

**EMCON**

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DEPT. OF ECOLOGY

October 4, 1995  
Project 40233-114.001

Mr. Chuck Hutchens  
ARCO Products Company  
12520 Northeast 160th Place  
Woodinville, Washington 98072-7960

Re: Quarterly Soil Vapor Extraction System Monitoring, February through June 1995,  
ARCO Station 5810, Naval Avenue and Sixth Street, Bremerton, Washington

Dear Mr. Hutchens:

The following report contains findings from the second quarterly soil vapor extraction system (SVES) operation and maintenance site visits at ARCO Products Company (ARCO) Station 5810 at 2101 6th Street, Bremerton, Washington (Figure 1).

ARCO retained EMCON to measure monthly SVES volatile emissions, vacuum, and flow rates, to evaluate and optimize SVES performance, to perform light SVES maintenance, and to report the activities and findings of the site visits. EMCON's activities were authorized under Change Order 004 to Blanket Order 88-100, dated January 19, 1995, and under Work Authorization 1724500, dated February 22, 1995.

## BACKGROUND

Arco Service Station 5810 consists of an AM-PM Mini Market, one gasoline dispensing island with a canopy, and four underground storage tanks (Figure 2). The SVES, consisting of eight vapor extraction wells (VR-1 through VR-8) and a Rotron EN 707 blower, was installed and activated in by Geraghty and Miller between March 1990 and December 1991. The SVES was continuously active from January 1993 to July 1994. Approximately 500 pounds of petroleum hydrocarbons reportedly were removed by the SVES during this period.

EMCON personnel visited the site in February 1995 to evaluate the SVES components and connections and to activate the SVES. It was noted at that time that all well heads had been paved over and were not accessible for direct measurement. In April 1995, EMCON personnel returned to the site to carry out minor repairs to the SVES (replacement of



control valves on VR-1, VR-2, and VR-4) and to monitor the SVES. A summary of SVES performance for the monitoring period from February through June 1995, is presented below.

## **SCOPE OF WORK**

EMCON performed the following tasks for the monitoring period of February through June 1995:

- Replaced control valves on VR-1, VR-2, and VR-4.
- Measured SVES vacuum pressures monthly by using either a portable or a permanently installed vacuum gauge.
- Measured volatile hydrocarbon emissions monthly by using a portable flame ionization detector (FID).
- Measured monthly air flow rates within the exhaust stack by using a portable anemometer.
- Evaluated the data and prepared this report.

## **REMEDIATION SYSTEM MONITORING AND EMISSIONS**

The SVES was continuously active during the monitoring period. Total SVES flow rates measured at the exhaust stack ranged from 122 to 287 cubic feet minute (cfm). Total SVES vacuum pressure measured at the blower intake ranged from 59 to 72 inches of water. SVES hydrocarbon emission concentrations, measured with an FID, ranged from 12 to 100 parts per million (ppm). The SVES has removed approximately 53 gallons (303 pounds) of petroleum hydrocarbons since system startup in February 1995. The SVES has operated for approximately 3,100 hours since February 21, 1995, and continues to operate effectively.

Field measurements and estimates of petroleum hydrocarbon mass removal rates are presented in the table. Figure 3 displays estimated petroleum hydrocarbon emissions removed per monitoring period since system startup in February 1995. Figure 4 displays the total estimated petroleum hydrocarbon emissions removed since February 1995.

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Page 3

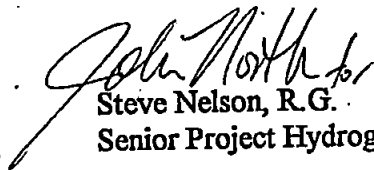
### SCHEDULED ACTIVITIES

Monthly operation and maintenance site visits are scheduled through 1995. The SVES will continue to be run continuously. The next performance evaluation will be prepared in October 1995.

If you have any questions regarding this report, please call.

Sincerely,

EMCON

  
Steve Nelson, R.G.  
Senior Project Hydrogeologist

  
John H. Guenther, C.P.G.  
Project Manager

Attachments: Limitations

Figure 1 - Site Vicinity Map

Figure 2 - Site Map

Figure 3 - Petroleum Hydrocarbons Removed Per Monitoring Period

Figure 4 - Total Petroleum Hydrocarbons Removed to Date

Table - SVES Petroleum Hydrocarbon Removal

cc: Elaine Atkinson; Ecology

## **LIMITATIONS**

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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.

Table

**Soil Vapor Extraction System Petroleum Hydrocarbon Mass Removal  
ARCO Station 5810, Bremerton, Washington  
Work Authorization Number 17245 00**

| VES Inspection Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Flow Rate at Stack (cfm) | Vacuum Pressure Reading (inches of water) | Stack Emissions FID Measurement (ppm) | Comments                    | Estimated HC Emissions Rate (lbs/day) | Estimated HC Emissions per Period (lb) | Estimated HC Emissions per Period (gal) | Estimated Total Emissions to Date (lb) | Estimated Total Emissions to Date (gal) |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------|---------------------------------------|-----------------------------|---------------------------------------|----------------------------------------|-----------------------------------------|----------------------------------------|-----------------------------------------|
| 02/21/95                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 287                      | 65                                        | 12                                    | System running continuously | 1.3                                   | 0                                      | 0                                       | 0                                      | 0                                       |
| 04/25/95                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 122                      | 72                                        | 37                                    | System running continuously | 1.7                                   | 97                                     | 17                                      | 97                                     | 17                                      |
| 05/01/95                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 218                      | 62                                        | <75                                   | System running continuously | 0                                     | 18                                     | 3                                       | 116                                    | 20                                      |
| 06/22/95                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 261                      | 59                                        | 100                                   | System running continuously | 10.1                                  | 187                                    | 33                                      | 303                                    | 53                                      |
| <b>TOTAL ESTIMATED HYDROCARBONS REMOVED TO DATE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                          |                                           |                                       |                             |                                       |                                        |                                         | <b>303</b>                             | <b>53</b>                               |
| <b>NOTES:</b> Flow rates calculated from field measurements of stack anemometer.<br>Vacuum pressure reading from Rotron DR 454 performance curves or from magnehelic pressure gauges at manifold, ending 01/93.<br>Vacuum pressure reading from Rotron EN 606 performance curves or from magnehelic pressure gauges at manifold, starting 08/93.<br>Stack emission sampled on 10/15/91. WTPH-G = 170 mg/m3 (ppmv)<br>$\text{Emissions rate (lb/day)} = \text{cfm} \times \text{ppm} \times \text{MW} \times 1.581\text{E-}07 \times (\text{hrs of operation})/\text{day}$ ; $\text{MW(gasoline)} = 102.2 \text{ g/g-mole (or) lb/lb-mole}$ .<br>$\text{Emissions per period (lb)} = \text{number of days per period times average emission rate during period}$ .<br>Total emissions calculation assumes linear change in emission rates between monitoring dates.<br>5.7 pounds of gasoline = 1 gallon of gasoline.<br>Stack diameter = 2 inches until 8/93.<br>Stack diameter = 4 inches as of 8/93.<br>Reference: "Estimating Air Emissions from Petroleum UST Cleanups," USEPA, June 1989.<br>cfm = cubic feet per minute.<br>ppm = parts per million.<br>HC = hydrocarbon— assumed to be gasoline.<br>FID = flame ionization detector. |                          |                                           |                                       |                             |                                       |                                        |                                         |                                        |                                         |



SOURCE: USGS 7.5 MINUTE QUADRANGLE, BREMERTON WEST, WASHINGTON 1981.



WASHINGTON



0 2000 4000  
SCALE (ft)



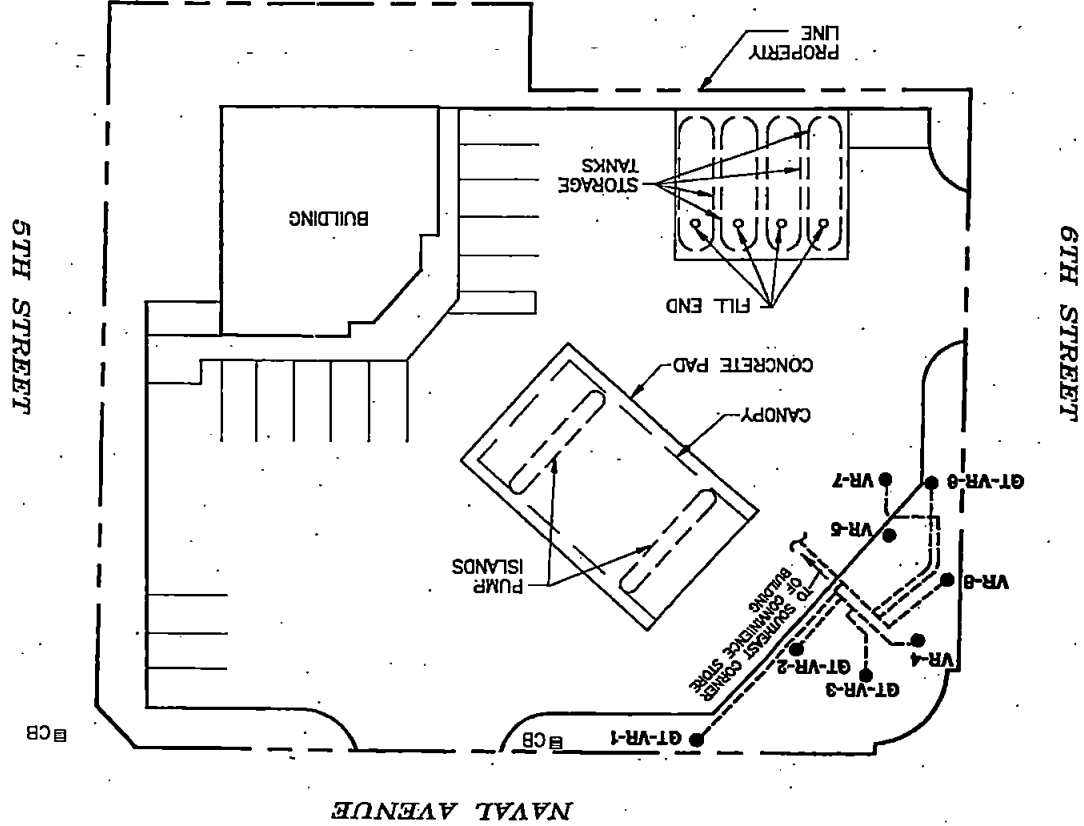
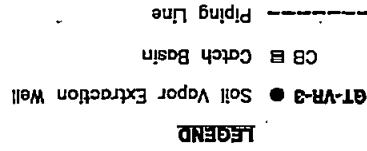
**emcon**  
Northwest, Inc.

DATE 12/94  
DWN. CEC  
REV. \_\_\_\_\_  
APPR. \_\_\_\_\_  
PROJECT NO. \_\_\_\_\_

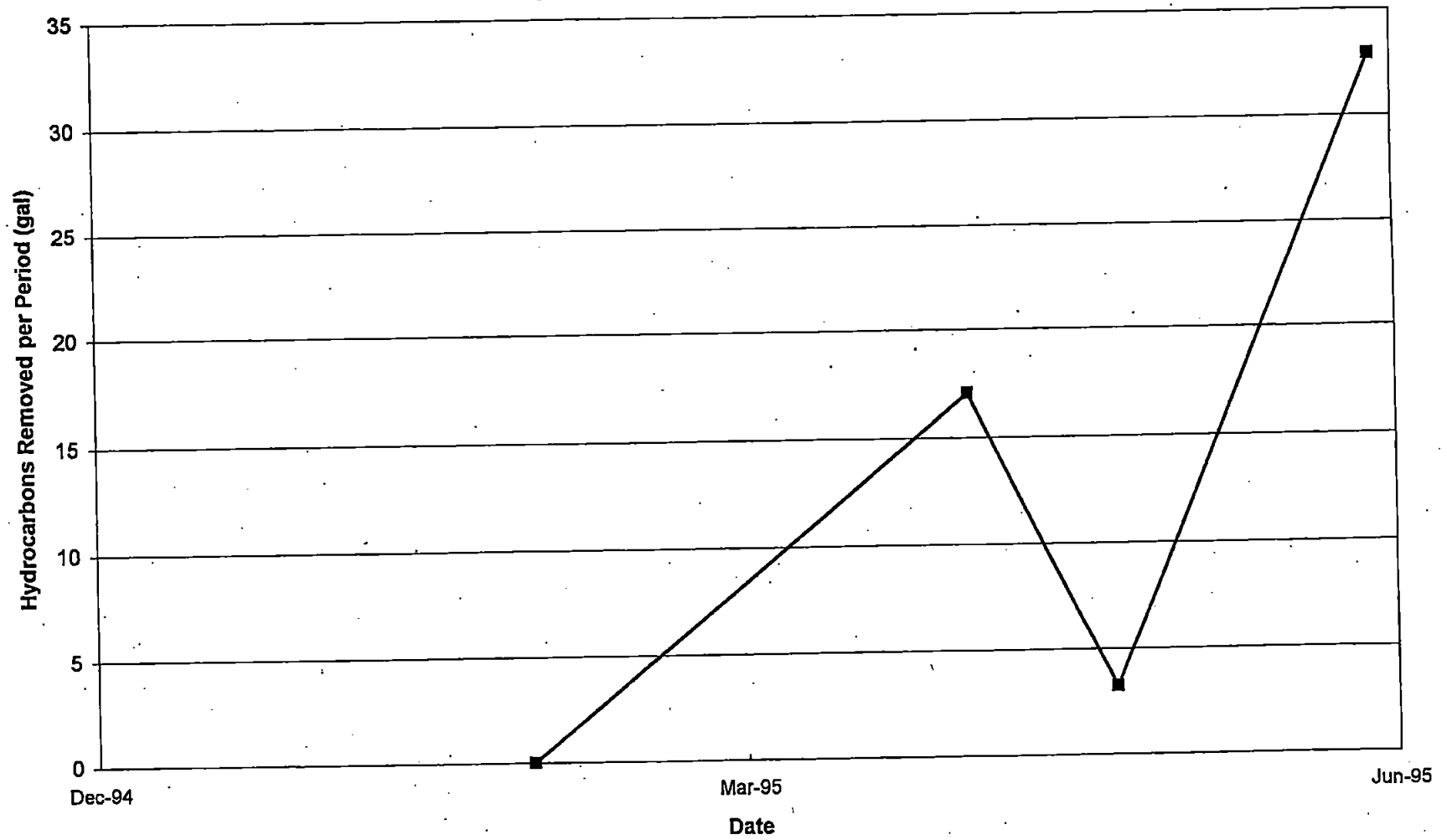
Figure 1  
ARCO STATION NO. 5810  
BREMERTON, WASHINGTON

**SITE VICINITY MAP**

DATE 12-84  
DWN. MLP  
REV. \_\_\_\_\_  
APPR. \_\_\_\_\_  
PROJECT NO. \_\_\_\_\_  
WA



**FIGURE 3**  
**ARCO Station 5810, Bremerton, Washington**  
**Petroleum Hydrocarbons Removed per Monitoring Period**



**FIGURE 4**  
**ARCO Station 5810, Bremerton, Washington**  
**Total Petroleum Hydrocarbons Removed to Date**

