

**INTEGRATED ENVIRONMENTAL
MONITORING STATUS REPORT
FOR THIRD QUARTER 1999**

-- 2687

**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO**



DECEMBER 1999

U.S. DEPARTMENT OF ENERGY

51350-RP-0008

000601

REV. 0

FINAL

-2687

**INTEGRATED ENVIRONMENTAL
MONITORING STATUS REPORT
FOR THIRD QUARTER 1999**

**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO**

DECEMBER 1999

U.S. DEPARTMENT OF ENERGY

000002

FINAL

TABLE OF CONTENTS

=- 2687

Introduction

Groundwater Remedy

On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring

Surface Water and Treated Effluent

Air Monitoring

Natural Resources

Meteorological

References

LIST OF FIGURES

- Figure 1-1 Groundwater Sampling Activities Covered in this Quarterly Report
- Figure 1-2 IEMP Water Quality Monitoring Wells and Extraction Wells
- Figure 1-3 Groundwater Elevation Monitoring Wells
- Figure 1-4 Location of Active Aquifer Restoration Modules
- Figure 1-5 Groundwater Sampling Activities Covered in the Next Quarterly Report
- Figure 1-6 Total Groundwater Pumped vs. Groundwater Treated for Third Quarter 1999
- Figure 1-7 Uranium Removal Indices
- Figure 1-8 Pumping Rates for South Field (Phase 1) Extraction Well 31550, 7/99 - 9/99
- Figure 1-9 Pumping Rates for South Field (Phase 1) Extraction Well 31560, 7/99 - 9/99
- Figure 1-10 Pumping Rates for South Field (Phase 1) Extraction Well 31561, 7/99 - 9/99
- Figure 1-11 Pumping Rates for South Field (Phase 1) Extraction Well 31562, 7/99 - 9/99
- Figure 1-12 Pumping Rates for South Field (Phase 1) Extraction Well 31563, 7/99 - 9/99
- Figure 1-13 Pumping Rates for South Field (Phase 1) Extraction Well 31564, 7/99 - 9/99
- Figure 1-14 Pumping Rates for South Field (Phase 1) Extraction Well 31565, 7/99 - 9/99
- Figure 1-15 Pumping Rates for South Field (Phase 1) Extraction Well 31567, 7/99 - 9/99
- Figure 1-16 Pumping Rates for South Field (Phase 1) Extraction Well 32276, 7/99 - 9/99
- Figure 1-17 Weekly Total Uranium Concentrations for the South Field (Phase 1) Extraction Module
- Figure 1-18 Pumping Rates for South Plume Extraction Well 3924, 7/99 - 9/99
- Figure 1-19 Pumping Rates for South Plume Extraction Well 3925, 7/99 - 9/99
- Figure 1-20 Pumping Rates for South Plume Extraction Well 3926, 7/99 - 9/99
- Figure 1-21 Pumping Rates for South Plume Extraction Well 3927, 7/99 - 9/99
- Figure 1-22 Pumping Rates for South Plume Extraction Well 32308, 7/99 - 9/99
- Figure 1-23 Pumping Rates for South Plume Extraction Well 32309, 7/99 - 9/99
- Figure 1-24 Weekly Total Uranium Concentrations for the South Plume Module
- Figure 1-25 Re-Injection Rates for Re-Injection Well 22107, 7/99 - 9/99
- Figure 1-26 Re-Injection Rates for Re-Injection Well 22108, 7/99 - 9/99
- Figure 1-27 Re-Injection Rates for Re-Injection Well 22109, 7/99 - 9/99
- Figure 1-28 Re-Injection Rates for Re-Injection Well 22111, 7/99 - 9/99
- Figure 1-29 Re-Injection Rates for Re-Injection Well 22240, 7/99 - 9/99
- Figure 1-30 Total Uranium Plume Map, Second Quarter 1999
- Figure 1-31 Cross-Section F-F', Geoprobe Results for Total Uranium in Groundwater, June/July 1999
- Figure 1-32 Routine Groundwater Elevations for Type 2 Wells, July 1999
- Figure 1-33 Routine Groundwater Elevations for Type 3 Wells, July 1999
- Figure 1-34 Modeled Groundwater Elevations for July-1999 Operational Conditions
- Figure 2-1 On-Site Disposal Facility Leak Detection Activities Covered in this Quarterly Report
- Figure 2-2 On-Site Disposal Facility Well Locations
- Figure 2-3 On-Site Disposal Facility Leak Detection Activities Covered in the Next Quarterly Report
- Figure 2-4 On-Site Disposal Facility Cell 1 Leak Detection System (12338D)Rate of Accumulation (Gallons/Acre/Day), July 25, 1999 through September 4, 1999
- Figure 2-5 On-Site Disposal Facility Cell 2 Leak Detection System (12339D)Rate of Accumulation (Gallons/Acre/Day), July 3, 1999 through September 11, 1999
- Figure 3-1 Surface Water and Treated Effluent Sampling Activities Covered in this Quarterly Report
- Figure 3-2 IEMP Surface Water and Treated Effluent Sample Locations

LIST OF FIGURES
(Continued)

- Figure 3-3 Surface Water and Treated Effluent Sampling Activities Covered in the Next Quarterly Report
- Figure 3-4 NPDES Permit Sample Locations
- Figure 3-5 Pounds of Uranium Discharged to the Great Miami River from the Parshall Flume (PF 4001) in 1999
- Figure 3-6 1999 Monthly Average Total Uranium Concentration in Water Discharged from the Parshall Flume (PF 4001) to the Great Miami River
- Figure 3-7 Controlled Surface Water Areas and Uncontrolled Flow Directions for Third Quarter 1999
- Figure 3-8 Total Uranium Concentrations in Paddys Run at Willey Road (SWP-03) Sample Location
- Figure 4-1 Air Sampling Activities Covered in this Quarterly Report
- Figure 4-2 Air Sampling Activities Covered in the Next Quarterly Report
- Figure 4-3 IEMP Air Monitoring Locations
- Figure 4-4 Total Uranium and Particulate Concentrations in Air (AMS-2)
- Figure 4-5 Total Uranium and Particulate Concentrations in Air (AMS-3)
- Figure 4-6 Total Uranium and Particulate Concentrations in Air (AMS-4)
- Figure 4-7 Total Uranium and Particulate Concentrations in Air (AMS-5)
- Figure 4-8 Total Uranium and Particulate Concentrations in Air (AMS-6)
- Figure 4-9 Total Uranium and Particulate Concentrations in Air (AMS-7)
- Figure 4-10 Total Uranium and Particulate Concentrations in Air (AMS-8A)
- Figure 4-11 Total Uranium and Particulate Concentrations in Air (AMS-9C)
- Figure 4-12 Total Uranium and Particulate Concentrations in Air (AMS-22)
- Figure 4-13 Total Uranium and Particulate Concentrations in Air (AMS-23)
- Figure 4-14 Total Uranium and Particulate Concentrations in Air (AMS-24)
- Figure 4-15 Total Uranium and Particulate Concentrations in Air (AMS-25)
- Figure 4-16 Total Uranium and Particulate Concentrations in Air (AMS-26)
- Figure 4-17 Total Uranium and Particulate Concentrations in Air (AMS-27)
- Figure 4-18 Total Uranium and Particulate Concentrations in Air (AMS-28)
- Figure 4-19 Total Uranium and Particulate Concentrations in Air (AMS-29)
- Figure 4-20 Total Uranium and Particulate Concentrations in Air (AMS-12)
- Figure 4-21 Total Uranium and Particulate Concentrations in Air (AMS-16)
- Figure 4-22 Thorium-228, Thorium-230, and Thorium-232 Concentrations in Air (WPTH-1)
- Figure 4-23 Thorium-228, Thorium-230, and Thorium-232 Concentrations in Air (WPTH-2)
- Figure 4-24 Total Uranium and Particulate Concentrations in Air (STP-1)
- Figure 4-25 Total Uranium and Particulate Concentrations in Air (STP-2)
- Figure 4-26 NESHAP Stack Emission Monitoring Locations
- Figure 4-27 Radon Monitoring - Continuous Alpha Scintillation Locations
- Figure 4-28 Quarterly K-65 Silo Head Space Radon Concentrations, 1992-1999
- Figure 4-29 Direct Radiation (thermoluminescent dosimeter) Monitoring Locations
- Figure 4-30 Quarterly Direct Radiation (TLD) Measurements, 1994-1999 (K-65 Silos Fenceline Versus Background Average)
- Figure 4-31 Quarterly Direct Radiation (TLD) Measurements, 1994-1999 (Location 6 Versus Background Average)
- Figure 6-1 1999 FEMP Monthly Precipitation Data
- Figure 6-2 Third Quarter 1999 Wind Rose Data, 10-Meter Height

000005

LIST OF TABLES

Table 1-1	Aquifer Restoration System Operational Summary Sheet for Third Quarter (July through September 1999)
Table 1-2	South Field (Phase 1) Extraction Module Operational Summary Sheet for Third Quarter (July through September 1999)
Table 1-3	South Plume Module Operational Summary Sheet for Third Quarter (July through September 1999)
Table 1-4	Re-Injection Demonstration Module Operational Summary Sheet for Third Quarter (July through September 1999)
Table 1-5	Paddys Run Road Site Groundwater Summary Statistics
Table 2-1	On-Site Disposal Facility Cell 1 Data Summary for Constituents Detected During Second Quarter 1999
Table 2-2	On-Site Disposal Facility Cell 2 Data Summary for Constituents Detected During Second Quarter 1999
Table 2-3	On-Site Disposal Facility Cell 3 Data Summary for Constituents Detected During Second Quarter 1999
Table 3-1	1999 Treatment Bypass Events
Table 4-1	Total Uranium Particulate Concentrations in Air
Table 4-2	Total Particulate Concentrations in Air
Table 4-3	Third Quarter NESHAP Compliance Tracking
Table 4-4	Year-To-Date NESHAP Compliance Tracking
Table 4-5	NESHAP Stack Emission Monitoring Results
Table 4-6	Continuous Environmental Radon Monitoring Monthly Average Concentrations
Table 4-7	Radon Head Space Concentrations
Table 4-8	Direct Radiation (TLD) Measurements

LIST OF ACRONYMS

2687

AMS	air monitoring station
amsl	above mean sea level
AWWT	Advanced Wastewater Treatment Facility
BRSR	Baseline Remedial Strategy Report
BTV	benchmark toxicity value
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FFCA	Federal Facilities Compliance Agreement
FRL	final remediation level
gpad	gallons per acre per day
gpm	gallons per minute
IEMP	Integrated Environmental Monitoring Plan
lbs	pounds
LCS	leachate collection system
LDS	leak detection system
mg/L	milligrams per liter
M gal	million gallons
mrem	millirem
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
OSDF	on-site disposal facility
pCi/L	picoCuries per liter
pCi/m ³	picoCuries per cubic meter
PRRS	Paddys Run Road Site
TLD	thermoluminescent dosimeter
WPRAP	Waste Pits Remedial Action Project
µg/L	micrograms per liter
µg/m ³	micrograms per cubic meter

000007

Introduction

-2687

000008

INTEGRATED ENVIRONMENTAL MONITORING STATUS REPORT FOR THIRD QUARTER 1999

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), Revision 1 (DOE 1999b) for the Fernald site. The IEMP quarterly status reports document the results of DOE's ongoing assessment of environmental conditions at and near the site as full-scale remediation of the Fernald site proceeds. The primary objectives of the report are to:

- Provide a current summary of key environmental data that serves as the basis for tracking and assessing the collective effectiveness of site emission controls
- Support Fernald stakeholders by providing a timely assessment of off-property impacts associated with implementation and operation of remedial actions at the Fernald site
- Document the performance of the groundwater remedy for the Great Miami Aquifer
- Document the status of natural resource impacts and restoration activities.

The information presented in the quarterly status report is primarily organized in summary data tables and graphics with minimal textual discussion. This reporting format provides an efficient means of summarizing the wide range of environmental and operational data that are collected each quarter. In addition, the emphasis on data tables and graphic data displays is designed to aid readers in interpreting the data relative to historical information and applicable regulatory standards. The information summarized in the quarterly status reports is presented in greater detail in the Fernald's annual integrated site environmental report available in June of each year. The next IEMP quarterly status report will be submitted in March of 2000.

000009

-2687

Groundwater Remedy

000010

This section summarizes the third quarter 1999 operational data for the aquifer remedy and second quarter 1999 analytical data from groundwater monitoring. This section is consistent with the groundwater reporting requirements presented in the Integrated Environmental Monitoring Plan (IEMP), Revision 1 (DOE 1999b).

Figure 1-1 shows the sampling activities that contributed data to this section. Figure 1-2 identifies the IEMP groundwater monitoring wells by module/monitoring activity and Figure 1-3 shows the IEMP routine water-level (groundwater elevation) monitoring wells. Figure 1-4 shows the location of the active aquifer restoration modules and extraction/re-injection wells.

Figure 1-5 shows the groundwater monitoring activities to be summarized in the next IEMP quarterly status report to be submitted in March of 2000. The report will contain operational data and the plume capture assessment from October through December 1999 (fourth quarter), and analytical results from sampling activities conducted from July through September 1999 (third quarter).

000011

Table 1-1 summarizes the operational data from the three active restoration modules for the third quarter of 1999. The South Plume and South Field (Phase I) Extraction Modules pumped a total of 447.52 million gallons of groundwater and removed 187.23 pounds of uranium during this reporting period. The Re-Injection Demonstration Module re-injected 110.17 million gallons of groundwater back into the aquifer for a net total extraction of 337.35 million gallons. To date, 5.236 billion gallons of groundwater have been pumped and 1,362.57 pounds of uranium have been removed from the aquifer. During the third quarter of 1999, re-injection returned 11.98 pounds of uranium back into the aquifer. Figure 1-6 depicts the total groundwater pumped versus groundwater treated during the third quarter. Figure 1-7 shows the uranium removal indices for the South Field (Phase I) Extraction and South Plume Modules.

000012

South Field (Phase I) Extraction Module: The module target pumping rate for the combined nine active extraction wells was 1500 gallons per minute (gpm). For the majority of the period, all active extraction wells in the module were pumped at or above the rates specified in the Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1) (DOE 1997a). The monthly average pumping rate at Extraction Well 31550 was significantly lower in September than in July and August due to maintenance activities. Pumping rates for Extraction Wells 31562 and 32276 were increased to 200 and 300 gpm, respectively, on August 7, 1998, to compensate for the shutdown of Extraction Well 31566. After consultation with the U.S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA), Extraction Well 31566 was shut down in August 1998 due to low total uranium concentrations. Table 1-2 provides operational details for this module. Daily pumping rate figures, which identify operational percentages for each well and outages lasting longer than 24 hours, can be viewed by going to Table 1-2 and selecting the appropriate well number. Because Extraction Well 31566 was not being pumped, there is no daily pumping rate figure. Figure 1-17 provides the weekly total uranium concentrations for each extraction well in this module.

000013

South Plume Module: The South Plume Module target pumping rate was 2000 gpm. For the majority of the period, the six wells were pumped at or above the rates specified in the Baseline Remedial Strategy Report. The monthly average pumping rates for Extraction Wells 32308 and 32309 were significantly lower in September than in July or August due to the following activities:

- Re-injection wells were shut down.
- Distributed Control System was upgraded at the Advanced Wastewater Treatment (AWWT) facility.

Table 1-3 provides operational details for the South Plume Module. Daily pumping rate figures, which identify operational percentages for each well and outages lasting longer than 24 hours, can be viewed by going to Table 1-3 and selecting the appropriate well number. Figure 1-24 depicts the weekly total uranium concentrations for each well in this module.

000014

2687

Re-Injection Demonstration Module: The target re-injection rate for this module was 1000 gpm. Groundwater was re-injected through the five wells near the rates specified in the Baseline Remedial Strategy Report for the majority of the period. The monthly average module re-injection rate was significantly lower in September than in July or August due to the following activities:

- Planned maintenance activities of certain re-injection wells
- Distributed Control System was upgraded at the AWWT facility
- Precautions to address the increasing uranium concentrations in the injectate source water.

Total uranium concentrations in the injectate source water began increasing significantly in the second quarter and this trend continued into the third quarter. In accordance with the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment Project (DOE 1997c), regeneration of the ion exchange resins in the treatment plant (which supplies the injectate) began in July. The regeneration efforts were undertaken to bring the uranium concentration in the injectate back down to low levels. Regeneration of the resins was ongoing at the close of the quarter. EPA and OEPA were kept apprised of the situation via weekly teleconferences. It is anticipated that the regeneration efforts will be successful in reducing the concentration of uranium in the injectate during the fourth quarter. Daily pumping rate figures, which identify operational percentages for each well and outages lasting longer than 24 hours, can be viewed by going to Table 1-4 and selecting the appropriate well number.

000015

The total uranium plume map shown in Figure 1-30 was modified in the following four areas to account for higher total uranium concentrations reported for the second quarter of 1999:

- Direct push sample locations (Geoprobe® locations), which are located in the South Field area
- Monitoring Well 3027, which is located east of Waste Pit 6
- Monitoring Well 2546, which is located south of the Fernald site Administrative Boundary for aquifer restoration
- Monitoring Well 2390, which is located in the South Field area.

The current depiction of the total uranium plume (Figure 1-30) has been revised in the South Field area relative to what was shown in the Integrated Environmental Monitoring Status Report for Second Quarter 1999 (DOE 1999c). The plume in the South Field area was re-defined by incorporating total uranium concentration data collected from 11 new Geoprobe® locations (12409, 12416, 12410, 12411, 12415, 12431, 12432, 12433, 12434, 12442, and 12443) completed during the second quarter of 1999. Groundwater samples were collected at 10-foot depth increments beneath the water table until the base of the 20 micrograms per liter ($\mu\text{g/L}$) total uranium plume was defined. The direct push sampling data were transmitted to EPA and OEPA by facsimile on June 4, 1999 (F:SWP[ARWWP]:99-0010).

Monitoring Well 3027 had a total uranium concentration of approximately 180 $\mu\text{g/L}$ in June of 1999. As illustrated in Figure A.2-79 of the 1998 Integrated Site Environmental Report (DOE 1999a), the total uranium concentrations (with the exception of one measurement in 1993) have historically been below 20 $\mu\text{g/L}$. It is believed that the integrity of this well may have been compromised. Therefore, the previously identified Waste Storage area plume, which is located south of this well, has not been extended. Efforts are underway to verify and document the source of the elevated uranium concentration in this well. Progress on these efforts will be reported to the EPA and OEPA via the weekly teleconferences. Findings and actions taken will be summarized in future IEMP reports once they have been completed.

In May of 1999, a sample from Monitoring Well 2546 showed a total uranium concentration of 110 $\mu\text{g/L}$. As illustrated in Plate E-77 of the Remedial Investigation Report for Operable Unit 5 (DOE 1995), this well is within a uranium plume embedded within the Paddys Run Road Site (PRRS) plume. As illustrated in Figure A.2-57 of the 1998 Integrated Site Environmental Report, the last time that a concentration this high was reported in this well was in 1990 when a concentration of 144 $\mu\text{g/L}$ was measured. Total uranium concentrations at this well are predominantly below 20 $\mu\text{g/L}$. There are indications that the high uranium concentrations may be related to sample turbidity. Efforts are underway to determine if this high concentration is representative of the aquifer. The current results are being considered suspect until this effort is completed. Progress will be reported to the EPA and OEPA via the weekly teleconferences. Findings and actions taken will be summarized in future IEMP reports once they have been completed.

In June of 1999, the total uranium concentration measured at Monitoring Well 2390 was 123.3 $\mu\text{g/L}$. This well was previously shown on the map just outside of the 100 $\mu\text{g/L}$ concentration contour. The contour line has been redrawn so

~~2687~~

that the well is now located just inside of the 100 $\mu\text{g/L}$ concentration contour. Continued sampling will determine if the concentration continues to trend upward or go back down.

In a letter dated November 1, 1999 (DOE-0087-00) the U.S. Department of Energy (DOE) informed the EPA and the OEPA that four new monitoring wells (62408, 62433, 6880, and 6881) were being installed and would be added to the IEMP groundwater sampling program during the fourth quarter of 1999. DOE was able to begin sampling two of the wells early. Monitoring Wells 62408 and 62433 were sampled during the third quarter of 1999. Data will be reported via routine IEMP reporting requirements.

000017

A quarterly round of direct push groundwater sampling was conducted in June as part of the Re-Injection Demonstration at locations 12369, 12372, and 12373. This is Round E as described in the Re-Injection Demonstration Test Plan (DOE 1998a). As explained below, the June samples collected from location 12373 were biased due to cross contamination. Data collected from a confirmatory sampling event in July at location 12449, which is within 15 feet of 12373, better represent actual aquifer conditions. Figure 1-31 profiles the total uranium concentrations from 12369, 12372, and 12449 in a cross section. The profile will be used in the Re-Injection Demonstration Report to show how the plume is changing over the course of the demonstration at these locations. For reference, the screened interval depth of Re-Injection Well 22109 (located just upgradient from location 12369) is shown on the profile.

Location 12373 was sampled in June to 90 feet below the water table. The tool could not be advanced beyond that depth. Deep sampling was performed because the last round of sampling detected a uranium concentration of 21 $\mu\text{g/L}$ 70 feet below the water table. The June results at 70, 80, and 90 feet below the water table were 19, 40, and 38 $\mu\text{g/L}$ total uranium, respectively. The second quarter data suggested that a finger of the uranium plume might have been slipping beneath the main plume at this location. As explained below, the deep high uranium concentrations are believed to be the result of cross contamination, and are not representative of aquifer conditions.

Difficulties were encountered collecting samples deeper than 70 feet below the water table in June. At 70 feet, the sample was very sandy. At 80 feet, the crew was unable to purge the rod. The tool was pushed deeper, two feet at a time, until they were able to get a very slow purge prior to collecting the sample at 90 feet. The rod was pulled back to 80 feet and purged successfully. However, the 80-foot sample was not collected until the following morning. It is believed that the probe rods leaked, allowing water from the more contaminated zones higher in the aquifer to seep into the rods, thereby cross contaminating the deeper samples. Delays in collecting the deeper samples, in conjunction with not purging just prior to the collection of the 80-foot deep sample, could have contributed to the cross contamination problem.

To evaluate the viability of the cross-contamination hypothesis, confirmatory sampling was performed on July 19 at Location 12449 to determine if the June results were representative of aquifer conditions. No problems were encountered collecting samples during the confirmatory sampling event. Samples were collected down to a depth of 120 feet below the water table. The results are presented in Figure 1-31. The July confirmatory sampling results indicate that the deep contamination measured in the June samples is not representative of the aquifer. The fourth quarterly round of sampling at location 12373, which was collected in late September and early October, confirmed once again that the deeper contamination is not present. These results will be reported in the Integrated Environmental Monitoring Status Report for Fourth Quarter 1999.

000018

Groundwater elevation measurements for the third quarter of 1999 were collected from July 19 through July 22, 1999. The Type 2 and Type 3 measurements are contoured in Figure 1-32 and Figure 1-33, respectively. Actual pumping rates for each module from July 19 through July 22 are posted on the figures to document the pumping conditions on these dates.

Past experience at the Fernald site has shown that with a large number of wells (181) being measured each quarter, some measurement, transcription, or data entry errors occur (typically less than five percent). These errors often become apparent when the data are posted to maps and the contouring process begins. When the errors are identified, the erroneous data points are removed from the data set to be contoured in order to produce a water level map that represents aquifer conditions. Only one measurement was not used in the July contour data set. This water level measurement was from Monitoring Well 2545, which is located just west of Extraction Well 3924.

The measurement was removed because of the following circumstances:

- The elevation recorded (520.15 feet above mean sea level [amsl]) is approximately six feet higher than the average elevation of the surrounding wells (approximately 514 feet amsl).
- Between June and July the water level in the surrounding wells dropped approximately one foot, yet the water level recorded for Monitoring Well 2545 indicates a water level rise of approximately six feet.
- The water level in August for Monitoring Well 2545 (512.3 feet amsl) was once again consistent with the surrounding wells.

Capture of the main portion of the South Plume (north of PRRS above the 20 µg/L total uranium final remediation level) continued during the third quarter of 1999 due to pumping of the South Plume Module (refer to Figure 1-32).

Figure 1-34 shows the predicted steady state groundwater elevations based on the groundwater model with the South Field (Phase 1) Extraction, Re-Injection Demonstration, and South Plume Modules operating as specified in the Baseline Remedial Strategy Report. For comparative purposes, the 10-year, uranium-based restoration footprint (capture zone), the maximum total uranium plume outline (updated with second quarter 1999 data), and the interpreted capture zones from the groundwater elevation map (Figure 1-32) are also shown on the figure. Note that the modeled capture zone and the capture zone derived from the July water level measurements appear to be in good agreement.

000019

Analysis of the second quarter 1999 PRRS constituent concentration data for arsenic, phosphorous, potassium, and sodium indicates that capture of the total uranium plume is having a negligible influence on the PRRS plume. As shown in Table 1-5, most PRRS constituent concentrations were within the historical minimum-maximum range. Figure 1-2 identifies the well locations. No volatile organic compounds were detected in the monitoring wells used to sample for PRRS constituents.

000020

-2687

As reported in the Integrated Environmental Monitoring Status Report for Second Quarter 1999, Phase II of the groundwater model upgrade was initiated in the third quarter of 1999 with an anticipated finish date in mid-December 1999. The groundwater flow model is being re-calibrated using the October 1998 groundwater level data set to bring model predictions more in line with observed groundwater flow.

000021

TABLE 1-1
AQUIFER RESTORATION SYSTEM OPERATIONAL SUMMARY SHEET

Reporting Period						
	July through September 1999			August 1993 through September 1999		
	Gallons Pumped/Re-Injected (M gal)	Total Uranium Removed/Re-Injected (lbs)	Uranium Removal Index ^a (lbs/M gal)	Gallons Pumped/Re-injected (M gal)	Total Uranium Removed/Re-Injected (lbs)	Uranium Removal Index ^a (lbs/M gal)
South Field (Phase1) Extraction Module	198.77	121.52	0.61	919.259	594.16	0.65
South Plume Module	248.75	65.71	0.26	4,317.194	768.41	0.18
Re-Injection Demonstration Module	110.17	11.98	NA	454.571	22.36	NA
Aquifer Restoration Systems Totals						
(Extraction Wells)	447.52	187.23	0.42	5,236.453	1,362.57	0.26
(Re-Injection Wells)	110.17	11.98	NA	454.571	22.36	NA
(net)	337.35	175.25	NA	4,781.882	1,340.21	NA

^aNA = not applicable

000022

--2687

TABLE 1-2

**SOUTH FIELD (PHASE 1) EXTRACTION MODULE
OPERATIONAL SUMMARY SHEET FOR THIRD QUARTER
(JULY THROUGH SEPTEMBER 1999)**

Extraction Well	31565	31564	31566 ^{a,b}	31563	31567	31550 ^b	31560	31561	31562	32276
Baseline Remedial Strategy Report Target Pumping Rates (gpm)										
	200	200	200	200	100	100	100	100	100	200
Average Pumping Rates (gpm)										
July	203	203	NA	201	100	100	101	101	201	301
August	204	203	NA	202	101	100	100	101	200	298
September	203	201	NA	202	100	67	100	101	200	300
Quarterly Average	203	202	NA	202	100	89	100	101	200	300
Average Total Uranium Concentrations (µg/L)										
July	15.1	13.8	7.2	31.7	36.7	67.7	92.5	37.7	106.8	157.3
August	13.6	14.5	7.5	30.4	45.3	65.6	101.9	45.7	120.9	175.4
September	13.0	14.6	7.4	27.9	45.7	NS	97.1	44.7	111.8	178.5
Quarterly Average	13.9	14.3	7.4	30.0	42.6	66.7	97.2	42.7	113.2	170.4
Uranium Removal Index (Pounds of Total Uranium Removed/Million Gallons Pumped)										
July	0.13	0.12	0.06	0.26	0.31	0.56	0.77	0.31	0.89	1.31
August	0.11	0.12	0.06	0.25	0.38	0.55	0.85	0.38	1.01	1.46
September	0.11	0.12	0.06	0.23	0.38	NA	0.81	0.30	0.93	1.49
Quarterly Average	0.12	0.12	0.06	0.25	0.36	0.56	0.81	0.33	0.94	1.42
	Average Module Pumping Rate (gpm)		Water Pumped by Module (M gal)				Total Uranium Concentration from Module ^c (µg/L)			
July	1511		67.396				69.2			
August	1510		67.538				75.7			
September	1475		63.836				74.9			
	Quarterly Average 1499		Total 198.770				Quarterly Average 73.3			

^aExtraction Well 31566 was shut down in July, August, and September.

^bNA = not applicable

^cNS = not sampled

^dAverage is calculated from individual well total uranium concentrations and flow rates.

TABLE 1-3
SOUTH PLUME MODULE
OPERATIONAL SUMMARY SHEET FOR THIRD QUARTER
(JULY THROUGH SEPTEMBER 1999)

Extraction Well	3924	3925	3926	3927	32308	32309
Baseline Remedial Strategy Report Target Pumping Rates (gpm)						
	300	300	400	400	250	250
Average Pumping Rates (gpm)						
July	295	298	374	480	250	249
August	298	298	346	477	246	246
September	<u>273</u>	<u>297</u>	<u>384</u>	<u>489</u>	<u>166</u>	<u>164</u>
Quarterly Average	289	298	368	482	221	220
Average Total Uranium Concentrations (µg/L)						
July	30.6	29.5	21.9	1.6	63.9	62.0
August	38.1	34.1	23.4	1.7	73.4	72.4
September	<u>36.7</u>	<u>32.4</u>	<u>22.8</u>	<u>1.6</u>	<u>73.0</u>	<u>74.7</u>
Quarterly Average	35.1	32.0	22.7	1.6	70.1	69.7
Uranium Removal Index (Pounds of Total Uranium Removed/Million Gallons Pumped)						
July	0.26	0.25	0.18	0.01	0.53	0.52
August	0.32	0.28	0.20	0.01	0.61	0.60
September	<u>0.31</u>	<u>0.27</u>	<u>0.19</u>	<u>0.01</u>	<u>0.61</u>	<u>0.62</u>
Quarterly Average	0.30	0.27	0.19	0.01	0.58	0.58
	Average Module Pumping Rate (gpm)		Water Pumped by Module (M gal)		Total Uranium Concentration from Module ^a (µg/L)	
July	1945		86.856		29.9	
August	1912		85.284		34.7	
September	<u>1772</u>		<u>76.610</u>		<u>30.2</u>	
Quarterly Average	1876		Total 248.750		Quarterly Average 31.6	

^aAverage is calculated from individual well total uranium concentrations and flow rates.

000024

-- 2687

TABLE 1-4
RE-INJECTION DEMONSTRATION MODULE
OPERATIONAL SUMMARY SHEET FOR THIRD QUARTER
(JULY THROUGH SEPTEMBER 1999)

Re-Injection Well	22107	22108	22109	22240	22111
Baseline Remedial Strategy Report Target Re-Injection Rates					
(gpm)					
	200	200	200	200	200
Average					
Re-Injection Rates					
(gpm)					
July	200	197	197	198	197
August	194	193	191	193	194
September	<u>91</u>	<u>129</u>	<u>45</u>	<u>131</u>	<u>131</u>
Quarterly Average	162	173	144	174	174
	Average		Water Re-Injected		Total Uranium Concentration
	Module Re-Injection Rate		by Module		from Module
	(gpm)		(M gal)		(µg/L)
July	990		44.184		13.6
August	964		43.118		12.4
September	<u>527</u>		<u>22.867</u>		<u>13.0</u>
Quarterly Average	827		Total 110.169		Quarterly Average 13.0

TABLE 1-5
PADDYS RUN ROAD SITE GROUNDWATER SUMMARY STATISTICS

Constituent	Monitoring Well	Number of Samples ^{a,b,c}	Sampling Period				Results with Detections for Second Quarter 1999	
			January 1, 1988 through June 30, 1999				Sample Result (mg/L)	Validation Qualifier ^e
			Min. ^{a,b,c,d} (mg/L)	Max. ^{a,b,c,d} (mg/L)	Avg. ^{a,b,c,d} (mg/L)	SD ^{a,b,c,d} (mg/L)		
Arsenic	2128	209	0.0006	0.1876	0.013	0.02	0.0024	U
	2625	199	0.0048	0.05	0.012	0.008	0.0185	-
	2636	171	0.01	0.0939	0.04	0.02	0.0806	-
	2898	25	0.00035	0.0063	0.0016	0.0013	0.0011	-
	2899	24	0.00032	0.003	0.0013	0.0007	0.00094	-
	2900	207	0.00032	0.0548	0.0051	0.0051	0.0012	-
	3128	27	0.00085	0.234	0.012	0.045	0.0063	U
	3636	26	0.00075	0.014	0.0020	0.0025	0.0012	-
	3898	24	0.0006	0.0062	0.002	0.0012	0.0028	-
	3899	25	0.00032	0.003	0.0013	0.0008	0.001	-
	3900	25	0.000395	0.0045	0.0024	0.0010	0.0033	-
	Phosphorus	2128	35	0.04	16.2	2	3	0.65
2625		24	0.307	12.3	3.38	3.24	6.65	-
2636		23	9.6	170	95	50	131	-
2898		26	0.005	1.05	0.08	0.2	0.0191	U
2899		23	0.005	0.11	0.04	0.03	0.0191	U
2900		24	0.07	0.96	0.45	0.26	0.17	-
3128		34	0.005	13	0.4	2	0.02	J
3636		25	0.00955	1.1	0.10	0.21	0.0191	U
3898		23	0.00955	1.24	0.128	0.255	0.0191	U
3899		24	0.00955	0.83	0.13	0.18	0.0191	U
3900		25	0.005	1.26	0.1	0.25	0.0191	U
Potassium		2128	27	1.09	18	4.1	4.7	1.95
	2625	24	0.64	6.26	3.4	1.7	4.05	-
	2636	23	8.51	218	82.4	54.7	108	-
	2898	26	1.11	5.05	3.60	0.788	4.37	-
	2899	24	1.36	4.42	3.53	0.596	3.71	-
	2900	25	0.0095	6	1.7	1.2	1.71	-
	3128	27	1.09	3.7	2.5	0.62	1.74	-
	3636	25	1.09	4.24	2.52	0.595	2.2	-
	3898	24	0.61	3.93	2.2	0.72	2.3	-
	3899	25	1.335	3.22	2.43	0.334	2.24	-
	3900	25	0.975	3.19	1.89	0.520	1.73	-
	Sodium	2128	27	22.9	75.2	38.9	12.8	49.6
2625		24	16.5	50.7	33.8	7.88	32.8	-
2636		23	23	79.9	47	16	24.8	-
2898		26	4.945	29.2	18.2	4.86	13.6	-
2899		24	11.2	22.9	17.1	3.21	14.9	-
2900		25	0.01355	43.3	29	9.8	30	-
3128		27	3.56	13.4	6.81	3.35	3.71	-
3636		25	4.34	13	8.2	3.0	4.34	-
3898		24	7.29	14.6	9.04	1.72	10.2	-
3899		25	6.24	12.1	8.8	1.4	7.6	-
3900		25	4.19	10.8	6.35	1.86	4.19	-

^aThe data are based on unfiltered samples from the Operable Unit 5 remedial investigation/feasibility study data set (1988 through 1993) and 1994 through 1999 groundwater data.

^bIf more than one sample is collected per well per day (e.g., duplicate), then only one sample is counted for the total number of samples, and the sample with the maximum concentration is used for determining the summary statistics (minimum, maximum, average, and standard deviation[SD]).

^cRejected data qualified with either a R or Z were not included in this count or the summary statistics.

^dFor results where the concentrations are below the detection limit, the results used in the summary statistics are each set at half the detection limit.

^eValidation qualifier codes are provided in Appendix D of the Sitewide CERCLA Quality Assurance Project Plan (DOE 1998b).

2687

FIGURE 1-1

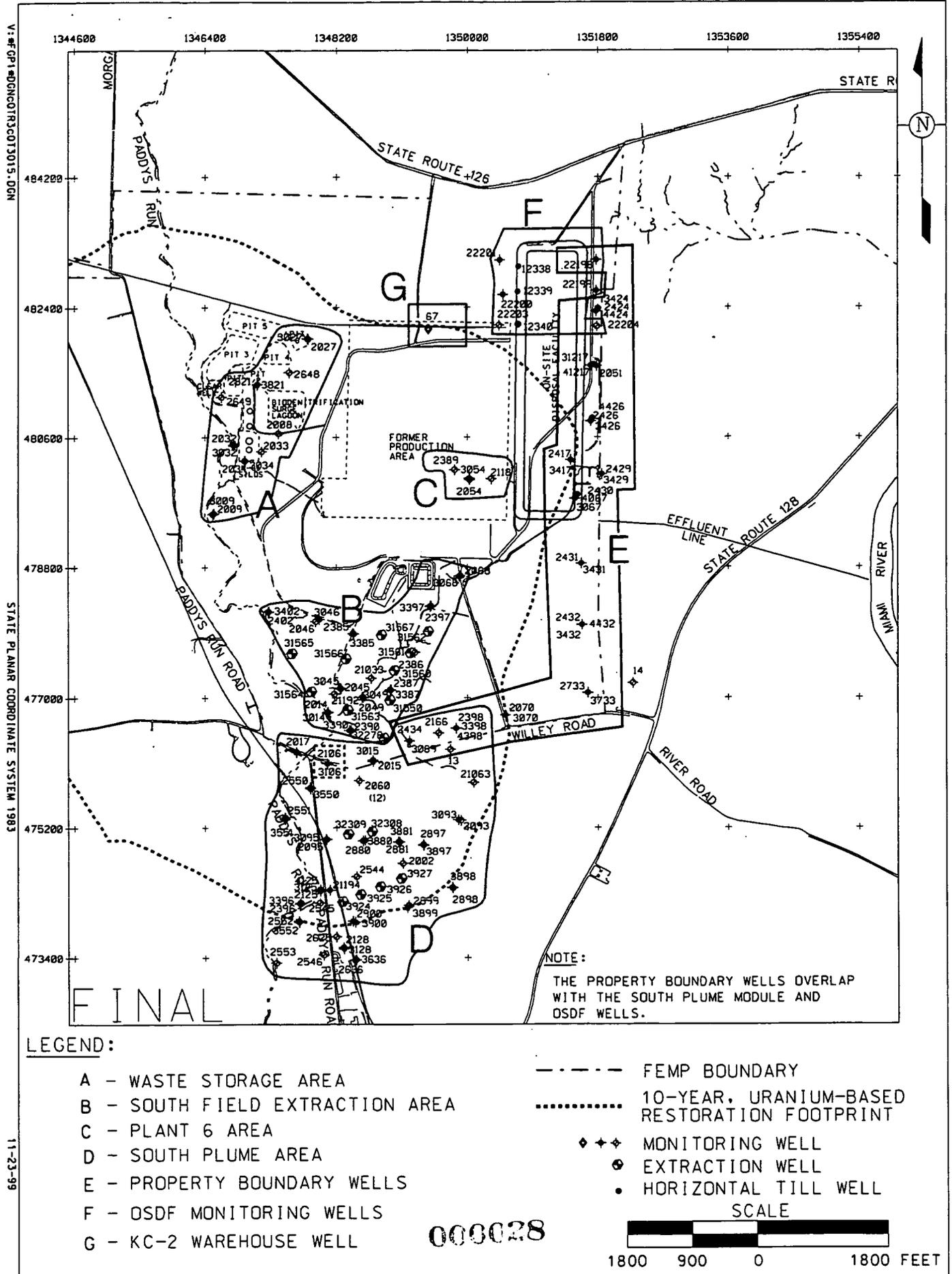
GROUNDWATER SAMPLING ACTIVITIES COVERED IN THIS QUARTERLY REPORT

1999											
First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
SAMPLING ACTIVITIES											
South Plume Module:											
						◆	◆	◆			
Operational											
Aquifer Conditions											
South Field Extraction Module:											
						◆	◆	◆			
Operational (Phase 1)											
Aquifer Conditions											
Re-Injection Demonstration Module *											
						◆	◆	◆			
Operational											
Waste Storage Area Module:											
						◆					
Aquifer Conditions											
Plant 6 Area Module:											
						◆					
Aquifer Conditions											
Routine Water-Level/Flow Direction Monitoring											
			◆			◆					
Property Boundary Monitoring											
			◆								
Private Well Monitoring											
KC-2 Warehouse Well Monitoring											

◆ Data summarized/evaluated in this report

FINAL

*Aquifer conditions for this module are being addressed in the Re-Injection Demonstration Report.



V:\#01\#00\001\3\0013015.DGN

STATE PLANAR COORDINATE SYSTEM 1983

11-23-99

LEGEND:

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

- - - - FEMP BOUNDARY
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- ◆◆◆ MONITORING WELL
- ⊙ EXTRACTION WELL
- HORIZONTAL TILL WELL

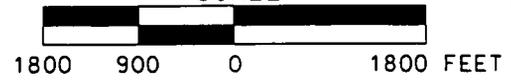
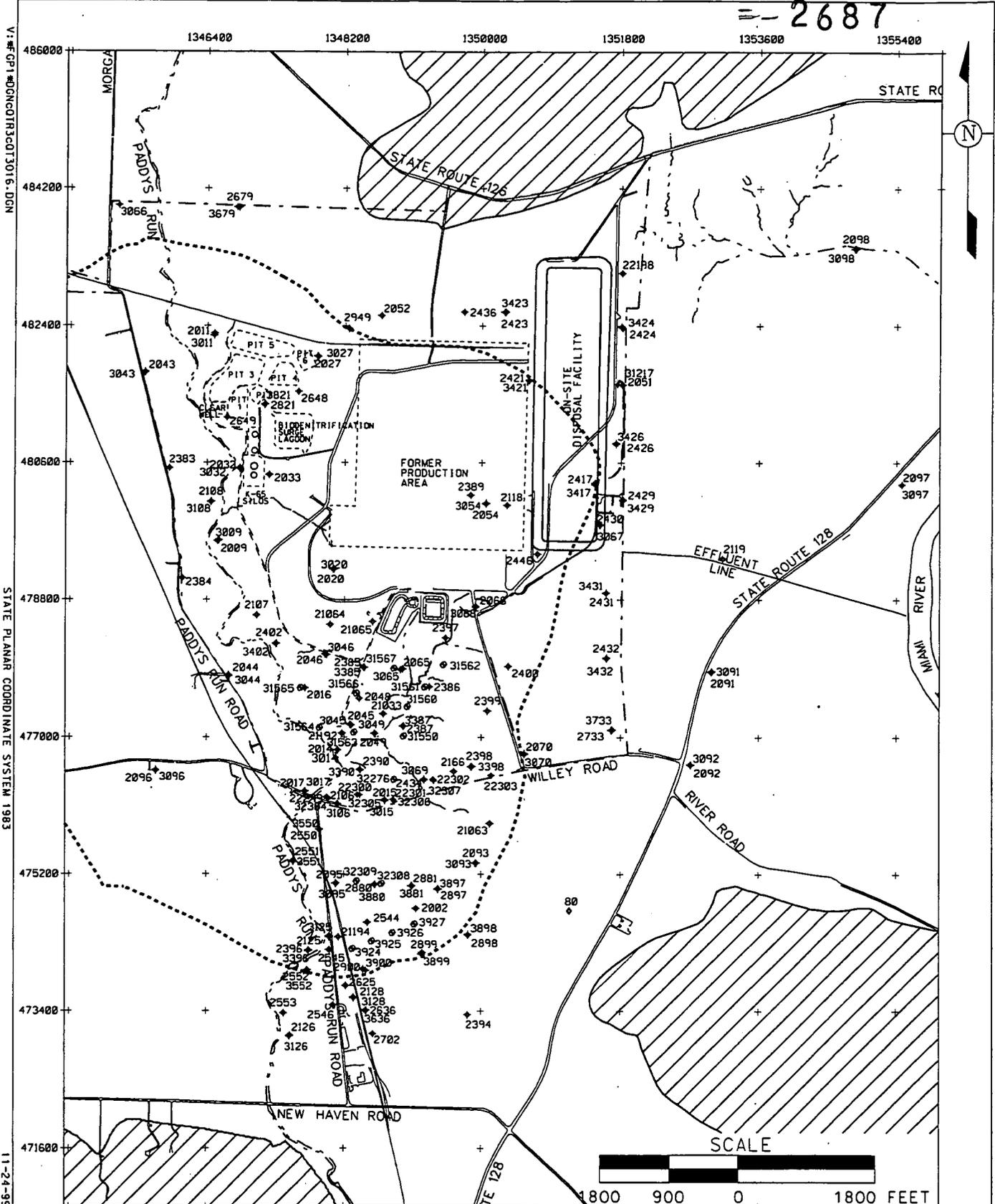


FIGURE 1-2. IEMP WATER QUALITY MONITORING WELLS AND EXTRACTION WELLS

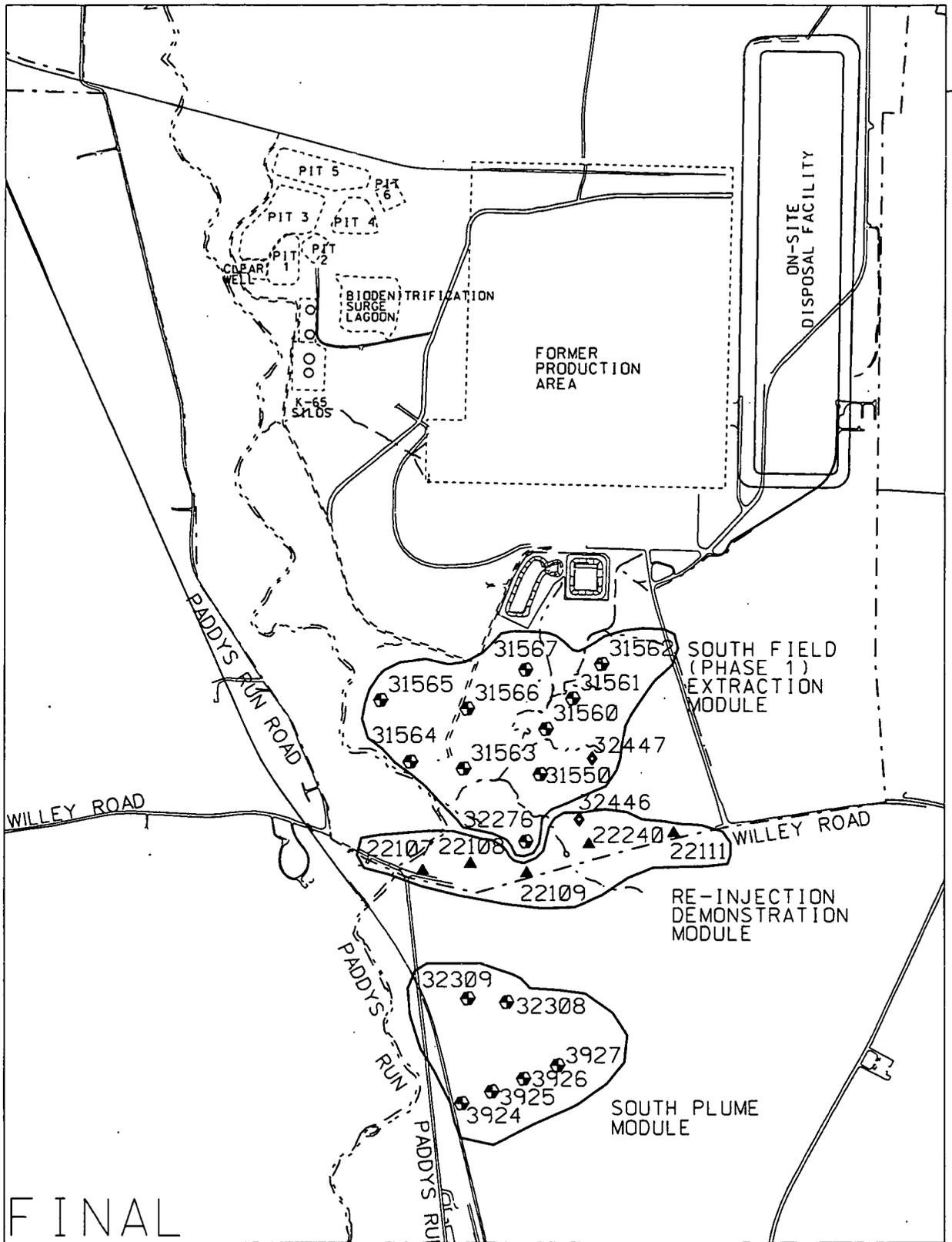


LEGEND:

-----	FEMP BOUNDARY	10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
◆ 2046	TYPE 2 MONITORING WELL	▨	BEDROCK HIGHS
✦ 3046	TYPE 3 MONITORING WELL		
● 31564	EXTRACTION WELL		
◆ 80	PRIVATE WELL		

FINAL **000029**

FIGURE 1-3. GROUNDWATER ELEVATION MONITORING WELLS



FINAL

LEGEND:

- FEMP BOUNDARY
- ⊕ EXTRACTION WELL
- ▲ RE-INJECTION WELL
- ◆ NEW EXTRACTION WELLS BEING INSTALLED IN 1999

000030



1250 625 0 1250 FEET

FIGURE 1-4. LOCATION OF ACTIVE AQUIFER RESTORATION MODULES

=-2687

FIGURE 1-5

GROUNDWATER SAMPLING ACTIVITIES COVERED IN THE NEXT QUARTERLY REPORT

SAMPLING ACTIVITIES

South Plume Module:

Operational

Aquifer Conditions

South Field Extraction Module:

Operational (Phase 1)

Aquifer Conditions

Re-Injection Demonstration Module^a

Operational

Waste Storage Area Module:

Aquifer Conditions

Plant 6 Area Module:

Aquifer Conditions

Routine Water-Level/Flow Direction Monitoring

Property Boundary Monitoring

Private Well Monitoring

KC-2 Warehouse Well Monitoring^b

1999											
First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
									♦	♦	♦
							♦		♦	♦	♦
								♦			
									♦		
							♦				
							♦				
								♦			

♦ Data summarized/evaluated in the next report

FINAL

^aAquifer conditions for this module are being addressed in the Re-Injection Demonstration Report.

^bThis activity will be discontinued in 2000 due to dismantling of the KC-2 Warehouse and subsequent plugging and abandonment of the KC-2 Warehouse well.

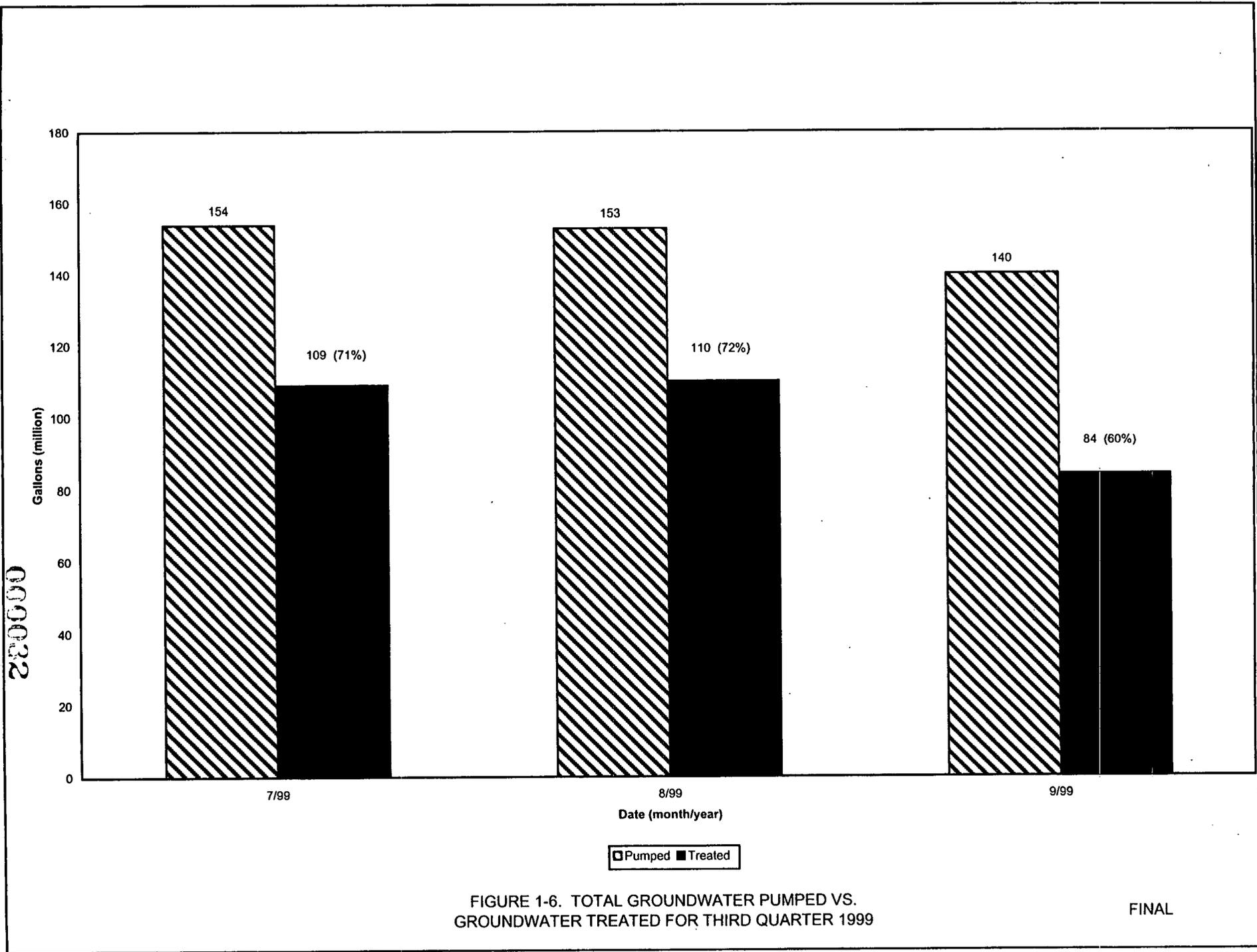


FIGURE 1-6. TOTAL GROUNDWATER PUMPED VS. GROUNDWATER TREATED FOR THIRD QUARTER 1999

FINAL

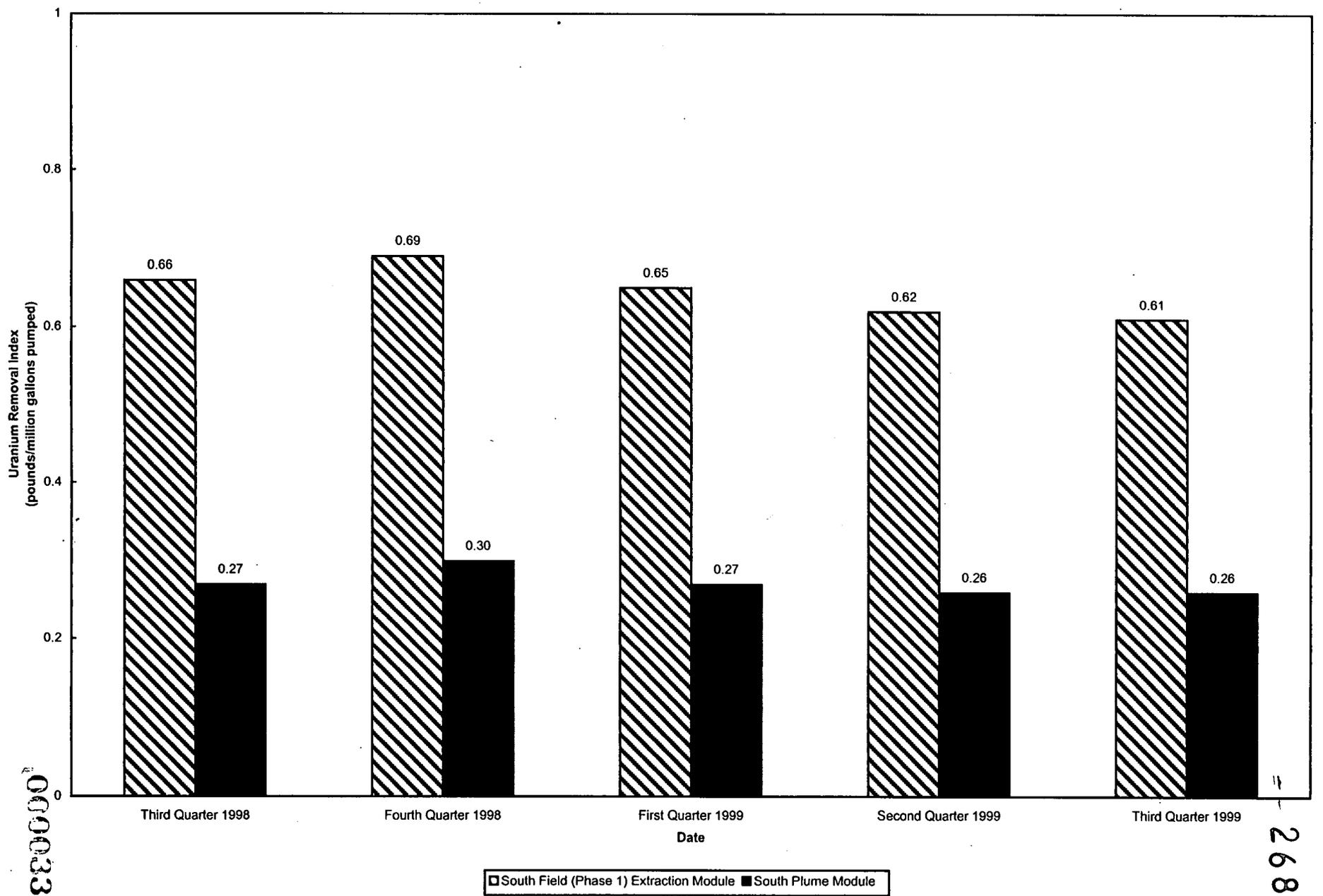


FIGURE 1-7. URANIUM REMOVAL INDICES BY MODULE

FINAL

000033

2687

Hours in reporting period: 2210
Hours pumped: 1966
Hours not pumped: 244
Operational percent: 89.0

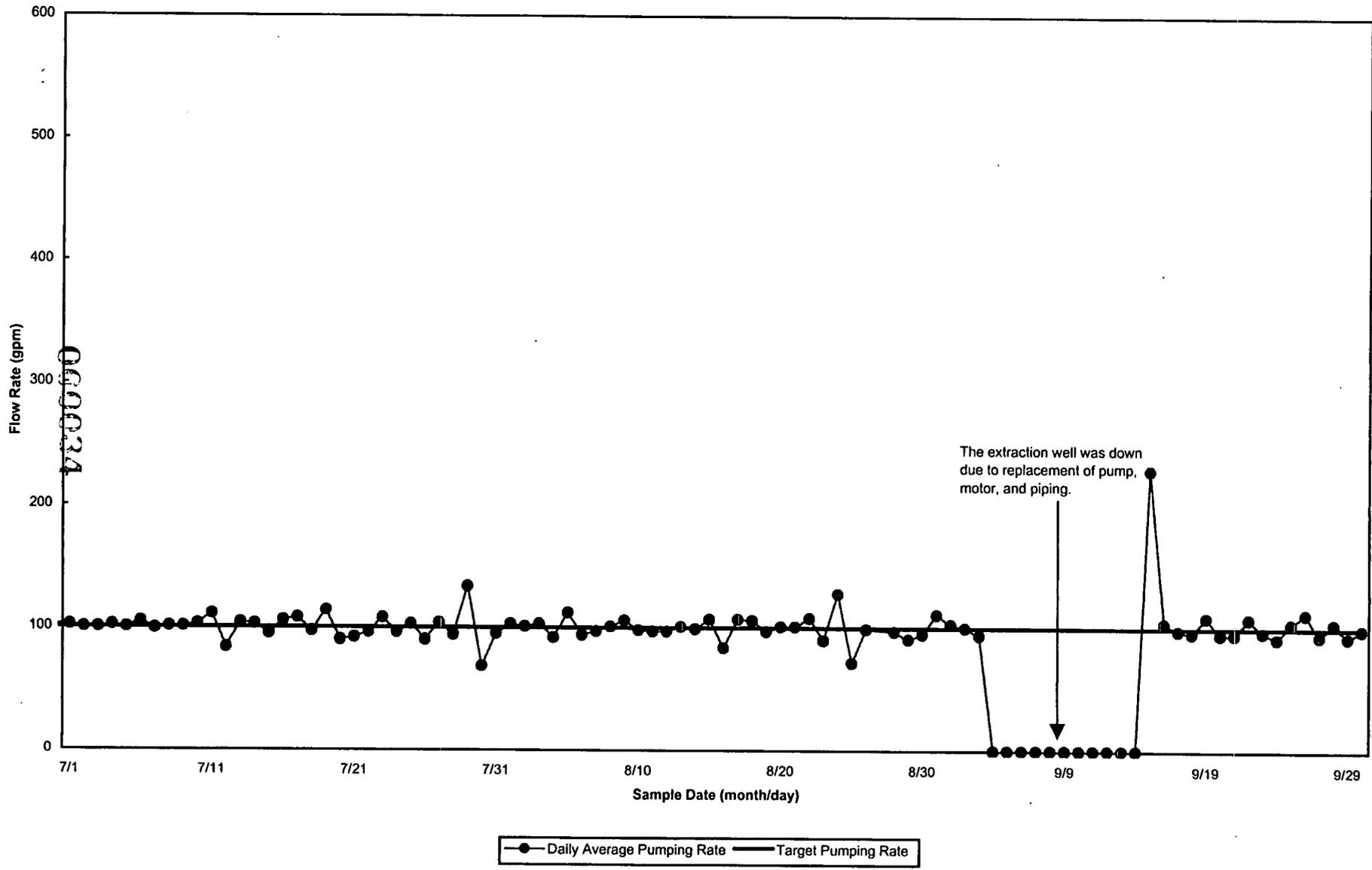
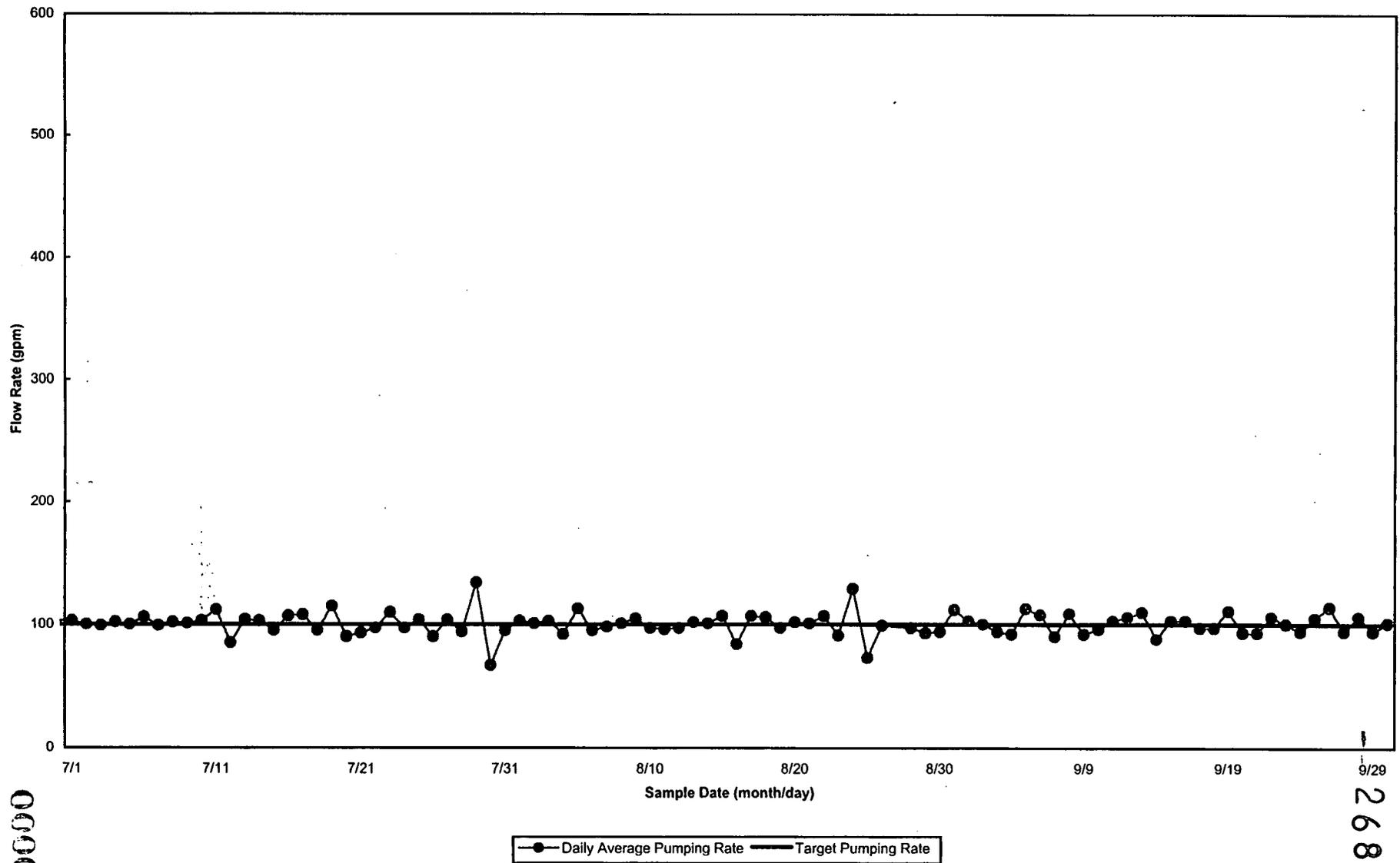


FIGURE 1-8. PUMPING RATES FOR SOUTH FIELD (PHASE 1) EXTRACTION WELL 31550, 7/99 - 9/99

FINAL

Hours in reporting period: 2210
Hours pumped: 2206
Hours not pumped: 4
Operational percent: 99.8



000035

2687

FIGURE 1-9. PUMPING RATES FOR SOUTH FIELD (PHASE 1) EXTRACTION WELL 31560, 7/99 - 9/99

FINAL

Hours in reporting period: 2210
Hours pumped: 2206
Hours not pumped: 4
Operational percent: 99.8

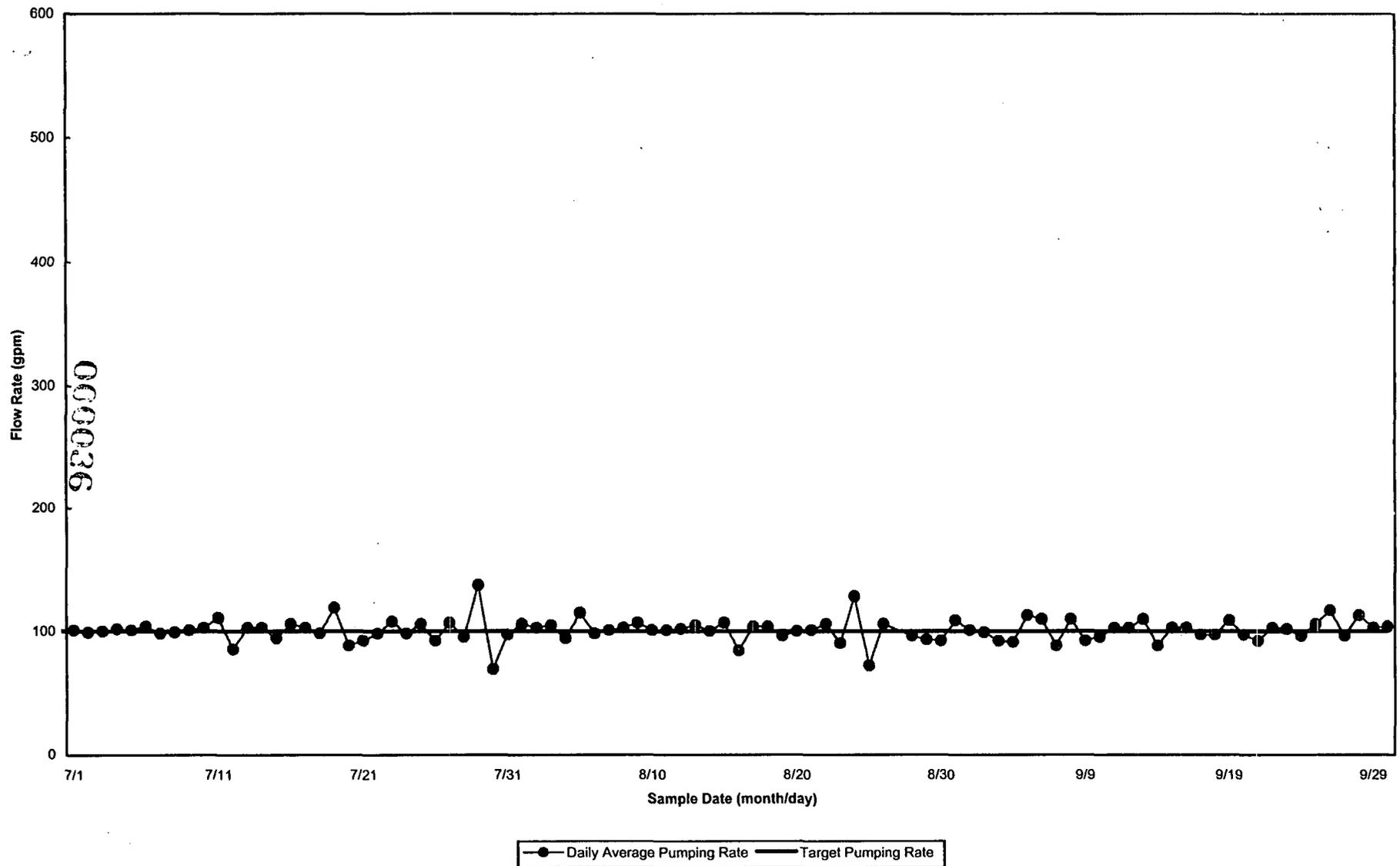


FIGURE 1-10. PUMPING RATES FOR SOUTH FIELD (PHASE 1) EXTRACTION WELL 31561, 7/99 - 9/99

FINAL

Hours in reporting period: 2210
Hours pumped: 2206
Hours not pumped: 4
Operational percent: 99.8

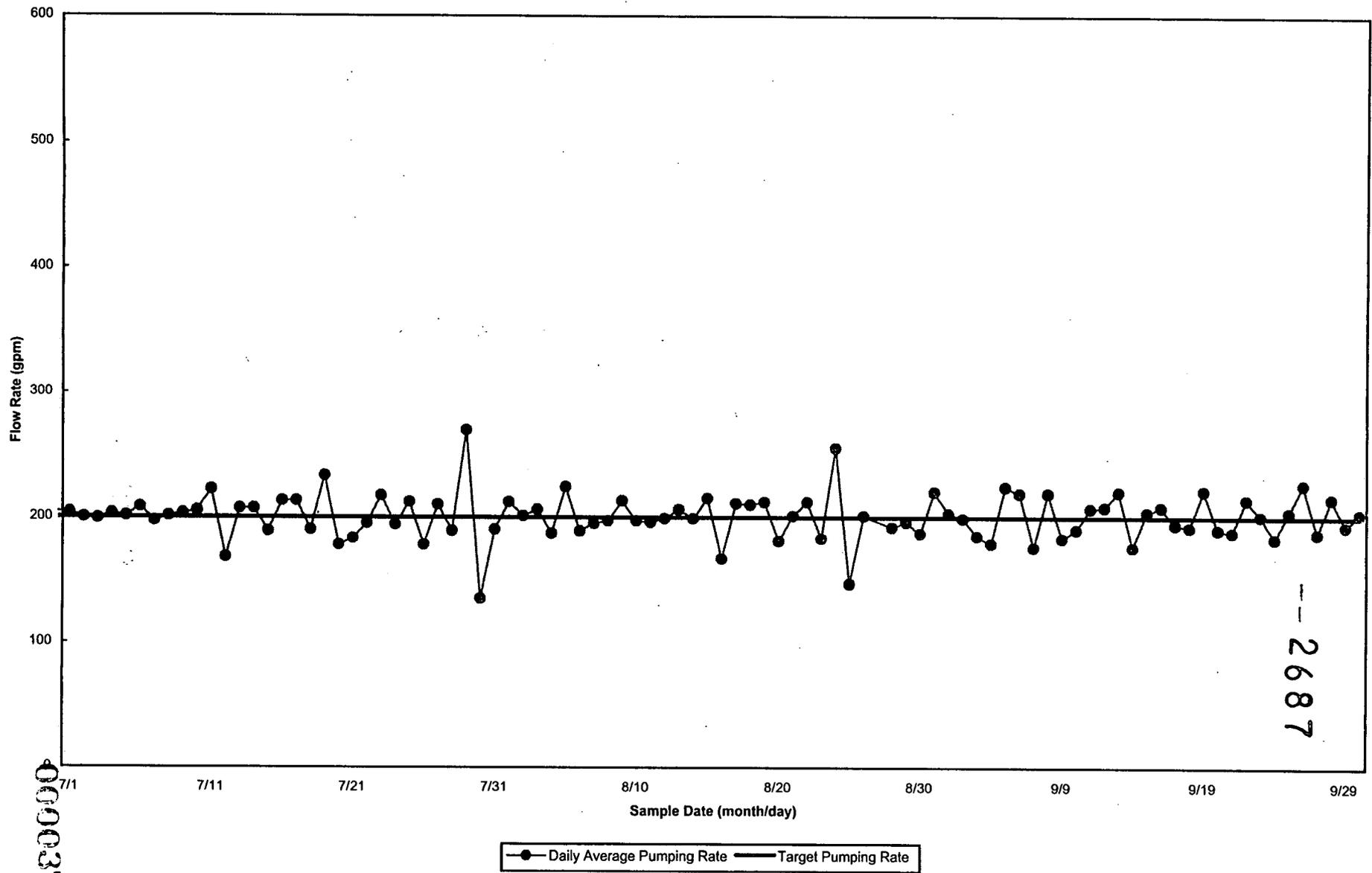


FIGURE 1-11. PUMPING RATES FOR SOUTH FIELD (PHASE 1) EXTRACTION WELL 31562, 7/99 - 9/99

FINAL

Hours in reporting period: 2211
Hours pumped: 2207
Hours not pumped: 4
Operational percent: 99.8

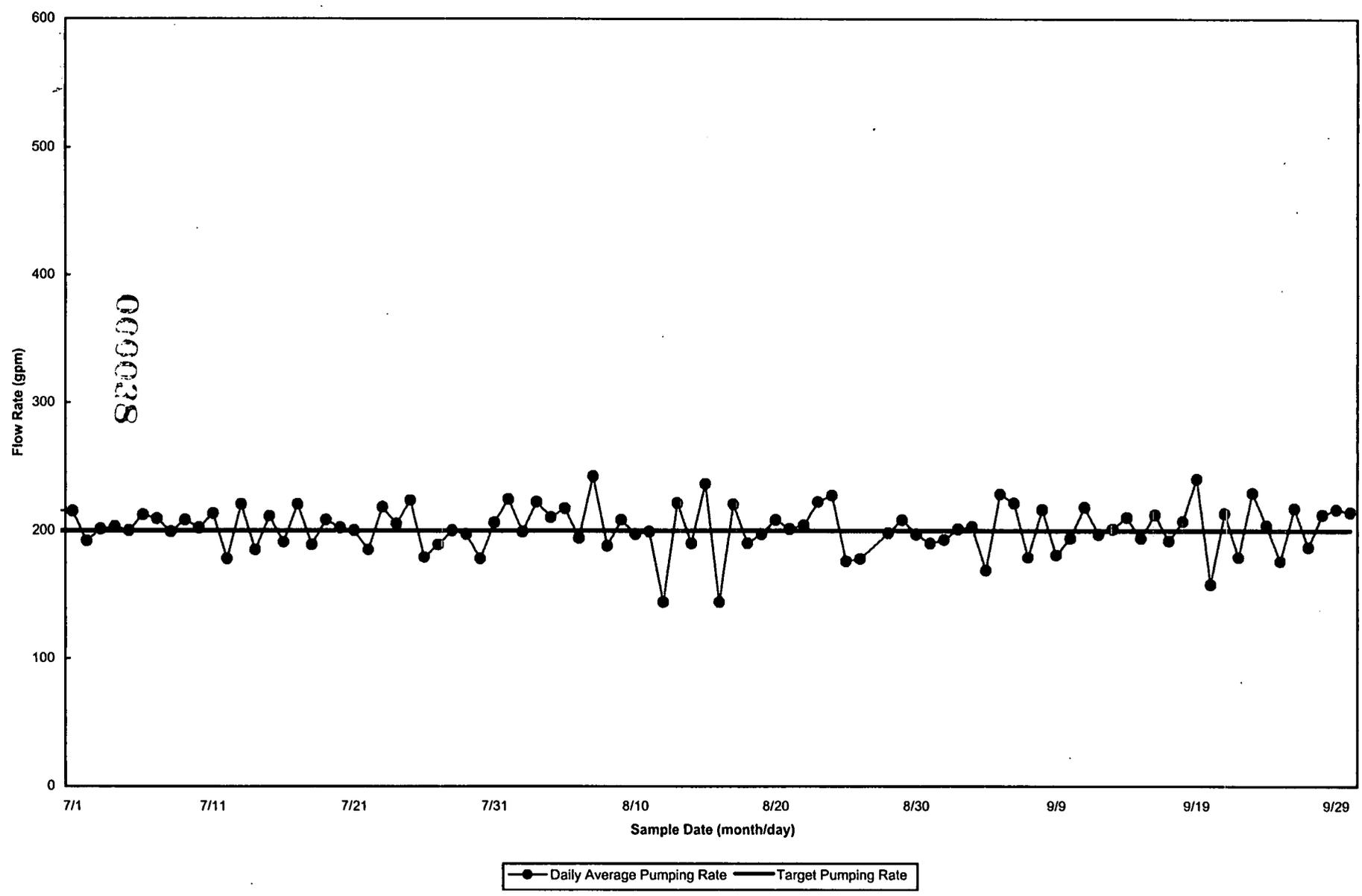
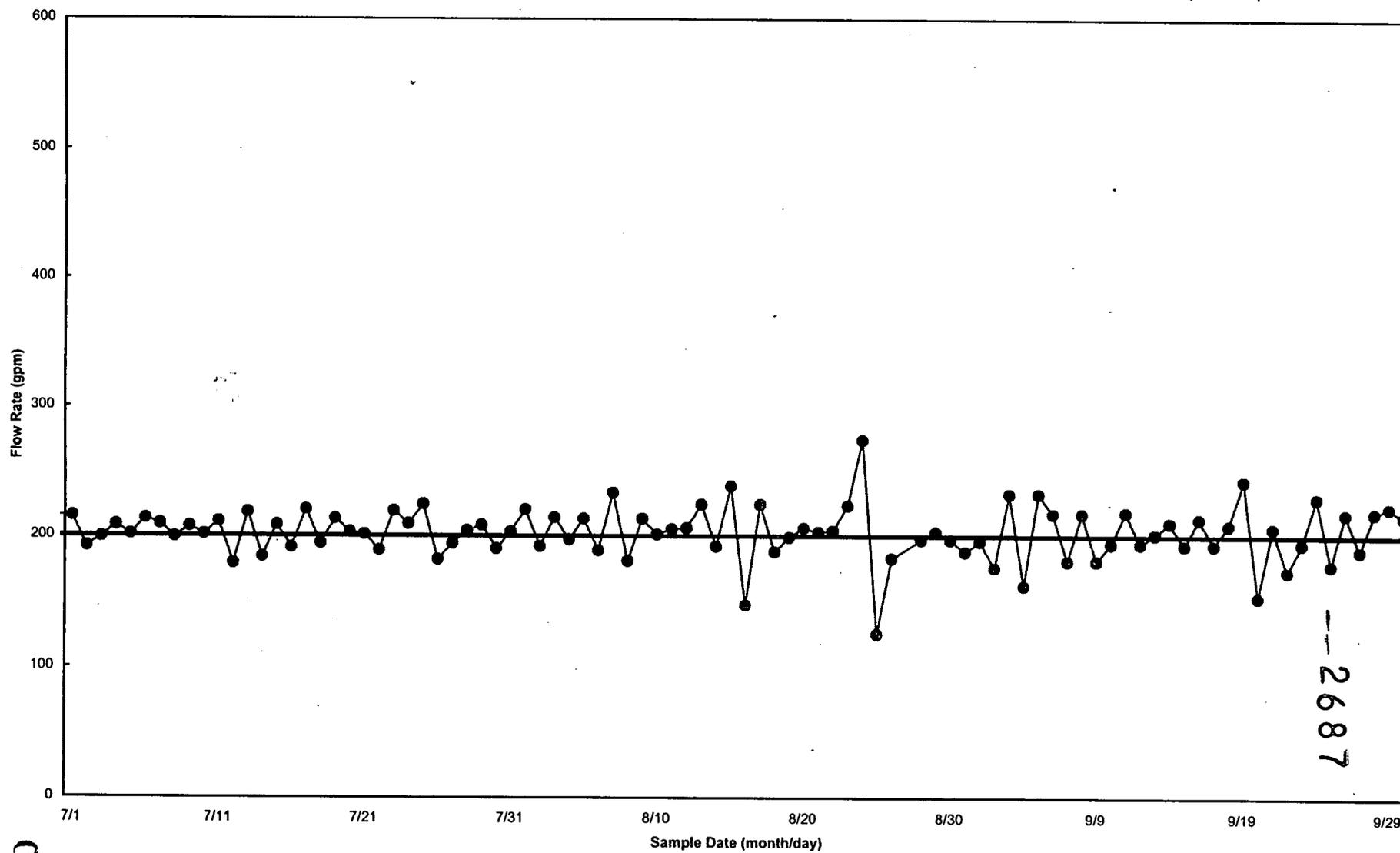


FIGURE 1-12. PUMPING RATES FOR SOUTH FIELD (PHASE 1) EXTRACTION WELL 31563, 7/99 - 9/99

FINAL

Hours in reporting period: 2211
Hours pumped: 2205
Hours not pumped: 6
Operational percent: 99.7



● Daily Average Pumping Rate — Target Pumping Rate

000039

FIGURE 1-13. PUMPING RATES FOR SOUTH FIELD (PHASE 1) EXTRACTION WELL 31564, 7/99 - 9/99

FINAL

Hours in reporting period: 2211
Hours pumped: 2205
Hours not pumped: 6
Operational percent: 99.7

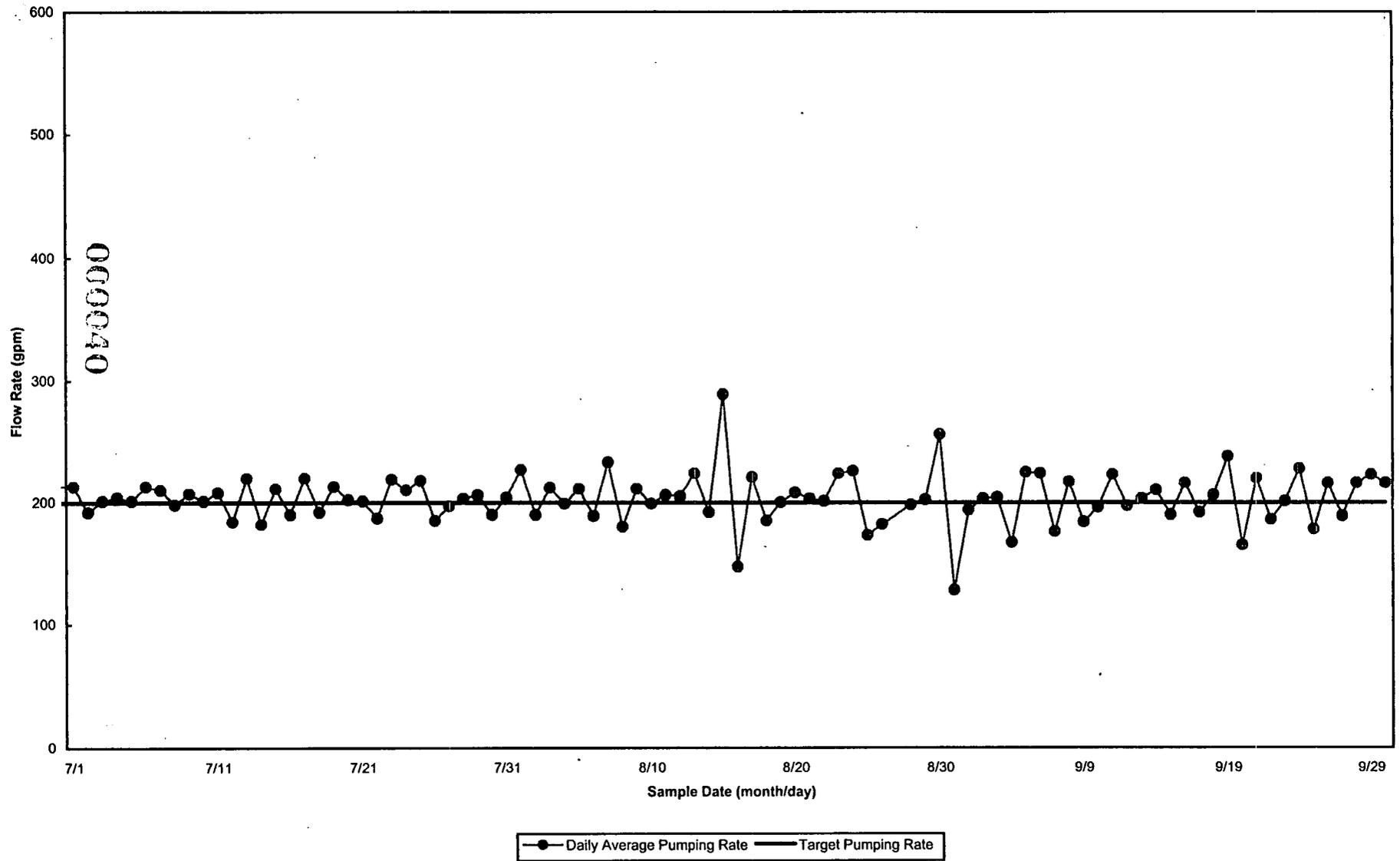
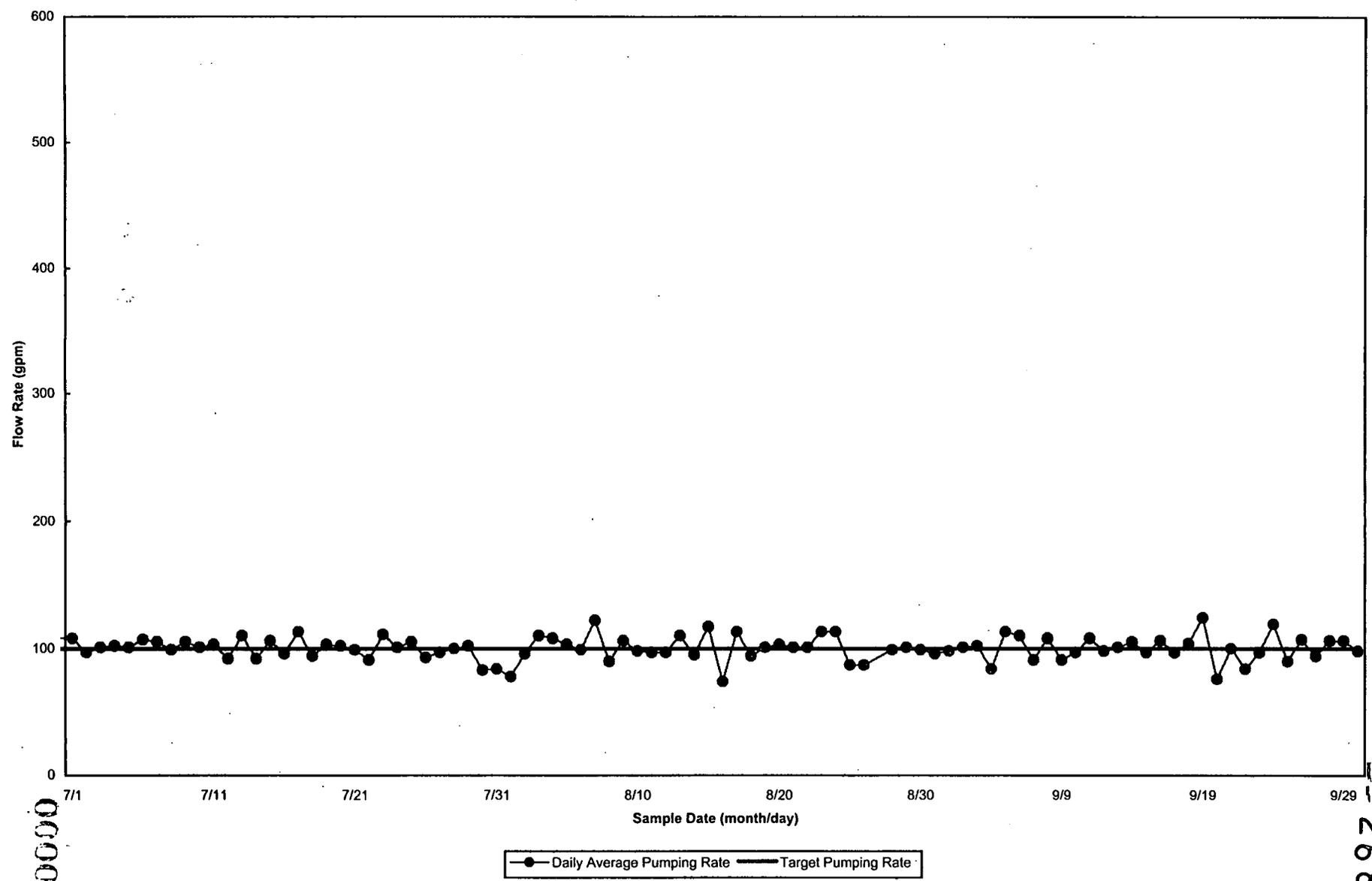


FIGURE 1-14. PUMPING RATES FOR SOUTH FIELD (PHASE 1) EXTRACTION WELL 31565, 7/99 - 9/99

FINAL

Hours in reporting period: 2211
Hours pumped: 2207
Hours not pumped: 4
Operational percent: 99.8



000041

FIGURE 1-15. PUMPING RATES FOR SOUTH FIELD (PHASE 1) EXTRACTION WELL 31567, 7/99 - 9/99

FINAL

2687

Hours in reporting period: 2211
Hours pumped: 2207
Hours not pumped: 4
Operational percent: 99.8

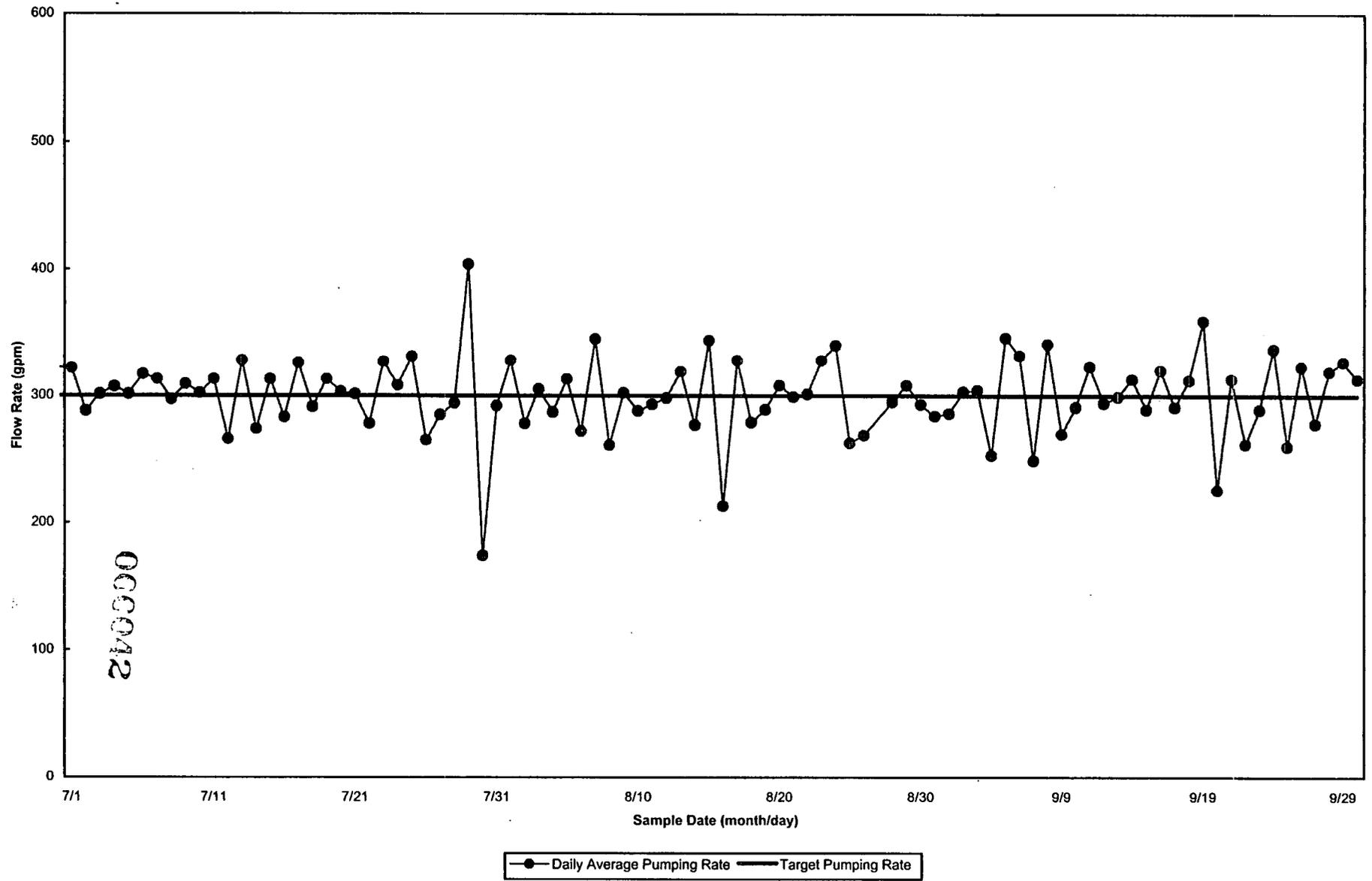
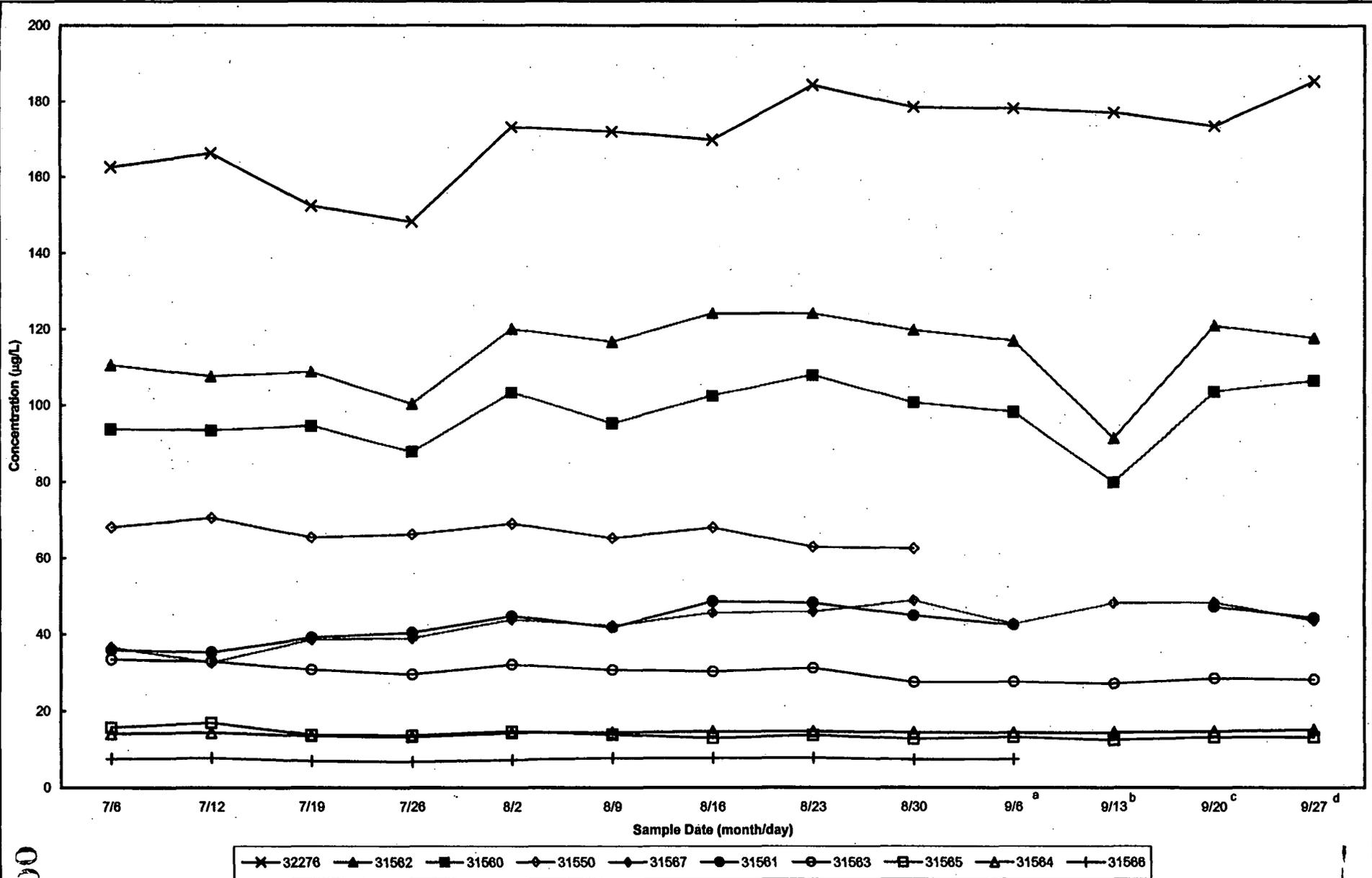


FIGURE 1-16. PUMPING RATES FOR SOUTH FIELD (PHASE 1) EXTRACTION WELL 32276, 7/99 - 9/99

FINAL



^a A sample was not collected for Extraction Well 31550.

^c A sample was not collected for Extraction Wells 31550 and 31586.

^b A sample was not collected for Extraction Wells 31550, 31561, and 31586.

^d A sample was not collected for Extraction Wells 31550 and 31586.

FIGURE 1-17. WEEKLY TOTAL URANIUM CONCENTRATIONS FOR THE SOUTH FIELD (PHASE 1) EXTRACTION MODULE

000043

2687
FINAL

Hours in reporting period: 2208
Hours pumped: 2139
Hours not pumped: 69
Operational percent: 96.9

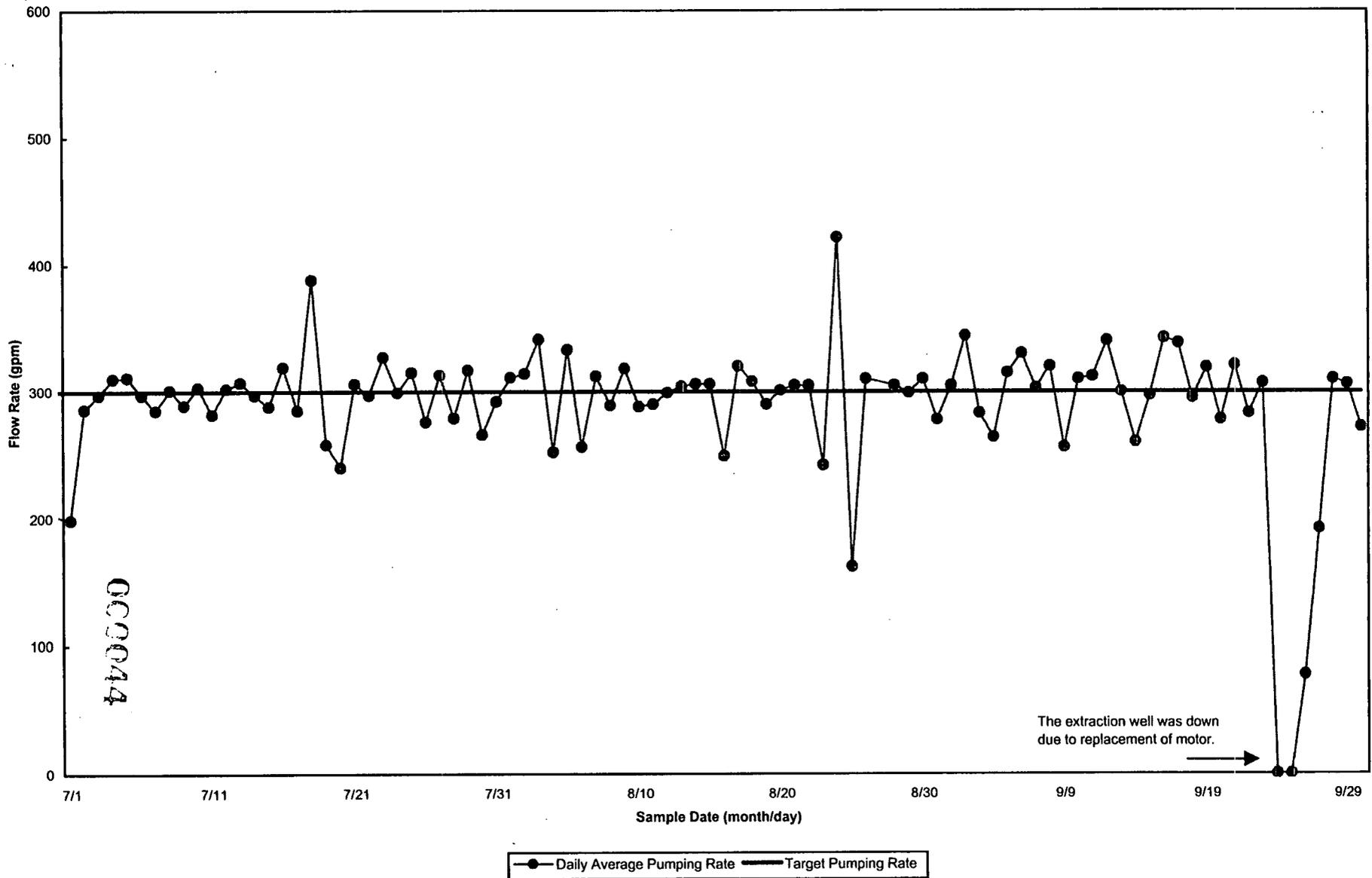
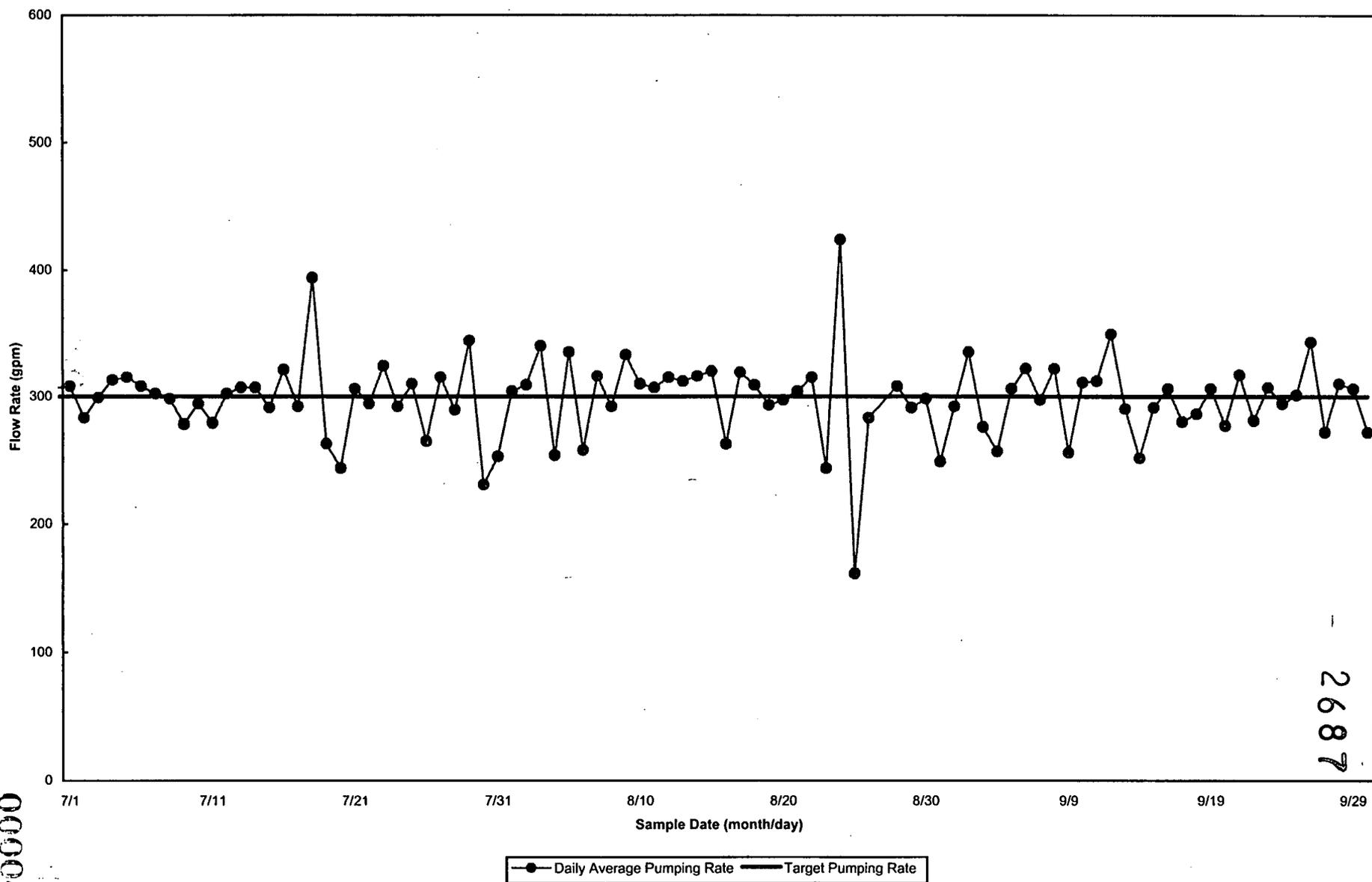


FIGURE 1-18. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3924, 7/99 - 9/99

FINAL

Hours in reporting period: 2208
Hours pumped: 2199
Hours not pumped: 9
Operational percent: 99.6



2687

000015

FIGURE 1-19. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3925, 7/99 - 9/99

FINAL

Hours in reporting period: 2208
Hours pumped: 2133
Hours not pumped: 75
Operational percent: 96.6

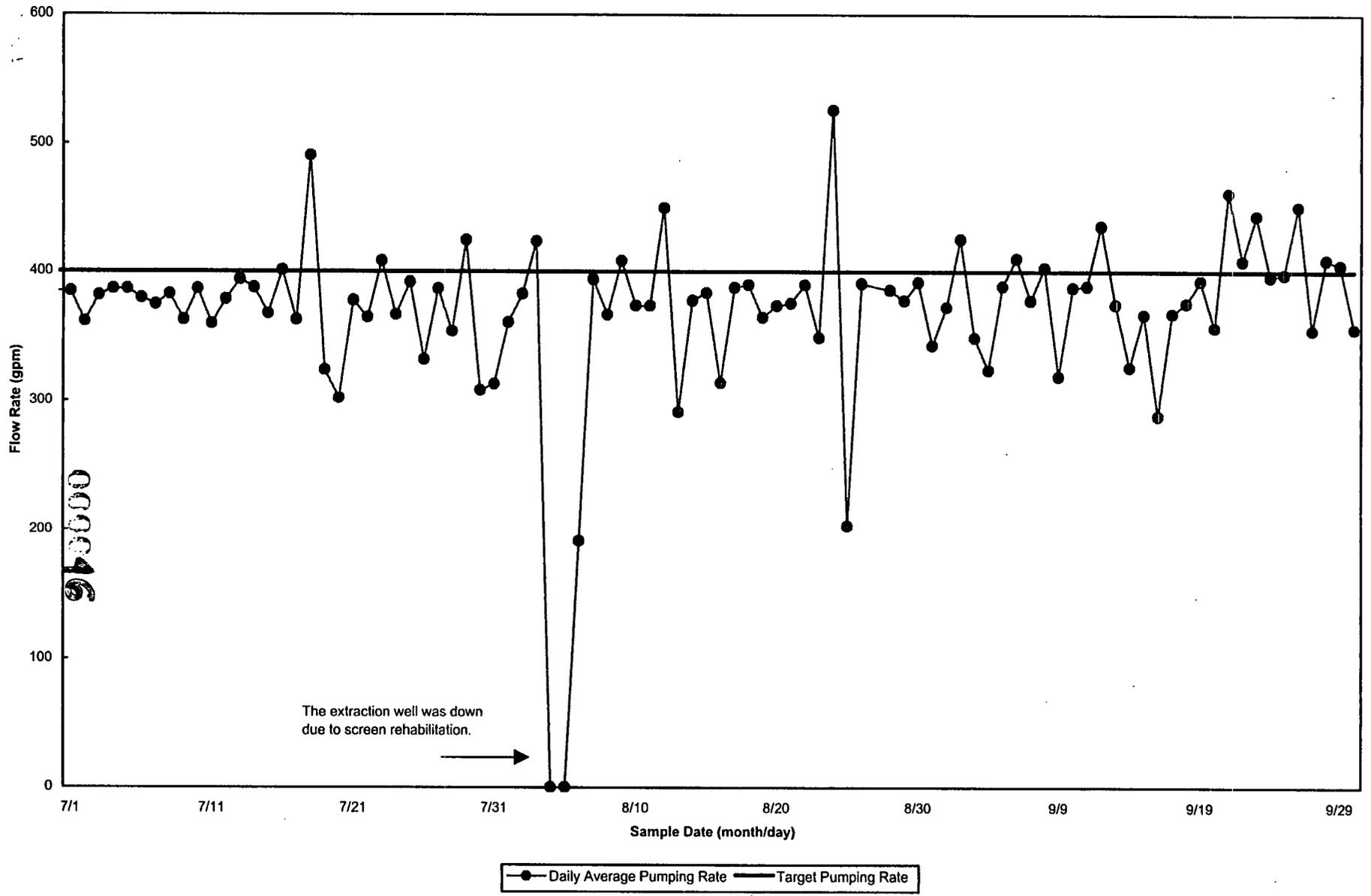


FIGURE 1-20. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3926, 7/99 - 9/99

FINAL

Hours in reporting period: 2208
Hours pumped: 2190
Hours not pumped: 18
Operational percent: 99.2

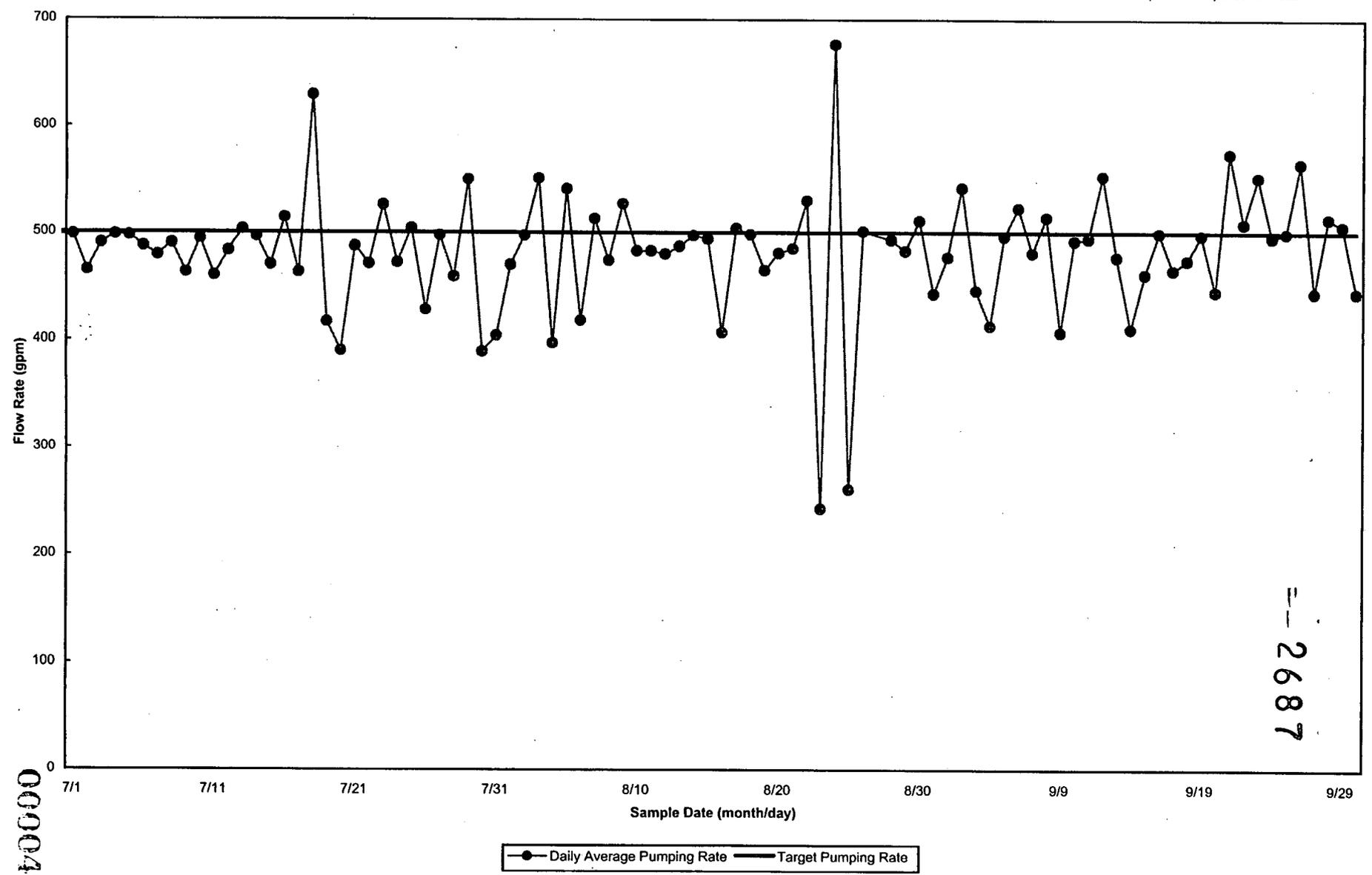


FIGURE 1-21. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3927, 7/99 - 9/99

FINAL

000047

Hours in reporting period: 2208
Hours pumped: 1959
Hours not pumped: 249
Operational percent: 88.7

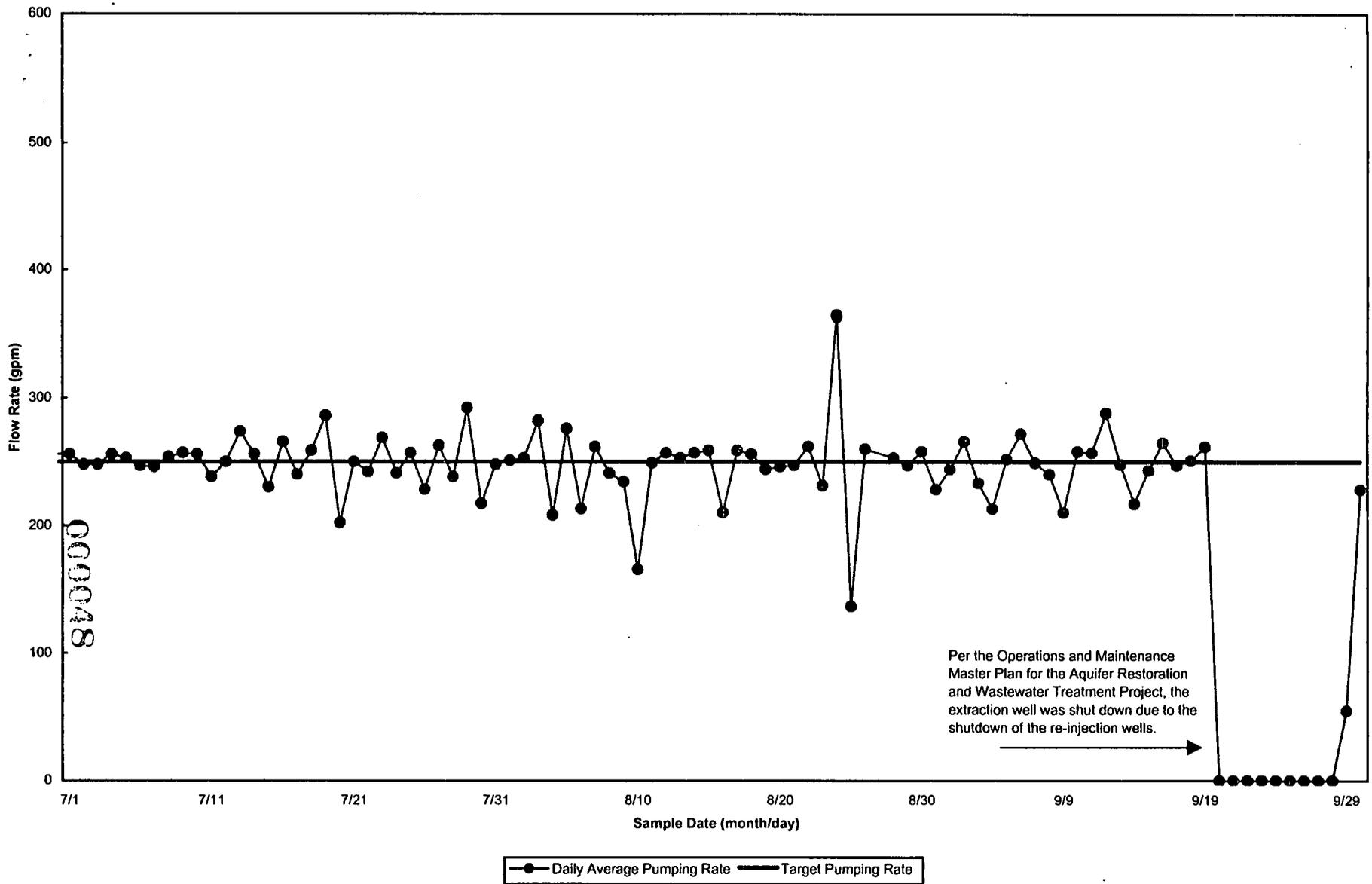
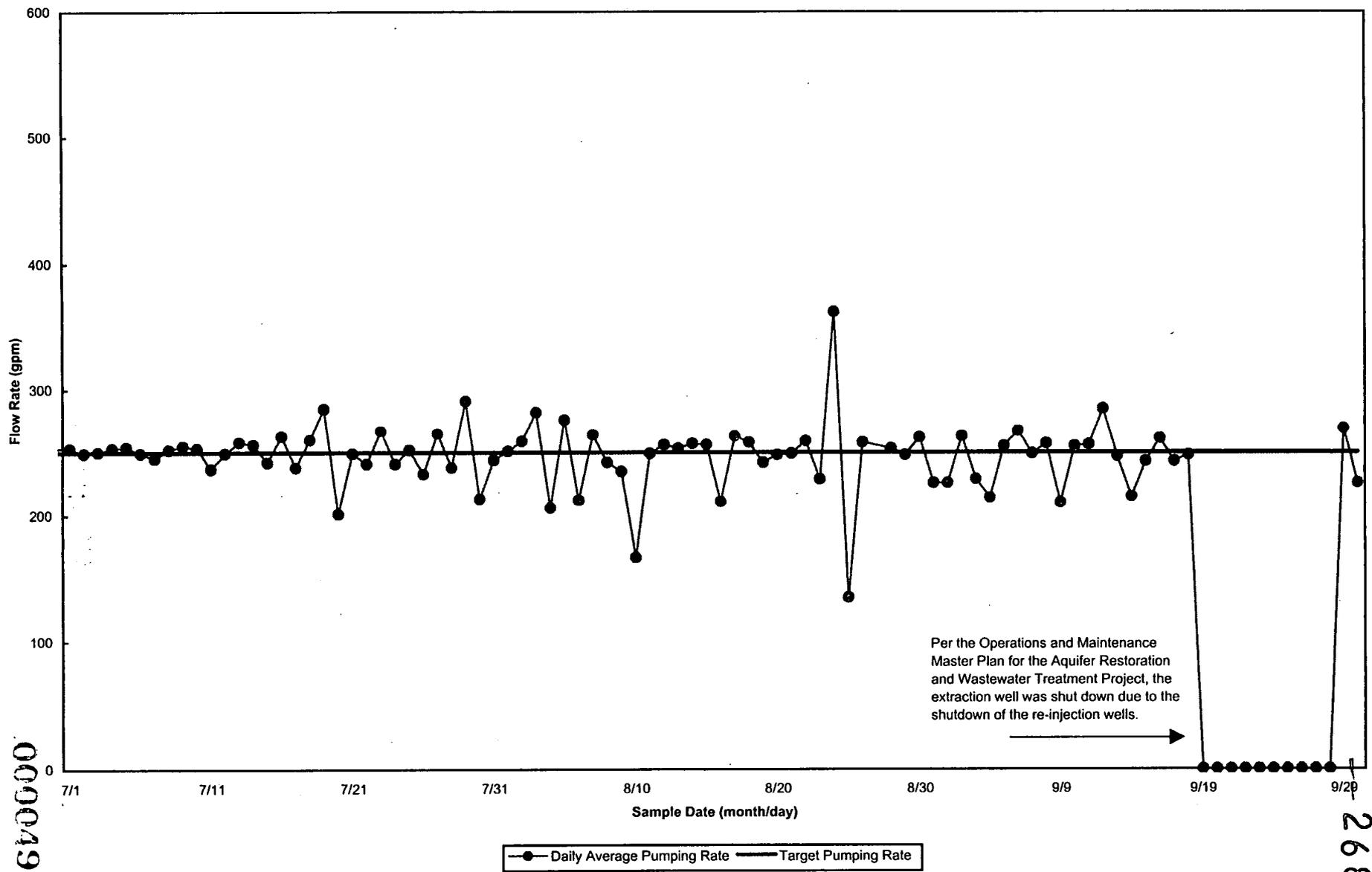


FIGURE 1-22. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 32308, 7/99 - 9/99

FINAL

Hours in reporting period: 2208
 Hours pumped: 1977
 Hours not pumped: 231
 Operational percent: 89.5

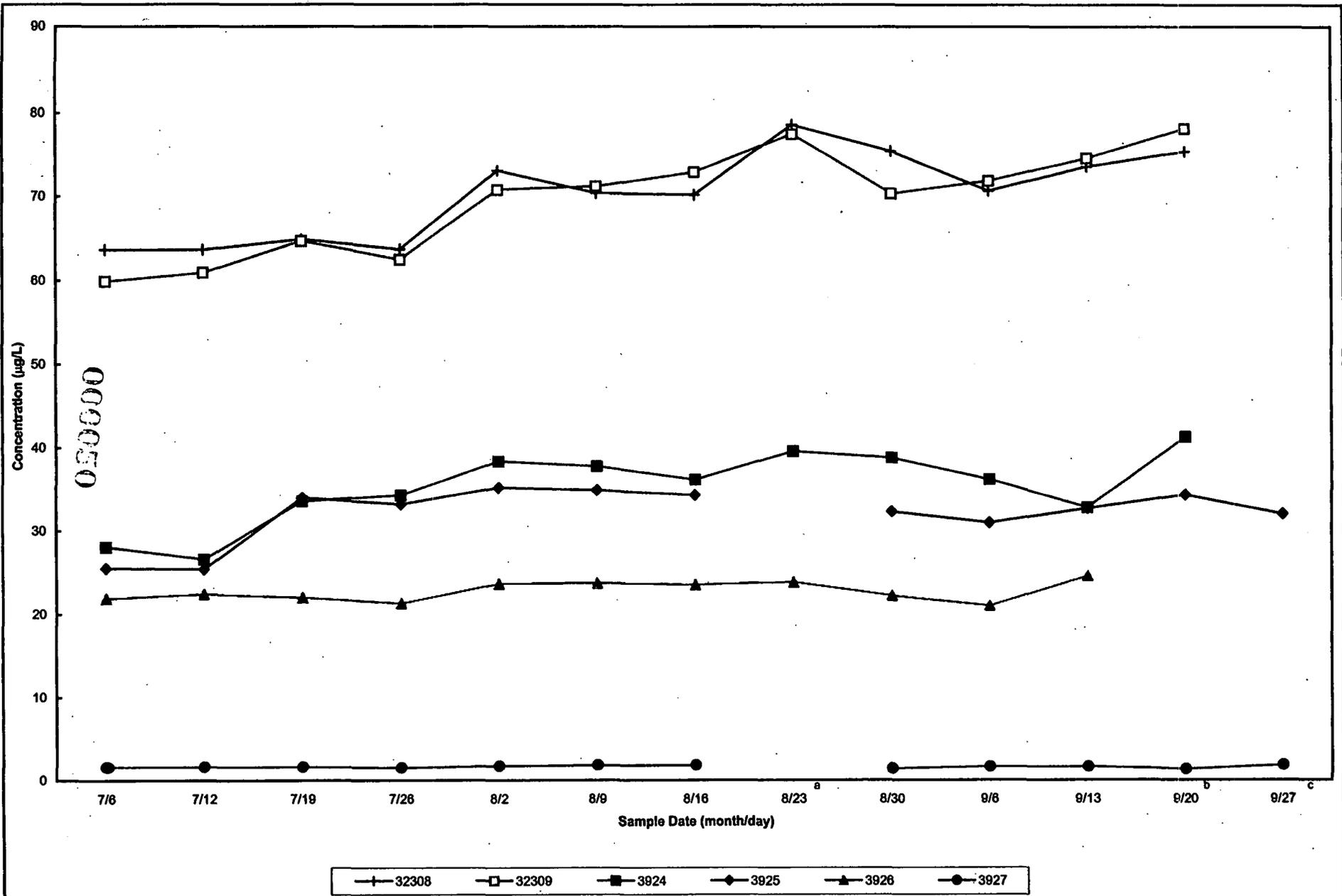


000049

2687

FIGURE 1-23. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 32309, 7/99 - 9/99

FINAL



^a A sample was not collected for Extraction Wells 3925 and 3927.

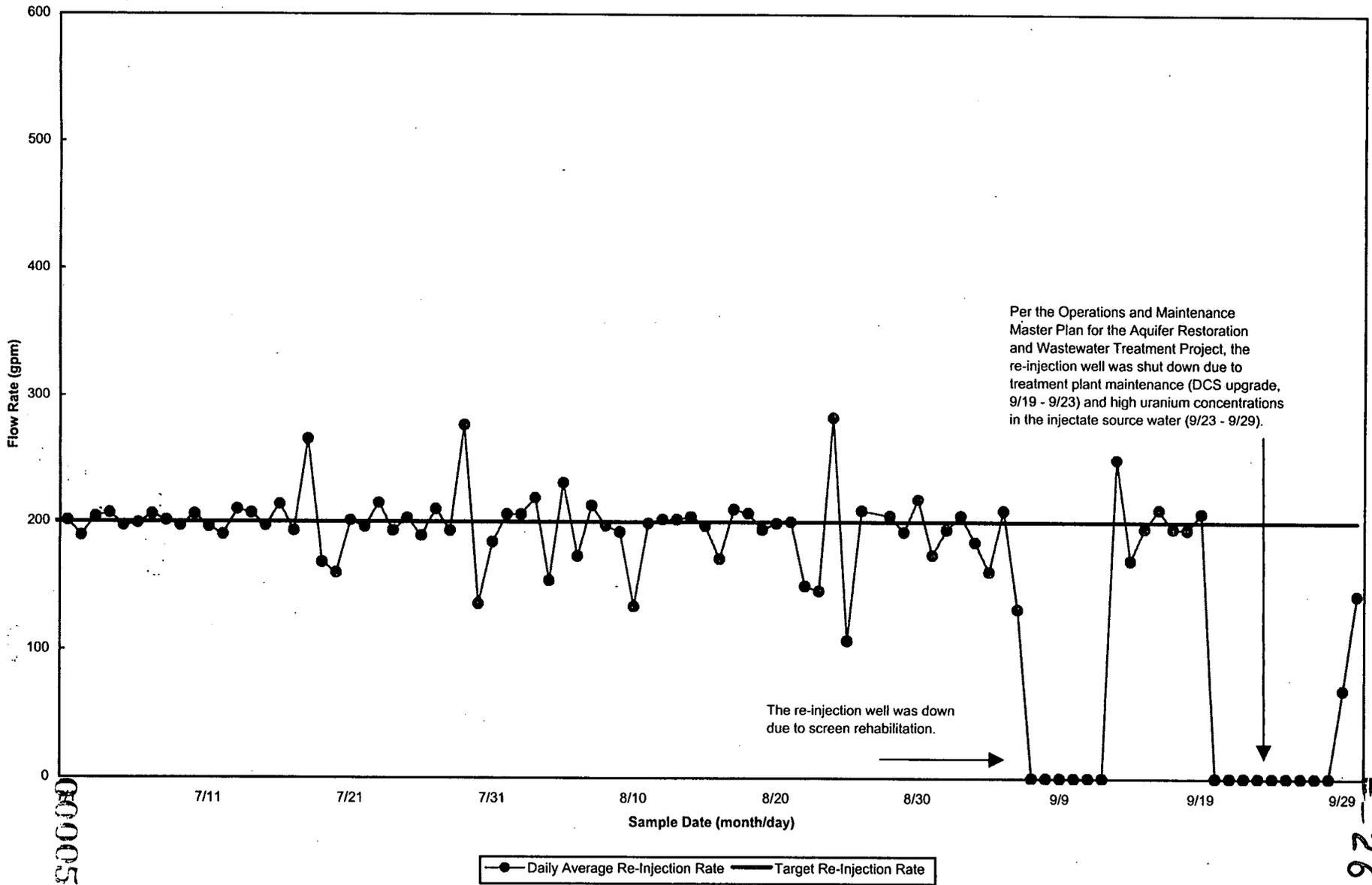
^b A sample was not collected for Extraction Well 3926.

^c A sample was not collected for Extraction Wells 3924, 3926, 32308, and 32309.

FIGURE 1-24. WEEKLY TOTAL URANIUM CONCENTRATIONS FOR THE SOUTH PLUME MODULE

FINAL

Hours in reporting period: 2208
 Hours pumped: 1825
 Hours not pumped: 383
 Operational percent: 82.7



Per the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment Project, the re-injection well was shut down due to treatment plant maintenance (DCS upgrade, 9/19 - 9/23) and high uranium concentrations in the injectate source water (9/23 - 9/29).

The re-injection well was down due to screen rehabilitation.

FIGURE 1-25. RE-INJECTION RATES FOR RE-INJECTION WELL 22107, 7/99 - 9/99

000051

2687

FINAL

Hours in reporting period: 2222
Hours pumped: 1981
Hours not pumped: 241
Operational percent: 89.2

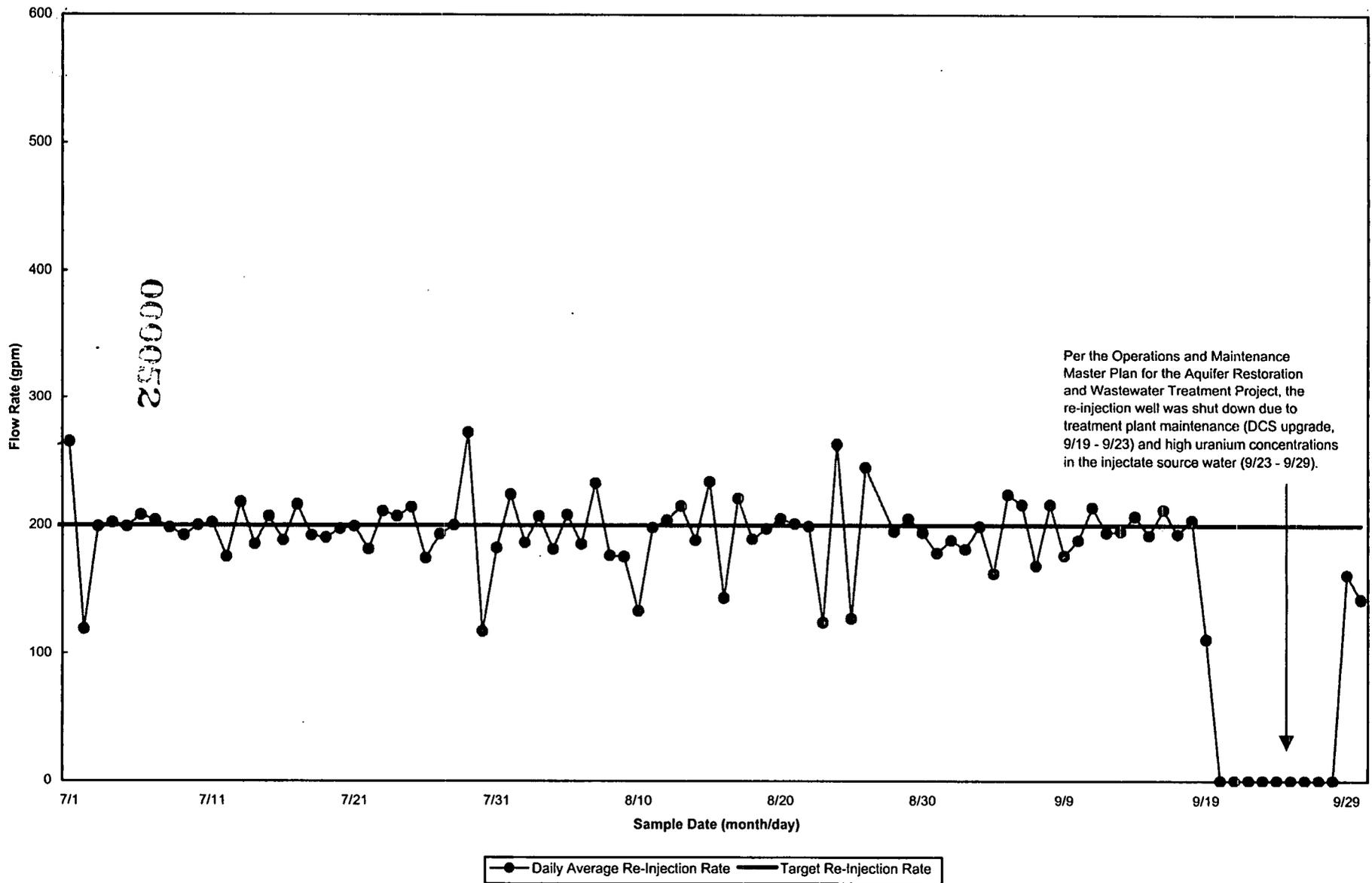
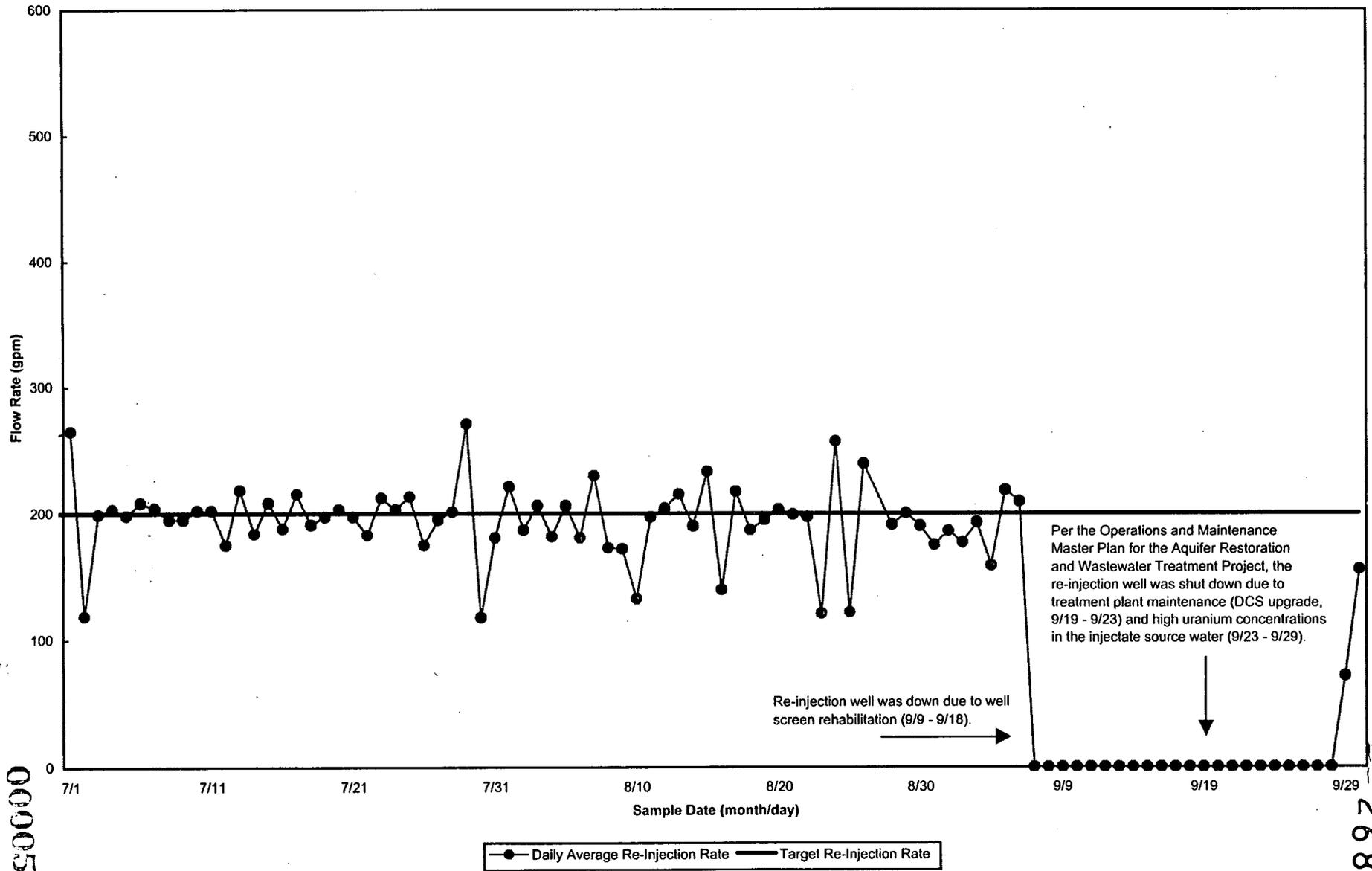


FIGURE 1-26. RE-INJECTION RATES FOR RE-INJECTION WELL 22108, 7/99 - 9/99

FINAL

Hours in reporting period: 2211
 Hours pumped: 1657
 Hours not pumped: 554
 Operational percent: 74.9



000053

2687

FIGURE 1-27. RE-INJECTION RATES FOR RE-INJECTION WELL 22109, 7/99 - 9/99

FINAL

Hours in reporting period: 2209
Hours pumped: 1970
Hours not pumped: 239
Operational percent: 89.2

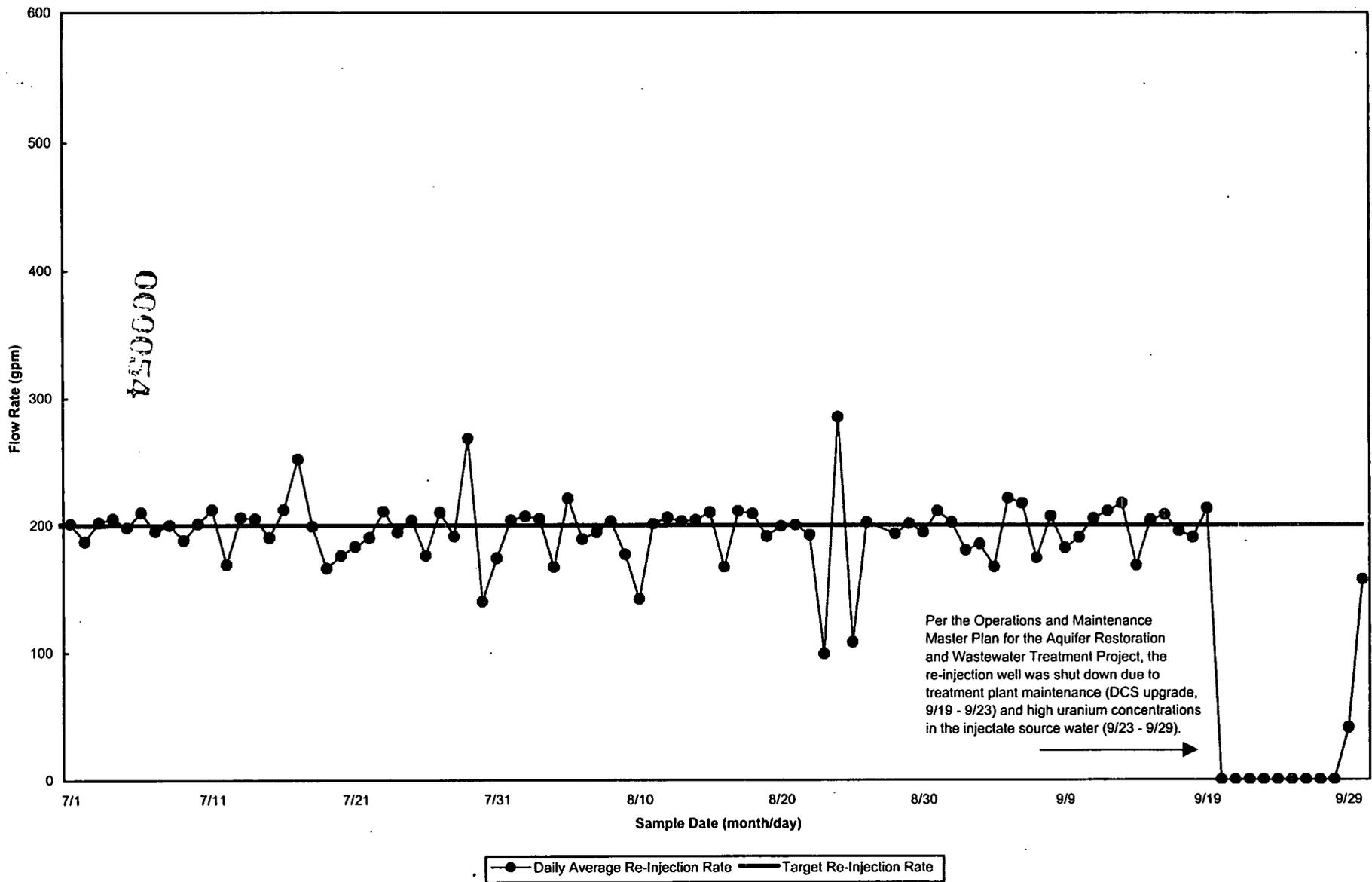


FIGURE 1-28. RE-INJECTION RATES FOR RE-INJECTION WELL 22111, 7/99 - 9/99

FINAL

Hours in reporting period: 2209
Hours pumped: 1970
Hours not pumped: 239
Operational percent: 89.2

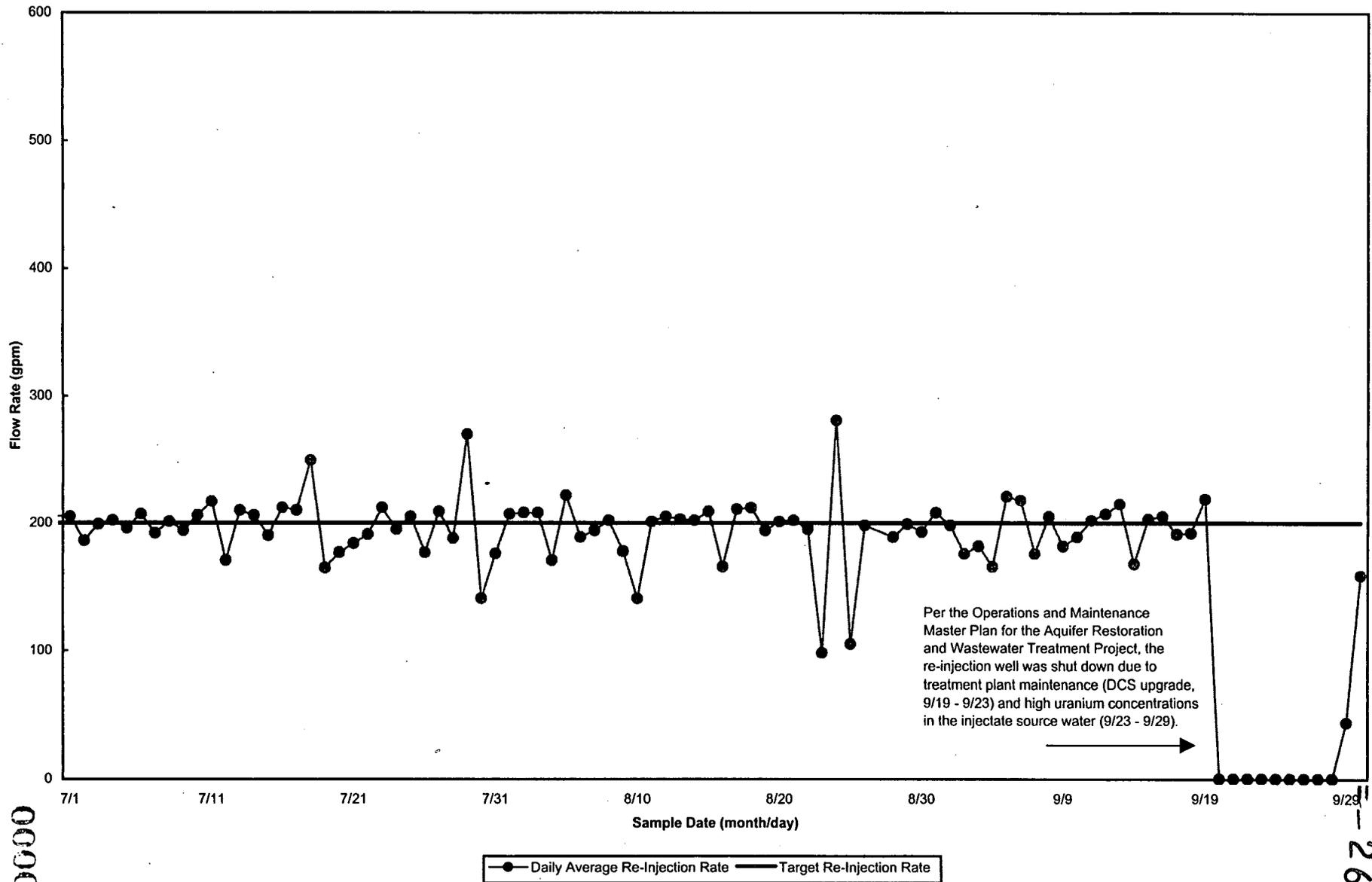


FIGURE 1-29. RE-INJECTION RATES FOR RE-INJECTION WELL 22240, 7/99 - 9/99

000055

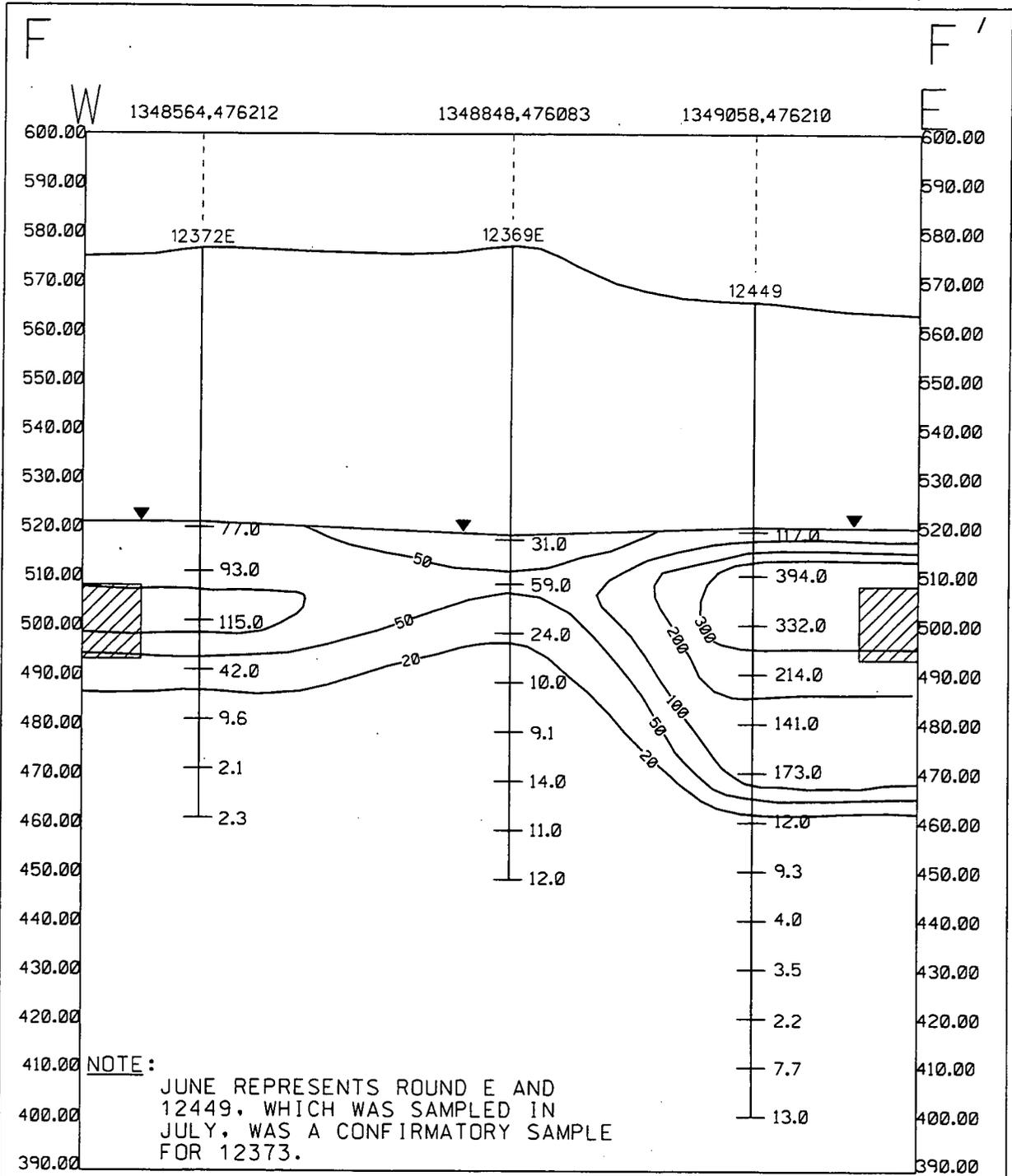
2687
FINAL

--2687

V:\#GP1\#OGN\GTR\3\013018.DGN

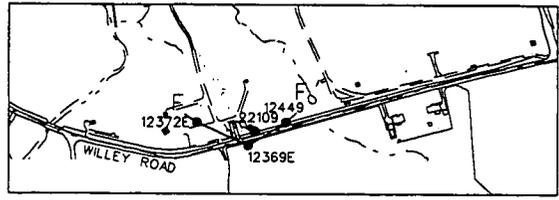
STATE PLANAR COORDINATE SYSTEM 1983

11-24-99



LEGEND:

- + 1.8 TOTAL URANIUM ($\mu\text{g/L}$) IN GROUNDWATER
- [Hatched Box] INJECTION DEPTH IN 22109



FINAL

000057

FIGURE 1-31. CROSS SECTION F-F', GEOPROBE RESULTS FOR TOTAL URANIUM IN GROUNDWATER, JUNE/JULY 1999

FIGURE 1-32. ROUTINE GROUNDWATER ELEVATIONS FOR TYPE 2 WELLS, JULY 1999

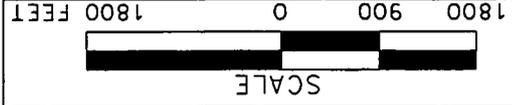
BRSR, MODIFIED QUARTERLY AS NEEDED
URANIUM 20 µg/L CONTOUR FROM
EXTENT OF THE MAXIMUM TOTAL
EXTRACTION WELL
GROUNDWATER ELEVATION (FEET AMSL)
APPROXIMATE LOCATION OF
GROUNDWATER FLOW DIVIDE

LEGEND:
FEMP BOUNDARY
GROUNDWATER ELEVATION
CONTOUR (FEET AMSL)
CAPTURE ZONE
BEDROCK HIGHS

11-23-99

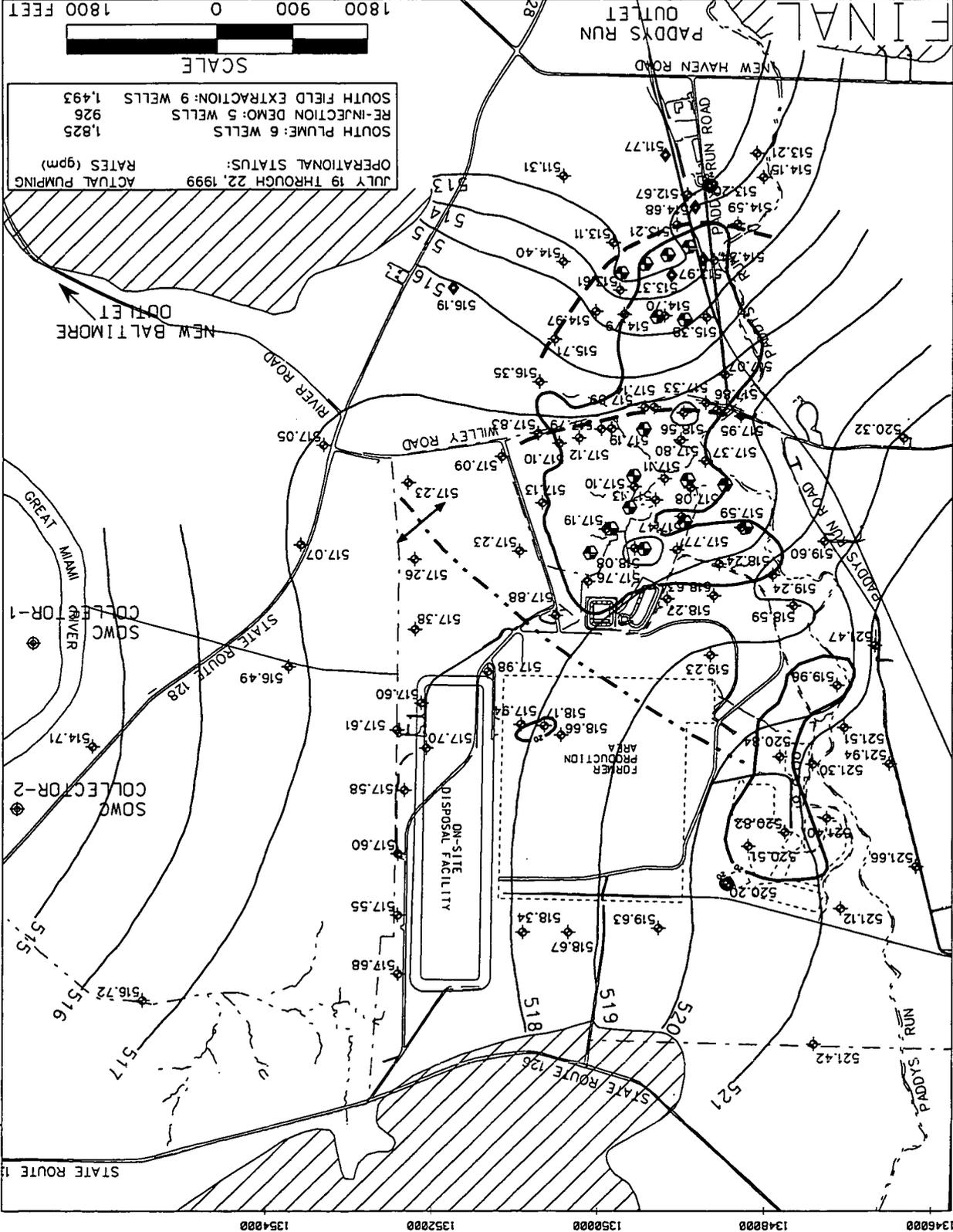
STATE PLANAR COORDINATE SYSTEM 1983

V:\FPI\04MG01R3-013081.DGN



ACTUAL PUMPING RATES (gpm)	
SOUTH PLUME: 6 WELLS	1,825
RE-INJECTION DEMO: 5 WELLS	926
SOUTH FIELD EXTRACTION: 9 WELLS	1,493

OPERATIONAL STATUS:
JULY 19 THROUGH 22, 1999



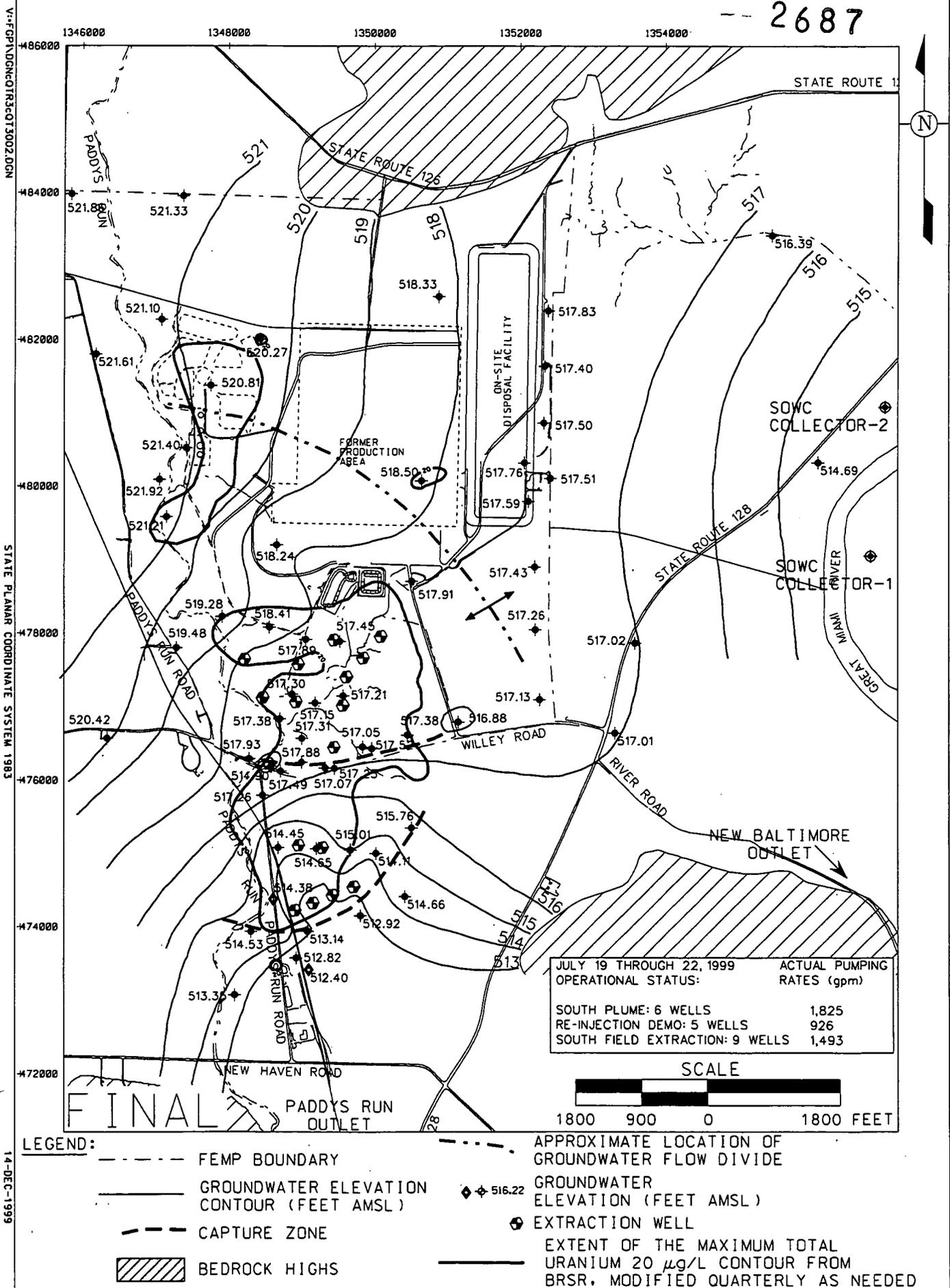
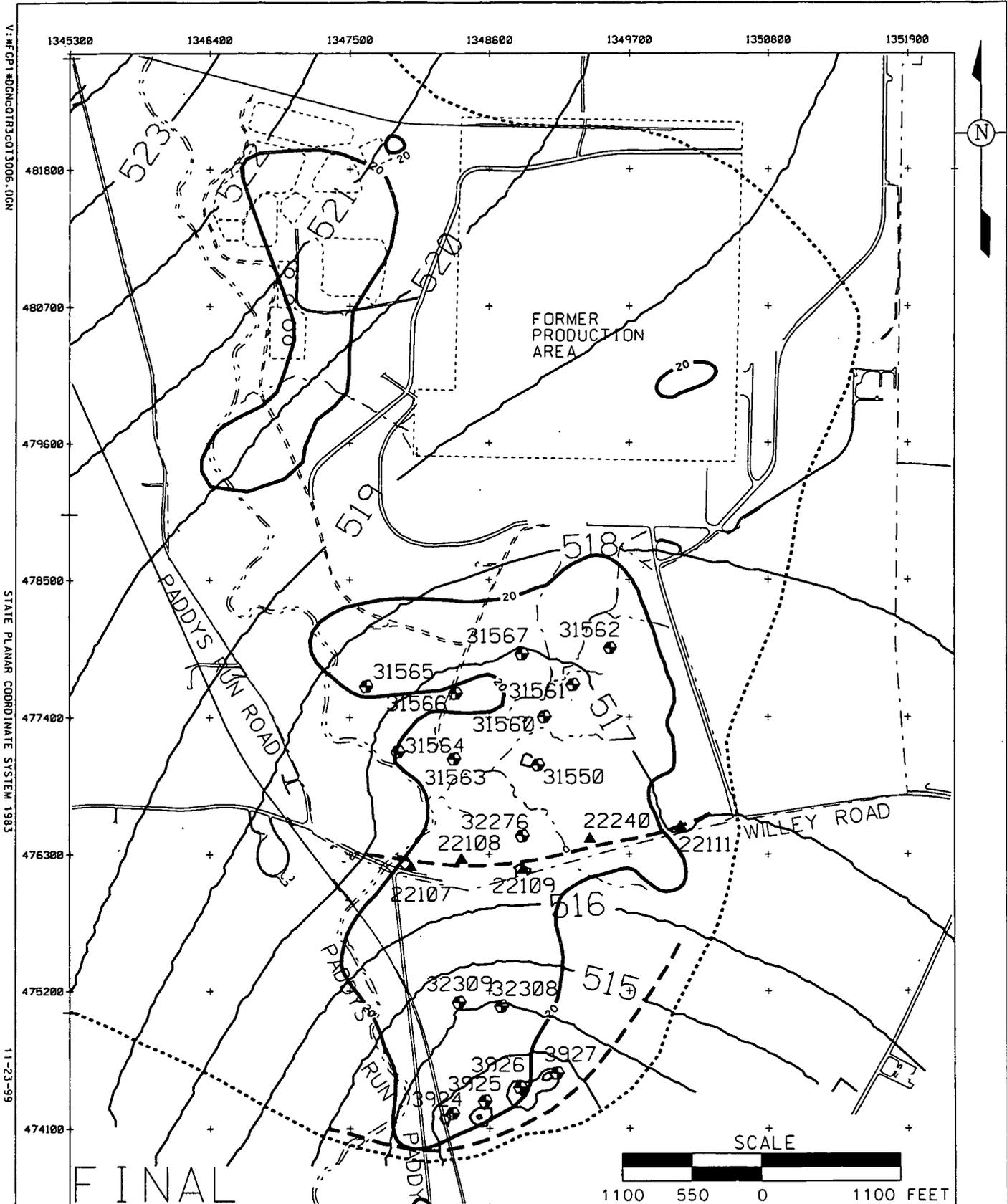


FIGURE 1-33. ROUTINE GROUNDWATER ELEVATIONS FOR TYPE 3 WELLS, JULY 1999

000059

V:\FOP\INDC\OTR3\c013002.DGN
STATE PLANNER COORDINATE SYSTEM 1983
14-DEC-1999



V:\GPI\#00\CO\TR\CO\13006.000
 STATE PLANAR COORDINATE SYSTEM 1983
 11-23-99

- FINAL**
- LEGEND:**
- FEMP BOUNDARY
 - INTERPRETED CAPTURE ZONES, JULY 1999
 - 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
 - EXTENT OF THE MAXIMUM TOTAL URANIUM 20 µg/L CONTOUR FROM BRSR, MODIFIED QUARTERLY AS NEEDED
 - MODEL PREDICTED WATER LEVEL
 - ▲ RE-INJECTION WELL
 - EXTRACTION WELL

FIGURE 1-34. MODELED GROUNDWATER ELEVATIONS FOR JULY 1999 OPERATIONAL CONDITIONS

000060

-- 2687

**On-Site Disposal Facility
Groundwater/Leak Detection and
Leachate Monitoring**

000061

This section summarizes the third quarter 1999 leachate collection system (LCS) and leak detection system (LDS) volume data and second quarter 1999 analytical results from LCS, LDS, horizontal till well, and Great Miami Aquifer associated with the on-site disposal facility leak detection monitoring. This section is consistent with the groundwater reporting requirements presented in the Integrated Environmental Monitoring Plan (IEMP), Revision 1 (DOE 1999b).

Figure 2-1 shows the sampling activities that contributed data to this section. Figure 2-2 identifies the well locations associated with the on-site disposal facility.

Figure 2-3 shows the on-site disposal facility leak detection monitoring activities to be summarized in the next IEMP quarterly status report to be submitted in March of 2000. The report will contain LCS and LDS volume data from October through December 1999 (fourth quarter), and analytical results from on-site disposal facility leak detection sampling activities conducted from July through September 1999 (third quarter).

Analytical Status for Cell 1:

Sampling continues to be conducted in accordance with the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan (DOE 1997b) and follows agreements associated with that plan. Figure 2-2 identifies the well locations.

On July 22, 1999, the U.S. Department of Energy (DOE) transmitted responses to the second round of Ohio Environmental Protection Agency (OEPA) comments on the Draft Technical Memorandum for the On-Site Disposal Facility Cell 1 Baseline Groundwater Conditions. DOE briefly discussed the responses with OEPA during a meeting on July 27, 1999; however, a resolution to the comment pertaining to the timing and duration of the horizontal till well pre-waste placement baselining for the remaining cells was not reached during the reporting period. A resolution is anticipated during the fourth quarter of 1999.

For the second quarter of 1999, the following samples were collected: one sample each of leachate (location 12338C) and LDS water (location 12338D); a baseline sampling event for perched groundwater (Horizontal Till Well 12338), and quarterly samples from the upgradient Great Miami Aquifer Monitoring Well 22201, and downgradient Great Miami Aquifer Monitoring Well 22198. Table 2-1 provides detected results for the quarter along with a summary of previous data for those constituents. The following summarizes the types of information provided in the table:

- Constituents posted on Table 2-1 were detected during the reporting period (second quarter) in at least one of the four monitored horizons (i.e., LCS, LDS, horizontal till well, or one of the Great Miami Aquifer wells).
- For each monitored horizon and each constituent detected during the reporting period, the following four pieces of information are provided:
 - Row 1, Column 1, total number of samples with detections since sampling began at that monitoring point / total number of samples analyzed since sampling began at that monitoring point (highlighted in blue)
 - Row 1, Column 2, range of results from monitoring point since sampling began at that monitoring point (highlighted in blue)
 - Row 2, Column 1, total number of samples with detections for the reporting period (highlighted in green)
 - Row 2, Column 2, range of results from the monitoring point for the reporting period (highlighted in green).

Trend analysis will be performed annually on the analytical data collected from the LCS and LDS and will be provided in IEMP annual integrated site environmental reports. Horizontal till well results will continue to be reported quarterly and annually. Horizontal till well results will be provided annually on updated control charts once those charts are established in early 2001. The Great Miami Aquifer monitoring well results will continue to be reported quarterly as presented in this report and in IEMP annual integrated site environmental reports on updated control charts.

-- 2687

Cell 1 Leak Detection System Volumes:

Volumes pumped from the Cell 1 LDS for the third quarter of 1999 are as follows: July (105 gallons); August (84 gallons); and September (96 gallons).

Figure 2-4 depicts quantitative measurement of the LDS water accumulation rates along with summary statistics (minimum, maximum, and average) for the quarter. The quarterly average accumulation rate for Cell 1 (0.66 gallons per acre per day [gpad]) is slightly higher than the average for the last quarter (0.52 gpad). The slight increase is attributed to the compaction of waste materials within Cell 1 as part of the waste placement operations, which were reinitiated on July 8. The final accumulation rate measured for the quarter in early September (0.48 gpad) continued this overall decreasing trend (refer to Figure 2-4). The accumulation rate measurements indicate that the liner system for Cell 1 continues to perform as designed in that these accumulation rates are far below the on-site disposal facility design-established initial response leakage rate of 20 gpad. Note that the Cell 1 quarterly accumulation rate is less than that of Cell 2. This difference is consistent with what is expected given that the stage of filling in Cell 1 is farther along than Cell 2.

Analytical Status for Cell 2:

Sampling continues to be conducted in accordance with the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan and follows agreements associated with that plan. Figure 2-2 identifies the well locations.

For the second quarter of 1999, the following samples were collected: one sample each of leachate (location 12339C) and LDS water (location 12339D); and baseline sampling events for perched groundwater (Horizontal Till Well 12339), upgradient Great Miami Aquifer Monitoring Well 22200, and downgradient Great Miami Aquifer Monitoring Well 22199. Table 2-2 provides detected results for the quarter along with a summary of previous data for those constituents. The following summarizes the types of information provided in the table:

- Constituents posted on Table 2-2 were detected during the reporting period (second quarter) in at least one of the four monitored horizons (i.e., LCS, LDS, horizontal till well, or one of the Great Miami Aquifer wells).
- For each monitored horizon and each constituent detected during the reporting period, the following four pieces of information are provided:
 - Row 1, Column 1, total number of samples with detections since sampling began at that monitoring point / total number of samples analyzed since sampling began at that monitoring point (highlighted in blue).
 - Row 1, Column 2, range of results from monitoring point since sampling began at that monitoring point (highlighted in blue).
 - Row 2, Column 1, total number of samples with detections for the reporting period (highlighted in green).
 - Row 2, Column 2, range of results from the monitoring point for the reporting period (highlighted in green).

Trend analysis will be performed annually on the analytical data collected from the LCS and LDS and will be provided in IEMP annual integrated site environmental reports. Horizontal till well results will continue to be reported quarterly and annually. Horizontal till well results will be provided annually on updated control charts once those charts are established in early 2001. The Great Miami Aquifer monitoring well results will continue to be reported quarterly as presented in this report and in IEMP annual integrated site environmental reports.

Note that the LDS total uranium concentration (41.5 micrograms per liter [$\mu\text{g/L}$]) continues to decline from the December 1998 high of 71 $\mu\text{g/L}$. This indicates that the residual contamination from the water that backed up in the system is being flushed out. In May 1999, DOE initiated sampling of the LDS water for total uranium concentration each time the LDS inner containment vessel is pumped out. This is being done to provide additional information (above the

routine quarterly sampling) on this important system. The additional total uranium data indicate a continued decline in the Cell 2 LDS total uranium concentration to 13.2 $\mu\text{g/L}$ on September 11, 1999.

Cell 2 Leak Detection System Volumes:

Volumes pumped from the Cell 2 LDS for the third quarter of 1999 are as follows: July (882 gallons); August (474 gallons); and September (102 gallons).

Figure 2-5 shows quantitative measurement of the LDS water accumulation rates along with summary statistics for the quarter. The quarterly average accumulation rate for Cell 2 (3.8 gpad) is lower than the average for the last quarter (4.5 gpad). The third quarter decrease is expected after experiencing an initial increase in the accumulation rate concurrent with the startup of Cell 2 waste placement activities in June of 1999 (reference the Integrated Environmental Monitoring Status Report for Second Quarter 1999, Figure 1-38 [DOE 1999c]). The June increase in the Cell 2 LDS accumulation rate is attributed to waste compaction activities as waste placement operations were reinitiated at Cell 2. The final accumulation rate measured for the quarter on September 11 showed a dramatic decrease for the quarter in that the rate was down to 0.9 gpad. The accumulation rate measurements indicate that the liner system for Cell 2 continues to perform as designed in that these accumulation rates are far below the on-site disposal facility design-established initial response leakage rate of 20 gpad. Note that the Cell 2 quarterly accumulation rate is considerably more than that of Cell 1. This difference is consistent with what is expected given that the stage of filling in Cell 1 is farther along than Cell 2.

000067

Analytical Status for Cell 3:

Sampling continues to be conducted in accordance with the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan and follows agreements associated with that plan. Figure 2-2 identifies the well locations.

For the second quarter of 1999, the following samples were collected: four baseline sampling events occurred for perched groundwater (Horizontal Till Well 12340), and three baseline sampling events occurred at upgradient Great Miami Aquifer Monitoring Well 22203, and downgradient Great Miami Aquifer Monitoring Well 22204. Table 2-3 provides detected results for the quarter along with a summary of previous data for those constituents. The following summarizes the types of information provided in the table:

- Constituents posted on Table 2-3 were detected during the reporting period (second quarter) in at least one of the two monitored horizons (i.e., horizontal till well or one of the Great Miami Aquifer wells).
- For each monitored horizon and each constituent detected during the reporting period, the following four pieces of information are provided:
 - Row 1, Column 1, total number of samples with detections since sampling began at that monitoring point/total number of samples analyzed since sampling began at that monitoring point (highlighted in blue).
 - Row 1, Column 2, range of results from monitoring point since sampling began at that monitoring point (highlighted in blue).
 - Row 2, Column 1, total number of samples with detections for the reporting period (highlighted in green)
 - Row 2, Column 2, range of results from the monitoring point for the reporting period (highlighted in green).

Cell 3 Leak Detection System Volumes:

Quantitative measurement of Cell 3 LDS water accumulation rates is scheduled to begin in early October 1999, just before waste placement begins. The fourth quarter 1999 rates will be reported in the next IEMP quarterly status report to be submitted in March of 2000.

000009

- 2687

Status for Cell 4:

The downgradient Great Miami Aquifer Monitoring Well 22205 for Cell 4 was installed in August. Development of this well has been postponed till next spring due to unusually low water levels. Installation of a new well, to serve as the upgradient well for Cell 4, will not be required as existing Monitoring Well 2421 will be used. Baseline sampling of these two wells is scheduled to begin next summer.

000070

Leachate Collection System Volumes:

Volume from the LCS for the third quarter of 1999 are as follows: July (72,053 gallons); August (282,418 gallons); and September (69,561 gallons).

000071

2687

TABLE 2-1

ON-SITE DISPOSAL FACILITY CELL 1 DATA SUMMARY FOR CONSTITUENTS DETECTED DURING SECOND QUARTER 1999

Note: Highlighting pertains to total number of samples (including second quarter samples).
Highlighting pertains to second quarter samples only.

Constituent (FRL) ^a	Great Miami Aquifer									
	LCS ^{b,c,d,e} (12338C)		LDS ^{b,c,d,e} (12338D)		HTW ^{b,c,d,e} (12338)		Upgradient ^{b,c,d} (22201)		Downgradient ^{b,c,d} (22198)	
	No. of Samples with Detections	Range	No. of Samples with Detections	Range	No. of Samples with Detections	Range	No. of Samples with Detections	Range	No. of Samples with Detections	Range
	No. of Samples		No. of Samples		No. of Samples		No. of Samples		No. of Samples	
Total Organic Halogens (NA) ^f (mg/L)	5/6	ND to 0.049	4/5	ND to 0.0426	10/20	ND to 0.077	12/21	ND to 0.078	7/21	ND to 0.0526
	1/1	0.0119	1/1	0.0164	1/1	0.00932	0/1	ND	0/1	ND
Boron (0.33 mg/L)	7/7	0.0642 to 2.8	5/5	0.0296 to 0.321	16/21	ND to 0.685	16/21	ND to 0.142	21/28	ND to 0.116
	1/1	1.46	1/1	0.253	0/1	ND	1/1	0.121	2/2	0.0326 to 0.0538
Technetium-99 (94.0 pCi/L)	2/6	ND to 18.28	1/5	ND to 8.92	7/21	ND to 21.1	1/21	ND to 13.41	2/28	ND
	0/1	ND	1/1	8.92	0/1	ND	0/1	ND	0/2	ND
Total Uranium (20 µg/L)	5/6	ND to 119	5/5	15 to 20.17	20/21	ND to 19	19/21	ND to 5.196	28/28	0.57 to 3.814
	1/1	102.14	1/1	18.04	1/1	1.58	1/1	0.24	2/2	1.03 to 1.221

^aFrom Operable Unit 5 Record of Decision, Table 9-4

^bIf there was more than one sample result per day (e.g., a duplicate sample), then only the maximum sample concentration was counted and compared to the FRL.

^cRejected data qualified with either a R or Z were not used in this comparison.

^dND = not detected

^eLCS = leachate collection system

LDS = leak detection system

HTW = horizontal till well

^fNA = not applicable

TABLE 2-2

ON-SITE DISPOSAL FACILITY CELL 2 DATA SUMMARY FOR CONSTITUENTS DETECTED DURING SECOND QUARTER 1999

Note: **Highlighting** pertains to total number of samples (including second quarter samples).
Highlighting pertains to second quarter samples only.

Constituent (FRL) ^a	Great Miami Aquifer									
	LCS ^{b,c,d,e} (12339C)		LDS ^{b,c,d,e} (12339D)		HTW ^{b,c,d,e} (12339)		Upgradient ^{b,c,d} (22200)		Downgradient ^{b,c,d} (22199)	
	No. of Samples with Detections	Range	No. of Samples with Detections	Range	No. of Samples with Detections	Range	No. of Samples with Detections	Range	No. of Samples with Detections	Range
Total Organic Carbon (NA ^f mg/L)	2/3	ND to 3.51	2/3	ND to 8.19	18/20	ND to 4.22	14/16	ND to 47.6	12/16	ND to 51.8
Total Organic Halogens (NA ^f mg/L)	1/1	3.51	0/1	ND	0/2	ND	0/1	ND	0/1	ND
Boron (0.33 mg/L)	3/4	ND to 0.915	3/3	0.841 to 2.22	12/20	ND to 0.0829	10/16	ND to 0.158	10/16	ND to 0.0569
Mercury (0.0020 mg/L)	0/3	ND	0/3	ND	2/19	ND to 0.00025	0/16	ND	0/16	ND
Technetium-99 (94.0 pCi/L)	1/3	ND to 21.25	1/3	ND to 15.99	5/21	ND to 12	0/15	ND to 2.15	0/16	ND to 2.66
Total Uranium (20 µg/L)	3/3	16.98 to 22.022	3/3	41.5 to 71	20/21	ND to 3.607	12/16	ND to 1.11	16/16	0.259 to 11.826

^aFrom Operable Unit 5 Record of Decision, Table 9-4

^bIf there was more than one sample result per day (e.g., a duplicate sample), then only the maximum sample concentration was counted and compared to the FRL.

^cRejected data qualified with either a R or Z were not used in this comparison.

^dND = not detected

^eLCS = leachate collection system

^fLDS = leak detection system

HTW = horizontal till well

^fNA = not applicable

000073

TABLE 2-3

ON-SITE DISPOSAL FACILITY CELL 3 DATA SUMMARY FOR CONSTITUENTS DETECTED DURING SECOND QUARTER 1999

Note: **Highlighting** pertains to total number of samples (including second quarter samples).
Highlighting pertains to second quarter samples only.

Constituent (FRL) ^a	Great Miami Aquifer					
	HTW ^{b,c,d} (12340)		Upgradient ^{b,c,d} (22203)		Downgradient ^{b,c,d} (22204)	
	No. of Samples with Detections	Range	No. of Samples with Detections	Range	No. of Samples with Detections	Range
Total Organic Carbon (NA ^f mg/L)	No. of Samples		No. of Samples		No. of Samples	
	7/13	ND to 2.79	3/11	ND to 3.51	3/11	ND to 5
Total Organic Halogens (NA ^f mg/L)	2/4	ND to 2.4	0/3	ND	0/3	ND
	10/13	ND to 0.0461	6/11	ND to 0.0171	5/11	ND to 0.03
Boron (0.33 mg/L)	3/4	ND to 0.0461	2/3	ND to 0.0137	1/3	ND to 0.0116
	10/13	ND to 0.165	6/11	ND to 0.0776	5/11	ND to 0.0472
Mercury (0.0020 mg/L)	4/4	0.044 to 0.165	2/3	ND to 0.0454	2/3	ND to 0.0472
	1/13	ND to 0.00026	0/11	ND	1/11	ND to 0.00028
Technetium-99 (94.0 pCi/L)	1/4	ND to 0.00026	0/3	ND	1/3	ND to 0.00028
	2/13	ND to 38.35	0/11	ND	0/11	ND
Total Uranium (20 µg/L)	2/4	ND to 38.35	0/3	ND	0/3	ND
	11/13	ND to 9.14	8/11	ND to 0.559	10/11	ND to 2.995
	4/4	4.27 to 8.64	1/3	ND to 0.16	2/3	ND to 1.67

^aFrom Operable Unit 5 Record of Decision, Table 9-4

^bIf there was more than one sample result per day (e.g., a duplicate sample), then only the maximum sample concentration was counted and compared to the FRL.

^cRejected data qualified with either a R or Z were not used in this comparison.

^dND = not detected

^eHTW = horizontal till well

^fNA = not applicable

000074

FIGURE 2-1

ON-SITE DISPOSAL FACILITY LEAK DETECTION ACTIVITIES COVERED IN THIS QUARTERLY REPORT

LEAK DETECTION ACTIVITIES

Cell 1

LDS Volumes
Analytical

Cell 2

LDS Volumes
Analytical

Cell 3

LDS Volumes
Analytical

LCS Volumes

1999											
First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
			◆	◆		◆	◆	◆			
			◆	◆	◆	◆	◆	◆			
			◆	◆	◆						
						◆	◆	◆			

◆ Data summarized/evaluated in this report

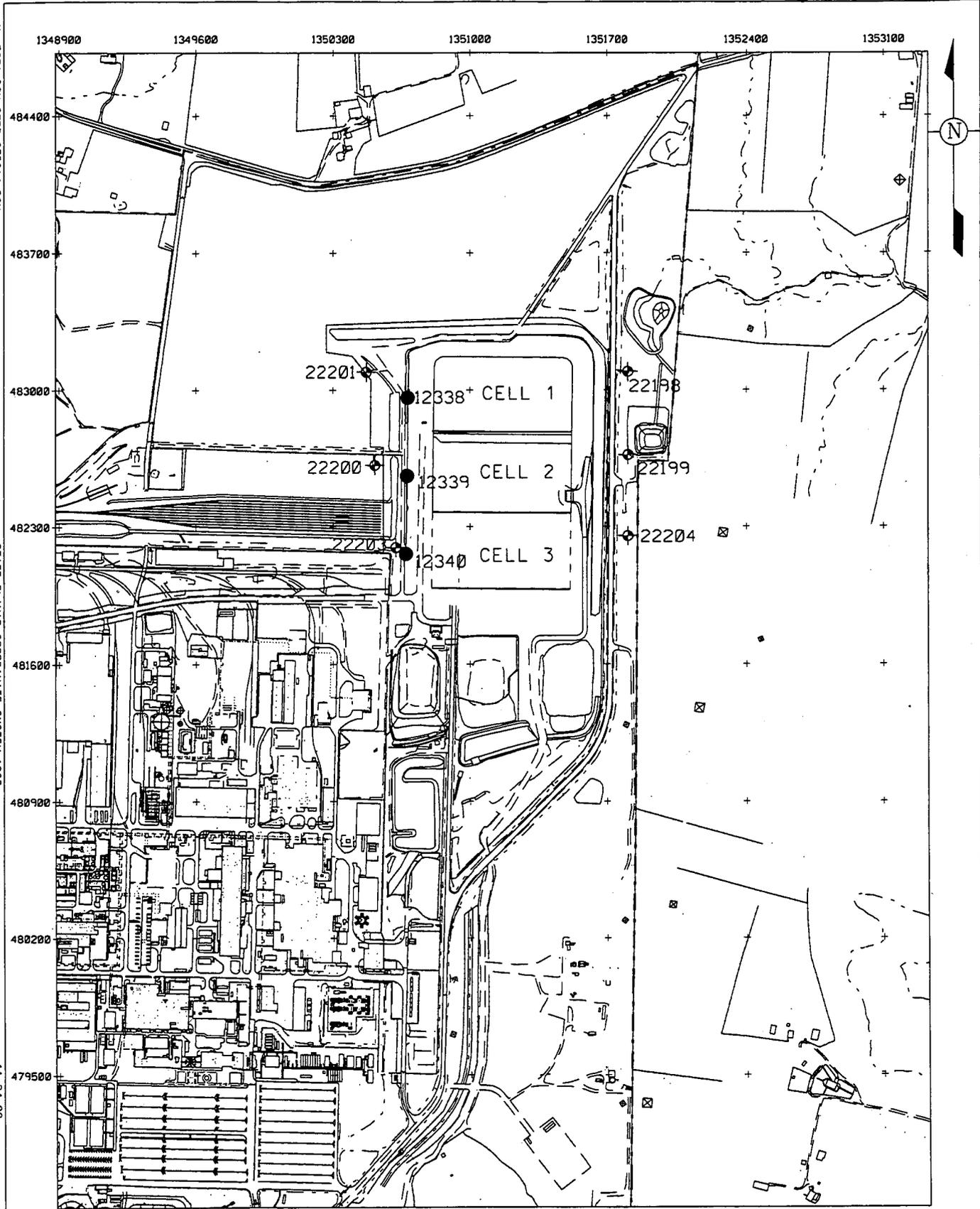
FINAL

000075

V:\#GP1\#OGC\OTR3\CGT3014.DGN

STATE PLANAR COORDINATE SYSTEM 1983

11-24-99



LEGEND:

- FEMP BOUNDARY
- ◆ TYPE 2 MONITORING WELL
- HORIZONTAL TILL WELL

FINAL

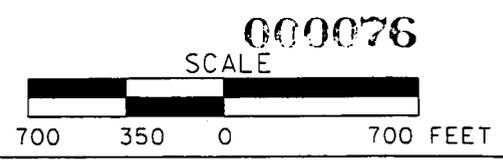


FIGURE 2-2. ON-SITE DISPOSAL FACILITY WELL LOCATIONS

FIGURE 2-3

ON-SITE DISPOSAL FACILITY LEAK DETECTION ACTIVITIES COVERED IN THE NEXT QUARTERLY REPORT

LEAK DETECTION ACTIVITIES

Cell 1

LDS Volumes
 Analytical

Cell 2

LDS Volumes
 Analytical

Cell 3

LDS Volumes
 Analytical

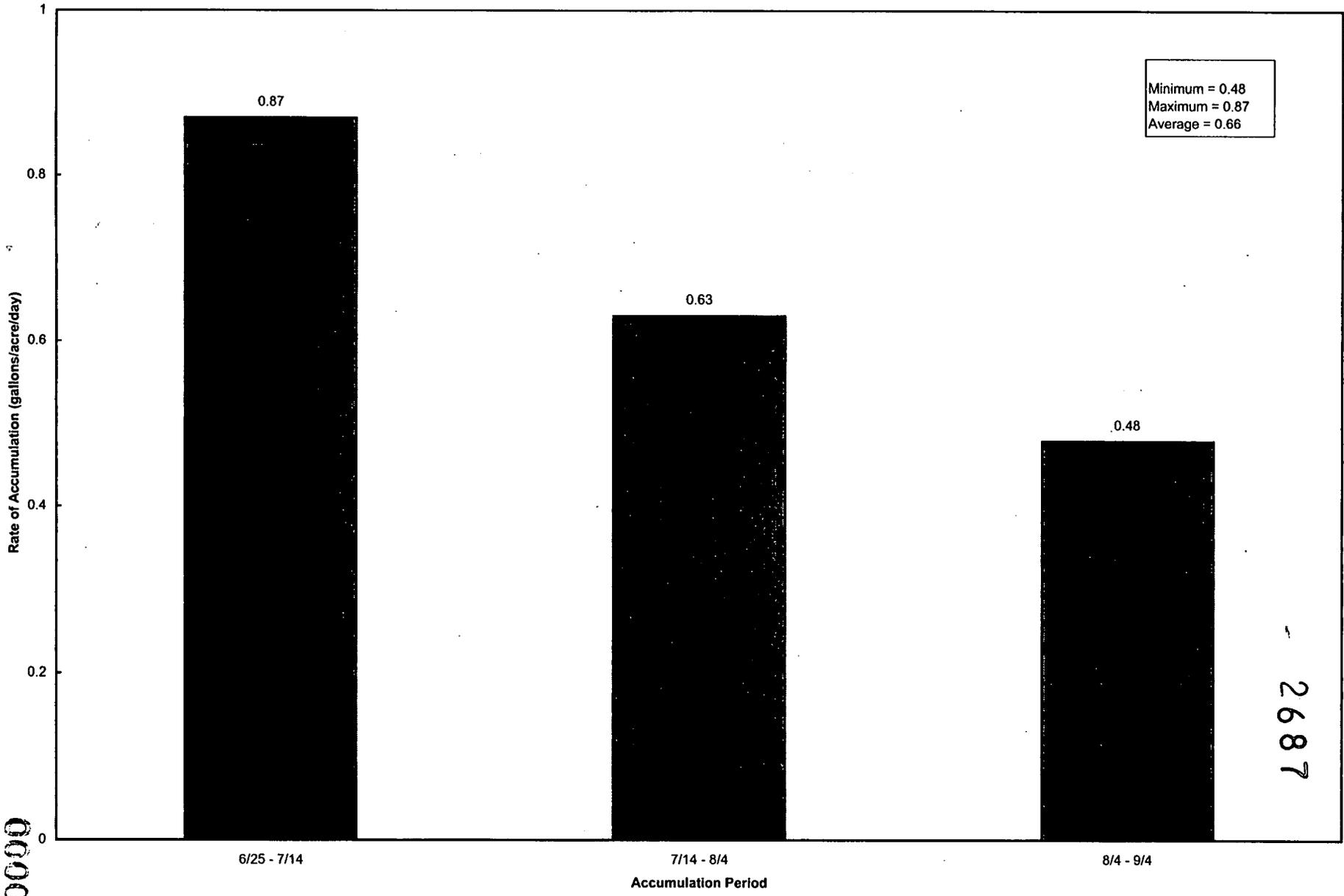
LCS Volumes

1999											
First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
						◆	◆		◆	◆	◆
							◆		◆	◆	◆
						◆	◆	◆	◆	◆	◆
									◆	◆	◆

◆ Data summarized/evaluated in the next report

FINAL

000077



000078

FIGURE 2-4. ON-SITE DISPOSAL FACILITY CELL 1 LEAK DETECTION SYSTEM (12338D)
RATE OF ACCUMULATION (GALLONS/ACRE/DAY), JULY 25, 1999 THROUGH SEPTEMBER 4, 1999

FINAL

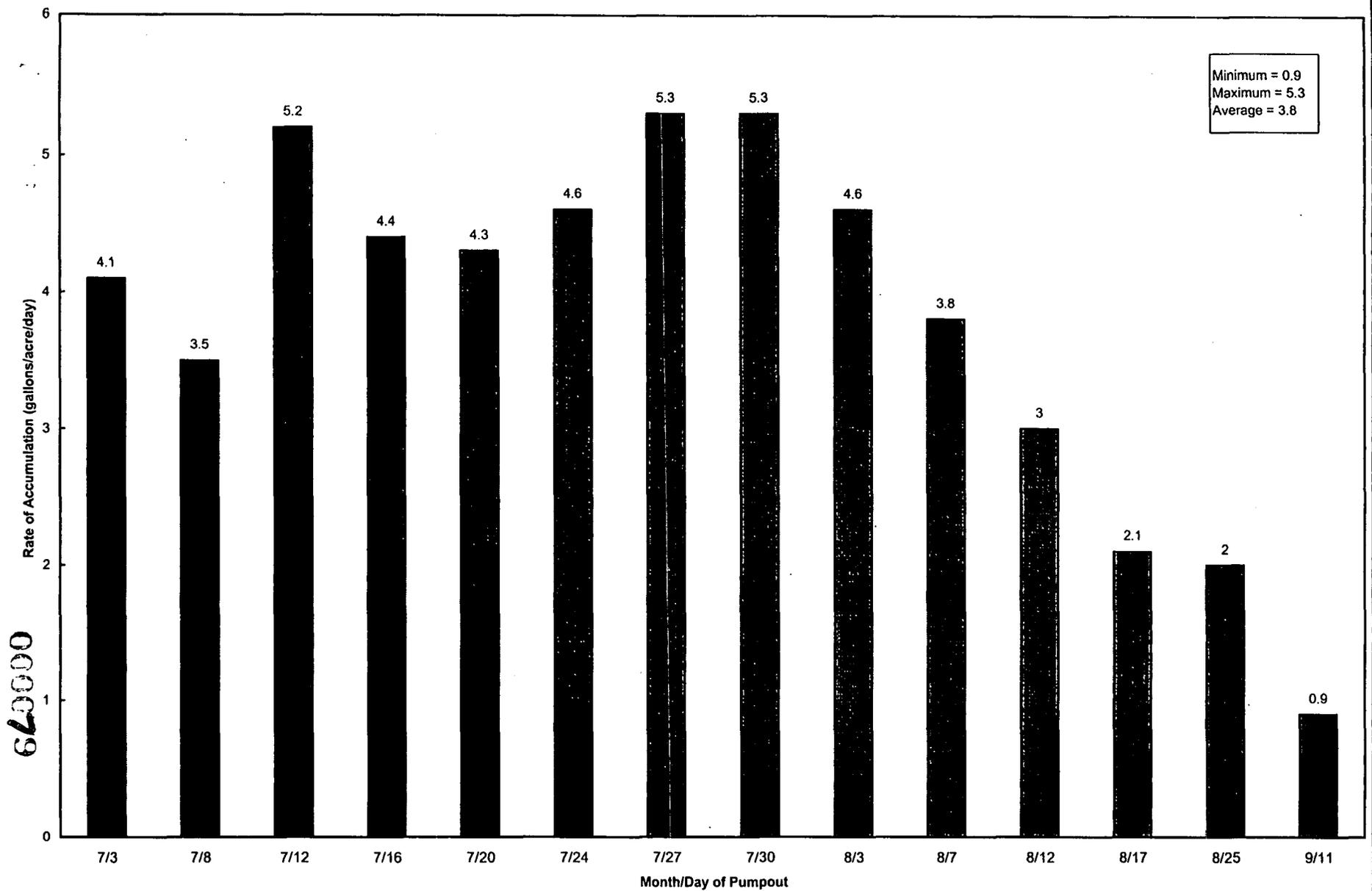


FIGURE 2-5. ON-SITE DISPOSAL FACILITY CELL 2 LEAK DETECTION SYSTEM (12339D)
RATE OF ACCUMULATION (GALLONS/ACRE/DAY), JULY 3, 1999 THROUGH SEPTEMBER 11, 1999

FINAL

-- 2687

Surface Water and Treated Effluent

000080

This section provides a status of the surface water and treated effluent monitoring for the third quarter of 1999.

Figure 3-1 shows the data included in this section. Figure 3-2 identifies 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 Integrated Environmental Monitoring Plan (IEMP), Revision 1 (DOE 1999b):

- National Pollutant Discharge Elimination System (NPDES) permit (data obtained from July through September 1999)
- Federal Facilities Compliance Agreement (FFCA) requirements (data obtained from July through September 1999)
- IEMP Characterization Program results (data obtained from April through June 1999).

Figure 3-3 shows the data from the surface water and treated effluent sampling activities that will be included in the next IEMP quarterly status report to be submitted in March of 2000. The report will contain NPDES and FFCA data from October through December 1999 (fourth quarter) and the results of the analytical data from the IEMP Characterization Program from July through September 1999 (third quarter).

Figure 3-4 identifies the surface water and treated effluent sample locations associated with NPDES compliance monitoring. Wastewater and storm water discharges from the Fernald site were in compliance 100 percent of the time during the third quarter of 1999.

000082

-- 2687

Figure 3-5 shows that a cumulative total of 189 pounds of uranium were discharged to the Great Miami River in effluent from January through September 1999. 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.

Uncontrolled runoff also contributes to the amount of total uranium entering the environment. To date, the uncontrolled runoff estimate has been calculated using a loading term of 6.25 pounds of uranium discharged to Paddys Run for every inch of rainfall. This loading term was originally determined during the remedial investigation and has been re-evaluated as part of the annual review process for the IEMP. The U.S. Department of Energy (DOE) has notified the agencies of the proposed loading term in a letter transmitted on November 1, 1999, (letter [DOE-0087-00] from DOE to the Ohio Environmental Protection Agency and the U.S. Environmental Protection Agency). As expected, the revised loading term for the amount of uranium released through uncontrolled runoff is significantly less (2.53 pounds per inch of rainfall) as a result of the removal of contaminant sources and the additional measures that have been taken to control contaminated runoff over the last several years. Upon approval, the new value of 2.53 will be used in future IEMP quarterly status reports and annual integrated site environmental reports. Figure 6-1 shows that precipitation during the third quarter of 1999 was 5.24 inches; therefore, the mass of total uranium discharged to Paddys Run through uncontrolled runoff from July through September 1999 (using the 6.25 value) is estimated to be 32.75 pounds.

Figure 3-6 illustrates that the monthly average total uranium concentration limit of 20 micrograms per liter ($\mu\text{g/L}$) for water discharged to the Great Miami River was met each month during the third quarter of 1999. There were no changes to Table 3-1 because no treatment plant maintenance or significant precipitation bypass events occurred during the second or third quarter of 1999.

Figure 3-7 presents controlled and uncontrolled surface water flow areas for the third quarter of 1999. As identified in previous IEMP quarterly status reports, an evaluation of controlled areas is to occur at least quarterly in order to help ensure that the appropriate areas are being controlled. No changes to controlled areas or uncontrolled runoff flow directions occurred during the third quarter.

There were no final remediation level (FRL) or benchmark toxicity value (BTV) exceedances at any monitored location. Therefore, there were no FRL or BTV exceedances attributable to the Fernald site in the Great Miami River.

There were no exceedances of the 530 µg/L surface water total uranium FRL. As Figure 3-8 shows, the results from the property boundary at Paddys Run (SWP-03) indicate that total uranium concentrations in surface water leaving the site are consistently below both the surface water FRL and the groundwater FRL.

Sample location STRM 4004 was dry during the second quarter of 1999; therefore, there is no total uranium result, and SWD-03 was inaccessible during the second quarter.

The following activities occurred during the third quarter of 1999 which could have potentially impacted the water quality at various surface water sample locations (identified in parentheses):

- Excavation, screening, and hauling activities in the on-site disposal facility borrow area (SWD-02 and STRM 4003)
- Construction activities associated with on-site disposal facility Cell 3 (SWD-02 and STRM 4003)
- Excavation, hauling, and placement of waste material into on-site disposal facility Cells 2 and 3 associated with Area 1, Phase II and the old sewage treatment plant (SWD-02, STRM 4003, and PF 4001)
- Excavation of southern waste unit material and hauling of excavated materials to the on-site disposal facility via the impacted material haul road (STRM 4004 and PF 4001)
- Construction activities associated with the wetland mitigation efforts in Area 1, Phase I (STRM 4003 and SWD-01)
- Initiation of the excavation of Waste Pit 3 and general waste pit area activities in support of Waste Pits Remedial Action Project (WPRAP) (PF 4001)
- Loading and shipping of contaminated material in support of the WPRAP activities (STRM 4005, PF 4001, and SWP-02)
- Rail yard activities in support of the loading and shipping of trains (STRM 4006 and SWP-02)
- Construction activities associated with the roads and electrical upgrades portion of the Silos Infrastructure Project (STRM 4005).

000084

-- 2687

Review of the surface water and treated effluent data available for this report indicate that these activities have not caused any significant FRL or BTV exceedances (identified in surveillance subsection). However, data will continue to be evaluated in light of ongoing remediation activities to assess impacts to the surface water pathway.

TABLE 3-1
1999 TREATMENT BYPASS EVENTS

Event	Duration (hours)	Number of Bypass Days*	Cumulative Number of Bypass Days	Total Uranium Discharged (pounds) (to Great Miami River)	Total Water Discharged (millions of gallons) (to Great Miami River)
Treatment Plant Maintenance Bypasses					
March 15 through March 17	72	3	3	3.29	13.767

*Days are counted according to the definition provided in the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment Project (DOE 1997c).

2687

FIGURE 3-1

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

SAMPLING ACTIVITIES

NPDES

FFCA

IEMP Characterization

1999											
First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
						◆	◆	◆			
						◆	◆	◆			
			◆	◆	◆						

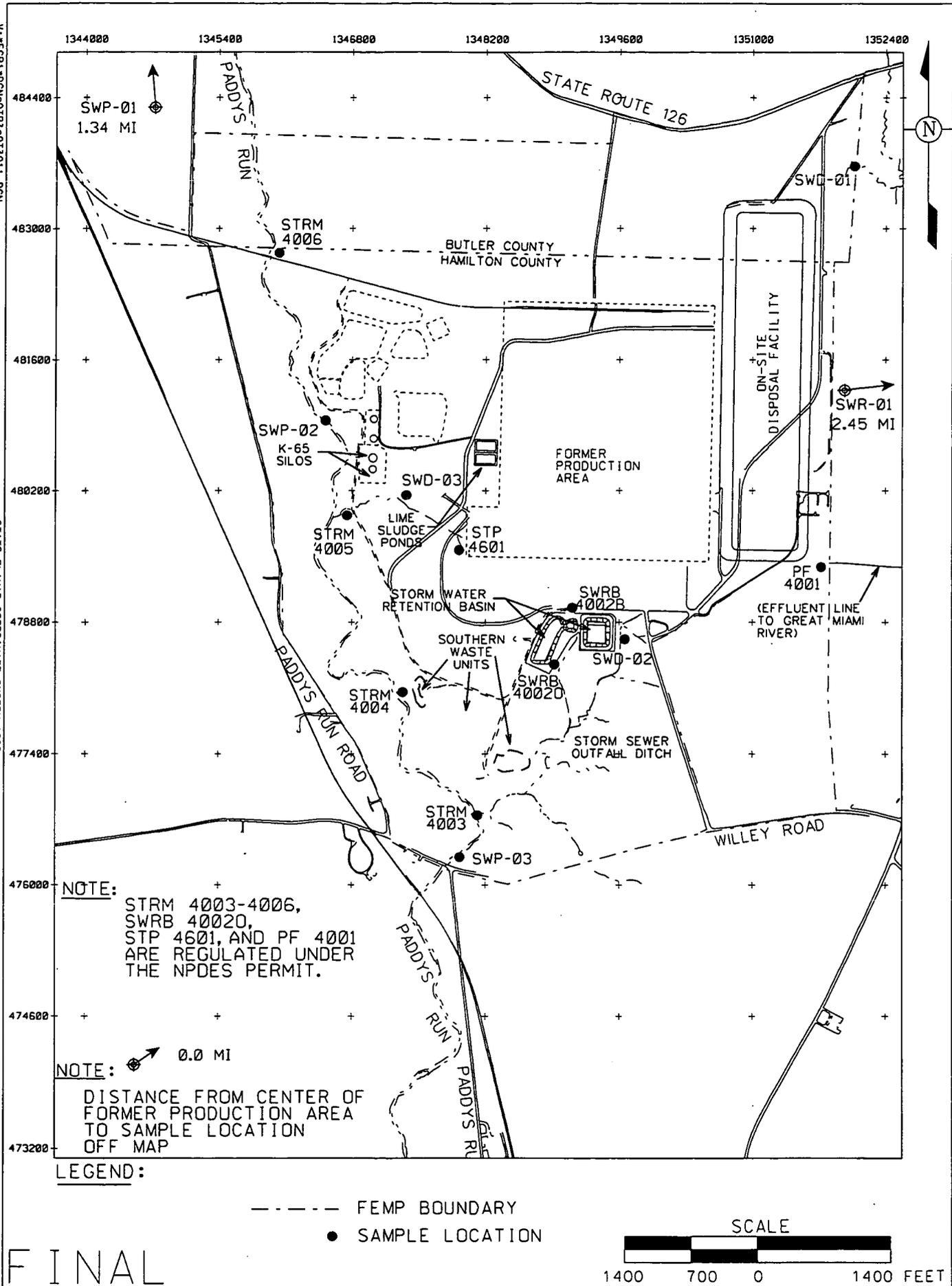
◆ Data summarized/evaluated in this report

FINAL

V:\FP\1806\G01R3\013011.DGN

STATE PLANNED COORDINATE SYSTEM 1983

11-24-99



NOTE: STRM 4003-4006, SWRB 40020, STP 4601, AND PF 4001 ARE REGULATED UNDER THE NPDES PERMIT.

NOTE: 0.0 MI
DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO SAMPLE LOCATION OFF MAP

LEGEND:

- FEMP BOUNDARY
- SAMPLE LOCATION

SCALE



1400 700 0 1400 FEET

FINAL

FIGURE 3-2. IEMP SURFACE WATER AND TREATED EFFLUENT SAMPLE LOCATIONS

000088

FIGURE 3-3

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

SAMPLING ACTIVITIES

NPDES

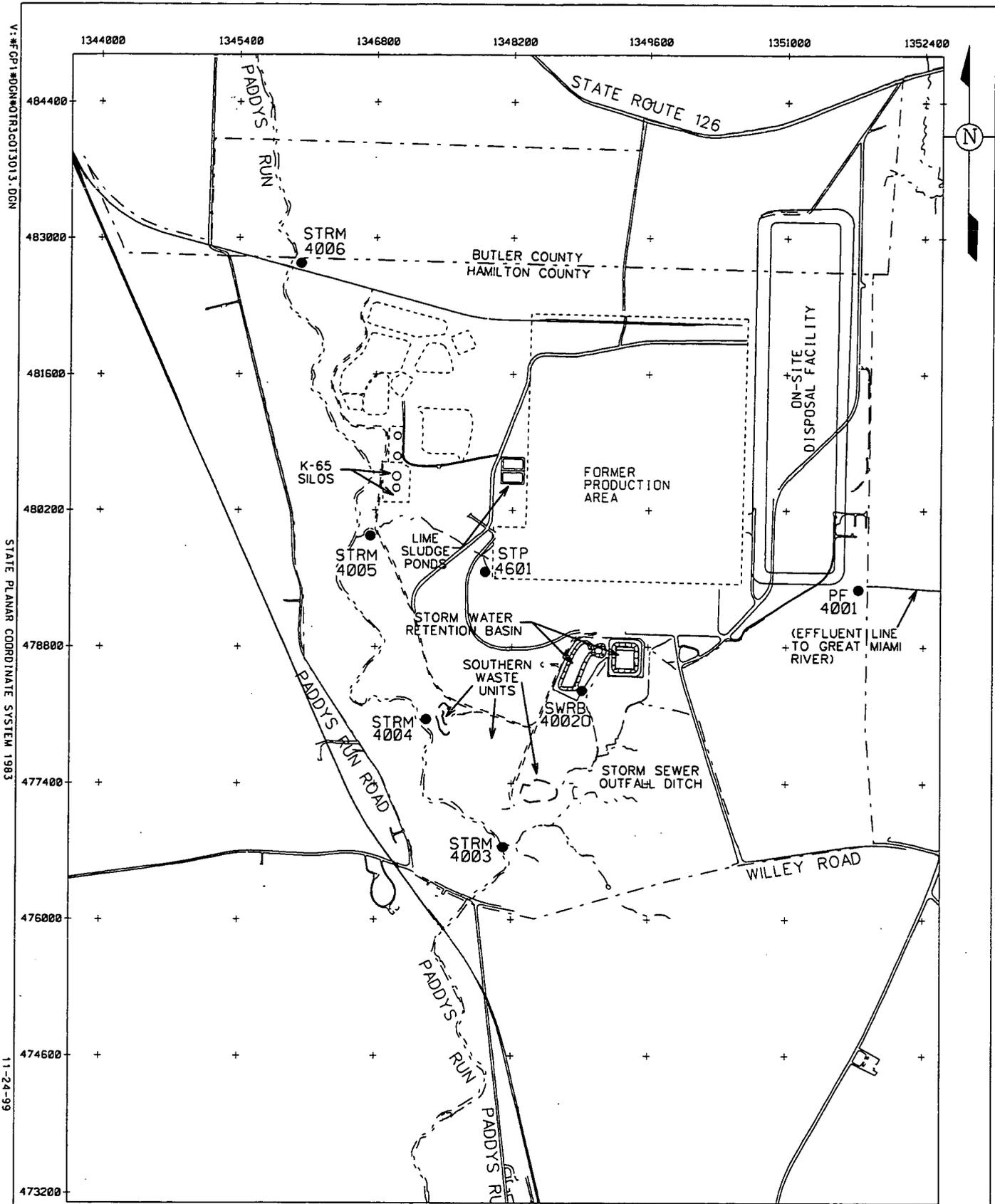
FFCA

IEMP Characterization

1999											
First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
J A N	F E B	M A R	A P R	M A Y	J U N	J U L	A U G	S E P	O C T	N O V	D E C
									◆	◆	◆
									◆	◆	◆
						◆	◆	◆			

◆ Data summarized/evaluated in the next report

FINAL



LEGEND:

- FEMP BOUNDARY
- SAMPLE LOCATION



FINAL

FIGURE 3-4. NPDES PERMIT SAMPLE LOCATIONS

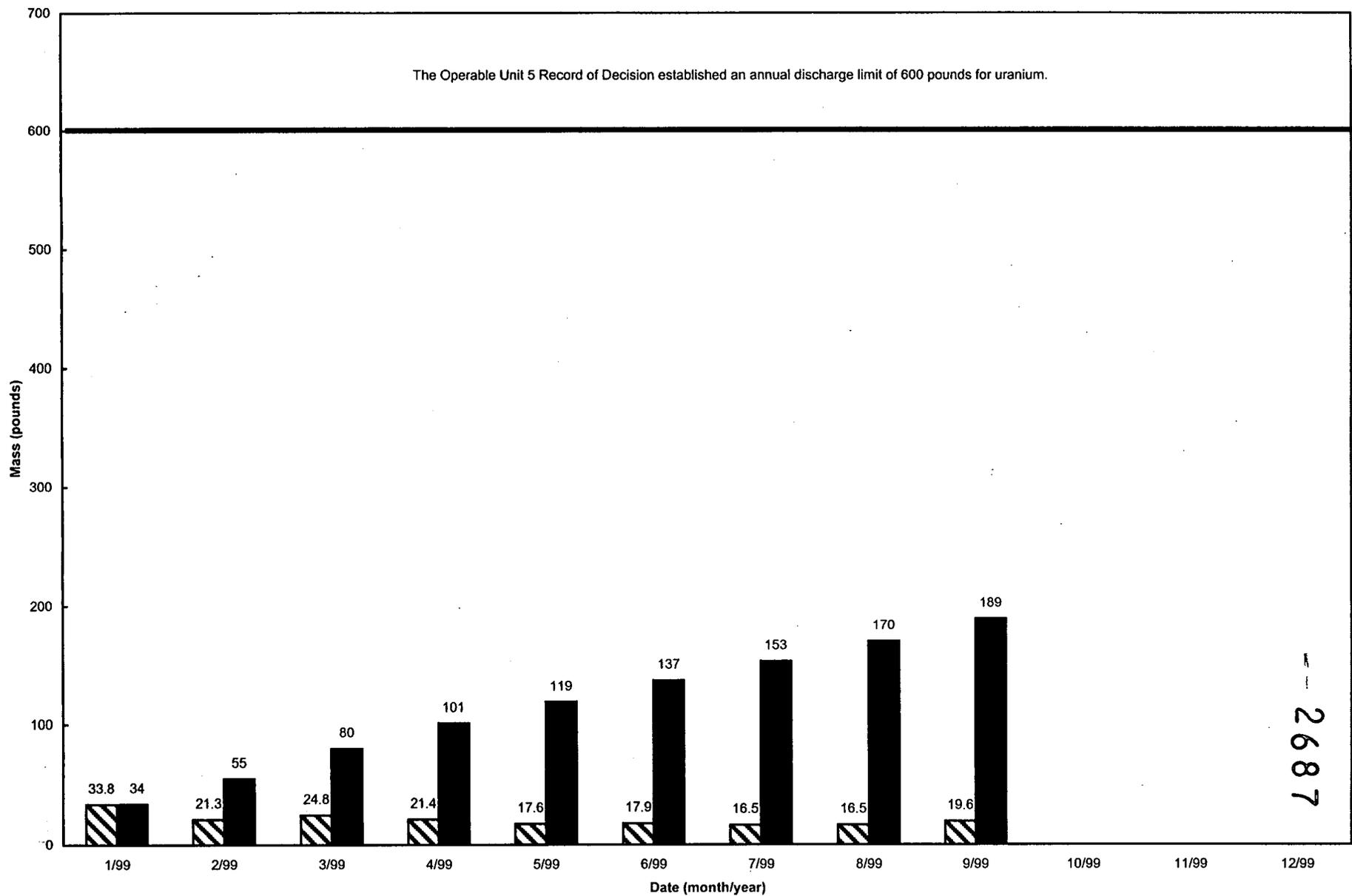
000090

V:\#CP1\#DGN\#R3\CD13013.DGN

STATE PLANAR COORDINATE SYSTEM 1983

11-24-99

The Operable Unit 5 Record of Decision established an annual discharge limit of 600 pounds for uranium.



2687

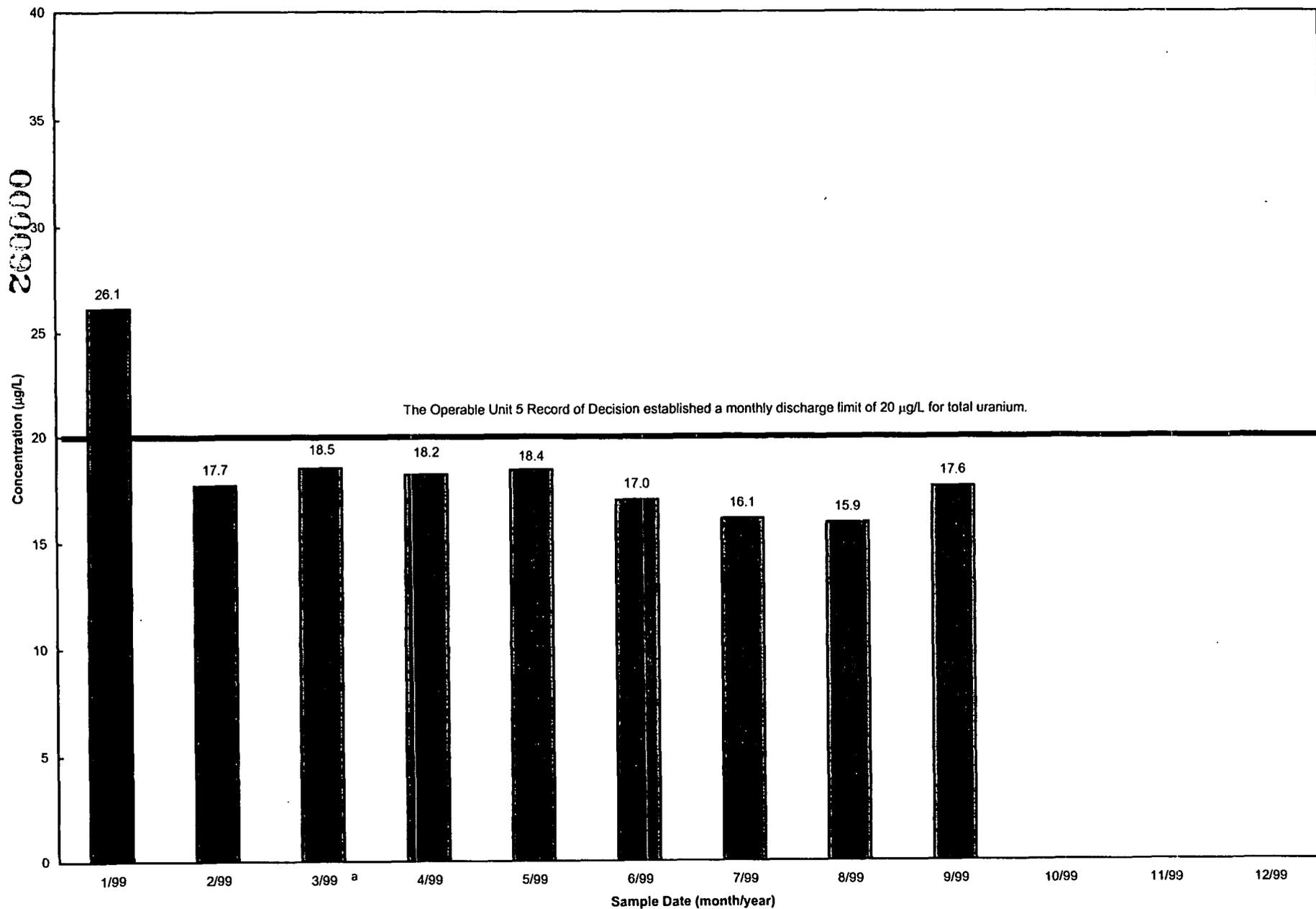
Note: Sum of monthly discharges may not always agree with cumulative total due to rounding differences.

□ Monthly ■ Cumulative

FIGURE 3-5. POUNDS OF URANIUM DISCHARGED TO THE GREAT MIAMI RIVER FROM THE PARSHALL FLUME (PF 4001) IN 1999

FINAL

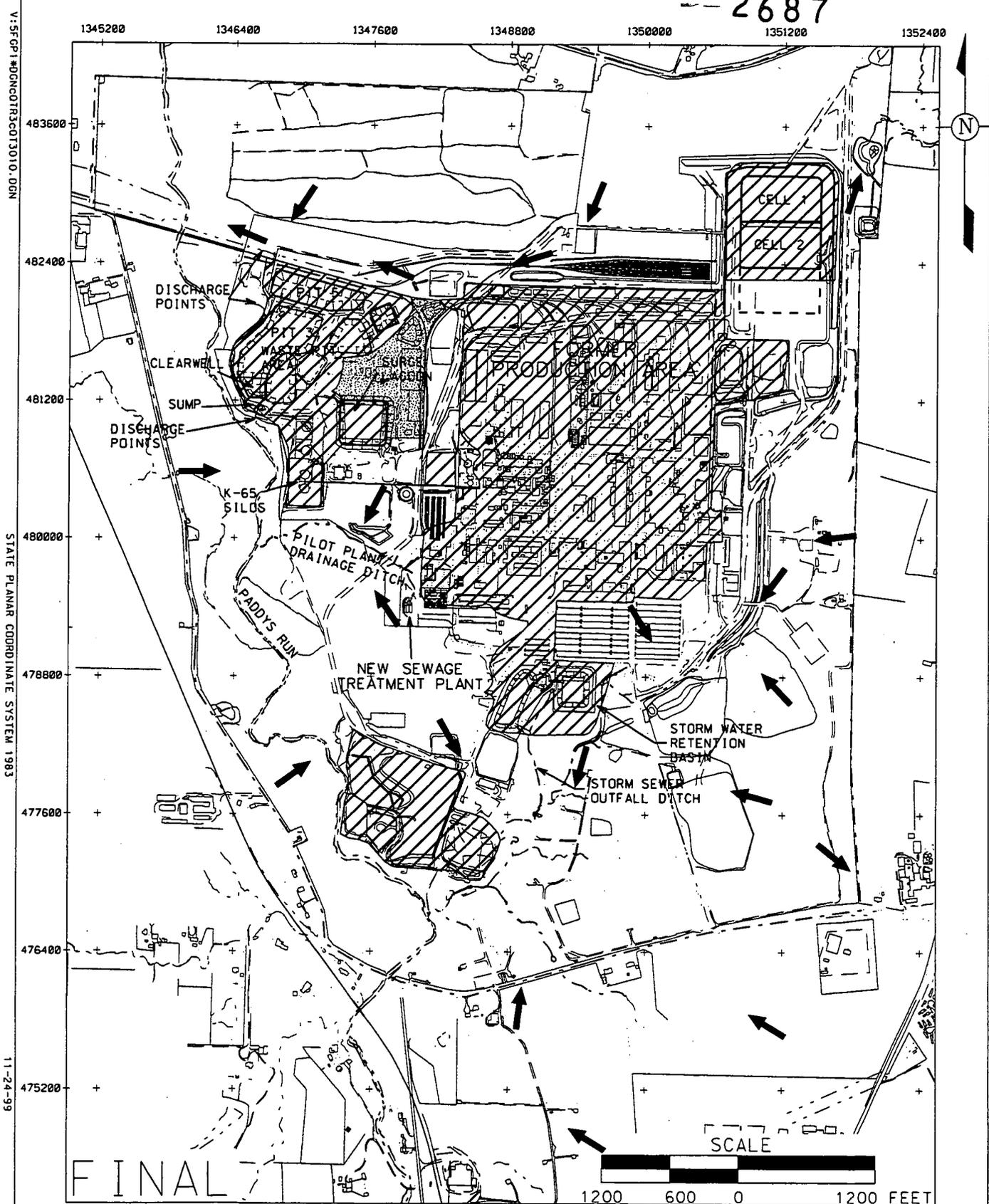
070091



^a Actual concentration was 19.4 µg/L. Eliminating the three "treatment plant maintenance" bypass days reduces average to 18.5 µg/L.

FIGURE 3-6. 1999 MONTHLY AVERAGE TOTAL URANIUM CONCENTRATION IN WATER DISCHARGED FROM THE PARSHALL FLUME (PF 4001) TO THE GREAT MIAMI RIVER

2687



V:\SFGP1\MDN\CTR3\CO13010.DGN
 STATE PLANNING COORDINATE SYSTEM 1983
 11-24-99

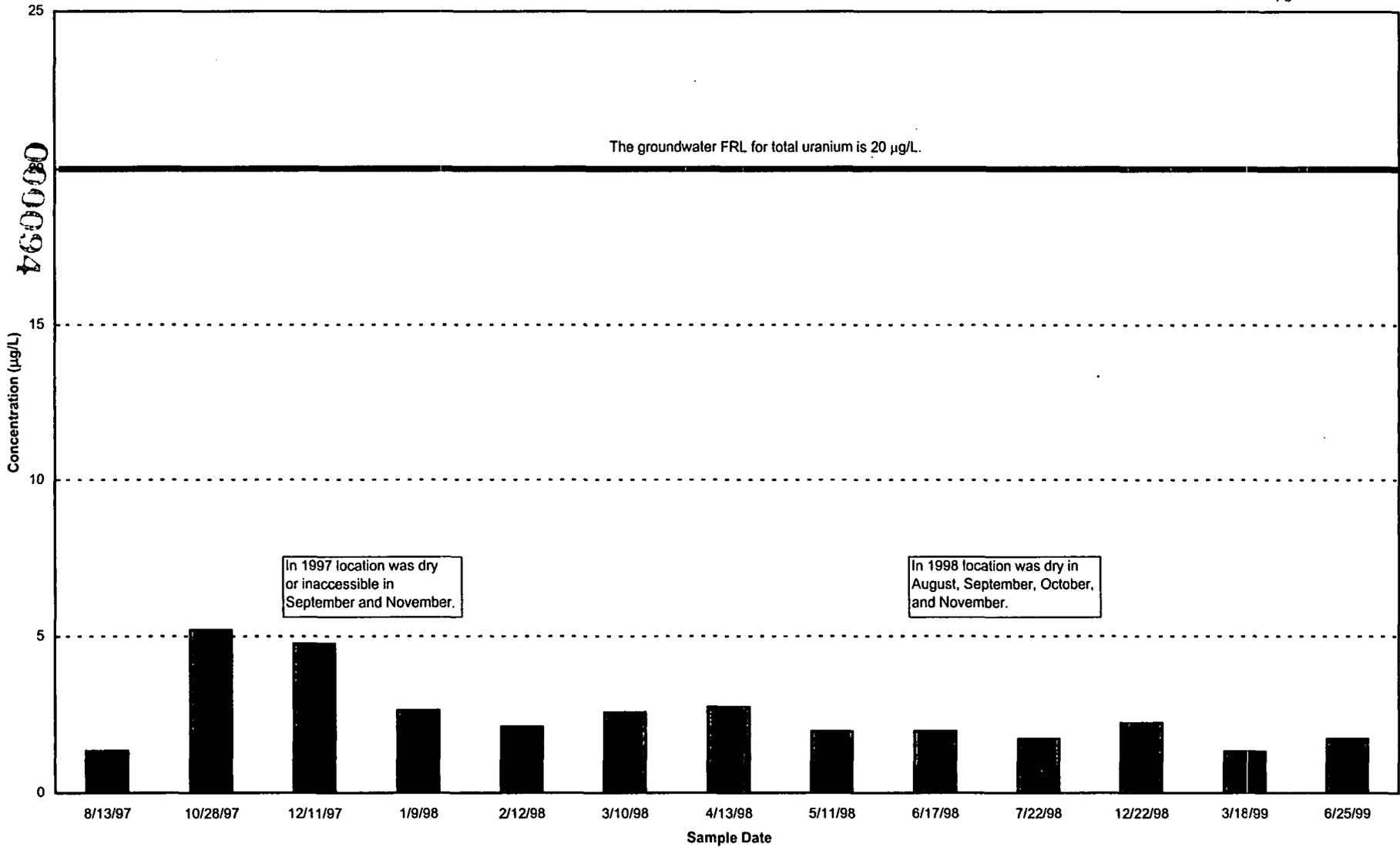
- LEGEND:**
- FEMP BOUNDARY
 - [Hatched Box] CONTROLLED AREA
 - [Arrow] UNCONTROLLED RUNOFF FLOW DIRECTION

- NOTE:**
- [Stippled Box] CONTROLLED MEANS WATER IS COLLECTED AND SENT FOR TREATMENT AT THE AWWT.
 - [Stippled Box] WATER TREATED IF TOTAL URANIUM RESULT IS $>20 \mu\text{g/L}$

FIGURE 3-7. CONTROLLED SURFACE WATER AREAS AND UNCONTROLLED FLOW DIRECTIONS FOR THIRD QUARTER 1999-2003

Note: The surface water FRL for total uranium is 530 µg/L.

Statistics from SWP-03:
No. of Samples: 13
Min.: 1.337 µg/L
Max.: 5.2 µg/L
Avg.: 2.5 µg/L
Median: 2.15 µg/L



Note: Per the IEMP, Revision 1, samples are only collected quarterly in 1999.

FIGURE 3-8. TOTAL URANIUM CONCENTRATIONS IN PADDYS RUN AT WILLEY ROAD (SWP-03) SAMPLE LOCATION

FINAL

--2687

Air Monitoring

000095

This section provides a summary of the third quarter 1999 monitoring activities and analytical results for the Integrated Environmental Monitoring Plan (IEMP) air monitoring program. Figure 4-1 shows the data included in this section. 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 Pollutants (NESHAP) Compliance
 - Monitoring Thorium Emissions from the Waste Pit Remedial Action Project
 - Project-Specific Air Monitoring at the Sewage Treatment Plant Complex
- NESHAP Stack Emissions Monitoring
- Radon Monitoring:
 - Continuous Alpha Scintillation Monitoring - Silo Head Space and Environmental Data
- Direct Radiation Monitoring (via thermoluminescent dosimeters [TLDs]).

Figure 4-2 shows the data from the air monitoring activities that will be included in the next IEMP quarterly status report to be submitted in March of 2000. The report will contain data from air monitoring activities from October through December 1999 (fourth quarter). Monitoring activities defined under the IEMP for radiological particulate, stack, radon, and direct radiation monitoring will continue as planned during the fourth quarter of 1999.

Airborne uranium particulate concentrations measured during the third quarter exhibited a similar pattern to those observed during the third quarter of 1998. As expected, with the start-up of earth moving, waste hauling, and waste placement operations associated with the opening of the on-site disposal facility and with the dry conditions recorded during the summer months, uranium concentrations exhibited a general increase when compared to second quarter data. This pattern is most notable at monitoring locations AMS-3, AMS-8A, and AMS-9C. These three monitors are predominantly located in the down wind direction (refer to Figure 6-2 for the third quarter wind rose) and in close proximity to the waste placement and remediation activities at the on-site disposal facility and Sewage Treatment Plant Complex. Figure 4-3 identifies the location of the air monitoring stations. Table 4-1 provides a summary of third quarter, year-to-date, and historical total uranium concentrations.

One notable temporary increase in uranium concentrations was observed during the end of July at monitoring location AMS-8A. This temporary increase coincides with the placement of waste materials from the Sewage Treatment Plant Complex into Cell 2 of the on-site disposal facility. These data were shared with the on-site disposal facility project manager to support an evaluation of emission controls at the project. However, the project manager had already taken action to improve emission controls by lengthening the access ramp into Cell 2 to reduce the drop height of the material during waste placement. Data were once again within historical levels following the second week of August. Third quarter and historical total uranium concentration graphs for each location can be viewed by going to Table 4-1 and selecting the appropriate location.

The general pattern of increasing uranium particulate concentrations during the summer months can be expected to continue over the coming years as the cycle of earth moving, waste hauling, and waste placement operations is repeated. However, as demonstrated through tracking of the annual dose at the site fenceline under the NESHAP compliance program (refer to the Radiological Air Particulate Monitoring directory, NESHAP Compliance file), to date these seasonal increases in airborne uranium concentrations have not contributed to an increasing trend in the annual dose at the site fenceline.

Table 4-2 provides a summary of third quarter, year-to-date, and historical total particulate concentrations. Third quarter and historical total particulate concentration graphs for each location can be viewed by going to Table 4-2 and selecting the appropriate location. As indicated by the graphs, particulate concentrations at fenceline and background locations during the third quarter of 1999 are, in general, comparable to second quarter 1999 particulate concentrations.

The waste pit monitors (refer to Figure 4-3 for WPTH-1 and WPTH-2 locations) were installed to address potential increases in airborne thorium concentrations, specifically thorium-230, resulting from fugitive emissions from the excavation of the waste pits. Early in the third quarter, the biweekly thorium concentrations measured at WPTH-1 and

WPTH-2 (refer to Figure 4-22 and Figure 4-23, respectively) increased when compared to second quarter 1999 concentrations. This upward trend, which is clearly evident at the WPTH-1 location, as shown in Figure 4-22, is attributed to seasonal variations in airborne thorium levels since the excavation of the waste pits did not begin until later in the third quarter (September 3, 1999). However, late in the third quarter, after the excavation of the waste pits had begun, a further increase in the thorium-230 concentration was noted at the WPTH-1 monitor. The biweekly thorium concentrations measured at WPTH-1 and WPTH-2 will continue to be monitored and compared to the baseline levels in order to assess the impact of fugitive emissions from the excavation of the waste pits.

Late in the third quarter, the results of several WPTH-1 and WPTH-2 samples were determined to be affected by very low levels of thorium-230 contamination within the on-site laboratory analyzing the samples. A review of laboratory operations indicated that the low level contamination, which was found in laboratory method blank samples, filter blank samples and the WPTH-1 and WPTH-2 samples, was connected to the recent processing and analysis of waste material samples which contained relatively high levels of thorium-230. In response to the thorium-230 contamination, the on-site laboratory has implemented several steps to prevent future sample contamination. These steps include preparing new reagents and acquiring new glassware/equipment for running future low-level thorium samples and reducing tracer spike amounts to reduce trace contaminants of the isotopes of concern in the tracer solution. In addition, off-site laboratory contracts will be placed to provide backup capabilities in the event the on-site laboratory experiences problems in running the biweekly thorium analyses. These laboratory issues do not affect the quarterly composite thorium analyses from the 18 air monitors used for determining compliance with NESHAP, Subpart H limits.

Project-specific environmental radiological air monitoring for the dismantlement of the Sewage Treatment Plant Complex continued through the third quarter of 1999. During the second quarter of 1999, the project-specific monitor was moved from its initial location (designated as STP-1 on Figure 4-3) to a new location (STP-2). This relocation was performed to accommodate below-grade excavations of the Sewage Treatment Plant Complex. The average third quarter 1999 total uranium concentrations at the project specific monitor (STP-2) increased approximately 350 percent when compared to average second quarter 1999 total uranium concentrations at STP-2. Average particulate concentrations during the third quarter were approximately the same as average second quarter 1999 particulate concentrations. The increases in uranium concentration are attributable to the demolition and below-grade excavation of the Sewage Treatment Plant Complex. The excavation of the Sewage Treatment Plant Complex will be completed in October 1999. Refer to Table 4-1 and Table 4-2 for STP-1 and STP-2 total uranium and total particulate concentrations, respectively. In addition, Figure 4-24 and Figure 4-25 depict this information graphically for STP-1 and STP-2, respectively.

The maximum third quarter dose equivalent, calculated from the third quarter air composite data, was 0.1 millirem (mrem) which occurred at AMS-3. Table 4-3 contains the third quarter doses for each air monitoring station and the fractional contribution of each radionuclide to the total dose. During the third quarter, uranium isotopes contributed approximately 74 percent of the dose at AMS-3, while the average fenceline uranium dose contribution was 75 percent.

The maximum year-to-date dose equivalent, calculated from the sum of the three quarterly air composites, was 0.225 mrem which also occurred at AMS-3. This maximum year-to-date fenceline dose represents 2.25 percent of the 10 mrem NESHAP Subpart H standard. Based on the results observed through the first three quarters of the year, it is projected that the annual dose for 1999 (projected through December) will remain well below the NESHAP standard. Table 4-4 contains the year-to-date doses for each air monitoring station and the fractional contribution of each radionuclide to the total dose.

One issue involving the shipment of quarterly composite samples to the off-site laboratory did arise during the third quarter. A portion of the composite sample for AMS-23 leaked from the sample container into the packaging materials during shipment. While none of the sample escaped the shipping container, the leaked sample volume could not be recovered for analysis. As a result, there was insufficient sample volume available for the complete analysis. It was determined, based on historical data from this air monitor that isotopic uranium and isotopic thorium are the primary contributors to dose. Therefore, the available sample was analyzed for uranium and thorium isotopes with no analysis for radium-226. The loss of the radium-226 data for AMS-23 is not expected to have a significant impact on the total AMS-23 dose, or NESHAP Subpart H compliance, since there was no radium-226 contribution to dose during the first two quarters of 1999 at this location.

Third quarter 1999 results for the Laundry and Building 71 stacks are within expected ranges. Typically, post production (1991 to present) stack monitoring results are near or below the minimum detectable concentration levels for all isotopes monitored. No significant changes in the source operations associated with either stack were noted during the third quarter. The NESHAP stack emissions monitoring results are reported in Table 4-5. The NESHAP stack emissions monitoring locations are shown in Figure 4-26.

000099

As expected, the highest continuous environmental radon monitoring results were recorded at the K-65 exclusion fence resulting from radon emissions from the K-65 Silos. Over time, there has been a gradual increase in radon levels recorded at the exclusion fence corresponding to the increase in the K-65 Silo head space concentrations. In general, the four K-65 exclusion fence monitors (refer to Figure 4-27) recorded lower monthly average radon levels than the same monthly periods in 1998. Table 4-6 summarizes data from the third quarter of 1999, with ranges of monthly average concentrations for the first three quarters of 1999 and all of 1998. The maximum monthly average was 9.3 pCi/L and was recorded at location KNE in the prevailing wind direction.

During the third quarter of 1999, there were no exceedances of the U.S. Department of Energy Order 5400.5 100 pCi/L radon limit recorded at the Fernald Environmental Monitoring Project. Following the re-sealing of the silo domes, which was completed on June 4, 1999, radon data from the K-65 Silo area has been closely monitored in order to gauge the effectiveness of this interim control measure until radon emissions are mitigated through implementation of the Accelerated Waste Retrieval Project.

Radon data from the site boundary monitoring locations are influenced heavily by diurnal temperature inversion patterns. Maximum concentrations continue to be experienced in the early morning hours and are greatest during the second half of the year. Maximum monthly averages are consistent with previous years' data. Year-to-date averages for all boundary locations suggest that the 3 pCi/L above background annual average radon concentration limit at the facility boundary will not be exceeded during 1999.

000100

K-65 Silo head space radon concentrations fluctuate seasonally due to changes in meteorological parameters (e.g., temperature, barometric pressure, humidity, etc.). To account for the seasonal variations, concentrations are summarized quarterly (from the daily average concentrations) in order to compare data collected under similar meteorological conditions (refer to Figure 4-28). The monthly average continuous monitoring results for K-65 Silo 1 during the third quarter of 1999 ranged between 13.6 and 14.0 million pCi/L. The quarterly average concentration increased approximately 3.6 percent over the quarterly average concentration during the same period in 1998 and is approximately 53 percent of the pre-bentonite concentration level (~26 million pCi/L). Third quarter 1999 monthly average continuous monitoring results for K-65 Silo 2 ranged between 8.52 and 8.69 million pCi/L. The quarterly average concentration decreased approximately 1.4 percent from the average concentrations during the same period in 1998 and is approximately 29 percent of the pre-bentonite concentration level (~30 million pCi/L). Figure 4-28 shows the quarterly silo head space radon concentrations and Table 4-7 presents the monthly average silo head space radon concentrations.

All monitoring results from direct radiation measurements for the third quarter of 1999 were within historical ranges (refer to Figure 4-29 for monitoring locations and Table 4-8 for direct radiation measurements). As noted in previous IEMP quarterly status reports, a positive trend in the immediate area of the K-65 Silos (locations 22 through 26) has been identified and will continue to be monitored (refer to Figure 4-30). This trend is attributed to a corresponding increase in radon-progeny 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.

As discussed in previous reports, a slight positive trend in direct radiation measurements at the site fenceline nearest the K-65 Silos (location 6) has been identified and continues to be monitored. The increase is associated with the increasing direct radiation levels at the K-65 Silos discussed above. Figure 4-31 shows the slight positive trend at location 6.

000102

TABLE 4-1
TOTAL URANIUM PARTICULATE CONCENTRATIONS IN AIR

Location ^a	No. of Samples	Third Quarter 1999 Results ^{b,c} (pCi/m ³ x 1E-6)			No. of Samples	1999 Summary Results ^b (pCi/m ³ x 1E-6)			1990 through 1998 Summary Results ^{b,c} (pCi/m ³ x 1E-6)	
		Min.	Max.	Avg.		Min.	Max.	Avg.	Min.	Max.
Fenceline										
AMS-2	5 ^d	26	143	67	18	10	143	44	0	3500
AMS-3	6	83	585	352	19	13	585	143	0	17000
AMS-4	6	26	42	35	19	0	65	25	0	2300
AMS-5	6	16	41	26	19	0	41	17	0	4400
AMS-6	6	13	111	47	19	3	111	32	0	3200
AMS-7	6	15	83	35	19	0	83	22	0	7800
AMS-8A	6	8	1135	322	19	0	1135	135	7.9	900
AMS-9C ^e	6	31	409	183	19	14	409	95	0	562
AMS-22	6	16	49	36	19	0	49	29	0	101
AMS-23	6	18	136	62	19	0	136	33	9.0	194
AMS-24	6	0	43	24	19	0	44	18	0	65
AMS-25	6	3	51	21	19	0	51	17	0	79
AMS-26	6	0	29	19	19	0	75	21	0	98
AMS-27	6	22	57	36	19	0	57	26	0	64
AMS-28	6	0	38	15	19	0	62	17	0	216
AMS-29	6	21	89	49	19	0	89	30	0	121
Background										
AMS-12	6	0	45	13	19	0	45	10	0	480
AMS-16	6	0	19	10	19	0	33	16	0	350
Project-Specific										
STP-1 ^{f,g}	0	NA	NA	NA	11	20	143	56	38	891
STP-2 ^h	6	63	380	258	9	5	380	196	NA	NA

^aRefer to Figure 4-3

^bFor blank corrected concentrations less than or equal to 0.0 pCi/m³, the concentration is set as 0.0 pCi/m³.

^cNA = not applicable

^dAMS-2 sample from 9/7/99 to 9/21/99 was lost in the laboratory due to a broken beaker.

^eSummary results for 1990 through 1998 include AMS-9B/C data.

^fProject-specific monitor was not in operation prior to 1997.

^gSTP-1 was relocated to STP-2 on May 25, 1999.

-2687

TABLE 4-2
TOTAL PARTICULATE CONCENTRATIONS IN AIR

Location ^a	Third Quarter 1999 Results ^b ($\mu\text{g}/\text{m}^3$)			1999 Summary Results ($\mu\text{g}/\text{m}^3$)			1990 through 1998 Summary Results ^b ($\mu\text{g}/\text{m}^3$)			
	No. of Samples	Min.	Max.	Avg.	No. of Samples	Min.	Max.	Avg.	Min.	Max.
Fenceline										
AMS-2	6	34	45	41	19	11	69	36	7.0	77
AMS-3	6	27	83	51	19	19	83	39	8.0	159
AMS-4	6	35	59	43	19	18	74	41	13	79
AMS-5	6	28	36	31	19	20	45	30	9.6	62
AMS-6	6	32	40	37	19	19	48	32	8.0	69
AMS-7	6	33	84	44	19	22	84	35	6.8	76
AMS-8A	6	37	60	45	19	20	63	38	13	89
AMS-9C ^c	6	38	66	49	19	19	66	40	7.1	136
AMS-22	6	33	45	38	19	16	53	39	13	57
AMS-23	6	30	43	34	19	19	57	32	15	51
AMS-24	6	13	57	42	19	13	57	37	18	79
AMS-25	6	30	40	36	19	17	45	31	21	69
AMS-26	6	29	35	33	19	21	52	33	15	51
AMS-27	6	36	73	54	19	30	73	49	24	86
AMS-28	6	29	37	32	19	15	51	28	12	49
AMS-29	6	37	47	41	19	18	52	35	11	62
Background										
AMS-12 ^d	6	28	40	34	19	16	48	30	6.0	416
AMS-16 ^d	6	43	59	49	19	26	60	44	18	84
Project-Specific										
STP-1 ^{e,f}	0	NA	NA	NA	11	21	54	31	25	93
STP-2 ^f	6	40	72	53	9	40	72	54	NA	NA

^aRefer to Figure 4-3

^bNA = not applicable

^cSummary results for 1990 through 1998 include AMS-9B/C data.

^dTotal particulate analysis was discontinued during 1994 and was reinstated for AMS-12 and AMS-16 in 1997.

^eProject-specific monitor was not in operation prior to 1997.

^fSTP-1 was relocated to STP-2 on May 25, 1999.

TABLE 4-3

THIRD QUARTER NESHAP COMPLIANCE TRACKING

40 CFR 61 (NESHAP) Subpart H Appendix E, Table 2; Net Ratios ^b														
Location ^a	Ac-228 ^c	Ra-224 ^c	Ra-226	Ra-228 ^c	Th-228	Th-230	Th-231 ^c	Th-232	Th-234 ^c	U-234	U-235 U-236	U-238	Ratio Totals	Dose ^d (mrem)
Fenceline														
AMS-2	-	-	6.6E-04	-	5.0E-05	4.1E-04	2.1E-09	-	8.3E-06	2.1E-03	8.2E-05	2.2E-03	0.006	0.055
AMS-3	2.3E-07	5.6E-06	-	1.4E-04	4.1E-04	6.7E-04	5.2E-09	1.4E-03	1.3E-05	3.7E-03	2.1E-04	3.4E-03	0.010	0.100
AMS-4	2.5E-08	6.2E-07	9.3E-05	1.6E-05	4.5E-05	3.9E-04	2.2E-09	1.5E-04	4.9E-06	1.3E-03	8.4E-05	1.3E-03	0.003	0.034
AMS-5	-	-	-	-	-	-	-	-	3.1E-07	1.3E-04	-	8.1E-05	0.000	0.002
AMS-6	-	-	-	-	-	-	-	-	2.2E-06	4.5E-04	-	5.7E-04	0.001	0.010
AMS-7	-	-	-	-	-	1.7E-04	5.9E-10	-	1.1E-06	2.1E-04	2.3E-05	2.9E-04	0.001	0.007
AMS-8A	6.4E-08	1.6E-06	-	4.0E-05	-	7.0E-04	5.3E-09	3.8E-04	1.4E-05	3.8E-03	2.1E-04	3.6E-03	0.009	0.088
AMS-9C	2.5E-07	6.1E-06	4.3E-05	1.5E-04	2.8E-04	7.4E-04	2.9E-09	1.5E-03	9.2E-06	2.5E-03	1.1E-04	2.4E-03	0.008	0.077
AMS-22	-	-	-	-	-	-	-	-	3.8E-07	1.2E-04	-	1.0E-04	0.000	0.002
AMS-23	-	-	-	-	3.5E-03	-	-	-	3.6E-06	6.6E-04	-	9.4E-04	0.005	0.051
AMS-24	9.0E-08	2.2E-06	1.8E-03	5.6E-05	3.3E-04	4.0E-04	7.3E-10	5.4E-04	5.0E-07	2.1E-04	2.9E-05	1.3E-04	0.004	0.035
AMS-25	-	-	-	-	-	2.2E-05	-	-	1.4E-07	2.6E-05	-	3.7E-05	0.000	0.001
AMS-26	-	-	-	-	-	-	-	-	1.8E-07	-	-	4.9E-05	0.000	0.000
AMS-27	2.9E-08	7.1E-07	5.4E-04	1.8E-05	7.0E-05	2.5E-04	9.6E-10	1.7E-04	1.3E-06	3.9E-04	3.8E-05	3.3E-04	0.002	0.018
AMS-28	-	-	-	-	-	-	-	-	9.9E-09	3.8E-05	-	2.6E-06	0.000	0.000
AMS-29	-	-	-	-	1.0E-04	1.8E-04	1.3E-09	-	2.1E-06	5.4E-04	5.0E-05	5.6E-04	0.001	0.014
Background														
AMS-12	3.6E-07	8.8E-06	-	2.2E-04	5.1E-04	4.9E-04	-	2.1E-03	1.6E-06	4.4E-04	-	4.3E-04	NA ^f	
AMS-16	6.0E-07	1.5E-05	6.8E-04	3.8E-04	6.7E-04	8.0E-04	-	3.6E-03	1.0E-06	2.3E-04	0.0E-00	2.7E-04	NA ^f	

Maximum Quarterly Ratio: 0.0100

Maximum Quarterly Dose (mrem): 0.100

^aRefer to Figure 4-3

^bA "-" 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.

^cIsotopes assumed to be in equilibrium with their parents.

^dDose conversions are based on the NESHAP standard of 10 mrem per year.

^eSample was lost during processing.

^fNA = not applicable

TABLE 4-4
YEAR-TO-DATE NESHAP COMPLIANCE TRACKING

40 CFR 61 (NESHAP) Subpart H Appendix E, Table 2; Net Ratios ^b														
Location ^a	Ac-228 ^c	Ra-224 ^c	Ra-226 ^d	Ra-228 ^c	Th-228	Th-230	Th-231 ^e	Th-232	Th-234 ^c	U-234	U-235 U-236	U-238	Ratio Totals	Dose ^f (mrem)
Fenceline														
AMS-2	6.8E-07	1.7E-05	3.5E-03	4.2E-04	9.4E-04	1.4E-03	3.0E-09	4.0E-03	1.0E-05	2.5E-03	1.2E-04	2.7E-03	0.016	0.157
AMS-3	4.2E-07	1.0E-05	7.9E-03	2.6E-04	6.7E-04	1.1E-03	5.8E-09	2.5E-03	1.8E-05	5.0E-03	2.3E-04	4.8E-03	0.022	0.225
AMS-4	5.1E-07	1.2E-05	9.9E-04	3.2E-04	4.6E-03	1.1E-03	2.4E-09	3.0E-03	6.6E-06	1.5E-03	9.5E-05	1.8E-03	0.013	0.134
AMS-5	1.7E-07	4.3E-06	-	1.1E-04	1.4E-04	3.3E-04	-	1.0E-03	9.0E-07	1.9E-04	-	2.4E-04	0.002	0.021
AMS-6	1.1E-07	2.8E-06	4.5E-04	7.0E-05	1.2E-04	2.2E-04	1.1E-09	6.7E-04	4.0E-06	8.2E-04	4.2E-05	1.1E-03	0.003	0.034
AMS-7	1.6E-07	3.9E-06	-	9.8E-05	2.6E-04	4.7E-04	5.9E-10	9.3E-04	2.3E-06	5.7E-04	2.3E-05	6.0E-04	0.003	0.030
AMS-8A	3.1E-07	7.7E-06	2.8E-03	2.0E-04	3.5E-04	1.1E-03	6.0E-09	1.9E-03	1.8E-05	4.9E-03	2.3E-04	4.9E-03	0.016	0.164
AMS-9C	6.0E-07	1.5E-05	2.0E-03	3.8E-04	7.4E-04	1.6E-03	4.8E-09	3.6E-03	1.6E-05	4.2E-03	1.9E-04	4.2E-03	0.017	0.169
AMS-22	3.6E-07	9.0E-06	5.4E-04	2.3E-04	5.0E-04	6.8E-04	6.8E-10	2.2E-03	4.4E-06	8.9E-04	2.7E-05	1.2E-03	0.006	0.062
AMS-23	1.1E-07	2.8E-06	^g	7.1E-05	3.7E-03	5.1E-04	-	6.7E-04	4.9E-06	9.7E-04	-	1.3E-03	0.007	0.072
AMS-24	9.0E-08	2.2E-06	3.8E-03	5.6E-05	3.3E-04	4.0E-04	9.6E-10	5.4E-04	1.3E-06	4.3E-04	3.8E-05	3.5E-04	0.006	0.059
AMS-25	-	-	3.7E-04	-	-	2.2E-05	3.1E-10	-	2.1E-07	2.6E-05	1.2E-05	5.6E-05	0.000	0.005
AMS-26	7.0E-08	1.7E-06	1.6E-03	4.4E-05	1.0E-04	1.4E-04	7.9E-10	4.2E-04	2.5E-06	6.3E-04	3.1E-05	6.5E-04	0.004	0.036
AMS-27	4.1E-07	1.0E-05	4.9E-03	2.6E-04	5.6E-04	9.8E-04	9.6E-10	2.4E-03	2.7E-06	6.5E-04	3.8E-05	7.1E-04	0.011	0.105
AMS-28	8.8E-08	2.2E-06	3.6E-04	5.5E-05	1.5E-04	1.9E-04	1.8E-10	5.2E-04	5.1E-07	7.5E-05	6.9E-06	1.3E-04	0.001	0.015
AMS-29	1.9E-07	4.6E-06	-	1.2E-04	1.3E-03	6.9E-04	1.8E-09	1.1E-03	3.3E-06	7.8E-04	7.2E-05	8.7E-04	0.005	0.050
Background														
AMS-12	7.2E-07	1.8E-05	8.2E-04	4.5E-04	9.9E-04	1.1E-03	5.8E-10	4.3E-03	3.6E-06	1.1E-03	2.3E-05	9.7E-04	NA ^h	
AMS-16	1.6E-06	3.9E-05	5.9E-03	9.8E-04	1.9E-03	2.2E-03	4.5E-10	9.4E-03	4.3E-06	1.2E-03	1.8E-05	1.1E-03	NA ^h	

Maximum Quarterly Ratio: 0.0225
Maximum Quarterly Dose (mrem): 0.225

^aSee Figure 4-3

^bA "--" 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.

^cIsotopes assumed to be in equilibrium with their parents.

^dFirst quarter 1999 radium-226 data were rejected and substituted with first quarter 1998 radium-226 data.

^eDose conversions are based on the NESHAP standard of 10 mrem per year.

^fSample was lost during processing.

^hNA = not applicable

TABLE 4-5
NESHAP STACK EMISSION MONITORING RESULTS

Analysis Performed	Third Quarter 1999 Results		1999 Year-to-Date Results		1998 Summary Results	
	No. of Samples	Total Pounds ^{a,b}	No. of Samples	Total Pounds ^{a,b}	No. of Samples	Total Pounds ^a
Building 71 Stack						
Uranium, Total	1	ND	3	2.2E-05	5	1.3E-05
Thorium-232	1	7.0E-06	3	5.2E-05	5	8.6E-05
Thorium-230	1	1.3E-10	3	7.4E-10	5	1.2E-09
Total Particulate	1	1.0E-02	2 ^c	1.5E-02	1 ^c	7.2E-02
Laundry Stack						
Uranium, Total	2	ND	6	ND	10	7.0E-06
Thorium-232	2	1.0E-04	6	4.2E-04	10	4.5E-04
Thorium-230	2	1.4E-09	6	4.9E-09	10	5.8E-09
Total Particulate	1 ^c	1.1E-01	5	3.9E-01	8 ^c	1.1E+00

^aTotal pounds are only determined from detected results.

^bND = non-detectable

^cSome particulate result(s) could not be determined due to a damaged filter(s).

000107

2687

TABLE 4-6

**CONTINUOUS ENVIRONMENTAL RADON MONITORING
MONTHLY AVERAGE CONCENTRATIONS^a**

Location ^b	Third Quarter 1999 Monthly Results ^{c,d} (Instrument Background Corrected) (pCi/L)			1999 Summary Results ^c (Instrument Background Corrected) (pCi/L)			1998 Summary Results ^{c,d} (Instrument Background Corrected) (pCi/L)		
	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
Fenceline									
AMS-02	0.6	1.0	0.8	0.2	1.0	0.5	0.2	0.7	0.4
AMS-03	0.6	1.0	0.8	0.1	1.0	0.4	0.6	0.8	0.7
AMS-04	0.5	0.8	0.6	0.1	0.8	0.4	0.1	0.7	0.4
AMS-05	0.8	1.4	1.0	0.2	1.4	0.6	0.2	1.3	0.6
AMS-06	0.6	0.8	0.7	0.2	0.8	0.5	0.2	0.9	0.5
AMS-07	0.9	1.5	1.1	0.3	1.5	0.7	0.2	1.5	0.7
AMS-08A ^e	0.3	0.6	0.5	0.1	0.8	0.4	0.8	NA	NA
AMS-09C	0.6	0.8	0.6	0.2	0.8	0.5	0.2	0.9	0.6
AMS-22	0.4	0.5	0.5	0.1	0.5	0.3	0.2	0.7	0.4
AMS-23	0.4	0.6	0.5	0.1	0.6	0.3	0.4	0.5	0.4
AMS-24 ^c	0.6	1.1	0.8	0.2	1.1	0.5	0.7	NA	NA
AMS-25 ^c	0.5	0.8	0.7	0.2	0.8	0.4	0.6	NA	NA
AMS-26	0.5	0.8	0.6	0.2	0.8	0.4	0.2	0.8	0.6
AMS-27	0.8	1.1	0.9	0.2	1.1	0.5	0.2	1.1	0.7
AMS-28 ^c	0.6	0.8	0.7	0.1	0.8	0.4	0.4	NA	NA
AMS-29 ^c	0.4	0.8	0.5	0.1	0.8	0.3	0.7	NA	NA
Background									
AMS-12	0.3	0.5	0.4	0.1	0.5	0.2	0.1	0.6	0.3
AMS-16	0.3	0.5	0.4	0.1	0.5	0.2	0.2	0.6	0.4
On Site									
KNE	6.2	9.3	7.9	6.2	18.3	10.4	2.0	18.2	9.1
KNW	2.1	4.2	2.9	2.1	4.2	3.2	1.0	4.8	2.4
KSE	2.8	5.4	4.1	2.8	9.9	5.5	2.4	16.9	8.3
KSW	2.1	4.2	2.8	2.1	4.2	3.1	1.4	5.2	3.1
KTOP	5.2	7.4	6.0	5.2	15.8	9.7	7.2	24.6	13.0
Pilot Plant Warehouse	0.5	0.8	0.6	0.3	0.8	0.4	0.1	0.9	0.4
Rally Point 4	0.6	1.0	0.7	0.5	1.3	0.7	0.2	1.3	0.7
Surge Lagoon	0.6	1.0	0.8	0.4	1.0	0.6	0.3	1.3	0.7
T28	2.5	3.8	3.4	1.2	3.8	2.3	0.9	2.8	1.8
TS4 ^f	0.5	0.8	0.6	0.2	0.8	0.4	NA	NA	NA
WP-17A	0.6	0.9	0.7	0.1	0.9	0.5	0.2	0.9	0.5

^aMonthly average radon concentrations are calculated from daily average concentrations. Daily average concentrations are calculated by summing all hourly count data, treating the sum as a single daily measurement, and then converting the sum to a (daily average) concentration.

^bRefer to Figure 4-27

^cInstrument background changes as monitors are replaced

^dNA = not applicable

^eUnit was placed in service in December 1998.

^fUnit was placed in service in January 1999.

000108

TABLE 4-7
RADON HEAD SPACE CONCENTRATIONS

Radon Head Space Concentrations ^{a,b,c} (pCi/L)												
Month	Silo 1 1999			Silo 1 1998			Silo 2 1999			Silo 2 1998		
	Min.	Max.	Avg.									
January	1.24E+07	1.44E+07	1.34E+07	1.06E+07	1.18E+07	1.13E+07	8.78E+06	1.11E+07	9.95E+06	8.24E+06	1.01E+07	9.10E+06
February	1.27E+07	1.35E+07	1.32E+07	1.06E+07	1.18E+07	1.12E+07	8.70E+06	9.68E+06	9.20E+06	8.02E+06	9.48E+06	8.96E+06
March	1.25E+07	1.33E+07	1.29E+07	1.01E+07	1.17E+07	1.10E+07	8.66E+06	9.89E+06	9.30E+06	7.27E+06	9.19E+06	8.45E+06
April	1.22E+07	1.30E+07	1.25E+07	9.89E+06	1.09E+07	1.05E+07	7.74E+06	8.53E+06	8.10E+06	7.34E+06	8.87E+06	8.14E+06
May	1.21E+07	1.32E+07	1.26E+07	1.05E+07	1.20E+07	1.10E+07	7.77E+06	8.73E+06	8.21E+06	8.38E+06	8.99E+06	8.62E+06
June	1.25E+07	1.36E+07	1.30E+07	1.08E+07	1.22E+07	1.15E+07	8.04E+06	9.08E+06	8.50E+06	8.25E+06	9.05E+06	8.62E+06
July	1.26E+07	1.43E+07	1.36E+07	1.20E+07	1.41E+07	1.29E+07	8.40E+06	9.06E+06	8.69E+06	8.79E+06	9.44E+06	9.06E+06
August	1.34E+07	1.43E+07	1.37E+07	1.34E+07	1.43E+07	1.39E+07	8.29E+06	8.92E+06	8.58E+06	8.73E+06	9.08E+06	8.93E+06
September	1.28E+07	1.49E+07	1.40E+07	1.23E+07	1.42E+07	1.31E+07	8.20E+06	8.77E+06	8.52E+06	7.78E+06	8.79E+06	8.15E+06

^aMinimum equals minimum recorded daily average radon concentration.

^bMaximum equals maximum recorded daily average radon concentration.

^cAverage equals monthly average of recorded daily radon concentrations.

-- 2687

TABLE 4-8
DIRECT RADIATION (TLD) MEASUREMENTS

Location ^a	Direct Radiation (mrem)		
	Third Quarter 1999 Results ^b	1999 Year-to-Date Results ^c	1998 Summary Results ^b
Fenceline			
2	19	56	74
3	19	53	67
4	18	51	66
5	18	53	68
6	21	62	84
7	18	52	69
8A	19	56	75
9C	21	58	79
13	19	56	74
14	19	54	77
15	21	59	79
16	22	62	81
17	19	52 ^d	73
34	20	57	75
35	18	54	70
36	16	48	65
37	20	57	77
38	17	48	63
39	21	60	79
40	17	52	67
41	19	55	73
Min.	16	48	63
Max.	22	62	84
On Site			
22	209	626	776
23 ^{e,f}	NA	645	817
23A ^{e,f}	214	674	NA
24	199	507	632 ^g
25	226	644	698
26	143	403	496
32	14	42	55
Min.	14	42	55
Max.	226	674	817
Background			
18	20	59	77
19	16	48	65
20	16	48	61
27	16	48	64
33	17	51	68
Min.	16	48	61
Max.	20	59	77

^aRefer to Figure 4-29

^bNA = not applicable

^c1999 summary result value may not always agree with quarterly results due to rounding differences.

^dEstimated second quarter direct radiation levels

^eDirect radiation levels for TLD locations 23 and 23A were extrapolated for second quarter results.

^fTLD location 23 was relocated to TLD location 23A on May 26, 1999.

^gDirect radiation value includes estimated second quarter results which were based on first quarter results.

FIGURE 4-1

AIR SAMPLING ACTIVITIES COVERED IN THIS QUARTERLY REPORT

SAMPLING ACTIVITIES

Radiological Particulate Monitoring:

 NESHAP Quarterly Composite

NESHAP Stack Emissions Monitoring

Radon Monitoring – Continuous Alpha Scintillation Monitors

Direct Radiation (TLD) Monitoring

1999											
First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
						♦	♦	♦			
								♦			
						♦	♦	♦			
						♦	♦	♦			
								♦			

♦ Data summarized/evaluated in this report

FINAL

FIGURE 4-2

AIR SAMPLING ACTIVITIES COVERED IN THE NEXT QUARTERLY REPORT

SAMPLING ACTIVITIES

Radiological Particulate Monitoring:

NESHAP Quarterly Composite

NESHAP Stack Emissions Monitoring

Radon Monitoring - Continuous Alpha Scintillation Monitors

Direct Radiation (TLD) Monitoring

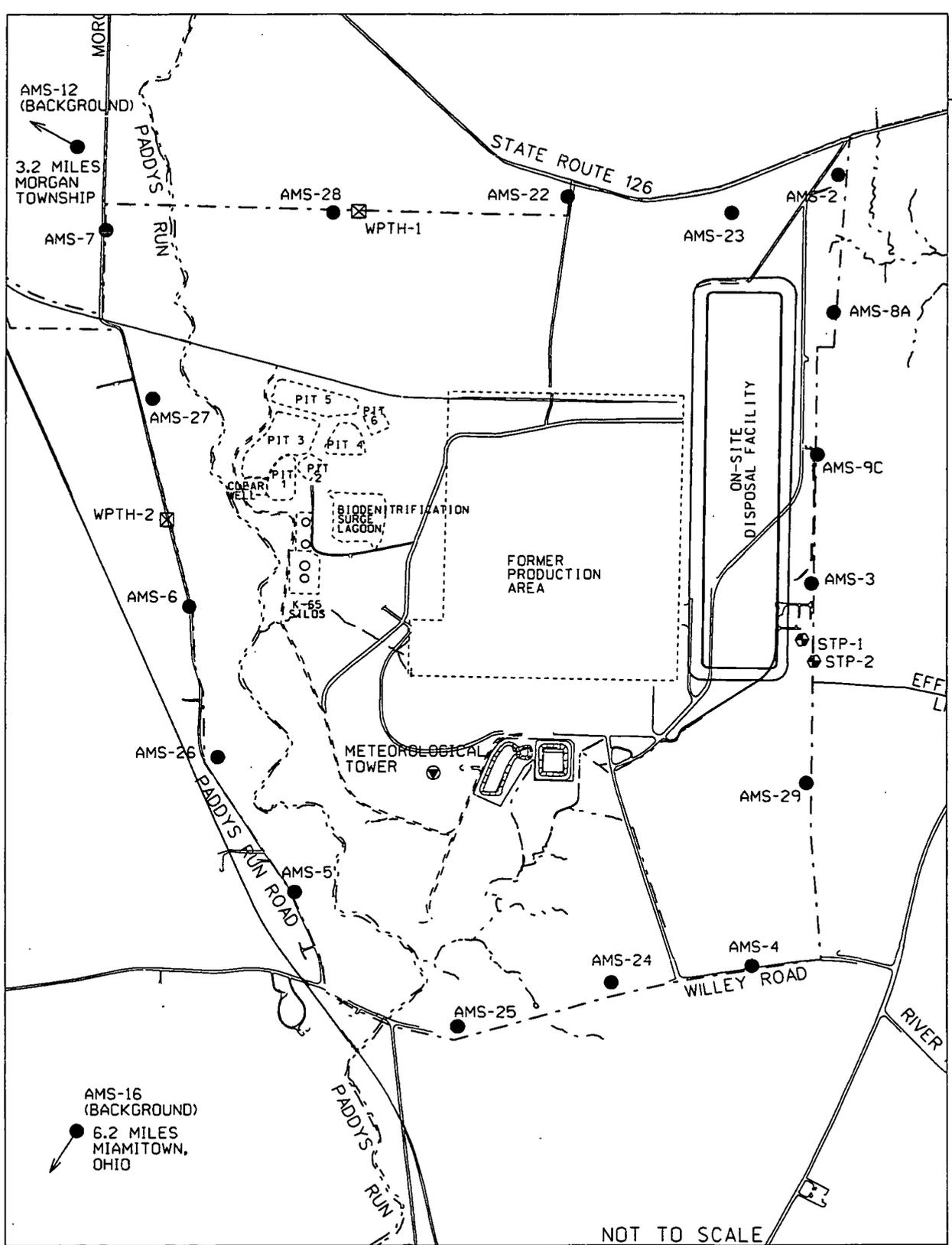
1999											
First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
J A N	F E B	M A R	A P R	M A Y	J U N	J U L	A U G	S E P	O C T	N O V	D E C
									◆	◆	◆
											◆
									◆	◆	◆
									◆	◆	◆
											◆

◆ Data summarized/evaluated in the next report

FINAL

V:*GP1*MOGNC01R3C01S012.DGN

11-24-99



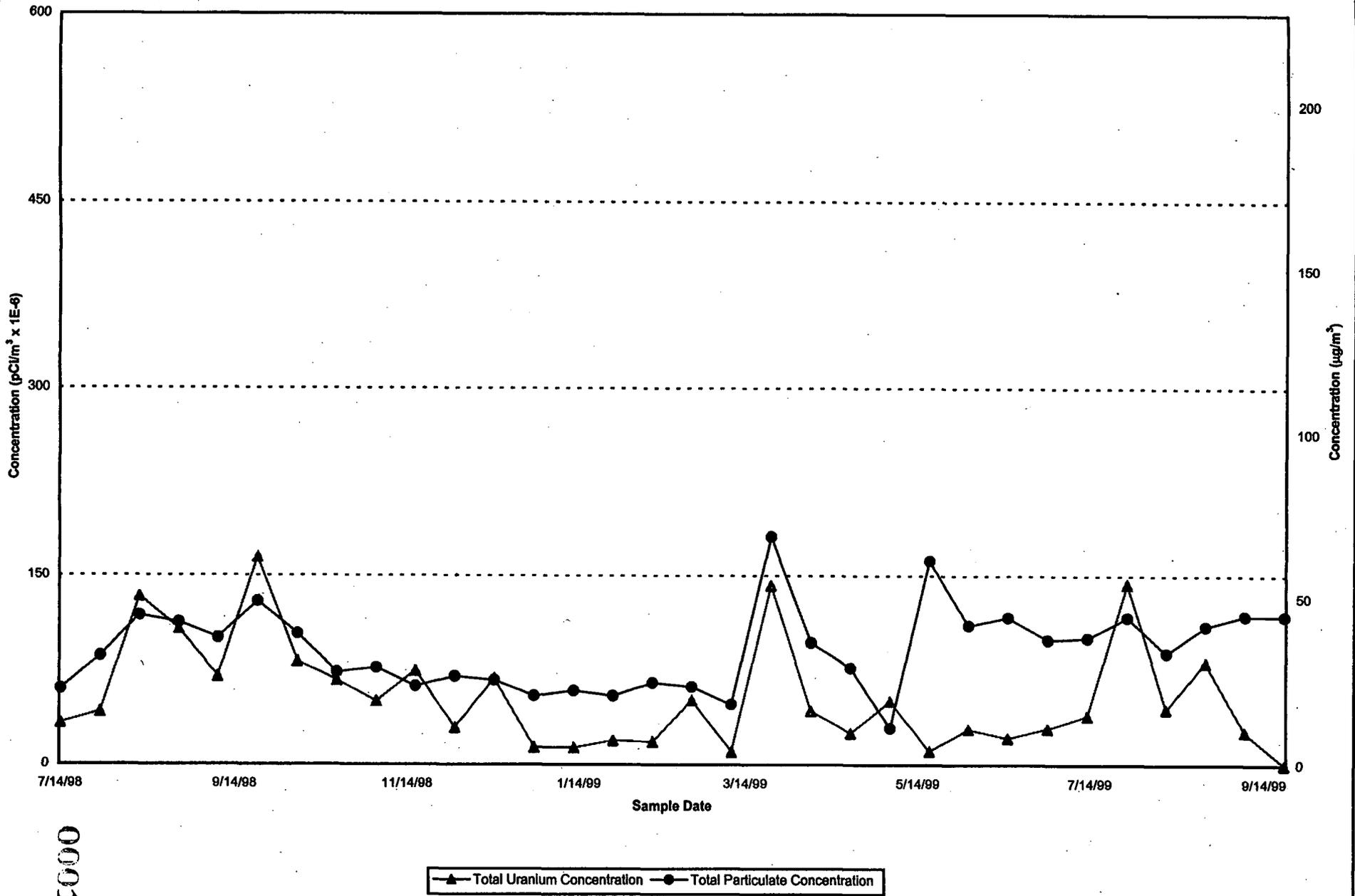
LEGEND:

- - - - - FEMP BOUNDARY
- AMS LOCATION
- ☒ THORIUM MONITOR LOCATION
- ◆ PROJECT SPECIFIC LOCATION
- (with arrow) DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO AMS LOCATION OFF MAP

FINAL

FIGURE 4-3. IEMP AIR MONITORING LOCATIONS

000113



000114

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

FINAL

2687

000115
ST1600

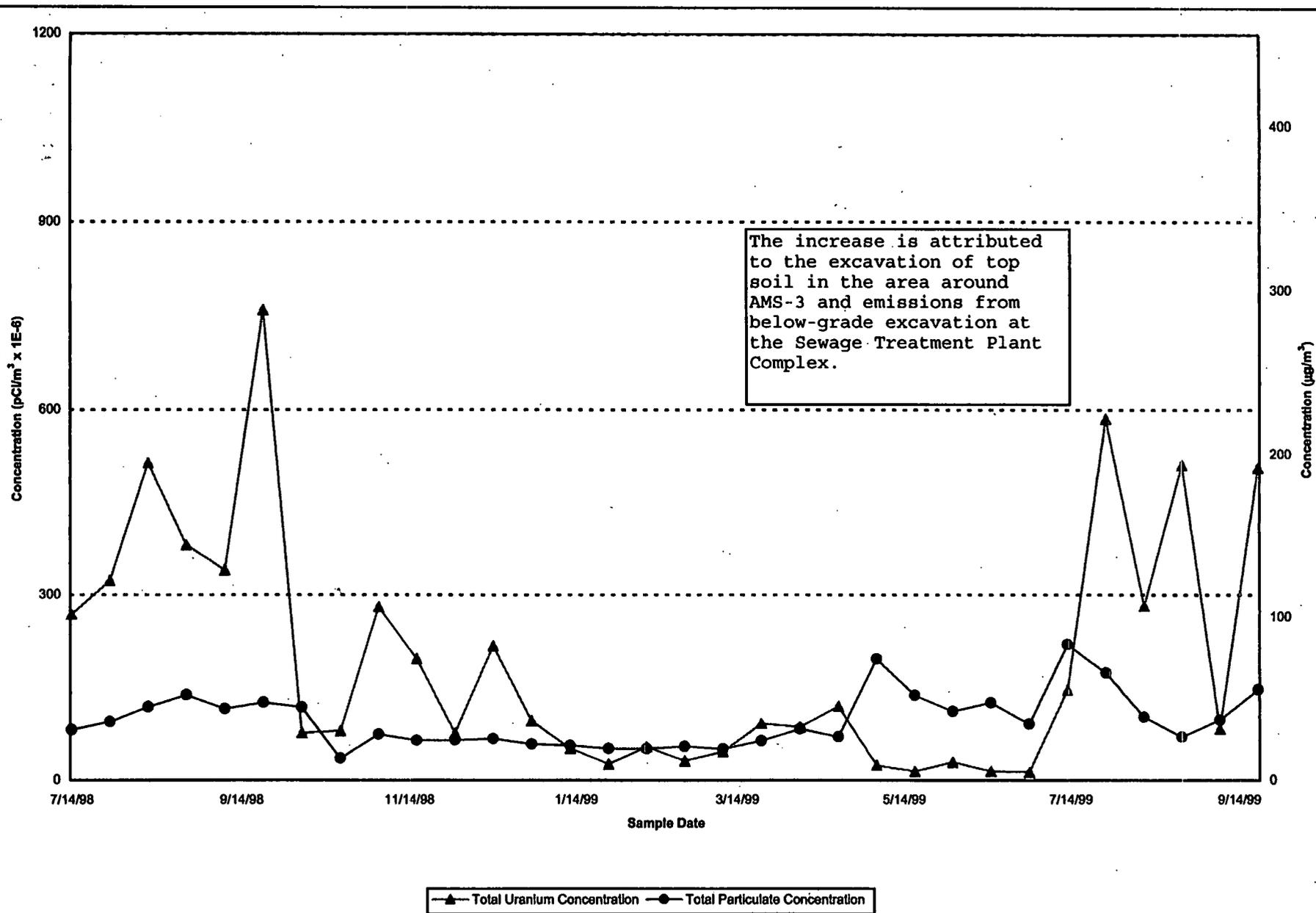


FIGURE 4-5. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-3)

FINAL

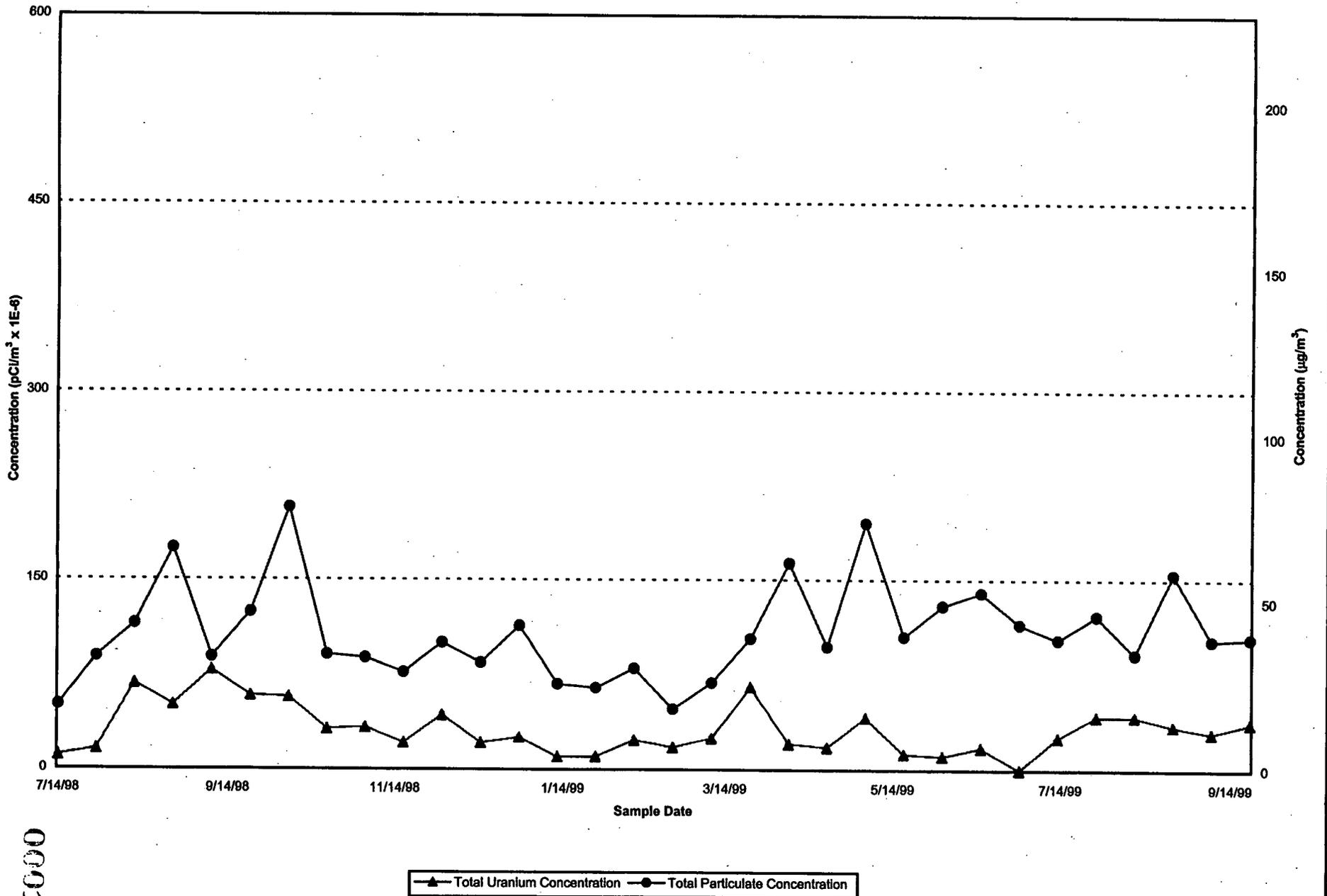


FIGURE 4-6. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-4)

000116

2687

FINAL

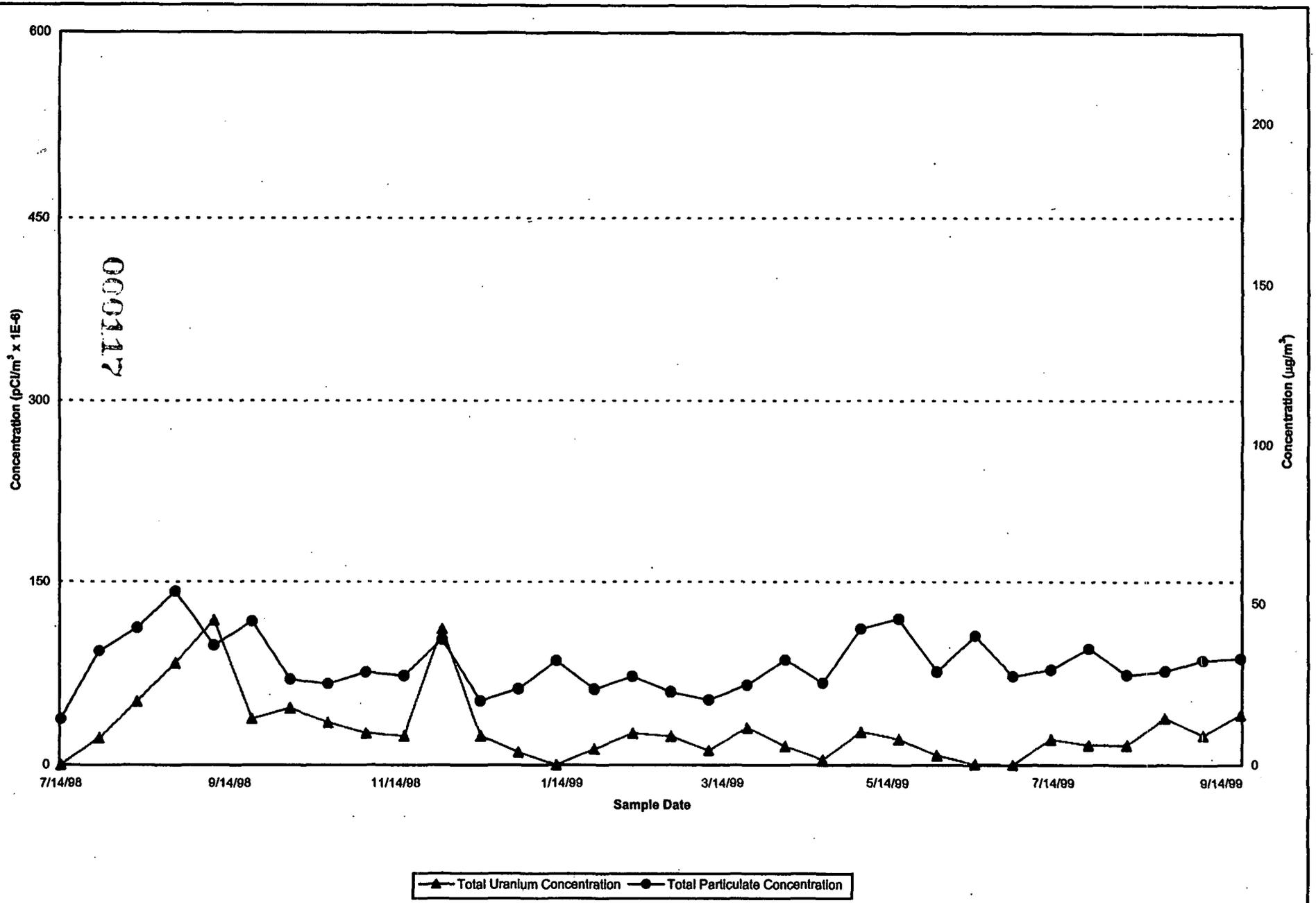


FIGURE 4-7. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-5)

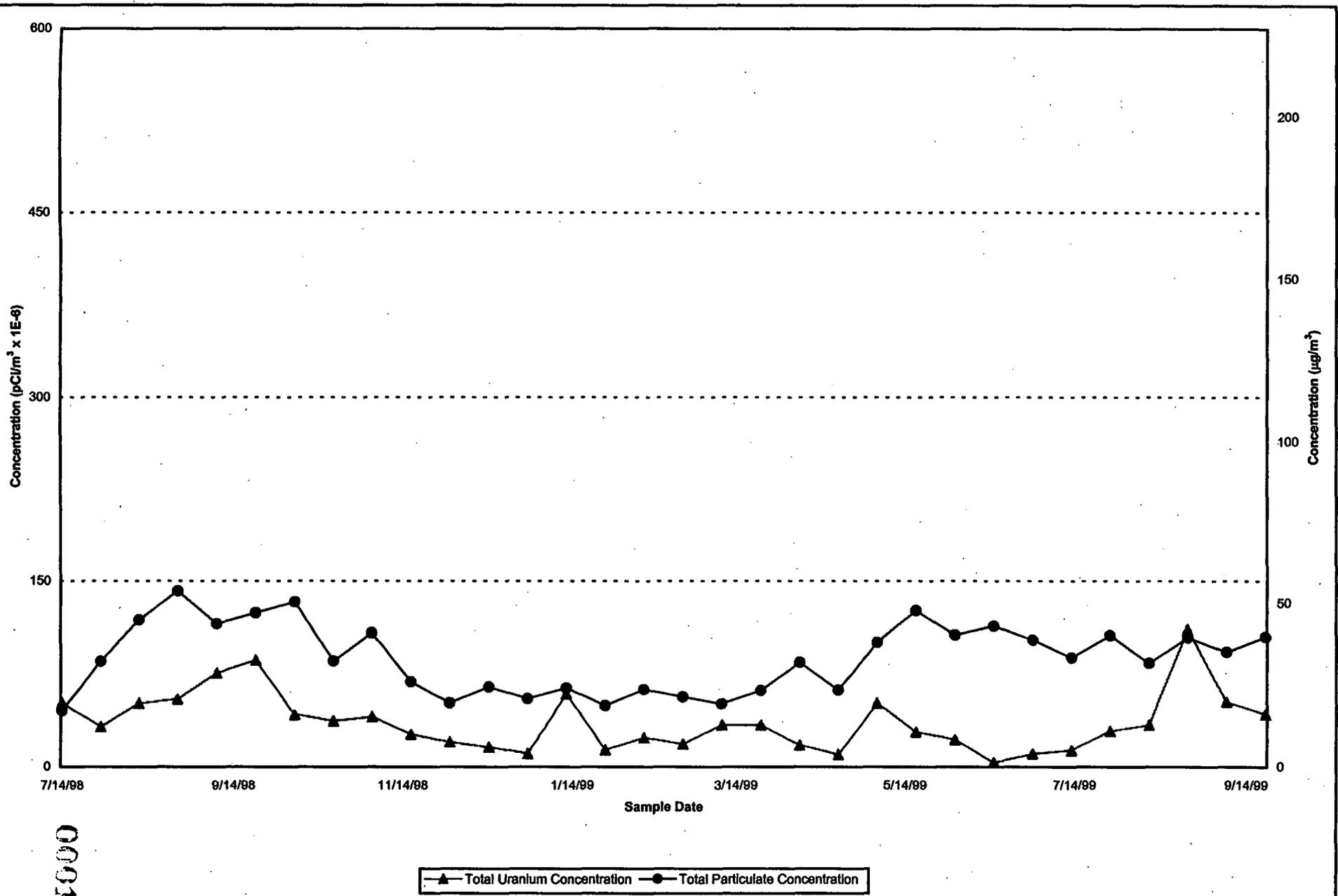


FIGURE 4-8. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-6)

000118

2687

FINAL

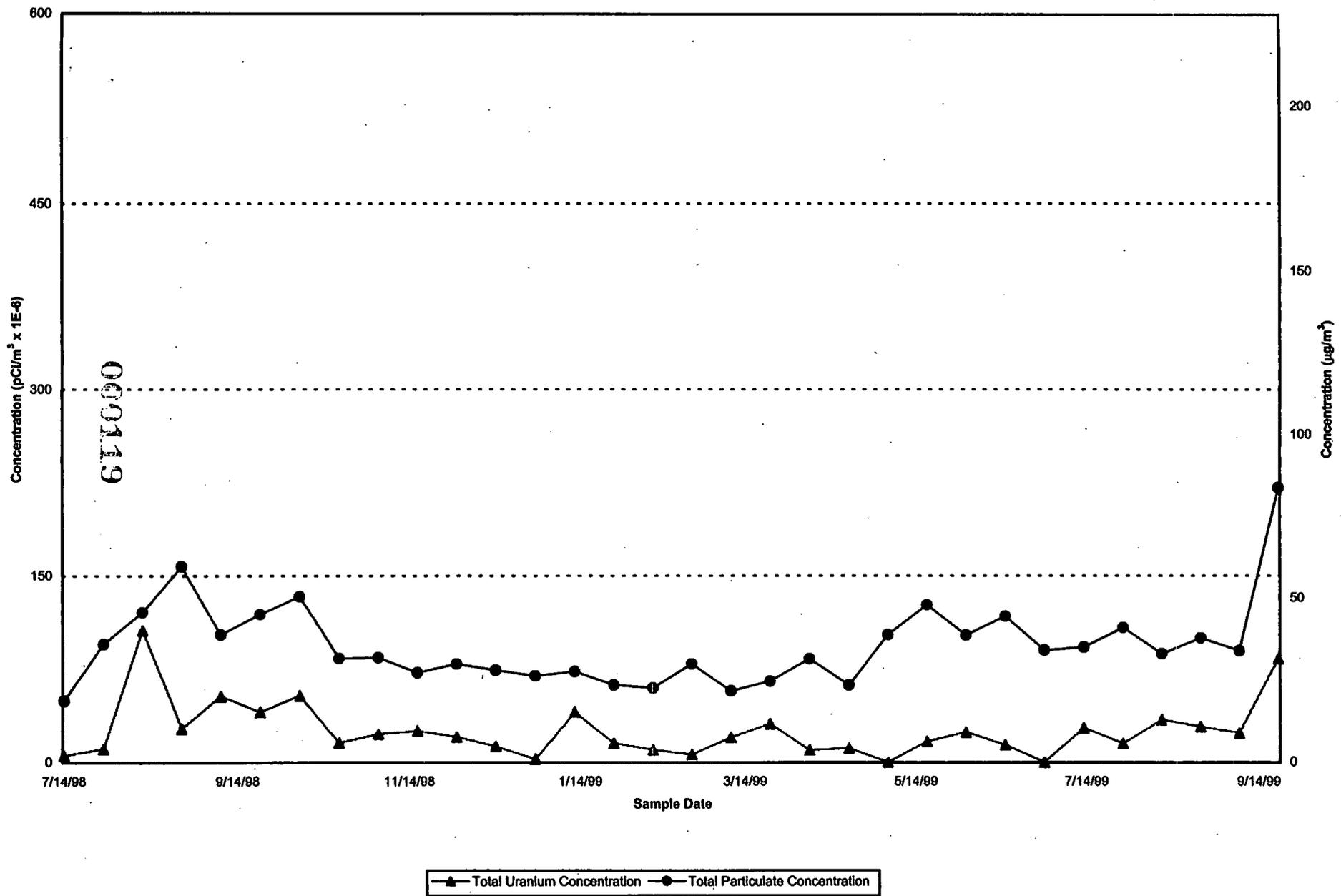
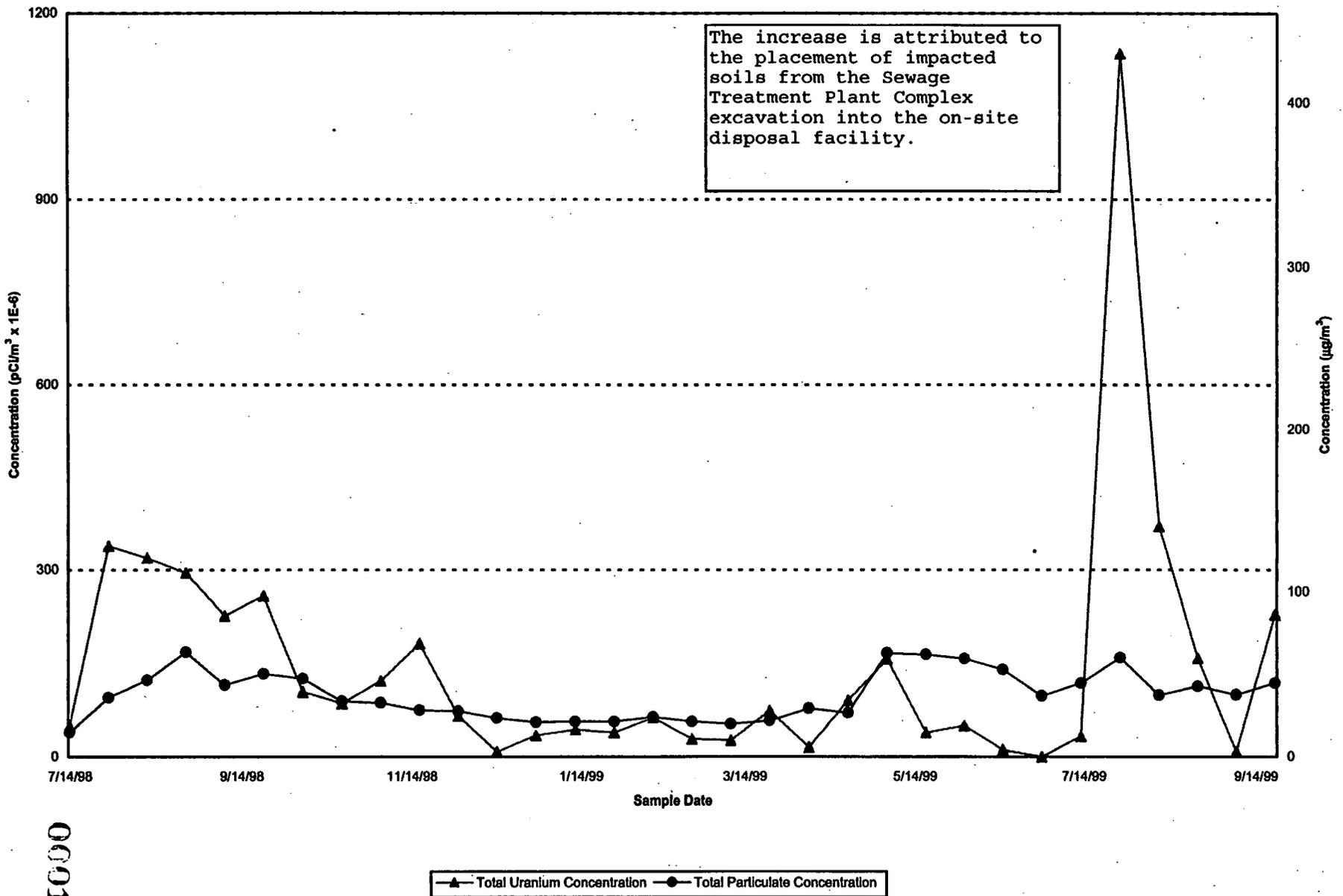


FIGURE 4-9. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-7)

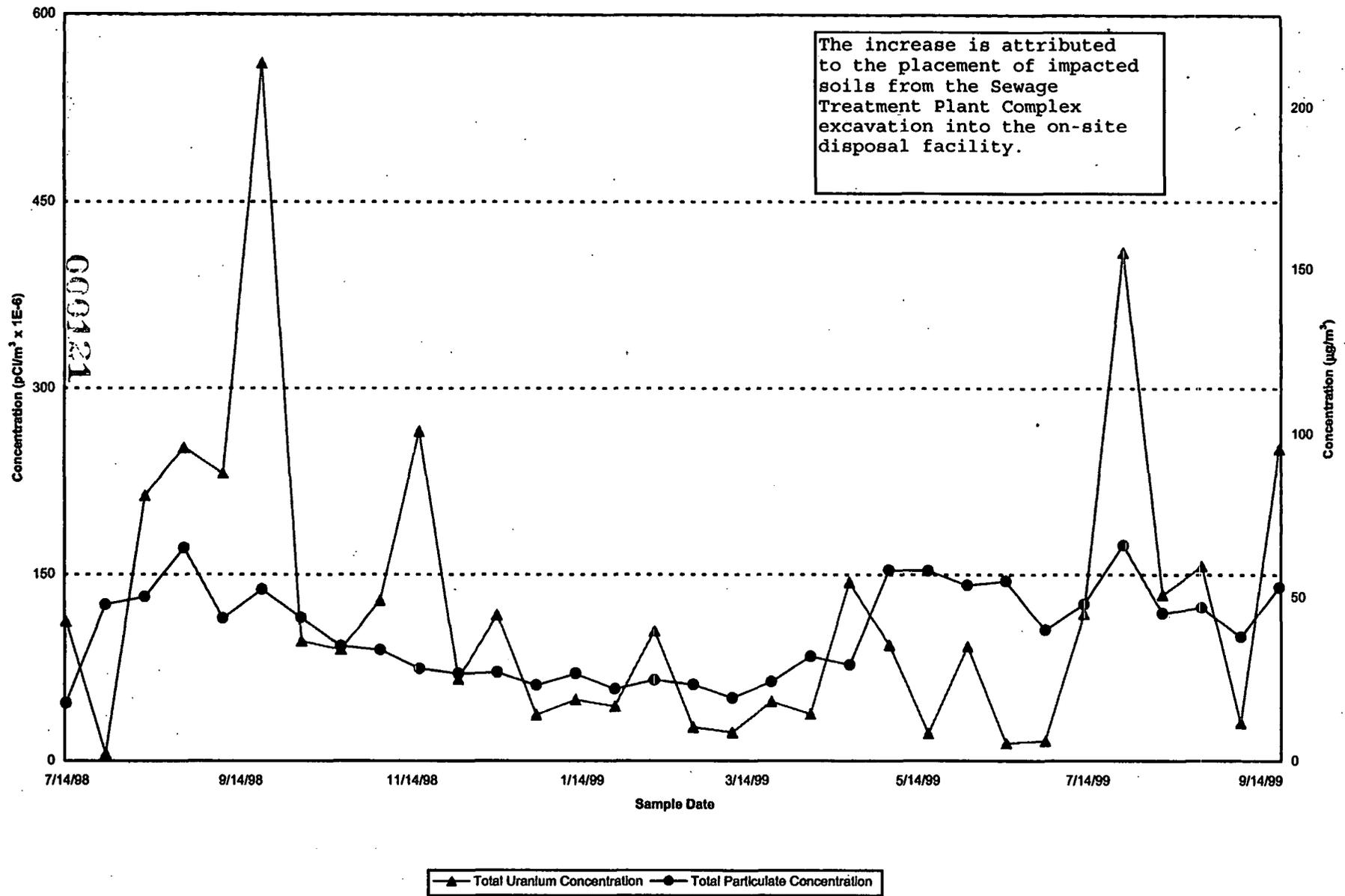


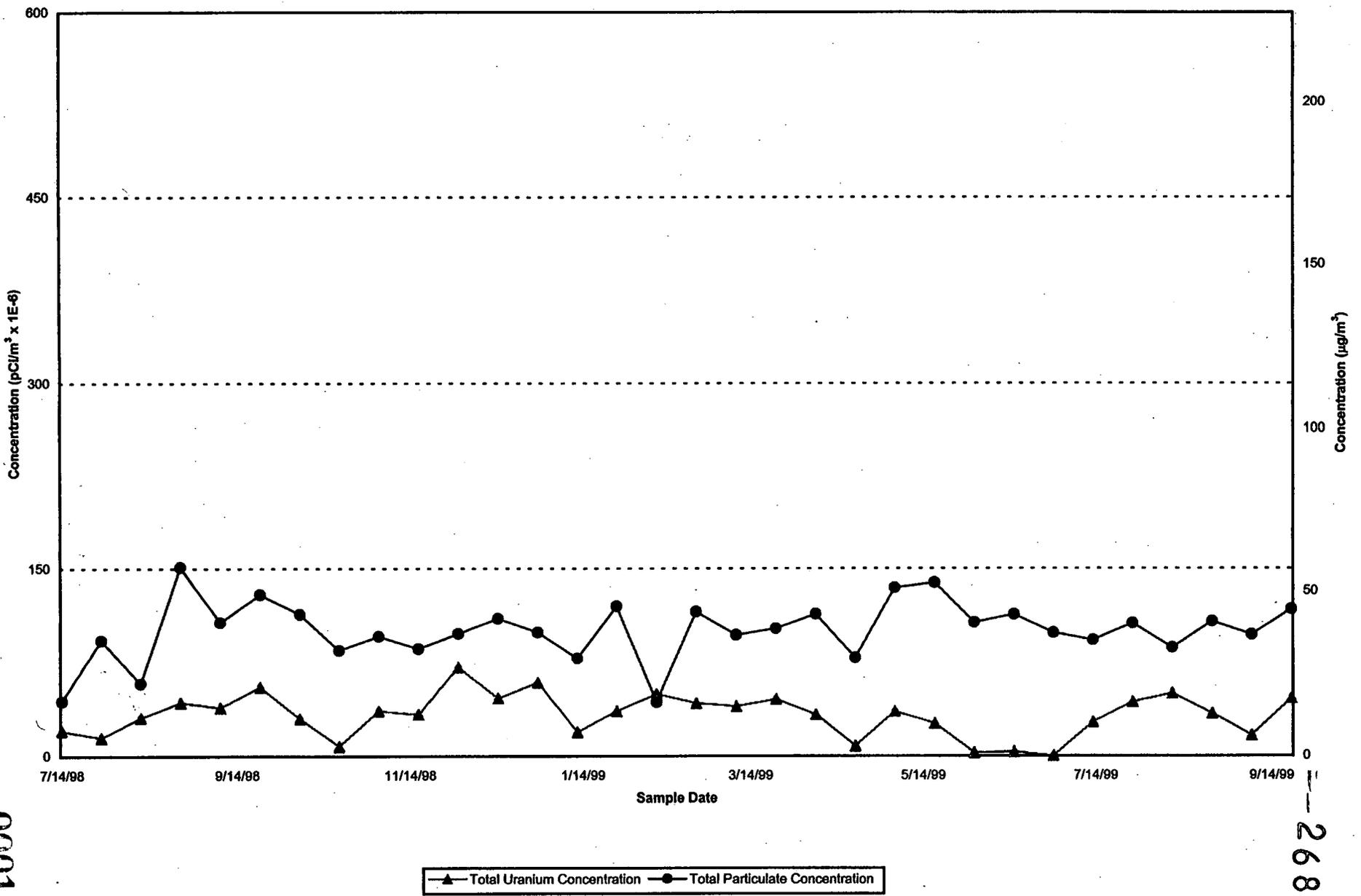
000120

FIGURE 4-10. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-8A)

FINAL

2687





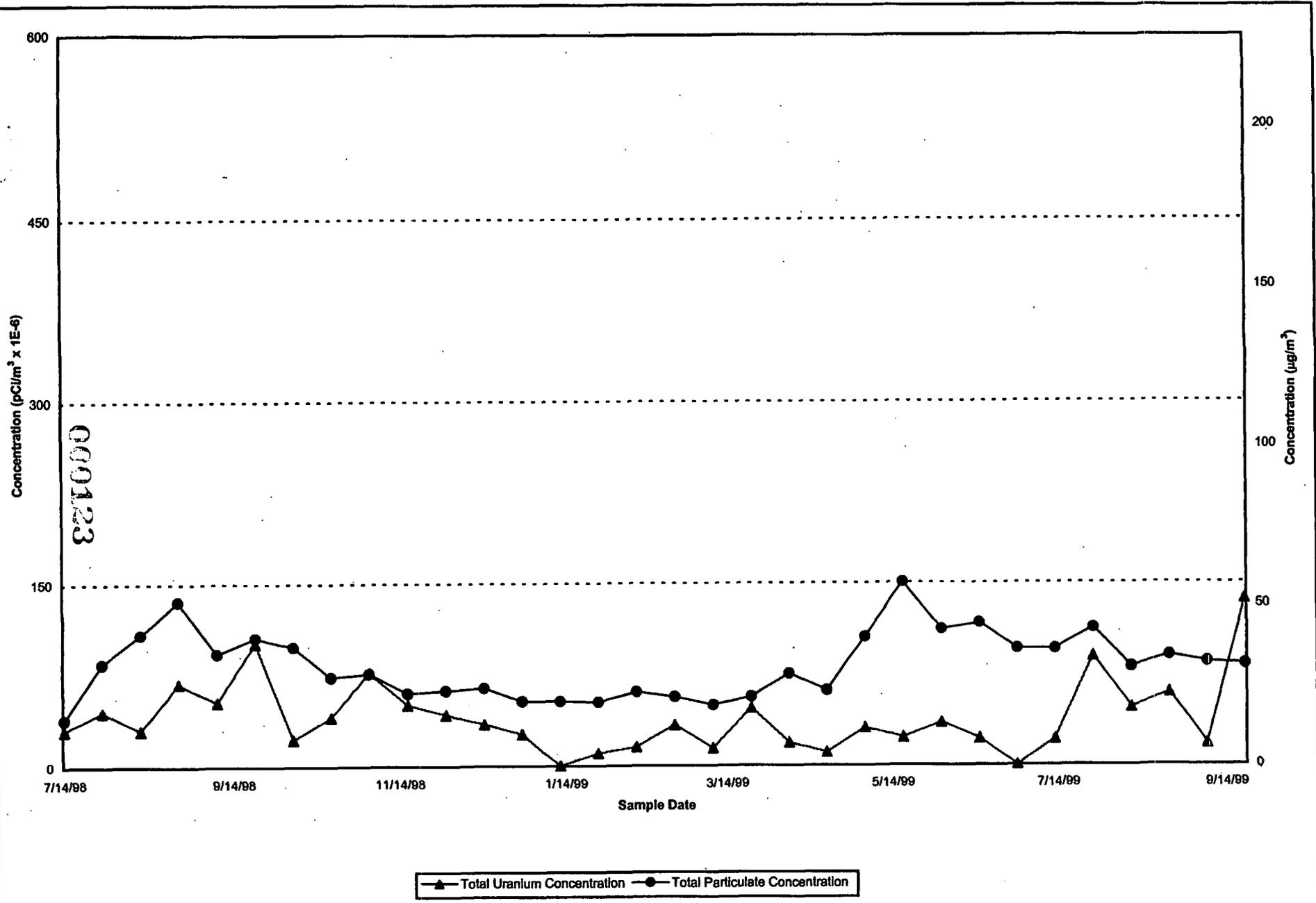
▲ Total Uranium Concentration ● Total Particulate Concentration

FIGURE 4-12. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-22)

000122

2687

FINAL



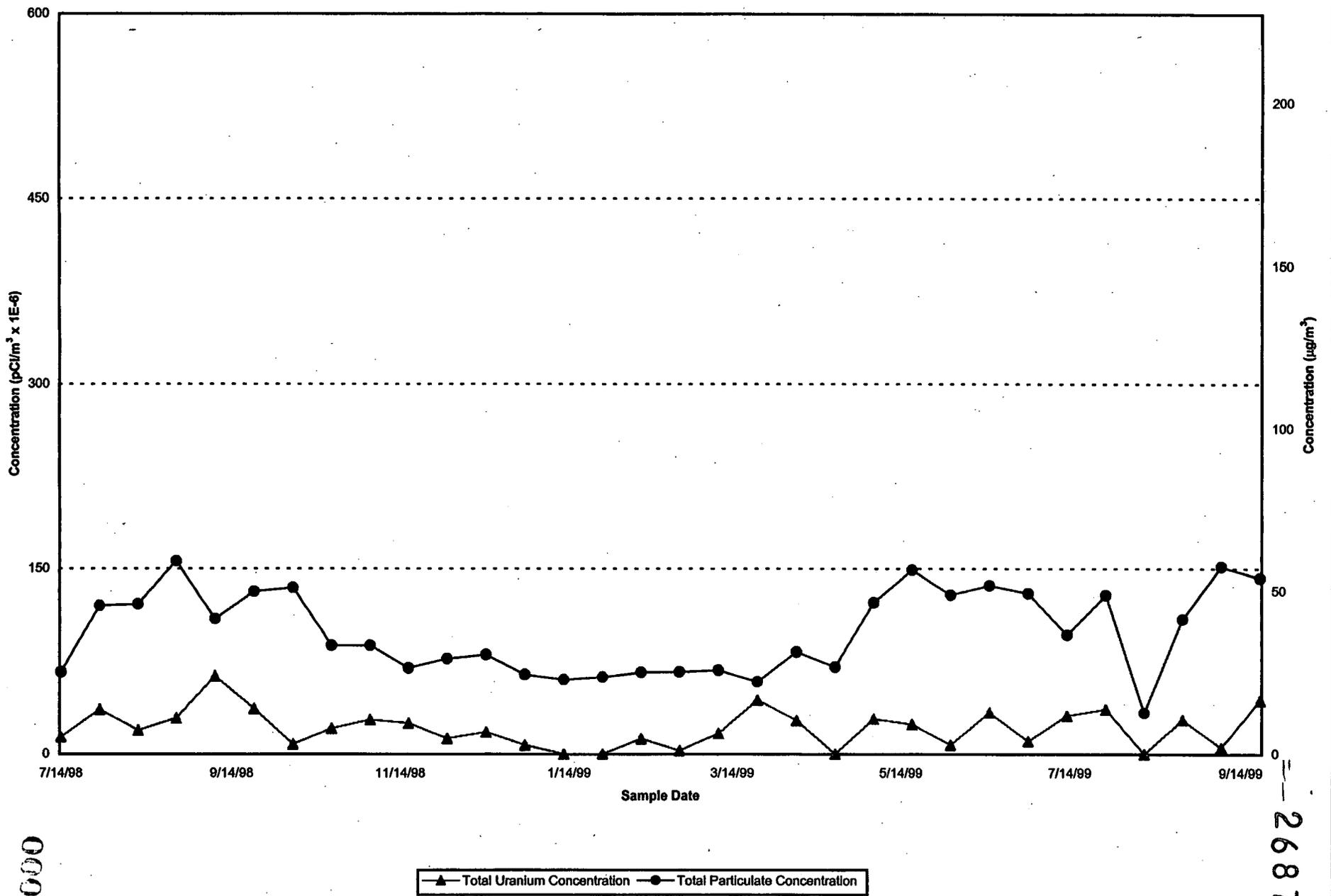


FIGURE 4-14. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-24)

000124

2687

FINAL

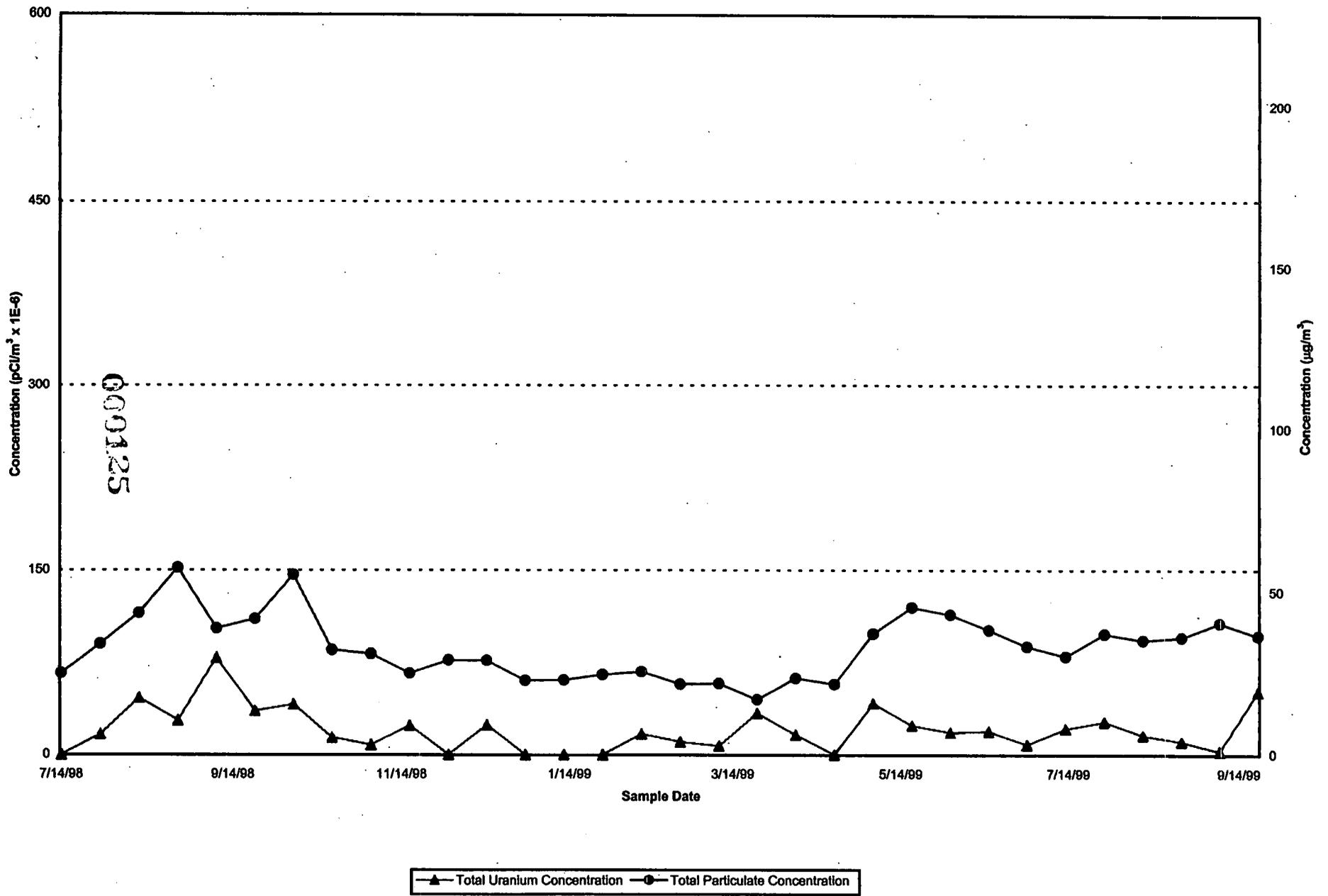


FIGURE 4-15. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-25)

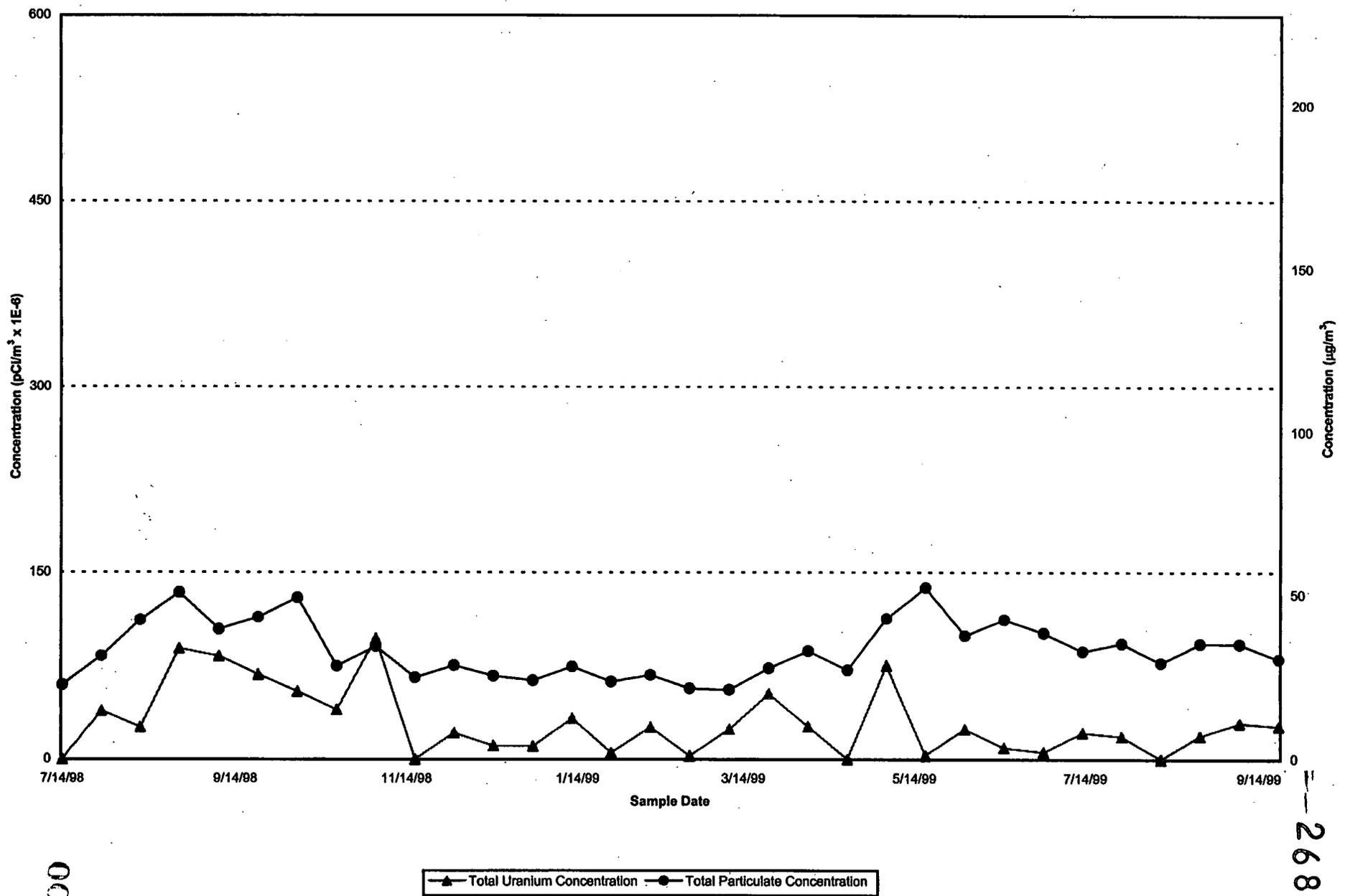


FIGURE 4-16. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-26)

000126

2687

FINAL

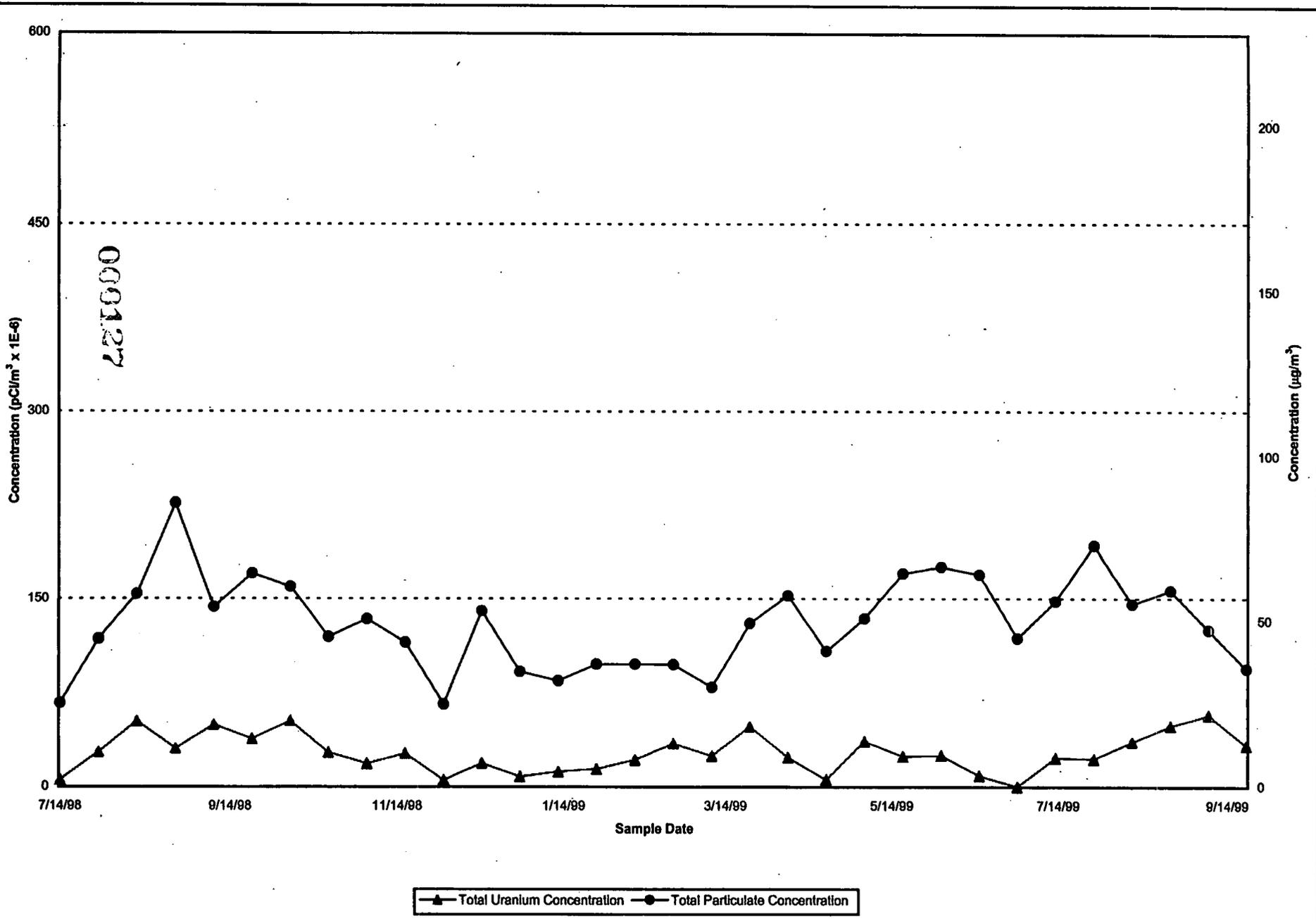


FIGURE 4-17. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-27)

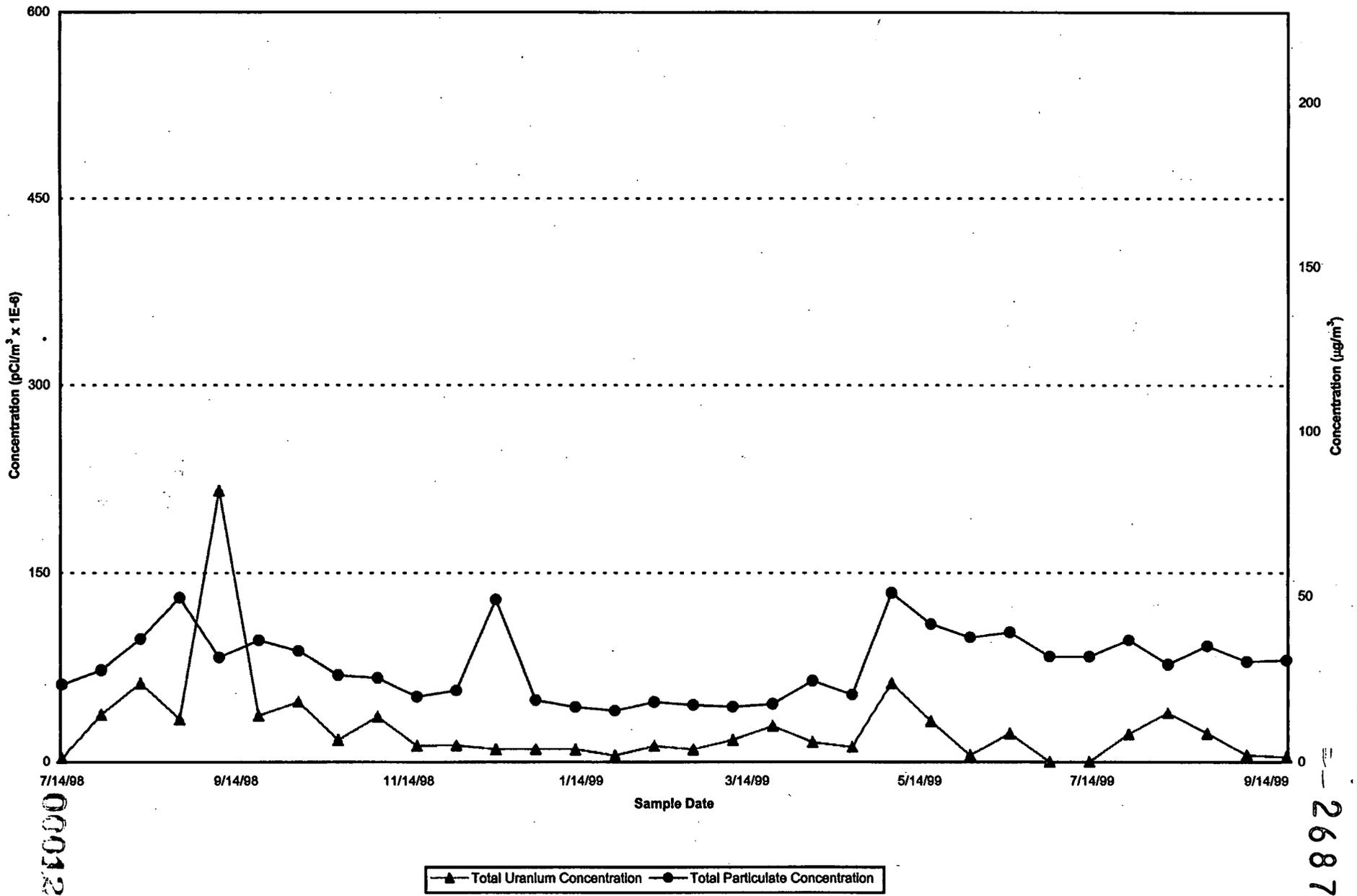


FIGURE 4-18. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-28)

000128

2687

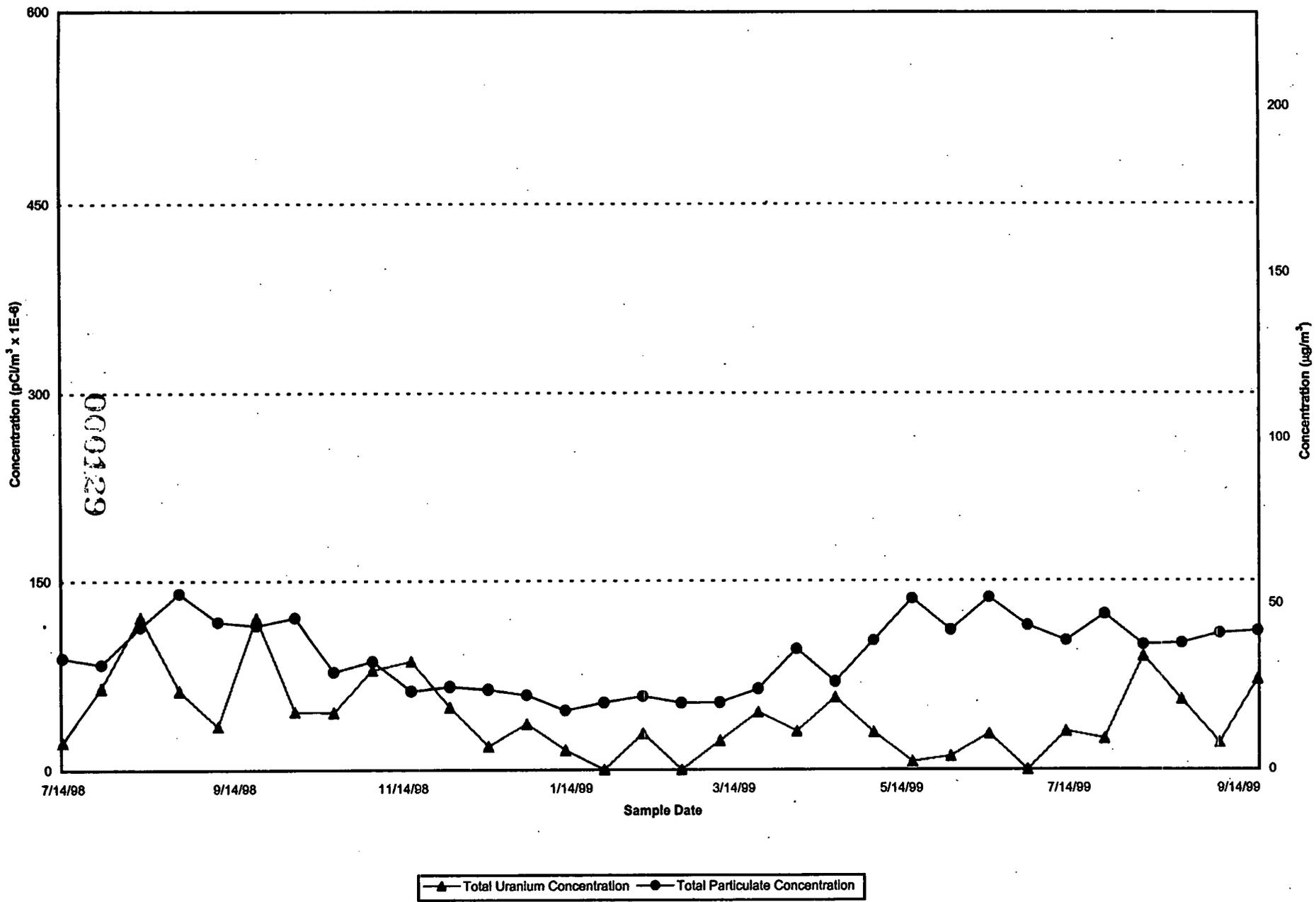


FIGURE 4-19. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-29)

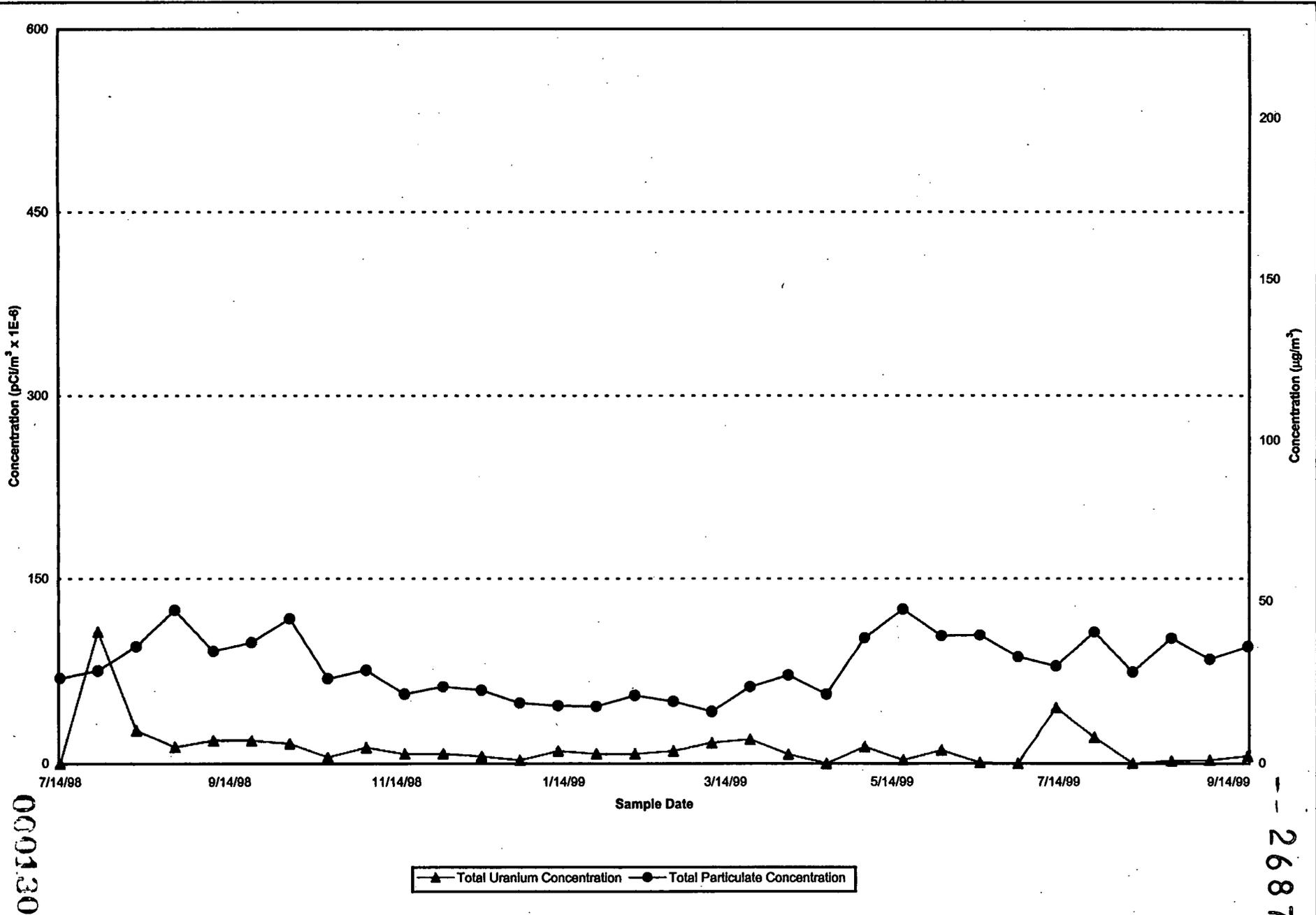


FIGURE 4-20. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-12)

000130

2687
FINAL

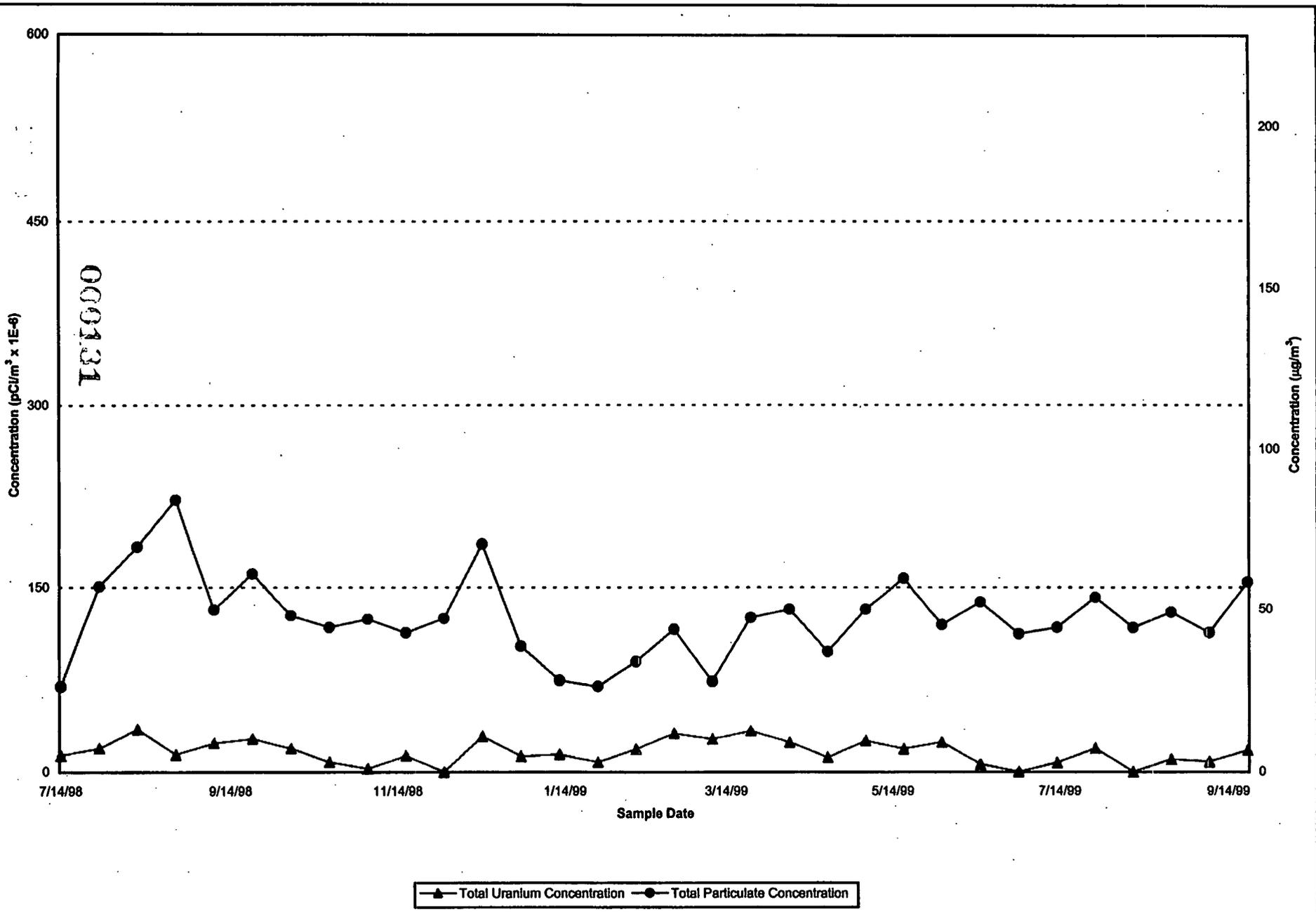
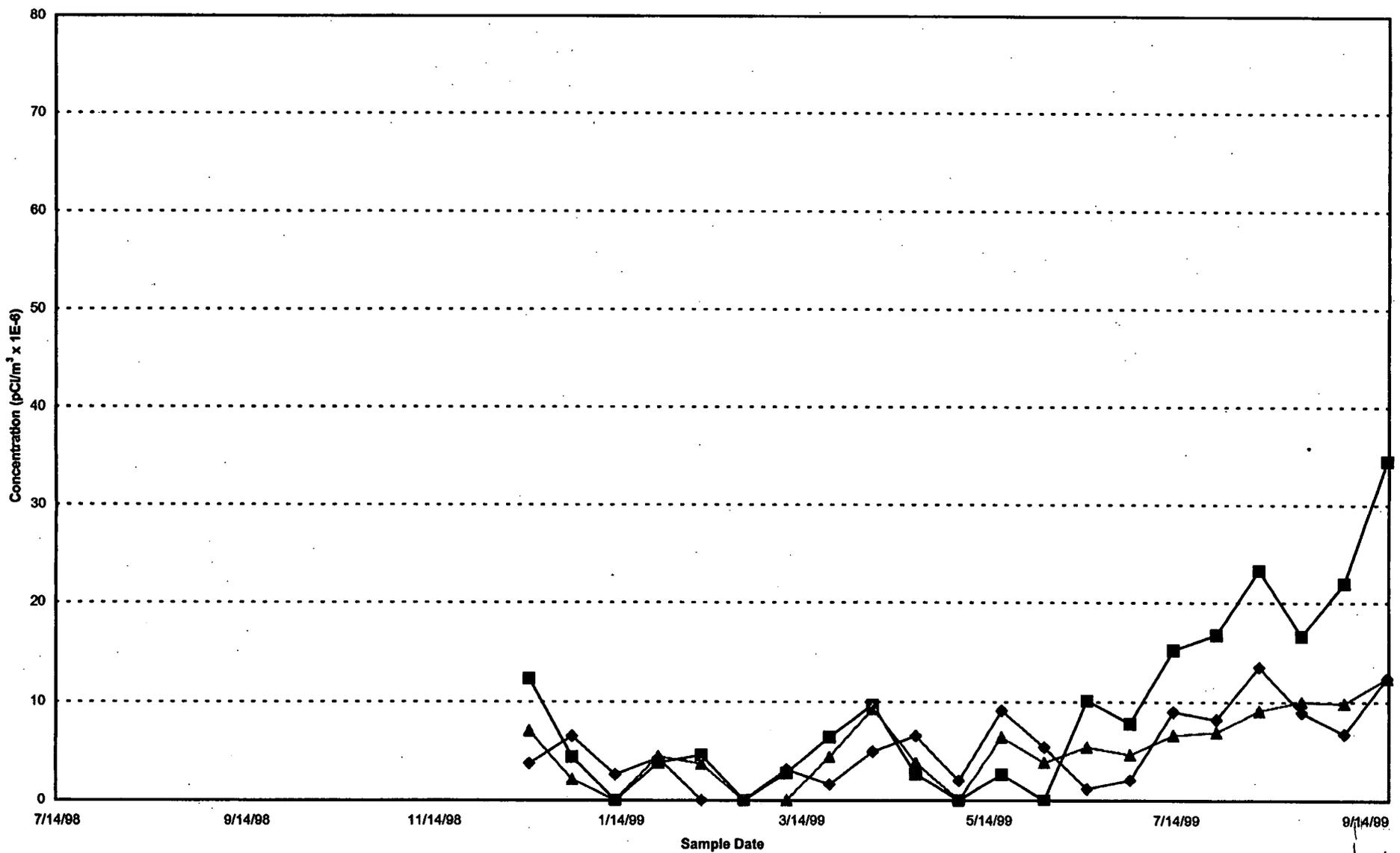


FIGURE 4-21. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-16)



◆ Thorium-228 ■ Thorium-230 ▲ Thorium-232

FIGURE 4-22. THORIUM-228, THORIUM-230, AND THORIUM-232 CONCENTRATIONS IN AIR (WPTH-1)

000122

2687

FINAL

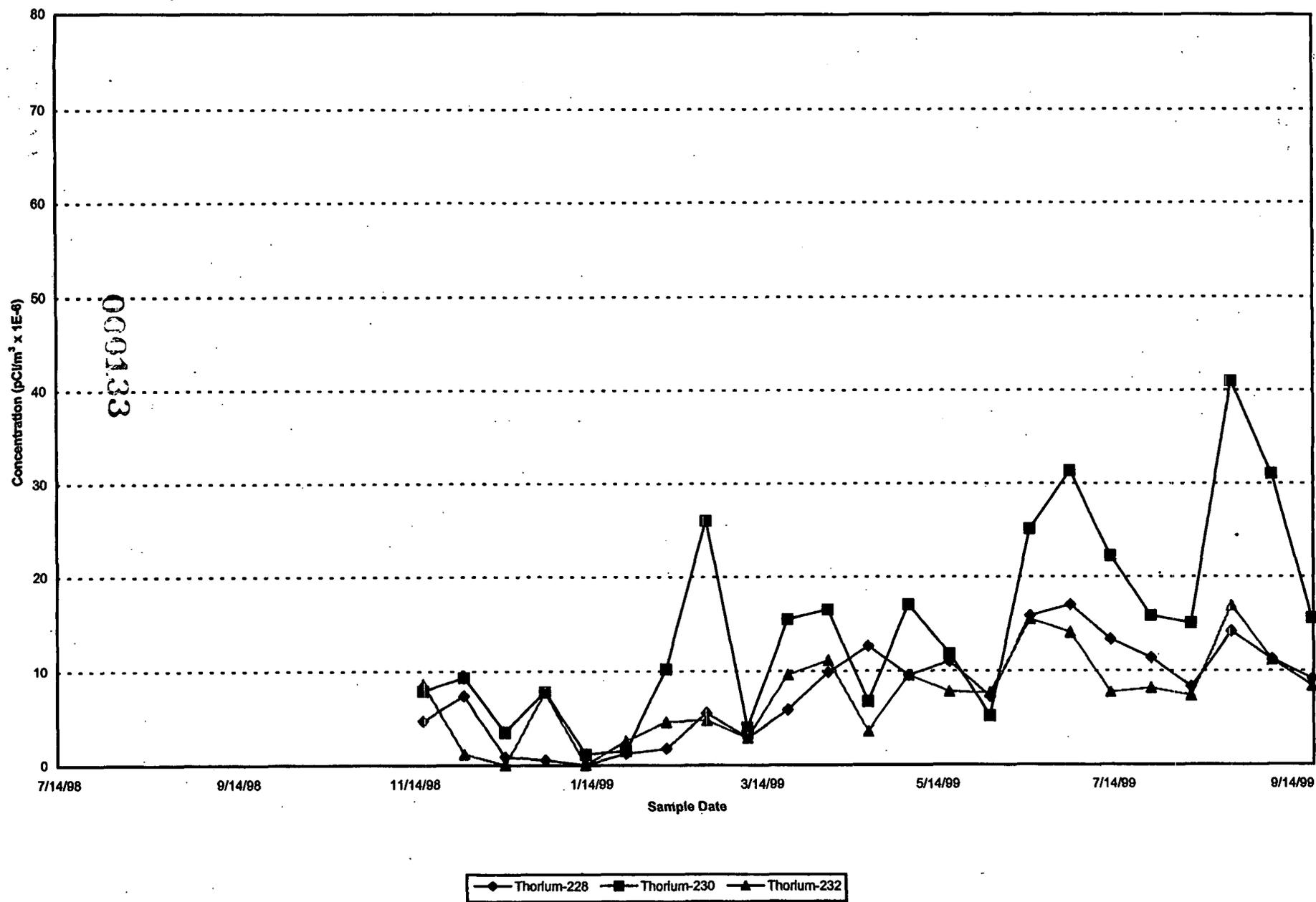
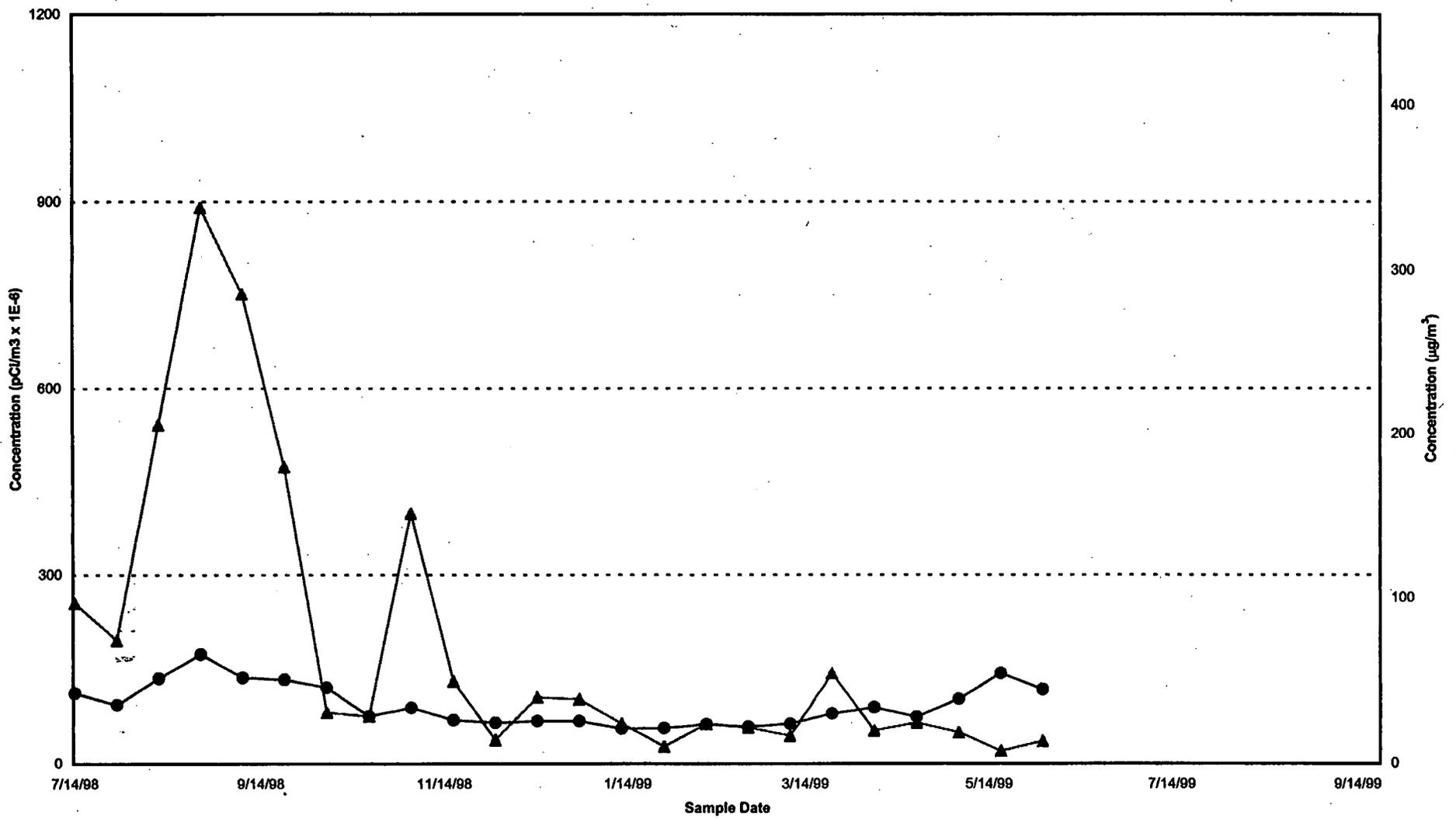
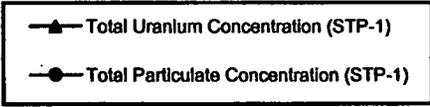


FIGURE 4-23. THORIUM-228, THORIUM-230, AND THORIUM-232 CONCENTRATIONS IN AIR (WPTH-2)



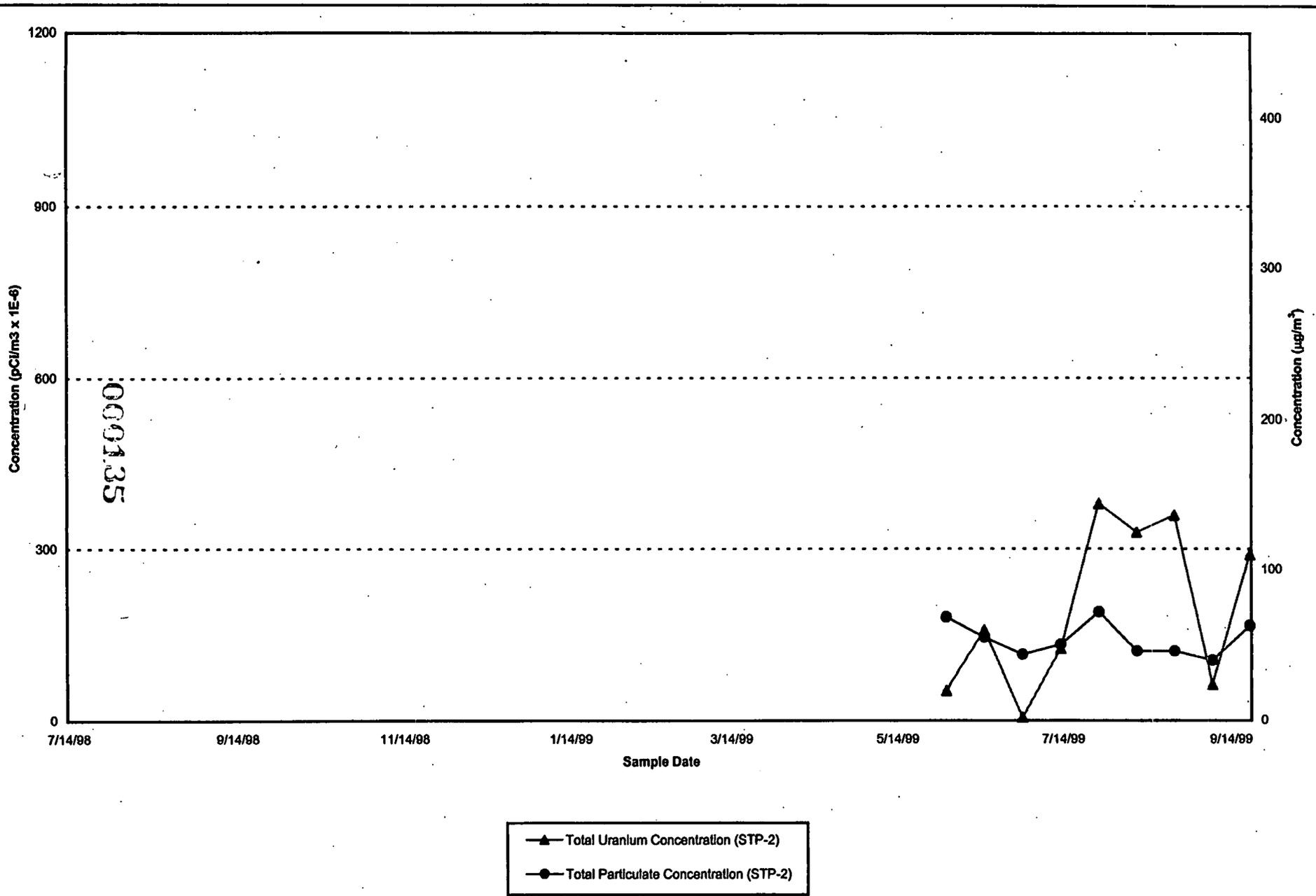
000134

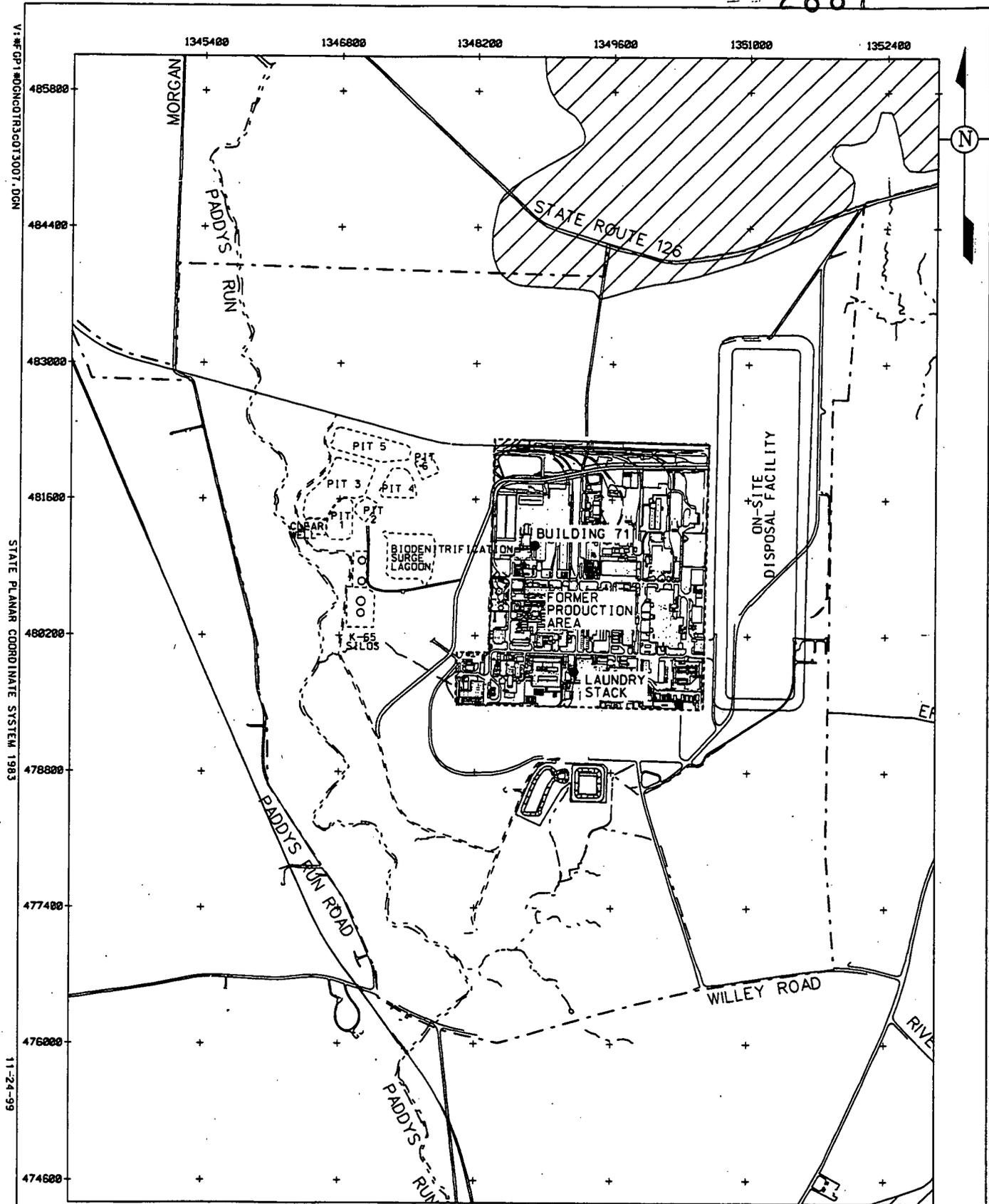


2687

FIGURE 4-24. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (STP-1)

FINAL



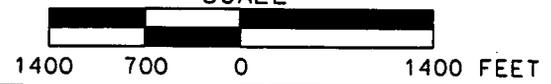


LEGEND:

- FEMP BOUNDARY
- NESHAP STACK EMISSION MONITORING LOCATION

000136

SCALE



FINAL

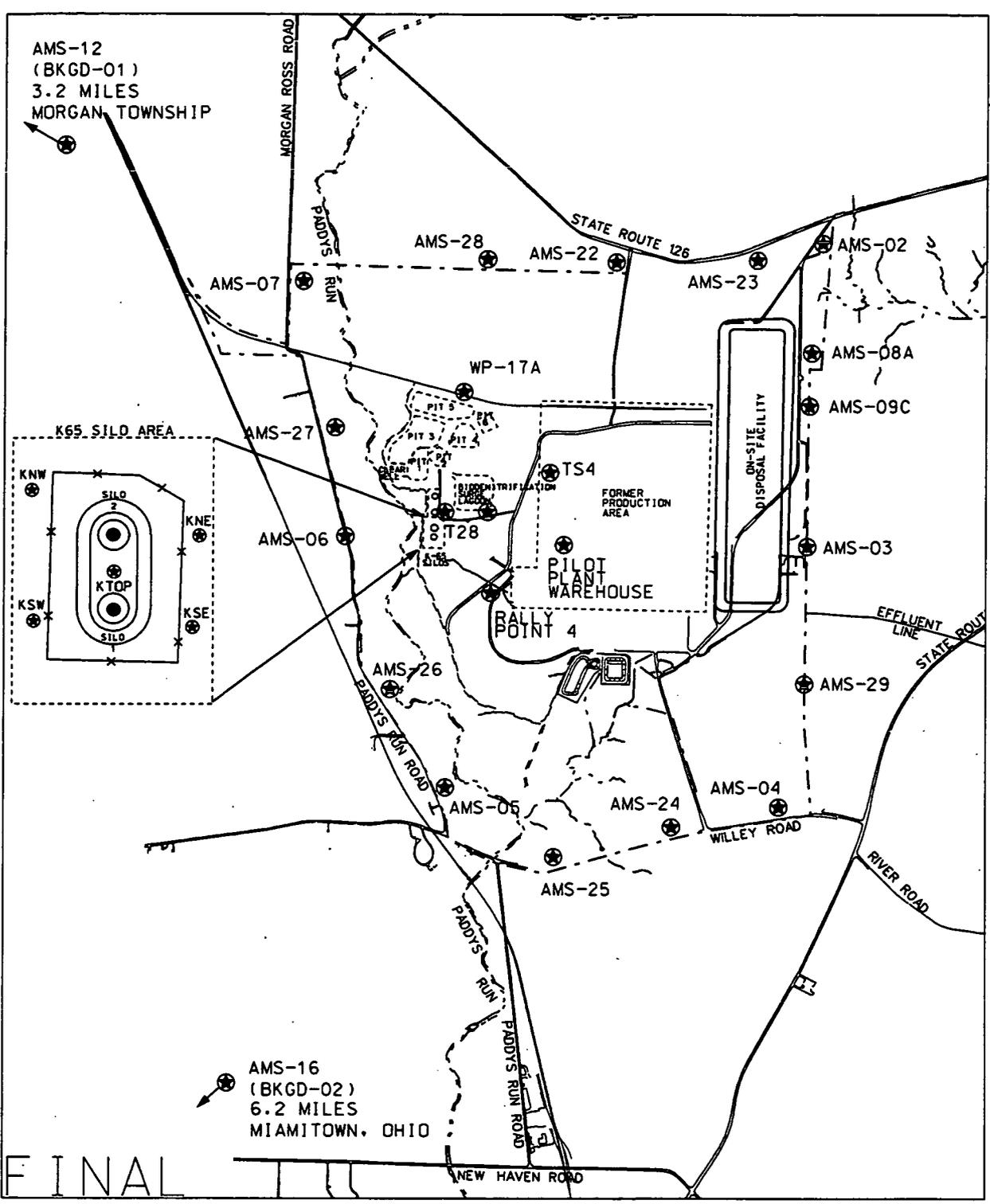
FIGURE 4-26. NESHAP STACK EMISSION MONITORING LOCATIONS

V:*GP1*DGN\CD\TR3\CD\3007.DGN
 STATE PLANNER COORDINATE SYSTEM 1983
 11-24-99

V:\OP1\00H\01\3\01\3009.DGN

STATE PLANNING COORDINATE SYSTEM 1983

11-24-99



LEGEND:

----- FEMP BOUNDARY

● ENVIRONMENTAL RADON MONITORING - CONTINUOUS ALPHA SCINTILLATION LOCATION

⊗ DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO LOCATION OFF MAP

● SILO HEAD SPACE RADON MONITORING - CONTINUOUS ALPHA SCINTILLATION LOCATION

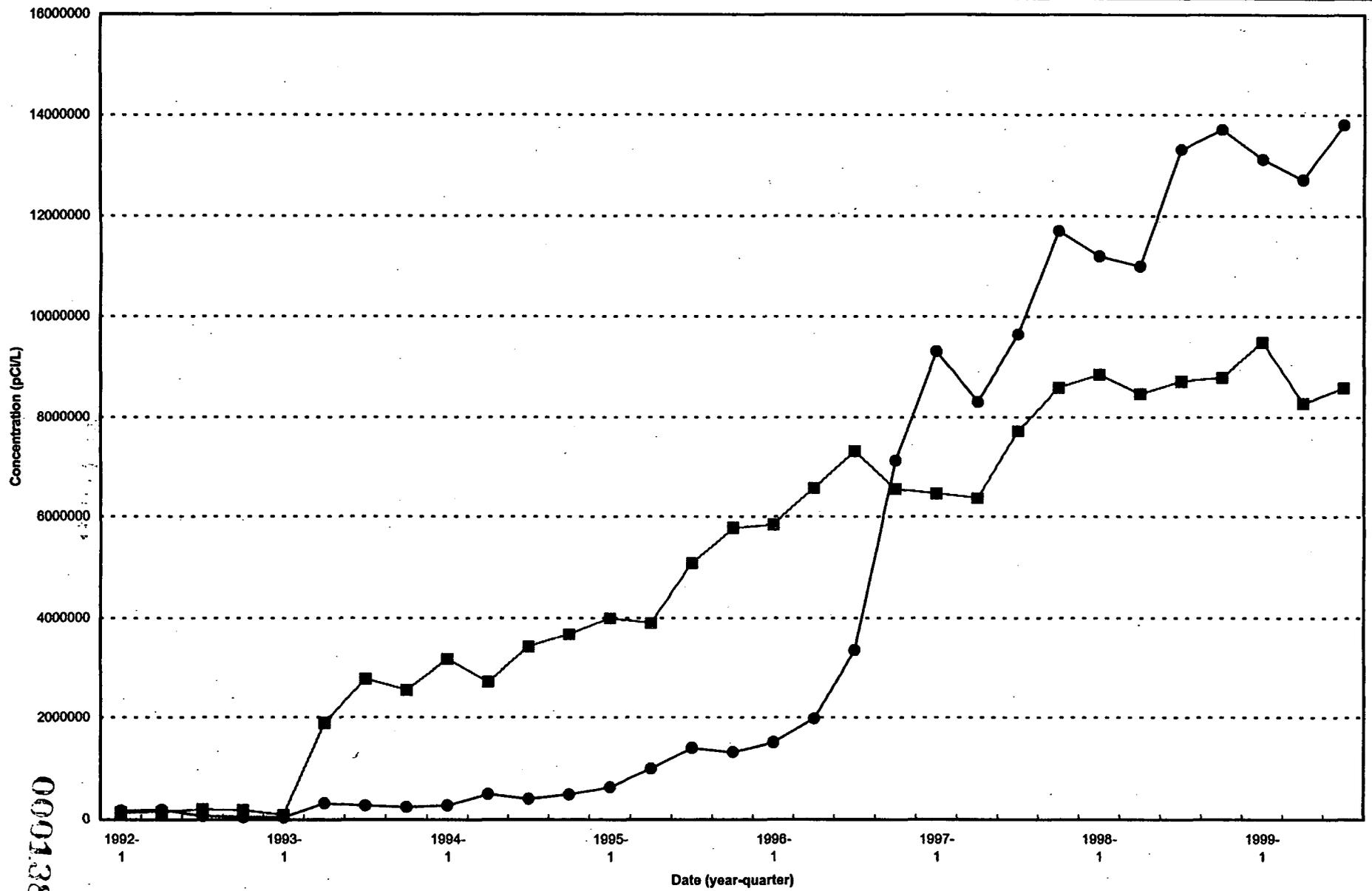
SCALE



000137

2000 1000 0 2000 FEET

FIGURE 4-27. RADON MONITORING - CONTINUOUS ALPHA SCINTILLATION LOCATIONS



881000

Note: Defective sample line for Silo 1 was replaced during fourth quarter 1996.

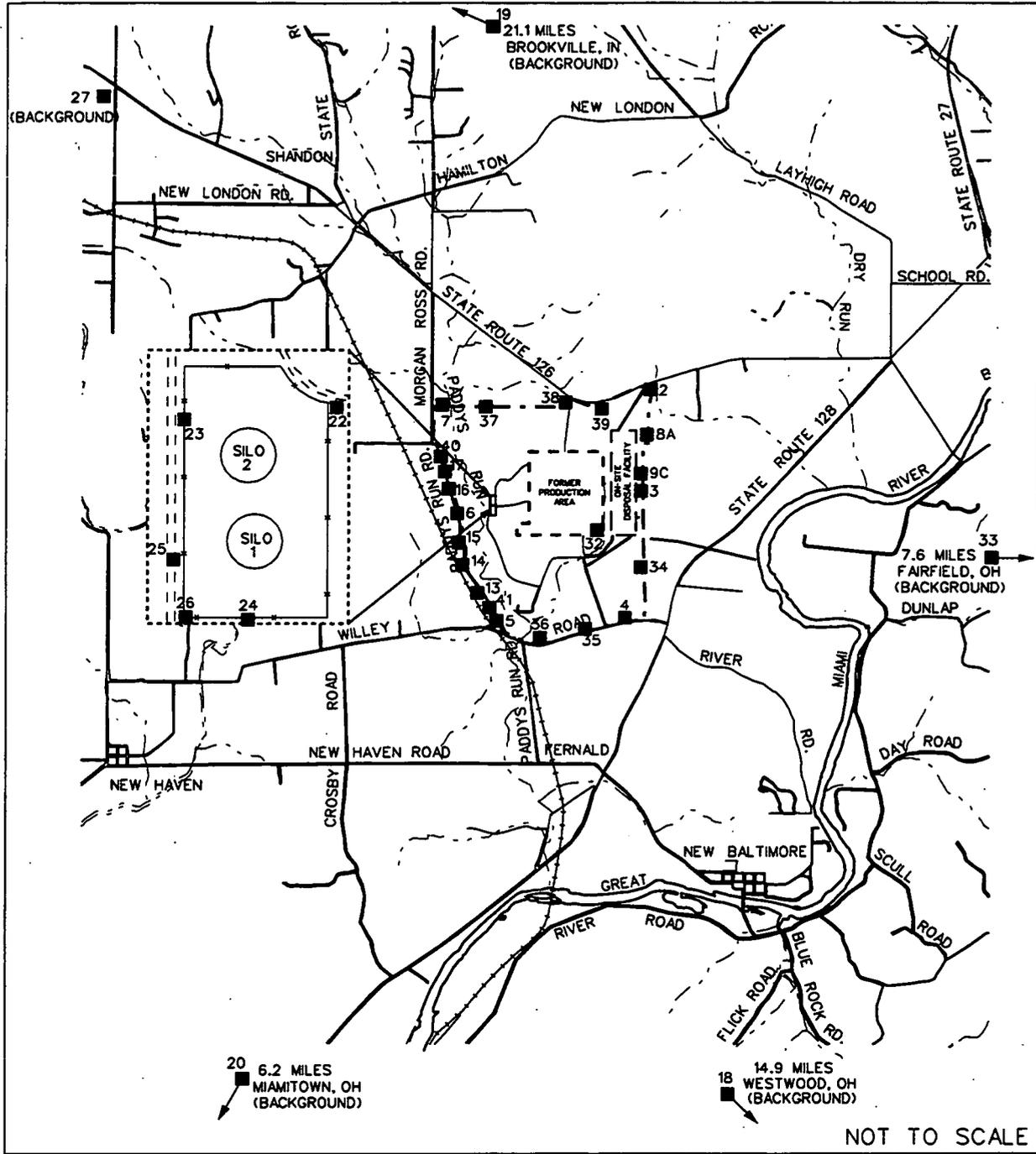
● Silo 1 ■ Silo 2

Pre-Bentonite Levels:
 Silo 1 ~ 28,000,000 pCi/L
 Silo 2 ~ 30,000,000 pCi/L

FIGURE 4-28. QUARTERLY K-65 SILO HEAD SPACE RADON CONCENTRATIONS, 1992 - 1999

FINAL

2687



LEGEND:



DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO SAMPLE LOCATIONS OFF MAP

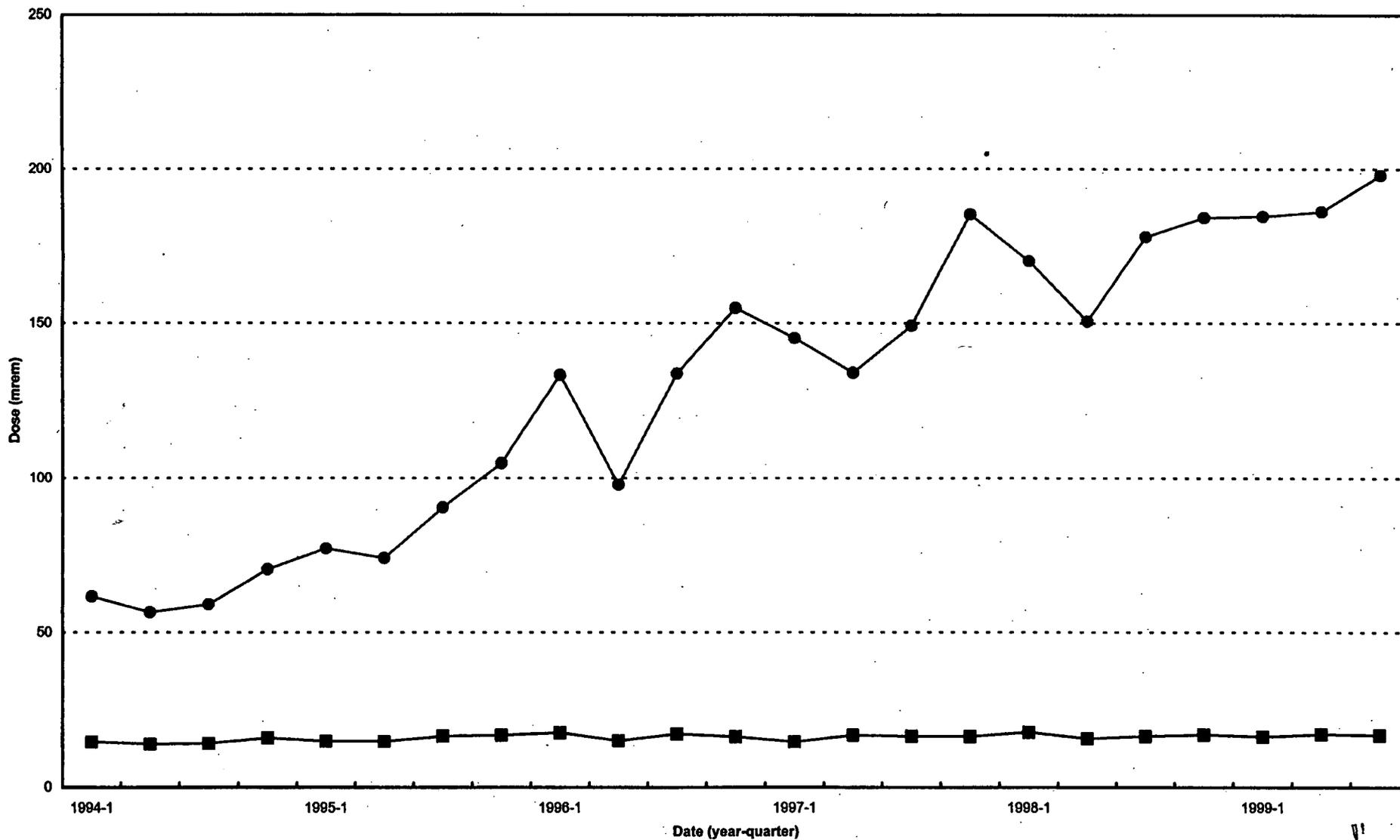
--- FEMP BOUNDARY

■ DIRECT RADIATION (TLD) MONITORING LOCATION

FINAL

000139

FIGURE 4-29. DIRECT RADIATION (THERMOLUMINESCENT DOSIMETER) MONITORING LOCATIONS



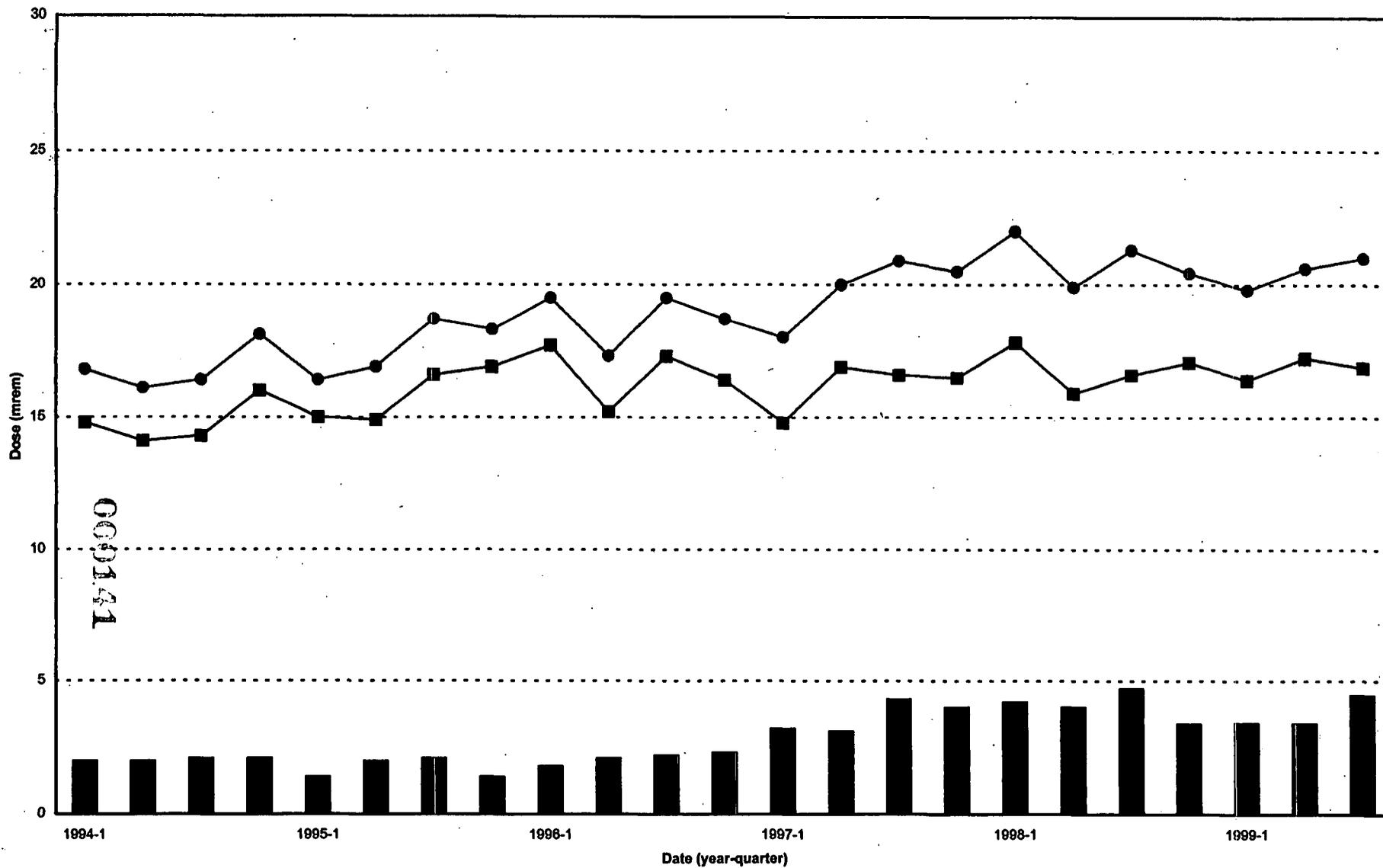
000140
 Pre-Bentonite Silos Fenceline Average
 1991: 484 mrem

● K-65 Silos Fenceline Average ■ Background Average

FIGURE 4-30. QUARTERLY DIRECT RADIATION (TLD) MEASUREMENTS, 1994 - 1999
 (K-65 SILOS FENCELINE AVERAGE VERSUS BACKGROUND AVERAGE)

2687

FINAL



Pre-Bentonite Silos Fenceline
Average 1991: 484 mrem

■ Net Difference (TLD 6 - Bkgd. Avg.) ● Closest Fenceline Location (location 6) ■ Background Average

FIGURE 4-31. QUARTERLY DIRECT RADIATION (TLD) MEASUREMENTS, 1994 - 1999
(LOCATION 6 VERSUS BACKGROUND AVERAGE)

FINAL

Natural Resources

2687

000142

This section provides a summary of newly impacted or ecologically restored areas, as well as a status of wetlands and endangered species at the Fernald site.

During the third quarter of 1999, no habitat impacts were caused by field activities, and no ecological restoration projects were initiated. However, the areas associated with the Wetland Mitigation Project, the Aesthetic Barrier Project, and the Ecological Restoration Park were periodically watered as conditions warranted. The Prairie Restoration Project in Area 8, Phase I was mowed to control weeds, and the Ecological Restoration Park was also mowed and weeded. Monitoring and surveillance continued in the Invasive Plant Control Research Project in Area 1, Phase III during the third quarter.

The northern on-property reach of Paddys Run was surveyed for the presence of the Indiana brown bat (*Myotis sodalis*), a federally listed endangered species, during the third quarter. As specified in the Integrated Environmental Monitoring Plan, Revision 1, habitat for the Indiana brown bat exists north of the train trestle in Paddys Run, and monitoring is performed when potential impacts to the habitat due to remediation are identified. Since ecological restoration work is planned for the spring of 2000 in an area that could impact this habitat, a survey was performed during the third quarter, prior to any restoration work being initiated. Specifically during August 9 and 10, 1999, the Fernald site bat population survey was conducted using mist nets as the means of capture. Thirty-five bats were captured. The species were identified, and the bats were weighed and released. One Indiana brown bat was identified. The other species identified were the big brown bat (*Eptesicus fuscus*) and the red bat (*Lasiurus borealis*). The presence of the Indiana brown bat confirms the need for preservation of the Paddys Run corridor upstream of the train trestle.

There were no unexpected conditions observed in Paddys Run during Sloan's crayfish monitoring in the third quarter of 1999. No Fernald-induced increases in turbidity above ambient conditions were observed. Therefore, no Fernald site activities have adversely impacted the Sloan's crayfish population.

000143

Meteorological

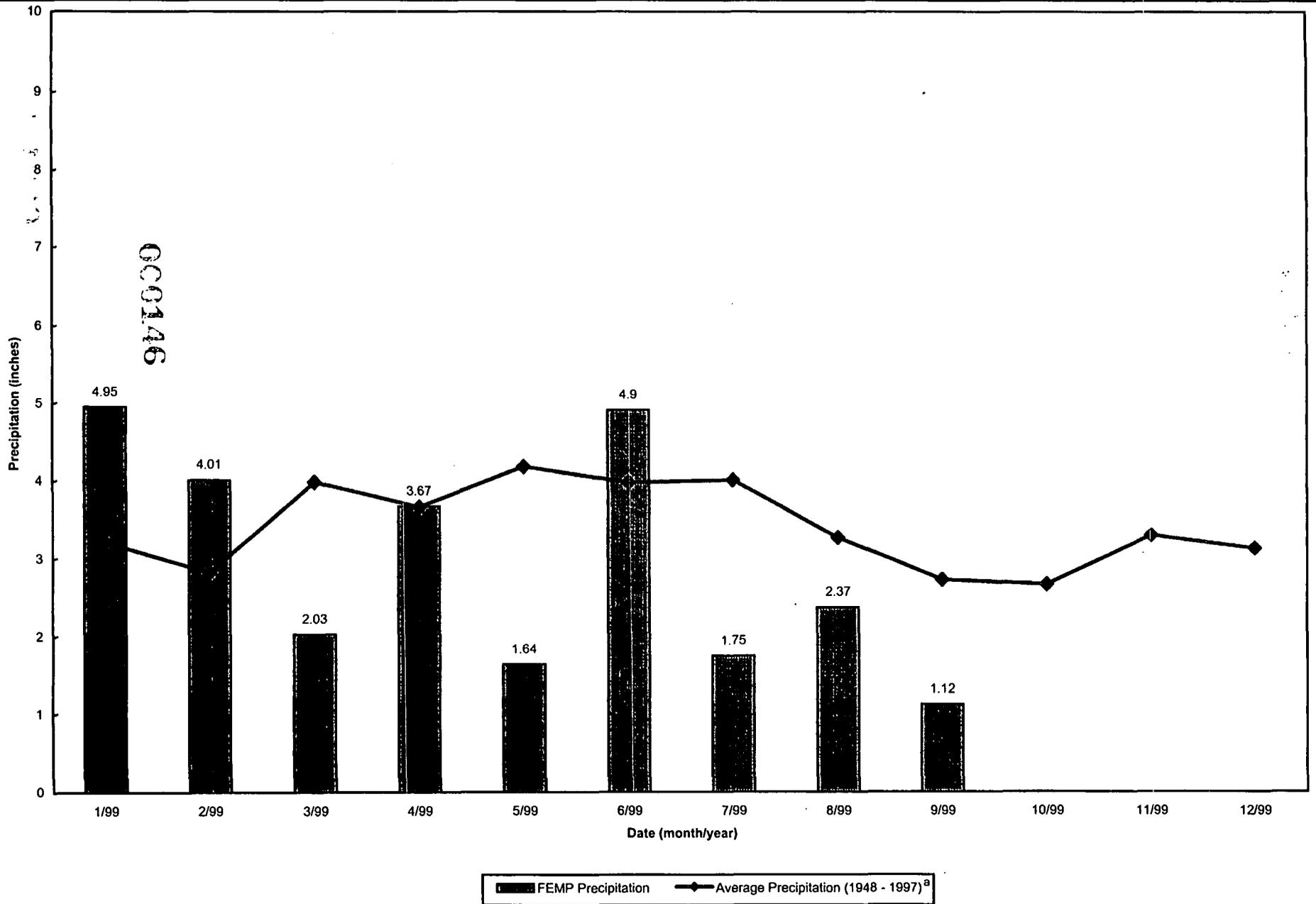
- 2687

000144

-- 2687

This section provides the third quarter 1999 monitoring activities for the Integrated Environmental Monitoring Plan (IEMP) meteorological monitoring program. Figure 6-1 shows 1999 precipitation by month in the Fernald area compared to the Cincinnati area average precipitation by month from 1948 through 1997, based on data collected at the Greater Cincinnati/Northern Kentucky International Airport. This figure shows that precipitation during the third quarter of 1999 was 5.24 inches.

000145



^a Average precipitation is based on data collected at the Greater Cincinnati/Northern Kentucky International Airport.

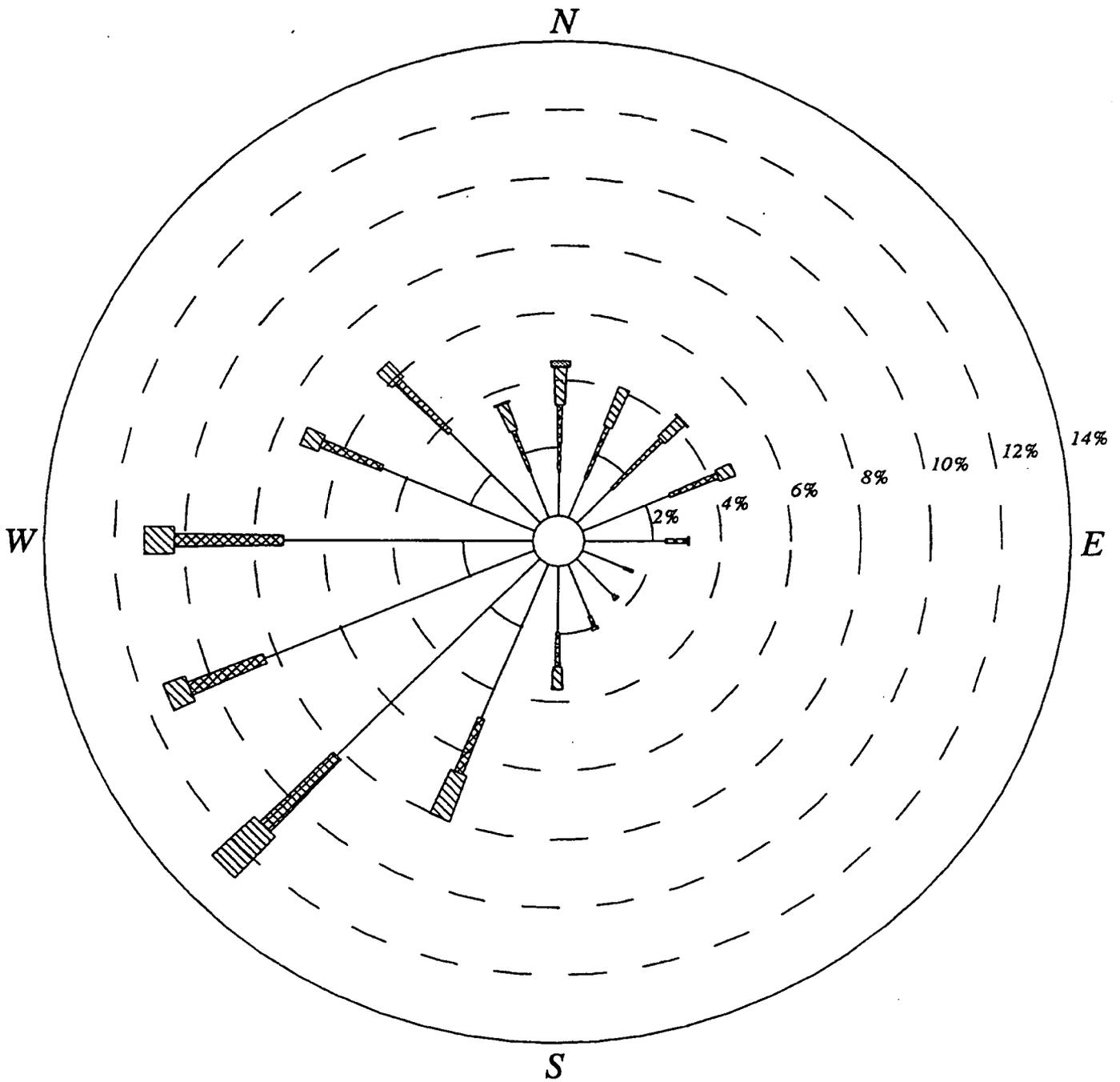
FIGURE 6-1. 1999 FEMP MONTHLY PRECIPITATION DATA

FINAL

--2687

This section provides the third quarter 1999 monitoring activities for the IEMP meteorological monitoring program. The third quarter 1999 wind rose (Figure 6-2) indicates that the predominant wind directions were from the west and southwest sectors. The wind rose indicates that airborne emissions from site remediation activities would be carried towards the eastern fenceline and air monitors in the northeast quadrant of the site. Third quarter wind rose is consistent with annual wind rose data for the Fernald area which indicates the prevailing wind directions are from the southwest which includes south-southwest, southwest, and west-southwest sectors.

000147



CALM WINDS 9.59%

WIND SPEED (KNOTS)

NOTE: Frequencies indicate direction from which the wind is blowing.

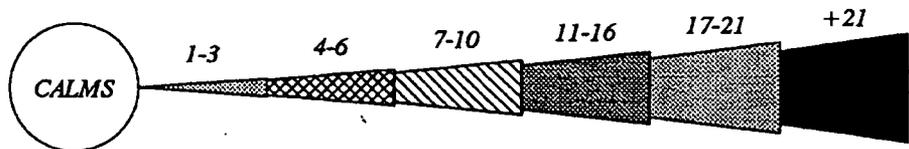


FIGURE 6-2. THIRD QUARTER 1999 WIND ROSE DATA, 10-METER HEIGHT

000148

References

-- 2687

000149

2687

REFERENCES

- U.S. Dept. of Energy, 1999a, "1998 Integrated Site Environmental Report," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.
- U.S. Dept. of Energy, 1999b, "Integrated Environmental Monitoring Plan, Revision 1," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.
- U.S. Dept. of Energy, 1999c, "Integrated Environmental Monitoring Status Report for Second Quarter 1999," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Cincinnati, OH.
- U.S. Dept. of Energy, 1998a, "Re-Injection Demonstration Test Plan," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.
- U.S. Dept. of Energy, 1998b, "Sitewide CERCLA Quality Assurance Project Plan," Revision 1, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.
- U.S. Dept. of Energy, 1997a, "Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1)," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.
- U.S. Dept. of Energy, 1997b, "On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.
- U.S. Dept. of Energy, 1997c, "Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment Project," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.
- U.S. Dept. of Energy, 1996, "Record of Decision for Remedial Actions at Operable Unit 5," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.
- U.S. Dept. of Energy, 1995, "Remedial Investigation Report for Operable Unit 5," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

000150