March 24, 1995

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MAR 27 1995
DEPT. OF NATURAL RESOURCES
SD HEADQUARTERS

Mr. Wendell Wojner
Wisconsin Department of Natural Resources
Southern District Headquarters
3911 Fish Hatchery Road
Fitchburg, WI 53711

RE: Status Report
Bennett's Amoco, Middleton, Wisconsin

Dear Mr. Wojner:

This letter comprises the first status report since startup of the groundwater and soil remediation system at the above-referenced location. In the summer of 1994, a multi-technology remediation system was installed at the site, and was started up in a phased approach in July and August 1994. The technologies employed include groundwater pumping and disposal to the POTW (P&D), soil vapor extraction (SVE), and air sparging (AS).

The P&D system and the SVE system were started on July 19, 1994. The AS system was started on August 16, 1994, after the SVE exhaust concentrations decreased from their initial peak levels. The systems are monitored on a monthly basis and have operated nearly continuously since startup, with few exceptions.

Pumping and Disposal System

The purpose of the P&D system is to establish hydraulic control of the contaminated groundwater plume. The system consists of two recovery wells located downgradient of the source area near the west property boundary. These wells pump 4 to 6 gallons per minute combined. Since startup, approximately 656,000 gallons of water have been pumped and discharged to the sanitary sewer. The influent and effluent streams are sampled and analyzed monthly. An estimation of the quantity of contaminant removed is made on the basis of laboratory analysis of the effluent and the flow volume. It is estimated that this system has removed approximately 1.5 pounds of dissolved petroleum hydrocarbons since startup. The historical laboratory results for the recovery well are included as Table 1.

The effectiveness of the P&D system in establishing hydraulic control of the site has been assessed. On the basis of a pumping test and capture zone analysis performed prior to the startup of the remedial systems, a combined pumping rate of 4 to 6 gallons per minute would be sufficient to maintain control of contaminated groundwater in the sand aquifer beneath the site. This conclusion was based on the assumption that the groundwater flow direction would not vary more than 45 degrees from due west, the flow direction in the fall of 1993 and the spring of 1994.

A water table contour map of the site based on water levels measured on January 27, 1995, is included as Figure 1. The water table slopes to the north-northeast. However, the water table may

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not be indicative of the groundwater flow direction. SVE and AS at the site are likely causing perturbations in the water surface, because the air pressure beneath the site is typically lower than atmospheric pressure. During an upcoming scheduled system shutdown, water level data will be collected and evaluated to verify flow direction under static conditions.

Soil Vapor Extraction System

The purpose of the SVE system is to remove vapor-phase contaminants from the unsaturated zone. The contaminants recovered by the SVE system are those that exist in the unsaturated soil and those that are generated via air sparging in the saturated zone and that migrate upward.

On a monthly basis, a gas sample from the SVE blower exhaust is collected and analyzed for BETX and TPH. The laboratory results and average airflow data are then used to estimate the quantity of hydrocarbons removed. It is estimated that the SVE system has removed approximately 3,470 pounds of petroleum hydrocarbons since its startup in July 1994. This quantity includes approximately 32 pounds of benzene. Using a rough conversion, this equates to approximately 550 gallons of gasoline removed from the soil and groundwater.

Although it has recovered a significant quantity of petroleum hydrocarbons, the SVE system has consistently remained in compliance with emission limits per NR 419 (less than 9 lbs/hr of volatile organic compounds) and NR 445 (300 lbs/year of benzene).

As shown in Table 2 and on Figure 2, the rate of recovery for petroleum hydrocarbons decreased sharply after the initial 3 weeks of operation. After the air sparging system was activated on August 16, the recovery rate showed an increase over the next 3-week period, confirming the effectiveness of the stripping effects of air sparging. The recovery rates since then have decreased, but at a slower rate than observed with SVE alone.

Air Sparging System

The purpose of the air sparging system is twofold. The primary purpose is to strip volatile contaminants from groundwater and saturated soil, and the secondary purpose is to increase dissolved oxygen concentrations in the groundwater, thereby promoting enhanced *in situ* biodegradation of contaminants.

The effectiveness of the air sparging system is demonstrated in two ways at this site. First, the recovery rate for petroleum hydrocarbons via SVE was boosted after the startup of the AS system, as mentioned above. Second, the groundwater quality in on-site monitoring wells showed a marked improvement since startup of the AS system (Table 3 and Figure 3). This improvement is attributed to *in situ* stripping and enhanced biodegradation resulting from AS.

Future Operation

Operation of the system will continue essentially as it has since startup. The operating schedule and pattern for the AS and SVE wells will be modified slightly in an effort to maximize contaminant removal rates. Also, a scheduled shutdown of the system will take place this spring in order to inspect/repair the influent line from RW-1. During this shutdown, we will collect water level data to verify groundwater flow characteristics under static conditions. We will also collect groundwater dissolved oxygen data periodically immediately following shutdown to assess dissolved oxygen depletion caused by enhanced biodegradation. After re-starting the system, a gas sample at the SVE blower exhaust will be collected and analyzed to assess the effects of starting and restarting the system.

Please review the data, and contact Kris Krause or me with any questions or comments you have.

Sincerely,

Jack W. Anderson, P.E.
Project Engineer

amt

cc: Bill Love, Bennett's Amoco
Paul Nehm, Madison Metropolitan Dewerage District
Kris Krause, RMT
Jeff Ackerman, RMT

TABLE 1

GROUNDWATER RECOVERY SUMMARY
Bennett's Amoco
Middleton, WI
Project # 2840.11

printed
03/24/95

Sample Location	Date	Benzene (ug/L)	Ethyl-benzene (ug/L)	Toluene (ug/L)	Xylenes (ug/L)	MTBE (ug/L)
Enforcement Standard >		5.0	700	343	620	60
Preventative Action Limit >		0.5	140	68.6	124	12
RW-1	02/26/94	810	1600	710	6100	350
	03/02/94	1100	1800	1200	7000	830
AS Startup	08/16/94	NS	NS	NS	NS	NS
	08/25/94	69	19	67	320	320
	09/09/94	65	28	170	410	220
	11/17/94	ND	1.1	2.1	9.8	22
	12/30/94	ND	ND	4.1	9.3	39
	01/31/95	ND	ND	1.1	4.4	27
(RW-1 down)	02/28/95	NS	NS	NS	NS	NS
RW-2	02/26/94	NS	NS	NS	NS	NS
	03/02/94	NS	NS	NS	NS	NS
AS Startup	08/16/94	NS	NS	NS	NS	NS
	08/25/94	1.2	2.0	2.0	5.4	2
	09/09/94	NS	NS	NS	NS	NS
	11/17/94	0.7	2.3	6	5.5	1.3
	12/30/94	1.2	6.5	16	23.9	3.4
	01/31/95	1.5	6.4	13	23.2	3.6
	02/28/95	1	2.7	4.6	8.7	3.1
EFFLUENT	02/26/94	NS	NS	NS	NS	NS
	03/02/94	NS	NS	NS	NS	NS
	08/25/94	32.0	8.8	27.0	67.0	150
	09/09/94	65	28	170	410	220
	11/17/94	1	1.9	2.3	10.8	8.7
	12/30/94	0.6	2.5	6.1	9.5	8.7
	01/31/95	0.8	3.1	6.4	11.1	5.5
	02/28/95	0.7	1.6	3.1	5.3	3.4

ND = compound was not detected at or above the detection limit
NS = not sampled

TABLE 2

AIR EMISSION WORKSHEET
Bennett's Amoco
Middleton, WI
RMT Project No. 2840.11

SYSTEM STARTUP DATES: SVE 07/19/94
AS 08/16/94

Sample Date	Days Since Startup	Lab Results Benzene (ug/l)	E.benzene (ug/l)	Toluene (ug/l)	Xylenes (ug/l)	TPH (ug/l)	Comparative Benzene Emissions (lb/yr)	Cumulative Benzene Emissions (lb)	Hourly TPH (VOC) Emissions (lb/hr)	Cumulative TPH Emissions (lb)
07/19/94	0	ND	ND	ND	ND	8	0	0.00	0.01	0.0
07/20/94	1	64	31	170	150	3600	461	1.26	2.96	71.1
07/21/94	2	58	25	140	110	3400	418	2.41	2.80	138.2
07/28/94	9	23	10	88	76	1200	166	5.59	0.99	303.9
08/03/94	15	17	20	110	140	1100	122	7.60	0.90	434.2
08/11/94	23	1	1	11	51	270	6	7.72	0.22	476.8
08/16/94	28	6	9	63	81	800	45	8.34	0.66	555.8
08/25/94	37	9	9	65	83	1300	63	9.90	1.07	786.7
09/08/94	51	10	15	91	170	1400	70	12.58	1.15	1173.5
11/29/94	133	12	ND	17	ND	1100	79	30.24	0.82	2791.9
12/27/94	161	2	1	11	12	340	11	31.09	0.25	2962.8
02/09/95	205	2	2	12	50	440	10	32.27	0.33	3310.1
02/28/95	224	2	1	11	41	470	12	32.89	0.35	3470.3

Shaded area denotes air sparging system startup.

Approx. gallons of gasoline recovered: 550

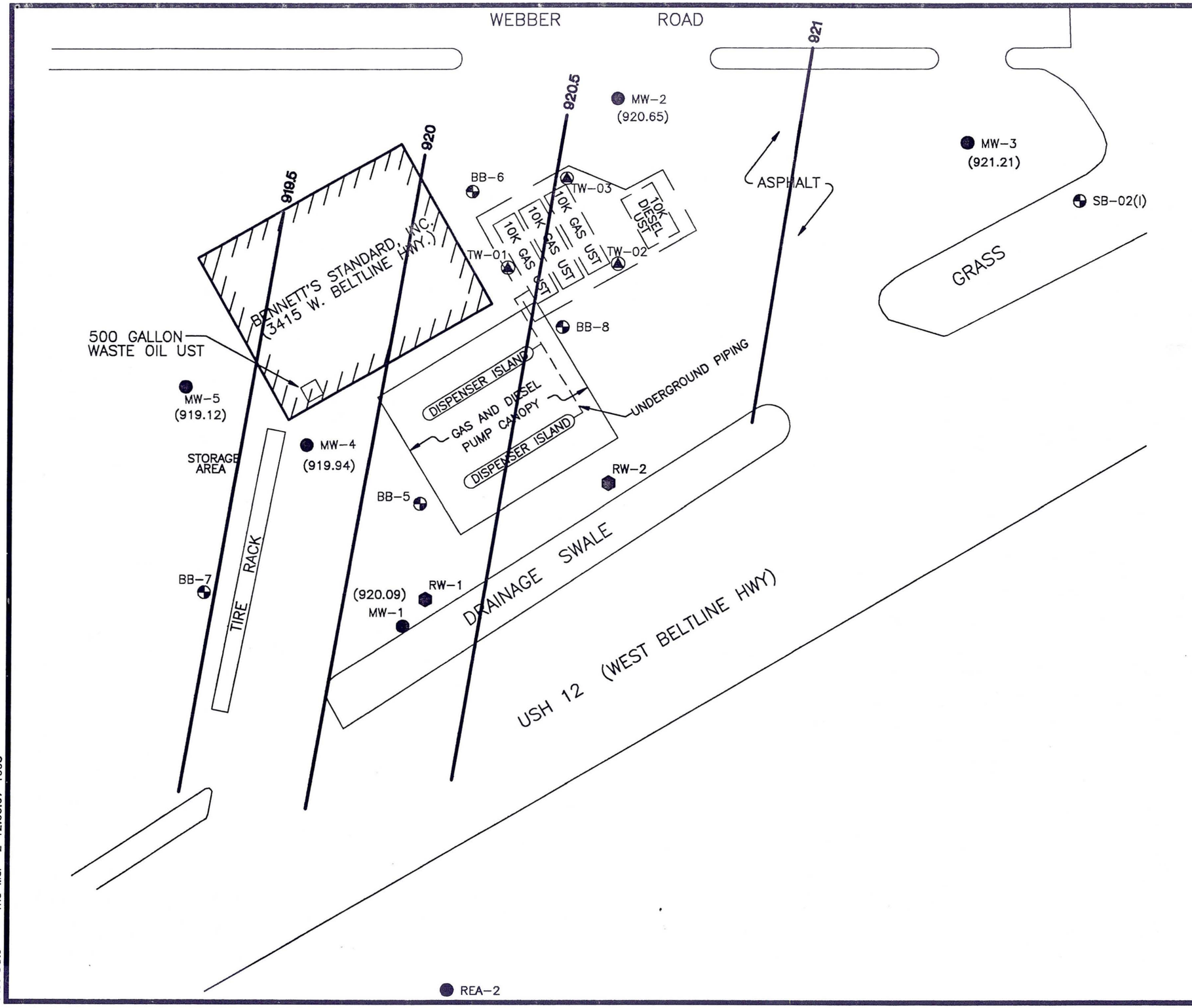
TABLE 3

GROUNDWATER QUALITY SUMMARY
BENNETT'S AMOCO
Middleton, WI
RMT Project No. 2840.11

printed
02/21/95

Sample Location	Date	Benzene (ug/L)	E.benzene (ug/L)	Toluene (ug/L)	Xylenes (ug/L)	MTBE (ug/L)
Enforcement Standard >		5.0	700	343	620	60
Preventive Action Limit >		0.5	140	68.6	124	12
MW-1	10/08/93	2100	2300	240	8000	130
	04/07/94	1100	740	380	3000	480
	07/19/94	1800	890	370	2590	1300
AS Start	08/16/94					
	09/09/94	130	97	2 *	130	210
	10/26/94	0.6 *	1.0 *	1.0 *	2.0 *	20
	01/27/95	0.6 *	1.0 *	1.0 *	2.0 *	46
MW-2	10/08/93	1.0 *	1.0 *	2.3	3.0 *	1 *
	04/07/94	0.6 *	1.0 *	1.0 *	2.0 *	1 *
	07/19/94	0.6 *	1.0 *	1.0 *	2.0 *	1 *
AS Start	08/16/94					
	09/09/94	NS	NS	NS	NS	NS
	10/26/94	0.6 *	1.0 *	1.0 *	2.0 *	1 *
	01/27/95	0.6 *	1.0 *	1.0 *	2.0 *	1 *
MW-3	10/08/93	1.0 *	1.0 *	12.0	3.0 *	1 *
	04/07/94	0.6 *	1.0 *	1.0 *	2.0 *	1 *
	07/19/94	0.6 *	1.0 *	1.0 *	2.0 *	1 *
AS Start	08/16/94					
	09/09/94	NS	NS	NS	NS	NS
	10/26/94	0.6 *	1.0 *	1.0 *	2.0 *	1 *
	01/27/95	0.6 *	1.0 *	1.0 *	2.0 *	1 *
MW-4	10/08/93	1800	1500	2800	6000	260
	04/07/94	4500	2200	8100	9600	1500
	07/19/94	4800	2900	9200	13100	780
AS Start	08/16/94					
	09/09/94	1100	910	3000	4400	200
	10/26/94	180	200	350	1300	10 *
	01/27/95	3.7	110	110	490	7.4 *
MW-5	11/12/93	1.0 *	1.0 *	1.0 *	3.0 *	1 *
	04/07/94	0.6 *	1.0 *	1.0 *	2.0 *	1 *
	07/19/94	0.7	1.0 *	1.0 *	2.0 *	1 *
AS Start	08/16/94					
	09/09/94	NS	NS	NS	NS	NS
	10/26/94	0.6 *	1.0 *	1.0 *	2.0 *	1 *
	01/27/95	4.5	1.0 *	1.0 *	2.0 *	1 *

NS = Not Sampled
* = detection limit
light shaded area = level above PAL
dark shaded area = level above ES



LEGEND

BB-8	BORING INSTALLED BY RMT, OCTOBER, 1993
MW-3	MONITORING WELL INSTALLED BY RMT, OCTOBER OR NOVEMBER, 1993
TW-01	TEST WELL IN TANK PIT
REA-2	WELL INSTALLED BY RESOURCE ENGINEERING ASSOCIATES AT AHREN'S SITE
RW-2	RECOVERY WELL
(920.65)	WATER LEVEL IN WELL (1/27/95)
920.5	WATER TABLE CONTOUR LINE (FEET M.S.L.)

NOTES

1. THE WATER TABLE CONTOURS REPRESENT THE TOP OF THE ZONE OF SATURATION. ACTIVE SOIL VAPOR EXTRACTION AT THE SITE MAY CAUSE THE TOP OF THE ZONE OF SATURATION TO OCCUR AT A POSITION WHERE PRESSURE IS DIFFERENT FROM ATMOSPHERIC PRESSURE. THEREFORE, DETERMINING A GROUNDWATER FLOW DIRECTION USING THIS DATA MAY BE INAPPROPRIATE.
2. AIR SPARGE POINTS AND SOIL VAPOR EXTRACTION WELLS ARE NOT SHOWN ON THIS FIGURE.

0 30 60

SCALE: 1" =30'

WATER TABLE CONTOUR MAP

BENNETT'S STANDARD, INC.
MIDDLETON, WISCONSIN

RMT INC.

DWN. BY:	RBN
APPROVED BY:	JAA
DATE:	FEBRUARY 1995
PROJ. #	2840.11
FILE #	28401104

FIGURE 1

MAR 0 1 1995

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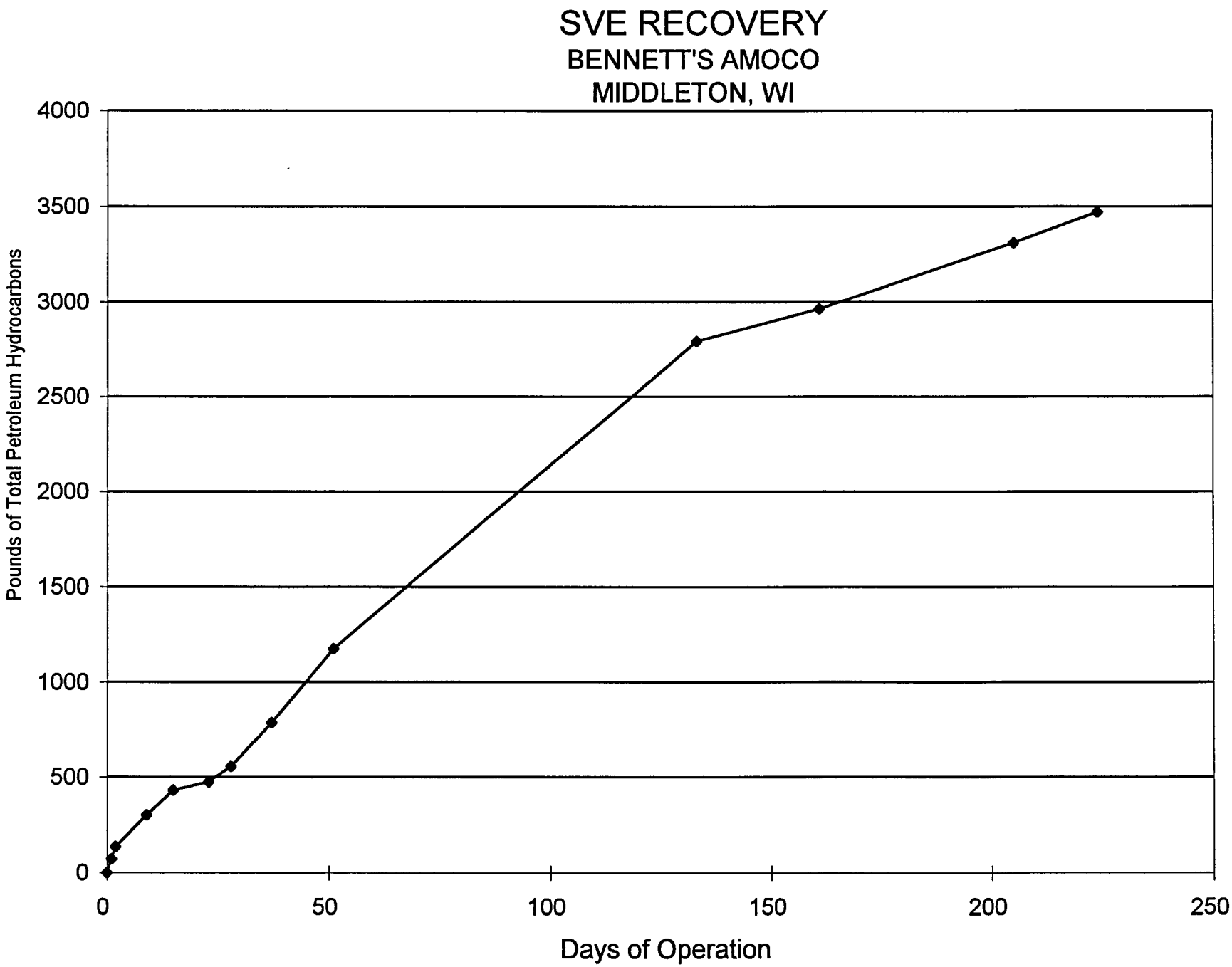
SVE RECOVERY
BENNETT'S AMOCO
MIDDLETON, WI
Pounds of Total Petroleum Hydrocarbons
4000
3500
3000
2500
2000
1500
1000
500
0
0
50
100
150
200
250
Days of Operation

FIGURE 2

GROUNDWATER CONCENTRATIONS
BENNETT'S AMOCO
MIDDLETON, WI

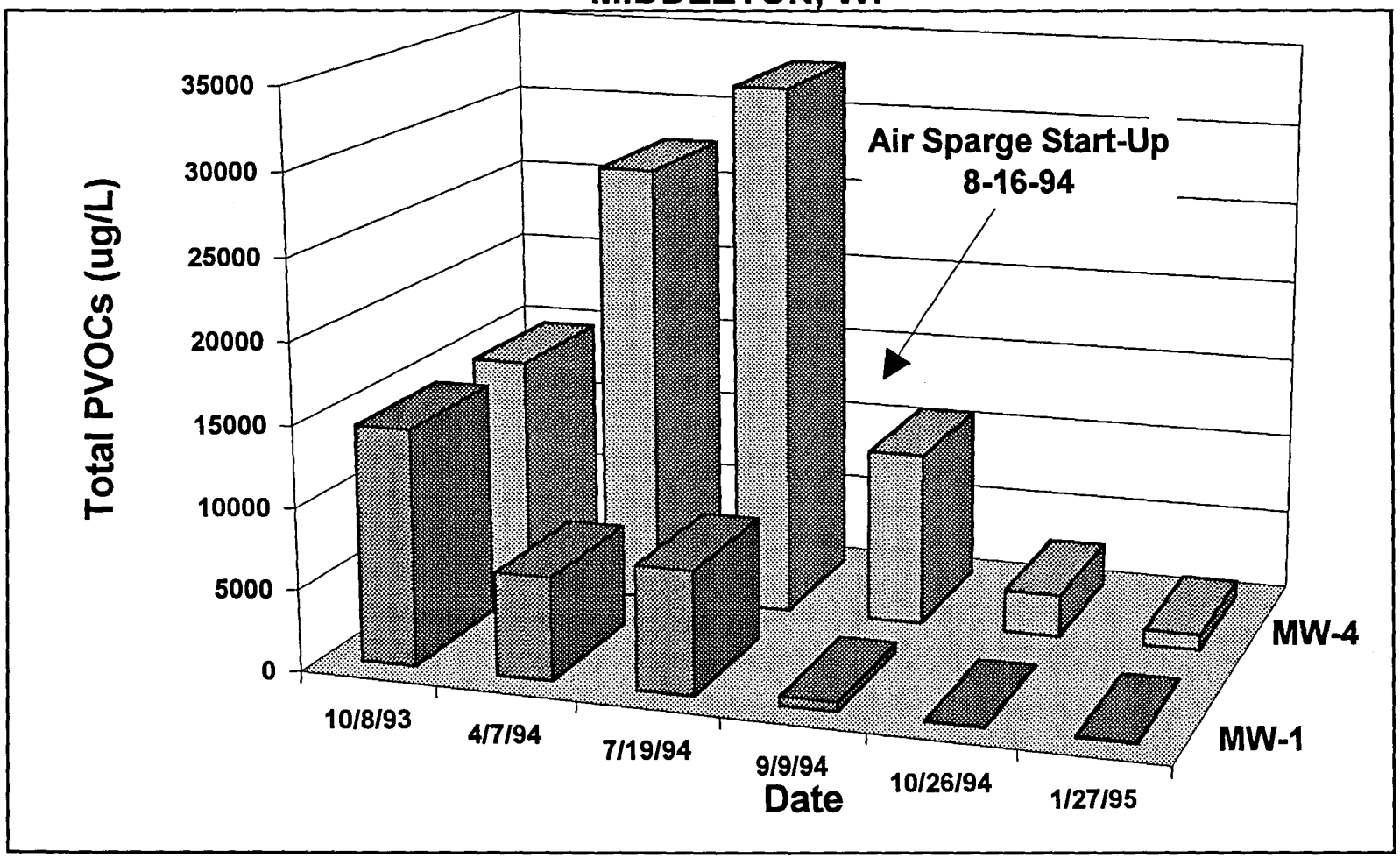

FIGURE 3