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FINAL MONTHLY ACTIVITIES REPORT MOBILE ENHANCED MULTI-PHASE EXTRACTION  
MILLINGTON SUPPACT TN  
8/10/1999  
BAT ASSOCIATES, INC.

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# **MONTHLY ACTIVITIES REPORT**

## **MOBILE ENHANCED MULTI-PHASE EXTRACTION (MEME) AT THE NAVAL EXCHANGE SERVICE STATION; NAVAL SUPPORT ACTIVITY MID-SOUTH, MILLINGTON, TENNESSEE**

**FACILITY I.D. No. 0-791718**

**FINAL August 10, 1999**

Prepared by:

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Prepared for:

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Southern Division  
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Naval Facilities Engineering Command  
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## **1.0 PROJECT DESCRIPTION AND BACKGROUND**

### **1.1 Project Description**

BAT Associates, Inc. (BAT), under contract number N62467-98-D-0938, has been tasked by the Department of the Navy, Southern Division Engineering Facilities Command to perform mobile enhanced multi-phase extraction (MEME) technology at the Naval Exchange Service Station at the Naval Support Activity (NSA) MID-South, Millington, Tennessee (Facility I.D. No. 0-791718).

The application of the MEME events are intended to be an abatement initiative to reduce the levels of dissolved benzene, toluene, ethyl benzene, and xylene (BTEX), and total petroleum hydrocarbons (TPH) constituents in groundwater. This report summarizes data obtained from the MEME performed July 19, 1999. Field activities were conducted in accordance with BAT's approved final Plan of Action and the Tennessee Department of Environment and Conservation's (TDEC) Technical Guidance Document (TGD)-016.

### **1.2 Project Background**

The Naval Exchange Service Station is located in the northwestern quadrant of NSA Memphis. The site encompasses approximately three acres, is flat, drains surficially to the west, and is covered with asphalt pavement.

A loss of gasoline was discovered in February 1986 by Exchange Service Station personnel. The initial release was reported to TDEC in March 1986. A preliminary investigation of this leak by Navy personnel revealed that a pipe joint on the regular unleaded gasoline fuel line was leaking. As part of former site assessments, twenty-two (22) groundwater monitoring wells were installed.

Several groundwater monitoring events performed between 1987 and 1998 indicate that the contaminated groundwater has not moved from the immediate vicinity of the fuel line leak. TDEC has established that cleanup levels for groundwater for the "non-drinking water" classification is 0.070 ppm for benzene and 1.0 ppm for TPH. TPH and Benzene concentrations in the groundwater did exceed TDEC action levels for a non-drinking aquifer in ten (10) monitoring wells (MEM-757-1 through -3, MEM-757-6 through -8, MEM-757-12 through -14, and MEM-757-B3). Therefore, only these ten (10) wells were used for this MEME event. Location of the wells is shown on Figure 1-1.

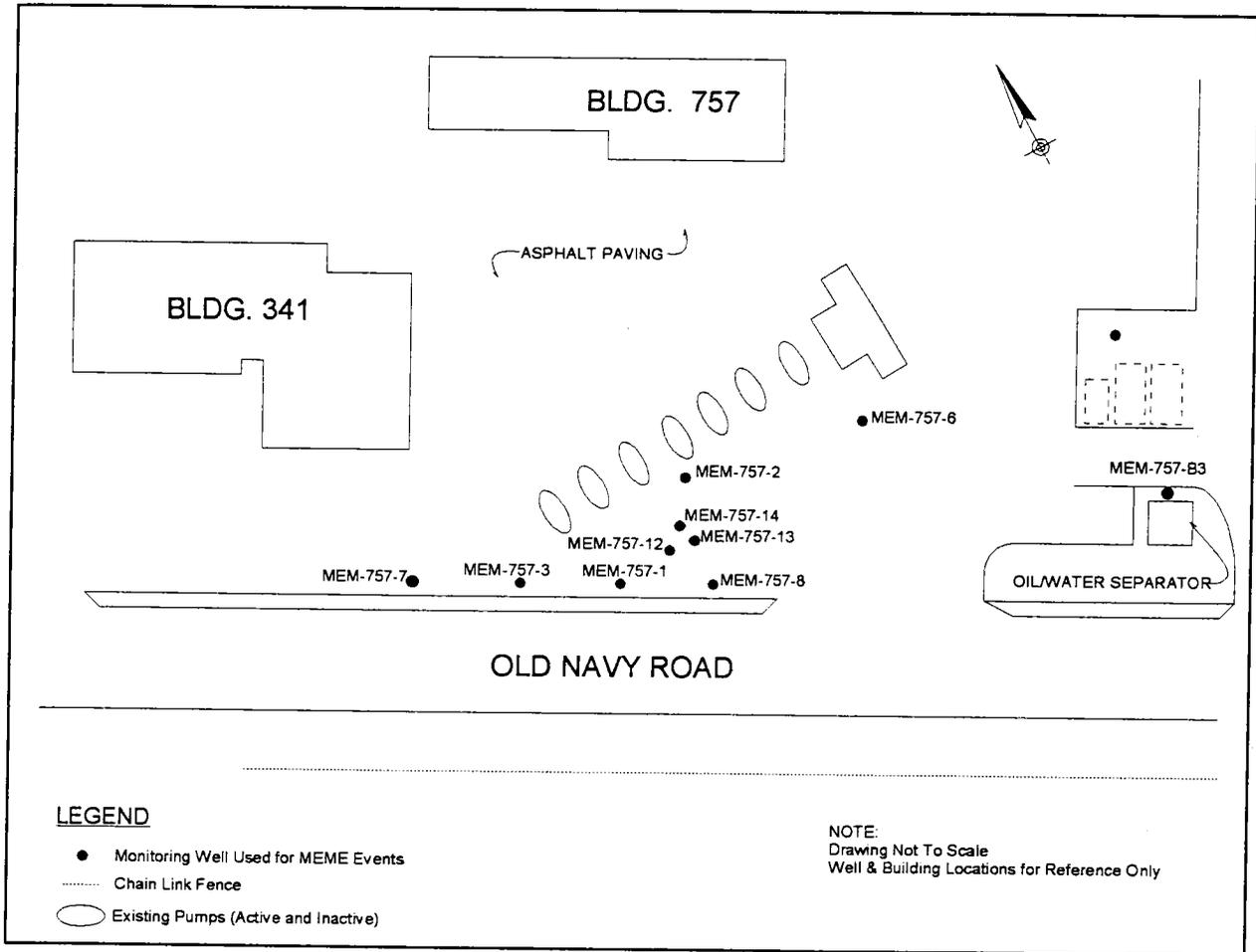


Figure 1-1 Site Map and Monitoring Well Locations

### 1.3 MEME Technology Employed

BAT utilized Enhanced Fluid Recovery (EFR™), a mobile variation of what is commonly referred to as multi-phase extraction, dual-phase extraction, and vacuum enhanced recovery. This technology is a remediation method that utilizes high vacuum pressures and flow rates to remove multiple phase (i.e. vapor, adsorbed, dissolved, and free phase) volatile organic compounds (VOCs) from the subsurface. It utilizes high vacuum and high flow rates simultaneously connected to monitoring or recovery wells.

The MEME simultaneously removes vapors, free product, and groundwater from the subsurface. It volatilizes adsorbed and free phase VOCs through a process similar to soil vapor extraction, but with much higher vacuum and radius of influence. MEME can also treat adsorbed phase VOCs existing in the "smear zone" (i.e. the zone of seasonal or climatic groundwater fluctuation) that act as a source for dissolved phase VOCs. MEME dewateres and exposes the smear zone to the effects of "high rate" soil vapor extraction. MEME also introduces oxygen to the vadose zone and saturated zones, thereby enhancing aerobic biodegradation.

## 2.0 SUMMARY OF RESULTS

This MEME is the ninth event that has been conducted at this site. Eight previous events were conducted January 15-16, 1998 (initial event), January 29-30, 1998 (second event), January 19, 1999 (third event), February 10, 1999 (fourth event), March 15, 1999 (fifth event), April 15, 1999 (sixth event), May 17, 1999 (seventh event), and June 18, 1999 (eighth event).

Separate phase hydrocarbons (SPH) were not detected prior to, or upon completion of, conducting the July 19, 1999 MEME event. SPH has also not been detected during the previous eight MEME events. This MEME event was performed for a duration of eight hours at ten extraction points, consisting of the initial three hours at monitoring wells MEM-2, MEM-8, MEM-13, and MEM-14, the ensuing three hours at MEM-1, MEM-3, MEM-7, and MEM-12, and the final two hours at MEM-6 and B-3.

The first and second events were conducted over two days consisting of eight hours at wells MEM-1, MEM-2, MEM-3, MEM-7, MEM-8, MEM-12, MEM-13, and MEM-14 on the first day, and eight hours at wells MEM-6 and B3 on the second day. The third event was conducted for eight hours consisting of the initial three hours at monitoring wells MEM-2, MEM-8, MEM-13, and MEM-14, the ensuing three hours at wells MEM-1, MEM-3, MEM-7, and MEM-12, and the final two hours at MEM-6 and B-3. The fourth, fifth, sixth, seventh, and eighth events were conducted in the same configuration and for the same duration as this ninth event.

### 2.1 Petroleum Hydrocarbons Removed

A calculated total of 1,262 pounds of carbon (approximately equivalent to 1,688 pounds of adsorbed petroleum hydrocarbons - 278 equivalent gallons of gasoline) were removed during this MEME event. This recovered mass/volume of petroleum hydrocarbons represents an increase from the removal achieved during the eighth event (i.e. a calculated total of 834 pounds of petroleum hydrocarbons - approximately 138 equivalent gallons of gasoline), and is within the range of removals achieved during previous events (i.e. calculated total of 499 to 3,704 pounds of petroleum hydrocarbons - approximately 82 to 611 equivalent gallons of gasoline). A combined total of 12,044 pounds of petroleum hydrocarbons (approximately 1,986 gallons of gasoline) have been recovered during the nine MEME events conducted at this site.

A summary of petroleum hydrocarbons removed to date is shown in Table 1.

| <b>TABLE 1</b>                                   |                         |  |   |
|--|-------------------------|--|---|
| <b>Summary of Petroleum Hydrocarbons Removed</b> |                         |  |   |
| <b>MEME Event Number</b>                         | <b>MEME Event Date</b>  | <b>Petroleum Hydrocarbons Removed (lbs.)</b> | <b>Equivalent Gasoline Removed (gal.)</b> |
| 1*   | January 15 and 16, 1998 | 905  | 149                                       |
| 2*   | January 29 and 30, 1998 | 581  | 95  |
| 3  | January 19, 1999        | 3,704  | 611                                       |
| 4  | February 10, 1999       | 1,307  | 216                                       |
| 5  | March 15, 1999          | 1,839  | 304                                       |
| 6  | April 15, 1999          | 499  | 82  |
| 7  | May 17, 1999            | 687  | 113                                       |
| 8  | June 18, 1999           | 834  | 138                                       |
| 9  | July 19, 1999           | 1,688  | 278                                       |
| <b>Total Removed To Date</b>                     |                         | <b>12,044</b>                                | <b>1,986</b>                              |
| *Performed by others                             |                         |  |   |

The carbon removal rate ranged from 1.7 to 404 pounds per hour during this MEME event. The removal rate decreased from 404 to 96 pounds per hour during the initial three hours of extraction from wells MEM-2, MEM-8, MEM-13, and MEM-14. Upon commencement of extraction from wells MEM-1, MEM-3, MEM-7, and MEM-12, the carbon removal rate initially increased to 192 pounds per hour and ranged from 119 to 202 pounds per hour during the ensuing three hours of extraction. Upon commencement of extraction from MEM-6 and B-3, the carbon removal rate decreased from 5.9 to 1.7 pounds per hour during the final 2 hours of this event. These removal rates encompassed the range of removal achieved during previous events (i.e. 0.7 to 1,192 pounds per hour).

## 2.2 Offgas Concentrations

Offgas concentrations ranged from 600 to >100,000 ppm during this MEME event. Offgas concentrations decreased from >100,000 to 26,000 ppm during the initial three hours of extraction from MEM-2, MEM-8, MEM-13, and MEM-14. Upon commencement of extraction from MEM-1, MEM-3, MEM-7, and MEM-12, offgas concentrations initially decreased from 72,000 to 40,000 ppm during the initial 0.25 hour and ranged from 22,000 to 50,000 ppm during the ensuing 2.75 hours of extraction. Upon commencement of extraction from wells MEM-6 and B-3, the offgas

concentrations decreased from 2,000 to 600 ppm during the final two hours of this event. These offgas concentrations ranged higher than those recorded during the previous event (i.e. 400 to 82,000 ppm).

### 2.3 Flow Rates

Flow rates attained during this MEME event ranged from 378 to 504 CFM (256 to 379 dry standard CFM). The flow rates increased from 378 to 409 CFM during the initial one hour of this event and ranged from 394 to 409 CFM during the ensuing two hours of extraction from MEM-2, MEM-8, MEM-13, and MEM-14. Upon commencement of extraction from MEM-1, MEM-3, MEM-7, and MEM-12, the flow rates increased from 409 to 504 CFM during the initial 1.5 hours and ranged from 472 to 504 CFM during the ensuing 1.5 hours of this event. Upon commencement of extraction from MEM-6 and B-3, the flow rates decreased from 394 to 378 CFM during the initial 0.5 hour and remained stable at 378 CFM during the final 1.5 hours of this event. These flow rates are within the range of flow rates recorded during the ninth event (i.e. 367 to 587 CFM) and during previous events (i.e. 236 to 1,100 CFM).

### 2.4 Extraction Wellhead Vacuum Readings

The range of vacuum readings recorded at the extraction wells during this MEME event are detailed in the field data sheets (Appendix A) and are summarized in Table 2 below.

| Extraction Well Location | Vacuum Reading<br>(in. of mercury) |
|--------------------------|------------------------------------|
| MEM-1                    | 6 to 7                             |
| MEM-2                    | 14 to 15                           |
| MEM-3                    | 11 to 12                           |
| MEM-6                    | 16                                 |
| MEM-7                    | 8 to 9                             |
| MEM-8                    | 9 to 10                            |
| MEM-12                   | 12 to 13                           |
| MEM-13                   | 13 to 14                           |
| MEM-14                   | 12 to 13                           |
| B-3                      | 6 to 7                             |

Differential pressures were recorded during this event at wells MEM-3 and MEM-6 to assess the vacuum induced by MEME in the vadose zone. Differential pressure data are detailed in Appendix A.

Groundwater levels were recorded during this event to determine drawdown of the aquifer during the MEME and is detailed below.

| <u>Monitoring Well</u> | <u>Maximum Change</u>         | <u>Nearest Extraction Well Used For<br/>MEME Event<br/>(Approx. Distance)</u> |
|------------------------|-------------------------------|---|
| MEM-3                  | -0.17 inches of water         | MEM-14 (50 feet)  |
| MEM-6                  | -2.64 / -2.47 inches of water | B-2 (75 feet) / MEM - 12 (90 feet)  |

## 2.5 Groundwater Disposal

Approximately 697 gallons of liquid (SPH was not detected in the vacuum truck tank upon conclusion of MEME activities) were removed during this MEME and off loaded to an on-base oil/water separator at the direction of the NSA environmental personnel.

## 2.6 Conclusions and Recommendations

Analytical data from past sampling events show a trend that indicates the MEME application is effective in reducing the levels of dissolved BTEX and total TPH constituents in the groundwater. However, in the ten wells used for the MEME, the petroleum contaminants are still above the established TDEC "non-drinking water" classification cleanup levels (0.070 ppm for benzene and 1.0 ppm for TPH) for groundwater.

An additional groundwater sampling event has been scheduled for the week of August 8, 1999. Once sampling is complete, the data can then be compared with data from groundwater sampling and past MEME events in order to gain a better understanding of the effectiveness of MEME activities over the past eight months.

**APPENDIX A**  
**MEME FIELD DATA SHEETS**

# EFR<sup>®</sup> FIELD DATA SHEET

Client: BAT Env. Facility Name: NEX (Navy Exchange) Auto Part/Fuel Lock Facility ID#: 0-791718 Event #: 9  
 Facility Address: 757 Old Navy Road, Millington, Tennessee Technician: Lewis Date: 7/19/99

| Extraction Well(s) | Start Time (hh:mm) | End Time (hh:mm) | Interval Time (min) | Extraction Well-head Vacuum (in. Hg) |       |       |       |       |       |       |        |        |        |     |                          |                         | Offgas Velocity (ft/min) | Total Flow (CFM) | Stack Gas Temp. (° F) | Total Flow (DSCFM) | Offgas Concentrations    |         |     | Rate of Carbon Removal (lbs/hour) | Total Carbon Removed (pounds) |
|--------------------|--------------------|------------------|---------------------|--------------------------------------|-------|-------|-------|-------|-------|-------|--------|--------|--------|-----|--------------------------|-------------------------|--------------------------|------------------|-----------------------|--------------------|--------------------------|---------|-----|-----------------------------------|-------------------------------|
|                    |                    |                  |                     | Inlet                                | MEM-1 | MEM-2 | MEM-3 | MEM-6 | MEM-7 | MEM-8 | MEM-12 | MEM-13 | MEM-14 | B-3 | Initial PPM <sub>v</sub> | Ending PPM <sub>v</sub> |                          |                  |                       |                    | Average PPM <sub>v</sub> |         |     |                                   |                               |
|                    |                    |                  |                     |                                      | -     | -     | -     | -     | -     | -     | -      | -      | -      |     |                          |                         |                          |                  |                       |                    |                          | -       |     |                                   |                               |
| MEM-2,8,13,14      | 7:00               | 7:15             | 15                  | 18                                   | -     | 15    | -     | -     | -     | -     | 9      | -      | 14     | 13  | -                        | 4,800                   | 378                      | 90               | 360                   | 100,000            | 100,000                  | 100,000 | 404 | 101                               |                               |
| "                  | 7:15               | 7:30             | 15                  | 17                                   | -     | 15    | -     | -     | -     | -     | 9      | -      | 14     | 13  | -                        | 4,800                   | 378                      | 110              | 345                   | 100,000            | 100,000                  | 100,000 | 387 | 97                                |                               |
| "                  | 7:30               | 7:45             | 15                  | 17                                   | -     | 15    | -     | -     | -     | -     | 10     | -      | 13     | 12  | -                        | 5,000                   | 394                      | 120              | 348                   | 100,000            | 100,000                  | 100,000 | 391 | 98                                |                               |
| "                  | 7:45               | 8:00             | 15                  | 17                                   | -     | 15    | -     | -     | -     | -     | 10     | -      | 13     | 12  | -                        | 5,200                   | 409                      | 130              | 347                   | 100,000            | 100,000                  | 100,000 | 390 | 97                                |                               |
| "                  | 8:00               | 8:30             | 30                  | 16                                   | -     | 14    | -     | -     | -     | -     | 10     | -      | 13     | 12  | -                        | 5,000                   | 394                      | 150              | 294                   | 100,000            | 66,000                   | 83,000  | 274 | 137                               |                               |
| "                  | 8:30               | 9:00             | 30                  | 16                                   | -     | 14    | -     | -     | -     | -     | 10     | -      | 13     | 12  | -                        | 5,000                   | 394                      | 150              | 294                   | 66,000             | 52,000                   | 59,000  | 194 | 97                                |                               |
| "                  | 9:00               | 9:30             | 30                  | 16                                   | -     | 14    | -     | -     | -     | -     | 10     | -      | 13     | 12  | -                        | 5,200                   | 409                      | 150              | 306                   | 52,000             | 30,000                   | 41,000  | 141 | 70                                |                               |
| MEM-1,3,7,12       | 9:30               | 10:00            | 30                  | 16                                   | -     | 14    | -     | -     | -     | -     | 10     | -      | 13     | 12  | -                        | 5,200                   | 409                      | 150              | 306                   | 30,000             | 26,000                   | 28,000  | 96  | 48                                |                               |
| "                  | 10:00              | 10:15            | 15                  | 15                                   | 6     | -     | 11    | -     | 8     | -     | 12     | -      | -      | -   | -                        | 5,200                   | 409                      | 150              | 306                   | 72,000             | 40,000                   | 56,000  | 192 | 48                                |                               |
| "                  | 10:15              | 10:30            | 15                  | 15                                   | 7     | -     | 12    | -     | 9     | -     | 13     | -      | -      | -   | -                        | 5,800                   | 457                      | 150              | 341                   | 40,000             | 22,000                   | 31,000  | 119 | 30                                |                               |
| "                  | 10:30              | 11:00            | 30                  | 15                                   | 7     | -     | 12    | -     | 9     | -     | 12     | -      | -      | -   | -                        | 6,000                   | 472                      | 150              | 353                   | 22,000             | 40,000                   | 31,000  | 123 | 61                                |                               |
| "                  | 11:00              | 11:30            | 30                  | 15                                   | 7     | -     | 12    | -     | 9     | -     | 12     | -      | -      | -   | -                        | 6,400                   | 504                      | 150              | 376                   | 40,000             | 50,000                   | 45,000  | 190 | 95                                |                               |
| "                  | 11:30              | 12:00            | 30                  | 15                                   | 7     | -     | 12    | -     | 9     | -     | 12     | -      | -      | -   | -                        | 6,400                   | 504                      | 150              | 376                   | 50,000             | 46,000                   | 48,000  | 202 | 101                               |                               |
| "                  | 12:00              | 12:30            | 30                  | 15                                   | 7     | -     | 12    | -     | 9     | -     | 12     | -      | -      | -   | -                        | 6,400                   | 504                      | 150              | 376                   | 46,000             | 40,000                   | 43,000  | 181 | 91                                |                               |
| MEM-6;B-3          | 12:30              | 13:00            | 30                  | 15                                   | 7     | -     | 12    | -     | 9     | -     | 12     | -      | -      | -   | -                        | 6,000                   | 472                      | 140              | 379                   | 40,000             | 40,000                   | 40,000  | 170 | 85                                |                               |
| "                  | 13:00              | 13:15            | 15                  | 18                                   | -     | -     | -     | 16    | -     | -     | -      | -      | -      | -   | -                        | 5,000                   | 394                      | 150              | 294                   | 2,000              | 1,600                    | 1,800   | 5.9 | 1.5                               |                               |
| "                  | 13:15              | 13:30            | 15                  | 17                                   | -     | -     | -     | 16    | -     | -     | -      | -      | -      | -   | -                        | 4,800                   | 378                      | 150              | 282                   | 1,600              | 1,600                    | 1,600   | 5.1 | 1.3                               |                               |
| "                  | 13:30              | 14:00            | 30                  | 17                                   | -     | -     | -     | 16    | -     | -     | -      | -      | -      | -   | -                        | 4,800                   | 378                      | 160              | 256                   | 1,600              | 800                      | 1,200   | 3.4 | 1.7                               |                               |
| "                  | 14:00              | 14:30            | 30                  | 17                                   | -     | -     | -     | 16    | -     | -     | -      | -      | -      | -   | -                        | 4,800                   | 378                      | 160              | 256                   | 800                | 600                      | 700     | 2.0 | 1.0                               |                               |
| "                  | 14:30              | 15:00            | 30                  | 17                                   | -     | -     | -     | 16    | -     | -     | -      | -      | -      | -   | -                        | 4,800                   | 378                      | 160              | 256                   | 600                | 600                      | 700     | 1.7 | 0.9                               |                               |

| Vacuum Truck Information |                |
|--------------------------|----------------|
| Subcontractor:           | NB Env.        |
| Invoice No.:             |                |
| Truck Operator:          | Crabtree       |
| Truck No.:               | KingVac VK-32  |
| Vacuum Pump Type:        | Liquid Ring    |
| Tank Capacity:           | 2,866          |
| Stack I.D. (inches):     | 3.8            |
| Calibration Gas:         | 500 ppm Hexane |
| Molecular Weight:        | 75 g/mole      |

| Well No. | Breather Port (CFM) | Stinger Depth (feet) |
|----------|---------------------|----------------------|
| MEM-1    | 0 (closed)          | 10                   |
| MEM-2    | 0 (closed)          | 10                   |
| MEM-3    | 0 (closed)          | 10                   |
| MEM-6    | 0 (closed)          | 10                   |
| MEM-7    | 0 (closed)          | 10                   |
| MEM-8    | 0 (closed)          | 10                   |
| MEM-12   | 0 (closed)          | 10                   |
| MEM-13   | 0 (closed)          | 10                   |
| MEM-14   | 0 (closed)          | 10                   |
| B-3      | 0 (closed)          | 10                   |

| Recovery/Disposal Information  |        |
|--------------------------------|--------|
| Total Gal. of Liquid:          | 697    |
| Disposal Facility:             | *      |
| Manifest No.:                  | *      |
| Total Lbs. of Carbon (Offgas): | 1,262  |
| Cum. Lbs. Carbon Removed:      | 8,615  |
| Lbs. Hydrocarbons Removed:     | 1,688  |
| Cum. Lbs. Hydrocarbons:        | 12,044 |
| Equiv. Gal. Removed:           | 278    |
| Cum. Equiv. Gal. Removed:      | 1,986  |

Comments: \* Offloaded extracted liquid to an on-site oil/water separator



# EFR<sup>®</sup> EVENT GAUGING DATA

| Client: BAT Env.  |                        | Facility Name: NEX (Navy Exchange) Auto Part/Fuel Lock |                               |                       |                      | Facility ID#: 0-791718       |                       | Event #: 9           |                               |
|---|------------------------|--|-------------------------------|-----------------------|----------------------|------------------------------|-----------------------|----------------------|-------------------------------|
| Facility Address: 757 Old Navy Road, Millington, Tennessee                        |                        |  |                               |                       |                      | Technician: Lewis            |                       | Date: 7/19/99        |                               |
| Well Designation  | Well Diameter (inches) | Total Depth (feet)                                     | Before EFR <sup>®</sup> Event |                       |                      | After EFR <sup>®</sup> Event |                       |                      | Depth to Liquid Change (feet) |
|   |                        |  | Depth to SPH (feet)           | Depth to Water (feet) | SPH Thickness (feet) | Depth to SPH (feet)          | Depth to Water (feet) | SPH Thickness (feet) |                               |
| MEM-1   | 4                      |  | -                             | 5.63                  | 0.00                 | -                            | 9.90                  | 0.00                 | -4.27                         |
| MEM-2   | 4                      |  | -                             | 4.46                  | 0.00                 | -                            | 10.30                 | 0.00                 | -5.84                         |
| MEM-3   | 4                      |  | -                             | 5.33                  | 0.00                 | -                            | 9.70                  | 0.00                 | -4.37                         |
| MEM-6   | 4                      |  | -                             | 4.64                  | 0.00                 | -                            | 10.10                 | 0.00                 | -5.46                         |
| MEM-7   | 4                      |  | -                             | 5.38                  | 0.00                 | -                            | 9.70                  | 0.00                 | -4.32                         |
| MEM-8   | 4                      |  | -                             | 5.83                  | 0.00                 | -                            | 9.90                  | 0.00                 | -4.07                         |
| MEM-11  | 4                      |  | -                             | 5.89                  | 0.00                 | -                            | 6.30                  | 0.00                 | -0.41                         |
| MEM-12  | 4                      |  | -                             | 5.74                  | 0.00                 | -                            | 11.50                 | 0.00                 | -5.76                         |
| MEM-13  | 4                      |  | -                             | 5.43                  | 0.00                 | -                            | 11.20                 | 0.00                 | -5.77                         |
| MEM-14  | 6                      |  | -                             | 5.33                  | 0.00                 | -                            | 10.40                 | 0.00                 | -5.07                         |
| MEM-16  | 6                      |  | -                             | 7.40                  | 0.00                 | -                            | 7.35                  | 0.00                 | 0.05                          |
| B-3   | 4                      |  | -                             | 6.29                  | 0.00                 | -                            | 9.70                  | 0.00                 | -3.41                         |
| B-4   | 4                      |  | -                             | 6.75                  | 0.00                 | -                            | 6.75                  | 0.00                 | 0.00                          |
|  |                        |  | Comments:                     |                       |                      |                              |                       |                      |                               |
|   |                        |  |                               |                       |                      |                              |                       |                      |                               |
|   |                        |  |                               |                       |                      |                              |                       |                      |                               |
|   |                        |  |                               |                       |                      |                              |                       |                      |                               |

Differential Pressure and Groundwater Drawdown Data Recorded During EFR®  
 Event No. 9 (July 19, 1999)  
 NEX (Navy Exchange) Auto Part/Fuel Lock  
 757 Old Navy Road  
 Millington, Tennessee

**DIFFERENTIAL PRESSURE DATA**

|                          |              | Well Designation:                                 |           |           |
|--------------------------|--------------|---|-----------|-----------|
|                          |              | MEM-3   | MEM-6     | MEM-6     |
| Nearest Extraction Well: |              | MEM-14  | MEM-2     | MEM-12    |
| (Approx. Distance):      |              | (50 feet)   | (75 feet) | (90 feet) |
| Time                     | Elapsed Time | Differential Pressure Readings (inches of water): |           |           |
| 7:30                     | 0.5 hr.      | 0.00  | -         | -         |
| 8:00                     | 1.0 hr.      | 0.00  | -         | -         |
| 8:30                     | 1.5 hrs.     | 0.00  | -2.58     | -         |
| 9:00                     | 2.0 hrs.     | -0.02   | -2.64     | -         |
| 10:00                    | 3.0 hrs.     | -0.17   | -2.51     | -         |
| 11:00                    | 4.0 hrs.     | -   | -         | -1.70     |
| 12:00                    | 5.0 hrs.     | -   | -         | -2.12     |
| 13:00                    | 6.0 hrs.     | -   | -         | -2.47     |
| Maximum Change:          |              | -0.17   | -2.64     | -2.47     |

**GROUNDWATER DRAWDOWN DATA**

|                          |              | Well Designation:                           |
|--------------------------|--------------|---|
|                          |              | MEM-3                                       |
| Nearest Extraction Well: |              | MEM-14                                      |
| (Approx. Distance):      |              | (50 feet)                                   |
| Time                     | Elapsed Time | Depth to Liquid (feet below top of casing): |
| Prior to EFR®            |              | 5.33  |
| 10:00                    | 3.0 hrs.     | 5.45  |
| Maximum Change:          |              | -0.12                                       |