



Chevron U.S.A. Products Company

2410 Camino Ramon, San Ramon, California • Phone (510) 842-9500
Mail Address: P.O. Box 5004, San Ramon, CA 94583-0804

92 OCT 13 11:52

October 13, 1992

Ms. Jennifer Eberle
Alameda County Health Care Services
80 Swan Way, Room 200
Oakland, CA 94621

478

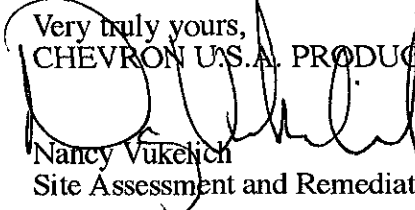
**Re: Former Chevron Service Station #9-4816
301 14th Street, Oakland**

Dear Ms. Eberle:

Enclosed we are forwarding the Bimonthly Progress Report dated October 7, 1992, prepared by our consultant Weiss Associates for the above referenced site. This report presents an evaluation of the soil vapor extraction and treatment system operating at the referenced site during the period of August 1, 1992 to September 30, 1992. The system operated almost continually during this period with the exception of two (2) days to allow for repair work. During this period approximately 1,849 lbs. of hydrocarbons have been removed. Cumulative to date, approximately 9,022 lbs. of hydrocarbons (approximately 1,370 gallons) have been removed.

Chevron will continue to submit bimonthly progress reports on the soil vapor extraction system until system shutdown.

If you have any questions or comments, please do not hesitate to contact me at (510) 842-9581.

Very truly yours,
CHEVRON U.S.A. PRODUCTS COMPANY

Nancy Vukelich
Site Assessment and Remediation Engineer

Enclosure

cc: Mr. Rich Hiatt, RWQCB
Mr. R.W. Cosby, 225/1936
Ms B.C. Owen
File (9-4816-5)

Ms. Beth D. Castleberry
Ware & Freidenrich
400 Hamilton Avenue
Palo Alto, CA 94301-1825


Weiss Associates

5500 Shellmound Street, Emeryville, CA 94608-2411

Environmental and Geologic Services

Fax: 510-547-5043 Phone: 510-547-5420

October 7, 1992

Nancy Vukelich
 Chevron U.S.A. Products Company
 P.O. Box 5004
 San Ramon CA 94583-0804

Re: Bi-monthly Progress Report
 August through September 1992
 Chevron Service Station #9-4816
 301-14th Street
 Oakland, California
 WA Job #4-582-51

Dear Ms. Vukelich,

As you requested, Weiss Associates (WA) presents the following bi-monthly report for the soil vapor extraction (SVE) and treatment system operating at the above referenced site (Figure 1). The SVE and treatment system consists of an internal combustion engine (ICE) which presently extracts vapors from wells VEW-1 and VEW-2 (Figure 2). ICE operation is permitted by the Bay Area Air Quality Management District (BAAQMD) under Permit to Operate #8272. The system operated in compliance throughout this reporting period.

In accordance with BAAQMD requirements, WA monitors the influent and effluent vapor stream monthly. Samples are collected in Tedlar bags for submittal to a state-certified analytical laboratory where they are analyzed for total petroleum hydrocarbons as gasoline (TPH-G), benzene, ethylbenzene, toluene and total xylenes. Additionally, field measurements are taken with a flame ionization detector (FID). Table 1 presents a summary of analytic results, FID measurements, hours of system operation, calculated emission rates and estimated destruction efficiencies since system start-up. Table 2 presents calculated hydrocarbon removal rates and total pounds of hydrocarbons removed. Figure 3 illustrates total pounds of hydrocarbons removed from the site via SVE versus time. We estimate that as of September 21, 1992, about 9,022 lbs (1,370 gallons) of hydrocarbons have been removed from soil and ground water beneath the site. As shown on Figure 4, influent concentrations have declined from 100,000 parts per million by volume (ppmv) to 1,800 ppmv since mid-March 1992. Benzene concentrations have declined from 1,800 to 10 ppmv. The analytical reports and chain-of-custody forms for August and September are included as Attachment A. A sample emissions

calculation based on the BAAQMD Manual of Procedures for Soil Vapor Extraction dated July 12, 1991, is presented as Attachment B.

To maximize the total vapor extraction rate, WA disconnected wells CR-1 and C-5 from the vapor extraction system on August 10, 1992 to extract exclusively from wells VEW-1 and VEW-2. FID and flow measurements taken August 10 before and after the wells were disconnected indicated an increase in both flow and TPH concentrations. Between June 19 and August 10, soil vapor was extracted from wells CR-1, C-5, VEW-1 and VEW-2 simultaneously. During this time, the average well gas flow rate was 29.5 standard cubic feet per minute (scfm). Since August 10, the average flow rate has been 35.4 scfm, indicating that extraction from wells VEW-1 and VEW-2 is more efficient than extraction from all four wells.

In conjunction with vapor stream monitoring, WA measured separate-phase hydrocarbon thicknesses in onsite wells. These measurements are presented in Table 3. During August and September, no separate-phase hydrocarbons were detected in any onsite wells. It is likely that separate-phase hydrocarbons have migrated away from wells CR-1 and C-3 and towards wells VEW-1 and VEW-2 due to the new vapor extraction configuration. We measured for separate-phase hydrocarbons in wells VEW-1 and VEW-2 on September 15, but both of these vadose zone wells remain dry.

During this two month period, the SVE and treatment system operated almost continually. On August 3, WA installed a new vacuum sensor and gear motor in the ICE. On August 25, the system shut down due to battery failure. WA technicians diagnosed that the problem was actually the alternator. The alternator was repaired and reinstalled and the system was restarted on August 26.

Nancy Vukelich
October 7, 1992

3

Weiss Associates



As required, WA will continue monthly monitoring and bimonthly reporting. Please call if you have any questions or require additional information.

Sincerely,
Weiss Associates

A handwritten signature in cursive script, appearing to read 'Kimberly Ohara'.

Kimberly Ohara
Staff Engineer

A handwritten signature in cursive script, appearing to read 'Thomas R. Berry'.

Thomas R. Berry
Project Geologist

TRB:kao
C:\KAO\582L1SE2.WP

Attachments:

- Figure 1 - Site Location Map
- Figure 2 - Monitoring and Extraction Well Locations
- Figure 3 - Total Hydrocarbon Removal
- Figure 4 - Influent Concentrations
- Table 1 - System Performance and Analytic Results
- Table 2 - Total Hydrocarbon Removal
- Table 3 - Free Product Thickness
- Attachment A - Analytical Reports and Chain-of-Custody Forms
- Attachment B - Sample Emission Calculations

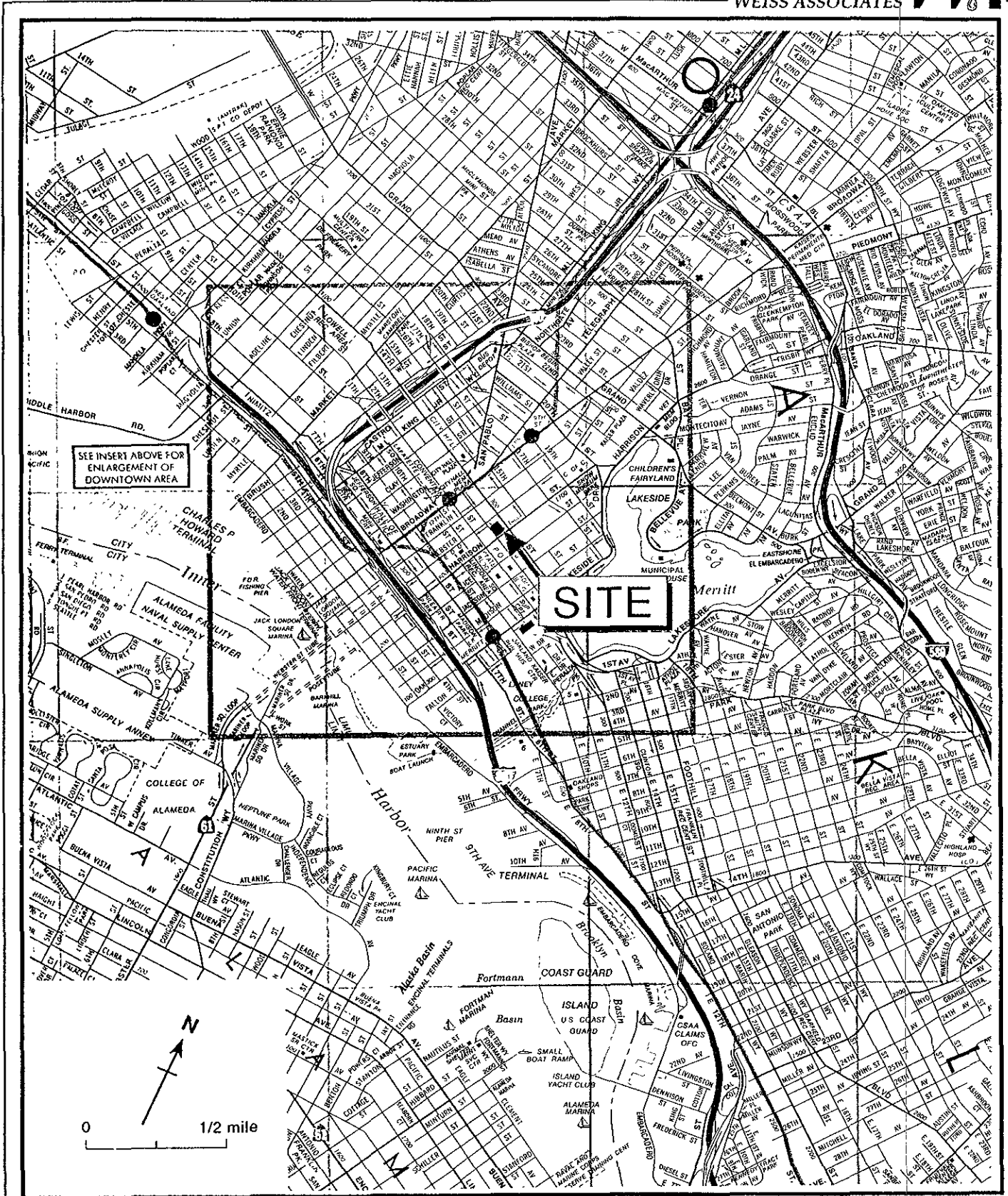


Figure 1. Site Location Map - Former Chevron Service Station #9-4816, 301 14th Street, Oakland, California

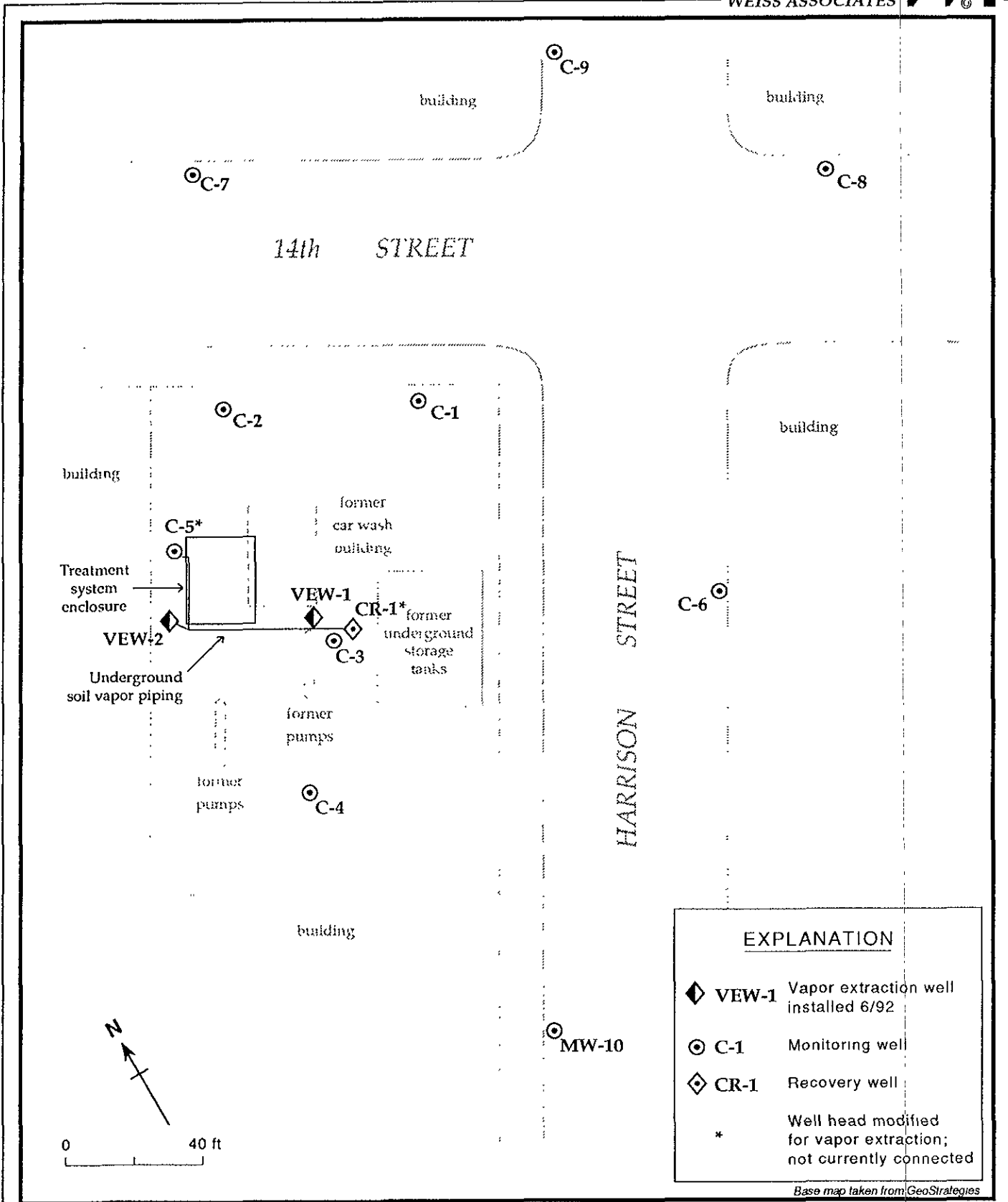


Figure 2. Monitoring and Extraction Well Locations - Former Chevron Service Station #9-4816, 301 14th Street, Oakland, California

Figure 3. TOTAL HYDROCARBON REMOVAL
FORMER CHEVRON SS#9-4816, OAKLAND

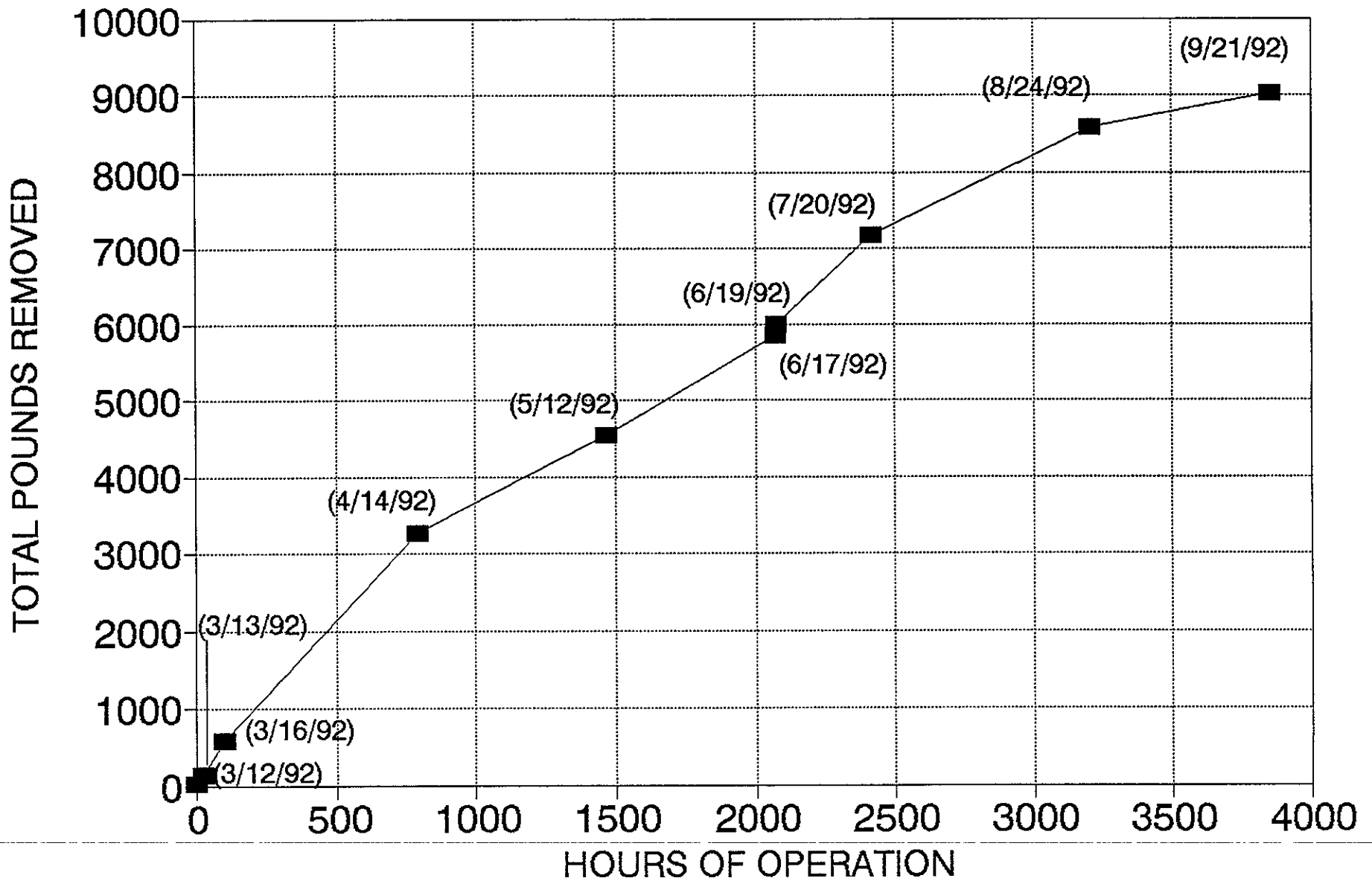
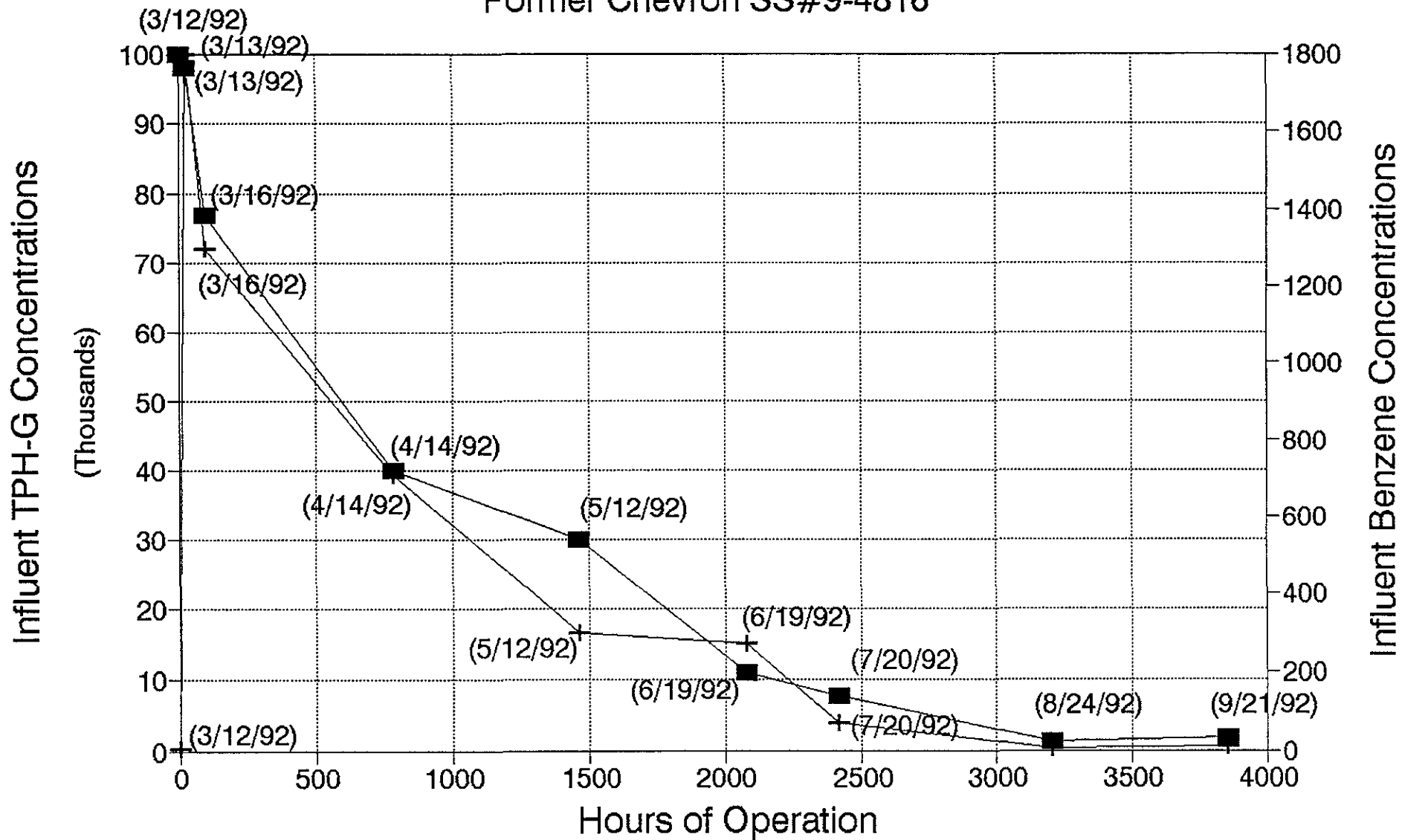


Figure 4. INFLUENT CONCENTRATIONS
Former Chevron SS#9-4816



TPH-G (ppmv)

+ Benzene (ppmv)

Table 1. System Performance and Analytic Results, Former Chevron SS#9-4816, 301 14th Street, Oakland, California

DATE	WELL ID a	TOTAL HOURS b	TOTAL WELL GAS FLOW RATE (SCFM)	TOTAL SYSTEM FLOW RATE (SCFM)	FUEL HYDROCARBON CONCENTRATIONS (ppmv)					
					INFLUENT			EFFLUENT		
					FID c	TPH-G	BENZENE	FID c	TPH-G	BENZENE
03/12/92	CR-1/C-5	5	4.9 f	34.5	>46,000	100,000	<4.2	185	<30	<0.085
03/13/92	CR-1/C-5	23	4.9 f	27.0	>47,800	98,000	1,800	80	<30	<0.085
03/16/92	CR-1/C-5	98	4.9 f	26.5	>50,000	77,000	1,300	NA	<30	0.12
04/14/92	CR-1/C-5	790	5.1 h	39.3	2,550	40,000	710	NA	<30	0.54
05/12/92	CR-1/C-5	1,465	2.7 h	52.9	6,500	30,000	300	NA	450	8.1
05/26/92	CR-1/C-5				2,934	---	---	1.9	---	---
06/17/92	CR-1/C-5	2,071	8.0 h,l	35.1	---	---	---	---	---	---
06/19/92	CR-1/C-5 & VEW-1 & VEW-2	2,077	25.6 h,m	77.0	2,100	11,000	270	100	<30	0.64
07/20/92	CR-1/C-5 & VEW-1 & VEW-2	2,422	31.0 h	72.0	900	7,600	70	22	31	0.33
08/10/92	CR-1/C-5 & VEW-1 & VEW-2	2,700	31.2 h	70.7	750	---	---	---	---	---
08/10/92	VEW-1 & VEW-2 n		34.8 h		1,980	---	---	---	---	---
08/17/92	VEW-1 & VEW-2	3,036	34.7 h	74.1	1,778	---	---	300	---	---
08/24/92	VEW-1 & VEW-2	3,204	31.4 h	67.6	---	1,100	7.8	---	<30	0.15
08/31/92	VEW-1 & VEW-2	3,345		76.2	8,850	---	---	100	---	---
09/08/92	VEW-1 & VEW-2	3,541	38.3	78.8	8,760	---	---	100	---	---
09/21/92	VEW-1 & VEW-2	3,852	37.6 h	78.5	15,740	1,800	10	640	<30	<0.085

--- Table 1 continues on next page ---



Table 1. System Performance and Analytic Results, Former Chevron SS#9-4816, 301 14th Street, Oakland, California

DATE	WELL ID a	REMOVAL RATE (#/DAY) d		EMISSION RATE (#/DAY) e		DESTRUCTION EFFICENCY (%)	
		TPH-G	BENZENE	TPH-G	BENZENE	TPH-G	BENZENE
03/12/92	CR-1/C-5	157	<0.06	<0.33	<0.0009	>99.80	>85.80 g
03/13/92	CR-1/C-5	154	2.6	<0.26	<0.0006	>99.80	>99.98
03/16/92	CR-1/C-5	121	1.9	<0.26	0.0009	>99.80	99.95
04/14/92	CR-1/C-5	65	1.1	<0.38	0.0062	>99.40	99.40
05/12/92	CR-1/C-5	26	0.24	7.1	0.12	72.60	50.00 i,j
05/26/92	CR-1/C-5					99.93 k	
06/17/92	CR-1/C-5						
06/19/92	CR-1/C-5 & VEW-1 & VEW-2	90	2.0	<0.74	0.014	99.20	99.30
07/20/92	CR-1/C-5 & VEW-1 & VEW-2	76	0.63	0.72	0.0069	99.00	98.90
08/10/92	CR-1/C-5 & VEW-1 & VEW-2						
08/10/92	VEW-1 & VEW-2 n						
08/17/92	VEW-1 & VEW-2						
08/24/92	VEW-1 & VEW-2	11	0.071	<0.65	0.0030	>94.1 g	95.8
08/31/92	VEW-1 & VEW-2					98.9	
09/08/92	VEW-1 & VEW-2					98.9	
09/21/92	VEW-1 & VEW-2	21.7	0.11	<0.76	<0.0019	>96.5 g	>98.3

--Table 1 continues next page--



Table 1. System Performance and Analytic Results, Former Chevron SS#9-4816, 301 14th Street, Oakland, California

NOTES:

- a = Measurements/samples represent combined extraction from wells listed.
- b = Total hours of operation equals engine hours as appear on engine computer printout minus 3050 hours of previous use at other sites.
- c = Value reflects subtraction of carbon-tip (methane) measurement. In some cases, FID measurement of total VOCs exceeded instrument measurement range of 50,000 ppmv.
- d = Removal rate based on total well gas flow rate.
- e = Emission rate based on total system flow rate which includes system dilution air and is measured by the ICE internal flow sensor.
- f = Based on flow data for similar operation parameters, measured vacuum, and assumed influent temperature of 70 F.
- g = Destruction efficiency calculation limited by analytic detection limit.
- h = Based on measured vacuum and flow, and assumed influent temperature of 70 F.
- i = System was shut down May 19, 1992, immediately following receipt of analytic results indicating system non-compliance due to low system destruction efficiency. Low efficiency was due to system adjustments made during a manufacturer's demonstration for Chevron USA. System was restarted May 20, 1992 and optimized according to previously effective system parameters. Mr. Alex Saschin of the BAAQMD was also notified of system non-compliance on May 20.
- j = Contains corrected removal and emission rates and destruction efficiencies
- k = Destruction efficiency based on FID measurements. The measurements were collected as requested by the BAAQMD to verify that the system optimization performed on May 20, 1992 was effective.
- l = Based on vacuum and flow readings from the 6/10/92 site visit.
- m = First day of system operations with the new wells VEW-1 and VEW-2 (installed June 11, 1992) connected to the system as extraction wells.
- n = CR-1 and C-5 disconnected from system to optimize TPH removal rate.

--Table 1 continues next page--

Table 1. System Performance and Analytic Results, Former Chevron SS#9-4816, 301 14th Street, Oakland, California

DEFINITIONS:

--- = Samples not collected
SCFM = Standard cubic feet per minute.
ppmv = Parts per million on volume to volume basis.
as measured by Foxburo organic vapor
analyzer/flame ionization device.
TPH-G = Total purgeable hydrocarbons as gasoline.
NA = FID not functioning.
<n = Analytic result below detection limit of n.

Table 2. Total Hydrocarbon Removal, Former Chevron SS#9-4816, 301 14th Street, Oakland, California

DATE	WELL ID a	HOURS OF OPERATION b	TOTAL WELL GAS FLOW RATE (SCFM)	REMOVAL #TPH-G/HR	INTERVAL AVERAGE #TPH-G/HR	INTERVAL HOURS	INTERVAL TOTAL POUNDS TPH-G	CUMMULATIVE TOTAL POUNDS TPH-G REMOVED
03/12/92	CR-1/C-5	5	4.9 c	6.54	6.54	5	33	33
03/13/92	CR-1/C-5	23	4.9 c	6.42	6.48	18	117	150
03/16/92	CR-1/C-5	98	4.9 c	5.04	5.73	75	430	580
04/14/92	CR-1/C-5	790	5.1 d	2.71	3.88	692	2,685	3,265
05/12/92	CR-1/C-5	1,465	2.7 d	1.08	1.90	675	1,283	4,548
06/17/92 e	CR-1/C-5	2,071	8.0 d,f	3.21 g	2.14	606	1,297	5,845
06/19/92	CR-1/C-5 & VEW-1 & VEW-2	2,077	25.6 d	3.75	3.75	6	23	5,983
07/20/92	CR-1/C-5 & VEW-1 & VEW-2	2,422	31.0 d	3.15	3.45	345	1,190	7,173
08/24/92	VEW-1 & VEW-2	3,204	31.4 d	0.45	1.80	782	1,408	8,581
09/21/92	VEW-1 & VEW-2	3,852	37.6 d	0.90	0.68	648	441	9,022

Notes:

- a = Measurements/samples represent combined extraction from wells listed.
- b = Total hours of operation equals engine hours as appear on engine computer printout minus 3050 hours of previous use at other sites.
- c = Based on flow data for similar operation parameters, measured vacuum, and assumed influent temperature of 70 F.
- d = Based on measured vacuum and flow, and assumed influent temperature of 70 F.
- e = First day of system operation with the two new wells (installed June 11, 1992) connected to the system as extraction wells.
- f = Based on measured vacuum and flow from the 06/10/92 site visit.
- g = Calculated estimates based on concentrations in samples collected 05/12/92.
- SCFM = Standard cubic feet per minute.
- ppmv = Parts per million on volume to volume basis.
- # = Pounds
- FID = Total volatile organic compounds (VOCs) as measured by Foxboro organic vapor analyzer/flame ionization device.
- TPH-G = Total purgeable hydrocarbons as gasoline.

Table 3. Free Product Thickness, Former Chevron Service Station #9-4816
301 14th Street, Oakland, California

DATE	C-1	C-2	C-3	C-4	C-5	CR-1	VEW-1	VEW-2
<-----product thickness (ft)----->								
11/05/91 a	0	0.04	2.46	0	2.29	2.43		
03/11/92	0	NM	1.09	NM	0.30	3.21		
03/16/92	0	NM	2.32	NM	0	8.88		
03/25/92	0	NM	2.31	NM	0	7.83		
05/05/92	NM	NM	2.11	0	0	5.67		
05/12/92	0	0	1.89	0	0.27	5.97		
05/19/92 b	NM	NM	2.00	NM	NM	2.92		
06/18/92 c	0	0	2.16	NM	0.85	3.12	NM	NM
07/28/92	0	0	0.51	NM	0	3.41	NM	NM
08/17/92	0	0	0	0	0	0	NM	NM
09/15/92	0	0	0	0	0	0	0	0

Notes:

NM = Not Measured

a = From 4th Quarter 1992 Ground Water Monitoring Report prepared by Alton Geoscience, Concord, California

b = Measurement on 5/19/92 was taken prior to free product removal by Erickson, Inc. from wells CR-1 and C-3. Erickson vacuumed product from the wells until <1/4 inch remained.

c = VEW-1 and VEW-2 installed June 11, 1992 by Groundwater Technology, Concord, California

ATTACHMENT A
ANALYTICAL REPORTS AND CHAIN-OF-CUSTODY FORMS



Superior Precision Analytical, Inc.

1555 Burke, Unit I • San Francisco, California 94124 • (415) 647-2081 / fax (415) 821-7123

C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 13408
CLIENT: Weiss Associates
CLIENT JOB NO.: 4-582-51

DATE RECEIVED: 08/25/92
DATE REPORTED: 08/28/92

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration (ppb)			
		Benzene	Toluene	Ethyl Benzene	Xylenes
1	082-INF	7800	8500	710	17000
2	082-OUT	150	ND<250	ND<65	ND<250

ppb - parts per billion in air

Minimum Detection Limit for Benzene in air = 85 ppb
Minimum Detection Limit for Toluene and Xylenes in air = 250 ppb
Minimum Detection Limit for Ethyl Benzene in air = 65 ppb
Concentration of BTXE in air is calculated based on 20 C and 1 ATM.
Reported as volume to volume.

QAQC Summary:

Daily Standard run at 20ug/L: %DIFF 8020 = <15%
MS/MSD Average Recovery = 108% : Duplicate RPD = 3%

Richard Srna, Ph.D.

Cecilia G. Jorgensen (for)
Laboratory Director



Superior Precision Analytical, Inc.

1555 Burke, Unit I • San Francisco, California 94124 • (415) 647-2081 / fax (415) 821-7123

C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 13408
CLIENT: Weiss Associates
CLIENT JOB NO.: 4-582-51

DATE RECEIVED: 08/25/92
DATE REPORTED: 08/28/92

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS by Modified EPA SW-846 Method 5030 and 8015

LAB #	Sample Identification	Concentration (ppm) Gasoline Range
1	082-INF	1100
2	082-OUT	ND<30

ppm - parts per million in air
Minimum Detection Limit for Gasoline in Air: 30 ppm
Concentration of gasoline in air is calculated based on 20 C and 1 ATM and an assumed molecular weight of hexane.
Reported as volume to volume.

QAQC Summary:

Daily Standard run at 2mg/L: %DIFF Gasoline = <15
MS/MSD Average Recovery = 111%: Duplicate RPD = 5%

Richard Srna, Ph.D.

Cecilia G. Jones (for)
Laboratory Director



Superior Precision Analytical, Inc.

1555 Burke, Unit 1 • San Francisco, California 94124 • (415) 647-2081 / fax (415) 821-7123

MOCK INVOICE

Chevron USA
P.O. Box 5004
San Ramon, CA 94583

Date: 08/28/92
Date Rcvd: 08/25/92
Date Rptd: 08/28/92
Our Job #: 13408
Invoice #: 13408

Weiss Associates Job # 4-582-51
Chevron USA Release # 3523000

Facility #: 9-4816

QTY/MATRIX	ANALYSIS	EXT. PRICE
2 Air sample(s) for VBAIR	@ \$0.00 (RUSH)	0.00
TOTAL INVOICE		0.00

Please Send Payment To:
Superior Precision Analytical
P.O. Box 1545
Martinez, CA 94553

TERMS: NET 30
A charge of 1.5% per month may be applied to unpaid balances.



Superior Precision Analytical, Inc.

1555 Burke, Unit I • San Francisco, California 94124 • (415) 647-2081 / fax (415) 821-7123

C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 13501
CLIENT: Weiss Associates
CLIENT JOB NO.: 4-582-51

DATE RECEIVED: 09/21/92
DATE REPORTED: 09/23/92
DATE ANALYZED: 09/22/92

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS by Modified EPA SW-846 Method 5030 and 8015

LAB #	Sample Identification	Concentration (ppm) Gasoline Range
1	092IN	1800
2	092OUT	ND<30

ppm - parts per million in air
Minimum Detection Limit for Gasoline in Air: 30 ppm
Concentration of gasoline in air is calculated based on 20 C and 1 ATM and an assumed molecular weight of hexane.
Reported as volume to volume.

QAQC Summary:

Daily Standard run at 2mg/L: %DIFF Gasoline = <15
MS/MSD Average Recovery = 89%: Duplicate RPD = 3%

*KAC,
Oxide level 14%
hard copy results
3-monthly report
should be ready for my
review by 10/6 Thanks
-TRB*

Richard Srna, Ph.D.

Greg A. Nwogu (for)
Laboratory Director



Superior Precision Analytical, Inc.

1555 Burke, Unit 1 ▪ San Francisco, California 94124 ▪ (415) 647-2081 / fax (415) 821-7123

C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 13501
CLIENT: Weiss Associates
CLIENT JOB NO.: 4-582-51

DATE RECEIVED: 09/21/92
DATE REPORTED: 09/23/92
DATE ANALYZED: 09/22/92

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration (ppb)			
		Benzene	Toluene	Ethyl Benzene	Xylenes
1	092IN	10000	5600	350	1900
2	092OUT	ND<85	ND<250	ND<65	ND<250

ppb - parts per billion in air

Minimum Detection Limit for Benzene in air = 85 ppb
Minimum Detection Limit for Toluene and Xylenes in air = 250 ppb
Minimum Detection Limit for Ethyl Benzene in air = 65 ppb
Concentration of BTXE in air is calculated based on 20 C and 1 ATM.
Reported as volume to volume.

QAQC Summary:

Daily Standard run at 20ug/L: %DIFF 8020 = <15%
MS/MSD Average Recovery = 97% : Duplicate RPD = 3%

Richard Srna, Ph.D.

Greg A. Nwoga
Laboratory Director



Superior Precision Analytical, Inc.

1555 Burke, Unit I ▪ San Francisco, California 94124 ▪ (415) 647-2081 / fax (415) 821-7123

MOCK INVOICE

Chevron USA
P.O. Box 5004
San Ramon, CA 94583

Date: 09/23/92
Date Rcvd: 09/22/92
Date Rptd: 09/23/92
Our Job #: 13501
Invoice #: 13501

Weiss Associates Job # 4-582-51
Chevron USA Release # 3523000

Facility #: 9-4816

QTY/MATRIX	ANALYSIS	EXT. PRICE
2 Air sample(s) for VBAIR	@ \$0.00 (RUSH)	0.00
TOTAL INVOICE		0.00

Please Send Payment To:
Superior Precision Analytical
P.O. Box 1545
Martinez, CA 94553

TERMS: NET 30
A charge of 1.5% per month may be applied to unpaid balances.

ATTACHMENT B
SAMPLE EMISSION CALCULATIONS

SAMPLE EMISSION CALCULATIONS

Chevron Service Station #9-4816
301-14th Street
Oakland, California

Given: System data from May 12, 1992

- Influent TPH-G concentration = 30,000 ppmv
- Effluent TPH-G concentration = 450 ppmv
- Influent benzene concentration = 300 ppmv
- Effluent benzene concentration is = 8.1 ppmv
- System vacuum = 38 inches of water
- Molecular weight of TPH-G (assumed to be equal to hexane) = 86 lbs/lb-mole.
- Molecular weight of benzene = 78 lbs/lb-mole
- Extraction flow rate based on the flow sensor and differential pressure gauge located before the ICE. The differential pressure = 0.05
- Emission flow rate is based on measurement by the ICE flow meter. Flow rate = 56.5 cfm

Uncontrolled Emissions (lb per day):

The extraction flow rate is based on measurements using a pitot tube type flow sensor with a differential pressure gauge and an assumed temperature at the sensor of 60°F. The estimated extraction flow rate for the May 12, 1992 data is 2.7 scfm.

The equation for the mass of hydrocarbons entering the treatment system per unit time is:

$$\text{Removal Rate} \left(\frac{\text{lbs}}{\text{day}} \right) = \text{Conc. (ppmv)} \times 10^{-6} \times \text{flowrate (scfm)} \times \frac{1 \text{ lb-mole}}{386 \text{ ft}^3} \times \text{mol. wt.} \left(\frac{\text{lb}}{\text{lb-mole}} \right) \times \frac{1440 \text{ min.}}{\text{day}}$$

For TPH-G and benzene:

$$\text{TPH-G} = 30,000 \times 10^{-6} \times 2.7 \text{ scfm} \times \frac{1 \text{ lb-mole}}{386 \text{ ft}^3} \times \frac{86 \text{ lbs}}{\text{lb-mole}} \times \frac{1440 \text{ min.}}{\text{day}} = 25.9 \frac{\text{lbs}}{\text{day}}$$

$$\text{Benzene} = 300 \times 10^{-6} \times 2.7 \text{ scfm} \times \frac{1 \text{ lb-mole}}{386 \text{ ft}^3} \times \frac{78 \text{ lbs}}{\text{lb-mole}} \times \frac{1440 \text{ min.}}{\text{day}} = 0.24 \frac{\text{lbs}}{\text{day}}$$

Controlled Emissions (lb per day):

The emission flow rate is based on the measurement by the ICE flow sensor in cfm, which must be converted to scfm using the following equation:

$$\text{flowrate (scfm)} = \text{flowrate(ICE) (cfm)} \times \left(\frac{14.7 + \text{psig}}{14.7} \right) \times \left(\frac{520}{460 + T_F} \right)$$

where

- T_F = temperature of air in °F,
- $520 = 460 + 60^\circ$ = standard temperature rankine, and
- $\text{psig} = \frac{\text{inches of water pressure (negative)}}{27.7 \text{ inches of water / 1 psi}}$

So the effluent flow rate is:

$$\text{Flowrate} = 56.5 \text{ cfm} \times \frac{14.7 - 45}{14.7} \times \frac{520}{460 + 70} = 49.3 \text{ scfm}$$

For TPH-G and benzene:

$$\text{TPH-G} = 450 \times 10^{-6} \times 49.3 \text{ scfm} \times \frac{1 \text{ lb-mole}}{386 \text{ ft}^3} \times \frac{86 \text{ lbs}}{\text{lb-mole}} \times \frac{1440 \text{ min.}}{\text{day}} = 7.11 \frac{\text{lbs}}{\text{day}}$$

$$\text{Benzene} = 8.1 \times 10^{-6} \times 49.3 \text{ scfm} \times \frac{1 \text{ lb-mole}}{386 \text{ ft}^3} \times \frac{78 \text{ lbs}}{\text{lb-mole}} \times \frac{1440 \text{ min.}}{\text{day}} = 0.12 \frac{\text{lbs}}{\text{day}}$$

Destruction Efficiency

The equation for destruction efficiency is:

$$\text{Destruction efficiency} = \frac{\frac{\text{lbs removed}}{\text{day}} - \frac{\text{lbs emitted}}{\text{day}}}{\frac{\text{lbs removed}}{\text{day}}} \times 100\%$$

For TPH-G and benzene:

$$\text{TPH-G destruction efficiency} = \frac{25.9 - 7.1}{25.9} \times 100\% = 72.6\%$$

$$\text{benzene destruction efficiency} = \frac{0.24 - 0.12}{0.24} \times 100\% = 50.0\%$$