002	08-29-96	7700	490	450	260	990	<30#	--	--
A-6	08-29-96	13.51	10.52	2.99	ND	W	0.002	08-29-96	80	<0.5	<0.5	<0.5	<0.5	6	--	--
AR-1	08-29-96	15.61	12.12	3.49	ND	W	0.002	08-29-96	<50	<0.5	<0.5	<0.5	0.8	<3	--	--
AR-2	08-29-96	15.28	12.20	3.08	ND	W	0.002	08-29-96	<50	<0.5	<0.5	<0.5	<0.5	95	--	--
ADR-1	08-29-96	13.95	10.77	3.18	ND	W	0.002	08-29-96	5300	190	58	76	470	85	--	--
ADR-2	08-29-96	14.64	11.64	3.00	ND	W	0.002	08-29-96	8000	230	180	150	730	53	--	--

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

MWN: ground-water flow direction and gradient apply to the entire monitoring well network

ft/ft: foot per foot

TPHG: total petroleum hydrocarbons as gasoline, California DHS LUFT Method

µg/L: micrograms per liter

EPA: United States Environmental Protection Agency

MTBE: methyl-tert-butyl ether

TPHD: total petroleum hydrocarbons as diesel, California DHS LUFT Method

ND: none detected

W: west

#: method reporting limit was raised due to (1) high analyte concentration requiring sample dilution, or (2) matrix interference

--: not analyzed

Table 2
 Historical Groundwater Elevation and Analytical Data
 Petroleum Hydrocarbons and Their Constituents
 1994 - Present***

ARCO Service Station 2169
 889 West Grand Avenue, Oakland, CA

Date: 11-25-96

Well Designation	Water Level Field Date	Top of Casing Elevation ft-MSL	Depth to Water feet	Groundwater Elevation ft-MSL	Floating Product Thickness feet	Groundwater Flow Direction MWN	Hydraulic Gradient ft/ft	Water Sample Field Date	TPHC LUFT Method µg/L	Benzene EPA 8020 µg/L	Toluene EPA 8020 µg/L	Ethylbenzene EPA 8020 µg/L	Total Xylenes EPA 8020 µg/L	MTBE EPA 8020 µg/L	MTBE EPA 8240 µg/L	TPHD LUFT Method µg/L
A-1	02-09-94	14.16	10.09	4.07	ND	NR	NR	02-09-94	3000	560	150	66	190	--	--	^650
A-1	05-04-94	14.16	10.68	3.48	ND	NW	0.004	05-04-94	1300	250	61	27	110	--	--	^2100
A-1	08-10-94	14.16	10.28	3.88	ND	WNW	0.007	08-10-94	27000	3700	1100	540	3000	--	--	^3000
A-1	11-16-94	14.16	9.75	4.41	ND	NW	0.005	11-16-94	2100	460	6.4	62	120	--	--	^^^640
A-1	03-24-95	14.16	8.10	6.06	ND	NW	0.009	03-24-95	1200	230	39	34	66	--	--	^^^160
A-1	06-05-95	14.16	11.13	3.03	ND	NW	0.002	06-05-95	1500	310	27	36	76	--	--	^710
A-1	08-17-95	14.16	11.71	2.45	ND	W	0.001	08-18-95	1600	470	35	48	110	120	--	^240
A-1	12-04-95	14.16	12.28	1.88	ND	NNW	0.002	12-04-95	1200	240	17	25	56	--	120	--
A-1	03-01-96	14.16	8.78	5.38	ND	NW	0.003	03-13-96	1300	300	74	29	73	100	--	--
A-1	05-29-96	14.16	9.85	4.31	ND	NW	0.002	05-29-96	Not sampled: not scheduled for chemical analysis							
A-1	08-29-96	14.16	11.08	3.08	ND	W	0.002	08-29-96	1200	320	5.9	25	27	110	--	--
A-2	02-09-94	14.55	10.67	3.88	ND	NR	NR	02-09-94	^^260	<0.6	<0.5	<0.5	<0.5	--	--	--
A-2	05-04-94	14.55	11.25	3.30	ND	NW	0.004	05-04-94	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-2	08-10-94	14.55	11.56	2.99	ND	WNW	0.007	08-10-94	690	47	25	3.9	86	--	--	--
A-2	11-16-94	14.55	10.31	4.24	ND	NW	0.005	11-16-94	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-2	03-24-95	14.55	8.64	5.91	ND	NW	0.009	03-24-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-2	06-05-95	14.55	11.72	2.83	ND	NW	0.002	06-05-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-2	08-17-95	14.55	12.35	2.20	ND	W	0.001	08-17-95	<50	<0.5	<0.5	<0.5	<0.5	12	--	--
A-2	12-04-95	14.55	12.74	1.81	ND	NNW	0.002	12-04-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-2	03-01-96	14.55	9.34	5.21	ND	NW	0.003	03-13-96	<50	<0.5	0.6	<0.5	1.3	<9	--	--
A-2	05-29-96	14.55	10.40	4.15	ND	NW	0.002	05-29-96	<50	<0.5	<0.5	<0.5	<0.5	<20	--	--
A-2	08-29-96	14.55	11.50	3.05	ND	W	0.002	08-29-96	<50	<0.5	<0.5	<0.5	<0.5	<39#	--	--

Table 2
 Historical Groundwater Elevation and Analytical Data
 Petroleum Hydrocarbons and Their Constituents
 1994 - Present***

ARCO Service Station 2169
 889 West Grand Avenue, Oakland, CA

Date: 11-25-96

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Groundwater Flow Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240	TPHD LUFT Method
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
A-3	02-09-94	15.75	11.32	4.43	ND	NR	NR	02-09-94	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-3	05-04-94	15.75	11.99	3.76	ND	NW	0.004	05-04-94	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-3	08-10-94	15.75	11.12	4.63	ND	WNW	0.007	08-10-94	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-3	11-16-94	15.75	11.02	4.73	ND	NW	0.005	11-16-94	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-3	03-24-95	15.75	8.83	6.92	ND	NW	0.009	03-24-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-3	06-05-95	15.75	12.44	3.31	ND	NW	0.002	06-05-95	Not sampled, not scheduled for chemical analysis							
A-3	08-17-95	15.75	13.04	2.71	ND	W	0.001	08-17-95	Not sampled, not scheduled for chemical analysis							
A-3	12-04-95	15.75	13.57	2.18	ND	NNW	0.002	12-04-95	Not sampled, not scheduled for chemical analysis							
A-3	03-01-96	15.75	9.90	5.85	ND	NW	0.003	03-13-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
A-3	05-29-96	15.75	11.08	4.67	ND	NW	0.002	05-29-96	Not sampled, not scheduled for chemical analysis							
A-3	08-29-96	15.75	12.38	3.37	ND	W	0.002	08-29-96	Not sampled, not scheduled for chemical analysis							
A-4	02-09-94	15.25	10.01	5.24	ND	NR	NR	02-09-94	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-4	05-04-94	15.25	11.08	4.17	ND	NW	0.004	05-04-94	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-4	08-10-94	15.25	11.75	3.50	ND	WNW	0.007	08-10-94	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-4	11-16-94	15.25	9.78	5.47	ND	NW	0.005	11-16-94	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-4	03-24-95	15.25	7.20	8.05	ND	NW	0.009	03-24-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
A-4	06-05-95	15.25	11.70	3.55	ND	NW	0.002	06-05-95	Not sampled, not scheduled for chemical analysis							
A-4	08-17-95	15.25	12.28	2.97	ND	W	0.001	08-17-95	Not sampled, not scheduled for chemical analysis							
A-4	12-04-95	15.25	12.63	2.62	ND	NNW	0.002	12-04-95	Not sampled, not scheduled for chemical analysis							
A-4	03-01-96	15.25	8.55	6.70	ND	NW	0.003	03-13-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--
A-4	05-29-96	15.25	10.32	4.93	ND	NW	0.002	05-29-96	Not sampled, not scheduled for chemical analysis							
A-4	08-29-96	15.25	11.55	3.70	ND	W	0.002	08-29-96	Not sampled, not scheduled for chemical analysis							

Table 2
 Historical Groundwater Elevation and Analytical Data
 Petroleum Hydrocarbons and Their Constituents
 1994 - Present***

ARCO Service Station 2169
 889 West Grand Avenue, Oakland, CA

Date: 11-25-96

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Groundwater Flow Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240	TPHD LUFT Method
		ft-MSL	feet	ft-MSL	feet	MWN										
A-5	02-09-94	13.51	9.44	4.07	ND	NR	NR	02-09-94	2200	190	130	130	310	--	--	--
A-5	05-04-94	13.51	10.00	3.51	ND	NW	0.004	05-09-94	13000	1000	1500	490	2000	--	--	--
A-5	08-10-94	13.51	10.76	2.75	ND	WNW	0.007	08-10-94	11000	730	930	310	1300	--	--	--
A-5	11-16-94	13.51	9.09	4.42	ND	NW	0.005	11-16-94	2600	160	220	130	400	--	--	--
A-5	03-24-95	13.51	7.40	6.11	ND	NW	0.009	03-24-95	3300	200	310	130	460	--	--	--
A-5	06-05-95	13.51	10.43	3.08	ND	NW	0.002	06-05-95	57000	2700	4600	1500	6800	--	--	--
A-5	08-17-95	13.51	11.15	2.36	ND	W	0.001	08-18-95	34000	1600	2700	1100	5100	<28	--	--
A-5	12-04-95	13.51	11.42	2.09	ND	NNW	0.002	12-04-95	61	<0.5	<0.5	<0.5	<0.5	--	--	--
A-5	03-01-96	13.51	8.11	5.40	ND	NW	0.003	03-13-96	11000	860	960	380	1600	<100	--	--
A-5	05-29-96	13.51	9.30	4.21	ND	NW	0.002	05-29-96	19000	1600	1900	880	3300	<100	--	--
A-5	08-29-96	13.51	10.60	2.91	ND	W	0.002	08-29-96	7700	490	450	260	990	<30#	--	--
A-6	02-09-94	13.51	9.48	4.03	ND	NR	NR	02-09-94	640	<2.9	<3.7	<2.4	<8.2	--	--	--
A-6	05-04-94	13.51	10.07	3.44	ND	NW	0.004	05-04-94	260	<0.5	<1.5	<1.5	<0.5	--	--	--
A-6	08-10-94	13.51	10.77	2.74	ND	WNW	0.007	08-10-94	300	<0.6	<2.5	<0.8	<1	--	--	--
A-6	11-16-94	13.51	9.14	4.37	ND	NW	0.005	11-16-94	250	<0.5	<1.5	<0.6	<1.5	--	--	--
A-6	03-24-95	13.51	7.89	5.62	ND	NW	0.009	03-24-95	120	<0.5	<1	<0.5	<1.5	--	--	--
A-6	06-05-95	13.51	10.06	3.45	ND	NW	0.002	06-05-95	160	<0.5	<0.6	<0.5	<0.5	--	--	--
A-6	08-17-95	13.51	11.10	2.41	ND	W	0.001	08-18-95	530	<0.5	<0.5	<2.4	<4.2	6	--	--
A-6	12-04-95	13.51	11.52	1.99	ND	NNW	0.002	12-04-95	28000	1600	1800	880	3600	--	--	--
A-6	03-01-96	13.51	8.21	5.30	ND	NW	0.003	03-13-96	1400	<3	<15	<7	<10	<20	--	--
A-6	05-29-96	13.51	9.25	4.26	ND	NW	0.002	05-29-96	410	<2	<2	<2	<2	3	--	--
A-6	08-29-96	13.51	10.52	2.99	ND	W	0.002	08-29-96	80	<0.5	<0.5	<0.5	<0.5	6	--	--

Table 2
 Historical Groundwater Elevation and Analytical Data
 Petroleum Hydrocarbons and Their Constituents
 1994 - Present***

ARCO Service Station 2169
 889 West Grand Avenue, Oakland, CA

Date: 11-25-96

Well Designation	Water Level Field Date	Top of Casing Elevation ft-MSL	Depth to Water feet	Groundwater Elevation ft-MSL	Floating Product Thickness feet	Groundwater Flow Direction MWN	Hydraulic Gradient ft/ft	Water Sample Field Date	TPHG LUFT Method µg/L	Benzene EPA 8020 µg/L	Toluene EPA 8020 µg/L	Ethylbenzene EPA 8020 µg/L	Total Xylenes EPA 8020 µg/L	MTBE EPA 8020 µg/L	MTBE EPA 8240 µg/L	TPHD LUFT Method µg/L
AR-1	02-09-94	15.61	11.08	4.53	ND	NR	NR	02-09-94	26000	2900	450	920	3000	--	--	^4200
AR-1	05-04-94	15.61	11.83	3.78	ND	NW	0.004	05-04-94	36000	3400	360	1400	3700	--	--	^7200
AR-1	08-10-94	15.61	11.09	4.52	ND	WNW	0.007	08-10-94	6100	120	66	65	530	--	--	^2900
AR-1	11-16-94	15.61	10.19	5.42	ND	NW	0.005	11-16-94	1200	66	20	34	210	--	--	^^^560
AR-1	03-24-95	15.61	7.25	8.36	ND	NW	0.009	03-24-95	270	14	0.6	2.5	2.1	--	--	^^^130
AR-1	06-05-95	15.61	11.37	4.24	ND	NW	0.002	06-05-95	190	10	<0.5	0.8	0.5	--	--	^580
AR-1	08-17-95	15.61	12.40	3.21	ND	W	0.001	08-17-95	960	110	12	4.5	150	14	--	<50
AR-1	12-04-95	15.61	12.90	2.71	ND	NNW	0.002	12-04-95	<50	1.5	<0.5	<0.5	0.8	--	--	--
AR-1	03-01-96	15.61	8.19	7.42	ND	NW	0.003	03-13-96	150	3.8	0.5	1.4	1.3	△3	--	--
AR-1	05-29-96	15.61	10.41	5.20	ND	NW	0.002	05-29-96	Not sampled: not scheduled for chemical analysis							
AR-1	08-29-96	15.61	12.12	3.49	ND	W	0.002	08-29-96	<50	<0.5	<0.5	<0.5	0.8	△3	--	--
AR-2	02-09-94	15.28	11.33	3.95	ND	NR	NR	02-09-94	^^82	<0.5	<0.5	<0.5	<0.5	--	--	<50
AR-2	05-04-94	15.28	11.88	3.40	ND	NW	0.004	05-04-94	<50	<0.5	<0.5	<0.5	<0.5	--	--	<50
AR-2	08-10-94	15.28	12.48	2.80	ND	WNW	0.007	08-10-94	200	5	1.7	2.7	38	--	--	^55
AR-2	11-16-94	15.28	10.95	4.33	ND	NW	0.005	11-16-94	<50	0.8	<0.5	<0.5	<0.5	--	--	<50
AR-2	03-24-95	15.28	9.13	6.15	ND	NW	0.009	03-24-95	<50	6.2	<0.5	<0.5	0.6	--	--	<50
AR-2	06-05-95	15.28	12.09	3.19	ND	NW	0.002	06-05-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	<50
AR-2	08-17-95	15.28	12.78	2.50	ND	W	0.001	08-18-95	<50	<0.5	<0.5	<0.5	<0.5	4	--	<50
AR-2	12-04-95	15.28	11.44	3.84	ND	NNW	0.002	12-13-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--
AR-2	03-01-96	15.28	9.83	5.45	ND	NW	0.003	03-13-96	190	26	2.6	3.3	13	200	--	--
AR-2	05-29-96	15.28	10.97	4.31	ND	NW	0.002	05-29-96	Not sampled: not scheduled for chemical analysis							
AR-2	08-29-96	15.28	12.20	3.08	ND	W	0.002	08-29-96	<50	<0.5	<0.5	<0.5	<0.5	95	--	--

Table 2
 Historical Groundwater Elevation and Analytical Data
 Petroleum Hydrocarbons and Their Constituents
 1994 - Present***

ARCO Service Station 2169
 889 West Grand Avenue, Oakland, CA

Date 11-25-96

Well Designation	Water Level Field Date	Top of Casing Elevation ft-MSL	Depth to Water feet	Groundwater Elevation ft-MSL	Floating Product Thickness feet	Groundwater Flow Direction MWN	Hydraulic Gradient ft/ft	Water Sample Field Date	TPHC LUFT Method µg/L	Benzene EPA 8020 µg/L	Toluene EPA 8020 µg/L	Ethylbenzene EPA 8020 µg/L	Total Xylenes EPA 8020 µg/L	MTBE EPA 8020 µg/L	MTBE EPA 8240 µg/L	TPHD LUFT Method µg/L
ADR-1	02-09-94	13.95	9.90	4.05	ND	NR	NR	02-09-94	3000	380	140	59	240	--	--	^110
ADR-1	05-04-94	13.95	10.50	3.45	ND	NW	0.004	05-04-94	2100	490	93	68	140	--	--	^60
ADR-1	08-10-94	13.95	10.36	3.59	ND	WNW	0.007	08-10-94	150000	5400	15000	3600	24000	--	--	^^4800
ADR-1	11-16-94	13.95	9.64	4.31	Sheen	NW	0.005	11-16-94	Not sampled: well contained floating product							
ADR-1	03-24-95	13.95	8.04	** 5.92	0.01	NW	0.009	03-24-95	Not sampled: well contained floating product							
ADR-1	06-05-95	13.95	11.02	2.93	ND	NW	0.002	06-05-95	23000	310	420	300	1900	--	--	^13000
ADR-1	08-17-95	13.95	11.86	2.09	ND	W	0.001	08-18-95	4400	150	120	95	620	120	--	^4500
ADR-1	12-04-95	13.95	10.05	3.90	ND	NNW	0.002	12-13-95	8800	100	130	120	990	--	--	--
ADR-1	03-01-96	13.95	8.76	5.19	ND	NW	0.003	03-13-96	89000	370	1000	840	8100	<500	--	--
ADR-1	05-29-96	13.95	9.74	4.21	ND	NW	0.002	05-30-96	27000	230	380	370	2700	<100	--	--
ADR-1	08-29-96	13.95	10.77	3.18	ND	W	0.002	08-29-96	5300	190	58	76	470	85	--	--
ADR-2	02-09-94	14.64	10.73	3.91	ND	NR	NR	02-09-94	83000	6300	6100	2000	11000	--	--	12000
ADR-2	05-04-94	14.64	11.31	3.33	ND	NW	0.004	05-04-94	36000	4600	2600	930	4500	--	--	^4200
ADR-2	08-10-94	14.64	9.81	** 4.90	0.10	WNW	0.007	08-10-94	Not sampled: well contained floating product							
ADR-2	11-16-94	14.64	9.84	** 4.87	0.09	NW	0.005	11-16-94	Not sampled: well contained floating product							
ADR-2	03-24-95	14.64	8.41	NR*	>3.00*	NR*	NR*	03-24-95	Not sampled: well contained floating product							
ADR-2	06-05-95	14.64	11.45	NR*	>3.00*	NR*	NR*	06-05-95	Not sampled: well contained floating product							
ADR-2	08-17-95	14.64	12.10	** 2.56	0.03	W	0.001	08-17-95	Not sampled: well contained floating product							
ADR-2	12-04-95	14.64	10.93	** 3.73	0.03	NNW	0.002	12-13-95	Not sampled: well contained floating product							
ADR-2	03-01-96	14.64	8.74	5.90	ND	NW	0.003	03-13-96	29000	1100	1200	710	3800	<500	--	--
ADR-2	05-29-96	14.64	10.43	4.21	ND	NW	0.002	05-29-96	33000	510	500	470	2300	120	--	--
ADR-2	08-29-96	14.64	11.64	3.00	ND	W	0.002	08-29-96	8000	230	180	150	730	53	--	--

Table 2
 Historical Groundwater Elevation and Analytical Data
 Petroleum Hydrocarbons and Their Constituents
 1994 - Present***

ARCO Service Station 2169
 889 West Grand Avenue, Oakland, CA

Date: 11-25-96

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Groundwater Flow Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240	TPHD LUFT Method
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L

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

MWN, groundwater flow direction and gradient apply to the entire monitoring well network

ft/ft: foot per foot

TPHG: total petroleum hydrocarbons as gasoline, California DHS LUFT Method

µg/L: micrograms per liter

EPA: United States Environmental Protection Agency

MTBE: Methyl-tert-butyl ether

TPHD: total petroleum hydrocarbons as diesel, California DHS LUFT Method

ND: none detected

NR: not reported; data not available or not measurable

NW: northwest

WNW: west-northwest

W: west

NNW: north-northwest

#: method reporting limit was raised due to: (1) high analyte concentration requiring sample dilution, or (2) matrix interference

^: sample contains a lower boiling point hydrocarbon quantitated as diesel, chromatogram does not match the typical diesel fingerprint

^^: sample contains a single non-fuel component eluting in the gasoline range, and quantified as gasoline

^^^: sample contains a mixture of diesel and a lower boiling point hydrocarbon quantitated as diesel; chromatogram does not match the typical diesel fingerprint

^^^^: sample contains components eluting in the diesel range, quantified as diesel; chromatogram does not match the typical diesel fingerprint

--: not analyzed or not applicable

*: well contained more than 3 feet of floating product; exact product thickness and groundwater elevation could not be measured

** : [corrected elevation (Z)] = Z + (h * 0.73) where Z = measured elevation, h = floating product thickness, 0.73 = density ratio of oil to water

***: For previous historical groundwater elevation data please refer to *Fourth Quarter 1995 Groundwater Monitoring Program Results and Remediation System Performance Evaluation Report, ARCO Service Station 2169, 889 West Grand Avenue, Oakland, California, (EMCON, March 4, 1996)*

Table 3
Approximate Cumulative Floating Product Recovered

ARCO Service Station 2169
889 West Grand Avenue, Oakland, CA

Date: 11-25-96

Well Desig- nation	Date	Floating Product Recovered gallons
ADR-1	1994	0.0
ADR-2		0.0
ADR-1	1995	0.0
ADR-2		4.8
ADR-1	1996	0.0
ADR-2		0.0
1994 to 1996 Total:		4.8

Table 4
Soil-Vapor Extraction System
Operation and Performance Data

Facility Number: 2169 Location: 889 West Grand Avenue Oakland, California Consultant: EMCON 1921 Ringwood Avenue San Jose, California	Vapor Treatment Unit: ThermTech Model VAC-25, 250cfm Thermal/ Catalytic Oxidizer Start-Up Date: 06-02-94 Operation and Performance Data From: 06-02-94 To: 10-01-96
--	--

Beginning Date:	06-02-94	06-02-94	06-07-94	06-16-94	06-22-94
Ending Date:	06-02-94	06-07-94	06-16-94	06-22-94	06-30-94
Down-time (days):	0	0	1	0	4
Total Operation (days):	0	5	8	6	4
Total Operation (hours):	1.7	121.3	193.7	145.2	106.3
Operation Hours to Date:	1.7	123.0	316.7	462.0	568.2
<u>TPH Concentrations</u>					
Average Influent (ppmv):	18,000	16,000	830	1,100	230
Average Effluent (ppmv):	ND	45	ND	4.9	75.0
<u>Benzene Concentrations</u>					
Average Influent (ppmv):	270	420	17	24	3.8
Average Effluent (ppmv):	ND	0.30	ND	0.08	0.78
<u>Flow Rates</u>					
Average Influent (scfm):	61.1	131.5	145.3	194.1	176.7
Average Dilution (scfm):	184.2	97.8	69.9	0.0	0.0
Average Effluent (scfm):	268.6	272.3	289.7	264.4	288.9
<u>TPH-G Recovery Data</u>					
Recovery Rate (lbs/hr):	11.12	21.26	1.22	2.16	0.41
Recovery Rate (lbs/day):	266.80	510.34	29.27	51.77	9.86
Destruction Efficiency (%):	100.00	99.46	100.00	99.39	46.70
Product Recovered (lbs):	18.68	2779.35	236.08	313.27	43.64
Product Recovered to Date (lbs):	18.68	2798.02	2834.10	3147.37	3191.01
Product Recovered to Date (gal):	3.11	433.00	472.35	524.56	531.83
<u>Benzene Recovery Data</u>					
Recovery Rate (lbs/hr):	0.185	0.670	0.030	0.056	0.008
Recovery Rate (lbs/day):	4.447	16.076	0.719	1.355	0.195
Destruction Efficiency (%):	100.00	99.86	100.00	99.56	66.45
Product Recovered (lbs):	0.311	81.249	5.802	8.202	0.865
Product Recovered to Date (lbs):	0.311	81.561	87.363	95.565	96.430
Product Recovered to Date (gal):	0.043	11.270	12.050	13.181	13.301

Page 1 Footnotes

ppmv: parts per million by volume
 scfm: standard cubic feet per minute
 lbs/hr: pounds per operational hour
 lbs/day: pounds per day
 lbs: pounds
 gal: gallons

ND: None Detected; Recovery data calculated using laboratory detection limits

Notes:

1. Molecular weights used in recovery calculations are 65 for TPH and 78 for benzene.
2. Densities used in recovery calculations are 6.0 lbs/gal for TPH and 7.27 lbs/gal for benzene
3. All data and calculations on this page were prepared by GeoStrategies, Inc. (GSI), as presented in *Letter Report, Vapor Extraction Start Up and Quarterly Groundwater Monitoring, Second Quarter 1994*, (GSI, September 1994)

Table 4
Soil-Vapor Extraction System
Operation and Performance Data

Facility	Number: 2169 Location: 889 West Grand Avenue Oakland, California	Vapor Treatment Unit: ThermTech Model VAC-25, 250cfm Thermal/ Catalytic Oxidizer
Consultant: EMCON 1921 Ringwood Avenue San Jose, California	Start-Up Date: 06-02-94 Operation and Performance Data From: 06-02-94 To: 10-01-96	

Date Begin:	07-01-94	08-01-94	09-01-94	12-01-94	01-01-95
Date End:	08-01-94	09-01-94	12-01-94	01-01-95	02-01-95
Mode of Oxidation:	Therm-Ox	Cat-Ox	Cat-Ox	Cat-Ox	Cat-Ox
Days of Operation:	11	17	35	16	26
Days of Downtime:	20	14	56	15	5
<u>Average Vapor Concentrations (1)</u>					
Well Field Influent: ppmv (2) as gasoline	1983	680	450	1500	<15
mg/m3 (3) as gasoline	5333	1800	1200	5600	<60
ppmv as benzene	29	7.6	2.9	7	<0.1
mg/m3 as benzene	95	25	9.4	22	<0.5
System Influent: ppmv as gasoline	1983	680	450	400	<15
mg/m3 as gasoline	5333	1800	1200	1600	<60
ppmv as benzene	29	7.6	2.9	1.9	<0.1
mg/m3 as benzene	95	25	9.4	6	<0.5
System Effluent: ppmv as gasoline	17	44	4.1	<15	<15
mg/m3 as gasoline	46	118	11.1	<60	<60
ppmv as benzene	0.15	0.7	0.04	<0.1	<0.1
mg/m3 as benzene	0.49	2.3	0.143	<0.5	<0.5
Average Well Field Flow Rate (4), scfm (5):	198.3	212.6	214.3	17.7	16.7
Average System Influent Flow Rate (4), scfm:	198.3	212.6	214.3	120.1	164.3
Average Destruction Efficiency (6), percent (7):	99.1	93.4	99.1	96.3	NA
<u>Average Emission Rates (8), pounds per day (9)</u>					
Gasoline:	0.82	2.25	0.21	0.65	0.89
Benzene:	0.01	0.04	0.00	0.01	0.01
Operating Hours This Period:	<u>255.95</u>	<u>414.28</u>	<u>833.57</u>	<u>385.86</u>	<u>614.80</u>
Operating Hours To Date:	256.0	670.2	1503.8	1889.7	2504.5
Pounds/ Hour Removal Rate, as gasoline (10):	3.96	1.43	0.96	0.37	0.00
Pounds Removed This Period, as gasoline (11):	<u>1013.1</u>	<u>593.4</u>	<u>802.3</u>	<u>143.1</u>	<u>2.3</u>
Pounds Removed To Date, as gasoline:	4204.1	4797.4	5599.7	5742.9	5745.2
Gallons Removed This Period, as gasoline (12):	<u>163.4</u>	<u>95.7</u>	<u>129.4</u>	<u>23.1</u>	<u>0.4</u>
Gallons Removed To Date, as gasoline:	678.1	773.8	903.2	926.3	926.7

Table 4
Soil-Vapor Extraction System
Operation and Performance Data

Facility Number: 2169		Vapor Treatment Unit: ThermTech Model			
Location: 889 West Grand Avenue Oakland, California		VAC-25, 250cfm Thermal/ Catalytic Oxidizer			
Consultant: EMCON		Start-Up Date: 06-02-94			
1921 Ringwood Avenue		Operation and Performance Data From: 06-02-94			
San Jose, California		To: 10-01-96			
Date Begin:	02-01-95	07-01-95	08-01-95	09-01-95	10-01-95
Date End:	07-01-95	08-01-95	09-01-95	10-01-95	11-01-95
Mode of Oxidation:	Cat-Ox	Cat-Ox	Cat-Ox	Cat-Ox	Cat-Ox
Days of Operation:	0	14	19	27	12
Days of Downtime:	150	17	12	3	19
Average Vapor Concentrations (1)					
Well Field Influent: ppmv (2) as gasoline	NA (13)	1567	1975	1400	250
mg/m3 (3) as gasoline	NA	5767	7175	5200	900
ppmv as benzene	NA	12	10	3.1	0.6
mg/m3 as benzene	NA	40	33	10	1.7
System Influent: ppmv as gasoline	NA	200	270	230	66
mg/m3 as gasoline	NA	740	970	920	240
ppmv as benzene	NA	1.6	1	0.6	0.1
mg/m3 as benzene	NA	5.2	3.3	1.8	<0.5
System Effluent: ppmv as gasoline	NA	23	<15	<15	<15
mg/m3 as gasoline	NA	83	<60	<60	<60
ppmv as benzene	NA	<0.1	<0.1	<0.1	<0.1
mg/m3 as benzene	NA	<0.5	<0.5	<0.5	<0.5
Average Well Field Flow Rate (4), scfm (5):	0.0	27.9	43.0	58.1	67.0
Average System Influent Flow Rate (4), scfm:	0.0	197.6	166.8	167.9	174.1
Average Destruction Efficiency (6), percent (7):	NA	88.8	93.8	93.5	75.0
Average Emission Rates (8), pounds per day (9)					
Gasoline:	0.00	1.47	0.90	0.90	0.94
Benzene:	0.00	0.01	0.01	0.01	0.01
Operating Hours This Period:	<u>0.00</u>	<u>346.17</u>	<u>462.40</u>	<u>652.27</u>	<u>278.16</u>
Operating Hours To Date:	2504.5	2850.6	3313.0	3965.3	4243.5
Pounds/ Hour Removal Rate, as gasoline (10):	0.00	0.60	1.15	1.13	0.23
Pounds Removed This Period, as gasoline (11):	<u>0.0</u>	<u>208.5</u>	<u>533.9</u>	<u>737.6</u>	<u>62.8</u>
Pounds Removed To Date, as gasoline:	5745.2	5953.6	6487.6	7225.1	7287.9
Gallons Removed This Period, as gasoline (12):	<u>0.0</u>	<u>33.6</u>	<u>86.1</u>	<u>119.0</u>	<u>10.1</u>
Gallons Removed To Date, as gasoline:	926.7	960.3	1046.4	1165.4	1175.5

Table 4
Soil-Vapor Extraction System
Operation and Performance Data

Facility Number:	2169	Vapor Treatment Unit:	ThermTech Model
Location:	889 West Grand Avenue Oakland, California		VAC-25, 250cfm Thermal/ Catalytic Oxidizer
Consultant:	EMCON 1921 Ringwood Avenue San Jose, California	Operation and Performance Data	Start-Up Date: 06-02-94 From: 06-02-94 To: 10-01-96

Date Begin:	11-01-95	01-01-96	04-01-96
Date End:	01-01-96	04-01-96	07-01-96
Mode of Oxidation:	Cat-Ox	Cat-Ox	Cat-Ox
Days of Operation:	0	0	0
Days of Downtime:	61	91	91

Average Vapor Concentrations (1)

Well Field Influent:	ppmv (2) as gasoline	NA	NA	NA
	mg/m3 (3) as gasoline	NA	NA	NA
	ppmv as benzene	NA	NA	NA
	mg/m3 as benzene	NA	NA	NA
System Influent:	ppmv as gasoline	NA	NA	NA
	mg/m3 as gasoline	NA	NA	NA
	ppmv as benzene	NA	NA	NA
	mg/m3 as benzene	NA	NA	NA
System Effluent:	ppmv as gasoline	NA	NA	NA
	mg/m3 as gasoline	NA	NA	NA
	ppmv as benzene	NA	NA	NA
	mg/m3 as benzene	NA	NA	NA
Average Well Field Flow Rate (4), scfm (5):	0.0	0.0	0.0	
Average System Influent Flow Rate (4), scfm:	0.0	0.0	0.0	
Average Destruction Efficiency (6), percent (7):	NA	NA	NA	

Average Emission Rates (8), pounds per day (9)

Gasoline:	0.00	0.00	0.00
Benzene:	0.00	0.00	0.00
Operating Hours This Period:	<u>0.00</u>	<u>0.00</u>	<u>0.00</u>
Operating Hours To Date:	4243.5	4243.5	4243.5
Pounds/ Hour Removal Rate, as gasoline (10):	0.00	0.00	0.00
Pounds Removed This Period, as gasoline (11):	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Pounds Removed To Date, as gasoline:	7287.9	7287.9	7287.9
Gallons Removed This Period, as gasoline (12):	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Gallons Removed To Date, as gasoline:	1175.5	1175.5	1175.5

Table 4
Soil-Vapor Extraction System
Operation and Performance Data

Facility Number: 2169	Vapor Treatment Unit: ThermTech Model		
Location: 889 West Grand Avenue Oakland, California	VAC-25, 250cfm Thermal/ Catalytic Oxidizer		
Consultant: EMCON	Start-Up Date: 06-02-94		
1921 Ringwood Avenue San Jose, California	Operation and Performance Data From: 06-02-94 To: 10-01-96		

Date Begin.	07-01-96	08-01-96	09-01-96
Date End.	08-01-96	09-01-96	10-01-96
Mode of Oxidation:	Cat-Ox	Cat-Ox	Cat-Ox
Days of Operation:	0	18	8
Days of Downtime:	31	13	22
Average Vapor Concentrations (1)			
Well Field Influent: ppmv (2) as gasoline	NA	140	770
mg/m3 (3) as gasoline	NA	570	3200
ppmv as benzene	NA	1.6	2.4
mg/m3 as benzene	NA	5	7.8
System Influent: ppmv as gasoline	NA	73	300
mg/m3 as gasoline	NA	300	1200
ppmv as benzene	NA	0.8	0.8
mg/m3 as benzene	NA	2.6	2.6
System Effluent: ppmv as gasoline	NA	<5	<5
mg/m3 as gasoline	NA	<20	<20
ppmv as benzene	NA	<0.2	<0.1
mg/m3 as benzene	NA	<0.5	<0.4
Average Well Field Flow Rate (4), scfm (5):	0.0	119.3	128.6
Average System Influent Flow Rate (4), scfm:	0.0	153.0	204.3
Average Destruction Efficiency (6), percent (7):	NA	93.3	98.3
Average Emission Rates (8), pounds per day (9)			
Gasoline:	0.00	0.27	0.37
Benzene:	0.00	0.01	0.01
Operating Hours This Period:	<u>1.82</u>	<u>435.13</u>	<u>180.20</u>
Operating Hours To Date:	4245.3	4680.4	4860.6
Pounds/ Hour Removal Rate, as gasoline (10):	0.00	0.25	1.54
Pounds Removed This Period, as gasoline (11):	<u>0.0</u>	<u>110.7</u>	<u>277.5</u>
Pounds Removed To Date, as gasoline:	7287.9	7398.7	7676.2
Gallons Removed This Period, as gasoline (12):	<u>0.0</u>	<u>17.9</u>	<u>44.8</u>
Gallons Removed To Date, as gasoline:	1175.5	1193.4	1238.2

Table 4
Soil-Vapor Extraction System
Operation and Performance Data

Facility Number: 2169 Location: 889 West Grand Avenue Oakland, California Consultant: EMCON 1921 Ringwood Avenue San Jose, California	Vapor Treatment Unit: ThermTech Model VAC-25, 250cfm Thermal/ Catalytic Oxidizer Start-Up Date: 06-02-94 Operation and Performance Data From: 06-02-94 To: 10-01-96
--	--

CURRENT REPORTING PERIOD:	07-01-96	to	10-01-96
DAYS / HOURS IN PERIOD:	92		2208.0
DAYS / HOURS OF OPERATION:	26		617.2
DAYS / HOURS OF DOWN TIME:	66		1590.9
PERCENT OPERATIONAL:			28.0 %
PERIOD POUNDS REMOVED:	388.3		
PERIOD GALLONS REMOVED:	62.6		
AVERAGE WELL FIELD FLOW RATE (scfm):			121.7
AVERAGE SYSTEM INFLUENT FLOW RATE (scfm):			167.5

- 1 Average concentrations are based on discrete sample results reported during the month; refer to Appendix C for discrete sample results.
- 2 ppmv. parts per million by volume
- 3 mg/m3: milligrams per cubic meter
- For the period from July 1 to December 1, 1994, ppmv results were converted to mg/m3 using the following formula:
 concentration (as gasoline in mg/m3) = [concentration (as gasoline in ppmv) x 65 lb/lb-mole / 24.05 (lb/m3/lb-mole of air)/mg] (rounded as appropriate)
 concentration (as benzene in mg/m3) = [concentration (as benzene in ppmv) x 78 lb/lb-mole / 24.05 (lb/m3/lb-mole of air)/mg] (rounded as appropriate)
- For the period from December 1, 1994, to July 1, 1995, ppmv results were converted to mg/m3 using the following formula:
 concentration (as gasoline in mg/m3) = [concentration (as gasoline in ppmv) x 87 lb/lb-mole / 24.05 (lb/m3/lb-mole of air)/mg] (rounded as appropriate)
 concentration (as benzene in mg/m3) = [concentration (as benzene in ppmv) x 78 lb/lb-mole / 24.05 (lb/m3/lb-mole of air)/mg] (rounded as appropriate)
- After July 1, 1995, all vapor results were reported by the laboratory in ppmv and mg/m3.
4. Average flow rates (time weighted average) are based on instantaneous flow rates recorded during the month, refer to Appendix C for instantaneous flow data.
- 5 scfm: flow in standard cubic feet per minute at one atmosphere and 70 degrees Fahrenheit
- 6 Average destruction efficiencies are calculated using monthly average concentrations; refer to Appendix C for instantaneous destruction efficiency data
- 7 destruction efficiency, percent = [(system influent concentration (as gasoline in mg/m3) - system effluent concentration (as gasoline in mg/m3)) / system influent concentration (as gasoline in mg/m3)] x 100 percent
- 8 Average emission rates are calculated using monthly average concentrations and flow rates; refer to Appendix C for instantaneous emission rate data.
- 9 emission rates (pounds per day) = system effluent concentration (as gasoline or benzene in mg/m3) x system influent flow rate (scfm) x 0.02832 m3/l3 x 1440 minutes/day x 1 pound/454,000 mg
- 10 pounds/ hour removal rate (as gasoline) = well field influent concentration (as gasoline in mg/m3) x well field influent flow rate (scfm) x 0.02832 m3/l3 x 60 minutes/hour x 1 pound/454,000 mg
- 11 pounds removed this period (as gasoline) = pounds/ hour removal rate x hours of operation
- 12 gallons removed this period (as gasoline) = pounds removed this period (as gasoline) x 0.1613 gallons/pound of gasoline
13. NA: not applicable, not analyzed, or not available

Table 5
Soil-Vapor Extraction Well Data

ARCO Service Station 2169
889 West Grand Avenue, Oakland, CA

Date: 11-26-96

Date	Well Identification											
	A-1			A-2			A-3			A-4		
	Valve Position	TVHG	Vacuum Response	Valve Position	TVHG	Vacuum Response	Valve Position	TVHG	Vacuum Response	Valve Position	TVHG	Vacuum Response
		ppmv	in-H2O		ppmv	in-H2O		ppmv	in-H2O		ppmv	in-H2O
For SVE well monitoring data prior to January 1, 1995, please refer to the third quarter 1995 groundwater monitoring report for this site.												
01-13-95	passive	NA	0	passive	NA	0	passive	NA	0	passive	NA	0
01-26-95	passive	NA	0	passive	NA	0	passive	NA	0	passive	NA	0
07-17-95	System was shut down on January 26, 1995			System was restarted on July 17, 1995.								
07-17-95	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
07-25-95	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
08-22-95	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
09-21-95	closed	NA	0	closed	NA	0	closed	NA	0	closed	NA	0
09-21-95	open	NA	46	closed	NA	0	closed	NA	0	closed	NA	0
09-21-95	open	600 LAB	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
10-12-95	open	NA	36	closed	NA	0	closed	NA	0	closed	NA	0
10-12-95	System was manually shut down											
08-02-96	closed	NA	0	closed	NA	0	open	NA	46	closed	NA	0
08-05-96	closed	NA	NA	closed	NA	NA	open	NA	22	closed	NA	NA
09-23-96	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
<p>TVHG: concentration of total volatile hydrocarbons as gasoline ppmv parts per million by volume in-H2O inches of water open open to the system passive: open to the atmosphere closed: closed to the system and atmosphere NA: not analyzed or not measured FID: TVHG concentration was measured with a portable flame ionization detector LAB: TVHG concentration was analyzed in the laboratory PID: TVHG concentration was measured with a portable photoionization detector</p>												

Table 5
Soil-Vapor Extraction Well Data

ARCO Service Station 2169
889 West Grand Avenue, Oakland, CA

Date: 11-26-96

Date	Well Identification											
	AV-1			AV-2			AV-3			AV-4		
	Valve Position	TVHG	Vacuum Response	Valve Position	TVHG	Vacuum Response	Valve Position	TVHG	Vacuum Response	Valve Position	TVHG	Vacuum Response
		ppmv	in-H2O		ppmv	in-H2O		ppmv	in-H2O		ppmv	in-H2O
For SVE well monitoring data prior to January 1, 1995, please refer to the third quarter 1995 groundwater monitoring report for this site												
01-13-95	passive	NA	15	passive	NA	0	passive	NA	0	open	463 PID	16
01-26-95	passive	NA	27	passive	NA	0	passive	NA	0	open	1 8 FID	30
07-17-95	System was shut down on January 26, 1995.			System was restarted on July 17, 1995								
07-17-95	open	NA	NA	open	NA	NA	open	NA	NA	closed	NA	NA
07-25-95	open	1026 PID	42	open	1364 PID	42	open	869 PID	42	closed	NA	NA
07-25-95	open	1200 LAB	NA	open	1600 LAB	NA	open	980 LAB	NA	closed	NA	NA
08-22-95	open	NA	42	open	NA	44	open	NA	44	closed	NA	NA
09-21-95	open	NA	43	open	NA	47	open	NA	47	closed	NA	0
09-21-95	open	NA	46	open	NA	46	open	NA	46	closed	NA	1
10-12-95	open	NA	44	open	NA	43	open	NA	43	closed	NA	1
10-12-95	System was manually shut down.											
08-02-96	closed	48.5 PID	6	open	863 PID	46	open	322 PID	44	closed	NA	0
08-05-96	closed	NA	NA	open	NA	32	open	NA	36	open	NA	32
09-23-96	open	NA	42	open	NA	50	open	NA	53	open	NA	50
TVHG: concentration of total volatile hydrocarbons as gasoline ppmv: parts per million by volume in-H2O: inches of water open: open to the system passive: open to the atmosphere closed: closed to the system and atmosphere NA: not analyzed or not measured FID: TVHG concentration was measured with a portable flame ionization detector LAB: TVHG concentration was analyzed in the laboratory PID: TVHG concentration was measured with a portable photoionization detector												

Table 5
Soil-Vapor Extraction Well Data

ARCO Service Station 2169
889 West Grand Avenue, Oakland, CA

Date: 11-26-96

Date	Well Identification											
	AV-5			AV-6			AV-7			AR-2		
	Valve Position	TVHG ppmv	Vacuum Response in-H2O	Valve Position	TVHG ppmv	Vacuum Response in-H2O	Valve Position	TVHG ppmv	Vacuum Response in-H2O	Valve Position	TVHG ppmv	Vacuum Response in-H2O
For SVE well monitoring data prior to January 1, 1995, please refer to the third quarter 1995 groundwater monitoring report for this site.												
01-13-95	passive	NA	1	open	46 PID	16	passive	NA	0	passive	NA	0
01-26-95	open	2.2 FID	30	open	2.3 FID	30	passive	NA	0	passive	NA	0
07-17-95	System was shut down on January 26, 1995			System was restarted on July 17, 1995.								
07-17-95	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
07-25-95	closed	NA	NA	closed	NA	NA	closed	NA	NA	closed	NA	NA
08-22-95	closed	NA	NA	closed	NA	NA	closed	NA	NA	open	NA	44
09-21-95	closed	NA	0	closed	NA	0	closed	NA	0	open	NA	48
09-21-95	closed	NA	0	open	NA	46	closed	NA	0	open	NA	46
09-21-95	closed	NA	NA	open	2300 LAB	NA	closed	NA	NA	open	NA	NA
10-12-95	closed	NA	0	open	NA	42	closed	NA	0	open	NA	43
10-12-95	System was manually shut down											
08-02-96	open	NA	44	open	185 PID	42	open	NA	44	closed	NA	40
08-05-96	open	NA	30-36	open	NA	32	open	NA	34	open	NA	28
09-23-96	open	455 PID	50	open	282 PID	49	closed	NA	NA	open	13.2 PID	45
<p>TVHG: concentration of total volatile hydrocarbons as gasoline ppmv: parts per million by volume in-H2O: inches of water open: open to the system passive: open to the atmosphere closed: closed to the system and atmosphere NA: not analyzed or not measured FID: TVHG concentration was measured with a portable flame ionization detector LAB: TVHG concentration was analyzed in the laboratory PID: TVHG concentration was measured with a portable photoionization detector</p>												

Table 5
Soil-Vapor Extraction Well Data

ARCO Service Station 2169
889 West Grand Avenue, Oakland, CA

Date: 11-26-96

Date	Well Identification					
	ADR-1			ADR-2		
	Valve Position	TVHG ppmv	Vacuum Response in-H ₂ O	Valve Position	TVHG ppmv	Vacuum Response in-H ₂ O
For SVE well monitoring data prior to January 1, 1995, please refer to the third quarter 1995 groundwater monitoring report for this site						
01-13-95	open	58 PID	16	open	160 PID	16
01-26-95	open	2 2 FID	30	open	4 4 FID	30
07-17-95	System was shut down on January 26, 1995.			System was restarted on July 17, 1995.		
07-17-95	open	NA	NA	open	NA	NA
07-25-95	open	1184 PID	42	open	1057 PID	42
07-25-95	open	1400 LAB	NA	open	1300 LAB	NA
08-22-95	open	NA	44	open	NA	44
09-21-95	open	NA	48	open	NA	47
09-21-95	open	NA	45	open	NA	46
10-12-95	open	NA	43	open	NA	44
10-12-95	System was manually shut down.					
08-02-96	closed	NA	0	open	950 PID	42
08-05-96	closed	NA	NA	open	NA	32
09-23-96	open	1221 PID	NA	open	950 PID	50
TVHG: concentration of total volatile hydrocarbons as gasoline ppmv: parts per million by volume in-H ₂ O: inches of water open: open to the system passive: open to the atmosphere closed: closed to the system and atmosphere NA: not analyzed or not measured FID: TVHG concentration was measured with a portable flame ionization detector LAB: TVHG concentration was analyzed in the laboratory PID: TVHG concentration was measured with a portable photoionization detector						

Table 6
Air-Sparge System
Operation and Performance Data

Facility Number: 2169 Location: 889 West Grand Avenue Oakland, California Consultant: EMCON 1921 Ringwood Avenue San Jose, California	Air-Sparge Unit:* 3-horsepower Conde blower 5-horsepower air compressor Start-Up Date: 07-15-94 Operation and Performance Data From: 07-15-94 To: 10-01-96
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	07-15-94	08-01-94	08-01-94	08-01-94	08-15-94	09-13-94	09-13-94
Date Begin:	07-15-94	08-01-94	08-01-94	08-01-94	08-15-94	09-13-94	09-13-94
Date End:	08-01-94	08-01-94	08-01-94	08-15-94	09-13-94	11-28-94	11-28-94
Days of Operation:	6	0	0	19	27	0	0
Days of Downtime:	11	0	0	12	3	76	76
Air-Sparge Well Status:							
AS-1	open	open	open	open	open	open	closed
AS-2	open	open	open	open	open	open	closed
AS-3	open	open	open	open	open	open	closed
AS-4	open	open	open	open	open	open	closed
AS-5	open	open	open	open	open	open	closed
Air-Sparge Well Pressure (psig) (1):							
AS-1	2.8	2.8	3.0	2.0	2.4	2.4	0.0
AS-2	3.0	3.0	2.8	2.2	2.4	2.4	0.0
AS-3	3.6	3.6	3.8	3.1	2.2	2.2	0.0
AS-4	3.1	3.1	3.4	3.0	2.8	2.8	0.0
AS-5	2.8	2.8	3.2	2.8	3.2	3.2	0.0
Total Air-Sparge Flow Rate (scfm) (2):	25.0	29.0	29.0	27.0	29.0	29.0	0.0
Total Air-Sparge Pressure (psig):	5.0	2.8	2.8	2.6	3.0	3.0	0.0
Dissolved Oxygen (mg/L) (3):							
Air-Sparge Wells:							
AS-1	NA (4)	NA	NA	NA	NA	NA	1.4
AS-2	NA	NA	NA	NA	NA	NA	1.2
AS-3	NA	NA	NA	NA	NA	NA	1.2
AS-4	NA	NA	NA	NA	NA	NA	0.8
AS-5	NA	NA	NA	NA	NA	NA	1.4
Depth to Water (ft-BGS) (5):							
Air-Sparge Wells:							
AS-1	NA	NA	NA	NA	NA	NA	10.55
AS-2	NA	NA	NA	NA	NA	NA	11.29
AS-3	NA	NA	NA	NA	NA	NA	10.78
AS-4	NA	NA	NA	NA	NA	NA	10.27
AS-5	NA	NA	NA	NA	NA	NA	10.65

Table 6
Air-Sparge System
Operation and Performance Data

Facility Number: 2169		Air-Sparge Unit:*				
Location: 889 West Grand Avenue Oakland, California		3-horsepower Conde blower 5-horsepower air compressor				
Consultant: EMCON 1921 Ringwood Avenue San Jose, California		Start-Up Date: 07-15-94 Operation and Performance Data From: 07-15-94 To: 10-01-96				
Date Begin:	11-28-94	01-03-95	02-03-95	03-31-95	07-25-95	08-10-95
Date End:	01-03-95	02-03-95	03-31-95	06-28-95	08-10-95	08-22-95
Days of Operation:	0	0	0	0	2	0
Days of Downtime:	36	31	56	89	14	12
Air-Sparge Well Status:						
AS-1	closed	closed	closed	closed	open	open
AS-2	closed	closed	closed	closed	closed	closed
AS-3	closed	closed	closed	closed	closed	closed
AS-4	closed	closed	closed	closed	open	open
AS-5	closed	closed	closed	closed	closed	closed
Air-Sparge Well Pressure (psig) (1):						
AS-1	0.0	0.0	0.0	0.0	8.9	5.5
AS-2	0.0	0.0	0.0	0.0	0.0	0.0
AS-3	0.0	0.0	0.0	0.0	0.0	0.0
AS-4	0.0	0.0	0.0	0.0	2.0	2.3
AS-5	0.0	0.0	0.0	0.0	0.0	0.0
Total Air-Sparge Flow Rate (scfm) (2):						
	0.0	0.0	0.0	0.0	2.0	2.0
Total Air-Sparge Pressure (psig):						
	0.0	0.0	0.0	0.0	50	45
Dissolved Oxygen (mg/L) (3):						
Air-Sparge Wells:						
AS-1	NA	NA	NA	NA	1.1	NA
AS-2	NA	NA	NA	NA	NA	NA
AS-3	NA	NA	NA	NA	NA	NA
AS-4	NA	NA	NA	NA	1.4	NA
AS-5	NA	NA	NA	NA	1.0	NA
Depth to Water (ft-BGS) (5):						
Air-Sparge Wells:						
AS-1	NA	NA	8.79	NA	11.75	NA
AS-2	NA	NA	9.37	NA	NA	NA
AS-3	NA	NA	8.93	NA	NA	NA
AS-4	NA	NA	8.43	NA	11.31	NA
AS-5	NA	NA	8.80	NA	11.62	NA

Table 6
Air-Sparge System
Operation and Performance Data

Facility Number: 2169 Location: 889 West Grand Avenue Oakland, California Consultant: EMCON 1921 Ringwood Avenue San Jose, California	Air-Sparge Unit:* 3-horsepower Conde blower 5-horsepower air compressor Start-Up Date: 07-15-94 Operation and Performance Data From: 07-15-94 To: 10-01-96
--	---

Date Begin:	08-22-95	09-21-95	10-12-95	01-01-96	04-01-96
Date End:	09-21-95	10-12-95	01-01-96	04-01-96	07-01-96
Days of Operation:	11	NA	NA	NA	NA
Days of Downtime:	19	NA	NA	NA	NA

Air-Sparge Well Status:					
AS-1	open	closed	closed	closed	closed
AS-2	closed	closed	closed	closed	closed
AS-3	closed	closed	closed	closed	closed
AS-4	open	closed	closed	closed	closed
AS-5	open	closed	closed	closed	closed

Air-Sparge Well Pressure (psig) (1):					
AS-1	7.0	0.0	0.0	0.0	0.0
AS-2	0.0	0.0	0.0	0.0	0.0
AS-3	0.0	0.0	0.0	0.0	0.0
AS-4	1.5	0.0	0.0	0.0	0.0
AS-5	1.0	0.0	0.0	0.0	0.0

Total Air-Sparge Flow Rate (scfm) (2):	6.0	0.0	0.0	0.0	0.0
Total Air-Sparge Pressure (psig):	45	0	0	0	0

Dissolved Oxygen (mg/L) (3):					
Air-Sparge Wells:					
AS-1	NA	7.4	NA	NA	NA
AS-2	NA	NA	NA	NA	NA
AS-3	NA	NA	NA	NA	NA
AS-4	NA	1.5	NA	NA	NA
AS-5	NA	1.6	NA	NA	NA

Depth to Water (ft-BGS) (5):					
Air-Sparge Wells:					
AS-1	NA	12.12	NA	NA	NA
AS-2	NA	NA	NA	NA	NA
AS-3	NA	NA	NA	NA	NA
AS-4	NA	11.78	NA	NA	NA
AS-5	NA	12.05	NA	NA	NA

Table 6
Air-Sparge System
Operation and Performance Data

Facility Number: 2169 Location: 889 West Grand Avenue Oakland, California Consultant: EMCON 1921 Ringwood Avenue San Jose, California	Air-Sparge Unit: * 3-horsepower Conde blower 5-horsepower air compressor Start-Up Date: 07-15-94 Operation and Performance Data From: 07-15-94 To: 10-01-96
--	--

Date Begin:	07-01-96	08-01-96	09-01-96
Date End:	08-01-96	09-01-96	10-01-96
Days of Operation:	0	18	0
Days of Downtime:	31	13	22

Air-Sparge Well Status:

AS-1	closed	open	open
AS-2	closed	closed	open
AS-3	closed	open	open
AS-4	closed	open	open
AS-5	closed	open	open

Air-Sparge Well Pressure (psig) (1):

AS-1	0.0	2.0	1.5
AS-2	0.0	NA	1.5
AS-3	0.0	2.0	1.5
AS-4	0.0	2.0	1.5
AS-5	0.0	1.5	1.5

Total Air-Sparge Flow Rate (scfm) (2): 0.0 6.0 12.0

Total Air-Sparge Pressure (psig): 0.0 40 45

Dissolved Oxygen (mg/L) (3):

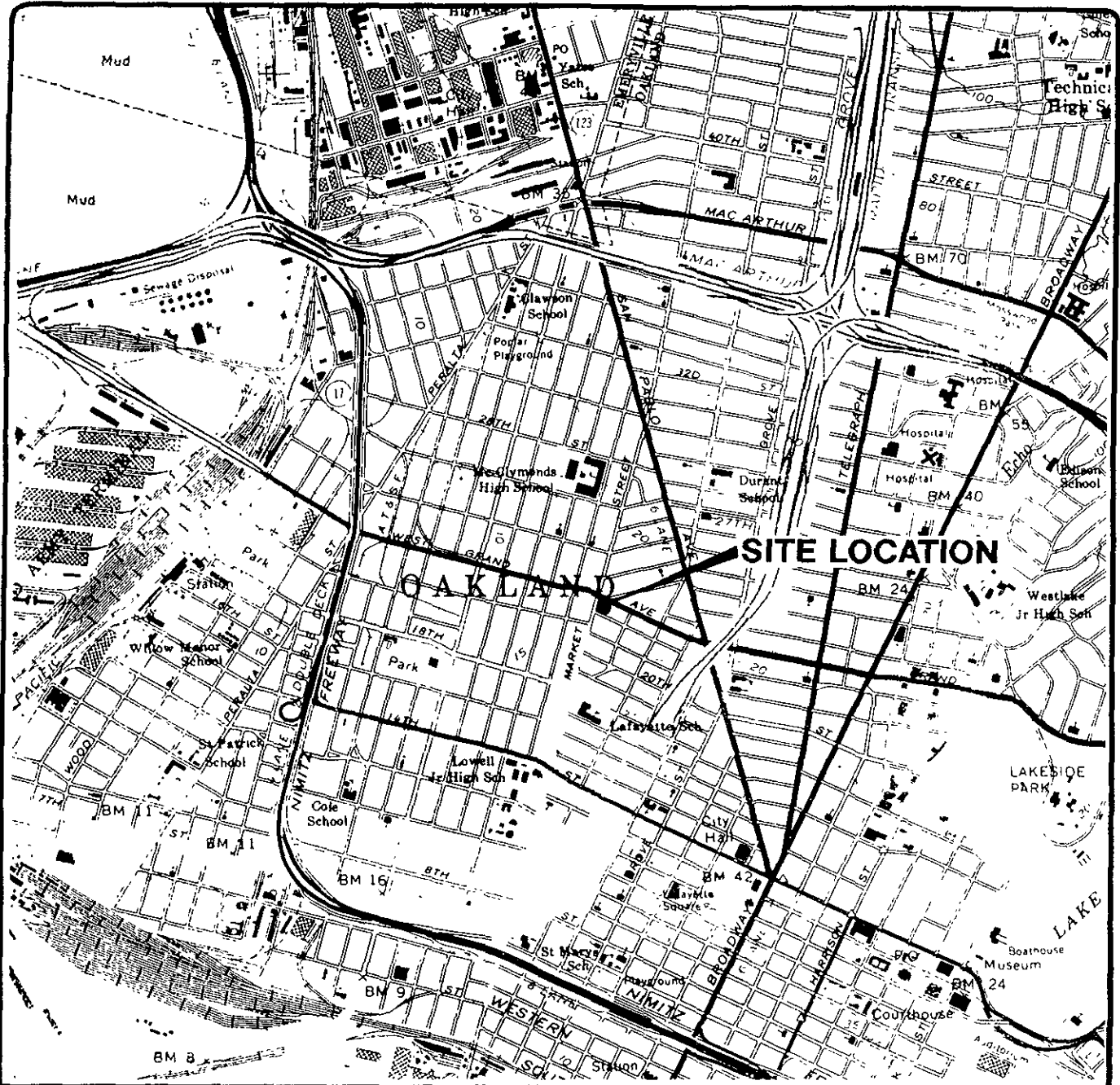
Air-Sparge Wells:

AS-1	NA	NA	NA
AS-2	NA	NA	NA
AS-3	NA	NA	NA
AS-4	NA	NA	NA
AS-5	NA	NA	NA

Depth to Water (ft-BGS) (5):

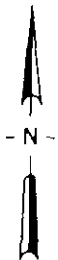
Air-Sparge Wells:

AS-1	NA	NA	NA
AS-2	NA	NA	NA
AS-3	NA	NA	NA
AS-4	NA	NA	NA
AS-5	NA	NA	NA



Base map from USGS 7.5' Quad. Map:
Oakland West, California.
(Photorevised 1980).

Scale : 0 2000 4000 Feet



EMCON

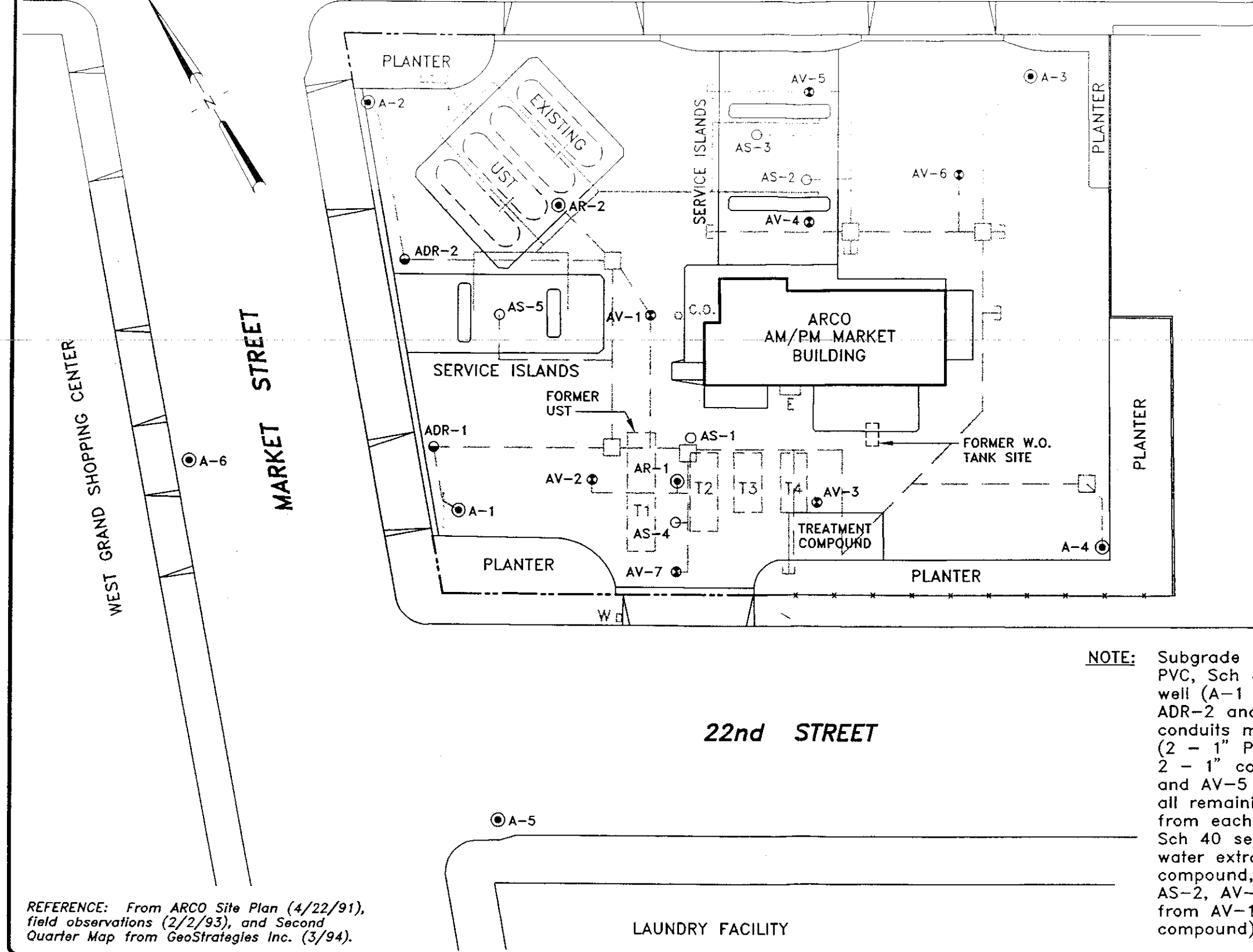
ARCO PRODUCTS COMPANY
SERVICE STATION 2169, 889 WEST GRAND AVE.
QUARTERLY GROUNDWATER MONITORING
OAKLAND, CALIFORNIA

SITE LOCATION

FIGURE

1

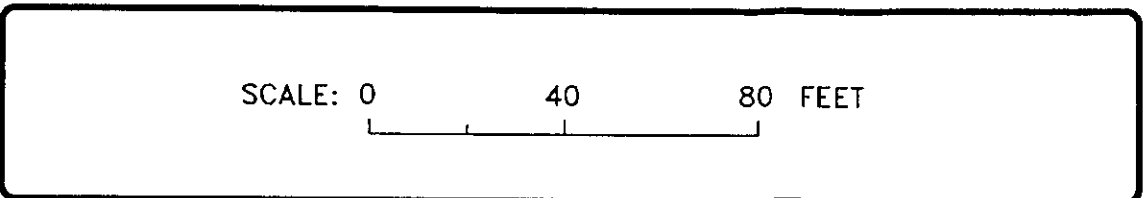
PROJECT NO.
805-129.03



Symbol	EXPLANATION
●	Groundwater well
⊗	Vapor extraction well
○	Groundwater extraction well
○	Air sparge well
□	Junction
---	Centerline subgrade (See notes)
]	Stub-out (grade) marker and out location
C.O. ○	Sewer cleanout
E	Existing structure
W	Water meter
○	Wells A-1 through A-6 and AR-1 through AR-2 vapor extraction wells

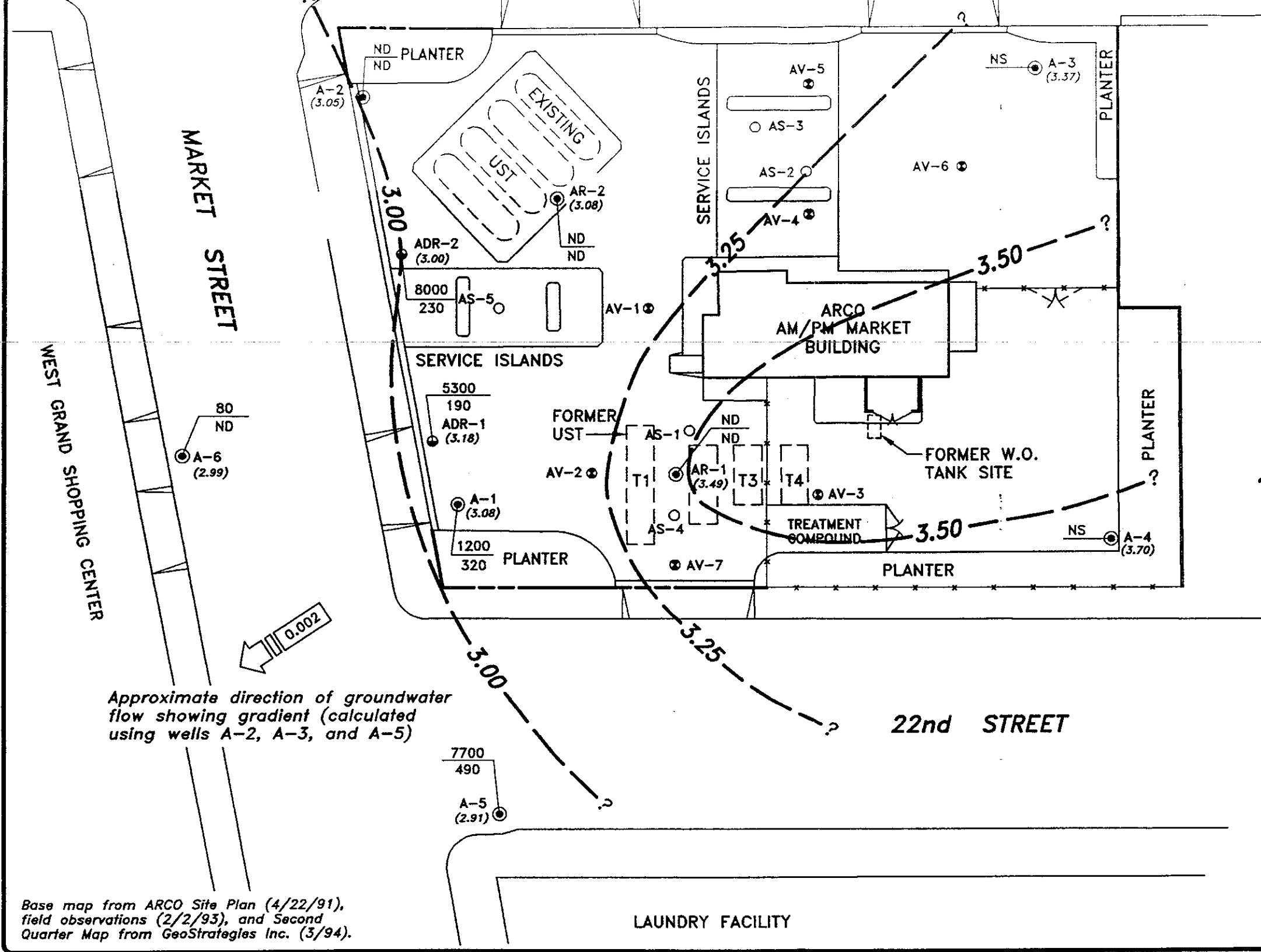
NOTE: Subgrade remediation piping consists of PVC, Sch 40 vapor lines from each well (A-1 through A-4, AV-1 through AV-7, ADR-2 and AR-2), two 1" PVC Sch 40 conduits manifolded to each well (2 - 1" PVC elec. conduits from A-1, A-2, AV-1, AV-2, AV-3, AV-4, AV-5, AV-6, AV-7, and AV-8 to compound, and 2 - 1" conduits from A-3, AV-6, and AV-5 to compound, and 2 - 1" all remaining wells), a 2" Sch 80 PVC line from each sparge well to the compound, and a 2" Sch 40 secondary containment pipe for water extraction (1 - 4" pipe from A-1, A-2, AV-1, AV-2, AV-3, AV-4, AV-5, AV-6, AV-7, AV-8, and AV-9 to compound, 1 - 4" manifold pipe from AV-1, AS-1, AV-3 and one to compound).

REFERENCE: From ARCO Site Plan (4/22/91), field observations (2/2/93), and Second Quarter Map from GeoStrategies Inc. (3/94).



ARCO PRODUCTS COMPANY
 SERVICE STATION 2169, 889 WEST GRAND AVENUE
 OAKLAND, CALIFORNIA
 SITE PLAN

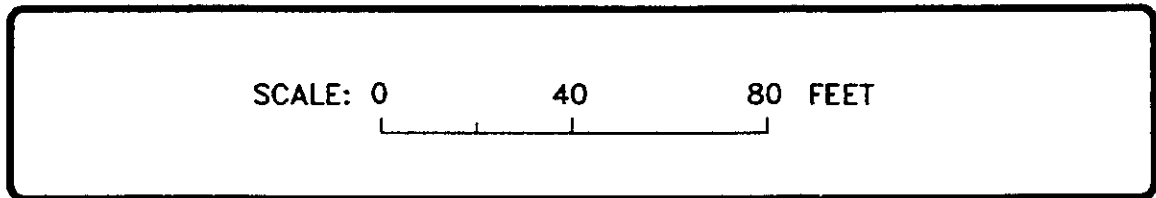
G:\805-129\G00 REV 0 11/21/96 12:59:22 DD DU



Approximate direction of groundwater flow showing gradient (calculated using wells A-2, A-3, and A-5)

Base map from ARCO Site Plan (4/22/91), field observations (2/2/93), and Second Quarter Map from GeoStrategies Inc. (3/94).

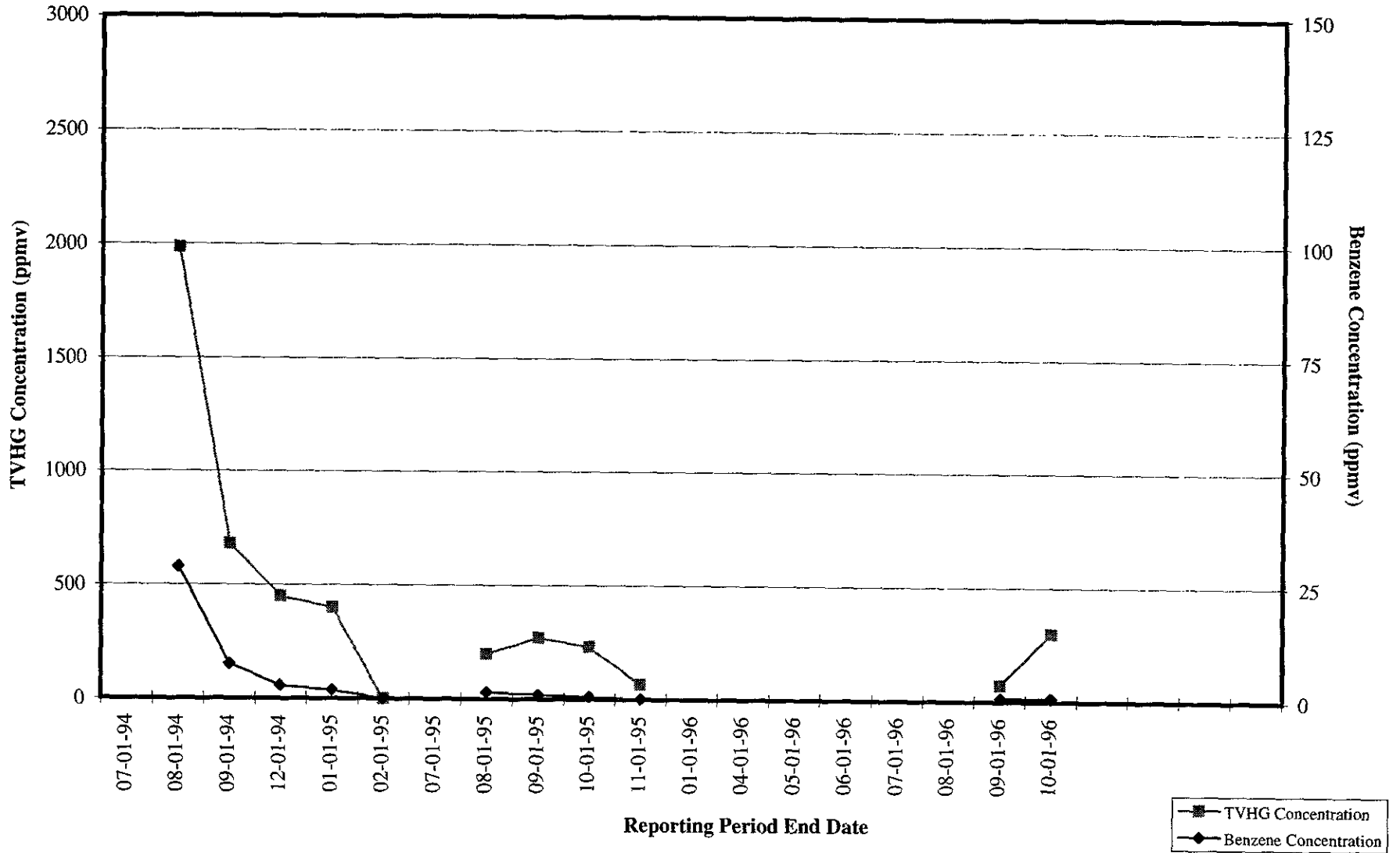
- EXPLANATION**
- ⊙ Groundwater
 - ⊕ Vapor extrac
 - Groundwater extraction v
 - Air sparging
 - (3.70) Groundwater measured
 - ? Groundwater (Ft.-MSL)
 - 5300 / 190 TPHG concs sampled 8,
 - Benzene conc sampled 8,
 - ND Not detected limit for TP benzene (0.
 - NS Not sampled chemical an



ARCO PRODUCTS COMPANY
 SERVICE STATION 2169, 889 WEST GRAND AVENUE
 QUARTERLY GROUNDWATER MONITORING
 OAKLAND, CALIFORNIA
 GROUNDWATER DATA
 THIRD QUARTER 1996

Figure 4

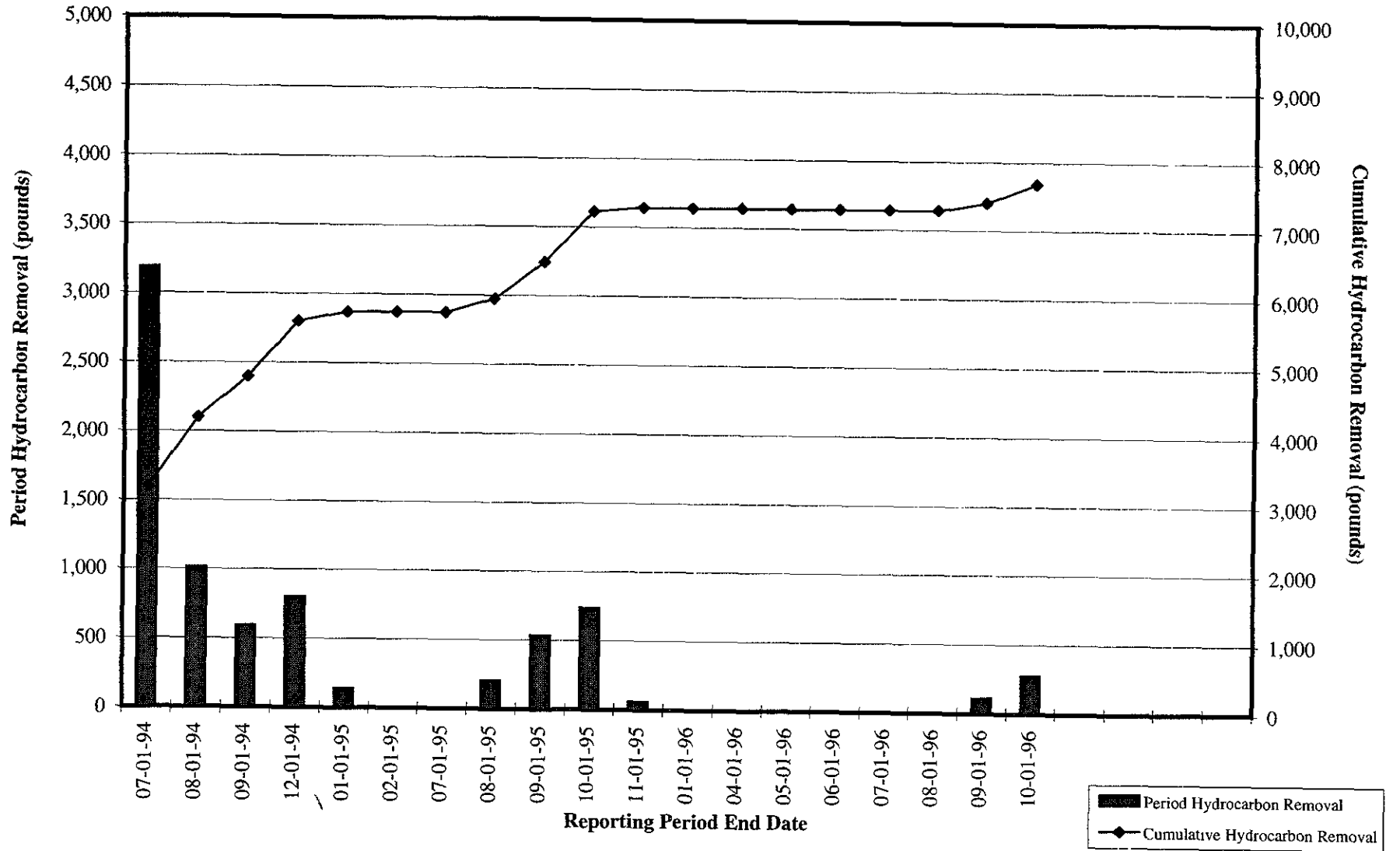
ARCO Service Station 2169
Soil-Vapor Extraction and Treatment System
Historical System Influent TVHG and Benzene Concentrations



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

Figure 5

ARCO Service Station 2169
Soil-Vapor Extraction and Treatment System
Historical Hydrocarbon Removal Rates



APPENDIX A

**FIELD DATA SHEETS, THIRD QUARTER 1996
GROUNDWATER MONITORING EVENT**

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

PROJECT # : 21775-235.002 STATION ADDRESS : 899 West Grand Avenue, Oakland

DATE : 8/29/96

ARCO STATION # : 2169

FIELD TECHNICIAN : DG/MG

DAY : Thu

DTW Order	WELL ID	Well Box Seal	Well Lid Secure	Gasket Present	Lock Number	Type Of Well Cap	FIRST DEPTH TO WATER (feet)	SECOND DEPTH TO WATER (feet)	DEPTH TO FLOATING PRODUCT (feet)	FLOATING PRODUCT THICKNESS (feet)	WELL TOTAL DEPTH (feet)	COMMENTS
1	A-2	X	X	X	1692	Tec	11.50	11.50	ND	ND	24.6	
2	A-3	X	X	X	None	Screw	12.38	12.38	ND	ND	28.2	
3	A-4	X	X	X	None	Screw	11.55	11.55	ND	ND	28.4	
4	AR-1	X	X	X	↓	↓	12.12	12.12	ND	ND	27.3	
5	AR-2	X	X	X	↓	↓	12.20	12.20	ND	ND	28.5	
6	A-6	X	X	X	ARCO	LWC	10.52	10.52	ND	ND	27.0	
7	A-1	X	X	X	None	Tec	11.08	11.08	ND	ND	23.6	
8	A-5	X	X	X	ARCO	LWC	10.60	10.60	ND	ND	29.6	
9	ADR-1	X	X	X	None	Tec	10.77	10.77	ND	ND	20.8	
10	ADR-2	X	X	X	↓	Tec	11.64	11.64	ND	ND	26.3	

SURVEY POINTS ARE TOP OF WELL CASINGS



WATER SAMPLE FIELD DATA SHEET

Rev. 3, 2/94

EMCON ASSOCIATES

PROJECT NO: 21775-235-002
PURGED BY: NIG/JAG
SAMPLED BY: V

SAMPLE ID: A-1(13)
CLIENT NAME: APCO #2169
LOCATION: OAKLAND, CA

TYPE: Ground Water Surface Water _____ Treatment Effluent _____ Other _____
CASING DIAMETER (inches): 2 _____ 3 4 _____ 4.5 _____ 6 _____ Other _____

CASING ELEVATION (feet/MSL): N/A VOLUME IN CASING (gal.): 41.59
DEPTH TO WATER (feet): 11.08 CALCULATED PURGE (gal.): 13.77
DEPTH OF WELL (feet): 23.6 ACTUAL PURGE VOL. (gal.): 14.0

DATE PURGED: 8-29-96 Start (2400 Hr) 1349 End (2400 Hr) 1353
DATE SAMPLED: ↓ Start (2400 Hr) 1400 End (2400 Hr) _____

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1350</u>	<u>4.5</u>	<u>7.16</u>	<u>1508</u>	<u>74.8</u>	<u>cloudy</u>	<u>mod</u>
<u>1351</u>	<u>9.0</u>	<u>7.02</u>	<u>1507</u>	<u>74.0</u>	<u>↓</u>	<u>light</u>
<u>1353</u>	<u>14.0</u>	<u>7.01</u>	<u>1509</u>	<u>73.7</u>	<u>↓</u>	<u>↓</u>
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

D. O. (ppm): 1 ODOR: no odor
Field QC samples collected at this well: N/A Parameters field filtered at this well: N/A
(COBALT 0 - 500) (NTU 0 - 200 or 0 - 1000)

PURGING EQUIPMENT

SAMPLING EQUIPMENT

- | | | | |
|--|---|--|--|
| <input type="checkbox"/> 2" Bladder Pump | <input type="checkbox"/> Bailer (Teflon®) | <input type="checkbox"/> 2" Bladder Pump | <input checked="" type="checkbox"/> Bailer (Teflon®) |
| <input checked="" type="checkbox"/> Centrifugal Pump | <input type="checkbox"/> Bailer (PVC) | <input type="checkbox"/> DDL Sampler | <input type="checkbox"/> Bailer (Stainless Steel) |
| <input type="checkbox"/> Submersible Pump | <input type="checkbox"/> Bailer (Stainless Steel) | <input type="checkbox"/> Dipper | <input type="checkbox"/> Submersible Pump |
| <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated | <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated |
- Other: _____ Other: _____

WELL INTEGRITY: Good LOCK #: None

REMARKS: 911 samples taken

Meter Calibration: Date: 8/29/96 Time: _____ Meter Serial #: 9204 Temperature °F: _____
(EC 1000 _____ / _____) (DI _____) (pH 7 _____ / _____) (pH 10 _____ / _____) (pH 4 _____ / _____)
Location of previous calibration: R-2

Signature: [Signature] Reviewed By: [Signature] Page 1 of 8



EMCON ASSOCIATES

WATER SAMPLE FIELD DATA SHEET

Rev. 3, 2/94

PROJECT NO: 21775-235.002

SAMPLE ID: A-5 (29')

PURGED BY: M. Gallages

CLIENT NAME: ARCO # 2169

SAMPLED BY: ↓

LOCATION: OAKLAND, CA

TYPE: Ground Water Surface Water Treatment Effluent Other

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

CASING ELEVATION (feet/MSL):	<u>NR</u>	VOLUME IN CASING (gal.):	<u>3.10</u>
DEPTH TO WATER (feet):	<u>10.60</u>	CALCULATED PURGE (gal.):	<u>9.31</u>
DEPTH OF WELL (feet):	<u>29.6</u>	ACTUAL PURGE VOL. (gal.):	<u>9.5</u>

DATE PURGED:	<u>7-29-94</u>	Start (2400 Hr)	<u>1511</u>	End (2400 Hr)	<u>1514</u>
DATE SAMPLED:	<u>↓</u>	Start (2400 Hr)	<u>1520</u>	End (2400 Hr)	<u>—</u>

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1512</u>	<u>3.0</u>	<u>7.36</u>	<u>1063</u>	<u>72.4</u>	<u>BROWN</u>	<u>HEAVY</u>
<u>1513</u>	<u>6.0</u>	<u>7.24</u>	<u>1081</u>	<u>72.9</u>	<u>↓</u>	<u>↓</u>
<u>1514</u>	<u>9.5</u>	<u>7.30</u>	<u>1074</u>	<u>72.7</u>	<u>↓</u>	<u>↓</u>

D. O. (ppm): 2 ODOR: Moderate COLOR: NR TURBIDITY: NR
(COBALT 0 - 500) (NTU 0 - 200 or 0 - 1000)

Field QC samples collected at this well: NR Parameters field filtered at this well: 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 checked="" type="checkbox"/> Centrifugal Pump	<input type="checkbox"/> Bailer (PVC)	<input type="checkbox"/> DDL Sampler	<input type="checkbox"/> Bailer (Stainless Steel)
<input type="checkbox"/> Submersible Pump	<input type="checkbox"/> Bailer (Stainless Steel)	<input type="checkbox"/> Dipper	<input type="checkbox"/> Submersible Pump
<input type="checkbox"/> Well Wizard™	<input type="checkbox"/> Dedicated	<input type="checkbox"/> Well Wizard™	<input type="checkbox"/> Dedicated
Other: _____		Other: _____	

WELL INTEGRITY: Good LOCK #: ARCO-1221

REMARKS: All samples taken

Meter Calibration: Date: 7/29/94 Time: _____ Meter Serial #: 9204 Temperature °F: _____
 (EC 1000 _____ / _____) (DI _____) (pH 7 _____ / _____) (pH 10 _____ / _____) (pH 4 _____ / _____)
 Location of previous calibration: A-2

Signature: [Signature] Reviewed By: [Signature] Page 3 of 8



EMCON ASSOCIATES

WATER SAMPLE FIELD DATA SHEET

Rev. 3, 2/94

PROJECT NO: 21775-235.002

SAMPLE ID: A-G (27')

PURGED BY: M.G. / A.G.

CLIENT NAME: ARCO # 2169

SAMPLED BY: ↓

LOCATION: OAKLAND, CA

TYPE: Ground Water Surface Water Treatment Effluent Other

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

CASING ELEVATION (feet/MSL): <u>NR</u>	VOLUME IN CASING (gal.): <u>2.64</u>
DEPTH TO WATER (feet): <u>10.52</u>	CALCULATED PURGE (gal.): <u>9.07</u>
DEPTH OF WELL (feet): <u>27.0</u>	ACTUAL PURGE VOL. (gal.): <u>4.0</u>

DATE PURGED: <u>8-29-94</u>	Start (2400 Hr) <u>1454</u>	End (2400 Hr) <u>1456</u>
DATE SAMPLED: <u>↓</u>	Start (2400 Hr) <u>1459</u>	End (2400 Hr) <u>---</u>

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (umhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1455</u>	<u>3.0</u>	<u>6.81</u>	<u>1158</u>	<u>75.4</u>	<u>BRN</u>	<u>Heapy</u>
	<u>well drawed at 4.0 gallons</u>					
<u>1459</u>	<u>recharge</u>	<u>6.85</u>	<u>1195</u>	<u>75.1</u>	<u>↓</u>	<u>↓</u>
D. O. (ppm): <u>2.</u>	ODOR: <u>Moderate.</u>				<u>NR</u>	<u>NR</u>
Field QC samples collected at this well: <u>NR</u>			Parameters field filtered at this well: <u>NR</u>			
						(COBALT 0 - 500) (NTU 0 - 200 or 0 - 1000)

PURGING EQUIPMENT

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

SAMPLING EQUIPMENT

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

WELL INTEGRITY: Good LOCK #: AK10-kev

REMARKS: Cell samples taken

Meter Calibration: Date: 8/26/94 Time: _____ Meter Serial #: 9204 Temperature °F: _____

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

Location of previous calibration: A-2

Signature: M. D. [unclear] Reviewed By: SA Page 4 of 8



EMCON ASSOCIATES

WATER SAMPLE FIELD DATA SHEET

Rev. 3, 2/94

PROJECT NO: 21775-235002
PURGED BY: M. Gallagher/A.G.
SAMPLED BY: ✓

SAMPLE ID: AR-1 (27')
CLIENT NAME: ARCO # 2169
LOCATION: OAKLAND, CA.

TYPE: Ground Water Surface Water _____ Treatment Effluent _____ Other _____
CASING DIAMETER (inches): 2 _____ 3 _____ 4 _____ 4.5 _____ 6 Other _____

CASING ELEVATION (feet/MSL): N/A VOLUME IN CASING (gal.): 22.31
DEPTH TO WATER (feet): 12.12 CALCULATED PURGE (gal.): 66.941
DEPTH OF WELL (feet): 273 ACTUAL PURGE VOL. (gal.): 410.0

DATE PURGED: 8-29-96 Start (2400 Hr) 1249 End (2400 Hr) 1254
DATE SAMPLED: ✓ Start (2400 Hr) 1300 End (2400 Hr) _____

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (umhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)	
<u>1251</u>	<u>22.5</u>	<u>7.41</u>	<u>1079</u>	<u>75.2</u>	<u>BRN</u>	<u>MOD</u>	
	<u>well dried at 40.0 gallons</u>						
<u>1303</u>	<u>well dried</u>	<u>7.58</u>	<u>868</u>	<u>76.4</u>	<u>↓</u>	<u>↓</u>	
D. O. (ppm): <u>1</u>		ODOR: <u>moderate</u>			<u>N/A</u>	<u>N/A</u>	
Field QC samples collected at this well: <u>N/A</u>			Parameters field filtered at this well: <u>N/A</u>			(COBALT 0 - 500)	(NTU 0 - 200 or 0 - 1000)

PURGING EQUIPMENT

- 2" Bladder Pump
- Centrifugal Pump
- Submersible Pump
- Well Wizard™
- Other: _____

SAMPLING EQUIPMENT

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

WELL INTEGRITY: Good LOCK #: None

REMARKS: All samples taken

Meter Calibration: Date: 8/29/94 Time: _____ Meter Serial #: 9204 Temperature °F: _____
(EC 1000 _____ / _____) (DI _____) (pH 7 _____ / _____) (pH 10 _____ / _____) (pH 4 _____ / _____)
Location of previous calibration: A-2

Signature: [Signature] Reviewed By: [Signature] Page 5 of 8



EMCON ASSOCIATES

WATER SAMPLE FIELD DATA SHEET

Rev. 3, 2/94

PROJECT NO: 21775-235-002

SAMPLE ID: AR-2 (28')

PURGED BY: M. Galligan / S.G.

CLIENT NAME: ARCO # 2169

SAMPLED BY: J

LOCATION: OAKLAND, CA

TYPE: Ground Water Surface Water _____ Treatment Effluent _____ Other _____

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

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): 10.64
 DEPTH TO WATER (feet): 12.20 CALCULATED PURGE (gal.): 31.94
 DEPTH OF WELL (feet): 28.5 ACTUAL PURGE VOL. (gal.): 32.0

DATE PURGED: 8-29-94 Start (2400 Hr) 1315 End (2400 Hr) 1320
 DATE SAMPLED: J Start (2400 Hr) 1325 End (2400 Hr) _____

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1316</u>	<u>10.5</u>	<u>8.19</u>	<u>962</u>	<u>72.1</u>	<u>Cloudy</u>	<u>mod</u>
<u>1318</u>	<u>21.0</u>	<u>7.86</u>	<u>946</u>	<u>72.7</u>	<u>✓</u>	<u>✓</u>
<u>1320</u>	<u>32.0</u>	<u>7.85</u>	<u>952</u>	<u>72.5</u>	<u>✓</u>	<u>✓</u>
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

D. O. (ppm): 1 ODOR: Moderate NR NR
 (COBALT 0 - 500) (NTU 0 - 200 or 0 - 1000)

Field QC samples collected at this well: NR Parameters field filtered at this well: NR

PURGING EQUIPMENT **SAMPLING EQUIPMENT**

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

Other: _____ Other: _____

WELL INTEGRITY: Good LOCK #: None

REMARKS: All samples taken

Meter Calibration: Date: 8/29/94 Time: _____ Meter Serial #: 9204 Temperature °F: _____
 (EC 1000 _____ / _____) (DI _____) (pH 7 _____ / _____) (pH 10 _____ / _____) (pH 4 _____ / _____)
 Location of previous calibration: A-2

Signature: [Signature] Reviewed By: [Signature] Page 6 of 8



EMCON ASSOCIATES

WATER SAMPLE FIELD DATA SHEET

Rev. 3, 2/94

PROJECT NO: 21775-235-002

SAMPLE ID: ADR-1(20)

PURGED BY: M. Gall-Gos

CLIENT NAME: ARCO # 2169

SAMPLED BY: [Signature]

LOCATION: CAKLAND, CA

TYPE: Ground Water Surface Water Treatment Effluent Other

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

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): 6.55
 DEPTH TO WATER (feet): 10.77 CALCULATED PURGE (gal.): 19.65
 DEPTH OF WELL (feet): 20.8 ACTUAL PURGE VOL. (gal.): 20.0

DATE PURGED: 8-29-96 Start (2400 Hr) 1413 End (2400 Hr) 1417
 DATE SAMPLED: [Signature] Start (2400 Hr) 1424 End (2400 Hr) ---

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1414</u>	<u>6.5</u>	<u>6.91</u>	<u>1516</u>	<u>74.2</u>	<u>cloudy</u>	<u>light</u>
<u>1415</u>	<u>13.0</u>	<u>6.90</u>	<u>1540</u>	<u>74.6</u>	<u>clear</u>	<u>clear</u>
<u>1417</u>	<u>20.0</u>	<u>6.89</u>	<u>1539</u>	<u>74.8</u>	<u>"</u>	<u>"</u>
---	---	---	---	---	---	---
---	---	---	---	---	---	---

D. O. (ppm): 1 ODOR: strong (COBALT 0 - 500) NR (NTU 0 - 200 or 0 - 1000) NR
 Field QC samples collected at this well: NR Parameters field filtered at this well: NR

- PURGING EQUIPMENT**
- 2" Bladder Pump
 - Centrifugal Pump
 - Submersible Pump
 - Well Wizard™
 - Other: _____
- SAMPLING EQUIPMENT**
- Bailer (Teflon®)
 - Bailer (PVC)
 - Bailer (Stainless Steel)
 - Dedicated
 - 2" Bladder Pump
 - DDL Sampler
 - Dipper
 - Well Wizard™
 - Bailer (Teflon®)
 - Bailer (Stainless Steel)
 - Submersible Pump
 - Dedicated
 - Other: _____

WELL INTEGRITY: Good LOCK #: None

REMARKS: all sample taken

Meter Calibration: Date: 8/29/96 Time: _____ Meter Serial #: 3204 Temperature °F: _____
 (EC 1000 _____ / _____) (DI _____) (pH 7 _____ / _____) (pH 10 _____ / _____) (pH 4 _____ / _____)
 Location of previous calibration: A-2

Signature: [Signature] Reviewed By: [Signature] Page 7 of 8



EMCON ASSOCIATES

WATER SAMPLE FIELD DATA SHEET

Rev. 3, 2/94

PROJECT NO: 21775-2351 002

SAMPLE ID: ADR-2(261)

PURGED BY: M.C./D.G.

CLIENT NAME: ARCO #2169

SAMPLED BY: [Signature]

LOCATION: OAKLAND, CA

TYPE: Ground Water Surface Water Treatment Effluent Other

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

CASING ELEVATION (feet/MSL): N/R VOLUME IN CASING (gal.): 9.57
 DEPTH TO WATER (feet): 11.64 CALCULATED PURGE (gal.): 28.73
 DEPTH OF WELL (feet): 26.3 ACTUAL PURGE VOL. (gal.): 14.0

DATE PURGED: 8-29-94 Start (2400 Hr) 1434 End (2400 Hr) 1436
 DATE SAMPLED: [Signature] Start (2400 Hr) 1440 End (2400 Hr) ---

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (umhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1435</u>	<u>9.5</u>	<u>7.03</u>	<u>1402</u>	<u>73.3</u>	<u>5.0/3.15</u>	<u>Heavy</u>
	<u>well dried out</u>			<u>14.0</u>	<u>gallons</u>	
<u>1443</u>	<u>recharge</u>	<u>6.97</u>	<u>1379</u>	<u>72.9</u>	<u>1</u>	<u>NO D</u>
D. O. (ppm): <u>1</u>		ODOR: <u>Strong</u>			<u>2/12</u>	<u>2/12</u>
Field QC samples collected at this well: <u>N/R</u>		Parameters field filtered at this well: <u>N/R</u>			(COBALT 0 - 500)	(NTU 0 - 200 or 0 - 1000)

- | PURGING EQUIPMENT | | SAMPLING EQUIPMENT | |
|--|---|--|--|
| <input type="checkbox"/> 2' Bladder Pump | <input type="checkbox"/> Bailer (Teflon®) | <input type="checkbox"/> 2' Bladder Pump | <input checked="" type="checkbox"/> Bailer (Teflon®) |
| <input checked="" type="checkbox"/> Centrifugal Pump | <input type="checkbox"/> Bailer (PVC) | <input type="checkbox"/> DDL Sampler | <input type="checkbox"/> Bailer (Stainless Steel) |
| <input type="checkbox"/> Submersible Pump | <input type="checkbox"/> Bailer (Stainless Steel) | <input type="checkbox"/> Dipper | <input type="checkbox"/> Submersible Pump |
| <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated | <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated |
| Other: _____ | | Other: _____ | |

WELL INTEGRITY: Good LOCK #: None

REMARKS: all samples taken

Meter Calibration: Date: 8/29/94 Time: _____ Meter Serial #: 9204 Temperature °F: _____
 (EC 1000 _____ / _____) (DI _____) (pH 7 _____ / _____) (pH 10 _____ / _____) (pH 4 _____ / _____)
 Location of previous calibration: R-2

Signature: [Signature] Reviewed By: [Signature] Page 8 of 8

APPENDIX B

**ANALYTICAL RESULTS AND CHAIN OF CUSTODY
DOCUMENTATION, THIRD QUARTER 1996
GROUNDWATER MONITORING EVENT**

**Columbia
Analytical
Services inc.**

September 12, 1996

Service Request No.: S9601425

Mr. John Young
EMCON
1921 Ringwood Avenue
San Jose, CA 95131

RE: 2169 OAKLAND/20805-129.003/TO#19350.00

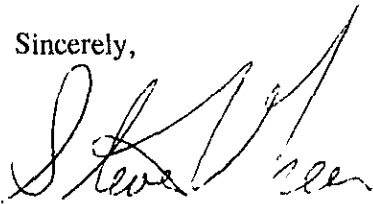
Dear Mr. Young:

Attached are the results of the samples submitted to our lab on August 29, 1996.
For you reference, our service request number for this work is S9601425.

Analytical results were produced by procedures consistent with Columbia Analytical Services' (CAS) Quality Assurance Manual (with any deviations noted). Signature of this CAS Analytical Report below confirms that pages 2 through 10, following, have been thoroughly reviewed and approved for release in accord with CAS Standard Operating Procedure ADM-DatRev3.

If you have questions or further needs, please call me at (408) 428-1282.

Sincerely,



Steve Green
Project Chemist

SG/sh

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	<i>Modified</i>
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
TTLIC	Total Threshold Limit Concentration
VOA	Volatile Organic Analyte(s)

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: 2169 OAKLAND/20805-129.003/TO#19350.00
Sample Matrix: Water

Service Request: S9601425
Date Collected: 8/29/96
Date Received: 8/29/96
Date Extracted: NA

BTEX, MTBE and TPH as Gasoline
EPA Methods 5030/8020/California DHS LUFT Method
Units: ug/L (ppb)

Sample Name:	A-2 (24)	AR-1 (27)	AR-2 (28)
Lab Code:	S9601425-001	S9601425-002	S9601425-003
Date Analyzed:	9/9/96	9/9/96	9/9/96

Analyte	MRL			
TPH as Gasoline	50	ND	ND	ND
Benzene	0.5	ND	ND	ND
Toluene	0.5	ND	ND	ND
Ethylbenzene	0.5	ND	ND	ND
Total Xylenes	0.5	ND	0.8	ND
Methyl <i>tert</i> -Butyl Ether	3	<39*	ND	95

* Raised MRL due to matrix interference.

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: 2169 OAKLAND/20805-129.003/TO#19350.00
Sample Matrix: Water

Service Request: S9601425
Date Collected: 8/29/96
Date Received: 8/29/96
Date Extracted: NA

BTEX, MTBE and TPH as Gasoline
EPA Methods 5030/8020/California DHS LUFT Method
Units: ug/L (ppb)

Sample Name:	A-6 (27)	A-1 (23)	A-5 (29)
Lab Code:	S9601425-004	S9601425-005	S9601425-006
Date Analyzed:	9/9/96	9/6/96	9/9/96

Analyte	MRL			
TPH as Gasoline	50	80	1,200	7,700
Benzene	0.5	ND	320	490
Toluene	0.5	ND	5.9	450
Ethylbenzene	0.5	ND	25	260
Total Xylenes	0.5	ND	27	990
Methyl <i>tert</i> -Butyl Ether	3	6	110	<30 C

C The MRL is elevated due to high analyte concentration requiring sample dilution.

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: 2169 OAKLAND/20805-129.003/TO#19350.00
Sample Matrix: Water

Service Request: S9601425
Date Collected: 8/29/96
Date Received: 8/29/96
Date Extracted: NA

BTEX, MTBE and TPH as Gasoline
EPA Methods 5030/8020/California DHS LUFT Method
Units: ug/L (ppb)

Sample Name:	ADR-1 (20)	ADR-2 (26)	Method Blank
Lab Code:	S9601425-007	S9601425-008	S960906-WB1
Date Analyzed:	9/10/96	9/9/96	9/6/96

Analyte	MRL			
TPH as Gasoline	50	5,300	8,000	ND
Benzene	0.5	190	230	ND
Toluene	0.5	58	180	ND
Ethylbenzene	0.5	76	150	ND
Total Xylenes	0.5	470	730	ND
Methyl <i>tert</i> -Butyl Ether	3	85	53	ND

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: 2169 OAKLAND/20805-129.003/TO#19350.00
Sample Matrix: Water

Service Request: S9601425
Date Collected: 8/29/96
Date Received: 8/29/96
Date Extracted: NA

BTEX, MTBE and TPH as Gasoline
EPA Methods 5030/8020/California DHS LUFT Method
Units: ug/L (ppb)

Sample Name:	Method Blank	Method Blank
Lab Code:	S960909-WB1	S960910-WB1
Date Analyzed:	9/9/96	9/10/96

Analyte	MRL		
TPH as Gasoline	50	ND	ND
Benzene	0.5	ND	ND
Toluene	0.5	ND	ND
Ethylbenzene	0.5	ND	ND
Total Xylenes	0.5	ND	ND
Methyl <i>tert</i> -Butyl Ether	3	ND	ND

APPENDIX A

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 2169 OAKLAND/20805-129.003/TO#19350.00
Sample Matrix: Water

Service Request: S9601425
Date Collected: 8/29/96
Date Received: 8/29/96
Date Extracted: NA
Date Analyzed: 9/6-10/96

Surrogate Recovery Summary
 BTEX, MTBE and TPH as Gasoline
 EPA Methods 5030/8020/California DHS LUFT Method

Sample Name	Lab Code	PID Detector	FID Detector
		Percent Recovery 4-Bromofluorobenzene	Percent Recovery α,α,α -Trifluorotoluene
A-2 (24)	S9601425-001	102	96
AR-1 (27)	S9601425-002	102	100
AR-2 (28)	S9601425-003	105	93
A-6 (27)	S9601425-004	96	97
A-1 (23)	S9601425-005	98	99
A-5 (29)	S9601425-006	100	104
ADR-1 (20)	S9601425-007	99	95
ADR-2 (26)	S9601425-008	99	103
A-2 (24) (MS)	S9601425-001MS	98	107
A-2 (24) (DMS)	S9601425-001DMS	98	106
Method Blank	S960906-WB1	99	94
Method Blank	S960909-WB1	101	98
Method Blank	S960910-WB1	102	93

CAS Acceptance Limits: 69-116 69-116

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 2169 OAKLAND/20805-129.003/TO#19350.00
Sample Matrix: Water

Service Request: S9601425
Date Collected: 8/29/96
Date Received: 8/29/96
Date Extracted: NA
Date Analyzed: 9/9/96

Matrix Spike/Duplicate Matrix Spike Summary
 TPH as Gasoline
 EPA Methods 5030/California DHS LUFT Method
 Units: ug/L (ppb)

Sample Name: A-2 (24)
Lab Code: S9601425-001

Analyte	Spike Level		Sample Result	Spike Result		Percent Recovery				Relative Percent Difference
	MS	DMS		MS	DMS	CAS		Acceptance Limits		
	MS	DMS		MS	DMS	MS	DMS			
Gasoline	250	250	ND	230	230	92	92	67-121	<1	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 2169 OAKLAND/20805-129.003/TO#19350.00

Service Request: S9601425
Date Analyzed: 9/6/96

Initial Calibration Verification (ICV) Summary
BTEX, MTBE and TPH as Gasoline
EPA Methods 5030/8020/California DHS LUFT Method
Units: ppb

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Benzene	25	24.9	100	85-115
Toluene	25	24.7	99	85-115
Ethylbenzene	25	24.1	96	85-115
Xylenes, Total	75	73.1	97	85-115
Gasoline	250	240	96	90-110
Methyl <i>tert</i> -Butyl Ether	50	47	94	85-115

ARCO Facility no. 2169 City (Facility) Oakland Project manager (Consultant) John Young
 ARCO engineer Mike Whelan Telephone no. (ARCO) Telephone no. (Consultant) (408)453-7307 Fax no. (Consultant) (408)453-0452
 Consultant name EMCON Address (Consultant) 1921 Ringwood Ave. San Jose, CA 95131

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 1602/8020/8015	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/SM 503E	EPA 801/8010	EPA 824/8240	EPA 826/8270	TCLP Metals <input type="checkbox"/> VOA <input type="checkbox"/> VOA <input type="checkbox"/>	SEM Metals EPA 601/7000 TTL <input type="checkbox"/> STL <input type="checkbox"/>	Lead Org./DHS Lead EPA 7420/7421 <input type="checkbox"/>			
			Soil	Water	Other	Ice	Acid																
A-264 ①		2		X		X	HCL	8/29/96	1240		X												
AR-167 ②		2		X		X	HCL		1300		X												
AR-268 ③		2		X		X	HCL		1325		X												
A-627 ④		2		X		X	HCL		1459		X												
A-164 ⑤		2		X		X	HCL		1400		X												
A-529 ⑥		2		X		X	HCL		1520		X												
ADR-160 ⑦		2		X		X	HCL		1424		X												
ADR-266 ⑧		2		X		X	HCL	✓	1440		X												

Method of shipment
 Sampler will deliver

Special detection Limit/reporting
 Lowest possible

Special QA/QC
 As Normal

Remarks
 2-40ml HCL
 VOAs

#20805-029.003
 Lab number
 59601425

Turnaround time
 Priority Rush 1 Business Day
 Rush 2 Business Days
 Expedited 5 Business Days
 Standard 10 Business Days

Condition of sample: INTACT Temperature received: cool
 Relinquished by sampler [Signature] Date 8/29/96 Time 16:15 Received by [Signature]
 Relinquished by [Signature] Date [] Time [] Received by [Signature]
 Relinquished by [Signature] Date 8/29/96 Time 16:15 Received by laboratory [Signature]

APPENDIX C
SVE SYSTEM MONITORING DATA LOG SHEETS

ARCO 2169
SVE SYSTEM
MONITORING DATA

Reporting Period		Hours in Period: 720 00		Operation + Down Hours: 720 00																																									
09/01/96 00:00 10/01/96 00:00		Days in Period: 30 00		Operation + Down Days: 30.00																																									
Reading Date & Time	Field Monitoring Data						Laboratory Sample Time	Laboratory Monitoring Data																																					
	Flow Rates		FID or PID Results					Well Field Influent		System Influent		System Effluent		Destruction Efficiency		Gasoline Emission Rate		Benzene Emission Rate																											
	Well Field Flow Rate	System Influent Flow Rate	Well Field	System Influent	System Effluent	Destruction Efficiency		Gasoline	Benzene	Gasoline	Benzene	Gasoline	Benzene	Destruction Efficiency	Gasoline Emission Rate	Benzene Emission Rate	Period Hours	Meter Hours	Hours of Operation	Days of Operation	Down Hours	Down Days																							
	scfm	scfm	ppm	ppm	ppm	%	ppmv	mg/m3	ppmv	mg/m3	ppmv	mg/m3	ppmv	mg/m3	ppmv	mg/m3	%	lb/day	lb/day																										
09/01/96 00:00																																													
09/23/96 11:25	0.0	0.0																																											
09/23/96 11:48	0.0	0.0																																											
09/23/96 12:30	122.4	191.3																																											
10/01/96 00:00	128.6	204.3																																											
Period Totals																					720.00		180.20	7.51	539.80	22.49																			
Period Averages																					128.6	204.3					770	3200	2.4	7.8	300	1200	0.8	<0.5	<5	<20	<0.1	<0.4	98.3	0.37	0.01				

APPENDIX D

**FIELD DATA SHEETS, OPERATION AND MAINTENANCE VISITS,
THIRD QUARTER 1996**

Remarks: *Installed rebuilt blower for Therm-Tec, systems checked OK. started system*

Unscheduled site visit Scheduled site visit

SYSTEM PARAMETERS (Therm Tech Model VAC-25 thermal/catalytic oxidizer)

Arrival Time (24:00 hour)	1000	Effluent (E-1) (12"x12")	
System Status (on or off)	OFF	Stack Temperature (°F)	721
Shutdown Time (24:00 hour)	-	SYSTEM	
Restart Time (24:00 hour)	1400	Fire Box Temperature (°F)	632
Reading Time (24:00 hour)	1420	Set Point (°F)	630
Well Field I-1 (3")	/	TOTAL HOURS	4699.73 @ 1100
Vacuum (in. of H ₂ O)	/	Electric Meter (kwh)	-
Velocity (ft/min)	/	Natural Gas (cf)	-
Temperature (°F)	/	AIR MONITORING	
After Blower I-2 (4")		FID (ppm)	Amb I-1 I-2 E-1
Total Pressure (in. of H ₂ O)	3.5	Date: (WITHOUT CARBON FILTER)	
Total Flow (in. of H ₂ O)	.28	Date: (WITH CARBON FILTER)	
Temperature (°F)	215	PID (ppm)	CAL GAS:
Dilution Air (3") Temperature (°F)	72	Date: 8/2/96	Calcal
Dilution Air Flow (in of H ₂ O) (156.0)	.15	Date:	
ATI operating properly: yes/no	yes	Lab samples taken for analysis at:	

WELL FIELD

SVE WELL ID	Well Diameter	Screen Interval	DTFP (feet)	DTW (feet)	Valve Position (% open)	Vacuum (in. of H ₂ O)	Velocity (ft/min)	DO (mg/l)	PID (ppm)
AV-1	2"	5'-14'			0	6	(2')		48.5
AV-2	2"	5'-14'			100	46	(2') some water		863
AV-3	2"	5'-14'			100	46	(2') some water		-
AV-4	4"	5'-14'			100	42	(2') water		-
AV-5	4"	5'-14'			100	44	(2') some water		-
AV-6	4"	5'-14'			100	42	(2')		185
AV-7	4"	5'-14'			100	44	(2') some water		-
A-1	3"	9'-25'			0	0	(2') water		-
A-2	3"	10'-25'			0	0	(2') water		-
A-3	3"	9'-29.5'			100	44	(2')		322
A-4	3"	8'-28'			0	0	(2') water		-
AR-2	4"	8.5'-28.5'			0	40	(2') water		-
ADR-1	4"	5'-22'			0	0	(2') water		-
ADR-2	4"	5'-22'			100	42	(2')		950

SPARGE WELL ID	Well Diameter	Screen Interval	DTFP (feet)	DTW (feet)	Valve Position (% open)	Pressure (psi)	Air Flow (scfm)	DO (mg/l)	REMARKS
AS-1	2"	27'-29'				2			
AS-2	2"	21'-23'				-			
AS-3	2"	26'-29'				2			
AS-4	2"	20'-22'				2			
AS-5	2"	20.5'-22.5'				1.5			

Total Sparge Data

Total Air Sparge Pressure(psi)= 40 Total Air Sparge Flow Rate(scfm)= 5 Compressor Hours= 353.23 Total Air Sparge Temp(F)= Amb

Special Instructions:

Use only ARCO chain-of-custody forms. Please include all analytical method numbers as requested on the chain-of-custody form. Request all TPHG, BTEX, and Benzene results in mg/m³. Report O₂ and CO₂ in % by volume.



Project# 20805-129.003
Operator: *V. Whitten/Ruth* Date: *8/2/96*

Work Authorization # 19300

Remarks:

Took readings & samples Reformation of EM.
hubed Blower - check system - OK

Unscheduled site visit Scheduled site visit

SYSTEM PARAMETERS (Therm Tech Model VAC-25 thermal/catalytic oxidizer)

Arrival Time (24:00 hour)	1030	Effluent (E-1) (12"x12")	
System Status (on or off)	ON	Stack Temperature (°F)	627
Shutdown Time (24:00 hour)	-	SYSTEM	
Restart Time (24:00 hour)	-	Fire Box Temperature (°F)	625
Reading Time (24:00 hour)	1200	Set Point (°F)	620
Well Field I-1 (3")	/	TOTAL HOURS	4770.85
Vacuum (in. of H ₂ O)	/	Electric Meter (kwh)	-
Velocity (ft/min)	/	Natural Gas (cf)	-
Temperature (°F)	/	AIR MONITORING	
After Blower I-2 (4")		FID (ppm)	Amb I-1 I-2 E-1
Total Pressure (in. of H ₂ O)	4	Date: (WITHOUT CARBON FILTER)	/
Total Flow (in. of H ₂ O)	.35	Date: (WITH CARBON FILTER)	/
Temperature (°F)	195	PID (ppm)	CAL GAS:
Dilution Air (3") Temperature (°F)	Amb.	Date:	/
Dilution Air Flow (in of H ₂ O)	.12"	Date:	/
ATI operating properly: yes/no		Lab samples taken for analysis at:	CAS

WELL FIELD

SVE WELL ID	Well Diameter	Screen Interval	DTFP (feet)	DTW (feet)	Valve Position (% open)	Vacuum (in. of H ₂ O)	Velocity (ft/min)	DO (mg/l)	PID (ppm)
AV-1	2"	5'-14'			0	0	(2")		
AV-2	2"	5'-14'			100	32	(2")		
AV-3	2"	5'-14'			100	36	(2")		
AV-4	4"	5'-14'			100	32	(2")		
AV-5	4"	5'-14'			100	30-36	(2")		
AV-6	4"	5'-14'			100	32	(2")		
AV-7	4"	5'-14'			100	34	(2")		
A-1	3"	9'-25'			0	0	(2")		
A-2	3"	10'-25'			0	0	(2")		
A-3	3"	9'-29.5'			100	22	(2")		
A-4	3"	8'-28'			0	0	(2")		
AR-2	4"	8.5'-28.5'			100	28	(2")		
ADR-1	4"	5'-22'			0	0	(2")		
ADR-2	4"	5'-22'			100	32	(2")		

SPARGE WELL ID	Well Diameter	Screen Interval	DTFP (feet)	DTW (feet)	Valve Position (% open)	Pressure (psi)	Air Flow (scfm)	DO (mg/l)	REMARKS
AS-1	2"	27'-29'				2	/		
AS-2	2"	21'-23'				2	/		
AS-3	2"	26'-29'				2	/		
AS-4	2"	20'-22'				2	/		
AS-5	2"	20.5'-22.5'				1.5	/		

Total Sparge Data

Total Air Sparge Pressure(psi)= 40 Total Air Sparge Flow Rate(scfm)= 6 Compressor Hours= Total Air Sparge Temp(F)= Amb.

Special Instructions:

Use only ARCO chain-of-custody forms. Please include all analytical method numbers as requested on the chain-of-custody form. Request all TPHG, BTEX, and Benzene results in mg/m'. Report O, and CO, in % by volume.



Project# 20805-129.003

Work Authorization # 19300

Operator: P. Whitten

Date: 8/5/96

ARCO 2169 Soil Vapor Extraction System

Remarks:

Restarted Unit after power outage in area. check w/ Ivy if ATI working - O.K.

Unscheduled site visit

Scheduled site visit

SYSTEM PARAMETERS (Therm Tech Model VAC-25 thermal/catalytic oxidizer)

Arrival Time (24:00 hour)	1130	Effluent (E-1) (12"x12")	
System Status (on or off)	OFF	Stack Temperature (°F)	630
Shutdown Time (24:00 hour)	-	SYSTEM	
Restart Time (24:00 hour)	1255	Fire Box Temperature (°F)	630
Reading Time (24:00 hour)	1300	Set Point (°F)	630
Well Field I-1 (3")	/	TOTAL HOURS	4894.67
Vacuum (in. of H ₂ O)	/	Electric Meter (kwh)	-
Velocity (ft/min)	/	Natural Gas (cf)	-
Temperature (°F)	/	AIR MONITORING	
After Blower I-2 (4")		FID (ppm)	Amb I-1 I-2 E-1
Total Pressure (in. of H ₂ O)	2.5 atm	Date: (WITHOUT CARBON FILTER)	
Total Flow (in. of H ₂ O)	.18 (175)	Date: (WITH CARBON FILTER)	
Temperature (°F)	195	PID (ppm)	CAL GAS:
Dilution Air (3") Temperature (°F)	69	Date:	
Dilution Air Flow (in of H ₂ O)	.10 (129)	Date:	
ATI operating properly: yes/no		Lab samples taken for analysis at:	

WELL FIELD

SVE WELL ID	Well Diameter	Screen Interval	DTFP (feet)	DTW (feet)	Valve Position (% open)	Vacuum (in. of H ₂ O)	Velocity (ft/min)	DO (mg/l)	PID (ppm)
AV-1	2"	5'-14'					(2')		
AV-2	2"	5'-14'					(2')		
AV-3	2"	5'-14'					(2')		
AV-4	4"	5'-14'					(2')		
AV-5	4"	5'-14'					(2')		
AV-6	4"	5'-14'					(2')		
AV-7	4"	5'-14'					(2')		
A-1	3"	9'-25'					(2')		
A-2	3"	10'-25'					(2')		
A-3	3"	9'-29.5'					(2')		
A-4	3"	8'-28'					(2')		
AR-2	4"	8.5'-28.5'					(2')		
ADR-1	4"	5'-22'					(2')		
ADR-2	4"	5'-22'					(2')		

SPARGE WELL ID	Well Diameter	Screen Interval	DTFP (feet)	DTW (feet)	Valve Position (% open)	Pressure (psi)	Air Flow (scfm)	DO (mg/l)	REMARKS
AS-1	2"	27'-29'							
AS-2	2"	21'-23'							
AS-3	2"	26'-29'							
AS-4	2"	20'-22'							
AS-5	2"	20.5'-22.5'							

Total Sparge Data

Compressor Hours=

Total Air Sparge Pressure(psi)=

Total Air Sparge Flow Rate(scfm)=

Total Air Sparge Temp(F)=

Special Instructions:

Use only ARCO chain-of-custody forms. Please include all analytical method numbers as requested on the chain-of-custody form. Request all TPHG, BTEX, and Benzene results in mg/m³. Report O₂ and CO₂ in % by volume



Project# 20805-129.003

Work Authorization # 19300

Operator: B/13/96

Date: V. Whittier

ARCO 2169 Soil Vapor Extraction System

Remarks:

Shut system Down (Low VOC's)

Unscheduled site visit Scheduled site visit

SYSTEM PARAMETERS (Therm Tech Model VAC-25 thermal/catalytic oxidizer)

Arrival Time (24:00 hour)	1130	Effluent (E-1) (12"x12")	
System Status (on or off)	ON	Stack Temperature (°F)	1670/630
Shutdown Time (24:00 hour)	1315	SYSTEM	
Restart Time (24:00 hour)	-	Fire Box Temperature (°F)	1670/630
Reading Time (24:00 hour)	1315	Set Point (°F)	1670/630
Well Field I-1 (3")	20"	TOTAL HOURS	5134.86
Vacuum (in. of H ₂ O)	20"	Electric Meter (kwh)	-
Velocity (ft/min)	-	Natural Gas (cf)	-
Temperature (°F)	72	AIR MONITORING	
After Blower I-2 (4")		FID (ppm)	Amb I-1 I-2 E-1
Total Pressure (in. of H ₂ O)	2.5	Date (WITHOUT CARBON FILTER)	
Total Flow (in. of H ₂ O)	.18	Date: (WITH CARBON FILTER)	
Temperature (°F)	195	PID (ppm)	CAL GAS:
Dilution Air (3") Temperature (°F)	-	Date:	
Dilution Air Flow (in of H ₂ O)	-	Date:	
ATI operating properly: yes/no	Yes	Lab samples taken for analysis at:	

WELL FIELD

SVE WELL ID	Well Diameter	Screen Interval	DTFP (feet)	DTW (feet)	Valve Position (% open)	Vacuum (in. of H ₂ O)	Velocity (ft/min)	DO (mg/l)	PID (ppm)
AV-1	2"	5'-14'				0FA	(2')		
AV-2	2"	5'-14'				20	(2')		
AV-3	2"	5'-14'				20	(2')		
AV-4	4"	5'-14'				20	(2')		
AV-5	4"	5'-14'				20	(2')		
AV-6	4"	5'-14'				20	(2')		
AV-7	4"	5'-14'				20	(2')		
A-1	3"	9'-25'				0FA	(2')		
A-2	3"	10'-25'				0FA	(2')		
A-3	3"	9'-29.5'				12	(2')		
A-4	3"	8'-28'				0FA	(2')		
AR-2	4"	8.5'-28.5'				18	(2')		
ADR-1	4"	5'-22'				0FA	(2')		
ADR-2	4"	5'-22'				22	(2')		

SPARGE WELL ID	Well Diameter	Screen Interval	DTFP (feet)	DTW (feet)	Valve Position (% open)	Pressure (psi)	Air Flow (scfm)	DO (mg/l)	REMARKS
AS-1	2"	27'-29'				2			
AS-2	2"	21'-23'				-			
AS-3	2"	26'-29'				2			Total ColFM
AS-4	2"	20'-22'				2			
AS-5	2"	20.5'-22.5'				1.5			

Total Sparge Data

Total Air Sparge Pressure(psi)= 40 Total Air Sparge Flow Rate(scfm)= 6 Compressor Hours= 707.11 Total Air Sparge Temp(F)= Amb

Special Instructions:

Use only ARCO chain-of-custody forms. Please include all analytical method numbers as requested on the chain-of-custody form. Request all TPHG.BTEX. and Benzene results in mg/m³. Report O₂ and CO₂ in % by volume.



Project# 20805-129.003

Work Authorization # 19300

Operator: V. Whitten

Date: 8/23/96

ARCO 2169 Soil Vapor Extraction System



EMCON

1921 Ringwood Avenue
San Jose, California

OPERATION AND MAINTENANCE FIELD WORK REQUEST

TO: Lisle Rath

DATE: September 15, 1996

FROM: Valli Voruganti

PROJECT: 20805-128,002
9/13

RE: O&M at ARCO 2169, 889 West Grand Avenue, Oakland, California

Lisle: Water at ARCO 2169 is at its lowest it has been for the year approx. 12 to 13 feet BGS. So start up the SVE system with wells ADR-1, ADR-2, AV-1, AV-2, AV-3, AV-4, AV-5, AV-6, and AR-2 on-line, at the max. possible vacuum you can. Do individual PID's at each well and record flow and vacuum readings. Based on the highest PID and flow readings you and I can then discuss which wells we will leave on-line for the SVE system. If you are pulling up water because of too much vacuum, try opening A-1, A-2, A-3, and A-4 to the atmosphere and see if this helps. If this does not turn off the problem wells or try w/them on-line for passive vent.

Having started the SVE system, lets now start the AS system. Take water levels and depths in AS-4, AS-2, and AS-5. Based on this water level and where the screen is in these wells, determine the min pressure required to make sure we have pushed water below the screen. Now turn on each well for AS one at a time and keep an air flow of 2 scfm per well. Make sure pressure to flow meter does not fall below 40 psi. Van previously required 2 to 3 psi for each sparge well to get air flow in wells.

Now do the monthly air sampling of the SVE system and record all parameters on the flow sheets. The originals are in Van's office.

Call me and keep me posted on the status of the system.

Thanks valli

Anometer
+
vacuum meter
given to Stan Strong
FOR EM corp system
start up.

complete

9-23-96

On-off for ATI Found on Battery Unplugged

Remarks: Arrived on site at 1125 HRS FOR VAN WATKA. All systems OFF upon arrival. Coil Venti. Check ATI SYSTEM 1200 HRS ATI OK. Pulling H2O into System at 50 W.C. Open Sample Ports on A-1, 2, 3, 4. Anometer and Vacuum gauge NOT Available today. START SPARGE System at 1226 HRS SAMPLE I-1 I-2 E-1 FOR TPH GAS BTEX. System Running upon departure.

Unscheduled site visit Scheduled site visit

Manual Gas shut OFF Not closing

SYSTEM PARAMETERS (Therm Tech Model VAC-25 thermal/catalytic oxidizer)

Arrival Time (24:00 hour)	1125	Effluent (E-1) (12"x12")	
System Status (on or off)	OFF	Stack Temperature (°F)	681
Shutdown Time (24:00 hour)	NA	SYSTEM	
Restart Time (24:00 hour)	1148	Fire Box Temperature (°F)	620
Reading Time (24:00 hour)	1230	Set Point (°F)	630
Well Field I-1 (3")		TOTAL HOURS	1125 HRS 05134.86
Vacuum (in. of H ₂ O)	50	Electric Meter (kwh)	80591
Velocity (ft/min)	NR	Natural Gas (cf)	NOT Sure where is it
Temperature (°F)	70	AIR MONITORING	
After Blower I-2 (4")		FID (ppm)	Amb I-1 I-2 E-1
Total Pressure (in. of H ₂ O)	4	Date: (WITHOUT CARBON FILTER)	
Total Flow (in. of H ₂ O)	.32 (2250)	Date: (WITH CARBON FILTER)	
Temperature (°F)	200	PID (ppm)	CAL GAS: NR
Dilution Air (3") Temperature (°F)	69	Date:	
Dilution Air Flow (in of H ₂ O)	0.12 (1400)	Date:	
ATI operating properly: yes/no	YES	Lab samples taken for analysis at:	

Manual AIR line Shut off will not open

Pressure Switch FOR Sparger system locked out Fix problem 1215 HR

WELL FIELD

SVE WELL ID	Well Diameter	Screen Interval	DTFP (feet)	DTW (feet)	Valve Position (% open)	Vacuum (in. of H ₂ O)	Velocity (ft/min)	DO (mg/l)	PID (ppm)
AV-1	2"	5'-14'	NR	NR	100	42	(2")		water
AV-2	2"	5'-14'			100	50	(2")		water
AV-3	2"	5'-14'			100	53	(2")		water
AV-4	4"	5'-14'			100	50	(2")		water
AV-5	4"	5'-14'			100	50	(2")		455
AV-6	4"	5'-14'			100	49	(2")		282
AV-7	4"	5'-14'			0	0	(2")		
A-1	3"	9'-25'			0	0	(2")		
A-2	3"	10'-25'			0	0	(2")		
A-3	3"	9'-29.5'			0	0	(2")		
A-4	3"	8'-28'			0	0	(2")		
AR-2	4"	8.5'-28.5'			100	45	(2")		13.2
ADR-1	4"	5'-22'			100	0?	(2")		1221
ADR-2	4"	5'-22'			100	50	(2")		950

AIR COMP Powerex motor used ST50501 22V Cycling off 34:36 on 34:54 off 35:33 on 35:52 off 36:31

SPARGE WELL ID	Well Diameter	Screen Interval	DTFP (feet)	DTW (feet)	Valve Position (% open)	Pressure (psi)	Air Flow (scfm)	DO (mg/l)	REMARKS
AS-1	2"	27'-29'	NR	NR	100	1-2	2-3	NR	
AS-2	2"	21'-23'				1-2	2-3		
AS-3	2"	26'-29'				1-2	2-3		
AS-4	2"	20'-22'				1-2	2-3		
AS-5	2"	20.5'-22.5'				1-2	2-3		

Total Sparge Data

Total Air Sparge Pressure (psi) = 45	Total Air Sparge Flow Rate (scfm) = 12	Compressor Hours = 00707.11	Total Air Sparge Temp (F) = NR
--------------------------------------	--	-----------------------------	--------------------------------

Special Instructions: Use only ARCO chain-of-custody forms. Please include all analytical method numbers as requested on the chain-of-custody form. Request all TPHG, BTEX, and Benzene results in mg/m³. Report O₂ and CO₂ in % by volume.

Project# 20805-129.003 Work Authorization # 19300

Operator: L. RATH Date: 9-23-96 ARCO 2169 Soil Vapor Extraction System



DISSOLVED OXYGEN DATA SHEET



EMCON

Project Number: #20805-129.038

Date: 8/29/96

Station Number: ARCO #2169

Day: Thu

Location: Oakland, CA

Sampler: DR/MG

Measuring Method(s): X D.O. Kit

 D.O. Meter

Well ID	Date	Time	D.O. Reading
A-2	8/29/96		1
A-3		1048	2
A-4		1039	1-2
AR-1			1
AR-2			1
A-6			2
A-1			1
A-5			2
ADR-1			1
ADR-2			1

SIGNATURE: *[Handwritten Signature]*

APPENDIX E

**ANALYTICAL RESULTS AND CHAIN-OF-CUSTODY
DOCUMENTATION FOR SOIL-VAPOR EXTRACTION SYSTEM,
THIRD QUARTER 1996**

**Columbia
Analytical
Services^{INC.}**

August 16, 1996

Service Request No.: S9601261

Ms. Ivy Inouye
EMCON
1921 Ringwood Avenue
San Jose, CA 95131

RE: 2169 OAKLAND/20805-129.003/TO#19300.00

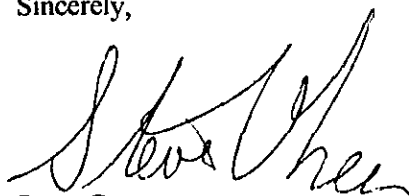
Dear Ms. Inouye:

Attached are the results of the samples submitted to our lab on August 5, 1996.
For you reference, our service request number for this work is S9601261.

Analytical results were produced by procedures consistent with Columbia Analytical Services' (CAS) Quality Assurance Manual (with any deviations noted). Signature of this CAS Analytical Report below confirms that pages 2 through 12, following, have been thoroughly reviewed and approved for release in accord with CAS Standard Operating Procedure ADM-DatRev3.

If you have questions or further needs, please call me at (408) 428-1282.

Sincerely,



Steve Green
Project Chemist

SG/sh

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	<i>Methylene Blue Active Substances</i>
MCL	Maximum Contaminant Level. The highest permissible concentration of a substance allowed in drinking water as established by the U. S. EPA.
MDL	<i>Method Detection Limit</i>
MPN	Most Probable Number
MRL	Method Reporting Limit
MS	<i>Matrix Spike</i>
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, II A, and II B.
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
TTLIC	Total Threshold Limit Concentration
VOA	Volatile Organic Analyte(s)

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: 2169 OAKLAND/20805-129.003/TO#19300.00
Sample Matrix: Air

Service Request: S9601261
Date Collected: 8/5/96
Date Received: 8/5/96
Date Extracted: NA
Date Analyzed: 8/6/96

BTEX and Total Volatile Hydrocarbons
 EPA Methods 5030/8020/Modified 8015

Sample Name: E-1
Lab Code: S9601261-001

	MRLs		Results	
	mg/m3	uL/L (ppmv)	mg/m3	uL/L (ppmv)
Benzene	0.5	0.2	ND	ND
Toluene	0.5	0.1	ND	ND
Ethylbenzene	0.5	0.1	ND	ND
Xylenes, Total	1	0.2	ND	ND
Total Volatile Hydrocarbons:				
C1 - C5	10	5	17	ND
C6 - C12	20	5	ND	ND
TPH as Gasoline*	20	5	ND	ND

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: 2169 OAKLAND/20805-129.003/TO#19300.00
Sample Matrix: Air

Service Request: S9601261
Date Collected: 8/5/96
Date Received: 8/5/96
Date Extracted: NA
Date Analyzed: 8/6/96

BTEX and Total Volatile Hydrocarbons
EPA Methods 5030/8020/Modified 8015

Sample Name: I-1
Lab Code: S9601261-002

	MRLs		Results	
	mg/m3	uL/L (ppmv)	mg/m3	uL/L (ppmv)
Benzene	0.5	0.2	5	1.6
Toluene	0.5	0.1	7	1.9
Ethylbenzene	0.5	0.1	4	0.9
Xylenes, Total	1	0.2	33	7.6
Total Volatile Hydrocarbons:				
C1 - C5	10	5	410	100
C6 - C12	20	5	570	140
TPH as Gasoline*	20	5	570	140

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: 2169 OAKLAND/20805-129.003/TO#19300.00
Sample Matrix: Air

Service Request: S9601261
Date Collected: 8/5/96
Date Received: 8/5/96
Date Extracted: NA
Date Analyzed: 8/6/96

BTEX and Total Volatile Hydrocarbons
EPA Methods 5030/8020/Modified 8015

Sample Name: I-2
Lab Code: S9601261-003

	MRLs		Results	
	mg/m3	uL/L (ppmv)	mg/m3	uL/L (ppmv)
Benzene	0.5	0.2	2.6	0.8
Toluene	0.5	0.1	3.6	1.0
Ethylbenzene	0.5	0.1	2.0	0.5
Xylenes, Total	1	0.2	16	3.7
Total Volatile Hydrocarbons:				
C1 - C5	10	5	220	54
C6 - C12	20	5	300	73
TPH as Gasoline*	20	5	300	73

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: 2169 OAKLAND/20805-129.003/TO#19300.00
Sample Matrix: Air

Service Request: S9601261
Date Collected: 8/5/96
Date Received: 8/5/96
Date Extracted: NA
Date Analyzed: 8/6/96

BTEX and Total Volatile Hydrocarbons
EPA Methods 5030/8020/Modified 8015

Sample Name: Method Blank
Lab Code: S960806-VB1

	MRLs		Results	
	mg/m3	uL/L (ppmv)	mg/m3	uL/L (ppmv)
Benzene	0.5	0.2	ND	ND
Toluene	0.5	0.1	ND	ND
Ethylbenzene	0.5	0.1	ND	ND
Xylenes, Total	1	0.2	ND	ND
Total Volatile Hydrocarbons:				
C1 - C5	10	5	ND	ND
C6 - C12	20	5	ND	ND
TPH as Gasoline*	20	5	ND	ND

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

APPENDIX A

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 2169 OAKLAND/20805-129.003/TO#19300.00
Sample Matrix: Air

Service Request: S9601261
Date Collected: 8/5/96
Date Received: 8/5/96
Date Extracted: N/A
Date Analyzed: 8/6/96

Duplicate Summary
 BTEX and Total Volatile Hydrocarbons

Units: mg/m³

Sample Name: Batch QC
Lab Code: S9601260-001

Analyte	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Benzene	0.5	ND	ND	--	--
Toluene	0.5	ND	ND	--	--
Ethylbenzene	0.5	ND	ND	--	--
Xylenes, Total	1	ND	ND	--	--
Total Volatile Hydrocarbons					
C1 - C5	10	230	230	230	<1
C6 - C12	20	38	37	38	3
TPH as Gasoline*	20	38	37	38	3

Note: $\text{ppmV} = \text{mg/m}^3 \times [24.45 (\text{gas constant}) / \text{molecular weight (MW)}]$
 MW Benzene = 78, Toluene = 92, Ethylbenzene = 106, Total Xylenes = 106
 MW Gasoline = 100

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

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
 Project: 2169 OAKLAND/20805-129.003/TO#19300.00
 Sample Matrix: Air

Service Request: S9601261
 Date Collected: 8/5/96
 Date Received: 8/5/96
 Date Extracted: N/A
 Date Analyzed: 8/6/96

Duplicate Summary
 BTEX and Total Volatile Hydrocarbons

Units: uL/L (ppmv)

Sample Name: Batch QC
 Lab Code: S9601260-001

Analyte	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Benzene	0.2	ND	ND	--	--
Toluene	0.1	ND	ND	--	--
Ethylbenzene	0.1	ND	ND	--	--
Xylenes, Total	0.2	ND	ND	--	--
Total Volatile Hydrocarbons					
C1 - C5	5	56	56	56	<1
C6 - C12	5	9	9	9	<1
TPH as Gasoline*	5	9	9	9	<1

Note: $\text{ppmV} = \text{mg/m}^3 \times [24.45 (\text{gas constant}) / \text{molecular weight (MW)}]$
 MW Benzene = 78, Toluene = 92, Ethylbenzene = 106, Total Xylenes = 106
 MW Gasoline = 100

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

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 2169 OAKLAND/20805-129.003/TO#19300.00
LCS Matrix: Air

Service Request: S9601261
Date Collected: 8/5/96
Date Received: 8/5/96
Date Extracted: NA
Date Analyzed: 8/6/96

Laboratory Control Sample Summary
BTEX and Total Volatile Hydrocarbons

Units: mg/m³

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Gasoline	200	210	105	60-140

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 2169 OAKLAND/20805-129.003/TO#19300.00
LCS Matrix: Air

Service Request: S9601261
Date Collected: 8/5/96
Date Received: 8/5/96
Date Extracted: NA
Date Analyzed: 8/6/96

Laboratory Control Sample Summary
BTEX and Total Volatile Hydrocarbons

Units: uL/L (ppmv)

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Gasoline	49	51	104	60-140

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 2169 OAKLAND/20805-129.003/TO#19300.00

Service Request: S9601261
Date Analyzed: 8/6/96

Initial Calibration Verification (ICV) Summary
BTEX and Total Volatile Hydrocarbons

Units: mg/m³

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Benzene	25	22.0	88	80-120
Toluene	25	22.0	88	80-120
Ethylbenzene	25	21.4	86	80-120
Xylenes, Total	75	63.7	85	80-120
Gasoline	250	228	91	80-120

**Columbia
Analytical
Services^{inc.}**

October 7, 1996

Service Request No.: S9601548

Valli Voruganti
EMCON
1921 Ringwood Avenue
San Jose, CA 95131

RE: 2169 OAKLAND/#20805-129.003/TO#19300.00

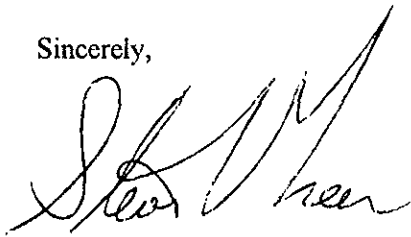
Dear Ms. Voruganti:

Attached are the results of the samples submitted to our lab on September 23, 1996.
For your reference, our service request number for this work is S9601548.

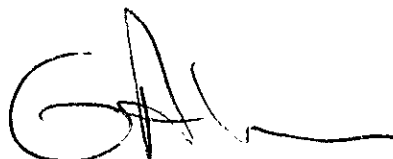
Analytical results were produced by procedures consistent with Columbia Analytical Services' (CAS) Quality Assurance Manual (with any deviations noted). Signature of this CAS Analytical Report below confirms that pages 2 through 9, following, have been thoroughly reviewed and approved for release in accord with CAS Standard Operating Procedure ADM-DatRev3.

If you have questions or further needs, please call me at (408) 428-1283.

Sincerely,



Steven L. Green
Project Chemist



Greg Anderson
Regional QA Coordinator

SG/sh

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
TTLIC	Total Threshold Limit Concentration
VOA	Volatile Organic Analyte(s)

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: 2169 OAKLAND/#20805-129.003/TO#19300.00
Sample Matrix: Air

Service Request: L9603987
Date Collected: 9/23/96
Date Received: 9/23/96
Date Extracted: NA
Date Analyzed: 9/25/96

BTEX and Total Volatile Hydrocarbons
EPA Methods 8020/Modified 8015

Sample Name: I-1
Lab Code: L9603987-001

	MRLs		Results	
	mg/m3	uL/L (ppmv)	mg/m3	uL/L (ppmv)
Benzene	0.4	0.1	7.8	2.4
Toluene	0.4	0.1	25	6.5
Ethylbenzene	0.5	0.1	13	3.0
Xylenes, Total	0.9	0.2	71	16
Total Volatile Hydrocarbons:				
C1 - C5	20	5	2800	670
C6 - C12*	20	5	3200	770

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: 2169 OAKLAND/#20805-129.003/TO#19300.00
Sample Matrix: Air

Service Request: L9603987
Date Collected: 9/23/96
Date Received: 9/23/96
Date Extracted: NA
Date Analyzed: 9/25/96

BTEX and Total Volatile Hydrocarbons
EPA Methods 8020/Modified 8015

Sample Name: I-2
Lab Code: L9603987-001

	MRLs		Results	
	mg/m3	uL/L (ppmv)	mg/m3	uL/L (ppmv)
Benzene	0.4	0.1	2.6	0.8
Toluene	0.4	0.1	10	2.6
Ethylbenzene	0.5	0.1	5.8	1.3
Xylenes, Total	0.9	0.2	29	6.6
Total Volatile Hydrocarbons:				
C1 - C5	20	5	1100	270
C6 - C12*	20	5	1200	300

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: 2169 OAKLAND/#20805-129.003/TO#19300.00
Sample Matrix: Air

Service Request: L9603987
Date Collected: 9/23/96
Date Received: 9/23/96
Date Extracted: NA
Date Analyzed: 9/25/96

BTEX and Total Volatile Hydrocarbons
EPA Methods 8020/Modified 8015

Sample Name: E-1
Lab Code: L9603987-003

	MRLs		Results	
	mg/m3	uL/L (ppmv)	mg/m3	uL/L (ppmv)
Benzene	0.4	0.1	ND	ND
Toluene	0.4	0.1	ND	ND
Ethylbenzene	0.5	0.1	ND	ND
Xylenes, Total	0.9	0.2	ND	ND
Total Volatile Hydrocarbons:				
C1 - C5	20	5	270	64
C6 - C12*	20	5	ND	ND

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: 2169 OAKLAND/#20805-129.003/TO#19300.00
Sample Matrix: Air

Service Request: L9603987
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 9/25/96

BTEX and Total Volatile Hydrocarbons
EPA Methods 8020/Modified 8015

Sample Name: Method Blank
Lab Code: L9603987-MB

	MRLs		Results	
	mg/m3	uL/L (ppmv)	mg/m3	uL/L (ppmv)
Benzene	0.4	0.1	ND	ND
Toluene	0.4	0.1	ND	ND
Ethylbenzene	0.5	0.1	ND	ND
Xylenes, Total	0.9	0.2	ND	ND
Total Volatile Hydrocarbons:				
C1 - C5	20	5	ND	ND
C6 - C12*	20	5	ND	ND

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

APPENDIX A

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 2169 OAKLAND/#20805-129.003/TO#19300.00
Sample Matrix: Air

Service Request: L9603987
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 9/20/96

Duplicate Summary
 BTEX and Total Volatile Hydrocarbons
 EPA Methods 8020/Modified 8015
 Units: uL/L (ppmv)

Sample Name: BATCH QC
Lab Code: L9603951-001

Analyte	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Benzene	0.1	1.63	1.55	1.59	5
Toluene	0.1	9.75	11.2	10.5	14
Ethylbenzene	0.1	6.99	6.56	6.78	6
Total Xylenes	0.2	27.7	26.4	27.0	5
Total Volatile Hydrocarbon:					
C1-C5	5	475	475	475	<1
C6-C12*	5	513	510	512	<1

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

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 2169 OAKLAND/#20805-129.003/TO#19300.00
LCS Matrix: Air

Service Request: L9603987
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 9/25/96

Laboratory Control Sample Summary
BTEX and Total Volatile Hydrocarbons
EPA Methods 8020/Modified 8015
Units: uL/L (ppmv)

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Benzene	10.0	7.22	72	60-140
Toluene	10.0	8.16	82	60-140
Ethylbenzene	10.0	8.72	87	60-140
TPH as Gasoline*	710	527	74	60-140

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

