

# SVE at Site ST-35

## Davis-Monthan AFB

### Site Background

This section focuses on the SVE system located at Site ST-35, Davis-Monthan AFB.

Performance of the groundwater system is not evaluated. A site map for ST-35 is included as Figure 4.

#### Contaminants in Soil

- Approximately 63,000 cubic yards of soil were contaminated with JP-4 fuel. Soil contamination extended from near the ground surface to a depth of about 260 feet below ground surface (bgs).
- Total petroleum hydrocarbons (TPH) was detected in soil at levels up to 320,000 parts per million (ppm), and benzene was detected at levels up to 110 ppm.

#### Contaminants in Groundwater

- The groundwater at the site was contaminated with JP-4 from the fuel spill.
- Groundwater sampling and analysis at two monitoring wells identified dissolved hydrocarbons (including benzene with a concentration of 510 parts per billion [ppb]) and 1 to 3 inches of floating JP-4.

#### Lithology

- Groundwater at the site is encountered approximately 320 feet bgs.
- The lithology at Site ST-35 is comprised mainly of sandy clay with interbedded gravels and sands in the upper 260 feet.
- A caliche (cemented silts and clays) layer located at approximately 240 feet bgs impeded much of the vertical migration of the fuel toward groundwater.

#### SVE System Details

- A full-scale SVE System with two 460 cubic inch internal combustion engines (ICEs).
- The SVE/ICE system consisted of 6 vapor extraction wells, a blower system, moisture separator, thermal oxidizer, and air treatment system.
- The SVE system operated at an average flow rate of 123 standard cubic feet per minute (scfm).
- The SVE system treated approximately 1,200 lbs/day.
- Soil gas is extracted from the vadose zone by the vacuum created by the ICEs and subsequently burned as fuel in the ICEs. As contaminant concentrations were reduced, supplemental fuel is added to operate the ICEs.

#### Operation Period

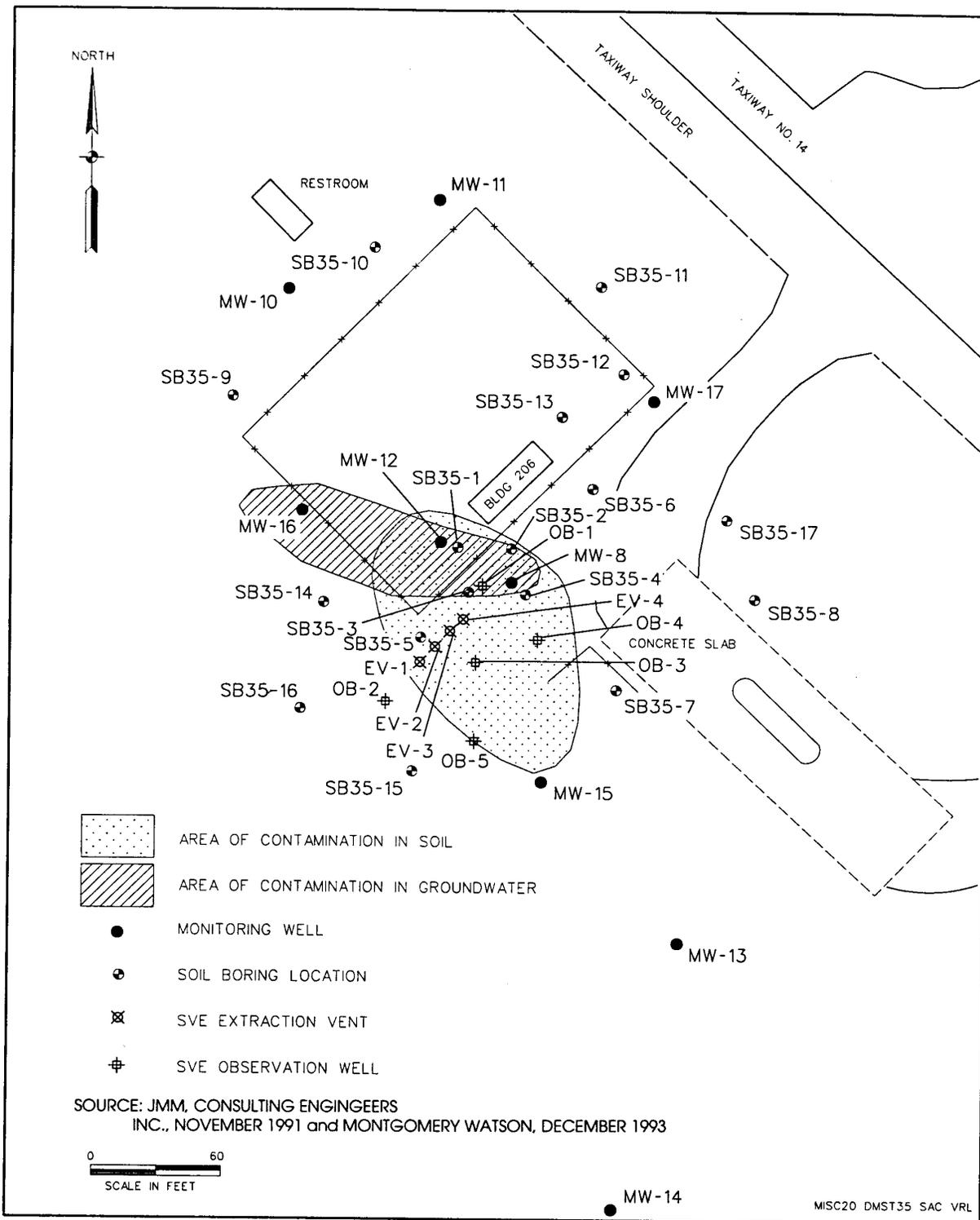
- The SVE/ICE system was operated from September 1995 through July 1997.

#### Total Capital Costs

- \$162,000 (estimated).

#### Total O&M Costs

- The total O&M cost for the SVE/ICE system from September 1995 through July 1997, after 22 months of operation, was approximately \$45,000 (Radian, 1997).
- O&M costs for the SVE/ICE system from September 1995 through December 1996 were \$32,700.



**Figure 4. Extent of Known Groundwater and Soil Contamination at ST-35, Davis-Monthan AFB**

## **Cost and Performance of SVE at Site ST-35**

### **SVE Operational Objectives**

The objective of SVE is typically to remove contamination in the soil as cost-effectively as possible to prevent contamination of surrounding soil and groundwater.

### **Cost for Operation**

Figure 5 illustrates the O&M costs for the SVE at Site ST-35. The monthly O&M costs range from \$1,818 to \$2,602. Total O&M costs after 16 months of operation were \$32,700.

### **Contaminant Removal**

Figure 6 illustrates the contaminant removal rates of total volatile hydrocarbons (TVH) for the SVE system at Site ST-35. Monthly contaminant removal rates ranged from 14,700 to 67,800 lbs. Total contaminant removal after 16 months of operation was 585,700 lbs. of TVH. In October 1996, the curve representing the cumulative removal rate had begun to flatten. The ICE engine was reconfigured with a smaller engine to reduce the need for supplemental fuel. Following the reconfiguration, the system performance improved and was meeting its operational objectives.

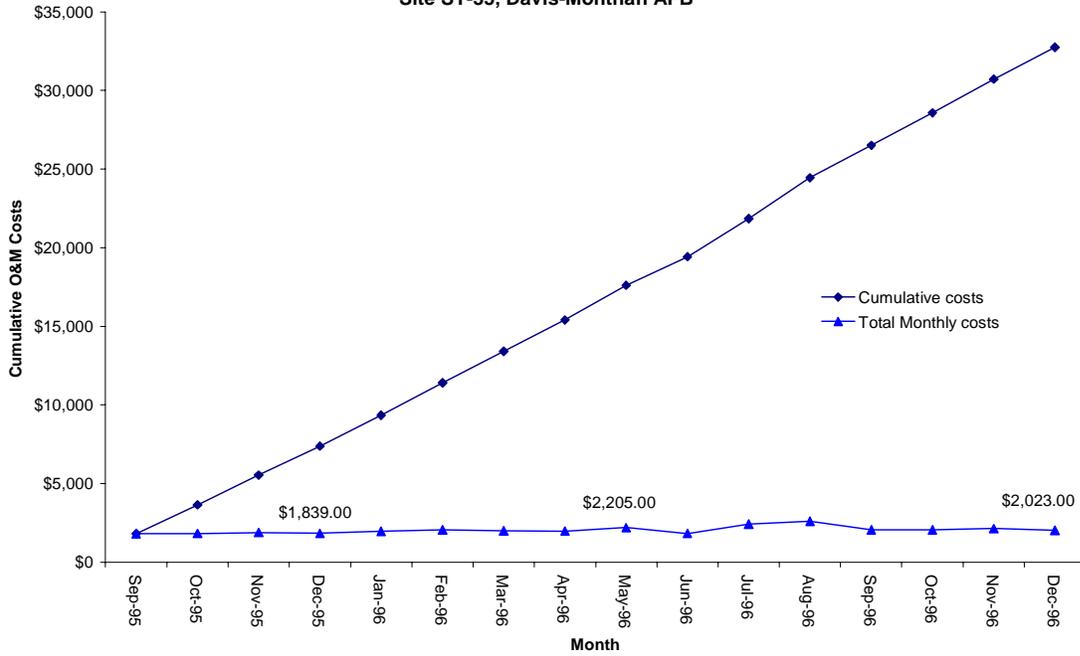
### **Correlation of Costs and Contaminant Removal**

Figures 7 and 8 illustrate the relationship between the O&M costs and the removal rates for the SVE system at Site ST-35.

Figure 7 illustrates the cumulative O&M cost over the cumulative contaminant removal. As of October 1996, this curve had begun to steepen as the cost per unit of contaminant removal rose. The ICE engine was reconfigured with a smaller engine to reduce the need for supplemental fuel. Following the reconfiguration, the system performance improved and was meeting its operational objectives.

Figure 8 illustrates the monthly as well as the cumulative cost per unit of contaminant removal over the operation time of the technology. The first curve illustrates the cost per unit of contaminant removal in each month. The cumulative curve illustrates that the average cost per unit of contaminant removal for after 16 months of operation time (December 1996) was \$0.06/pound of JP-4.

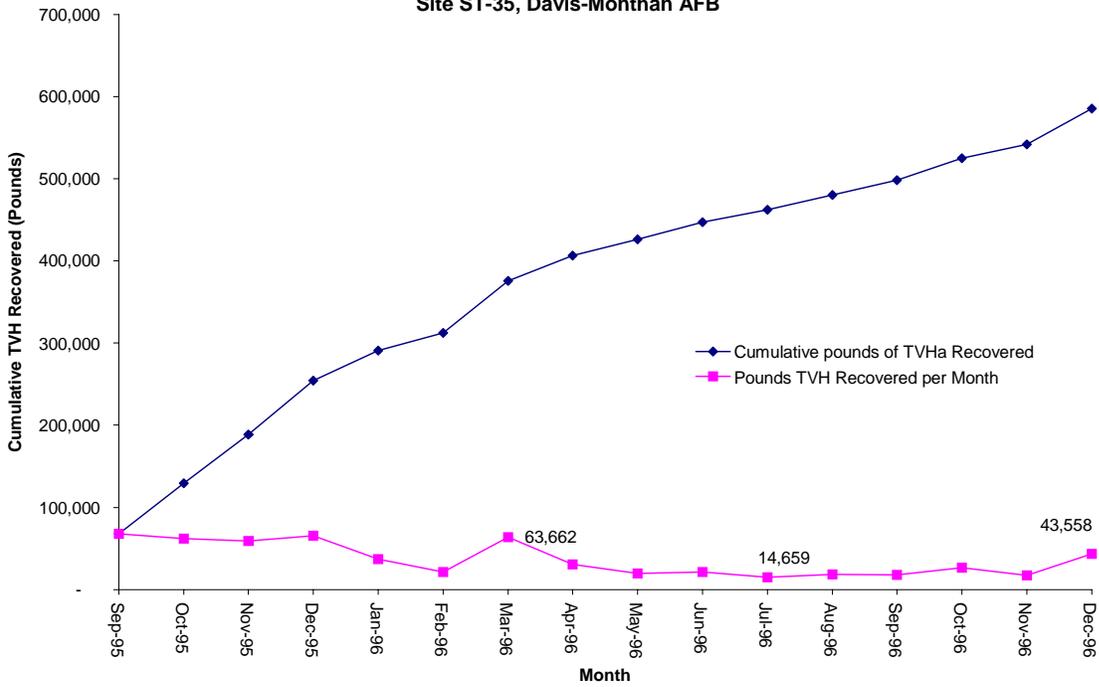
**Figure 5**  
**Monthly and Cumulative O&M Costs vs. Time**  
**Site ST-35, Davis-Monthan AFB**



Capital cost of SVE/ICE system = \$162,000

Davis\_m1.xls; Cumm Cost\_Pound

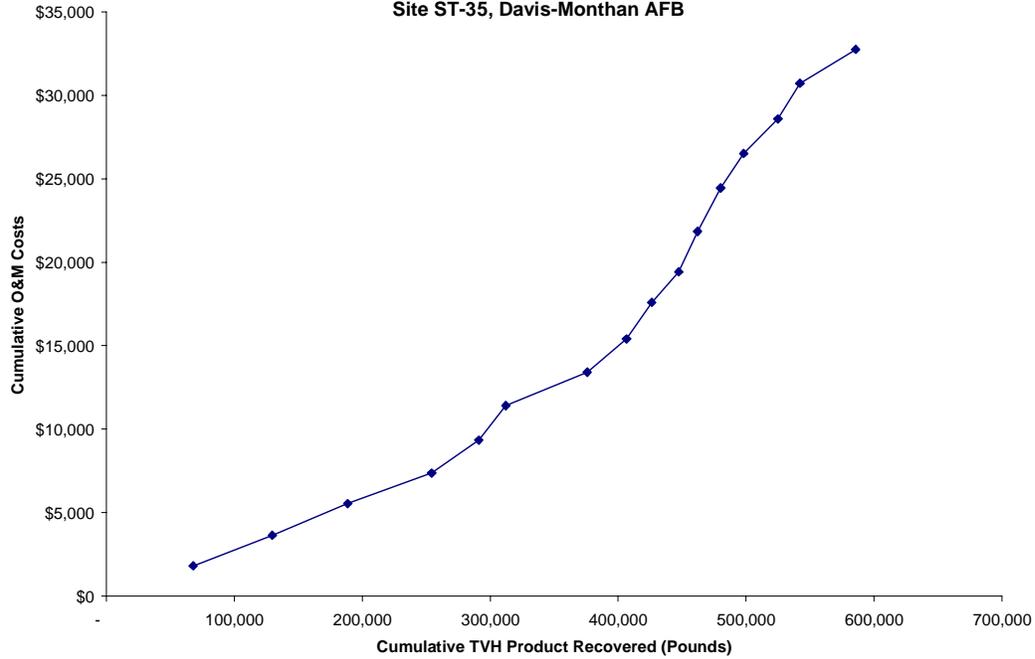
**Figure 6**  
**Monthly and Cumulative TVH<sup>a</sup> Recovered vs Time**  
**Site ST-35, Davis-Monthan AFB**



<sup>a</sup> TVH = total volatile hydrocarbons  
 Hydrocarbons were removed via an SVE system with modified ICEs

Davis\_m1.xls; Cumm Removal

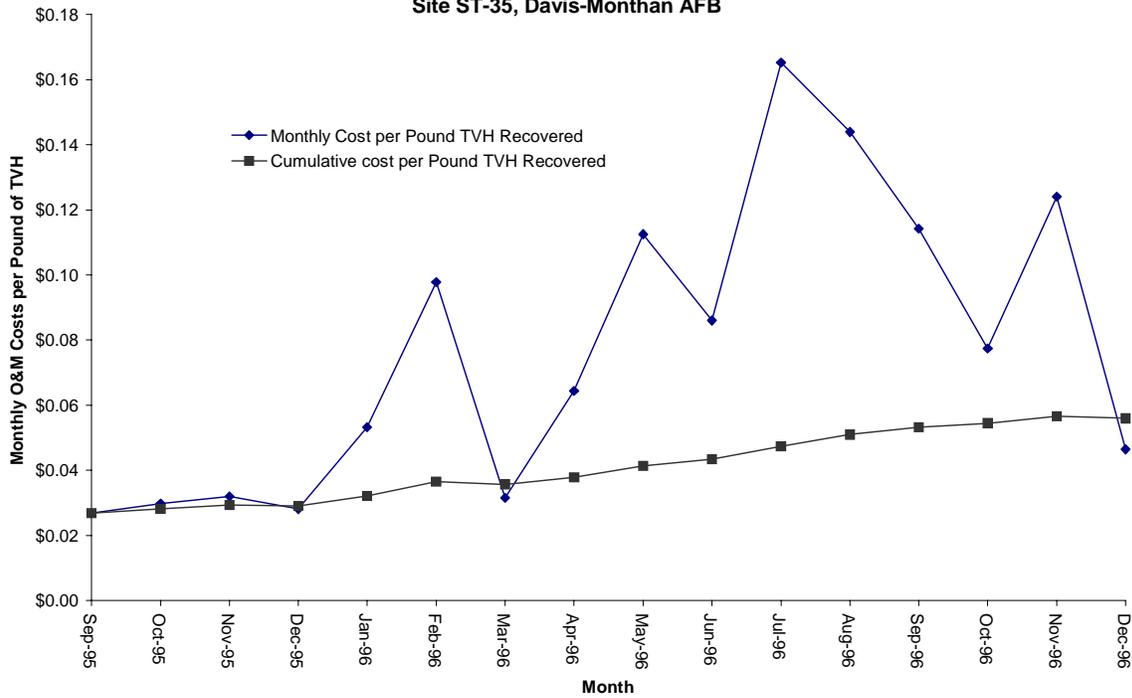
**Figure 7**  
**Cumulative O&M Costs vs. Cumulative TVH<sup>a</sup> Recovered**  
**Site ST-35, Davis-Monthan AFB**



<sup>a</sup> TVH = total volatile hydrocarbons  
 Capital Cost = \$162,000

Davis\_m1.xls; OM vs Mass

**Figure 8**  
**Cumulative and Monthly O&M Cost per Pound of TVH<sup>a</sup> vs. Time**  
**Site ST-35, Davis-Monthan AFB**



<sup>a</sup> TVH = total volatile hydrocarbons

Davis\_m1.xls; Monthly Cost

**APPENDIX A**

**Detailed Cost and Performance Data Table**

**FULL SCALE OPERATION  
SITE ST-35 DAVIS-MONTHAN AFB  
TUSCON, AZ**

| <b>Month</b> | <b>Days of Operation</b> | <b>Average Influent TVH Concentration</b> | <b>Average Flow Rate (scfm)</b> | <b>Pounds of TVH Recovered per Month</b> | <b>Cumulative pounds of TVH Recovered</b> | <b>Monthly Cost per Pound TVH Recovered</b> | <b>Cumulative cost per Pound of TVH Recovered</b> | <b>Monthly Costs</b> | <b>Cumulative Costs</b> |
|--------------|--------------------------|---|---------------------------------|--|---|---|---|----------------------|-------------------------|
| Sep-95       | 30                       | 43,000                                    | 141                             | 67,791                                   | 67,791                                    | \$0.03                                      | \$0.03  | \$1,818              | \$1,818                 |
| Oct-95       | 31                       | 39,000                                    | 137                             | 61,732                                   | 129,523                                   | \$0.03                                      | \$0.03  | \$1,831              | \$3,649                 |
| Nov-95       | 22                       | 50,000                                    | 144                             | 59,037                                   | 188,560                                   | \$0.03                                      | \$0.03  | \$1,890              | \$5,539                 |
| Dec-95       | 27                       | 42,000                                    | 155                             | 65,511                                   | 254,071                                   | \$0.03                                      | \$0.03  | \$1,839              | \$7,378                 |
| Jan-96       | 30                       | 22,000                                    | 150                             | 36,898                                   | 290,969                                   | \$0.05                                      | \$0.03  | \$1,962              | \$9,340                 |
| Feb-96       | 23                       | 19,000                                    | 130                             | 21,173                                   | 312,142                                   | \$0.10                                      | \$0.04  | \$2,070              | \$11,410                |
| Mar-96       | 31                       | 38,000                                    | 145                             | 63,662                                   | 375,804                                   | \$0.03                                      | \$0.04  | \$2,007              | \$13,417                |
| Apr-96       | 30                       | 25,000                                    | 110                             | 30,748                                   | 406,552                                   | \$0.06                                      | \$0.04  | \$1,980              | \$15,397                |
| May-96       | 31                       | 16,000                                    | 106                             | 19,595                                   | 426,147                                   | \$0.11                                      | \$0.04  | \$2,205              | \$17,602                |
| Jun-96       | 30                       | 19,000                                    | 100                             | 21,244                                   | 447,391                                   | \$0.09                                      | \$0.04  | \$1,827              | \$19,429                |
| Jul-96       | 23                       | 19,000                                    | 90                              | 14,659                                   | 462,050                                   | \$0.17                                      | \$0.05  | \$2,421              | \$21,850                |
| Aug-96       | 28                       | 22,500                                    | 77                              | 18,080                                   | 480,130                                   | \$0.14                                      | \$0.05  | \$2,602              | \$24,452                |
| Sep-96       | 30                       | 15,000                                    | 108                             | 18,048                                   | 498,178                                   | \$0.11                                      | \$0.05  | \$2,062              | \$26,514                |
| Oct-96       | 31                       | 21,000                                    | 111                             | 26,712                                   | 524,890                                   | \$0.08                                      | \$0.05  | \$2,068              | \$28,582                |
| Nov-96       | 27.5                     | 13,000                                    | 129                             | 17,228                                   | 542,118                                   | \$0.12                                      | \$0.06  | \$2,136              | \$30,718                |
| Dec-96       | 31                       | 29,000                                    | 130                             | 43,558                                   | 585,676                                   | \$0.05                                      | \$0.06  | \$2,023              | \$32,741                |