COPY

January 3, 1995
Project 0805-122-01

Mr. Scott Owen
Senior air Quality Engineer
Permit Services Division
Bay Area Air Quality Management District
939 Ellis Street
San Francisco, California 94109

Re: Soil vapor extraction system performance test results, ARCO service station 771, 899 Rincon Avenue, Livermore, California (BAAQMD Application #9051, Plant #7801)

Dear Mr. Owen:

On behalf of ARCO Products Company (ARCO), EMCON Associates (EMCON) is submitting results of startup and performance testing of an interim soil vapor extraction (SVE) system at the above-referenced site. The SVE system was not started up in 1993 or most of 1994 due to more than a ten to 20-foot rise in groundwater levels. This rise in groundwater levels caused submergence of the screened intervals in the wells selected for SVE.

DESCRIPTION OF INTERIM SVE SYSTEM

Construction of the SVE system was completed in March, 1993. Primary components of the SVE system include a total of six existing SVE wells (vadose well VW-1, and monitoring wells MW-1, MW-2, MW-4, MW-5 and MW-7), a 7.5 horsepower (hp) positive displacement blower for SVE and a 200 cubic feet per minute (cfm) King/Buck catalytic oxidizer (Model MMC-6A/E) for abatement of extracted vapors.

SVE SYSTEM STARTUP AND PERFORMANCE TESTING

The SVE system was started up on December 20, 1994. The system was operated on wells VW-1 and MW-4. The remaining SVE wells were closed due to no available well screen for venting. After approximately two hours of continuous operation, operational parameters of the system, including process temperature, stack temperature, flow rate of extracted soil vapor into the system, and influent and effluent stream concentrations of soil vapors, were recorded. Velocity of influent soil vapor to the system was recorded with a Dwyer flow sensor that was installed on the system by the manufacturer. Influent

(before and after fresh air dilution) and effluent concentrations (at the exhaust stack) of extracted soil vapors were measured with a photo ionization detector.

After the operational parameters of the system were recorded, samples from the influent stream, I-1(before fresh air dilution), I-2 (after fresh air dilution), and, effluent stream, E-1 (stack exhaust) were collected for laboratory chemical analysis. The samples were shipped to Golden State/CAS Laboratories, Inc. in Los Angeles, California. The samples were analyzed for total petroleum hydrocarbons as gasoline (TPHG), and benzene, toluene, ethylbenzene and total xylenes (BTEX) using modified EPA Methods 8015 and 8020. Copies of laboratory analytical reports are presented in Appendix A.

SVE SYSTEM PERFORMANCE RESULTS

Combined air flow rate from wells VW-1 and MW-4 based on air velocity measurement and cross-sectional area of pipe is calculated to be 41 cubic feet per minute (cfm). To provide sufficient flow rate and oxygen for combustion, fresh air was introduced into the influent vapor via a manual fresh air dilution valve. Total velocity pressure of extracted hydrocarbons from the soil and fresh air using the Dwyer flow sensor was recorded as 2.3 inches of water (IW). Total air flow rate to the system corresponding to a velocity pressure of 2.3 IW in a 2.5-inch diameter pipe, based on the chart provided by the Dwyer flow sensor manufacturer, Dwyer Instruments, Inc., is 130 standard cubic feet per minute (scfm).

Laboratory analytical results of air sample I-1 (before fresh air dilution) indicate benzene and TPHG concentrations of <0.5 and 300 milligrams per cubic meter (mg/m3), respectively. Laboratory analytical results of air sample I-2 (after fresh air dilution) indicate benzene and TPHG concentrations to be below the detection limits of <0.5 and <60 mg/m3, respectively, for these compounds. Since influent benzene and TPHG concentrations in sample I-2 are below the detection limits, for calculation purposes the detection limits for these compounds were assumed as the actual benzene and TPHG concentrations in the influent stream to the system. Thus, instantaneous hydrocarbon mass removal rates (loading rates to the system) of benzene and TPHG, based on the detection limits, and a total flow rate of 130 scfm were calculated to be <0.0058 and <0.7 pounds per day (lbs/day), respectively. Since effluent benzene and TPHG concentrations were also below the detection limits, mass emission rates of benzene and TPHG from the system to the atmosphere are also assumed to be <0.0058 and <0.7 lbs/day, respectively. Laboratory analytical results of air samples and hydrocarbon removal and emission rates are summarized in Tables 1 and 2, respectively.

DESTRUCTION EFFICIENCY

Permit condition 8049 specified by the Bay Area Air Quality Management District (BAAQMD), stipulates the following: 1) for influent concentrations between 1,000 and 3,000 ppmv, a minimum destruction efficiency of 97 percent is required, and, 2) for influent concentrations less than 1,000 ppmv, a minimum destruction efficiency of 90 percent is required, and, 3) the minimum destruction efficiency of 90 percent shall be waived if TPHG emissions from the system are less than one lb/day and benzene emissions are less than 0.02 lb/day. As can be seen from the laboratory analytical results, benzene and TPHG concentrations in both influent (I-1) and effluent (E-1) streams are below the detection limits for these compounds during this sampling event. Therefore destruction efficiency of the system is not calculated. Although the destruction efficiency is not calculated, the calculated benzene and TPHG emission rates of <0.0058 and <0.7 lbs/day, respectively, are below the emission limits specified for these compounds for the waiver of a minimum 90 percent destruction efficiency. Therefore, the system is operating in compliance with the conditions stipulated by the BAAQMD. EMCON therefore, requests the BAAQMD to issue a Permit to Operate for the system at this site.

Please call if you have questions, or need additional information.

Sincerely,

EMCON Associates

Sailaja Yelamanchili
Staff Engineer

John C. Young
Project Manager

Attachment:
- Table 1 - Laboratory Analytical Results of Air Samples, SVE System Startup and Performance Test
- Table 2 - Hydrocarbon Mass Removal and Emission Rates, SVE Startup and Performance Test
- Appendix A - Laboratory Analytical Report
- Appendix B - Dwyer Chart (flow versus differential pressure)

cc: Mr. Mike Whelan, ARCO Products Company

TABLE 1
LABORATORY ANALYTICAL RESULTS OF AIR SAMPLES
SVE STARTUP AND PERFORMANCE TEST

ARCO Station 771
899 Rincon Avenue, Livermore, California

Sample Location	Date	Sample ID	Concentration in air (mg/m^3)				
			Benzene	Toluene	Ethylbenzene	Total Xylenes	TPHG
Detection Limit			0.5	0.5	0.5	1.0	60
Well Field Influent (before dilution)	12/20/94	I-1	<0.5	<0.5	<0.5	7.1	300
Influent to System (after dilution)	12/20/94	I-2	<0.5	<0.5	<0.5	1.9	<60
Effluent (stack exhaust)	12/20/94	E-1	<0.5	0.7	<0.5	2.5	<60

Notes:
mg/m^3: Milligrams per cubic meter
TPHG: Total Petroleum Hydrocarbons as Gasoline
Analysis Method: Modified EPA 8015/8020

TABLE 2
HYDROCARBON REMOVAL AND EMISSION RATES
SVE STARTUP AND PERFORMANCE TEST

ARCO Station 771
899 Rincon Avenue, Livermore, California

Date	Compound	Concentration (mg/m^3)		Flow Rate	Mass Removal	Mass Emisson	Destruction
		Influent(I-2)	Effluent (E-1)	(scfm or ft^3/min)	Rate (lbs/day)	Rate (lbs/day)	Efficiency (%)
12/20/94	Benzene	<0.5	<0.5	130	<0.0058	<0.0058	NC
12/20/94	TPHG	<60	<60	130	<0.7	<0.7	NC

Notes:

mg/m^3:	milligrams per cubic meter
scfm:	standard cubic feet per minute
ft^3/min:	cubic feet per minute
TPHG:	Total Petroleum Hydrocarbons as Gasoline
lbs/day:	pouinds per day
NC:	Not calculated

Sample Calculation:

TPHG removal rate:

inf.conc. (mg TPHG/m^3 air) x flow rate(ft^3 air/min) x 1 lb/454,000 mg x 0.0283 m^3/ft^3 x 1440 min/day = lbs TPHG /day

APPENDIX A

LABORATORY ANALYTICAL REPORT

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EMCON Associates	**Service Request:**	L943912
Project:	ARCO Products Company/#0805-122.01	**Date Collected:**	12/20/94
Sample Matrix:	Vapor	**Date Received:**	12/23/94
		Date Extracted:	NA

Permanent Gases*
Units: % (v/v)

	Sample Name:	**I-1**	**Method Blank**
	Lab Code:	L943912-003	L943912-MB
	Date Analyzed:	12/23/94	

Analyte	**MRL**		
Carbon Dioxide	1	6	ND
Oxygen	1	17	ND

NA	Not Applicable
*	Analysis performed using gas chromatography with a thermal conductivity detector.
MRL	Method Reporting Limit
ND	None detected at or above the method reporting limit

Approved By: Eydie Schwartz Date: 12/27/94

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EMCON Associates
Project: ARCO Products Company/#0805-122.01
Sample Matrix: Vapor

Service Request: L943912
Date Collected: 12/20/94
Date Received: 12/23/94
Date Extracted: NA

BTEX and Total Volatile Hydrocarbons*
Units: mg/m^3

Sample Name:	E-1	I-2	I-1
Lab Code:	L943912-001	L943912-002	L943912-003
Date Analyzed:	12/23/94	12/23/94	12/23/94

Analyte	MRL			
Benzene[1]	0.5	ND	ND	ND
Toluene[1]	0.5	0.7	ND	ND
Ethylbenzene[2]	0.5	ND	ND	ND
Total Xylenes[2]	1.0	2.5	1.9	7.1
Total Volatile Hydrocarbons**	60	ND	ND	350
C_1-C_4 Hydrocarbons*	20	ND	ND	48
C_5-C_8 Hydrocarbons*	20	ND	ND	200
C_9-C_{12} Hydrocarbons*	20	ND	ND	99
Total Volatile Hydrocarbons**[a]	60	ND	ND	300

NA Not Applicable
[1] Benzene and Toluene are included in the C_5-C_8 hydrocarbon fraction.
[2] Ethylbenzene and Total Xylenes are included in the C_9-C_{12} hydrocarbon fraction due to the use of C_1-C_8 n-paraffins as the standard for Total Volatile Hydrocarbons.
* Total Volatile Hydrocarbons quantified using n-paraffins with a range of C_1-C_8.
** Result is rounded to two significant figures.
[a] Gasoline Fraction (C_5-C_{12})
MRL Method Reporting Limit
ND None detected at or above the method reporting limit.

Approved By: Eydie Schwartz Date: 12/27/94

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GOLDEN STATE/CAS
LABORATORIES, INC.

December 27, 1994

Valli Voruganti
EMCON Associates
1921 Ringwood Avenue
San Jose, CA 95131-1721

Re: **ARCO Facility #771-Livermore/Project #0805-122.01**

Dear Valli:

Enclosed are the results of the rush samples submitted to our lab on December 23, 1994. For your reference, these analyses have been assigned our service request number L943912.

All analyses were performed in accordance with our laboratory's quality assurance program. Golden State / CAS is certified for environmental analyses by the California Department of Health Services (Certificate # 1296/Expiration - August 1996).

Please call if you have any questions.

Respectfully submitted,

Golden State / CAS Laboratories, Inc.

Eydie Schwartz for

Dr. B. Gene Bennett
Laboratory Director

Stuart Sigman
Quality Assurance Coordinator

GB/iz

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EMCON Associates
Project: ARCO Products Company/#0805-122.01
Sample Matrix: Vapor

Service Request: L943912
Date Collected: 12/20/94
Date Received: 12/23/94
Date Extracted: NA

BTEX and Total Volatile Hydrocarbons*
Units: mg/m^3

	Sample Name:	VW-1	MW-4	Method Blank
	Lab Code:	L943912-004	L943912-005	L943912-MB
	Date Analyzed:	12/23/94	12/23/94	12/23/94
Analyte	**MRL**			
Benzene[1]	0.5	ND	ND	ND
Toluene[1]	0.5	ND	ND	ND
Ethylbenzene[2]	0.5	4.0	ND	ND
Total Xylenes[2]	1.0	13	ND	ND
Total Volatile Hydrocarbons**	60	720	260	ND
C_1-C_4 Hydrocarbons*	20	79	72	ND
C_5-C_8 Hydrocarbons*	20	430	190	ND
C_9-C_{12} Hydrocarbons*	20	210	ND	ND
Total Volatile Hydrocarbons**[a]	60	640	190	ND

NA	Not Applicable
1	Benzene and Toluene are included in the C_5-C_8 hydrocarbon fraction.
2	Ethylbenzene and Total Xylenes are included in the C_9-C_{12} hydrocarbon fraction due to the use of C_1-C_8 n-paraffins as the standard for Total Volatile Hydrocarbons.
*	Total Volatile Hydrocarbons quantified using n-paraffins with a range of C_1-C_8.
**	Result is rounded to two significant figures.
a	Gasoline Fraction (C_5-C_{12})
MRL	Method Reporting Limit
ND	None detected at or above the method reporting limit.

Approved By: Eydie Schwartz Date: 12/27/94

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Page No.:

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EMCON Associates
Project: ARCO Products Company/#0805-122.01
Sample Matrix: Vapor

Service Request: L943912
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: NA

Duplicate Summary
Permanent Gases*
% (v/v)

Sample Name	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Carbon Dioxide	1	7.17	6.75	6.96	6
Oxygen	1	15.8	17.2	16.5	8

NA Not Applicable
* Analysis performed using gas chromatography with a thermal conductivity detector.
MRL Method Reporting Limit

Approved By: Eydie Schwartz Date: 12/27/94

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COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EMCON Associates
Project: ARCO Products Company/#0805-122.01
Sample Matrix: Vapor

Service Request: L943912
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 12/23/94

Duplicate Summary
BTEX and Total Volatile Hydrocarbons*
Units: mg/m^3

Sample Name: Batch QC
Lab Code: L943908-002

Analyte	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Benzene	0.5	64.3	63.5	63.9	1
Toluene	0.5	354	352	353	<1
Ethylbenzene	0.5	64.0	65.0	64.5	2
Total Xylenes	1.0	419	429	424	2
Total Volatile Hydrocarbon**	60	4800	4500	4600	6
C_1-C_4 Hydrocarbons*	20	33.3	31.3	32.3	6
C_5-C_8 Hydrocarbons*	20	3280	3270	3280	<1
C_9-C_{12} Hydrocarbons*	20	1480	1210	1340	20

NA Not Applicable
* Total Volatile Hydrocarbons quantified using n-paraffins with a range of C_1-C_8.
** Result is rounded to two significant figures.
MRL Method Reporting Limit
ND None detected at or above the method reporting limit.

Approved By: Eydie Schwartz Date: 12/27/94

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ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 771-94-5

Chain of Custody

ARCO Facility no. 771	City (Facility) Livermore	Project manager (Consultant) R. Vora ganti / D. Larsen	Laboratory name CAS
ARCO engineer Mike Whelan	Telephone no. (ARCO) 415 5712449	Telephone no. (Consultant) 408 453 7300	Fax no. (Consultant) 408 453 0452
Consultant name EMCON	Address (Consultant) 1921 Ringwood San Jose, CA. 95131		Contract number 02077

Method of shipment: Tech.

Sample I.D.	Lab no. L943912	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other (Vapor)	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015 Gas	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐	CO_2 O_2
E-1	1	1			X			12-20-94	1500		X										
I-2	2	1			X				1505		X										
I-1	3	1			X				1514		X										X
VW-1	4	1			X				1550		X										
MW-4	5	1			X			↓	1619		X										

Special detection Limit/reporting: please report in mg/m³

Special QA/QC

Remarks: 0805-122.01

Lab number: L943912

Turnaround time

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

Condition of sample:

Temperature received:

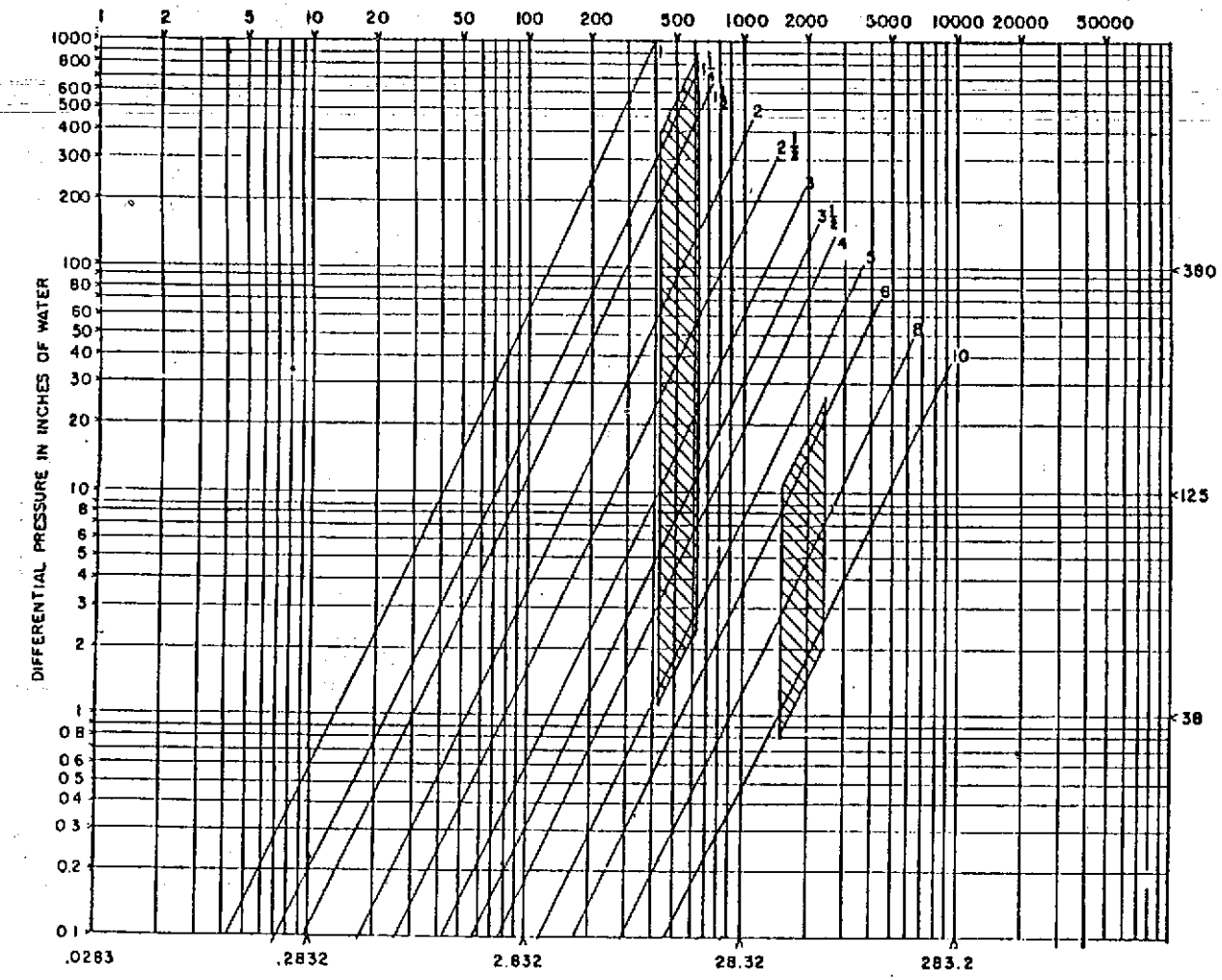
	Date	Time		Date	Time
Relinquished by sampler	12-21-94	0905	Received by	12/21/94	0910
Relinquished by	12/21/94	400 P	Received by		
Relinquished by			Received by laboratory	12-23-94	0900

Distribution: White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant
APPC-3292 (2-91)

APPENDIX B

DWYER CHART
(flow versus differential pressure)

SCFM AIR AT 70° F. 14.696 PSIA



SHADED AREA INDICATES FLOW REGION WHERE CONTINUOUS OPERATION MAY CAUSE VIBRATIONAL DAMAGE TO FLOW METER

1. ENTER CHART WITH FLOW RATE
2. GO VERTICALLY DOWN TO NOMINAL PIPE SIZE
3. READ DIFFERENTIAL PRESSURE AT LEFT

DWYER INSTRUMENTS, INC.
P. O. BOX 373 • MICHIGAN CITY, INDIANA 46360, U.S.A.
Telephone 219/879-8000
Fax 219/872-9057 Telex 25916