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EMCON Northwest, Inc.
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January 13, 1995
Project 0311-104.01

Mr. Tim Johnson
Chevron U.S.A. Products Company
Site Assessment and Remediation Group
20500 Richmond Beach Drive Northwest
Seattle, Washington 98177

Re: Fourth Quarter (September 22 to December 19, 1994) Vapor Extraction System Monitoring
Former Chevron Bulk Fuel Facility 61001351
1310 Highland Avenue
Bremerton, Washington

Dear Mr. Johnson:

EMCON is pleased to submit this report regarding the status of ongoing remediation activities at the above-referenced former bulk fuel facility located at 1310 Highland Avenue in Bremerton, Washington (Figure 1). This report summarizes the vapor extraction system (VES) operation and maintenance activities at the facility from September 22 to December 19, 1994. The scope of work conducted was consistent with EMCON's VES operation and maintenance program proposal, dated April 12, 1993.

BACKGROUND

Site Location and Description

The former bulk fuel facility occupies approximately 1.5 acres along the shoreline of the Port Washington Narrows. The site is located to the east of Highland Avenue and is bound to the north and east by the Port Washington Narrows shoreline. The site lies approximately 10 to 25 feet above mean sea level.

The former bulk fuel facility is divided into a Lower Yard and an Upper Yard. The Upper Yard occupies the south portion of the property and is approximately 10 feet higher than the Lower Yard. The Upper Yard is the former location of aboveground tanks, storing primarily diesel and gasoline. The north portion of the site is designated as the Lower

Yard. This area formerly contained office buildings, garage facilities, loading racks, and dock facilities.

Hart Crowser Inc., obtained permits from the Puget Sound Air Pollution Control Authority (PSAPCA) to construct a soil vapor extraction system on May 5, 1990. The VES was installed in October 1990, under Hart Crowser's direction. The system was activated on November 7, 1990. The VES is located in the Lower Yard and consists of 18 vertical extraction points (Figure 2). Sixteen of the eighteen extraction points are situated on three horizontal branches extending from the treatment system area near the former facility dock. Two extraction points, MW-4 and MW-6, are piped directly to one Rotron DR 404 regenerative blower and a 35-gallon condensate knockout tank. The remaining 16 points are piped into a common manifold which is plumbed in parallel to four Rotron DR 404 regenerative blowers with four 35-gallon condensate knockout tanks. The exhaust side of each blower is connected to a common exhaust line which vents to a 4-inch-diameter stack.

EMCON has conducted quarterly VES monitoring since June 15, 1993. Hydrocarbon removal rates from July 25 to September 22, 1994, ranged from 2.2 to 7.1 pounds per day. EMCON previously monitored the site on September 22, 1994, with results reported in the *Third Quarter Vapor Extraction System Monitoring Report*, dated October 6, 1994. By the end of the third quarter of 1994, an estimated cumulative total of 195,296 pounds of volatile organic vapors had been removed from the site subsurface.

SCOPE OF WORK AND METHODS

EMCON monitored and evaluated the VES operation at the site on October 31, November 28, and December 19, 1994, during the fourth quarter reporting period.

EMCON's system monitoring visits consisted of recording airflow, vacuum pressure, and volatile organic vapor concentrations. Airflow measured at the system stack and at common manifold points ML-1 and ML-2 was recorded in linear feet per minute (fpm) by using a Kurz™ Instruments Inc. Mini Anemometer Series 490. Linear airflow was converted to cubic feet per minute (cfm) by using the diameter of the system stack (4 inches), the common manifold point ML-1 (6 inches), and the common manifold point ML-2 (2 inches).

Vacuum pressure was monitored at ML-1 (the point at which four blowers are plumbed together and exit the treatment area) and ML-2 (the common manifold for MW-4 and MW-6) by using a portable set of magnehelic gauges with a pressure range of 0.01 to

50 inches of water. Each of the five condensate tanks has a permanent vacuum gauge. Vacuum pressure measurements obtained from the permanent gauges may be unreliable because several gauges indicated the system was under vacuum when the blowers were deactivated.

Volatile organic vapor concentrations were monitored by using a flame ionization detector (FID), Foxboro™ Model 88 OVA, and a photoionization detector (PID), Model 580 OVM. Readings were collected at the system stack and at the common manifold points, ML-1 and ML-2.

Hydrocarbon mass removal rates were calculated by using the following formula:

lbs/day = cfm x FID (ppmv) x molecular weight (hexane) x 1.581×10^{-7} x 24 hrs/day[1]

The following assumptions applied for the calculation of hydrocarbon mass removal:

1) cfm = the volumetric airflow from the system stack.

2) FID = volatile organic vapor concentrations measured in parts per million - volume (µl/L).

3) Molecular weight of hexane, the FID calibration gas, is 86 mg/mole.

4) 1.581×10^{-7} lb-mole min/ft^3 ppmv hr = $\frac{1}{10^6 \ ppm - v} \ x 60 \ \frac{min}{hr} \ x \ \frac{1lb - mole}{379.5 ft^3}$.

5) Total pounds were calculated assuming a linear increase or decrease in stack emissions from monitoring date to monitoring date.

The following formula was used to calculate total pounds removed from the site between site visits:

$$\text{Total Pounds} = \frac{FE + IE}{2} \ x \ \text{Days}$$

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[1] Reference: United States Environmental Protection Agency, Office of Underground Storage Tanks, June 1989. *Estimating Air Emissions from Petroleum UST Cleanups.*

1) FE = final emissions in lbs/day during previous site visit.

2) IE = initial emissions in lbs/day during the next site visit.

3) Days = number of days between site visits.

RESULTS

During the monitoring visits, each vapor extraction point was isolated to record vacuum pressure, linear airflow, and volatile organic concentrations. Attachment A contains the field measurements collected during the fourth quarter site visits.

The VES was operating properly upon arrival on October 31, 1994. Vacuum was applied to vapor extraction points MW-6, MW-14, EX-2, EX-6, and EX-8. Following isolation and adjustment, the system was adjusted with vacuum applied to MW-4, MW-6, MW-15, EX-2, EX-6, and EX-9. System operating parameters were recorded. Vacuum at the manifold ML-1 registered 24 inches of water. Linear airflow at the stack was recorded at 1,200 fpm, with a volatile organic concentration of 60 ppmv at the discharge stack. The air intake valves at the condensate tanks remained closed. Approximately 12 gallons of condensate were drained from condensate tank #1.

The VES was operating properly upon arrival on November 28, 1994. The suction hose from Rotron Blower Number 4 for vapor extraction points MW-4 and MW-6 was noted to be cracked and leaking. The hose was temporarily repaired with duct tape to close the leak. Vapor extraction points were isolated, and system operating parameters were recorded. The system was adjusted with vacuum applied to MW-4, MW-6, EX-2, and EX-6. Final system setup recorded volatile organic vapor concentrations of 25 ppmv at the discharge stack with linear airflow of 1,200 fpm recorded at the discharge stack. Vacuum at the manifold (ML-1) registered 32 inches of water.

The system was operating properly upon arrival on December 19, 1994. The hose to Rotron Blower Number 4 for vapor extraction points MW-4 and MW-6 was replaced during the site visit. A high tide was noted during the site visit. Depth to groundwater was approximately 2.5 feet below the ground surface. The condensate tank filters were removed and replaced resulting in a notable increase of air flow. The vapor extraction points were isolated, and the operating parameters were recorded. The system was adjusted with vacuum applied to MW-4, MW-6, MW-14, EX-6, and EX-9. Volatile organic concentrations at the discharge stack were recorded at 20 ppmv. The final setup

applied a total system vacuum of 40 inches of water at the manifold ML-1. Linear airflow at the stack was recorded at 1,200 fpm. The air intake valves at the condensate collectors remained closed.

Table 1 presents system operating parameters and calculated emissions since January 15, 1993. A cumulative estimate of total VOCs emitted is approximately 195,518 pounds. A graphic representation of daily system emissions since January 1993 is shown on Figure 3.

CONCLUSIONS

The VES daily emissions of volatile hydrocarbons from the subsurface declined during the fourth quarter reporting period of September 22 to December 19, 1994. During this period, 222 pounds of volatile hydrocarbons were removed from the site. Hydrocarbon removal rates ranged from 0.2 to 2.1 pounds per day.

During the fourth quarter, the vapor extraction system operated properly. The hose to Rotron Blower Number 4 for vapor extraction points MW-4 and MW-6 was discovered cracked and leaking on November 28, 1994. The piping was temporarily fixed until December 19, 1994, when the hose was replaced. System operating parameters for linear airflow ranged from 500 to 1,600 fpm at the discharge stack, volatile organic concentrations from 8 to 60 ppmv at the discharge stack, and vacuum pressure from 20 to 40 inches of water at manifold ML-1.

Daily hydrocarbon removal rates and volatile organic concentrations declined during the fourth quarter period. The decline was due to the subsequent rise of water levels. This decreased the area for applying vacuum in the VES lines and the points. During the fourth quarter, vapor extraction point EX-6 volatile organic concentrations declined to a maximum concentration of 325 ppmv. The final hydrocarbon removal rate of 0.7 pounds per day was recorded on the December 19, 1994 site visit. A high tide was noted during the December site visit due to the shallow depth to water measurements. Hydrocarbon removal rates are expected to be low during the first quarter of 1995. System operations will continue to be maintained at this site.

LIMITATIONS

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is

made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, nor the use of segregated portions of this report.

We appreciate the opportunity to be of service to Chevron U.S.A. Products Company on this project. Please contact us if you have any questions about this report.

Sincerely,

EMCON

Lisa A. Rutan
Project Manager

Daniel Balbiani, P.E.
Assistant Director of Remediation Services

Attachments:
- Table 1 - Volatile Organic Vapor Emissions/Mass Removal Results
- Figure 1 - Site Location Map
- Figure 2 - Site Plan
- Figure 3 - Daily Volatile Organic Vapor Emissions (January 1993 to December 1994)
- Attachment A - Field Data Sheets

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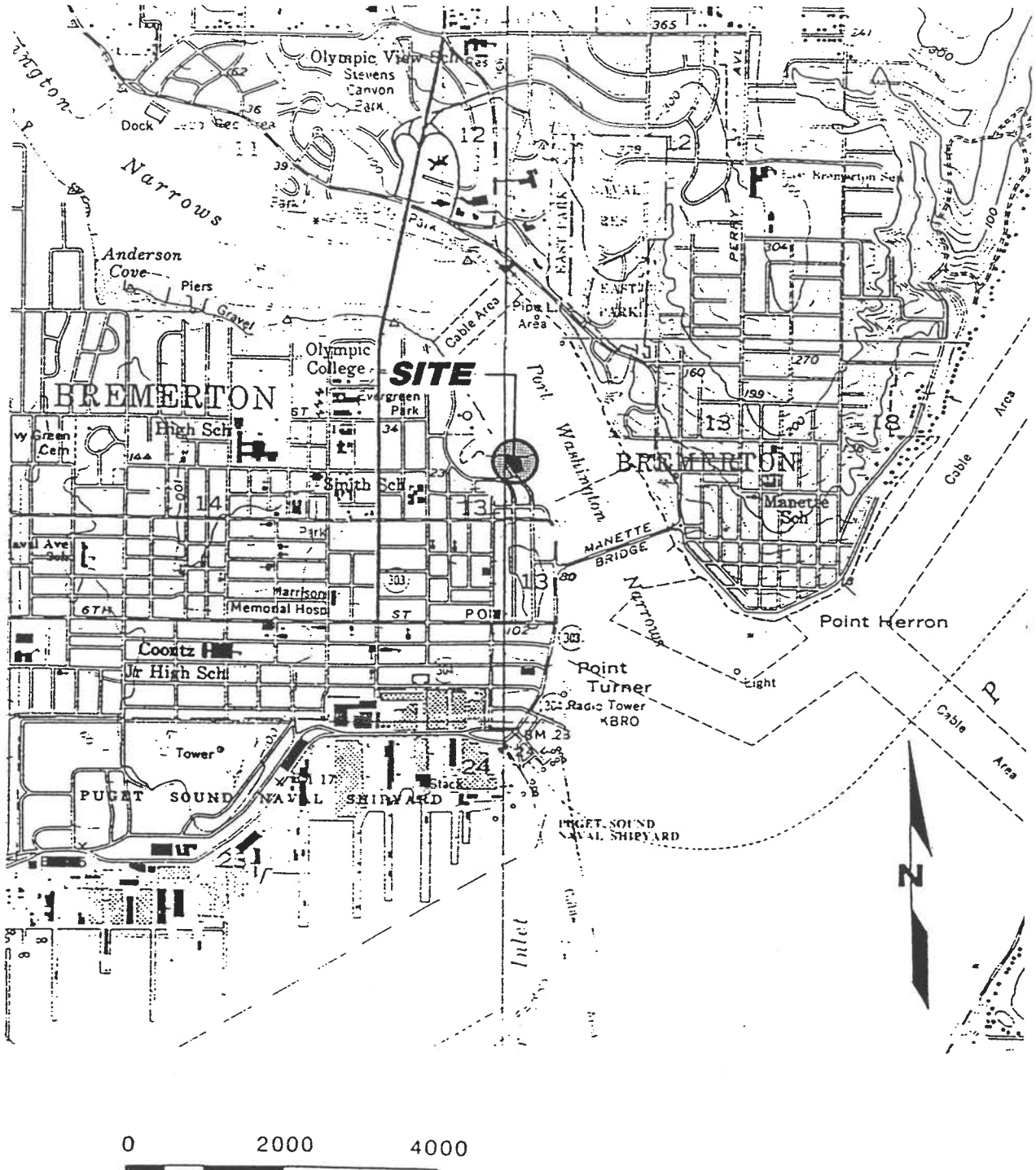

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Figure 1
CHEVRON USA PRODUCTS COMPANY
BREMERTON, WASHINGTON
SITE LOCATION MAP

FOURTH QUARTER REPORT

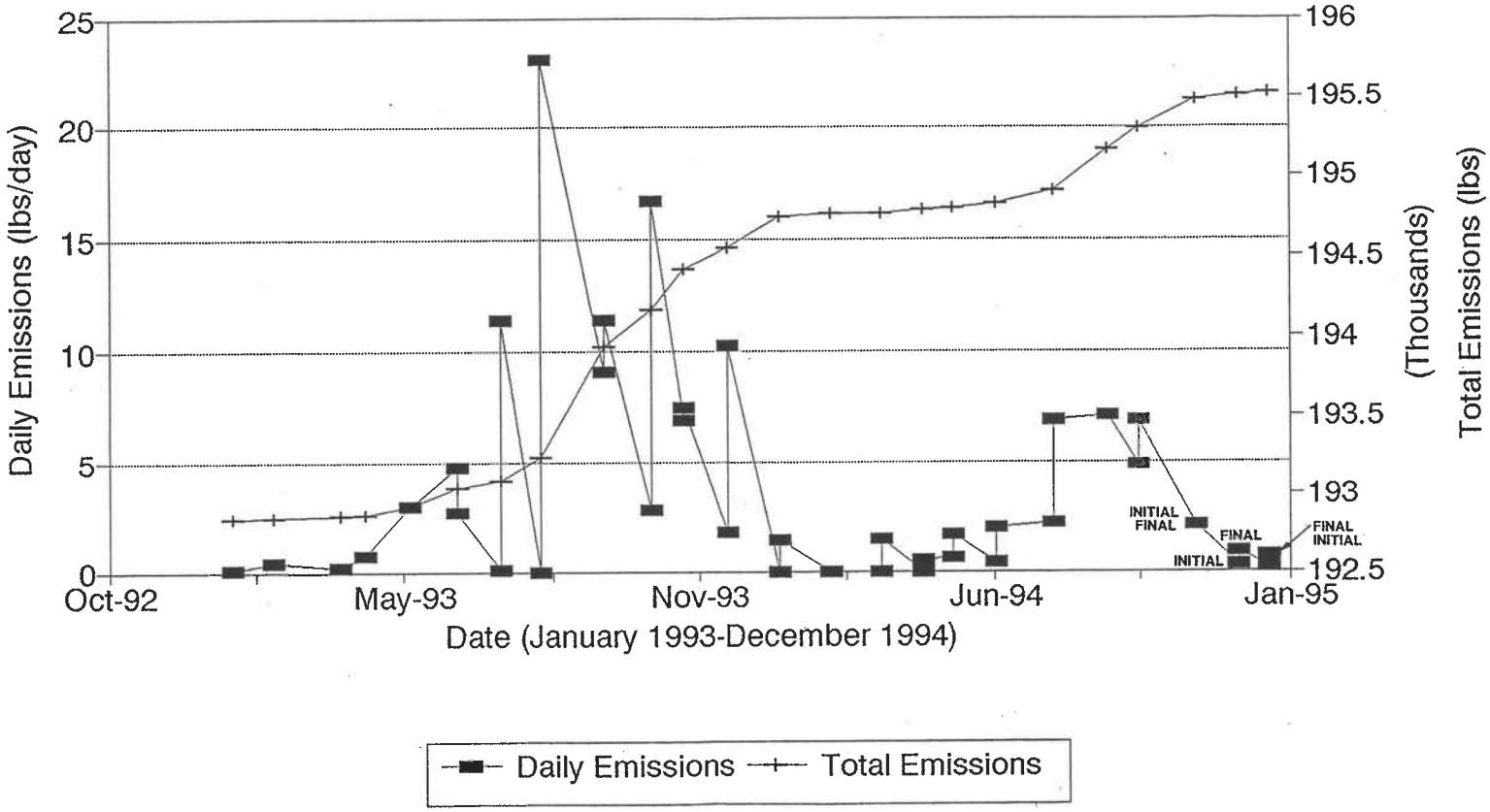

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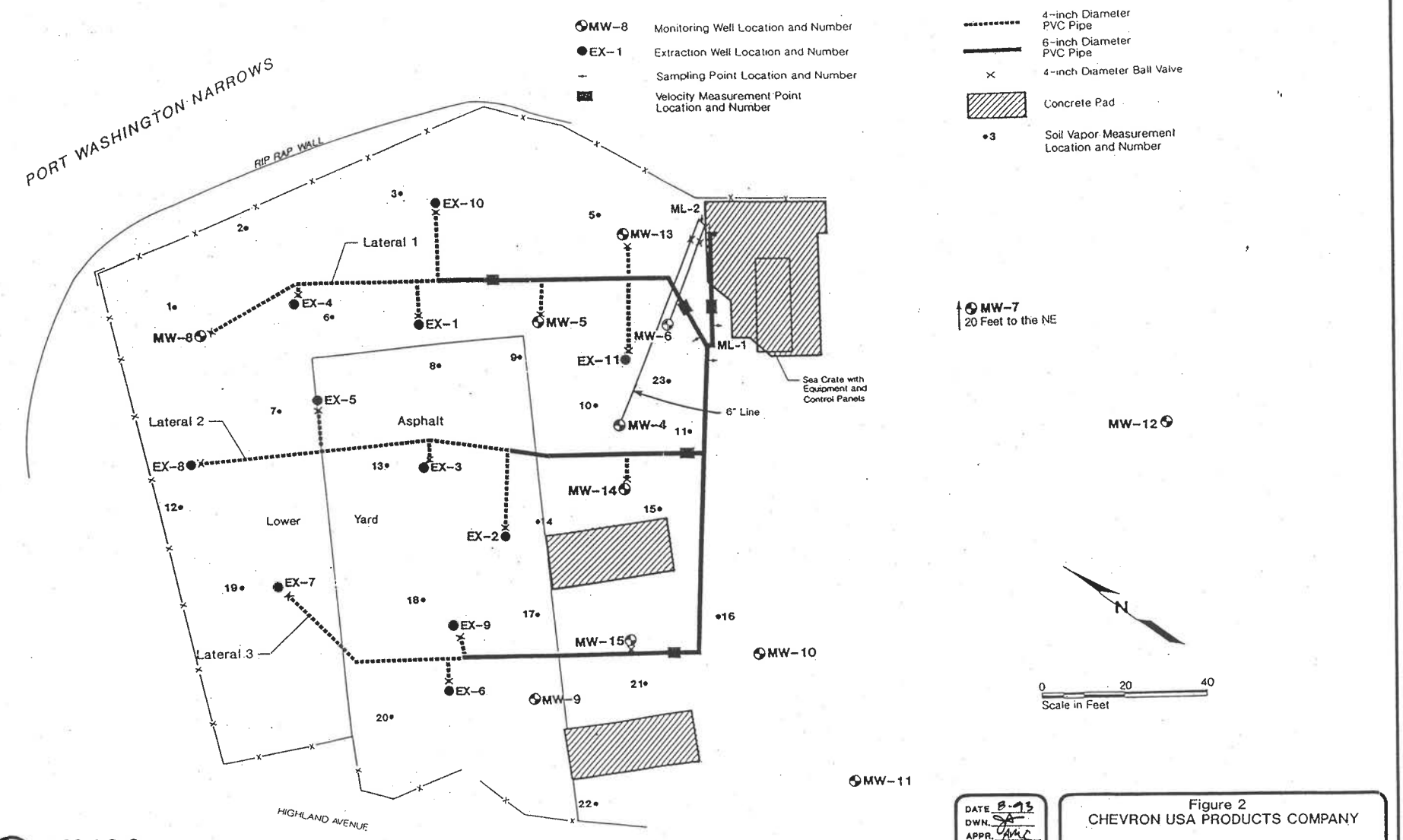
Figure 3
CHEVRON USA PRODUCTS COMPANY
FACILITY NO. 61001351
BREMERTON, WASHINGTON
TOTAL AND DAILY PETROLEUM HYDROCARBON EMISSIONS



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SOURCE: HART CROWSER Figure 1, Soil Vapor Monitoring Location Plan

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Figure 2
CHEVRON USA PRODUCTS COMPANY
BREMERTON, WASHINGTON
SITE PLAN

Table 1

Fourth Quarter 1994
Hydrocarbon Emissions/Mass Removal Results
CHEVRON U.S.A. Products Company 61001351
Bremerton, Washington
Project #0311-104.01

Date	Flow @ Stack (fpm)	Flow @ Stack (cfm)	Vacuum (" water)	FID (ppmv)	Emissions (lbs/day)	Total[a] (pounds)
01/15/93 *	NA	NA	NA	NA	0.1	192,836
02/12/93 *	NA	NA	NA	NA	0.4	192,843
03/30/93 *	NA	NA	NA	NA	0.2	192,857
04/15/93 *	NA	225	NA	9	0.7	192,864
05/15/93 *	NA	287	NA	32	3.0	192,920
06/15/93 (initial)	6,000	491	18	30	4.8	193,041
06/15/93 (final)	3,200	279	20	30	2.7	193,041
07/15/93 (initial)	1,000	87	40	2	0.06	193,082
07/15/93 (final)	2,500	218	15	160	11.4	193,082
08/11/93 (initial)	Reactivated system.					193,236
08/11/93 (final)	2,700	236	22	300	23.1	193,236
09/23/93 (initial)	4,000	349	11	80	9.1	193,928
09/23/93 (final)	4,000	349	2	100	11.4	193,928
10/26/93 (initial)	5,500	480	2.5	18	2.8	194,162
10/26/93 (final)	4,500	393	14	130	16.7	194,162
11/16/93 (initial)	3,500	305	14	70	6.9	194,410
11/16/93 (final)	3,500	305	20	75	7.5	194,410
12/16/93 (initial)	3,500	305	29	18	1.8	194,550
12/16/93 (final)	4,000	349	17	90	10.3	194,550
01/21/94 (initial)	2,500	218	17	ND	0	194,735
01/21/94 (final)	2,000	175	40	25	1.4	194,735
02/25/94 (initial)	2,300	201	40	ND	0	194,760
02/25/94 (final)	2,300	201	40	ND	0	194,760
03/30/94 (initial)	2,500	218	25	ND	0	194,760
03/30/94 (final)	2,000	175	38	26	1.5	194,760
04/28/94 (initial)	1,800	157	30	ND	0	194,782
04/28/94 (final)	1,800	157	10	10	0.5	194,782
05/18/94 (initial)	1,800	157	10	12	0.6	194,793
05/18/94 (final)	1,200	105	15	50	1.7	194,793
06/16/94 (initial)	1,500	131	15	10	0.4	194,823
06/16/94 (final)	2,000	175	17	35	2.0	194,823
07/25/94 (initial)	2,250	196.5	12	34	2.2	194,905
07/25/94 (final)	2,000	175	12	120	6.9	194,905
08/31/94 (initial)	2,250	196.5	12	110	7.1	195,164
08/31/94 (final)	2,250	196.5	12	110	7.1	195,164
09/22/94 (initial)	1,800	157	19	95	4.9	195,296
09/22/94 (final)	2,000	175	14	120	6.9	195,296
10/31/94 (initial)	1,600	140	20	45	2.1	195,472

Table 1

Fourth Quarter 1994
Hydrocarbon Emissions/Mass Removal Results
CHEVRON U.S.A. Products Company 61001351
Bremerton, Washington
Project #0311-104.01

Date	Flow @ Stack (fpm)	Flow @ Stack (cfm)	Vacuum (" water)	FID (ppmv)	Emissions (lbs/day)	Total[a] (pounds)
10/31/94 (final)	1,200	105	24	60	2.1	195,472
11/28/94 (initial)	1,200	105	26	8	0.3	195,506
11/28/94 (final)	1,200	105	32	25	0.9	195,506
12/19/94 (initial)	500	44	36	11	0.2	195,518
12/19/94 (final)	1,200	105	40	20	0.7	195,518

NOTE: NA = Not available.
ND = Not detected.
* = Data were collected and calculated by Hart Crowser. Information was transcribed from previously submitted reports. EMCON did not review or evaluate any calculations made before the June 15, 1993, visit.
Equation: ER (emission rate, lbs/day) = cfm x FID (ppmv) x MW x 1.581 ^-7 x 24 hours/day. (Molecular weight (MW) for hexane, the FID calibration gas, 86 grams/mole)
Reference: United States Environmental Protection Agency, Office of Underground Storage Tanks, June 1989. *Estimating Air Emissions from Petroleum UST Cleanups.*

[a] Total pounds were calculated assuming a linear increase or decrease in stack emissions from monitoring date to monitoring date.

ATTACHMENT A

FIELD DATA SHEETS

CHEVRON STATION NUMBER: 61001351
LOCATION: 1310 Highland Ave., Bremerton, WA

DATE: 12-19-94

STARTUP: November 7, 1990
EQUIPMENT: (5) Rotron DR404 Blower

SAMPLE LOCATION	INITIAL SET-UP			ISOLATED			FINAL SET-UP		
	Vacuum ("water)	Flow (fpm)	FID (ppm-v)	Vacuum ("water)	Flow (fpm)	FID (ppm-v)	Vacuum ("water)	Flow (fpm)	FID (ppm-v)
Stack 4"ø	N/A	500	11 ppm	N/A			N/A	1200	20
Manifold (ML-1) 6"ø	36"	125	11 ppm				40"	150	20
Cond. Tank 1	38"	N/A	N/A		N/A	N/A		N/A	N/A
Cond. Tank 2	55"	N/A	N/A		N/A	N/A		N/A	N/A
Cond. Tank 3	28"	N/A	N/A		N/A	N/A		N/A	N/A
Cond. Tank 4	40"	N/A	N/A		N/A	N/A		N/A	N/A
Cond. Tank 5	60"	N/A	N/A		N/A	N/A		N/A	N/A
MW-8	OFF			36"		ND	OFF		
EX-4	OFF					ND	OFF		
EX-1	OFF					ND	OFF		
EX-10	OFF					ND	OFF		
MW-5	OFF					ND	OFF		
MW-13	OFF					ND	OFF		
MW-6	ON		ND			ND	ON		
EX-11	OFF					ND	OFF		
MW-4	48"	200	110 ppm			110	48" ON	200	110 ppm
EX-8	OFF					ND	OFF		
EX-5	OFF					ND	OFF		
EX-3	OFF					ND	OFF		
EX-2	ON					ND	OFF		
MW-14	OFF					10	ON		
EX-7	OFF					ND	OFF		
EX-9	OFF					15	ON		
EX-6	ON					140	ON		
MW-15	OFF					ND	OFF		

High tide + rain => less screen area in VES lines and points.

Air intake valve at condensate tank open (initial): YES/NO
(final): YES/NO

COMMENTS: High tide. Water levels high in vapor recovery wells.

44 cfm * 11ppmv * 86g/mol * 1.581^{-7} * 24 hrs/day = 0.2 lb/day

105 cfm * 20ppmv * 86/mol * 1.581^{-7} * 24 hrs/day ≈ 0.7 lb/day.

CHEVRON STATION NUMBER: 61001351
LOCATION: 1310 Highland Ave., Bremerton, WA

DATE: 11-28-94

STARTUP: November 7, 1990
EQUIPMENT: (5) Rotron DR404 Blower

SAMPLE LOCATION	INITIAL SET-UP			ISOLATED			FINAL SET-UP		
	Vacuum ("water)	Flow (fpm)	FID (ppm-v)	Vacuum ("water)	Flow (fpm)	FID (ppm-v)	Vacuum ("water)	Flow (fpm)	FID (ppm-v)
Stack	N/A	1200	8	N/A			N/A	1200	25
Manifold (ML-1)	26"	250	35				32	200	47
Cond. Tank 1	30"	N/A	N/A		N/A	N/A		N/A	N/A
Cond. Tank 2	10"	N/A	N/A		N/A	N/A		N/A	N/A
Cond. Tank 3	20"	N/A	N/A		N/A	N/A		N/A	N/A
Cond. Tank 4	32"	N/A	N/A		N/A	N/A		N/A	N/A
Cond. Tank 5	35"	N/A	N/A		N/A	N/A		N/A	N/A
MW-8	Closed			26"		ND	OFF		
EX-4	Closed					ND	OFF		
EX-1	Closed					ND	OFF		
EX-10	Closed					ND	OFF		
MW-5	Closed					ND	OFF		
MW-13	Closed					ND	OFF		
MW-6	Open					ND	ON		
EX-11	Closed					ND	OFF		
MW-4	Open					ND	ON		
EX-8	Closed					ND	OFF		
EX-5	Closed					ND	OFF		
EX-3	Closed					ND	OFF		
EX-2	Open					20	Open		
MW-14	Closed					7	OFF		
EX-7	Closed					ND	OFF		
EX-9	ON					10	OFF		
EX-6	ON					170	ON		
MW-15	ON			↓		11	OFF		

ND ≤ 5ppmv

Air intake valve at condensate tank open (initial): YES/(NO)
(final): YES/(NO)

COMMENTS:

105 cfm * 8ppmv * 86 g/mol * 1.581^{-7} * 24 hrs/day = 0.3 lb/day

105 cfm * 25ppmv * 86 g/mol * 1.581^{-7} * 24 hrs/day = 0.9 lb/day

CHEVRON STATION NUMBER: 61001351
LOCATION: 1310 Highland Ave., Bremerton, WA

DATE: 10-21-94

STARTUP: November 7, 1990
EQUIPMENT: (5) Rotron DR404 Blower

SAMPLE LOCATION	INITIAL SET-UP			ISOLATED			FINAL SET-UP		
	Vacuum ("water)	Flow (fpm)	FID (ppm-v)	Vacuum ("water)	Flow (fpm)	FID (ppm-v)	Vacuum ("water)	Flow (fpm)	FID (ppm-v)
Stack	N/A	1600	45	N/A			N/A	1200	60
Manifold (ML-1)	20	400	50				24	300	85
Cond. Tank 1	25	N/A	N/A		N/A	N/A		N/A	N/A
Cond. Tank 2	10	N/A	N/A		N/A	N/A		N/A	N/A
Cond. Tank 3	18	N/A	N/A		N/A	N/A		N/A	N/A
Cond. Tank 4	27	N/A	N/A		N/A	N/A		N/A	N/A
Cond. Tank 5	55	N/A	N/A		N/A	N/A		N/A	N/A
MW-8	Closed			20"		ND	Closed		
EX-4	Closed					ND			
EX-1	Closed					ND			
EX-10	Closed					ND			
MW-5	Closed					ND	Closed		
MW-13	Closed					11ppm	Open		
MW-6	Open					ND	Closed		
EX-11	Closed					14ppm	Open		
MW-4	Closed					8ppm	Closed		
EX-8	Closed	Open				ND	Closed		
EX-5	Closed					ND	Closed		
EX-3	Closed					75ppm	Open		
EX-2	Open					14ppm	Closed		
MW-14	Open					ND	Closed		
EX-7	Closed					50	Open		
EX-9	Closed					325	OPEN		
EX-6	OPEN					19	Open		
MW-15	Closed								

ND ≤ 5ppmv

Air intake valve at condensate tank open (initial): YES (NO)
(final): YES (NO)

Drained 12 gallons of condensate from tank #1.

COMMENTS:

Init = 140 cfm * 45 ppmv * 86 g/mol * 1.581^{-7} * 24 hrs/day ≃ 2.1 lbs / day

Final = 105 cfm * 60 ppmv * 86 g/mol * 1.581^{-7} * 24 hrs/day ≃ 2.1 lbs / day