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**INTEGRATED ENVIRONMENTAL  
MONITORING STATUS REPORT  
FOR FIRST QUARTER 1998**

**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT  
FERNALD, OHIO**



**JUNE 1998**

**U.S. DEPARTMENT OF ENERGY  
FERNALD AREA OFFICE**

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**Attachment To:**

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**FINAL**

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**FINAL**

**000002**

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## LIST OF ACRONYMS

AMS	air monitoring station
A	feet above mean sea level
AWWT	advanced wastewater treatment
DOE	U.S. Department of Energy
FEMP	Fernald Environmental Management Project
FFCA	Federal Facilities Compliance Agreement
gpm	gallons per minute
IEMP	Integrated Environmental Monitoring Plan
lbs	pounds
M gal	million gallons
mgpd	million gallons per day
mrem	millirem
NESHAP	National Emissions Standards for Hazardous Air Pollutant
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
OSDF	on-site disposal facility
pCi/L	picoCuries per liter
pCi/m <sup>3</sup>	picoCuries per cubic meter
ROD	record of decision
SWRB	Storm Water Retention Basin
TLD	thermoluminescent dosimeter
µg/L	micrograms per liter
µg/m <sup>3</sup>	micrograms per cubic meter

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**FOREWORD**

The U.S. Department of Energy (DOE) has prepared this report to meet the quarterly reporting obligation defined in the Integrated Environmental Monitoring Plan (IEMP) (DOE 1997a) for the Fernald Environmental Management Project. It provides an incremental assessment of the environmental data collected under the routine monitoring programs defined in the IEMP and includes selected project-specific information as necessary to support a comprehensive data evaluation. The report is organized around the principal environmental media and contaminant migration pathways routinely monitored under the IEMP including groundwater, surface water and treated effluent, air, as well as natural resources. The format is designed to provide a summary level presentation of data utilizing figures and tables to highlight key performance indicators and significant findings associated with each environmental media.

Environmental and operational data available through the first quarter of 1998 are highlighted in this report. However, the data sets provided for each media-specific monitoring program will vary based on program sampling schedules and analytical complexity. It should be noted that data from routine sampling activities conducted during the fourth quarter of 1997 not available for presentation in the Integrated Environmental Monitoring Status Report for Fourth Quarter 1997 (DOE 1997b) were included in the 1997 Integrated Site Environmental Report (DOE 1998) submitted in June 1998. The specific data sets included in this report for each environmental media are defined within the corresponding section. Data sets to be included in the next quarterly status report due to the agencies in September 1998 are also defined within this report.

Comments received from the Ohio Environmental Protection Agency on the Integrated Environmental Monitoring Status Report for Fourth Quarter 1997 have been incorporated into the content of this report, as appropriate. It is expected that the content and format of future quarterly status reports will continue to evolve as additional stakeholder input is received and incorporated. To facilitate this process, DOE will continue to provide a written response to all comments received. Actions resulting from the comments which require a change to the report or reporting format have been and will be incorporated into subsequent reports.

## 1.0 GROUNDWATER MONITORING UPDATE

### 1.1 INTRODUCTION

This section provides a summary of the first quarter 1998 operational results for the aquifer remedy consistent with the Integrated Environmental Monitoring Plan (IEMP) (DOE 1997a) groundwater monitoring program. The detailed analytical results from the fourth quarter of 1997 were reported in the 1997 Integrated Site Environmental Report (DOE 1998), issued June 1, 1998, and are therefore not included in this report.

Figure 1-1 identifies the data included in this section. Figure 1-2 shows the IEMP groundwater monitoring wells by module/monitoring activity and Figure 1-3 shows the IEMP routine water-level (groundwater elevation) monitoring wells.

### 1.2 FINDINGS

The principal findings from the reporting period are summarized below:

#### Operational Summary

- The South Plume Module was operated in the four-well, 1500 gallons per minute (gpm) target pumping configuration during the entire first quarter of 1998. The pumping rate on Extraction Well 3927 (RW-4) was increased from 400 gpm to 500 gpm on November 6, 1997 to maximize the eastern extent of the capture zone. This 100 gpm pumping rate increase equates to 1500 gpm for the four-well system. The module will continue to operate at the 1500 gpm pumping rate until after the South Field (Phase 1), South Plume Optimization, and Re-Injection Demonstration modules are brought on line later in 1998 when it is anticipated that capture of the northeastern lobe of the total uranium plume will be confirmed.
- During the first quarter of 1998, 187.9 million gallons of groundwater were pumped and 33.2 pounds of uranium were removed from the Great Miami Aquifer. Since system startup began in August 1993, three billion gallons of water have been pumped, resulting in a removal of 422.6 pounds of uranium.

(Refer to Figures 1-4 through 1-15 and Tables 1-1 through 1-5.)

#### Remedy Construction

- The two new Extraction Wells, 32308 (RW-6) and 32309 (RW-7), that comprise the South Plume Optimization Module, have been installed and well development was

completed in December 1997 and January 1998, respectively. Samples collected near the end of well development indicated total uranium concentrations of 123 micrograms per liter ( $\mu\text{g/L}$ ) for 32308 (RW-6) and 143  $\mu\text{g/L}$  for 32309 (RW-7).

- As of the end of March 1998, construction continued on the pipeline distribution network and associated electronic controls for three groundwater restoration modules: South Plume Optimization Module, South Field Extraction Module (Phase 1), and Re-Injection Demonstration Module. These modules are scheduled to begin operating later in 1998. Operational well testing for these modules will be initiated during the second quarter of 1998. (Figure 1-16 shows the location of near-term aquifer restoration modules which are already installed.)
- Construction has been completed on the expansion of the advanced wastewater treatment facility. The facility is expected to begin treating groundwater in April 1998, in accordance with the schedule established in the Remedial Action Work Plan for Aquifer Restoration at Operable Unit 5 (DOE 1997e).

#### Groundwater Elevation Data and Capture Assessment

- Capture of the main portion of the South Plume continued during the first quarter of 1998.
- Groundwater elevation data collected from Type 2 and Type 3 monitoring wells in January 1998 are presented in Figures 1-17 and 1-18, respectively. The general location of important flow divides, the capture zone produced by the South Plume Extraction System, and the 20  $\mu\text{g/L}$  total uranium concentration contour from the fourth quarter 1997 sampling event are also shown in the figures. Figures 1-19 and 1-20 are detailed water elevation maps of the South Plume area.
- Figure 1-21 and Table 1-6 present borescope data collected during the first quarter of 1998. Data was collected from three areas: south of the South Plume Extraction System, along the eastern edge of the capture zone, and in the area of the northeastern lobe of the total uranium plume.

Borescope observations in the area of the northeastern lobe of the total uranium plume indicate that flow directions change with respect to depth below the water table. Consistent with borescope observations from the previous quarter, groundwater flow at 17.5 feet below the water table in Re-Injection Well 22111 was due east at  $89.8^\circ$ . Monitoring Well 22303 was borescoped for the first time during the first quarter of 1998. It was measured twice during this quarter and is immediately adjacent to Re-Injection Well 22111. Groundwater flow was observed in this well at  $196.3^\circ$  (southwest) at 3.1 feet below the water table and at  $226.9^\circ$  (southwest) at 1.1 feet below the water table. Considering these three observations, it appears that groundwater flow near the top of the water table in this area is to the south and southwest toward the South Plume Extraction System and that flow directions gradually shift to the east with depth below the water table.

Borescope observations along the eastern edge of the capture zone in Monitoring Wells 2093 and 21063 are generally consistent with observations from the fourth quarter of 1997. Groundwater flow directions were 142.6° (southeast) at 29.6 feet below the water table and 212.2° (southwest) at 3.4 feet below the water table in Monitoring Wells 21063 and 2093, respectively. These observations are consistent with the interpretation that groundwater flow gradually shifts eastward with depth in this area. Note that Monitoring Well 21063 is screened at a deeper interval than a typical Type 2 monitoring well in order to monitor the same horizon of the total uranium plume associated with Private Well 13 (located to the northwest).

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Groundwater flow directions in monitoring wells south of the South Plume Extraction System indicated that flow directions are to the southeast away from the extraction wells (Monitoring Wells 2898 and 2899) and southwest (Monitoring Wells 3898 and 3899). These flow directions are consistent with fourth quarter 1997 observations and the interpreted capture zone from first quarter 1998 groundwater elevation data. Groundwater flow directions have significantly shifted at Monitoring Wells 2900 and 3900 from a west/northwesterly direction during the fourth quarter of 1997 to an easterly direction during the first quarter of 1998. This change is believed to be due to additional recharge from Paddys Run. Consistent with previous observations, flow directions at Monitoring Wells 2552 and 3552 were to the northeast toward the extraction wells and almost due north, respectively.

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(Refer to Table 1-6 for a summary of the flow direction data from borescope observations taken during the first quarter of 1998.)

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- Figure 1-22 presents modeled flow directions with the South Plume Extraction System pumping at 1500 gpm. As discussed in the Integrated Environmental Monitoring Status Report for Fourth Quarter 1997 (DOE 1997b), the model predicts more southerly flow directions in the area of the northeastern lobe of the plume than are interpreted from water level data. Preliminary analysis reveals that the difference between modeled and observed flow directions in the area of the northeast lobe of the plume may be due to increased pumping at Southwest Ohio Water Company Collector Well 2 from 10 million gallons per day (mgpd) to 12 mgpd. Model boundary conditions may have to be updated near the collector wells along the eastern edge of the model to improve model predictions of flow in the area of the northeast lobe of the plume. Changes to the model to improve flow predictions will be incorporated as necessary into the model upgrade project which is currently ongoing.

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- Significant expansion of the capture zone is likely to occur in the area of the northeast lobe of the plume once the South Field Extraction (Phase 1), the South Plume Optimization, and the Re-Injection Demonstration modules come on line later in 1998.

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(Refer to Figures 1-17 through 1-22.)

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### Additions to the IEMP for the South Field Extraction Module Sampling

- During the first quarter of 1998, Monitoring Well 3046 was added to the list of wells to be sampled for the South Field Extraction Module. Monitoring Well 2046, which is part of the same well cluster, was identified in the IEMP as part of the South Field Extraction Module, however 3046 was inadvertently omitted from the list. Monitoring Well 3046 was sampled in the first quarter of 1998 and will continue to be sampled for the same list of constituents and at the same frequency as the other wells in this module. These constituents and sampling frequencies are identified in Section 3.5.1.2 of the IEMP. This well will be formally added to this module when the IEMP is revised later in 1998. Data from this well will be provided in future quarterly status reports.
- Monitoring Well 21192 was also added to the South Field Extraction Module during first quarter 1998. This well, which is down gradient of the inactive fly ash pile and close to South Field Extraction Well 31563, was added to address Ohio Environmental Protection Agency (OEPA) concerns from surface water spilt sampling results in the South Field area. Technetium-99, one of the constituents monitored annually in the South Field Extraction Module, was monitored quarterly for the first two quarters of 1998 in Monitoring Well 21192 in order to address OEPA concerns. The sampling frequency for this well will be re-evaluated after the first two quarters of 1998 data are analyzed. Data from this well will be provided in future quarterly status reports.

### On-Site Disposal Facility Sampling

#### Status for Cell 1:

- Baseline sampling was completed for the Great Miami Aquifer and horizontal till well during the fourth quarter of 1997, prior to waste placement. A baseline report for Cell 1 is scheduled to be issued during the third quarter of 1998. After placement of waste is initiated in the cells, sampling will be conducted on a quarterly basis as specified in the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan (DOE 1997c). In February 1998, samples were collected from the Great Miami Aquifer, horizontal till well, leachate collection system, and leak detection system and will continue to be collected on a quarterly basis. The data will be provided in the next quarterly status report.

#### Status for Cell 2:

- Baseline sampling of the Great Miami Aquifer for Cell 2 continued during the first quarter of 1998. Three aquifer baseline samples were collected during the first quarter for a total of 10 baseline samples. The data will be provided in the next quarterly status report. Installation of the horizontal till well will be completed during the third quarter of 1998. Baseline sampling will be initiated after installation and development are complete.

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is for Cell 3:

- Installation of aquifer wells will be initiated during the second quarter of 1998. Installation of the horizontal till well will be completed during the third quarter of 1998. Baseline sampling will be initiated after installation and development are complete.

Figure 1-23 shows the data from the groundwater monitoring activities that will be included in the next IEMP quarterly status report. This next quarterly status report will be submitted in September 1998. The report will contain operational data and the plume capture assessment for the South Plume Module from April 1 through June 30, 1998, and analytical results from sampling activities conducted from January 1 through March 31, 1998.

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TABLE 1-1

**EXTRACTION WELL 3924 (RW-1)  
OPERATIONAL SUMMARY SHEET  
FOR FIRST QUARTER (JANUARY THROUGH MARCH) 1998**

Reference Elevation (feet above mean sea level [AMSL]) - 531.9 (top of casing)  
Northing Coordinate ('83) - 474,190.37  
Easting Coordinate ('83) - 1,379,783.13

Hours in reporting period - 2,159      Hours pumped - 2,065      Target pumping rate - 300 gpm  
Hours not pumped - 94      Operational percent - 95.7

Monthly Measurements at Wellfield				
Month	Monthly Average Pumping Rate (gpm)	Million Gallons Pumped	Monthly Average Uranium Concentration (µg/L)	Well Efficiency (lbs/M gal)
1/98 <sup>a</sup>	297	13.3	46.0	0.38
2/98	294	11.8	46.3	0.39
3/98 <sup>b</sup>	<u>290</u>	<u>12.9</u>	<u>50.6</u>	<u>0.42</u>
	Quarterly Average 294	Total 38.0	Quarterly Average 47.6	Quarterly Average 0.40

<sup>a</sup>Extraction well was out of service for one day due to well screen chlorination.

<sup>b</sup>Extraction well was out of service for one day due to construction activities on pipeline distribution system for aquifer remedy.

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TABLE 1-2

**EXTRACTION WELL 3925 (RW-2)  
OPERATIONAL SUMMARY SHEET  
FOR FIRST QUARTER (JANUARY THROUGH MARCH) 1998**

Reference Elevation (feet AMSL) - 540.3 (top of casing)  
Northing Coordinate ('83) - 474,290.32  
Easting Coordinate ('83) - 1,380,034.28

Hours in reporting period - 2,159      Hours pumped - 2,076      Target pumping rate - 300 gpm  
Hours not pumped - 83      Operational percent - 96.2

Monthly Measurements at Wellfield				
Month	Monthly Average Pumping Rate (gpm)	Million Gallons Pumped	Monthly Average Uranium Concentration (µg/L)	Well Efficiency (lbs/M gal)
1/98 <sup>a</sup>	288	12.9	31.7	0.26
2/98	297	11.9	24.5	0.20
3/98 <sup>b</sup>	<u>291</u>	<u>13.0</u>	<u>31.7</u>	<u>0.26</u>
	Quarterly Average 292	Total 37.8	Quarterly Average 29.3	Quarterly Average 0.24

<sup>a</sup>Extraction well was out of service for one day due to well screen chlorination.

<sup>b</sup>Extraction well was out of service for one day due to construction activities on pipeline distribution system for aquifer remedy.

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TABLE 1-3

**EXTRACTION WELL 3926 (RW-3)  
OPERATIONAL SUMMARY SHEET  
FOR FIRST QUARTER (JANUARY THROUGH MARCH) 1998**

Reference Elevation (feet AMSL) - 585.0 (top of casing)  
Northing Coordinate ('83) - 474,399.22  
Easting Coordinate ('83) - 1,380,306.40

Hours in reporting period - 2,159      Hours pumped - 2,059      Target pumping rate - 400 gpm  
Hours not pumped - 100      Operational percent - 95.4

Monthly Measurements at Wellfield				
Month	Monthly Average Pumping Rate (gpm)	Million Gallons Pumped	Monthly Average Uranium Concentration ( $\mu\text{g/L}$ )	Well Efficiency (lbs/M gal)
1/98	402	18.0	13.9	0.12
2/98 <sup>a,b</sup>	369	14.8	15.2	0.13
3/98 <sup>c</sup>	<u>382</u>	<u>17.0</u>	<u>17.0</u>	<u>0.14</u>
	Quarterly Average 384	Total 49.8	Quarterly Average 15.4	Quarterly Average 0.13

<sup>a</sup>Extraction well was out of service for one day for well screen chlorination.

<sup>b</sup>Extraction well was out of service for one day to install underground electrical lines for South Plume improvement project.

<sup>c</sup>Extraction well was out of service for one day due to construction activities on pipeline distribution system for aquifer remedy.

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**TABLE 1-4**  
**EXTRACTION WELL 3927 (RW-4)**  
**OPERATIONAL SUMMARY SHEET**  
**FOR FIRST QUARTER (JANUARY THROUGH MARCH) 1998**

Reference Elevation (feet AMSL) - 589.0 (top of casing)  
 Northing Coordinate ('83) - 474,512.49  
 Easting Coordinate ('83) - 1,380,596.15

Hours in reporting period - 2,159      Hours pumped - 2,069      Target pumping rate - 500 gpm  
 Hours not pumped - 90      Operational percent - 95.8

Monthly Measurements at Wellfield				
Month	Monthly Average Pumping Rate (gpm)	Million Gallons Pumped	Monthly Average Uranium Concentration (µg/L)	Well Efficiency (lbs/M gal)
1/98	505	22.6	1.3	0.01
2/98 <sup>a,b</sup>	460	18.5	1.5	0.01
3/98 <sup>c</sup>	<u>474</u>	<u>21.2</u>	<u>1.1</u>	<u>0.01</u>
	Quarterly Average 480	Total 62.3	Quarterly Average 1.3	Quarterly Average 0.01

<sup>a</sup>Extraction well was out of service one day due to well screen chlorination.

<sup>b</sup>Extraction well was out of service one day to install underground electrical lines for South Plume improvement project.

<sup>c</sup>Extraction well was out of service one day due to construction activities on pipeline distribution system for aquifer remedy.

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TABLE 1-5

**SOUTH PLUME EXTRACTION SYSTEM OPERATIONAL SUMMARY SHEET  
FOR FIRST QUARTER (JANUARY THROUGH MARCH) 1998**

Total gallons pumped for this reporting period (M gal) - 187.9  
 Total uranium removed for this reporting period (lbs) - 33.2  
 Average system efficiency for this reporting period (lbs/M gal) - 0.18  
 Gallons pumped from August 1993 to March 1998 (billion gal) - 3.0  
 Total uranium removed from August 1993 to March 1998 (lbs) - 422.6  
 System efficiency from August 1993 to March 1998 (lbs/M gal) - 0.14

Monthly Measurements at Storm Water Retention Basin Valve House  
for First Quarter (January through March) 1998

Month	Monthly Average Well Pumping Rates (gpm)				Monthly Average System Pumping Rate (gpm)	Water Pumped from Extraction Wells (M gal)	Water Treated from Extraction Wells (M gal)	Percent Treated <sup>a</sup>	Total Uranium Concentration from South Plume Extraction System <sup>b,c</sup> (µg/L)		
	RW-1	RW-2	RW-3	RW-4					Min.	Max.	Avg.
1/98	297	288	402	505	1492	66.8	33.9	50.7	7.4	35.4	19.6
2/98	294	297	369	460	1420	57.0	31.3	54.9	8.3	64.1	23.0
3/98	290	291	382	474	<u>1437</u>	<u>64.1</u>	<u>35.1</u>	<u>54.8</u>	16.9	29.4	21.3
					Quarterly Average 1450	Total 187.9	Total 100.3	Quarterly Average 53.4			

<sup>a</sup>The amount of groundwater treated per month is variable based on site storm water treatment needs. In general, during months with low amounts of precipitation, more groundwater is treated. During months with higher precipitation, less groundwater is treated.

<sup>b</sup>These concentrations represent both the concentrations that are sent to treatment and to the outfall.

<sup>c</sup>Monthly averages are flow-weighted calculations of daily grab samples of extracted South Plume groundwater collected at the storm water retention basin valve house.

TABLE 1-6  
 FIRST QUARTER 1998 FLOW DIRECTION DATA FROM BORESCOPE OBSERVATIONS

Monitoring Well	Date of Observation	Feet Below Water Level	Average Flow Direction <sup>a,b</sup> (degrees)	Standard Deviation <sup>b</sup> (degrees)
2093	3/16	3.44	212.2	25.1
21063	3/16	29.64	142.6	12.7
22111	3/10	17.48	89.8	4.4
22303	3/9	1.12	226.9	14.9
22303	3/9	3.12	196.3	4.6
2552	3/11	10.24	55.4	26.7
3552	3/11	67.32	352.2	22.3
2898	3/4	4.28	105.9	7.9
3898	3/3	68.14	214.5	34.8
2899	3/4	2.24	89.7	19.2
3899	3/5	67.54	250.6	28.1
2900	3/5	4.52	73.7	59.7
3900	3/9	66.94	79.2	26.3

<sup>a</sup>Average flow direction is measured clockwise in degrees from magnetic north.  
<sup>b</sup>Values are calculated after statistical filtering to remove outliers.

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000020

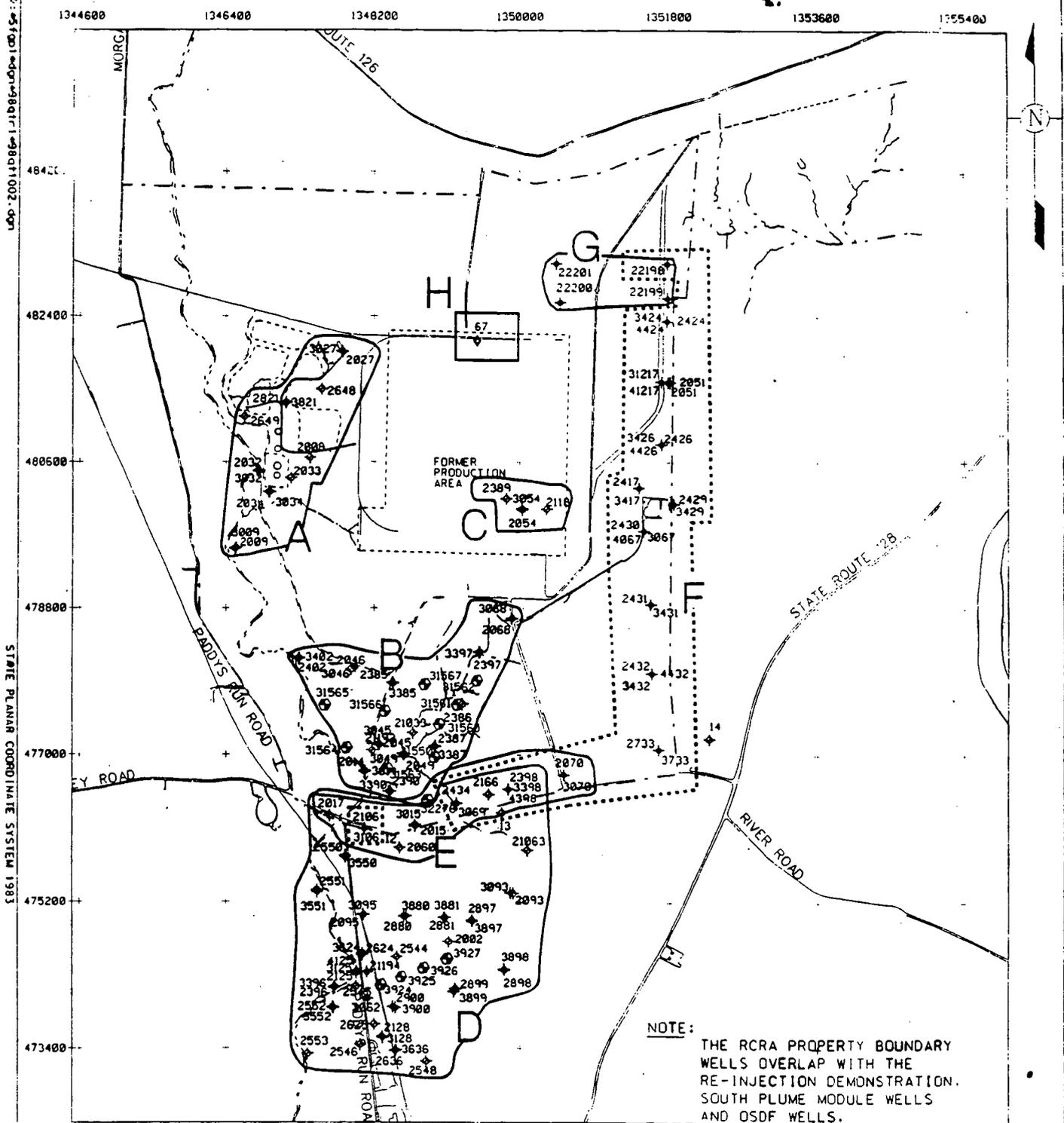
FIGURE 1-1

GROUNDWATER SAMPLING ACTIVITIES COVERED IN THIS QUARTERLY REPORT

**SAMPLING ACTIVITIES**

1998											
1st Quarter			2nd Quarter			3rd Quarter			4th Quarter		
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
◆	◆	◆									
◆											

◆ Data summarized/  
evaluated in this report



**LEGEND:**

- A - WASTE STORAGE AREA
- B - SOUTH FIELD EXTRACTION AREA
- C - PLANT 6 AREA
- D - SOUTH PLUME AREA
- E - RE-INJECTION DEMONSTRATION AREA
- F - RCRA PROPERTY BOUNDARY WELLS
- G - OSDF MONITORING WELLS
- H - KC-2 WAREHOUSE WELL

- - - - FEMP BOUNDARY  
 ◆ MONITORING WELL  
 ⊙ EXTRACTION WELL

SCALE

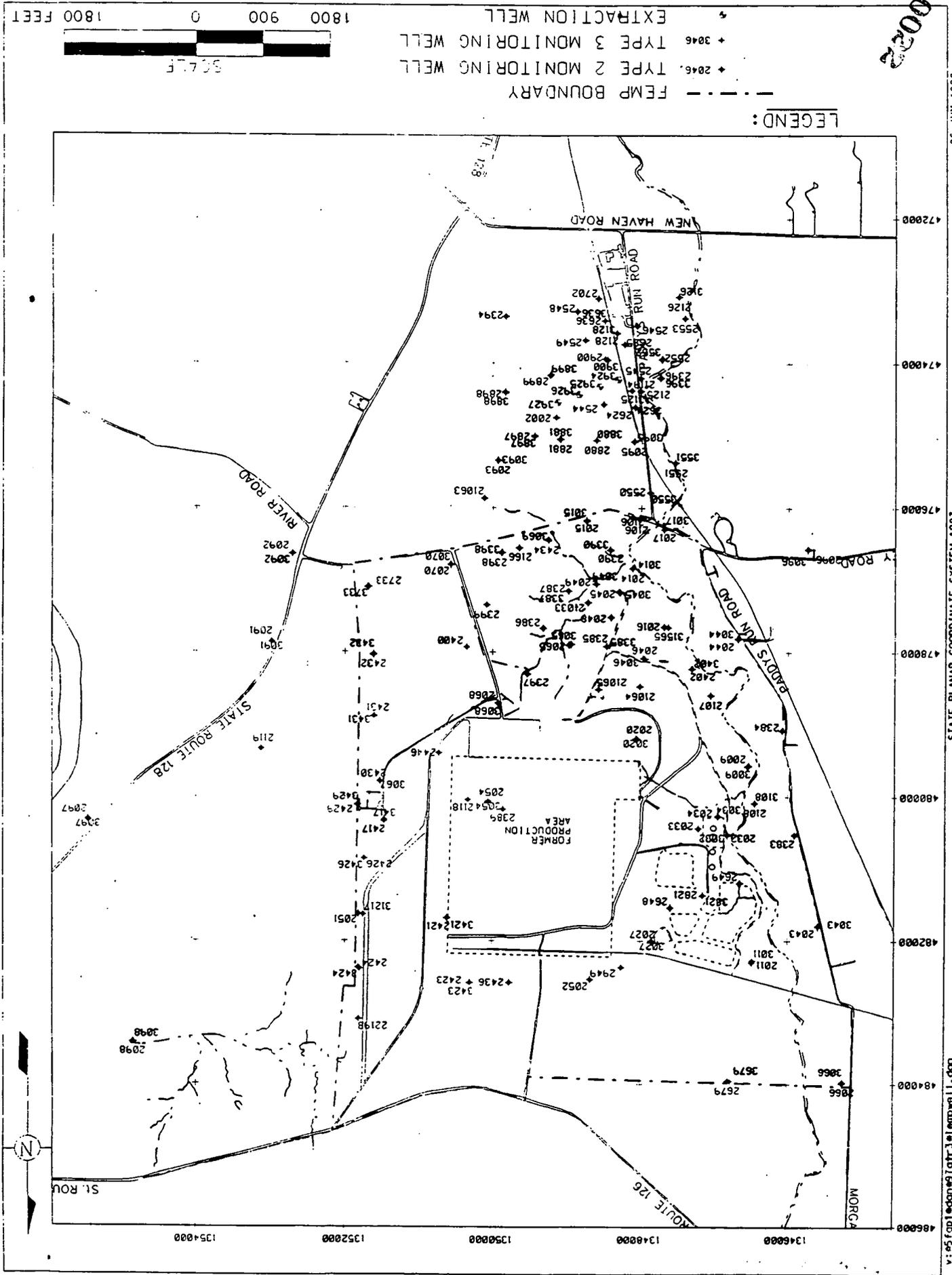
1800 900 0 1800 FEET

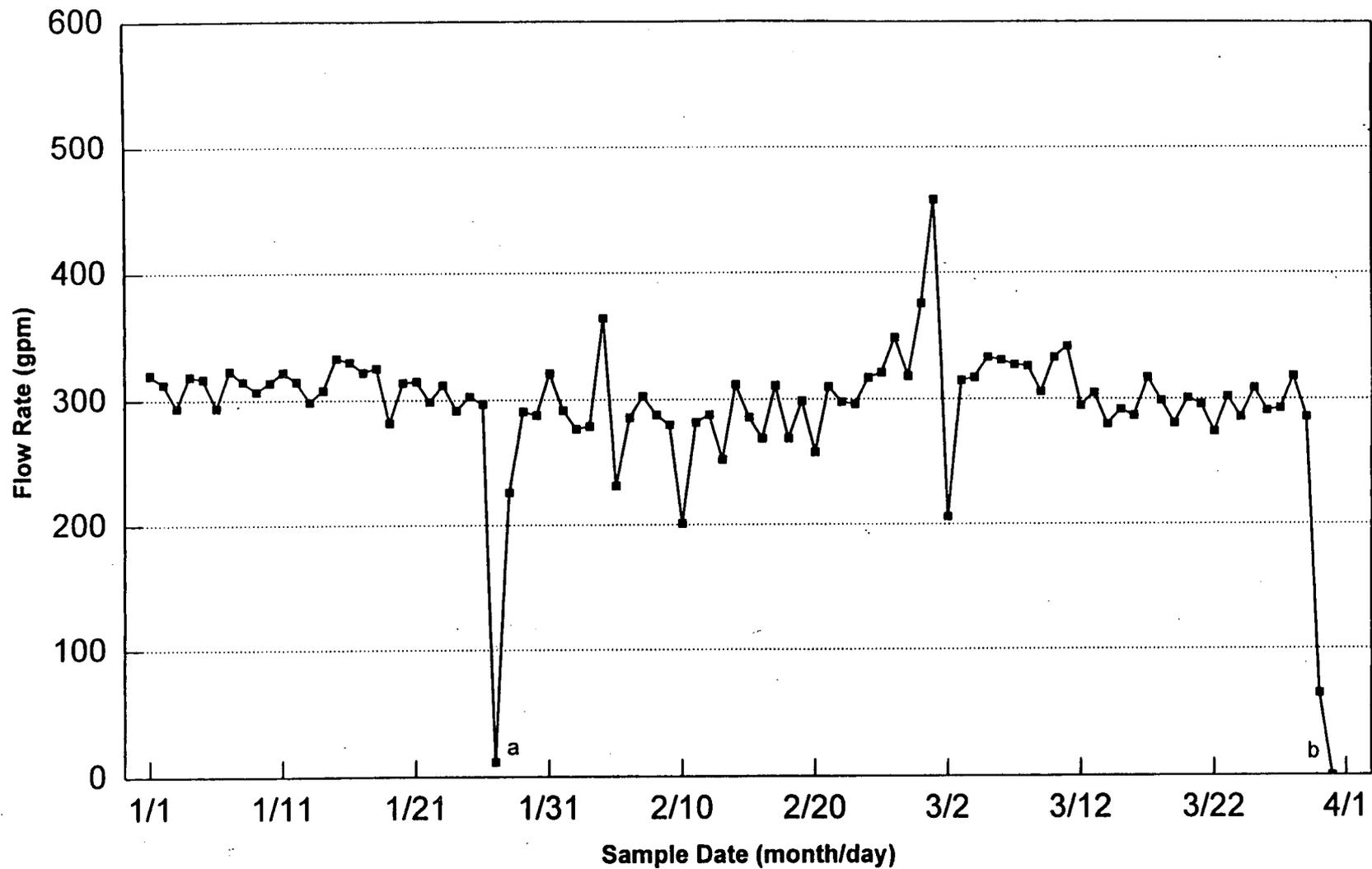
FIGURE 1-2. IEMP WATER QUALITY MONITORING WELLS AND EXTRACTION WELLS  
 000021

STATE PLANAR COORDINATE SYSTEM 1983  
 26-JUN-1998

FIGURE 1-3. FEMP GROUNDWATER ELEVATION MONITORING WELLS FOR 1997 AND 1998

0000022





<sup>a</sup>Extraction well was out of service for one day due to well screen chlorination.

<sup>b</sup>Extraction well was out of service for one day due to construction activities on pipeline distribution system for aquifer remedy.

FIGURE 1-4. DAILY AVERAGE PUMPING RATES FOR SOUTH PLUME  
EXTRACTION WELL 3924 (RW-1), 1/98 - 3/98

000024

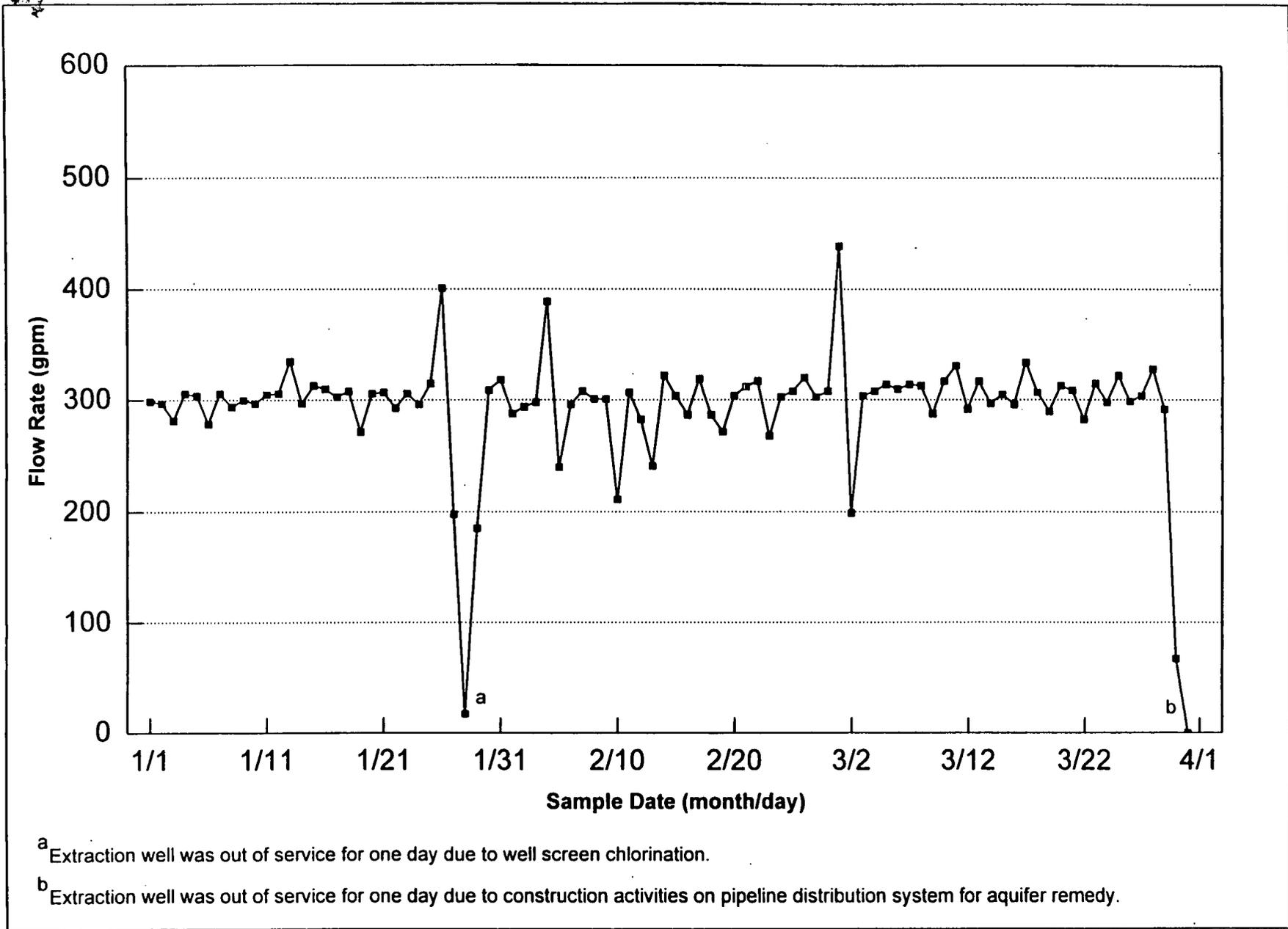
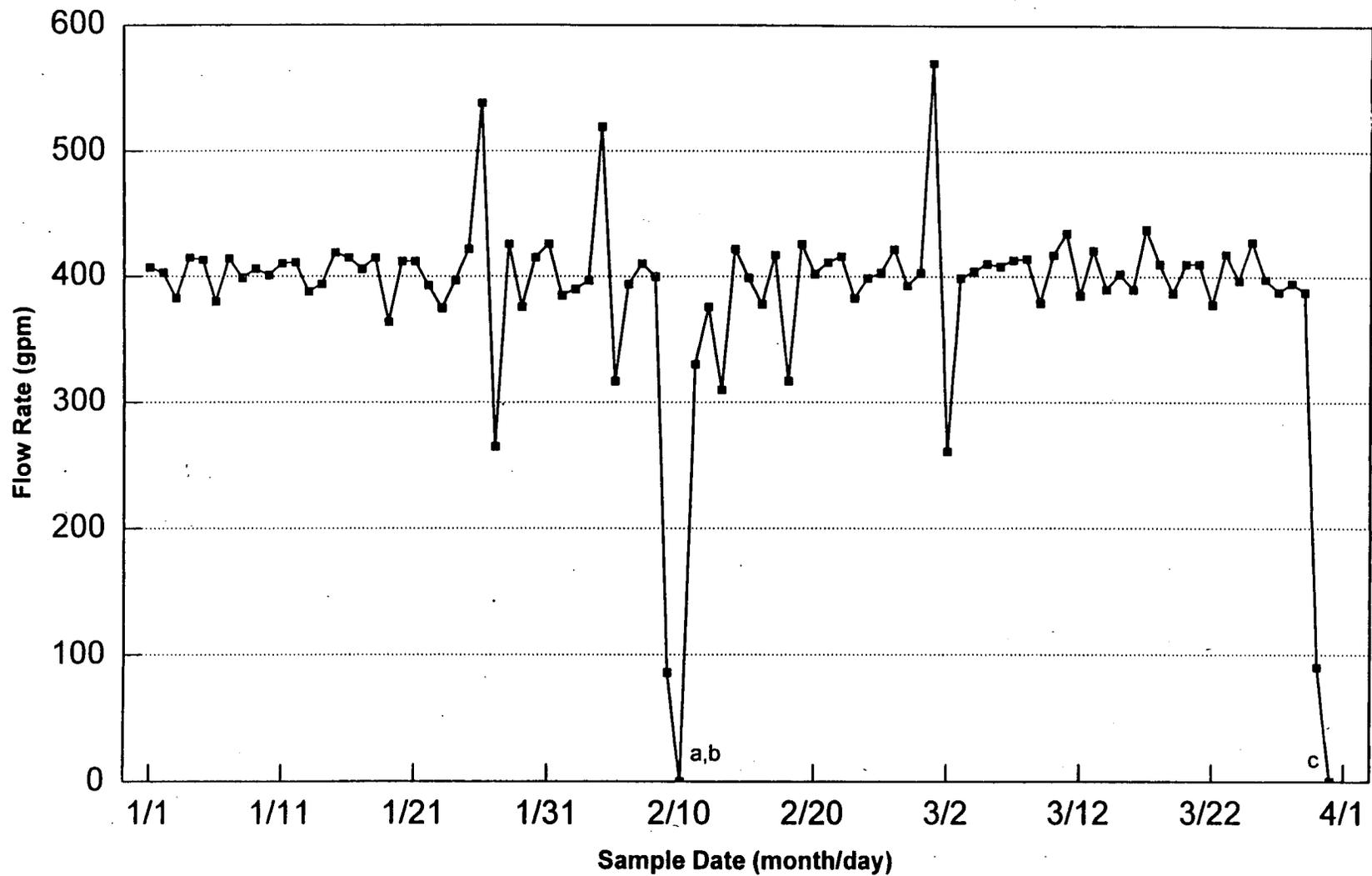


FIGURE 1-5. DAILY AVERAGE PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3925 (RW-2), 1/98 - 3/98



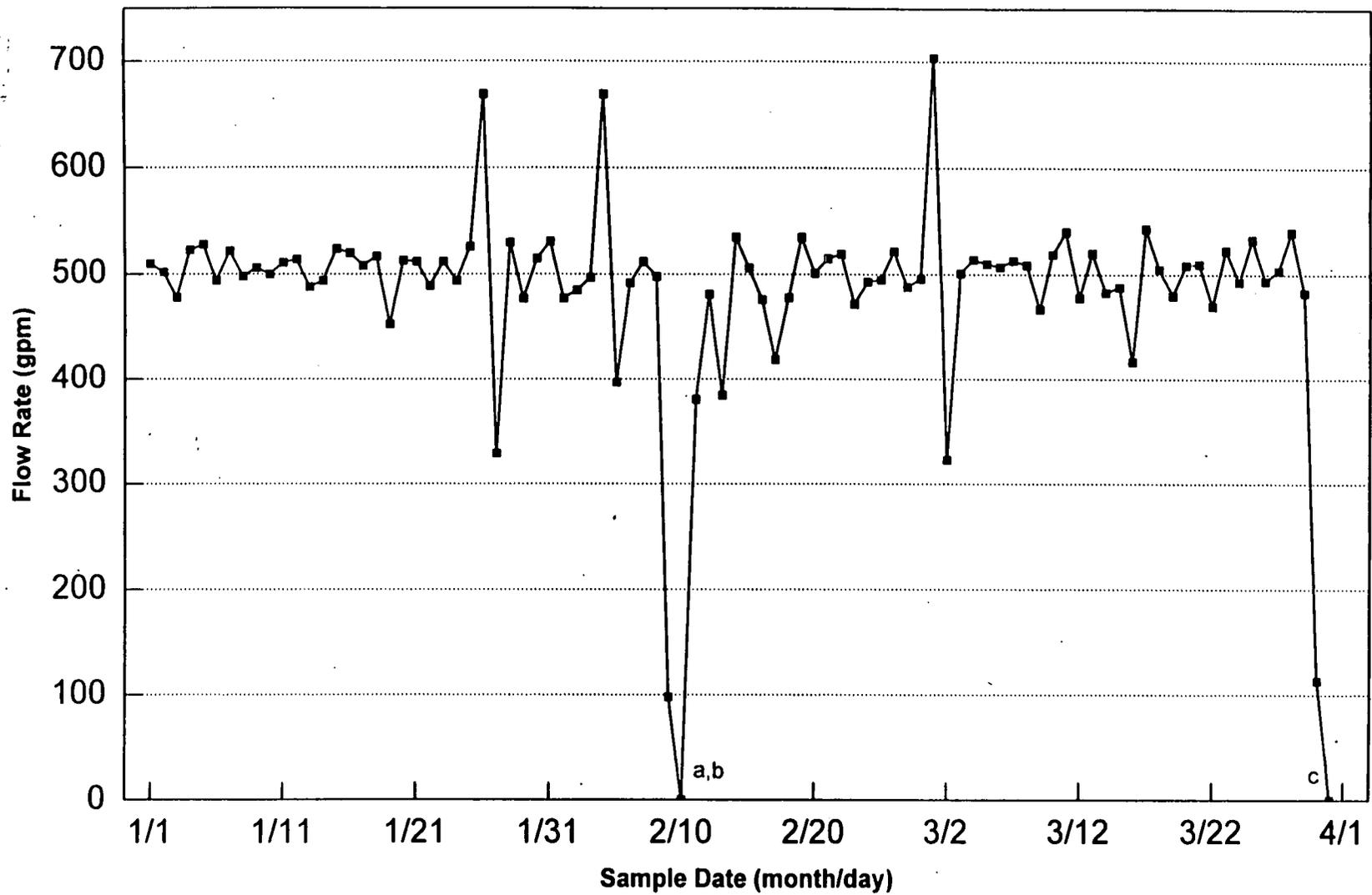
- <sup>a</sup> Extraction well was out of service for one day due to well screen chlorination.
- <sup>b</sup> Extraction well was out of service for one day to install underground electrical lines for South Plume improvement project.
- <sup>c</sup> Extraction well was out of service for one day due to construction activities on pipeline distribution system for aquifer remedy.

FIGURE 1-6. DAILY AVERAGE PUMPING RATES FOR SOUTH PLUME  
EXTRACTION WELL 3926 (RW-3), 1/98 - 3/98

000025

1585

000026



- <sup>a</sup> Extraction well was out of service one day due to well screen chlorination.
- <sup>b</sup> Extraction well was out of service one day to install underground electrical lines for South Plume improvement project.
- <sup>c</sup> Extraction well was out of service one day due to construction activities on pipeline distribution system for aquifer remedy.

FIGURE 1-7. DAILY AVERAGE PUMPING RATES FOR SOUTH PLUME  
EXTRACTION WELL 3927 (RW-4), 1/98 - 3/98

000027

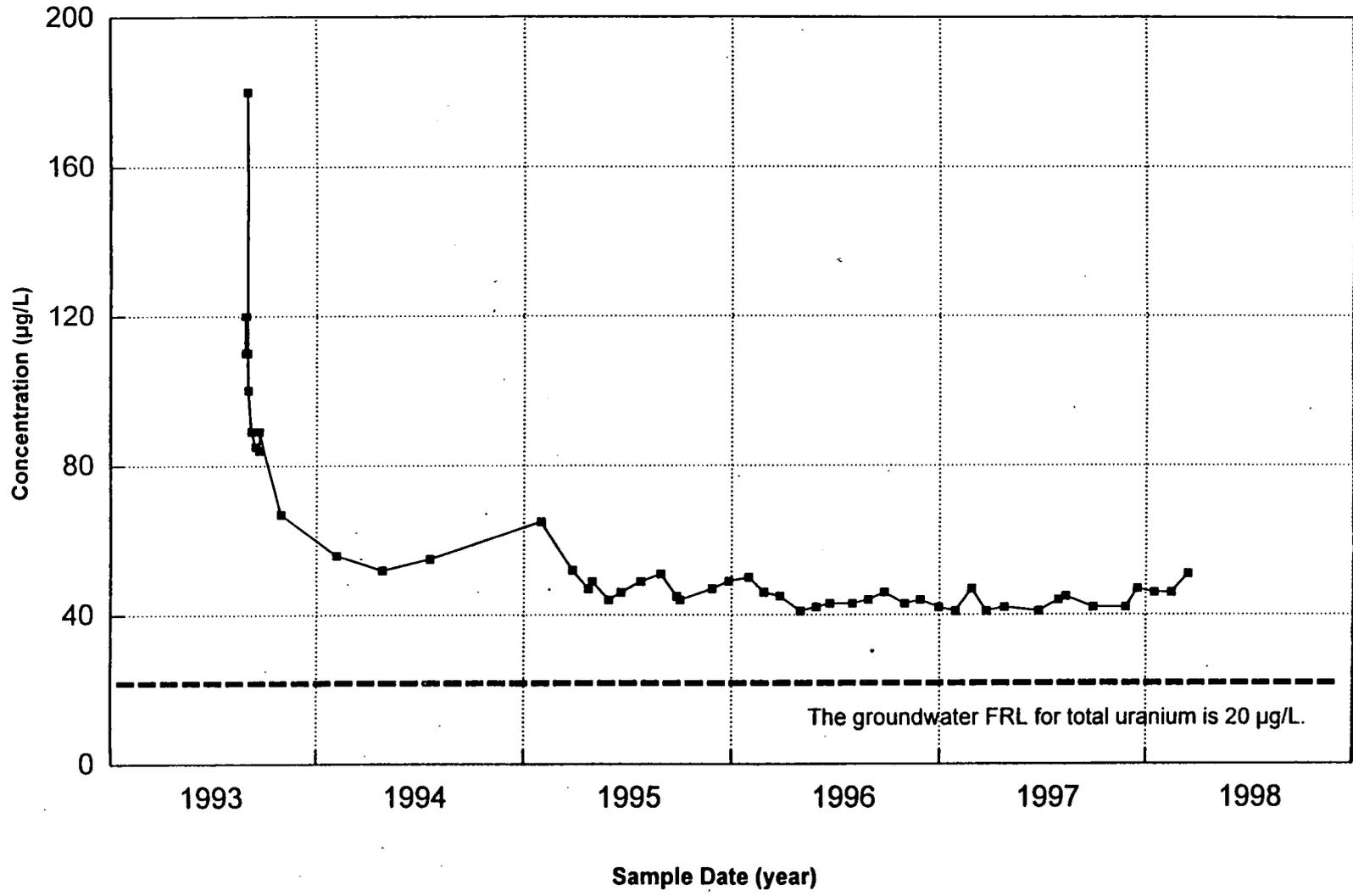


FIGURE 1-8. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR EXTRACTION WELL 3924 (RW-1)

1585

000028

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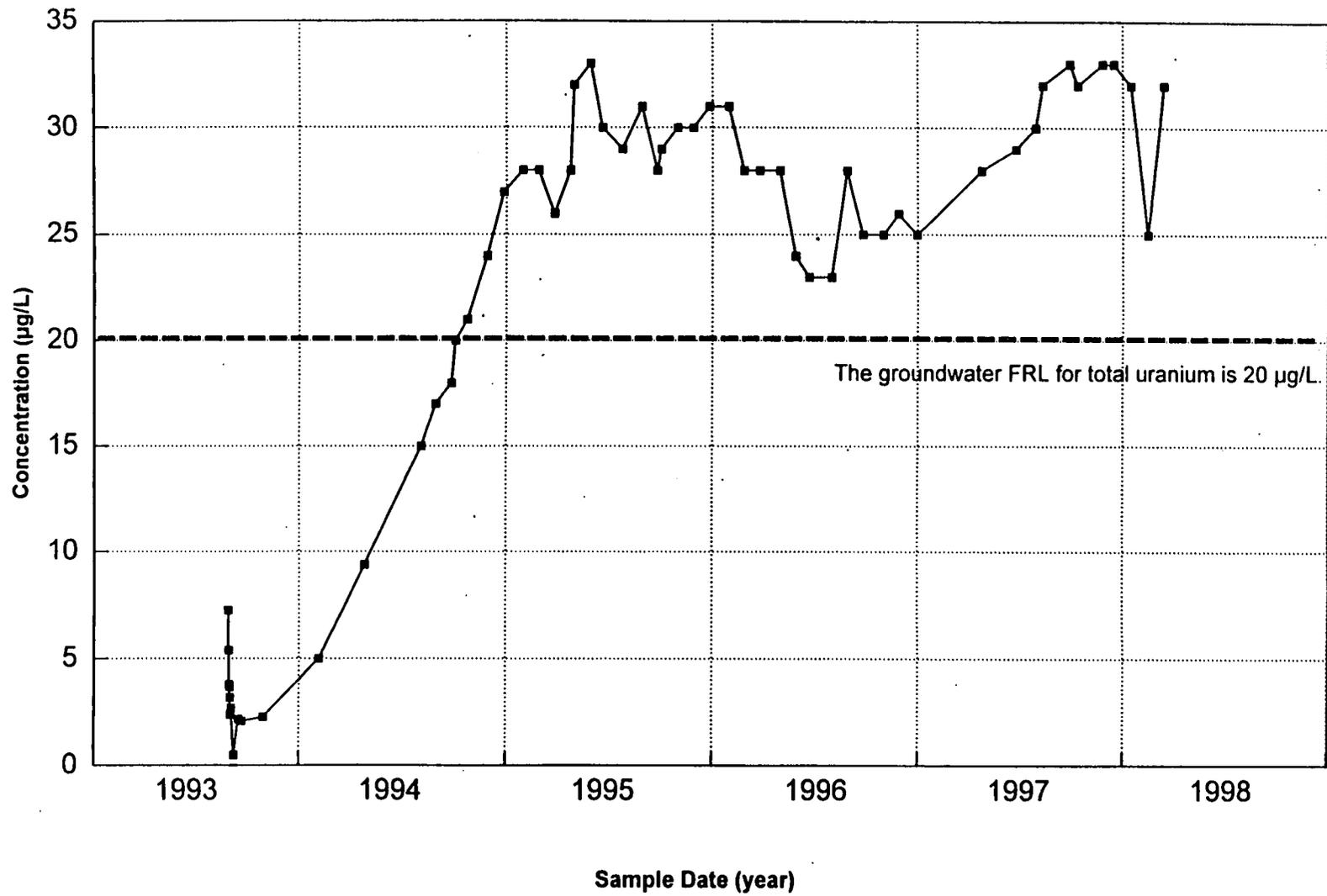


FIGURE 1-9. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR EXTRACTION WELL 3925 (RW-2)

Note: Due to well rehabilitation, no samples were collected from May through November 1996.

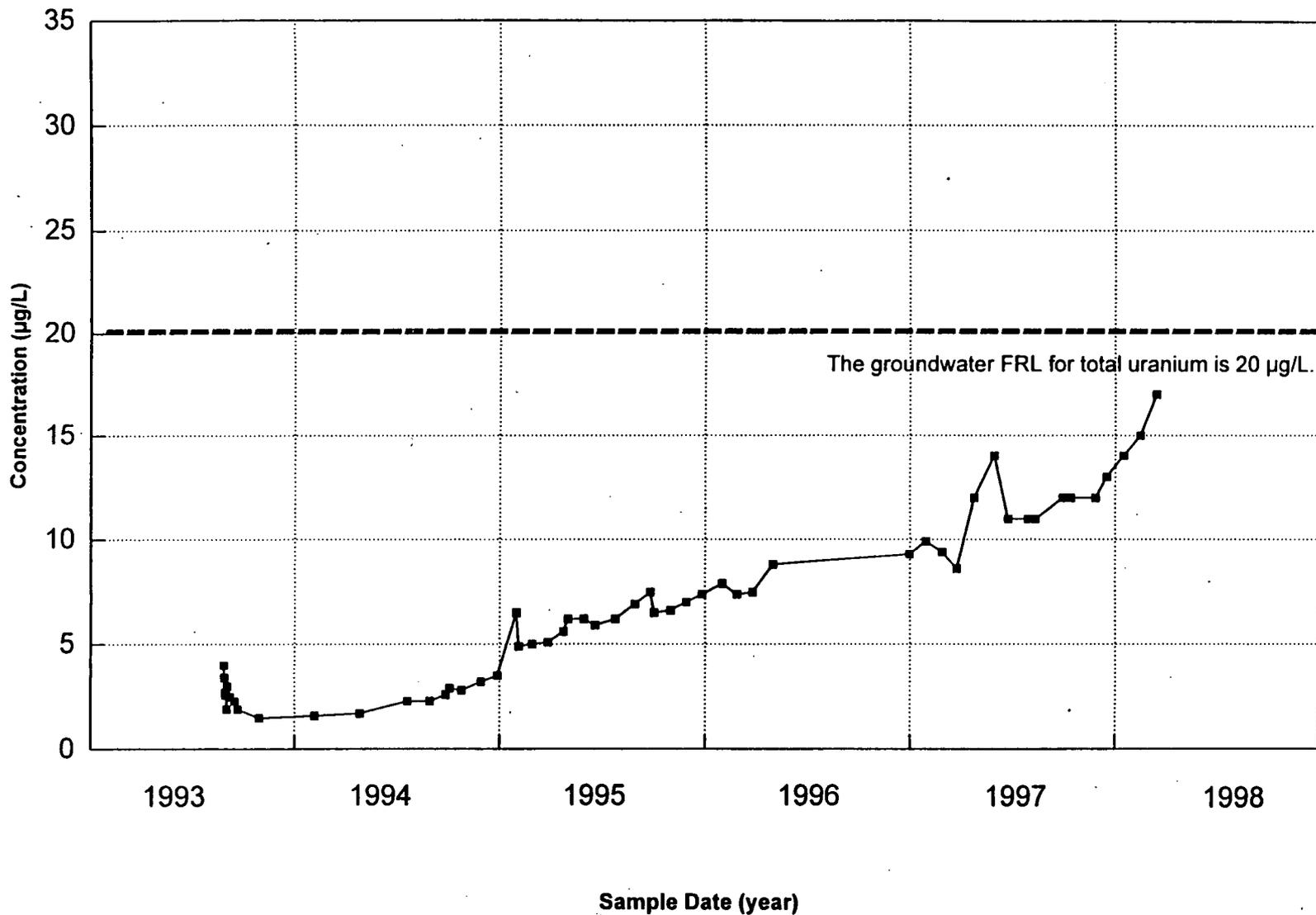


FIGURE 1-10. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR EXTRACTION WELL 3926 (RW-3)

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050000

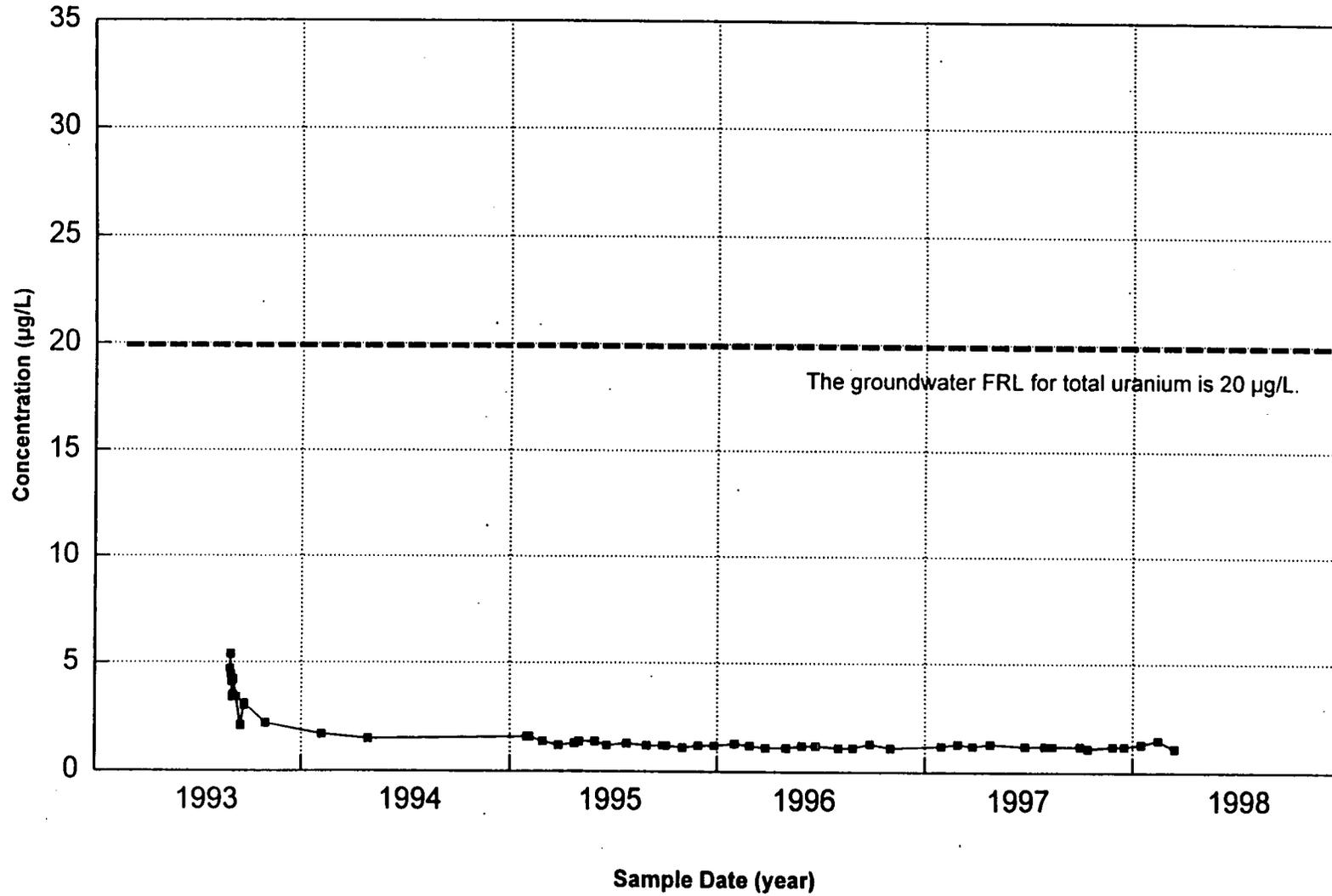


FIGURE 1-11. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR EXTRACTION WELL 3927 (RW-4)

000031  
TE0000

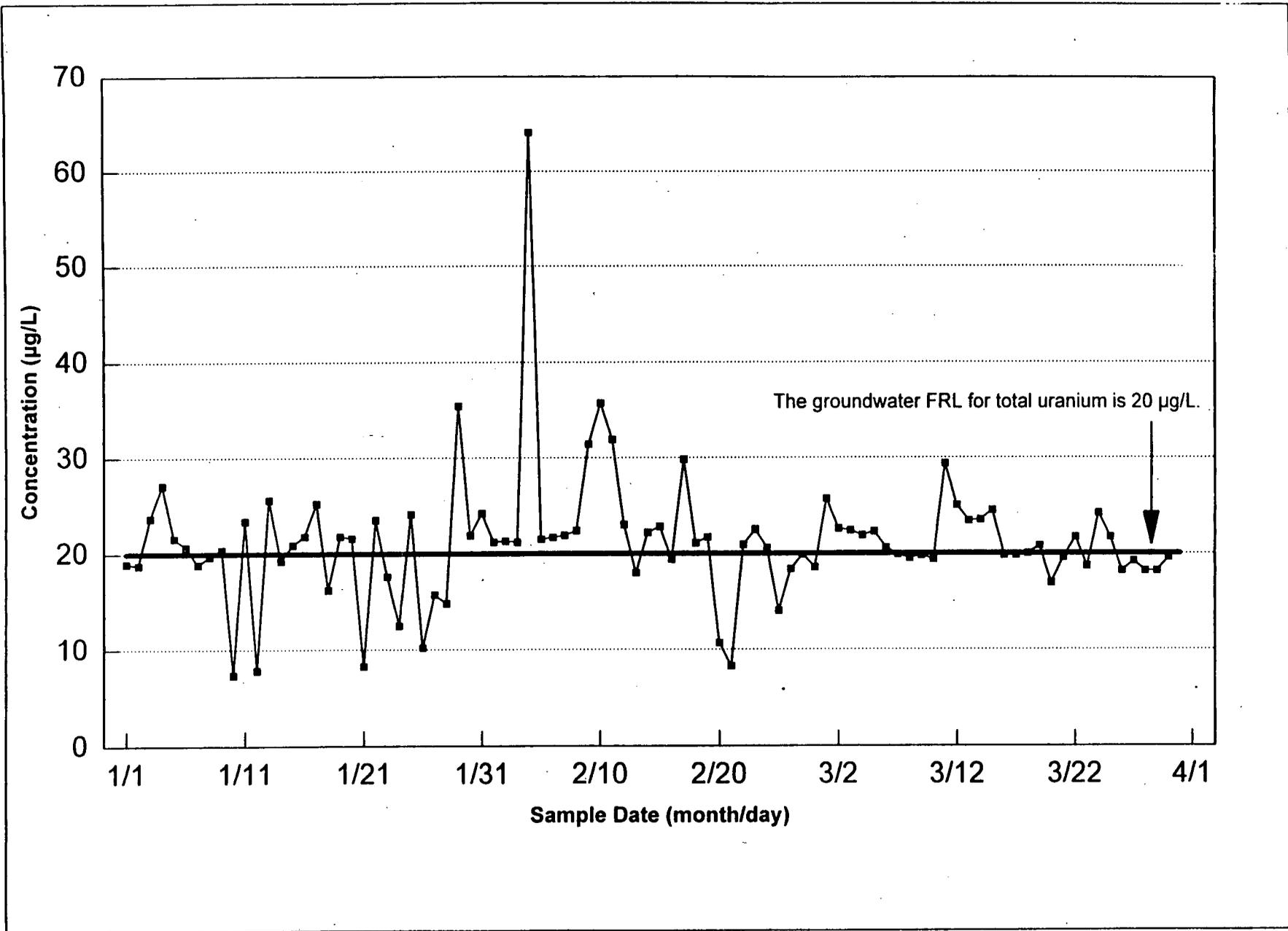


FIGURE 1-12. DAILY TOTAL URANIUM CONCENTRATIONS IN  
EXTRACTED SOUTH PLUME GROUNDWATER, 1/98 - 3/98

000032

Note: Monthly averages are flow-weighted calculations of daily grab samples collected at the storm water retention basin valve house from the South Plume groundwater.

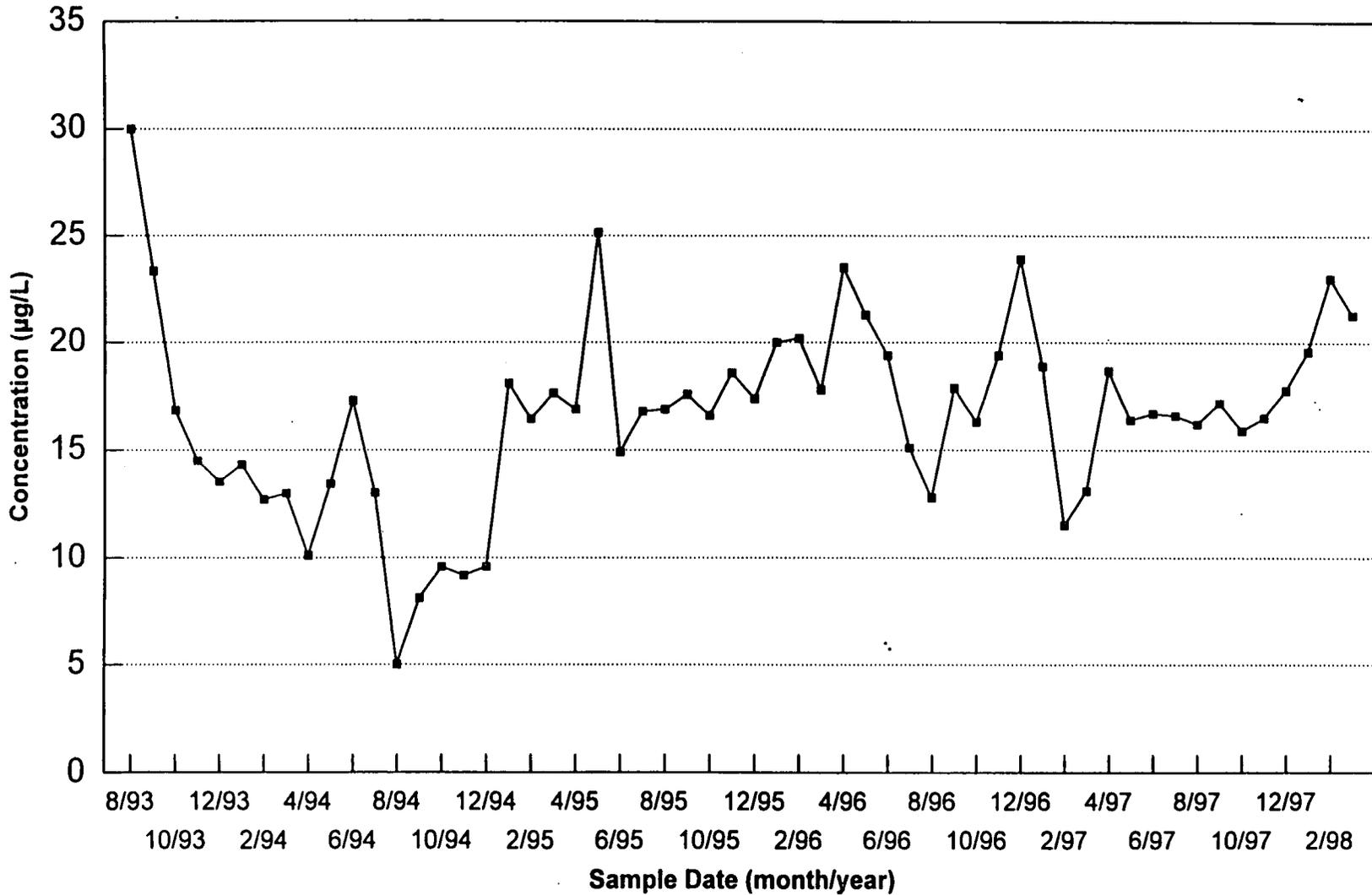


FIGURE 1-13. MONTHLY AVERAGE TOTAL URANIUM CONCENTRATIONS IN  
-EXTRACTED SOUTH PLUME GROUNDWATER, 8/93 - 3/98

000000

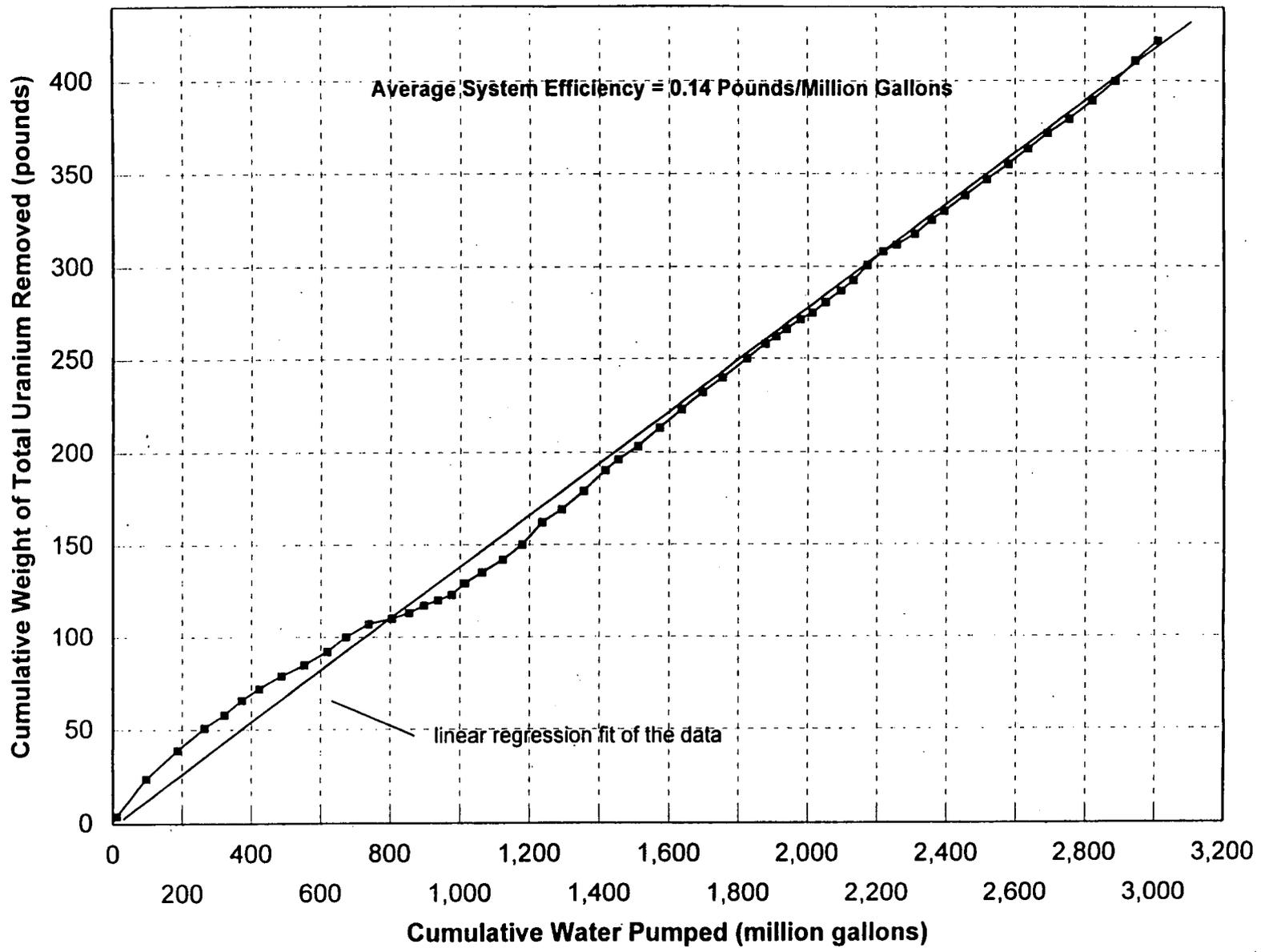


FIGURE 1-14. CUMULATIVE TOTAL URANIUM REMOVED VS. CUMULATIVE WATER PUMPED FROM SOUTH PLUME WELLFIELD, 8/93 - 3/98

1585

000034  
80000

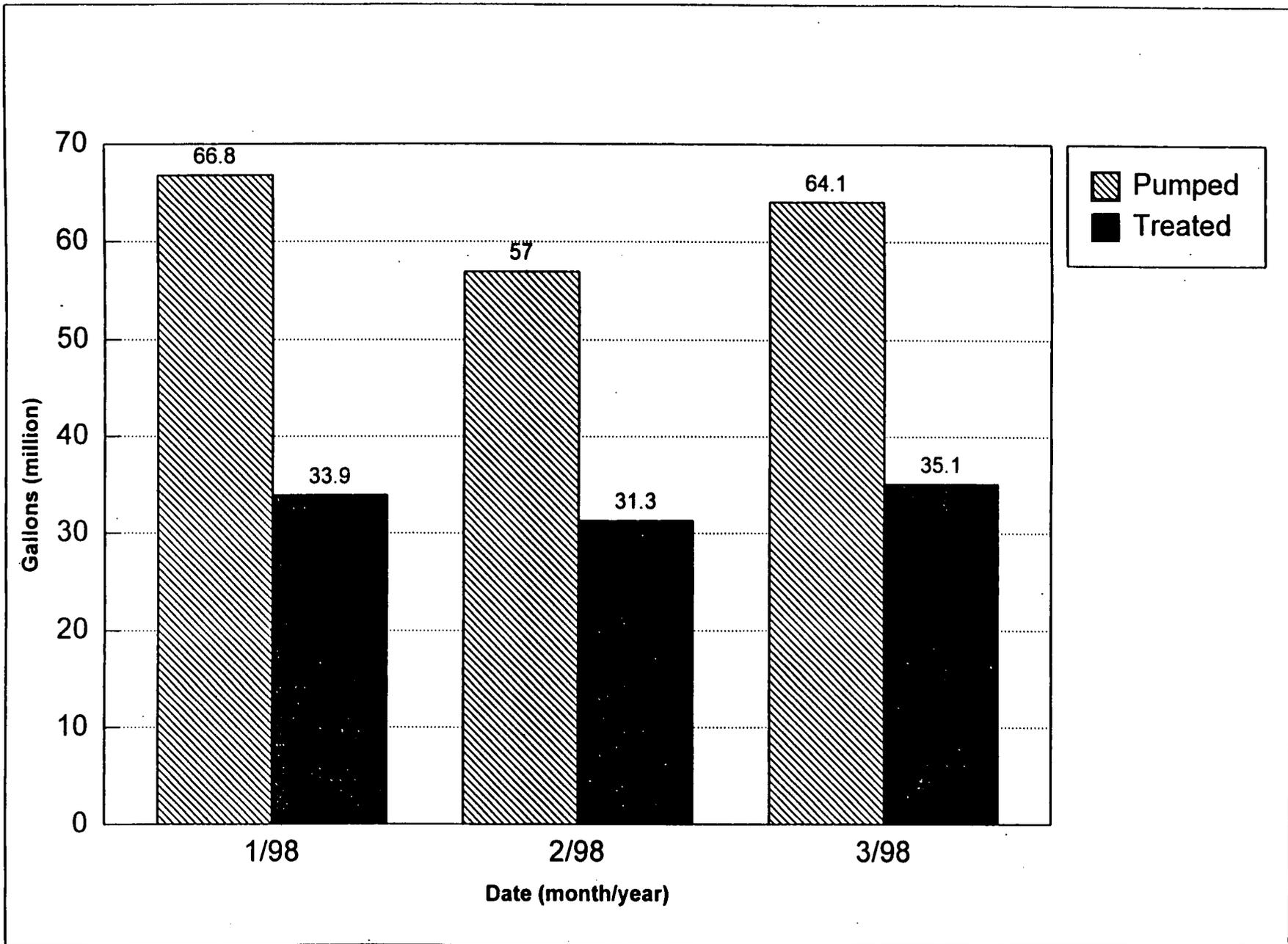
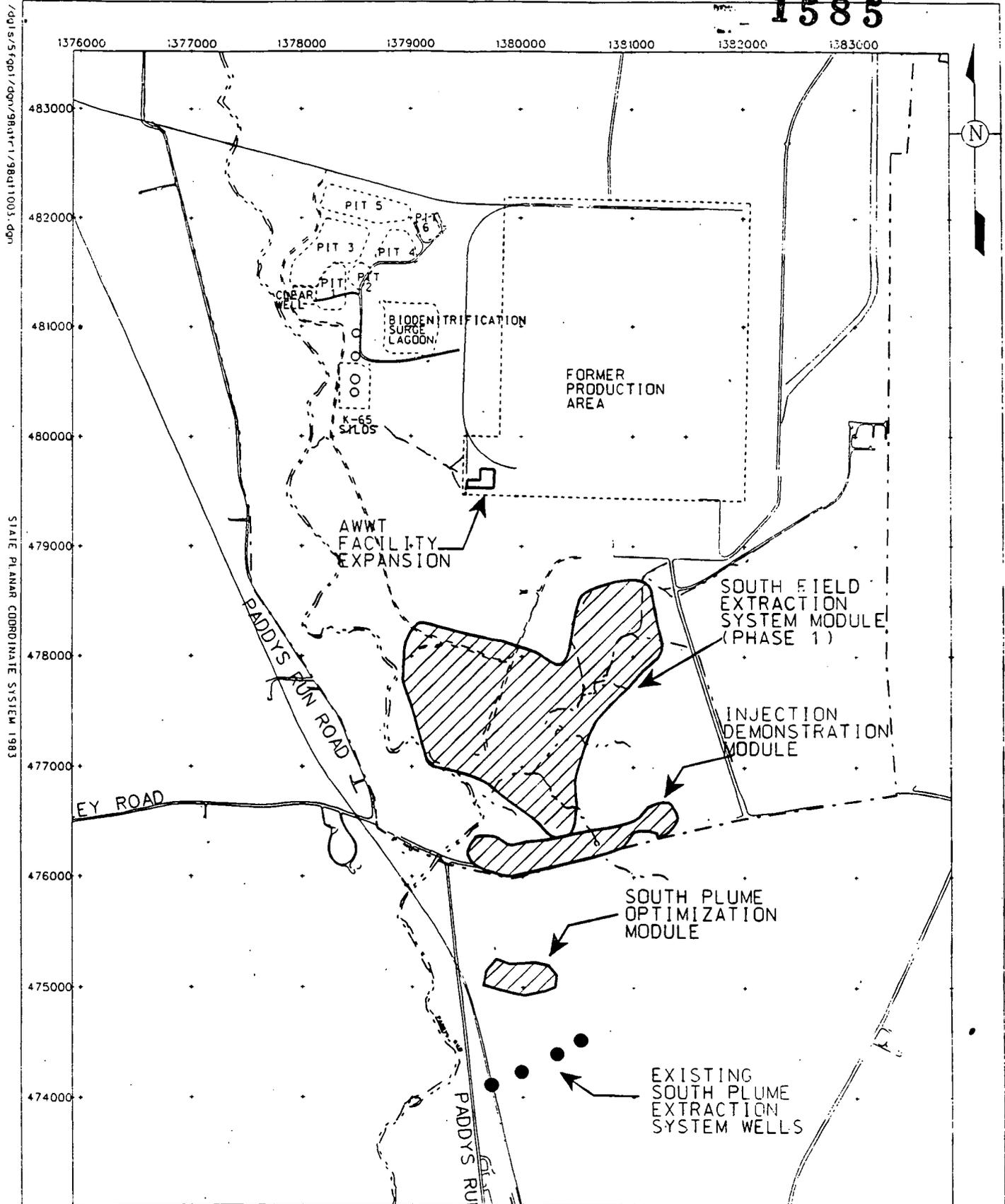


FIGURE 1-15. TOTAL GROUNDWATER PUMPED VS. GROUNDWATER TREATED FOR FIRST QUARTER 1998



/d:/s/5/frg1/dm/9811/1/9811003.dgn

STATE PLANAR COORDINATE SYSTEM 1983

8 JUN 1998

**LEGEND:**

----- FEMP BOUNDARY

 GEOGRAPHIC AREAS WITHIN WHICH EXTRACTION AND/OR INJECTION WELLS ARE PLANNED

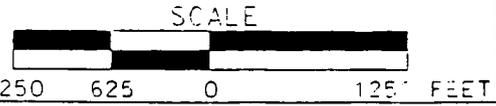
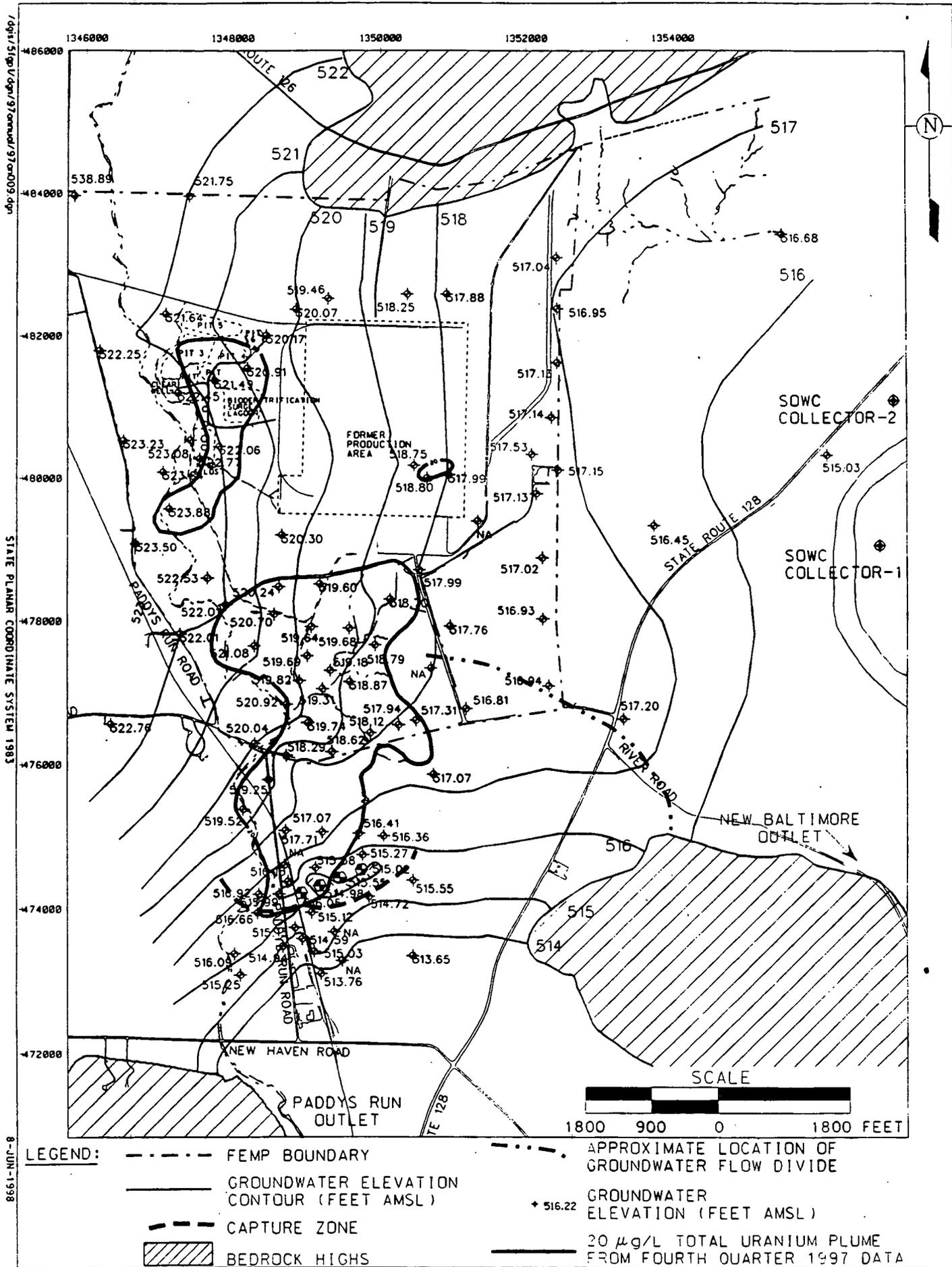


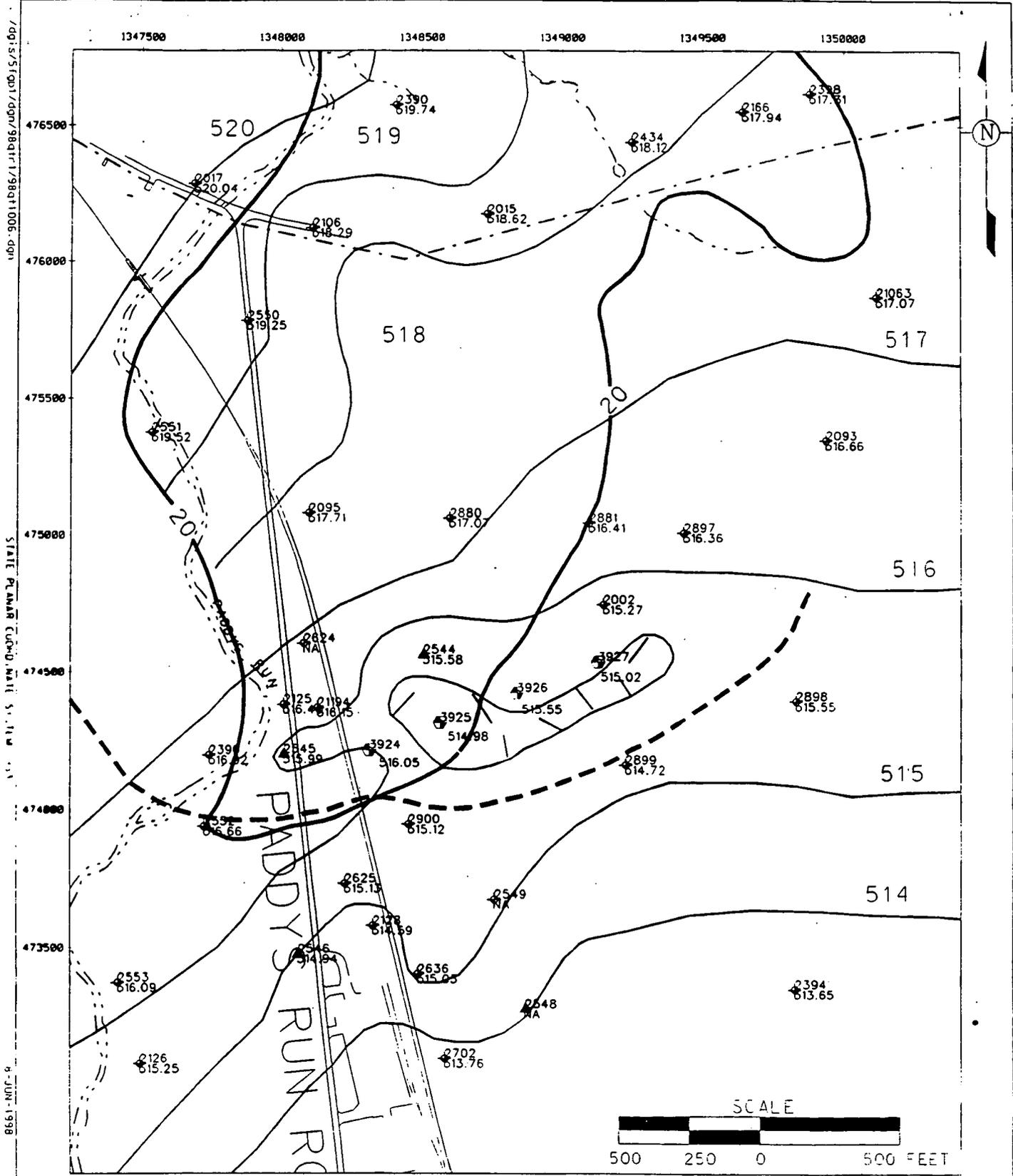
FIGURE 1-16. LOCATION OF NEAR-TERM AQUIFER RESTORATION MODULES

000035



000036 FIGURE 1-17. GROUNDWATER ELEVATIONS FOR TYPE 2 WELLS, JANUARY 1998





**LEGEND:**

- - - - FEMP BOUNDARY
- GROUNDWATER ELEVATION CONTOUR (FEET AMSL)
- - - CAPTURE ZONE
- 516.22 GROUNDWATER ELEVATION (FEET AMSL)
- 20 µg/L TOTAL URANIUM PLUME FROM FOURTH QUARTER 1997 DATA

000038

FIGURE 1-19. DETAILED GROUNDWATER ELEVATIONS IN SOUTH PLUME AREA FOR TYPE 2 WELLS, JANUARY 1998



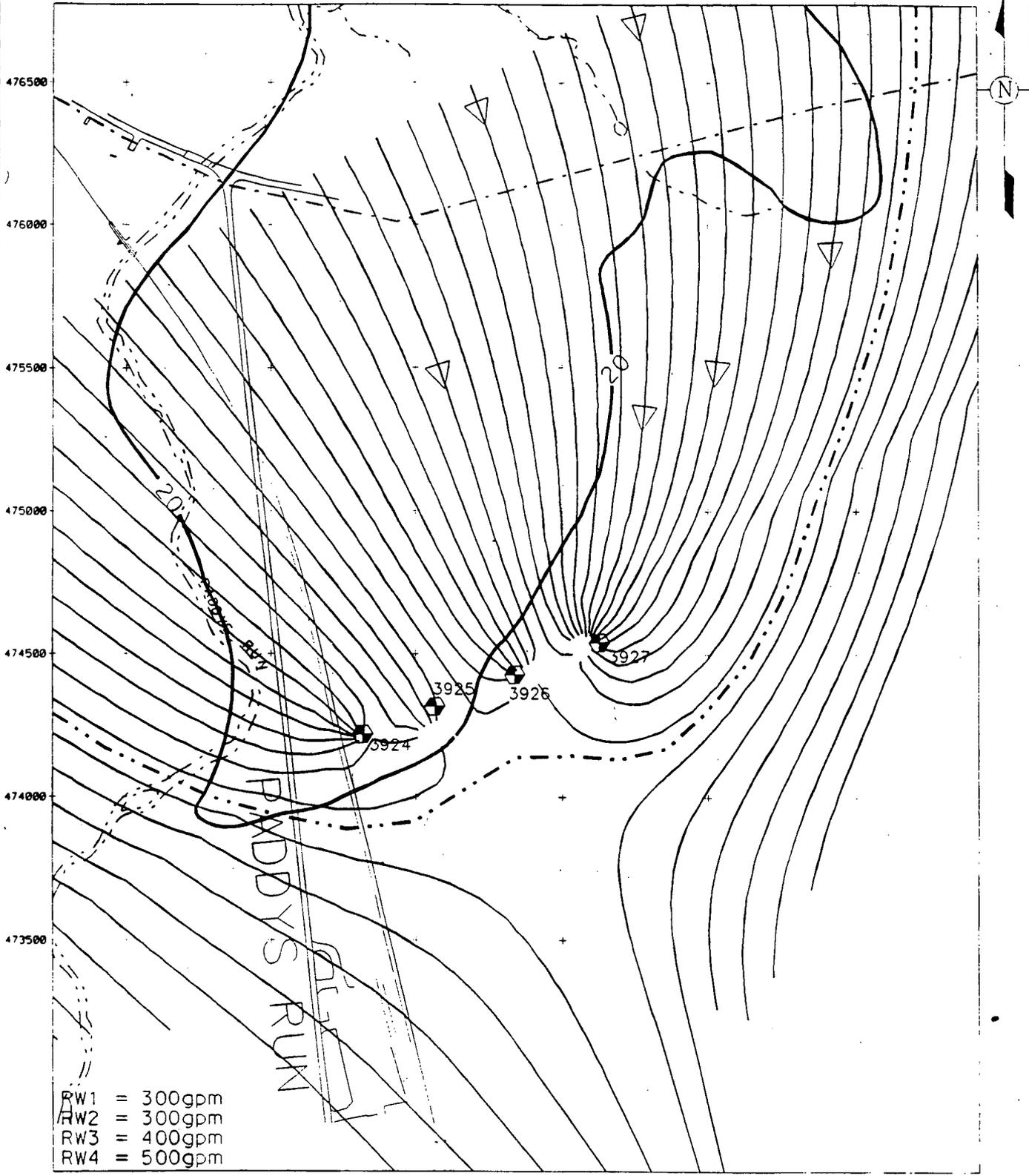


d:\s5\fgnl\dgn\98qir1\98qir1004.dgn

STATE PLANNED COORDINATE SYSTEM 1983

8-JUN-1993

1347500 1348000 1348500 1349000 1349500 1350000



- RW1 = 300gpm
- RW2 = 300gpm
- RW3 = 400gpm
- RW4 = 500gpm

LEGEND:

- - - - FEMP BOUNDARY
- . . . . MODELED CAPTURE ZONE (1500 gpm)
- MODELED PARTICLE TRACK (1500 gpm)  
(ARROW INDICATES DIRECTION)

— 20 µg/L TOTAL URANIUM  
PLUME, FOURTH QUARTER 1997

● EXTRACTION WELL

SCALE

50 100 200 300 FEET

FIGURE 1-22. MODELED 1500 GPM PUMPING CONFIGURATION, PARTICLE TRACKS, AND CAPTURE ZONE

000041

000042

FERIEMP-QTR16-98ISECT-698.wpd\June 25, 1998 1:48PM

1-34

FIGURE 1-23

## GROUNDWATER SAMPLING ACTIVITIES COVERED IN THE NEXT QUARTERLY REPORT

SAMPLING ACTIVITIES	1998											
	1st Quarter			2nd Quarter			3rd Quarter			4th Quarter		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
South Plume Extraction System (Operational)				◆	◆	◆						
South Plume Module (Restoration)		◆										
Routine Water-Level Monitoring				◆								
RCRA Property Boundary Monitoring	◆											
OSDF Groundwater Monitoring												
Post Baseline (Cell 1)		◆										
Baseline (Cell 2)	◆	◆	◆									
Private Well Monitoring	◆											
South Field Extraction Module			◆									
Waste Storage Area Module												
Plant 6 Area Module												
KC-2 Warehouse Monitoring												

◆ Data summarized/  
evaluated in next report

**2.0 SURFACE WATER AND TREATED EFFLUENT UPDATE**

**2.1 INTRODUCTION**

This section provides a summary of the first quarter 1998 surface water and treated effluent monitoring results. The detailed analytical results from the IEMP Characterization Program for fourth quarter 1997 were reported in the 1997 Integrated Site Environmental Report, issued June 1, 1998, and are therefore not included in this report.

Figure 2-1 identifies the data included in this section. Figure 2-2 shows the surface water and treated effluent sample locations. Analytical results from the following routine monitoring program elements were utilized to complete the reporting requirements identified in Section 4.6.2 of the IEMP:

- National Pollutant Discharge Elimination System (NPDES) permit (data obtained from January through March 1998)
- Federal Facilities Compliance Agreement (FFCA) requirements (data obtained from January through March 1998).

Surface water and treated effluent information previously reported through quarterly FFCA reports is transitioned to the IEMP quarterly status reports beginning with the first quarter 1998 data in this report.

**2.2 FINDINGS**

The principal findings from the reporting period are summarized below:

**NPDES Permit Compliance**

- Wastewater and storm water discharges from the Fernald Environmental Management Project (FEMP) were in compliance 100 percent of the time during first quarter 1998.

**FFCA and Operable Unit 5 Record of Decision Compliance**

- As shown in Figure 2-3, a cumulative total of 35 pounds of uranium were discharged to the Great Miami River in treated effluent from January through March 1998. The Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996) established an annual discharge limit to the Great Miami River of 600 pounds for total uranium.

000043

- Uncontrolled runoff is also contributing to the amount of total uranium entering the environment. It is estimated that 6.25 pounds of total uranium is discharged to the environment through uncontrolled runoff with every inch of rain. Precipitation during the first quarter of 1998 amounted to 8.07 inches; therefore, the mass of total uranium discharged to the environment through uncontrolled runoff during January through March was approximately 50.4 pounds.
- The monthly average total uranium concentration limit of 20  $\mu\text{g/L}$  in water discharged to the Great Miami River (effective January 1, 1998) was met during the first quarter of 1998, as shown in Figure 2-4. Two of the 10 allowable "significant precipitation" bypass days were utilized to meet the limit. Details concerning these bypasses are presented in Table 2-1.

### Surveillance Monitoring

- There were no final remediation level or benchmark toxicity value exceedances associated with surface water and treated effluent for the first quarter data provided in this report. (Figure 2-1 identifies data presented in this report.)

Figure 2-5 shows the data from the surface water and treated effluent sampling activities that will be included in the next IEMP quarterly status report. This next quarterly status report will be submitted in September 1998. The report will contain NPDES and FFCA data from April 1 through June 30, 1998 (second quarter) and the results of the analytical data from the IEMP Characterization Program for the first quarter, January 1 through March 31, 1998.

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TABLE 2-1

## FIRST QUARTER 1998 STORM WATER TREATMENT BYPASS EVENTS

Bypass Days	Duration (hours)	Total No. of Bypass Days	Cumulative No. of Bypass Days	Total Uranium Discharged to Great Miami River (pounds)
<b>Significant Precipitation-Related</b>				
January 7 through January 9	53.8	2 <sup>a</sup>	2	7.81

<sup>a</sup>The bypass encompassed three calendar days; however, per the Operable Unit 5 ROD, cumulative hours equate to two bypass days.

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000045

FIGURE 2-1

SURFACE WATER AND TREATED EFFLUENT SAMPLING ACTIVITIES COVERED IN THIS QUARTERLY REPORT

1998											
1st Quarter			2nd Quarter			3rd Quarter			4th Quarter		
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
◆	◆	◆									
◆	◆	◆									

◆ Data summarized/  
evaluated in this report

SAMPLING ACTIVITIES

NPDES

FFCA

IEMP Characterization

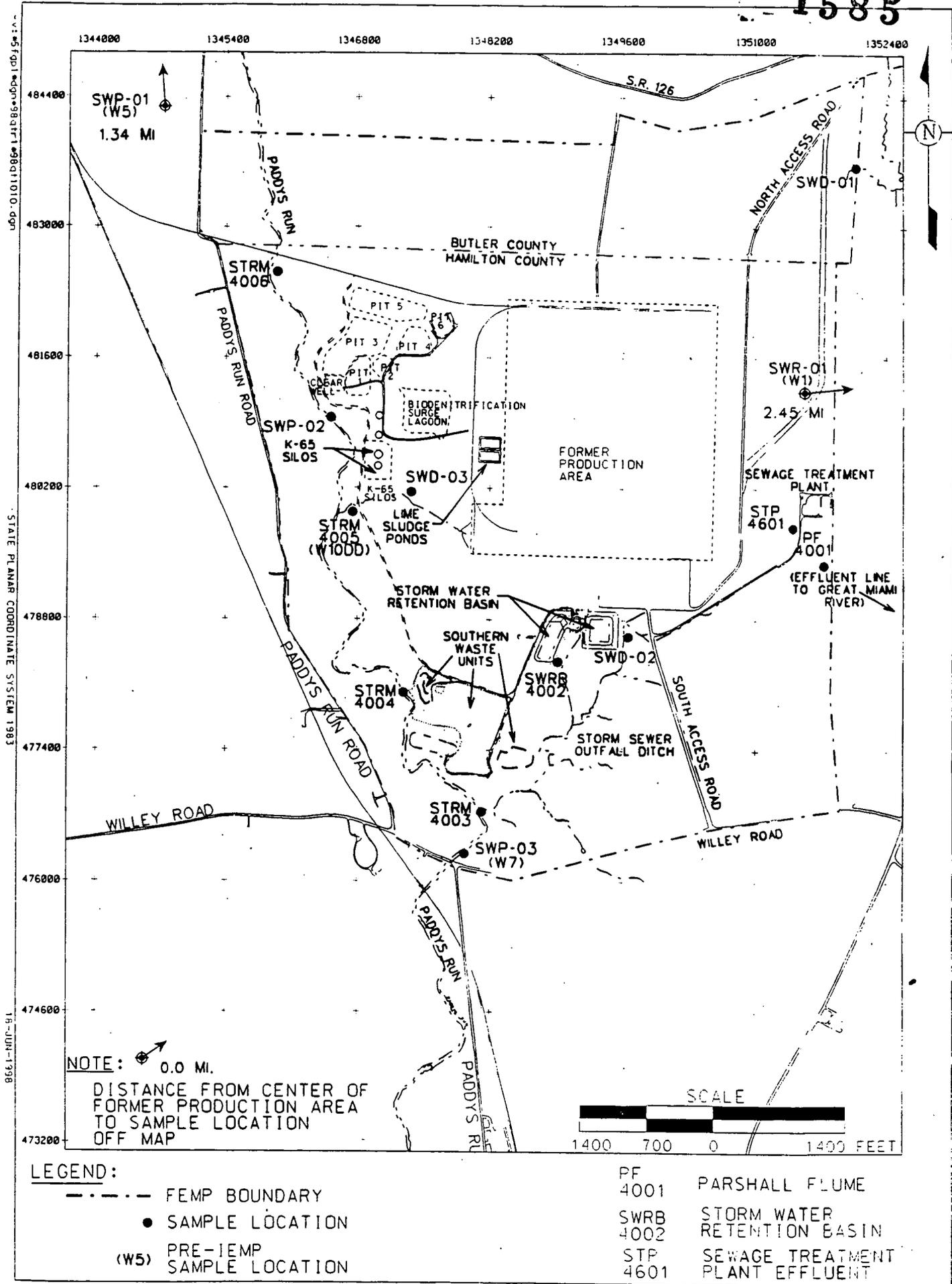


FIGURE 2-2. SURFACE WATER AND TREATED EFFLUENT SAMPLE LOCATIONS

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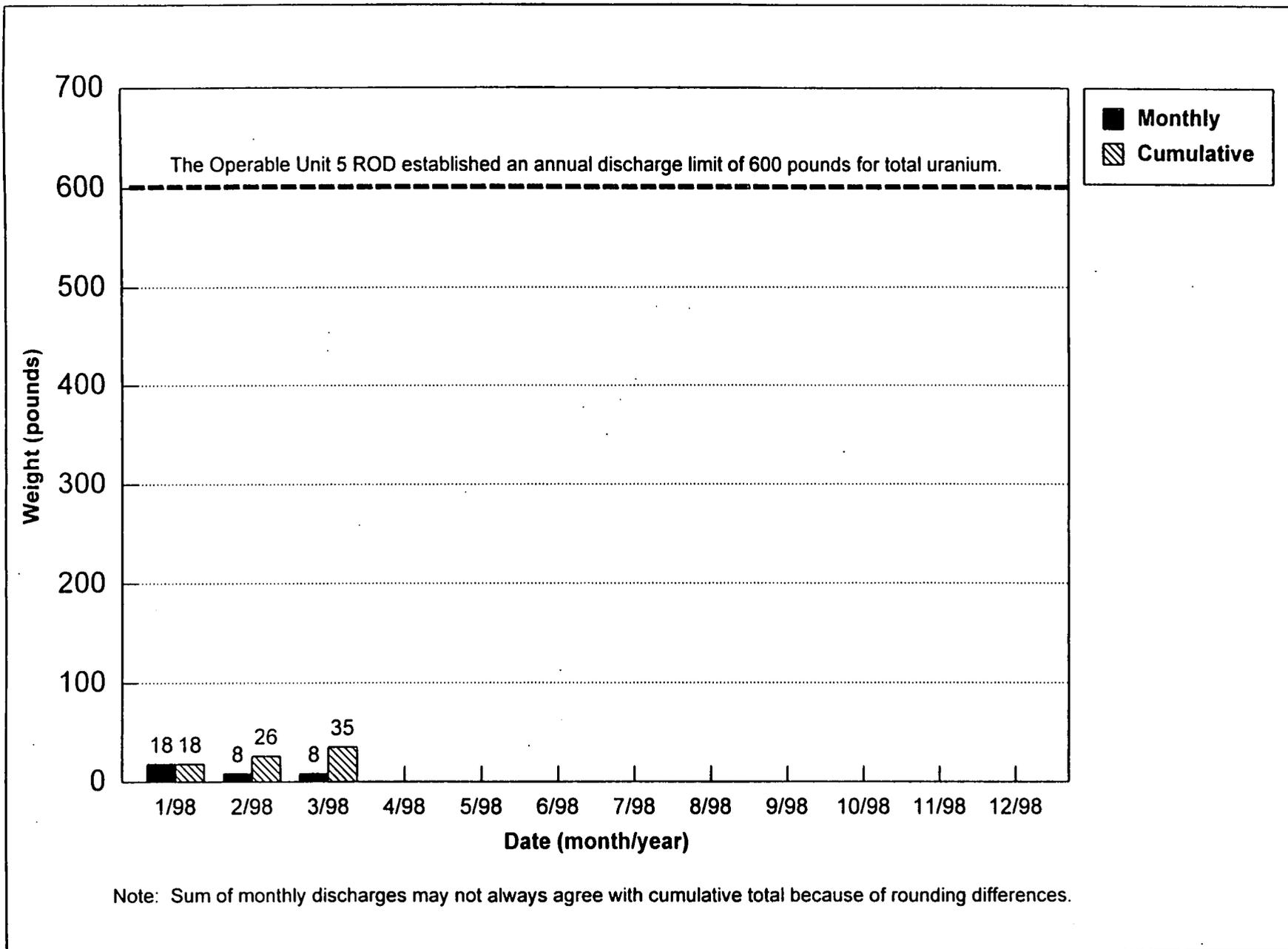
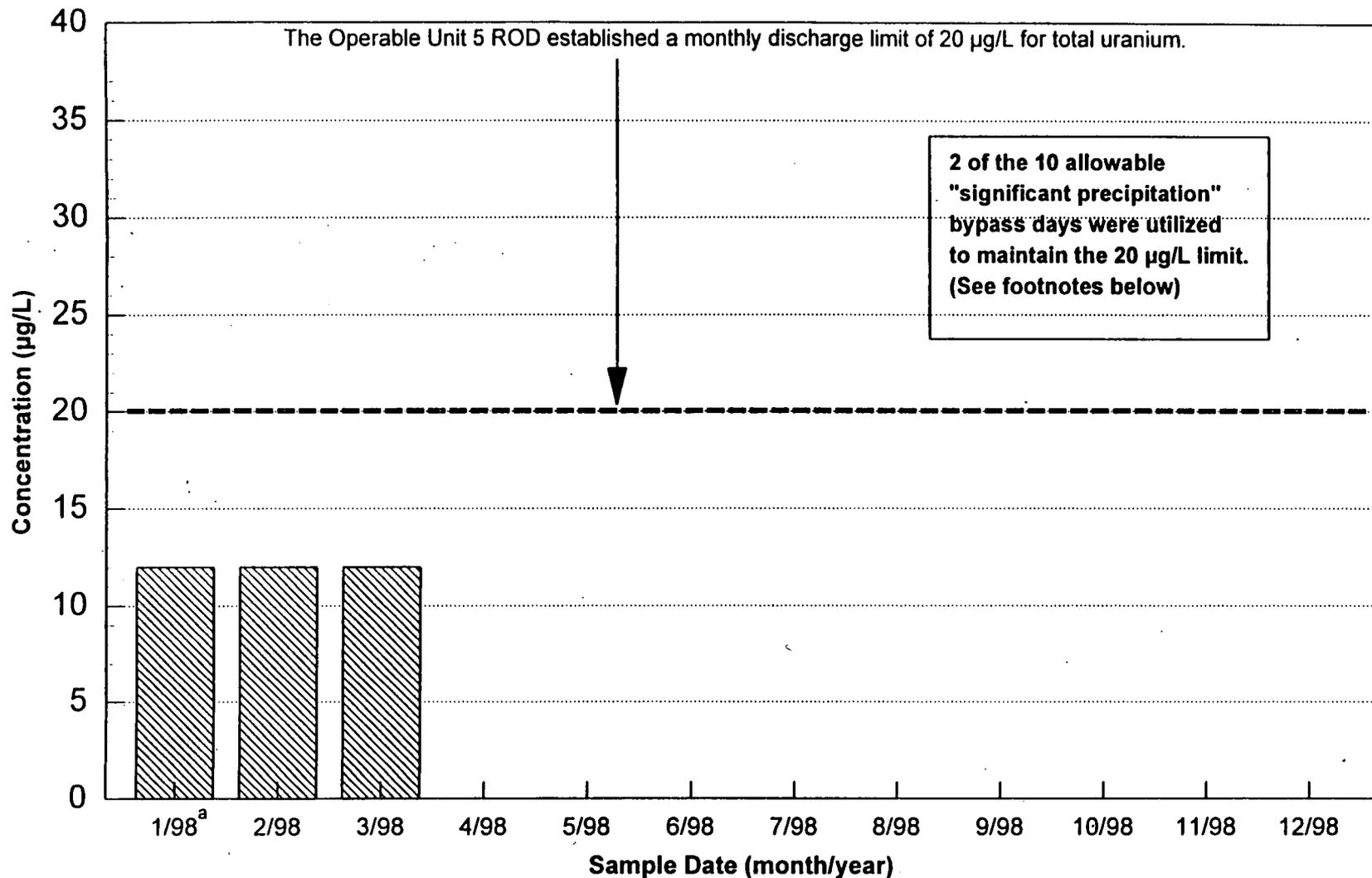


FIGURE 2-3. POUNDS OF URANIUM DISCHARGED TO THE GREAT MIAMI RIVER FROM THE PARSHALL FLUME (PF 4001) IN 1998



<sup>a</sup>Actual concentration was 23.2 µg/L. Eliminating 2 "significant precipitation" bypass days reduces average to 12.0 µg/L.

FIGURE 2-4. 1998 MONTHLY AVERAGE TOTAL URANIUM CONCENTRATION IN WATER DISCHARGED FROM THE PARSHALL FLUME (PF 4001) TO THE GREAT MIAMI RIVER

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FIGURE 2-5

SURFACE WATER AND TREATED EFFLUENT SAMPLING ACTIVITIES COVERED IN THE NEXT QUARTERLY REPORT

1998											
1st Quarter			2nd Quarter			3rd Quarter			4th Quarter		
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
<b>SAMPLING ACTIVITIES</b>											
NPDES			◆	◆	◆						
FFCA			◆	◆	◆						
◆	◆	◆									
IEMP Characterization											

◆ Data summarized/  
evaluated in next report

### 3.0 AIR MONITORING UPDATE

#### 3.1 INTRODUCTION

This section provides a summary of the first quarter 1998 monitoring activities and analytical results for the IEMP air monitoring program. The data included in this section are identified in Figure 3-1.

Analytical results from the following routine air monitoring program elements and project-specific air monitoring activities covered in this section include:

- Radiological Air Particulate Monitoring
  - National Emissions Standards for Hazardous Air Pollutant (NESHAP) Compliance
  - Project-Specific Air Monitoring
  - Air Particulate Monitoring Research Project
- Radon Monitoring
  - Continuous Alpha Scintillation Monitoring - Silo Head Space and Environmental
- Direct Radiation Monitoring (via thermoluminescent dosimeters [TLDs])
- NESHAP Stack Emissions Monitoring.

Radon monitoring data collected via continuous alpha scintillation monitors previously reported through quarterly FFCA/Federal Facility Agreement reports are transitioned to the IEMP quarterly status reports beginning with the first quarter 1998 data in this report.

#### 3.2 FINDINGS

The principle findings from the reporting period are summarized below:

##### **Radiological Air Particulate Monitoring**

- Total uranium and total particulate concentrations at all air monitoring stations (AMS) were within historical ranges and did not exhibit any increasing trends during first quarter 1998.

- AMS-24 was relocated approximately 330 feet due east of its original location in order to address nearby property owner concerns regarding noise and electrical interferences. The air monitoring station was out of service between March 31 and April 3, 1998, due to this relocation. The new location is identified on Figure 3-2.

(Refer to Figure 3-2 for the location of air monitoring stations and Tables 3-1 and 3-2 and Figures 3-3 through 3-12 for data evaluation.)

### NESHAP Compliance

- Recognizing that the primary source of air emissions at the FEMP has changed under full scale remediation from point sources to fugitive dust from diffuse sources, the IEMP Radiological Air Particulate Monitoring Program defines a new approach for demonstrating NESHAP Subpart H compliance. The new approach, which began on January 1, 1998, utilizes air composite results rather than computer modeling to estimate the dose from airborne particulates to off-site receptors.
- As shown in Table 3-3, the maximum estimated dose at the site fenceline calculated from air composite results from first quarter 1998 was 0.056 millirem (mrem) at AMS-25. This represents 0.56 percent of the 10 mrem NESHAP Subpart H Standard.

(Refer to Figure 3-2 for the location of air monitoring stations and Table 3-3 for data evaluation.)

### Project-Specific Air Monitoring

- Project-specific radiological air monitoring activities initiated in October 1997 continued during first quarter 1998 to support the decontamination and dismantlement for the Thorium/Plant 9 Complex. This monitoring is conducted under the Operable Unit 3, Integrated Remedial Action, Thorium/Plant 9 Complex Implementation Plan for Above-Grade Decontamination and Dismantlement (DOE 1997d). The monitoring program includes five project-specific air monitoring stations located near the project boundary that are monitored weekly for total uranium. Results from first quarter 1998 indicate increases in total uranium concentrations above the maximum baseline level measured prior to the start of decontamination and dismantlement activities. The implementation plan states that if radiological levels from four consecutive weeks of air monitoring are more than twice the maximum baseline levels, then an evaluation of the effectiveness of engineered controls will be performed as soon as practical. Although the results were not above twice the maximum baseline levels over four consecutive weeks, additional engineered controls were implemented at the project. These engineered controls include: reconfiguration of the Plant 9 vestibule; application of sealants on debris staged outdoors; and water washing of project vehicle wheels (i.e., bobcats). It should be noted that the average total uranium concentrations for the Thorium/Plant 9 Complex are within historical ranges of the Plant 1, 4, and 7 projects during similar work activities. In addition, the increases at the Thorium/Plant 9 Complex have not been observed at the IEMP fenceline air monitors.

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**Air Particulate Monitoring Research Project**

- During the first quarter of 1998, the DOE Environmental Measurements Research Laboratory continued to collect samples in order to measure the uranium concentration and the particle size distribution of particulate emissions. Since the analysis of samples collected in late 1997 and early 1998 showed the uranium concentrations to be at or below the detection limit, the analysis of the remaining first quarter samples is on hold until improvements can be made to the analytical procedure. It should be noted that a new sampler with a higher flow rate is being developed which will also improve the detection limit for future samples. The new sampler is expected to be installed during the second half of 1998.

**Radon Monitoring**

- During first quarter 1998, there were two days when the 100 picoCuries per liter (pCi/L) radon limit specified in DOE Order 5400.5 was exceeded. These exceedances were detected in continuous radon monitor KNE located immediately adjacent to the K-65 Silos. These exceedances were of short-duration, and were not observed outside the immediate vicinity of the K-65 exclusion fence. As in the past, these exceedances were associated with particularly strong atmospheric inversions rather than with any operational change associated with the K-65 Silos. Based on the limited occurrence, short duration, and limited aerial extent of the exceedances, no additional actions are planned.

(Refer to Figure 3-13 for radon monitoring - continuous alpha scintillation locations.)

- During the first quarter of 1998, continuous radon monitoring data were collected from the FEMP's network of 19 continuous radon monitors. As expected, the highest radon concentrations were recorded at the K-65 exclusion fence resulting from radon emissions from the K-65 Silos. First quarter data does not indicate the potential for an exceedance of the DOE on-site or off-site annual average radon limits during 1998.

(Refer to Table 3-4 for monthly continuous radon monitor concentration data.)

- First quarter measurements of radon concentrations in the Silo 1 head space showed an increase of approximately 17 percent over first quarter 1997 results. Radon concentrations in Silo 2 showed an increase of approximately 26 percent over concentrations measured during the first quarter 1997. Although increasing annually, the radon concentration in both silos is significantly lower than pre-bentonite levels. These increases in head space radon concentrations are measurable in monitors located at the K-65 exclusion fenceline.

(Refer to Figure 3-14 for silo head space radon concentrations.)

000053-01

### Direct Radiation (TLD) Monitoring

- All monitoring results from direct radiation measurements for first quarter 1998 were within historical ranges. A slight positive trend in the immediate area of the K-65 Silos has been identified and will continue to be monitored. This trend is attributed to a corresponding increase in radon concentrations observed in the K-65 Silo head space. The increase in direct radiation measurements adjacent to the silos is still well below the levels observed prior to the addition of bentonite to the silos in 1991. Data from the first quarter of 1998 does indicate a slight positive trend at the site fenceline, specifically at TLD location 6. This trend is also attributed to the increasing head space radon concentrations. The increase is still well below the levels observed at the site fenceline prior to the addition of bentonite. The trend will continue to be monitored and is not expected to result in a significant dose from direct radiation during 1998.

(Refer to Table 3-5 and Figures 3-15 and 3-16.)

### NESHAP Stack Emissions Monitoring

- In February 1998, monitoring at the T-Hopper stack was initiated. The monitoring was required because CAP88-PC modeling of the emissions from the T-Hopper stack indicated there was a potential to exceed 0.1 mrem/year.
- Data associated with Building 71 are not provided in this report due to a delay in sample recovery and filter changes. These delays occurred because it was necessary to modify the Building 71 system in order to provide safer access for sampling personnel. First quarter 1998 results from Building 71 will be included in the next quarterly status report.
- First quarter results from the Laboratory and Laundry stacks are within historical ranges and no significant changes in the source operations associated with the stacks were noted. Results from the T-Hopper stack are within the expected range of results for High Efficiency Particulate Air filtered stack emissions.

(Refer to Figure 3-17 for NESHAP stack emissions monitoring locations.)

Figure 3-18 shows the data from the air monitoring activities that will be included in the next IEMP quarterly status report. This next quarterly status report will be submitted in September 1998. Monitoring activities defined under the IEMP for radiological particulate, radon, and direct radiation monitoring will continue as planned during the second quarter of 1998.

000054

**TABLE 3-1**  
**TOTAL URANIUM PARTICULATE CONCENTRATIONS IN AIR**

Location <sup>a</sup>	First Quarter 1998 Results <sup>b</sup> (pCi/m <sup>3</sup> x 1E-6)				1997 Summary Results <sup>b,c,d</sup> (pCi/m <sup>3</sup> x 1E-6)				1990 - 1996 Summary Results <sup>b,d</sup> (pCi/m <sup>3</sup> x 1E-6)	
	No. of Samples	Min.	Max.	Avg.	No. of Samples	Min.	Max.	Avg.	Min.	Max.
<b>Fenceline</b>										
AMS-2	6	11	42	26	28	0	247	51	0	3500
AMS-3	6	27	140	68	28	2.5	1167	186	0	17000
AMS-4	6	7.7	51	25	28	0	257	33	0	2300
AMS-5	6	13	86	39	28	0	220	27	0	4400
AMS-6	6	2.7	43	26	28	5.0	140	42	0	3200
AMS-7	6	2.4	67	33	28	0	146	36	0	7800
AMS-8A	6	13	71	35	28	10	234	82	13	900
AMS-9C	6	15	85	35	28	0	431	111	NA <sup>f</sup>	NA <sup>f</sup>
AMS-22	6	9.5	28	18	6	0	29	14	NA <sup>g</sup>	NA <sup>g</sup>
AMS-23	6	13	30	23	6	9.8	53	29	NA <sup>g</sup>	NA <sup>g</sup>
AMS-24	6	0	65	28	1	106	NA	NA	NA <sup>g</sup>	NA <sup>g</sup>
AMS-25	6	3.6	50	32	6	6.7	30	19	NA <sup>g</sup>	NA <sup>g</sup>
AMS-26	6	7.5	72	41	6	0	41	19	NA <sup>g</sup>	NA <sup>g</sup>
AMS-27	6	9.8	64	34	6	0	30	20	NA <sup>g</sup>	NA <sup>g</sup>
AMS-28	6	2.6	26	13	6	0	29	13	NA <sup>g</sup>	NA <sup>g</sup>
AMS-29	6	16	44	26	6	0	76	29	NA <sup>g</sup>	NA <sup>g</sup>
<b>Background</b>										
AMS-12	6	0	21	7.2	28	0	29	8.1	0	480
AMS-16	6	0	24	12	28	0	106	19	0	350

<sup>a</sup>See Figure 3-2

<sup>b</sup>For blank corrected concentrations less than or equal to 0.0 pCi/m<sup>3</sup>, the concentration is set as 0.0 pCi/m<sup>3</sup>.

<sup>c</sup>If the total number of samples is equal to one, then the data point is reported as the minimum.

<sup>d</sup>NA = not applicable

<sup>e</sup>Summary results for 1997 include AMS-9B/C data.

<sup>f</sup>No meaningful comparative data exist for AMS-9C for this period.

<sup>g</sup>AMS locations were placed in service in 1997.

000056

**TABLE 3-2**  
**TOTAL PARTICULATE CONCENTRATIONS IN AIR**

Location <sup>a</sup>	First Quarter 1998 Results ( $\mu\text{g}/\text{m}^3$ )			1997 Summary Results <sup>b,c</sup> ( $\mu\text{g}/\text{m}^3$ )			1990 - 1996 Summary Results <sup>c</sup> ( $\mu\text{g}/\text{m}^3$ )			
	No. of Samples	Min.	Max.	Avg.	No. of Samples	Min.	Max.	Avg.	Min.	Max.
<b>Fenceline</b>										
AMS-2	5 <sup>d</sup>	14	27	20	28	16	77	31	7.0	67
AMS-3	6	14	29	22	28	17	159	39	8.0	128
AMS-4	6	16	35	27	28	14	51	30	13	69
AMS-5	6	9.6	34	22	28	11	42	28	12	62
AMS-6	6	16	48	28	28	8.0	53	29	8.0	69
AMS-7	6	16	35	25	28	24	55	34	13	76
AMS-8A	6	13	29	23	27 <sup>d</sup>	18	89	35	19	53
AMS-9C	6	15	32	26	28	7.1	136	42	NA <sup>f</sup>	NA <sup>f</sup>
AMS-22	6	15	36	29	6	21	30	27	NA <sup>g</sup>	NA <sup>g</sup>
AMS-23	6	15	33	24	6	22	28	25	NA <sup>g</sup>	NA <sup>g</sup>
AMS-24	6	18	39	31	1	74	NA	NA	NA <sup>g</sup>	NA <sup>g</sup>
AMS-25	6	21	51	37	6	26	40	33	NA <sup>g</sup>	NA <sup>g</sup>
AMS-26	6	15	31	25	6	20	23	22	NA <sup>g</sup>	NA <sup>g</sup>
AMS-27	6	24	56	39	6	33	49	38	NA <sup>g</sup>	NA <sup>g</sup>
AMS-28	6	12	24	18	6	16	30	19	NA <sup>g</sup>	NA <sup>g</sup>
AMS-29	6	11	30	22	6	19	30	25	NA <sup>g</sup>	NA <sup>g</sup>
<b>Background</b>										
AMS-12 <sup>h</sup>	6	12	26	20	14	18	41	27	6.0	416
AMS-16 <sup>h</sup>	6	18	47	36	14	27	79	46	22	59

<sup>a</sup>See Figure 3-2

<sup>b</sup>If the total number of samples is equal to one, then the data point is reported as the minimum.

<sup>c</sup>NA = not applicable

<sup>d</sup>One data point was not obtained due to a damaged filter.

<sup>e</sup>Summary results for 1997 include AMS-9B/C data.

<sup>f</sup>No meaningful comparative data exist for AMS-9C for this period.

<sup>g</sup>AMS locations were not in operation prior to 1997.

<sup>h</sup>Total particulate analysis was discontinued during 1994 and was reinstated for AMS-12 and AMS-16 in 1997.

**TABLE 3-3**

**FIRST QUARTER TRACKING - NESHAP COMPLIANCE REPORT  
PERIMETER AIR MONITORS**

40 CFR 61 (NESHAP) Subpart H Appendix E, Table 2; Net Ratios<sup>b</sup>

Location <sup>a</sup>	Actinium-228 <sup>c</sup>	Radium-224 <sup>c</sup>	Radium-226	Radium-228	Thorium-228 <sup>c</sup>	Thorium-230	Thorium-231 <sup>c</sup>	Thorium-232	Thorium-234 <sup>c</sup>	Uranium-234	Uranium-235 Uranium-236	Uranium-238	Ratio Totals	Dose <sup>d</sup> (mrem)
<b>Fenceline</b>														
AMS-2	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-09	0.0E+00	3.6E-07	7.3E-05	4.2E-05	9.5E-05	2.1E-04	0.0021
AMS-3	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.5E-09	0.0E+00	2.7E-06	7.7E-04	1.0E-04	7.1E-04	1.6E-03	0.016
AMS-4	0.0E+00	0.0E+00	4.8E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.4E-07	5.3E-05	0.0E+00	1.2E-04	6.5E-04	0.0065
AMS-5	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E-04	8.3E-10	0.0E+00	1.1E-06	2.4E-04	3.3E-05	2.8E-04	7.0E-04	0.0070
AMS-6	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-09	0.0E+00	7.7E-07	1.9E-04	4.5E-05	2.1E-04	4.4E-04	0.0044
AMS-7	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.4E-09	0.0E+00	1.5E-06	3.8E-04	9.6E-05	4.0E-04	8.7E-04	0.0087
AMS-8A	0.0E+00	0.0E+00	2.6E-04	0.0E+00	0.0E+00	0.0E+00	2.7E-09	0.0E+00	2.0E-06	5.1E-04	1.0E-04	5.2E-04	1.4E-03	0.014
AMS-9C	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.9E-09	0.0E+00	2.1E-06	5.5E-04	1.5E-04	5.6E-04	1.3E-03	0.013
AMS-22	0.0E+00	0.0E+00	5.4E-04	0.0E+00	0.0E+00	3.1E-04	2.0E-09	0.0E+00	6.0E-07	1.7E-04	7.9E-05	1.6E-04	1.3E-03	0.013
AMS-23	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.3E-05	0.0E+00	0.0E+00	5.8E-07	7.1E-05	0.0E+00	1.5E-04	2.6E-04	0.0026
AMS-24	1.1E-07	2.8E-06	0.0E+00	7.1E-05	0.0E+00	3.0E-04	0.0E+00	6.8E-04	7.0E-07	1.6E-04	0.0E+00	1.9E-04	1.4E-03	0.014
AMS-25	4.1E-07	1.0E-05	3.7E-04	2.6E-04	3.7E-04	1.2E-03	2.6E-09	2.4E-03	1.7E-06	3.6E-04	1.0E-04	4.5E-04	5.6E-03	0.056
AMS-26	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.4E-09	0.0E+00	1.7E-06	3.6E-04	9.4E-05	4.4E-04	9.0E-04	0.0090
AMS-27	8.5E-08	2.1E-06	0.0E+00	5.3E-05	0.0E+00	1.7E-04	2.3E-09	5.1E-04	2.1E-06	5.6E-04	9.0E-05	5.7E-04	1.9E-03	0.019
AMS-28	0.0E+00	0.0E+00	3.6E-04	0.0E+00	0.0E+00	0.0E+00	1.0E-09	0.0E+00	1.6E-07	0.0E+00	4.0E-05	4.3E-05	4.4E-04	0.0044
AMS-29	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E-04	0.0E+00	0.0E+00	1.3E-06	2.9E-04	0.0E+00	3.6E-04	8.0E-04	0.0080
<b>Background</b>														
AMS-12	1.7E-07	4.3E-06	0.0E+00	1.1E-04	2.6E-04	3.3E-04	9.6E-10	1.0E-03	8.3E-07	2.3E-04	3.7E-05	2.2E-04	2.2E-03	
AMS-16	5.5E-07	1.3E-05	0.0E+00	3.4E-04	7.1E-04	7.9E-04	0.0E+00	3.3E-03	1.3E-06	3.7E-04	0.0E+00	3.5E-04	5.8E-03	

Maximum Quarterly Ratio: 0.0056  
Maximum Quarterly dose (mrem): 0.056

<sup>a</sup>See Figure 3-2

<sup>b</sup>A ratio of 0.0+00 indicates the filter results were less than or equal to the blank results, and/or the indicator concentrations were less than or equal to the average net background concentrations.

<sup>c</sup>Isotopes assumed to be in equilibrium with their parents.

<sup>d</sup>Dose conversions are based on the NESHAP Standard of 10 mrem per year.

00057

TABLE 3-4

CONTINUOUS ENVIRONMENTAL RADON MONITORING  
MONTHLY AVERAGE CONCENTRATIONS<sup>a</sup>

Location <sup>b</sup>	First Quarter 1998 Results (Instrument Background Corrected) (pCi/L)			First Quarter 1998 Results <sup>c</sup> (Including Instrument Background) (pCi/L)			1997 Summary Results <sup>c</sup> (Including Instrument Background) (pCi/L)		
	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
<b>Fenceline</b>									
AMS-02	0.1	0.3	0.2	0.6	0.7	0.6	0.7	1.2	0.9
AMS-04	0.1	0.3	0.2	0.7	0.9	0.8	0.6	1.1	0.8
AMS-05	0.3	0.4	0.4	0.6	0.8	0.7	0.7	1.6	1.0
AMS-06	0.2	0.3	0.3	0.6	0.7	0.6	0.8	1.1	0.9
AMS-07	0.2	0.3	0.3	1.3	1.4	1.3	0.7	2.3	1.3
<b>Off Site</b>									
AMS-11	0.1	0.2	0.2	0.7	0.8	0.8	0.6	1.5	0.9
<b>Background</b>									
AMS-12	0.1	0.1	0.1	0.8	0.9	0.9	0.4	1.0	0.7
AMS-16	0.3	0.3	0.3	0.7	1.0	0.8	0.6	0.9	0.7
<b>On Site</b>									
KNE	2.0	4.8	3.8	5.0	5.2	5.1	3.5	8.3	6.1
KNW	1.2	2.5	1.8	1.5	2.9	2.2	1.4	2.9	2.1
KSE	2.4	4.6	3.9	3.3	5.5	4.7	3.6	12	6.3
KSW	2.4	4.0	3.2	3.4	5.0	4.2	1.8	4.3	2.8
KTOP	7.2	12	9.1	7.9	12	9.7	6.5	13	10
Pilot Plant Warehouse	0.0	0.2	0.1	0.6	0.7	0.6	0.5	1.4	0.8
Pit 5	0.2	0.3	0.3	0.8	1.0	0.9	0.5	1.4	0.9
Rally Point 4	0.2	0.5	0.4	0.5	0.8	0.7	0.9	1.6	1.3
Surge Lagoon	0.1	0.5	0.3	0.9	0.9	0.9	0.9	1.8	1.4
T28	0.9	1.6	1.2	1.4	2.0	1.7	1.4	3.0	2.3
WP-17A	0.2	0.4	0.3	0.8	0.9	0.9	0.7	1.6	1.0

<sup>a</sup>The 1997 data have not been corrected for instrument background; therefore, an additional column of 1998 data, with instrument background contribution, has been included to allow for comparison purposes.

<sup>b</sup>See Figure 3-13

<sup>c</sup>Instrument background changes as monitors are replaced.

000058

**TABLE 3-5**  
**DIRECT RADIATION (TLD) MEASUREMENTS**

Direct Radiation $\pm$ Uncertainty <sup>b</sup> (mrem)			
Location <sup>a</sup>	First Quarter 1998 Results	1997 Summary Results	1996 Summary Results <sup>c,d</sup>
<b>Fenceline</b>			
2	19 $\pm$ 3.0	72 $\pm$ 10	73 $\pm$ 7.0
3	18 $\pm$ 2.8	65 $\pm$ 9.0	67 $\pm$ 6.4
4	17 $\pm$ 2.7	65 $\pm$ 9.1	64 $\pm$ 6.1
5	18 $\pm$ 2.7	67 $\pm$ 9.3	67 $\pm$ 6.5
6	22 $\pm$ 3.5	79 $\pm$ 11	75 $\pm$ 7.2
7	18 $\pm$ 2.8	65 $\pm$ 9.0	67 $\pm$ 6.5
8A	20 $\pm$ 3.1	74 $\pm$ 10	77 $\pm$ 7.5 <sup>e</sup>
9C	20 $\pm$ 3.2	79 $\pm$ 11 <sup>f</sup>	83 $\pm$ 8.0
13	19 $\pm$ 3.0	71 $\pm$ 9.9	71 $\pm$ 6.9
14	19 $\pm$ 3.0	70 $\pm$ 9.8	71 $\pm$ 6.9
15	20 $\pm$ 3.1	74 $\pm$ 10	73 $\pm$ 7.0
16	20 $\pm$ 3.2	77 $\pm$ 11	78 $\pm$ 7.5
17	18 $\pm$ 2.9	70 $\pm$ 9.7	70 $\pm$ 6.8
34 <sup>g</sup>	20 $\pm$ 3.1	73 $\pm$ 14	NA
35 <sup>g</sup>	19 $\pm$ 2.9	67 $\pm$ 13	NA
36 <sup>g</sup>	17 $\pm$ 2.7	60 $\pm$ 12	NA
37 <sup>g</sup>	20 $\pm$ 3.1	75 $\pm$ 14	NA
38 <sup>g</sup>	17 $\pm$ 2.6	60 $\pm$ 11	NA
39 <sup>g</sup>	20 $\pm$ 3.2	76 $\pm$ 14	NA
40 <sup>g</sup>	17 $\pm$ 2.7	65 $\pm$ 12	NA
41 <sup>g</sup>	19 $\pm$ 2.9	70 $\pm$ 13	NA
Min.	17 $\pm$ 2.7	60 $\pm$ 12	64 $\pm$ 6.1
Max.	22 $\pm$ 3.5	79 $\pm$ 11	83 $\pm$ 8.0
<b>On Site</b>			
1B	23 $\pm$ 3.5	84 $\pm$ 12	82 $\pm$ 7.9 <sup>h</sup>
22	190 $\pm$ 30	778 $\pm$ 108	630 $\pm$ 60
23	209 $\pm$ 33	712 $\pm$ 99	630 $\pm$ 61
24	154 $\pm$ 24	512 $\pm$ 71	460 $\pm$ 44
25	175 $\pm$ 27	641 $\pm$ 89	560 $\pm$ 54
26	122 $\pm$ 19	425 $\pm$ 59	330 $\pm$ 32
32	15 $\pm$ 2.4	54 $\pm$ 7.5	55 $\pm$ 5.4
Min.	15 $\pm$ 2.4	54 $\pm$ 7.5	55 $\pm$ 5.4
Max.	209 $\pm$ 33	778 $\pm$ 108	630 $\pm$ 61
<b>Off Site</b>			
10	15 $\pm$ 2.3	52 $\pm$ 7.3	55 $\pm$ 5.3
11	18 $\pm$ 2.8	65 $\pm$ 9.1	67 $\pm$ 6.5
12	16 $\pm$ 2.6	59 $\pm$ 8.2	60 $\pm$ 5.8
30	17 $\pm$ 2.7	59 $\pm$ 8.2	60 $\pm$ 5.8
Min.	15 $\pm$ 2.3	52 $\pm$ 7.3	55 $\pm$ 5.3
Max.	18 $\pm$ 2.8	65 $\pm$ 9.1	67 $\pm$ 6.5

**TABLE 3-5  
(Continued)**

Location <sup>a</sup>	Direct Radiation $\pm$ Uncertainty <sup>b</sup> (mrem)		
	First Quarter 1998 Results	1997 Summary Results	1996 Summary Results <sup>c,d</sup>
<b>Background</b>			
18	20 $\pm$ 3.2	74 $\pm$ 10	74 $\pm$ 7.2
19	17 $\pm$ 2.7	60 $\pm$ 8.4	63 $\pm$ 6.0
20	16 $\pm$ 2.5	57 $\pm$ 8.0	59 $\pm$ 5.7
21	18 $\pm$ 2.9	67 $\pm$ 9.4	68 $\pm$ 6.6
27	17 $\pm$ 2.7	60 $\pm$ 8.3	62 $\pm$ 5.9
33	18 $\pm$ 2.8	65 $\pm$ 9.1	69 $\pm$ 6.7
<b>Min.</b>	<b>16 <math>\pm</math> 2.5</b>	<b>57 <math>\pm</math> 8.0</b>	<b>59 <math>\pm</math> 5.7</b>
<b>Max.</b>	<b>20 <math>\pm</math> 3.2</b>	<b>74 <math>\pm</math> 10</b>	<b>74 <math>\pm</math> 7.2</b>

<sup>a</sup>See Figure 3-15

<sup>b</sup>Associated laboratory uncertainty

<sup>c</sup>Some of the numbers are slightly different than previously reported due to rounding.

<sup>d</sup>NA = not applicable

<sup>e</sup>1996 summary results for location 8A are extrapolated from third and fourth quarter measurements.

<sup>f</sup>Locations 9B and 9C are combined to determine 1997 year end results.

<sup>g</sup>1997 data for locations 34 through 41 are calculated from fourth quarter (October through December) measurement. These locations were established during fourth quarter 1997.

<sup>h</sup>1996 summary results for location 1B are extrapolated from third and fourth quarter measurements.

000060

FIGURE 3-1

AIR SAMPLING ACTIVITIES COVERED IN THIS QUARTERLY REPORT

1998											
1st Quarter			2nd Quarter			3rd Quarter			4th Quarter		
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
<b>SAMPLING ACTIVITIES</b>											
◆	◆	◆									
		◆									
◆	◆	◆									
◆	◆	◆									
◆	◆	◆									
◆	◆	◆									

◆ Data summarized/  
evaluated in this report

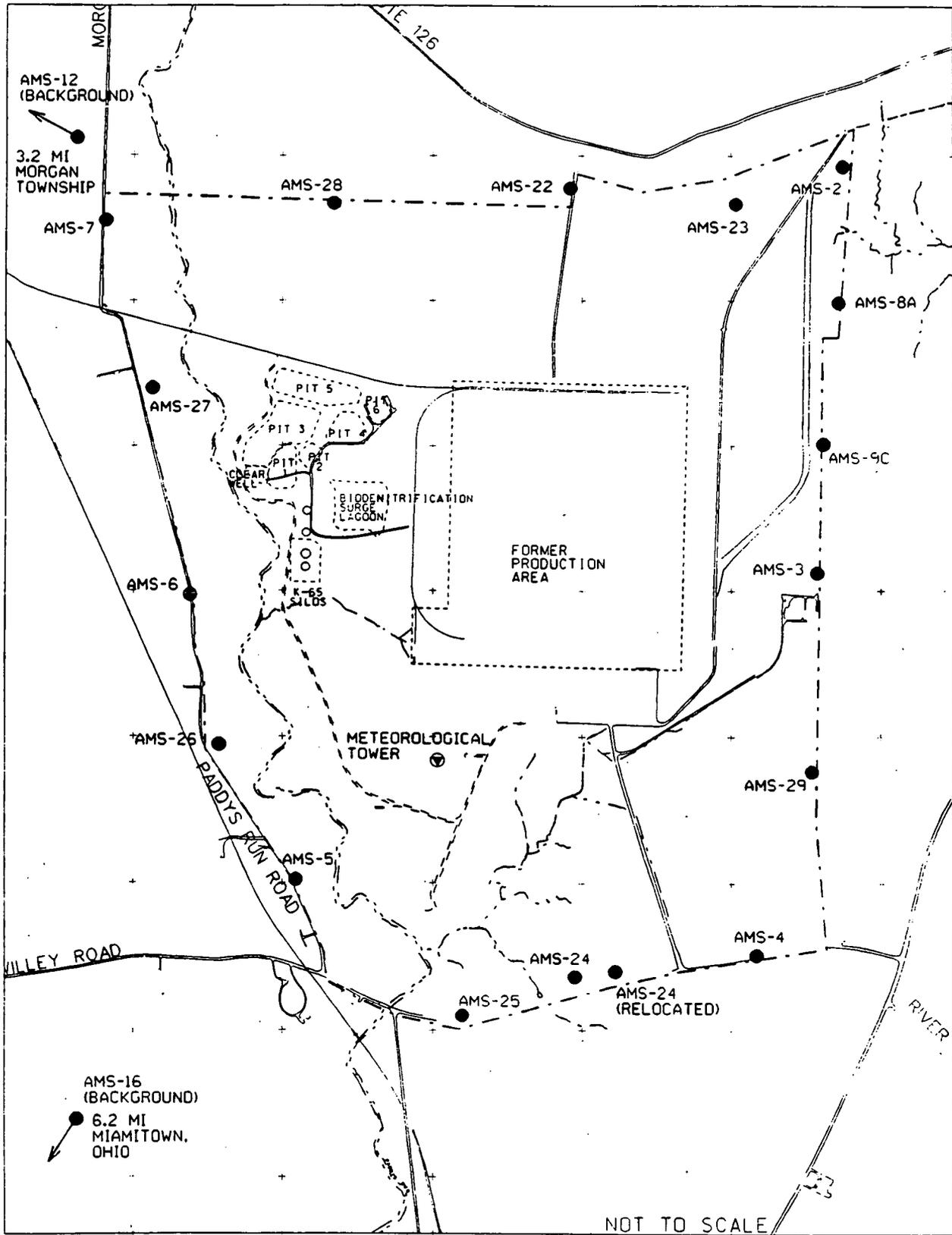
000061

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Map: 11011011011-1986

Scale: 1:100,000

8651-1000-81



LEGEND:

- - - FEMP BOUNDARY
- IEMP AMS LOCATION
- (with arrow) DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO AMS LOCATION OFF MAP

000062

FIGURE 3-2. IEMP RADIOLOGICAL AIR MONITORING PROGRAM

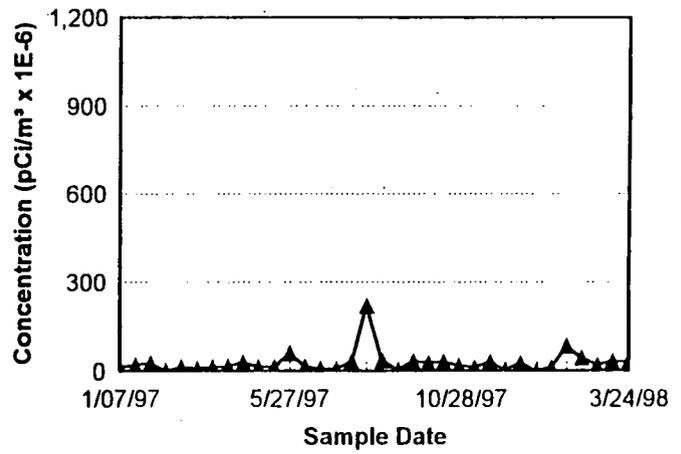
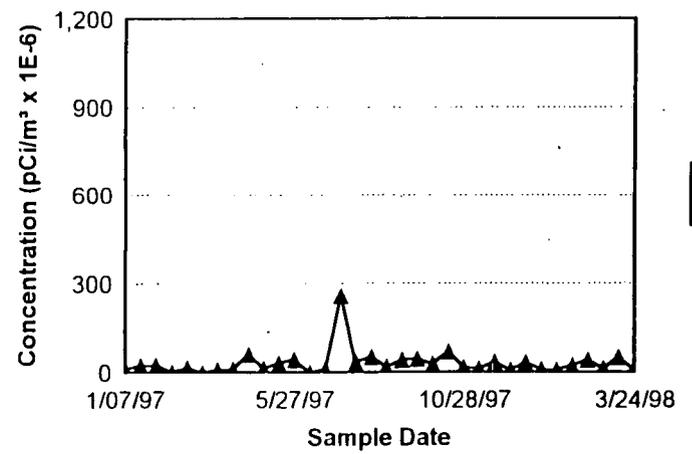
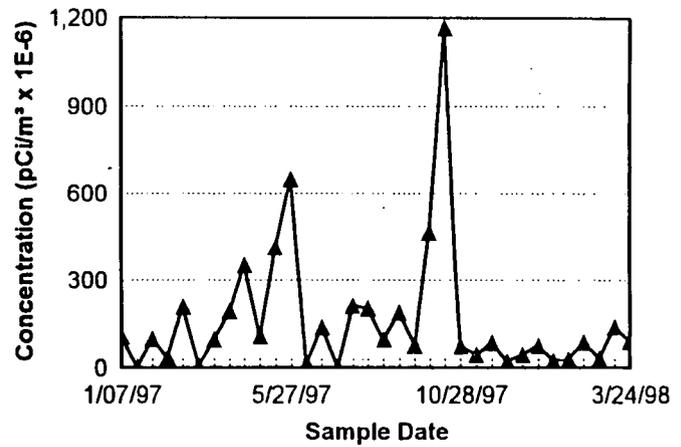
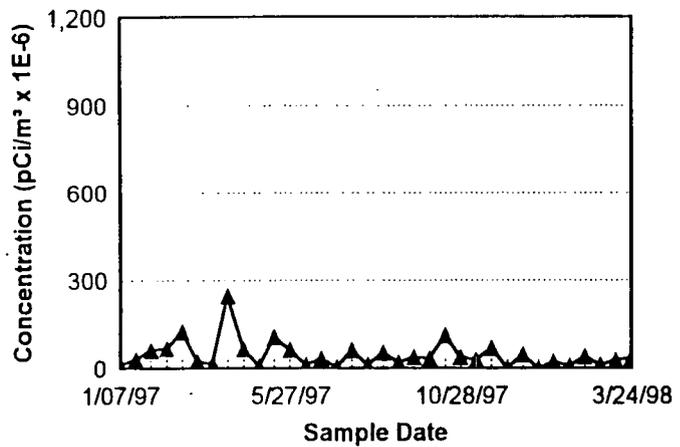


FIGURE 3-3. TOTAL URANIUM PARTICULATE CONCENTRATIONS IN AIR (AMS-2, AMS-3, AMS-4, AND AMS-5)

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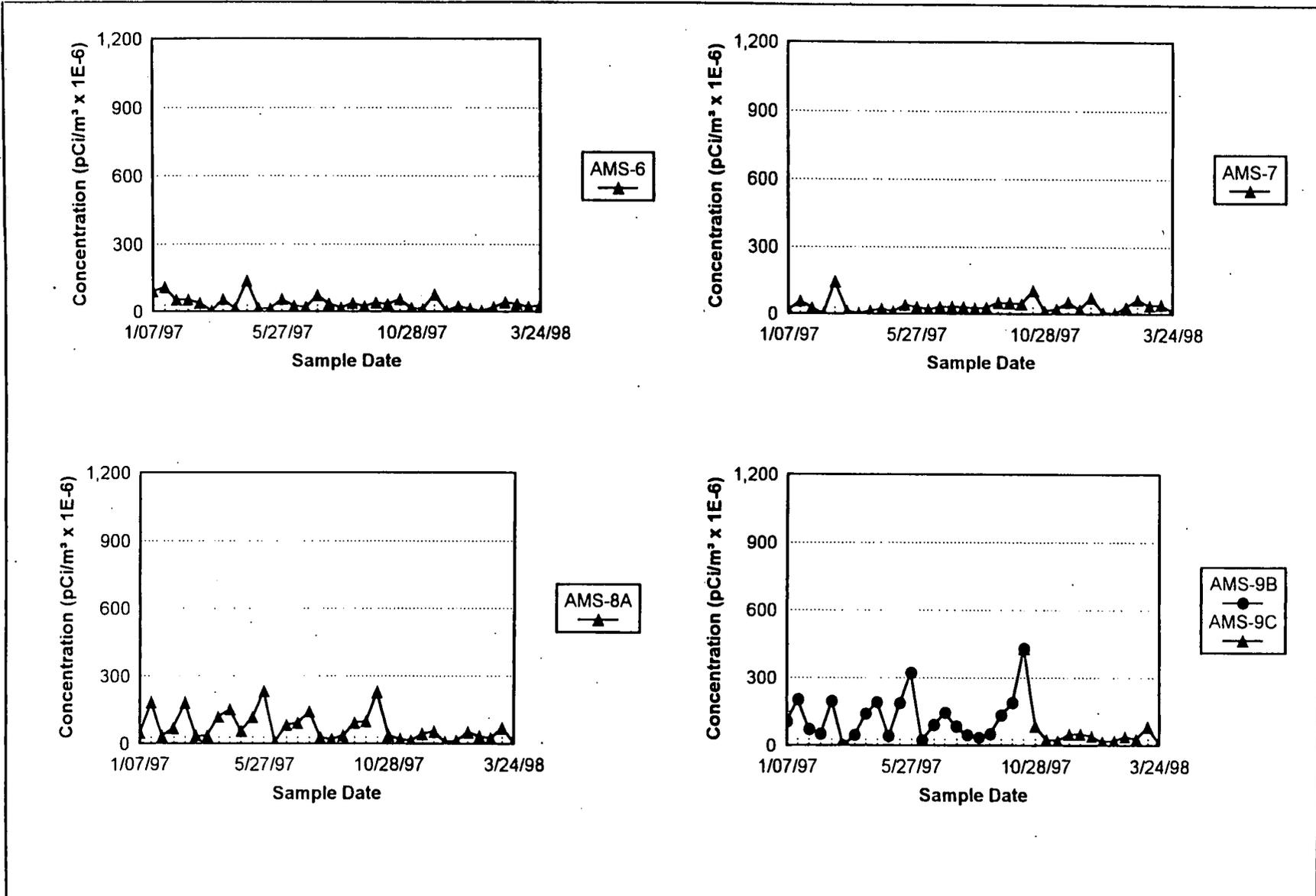


FIGURE 3-4. TOTAL URANIUM PARTICULATE CONCENTRATIONS IN AIR  
(AMS-6, AMS-7, AMS-8A, AND AMS-9C)

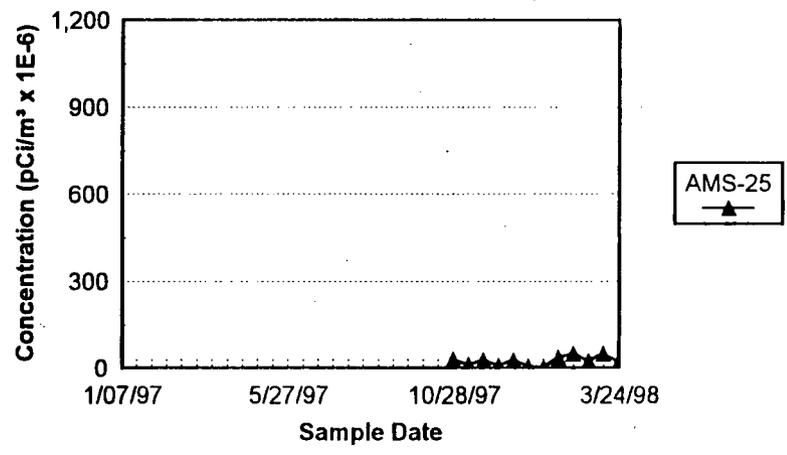
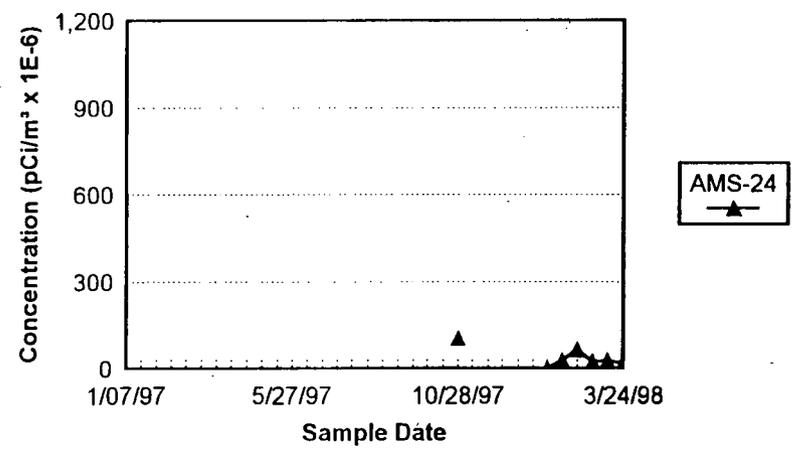
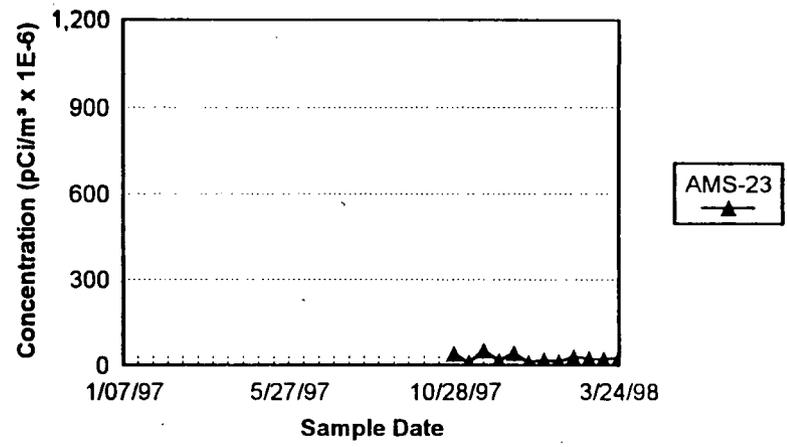
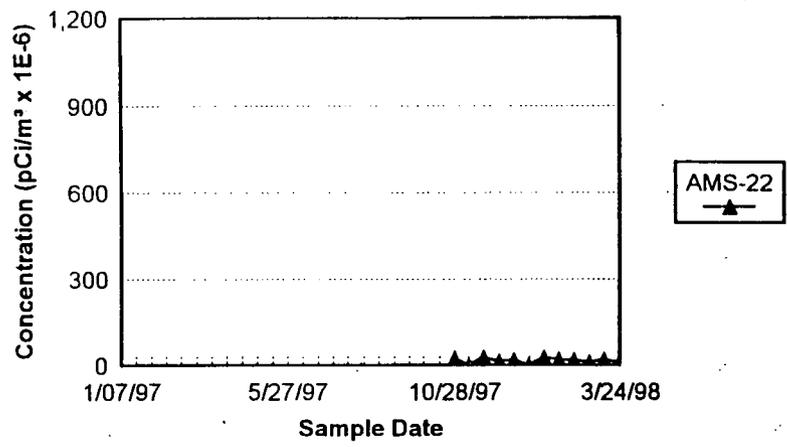


FIGURE 3-5. TOTAL URANIUM PARTICULATE CONCENTRATIONS IN AIR  
(AMS-22, AMS-23, AMS-24, AND AMS-25)

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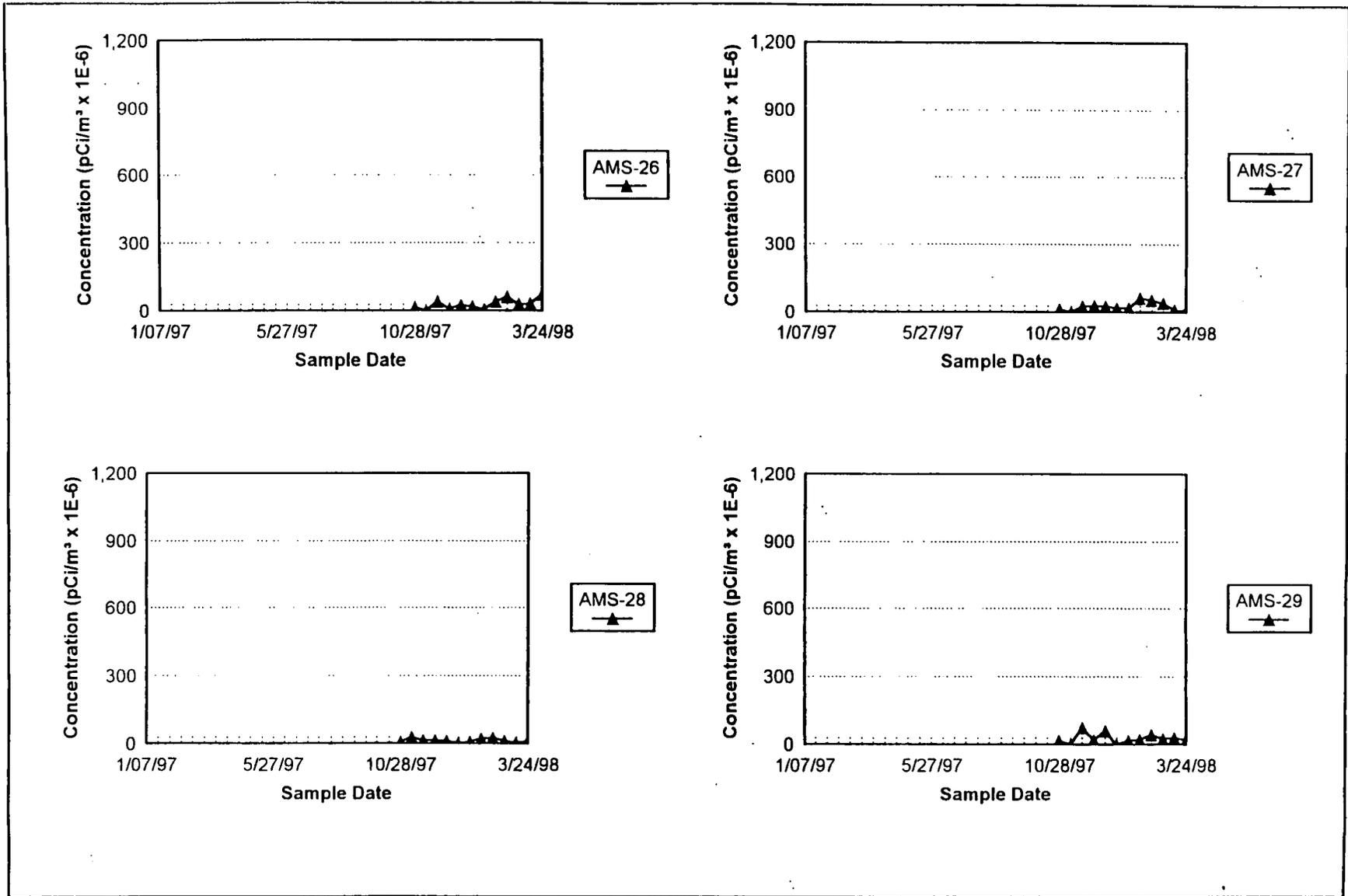
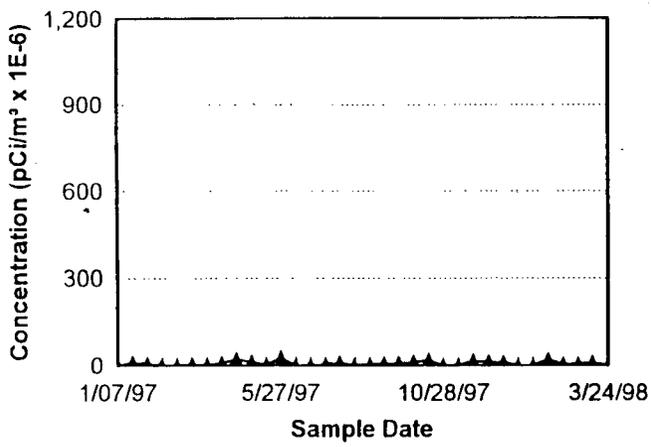
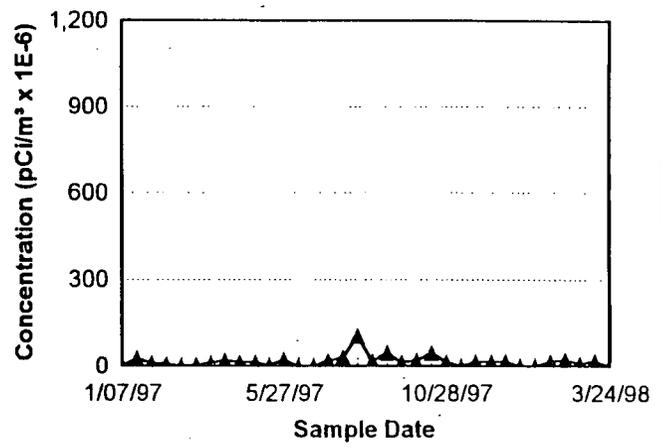


FIGURE 3-6. TOTAL URANIUM PARTICULATE CONCENTRATIONS IN AIR  
(AMS-26, AMS-27, AMS-28, AND AMS-29)



AMS-12  
▲



AMS-16  
▲

FIGURE 3-7. TOTAL URANIUM PARTICULATE CONCENTRATIONS IN AIR  
(AMS-12 AND AMS-16)

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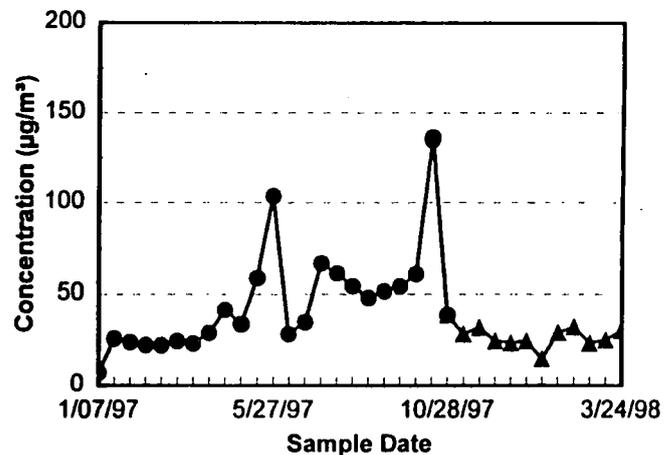
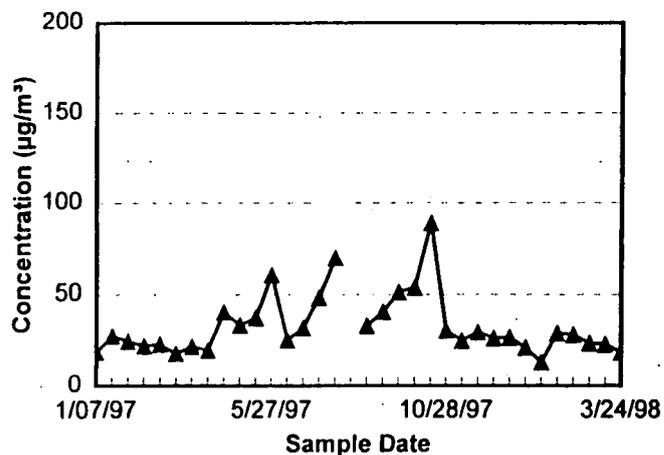
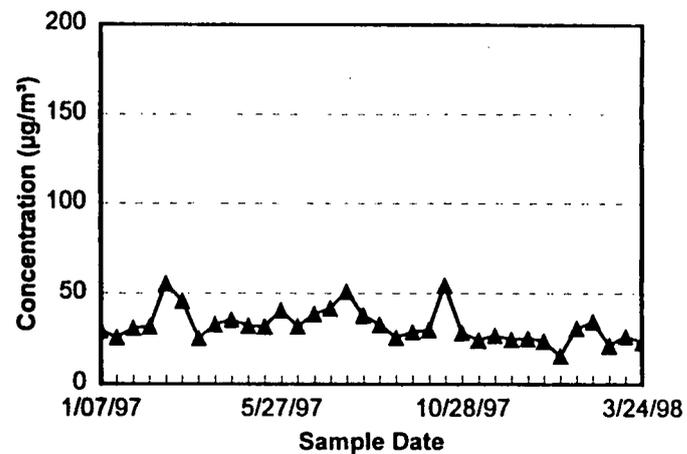
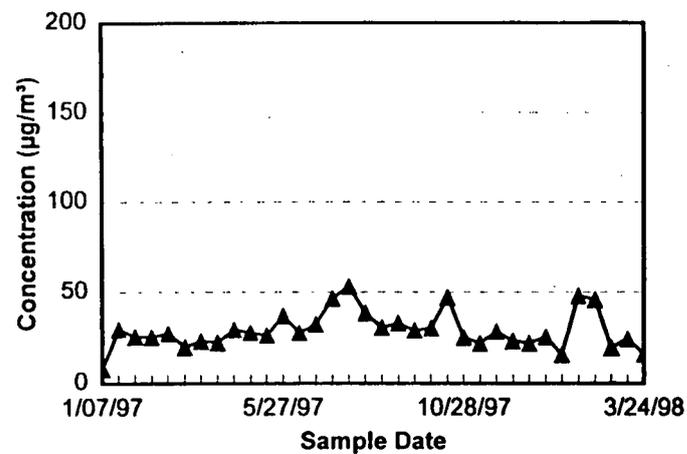


FIGURE 3-9. TOTAL PARTICULATE CONCENTRATIONS IN AIR  
(AMS-6, AMS-7, AMS-8A, AND AMS-9C)

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0.0000

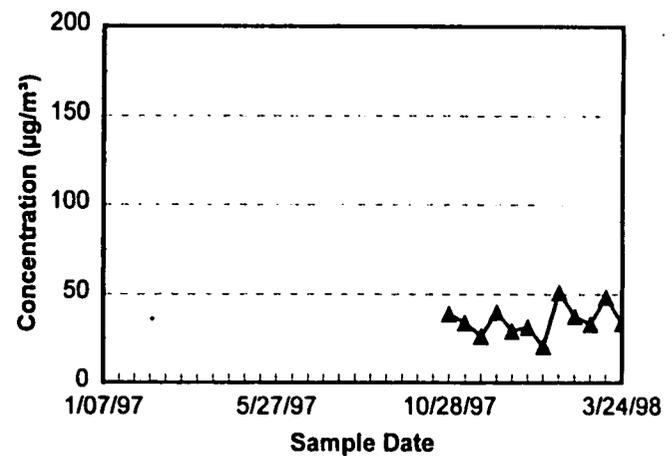
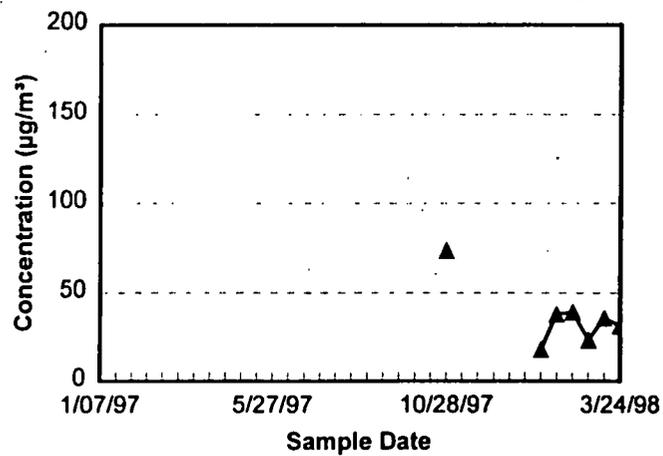
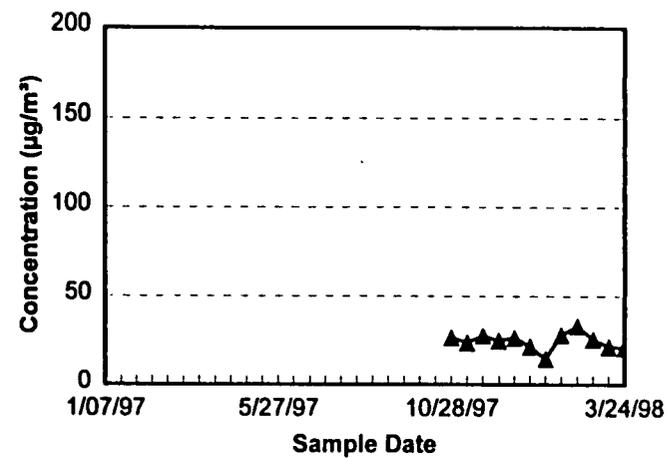
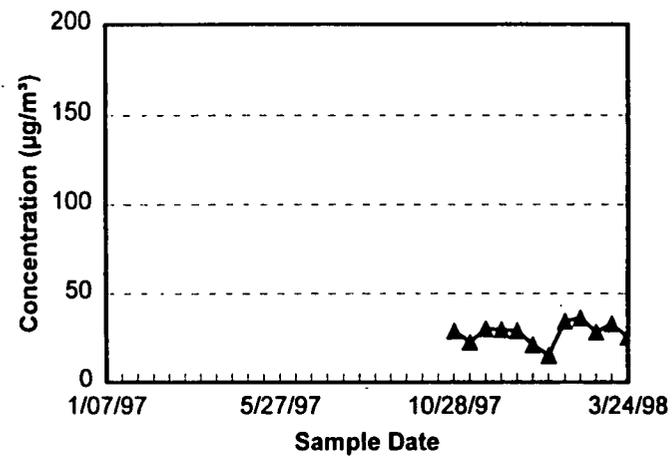


FIGURE 3-10. TOTAL PARTICULATE CONCENTRATIONS IN AIR (AMS-22, AMS-23, AMS-24, AND AMS-25)



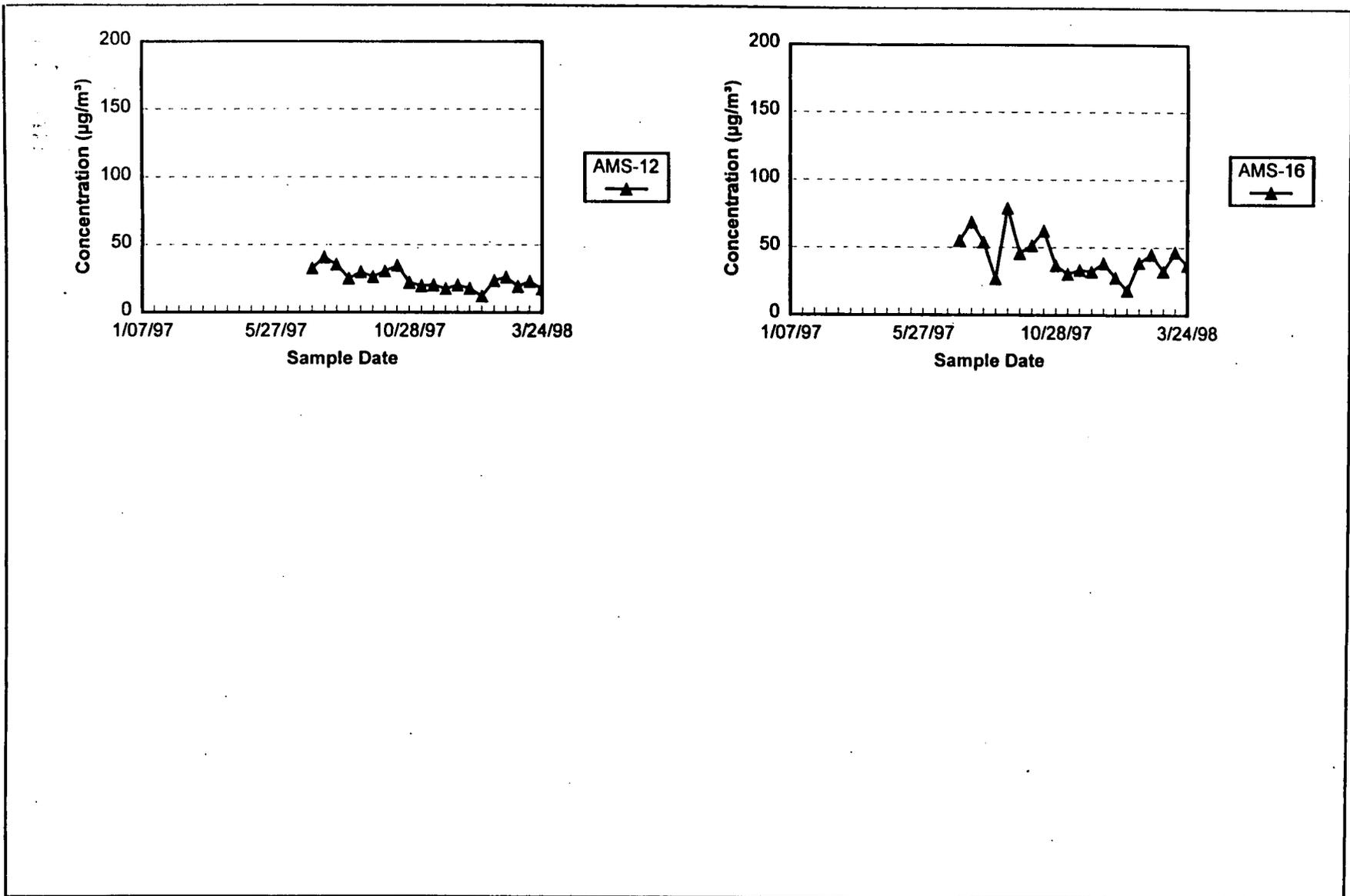
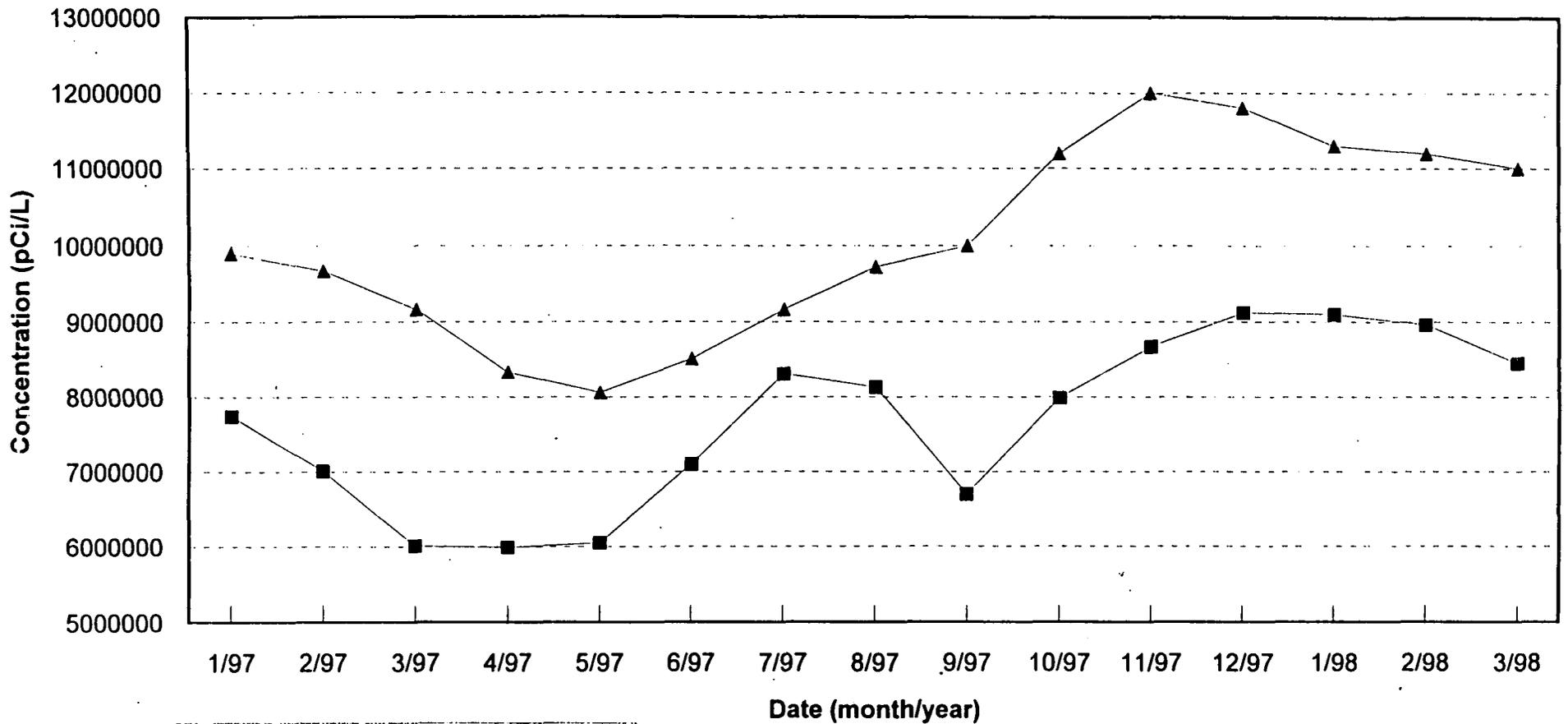


FIGURE 3-12. TOTAL PARTICULATE CONCENTRATIONS IN AIR (AMS-12 AND AMS-16)



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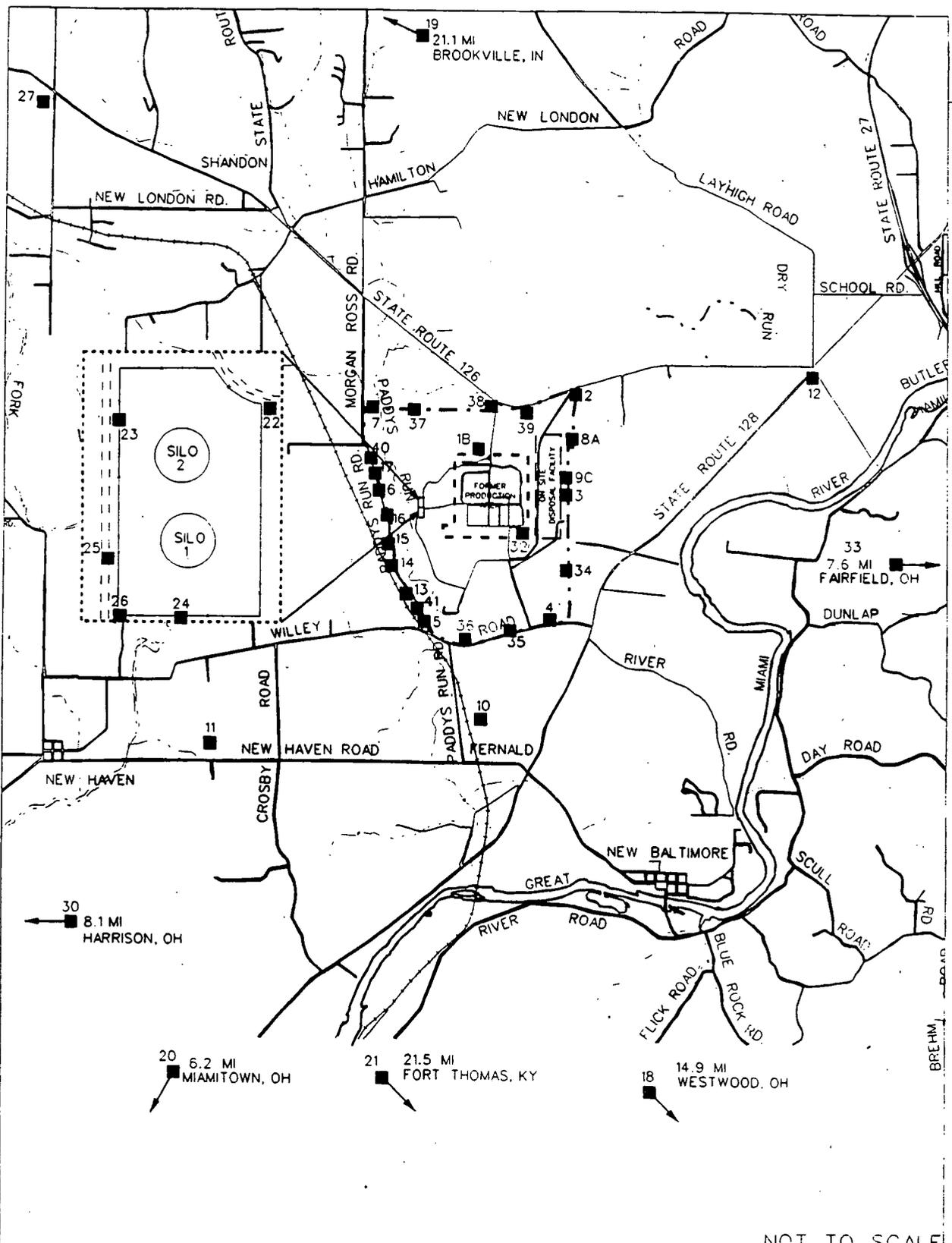


As reported in the Remedial Investigation Report for Operable Unit 4 (DOE 1993), the pre-bentonite radon head space concentrations were 26,000,000 pCi/L for Silo 1 and 30,000,000 pCi/L for Silo 2.

—▲— Silo 1  
—■— Silo 2

FIGURE 3-14. MONTHLY AVERAGE SILO HEAD SPACE RADON CONCENTRATIONS FROM CONTINUOUS MONITORS

1/9/81 5:51pm / dgm/3884/1/78/11009.dgm



NOT TO SCALE

LEGEND:

--- FEMP BOUNDARY

Distance from center of former production area to location off map

■ DIRECT RADIATION (TLD) MONITORING LOCATION

000075

FIGURE 3-15. DIRECT RADIATION (THERMOLUMINESCENT DOSIMETERS) MONITORING LOCATIONS

10-JUN-1981

000076

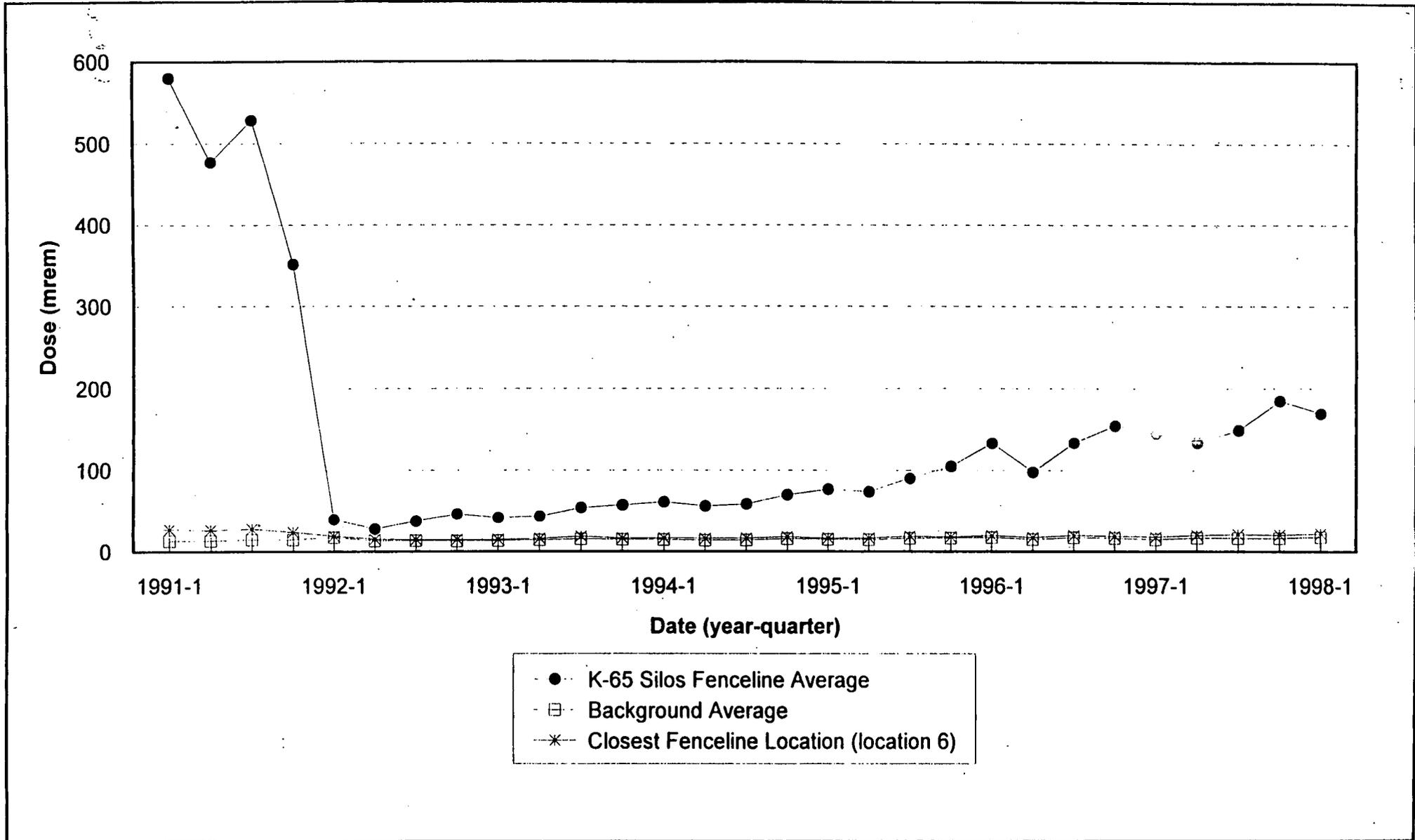
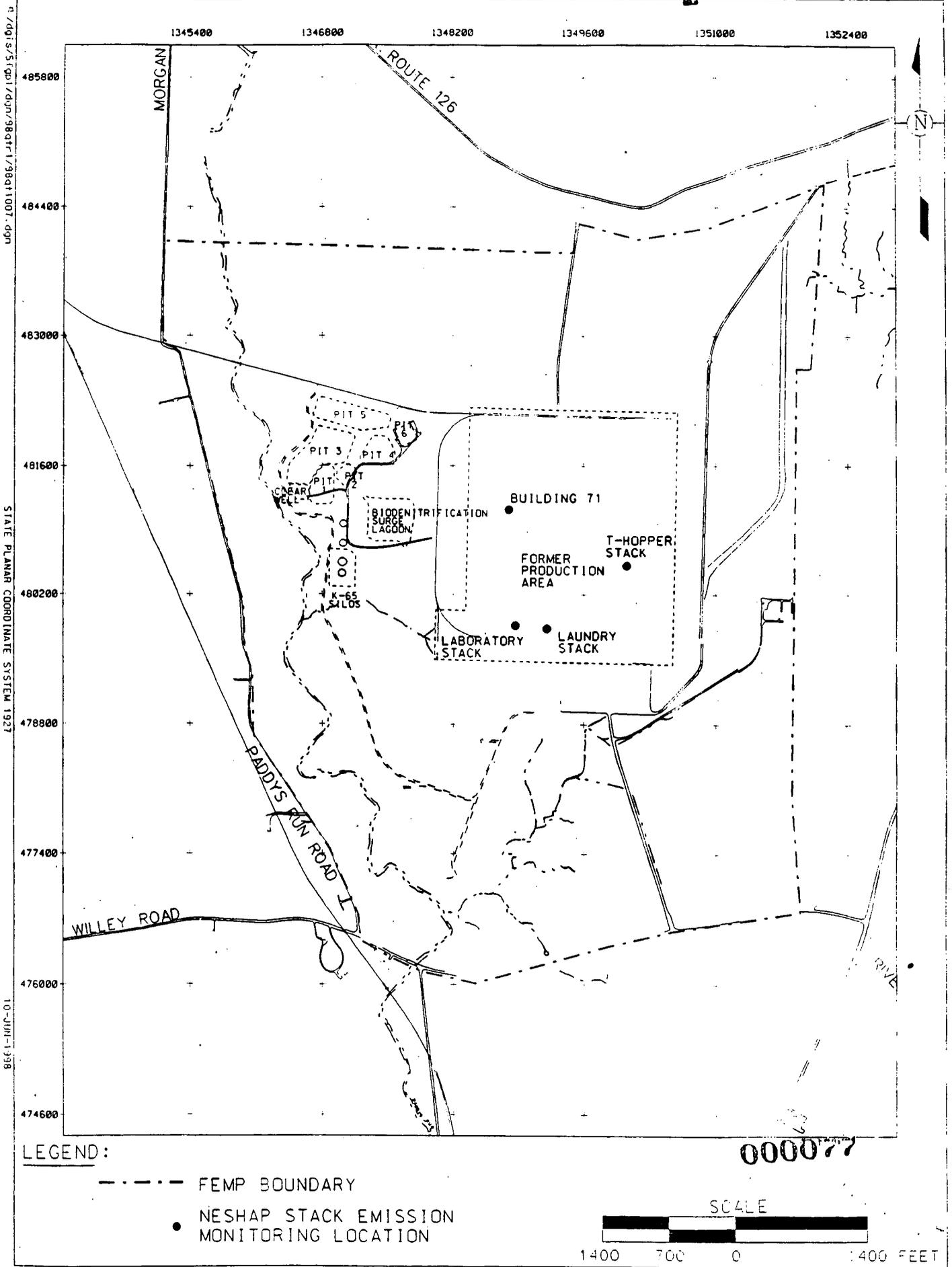


FIGURE 3-16. QUARTERLY DIRECT RADIATION (TLD) MEASUREMENTS, 1991-1998



LEGEND:

- FEMP BOUNDARY
- NESHAP STACK EMISSION MONITORING LOCATION

SCALE

1400 700 0 1400 FEET

FIGURE 3-17. NESHAP STACK EMISSION MONITORING LOCATIONS

000073

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3-28

FIGURE 3-18

AIR SAMPLING ACTIVITIES COVERED IN THE NEXT QUARTERLY REPORT

1998											
1st Quarter			2nd Quarter			3rd Quarter			4th Quarter		
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
			◆	◆	◆						
					◆						
			◆	◆	◆						
			◆	◆	◆						
			◆	◆	◆						

**SAMPLING ACTIVITIES**

Radiological Particulate Monitoring

NESHAP Quarterly Composite

Radon Monitoring - Continuous Alpha Scintillation Monitors

Radon Monitoring - Alpha Track-etch Cups

Direct Radiation (TLD) Monitoring

NESHAP Stack Emissions Monitoring

◆ Data summarized/evaluated in next report

#### 4.0 NATURAL RESOURCES UPDATE

This section in previous quarterly status reports has provided updates for the following natural resource monitoring activities conducted under the Natural Resource Impact Monitoring Plan (Appendix D of the IEMP):

- Impacted Habitat
- Status of Wetlands
- Threatened and Endangered Species Surveys
- Cultural Resources.

In April 1998, the Fernald Natural Resource Trustees (including the OEPA) agreed that reporting associated with natural resources will be provided annually through both the integrated site environmental reports and through correspondence between DOE and the Fernald Natural Resource Trustees at a frequency yet to be determined (e.g., semi-annual, annual). It was also agreed that impacted habitat monitoring associated with natural resources will not be necessary because the proposed settlement identifies that natural resource restoration will be performed for all on-property areas outside the on-site disposal facility, the Operable Unit 4 supplemental projects, and the area under consideration by the Community Reuse Organization for economic development.

Annual reporting will identify progress of natural resource restoration activities and will also contain pertinent updates regarding threatened and endangered species and wetlands. Cultural resource updates will be conducted pursuant to programmatic agreements regarding archeological investigations at the site.

## REFERENCES

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