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FINAL MONTHLY ACTIVITIES REPORT MOBILE ENHANCED MULTI-PHASE EXTRACTION
WITH TRANSMITTAL MILLINGTON SUPPACT TN
3/4/1999
BAT ASSOCIATES, INC.

BAT

BAT Associates, Inc.

ENVIRONMENTAL HEALTH & SAFETY SERVICES

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March 4, 1999

Mr. John Karlyk
ATTN: Code 1846
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, SC 29419-1910

**RE: FINAL MONTHLY ACTIVITIES REPORT FOR THE MEME CONDUCTED
FEBRUARY 10, 1999 AT THE NAVAL SUPPORT ACTIVITY MID-SOUTH,
MILLINGTON, TENNESSEE; FACILITY ID No. 0-791-718**

Dear Mr. Karlyk:

BAT Associates, Inc. is pleased to submit one (1) copy of the above referenced monthly report. Three (3) copies of this report have been forwarded to Mr. Randy Wilson. Comments from the draft submittal have been incorporated into this final report.

BAT is scheduled to conduct the fifth MEME event on March 15, 1999. Should you have any questions or require additional information, please contact me at (423) 481-8105.

Sincerely,



James Summers
Project Manager

CA:JS

cc: R. Wilson (NAS)
File 983019

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. 0-791#718

FINAL March 4, 1999

Prepared by:

BAT Associates, Inc.
704 South Illinois Ave, Suite C-202
Oak Ridge, Tennessee 37830

Prepared for:

Department of the Navy
Southern Division
Under Contract No. N62467-98-D-0938
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 February 10, 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.

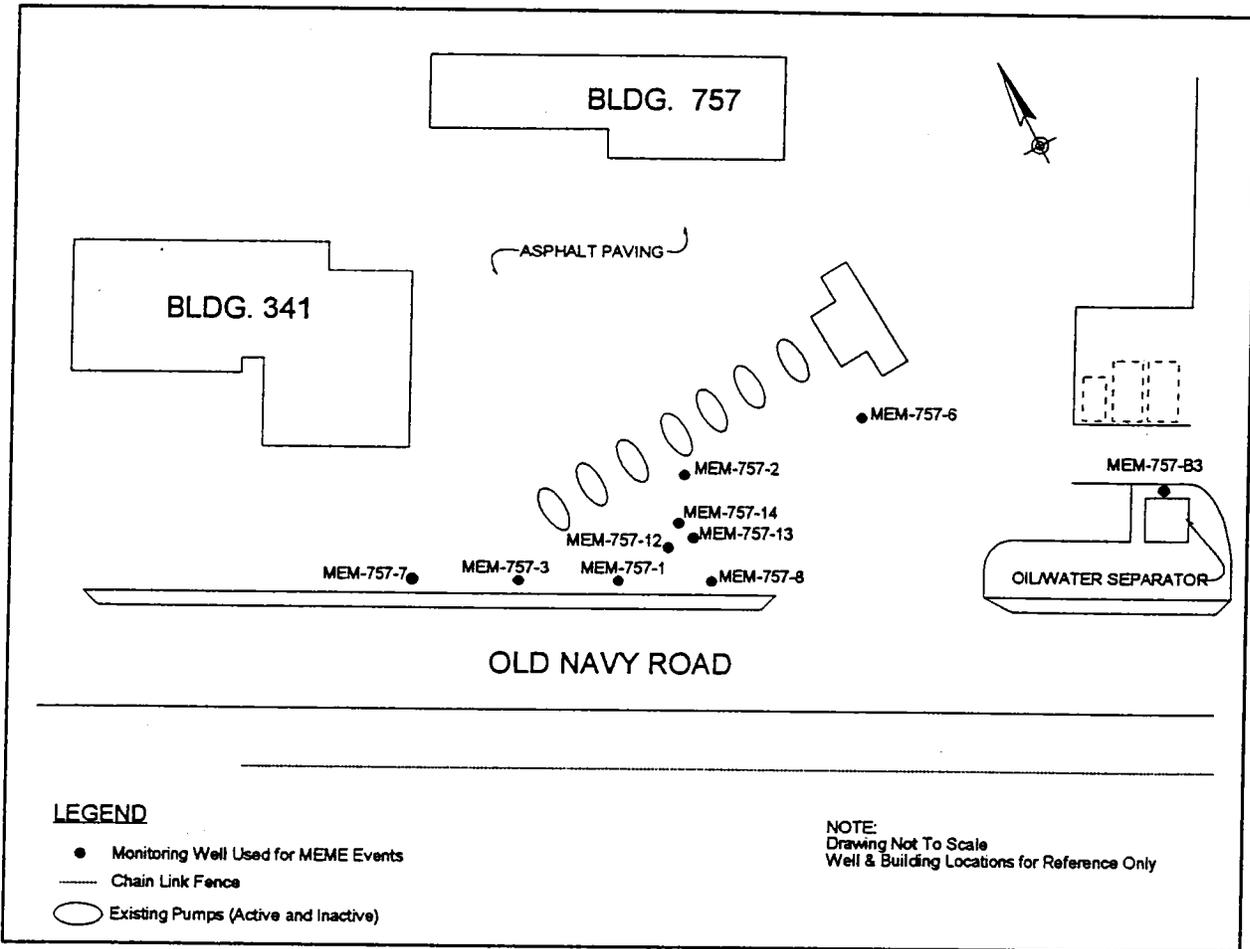


Figure 1-1 Site Map and Monitoring Well Locations

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 fourth event that has been conducted at this site. Three previous events were conducted January 15-16, 1996 (initial event), January 29-30, 1998 (second event), and January 19, 1999 (third event).

Separate phase hydrocarbons (SPH) were not detected prior to, or upon completion of, conducting the February 10, 1999 MEME event. SPH has not been detected prior to the previous three 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 six hours at monitoring well MEM-1, MEM-2, MEM-3, MEM-7, MEM-8, MEM-12, MEM-13, and MEM-14 and the final two hours at MEM-6 and B-3.

2.1 Petroleum Hydrocarbons Removed

A calculated total of 898 pounds of carbon (approximately equivalent to 1,307 pounds of petroleum hydrocarbons - 216 equivalent gallons of gasoline) were removed during this MEME event. This recovered mass/volume of petroleum hydrocarbons represents a decrease from the removals achieved during the third event (i.e. a calculated total of 3,704 pounds of petroleum hydrocarbons - approximately 611 equivalent of gasoline), and an increase in the removals achieved during previous events (i.e. a calculated total of 581 to 905 pounds of petroleum hydrocarbons, approximately 95 - 149 equivalent gallons of gasoline). A calculated total of 6,497 pounds of petroleum hydrocarbons (approximately 1,071 gallons of gasoline) have been recovered during the four MEME events at this site.

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

TABLE 1			
Summary of Petroleum Hydrocarbons Removed			
MEME Event Number	MEME Event Date	Petroleum Hydrocarbons Removed (lbs.)	Equivalent Gasoline Removed (gal.)
1*	January 15 and 16, 1998	905	149
2*	January 29 and 30, 1998	581	95
3	January 19, 1999	3704	611
4	February 10, 1999	1307	216
Total Removed To Date		6497	1071
*Performed by others			

The carbon removal rate ranged from 1.7 to 315 pounds per hour during this MEME event. The removal rate decreased from 315 to 97 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 increased from 179 to 195 pounds during the initial one hour and decreased to 99 pounds per hour during the ensuing two hours of extraction. Upon commencement of extraction from MEM-6 and B-3, the carbon removal rate decreased to 1.8 pounds per hour and ranged from 1.5 to 1.8 pounds per hour during the final two hours of this event. These removal rates ranged lower than those achieved during the third event (i.e. 4 to 1,192 pounds per hour) and encompassed the range of removal rates achieved during previous events (i.e. 3 to 165 pounds per hour).

2.2 Offgas Concentrations

Offgas concentrations ranged from 620 to 90,000 ppm during this MEME event. Offgas concentrations decreased from 90,000 to 28,000 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 increased from 38,000 to 56,000 ppm during the initial 0.5 hour and decreased to 20,000 ppm during the ensuing 2.5 hours of extraction. Upon commencement of extraction from wells MEM-6 and B-3, the offgas concentrations decreased from 1,200 to 620 ppm during the initial 0.25 hour and increased to and stabilized at 1,000 ppm during the final 1.75 hours of this event. These offgas concentrations ranged lower than those recorded during the third event (i.e. 1,400 to 100,000 ppm) and encompassed the range of concentrations recorded during previous events (i.e. 700 to 30,000 ppm).

2.3 Flow Rates

Flow rates attained during this MEME event ranged from 257 to 477 CFM (152 to 383 DSCFM),

including approximately 11 CFM attributed to atmospheric air inflow at the MEM-2 wellhead breather ports. Breather ports are sometimes utilized to enhance the recovery of petroleum hydrocarbons and/or groundwater. The flow rate increased from 330 to 440 CFM during the initial one hour of this event and remained stable at 440 CFM during the ensuing two hours of extraction from wells 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 rate remained stable at 440 CFM during the initial two hours and decreased to 477 CFM during the ensuing one hour of extraction. Upon commencement of extraction from wells MEM-6 and B-3, the flow rate decreased to and remained stable at 257 CFM during the final two hours of this event. These flow rates were within the lower range of flow rates recorded during the third event (i.e. 257 to 1,100 CFM) and ranged lower than those recorded during the previous events (i.e. 403 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 (in. of mercury)
MEM-1	10 to 14
MEM-2	15 to 17
MEM-3	14 to 16
MEM-6	15 to 16
MEM-7	8
MEM-8	8
MEM-12	7 to 15
MEM-13	15 to 17
MEM-14	16
B-3	10 to 12

The vacuum readings recorded at extraction well MEM-2 may have been biased by atmospheric air inflow at the wellhead breather port.

2.5 Groundwater Disposal

Approximately 1,355 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 NAS Environmental Protection Coordinator.

APPENDIX A
MEME FIELD DATA SHEETS

EFR[®] FIELD DATA SHEET

Client: BAT Env. Facility Name: NEX (Navy Exchange) Auto Part/Fuel Lock Facility ID#: 0-740479 Event #: 6
 Facility Address: 757 Old Navy Road, Millington, Tennessee Technician: Lewis Date: 2/10/99

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 _v	Ending PPM _v	Average PPM _v			
					-	-	-	-	-	-	-	-	-											-
MEM-2,8,13,14	8:00	8:15	15	21	-	17	-	-	-	-	8	-	17	16	-	1,800	330	80	319	90,000	86,000	88,000	315	79
	8:15	8:30	15	20	-	17	-	-	-	-	8	-	17	16	-	1,800	330	110	301	86,000	80,000	83,000	281	70
	8:30	8:45	15	19	-	16	-	-	-	-	8	-	15	16	-	2,000	367	150	274	80,000	48,000	64,000	197	49
	8:45	9:00	15	18	-	15	-	-	-	-	8	-	15	16	-	2,400	440	160	298	48,000	46,000	47,000	157	39
	9:00	9:30	30	18	-	15	-	-	-	-	8	-	15	16	-	2,400	440	160	298	46,000	44,000	45,000	150	75
	9:30	10:00	30	18	-	15	-	-	-	-	8	-	15	16	-	2,400	440	160	298	44,000	38,000	41,000	137	68
	10:00	10:30	30	18	-	15	-	-	-	-	8	-	15	16	-	2,400	440	160	298	38,000	30,000	34,000	114	57
MEM-1,3,7,12	10:30	11:00	30	18	-	15	-	-	-	8	-	15	16	-	2,400	440	160	298	30,000	28,000	29,000	97	48	
	11:00	11:15	15	18	10	-	14	-	-	8	-	7	-	-	2,800	513	160	348	38,000	54,000	46,000	179	45	
	11:15	11:30	15	18	11	-	14	-	-	8	-	14	-	-	2,400	440	160	298	54,000	56,000	55,000	184	46	
	11:30	12:00	30	20	13	-	16	-	-	8	-	15	-	-	2,400	440	160	298	56,000	50,000	53,000	195	98	
	12:00	12:30	30	19	13	-	16	-	-	8	-	15	-	-	2,400	440	160	298	50,000	32,000	41,000	137	68	
	12:30	13:00	30	19	14	-	16	-	-	8	-	15	-	-	2,400	440	160	298	32,000	30,000	31,000	104	52	
	13:00	13:30	30	19	14	-	16	-	-	8	-	15	-	-	2,600	477	160	323	30,000	26,000	28,000	101	51	
MEM-6,B-3	13:30	14:00	30	19	14	-	16	-	-	8	-	15	-	-	2,600	477	140	383	26,000	20,000	23,000	99	49	
	14:00	14:15	15	19	-	-	-	16	-	-	-	-	-	10	1,400	257	160	174	1,200	620	910	1.8	0.4	
	14:15	14:30	15	19	-	-	-	16	-	-	-	-	-	10	1,400	257	165	163	620	1,000	810	1.5	0.4	
	14:30	15:00	30	18	-	-	-	15	-	-	-	-	-	11	1,400	257	170	152	1,000	1,000	1,000	1.7	0.9	
	15:00	15:30	30	17	-	-	-	15	-	-	-	-	-	11	1,400	257	170	152	1,000	1,000	1,000	1.7	0.9	
15:30	16:00	30	17	-	-	-	15	-	-	-	-	-	12	1,400	257	170	152	1,000	1,000	1,000	1.7	0.9		

Vacuum Truck Information		Well No.	Breather Port (CFM)	Stinger Depth (feet)	Recovery/Disposal Information
Subcontractor:	NB Env.	MEM-1	0 (closed)	10	Total Gal. of Liquid: 1,355 Disposal Facility: * Manifest No.: * Total Lbs. of Carbon (Offgas): 898 Cum. Lbs. Carbon Removed: 4,571 Lbs. Hydrocarbons Removed: 1,307 Cum. Lbs. Hydrocarbons: 6,497 Equiv. Gal. Removed: 216 Cum. Equiv. Gal. Removed: 1,071
Invoice No.:		MEM-2	11	10	
Truck Operator:	Lowe	MEM-3	0 (closed)	10	
Truck No.:	KingVac VK-39	MEM-6	0 (closed)	10	
Vacuum Pump Type:	Liquid Ring	MEM-7	0 (closed)	10	
Tank Capacity:	2,566	MEM-8	0 (closed)	10	
Stack I.D. (inches):	5.8	MEM-12	0 (closed)	10	
Calibration Gas:	500 ppm Hexane	MEM-13	0 (closed)	10	
Molecular Weight:	75 g/mole	MEM-14	0 (closed)	10	
		B-3	0 (closed)	10	

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



EFR[®] EVENT GAUGING DATA

Client: BAT Env.		Facility Name: NEX (Navy Exchange) Auto Part/Fuel Lock				Facility ID#: 0-740479		Event #: 6	
Facility Address: 757 Old Navy Road, Millington, Tennessee						Technician: Lewis		Date: 2/10/99	
Well Designation	Well Diameter (inches)	Total Depth (feet)	Before EFR [®] Event			After EFR [®] 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		-	5.44	0.00	-	10.00	0.00	-4.56
MEM-2	4		-	3.24	0.00	-	10.00	0.00	-6.76
MEM-3	4		-	4.34	0.00	-	9.70	0.00	-5.36
MEM-6	4		-	3.58	0.00	-	10.00	0.00	-6.42
MEM-7	4		-	4.27	0.00	-	9.80	0.00	-5.53
MEM-8	4		-	5.02	0.00	-	10.00	0.00	-4.98
MEM-11	4		-	5.39	0.00	-	5.35	0.00	-0.33
MEM-12	4		-	5.94	0.00	-	11.40	0.00	-6.01
MEM-13	4		-	3.95	0.00	-	11.20	0.00	-5.26
MEM-14	6		-	3.95	0.00	-	10.40	0.00	-6.45
MEM-16	6		-	4.16	0.00	-	4.16	0.00	-0.21
B-3	4		-	3.55	0.00	-	9.70	0.00	-5.75
B-4	4		-	4.68	0.00	-	4.68	0.00	-1.13
			Comments:						