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MAY 29 1998

DOE-0830-98

Mr. James A. Saric, Remedial Project Manager
U.S. Environmental Protection Agency
Region V-SRF-5J
77 West Jackson Boulevard
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Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, Ohio 45402-2911

Dear Mr. Saric and Mr. Schneider:

TRANSMITTAL OF THE 1997 INTEGRATED SITE ENVIRONMENTAL REPORT

This letter serves to transmit the Fernald Environmental Management Project's (FEMP) Integrated Site Environmental Report for Calendar Year 1997. This report is designed to fulfill the annual reporting commitments identified in the FEMP's Integrated Environmental Monitoring Plan (IEMP).

The 1997 Integrated Site Environmental Report begins the transition to the annual reporting format outlined in the IEMP and therefore, differs in some aspects from past annual site environmental reports. Specifically, the report has been expanded to include a summary report and two volumes of detailed supporting appendices as described below:

- The summary report documents the results of the environmental monitoring activities for Calendar Year 1997 and highlights the significant programmatic changes which took place through implementation of the IEMP. Similar to previous annual site environmental reports, it includes background information about the FEMP and associated remediation activities. It also provides a summary-level presentation of environmental data for groundwater, surface water and treated effluent, sediment, air, biota (produce), and natural resources. This summary report also includes an exposure pathway dose assessment for 1997.

- Volume I of the appendices provides a detailed presentation of supplemental environmental data for 1997, primarily in graphical and tabular formats. This detailed information supports the findings and data interpretations presented in the summary report.

- Volume II of the appendices provides the National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart H compliance report and supporting documentation.

The summary report is intended to serve the same wide audience as past annual reports and will receive the same broad distribution to Fernald stakeholders. The detailed appendices are intended to serve a more technical audience and will receive a more limited initial distribution. The summary report and appendices will be available to all stakeholders through the Public Environmental Information Center.

The enclosed report is submitted as a black and white reproduction in order to meet the June 1, 1998, commitment date. However, color printing and binding of the summary report is currently being coordinated through the Government Printing Office. Color copies of the summary report will forwarded to you by the end of June 1998.

To assist in your review, the remaining raw data associated with 1997 that has not previously been submitted are provided in electronic format. The analytical data are provided on three disks: one disk contains groundwater data; one disk contains surface water and sediment data; and the final disk contains air (radon) and produce data. Each disk contains a WordPerfect file which identifies the files on each disk and also identifies the files that have been previously sent with the quarterly status reports.

If you have any questions concerning this report, please contact Kathleen Nickel at (513) 648-3166, or Edward Skintik at (513) 648-3151.

Sincerely,

Johnny Reising

FEMP:Nickel

Johnny W. Reising
Fernald Remedial Action
Project Manager

Enclosures: As Stated

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1997 INTEGRATED SITE ENVIRONMENTAL REPORT

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

MAY 1998

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

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1997 INTEGRATED SITE ENVIRONMENTAL REPORT

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

MAY 1998

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

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List of Acronyms

ALARA	as low as reasonably achievable
AMS	air monitoring station
ARAR	applicable or relevant and appropriate requirement
BTV	benchmark toxicity value
CAP88-PC	Clean Air Act Assessment Package 1988
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
D&D	decontamination and dismantling
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FDF	Fluor Daniel Fernald
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
FFA	Federal Facility Agreement
FFCA	Federal Facility Compliance Agreement
FRL	final remediation level
FS	feasibility study
gpm	gallons per minute
IEMP	Integrated Environmental Monitoring Plan
NESHAP	National Emissions Standards for Hazardous Air Pollutant
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
OSDF	on-site disposal facility
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
SARA	Superfund Amendment and Reauthorization Act
SWRB	Storm Water Retention Basin
TLD	thermoluminescent dosimeter
TSCA	Toxic Substance Control Act

Units (Abbreviations) and Conversion Table

Multiply	By	To Obtain	Multiply	by	To Obtain
inches (in)	2.54	centimeters (cm)	cm	0.3937	in
feet (ft)	0.3048	meters (m)	m	3.281	ft
miles (mi)	1.609	kilometers (km)	km	0.6214	mi
pounds (lb)	0.454	kilograms (kg)	kg	2.205	lb
tons	0.9072	metric tons	metric tons	1.102	tons
gallons	3.785	liters (L)	L	0.2642	gallons
square feet (ft^2)	0.0929	Square meters (m^2)	m^2	10.76	ft^2
acres	0.4047	hectares	hectares	2.471	acre
cubic yards (yd^3)	0.7646	cubic meters (m^3)	m^3	1.308	yd^3
cubic feet (ft^3)	0.02832	cubic meters (m^3)	m^3	35.31	ft^3
picocuries (pCi)	10^{-12}	curies (Ci)	Ci	10^{12}	pCi
pCi/L	10^{-6}	microcuries per liter (μCi/L)	μCi/L	10^{6}	pCi/L
Ci	3.7×10^{10}	becquerels (Bq)	Bq	2.7×10^{-11}	Ci
pCi	0.037	Bq	Bq	27.03	pCi
millirem (mrem)	0.001	rem	rem	1000	mrem
rem	0.01	Sievert	Sv	100	rem
milligrams per liter (mg/L)	1000	micrograms per liter (μg/L)	μg/L	0.001	mg/L
Fahrenheit (°F)	(°F - 32) x 5/9	Celsius (°C)	°C	(°C x 9/5) +32	°F
For Natural Uranium in Water					
pCi/L	0.0015	mg/L	mg/L	675.7	pCi/L
pCi/L	1.48	μg/L	μg/L	0.6757	pCi/L
μg/L	0.6757	pCi/L	pCi/L	1.48	μg/L
For Natural Uranium in Soil					
pCi/g	1.48	μg/g	μg/g	0.6757	pCi/g
mg/kg	1	μg/g	μg/g	1	mg/kg

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Executive Summary

The Fernald Environmental Management Project (FEMP) is a federally owned facility with operations administered through the Department of Energy (DOE). The facility produced high-quality uranium metals for military defense for nearly 40 years. DOE suspended production at the FEMP in 1989 and formally ended production in 1991. The current mission of the FEMP is environmental restoration under the Comprehensive Environmental Response, Compensation, and Liability Act. Although production activities have ceased, the FEMP continues to monitor the air and liquid pathways as possible routes through which pollutants from past operations and current remediation activities may leave the FEMP.

The 1997 Integrated Site Environmental Report is prepared in accordance with DOE Order 5400.1, General Environmental Protection Program, and the FEMP Integrated Environmental Monitoring Plan (IEMP) (DOE 1997g). This annual report provides FEMP stakeholders with the results from the FEMP's environmental monitoring program for calender year 1997 and provides a summary of DOE's progress toward final remediation of the FEMP. In addition, this report provides a summary of the FEMP's compliance with the various environmental regulations, compliance agreements, and DOE policies which govern FEMP activities.

For some readers, the highlights provided in this Executive Summary may provide sufficient information. Many readers, however, may wish to read the more detailed information presented in subsequent chapters. All information presented in this Executive Summary is discussed more fully within the body of this summary report and its two volumes of supporting appendices.

1997 was a year of important accomplishments at the FEMP. Significant progress was made toward implementing the full range of remediation activities required to achieve the final cleanup goals of the FEMP. Some of the major remediation highlights for 1997 include:

- Cell 1 of the on-site disposal facility was constructed and the first waste was placed in the cell in December 1997. Construction activities included the completion of a leachate conveyance system which conveys leachate from the on-site disposal facility to the headworks of the advanced wastewater treatment facility.

- Significant progress was made in several aspects of the soil remediation effort at the FEMP. Large-scale excavations of contaminated soil were completed in the northeast area of the FEMP. In addition, site preparation activities in support of excavation of the southern waste units (South Field, active and inactive flyash piles) was initiated. Excavation of the southern waste units is scheduled to begin in the summer of 1998. Furthermore, a portion of the bank of Paddys Run near the K-65 Silos was stabilized in 1997 to prevent further erosion by the creek.

- The Plant 1 Complex was decontaminated and dismantled. During the production years, uranium and thorium ore stocks were prepared for on-site processing at the Plant 1 Complex.

- A waste haul road was built to support transport of excavated wastes, primarily soil, from the southern waste units to the on-site disposal facility for disposal. (Note: only wastes meeting the waste acceptance criteria for the on-site disposal facility will be disposed of on site).

- A remedial action contract was awarded to International Technology Corporation for the excavation and waste processing operations required to complete remediation of Waste Pits 1 through 6 and the associated wastes within Operable Unit 1.

- Major construction activities associated with the on-site railyard were completed. The railyard will support transport of wastes designated for off-site disposal.

- Significant activities were initiated to implement the accelerated remediation strategy for the Great Miami Aquifer. These include the installation of groundwater extraction wells, re-injection wells, an extensive piping network, and expansion of the advanced wastewater treatment facility to provide additional groundwater treatment capacity beginning in 1998.

In conjunction with implementation of full-scale remediation activities at the FEMP, significant changes were made to the FEMP's environmental monitoring program during 1997. The changes focused on consolidatng various sitewide environmental monitoring and reporting activities under a single comprehensive program aligned with the FEMP's accelerated remediation plan. The programmatic changes and monitoring strategy are documented in the IEMP which was approved by the United States Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA) in July 1997 and implemented in August 1997. The integrated monitoring and reporting strategy presented in the IEMP is designed to provide an ongoing assessment of environmental conditions at the FEMP and to communicate findings to the remediation projects, the regulatory agencies, and FEMP stakeholders in a timely manner. This information provides the basis for ensuring that the cumulative environmental effects associated with remediation activities at the FEMP remain below established thresholds.

The following highlight the results of environmental monitoring activities conducted during 1997.

Liquid Pathway Highlights

Groundwater Pathway

The groundwater pathway is routinely monitored at the FEMP to:

- Provide groundwater data to assess the capture and remediation of the total uranium plume

- Provide groundwater data to assess the capture and remediation of non-uranium constituents which have concentrations exceeding their respective final remediation levels (FRLs)

- Meet compliance-based groundwater monitoring obligations.

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In 1997, approximately 128 monitoring wells were periodically sampled for water quality. Water elevations were measured quarterly in up to 161 monitoring wells. The following highlights describe the key findings from the assessment of the 1997 groundwater data:

- Pumping of the South Plume Removal Action System continues to meet the objective of preventing the further southward migration of the South Plume beyond the extraction wells.

- Additional groundwater monitoring data collected on property in 1997 confirms that the design of the enhanced groundwater remedy is appropriate in that the on-property portion of the total uranium plume remains within the projected 10-year, uranium-based restoration footprint.

- Groundwater data collected in 1997 continues to confirm that the enhanced groundwater remedy design is appropriate in that there are no other significant contaminants present in the aquifer with concentrations above their respective FRLs which would require modification of the enhanced groundwater remedy design.

- Groundwater monitoring data collected under the IEMP in 1997 continued to meet specific regulatory and compliance requirements. Specifically, groundwater monitoring data was collected in support of the Resource Conservation and Recovery Act Property Boundary Monitoring Program, the KC-2 Warehouse Well Monitoring Program, the Private Property Well Monitoring Program, and the Coal Pile Runoff Basin Monitoring Program.

Surface Water and Treated Effluent Pathway

Surface water and treated effluent are routinely monitored to determine the effects of FEMP remediation activities on Paddys Run, the Great Miami River, and the underlying Great Miami Aquifer. In addition, the results from sediment sampling are discussed as a component of this primary exposure pathway because sediment (a secondary exposure pathway) is most directly affected by the surface water pathway.

The amount of total uranium discharged in uncontrolled runoff and treated effluent during 1997 continued the decreasing trend observed since production operations were discontinued in 1989.

- The estimated pounds of uranium discharged to the environment through uncontrolled storm water runoff decreased by 31 percent in 1997 compared to 1996 results. In 1997, an estimated 252 pounds (114 kilograms [kg]) of uranium were discharged versus an estimated 369 pounds (168 kg) discharged in 1996.

- The pounds of uranium in treated effluent discharged to the Great Miami River decreased by 54 percent in 1997 compared to 1996 results. In 1997, 126 pounds (57.2 kg) of uranium were discharged versus 275 pounds (125 kg) discharged in 1996.

- The pounds of uranium discharged through overflows of the Storm Water Retention Basin decreased by approximately 88 percent in 1997 compared to 1996. In 1997, 3.46 pounds (1.57 kg) of uranium were discharged versus 13 pounds (6 kg) discharged in 1996.

These decreases are attributable to less than average rainfall in 1997, increased efficiency in the site's advanced wastewater treatment facility, decreases in storm water-related bypasses, and aggressive implementation of storm water runoff controls.

No surface water or treated effluent analytical results from samples collected in 1997 exceeded the FRL for total uranium, the primary site contaminant. FRL and benchmark toxicity value (BTV) exceedances in surface water samples were limited to nine and 11 constituents, respectively. These occasional, sporadic FRL and BTV exceedances are to be expected until site remediation is complete.

Radiological results of sediment samples indicate a general decrease when compared to 1996 results. Only one sample collected during 1997 exceeded a sediment FRL. This sample was collected from the Storm Sewer Outfall Ditch near the Storm Water Retention Basin. The 1997 result slightly exceeded the thorium-232 FRL (1.60 picoCuries per gram [pCi/g]) at 1.63 pCi/g.

Air Pathway Highlights

Monitoring under the air pathway includes radiological air particulates, radon, and direct radiation. In addition, the results from biota (produce) sampling are discussed under the air pathway because produce (a secondary exposure pathway) would most likely be affected by air deposition of contaminants on the produce itself or the soil with subsequent uptake of contaminants through the roots.

Radiological Air Particulate Monitoring

Significant changes occurred in the radiological air particulate monitoring program during the fourth quarter of 1997. These changes were made in preparation for full implementation of the IEMP radiological air particulate monitoring program beginning January 1, 1998. This included the installation of eight new air monitoring stations on the site fenceline and the relocation of one existing monitor. The program was redesigned to provide a monitoring-based approach for demonstrating compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart H requirements which limit radionuclide emissions from DOE facilities. Beginning in 1998, the FEMP will utilize a network of 18 high volume air monitors to measure radionuclide concentrations at the site fenceline. This information will be used to estimate the annual dose received by members of the public due to FEMP emissions. During 1997, as in the past, this assessment was conducted using computer models to estimate off-property exposures.

Data collected from fenceline air monitoring stations showed that the annual average radionuclide concentrations were all less than one percent of DOE derived concentration guidelines. When converted to dose, the concentrations represent less than 10 percent of the NESHAP standard of 10 millirem (mrem) per year. Airborne total uranium emissions for 1997 were estimated to be 19.5 pounds (8.84 kg). This compares to 11.1 pounds (5.0 kg) estimated in 1996. This increase in estimated total uranium emissions reflects the implementation of full-scale remediation activities at the FEMP. However, the estimated emissions remain well below the levels observed during active production and all EPA, OEPA, and DOE standards.

Radon Monitoring

In 1997, the annual average radon concentration (measured with alpha track-etch cups) recorded at the FEMP fenceline ranged from 0.2 ± 0.1 picoCuries per liter (pCi/L) to 1.0 ± 0.2 pCi/L. Fenceline and off-property results were well below the DOE standard of 3.0 pCi/L annual average above background. Background concentrations measured in 1997 ranged between 0.1 ± 0.1 pCi/L to 0.2 ± 0.2 pCi/L.

The head spaces of K-65 Silos 1 and 2 (part of Operable Unit 4) continue to be monitored for radon concentrations. The protective layer of bentonite clay placed over the silo material in 1991 to lower head space radon concentrations has lost some effectiveness due to the "drying out" of the clay. As a result, radon concentrations in both silos have increased. As of December 1997, the head space concentrations remain approximately 60 percent lower than values measured prior to the addition of the bentonite. The increasing radon concentrations in the silo head space will be mitigated through implementation of the Operable Unit 4 remediation.

Direct Radiation Monitoring

Measurements of direct radiation indicate that levels increase with proximity to K-65 Silos 1 and 2. The increasing direct radiation measurements correlate with the increasing radon concentrations in the head spaces of K-65 Silos 1 and 2. However, these levels remain approximately 67 percent lower than radiation levels measured in 1991 prior to the addition of the bentonite layer to K-65 Silos 1 and 2. These measurements are consistent with the fact that the silos contain radium and its decay products which contribute to the direct radiation in the vicinity of the silos. Direct radiation measurements at the FEMP fenceline in 1997 were similar to background concentrations.

Biota (Produce) Monitoring

Biota (produce) is collected to determine if total uranium concentrations in produce grown within 3 miles (5 kilometers [km]) of the FEMP are higher than concentrations in produce grown at distant locations (7 to 26 miles [11 to 42 km]). The sample results are then used to estimate the potential dose to people from this secondary component of the air pathway.

Comparisons between the average total uranium concentrations in corn, soybeans, squash, and tomatoes grown near the FEMP with concentrations in produce grown at a distance from the FEMP indicate very little difference in average concentrations. In addition, when compared to historical background ranges for each of the produce listed, the data for 1997 are within the background range reported for 1990 to 1996. As seen in previous years, these comparisons suggest that there is no substantial impact from past or current FEMP emissions on produce grown in the area.

Estimated Dose for 1997

Scientists calculate potential radiation doses to nearby residents by utilizing mathematical models which include off-property radionuclide concentrations determined through environmental monitoring and sampling.

In 1997, the hypothetical maximally exposed individual living closest to the FEMP, exclusively consuming local produce from the Fernald area, could have received a maximum committed effective dose (exclusive of radon dose) of approximately 1.5 mrem. This dose can be compared to the limit of 100 mrem for all pathways that was established by the International Commission on Radiological Protection and adopted by DOE.

Natural Resources

Natural resources encompass the rich diversity of plant and animal life and their supporting habitats found in and around the FEMP. During 1997, monitoring was conducted to evaluate the impacts to Sloan's crayfish (a State of Ohio threatened species) habitat in Paddys Run from FEMP remediation activities. This measured impact was based on an evaluation of sediment from the FEMP that deposits into Paddys Run Creek. The monitoring results indicated no significant impact from sediment loading to Paddys Run as a result of FEMP remediation activities.

The FEMP also monitors impacts to sensitive habitat areas including northern woodlot/pines, southern pines and waste units, grassland, Paddys Run corridor, and wetlands. The projected impacts to these habitats resulting from FEMP remediation activities have been assessed and document in the Draft Natural Resource Impact Assessment (DOE 1997i). During 1997, approximately 55 acres (22 hectares) of habitat were impacted. The cumulative impacted habitat through 1997 equals approximately 110 acres (44.5 hectares). The projected total impacted habitat through FEMP remediation is 305 acres (123 hectares).

In addition, the FEMP has a number of archeological and historical sites representative of the cultural resources of the area. To protect these valuable resources, the FEMP conducts cultural resource surveys prior to soil excavation activities in designated areas of the FEMP. During 1997, there were no significant unexpected cultural resource discoveries.

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The Fernald Environmental Management Project

The scope of the Fernald Environmental Management Project (FEMP) is the implementation of full-scale environmental remediation and waste management activities at an inactive uranium processing facility located near the village of Fernald in Southwestern Ohio. Mission direction and project oversight for the federally owned facility are provided by the U.S. Department of Energy (DOE) Fernald site office. Project activities are managed and executed by Fluor Daniel Fernald operating under the terms of a prime contract with DOE.

The site's production mission spanned more than 37 years. During that time, in excess of 500 million pounds (227 million kilograms [kg]) of uranium metal products were delivered to other DOE sites in support of national security initiatives. As a consequence of this large-scale production operation, an estimated 400,000 to 1 million pounds (180,000 to 450,000 kg) of uranium were released to the environment. These environmental releases resulted in widespread contamination of surface soil, surface water, sediment, and groundwater.

In the 1980s, an environmental monitoring program was initiated to assess the impact of past operations on the environment and monitor potential exposure pathways to the local community. This monitoring program has been continually refined and improved to provide a comprehensive assessment of the impact of FEMP operations on the surrounding environment. Consistent with this approach of continuous program improvement, the environmental monitoring program underwent significant changes during 1997 to align with the types of remedial construction, excavation, demolition, and waste processing operations which are occurring as the FEMP moves toward final site restoration. These changes are reflected in the Integrated Environmental Monitoring Plan (IEMP) (DOE 1997g) which was approved by the U.S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA) in July 1997 and implemented in August 1997. The IEMP established a comprehensive framework for consolidating various sitewide environmental monitoring activities and routine reports into a single program aligned with the FEMP's accelerated remediation plan. Transition to the monitoring program design presented in the IEMP began in August 1997 and was completed by the end of the calendar year.

A key component of the IEMP is an integrated reporting strategy designed to communicate the results of environmental monitoring and groundwater remediation activities on a routine basis. The reporting strategy includes a routine quarterly status report which provides a timely assessment of key environmental data and a comprehensive annual report that provides a detailed roll-up of the environmental data, associated findings, and actions presented in the quarterly reports. This annual report begins the transition to the annual reporting format outlined in the IEMP. It has been expanded to include this summary report and two volumes of detailed supporting appendices. A brief description of each component of this annual report is provided below.

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Summary Report This summary report documents the results of the environmental monitoring activities for calendar year 1997 and highlights the significant programmatic changes which took place through implementation of the IEMP. Similar to previous annual site environmental reports, it includes background information about the FEMP and associated remediation activities. It also provides a summary-level presentation of environmental data for groundwater, surface water and treated effluent, sediment, air, biota (produce), and natural resources. This summary report also includes an exposure pathway dose assessment for 1997.

Appendices Volume I Volume I of the appendices provides a detailed presentation of environmental data for 1997, primarily in graphical and tabular formats for 1997. This detailed information supports the findings and data interpretations presented in the summary report.

Appendices Volume II Volume II of the appendices provides the National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 Code of Federal Regulations 61 Subpart H) (EPA 1985) compliance report and supporting documentation.

The expanded format of this annual report is intended to provide FEMP stakeholders a comprehensive assessment of environmental impacts resulting from FEMP remediation activities and a status of the progress toward final remediation of the FEMP.

The remainder of this chapter provides the following:

- **The FEMP Mission: Past and Present**, a brief historical overview of the FEMP's former operations and a description of its current cleanup mission, organization, and major remediation activities
- **Environmental Monitoring Program Information**, a description of FEMP activities aimed at monitoring environmental quality, including a detailed discussion of the FEMP's transition to the monitoring program design as presented in the IEMP
- **Site Setting**, an introduction to the physical, ecological, and human characteristics of the area.

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The FEMP Mission: Past and Present

The FEMP was originally called the Feed Materials Production Center because it produced "feed" materials in the form of purified uranium metal for use by other DOE sites in production. The facility was built by the Atomic Energy Commission (a predecessor to the DOE). After evaluating several sites, the government selected a 1,050-acre (425-hectare) site situated just north of the small farming community of Fernald, Ohio, located approximately 18 miles (29 kilometers [km]) northwest of downtown Cincinnati. Construction began in 1951 in the midst of the Cold War era. Production operations began in 1952 and ended in July 1989.

In general, the relative importance and corresponding funding of the former production and environmental activities reflect the course of United States defense history from the end of World War II until today. Uranium-metal production reached a peak during the height of the Cold War in the 1950s and 1960s. During the late 1970s, funding for production and supporting organizations was significantly reduced. Production accelerated again in the early 1980s when the United States increased defense spending. By the late 1980s, however, an increasing demand for environmental accountability, combined with a decreasing demand for uranium metal at other DOE facilities, led DOE to change the FEMP's mission from uranium production to environmental restoration.

Production was suspended in July 1989. In October 1990, DOE transferred management responsibility for the FEMP from its Defense Programs organization to the Office of Environmental Restoration and Waste Management. In February 1991, DOE announced its intention to formally end the production mission and submitted a closure plan to Congress, which became effective in June 1991.

CERCLA Remedial Process

In broad terms, the remedial response process for remediating sites under CERCLA consists of the following three general phases.

Site Characterization - This phase determines what contaminants are present, and at what levels, and evaluates the potential impacts of those contaminants on human health and the environment. Activities associated with this phase include the remedial investigation (RI) and the baseline risk assessment.

Remedy Selection - This phase develops and evaluates different cleanup alternatives and, with appropriate public involvement, selects a remedy. Activities associated with this phase are the feasibility study (FS) and proposed plan. Following a public comment period, this phase culminates in the selection of a remedial alterative which is documented in a record of decision.

The first and second phases discussed above are commonly referred to as the "study" portions of the process. These phases of the process at the FEMP are essentially complete.

Remedial Design and Remedial Action - This phase of the CERCLA process includes the detailed design and implementation of the remedy.

Environmental Restoration

The current mission of the FEMP is full-scale environmental restoration under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In 1986, the FEMP began working through the CERCLA process to characterize the nature and extent of contamination at the site, establish risk-based cleanup standards, and select the appropriate remediation technologies to achieve those standards. To facilitate this process, the FEMP was organized into five operable units in 1991. The operable units were defined based on their location and/or the potential for similar technologies to be used for remediation. The remedy selection process culminated in 1996 with approval of the final records of decision for the operable units.

Following approval of the records of decision, work began on the design and implementation of the operable unit remedies. While the operable unit management approach was successful for completing the characterization and remedy-selection process, it did not represent the most effective organization of FEMP responsibility to complete remedial design and to

implement the remedial actions. In order to align sitewide responsibilities and regulatory obligations across the five operable units to most efficiently execute remedial design and remedial action, the FEMP established fully integrated project organizations in 1996. Realignment into project organizations reflected the actual work processes and operations necessary to complete the remediation and did not alter the requirements of the FEMP's records of decision. The project organizations with primary responsibilities for CERCLA remediation at the FEMP are as follows:

- Waste Pits Remedial Action Project: This project is responsible for the completion of remediation activities for the excavation, drying (as required), loading, and rail transport of contents of Waste Pits 1-6, the burn pit and the clearwell to an off-site disposal facility, and responsibility for the off-site disposal of contaminated soil and debris that exceed the waste acceptance criteria for the on-site disposal facility. In addition, this project is responsible for the collection, pretreatment (as needed), and transport of remediation wastewaters to the headworks of the advanced wastewater treatment facility.

- Soil Characterization and Excavation Project: This project is responsible for the completion of remediation activities to address contaminated soil at the FEMP and miscellaneous waste units including the South Field, flyash piles, lime sludge ponds, and the solid waste landfill; also excavation/removal of building foundations, roadways, underground utilities and piping systems, sitewide remediation activities, and collection and transport of perched water encountered during remediation to the headworks of the advanced wastewater treatment facility.

- On-Site Disposal Facility Project: This project is responsible for the construction of an eight-cell engineered disposal facility, and operation and maintenance of a leachate collection system that will transport leachate to the advanced wastewater treatment facility, and a haul road that will be used to transport material to the on-site disposal facility. Located near the FEMP's northeastern border, the facility will contain 2.5 million cubic yards (yd^3) (1.9 million cubic meters [m^3]) of soil and debris from remediation of the FEMP. Material and soil to be disposed of in the facility must meet the facility's waste acceptance criteria.

- Facilities Closure and Demolition Project: This project is responsible for the completion of decontamination and dismantling of the above-grade portion of the former uranium processing facilities and all remedial action facilities. This project's scope includes the collection and transport of associated wastewaters to the headworks of the advanced wastewater treatment facility.

- Silos Projects: This project is responsible for the completion of remediation activities for the contents of K-65 Silos 1 and 2 and Silo 3, including the removal, stabilization, and transport of the inventoried residues for off-site disposal. This project's scope includes the collection and transport of associated wastewaters to the headworks of the advanced wastewater treatment facility.

- Aquifer Restoration and Wastewater Project: This project is responsible for the completion of remediation activities necessary to restore the water quality in the affected portions of the Great Miami Aquifer. These activities include the design, construction, operation, monitoring, and reporting for the groundwater restoration and wastewater treatment systems at the FEMP. This project's range of

responsibilities also includes treatment of the waters within Operable Units 1 through 5 necessary to meet the FEMP's storm water, sanitary, and remediation wastewater treatment needs.

Table 1-1 describes each operable unit and its associated remedy and provides a crosswalk between each operable unit and the FEMP project organizations' responsibilities for implementing each remedy.

Exposure Pathways

An **exposure pathway** is a route by which materials could travel between the point of release (a source) and the point of delivering a radiation or chemical dose (a receptor). At the FEMP, two **primary exposure pathways** (liquid and air) have been identified. A primary pathway is one that may allow pollutants to directly reach the public and/or the environment. Therefore, the liquid and air pathways provide a basis for environmental sampling and information useful for evaluating potential dose to the public and the environment.

The liquid pathway accounts for all waterborne pollutants that may be present in the groundwater and treated effluent discharge and/or surface water runoff from the site to the Great Miami River and Paddys Run. The type and concentration of the waterborne pollutant will determine how and where samples should be collected. Refer to Chapters Three and Four for monitoring activities associated with this primary exposure pathway.

The air pathway includes consideration of all airborne pollutants from FEMP activities, such as stack and vent emissions, dust from construction and remediation activities, waste handling, and wind erosion. Refer to Chapter Five for monitoring activities associated with this primary exposure pathway.

In addition to the primary exposure pathways, **secondary exposure pathways** have been thoroughly evaluated under previous environmental monitoring programs. Secondary exposure pathways represent indirect routes by which pollutants may reach receptors. An example of a secondary pathway is the food chain whereas one organism directly consumes a contaminant and is accumulated prior to human consumption. The air-to-soil-to-roots-to-produce-to-human is one such scenario. An evaluation of past monitoring activities has shown that secondary exposure pathways at the FEMP are insignificant routes of exposure to off-site receptors. Therefore, to ensure continued protection of the public and the environment, the IEMP focuses on the primary exposure pathways.

Refer to Chapter Six for information pertaining to dose calculations for 1997 from all pathways.

Environmental Monitoring Program

The environmental monitoring program historically has provided comprehensive on- and off-property environmental surveillance monitoring that specifically addressed the monitoring and reporting needs associated with active uranium production at the site. However, with the conclusion of the FEMP's uranium production mission and completion of the CERCLA remedy selection process (with the exception of certain elements of Operable Unit 4, which are discussed in Chapter Two), focus is now being directed to the safe and efficient implementation of FEMP remediation activities and facility decontamination and dismantling operations. In recognition of this shift in emphasis toward remedy implementation, the FEMP's environmental monitoring program was revised during 1997 to align with the remediation activities planned for the FEMP. As discussed earlier, this revised program is defined in the IEMP.

A key element in directing the focus of the environmental monitoring program presented in the IEMP is the depth of understanding site environmental conditions gained from nearly 10 years of detailed site characterization efforts through the CERCLA process. These detailed environmental evaluations culminated in the Final Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996a). Operable Unit 5 represents all of the FEMP's environmental media and contaminant transport pathways (soil, groundwater, surface water, sediment, air, and biota [produce]) that have been affected by past uranium production operations at the FEMP. The selected remedy for Operable Unit 5 designates the FEMP's final cleanup levels and establishes the aerial extent of on- and off-property remedial actions necessary to provide permanent solutions to environmental concerns posed by the site.

TABLE 1-1

FEMP OPERABLE UNIT REMEDIES AND ASSOCIATED PROJECT RESPONSIBILITIES

Operable Unit	Description	Remedy Overview[a]	Project Organization/Responsibilities
1	• Waste Pits 1 - 6 • Clearwell • Burn pit • Berms, liners, caps, and soil within the boundary	Record of Decision Approved: March 1995 Excavation of materials with constituents of concern above final remediation levels (FRLs), waste processing and treatment by thermal drying (as necessary), off-site disposal at a permitted facility, and FEMP remediation	Waste Pits Remedial Action Project is responsible for rail upgrade, excavation of Operable Unit 1 waste units, waste processing and drying, loading, rail transport, and off-site disposal of contaminated soil and debris that exceed the waste acceptance criteria for the on-site disposal facility. (Note: This project will be performed by International Technology (IT) Corporation.) Soil Characterization and Excavation Project is responsible for directing excavation and certification of contaminated soil beneath the waste pits, as well as at- and below-grade remediation facilities, including the railroad. Aquifer Restoration and Wastewater Project is responsible for final treatment of contaminated runoff, perched water collected during waste pit excavation, and processing wastewater discharges. Each project is responsible for transporting remediation wastewater to the headworks of the advanced wastewater treatment facility for treatment. Facilities Closure and Demolition Project is responsible for decontamination and dismantling of Operable Unit 1 remediation facilities not specifically the responsibility of IT Corporation.
2	• Solid waste landfill • Inactive flyash pile • Active flyash pile (now inactive) • North and south lime sludge ponds • Other South Field disposal areas • Berms, liners, and soil within the operable unit boundary	Record of Decision Approved: May 1995 Excavation of all materials with constituents of concern above FRLs, treatment for size reduction and moisture control as required, on-site disposal in the on-site disposal facility, off-site disposal of a small fraction of excavated material that exceeds the waste acceptance criteria for the on-site disposal facility and lead-contaminated soil from the South Field firing range, and FEMP remediation	Soil Characterization and Excavation Project is responsible for excavation and disposition of waste from all Operable Unit 2 subunits and certify the footprints. On-Site Disposal Facility Project is responsible for design, construction, and closure of the on-site disposal facility that will contain Operable Unit 2 subunit wastes; Operable Unit 5 soil and debris, and Operable Unit 3 debris; responsible for monitoring leachate within the on-site disposal facility and perched groundwater in the till beneath the on-site disposal facility. Waste Acceptance Operations are responsible for field oversight of soil excavations, for reviewing and signing manifests for impacted material delivered to the on-site disposal facility for placement, and for rejecting any unacceptable shipments. Aquifer Restoration and Wastewater Project is responsible for treating contaminated runoff and perched water collected during excavation of Operable Unit 2 subunit wastes; responsible for treating leachate from the on-site disposal facility; each project is responsible for transporting remediation wastewater to the headworks of the advanced wastewater treatment facility for treatment.
3	Former production area, associated facilities, and equipment (includes all above- and below-grade improvements) including, but not limited to: • All structures, equipment, utilities, effluent lines, and K-65 transfer line • Wastewater treatment facilities • Fire training facilities • Coal pile • Scrap metals piles • Drums, tanks, solid waste, waste product, feedstocks, and thorium	Record of Decision Approved: September 1996 Adoption of Operable Unit 3 Interim Record of Decision; alternatives to disposal through the unrestricted or restricted release of materials, as economically feasible for recycling, reuse, or disposal; treatment of material for on- or off-site disposal; required off-site disposal for process residues, product materials, process-related metals, acid brick, concreted from specific locations, and any other material exceeding the on-site disposal facility waste acceptance criteria; and on-site disposal for material that meets the on-site disposal facility waste acceptance criteria	Facilities Closure and Demolition Project is responsible for decontamination and dismantling of all above-grade portions of buildings and facilities at the FEMP. Soil Characterization and Excavation Project is responsible for excavation and certification of soil beneath facilities and for removal of at- and below-grade structures. Waste Acceptance Operations are responsible for reviewing facility decontamination and dismantling planning documents; performing field oversight of debris sizing, segregation of on-site disposal facility material categories, and segregation of prohibited items; completing field tracking logs; completing manifests for on-site disposal facility-bound material; and compiling final records of decontamination and dismantling debris placed in the on-site disposal facility. Aquifer Restoration and Wastewater Project is responsible for treating decontamination and other wastewaters during decontamination and dismantling activities and processing wastewater discharges; each decontamination and dismantling project is responsible for transporting remediation wastewater to the headwater of the advanced wastewater treatment facility for treatment. On-Site Disposal Facility Project is responsible for design, construction, and closure of the on-site disposal facility that will contain Operable Unit 2 subunit wastes, Operable Unit 5 soil, and Operable Unit 3 debris.

TABLE 1-1
(Continued)

Operable Unit	Description	Remedy Overview[a]	Project Organization/Responsibilities
4	• Silos 1 and 2 (containing K-65 residues) • Silo 3 (containing cold metal oxides) • Silo 4 (empty and never used) • Decant tank system • Berms and soil within the operable unit boundary	Record of Decision Approved: December 1994 Silos 1 and 2 submit Record of Decision Amendment to EPA: December 2000 Silo 3 Explanation of Significant Differences Approved: March 1998 Removal of Silo 3 materials and Silos 1 and 2 residues and decant sump tank sludges with on-site stabilization of materials and residues and sludges followed by off-site disposal; demolition and decontamination, to the extent possible, of silos and remediation facilities; excavation of contaminated soil above the FRLs with on-site disposal for contaminated soils and debris that meet the on-site disposal facility waste acceptance criteria; and site restoration. Contaminated soil and debris that exceed the on-site disposal facility waste acceptance criteria will be disposed of off site	Silo 3 Project is responsible for Silo 3 content removal, treatment, and transport off site. Silos 1 and 2 Project is responsible for transfer of Silos 1 and 2 residues content to temporary transfer tanks, treatment, and transport off site. Infrastructure and support systems such as roads and utilities will be completed to support the final remediation of the silos. Soil Characterization and Excavation Project is responsible for certification, excavation, and disposition of contaminated soil beneath the silos and for removal of subsurface structures (i.e., sub-grade silo decant system). Aquifer Restoration and Wastewater Project is responsible for treating decontamination and other wastewaters during decontamination and demolition activities; each project is responsible for capturing and transporting remediation wastewater to the headwaters of the advanced wastewater treatment facility for treatment. On-Site Disposal Facility Project is responsible for design, construction, and closure of the on-site disposal facility that will contain Operable Unit 2 subunit wastes, Operable Unit 5 soil, and Operable Unit 3 debris. Facilities Closure and Demolition Project is responsible for decontamination and dismantling of all Operable Unit 4 remediation facilities and associated above ground pipings.
5	• Groundwater • Surface water and sediments • Soil not included in the definitions of Operable Units 1 through 4 • Flora and fauna	Record of Decision Approved: January 1996 Extraction of contaminated groundwater from the Great Miami Aquifer to meet FRLs at all affected areas of the aquifer. Treatment of contaminated groundwater, storm water, and wastewater to attain mass-based discharge limits and FRLs in the Great Miami River. Excavation of contaminated soil and sediment to meet FRLs. Excavation of contaminated soil containing perched water that presents an unacceptable threat, through contaminant migration, to the underlying aquifer. On-site disposal of contaminated soil, and sediment that meet the on-site disposal facility waste acceptance criteria. Soil and sediment that exceed the waste acceptance criteria for the on-site disposal facility will be treated, when possible, to meet the on-site disposal facility waste acceptance criteria or will be disposed of at an off-site facility. Site restoration, institutional controls, and post-remediation maintenance	Aquifer Restoration and Wastewater Project is responsible for designing, installing, and operating the extraction/injection systems for Great Miami Aquifer groundwater restoration; for groundwater monitoring in the Great Miami Aquifer; for designing, constructing, and operating all treated effluent discharge systems, and for treating, discharging, and reporting of contaminated groundwater, storm water, and remediation wastewaters at the FEMP. Soil Characterization and Excavation Project is responsible for certification of sitewide soil; excavation and disposition of contaminated soil, sediment, perched groundwater and at- and below-grade structures; and final site restoration. On-Site Disposal Facility Project is responsible for design, installation, and closure of the on-site disposal facility that will contain Operable Unit 2 subunit wastes, Operable Unit 5 soil, and Operable Unit 3 debris; and for operation and maintenance of a leachate collection system. Waste Acceptance Operations are responsible for reviewing Soils Characterization and Excavation Project planning documents; performing field oversight of soil excavations, segregation of on-site disposal facility material categories, and segregation of prohibited items; completing field tracking logs; completing manifests for on-site disposal facility-bound material; and compiling final records of soil and at- and below-grade debris placed in the on-site disposal facility. Facilities Closure and Demolition Project is responsible for decontamination and dismantling of all Operable Unit 5 remediation facilities.

[a] Source of information is each operable unit's Record of Decision and remedial design documents.

The results of the cleanup decisions reached in the Operable Unit 5 and the information gained from the site characterization activities conducted over the past 10 years served as the foundation for the development of the integrated environmental monitoring approach presented in the IEMP. The key elements of the IEMP are described below:

- The IEMP defines monitoring activities for environmental media, such as groundwater, surface water and treated effluents, sediment, air (including air particulate, radon, and direct radiation), biota (produce), and natural resources. Monitoring activities, in general, concentrate on the primary exposure pathways (liquid and air) and focus on assessing the collective effect of sitewide emissions on the surrounding environment.

- The plan establishes an integrated data evaluation and decision-making process for each environmental media. Through this process, environmental conditions at the FEMP are continuously evaluated and used to support a wide range of decisions affecting the implementation of remediation activities. For example, environmental data are routinely evaluated to identify any significant trends which may indicate the potential for an unacceptable future impact to the environment if action is not taken. This information is communicated to the appropriate remediation project organization(s) so that corrective actions can be identified and implemented before an unacceptable condition is reached.

- Recognizing that the dominant types and pace of remediation activities will change over the life of the cleanup effort, the IEMP was developed as a "living document" with a two-year focus. Under the living document concept, the IEMP will be reviewed annually and revised every two years to ensure that the monitoring program adequately addresses emerging remediation activities.

- The IEMP consolidates routine reporting of environmental data under a system consisting of quarterly status reports and a comprehensive annual report available to stakeholders.

The scope and intensity of the monitoring activities defined under the IEMP will change as remediation of the FEMP progresses; however, the core objectives of the IEMP will continue to serve as the framework for developing programmatic changes as needed. The core objectives of the IEMP are to:

- Maintain an integrated monitoring approach which provides a comprehensive assessment of environmental conditions at the FEMP

- Communicate monitoring results in a timely manner to support project decision making and stakeholder involvement

- Track the performance of the groundwater remedy

- Document that contaminant releases attributable to the implementation of the FEMP's sitewide remediation activities remain within established thresholds.

Site Setting

A brief description of the FEMP within the regional landscape encompasses its natural features and their characteristics. Elements of the site setting include: land use and demography, local geography, geology, surface hydrology, meteorological conditions, and natural resources.

Land Use and Demography

Modern economic activities in the area of the FEMP rely heavily on the physical environment. Examples of the primary land use in the area are as follows:

- Farming and raising beef cattle account for the majority of the land use in the area. Major crops include field corn, sweet corn, soybeans, and winter wheat. Several nearby farms sell produce locally or in nearby urban markets.

- Many gravel pit operations extract sand and gravel along the Great Miami River valley with a number operating in close proximity to the FEMP.

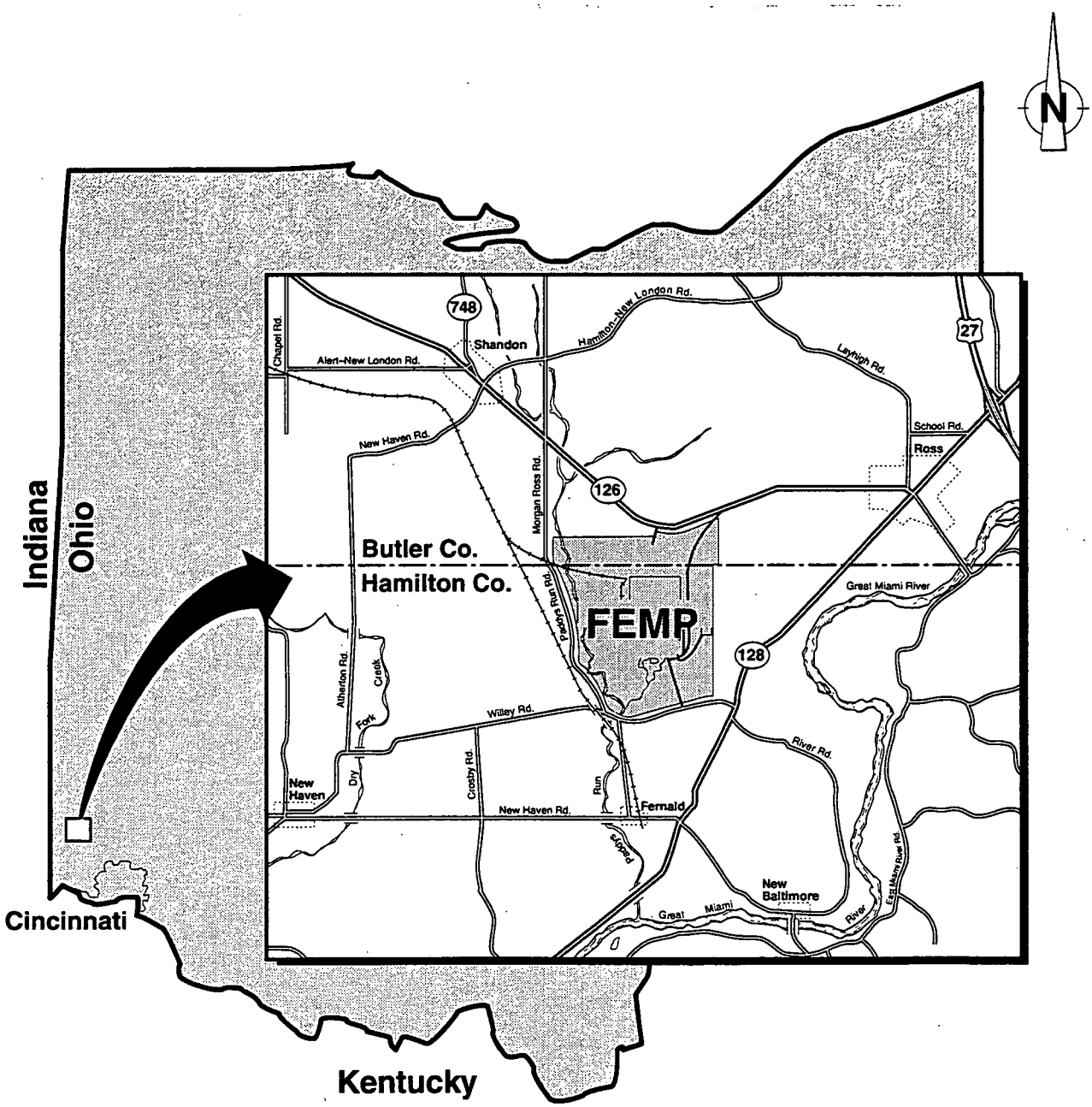
- A private water utility is located approximately 1.25 miles (2 km) upstream of the FEMP's effluent discharge to the Great Miami River; presently, this utility pumps about 20 million gallons (76 million liters) of groundwater per day for primarily industrial use.

Scattered residences and several villages including Fernald, New Baltimore, Ross, New Haven, and Shandon are located near the FEMP. Downtown Cincinnati is approximately 18 miles (29 km) southeast of the FEMP, and the cities of Hamilton and Fairfield are six to eight miles (10 to 13 km) to the northeast, respectively (Figure 1-1).

There is an estimated population of 14,600 within five miles (eight km) of the FEMP and an estimated 2.74 million within 50 miles (80 km). Figure 1-2 shows an estimate of population distribution in the surrounding areas.

Geography

The location of the major physical features associated with the FEMP, such as the buildings and supporting FEMP infrastructure, are depicted in Figure 1-3. The former production area and various administrative buildings dominate this view of the FEMP. The former production area occupies approximately 136 acres (55 hectares) in the center of the FEMP. The waste pit area and K-65 Silos are located adjacent to the western edge of the former production area. The Great Miami River cuts a terraced valley to the east of the FEMP while Paddys Run, an intermittent stream, flows from north to south along the FEMP's western boundary. In general, the FEMP lies on a gently sloping terrace between vegetated bedrock outcroppings to the north, southeast, and southwest.



The FEMP covers about 1,050 acres (425 hectares).

Figure 1-1. FEMP and Vicinity

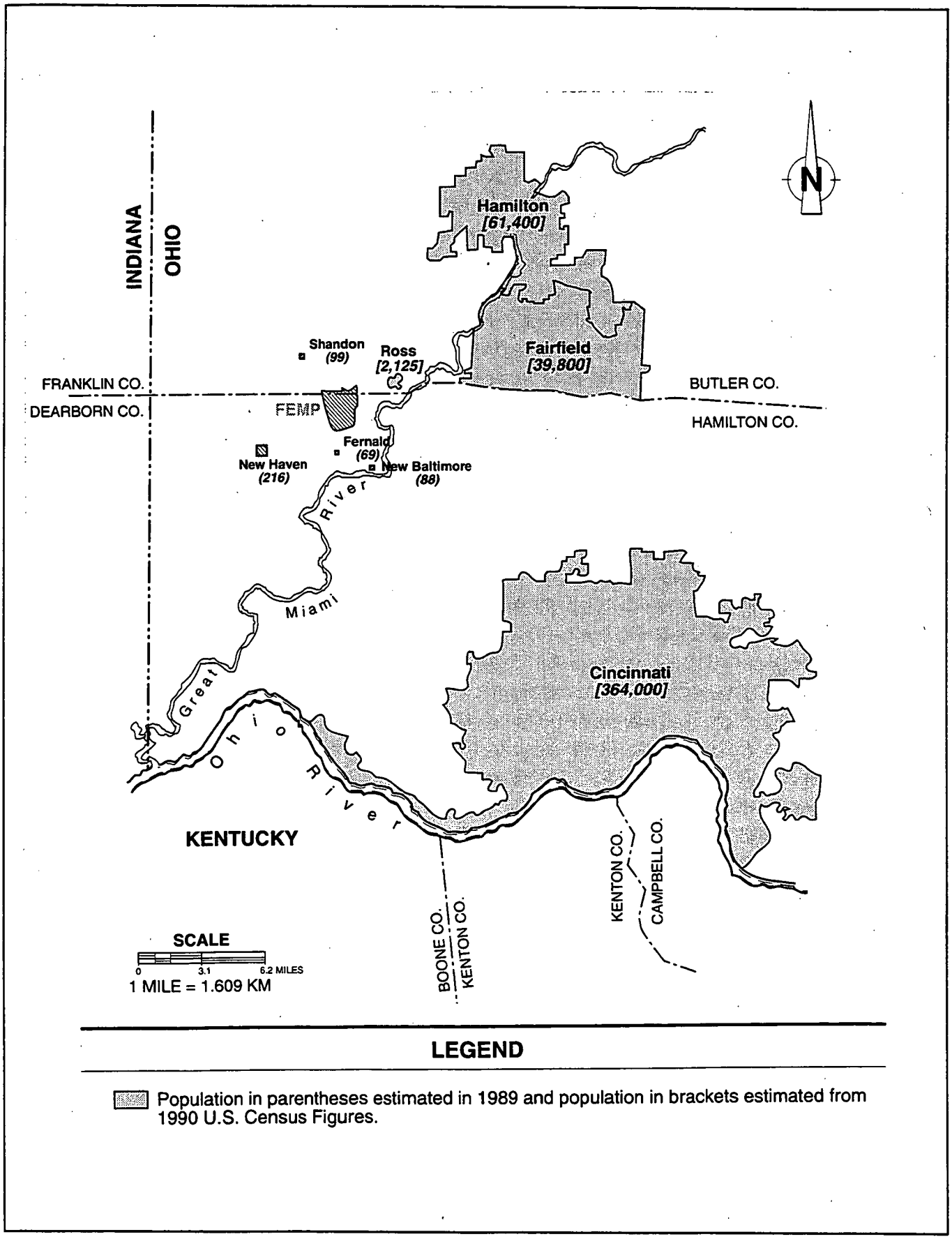


Figure 1-2. Major Communities in Southwestern Ohio

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1	Plant 1 (D&D complete)	12	Waste Pits
2/3	Plant 2/3	13	Silos 1 and 2
4	Plant 4 (D&D complete)	14	Silos 3 and 4
5	Plant 5	15	Vitrification Pilot Plant
6	Plant 6	16	Advanced Wastewater Treatment Facility
7	Plant 7 (D&D complete)	17	Storm Water Retention Basins
8	Plant 8	18	Waste Haul Road
9	Plant 9	19	Southern Waste Units
10	On-Site Disposal Facility Cell 1	20	Sewage Treatment Plant
11	Railyard	21	Boiler Plant

Figure 1-3. Fernald Site Perspective

Geology

Bedrock, sediments, and land forms in the area surrounding the FEMP indicate that approximately 450 million years ago the Cincinnati area was covered by a shallow sea. Flat-lying shale with interbedded limestone was deposited in the shallow sea as evidenced by the abundance of marine fossils that are present in the bedrock in the Cincinnati area. In the more recent geologic past, the advance and retreat of three separate glaciers shaped the southwestern Ohio landscape. A large river drainage system south of the glaciers created river valleys up to 200 feet (60 meters) deep, which were then filled with sand and gravel when the glaciers melted. These filled river valleys are called buried valleys.

The last glacier to reach the FEMP area left a relatively impermeable mixture of clay and silt with minor amounts of sand and gravel deposited across the land surface. This deposit of clay and silt is called glacial overburden.

The FEMP is situated on a layer of glacial overburden that overlies portions of a two to three mile (three to five km) wide buried valley. This valley, known as the New Haven Trough, makes up part of the Great Miami Aquifer. The impermeable nature of the shale and limestone bedrock that defines the edges and bottom of the New Haven Trough confines the groundwater to the sand and gravel within the buried valley. Where present, the glacial overburden limits the downward movement of precipitation and surface water runoff into the underlying sand and gravel of the Great Miami Aquifer.

The Great Miami River and its tributaries have eroded significant portions of the glacial overburden and exposed the underlying sand and gravel of the Great Miami Aquifer. Thus, in the areas where the glacial overburden has been eroded away, precipitation and surface water runoff can easily migrate into the underlying Great Miami Aquifer. Figure 1-4 provides a glimpse into the structure of subsurface deposits in the region along an east-west cross-section through the FEMP, while Figure 1-5 presents the regional groundwater flow patterns in the Great Miami Aquifer.

Surface Hydrology

The FEMP is part of the Great Miami River drainage basin, although it is situated above the floodplain (Figure 1-6). Natural drainage from the FEMP to the Great Miami River occurs primarily via Paddys Run. This intermittent stream begins losing flow to the underlying sand and gravel aquifer south of the waste pit area. Paddys Run empties into the Great Miami River 1.5 miles (2.4 km) south of the FEMP.

In addition to natural drainage through Paddys Run, FEMP surface runoff from the former production area and waste pit area is collected, treated, and discharged to the Great Miami River. Since January 1995, the majority of this runoff has been treated for uranium removal in the advanced wastewater treatment facility before being discharged. The Great Miami River, 0.6 mile (one km) east of the FEMP, runs in a southerly direction and flows into the Ohio River about 24 miles (39 km) downstream of the FEMP. The segment of the river between the FEMP and the Ohio River is not used as a source of public drinking water.

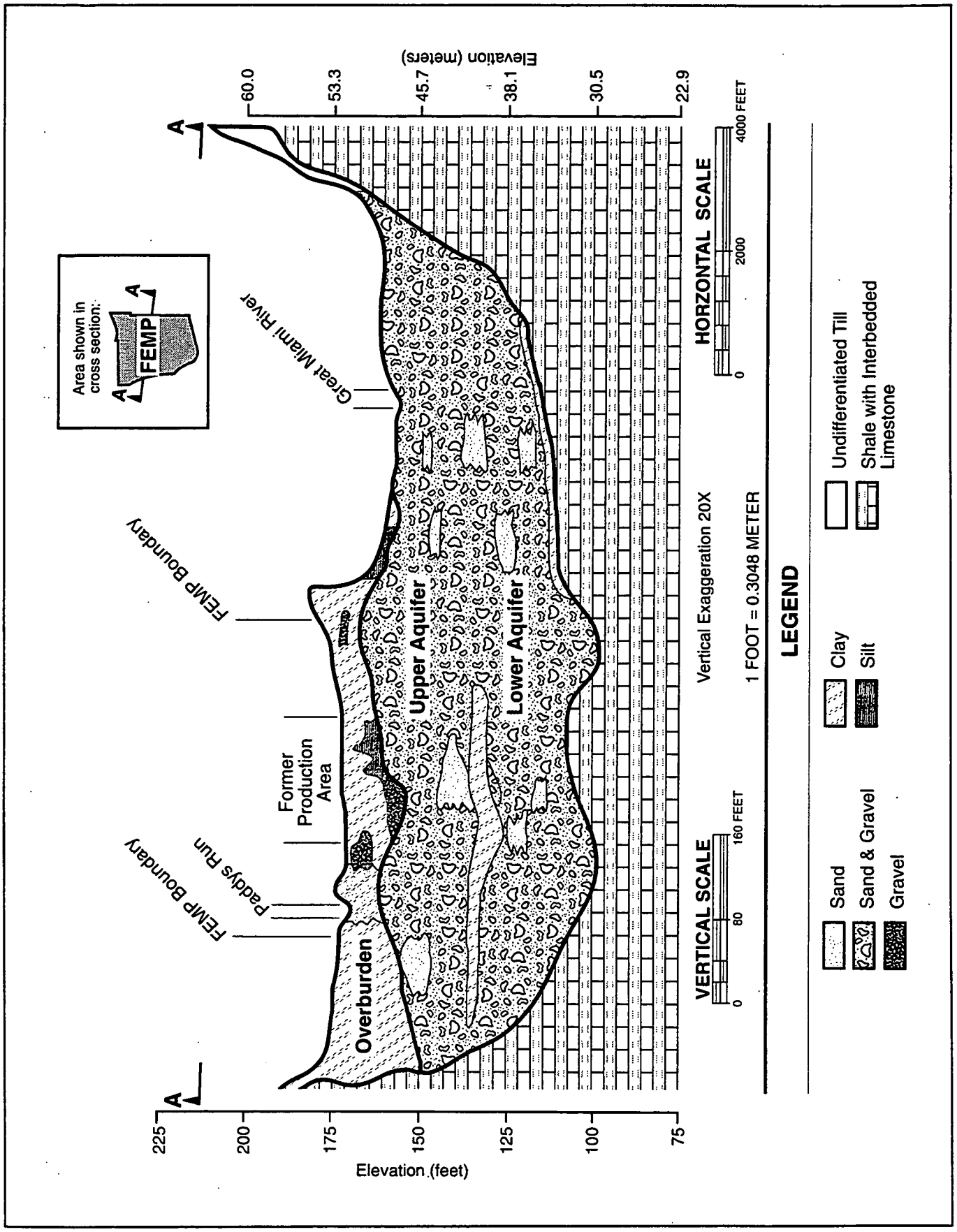
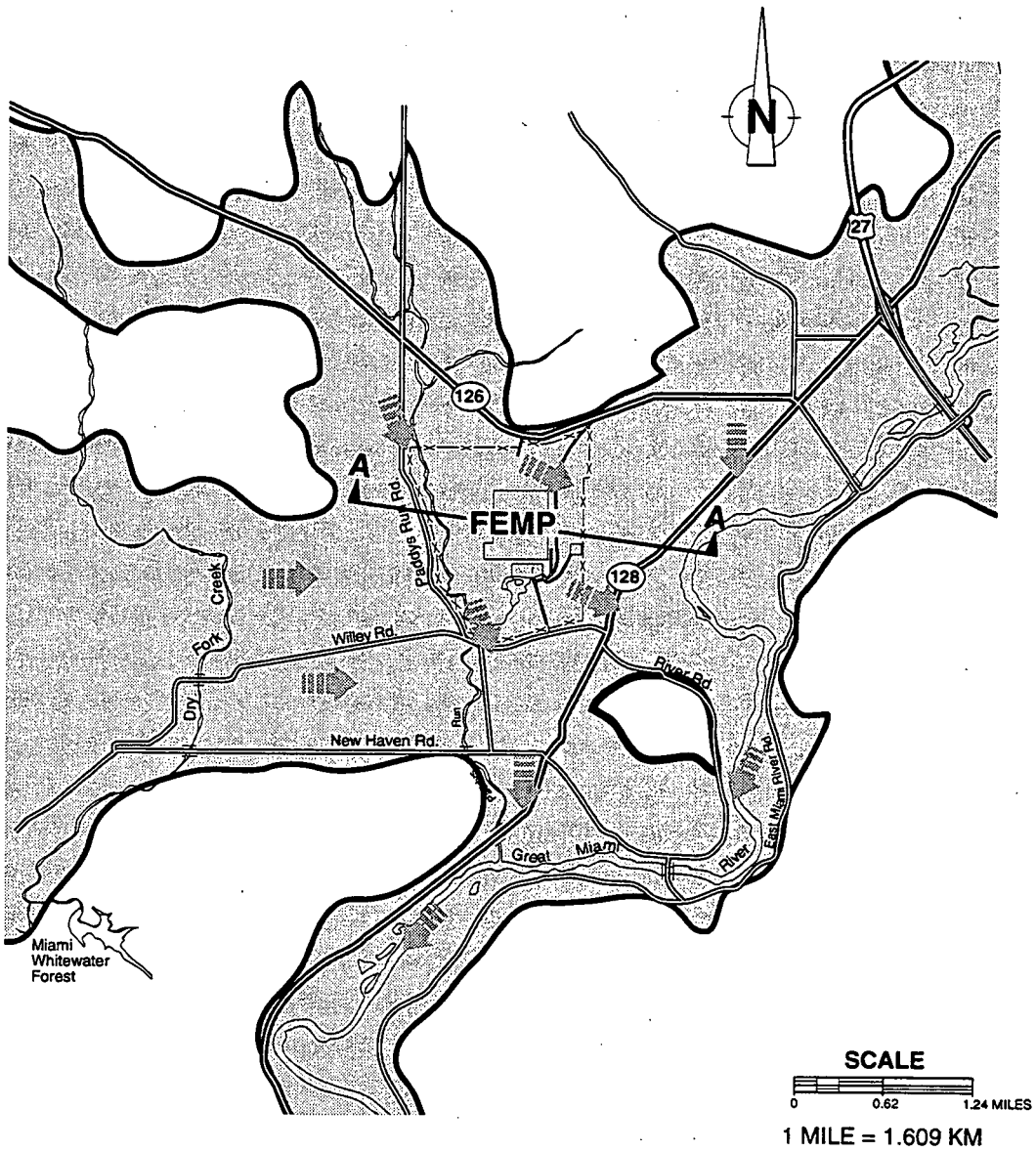


Figure 1-4. Cross-Section of the New Haven Trough, Looking North



LEGEND

- Buried Valley Aquifer
- General Direction of Groundwater Flow
- FEMP Boundary
- A A Location of Cross-Section Shown in Figure 1-4

Figure 1-5. Regional Groundwater Flow in the Great Miami Aquifer

000032

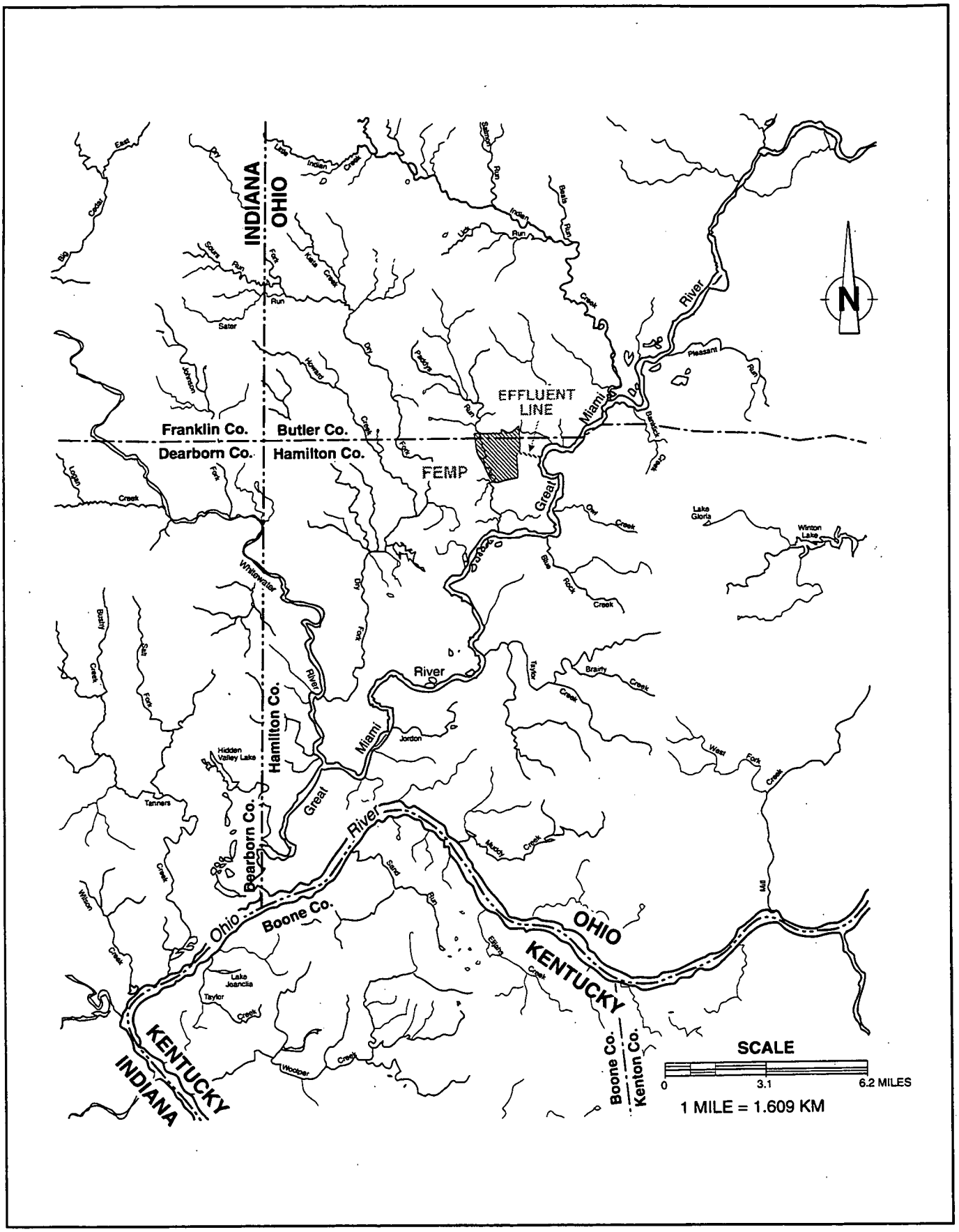


Figure 1-6. Great Miami River Drainage Basin

The average flow rate for the Great Miami River in 1997 was 3,850 cubic feet per second (ft^3/sec) (109 cubic meters per second [m^3/sec]), measured daily approximately 10 river miles (16 river km) upstream of the FEMP's effluent discharge.

Meteorological Conditions

Meteorological data gathered at the FEMP are primarily used to evaluate climatic conditions at the FEMP. The environmental monitoring program uses atmospheric models to determine how airborne effluents are mixed and dispersed. These models are then used to assess the impact of operations on the surrounding environment, in accordance with DOE requirements.

Airborne pollutants are subject to existing weather conditions. Wind speed and direction, precipitation, and atmospheric stability play a role in predicting how pollutants are distributed in the environment. Weather data, particularly wind speed and direction, and precipitation play an important role in developing the monitoring program design and in interpreting environmental data.

Figures 1-7 and 1-8 are annual wind roses illustrating the average wind speed and general direction measured at the 33-foot (10-meter) and 197-foot (60-meter) levels in 1997. The prevailing winds were from the west through south-southwest approximately 30 to 40 percent of the time at both the 33- and 197-foot (10- and 60-meter) level. Tables in Appendix C, Attachment 4, of this report present meteorological data and wind direction and average speed for 1997.

In 1997, the precipitation measured at the FEMP was 40.11 inches (101.9 centimeters [cm]), which is slightly below the average annual precipitation of 41 inches (104 cm) for 1987 through 1996. Figure 1-9 shows 1997 total precipitation for the area in relation to the annual precipitation amounts recorded since 1987. (Precipitation totals through 1992 were taken from the measurements made at the Greater Cincinnati/Northern Kentucky International Airport because of a computer software problem at the FEMP meteorological tower. This problem was corrected, and the 1993 through 1997 totals were obtained from measurements made at the FEMP.) In addition, Figure 1-10 shows 1997 precipitation by month compared to average precipitation from 1919 to 1995.

Natural Resources

Natural resources have important aesthetic, ecological, educational, historical, recreational, and scientific value to the United States. Their management will be an ongoing process throughout federal ownership of the FEMP. Studies such as wildlife surveys (Facemire 1990) and the Operable Unit 5 Ecological Risk Assessment provided as Appendix B of the Remedial Investigation Report for Operable Unit 5 (DOE 1995c) show that terrestrial and aquatic flora and fauna at the FEMP are diverse, healthy, and similar in abundance and species composition to those populations of surrounding ecological communities. A detailed discussion of the site's diverse ecological habitats and cultural resources is provided in Chapter Seven.

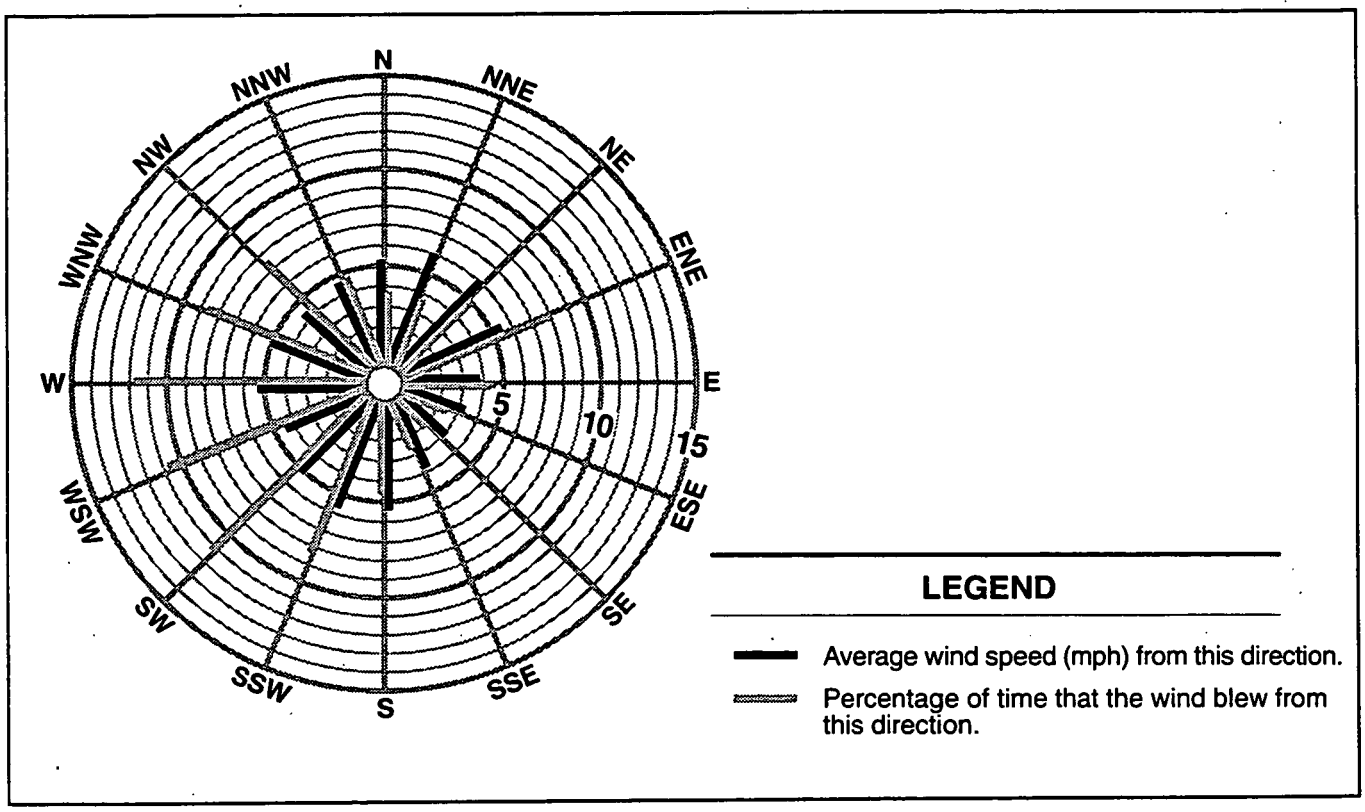


Figure 1-7. 1997 Wind Rose Data, 10-Meter Height

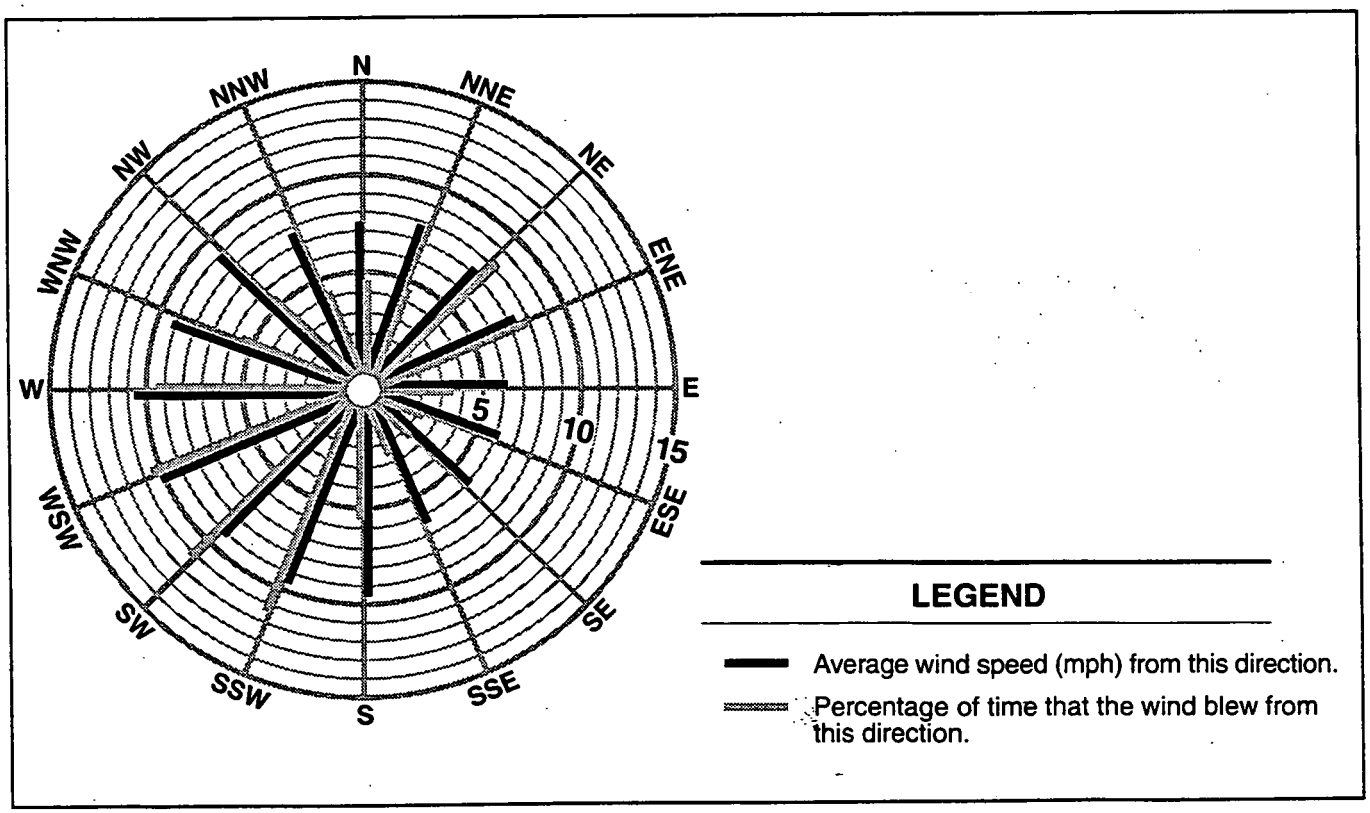


Figure 1-8. 1997 Wind Rose Data, 60-Meter Height

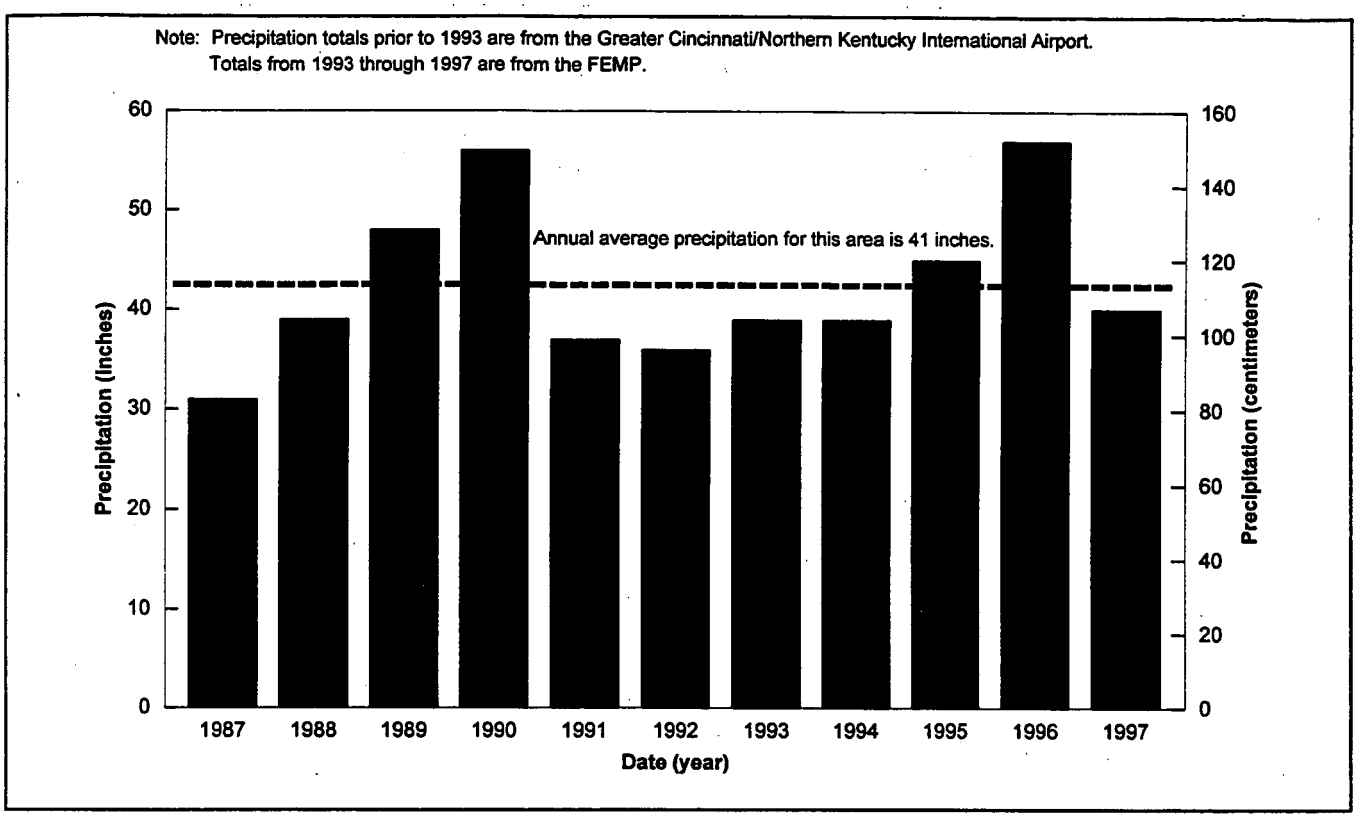


Figure 1-9. Annual Precipitation Data, 1987-1997

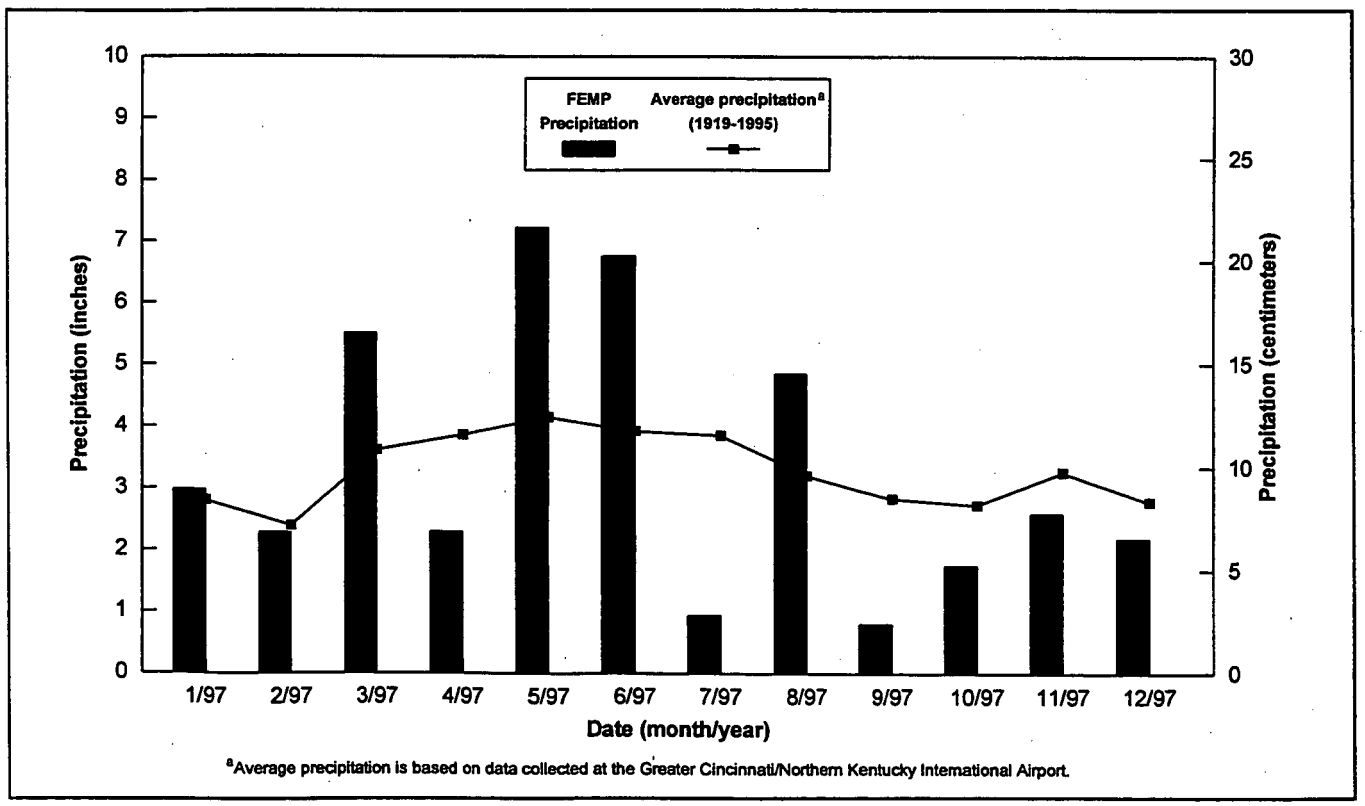


Figure 1-10. 1997 Monthly Precipitation Data

Remediation Status and Compliance Summary

In 1997, visible progress was made in site remediation at the FEMP. This section provides a status of the site remediation for 1997 and a summary of the FEMP's compliance with applicable environmental laws, regulations, and related legal agreements.

Compliance with these requirements is enforced by several agencies, including EPA, OEPA, and other local agencies. The EPA develops, promulgates, and enforces environmental protection regulations and technology-based standards. These regulations and standards are enforced by EPA regional offices and state agencies such as the OEPA. EPA Region V implements the CERCLA process, with the active participation of the OEPA. CERCLA is the primary driver for remediation of the FEMP.

For some programs, such as those under the Resource Conservation and Recovery Act (RCRA), the Clean Air Act (excluding NESHAP compliance), the Clean Water Act, and the Safe Drinking Water Act, EPA has granted the State of Ohio primary enforcement authority. For these programs, Ohio promulgates state regulations which must be at least as stringent as federal requirements. Several legal agreements between DOE and EPA Region V and/or OEPA identify FEMP-specific requirements for compliance with the regulations. As part of complying with these regulations, DOE Headquarters issues directives to its field offices and conducts audits to ensure compliance with all regulations.

CERCLA History and Remediation Status

Since 1989, the FEMP has been on the National Priorities List, which names sites requiring environmental cleanup under CERCLA. Consistent with the requirements of CERCLA Section 120, DOE and EPA signed the Consent Agreement in 1990 (EPA 1990) that outlined activities and schedules for FEMP remediation.

This agreement, which was amended in 1991 and 1993, divided the FEMP into operable units so that the site investigation portion of the CERCLA remedial response process could be more effectively managed. The operable units were defined, as described in Chapter One, based on their location or the potential for similar technologies to be used during FEMP remediation. The agreement set schedules for completion of the remedial investigation (RI) and feasibility study (FS) activities for each operable unit and initiated removal actions, which are tasks undertaken to abate immediate threats to the environment and public health.

In broad terms, the remedial response process for remediating sites under CERCLA consists of three general phases. The FEMP has completed the first two phases, site characterization and remedy selection (see CERCLA phases description in Chapter One). The final phase is remedial design and implementation of the remedial action(s). Remediation activities, documents, and schedules are identified in each operable unit's remedial design and remedial action work plans.

The EPA, with OEPA's concurrence, has approved remedy selection documents for all operable units and is currently re-examining the remedy for Operable Unit 4. Among the decisions recorded in these documents are the final remediation levels (FRLs) for specific media. Table 2-1 lists FRLs for the following IEMP-monitored media: groundwater, surface water, and sediment. The groundwater FRLs for fluoride and lead changed and were documented in the Operable Unit 5 Record of Decision by change pages.

In 1997, many documents that describe specific remediation activities were issued and approved. These documents include work plans, engineering designs and reports. Each document listed is available to the public in the FEMP Public Environmental Information Center.

These documents reflect the impact and input from stakeholders who have helped form the remediation strategy at the FEMP. Stakeholder participation is important under CERCLA and in the DOE philosophy at the FEMP. In 1997, stakeholder involvement included the following highlights:

- Fernald Citizens Advisory Board
  In July 1997, the Fernald Citizens Task Force changed its name to the Fernald Citizens Advisory Board to better align itself with the other site-specific advisory boards in the DOE complex. During the year, the Citizens Advisory Board focused on the Operable Unit 4/Silos Project dispute resolution process and path forward, recycling efforts, natural resource management, and transition of the FEMP's monitoring program to the IEMP.

- Fernald Community Reuse Organization
  In April 1997, the Fernald Community Reuse Organization established itself as a nonprofit corporation under Ohio statutes and received a $150,100 grant from DOE to support start-up activities, including retaining professional consultant services to help the group organize and plan its economic development strategy. Later in the year, the Community Reuse Organization awarded a contract to a local economic development consultant and established working committees to focus on economic development/worker transition issues and potential reuse of site assets, including property and equipment.

- Silos Projects Public Involvement
  Public involvement activities were extensive for the Silos Project during 1997. During the year, the Silos Project held several meetings, including public hearings, with local stakeholders and concerned citizens associated with the Nevada Test Site to involve them in developing a revised path forward for the project. As a result, consensus was reached with regulators and stakeholders and documented in a Dispute Resolution Agreement, which outlined future key milestones for the project.

- Monthly Meetings
  In September 1997, DOE and Fluor Daniel Fernald introduced a new monthly forum, the Cleanup Progress Briefing, which is designed to update stakeholders on current remediation projects, preview upcoming activities, and link stakeholders with decision makers. The new briefings have been endorsed by community leaders, regulatory agencies, and FEMP personnel as an effective method of

TABLE 2-1
FINAL REMEDIATION LEVELS
FOR GROUNDWATER, SURFACE WATER, AND SEDIMENT

	FRL[a,b]		
Constituent	**Groundwater**	**Surface Water**	**Sediment**
General Chemistry	**(mg/L)**	**(mg/L)**	**(mg/kg)**
Cyanide	NA	0.012	NA
Fluoride	4[c]	2	NA
Nitrate[d]	11	2,400	NA
Inorganics	**(mg/L)**	**(mg/L)**	**(mg/kg)**
Antimony	0.006	0.19	NA
Arsenic	0.05	0.049	94
Barium	2	100	NA
Beryllium	0.004	0.0012	33
Boron	0.33	NA	NA
Cadmium	0.014	0.0098	71
Chromium VI[d]	0.022	0.01	3,000
Cobalt	0.17	NA	36,000
Copper	1.3	0.012	NA
Lead	0.015[c]	0.01	NA
Manganese	0.9	1.5	410
Mercury	0.002	0.0002	NA
Molybdenum	0.1	1.5	NA
Nickel	0.1	0.17	NA
Selenium	0.05	0.005	NA
Silver	0.05	0.005	NA
Thallium	NA	NA	88
Vanadium	0.038	3.1	NA
Zinc	0.021	0.11	NA
Radionuclides	**(pCi/L)**	**(pCi/L)**	**(pCi/g)**
Cesium-137	NA	10	7
Neptunium-237	1	210	32
Lead-210	NA	11	390
Plutonium-238	NA	210	1,200
Plutonium-239/240	NA	200	1,100
Radium-226	20	38	2.9
Radium-228	20	47	4.8
Strontium-90	8	41	7,100
Technetium-99	94	150	200,000
Thorium-228	4	830	3.2
Thorium-230	15	3500	18,000
Thorium-232	1.2	270	1.6
	(µg/L)	**(µg/L)**	**(mg/kg)**
Total Uranium[e]	20	530	210

TABLE 2-1
(Continued)

Constituent	FRL[a,b] Groundwater	Surface Water	Sediment
Organics	(µg/L)	(µg/L)	(µg/kg)
Alpha-chlordane	2	0.31	NA
Aroclor-1254	0.2	0.2	670
Aroclor-1260	NA	0.2	670
Benzene	5	280	NA
Benzo(a)anthracene	NA	1	190,000
Benzo(a)pyrene	NA	1	19,000
Benzo(b)fluoranthene	NA	NA	190,000
Benzo(k)fluoranthene	NA	NA	1,900,000
Bis(2-chloroisopropyl)ether	5	280	NA
Bis(2-ethylhexyl)phthalate	6	8.4	5,000,000
Bromodichloromethane	100	240	NA
Bromoform	NA	NA	160,000
Bromomethane	2.1	1300	NA
Carbazole	11	NA	63,000
Carbon disulfide	5.5	NA	NA
Chloroethane	1	NA	NA
Chloroform	100	79	NA
Chrysene	NA	NA	19,000,000
Dibenzo(a,h)anthracene	NA	1	NA
3,3'-Dichlorobenzidene	NA	7.7	NA
1,1-Dichloroethane	280	NA	NA
1,1-Dichloroethene	7	15	NA
1,2-Dichloroethane	5	NA	NA
Dieldrin	NA	0.02	NA
Di-n-butylphthalate	NA	6,000	NA
Di-n-octylphthalate	NA	5	NA
Methylene chloride	5	430	NA
4-Methylphenol	29	2,200	NA
4-Methyl-2-pentanone	NA	NA	2,100,000
4-Nitrophenol	320	7,400,000	NA
N-nitrosodiphenylamine	NA	NA	260,000
Octachlorodibenzo-p-dioxin	0.0001	NA	NA
Phenanthrene	NA	NA	3
2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.01	NA	NA
Tetrachloroethene	NA	45	NA
1,1,1-Trichloroethane	NA	1	NA
1,1,2-Trichloroethane	NA	230	NA
Trichloroethene	5	NA	NA
Vinyl Chloride	2	NA	NA

[a]From *Record of Decision for Remedial Actions at Operable Unit 5*, Tables 9-4 through 9-6, January 1996
[b]Not Applicable - Indicates no FRL was required for this constituent in this particular environmental media.
[c]The groundwater FRLs for fluoride and lead were changed and documented in the Operable Unit 5 Record of Decision by change pages.
[d]Because of holding time considerations, nitrate/nitrite is analyzed for nitrate and total chromium is analyzed for chromium VI. This is acceptable because total chromium and nitrate/nitrite provide a more conservative result.
[e]Uranium consists of several isotopes. The common isotopes of uranium are: uranium-234, uranium-235, uranium-236, and uranium-238. This report interchangeably uses the terms uranium and total uranium. Either of these terms is defined as the sum of the various isotopic components.

communicating timely information on cleanup plans and activities while reducing the number of evening meetings.

- Public Tour
  To respond to stakeholders' increasing interest in FEMP cleanup progress, DOE and Fluor Daniel Fernald hosted a public bus tour of the FEMP during the October 1997 Cleanup Progress Briefing. Over 60 stakeholders attended.

- New Publications
  During 1997, DOE and Fluor Daniel Fernald created several new publications to appeal to both external and internal stakeholders: the Cleanup Progress Report is a new quarterly report that documents completed and ongoing remediation activities in a visual format; A Look Ahead is a one-page, bi-monthly newsletter highlighting future activities to alert FEMP stakeholders of upcoming cleanup plans and activities; and Let's Talk is a new information tool specifically designed to encourage FEMP management to share information with team members through regular, personal interaction.

- Volunteers
  The Fernald Community Involvement Team, a volunteer task force of FEMP employees dedicated to supporting humanitarian and/or environmental projects, was named Outstanding Corporate Volunteer Program for 1997 by the Cincinnati Association of Volunteer Administrators. Also, Fernald's Community Outreach Program received approximately $20,000 in fiscal year 1997 for DOE-funded science enrichment programs to benefit teachers and students in the Greater Cincinnati area. Over 10,000 students and 500 teachers participated in the programs.

The following sections summarize each remediation project's activities performed in 1997, including associated removal actions. Each project summary includes a list of important documents issued in 1997. Refer to Table 1-1 in Chapter One for an explanation of each project's responsibility for implementing operable unit records of decision.

Waste Pits Remedial Action Project

In 1997, the Waste Pits Remedial Action Project awarded a contract to International Technology Corporation to remove and dry the pit waste. Numerous rail improvements were also made during the year. Field work performed during 1997 consisted of upgrades to off-site trestles along the branch line connecting the FEMP with the CSXT main rail line at Cottage Grove, Indiana and on-site infrastructure improvements to rail facilities in the support area for the remediation facilities. Other activities included:

- Site preparation for construction of the waste processing facility and loadout facility. This included an upgrade to the current rail system and installation of a storm water management system.

- North railyard upgrade preparation, construction of storm water controls and a sedimentation basin, and actual construction on the north railyard

- Paddys Run, Okeana, Camp Run, and South Wynn railway trestles upgrades (structural improvements)

- Relocation of the old north access road and turning lane upgrade on State Route 126 occurred. These improvements will provide safe access for deliveries through the old north access road, especially during heavy delivery times.

TABLE 2-2
1997 WASTE PITS REMEDIAL ACTION PROJECT
(Supports Operable Unit 1)

Document	Date
Final Operable Unit 1 Remedial Action Work Plan was submitted to agencies.	January 3, 1997
Request for Proposal #F96P157987, Waste Pits Remedial Action Project was submitted to offerers.	January 31, 1997

The key project documents submitted by the Waste Pits Remedial Action Project are summarized in Table 2-2.

Soil Characterization and Excavation Project

The Soil Characterization and Excavation Project conducted a variety of excavation-related activities in 1997, including characterization sampling and analysis, certification that FRLs had been reached, and site preparation activities for soil remediation. The following list describes the actions taken for each remediation area:

- Certification sampling for Area 1, Phase I was completed and the Area 1, Phase I Certification Report, including Waste Acceptance Criteria Attainment Completion Reports for the East and West Soil Stockpiles Generated During Area 1, Phase I Activities (DOE 1997c) were submitted to the regulatory agencies. Area 1, Phase I is in the northeastern part of the FEMP and overlaps the footprint of the on-site disposal facility.

- In Area 1, Phase II, which is located in the eastern portion of the FEMP, several pre-design characterization studies were conducted to support the development of the Integrated Remedial Design Package for Area 1, Phase II. The Draft Integrated Remedial Design Package for Area 1, Phase II (DOE 1997h) was submitted to the regulatory agencies for review.

TABLE 2-3
1997 SOIL CHARACTERIZATION AND EXCAVATION PROJECT
(Supports Operable Units 2 and 5)

Document	Date
Draft Sitewide Excavation Plan and Draft Radiological Tracking System Applicability Study were submitted to agencies.	July 11, 1997
Certification Report for Area 1, Phase I was submitted to agencies.	June 30, 1997
Pre-final Integrated Remedial Design Package for Area 1, Phase II was submitted to agencies.	November 20, 1997
Pre-final Integrated Remedial Design Package for Area 2, Phase I was submitted to agencies.	October 23, 1997

- In Area 2, Phase I, the Operable Unit 2 southern waste units in the southern part of the site, pre-design characterization studies were completed and site preparation activities, such as installing sedimentation basins and runoff ditches, were initiated.

The list of Soil Characterization and Excavation Project document deliverables to the regulatory agencies in 1997 is summarized in Table 2-3.

On-Site Disposal Facility Project

The completion of Cell 1 of the on-site disposal facility in 1997 was vital to the progress of other FEMP projects which were generating waste. Construction and contracting activities

were heavy in 1997, and the first waste was placed into Cell 1 of the eight-cell on-site disposal facility in December 1997.

Construction activities for the on-site disposal facility in 1997 also included:

- The leachate conveyance system to carry leachate from the on-site disposal facility for eventual treatment at the advanced wastewater treatment facility
- A new haul road for transporting contaminated soil and debris from the southern waste units to the on-site disposal facility
- The new north access road to the FEMP was relocated to allow for on-site disposal facility construction.

In addition to these activities, groundwater monitoring was initiated in 1997 to establish baseline conditions prior to waste placement. Details of this monitoring are provided in Chapter Three.

All waste being placed in the on-site disposal facility must meet the physical, chemical, and radiological standards known as on-site waste acceptance criteria. These criteria are established to ensure the physical protection of the cell and underlying Great Miami Aquifer. The Waste Acceptance Organization, an internal oversight organization, was created in 1997 to ensure that all waste placed in the on-site disposal facility meets the facility's waste acceptance criteria. The Waste Acceptance Organization reviews waste generation and placement plans and documentation for compliance with the Waste Acceptance Criteria Attainment Plan for the On-Site Disposal Facility (DOE 1998b), which describes the approach for demonstrating attainment with the radiological, chemical, and physical waste acceptance criteria for all FEMP waste streams identified for on-site disposal. Waste Acceptance Organization also provides field inspectors who oversee waste generation and disposal into the facility.

The key project documents submitted by the on-site disposal facility project in 1997 are summarized in Table 2-4.

TABLE 2-4
1997 ON-SITE DISPOSAL FACILITY PROJECT
(Supports All Operable Units)

Document	Date
Final On-Site Disposal Facility Groundwater Leak Detection and Leachate Monitoring Plan was submitted to agencies.	August 7, 1997
Impacted Materials Placement Plan was submitted to agencies.	August 21, 1997
Revision 0, Final On-Site Disposal Facility and Remedial Action Work Plan was submitted to the agencies.	May 22, 1997

TABLE 2-5
1997 FACILITIES CLOSURE AND DEMOLITION PROJECT
(Supports Operable Unit 3)

Document	Date
Comment responses and revision to the Operable Unit 3 Integrated Remedial Design/Remedial Action Work Plan were submitted to agencies.	March 7, 1997
Comment responses and revisions to the Operable Unit 3 Integrated Remedial Design/Remedial Action Work Plan were submitted to agencies.	May 12, 1997
Received EPA approval of the Integrated Remedial Design/Remedial Action Work Plan	June 11, 1997
Final Integrated Remedial Design/Remedial Action Work Plan was submitted to agencies.	June 19, 1997
Thorium/Plant 9 Complex	
Operable Unit 3 Integrated Remedial Action Thorium/Plant 9 Complex Implementation Plan for Above-Grade Decontamination and Dismantlement was submitted to agencies.	January, 2, 1997
Comment responses and revisions to the Thorium/Plant 9 Implementation Plan were submitted to agencies.	April 4, 1997 June 26, 1997
Building 4A	
Building 4A Remediation Report/Project Closure Report was submitted to agencies.	January 15, 1997
Comment Responses and revised Project Completion Report for the Building 4A Decontamination and Dismantlement were submitted to agencies.	March 27, 1997
Boiler Plant/Water Plant	
Responses to Comments on Boiler Plant/Water Plant Implementation Plan were submitted to agencies.	February 13, 1997
High and Low Nitrate Tanks	
Comment responses and revised Project Completion Report for the High- and Low-Nitrate Tanks Decontamination and Dismantlement were submitted to agencies.	March 27, 1997
Plant 1	
Plant 1 Decontamination and Dismantlement Completion Report was submitted to agencies.	August 25, 1997
Revised Plant 1 Complex Project completion Report was submitted to agencies.	December 23, 1997
Air Monitoring	
Annual NESHAP report was submitted to EPA.	June 20, 1997

Facilities Closure and Demolition Project

In June 1997, the EPA approved the Final Operable Unit 3 Integrated Remedial Design/Remedial Action Work Plan (DOE 1997j). This work plan integrated Removal Actions 9, 12, 17, and 26 into the Operable Unit 3 remedial action. Decontamination and dismantlement activities and removal actions are discussed below. The list of Facilities Closure and Demolition Project documents during 1997 is summarized in Table 2-5.

Decontamination and dismantlement activities focused on the Plant 1 Complex, the boiler plant/water plant, the Thorium/Plant 9 complex, and the high- and low-nitrate tanks. These activities are summarized below:

- Plant 1, the preparation plant, was imploded in February 1997. Decontamination and dismantlement field activities were complete by June 1997, seven months ahead of schedule. Chapter Five discusses related air monitoring activities.
- Dismantlement of the high- and low-nitrate tanks was completed and the project completion report submitted to the agencies in January 1997.
- Boiler plant/water plant decontamination and dismantlement began in March 1997. Activities included demolition of office trailers, the utilities heavy equipment building, the water treatment plant and clearwell building, the railroad scale house, the water plant east and west reactivator tanks, the boiler plant flyash silo, and the boiler plant electrostatic precipitators. Completion of boiler plant/water plant decontamination and dismantlement is projected for September 1998.

As stated before, removal actions are undertaken when immediate action is required to protect public health and/or the environment. The following removal actions were initiated or continued in 1997 within the work scope of the Facilities Closure and Demolition Project:

Removal Actions - Thirty-two removal actions have been initiated at the FEMP in response to a need to accelerate cleanup activities that address releases or potential releases of hazardous substances. Twenty-seven removal actions were completed prior to 1997 and five are ongoing - one that is being incorporated into the remediation of the groundwater in the Great Miami Aquifer and four that focus on removal of waste inventories and asbestos, safe shutdown of the former production area, and improved storage of soil and debris. All removal actions are being incorporated into final remediation activities for the site.

Removal Action No. 9, Removal of Waste Inventories, involves the characterization, overpacking, and disposition of low-level radioactive waste materials. Under Removal Action No. 9, some waste inventory is being treated on site prior to off-site disposal. The FEMP's aggressive waste shipping program was interrupted during 1997 due to problems with some shipping containers bound for the Nevada Test Site. DOE is working to resolve all related issues before waste shipping resumes. The 1997 waste shipping activities are summarized in Table 2-6.

TABLE 2-6
FEMP's 1997 REMOVAL OF WASTE INVENTORIES UNDER REMOVAL ACTION NO. 9

Category	Drum Equivalent
Asbestos	3,587
Uranium residues	9,754
Process area scrap	44,023
Contaminated trash	1,562
Thorium	10,875
Stabilized mixed waste	1,309
Legacy construction waste	840
Newly generated construction waste	6,773
Liquid Mixed Waste Project	0[a]
Non-LDR Project	1,847
Total to Off Site, Calendar Year 1997	80,570

[a]The Liquid Mixed Waste Project bulked 391 drum equivalents, but none were shipped to the Toxic Substances Control Act incinerator in Oak Ridge, Tennessee. Shipments to the incinerator have been delayed pending resolution of approval issues between the incinerator and the State of Tennessee.

The 1997 total represents an increase of 31,190 drum equivalents shipped off site compared to 1996.

Several mixed waste treatment projects are being conducted under Removal Action No. 9 and in accordance with the Director's Findings and Orders issued by OEPA in October 1996. These waste streams are being treated to meet RCRA land disposal restrictions and will be shipped off site for final disposition after treatment is complete. In 1997, the Mixed Waste Treatment Project completed chemical treatment by neutralization, precipitation, deactivation, and stabilization on 72 yd^3 (55 m^3) of waste. The Liquid Mixed Waste Project bulked 102 yd^3 (78.2 m^3) of mixed waste, for a total of 174.2 yd^3 (133.2 m^3). This volume is considerably lower than the 1996 total because the liquid mixed waste that had accumulated on site had been bulked and shipped prior to 1997. Liquid waste is now bulked as it is generated.

Approximately half of the FEMP's 32.0 million net pounds (14.5 million net kg) of uranium products that were in inventory when the site shut down in 1989 have been removed from the FEMP by either being transferred to other DOE sites for future use,

returned to suppliers, sold to commercial vendors for nonmilitary uses, or buried as waste. Table 2-7 identifies the FEMP's inventory of uranium product materials as of the end of 1997.

TABLE 2-7
1997 FEMP URANIUM PRODUCT MATERIALS INVENTORY

Waste	Million Net Pounds	Million Net Kg
Depleted	8.5	3.9
Normal	0.4	0.2
Enriched	6.3	2.9
Total	15.2	7.0

In 1997, most of the effort to disposition product materials focused on continuing sampling/analytical activities, negotiating contracts, and reviewing inventories to determine whether or not all avenues of dispositioning the materials as product had been exhausted. It was concluded during this time period that no disposition alternatives for the depleted materials were feasible outside of declaring the material as waste. Accordingly, in November 1997, a waste recommendation was forwarded to DOE for almost all of the depleted metal and the uranium tetrafluoride contained in bulk packages known as T-hoppers (the remaining depleted compounds were held for a potential technology initiative). The final waste declaration has not been made by DOE and is still pending on this material. As the technology initiative has not yet proven to be viable, it is expected that the remaining depleted materials will be recommended for waste declaration in 1998 as well. Two contracts are still being negotiated for a small portion of the depleted metal and all of the normal metal. In addition, a contract was finalized in September 1997 to sell approximately one-third of the enriched materials.

Table 2-8 identifies the uranium product inventories shipped off site in 1997:

TABLE 2-8
1997 URANIUM PRODUCT INVENTORIES SHIPPED OFF SITE

Waste	Net Pounds	Net Kg
Depleted metal and compounds	25,287	11,480
Normal metal	48,590	22,060
Enriched metal	3,163	1,436
Total	77,040	34,976

Removal Action No. 12, Safe Shutdown, was initiated to ensure the safe and permanent shutdown of production facilities in the former production area. This includes the removal of uranium and other process/raw materials and waste materials from equipment, lines, and ductwork.

Removal Action No. 17, Improved Storage of Soil and Debris, was initiated to address the interim storage of contaminated soil and debris generated as a result of continued construction and maintenance projects, removal actions, and remediation actions at the

FEMP. Removal Action No. 17 is ultimately being phased out, as pertinent elements are incorporated into Operable Units 2, 3, and 5 design plans.

Removal Action No. 26, Asbestos Removal, which documents the ongoing asbestos abatement activities at the FEMP, continued in 1997.

Silos Projects

1997 was a year of refocusing and reorganizing for the FEMP Silos Projects. A number of remedial design/remedial action milestones, associated with performance testing of the vitrification process for on-site treatment of Silos 1, 2, and 3 residues, were missed in 1996. One of the contributors was the leak that occurred in the melter in the vitrification pilot plant in December 1996. DOE then entered into a period of informal dispute resolution with EPA. During this period, DOE, EPA, OEPA, and other FEMP stakeholders began reassessing the path forward for the silos remedy. As part of this process, DOE, in consultation with EPA and OEPA, established an independent review team of industry experts and local stakeholders to evaluate the results of the silos vitrification program and the technical and schedule impacts associated with the increase in cost estimates for the final remediation of the silos. As a result of the dispute resolution in July 1997, the following path forward and regulatory milestones were established:

- The Silo 3 material will be remediated separately from K-65 Silos 1 and 2 material. The change in the remedy for Silo 3 will be documented in an Explanation of Significant Differences.

- The Feasibility Study Report for Operable Unit 4 (DOE 1994a), and the Proposed Plan for Operable Unit 4 (DOE 1994b), and Record of Decision for Remedial Actions at Operable Unit 4 (DOE 1994c) will be amended and resubmitted for approval in order to document changes to the remedy for K-65 Silos 1 and 2.

- The dispute resolution amended the Amended Consent Agreement with the following new milestones for silos remediation:

  - Draft Silo 3 Explanation of Significant Differences (DOE 1997f) (submitted September 12, 1997)

  - Award multi-tech proof of principle contract for Silos 1 and 2 by August 10, 1998

  - Submit Draft Silos 1 and 2 Feasibility Study/Proposed Plan to EPA by February 1, 2000

  - Submit Draft Silos 1 and 2 Record of Decision Amendment to EPA by December 29, 2000

  - Submit the revised Remedial Design Work Plans for Silo 3 and K-65 Silos 1 and 2 to EPA within 60 days of approval of the explanation of significant differences and record of decision amendment, respectively.

To compensate for missed Operable Unit 4 milestones in 1996, the dispute agreement also requires the DOE to perform the following five supplemental environmental projects at the FEMP:

- Establishment of a conservation area near the FEMP
- Research grants for ecological restoration
- Creation of a wild bird/wild flower habitat area
- Railroad track recycling
- Structural steel debris recycling.

DOE, with the support of EPA, OEPA, and other FEMP stakeholders, began refining the scopes of these supplemental projects during 1997.

TABLE 2-9
1997 SILOS PROJECTS
(Supports Operable Unit 4)

Document	Date
Silo 3 Explanation of Significant Differences was submitted to agencies.	September 12, 1997
Work Plan for Structural Steel Debris Recycling Project and Work Plan for Railroad Track Recycling Project were submitted to agencies.	September 12, 1997
Work Plan for Establishment of a Conservation Area Near the FEMP and Work Plan for Research Grants for Ecological Restoration were submitted to agencies.	November 20, 1997
Draft Final Work Plan for Recycling Supplemental Environmental Project was submitted to agencies.	December 9, 1997
Supplemental Analysis for Operable Unit 4 was submitted to agencies.	December 22, 1997
Work Plan for Habitat Area Project was submitted to agencies.	December 29, 1997

As a result of the decision to separate the remediation of Silo 3 waste from K-65 Silos 1 and 2 waste, the Silos Project reorganized into the Silos 1 and 2 Project, and the Silo 3 Project in 1997. The documents submitted by the Silos Projects in 1997 are summarized in Table 2-9. Following is a summary of each project's activities during the year.

Silos 1 and 2 Project

Silos 1 and 2 Project activities in 1997 focused on developing a modified path forward for the project in cooperation with its stakeholders. On July 22, 1997, DOE resolved its dispute with the EPA over certain Operable Unit 4 milestones. As specified by the Operable Unit 4 dispute settlement, the original Silos Project Record of Decision, which was approved by EPA in 1994, must be amended. As part of the process, DOE has agreed to reevaluate/reconfirm the best stabilization technology to use when remediating K-65 Silos 1 and 2. The next step of this amendment process entails testing and proving the following technology families, a process known as proof-of-principle testing:

- Vitrification - joule-heated
- Vitrification - non-joule-heated
- Chemical Stabilization - cement based
- Chemical Stabilization - non-cement based.

Results of this testing will be included in a revised feasibility study document, which is expected to be completed by February 2000. In the interim, DOE has agreed with EPA to award the contracts for the proof-of-principle testing by August 10, 1998. One contract will be awarded in each of the four technology families.

An accelerated waste retrieval project is underway to address the technical uncertainties of the overall silos project remediation. The accelerated waste retrieval project will address the risks associated with the increasing radon concentrations in the K-65 Silos 1 and 2 head space, silo integrity, heterogeneity of the material for the final treatment facility, as well as streamlining the overall remediation process for Operable Unit 4.

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Silo 3 Project

EPA approved the Draft Final Silo 3 Explanation of Significant Differences on November 5, 1997. The Explanation of Significant Differences explained how the newly proposed remediation of Silo 3 waste differs from the remediation identified in the Operable Unit 4 Record of Decision. The draft final version was available for public review from November 17, 1997, through December 16, 1997. Formal public hearings were held at the FEMP and at the Nevada Test Site to receive stakeholder comments and concerns. The new proposed remedy for Silo 3 material consists of:

- Treatment, using either chemical stabilization/solidification or a polymer-based encapsulation process, to stabilize characteristic metals to meet limits imposed by RCRA and to meet off-site disposal facility waste acceptance criteria
- Off-site disposal at either the Nevada Test Site or an appropriately permitted commercial disposal facility.

The Explanation of Significant Differences is expected to be finalized in March 1998, and will include the responsiveness summary which will document to the stakeholders how comments on the Explanation of Significant Differences will be incorporated.

Aquifer Restoration and Wastewater Project

Many plans and reports relating to water treatment and groundwater restoration were issued in 1997 (Table 2-10). Activities of the Aquifer Restoration and Wastewater Project for 1997 include the following:

- The advanced wastewater treatment facility underwent improvements and a major expansion project was initiated to accommodate groundwater remediation activities.
- In support of the enhanced groundwater remedy (described in Chapter Three), extraction wells were added in the South Plume and South Field areas; five groundwater re-injection demonstration wells and nine associated monitoring wells were installed on property along Willey Road; and part of the pipeline to carry groundwater was installed.
- The biodenitrification/effluent treatment system was relocated and utilized as part of the new sewage treatment plant.
- The parking lot storm water runoff diversion project was completed in June 1997.

In addition to these remediation activities, the Aquifer Restoration and Wastewater Project is also responsible for continuing operation of the South Plume Removal Action System. A total of 645.6 million gallons (2,444 million liters) of groundwater were extracted through the South Plume Extraction System in 1997, and approximately 88.6 pounds (40.2 kg) of total uranium were removed from the aquifer. The South Plume Performance Monitoring and Maintenance Plan for Operable Unit 5 (DOE 1997o) was developed and implemented in 1997. This plan will support the successful long-term operation of the

extraction well system and has been incorporated into the Operations and Maintenance Master Plan for Aquifer Restoration and Wastewater Treatment (1997l).

The advanced wastewater treatment facility, which began operating in 1995, provides final treatment of FEMP contaminated storm water and wastewater. It also provides treatment for contaminated groundwater associated with FEMP groundwater remediation. In 1997, the following projects supported this facility:

- Construction was completed and testing began of a system to regenerate the resins used to remove uranium from contaminated water.
- Continuous operation of new multi-media filters began at the existing facility. These filters remove particulates from the wastewater prior to treatment for uranium removal.
- Construction of the advanced waste water treatment facility expansion began in February 1997. The expansion is expected to treat an average of 1,500 gallons per minute (gpm) (5,700 liters per minute [L/min]). Operation of the expansion is expected to begin in 1998.

TABLE 2-10
AQUIFER RESTORATION AND WASTEWATER TREATMENT PROJECT
(Supports Operable Unit 5)

Document	Date
Draft Final Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1) and Draft Final Remedial Action Work Plan for Aquifer Restoration at Operable Unit 5 were submitted to agencies.	April 11, 1997
Response to Comments Document of the Restoration Area Verification Sampling Program, Project-Specific Plan was submitted to agencies.	March 27, 1997
Final Remedial Action Work Plan for Aquifer Restoration at Operable Unit 5 and Final Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1) were submitted to agencies.	June 27, 1997
Final Restoration Area Verification Sampling Program, Project-Specific Plan was submitted to agencies.	May 21, 1997
South Plume	
Design Monitoring Evaluation Program Plan, System Evaluation Report was submitted to agencies.	March 27, 1997
Design Monitoring Evaluation Program Plan Semi-Annual Report was submitted to agencies.	September 23, 1997
Aquifer Restoration Extraction/Re-Injection Modules	
Comment Responses on the South Field Injection Test Phase II Report were submitted to agencies.	January 8, 1997
South Plume Optimization and Re-Injection Demonstration Pre-Final Design Packages were submitted to agencies.	February 3, 1997
South Plume Optimization and Re-Injection Demonstration Systems design was approved.	May, 1997
South Plume Optimization and Re-Injection Demonstration Test Plan was submitted to agencies.	August 29, 1997
Groundwater Monitoring	
RCRA Annual Report (includes RCRA annual groundwater monitoring data) was submitted to OEPA.	February 28, 1997
Ohio Department of Natural Resources Water Report was submitted to agencies.	February 28, 1997
Draft Operations and Maintenance Master Plan for the Aquifer and Wastewater Treatment Project was submitted to agencies.	June 30, 1997
Final Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment Project was submitted to agencies.	November 7, 1997

Summary of Compliance with Other Requirements

CERCLA requires that certain laws and regulations must be complied with as part of remediation of the FEMP. These other requirements are referred to as applicable or relevant and appropriate requirements, or ARARs. ARARs that are pertinent to remediation of the FEMP are specified in the record of decision for each operable unit. This section of Chapter Two highlights some of these requirements and how the FEMP complied with these requirements in 1997.

The regulations discussed in this section have been identified as ARARs in the FEMP operable unit records of decision. The FEMP must comply with these regulations while site remediation under CERCLA is underway.

Some of these requirements include permits for controlled releases to surface water and air, and for managing hazardous waste. The FEMP's permit for discharging water under the National Pollutant Discharge Elimination System (NPDES) regulations is discussed in the "Clean Water Act" section of this chapter. Another permit to install, issued in September 1990 by OEPA, covers the monitoring of the Coal Pile Runoff Basin and is discussed in Chapter Three of this report. The FEMP's permit for RCRA treatment, storage, and disposal (OH6890008976) cover RCRA activities described later in this chapter. The FEMP has 14 current air Permits to Operate and 10 associated Permits to Install, one of which was issued in 1997. These permits cover boilers, diesel storage tanks, clothes dryers, the respirator washing facility, maintenance shop facilities, a laboratory hood system, and a gasoline dispensing facility.

DOE requirements applicable to FEMP activities are identified in the FEMP Standards/Requirements Identification Document, which is included in the Fluor Daniel Fernald Management Plan (FDF 1998), and compliance with them is mandatory. DOE orders are pivotal in defining business practices and operations standards for remediation.

Resource Conservation and Recovery Act (RCRA)

RCRA regulates treatment, storage, and disposal of hazardous waste. Hazardous wastes and radioactive wastes mixed with hazardous waste (referred to as mixed waste) are generated during uranium production. These wastes are regulated under RCRA and Ohio hazardous waste regulations; thus, the FEMP must comply with legal requirements for managing these hazardous and mixed wastes. OEPA has been authorized by EPA to enforce its hazardous waste regulations in lieu of the federal RCRA program. In addition, hazardous waste management is subject to the 1988 Consent Decree and its 1993 Stipulated Amendment entered into between the State of Ohio and the DOE, and a series of Director's Final Findings and Orders issued by OEPA.

The FEMP completed several administrative activities related to mixed waste storage and treatment during 1997, including:

- Submittal of the 1996 RCRA Annual Report (DOE 1997a), which described hazardous waste activities for 1997
- Revisions to several sections of the RCRA Part A and B permit application
- Submittal of the annual 1997 update to the Site Treatment Plan (DOE 1997b) required under the Federal Facility Compliance Agreement (FFCA).

Additional details on projects involving treatment of mixed wastes are provided in the subsection "Mixed Waste Treatment" later in this chapter.

RCRA Property Boundary Groundwater Monitoring

The Director's Findings and Orders, which was signed September 10, 1993, and described an alternate groundwater monitoring system, was modified in 1997 to coincide with the groundwater monitoring strategy identified in the IEMP. This program is discussed in more detail in Chapter Three.

RCRA Closures

The Stipulated Amendment to Consent Decree required that the FEMP identify all hazardous waste management units at the FEMP. As a result, burners, incinerators, furnaces, stills, process equipment, tank units, dust collectors, and other potential waste containment units were evaluated in the early 1990s to determine if these units were hazardous waste management units or solid waste management units. This evaluation was completed in 1994. In 1996, the OEPA issued a Director's Findings and Orders to integrate RCRA closure requirements with CERCLA response actions for FEMP hazardous waste management units. During 1997, the FEMP continued to integrate RCRA closure activities with CERCLA response actions for FEMP hazardous waste management units. Remediation of one hazardous waste management unit, the Plant 1 Storage Building (Building 67), was completed in 1997 under this integrated RCRA/CERCLA remediation process. Also, between 1993 and 1996, 12 hazardous waste management units were reclassified to solid waste management unit status, based upon additional analytical and/or process knowledge. These units were not required to undergo RCRA hazardous waste management unit closure criteria, or to meet the RCRA requirements of the Director's Findings and Orders.

Thorium Management

A thorium management strategy and schedule to complete RCRA determinations of thorium materials and to improve the storage of thorium materials at the FEMP were developed as part of the Stipulated Amended Consent Decree. This strategy is based on three primary objectives:

- To maintain environmentally stable interim storage of the thorium inventory while minimizing personnel radiation exposure
- To implement actions required to complete RCRA evaluations of the thorium materials
- To implement long-term storage and disposal alternatives.

In 1997, the FEMP removed 3,400 containers of thorium material and shipped 10,875 drum equivalents, or 80,480 cubic feet (2,279 m^3), of thorium material to the Nevada Test Site for disposal, completing the Thorium Overpack Project. Characterization of the remaining estimated 8,500 containers of thorium legacy waste at the FEMP was initiated in 1997. An extensive sampling and analysis program was implemented and formal characterization documentation was initiated. The characterization documentation and formal RCRA waste determinations are expected to be completed in 1998. The thorium legacy waste determined to be low-level radioactive non-hazardous waste will be prepared and shipped to the Nevada Test Site for disposal. The thorium legacy waste determined to be hazardous under RCRA will be treated to meet land disposal restrictions and, upon analytical confirmation, prepared and shipped to the Nevada Test Site for disposal. Both the low-level and hazardous waste activities are expected to begin in 1998.

Mixed Waste Treatment

The FEMP stores mixed wastes that are subject to RCRA land disposal restrictions. These restrictions currently prohibit the storage of certain hazardous waste streams for longer than one year unless an extension is approved by the EPA or the appropriate state regulatory agency (i.e., OEPA).

The 1992 amendment to RCRA provided DOE with an exemption from enforcement under the land disposal restrictions storage prohibition, provided that the FEMP complies with the plans and schedules for mixed waste treatment provided in the Site Treatment Plan and the implementing Director's Findings and Orders issued by OEPA on October 4, 1995. The FEMP submitted the Site Treatment Plan Annual Update to OEPA in December 1997. This update contains an amendment to treat remaining thorium inventories on site by stabilization. It describes the status of mixed waste treatment projects developed under the plan, added newly generated/newly identified waste streams, and certified that the FEMP met all regulatory milestone dates for the treatment of mixed wastes identified in the plan and in implementing Director's Findings and Orders through December 31, 1997.

The implementation of the Directors' Findings and Orders is accomplished through Removal Action No. 9, Removal of Waste Inventories. The Final Operable Unit 3 Record of Decision adopts the procedures and disposition decisions of this removal action to continue the disposition of the products, residues, and nuclear materials generated during site operations.

Radiologically contaminated polychlorinated biphenyls (PCBs) solids (also regulated under the Toxic Substances Control Act) have no current treatment or disposal options and will remain in storage on site until treatment or disposal capacity is available. Options for their

disposal are scheduled to be pursued in conjunction with Removal Action No. 9, Removal of Waste Inventories. Mixed waste treatment technology developed as part of the Site Treatment Plan was being tested during 1997.

In 1997, the FEMP initiated and completed the following projects to treat mixed wastes:

- Completed treatment by chemical precipitation and cement stabilization of 6,630 pounds (3,010 kg) of barium chloride residues
- Neutralized 9,587 pounds (4,352 kg) of corrosive wastes
- Deactivated 4,110 pounds (1,866 kg) of reactive wastes
- Treated 10,279 pounds (4,667 kg) of oxidizers, uranyl, and thorium nitrate solids and liquids, and other thorium-contaminated wastes by chemical precipitation, chemical reduction, and cement stabilization
- Treated 33,458 pounds (15,190 kg) of lead-based paint chips, cleaning residues, scrap salts, and hazardous trash using a cement-based stabilization process as part of the Chemical Treatment Stabilization Subproject
- Bulked 172,000 pounds (78,088 kg) of liquid mixed waste into Batches 7, 8, and 9 for shipment to the K-25 Toxic Substance Control Act Incinerator in Oak Ridge, Tennessee, for treatment
- Shipped 755,062 pounds (342,798 kg) of mixed waste to Envirocare of Utah in Clive, Utah, for disposal
- Treated 2,386 pounds (1,083 kg) of mixed (radioactive/hazardous) PCB waste to meet land disposal restriction requirements through the Terra-Kleen demonstration.

Clean Water Act

Under the Clean Water Act, the FEMP is governed by NPDES regulations which require the control of discharges of non-radioactive pollutants to waters of the State of Ohio. The NPDES permit, issued by the State of Ohio, specifies discharge and sample locations, sampling and reporting schedules, and discharge limitations. The FEMP submits monthly reports on NPDES activities to the OEPA. The current permit 1IO00004*ED became effective November 1, 1995, and expires March 31, 1998. On September 22, 1997, the FEMP applied for the new permit. The permit covers both surface water and effluent discharges. Chapter Four discusses the surface water and treated effluent results in detail.

Clean Air Act

NESHAP Subpart H imposes a limit of 10 millirem (mrem) per year on the effective dose equivalent to the maximally exposed individual as a result of all emissions (with the exception of radon) from the facility in a single year. This standard also imposes requirements for continuous monitoring of certain emission sources and periodic confirmatory measurements of smaller sources. Because the FEMP is a former uranium

processing plant, uranium is the radioactive particulate of most concern in monitoring airborne emissions. The FEMP estimated that airborne uranium emissions for 1997 were 19.5 pounds (8.84 kg).

EPA regulates the FEMP's radionuclide sources. OEPA has authority to enforce the State of Ohio's air standards while EPA enforces the NESHAP regulations. FEMP air emissions are regulated by OEPA as either particulate, chemical, or toxic emission sources. In 1997, the FEMP complied with all particulate, chemical, and toxic emissions standards.

Several activities during remediation may result in the generation of fugitive dust, which is also regulated by OEPA. These activities include decontamination and dismantlement, soil excavation, on-site disposal facility construction and waste placement, and other construction activities. In 1997, OEPA and DOE agreed on how the FEMP will comply with regulatory fugitive dust limits. The requirements in the Best Available Technology Determination for Remedial Construction Activities on the Fernald Environmental Management Project (DOE 1997e) are incorporated into each operable unit's remedial design and remedial action deliverables. Compliance is primarily determined through visual inspection of dust during activities and through proper dust control. In 1997, the FEMP complied with the fugitive dust requirements.

Superfund Amendments and Reauthorization Act of 1986

The Superfund Amendments and Reauthorization Act of 1986 (SARA) amended CERCLA and was enacted, in part, to clarify and expand CERCLA ("Superfund") requirements. The SARA Title III, Section 312, Emergency and Hazardous Chemical Inventory Report (DOE 1998a) for 1997 will be submitted to OEPA and other local emergency planning/response organizations in February 1998. The report lists the amount and location of hazardous chemicals/substances stored or used in amounts greater than the minimum reporting threshold during any one given 24-hour period.

The SARA Title III, Section 313, Toxic Chemical Release Inventory Report (DOE 1997n) was submitted to OEPA and EPA on July 1, 1997. The Toxic Chemical Release Inventory Report lists routine and accidental releases, as well as information about the activities, uses, and waste for each reported toxic chemical. In 1997, no chemicals met the SARA 313 manufactured, processed, or otherwise used reporting threshold requirements.

Any off-site release meeting or exceeding a reportable quantity as defined by SARA Title III, Section 304, requires immediate notifications to local emergency planning committees and the state emergency response commission. Depending on the respective requirements, notifications are made to the National Response Center and to the appropriate federal, state, and local regulatory entities. All releases occurring at the FEMP are evaluated and documented to ensure that proper notifications are made in accordance with SARA. In addition to SARA, releases are also evaluated for notification under CERCLA Section 103, RCRA, the Toxic Substances Control Act, the Clean Air Act, the Clean Water Act, Ohio environmental laws and regulations, and the Ohio Fire Code.

In 1997, one FEMP release was reported to regulatory and other agencies. On December 3, 1997, the National Response Center was notified of a release to the environment that occurred at the FEMP. The notification was made because water with a pH of 12.6 was detected in an excavated trench. The water in the trench was perched groundwater (defined as groundwater existing above a dense clay layer of soil which limits vertical migration). The high pH value of the water was attributed to historical operations of two nearby caustic tanks which were installed at the site in the 1950s. Weathering of the tanks' secondary containment system over time allowed a pathway from the tanks to the soils beneath and adjacent to the trench. Precipitation and runoff from the tanks and secondary containment over the years contributed to seepage into the adjacent soils and underlying perched water. An estimated 2,994 pounds (1,359 kg) of water were collected in the excavated trench. The reportable quantity for liquids with a pH greater than or equal to 12.5 is 100 pounds (45.4 kg). The water in the trench was collected and treated through the FEMP's wastewater treatment system. The trench was backfilled with soil on December 3, 1997. The caustic tanks were emptied and rinsed to the extent practicable to mitigate any future leaks, prior to final removal of the tanks.

Other Environmental Regulations

The FEMP is also required to comply with several other environmental laws and regulations besides those described above. Table 2-11 summarizes compliance with each of these requirements for 1997.

Site-Specific Regulatory Agreements

Federal Facility Compliance Agreement (FFCA)

In 1986, the FEMP entered into a FFCA with the EPA. The key components of this agreement requires the FEMP to:

- Maintain a continuous sample collection program for radiological constituents at the FEMP's treated-effluent discharge points and report the results quarterly to the EPA, OEPA, and the Ohio Department of Health. The sampling program to address this requirement has been modified over the years and is currently governed by an agreement reached with EPA and OEPA in early 1996. This agreement became effective May 1, 1996. This agreement requires sampling at the Parshall Flume (PF 4001) and the Storm Water Retention Basin spillway for radiological parameters.

- Maintain a sampling program for daily flow and total uranium at the South Plume Extraction Wells and report the results quarterly to the EPA, OEPA, and Ohio Department of Health. The sampling program conducted to address this requirement has also been modified over the years and is currently governed by the agreement reached with EPA and OEPA on May 1, 1996.

TABLE 2-11
COMPLIANCE WITH OTHER ENVIRONMENTAL REGULATIONS

Purpose of Regulation	Background Compliance Issues	1997 Compliance Activities
Toxic Substances Control Act (TSCA)		
Regulates the manufacturing, use, storage, and disposal of toxic materials, including PCBs and PCB items	An OEPA Director's Findings and Orders allowed for extended storage of mixed wastes, which include PCB wastes. EPA conducted a routine TSCA compliance inspection of the FEMP on September 21, 1994. No violations of PCB regulations were identified during the inspection.	Non-radiologically contaminated PCBs and PCB items were shipped to TSCA-approved commercial disposal facilities for incineration on an "as-needed basis". Radiologically contaminated PCB liquids were bulked for later shipment to the TSCA permitted DOE incinerator in Oak Ridge, TN. Most radiologically contaminated PCB solids currently had no treatment or disposal options and remain in storage on site. Some radiologically contaminated PCB wastes were treated as part of a treatment technology demonstration under Removal Action No. 9 and the Site Treatment Plan.
Ohio Solid Waste Act		
Regulates infectious waste	The FEMP is registered with OEPA as a large generator of infectious waste, generating more than the 50 lbs (23 kg) per month.	All infectious wastes generated in the medical department were transported to a licensed treatment facility for incineration.
Federal Insecticide, Fungicide, and Rodenticide Act		
Regulate the registration, storage, labeling, and use of pesticides (such as insecticides, herbicides, and rodenticides)	The last inspection of the Federal Insecticide, Fungicide, and Rodenticide Act program conducted by EPA Region V on September 21, 1994, found the FEMP to be in full compliance with the requirements mandated by Federal Insecticide, Fungicide, and Rodenticide Act.	All pesticide applications at the FEMP were conducted according to Federal and State regulatory requirements.
National Environmental Policy Act		
Requires the evaluation of environmental, socio-economic, and cultural impacts before any action, such as a construction or cleanup project, is initiated by a federal agency	An environmental assessment was completed in 1995 for the disposition of the Native American remains uncovered as part of the Public Water Supply Project. A Finding of No Significant Impact, to close out the National Environmental Policy Act environmental assessment process, was placed on hold by DOE-FEMP until final disposition of the remains could be negotiated with the participating Native American tribes and groups.	The Finding of No Significant Impact for disposition of the Native American remains was approved by DOE-Ohio Field Office on April 28, 1997 prior to final disposition of the remains. Final disposition of the remains occurred on the FEMP in May of 1997. A supplemental analysis for Operable Unit 4 that addressed the proposed accelerated waste retrieval from K-65 Silos 1 and 2 was submitted to DOE-FEMP on December 22, 1997.
Endangered Species Act		
Requires the protection of any threatened or endangered species found at the site as well as any critical habitat that is essential for the species' existence	Ecological surveys conducted by Miami University and DOE, in consultation with the Ohio Department of Natural Resources and U.S. Fish and Wildlife Service, have established the following list of threatened and endangered species and their habitats existing onsite: Cave salamander, state-listed endangered – marginal habitat, none found; Sloan's crayfish, state-listed threatened – found on northern sections of Paddys Run; Indiana bat, federally-listed endangered – suitable habitat in riparian areas along Paddys Run.	No surveys were conducted in 1997, however, visual observations were conducted of Sloan's crayfish habitat after storm events which indicated no FEMP-induced adverse effects.

TABLE 2-11
(Continued)

Purpose of Regulation	Background Compliance Issues	1997 Compliance Activities
Floodplains/ Wetlands Review Requirements		
DOE regulations require a floodplain/wetland assessment for DOE construction and improvement projects.	A wetlands delineation of the FEMP, completed in 1992 and approved by the U.S. Army Corps of Engineers in August 1993, identified 36 acres (15 hectares) of freshwater wetland on the FEMP property. Updated delineations are conducted approximately every five years.	A Wetland Notice of Involvement and Wetland Assessment were completed in 1997 in support of the installation of an air monitoring station. The Notice was published in the Federal Register on October 14, 1997.
National Historic Preservation Act		
Mandates protection of historic and prehistoric cultural resources	The FEMP site is within an area rich in historic and prehistoric cultural resources. These cultural resources include 104 prehistoric sites within two 1.24 miles (two km) of the FEMP and 27 historic sites.	Activities were conducted to avoid and address impacts to cultural resources (Chapter Seven).
Native American Graves Protection and Repatriation Act		
Requires the identification and preservation of cultural resources on federal lands, and consultation with Native American Tribes on removal and management of inadvertently discovered Native American cultural items	Historical remains and artifacts were discovered during a 1994 construction project. The Native American remains – which included an adolescent boy and his dog – were discovered on private property during installation of pipelines for the Public Water Supply project. Partial remains of approximately 20 more people and numerous artifacts were also found.	On May 25, 1997, Native American remains and associated artifacts dating back 950 years were interred on Fernald property – protected federal land – during a sacred ceremony performed by representatives from several tribes.
Natural Resource Trusteeship		
CERCLA and Executive Order 12580 requires DOE to act as a Trustee (i.e., guardian) for natural resources at its federal facilities.	DOE and the other Trustees, which include U.S. Department of the Interior, U.S. Fish & Wildlife Service, OEPA, Ohio Attorney General's Office, and EPA, meet regularly to discuss potential impact to natural resources and to coordinate Trustee activities. The Trustees also interact with the Fernald Citizens Advisory Board and Community Reuse Organization.	The Trustees agreed to develop a natural resource restoration plan, integrating on-property natural resource restoration activities with remediation activities at the FEMP in an effort to resolve DOE's liability for injuries to natural resources.

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Federal Facility Agreement (FFA), Control and Abatement of Radon-222 Emissions

This agreement between DOE and EPA, signed on November 19, 1991, ensures that DOE takes all necessary actions to control and abate radon-222 emissions at the FEMP, under the authority of 40 Code of Federal Regulations 61, Subpart Q. This agreement acknowledges that the K-65 Silos 1 and 2 exceed the radon flux rate of 20 picoCuries per square meter per second (pCi/m^2/sec), but allows the FEMP to address this exceedance by implementing a removal action to bring radon emissions from the silos to a level as low as reasonably achievable (ALARA), and to attain the NESHAP Subpart Q standard upon completion of final remediation. The FFA also requires demonstration of compliance with the Subpart Q standard (upon completion of remedial actions) for the waste pits, clearwell, and any other sources found to emit radon in excess of 20 pCi/m^2/sec.

ALARA

DOE Order 5400.5 requires the FEMP to adopt an ALARA philosophy. The ALARA philosophy was adopted to minimize exposure of general employees, the public, or the environment to ionizing radiation to the extent that social, technical, economic, practical, and public policy considerations allow. The FEMP is committed to reducing radiation exposures by applying ALARA concepts and practices in all activities in accordance with DOE 5400.5, other applicable DOE orders, and Title 10 of the Code of Federal Regulations, part 835.

The ALARA process ensures the selection of the optimum physical design features and administrative controls which will eliminate, control, or mitigate radiological exposure of general employees, the public, and the environment.

ALARA requires judgement with respect to what is reasonably achievable. Factors that relate to societal, technological, economic, and other public policy considerations shall be evaluated to the extent practicable in making such judgements. The minimum factors to be considered when applying the philosophy of ALARA to the environment shall include:

- The maximum dose to members of the public
- The collective dose to the population
- Alternative processes, such as alternative treatments of discharge streams, operating methods, or controls
- Doses for each process alternative
- Costs for each of the technological alternatives
- Examination of the changes in cost among alternatives
- Changes in societal impact associated with process alternatives (e.g., differential doses from various pathways).

Split Sampling Program

In 1997, DOE and OEPA cooperated in a program in which samples of ground water, surface water, sediment, and produce were "split" and sent to different analytical laboratories. This is an important part of the quality assurance program at the FEMP. The FEMP has participated in this program with the state since 1987. In the split sampling program, the true variability in analysis between laboratories is measured with the comparison of sample results that were directly collected from the environment.

To obtain split samples, technicians alternately add a portion of the sample being collected to two individual sample containers. This collection method helps ensure that both samples are as identical as possible. Split samples are then submitted to two independent laboratories for analysis.

In 1997, the results from the split sampling program show close agreement between DOE and OEPA results for the groundwater and surface water samples. However, a greater degree of variability exists between DOE and OEPA results for sediment and produce samples. This is not unusual for these types of sample matrices based on the potential variability within the samples themselves. In addition, variability in the sample results may be affected by incomplete sample homogenization (mixing) in the field and differences in sample preparation methods at the analytical laboratories. DOE and OEPA have discussed these issues and will continue to work together to ensure the highest degree of quality in the split sampling program. The results for the 1997 OEPA split samples are presented in Table 1-1 in Appendix D, Attachment 1, of this report.

Groundwater Pathway

Results in Brief: 1997 Groundwater Pathway

Enhanced Groundwater Remedy Construction - Significant portions of the enhanced groundwater remedy were put in place in 1997. Two extraction wells were completed in the South Plume area to optimize the existing South Plume Removal Action System. Five groundwater re-injection test wells were installed on property along Willey Road. Another extraction well was installed on property in the South Field area to enhance contaminant recovery. Significant portions of the pipeline to convey groundwater to and from the well fields were installed in 1997. The South Plume Optimization, South Field Extraction (Phase I), and the Re-Injection Demonstration systems are scheduled to begin operations in the summer of 1998.

South Plume Removal Action System Operations - A total of 645.6 million gallons (2443.6 million liters) of groundwater and 88.6 pounds (40.2 kg) of total uranium were removed from the Great Miami Aquifer by four wells in the South Plume Removal Action System. The system continued to meet the primary objective of preventing further southward movement of the total uranium plume.

Groundwater Monitoring Results - The results of groundwater monitoring for total uranium and non-uranium constituents confirm that the enhanced remedy design for aquifer restoration is appropriate. No significant contaminants were identified in the aquifer with concentrations above their respective FRLs which would require modification of the enhanced groundwater remedy design. The design includes 37 groundwater extraction wells and 10 groundwater re-injection wells.

On-Site Disposal Facility Monitoring - Groundwater sampling to establish a baseline of groundwater quality prior to waste placement was completed for Cell 1. A technical memorandum will be issued in 1998 to discuss the baseline results. Groundwater sampling was also initiated in 1997 to obtain a baseline around Cell 2.

This chapter provides background information on the nature and extent of groundwater contamination in the Great Miami Aquifer due to past operations at the FEMP and summarizes:

- Significant achievements realized by the Aquifer Restoration and Wastewater Project in 1997
- Groundwater monitoring activities and results for 1997.

Restoration and continued protection of the groundwater pathway are primary considerations in the accelerated remediation strategy for the FEMP. While significant achievements have been made in limiting exposure to contaminated groundwater, such as the installation of a public water supply in 1996, the FEMP continues to focus on accelerating the groundwater restoration. In addition, the FEMP will continue to monitor the groundwater pathway throughout remediation to ensure the future protection of this primary exposure pathway.

Groundwater modeling at the FEMP

The FEMP uses computer models to make predictions about how the aquifer and contaminants in the aquifer will look in the future, based on current conditions. Because the model contains simplifying assumptions about the aquifer and the contaminants, it makes approximate predictions about future behavior which must be verified with field measurements obtained from groundwater monitoring activities.

If groundwater monitoring data indicate the need for operational changes to the groundwater remedy, then the groundwater model is run to predict the effect those changes might have on the aquifer and the contaminants. If the predictions indicate the proposed changes would increase clean-up efficiency and reduce the clean-up time and cost, then the operational changes are made and monitoring data are collected after the changes to verify whether model predictions were correct. If model predictions prove to be incorrect, then modifications will be made to the model to improve its predictive capabilities.

Summary of the Nature and Extent of Groundwater Contamination

The nature and extent of groundwater contamination from operations at the FEMP has been investigated, and the risk to human health and the environment from those contaminants has been evaluated in the Operable Unit 5 RI Report. As documented in that report, the primary groundwater contaminant at the FEMP is uranium. Approximately 170 acres (69 hectares) of the Great Miami Aquifer are contaminated above the groundwater FRL for total uranium.

Contamination of the groundwater resulted from infiltration through the bed of Paddys Run where the glacial overburden is eroded, and the sand and gravel of the aquifer are in direct contact with uranium-contaminated surface water from the FEMP. To a lesser degree, groundwater contamination also resulted where man-made excavations, such as the waste pits, removed some of the protective glacial overburden and exposed the aquifer to contamination.

Selection and Design of the Groundwater Remedy

After the nature and extent of groundwater contamination was defined, various remediation technologies were evaluated in the Feasibility Study Report for Operable Unit 5 (DOE 1995a). Remediation cost, efficiency, and various land-use scenarios were considered in arriving at a preferred remedy for restoring the quality of the groundwater in the aquifer.

The Operable Unit 5 FS Report recommended a pump-and-treat remedy for the groundwater contaminated with uranium. The remedy consisted of 28 groundwater extraction wells located on- and off-property. Computer modeling suggested that the 28 extraction wells pumping at a combined rate of 4,000 gpm (15,140 L/min) would remediate the aquifer within 27 years. The recommended groundwater remedy was presented to the EPA, the OEPA, and FEMP stakeholders in the Proposed Plan for Operable Unit 5 (DOE 1995b).

Once the preferred groundwater remedy was identified and approved in the Operable Unit 5 Proposed Plan, the Operable Unit 5 Record of Decision was presented to FEMP stakeholders and subsequently approved by EPA and OEPA in January 1996. The Operable Unit 5 Record of Decision established FRLs for all constituents of concern and formalized the agreement to implement the selected remedy. The Operable Unit 5 Record of Decision committed to continue evaluating innovative remediation technologies so that remedy performance could be improved as such technologies become available. As a result of this commitment, an enhanced groundwater remedy was presented in the Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1) (DOE 1997d).

Re-injection at the FEMP

Re-injection is an enhancement to the groundwater remedy. Groundwater pumped from the aquifer is treated to remove contaminants and then re-injected back into the aquifer at strategic locations. The "push" from the re-injected groundwater increases the speed at which contaminants move through the aquifer and are "pulled" by extraction wells, thereby decreasing the overall remediation time.

The enhanced groundwater remedy includes a test of large-scale groundwater re-injection. If groundwater re-injection proves to be viable, then it will increase the rate at which contaminants are flushed through the sand and gravel of the aquifer and into the extraction wells. The enhanced groundwater remedy also included additional extraction wells in on-property areas of aquifer contamination which are not accessible until after contaminated surface soils are remediated. Groundwater modeling studies conducted in support of the enhanced groundwater remedy suggest that, with the early installation of additional extraction wells and re-injection technology, the remedy could potentially be shortened by as much as 17 years. The enhanced groundwater remedy was approved by the EPA and OEPA.

The extraction and re-injection well locations for the enhanced groundwater remedy are shown in Figure 3-1. Extraction wells are indicated by a shaded dot; re-injection wells are indicated by an open dot; and three wells in the South Field area, which are scheduled to be converted from extraction to re-injection during the later years of the remedy, are indicated by a star symbol. Schedules for the design, construction, and start-up of the enhanced groundwater remedy can be found in the Remedial Design Work Plan for Remedial Actions at Operable Unit 5 (DOE 1996b) and in the Remedial Action Work Plan for Aquifer Restoration at Operable Unit 5 (DOE 1997m).

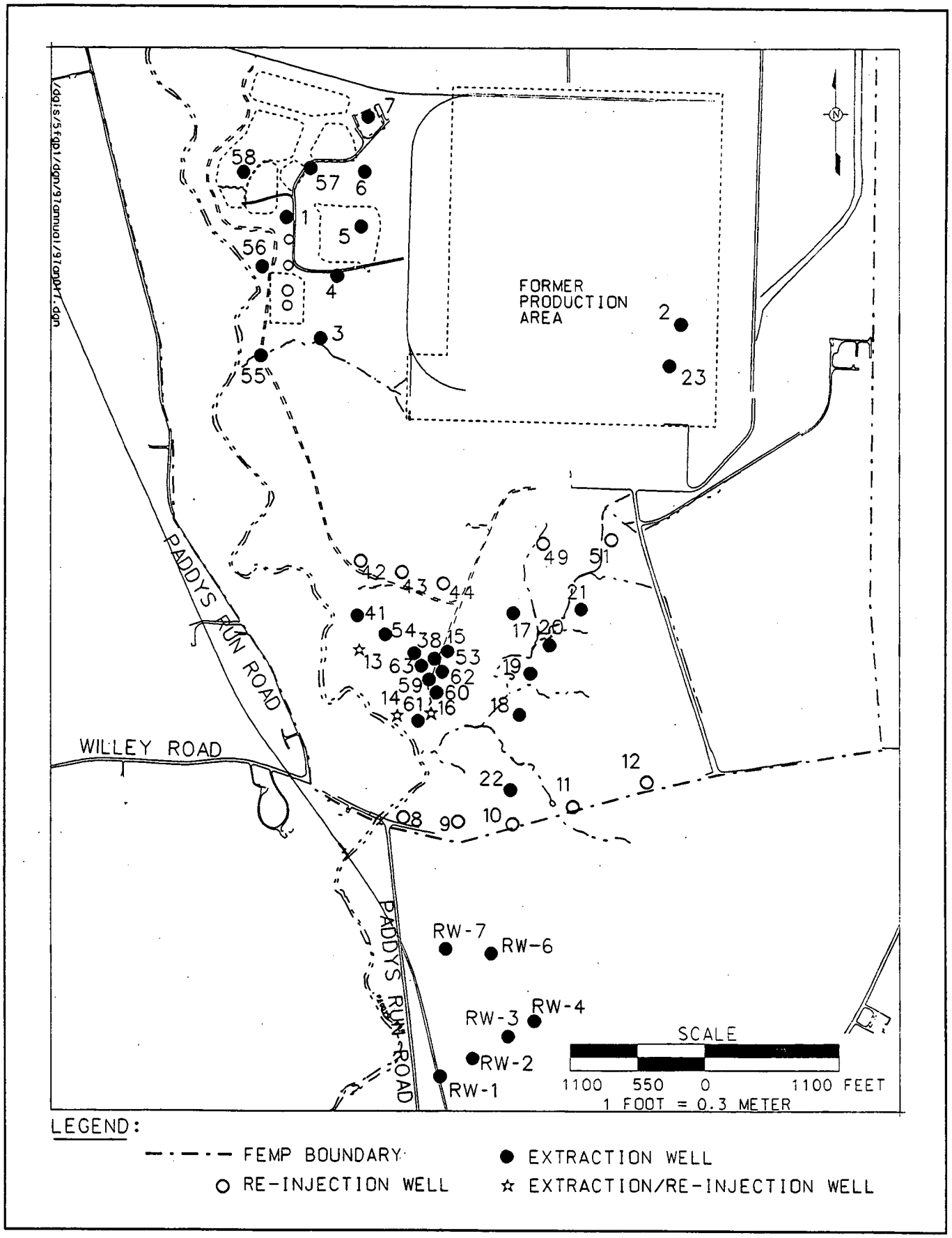

Figure 3-1. Extraction and Re-Injection Wells for the Enhanced Groundwater Remedy

While the RI and FS process was in progress and a groundwater remedy was being selected, off-property contaminated groundwater was being pumped in the South Plume area under Removal Action 3 by the South Plume Removal Action System. In 1993, this system was installed south of Willey Road and east of Paddys Run Road to stop the total uranium plume in this area from moving any further to the south. Figure 3-1 identifies the four operational extraction wells: RW-1, RW-2, RW-3, and RW-4. These extraction wells have successfully stopped further migration of the total uranium plume and have contributed to significantly reducing total uranium concentrations in the off-property portion of the plume. Furthermore, the South Plume Removal Action System is included as part of the final enhanced groundwater remedy design.

Groundwater Monitoring Highlights for 1997

Transition to IEMP

Groundwater elevation measurements - are collected from aquifer monitoring wells at the FEMP. Elevations are plotted on maps and then contoured to see the shape of the water table beneath the FEMP. The elevation contour maps are used by FEMP scientists to study the direction and rate of groundwater flow in the aquifer.

Reporting under the IEMP combines all FEMP groundwater monitoring programs into a single program and ensures that groundwater monitoring efficiently supports the enhanced groundwater remedy. With the approval of the IEMP in July 1997, the following groundwater monitoring programs at the FEMP were incorporated under the IEMP:

- Radiological Environmental Monitoring (Private Well) Program
- RCRA Property Boundary Monitoring Program
- South Plume Removal Action Monitoring Program
- KC-2 Warehouse Well Monitoring Program.

The key elements of the IEMP groundwater program design are described below:

- Sampling - Sample locations, frequency, and the constituents were selected to address operational assessment, restoration assessment, and compliance requirements. In general, under the IEMP, more constituents are monitored (up to 50 groundwater FRL constituents, Table 2-1) and more well locations are monitored than under previous separate monitoring programs in order to monitor the enhanced groundwater remedy. Figure 3-2 shows a typical groundwater monitoring well at the FEMP. As part of the comprehensive IEMP groundwater monitoring program, 109 wells are monitored quarterly; 18 wells are monitored semi-annually; and one well is monitored annually for groundwater quality (Figure 3-3). In addition to water quality monitoring, 161 wells are monitored quarterly for groundwater elevations (Figure 3-4).

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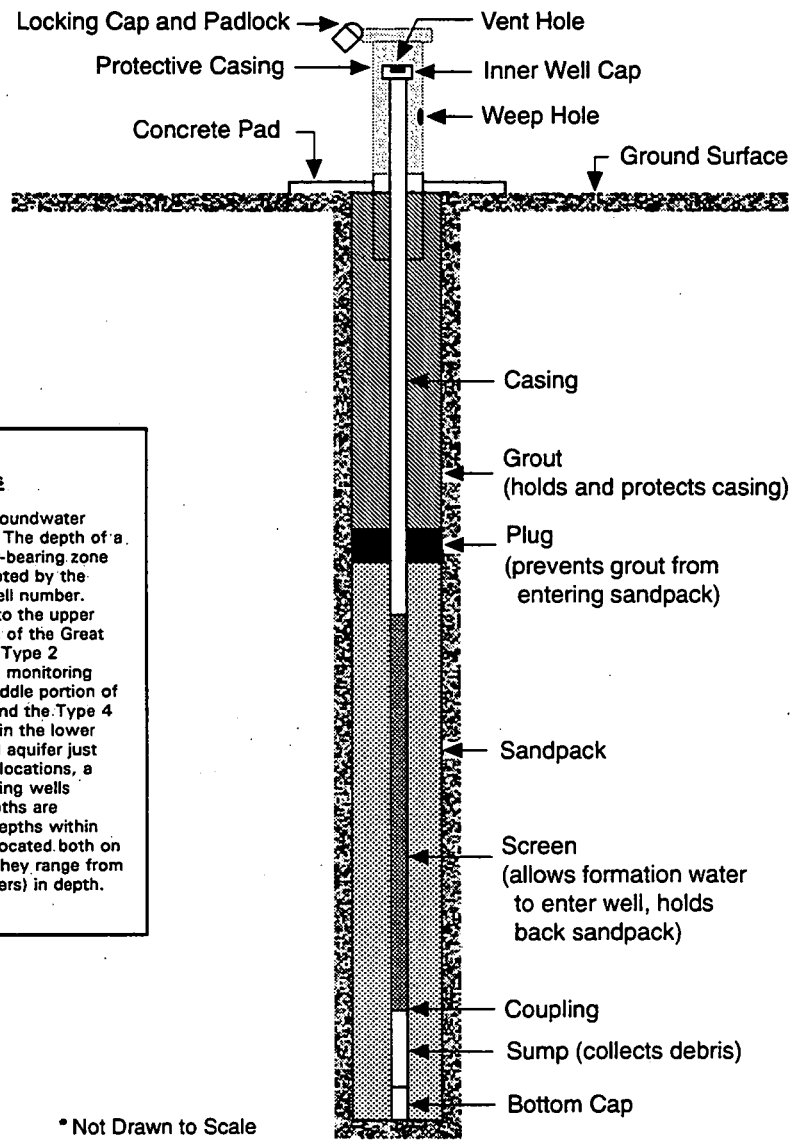

Groundwater Monitoring Wells

Figure 3-2 depicts a typical groundwater monitoring well at the FEMP. The depth of a monitoring well and the water-bearing zone into which it extends are denoted by the first digit of the monitoring well number. Monitoring wells extending into the upper portion of the sand and gravel of the Great Miami Aquifer are denoted as Type 2 monitoring wells. The Type 3 monitoring wells are placed within the middle portion of the sand and gravel aquifer, and the Type 4 monitoring wells are installed in the lower portion of the sand and gravel aquifer just above the bedrock. At many locations, a group of two or more monitoring wells (cluster wells) of different depths are installed to sample different depths within the aquifer. These wells are located both on and off the FEMP property. They range from 35 to 250 feet (11 to 76 meters) in depth.

Figure 3-2. Monitoring Well Diagram

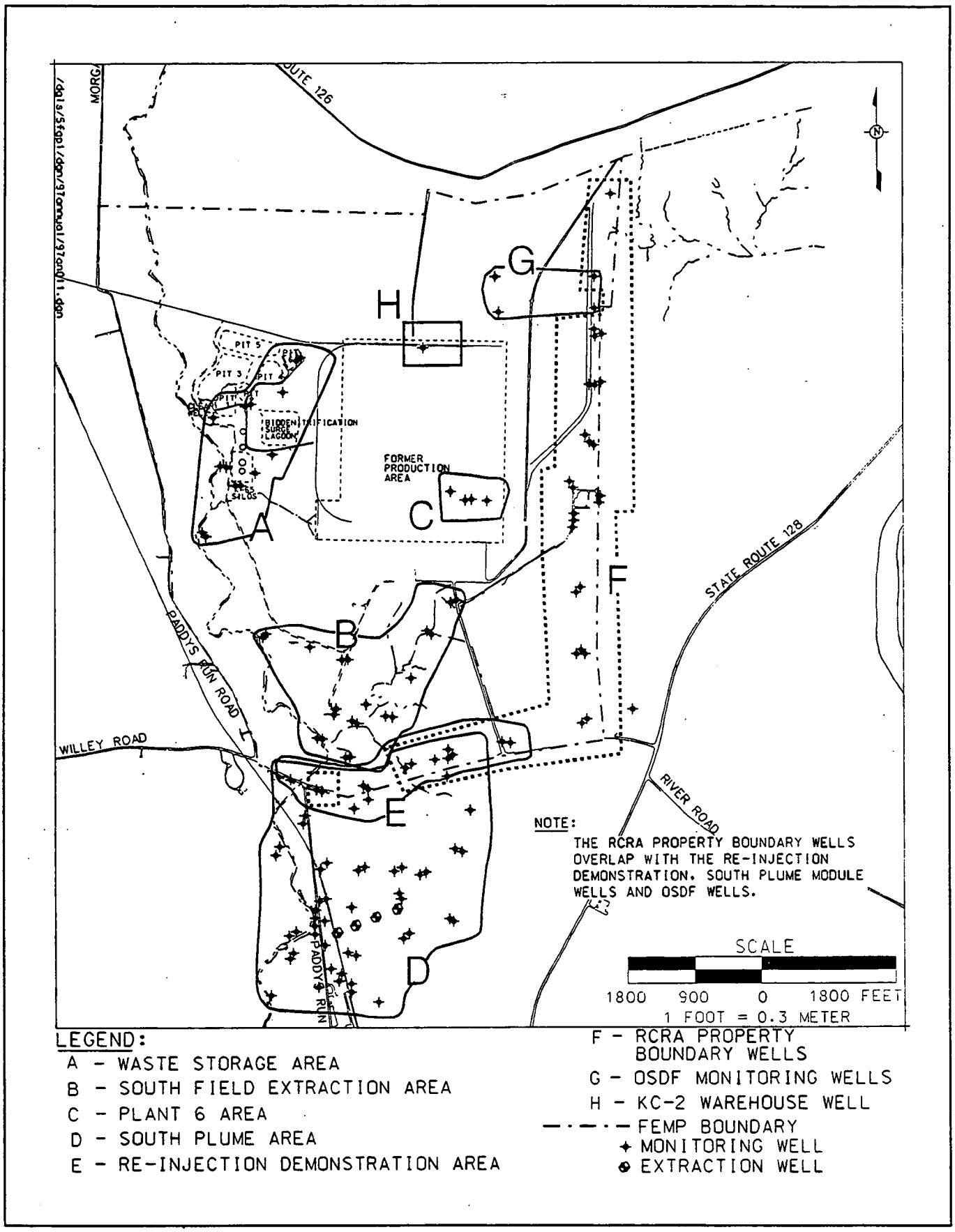

Figure 3-3. IEMP Monitoring Wells for Groundwater Quality

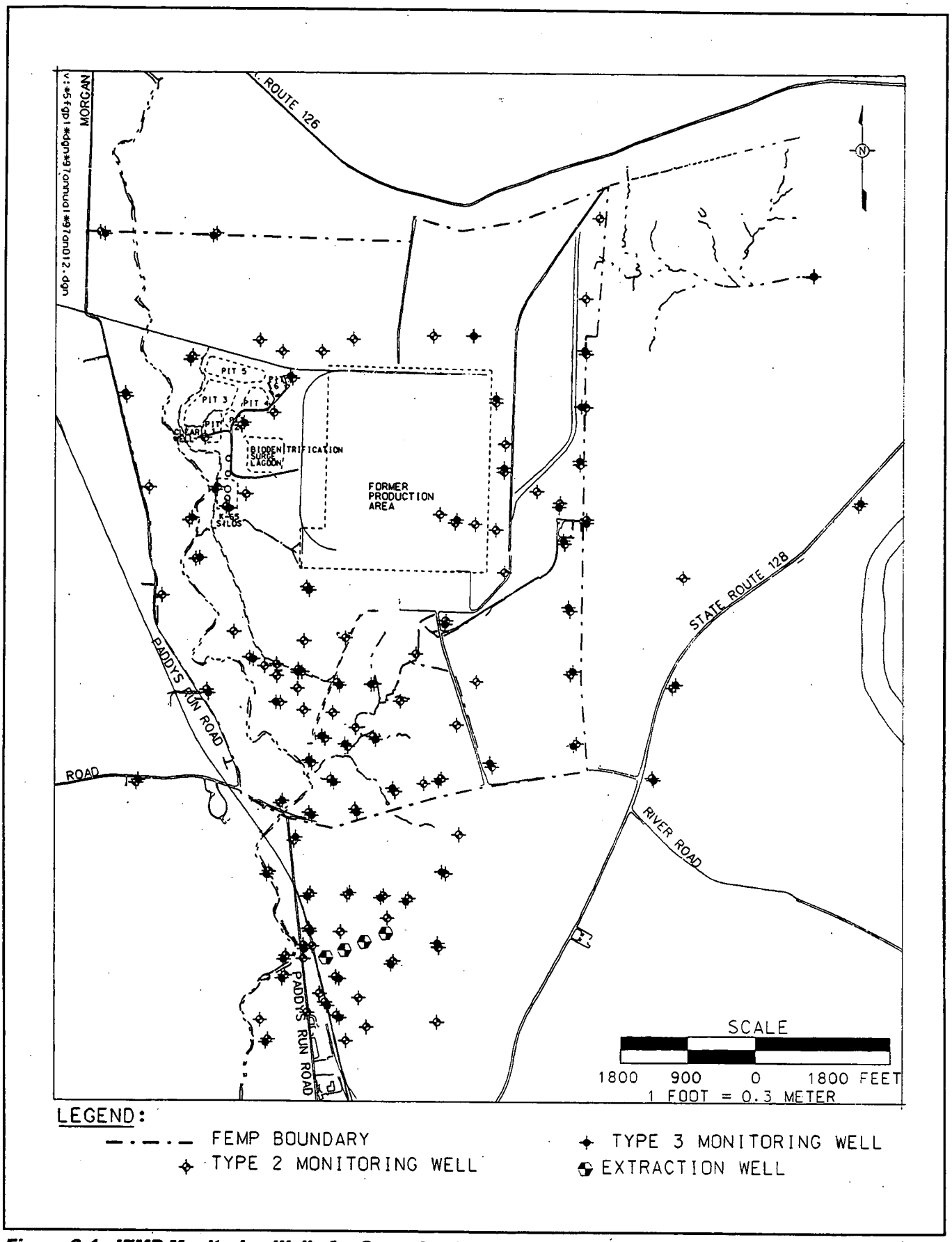

Figure 3-4. IEMP Monitoring Wells for Groundwater Elevation

- Data Evaluation - The integrated data evaluation process focuses on looking at the data collected from all wells to determine: capture and restoration of the total uranium plume, capture and restoration of non-uranium FRL constituents, water quality conditions in the aquifer that indicate a need to modify the design and installation of restoration modules, and the impact of current groundwater restoration on the Paddys Run Road Site plume (a separate contaminant plume south of the FEMP property along Paddys Run Road resulting from independent industrial activities in the area).

- Reporting - The separate FEMP groundwater monitoring activities and associated reports (i.e., the semi-annual south plume removal action design monitoring evaluation program plan, system evaluation reports, RCRA annual reports, annual site environmental reports, and various other minor groundwater reports) are replaced by an annual integrated site environmental report and quarterly status reports.

Status of Enhanced Groundwater Remedy Construction

Significant portions of the enhanced groundwater remedy were completed in 1997. Two additional extraction wells, RW-6 and RW-7, were completed in the South Plume area to optimize the existing South Plume Removal Action System (Figure 3-1). Five groundwater re-injection wells (8, 9, 10, 11, and 12) as shown in Figure 3-1 were installed on property along Willey Road, and a significant portion of the pipeline network to carry groundwater has been installed. Another extraction well, 22, was installed on property in the South Field area to enhance contaminant recovery (Figure 3-1). The South Plume Optimization, South Field Extraction (Phase I), and the Re-Injection Demonstration systems are scheduled to begin operations in the summer of 1998. When all three systems are on line with the existing South Plume Removal Action System, they will pump 3,500 gpm (13,250 L/min) from the aquifer and re-inject 1,000 gpm (3,785 L/min) for a net pumping rate of 2,500 gpm (9,462 L/min).

Work continues on a 1,500 gpm (5,678 L/min) expansion of the advanced wastewater treatment facility. This expansion will add significant groundwater treatment capacity and will be used to provide treated groundwater for re-injection. When the expansion is completed, the total treatment capacity at the FEMP for extracted groundwater, storm water, and remediation wastewater will be 2,875 gpm (10,880 L/min).

Restoration Monitoring

Restoration monitoring is discussed in the following subsections:

- South Plume Removal Action System Operation Summary
- Monitoring Results for Total Uranium
- Monitoring Results for Non-Uranium Constituents.

South Plume Removal Action System Operational Summary

As mentioned earlier during the discussion of selection and design of the groundwater remedy, a removal action was initiated in August 1993 in the South Plume area to halt further advance of the plume away from FEMP property. Five groundwater extraction

wells were installed in an east-west line just east of Paddys Run Road and south of Willey Road along the leading edge of the plume. Contaminated groundwater from the South Plume is pumped back on property where it is monitored and treated, as necessary to meet discharge limitations, before being pumped to the Great Miami River.

Pumping at four of the five extraction wells in the South Plume Removal Action System continued during the groundwater remedy design and construction in 1997. The eastern most well of the five extraction wells was removed from service in December 1994 because operational data indicated that it was not needed to prevent further movement of the South Plume contamination. In addition to accomplishing the objective of halting further southward migration of the plume beyond the wells, the system removed 388.9 pounds (176.6 kg) of total uranium from the aquifer and pumped 2.8 billion gallons (11 billion liters) of groundwater by the end of 1997. The annual uranium removal performance data are shown in Figure 3-5. Additional data summarizing the operation of the South Plume Removal Action System for 1997 can be found in Appendix A, Attachment 1, of this report.

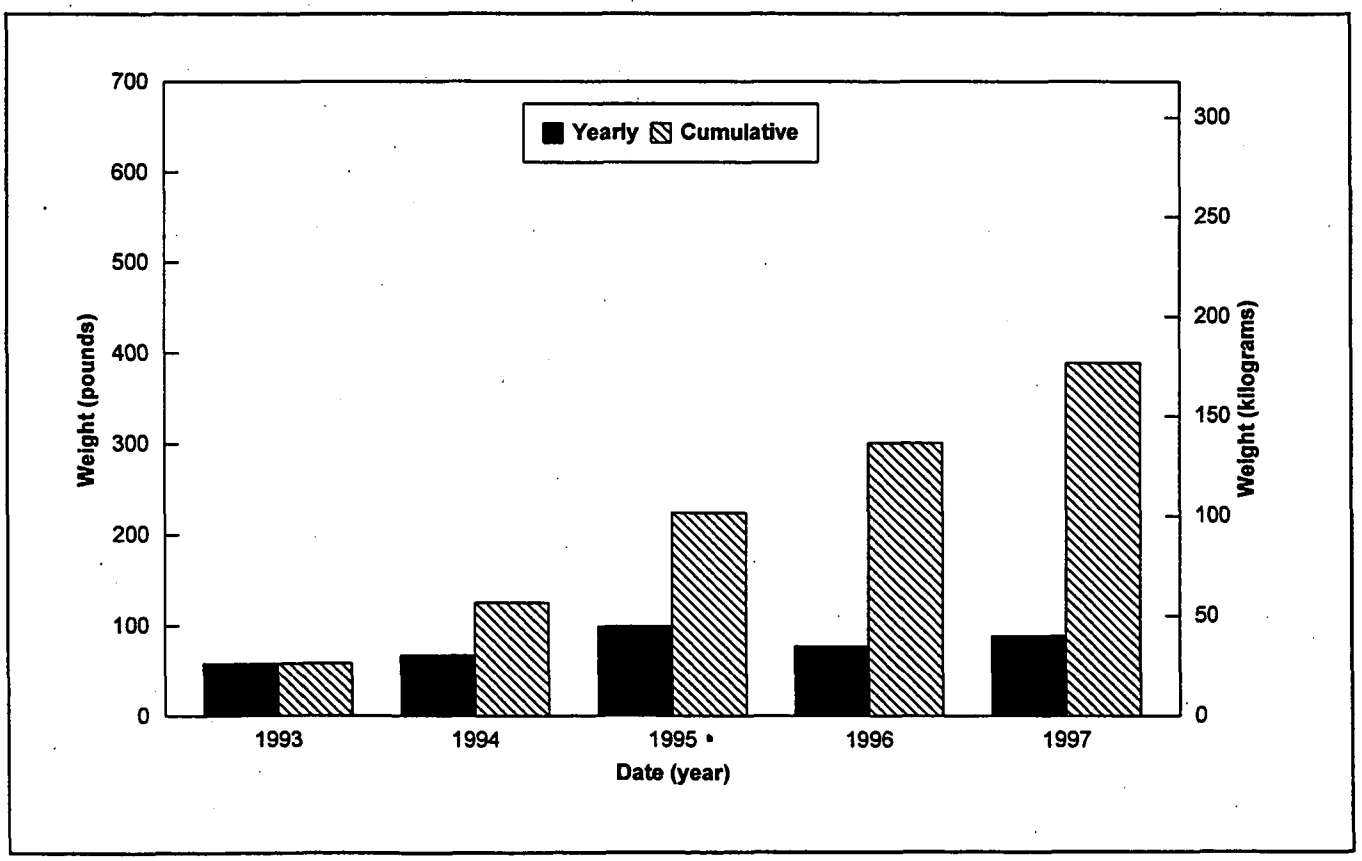

Figure 3-5. Pounds of Uranium Removed from the Great Miami Aquifer, 1993-1997

The South Plume Removal Action System is evaluated quarterly to ensure that it continues to meet the primary objective of preventing the further southward movement of the plume. The evaluation is done by collecting and mapping groundwater quality data and groundwater elevation data, and then analyzing the results. Concentration maps were developed from analytical data and compared with groundwater elevation maps depicting the location of the capture zone. Based on analysis of this data, the South Plume Removal Action System continues to meet the primary objective of the removal action in that

southward movement of the total uranium plume, beyond the extraction wells, has not been detected.

A secondary objective of the South Plume Removal Action System is to ensure that the pumping action of the system does not adversely impact the Paddys Run Road Site Plume immediately south of the extraction wells. This plume is a result of separate industrial activities along Paddys Run Road that is not associated with the FEMP. Based on groundwater results from around the Paddys Run Road Site, it can be concluded that the South Plume Removal Action System is not adversely impacting the Paddys Run Road Site plume.

Additional data to support the interpretations made here can be found in Appendix A, Attachments 2 and 3, of this report.

Monitoring Results for Total Uranium

Although there are 50 groundwater FRLs, total uranium is the primary FRL constituent because it is the most prevalent site contaminant and has impacted the largest area of the aquifer. For this reason, beginning in late 1996 and continuing into the first quarter of 1997, an extensive groundwater sampling program was conducted in support of groundwater remedial design to refine the definition of the vertical and lateral extent of the total uranium plume in the South Field and South Plume areas. A "direct push" sampling system (Geoprobe®) was used which allowed for collection of groundwater samples at specified intervals to obtain vertical profile information on total uranium concentrations. The additional data gathered from the 19 locations sampled was used to finalize the design of the enhanced groundwater remedy discussed above. The sampling results were presented in detail in the Baseline Remedial Strategy Report.

Figure 3-6 shows the extent of the total uranium plume in the aquifer at the end of 1997 and the groundwater flow directions in the aquifer. The shaded areas represent the total uranium plume which is above the 20 microgram per liter (μg/L) or 13.5 picoCuries per liter (pCi/L) FRL for total uranium in groundwater. Figure 3-6 also shows that the total uranium concentrations greater than the FRL are within the 10-year, uranium-based restoration footprint. The actual observed capture zone resulting from pumping at the South Plume Removal Action System is also depicted in Figure 3-6 to show that the main portion of the South Plume is being captured by the existing system and that further movement of uranium to the south is being prevented by the system.

Groundwater sample data collected during the third and fourth quarters of 1997 in the South Field and South Plume areas (areas B, D, and E in Figure 3-3) indicate that the total uranium plume in the southern half of the South Field area and in the South Plume area has not significantly changed in size or concentration since the data acquired in support of the enhanced groundwater remedy design, as finalized in the Baseline Remedial Strategy Report.

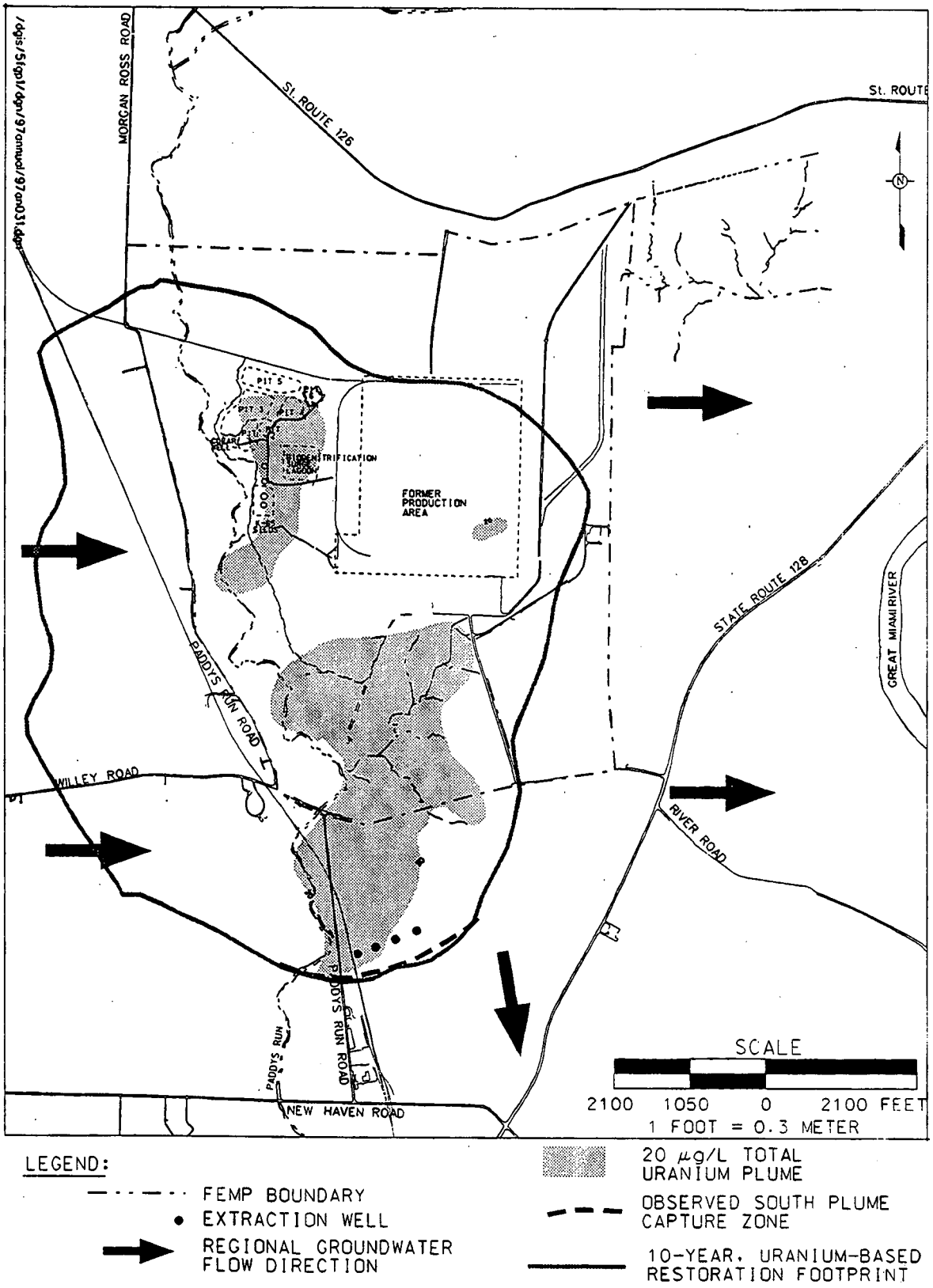

Figure 3-6. Total Uranium Plume in the Aquifer with Concentrations Greater than 20 µg/L at the End of 1997

The northern half of the South Field Plume was also sampled during the third and fourth quarters of 1997, and as in the southern portion of the plume, no significant changes in concentration or plume size were noted.

Groundwater was sampled for the first time since 1993 in the waste pit area (waste storage area) and in the Plant 6 area during the fourth quarter of 1997 to track water quality conditions and determine if changes to the enhanced groundwater remedy design were needed. While the total uranium plume in the Plant 6 area has not significantly changed since sampling began in 1993, the total uranium plume in the waste pit area has increased and has moved eastward slightly from the 1993 plume location. The enhanced groundwater remedy, including 10 extraction wells in the waste pit area and two extraction wells in the Plant 6 area, is scheduled to begin operation after soil remediation is complete in these areas.

Groundwater monitoring for total uranium and other constituents of concern under the IEMP will continue in these areas, and results will be presented and discussed in future IEMP quarterly status reports and annual integrated site environmental reports.

Additional data on the total uranium plumes can be found in Appendix A, Attachment 2, of this report.

Monitoring Results for Non-Uranium Constituents

Although the enhanced groundwater remedy was primarily designed to remediate uranium from groundwater, other FRL constituents (Table 2-1) which occur above their respective FRLs are being addressed by the enhanced groundwater remedy. Because FRL constituents move at different rates in groundwater, the FEMP also monitors these other constituents to see where they exceed the FRL and to see if any of the locations with FRL exceedances fall outside the 10-year, uranium-based restoration footprint.

Table 3-1 summarizes the results of monitoring for non-uranium FRL constituents, and Figure 3-7 identifies the locations of the wells that had FRL exceedances. Included in the table for each FRL constituent are the number of wells with 1997 FRL exceedances, the number of wells with FRL exceedances outside the 10-year, uranium-based restoration footprint, and the range of 1997 data above the FRL from wells inside or outside the 10-year, uranium-based restoration footprint.

During 1997, FRL exceedances were observed for 11 FRL constituents at 29 monitoring well locations, as shown in Figure 3-7. All these exceedances are within the 10-year, uranium-based restoration footprint and are expected to be addressed by the enhanced groundwater remedy, except exceedances for zinc, manganese, lead, cadmium, and chromium at various monitoring well locations along the property boundary (Figure 3-7). No plumes for these constituents at these locations were identified in the extensive groundwater characterization efforts evaluated as part of the Operable Unit 5 RI Report. These constituents with FRL exceedances at the well locations outside the 10-year, uranium-based restoration footprint were further evaluated to see if they were random events or if they were persistent according to criteria discussed in Appendix A,

TABLE 3-1
NON-URANIUM CONSTITUENTS WITH 1997 RESULTS ABOVE FINAL REMEDIATION LEVELS

Constituent	Number of Wells Exceeding FRL	Number of Wells Exceeding FRL Outside 10-Year, Uranium-Based Restoration Footprint	GW FRL	Range of 1997 Data Inside 10-Year, Uranium-Based Restoration Footprint above FRL[a]	Range of 1997 Data Outside 10-Year, Uranium-Based Restoration Footprint above FRL[a]
Inorganics			**(mg/L)**	**(mg/L)**	**(mg/L)**
Antimony	1	0	0.006	0.0196	NA
Boron	1	0	0.33	0.467 to 1.14	NA
Cadmium	1	1	0.014	NA	0.0147
Chromium	13	1	0.022	0.023 to 0.212	0.0362
Lead	5	1	0.015	0.0159 to 0.0636	0.028
Manganese	12	4[b]	0.9	0.917 to 2.93	0.956 to 2.86
Molybdenum	1	0	0.1	0.69	NA
Nickel	1	0	0.1	0.103 to 0.252	NA
Nitrate/Nitrite	1	0	11	36	NA
Zinc	18	5	0.021	0.0331 to 3.78	0.0298 to 0.0476
Radionuclides			**(pCi/L)**	**(pCi/L)**	**(pCi/L)**
Technetium-99	1	0	94	1207.77	NA

[a]NA = not applicable
[b]Manganese exceedances were determined to be persistent at three of the four monitoring wells (2426, 2430, and 2431) that had FRL exceedances in 1997.

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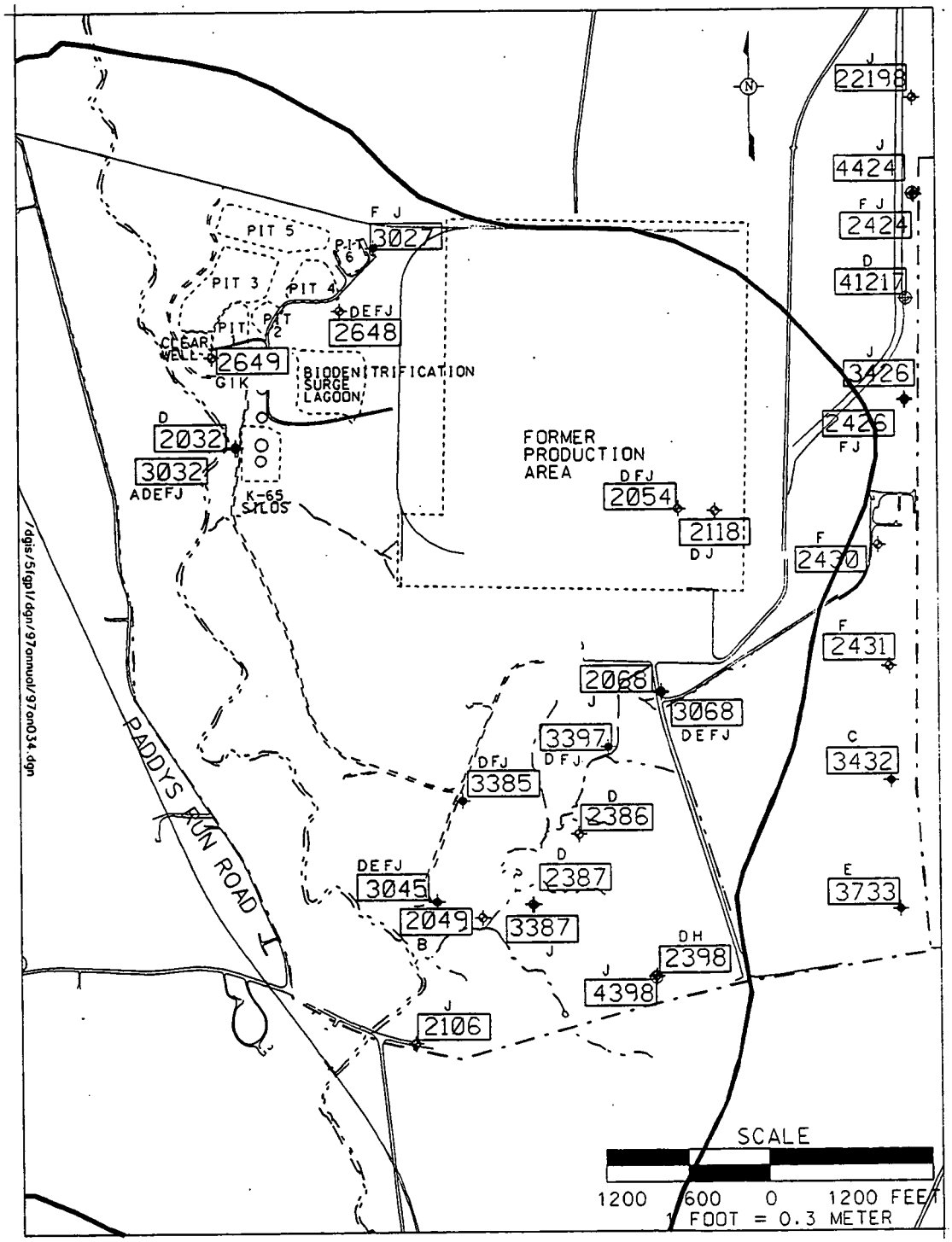

LEGEND:

- FEMP BOUNDARY
- MONITORING WELL LOCATIONS WITH FRL EXCEEDANCE
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

FRL EXCEEDANCE KEY:

A ANTIMONY
B BORON
C CADMIUM
D CHROMIUM
E LEAD
F MANGANESE
G MOLYBDENUM
H NICKEL
I NITRATE/NITRITE
J ZINC
K TECHNETIUM-99

Figure 3-7. Non-uranium Constituents with 1997 Results above Final Remediation Levels

Attachment 4, of this report. Persistent FRL exceedances are further evaluated to determine the potential cause of persistence.

Of the constituents exceeding the FRL outside the 10-year, uranium-based restoration footprint, only manganese was persistent. Manganese exceedances are believed to be associated with bacterial growth in and around the monitoring wells which tend to accumulate iron, manganese, and other metals. Bacterial growth is not uncommon in wells in the Great Miami Aquifer. The monitoring wells with persistent manganese exceedances will be treated for bacterial growth to see if future monitoring data show a decrease in manganese concentrations.

The remaining FRL exceedances occurring outside the 10-year, uranium-based restoration footprint were determined to be one-time events, which require no further evaluation other than the routine monitoring, which will continue under the IEMP or additional data is required to determine persistence. The FRL exceedances requiring additional data will be further evaluated using 1998 IEMP monitoring data. For additional details on the evaluation of 1997 FRL exceedances, see Appendix A, Attachment 4, of this report.

Compliance Monitoring

Three compliance monitoring programs have been integrated into the IEMP:

- Private Well Monitoring
- RCRA Property Boundary Monitoring
- KC-2 Warehouse Well Monitoring.

The groundwater data from these former compliance monitoring programs, along with the data from all other IEMP groundwater monitoring activities, are collectively evaluated and conclusions are presented in the monitoring results for total uranium and non-uranium constituents of concern. The discussion below provides additional details on the Private Well, RCRA Property Boundary, and KC-2 Warehouse well monitoring activities.

Three of the private wells from the former radiological environmental monitoring program were monitored in 1997 and will continue to be monitored quarterly for total uranium as part of the IEMP. These three wells located along Willey Road include the private well where off-property contamination was initially reported in 1981. The other private wells previously monitored have not been carried forward into the IEMP program because a public water supply is now available to FEMP neighbors who have been affected by off-property groundwater contamination. In addition, the wells being monitored under the IEMP provide adequate monitoring coverage both on and off property. Data from the three private wells sampled under the IEMP were used to produce the total uranium plume map shown in Figure 3-6.

The RCRA Property Boundary Monitoring Program has also been incorporated into the IEMP. This network of 33 monitoring wells, located downgradient of the FEMP along the eastern and southern property boundaries, is monitored quarterly for 27 of the most mobile FRL constituents. Sampling of these 33 wells is conducted in order to determine if

contaminant excursions at the property boundary are occurring during the remediation process. Data from these wells are integrated with other IEMP data for 1997 and were used to produce the total uranium plume map shown in Figure 3-6. Non-uranium data from these wells were included above in the section on monitoring results for non-uranium constituents. Additional detail can be found in Appendix A, Attachments 2 and 4, of this report.

The KC-2 Warehouse well monitoring has been included as part of the IEMP. Monitoring of this well is conducted on an annual basis and will continue until the warehouse is decommissioned and dismantled, at which time the well will be removed.

The August 1997 sampling event for the KC-2 Warehouse well indicated concentrations of hazardous substance list metals which were higher than routinely indicated in previous sampling results. Similar anomalously high concentrations were also recorded in the January 1995 sampling event. On that occasion, the elevated results were believed to have been caused by a disturbance of the contaminated sediment at the bottom of the well. In an effort to determine if the sediment at the bottom of the well may have been disturbed in the August 1997 sampling event, the well was resampled in January 1998 ensuring the bottom sediment was not disturbed. The results from the January 1998 sampling event are more consistent with sample results reported prior to August 1997, indicating that the August 1997 event was not representative. The monitoring results for this well and additional details on the sampling events are presented in Appendix A, Attachment 5, of this report.

Monitoring for Coal Pile Runoff Basin

Two monitoring wells installed in the perched groundwater zone within the glacial overburden have been used to monitor the Coal Pile Runoff Basin on a routine basis. Monitoring and reporting is conducted in accordance with Ohio Permit to Install No. 05-4172, issued and effective on September 13, 1990. As required by the Permit to Install, the monitoring data from the Coal Pile Runoff Basin for 1997 is presented in Appendix A, Attachment 5, of this report.

On-Site Disposal Facility Monitoring

Groundwater monitoring in support of the on-site disposal facility was initiated in 1997. This monitoring program is designed to accomplish the following:

- Establish a baseline of groundwater conditions in the perched water and Great Miami Aquifer for each cell of the on-site disposal facility prior to first waste placement in the cell. This data will be used to evaluate future changes in perched groundwater and groundwater quality to determine if the changes are due to on-site disposal facility operations.

- Continue routine groundwater sampling following waste placement as part of the comprehensive leak detection monitoring program for the on-site disposal facility. This information will be used to verify the ongoing performance and integrity of the on-site disposal facility.

Construction of Cells 1 and 2 of the on-site disposal facility in 1997 was accompanied by groundwater sampling from Monitoring Wells 22198, 22199, 22200, and 22201 around the cells (Figure 3-8). Monitoring Well 12338, in Figure 3-8, is a horizontal till well which is used to sample the perched groundwater in the glacial overburden beneath the sump for Cell 1.

Groundwater sampling was initiated and completed for Cell 1 in 1997 to establish a baseline for the monitoring wells prior to waste placement. A technical memorandum will be issued in 1998 to discuss the baseline results. Baseline sampling was also initiated in 1997 for wells around Cell 2.

Construction of the leachate collection system and the leak detection system for Cell 1 was completed as of December 1997, and waste placement was initiated. Construction of the leachate collection system and the leak detection system for Cell 2 is expected to be completed in late 1998.

None of the constituents sampled and analyzed under this program exceeded the groundwater FRLs except Monitoring Well 22198 (also sampled under the RCRA Property Boundary Monitoring Program) which had a single exceedance for zinc in 1997. Zinc is not a constituent of concern associated with the waste acceptance criteria for the on-site disposal facility and is therefore not considered to be significant. However, it will continue to be monitored over time under the RCRA Property Boundary Monitoring Program. For additional information on the groundwater sampling results for the on-site disposal facility, refer to Appendix A, Attachment 6, of this report.

Guide to Aquifer Restoration Project Documents

As described in Chapter Two, the FEMP is on the National Priorities List, a list of sites requiring environmental cleanup under CERCLA. Numerous studies and reports have been issued by the FEMP during the CERCLA process to document the progress of the cleanup.

Table 3-2 is a reference for the reader to consult when seeking additional information about any phase of the site CERCLA process related to groundwater which has been completed to date. The times during which the major accomplishments under the CERCLA process and predictions of future activities are shown on the left. The middle column identifies the major CERCLA process which was in progress at the time. The last column indicates the documents where significant findings, results, and recommendations can be located. These documents are available for public viewing in the FEMP Public Environmental Information Center.

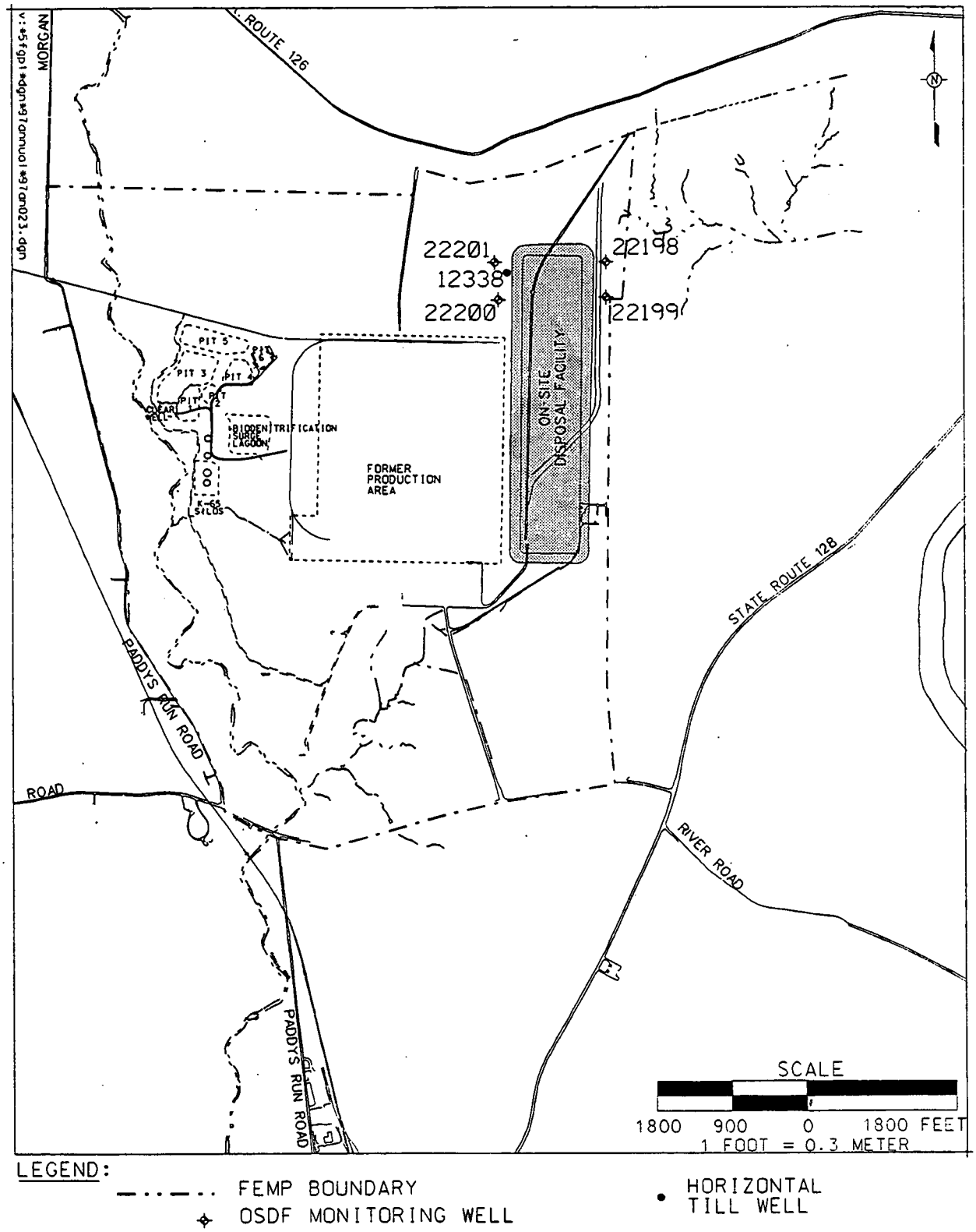

Figure 3-8. On-Site Disposal Facility Footprint and Monitoring Well Locations

TABLE 3-2

CHRONOLOGICAL SUMMARY OF AQUIFER RESTORATION ACTIVITIES

Date	Activity	Reporting Document[a]
1988	Determine the Scope of the Problem and Select A Solution	
	Determine the nature and extent of groundwater contamination and investigate the risk posed to human health and/or the environment	**Remedial Investigation Report for Operable Unit 5** (1995)
	Evaluate various remediation technologies; consider efficiency, land use scenarios, and cost	**Feasibility Study Report for Operable Unit 5** (1995)
	Establish remediation goals for site contaminants in environmental media; commit to a selected cleanup remedy	**Record of Decision for Remedial Actions at Operable Unit 5** (1996)
1996	Design and Construct a System to Clean Up the Aquifer	
	Define how and when needed construction drawings, specifications, plans, and procurement documents will be prepared	**Remedial Design Work Plan for Remedial Actions at Operable Unit 5** (1996)
	Develop a strategy and schedule for completing restoration of the aquifer	**Remedial Action Work Plan for Aquifer Restoration at Operable Unit 5** (1997)
	Design the aquifer restoration system (e.g., number of wells, pumping rates, well locations, etc.)	**Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1)** (1997)
	Develop a plan to monitor progress of the clean up	Chapter 3 of the **Integrated Environmental Monitoring Plan** (1997)
	Develop operational strategy for the aquifer system	**Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment Project** (1997)
1997-1998	Start-Up the Systems to Clean Up the Aquifer	
	South Plume Module activity began as a removal action in 1993 integrated into remediation.	**South Plume Removal Action Design Monitoring Evaluation Program Plan** (1993)
		Design Monitoring Evaluation Program Plan System Evaluation Report (various dates through September 1997)
	South Field (Phase 1) & South Plume Optimization Modules, which are scheduled to begin operation in 1998	**Start-Up Monitoring Plan for the South Field Extraction and South Plume Optimization Modules** (1998)
	Re-Injection Demonstration Module, which is scheduled to begin operation in 1998	**Re-Injection Demonstration Test Plan** (1997)
1997-1998	Operation of the systems to clean up the Aquifer	IEMP quarterly status reports beginning with December 1997

[a]These documents are available for review at the FEMP Public Environmental Information Center.

Surface Water and Treated Effluent Pathway

Results in Brief: 1997 Treated Effluent and Surface Water Pathway

Surveillance Monitoring - No surface water or treated effluent analytical results from samples collected in 1997 exceeded the FRL for total uranium, the primary site contaminant. FRL and benchmark toxicity value (BTV) exceedances in surface water samples were limited to nine and 11 constituents, respectively. These occasional, sporadic FRL and BTV exceedances are to be expected until site remediation is complete.

NPDES - Permitted discharges were in compliance with the current NPDES permit requirements 99.8 percent of the time. Total suspended solids exceeded the permit limits three times in treated effluent at the Parshall Flume (PF 4001) and two times in treated effluent from the Sewage Treatment Plant (STP 4601).

Uranium Discharges - In 1997, 126 pounds (57.2 kg) of uranium were discharged in treated effluent to the Great Miami River. Approximately 252 pounds (114 kg) of uranium were released to the environment through uncontrolled storm water runoff. Additionally, 3.46 pounds (1.57 kg) of uranium were released to Paddys Run during overflow of the Storm Water Retention Basin due to excessive amounts of precipitation. The total pounds of uranium released through the surface water and treated effluent pathway (approximately 378 pounds [172 kg]) decreased 42 percent from 1996 (approximately 657 pounds [298 kg]).

Sediment - Sediment results in general, decreased when compared to 1996 results. One sample result for thorium-232 (1.63 picoCuries per gram [pCi/g]) collected in the Storm Sewer Outfall Ditch slightly exceeded the thorium-232 FRL of 1.60 pCi/g.

This chapter presents the 1997 monitoring activities and results for surface water, treated effluent, and sediment to determine the effects of remediation activities on the surface water pathway.

In general, low levels of contaminants enter the surface water pathway at the FEMP by two primary mechanisms: treated effluent that is monitored as it is discharged to the Great Miami River, and through uncontrolled runoff entering the site's drainages from areas of the site containing low levels of soil contamination. Recognizing that these discharges will continue throughout remediation, the FEMP continues to place emphasis on monitoring this exposure pathway. Through expansion of the site's wastewater treatment capabilities and through strict implementation of the site's runoff and sediment controls, the FEMP strives to minimize its impact on the surface water pathway.

Summary of Surface Water and Treated Effluent Pathway

To assist in the understanding of this chapter, the following key definitions are provided:

- **Controlled runoff** is contaminated storm water requiring treatment that is collected, treated and eventually discharged as treated effluent.
- **Uncontrolled runoff** is storm water that is not collected by the site for treatment, but enters the site's natural drainages.
- **Treated effluent** is water from numerous sources at the site which is treated through one of the site's wastewater treatment facilities and discharged to the Great Miami River.
- **Surface water** is water that is flowing within natural drainage features.

The sources of treated effluent include groundwater extracted from the aquifer, controlled runoff from the waste storage area and former production area, process wastewaters (e.g., Boiler Plant and decontamination wastewater), and effluent from the Sewage Treatment Plant. Controlled runoff and process wastewater are routed to one of the designated site water treatment facilities, treated, and then discharged through the effluent line to the Great Miami River (Figure 4-1).

The volume and flow rate of uncontrolled runoff is dependent upon the amount of precipitation within any given period of time. Monthly precipitation totals for 1997 are shown in Figure 1-10 in Chapter One. Figure 4-1 shows the site's natural drainage features and defines the areas from which runoff is either controlled or uncontrolled. The site's natural surface water drainages include several tributaries to Paddys Run (e.g., Pilot Plant Drainage Ditch, Storm Sewer Outfall Ditch, etc.) and the northeast drainage. The arrows on this figure indicate the general flow direction of uncontrolled runoff which is determined from the site's topography. Uncontrolled runoff from the FEMP leaves the property via two drainage pathways, Paddys Run and the northeast drainage.

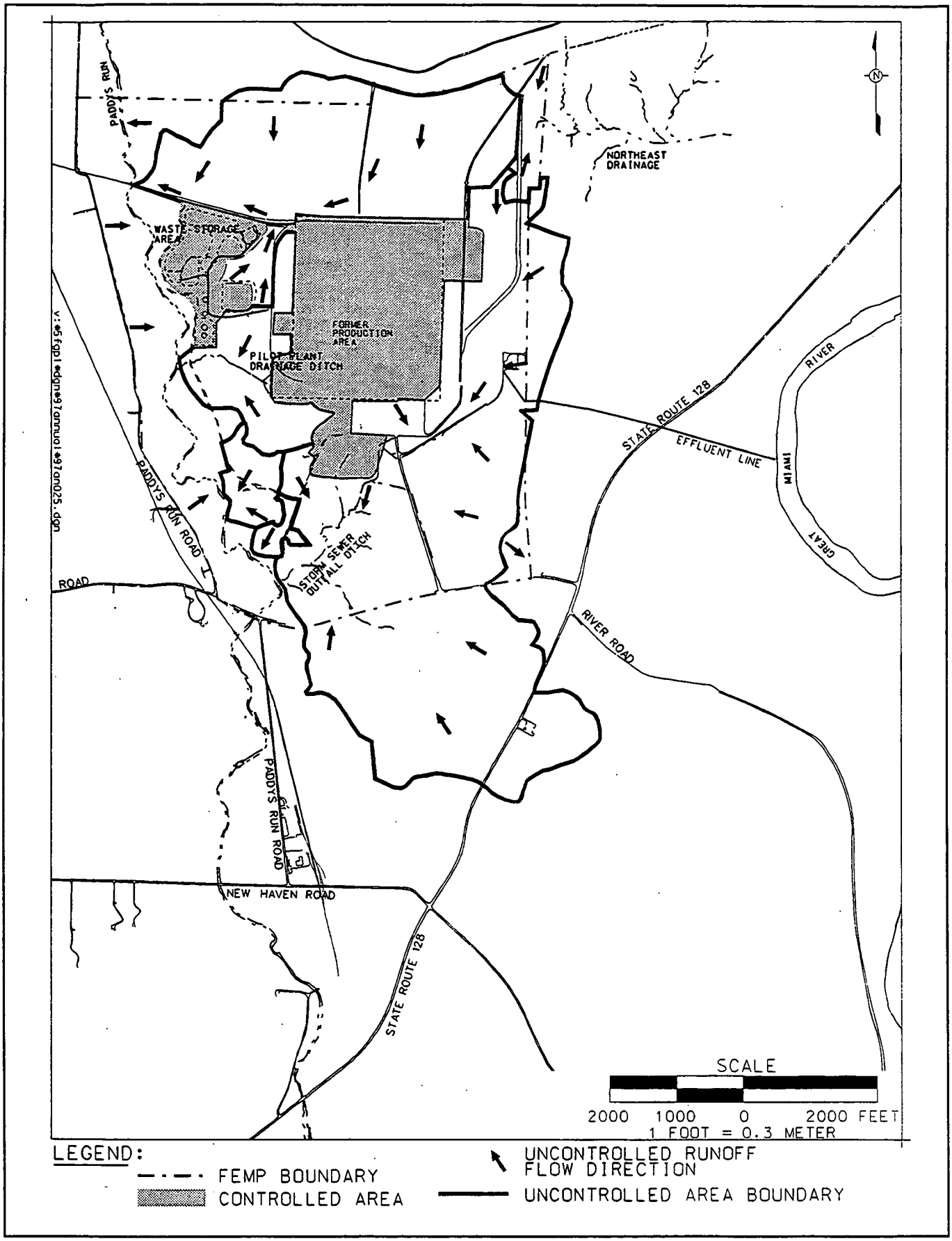

Figure 4-1. Controlled Runoff Delineation and Uncontrolled Runoff Flow Directions

Remediation Activities Affecting Surface Water Pathway

Activities associated with remediation in 1997 that potentially affect the surface water pathway included:

- Construction of the on-site disposal facility, on-site disposal facility leachate conveyance system, north railyard complex, new north access road, waste haul road, and numerous storm water sediment basins
- Installation of the pipelines for the Groundwater Re-Injection Demonstration Project and South Field Extraction System
- Stabilization activities on the bank of Paddys Run near K-65 Silos 1 and 2
- Excavation and construction activities associated with the remediation of the southern waste units
- Remediation of soil in Area 1, Phase I, located on the northeastern portion of the site
- Diversion of parking lot storm water to the Storm Sewer Outfall Ditch.

To minimize the effects of remediation on the environment, engineered and administrative controls are used at the FEMP to reduce the amount of sediment entering the surface water drainages during rainfall events. As water flows over soil, contaminants typically move with the water either by being adsorbed to sediment eroded from the land surface or dissolved in the water itself. The chosen sediment control method varies based on the contaminants expected during excavation, the topography of the area, and the size and duration of the excavation.

Engineered controls can include the construction of sedimentation basins (lined or unlined), silt fences, check dams, and permanent or temporary seeding. Diversion ditches are also constructed as an engineered control to divert clean water from upgradient areas away from areas of remediation. Ditches are also sometimes lined with riprap and/or synthetic liners to control erosion. In areas where remediation activities may expose contaminated materials (e.g., the southern waste units), contaminated runoff is collected in lined basins and routed for treatment at one of the site's wastewater treatment facilities. Administrative controls include limiting the duration of open excavations, as well as routinely inspecting each of the engineered controls constructed at the FEMP.

Each remediation project is responsible for constructing the engineered control structures required under their remedial design. All engineered sediment and surface water controls are inspected at least once a week and within 24 hours of any rain event measuring greater than 0.5 inch (1.3 cm) of rain in a 24-hour period. Discharge points for uncontrolled runoff to Paddys Run are also inspected periodically to assess the effectiveness of upgradient controls in preventing significant impacts to Paddys Run. Minor problems (e.g., silt fence requiring repairs, reseeding of eroded areas, etc.) were identified in 1997

during these inspections. The problems identified were communicated to the responsible individual for implementation of corrective action. No measurable impacts from these problems were detected through the IEMP surface water, treated effluent, and sediment monitoring programs.

During 1997, numerous engineered controls were installed to protect surface water drainages downgradient of remediation activities. Nine basins were installed at various locations around the FEMP including the northeastern portion of the FEMP, southeast of the Silos, east of the waste pit area, and west of the new north railyard. Construction of a series of diversion ditches and sedimentation basins was initiated in the fall of 1997 to provide storm water control during remediation of the southern waste units. At a minimum, silt fencing was installed to control erosion at all excavation and construction projects. Temporary seeding was completed for those areas where final grading was postponed pending completion of other portions of a project.

Surface Water, Treated Effluent, and Sediment Highlights for 1997

Surface water, treated effluent, and sediment are sampled to determine the effect of the FEMP's remediation activities on the environment. Surface water is sampled at several locations in the site's drainages and analyzed for various radiological and non-radiological constituents. Treated effluent is sampled prior to discharge into the Great Miami River. Sediment is sampled in the major site drainages (i.e., Paddys Run and Storm Sewer Outfall Ditch) and in the Great Miami River for radiological constituents.

Transition to IEMP

Historically, surface water and treated effluent sampling has been conducted under three separate programs, each designed to meet the requirements of a unique regulatory driver, with a distinct technical focus and reporting requirement. These three programs were defined in the Fernald Site Environmental Monitoring Plan (FERMCO 1995), NPDES permit, and FFCA, respectively. With approval of the IEMP in July 1997, these programs were integrated into a single monitoring program providing a comprehensive assessment of the site's impact on the surface water pathway.

The IEMP sediment sampling program largely reflects a continuation of the FEMP's sediment sampling program conducted prior to development of the IEMP. This includes an annual sampling program with data reported through annual integrated site environmental reports.

The key elements of the surface water and treated effluent program design are described below:

Benchmark Toxicity Values (BTVs) - are concentrations in sediment and surface water established in scientific literature to be used as a "benchmark" to determine if a particular constituent may be having a detrimental effect on a particular ecological receptor. For surface water and sediment, ecological receptors include any fish or animal that inhabits the surface water body or uses surface water as a source of drinking water. Additional details concerning BTVs can be found in the Operable Unit 5 Sitewide Ecological Risk Assessment, (Appendix B of the Operable Unit 5 RI Report), Operable Unit 5 FS Report, and in the IEMP.

- **Sampling** - Sample locations, frequency, and constituents were selected to address both the prescriptive requirements of the NPDES permit, FFCA, and Operable Unit 5 Record of Decision, and to provide a comprehensive assessment of surface water quality at 19 key locations in on-site drainages and off property in the Great Miami River. Prior to implementation of the IEMP, primarily total uranium and NPDES constituents were monitored. With the IEMP sampling program, surface water is monitored for up to 55 FRL constituents (Table 2-1) and 31 benchmark toxicity value (BTV) constituents.

- **Data Evaluation** - The integrated data evaluation process focuses on tracking and evaluating data compared with background and historical ranges, FRLs, BTVs, and NPDES limits. This information is used to assess impacts to surface water due to site remediation activities affecting uncontrolled runoff or treated effluent. The assessment includes identifying the potential for impacts from surface water to the groundwater in the underlying Great Miami Aquifer. The ongoing data evaluation is designed to support remedial action decision making by providing timely feedback to the remediation project organizations on the effectiveness of storm water runoff controls and treatment processes.

- **Reporting** - Prior to implementation of the IEMP, surface water and treated effluent reporting requirements consisted of quarterly FFCA reports, monthly NPDES reports, and annual site environmental reports. These surface water and treated effluent reporting requirements were combined into quarterly status reports and annual integrated site environmental reports. The FFCA surface water and treated effluent requirements were reported for the entire year of 1997 in the FFCA quarterly reports; however, beginning in 1998, the surface water and treated effluent results will not be reported in the FFCA quarterly reports but will be reported in annual integrated site environmental reports and the quarterly status reports. The monthly discharge monitoring reports required by the NPDES permit will continue to be submitted separately as scheduled.

Data from samples collected under the IEMP are used to fulfill both compliance monitoring and surveillance monitoring functions. Compliance monitoring includes sampling at storm water and treated effluent discharge points into the surface water and is conducted to comply with provisions in the NPDES permit, including the Storm Water Pollution Prevention Plan and the FFCA. Surveillance monitoring results of the IEMP surface water and treated effluent program are used to assess the collective effectiveness of site storm water controls and wastewater treatment processes in preventing unacceptable impacts to the surface water and groundwater pathways. The data are routinely evaluated to identify any unacceptable trends and to trigger corrective actions when needed to ensure protection of these critical environmental pathways. Surface water and treated effluent sample locations for pre-IEMP and IEMP are identified in Figures 4-2 and 4-3, respectively.

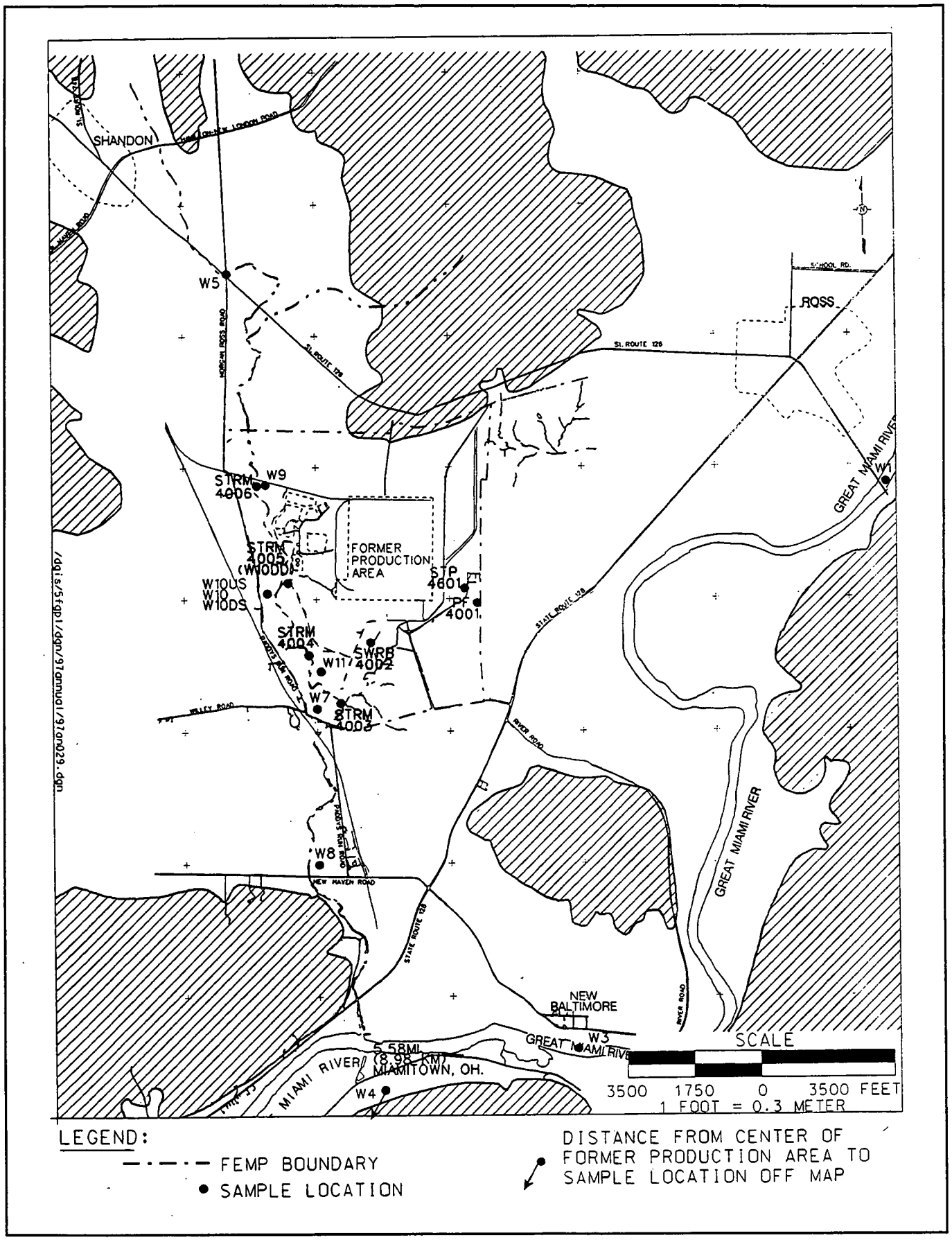

Figure 4-2. Pre-IEMP Surface Water and Treated Effluent Sample Locations

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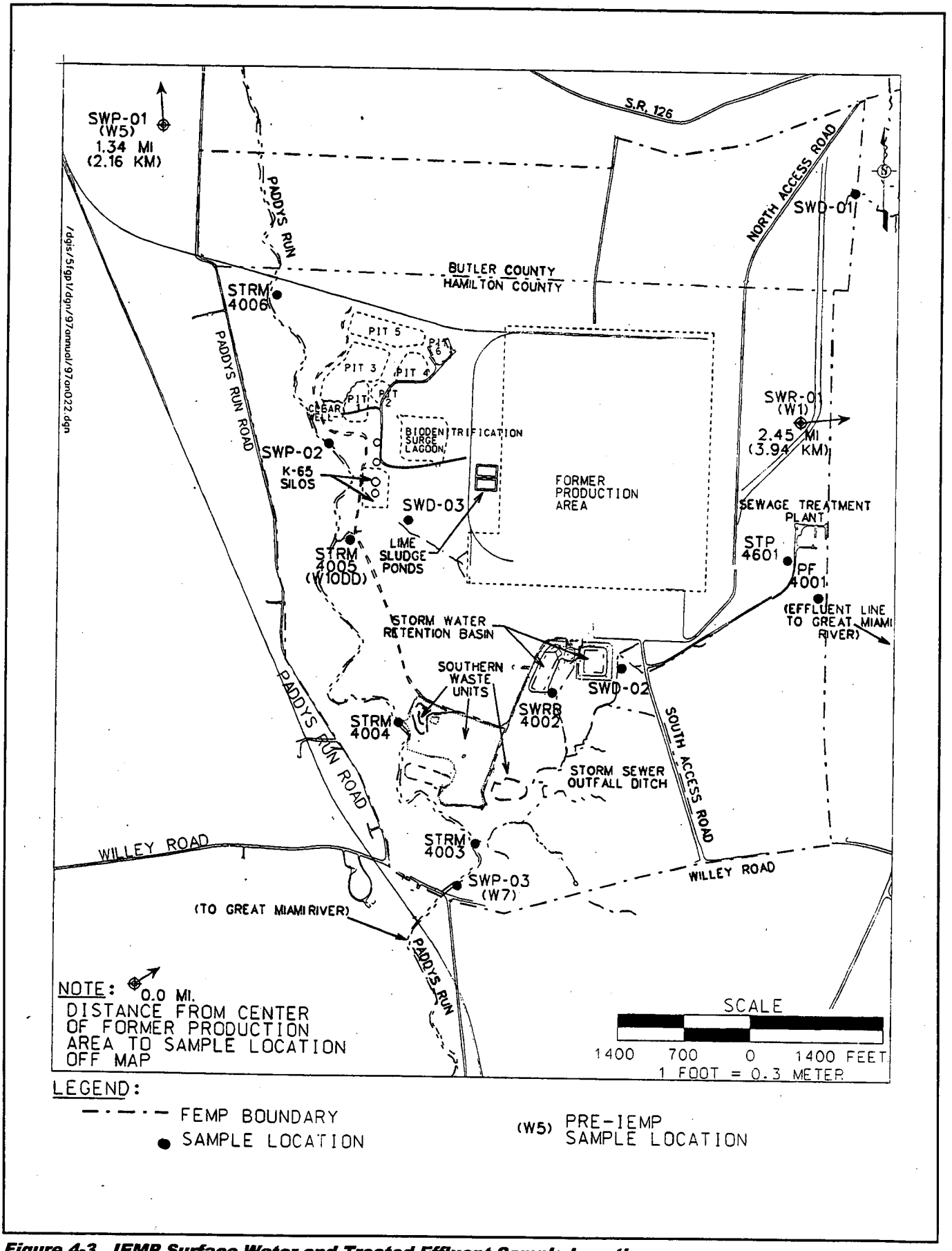

Figure 4-3. IEMP Surface Water and Treated Effluent Sample Locations

Treated effluent is discharged to the Great Miami River through the effluent line, identified on Figure 4-1. Prior to discharge through the effluent line, samples of the treated effluent are collected using an automated continuous sampling device at the Parshall Flume (PF 4001). The resulting data are used to calculate the concentration of each FRL constituent after the water mixes with water in the Great Miami River.

Surveillance Monitoring

Data resulting from 1997 sampling efforts were evaluated to provide surveillance monitoring of the remediation activities. This evaluation showed that during 1997 there were no exceedances of the surface water total uranium FRL detected in any of the surface water and treated effluent samples. There were, however, nine non-uranium FRL exceedances and 11 BTV non-uranium exceedances detected. These exceedances are summarized in Table 4-1. In general, these exceedances were sporadic in nature and do not indicate any significant impacts to the environment or operational problems with the site's storm water and sediment control systems. The persistent aluminum BTV exceedances are due to the background aluminum concentrations in Paddys Run and the Great Miami River being above the BTV for this constituent and is not necessarily the result of FEMP operations.

Even with the FEMP's strict implementation of storm water and sediment controls, these types of occasional, sporadic FRL and BTV exceedances can be expected to occur until final remediation of contaminated source areas (soils and sediments) are complete. The IEMP sampling program will continue to evaluate FRL and BTV exceedances for persistence and to identify any increasing trends in the data through final remediation. This information will be used to provide feedback to the remediation projects on the collective effectiveness of their storm water and sediment controls.

Additional details of the FRL and BTV exceedances are presented in Appendix B, Attachment 1, of this report.

TABLE 4-1
CONSTITUENTS WITH 1997 RESULTS ABOVE FRLs OR BTVs

Constituent	Number of Locations Exceeding FRL[a]	Number of Locations Exceeding BTV	FRL[a]	BTV	Range of 1997 Data above FRL[a]	Range of 1997 Data above BTV[a]
General Chemistry			(mg/L)	(mg/L)	(mg/L)	(mg/L)
Ammonia	NA	1	NA	1	NA	1.73
Inorganics						
Aluminum	NA	11	NA	0.087	NA	0.102 to 161
Barium	0	2	100	0.145	NA	0.16 to 0.284
Beryllium	3	0	0.0012	0.15	0.0016 to 0.0076	NA
Cadmium	1	1	0.0098	0.0035	0.0105	0.0105
Chromium	4	4	0.010	0.011	0.0207 to 0.181	0.0207 to 0.181
Copper	6	2	0.012	0.034	0.0144 to 0.269	0.0448 to 0.269
Lead	3	0	0.010	0.030	0.0149 to 0.0259	NA
Manganese	2	8	1.5	0.098	1.57 to 9.69	0.106 to 9.69
Mercury	1	1	0.00020	0.00020	0.0004	0.0004
Silver	0	1	0.0050	0.0013	NA	0.0014
Zinc	2	1	0.11	0.28	0.201 to 0.366	0.32 to 0.366
Semivolatile Organics			(µg/L)	(µg/L)	(µg/L)	(µg/L)
Bis(2-ethylhexyl) phthalate	1	1	8.4	8.4	23	23

[a]NA = not applicable

000087

The following two key sample locations represent points where surface water or treated effluent leave the site:

- Paddys Run at the property boundary (Willey Road) sample location SWP-03 (formerly referred to as location W7 in past site environmental reports)
- Parshall Flume (PF 4001) located at the entry point of the effluent line leading to the Great Miami River.

Evaluation of the data from these locations is especially important because it represents points beyond which direct exposure to the public is possible.

The annual average total uranium concentration in Paddys Run at Willey Road for the period 1985 through 1997 is shown in Figure 4-4. This figure illustrates the decrease of the total uranium concentration in Paddys Run from 1986 following completion of the Storm Water Retention Basin; the basin collects contaminated storm water from the former production area.

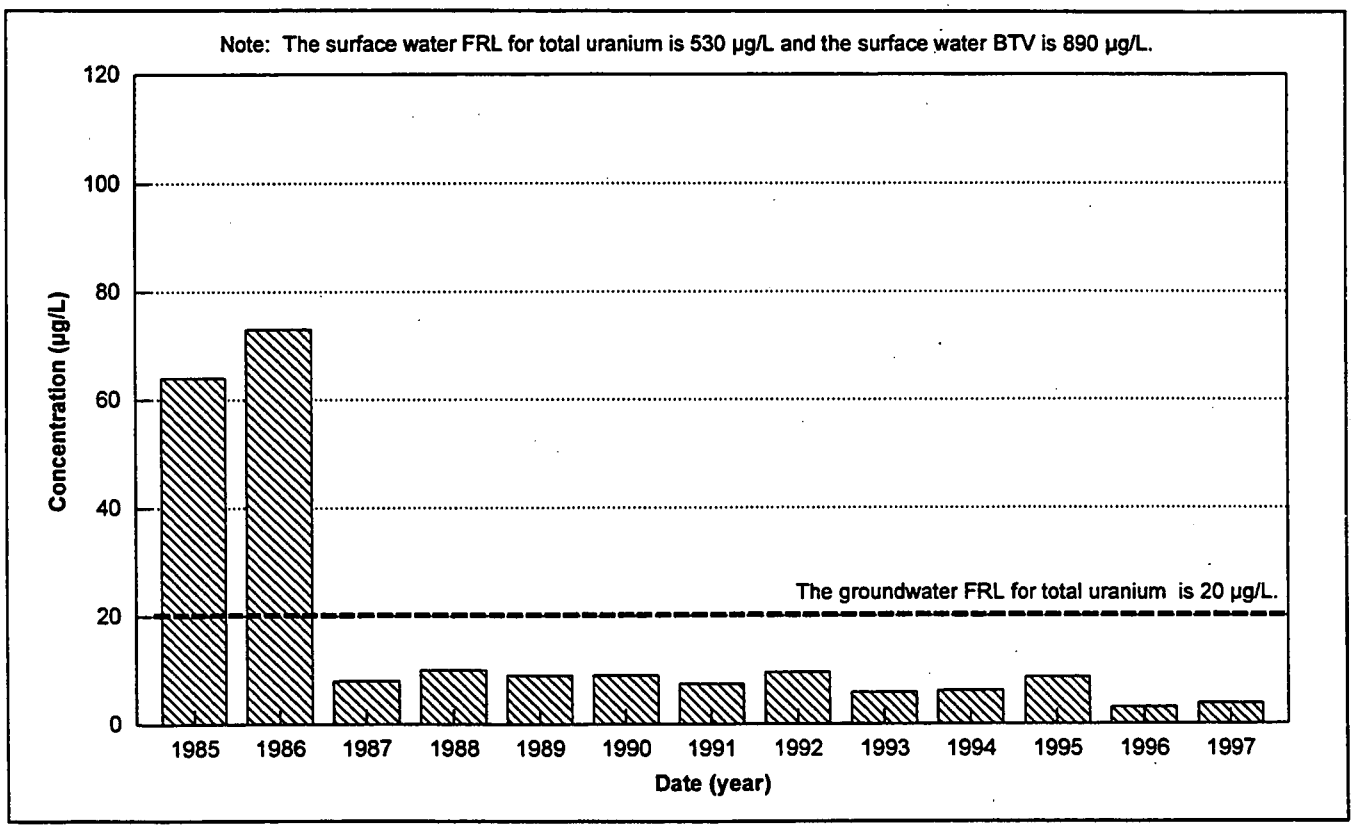

Figure 4-4. Annual Average Total Uranium Concentrations in Paddys Run at Willey Road (SWP-03/W7) Sample Location, 1985-1997

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Figure 4-5 shows the total uranium concentrations in Paddys Run at Willey Road for 1997. An elevated total uranium concentration detected on June 4, 1997, at this sample location was due to a storm-water related overflow of the Storm Water Retention Basin. The total uranium concentration, although elevated from previous sampling events, was still below both the surface water FRL (530 μg/L [358 pCi/L]) and groundwater FRL (20 μg/L [13.5 pCi/L]).

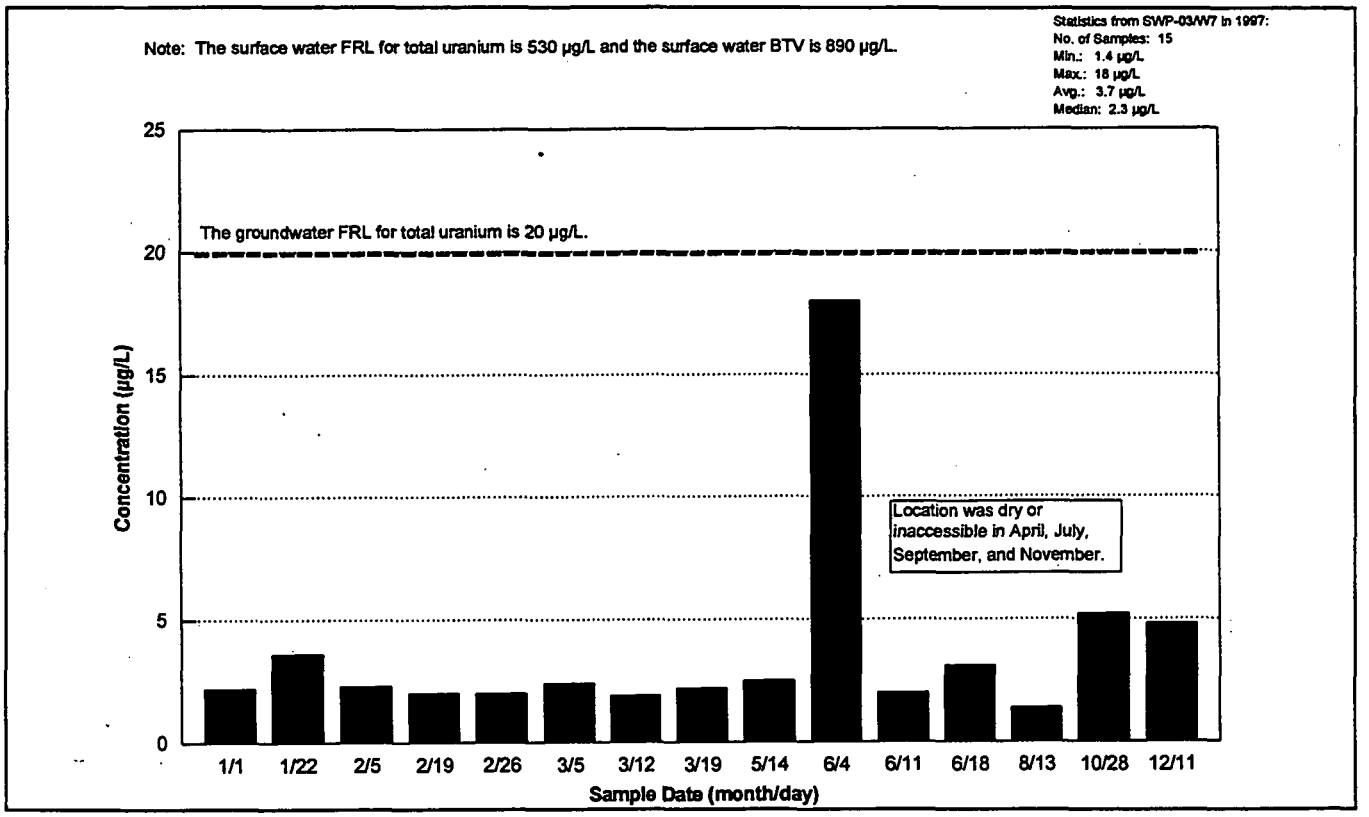

Figure 4-5. 1997 Total Uranium Concentrations in Paddys Run at Willey Road (SWP-03/W7) Sample Location

Total uranium concentrations from the Parshall Flume (PF 4001) were also well below the associated total uranium FRL and are discussed in more detail in the compliance monitoring section.

Evaluation of surface water data is also performed to provide an ongoing assessment of the potential for cross-media impacts from surface water to the underlying Great Miami Aquifer. To provide this assessment, sample locations were selected to evaluate contaminant concentrations in surface water just upstream or within those areas where site drainages have eroded through the protective glacial overburden. These sample locations are SWP-02, SWD-02, and SWRB 4002. In areas where the overburden is absent, a direct pathway exists for contaminants to reach the aquifer. This contaminant pathway to the aquifer was considered in the design of the enhanced groundwater remedy and includes placing groundwater extraction wells downgradient of these areas where direct infiltration occurs to mitigate any potential cross-media impacts.

000089

During 1997, total uranium in surface water samples exceeded the groundwater FRL at the selected locations; however, the exceedances were not persistent. Table 4-2 summarizes these exceedances. Based on the limited duration of these exceedances, it is not likely that there were any significant cross-media impacts to the Great Miami Aquifer. Data will continue to be collected at these sensitive areas under the IEMP to address the cross-media concern. Additional details concerning the cross-media impacts are provided in Appendix B, Attachment 1, of this report.

TABLE 4-2
EVALUATION OF 1997 TOTAL URANIUM GROUNDWATER FRL EXCEEDANCES FOR CROSS-MEDIA IMPACTS[a]

	Number of Exceedances	Number of Samples	Maximum Total Uranium Result (μg/L)
SWP-02	1	4	37
SWD-02	2	5	73
Overflow of Storm Water Retention Basin	1	1	314[b]

[a]Groundwater total uranium FRL is 20 μg/L.
[b]Overflows from the Storm Water Retention Basin are rare (i.e., only one overflow of the Storm Water Retention Basin occurred in 1997).

Data are also evaluated to determine the impact of soil erosion on surface water. During the summer of 1997, it was discovered that erosion of the streambank in Paddys Run west of the K-65 Silos had resulted in approximately 1,700 ft^3 (48 m^3) of soil, trees, and metal debris falling into the streambed. In the fall of 1997, the Paddys Run Embankment Stabilization Project was initiated to construct erosion prevention measures on the eastern bank of Paddys Run, directly west of K-65 Silos 1 and 2, and to remove contaminated soil and debris that had fallen into Paddys Run. The collapsed soil and debris contained elevated levels of radionuclides; however, based on the 1997 sampling results, no impact to surface water or sediment downstream of the debris was observed.

Compliance Monitoring

FFCA and Operable Unit 5 Record of Decision Compliance

The FEMP is required to monitor treated effluent discharges at the Parshall Flume (PF 4001) for the mass of total uranium discharged and the total uranium concentration. These requirements are encompassed under the FFCA and the Operable Unit 5 Record of Decision. The Operable Unit 5 Record of Decision requires treatment of effluent so that the mass of total uranium discharged to the Great Miami River through the Parshall Flume does not exceed 600 pounds (272 kg) per year. The Operable Unit 5 Record of Decision also requires that as of January 1, 1998, the monthly average total uranium concentration in the effluent must be at or below 20 μg/L.

000030

The regulatory agencies allow the FEMP to discharge water from the Storm Water Retention Basin directly to the Great Miami River during periods of heavy precipitation to minimize the possibility of overflowing the Storm Water Retention Basin. These allowable "significant precipitation" bypasses are necessary to provide relief during those times when the volume of storm water has the potential to exceed retention and treatment capacities. To comply with the 20 μg/L limit during these types of bypasses, the FEMP is allowed to deduct the concentration of uranium from the monthly average calculation for up to 10 significant precipitation bypass days per year. The mass of total uranium discharged during these 10 days per year is still counted in the total discharge mass to ensure the 600 pound per year discharge limit is not exceeded. Additionally, the concentration of these bypasses can not be such that they would cause an exceedance of the surface water total uranium FRL (530 μg/L) outside the mixing zone in the Great Miami River (i.e., the point where discharged water is completely mixed with water in the Great Miami River).

In addition to "significant precipitation" related bypasses, the FEMP is also allowed to bypass water from treatment during certain scheduled wastewater treatment plant maintenance activities. These maintenance bypasses must be preapproved by the regulatory agencies. The mass of total uranium discharged during these maintenance bypasses is added to the annual calculation to determine compliance with the 600 pound discharge limit. The total uranium concentration in the discharge is not added to the 20 μg/L concentration limit; however, the bypasses can not cause an exceedance of the surface water total uranium FRL in the Great Miami River.

The 600 pound annual limit for total uranium discharges was effective with approval of the Operable Unit 5 Record of Decision in 1996. Figure 4-6 shows that the total cumulative mass of total uranium discharged to the Great Miami River for 1997 (126 pounds [57.2 kg]) is well below the 600 pound annual limit. The 20 μg/L monthly discharge limit does not become effective until January 1, 1998; however, during 1997, the FEMP monitored total uranium concentrations to determine compliance with the future limit. Figure 4-7 shows that the FEMP complied with the future limit for the entire year, ahead of the effective date for the limit. Table 4-3 shows a summary of the treatment bypass events during 1997. Appendix B, Attachment 1, of this report provides more detail on the bypass days deleted from the monthly average calculation to determine compliance with the 20 μg/L limit.

TABLE 4-3
1997 STORM WATER TREATMENT BYPASS EVENTS

Bypass Days	Duration (hours)	Total No. of Bypass Days	Cumulative No. of Bypass Days	Total Uranium Discharged to Great Miami River (pounds)	(kg)
Significant Precipitation-Related					
January 27 to January 28	22.5	1	1	2.71	1.23
March 2 to March 4	57.5	2	3	10.1	4.59
June 1 to June 3	71.0	3	6	7.24	3.29
June 8 to June 10	48.75	2	8	4.55	2.07
Maintenance-Related					
August 18 to August 20	60.5	3	3	10.4	4.72

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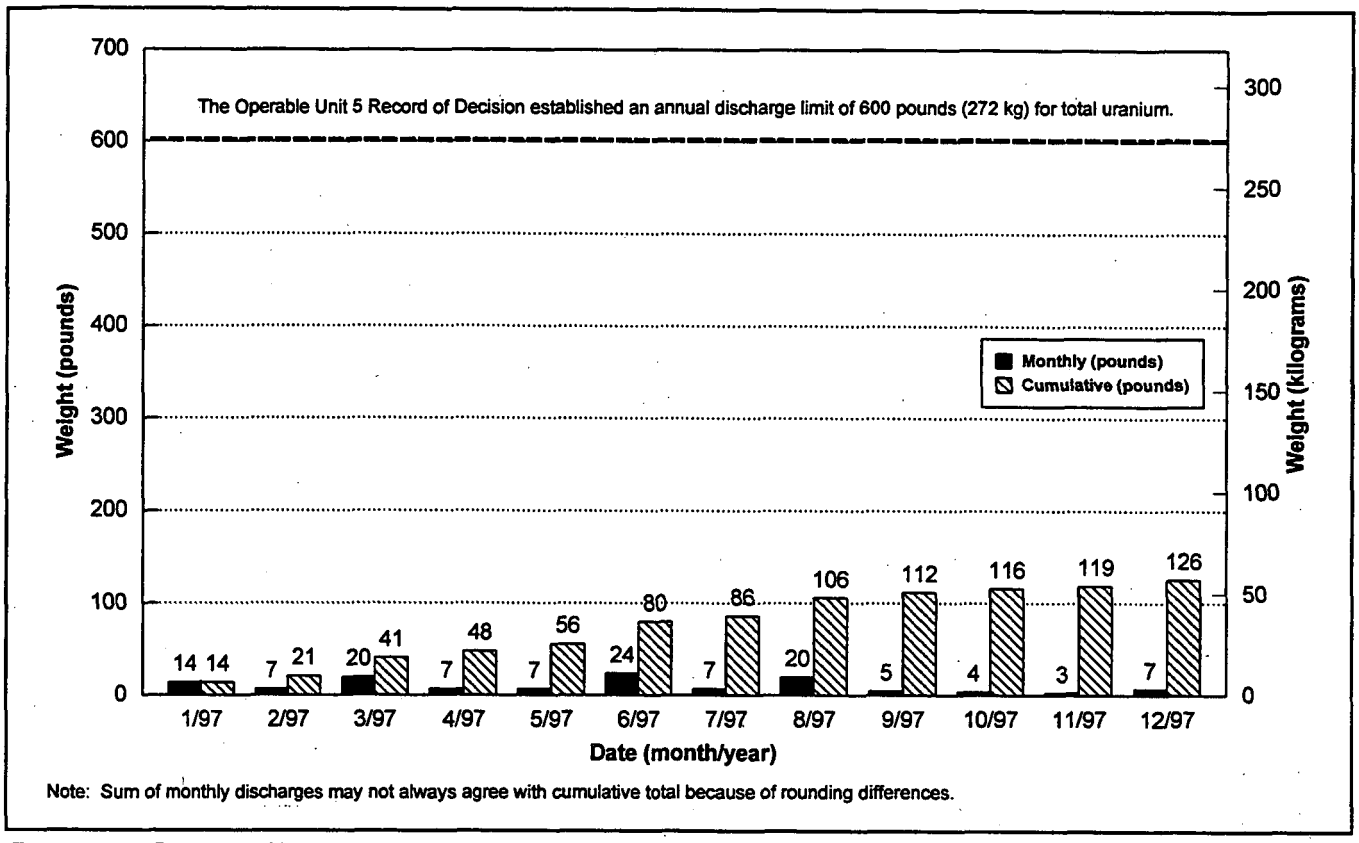

Figure 4-6. Pounds of Uranium Discharged to the Great Miami River from the Parshall Flume (PF 4001) in 1997

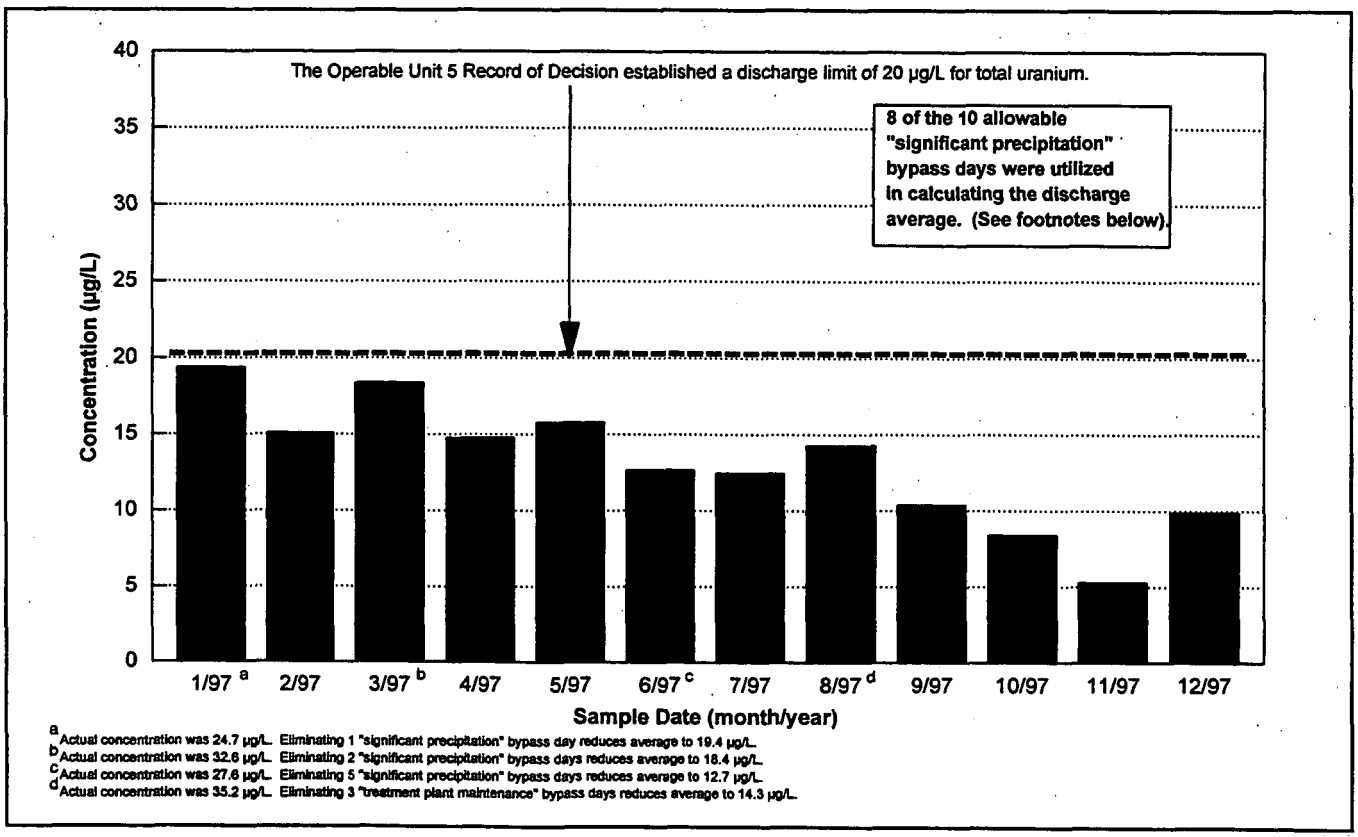

Figure 4-7. 1997 Monthly Average Total Uranium Concentration in Water Discharged from the Parshall Flume (PF 4001) to the Great Miami River

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NPDES Permit Compliance

Compliance sampling, consisting of sampling uncontrolled runoff and treated effluent discharges from the FEMP, is regulated under the state-administrated NPDES program and remains unchanged with implementation of the IEMP. The current permit became effective November 1, 1995, and expires on March 31, 1998. The permit specifies discharge and sample requirements, as well as discharge limits for several chemical constituents. NPDES sample locations are shown on Figures 4-2 and 4-3.

Sampling to support the renewal of the NPDES permit was accomplished in 1997. The data collected during this sampling effort were submitted with the NPDES permit renewal application on September 22, 1997. The submittal of the application allows the FEMP to continue to abide by the terms of the expired permit until approval of the permit application by the OEPA.

Wastewater and uncontrolled runoff discharges from the FEMP were in compliance with the current permit requirements 99.8 percent of the time during 1997. Of the 2,274 monitoring results reported to OEPA during the year, only five were not within the discharge limits specified by the permit. Three violations occurred at the Parshall Plume (PF 4001) which discharges to the Great Miami River. The remaining violations occurred at an internal location monitoring treated effluent from the Sewage Treatment Plant (STP 4601). All of the violations resulted from exceedances of the total suspended solid limits. All non-compliant conditions were reported to OEPA, as required by the NPDES permit. All required data were successfully obtained. The only effluent limitation stipulated at the four uncontrolled storm water runoff monitoring locations is for pH, for which the FEMP demonstrated compliance 100 percent of the time.

Uranium Discharges in Surface Water and Treated Effluent

As identified in Figure 4-6, 126 pounds (57.2 kg) of total uranium in treated effluent were discharged to the Great Miami River through the Parshall Flume (PF 4001) in 1997. In addition to the treated effluent, uncontrolled runoff is also contributing to the amount of total uranium entering the environment. It is estimated that 6.3 pounds (2.9 kg) of total uranium is discharged to the environment through uncontrolled runoff with every inch (2.54 cm) of rain. During 1997, 40.11 inches (101.9 cm) of precipitation fell at the FEMP; therefore, it is estimated that approximately 252 pounds (114 kg) of total uranium entered the environment through uncontrolled runoff. In addition to this calculated total uranium discharge to the environment, 3.46 pounds (1.57 kg) of total uranium were discharged to Paddys Run during an overflow of the Storm Water Retention Basin due to excessive amounts of precipitation on June 1, 1997. The total for the year for both controlled treated effluent discharges and uncontrolled runoff is 378 pounds (172 kg). This total represents a continued reduction in the pounds of total uranium being discharged to the environment, as presented graphically in Figure 4-8.

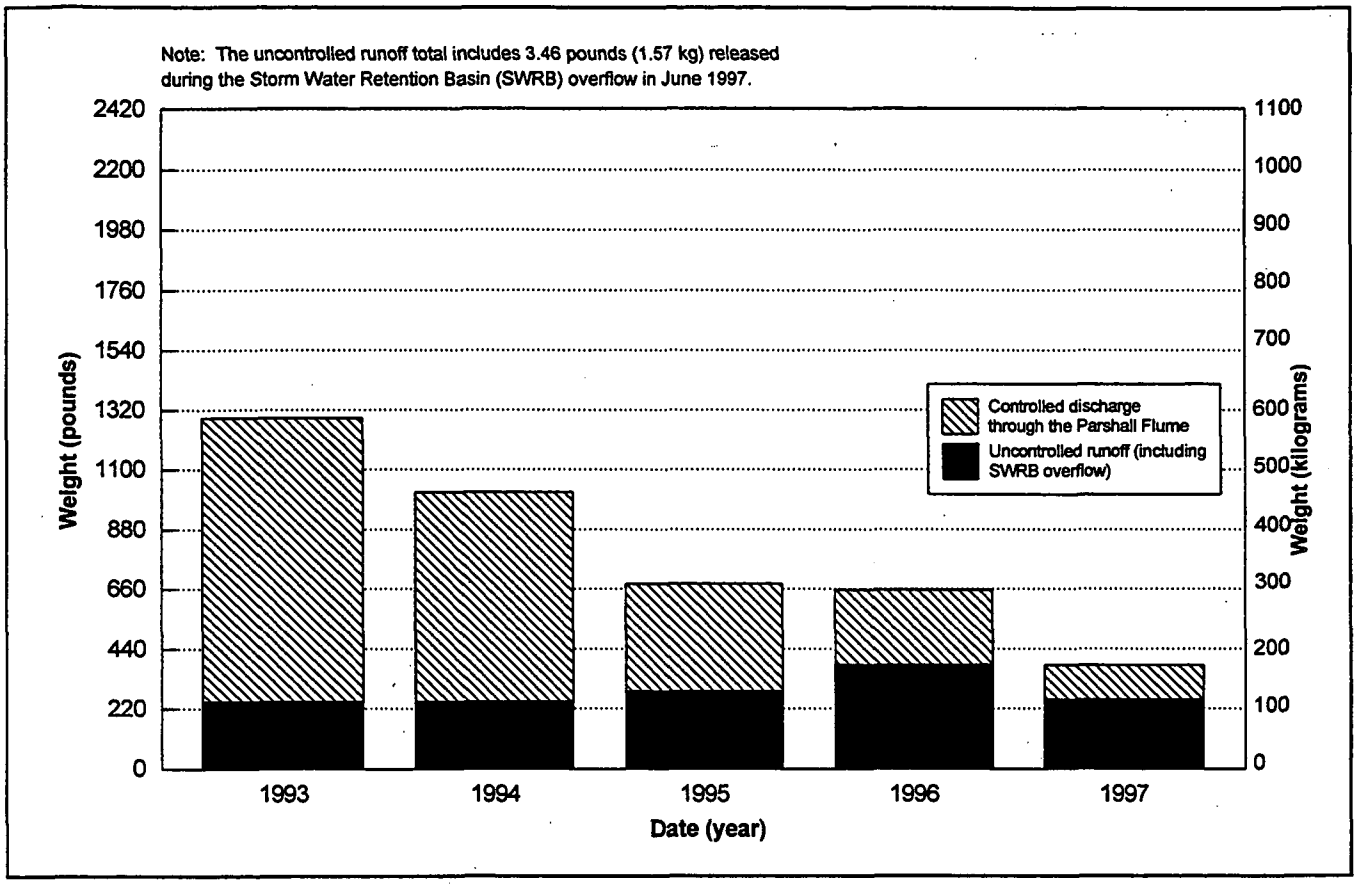

Figure 4-8. Total Uranium Discharged from the FEMP, 1993-1997

Sediment Monitoring

Sediment is a secondary exposure pathway and is monitored annually to assess the impact of remediation activities on sediments deposited along surface water drainages. Sediment is collected at strategic locations to ensure that the most recently deposited sediment is collected.

Sediment samples were collected in late June and early July at 20 locations along Paddys Run, the Storm Sewer Outfall Ditch, and the Great Miami River (Figure 4-9). Samples collected at each location were analyzed for total uranium. All samples collected from the Storm Sewer Outfall Ditch, Paddys Run north of the outfall ditch, and from the Paddys Run background location were also analyzed for radium-226 and isotopic thorium. Also, one location south of the Great Miami River effluent line and one location on Paddys Run south of the Storm Sewer Outfall Ditch were sampled and analyzed for radium-226 and isotopic thorium. Figure 4-9 illustrates specific sample locations that are summarized below:

- **Storm Sewer Outfall Ditch**: five samples collected along the Storm Sewer Outfall Ditch from Paddys Run to immediately south of the Storm Water Retention Basin (D1 through D5)

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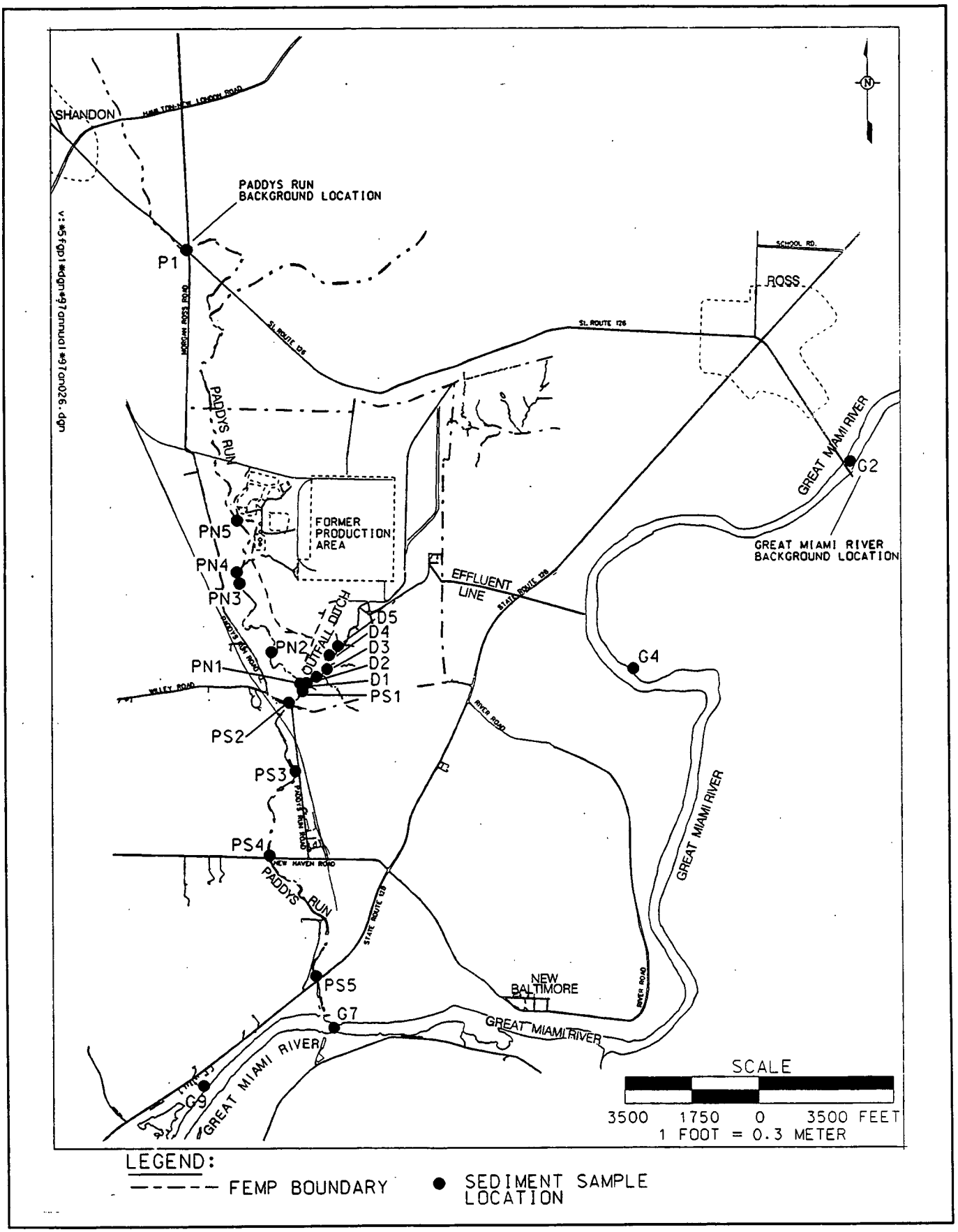

Figure 4-9. 1997 Sediment Monitoring Locations

- **Paddys Run**: five samples collected north of the confluence with the Storm Sewer Outfall Ditch (PN1 through PN5), five samples collected south of the confluence (PS1 through PS5), and one background sample collected north of the site (P1)

- **Great Miami River**: one sample collected north of the effluent line (background location, G2) and three locations south of the effluent line (G4, G7, and G9).

Analytical results of samples collected from Paddys Run and Great Miami River were below the FRL for total uranium, isotopic thorium, and radium-226. In general, the 1997 sample results indicate a decrease in concentrations from the 1996 samples. Total uranium results for 1997 from Paddys Run were within the range of background levels. The average total uranium concentration in the Storm Sewer Outfall Ditch is above background levels but well below the sediment FRL.

One sample collected in the Storm Sewer Outfall Ditch at location D5 near the Storm Water Retention Basin had a thorium-232 concentration of 1.63 picoCuries per gram (pCi/g) which slightly exceeds the FRL of 1.60 pCi/g. In 1996, a sediment sample was collected in the same vicinity with a thorium-232 concentration of 1.8 pCi/g, also slightly above the FRL. Sediment samples collected immediately downstream of these locations did not exceed the thorium-232 FRL in 1996 or 1997. The sources of this contamination are either Storm Water Retention Basin overflows or controlled runoff from the former production area prior to the installation of the storm water controls currently in place. Sporadic exceedances of the FRLs are expected until final remediation of the site occurs. Monitoring of the sediment will continue with the IEMP to determine the effectiveness of the engineered controls designed to reduce erosion and sedimentation of Paddys Run and its tributaries. Additional details of the sediment monitoring results are presented in Appendix B, Attachment 2, of this report.

Air Pathway

This chapter describes the air pathway components used to track and trend airborne emissions from the FEMP. It includes a discussion of radiological air particulates, radon, and direct radiation. In addition, the results from biota (produce) sampling are discussed under the air pathway because produce (a secondary exposure pathway) is most affected by air deposition of contaminants on the produce itself or on the soil with subsequent uptake of contaminants through plants roots.

Results in Brief: 1997 Air Pathway

Radiological Air Particulates and Uranium Emissions - Data collected from fenceline air monitoring stations show that average concentrations for each radionuclide monitored were less than one percent of the corresponding DOE derived concentration guide. Airborne uranium emissions for 1997 were estimated to be 19.5 pounds (8.84 kg).

Radon - There were no exceedances of the DOE standard (3.0 pCi/L annual average above background) at the FEMP fenceline and off-property locations. The maximum annual average concentration at the FEMP fenceline measured by alpha track-etch cups was 1.0 ± 0.2 pCi/L.

Direct Radiation - Measurements of direct radiation indicate levels increasing with proximity to the K-65 Silos. However, these levels are still approximately 67 percent lower than the radiation levels measured in 1991 prior to the addition of the bentonite layer within the K-65 Silos. These measurements are consistent with the fact that the K-65 Silos contain radium and its decay products, which contribute to direct radiation in the vicinity.

Produce - Total uranium concentrations in produce were consistent with previous years' data. Laboratory analyses did not detect significant differences in total uranium concentrations between produce grown near the FEMP and produce grown in outlying areas.

Boiler Plant - The FEMP converted from coal-fired to natural gas/diesel-fired boilers in 1997, which dramatically reduced boiler emissions. Additionally, there were no opacity excursions reported during 1997.

As discussed in Chapter One, the public may be exposed to radiation from the FEMP through the air pathway. This pathway includes emissions from specific point sources, such as plant stacks, as well as fugitive dust from large, active excavations. When production operations were suspended in July 1989, the major point source emissions from the FEMP were eliminated. Since then, the principal sources of airborne uranium emissions have been the cooling tower mists and laboratory fume hoods, which contain low levels of uranium, and fugitive dust from locations where environmental remediation activities are underway.

Air pathway monitoring focuses on airborne pollutants that may be carried from the FEMP as a particulate or gas and how these pollutants are distributed in the environment. The physical form and chemical makeup of pollutants influence how they are dispersed in the environment and how they may deliver radiation doses. For example, fine particles and gases remain suspended, while larger, heavier particles tend to settle and deposit on the surface. Chemical properties determine whether the pollutant will dissolve in water, be absorbed by plants and animals, or settle in sediment and soil.

Fugitive Dust - The term fugitive dust is used to describe the small amounts of airborne soil, waste materials, and construction dusts released from the FEMP as a result of ongoing remediation activities. Sources of fugitive dust at the FEMP as a result of ongoing remediation activities include active soil excavation, waste handling, and construction activities ongoing at the FEMP. To a lesser degree, fugitive dust is generated as a result of wind erosion of stock-piled materials and exposed excavations.

Diffuse Source - In contrast to a point source such as a stack or vent, diffuse sources of airborne emissions represent aerial sources with no concentrated or directed point of emission release. Examples include: soil stock-piles, open excavations, construction activities, and roadways.

Summary of Air Pathway

During 1997, radioactive materials in the air pathway continued to be monitored by sampling air particulates, radon, direct radiation, and as a secondary exposure pathway, biota (produce). Air pathway monitoring is conducted to evaluate the effects of remediation activities at the FEMP and fulfill the FEMP's obligations toward ongoing environmental surveillance and dose estimating.

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Remediation Activities Affecting the Air Pathway

When the mission of the FEMP changed from production to remediation, the scope of work activities also changed. This major change in work scope altered the mechanics of how airborne pollutants are distributed in the environment via the air pathway.

During the production years, the primary emission sources were point sources (i.e., stack and vents) from process facilities (see the Stack Monitoring section in this Chapter). Today primary emission sources include diffuse sources with fugitive emissions from current remediation activities (i.e., large scale excavations, demolition activities, wind erosion, and construction activities).

The following are 1997 remediation activities that generated emissions which may affect the air pathway:

- Construction activities associated with the on-site disposal facility, new north access road, railroad tracks, railroad spurs, and locomotive repair facility
- Large scale excavations associated with the waste haul road, on-site disposal facility, leachate collection system for the on-site disposal facility, waste pit site improvement activities, and excavation of contaminated soil in the northeast quadrant of the site
- Demolition activities associated with the completion of decontamination and dismantlement of Plant 1 and the ongoing decontamination and dismantlement of the Thorium/Plant 9 Complex.

Each project is responsible for designing and implementing administrative and engineered controls for each remediation activity. Implementation of the site fugitive emissions control policy ensures that fugitive emissions are visually monitored and that controls are implemented as necessary. The following two types of controls are used at the FEMP to keep point source and fugitive emissions to a minimum.

- Administrative Controls - typical administrative controls that are implemented include: management and control procedures, record keeping and periodic assessments; establishing speed limits, control zones, and construction zones.
- Engineered Controls - typical engineered controls that are applied include: physical barriers; wetting agents; control, collection, and treatment systems; filtration; fixatives; sealants; and dust suppressants. Engineered designs help reduce point source and fugitive emissions by using the best available technology. The selection of the best available technology for controlling project emissions is conducted during the design process and frequently includes the evaluation of several treatment alternatives.

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Air and Biota (Produce) Highlights for 1997

Transition to IEMP

The air pathway represents a critical exposure pathway because the potential exists for contaminants to migrate off property quickly and travel long distances. Recognizing the importance of this pathway, a significant level of consideration was given to the design of the air monitoring program presented in the IEMP. The IEMP air monitoring approach provides an ongoing assessment of the collective emissions originating from multiple concurrent remediation activities at the FEMP. Additionally, the results from this monitoring effort are intended to provide "early warning" feedback to remediation project organizations regarding the cumulative sitewide effectiveness of project-specific emission controls relative to health-protective standards. The key elements of the IEMP program design for air monitoring are:

- **Sampling** - Sample locations, frequency, and the constituents were selected to evaluate the air pathway, as well as for providing feedback to the remediation projects to assist in evaluating the effectiveness of administrative and engineered controls. Existing pre-IEMP radon, direct radiation, and biota (produce) monitoring locations were incorporated into the IEMP with little change. The Radiological Air Particulate Monitoring Program, however, underwent significant change through implementation of the IEMP. These changes are described in detail later in this section. In 1997, produce was sampled for the last time on an annual basis. In the future, produce will be sampled every third year from local farms and gardens.

- **Data Evaluation** - The data evaluation process focuses on the tracking and trending of data compared with historical data. In addition, comparisons to regulatory requirements and standards are conducted, when applicable. Each section contained within this chapter provides information pertaining to data evaluation and a comparison to applicable DOE, EPA, and OEPA regulatory standards and guidelines.

- **Reporting** - Prior to implementation of the IEMP, all data associated with the air monitoring program (air particulate, radon, direct radiation, and produce) were reported through the FEMP's annual site environmental reports. In addition, continuous radon monitoring data were submitted to EPA through Enclosure C of the FFCA/FFA quarterly reports. All data are now reported through IEMP quarterly status reports, in addition to annual site integrated environmental reports. The addition of quarterly reporting provides more timely information to the remediation projects, regulatory agencies, and FEMP stakeholders.

IEMP Radiological Air Particulate Monitoring Program Design

During the production years at the FEMP, emissions were primarily from point sources where direct, continuous measurements of point source emission rates and contaminant concentrations served as direct inputs to the Clean Air Act Assessment Package 1988 (CAP88-PC) dispersion model. This model is used to simulate the transport of contaminants from the source to potential receptor locations and generate an estimated dose received by potential off-property receptors via the air pathway. This process has been

used at the FEMP since the late 1980s to estimate the FEMP's radiological impacts beyond the site fenceline and for demonstrating compliance with the radiological dose limits established under NESHAP Subpart H. The NESHAP dose limit is 10 mrem per year to any member of the public. Modeling estimates have again been used for the dose assessment from airborne particulates for 1997. This will be the last year modeling will be utilized for demonstrating compliance with the NESHAP Subpart H limit. The NESHAP Subpart H Compliance Report for 1997 is included as Appendix E of this report.

Recognizing that the primary source of air emissions at the FEMP has changed under full scale remediation from point sources to fugitive emissions from diffuse sources, the IEMP Radiological Air Particulate Monitoring Program defines a new approach for demonstrating NESHAP Subpart H compliance. The new approach, which will begin on January 1, 1998, utilizes radiological air particulate monitoring results rather than computer modeling to estimate the dose from airborne particulates to off-site receptors. This change to a monitoring-based approach for demonstrating NESHAP compliance was necessary to eliminate the high degree of uncertainty that is associated with modeling fugitive emissions from diffuse sources.

With approval of the IEMP in July 1997, work began on the installation of the infrastructure (i.e., new electrical services, access roads, and security fencing) that was necessary to support the new air monitoring stations required under the IEMP. These activities continued through the fourth quarter of 1997. On January 1, 1998, the FEMP will begin utilizing a network of 18 high volume air particulate monitoring stations to measure the collective contributions from all fugitive and point source emissions from the site relative to the NESHAP dose limit. This monitoring network will include 16 monitoring locations (including eight new locations) on the FEMP fenceline and two background locations. Monitoring data will include routine bi-weekly total uranium and particulate analyses and a quarterly composite sample targeted at the expected major contributors to dose from the site (i.e., uranium, thorium, and radium). These data will be tracked and reported through the IEMP quarterly status reports throughout the year and provided in annual integrated site environmental reports.

Air Particulate Monitoring Research Project

The DOE Environmental Measurements Laboratory initiated a research project in 1997 to measure the particle size distribution of FEMP particulate emissions. The objective of the study was to evaluate the dose associated with various particle sizes and calculate the dose contributions from the respirable fraction of the total emissions. High volume samplers are the traditional method of air sampling for radionuclide analyses. These samplers not only collect particles in the respirable range, but they also collect particles greater than 15 microns (μm), which are not transported to the lungs.

To assess the uranium contribution of the various sizes of particles to the dose calculations, the Environmental Measurements Laboratory set up downwind (co-located with AMS-3), and upwind (co-located with AMS-10) sampling stations that seperate the spectrum of airborne particles into distinct size fractions. The samples were analyzed for isotopic uranium at the Environmental Measurements Laboratory. The results are comparable to the average uranium concentration measured at the same location by the DOE-FEMP high volume air samplers. After subtracting background concentrations, it was found that a significant fraction (30 to 50 percent) of the uranium is attributable to the nonrespirable size fraction (greater than 15 μm). A second data set was collected on October 31, 1997, and showed similar results.

The evaluated data represented single day samples, however, in November 1997, Environmental Measurements Laboratory set up an instrument that would continuously sample particle size distribution at a flow rate of one liter per minute for a four week period. These samples are analyzed according to a schedule that matches the DOE-FEMP high volume sample analysis. This instrument, co-located with AMS-9, also separates the spectrum of airborne particles into distinct size fractions. The instrument has been continuously operating during the winter and spring months. Analyses of December 1997 and January 1998 samples showed all size fractions below the detection limit. This is not unusual for this period of low activity in the eastern portion of the FEMP and the comparatively low sample flow rate of one liter per minute.

Improvements to the analytical procedures are planned that should significantly lower the detection limit. In addition, a new sampler with a flow rate of 10 liters per minute has been developed by the Environmental Measurements Laboratory. With the improved analytical procedures and new sampler, DOE should be able to determine uranium particle size distributions and associated doses for most samples collected at the FEMP during any part of the year. Additional progress on this research project will be reported in future quarterly status reports and annual integrated site environmental reports.

Radiological Air Particulate Sampling Results

In 1997, the FEMP operated 20 air monitoring stations 24 hours per day, seven days per week, as part of the Radiological Air Particulate Monitoring Program. During 1997, several changes were made to the program. These changes, summarized below, resulted from the implementation of the IEMP. Several off-property air monitoring stations were removed from service between October and December 1997. Eight new monitoring locations were installed along the site fenceline, and one monitor was relocated along the fenceline during this same time period. Figure 5-1 identifies all air particulate monitoring locations monitored during 1997.

The following summarizes the major changes in air monitoring locations which occurred throughout the year:

- AMS-1B was removed from service in late June due to power interruption from remediation activities in the area north of the former production area. This monitoring location was not necessary because three new locations to the north were installed to support the IEMP.
- AMS-9B was relocated south of the original location in order to better monitor remediation and construction activities along the eastern edge of the site. These activities include the construction of the on-site disposal facility and the new north access road. This location was renumbered AMS-9C.
- AMS-22 through AMS-29 were installed along the site fenceline in October 1997 to complete the NESHAP compliance monitoring network specified in the IEMP.
- AMS-10, AMS-11, AMS-13, AMS-14, and AMS-21 were located at off-site locations near the FEMP through the first three quarters of 1997. These monitors were removed from service during fourth quarter 1997 because they were not necessary to support a comprehensive assessment of radiological air particulate concentrations at the FEMP fenceline as identified in the IEMP. It should be noted that two of these locations (AMS-11 and AMS-13) will be operated by the OEPA in 1998 to support its oversight role at the FEMP.

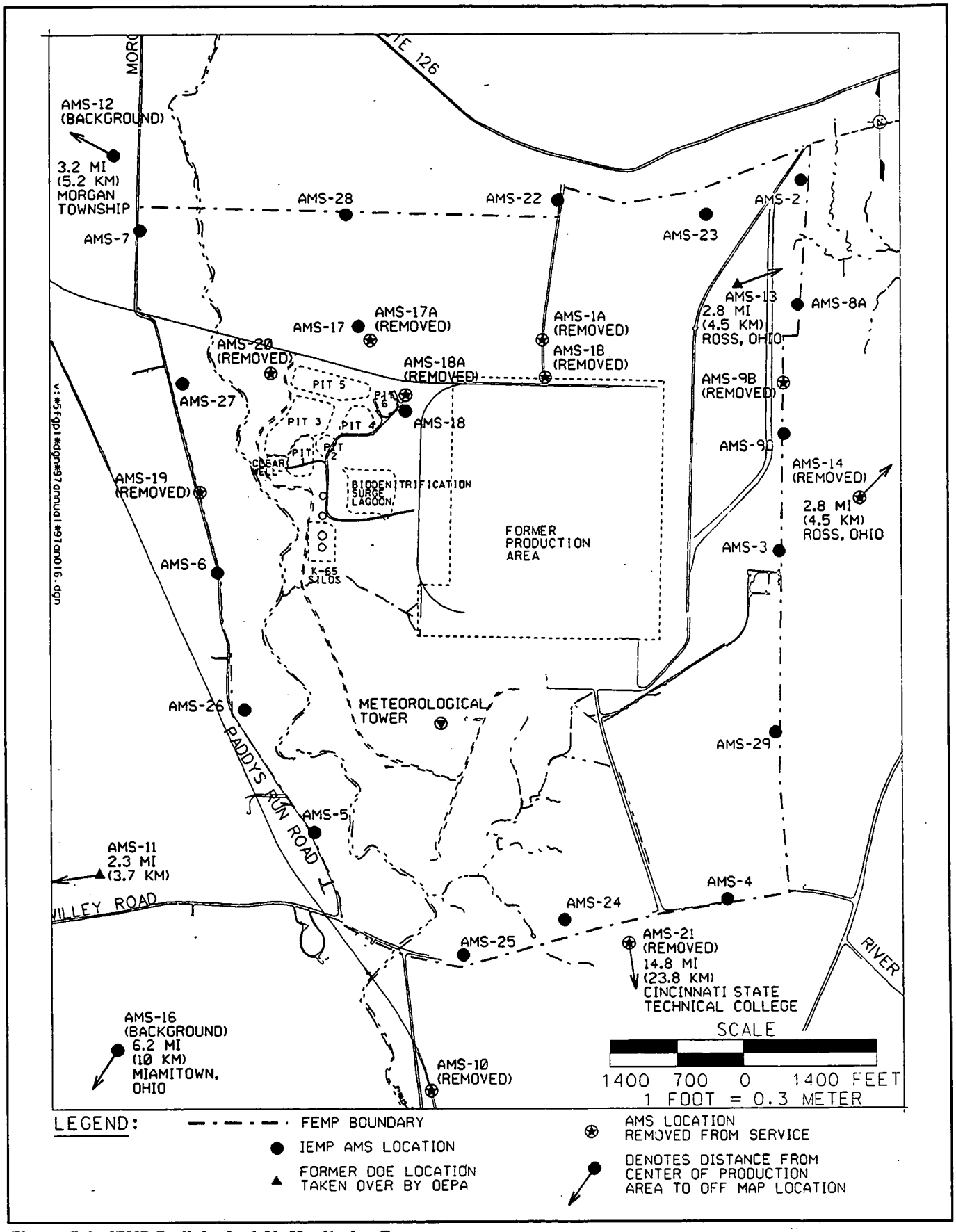

Figure 5-1. IEMP Radiological Air Monitoring Program

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- Onsite monitors AMS-17A, AMS-18A, AMS-19, and AMS-20, which provided monitoring of the waste pit emissions during the remedial investigation and characterization of the pit contents, are expected to be removed from service during the first two weeks of 1998. With implementation of the IEMP Radiological Air Particulate Monitoring Program in January 1998, fugitive emissions associated with the waste pit area will be monitored collectively with other project emissions to evaluate compliance with NESHAP Subpart H requirements. As implementation of the remedy for Operable Unit 1 proceeds, future needs for project-specific air monitoring will be evaluated based on the pertinent regulatory drivers and process control needs of the project.

During 1997, air monitoring station filters were collected on a two-week interval for total uranium analysis. A portion of each two-week sample was also retained for an annual composite analysis for an expanded suite of radionuclides. The results of these analyses are compared to the following DOE guidelines and regulatory limits to assist in interpreting the data:

- DOE Order 5400.5, Radiation Protection of the Public and Environment, establishes guidelines for concentrations of radionuclides in air emissions. These guidelines, referred to as derived concentration guide values, are concentrations of radionuclides that, under conditions of continuous exposure for one year by one exposure mode, would result in a dose of 100 mrem to the public. These derived concentration guide values are not limits, but serve as reference values to assist in evaluating the radiological air particulate data.

- The NESHAP Subpart H annual dose limit of 10 mrem is used as a benchmark for assessing the annual composite data.

Table 5-1 presents the total uranium concentrations for 1997 and 1996. Total uranium concentrations for 1997 were within historical ranges for all air monitoring stations. The average concentrations of total uranium at all fenceline air monitoring stations were less than one percent of the DOE derived concentration guide value for total uranium (0.1 picoCuries per cubic meter [pCi/m^3]). In 1997, ranges for total uranium at all air monitoring locations were from less than detectable concentrations to a maximum concentration of 1.2E-03 pCi/m^3 at AMS-3. For comparison, background locations ranged from less than detectable to 1.1E-04 pCi/m^3 at AMS-16.

In addition to the total uranium analyses, total particulate measurements are made from each filter every two weeks. Table 5-1 presents the toal particulate results for 1997 and 1996. Total particulate concentrations ranged from 7.1 micrograms per cubic meter (μg/m^3) to a maximum of 159 μg/m^3 at AMS-3. Historical data have been included for comparison. There are no general or site-specific regulatory limits associated with total particulate measurements used in the data evaluation process.

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However, total particulate data were evaluated with the total uranium results to identify any significant trends that may be related to remediation activities. During 1997, no significant trends were identified in the data which would indicate the potential for a significant impact to the environment. However, short-term increases in particulate and total uranium concentrations were detected at some air monitoring stations on the east fenceline during late September and early October. These temporary increases were due to the high level of construction activity associated with the on-site disposal facility and new north access road and the extremely dry, warm weather during this period. While these types of temporary increases present no significant impact to the environment, they will continue to be monitored and the data will be provided to the remediation projects to ensure that emission controls are operating as expected.

TABLE 5-1
TOTAL URANIUM AND TOTAL PARTICULATE CONCENTRATIONS IN AIR

Location	1997 Total Uranium (pCi/m^3)	1996 Total Uranium (pCi/m^3)	1997 Total Particulate[a] ($\mu g/m^3$)	1996 Total Particulate[a] ($\mu g/m^3$)
Fenceline Locations				
Minimum	0.0E+00	0.0E+00	7.1	7.2
Maximum	1.2E-03	9.4E-04	159	66
Background Locations				
Minimum	0.0E+00	0.0E+00	17	NS
Maximum	1.1E-04	6.2E-05	79	NS
Onsite Locations				
Minimum	0.0E+00	0.0E+00	15	16
Maximum	8.5E-04	2.2E-03	84	102
Offsite Locations				
Minimum	0.0E+00	0.0E+00	NS	NS
Maximum	7.1E-05	2.2E-04	NS	NS

[a]NS = not sampled

As discussed earlier, an annual composite sample was collected at each air monitoring station during 1997. The samples were analyzed for a list of trace radionuclides, including isotopes of radium, thorium, and uranium, as well as cesium-137, plutonium-238, plutonium-239/240, strontium-90, and technetium-99. The results of these analyses were compared to the DOE derived concentration guide values. All results at each monitoring station were below one percent of the corresponding DOE derived concentration guide values. In addition, the results at each air monitoring station were converted to a dose value and compared to the NESHAP 10 mrem dose limit. The calculated dose at each air monitoring station was below 10 percent of the NESHAP limit. Composite results also confirm that uranium isotopes are the major contributors to the dose. On average, uranium isotopes contribute 94 percent of the dose. Isotopes of thorium and radium account for the remainder of the dose.

Results from the data collected in 1997 for total uranium, total particulate, and the annual composite sample are provided in table format in Appendix C, Attachment 1, of this report. In addition to the data tables, Appendix C, Attachment 1, of this report provides graphical display of the 1997 total uranium and total particulate data.

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Summary of Project-Specific Air Monitoring

Prior to dismantling operations at Plant 1, four air monitoring stations were placed around the project boundary. The monitoring effort was designed to verify that negligible amounts of airborne radionuclide contaminants were released to the environment while dismantling the building. The monitors also provided data for evaluating the effectiveness of contamination control techniques. Plant 1 monitors went into operation in December 1995 and were in service until May 1997 when the rubble removal phase of Plant 1 was completed. Plant 1 was imploded on February 22, 1997. Air monitoring station filters were changed weekly and analyzed for total uranium.

Throughout decontamination and dismantlement activities, Plant 1 monitoring results indicated that airborne total uranium levels were relatively constant during the removal of equipment and duct work from the plant interior. Airborne total uranium levels remained below the DOE derived concentration guide values for total uranium in the air in the vicinity of Plant 1. As previously described, the DOE derived concentration guide values are used for comparative purposes and are not strict limits on the airborne total uranium concentration.

Project-specific radiological air monitoring activities were initiated in October 1997 and remain in place in support of Operable Unit 3 decontamination and dismantlement for the Thorium/Plant 9 Complex. Five air monitors were deployed near the project boundary and filters are exchanged weekly for total uranium analyses. Total uranium was analyzed because it is identified as the primary constituent of concern based on process knowledge and engineering evaluations. As per the Operable Unit 3, Integrated Remedial Action, Thorium/Plant 9 Complex Implementation Plan for Above-Grade Decontamination and Dismantlement (DOE 1997k), data from each monitor have been and will be continually evaluated to ensure project emission controls perform as expected.

Air monitoring in the vicinity of Plant 1 and the Thorium/Plant 9 Complex have, to date, verified that negligible amounts of radionuclide contaminants were released while dismantling the buildings. Each decontamination and dismantlement project will continue to be assessed to determine if air monitoring will be required to support the evaluation of project-specific emission controls.

Radon Monitoring

The concentration of radon in the atmosphere shows daily, seasonal, and annual variability. Many factors affect environmental radon concentrations, including the distribution of uranium in the earth's crust, porosity of the soil, local weather conditions, etc. These factors are not constant; for instance, rainfall or snowcover limits radon's ability to escape from the ground. Additionally, extreme temperatures cause cracks and porosity changes in the ground, influencing the rate at which radon escapes. Summary level meteorological data from 1997 are presented in Appendix C, Attachment 5, of this report. Also refer to Figures 1-7 through 1-10.

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Radon fluctuations are also caused by atmospheric conditions. During periods of calm winds and temperature inversions, air is held near the earth's surface, minimizing the mixing of air. Consequently, when these inversions occur, radon's movement is limited vertically, and concentrations tend to increase more near the ground.

The FEMP stores residual radioactive materials that generate radon. The principal source of radon is radium-bearing waste generated during the extraction of uranium from ore. This material is stored in K-65 Silos 1 and 2 (part of the Operable Unit 4 remediation). Other relatively small radon sources are six waste pits (part of the Operable Unit 1 remediation) and Building 65 Thorium Warehouse (part of the Operable Unit 3 remediation).

The radon monitoring program has gathered data concerning concentrations at various on- and off-property locations since the early 1980s. The program assesses potential impacts on the public and the environment and operates within the requirements of DOE Order 5400.5, Radiation Protection of the Public and the Environment. This order defines radiological protection requirements, guidelines for cleanup of residual radioactive material, management of resulting wastes and residues, and the release of radiological property.

Radon limits above interim storage facilities (such as the FEMP) are defined under DOE Order 5400.5 and must not exceed:

- 100 pCi/L at any given location and any given time
- Annual average concentration of 30 pCi/L (above background) over the facility
- Annual average concentration of 3 pCi/L (above background) at and beyond the facility fenceline.

Two monitoring devices are used to determine compliance with these limits: 1) long-term, time integrating monitors; and 2) continuous monitors. Long-term monitoring produces data used for assessing compliance with the annual limits. Long-term monitoring devices (alpha track-etch cups) used at the FEMP have no electrical requirements and can be placed virtually at any location. In contrast, continuous monitoring produces data used for assessing compliance with the instantaneous ambient radon concentration limit of 100 pCi/L and to track short-term and seasonal fluctuations through the year to ensure the DOE annual average radon concentration limits are not exceeded. Continuous monitoring devices (alpha scintillation detectors) used at the FEMP require electricity and are restricted in their placement.

In general, monitoring locations were selected based on DOE guidance and are consistent with siting criteria associated with air particulate monitoring (Figures 5-2 and 5-3). Both indicator and background locations have been selected for comparison purposes. In response to public concerns, several monitors are placed at nearby residences and schools. Additional radon monitoring locations near specific sources ensure regulatory compliance or are used during site-specific project activities that could produce radon. Also, the FFA

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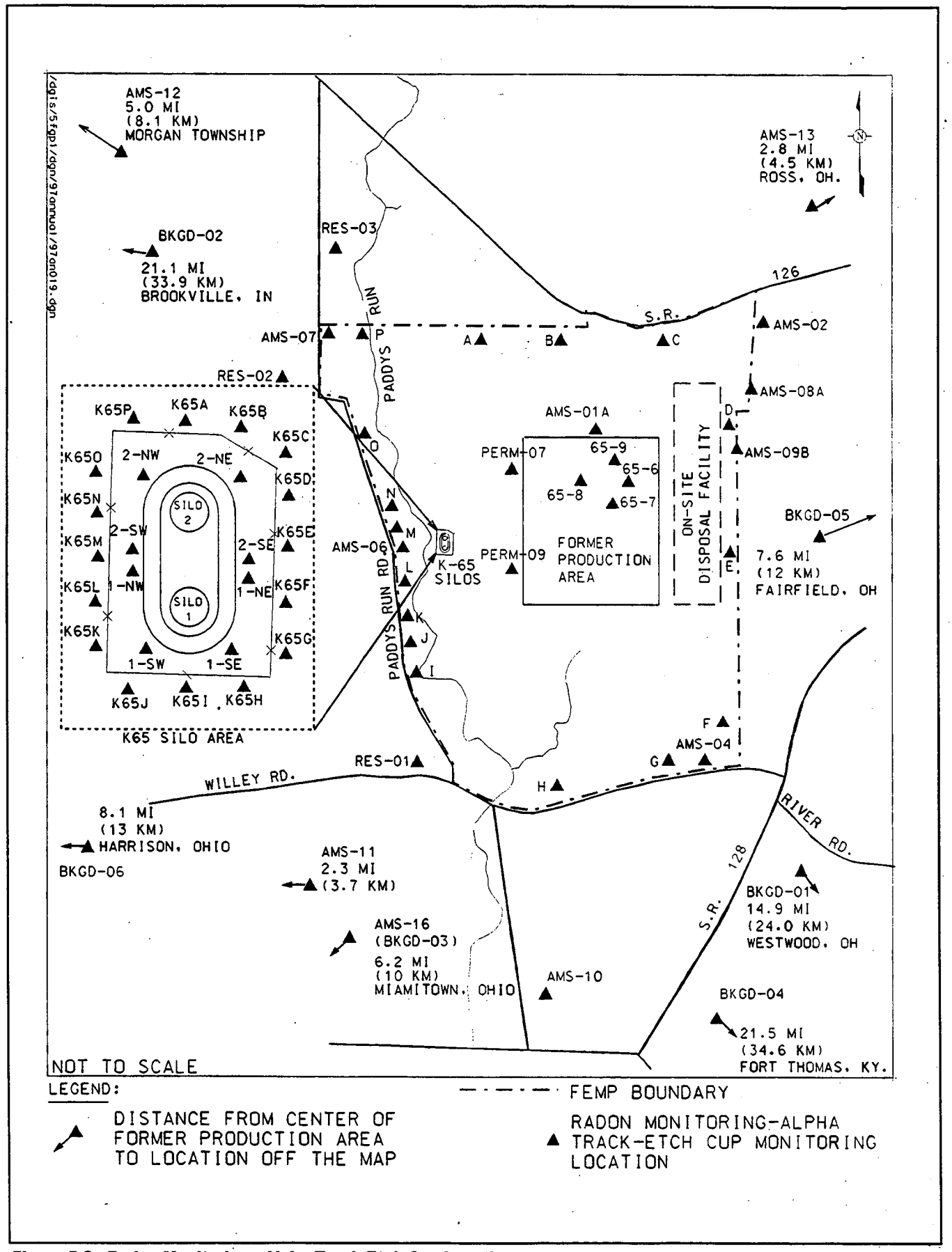

Figure 5-2. Radon Monitoring - Alpha Track-Etch Cup Locations

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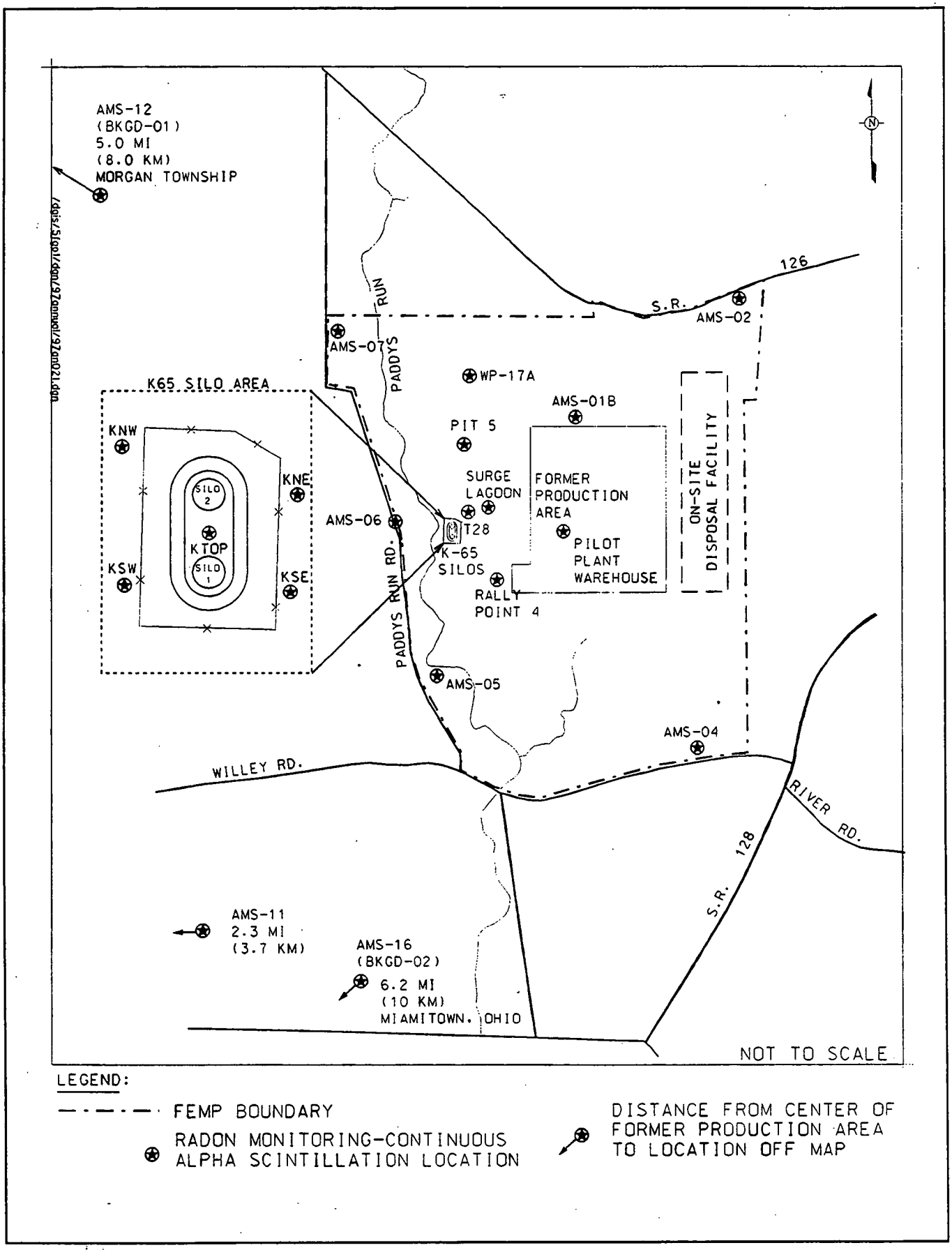

Figure 5-3. Radon Monitoring - Continuous Alpha Scintillation Locations

requires routine reporting of data from nine continuous radon monitors (collected in hourly intervals and summarized as daily averages). The FFA also requires the continuous measurement (collected in five-minute intervals) of radon concentrations in the head space of the K-65 Silos.

Alpha Track-Etch Detectors

Alpha track-etch detectors (radon cups) are used when monitoring requirements pertain to annual limits because they consider data over long periods of time and provide an overall average concentration. The detectors are placed at many locations and gather both site-specific and background information regarding the dispersion of radon. Currently, there are approximately 62 locations, with two to three detectors placed at each location. Most of the detectors are placed within the immediate vicinity of the K-65 Silos (24 locations) and at the FEMP fenceline (22 locations). Additionally, data are collected at other onsite locations, three local residences, and nine background locations.

During 1997, radon cups were analyzed over two six-month periods. Results from the fenceline and off-property locations were compared to the annual average limit of 3.0 pCi/L above background. Data from fenceline and off-property locations were within historical ranges and well below the DOE limit of 3.0 pCi/L above background. The annual range of concentrations at the fenceline was 0.2 ± 0.1 pCi/L to 1.0 ± 0.2 pCi/L. The annual range for background radon concentrations was 0.1 ± 0.1 pCi/L to 0.2 ± 0.2 pCi/L. In addition, other off-property locations had an annual range between 0.3 ± 0.2 pCi/L and 0.4 ± 0.2 pCi/L.

Concentrations at on-property locations along the K-65 exclusion fence ranged between 0.7 ± 0.2 pCi/L and 3.5 ± 0.8 pCi/L; the K-65 Silos dome locations ranged between 3.8 ± 0.7 pCi/L and 18.0 ± 1.6 pCi/L with the maximum concentration recorded at Silo 2. The maximum values recorded on property remain below the DOE limit of 30 pCi/L annual average, for any one location.

Table 5-2 presents minimum and maximum radon concentrations at alpha track-etch cup monitoring locations for 1997 and 1996. Appendix C, Attachment 2, of this report contains the environmental radon data collected during 1997 using alpha track-etch cups.

000109

TABLE 5-2
RADON MONITORING - ALPHA TRACK-ETCH CUPS, SUMMARY CONCENTRATIONS FOR 1997

Location	Radon Concentration ± Precision[a] (pCi/L)	
	1997 Location Average	1996 Location Average[b]
K-65 Silos 1 & 2 Exclusion Fence Locations		
Minimum	0.7 ± 0.2	1.2 ± 0.4
Maximum	3.5 ± 0.8	3.9 ± 1.1
K-65 Silos 1 & 2 Dome Locations		
Minimum	3.8 ± 0.7	4.1 ± 1.5
Maximum	18.0 ± 1.6	27.6 ± 14.9
Fenceline Locations		
Minimum	0.2 ± 0.1	0.6 ± 0.2
Maximum	1.0 ± 0.2	1.0 ± 0.2
Background Locations		
Minimum	0.1 ± 0.1	0.5 ± 0.1
Maximum	0.2 ± 0.2	0.9 ± 0.5
Other Onsite Locations		
Minimum	0.2 ± 0.1	0.6 ± 0.3
Maximum	0.4 ± 0.1	2.2 ± 0.3
Other Offsite Locations		
Minimum	0.3 ± 0.2	0.8 ± 0.5
Maximum	0.4 ± 0.2	1.0 ± 0.4

[a] ± 2 standard deviations
[b] Data for 1996 presented in Table 21 of the 1996 Site Environmental Report were not adjusted for the exposure period. 1996 data presented here have been adjusted and are correct.

In support of Operable Unit 4, and in accordance with the FFA, K-65 Silos 1 and 2 head space radon concentrations are monitored to supply the necessary information for evaluation of the K-65 Silos regarding remediation activities and to assess the effectiveness of the bentonite layer in reducing radon emissions. Recognizing that radon concentrations in the silo head space are trending upward, an evaluation was conducted during 1997 comparing historical annual average radon concentrations at the K-65 Silos exclusion fence to background concentrations and the annual average concentrations measured at the nearest fenceline monitoring points (alpha track-etch data were used for this comparison). The results indicate a measurable increase at the K-65 Silos exclusion fence with little or no effect observed at the site fenceline (Figure 5-4). It is important to note that the increase in average concentrations adjacent to the K-65 Silos are still well below the levels observed prior to the addition of bentonite to the K-65 Silos in 1991.

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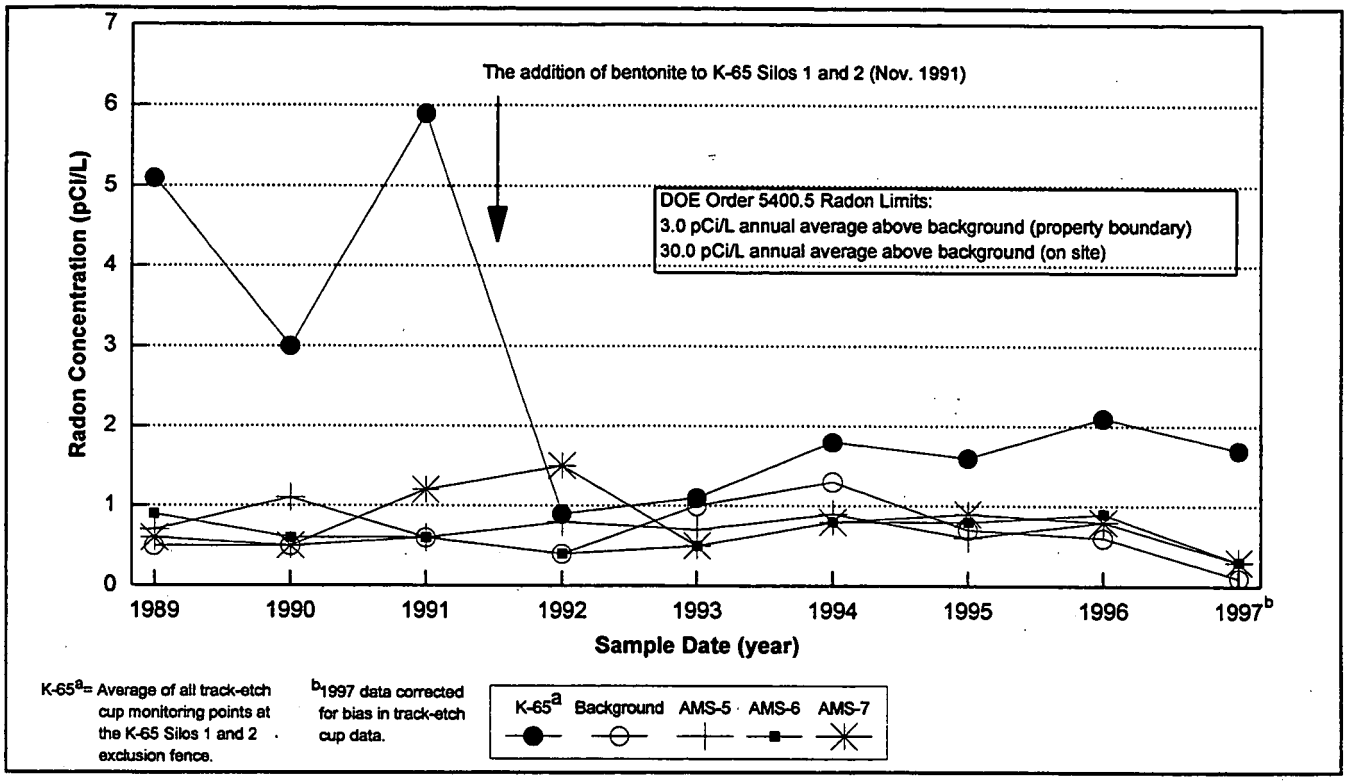

Figure 5-4. Annual Average Radon Concentrations at Selected Radon Locations, 1989-1997

Continuous Alpha Scintillation Detectors

Continuous monitors reveal important information regarding the dynamics of radon concentrations on and off property. These monitors allow for timely review of radon concentrations, which may indicate concentrations are significantly changing from day-to-day and week-to-week. However, there are certain restrictions to using these monitors. Electrical power is only available at a limited number of locations and due to the extensive remediation activities at the site, access to electric utilities is frequently changing. Additionally, extreme cold weather affects the reliability of the instruments and some of the data are rendered unusable due to instrument malfunction under these severe conditions.

During 1997, there were five exceedances of the 100 pCi/L DOE limit measured onsite. The exceedances were detected in continuous radon monitors located immediately adjacent to the K-65 Silos. The detections were of short duration and were not observed outside the immediate vicinity of the K-65 Silos exclusion fence. As in the past, these exceedances associated with radon emissions from the K-65 Silos were observed during particularly strong atmospheric inversions rather than with any operational change associated with the K-65 Silos. Based on the limited occurrence, short duration, and limited aerial extent of the exceedances, no additional actions were taken. More detail on these exceedances is provided in Appendix C, Attachment 2, of this report.

000111

Table 5-3 provides monthly average radon concentration data from the continuous radon monitors for 1997. This data is used to track radon concentrations through the year to ensure the DOE limits for annual average radon concentrations are not exceeded. In addition to the summary data presented here, Appendix C, Attachment 2, of this report provides graphical displays of monthly average radon concentrations from continuous radon monitors during 1997 and graphical displays of data from 1992 through 1997.

TABLE 5-3
1997 CONTINUOUS ENVIRONMENTAL RADON MONITORING MONTHLY AVERAGE CONCENTRATIONS[a]

	Location	Minimum (pCi/L)	Maximum (pCi/L)	Average (pCi/L)
Fenceline	AMS-02	0.7	1.2	0.9
	AMS-04	0.6	1.1	0.8
	AMS-05	0.7	1.6	1.0
	AMS-06	0.8	1.1	0.9
	AMS-07	0.7	2.3	1.3
	AMS-11	0.6	1.5	0.9
Background	AMS-12	0.4	1.0	0.7
	AMS-16	0.6	0.9	0.7
Onsite	AMS-01B	0.8	1.3	1.0
	KNE	3.5	8.3	6.1
	KNW	1.4	2.9	2.1
	KSE	3.6	12.1	6.3
	KSW	1.8	4.3	2.8
	KTOP	6.5	13.0	10.3
	Pilot Plant Warehouse	0.5	1.4	0.8
	Pit 5	0.5	1.4	0.9
	Rally Point 4	0.9	1.6	1.3
	Surge Lagoon	0.9	1.8	1.4
	T28	1.4	3.0	2.3
	WP-17A	0.7	1.6	1.0

[a]Radon data presented in this table includes a contribution from instrument background. Beginning in 1998, radon data will be reported without instrument background.

Monitoring for Direct Radiation

Direct radiation (x-rays, gamma rays, energetic beta particles, and neutrons) originates from sources such as cosmic radiation, naturally occurring radionuclides in soil, worldwide fallout from nuclear weapons testing, and radioactive materials at the FEMP. The largest source of direct radiation at the FEMP is the material stored in the K-65 Silos 1 and 2. Gamma rays and x-rays are the dominant types of radiation emitted from the silos. Energetic beta particles and neutrons are not a significant component of direct radiation at the FEMP because uranium, thorium, and their decay products do not emit this radiation at levels that create a public exposure concern.

Direct radiation levels at and around the FEMP were continuously measured at 30 locations with thermoluminescent dosimeters during the first three quarters of 1997. Eight additional locations were deployed during the fourth quarter at the new air monitoring locations. Thermoluminescent dosimeters absorb and store the energy of direct radiation within the thermoluminescent material. By heating the thermoluminescent material under controlled conditions, the stored energy is released as light, measured, and

correlated to the amount of direct radiation. Figure 5-5 identifies the thermoluminescent dosimeter monitoring locations. These monitoring locations were selected based on the need to monitor the K-65 Silos, the FEMP fenceline, and several offsite locations, including background locations.

Table 5-4 provides summary level information pertaining to direct radiation measurements for 1997 and 1996. Direct radiation levels vary from one location to another because of the differences in the terrestrial and cosmic components of natural background radiation. For example, varying concentrations of naturally occurring radium, thorium, and their decay products in soil result in different radiation levels.

TABLE 5-4
DIRECT RADIATION (THERMOLUMINESCENT DOSIMETER) MEASUREMENT SUMMARY

	Direct Radiation ± Uncertainty[a] (mrem)	
TLD Location	Summary of 1997 Results	Summary of 1996 Results
Fenceline		
Minimum	60 ± 12	64 ± 6.1
Maximum	79 ± 11	83 ± 8.0
Onsite		
Minimum	54 ± 7.5	55 ± 5.4
Maximum	778 ± 108	630 ± 61
Offsite		
Minimum	52 ± 7.3	55 ± 5.3
Maximum	65 ± 9.1	67 ± 6.5
Background		
Minimum	57 ± 8.0	59 ± 5.7
Maximum	74 ± 10	74 ± 7.2
Average	64 ± 12	66 ± 11

[a]Associated laboratory uncertainty

All monitoring results from thermoluminescent dosimeters for 1997 were within historical ranges. A slight increasing trend in the immediate area of the K-65 Silos has been identified and will continue to be monitored (Figure 5-6). This trend is attributable to a corresponding increase in radon concentrations observed in K-65 Silos head space as reported through Enclosure C of the FFCA/FFA quarterly reports. The increase in environmental direct radiation measurements adjacent to K-65 Silos are still well below the levels observed prior to the addition of bentonite to the K-65 Silos in 1991.

Detailed results of direct radiation measurements for 1997 and 1996 are provided in Appendix C, Attachment 3, of this report.

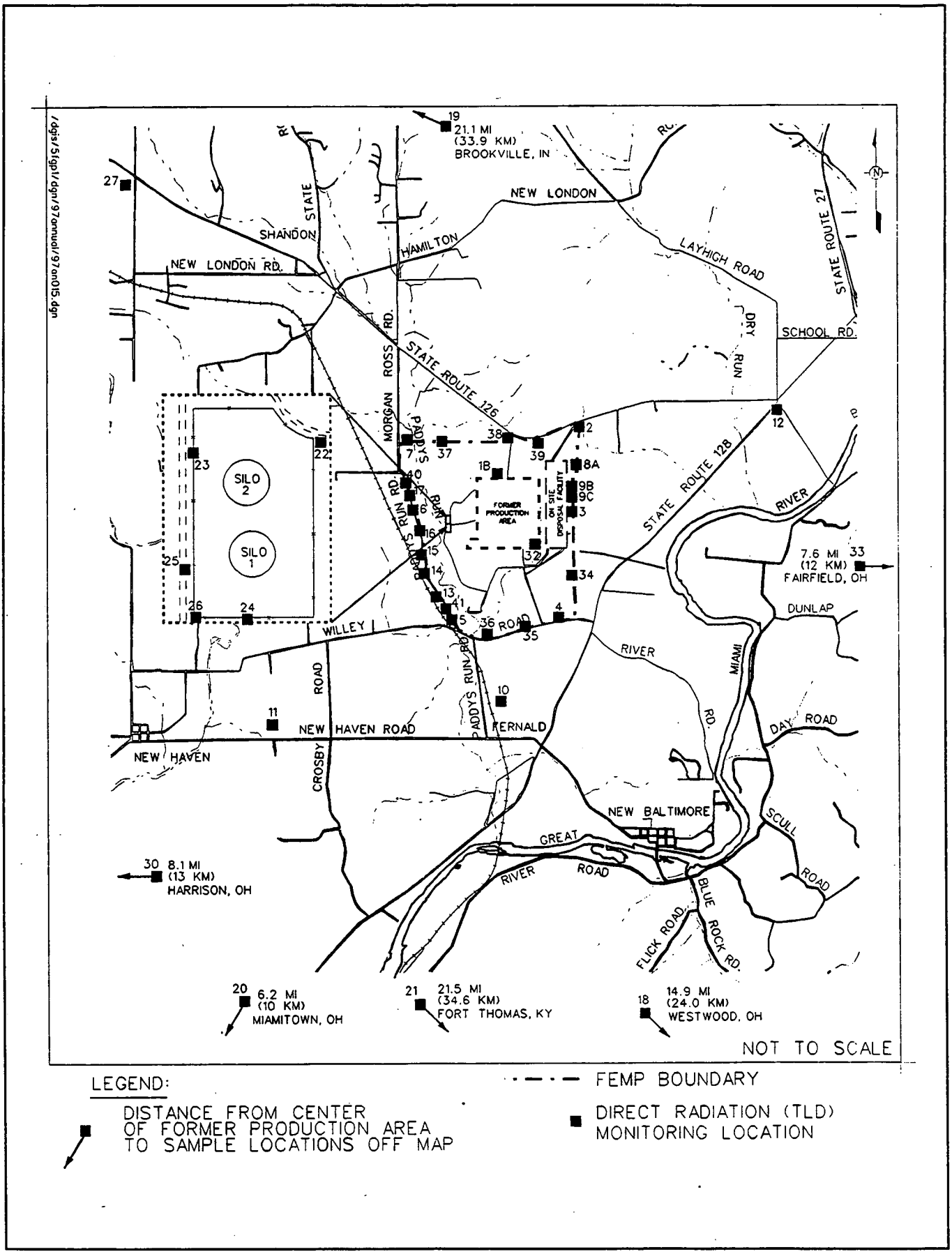

Figure 5-5. Direct Radiation (Thermoluminescent Dosimeter) Monitoring Locations

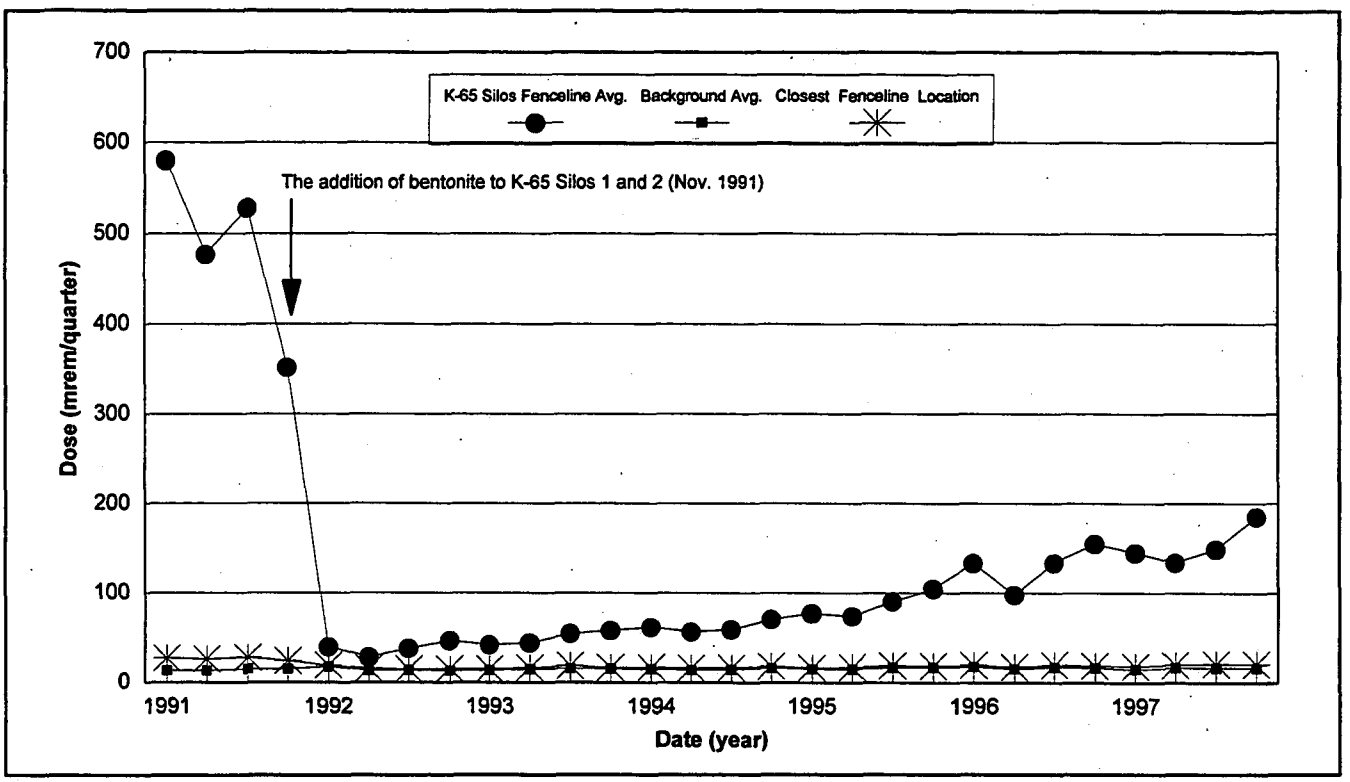

Figure 5-6. Quarterly Direct Radiation (Thermoluminescent Dosimeter) Measurements, 1991-1997

Stack Monitoring

With the transition from uranium production to full-scale remediation activities came a significant reduction in the number of stacks and vents (point sources) which require monitoring. During 1997, a total of four stack locations were continuously monitored. Figure 5-7 provides monitored stack locations.

In order to estimate the total 1997 airborne emissions from the FEMP, the results from stack monitoring were combined with estimated emissions from unmonitored stacks and vents. Emissions from unmonitored stacks and vents are estimated through modeling. This is accomplished by estimating the total amount of material handled in each facility, along with existing weather conditions (wind speed, direction, rainfall, temperature, etc.). Finally, fugitive emissions are estimated based on air monitoring data, meteorological data, and modeling. Table 5-5 summarizes FEMP estimated total uranium airborne emissions for 1997. Summary level meteorological data from 1997 are presented in Appendix C, Attachment 5, of this report.

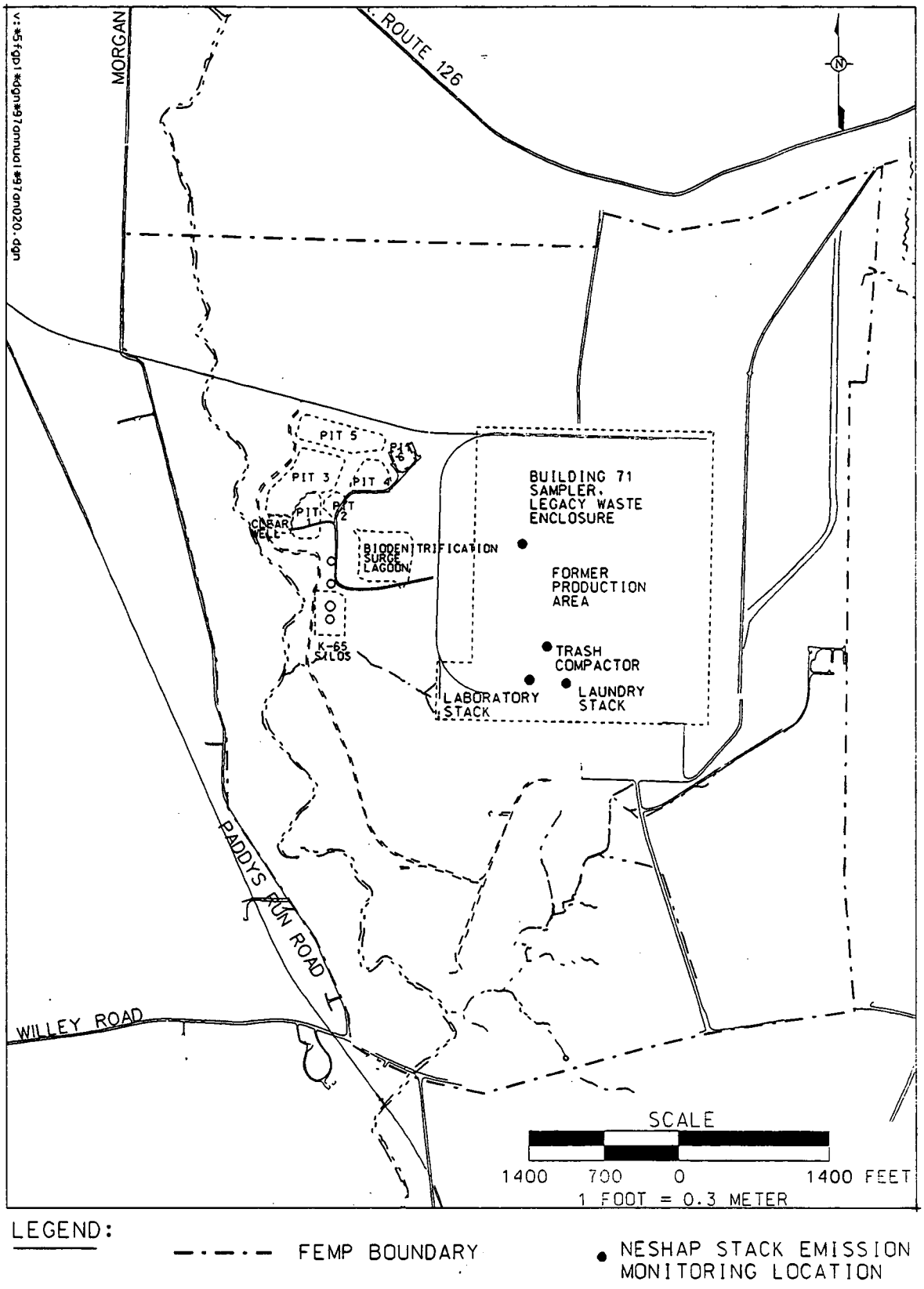

Figure 5-7. NESHAP Stack Emission Monitoring Locations

Method Used to Determine Airborne Emissions

Total uranium airborne emissions are determined by summing the estimated and measured emissions from a number of stacks, vents, and processes on site. Measured and estimated total uranium emissions for 1997 totaled 19.5 pounds (8.84 kg). This compares to 11.1 pounds (5.0 kg) estimated in 1996. Total uranium discharges from monitored stacks were the only measured emissions. Emissions from all other sources listed below were estimated.

TABLE 5-5
TOTAL URANIUM AIRBORNE EMISSIONS

Emission Category	Amount of Total Uranium Emission	Sources	Comments
Monitored Stacks	0.018 kg	3 stacks: Buildings 11-Laundry; 15-Laboratory; 71-Process Vent	High efficiency filters used to control emissions
Unmonitored Stacks, and Vents	0.331 kg	Plants 6 and 8; Buildings 11, 15, 20, 53, and 78	Estimated based on processes and amount of material handled in each facility
Fugitive Emissions	8.49 kg	Plant 1; Buildings 20, 51, 65; Waste Pit 5; WPRAP and miscellaneous soil stockpiles	Estimate based on ambient air monitoring data, meteorological conditions, and modeling

Monitoring for Nonradiological Pollutants

The OEPA requires an estimate of emissions from the Boiler Plant as part of the FEMP's effort to demonstrate compliance with the Clean Air Act. The FEMP estimated the amount of nonradiological pollutants including particulate matter, sulfur dioxide, nitrogen oxides, and carbon monoxide and measured the shade, or density, of particulate emissions from the boilers. Shade, or density, also called opacity, is a measure of how much light is blocked by particulate matter present in stack emissions. There were no excursions in opacity at the boilers for 1997. For comparison, there were a total of 14 excursions of the opacity standard in 1996. This reduction in opacity excursions is due to the FEMP's conversion from coal-fired boilers to natural gas/diesel-fired boilers which dramatically reduced boiler emissions.

In order to estimate sulfur dioxide emissions, scientists regularly determine the sulfur and heat content of the fuel. Using this information and the total amount of fuel burned, the amount of sulfur dioxide emissions can be calculated. For 1997, sulfur dioxide emissions from all boilers were calculated to be 180 pounds (82 kg). This was well below the allowable limit calculated from information in the permit issued by the OEPA.

The nitrogen oxide and carbon monoxide emissions are estimated using EPA-developed emission factors. Nitrogen oxide emissions for all boilers for 1997 were estimated to be 27,300 pounds (12,400 kg). Carbon monoxide emissions for all boilers in 1997 were estimated to be 13,500 pounds (6,130 kg). To date, the OEPA has not set nitrogen oxide or carbon monoxide limits for FEMP industrial processes.

Table 5-6 provides a comprehensive list of 1997 Boiler Plant emissions.

TABLE 5-6
BOILER PLANT EMISSIONS

Chemical Name	Type of Release	Quantity Released (lb/kg)	Major Release Sources	Basis of Estimate
Particulates	Stack Emissions	3,600/1,600	Fossil Fuels Combustion	AP-42 Emission Factors
Sulfur Dioxide	Stack Emissions	180/82	Fossil Fuels Combustion	AP-42 Emission Factors
Nitrogen Oxide	Stack Emissions	27,300/12,400	Fossil Fuels Combustion	AP-42 Emission Factors
Carbon Monoxide	Stack Emissions	13,500/6,130	Fossil Fuels Combustion	AP-42 Emission Factors
Non-methane Volatile Organic Compounds	Stack Emissions	70/30	Fossil Fuels Combustion	AP-42 Emission Factors

Biota (Produce) Sampling for Total Uranium

As mentioned in Chapter One, the FEMP is surrounded by farmland. Locally grown sweet corn and tomatoes are two of the major crops sold from roadside stands within three miles (five km) of the FEMP. Local residents also grow and sell apples, beets, cucumbers, lettuce, peppers, potatoes, and squash.

With air emissions reduced to very low levels, the possibility of uranium contamination in produce from air deposition is very low. While washing the produce before eating removes any surface contamination which may be present, some uranium may be taken up by plants through their root systems and incorporated into their edible portions. Uranium detected in produce may be uranium that was deposited from the air pathway, naturally occurring in the soil, or added by fertilizers.

Produce is collected to determine if total uranium concentrations in produce grown within three miles (five km) of the FEMP are higher than concentrations in produce grown at distant locations, seven to 26 miles (11 to 42 km). The sample results are then used to estimate the potential dose to people from this component of the air pathway (Chapter Six). Figure 5-8 presents produce monitoring locations.

The summary results of the produce sampling program are reported in Table 5-7. In general, total uranium concentrations greatly varied for each type of produce. Comparisons between the average total uranium concentrations in corn, soybeans, squash and tomatoes grown near the FEMP with concentrations grown distant from the FEMP indicated very little difference in average concentrations. In addition, when compared to historical background ranges, the data for 1997 are within the range of background reported for 1990 to 1996. These comparisons suggest that there is no substantial impact from past or current FEMP emissions on produce grown in the area.

Under the IEMP, produce will continue to be sampled once every three years. The next sampling round is scheduled for the year 2000.

TABLE 5-7
1997 BIOTA (PRODUCE) TOTAL URANIUM SUMMARY RESULTS

Produce	Number of Samples[a]	Minimum[a] (pCi/g, dry weight)	Maximum [a,b] (pCi/g, dry weight)	Background [b] (pCi/g, dry weight)	1990-1996 Historical Background Range[c] Minimum (pCi/g, dry weight)	Maximum (pCi/g, dry weight)
Corn[d]	9	2.4E-04	1.8E-03	4.2E-03	ND	2.0E-01
Squash[e]	2	3.8E-02	NA	1.9E-02	ND	3.4E-01
Soybean	5	1.8E-03	2.1E-02	NS	ND	1.2E+00
Tomatoes	6	5.6E-03	1.3E-01	2.4E-02	1.8E-04	6.1E-01

[a] If the number of "non-background" samples is equal to one, then the data point is reported as the minimum.
[b] NA - not applicable
NS - not sampled
[c] ND-indicates less than blank values or less than background.
[d] The corn family includes sweet corn for human consumption and field corn for livestock feed.
[e] The term squash includes, zucchini, and eggplant.

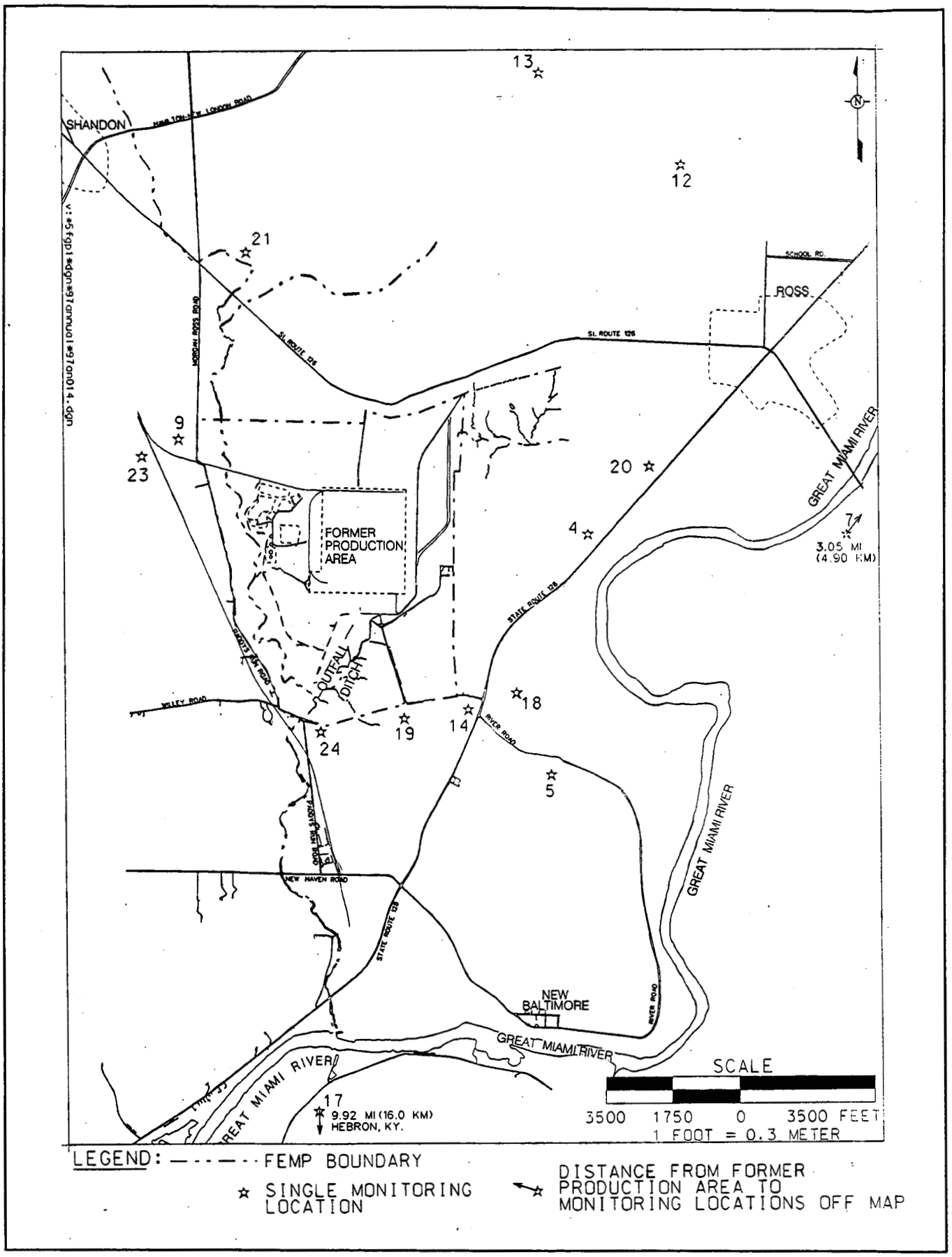

Figure 5-8. Produce Monitoring Locations

Radiation Dose

Results in Brief: 1997 Estimated Doses

Airborne Emissions - The estimated maximum committed effective dose to a member of the public from 1997 airborne emissions (excluding radon) was calculated to be 1.4 mrem.

Produce - The committed effective dose from eating produce grown within 3 miles (5 km) of the FEMP was estimated to be 0.1 mrem.

Direct Radiation - There was no significant statistical difference between direct radiation measurements at the site fenceline and measurements at background locations. Therefore no dose was attributable to direct radiation in 1997.

This chapter provides estimated doses from the air and direct radiation pathways for 1997. EPA regulations require the FEMP to demonstrate that its radionuclide airborne emissions are low enough to ensure that no one in the public receives an effective dose of 10 mrem or more in any one year. Moreover, to determine whether the FEMP is within the DOE dose limit of 100 mrem per year from all exposure pathways, estimates of the dose from eating produce grown near the FEMP and the dose due to direct radiation are made.

In previous annual reports, estimated doses from drinking well water and eating fish from the Great Miami River were provided. The installation of public water to the area surrounding the FEMP eliminated the groundwater pathway as a source of dose from FEMP operations; therefore, dose from drinking well water is no longer reported. Repeated assessments of the dose from eating fish from the Great Miami River have established this pathway as an insignificant contributor to dose from FEMP emissions. In addition, the emissions to the Great Miami River have been significantly reduced over the past several years. The sampling of fish and the assessment of dose from eating fish has therefore been eliminated under the IEMP.

Estimated Dose from Airborne Emissions

Dose estimates from airborne emissions are determined through the use of a set of computer models. The FEMP uses the computer model CAP88-PC to determine compliance with the NESHAP requirements of the Clean Air Act. The AIRDOS computer model calculates concentrations of radionuclides in the air, on the ground, and in food based on estimates of the amount of airborne radioactive material released. The concentrations are then used to calculate the intakes and subsequent doses to people.

The CAP88-PC model calculates airborne radionuclide concentrations based on estimated, calculated, or measured emission rates. The CAP88-PC computer model calculates both individual and collective doses. Collective dose is the sum of individual doses to people in the FEMP area and is reported in the units of person-Roentgen equivalent man (person-rem). (For example, if 10 people each receive one rem, then the collective dose is "10 person-rem"; if 20 people each receive 0.5 rem, then the collective dose also is "10 person-rem".) The person-rem unit is used as a broad measure of the radiological impacts of the FEMP and is useful in comparing the risks from FEMP operations with other facilities and industries.

The CAP88-PC model requires a large amount of data to estimate dose, which includes the number, height, and location of release points; wind speed and direction; the amount of radioactive material released; and population distribution in the FEMP area. Although some of the data were obtained through measurements and sampling, many were not directly measured and were estimated. Examples of estimated data are the amounts of airborne radioactive material released from the Laboratory Building and the cooling tower. The FEMP made very conservative estimates for these and all other emission sources

which were not directly measured. Conservative estimates, which are frequently used in environmental monitoring and dose calculations, are based on assumptions about an exposure situation that should result in the highest estimate of a dose. For example, an assumption about estimated doses at the air monitoring stations is that a person is outdoors at one location for 100 percent of the time during the year. Conservative estimates of emissions are used to ensure that dose estimates are not underestimated but are the maximum doses that could have resulted from FEMP operations during 1997.

Results of the CAP88-PC model estimated the maximum effective dose from 1997 airborne emissions to be 1.4 mrem to a person located 3,317 feet (1,011 meters) east-southeast of the former production area. This dose was well below the NESHAP standard of 10 mrem from the air pathway and was only 1.4 percent of the DOE guideline of 100 mrem per year from all pathways (Figure 6-1).

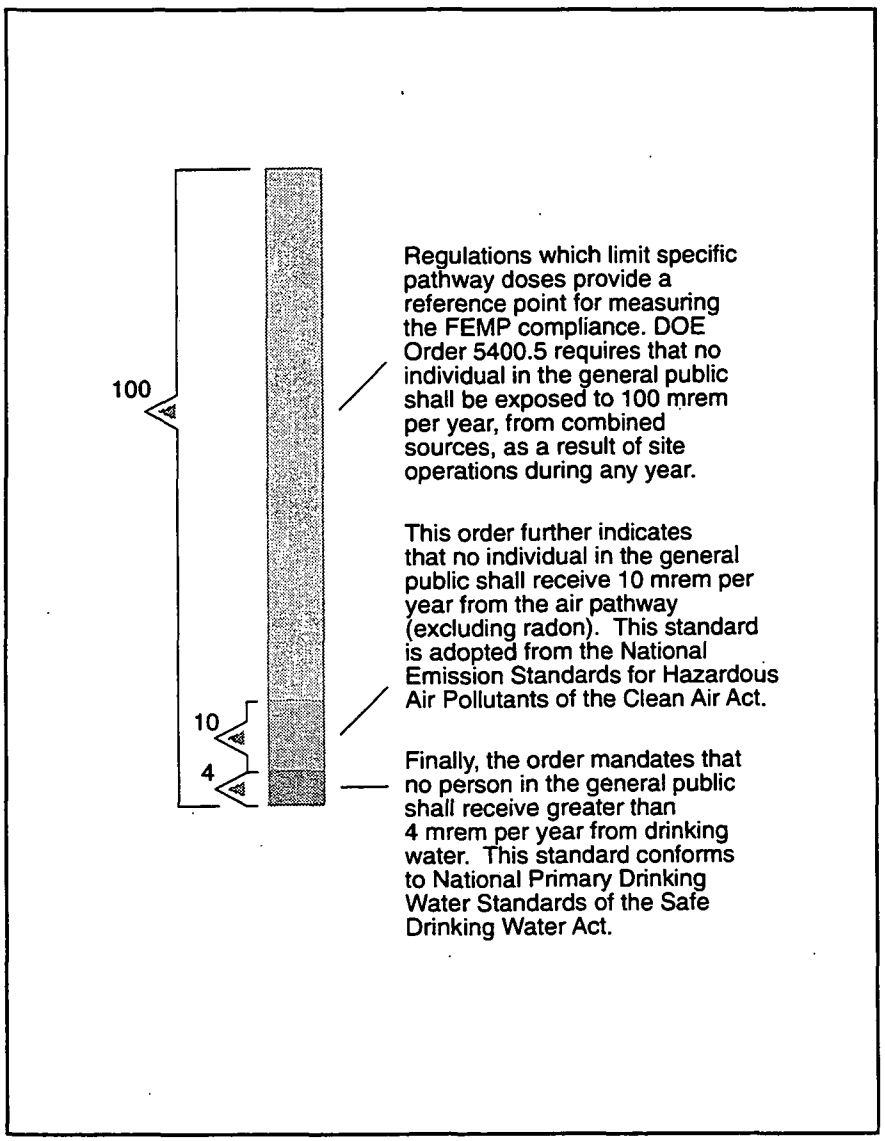

Figure 6-1. DOE Dose Limits

The collective effective dose from 1997 airborne emissions to the population within 50 miles (80 km) of the FEMP was also calculated by the CAP88-PC model. This dose was estimated to be 9.7 person-rem for a population of 2.7 million. For comparison, the same group of people received an estimated collective effective dose of 300,000 person-rem from background radiation, excluding radon.

Radon is subject to different regulations than other components of the air pathway. DOE Orders place limits on the concentration of radon but do not place limits on the dose from radon. Therefore, radon is not included as a component of the air pathway when calculating dose from FEMP emissions.

Estimated Dose from Eating Produce Grown Near the FEMP

Uranium deposited onto soil during the years the FEMP was in production may be absorbed by produce and thereby deliver a secondary pathway dose. This secondary pathway dose is estimated using the conservative assumption that a large fraction of a person's diet of vegetables comes from gardens and farms in the FEMP area. This modeled diet assumes an annual consumption of 100 pounds (45 kg) of grains (corn and soybeans) and 100 pounds (45 kg) of other vegetables (tomatoes and squash). To represent the foods in the diet, samples of corn, soybeans, tomatoes, and squash from local gardens and farms were analyzed for total uranium. The maximum total uranium concentration found in locally grown foods was used to estimate dose. The average total uranium background concentration in foods was subtracted from the maximum concentration to account for the natural occurrence of uranium in foods.

The committed effective dose received was calculated to be 0.1 mrem. This dose is comparable to the estimated doses from produce in previous years and is well below the 100 mrem per year limit for all pathways. Furthermore, this data, in conjunction with previous year's data, confirms that past and current emissions from the FEMP have had no substantial impact on produce grown in the area.

Direct Radiation Dose

Direct radiation dose is the result of radiation (i.e., gamma and x-rays) emitted from radionuclides stored on site. The largest sources of direct radiation are the wastes stored in the K-65 Silos and the thorium compounds stored at selected locations on site. Direct radiation dose is estimated using environmental thermoluminescent dosimeter measurements, rather than through the use of computer models.

The direct radiation dose was estimated using the highest dose from the fenceline monitoring locations (Figure 5-5) and subtracting the average dose measured at background thermoluminescent dosimeter locations 18, 19, 20, 21, 30, and 33, as shown in Figure 5-5. Limits in the precision on thermoluminescent dosimeter data and variations in natural background radiation require consideration of the uncertainty (the plus/minus [±] values) associated with each measurement in calculating dose. The uncertainty is calculated for a 95 percent confidence interval (two standard deviations) around the average.

From the data in Table 5-4, the highest 1997 fenceline dose occurred at location 6 and is 79 ± 11 mrem per year (two standard deviations). The average background dose from locations 18, 19, 20, 21, 30, and 33 is 63.8 ± 12.2 mrem per year. The data indicate that the highest fenceline dose is between 68 mrem (79 - 11 mrem) and 90 mrem (79 + 11 mrem) per year, while the average background dose is between 51.6 mrem (63.8 - 12.2 mrem) and 76 mrem (63.8 + 12.2 mrem) per year. Because the range of background and the range of fenceline doses overlap, there is no firm basis for stating that there is a difference between the fenceline and average background doses. Given this lack

of significant statistical difference between the doses, no dose was attributed to direct radiation for 1997.

Total of Doses to a Maximally Exposed Individual

The maximally exposed individual is a hypothetical member of the public who receives the highest calculated effective dose based on the location of his or her home, weather conditions, and the individual pathway doses. Because it is not possible to single out a specific individual in the FEMP area who receives the most dose, the results of the individual pathways and the CAP88-PC evaluation are added to predict the maximum dose that a person could receive. The dose to the maximally exposed individual (Table 6-1) is a total of estimated doses from breathing 1997 airborne emissions (excluding radon), eating produce grown near the FEMP, and receiving the direct radiation dose at the FEMP fenceline. The conservative assumptions used throughout the dose calculation process ensure that the dose to the maximally exposed individual is the upper limit of the actual dose any member of the public receives. The 1997 dose to the maximally exposed individual is estimated to be 1.5 mrem, which is well below the guideline of 100 mrem per year for all pathways. Figure 6-2 shows the doses to the maximally exposed individual from 1993 through 1997. Although an increasing trend is evident in Figure 6-2, it is important to note that the dose to the maximally exposed individual is below applicable DOE guidelines and EPA limits. Futhermore, the slight increase for 1997 is attributable to the substantial amount of activity at the FEMP and confirms that techniques used to control fugitive emissions (dust) from remediation projects were effective.

TABLE 6-1
DOSE TO MAXIMALLY EXPOSED INDIVIDUAL

Pathway	Dose Attributable to the FEMP	Applicable Guideline
Air		
Estimated 1997 emissions	1.4 mrem	10 mrem/air
Produce grown in Fernald area	0.1 mrem	100 mrem/all pathways
Direct radiation	0.00 mrem	100 mrem/all pathways
Maximally exposed individual	1.5 mrem	100 mrem/all pathways

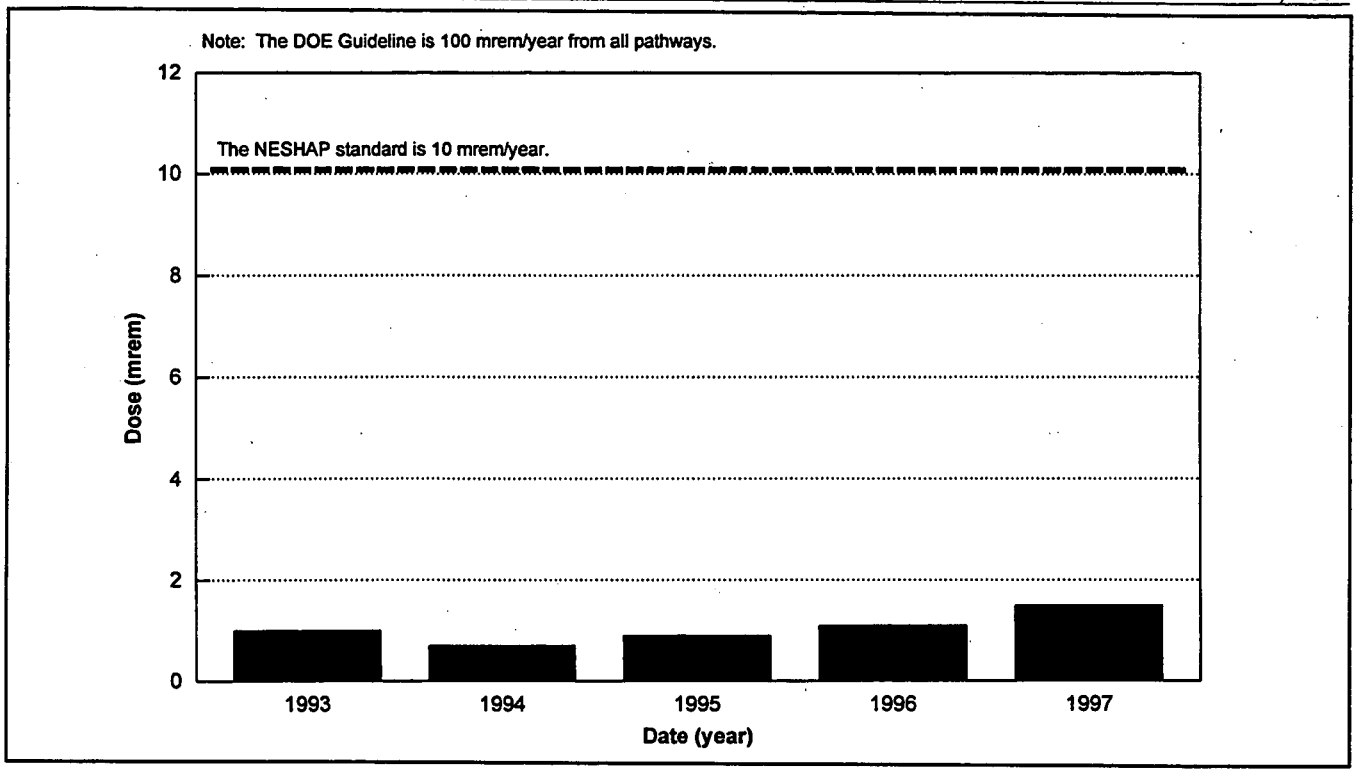

Figure 6-2. Dose to Maximally Exposed Individual, 1993-1997

Significance of Estimated Radiation Doses for 1997

One method of evaluating the significance of the estimated doses is to compare them with doses received from background radiation. Background radiation yields approximately 100 mrem per year from natural sources, excluding radon. For example, the dose received each year from cosmic and terrestrial background radiation contributes approximately 26 mrem and 28 mrem, respectively. In addition, the background radiation dose will vary in different parts of the country. Living in the Cincinnati area contributes an annual dose of approximately 110 mrem, while living in the Denver area would contribute approximately 125 mrem from background radiation (U.S. National Academy of Science 1980) (National Council on Radiation Protection and Measurements 1987). Comparing the maximally exposed individual dose to the background dose demonstrates that, even with the conservative estimates, the dose from the FEMP is much less than background. Although the estimated dose will be received in addition to the background dose, this comparison provides a basis for evaluating the significance of the estimated doses. A dose that is small in comparison to that of background radiation will produce no measurable health effects.

Another method of determining the significance of the estimated doses is to compare them with dose limits developed to protect the public. The International Commission on Radiological Protection has recommended that members of the public receive no more than 100 mrem per year. As a result of this recommendation, DOE has incorporated 100 mrem per year as the limit in Order 5400.5. The sum of all estimated doses from FEMP operations for 1997 was well below this limit.

Natural Resources

This chapter provides background information on the natural resources associated with the FEMP and summarizes the 1997 activities relating to these resources. Included in this chapter is a discussion of the following:

- Threatened and endangered species
- Cultural resources
- Impacted habitat areas.

Much of the 1,050 acres (425 hectares) of the FEMP property is undeveloped land that provides habitat for a variety of animals and plants. These areas, which are termed natural resources, include wetlands, deciduous and riparian (stream side) woodlands, old fields, grasslands, and aquatic habitats, like Paddys Run. Some of these areas provide habitat for state and federal endangered species. Cultural resources, such as archaeological sites, can also be found at the FEMP. These resources are considered in the Natural Resource Impact Monitoring Plan which was developed in 1997 and included in the IEMP. The plan outlines a monitoring and reporting approach to status several priority natural resources in order to remain in compliance with the pertinent regulations and agreements.

Sloan's Crayfish - The state-listed threatened Sloan's Crayfish (*Orconectes sloanii*) is a small crayfish found in the streams of southwest Ohio and southeast Indiana. It prefers streams with constant (though not necessarily fast) current flowing over rocky bottoms. A large, well-established population of Sloan's crayfish is found at the FEMP in the northern reaches of Paddys Run.

Indiana Brown Bat - The federally listed endangered Indiana Brown Bat (*Myotis sodalis*) forms colonies in hollow trees and under loose tree bark along riparian (stream side) areas during the summer. Excellent habitat for the Indiana Brown Bat has been identified at the FEMP along the wooded banks of the northern reaches of Paddys Run. The habitat provides an extensive mature canopy from older trees and water throughout the year.

Running Buffalo Clover - The federally listed endangered Running Buffalo Clover (*Trifolium stoloniferum*) is a member of the clover family whose flower resembles that of the common white clover. Its leaves, however, differ from white clover in that they are heart-shaped and a lighter shade of green. Running Buffalo Clover has not been identified at the FEMP. However, because Running Buffalo Clover is found nearby in the Miami Whitewater Forest, the potential exists for this species to establish at the FEMP. The Running Buffalo Clover prefers habitat with well-drained soil, filtered sunlight, limited competition from other plants and periodic disturbance. Suitable habitat areas include partially shaded grazed areas along Paddys Run and the Storm Sewer Outfall Ditch.

Spring Coral Root - The state-listed threatened Spring Coral Root (*Corallorhiza wisteriana*) is a white and red orchid which blooms in April and May and grows in partially shaded areas of forested wetlands and wooded ravines. This plant has not been identified at the FEMP. However, suitable habitat exists in portions of the northern woodlot.

Threatened and Endangered Species

The Endangered Species Act requires the protection of any federally listed threatened or endangered species, as well as any critical habitat that is essential for the species' existence. Several Ohio laws mandate the protection of state-listed endangered species as well. The FEMP conducted surveys in 1993 and 1994 to establish baseline information on any threatened or endangered species that may be found at the FEMP. As a result of these surveys, the state-listed threatened Sloan's Crayfish is the only threatened or endangered species determined to have a known population on the FEMP property. However, there is the potential for the presence of other state- and federally listed threatened and endangered species, such as the Indiana Brown Bat, Running Buffalo Clover, and Spring Coral Root, because each of their habitat ranges encompass the FEMP. No surveys were conducted in 1997 for the Indiana Brown Bat, Running Buffalo Clover, or Spring Coral Root because no remediation activities occurred within their respective potential habitat areas. Figure 7-1 shows the habitats and potential habitats of these species.

Sloan's Crayfish Monitoring and Provisions for Protection

As identified above, in 1993 and 1994, a population of the state-listed threatened species Sloan's Crayfish was found in the northern reaches

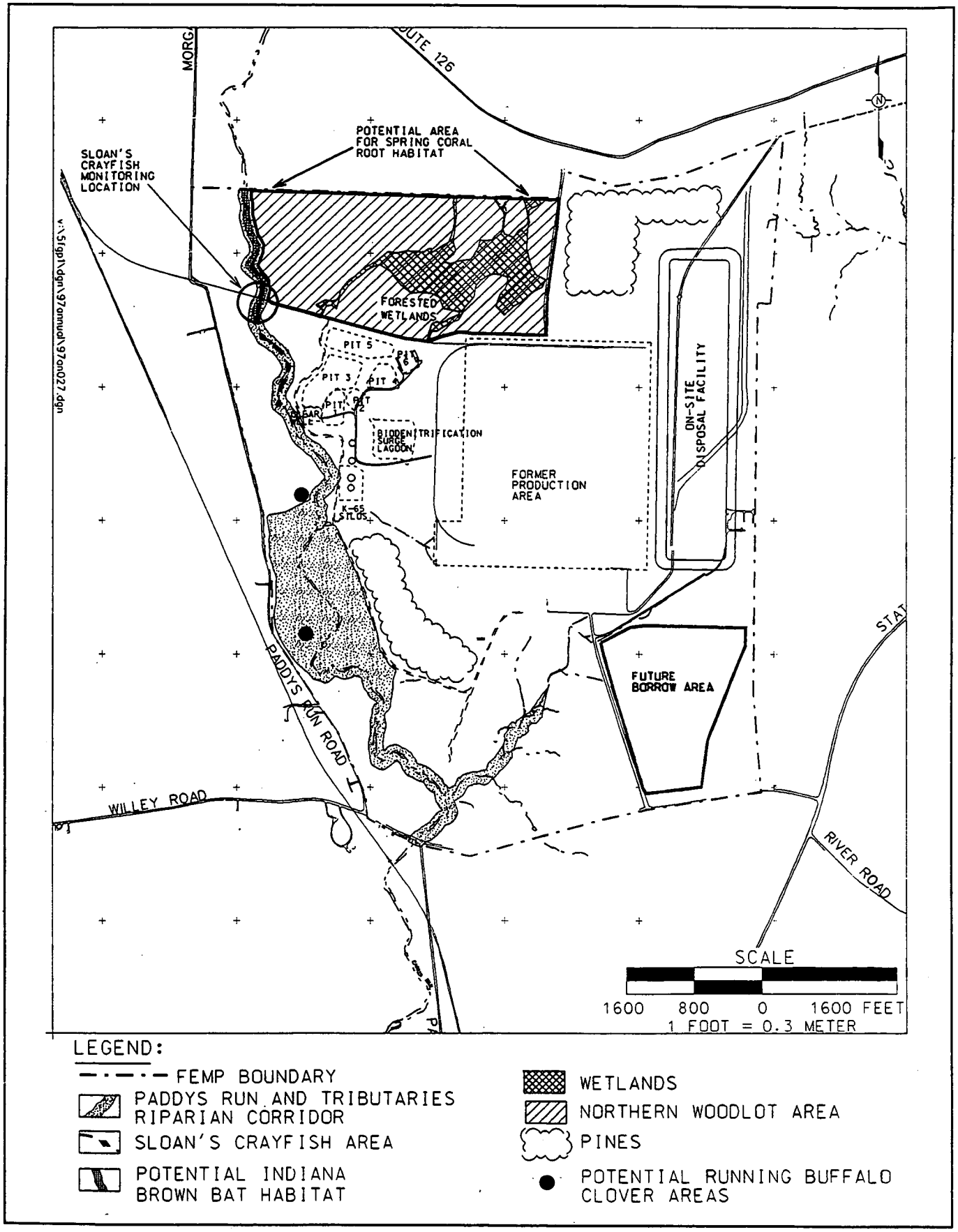

Figure 7-1. Priority Natural Resource Areas

of Paddys Run. In 1996, a follow-up survey for the Sloan's Crayfish was conducted in Paddys Run; the survey found a large, healthy population still residing in the creek.

A significant rain event - is considered to be 0.5 inch (1 cm) or more of rain in one storm event. There were approximately 20 significant rainfall events in 1997.

During 1997, visual field inspections of sediment loading in the Sloan's Crayfish habitat area were conducted within 24 hours of a significant rain event. The purpose of this monitoring was to determine if there was an increase of sediment in the northern reaches of Paddys Run due to FEMP activities. Sediment loading can adversely impact the Sloan's Crayfish by restricting its ability to "breathe" in water. If site activities caused sustained (four to five days) increased sediment loading to Sloan's Crayfish habitat in Paddys Run, then alternatives such as crayfish relocation would be considered.

Results of approximately 20 visual field inspections conducted in 1997 indicated that sediment loading from site activities has not impacted Sloan's Crayfish habitat in Paddys Run. When higher sediment loading conditions were observed, these conditions appeared to be a function of upstream influences unrelated to site activities. Field notes indicated that these higher sediment loading conditions persist for only one day or less following each rain event. Based on these findings, the FEMP has recommended to the EPA and OEPA to discontinue visual field inspections and is awaiting approval, which is expected to occur during early 1998. Visual field inspections will be reinitiated if significant soil disturbances occur in the drainage areas discharging to Paddys Run or if storm water control inspections indicate that sediment controls are not functioning properly. The routine inspections associated with storm water controls will continue and provide the necessary measure of protection to ensure that the Sloan's Crayfish habitat is not adversely impacted.

Cultural Resources

Factors such as geologic setting, surface water, soil, vegetation, and climate determine the population and cultural growth of an area. The FEMP and surrounding area are located in a region of rich soil and many sources of water, such as the Great Miami River. As a result, the area has rich cultural resource diversity. This diversity is by the number of historical periods represented in the area's history. These periods include the Paleo-Indian Occupation (12000 B.C. to 8000 B.C.), Archaic Occupation (8000 B.C. to 1000 B.C.), Woodland Tradition (1000 B.C. to 1000 A.D.), Mississippian Tradition (1000 A.D. to 1660 A.D.), and Historic Times (1660 A.D. to present).

Several laws have been established in order to protect cultural resources. The National Historic Preservation Act requires that DOE take into consideration the effects of its actions on sites that are either listed or eligible for listing on the National Register of Historic Places, sites which are termed "historic properties." Also, certain Native American artifacts, such as human remains, funerary objects, and sacred objects, are protected under the Native American Graves Protection and Repatriation Act.

Pursuant to implementing regulations for these laws, DOE has worked with the Advisory Council on Historic Preservation and the Ohio Historic Preservation Office to develop two programmatic agreements for the FEMP. These agreements specify all activities required to consider and protect cultural resources at the FEMP. As a result, DOE must survey for and recover historic properties prior to any ground-disturbing activity in non-contaminated

or previously undisturbed areas. Once construction activities start, DOE must have contingency plans in place if unexpected cultural resources are uncovered. The site has implemented procedures to ensure effective contingency plans are in place.

Prior to 1997, there were three known historic sites located on FEMP property (Figure 7-2). These sites consist of either prehistoric Native American artifacts or historic homesites. One of the sites at the FEMP is associated with both prehistoric and historic time periods.

TABLE 7-1
UNEXPECTED DISCOVERIES FOUND IN 1997

Unexpected Discovery*
Chert Blade (Prehistoric affiliation. Age unknown)
Kirk Corner Notched Cluster (7500 to 6900 B.C.)
Unnotched Pentagonal Cluster (500 to 1000 A.D.)
Spear Weight (10000 B.C. to 1000 A.D.)
Bone Handle (Prehistoric affiliation. Age unknown)

*No further excavation is warranted.

For 1997, most remediation activities at the FEMP occurred in areas that were already surveyed or otherwise exempt from cultural resource survey requirements (i.e., previously disturbed areas). However, there were five unexpected discoveries encountered during remediation activities in 1997 (Table 7-1). Figure 7-2 identifies the areas that have been surveyed and the location of the unexpected discoveries. In each case, archaeologists determined that the unexpected discoveries were not of a level of significance to prompt further excavation. No Native American Graves Protection and Repatriation Act items were uncovered in 1997.

Impacted Habitat Areas

Wetlands - are defined as areas covered or saturated with water for enough time to support growth of hydrophytic (water-loving) vegetation and the formation of hydric soil.

Sensitive habitat impact reporting fulfills requirements set forth in the Natural Resources Impact Monitoring Plan. Current negotiations with the FEMP natural resource trustees involve the formulation of a comprehensive restoration plan based on an estimate of past and future impacts to FEMP natural resources. The FEMP natural resource trustees require that several different habitats be monitored to compare estimated impacts with actual impacts. There are five habitat areas monitored for impacts: northern woodlot/pines, southern pines and waste units, grasslands, Paddys Run corridor, and wetlands. Figure 7-3 identifies the cumulative areas that were impacted through the end of 1997.

Approximately 55 acres (22 hectares) of habitat were impacted in 1997 bringing the total impacted habitat acreage to approximately 110 acres (44.5 hectares). It is estimated that a total of 305 acres (123 hectares) will ultimately be impacted through final remediation of the site. The extent of each impacted habitat area was surveyed using a Global Positioning System, or by visual observation in the case of wetlands associated with the waste pits/process areas. Wetlands are protected under the Clean Water Act, as well as other federal regulations. A wetlands delineation of the FEMP was conducted in December 1992 and approved by the U.S. Army Corps of Engineers in August 1993. A total of 36 acres (15 hectares) of freshwater wetlands were delineated on the FEMP. In 1997, an additional 0.5 acre (0.2 hectare) wetland was identified.

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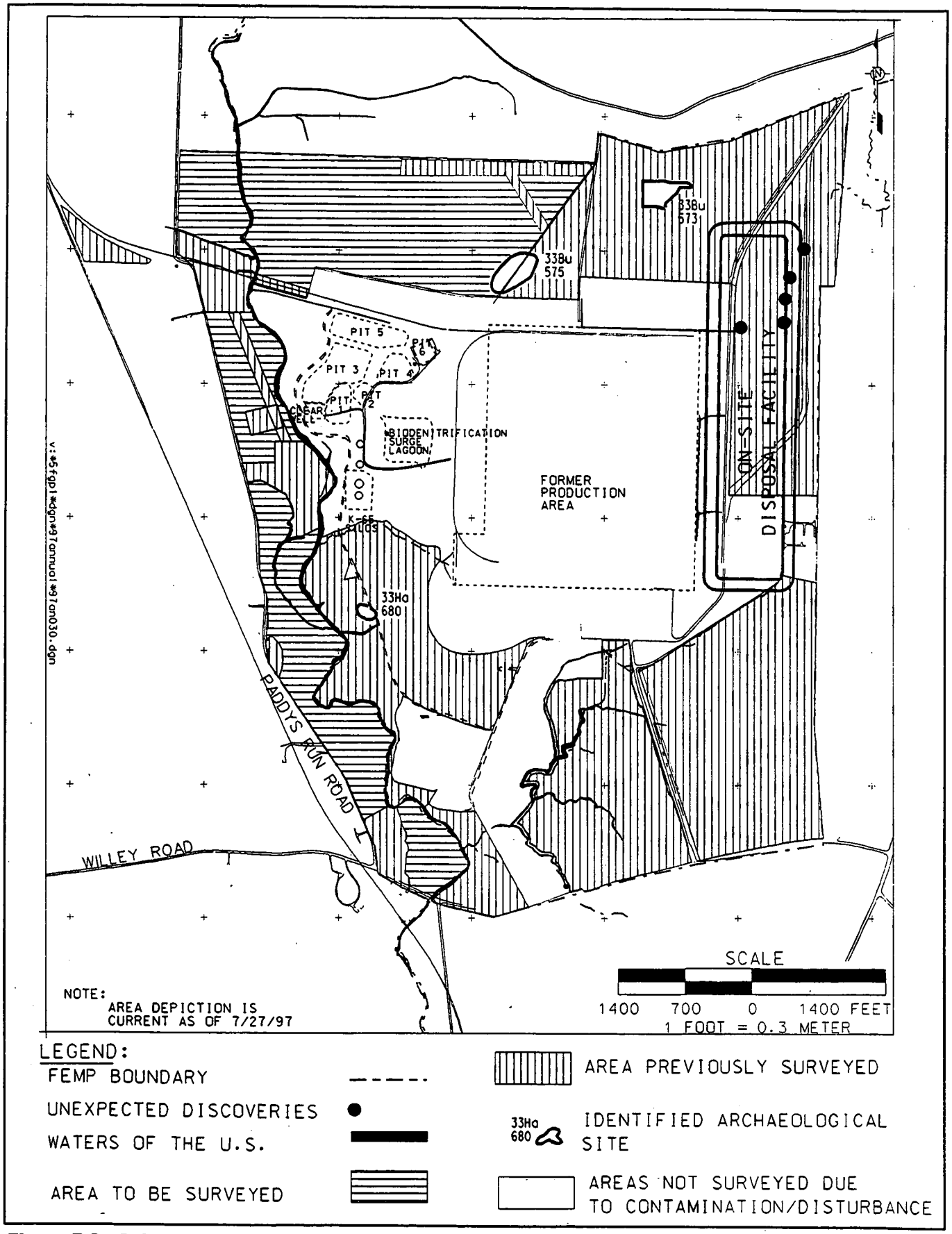
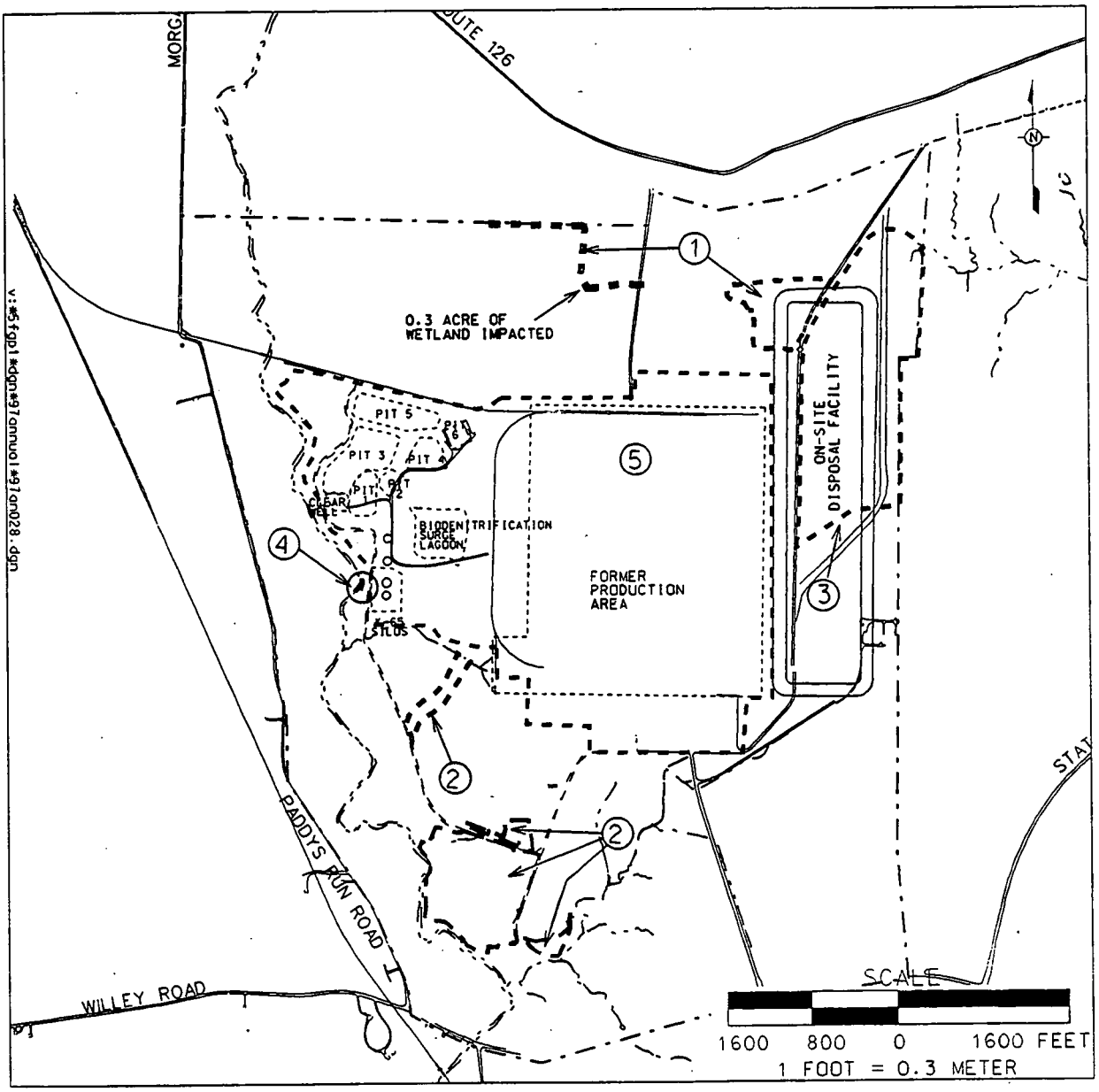


Figure 7-2. Cultural Resource Survey Areas



LEGEND:

— · — · — FEMP BOUNDARY

IMPACTED HABITAT AREAS:	TOTAL IMPACTED ACREAGE/HECTARES:
① NORTHERN WOODLOT/PINES (WETLANDS)	9.77 (3.95) 0.3 (0.1)
② SOUTHERN PINES/ WASTE UNITS	24.32 (9.84)
③ GRASSLAND	55.10 (22.30)
④ PADDYS RUN CORRIDOR	11.07 (4.48)
⑤ WETLANDS ASSOCIATED WITH WASTE PITS/PROCESS AREA	10.00 (4.05)

Figure 7-3. Impacted Habitat Monitoring Map

Wetlands

By the end of 1997, 10.3 acres (4.17 hectares) of wetlands had been impacted. The impacted wetland acreage is identified on Figure 7-3 and has occurred at two locations: within the waste pits/process area and within the northern woodlots due to an access road that was installed to reach an air monitoring station. During the remediation process, impacts to wetlands will be mitigated in accordance with the Clean Water Act.

Glossary

ALARA — A phrase and acronym (As Low As Reasonably Achievable) used to describe an approach to radiation exposure and emissions control or management whereby the exposures and resulting doses to the public are maintained as far below the specified limits as economic, technical, and practical considerations will permit.

Alpha Particle — Type of particulate radiation emitted from the nucleus of an atom. It consists of two protons and two neutrons. It does not travel long distances and loses its energy quickly.

Aquifer — A geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield economical quantities of water to wells and springs.

ARARs — Requirements set forth in regulations that implement environmental and public health laws and must be attained or exceeded by a selected remedy unless a waiver is invoked. ARARs are divided into three categories: chemical-specific, location-specific, and action-specific. These depend on whether the requirement is triggered by the presence or emission of a chemical, by a vulnerable or protected location, or by a particular action.

Background Radiation — Particle or wave energy spontaneously released from atomic nuclei in the natural environment, including cosmic rays and such releases from naturally radioactive elements both outside and inside the bodies of humans and animals, and fallout from nuclear weapons tests.

Baseline Risk Assessment — The study that characterized the threats to human health and the environment that may be posed by contaminants within FEMP soil, groundwater, sediment, and surface water.

Bedrock — Any solid rock exposed at the surface of the earth or overlain by unconsolidated material.

Beta Particle — Type of particulate radiation emitted from the nucleus of an atom that has a mass and charge equal in magnitude to that of the electron.

Bulking — Consolidation of small volumes of materials from multiple containers into a single container.

Bypass Events

A bypass event occurs when storm water is bypassed around treatment and is directly discharged to the Great Miami River via the FEMP effluent line. Bypass events can occur during "significant precipitation" or when water treatment facilities are down for maintenance. Bypassing treatment is only implemented when the FEMP's storm water retention capacity is in danger of being exceeded.

Confidence Interval

A value interval that has a designated probability (the confidence coefficient) of including some defined parameter of the population.

Conservative Estimate

Used frequently in environmental monitoring and dose calculation, it is based on assumptions about an exposure situation that should result in the highest reasonable estimate of a dose.

Contaminant

A substance that when introduced to air, surface water, sediment, soil, or groundwater causes degradation of the media.

Curie (Ci)

Unit of radioactivity that measures the rate of spontaneous, energy-emitting transformations in the nuclei of atoms.

Dose

Quantity of radiation absorbed in tissue.

Drum Equivalent

The number of 55-gallon drums that it would take to contain a given volume of waste.

Ecological Receptor

A biological organism selected by ecological risk assessors to represent a target species most likely to be affected by site-related chemicals, especially through bioaccumulation. Such organisms may include terrestrial and aquatic species. The FEMP ecological receptors were: the white-footed deer mouse, the western meadow vole, pine trees, and shiners.

Effective Dose Equivalent

The summation of the products of the dose equivalent received by specified tissues of the body and tissue-specific weighting factor. This sum is a risk-equivalent value and can be used to estimate the health-effects risk of the exposed individual. The tissue-specific weighting factor represents the fraction of the total health risk resulting from uniform whole-body irradiation that would be contributed by that particular tissue. The effective dose equivalent includes the committed effective dose equivalent from internal deposition of radionuclides and the effective dose equivalent due to penetrating radiation from sources external to the body. Effective dose equivalent is expressed in units of rem (or sievert).

Exposure Pathway

A route by which materials could travel between the point of release and the point of delivery of a radiation or chemical dose to a receptor organism.

FEMP	The Fernald Environmental Management Project, the present name (beginning August 23, 1991) for the former Feed Materials Production Center near Fernald, Ohio.
Gamma Ray	Type of electromagnetic radiation of discrete energy emitted during radioactive decay of many radioactive elements.
Glacial Overburden/Glacial Till	Silt, sand, gravel and clay deposited by glacial action on top of the Great Miami Aquifer and surrounding bedrock highs.
Great Miami Aquifer	Glaciofluvial sand and gravel deposited by the meltwaters of Pleistocene glaciers within the entrenched ancestral Ohio and Miami rivers. This is also termed a buried channel or sand and gravel aquifer.
Groundwater	Water in a saturated zone or stratum beneath the surface of land.
Headworks	Includes the various flow equalization basins and/or preliminary treatment units which serve as the central collection and distribution points to the wastewater treatment operations in the main facility.
Holding Time	The maximum allowable time from sample collection to laboratory analysis.
Hydrology	The study of the properties, distribution, and circulation of water through the local environment.
Implosion	A demolition method used at the FEMP to collapse structures with minimal damage to the surrounding infrastructure. This method employs strategic cutting of horizontal beams and vertical load-bearing columns and detonation of explosives to accomplish structural collapse.
Mixed Wastes	Hazardous waste that has been contaminated with low-level radioactive materials.
Monitoring Well	A well that is used to collect groundwater samples to monitor the water quality. It may be used to monitor groundwater level fluctuations.
Overpacking	The act of placing a deteriorating drum inside a new, larger drum to prevent further deterioration or the possible release of contaminants during storage.
Point Source	The single defined point (origin) of a release such as a stack, vent, or other discernable conveyance.

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Radiation The energy released as particles or waves when an atom's nucleus spontaneously loses or gains neutrons and/or protons. The three main types are alpha particles, beta particles, and gamma rays.

Radioactive Material Refers to any material or combination of materials that spontaneously emits ionizing radiation.

Radionuclide Refers to a radioactive nuclide. There are several hundred known radionuclides, both artificially produced and naturally occurring; radionuclides are characterized by the number of neutrons and protons in an atom's nucleus and their characteristic decay processes.

Receptors Individuals or organisms that are or potentially could be impacted by contamination.

Remedial Action The actual construction and implementation phase of a Superfund site cleanup that follows the remedy selection process and remedial design.

Remedial Response A long term action potentially involving site characterization, risk assessment, a technology treatability study, a feasibility study, a remedial design, and remedial implementation.

Removal Action A short-term cleanup or removal of released hazardous substances from the environment. This occurs in the event of a release or the imminent threat of release of hazardous substances into the environment.

Roentgen Equivalent Man (Rem) A special unit of dose equivalent that expresses the effective dose calculated for all radiation on a common scale; the absorbed dose in rads multiplied by certain modifying factors, (e.g., quality factor); 100 rem = 1 sievert.

Sediment The unconsolidated inorganic and organic material that is suspended in surface water and is either transported by the water or has settled out and become deposited in beds.

Thermoluminescent Dosimeter A devised used to monitor the amount of radiation to which it has been exposed.

Waste Acceptance Criteria Disposal facilities specify the types and sizes of materials, acceptable levels of constituents, and other criteria for all material that will be disposed in that facility. These are known as waste acceptance criteria. Off-site disposal facilities that will dispose of FEMP waste (such as the Nevada Test Site) have specific waste acceptance criteria. In addition, the FEMP on-site disposal facility has waste acceptance criteria that have been approved by the regulatory agencies. The FEMP Waste Acceptance Operations is responsible for ensuring that all waste to be placed in the on-site disposal facility meet all these criteria before waste placement.

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1997 INTEGRATED SITE ENVIRONMENTAL REPORT

1997 ENVIRONMENTAL SUMMARY
(Appendices A through D)

VOLUME I

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

MAY 1998

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

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51350-RP-0001
FINAL

1997 ENVIRONMENTAL SUMMARY

VOLUME I

(Appendices A through D)

Appendix A

APPENDIX A

SUPPLEMENTAL GROUNDWATER INFORMATION

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LIST OF ACRONYMS

AMSL	above mean sea level
billion gal	billions of gallons
DMEPP	Design Monitoring Evaluation Program Plan
DOE	U.S. Department of Energy
FEMP	Fernald Environmental Management Project
FRL	final remediation level
gpm	gallons per minute
IEMP	Integrated Environmental Monitoring Plan
lbs/M gal	pounds per million gallons
mg/L	milligrams per liter
mgpd	millions of gallons per day
μmhos/cm	micromhos per centimeter
OEPA	Ohio Environmental Protection Agency
PRRS	Paddys Run Road Site
RI/FS	remedial investigation/feasibility study
μg/L	micrograms per liter

APPENDIX A

Appendix A presents additional groundwater data and analysis in support of Chapter Three of the 1997 Integrated Site Environmental Report. This appendix consists of six attachments as follows:

- Attachment A.1 provides operational data for the South Plume Extraction System for 1997. The attachment evaluates system performance with respect to the two-part objective to prevent further southward movement of the total uranium plume without adverse impact to the Paddys Run Road Site (PRRS) plumes.

- Attachment A.2 provides total uranium data and plume maps for the third and fourth quarters of 1997 with statistical trend results (Statistical data trends are based on data from 1988 through 1997). Since 1997 was a transitional year for the Integrated Environmental Monitoring Program (IEMP) monitoring program, total uranium data for the first half of 1997, which was presented in the September 1997 South Plume Removal Action Design, Monitoring Evaluation Program Plan (DMEPP), System Evaluation Report (DOE 1997g), are not repeated here.

- Attachment A.3 evaluates the capture zone of the South Plume Extraction System by analyzing groundwater flow directions based on groundwater elevation data and well-specific flow direction data.

- Attachment A.4 provides an analysis of the 1997 non-uranium FRL exceedances both inside and outside the 10-year, uranium-based restoration footprint.

- Attachment A.5 provides detailed data from the miscellaneous, compliance-based monitoring activities in 1997 (i.e., the KC-2 Warehouse Monitoring Program and the Coal Pile Basin Runoff Monitoring Program).

- Attachment A.6 discusses 1997 activities associated with the On-Site Disposal Facility Monitoring Program.

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Attachment A.1

ATTACHMENT A.1

SOUTH PLUME OPERATIONAL PERFORMANCE

ATTACHMENT A.1

The South Plume Extraction System, also referred to as the South Plume Removal Action System, was operated in the four-well, 1,400 gallons per minute (gpm) target pumping configuration during most of 1997 until the first week of November. The pumping rate on Extraction Well 3927 (RW-4) was increased from 400 gpm to 500 gpm on November 6, 1997, to maximize the eastern extent of the capture zone. This 100 gpm pumping rate increase equates to 1,500 gpm for the four-well system. The system will continue to operate at the 1,500 gpm pumping rate until after the South Field Extraction (Phase I), South Plume Optimization, and Re-Injection Demonstration modules begin operating later in 1998, when it is anticipated that capture of the northeastern lobe of the total uranium plume will be confirmed.

A map showing the South Plume Extraction Wells and the IEMP monitoring wells in the area of the South Plume is shown in Figure A.1-1.

During 1997, 645.6 million gallons of groundwater were pumped by the four wells in the South Plume Removal Action System and 88.6 pounds of total uranium were removed from the Great Miami Aquifer. The system continued to meet the primary objective of preventing further southward movement of the total uranium plume and, in the process, the main lobe of the South Plume was within the capture zone imposed by the system. Additional details concerning the capture zone, along with supporting data, are presented in Attachment A.3.

Individual extraction well performance data are provided in Tables A.1-1 through A.1-4. A month-to-month breakdown of average pumping rates, total pumping rates, total water pumped, quantity of water treated, and total uranium concentration data are given in Table A.1-5. In preparing these tables, only individual extraction well or system outages of 24 hours or greater are specifically identified in the footnotes.

The total uranium concentration data for each extraction well since system start-up in 1993 through 1997 are shown in Figures A.1-2 through A.1-5. The total uranium concentrations depicted in these figures are reflective of the position of each of the extraction wells with respect to the total uranium plume. Extraction Well 3924 (RW-1) is located within the plume; during 1997, Extraction

Well 3924 (RW-1) continued to show total uranium concentrations just above 40 micrograms per liter (μg/L) (Figure A.1-2). Extraction Well 3925 (RW-2) is also within the total uranium plume and displayed an upward trend during 1997 with total uranium concentrations rising to 33 μg/L in the latter portion of the year (Figure A.1-3). Extraction Well 3926 (RW-3) displayed a 1997 year-end total uranium concentration of 13 μg/L indicating a continued rise during the year as the plume front is drawn to the well (Figure A.1-4). Extraction Well 3927 (RW-4) continues to extract groundwater with low total uranium concentrations (1997 average of 1.2 μg/L) ahead of the total uranium plume (Figure A.1-5). The primary purpose of continuing to pump this well is to maintain capture (to the degree possible with the existing system) of the northeast lobe of the total uranium plume during interim construction of remaining portions of the South Plume remedy.

Average monthly system total uranium concentration data and a graph of system efficiency (pounds of total uranium removed per million gallons pumped) are shown in Figures A.1-6 and A.1-7, respectively. Since daily pumping rate data for each extraction well for the fourth quarter of 1997 was presented for the first time in the Integrated Environmental Monitoring Status Report for Fourth Quarter 1997 (DOE 1998a), those plots have not been repeated here. Daily pumping rate data will continue to be reported quarterly throughout 1998; annual plots of daily pumping rate data will be presented in the 1998 Integrated Site Environmental Report to be issued in June 1999.

Operating highlights for 1997 included:

- Preventative maintenance procedures were revised and schedules were put in place for maintenance to address iron fouling of flow control valves which accounted for 35 days of individual well outages during 1997.

- Extraction Well 3924 (RW-1) was out of service for 17 days in October for well rehabilitation per the preventive maintenance schedules and procedures outlined in Appendix A of the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment Project (DOE 1997d). Detailed extraction well performance data are provided in Table A.1-1.

- Extraction Well 3925 (RW-2) was out of service for 81 days for well rehabilitation. The unexpected delay in rehabilitating Extraction Well 3925 (RW-2) resulted in the procedure revisions mentioned above so that future well rehabilitation activities will be initiated sooner. Detailed extraction well performance data are provided in Table A.1-2.

- The entire South Plume Extraction System was out of service only two days during 1997 (October 18 and 19) due to maintenance activities on the back pressure control valve.

- The target pumping rate for Extraction Well 3927 (RW-4) was increased from 400 gpm to 500 gpm on November 6, 1997 to maximize capture of the northeastern lobe of the total uranium plume. Additional information concerning this change and the resulting change in the capture zone are provided in Attachment A.3.

As in previous years, PRRS constituents of concern (arsenic, phosphorus, potassium, sodium, and volatile organic compounds) were monitored during 1997 at 12 monitoring well locations immediately south of the South Plume Extraction System to ensure that the operation of the system does not adversely impact the PRRS plume. The 12 wells monitored are 2128, 2548, 2625, 2636, 2898, 2899, 2900, 3128, 3636, 3898, 3899, and 3900 (Figure A.1-1).

Consistent with previous reporting, the Mann-Kendall test for trend was run on PRRS data collected from these wells since the South Plume Extraction System began operating in 1993. The Mann-Kendall test evaluates trends in the data by examining time-ordered data pairs then assigning a value of -1, 0, or 1 for decreases in concentrations, no change in concentrations, or increases in concentrations, respectively. The assigned values are summed for all time pairs to determine if any trend is present in the data and if so, whether the trend is up or down.

The significance of the up or down trend is evaluated by considering the probability of such an arrangement of data points occurring by random chance. A probability of 0.05 or less that the time-ordered data pairs could have occurred by chance is designated as a significant trend (up or down). A probability greater than 0.05 but less than or equal to 0.10 is designated as a marginal trend. A data set with a probability greater than 0.10 is designated as showing no trend.

As indicated in Table A.1-6, four wells monitored for PRRS constituents of concern had "Up, Significant" trends based on the Mann-Kendall test for trend:

- Consistent with the South Plume Removal Action DMEPP System Evaluation Report issued in September 1997, "Up, Significant" trends continue to be observed for phosphorus in Monitoring Wells 2898 and 2899, which are east and south of the extraction system.

- The phosphorus concentration in Monitoring Well 2898 decreased from a high of 1.05 milligrams per liter (mg/L) during the third quarter to 0.025 mg/L for the fourth quarter (Figure A.1-8). The phosphorus concentration in Monitoring Well 2899, which is west of Monitoring Well 2898, increased from 0.02 mg/L during the third quarter to 0.11 mg/L during the fourth quarter (Figure A.1-9). If the "Up, Significant" trends are related in these two monitoring wells, the phosphorus would have to be traveling from east to west towards the PRRS plume. These trends are not believed to be problematic at this time because the wells are over 1,000 feet north of the PRRS with several monitoring wells in between that exhibit no indications of increasing trends for phosphorus (i.e. Monitoring Wells 2625, 2128, and 2636; Figures A.1-10, A.1-11, and A.1-12, respectively). Furthermore, concentrations from the most recent quarter of sampling at both monitoring wells are below the 95th percentile groundwater background concentration of 0.954 mg/L for phosphorus, as reported in the site background report, Characterization of Background Water Quality for Streams and Groundwater (DOE 1994).

- Monitoring Well 2625 had an "Up, Significant" trend for potassium for the first time during 1997. Previously, data from this well indicated only an "Up, Marginal" trend. While the calculated trend is "Up, Significant" for this well, the maximum potassium concentration was observed during the second quarter of 1996 and concentrations have been less than this during the previous 18 months. A graph of the potassium concentration data versus time for this well is shown in Figure A.1-13 and indicates that the magnitude of variation in concentrations from sample to sample is significantly larger than the overall apparent upward drift in concentrations.

- Monitoring Well 2899 had an "Up, Significant" trend for potassium with a concentration increasing slightly from 3.8 mg/L in the third quarter to 4.0 mg/L in the fourth quarter. While the 4.0 mg/L concentration for potassium is above the 95th percentile value of 1.96 mg/L for background, examination of the graph of potassium concentration data versus time for this well, shown in Figure A.1-14, indicates that the "Up, Significant" statistical trend is questionable.

Although the monitoring activity for PRRS constituents of concern also included volatile organic compounds, only toluene was detected once in 1997 at Monitoring Well 3900. There were no other volatile organic compounds detected. The one toluene detection was reported in the September 1997 South Plume Removal Action DMEPP System Evaluation Report. As stated on page 3-7 of that report, a similar result was reported for 1996 in the April 1997 South Plume Removal Action DMEPP System Evaluation Report (DOE 1997f) for Monitoring Well 3636. Because Monitoring Well 3900 is approximately 500 feet north of Monitoring Well 3636, and up-gradient with respect to groundwater flow, the two positive results for toluene are probably not related. Furthermore, because Monitoring Well 2900, which is at the same location as Monitoring Well 3900, did not test positive for toluene, the detected toluene at Monitoring Well 3900 is believed to be a false positive.

TABLE A.1-1

EXTRACTION WELL 3924 (RW-1)
OPERATIONAL SUMMARY SHEET FOR 1997

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

Hours in reporting period - 8,760 Hours pumped - 7,940 Target pumping rate - 300 gpm
Hours not pumped - 820 Operational percent - 90.6

Monthly Measurements at Wellfield				
Month	Average Monthly Pumping Rate (gpm)	Million Gallons Pumped	Monthly Uranium Concentration (μg/L)	Well Efficiency (lbs/M gal)
1/97[a]	262	11.7	41	0.34
2/97[b]	224	9.0	47	0.39
3/97	309	13.8	41	0.34
4/97[c]	285	12.3	42	0.35
5/97[c]	280	12.5	NS[d]	NA[d]
6/97	298	12.8	41	0.34
7/97	286	12.8	44	0.37
8/97	286	12.8	45	0.38
9/97[e]	274	11.8	42	0.35
10/97[f]	137	6.1	NS[d]	NA[d]
11/97	295	12.8	42	0.35
12/97	308	13.7	47	0.39
	Average 270	Total 142.1	Average 43	Average 0.36

[a]Extraction well was out of service for four days due to malfunctioning flow control valve attributed to iron fouling.
[b]Extraction well was out of service for three days due to malfunctioning flow control valve attributed to iron fouling.
[c]Extraction well out of service for one day due to malfunctioning flow control valve attributed to iron fouling.
[d]NS = not sampled. No sample collected for monthly uranium analysis because extraction well was inoperative at the time of scheduled sampling. Therefore, well efficiency could not be calculated; NA = not applicable.
[e]Extraction well was out of service for two days due to well screen maintenance.
[f]Extraction well was out of service for 17 days due to well rehabilitation.

TABLE A.1-2

EXTRACTION WELL 3925 (RW-2)
OPERATIONAL SUMMARY SHEET FOR 1997

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

Hours in reporting period - 8,760 Hours pumped - 6,068 Target pumping rate - 300 gpm
Hours not pumped - 2,692 Operational percent - 69.3

Monthly Measurements at Wellfield				
Month	Average Monthly Pumping Rate (gpm)	Million Gallons Pumped	Monthly Uranium Concentration (μg/L)	Well Efficiency (lbs/M gal)
1/97[a]	164	7.3	NS[b]	NA[b]
2/97[a]	0	0	NS[b]	NA[b]
3/97[a]	0	0	NS[b]	NA[b]
4/97[a]	186	8.0	28	0.23
5/97[c]	32	1.4	NS[b]	NA[b]
6/97	303	13.1	29	0.24
7/97	293	13.1	30	0.25
8/97	291	13.0	32	0.27
9/97[d]	295	12.7	33	0.28
10/97[e]	336[f]	15.0	32	0.28
11/97	305	13.2	33	0.28
12/97	295	13.2	33	0.28
Average	250	Total 110.0	Average 31	Average 0.26

[a]Extraction well was out of service for 81 days for well rehabilitation.
[b]NS = not sampled. A sample was not collected for monthly uranium analysis because extraction well was inoperative at the time of scheduled sampling. Therefore, well efficiency could not be calculated; NA = not applicable.
[c]Extraction well was out of service for 27 days for installation of pump/motor assembly.
[d]Extraction well was out of service for one day due to well screen maintenance.
[e]Extraction well was out of service for two days due to back pressure control valve maintenance.
[f]Pumping rate temporarily increased to 400 gpm to maintain capture during the 17 day interval that RW-1 was out of service.

TABLE A.1-3

EXTRACTION WELL 3926 (RW-3)
OPERATIONAL SUMMARY SHEET FOR 1997

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

Hours in reporting period - 8,760 Hours pumped - 7,601 Target pumping rate - 400 gpm
Hours not pumped - 1159 Operational percent - 86.8

Monthly Measurements at Wellfield				
Month	Average Monthly Pumping Rate (gpm)	Million Gallons Pumped	Monthly Uranium Concentration (μg/L)	Well Efficiency (lbs/M gal)
1/97[a]	362	16.2	9.9	0.08
2/97	404	16.3	9.4	0.08
3/97	499	22.3	8.6	0.07
4/97[b]	256	11.1	12	0.10
5/97[c]	101	4.5	14	0.12
6/97	399	17.2	11	0.09
7/97	387	17.3	11	0.09
8/97	387	17.3	11	0.09
9/97[d]	400	16.3	12	0.10
10/97[e]	401	16.7	12	0.10
11/97[f]	398	16.3	12	0.10
12/97	408	17.5	13	0.11
Average	367	Total 189.0	Average 11	Average 0.09

[a]Extraction well was out of service for five days due to malfunctioning flow control valve attributed to iron fouling.
[b]Extraction well was out of service for 14 days due to malfunctioning flow control valve attributed to iron fouling.
[c]Extraction well was out of service for 23 days due to a clogged pump intake screen.
[d]Extraction well was out of service for one day due to well screen maintenance.
[e]Extraction well was out of service for two days for back pressure control valve maintenance.
[f]Extraction well was out of service for two days for pump and motor replacement.

TABLE A.1-4

EXTRACTION WELL 3927 (RW-4)
OPERATIONAL SUMMARY SHEET FOR 1997

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

Hours in reporting period - 8,760 | Hours pumped - 8,212 | Target pumping rate[a] - 400, 500 gpm
Hours not pumped - 548 | Operational percent - 93.7

Monthly Measurements at Wellfield				
Month	Average Monthly Pumping Rate (gpm)	Million Gallons Pumped	Monthly Uranium Concentration (μg/L)	Well Efficiency (lbs/M gal)
1/97[b,c]	216	9.6	1.2	0.01
2/97[d]	346	13.9	1.3	0.01
3/97	393	17.6	1.2	0.01
4/97[e]	374	16.2	1.3	0.01
5/97	398	17.7	NS[f]	NA[f]
6/97	402	17.3	1.2	0.01
7/97	384	17.2	1.2	0.01
8/97	386	17.3	1.2	0.01
9/97[g]	388	16.7	1.2	0.01
10/97[h]	380	17.0	1.1	0.01
11/97	485[a]	20.9	1.2	0.01
12/97	502	22.4	1.2	0.01
	Average 388	Total 203.8	Average 1.2	Average 0.01

[a]Target pumping rate increased from 400 to 500 gpm on November 6 to maximize capture of eastern lobe.
[b]Extraction was out of service for eight days in 1997 due to well rehabilitation which was initiated in 1996.
[c]Extraction well was out of service for four days due to malfunctioning flow control valve attributed to iron fouling.
[d]Extraction well was out of service for four days due to malfunctioning flow control valve attributed to iron fouling.
[e]Extraction well was out of service for one day due to malfunctioning flow control valve attributed to iron fouling.
[f]NS = not sampled. A sample was not collected for monthly uranium analysis because extraction well was inoperative at the time of scheduled sampling. Therefore, well efficiency could not be calculated; NA = not applicable.
[g]Extraction well was out of service for one day due to well screen maintenance.
[h]Extraction well was out of service for two days due to back pressure control valve maintenance.

TABLE A.1-5

WELL FIELD OPERATIONAL SUMMARY SHEET JANUARY 1, THROUGH DECEMBER 31, 1997

Total gallons pumped this reporting period (M gal) - 645.6
Total uranium removed this reporting period (lbs) - 88.6
Average system efficiency this reporting period (lbs/M gal) - 0.14
Gallons pumped from August 1993 to December 1997 (billion gal) - 2.8
Total uranium removed from August 1993 to December 1997 (lbs) - 388.9
System efficiency from August 1993 to December 1997 (lbs/M gal) - 0.14

Monthly Measurements at Storm Water Retention Basin Valve House

Month	Average Monthly Well Pumping Rates (gpm) RW-1 3924	RW-2 3925	RW-3 3926	RW-4 3927	Total System Pumping Rate (gpm)	Water Pumped from Recovery Wells (M gal)	Water Treated from Recovery Wells (M gal)	Percent Treated[a]	Total Uranium Concentration from South Plume System (μg/L)[b] Min.	Max.	Avg.
1/97	262	164	362	216	1004	44.8	21.2	47.3	12.6	38.1	18.9
2/97	224	0	404	346	974	39.3	15.8	40.2	2.4	20.7	11.5
3/97	309	0	499	393	1201	53.7	16.4	30.5	3.2	21.0	13.1
4/97	285	186	256	374	1101	47.6	31.6	66.4	6.3	71.9	18.7
5/97	280	32	101	398	811	36.2	16.2	44.8	8.0	47.4	16.4
6/97	298	303	399	402	1402	60.4	23.4	38.7	9.2	30.7	16.7
7/97	286	293	387	384	1350	60.3	46.1	76.4	10.1	20.7	16.6
8/97	286	291	387	386	1350	60.4	25.0	41.4	10.0	21.1	16.2
9/97	274	295	400	388	1357	57.5	37.1	64.5	10.4	28.2	17.2
10/97	137	336	401	380	1254	55.4	36.7	66.2	12.0	21.1	15.9
11/97	295	305	398	485	1483	63.2	40.4	63.9	9.0	20.8	16.5
12/97	308	295	408	502	1513	66.8	35.7	53.4	5.6	22.1	17.8
				Average	1233	Total 645.6	Total 345.6	Average 52.8			

[a]The amount of groundwater treated per month is variable based on site storm water treatment needs. In general, during months with low amounts of precipitation, more groundwater is treated. During months with higher precipitation, less groundwater is treated.
[b]These concentrations represent both the concentrations that are sent to treatment and to the outfall.

TABLE A.1-6

PADDYS RUN ROAD SITE GROUNDWATER SUMMARY STATISTICS AND TREND ANALYSIS

Constituent	Monitoring Well	Number of Samples[a,b,c]	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)	Trend[a,b,c,d]
Arsenic	2128	193	0.0006	0.19	0.014	0.023	Down, Significant
	2548	103	0.00065	0.35	0.027	0.040	No Significant Trend
	2625	185	0.005	0.05	0.01	0.009	No Significant Trend
	2636	158	0.01	0.1	0.04	0.02	No Significant Trend
	2898	19	0.00035	0.0063	0.0016	0.0014	No Significant Trend
	2899	18	0.00035	0.003	0.001	0.0008	No Significant Trend
	2900	191	0.0007	0.0548	0.005	0.005	Down, Significant
	3128	21	0.00085	0.234	0.014	0.051	No Significant Trend
	3636	20	0.0009	0.014	0.002	0.003	No Significant Trend
	3898	18	0.00095	0.0062	0.0023	0.0013	No Significant Trend
	3899	19	0.00035	0.003	0.001	0.009	No Significant Trend
	3900	19	0.0012	0.0045	0.0025	0.00099	No Significant Trend
Phosphorus	2128	29	0.090	16	2.3	3.3	Down, Significant
	2548	12	0.0855	5.4	1.7	1.5	Down, Marginal
	2625	19	0.307	12.3	2.98	3.31	No Significant Trend
	2636	18	9.6	170	92	51	No Significant Trend
	2898	20	0.005	1.05	0.097	0.23	**Up, Significant**
	2899	17	0.005	0.11	0.04	0.03	**Up, Significant**
	2900	19	0.07	0.96	0.5	0.3	Down, Significant
	3128	28	0.005	13	0.5	2	Up, Marginal
	3636	19	0.02	1.1	0.12	0.24	No Significant Trend
	3898	18	0.02	1.24	0.2	0.3	No Significant Trend
	3899	19	0.025	0.83	0.16	0.19	No Significant Trend
	3900	19	0.005	1.26	0.1	0.3	No Significant Trend
Potassium	2128	21	1.69	18	4.7	5.2	Down, Significant
	2548	12	1.36	40	10.1	10.4	No Significant Trend
	2625	19	0.64	6.26	3.3	1.8	**Up, Significant**
	2636	18	8.51	218	86.8	58.4	Down, Significant
	2898	20	2.5	5.05	3.8	0.61	No Significant Trend
	2899	18	1.36	4.42	3.49	0.675	**Up, Significant**
	2900	19	0.711	6	1.8	1.1	Down, Significant
	3128	21	1.79	3.7	2.6	0.56	Down, Significant
	3636	19	1.38	3.32	2.58	0.407	No Significant Trend
	3898	18	1.34	3.93	2.35	0.595	No Significant Trend
	3899	19	1.34	3.22	2.46	0.368	No Significant Trend
	3900	19	0.975	3.19	1.86	0.555	No Significant Trend
Sodium	2128	21	22.9	75.2	38.3	13.6	Down, Marginal
	2548	12	18.2	35	25	5.1	No Significant Trend
	2625	19	16.5	50.7	34.5	8.57	Down, Significant
	2636	18	28.3	79.9	52.5	14.2	Down, Significant
	2898	20	16	29.2	20	3.7	Down, Significant
	2899	18	11.2	22.9	17.3	3.64	No Significant Trend
	2900	19	18.1	43.3	30.9	7.99	No Significant Trend
	3128	21	4.32	13.4	7.65	3.34	Down, Significant
	3636	19	5.42	13	9.2	2.6	Down, Significant
	3898	18	7.29	14.6	9.04	1.83	No Significant Trend
	3899	19	6.24	12.1	8.90	1.58	Down, Marginal
	3900	19	4.45	10.8	6.47	2.04	Down, Significant

[a]The data are based on unfiltered samples from the OU5 RI/FS data set (1988 through 1993) and 1994 through 1997 groundwater data. However, the Mann-Kendall test for trend was performed on data from samples taken between August 1993 and the end of 1997 in order to determine the effect of the south plume pumping system.
[b]If 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]) and Mann-Kendall test for trend.
[c]Rejected data qualified with either a R or Z were not included in this count, the summary statistics, or Mann-Kendall test for trend.
[d]For results where the concentrations are below the detection limit, the results used in the summary statistics and Mann-Kendall test for trend are each set at half the detection limit.

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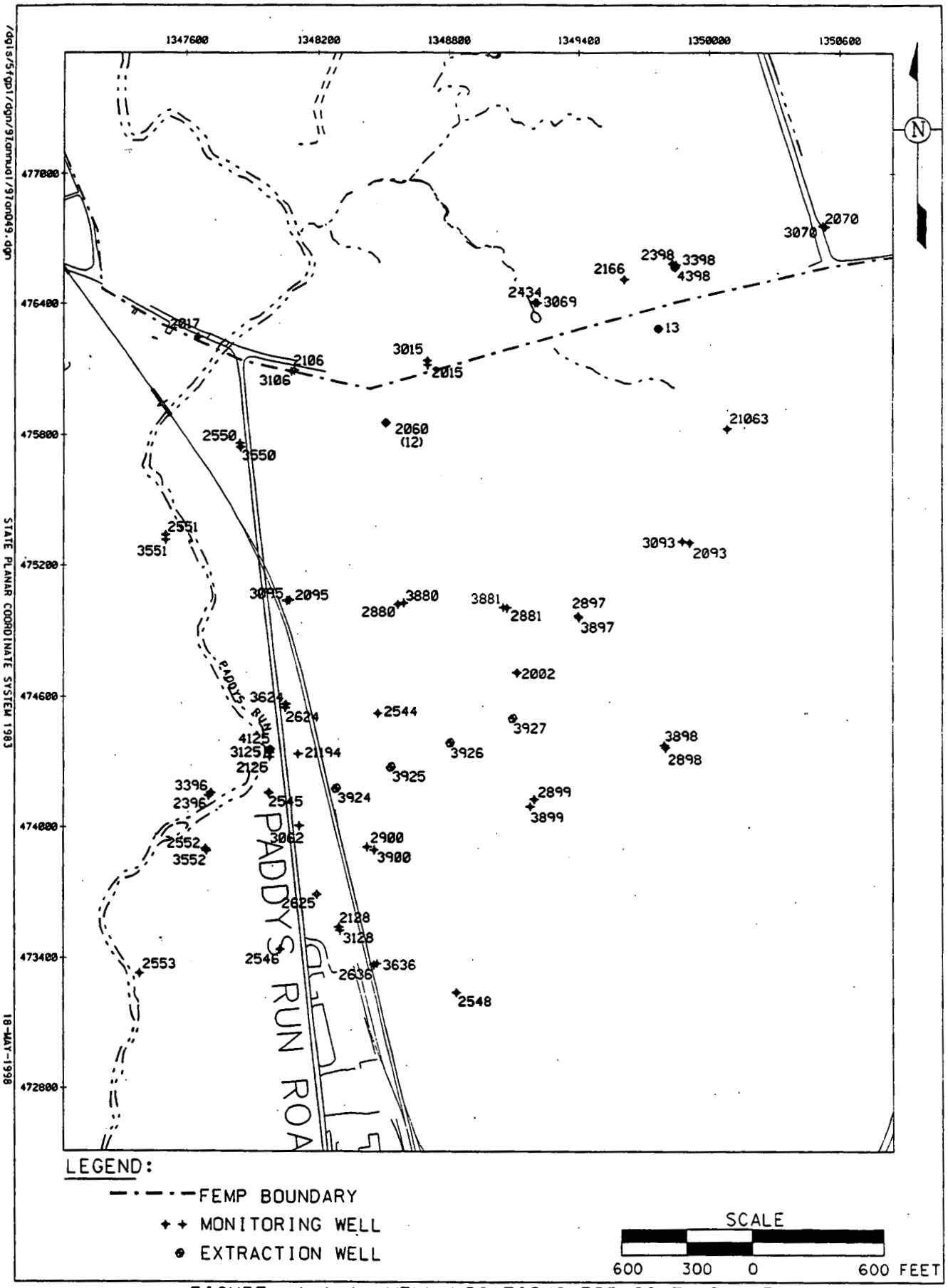


FIGURE A.1-1. WELL LOCATIONS FOR SOUTH PLUME AND PADDYS RUN ROAD SITE MONITORING ACTIVITES

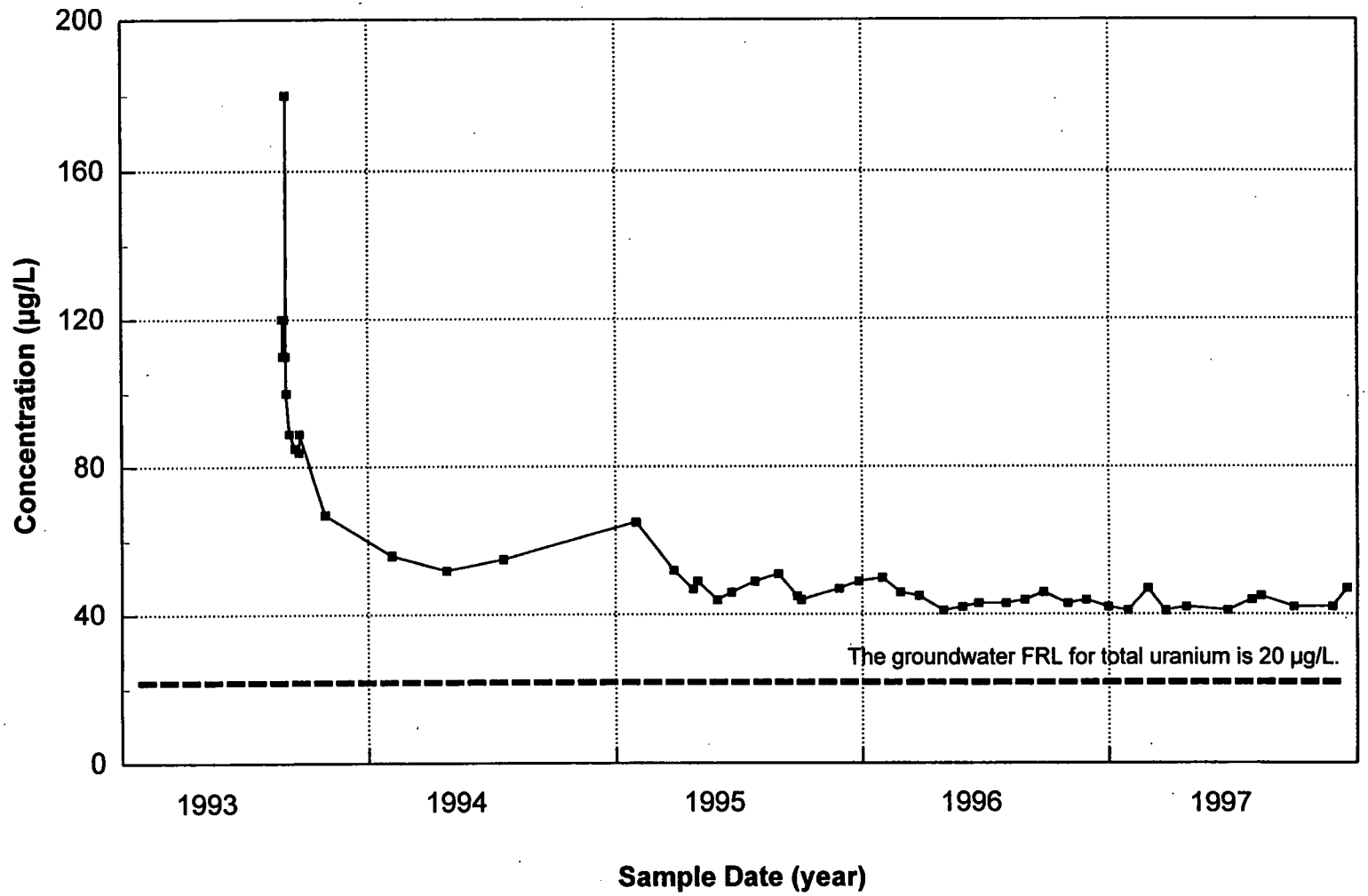


FIGURE A.1-2. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR EXTRACTION WELL 3924 (RW-1)

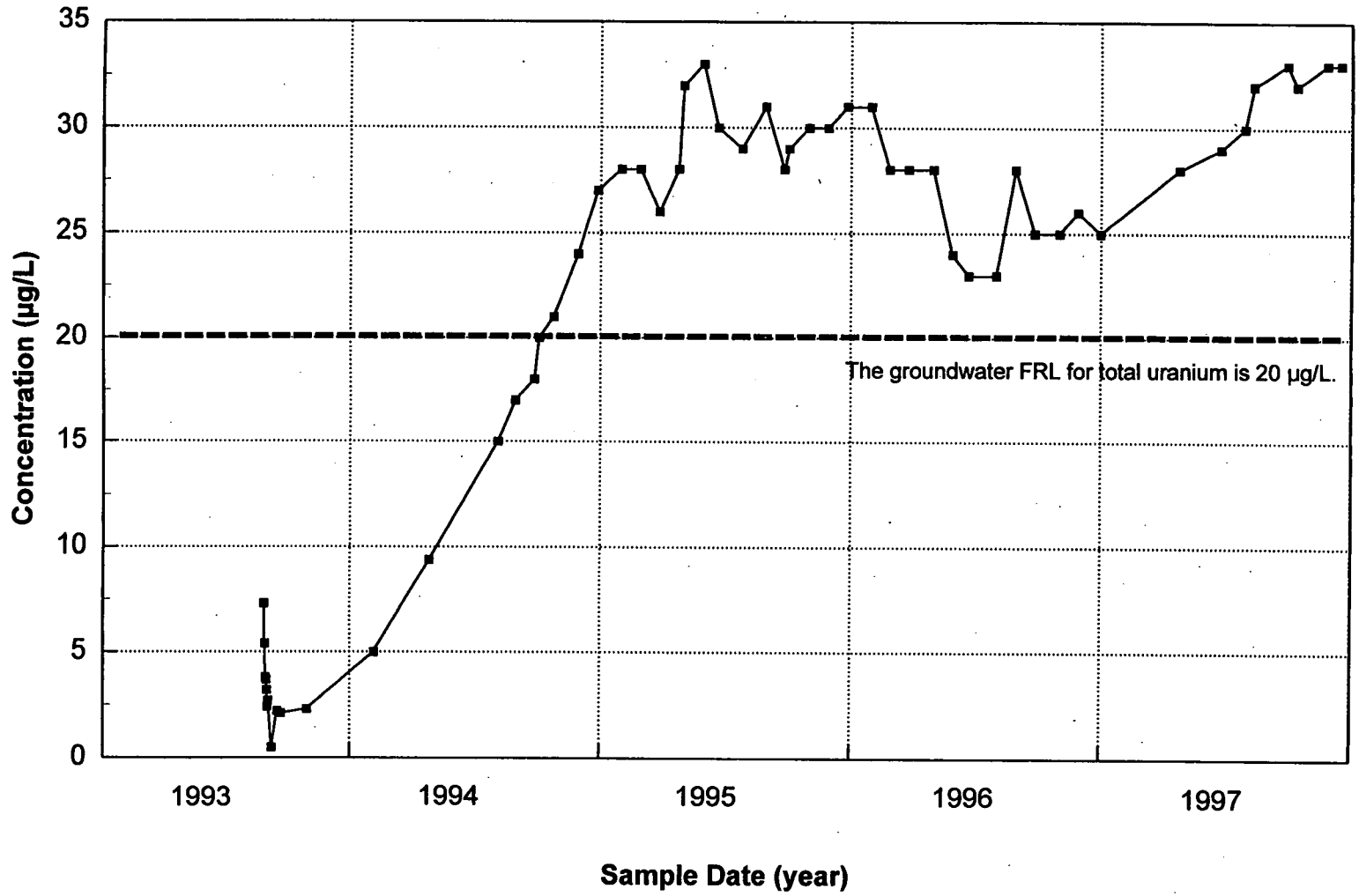


FIGURE A.1-3. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR EXTRACTION WELL 3925 (RW-2)

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

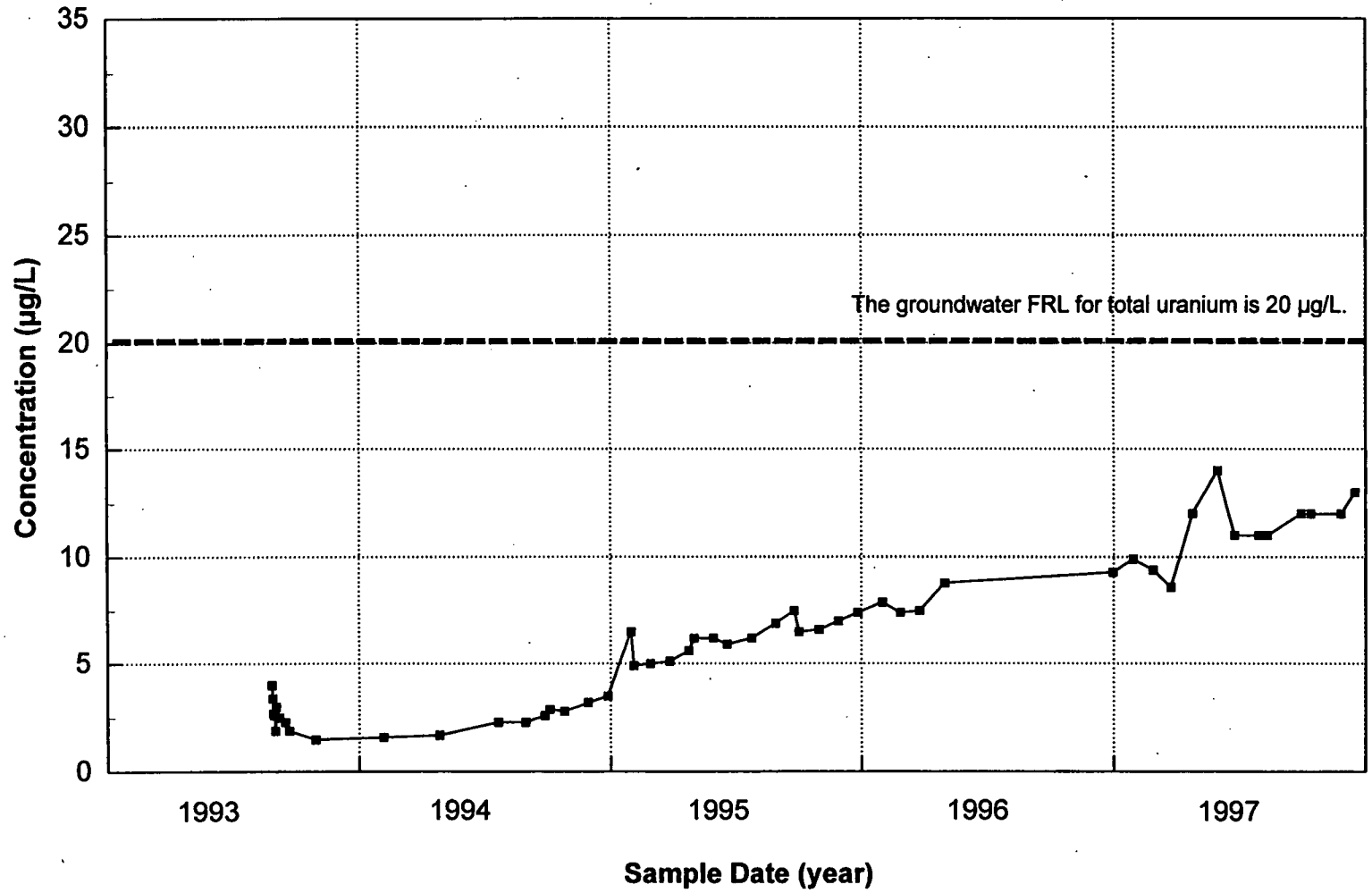


FIGURE A.1-4. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR EXTRACTION WELL 3926 (RW-3)

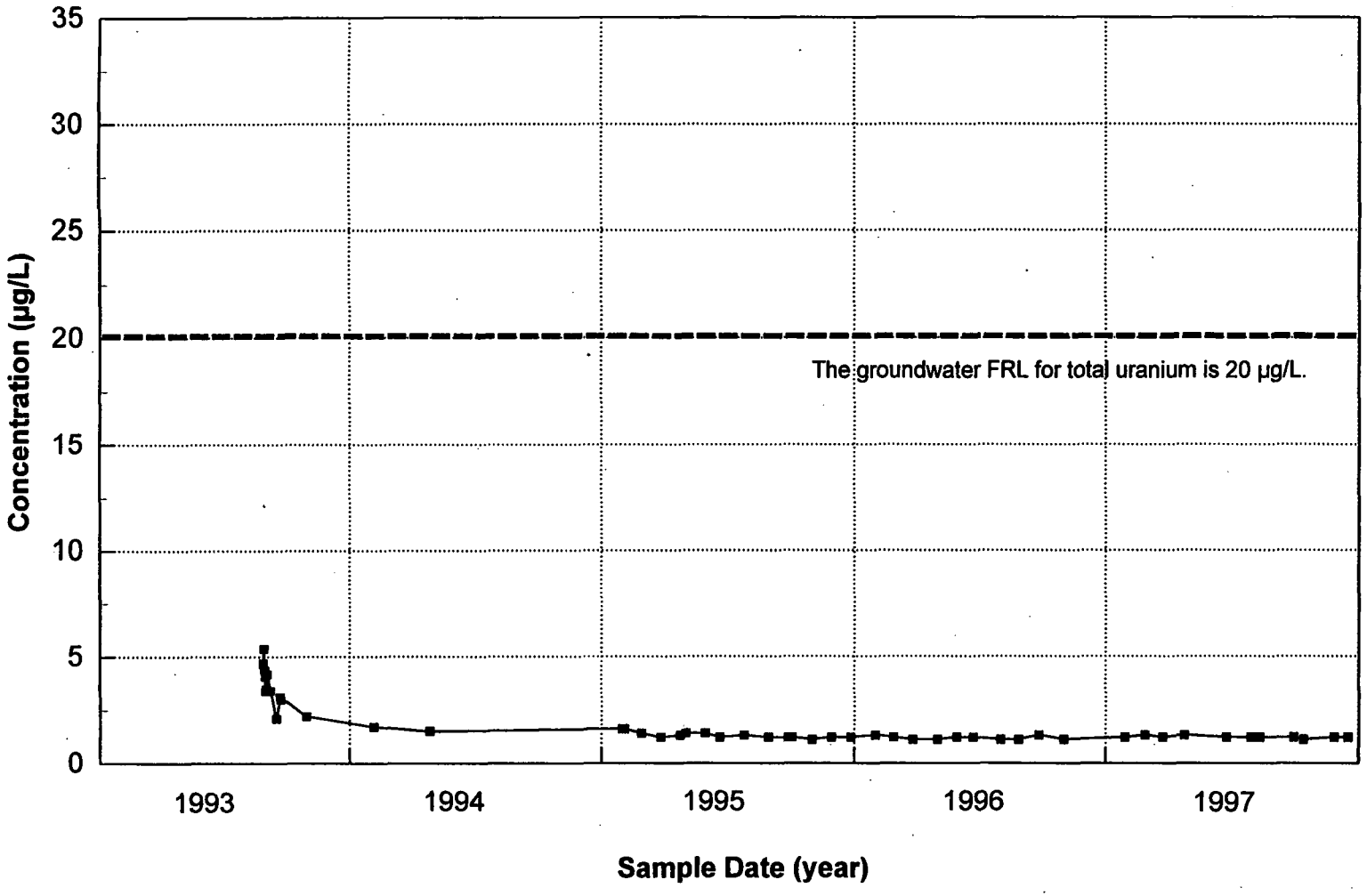


FIGURE A.1-5. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR EXTRACTION WELL 3927 (RW-4)

000163

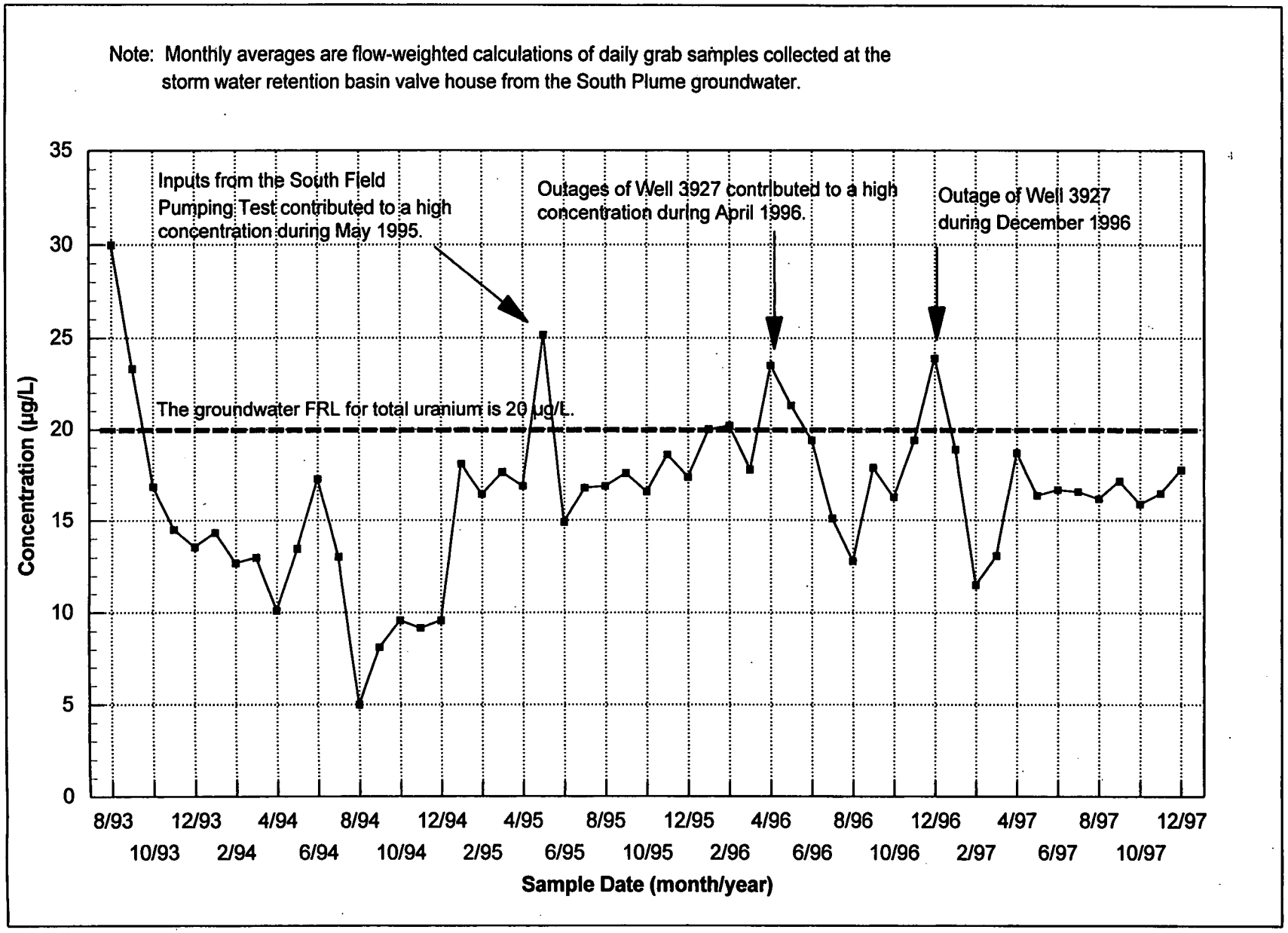


FIGURE A.1-6. AVERAGE MONTHLY TOTAL URANIUM CONCENTRATIONS IN EXTRACTED SOUTH PLUME GROUNDWATER, 8/93 - 12/97

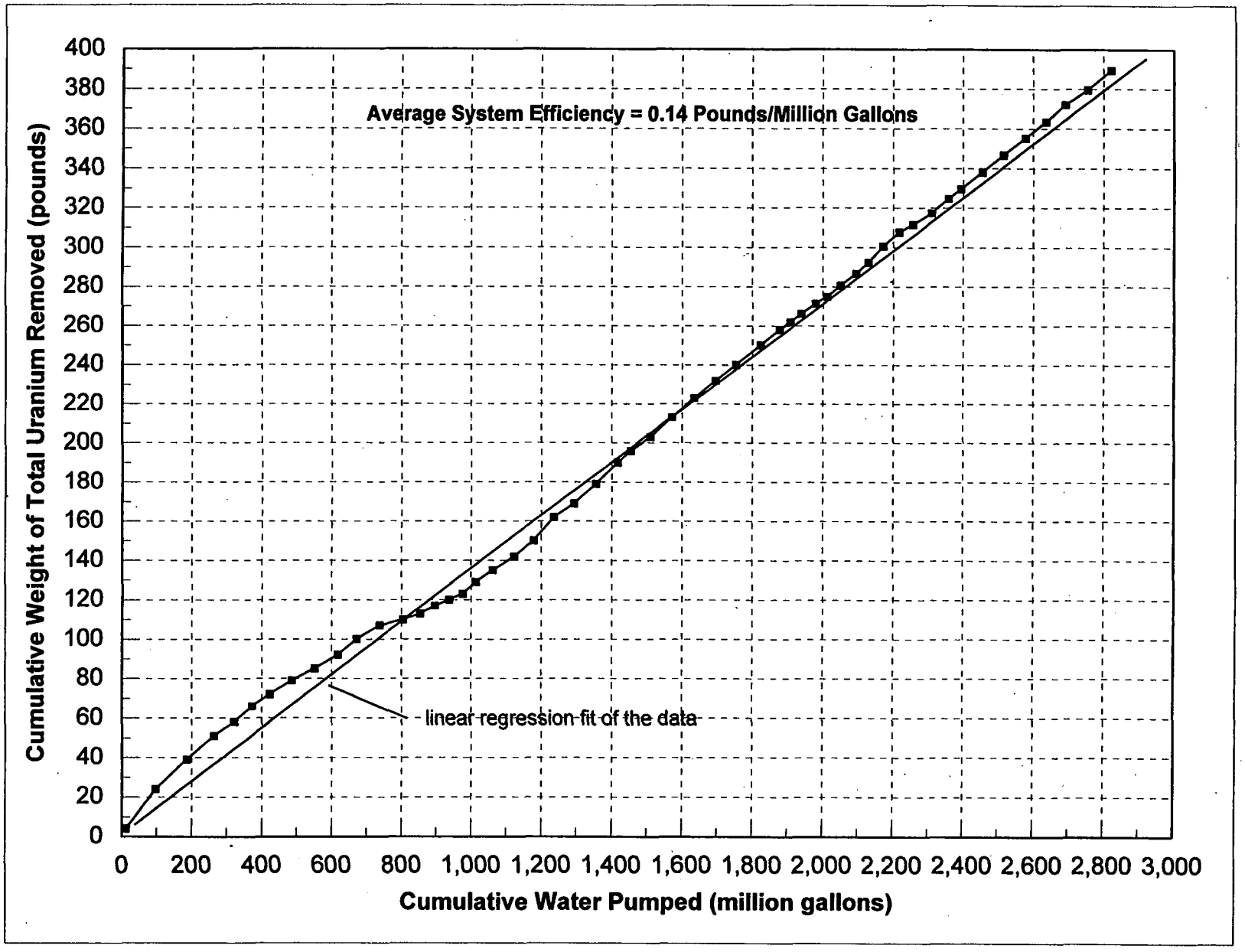


FIGURE A.1-7. CUMULATIVE TOTAL URANIUM REMOVED VERSUS CUMULATIVE WATER PUMPED FROM SOUTH PLUME WELLFIELD, 8/93 - 12/97

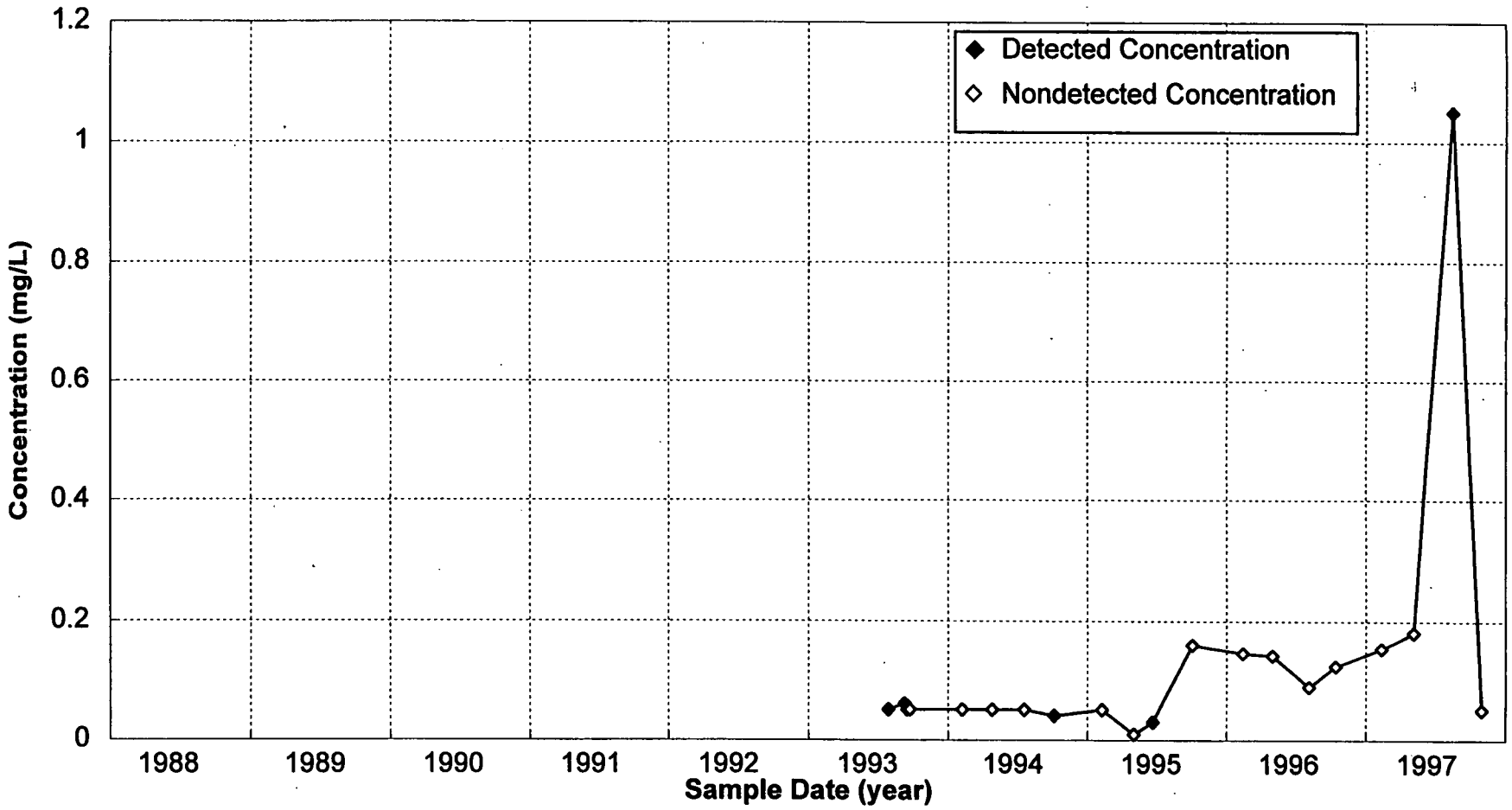


FIGURE A.1-8. PHOSPHORUS CONCENTRATION VS. TIME PLOT FOR WELL 2898

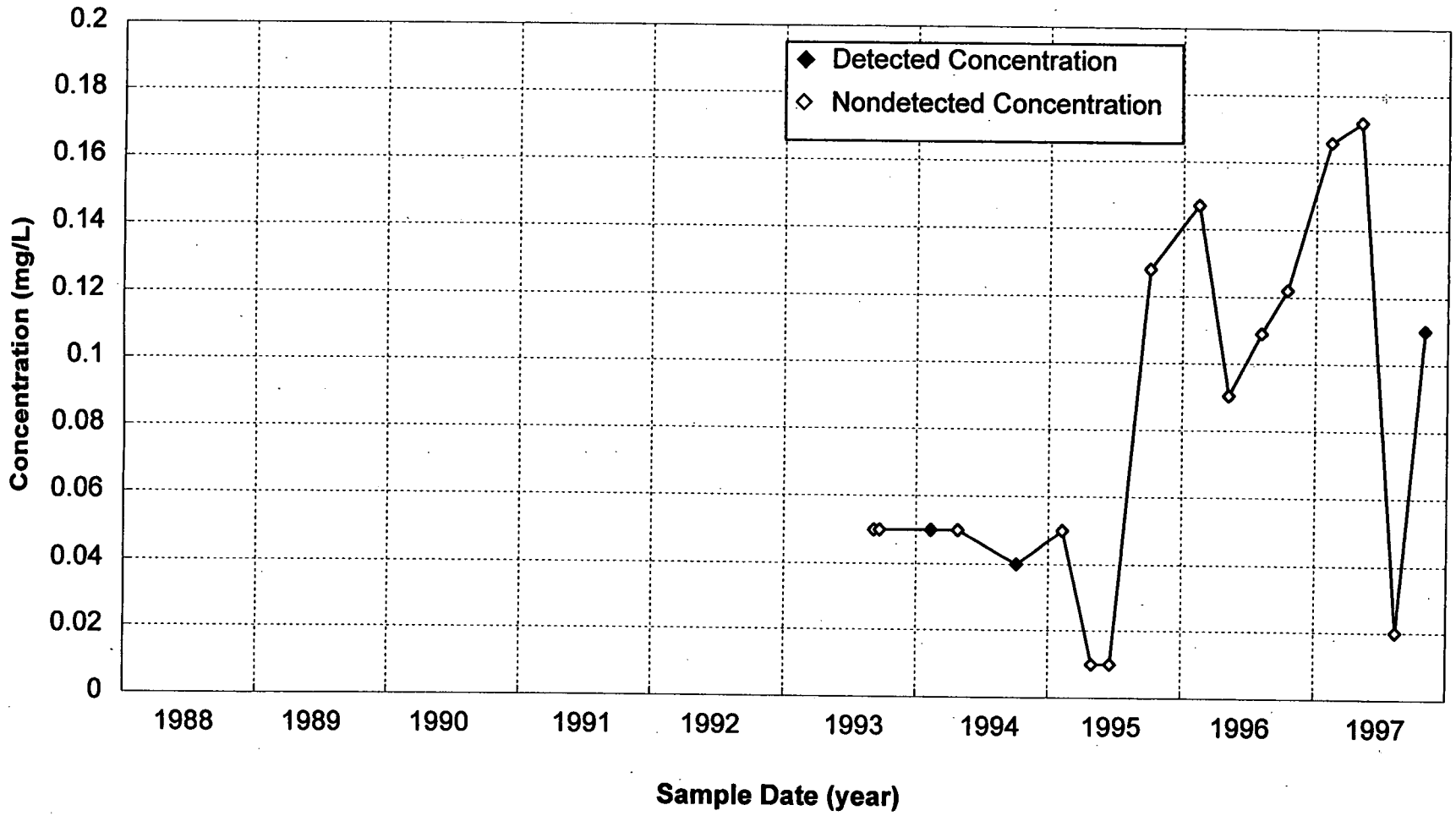


FIGURE A.1-9. PHOSPHORUS CONCENTRATION VS. TIME PLOT FOR WELL 2899

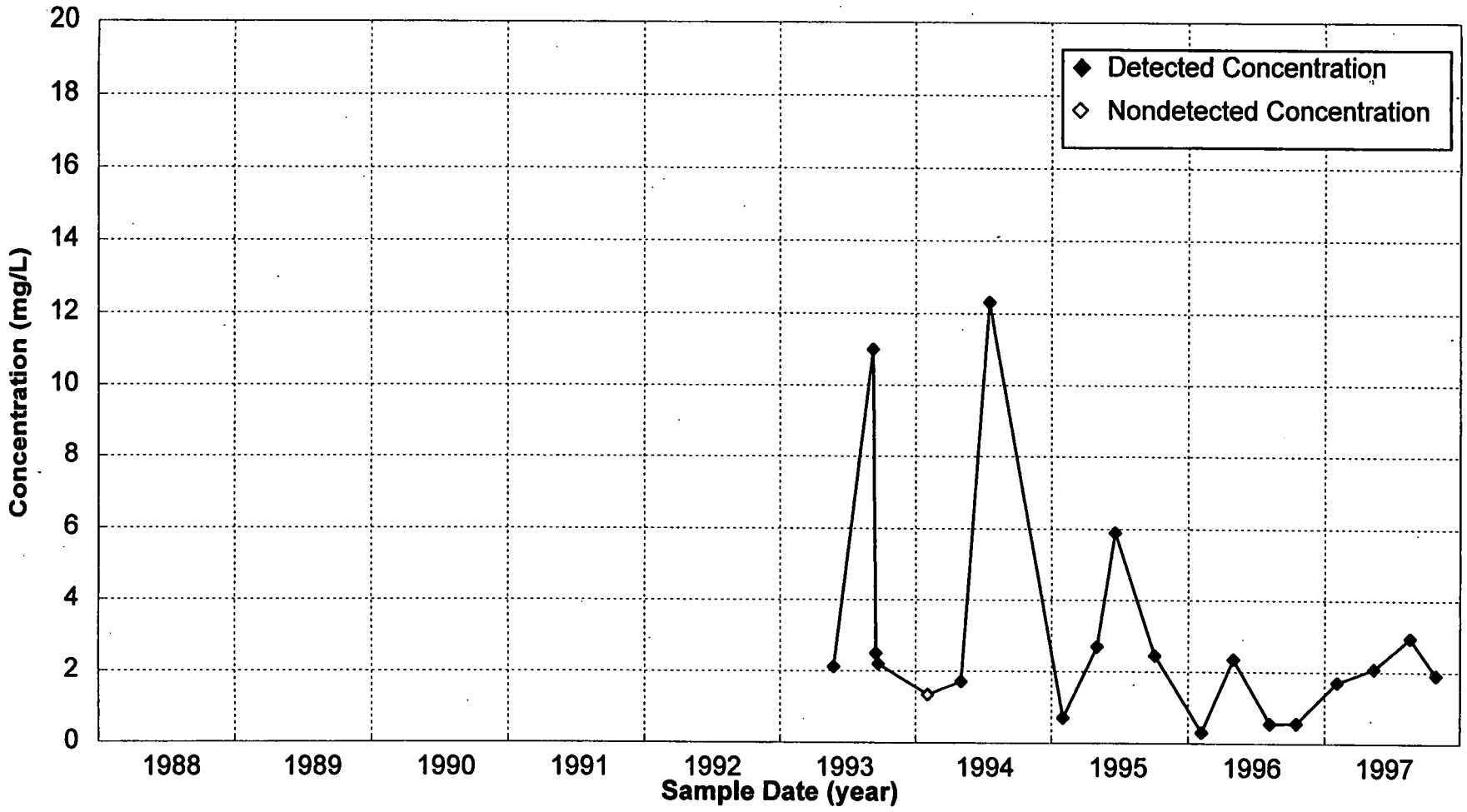


FIGURE A.1-10. PHOSPHORUS CONCENTRATION VS. TIME PLOT FOR WELL 2625

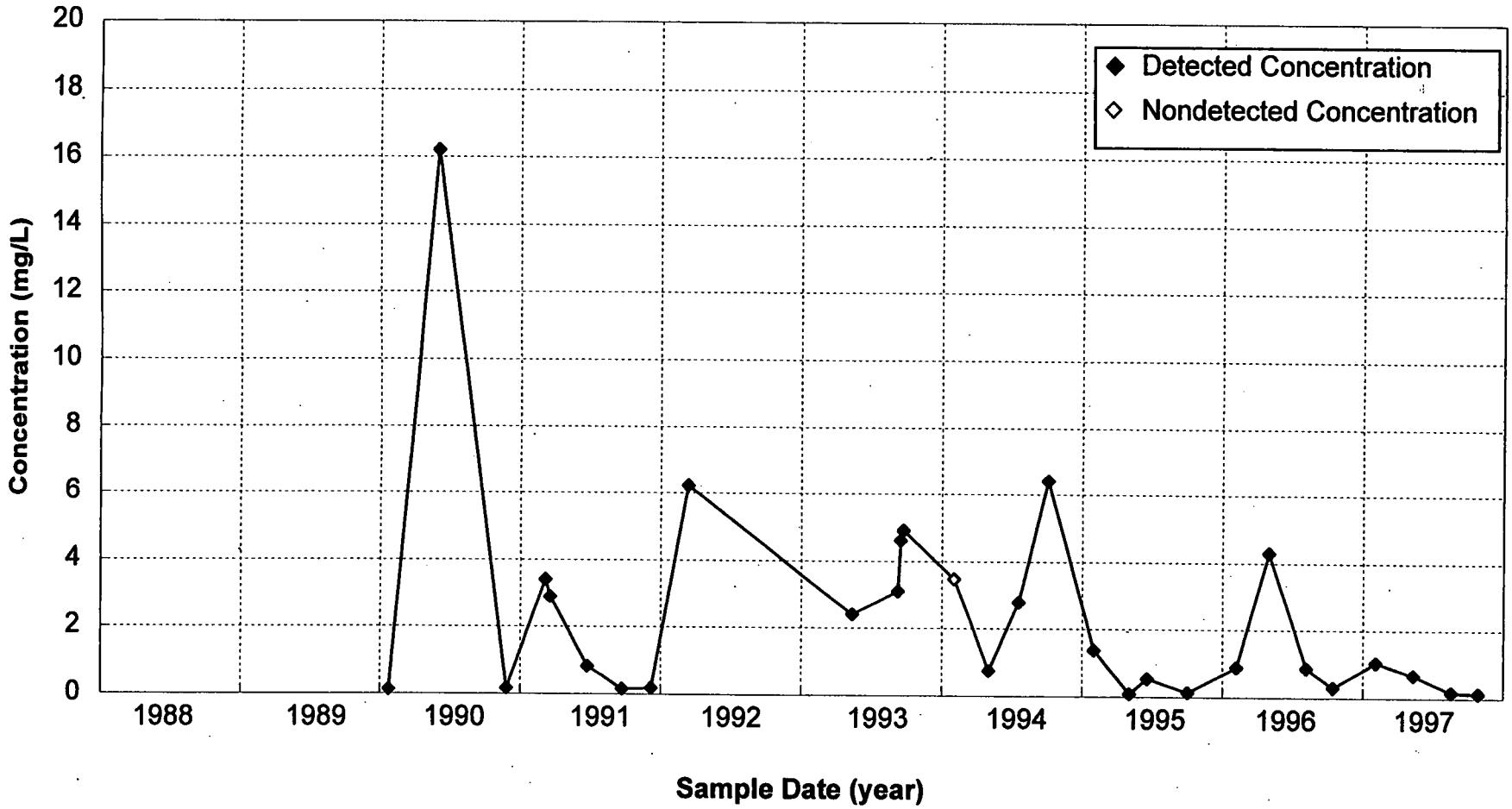


FIGURE A.1-11. PHOSPHORUS CONCENTRATION VS. TIME PLOT FOR WELL 2128

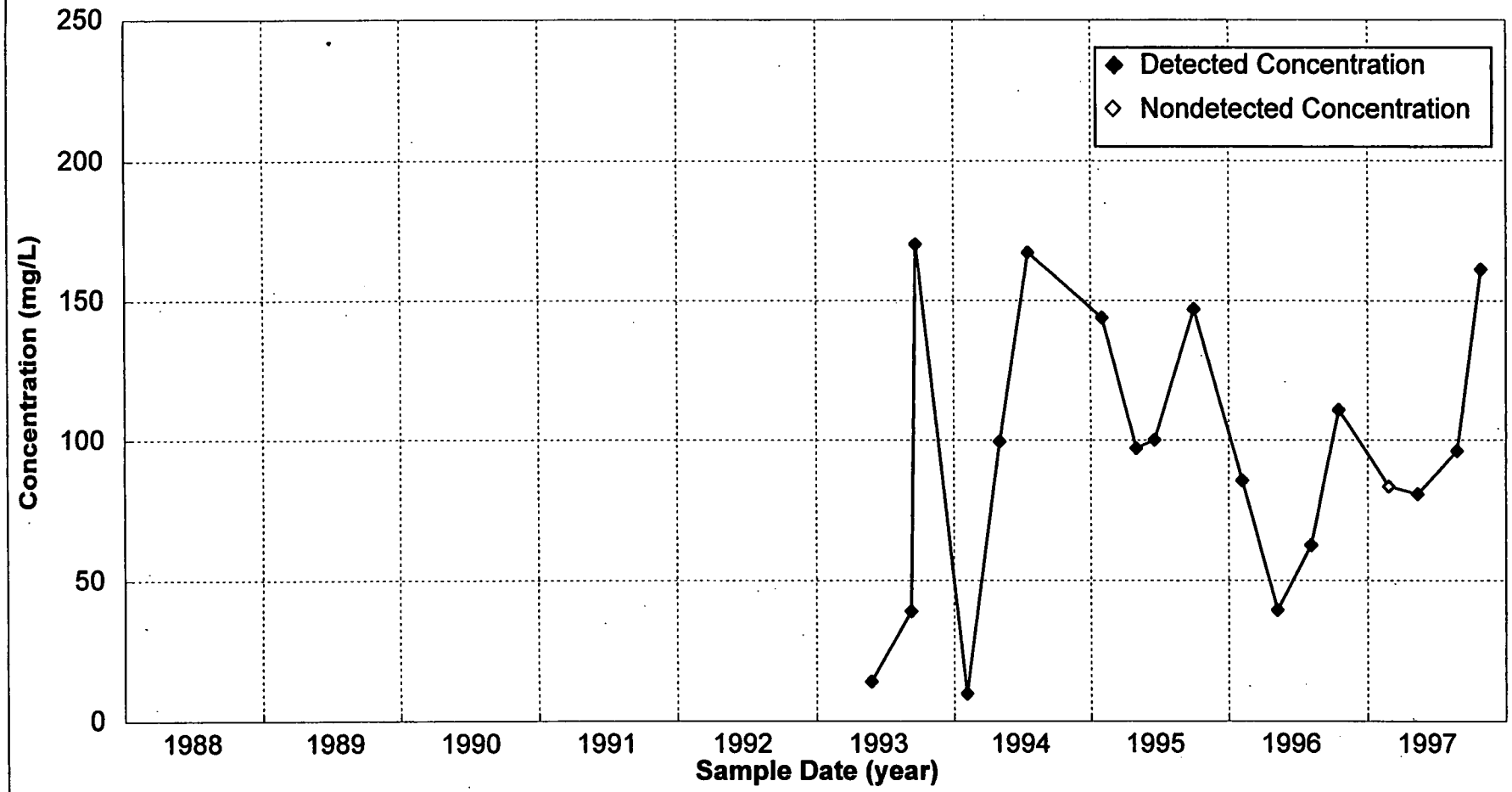


FIGURE A.1-12. PHOSPHORUS CONCENTRATION VS. TIME PLOT FOR WELL 2636

000169

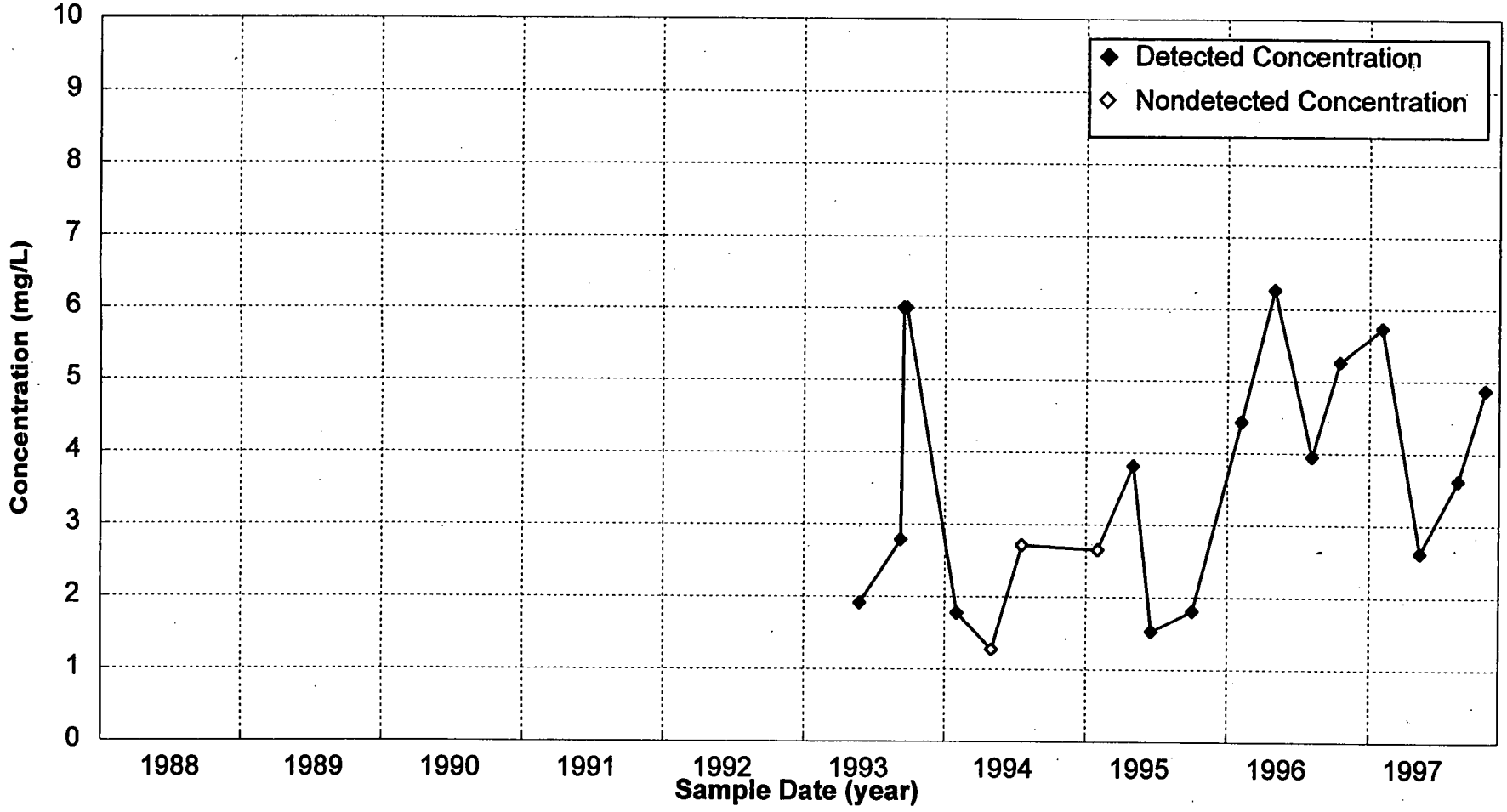


FIGURE A.1-13. POTASSIUM CONCENTRATION VS. TIME PLOT FOR WELL 2625

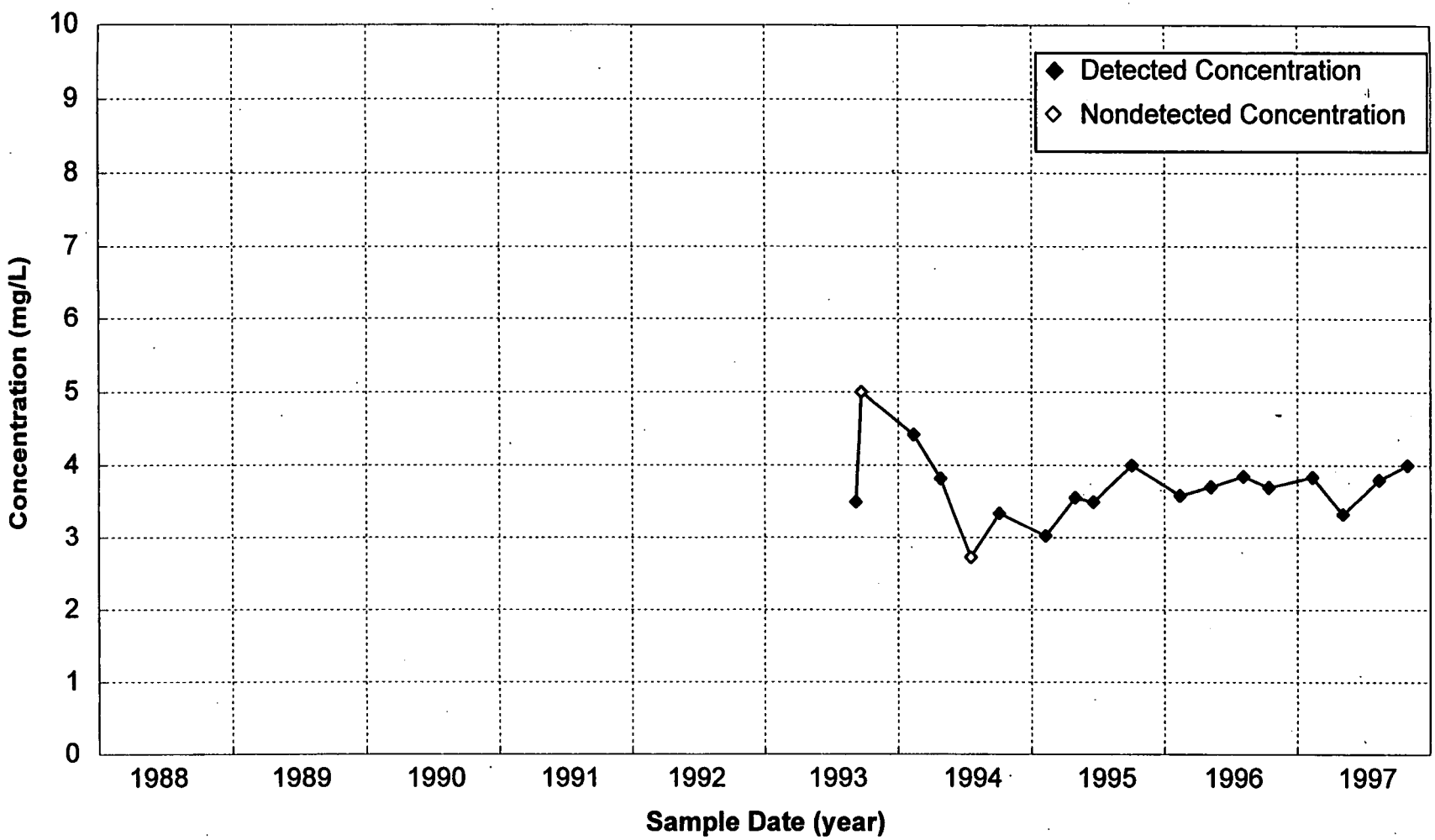


FIGURE A.1-14. POTASSIUM CONCENTRATION VS. TIME PLOT FOR WELL 2899

Attachment A.2

ATTACHMENT A.2

ASSESSMENT OF TOTAL URANIUM RESULTS

ATTACHMENT A.2

Table A.2-1 lists the monitoring wells where total uranium concentrations exceeded the 20 μg/L final remediation level (FRL) during 1997. Included in the table are statistical summaries for total uranium concentrations at each well and a calculated statistical trend for the data. Monitoring Well locations are shown in Figure A.2-1 and listed in numerical order in Table A.2-2 with the area designations from the map in Figure A.2-1.

All the monitoring wells presented in Table A.2-1 with confirmed total uranium FRL exceedances for 1997, are within the 10-year, uranium-based restoration footprint except Monitoring Well 2546. Monitoring Well 2546, which is south of the South Plume Extraction System and west of Paddys Run Road, had one total uranium sample result in May 1997 of 34 μg/L with "No Significant Trend" indicated from the Mann-Kendall test for trend. A similar sampling result was observed at this well in 1996 (Figure A.2-59). Subsequent sampling conducted throughout 1997 and preliminary results for 1998 indicate concentrations well below the 20 μg/L FRL for total uranium. This well is located within the PRRS plume (refer to the Remedial Investigation Report for Operable Unit 5 Plates E-77 and E-81 [DOE 1995c]). As discussed in the IEMP (Section 3.3.2 [DOE 1997c]), it was acknowledged in the Proposed Plan for Operable Unit 5 (DOE 1995b) that the U.S. Department of Energy's (DOE's) role and involvement in the Ohio Environmental Protection Agency's (OEPA's) ongoing assessment and/or cleanup of the PRRS plume, if any, would be defined separately as part of the PRRS response obligations and in accordance with the PRRS project schedule. Groundwater monitoring at this location will continue until such time as the need for action is established and implemented.

Total uranium concentrations, contoured on the maps in Figures A.2-2 and A.2-3, show the maximum total uranium plume for the third and fourth quarters of 1997, respectively. Data from the 1993 sampling for the Remedial Investigation Report for Operable Unit 5 were used in the waste storage and Plant 6 areas for the third quarter of 1997 concentration map (Figure A.2-2) because there were no recent data. The map for the fourth quarter of 1997 (Figure A.2-3) contains data collected as part of the IEMP during 1997 in the waste storage and Plant 6 areas, as well as data collected in other areas.

A comparison of the two figures shows that the total uranium plume in the waste storage area slightly expanded eastward since 1993 because there are increases in concentrations in Monitoring Wells 2033

and 2648. Monitoring Well 2033 showed an increase in concentration from 3.3 μg/L in 1993 to 89.7 μg/L in 1997, and Monitoring Well 2648 showed an increase in concentration from 23.9 μg/L in 1993 to 48.4 μg/L in 1997. These changes are expected as the plume moves slowly to the east. However, even with this slight eastward movement in 1997, the plume was still well within the 10-year, uranium-based restoration footprint. The plume and will be remediated by the Waste Storage Area Extraction System, which is scheduled to begin operations in the year 2003.

Because the maximum total uranium plume for the first two quarters of 1997 was presented in the September 1997 South Plume DMEPP System Evaluation Report and in the Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1) (DOE 1997a), it is not repeated here.

As indicated in Table A.2-1 and shown in Figure A.2-4, eight wells with a total uranium FRL exceedance had "Up, Significant" trends based on the Mann-Kendall test for trend. All wells with exceedances and "Up, Significant" trends were within the 10-year, uranium-based restoration footprint:

- Monitoring Wells 13, 2398, and 3069 were located near or within the northeastern lobe of the plume. Monitoring Wells 2398 and 3069 are on property while Monitoring Well 13 is a private homeowner well located off property. The "Up, Significant" trend in Monitoring Well 2398 indicates a continued slow eastward expansion of the plume. The "Up, Significant" trends in Monitoring Wells 3069 and 13 have been previously reported and the plume in this area was extensively surveyed in the first half of 1997 using a Geoprobe™ sampling tool. It is expected that with the start-up of the South Field Extraction (Phase I), Re-Injection Demonstration, and South Plume Optimization modules, scheduled to begin in August 1998, that these wells will be within the 10-year, uranium-based restoration footprint.

- Monitoring Wells 2386 and 2397 were located on the east side of the South Field Plume. As with Monitoring Well 2398 mentioned above, the "Up, Significant" trend indicates a continued slow eastward expansion of the plume as a result of the regional groundwater flow in this area. It is expected that with the South Field Extraction System (Phase I) scheduled to begin operation in August 1998 that these two wells will be within the capture zone and flow is expected to be reversed toward the South Field Extraction System.

- Monitoring Wells 3095 and 3125 were located in the South Plume immediately up-gradient from the South Plume Extraction System. Because both of these wells are up-gradient from the South Plume Extraction System, these trends are expected as the plume is drawn toward the extraction wells. When the South Plume Optimization extraction wells begin operating later in 1998, it is expected that concentrations in these

wells will begin to decrease with the improved efficiency from the new extraction wells.

- Well 3925 is a South Plume extraction well and the "Up, Significant" trend indicates that contamination was being drawn to the well from the higher concentrations in the heart of the South Plume to the north. When the South Plume Optimization extraction wells begin operating later in 1998, it is anticipated that concentrations in this extraction well will begin to decrease as the new extraction wells remove the higher concentrations in the South Plume immediately north of the present extraction wells.

Total uranium concentration versus time plots for all IEMP monitoring wells are presented in Figures A.2-5 through A.2-134. Only unfiltered, detected results were plotted.

TABLE A.2-1

SUMMARY STATISTICS AND TREND ANALYSIS FOR TOTAL URANIUM WITH 1997 RESULTS ABOVE FINAL REMEDIATION LEVEL

Well	No. of Samples Since 1988[a,b,c]	Minimum[a,b,c,d,e] (μg/L)	Maximum[a,b,c,d,e] (μg/L)	Average[a,b,c,d,e] (μg/L)	Standard Deviation[a,b,c,d,e,f] (μg/L)	Trend[a,b,c,d,e,f]
13	9	29	64	46	12	**Up, Significant**
2008	12	5	25.4	18	5.6	No Significant Trend
2009	8	13.6	39.2	24.7	7.46	No Significant Trend
2015	31	1.3	290	160	42	Down, Significant
2033	4	3.3	90	43.3	35	No Significant Trend
2045	13	256	462	311	56.5	Down, Marginal
2046	13	217	907	499	246	Down, Significant
2049	12	3	175	70	60	No Significant Trend
2054	9	2.84	58.8	25.2	16.2	Up, Marginal
2060 (12)	24	27	332	95	79	Down, Significant
2095	25	52.3	208	142	38.2	No Significant Trend
21033	3	26	43.2	32.5	NA	NA
2106	27	6.06	88.6	51.8	17.3	No Significant Trend
2125	25	4.2	88	27	23	Down, Significant
2166	11	48	75	64	7.9	No Significant Trend
2385	6	76.6	204	117	46.2	Down, Significant
2386	6	6.67	31.2	17.1	9.57	**Up, Significant**
2387	6	106	492	255	145	Down, Significant
2390	5	80.3	163	112	33.3	No Significant Trend
2397	7	212	339	294	46.3	**Up, Significant**
2398	21	0.663	28	12	7.7	**Up, Significant**
2544	19	0.4	521	35	120	No Significant Trend
2545	20	16	106	36	22	Down, Significant
2546	8	0.4	144	30	48	No Significant Trend
2550	18	65	120	81	14	Down, Significant
2551	18	7.5	90	30	19	No Significant Trend
2648	8	9.61	48.4	23	12	No Significant Trend
2821	3	27	32.6	30	NA	NA
3015	27	0.5	149	7	30	No Significant Trend
3067	25	0	57	2.6	11	Down, Significant
3069	29	0.5	334	86	91	**Up, Significant**
3095	26	2	21	10	5	**Up, Significant**
3125	23	19.3	82	54	16	**Up, Significant**
3390	4	81.7	110	97.5	13.6	No Significant Trend
3924	38	41	89	47	8.5	Down, Significant
3925	45	2.1	33	25	7.8	**Up, Significant**

[a]Summary statistics and Mann-Kendall test for trend are based on unfiltered samples from the OU5 RI/FS data set (1988 through 1993) and 1994 through 1997 groundwater data.
[b]If more than one sample is collected per well per day (e.g., duplicate), then only one sample is counted for the number of samples, and the sample with the maximum concentration is used for determining the summary statistics (minimum, maximum, average, and standard deviation [SD]) and Mann-Kendall test for trend.
[c]Rejected data qualified with either a R or Z were not included in this count, the summary statistics, or Mann-Kendall test for trend.
[d]If the number of samples is greater than or equal to four, then the Mann-Kendall test for trend and all of the summary statistics are reported. If the number of samples is equal to three, then the minimum, maximum, and average are reported. If the number of samples is equal to two, then the minimum and maximum are reported. If the number of samples is equal to one, then the data point is reported as the minimum.
[e]For results where the concentrations are below the detection limit, the results used in the summary statistics and Mann-Kendall test for trend are each set at half the detection limit.
[f]NA = not applicable

TABLE A.2-2

LISTING OF GROUNDWATER MONITORING WELLS

Well ID	Well Location[a]	Monitoring Activity
13	D,E,F	Private Well Monitoring
14	NA[b]	Private Well Monitoring
67	H	KC-2 Warehouse
2002	D	South Plume Module
2008	A	Waste Storage Area Module
2009	A	Waste Storage Area Module
2014	B	South Field Extraction System Module
2015	D,E	South Plume Module Injection Demonstration Module
2017	D,E	South Plume Module Injection Demonstration Module
2027	A	Waste Storage Area Module
2032	A	Waste Storage Area Module
2033	A	Waste Storage Area Module
2034	A	Waste Storage Area Module
2045	B	South Field Extraction System Module
2046	B	South Field Extraction System Module
2049	B	South Field Extraction System Module
2051	F	RCRA Boundary Monitoring
2054	C	Plant 6 Area Module
2060(12)	D,E	South Plume Module Injection Demonstration Module
2068	B	South Field/ Extraction System Module
2070	E,F	RCRA Boundary Monitoring Injection Demonstration Module
2093	D	South Plume Module
2095	D	South Plume Module
2106	D,E,F	South Plume Module RCRA Boundary Monitoring Injection Demonstration Module
2118	C	Plant 6 Area Module
2125	D	South Plume Module
2128	D	South Plume Module
2166	D,E,F	South Plume Modules RCRA Boundary Monitoring Injection Demonstration Module
2385	B	South Field Extraction System Module
2386	B	South Field Extraction System Module
2387	B	South Field Extraction System Module
2389	C	Plant 6 Area Module
2390	B	South Field Extraction System Module
2396	D	South Plume Module

TABLE A.2-2
(Continued)

Well ID	Well Location[a]	Monitoring Activity
2397	B	South Field Extraction System Module
2398	D,E,F	South Plume Module RCRA Boundary Monitoring Injection Demonstration Module
2402	B	South Field Extraction System Module
2417	F	RCRA Boundary Monitoring
2424	F	RCRA Boundary Monitoring
2426	F	RCRA Boundary Monitoring
2429	F	RCRA Boundary Monitoring
2430	F	RCRA Boundary Monitoring
2431	F	RCRA Boundary Monitoring
2432	F	RCRA Boundary Monitoring
2434	D,E,F	South Plume Module RCRA Boundary Monitoring Injection Demonstration Module
2544	D	South Plume Module
2545	D	South Plume Module
2546	D	South Plume Module
2548	D	South Plume Module
2550	D	South Plume Module
2551	D	South Plume Module
2552	D	South Plume Module
2553	D	South Plume Module
2624	D	South Plume Module
2625	D	South Plume Module
2636	D	South Plume Module
2648	A	Waste Storage Area Module
2649	A	Waste Storage Area Module
2733	F	RCRA Boundary Monitoring
2821	A	Waste Storage Area Module
2880	D	South Plume Module
2881	D	South Plume Module
2897	D	South Plume Module
2898	D	South Plume Module
2899	D	South Plume Module
2900	D	South Plume Module
3009	A	Waste Storage Area Module
3014	B	South Field Module
3015	D,E	South Plume Module Injection Demonstration
3027	A	Waste Storage Area Module
3032	A	Waste Storage Area Module
3034	A	Waste Storage Area Module

TABLE A.2-2
(Continued)

Well ID	Well Location[a]	Monitoring Activity
3045	B	South Field Extraction System Module
3049	B	South Field Extraction System Module
3054	C	Plant 6 Area Module
3062	D	South Plume Module
3067	F	RCRA Boundary Monitoring
3068	B	South Field Extraction System Module
3069	D,E,F	South Plume Module RCRA Boundary Monitoring Injection Demonstration Module
3070	E,F	RCRA Boundary Monitoring Injection Demonstration Module
3093	D	South Plume Module
3095	D	South Plume Module
3106	D,E,F	South Plume Module RCRA Boundary Monitoring Injection Demonstration Module
3125	D	South Plume Module
3128	D	South Plume Module
3385	B	South Field Extraction System Module
3387	B	South Field Extraction System Module
3390	B	South Field Extraction System Module
3396	D	South Plume Module
3397	B	South Field Extraction System Module
3398	D,E,F	South Plume Module RCRA Boundary Monitoring Injection Demonstration Module
3402	B	South Field Extraction System Module
3417	F	RCRA Boundary Monitoring
3424	F	RCRA Boundary Monitoring
3426	F	RCRA Boundary Monitoring
3429	F	RCRA Boundary Monitoring
3431	F	RCRA Boundary Monitoring
3432	F	RCRA Boundary Monitoring
3550	D	South Plume Module
3551	D	South Plume Module
3552	D	South Plume Module
3624	D	South Plume Module
3636	D	South Plume Module
3733	F	RCRA Boundary Monitoring
3821	A	Waste Storage Area Module
3880	D	South Plume Module
3881	D	South Plume Module
3897	D	South Plume Module

TABLE A.2-2
(Continued)

Well ID	Well Location[a]	Monitoring Activity
3898	D	South Plume Module
3899	D	South Plume Module
3900	D	South Plume Module
3924	D	South Plume Module
3925	D	South Plume Module
3926	D	South Plume Module
3927	D	South Plume Module
4067	F	RCRA Boundary Monitoring
4125	D	South Plume Module
4398	D,E,F	South Plume Module RCRA Boundary Monitoring Injection Demonstration Module
4424	F	RCRA Boundary Monitoring
4426	F	RCRA Boundary Monitoring
4432	F	RCRA Boundary Monitoring
21033	B	South Field Extraction System Module
21063	D	South Plume Module
21194	D	South Plume Module
31217	F	RCRA Boundary Monitoring
41217	F	RCRA Boundary Monitoring
22198	F	RCRA Boundary Monitoring

[a]Well location refers to Figure A.2-1.
[b]NA = Not Applicable. This well is located near the southeast corner of the Fernald Environmental Management Project (FEMP) property.

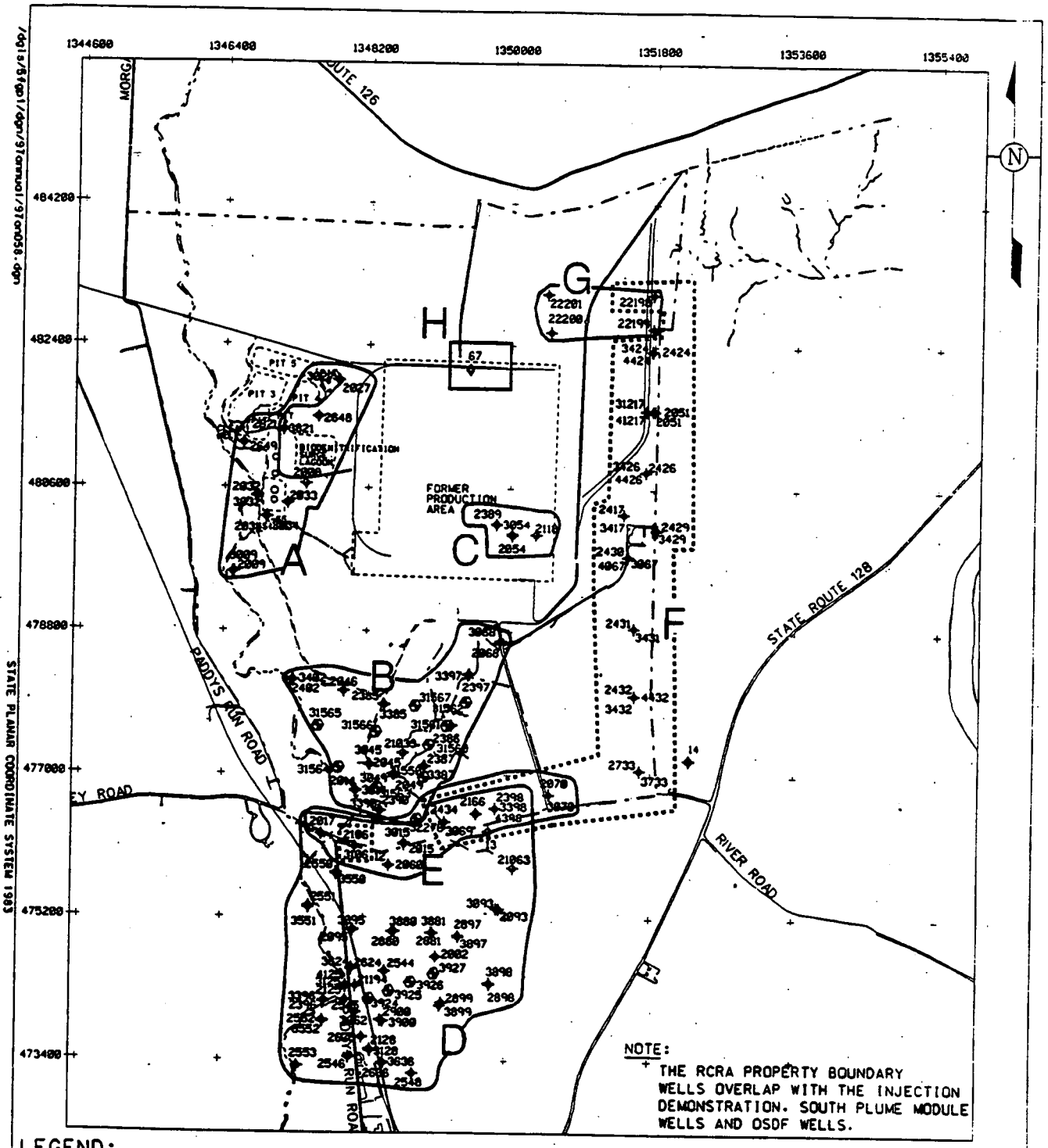


FIGURE A.2-1. IEMP WATER QUALITY MONITORING WELLS AND RECOVERY WELLS

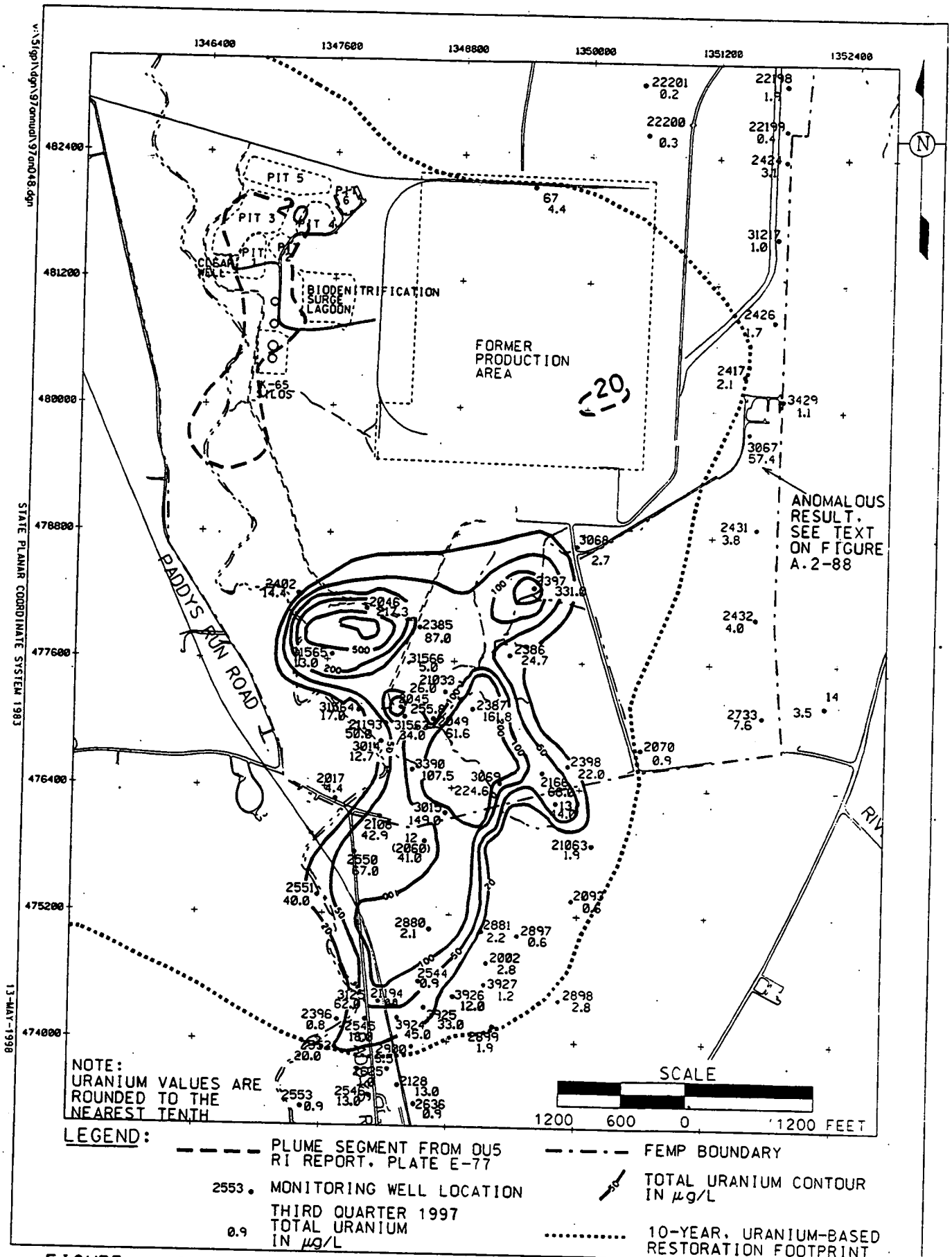


FIGURE A.2-2. MAXIMUM TOTAL URANIUM PLUME MAP, THIRD QUARTER 1997

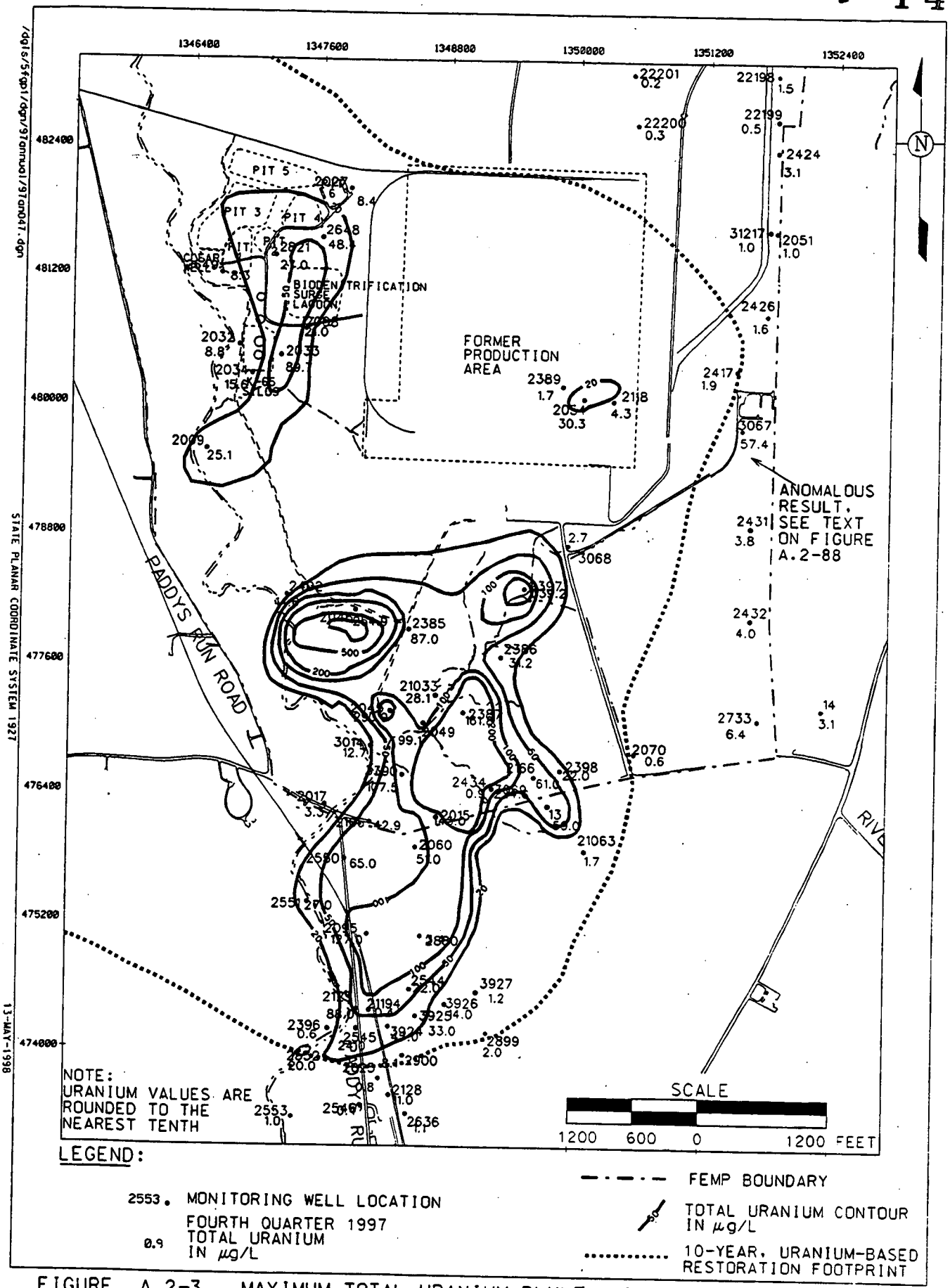


FIGURE A.2-3. MAXIMUM TOTAL URANIUM PLUME MAP, FOURTH QUARTER 1997

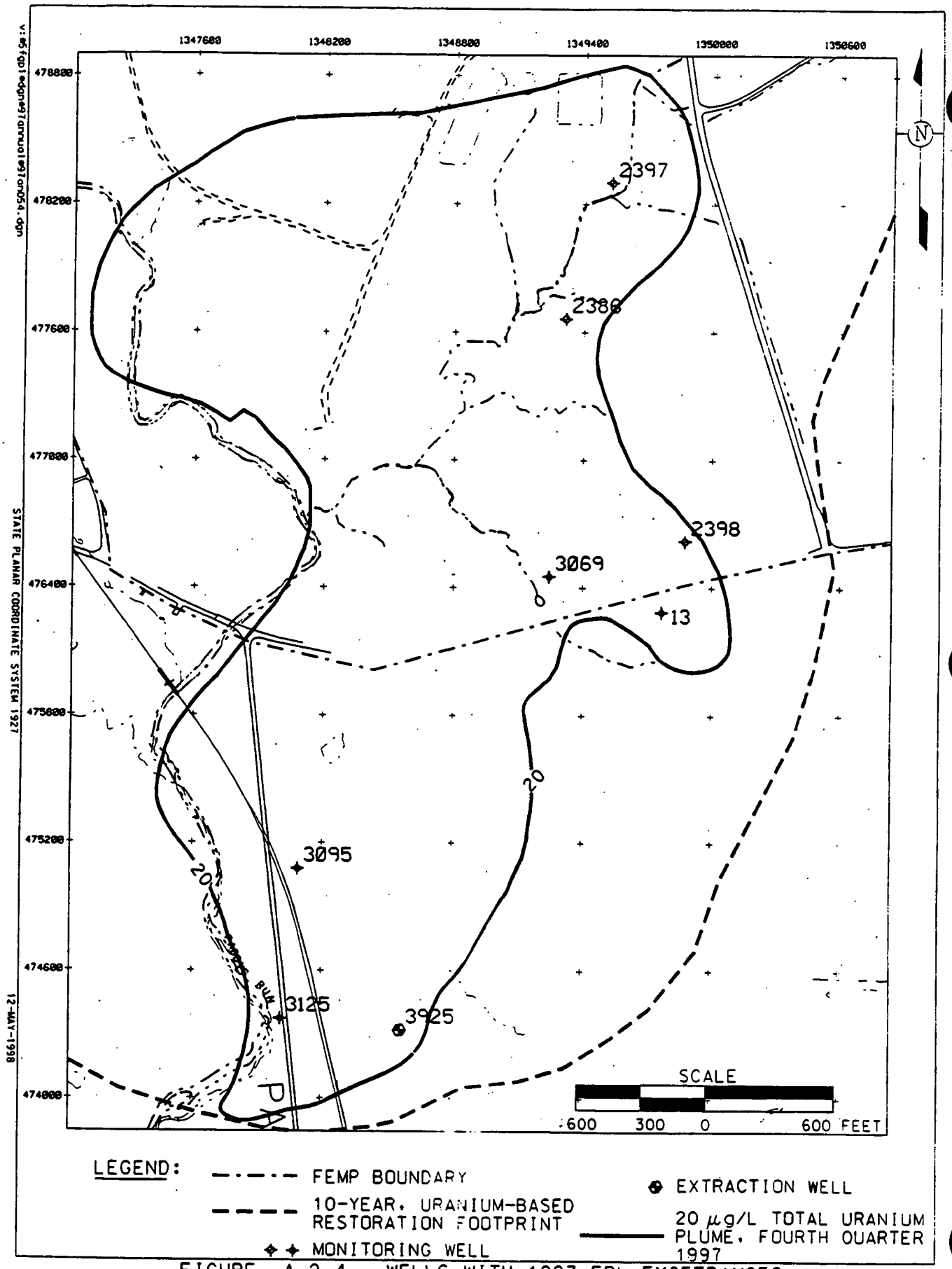


FIGURE A.2-4. WELLS WITH 1997 FRL EXCEEDANCES FOR TOTAL URANIUM AND UP SIGNIFICANT TRENDS

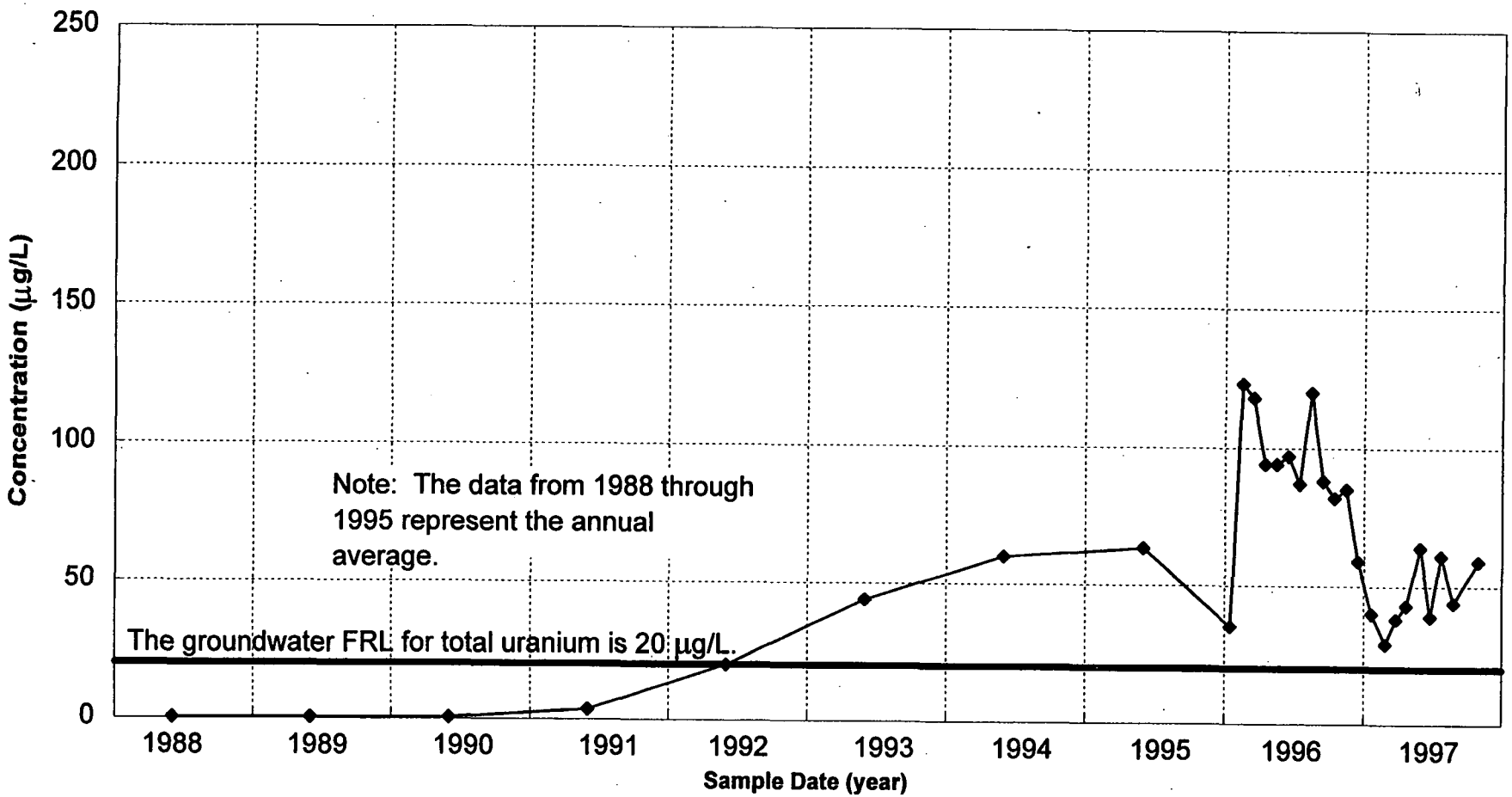


FIGURE A.2-5. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 13

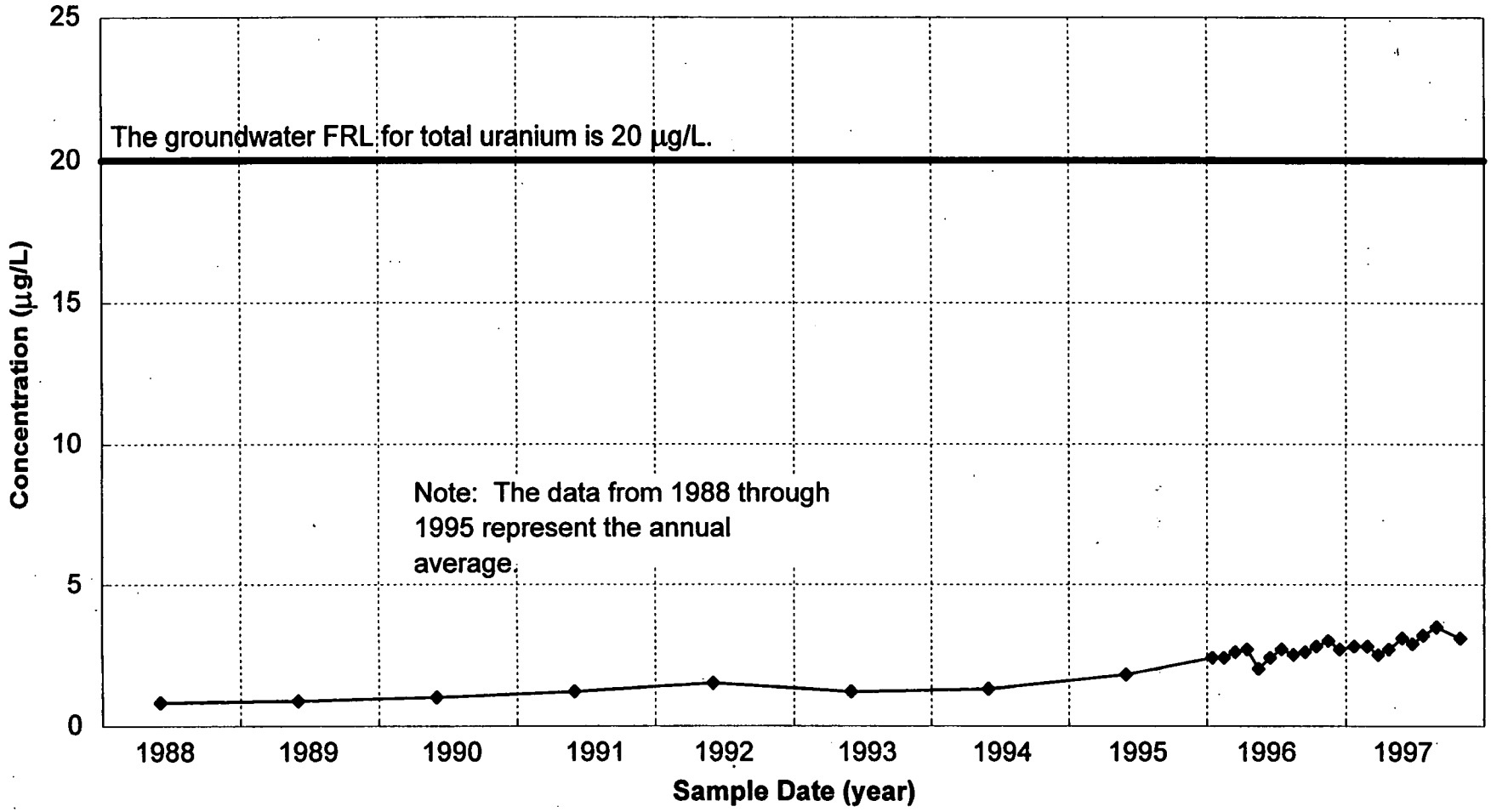


FIGURE A.2-6. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 14

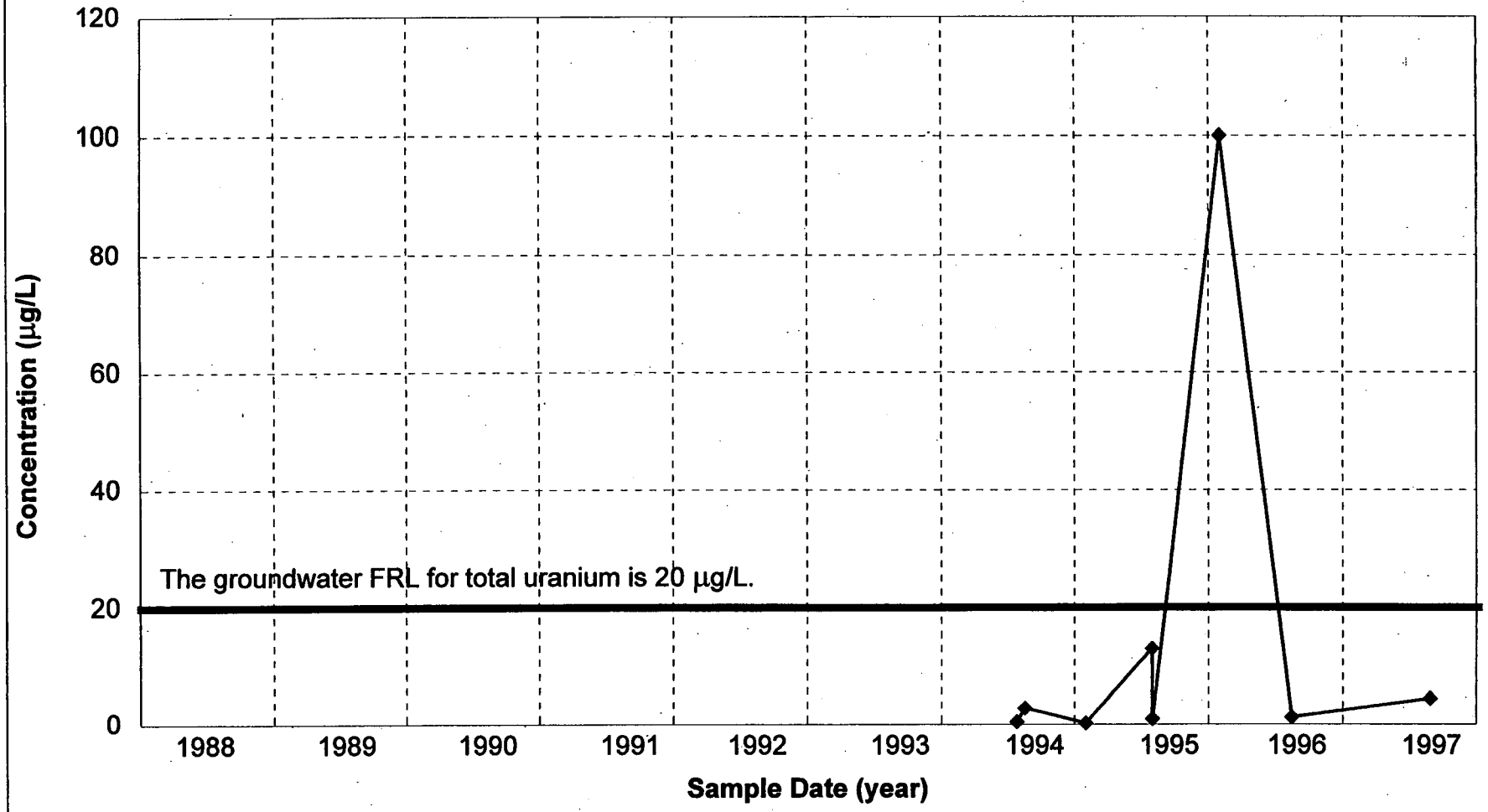


FIGURE A.2-7. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 67

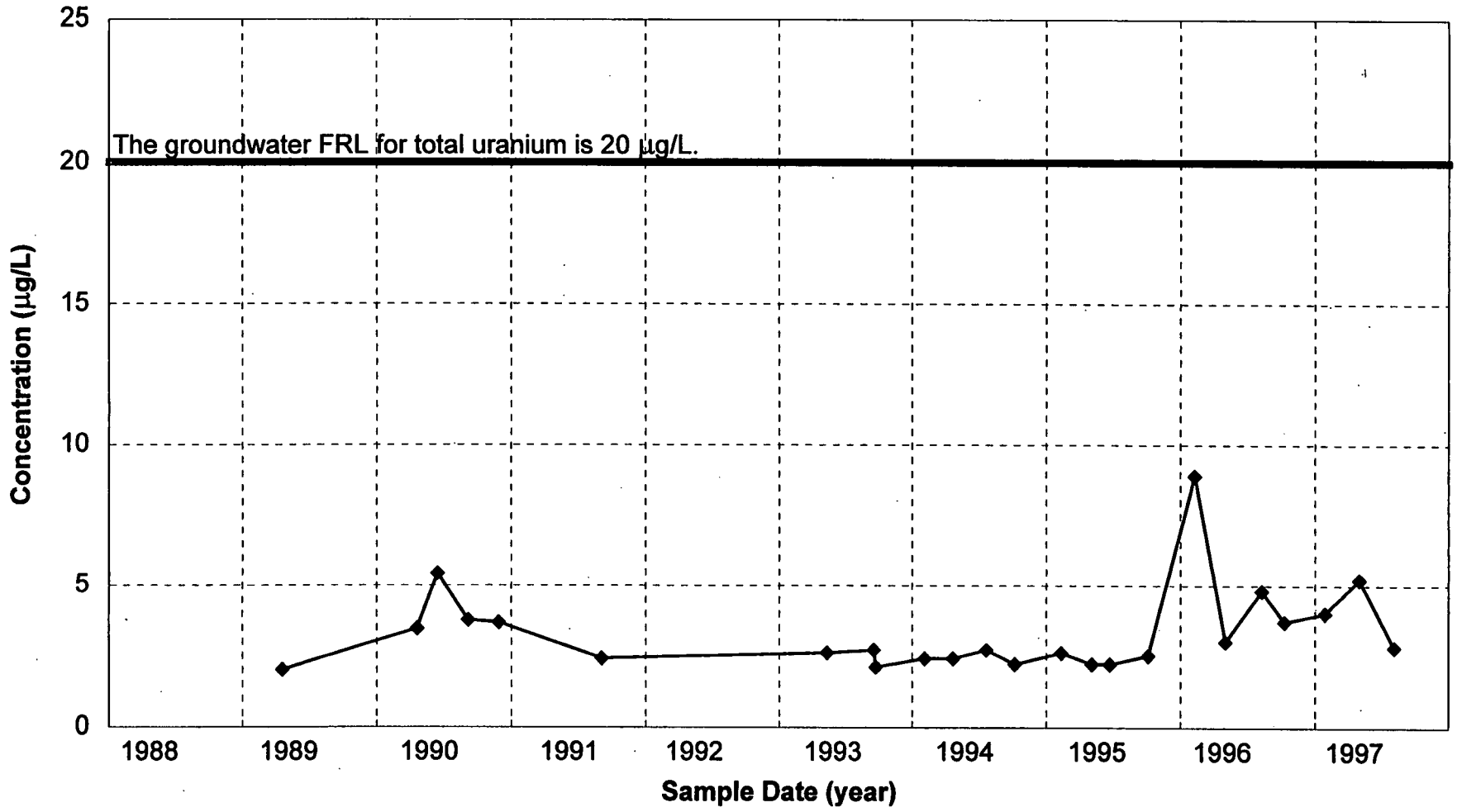


FIGURE A.2-8. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2002

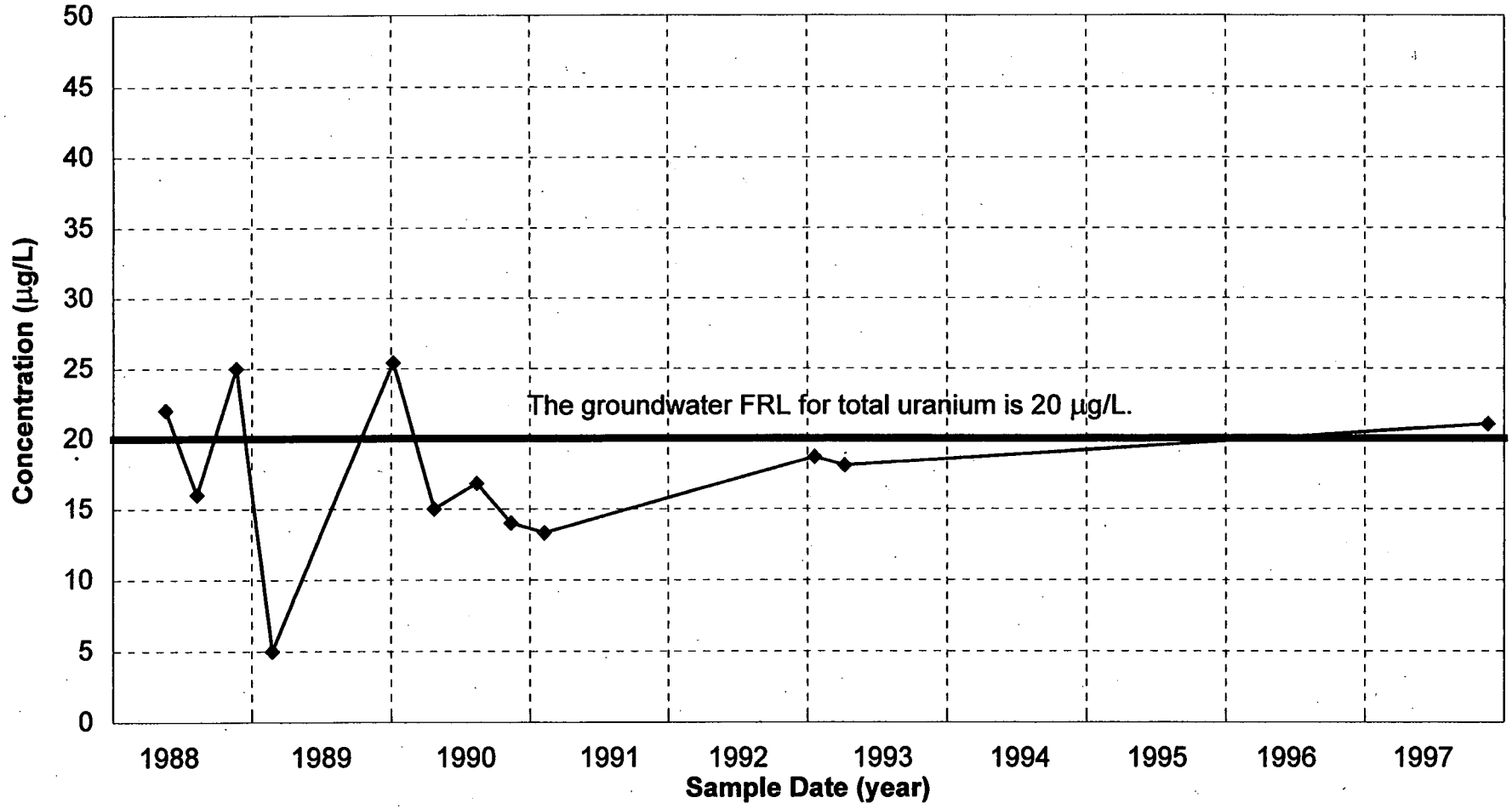


FIGURE A.2-9. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2008

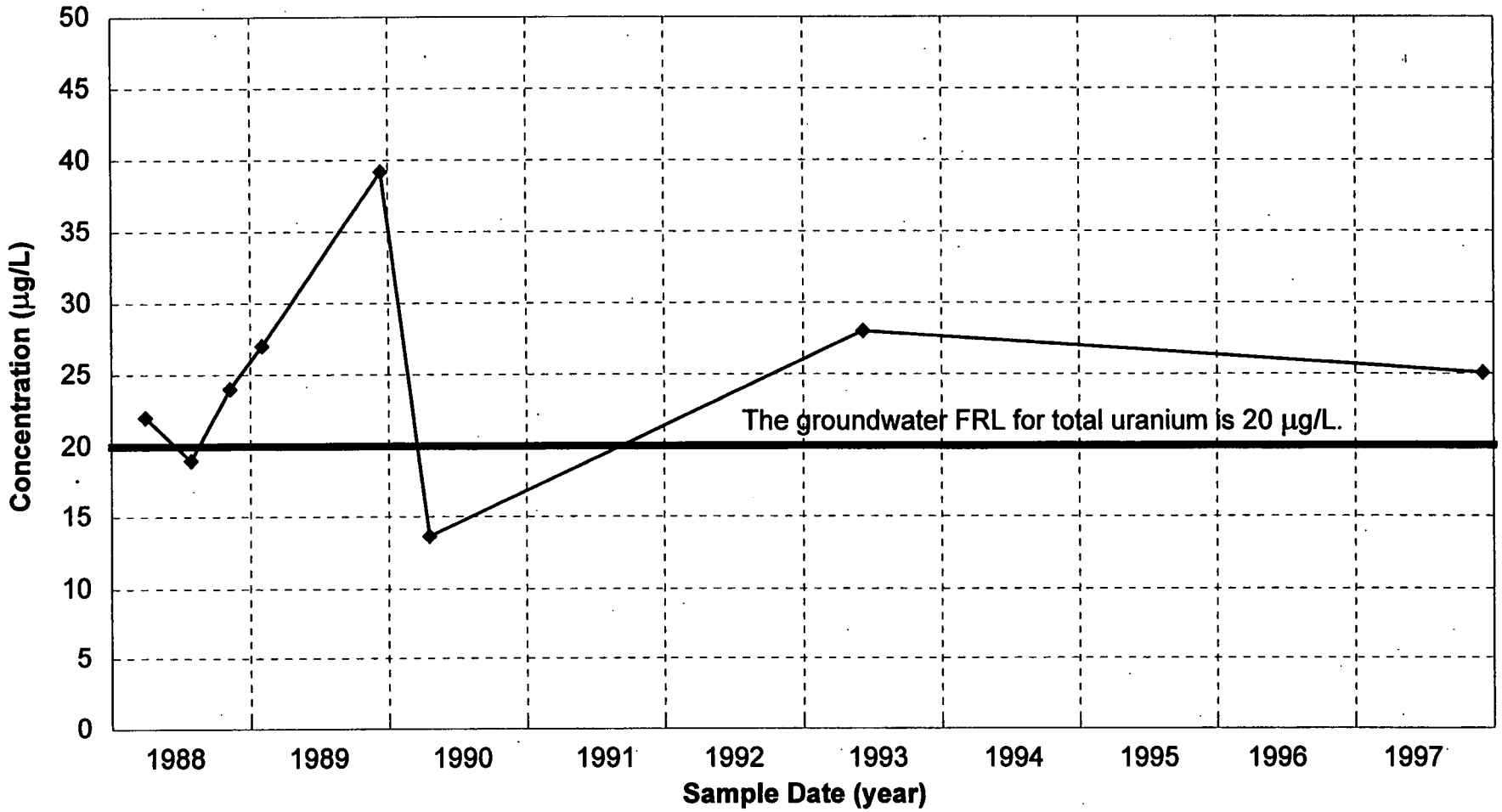


FIGURE A.2-10. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2009

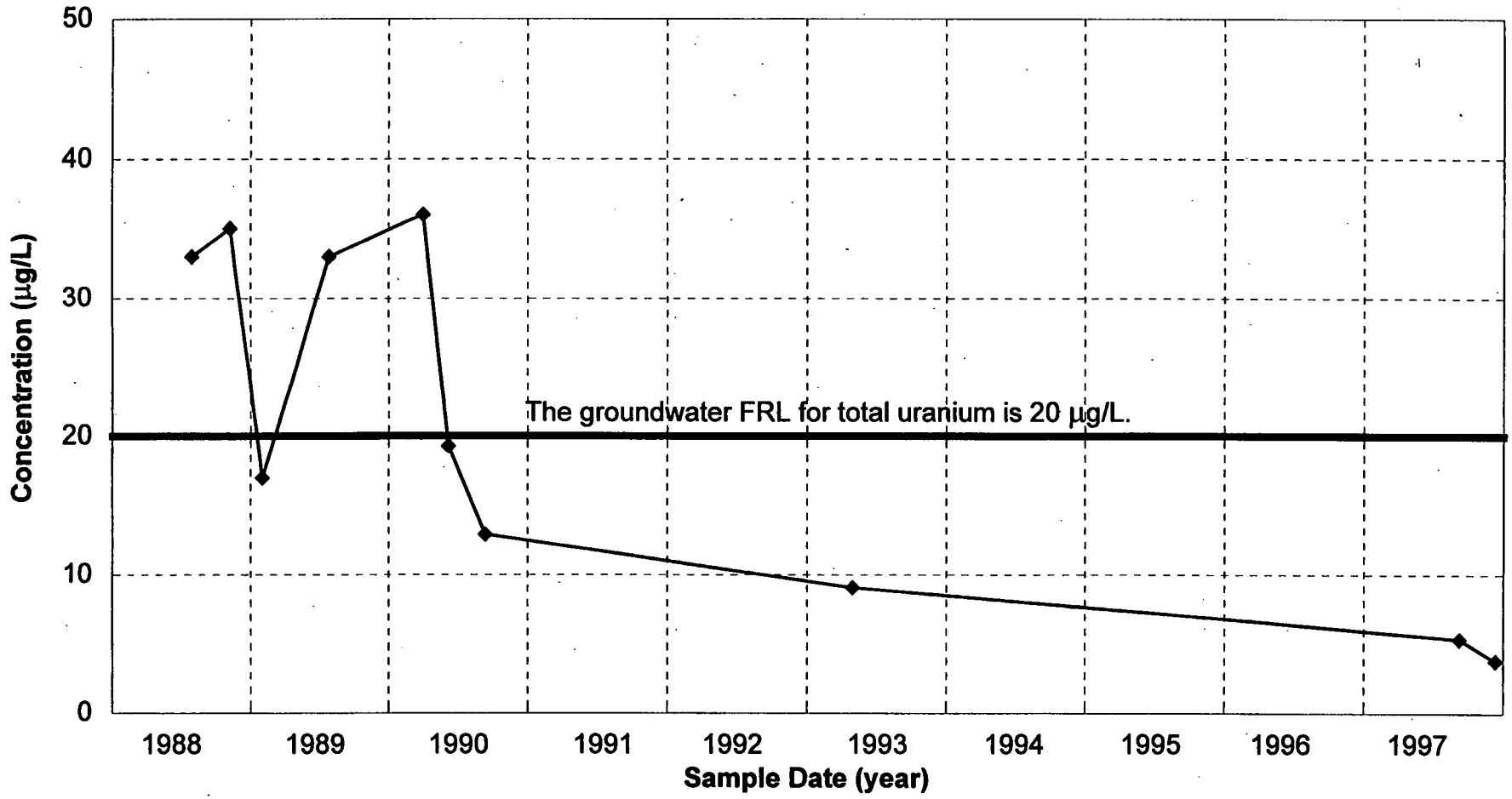


FIGURE A.2-11. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2014

000134

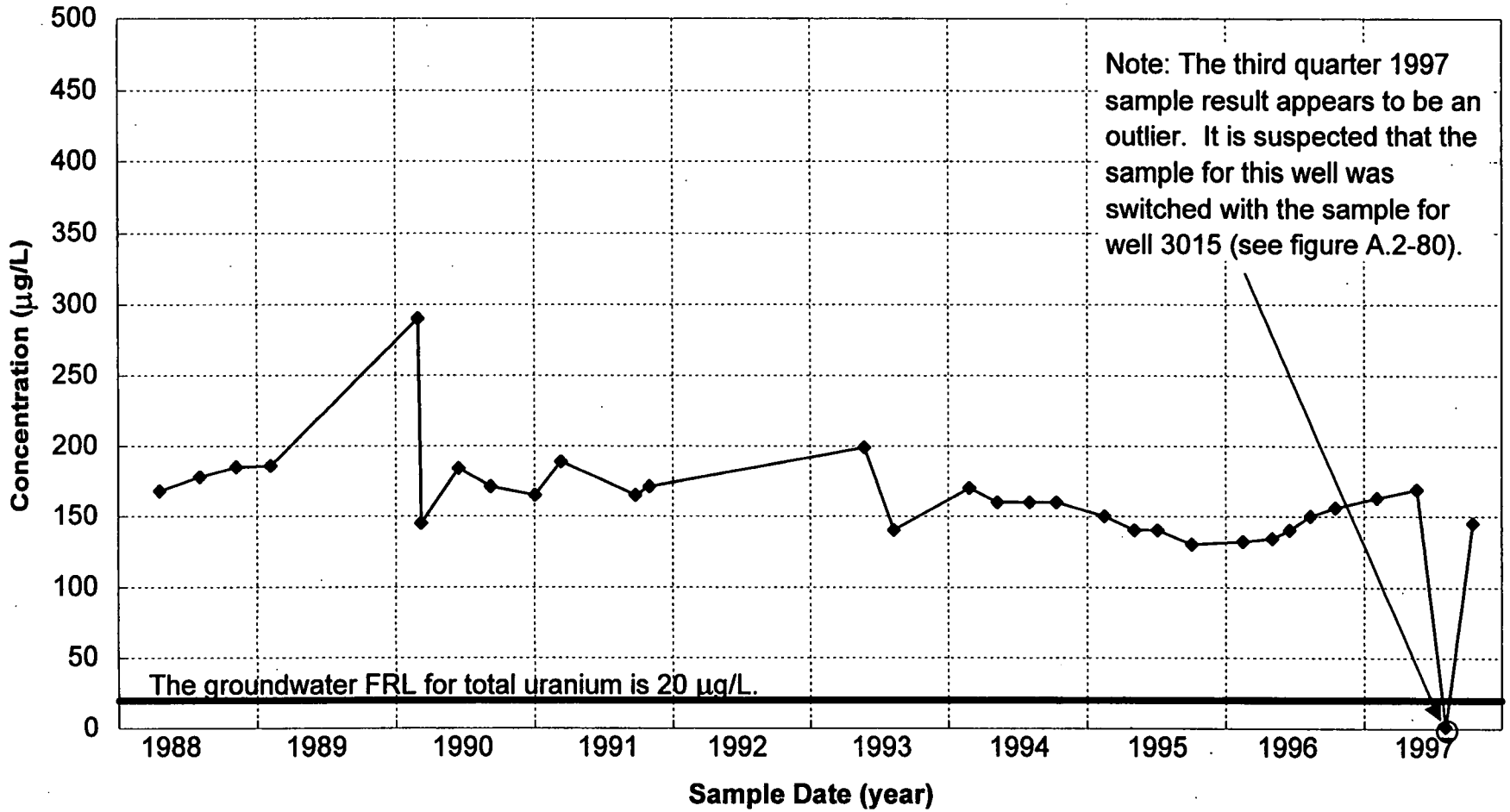


FIGURE A.2-12. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2015

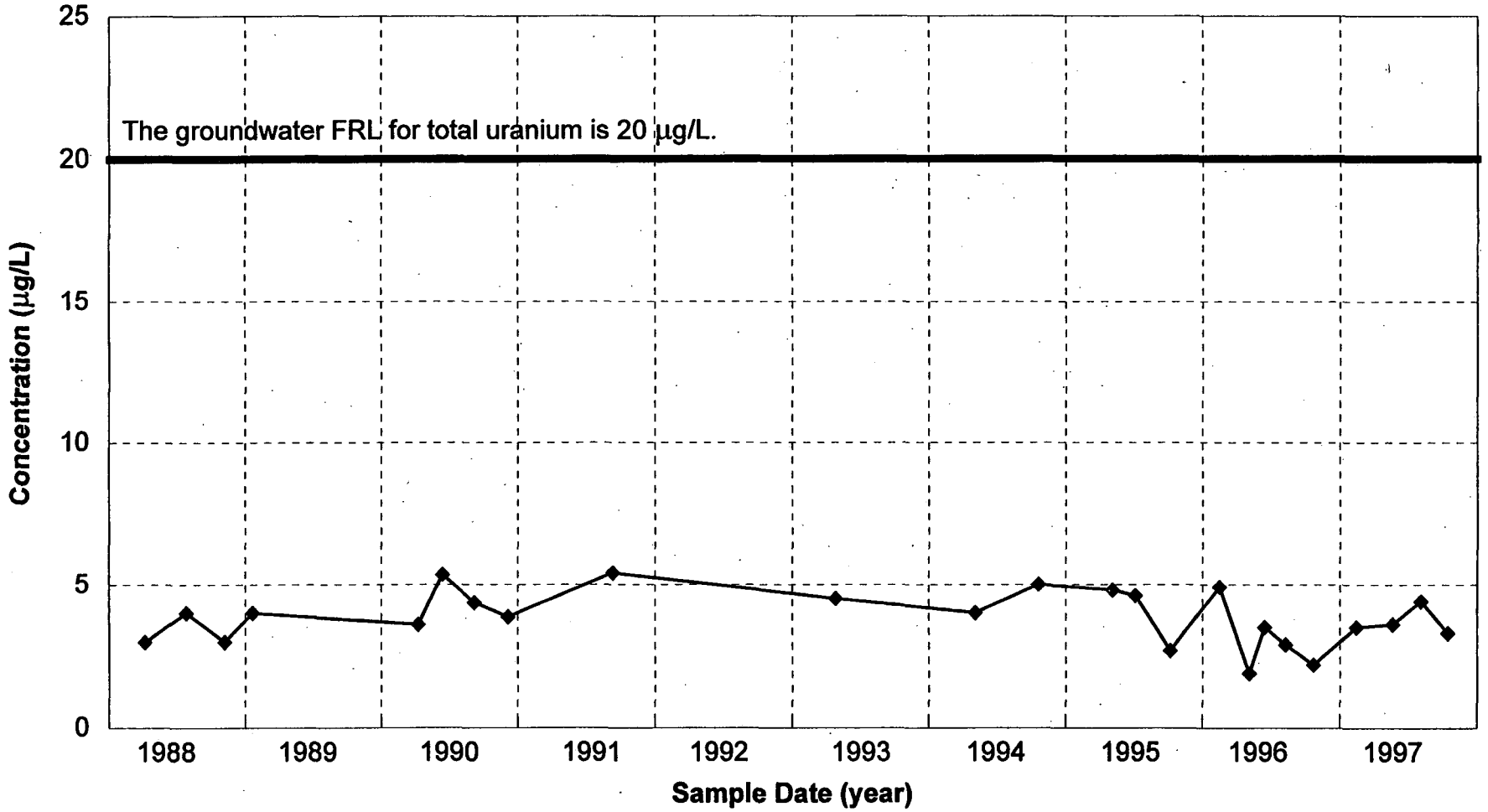


FIGURE A.2-13. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2017

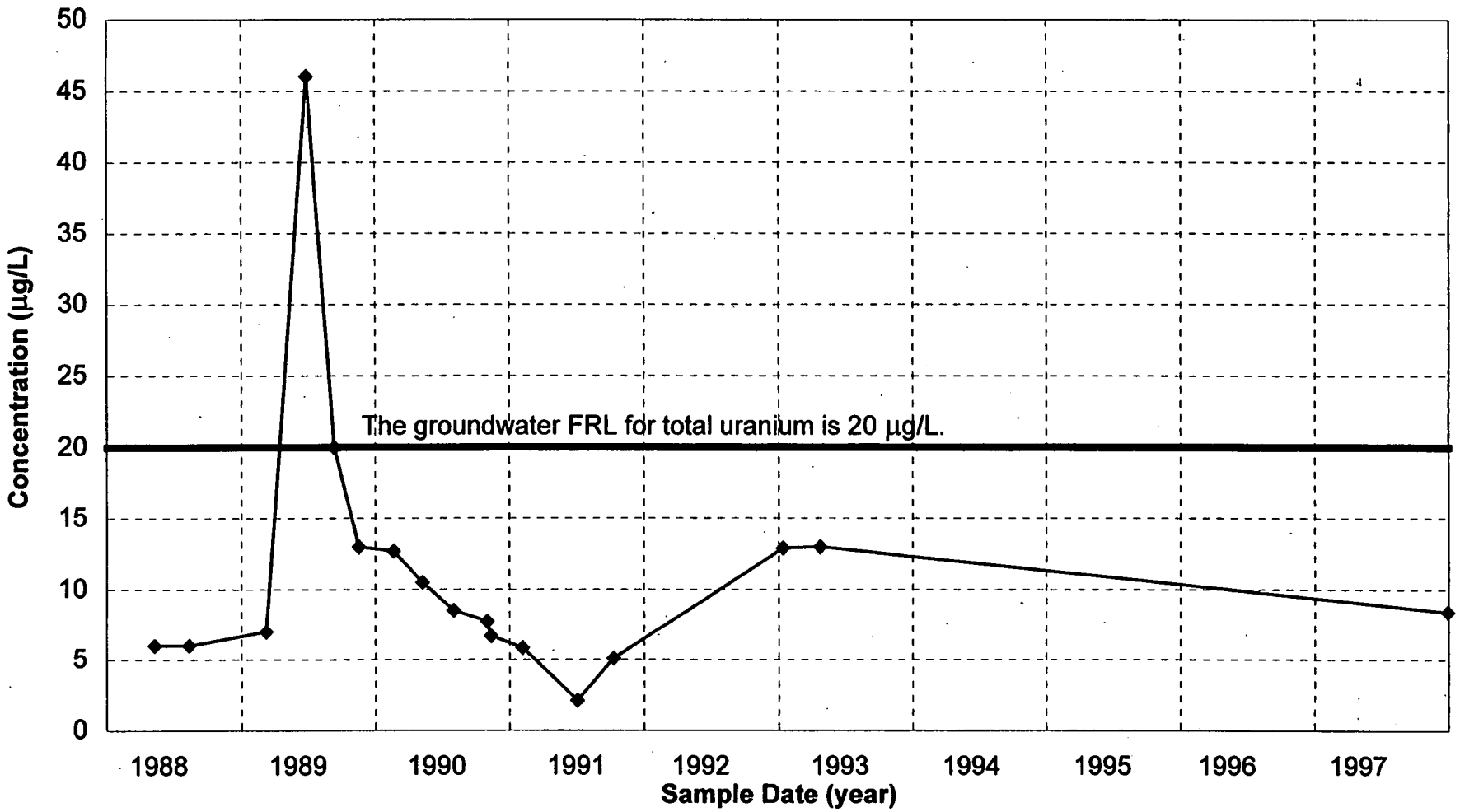


FIGURE A.2-14. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2027

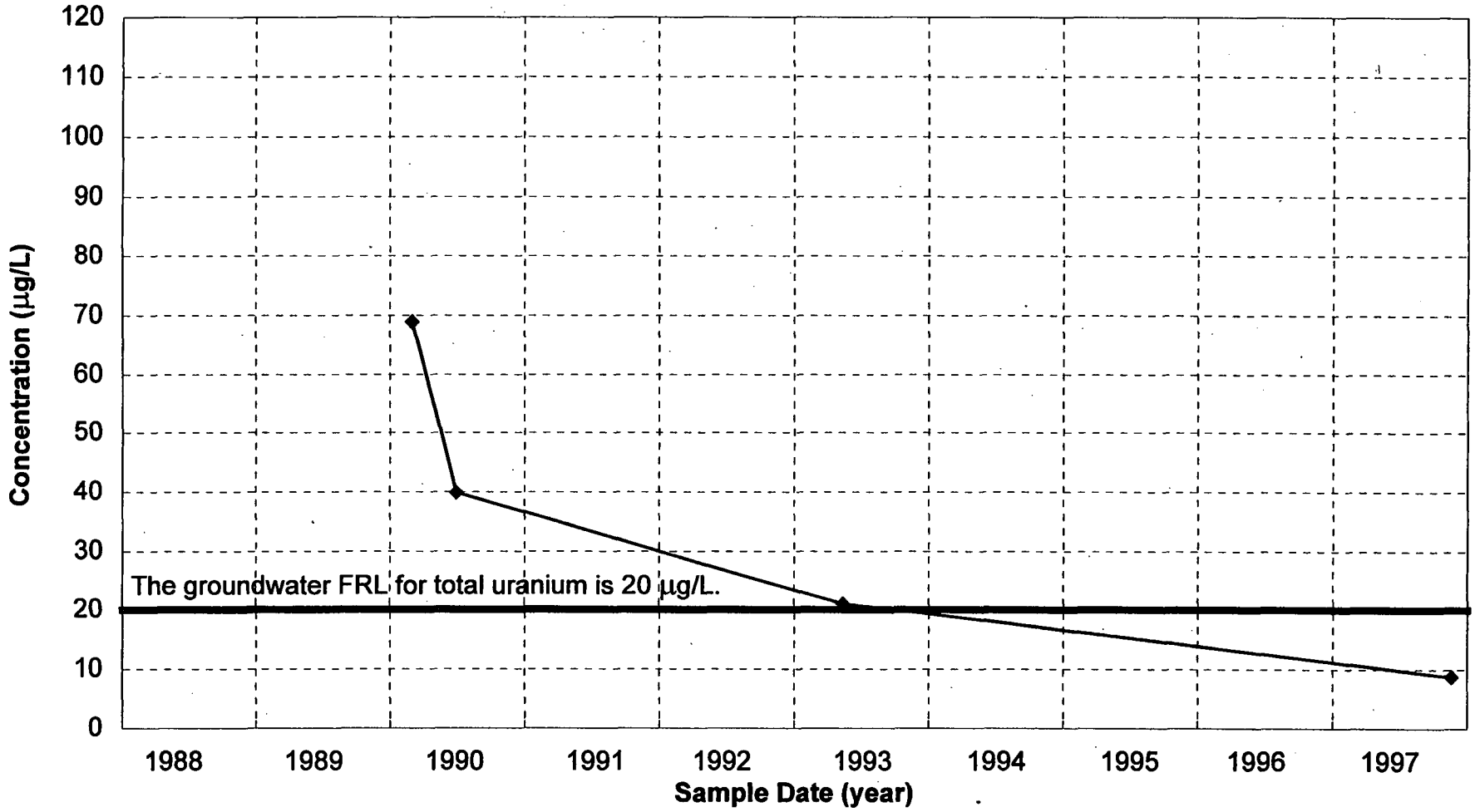


FIGURE A.2-15. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2032

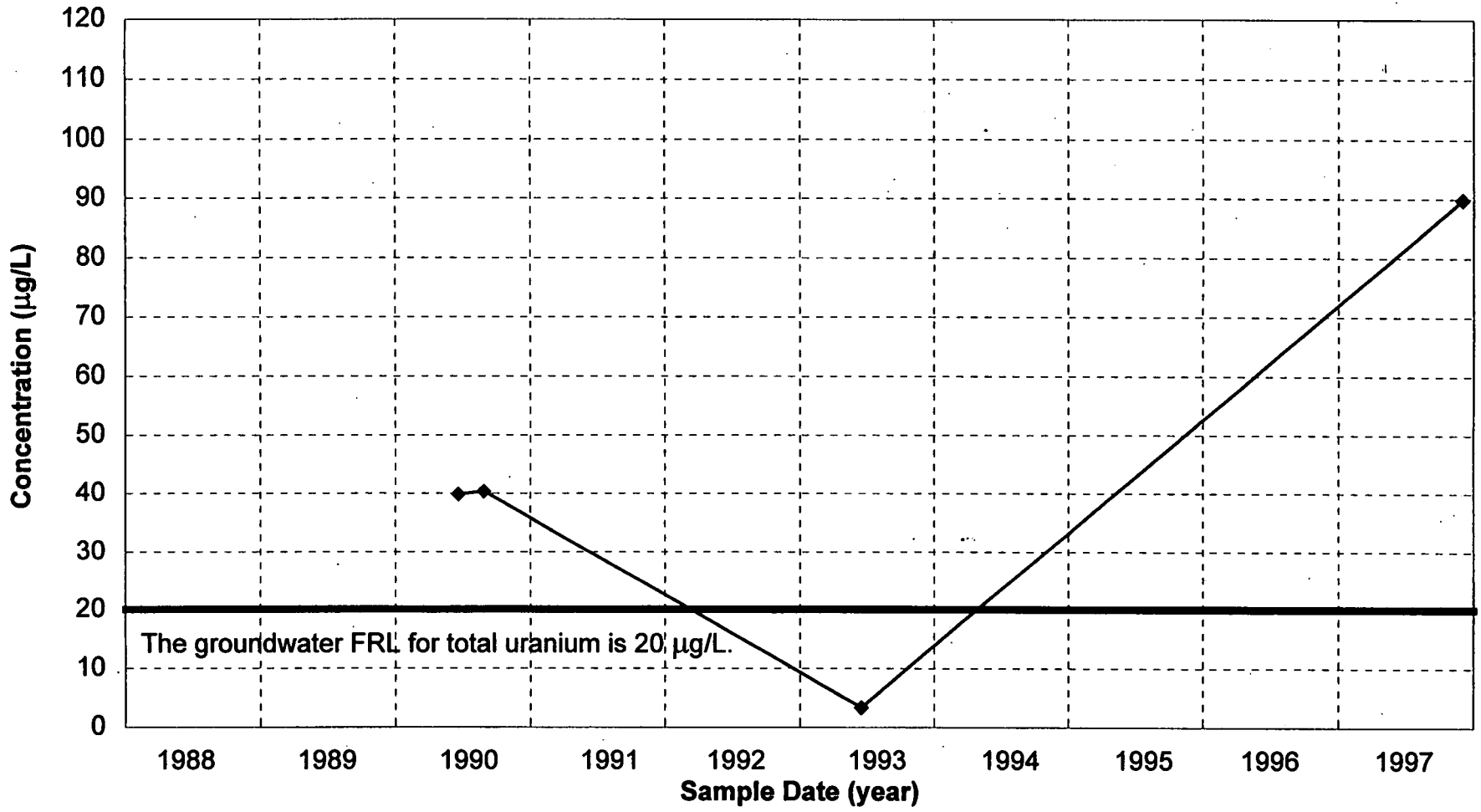


FIGURE A.2-16. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2033

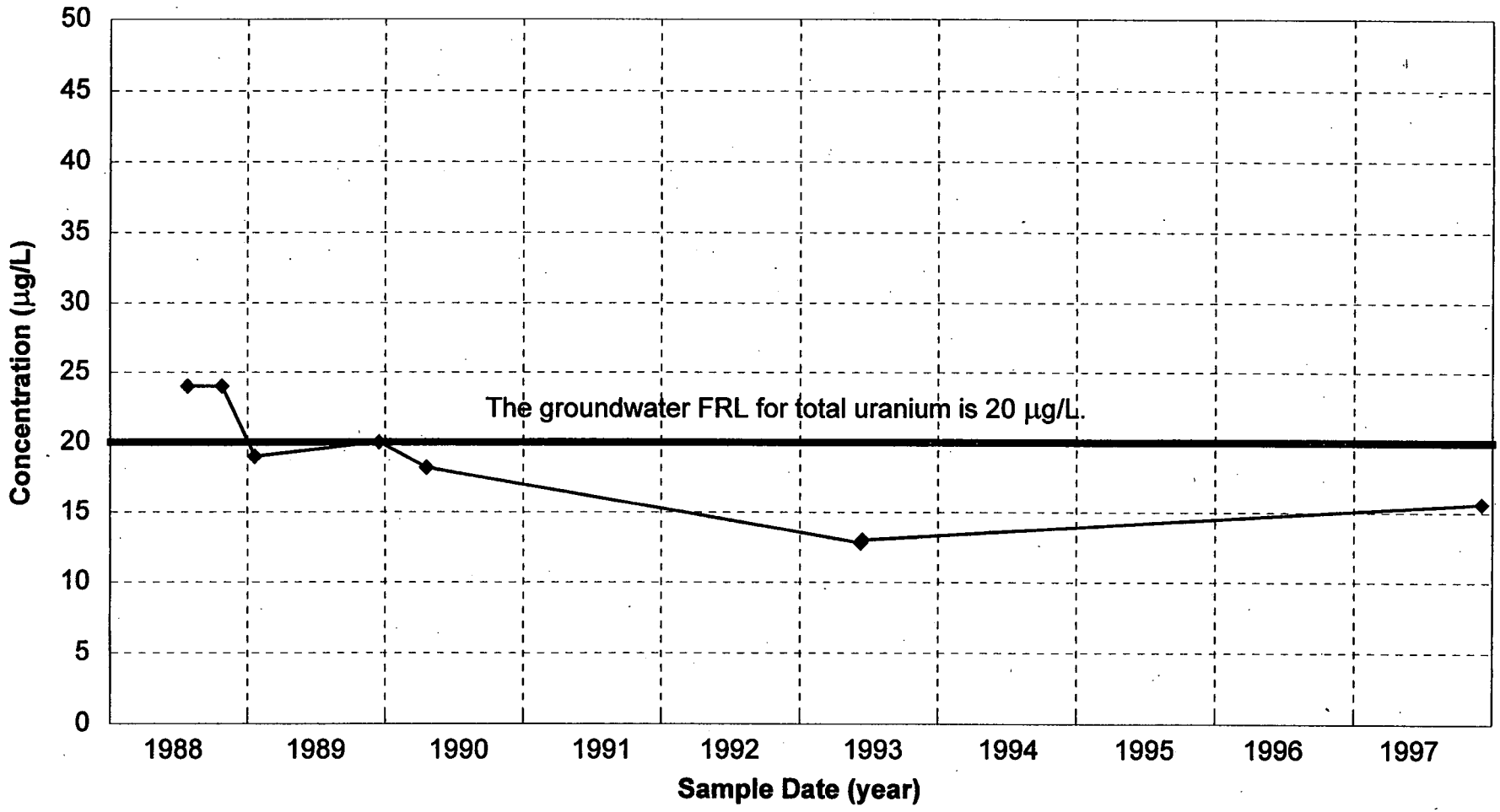


FIGURE A.2-17. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2034

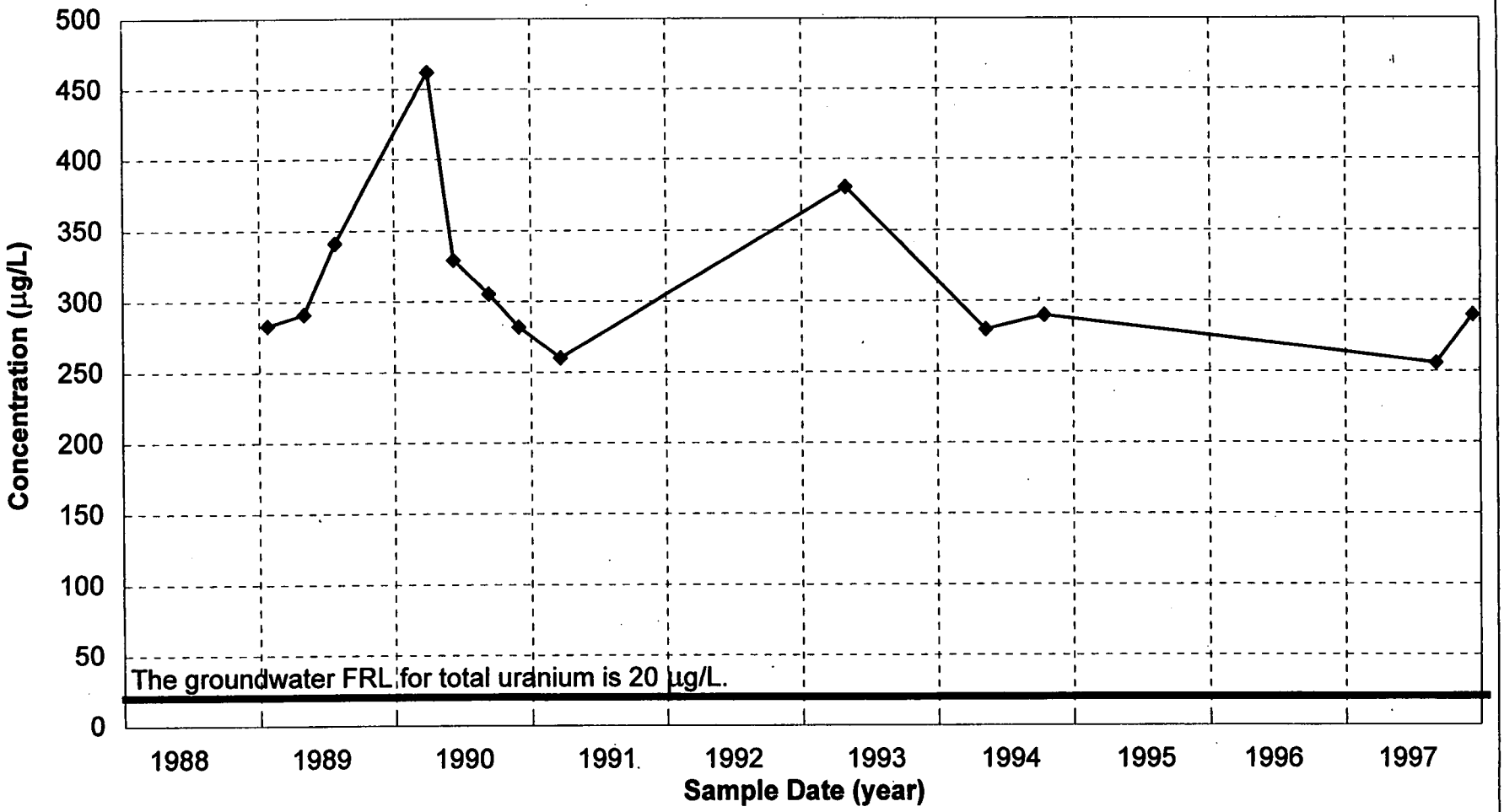


FIGURE A.2-18. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2045

FIGURE A.2-19. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2046

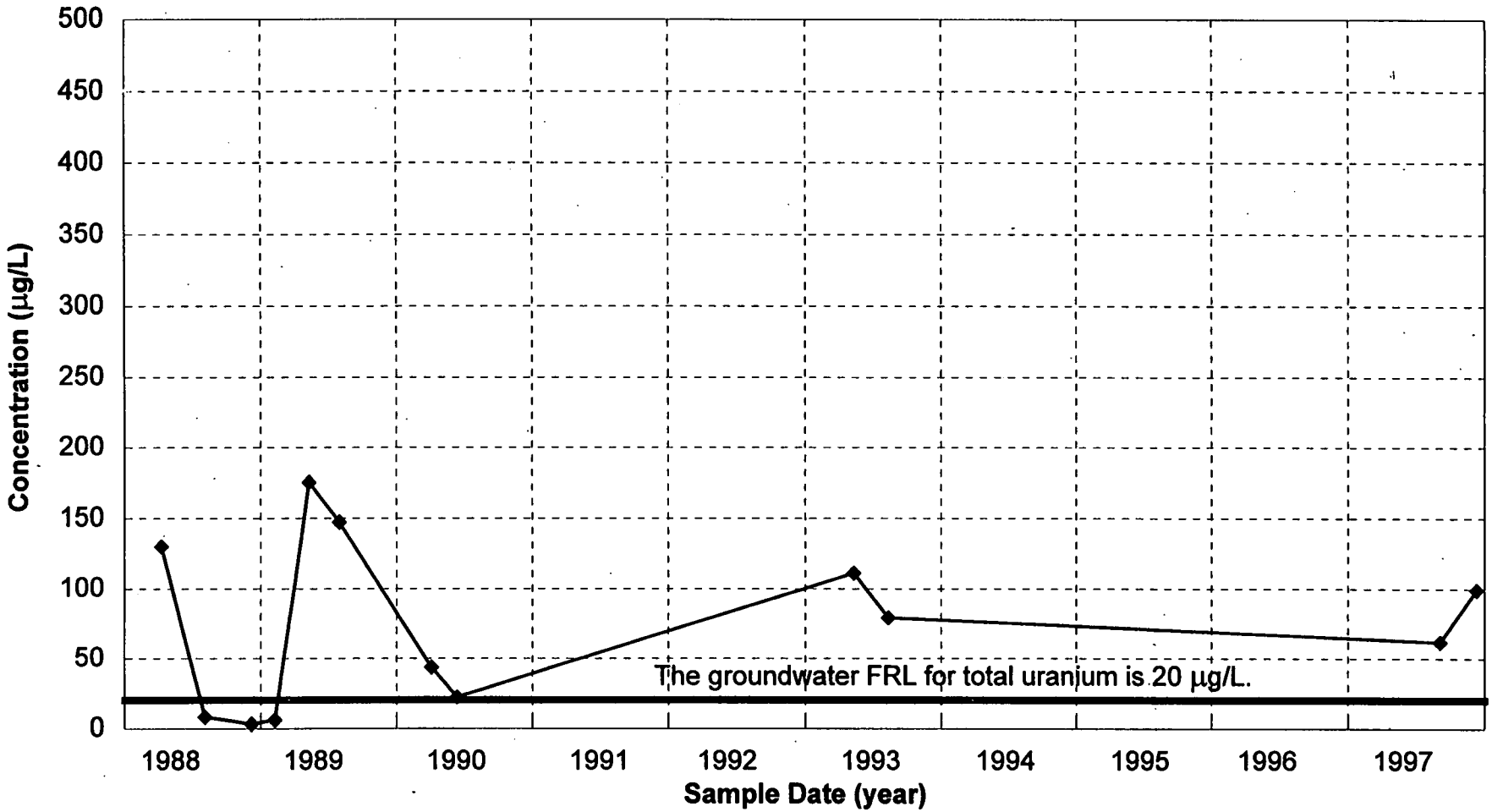


FIGURE A.2-20. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2049

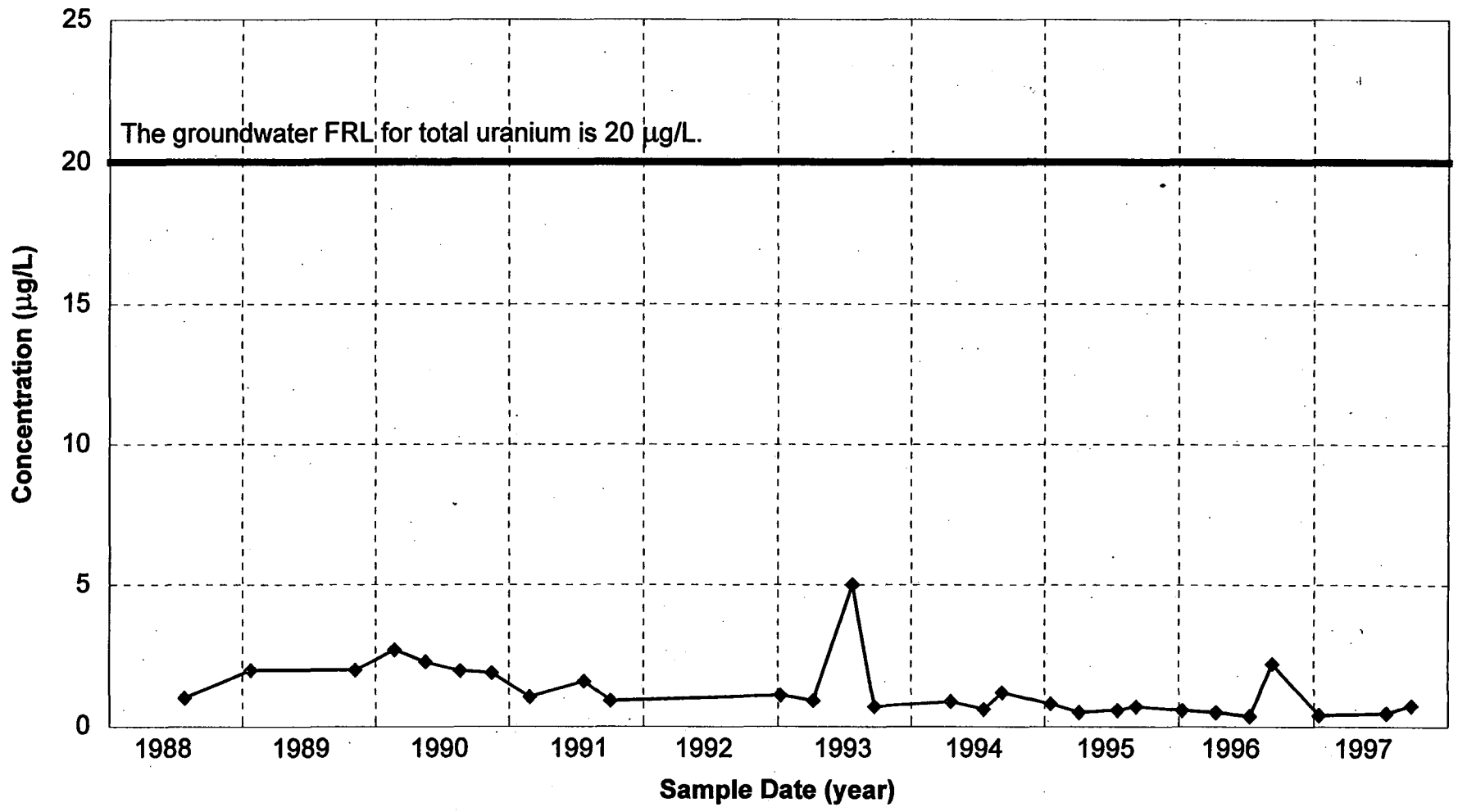


FIGURE A.2-21. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2051

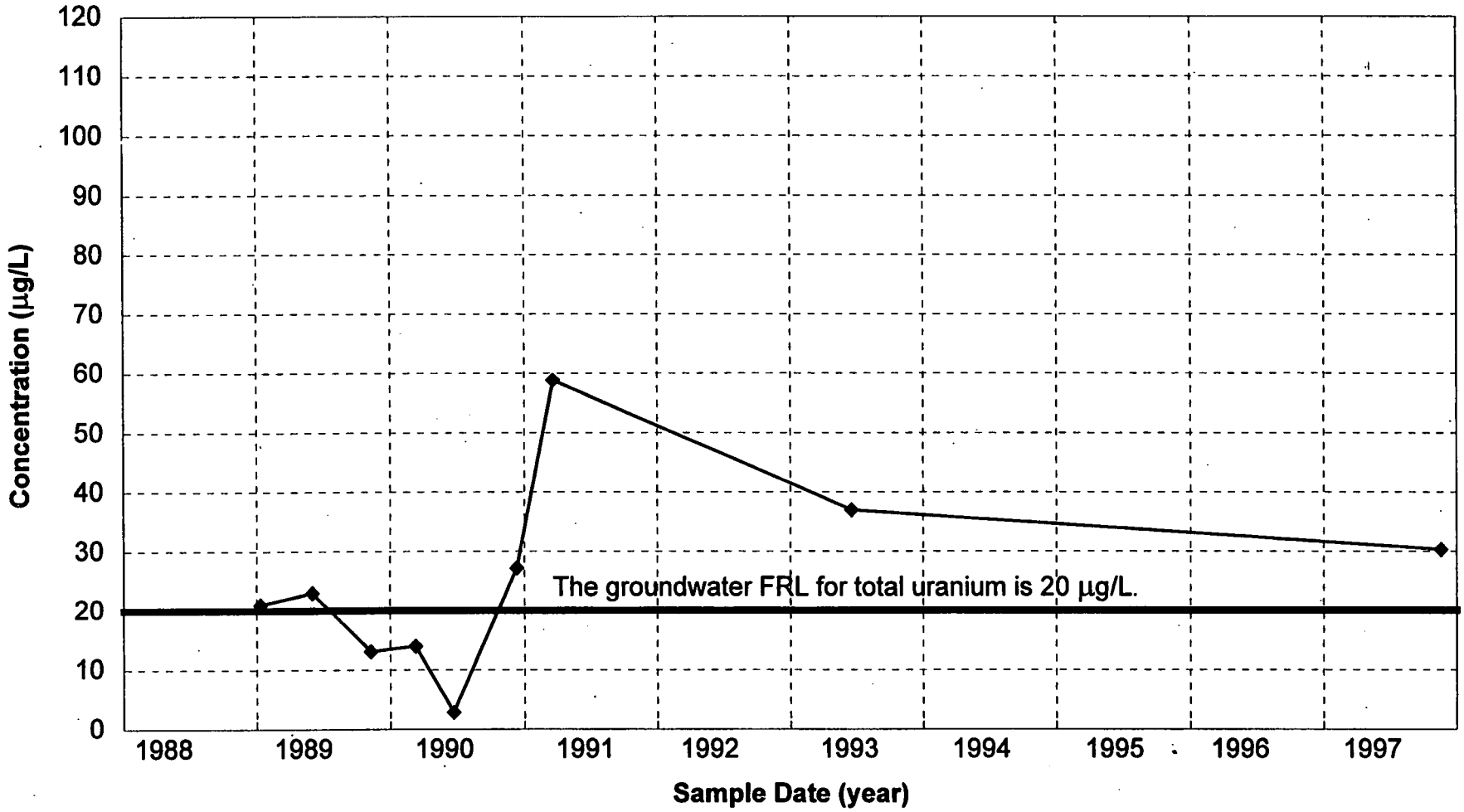


FIGURE A.2-22. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2054

002202

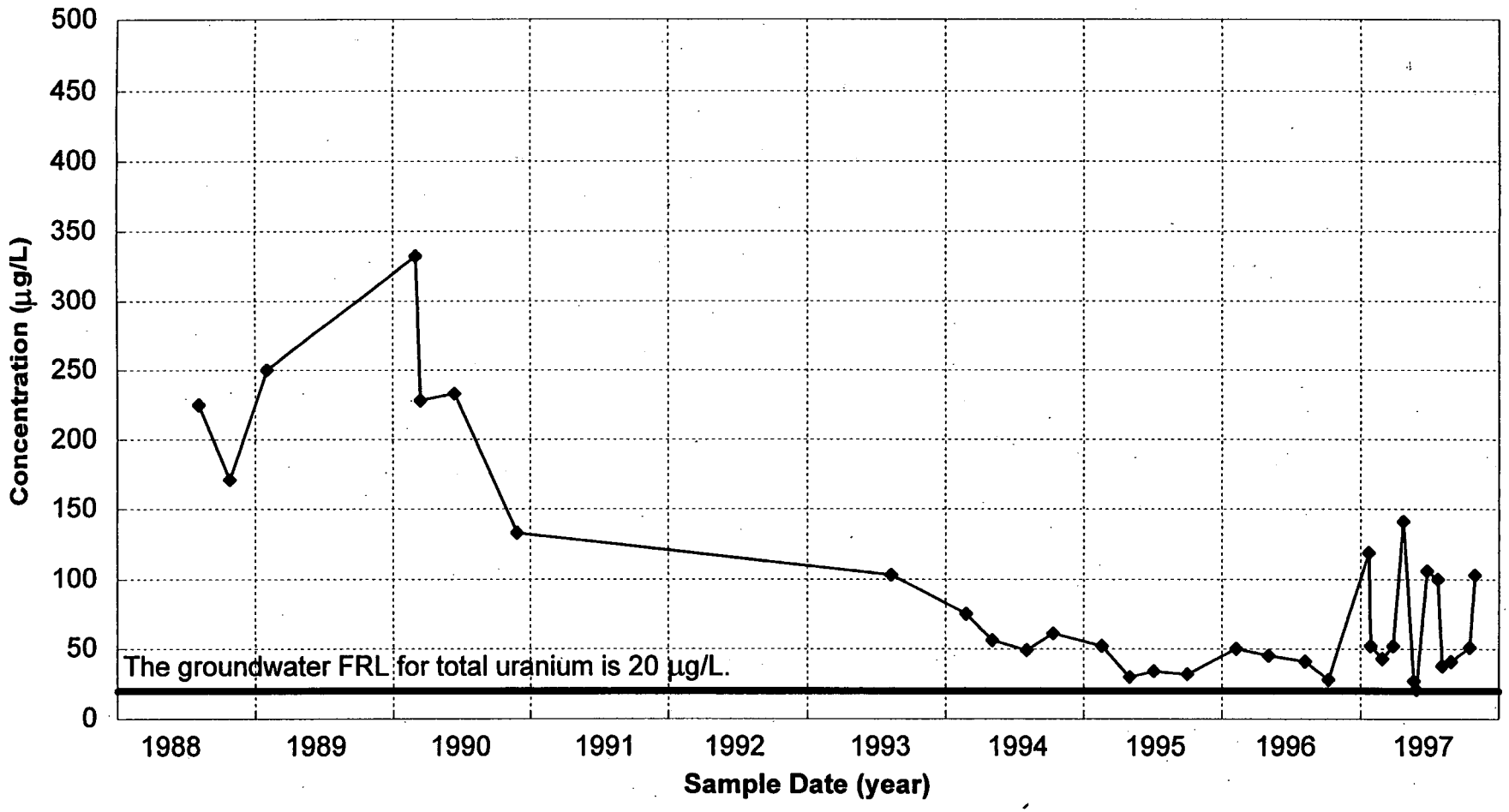


FIGURE A.2-23. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2060 (WELL 12)

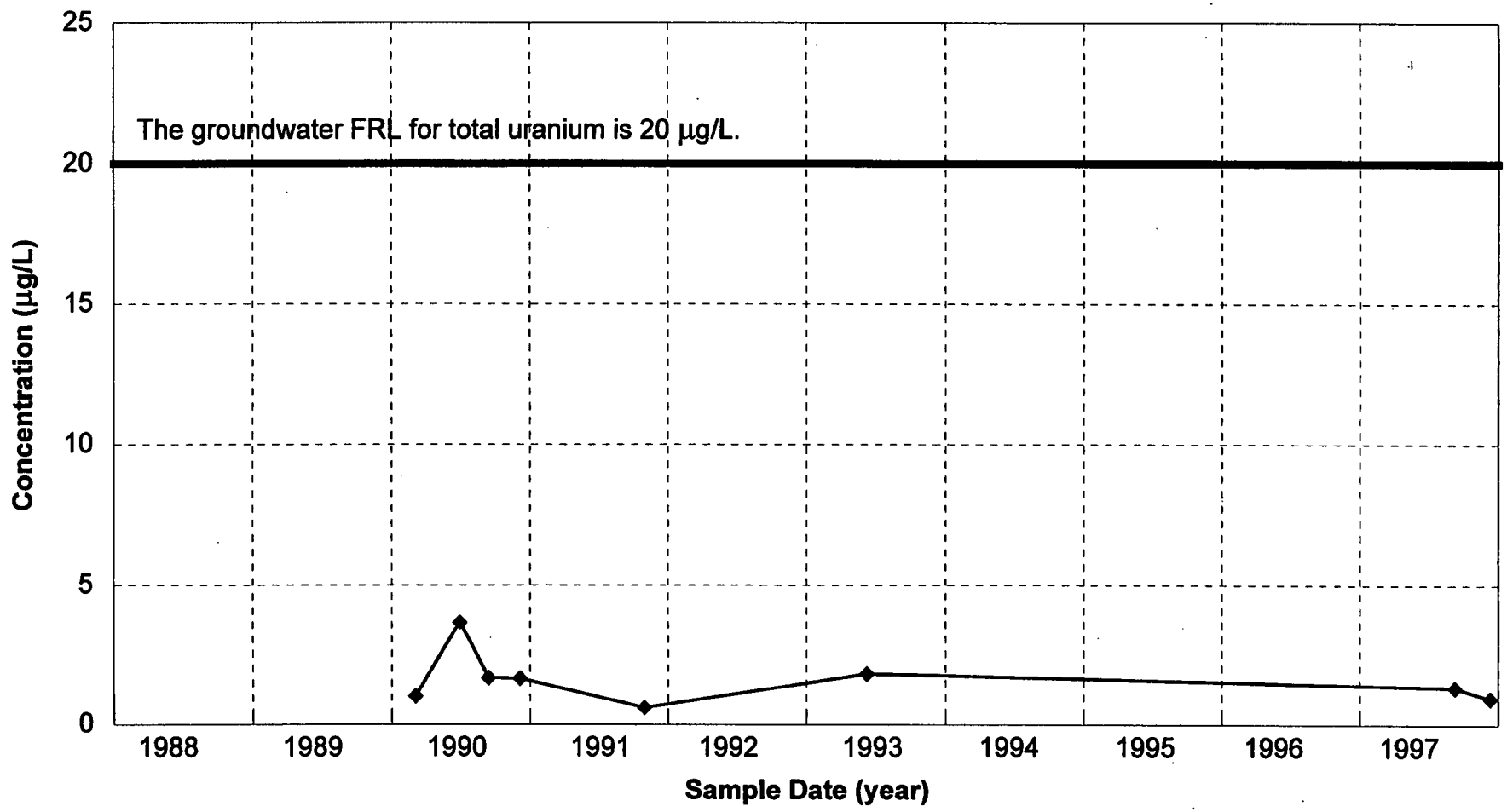


FIGURE A.2-24. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2068

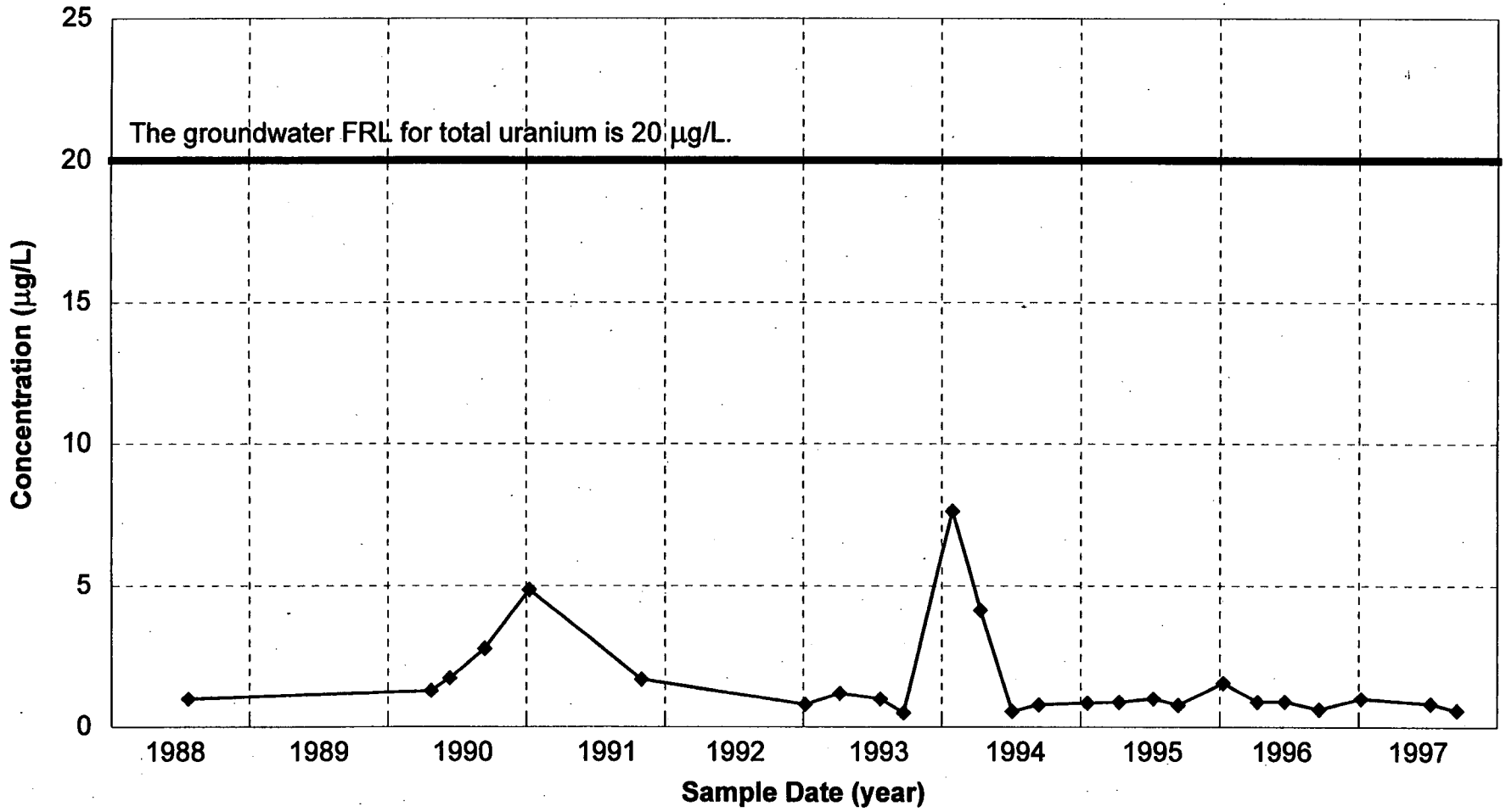


FIGURE A.2-25. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2070

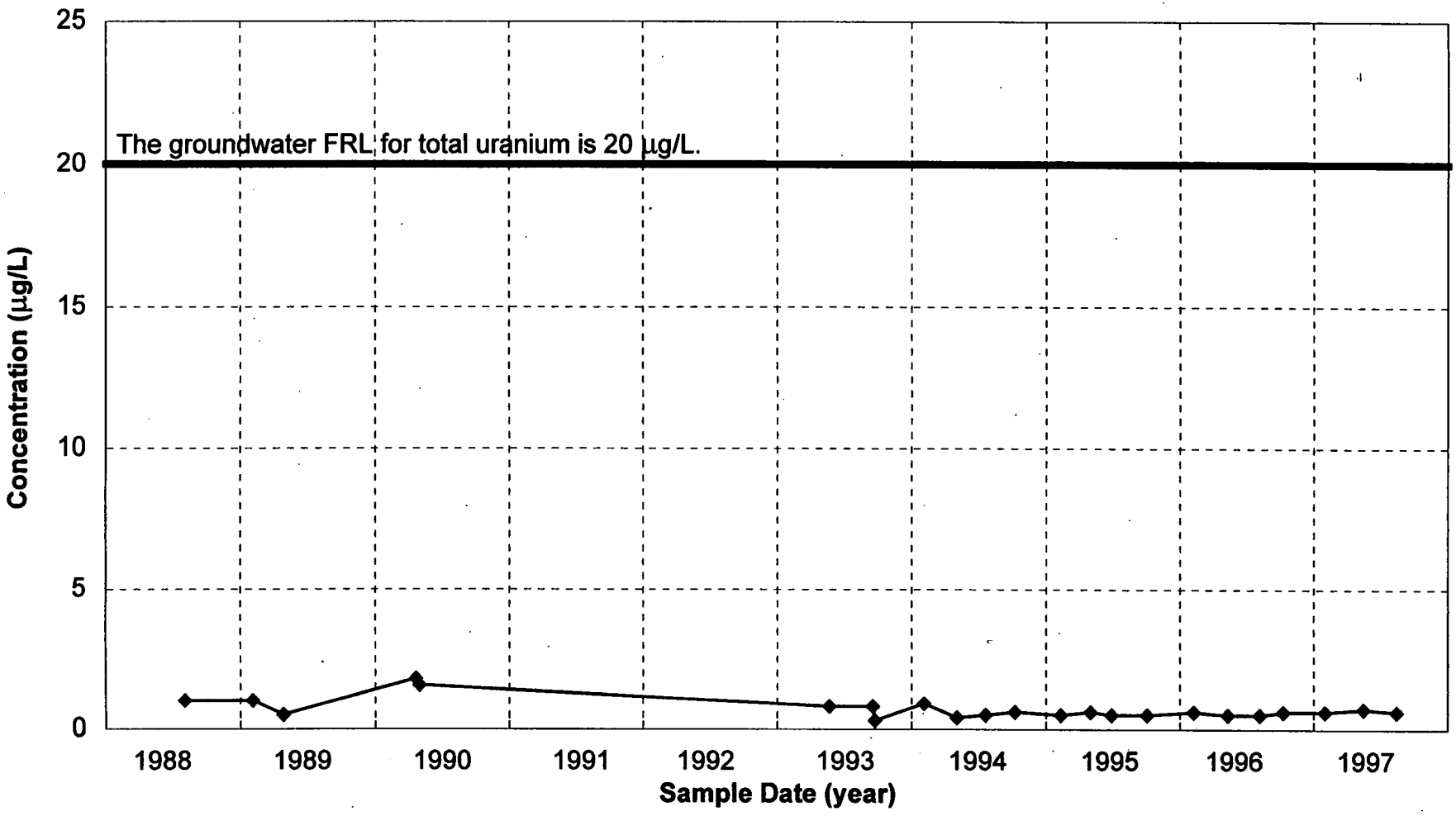


FIGURE A.2-26. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2093

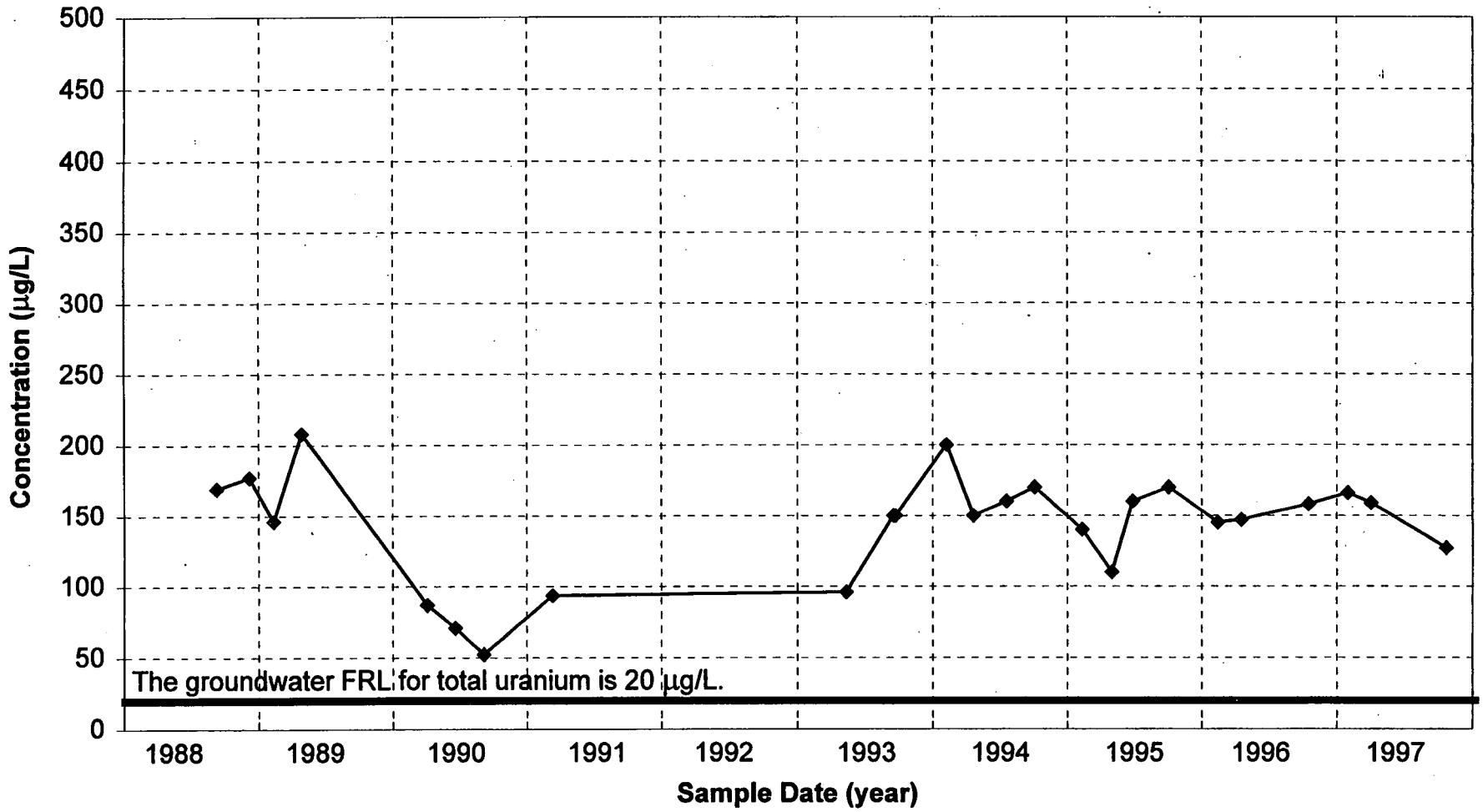


FIGURE A.2-27. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2095

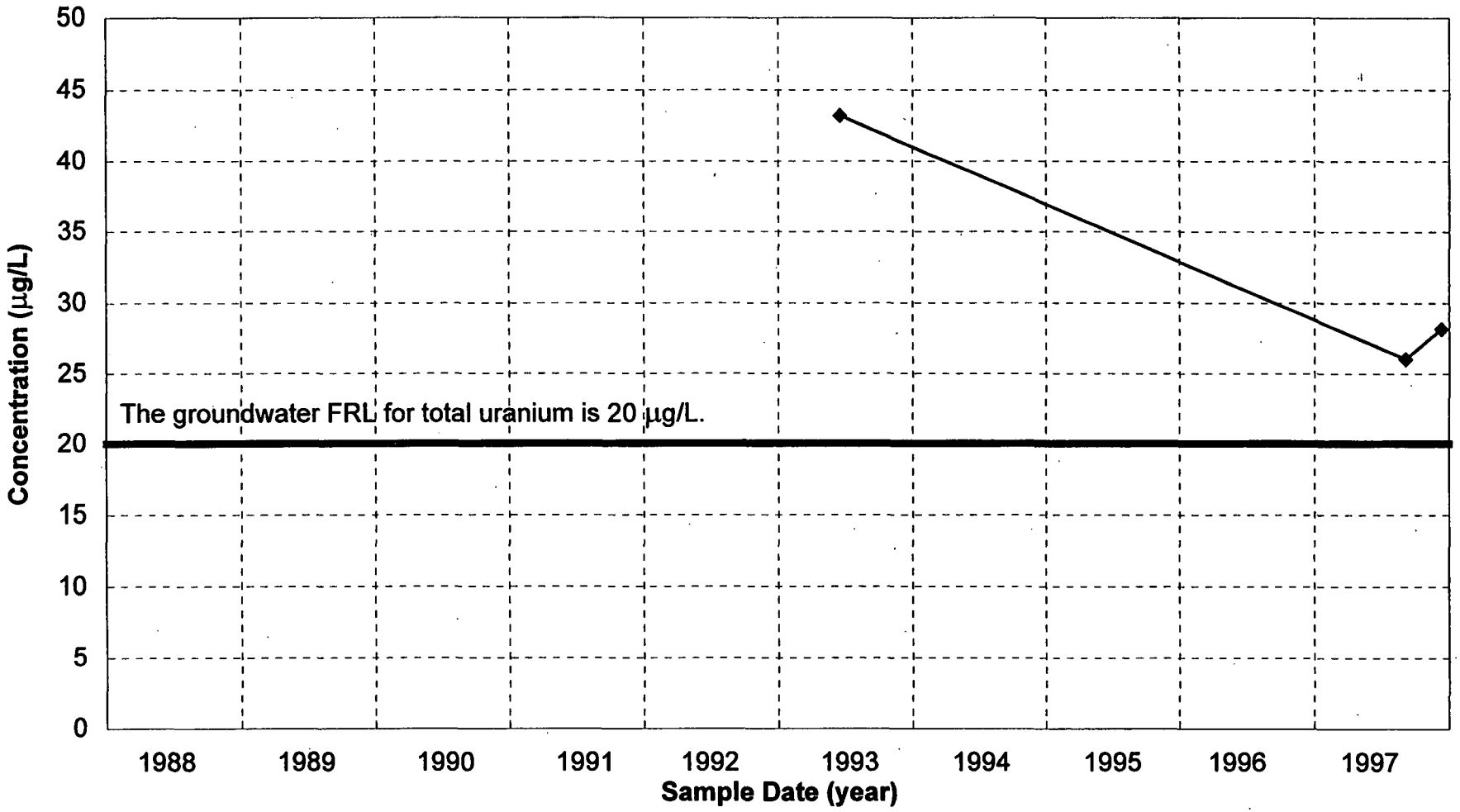


FIGURE A.2-28. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 21033

002008

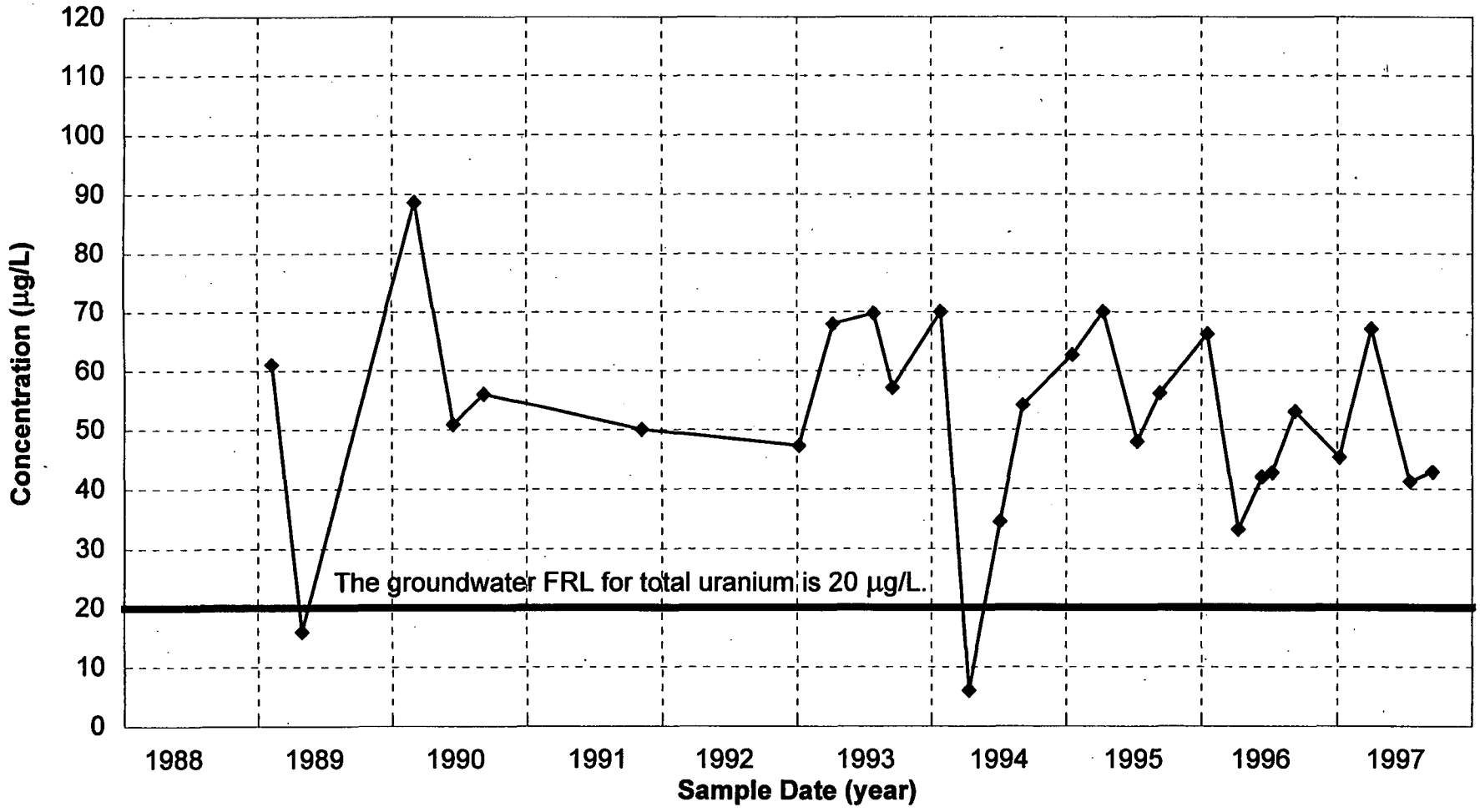


FIGURE A.2-29. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2106

002009

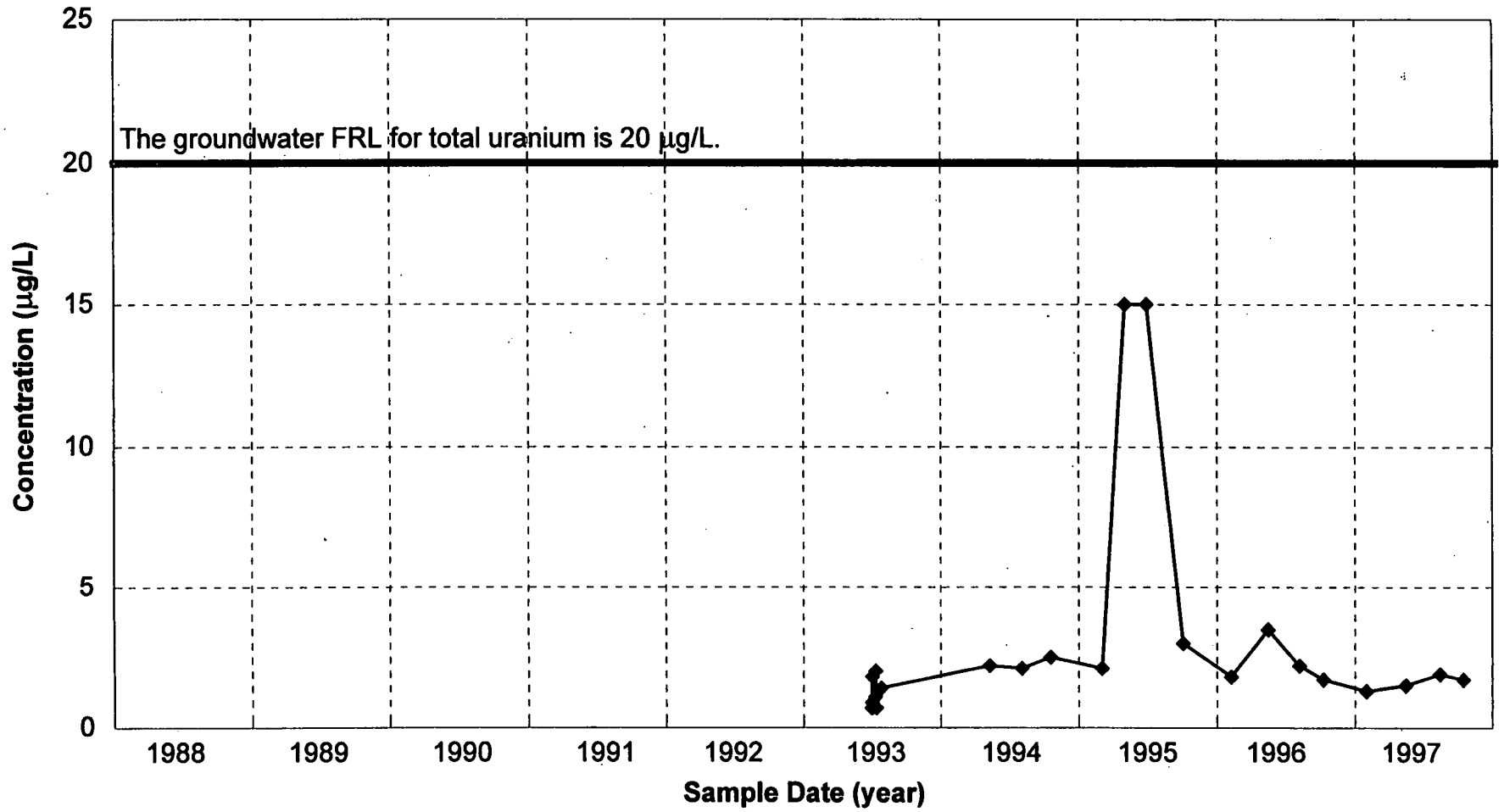


FIGURE A.2-30. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 21063

000210

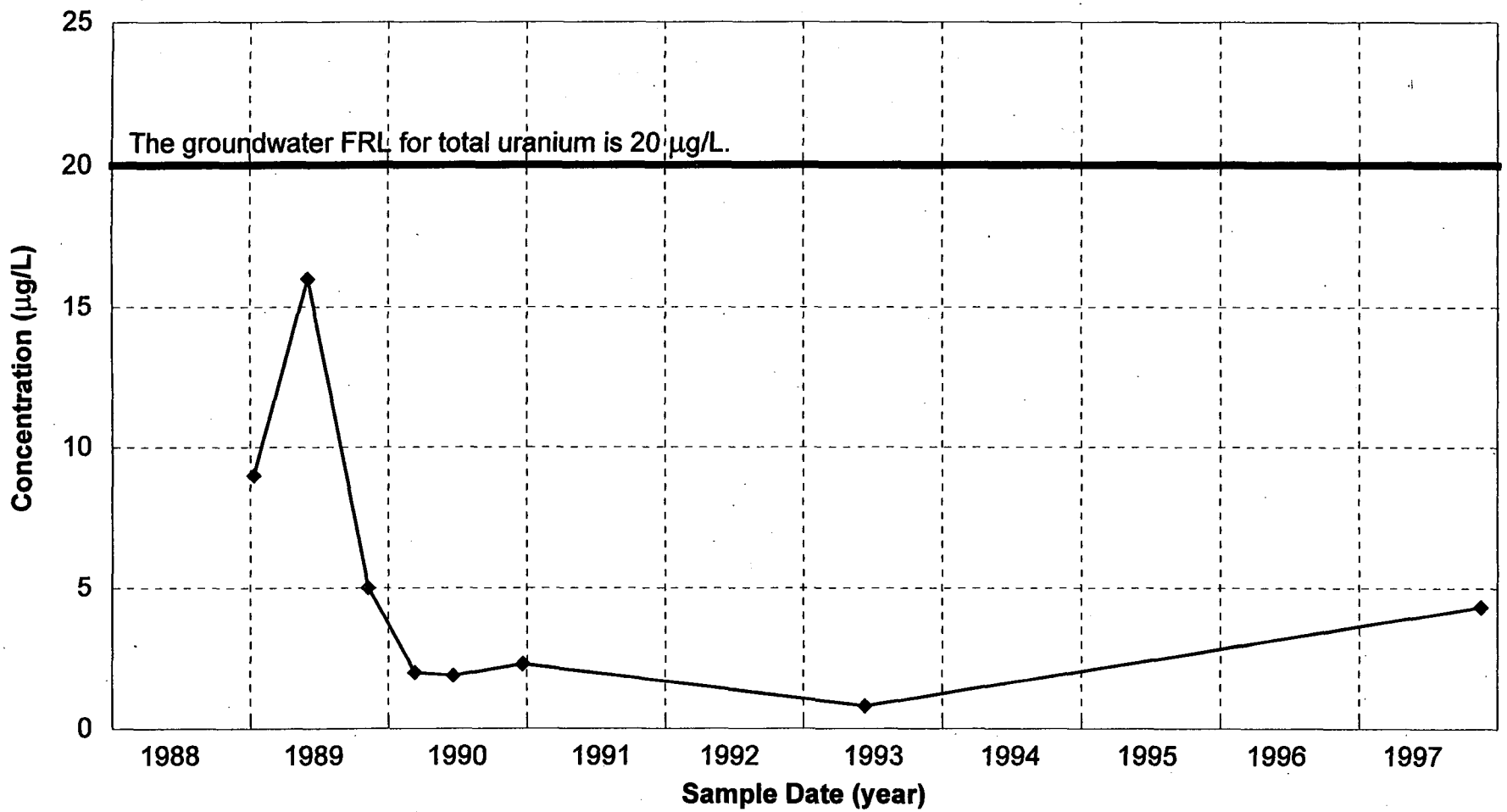


FIGURE A.2-31. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2118

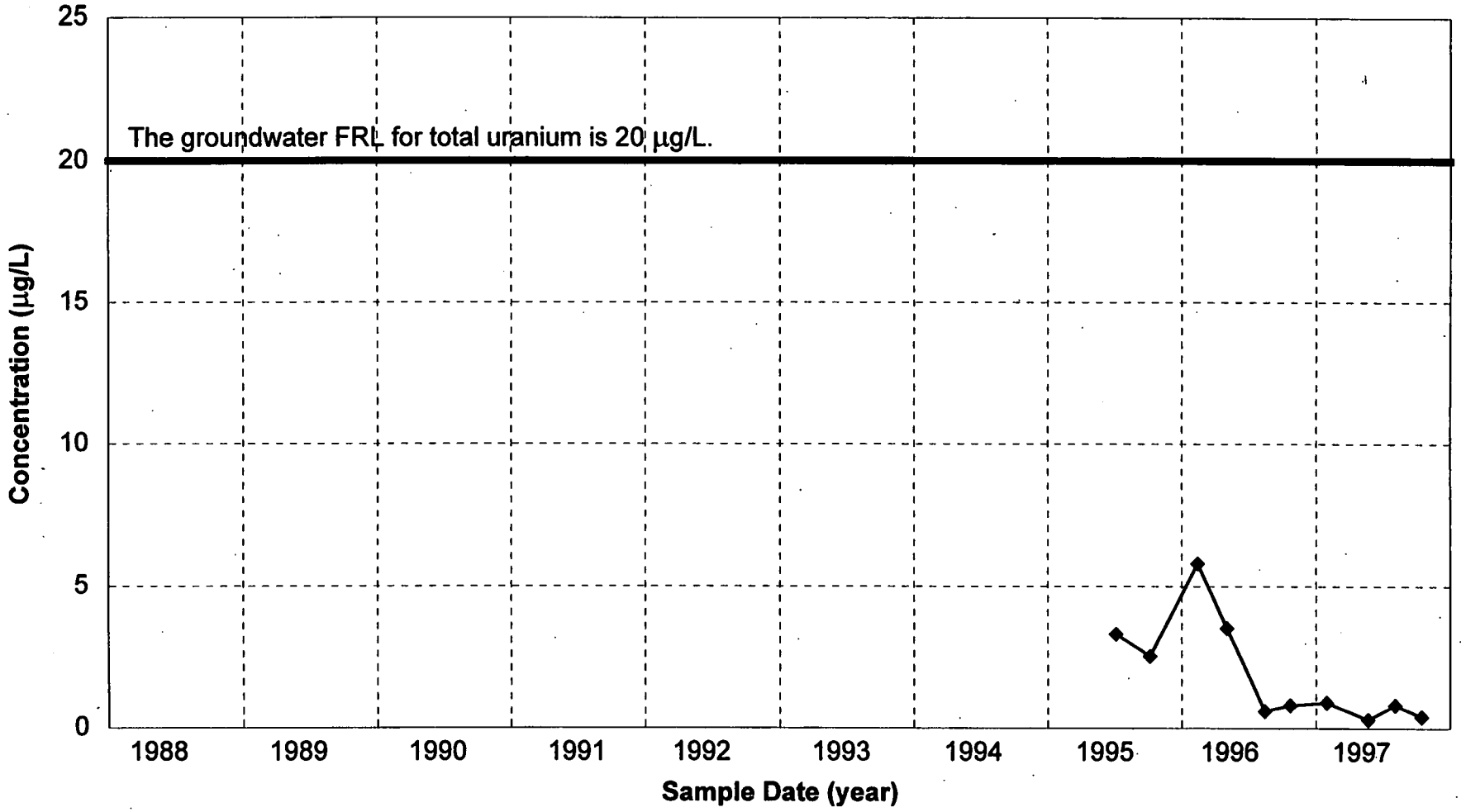


FIGURE A.2-32. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 21194

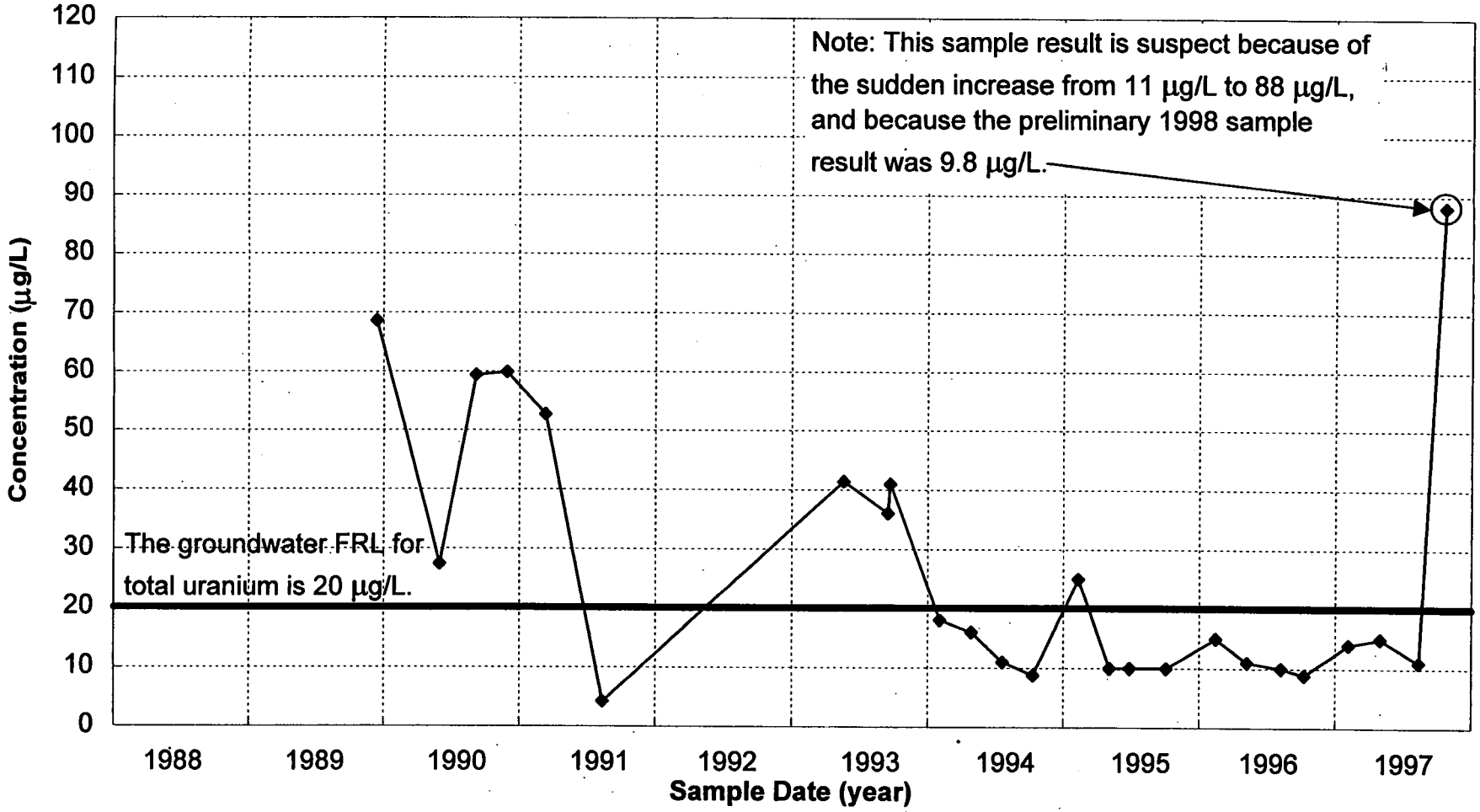


FIGURE A.2-33. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2125

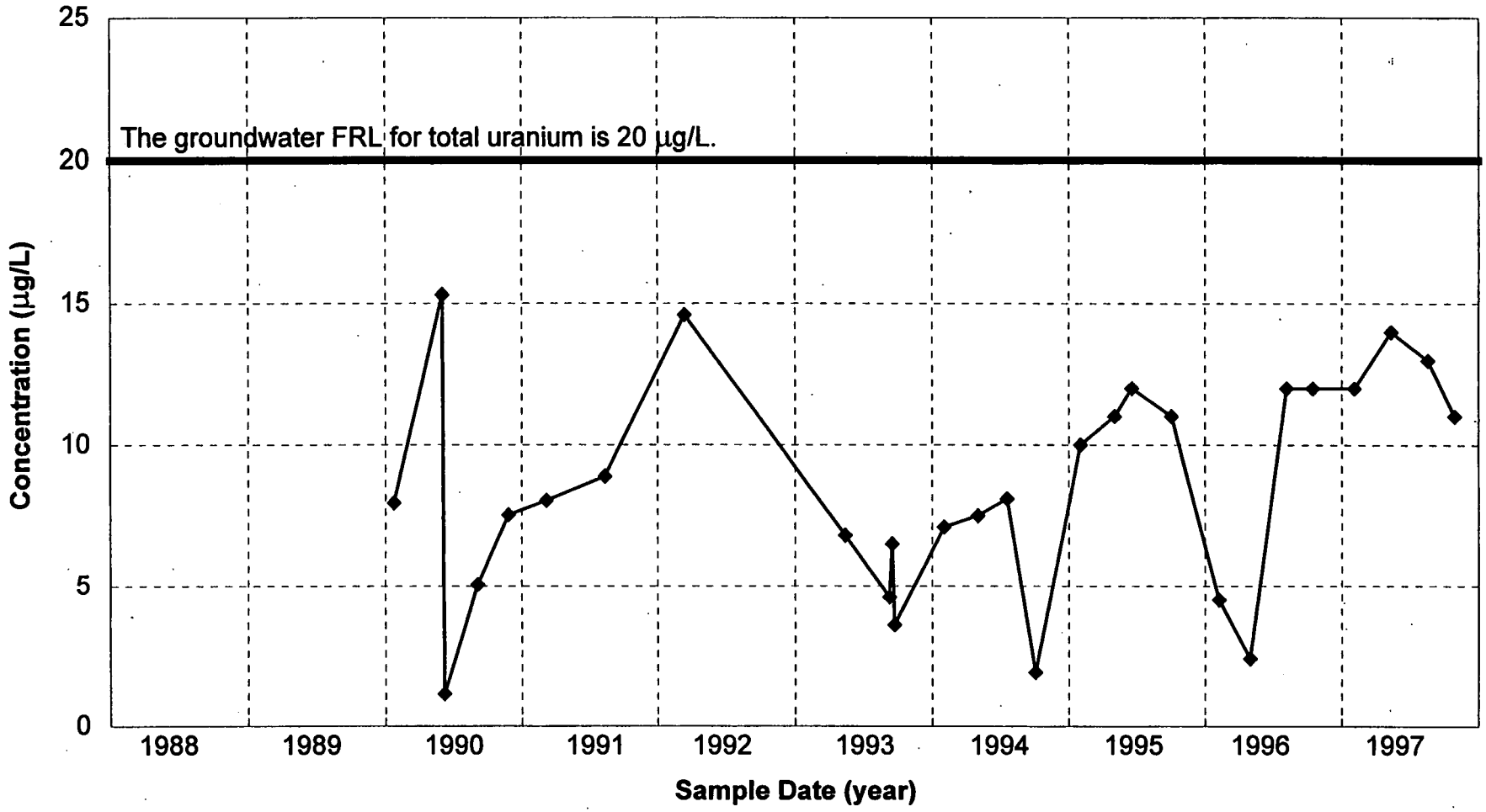


FIGURE A.2-34. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2128

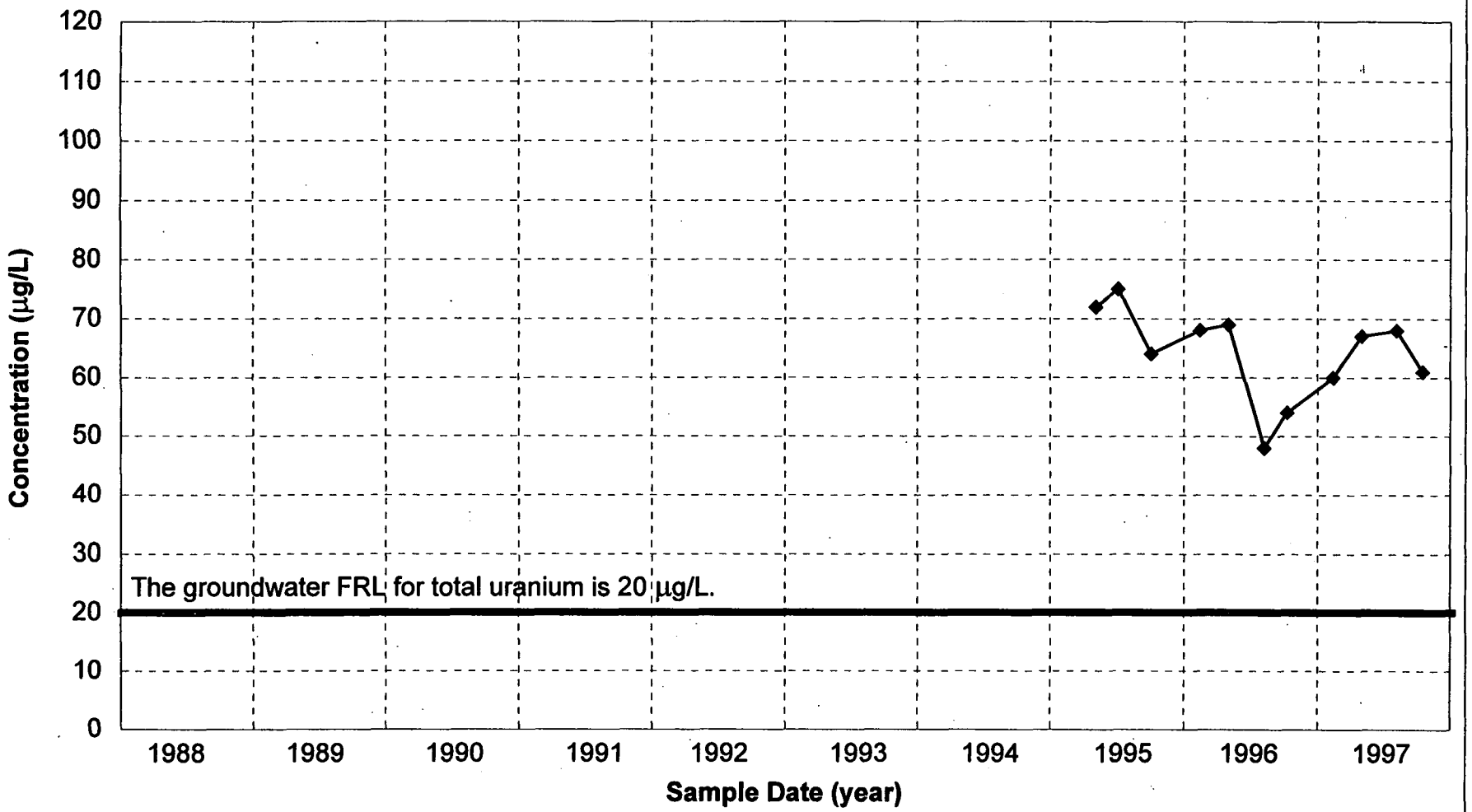


FIGURE A.2-35. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2166

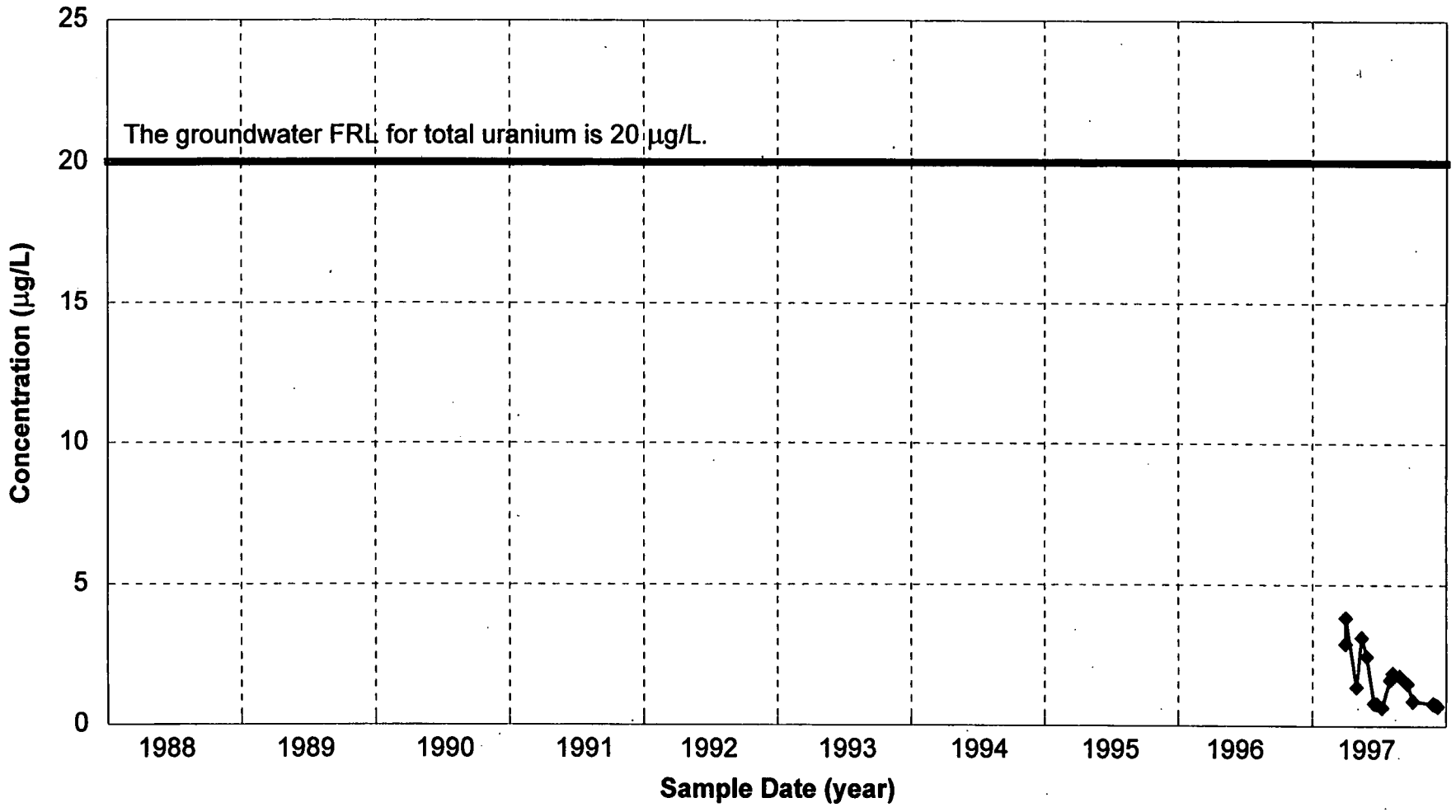


FIGURE A.2-36. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 22198

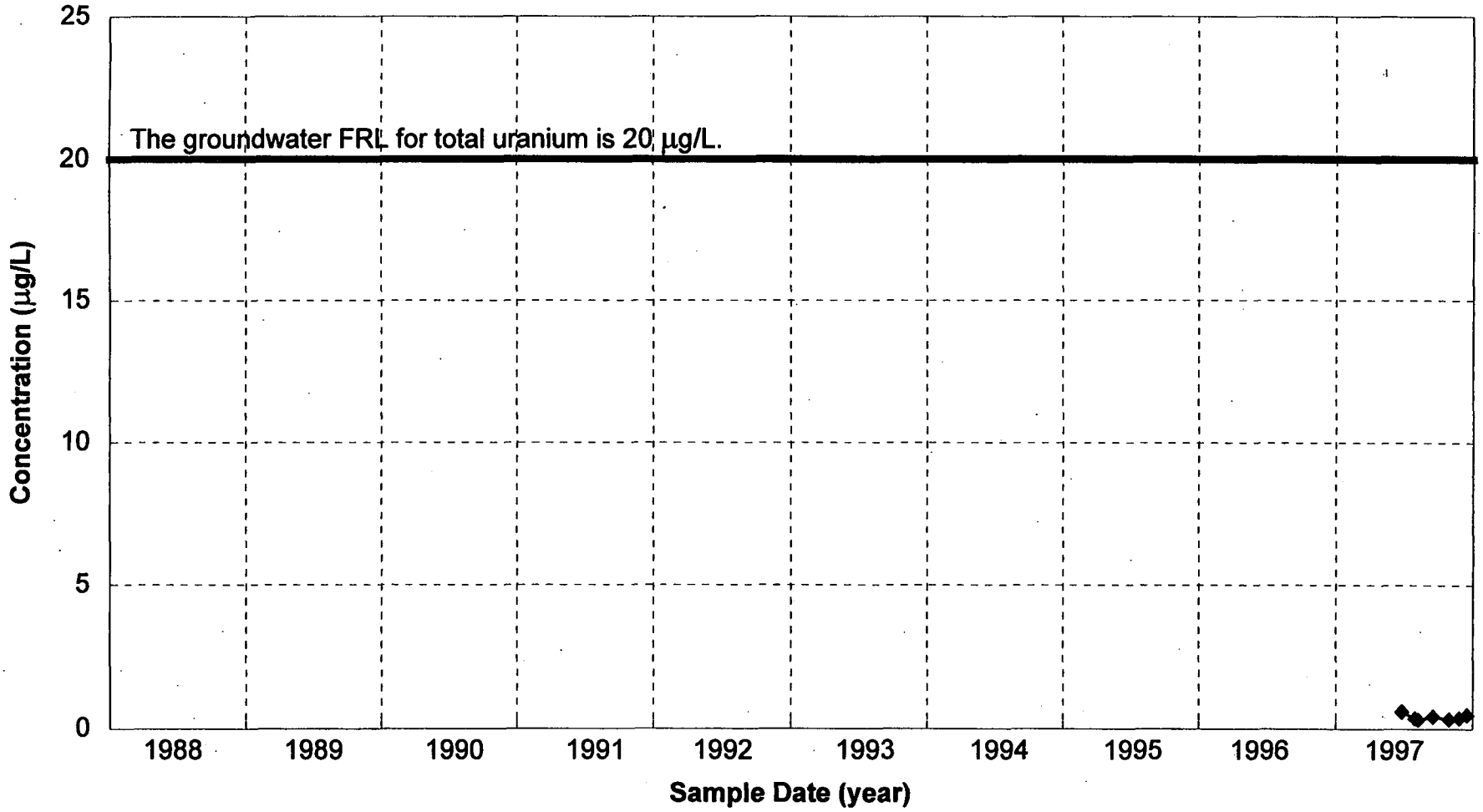


FIGURE A.2-37. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 22199

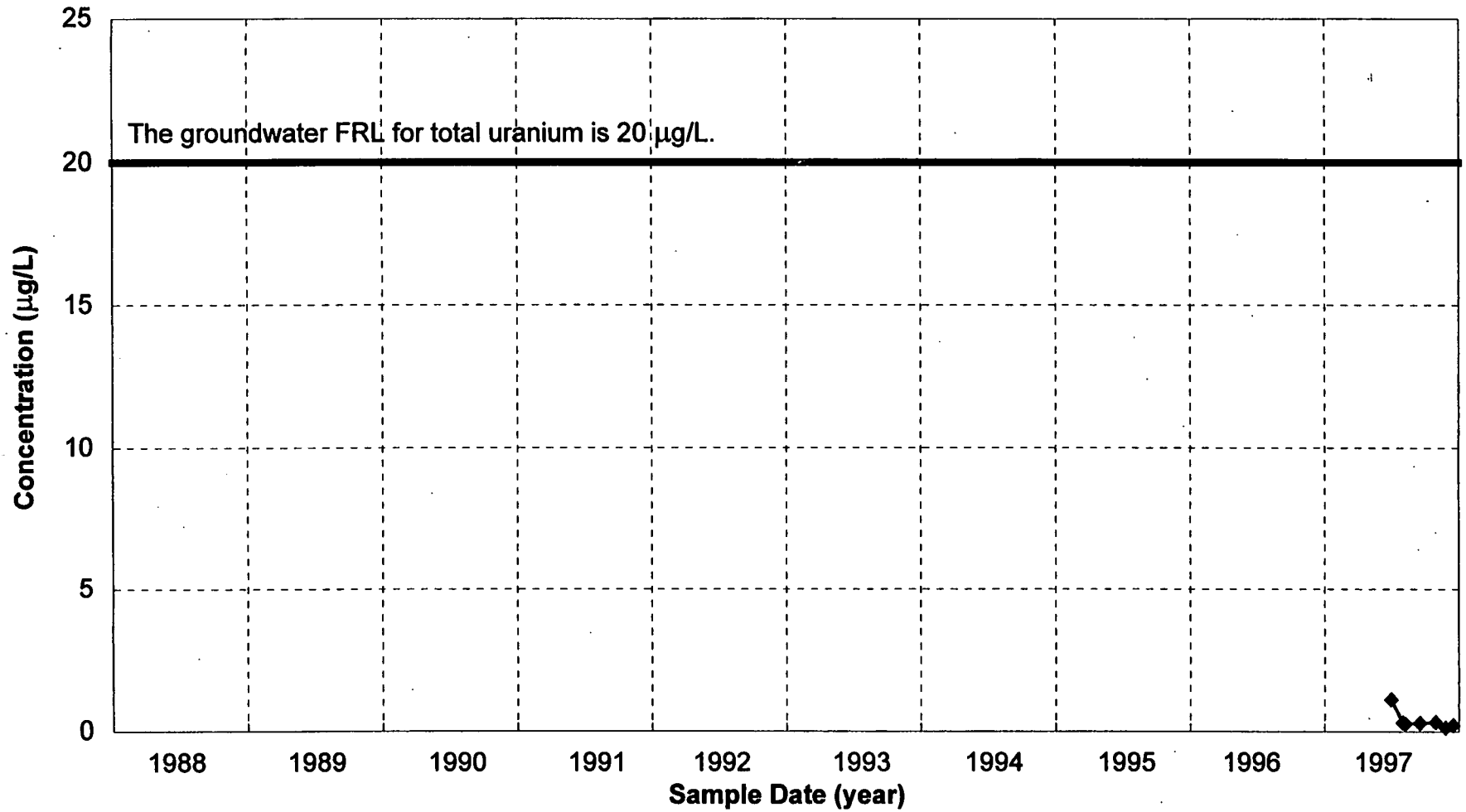


FIGURE A.2-38. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 22200

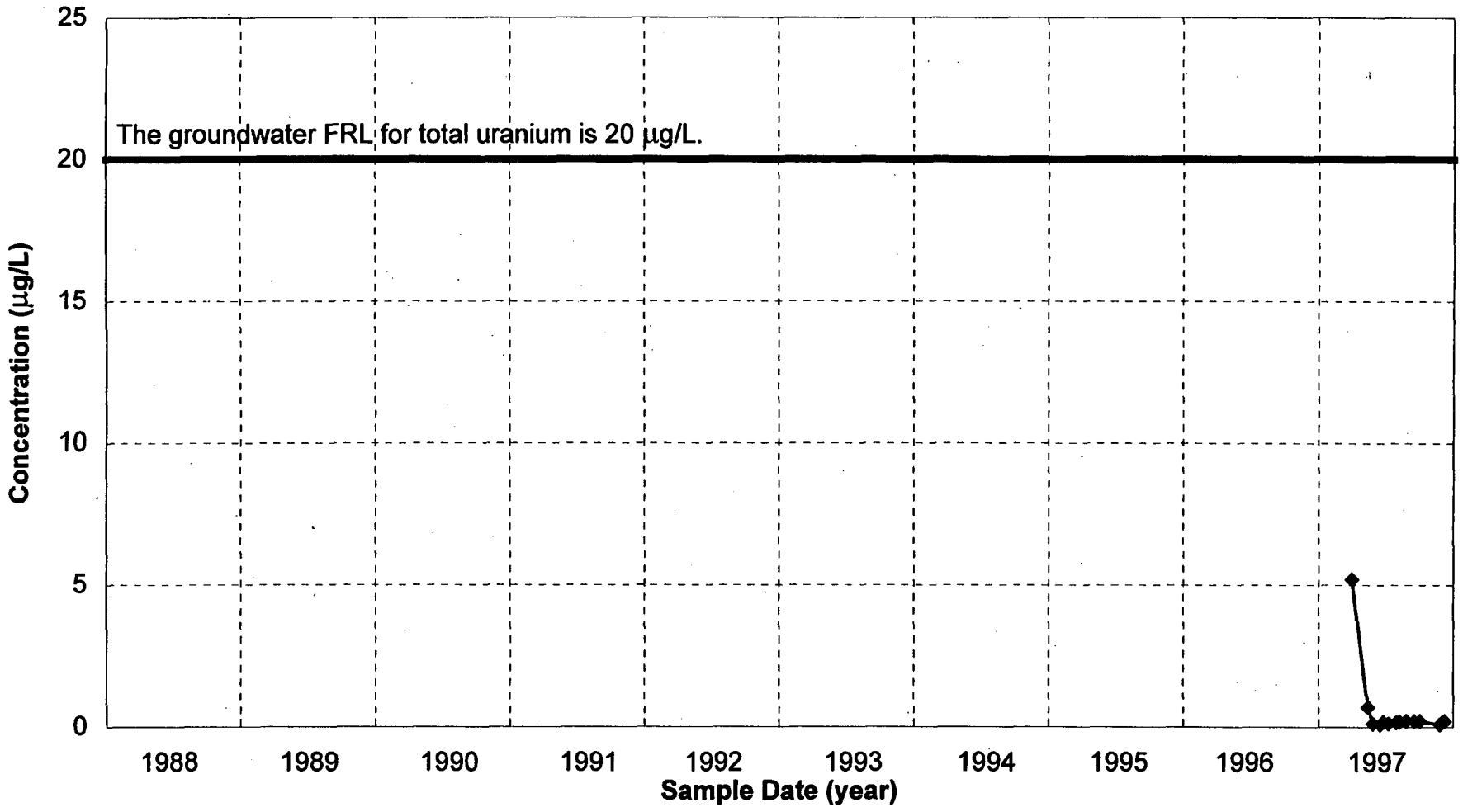


FIGURE A.2-39. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 22201

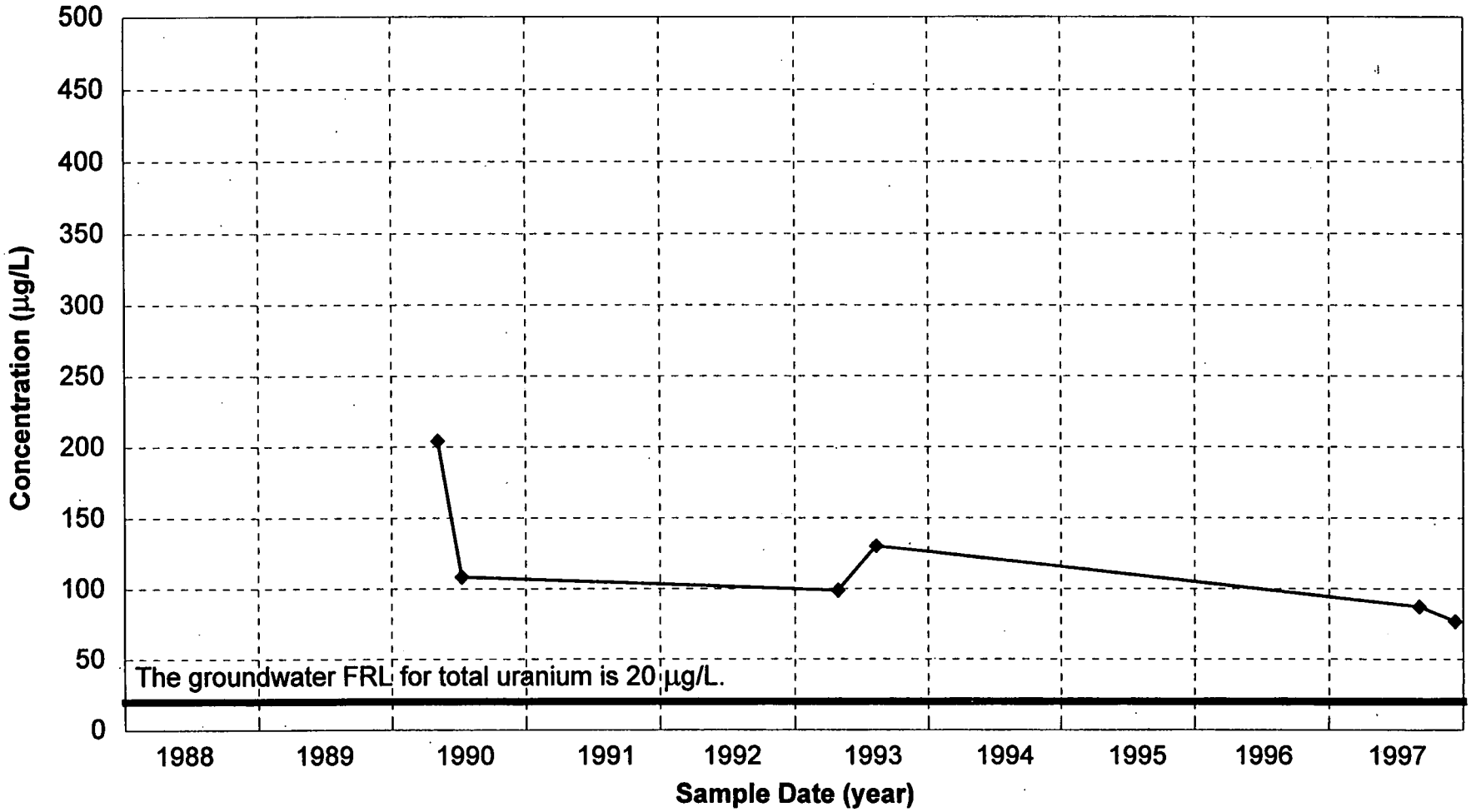


FIGURE A.2-40. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2385

022000

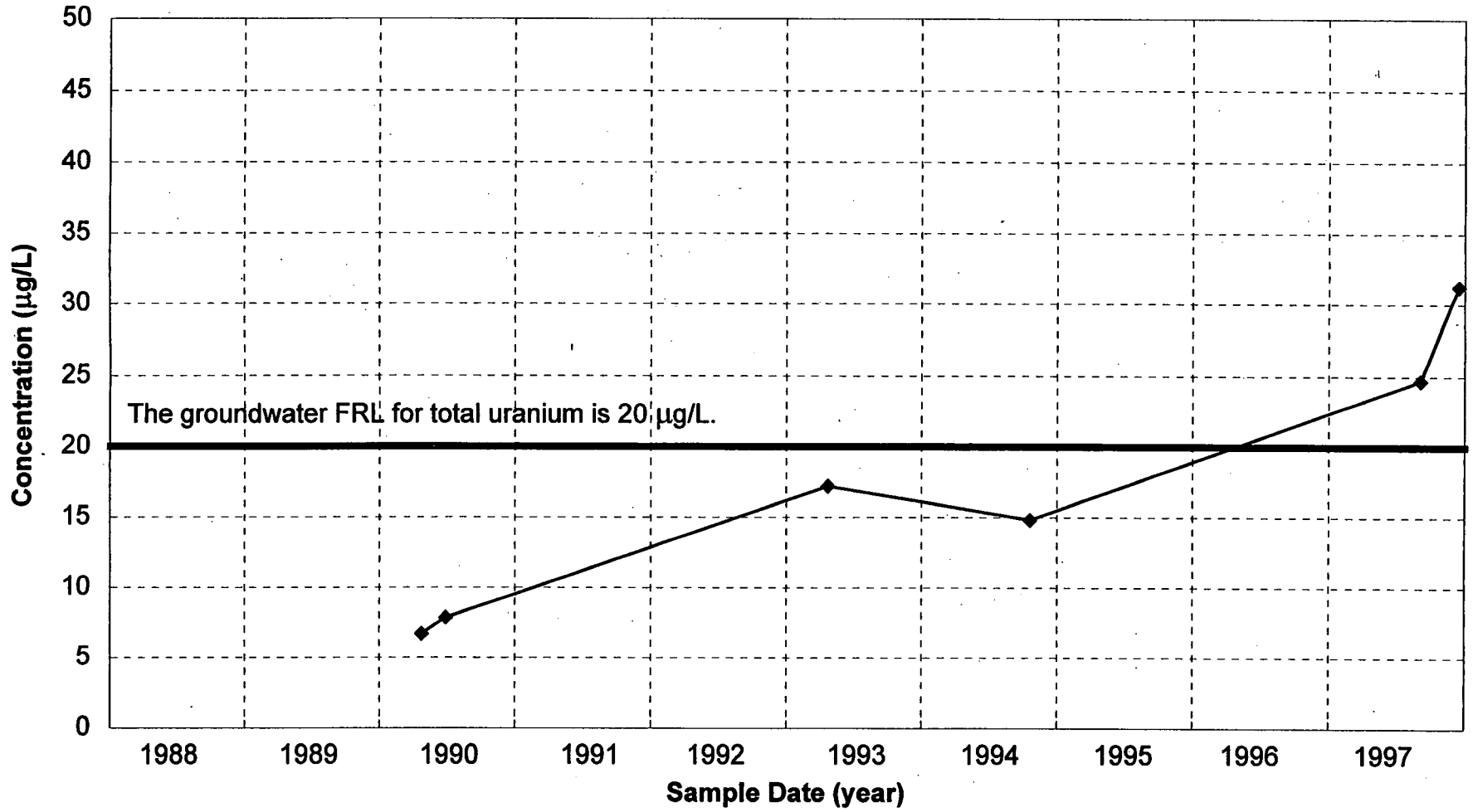


FIGURE A.2-41. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2386

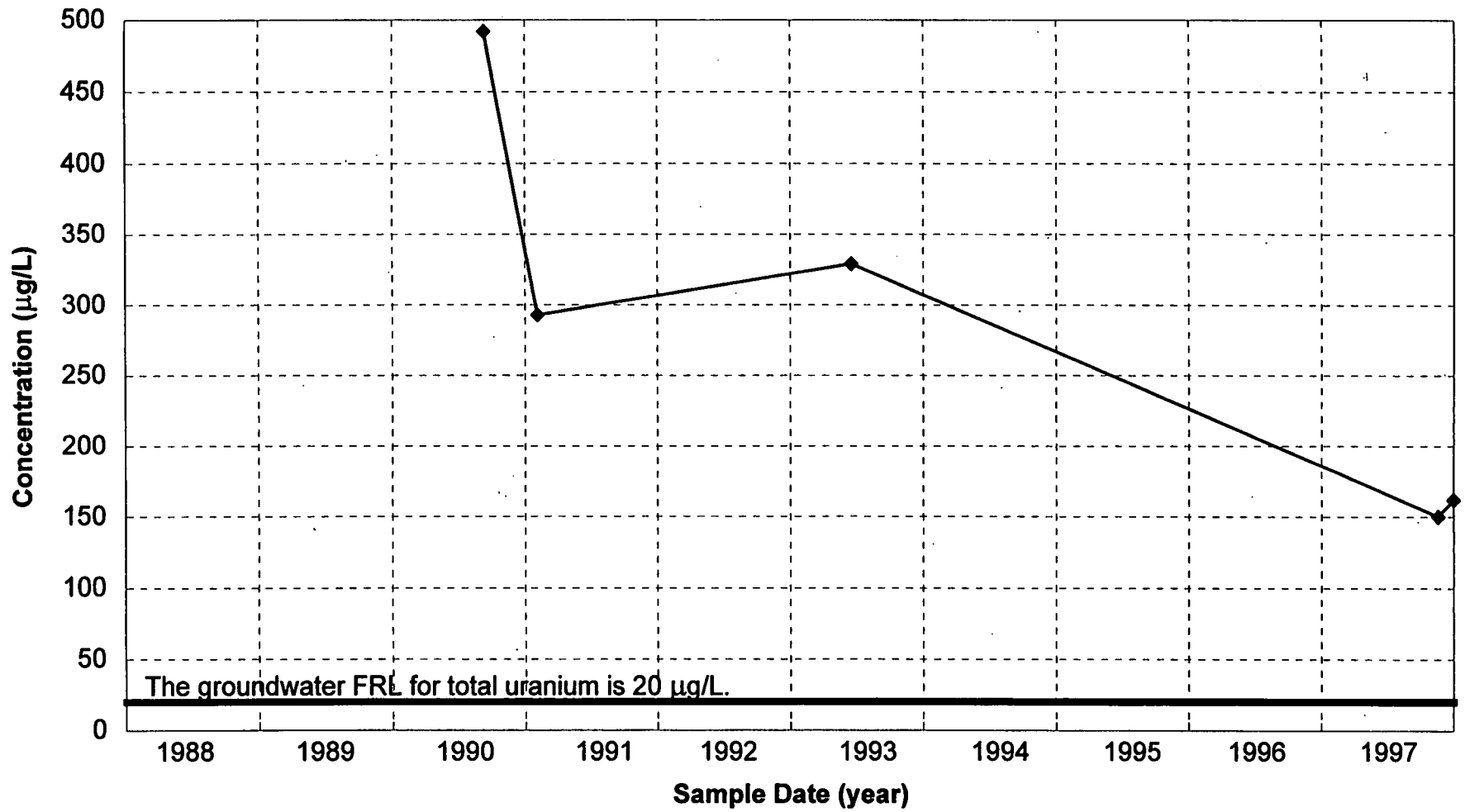


FIGURE A.2-42. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2387

000222

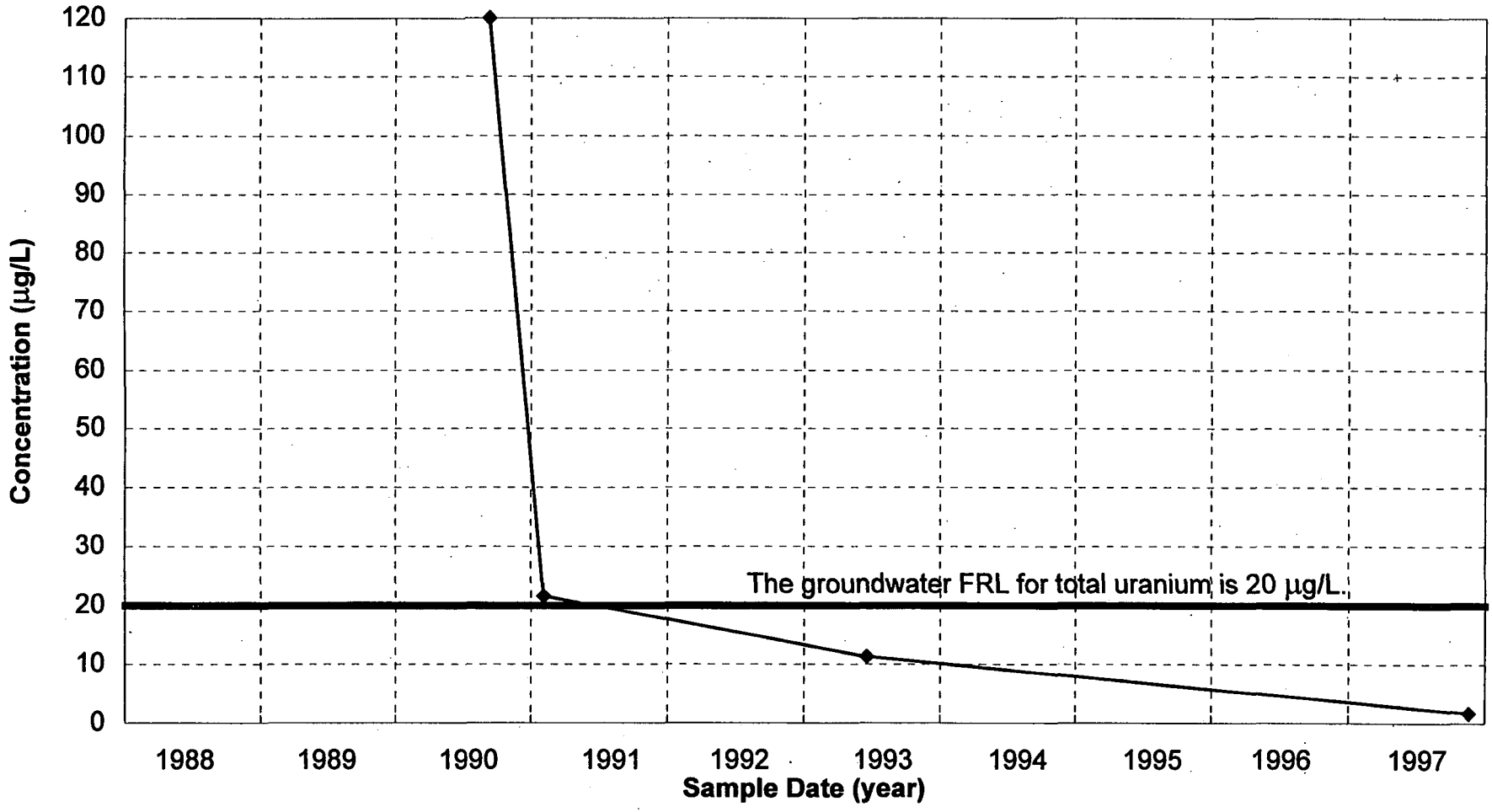


FIGURE A.2-43. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2389

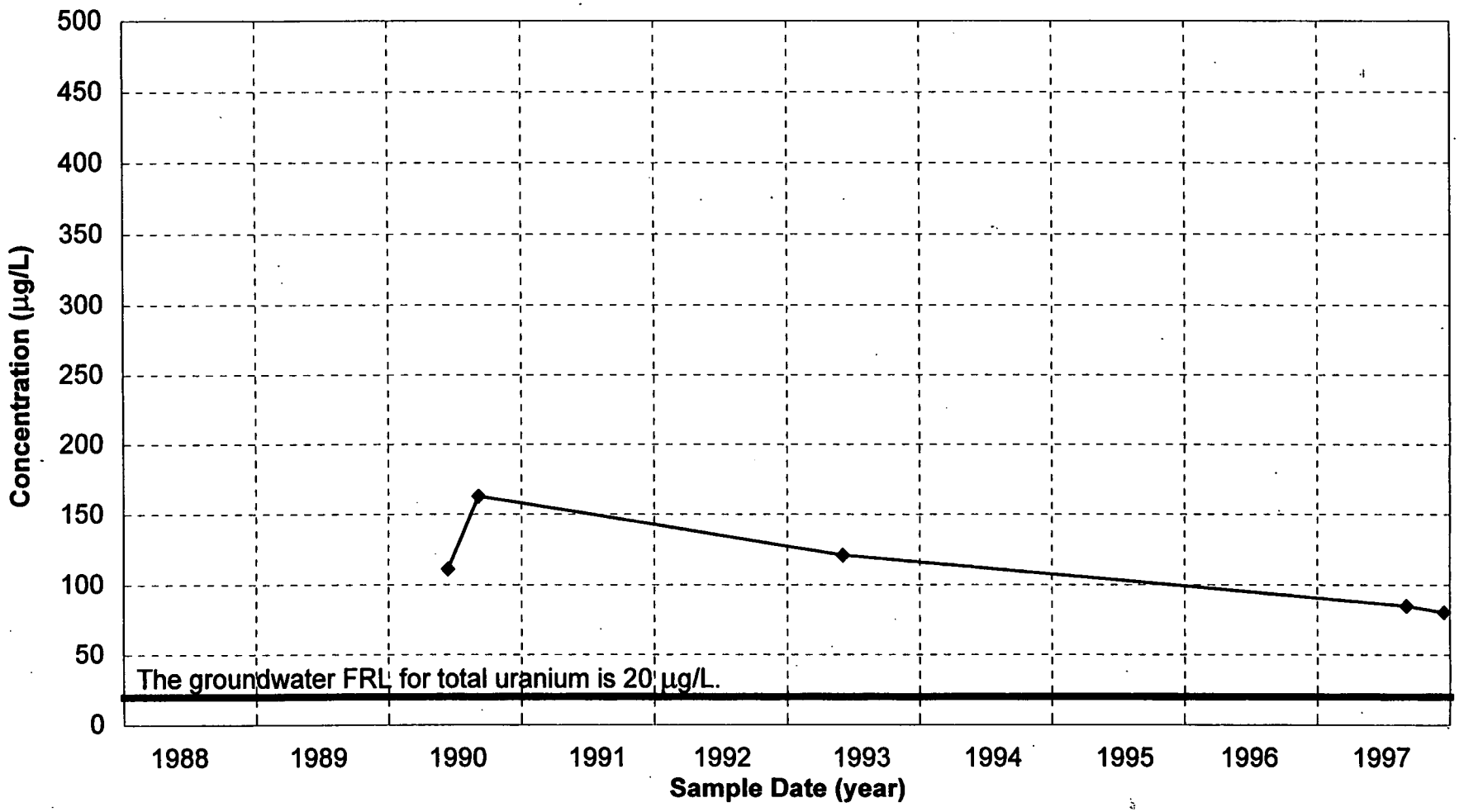


FIGURE A.2-44. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2390

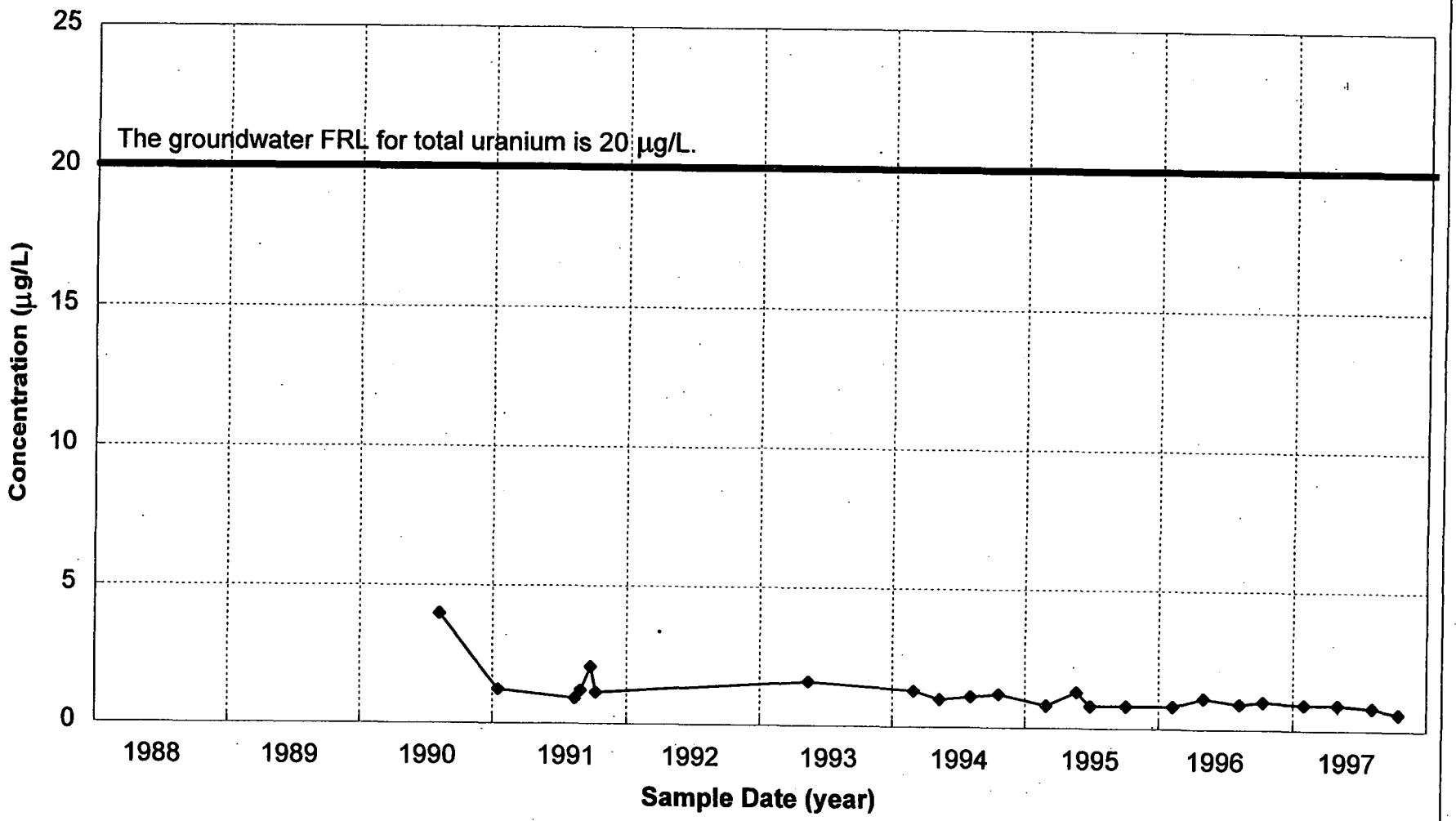


FIGURE A.2-45. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2396

000225

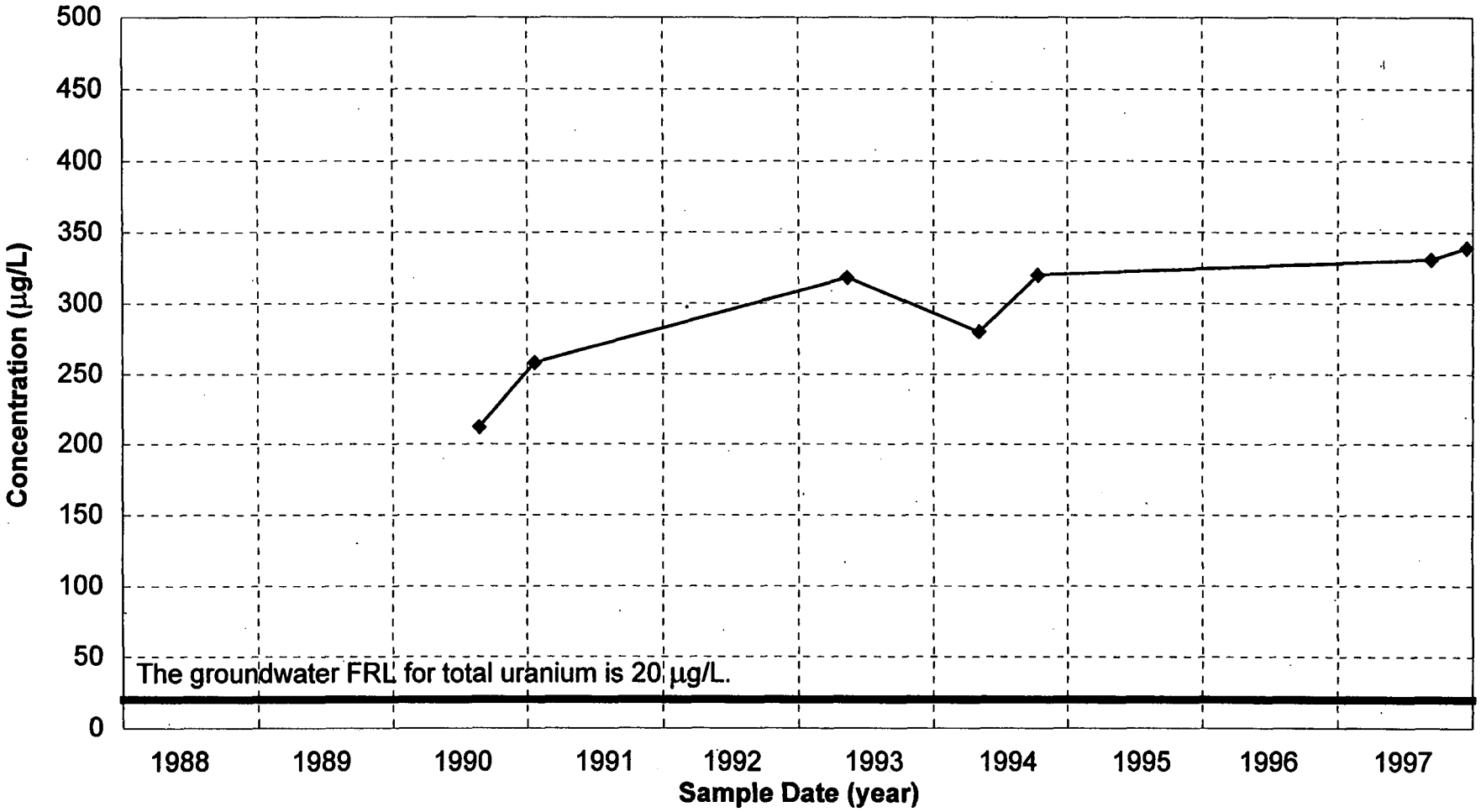


FIGURE A.2-46. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2397

922000

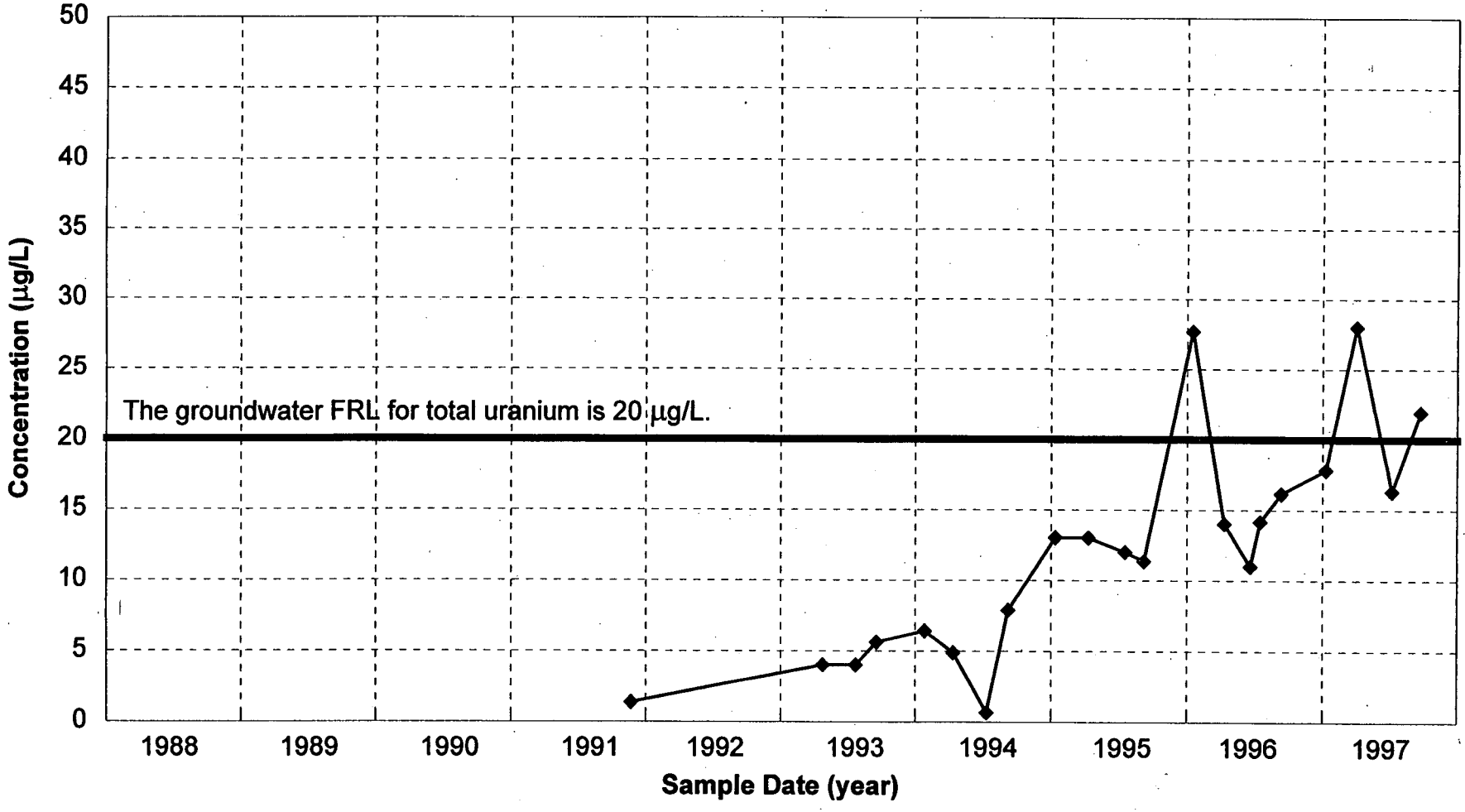


FIGURE A.2-47. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2398

000227

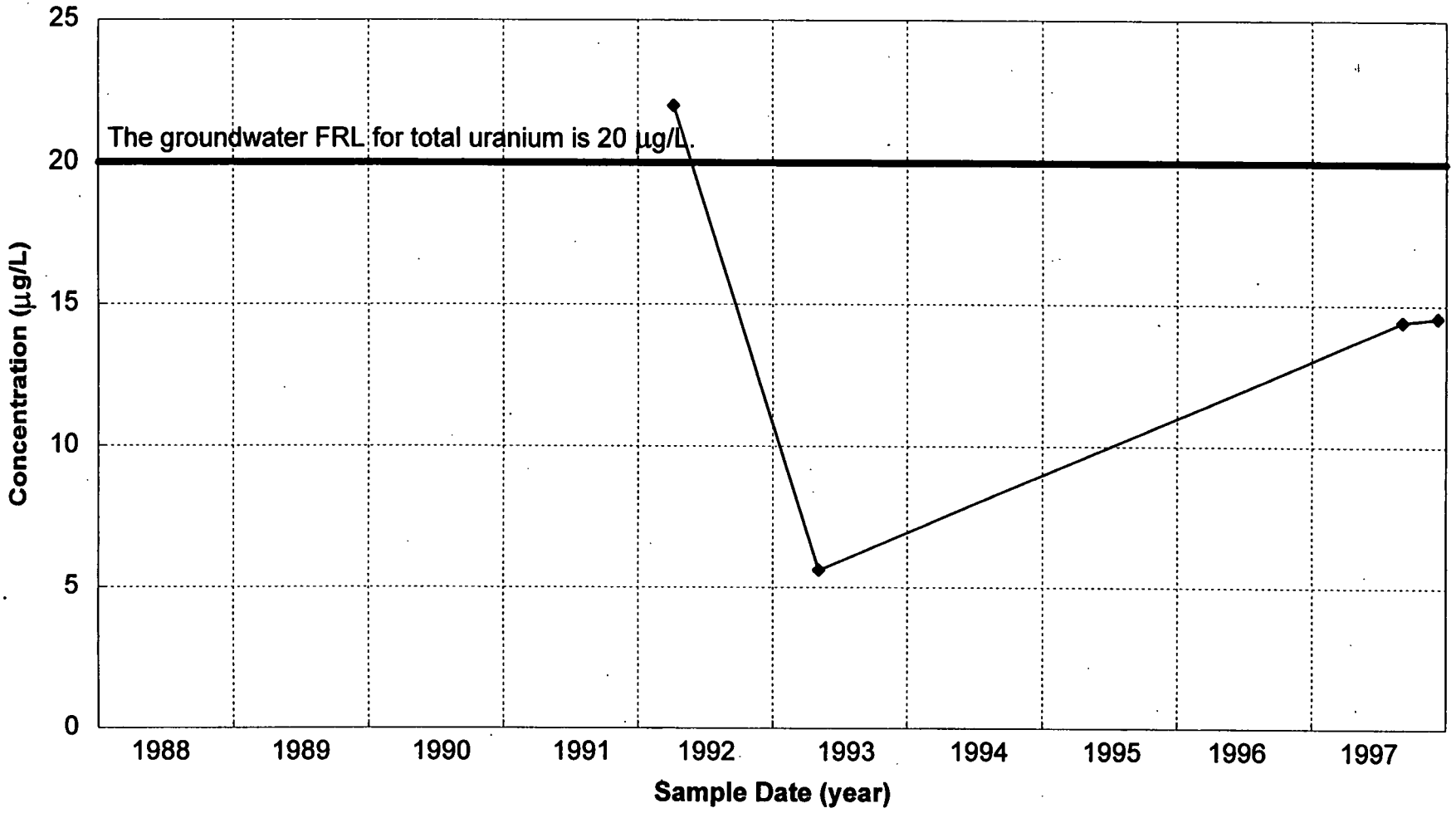


FIGURE A.2-48. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2402

000228

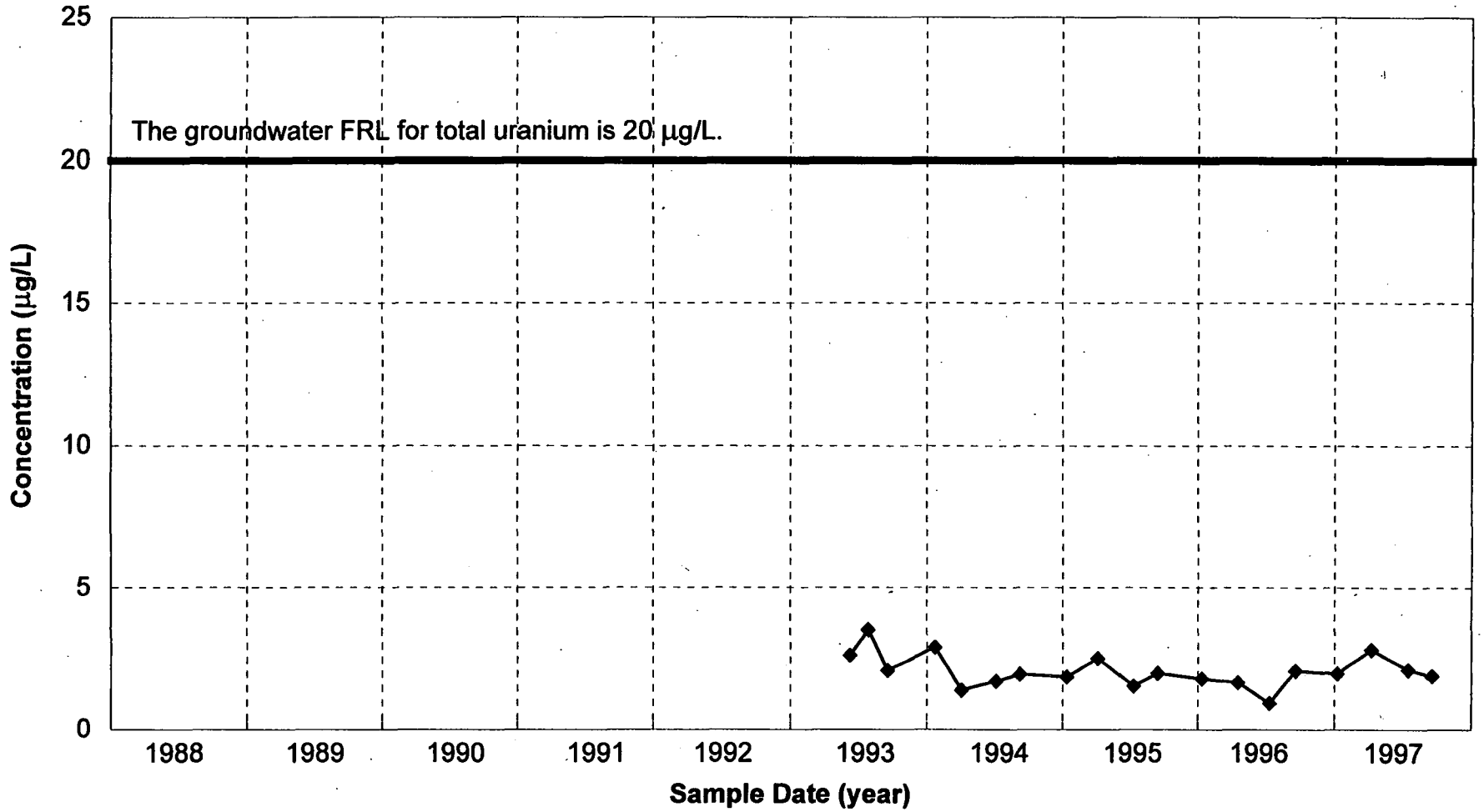


FIGURE A.2-49. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2417

000229

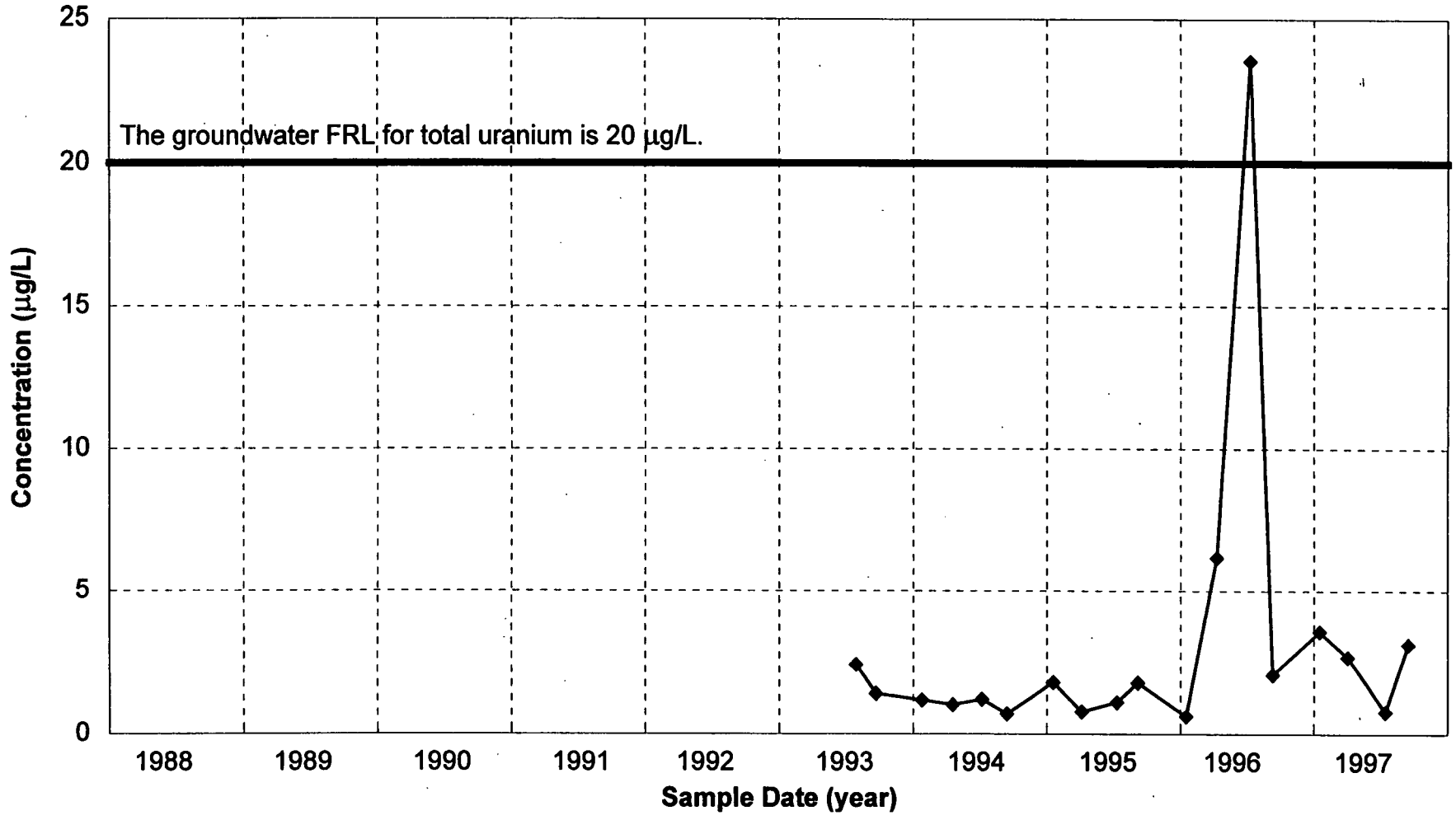


FIGURE A.2-50. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2424

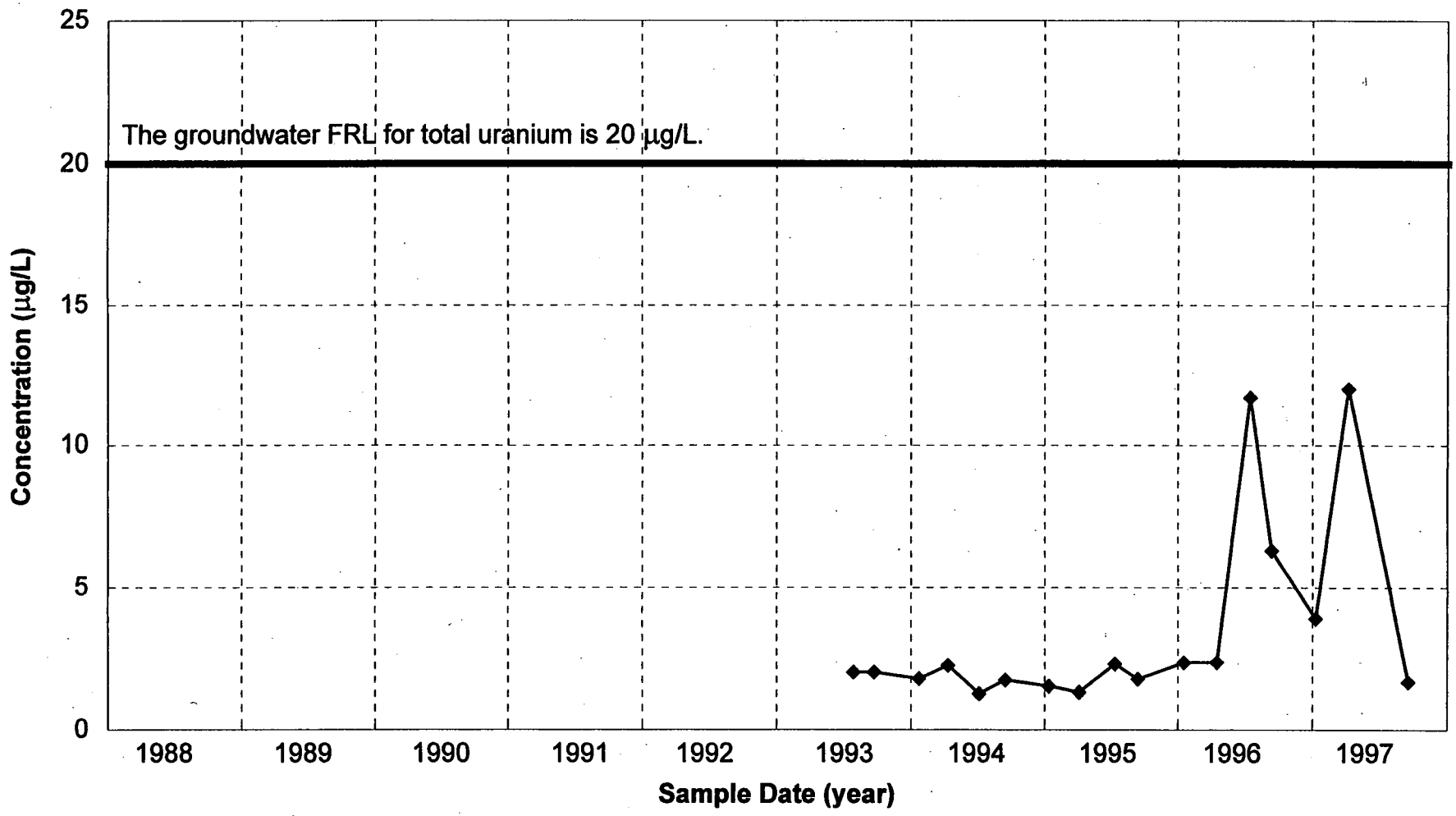


FIGURE A.2-51. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2426

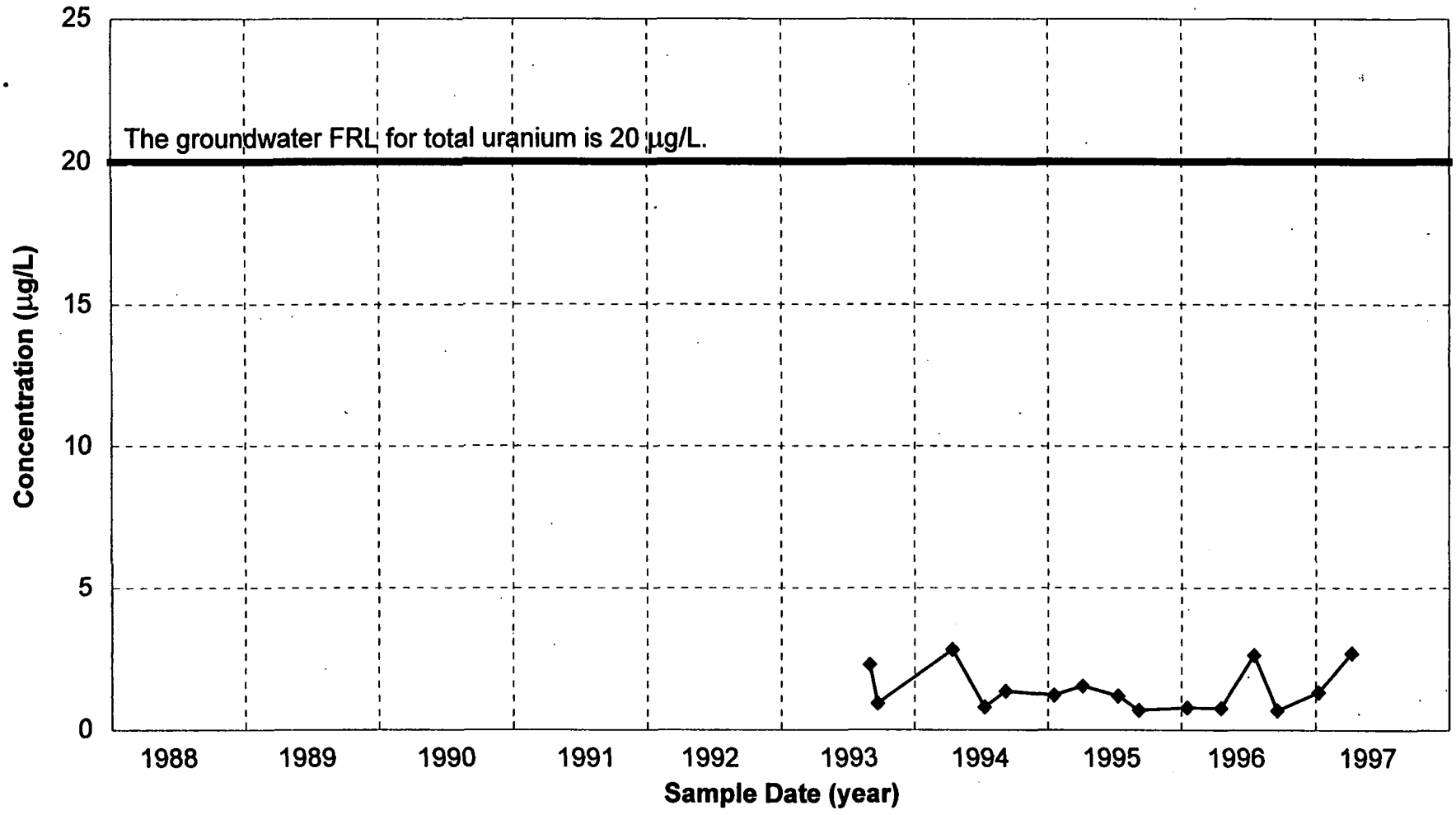


FIGURE A.2-52. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2429

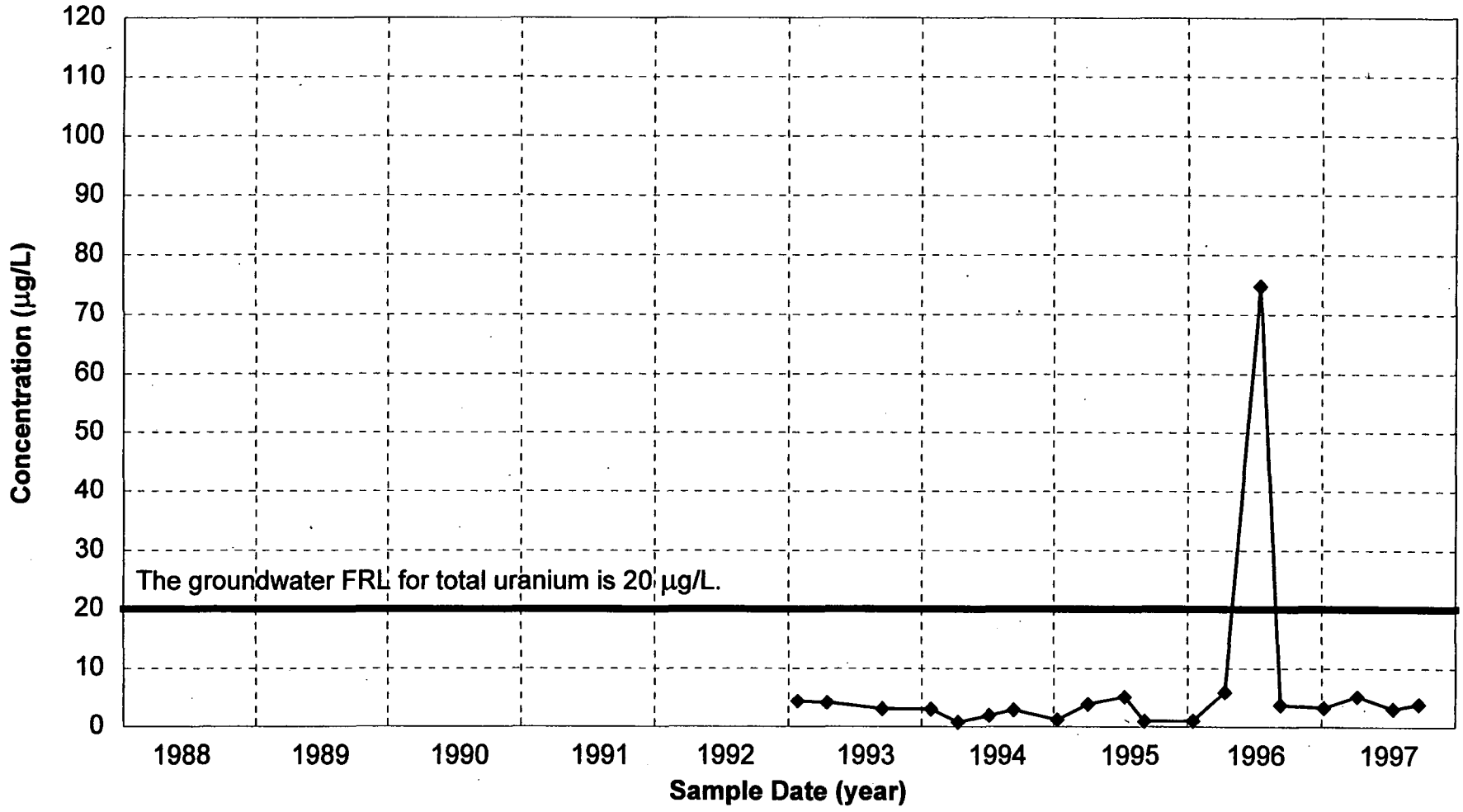


FIGURE A.2-53. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2430

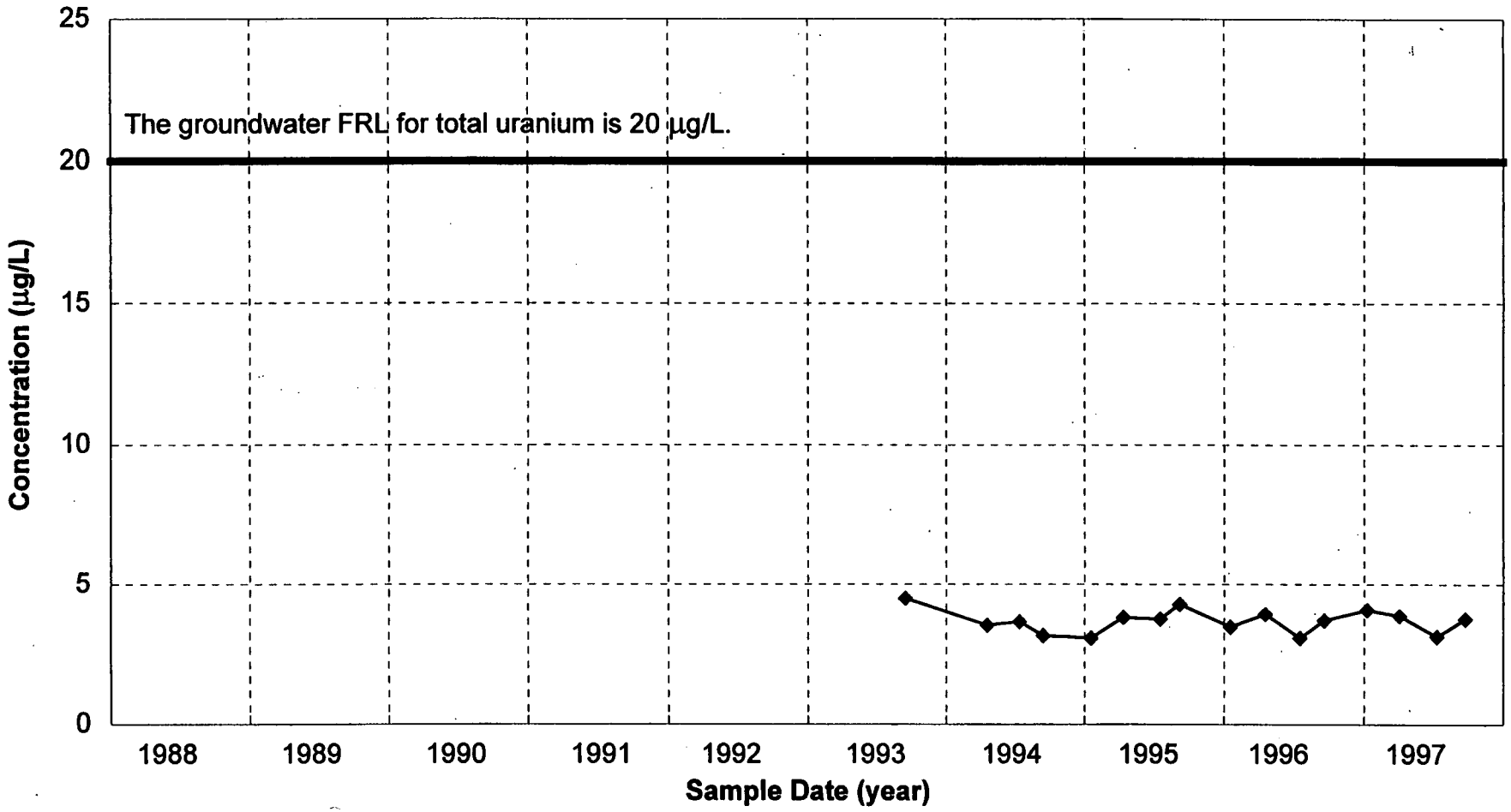


FIGURE A.2-54. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2431

0002234

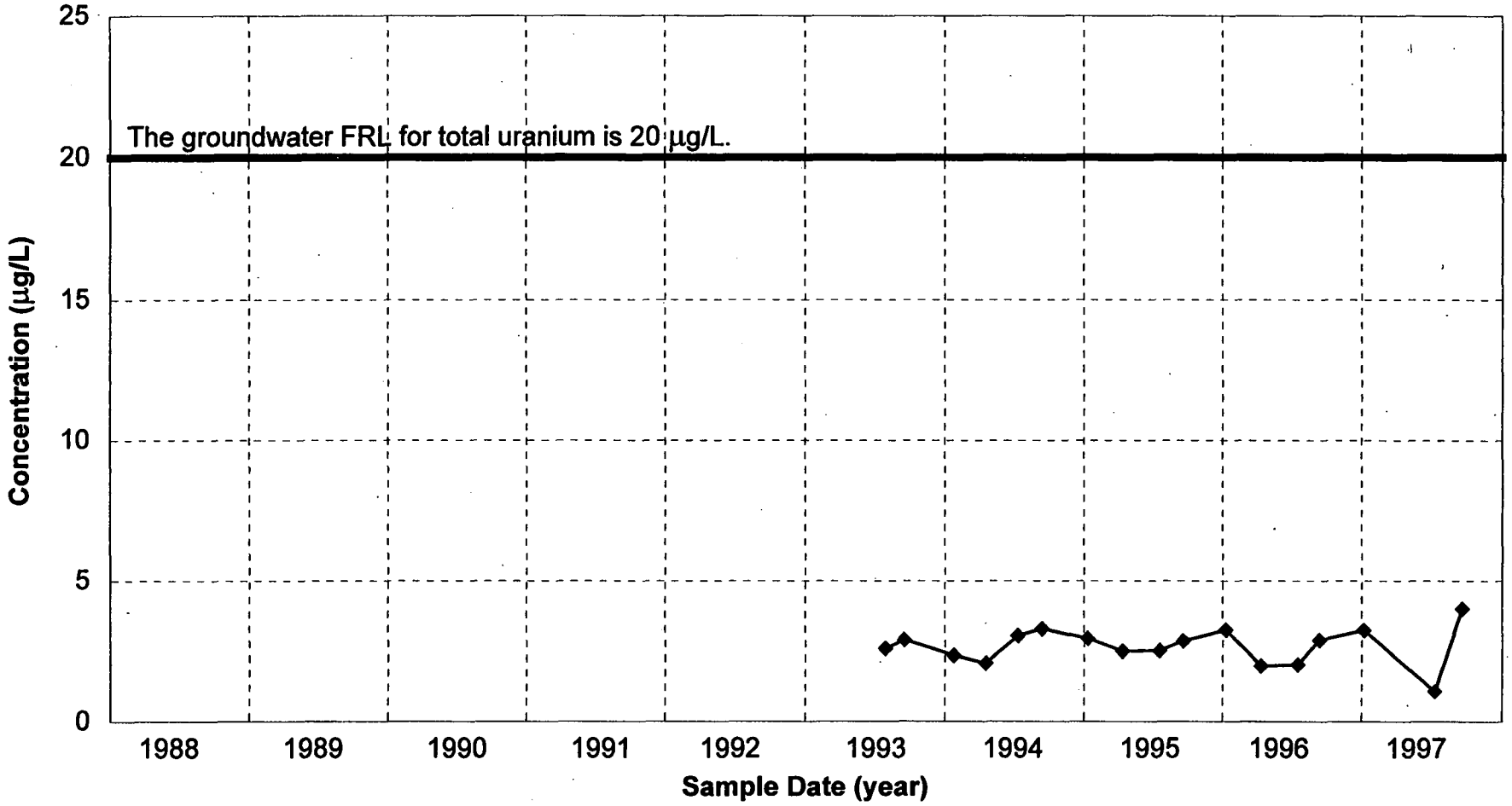


FIGURE A.2-55. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2432

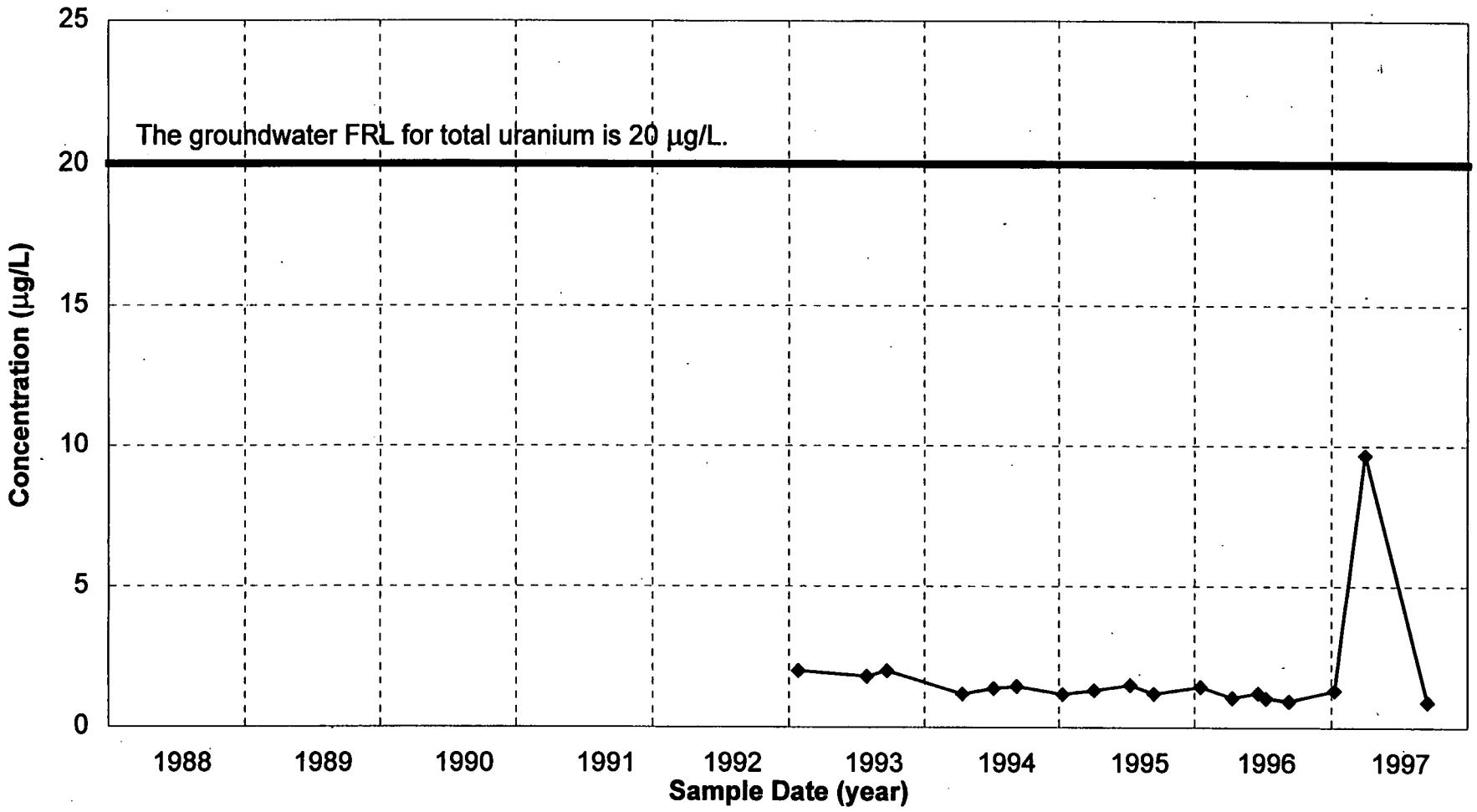


FIGURE A.2-56. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2434

000236

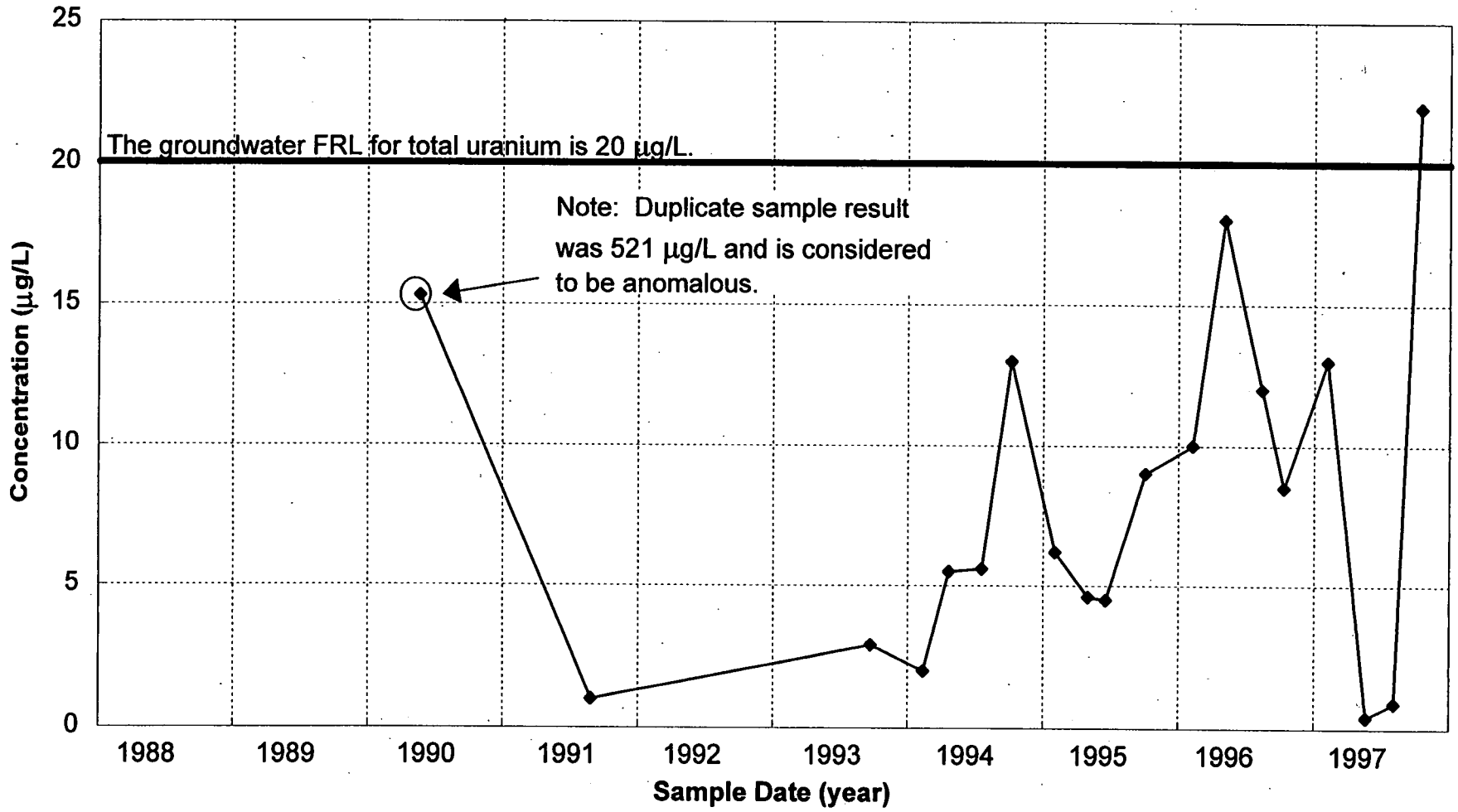


FIGURE A.2-57. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2544

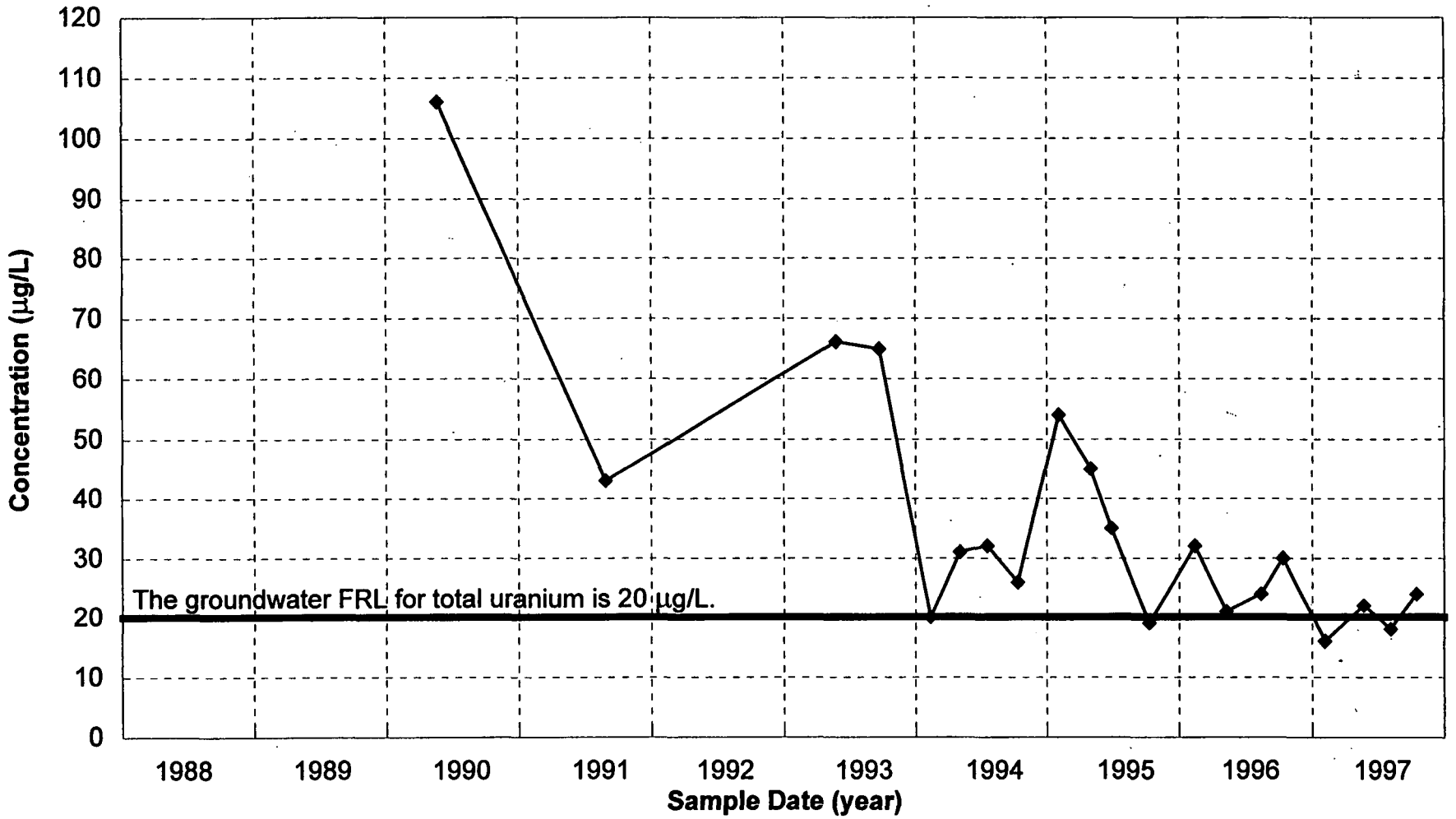


FIGURE A.2-58. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2545

000238

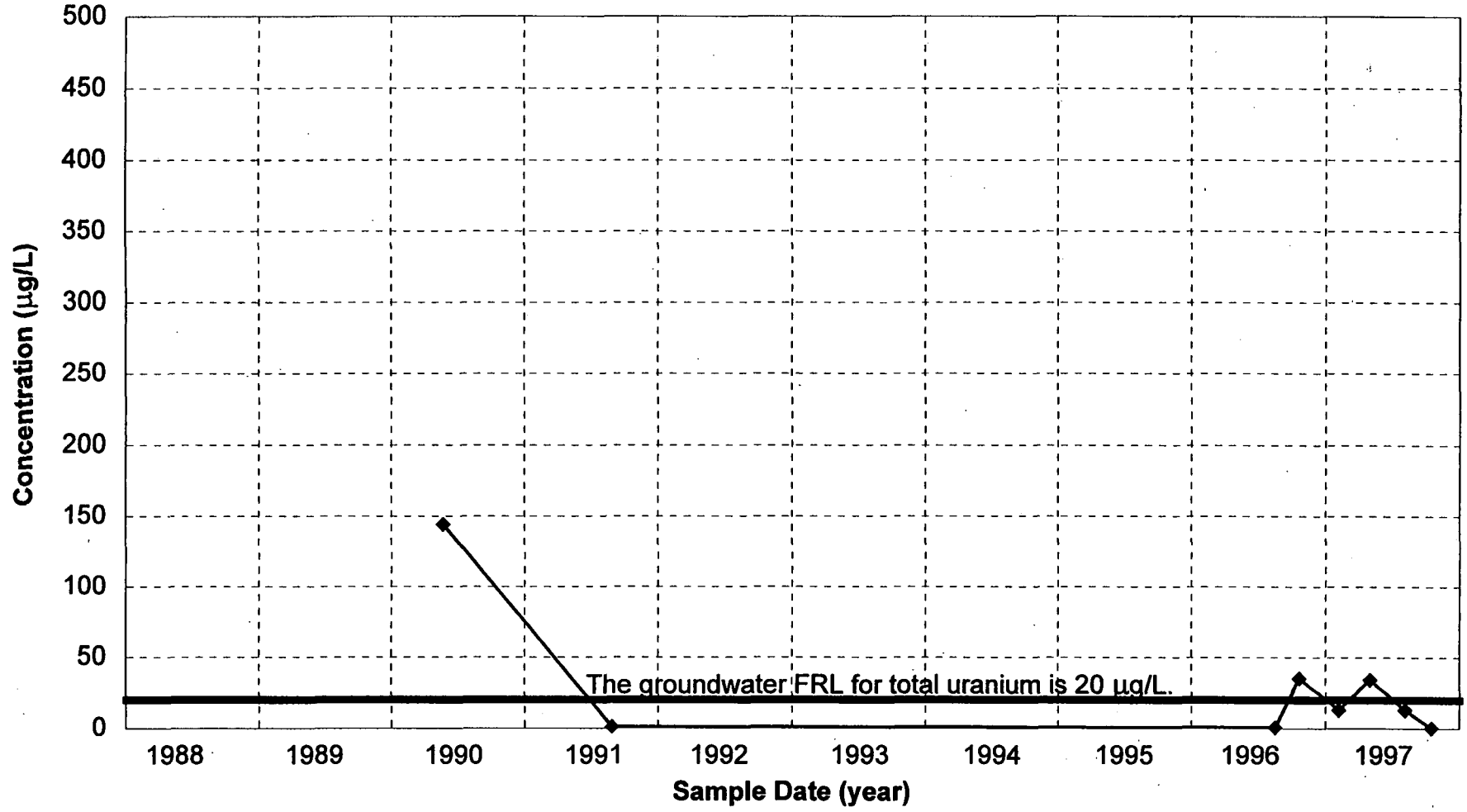


FIGURE A.2-59. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2546

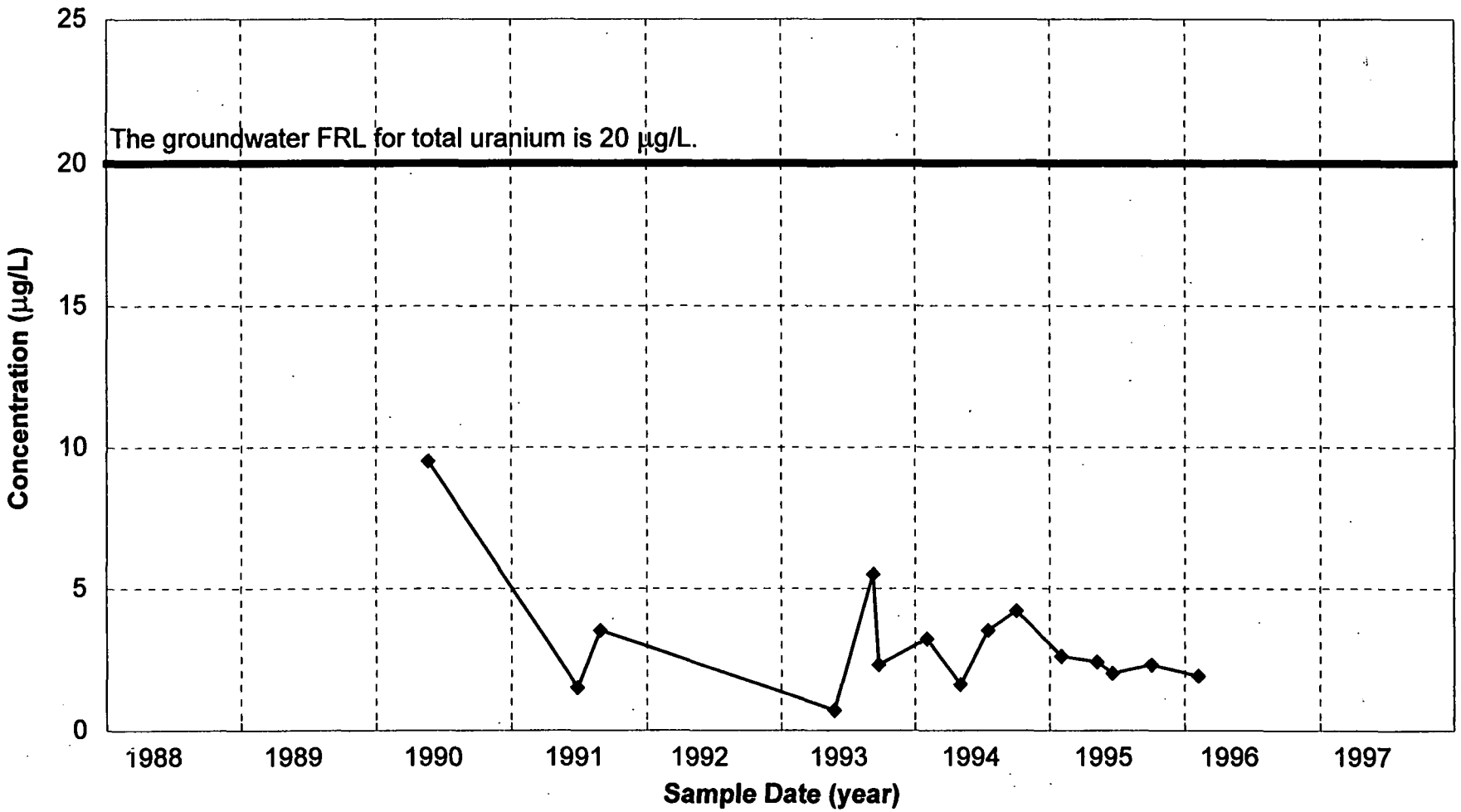


FIGURE A.2-60. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2548

000240

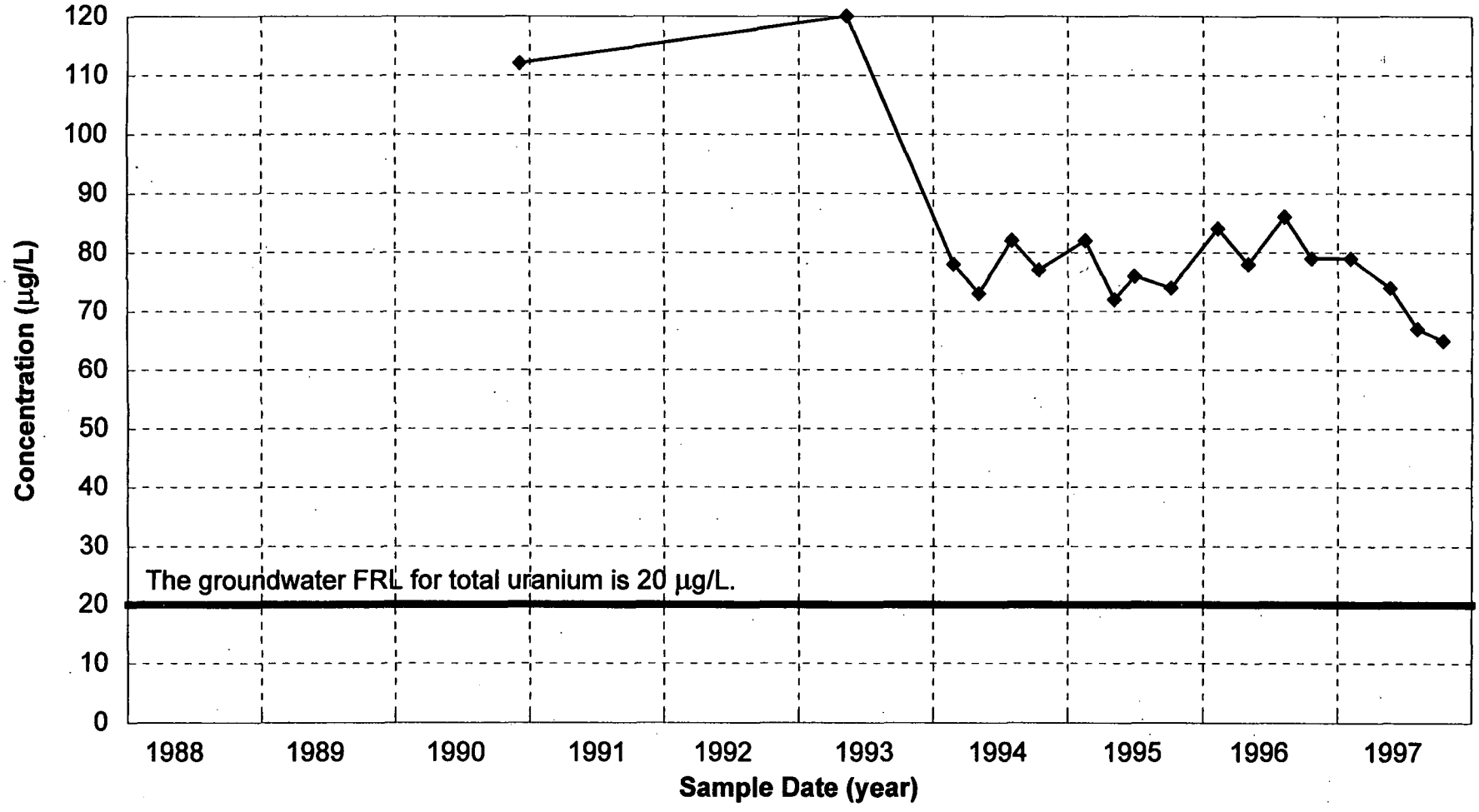


FIGURE A.2-61. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2550

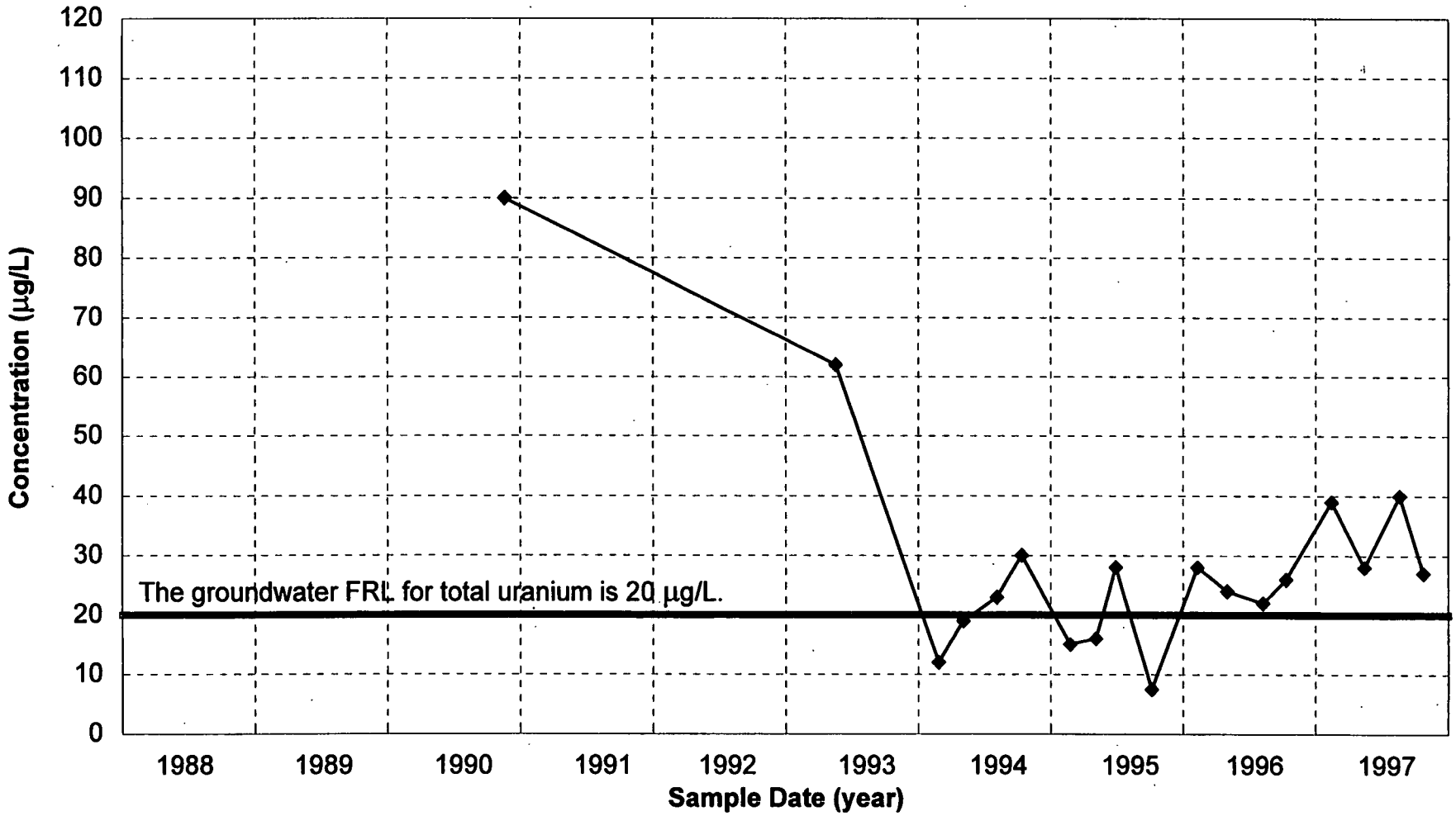


FIGURE A.2-62. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2551

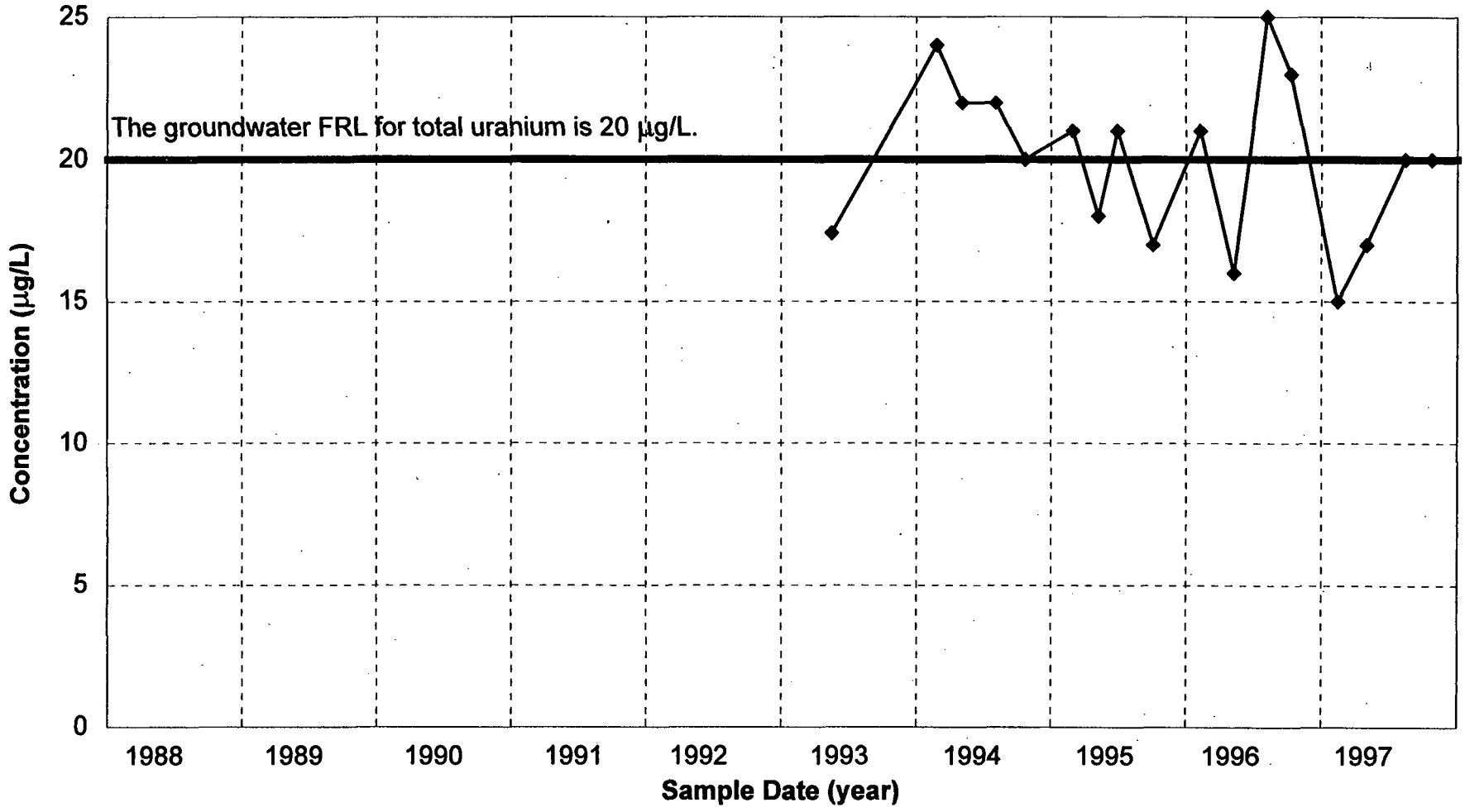


FIGURE A.2-63. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2552

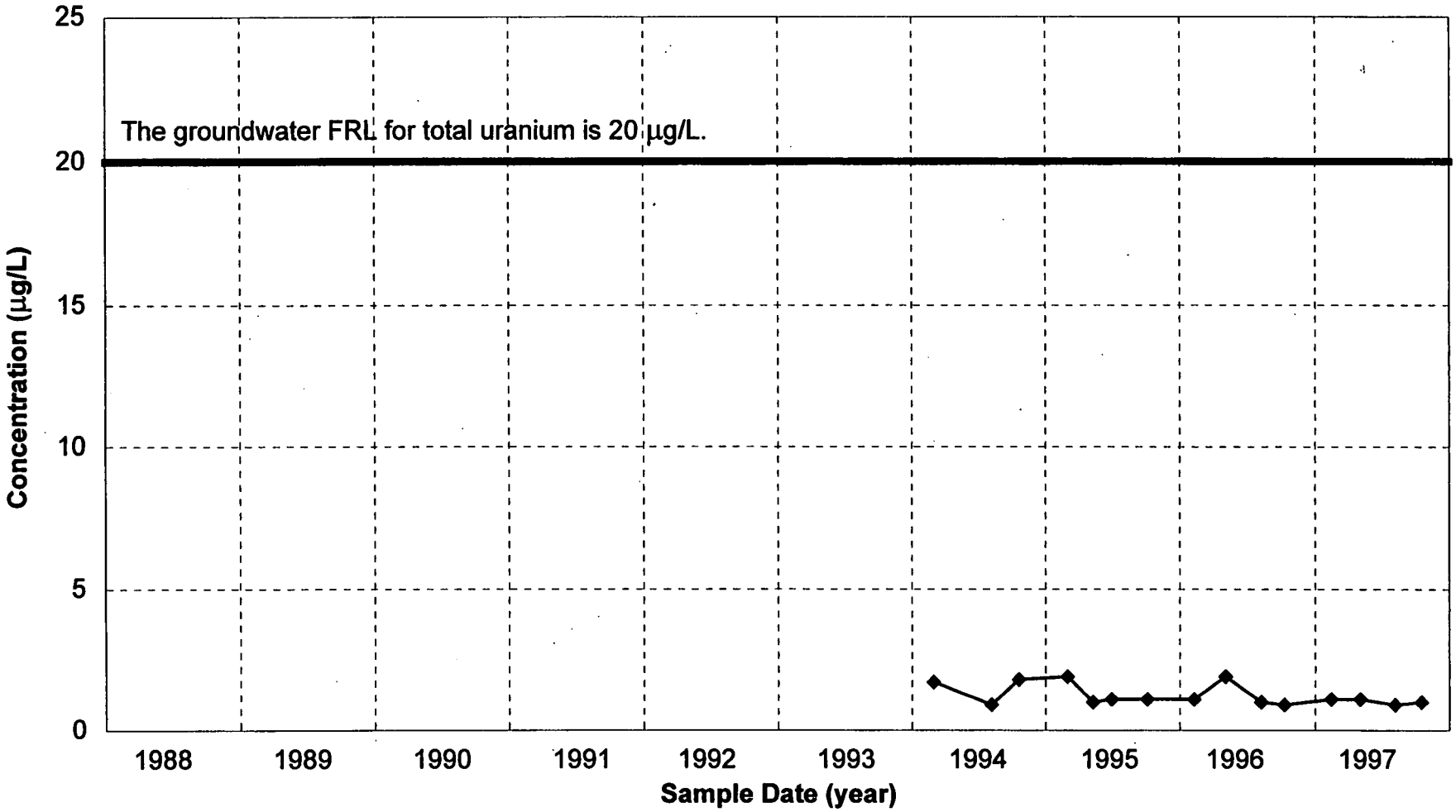


FIGURE A.2-64. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2553

000244

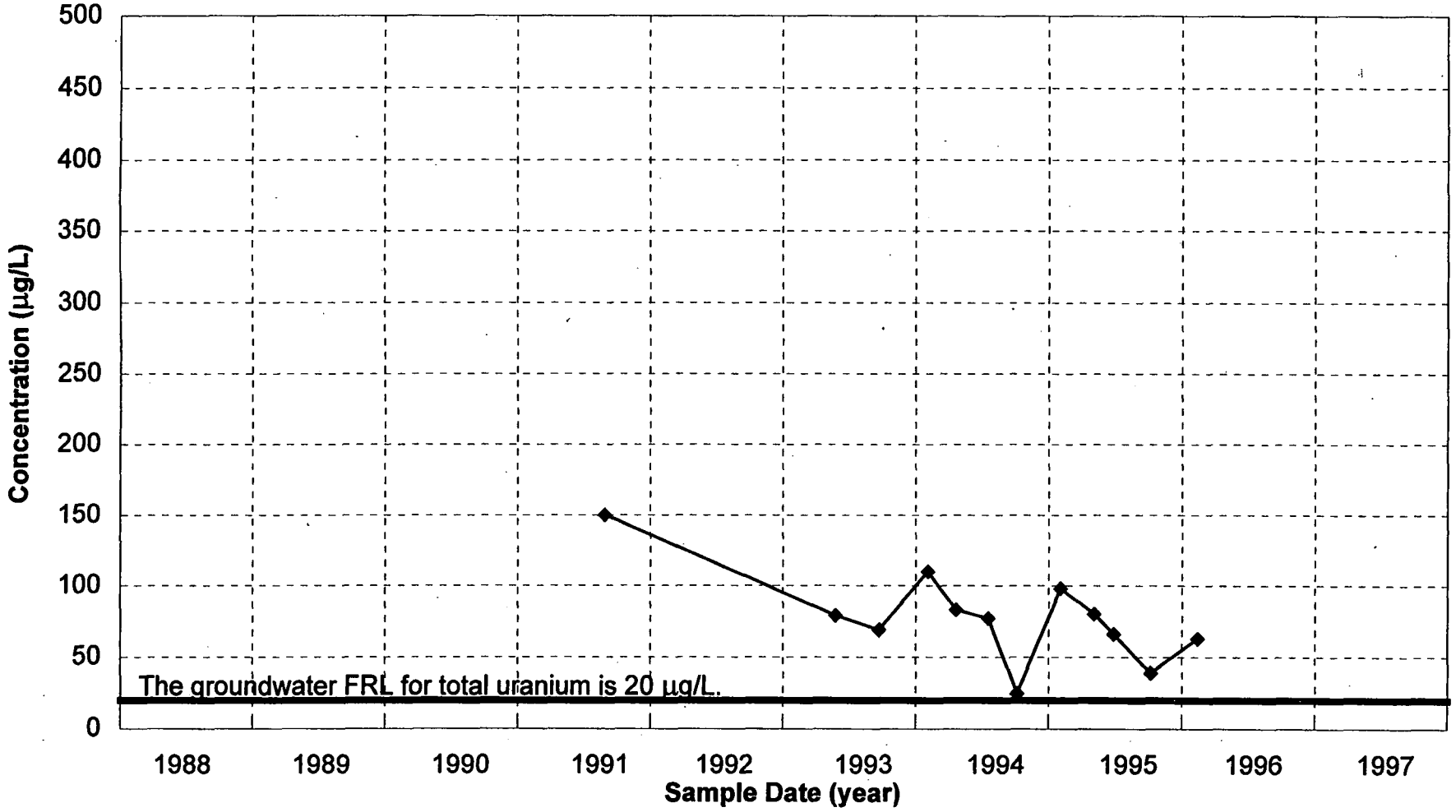


FIGURE A.2-65. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2624

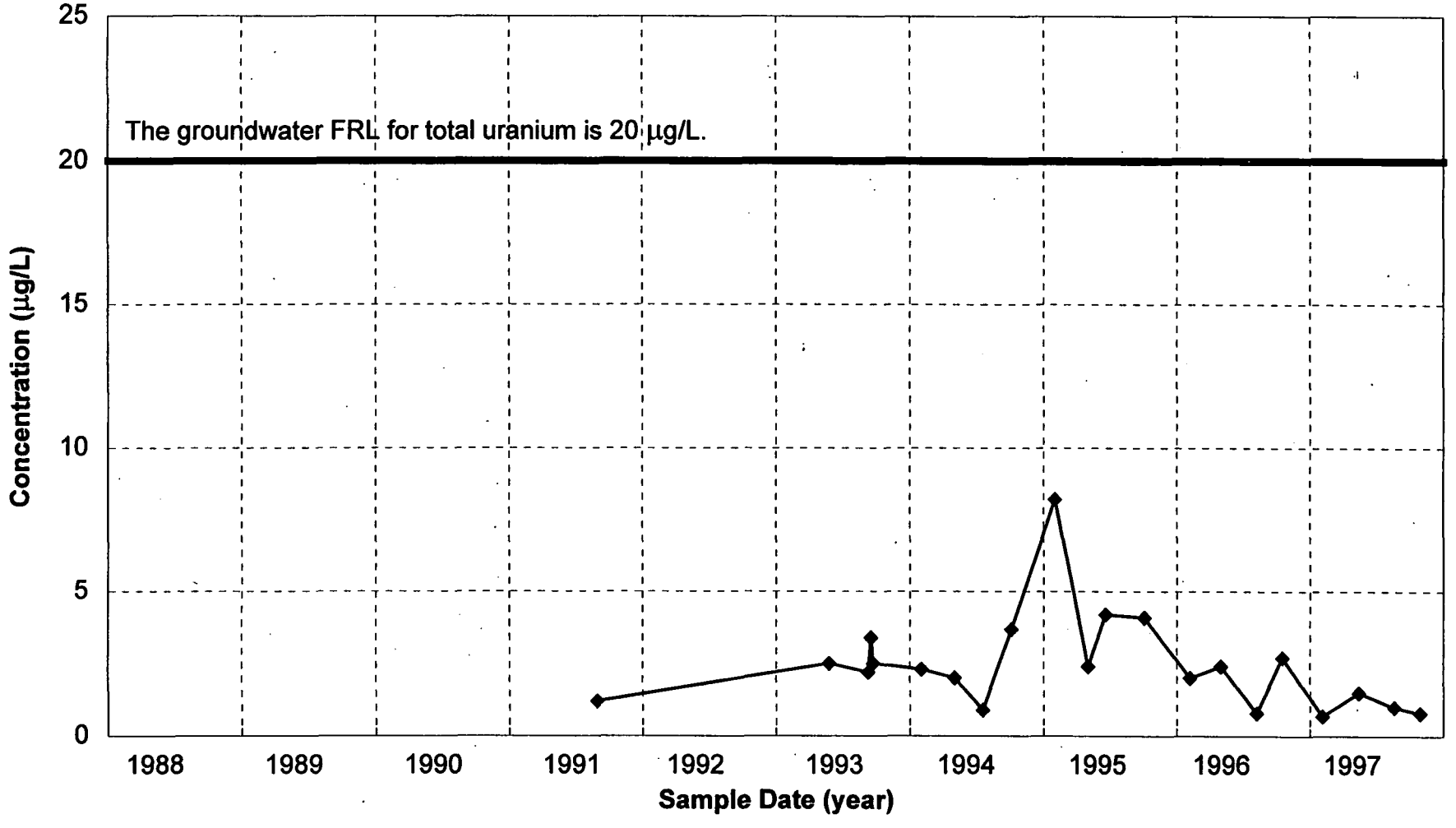


FIGURE A.2-66. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2625

000246

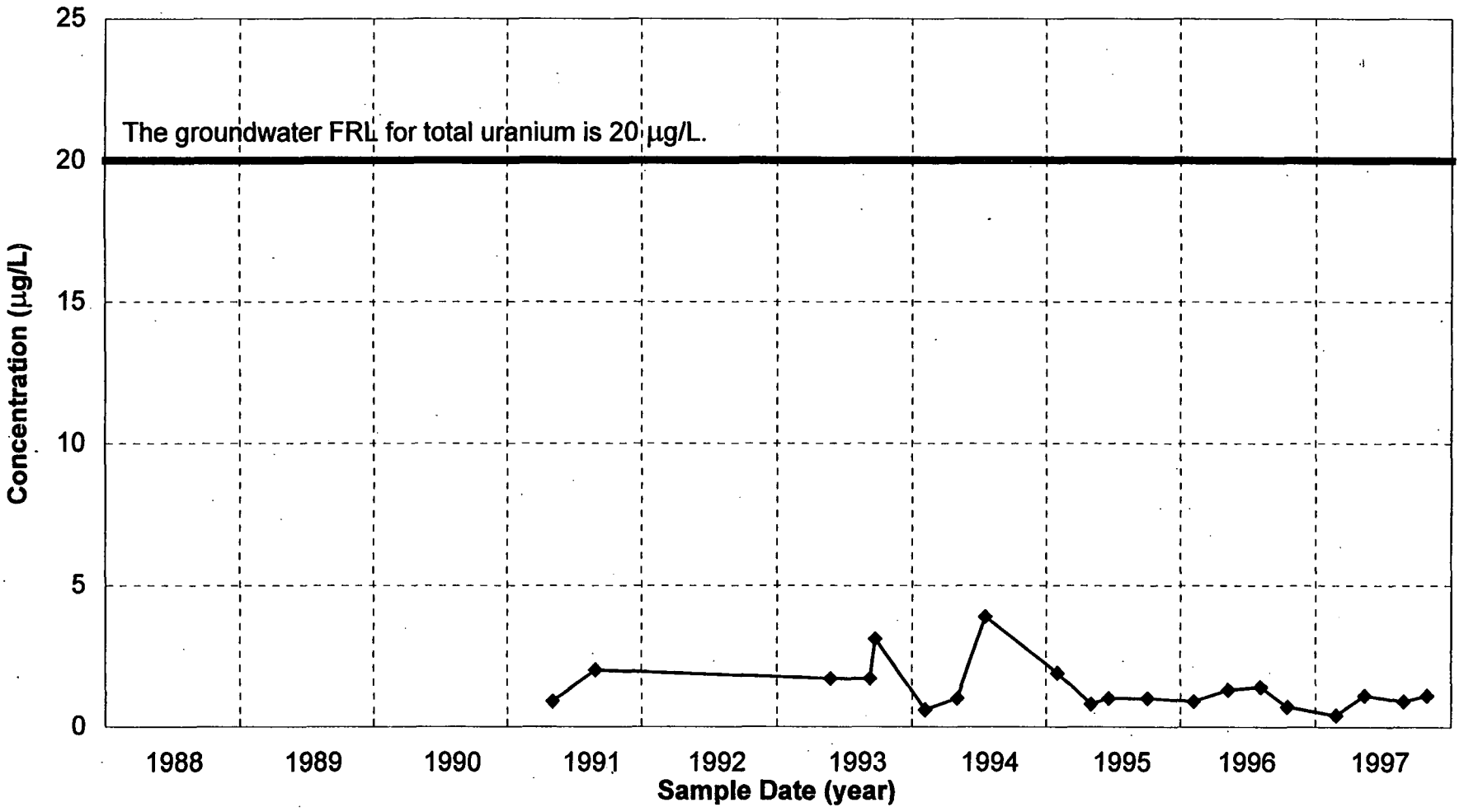


FIGURE A.2-67. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2636

000232

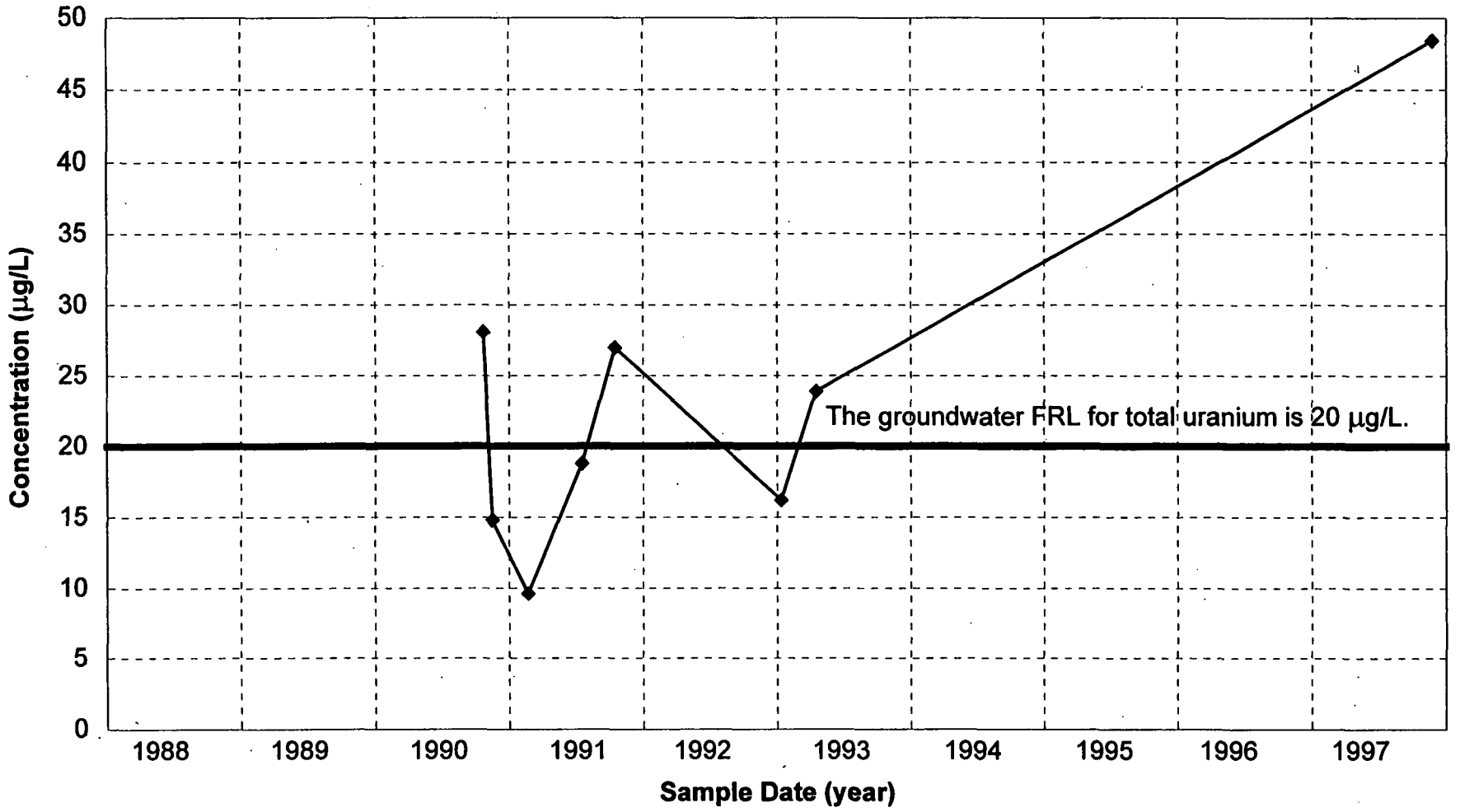


FIGURE A.2-68. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2648

000248

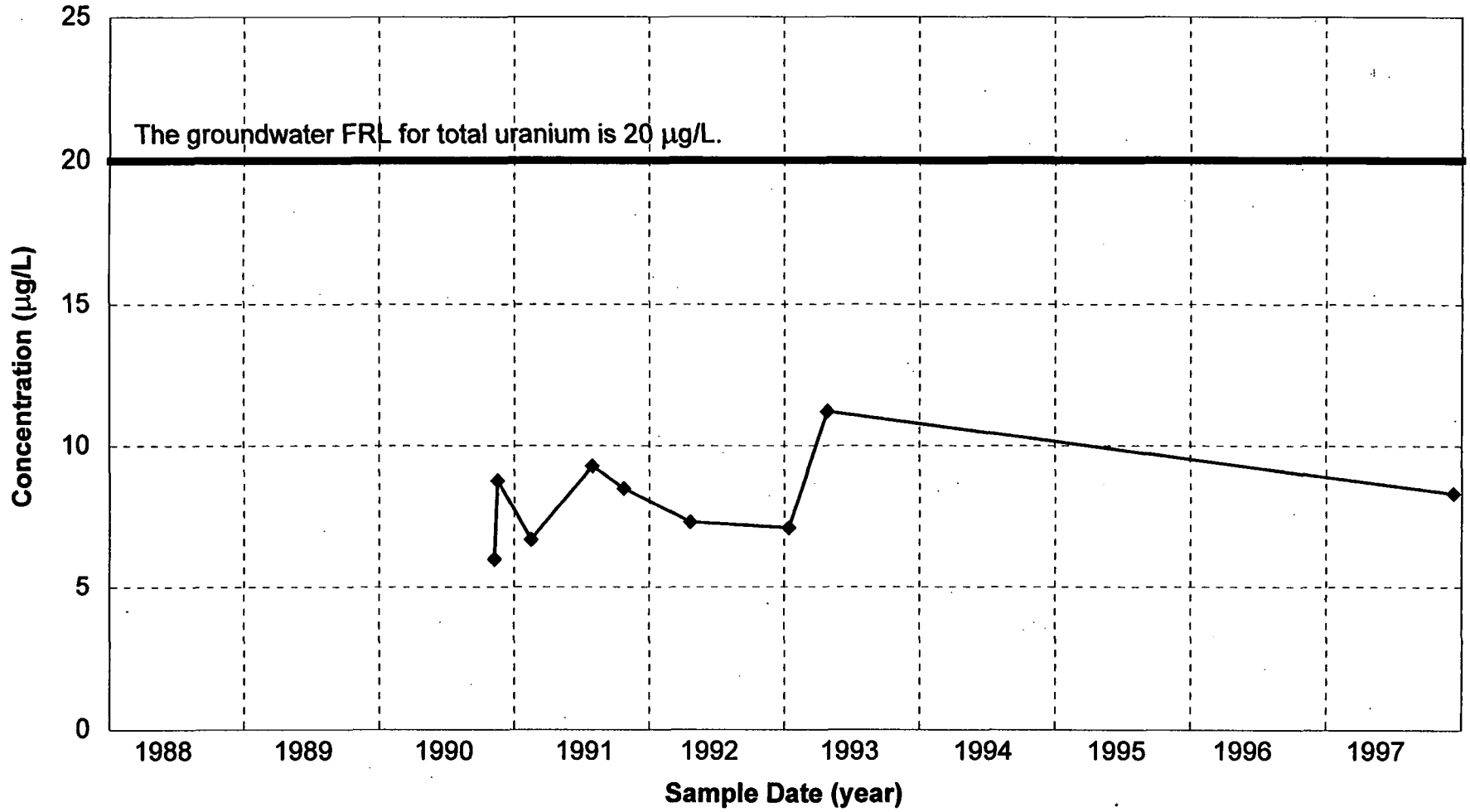


FIGURE A.2-69. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2649

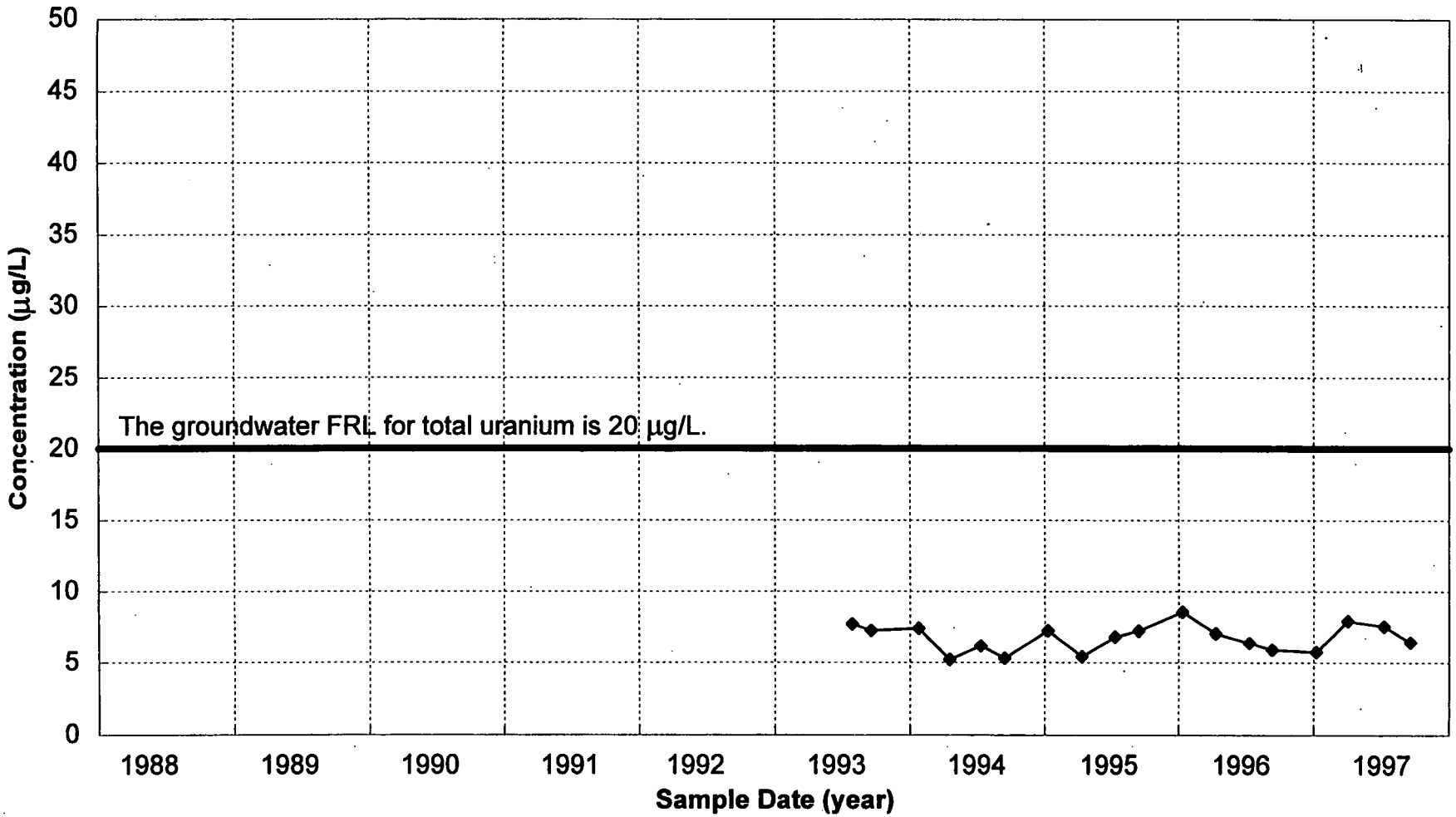


FIGURE A.2-70. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2733

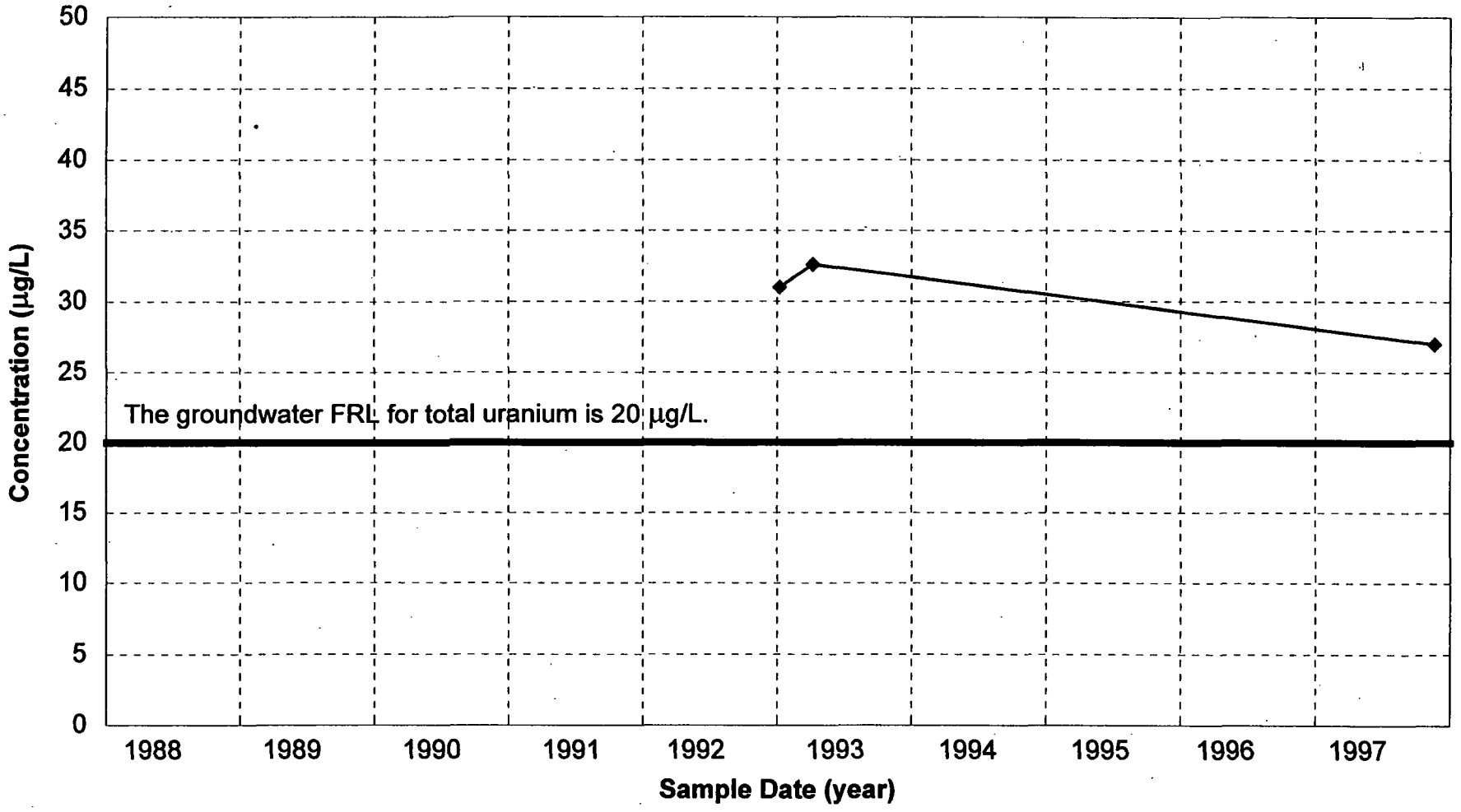


FIGURE A.2-71. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2821

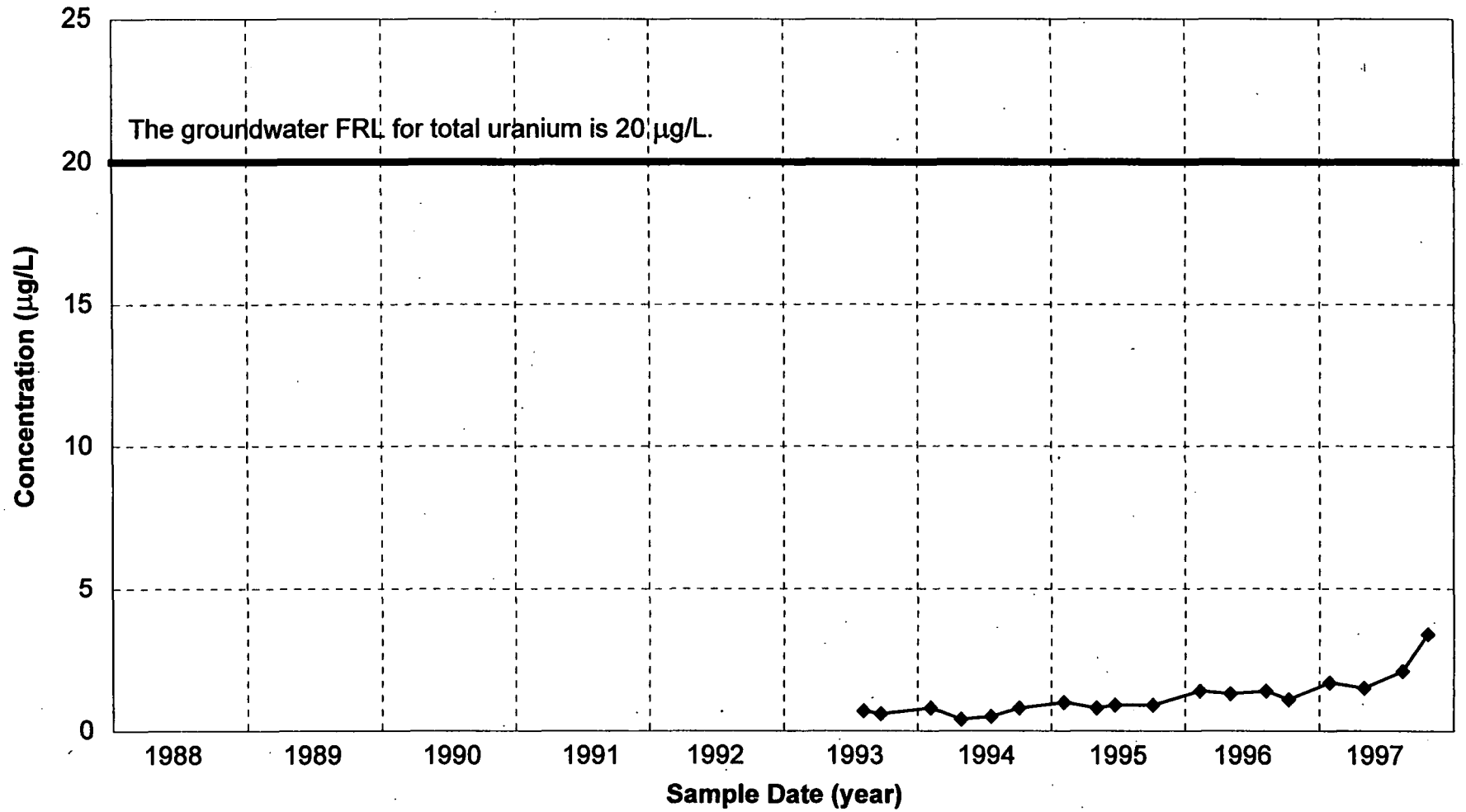


FIGURE A.2-72. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2880

000252

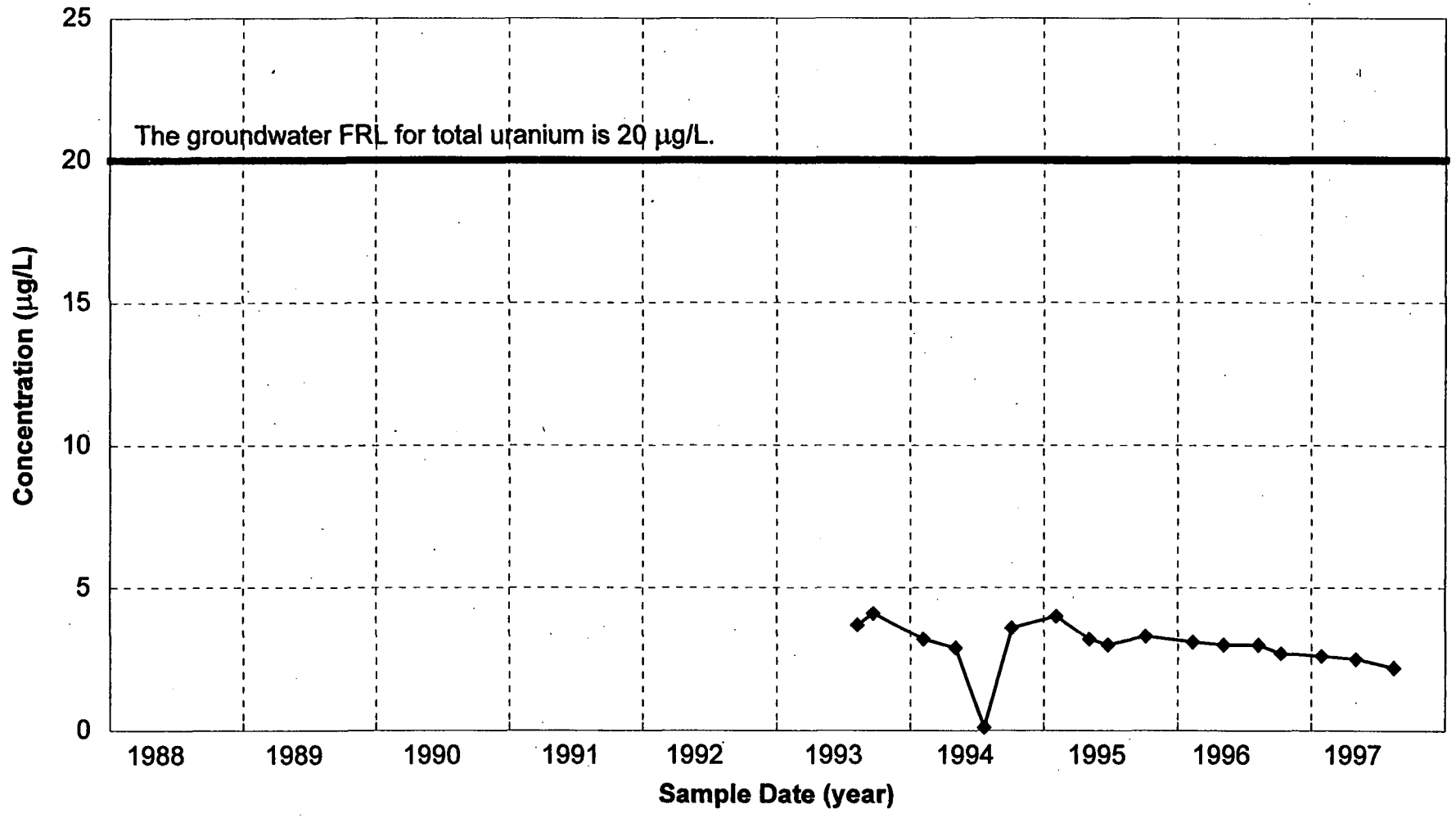


FIGURE A.2-73. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2881

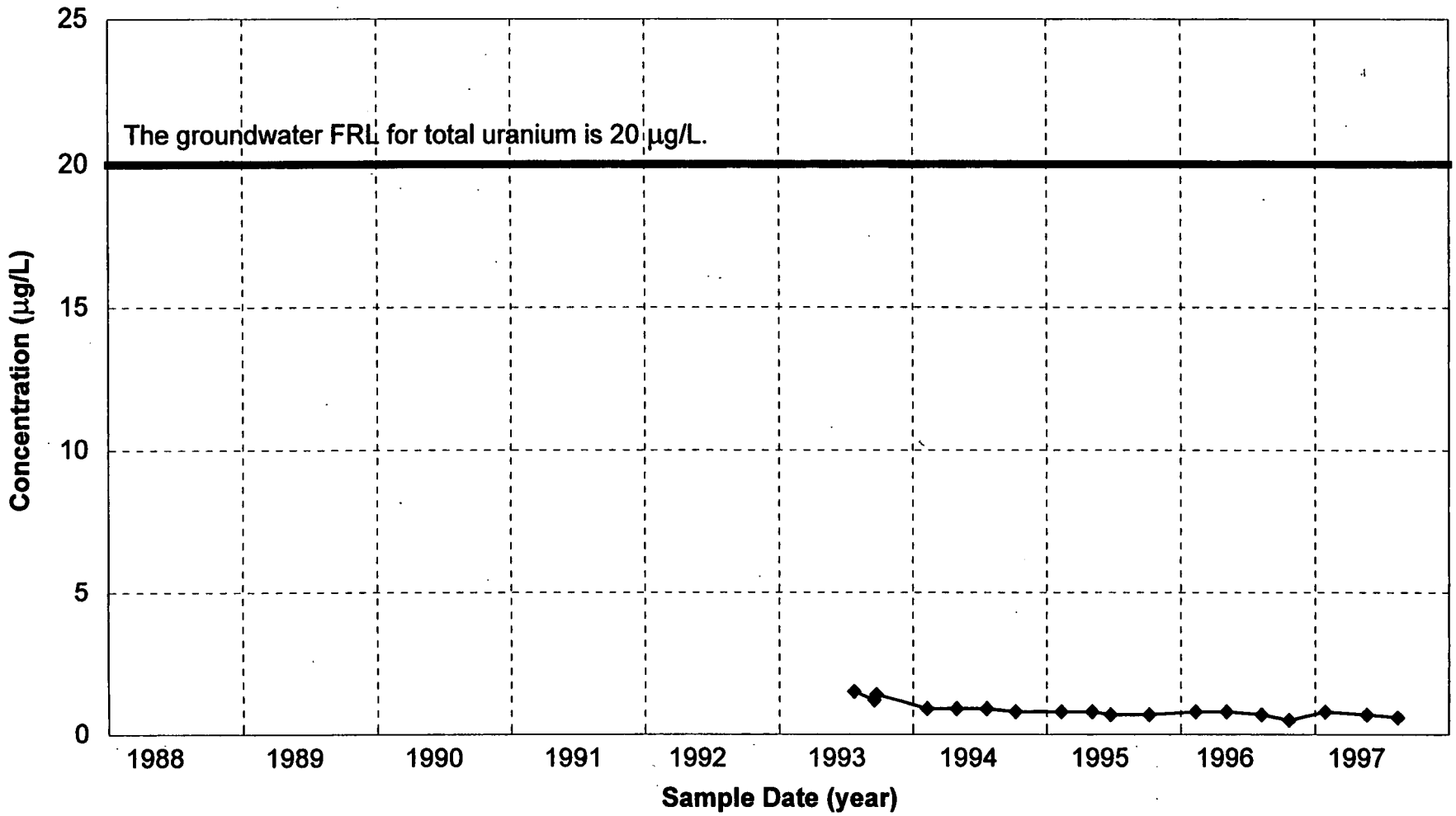


FIGURE A.2-74. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2897

000254

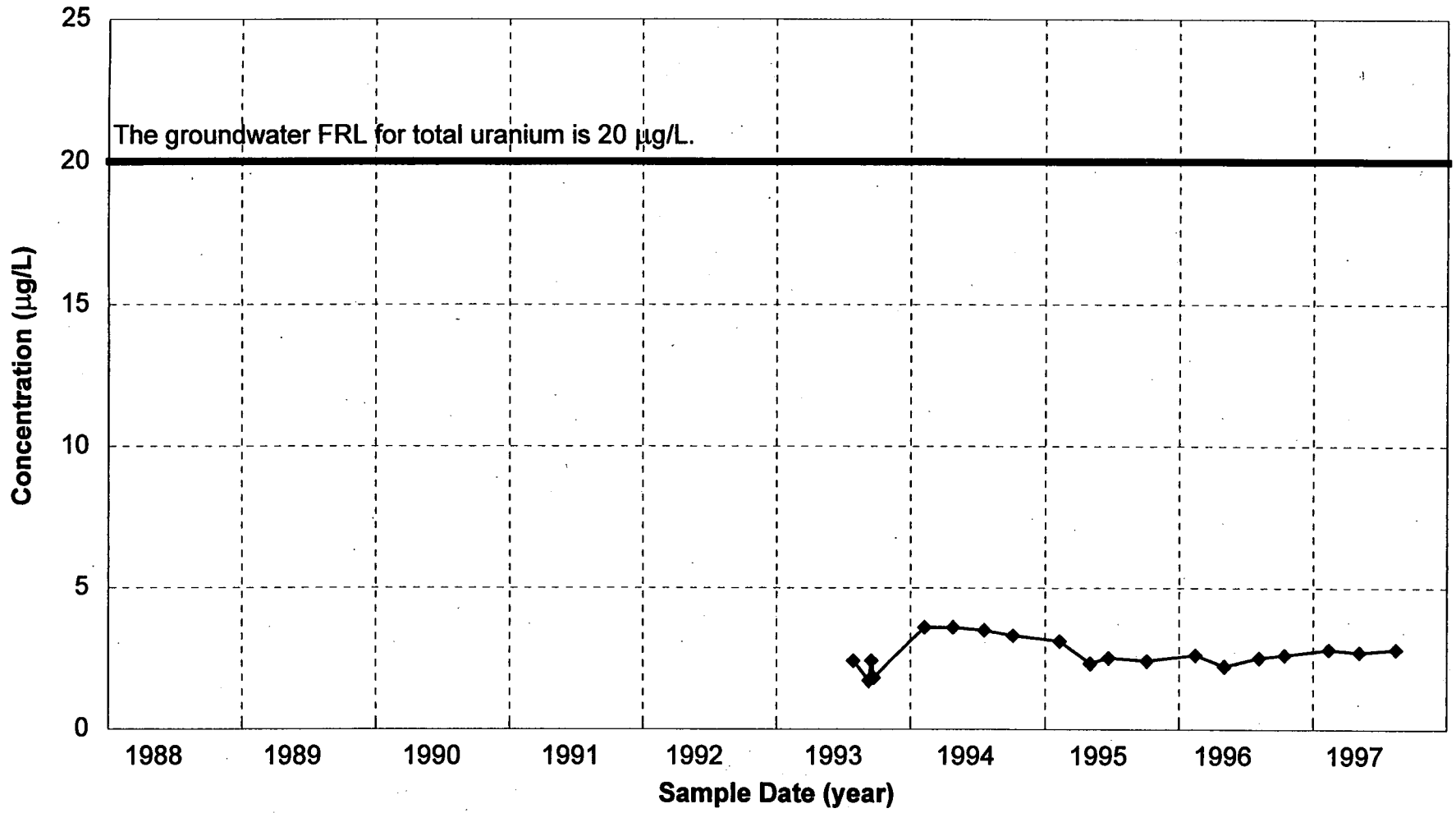


FIGURE A.2-75. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2898

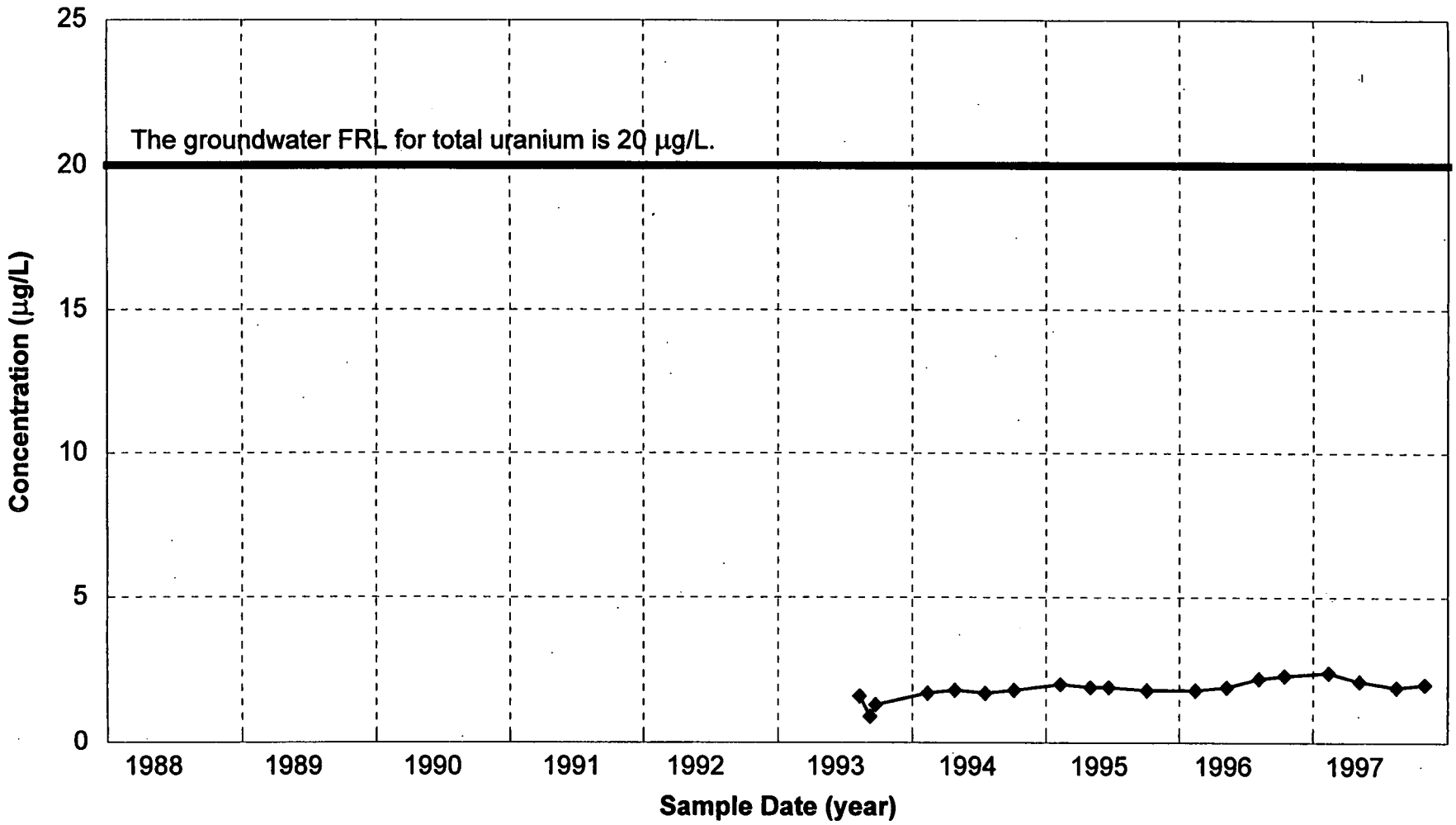


FIGURE A.2-76. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2899

9520000

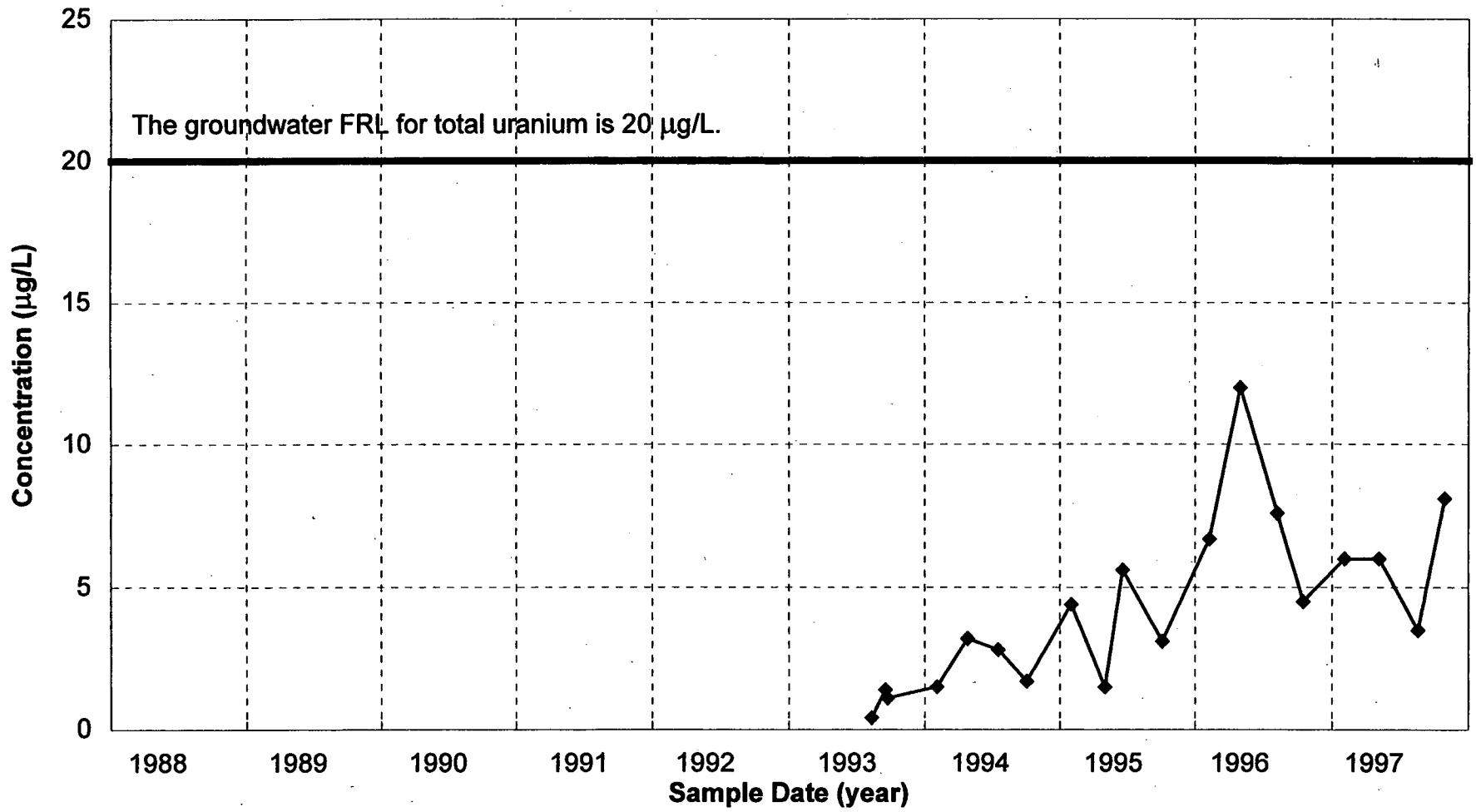


FIGURE A.2-77. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 2900

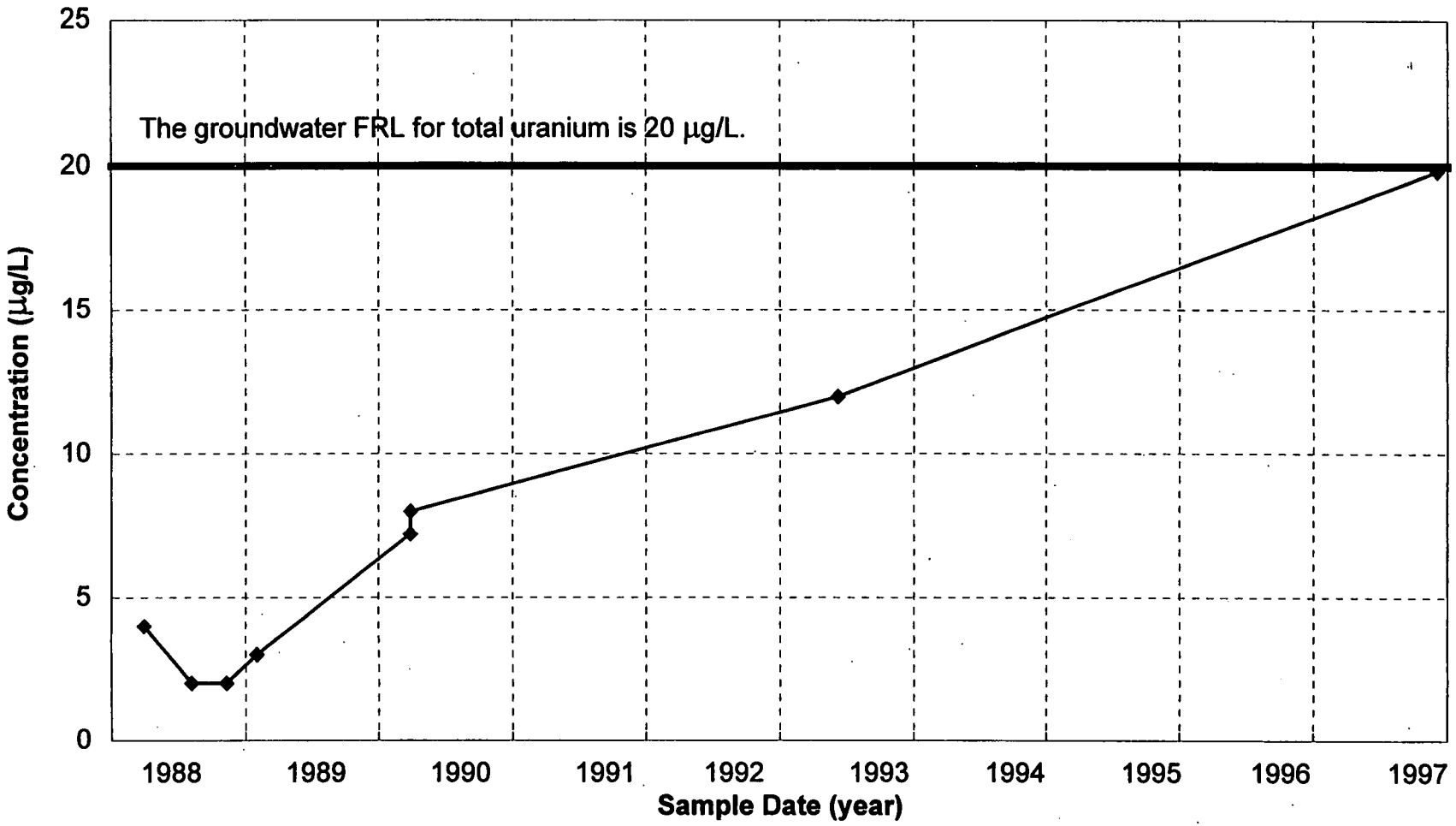


FIGURE A.2-78. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3009

000258

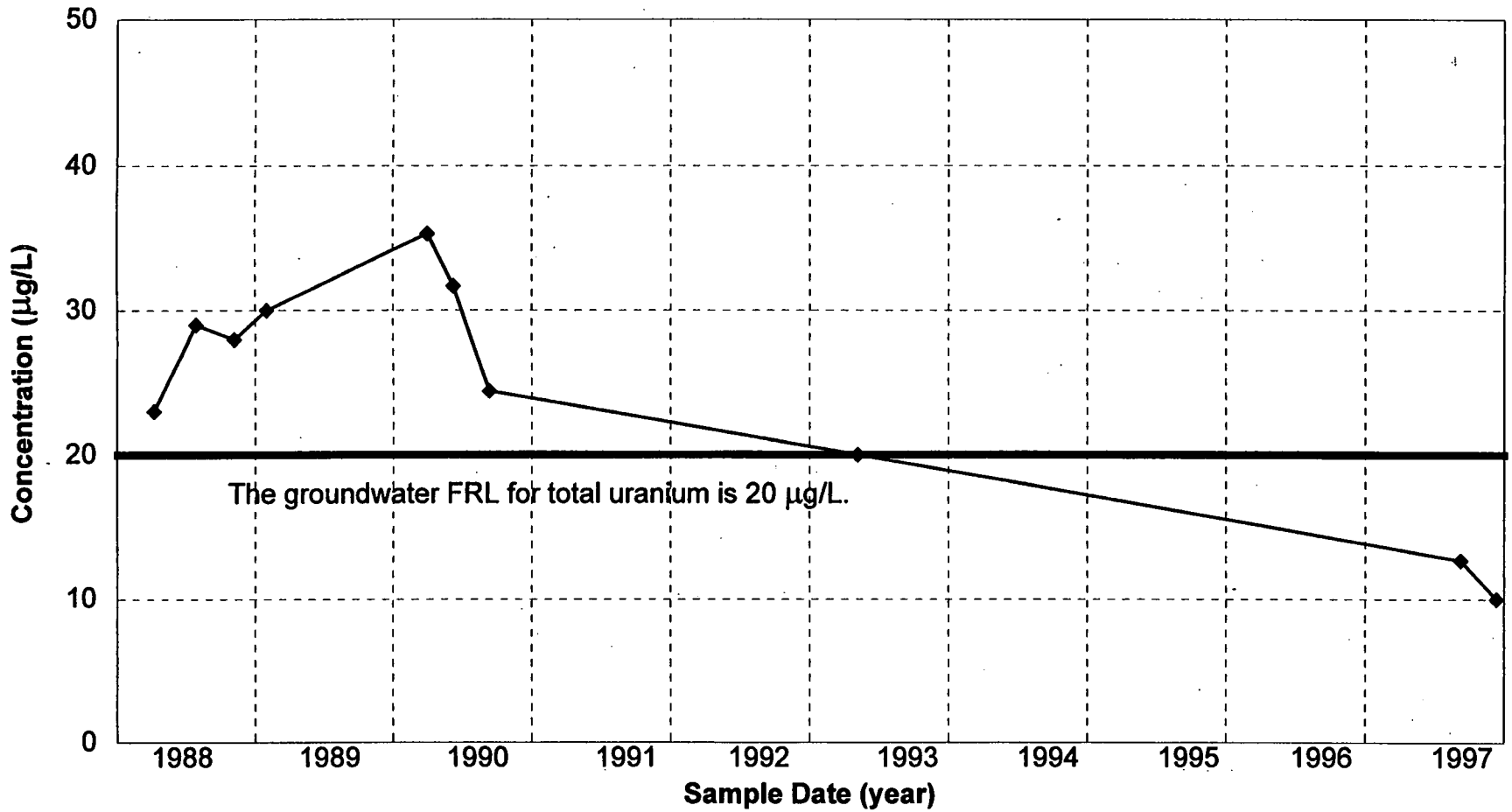


FIGURE A.2-79. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3014

000259

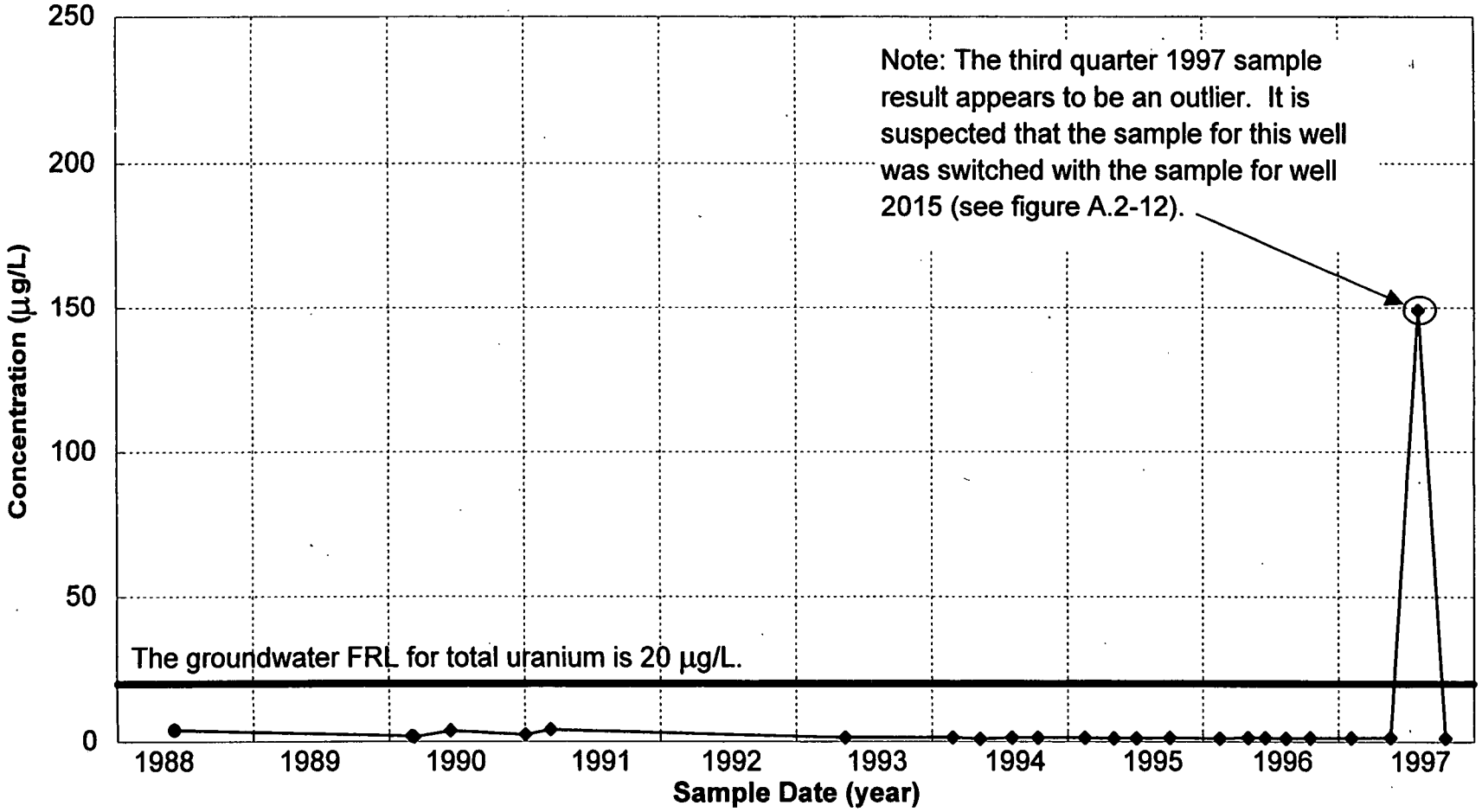


FIGURE A.2-80. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3015

092000

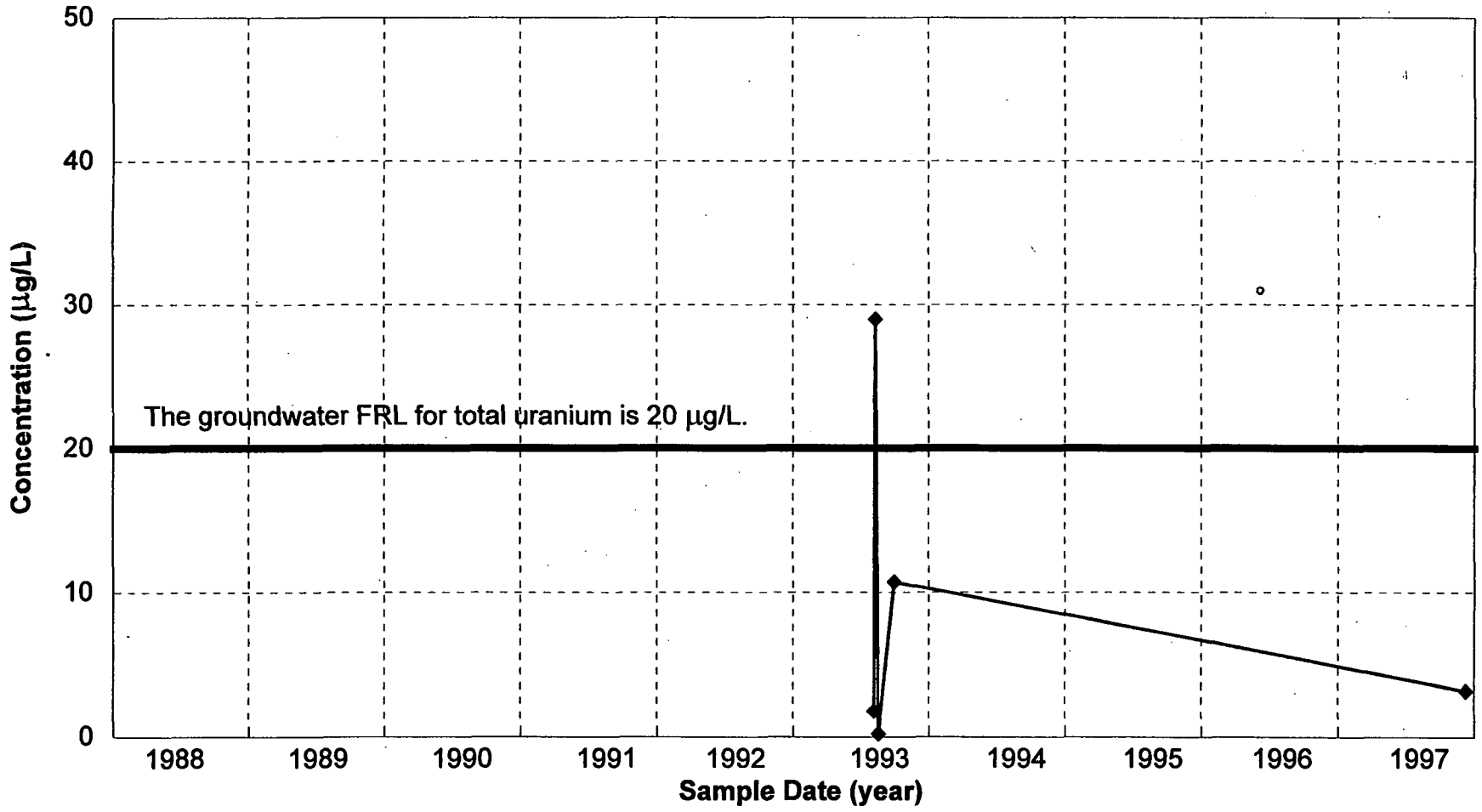


FIGURE A.2-81. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3027

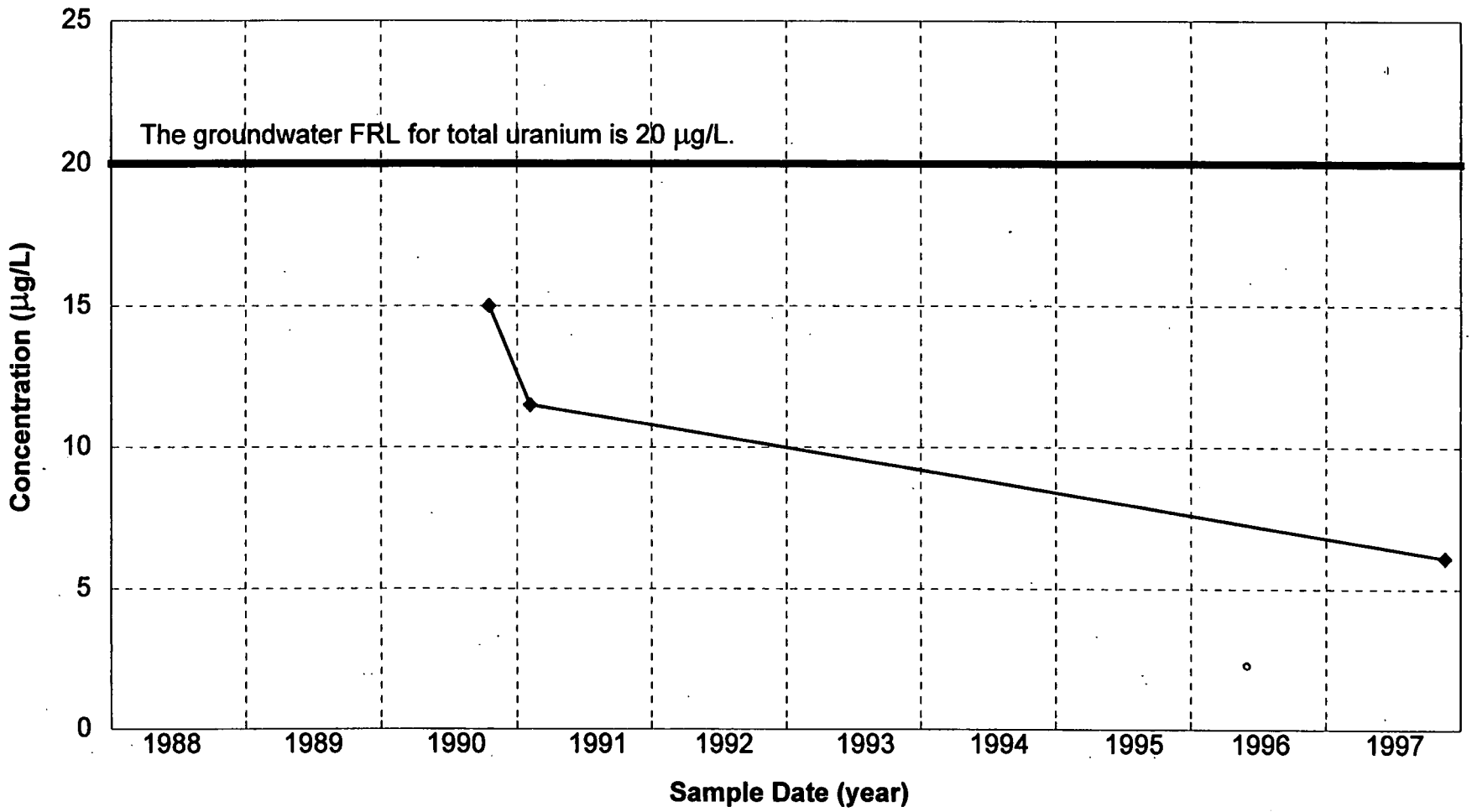


FIGURE A.2-82. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3032

292000

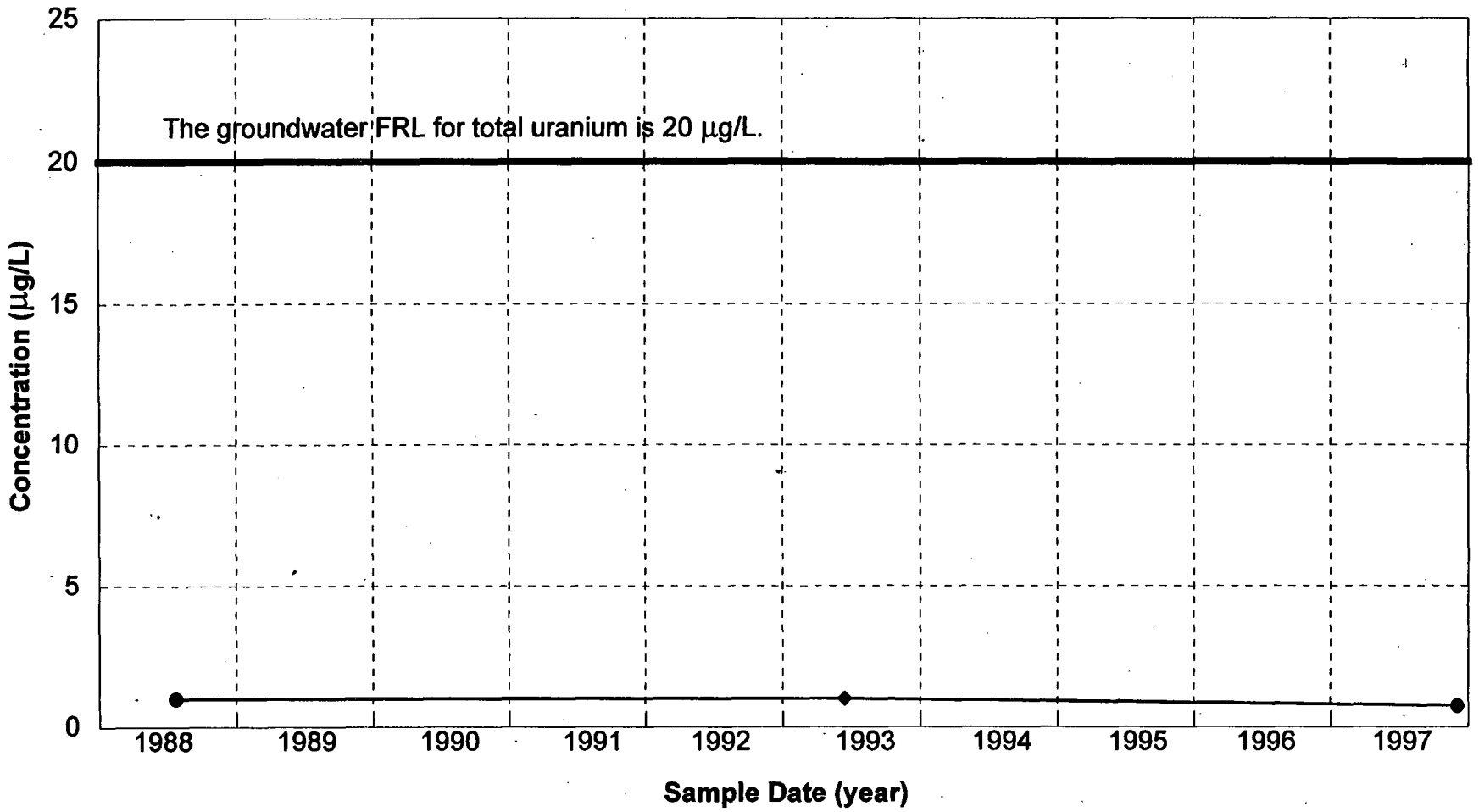


FIGURE A.2-83. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3034

000283

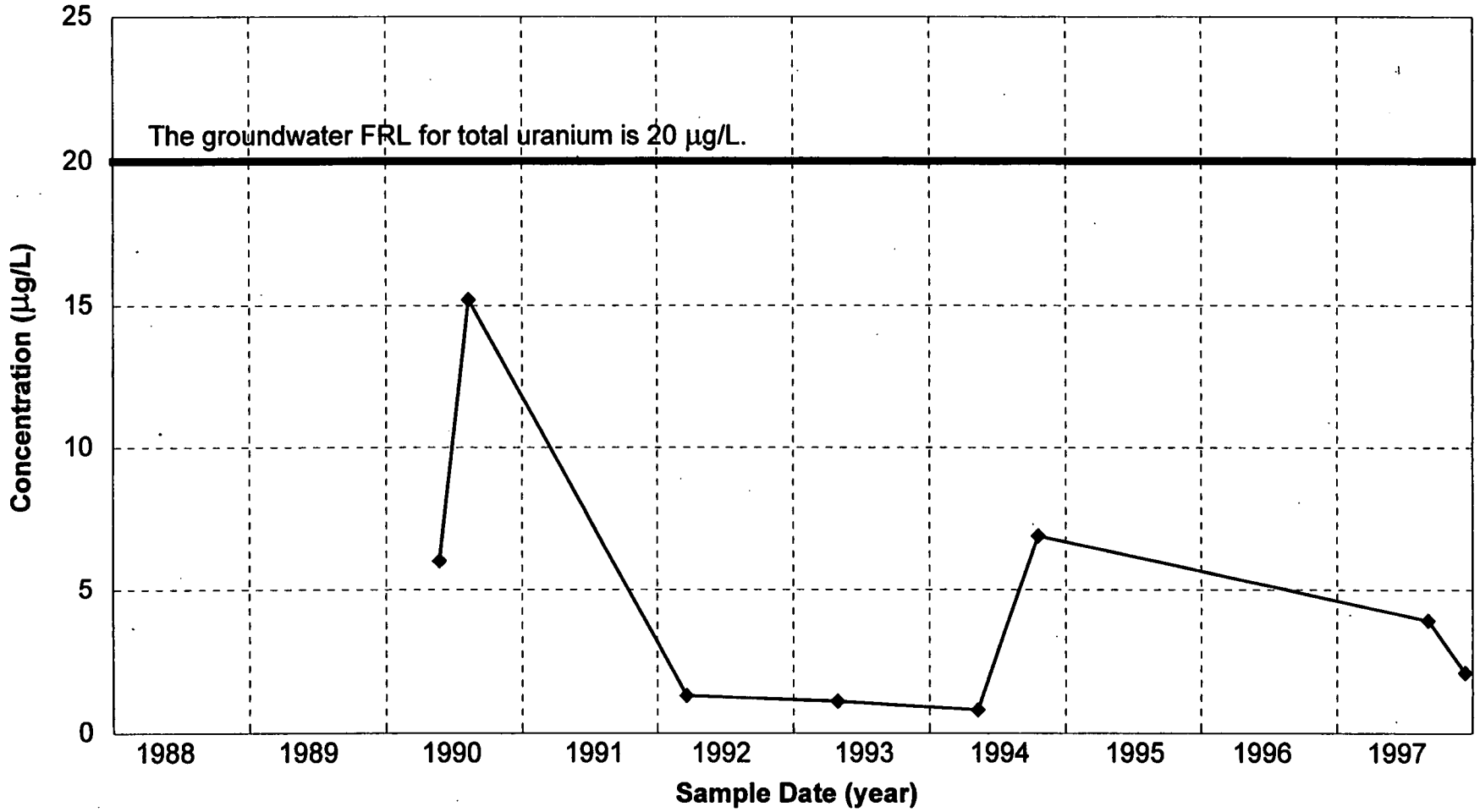


FIGURE A.2-84. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3045

000264

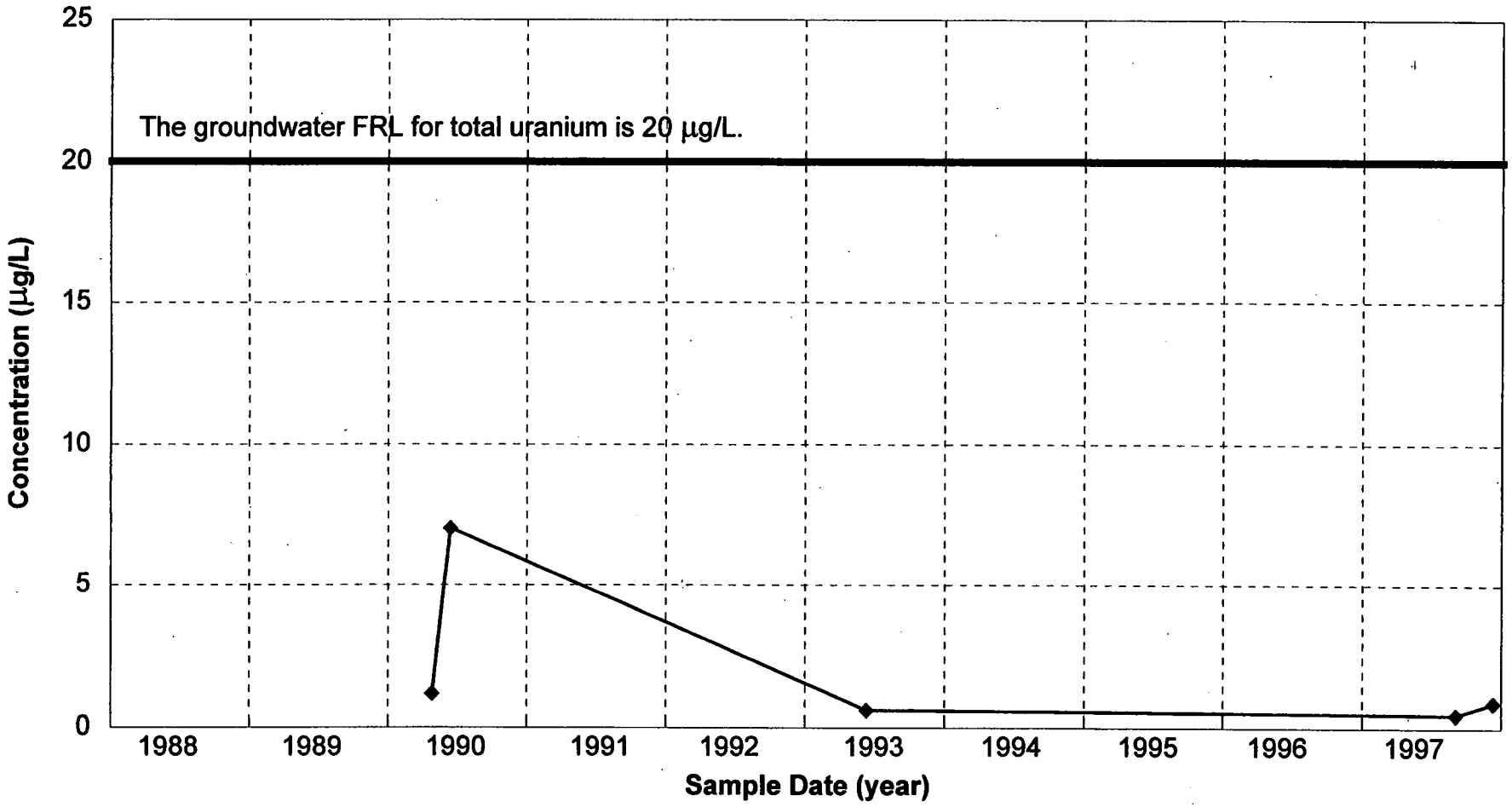


FIGURE A.2-85. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3049

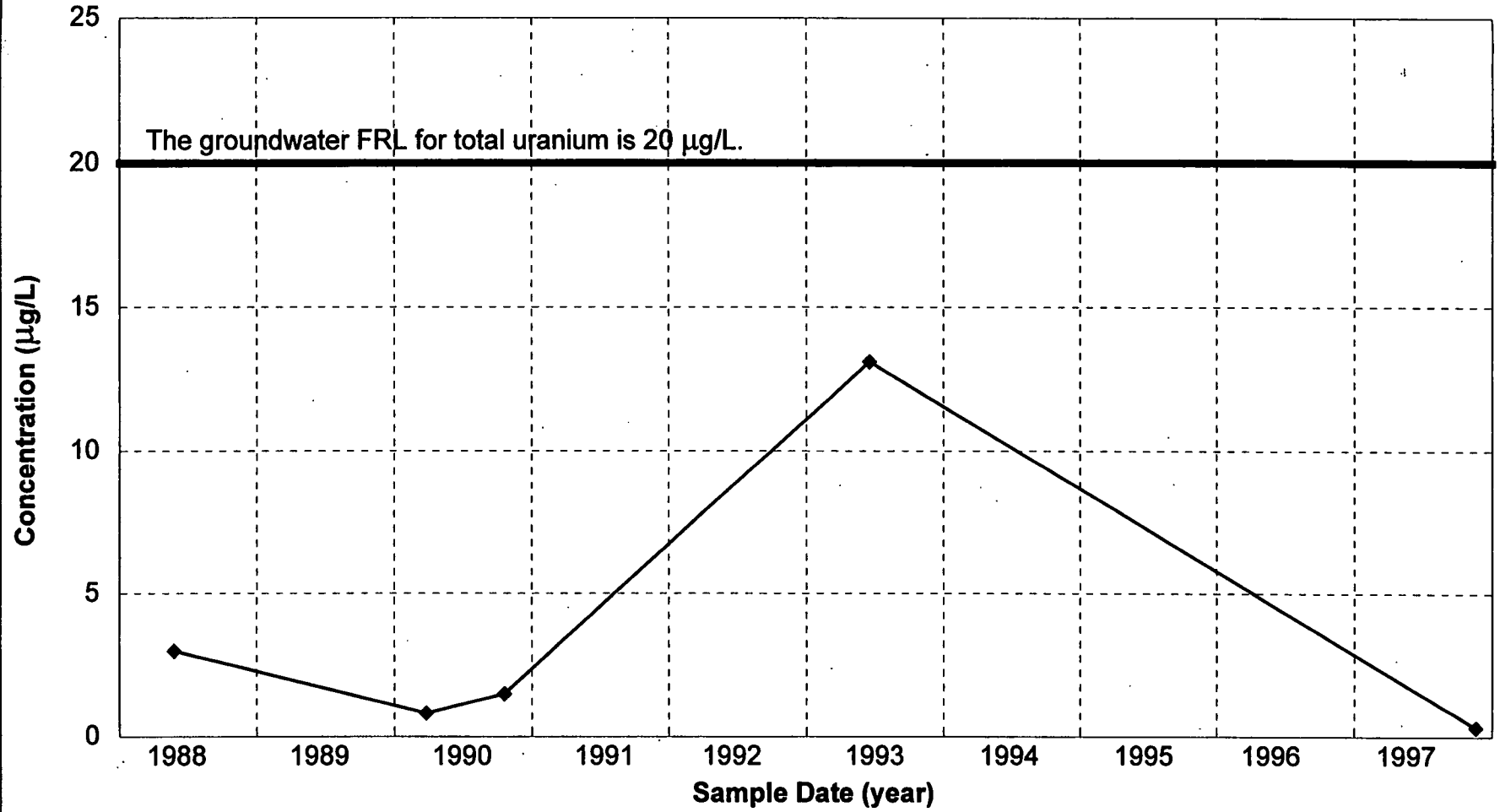


FIGURE A.2-86. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3054

002026

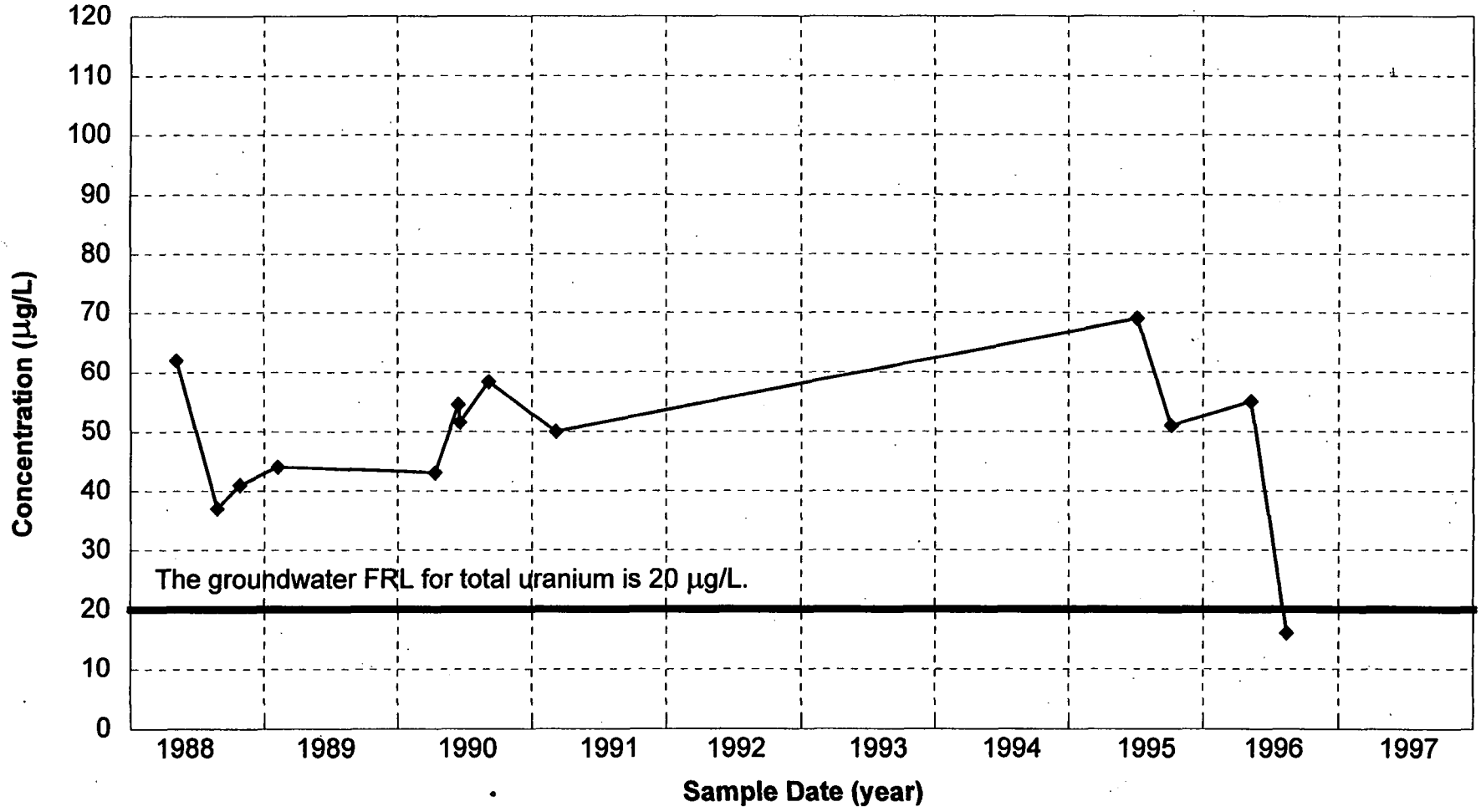


FIGURE A.2-87. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3062

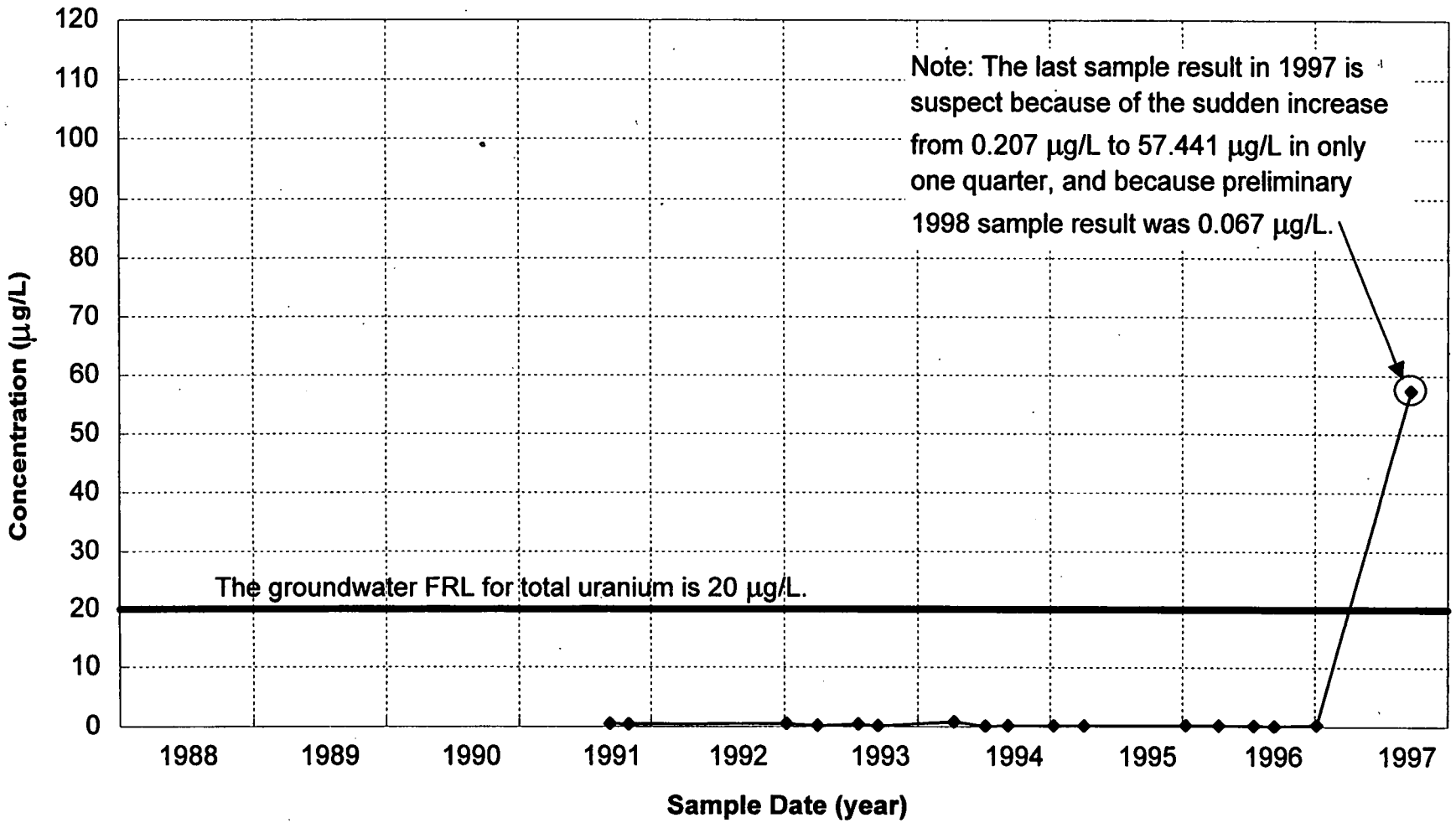


FIGURE A.2-88. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3067

000268

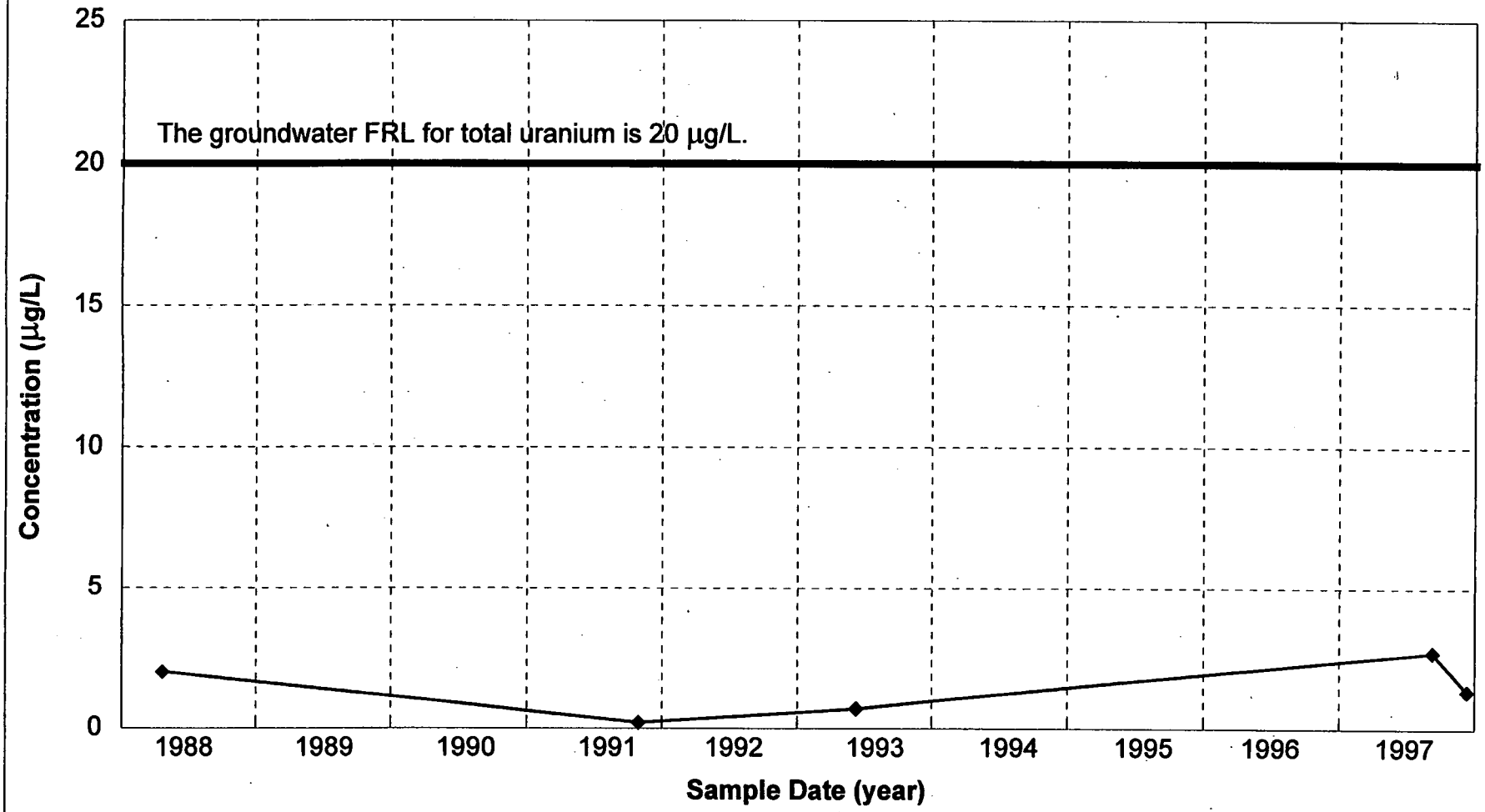


FIGURE A.2-89. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3068

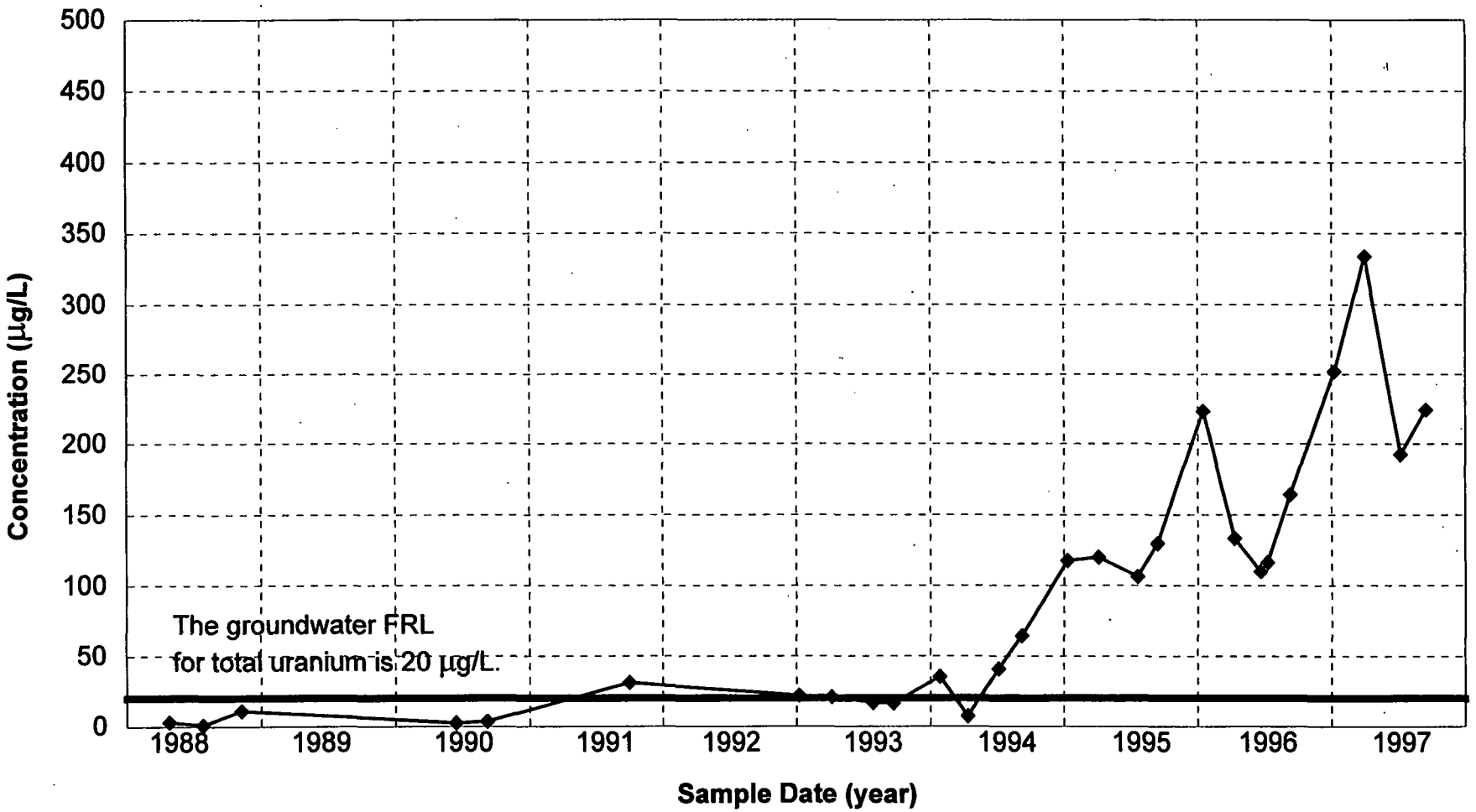


FIGURE A.2-90. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3069

022000

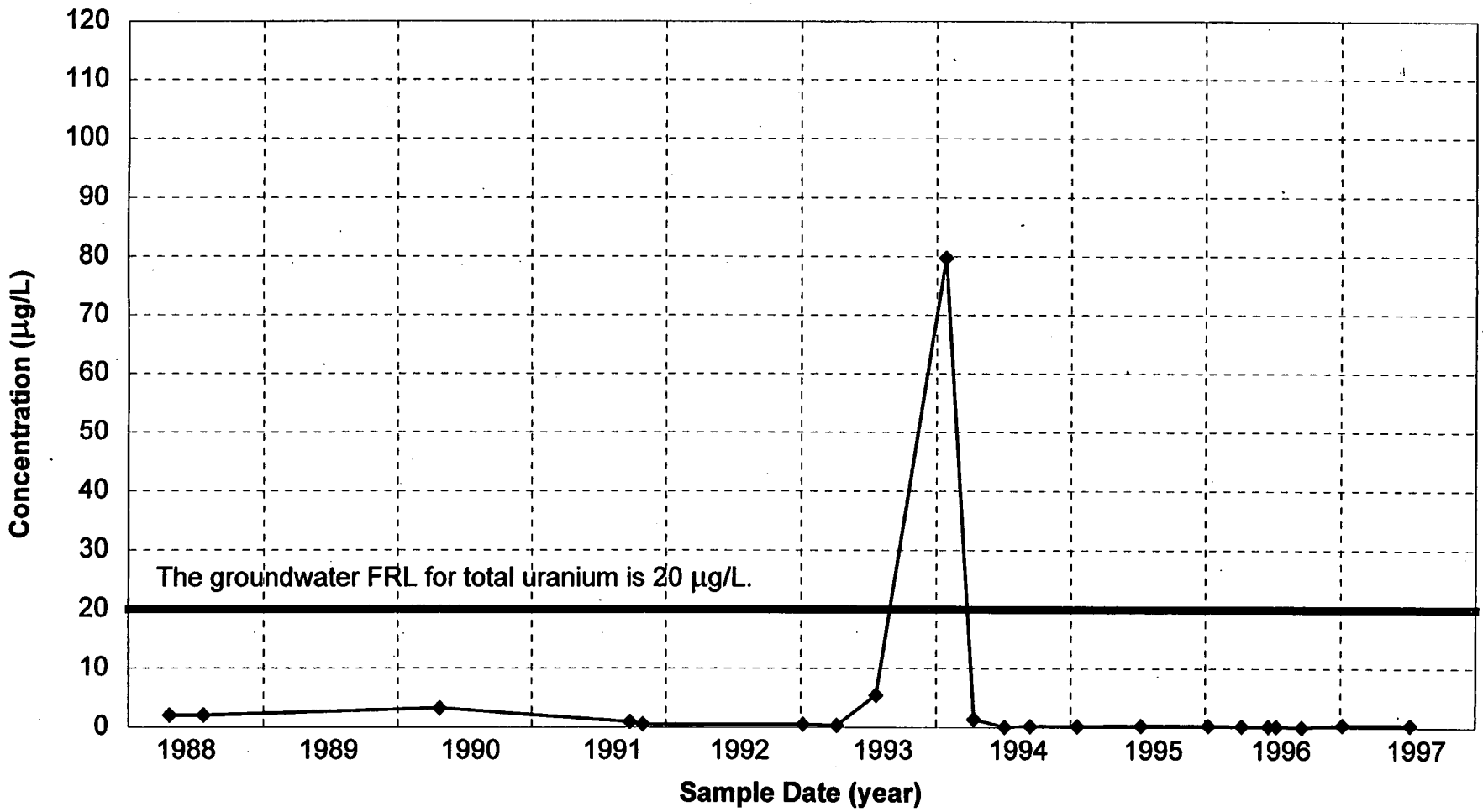


FIGURE A.2-91. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3070

000221

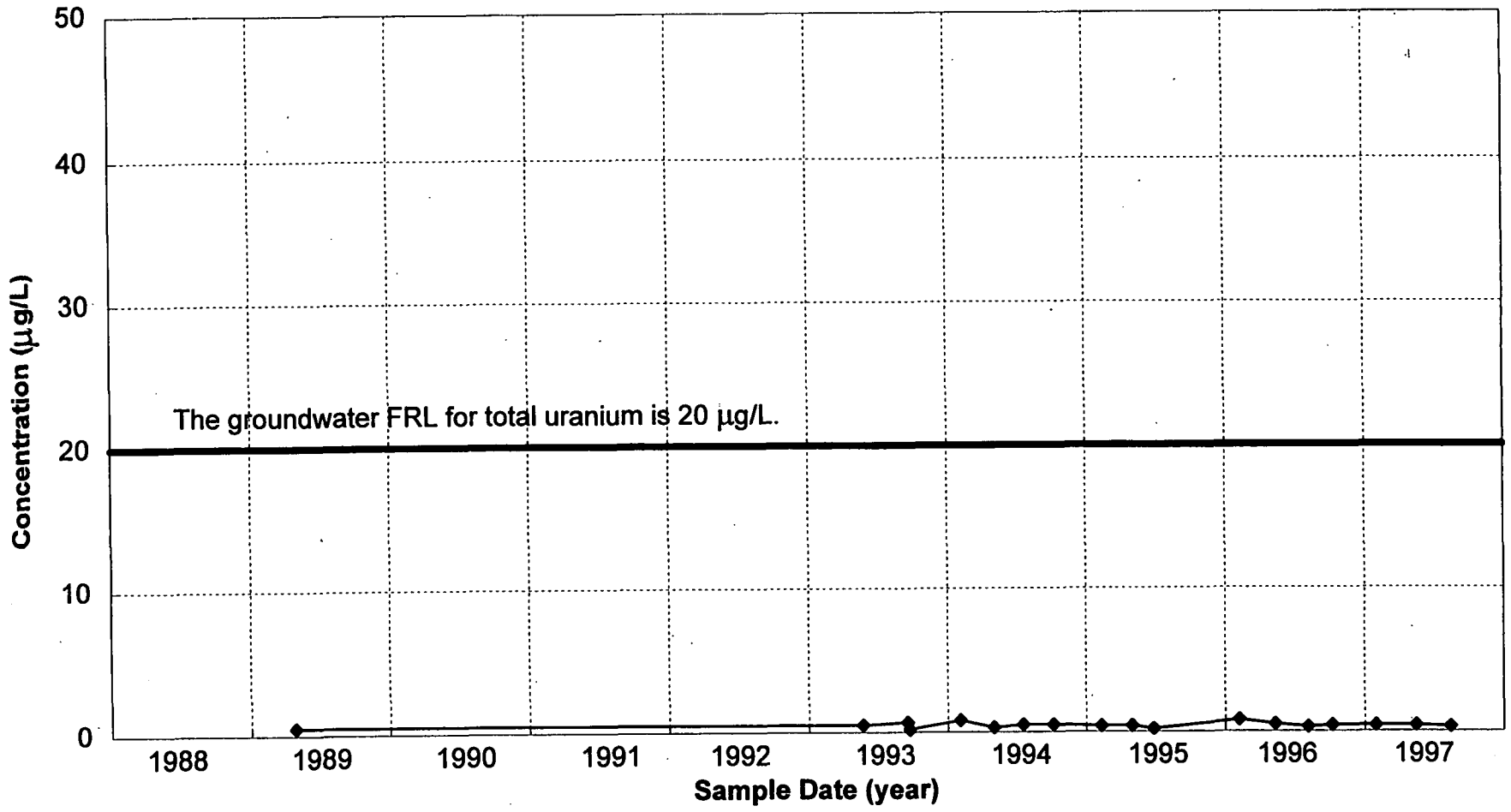


FIGURE A.2-92. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3093

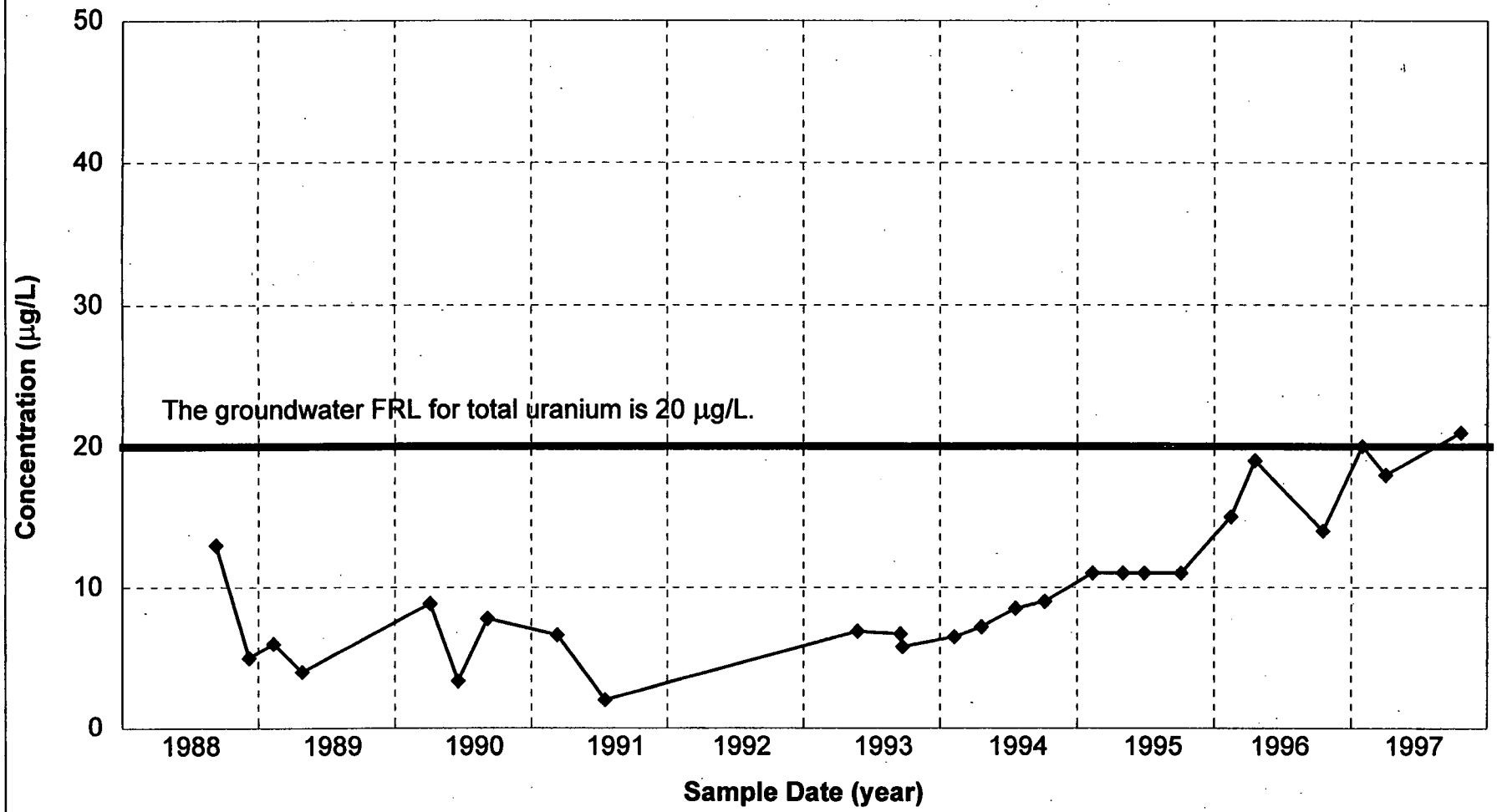


FIGURE A.2-93. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3095

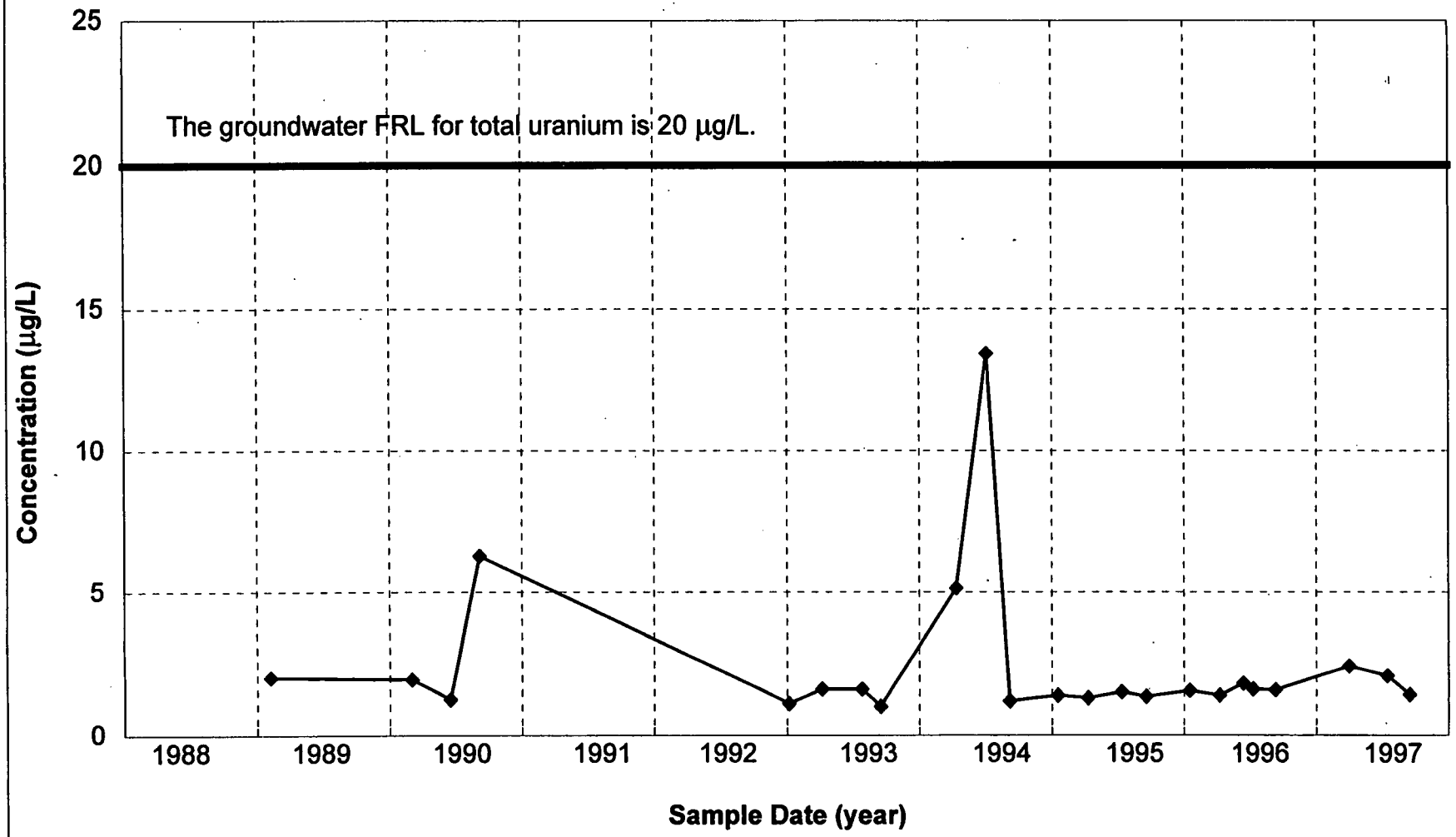


FIGURE A.2-94. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3106

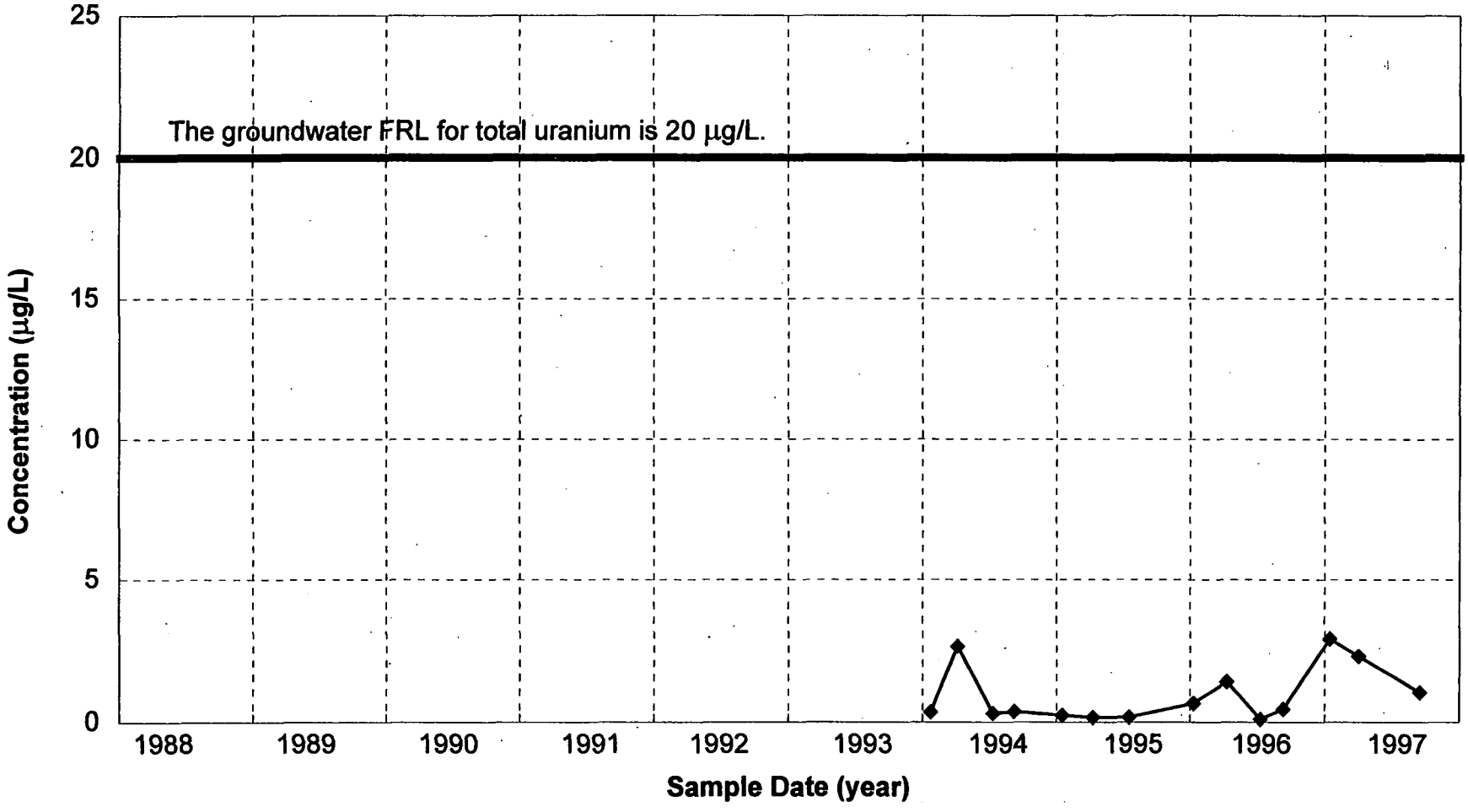


FIGURE A.2-95. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 31217

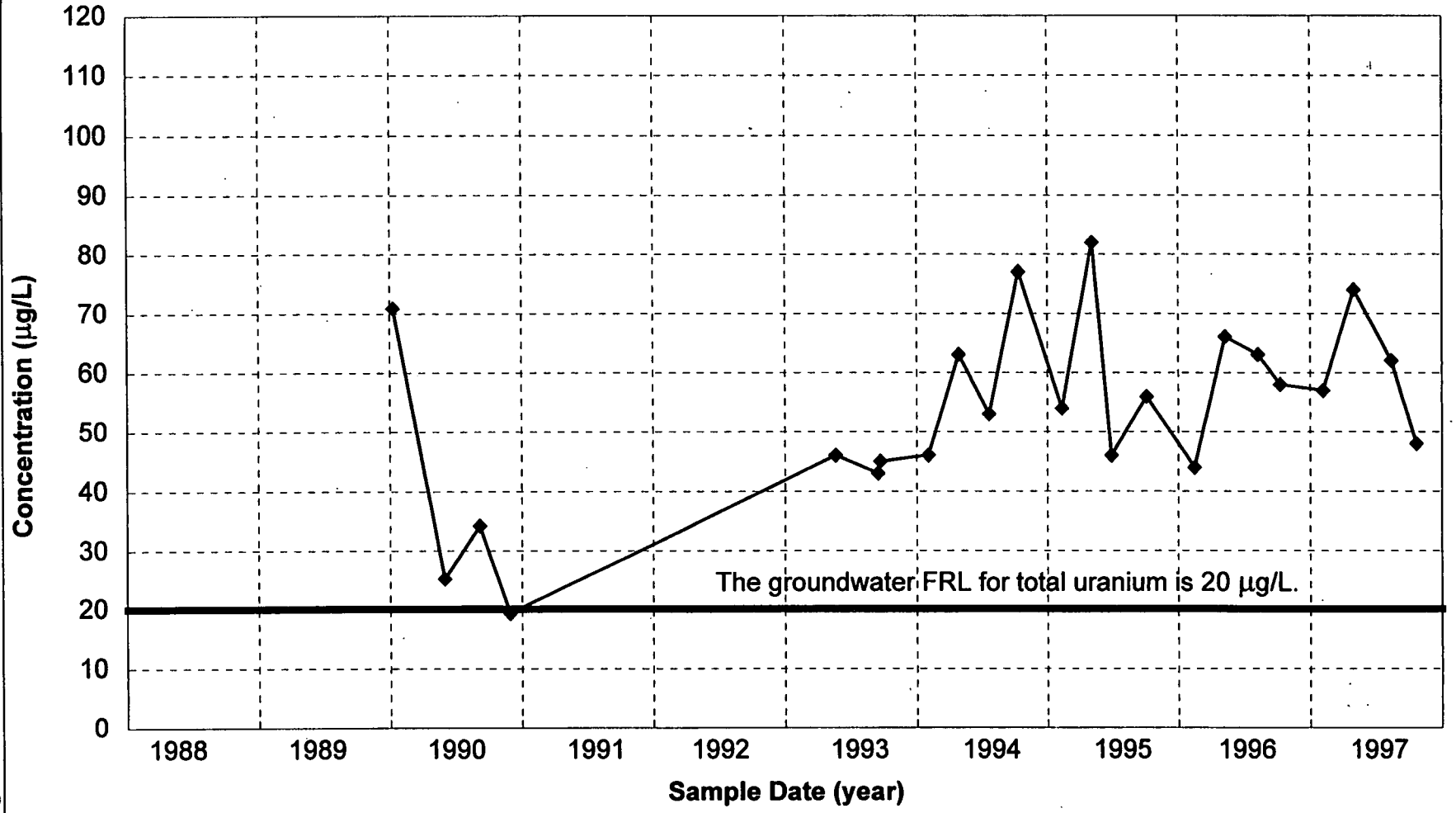


FIGURE A.2-96. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3125

92000

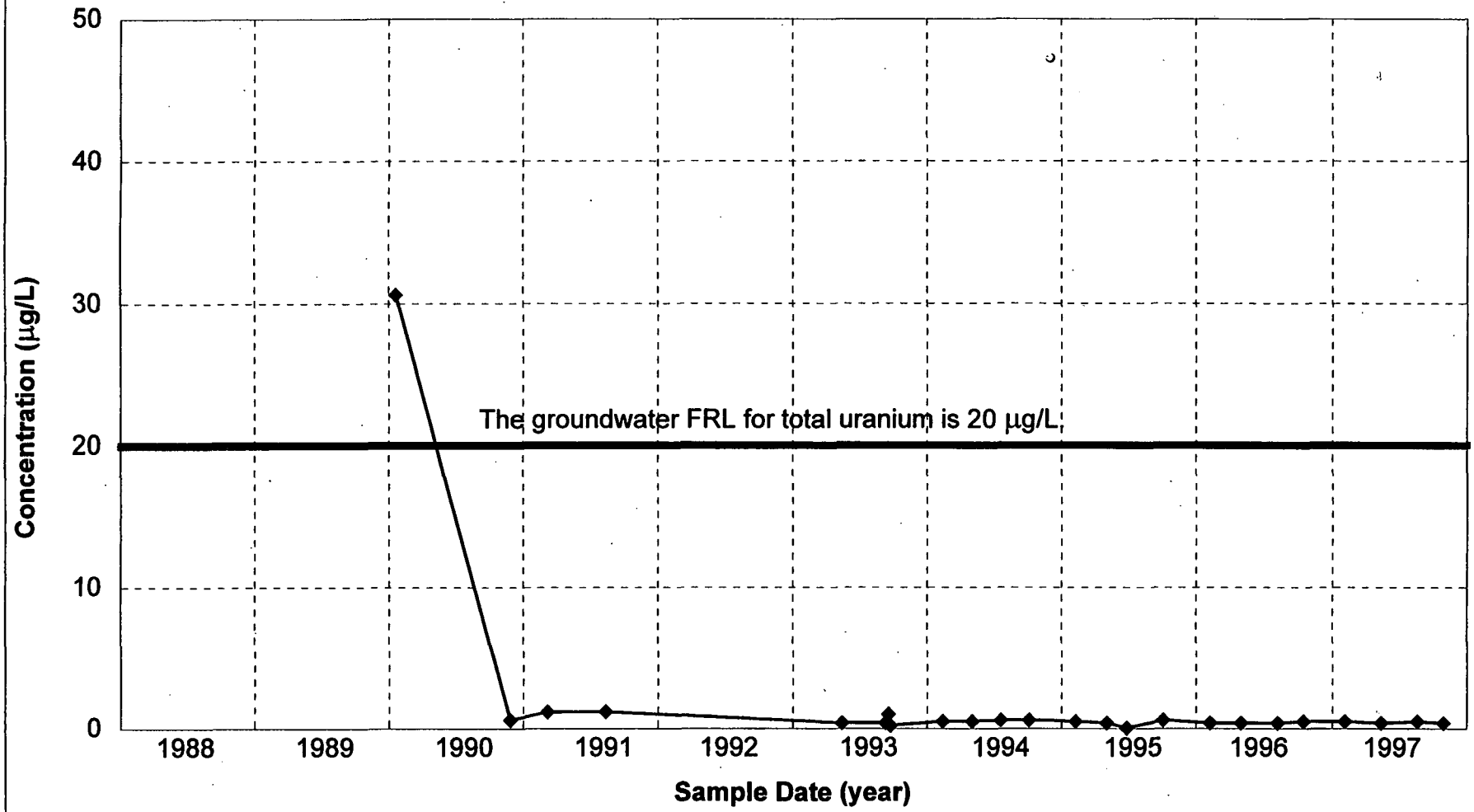


FIGURE A.2-97. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3128

000277

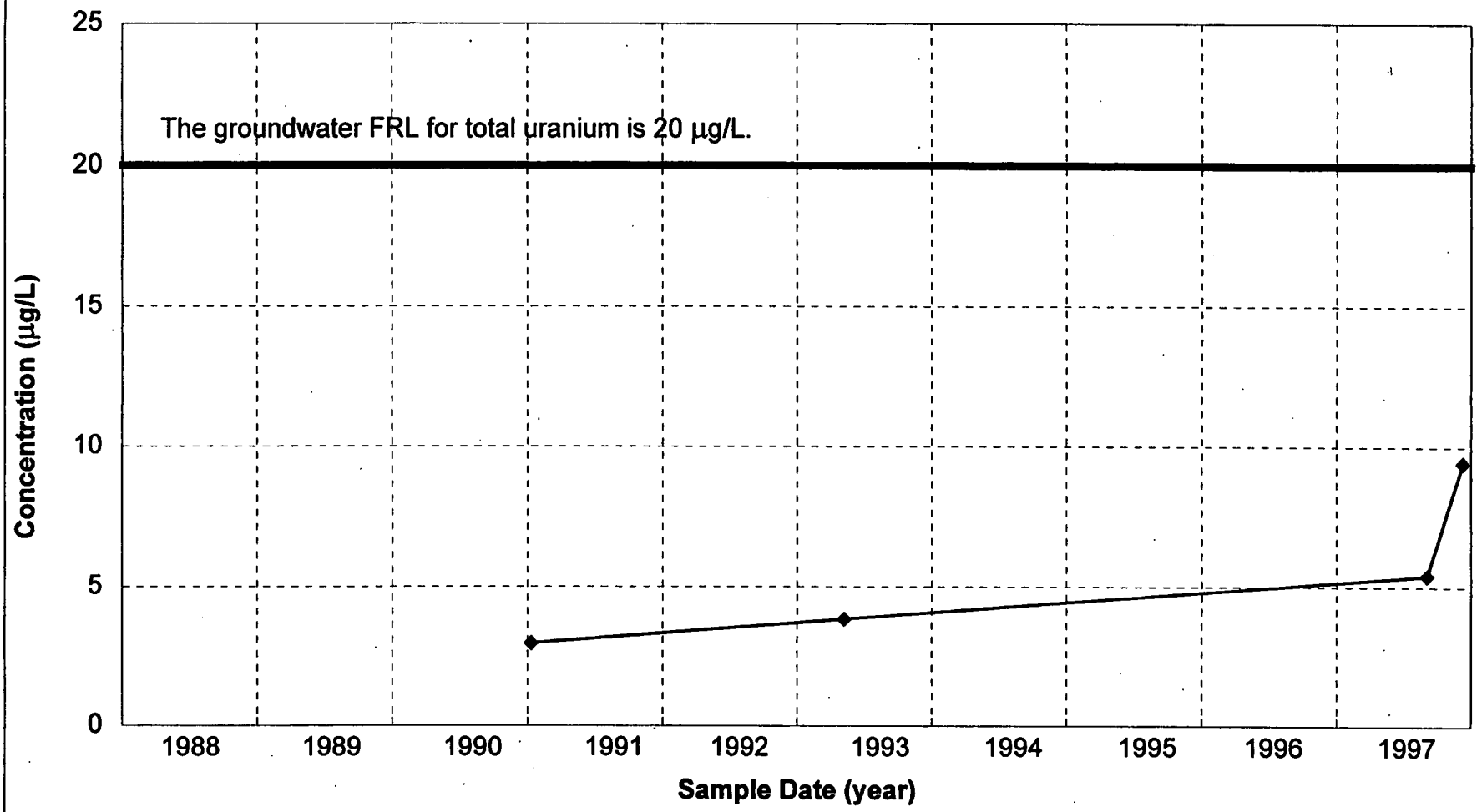


FIGURE A.2-98. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3385

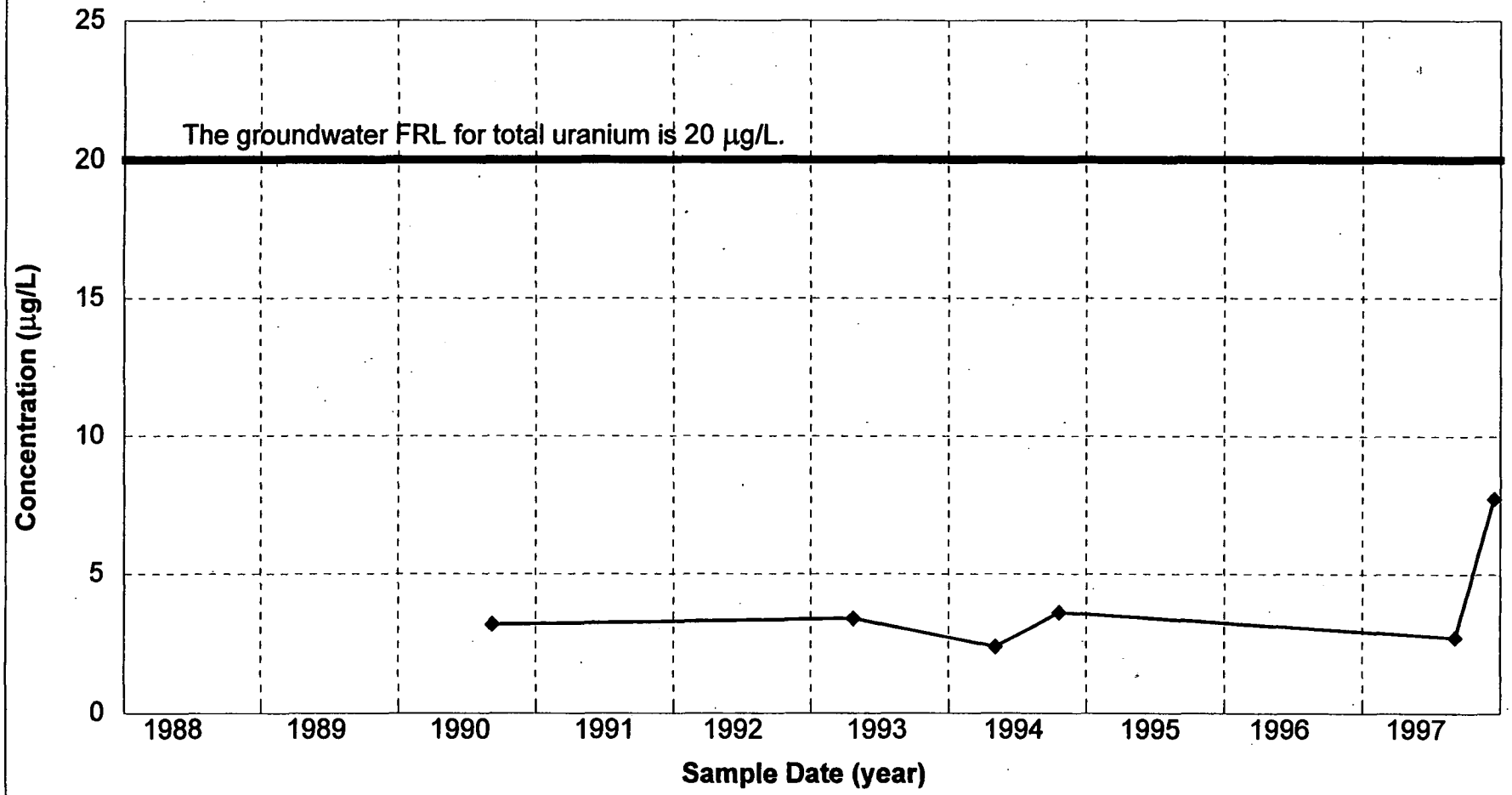


FIGURE A.2-99. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3387

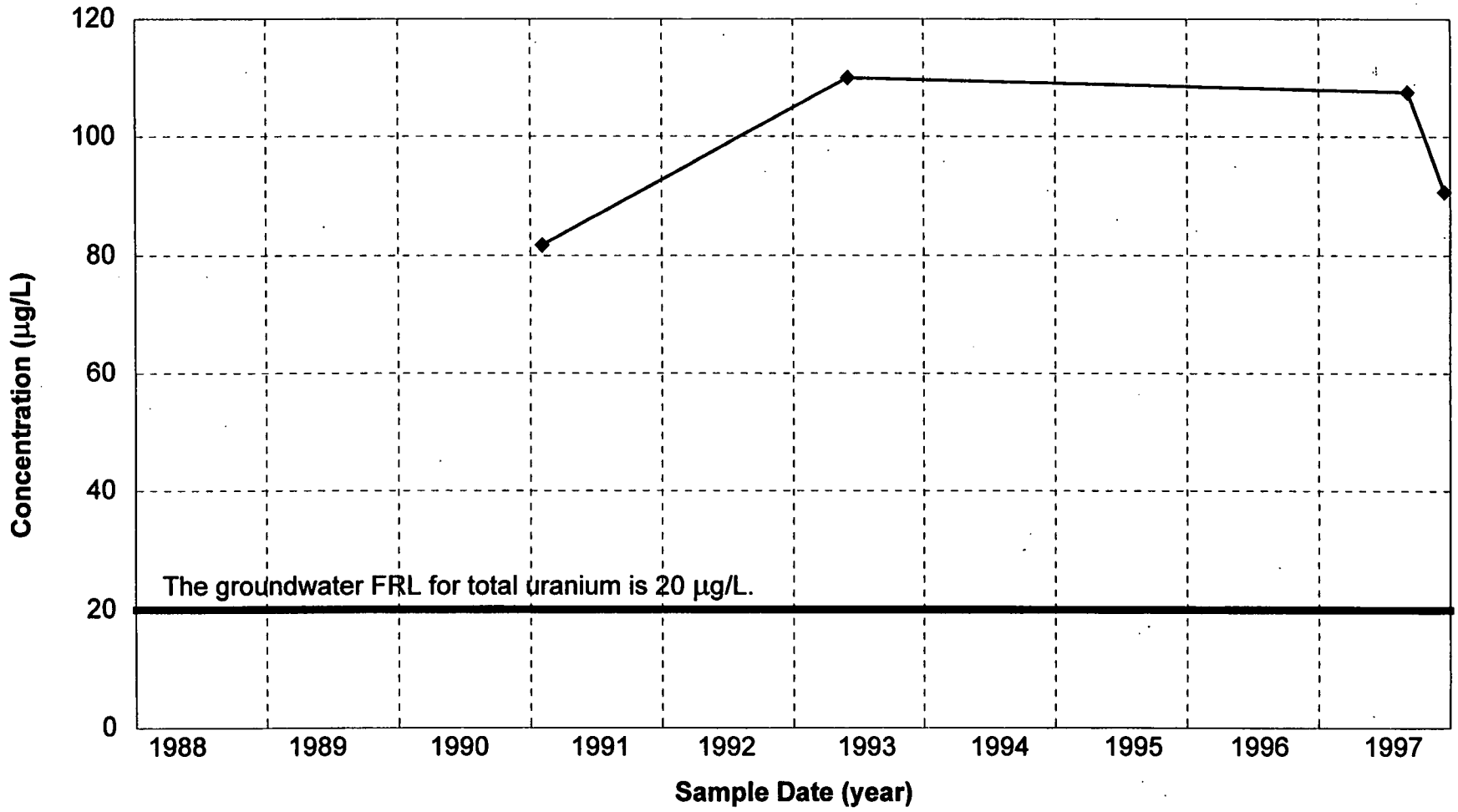


FIGURE A.2-100. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3390

002080

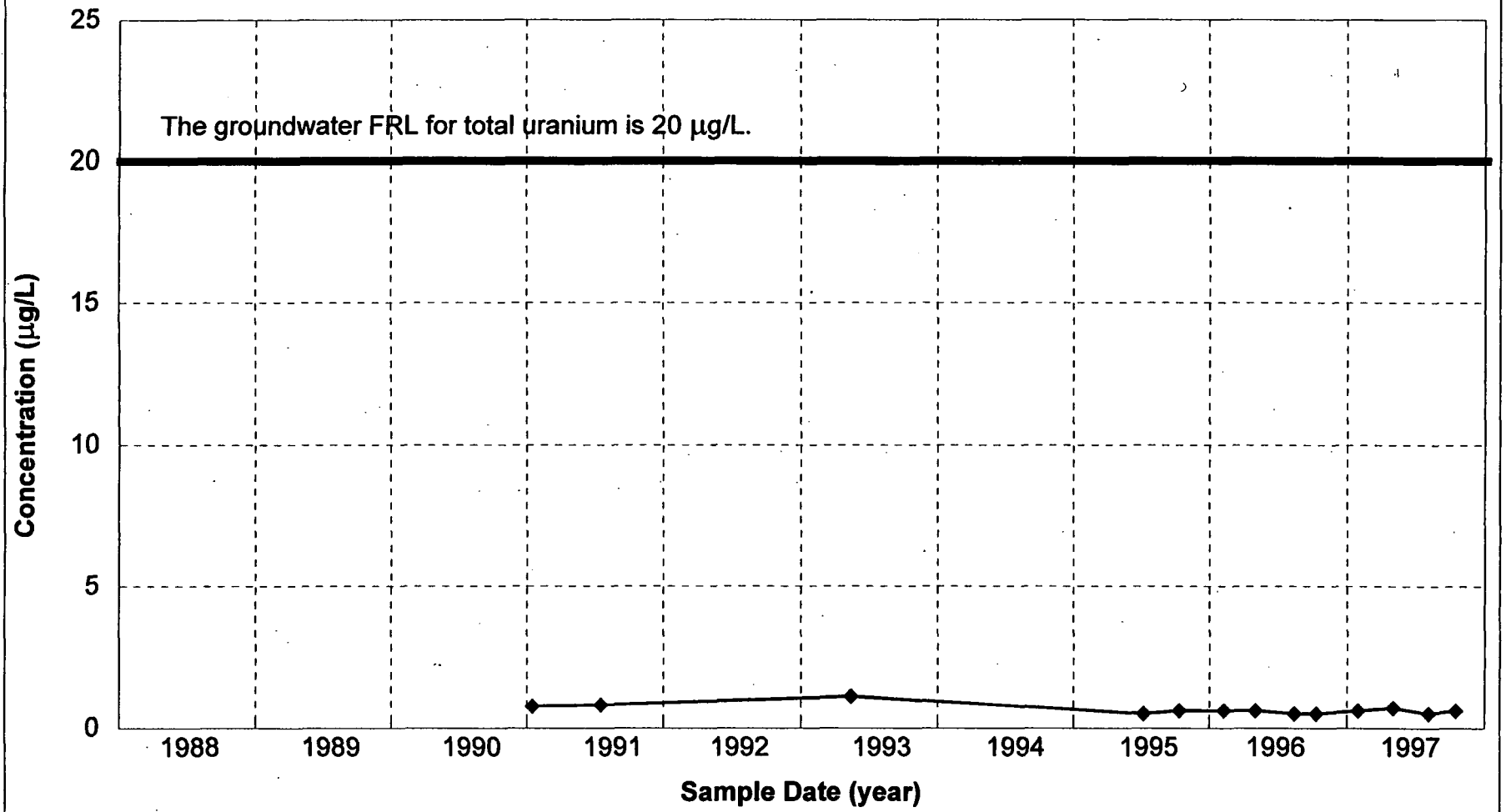


FIGURE A.2-101. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3396

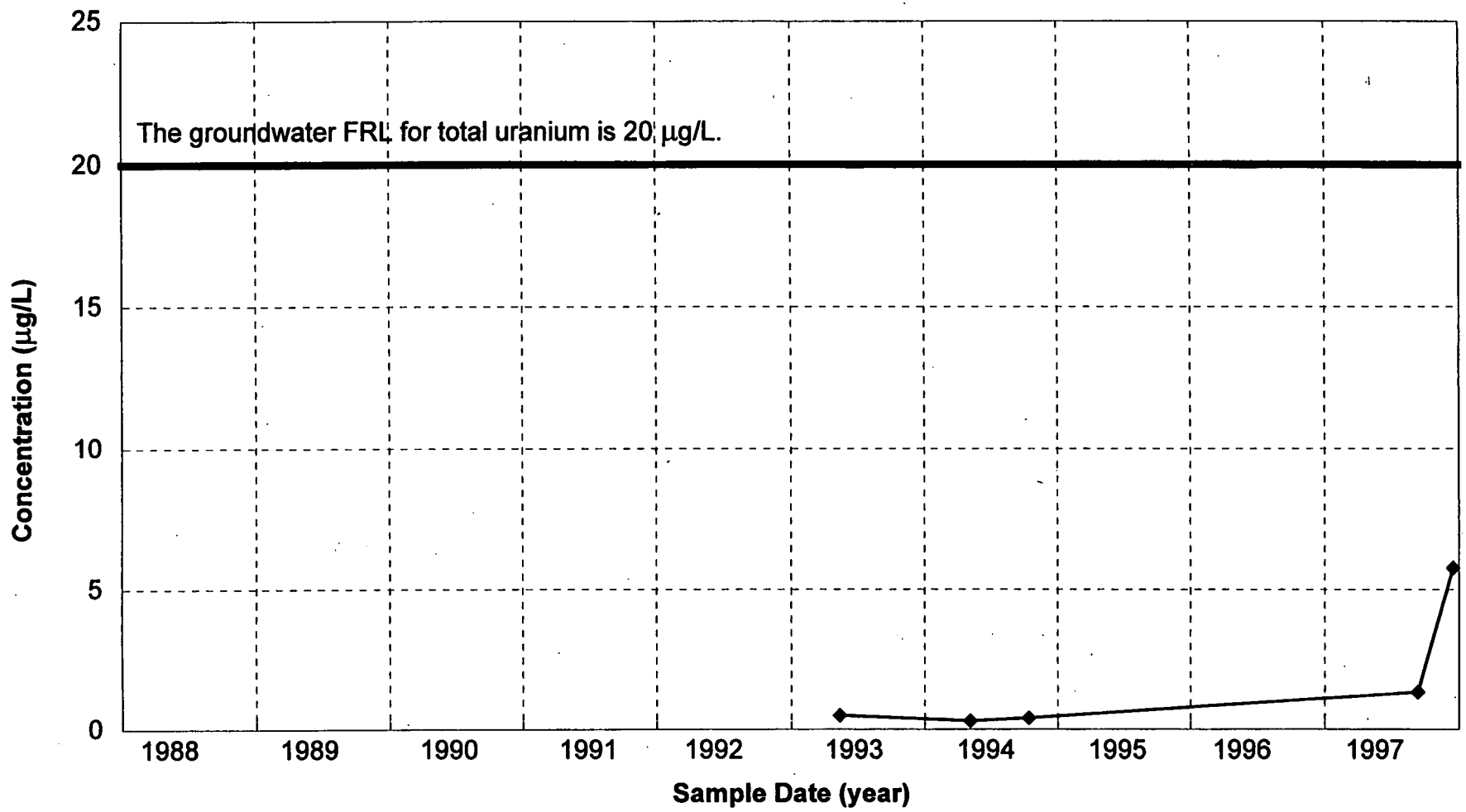


FIGURE A.2-102. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3397

0002232

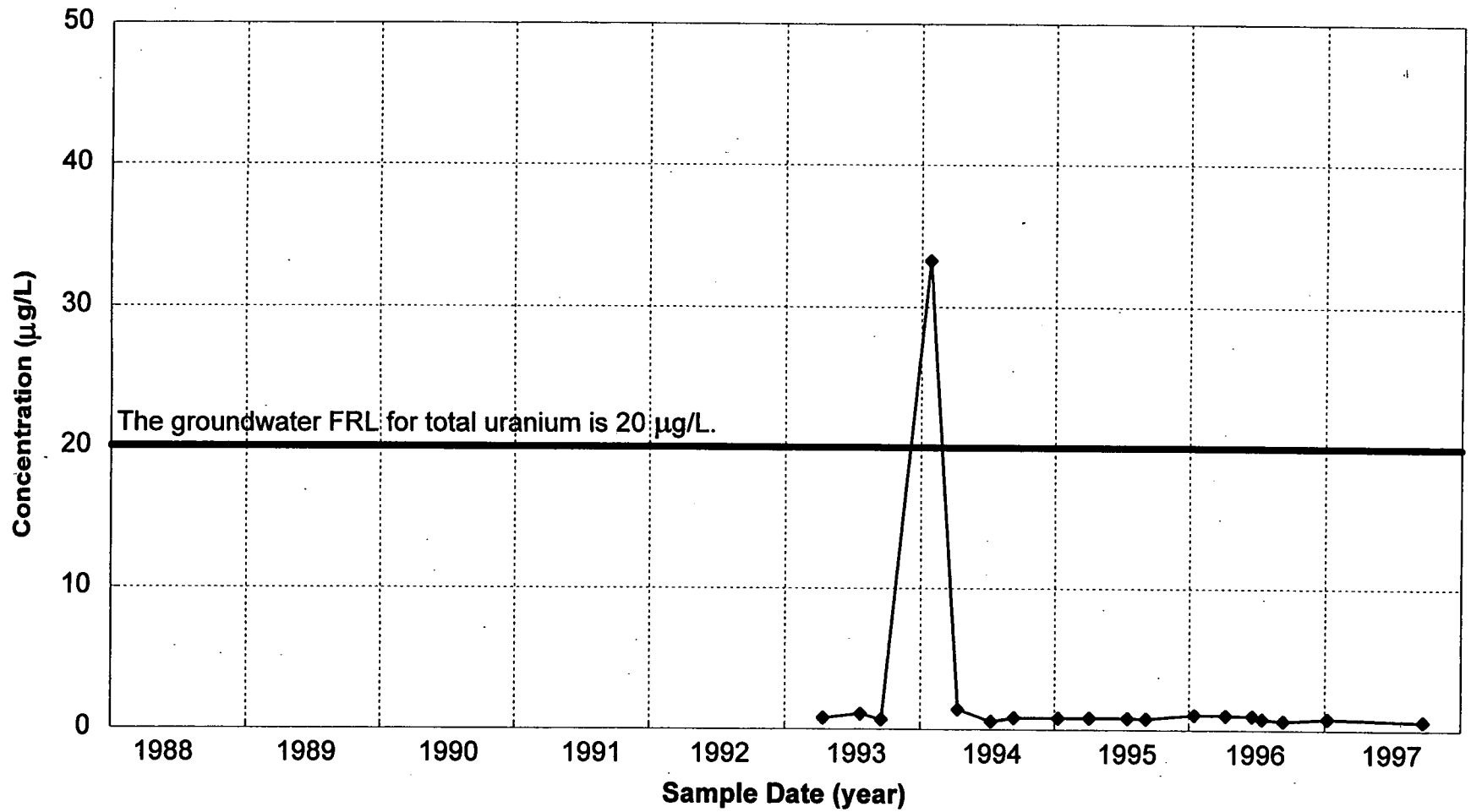


FIGURE A.2-103. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3398

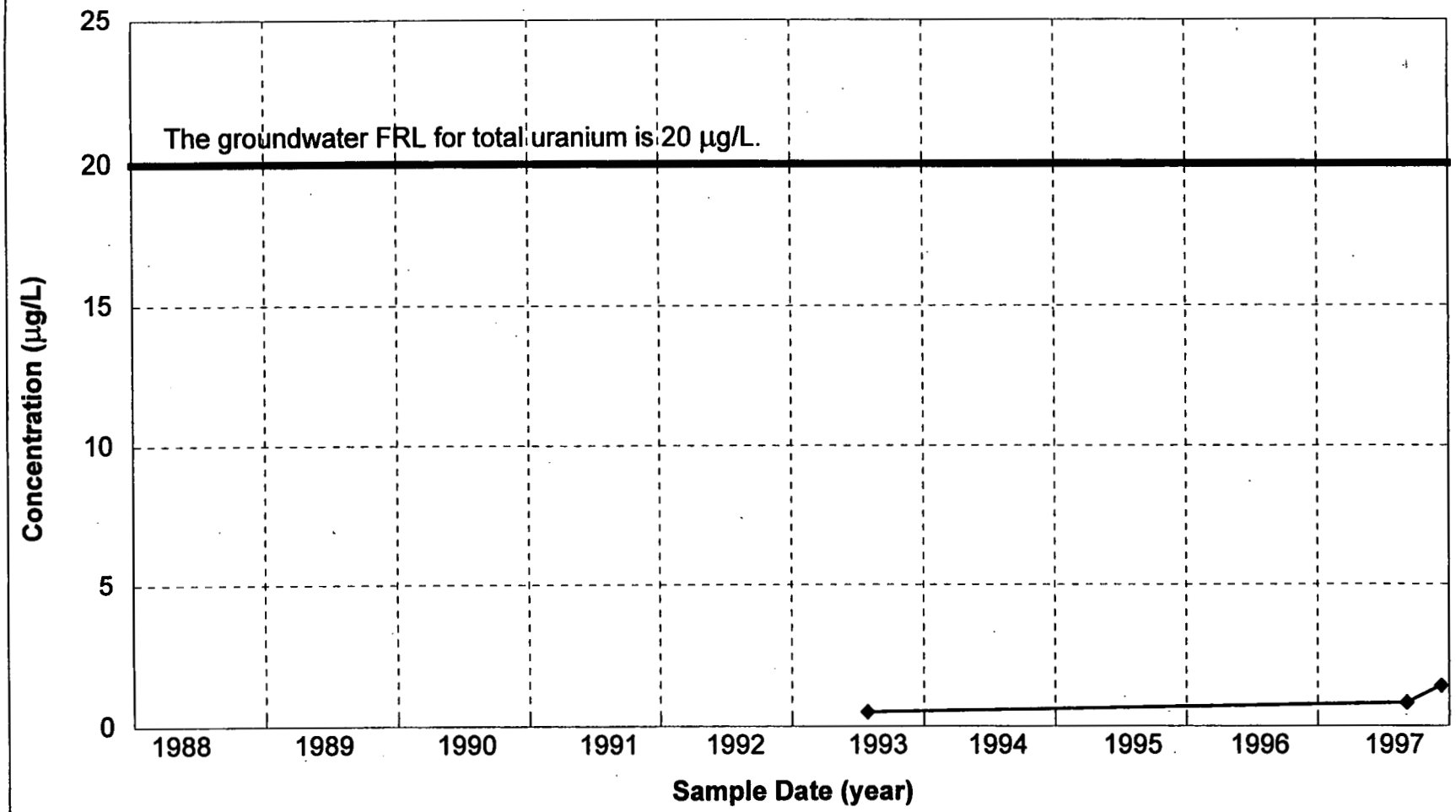


FIGURE A.2-104. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3402

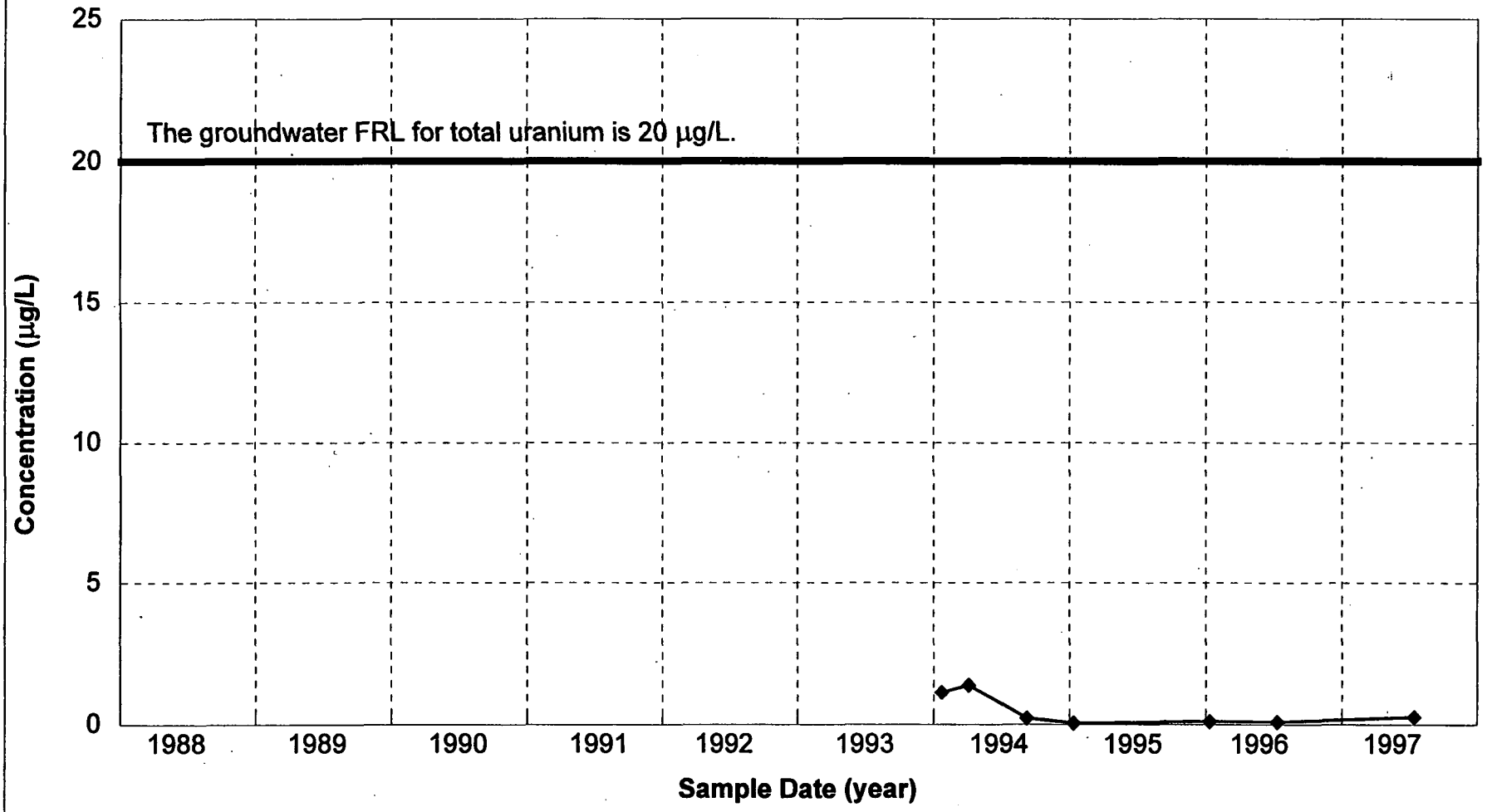


FIGURE A.2-105. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3417

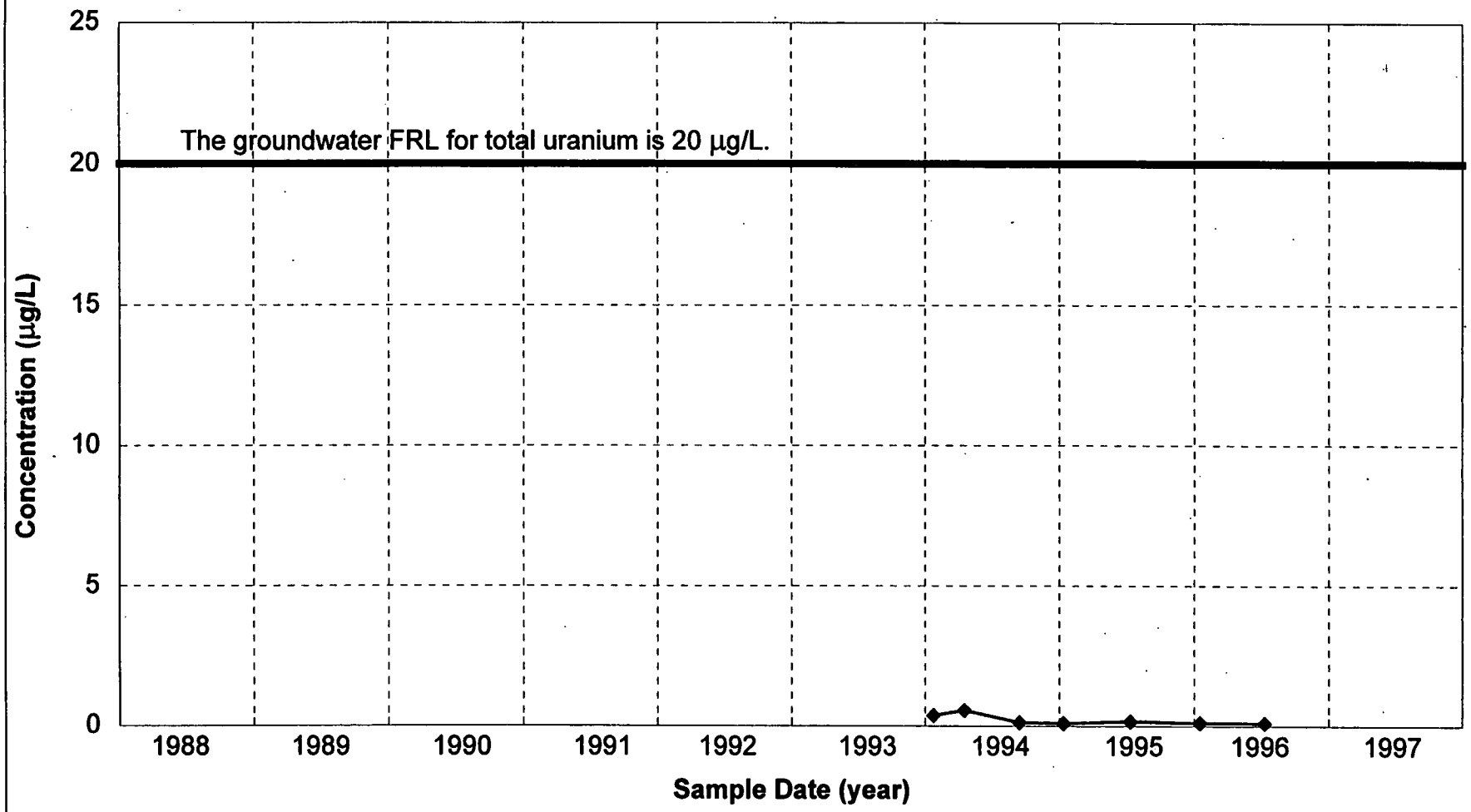


FIGURE A.2-106. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3424

000286

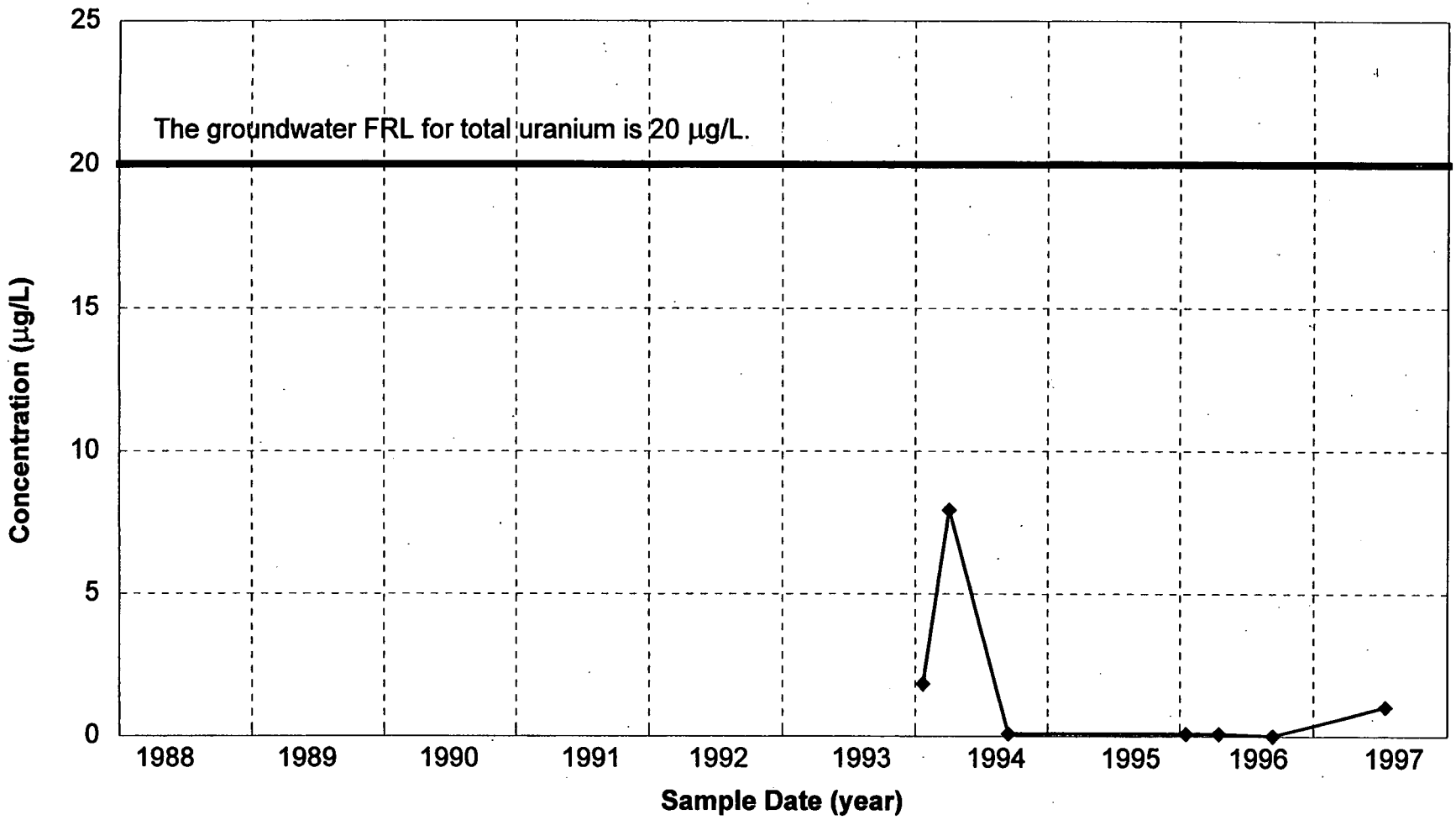


FIGURE A.2-107. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3426

000289

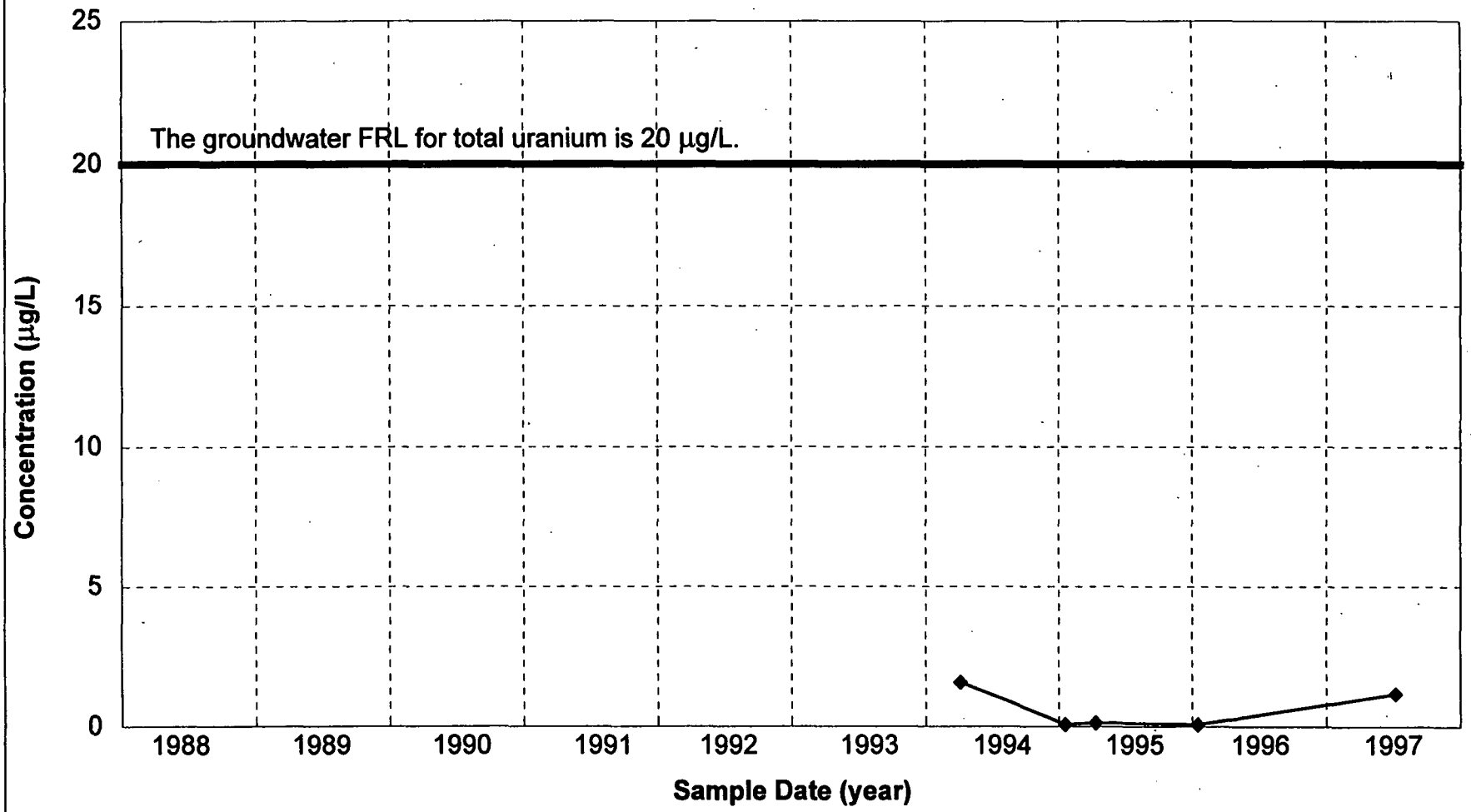


FIGURE A.2-108. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3429

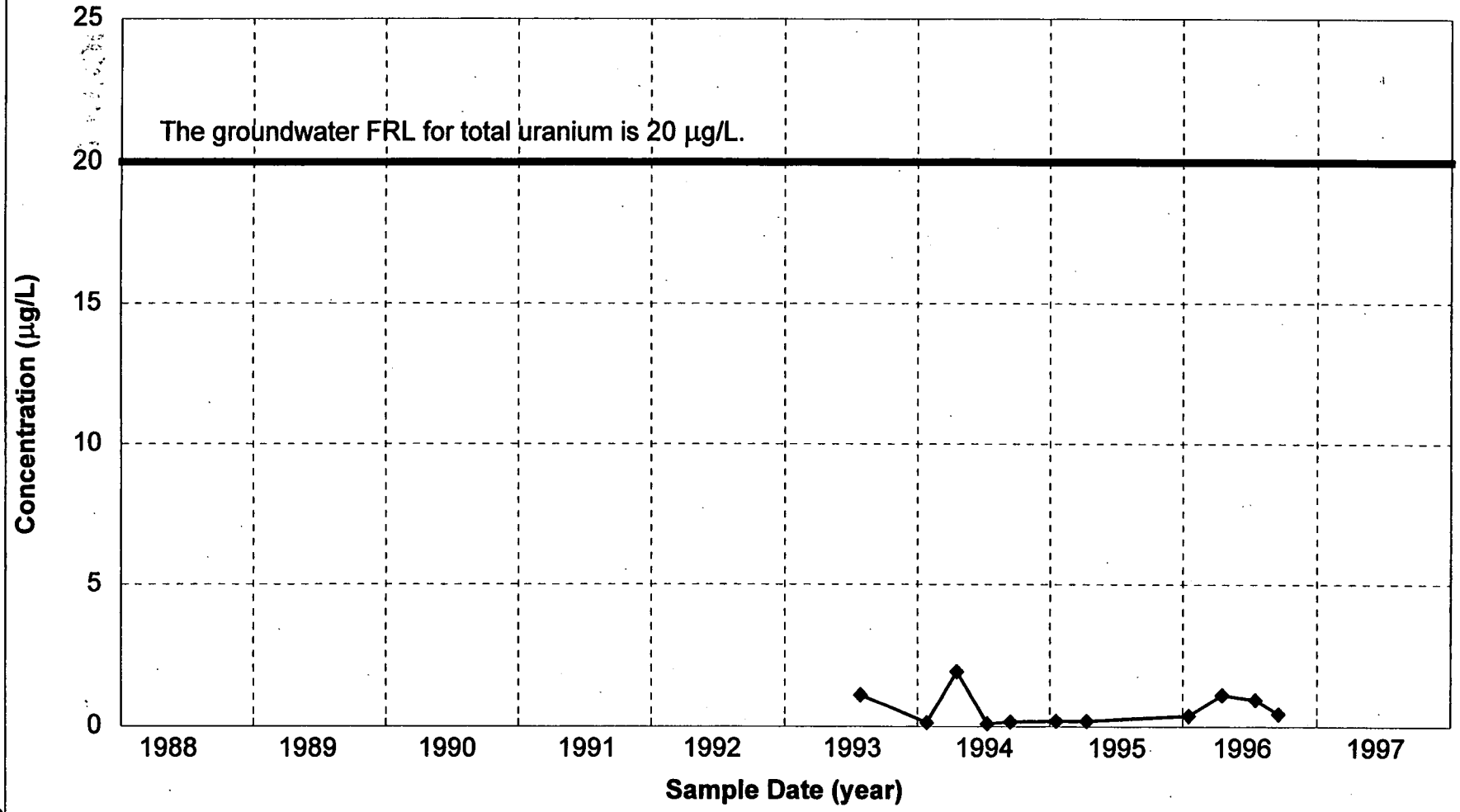


FIGURE A.2-109. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3431

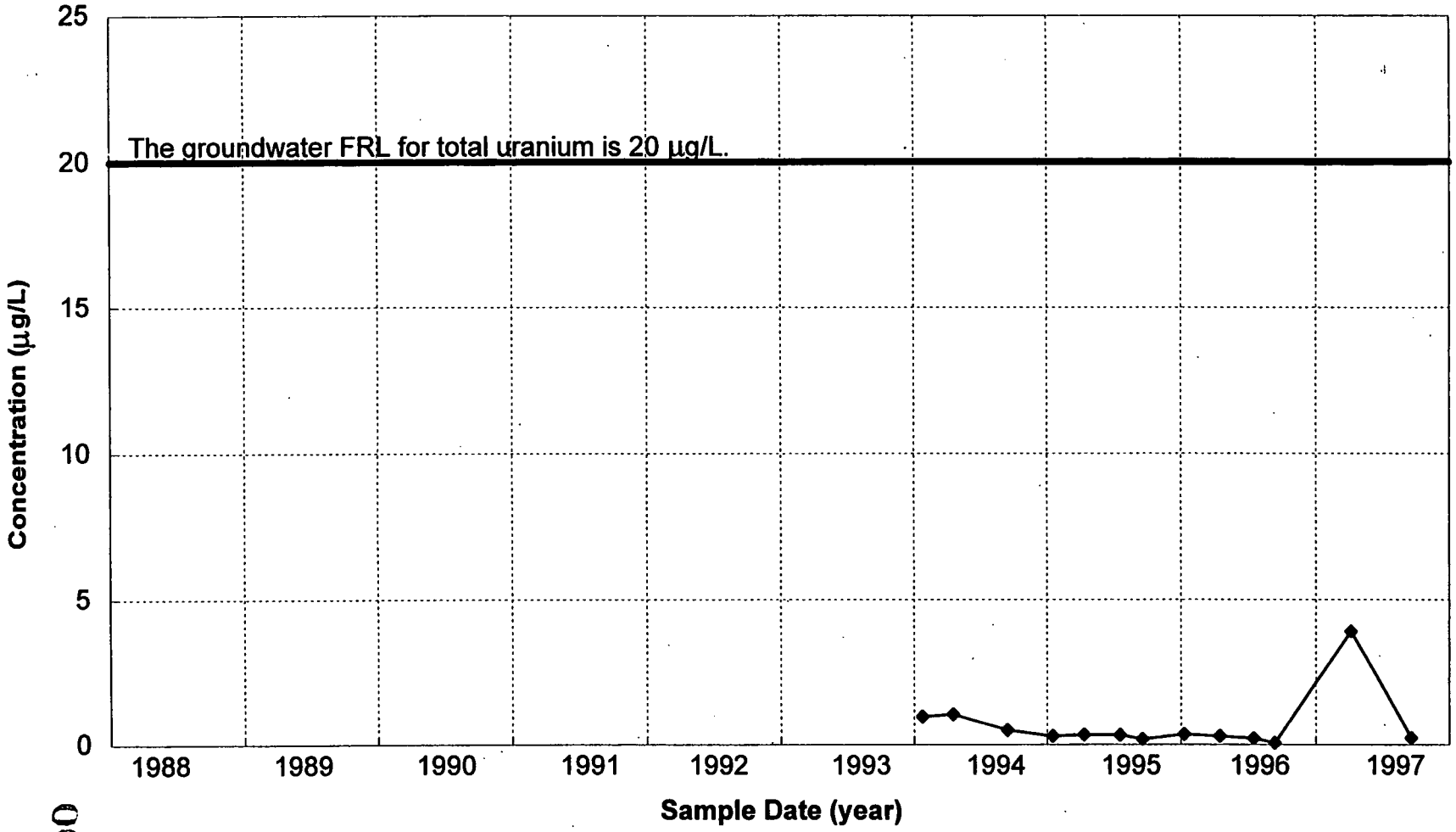


FIGURE A.2-110. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3432

000290

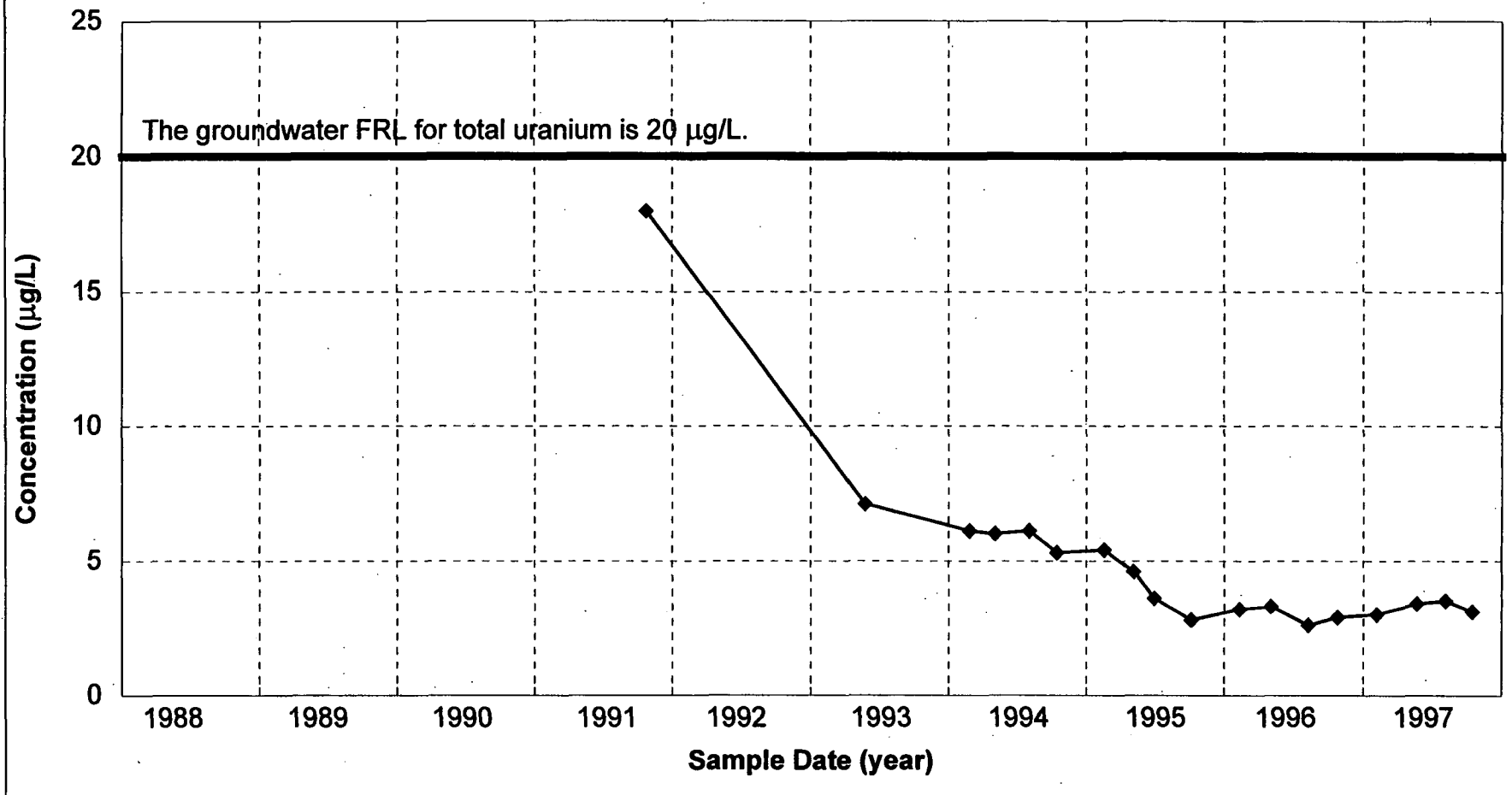


FIGURE A.2-111. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3550

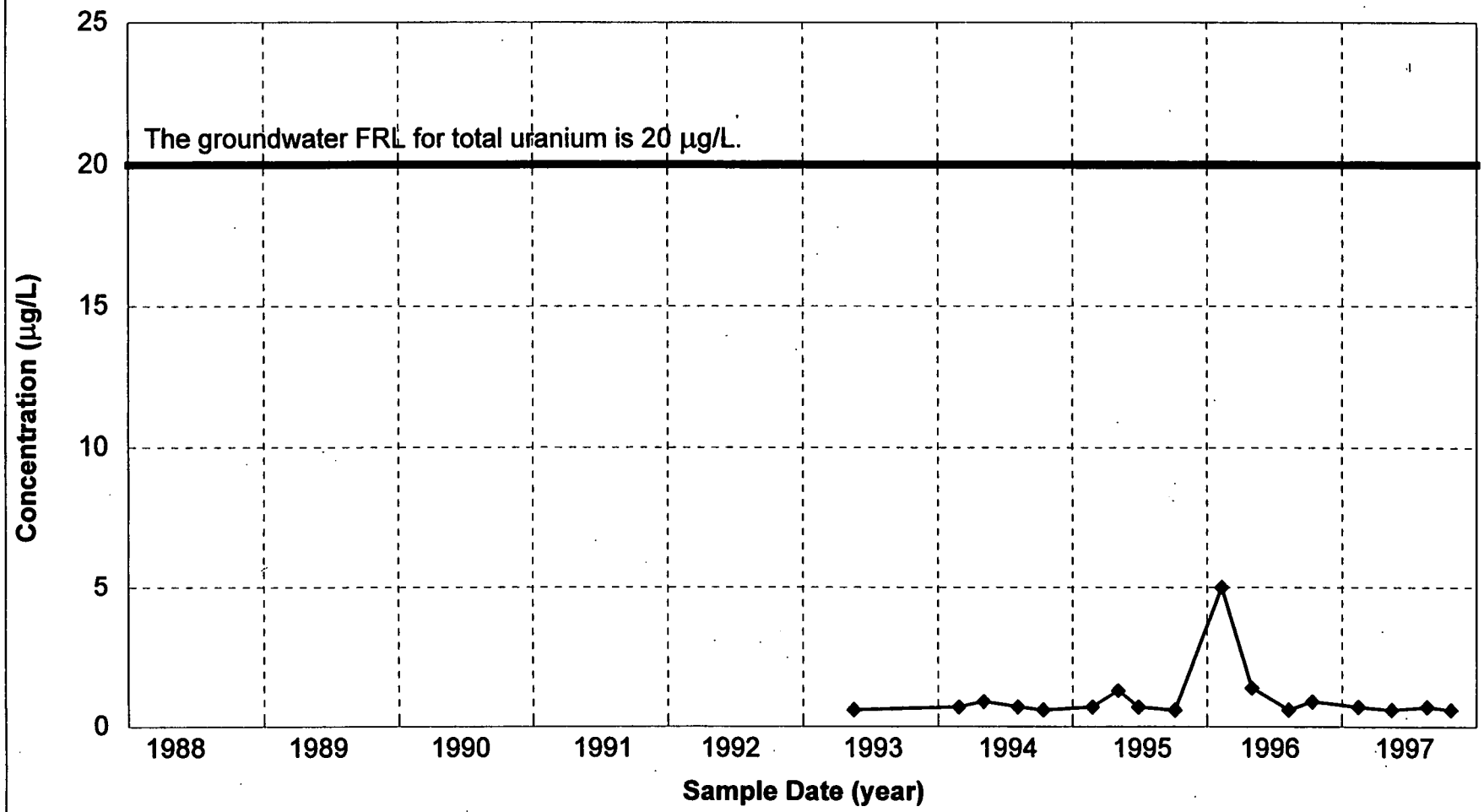


FIGURE A.2-112. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3551

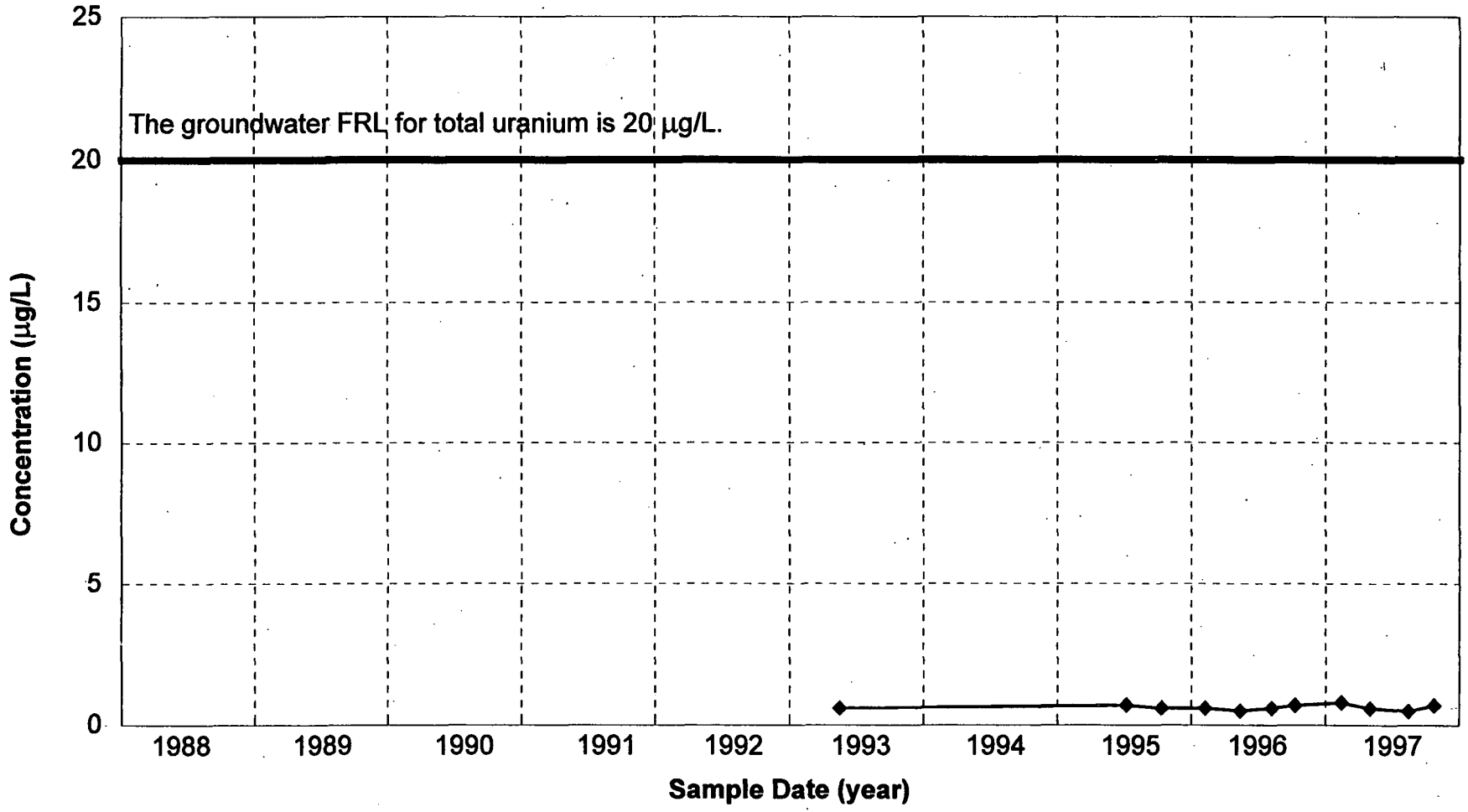


FIGURE A.2-113. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3552

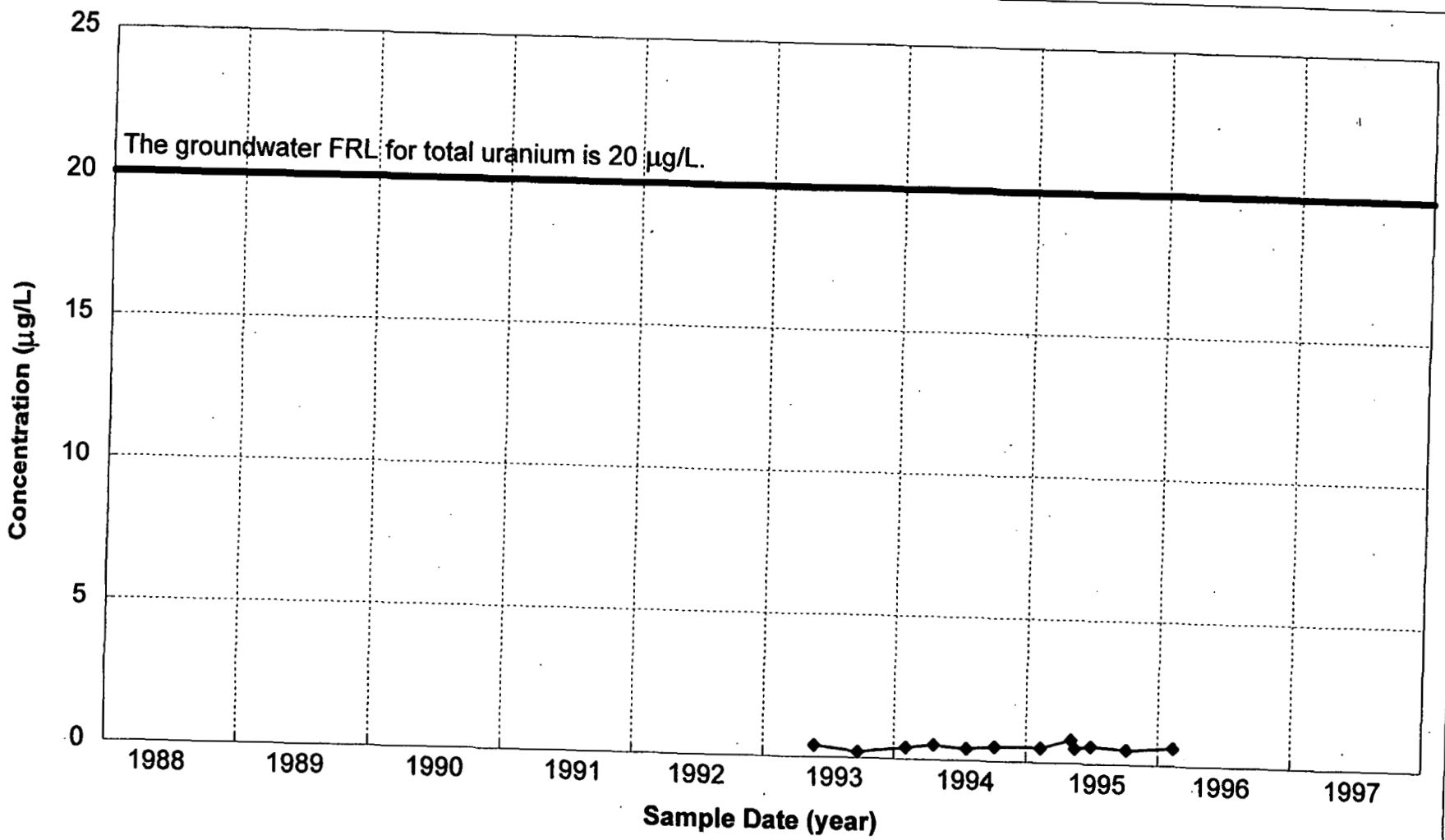


FIGURE A.2-114. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3624

000294

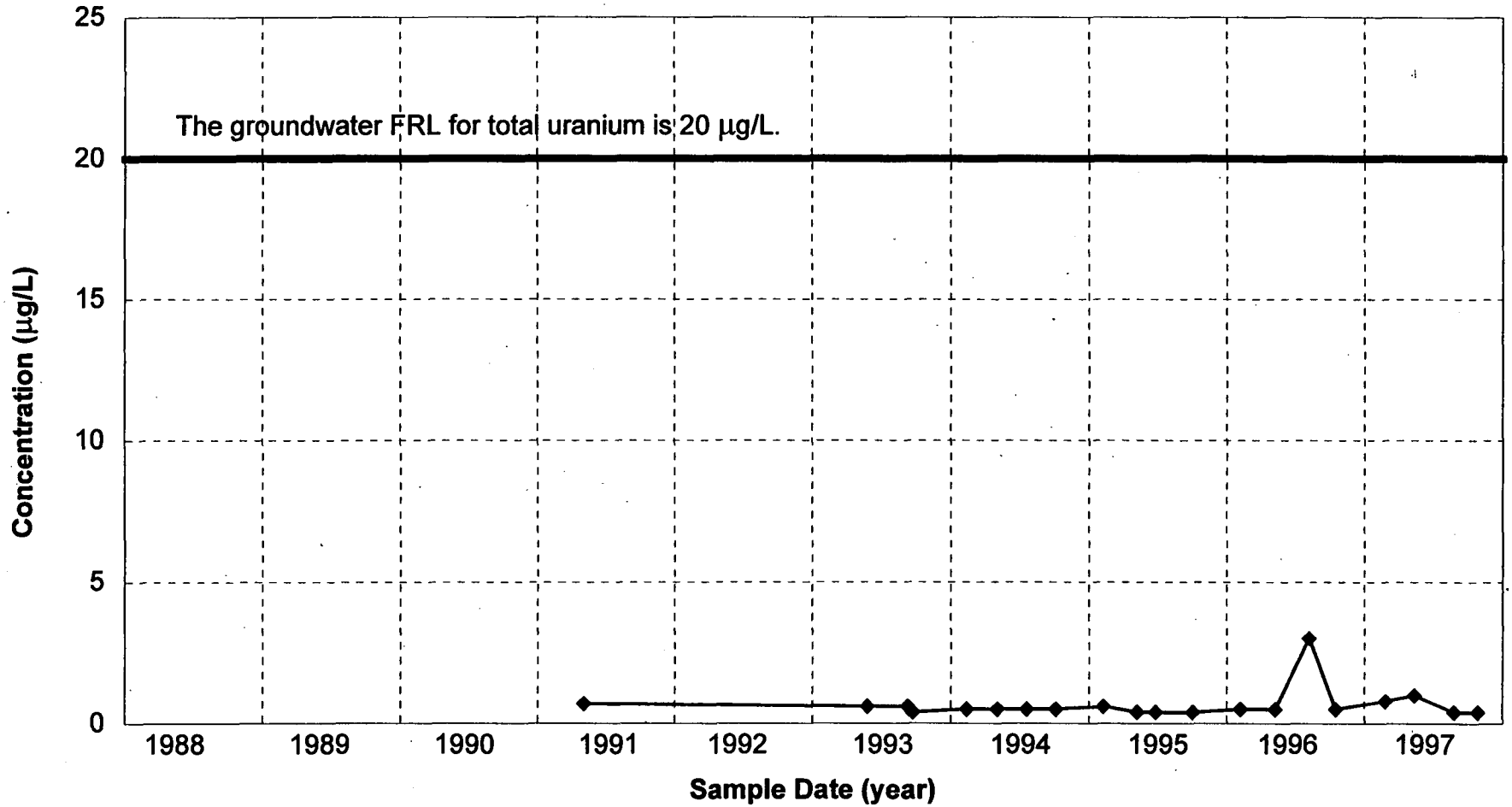


FIGURE A.2-115. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3636

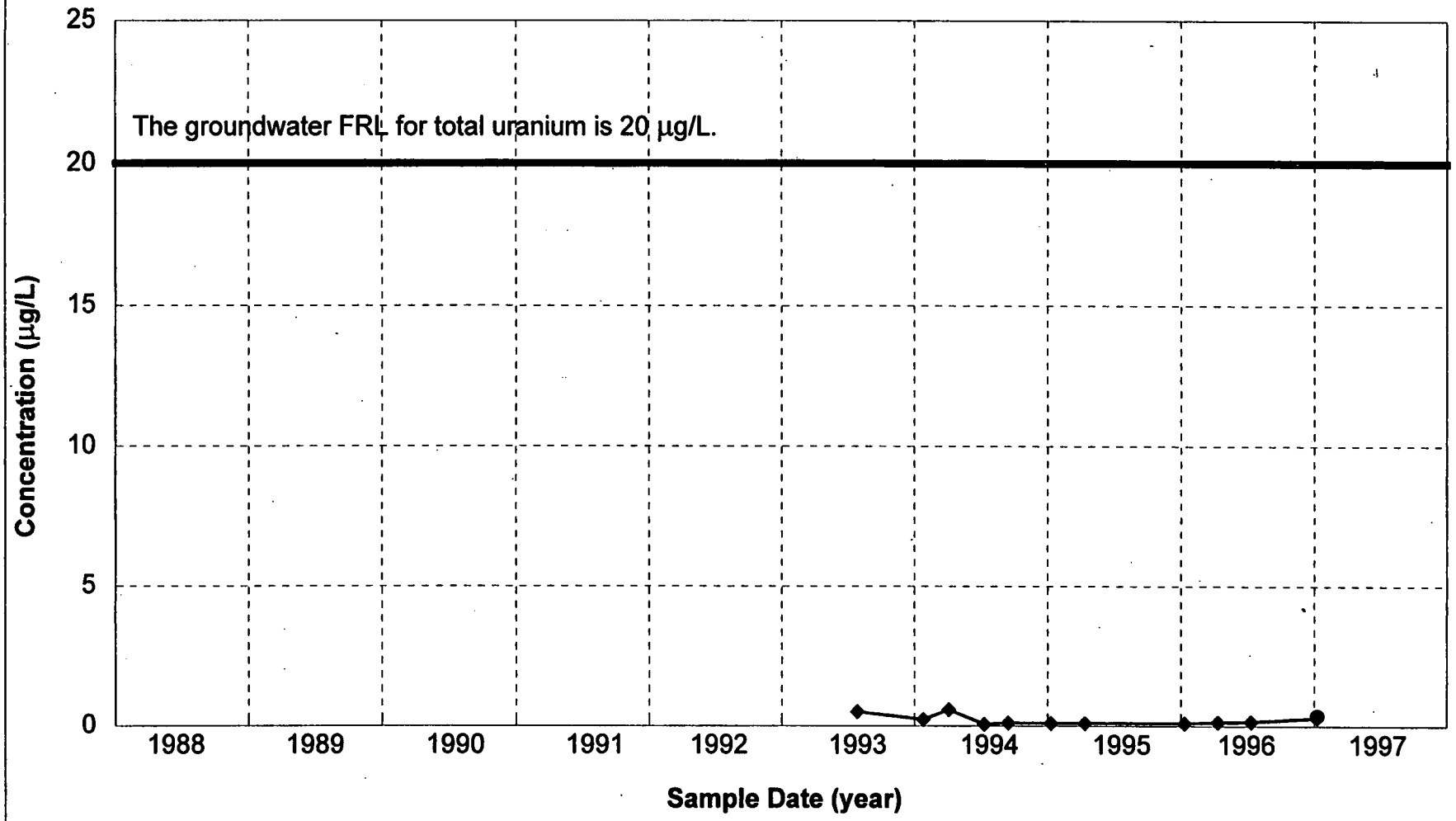


FIGURE A.2-116. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3733

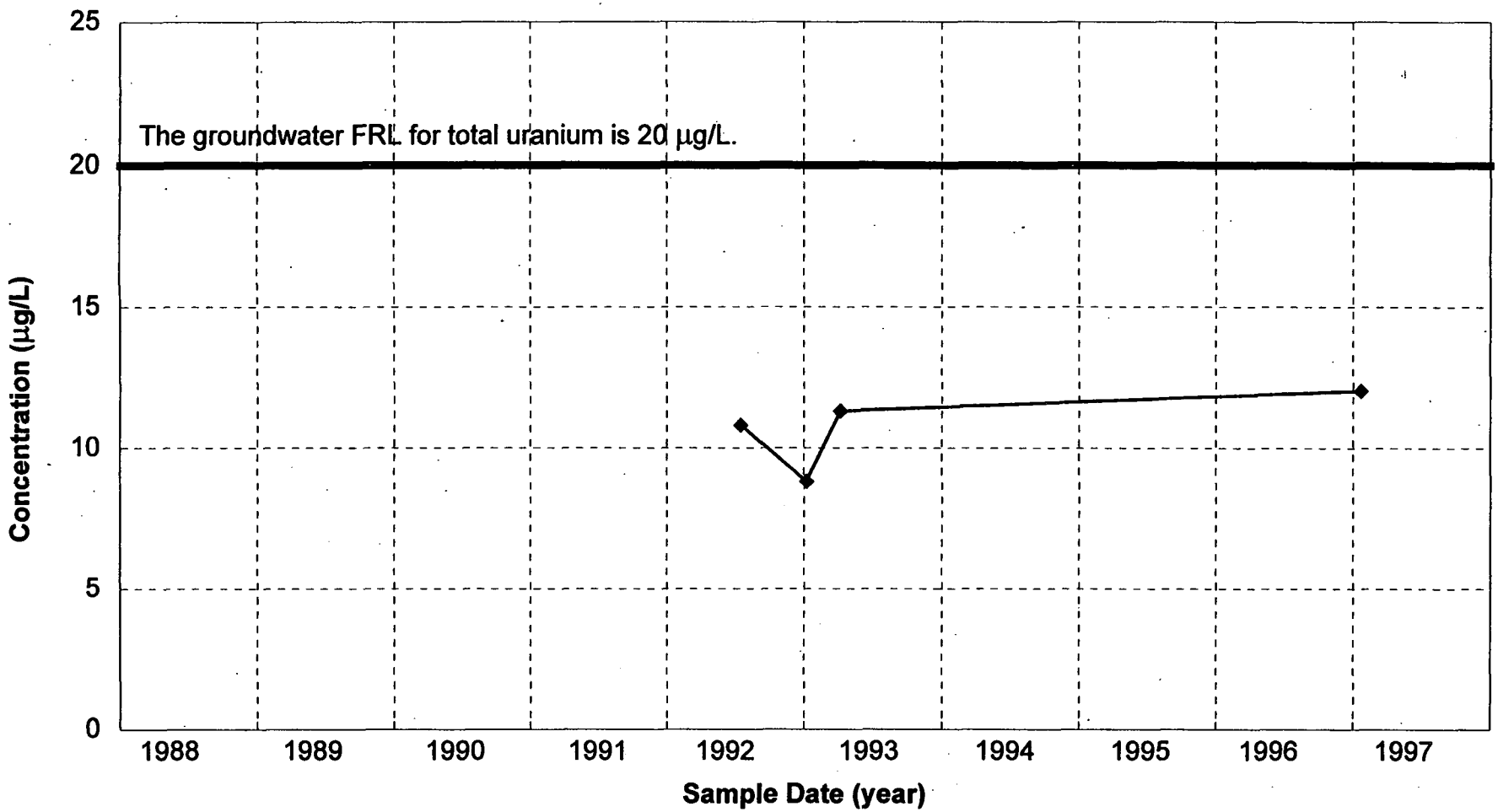


FIGURE A.2-117. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3821

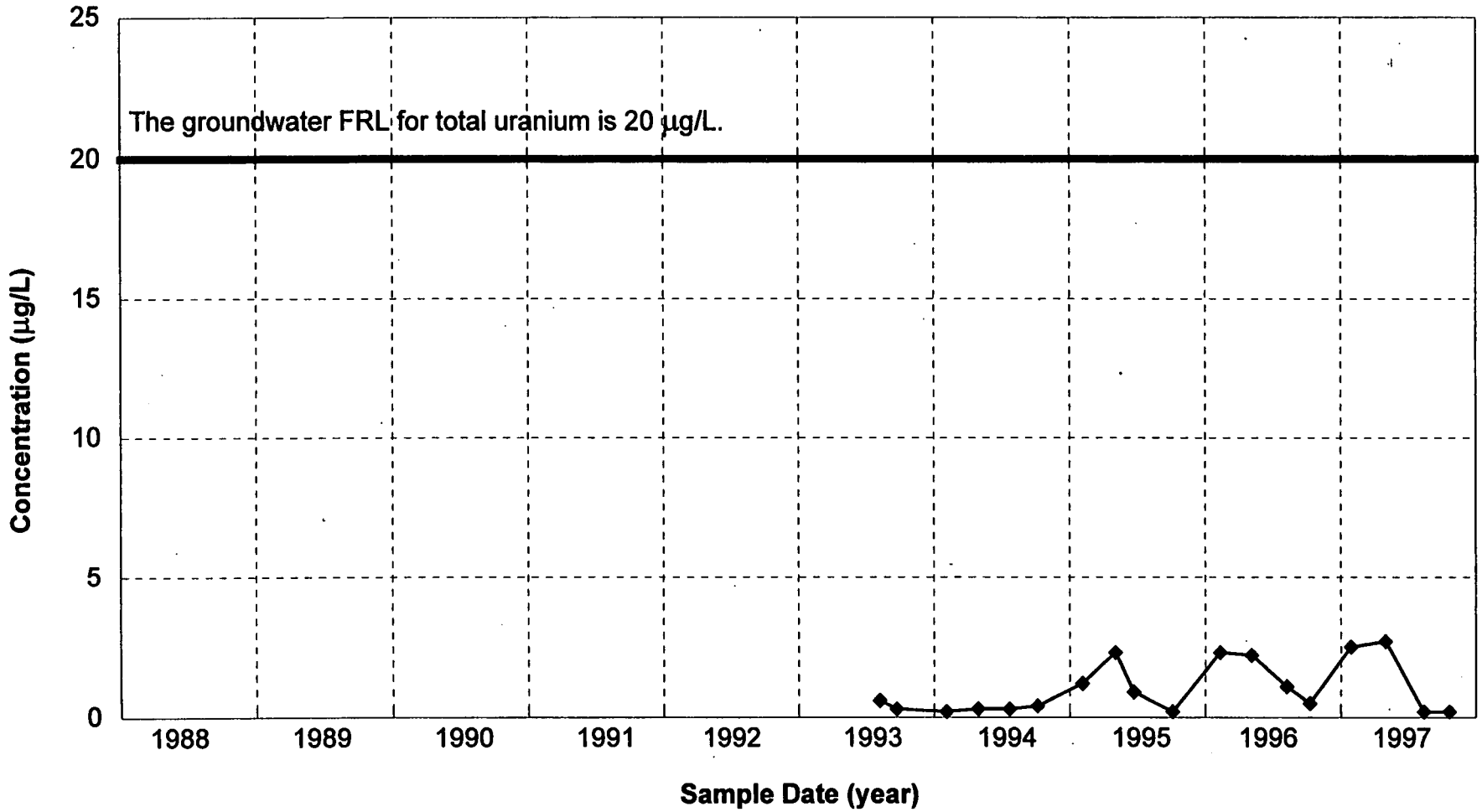


FIGURE A.2-118. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3880

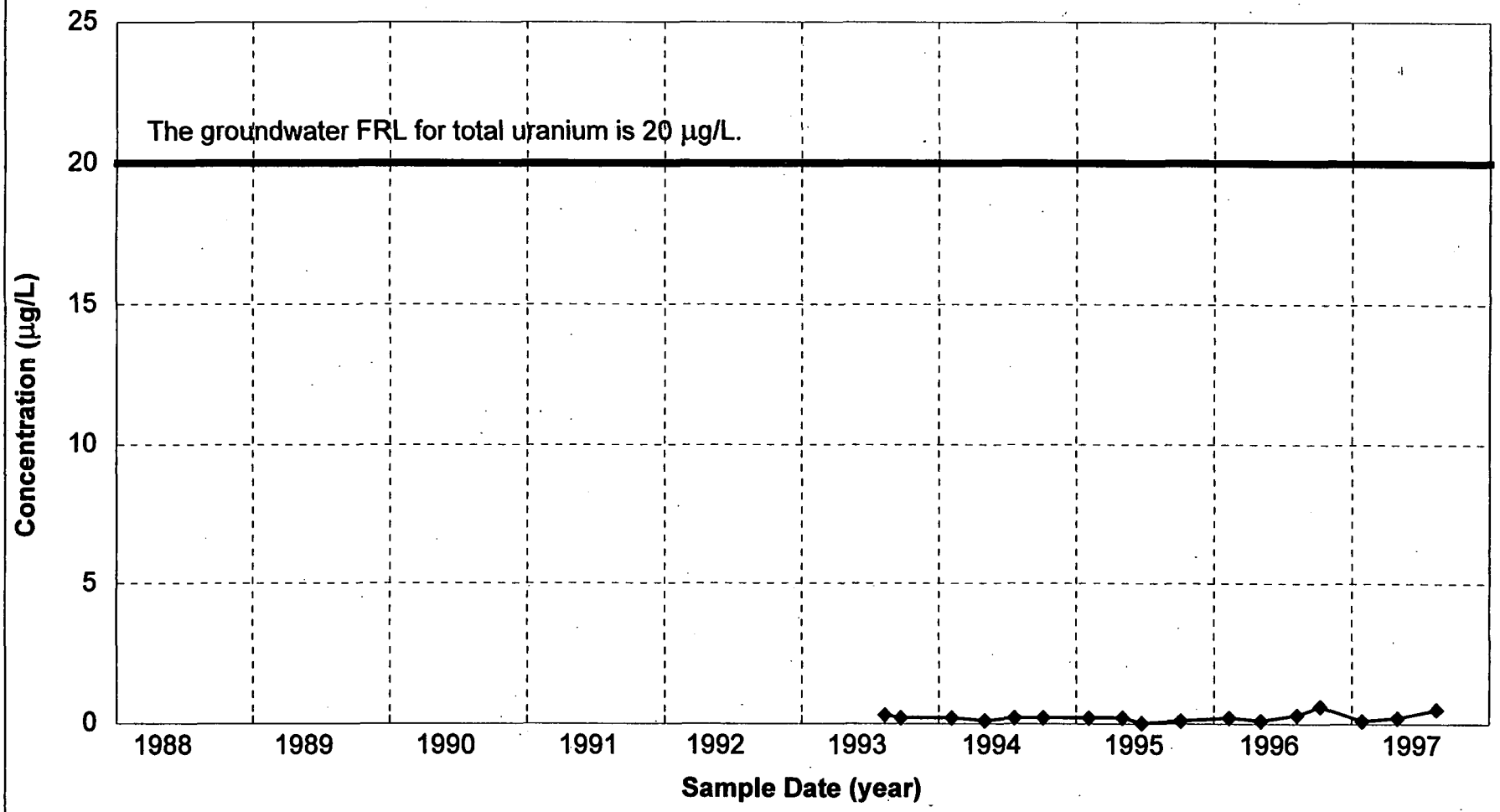


FIGURE A.2-119. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3881

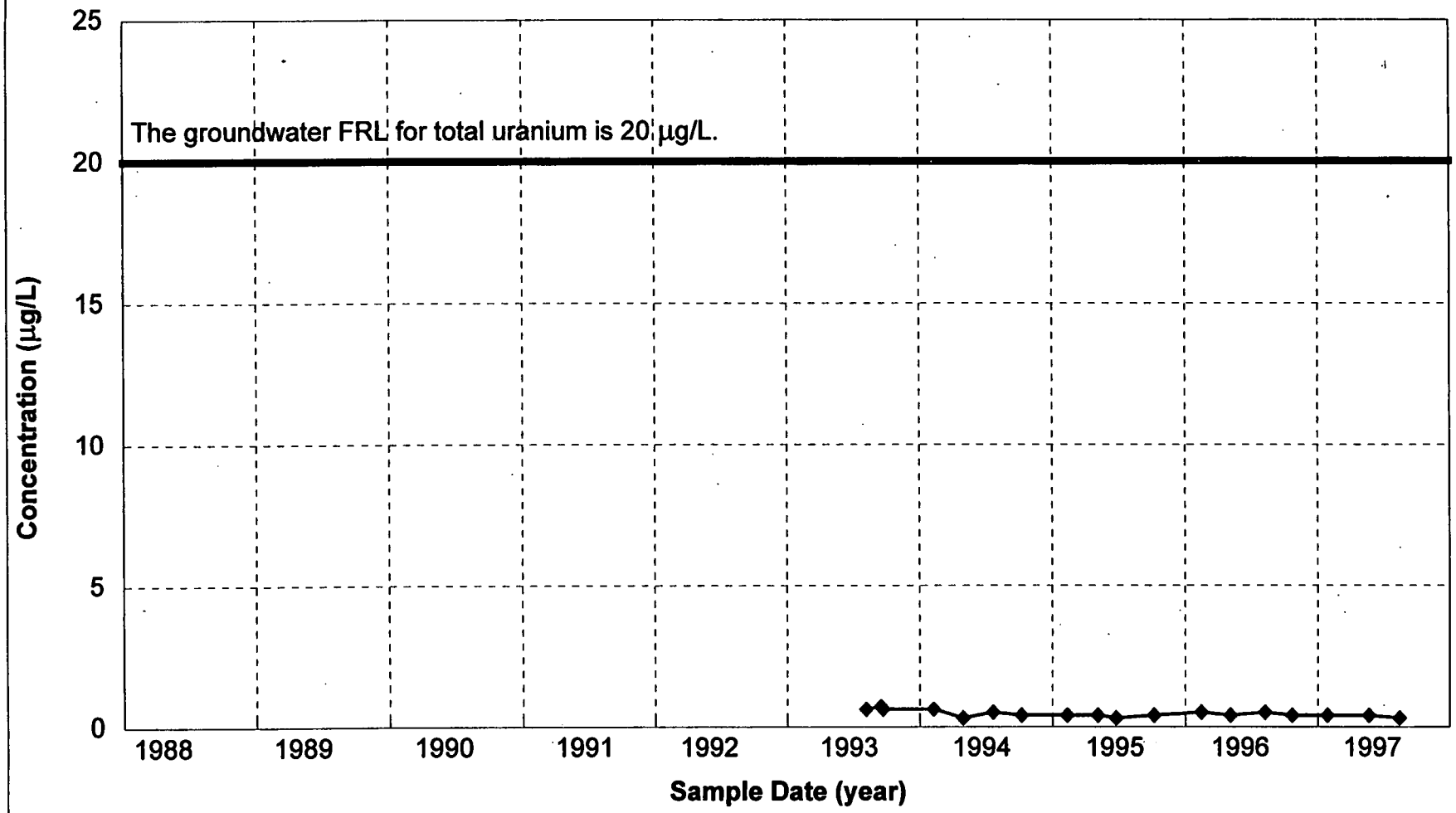


FIGURE A.2-120. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3897

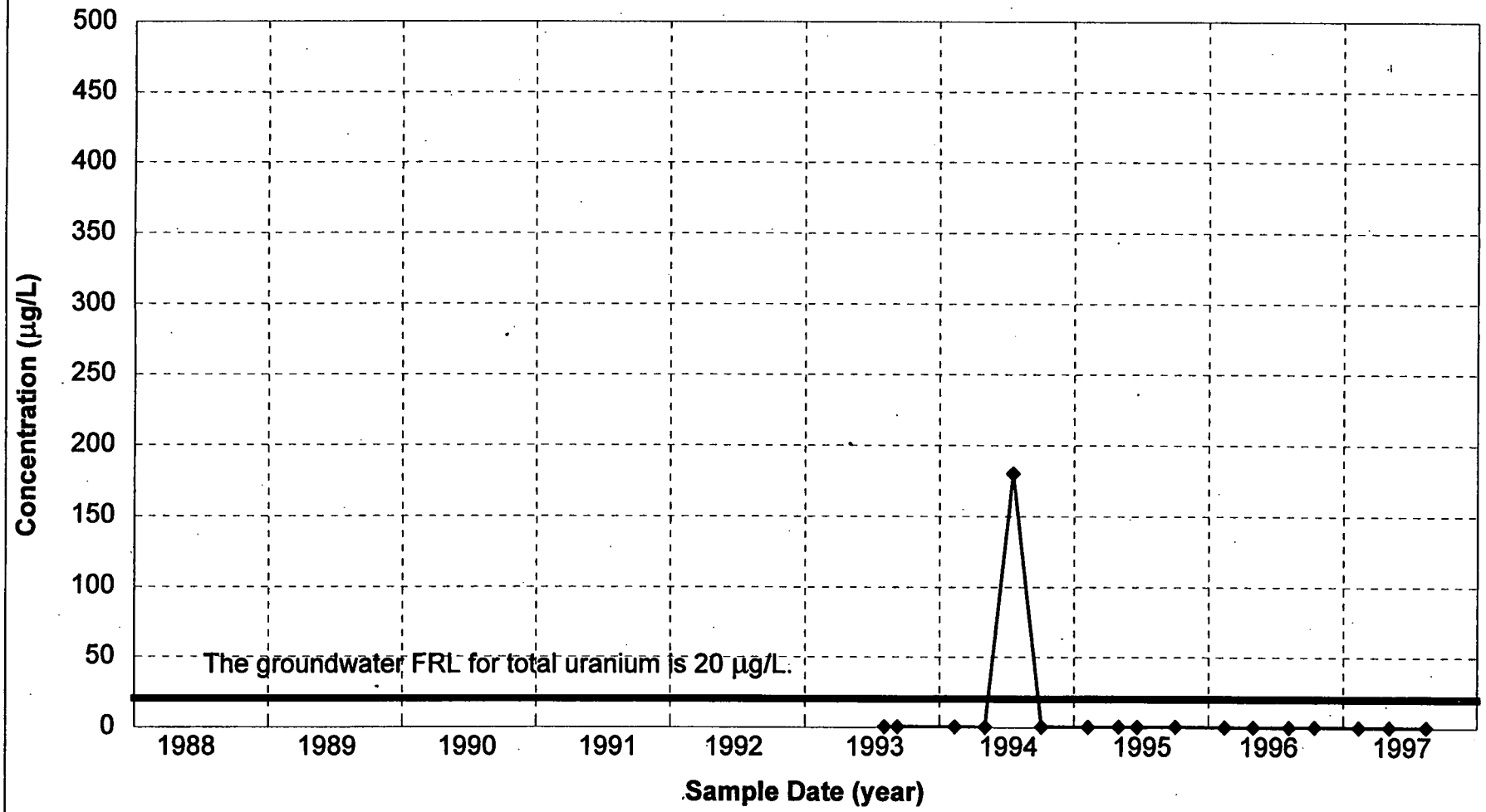


FIGURE A.2-121. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3898

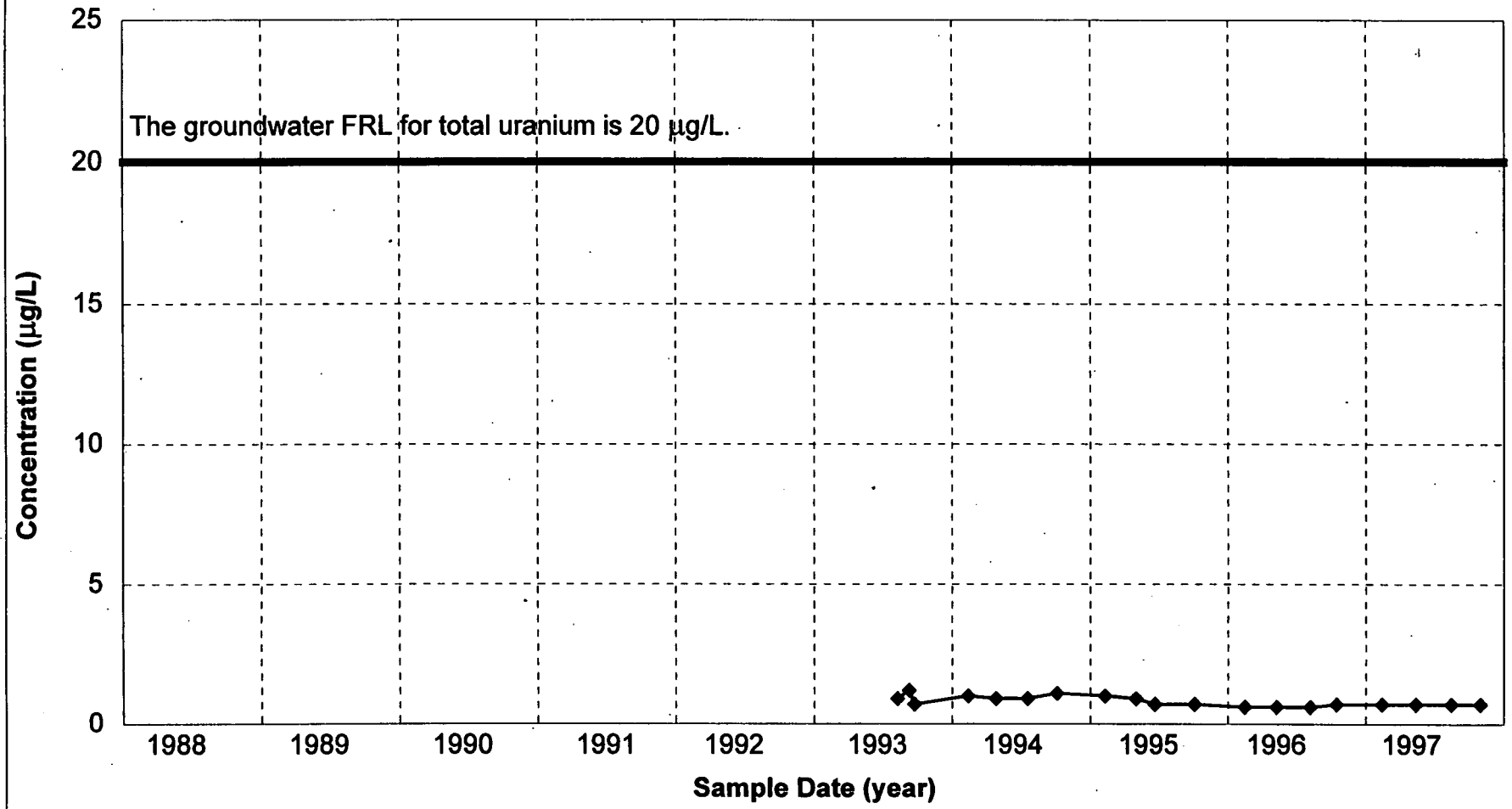


FIGURE A.2-122. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3899

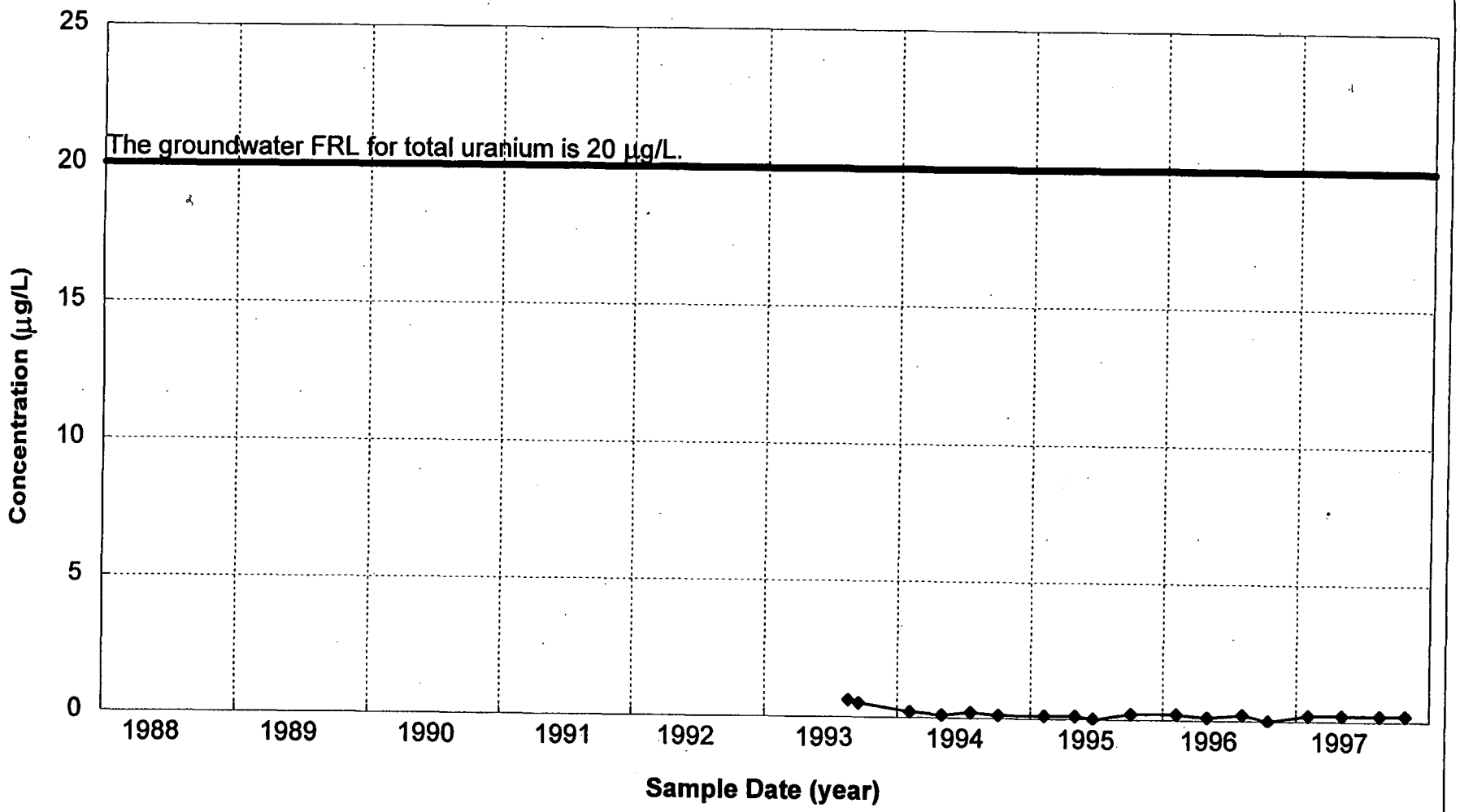


FIGURE A.2-123. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3900

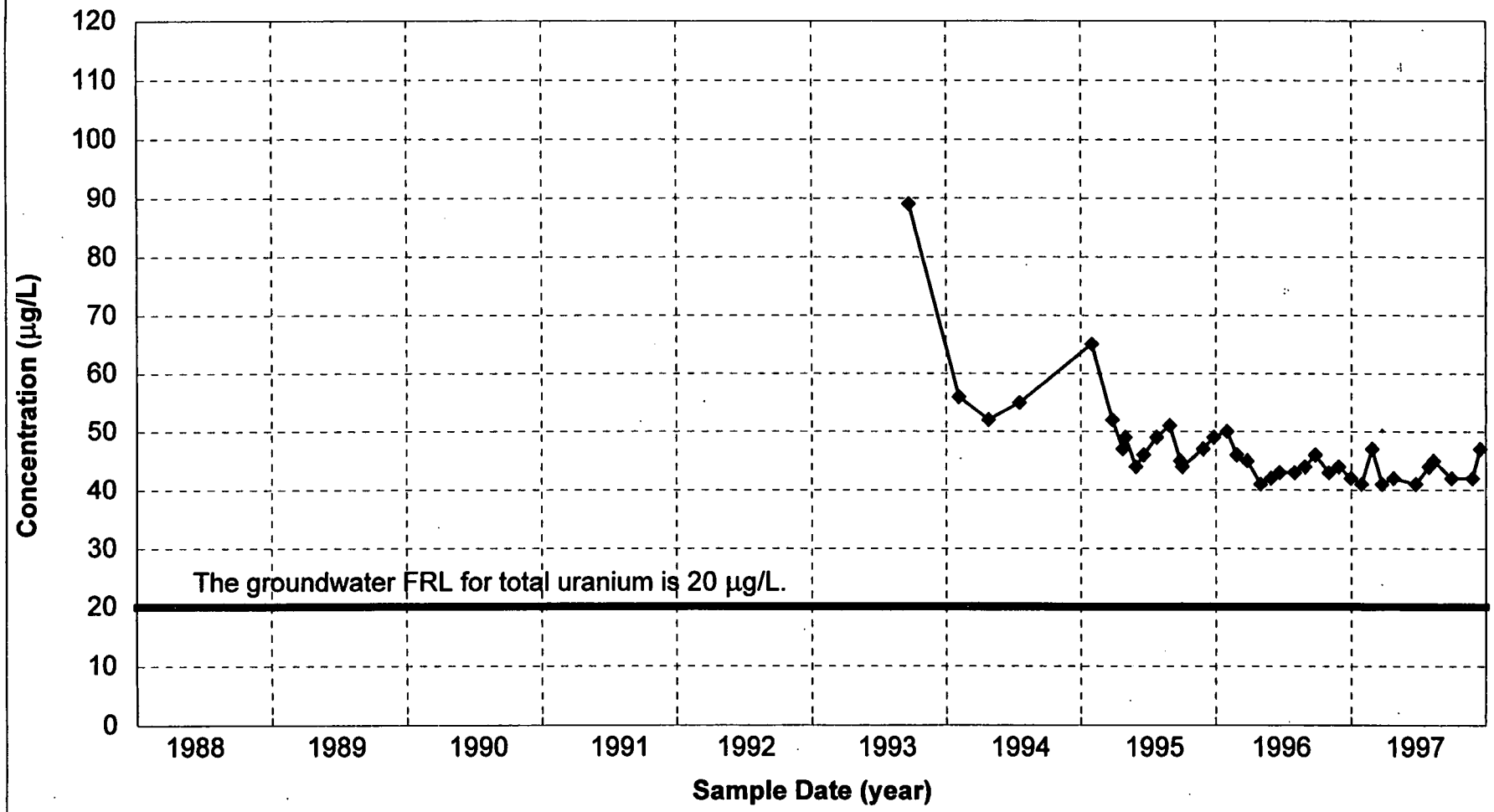


FIGURE A.2-124. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3924

000304

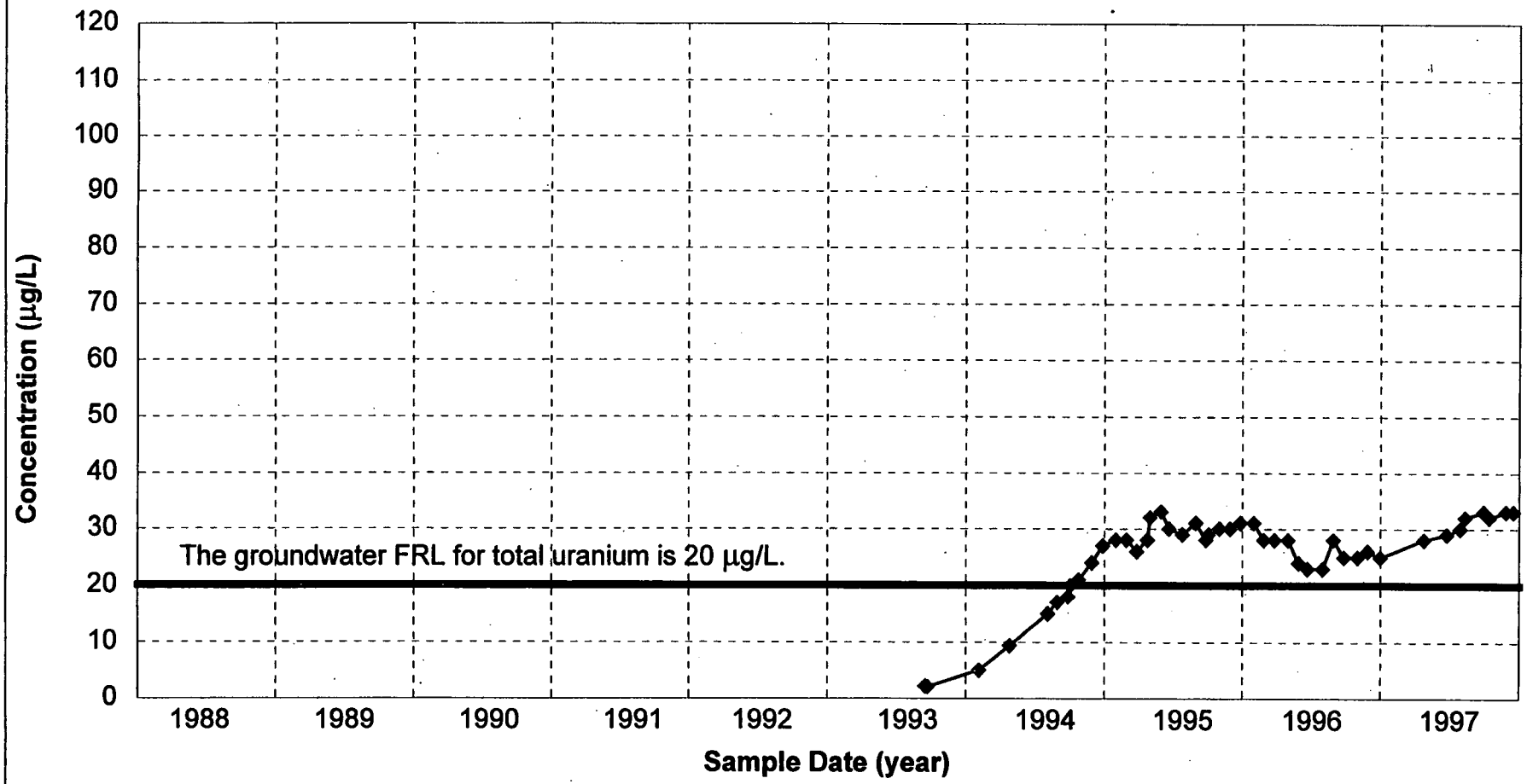


FIGURE A.2-125. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3925

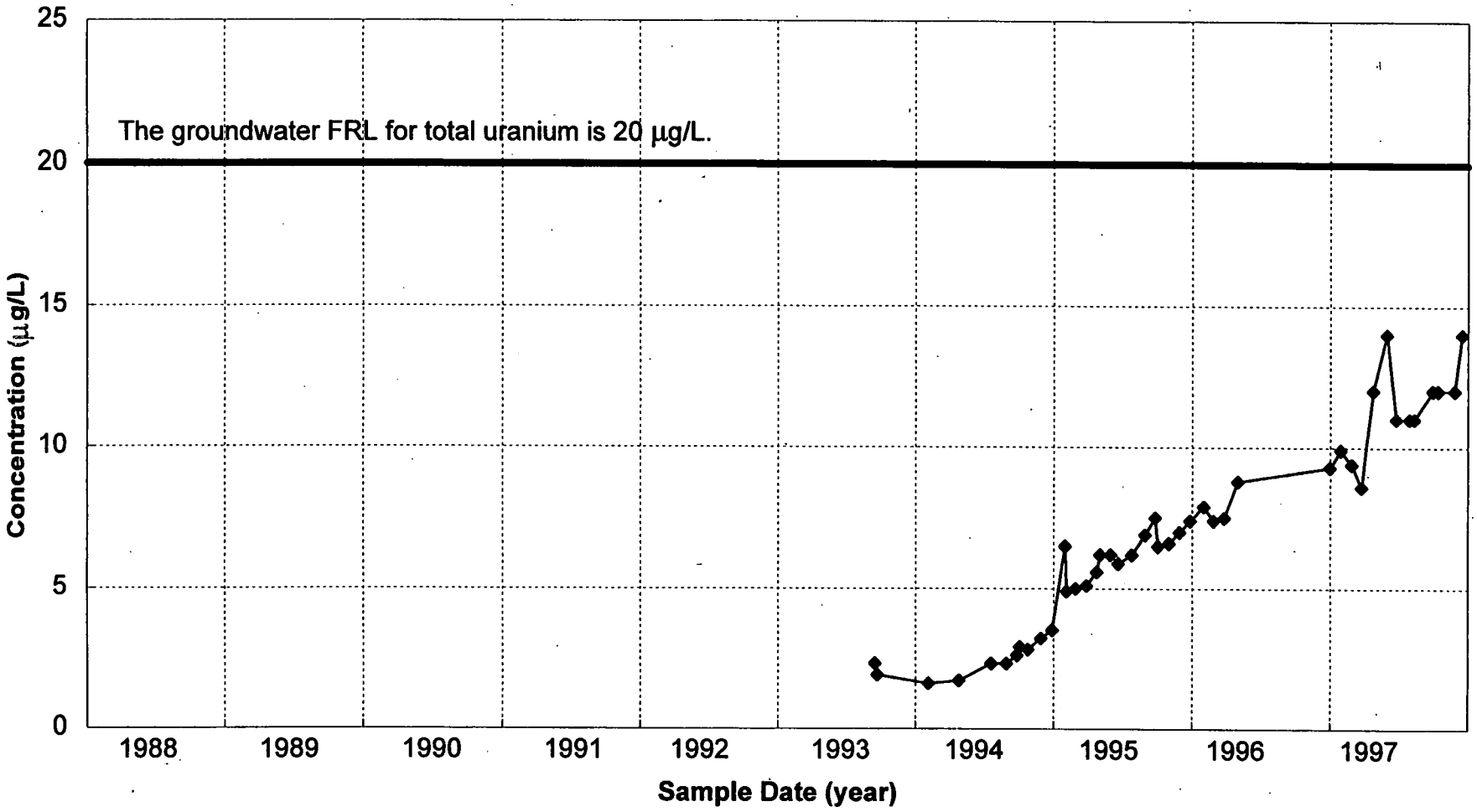


FIGURE A.2-126. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3926

000306

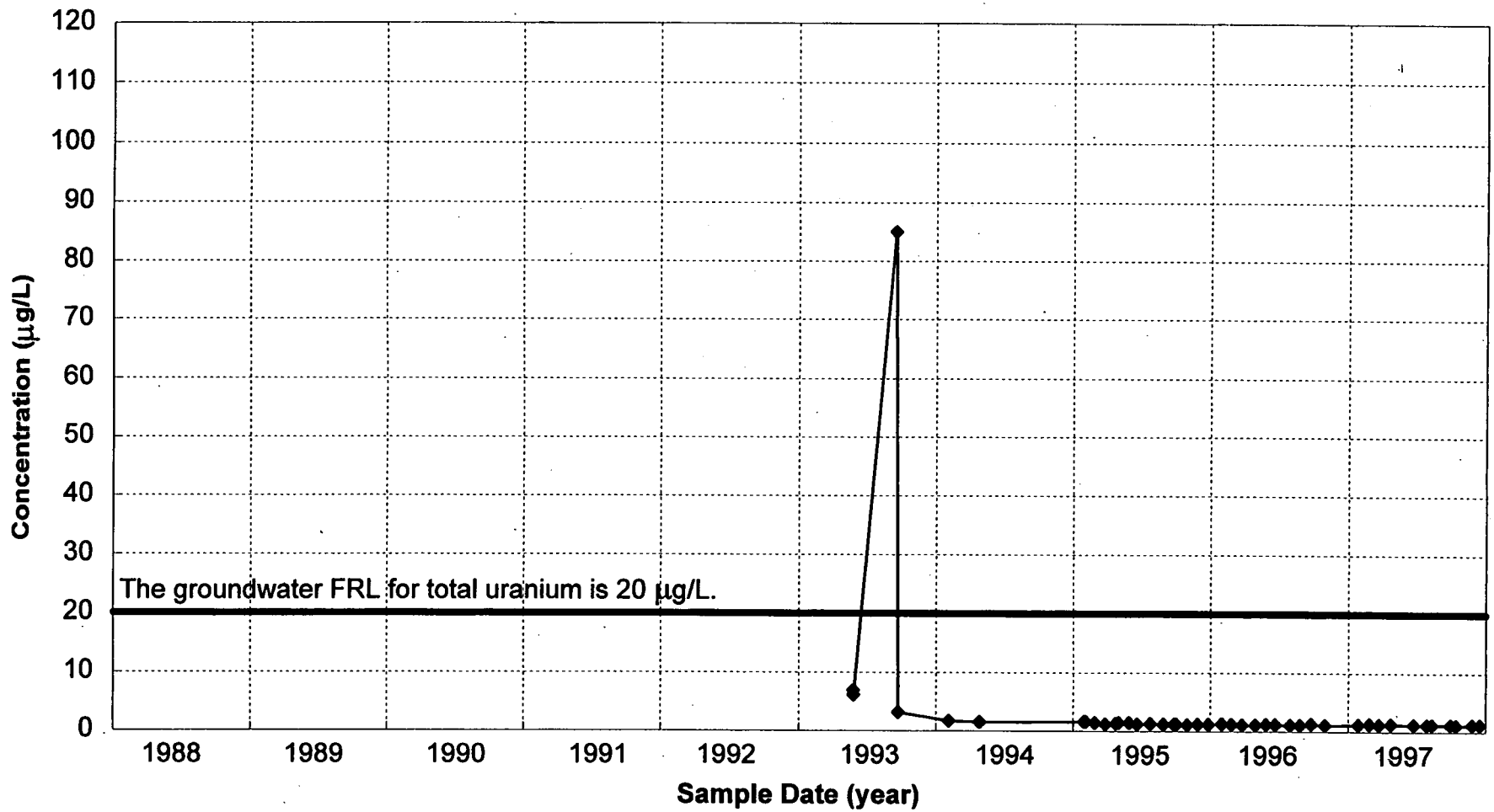


FIGURE A.2-127. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 3927

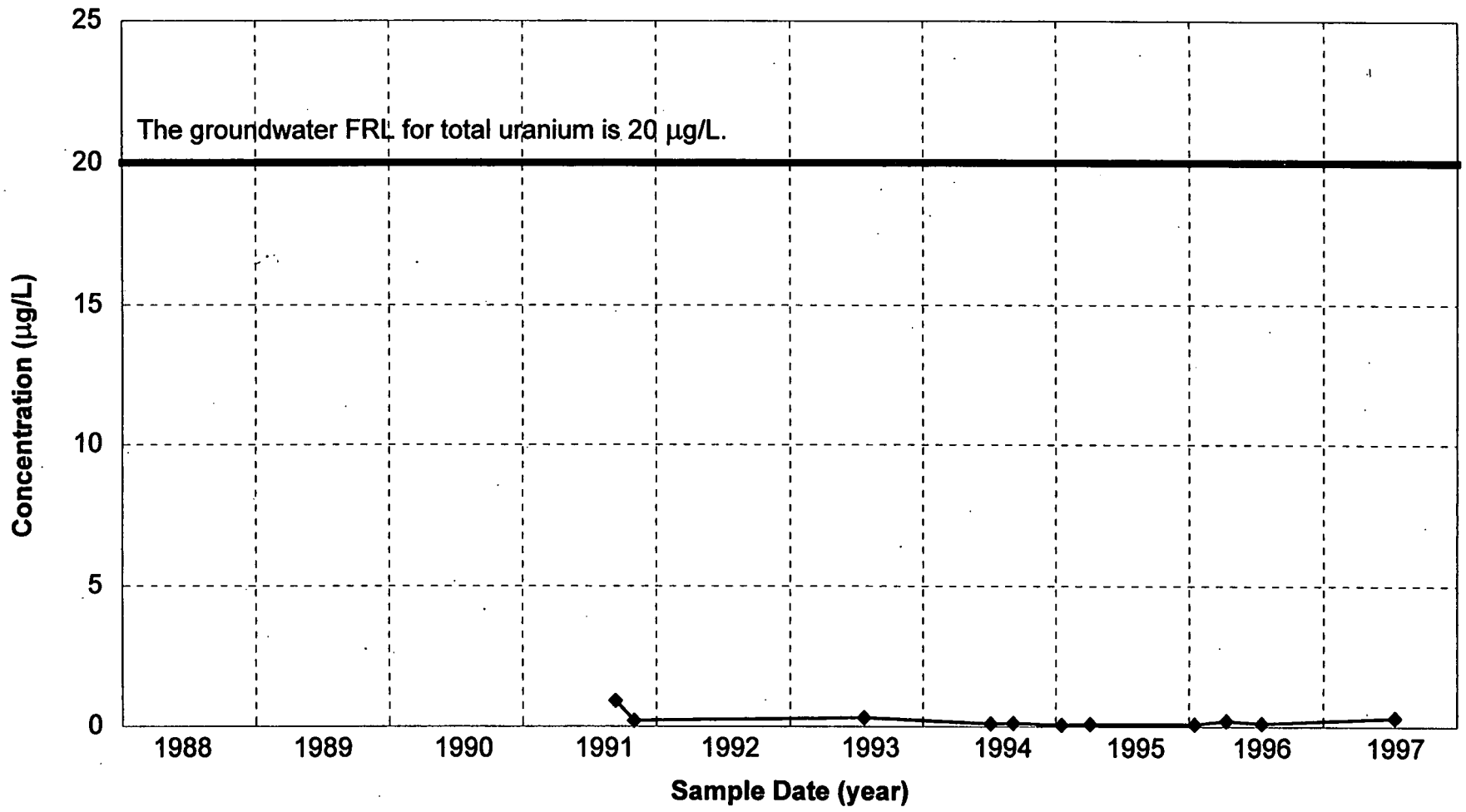


FIGURE A.2-128. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 4067

000308

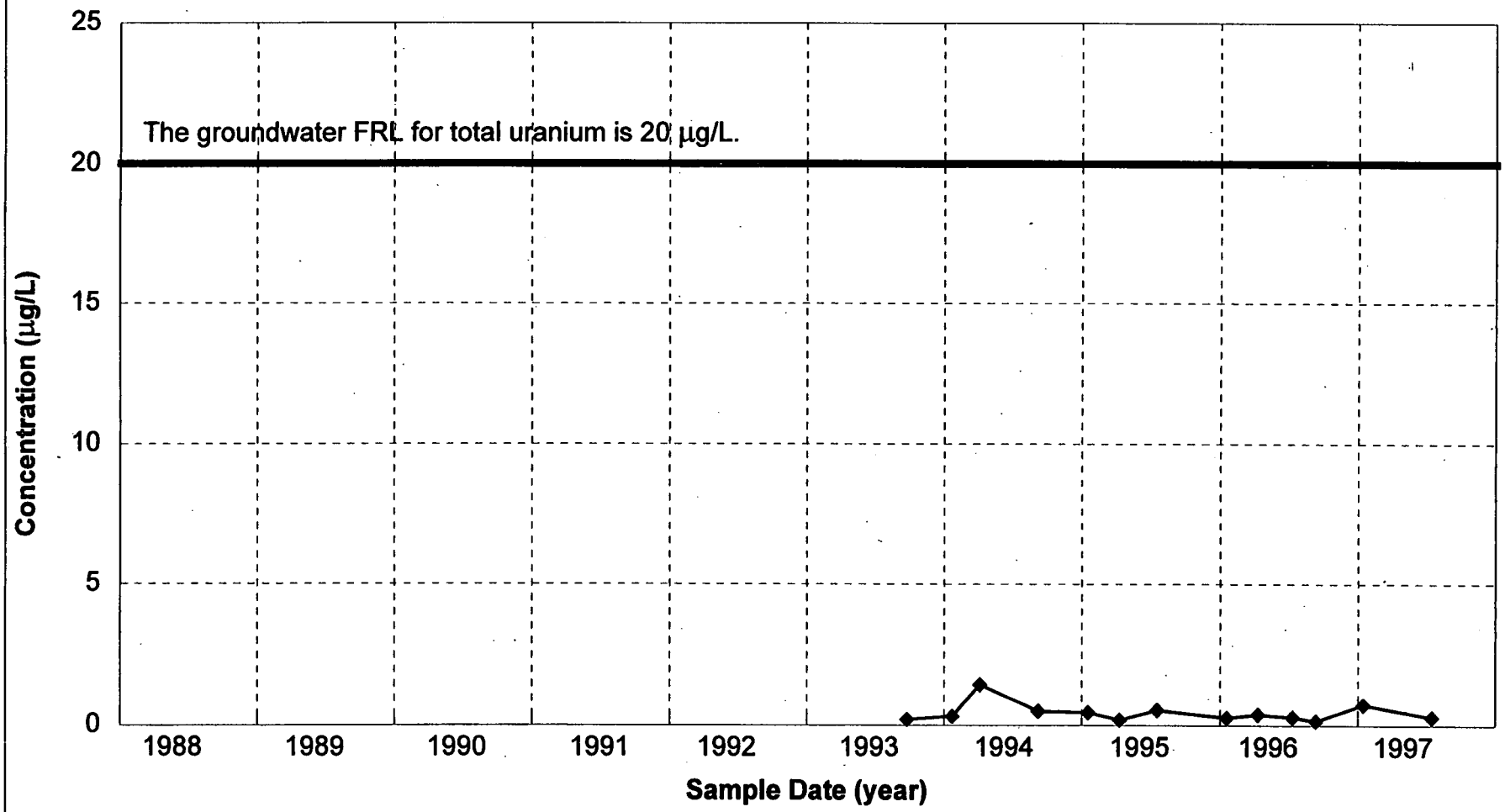


FIGURE A.2-129. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 41217

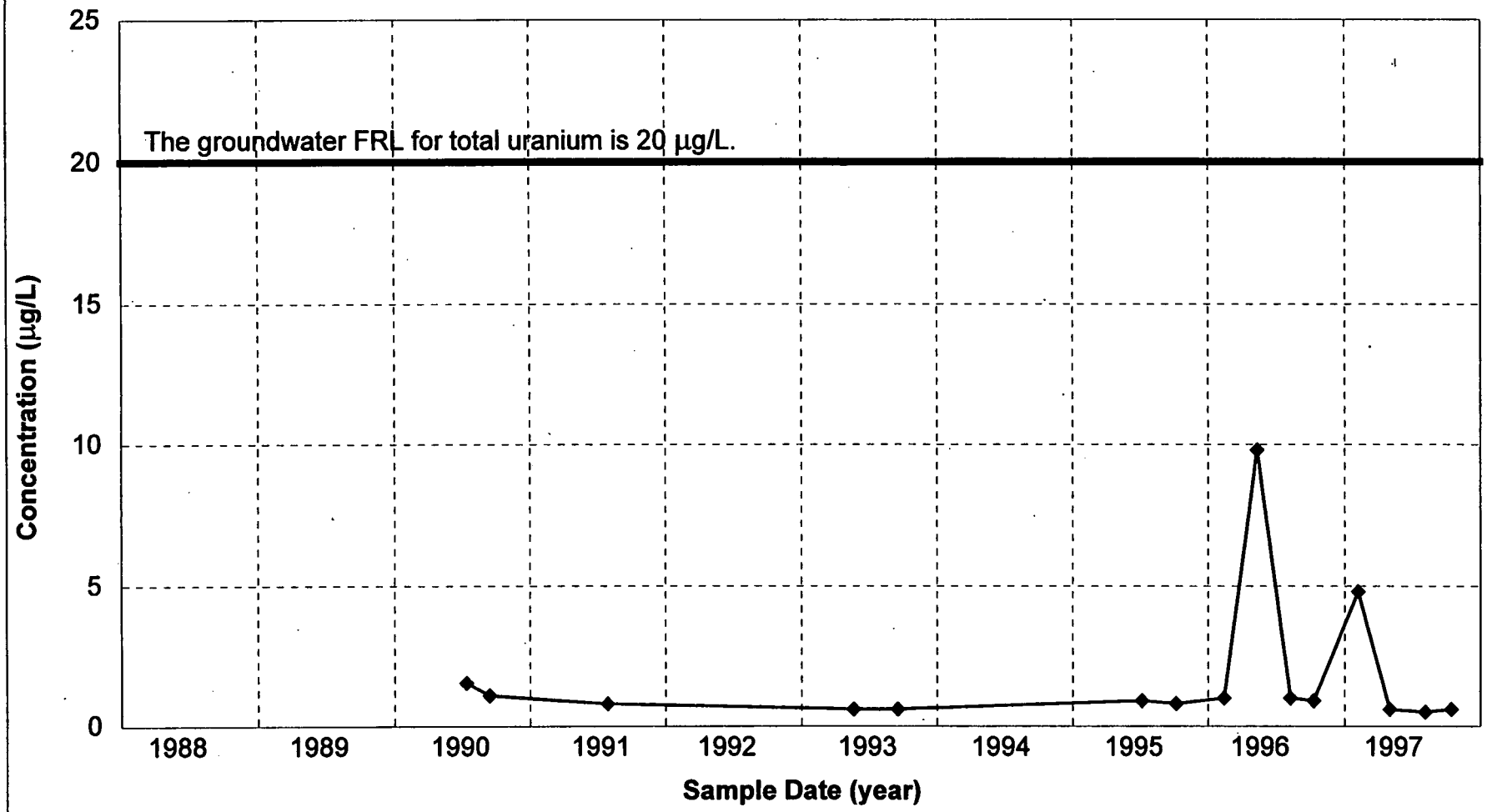


FIGURE A.2-130. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 4125

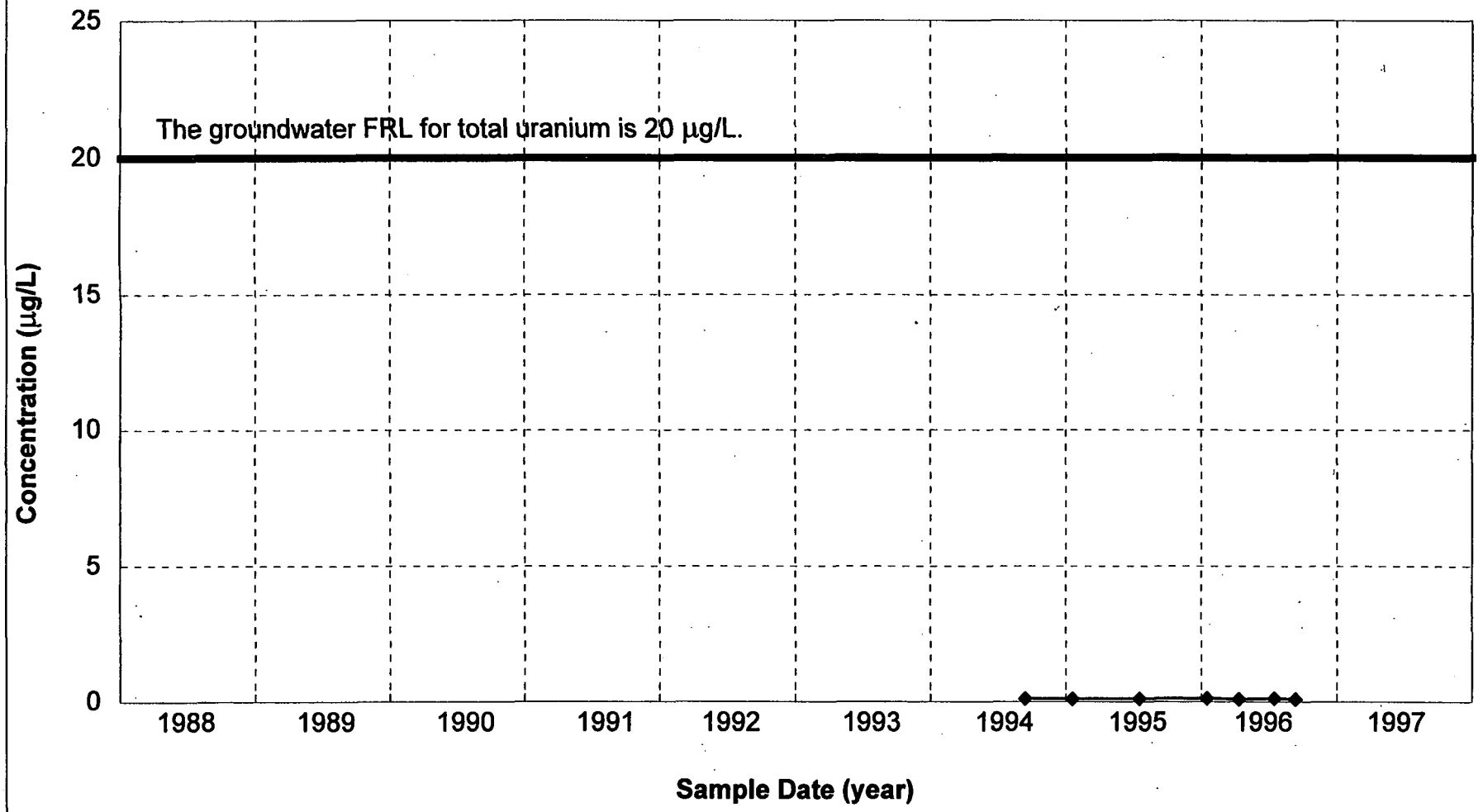


FIGURE A.2-131. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 4398

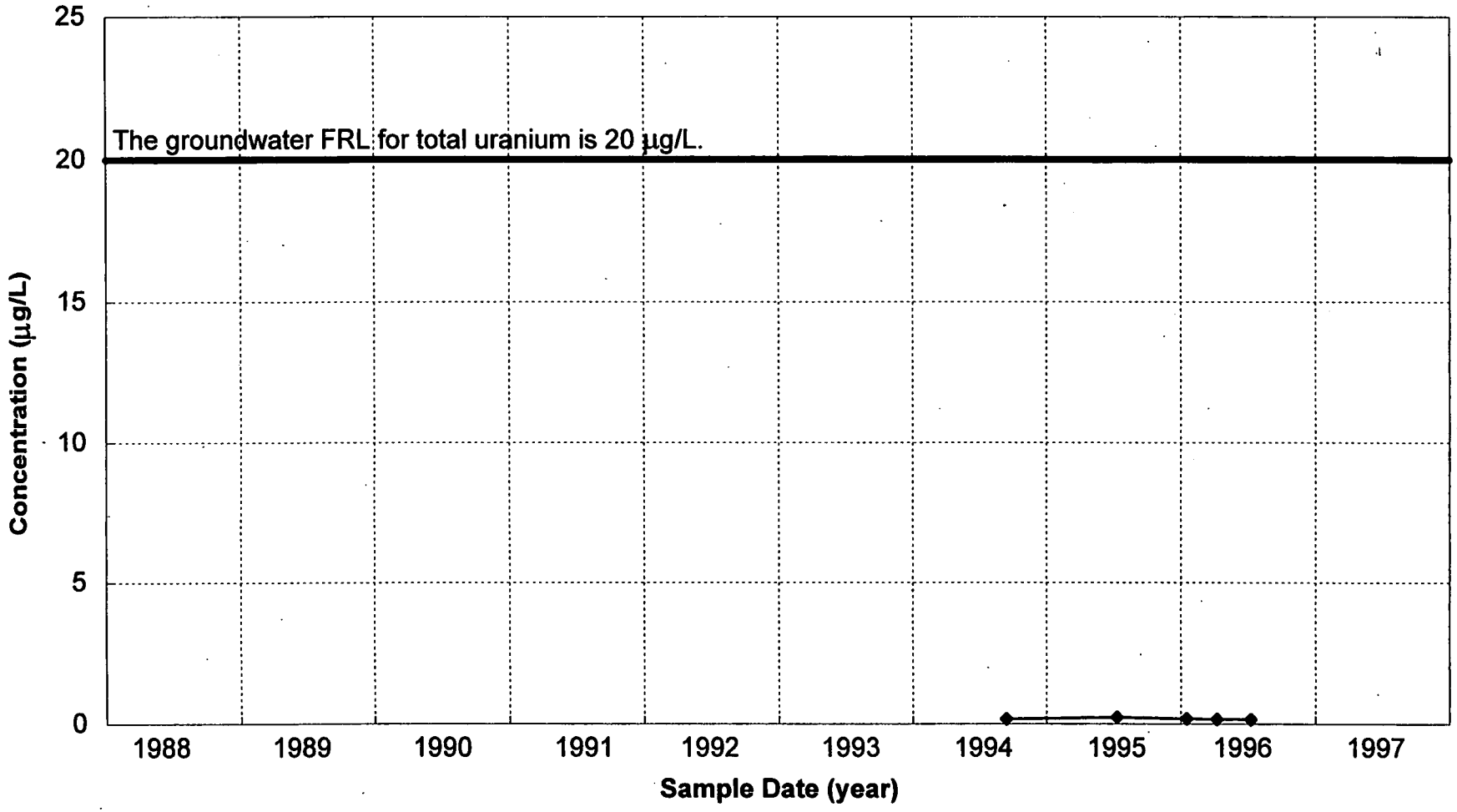


FIGURE A.2-132. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 4424

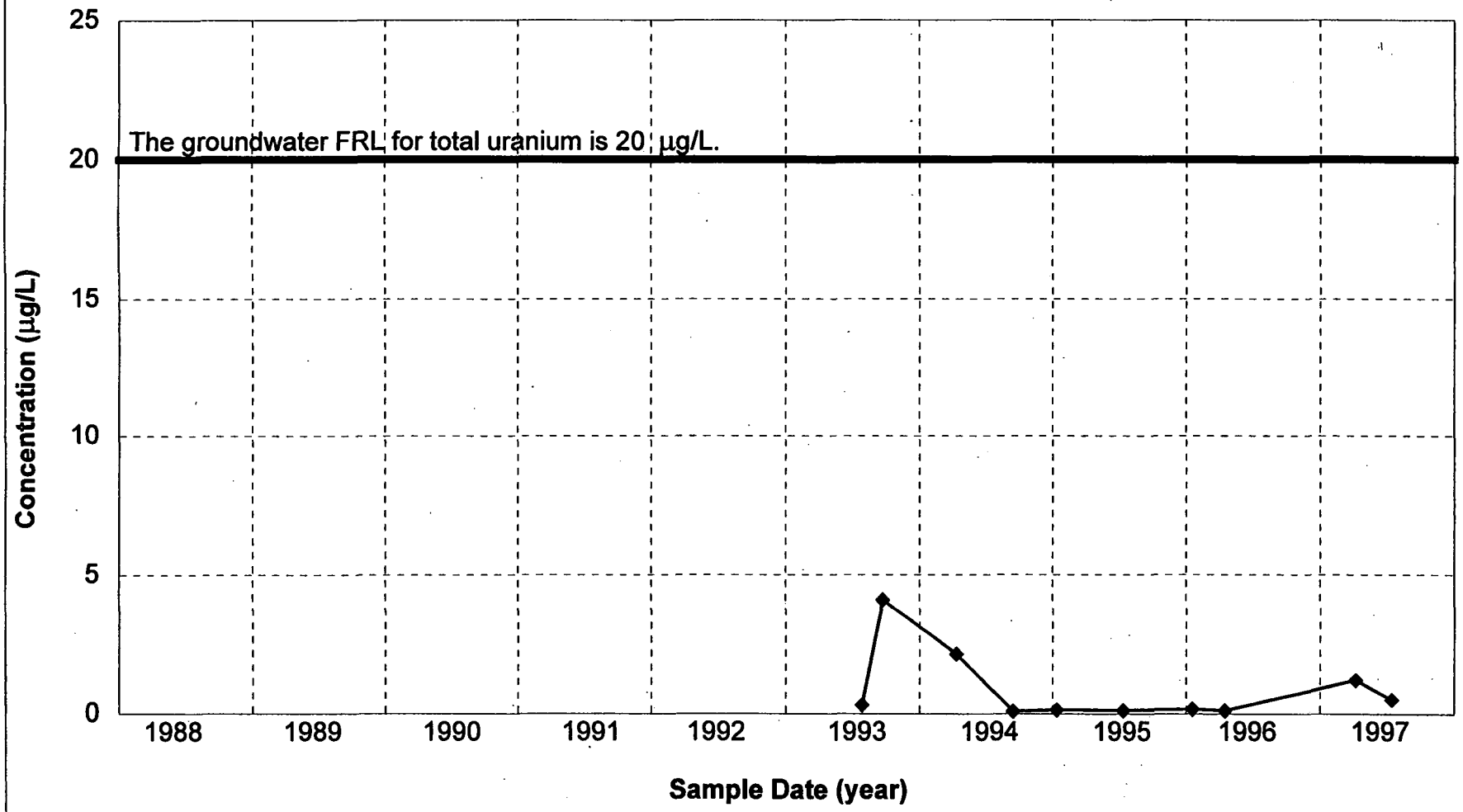


FIGURE A.2-133. TOTAL URANIUM CONCENTRATION VS.TIME PLOT FOR WELL 4426

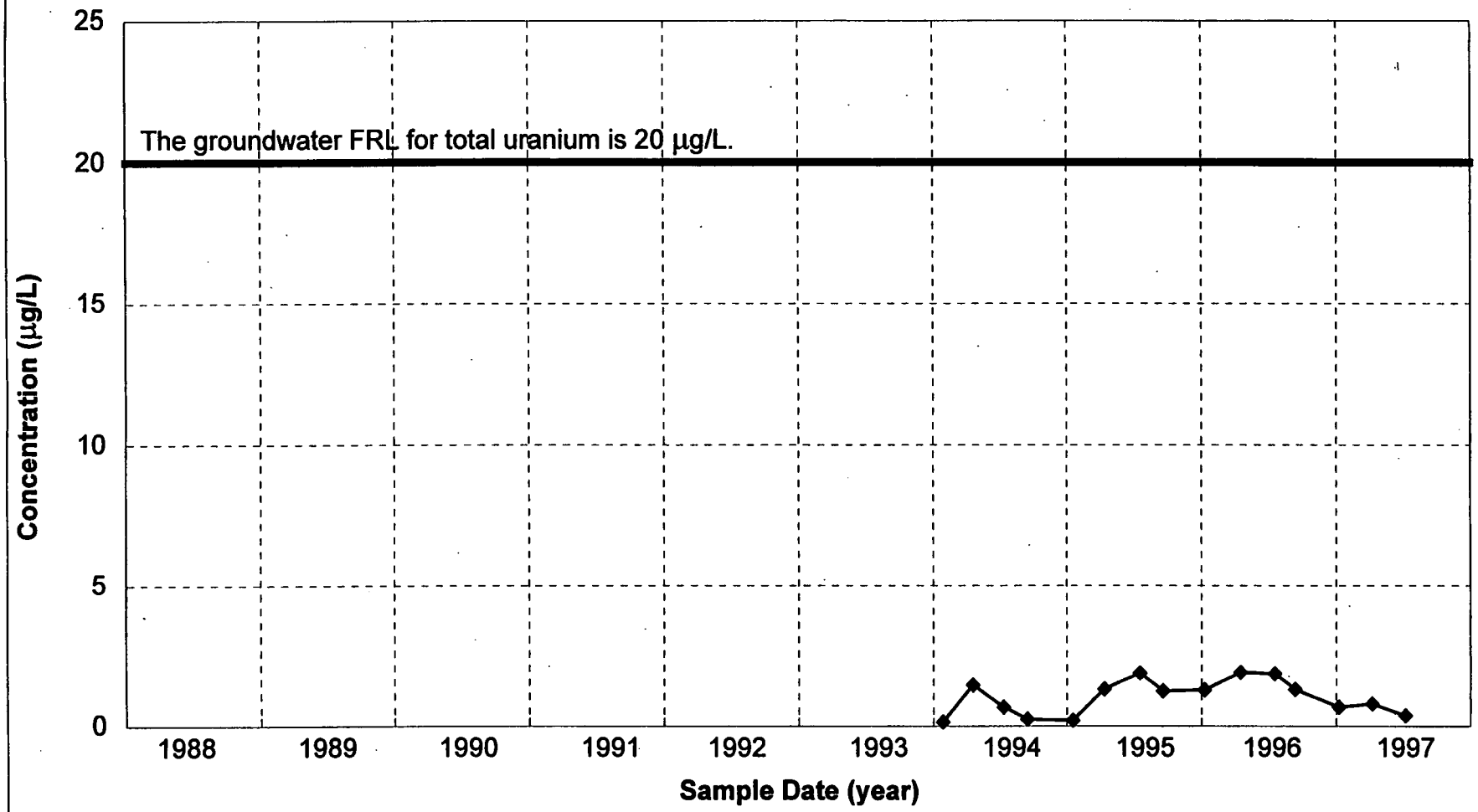


FIGURE A.2-134. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR WELL 4432

ATTACHMENT A.3

GROUNDWATER ELEVATIONS AND CAPTURE ASSESSMENT

ATTACHMENT A.3

Groundwater elevation maps are shown in Figures A.3-1 through A.3-10 for Type 2 and Type 3 groundwater monitoring wells for the four quarters of 1997 and for the first quarter of 1998. Elevation data for the first quarter of 1998 are included because this data set is representative of the water table when the South Plume Extraction System is pumping at 1,500 gpm. (Note: The set point for South Plume Extraction Well 3927 (RW-4) was increased from 400 gpm to 500 gpm on November 6, 1997, to maximize the extent of the eastern edge of the capture zone, which increased the total pumping rate for the system from 1,400 gpm to 1,500 gpm.) For additional operational details, see Attachment A.1.

Each groundwater elevation map contains an interpreted capture zone for the respective time period for the South Plume Extraction System made from the Type 2 elevation contours, then posted on both the Type 2 and Type 3 elevation maps. Also indicated on the maps are the bedrock highs and the major groundwater flow divide which separates groundwater exiting the New Haven Trough to the Great Miami River through the Paddys Run Outlet from groundwater exiting the New Haven Trough to the Great Miami River through the New Baltimore Outlet.

Detailed maps of the 10 groundwater elevation maps shown in Figures A.3-1 through A.3-10 in the area around the South Plume Extraction System are shown in Figures A.3-11 through A.3-20.

Hydrographs for the wells around the South Plume Extraction System are provided in Figures A.3-21 through A.3-30 to assess vertical groundwater gradients. For this reason, groundwater elevations from Type 2 and Type 3 wells at the same cluster were plotted on the same graph. The well clusters are identified by the last three digits of the monitoring wells (e.g., cluster 552 consists of Monitoring Wells 2552 and 3552). For well cluster locations, refer to Figure A.1-1.

Analysis of the Type 2 and Type 3 elevation data on these graphs indicate that they fall into three categories with respect to the slight vertical gradients indicated:

- The most prominent vertical gradients are evident at monitoring well clusters 624, 396, and 552 (Figures A.3-21, A.3-22, and A.3-23, respectively). These well clusters are along Paddys Run and show temporary vertical gradients (up to one foot difference) at various times which are interpreted to be due to infiltration events from Paddys Run.

Monitoring well cluster 125 (Figure A.3-24) is also along Paddys Run, but appears to show less effect from infiltration than the other well clusters in the vicinity of Paddys Run.

- Monitoring well clusters 881 and 897 (Figures A.3-25 and A.3-26, respectively), which are north of the South Plume Extraction System, appear to show slight differences in elevation measurements of approximately 0.1 foot which are persistent with time. Monitoring well cluster 898, which is east of the South Plume Extraction System, also shows this slight but persistent difference in elevations. In each of these three cases, the highest elevation in the cluster is at the Type 3 monitoring well. Monitoring well cluster 880, which is also north of the South Plume Extraction System, does not show this effect (Figure A.3-28).

- A slight reverse vertical gradient is observed at monitoring well cluster 899 (Figure A.3-29), which is immediately southeast of Extraction Wells 3926 (RW-3) and 3928 (RW-4). At this well cluster, the Type 2 well has slightly higher elevations when compared to the Type 3 well. The elevation difference is persistent with time and averages about 0.1 foot to 0.2 foot. However, monitoring well cluster 900 (Figure A.3-30) is south of Extraction Wells 3924 (RW-1) and 3925 (RW-2) and does not show this effect. In fact, Type 2 and Type 3 elevations at this well cluster are almost identical.

The cause for these slight and persistent differences in elevation measurements between Type 2 and Type 3 wells is unknown, but because they are minimal, they are not expected to affect the capture and containment of the total uranium plume.

The colloidal borescope was used in monitoring wells around the South Plume Extraction System during 1997 to provide additional data on the location of the capture zone. Quarterly data were collected and are being presented consistent with implementation of the IEMP reporting schedule. These data are presented in Table A.3-1 and in three period-specific sets of figures from Figures A.3-31 through A.3-60. Each set of figures consists of a map and graphs showing the average groundwater flow direction for each well after statistical filtering. The uncertainty after filtering, plus or minus one standard deviation, is indicated on the map by a fan-shaped wedge at each well location. Each flow direction map is followed by graphs of flow direction versus time for those wells that were borescoped:

- Figures A.3-31 through A.3-39 represent data from the first half of 1997 and are consistent with data presented in the September 1997 South Plume Removal Action DMEPP System Evaluation Report.

- Figures A.3-40 through A.3-48 represent third quarter 1997 data. Flow directions are generally similar to those observed during the first half of 1997.

- Figures A.3-49 through A.3-60 represent fourth quarter 1997 data. The observed flow directions during the fourth quarter were generally similar to those observed during the first half of 1997 and during the third quarter of 1997. The most notable difference was in the observed flow directions in Monitoring Well 3899 which shifted from northwest toward the South Plume Extraction System in the first half of 1997 and in the third quarter of 1997 to southwest and away from the South Plume Extraction System in the fourth quarter of 1997.

The borescope flow directions were not always consistent with flow directions interpreted from groundwater elevation data because the borescope monitors local flow regimes within the aquifer, while groundwater elevation data tend to give results which are more regional in nature. Generally, however, the borescope data were consistent with the capture zones interpreted from groundwater elevation data with the following exceptions:

- Monitoring Well 3552 appeared to be within the capture zone during all of 1997 based on the borescope flow directions to the north as shown in Figures A.3-31, A.3-40, and A.3-49. However, the capture zone interpreted from groundwater elevation data from the first three quarters of 1997 suggests the well was outside the capture zone. The capture zone interpreted from fourth quarter 1997 groundwater elevation data was consistent with the borescope results for this well. The differences were attributed to variation in scale between flow directions interpreted from elevation data, and flow directions observed with the borescope.

- Monitoring Well 2552 on the extreme western edge of the capture zone appeared to be outside the capture zone during the first half of 1997 based on the southeasterly flow direction indicated on Figure A.3-31. Capture at this location during the third and fourth quarters was uncertain because flow directions indicated on Figures A.3-40 and A.3-49 were almost due east and could have turned north toward the extraction system or south to the Paddys Run Outlet. The capture zone at this well location is believed to have varied during the year as infiltration from Paddys Run changed. Increased infiltration during the months with higher than normal precipitation provided water to the extraction system which decreased the areal extent of capture. In times when Paddys Run was not flowing, the capture zone may have expanded and possibly included Monitoring Well 2552.

Borescope measurements were taken in the area of the northeastern lobe of the total uranium plume during the fourth quarter of 1997 at Monitoring Wells 22111, 21063, and 2093 to determine

groundwater flow directions in this area and to determine which wells were within the capture zone of the South Plume Extraction System. Since the borescope had not been used in these wells before the fourth quarter, they do not appear on the borescope maps from earlier quarters.

Figures A.3-61 through A.3-63 show modeled particle tracks for South Plume Removal Action System pumping rates of 700 gpm, 1,100 gpm, and 1,500 gpm, respectively. The modeled flow directions agree with the flow directions interpreted from groundwater elevation data, except in the area of the northeast lobe of the total uranium plume. As presented in the Integrated Environmental Monitoring Status Report for Fourth Quarter 1997, groundwater elevation data indicate flow to the east and southeast in this area, while the model predicts flow to the south and southwest toward the South Plume Extraction System. This difference between observed and predicted flow directions is believed to be due to a change in the pumping rates at the Southwest Ohio Water Collector Wells 1 and 2. The model assumes a pumping configuration of 10 million gallons per day (mgpd) from Collector Well 2, which is on the north side of the Great Miami River, and eight mgpd from Collector Well 1. Refer to Figures A.3-1 through A.3-10 for collector well locations. In recent communications, Southwest Ohio Water Collector representatives indicated that Collector Well 2 was pumped at 12 mgpd and Collector Well 1 was pumped at six mgpd for nine months out of the year. During the late summer months and early fall, both collector wells were pumped at 12 mgpd each.

Preliminary model studies indicate that the predicted flow in the area of the northeastern lobe of the plume is extremely sensitive to boundary conditions along the eastern edge of the model, and therefore, also sensitive to Southwest Ohio Water Collector pumping rates. This change to Southwest Ohio Water Collector pumping rates and eastern model boundaries is being incorporated into the ongoing model upgrade project from SWIFT to VAM3D. Model predictions in this area will be re-evaluated and compared to observed groundwater flows when the model upgrade project is completed.

TABLE A.3-1

FLOW DIRECTION DATA FROM BORESCOPE OBSERVATIONS IN 1997

Monitoring Well	Date of Observation	Average Flow Direction[a,b] (degrees)	Standard Deviation[b] (degrees)
2093[c]	11/25	217.9	5.4
21063[c]	11/12	159.4	6.8
22111[c]	11/24	89.9	6.2
2552	3/13	135.1	38.9
	8/22	91.74	8.16
	11/13	96.7	18.2
3552	3/12	12.8	9.3
	8/26	350.8	64.4
	11/13	351.9	25.1
2898	2/24	103.5	10.4
	8/26	91.72	12.26
	10/06	100.3	9.8
3898	2/19	198.1	23.1
	8/26	235.6	18.1
	11/05	212.7	12.7
2899	5/27	144.9	10.6
	8/27	111.9	12.5
	11/17	134.5	11.2
3899	5/22	279.5	7.5
	8/27	279.9	11.2
	11/05	227.3	12.3
2900	3/12	358.6	27.5
	8/25	352.0	15.9
	10/08	310.1	5.9
3900	5/28	221.0	16.1
	8/25	225.8	25.2
	11/07	283.0	70.5

[a]Average flow direction is measured clockwise in degrees from magnetic north.
[b]Values are calculated after statistical filtering to remove outliers.
[c]These wells were not monitored with the borescope until the fourth quarter of 1997.

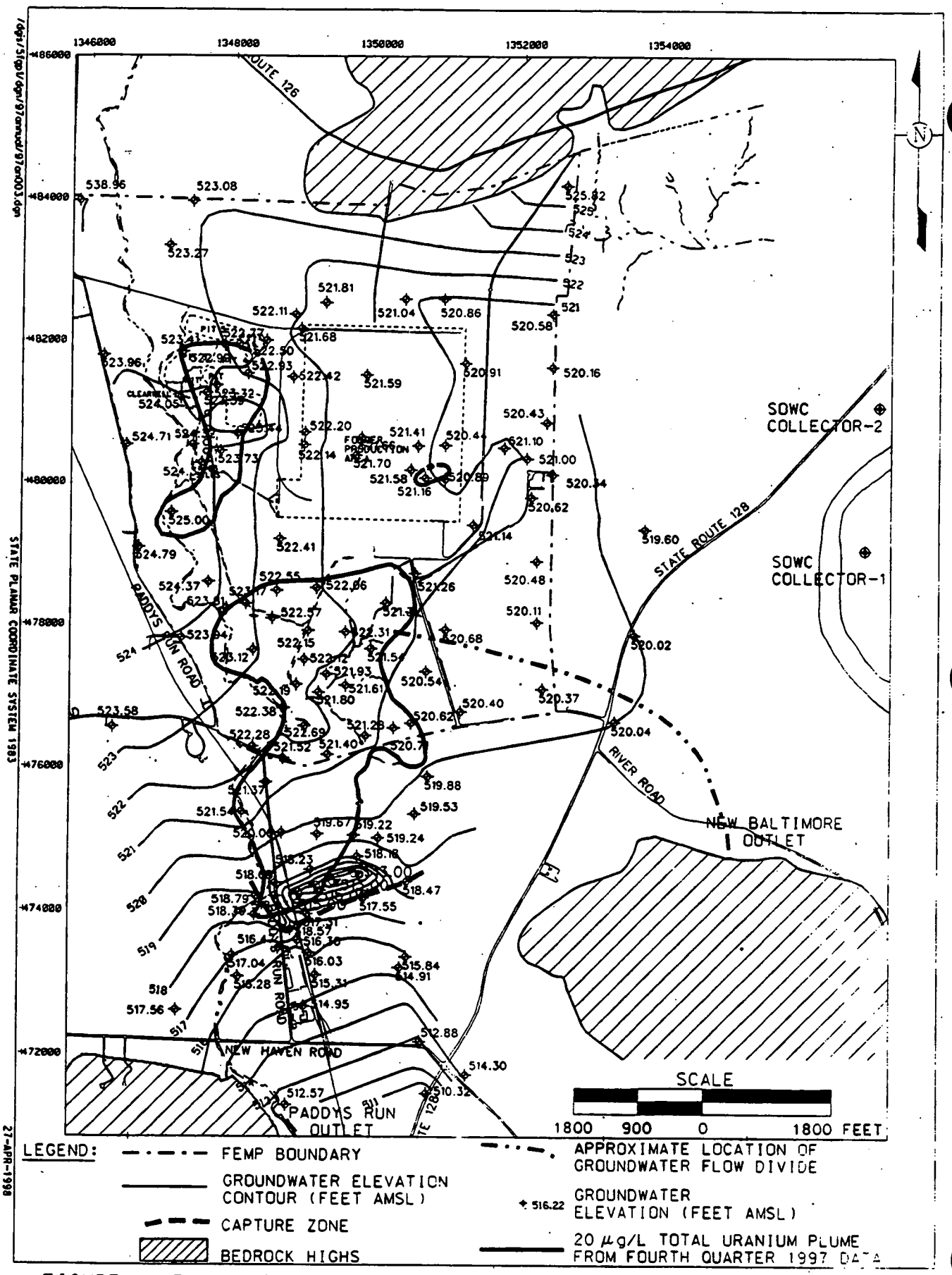


FIGURE A.3-1. GROUNDWATER ELEVATIONS, TYPE 2 WELLS, JANUARY 1997

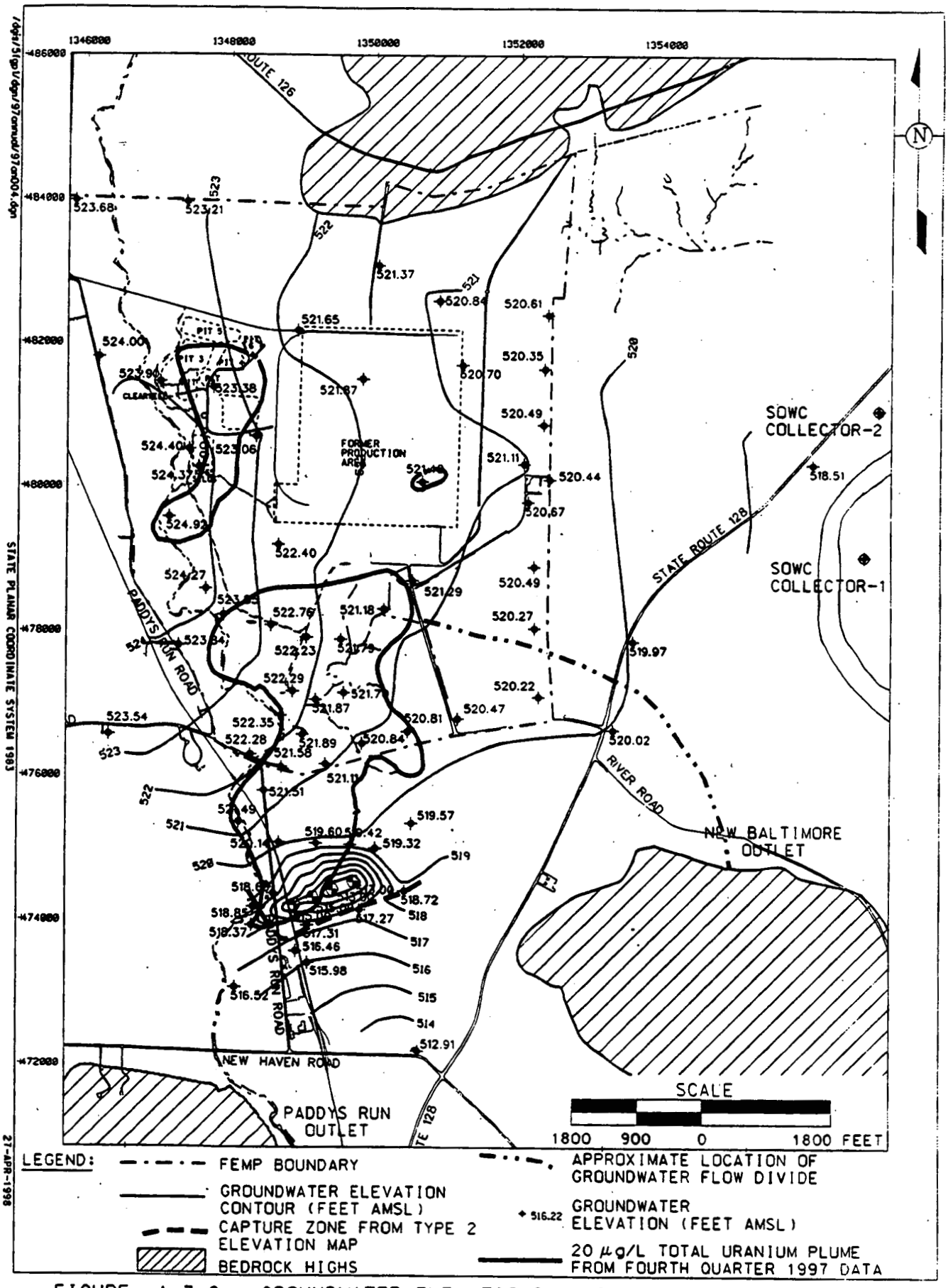


FIGURE A.3-2. GROUNDWATER ELEVATIONS, TYPE 3 WELLS, JANUARY 1997

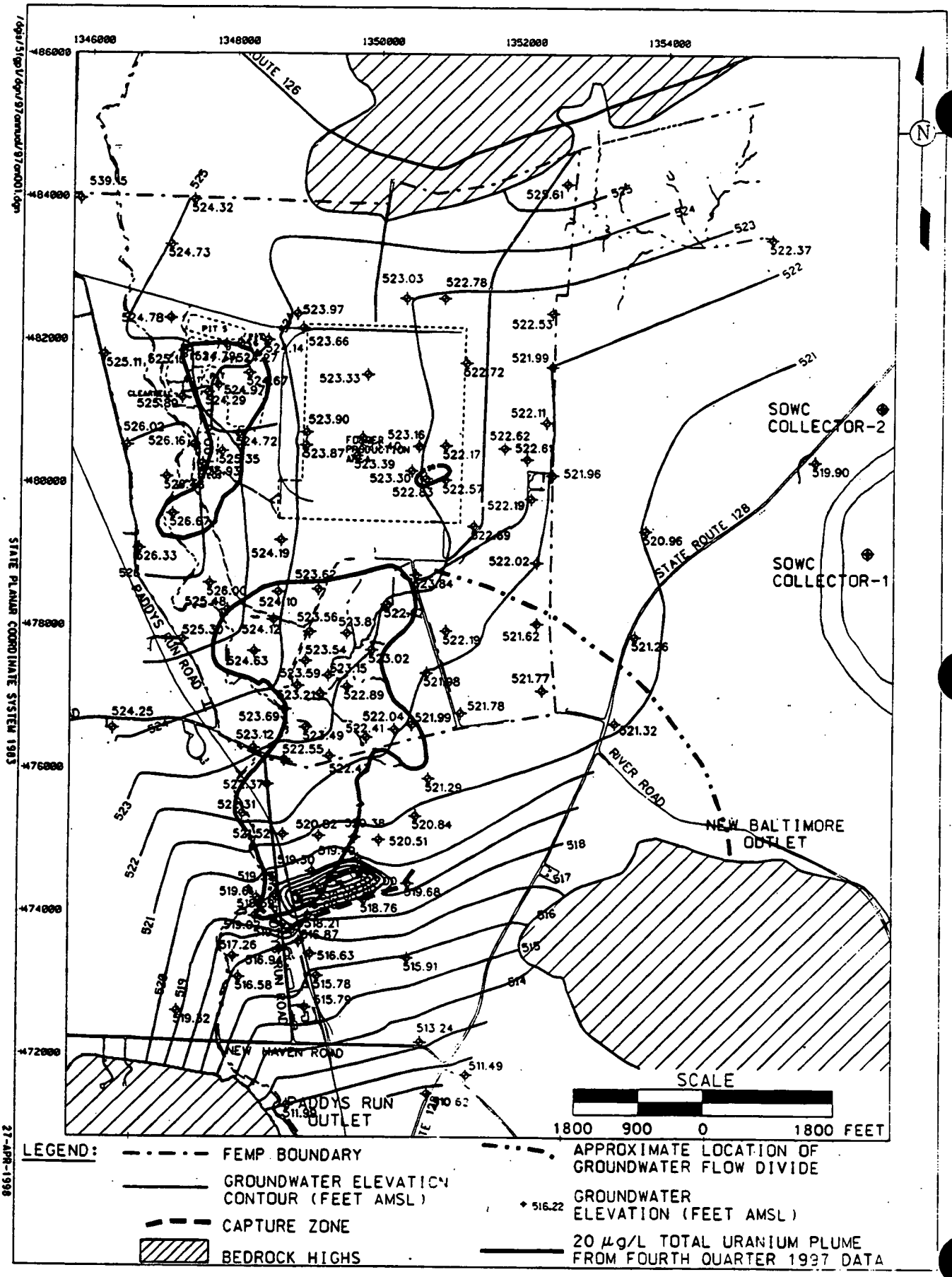


FIGURE A.3-3. GROUNDWATER ELEVATIONS, TYPE 2 WELLS, APRIL 1997

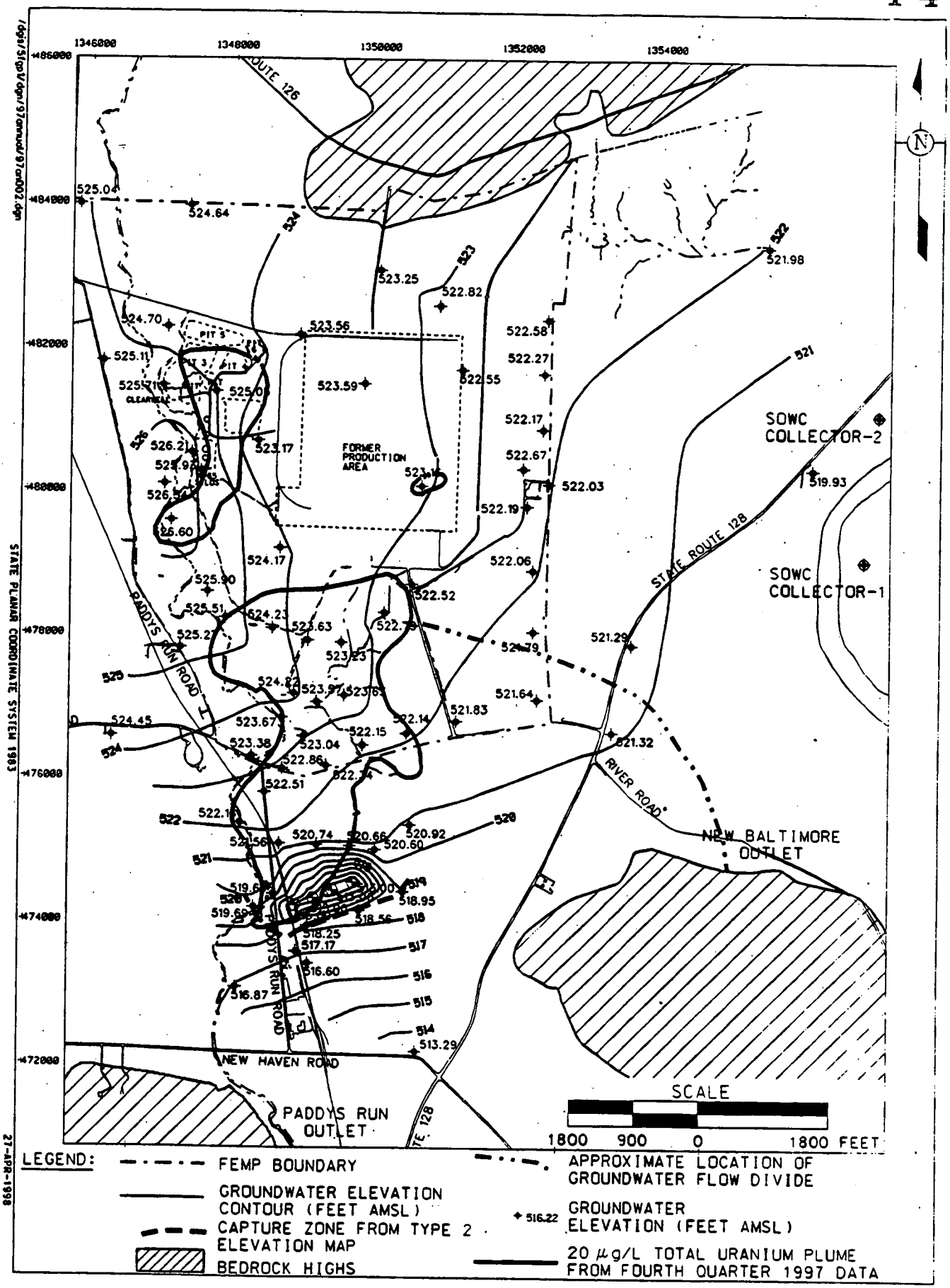


FIGURE A.3-4. GROUNDWATER ELEVATIONS, TYPE 3 WELLS, APRIL 1997

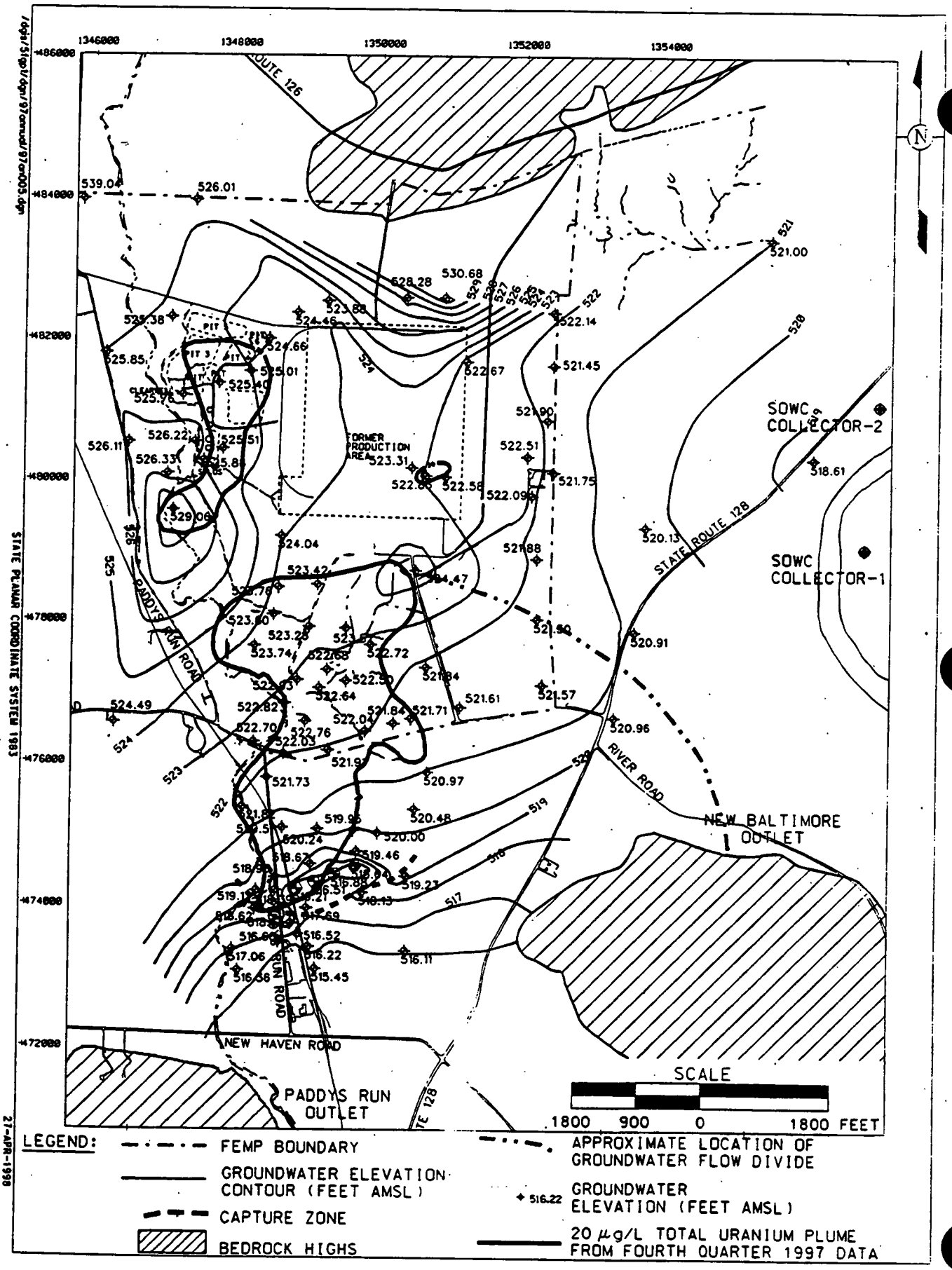


FIGURE A.3-5. GROUNDWATER ELEVATIONS, TYPE 2 WELLS, JULY 1997

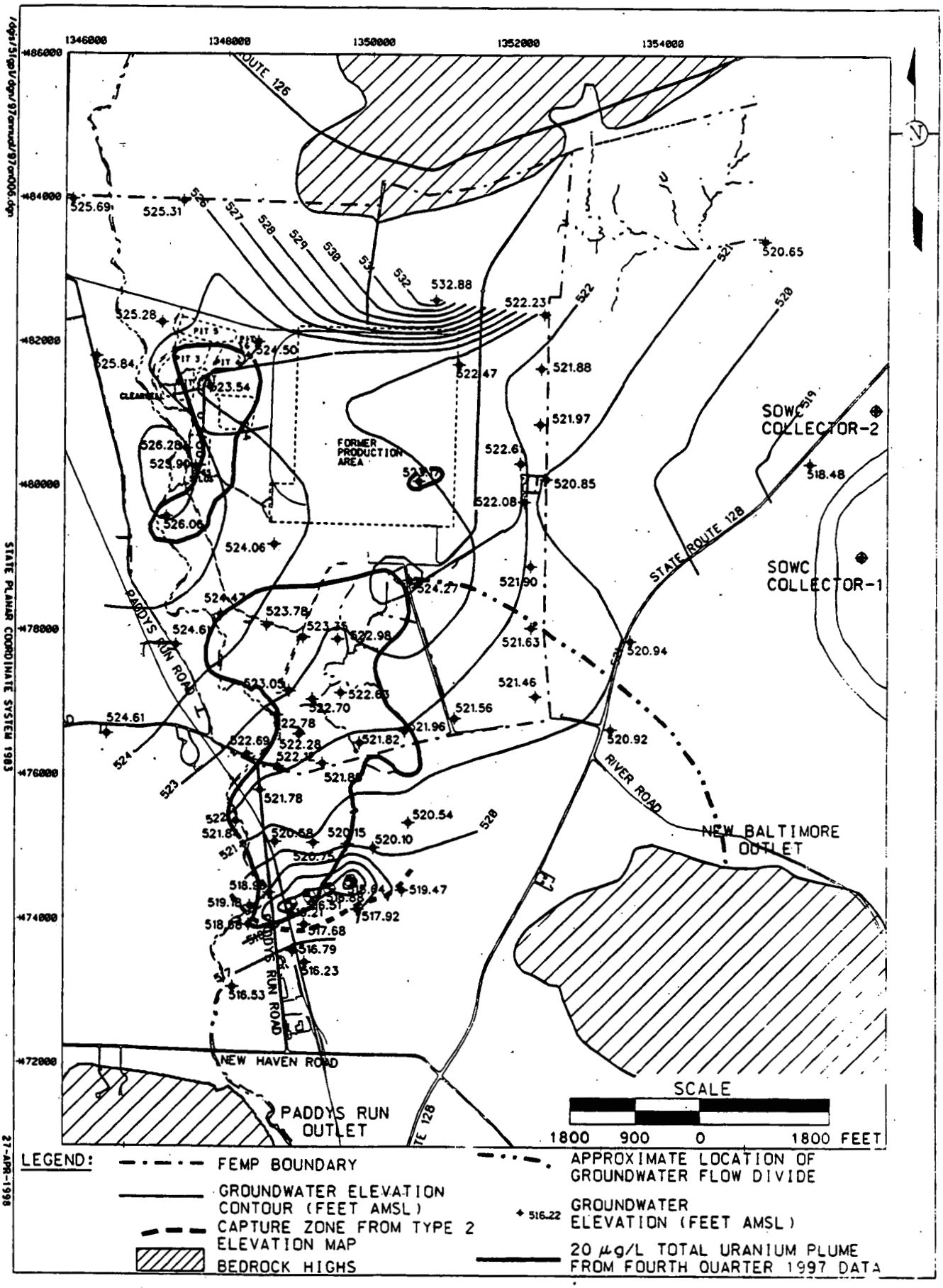


FIGURE A.3-6. GROUNDWATER ELEVATIONS, TYPE 3 WELLS, JULY 1997

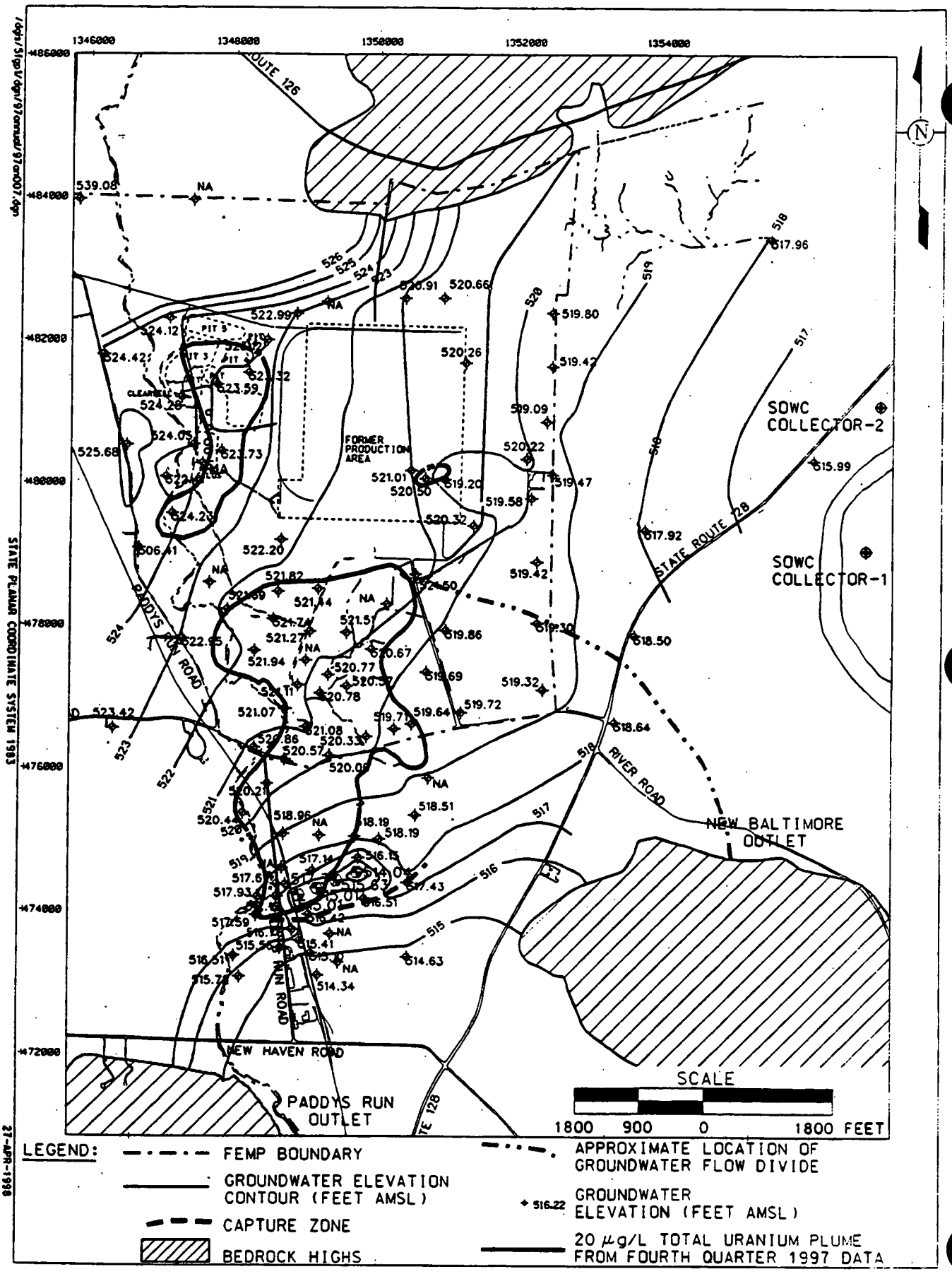


FIGURE A.3-7. GROUNDWATER ELEVATIONS, TYPE 2 WELLS, SEPTEMBER 1997

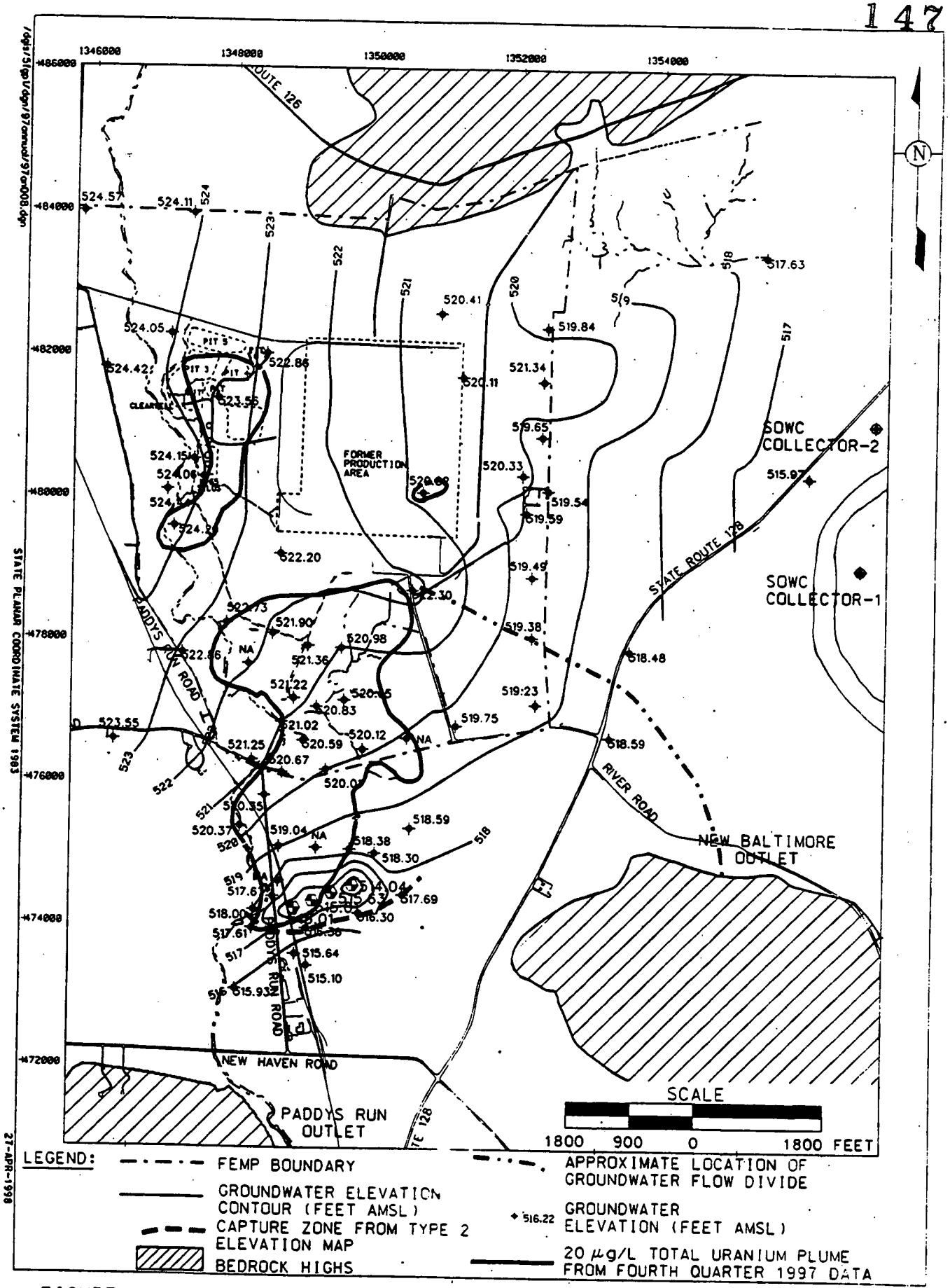


FIGURE A.3-8. GROUNDWATER ELEVATIONS, TYPE 3 WELLS, SEPTEMBER 1997

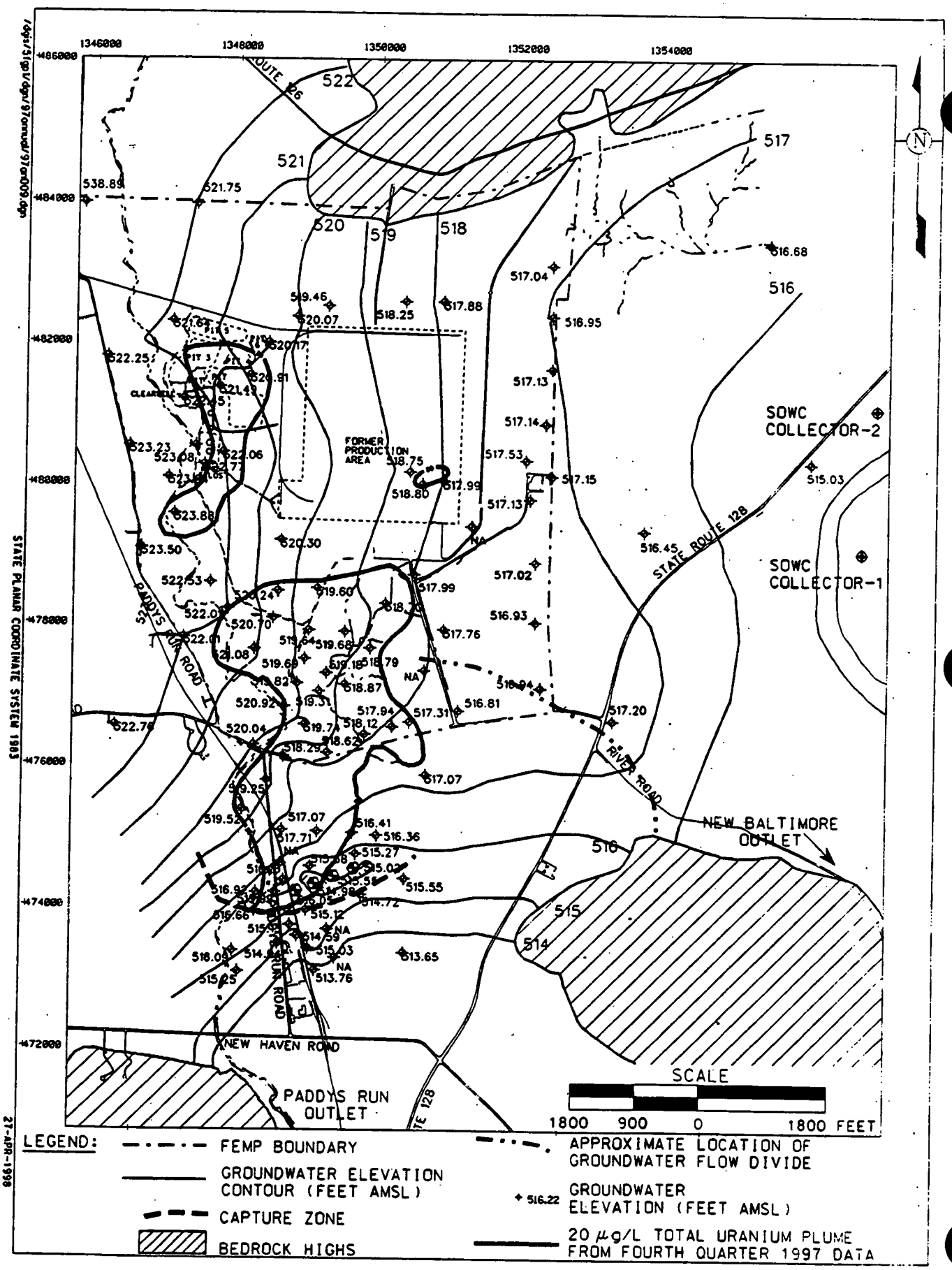


FIGURE A.3-9. GROUNDWATER ELEVATIONS, TYPE 2 WELLS, JANUARY 1998

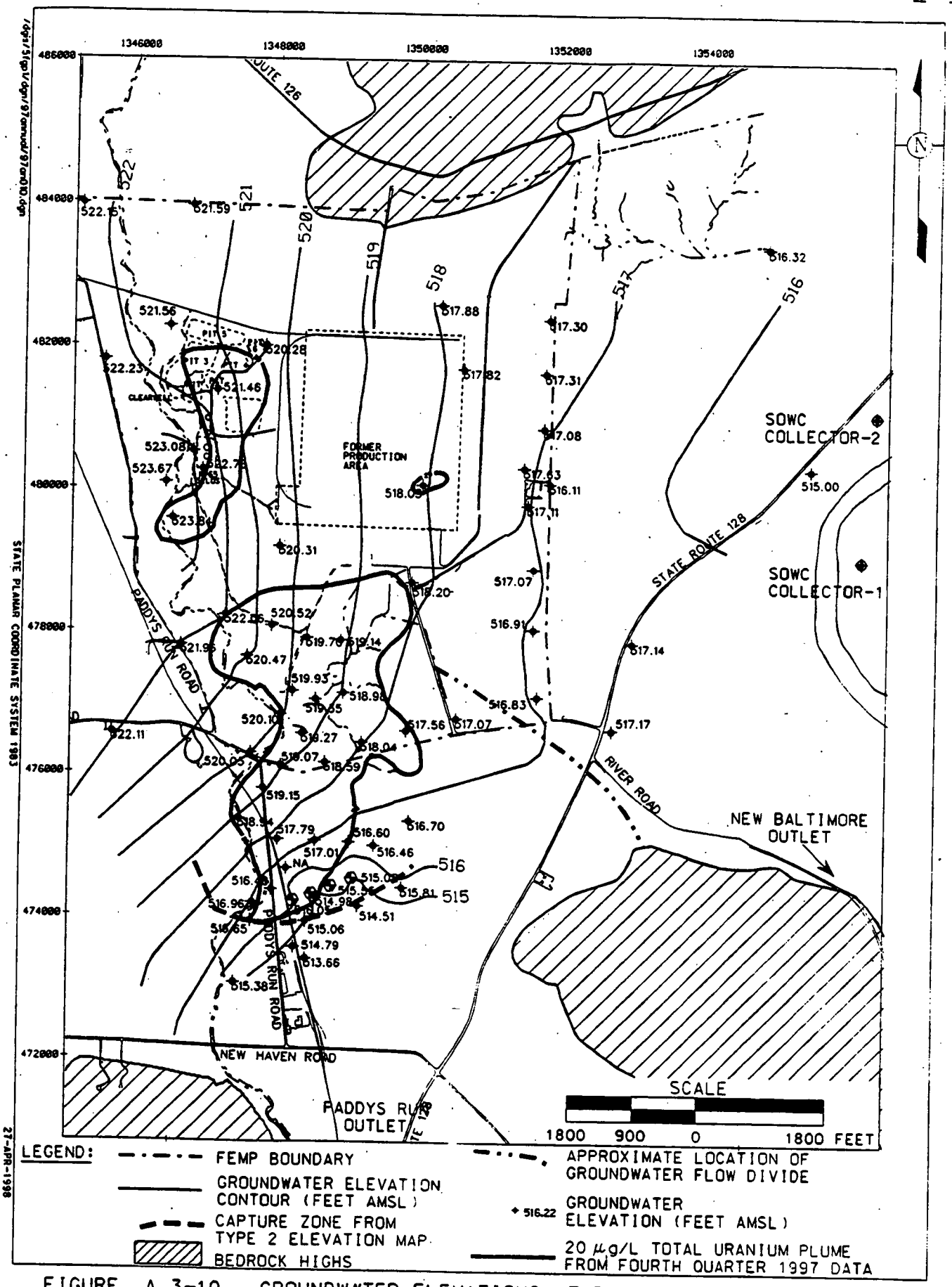


FIGURE A.3-10. GROUNDWATER ELEVATIONS, TYPE 3 WELLS, JANUARY 1998

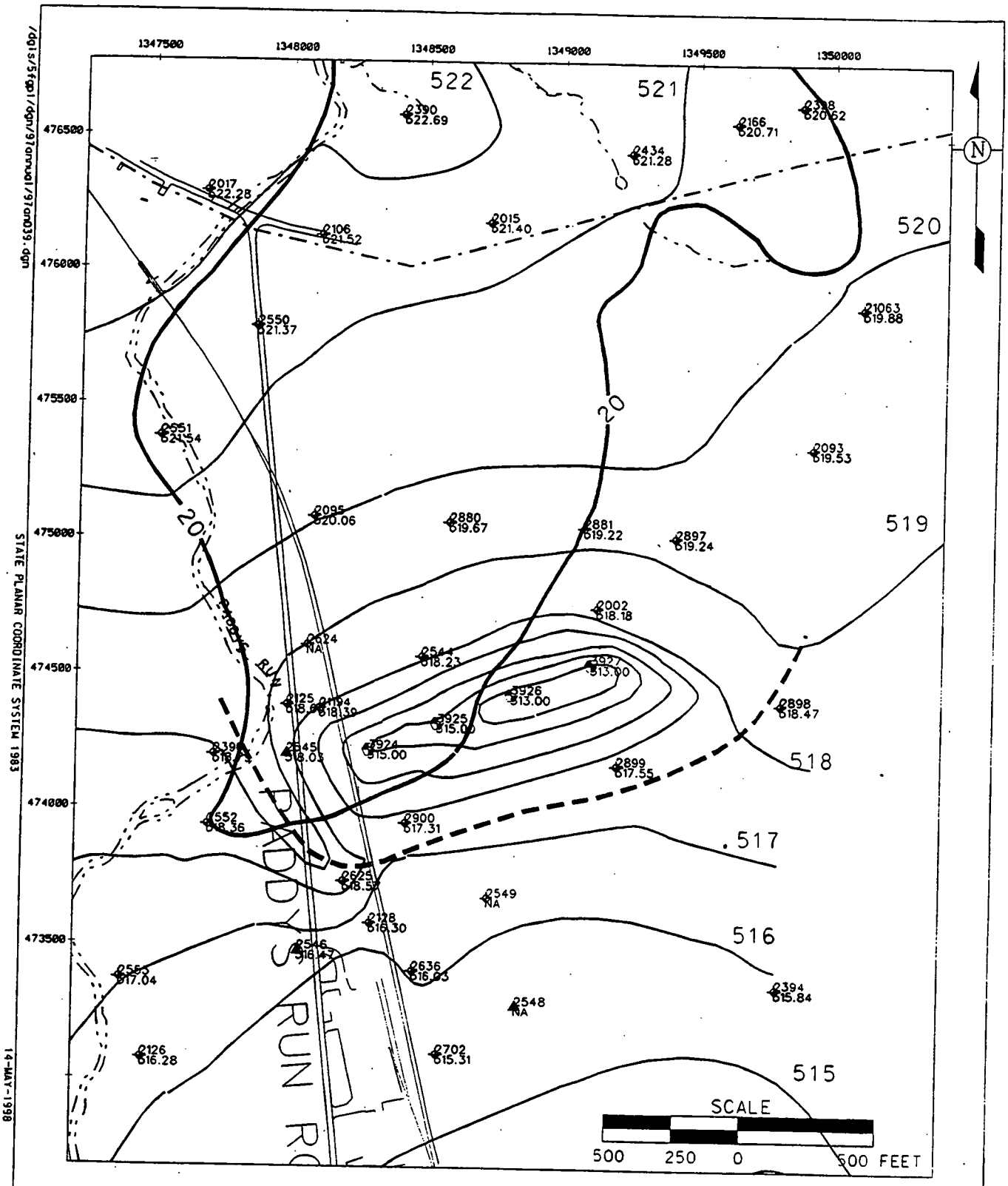
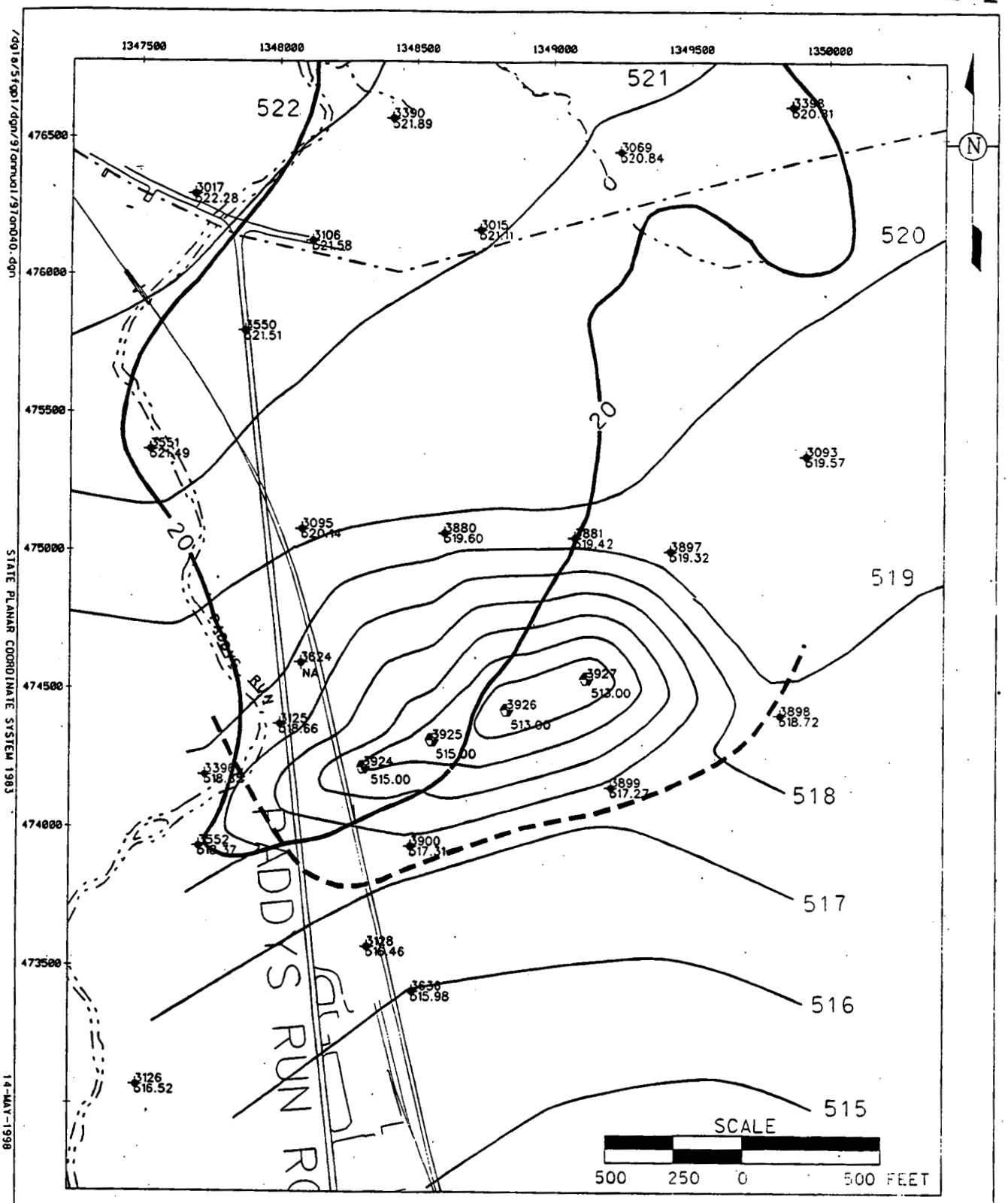


FIGURE A.3-11. GROUNDWATER ELEVATIONS, TYPE 2 WELLS, JANUARY 1997



LEGEND:

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

/dgn/5fqp1/dgn/9Tannual/9Ton040.dgn

STATE PLANAR COORDINATE SYSTEM 1983

14-MAY-1998

FIGURE A.3-12. GROUNDWATER ELEVATIONS, TYPE 3 WELLS, JANUARY 1997

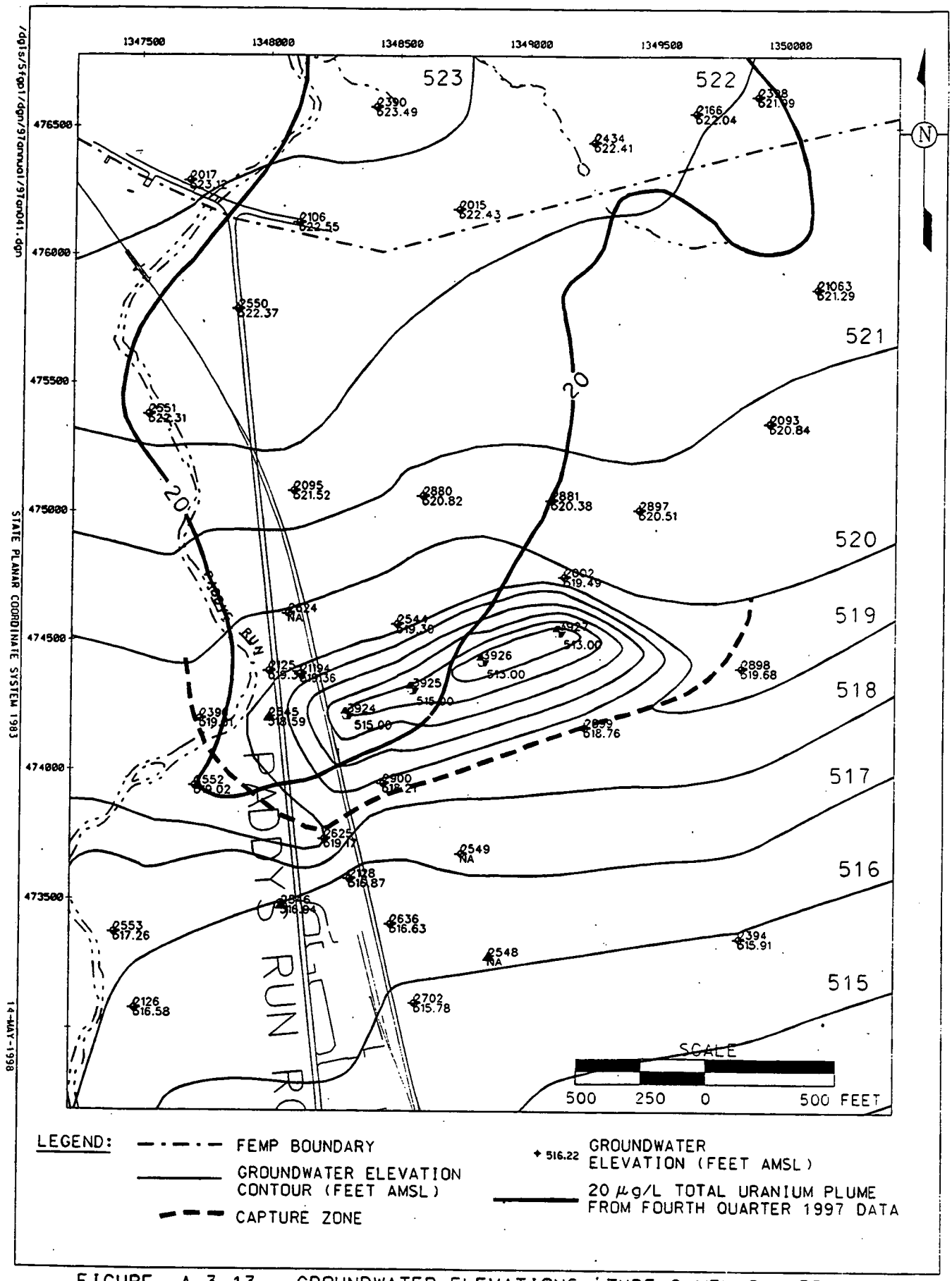
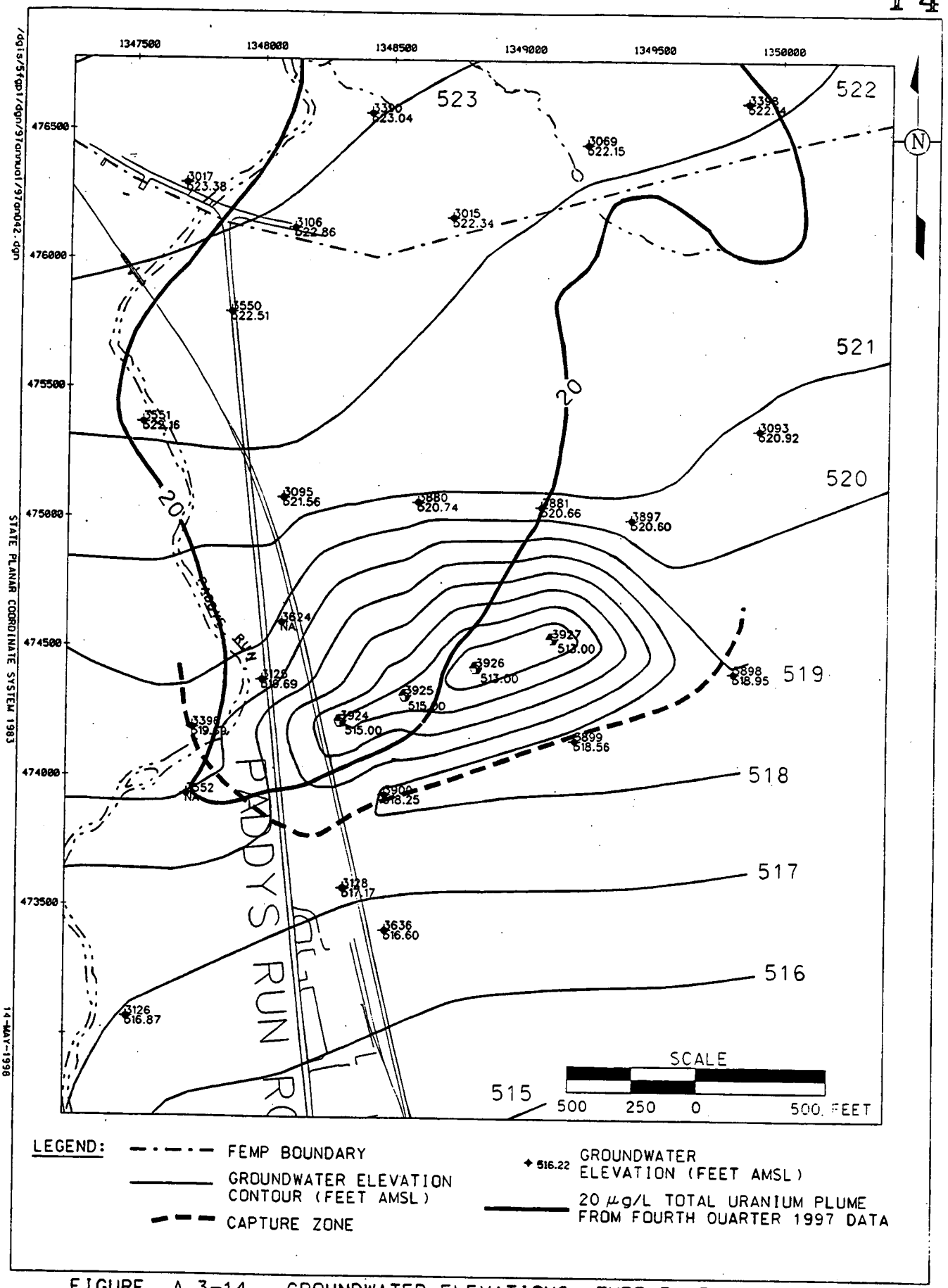


FIGURE A.3-13. GROUNDWATER ELEVATIONS, TYPE 2 WELLS, APRIL 1997



LEGEND:

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

FIGURE A.3-14. GROUNDWATER ELEVATIONS, TYPE 3 WELLS, APRIL 1997

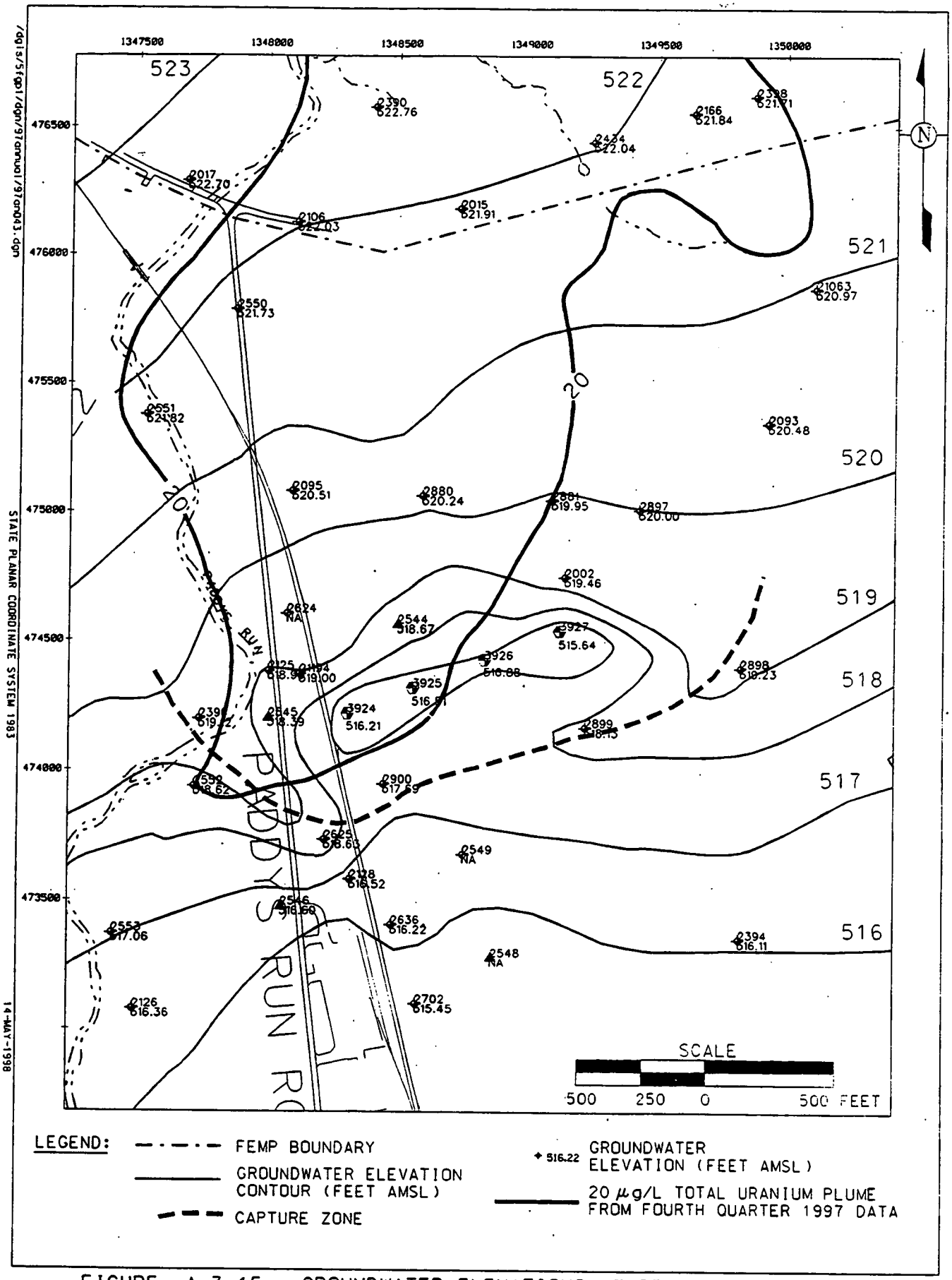


FIGURE A.3-15. GROUNDWATER ELEVATIONS, TYPE 2 WELLS, JULY 1997

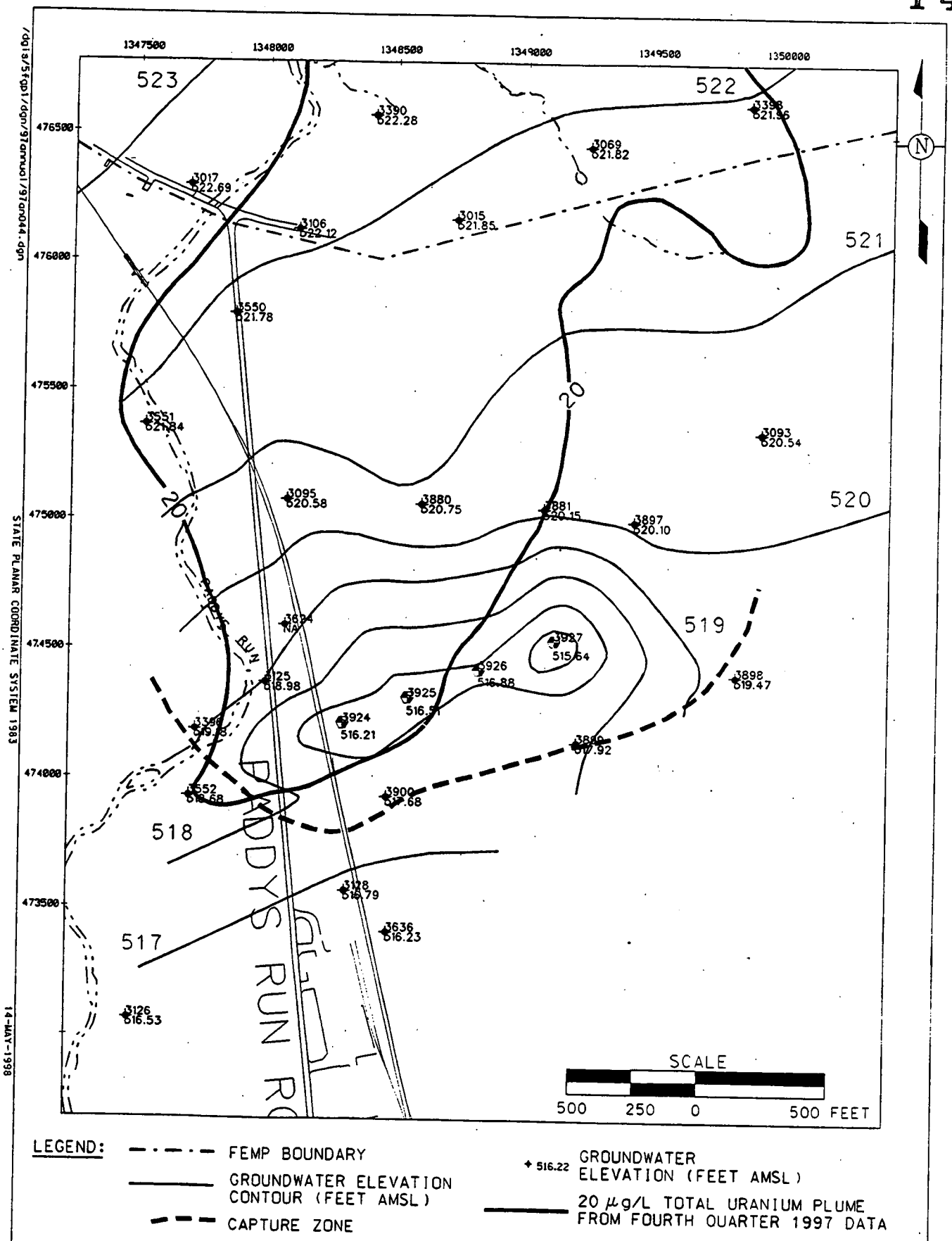


FIGURE A.3-16. GROUNDWATER ELEVATIONS, TYPE 3 WELLS, JULY 1997

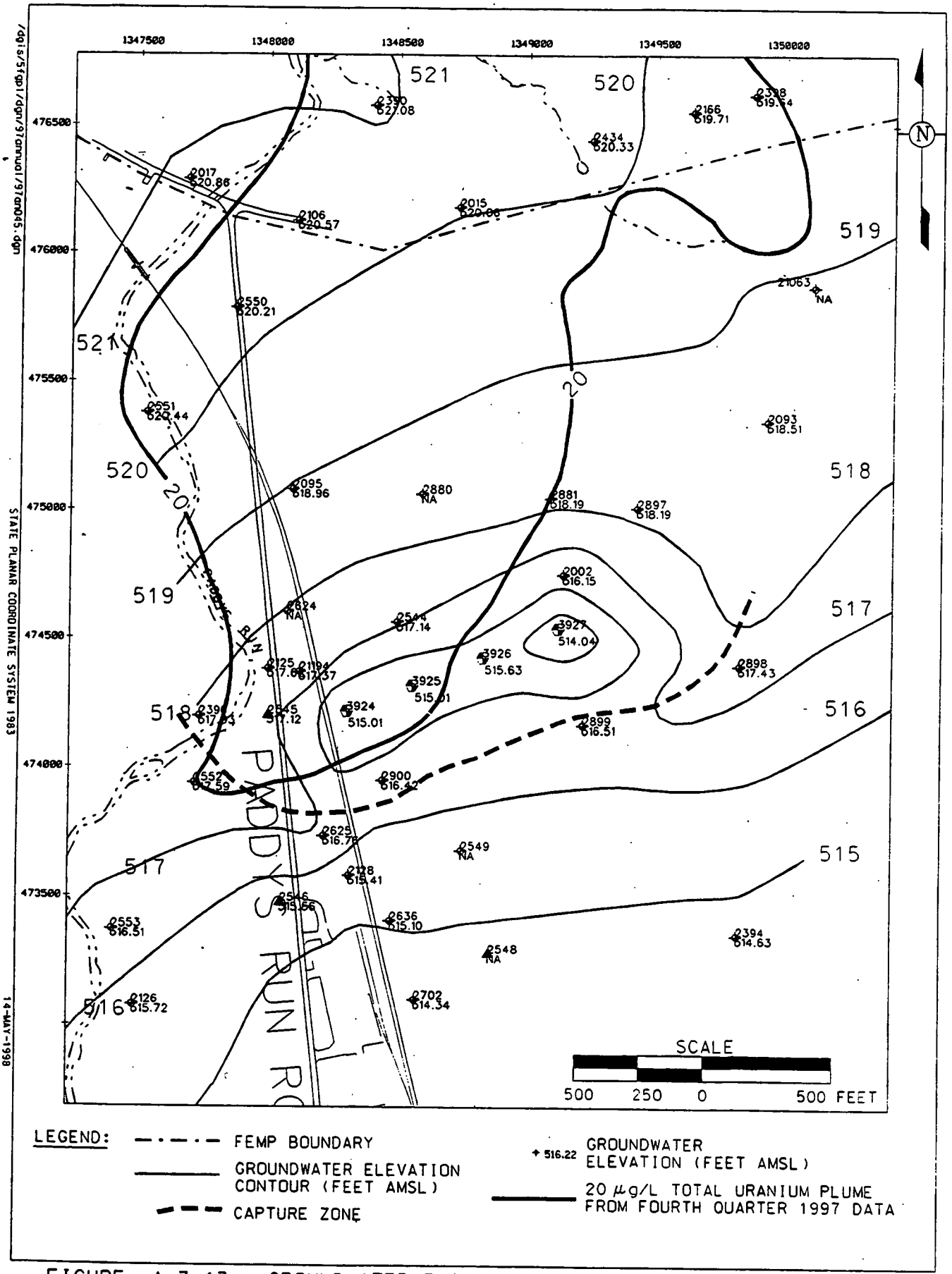
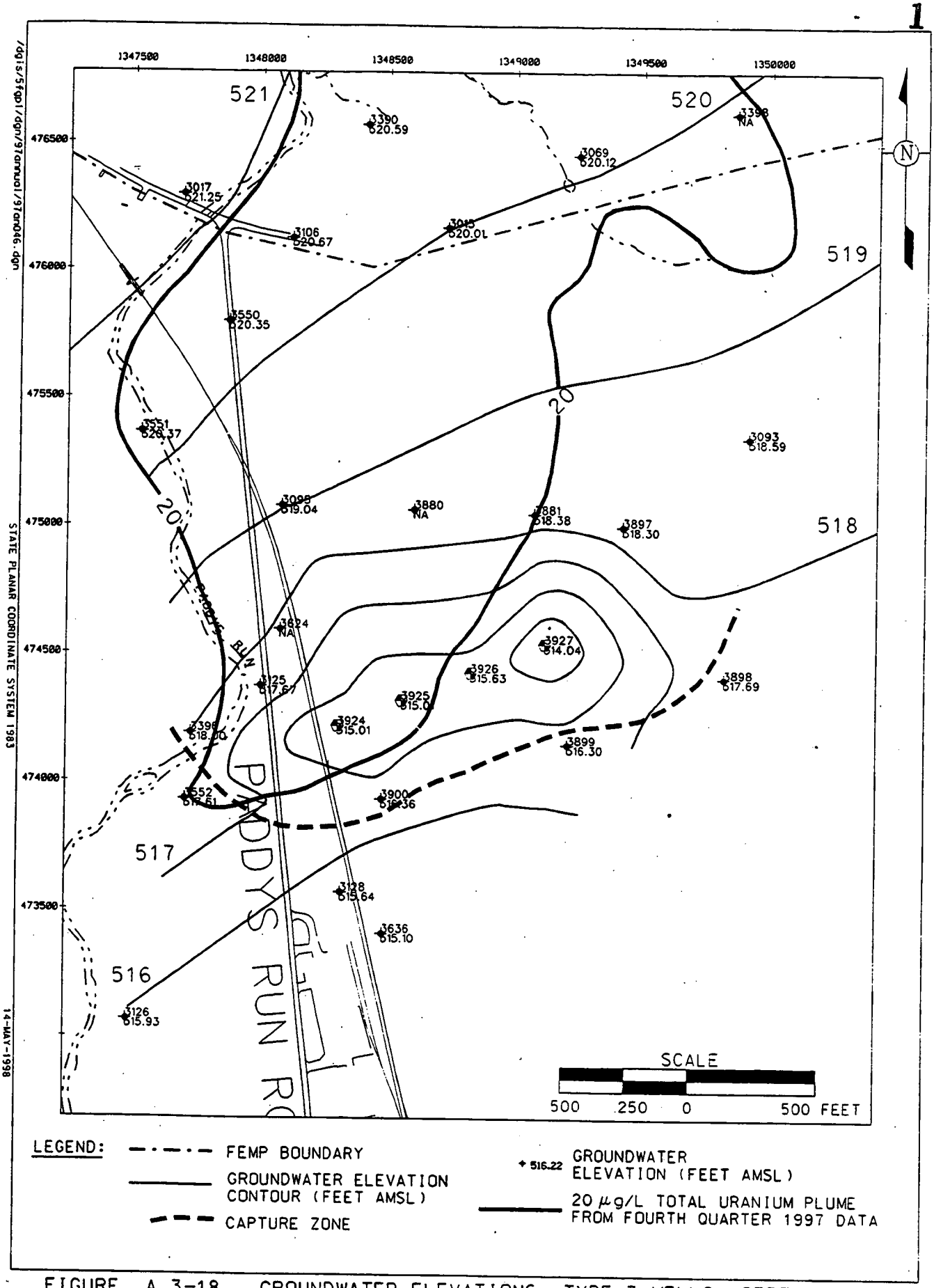


FIGURE A.3-17. GROUNDWATER ELEVATIONS, TYPE 2 WELLS, SEPTEMBER 1997



LEGEND:

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

FIGURE A.3-18. GROUNDWATER ELEVATIONS, TYPE 3 WELLS, SEPTEMBER 1997

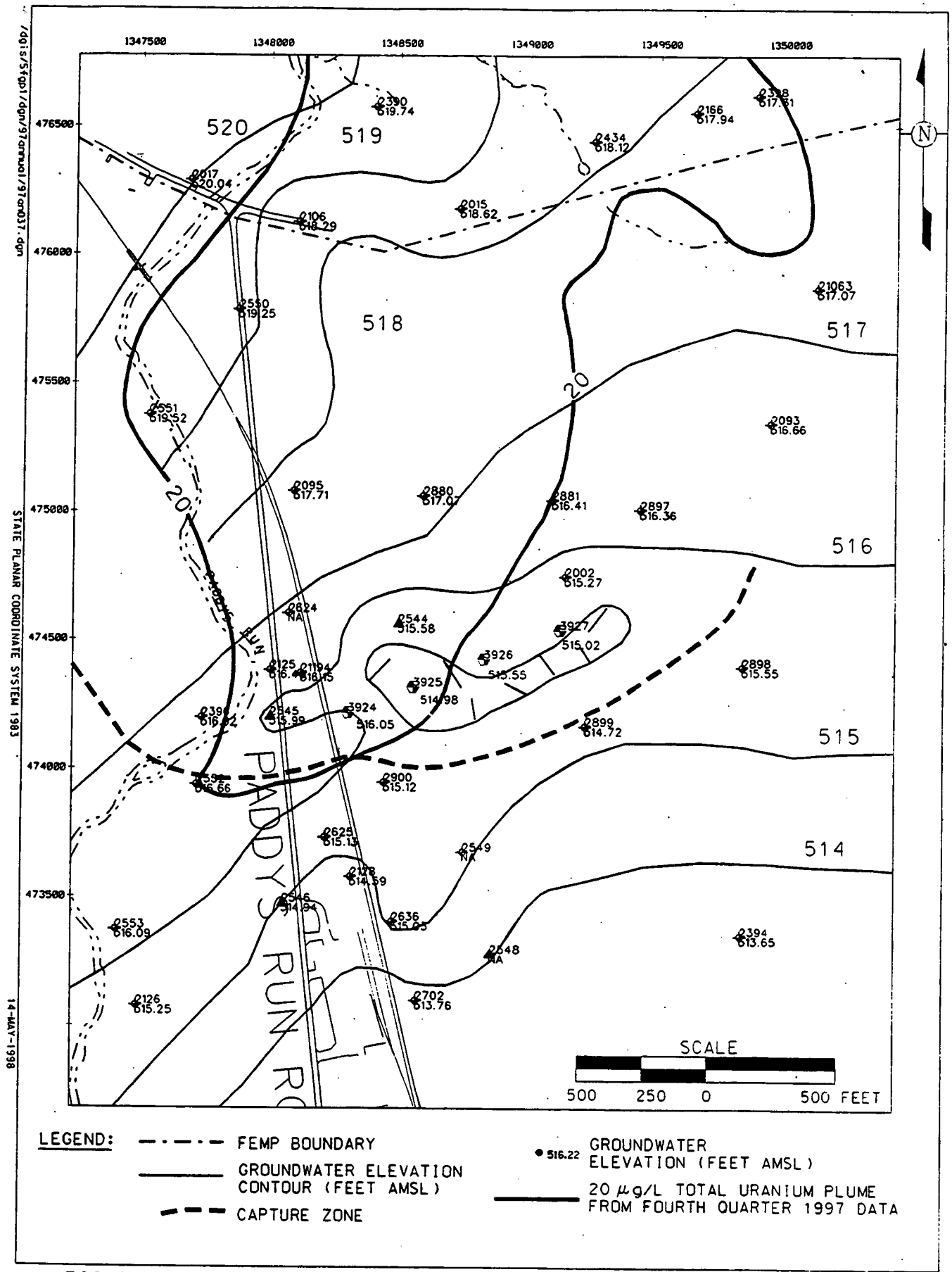


FIGURE A.3-19. GROUNDWATER ELEVATIONS, TYPE 2 WELLS, JANUARY 1998

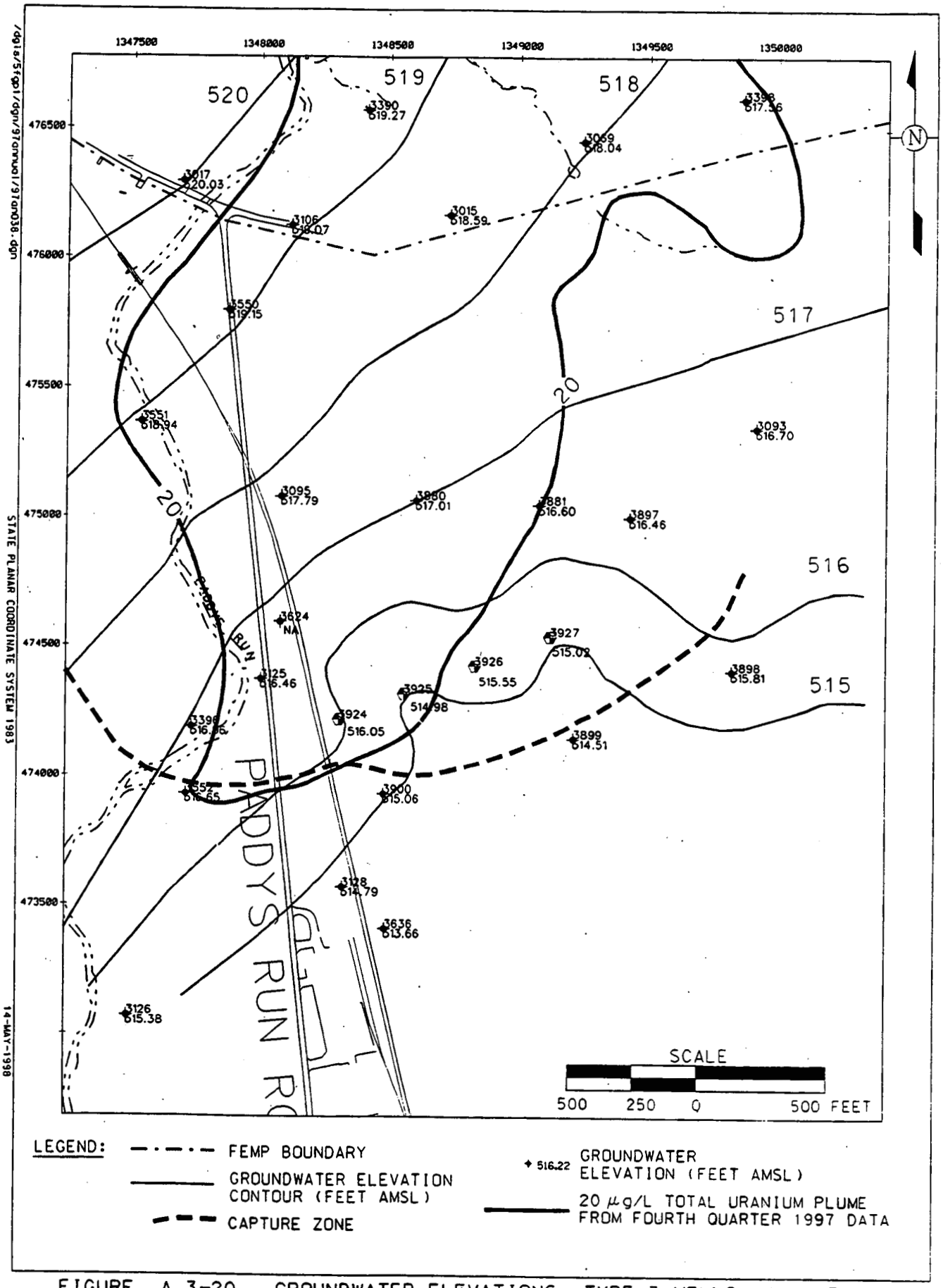


FIGURE A.3-20. GROUNDWATER ELEVATIONS, TYPE 3 WELLS, JANUARY 1998

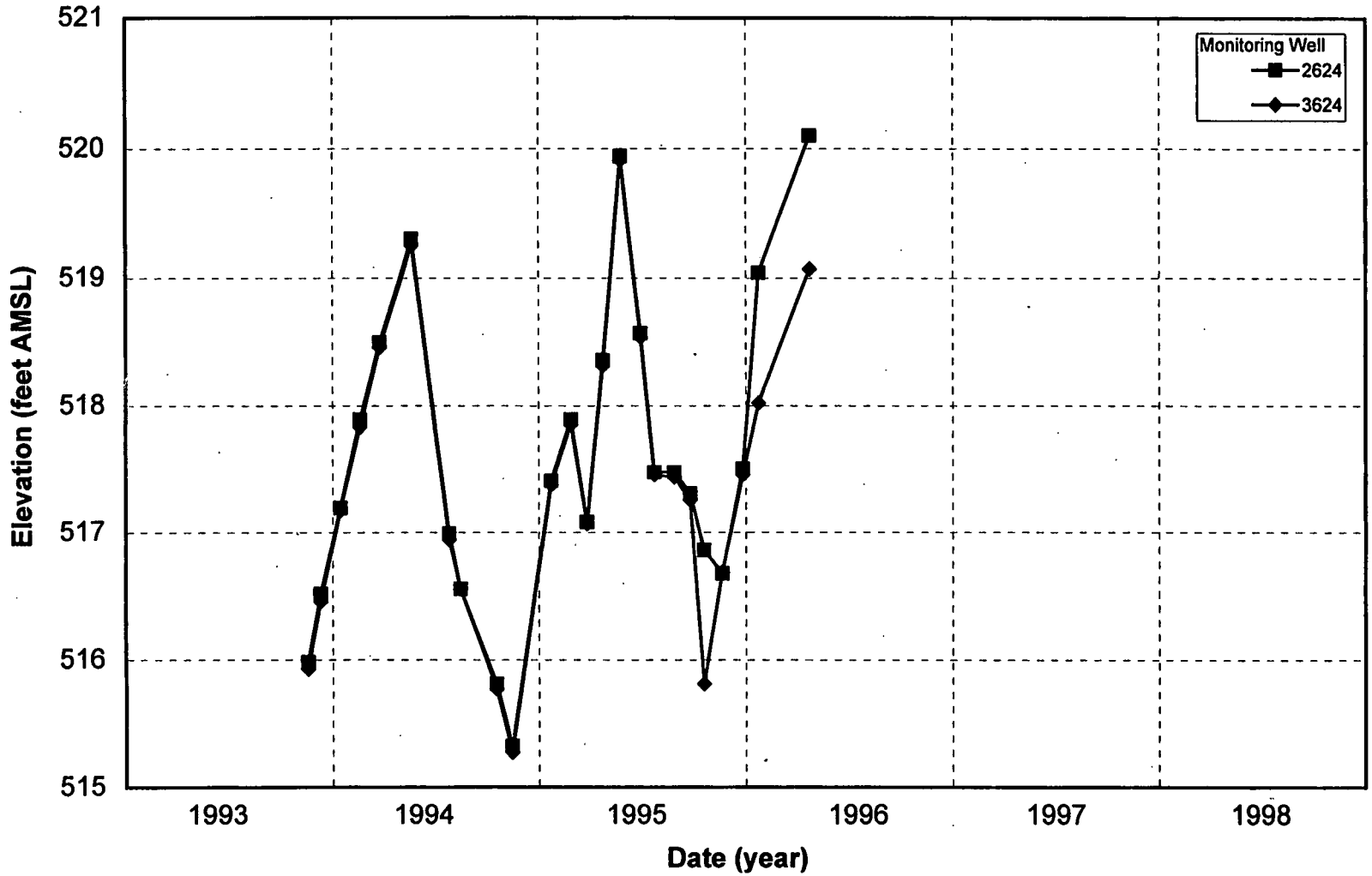


FIGURE A.3-21. HYDROGRAPH FOR WELL CLUSTER 624

000341

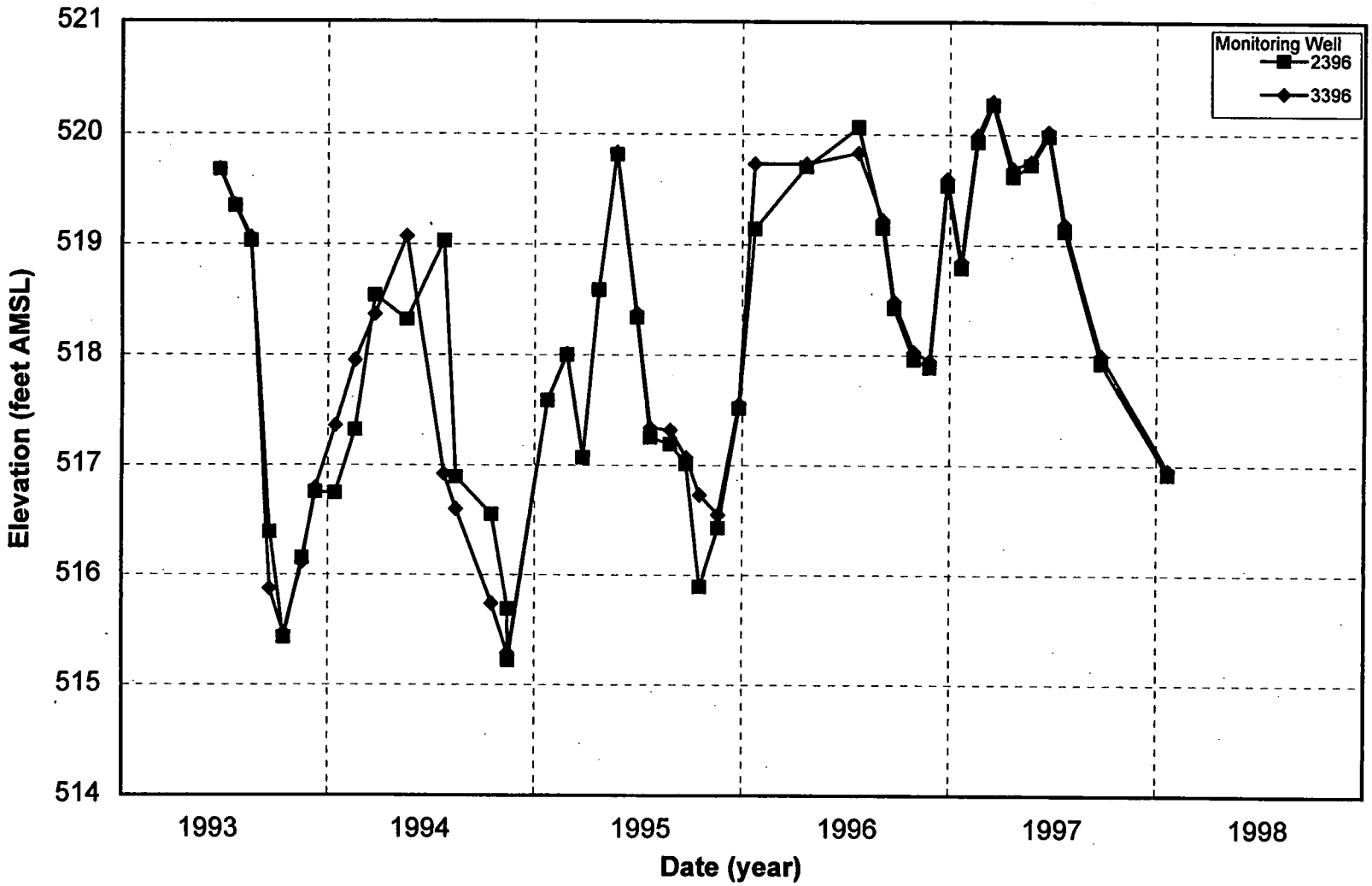


FIGURE A.3-22. HYDROGRAPH FOR WELL CLUSTER 396

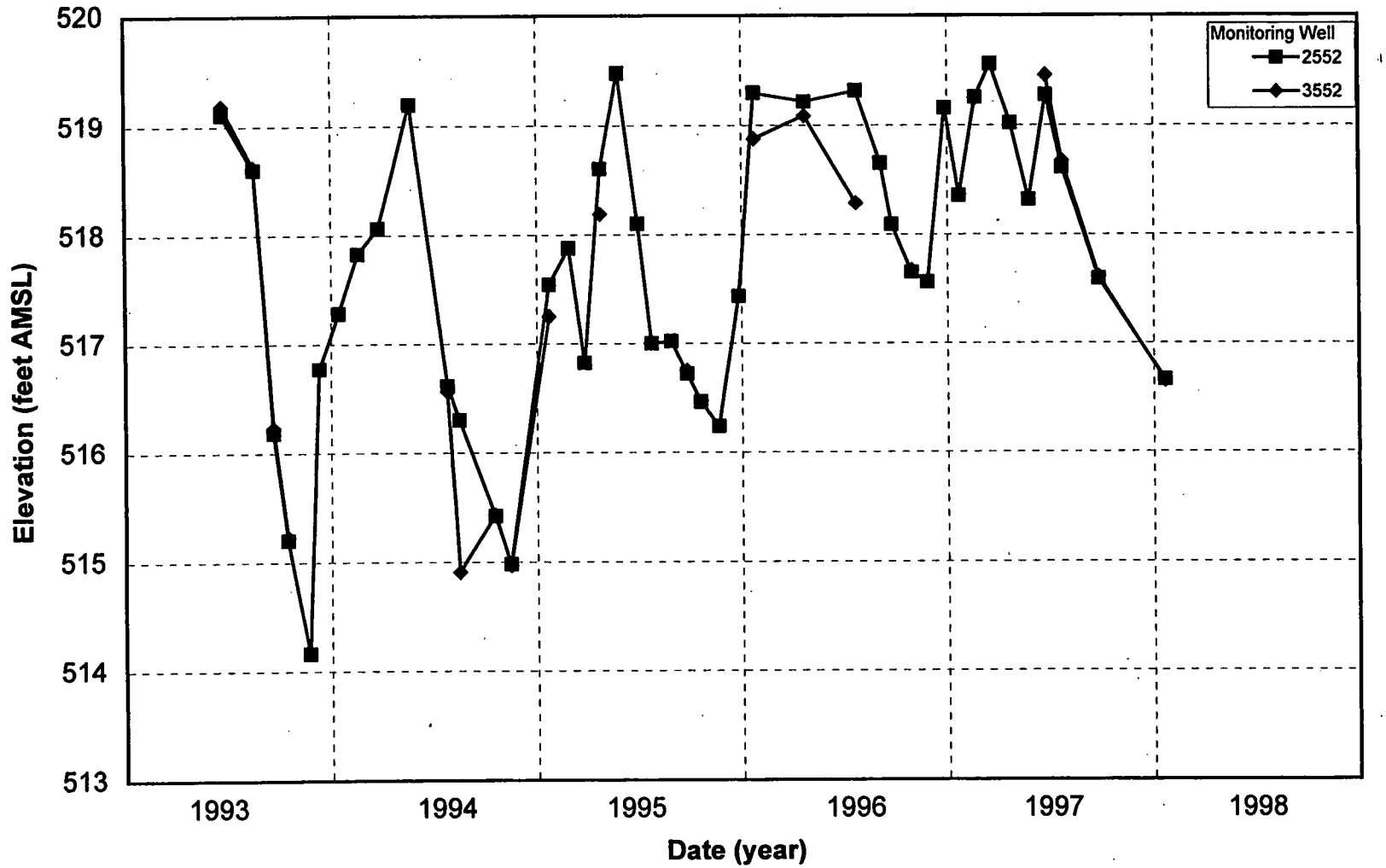


FIGURE A.3-23. HYDROGRAPH FOR WELL CLUSTER 552

000343

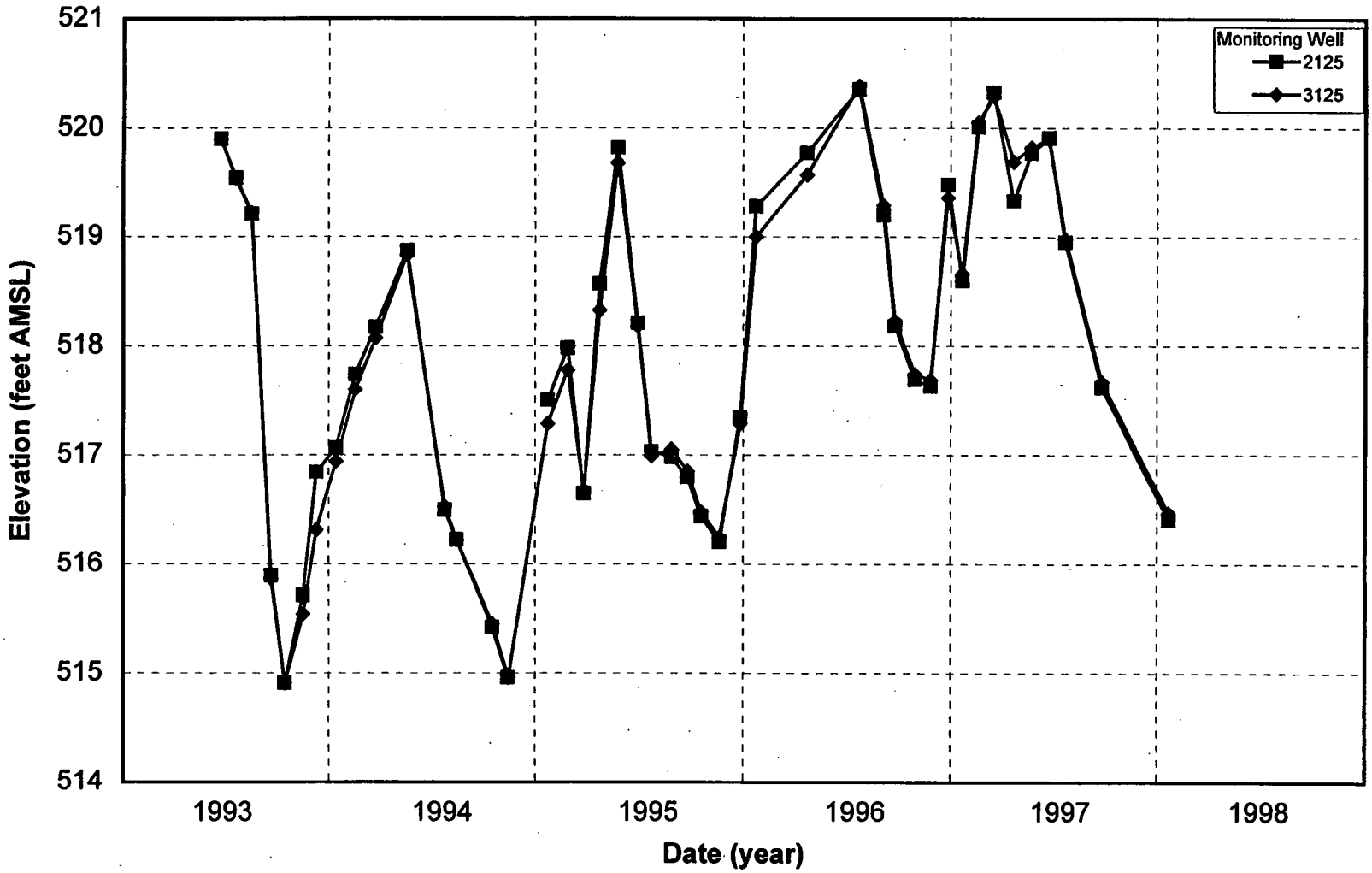


FIGURE A.3-24. HYDROGRAPH FOR WELL CLUSTER 125

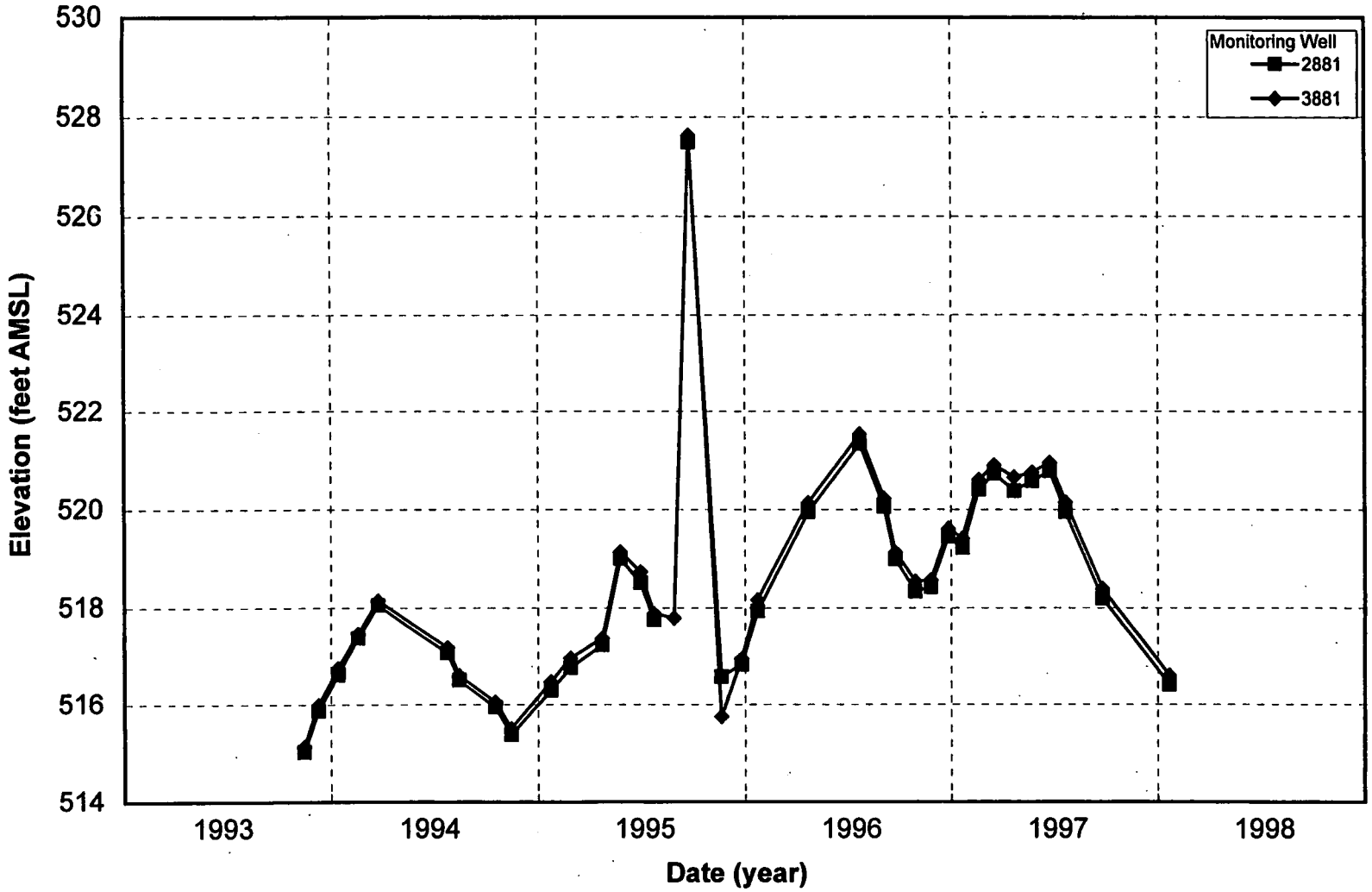


FIGURE A.3-25. HYDROGRAPH FOR WELL CLUSTER 881

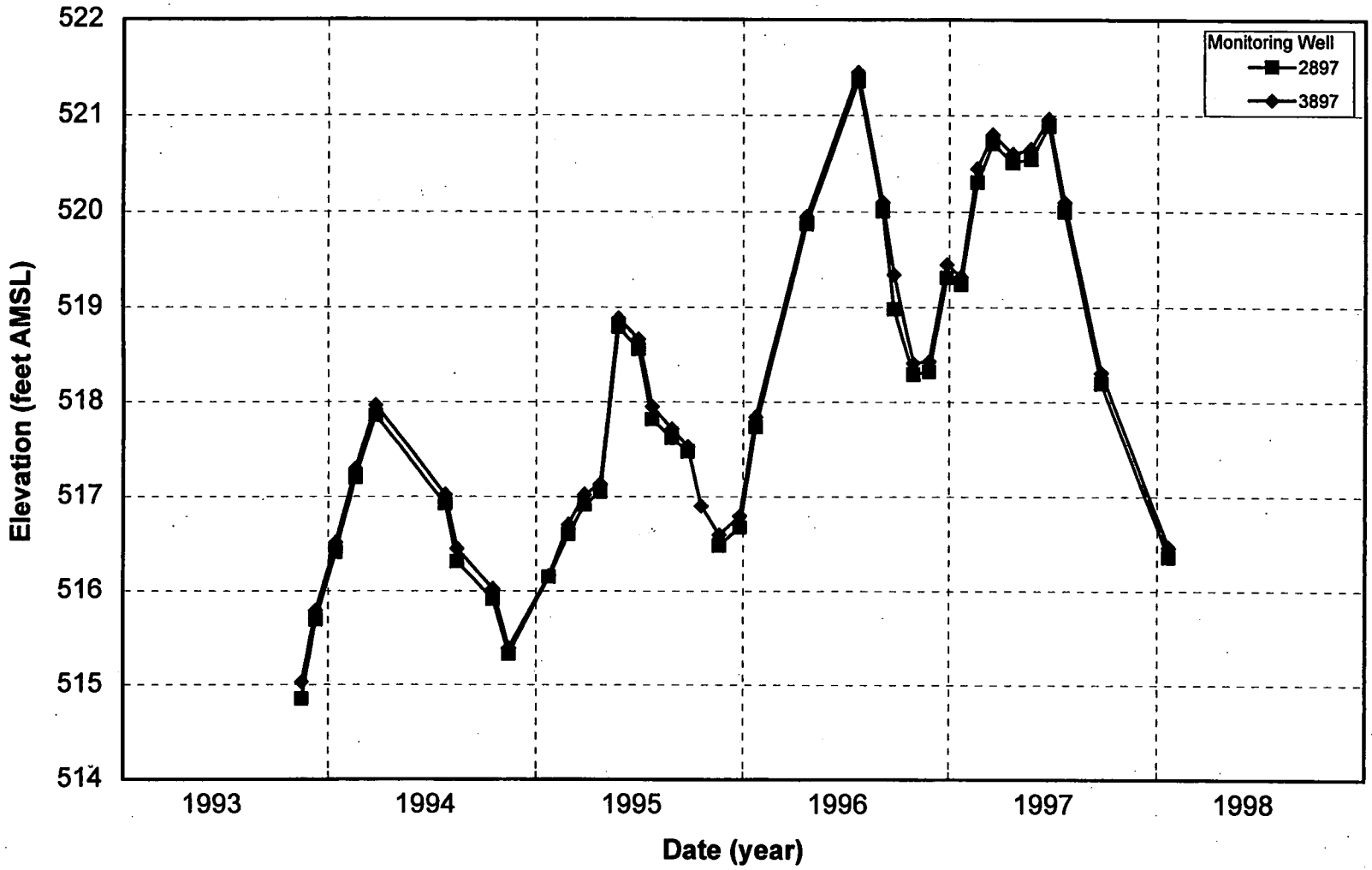


FIGURE A.3-26. HYDROGRAPH FOR WELL CLUSTER 897

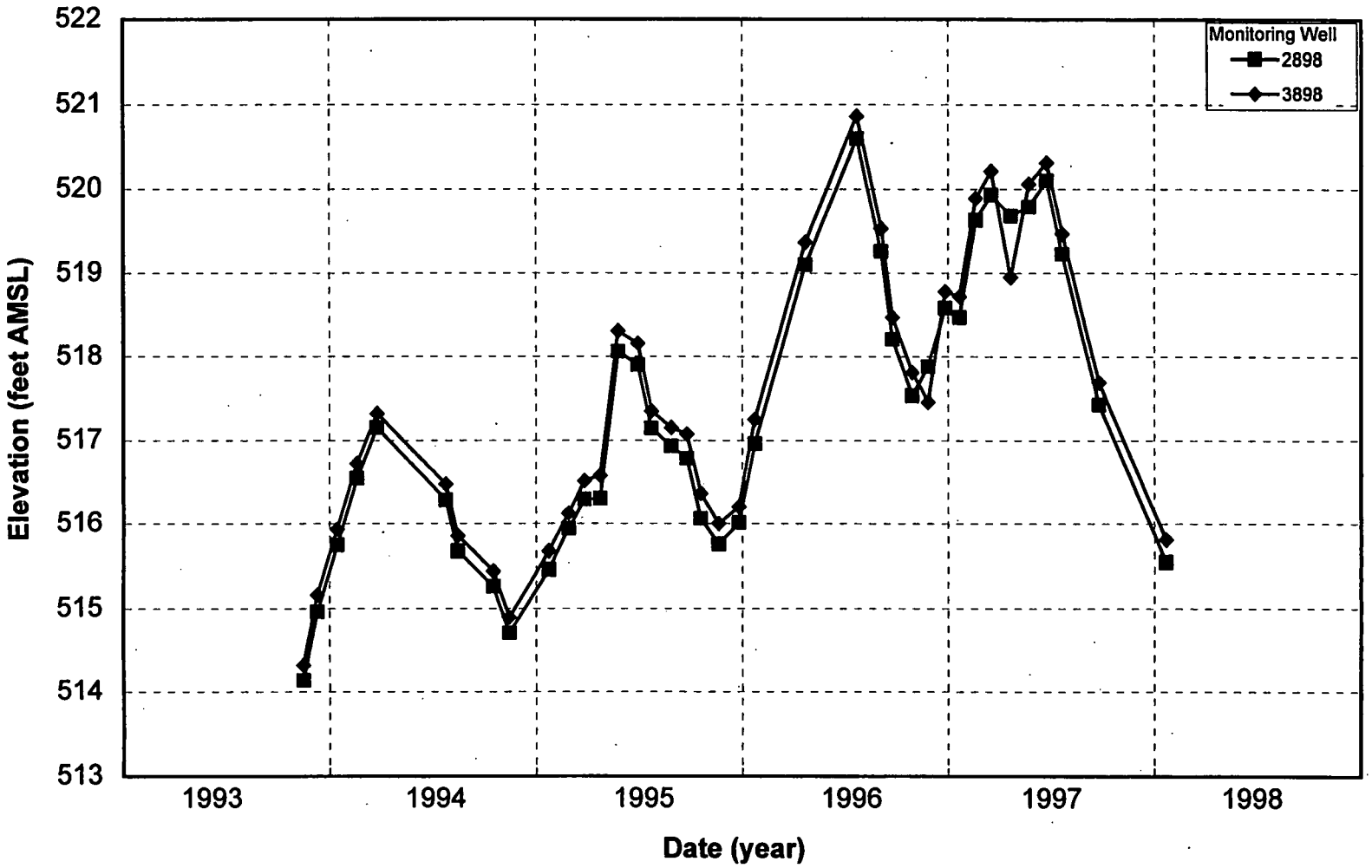


FIGURE A.3-27. HYDROGRAPH FOR WELL CLUSTER 898

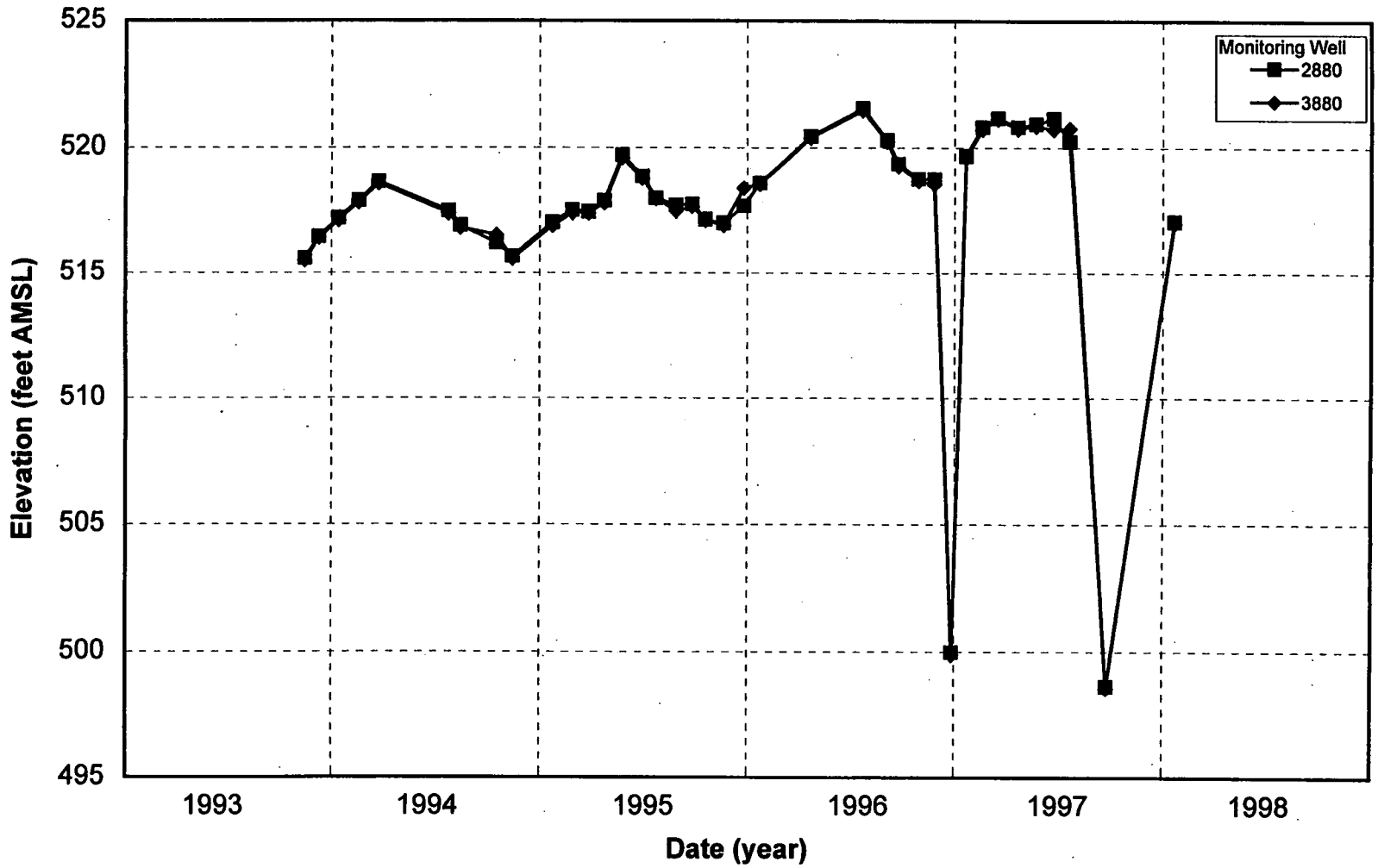


FIGURE A.3-28. HYDROGRAPH FOR WELL CLUSTER 880

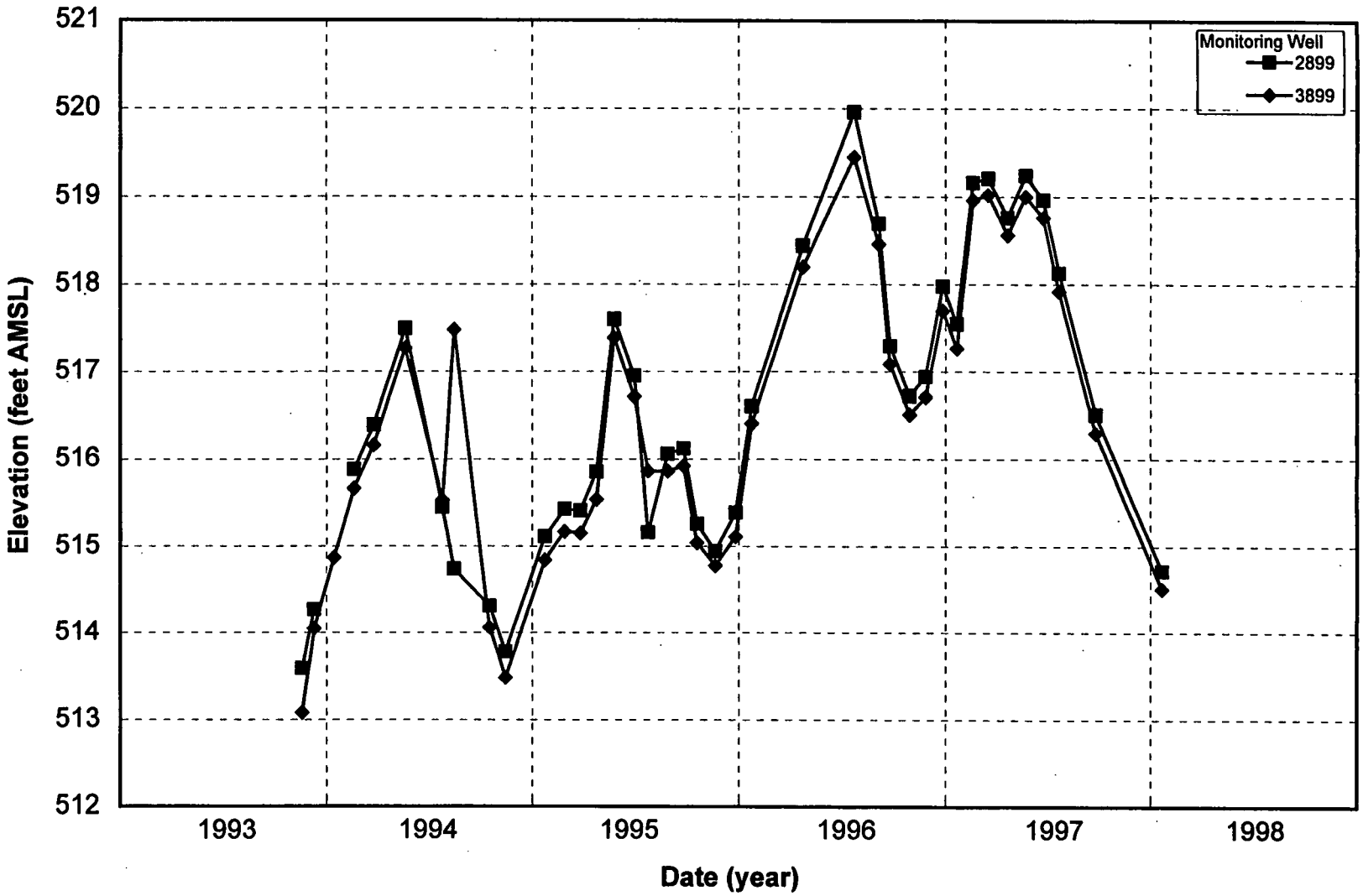


FIGURE A.3-29. HYDROGRAPH FOR WELL CLUSTER 899

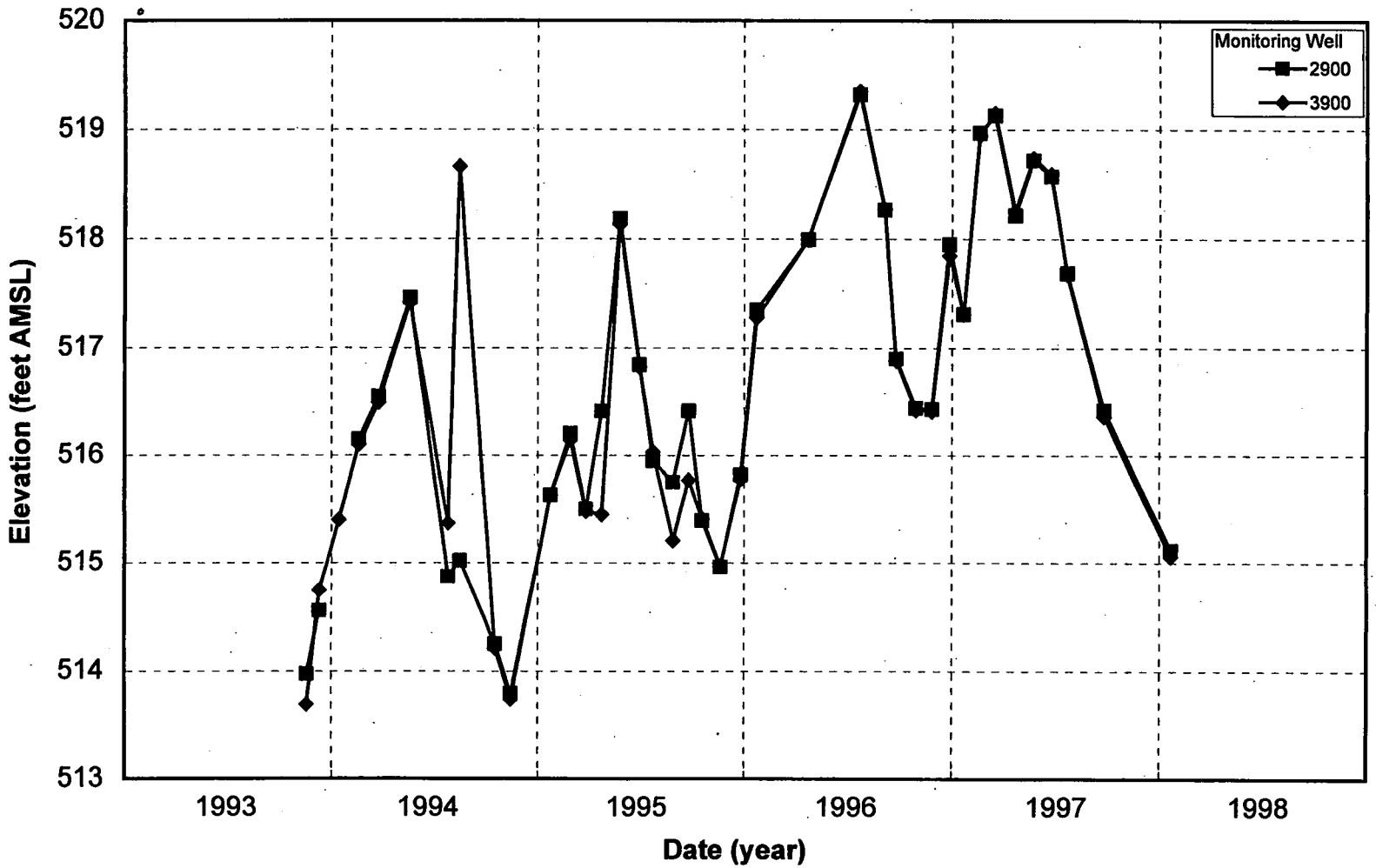


FIGURE A.3-30. HYDROGRAPH FOR WELL CLUSTER 900

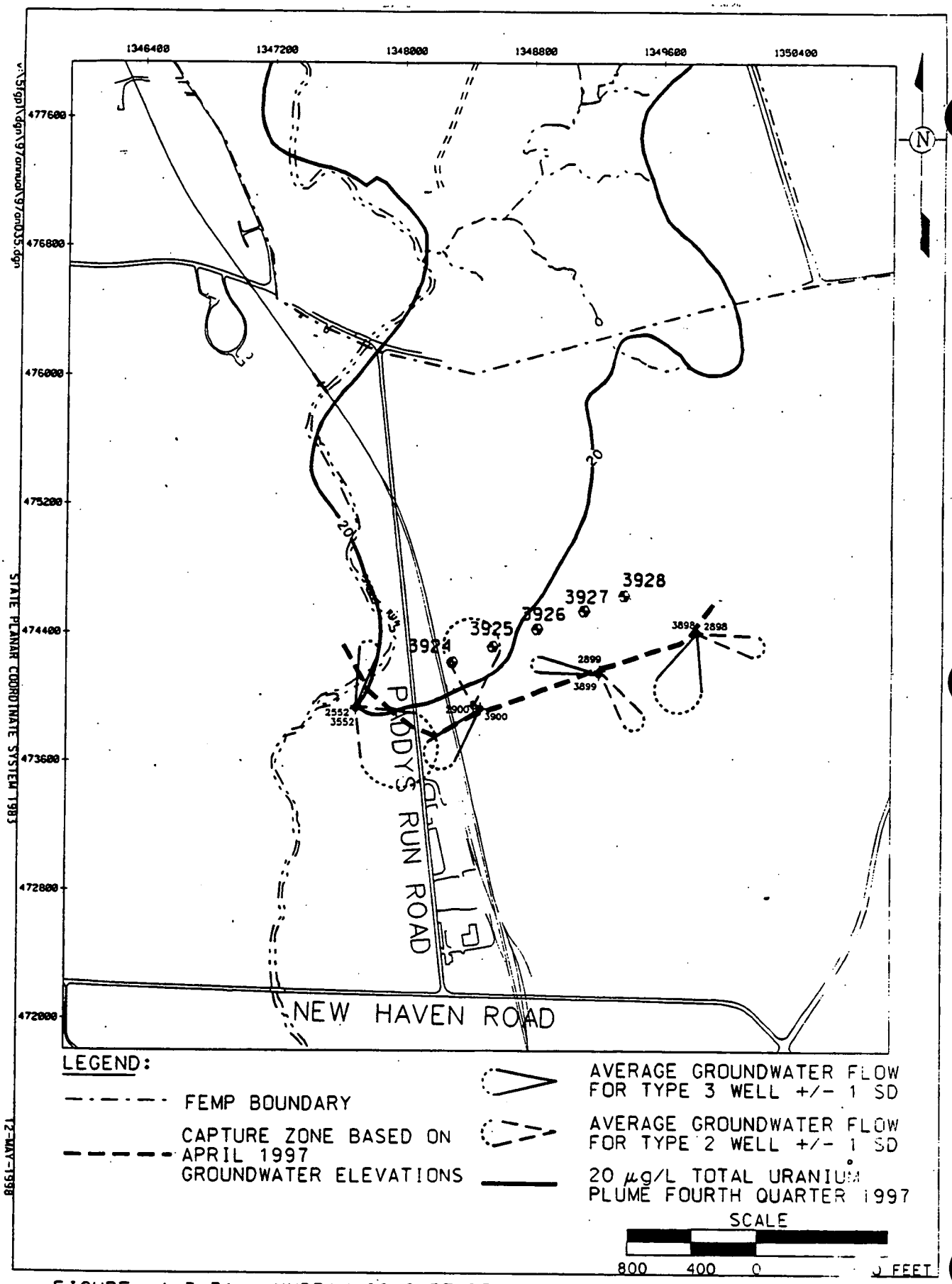


FIGURE A.3-31. HYDRAULIC CAPTURE ZONE AND COLLOIDAL BORESCOPE FLOW VECTORS FOR THE SOUTH PLUME MODULE, FIRST AND SECOND QUARTER 1997

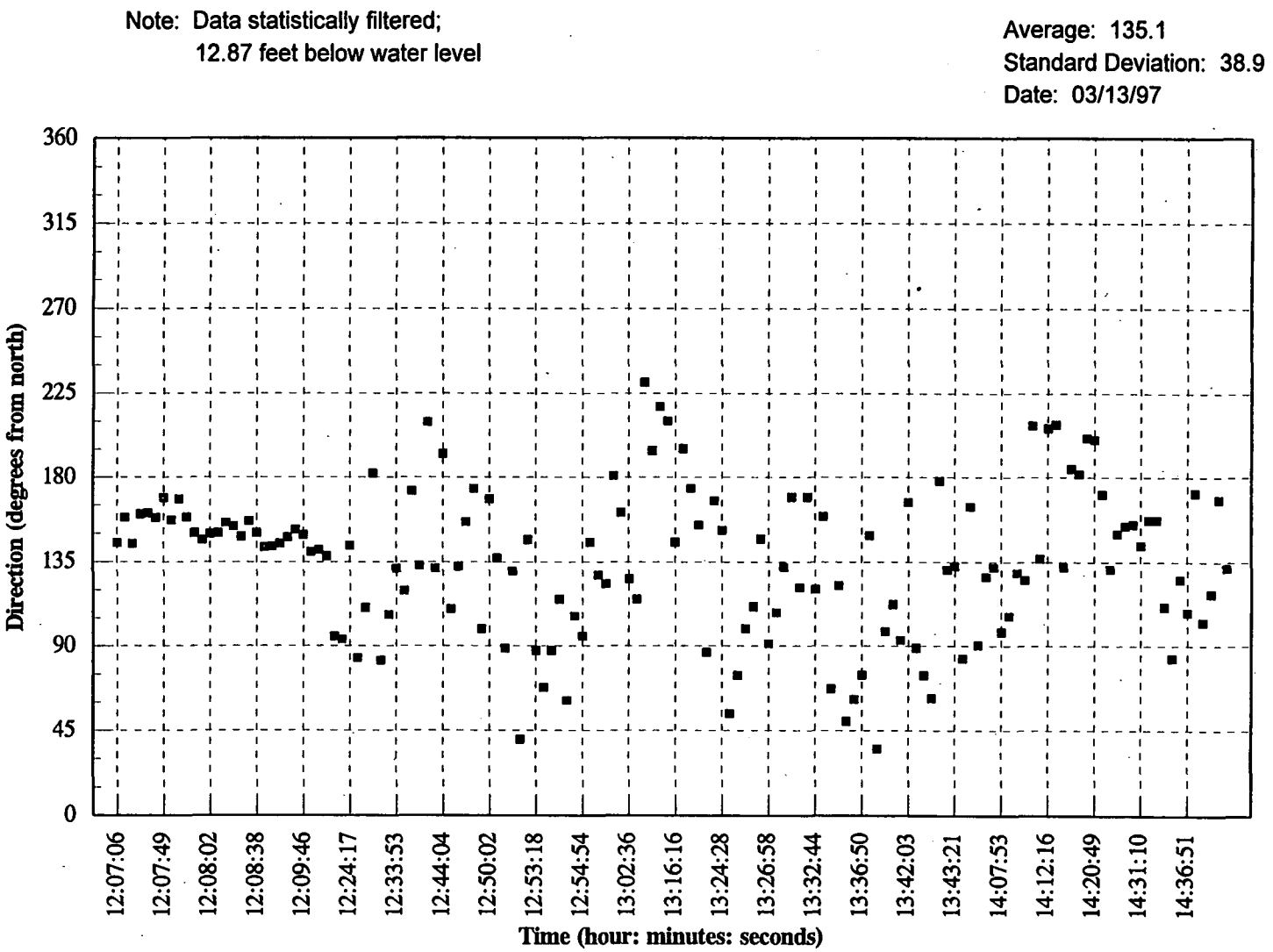


FIGURE A.3-32. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 2552 USING COLLOIDAL BORESCOPE

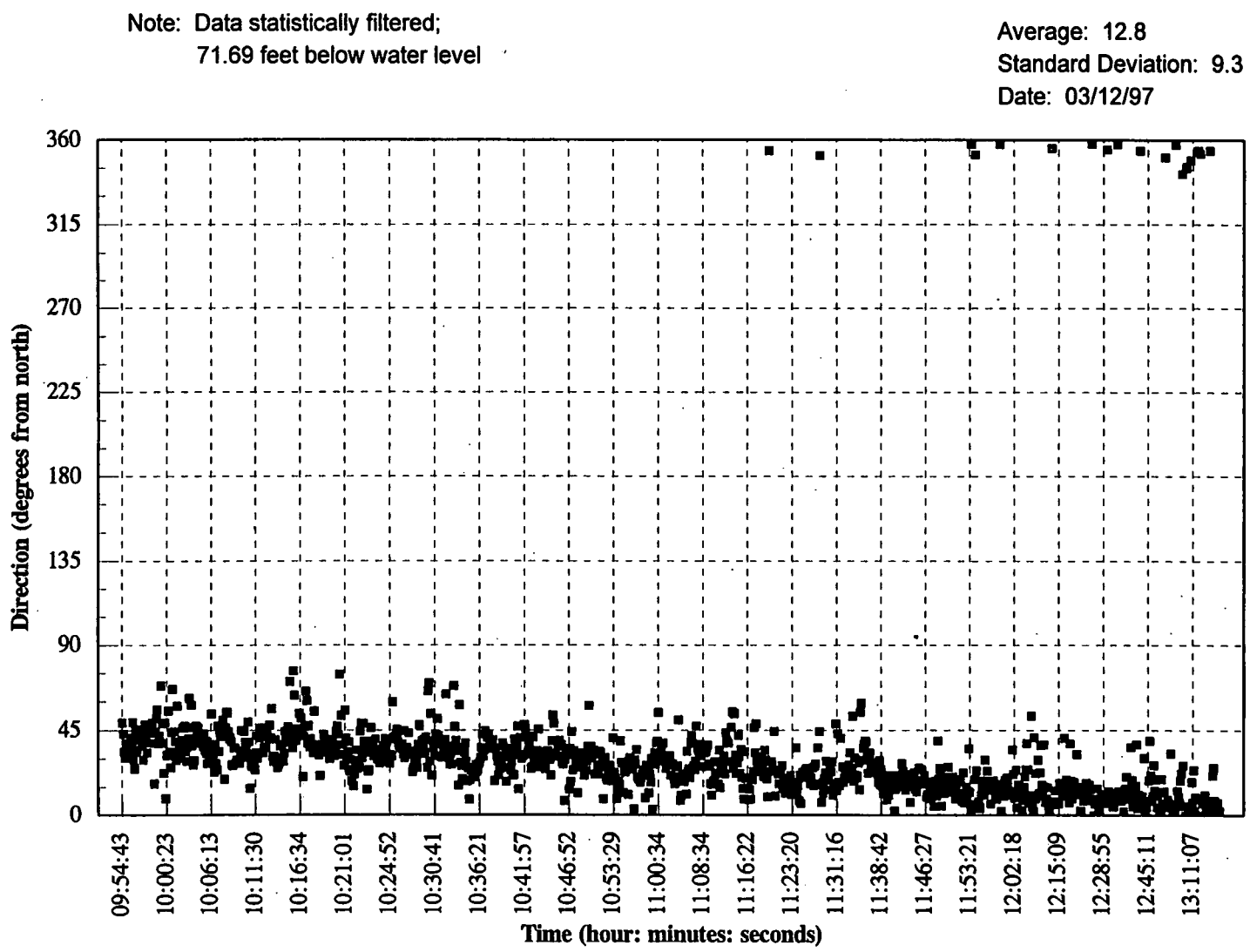


FIGURE A.3-33. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 3552 USING COLLOIDAL BORESCOPE

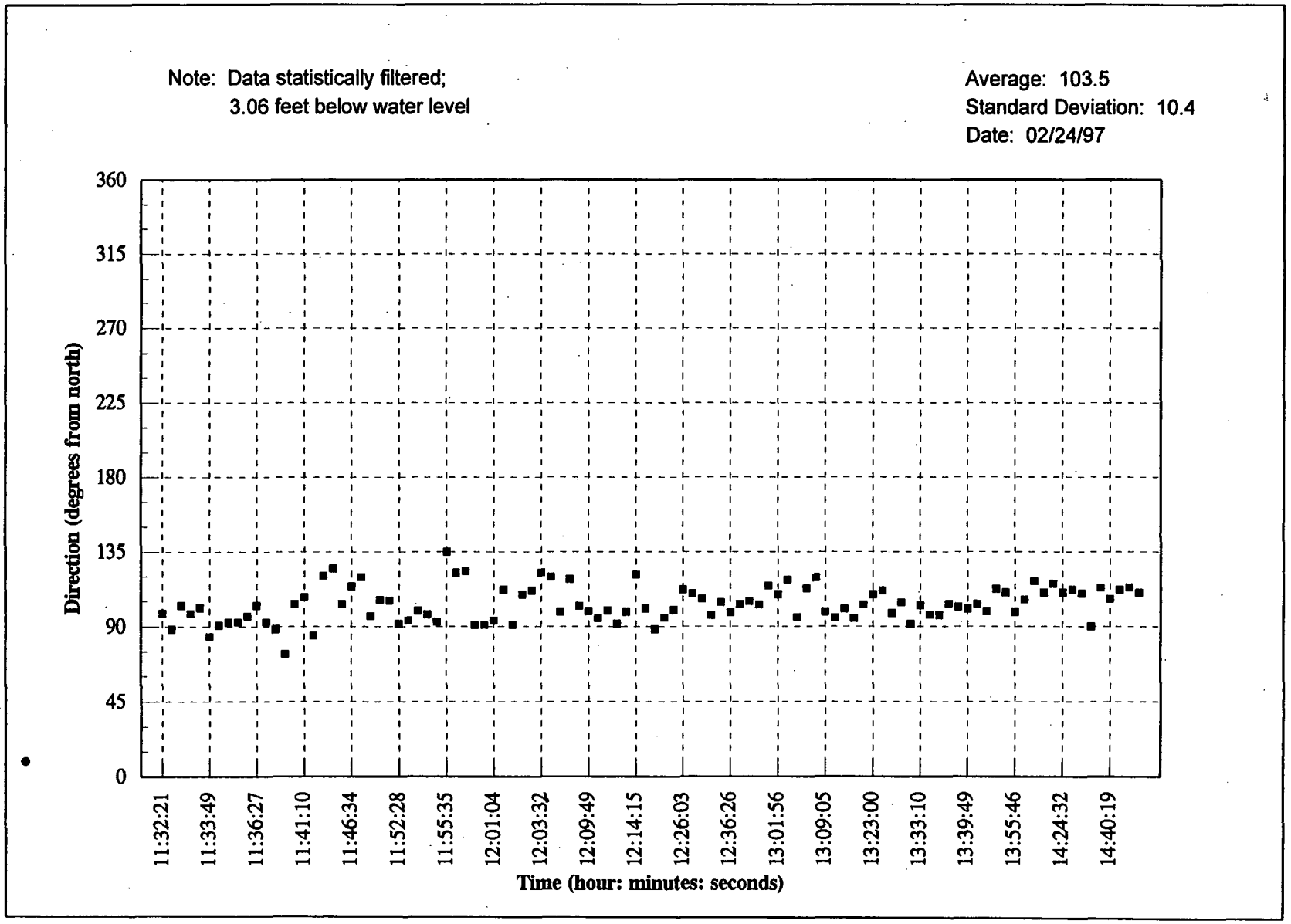


FIGURE A.3-34. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 2898 USING COLLOIDAL BORESCOPE

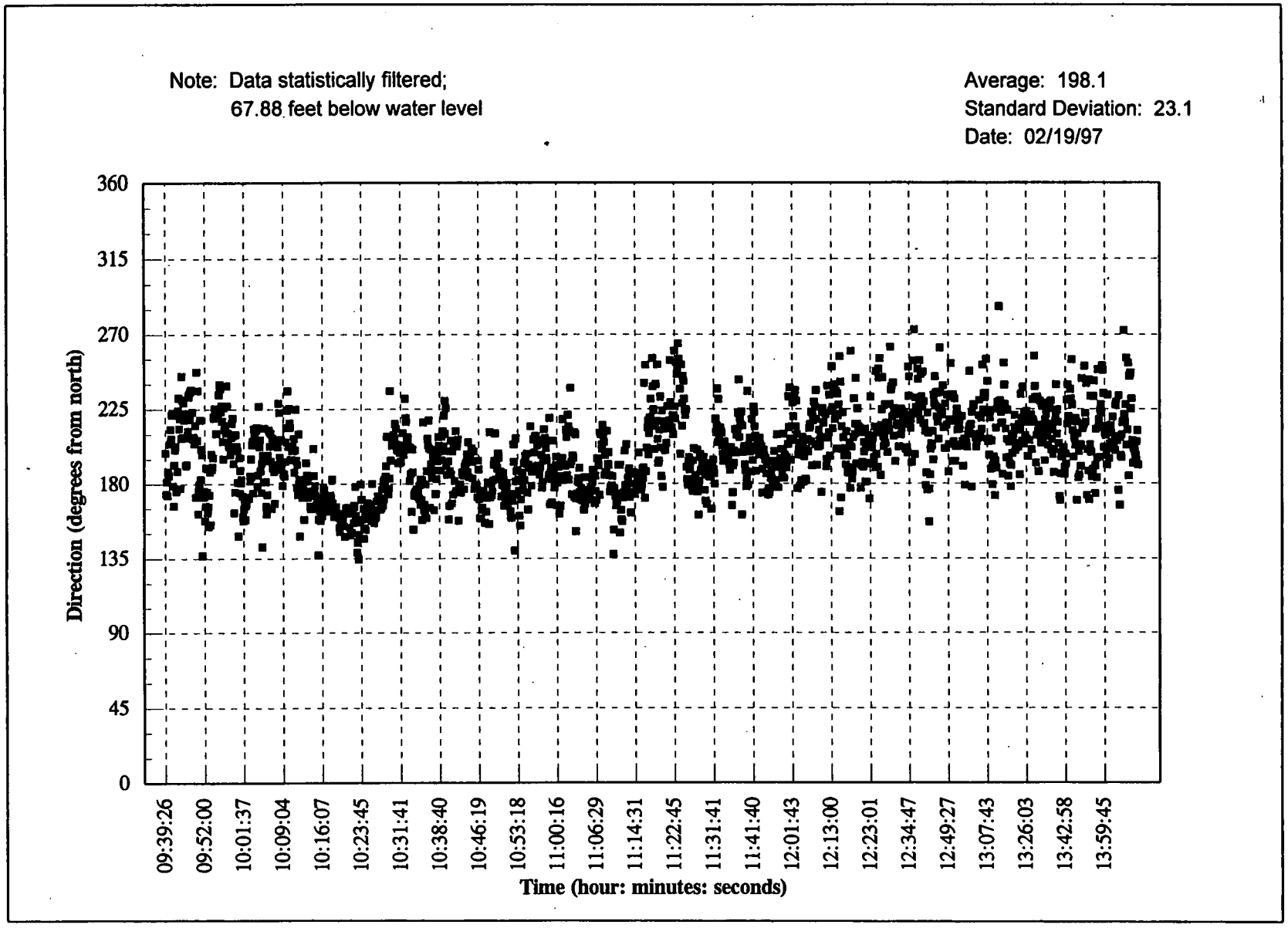


FIGURE A.3-35. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 3898 USING COLLOIDAL BORESCOPE

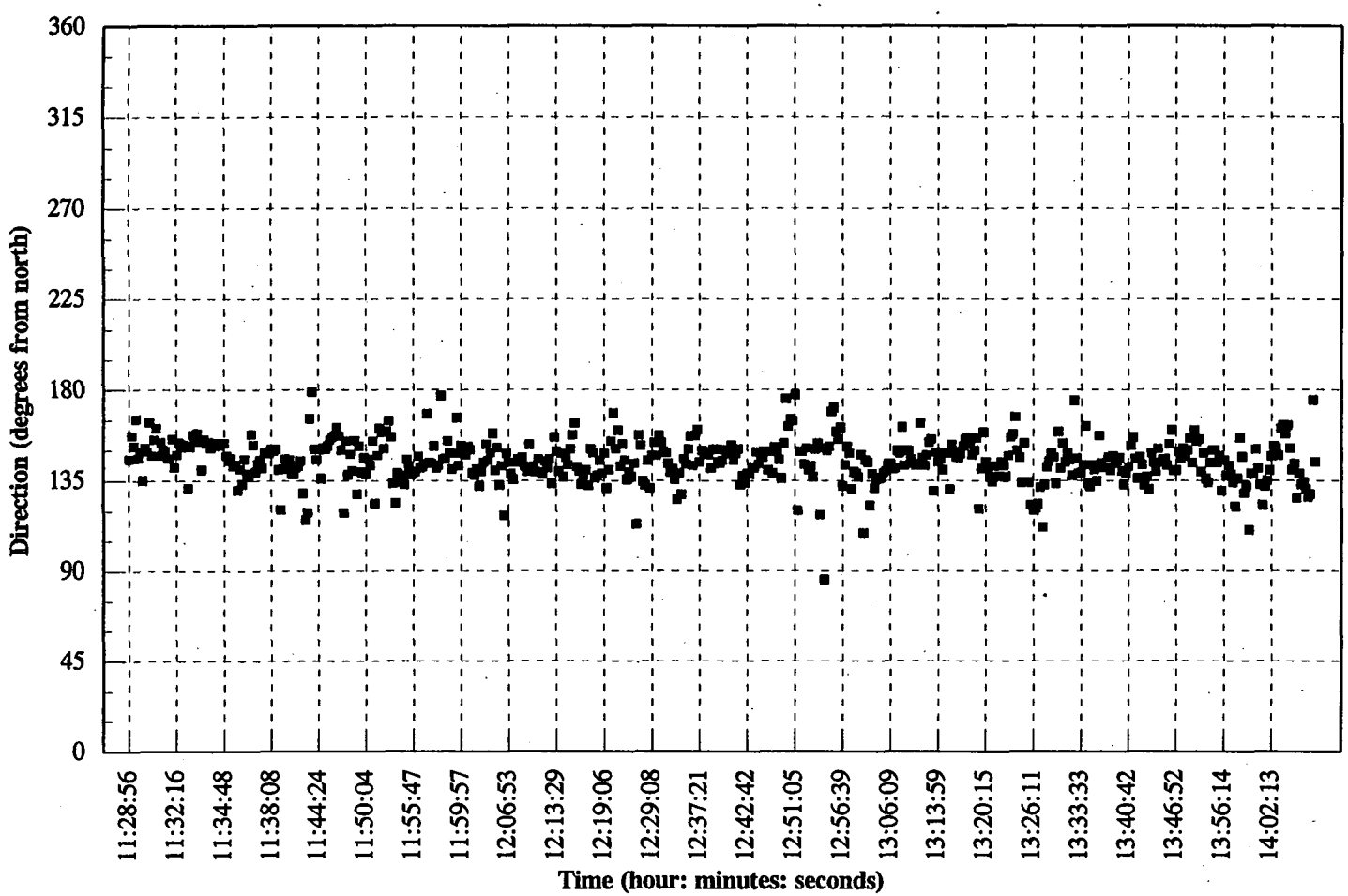


FIGURE A.3-36. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 2899 USING COLLOIDAL BORESCOPE

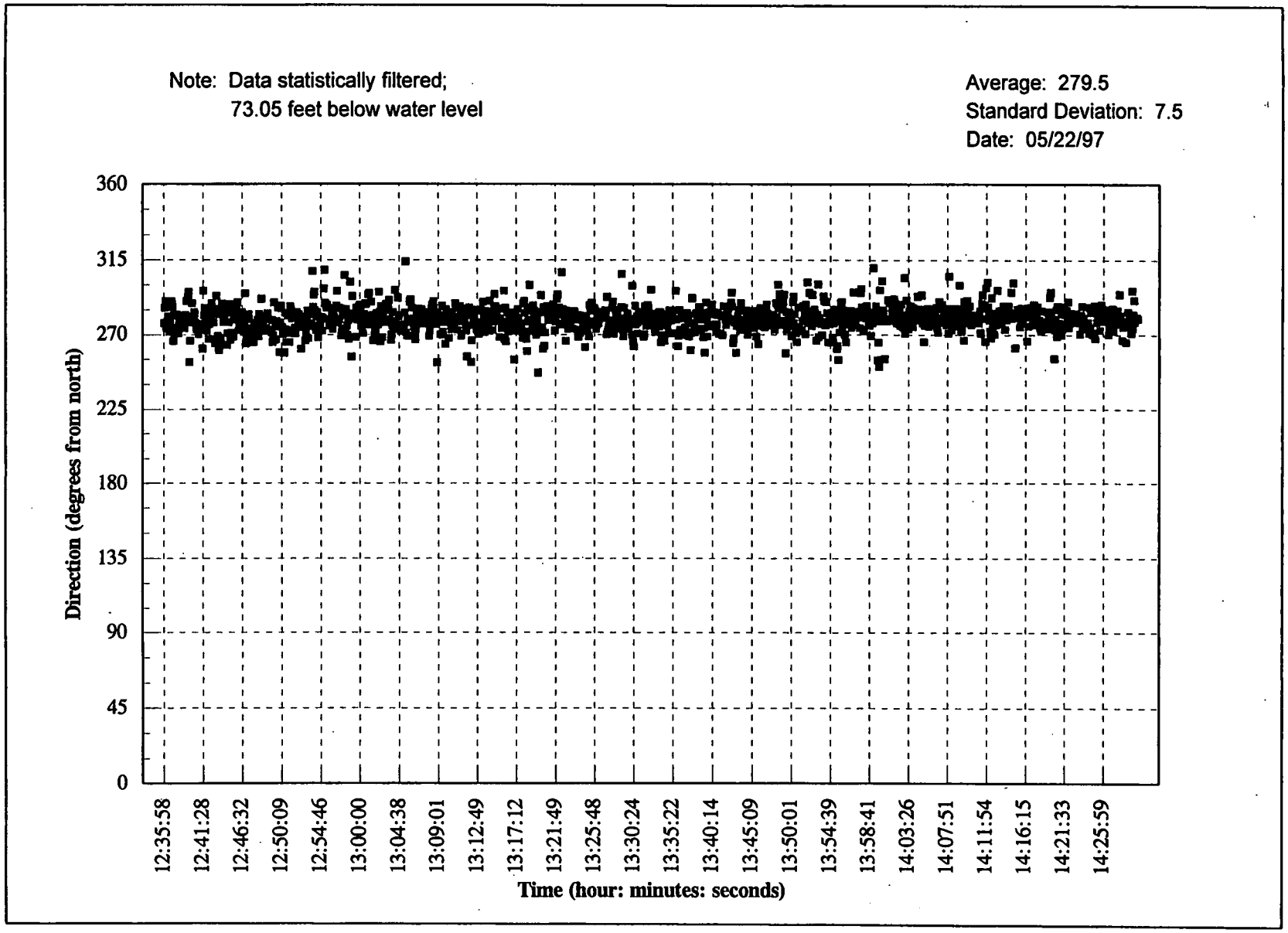


FIGURE A.3-37. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 3899 USING COLLOIDAL BORESCOPE

000357

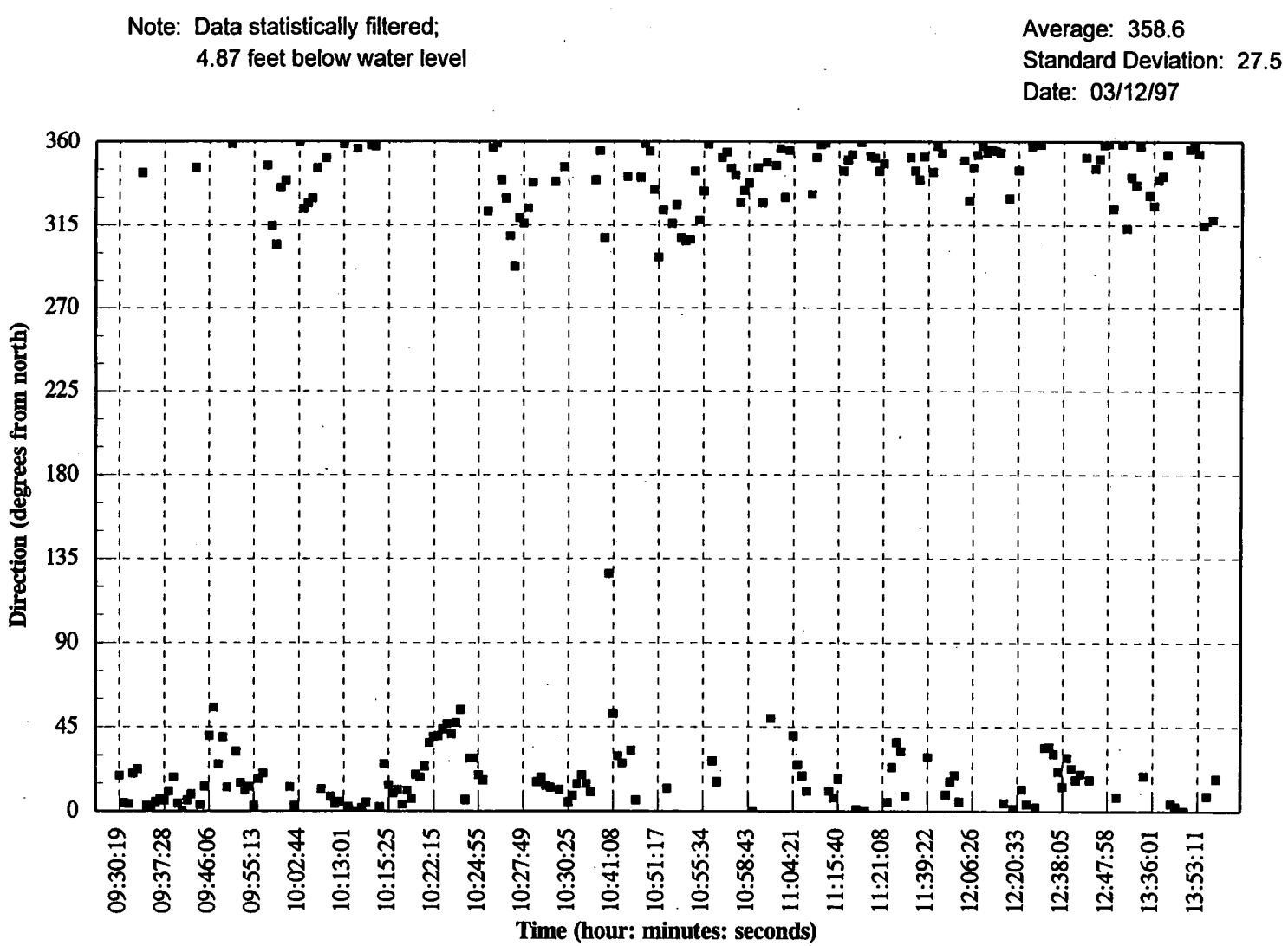


FIGURE A.3-38. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 2900 USING COLLOIDAL BORESCOPE

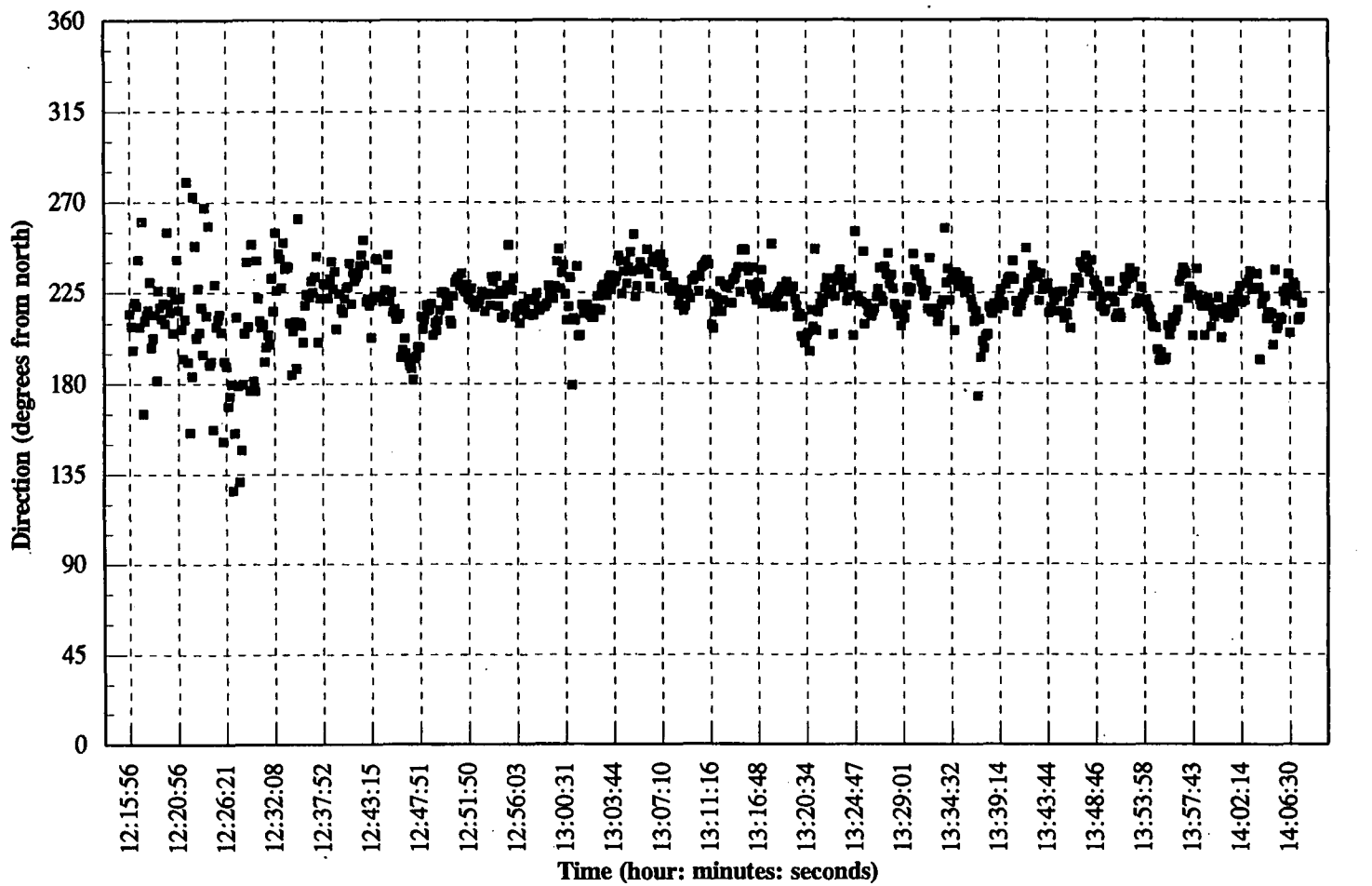


FIGURE A.3-39. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 3900 USING COLLOIDAL BORESCOPE

000359

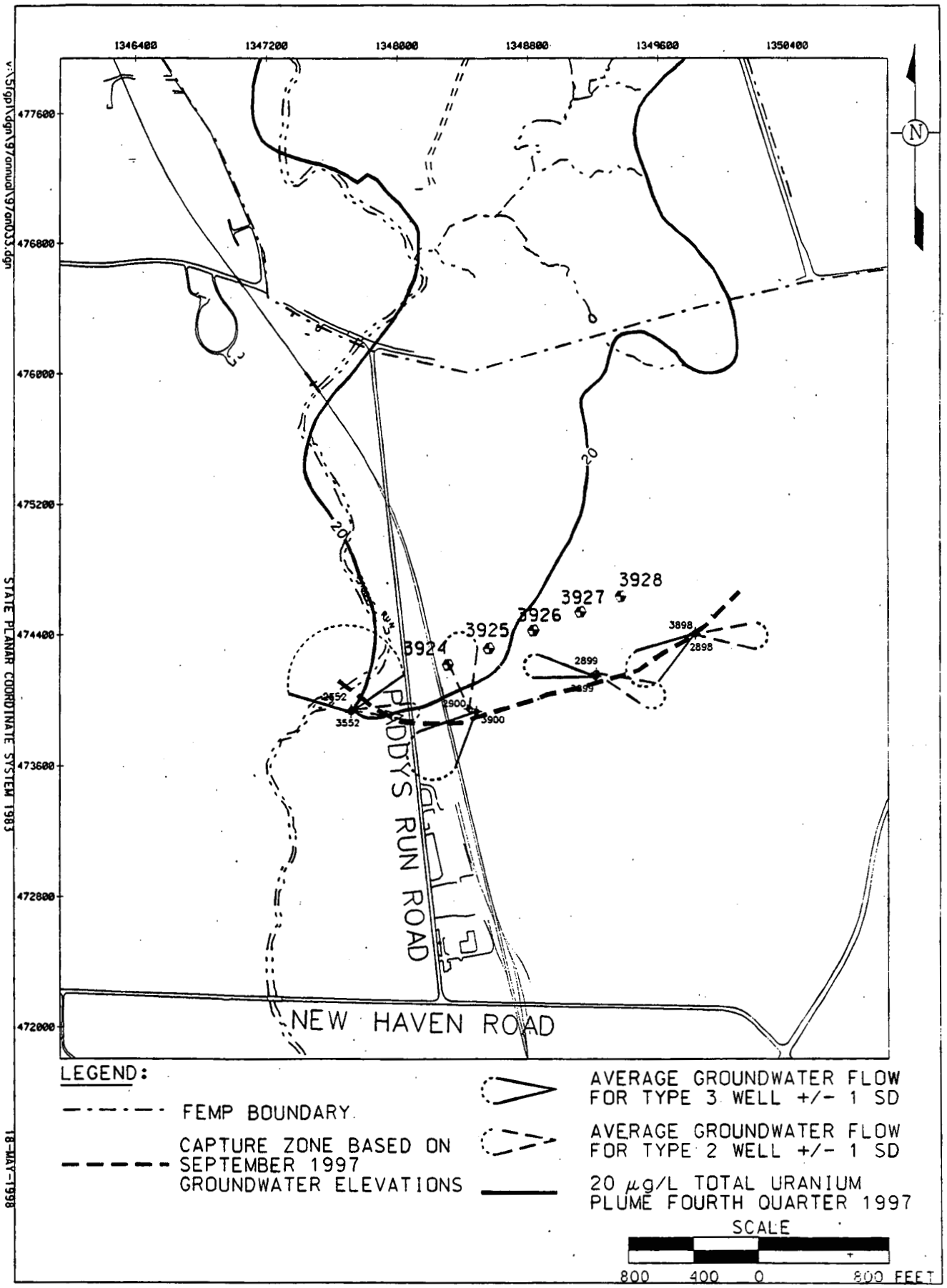


FIGURE A.3-40. HYDRAULIC CAPTURE ZONE AND COLLOIDAL BORESCOPE FLOW VECTORS FOR THE SOUTH PLUME MODULE, THIRD QUARTER 1997

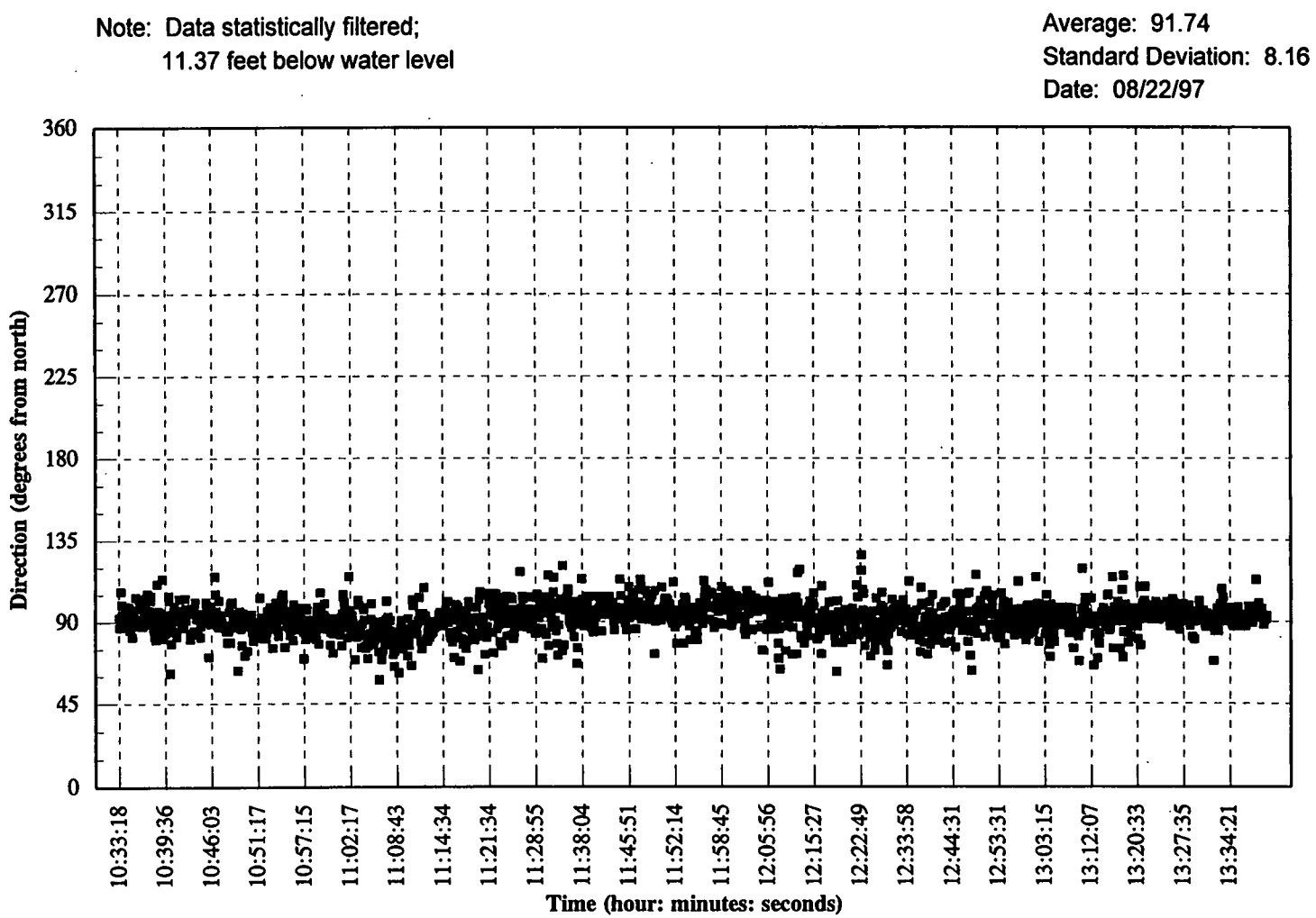


FIGURE A.3-41. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 2552 USING COLLOIDAL BORESCOPE

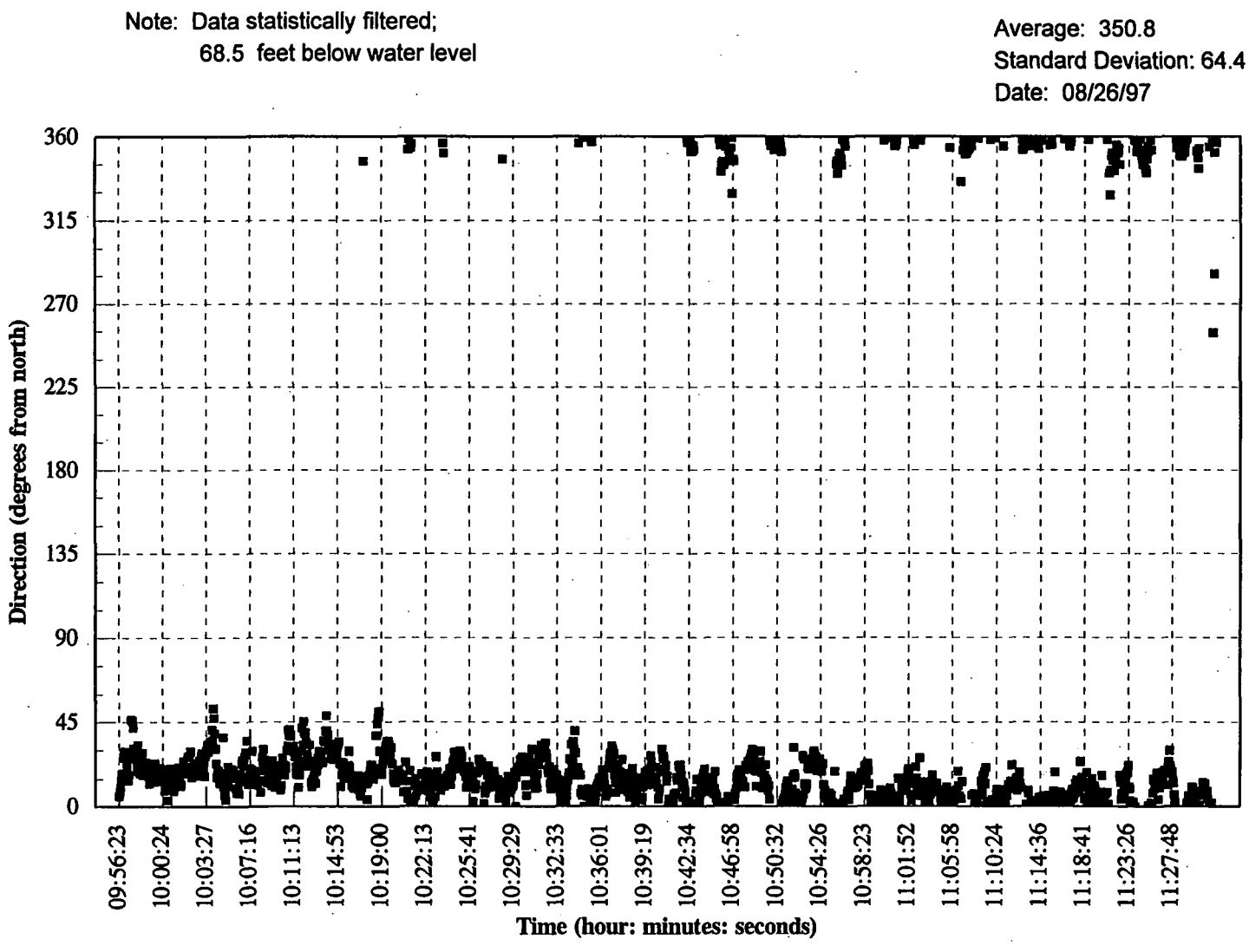


FIGURE A.3-42. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 3552 USING COLLOIDAL BORESCOPE

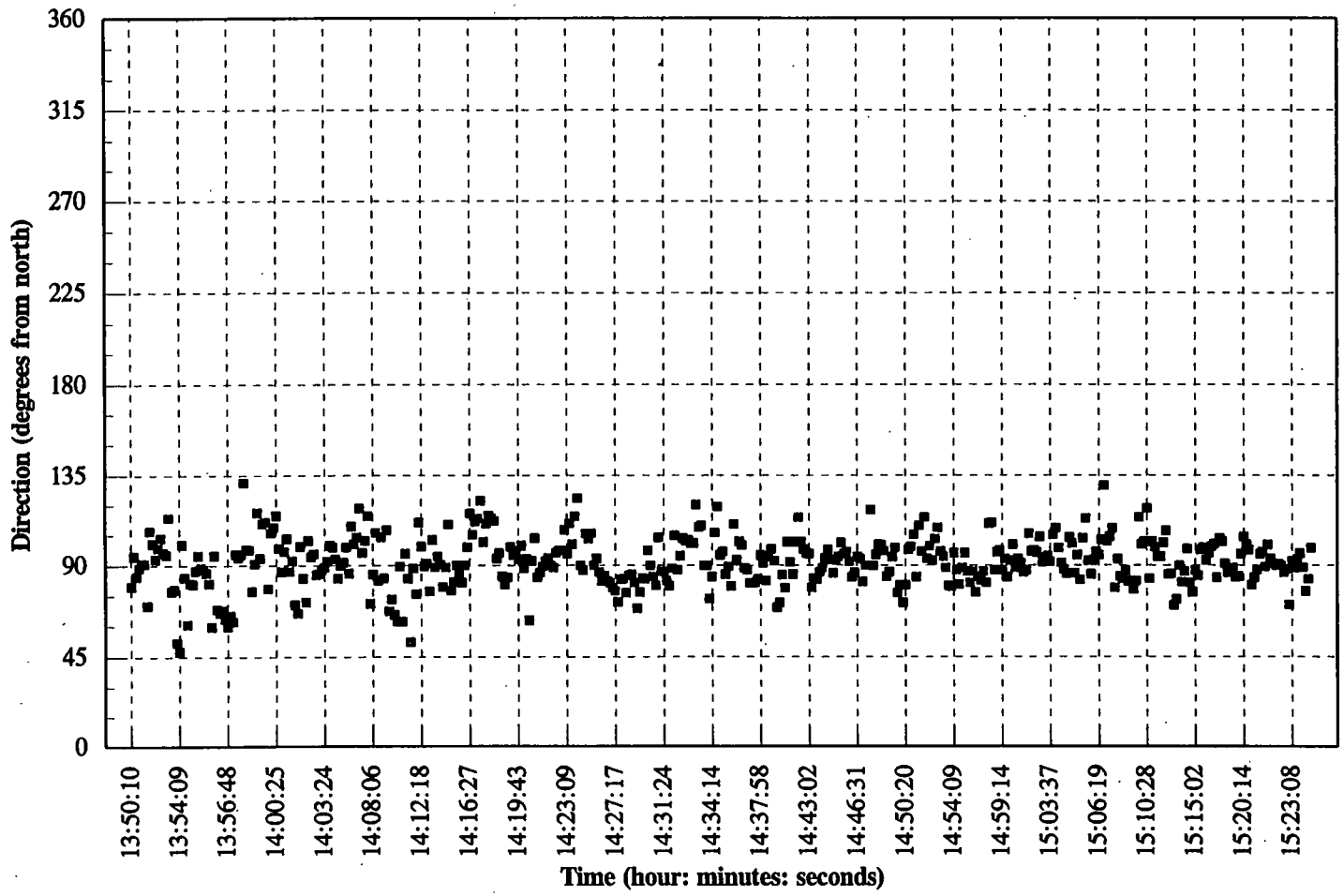


FIGURE A.3-43. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 2898 USING COLLOIDAL BORESCOPE

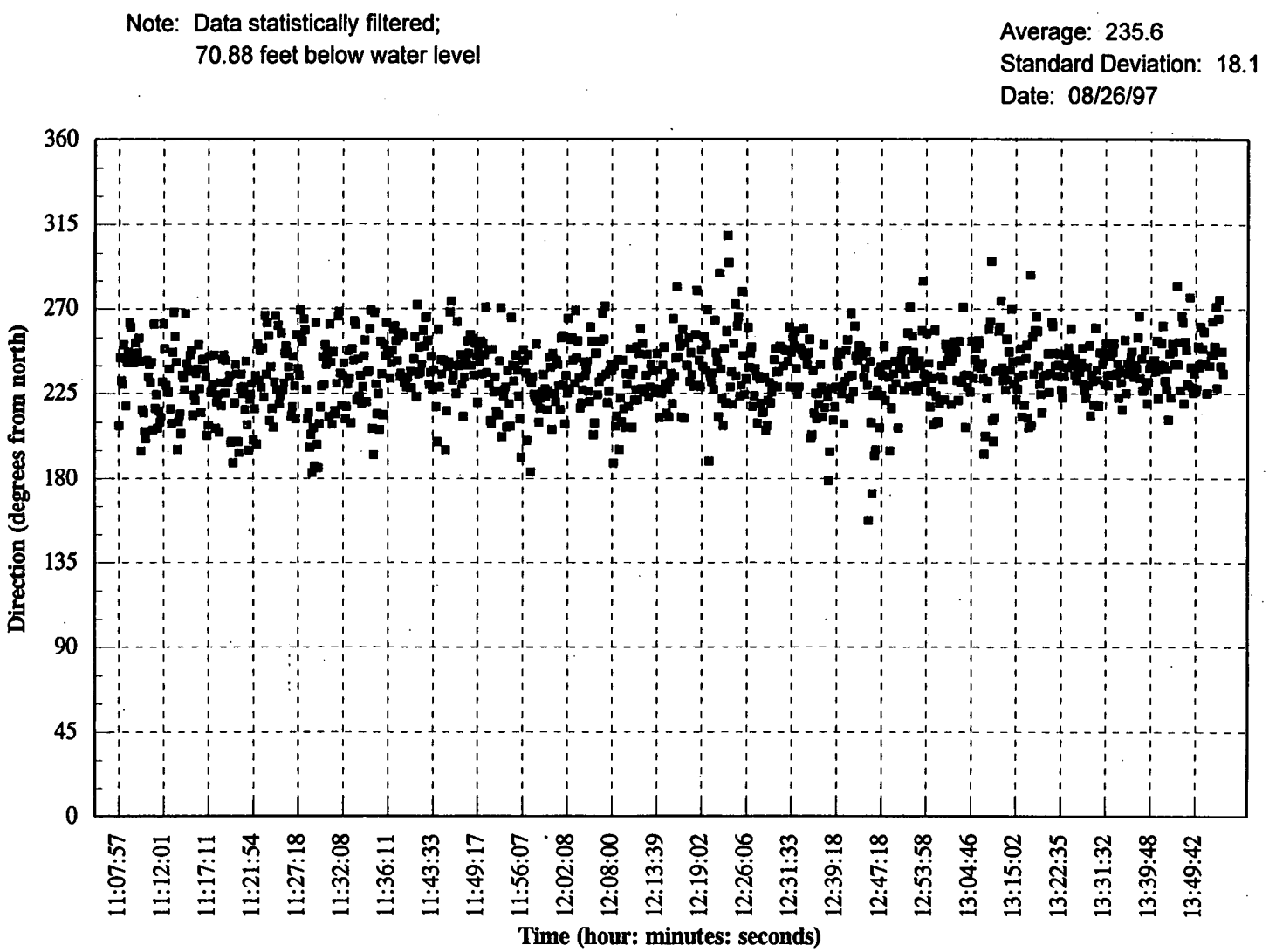


FIGURE A.3-44. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 3898 USING COLLOIDAL BORESCOPE

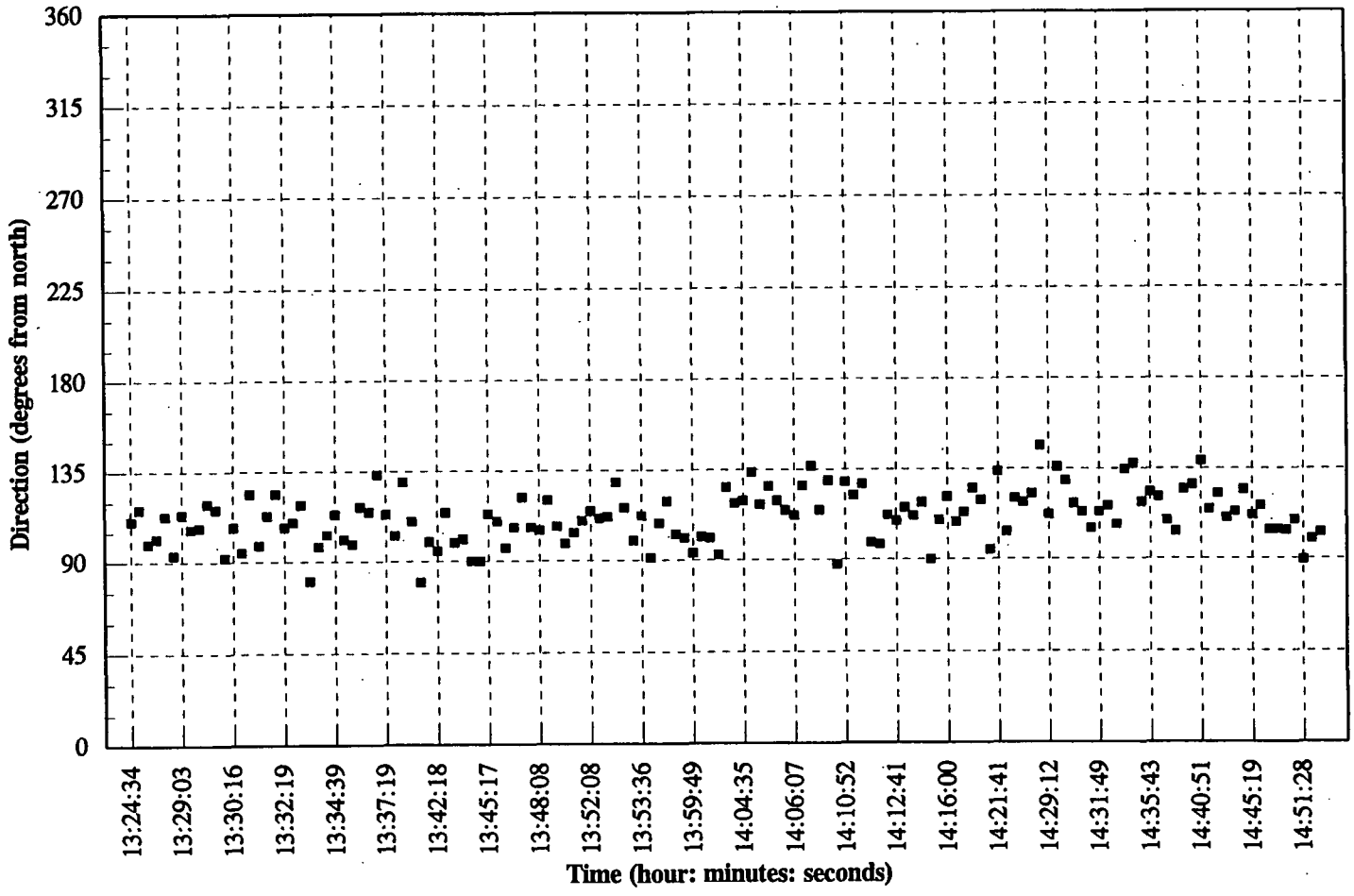


FIGURE A.3-45. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 2899 USING COLLOIDAL BORESCOPE

000365

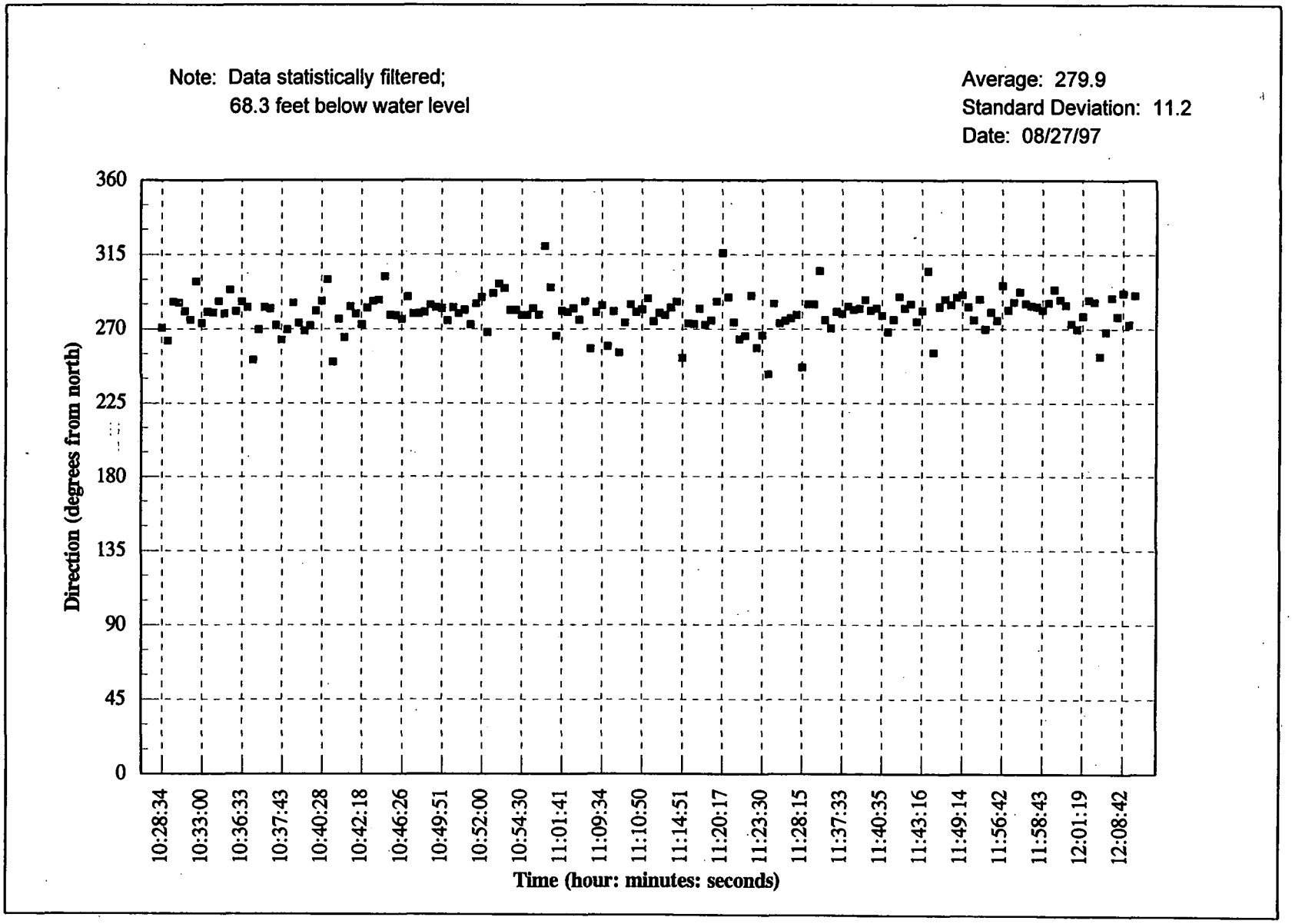


FIGURE A.3-46. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 3899 USING COLLOIDAL BORESCOPE

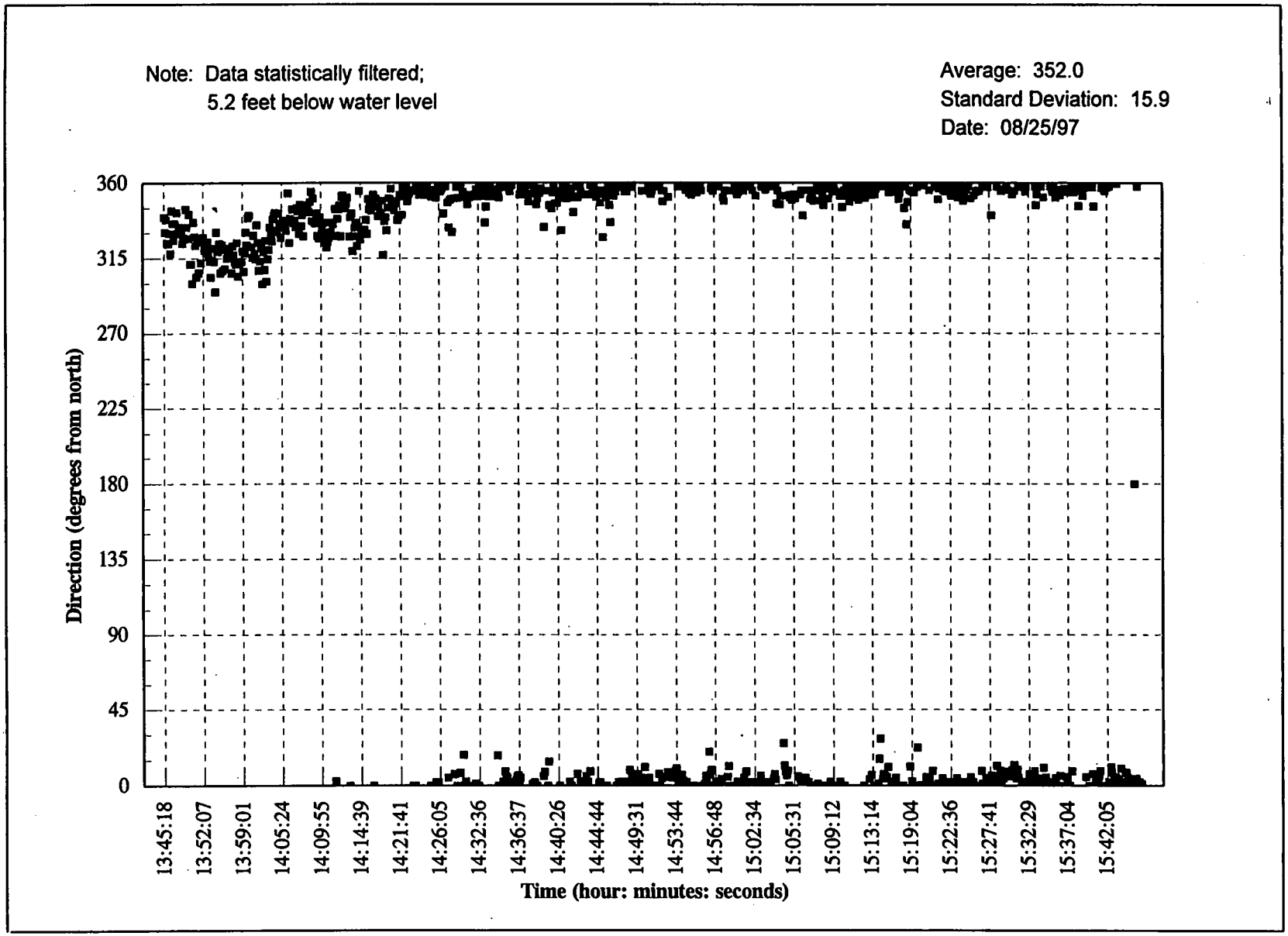


FIGURE A.3-47. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 2900 USING COLLOIDAL BORESCOPE

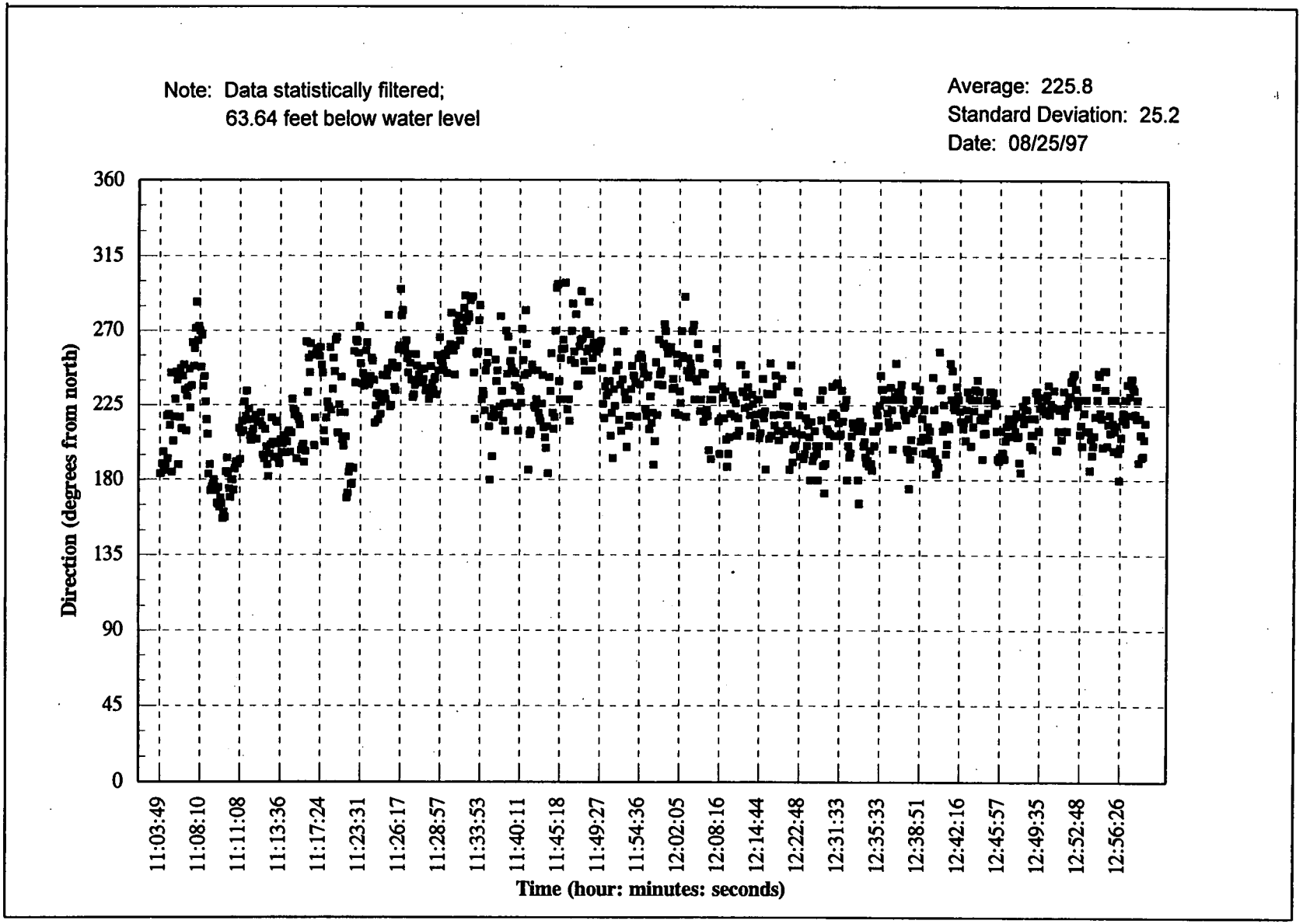


FIGURE A.3-48. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 3900 USING COLLOIDAL BORESCOPE

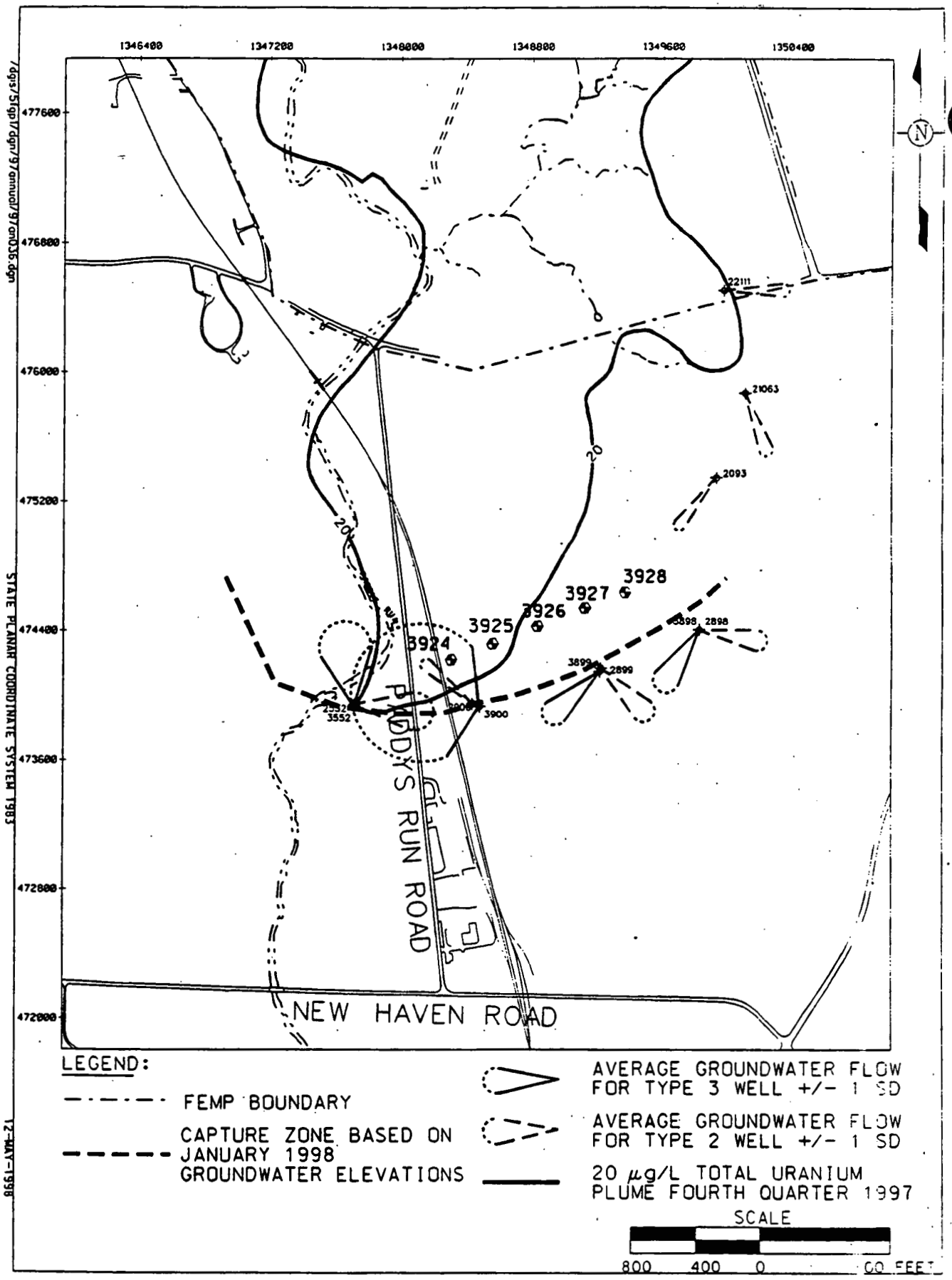


FIGURE A.3-49. HYDRAULIC CAPTURE ZONE AND COLLOIDAL BORESCOPE FLOW VECTORS FOR THE SOUTH PLUME MODULE, FOURTH QUARTER 1997

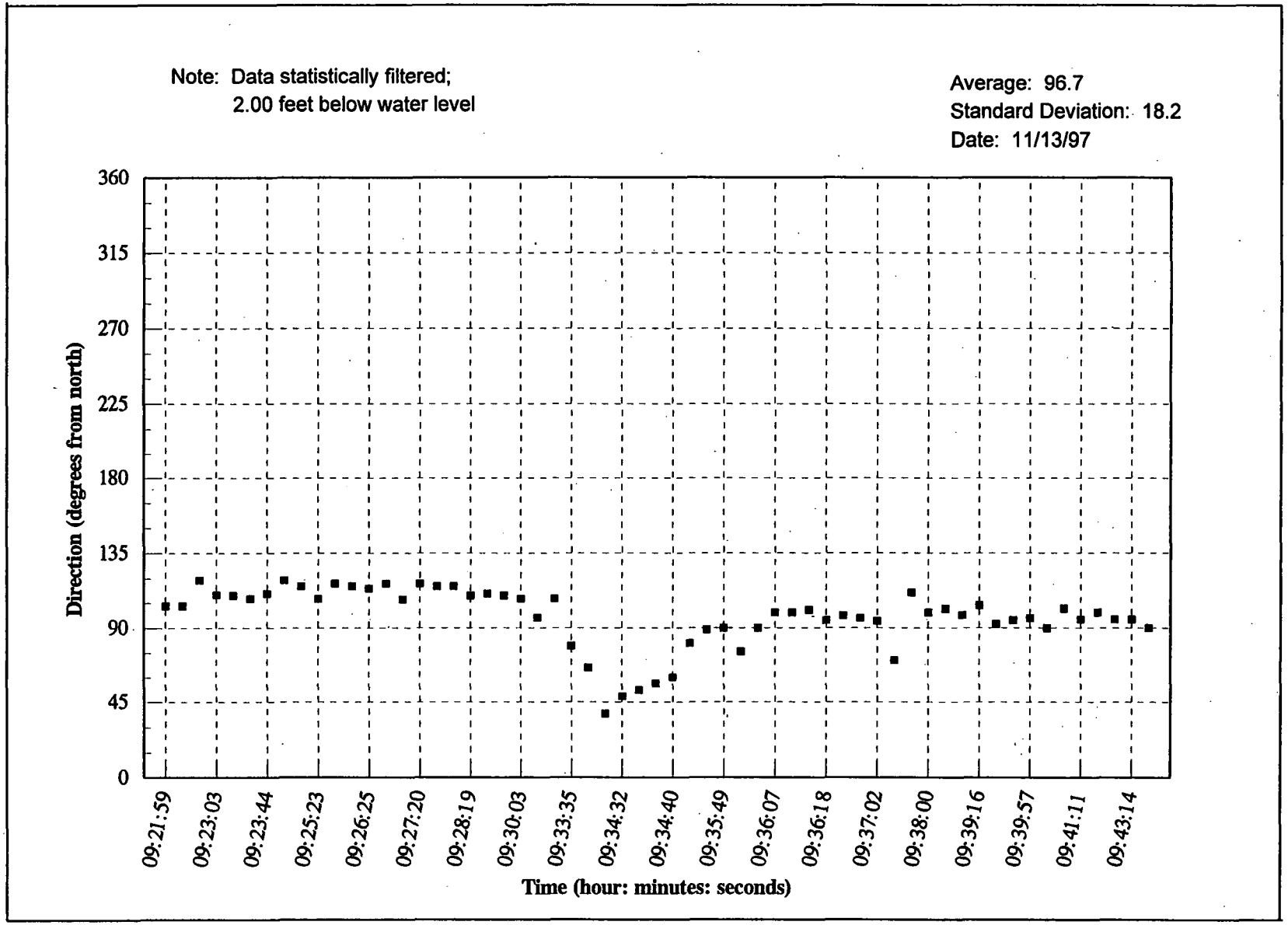


FIGURE A.3-50. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 2552 USING COLLOIDAL BORESCOPE

Note: Data statistically filtered;
67.49 feet below water level

Average: 351.9
Standard Deviation: 25.1
Date: 11/13/97

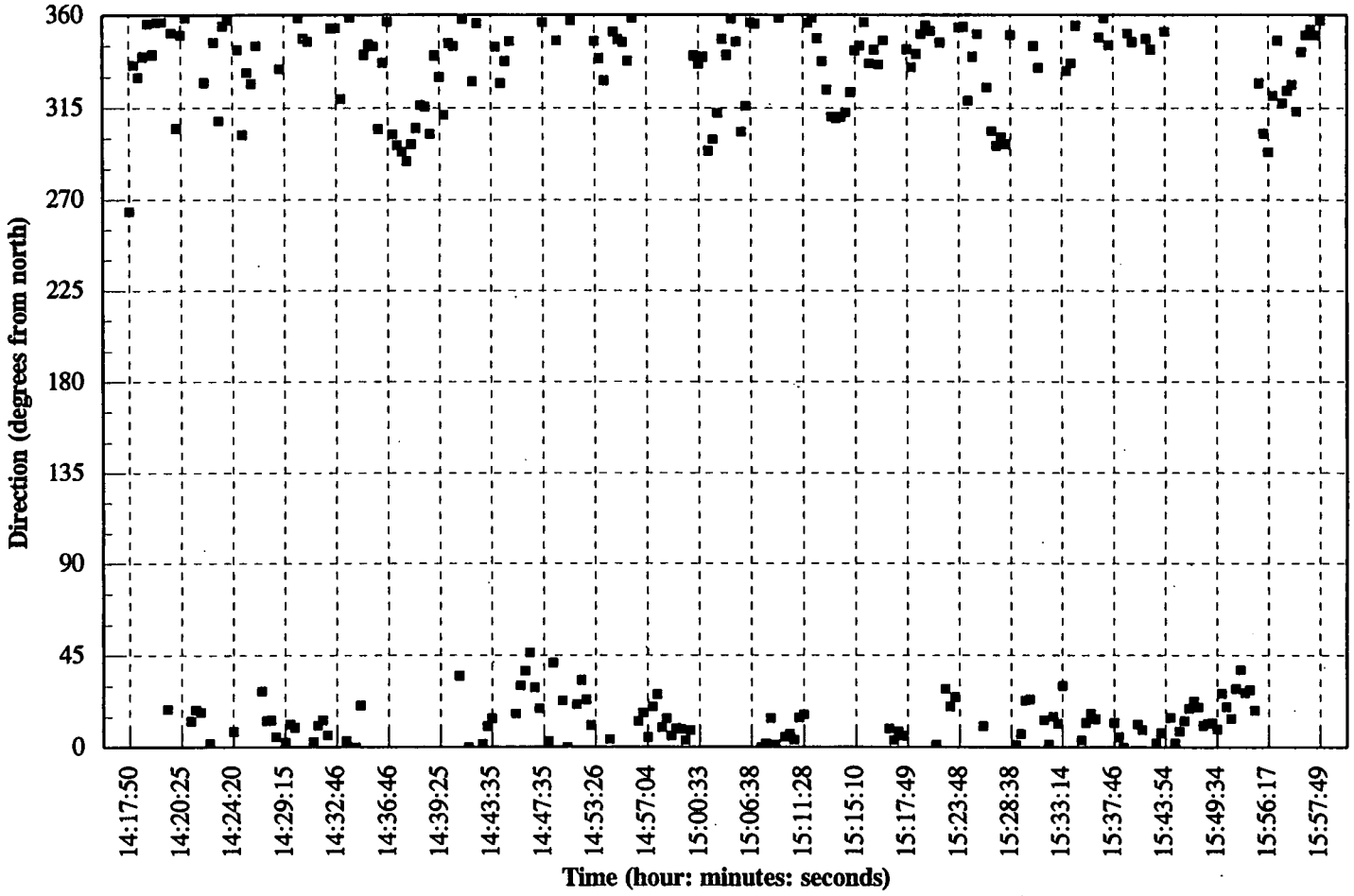


FIGURE A.3-51. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 3552 USING COLLOIDAL BORESCOPE

000371

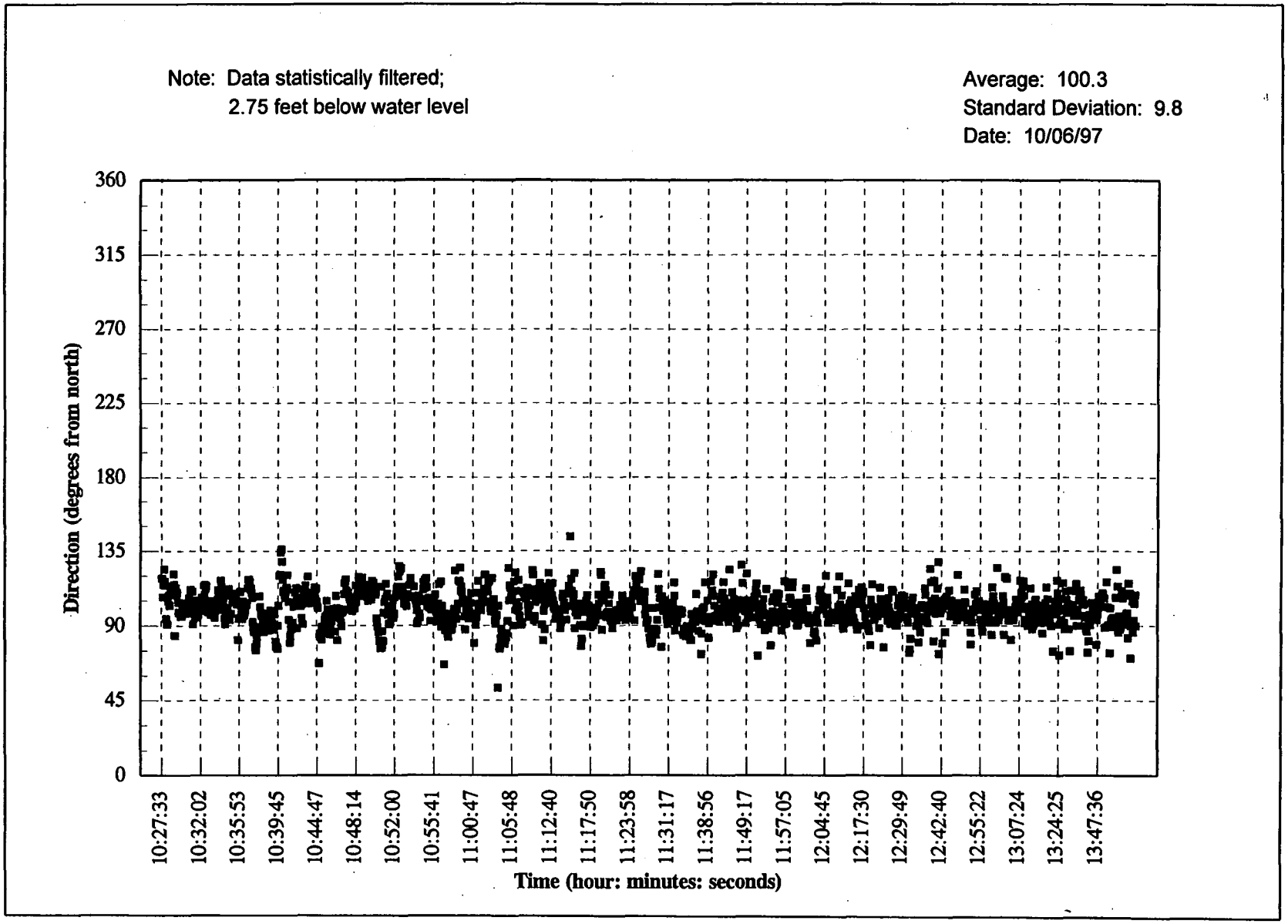


FIGURE A.3-52. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 2898 USING COLLOIDAL BORESCOPE

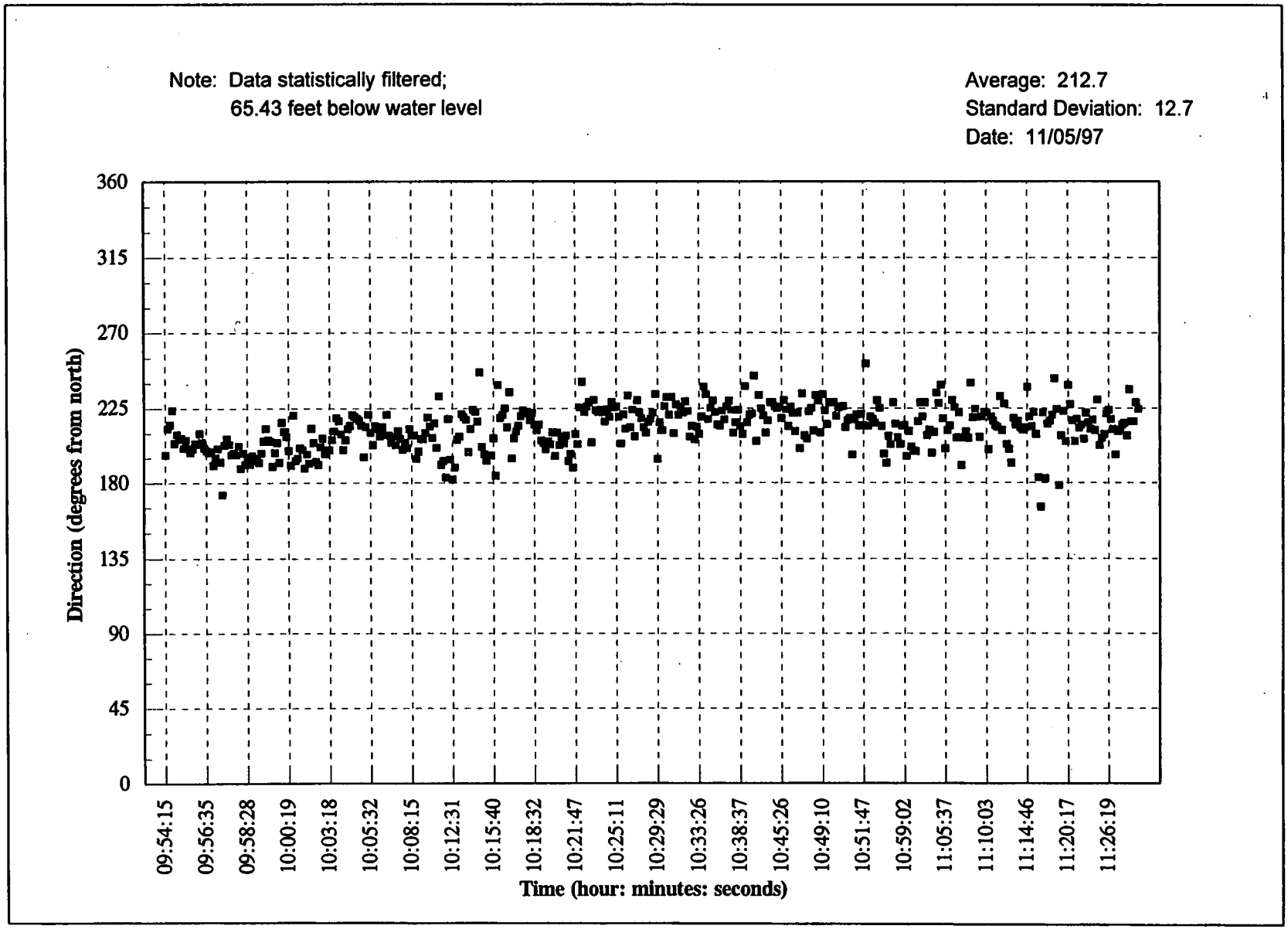


FIGURE A.3-53. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 3898 USING COLLOIDAL BORESCOPE

000373

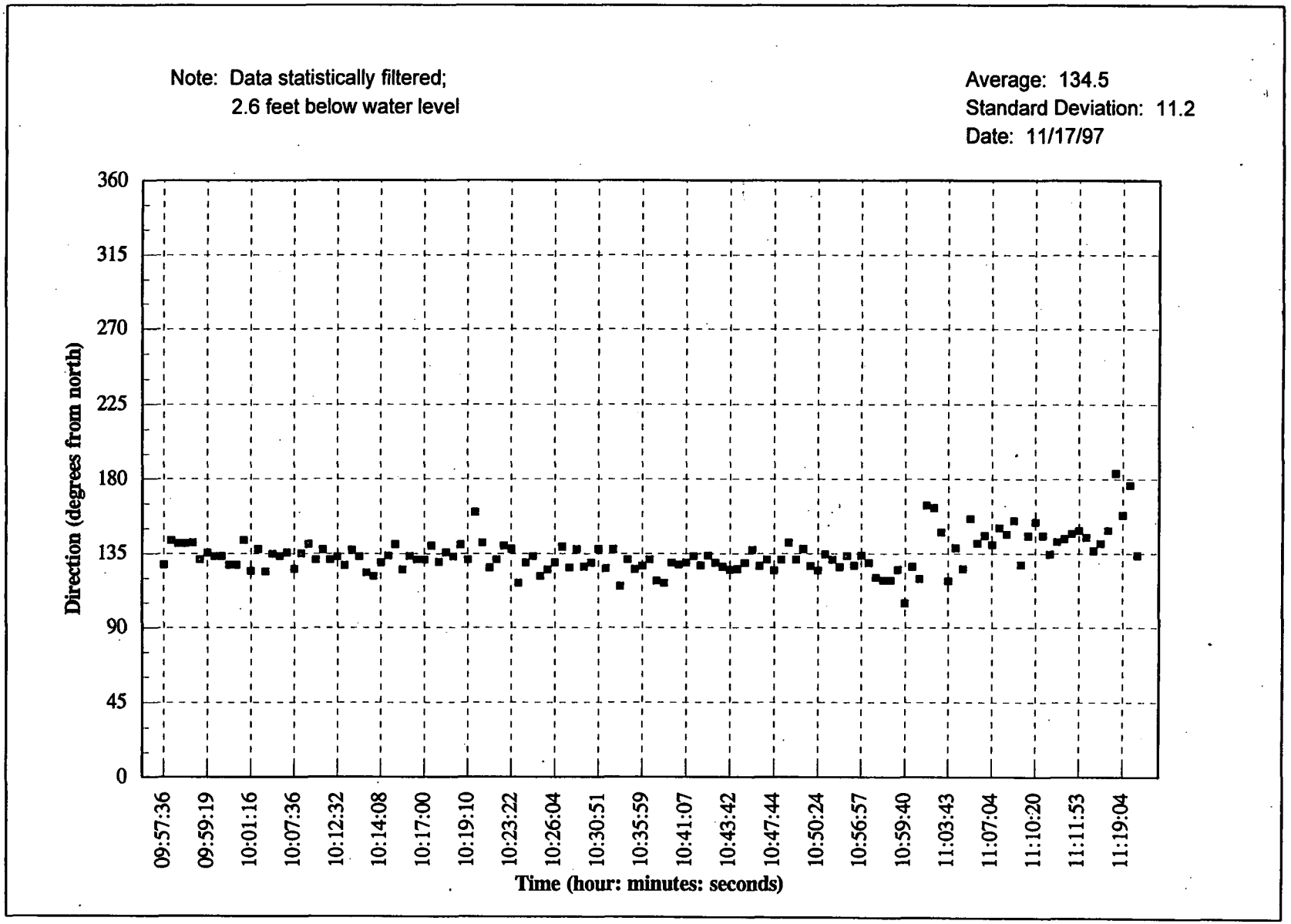


FIGURE A.3-54. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 2899 USING COLLOIDAL BORESCOPE

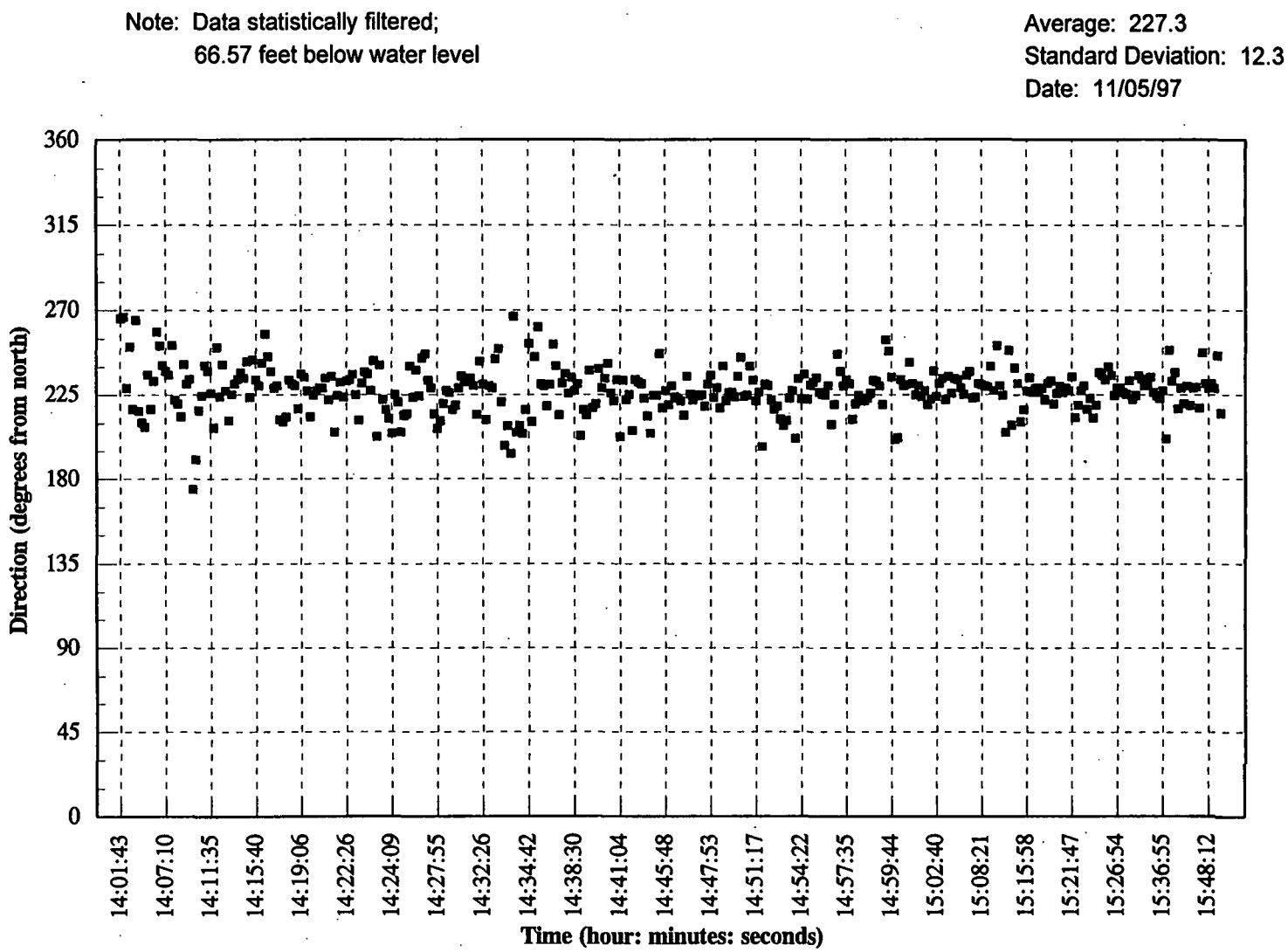


FIGURE A.3-55. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 3899 USING COLLOIDAL BORESCOPE

000375

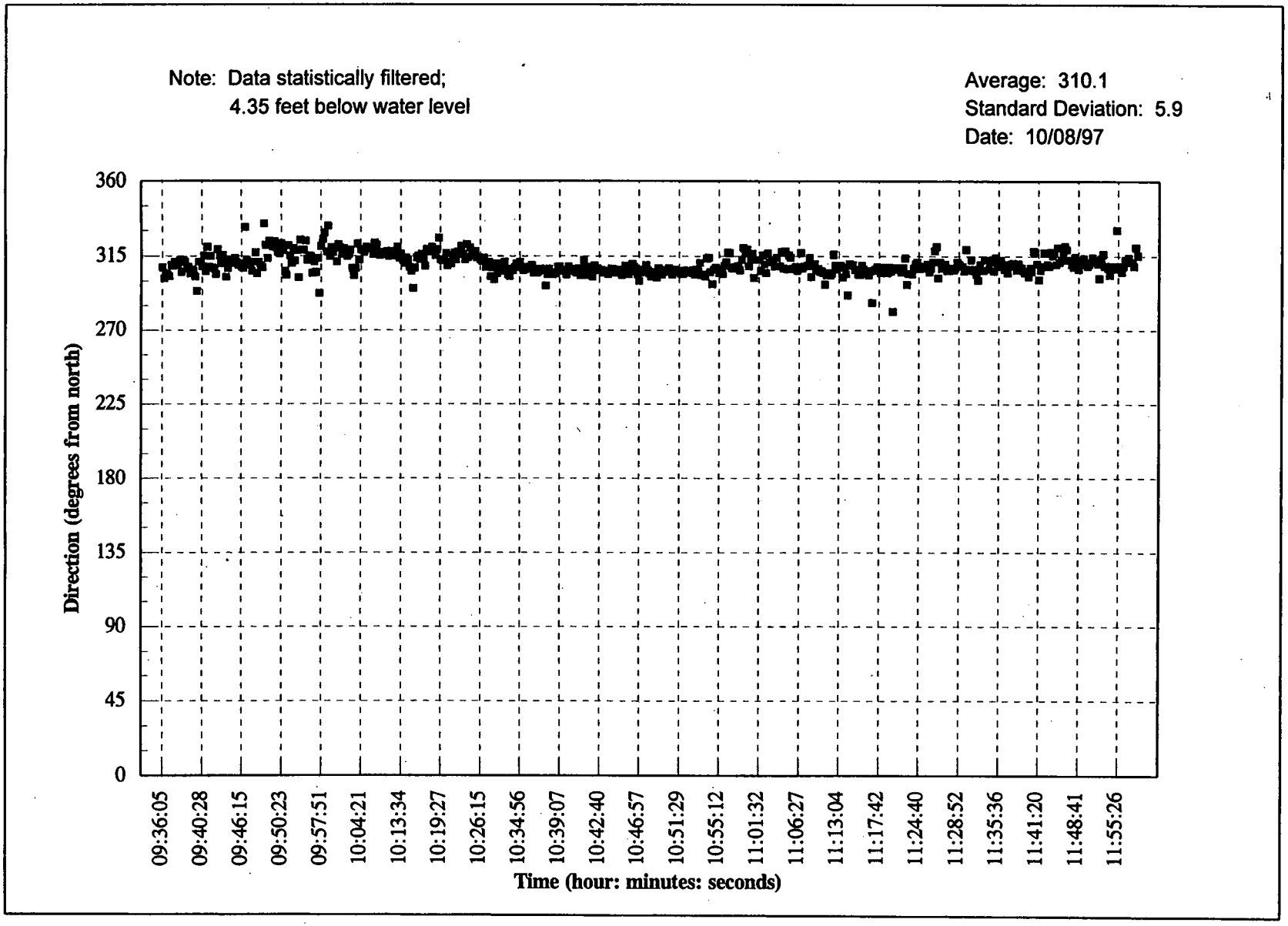


FIGURE A.3-56. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 2900 USING COLLOIDAL BORESCOPE

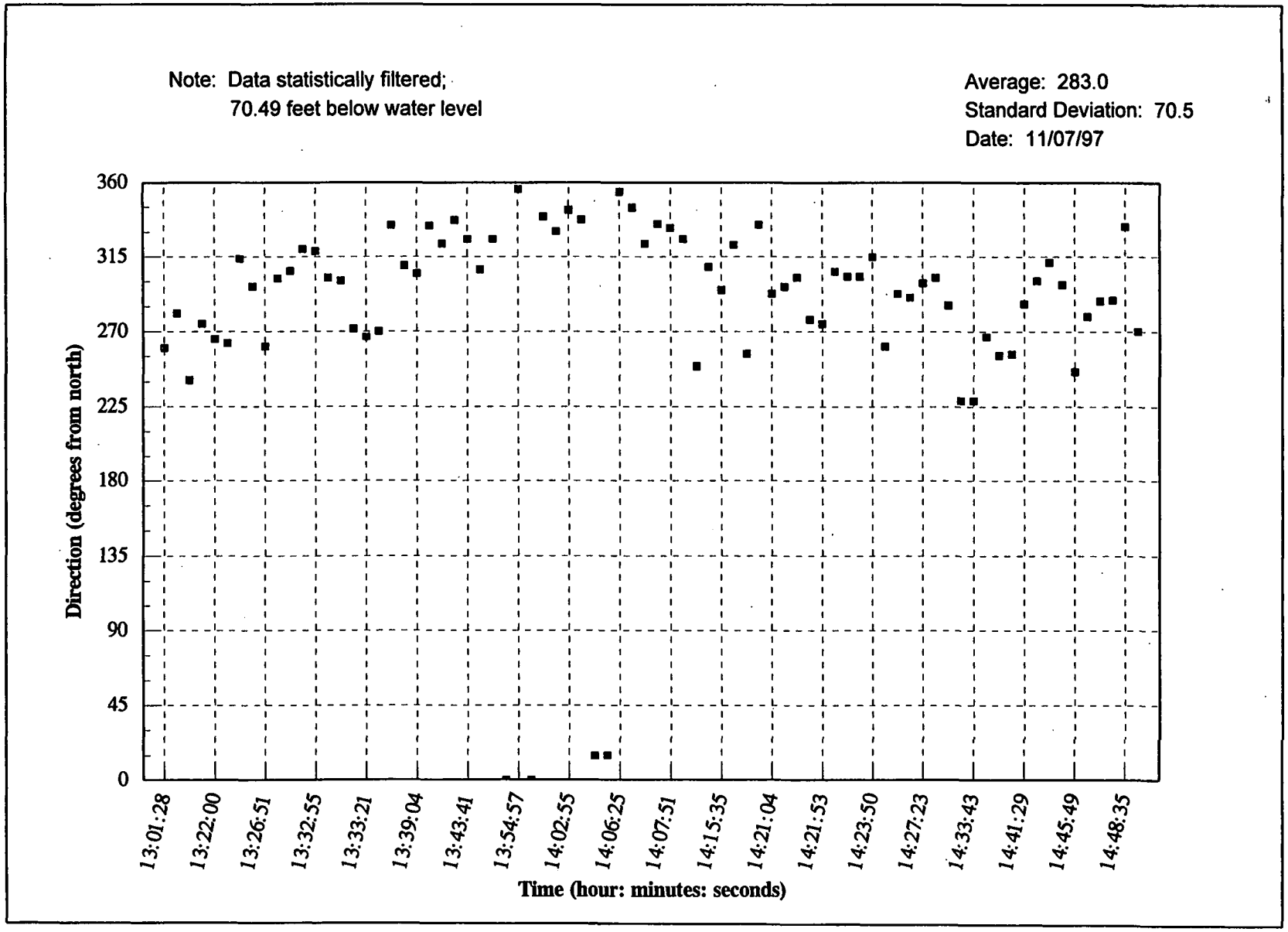


FIGURE A.3-57. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 3900 USING COLLOIDAL BORESCOPE

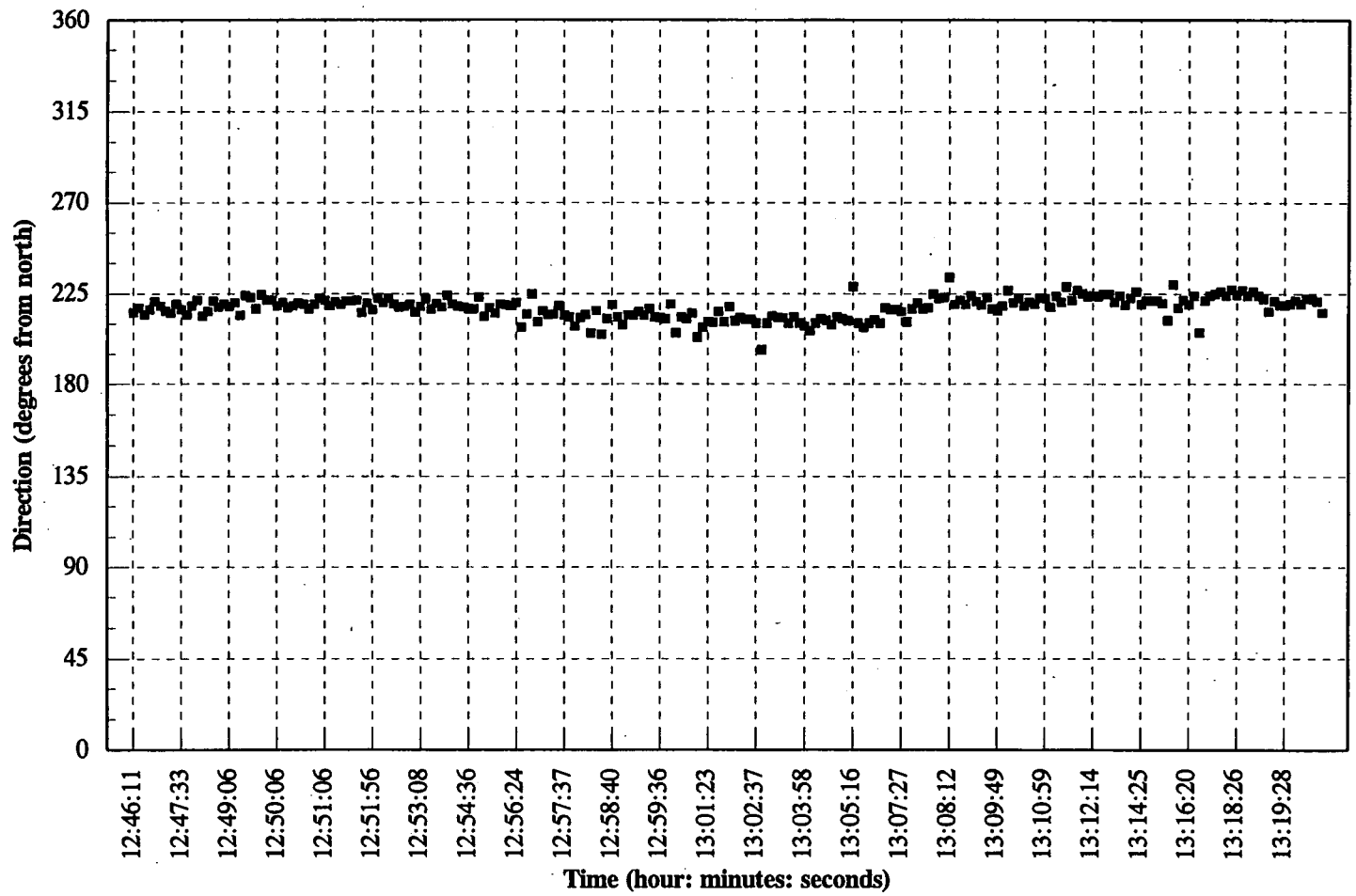


FIGURE A.3-58. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 2093 USING COLLOIDAL BORESCOPE

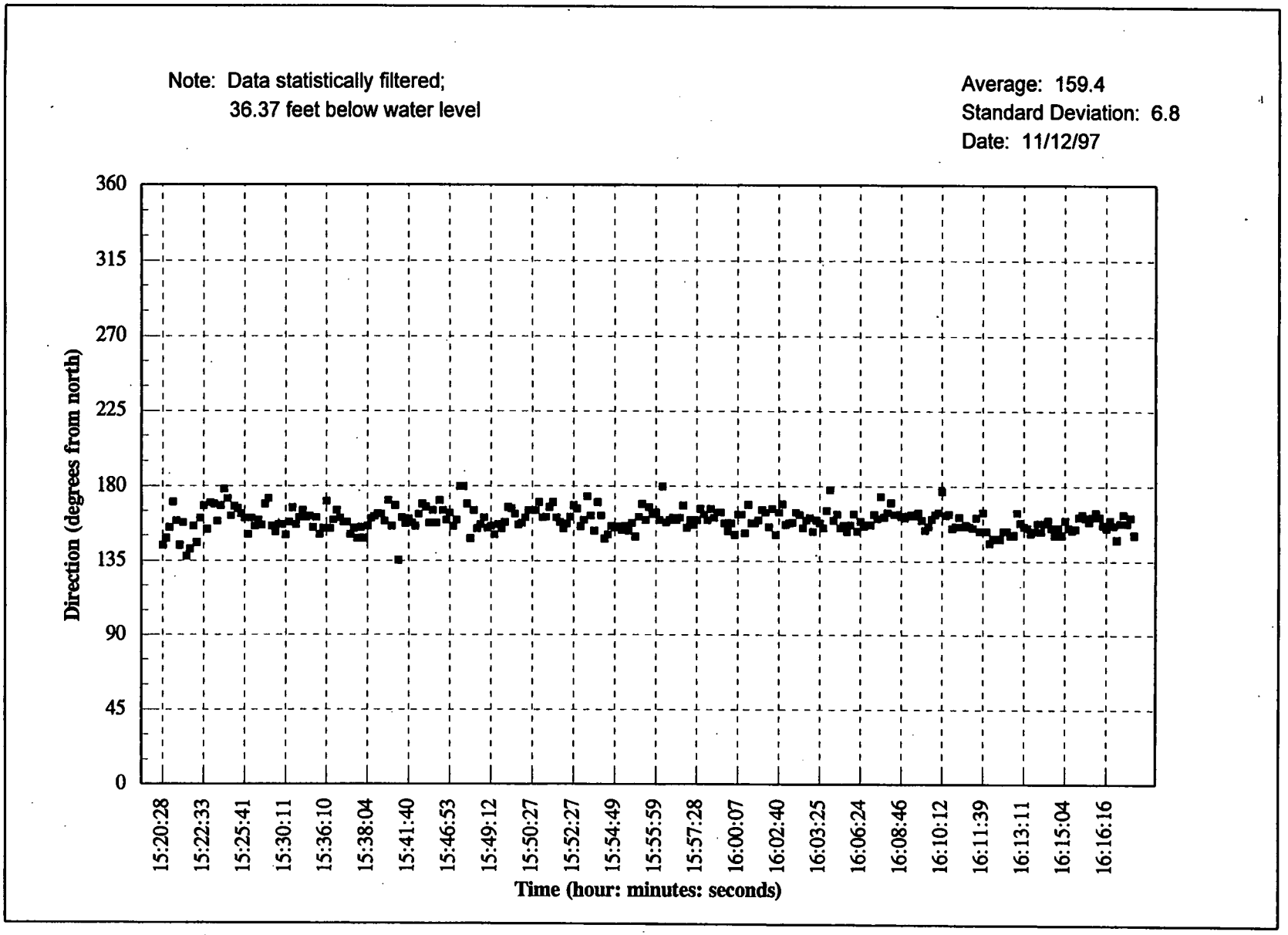


FIGURE A.3-59. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 21063 USING COLLOIDAL BORESCOPE

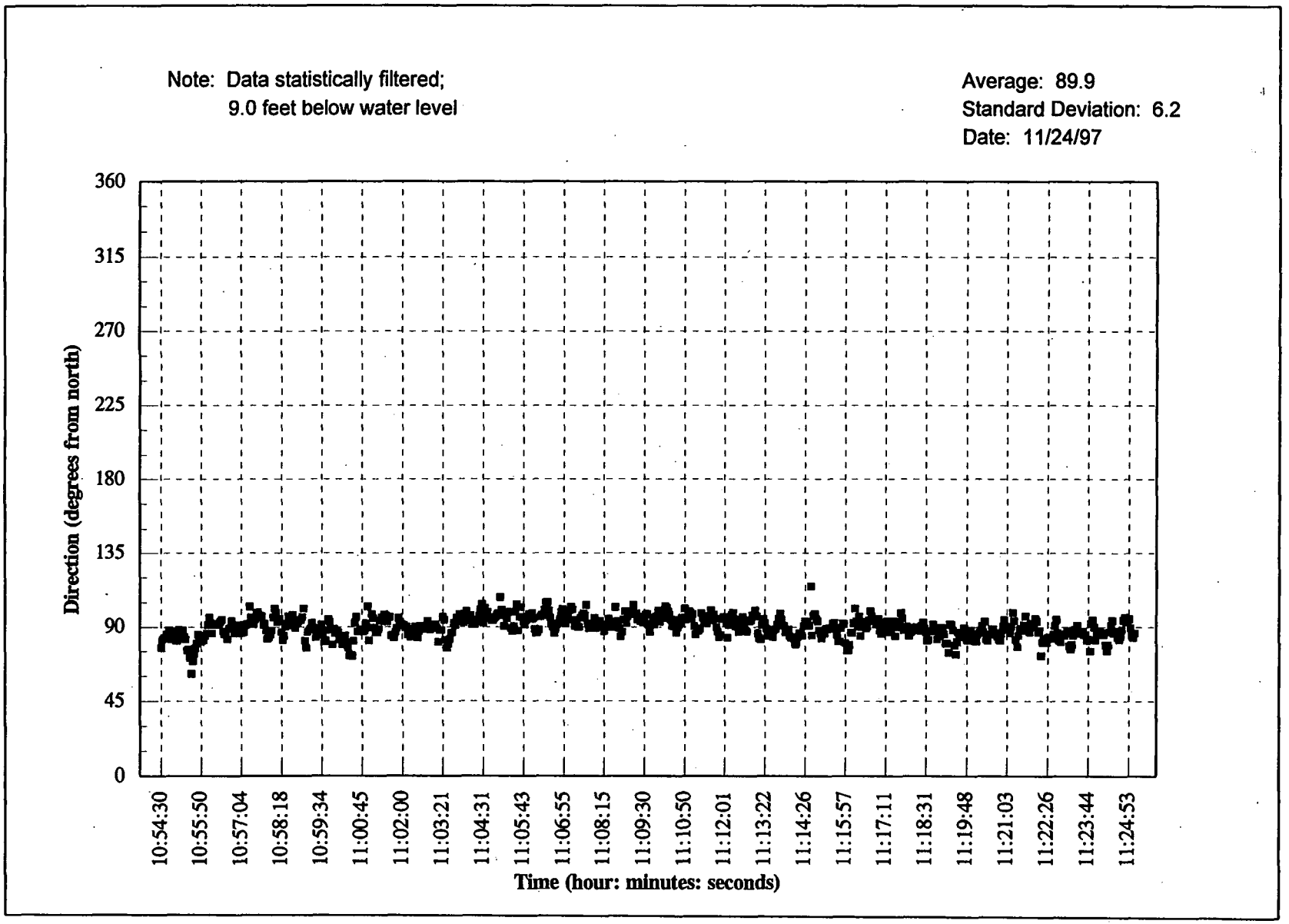


FIGURE A.3-60. GROUNDWATER FLOW DIRECTION IN MONITORING WELL 22111 USING COLLOIDAL BORESCOPE

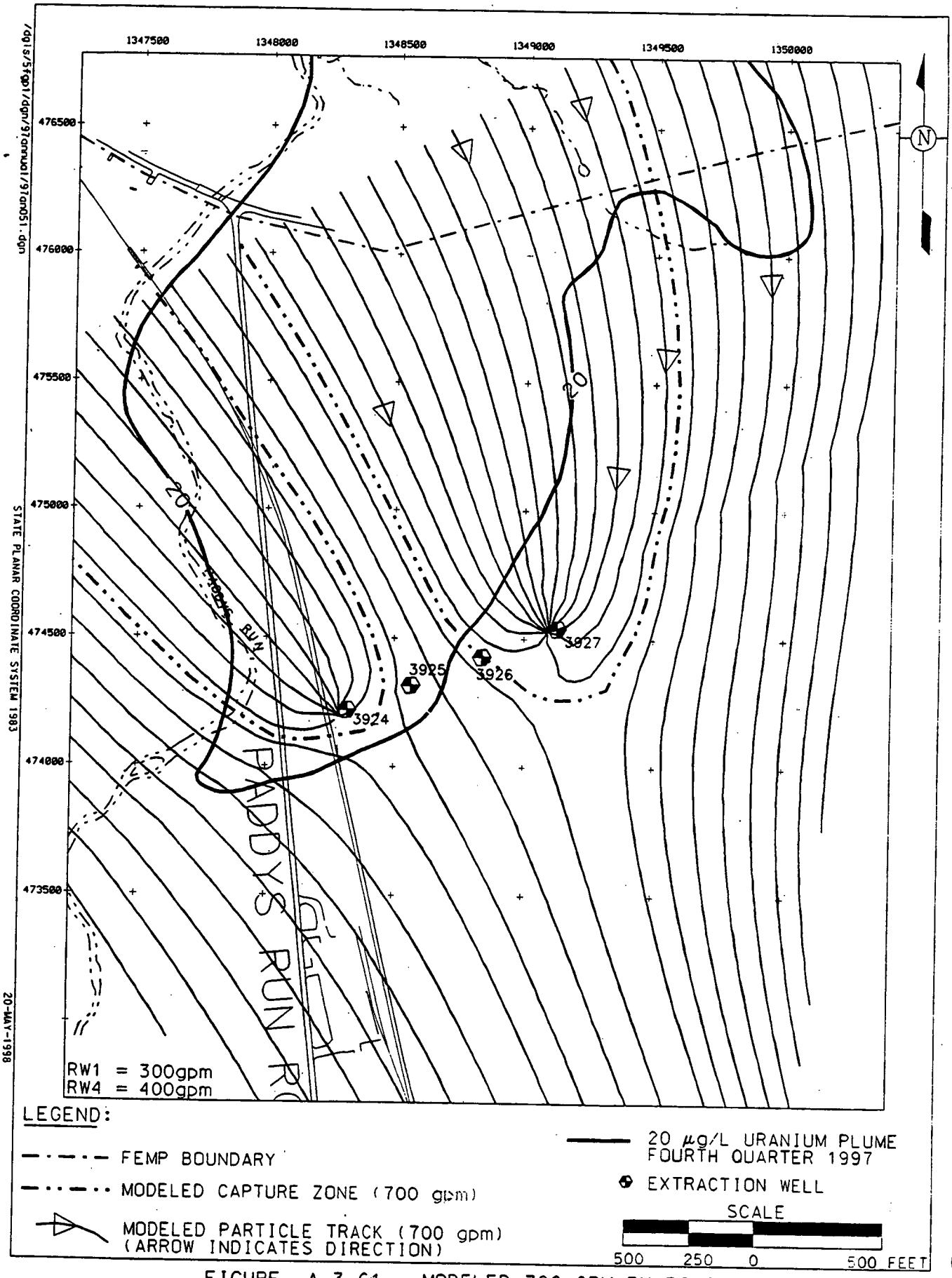


FIGURE A.3-61. MODELED 700 GPM PUMPING CONFIGURATION, PARTICLE TRACKS, AND CAPTURE ZONE

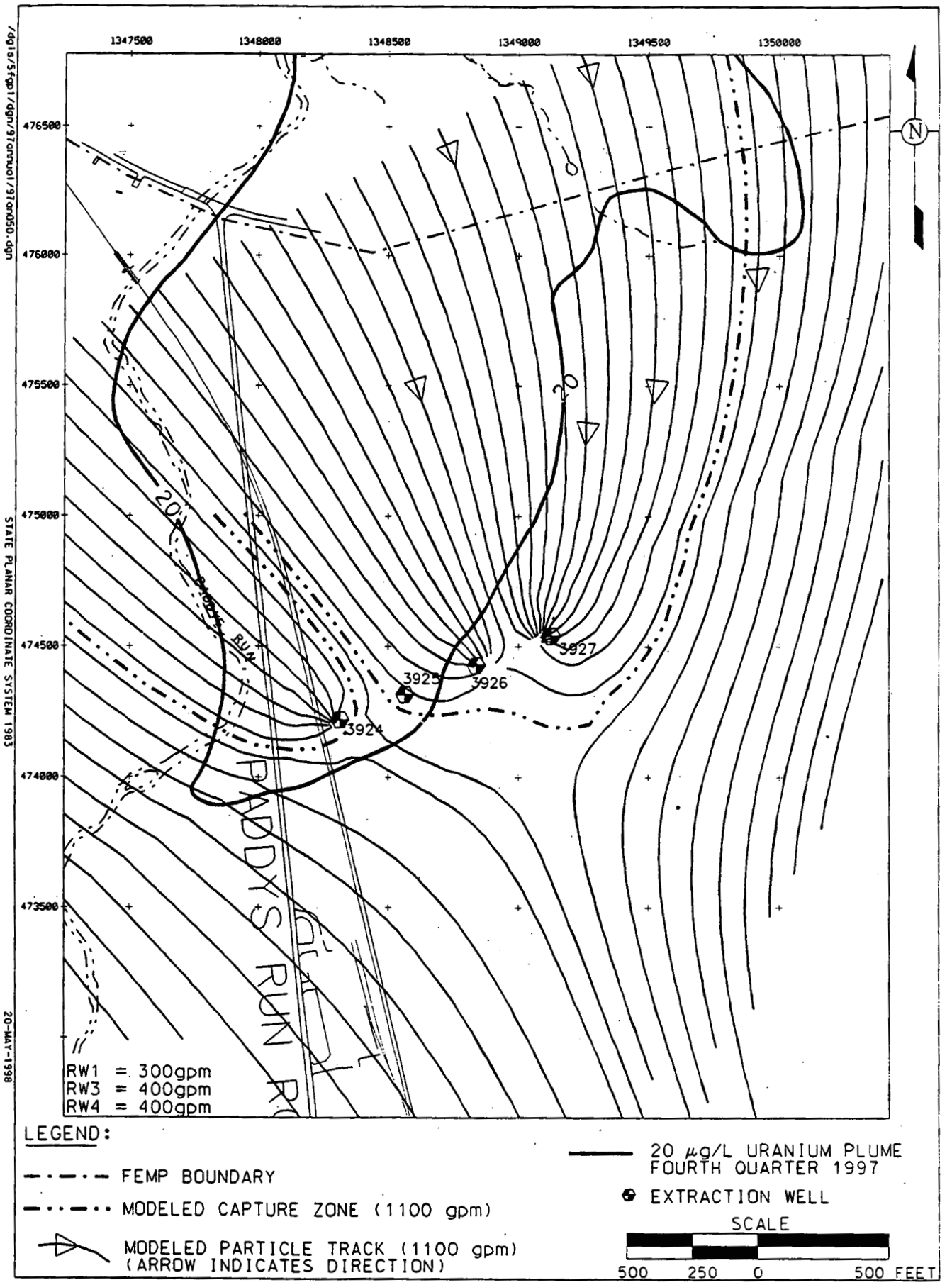


FIGURE A.3-62. MODELED 1100 GPM PUMPING CONFIGURATION, PARTICLE TRACKS, AND CAPTURE ZONE

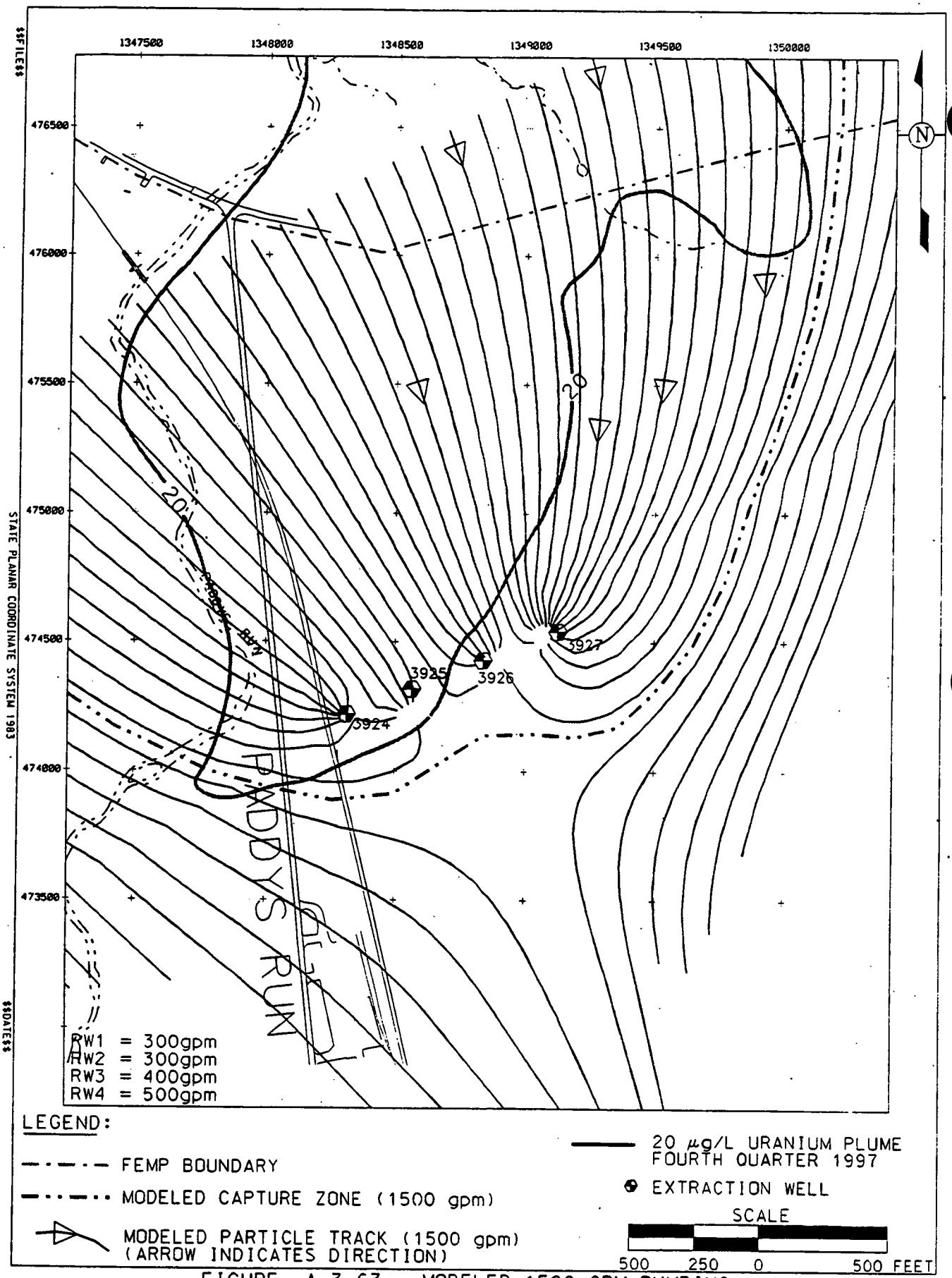


FIGURE A.3-63. MODELED 1500 GPM PUMPING CONFIGURATION, PARTICLE TRACKS, AND CAPTURE ZONE

Attachment A.4

ATTACHMENT A.4

NON-URANIUM FRL EXCEEDANCES

ATTACHMENT A.4

INTRODUCTION

This attachment to Appendix A evaluates non-uranium FRL exceedances which occurred in 1997. The evaluation provides the following information:

- A listing of and the location of the non-uranium FRL exceedances in 1997. These FRL exceedances were evaluated for trend using the Mann-Kendell test for trend. Data collected from 1988 (beginning of the remedial investigation/feasibility study [RI/FS] groundwater sampling) to 1997 were used in the trend analysis.
- A presentation of the 1997 non-uranium FRL exceedances inside the 10-year, uranium-based restoration footprint is provided.
- An evaluation of the 1997 non-uranium FRL exceedances outside the 10-year, uranium-based restoration footprint is provided.

NON-URANIUM FRL EXCEEDANCES DETECTED IN 1997

Table A.4-1 lists the 1997 non-uranium FRL exceedances both inside and outside the 10-year, uranium-based restoration footprint. The 1997 concentration data for each FRL exceedance were combined with data collected since 1988 to evaluate the trend at each exceedance location. Table A.4-1 identifies: the constituents which had a non-uranium FRL exceedance in 1997; the groundwater monitoring well location where the exceedance occurred; the number of unfiltered samples collected from 1988 through 1997; the number of unfiltered samples with concentrations above the FRL from 1988 through 1997; the number of unfiltered samples with concentrations above the FRL in 1997, respectively; summary statistics for each sample set; and statistical trend results. For the trend analysis, if four or more sample results existed, the trend of the concentration data was determined using a Mann-Kendell test for trend.

Figure A.4-1 identifies the location of the 1997 non-uranium FRL exceedances both inside and outside the 10-year, uranium-based restoration footprint.

NON-URANIUM FRL EXCEEDANCES DETECTED IN 1997 WITHIN THE 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

Non-uranium FRL exceedances were monitored inside the 10-year, uranium-based restoration footprint to determine:

- If any new FRL exceedances were being detected
- If any statistically "Up, Significant" trends were occurring.

In 1997, 10 constituents had one or more FRL exceedance at monitoring well locations inside the 10-year, uranium-based restoration footprint (Table A.4-1). The 10 constituents were: antimony, boron, chromium, lead, manganese, molybdenum, nickel, nitrate/nitrite, technetium-99, and zinc.

Background

A detailed parameter selection process was used to develop lists of constituents for groundwater monitoring of the aquifer restoration remedy. The detailed parameter selection process is presented in Appendix A of the IEMP and is summarized below.

The groundwater monitoring under the IEMP focused on the 50 groundwater FRL constituents listed in the Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996). For the purpose of modeling and monitoring, the aquifer was divided into different zones. A unique monitoring parameter list was developed for each zone, based on data collected from the aquifer from 1988 through 1995 and criteria defined in Appendix A of the IEMP. Constituents were categorized as follows:

- >MP The constituent had been detected in the aquifer at concentrations "greater than its established FRL" and was considered "mobile and persistent". It had been predicted to be able to migrate from the glacial overburden to the aquifer and had already caused a FRL exceedance in the aquifer.
- >N The constituent had been detected in the aquifer at concentrations "greater than its established FRL" but was "not considered mobile and persistent". This constituent was not predicted to be able to migrate vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk. Background conditions and/or surface water infiltrations may have caused isolated FRL exceedances noted in the historical record.

- <MP The constituent had "not been detected in the aquifer at concentrations greater than its established FRL", but was considered both "mobile and persistent". This constituent was predicted to be able to migrate through the glacial overburden to the aquifer (if no source removal/control actions are taken), but as yet has not caused exceedances of its established FRL.

- <N The constituent had "not been detected in the aquifer at concentrations greater than its established FRL" and was "not considered mobile and persistent".

New FRL Exceedances

If a new FRL exceedance was detected in a particular aquifer zone, then the constituent with the exceedance would need to be re-categorized for monitoring purposes from "<" to ">". Of the 10 constituents with FRL exceedances for 1997 noted above, chromium appears to require re-categorization from "<MP" to ">MP" in aquifer zones 1 and 2. This re-categorization is necessary for the following reasons:

- In aquifer zone 1, one or more chromium FRL exceedances were detected in 1997 at Monitoring Wells 2032, 3032, and 2648. Two chromium FRL exceedances occurred at Monitoring Well 2648 before 1996; therefore, chromium should already have been identified in the IEMP as ">MP" in aquifer zone 1 rather than "<MP".

- In aquifer zone 2, one or more chromium FRL exceedances were detected in 1997 at Monitoring Wells 2386, 2387, 2398, 3045, 3068, 3385, and 3397. Chromium FRL exceedances at Monitoring Well 2398 actually began back in 1996. It was categorized in the IEMP for aquifer zone 2 as "<MP" since the data used to prepare the IEMP only went through 1995.

The FRL for chromium is based on hexavalent chromium. However, total chromium was analyzed due to short laboratory "holding times" for hexavalent chromium. If the total chromium concentration was above the FRL, then it was not certain that the hexavalent component of the total chromium concentration was above the FRL. However, it has been conservatively assumed that all of the chromium in a particular sample was hexavalent, but this most likely was not the case. Given the pH and Eh conditions of the aquifer, the chromium exceedances were most likely false positive exceedances for hexavalent chromium. Therefore, it is proposed that an investigation of the valence state of chromium in the groundwater at the FEMP be conducted prior to adjusting the monitoring program for chromium. This investigation will be conducted in 1998. Results of this investigation will be discussed in future IEMP reports.

Statistically Up-Significant Concentration Trends

Statistically determined "Up, Significant" trends were used to identify areas of the aquifer where concentrations were increasing. Of the 10 constituents with FRL exceedances in 1997 within the 10-year, uranium-based restoration footprint, only chromium and nickel in Monitoring Well 2398 had statistically "Up, Significant" trends. Figure A.4-1 identifies the location of Monitoring Well 2398. Figures A.4-2 and A.4-3 present chromium and nickel concentration versus time plots, respectively, for Monitoring Well 2398. Figures A.4-2 and A.4-3 indicate that the upward trend in chromium and nickel concentrations appears to have begun around 1995.

In conjunction with the nickel and chromium increases, an increase in the chloride concentration at Monitoring Well 2398 has also been observed. The chloride concentration in this well has increased from approximately 20 mg/L in 1993 to approximately 55 mg/L in 1996. Given the corrosive nature of chloride and that nickel and chromium are components of the stainless steel comprising the well screen and casing, it is possible that the chromium and nickel increases in Monitoring Well 2398 were due to corrosion of the well materials. During 1998, DOE will further investigate the role of chloride as a corrosive agent that may be contributing to increases in nickel and chromium in monitoring wells at the FEMP. Progress of this investigation will be provided in future IEMP reports. Given that Monitoring Well 2398 is located within the 10-year, uranium-based restoration footprint, no additional actions beyond that specified above the scope of the current IEMP monitoring regime were required.

NON-URANIUM FRL EXCEEDANCES DETECTED IN 1997 OUTSIDE THE 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

The Restoration Area Verification Sampling Program Summary Report (DOE 1998c) indicates that any FRL exceedance detected outside the 10-year, uranium-based restoration footprint at a property boundary well as a result of routine IEMP groundwater monitoring would also be evaluated using the same conservative data evaluation method approved for the Restoration Area Verification Sampling Program, Project-Specific Plan (DOE 1997e). This section fulfills this commitment for calendar year 1997 data.

The purpose of this evaluation is to determine if an FRL exceedance detected outside the 10-year, uranium-based restoration footprint is persistent or not persistent. Data from samples collected immediately following an FRL exceedance are analyzed to determine if the detected FRL exceedance is

persistent. In accordance with the approved Restoration Area Verification Sampling method, if two or more sampling events following an FRL exceedance indicate that the concentration in question is back down below the groundwater FRL, then the exceedance is not considered persistent.

If an FRL exceedance detected outside of the 10-year uranium-based restoration footprint is determined to be not persistent, then no additional action is required above and beyond the routine groundwater monitoring specified in the IEMP. If an FRL exceedance is determined to be persistent, then the cause of the persistent exceedance needs to be identified, and its impact on the aquifer remedy design assessed. Ultimately, the cause needs to be addressed either through a modification of the aquifer remedy or by other means as applicable.

Evaluation of RCRA Property Boundary Well Data

Based on results from Appendix A of the Restoration Area Verification Sampling Project-Specific Plan and the Restoration Area Verification Sampling Program Summary Report, no persistent FRL exceedance was identified outside the 10-year, uranium-based restoration footprint. However, evaluation of 1997 RCRA Property Boundary Well data revealed three persistent manganese FRL exceedances in 1997.

Figure A.4-4 identifies the 26 property boundary monitoring wells which are located outside or near the boundary of the 10-year, uranium-based restoration footprint. The 26 wells are:

2417, 2424, 2051, 2070, 2426, 2429, 2430, 2431, 2432, 2733, 22198, 3417, 3424, 3426, 3429, 3067, 3070, 3431, 3432, 3733, 31217, 4067, 4424, 4426, 4432, and 41217.

In 1997, five FRL constituents had one or more exceedances involving 10 of the 26 property boundary groundwater monitoring wells located outside the 10-year, uranium-based restoration footprint, as noted below and on Figure A.4-4:

Cadmium	Monitoring Well 3432
Chromium	Monitoring Well 41217
Lead	Monitoring Well 3733
Manganese	Monitoring Wells 2424, 2426, 2430, and 2431
Zinc	Monitoring Wells 2424, 2426, 22198, 3426, and 4424

The manganese exceedances at Monitoring Wells 2424, 2426, 2430, and 2431 were statistically determined to have "Up, Significant" concentration trends. Figures A.4-5 through A.4-16 present individual concentration versus time graphs for each monitoring well and its associated FRL exceedances outside the 10-year, uranium-based restoration footprint. These graphs were prepared the same way the graphs were prepared for the Restoration Area Verification Sampling Project-Specific Plan and the Restoration Area Verification Sampling Program Summary Report. They are conservative in that:

- The values plotted on the graphs represent the greatest concentration for each date of the following: filtered samples, unfiltered samples, normal samples, and duplicate samples. Any large discrepancies between concentrations of the same constituent on the same date are noted on the individual graphs.
- Non-detects are graphed at the reported detection limit.

Sample results, by FRL constituent and by well, are further discussed below.

Cadmium - Monitoring Well 3432

Figure A.4-5 illustrates the cadmium concentration versus time for groundwater samples collected from Monitoring Well 3432 from 1988 through 1997. Prior to 1996, no FRL exceedances for cadmium had been detected at Monitoring Well 3432.

A cadmium FRL exceedance was detected in July 1997. However, the concentration of cadmium in groundwater samples collected throughout the rest of 1996 and 1997 was below the cadmium FRL. In accordance with the Restoration Area Verification Sampling Project-Specific Plan method, two or more sampling events with concentrations below the FRL are required after an exceedance to confirm that the exceedance is not persistent. Although the September 1997 cadmium concentration was below the groundwater FRL, an additional sample with a concentration below the FRL is required to satisfy the sampling plan. Therefore, another sample will be collected during the first quarter of 1998. Persistence of the July 1997 exceedance will be re-evaluated after first quarter 1998 sample results are obtained.

Chromium - Monitoring Well 41217

Figure A.4-6 illustrates the chromium concentration versus time for groundwater samples collected from Monitoring Well 41217 from 1988 through 1997. Prior to 1996, no persistent FRL exceedances for chromium had been detected at Monitoring Well 41217.

A chromium FRL exceedance was detected in January 1997. The concentrations of chromium in groundwater samples collected throughout the rest of 1996 and 1997 were below the chromium FRL. Therefore, in accordance with the Restoration Area Verification Sampling Project-Specific Plan method, the FRL exceedance for chromium at Monitoring Well 41217 in January of 1997 was not determined to be persistent.

Lead - Monitoring Well 3733

Figure A.4-7 illustrates the lead concentration versus time for groundwater samples collected from Monitoring Well 3733 from 1988 through 1997. Prior to 1996, no FRL exceedances for lead had been detected at Monitoring Well 3733.

A lead FRL exceedance was detected in July 1996, but the subsequent two samples indicated lead concentrations were below the lead FRL. A lead FRL exceedance was detected in September of 1997. In accordance with the Restoration Area Verification Sampling Project-Specific Plan method, two additional groundwater samples were required to determine the nature of the lead FRL exceedance detected in the September 1997 groundwater sample. The additional groundwater samples will be collected in 1998.

Manganese - Monitoring Well 2424

Figure A.4-8 illustrates manganese concentration versus time for groundwater samples collected from Monitoring Well 2424 from 1988 through 1997. FRL exceedances for manganese at Monitoring Well 2424 prior to 1996 were reported in the Restoration Area Verification Sampling Project-Specific Plan. Additional monitoring was conducted in 1996 and 1997 to satisfy the Restoration Area Verification Sampling Program Summary Report. It was reported in the Restoration Area Verification Sampling Program Summary Report that based on the concentration of the last three samples collected in 1997 the FRL exceedances for manganese at Monitoring Well 2424 were not persistent.

Manganese - Monitoring Well 2426

Figure A.4-9 illustrates the manganese concentration versus time for groundwater samples collected from Monitoring Well 2426 from 1988 through 1997. Prior to 1996, no FRL exceedances for manganese had been detected at Monitoring Well 2426.

Manganese FRL exceedances were detected in groundwater samples collected in September 1996 and January, April, and July 1997. The groundwater sample collected in September 1997 had a manganese concentration just below the manganese FRL. In accordance with the Restoration Area Verification Sampling Project-Specific Plan method established in the approved Restoration Area Verification Sampling Project-Specific Plan, the 1996 and 1997 manganese groundwater FRL exceedances at Monitoring Well 2426 were determined to be persistent.

As explained in the conclusion and recommendation section, additional monitoring will take place in 1998 and biofouling will be examined as a possible cause for the persistent manganese FRL exceedances at this well.

Manganese - Monitoring Well 2430

Figure A.4-10 illustrates the manganese concentration versus time for groundwater samples collected from Monitoring Well 2430 from 1988 through 1997. Prior to 1996, no FRL exceedances for manganese had been detected for Monitoring Well 2430.

A manganese FRL exceedance was detected in the groundwater sample collected in September 1996. The subsequent two sampling events in January and April 1997 indicate that the concentration of manganese was once again below the FRL for manganese. Therefore, in accordance with the Restoration Area Verification Sampling Project-Specific Plan method, the 1996 manganese groundwater FRL exceedance was not determined to be persistent.

In July and September 1997, the concentration of manganese measured in the groundwater samples collected from Monitoring Well 2430 were once again above the FRL for manganese. In accordance with the Restoration Area Verification Sampling Project-Specific Plan method, the 1997 manganese groundwater FRL exceedances at Monitoring Well 2430 were determined to be persistent.

As explained in the conclusion and recommendation section, additional monitoring will take place in 1998 and biofouling will be examined as a possible cause for the persistent manganese FRL exceedances at this well.

Manganese - Monitoring Well 2431

Figure A.4-11 illustrates the manganese concentration versus time for groundwater samples collected from Monitoring Well 2431 from 1988 through 1997. Prior to 1997, no FRL exceedances for manganese had been detected at Monitoring Well 2431.

Manganese FRL exceedances were detected in groundwater samples collected in January, April, and July 1997. The concentration of manganese in the groundwater sample collected in September was below the manganese FRL. In accordance with the Restoration Area Verification Sampling Project-Specific Plan method, the 1997 manganese groundwater FRL exceedances at Monitoring Well 2431 were determined to be persistent.

As explained in the conclusion and recommendation section, additional monitoring will take place in 1998 and biofouling will be examined as a possible cause for the persistent manganese FRL exceedances at this well.

Zinc - Monitoring Well 2424

Figure A.4-12 illustrates the zinc concentration versus time for groundwater samples collected from Monitoring Well 2424 from 1988 through 1997. This well was identified in Appendix A of the Restoration Area Verification Sampling Project-Specific Plan as having a pre-1996 zinc FRL exceedance. Additional monitoring was conducted in 1997 to satisfy the Restoration Area Verification Sampling Program Summary Report. The Restoration Area Verification Sampling Program Summary Report reported that based on the concentration of the last two samples collected in 1997 it did not appear that the FRL exceedances for zinc at Monitoring Well 2424 were persistent. Monitoring Well 2424 was re-developed in July 1997 through pumping. The zinc concentrations appear to decrease in July of 1997, indicating that re-development of the well by pumping may have lowered the zinc concentration.

Zinc - Monitoring Well 2426

Figure A.4-13 illustrates the zinc concentration versus time for groundwater samples collected from Monitoring Well 2426 from 1988 through 1997. This well was identified in Appendix A of the Restoration Area Verification Sampling Project-Specific Plan as having a pre-1996 zinc FRL exceedance. The pre-1996 exceedance was identified as a one-time exceedance.

A zinc FRL exceedance was detected in the groundwater samples collected in September 1996 and January 1997. Based on the last three samples collected in 1997, the FRL exceedance for zinc at Monitoring Well 2426 was not considered to be persistent.

The concentration of zinc in the last groundwater sample collected in 1997 was reported by the laboratory to be non-detectable at a concentration above the FRL. This reported non-detectable concentration was considered suspect, as the required contract detection limit was set below the FRL. The reported non-detect concentration was only slightly above the FRL and additional groundwater samples will be collected in 1998. It is believed that unless this exceedance occurs again, it is not a concern.

Zinc - Monitoring Well 22198

Figure A.4-14 illustrates the zinc concentration versus time for groundwater samples collected from Monitoring Well 22198 in 1997. This well was installed in 1997. Data reported in this appendix begins with the April 1997 sampling round. An FRL exceedance for zinc was detected in the April 1997 groundwater sample. Concentrations of zinc in the groundwater samples collected in July and September of 1997 were below the zinc FRL. Therefore, in accordance with the Restoration Area Verification Sampling Project-Specific Plan method, the FRL exceedance for zinc in Monitoring Well 22198 was not determined to be persistent.

Zinc - Monitoring Well 3426

Figure A.4-15 illustrates the zinc concentration versus time for groundwater samples collected from Monitoring Well 3426 from 1988 through 1997. Prior to 1996, no FRL exceedances for zinc had been detected at Monitoring Well 3426.

A zinc FRL exceedance was detected in April 1996 but no exceedance was detected in the subsequent four samples collected in July and September 1996 and January and April 1997. In accordance with the Restoration Area Verification Sampling Project-Specific Plan method, the FRL exceedance for zinc at Monitoring Well 4424 in 1996 was not determined to be persistent.

A zinc FRL exceedance was detected in July 1997. The concentration of zinc in the subsequent groundwater sample collected in September 1997 was below the zinc FRL. One more sample will be required to confirm the non-persistence of the September FRL exceedance. Additional sampling will take place in 1998.

Well 4424 - Zinc

Figure A.4-16 illustrates the zinc concentration versus time for groundwater samples collected from Monitoring Well 4424 from 1988 through 1997. Prior to 1996, no FRL exceedances for zinc had been detected at Monitoring Well 4424.

A zinc FRL exceedance was detected in April 1997. The concentrations of zinc in groundwater samples collected in July and September 1997 were below the zinc FRL. Therefore, in accordance with the Restoration Area Verification Sampling Project-Specific Plan method, the FRL exceedance for zinc at Monitoring Well 4424 in 1997 was not determined to be persistent.

CONCLUSIONS

- The following 1997 FRL exceedances were identified as being one-time exceedances and were not persistent:
  - Manganese and zinc at Monitoring Well 2424
  - Zinc at Monitoring Well 4424
  - Chromium at Monitoring Well 41217
  - Zinc at Monitoring Well 22198.
- Analysis of 1997 groundwater data indicated that persistent manganese groundwater FRL exceedances were detected at Monitoring Wells 2426, 2430, and 2431. As explained below, it was concluded that:
  - Persistent FRL exceedances for manganese in 1997 were considered to be only slightly above natural background concentrations.

- The FEMP was not a likely source for 1997 manganese contamination.
- Iron biofouling conditions were reported in the same monitoring wells that had manganese FRL exceedances.

Natural Background Conditions

Unconsolidated glacial/alluvial aquifers in Ohio, like the Great Miami Aquifer, have relatively high manganese concentrations. Manganese is an impurity in shale and sandstone. Shale forms the floors and walls of the buried valley containing the sand and gravel comprising the Great Miami Aquifer beneath the FEMP. The 90th percentile manganese concentration for unconsolidated glacial/alluvial aquifers in Ohio (based on 465 analyses) was reported in 1991 as 590 μg/L (Rowland and Pennel 1991). The background concentration study, Characterization of Background Water Quality for Streams and Groundwater, performed with samples from the Great Miami Aquifer at the FEMP, concluded that the 95th percentile of background concentration (based on 16 samples) was 900 μg/L. Manganese does not have a Maximum Contaminant Level Standard but it does have a Secondary Maximum Contaminant Level Standard, which is 50 μg/L in Ohio. The FRL for manganese at the FEMP was appropriately based on the determined background value for the area of 900 μg/L. Exceedances at Monitoring Wells 2426, 2430, and 2431 in 1997 were considered to be only slightly above background, with the maximum concentration at each monitoring well being 2860 μg/L, 965 μg/L, and 2200 μg/L, respectively.

The FEMP Is Not a Likely Source for Manganese Contamination

Manganese or compounds with manganese were not used in operations at the FEMP, but according to the Operable Unit 5 RI Report, manganese is a minor impurity (<1 percent) in uranium ores and ore concentrates. Potential sources for manganese contamination at the FEMP were identified in the Feasibility Study Report for Operable Unit 5 (DOE 1995a) as the waste pit area, flyash piles, South Field area, solid waste landfill, Plant 1 area, Plant 2/3 area, Pant 8 area, laboratory area, General Sump, and the Health and Safety Building. These potential source locations are not close to Monitoring Wells 2426, 2430, or 2431.

Manganese was detected during the Operable Unit 5 RI Report in groundwater collected from the Great Miami Aquifer at above-background concentrations, but no trend indicative of a plume or widespread

contamination was observed in the aquifer. Soil in the area of the sewage treatment plant appeared to have manganese concentrations that were above background.

Manganese has a medium solubility in groundwater and its tendency to adsorb to soil matrix is also medium, whereas uranium has a medium to high solubility in groundwater and its tendency to adsorb to soil matrix is also medium (DOE 1995a). It can be assumed that if a large amount of manganese was released to the groundwater, a manganese plume would exist today. However, no manganese plume emanating from the possible source areas noted above has been identified.

Biofouling Conditions within The Monitoring Wells

Metallic compounds are often bioaccumulated in a sequential manner around water wells. Iron and zinc concentrate very close to the well screen, while manganese accumulates further out (Cullimore 1993). The persistent manganese detections made in 1997 at Monitoring Wells 2426, 2430, and 2431, as well as some of the one-time detects noted in the past at various other wells, could have resulted from such bioaccumulation of metals around the monitoring wells. If biofouling is actually occurring in these wells, re-habilitation of the wells may decrease manganese concentrations.

It has been determined that both aerobic and sulfate-reducing bacteria are naturally present in the aquifer (DOE 1998b). Recently, groundwater sampling personnel have reported iron-fouling problems with a few of the groundwater monitoring wells routinely sampled at the FEMP. Recent reports from the field indicate that the water pumped from the wells has a red coloration and is very turbid. The three wells with the persistent manganese detections in 1997 have the reported iron problems. However, iron is not routinely sampled in the property boundary wells.

RECOMMENDATIONS AND AREAS OF FOCUS

In addition to the continuance of routine IEMP groundwater monitoring, the following issues will be addressed:

- No change will be made to the aquifer remedy at this time to address the persistent manganese FRL exceedances detected in 1997 at Monitoring Wells 2426, 2430, and 2431. The FRL exceedances could be due to biofouling within the monitoring wells.

- Samples will be collected from the RCRA Property Boundary Program wells to determine if iron concentrations correlate with manganese and zinc concentrations in an effort to develop a monitoring strategy to track if and when the wells should be redeveloped to address biofouling conditions.

- Monitoring Wells 2426, 2430, and 2431 will be treated for biofouling to determine if the treatment process lowers manganese concentrations.

- Samples will be collected at select wells for hexavalent chromium and geochemical parameters (Eh and pH) will be measured and reviewed in order to determine if the monitoring approach for chromium in the IEMP is appropriate to determine FRL exceedances.

- A data evaluation will be conducted to determine the relationship between chloride concentrations to nickel and chromium concentrations.

Results of the above-noted actions will be reported through normal IEMP deliverables.

TABLE A.4-1

SUMMARY STATISTICS AND TREND ANALYSIS FOR NON-URANIUM CONSTITUENTS WITH 1997 RESULTS ABOVE FINAL REMEDIATION LEVELS

Constituent (FRL)[a]	Monitoring Well	No. of Samples[b,c,d]	No. of Samples Above FRL[b,c,d]	No. of Samples Above FRL for 1997[c,d]	Minimum[b,c,d,e,f]	Maximum[b,c,d,e,f,g]	Average[b,c,d,e,f,g]	Standard Deviation[b,c,d,e,f,g]	Trend[b,c,d,e,f,g]
					(mg/L)	(mg/L)	(mg/L)	(mg/L)	
Antimony (0.0060 mg/L)	3032	1	1	1	0.0196	NA	NA	NA	NA
Boron (0.33 mg/L)	2049	2	2	2	0.467	1.14	NA	NA	NA
Cadmium (0.014 mg/L)	3432	17	1	1	0.0005	0.0147	0.0020	0.0033	No Significant Trend
Chromium (0.022 mg/L)[h]	2032	1	1	1	0.0478	NA	NA	NA	NA
	2054	2	1	1	0.0025	0.0448	NA	NA	NA
	2118	2	1	1	0.0025	0.0375	NA	NA	NA
	2386	3	1	1	0.002	0.165	0.05	NA	NA
	2387	2	1	1	0.0021	0.023	NA	NA	NA
	2398	19	7	4	0.00145	0.212	0.0366	0.0588	**Up, Significant**
	2648	4	3	1	0.008	0.134	0.06	0.05	No Significant Trend
	3032	1	1	1	0.0485	NA	NA	NA	NA
	3045	2	1	1	0.0015	0.0488	NA	NA	NA
	3068	2	1	1	0.0025	0.039	NA	NA	NA
	3385	2	1	1	0.002	0.0266	NA	NA	NA
	3397	2	1	1	0.002	0.0288	NA	NA	NA
	41217	17	2	1	0.0014	0.0962	0.010	0.023	No Significant Trend
Lead (0.015 mg/L)	2648	4	3	1	0.0005	0.0242	0.02	0.01	No Significant Trend
	3032	1	1	1	0.0636	NA	NA	NA	NA
	3045	2	1	1	0.0005	0.0268	NA	NA	NA
	3068	2	1	1	0.0022	0.0159	NA	NA	NA
	3733	18	2	1	0.0002	0.028	0.0032	0.0071	No Significant Trend
Manganese (0.90 mg/L)	2054	2	1	1	0.303	0.917	NA	NA	NA
	2424	19	4	1	0.018	2.83	0.71	0.71	**Up, Significant**
	2426	18	4	3	0.326	2.86	0.851	0.631	**Up, Significant**
	2430	18	3	2	0.283	1.25	0.643	0.252	**Up, Significant**
	2431	17	3	3	0.237	2.2	0.58	0.50	**Up, Significant**
	2648	4	2	1	0.566	2.93	1.42	1.08	No Significant Trend
	3027	2	2	1	1.29	1.69	NA	NA	NA

TABLE A.4-1
(Continued)

Constituent (FRL)[a]	Monitoring Well	No. of Samples[b,c,d]	No. of Samples Above FRL[b,c,d]	No. of Samples Above FRL for 1997[c,d]	Minimum[b,c,d,e,f]	Maximum[b,c,d,e,f,g]	Average[b,c,d,e,f,g]	Standard Deviation[b,c,d,e,f,g]	Trend[b,c,d,e,f,g]
Manganese (continued)	3032	1	1	1	0.977	NA	NA	NA	NA
	3045	2	1	1	0.0257	1.17	NA	NA	NA
	3068	2	1	1	0.186	1.39	NA	NA	NA
	3385	2	1	1	0.352	0.952	NA	NA	NA
	3397	2	1	1	0.233	1.13	NA	NA	NA
Molybdenum (0.10 mg/L)	2649	3	3	1	0.359	0.69	0.56	NA	NA
Nickel (0.10 mg/L)	2398	19	5	4	0.003	0.791	0.09	0.2	**Up, Significant**
Nitrate/Nitrite (11 mg/L)	2649	2	2	1	36	73.6	NA	NA	NA
					(pCi/L)	**(pCi/L)**	**(pCi/L)**	**(pCi/L)**	
Technetium-99 (94 pCi/L)	2649	1	1	1	1207.8	NA	NA	NA	NA
					(mg/L)	**(mg/L)**	**(mg/L)**	**(mg/L)**	
Zinc (0.021 mg/L)	2054	2	1	1	0.0065	0.0361	NA	NA	NA
	2068	2	1	1	0.0106	0.071	NA	NA	NA
	2106	19	4	2	0.00085	0.122	0.014	0.028	No Significant Trend
	2118	2	1	1	0.00465	0.035	NA	NA	NA
	22198	3	1	1	0.002	0.0474	0.02	NA	NA
	2424	19	5	1	0.00145	0.0914	0.0184	0.0251	No Significant Trend
	2426	18	3	1	0.0008	0.047	0.011	0.013	No Significant Trend
	2648	4	3	1	0.003	0.127	0.6	0.06	No Significant Trend
	3027	2	1	1	0.00385	3.78	NA	NA	NA
	3032	1	1	1	0.18	NA	NA	NA	NA
	3045	2	1	1	0.0095	0.0951	NA	NA	NA
	3068	2	1	1	0.0025	0.0613	NA	NA	NA
	3385	2	1	1	0.014	0.0543	NA	NA	NA

TABLE A.4-1
(Continued)

Constituent (FRL)[a]	Monitoring Well	No. of Samples[b,c,d]	No. of Samples Above FRL[b,c,d]	No. of Samples Above FRL for 1997[c,d]	Minimum[b,c,d,e,f]	Maximum[b,c,d,e,f,g]	Average[b,c,d,e,f,g]	Standard Deviation[b,c,d,e,f,g]	Trend[b,c,d,e,f,g]
Zinc (Continued)	3387	2	1	1	0.0121	0.0372	NA	NA	NA
	3397	2	1	1	0.0034	0.114	NA	NA	NA
	3426	17	2	1	0.00145	0.0699	0.0122	0.0165	No Significant Trend
	4398	17	1	1	0.00095	0.0495	0.0092	0.011	No Significant Trend
	4424	17	1	1	0.00145	0.0298	0.00833	0.00746	No Significant Trend

Note: Highlighting indicates well is outside the 10-year, uranium-based restoration footprint.

[a]From OU5 ROD, Table 9-4
[b]Based on unfiltered samples from the OU5 RI/FS data set (1988 through 1993) and 1994 through 1997
[c]If 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]) and Mann-Kendall test for trend.
[d]Rejected data qualified with either a R or Z were not included in the count, the summary statistics, or Mann-Kendall test for trend.
[e]If the number of samples is greater than or equal to four, then the Mann-Kendall test for trend and all of the summary statistics are reported. If the total number of samples is equal to three, then the minimum, maximum, and average are reported. If the total number of samples is equal to two, then the minimum and maximum are reported. If the total number of samples is equal to one, then the data point is reported as the minimum.
[f]For results where the concentrations are below the detection limit, the results used in the summary statistics and Mann-Kendall test for trend are each set at half the detection limit.
[g]NA = not applicable
[h]FRL based on Chromium VI, from OU5 ROD, Table 9-4

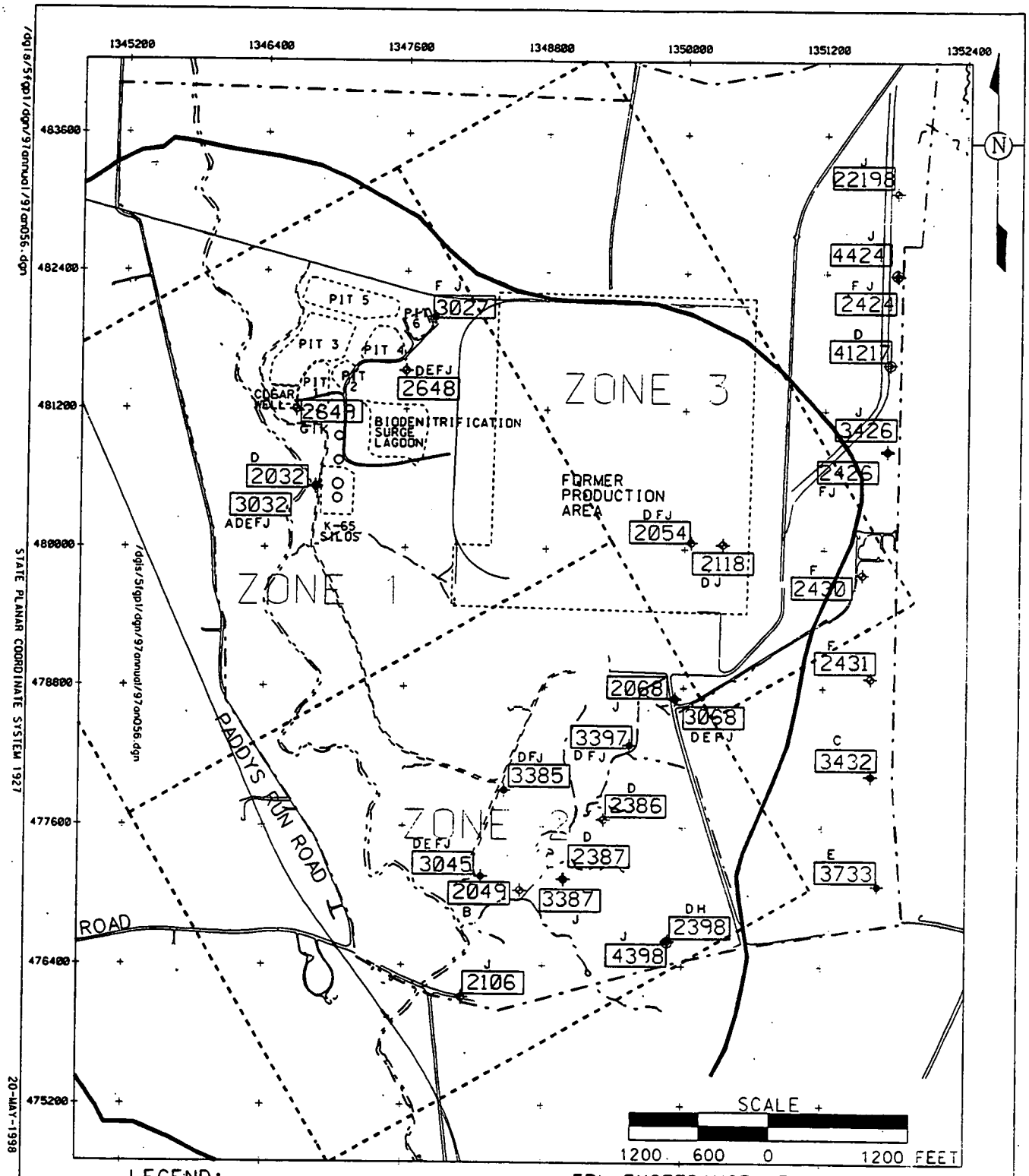


FIGURE A.4-1. NON-URANIUM CONSTITUENTS WITH 1997 RESULTS ABOVE FINAL REMEDIATION LEVELS

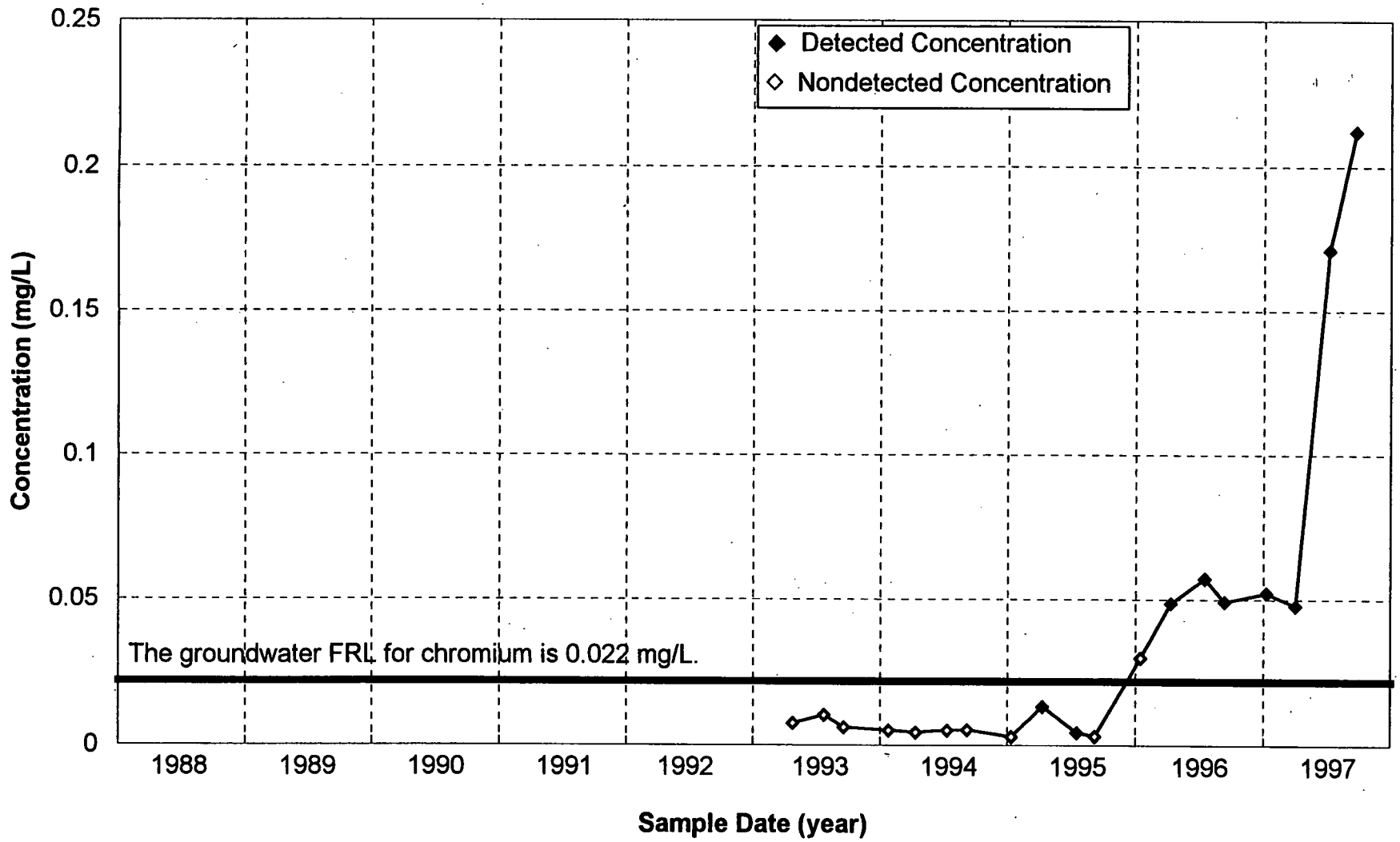


FIGURE A.4-2. CHROMIUM CONCENTRATION VS. TIME PLOT FOR WELL 2398

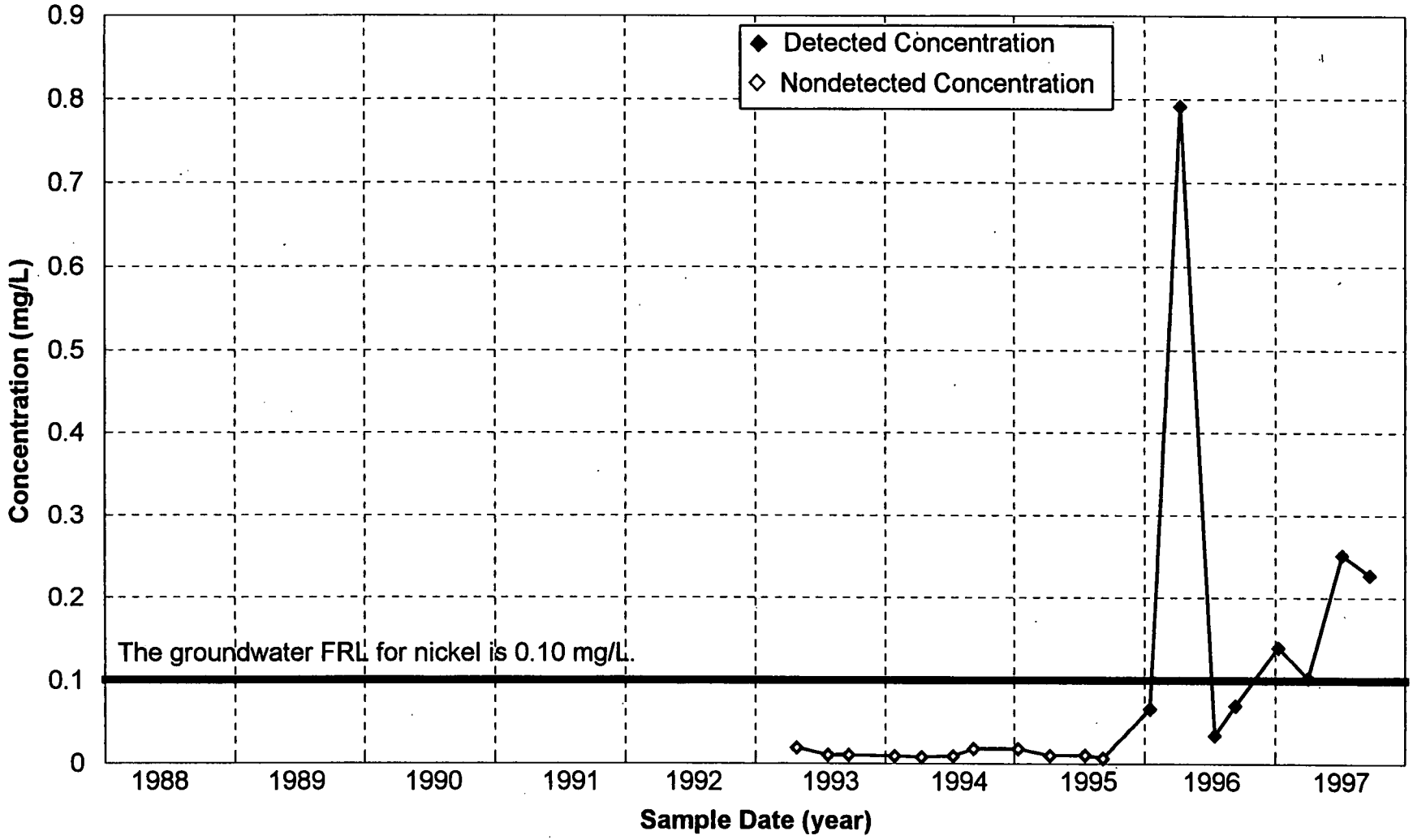


FIGURE A.4-3. NICKEL CONCENTRATION VS. TIME PLOT FOR WELL 2398

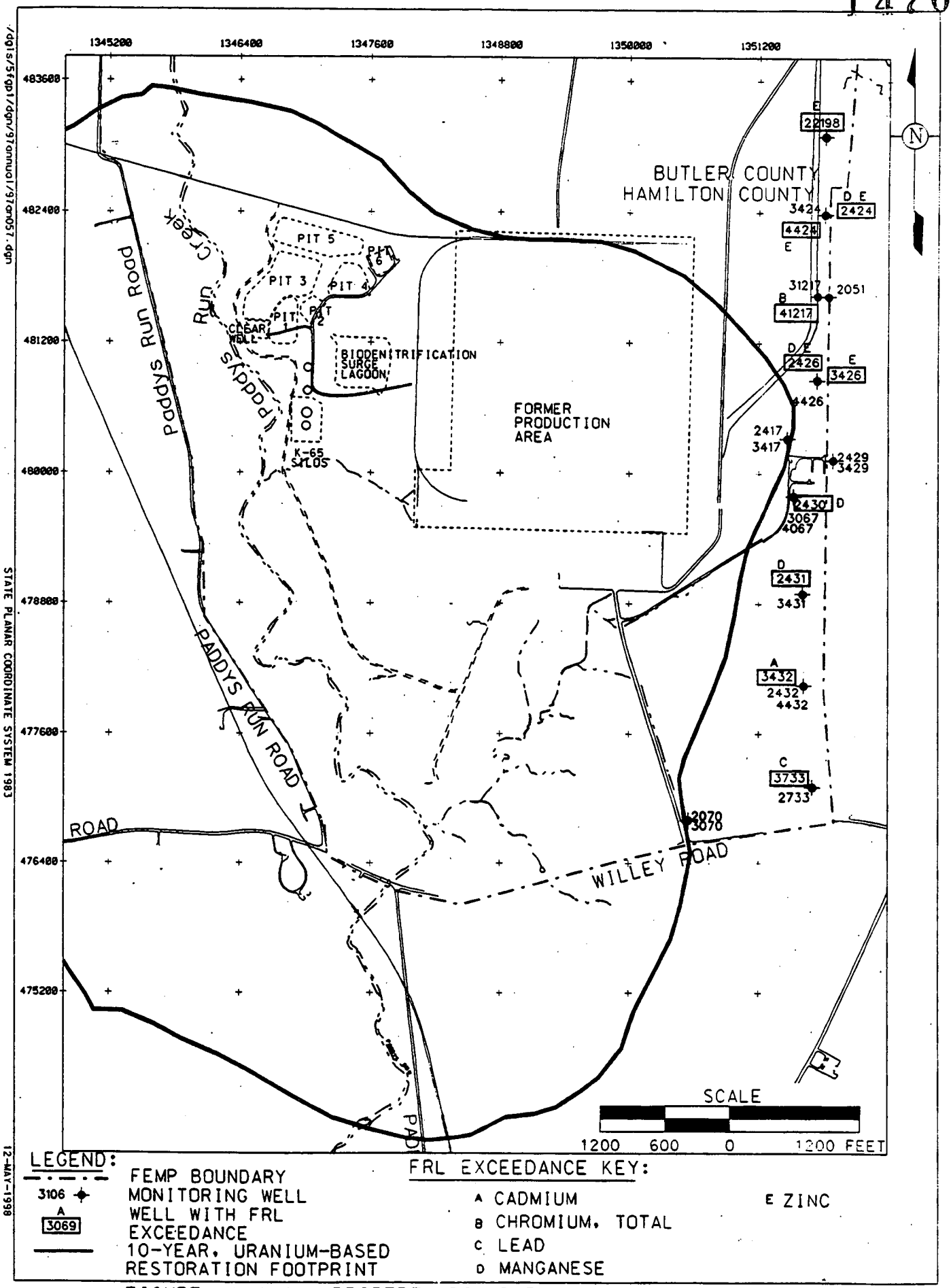


FIGURE A.4-4. PROPERTY BOUNDARY WELLS LOCATED OUTSIDE OF RESTORATION FOOTPRINT, AND 1997 FRL EXCEEDANCES

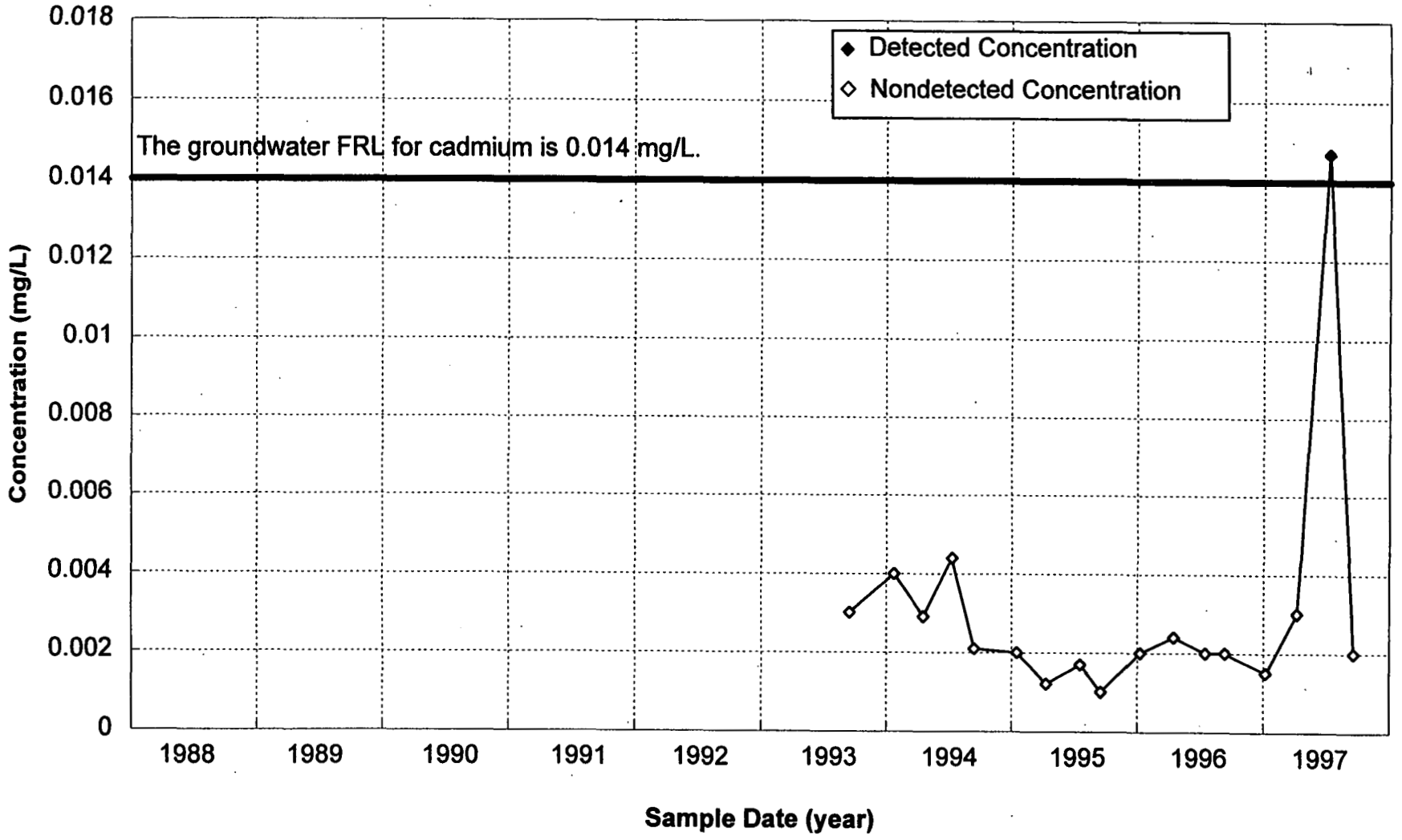


FIGURE A.4-5. CADMIUM CONCENTRATION VS. TIME PLOT FOR WELL 3432

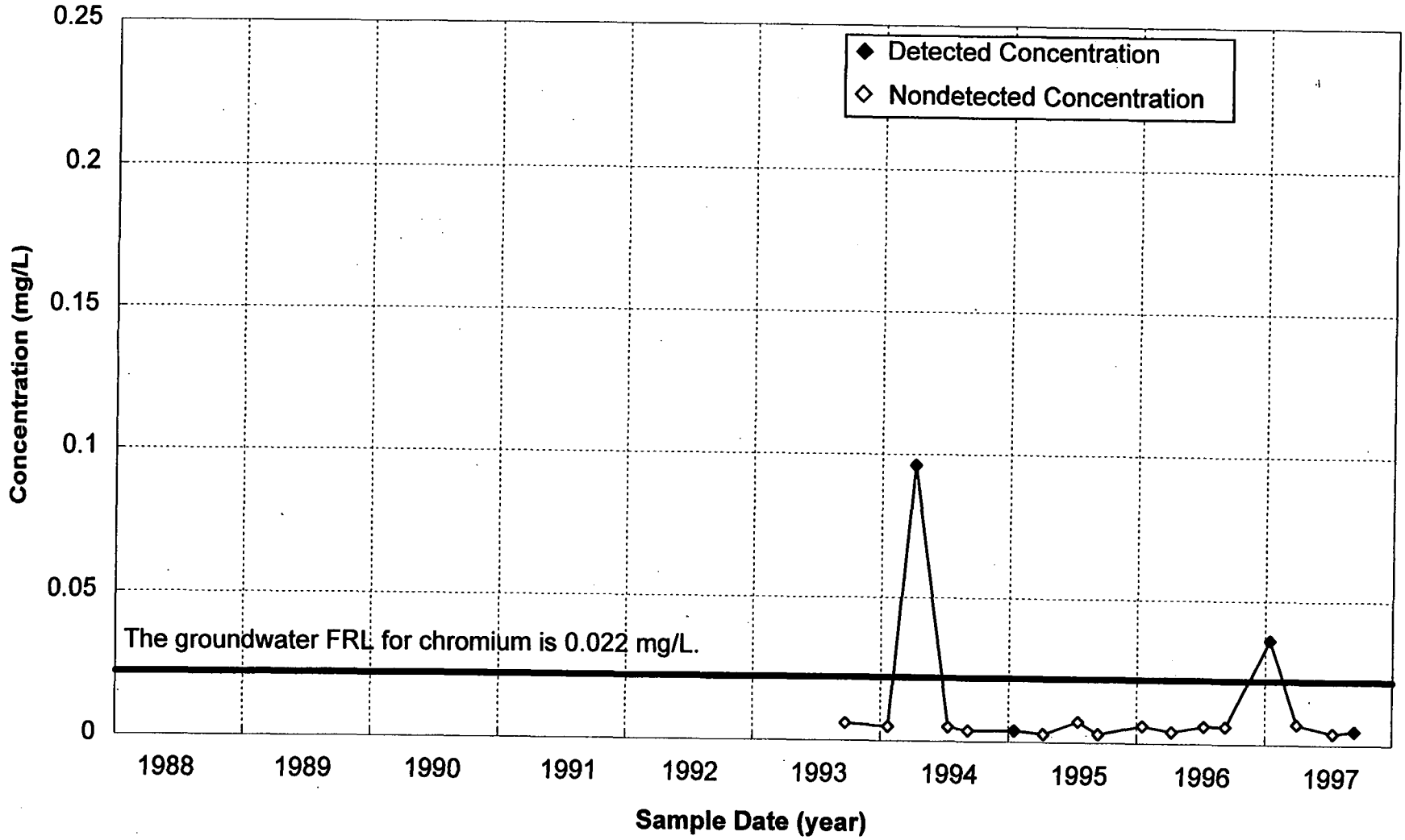


FIGURE A.4-6. CHROMIUM CONCENTRATION VS. TIME PLOT FOR WELL 41217

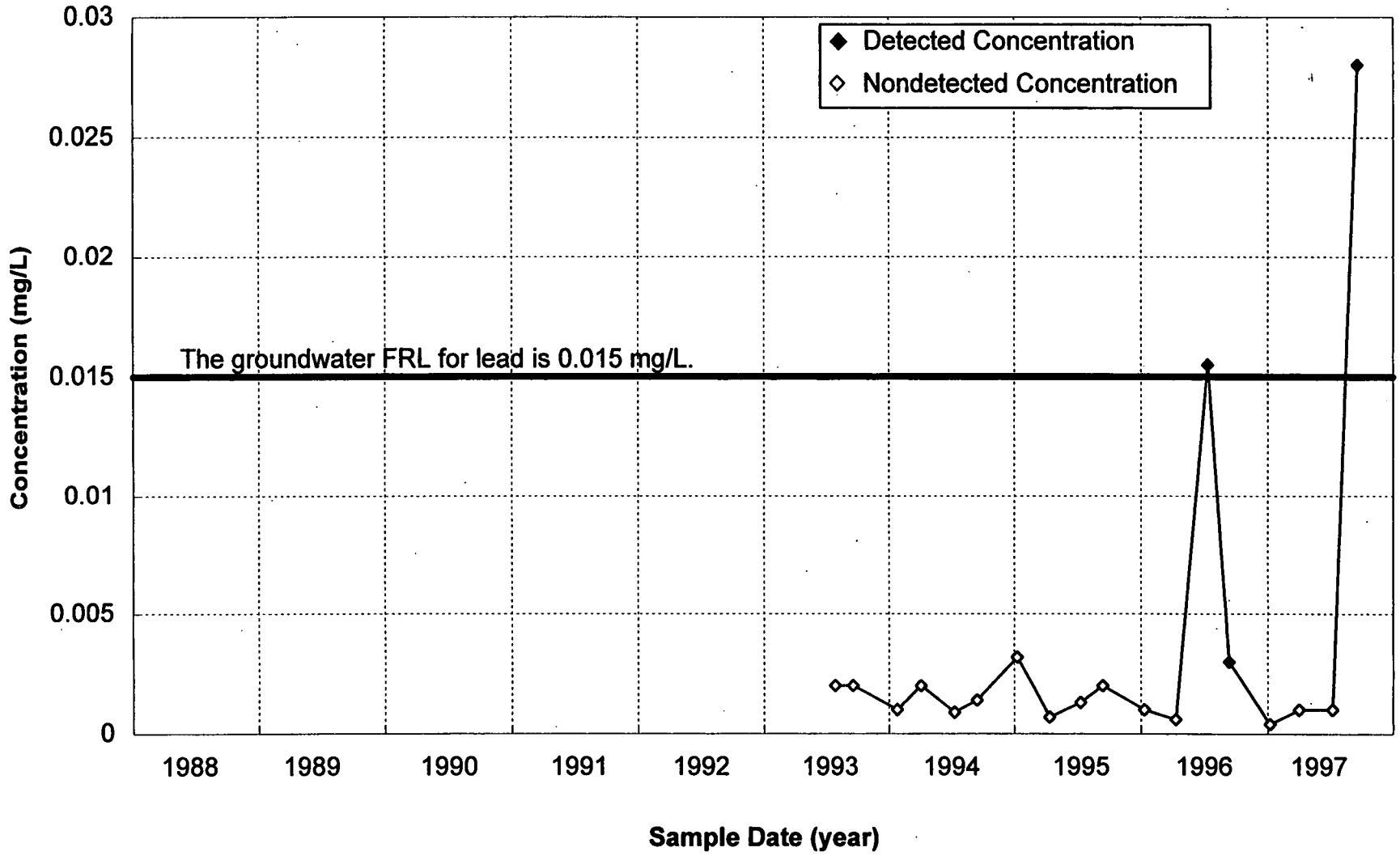


FIGURE A.4-7. LEAD CONCENTRATION VS. TIME PLOT FOR WELL 3733

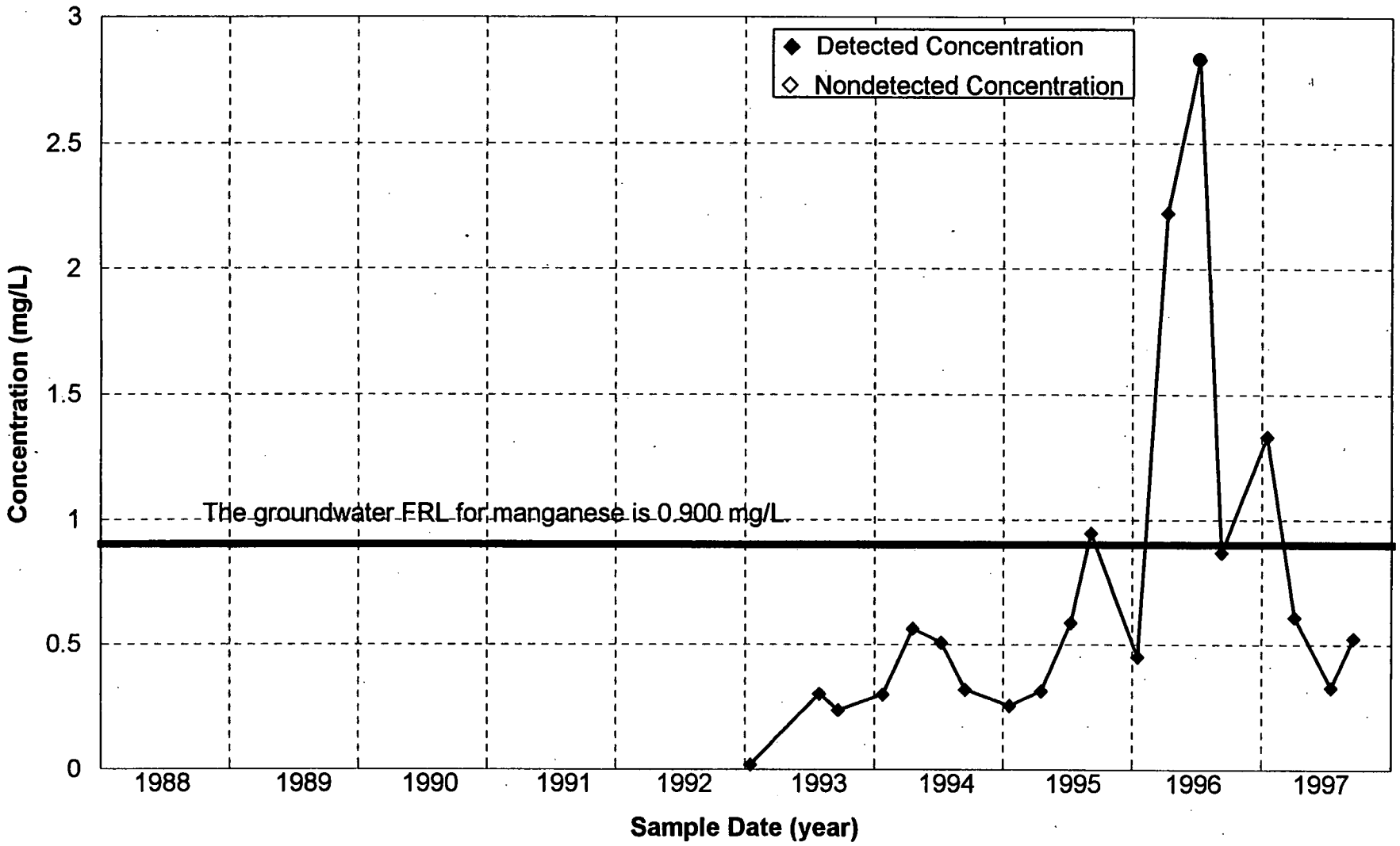


FIGURE A.4-8. MANGANESE CONCENTRATION VS. TIME PLOT FOR WELL 2424

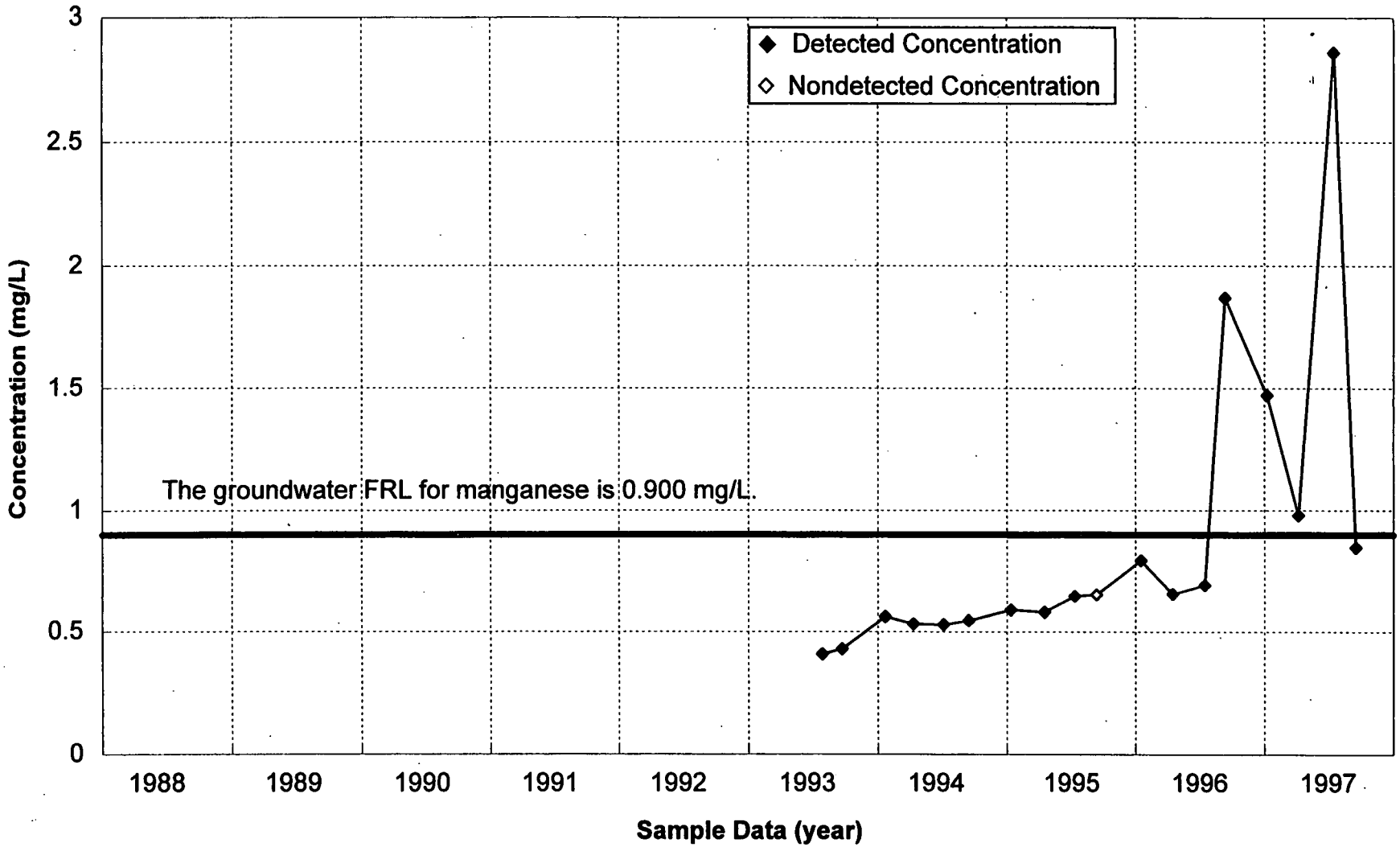


FIGURE A.4-9. MANGANESE CONCENTRATION VS. TIME PLOT FOR WELL 2426

000410

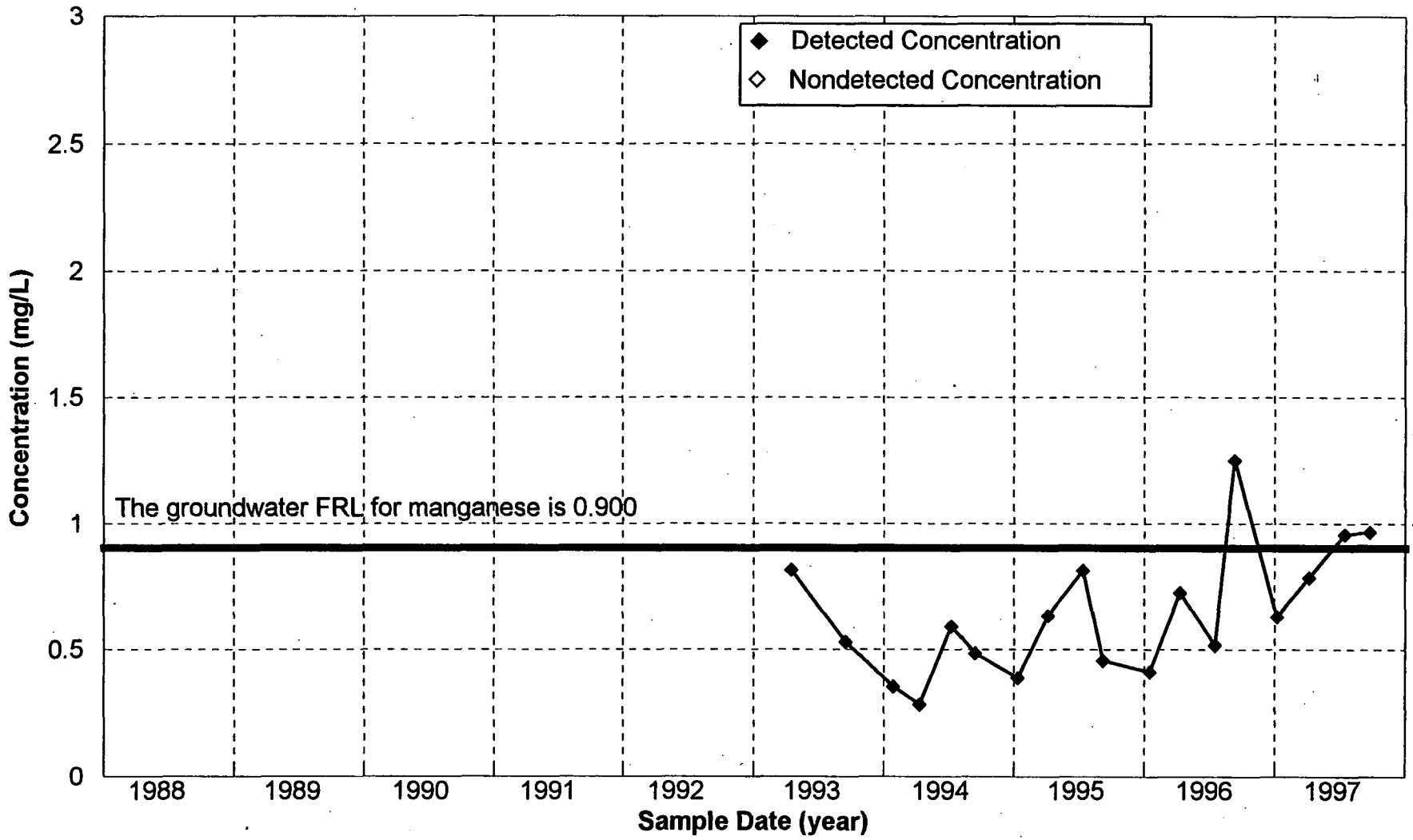


FIGURE A.4-10. MANGANESE CONCENTRATION VS. TIME PLOT FOR WELL 2430

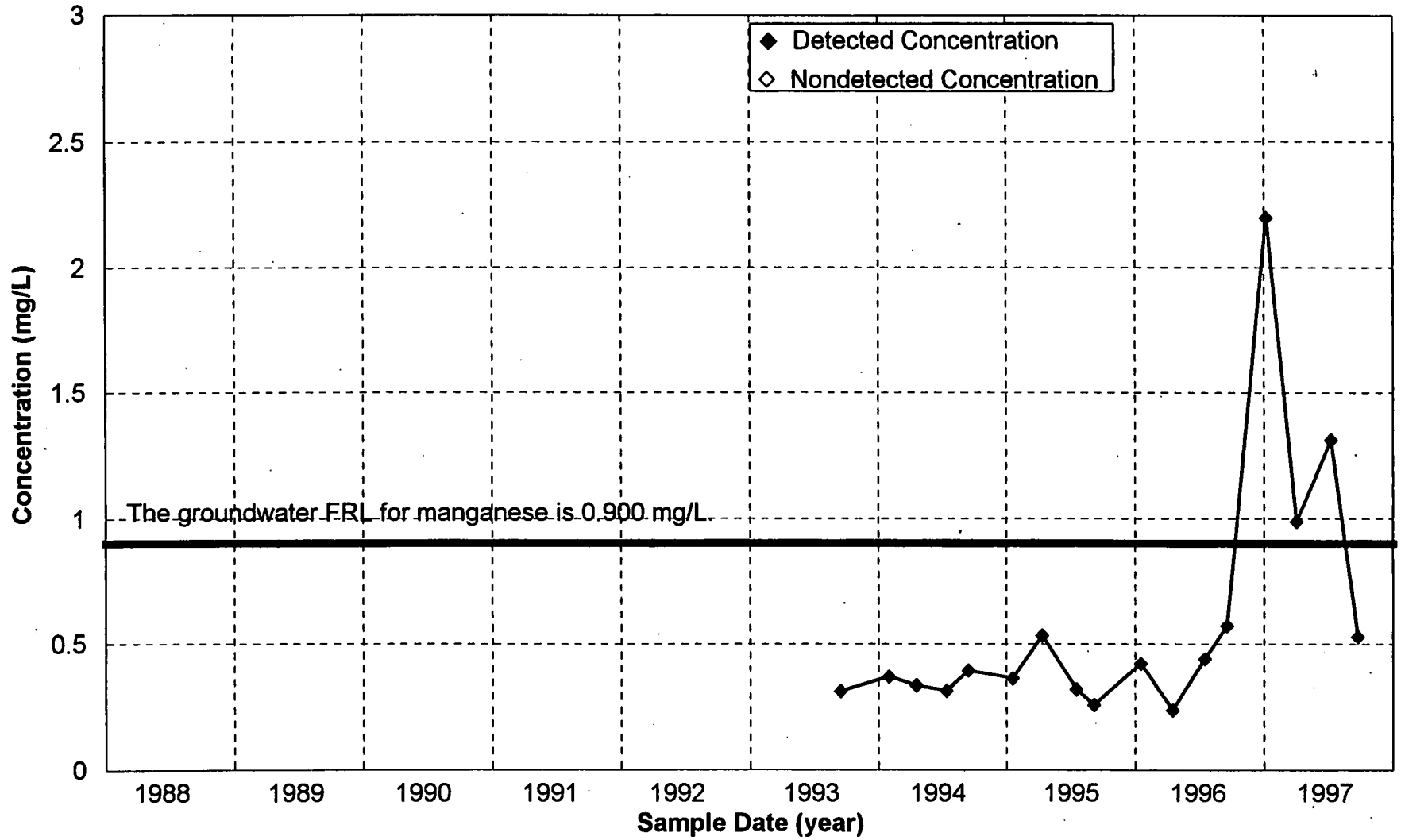


FIGURE A.4-11. MANGANESE CONCENTRATION VS. TIME PLOT FOR WELL 2431

000412

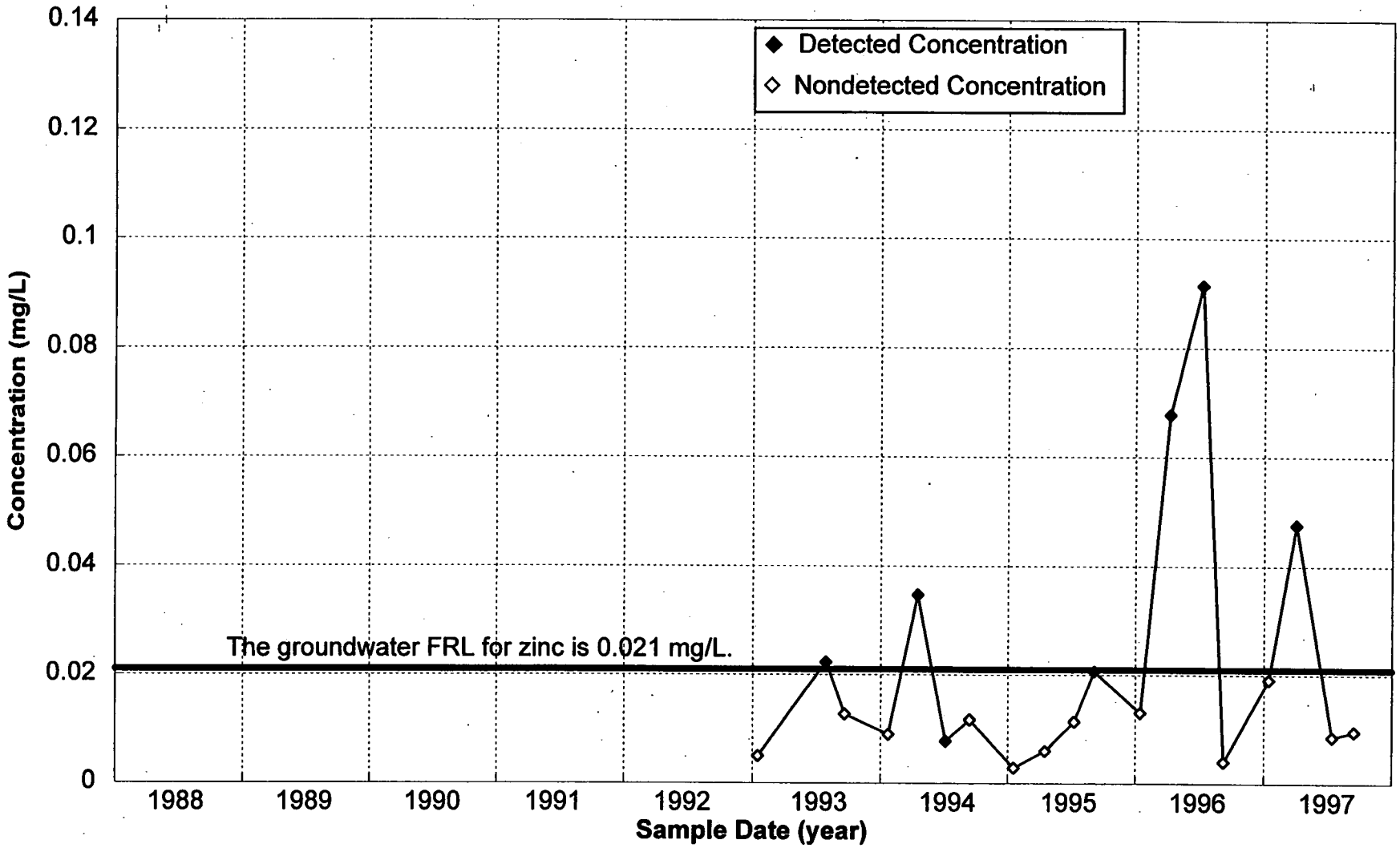


FIGURE A.4-12. ZINC CONCENTRATION VS. TIME PLOT FOR WELL 2424

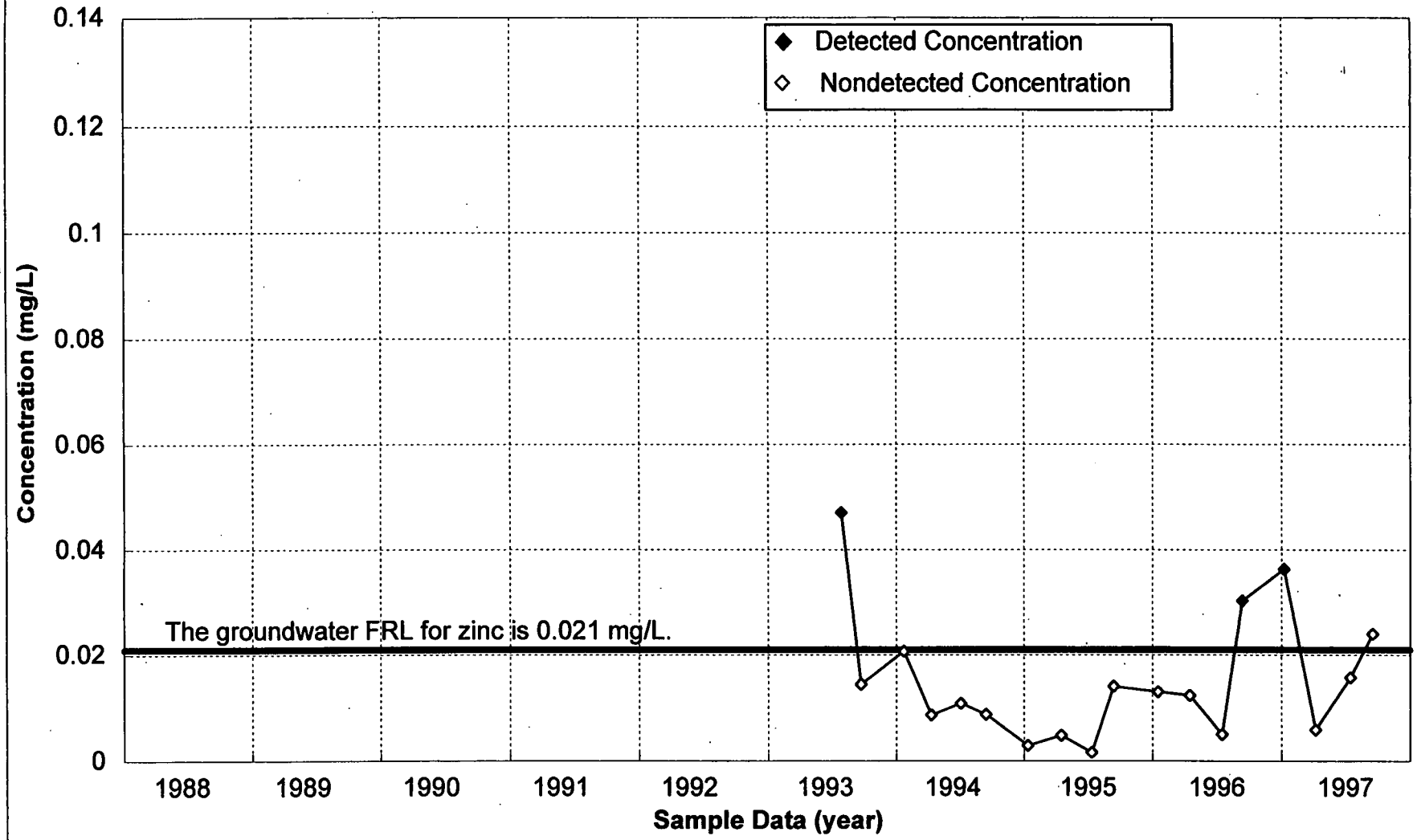


FIGURE A.4-13. ZINC CONCENTRATION VS. TIME PLOT FOR WELL 2426

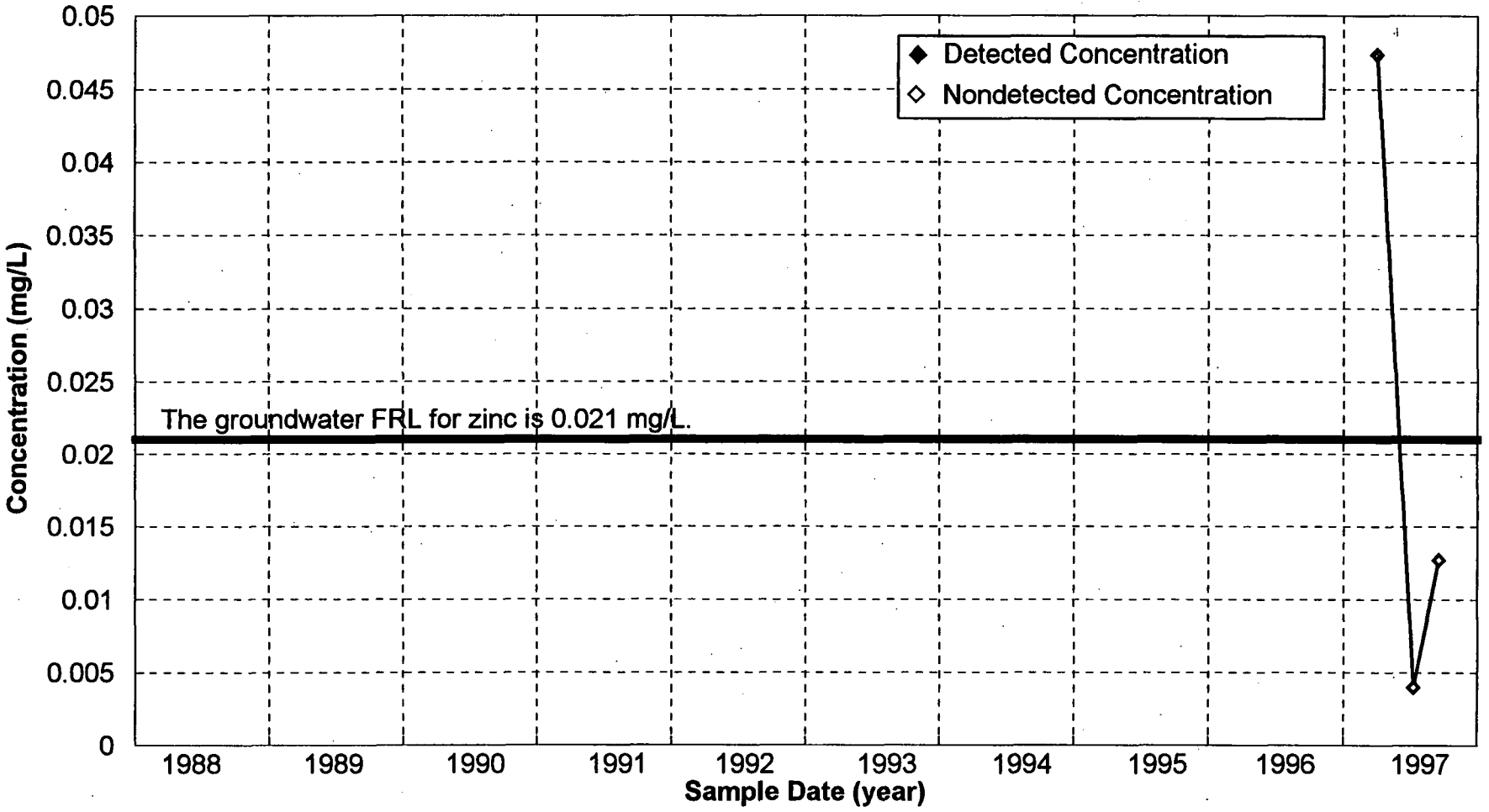


FIGURE A.4-14. ZINC CONCENTRATION VS. TIME PLOT FOR WELL 22198

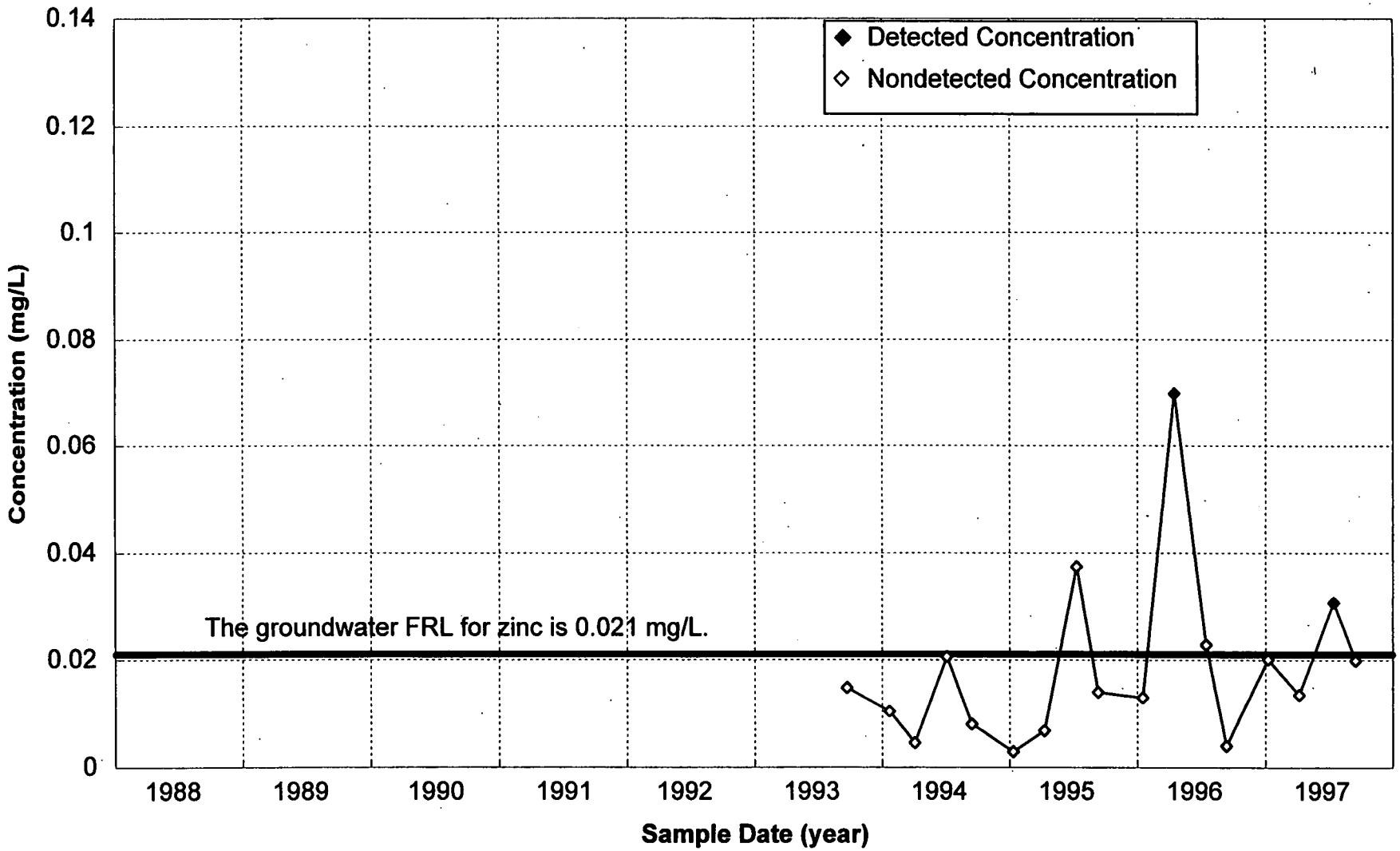


FIGURE A.4-15. ZINC CONCENTRATION VS. TIME PLOT FOR WELL 3426

000416

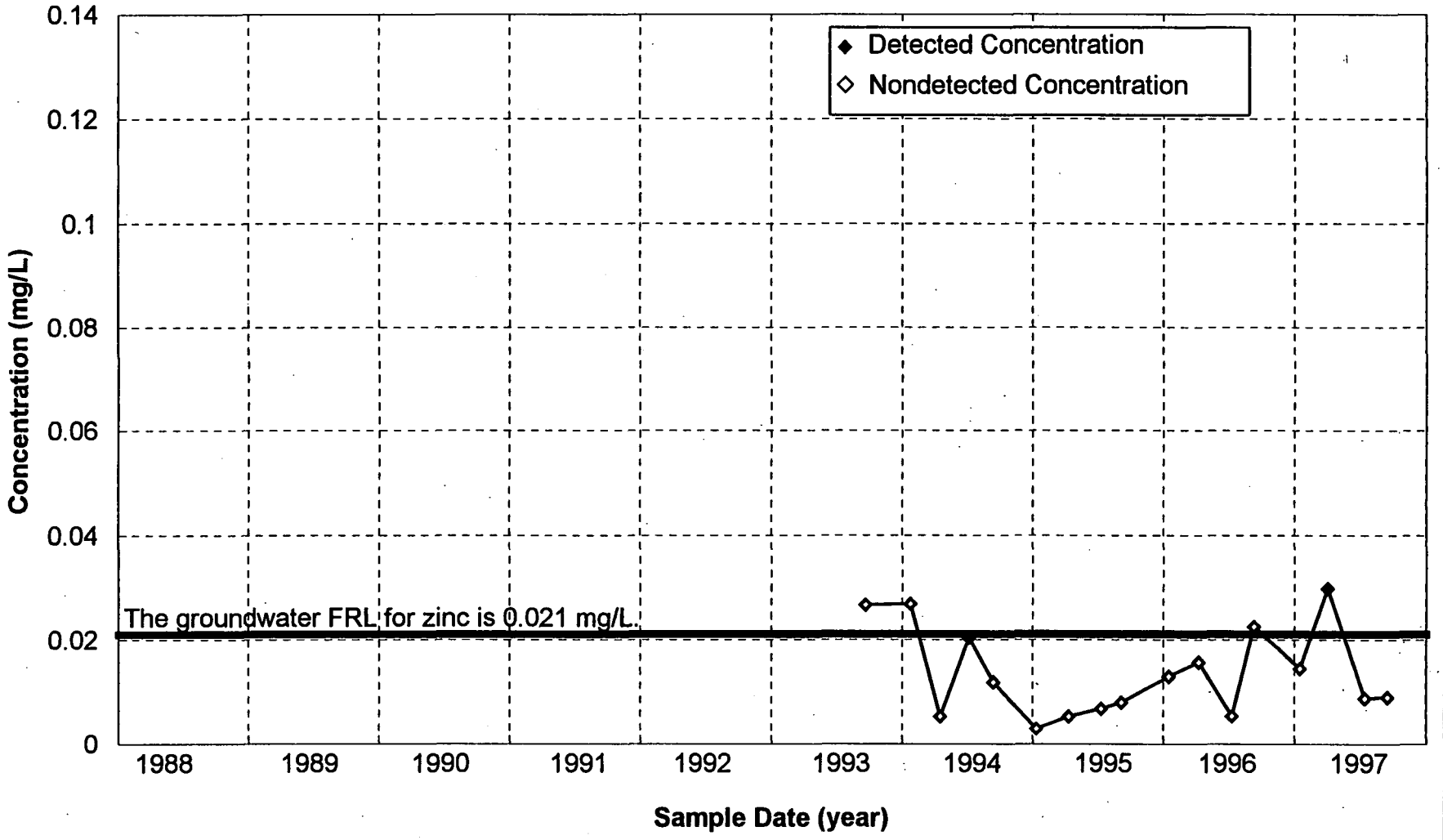


FIGURE A.4-16. ZINC CONCENTRATION VS. TIME PLOT FOR WELL 4424

Attachment A.5

ATTACHMENT A.5

MISCELLANEOUS MONITORING ACTIVITIES

ATTACHMENT A.5

KC-2 Warehouse Well Monitoring Activity

The KC-2 Warehouse Well (Well 67 in Figure A.5-1) was monitored as part of the IEMP. In accordance with an agreement with EPA, this well, located in the KC-2 Warehouse, was monitored on an annual basis. This monitoring program will continue until the warehouse is de-commissioned and demolished, at which time the well will be plugged and abandoned. Results of the KC-2 Warehouse well monitoring program, which were previously reported in letter form, will now be reported in annual integrated site environmental reports per the approved IEMP.

The August 1997 sampling event for the KC-2 Warehouse Well (Table A.5-1) indicated that concentrations of hazardous substance list metals were higher than routinely indicated in previous sampling results. Similar anomalously high concentrations were also recorded in the January 1995 sampling event. On that occasion, the elevated results were believed to have been caused by a disturbance of sediment at the bottom of the well during sampling. In an effort to determine if sediment at the bottom of the well may have been disturbed during the August 1997 sampling event, the well was resampled in January 1998. The validated results of the January 1998 sampling event are consistent with previously reported sampling events. A review of the field activity log sheets for the two sampling events indicate that the August sample was black in color and was significantly more turbid than the January sample. Therefore, the January sample is believed to be more representative of the groundwater concentrations at Monitoring Well 67.

Coal Pile Runoff Basin Monitoring

Two monitoring wells (1675 and 1676 on Figure A.5-1) installed in the glacial overburden, adjacent to the coal pile runoff basin, were used to monitor the Coal Pile Runoff Basin in 1997. Monitoring was conducted in accordance with Ohio Permit to Install No. 05-4172, issued and effective on September 13, 1990. Consistent with the requirements of the Permit to Install, the 1997 monitoring data from these two wells are presented in Table A.5-2.

TABLE A.5-1

KC-2 WAREHOUSE GROUNDWATER SUMMARY STATISTICS

Constituent	Number of Samples[a,b]	FRL[c,d] (mg/L)	Min.[a,b,e,f] (mg/L)	Max.[a,b,d,e,f] (mg/L)	Avg.[a,b,d,e,f] (mg/L)	SD[a,b,d,e,f] (mg/L)	1997 Data Sample Result (mg/L); Validation Qualifier;	1998 Data Sample Result (mg/L) Validation Qualifier[g]
Aluminum	10	NA	0.0466	80	16.7290	26.8602	11.5 J	0.262 U
Antimony	10	0.0060	0.002	0.22	0.0626	0.0739	0.128 J	0.0016 U
Arsenic	10	0.050	0.0008	0.0873	0.0194	0.0326	0.025 -	0.0013 U
Barium	10	2.0	0.103	0.867	0.3735	0.2823	0.342 -	0.363 -
Beryllium	10	0.0040	0.00011	0.005	0.0017	0.0016	0.00058 -	0.0004 U
Cadmium	10	0.014	0.0001	0.0671	0.0132	0.0233	0.0097 -	0.0033 U
Calcium	10	NA	46.3	1310	391.25	474.1690	361 J	115 -
Chromium	10	0.022[h]	0.0039	2.35	0.5198	0.8147	0.801 -	0.0184 U
Cobalt	10	0.17	0.0016	0.102	0.0307	0.0404	0.0277 -	0.0061 -
Copper	10	1.3	0.0015	0.373	0.1151	0.1530	0.116 -	0.0041 U
Cyanide	2	NA	0.00125	0.0025	NA	NA	0.0025 U	0.005 U
Iron	10	NA	3.18	620	179.814	243.8911	171 J	10.8 -
Lead	10	0.015	0.001	3.8	0.9556	1.4120	0.895 J	0.0131 J
Magnesium	10	NA	33.9	322	116.75	111.0513	121 J	40 -
Manganese	10	0.900	0.0733	8.52	2.4387	3.2829	2.36 J	0.136 U
Mercury	10	0.0020	0.00005	0.0022	0.0004	0.00068	0.00011 -	0.0001 U
Nickel	10	0.10	0.0051	1.21	0.2995	0.4297	0.431 -	0.0146 U
Potassium	9	NA	0.922	14.6	3.733	4.4820	4.42 J	2.18 U
Selenium	10	0.050	0.00039	0.0099	0.0032	0.0030	0.0061 U	0.0022 U
Silver	10	0.050	0.00035	0.0312	0.0065	0.0096	0.0007 U	0.0008 U
Sodium	9	NA	17.5	23.9	20.1778	2.0425	23.9 J	22.1 -
Thallium	10	NA	0.000445	1.8	0.1852	0.5675	0.0039 U	0.0018 U
Vanadium	10	0.038	0.00135	0.19	0.0450	0.0594	0.0343 -	0.011 U
Zinc	10	0.021	0.008	1.79	0.4568	0.6213	0.507 -	0.238 U
		(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)
Total Uranium	10	20	0.2	2400	248.13	756.2395	4.4	0.4

[a]If 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]).
[b]Rejected data qualified with either a R or Z were not included in this count or the summary statistics.
[c]From OU5 ROD, Table 9-4
[d]NA = not applicable
[e]For values where the concentrations are below the detection limit, the results used in the summary statistics are set at half the detection limit.
[f]If the total number of samples is greater than or equal to four, then all of the summary statistics are reported. If the total number of samples is equal to three, then the minimum, maximum, and average are reported. If the total number of samples is equal to two, then the minimum and maximum are reported. If the total number of samples is equal to one, then the data point is reported as the minimum.
[g]The January 1998 data is not included in the total number of samples or summary statistics.
[h]FRL based on Chromium VI, from OU5 ROD, Table 9-4.

TABLE A.5-2

COAL PILE RUNOFF BASIN SUMMARY STATISTICS FOR 1997 DATA

Well	Constituent	Number of Samples[a,b]	Min.[a,b,c,d]	Max.[a,b,c,d]	Avg.[a,b,c,d]
			(mg/L)	(mg/L)	(mg/L)
1675	Chloride	4	20	66	38
	Sulfate	4	265	395	349
	Total Dissolved Solids	4	957	1045	1010
			(Std. Units)	(Std. Units)	(Std. Units)
	pH	4	7.08	7.24	7.16
			(μmhos/cm)	(μmhos/cm)	(μmhos/cm)
	Specific Conductivity	4	1276	1361	1338
			(μg/L)	(μg/L)	(μg/L)
	Total Uranium	4	2.5	4.1	3.8
			(mg/L)	(mg/L)	(mg/L)
1676	Chloride	4	40	96	61
	Sulfate	4	220	385	297
	Total Dissolved Solids	4	719	1113	923
			(Std. Units)	(Std. Units)	(Std. Units)
	pH	4	7.10	7.30	7.16
			(μmhos/cm)	(μmhos/cm)	(μmhos/cm)
	Specific Conductivity	4	1278	1395	1354
			(μg/L)	(μg/L)	(μg/L)
	Total Uranium	4	9.7	19	14.7

[a]If 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, and average).
[b]Rejected data qualified with either a R or Z were not included in this count or the summary statistics.
[c]For values where the concentrations are below the detection limit, the results used in the summary statistics are set at half the detection limit.
[d]If the total number of samples is greater than or equal to three, then all of the summary statistics are reported. If the total number of samples is equal to two, the minimum and maximum are reported. If the total number of samples is equal to one, then the data point is reported as the minimum.

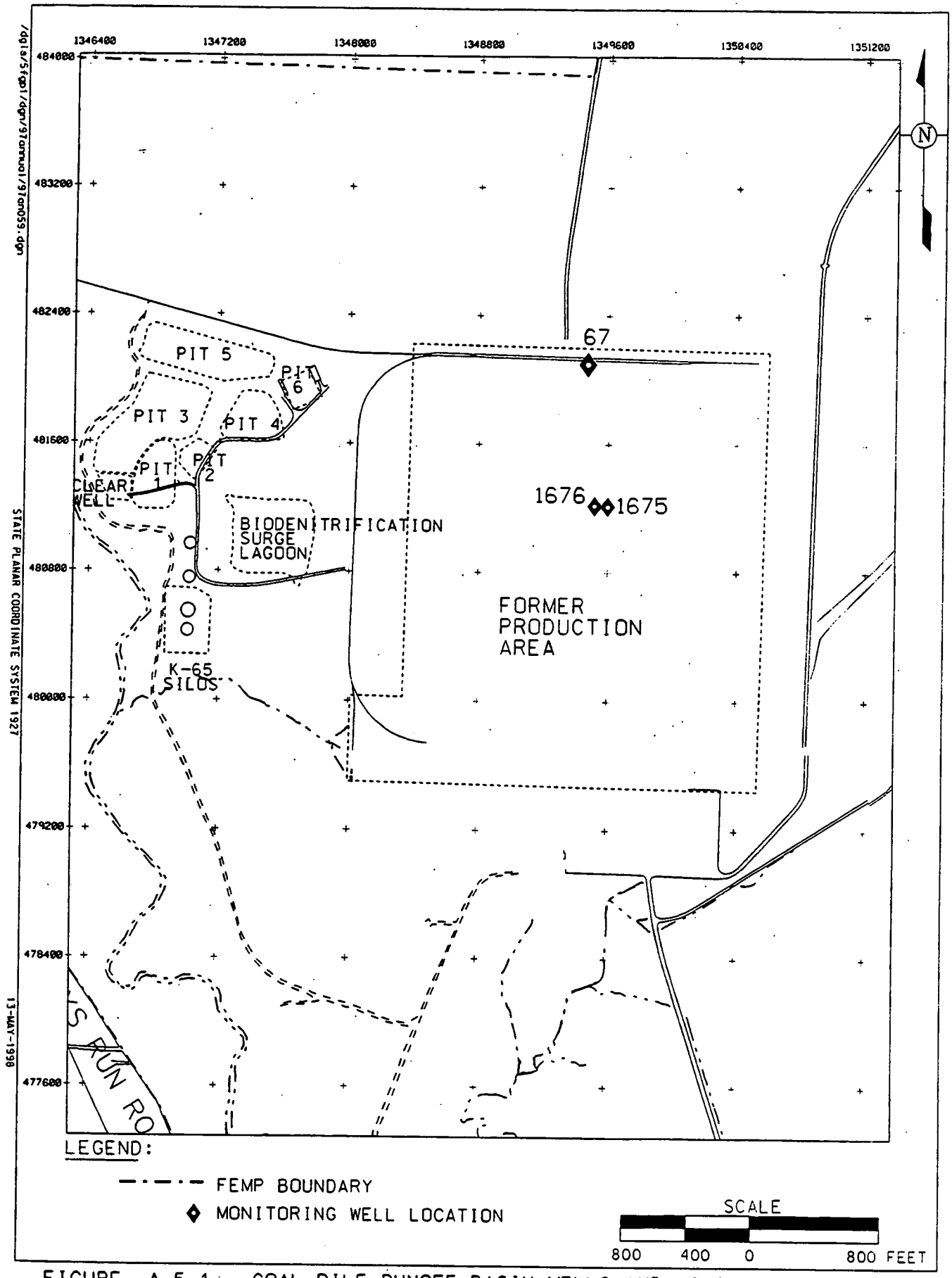


FIGURE A.5-1. COAL PILE RUNOFF BASIN WELLS AND KC-2 WAREHOUSE WELL

Attachment A-6

ATTACHMENT A.6

ON-SITE DISPOSAL FACILITY ACTIVITIES

ATTACHMENT A.6

The on-site disposal facility monitoring program fulfills two purposes: leak detection and leachate monitoring. It also meets the regulatory requirements for groundwater detection monitoring in the Great Miami Aquifer and perched groundwater system at the FEMP. The Final Groundwater/Leak Detection and Leachate Monitoring Plan for the On-Site Disposal Facility (DOE 1997b) presents the specific on-site disposal facility monitoring strategy for construction, closure, and post closure. The plan represents the first part of a three-tiered detection, assessment, and corrective action monitoring strategy required by EPA at all landfills.

Facility dimensions include: capacity of 2.5 million cubic yards, final maximum height of 40 feet, and an estimated areal coverage of 70 acres of the northeast area of the FEMP. Protection of the Great Miami Aquifer and the overlying perched groundwater system includes the following measures for each of the eight cells:

- Leachate collection system
- Leak detection system
- Multi-layer composite liner system
- Multi-layer composite cover.

The leachate collection system collects rainwater and surface water during cell construction, whereas the leak detection system sits beneath the primary liner; both drain west and exit the clay liner to manholes. Horizontal till wells set in the vicinity of where the pipe exits each cell will provide verification of groundwater quality. The location where the leachate detection and collection system piping exits the clay liner has been referred to as the "sump" in the monitoring plan. Currently, the Great Miami Aquifer groundwater monitoring wells exist in the planned location for Cell 1 and the horizontal well for Cell 1 is in place under the "sump". Baseline sampling for these wells has been completed and they are currently sampled under a quarterly sampling plan.

Table A.6-1 presents March through December 1997 monitoring data for on-site disposal facility wells 22198, 22199, 22200, and 22201. These wells were installed in March 1997. Horizontal till well 12338 was installed in December 1997, but was not monitored in 1997 for water quality. Refer to Chapter Three for a detailed discussion of 1997 groundwater monitoring activities at the on-site

disposal facility. Additionally, Figure A.6-1 depicts the 1997 on-site disposal facility monitoring well locations.

TABLE A.6-1

OSDF MONITORING WELL SUMMARY FROM INCEPTION THROUGH 1997
(March through December 1997)

Constituent	Monitoring Well	No. of Validated Samples[a,b]	No. of Validated Samples With Detections[a,b]	FRL[c,d]	Minimum[a,b,e,f]	Maximum[a,b,d,e,f]	Average[a,b,d,e,f]
Total Organic Carbon				(mg/L)	(mg/L)	(mg/L)	(mg/L)
				NA			
	22198	15	15		0.0143	25	7.65
	22199	7	7		0.0266	19.3	8.30
	22200	7	7		0.0232	19.4	8.66
	22201	15	15		0.0186	24	10.3
Total Organic Halogens				NA			
	22198	15	5		0.0062	0.0526	0.0243
	22199	7	2		0.0055	0.0066	NA
	22200	7	3		0.0073	0.0181	0.012
	22201	15	9		0.0055	0.078	0.0308
Boron				0.33			
	22198	16	12		0.0511	0.0805	0.0620
	22199	7	4		0.044	0.0569	0.0479
	22200	7	4		0.0473	0.158	0.0771
	22201	15	10		0.0575	0.123	0.0936
Technetium-99				(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
	22198	16	1	94.0	17.6	NA	NA
	22201	15	2		13.4	21.6	NA
Uranium, Total				(μg/L)	(μg/L)	(μg/L)	(μg/L)
	22198	16	16	20	0.645	3.81	1.61
	22199	7	7		0.325	0.608	0.426
	22200	7	7		0.131	1.11	0.377
	22201	15	14		0.08	5.30	0.558
Tetrachloroethene				NA			
	22201	15	1		1	NA	NA

[a]If more than one sample is collected per well per day (e.g., duplicate), then only one sample is counted for the number of validated samples, the number of validated samples with detections, and the sample with the maximum concentration is used for determining the summary statistics (minimum, maximum, and average).
[b]Rejected data qualified with either a R or Z were not included in this count or the summary statistics.
[c]From OU5 ROD, Table 9-4
[d]NA = not applicable
[e]If the total number of samples is greater than or equal to three, then the minimum, maximum, and average are reported. If the total number of samples is equal to two, then the minimum and maximum are reported. If the total number of samples is equal to one, then the data point is reported as the minimum.
[f]For results where the concentrations are below the detection limit, the results used in the summary statistics are each set at half the detection limit.

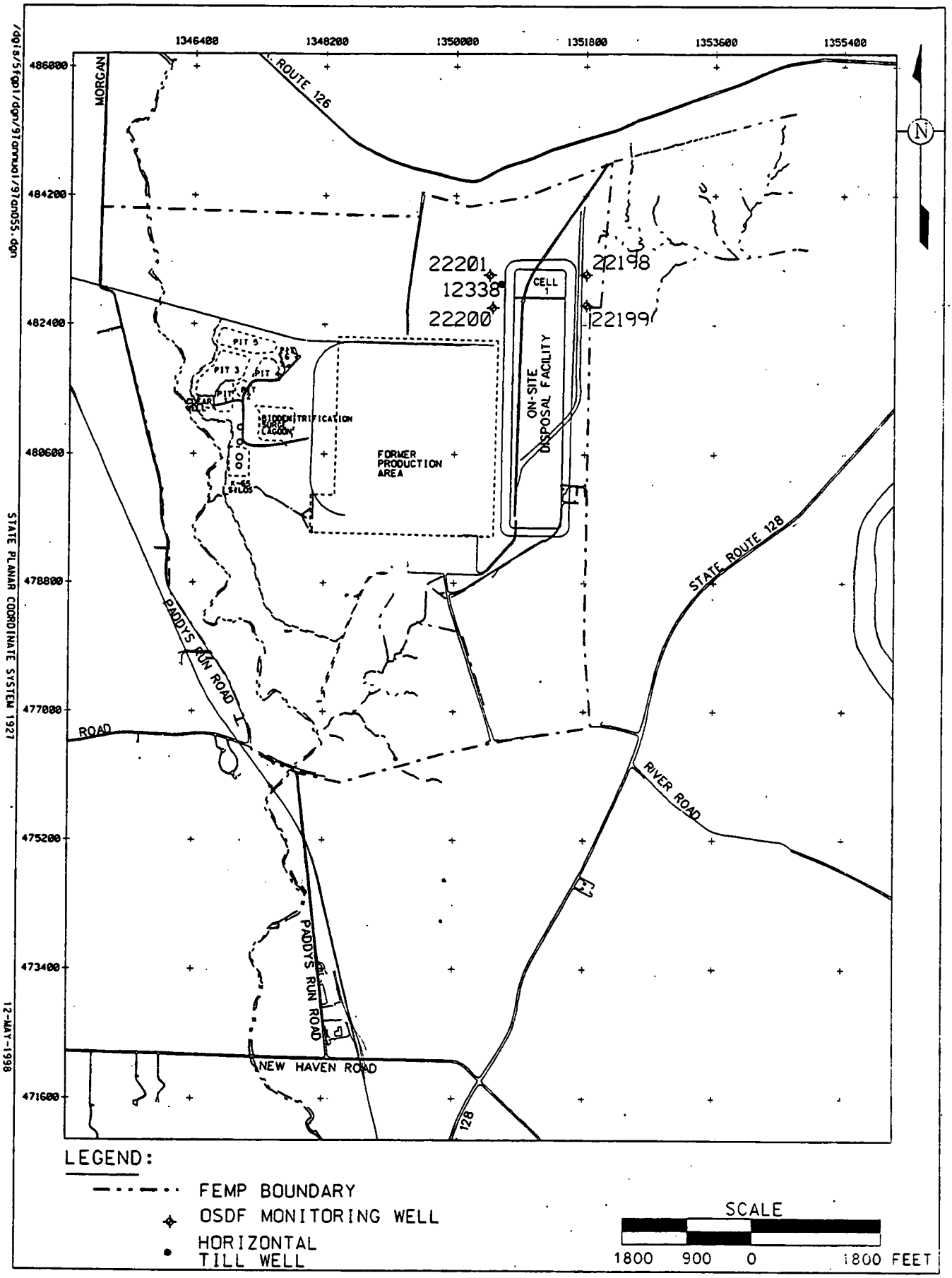


FIGURE A.6-1. ON-SITE DISPOSAL FACILITY FOOTPRINT AND MONITORING WELL LOCATIONS

Appendix B

APPENDIX B

SUPPLEMENTAL SURFACE WATER AND TREATED EFFLUENT INFORMATION

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Appendix B Supplemental Surface Water And Treated Effluent Information B-1

Attachment B.1 Surface Water and Treated Effluent B.1-1
Attachment B.2 Sediment B.2-1

LIST OF ACRONYMS

BTV	benchmark toxicity value
cfs	cubic feet per second
EPA	U.S. Environmental Protection Agency
FFCA	Federal Facilities Compliance Agreement
FRL	final remediation level
IEMP	Integrated Environmental Monitoring Plan
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
pCi/g	picoCuries per gram
pCi/L	picoCuries per liter
ROD	Record of Decision
SD	standard deviation
μg/L	micrograms per liter

APPENDIX B

Appendix B presents additional surface water, treated effluent, and sediment data in support of Chapter Four of the 1997 Integrated Site Environmental Report. This appendix consists of two attachments as follows:

- Attachment B.1 provides further evaluation of the final remediation levels (FRLs) and benchmark toxicity (BTV) exceedances for surface water and treated effluent including an assessment of potential cross-media impacts to the groundwater pathway. This attachment also provides detail on storm water-related bypasses pertaining to compliance with the Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996) total uranium treated effluent discharge limits.

- Attachment B.2 provides additional details pertaining to the 1997 sediment analytical results and historical results for comparison purposes.

REFERENCES

U.S. Dept. of Energy, 1995a, "Environmental Monitoring Plan," U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

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U.S. Dept. of Energy, 1997b, "Operations and Maintenance Master Plan for Aquifer Restoration and Wastewater Treatment Projects," Final, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

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ATTACHMENT B.1

SURFACE WATER AND TREATED EFFLUENT

ATTACHMENT B.1

During 1997, surface water and treated effluent samples were collected under the Integrated Environmental Monitoring Plan (IEMP) (DOE 1997a) and former programs for various constituents to fulfill both regulatory and surveillance monitoring requirements. The pre-IEMP and IEMP sample locations are presented in Figures B.1-1 and B.1-2, respectively. Surface water monitoring locations and the program for which samples were collected in 1997 are summarized in Table B.1-1.

DATA LIMITATIONS

Because the IEMP sampling was not implemented until August 1997, a minimal number of nonradiological, and for some locations, radiological sample results are available to be used for surveillance monitoring evaluation (i.e., comparison to FRLs and BTVs), to assess background concentrations, and to identify significant trends in the surface water data. Statistical and graphical trending was not completed due to the data limitations. As additional data become available, this information will be presented in future reports associated with the IEMP.

In addition to the limited data available for interpretation, detection limits required for some FRL or BTV constituents could not be met during analysis by the contracted laboratory. Constituents for which the laboratory did not meet detection limits consistently included several semi-volatile organic compounds, metals, and volatile organic compounds. The ability of the contracted laboratories to meet the respective detection limits has improved greatly with implementation of the IEMP in August 1997. As of October 1997, the only detection limit that was not achieved was for the aluminum BTV. As discussed later, the aluminum BTV is above the aluminum background concentration in both Paddys Run and the Great Miami River and monitoring against this BTV is being investigated.

SURVEILLANCE MONITORING

Surveillance monitoring is the comparison of surface water and treated effluent analytical results to the surface water FRLs and BTVs in order to determine effects of FEMP remediation activities on the surface water pathway. Surveillance monitoring also includes an assessment of surface to groundwater cross-media impacts.

All 1997 data with the exception of the data collected from the Sewage Treatment Plant (STP 4601) were compared to FRLs and BTVs. Results of treated effluent samples collected from the Sewage Treatment Plant (STP 4601) are not used for surveillance monitoring because these samples are collected at an internal point prior to the Sewage Treatment Plant treated effluent being discharged to the Parshall Flume (PF 4001). Samples collected at the Parshall Flume (PF 4001) are used in the surveillance evaluation because this is the last point treated effluent is sampled prior to discharge to the Great Miami River.

Water discharges to the Great Miami River are required to be below the FRLs at the point where discharged water is completely mixed with water in the Great Miami River (i.e., outside the mixing zone). To make a conservative determination of the concentration of each constituent at this point in the Great Miami River for comparison to the FRLs, the following calculation was applied to data from the Parshall Flume (PF 4001):

$$C_{PF4001} = \frac{[Q_{10}]\ [C_{GMR}] + [Q_{PF}]\ [C_{PF}]}{[Q_{10}] + [Q_{PF}]}$$

where:

C_{PF4001}	=	Flow-weighted average concentration outside the mixing zone in the Great Miami River, picoCuries per liter (pCi/L) or milligrams per liter (mg/L)
Q_{10}	=	7-day, 10-year low flow, 583 cubic feet per second (cfs)
C_{GMR}	=	Background concentration in Great Miami River from the Remedial Investigation Report for Operable Unit 5 (DOE 1995b), pCi/L or mg/L (0 was used when no background concentration was available)
Q_{PF}	=	Daily flow at Parshall Flume (PF 4001), cfs
C_{PF}	=	Daily concentration at Parshall Flume (PF 4001), pCi/L or mg/L

Table B.1-2 lists FRL exceedances at corresponding sample locations. Note that no exceedances occurred in the Great Miami River or at the point where Paddys Run flows off property. In addition,

the surface water FRL for total uranium was not exceeded at any surface water sample location. The FRL exceedances that did occur in 1997 were generally sporadic as indicated by the small number of replicate exceedances and the fact that the exceedances do not occur at multiple locations during each sampling event.

As noted on Table B.1-2, the copper FRL exceedance appears to be more prevalent than the remaining FRL exceedances. Copper is sampled biannually in the drainages to Paddys Run (STRM 4003, STRM 4004, STRM 4005, and STRM 4006) and during overflows of the Storm Water Retention Basin (SWRB 4002) to comply with the National Pollutant Discharge Elimination System (NPDES) permit. It is also sampled at other drainages on a more frequent basis. The copper FRL was exceeded in several samples during 1997; however, the exceedances were only slightly above the FRL and the copper FRL was not exceeded at the property boundary location in Paddys Run during 1997. These exceedances will continue to be monitored as established in the NPDES permit and in the IEMP to determine their significance.

The FRL for zinc was exceeded in three of five samples collected from the northeast drainage ditch (SWD-01) during 1997. The last time this location was sampled in December 1997, the zinc FRL was not exceeded. The zinc exceedance concentrations are consistent with historical results of samples collected within this drainage for the Remedial Investigation Report for Operable Unit 5. The zinc exceedances associated with this location are not considered to be significant at this time. However, recognizing that a portion of the drainage area (Area 1, Phase I) feeding the northeast drainage has been certified as meeting soil FRLs specified in the Record of Decision for Operable Unit 5, zinc concentrations in this drainage will continue to be monitored and tracked over time to determine the significance of these exceedances.

The sample collected at SWP-02 (Figure B.1-2) in October 1997 exceeded the FRL for six metal constituents (beryllium, cadmium, total chromium, copper, manganese, and mercury). Only minimal remediation activities within the drainage basin for SWP-02 were active during October, and previous and subsequent sample results did not exceed the FRLs for these constituents. No samples were required to be collected at the upstream locations (SWP-01 and STRM 4006) during October; the downstream location (SWP-03) was dry during the entire month of October. Moreover, data for STRM 4006 indicate that only copper exceeded the FRL during 1997. Due to minimal rainfall during

October, these exceedances may have been related instead to elevated levels of sediment in the sample. Sampling under the IEMP will continue to track these constituents and to determine if the exceedances are persistent.

Another objective of the IEMP surveillance monitoring program is to provide an ongoing assessment of the potential for cross-media impacts from surface water to the underlying Great Miami Aquifer. To provide this assessment, sample locations were selected to evaluate contaminant concentrations in surface water just upstream from those areas where site drainages have eroded through the protective glacial overburden (i.e., Storm Sewer Outfall Ditch and certain reaches of Paddys Run). In areas where the overburden is absent, a direct pathway exists for contaminants to reach the aquifer. Total uranium is used as an indicator to evaluate the impact of surface water on the Great Miami Aquifer because it is the primary contaminant at the site. A conservative assumption is used in this assessment, which considers the total uranium concentration in the surface water to be at the same concentration when the water reaches the Great Miami Aquifer through infiltration. However, the most likely scenario is that the total uranium concentration would decrease, because dilution and adsorption occur as the water infiltrates through the ground and is mixed with the groundwater in the Great Miami Aquifer.

As shown in Table B.1-3, the results of the cross-media impact assessment for 1997 indicate occasional exceedances of the groundwater total uranium FRL (20 micrograms per liter [μg/L]) in the areas where surface water is directly infiltrating into the Great Miami Aquifer. Key sample locations associated with these areas of direct infiltration are SWP-02, SWD-02, and SWRB 4002. The exceedances presented in Table B.1-3 have not been identified as being persistent based on the 1997 data set and it is not likely that the underlying Great Miami Aquifer has been significantly impacted by these sporadic exceedances. In addition, the design of the groundwater remediation systems has accounted for this contaminant pathway by designing extraction wells to be installed downgradient of these areas where direct infiltration occurs. Surface water monitoring under the IEMP will continue to focus on assessing the potential for cross-media impacts to the groundwater pathway throughout the remediation process.

BTV exceedances for 1997 were limited to 11 constituents at various locations. As noted in Table B.1-4, the aluminum BTV exceedances are more prevalent than the remaining constituents with BTV exceedances. The aluminum BTV was exceeded at nine locations which included the two

background locations. The background aluminum concentration in both the Great Miami River and Paddys Run is higher than the aluminum BTV and thus, indicates that the aluminum concentrations in surface water are not attributable to the FEMP. To address this issue, an assessment is currently being conducted at the site to determine the applicability of the current BTVs to surveillance monitoring. This evaluation was presented in the Sitewide Excavation Plan (DOE 1998) which has been submitted to the regulatory agencies for review in April 1998.

Based on the sporadic nature of these FRL and BTV exceedances, continued monitoring is recommended to determine their significance. The data will continue to be used to document exceedances, provide statistical analysis, assess the cross-media impacts, and determine if additional administrative or engineered controls are required to protect the surface water pathway. As more data is collected with implementation of the IEMP, the background concentrations will be refined and trends will also be established via graphical and statistical methods.

Storm Water-related Bypasses

The Operable Unit 5 Record of Decision stipulates compliance with a monthly flow-weighted average total uranium concentration of 20 μg/L at the Great Miami River via the Parshall Flume (PF 4001) beginning on January 1, 1998. During 1997, the FEMP monitored total uranium concentrations at the Parshall Flume (PF 4001) to assess the ability to achieve compliance with this 20 μg/L limitation prior to the implementation date.

The regulatory agencies allow the FEMP to directly discharge water collected in the Storm Water Retention Basin to the Great Miami River during periods of "significant precipitation". These are referred to as bypass events. As noted in Figure B.1-3, the Operable Unit 5 Record of Decision allows the FEMP to eliminate the flow-weighted concentration for these bypass days due to "significant precipitation" (up to 10 days each year) in order to comply with the 20 μg/L total uranium limit. Based on the recently approved refinements to the definition of how the bypass days are to be counted, eight of the 10 allowable annual "significant precipitation" bypass days were used during 1997 to comply with the limit. The refined definition was established in the Operations and Maintenance Master Plan for Aquifer Restoration and Wastewater Treatment Project (Section 3.6.2) (DOE 1997b). The Operations and Maintenance Master Plan was approved by the U.S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA) in October and

November 1997, respectively. In summary, "significant precipitation" bypass days are to be accounted for as follows:

- Each day(s) when bypassing for less than 12 hours occurs is (are) to be counted only as necessary to achieve the 20 μg/L monthly average total uranium limit
- Each day when bypassing for 12 or more hours occurs is to be counted as a full bypass day.

The flow-weighted concentration and flow rate for each bypass day are eliminated from the calculation for the month.

Figure B.1-3 shows that the FEMP complied with the limit for the entire year ahead of the effective date for the limit and provides more detail on the bypass days with respect to compliance with the 20 μg/L total uranium limit. This figure shows how the monthly flow-weighted average concentration at the Parshall Flume (PF 4001) drops as each allowable bypass day is utilized. Note that for the month of June, five "significant precipitation" bypass days were required to be utilized per the refined definition; however, only three days were required to meet the 20 μg/L total uranium limit.

A storm water-related bypass during scheduled treatment plant maintenance activities occurred on three days (August 18, 19, and 20) as noted on Figure B.1-3. Bypassing during scheduled treatment plant maintenance is permissible under the Operable Unit 5 Record of Decision; therefore, had the 20 μg/L discharge limit been in effect, the August bypass days would not have been considered in the calculation of the monthly average.

TABLE B.1-1

LISTING OF SURFACE WATER AND TREATED EFFLUENT SAMPLE LOCATIONS

Sample Location	Surface Water Program
PF 4001[a]	NPDES/FFCA/IEMP Characterization/NPDES Permit Renewal
SWRB 4002[a]	NPDES/FFCA/IEMP Characterization/NPDES Permit Renewal
STP 4601[a]	NPDES
STRM 4003[a]	NPDES/NPDES Permit Renewal
STRM 4004[a]	NPDES/NPDES Permit Renewal
STRM 4005[a] (W10DD)	NPDES/IEMP Characterization/(Pre-IEMP Environmental Monitoring Program)/NPDES Permit Renewal
STRM 4006[a]	NPDES/NPDES Permit Renewal
SWD-01	IEMP Characterization
SWD-02	IEMP Characterization
SWD-03	IEMP Characterization
SWP-01 (W5)	IEMP Characterization/(Pre-IEMP Environmental Monitoring Program)
SWP-02	IEMP Characterization
SWP-03 (W7)	IEMP Characterization/(Pre-IEMP Environmental Monitoring Program)
SWR-01 (W1)	IEMP Characterization/(Pre-IEMP Environmental Monitoring Program)
W3	Pre-IEMP Environmental Monitoring Program
W4	Pre-IEMP Environmental Monitoring Program
W8	Pre-IEMP Environmental Monitoring Program
W9	Pre-IEMP Environmental Monitoring Program
W10	Pre-IEMP Environmental Monitoring Program
W10DS	Pre-IEMP Environmental Monitoring Program
W10US	Pre-IEMP Environmental Monitoring Program
W11	Pre-IEMP Environmental Monitoring Program

[a]Permitted NPDES Outfall

TABLE B.1-2

1997 SURFACE WATER LOCATIONS WITH RESULTS ABOVE THE FRL, INCLUDING SUMMARY STATISTICS

Location[a]	Constituent	Total Number of Samples During 1997[b,c]	Number of Samples with FRL Exceedances During 1997[b,c]	FRL[d] (mg/L)	Summary Statistics[b,c,e,f] Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD (mg/L)
STRM 4003 (Southern Paddys Run Drainage Ditch)	Chromium	3	1	0.010[g]	0.00145	0.0207	0.00838	NA
	Copper	3	2	0.012	0.0028	0.016	0.011	NA
	Lead`	3	1	0.010	0.0021	0.015	0.0093	NA
STRM 4004 (Paddys Run Drainage Ditch Near Inactive Flyash Pile)	Beryllium	1	1	0.0012	0.0016	NA	NA	NA
	Chromium	2	1	0.010[g]	0.003	0.033	NA	NA
	Copper	2	2	0.012	0.0169	0.0293	NA	NA
	Lead	2	1	0.010	0.0108	0.0154	NA	NA
STRM 4005 (Pilot Plant Drainage Ditch)	Beryllium	1	1	0.0012	0.0021	NA	NA	NA
	Chromium	3	1	0.010[g]	0.0014	0.042	0.015	NA
	Copper	3	1	0.012	0.00285	0.0448	0.0182	NA
	Lead	3	1	0.010	0.00055	0.026	0.012	NA
	Manganese	1	1	1.5	1.57	NA	NA	NA
	Zinc	1	1	0.11	0.269	NA	NA	NA
				(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)
	bis(2-Ethylhexyl)phthalate	1	1	8.4	23	NA	NA	NA
				(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
STRM 4006 (Northern Paddys Run Drainage Ditch)	Copper	3	1	0.012	0.00285	0.0167	0.00922	NA
SWD-01 (Northeast Drainage)	Zinc	5	3	0.11	0.0384	0.366	0.200	0.144

TABLE B.1-2
(Continued)

Location[a]	Constituent	Total Number of Samples During 1997[b,c]	Number of Samples with FRL Exceedances During 1997[b,c]	FRL[d] (mg/L)	Summary Statistics[b,c,e,f] Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD (mg/L)
SWP-02 (Paddys Run)	Beryllium	4	1	0.0012	0.000015	0.0076	0.0020	0.0037
	Cadmium	4	1	0.0098	0.0001	0.0105	0.003	0.005
	Chromium	4	1	0.010[g]	0.0003	0.2	0.5	0.09
	Copper	4	1	0.012	0.0026	0.27	0.070	0.13
	Manganese	4	1	1.5	0.0067	9.7	2.4	4.8
	Mercury	4	1	0.00020	0.00005	0.0004	0.001	0.0002
SWRB 4002 (Storm Water Retention Basin Overflow)	Copper	1	1	0.012	0.0156	NA	NA	NA

[a]See location map (Figure B.1-2) and Table B.1-1 for locations and programs.
[b]If more than one sample is collected per surface water location per day (e.g., duplicate, grab, composite), then only one sample is counted for the total number of samples, and the sample with the maximum concentration is used for the summary statistics and in determining FRL exceedances.
[c]Rejected data qualified with either a R or Z was not used for this table.
[d]From OU5 ROD, Table 9-5
[e]If the total number of samples is greater than or equal to four, then all of the summary statistics are reported. If the total number of samples is equal to three, then the minimum, maximum, and average are reported. If the total number of samples is equal to two, then the minimum and maximum are reported. If the total number of samples is equal to one, then the data point is reported as the minimum.
[f]NA = not applicable
[g]FRL based on Chromium VI, from OU5 ROD, Table 9-5

TABLE B.1-3

EVALUATION OF 1997 TOTAL URANIUM GROUNDWATER FRL EXCEEDANCES FOR CROSS-MEDIA IMPACTS[a]

	Number of Exceedances	Number of Samples	Maximum Result (μg/L)
SWP-02	1	4	37
SWD-02	2	5	73
Overflow of Storm Water Retention Basin	1	1	314[b]

[a]Groundwater total uranium FRL is 20 μg/L.
[b]Overflows from the Storm Water Retention Basin are rare (i.e., only one Storm Water Retention Basin overflow occurred in 1997).

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TABLE B.1-4

SURFACE WATER LOCATIONS WITH RESULTS ABOVE THE BTV, INCLUDING SUMMARY STATISTICS

Location[a]	Constituent	Total Number of Samples During 1997[b,c]	Number of Samples with BTV Exceedances During 1997[b,c]	BTV[d] (mg/L)	Summary Statistics[b,c,e,f] Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD (mg/L)
SWD-01 (Northeast Drainage)	Aluminum	2	1	0.087	0.0823	7.9	NA	NA
	Manganese	5	1	0.098	0.0073	0.106	0.051	0.042
	Zinc	5	2	0.28	0.0384	0.366	0.200	0.144
SWD-02 (Storm Sewer Outfall Ditch)	Aluminum	5	5	0.087	0.479	3.28	2.04	1.12
	Manganese	5	3	0.098	0.0338	0.248	0.116	0.0827
SWD-03 (Waste Storage Area)	Aluminum	1	1	0.087	0.169	NA	NA	NA
	Manganese	4	3	0.098	0.0332	0.192	0.126	0.0667
SWP-01 (Paddys Run Background)	Aluminum	2	1	0.087	0.0528	0.11	NA	NA
SWP-02 (Paddys Run)	Aluminum	4	3	0.087	0.001	161	40	80
	Cadmium	4	1	0.0035	0.0001	0.0105	0.003	0.0051
	Chromium	4	1	0.011	0.0003	0.18	0.05	0.090
	Copper	4	1	0.034	0.0026	0.27	0.070	0.13
	Manganese	4	1	0.098	0.0067	9.7	2.4	4.8
	Mercury	4	1	0.0002	0.00005	0.0004	0.0001	0.0002
SWP-03 (Paddys Run at Downstream Property Boundary)	Aluminum	3	3	0.087	0.384	2.34	1.32	NA
	Silver	3	1	0.0013	0.0005	0.0014	0.0008	NA
SWR-01 (Great Miami River Background)	Aluminum	2	2	0.087	0.448	0.812	NA	NA
STRM 4003 (Southern Paddys Run Drainage Ditch)	Aluminum	1	1	0.087	17.8	NA	NA	NA
	Chromium	3	1	0.011	0.00145	0.0207	0.00838	NA
	Manganese	1	1	0.098	0.416	NA	NA	NA
STRM 4004 (Southern Paddys Run Drainage Ditch)	Aluminum	1	1	0.087	27.3	NA	NA	NA
	Barium	1	1	0.145	0.16	NA	NA	NA
	Chromium	2	1	0.011	0.003	0.0288	NA	NA
	Manganese	1	1	0.098	0.493	NA	NA	NA

TABLE B.1-4
(Continued)

Location[a]	Constituent	Total Number of Samples During 1997[b,c]	Number of Samples with BTV Exceedances During 1997[b,c]	BTV[d] (mg/L)	Summary Statistics[b,c,e,f] Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD (mg/L)
STRM 4005	Ammonia	3	1	1	0.05	1.73	0.7	NA
(Pilot Plant Drainage	Aluminum	1	1	0.087	36.8	NA	NA	NA
Ditch)	Barium	1	1	0.145	0.284	NA	NA	NA
	Chromium	3	1	0.011	0.00145	0.042	0.015	NA
	Copper	3	1	0.034	0.00285	0.0448	0.0182	NA
	Manganese	1	1	0.098	1.57	NA	NA	NA
				(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)
	bis(2-Ethlhexypl)phthalate	1	1	8.4	23	NA	NA	NA
				(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
STRM 4006	Aluminum	1	1	0.087	1.8	NA	NA	NA
(Northern Paddys Run Drainage Ditch)	Manganese	1	1	0.098	0.116	NA	NA	NA

[a]See location map (Figure B.1-2) and Table B.1-1 for locations and programs.
[b]If more than one sample is collected per surface water location per day (e.g., duplicate, grab, composite), then only one sample is counted for the total number of samples and the sample with the maximum concentration is used for the summary statistics and in determining BTV exceedances.
[c]Rejected data qualified with either a R or Z were not used for this table.
[d]From IEMP, Table 4-2
[e]If the total number of samples is greater than or equal to four, then all of the summary statistics are reported. If the total number of samples is equal to three, then the minimum, maximum, and arithmetical average are reported. If the total number of samples is equal to two, then the minimum and maximum are reported. If the total number of samples since 1997 is equal to one, then the data point is reported as the minimum.
[f]NA = not applicable

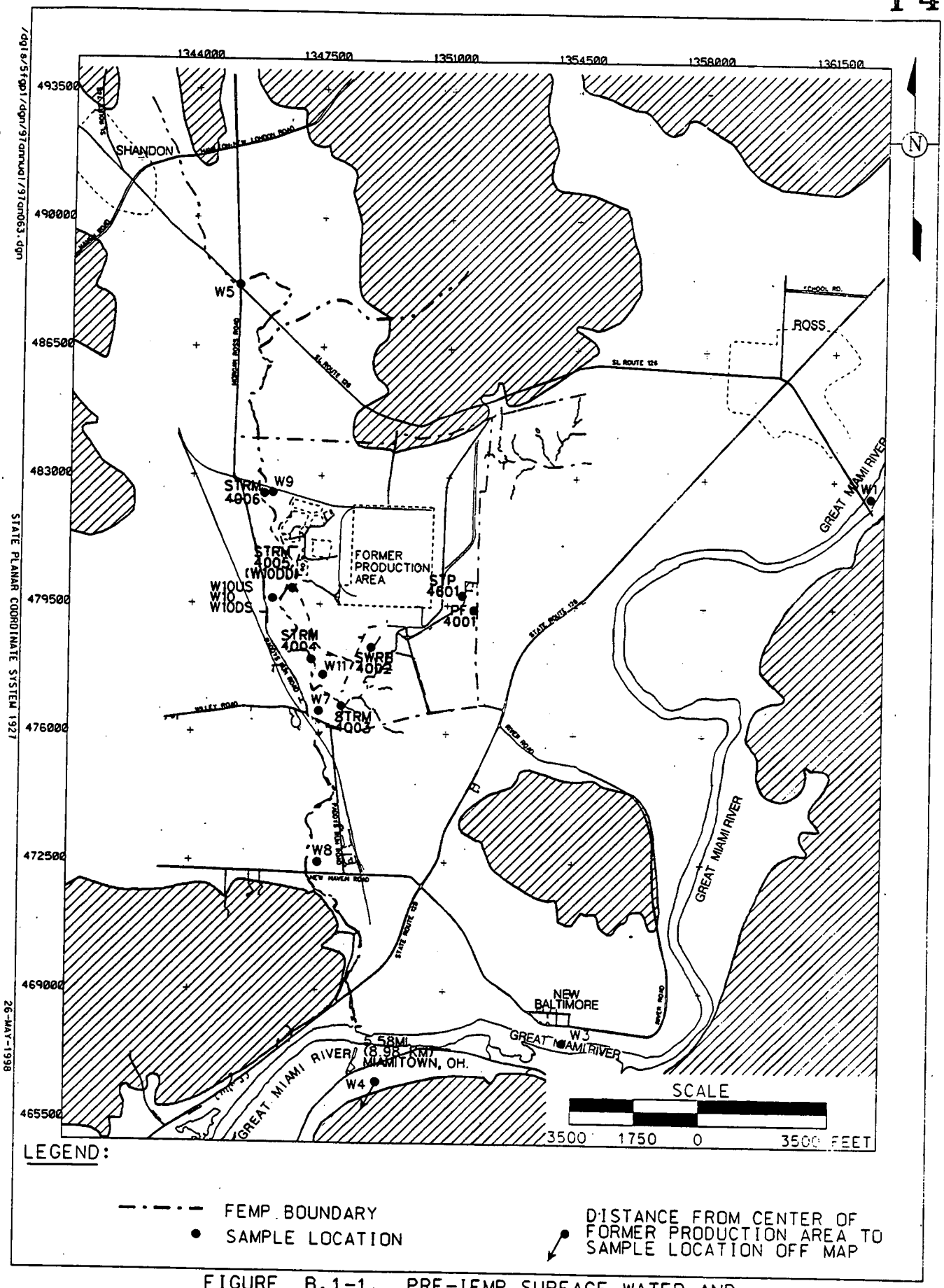


FIGURE B.1-1. PRE-IEMP SURFACE WATER AND TREATED EFFLUENT SAMPLE LOCATIONS

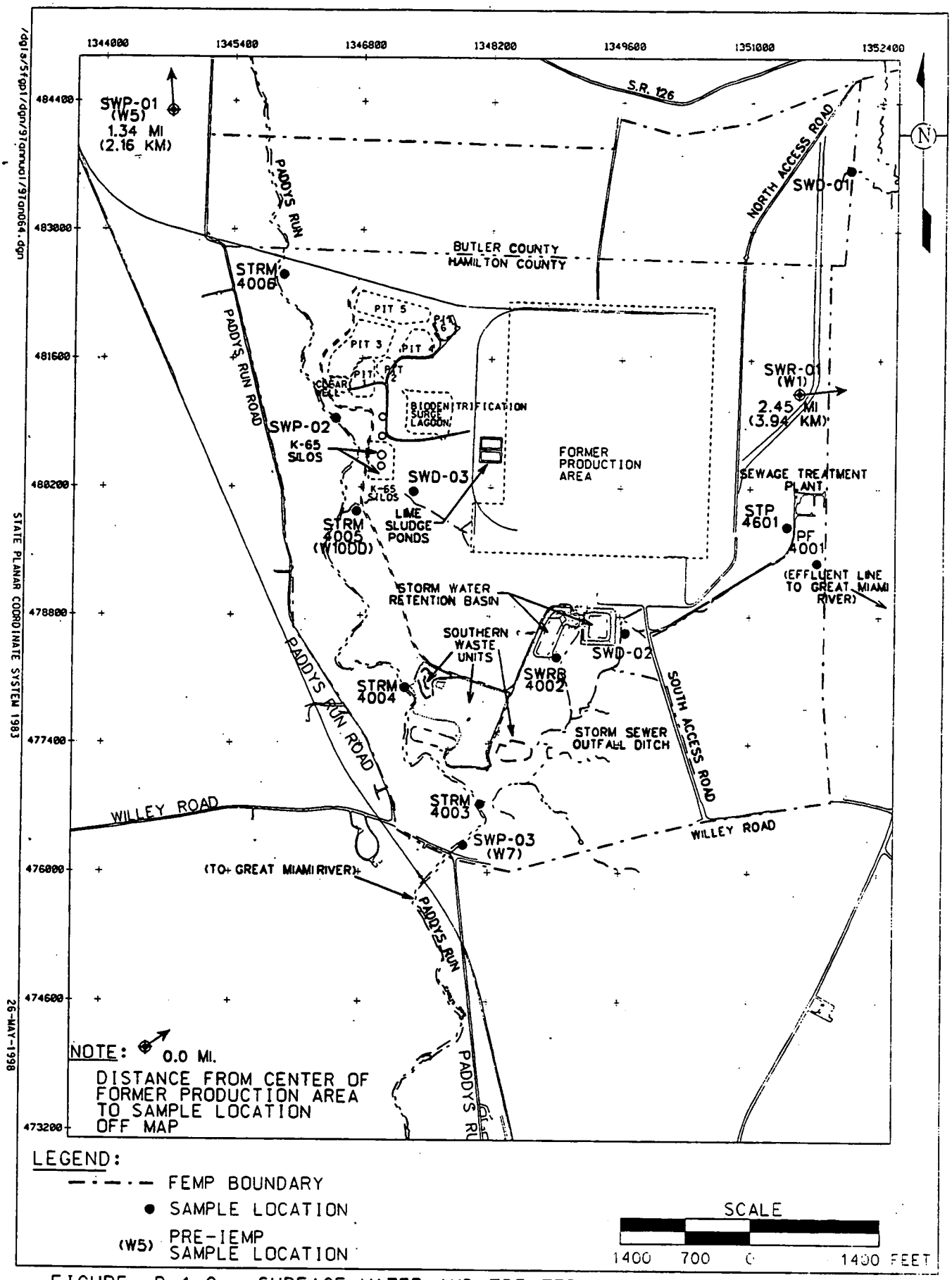
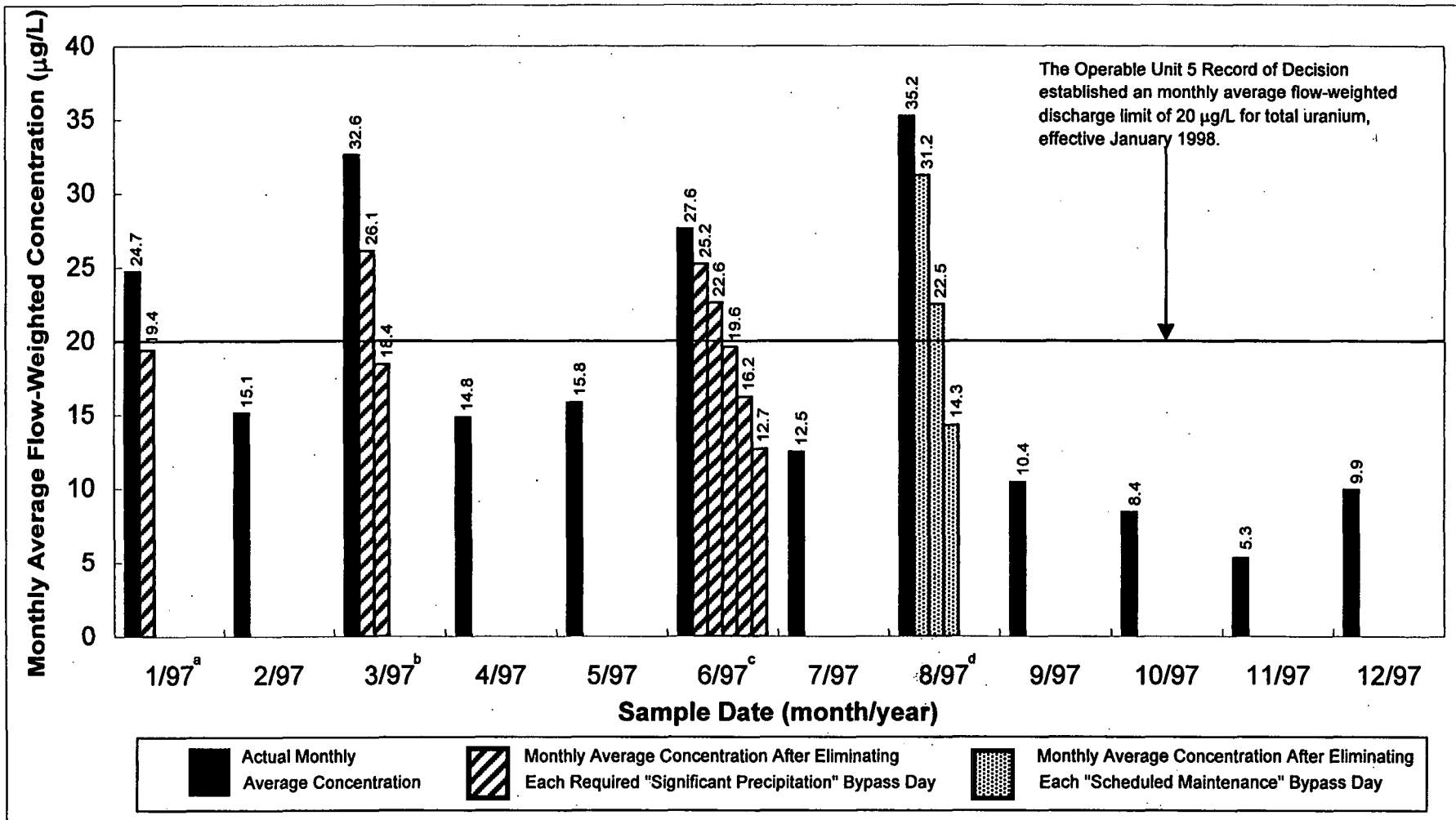


FIGURE B.1-2. SURFACE WATER AND TREATED EFFLUENT SAMPLE LOCATIONS



[a] Bypassing of storm water occurred for 0.94 day.

[b] Bypassing of storm water occurred for 2.40 days.

[c] Bypassing of storm water occurred for 4.99 days.

[d] Bypassing of storm water occurred for 2.52 days.

FIGURE B.1-3. 1997 BYPASS ELIMINATION DETAIL FOR TOTAL URANIUM DISCHARGES FROM THE PARSHALL FLUME (PF 4001) TO THE GREAT MIAMI RIVER

ATTACHMENT B.2

SEDIMENT

ATTACHMENT B.2

Sediment is a secondary exposure pathway and is monitored annually to assess the impact of remediation activities on sediments deposited along surface water drainages. Sediment is collected at strategic locations to ensure that the most recently deposited sediment is collected. Because the IEMP was not approved prior to the sediment sampling efforts for 1997, sediment sampling was conducted under the previously effective Environmental Monitoring Plan (DOE 1995a).

Results of the 1997 sediment monitoring program are summarized in Table B.2-1. Figure B.2-1 identifies each sediment sample location. Analytical results of samples collected from Paddys Run and Great Miami River were below the FRL for total uranium, isotopic thorium, and radium-226.

One sample collected in the Storm Sewer Outfall Ditch at location D5 near the Storm Water Retention Basin had a thorium-232 concentration of 1.63 picoCuries per gram (pCi/g) which slightly exceeds the FRL of 1.60 pCi/g. In 1996, a sediment sample was collected in the same vicinity with a thorium-232 concentration of 1.8 pCi/g, also slightly above the FRL. Sediment samples collected immediately downstream of these locations did not exceed the thorium-232 FRL in 1996 or 1997. The sources of this contamination are either Storm Water Retention Basin overflows or controlled runoff from the former production area prior to the installation of the storm water controls currently in place. Sporadic exceedances of the FRLs are expected until final remediation of the site occurs.

In general, the 1997 sample results indicate a decrease in concentrations from the samples collected from 1990 through 1996. Total uranium results for 1997 from Paddys Run were within the range of background levels. The average total uranium concentration in the Storm Sewer Outfall Ditch is above background levels, but well below the FRL. Figures B.2-2 through B.2-6 present sediment data trends. When compared to overall historical results, 1997 sediment results indicate no discernable trends; however, monitoring will continue to identify adverse impacts to the sediment pathway as remediation activities occur.

TABLE B.2-1

SUMMARY STATISTICS FOR SEDIMENT MONITORING PROGRAM

		1997 Results - Concentration (dry weight)[a,b]							1996 Results[a,c]						1990 - 1995 Results[a,b]			
	No. of	Minimum		Maximum		Average		No. of	Minimum		Maximum		Average		Minimum		Maximum	
Radionuclide	Samples	pCi/g	(mg/kg)	pCi/g	(mg/kg)	pCi/g	(mg/kg)	Samples	pCi/g	(mg/kg)	pCi/g	(mg/kg)	pCi/g	(mg/kg)	pCi/g	(mg/kg)	pCi/g	(mg/kg)
Great Miami River, North of the Effluent Line																		
Total Uranium	1	1.3	(1.9)	NA	NA	NA	NA	1	0.88	NA			NA	NA	0.5	(0.74)	1.8	(2.7)
Great Miami River, South of the Effluent Line																		
Radium-226	2	0.54	NA	0.57	NA	0.56	NA	1	0.55	NA	NA	NA	NA	NA	0.53	NA	0.93	NA
Thorium-228	2	0.37	NA	0.42	NA	0.40	NA	1	0.45	NA	NA	NA	NA	NA	0.46	NA	1.4	NA
Thorium-230	2	0.61	NA	0.68	NA	0.65	NA	1	0.58	NA	NA	NA	NA	NA	0.75		1.3	
Thorium-232	2	0.35	NA	0.37	NA	0.36	NA	1	0.41	NA	NA	NA	NA	NA	0.29	NA	0.62	NA
Total Uranium	4	1.0	(1.5)	1.2	(1.8)	1.1	(1.6)	3	0.68	(1.0)	2.4	(3.5)	0.88	(1.3)	0.30	(0.44)	2.6	(3.8)
Paddys Run Background, North of S.R. 126																		
Radium-226	1	0.48	NA	NA	NA	NA	NA	3	0.90	NA	1.1	NA	0.98	NA	0.00	NA	1.4	NA
Thorium-228	1	0.41	NA	NA	NA	NA	NA	3	0.91	NA	1.1	NA	1.0	NA	0.15	NA	1.2	NA
Thorium-230	1	0.58N	NA	NA	NA	NA	NA	3	0.87	NA	1.9	NA	1.3	NA	0.22	NA	1.5	NA
Thorium-232	1	0.34	NA	NA	NA	NA	NA	3	0.77	NA	0.86	NA	0.81	NA	0.15	NA	1.1	NA
Total Uranium	1	0.67	(1.0)	NA	NA	NA	NA	3	1.4	(2.0)	2.8	(4.1)	1.8	(2.7)	0.41	(0.61)	2.0	(3.0)
Paddy Run, North of the Storm Sewer Outfall Ditch																		
Radium-226	5	0.54	NA	1.0	NA	0.78	NA	8	0.72	NA	1.6	NA	0.93	NA	0.00	NA	3.7	NA
Thorium-228	5	0.31	NA	0.47	NA	0.41	NA	8	0.58	NA	1.4	NA	0.82	NA	0.25	NA	5.1	NA
Thorium-230	5	0.47	NA	0.65	NA	0.58	NA	8	0.60	NA	3.4	NA	1.1	NA	0.08	NA	9.8	NA
Thorium-232	5	0.25	NA	0.43	NA	0.34	NA	8	0.52	NA	1.1	NA	0.7	NA	0.19	NA	5.4	NA
Total Uranium	5	0.77	(1.1)	1.1	(1.7)	0.77	(1.1)	8	0.95	(1.4)	7.4	(11)	2.3	(3.4)	0.55	(0.81)	8.7	(13)
Storm Sewer Outfall Ditch																		
Radium-226	5	0.41	NA	0.98	NA	0.65	NA	5	0.68	NA	1.4	NA	0.97	NA	0.00	NA	1.3	NA
Thorium-228	5	0.31	NA	1.8	NA	0.76	NA	5	0.85	NA	1.9	NA	1.3	NA	0.05	NA	1.8	NA
Thorium-230	5	0.53	NA	1.7	NA	0.90	NA	5	1.2	NA	4	NA	2.4	NA	-0.02	NA	3.4	NA
Thorium-232	5	0.21	NA	1.6	NA	0.64	NA	5	0.66	NA	1.8	NA	1.1	NA	0.01	NA	2.1	NA
Total Uranium	5	0.93	(1.4)	9.1	(14)	3.4	(5.1)	5	2.5	(3.7)	14	(21)	6.9	(10)	0.41	(0.61)	16	(23)
Paddys Run, South of the Storm Sewer Outfall Ditch																		
Radium-226	2	0.49	NA	0.50	NA	0.50	NA	1	0.68	NA	NA	NA	NA	NA	0.44	NA	1.2	NA
Thorium-228	2	0.35	NA	0.36	NA	0.36	NA	1	0.65	NA	NA	NA	NA	NA	0.27	NA	1.3	NA
Thorium-230	2	0.56	NA	0.85	NA	0.70	NA	1	0.88	NA	NA	NA	NA	NA	0.21	NA	1.8	NA
Thorium-232	2	0.33	NA	0.34	NA	0.33	NA	1	0.63	NA	NA	NA	NA	NA	0.13	NA	1.1	NA
Total Uranium	6	0.68	(1.0)	1.2	(1.8)	0.94	(1.4)	7	1.0	(1.5)	3.0	(4.4)	1.6	(2.4)	0.55	(0.81)	30	(44)

TABLE B.2-1
(Continued)

FRLs	mg/kg	pCi/g
Radium-226	-	2.9
Thorium-228	-	3.2
Thorium-230	-	18000
Thorium-232	-	1.6
Total Uranium	210	-

[a]If more than one sample was collected per sediment location (e.g., split or duplicate), then only one sample is counted for the total number of samples and the sample with the maximum concentration is used for the summary statistics.
[b]If the total number of samples is greater than or equal to three, then the minimum, maximum, and arithmetical average area reported. If the total number of samples is equal to two, then the minimum and maximum are reported. If the total number of samples is equal to one, then the result is reported as the minimum.
[c]The minimum and maximum are reported unless the total number of samples is equal to one. In this case the result is reported as the minimum.
[d]Zero may indicate sample activity was less than blank activity.

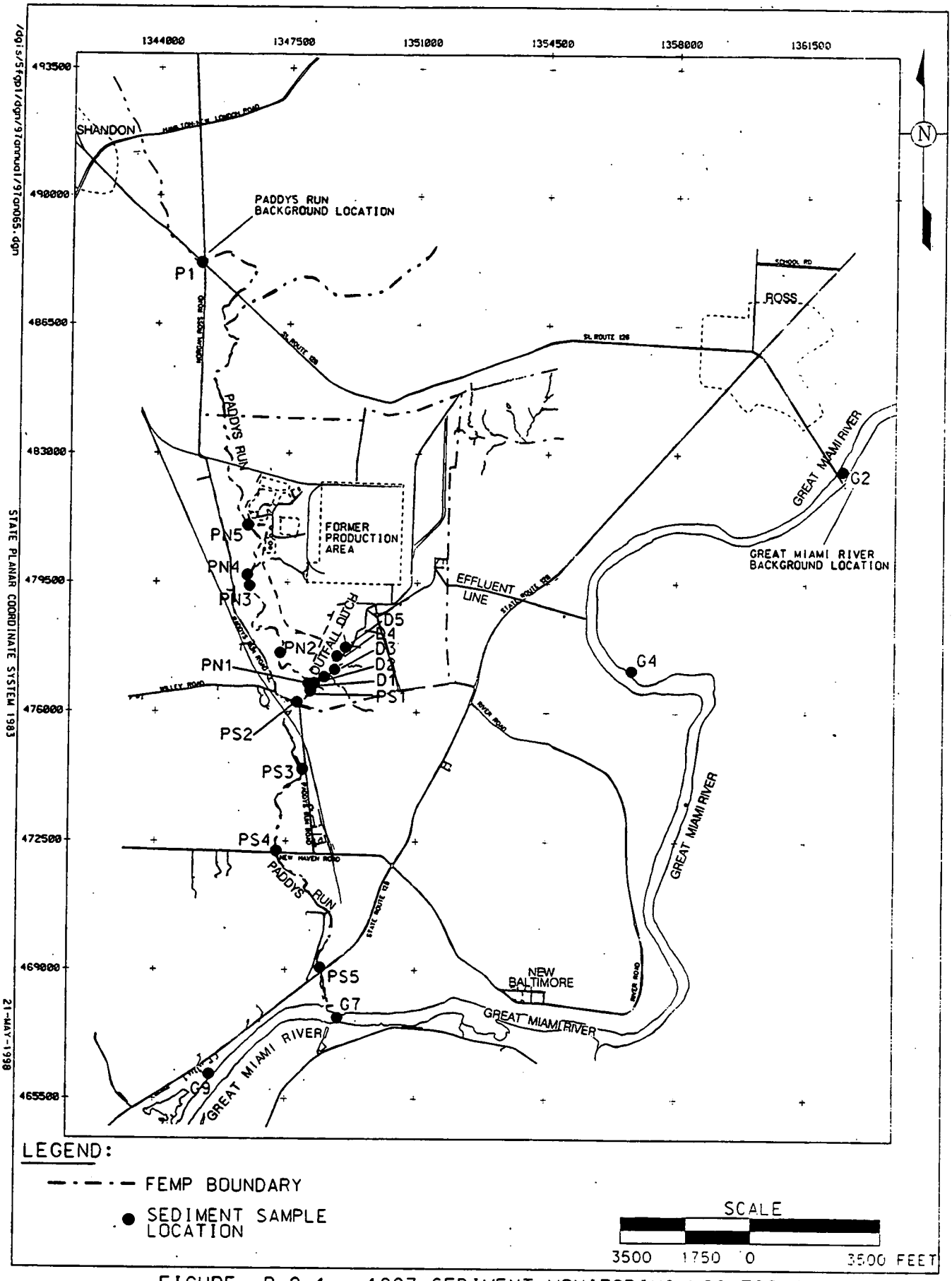


FIGURE B.2-1. 1997 SEDIMENT MONITORING LOCATIONS

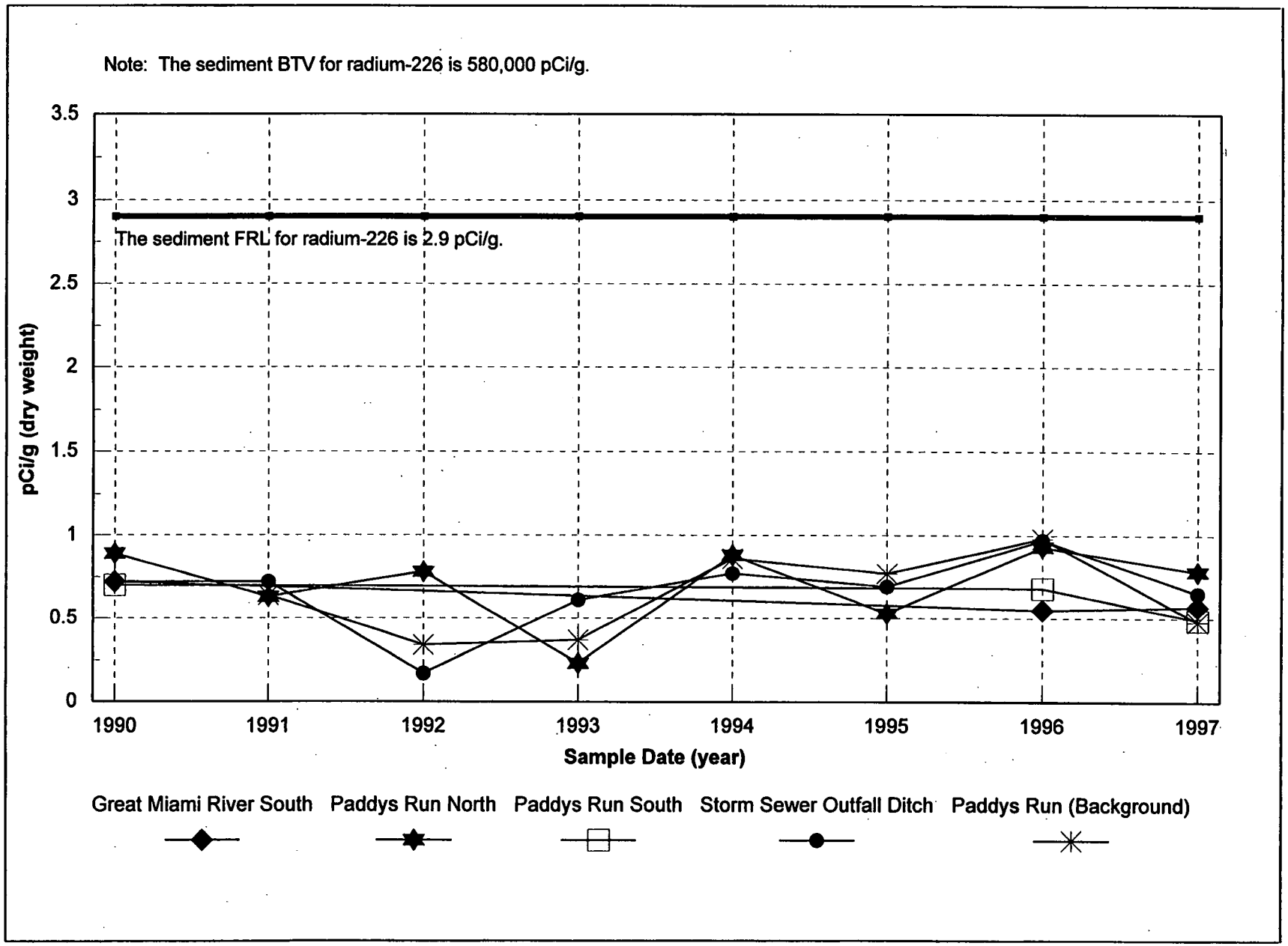


FIGURE B.2-2. RADIUM-226 CONCENTRATION VS. TIME PLOT FOR SEDIMENT

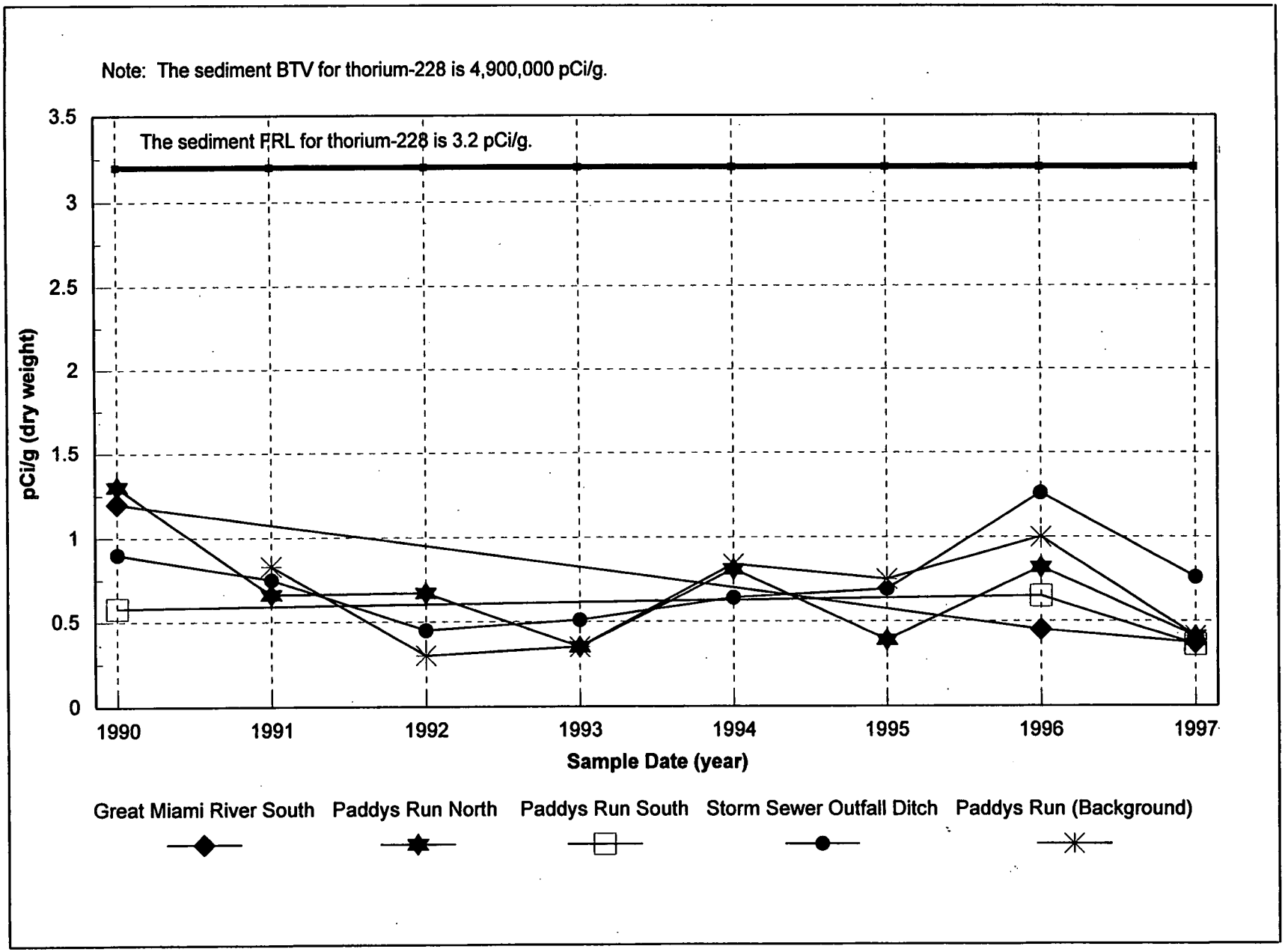


FIGURE B.2-3. THORIUM-228 CONCENTRATION VS. TIME PLOT FOR SEDIMENT

000455

Note: The sediment FRL for thorium-230 is 18,000 pCi/g and the BTV is 29,000,000 pCi/g.

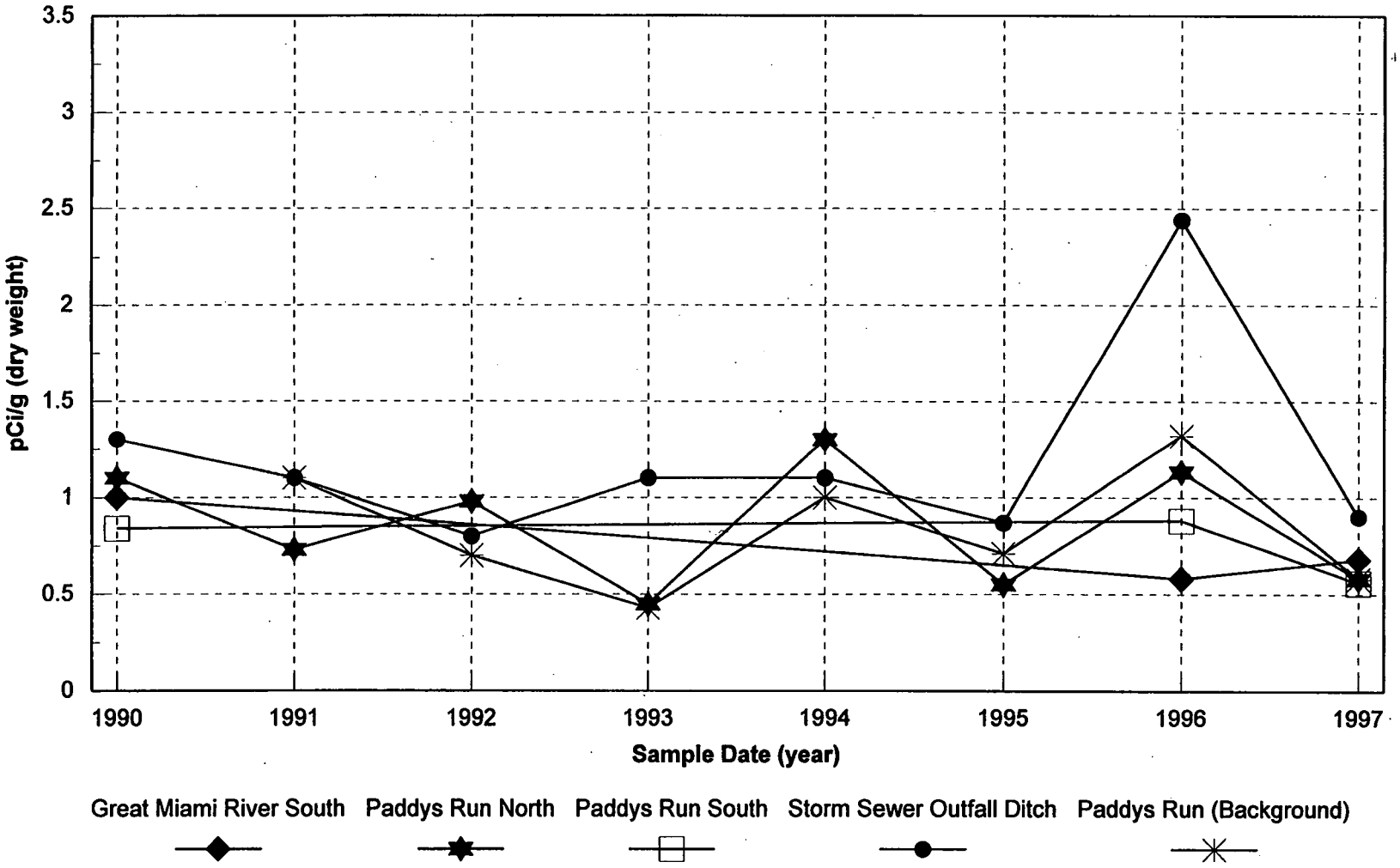


FIGURE B.2-4. THORIUM-230 CONCENTRATION VS. TIME PLOT FOR SEDIMENT

000456

1420

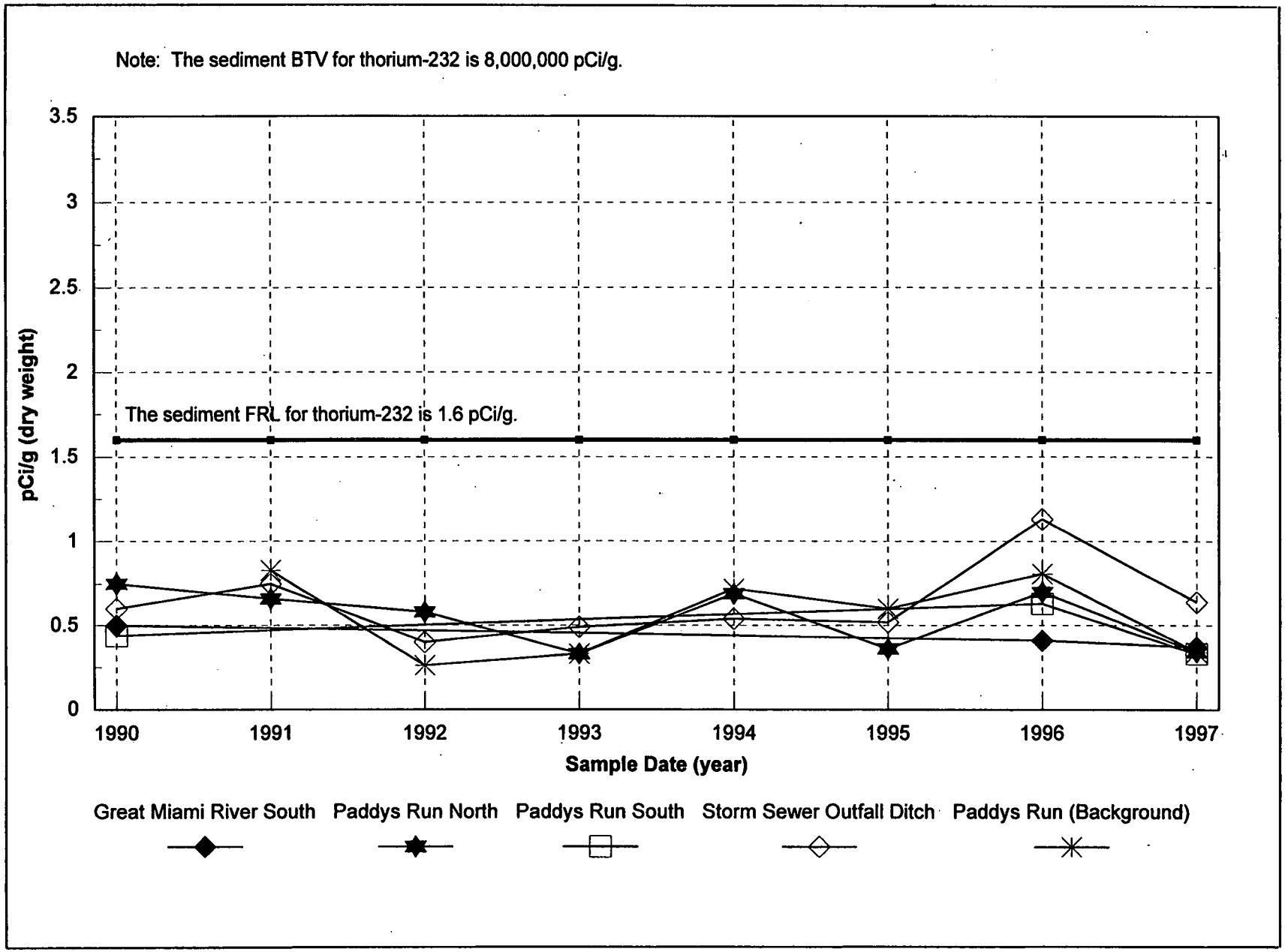


FIGURE B.2-5. THORIUM-232 CONCENTRATION VS. TIME PLOT FOR SEDIMENT

000457

Note: The sediment FRL for total uranium is 210 mg/kg.

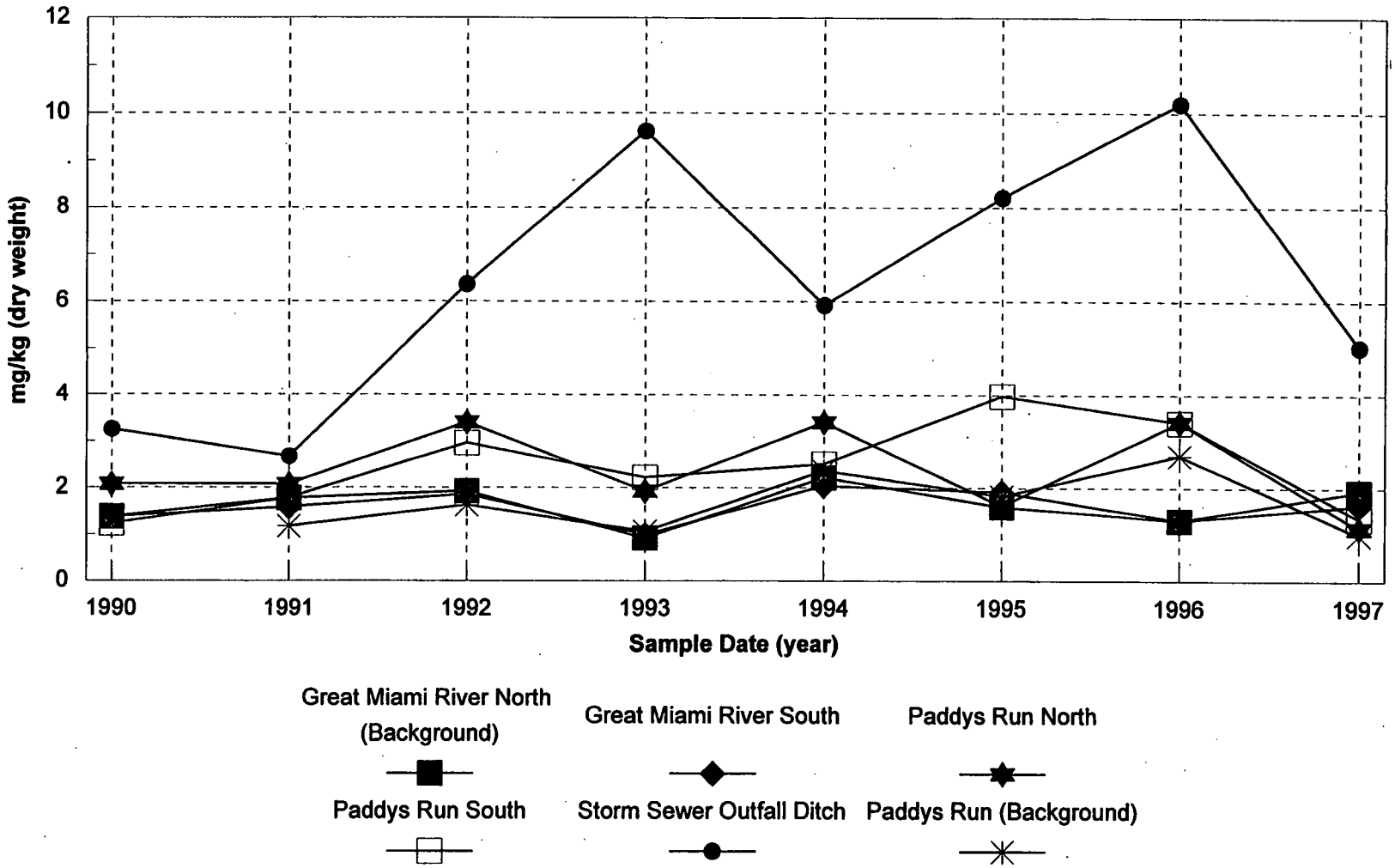


FIGURE B.2-6. TOTAL URANIUM IN CONCENTRATION VS. TIME PLOT FOR SEDIMENT

000458

1420

Appendix C

APPENDIX C

SUPPLEMENTAL AIR INFORMATION

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LIST OF ACRONYMS

AMS	air monitoring station
°C	Centigrade
cm	centimeters
DOE	U.S. Department of Energy
°F	Fahrenheit
FEMP	Fernald Environmental Management Project
IEMP	Integrated Environmental Monitoring Plan
in	inches
km	kilometers
kph	kilometers per hour
mi	mile
mph	miles per hour
mrem	millirem
mSv	milli Sievert
NESHAP	National Emissions Standards for Hazardous Air Pollutants
OEPA	Ohio Environmental Protection Agency
pCi/g	picoCuries per gram
pCi/L	picoCuries per liter
pCi/m^3	picoCuries per cubic meter
TLD	thermoluminescent dosimeter
$\mu g/m^3$	micrograms per cubic meter

APPENDIX C

Appendix C presents additional air monitoring data and analysis in support of Chapter Five of the 1997 Integrated Site Environmental Report. This appendix consists of five attachments as follows:

- Attachment C.1 provides the results of the radiological air particulate monitoring program, including an assessment of 1997 results with respect to historical data, and provides concentration versus time plots of the total uranium and total particulate data for 1997.

- Attachment C.2 provides the results of the radon monitoring program including results from alpha track-etch cups and continuous radon monitors. This discussion focuses on evaluating the radon data against the U.S. Department of Energy (DOE) standards contained in DOE Order 5400.5 and on identifying any significant trends in the 1997 data.

- Attachment C.3 provides the results of the direct radiation monitoring program including an assessment of 1997 results with respect to historical data.

- Attachment C.4 provides the results of the biota (produce) monitoring program including an assessment of the 1997 results with respect to historical data.

- Attachment C.5 provides a summary of the meteorological data measured at the site during 1997.

REFERENCES

U.S. Dept. of Energy, 1997, "1996 Site Environmental Report," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1998, "Integrated Environmental Monitoring Plan," Final, U.S. Dept. Of Energy, Fernald Area Office, Cincinnati, OH.

Attachment C.1

ATTACHMENT C.1

RADIOLOGICAL AIR PARTICULATE

ATTACHMENT C.1

Appendix C.1 provides a detailed discussion of the radiological air particulate data for calender year 1997. This information is used to assess the emissions of uranium and other trace radionuclides from the Fernald Environmental Monitoring Project (FEMP) to the surrounding environment.

During 1997, the network of high volume air samplers which comprise the FEMP's environmental radiological air particulate monitoring program were redesigned to reflect the National Emissions Standards for Hazardous Air Pollutants (NESHAP) compliance monitoring approach presented in the Integrated Environmental Monitoring Plan (IEMP) (DOE 1997). The primary changes to the monitoring network took place over the fourth quarter of 1997 and included the addition of eight new air monitoring stations (AMS) located at the site fenceline (AMS-22 through AMS-29) and the relocation of existing AMS-9B (designated as AMS-9C at the new location). As the new IEMP locations were being installed, five off-site locations (AMS-10, AMS-11, AMS-13, AMS-14, and AMS-21) were removed from service. These locations were not identified in the IEMP as necessary to support a comprehensive assessment of radiological air particulate concentrations at the FEMP property boundary. Two of these locations (AMS-11 and AMS-13) will be operated by the Ohio Environmental Protection Agency (OEPA) in 1998 to support its oversight role at the FEMP.

Prior to the IEMP transition over the fourth quarter of 1997, radiological air particulate monitoring was conducted at eight fenceline locations and six offsite locations. One on-site monitor (AMS-1B) was removed from service in late June due to extended power interruptions caused by construction of the Operable Unit 1 railyard. Figure C.1-1 provides the location of air monitoring stations during 1997 and historical air monitoring station locations (AMS-1A, AMS-17, and AMS-18). Table C.1-1 provides an operational summary for air monitoring stations in 1997.

Air filters were exchanged every two weeks at all the monitoring locations during 1997. The filters were analyzed for total uranium and in most cases total particulates. In addition, an aliquot of each filter was maintained to provide an annual composite sample to be analyzed for a suite of radionuclides.

The results of the biweekly total uranium analyses are summarized in Table C.1-2 and provided graphically in Figures C.1-2 through C.1-28. In addition, results from biweekly total particulate

monitoring are summarized in Table C.1-3 and provided graphically in Figures C.1-29 through C.1-50. It should be noted that total particulates were not monitored at off-site locations until July 1997 when background locations AMS-12 and AMS-16 were added to the total particulate monitoring.

The results for air monitoring in 1997 were consistent with the previous year's data and historical ranges. Temporary increases in total uranium and total particulate concentrations were observed along the eastern fenceline in late September and early October. This temporary increase was particularly evident at AMS-3 and is thought to be associated with dryer weather conditions and the heightened level of construction activities along the eastern fenceline during this period.

The results of the annual composite samples are presented in Table C.1-4. Composite sample results indicate concentrations of trace radionuclides (strontium-90, technetium-99, cesium-137, plutonium-238, and plutonium-239/240) are well below the DOE guidelines. Furthermore, the results confirm total uranium to be the major contributor to dose. On average, 94 percent of the air inhalation dose at each monitoring station is attributable to uranium. Beginning in 1998, a quarterly composite sample focusing on the expected major contributors to inhalation dose (uranium, radium, and thorium) will be collected at each air monitor. This information will be used to track compliance with the NESHAP Subpart H dose limit of 10 millirem (mrem) through the year. In addition, this information will also be used to trigger corrective actions if an exceedance of the NESHAP limit is projected over the course of the year.

TABLE C.1-1

OPERATIONAL SUMMARY FOR AIR PARTICULATE MONITORING STATIONS IN 1997

AMS Location	Number of Samples	First Sample Start Date	Last Sample Collection Date
Onsite/Fenceline			
AMS-1B	14	12/27/96	06/16/07
AMS-2	28	12/26/96	12/30/97
AMS-3	28	12/26/96	12/30/97
AMS-4	28	12/26/96	12/30/97
AMS-5	28	12/26/96	12/30/97
AMS-6	28	12/26/96	12/30/97
AMS-7	28	12/26/96	12/30/97
AMS-8A	28	12/26/96	12/30/97
AMS-9B/C	28	12/26/96	12/30/97
AMS-17A	27	01/10/97	12/26/97
AMS18A	27	01/10/97	12/26/97
AMS-19	27	01/10/97	12/26/97
AMS-20	27	01/10/97	12/26/97
AMS-22	6	10/14/97	12/30/97
AMS-23	6	10/14/97	12/30/97
AMS-24	1	10/14/97	10/28/97
AMS-25	6	10/14/97	12/30/97
AMS-26	6	10/14/97	12/30/97
AMS-27	6	10/14/97	12/30/97
AMS-28	6	10/14/97	12/30/97
AMS-29	6	10/14/97	12/30/97
Offsite/Background			
AMS-10	22	12/26/96	10/10/97
AMS-11	28	12/26/96	12/30/97
AMS-12	28	12/26/96	12/30/97
AMS-13	26	12/26/96	12/07/97
AMS-14	24	12/26/96	11/14/97
AMS-16	28	12/26/96	12/30/97
AMS-21	22	12/26/96	10/07/97

TABLE C.1-2

TOTAL URANIUM PARTICULATE CONCENTRATIONS IN AIR

	Summary of 1997 Year End Results[a,b,c] (pCi/m³)				Summary of 1996 Results[a,c,d] (pCi/m³)				Summary of 1990-1995 Results[a,c] (pCi/m³)	
Location[e]	No.	Min.	Max.	Avg.	No.	Min.	Max.	Avg.	Min.	Max.
Onsite/Fenceline										
AMS-1B	14	1.3E-04	8.5E-04	4.9E-04	16[f]	4.0E-05	2.2E-03	3.1E-04	NA[g]	NA[g]
AMS-2	28	0.0E+00	2.5E-04	5.1E-05	27	0.0E+00	9.4E-04	1.0E-04	0.0E+00	3.5E-03
AMS-3	28	2.5E-06	1.2E-03	1.9E-04	27	5.3E-06	7.2E-04	1.7E-04	0.0E+00	1.7E-02
AMS-4	28	0.0E+00	2.6E-04	3.3E-05	27	5.3E-06	4.1E-04	6.3E-05	0.0E+00	2.3E-03
AMS-5	28	0.0E+00	2.2E-04	2.7E-05	27	5.4E-06	3.7E-04	7.3E-05	0.0E+00	4.4E-03
AMS-6	28	5.0E-06	1.4E-04	4.2E-05	27	2.7E-06	5.1E-04	9.1E-05	0.0E+00	3.2E-03
AMS-7	28	0.0E+00	1.5E-04	3.6E-05	27	0.0E+00	2.0E-04	2.4E-05	0.0E+00	7.8E-03
AMS-8A	28	1.0E-05	2.3E-04	8.2E-05	11	1.3E-05	9.0E-04	3.1E-04	NA[g]	NA[g]
AMS-9B/C	28	0.0E+00	1.1E-04	4.3E-04	11[h]	1.6E-05	7.8E-04	3.1E-04	NA[g]	NA[g]
AMS-17A	27	0.0E+00	4.6E-04	9.2E-05	28[i]	0.0E+00	4.9E-04	9.7E-05	0.0E+00[j]	1.1E-03
AMS-18A	27	1.3E-05	3.5E-04	1.3E-04	27[k]	3.9E-05	2.2E-03	5.0E-04	0.0E+00[l]	3.9E-03
AMS-19	27	0.0E+00	6.3E-05	2.6E-05	27	0.0E+00	2.1E-04	4.4E-05	2.7E-06	4.7E-04
AMS-20	27	0.0E+00	9.8E-05	3.0E-05	27	0.0E+00	1.9E-04	5.7E-05	0.0E+00	7.3E-04
AMS-22	6	0.0E+00	2.9E-05	1.4E-05	0[m]	NA	NA	NA	NA	NA
AMS-23	6	9.8E-06	5.3E-05	2.9E-05	0[m]	NA	NA	NA	NA	NA
AMS-24	1	1.1E-04	NA	NA	0[m]	NA	NA	NA	NA	NA
AMS-25	6	6.7E-06	3.0E-05	1.9E-05	0[m]	NA	NA	NA	NA	NA
AMS-26	6	0.0E+00	4.1E-05	1.9E-05	0[m]	NA	NA	NA	NA	NA
AMS-27	6	0.0E+00	3.0E-05	2.0E-05	0[m]	NA	NA	NA	NA	NA
AMS-28	6	0.0E+00	2.9E-05	1.3E-05	0[m]	NA	NA	NA	NA	NA
AMS-29	6	0.0E+00	7.6E-05	2.9E-05	0[m]	NA	NA	NA	NA	NA
Offsite/Background										
AMS-10[n]	22	0.0E+00	4.5E-05	2.1E-05	26	0.0E+00	7.2E-05	2.2E-05	0.0E+00	2.2E-04
AMS-11[n]	28	0.0E+00	3.0E-05	1.2E-05	27	0.0E+00	2.2E-04	2.1E-05	0.0E+00	1.6E-04
AMS-12	28	0.0E+00	2.9E-05	8.1E-06	27	0.0E+00	3.7E-05	7.7E-06	0.0E+00	4.8E-04
AMS-13[n]	26	0.0E+00	7.1E-05	1.9E-05	27	4.5E-06	2.0E-04	2.7E-05	0.0E+00	2.3E-04
AMS-14[n]	24	0.0E+00	3.7E-05	1.8E-05	27	0.0E+00	7.5E-05	2.1E-05	0.0E+00	4.4E-04
AMS-16	28	0.0E+00	1.1E-04	1.9E-05	27	0.0E+00	6.2E-05	1.1E-05	0.0E+00	3.5E-04
AMS-21[n]	22	0.0E+00	4.4E-05	1.2E-05	27	0.0E+00	6.2E-05	1.8E-05	0.0E+00	4.3E-05

[a]For blank corrected concentrations less than or equal to 0.0E+00 pCi/m³, the concentration is set as 0.0E+00 pCi/m³.
[b]If the total number of samples is equal to one, then the data point is reported as the minimum.
[c]NA = not applicable
[d]1996 summary average results may be slightly higher than those reported in the 1996 Site Environmental Report (DOE 1997) (due to reporting sample activity that was less than the blank activity as a zero value).
[e]See Figure C.1-1.
[f]1996 summary results are from data collected at AMS-1A.
[g]No meaningful comparative data exist for AMS-1B, AMS-8A, or AMS-9B/C for this period.
[h]1996 summary results are from data collected at AMS-9B.
[i]1996 summary results are from data collected at AMS-17 and AMS-17A.
[j]1990-1995 summary results data are from data collected at AMS-17.
[k]1996 summary results are from data collected at AMS-18 and AMS-18A.
[l]1990-1995 summary results data are from data collected at AMS-18.
[m]AMS locations were placed in service in 1997.
[n]AMS locations were taken out of service during the fourth quarter of 1997.

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TABLE C.1-3

TOTAL PARTICULATE CONCENTRATIONS IN AIR

	Summary of 1997 Year End Results[b,c] ($\mu g/m^3$)				Summary of 1996 Results[c] ($\mu g/m^3$)				Summary 1990-1995 Results[c] ($\mu g/m^3$)	
Location[a,b]	# Samples	Min.	Max.	Avg.	# Samples	Min.	Max.	Avg.	Min.	Max.
Onsite/Fenceline										
AMS-1B	13	24	51	35	9[d]	25	49	36	NA[e]	NA[e]
AMS-2	28	16	77	31	20	7.2	52	28	11	67
AMS-3	28	17	159	39	20	16	56	33	8	128
AMS-4	28	14	51	30	20	19	63	34	13	69
AMS-5	28	11	42	28	20	17	56	33	12	62
AMS-6	28	8	53	29	20	19	56	32	8	69
AMS-7	28	24	55	34	20	18	59	34	13	76
AMS-8A	27	18	89	35	11	19	53	31	NA[e]	NA[e]
AMS-9B/C	28	7.1	136	42	11[f]	19	51	32	NA[e]	NA[e]
AMS-17A	27	20	84	34	20[g]	16	62	32	6.8[h]	68[h]
AMS-18A	27	17	49	33	19[i]	22	102	48	9.2[j]	88[j]
AMS-19	27	23	49	33	19	22	66	35	7.5	49
AMS-20	27	18	48	27	19	16	60	31	7.6	101
AMS-22	6	21	30	27	0[k]	NA	NA	NA	NA	NA
AMS-23	6	22	28	25	0[k]	NA	NA	NA	NA	NA
AMS-24	1	74	NA	NA	0[k]	NA	NA	NA	NA	NA
AMS-25	6	26	40	33	0[k]	NA	NA	NA	NA	NA
AMS-26	6	20	23	22	0[k]	NA	NA	NA	NA	NA
AMS-27	6	33	49	38	0[k]	NA	NA	NA	NA	NA
AMS-28	6	16	30	19	0[k]	NA	NA	NA	NA	NA
AMS-29	6	19	30	25	0[k]	NA	NA	NA	NA	NA
Offsite/Background										
AMS-10[l]	0	NS	NS	NS	0	NS	NS	NS	21	110
AMS-11[l]	0	NS	NS	NS	0	NS	NS	NS	15	88
AMS-12[l]	14	18	41	27	0	NS	NS	NS	6	416
AMS-13[l]	0	NS	NS	NS	0	NS	NS	NS	18	95
AMS-14[l]	0	NS	NS	NS	0	NS	NS	NS	19	126
AMS-16[l]	14	27	79	46	0	NS	NS	NS	22	59
AMS-21[l]	0	NS	NS	NS	0	NS	NS	NS	NS[m]	NS[m]

[a]See Figure C.1-1.
[b]If the total number of samples is equal to one, then the data point is reported as the minimum.
[c]NA = not applicable
NS = not sampled
[d]1996 summary results are from data collected at AMS-1A.
[e]No meaningful comparative data exist for AMS-1B, AMS-8A, or AMS-9B/C for this period.
[f]1996 summary results are from data collected at AMS-9B.
[g]1996 summary results are from data collected at AMS-17 and AMS-17A.
[h]1990-1995 summary results are from data collected at AMS-17.
[i]1996 summary results are from data collected at AMS-18 and AMS-18A.
[j]1990-1995 summary results are from data collected at AMS-18.
[k]AMS locations were not in operation prior to 1997.
[l]Total particulate analysis was discontinued during 1994 and was reinstated for AMS-12 and AMS-16 in 1997.
[m]AMS-21 was not sampled for total particulate during 1990-1995.

TABLE C.1-4

RADIONUCLIDES IN AIR DURING 1997

Sampling Location[b]	Concentration ±Uncertainty (pCi/m³ x .000001)[a]												
	Strontium-90	Technetium-99	Cesium-137	Radium-226	Radium-228	Thorium-228	Thorium-230	Thorium-232	Uranium-234	Uranium-235/ Uranium-236	Uranium-238	Plutonium-238	Plutonium-239/ Plutonium-240
Onsite/Fenceline													
AMS-1B	< 1.9	45 ± 27	< 24	9.5 ± 3.1	11 ± 5	7.2 ± 1.4	16 ± 4.2	6.4 ± 1.8	190 ± 20	32 ± 4.5	190 ± 20	< 0.83	0.83 ± 0.57
AMS-2	150 ± 22	< 18	< 17	8.7 ± 2.7	4.4 ± 4.3	7.3 ± 1.3	< 2.9	5.3 ± 1.6	41 ± 4.5	17 ± 2.3	35 ± 3.7	< 0.83	< 0.64
AMS-3	14 ± 4.2	< 26	< 15	9.9 ± 3.2	17 ± 5.3	14 ± 2	15 ± 3.9	11 ± 2	110 ± 11	35 ± 4.4	120 ± 12	< 0.9	< 0.61
AMS-4	< 1.8	< 22	< 13	11 ± 3.3	20 ± 5.1	8 ± 1.4	< 2.8	6.3 ± 1.6	30 ± 3.6	12 ± 1.8	34 ± 3.6	< 0.83	< 0.52
AMS-5	< 2	< 18	< 17	7.6 ± 2.6	< 4.2	7.1 ± 1.5	< 2.8	5 ± 1.6	25 ± 3.6	13 ± 2.2	26 ± 3.3	< 0.97	< 0.56
AMS-6	11 ± 3.8	260 ± 75	< 14	8 ± 2.5	9.2 ± 4.8	6.1 ± 1.4	3.7 ± 3.4	5.9 ± 1.7	27 ± 3.5	9.4 ± 1.9	28 ± 3.7	< 0.87	< 0.64
AMS-7	< 1.9	330 ± 99	< 13	8.5 ± 2.7	< 4.4	7.1 ± 1.4	< 3	5.3 ± 1.6	21 ± 3.1	12 ± 1.9	28 ± 3.2	< 0.99	< 0.59
AMS-8A	< 1.9	46.0 ± 20	< 16	12 ± 3.8	12 ± 4.8	9.9 ± 1.6	8.1 ± 3.5	8.5 ± 1.8	47 ± 5.1	18 ± 2.4	51 ± 5	< 0.97	< 0.76
AMS-9B/C	5.9 ± 2.8	< 22	< 15	14 ± 4.4	29 ± 6.4	14 ± 1.9	13 ± 3.9	15 ± 2.3	71 ± 7.8	35 ± 4.2	86 ± 8.7	< 0.98	< 0.59
AMS-17A	5.1 ± 3	< 21	< 14	11 ± 3.4	4.6 ± 4.4	9.4 ± 0.8	10 ± 1.9	9.7 ± 0.97	30 ± 2	10 ± 0.98	60 ± 3.1	< 1.2	< 0.98
AMS-18A	< 2.8	< 25	< 18	14 ± 4.3	6.3 ± 4.1	9.3 ± 1.4	8.6 ± 3.1	7.5 ± 1.5	55 ± 2.7	14 ± 1.6	92 ± 3.1	< 1	< 0.84
AMS-19	< 2.4	< 18	< 15	8 ± 2.7	6 ± 4.1	6.1 ± 1.4	5.3 ± 3.1	5.4 ± 1.4	15 ± 2.4	5 ± 1.2	20 ± 2.4	< 0.93	< 0.79
AMS-20	< 2.3	132 ± 39	< 13	5.9 ± 2	< 4.1	6.9 ± 1.3	< 1.7	4.9 ± 1.3	15 ± 2.2	4.2 ± 1.1	22 ± 2.4	< 1.3	< 1.1
Offsite/Background													
AMS-10	< 2	< 31	< 13	11 ± 3.4	5.1 ± 4.5	8.7 ± 1.6	8.5 ± 3.5	7.7 ± 1.8	17 ± 2.6	4.8 ± 1.3	20 ± 2.4	< 1.1	< 0.7
AMS-11	21 ± 5.1	< 23	< 17	< 0.22	5.9 ± 4	6.5 ± 1.6	< 2.4	5.8 ± 1.6	9.8 ± 2.3	2.1 ± 1.2	9.4 ± 1.8	< 1.1	< 0.93
AMS-12	< 2.4	< 21	< 15	6.8 ± 2.2	< 4.3	6.4 ± 1.5	< 2.4	5.6 ± 1.5	6.2 ± 1.9	< 1.2	7.3 ± 1.4	< 1	< 0.81
AMS-13	< 2.9	44 ± 18	< 14	7.3 ± 2.4	< 3.7	10 ± 1.8	9.5 ± 3.6	9.1 ± 1.8	14 ± 2.5	3.3 ± 1.3	14 ± 2.1	< 1.1	< 1
AMS-14	< 2.4	< 25	< 17	9.9 ± 3.1	< 3.6	8.8 ± 1.6	5.3 ± 3.2	9 ± 1.7	16 ± 2.5	3.7 ± 1.3	16 ± 2.2	< 1.2	< 1
AMS-16	< 2.4	< 19	< 15	11 ± 3.4	22 ± 5.4	10 ± 1.8	9.3 ± 3.5	13 ± 2.1	12 ± 2.2	2.8 ± 1.2	13 ± 1.9	< 1	< 0.69
AMS-21	< 2.5	< 29	< 20	9.1 ± 3	< 4	11 ± 2.1	7.2 ± 3.6	8.3 ± 1.8	10 ± 2.4	5.4 ± 1.6	12 ± 2	< 1.6	< 1.1
DCG[c]	9,000,000	2,000,000,000	400,000,000	1,000,000	3,000,000	40,000	40,000	7,000	90,000	100,000	100,000	30,000	20,000

[a]Plus/minus (±) values are the uncertainty in the analytical results at the 95 percent confidence level.
[b]See Figure C.1-1 for sample locations.
[c]Derived concentration guidelines from DOE Order 5400.5., Radiation Protection of the Public and the Environment, February 1990. Continuous inhalation of this concentration for one year will result in a committed effective dose equivalent of 100 mrem (1 mSv).

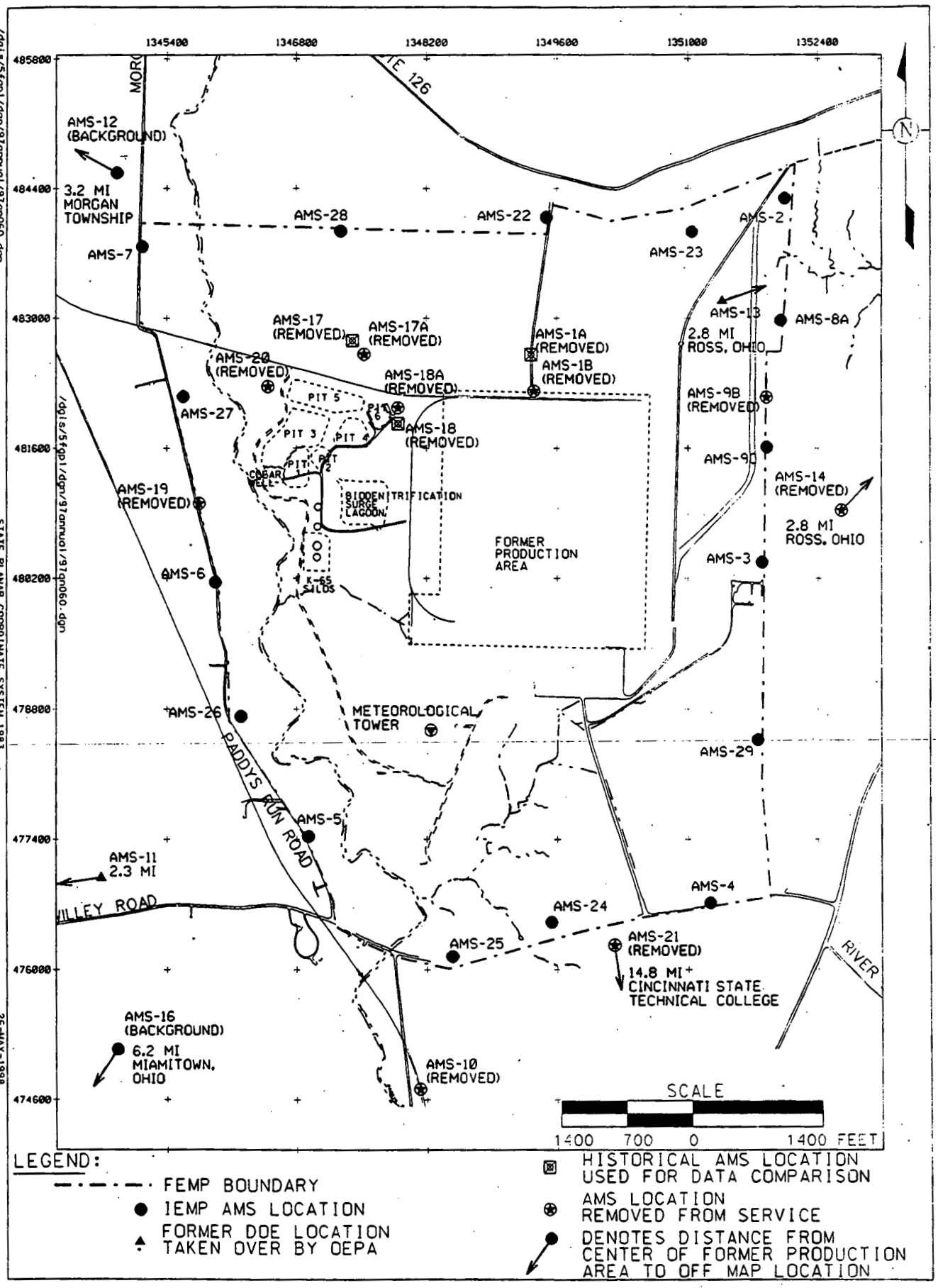

FIGURE C.1-1. IEMP RADIOLOGICAL AIR MONITORING PROGRAM

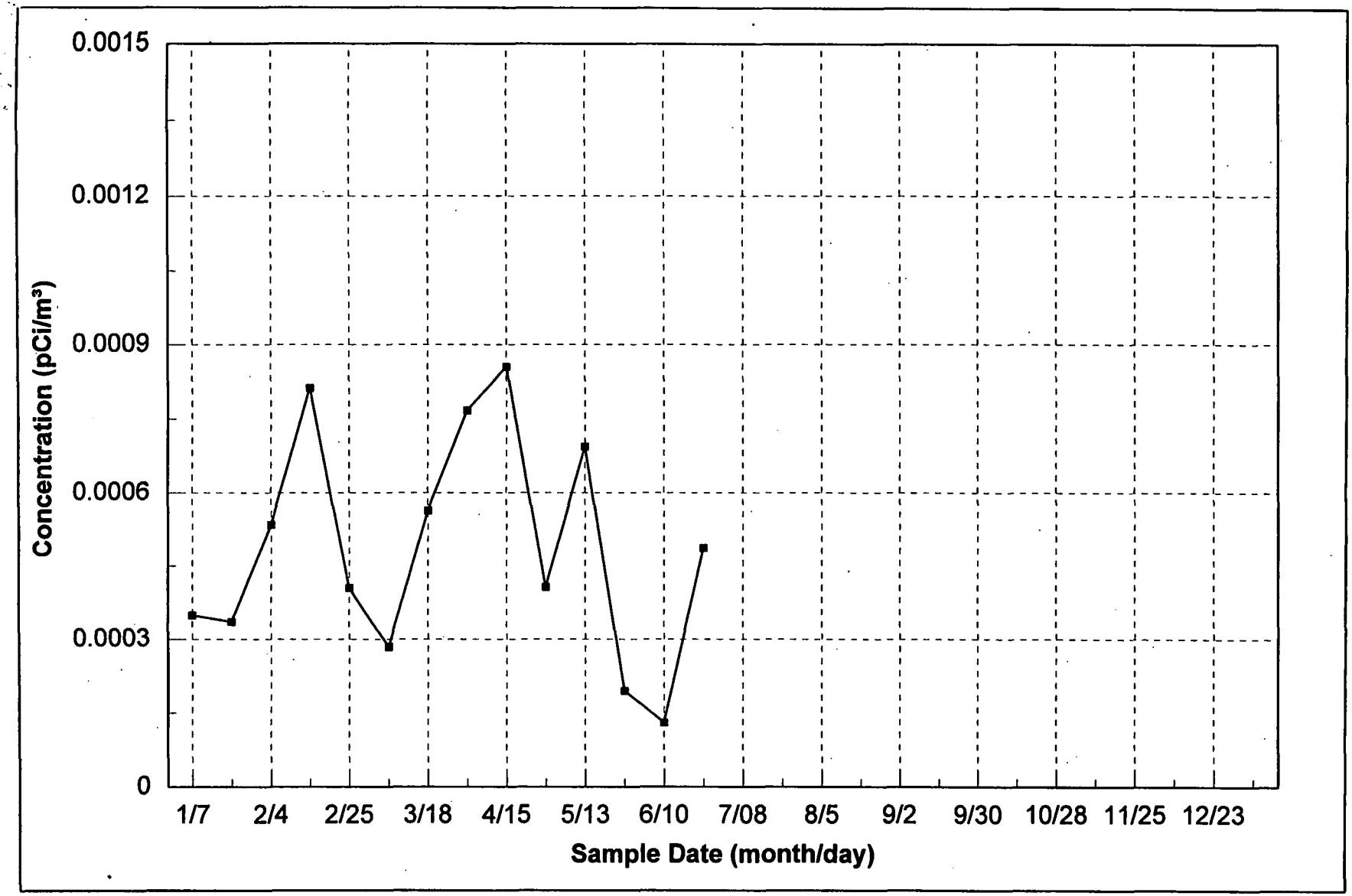

FIGURE C.1-2. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-1B

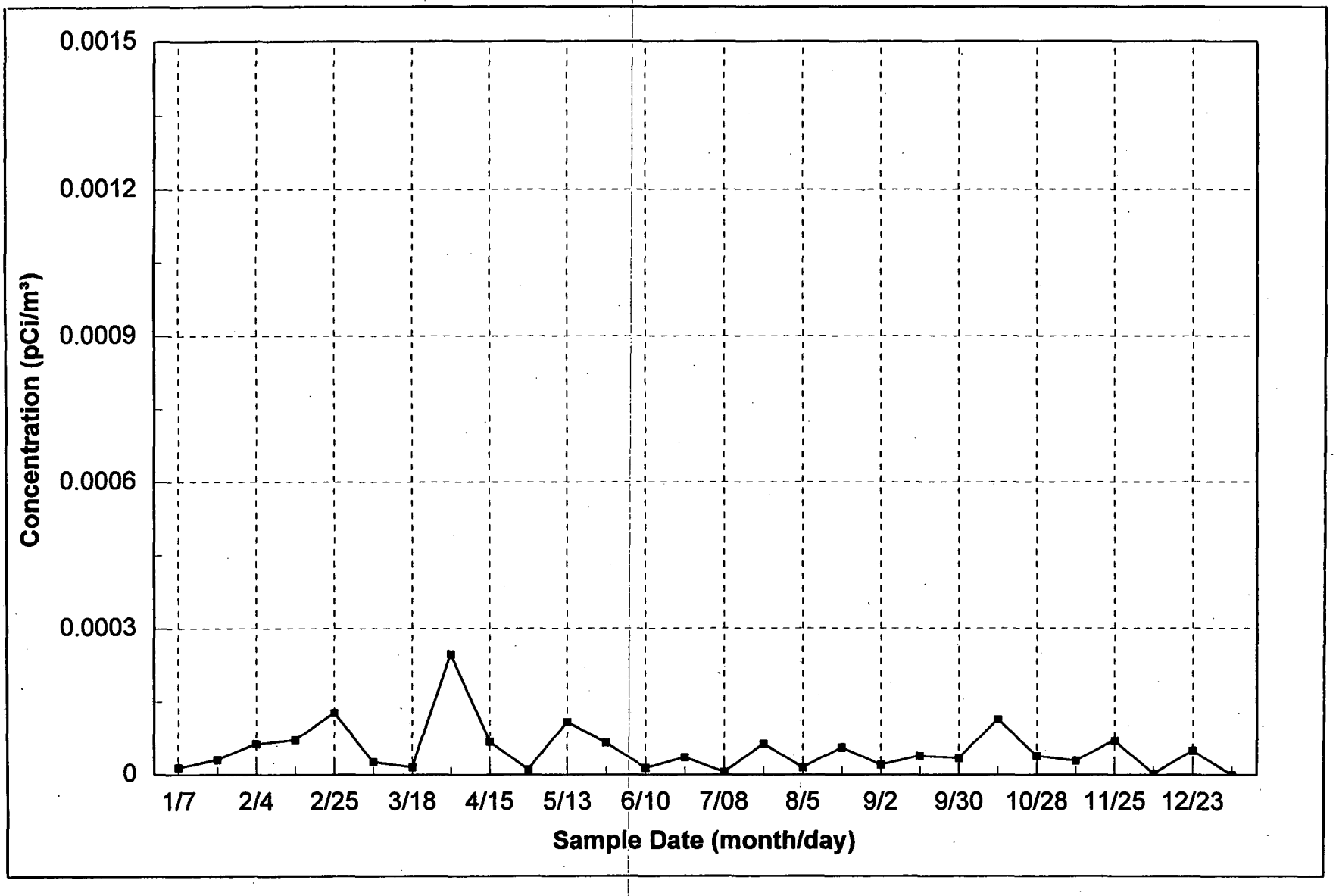

FIGURE C.1-3. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-2

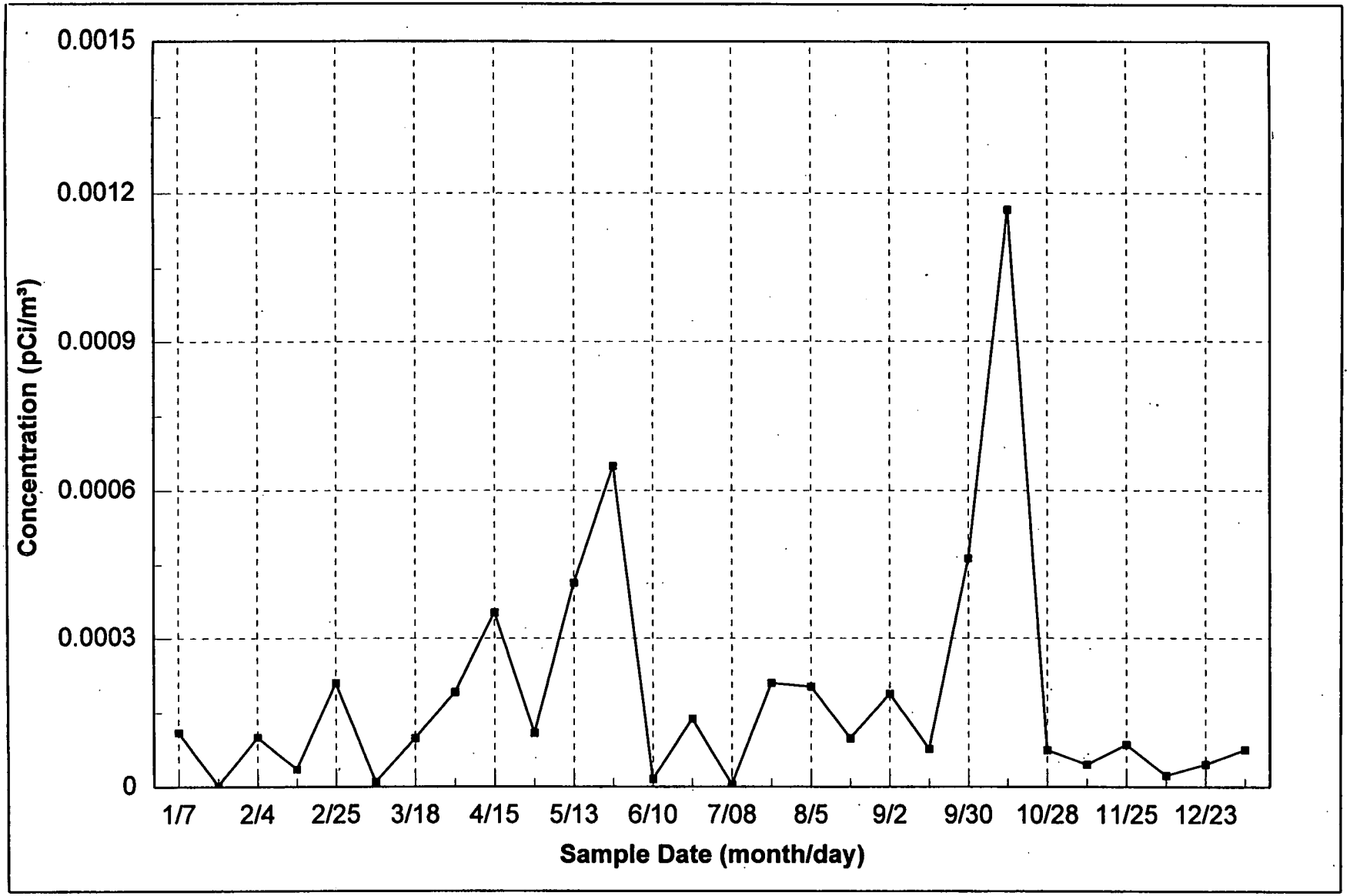

FIGURE C.1-4. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-3

000474

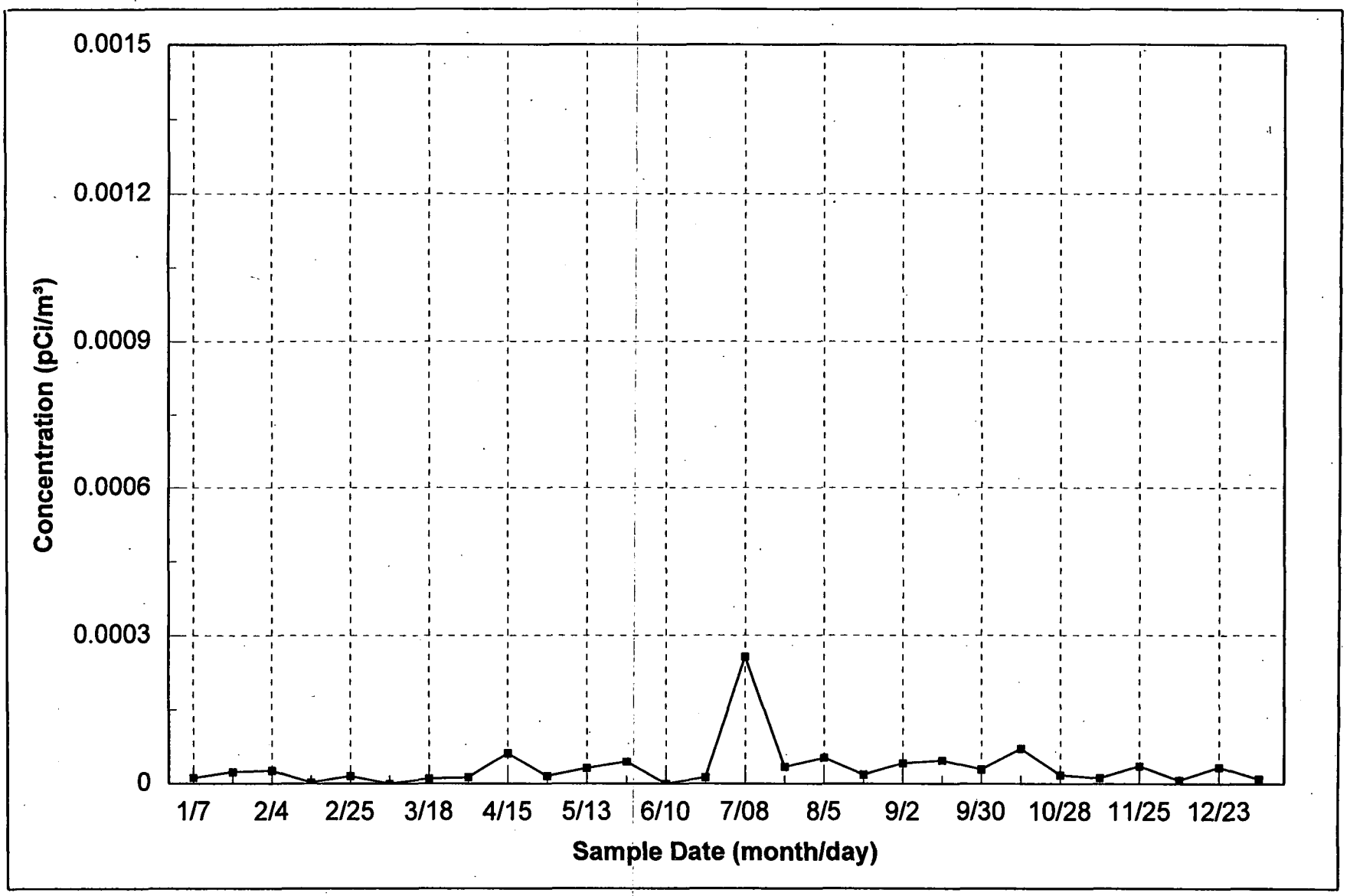

FIGURE C.1-5. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-4

000475

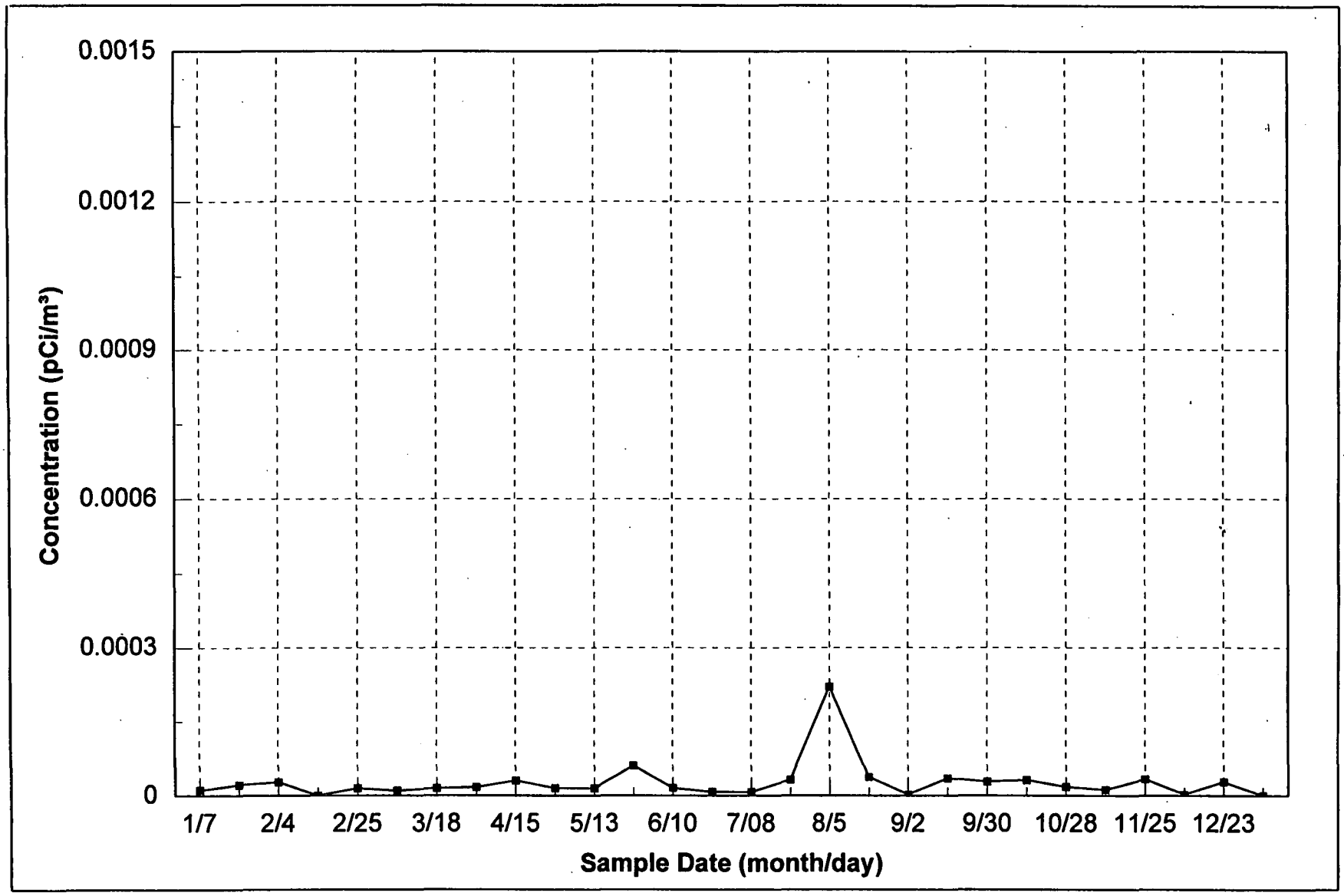

FIGURE C.1-6. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-5

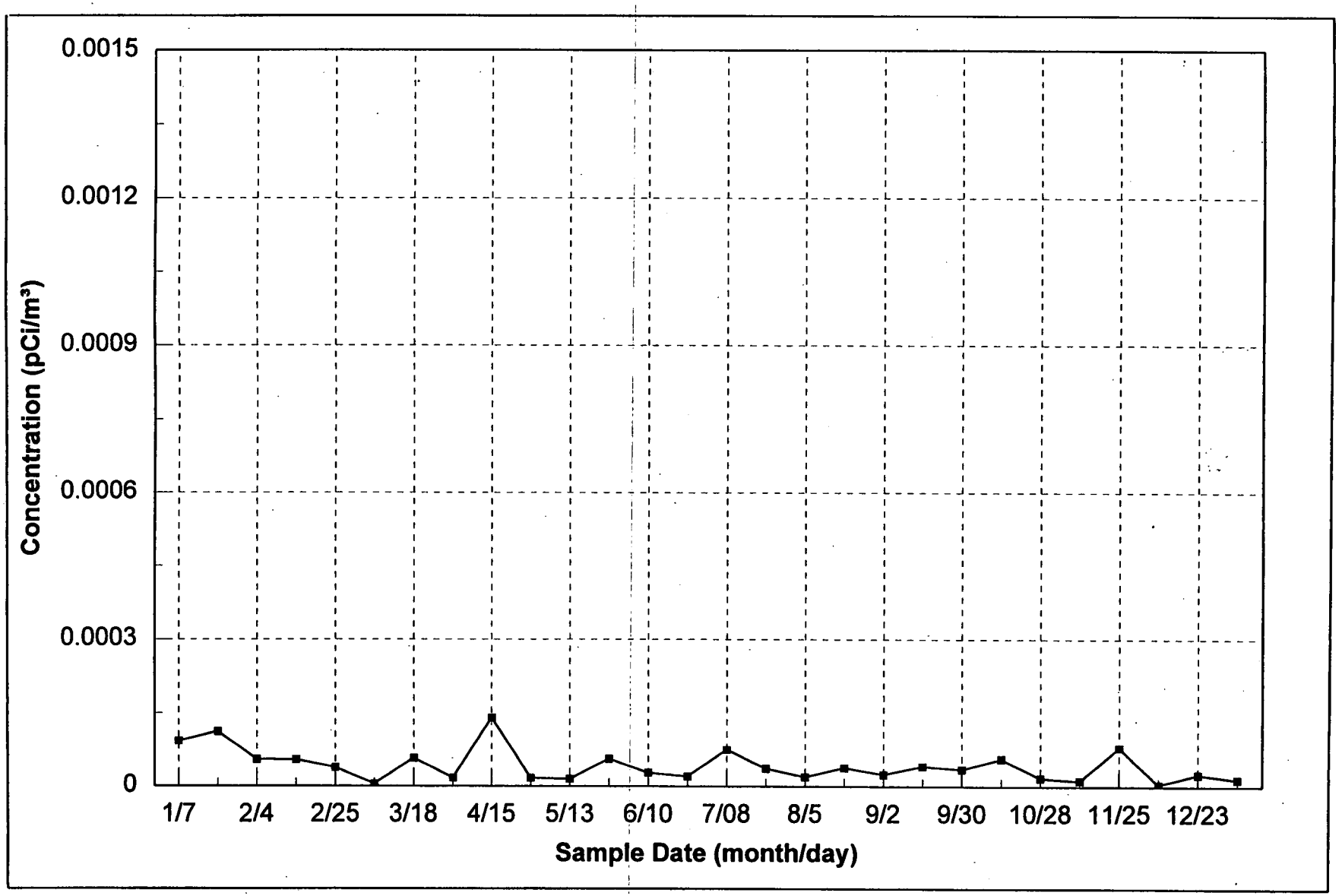

FIGURE C.1-7. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-6

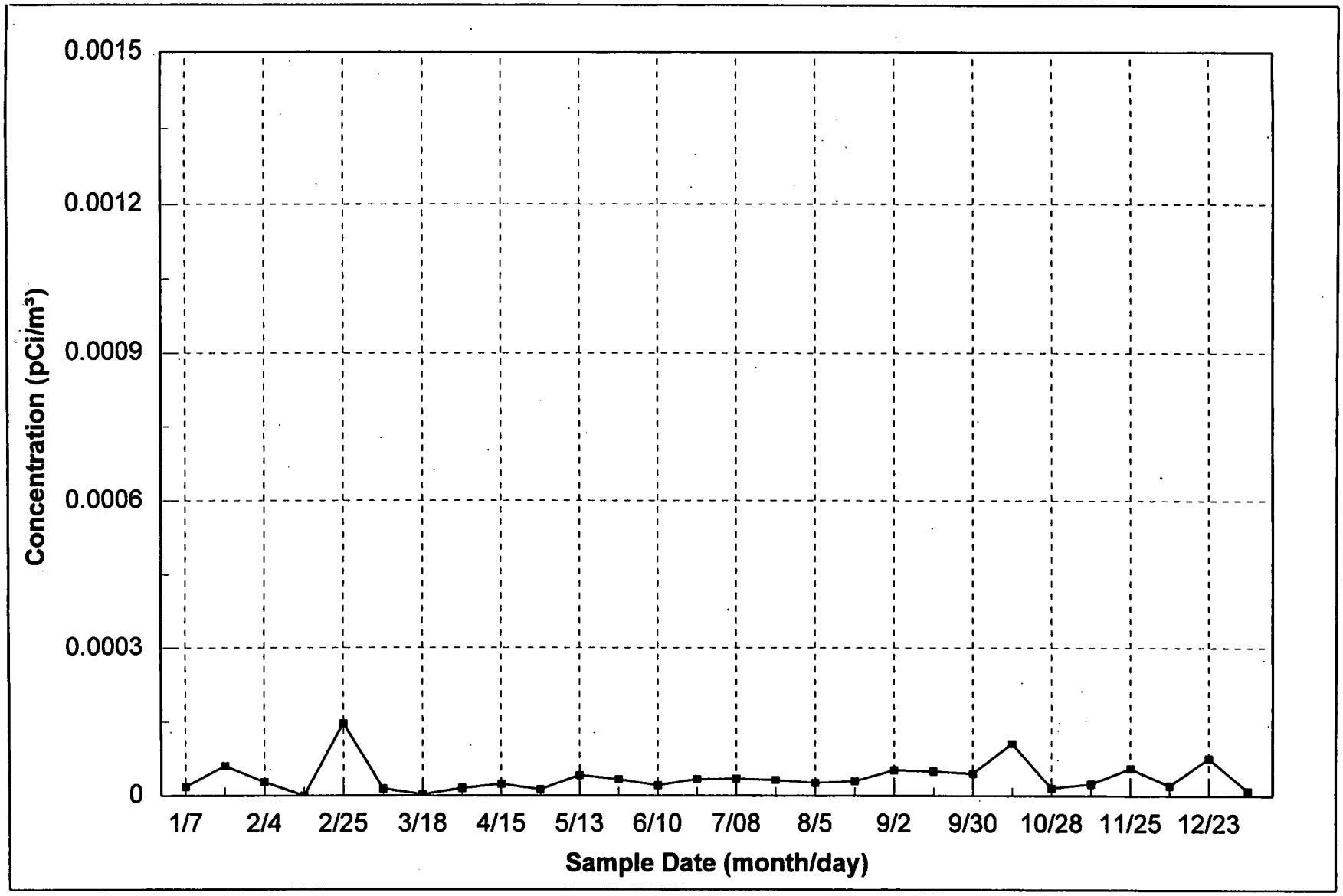

FIGURE C.1-8. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-7

000478

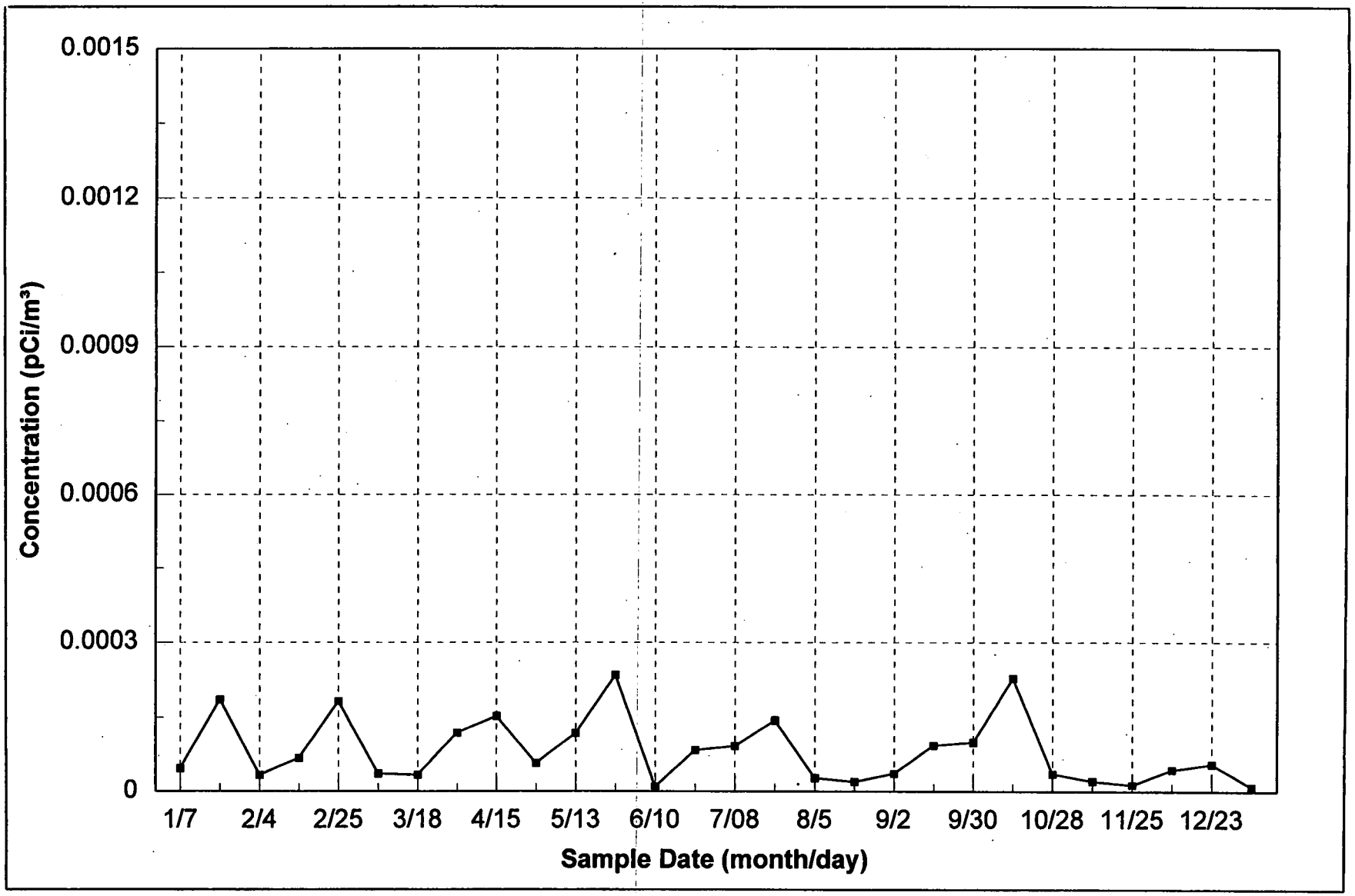

FIGURE C.1-9. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-8A

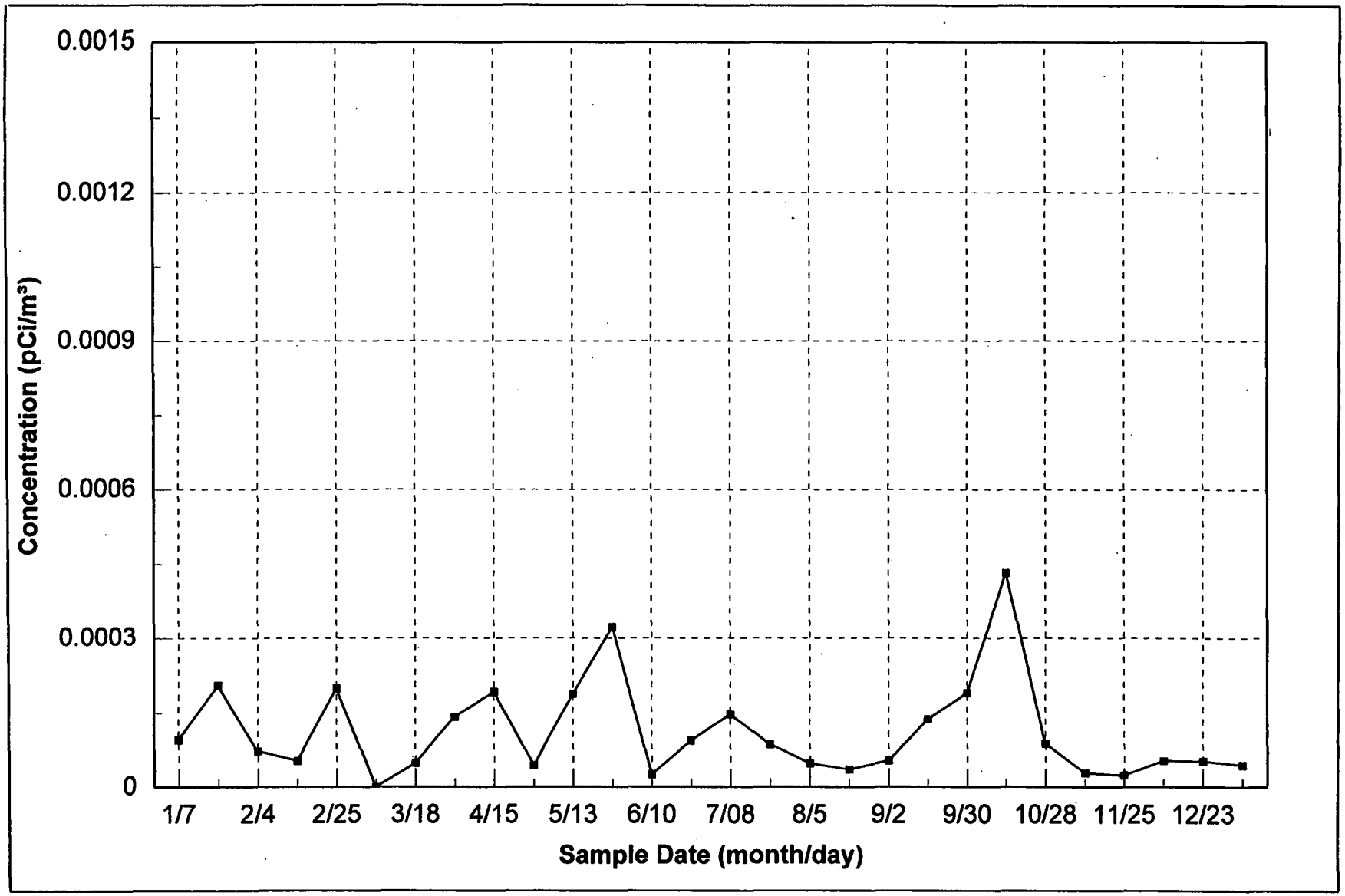

FIGURE C.1-10. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-9B/C

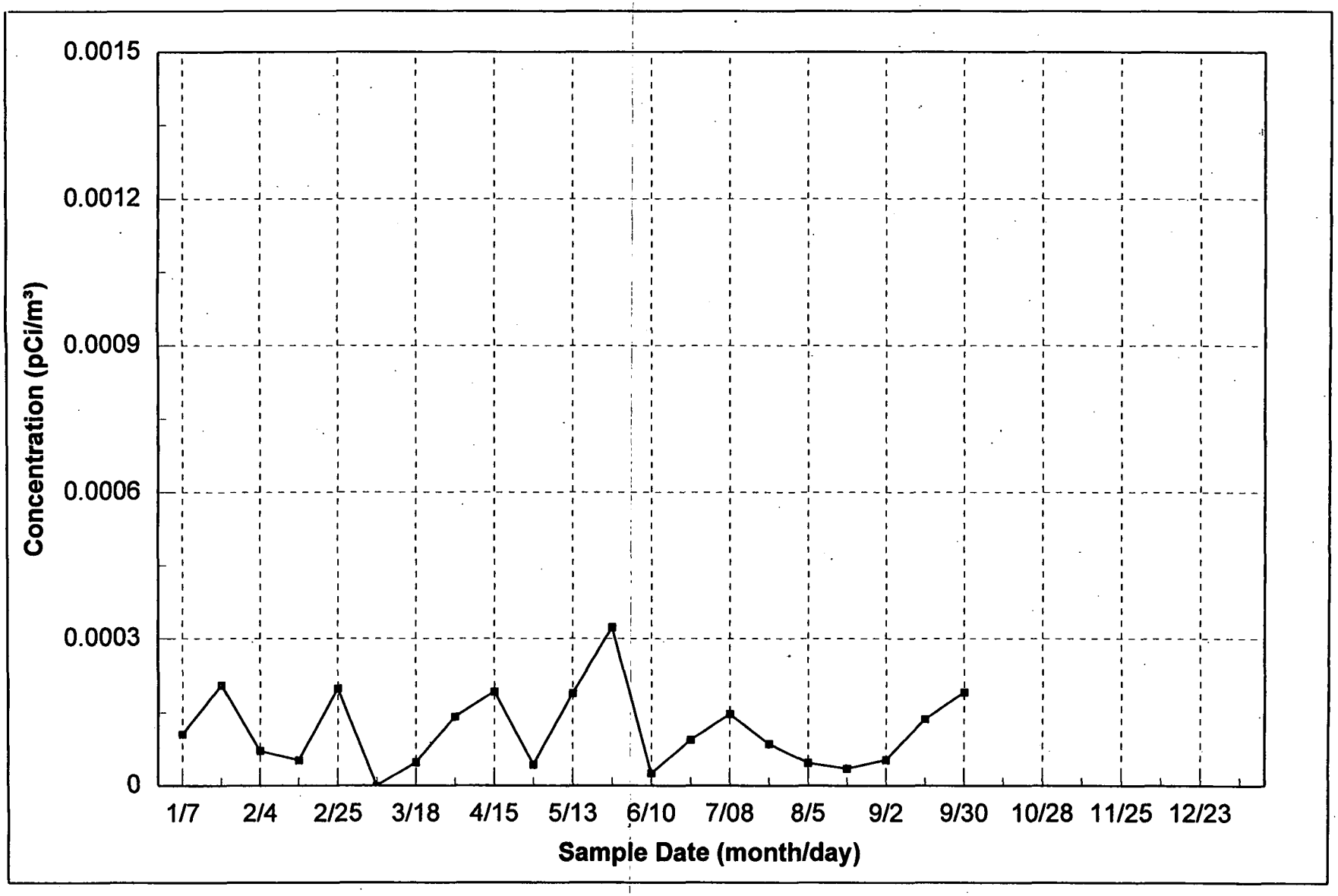

FIGURE C.1-11. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-10

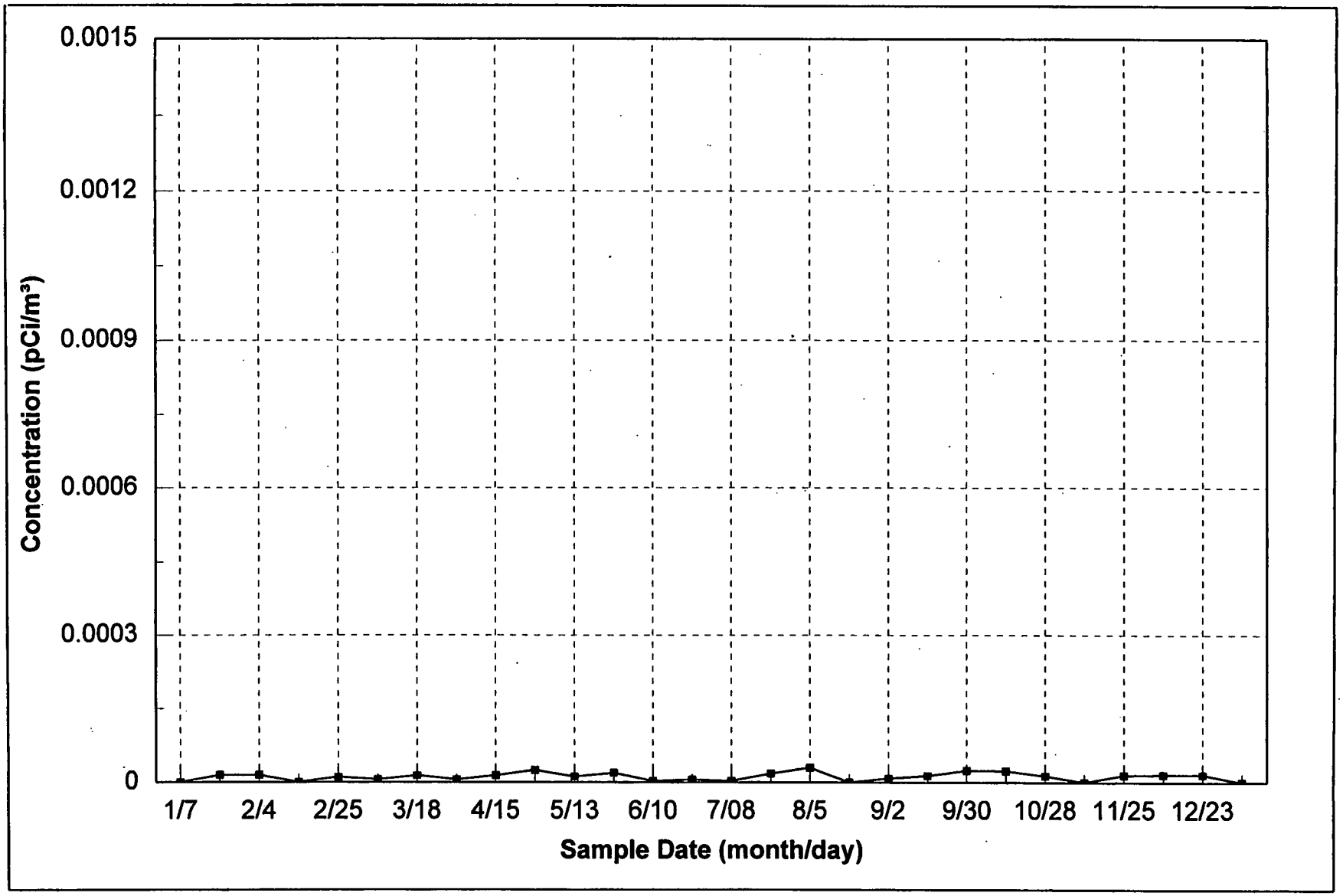

FIGURE C.1-12. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-11

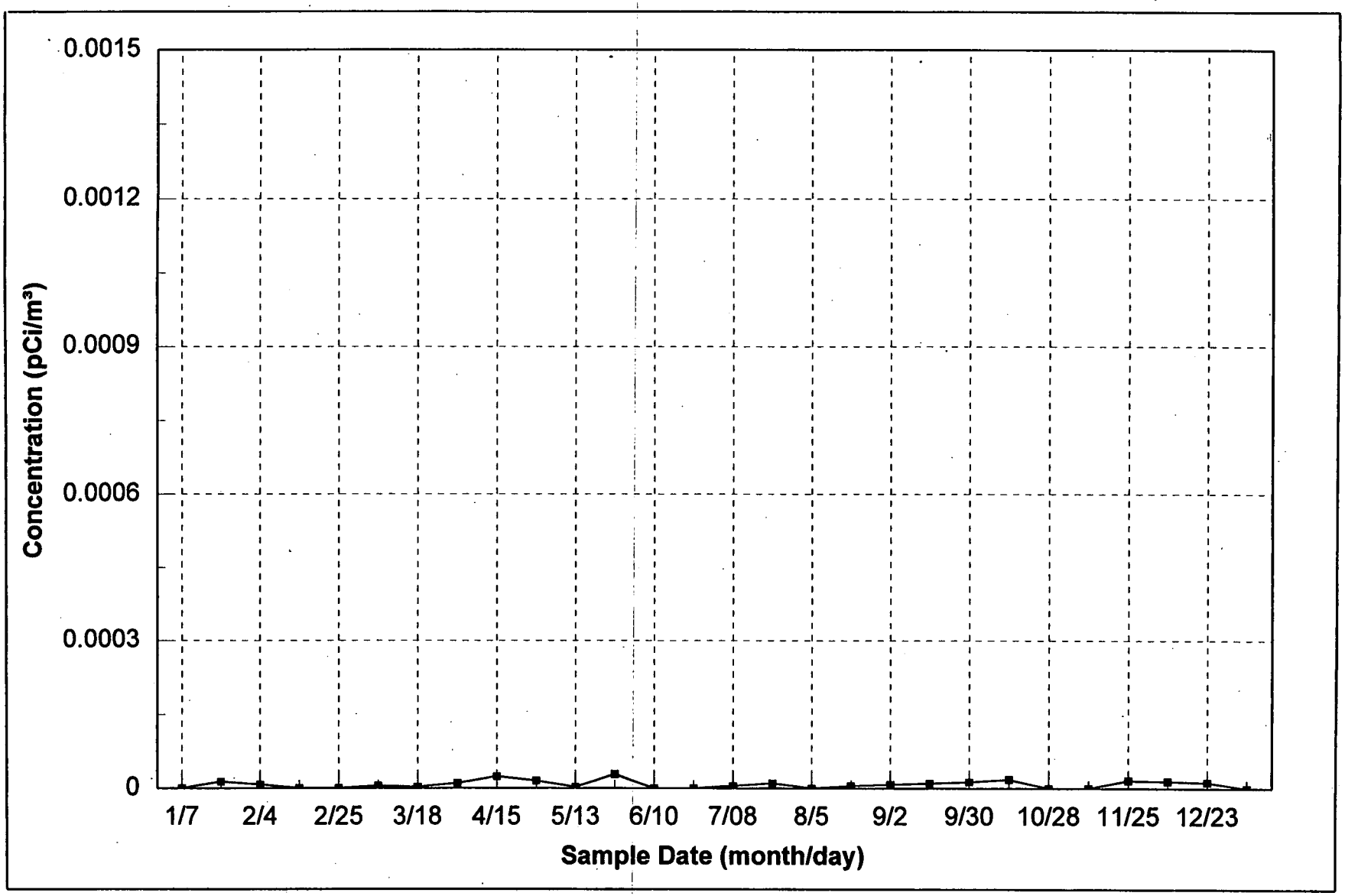

FIGURE C.1-13. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-12

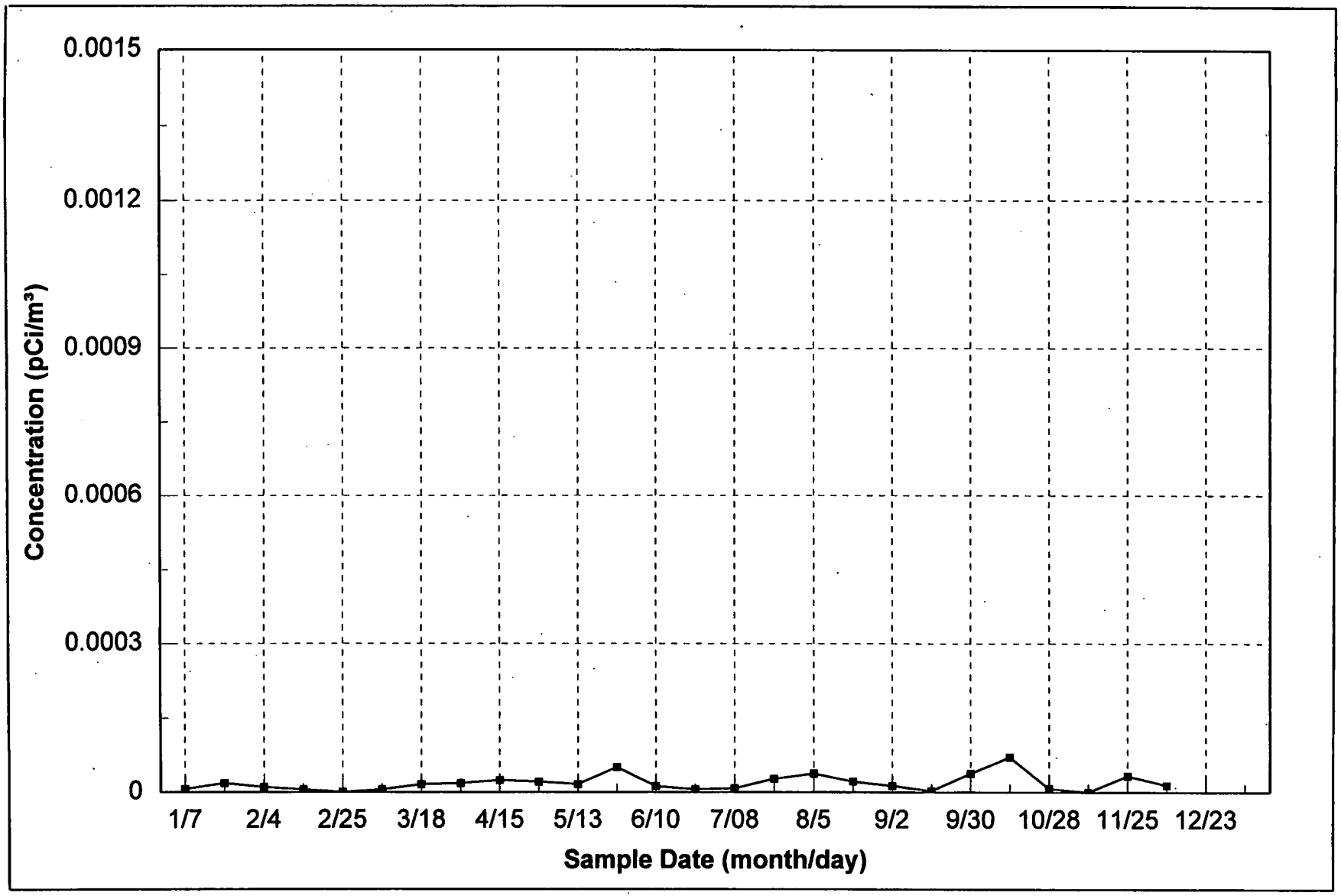

FIGURE C.1-14. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-13

000484

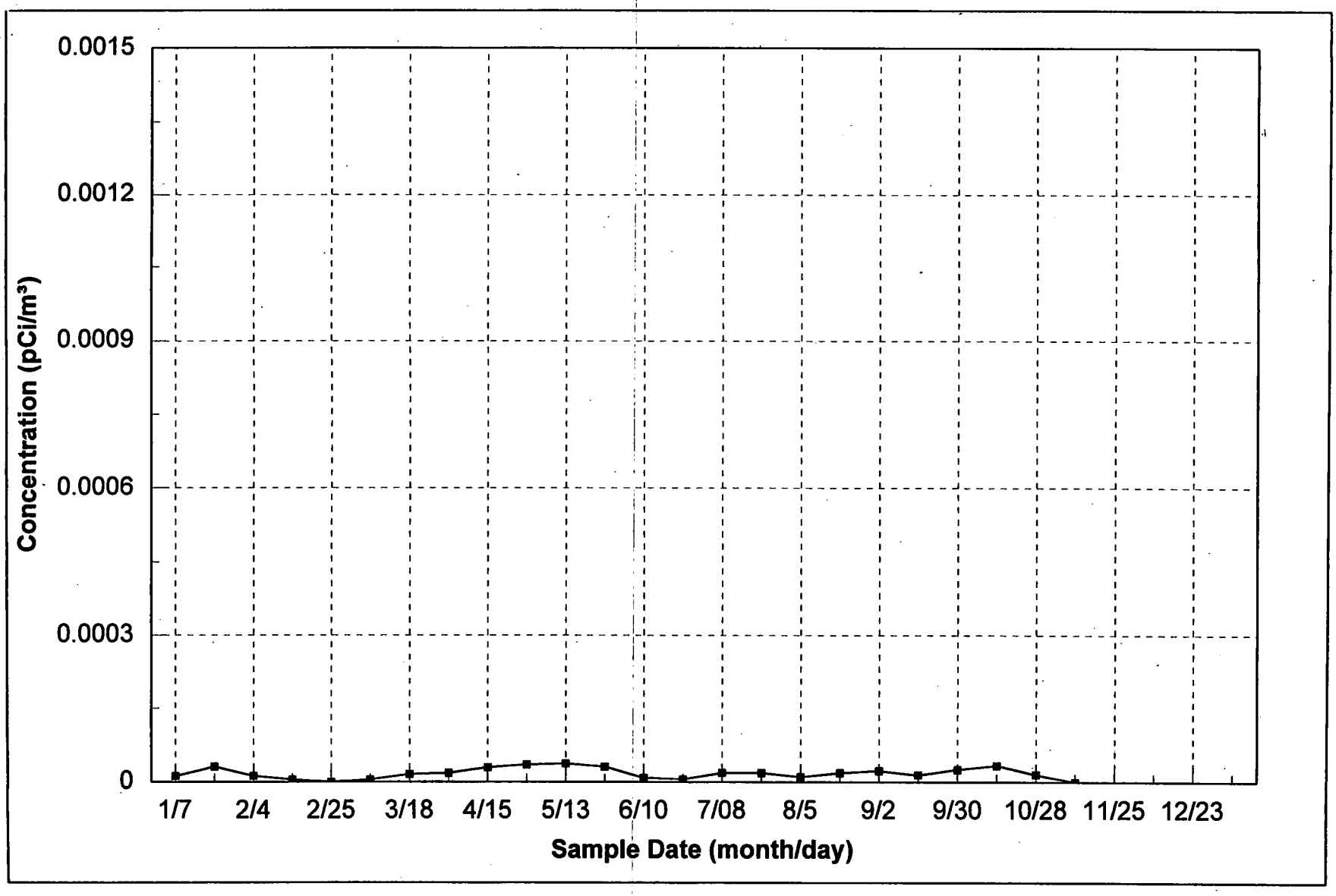

FIGURE C.1-15. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-14

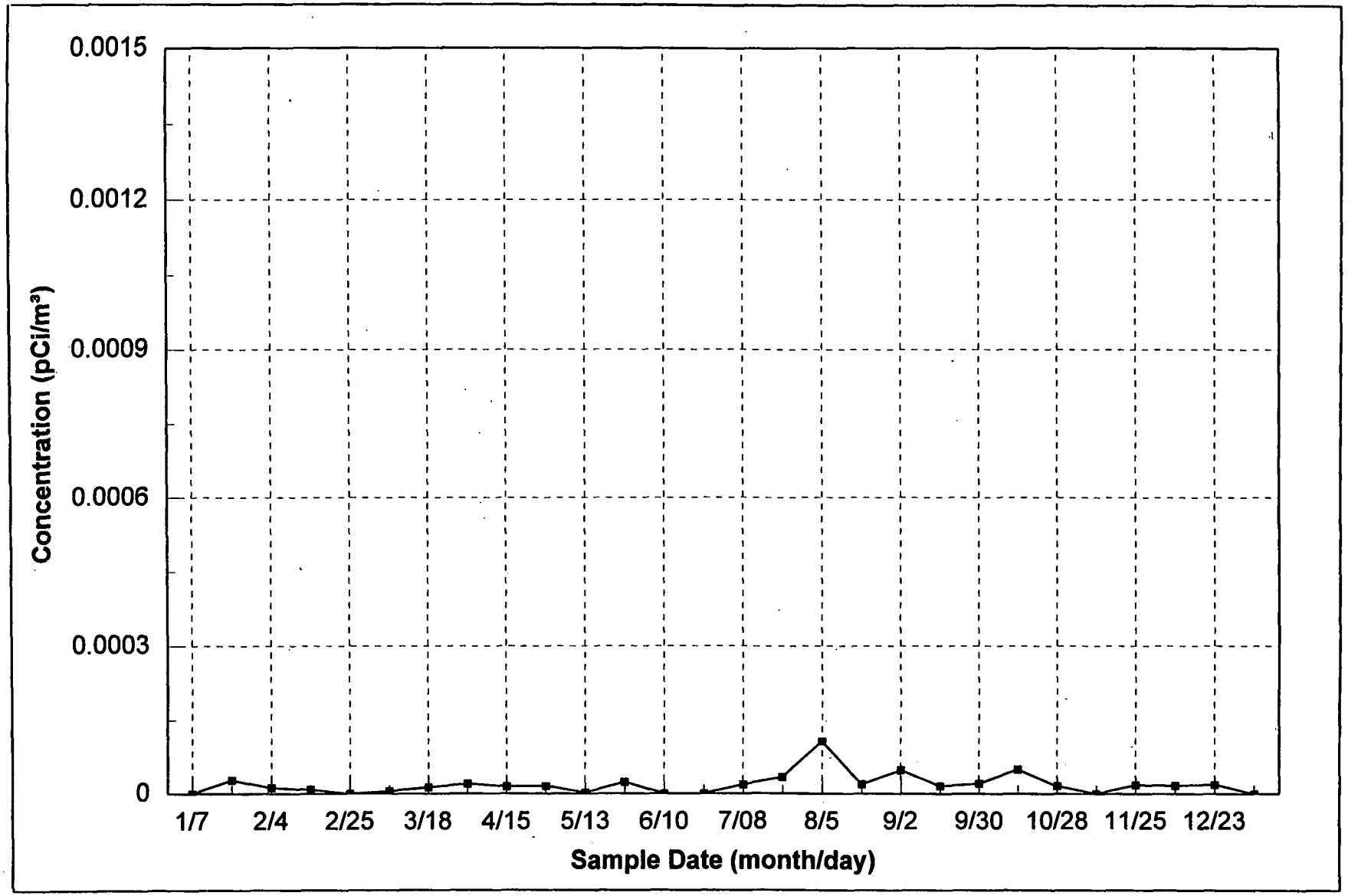

FIGURE C.1-16. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-16

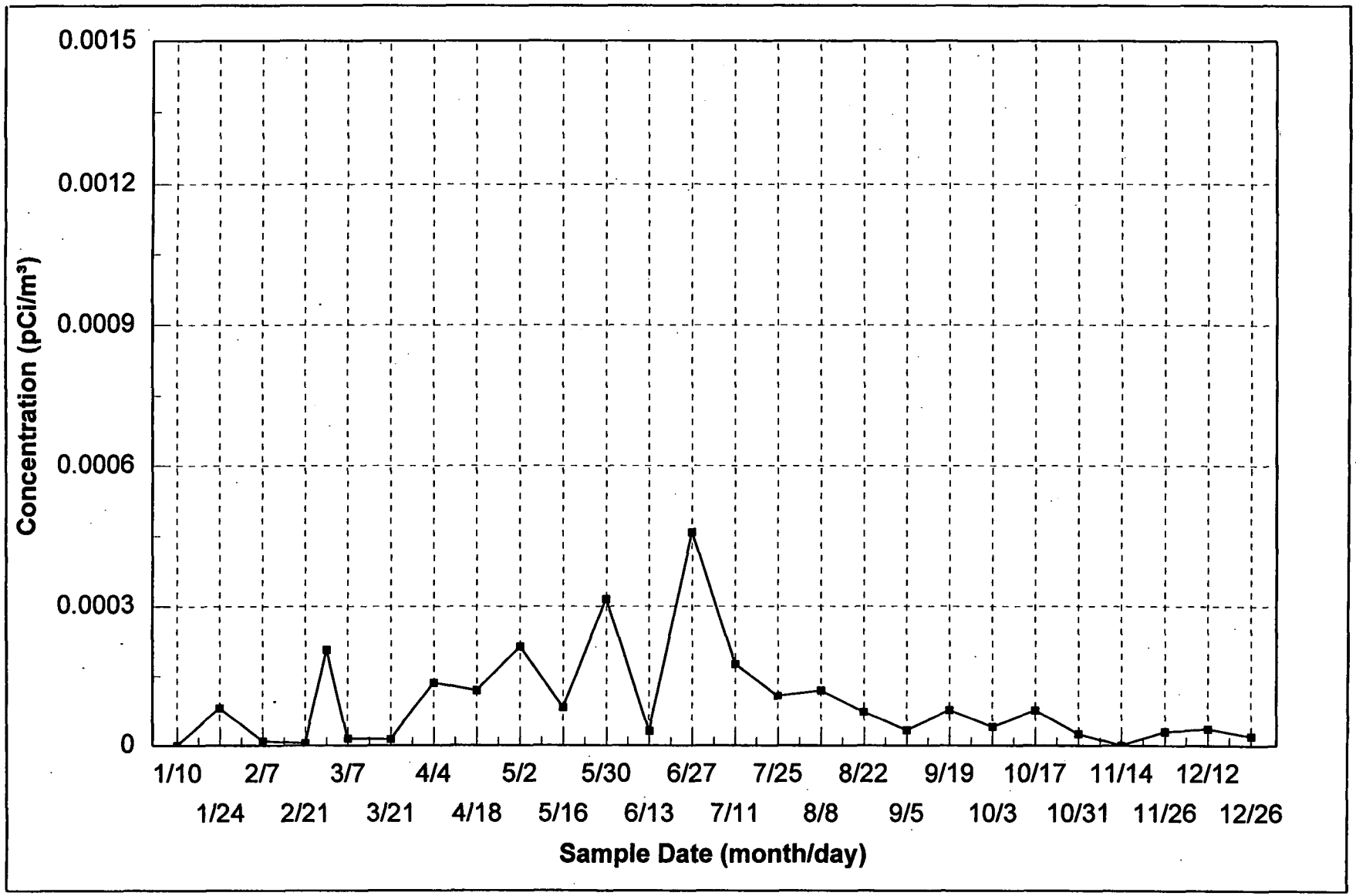

FIGURE C.1-17. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-17A

000487

1470

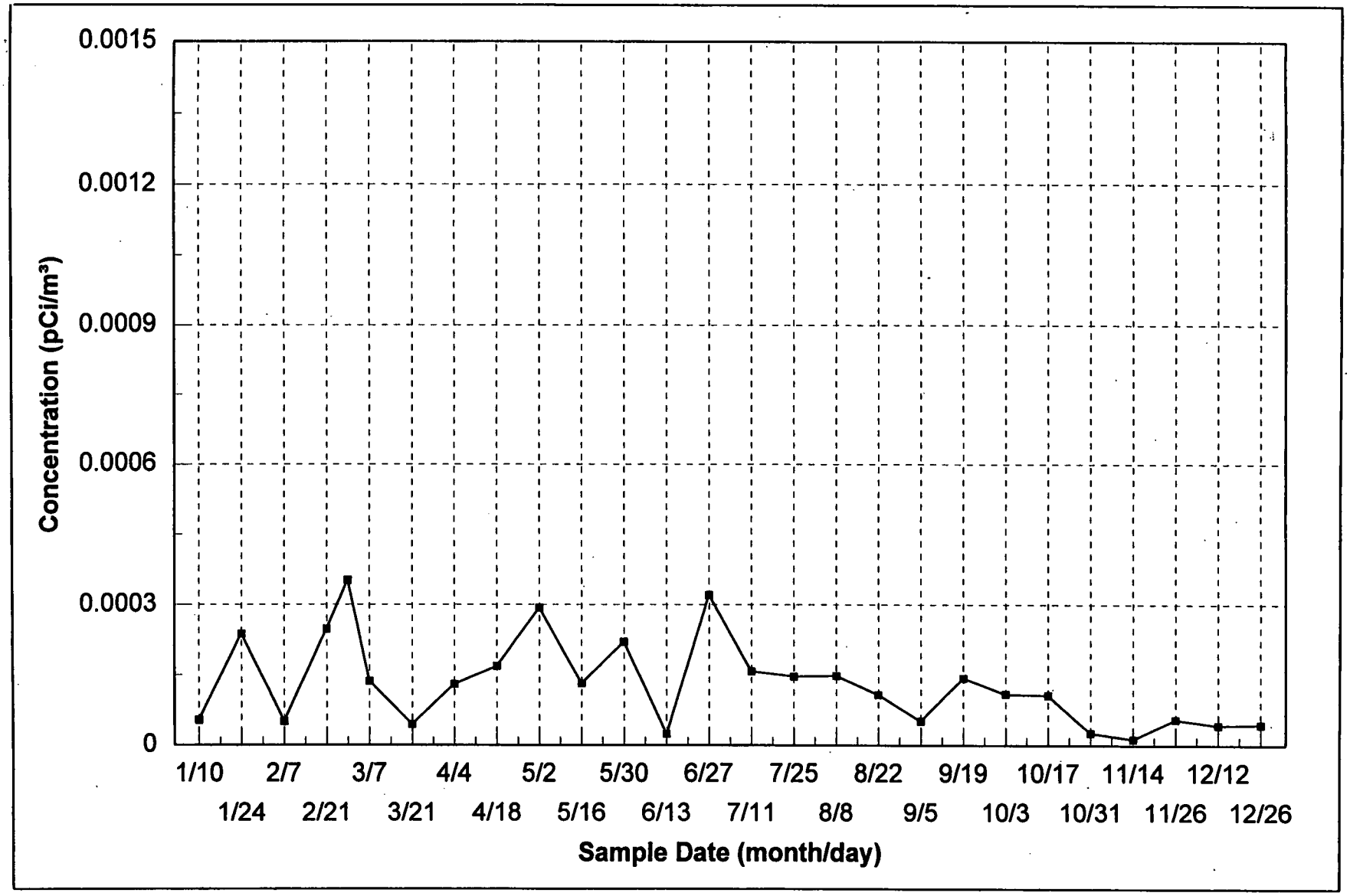

FIGURE C.1-18. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-18A

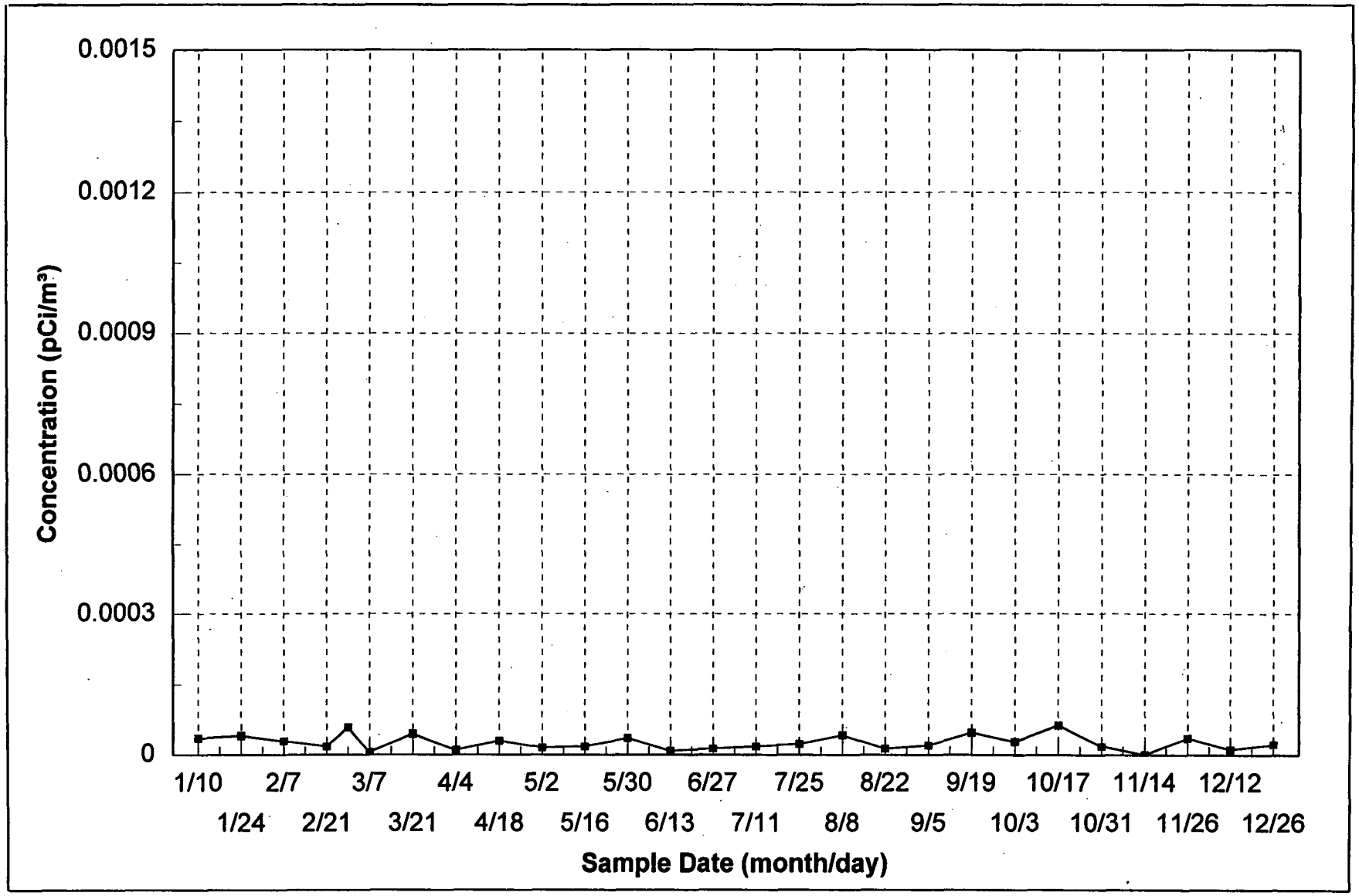

FIGURE C.1-19. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-19

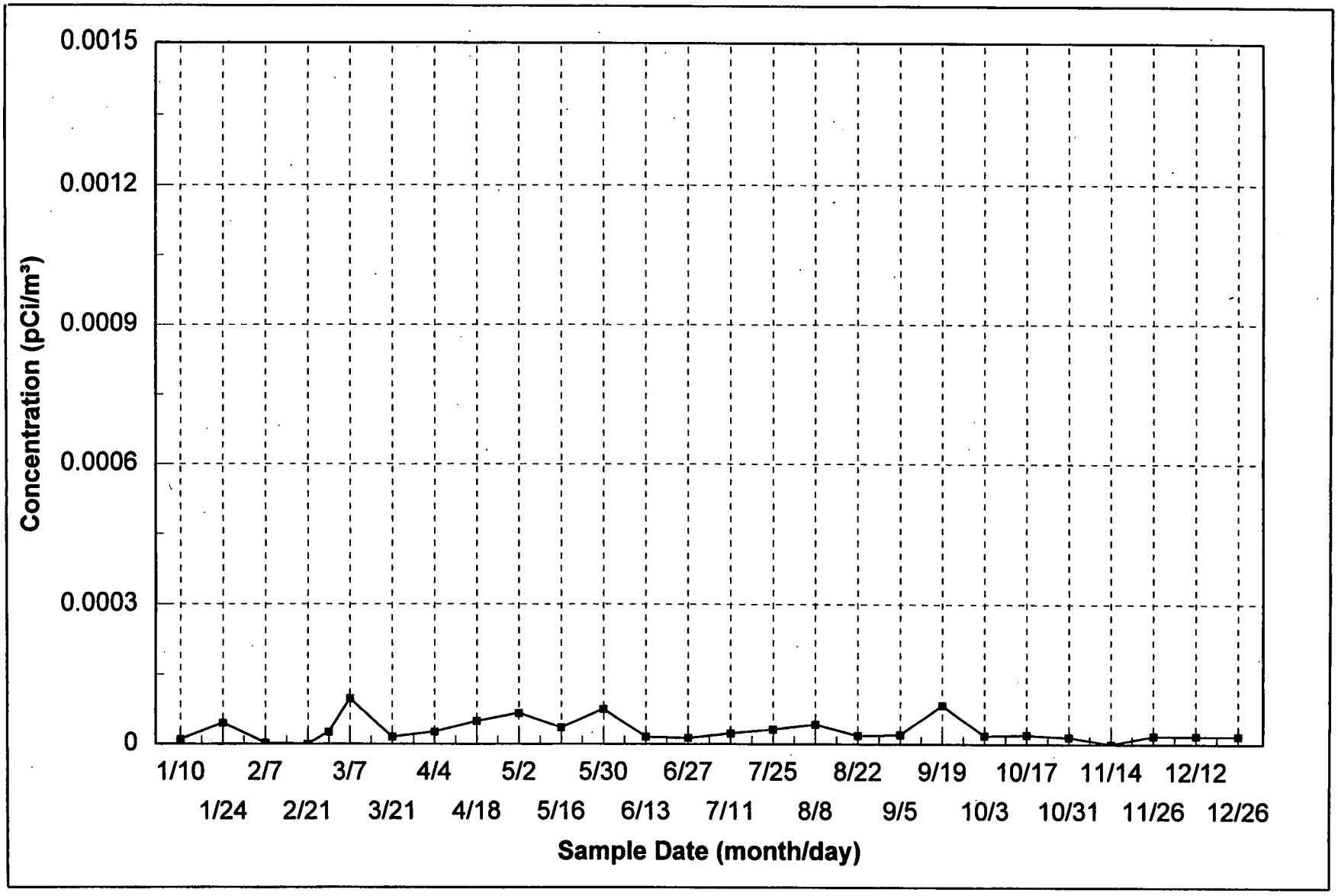

FIGURE C.1-20. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-20

000490

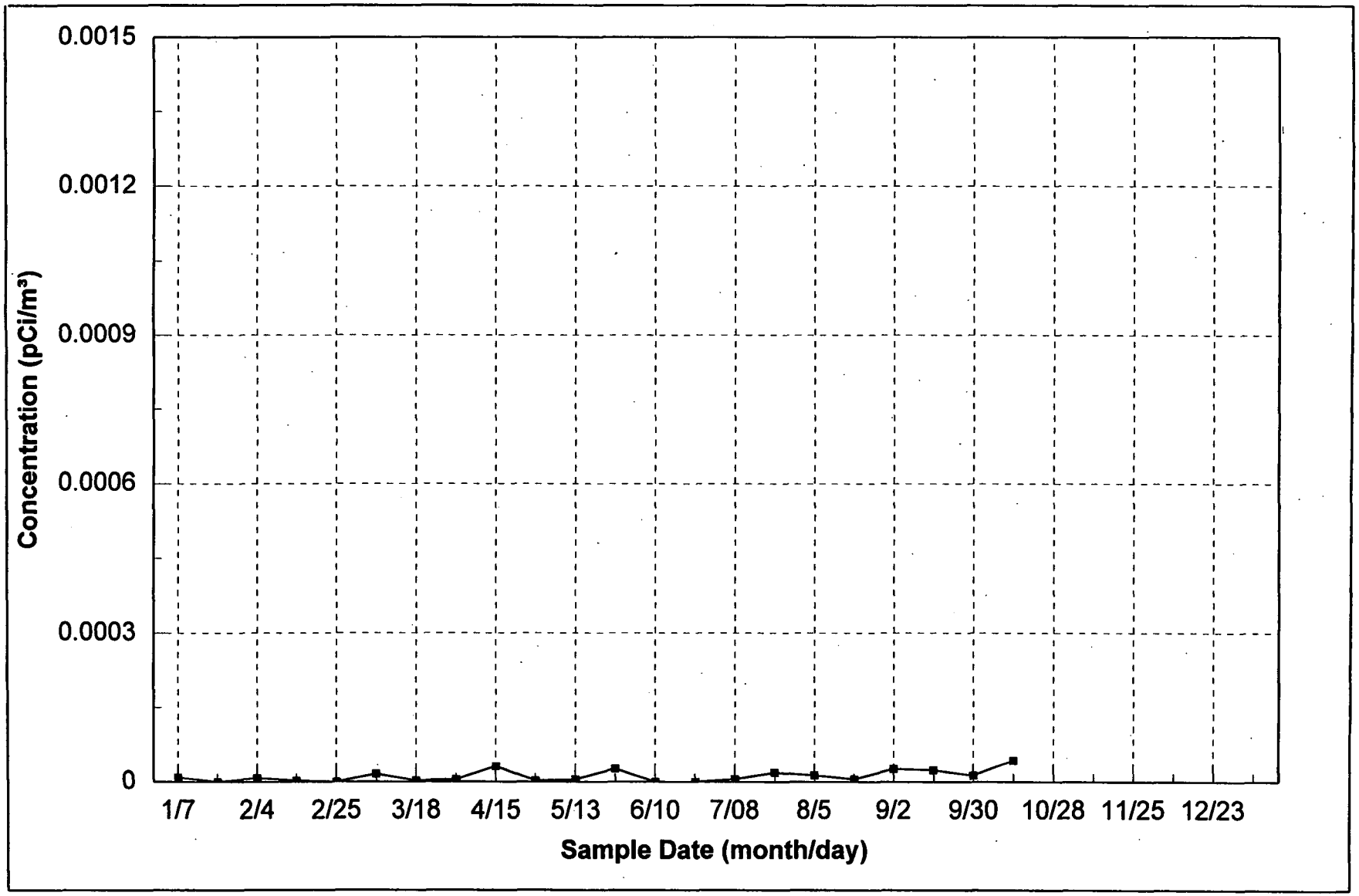

FIGURE C.1-21. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-21

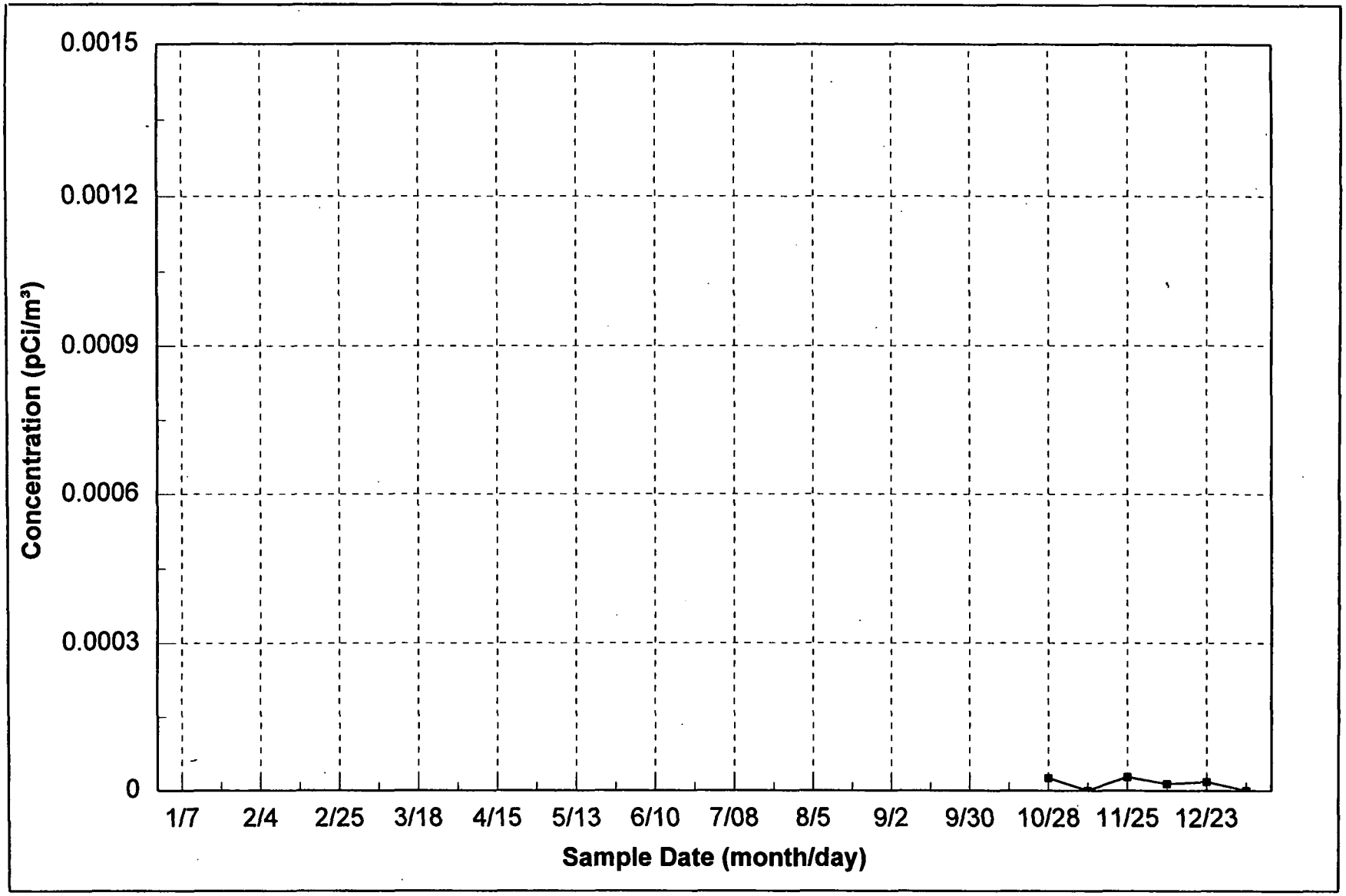

FIGURE C.1-22. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-22

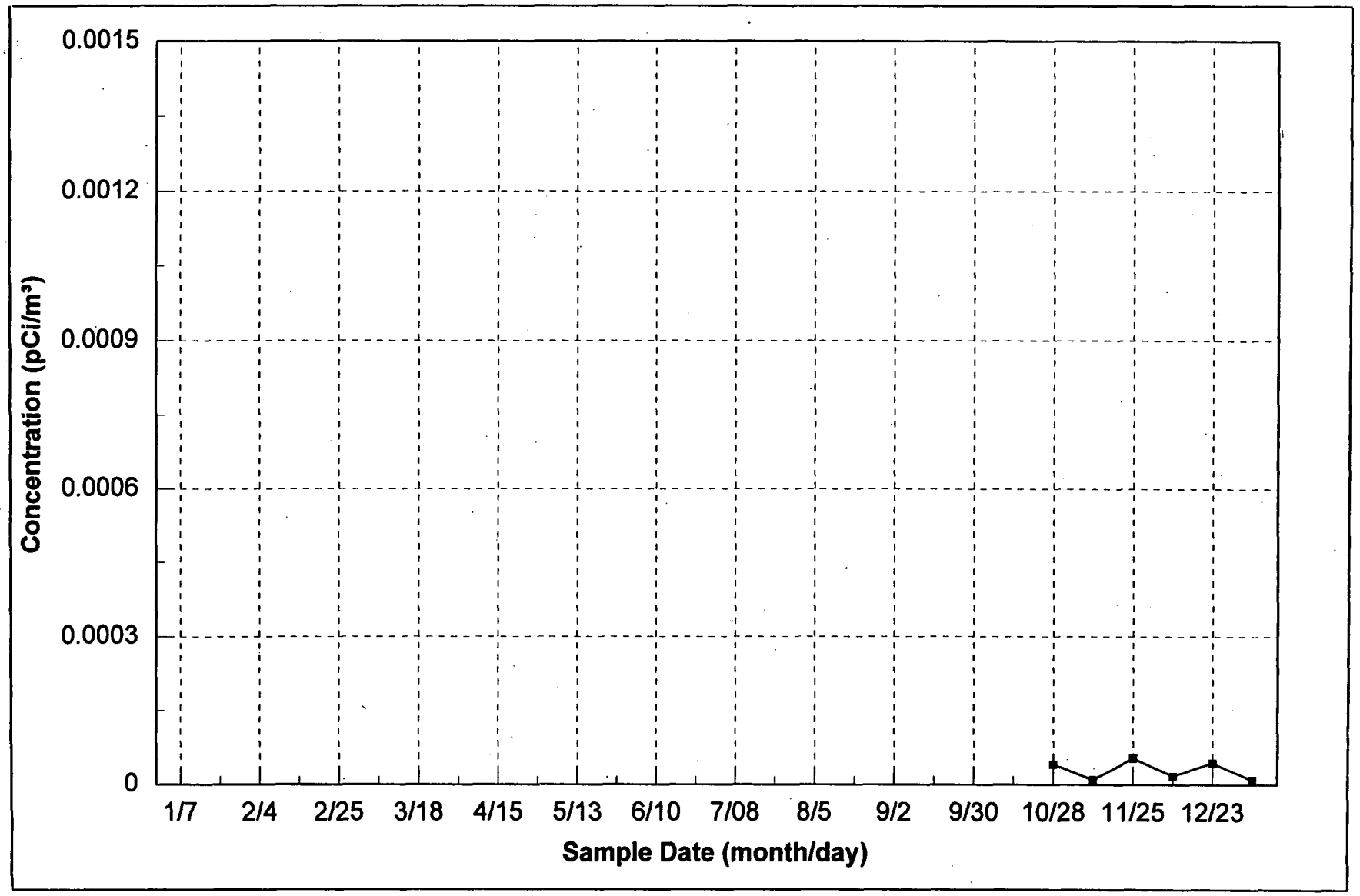

FIGURE C.1-23. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-23

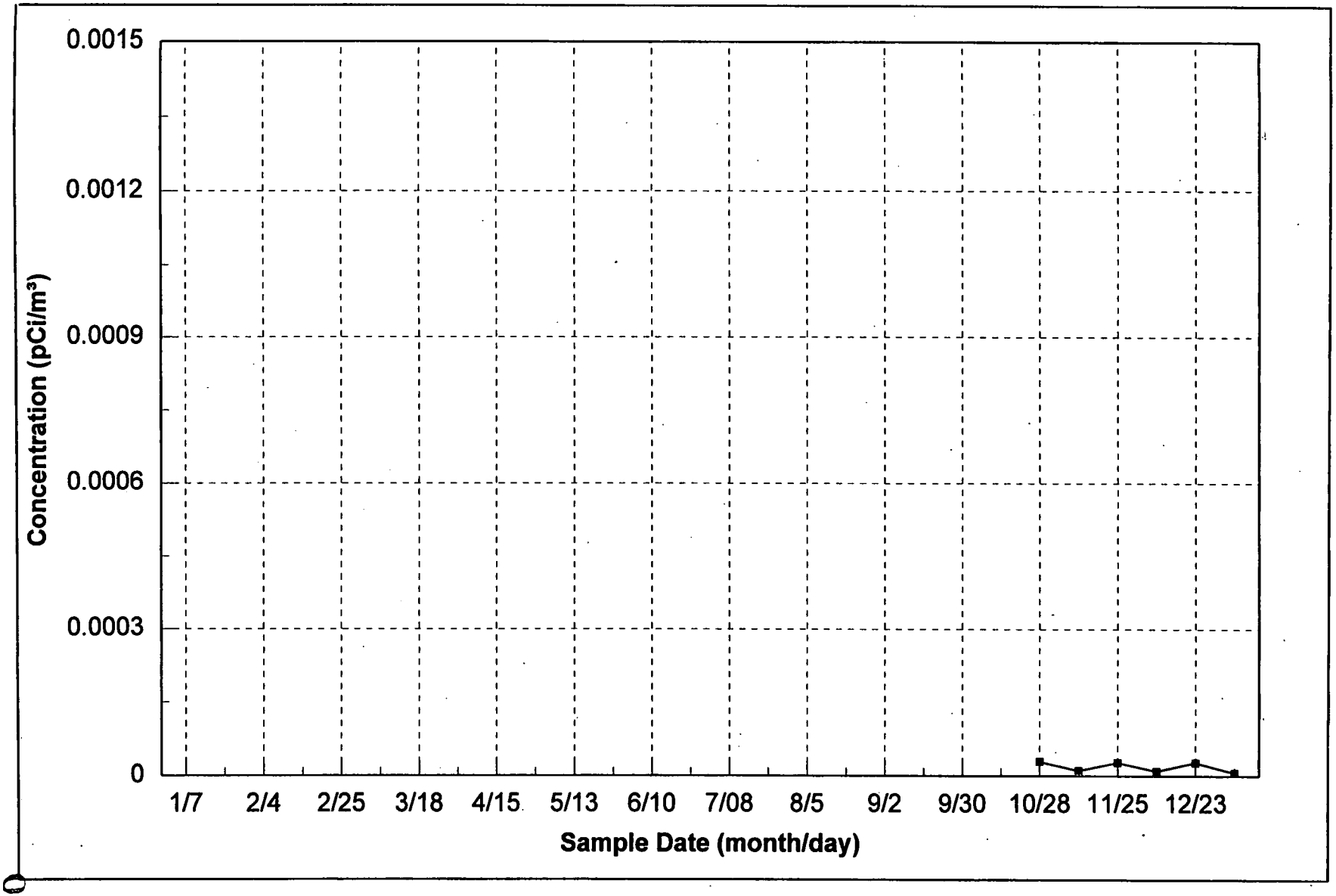

FIGURE C.1-24. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-25

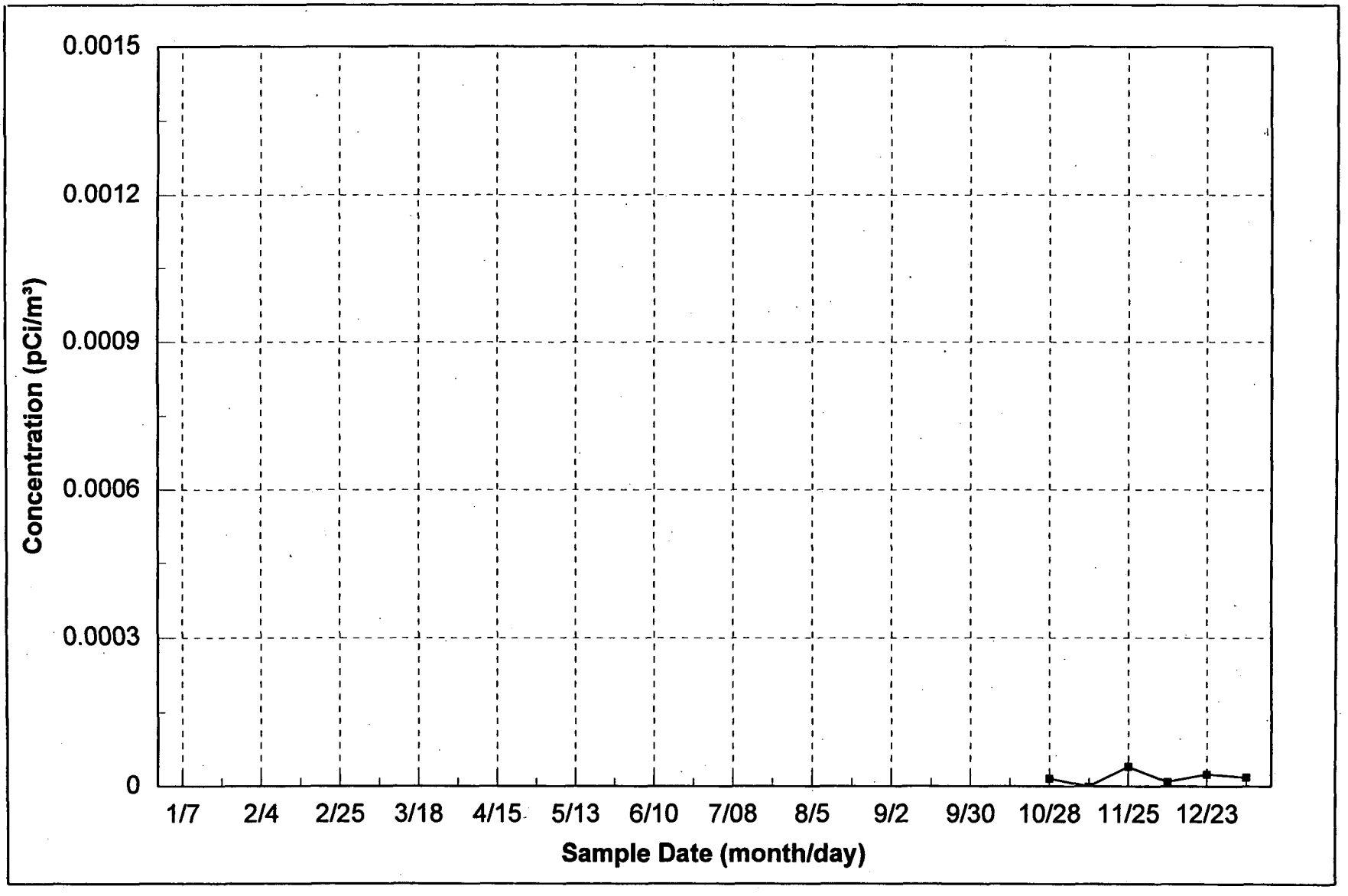

FIGURE C.1-25. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-26

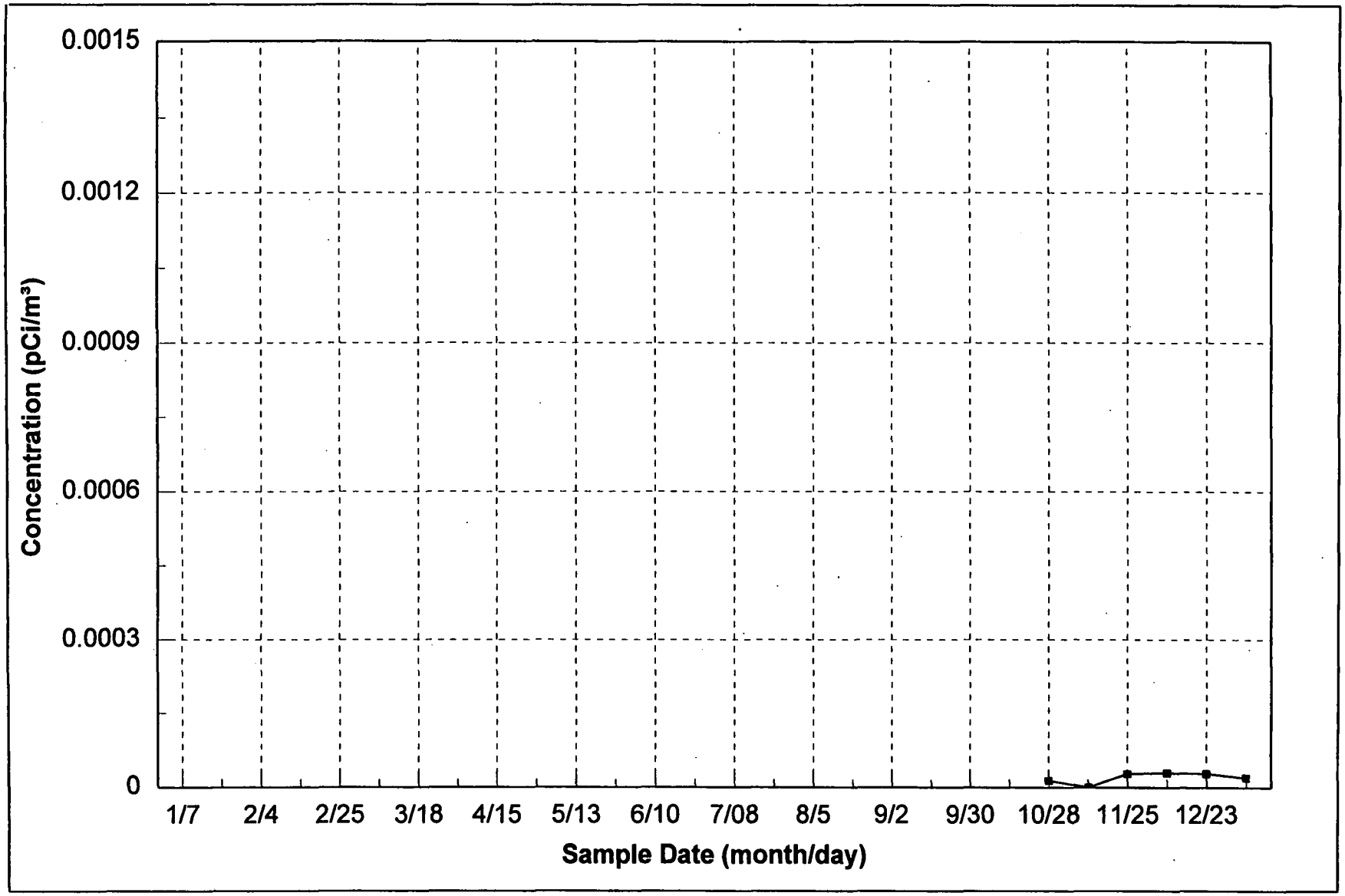

FIGURE C.1-26. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-27

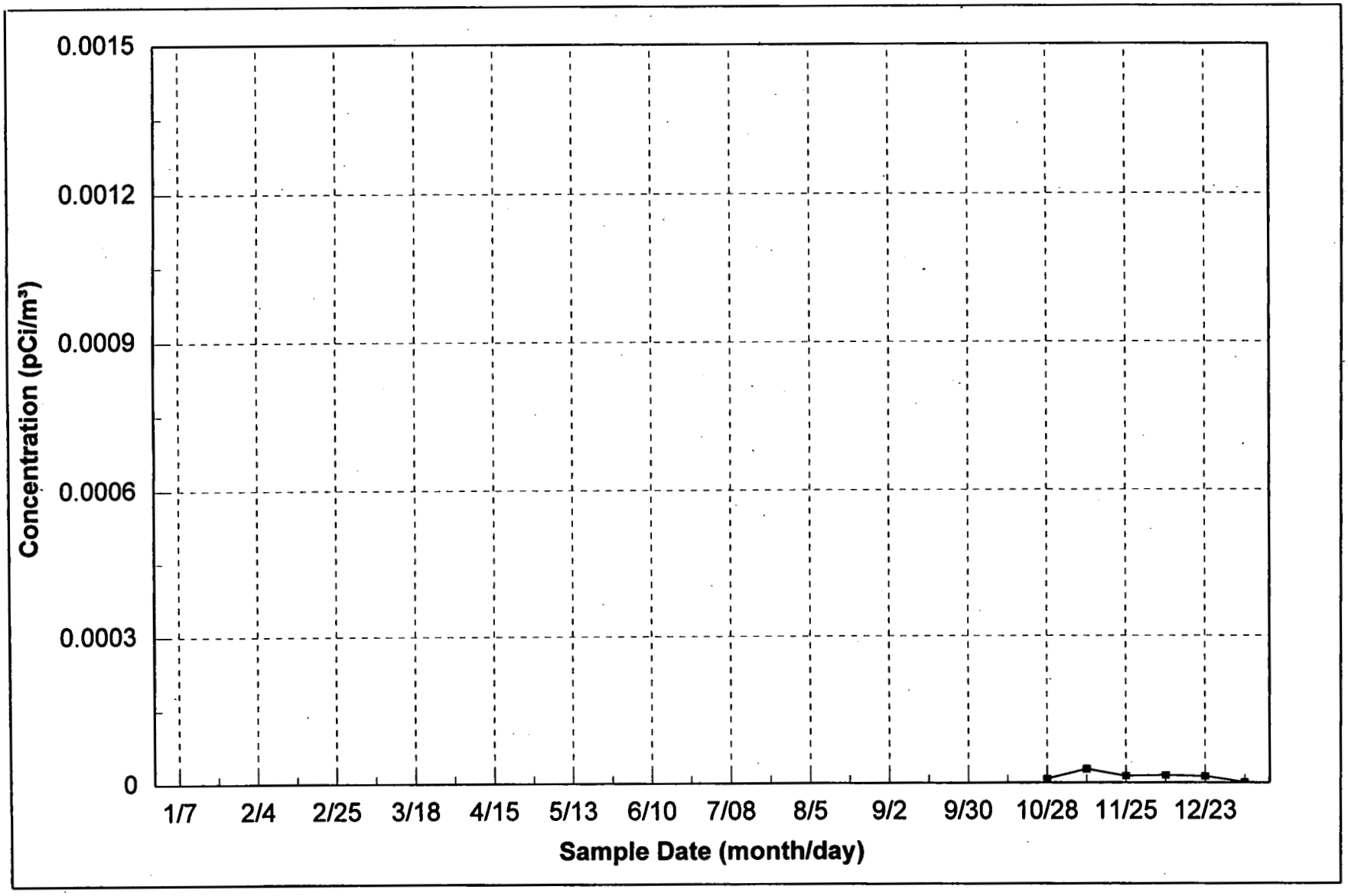

FIGURE C.1-27. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-28

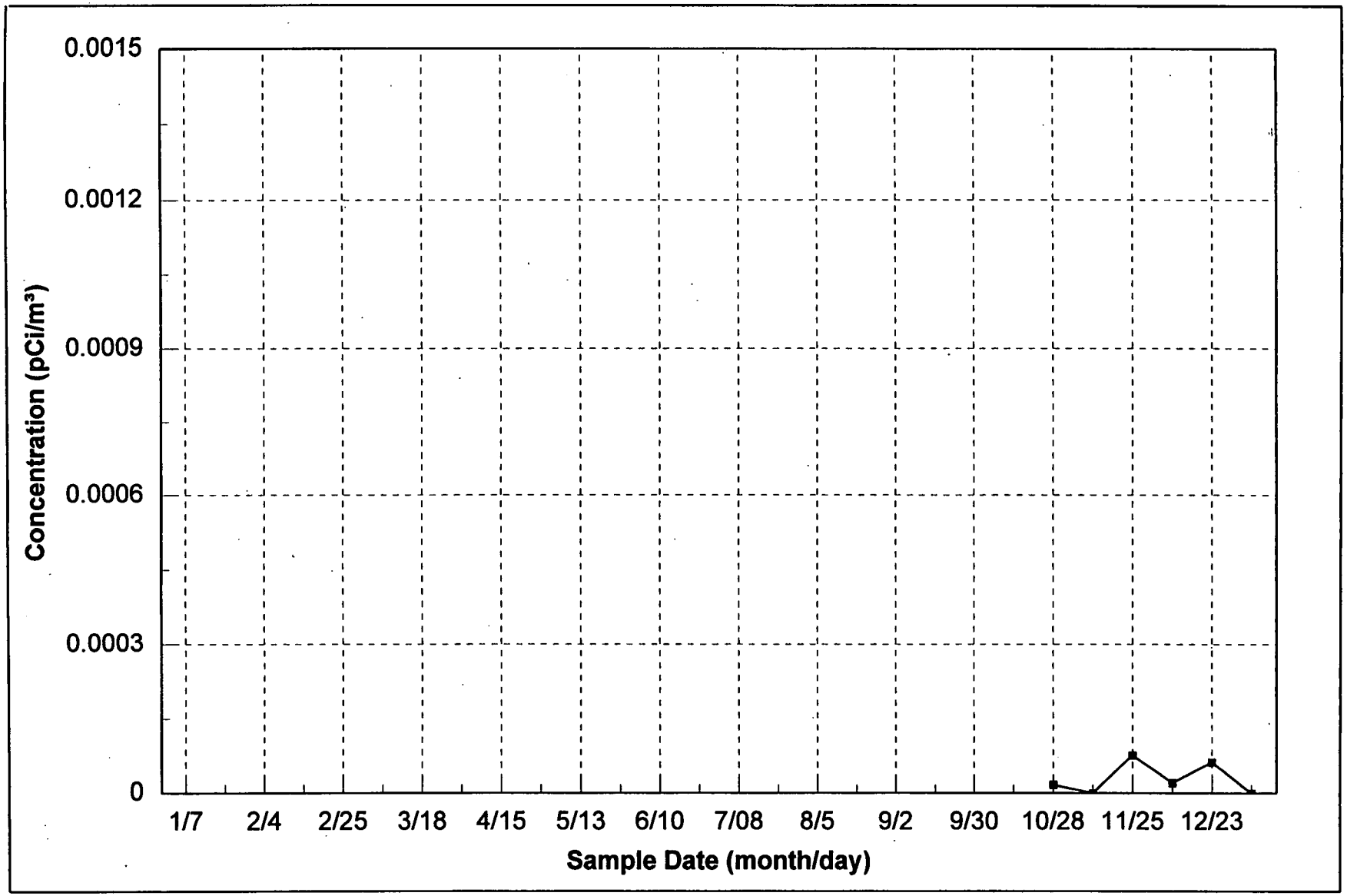

FIGURE C.1-28. 1997 TOTAL URANIUM PARTICULATE CONCENTRATION IN AIR FOR AMS-29

000498

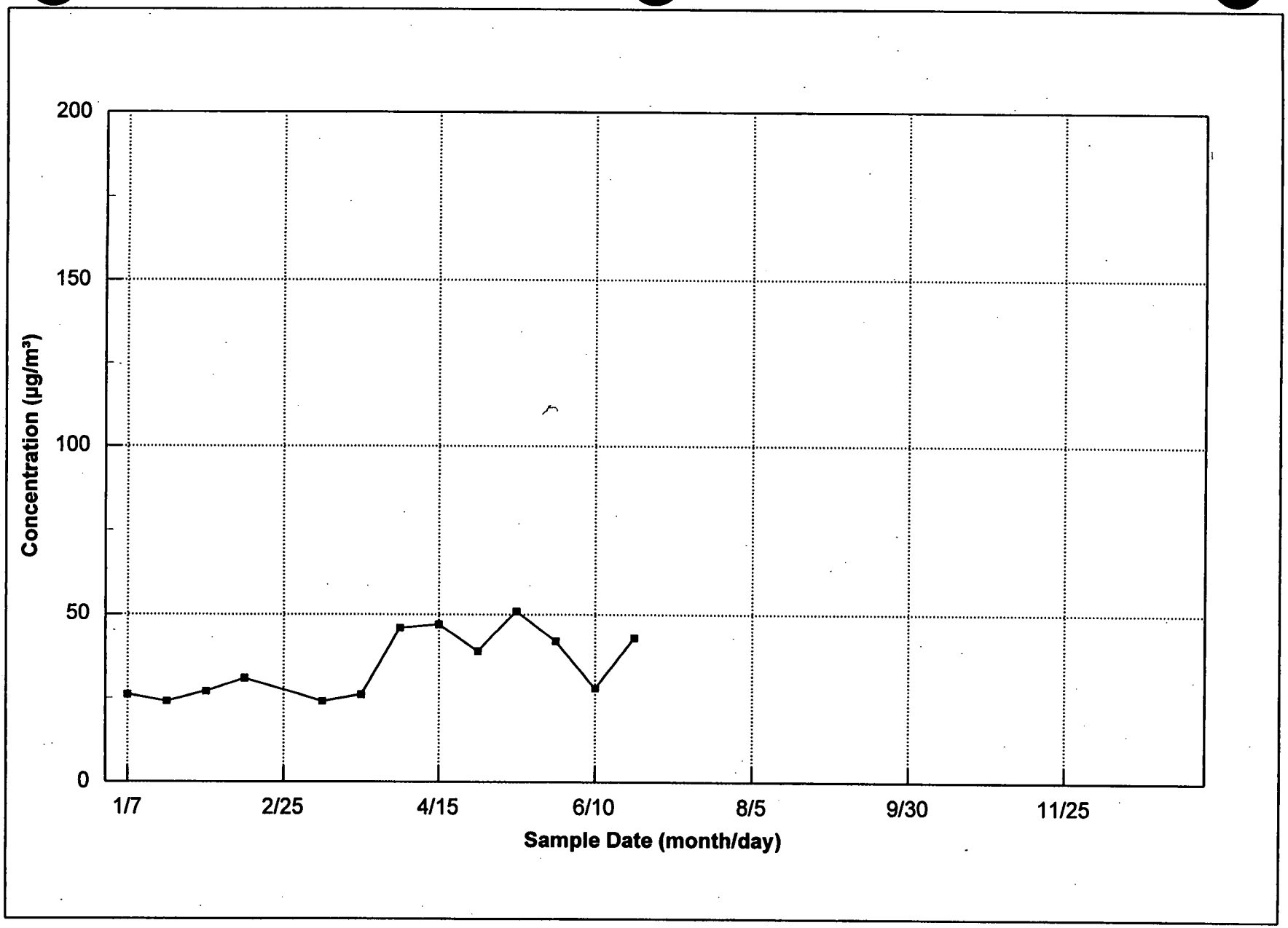

FIGURE C.1-29. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-1B

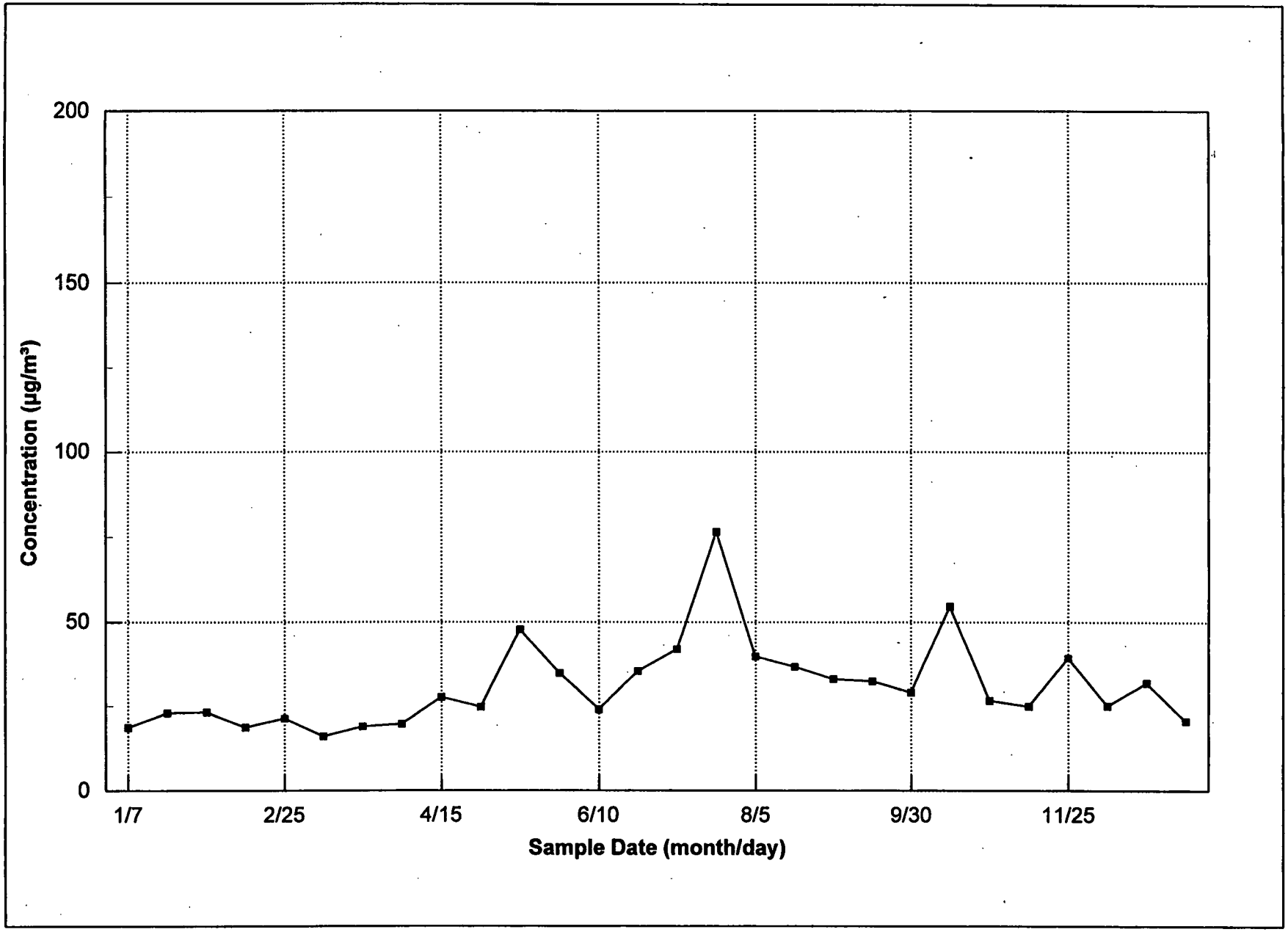

FIGURE C.1-30. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-2

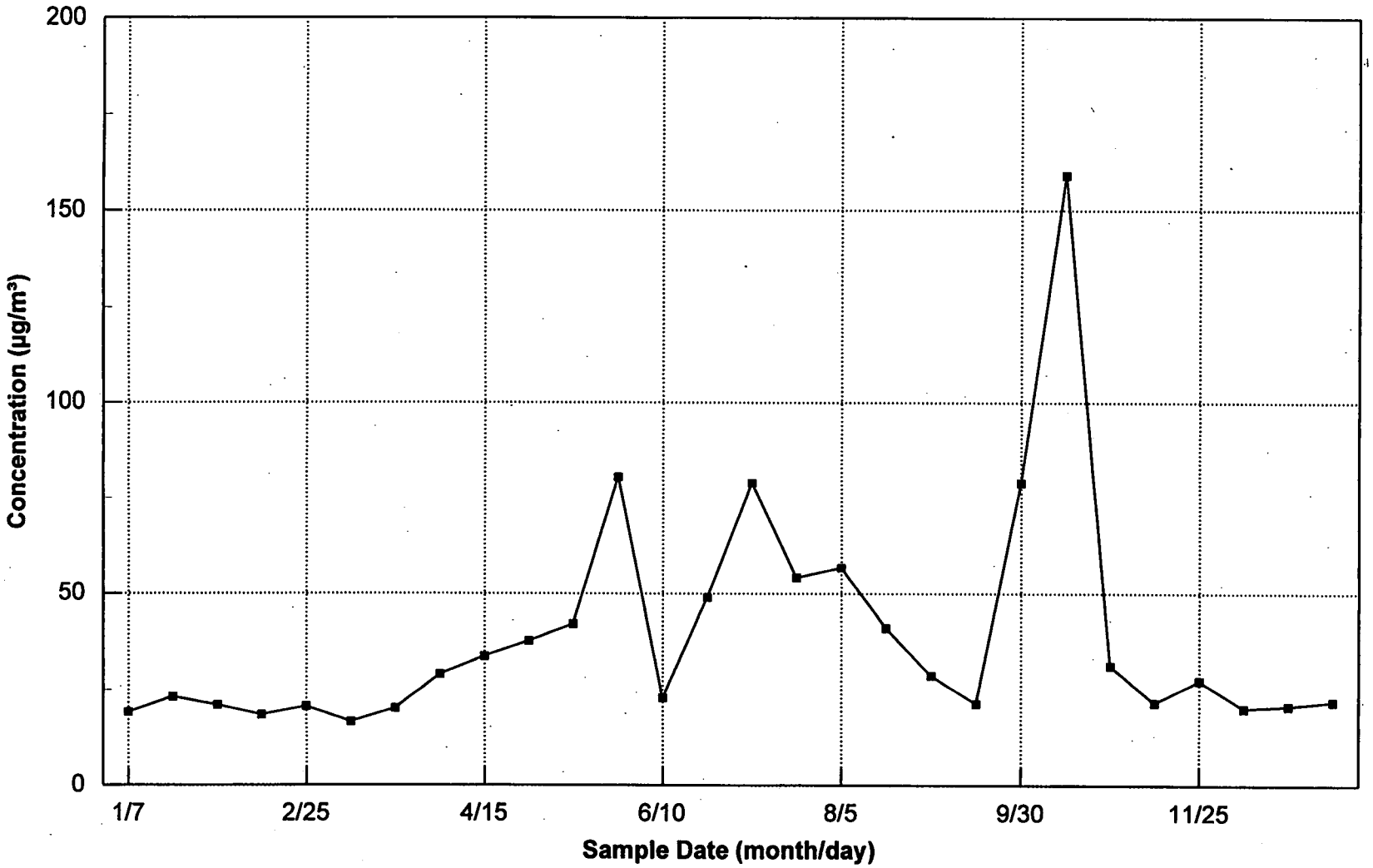

FIGURE C.1-31. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-3

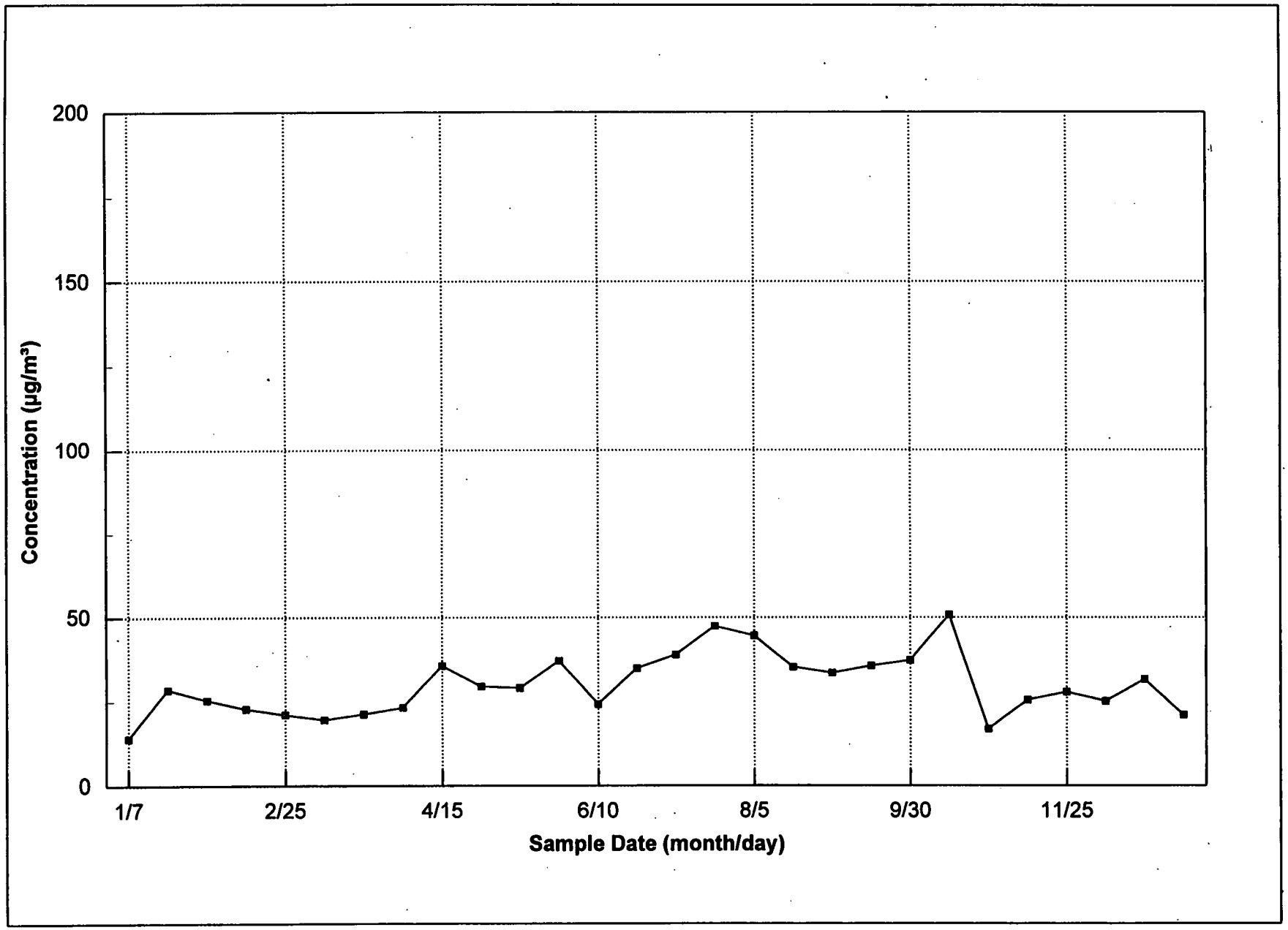

FIGURE C.1-32. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-4

000502

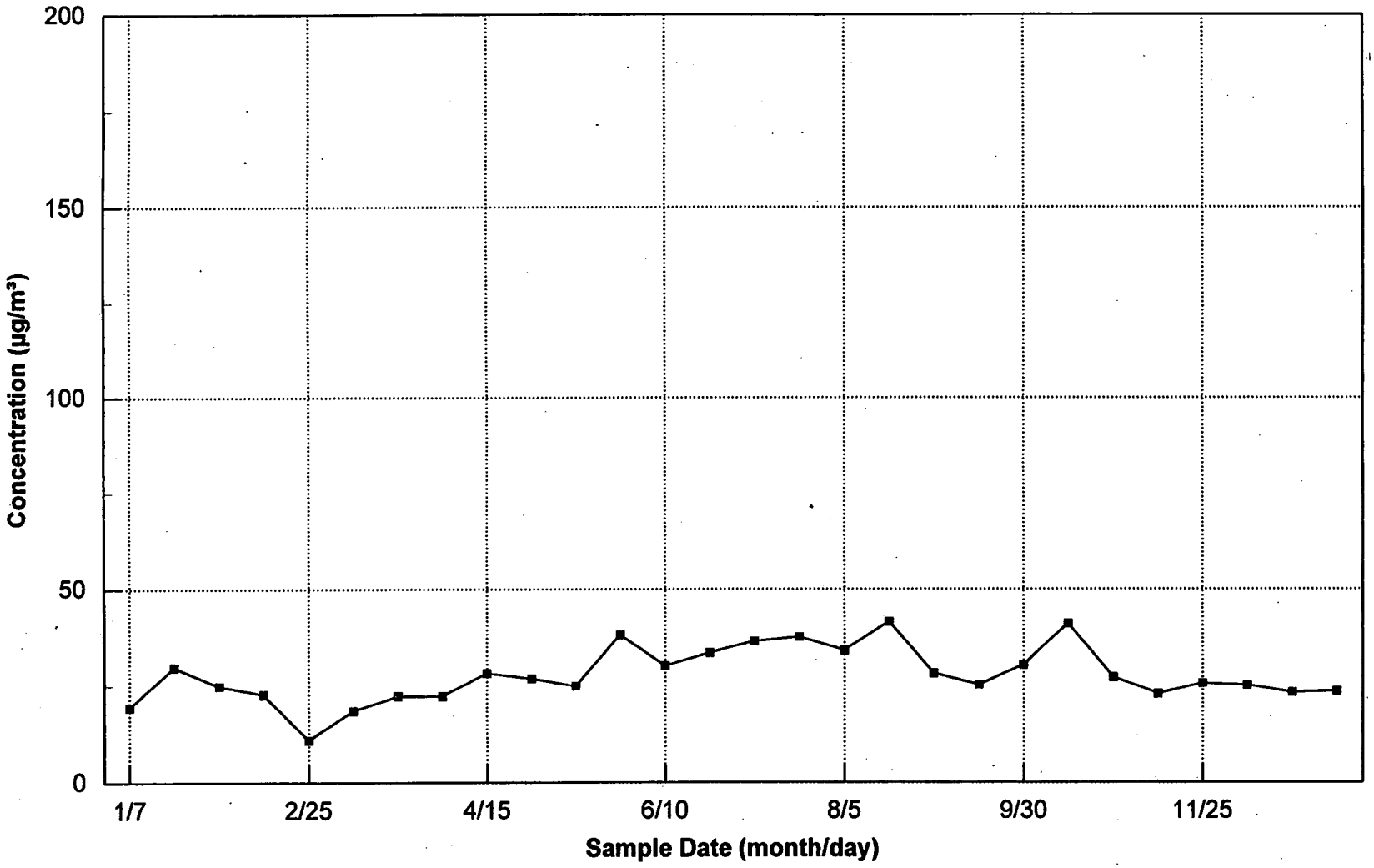

FIGURE C.1-33. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-5

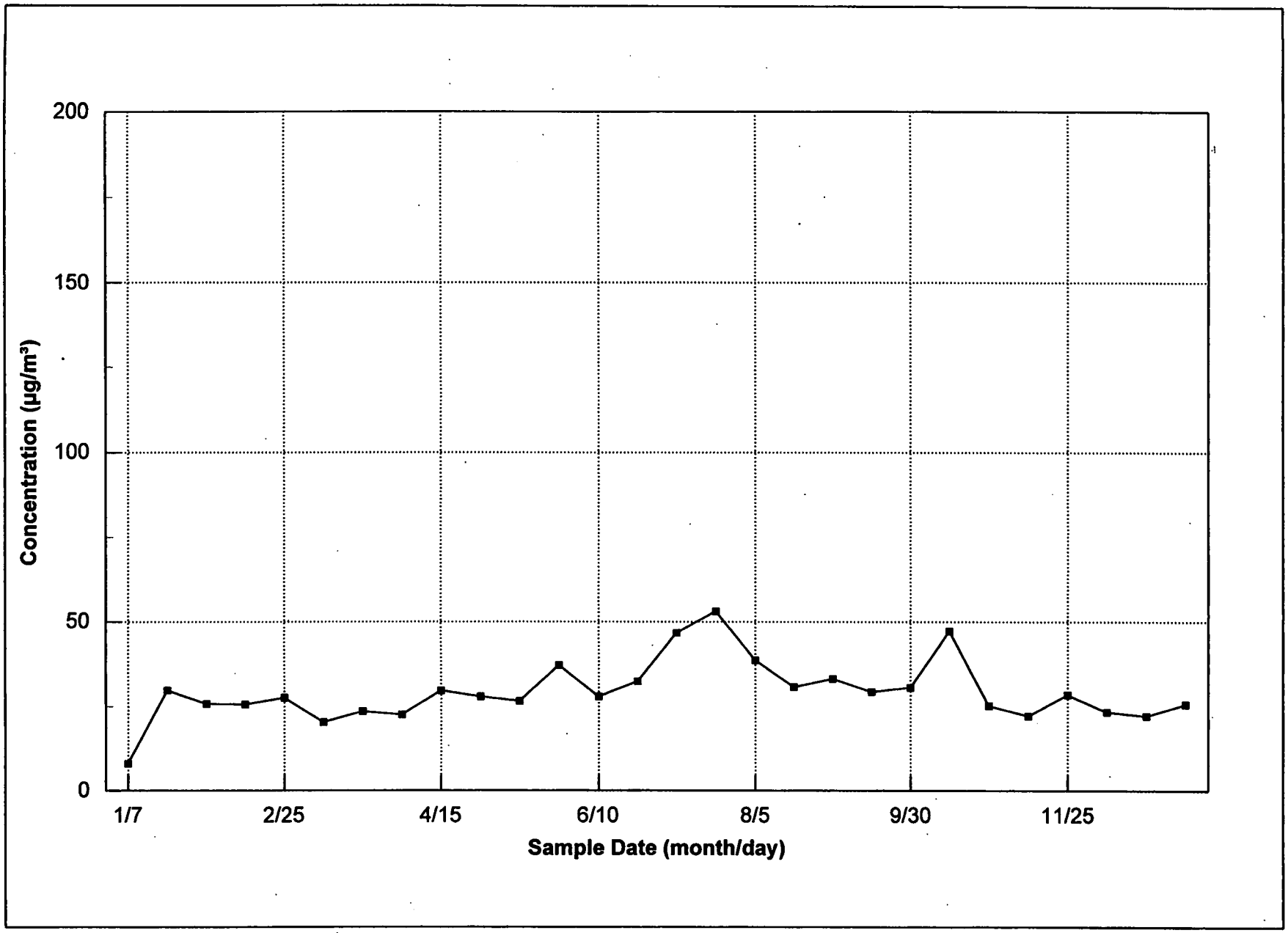

FIGURE C.1-34. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-6

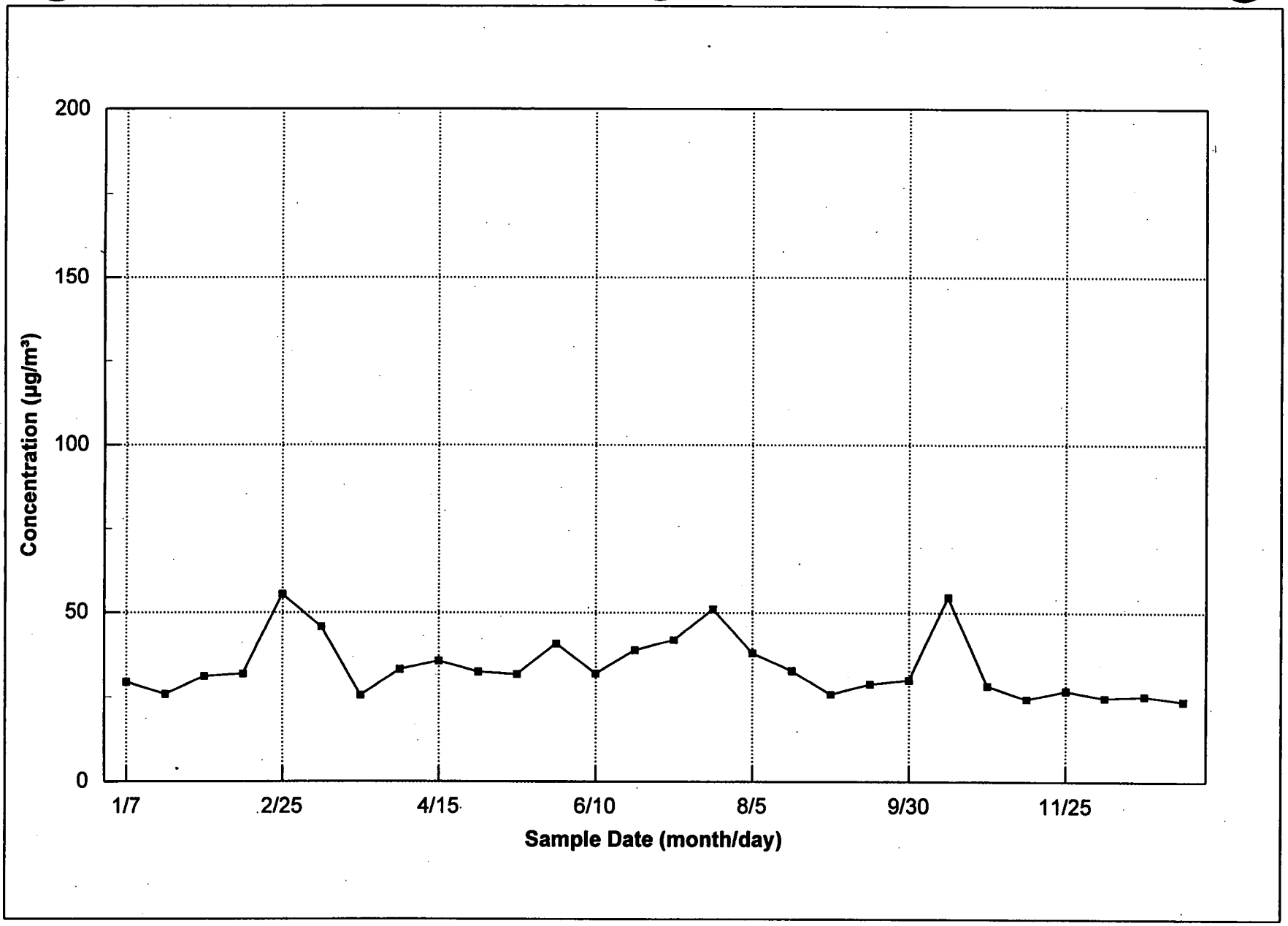

FIGURE C.1-35. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-7

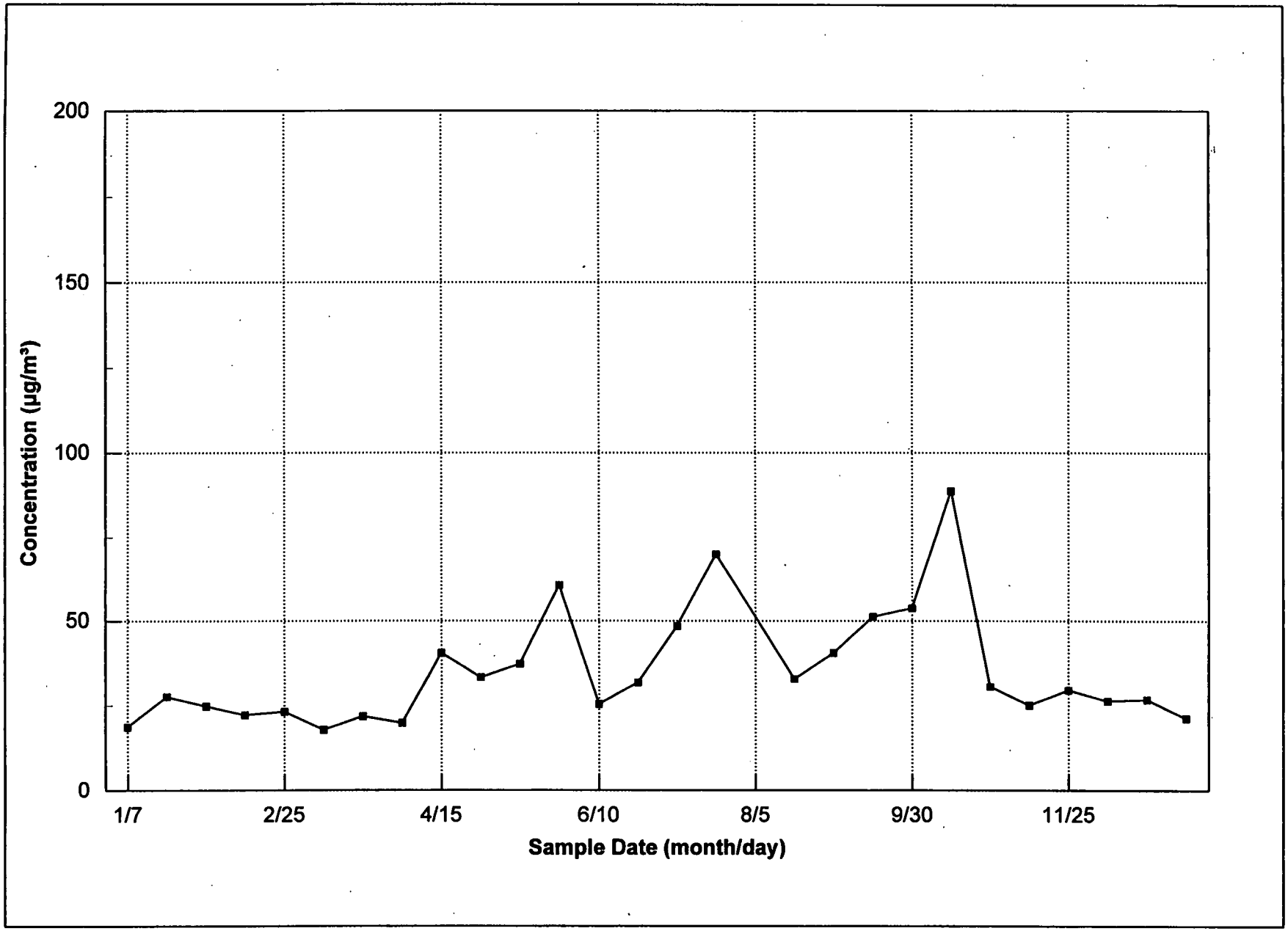

FIGURE C.1-36. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-8A

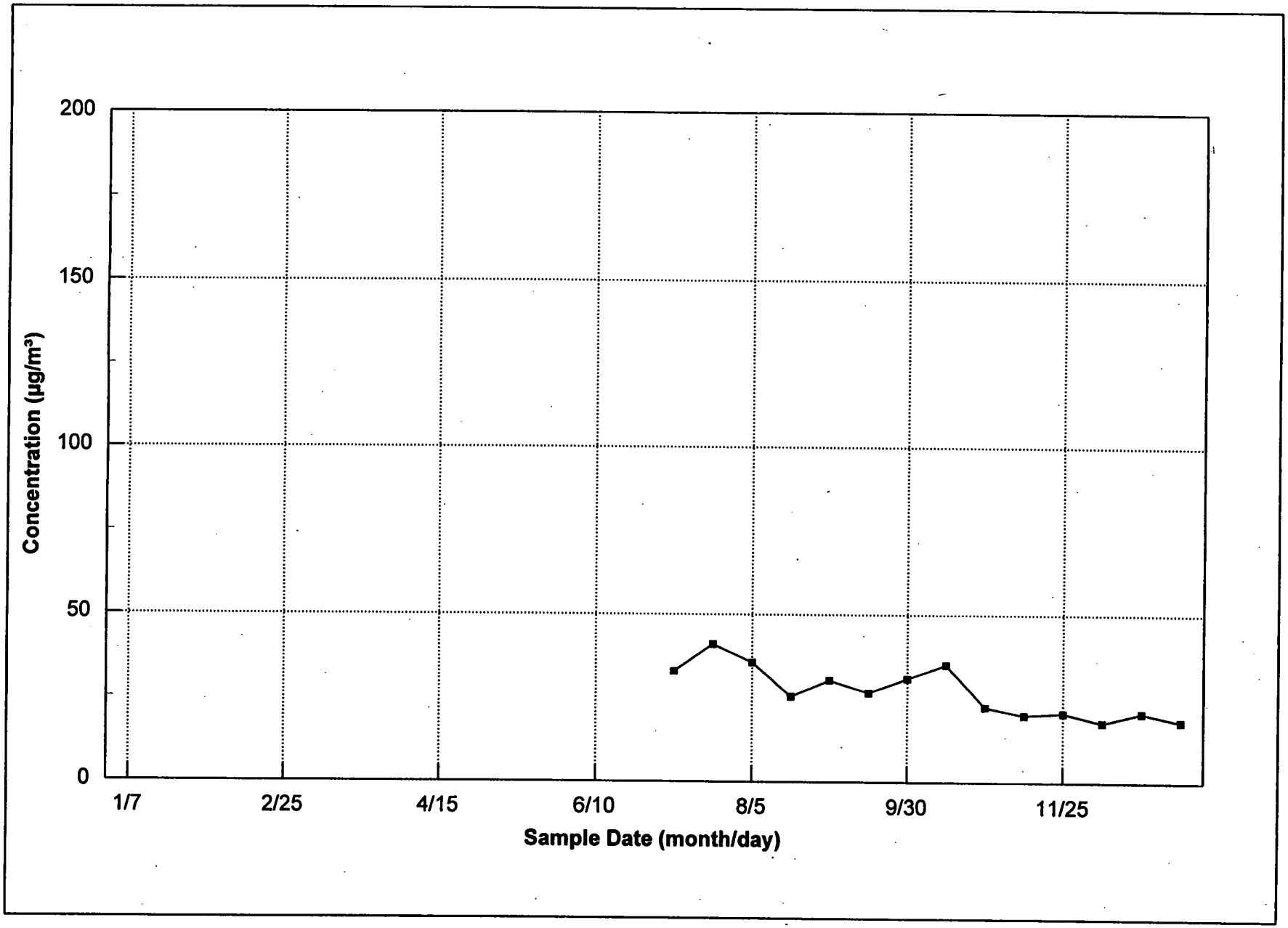

FIGURE C.1-38. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-12

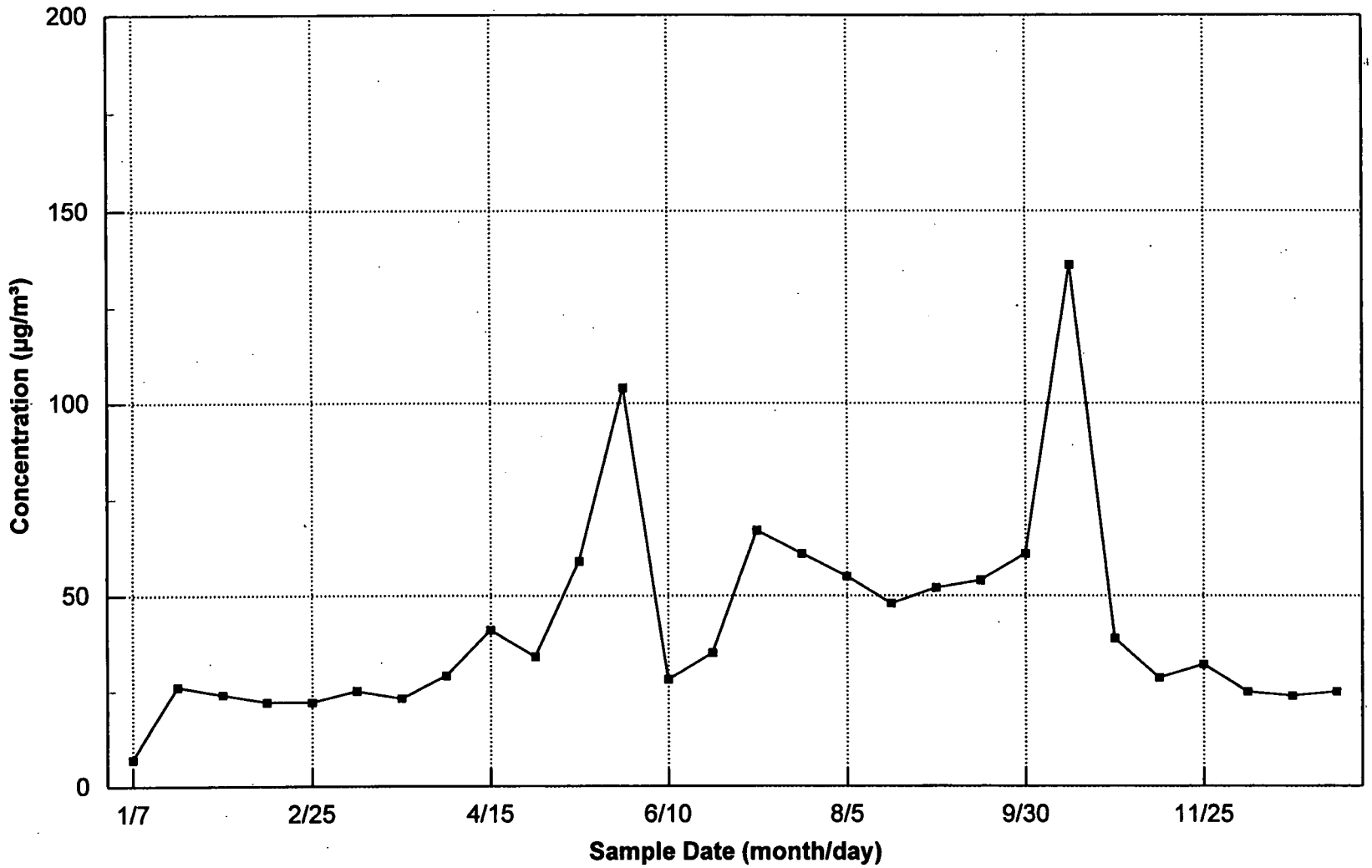

FIGURE C.1-37. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-9B/C

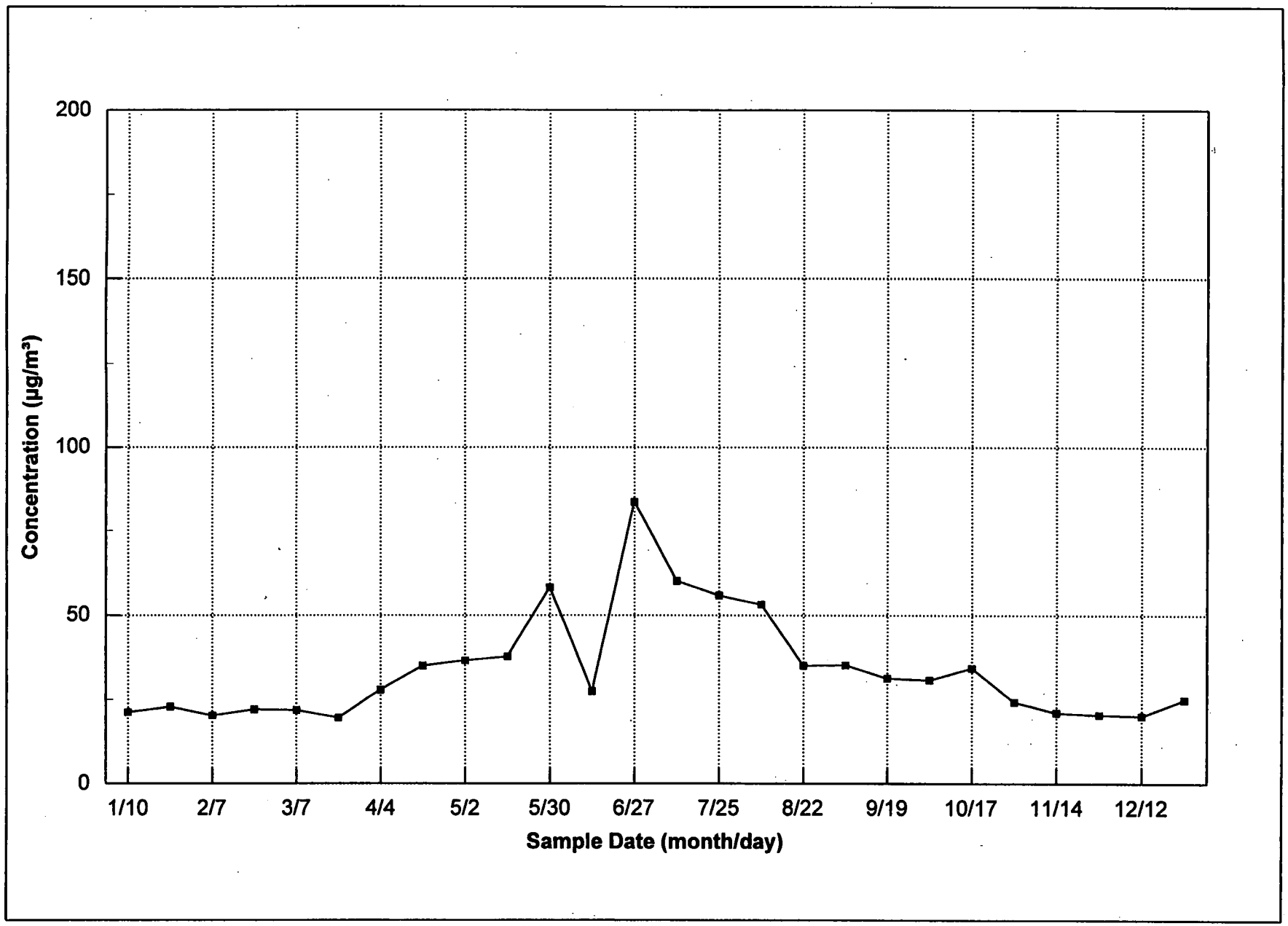

FIGURE C.1-40. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-17A

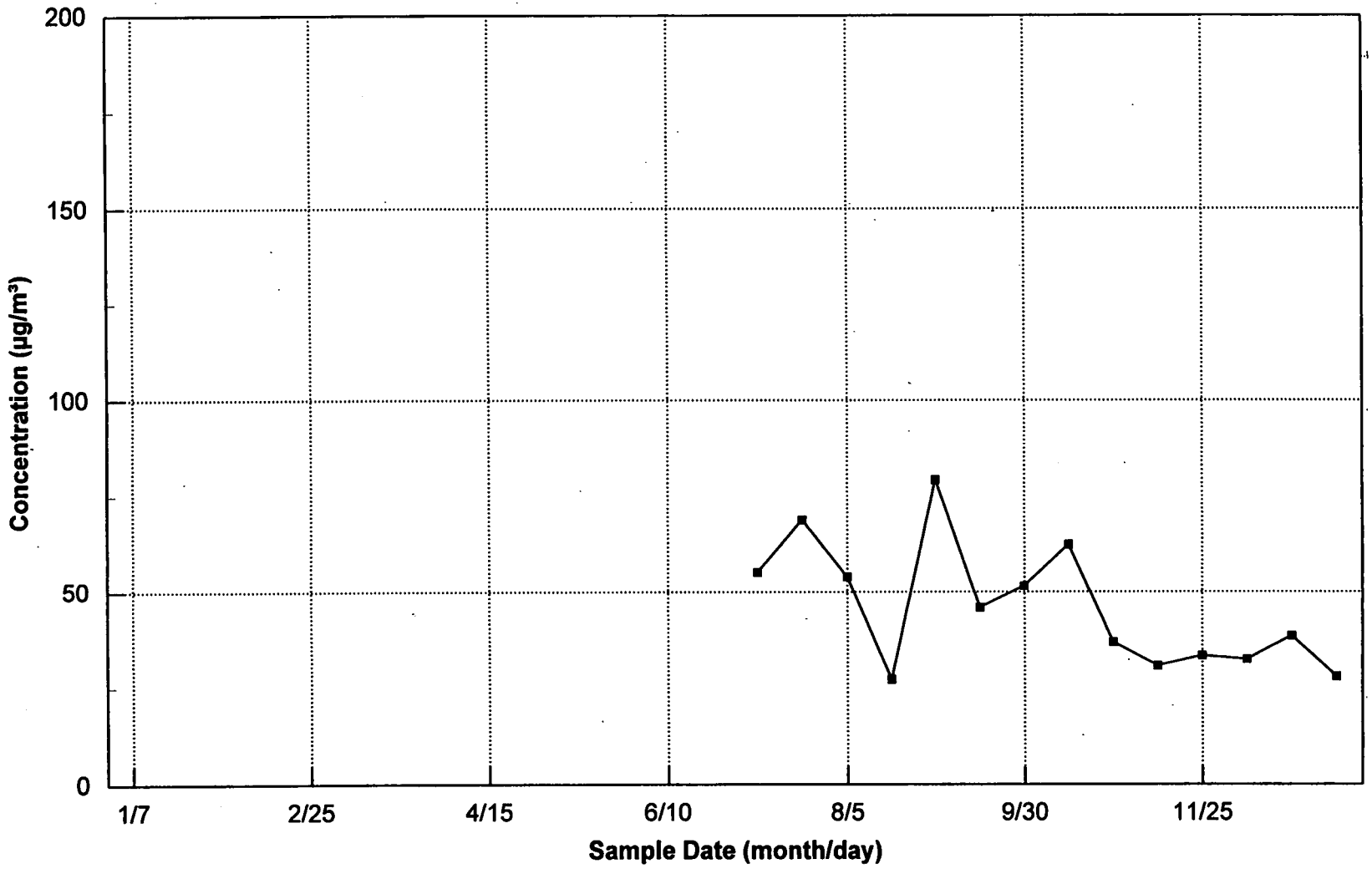

FIGURE C.1-39. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-16

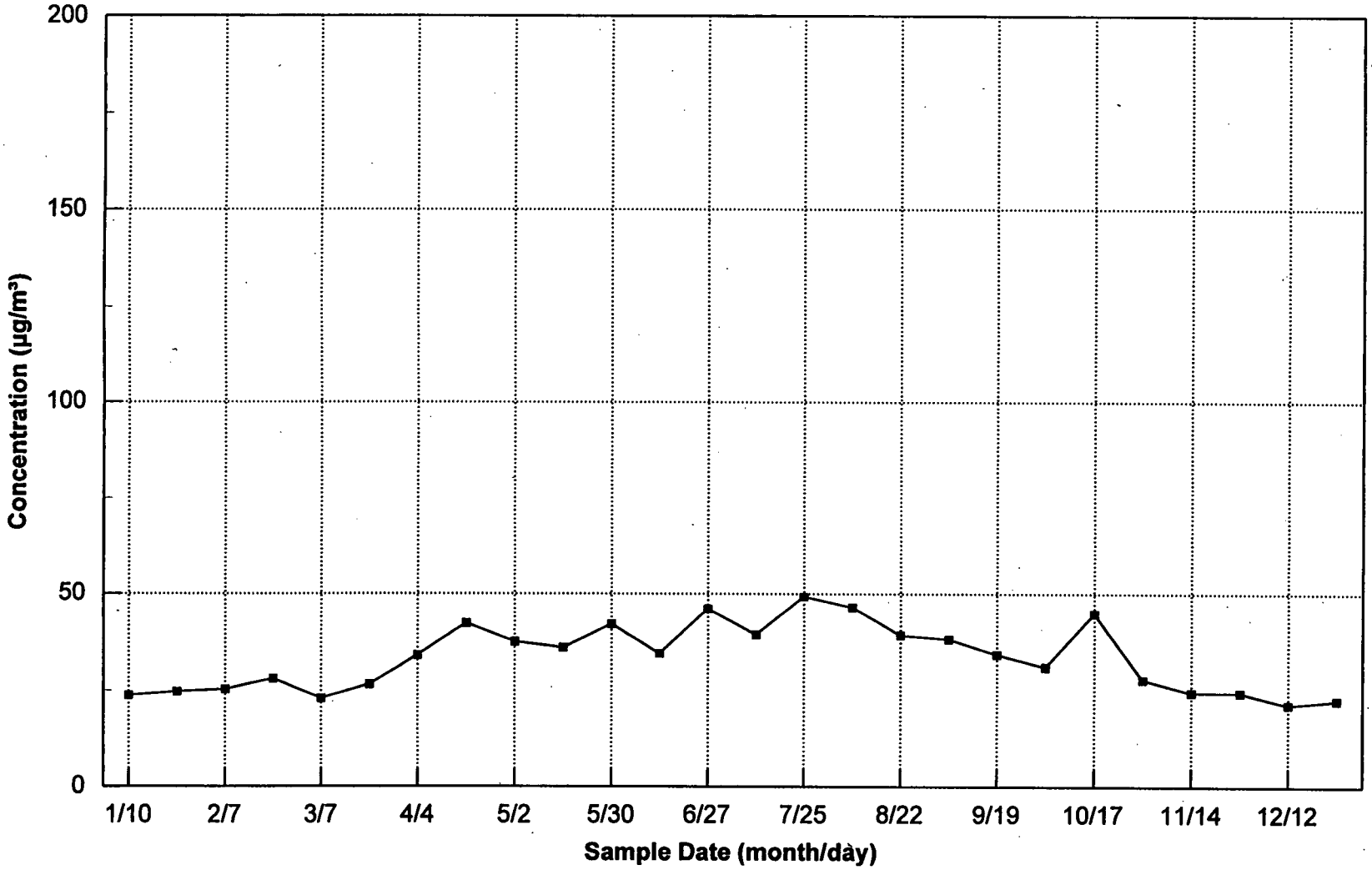

FIGURE C.1-41. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-18A

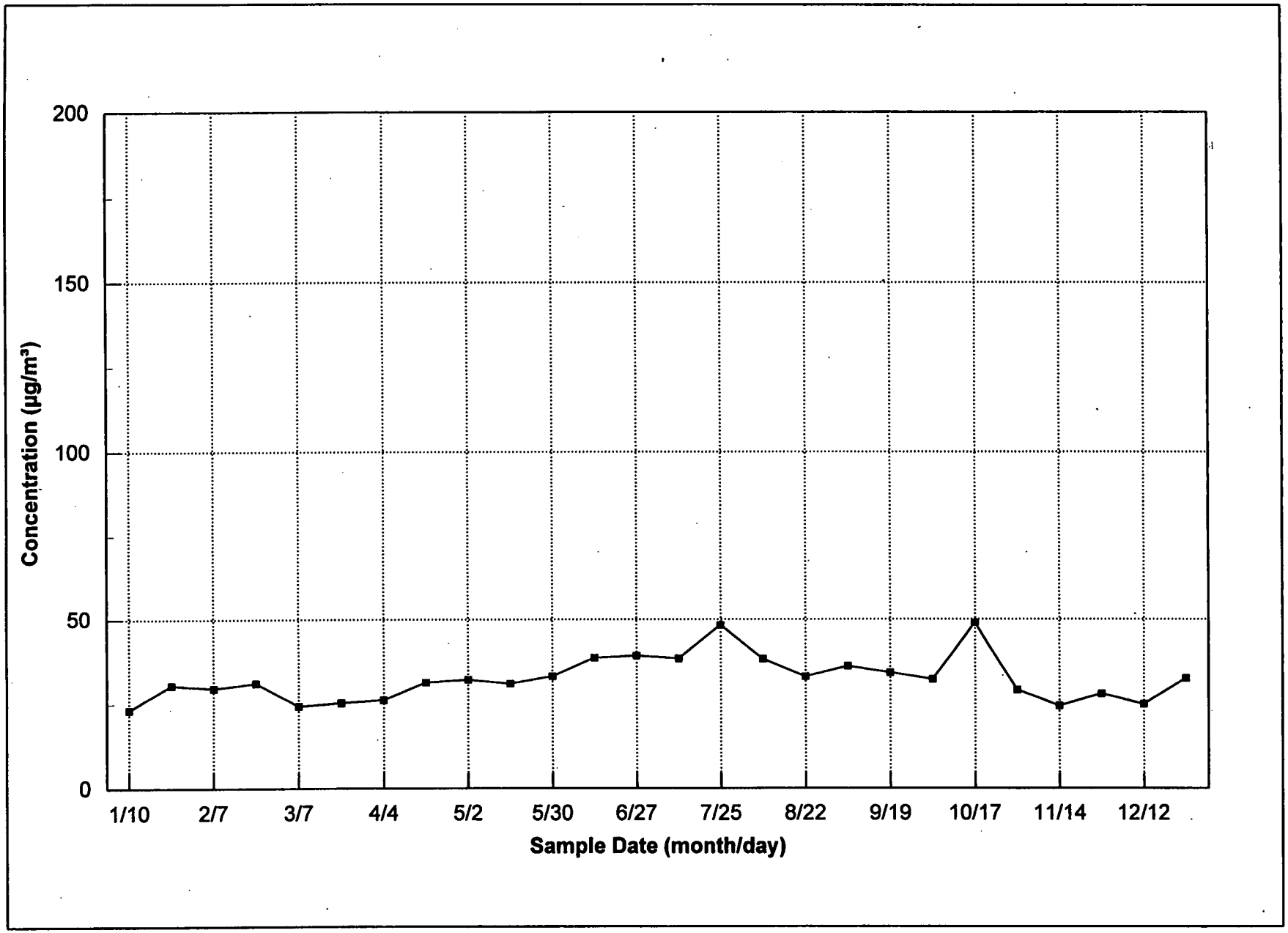

FIGURE C.1-42. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-19

000512

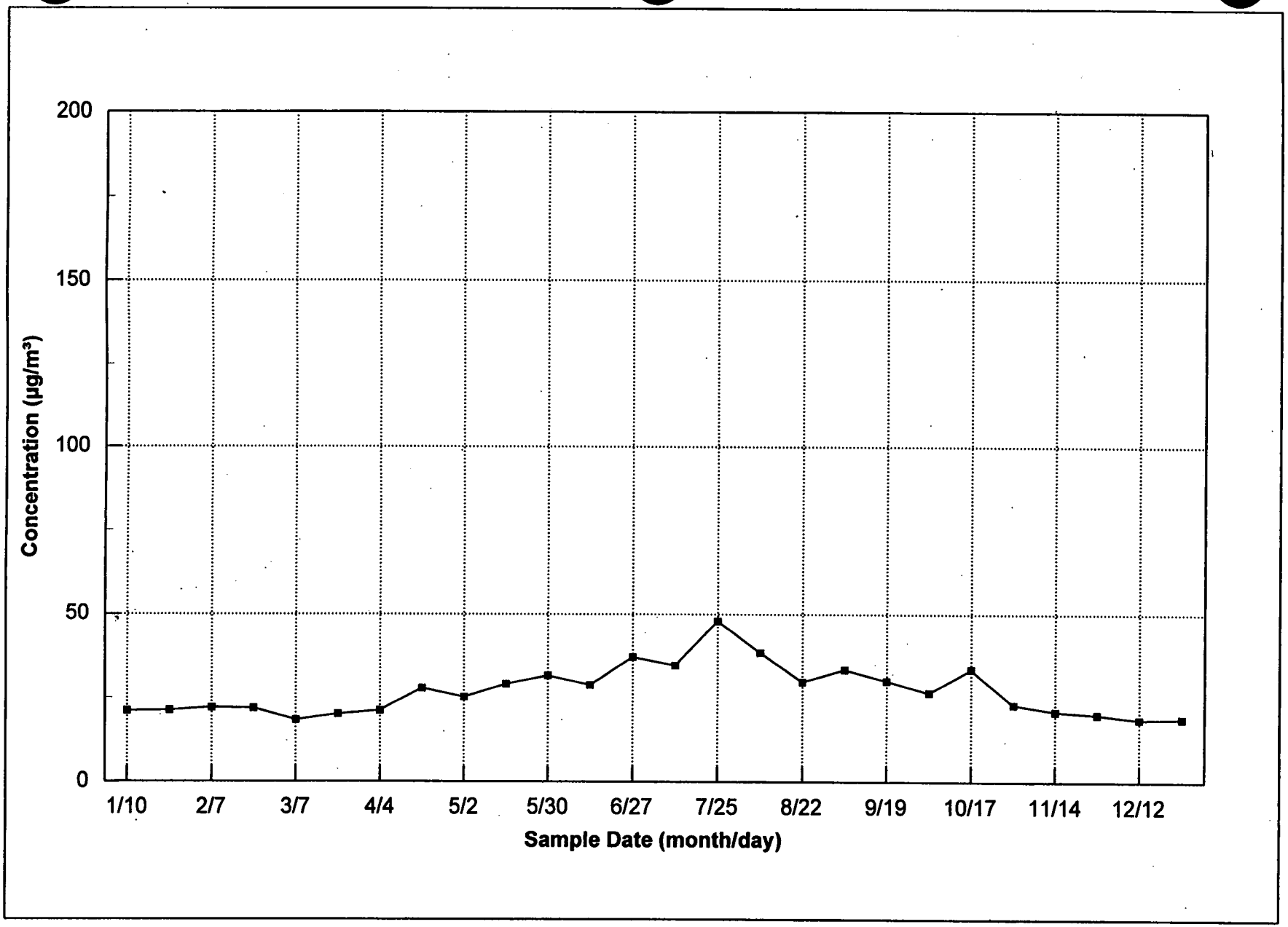

FIGURE C.1-43. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-20

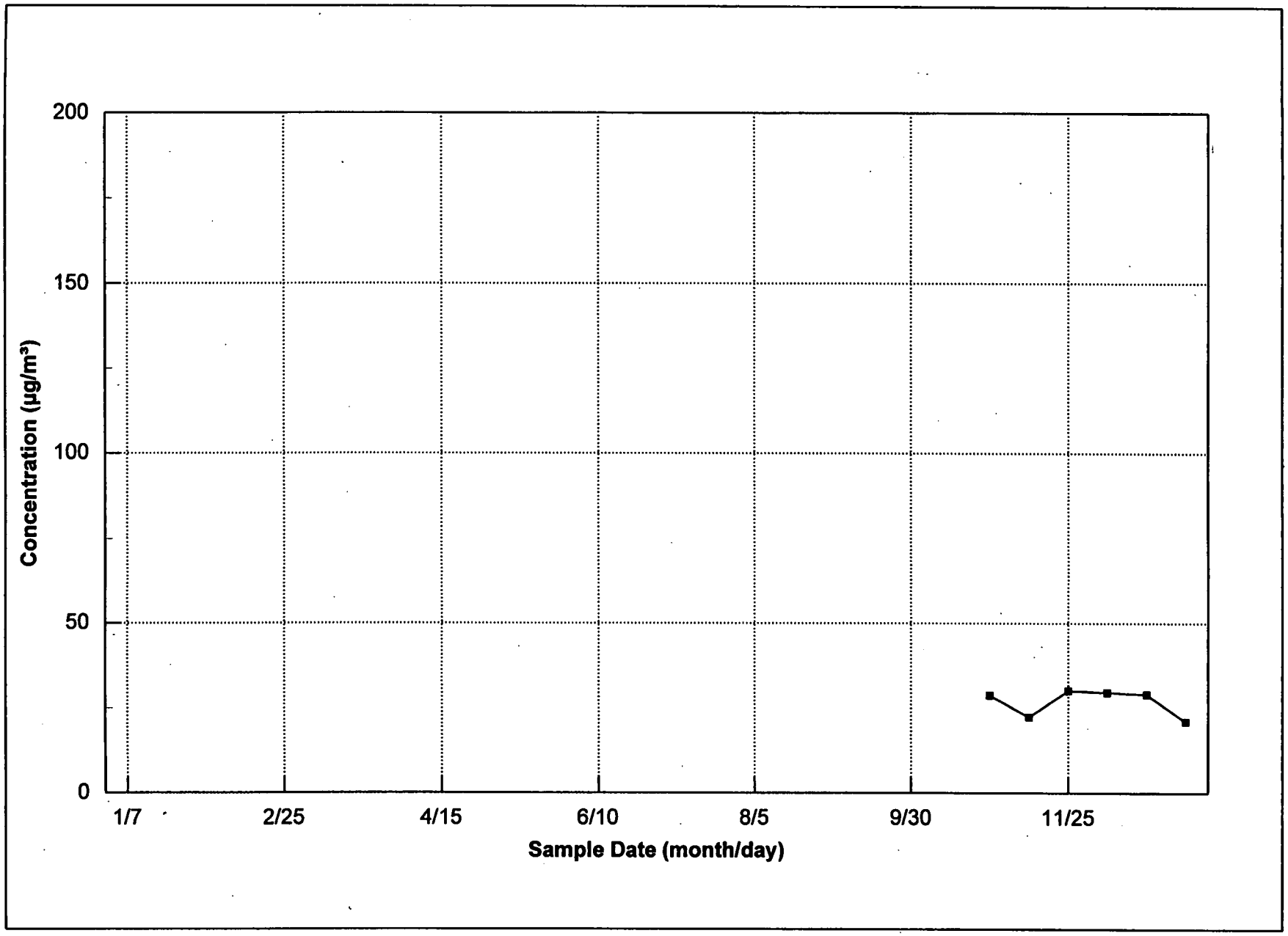

FIGURE C.1-44. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-22

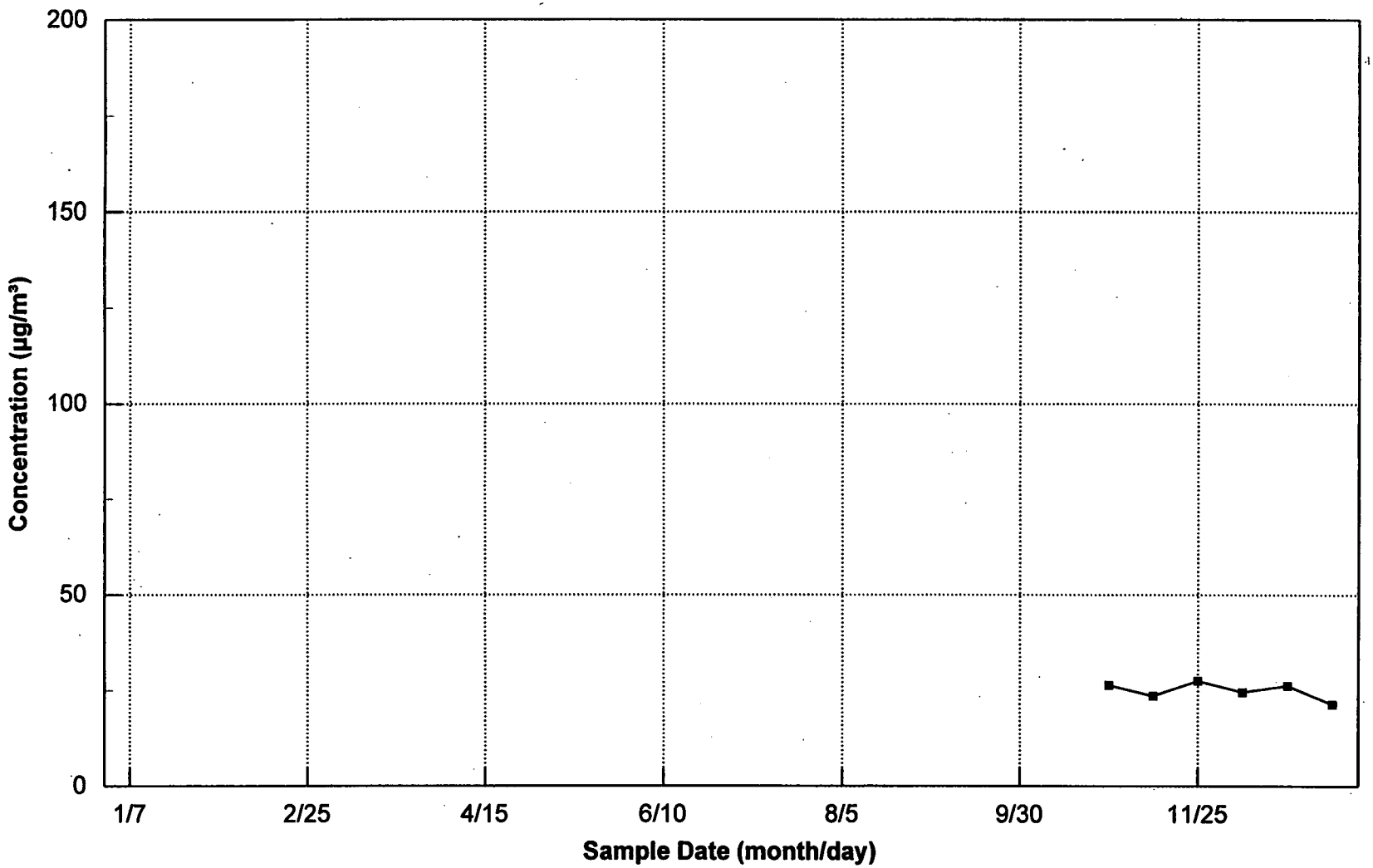

FIGURE C.1-45. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-23

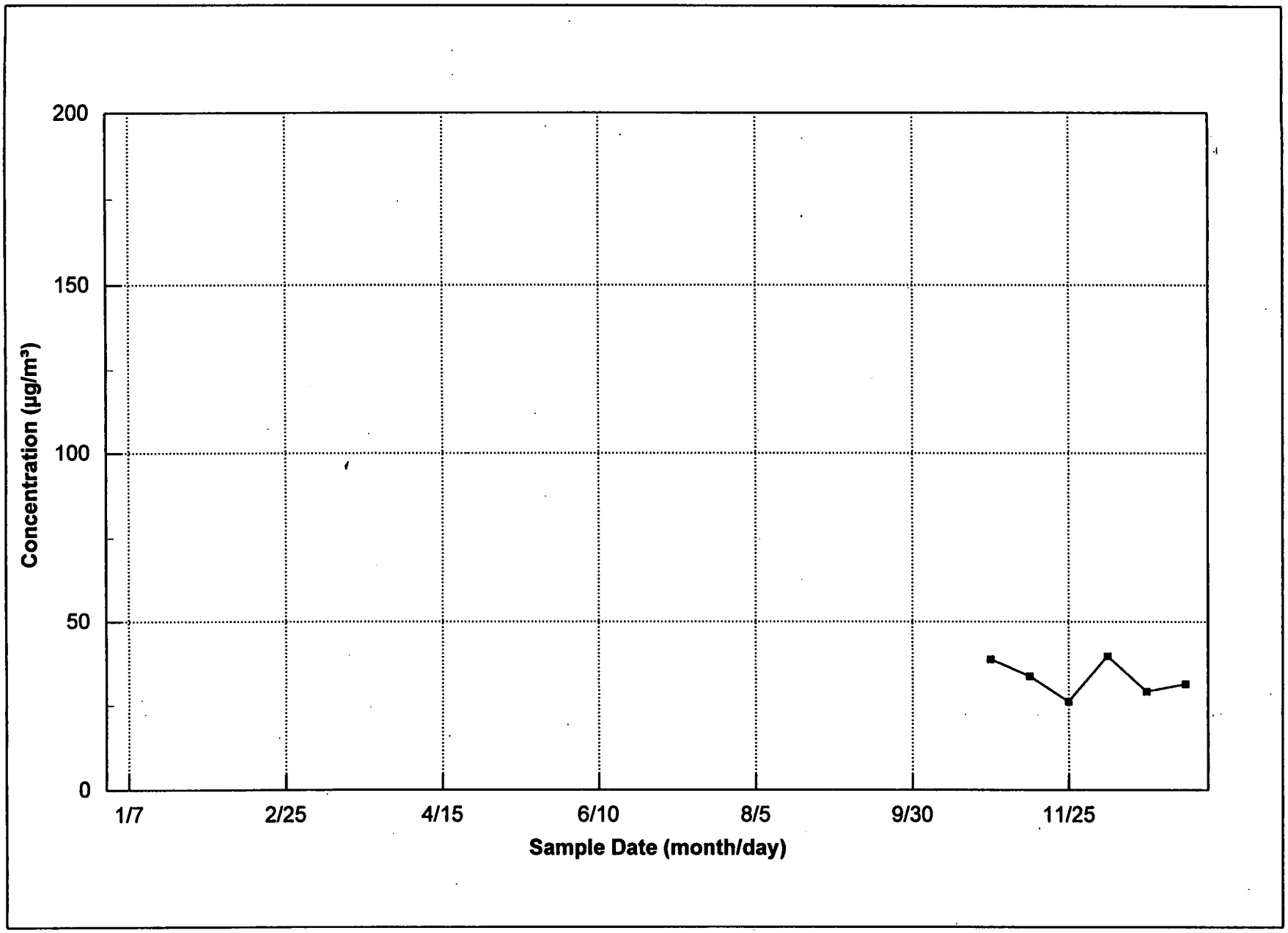

FIGURE C.1-46. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-25

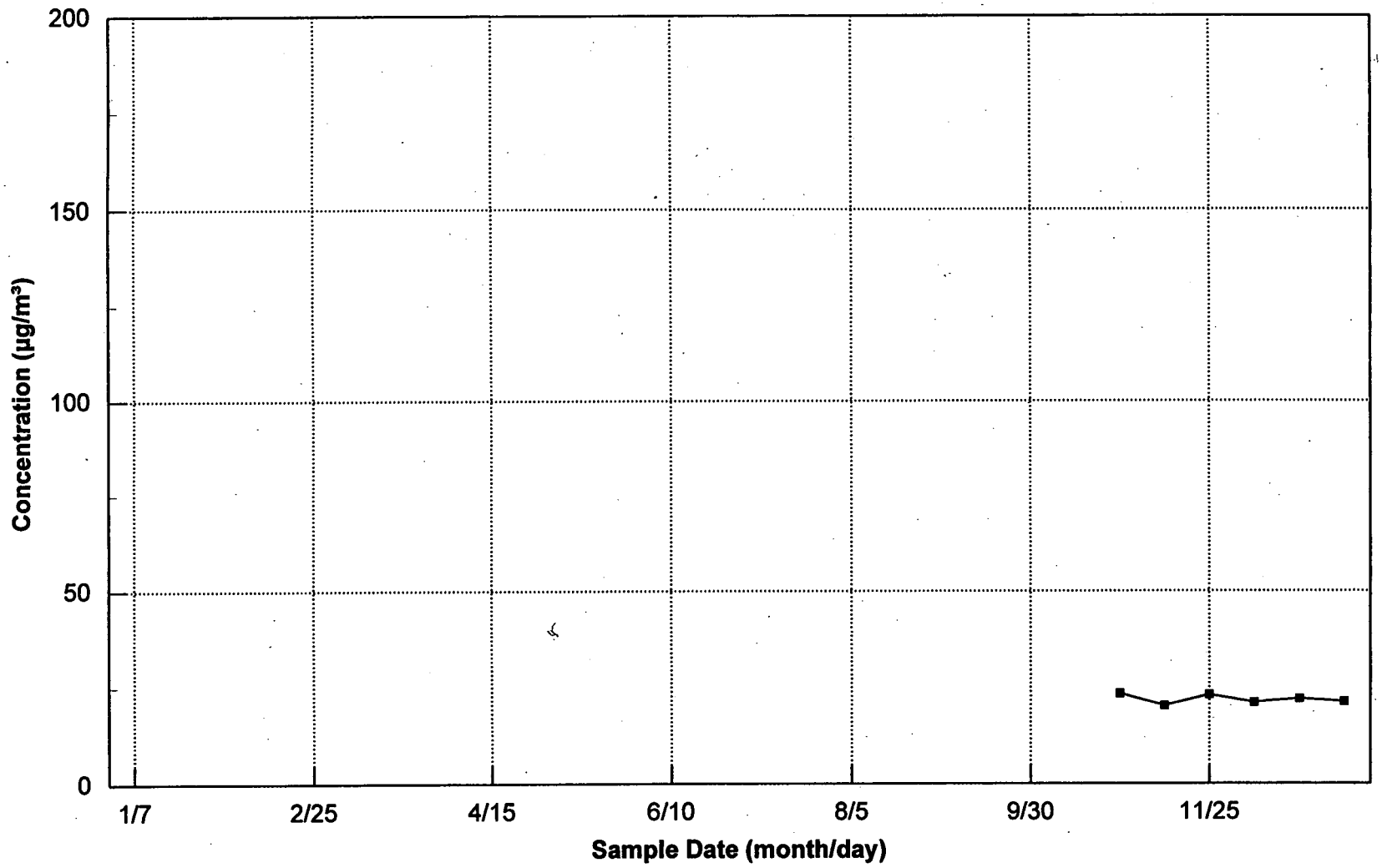

FIGURE C.1-47. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-26

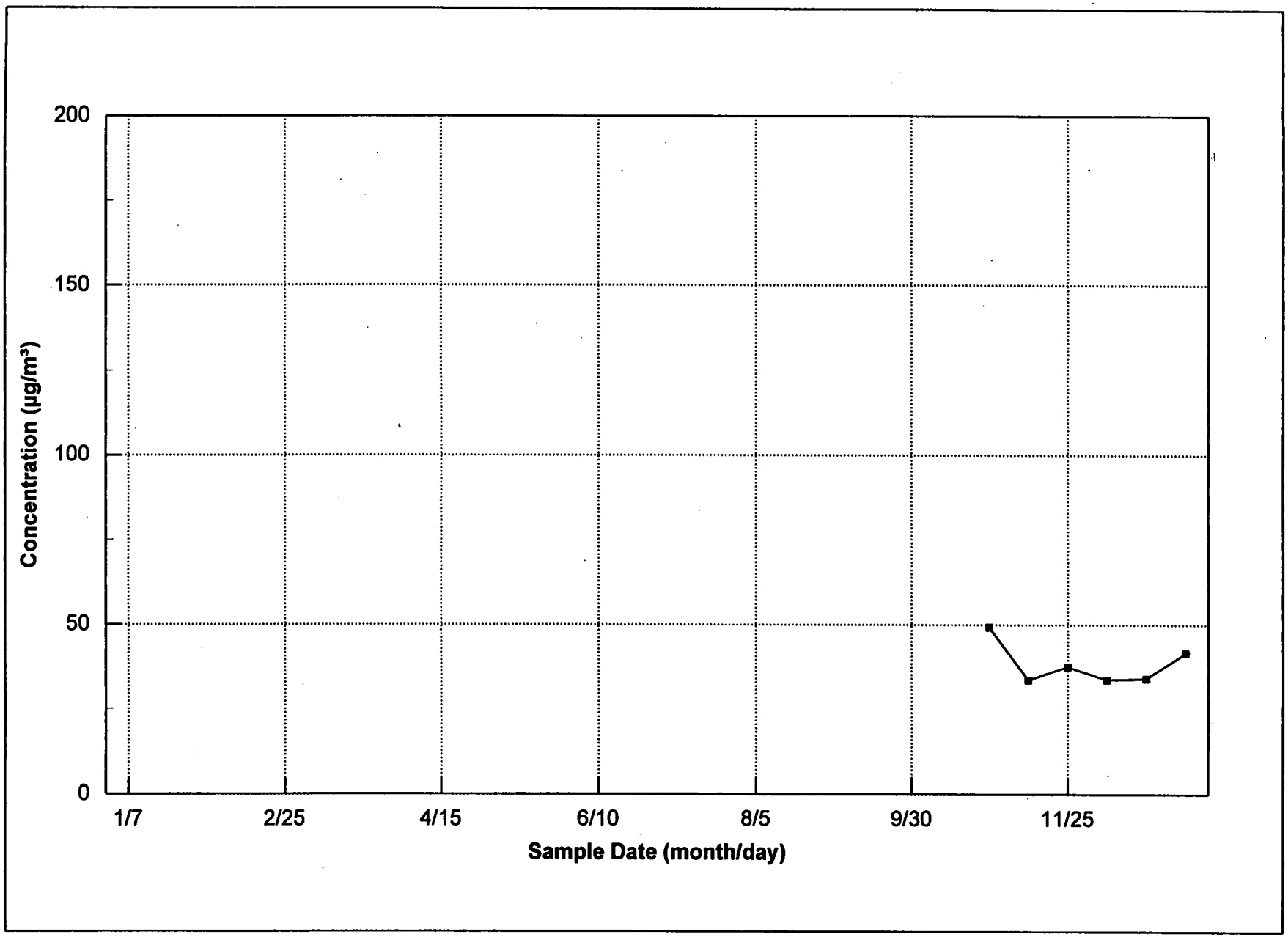

FIGURE C.1-48. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-27

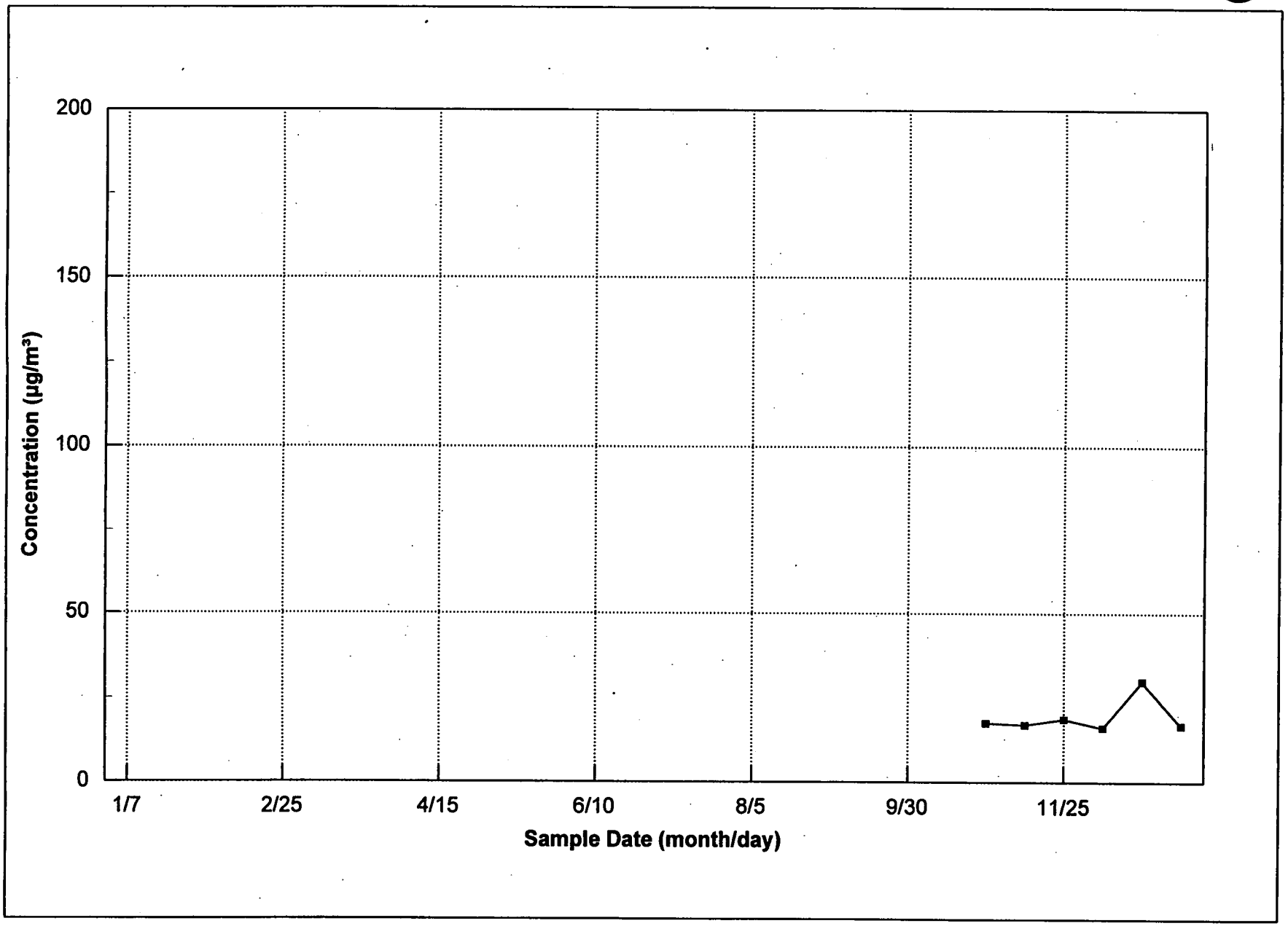

FIGURE C.1-49. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-28

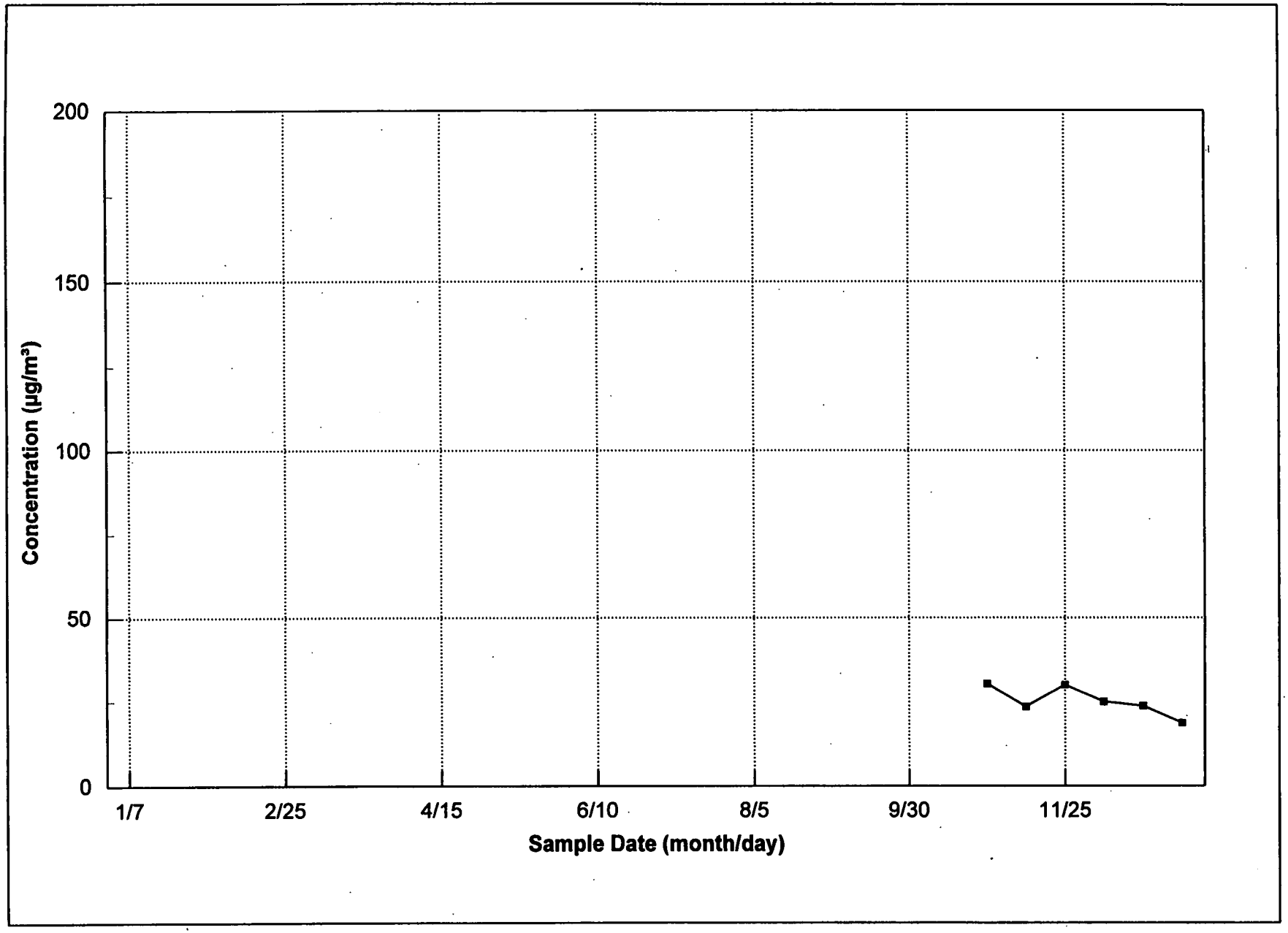

FIGURE C.1-50. 1997 TOTAL PARTICULATE CONCENTRATION IN AIR FOR AMS-29

000520

Attachment 2

ATTACHMENT C.2

RADON

ATTACHMENT C.2

As discussed in Chapter Five of this 1997 Integrated Site Environmental Report, the FEMP's radon monitoring program primarily focuses on assessing the effects of radon emissions from the K-65 Silos 1 and 2 on the surrounding environment. The radon data collected under the program are compared to the radon concentration standards contained in DOE Order 5400.5, Radiation Protection of the Public and the Environment. The pertinent standards and associated 1997 compliance status are provided below.

- The DOE annual average limit at and beyond the facility fenceline is 3.0 picoCuries per liter (pCi/L) above background; there were no exceedances in 1997.
- The DOE annual average limit over the facility is 30 pCi/L above background; there were no exceedances in 1997.
- The DOE limit measured at any point over the facility is 100 pCi/L; there were five exceedances during 1997.

In 1997, the radon monitoring program operated 20 continuous monitors (Pylon AB-5) within the K-65 Silos 1 and 2 exclusion fence, selected areas on site and at five air monitoring locations along the site fenceline and at off-site locations. These monitors are primarily utilized to determine compliance with DOE Order 5400.5, 100 pCi/L radon limit, as well as to identify increasing environmental radon concentrations in a timely manner so that corrective actions may be implemented as necessary. Also, the Federal Facilities Agreement requires routine reporting of data from nine continuous monitors to assess short-term fluctuations associated with radon emissions from the K-65 Silos 1 and 2.

Nineteen of the 20 continuous monitors were operational through 1997. Continuous monitoring location AMS-1B was removed from service in June 1997 due to power interruption from the ongoing remediation activities in the area north of the former production area. The remaining 19 units operated approximately 96 percent of the time during 1997. The four percent down-time was associated with extreme cold temperatures, power interruptions, and/or routine maintenance activities.

Data from the continuous radon monitors are provided in this attachment in the following three formats:

- Table C.2-1 provides a detailed summary of 100 pCi/L exceedences. During 1997, there were five exceedences of the 100 pCi/L DOE limit. As in past years, these exceedences have occurred during periods of particularly strong atmospheric inversions.

- Figure C.2-1 identifies the location of continuous radon monitoring locations in 1997. Figures C.2-2 through C.2-21 present the monthly average radon concentrations plotted over time for the 20 continuous radon monitoring stations which operated during 1997. The 3.0 pCi/L (fenceline and off site) and 30 pCi/L limits (on site) have been added as reference points to the appropriate graphs to assist in evaluating the data. For consistency with historical data, the results for 1997 have not been corrected for instrument background (uncorrected). Therefore, the measurements may be biased slightly higher than true ambient radon concentrations. The practice of correcting measurements for instrument background was adopted by the FEMP in October 1997. Therefore, data presented in future reports will be corrected for instrument background which will eliminate this bias from the measurements.

- Figure C.2-22 identifies the historical continuous radon monitoring locations from 1992 through 1996. Figures C.2-23 through C.2-47 show the minimum, maximum, and annual average radon concentrations (uncorrected) for continuous radon monitors from 1992 through 1997. It should be noted that annual average concentrations were calculated for monitors which had six or more monthly readings during the year. This provides a more representative annual average value since the natural fluctuations in radon concentrations are more likely to be accounted for between summer and winter months. In addition, because of the natural variability in environmental radon concentrations and the inherent errors associated with the two sampling technologies, the annual average values presented in the attached figures may differ slightly from annual average concentrations measured via alpha track-etch cup monitors placed at the same monitoring locations.

In addition to the continuous radon monitors, radon monitoring was conducted at 62 radon (alpha track-etch) cup locations during 1997. These detectors were collected every six months and analyzed by an off-site vendor. The data from this monitoring effort are provided in Table C.2-2 for each six month sample collection period, as well as the annual average concentrations for 1997. For comparison, 1996 results are also included in the table. The radon cups are utilized primarily to determine compliance with the DOE Order 5400.5 standards of 3.0 pCi/L (above background) annual average at the fenceline and off-site locations and 30 pCi/L (above background) annual average over the facility. Data collected from the fenceline and off-site locations were all below 3.0 pCi/L standard.

Likewise, all on-site monitoring locations were all below the 30 pCi/L standard. Figure C.2-48 identifies the radon alpha track-etch cup monitoring locations.

Beginning in 1997, new quality assurance methods were used to evaluate the alpha track-etch cup data. These methods were implemented to address analytical biases detected in previous years' data. The process includes screening the data against quality assurance samples of a known radon exposure that are analyzed in conjunction with the field samples. The IEMP describes the detailed screening process for acceptable data, as well as the treatment to adjust the data.

For 1997, the analyses for the known exposure quality assurance samples show a positive bias (i.e., analytical results were greater than the known exposure value). Therefore, the 1997 data from alpha track-etch cups were corrected downward to account for this bias. Radon data from alpha track-etch cups collected prior to 1997 have not been corrected, and therefore should be noted when comparing 1997 to 1996 data.

TABLE C.2-1

1997 RADON CONCENTRATIONS
100 pCi/L EXCEEDANCES AT THE K-65 SILOS 1 AND 2 EXCLUSION FENCE

	Monitoring Location		Meteorological Parameters	
Date-Time[a]	K65NE[b]	K65SE[b]	Delta T(°C)[c]	Stability Class[d]
02/26-0000	124.8	NA	5.2	G
02/26-0100	NA	114.4	6.3	G
02/26-0300	101.7	NA	5.4	G
06/16-0100	113.0	NA	6.3	G
09/25-0300	141.4	NA	4.7	G
09/25-0400	103.1	NA	3.2	F
10/24-0200	NA	105.3	7.7	G
11/18-0200	104.7	NA	5.9	G
11/18-0300	124.8	NA	5.1	G
11/18-0500	140.5	NA	5.7	G
11/18-0600	NA	100.3	3.2	F

[a]Time is in military time.
[b]NA = not applicable
[c]Delta T is the temperature difference between 60-meter and 10-meter elevations. A positive Delta T is indicative of an atmospheric inversion.
[d]The Stability Class parameter correlates to specific ranges of Delta T and acts as a measure of the intensity of the inversion. The 100 pCi/L exceedances were associated with very strong inversions. Below is a chart representing the parameter classification:

Range of Delta T	Stability Class
3.7 or greater	G
1.4 to 3.6	F
-0.4 to 1.3	E
-1.3 to -0.5	D
-1.5 to -1.4	C
-1.7 to -1.6	B
Less than -1.7	A

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TABLE C.2-2

RADON MONITORING-ALPHA TRACK-ETCH CUPS, CONCENTRATION DATA FOR 1997

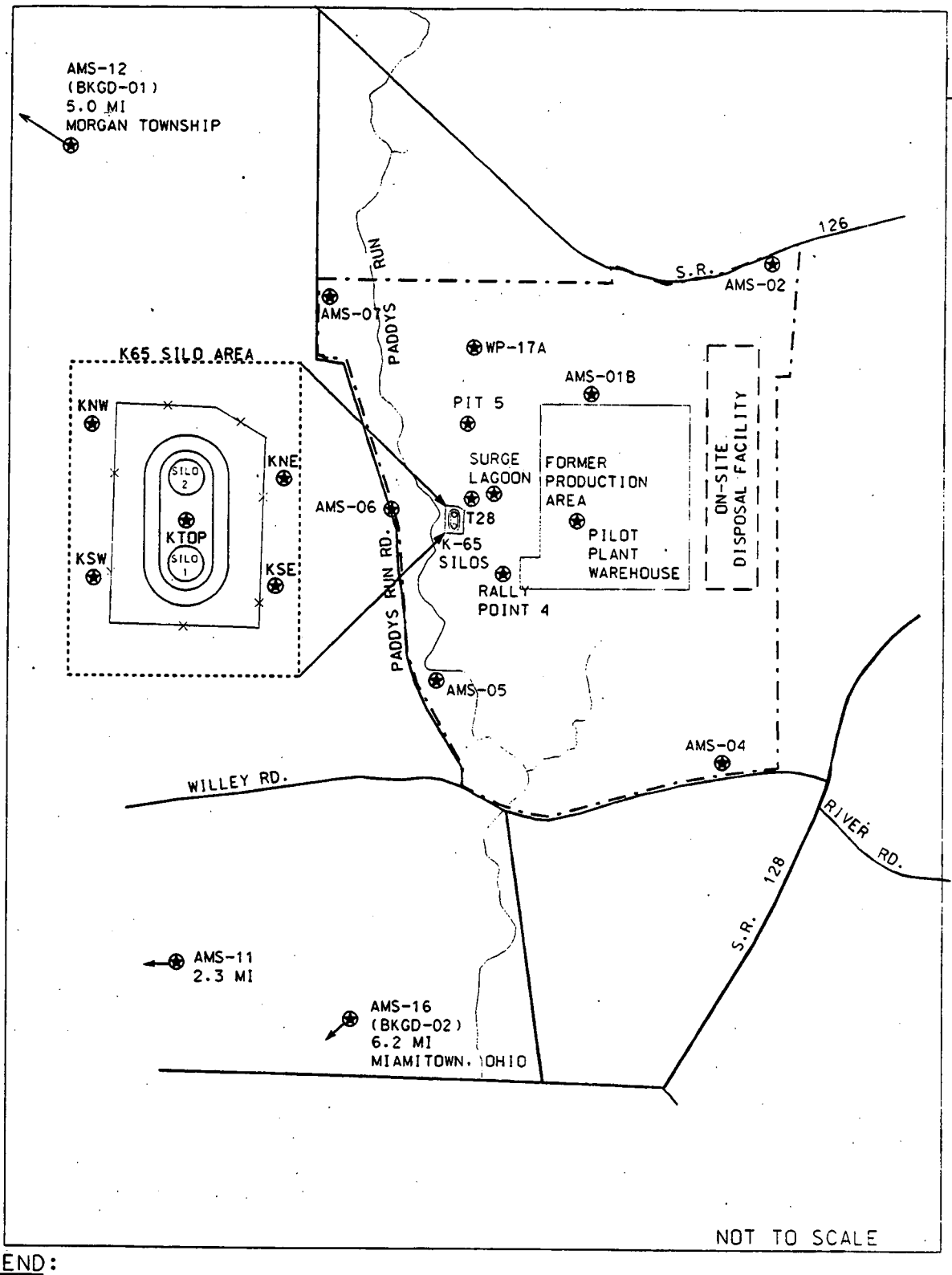
Location	Radon Concentration ± Precision[a] (pCi/L)			
	1st Half of Year 1997	2nd Half of Year 1997	1997 Location Average	1996 Location Average[b]
K-65 Silos 1 and 2 Exclusion Fence Locations				
K65A	0.9 ± 0.4	1.1 ± 0.3	1.0 ± 0.4	1.6 ± 0.5
K65B	1.3 ± 0.6	1.4 ± 0.5	1.4 ± 0.6	2.0 ± 0.1
K65C	2.0 ± 0.6	2.3 ± 0.1	2.2 ± 0.4	2.5 ± 0.9
K65D	2.8 ± 0.6	4.1 ± 1.0	3.5 ± 0.8	3.9 ± 1.1
K65E	2.9 ± 0.4	3.6 ± 0.2	3.3 ± 0.3	3.5 ± 0.9
K65F	2.7 ± 0.7	4.3 ± 0.9	3.5 ± 0.8	3.9 ± 0.8
K65G	1.7 ± 0.5	2.5 ± 0.4	2.1 ± 0.5	2.2 ± 0.6
K65H	1.1 ± 0.3	1.6 ± 0.5	1.4 ± 0.4	1.6 ± 0.6
K65I	0.8 ± 0.4	1.3 ± 0.4	1.1 ± 0.4	1.4 ± 0.4
K65J	0.5 ± 0.2	0.9 ± 0.2	0.7 ± 0.2	1.2 ± 0.4
K65K	0.8 ± 0.1[c]	1.0 ± 0.2	0.9 ± 0.2	1.3 ± 0.5
K65L	1.7 ± 0.9	1.8 ± 0.5	1.8 ± 0.7	2.0 ± 0.5
K65M	1.6 ± 0.6	1.5 ± 0.4	1.6 ± 0.5	1.9 ± 0.4
K65N	1.2 ± 0.4	1.5 ± 0.2	1.4 ± 0.3	1.8 ± 0.6
K65O	0.7 ± 0.2	1.1 ± 0.2	0.9 ± 0.2	1.4 ± 0.6
K65P	0.6 ± 0.5	0.9 ± 0.1	0.8 ± 0.4	1.4 ± 0.4
Minimum	**0.5 ± 0.2**	**0.9 ±0.2**	**0.7 ± 0.2**	**1.2 ± 0.4**
Maximum	**2.9 ± 0.4**	**4.3 ± 0.9**	**3.5 ± 0.8**	**3.9 ± 1.1**
K-65 Silos 1 and 2 Dome Locations				
SILO1-NE	12.3 ± 0.3	11.9 ± 0.3	12.1 ± 0.3	11.4 ± 5.5
SILO1-NW	6.5 ± 0.9	6.3 ± 0.7	6.4 ± 0.8	7.8 ± 1.1
SILO1-SE	6.0 ± 0.9	8.1 ± 0.1	7.1 ± 0.6	7.0 ± 0.4
SILO1-SW	3.2± 0.4	4.9 ± 0.2	4.1 ± 0.3	4.1 ± 1.5
SILO2-NE	18.3 ± 0.1	17.7 ± 2.2	18.0 ± 1.6	27.6 ± 14.9
SILO2-NW	4.0 ± 0.7	3.5 ± 0.6	3.8 ± 0.7	9.7 ± 1.1
SILO2-SE	12.1 ± 1.3	12.5 ± 0.7	12.3 ± 1.0	13.8 ± 2.6
SILO2-SW	7.4 ± 0.6	7.8 ± 0.8	7.6 ± 0.7	8.0 ± 1.4
Minimum	**3.2 ± 0.4**	**3.5 ± 0.6**	**3.8 ± 0.7**	**4.1 ± 1.5**
Maximum	**18.3 ± 0.1**	**17.7 ± 2.2**	**18.0 ± 1.6**	**27.6 ± 14.9**
Fenceline Locations				
AMS-02	0.1 ± 0.1	0.3 ± 0.1[d]	0.2 ± 0.1	0.7 ± 0.2
AMS-04	0.1 ± 0.2	0.3 ± 0.1[c]	0.2 ± 0.2	0.6 ± 0.2
AMS-06	0.1 ± 0.2	0.4 ± 0.1	0.3 ± 0.2	0.9 ± 0.5
AMS-07	0.1 ± 0.2	0.5 ± 0.1	0.3 ± 0.2	0.8 ± 0.2
AMS-08A	0.0 ± 0.1[c]	0.4 ± 0.1	0.2 ± 0.1	0.8 ± 0.2
AMS-09B	0.2 ± 0.1[h]	0.4 ± 0.1	0.3 ± 0.1	0.8 ± 0.4
FEMP-A	0.4 ± 0.2	0.4 ± 0.2[e]	0.4 ± 0.2	1.0 ± 0.2
FEMP-B	0.3 ± 0.2	0.3 ± 0.1	0.3 ± 0.2	0.8 ± 0.3
FEMP-C	0.1 ± 0.2	0.4 ± 0.1	0.3 ± 0.2	0.7 ± 0.2
FEMP-D	0.1 ± 0.2	0.3 ± 0.1	0.2 ± 0.2	0.6 ± 0.2
FEMP-E	0.1 ± 0.2	0.4 ± 0.1	0.3 ± 0.2	0.6 ± 0.4
FEMP-F	0.1 ± 0.1	0.3 ± 0.1	0.2 ± 0.1	0.7 ± 0.2
FEMP-G	0.1 ± 0.1	0.4 ± 0.1	0.3 ± 0.1	0.8 ± 0.4
FEMP-H	0.1 ± 0.2	0.4 ± 0.1	0.3 ± 0.2	0.8 ± 0.2
FEMP-I	0.2 ± 0.1	0.4 ± 0.2	0.3 ± 0.2	0.8 ± 0.3
FEMP-J	0.1 ± 0.1	0.4 ± 0.1	0.3 ± 0.1	0.7 ± 0.1

TABLE C.2-2
(Continued)

Location	Radon Concentration ± Precision[a] (pCi/L) 1st Half of Year 1997	2nd Half of Year 1997	1997 Location Average	1996 Location Average[h]
Fenceline Locations (Contd.)				
FEMP-K	0.2 ± 0.1[b]	0.5 ± 0.1[c]	0.4 ± 0.1	0.8 ± 0.3
FEMP-L	0.2 ± 0.1[b]	0.5 ± 0.2	0.4 ± 0.2	0.9 ± 0.3
FEMP-M	0.2 ± 0.2	0.5 ± 0.1	0.4 ± 0.2	0.8 ± 0.4
FEMP-N	0.2 ± 0.2	0.6 ± 0.1	0.4 ± 0.2	0.7 ± 0.2
FEMP-O	0.0 ± 0.2	2.0 ± 0.2[d]	1.0 ± 0.2	0.9 ± 0.2
FEMP-P	0.2 ± 0.2[e]	0.6 ± 0.1	0.4 ± 0.2	0.8 ± 0.3
Minimum	**0.0 ± 0.1**	**0.3 ± 0.1**	**0.2 ± 0.1**	**0.6 ± 0.2**
Maximum	**0.4 ± 0.2**	**2.0 ± 0.2**	**1.0 ± 0.2**	**1.0 ± 0.2**
Background Locations				
AMS-12	0.0 ± 0.1[d]	0.2 ± 0.1[c]	0.1 ± 0.1	0.9 ± 0.5
AMS-13	0.1 ± 0.2	0.3 ± 0.1[d]	0.2 ± 0.2	0.7 ± 0.2
AMS-16[f]	0.0 ± NA[g]	0.3 ± 0.1[c]	0.2 ± 0.1	0.5 ± 0.1
BKGD-01	0.0 ± NA[d,g]	0.2 ± 0.1	0.1 ± 0.1	0.6 ± 0.2
BKGD-02	0.0 ± 0.1	0.3 ± 0.1	0.2 ± 0.1	0.6 ± 0.3
BKGD-04	0.1 ± 0.2	0.2 ± 0.1[d]	0.2 ± 0.2	0.5 ± 0.3
BKGD-05	0.0 ± 0.1	0.3 ± 0.1[c]	0.2 ± 0.1	0.6 ± 0.1
BKGD-06	0.0 ± NA [d,g]	0.2 ± 0.1	0.1 ± 0.1	0.6 ± 0.2
Minimum	**0.0 ± 0.1**	**0.2 ± 0.1**	**0.1 ± 0.1**	**0.5 ± 0.1**
Maximum	**0.1 ± 0.2**	**0.3 ± 0.1**	**0.2 ± 0.2**	**0.9 ± 0.5**
Other Onsite Locations				
PERM-07	0.1 ± 0.1[d]	0.6 ± 0.1	0.4 ± 0.1	0.8 ± 0.2
PERM-09	0.0 ± 0.1	0.3 ± 0.1	0.2 ± 0.1	0.8 ± 0.6
BLDG-65-6	0.2 ± 0.2[e]	0.4 ± 0.2[e]	0.3 ± 0.2	0.6 ± 0.3
BLDG-65-7	0.3 ± 0.1[d]	0.2 ± 0.1	0.3 ± 0.1	2.2 ± 0.3
BLDG-65-8	0.3 ± 0.1[c]	0.3 ± 0.2[e]	0.3 ± 0.2	Unavailable[h]
BLDG-65-9	Unavailable[h]	0.3 ± 0.1[d]	0.3 ± 0.1	7.7 ± 1.3
AMS-1A	0.1 ± 0.1[c]	0.4 ± 0.1	0.3 ± 0.1	0.8 ± 0.4
Minimum	**0.0 ± 0.1**	**0.2 ± 0.1**	**0.2 ± 0.1**	**0.6 ± 0.3**
Maximum	**0.3 ± 0.1**	**0.6 ± 0.1**	**0.4 ± 0.1**	**2.2 ± 0.3**
Other Offsite Locations				
AMS-10	0.1 ± 0.2	0.4 ± 0.1	0.3 ± 0.2	0.8 ± 0.5
AMS-11	0.0 ± 0.1	0.5 ± 0.1	0.3 ± 0.1	1.0 ± 0.4
RES-01	0.0 ± 0.1[c]	0.5 ± 0.2[e]	0.3 ± 0.2	0.8 ± 0.2
RES-02	0.0 ± 0.1	0.6 ± 0.1	0.3 ± 0.1	0.8 ± 0.4
RES-03	0.1 ± 0.2	0.6 ± 0.2	0.4 ± 0.2	0.9 ± 0.6
Minimum	**0.0 ± 0.1**	**0.4 ± 0.1**	**0.3 ± 0.2**	**0.8 ± 0.5**
Maximum	**0.1 ± 0.2**	**0.6 ± 0.2**	**0.4 ± 0.2**	**1.0 ± 0.4**

[a] ±2 standard deviations
[b] Previously reported data for 1996 had not gone through the screening and verification process; therefore, data reported here are slightly different than data reported in the 1996 Site Environmental Report.
[c] Data edited due to IEMP Screening Criteria II.
[d] Data edited due to IEMP Screening Criteria III.
[e] Data edited due to IEMP Screening Criteria IV.
[f] Previously referred to as BKGD-03
[g] For laboratory bias correction factors greater than the exposure value, with associated precision values that do not encompass a positive concentration, the resulting negative corrected concentration is set at 0.0 and the associated precision is not applicable (NA).
[h] Data unavailable due to damage to the monitoring device.

NOTE: Some error terms may have slightly changed for first half 1997 data.



LEGEND:

FEMP BOUNDARY

RADON MONITORING-CONTINUOUS ALPHA SCINTILLATION LOCATION

DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO LOCATION OFF MAP

FIGURE C.2-1. 1997 RADON MONITORING-CONTINUOUS ALPHA SCINTILLATION LOCATIONS

/dgn/s5fgp1/dgn05/annual97/an0691.dgn
26-MAY-1998

Note: The DOE annual average limit over the facility is 30 pCi/L above background.
Monitor was removed from service in June 1997.

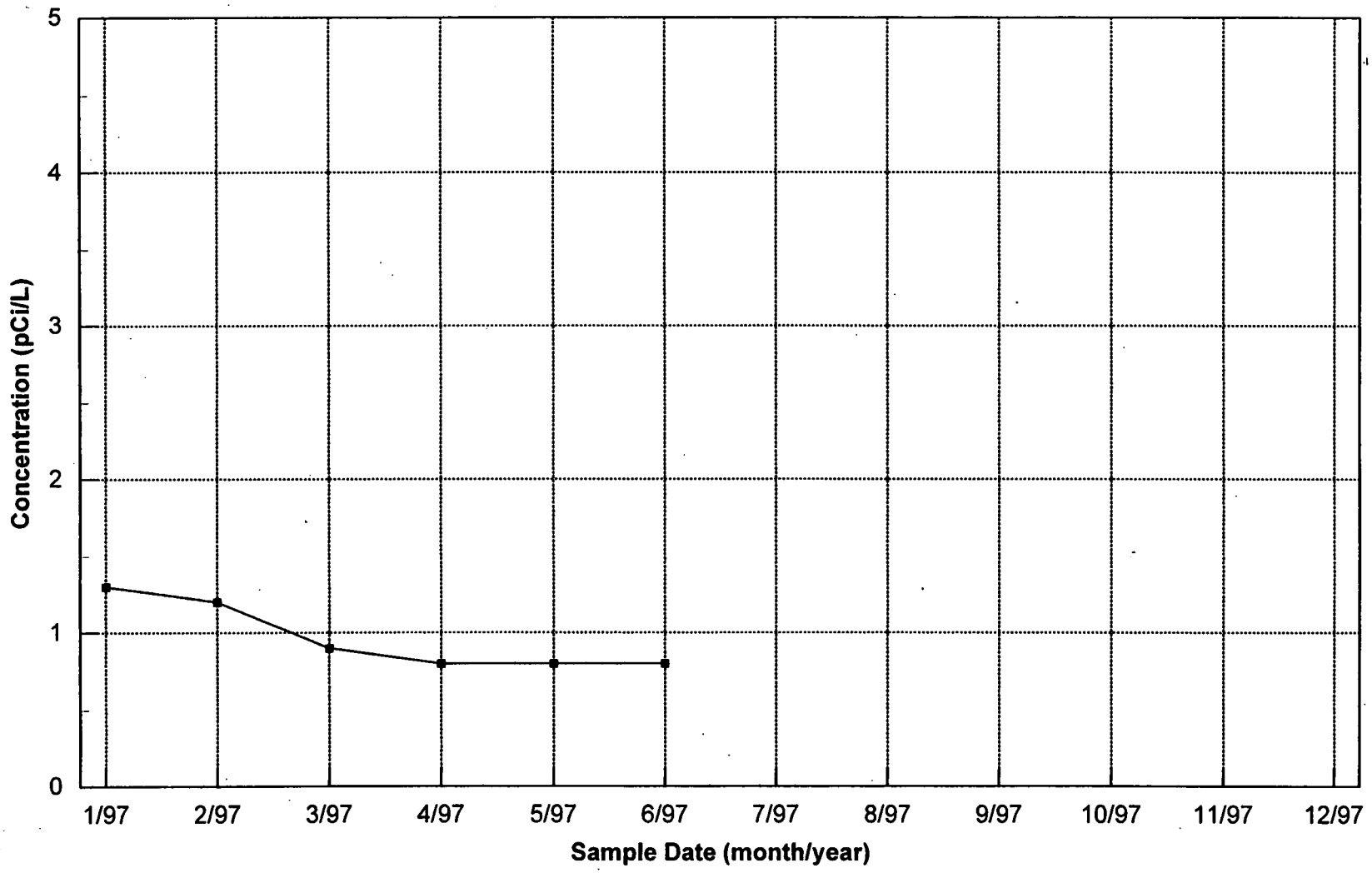


FIGURE C.2-2. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR AMS-01B

000539

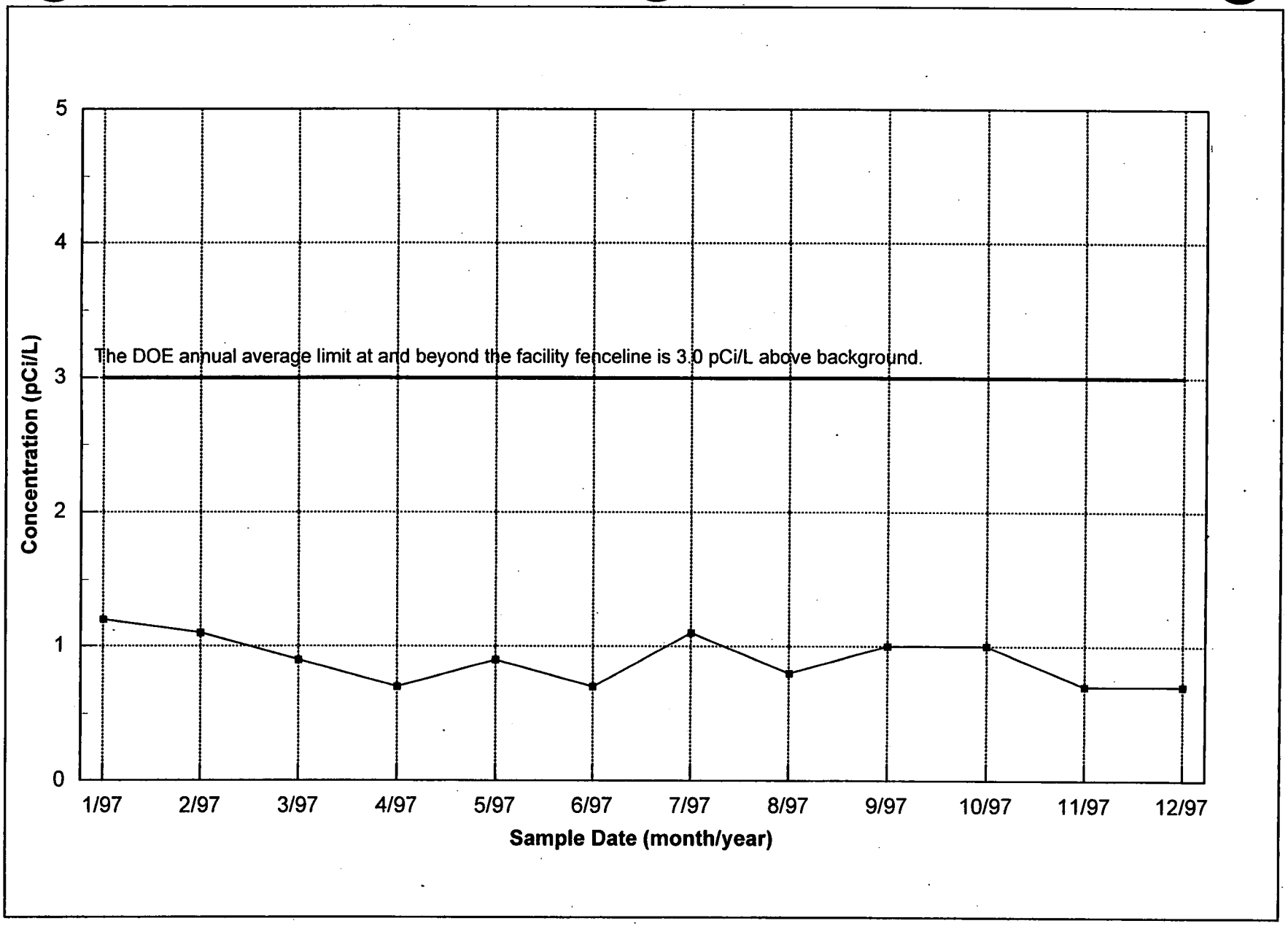


FIGURE C.2-3. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR AMS-02

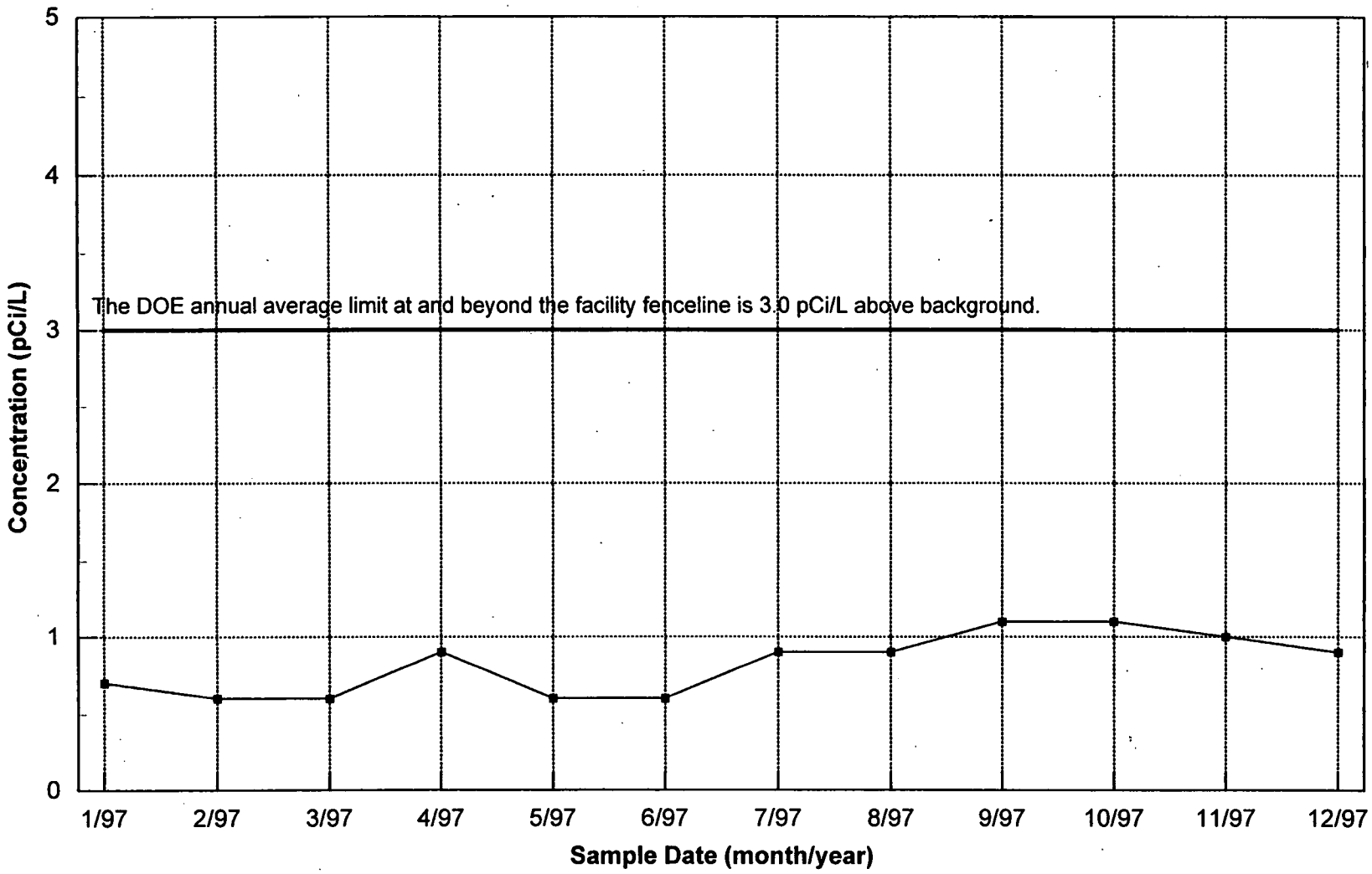


FIGURE C.2-4. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR AMS-04

000531

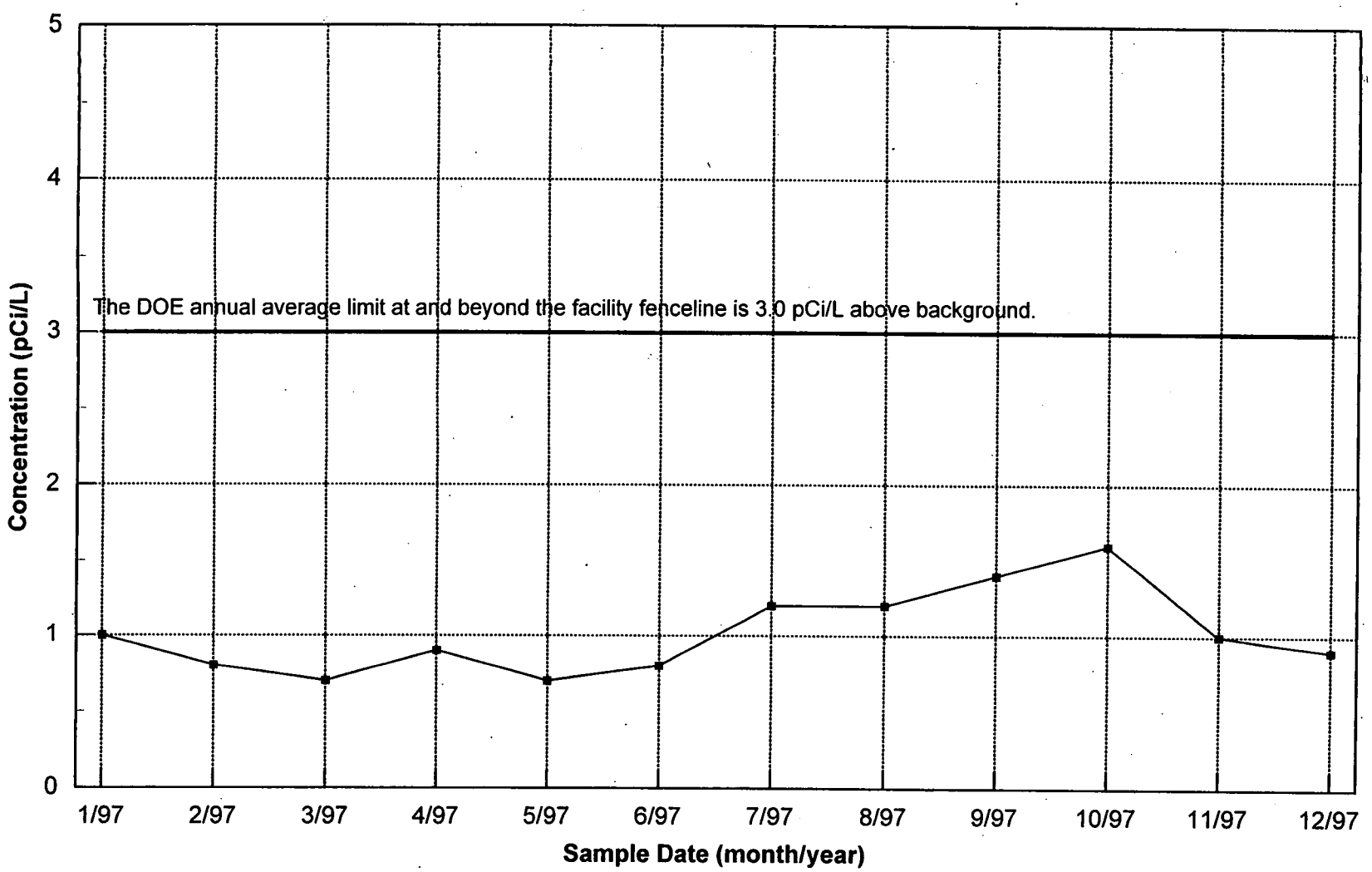


FIGURE C.2-5. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR AMS-05

000532

1420

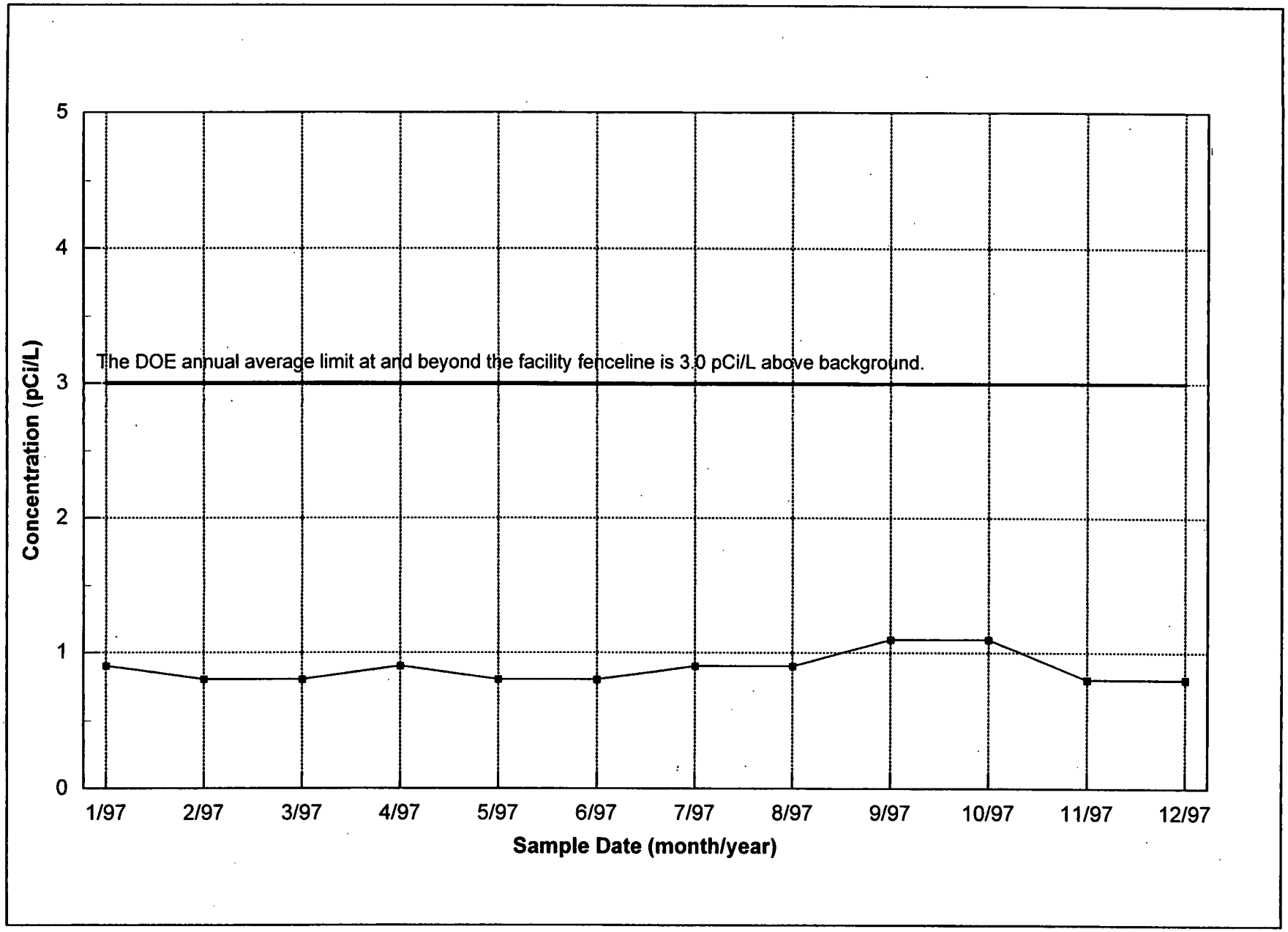


FIGURE C.2-6. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR AMS-06

000533

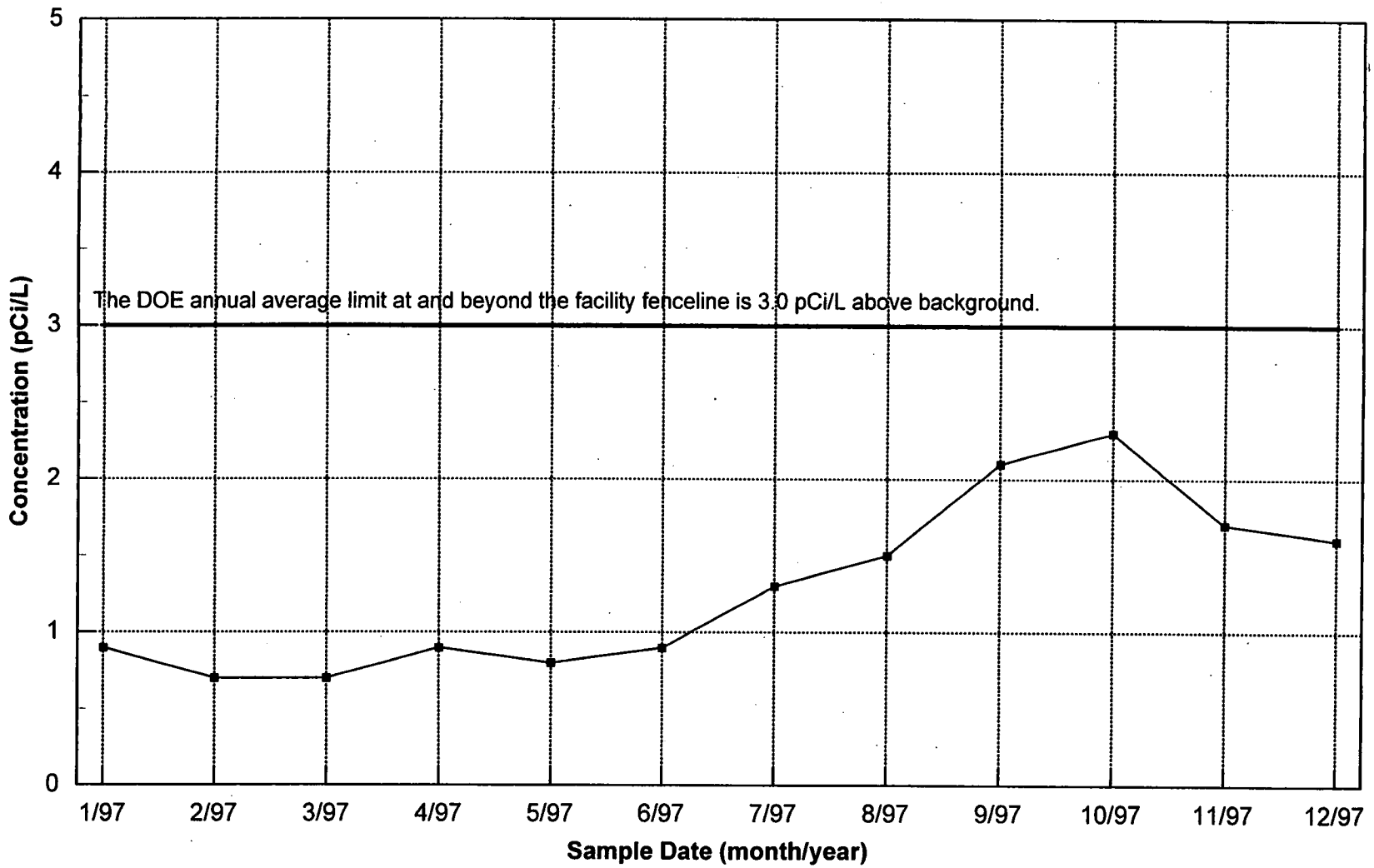


FIGURE C.2-7. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR AMS-07

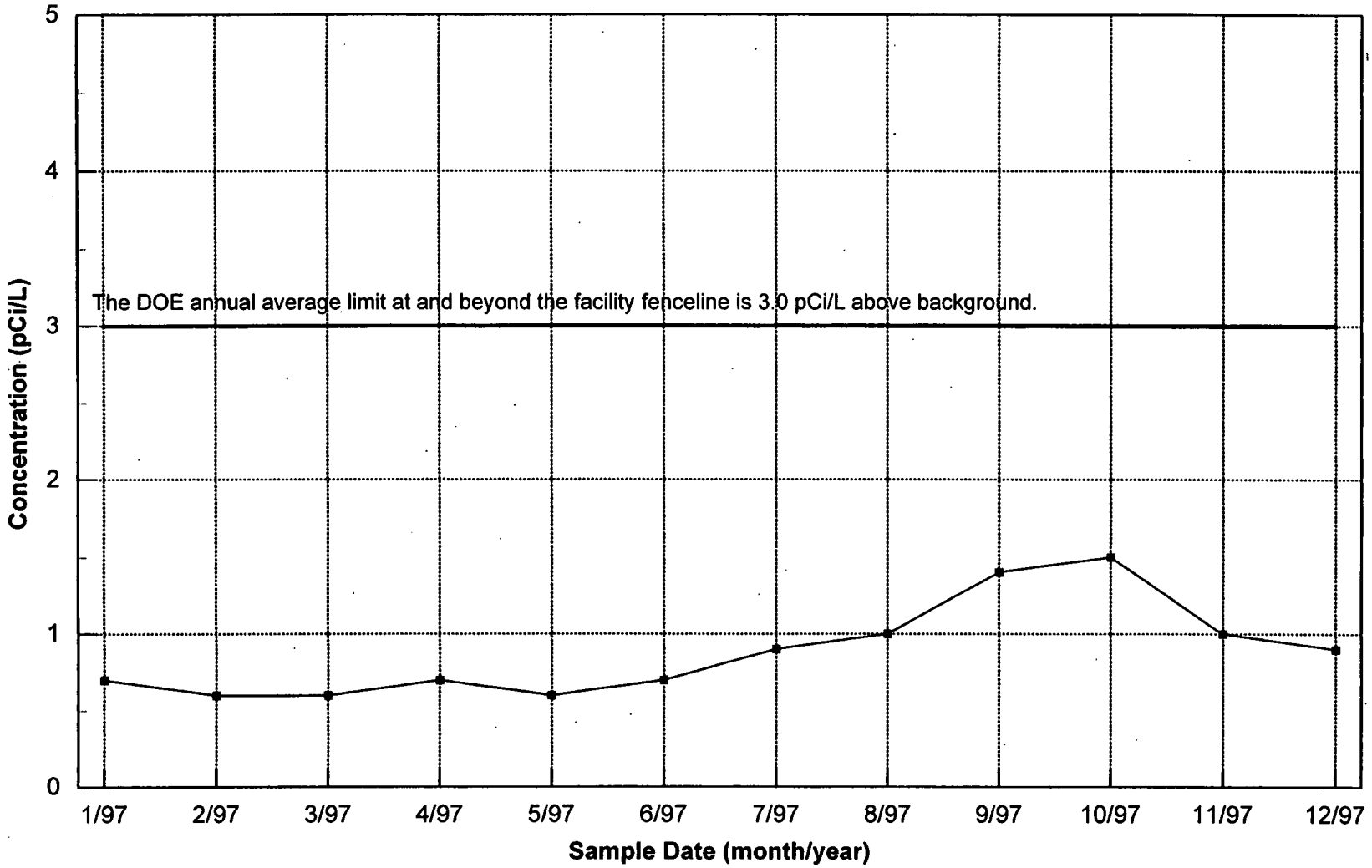


FIGURE C.2-8. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR AMS-11

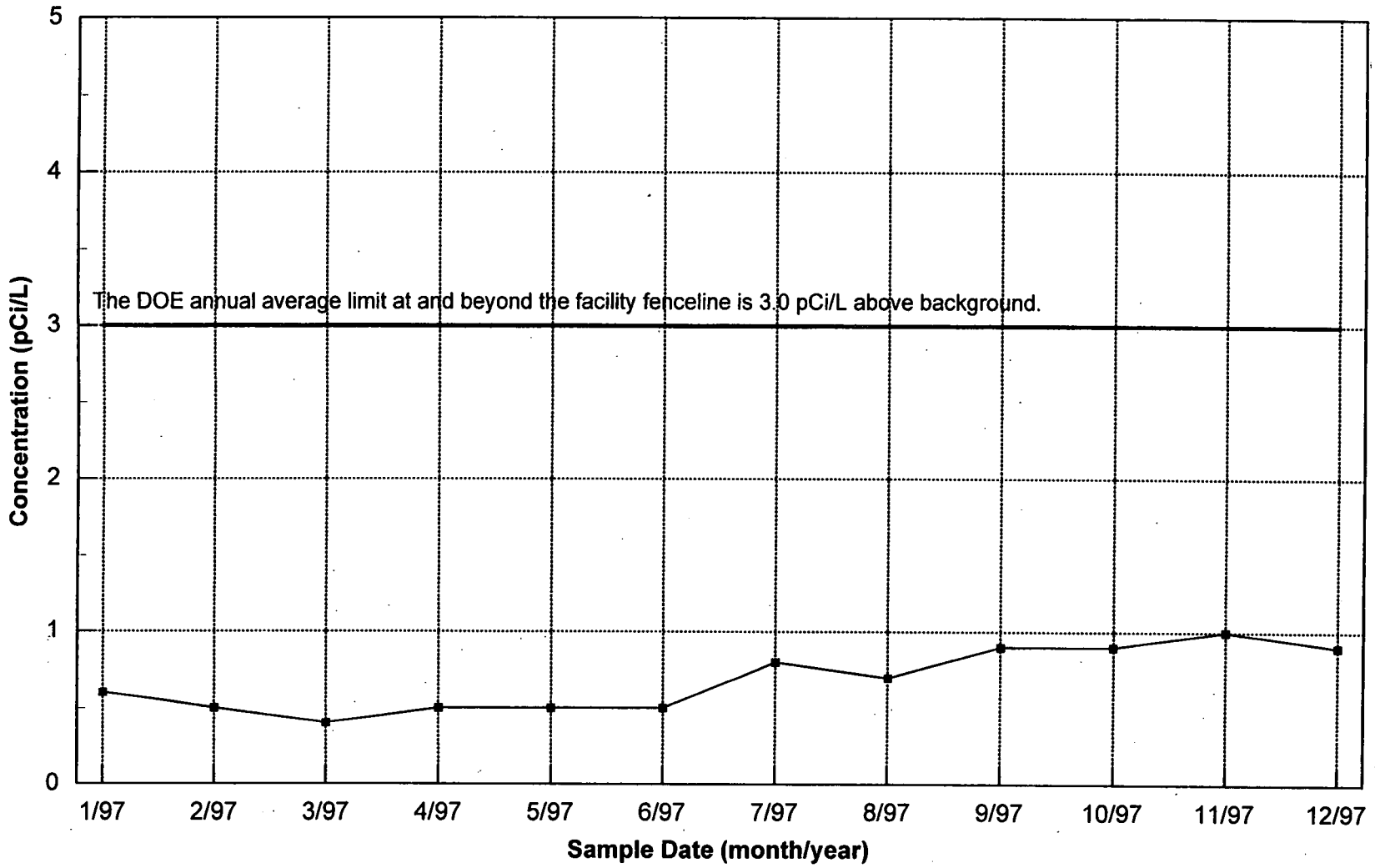


FIGURE C.2-9. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR AMS-12

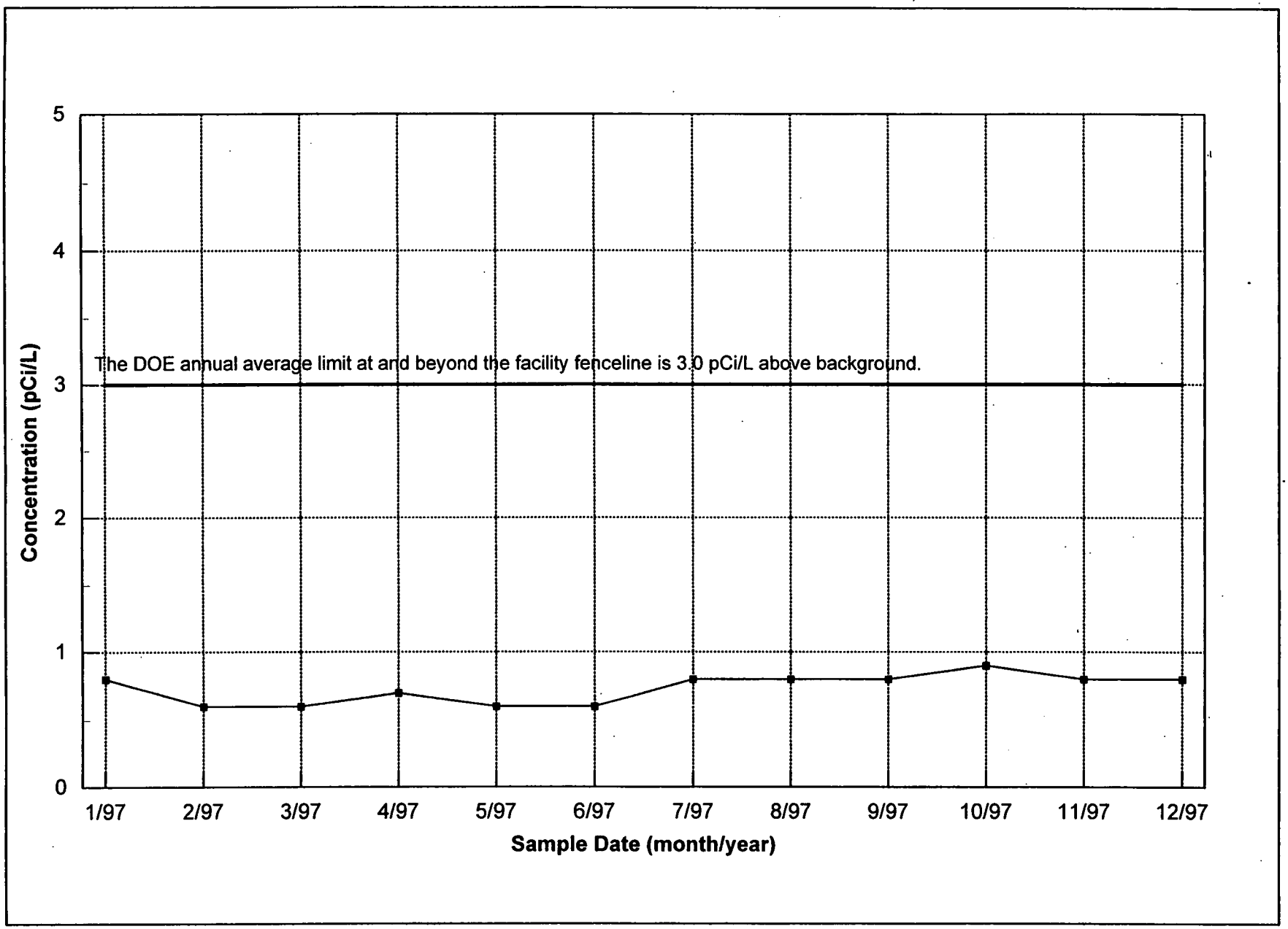


FIGURE C.2-10. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR AMS-16

000537

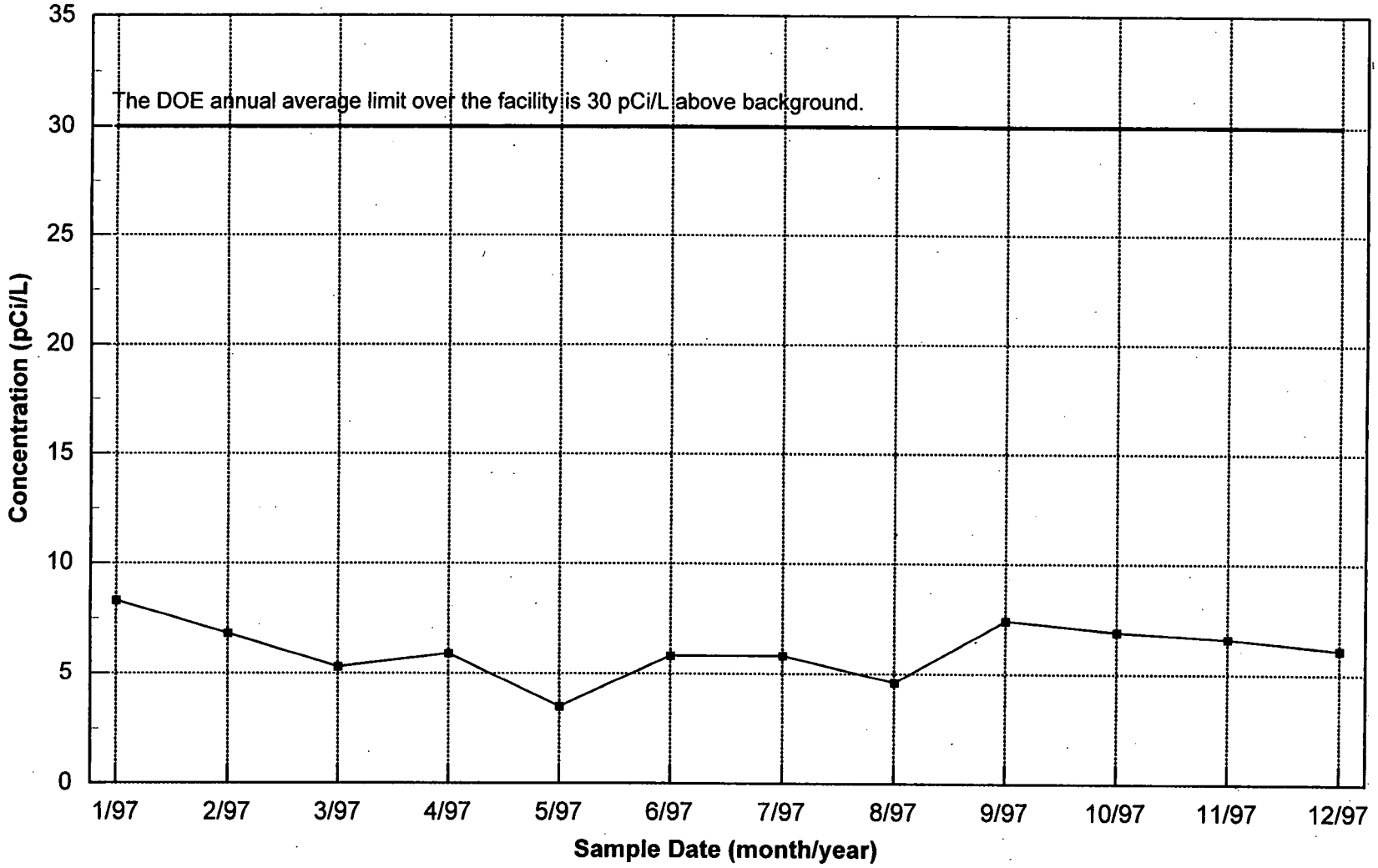


FIGURE C.2-11. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR KNE

000538

1420

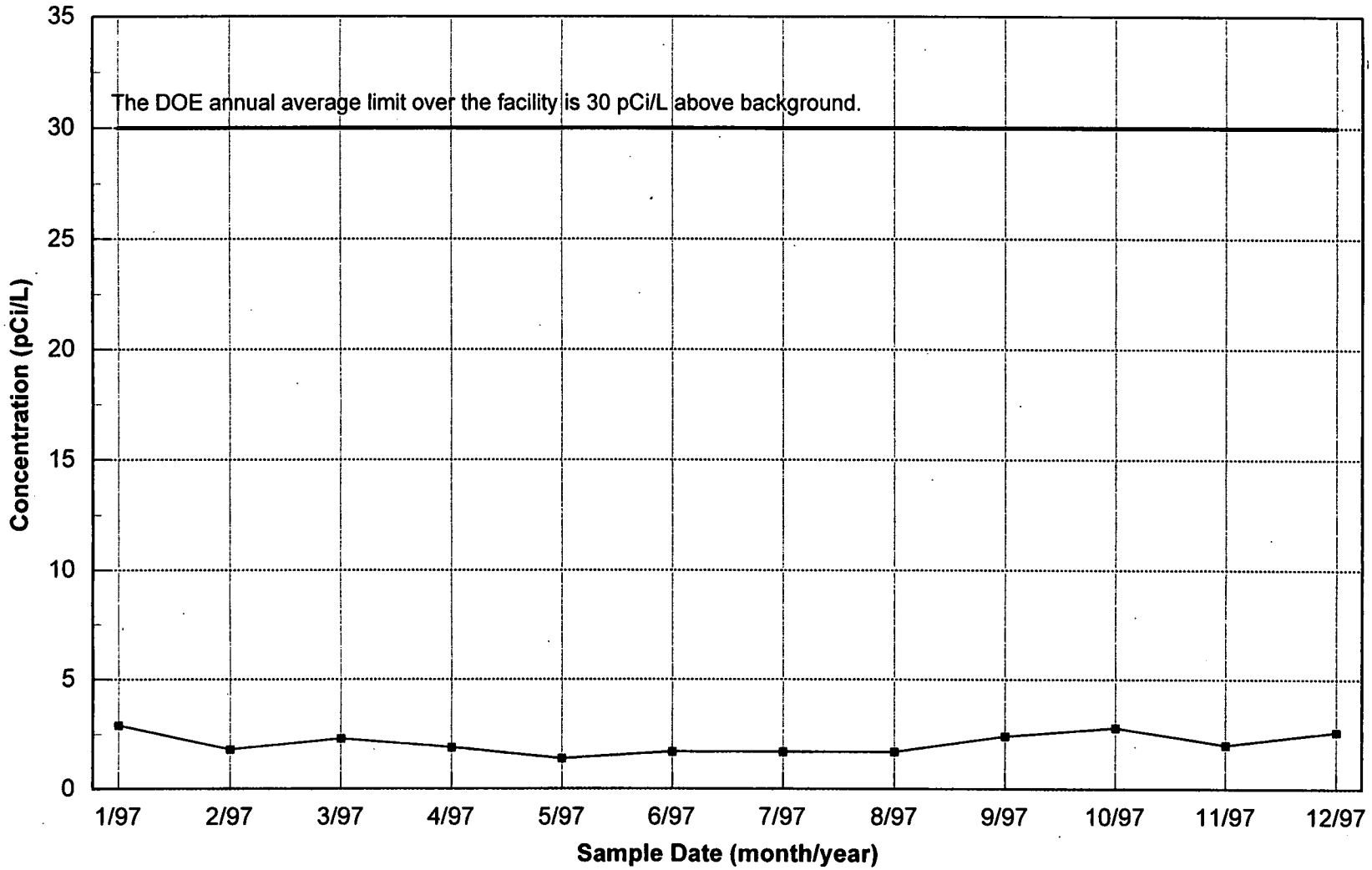


FIGURE C.2-12. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR KNW

000539

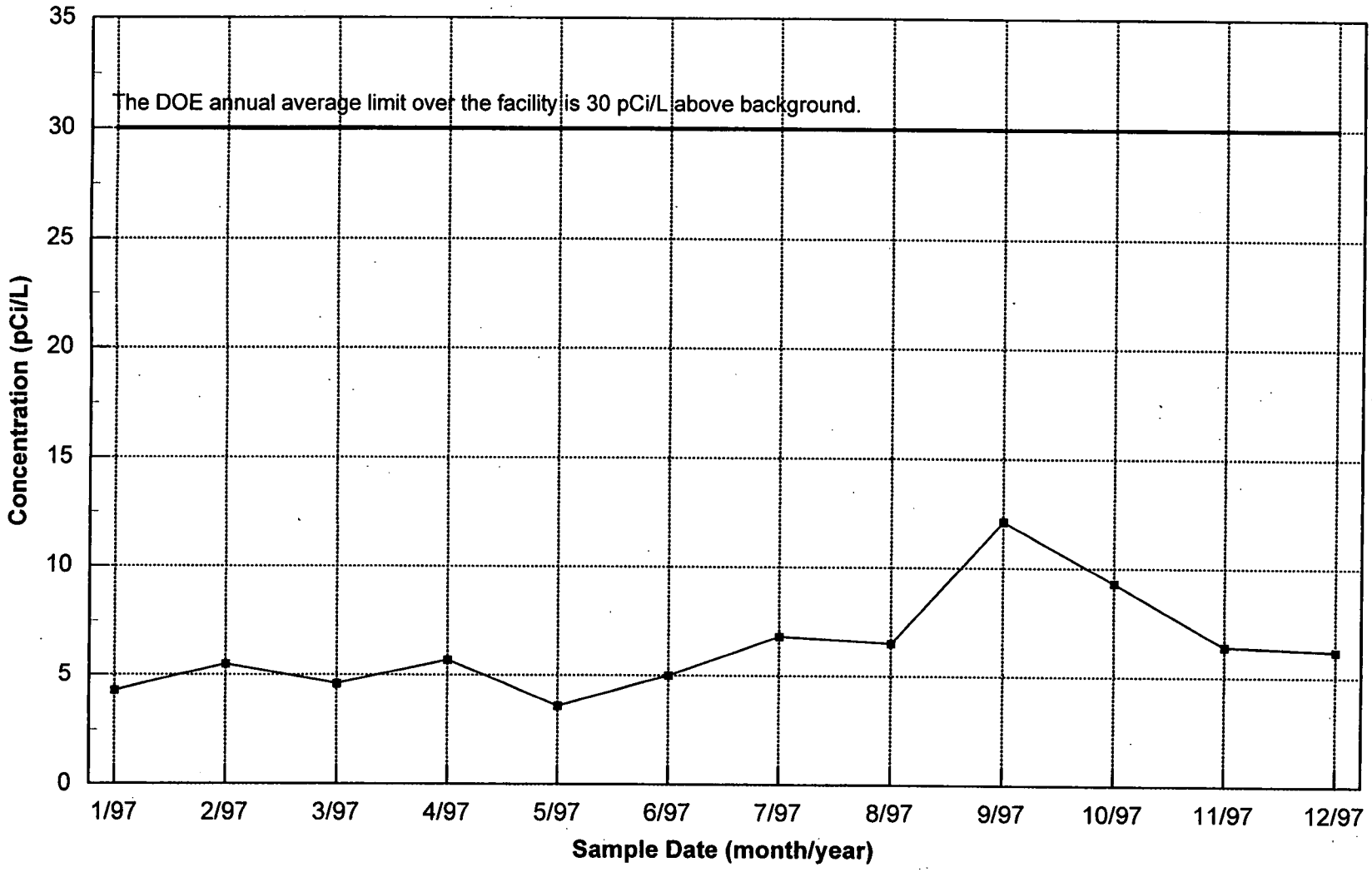


FIGURE C.2-13. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR KSE

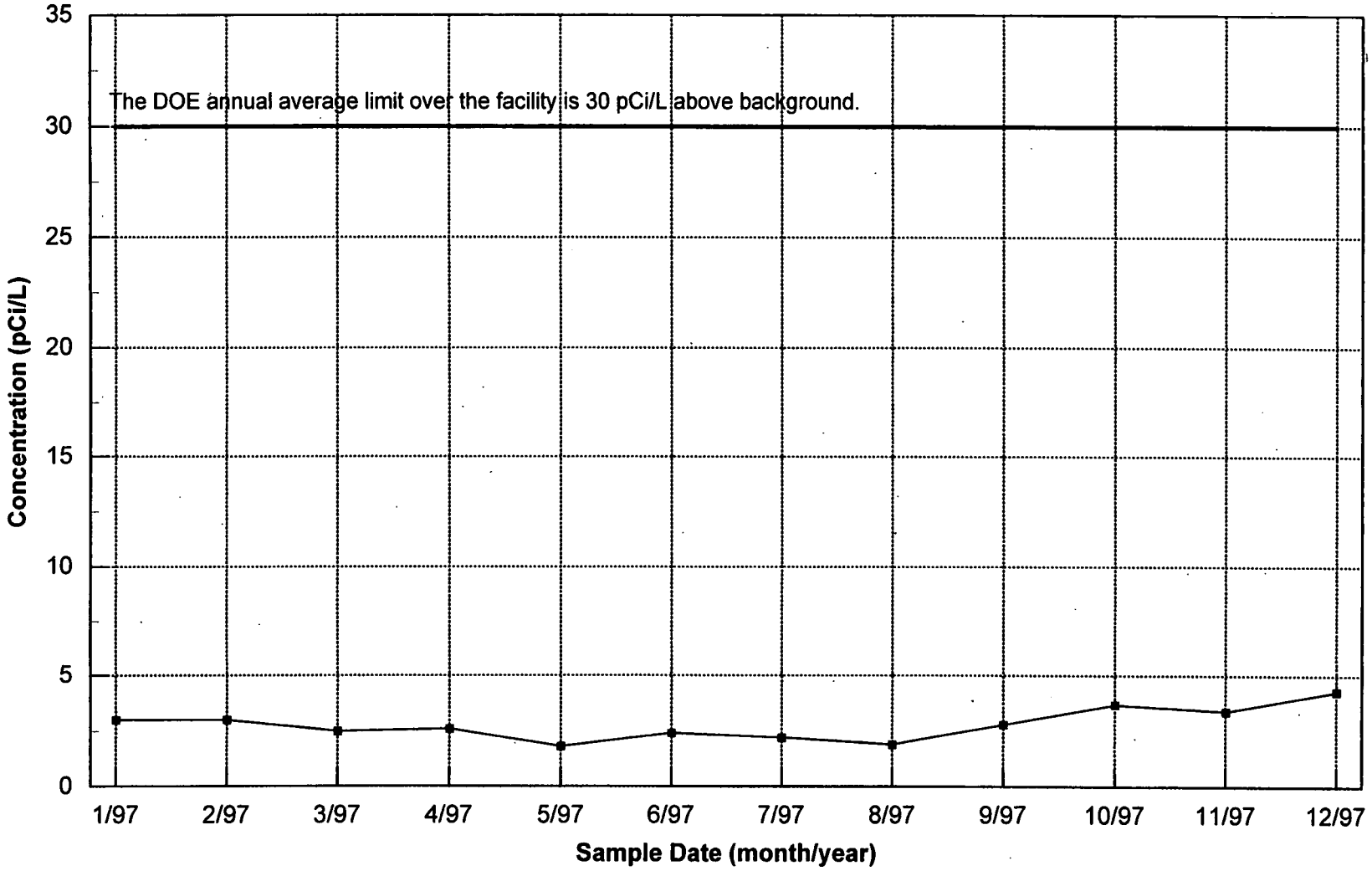


FIGURE C.2-14. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR KSW

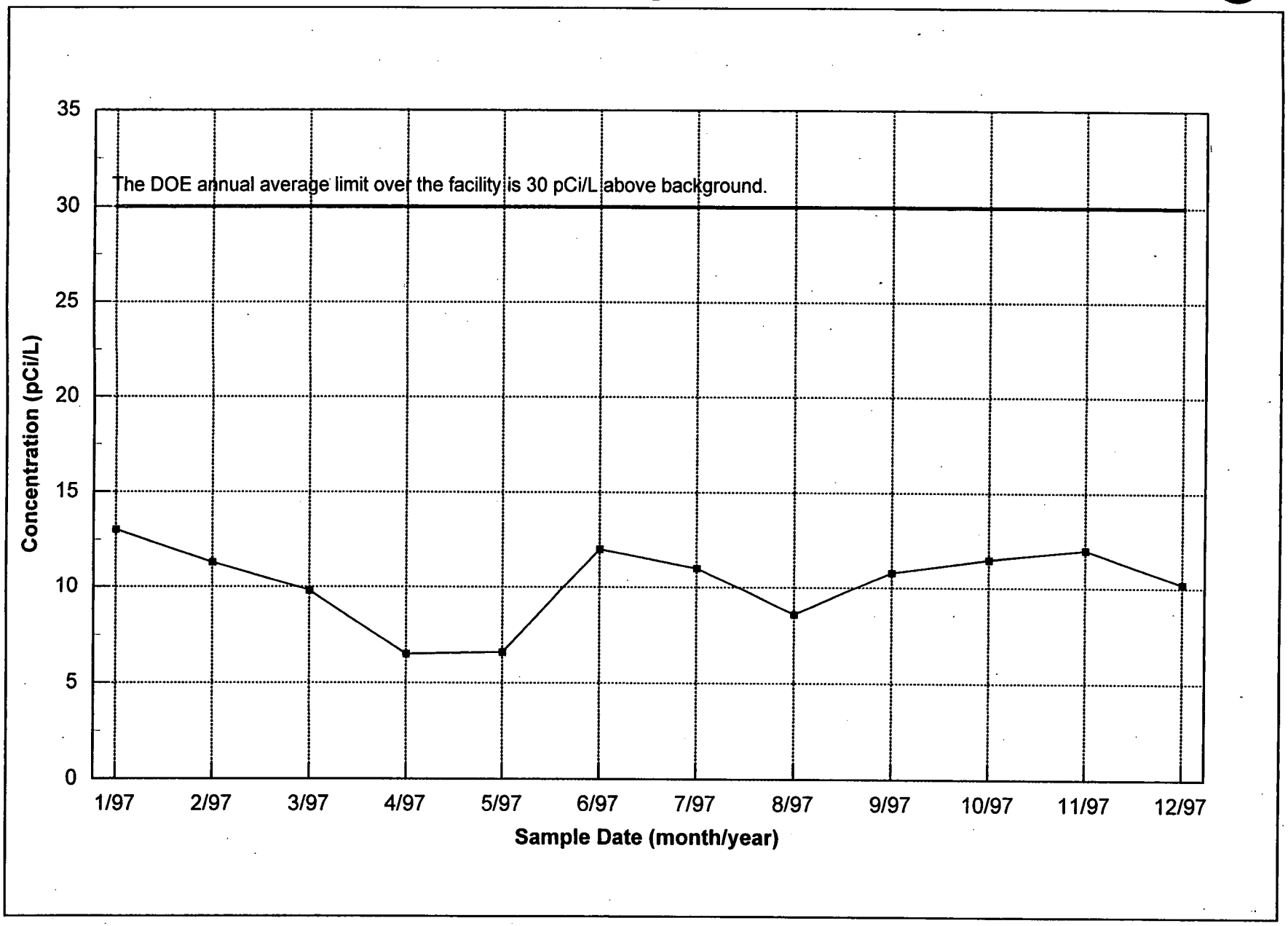


FIGURE C.2-15. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR KTOP

000542

1420

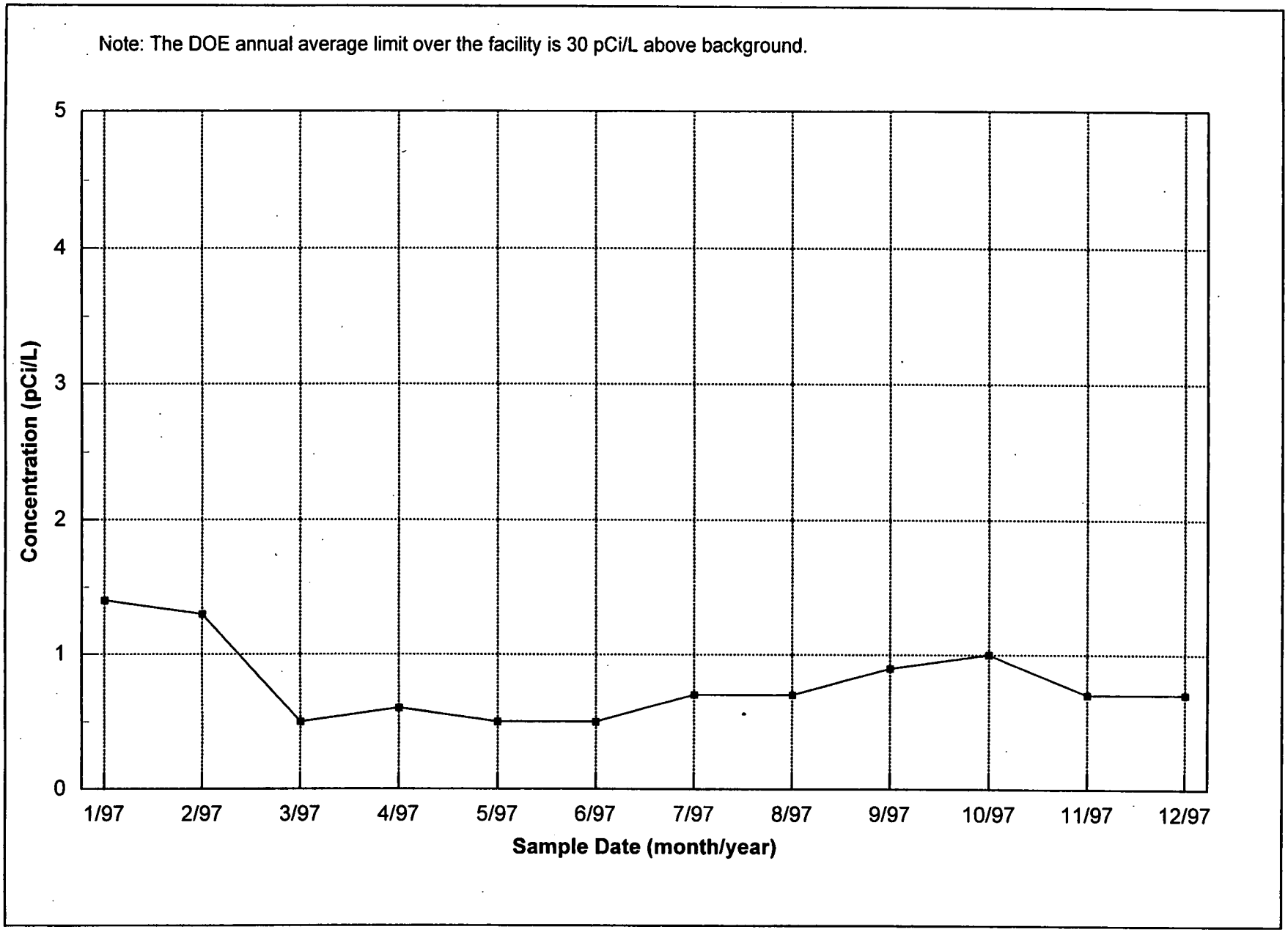


FIGURE C.2-16. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR PILOT PLANT WAREHOUSE

000543

Note: The DOE annual average limit over the facility is 30 pCi/L above background.

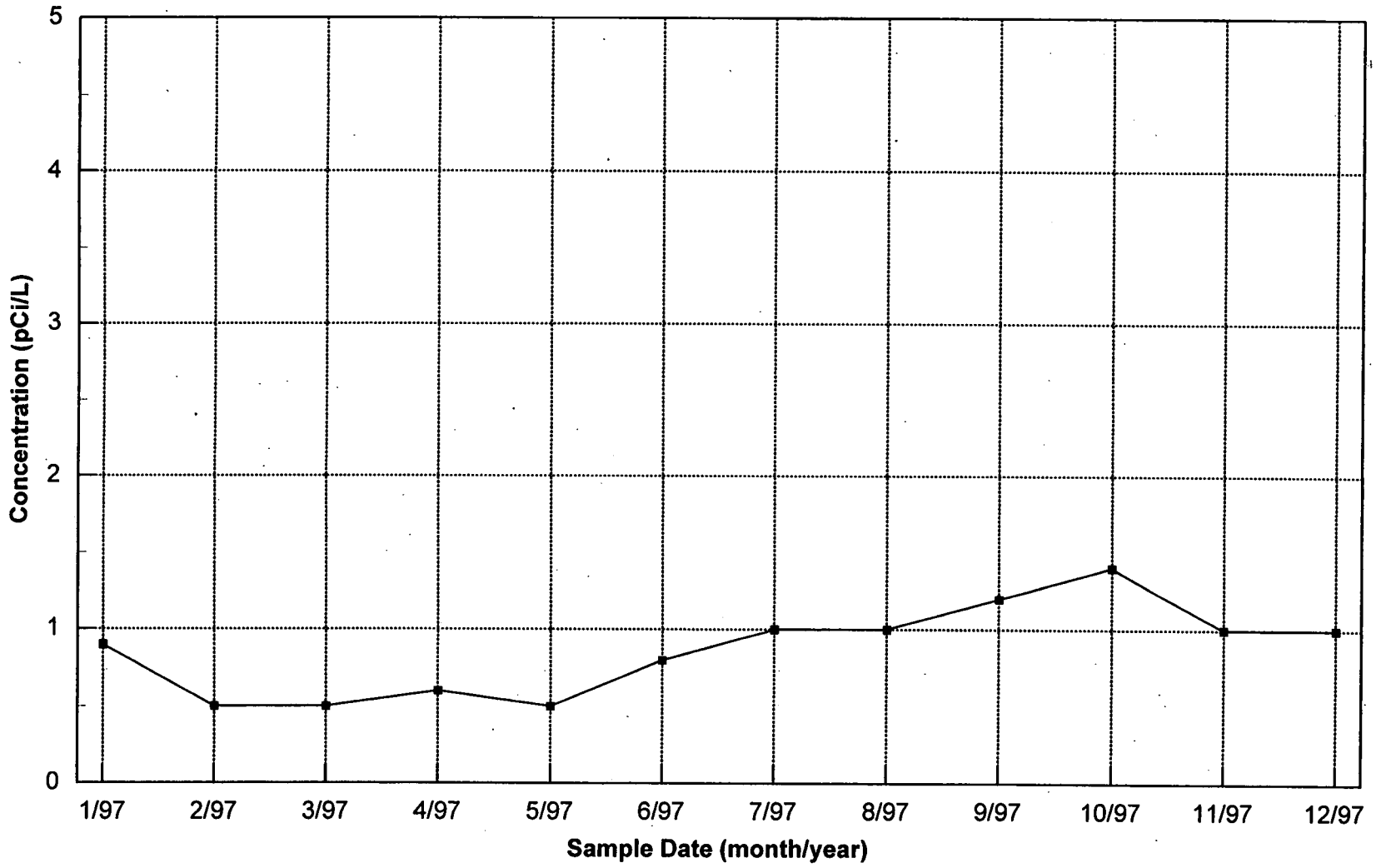


FIGURE C.2-17. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR PIT 5

Note: The DOE annual average limit over the facility is 30 pCi/L above background.

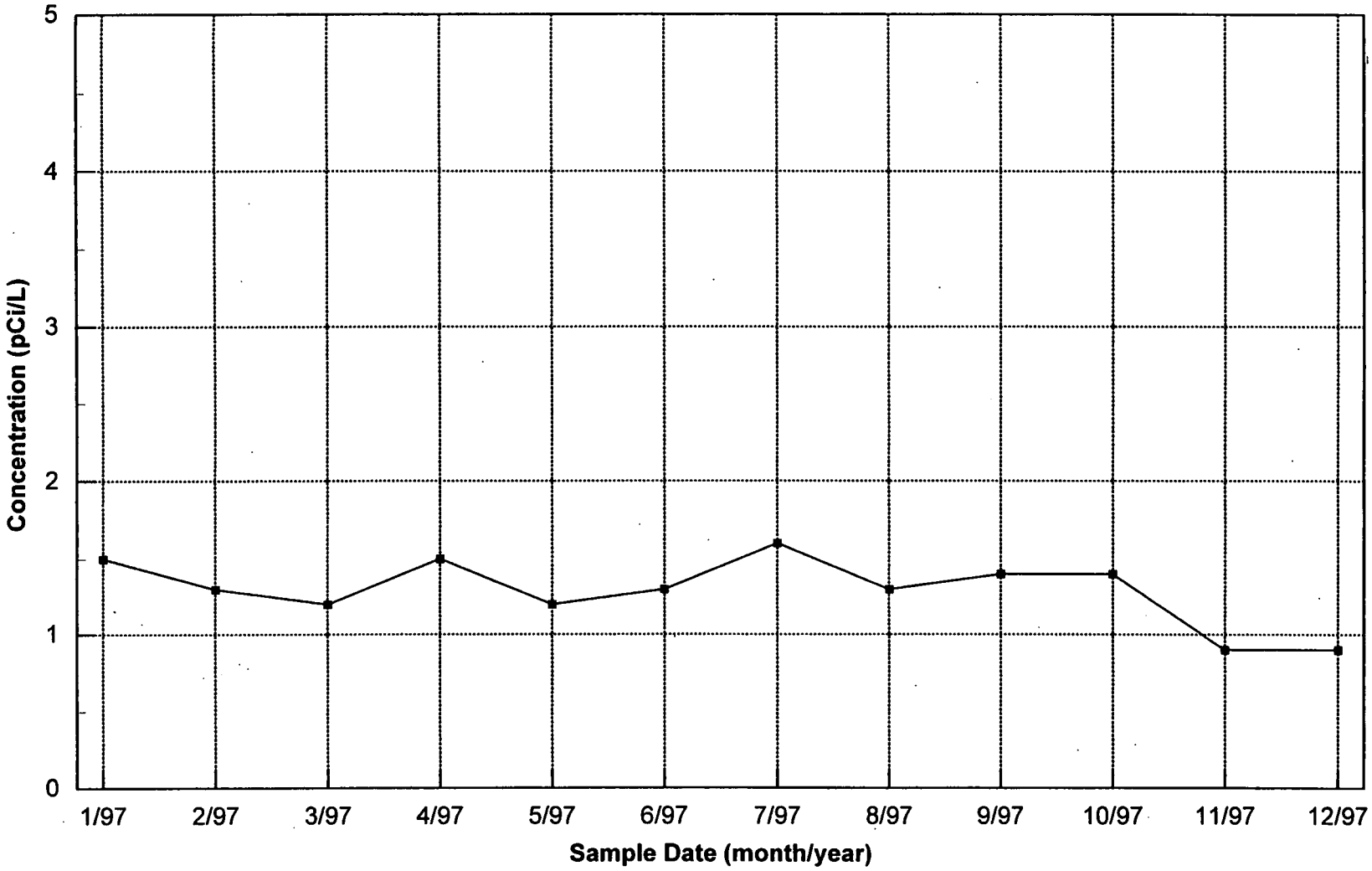


FIGURE C.2-18. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR RALLY POINT 4

000545

Note: The DOE annual average limit over the facility is 30 pCi/L above background.

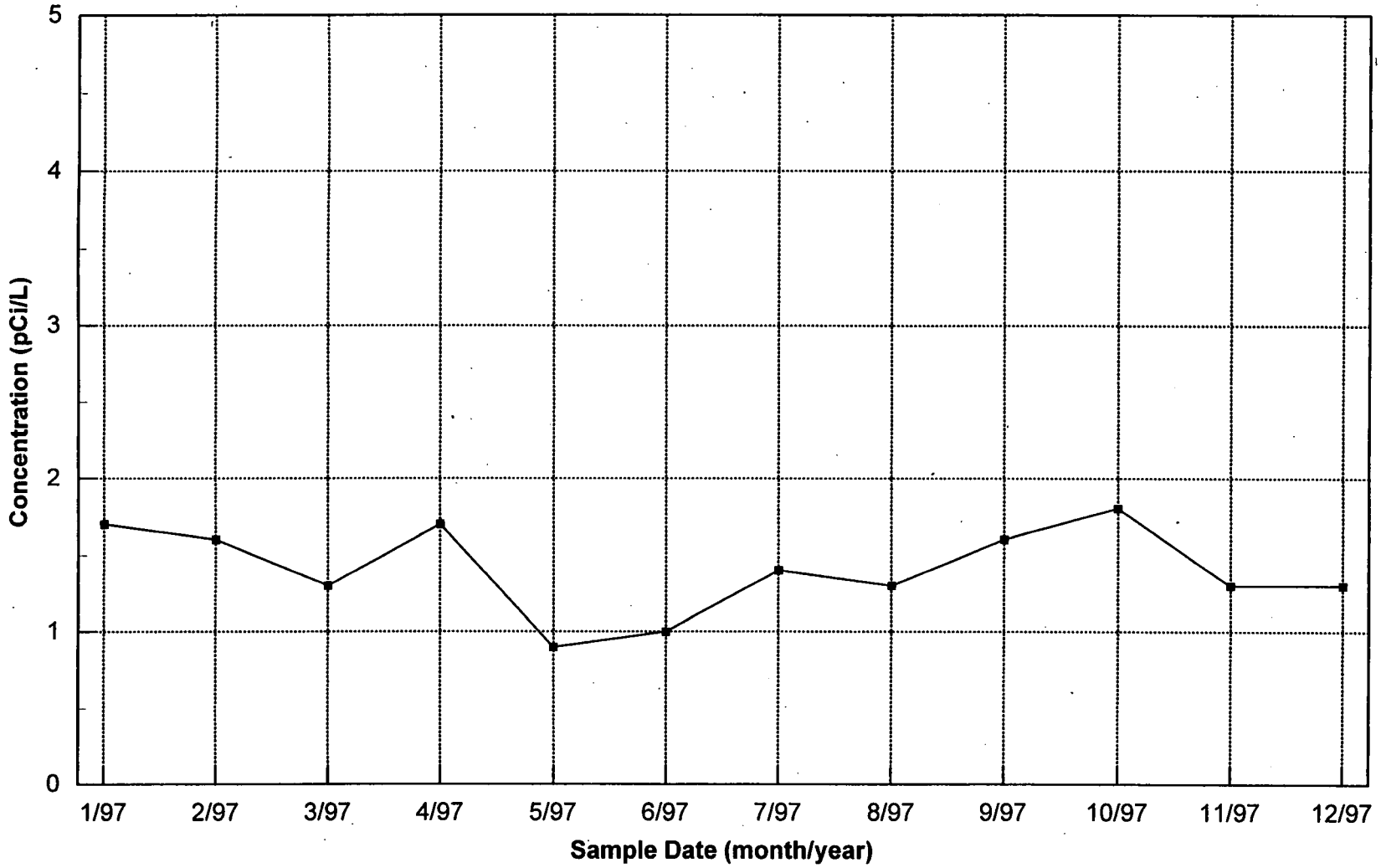


FIGURE C.2-19. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR SURGE LAGOON

Note: The DOE annual average limit over the facility is 30 pCi/L above background.

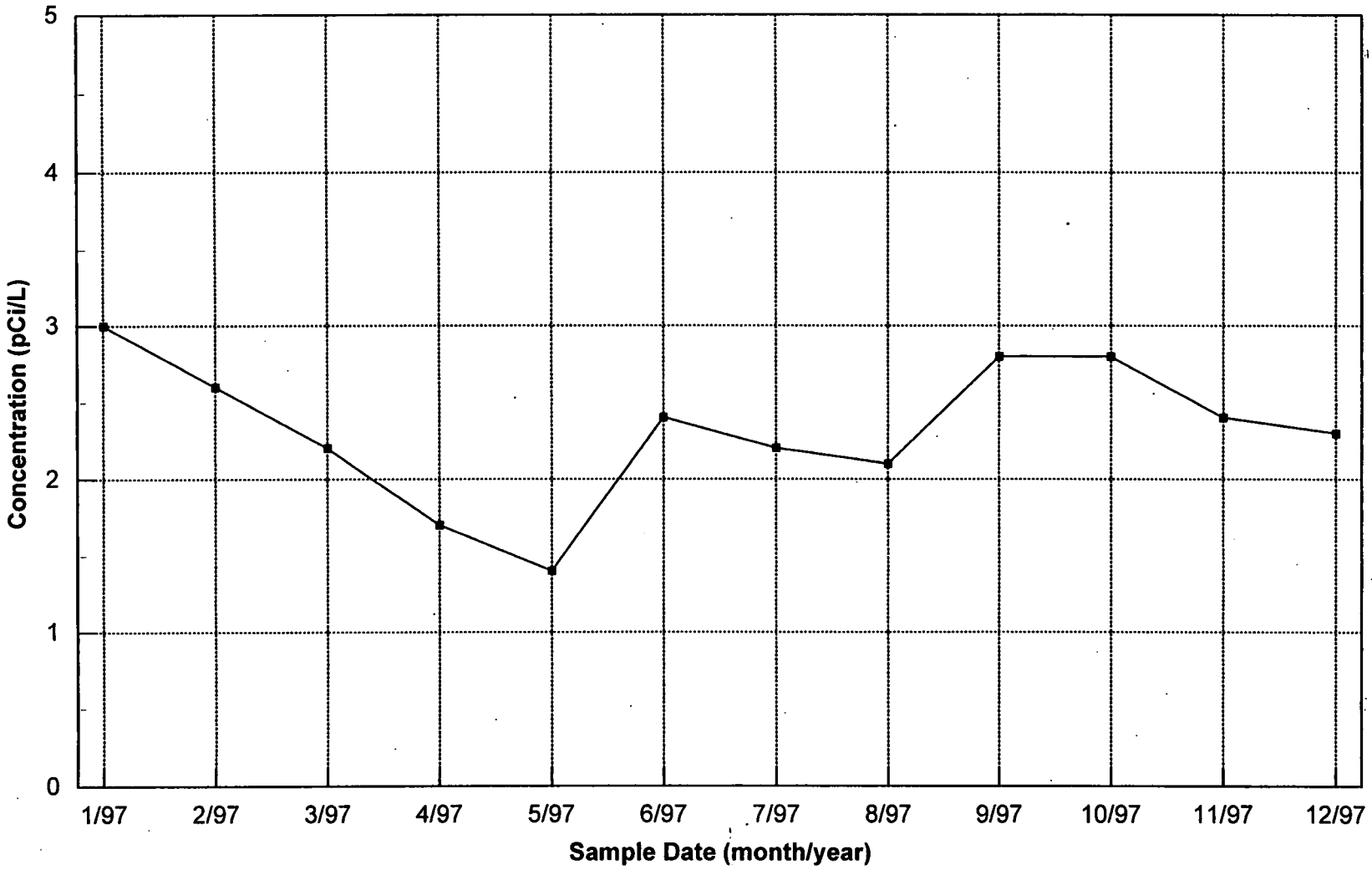


FIGURE C.2-20. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR T28

000547

Note: The DOE annual average limit over the facility is 30 pCi/L above background.

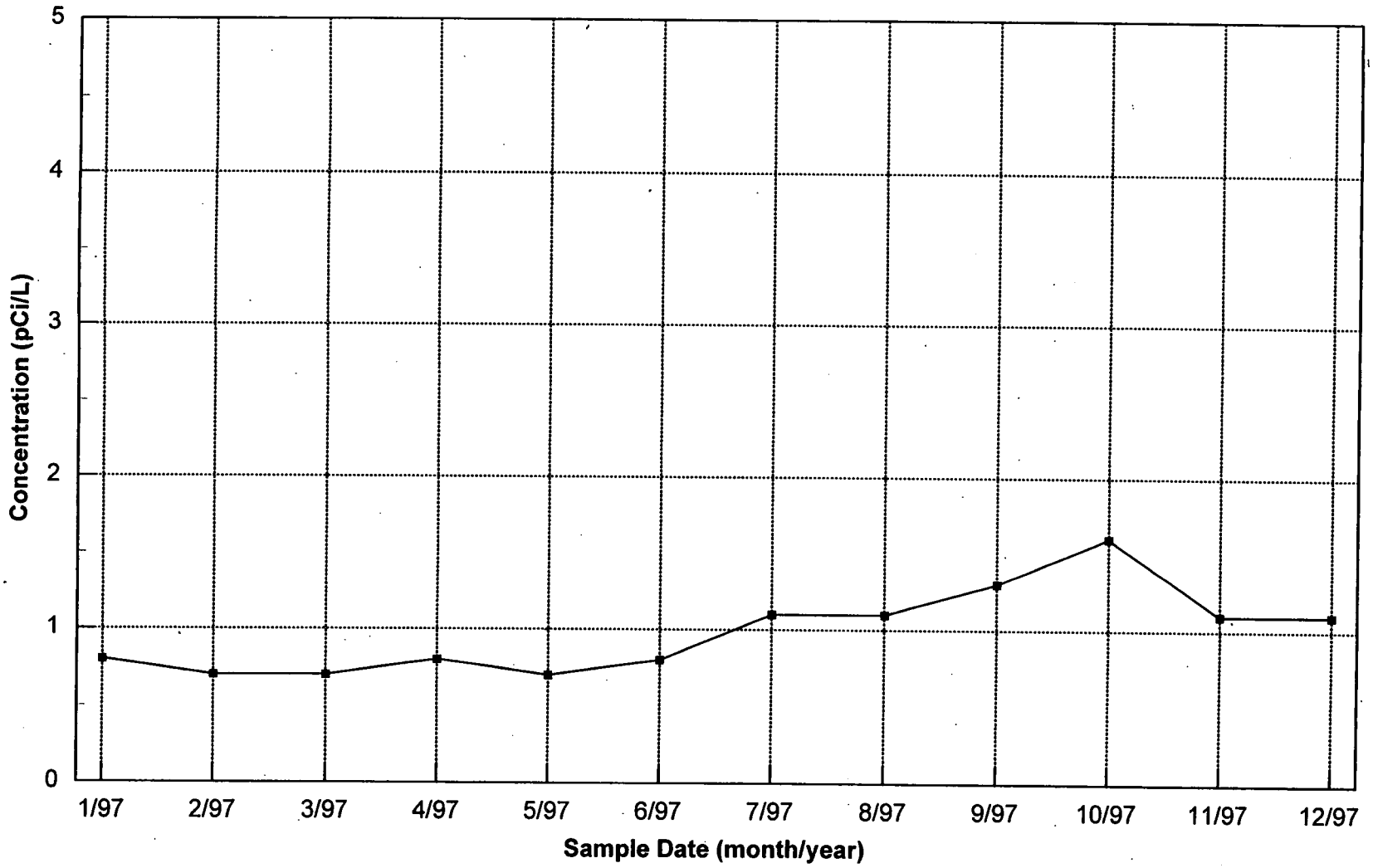
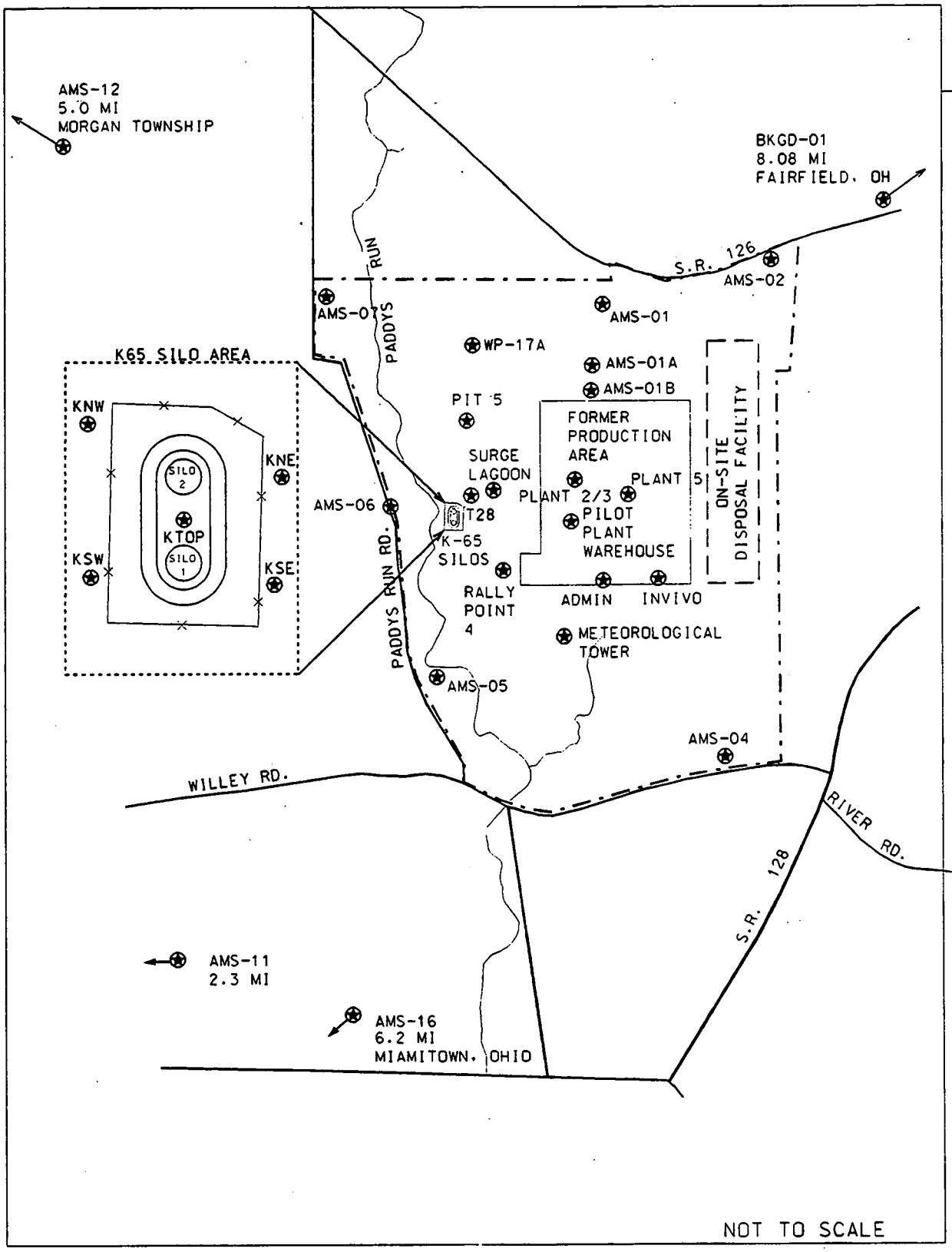


FIGURE C.2-21. 1997 MONTHLY AVERAGE CONTINUOUS RADON CONCENTRATION FOR WP-17A

000548

1470



LEGEND:

— · — · — FEMP BOUNDARY

RADON MONITORING-CONTINUOUS ALPHA SCINTILLATION LOCATION

DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO LOCATION OFF MAP

FIGURE C.2-22. 1992-1996 RADON MONITORING-CONTINUOUS ALPHA SCINTILLATION LOCATIONS

000549

/dgis/5fdp1/dgn/97annual/97an062.dgn

26-MAY-1998

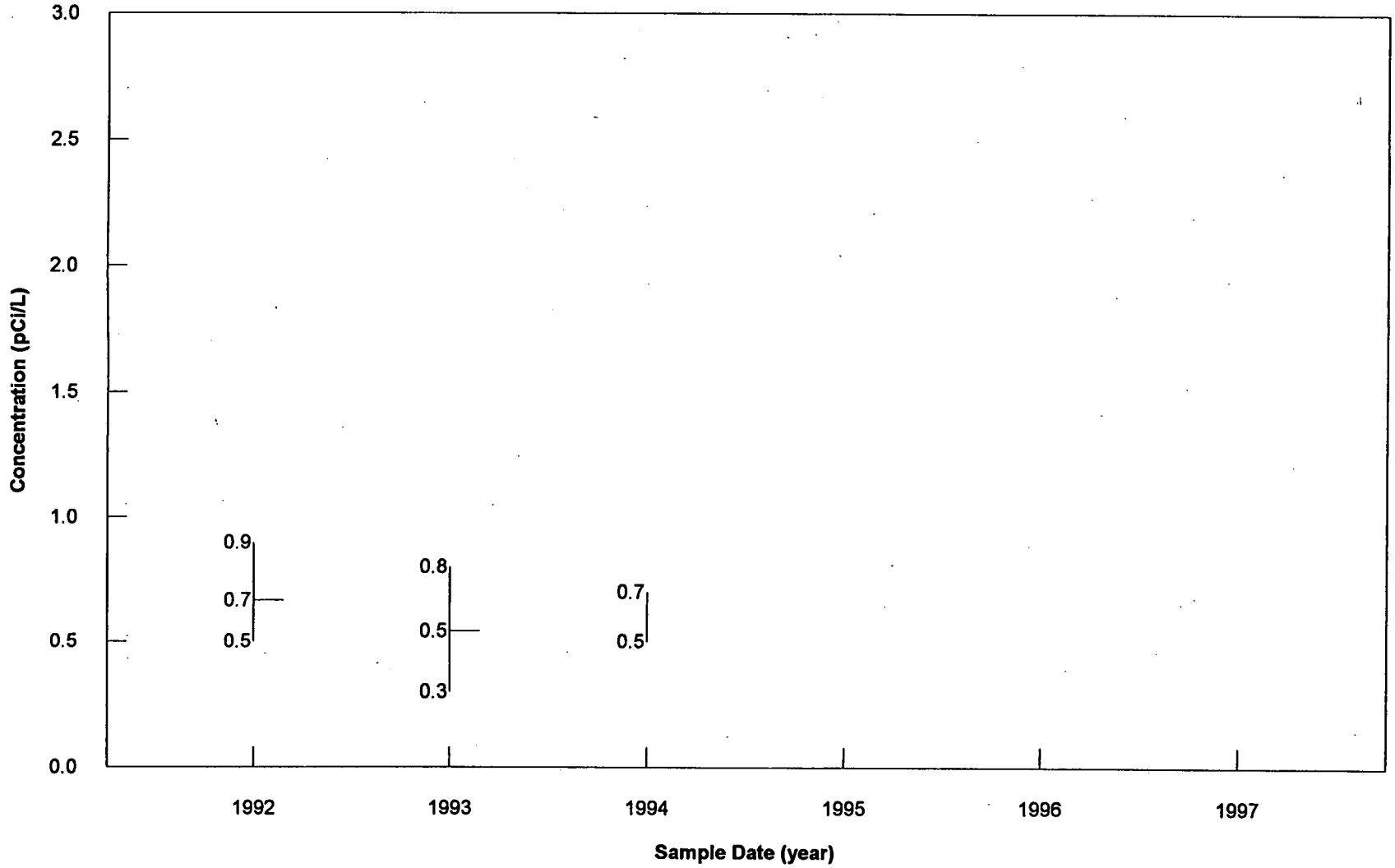


FIGURE C.2-23. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR ADMIN

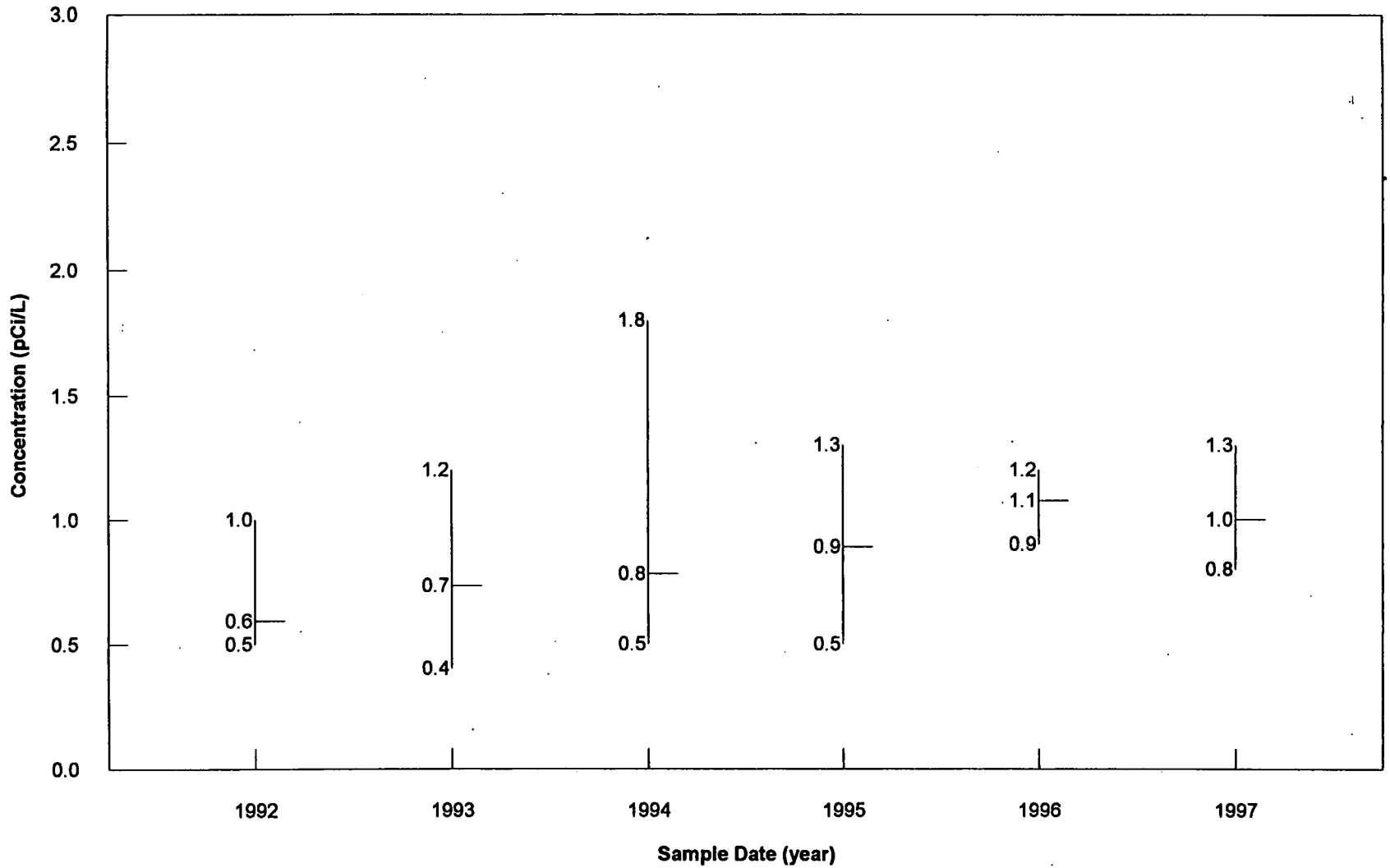


FIGURE C.2-24. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR AMS-01A

000551

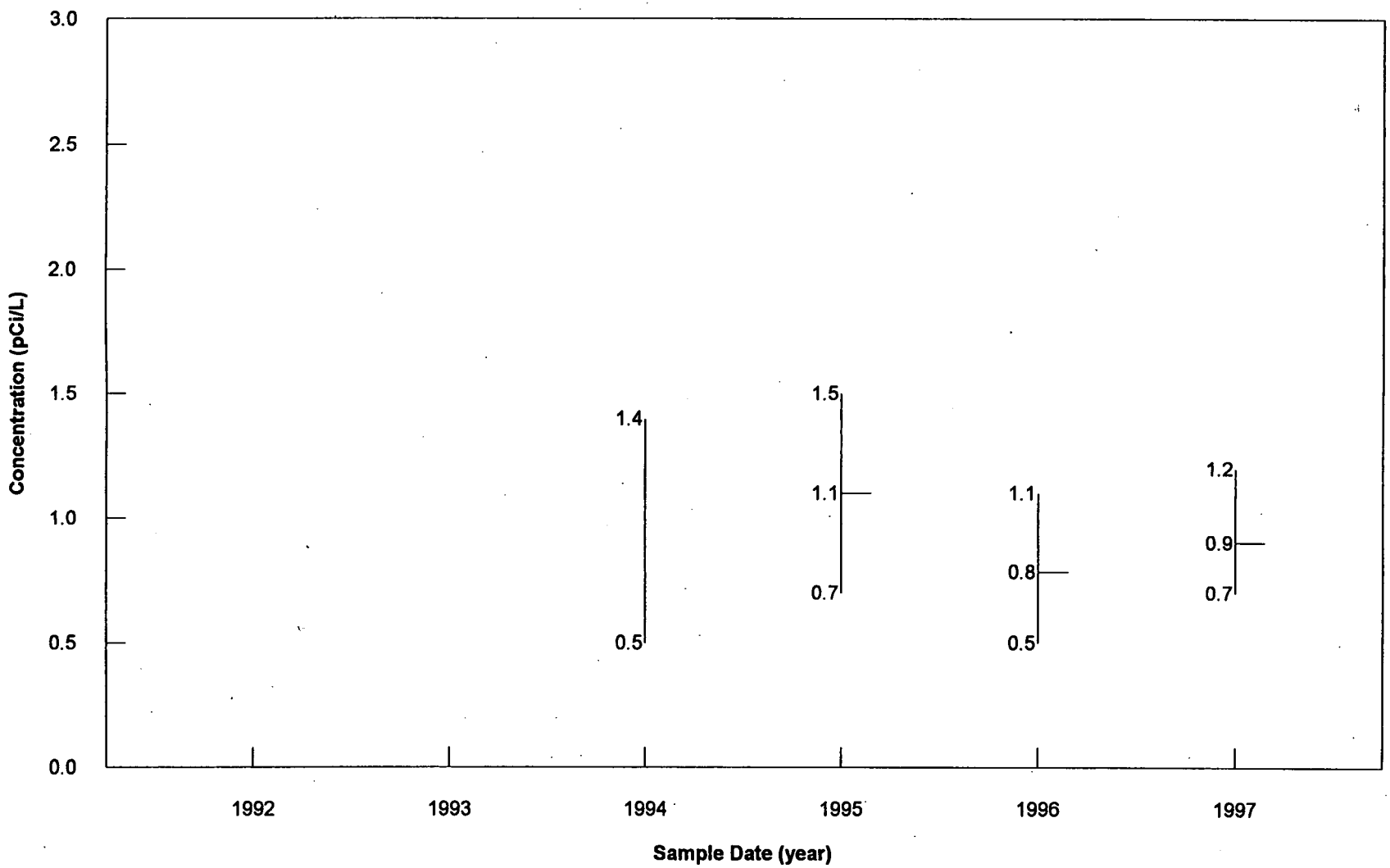


FIGURE C.2-25. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR AMS-02

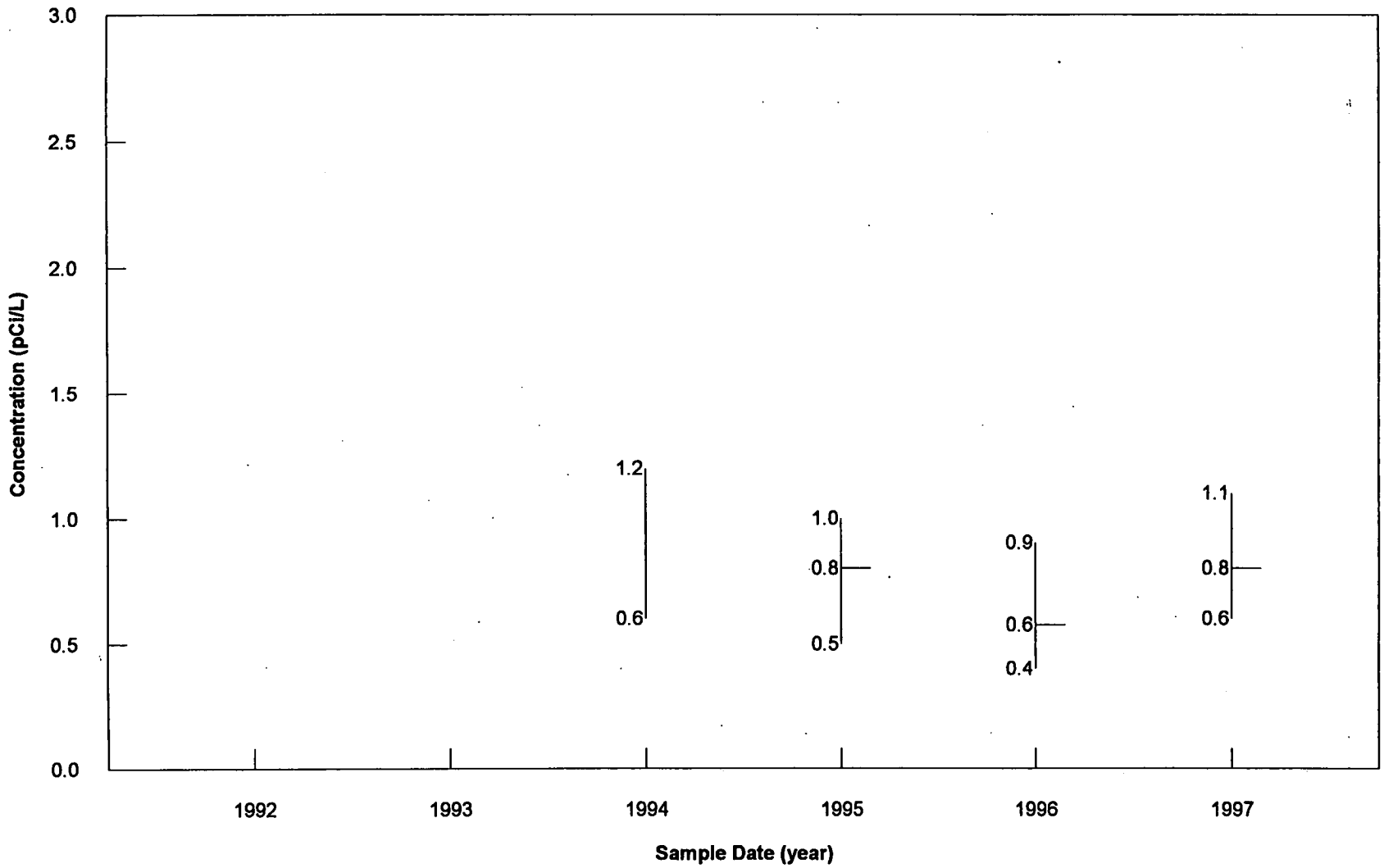


FIGURE C.2-26. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR AMS-04

000553

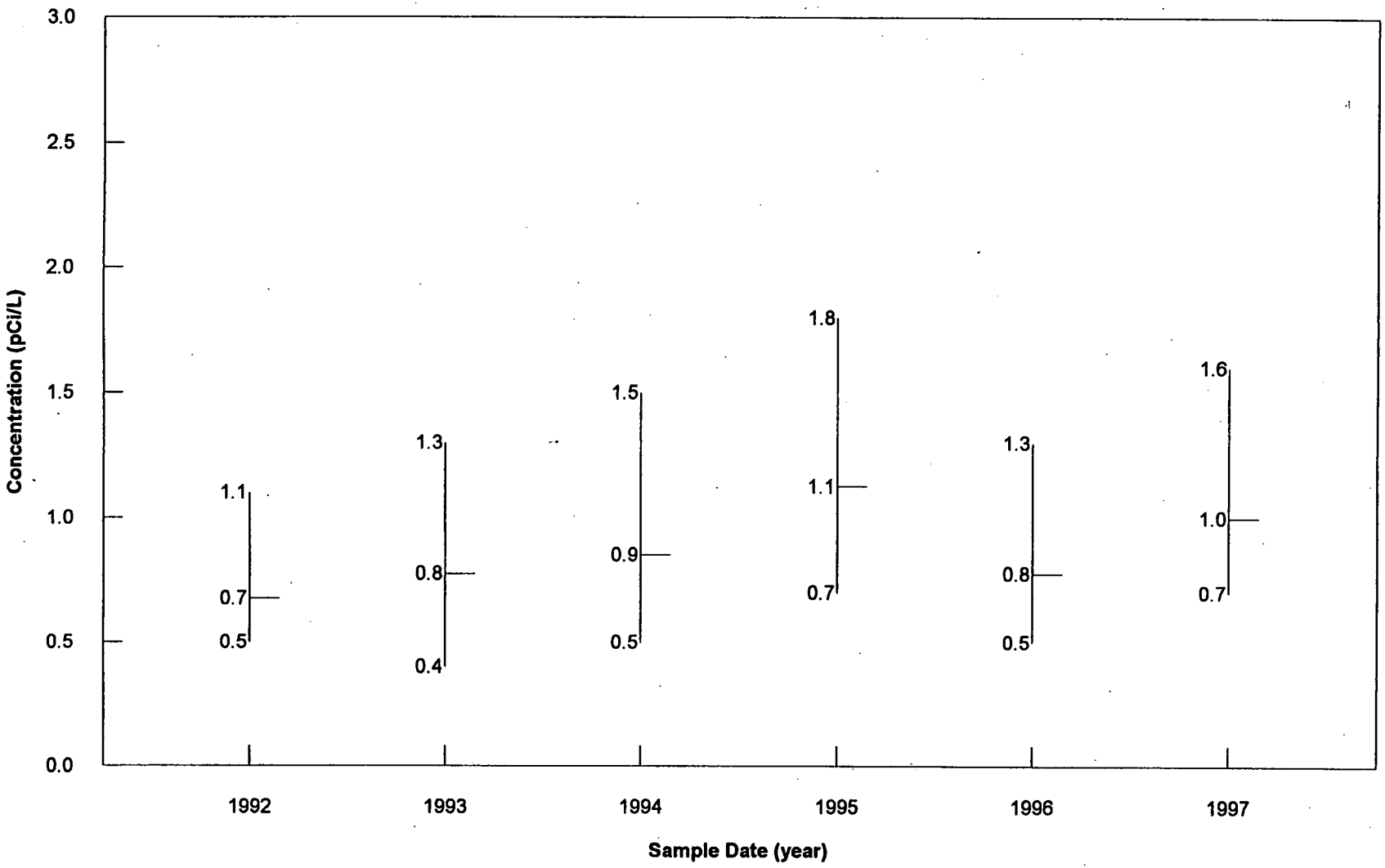


FIGURE C.2-27. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR AMS-05

000554

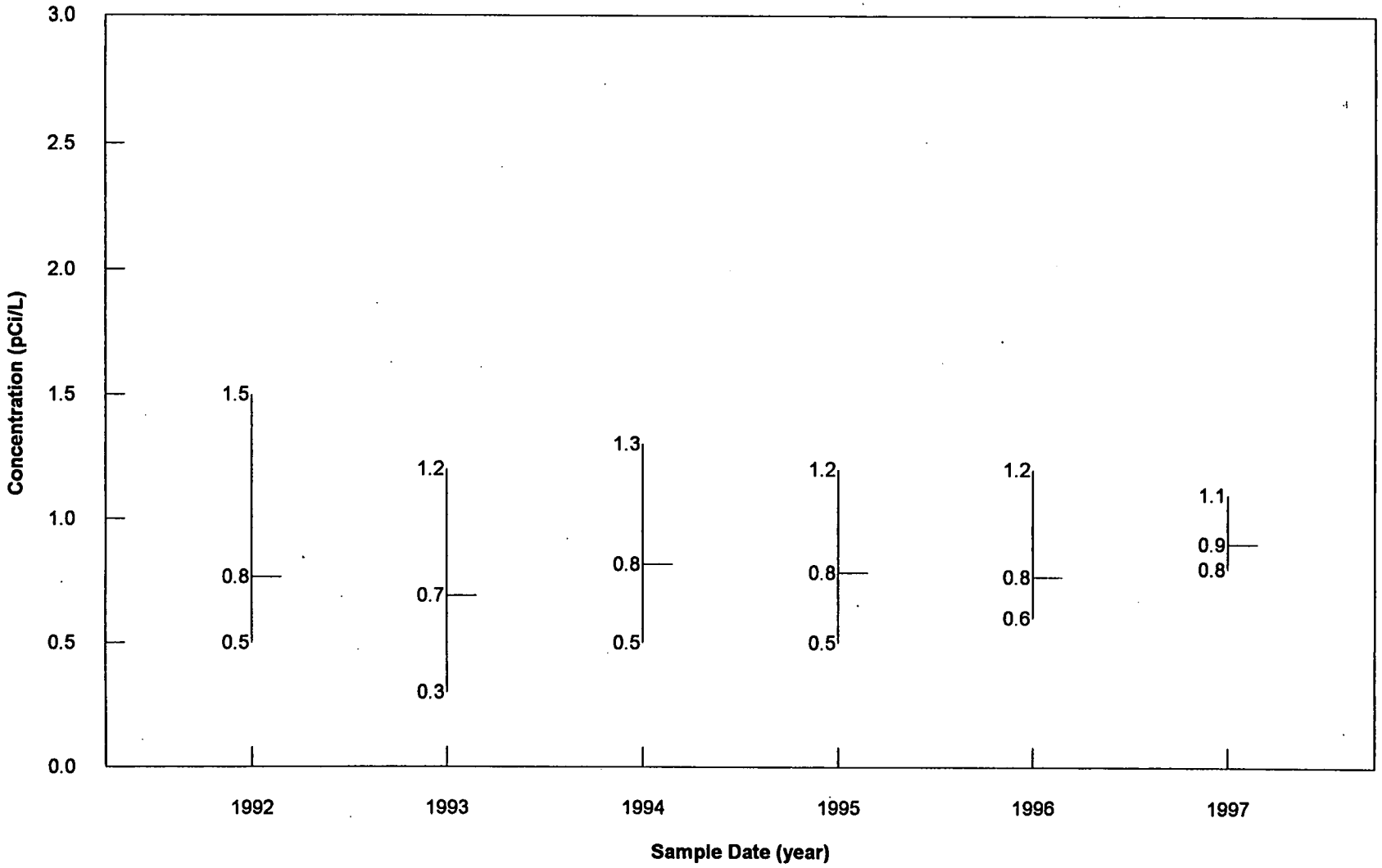


FIGURE C.2-28. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR AMS-06

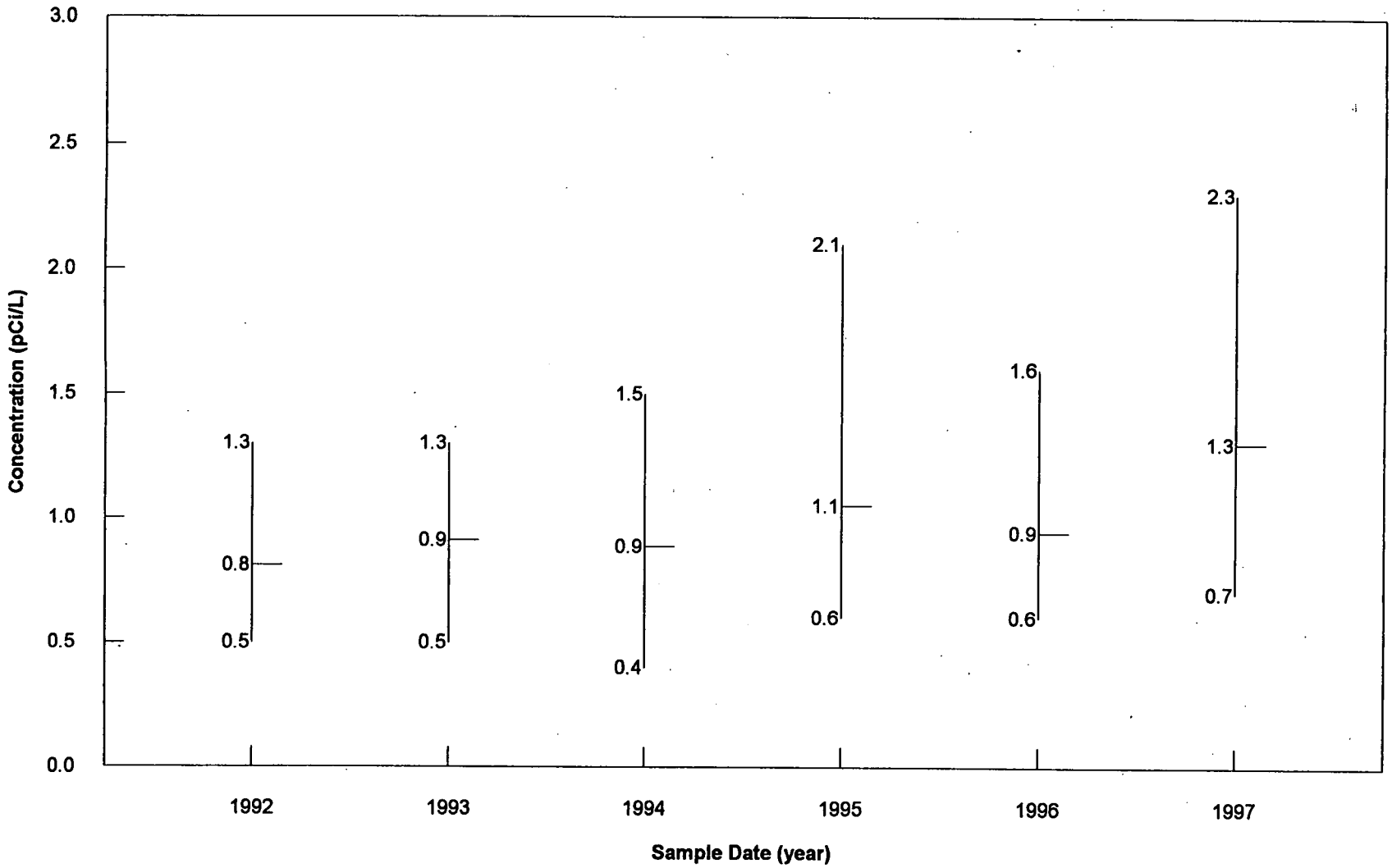


FIGURE C.2-29. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR AMS-07

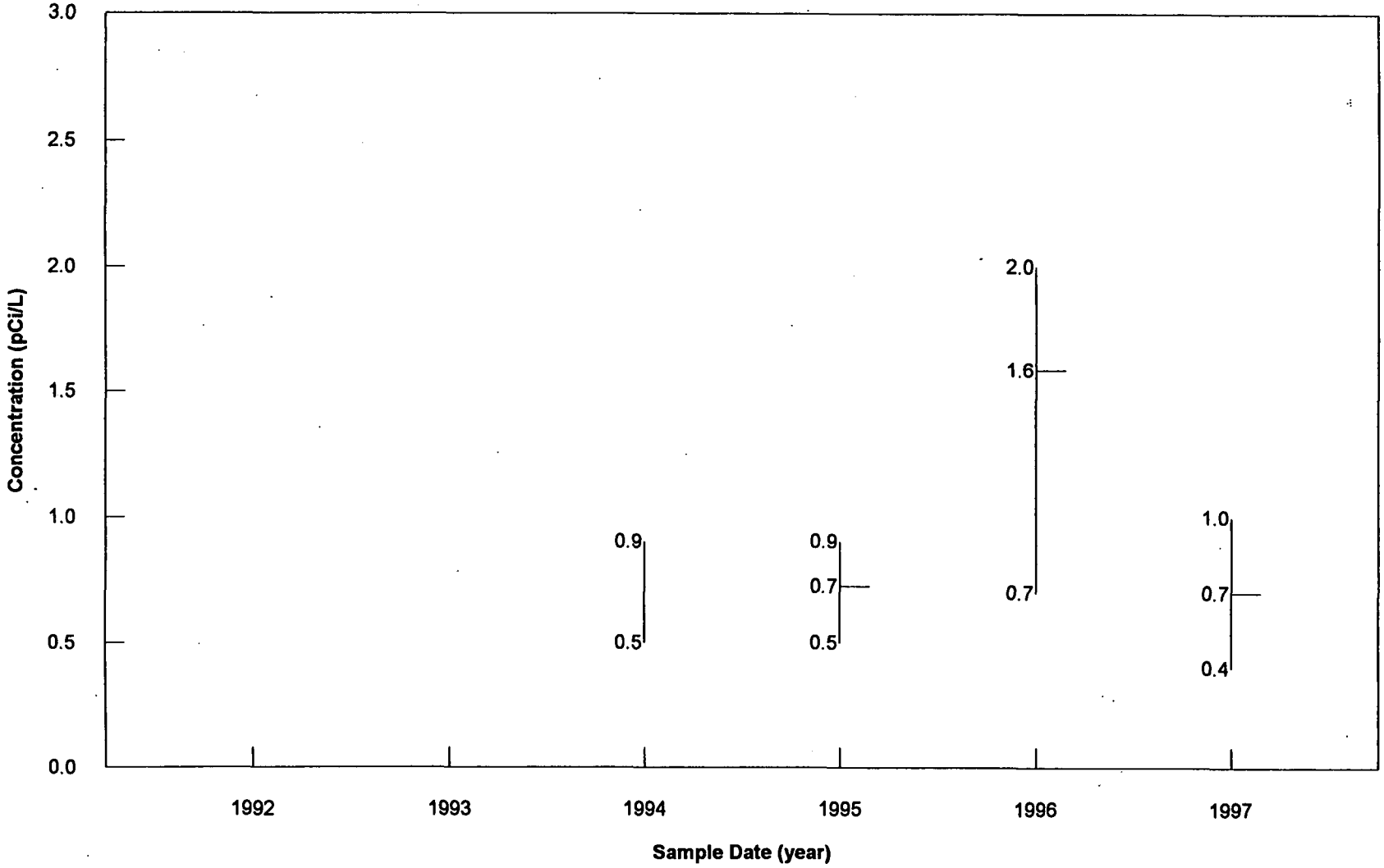


FIGURE C.2-30. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR AMS-12

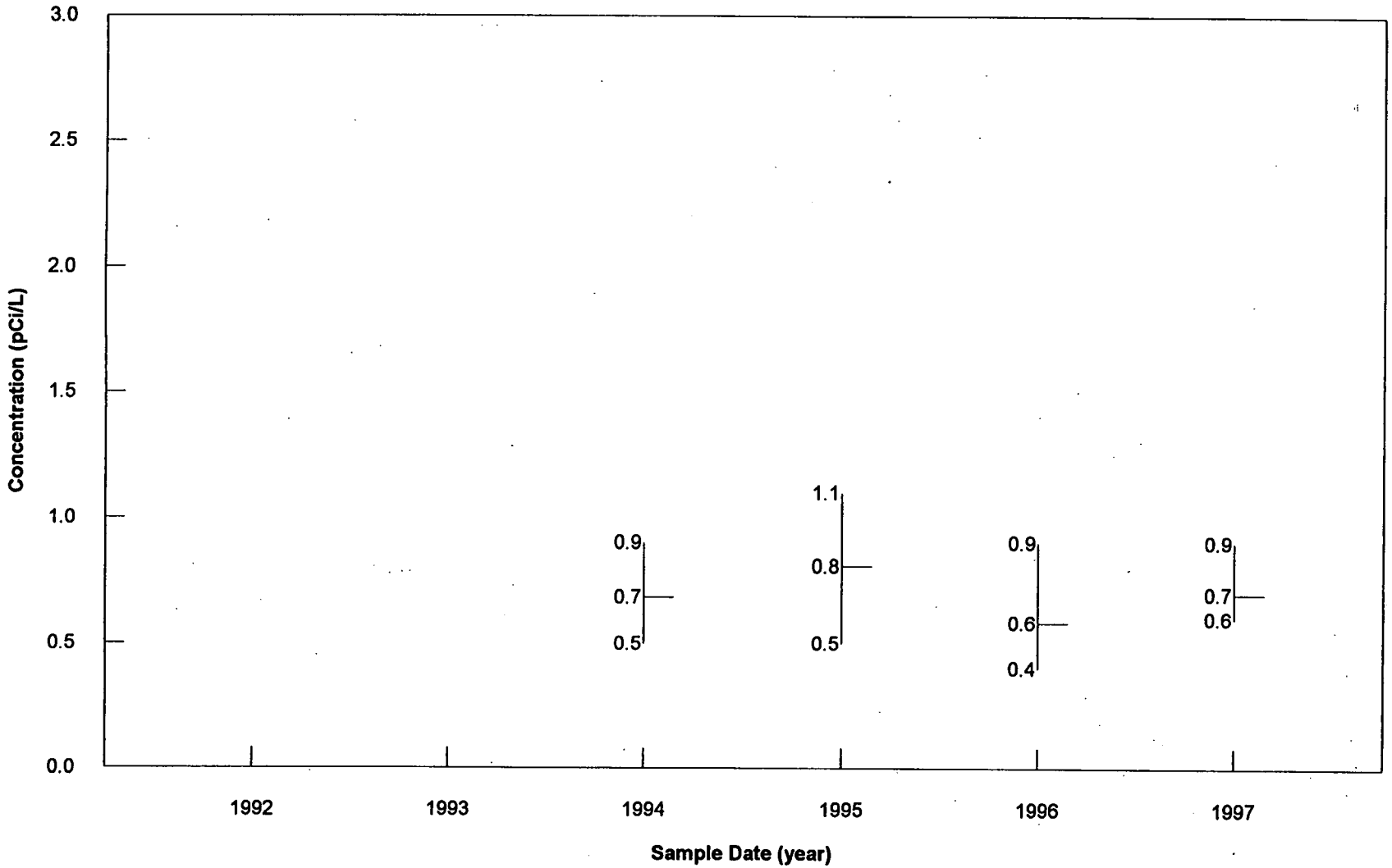


FIGURE C.2-31. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR AMS-16

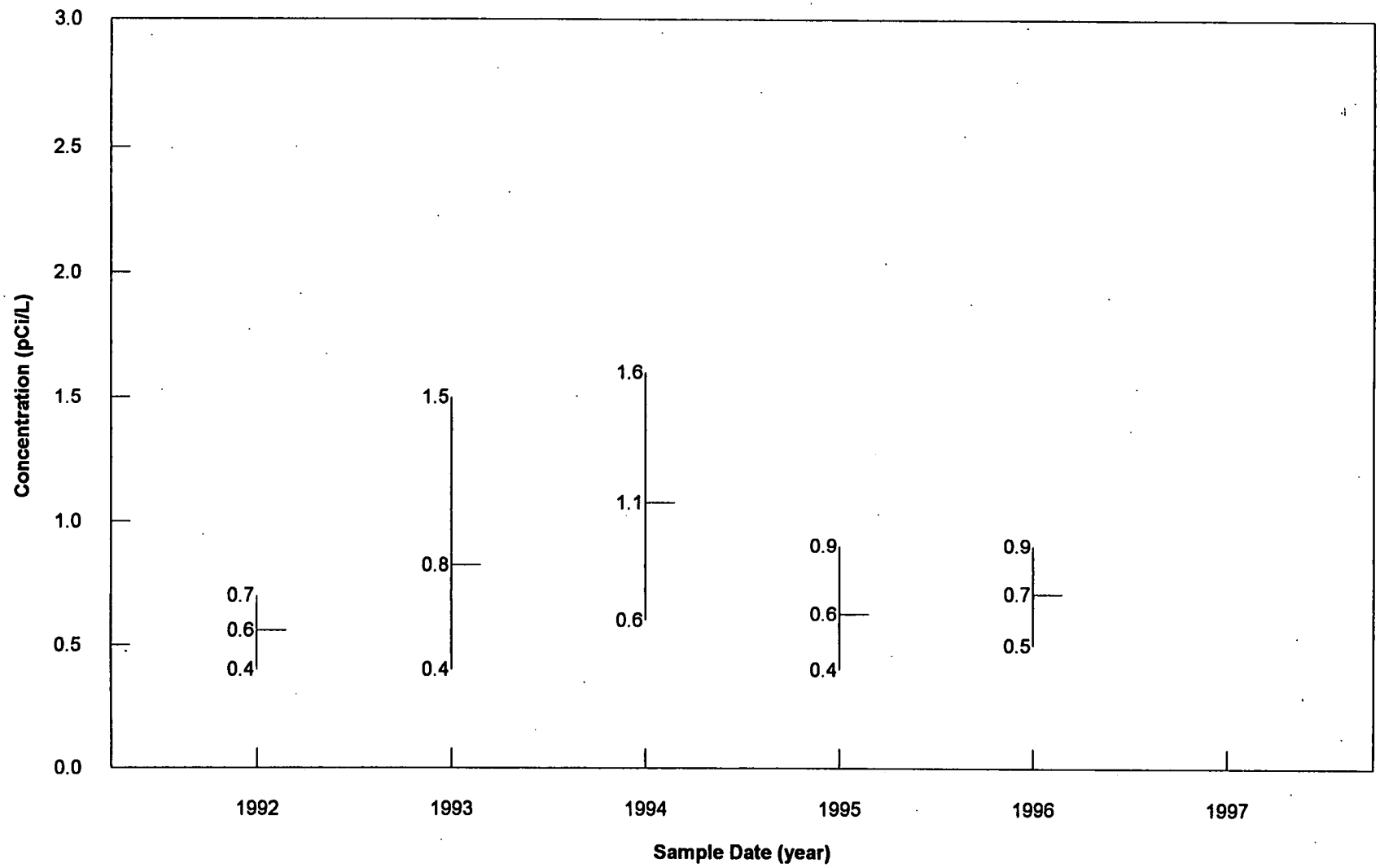


FIGURE C.2-32. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR BKGD-01

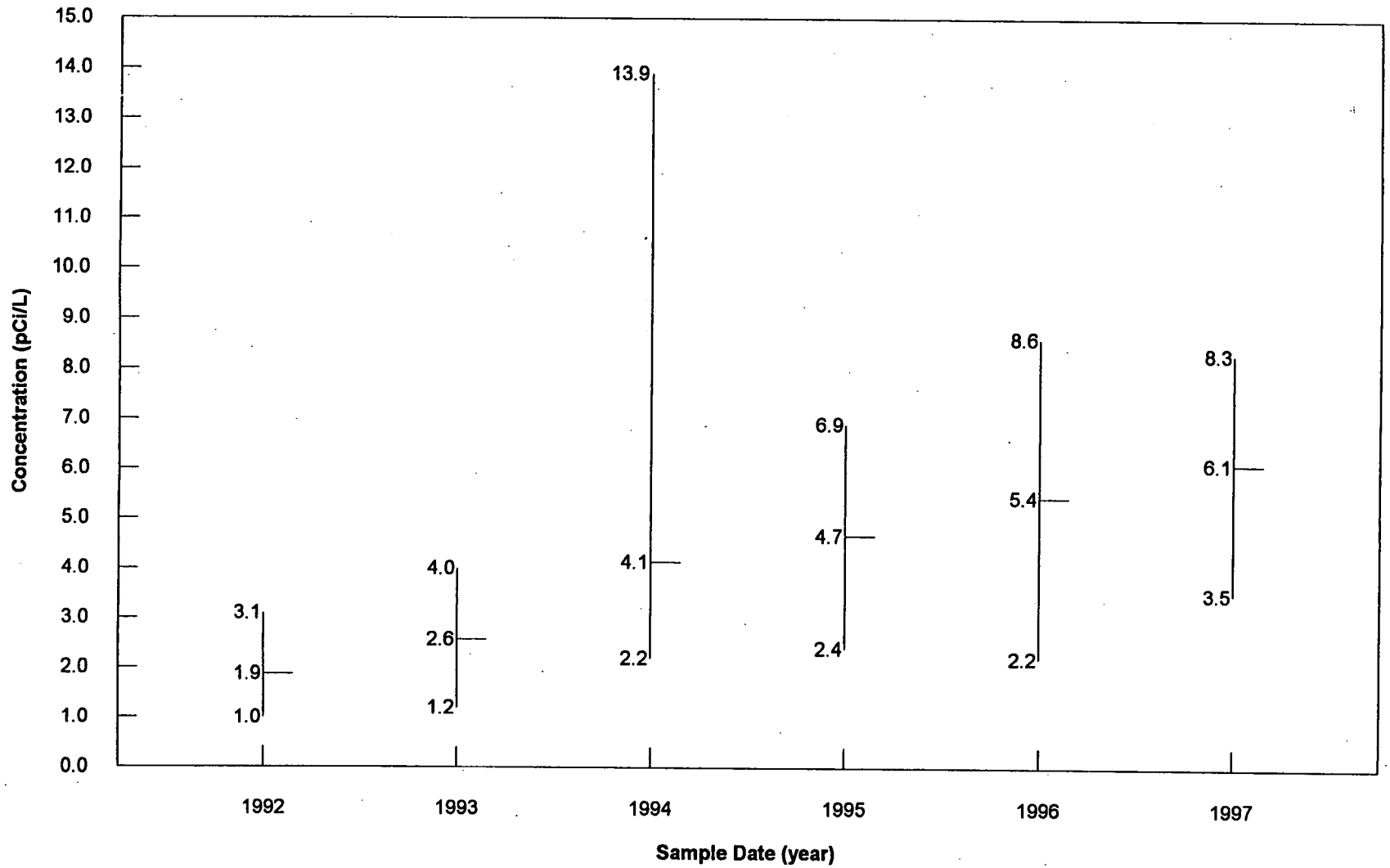


FIGURE C.2-33. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR KNE

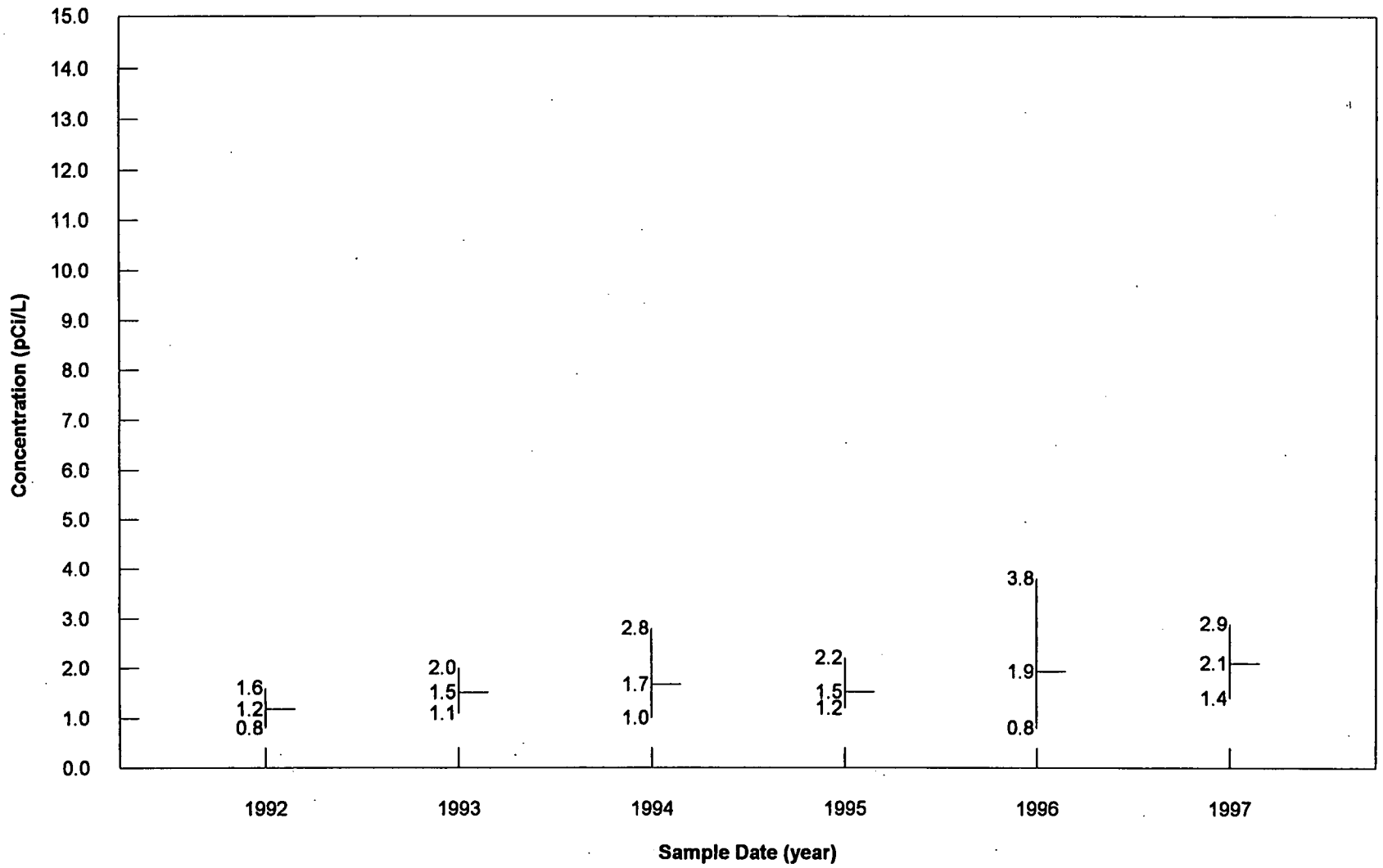


FIGURE C.2-34. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR KNW

000561

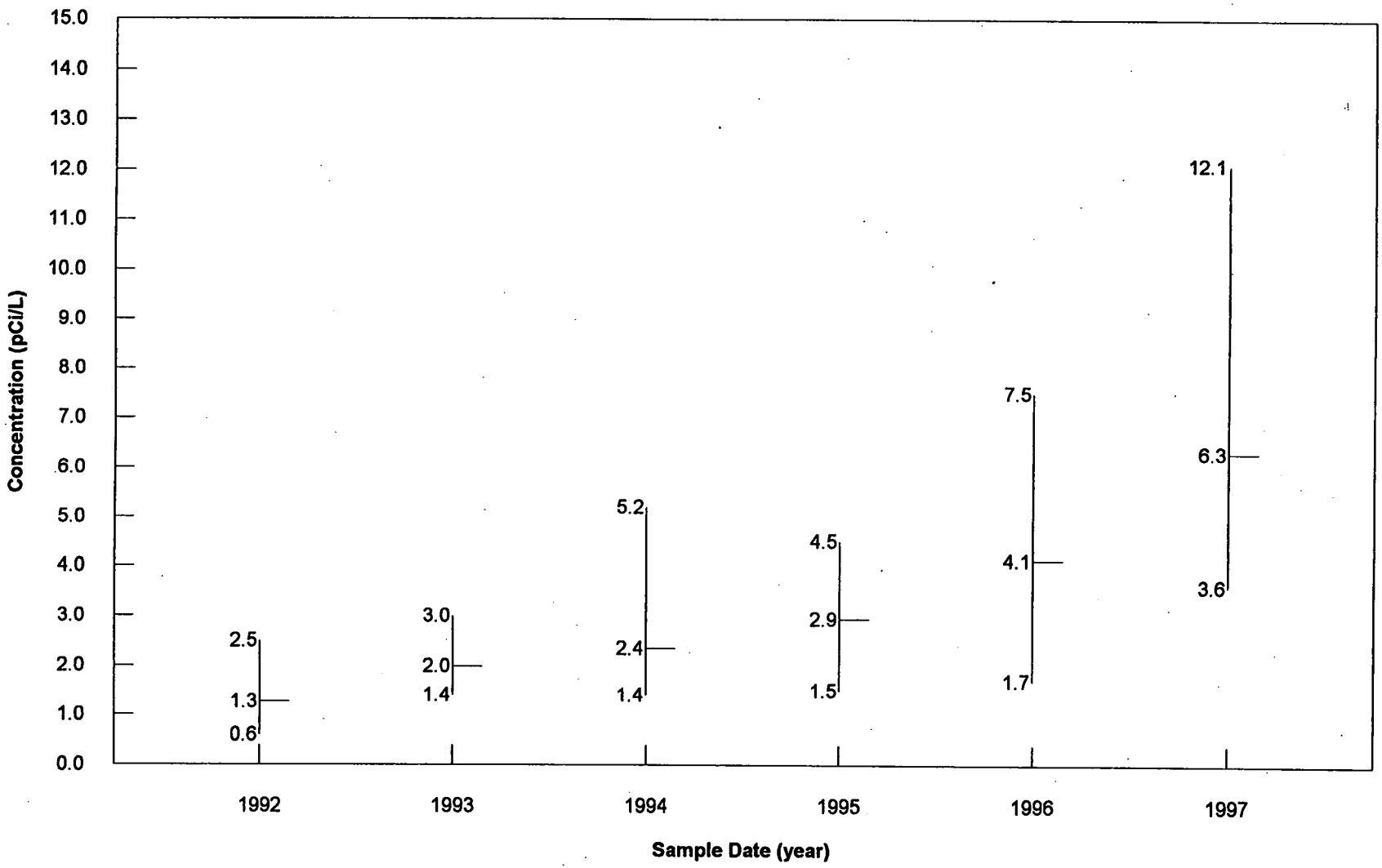


FIGURE C.2-35. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR KSE

000562

1420

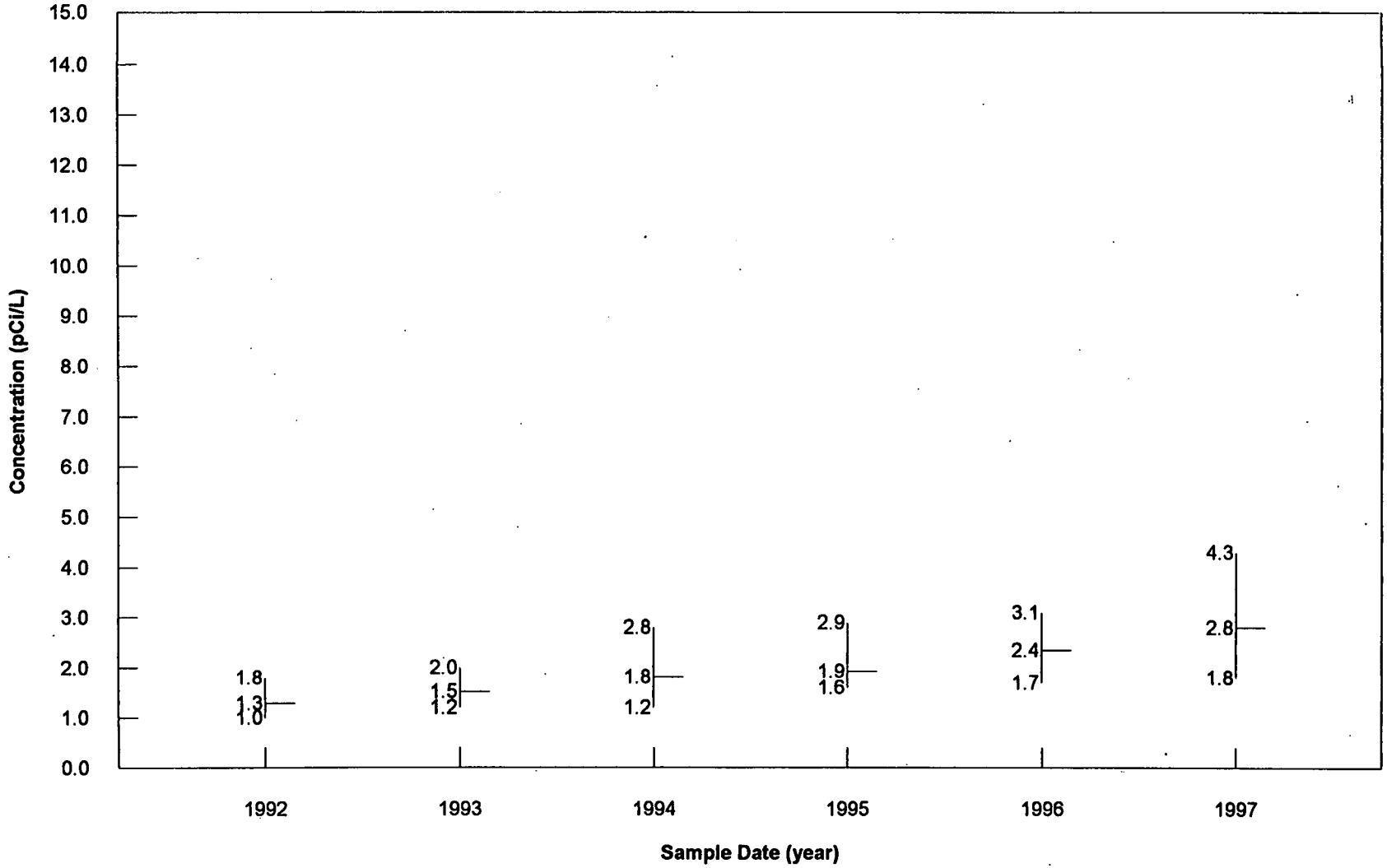


FIGURE C.2-36. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR KSW

000563

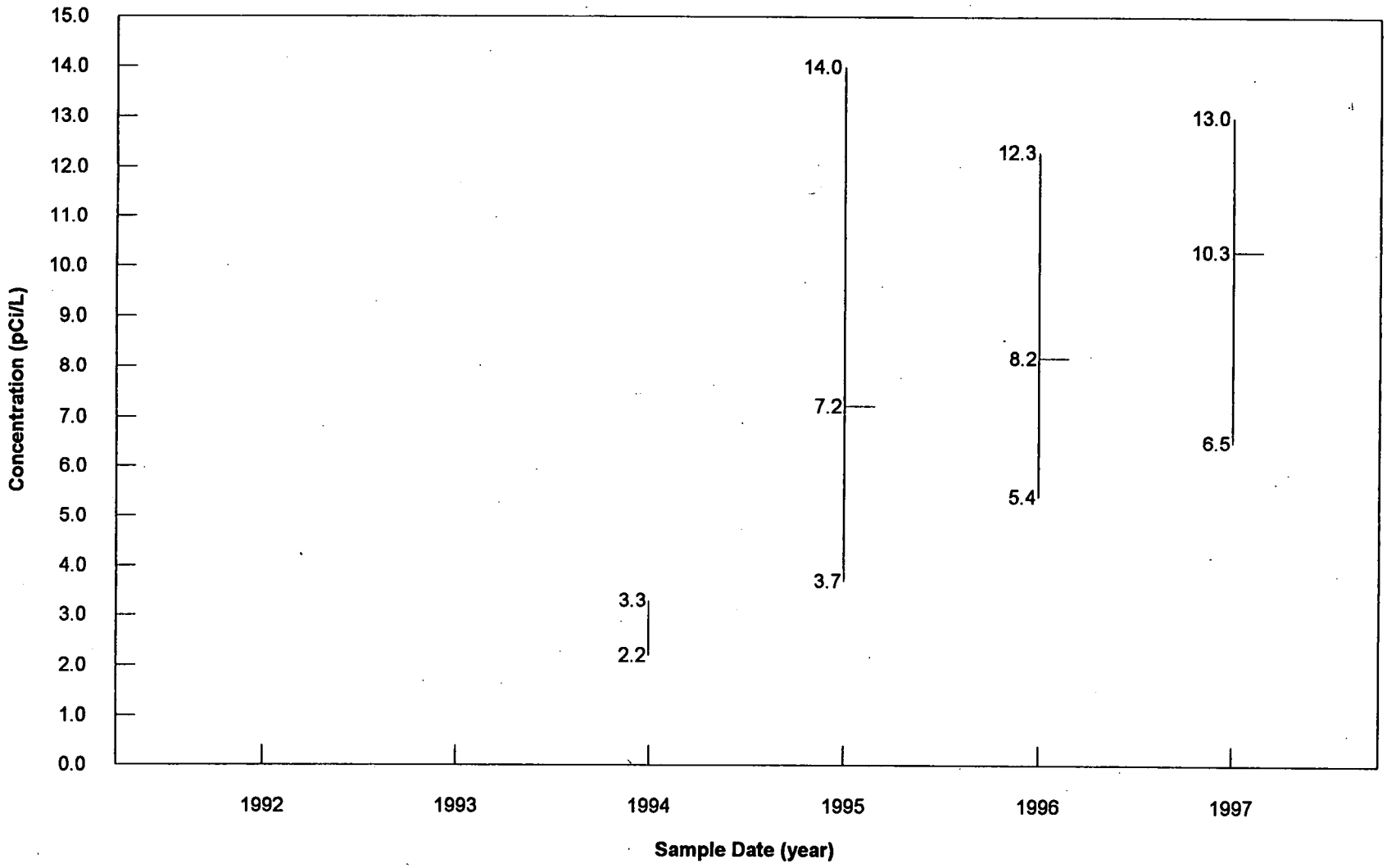


FIGURE C.2-37. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR KTOP

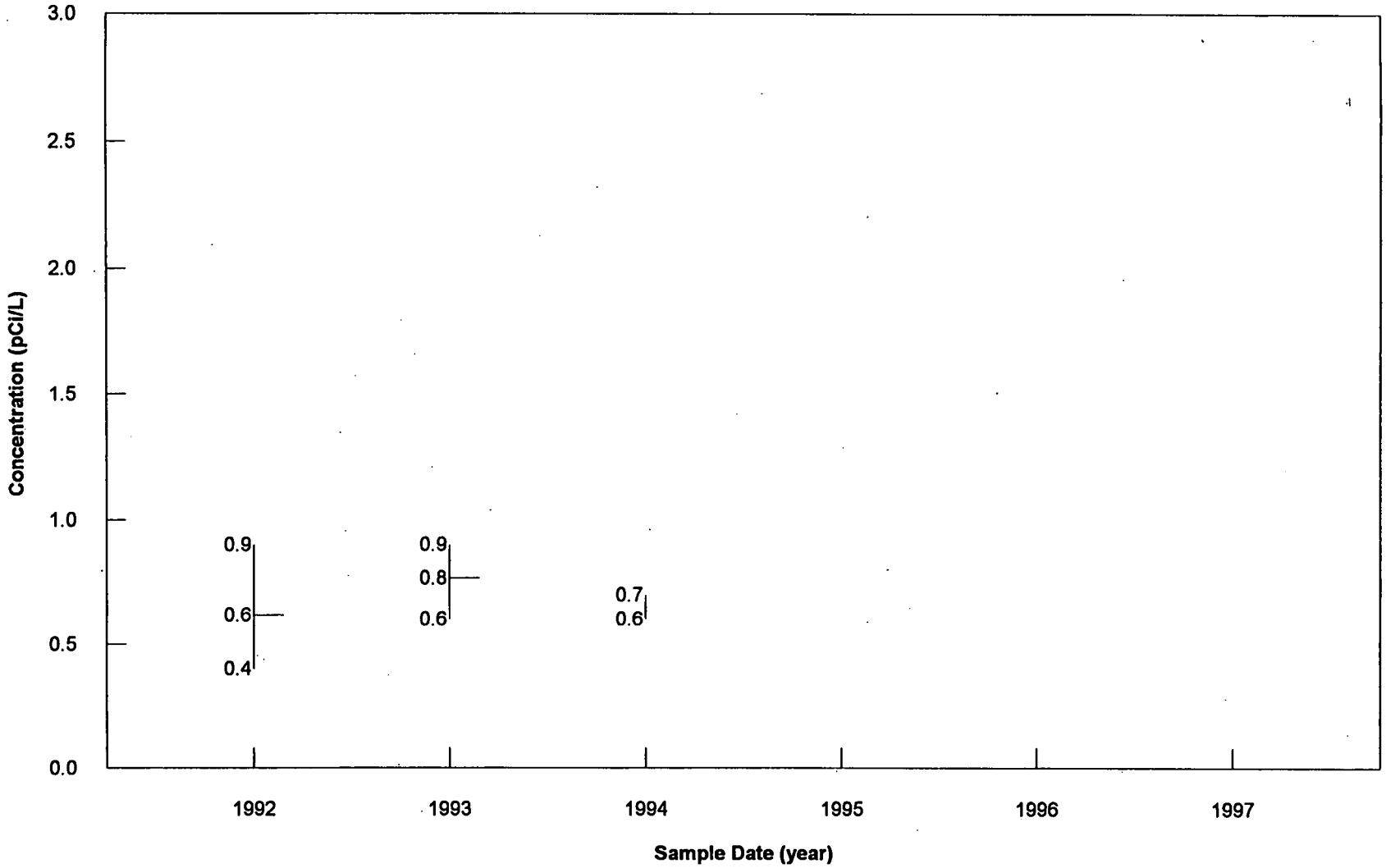


FIGURE C.2-38. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR INVIVO

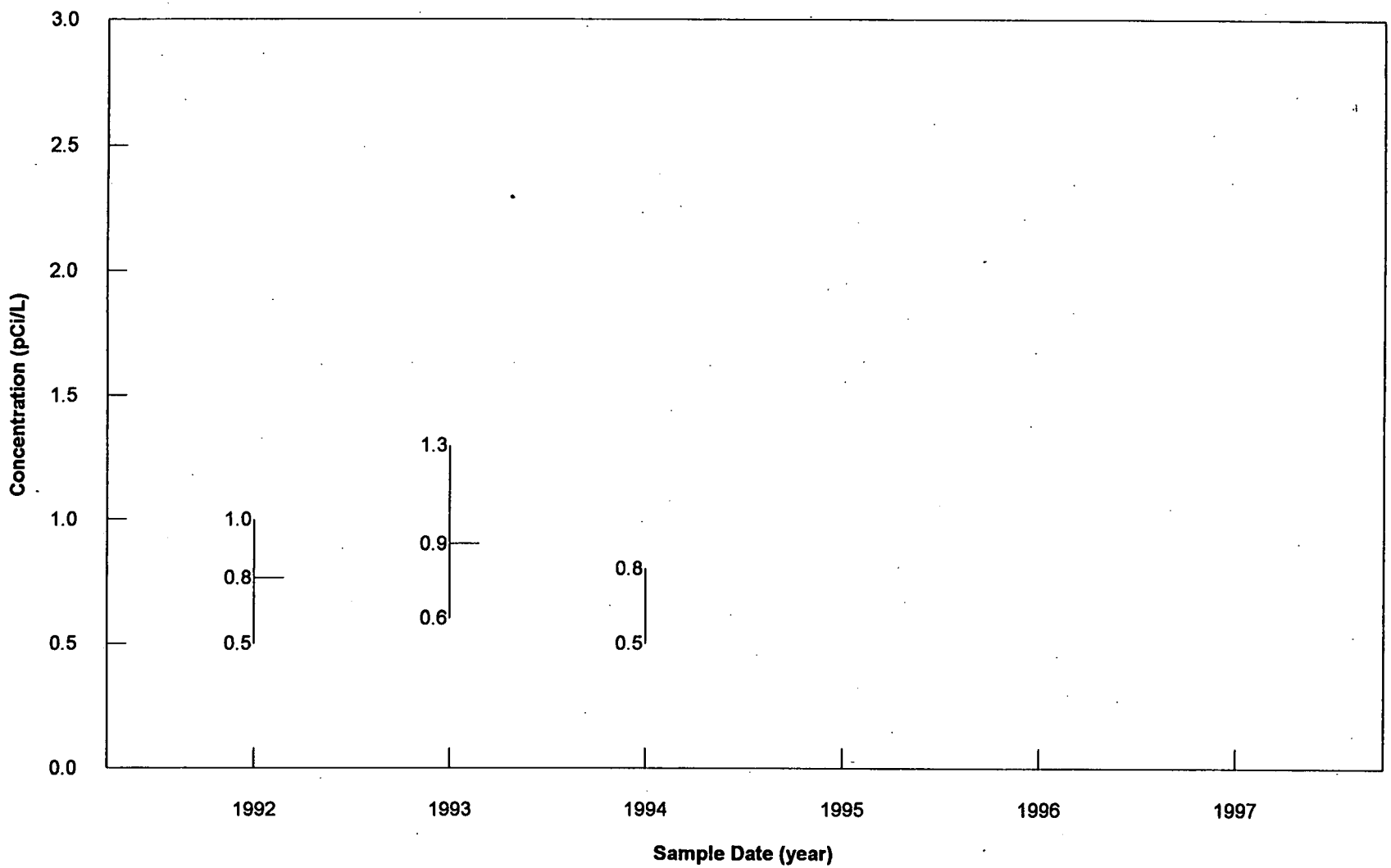


FIGURE C.2-39. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR METEOROLOGICAL TOWER

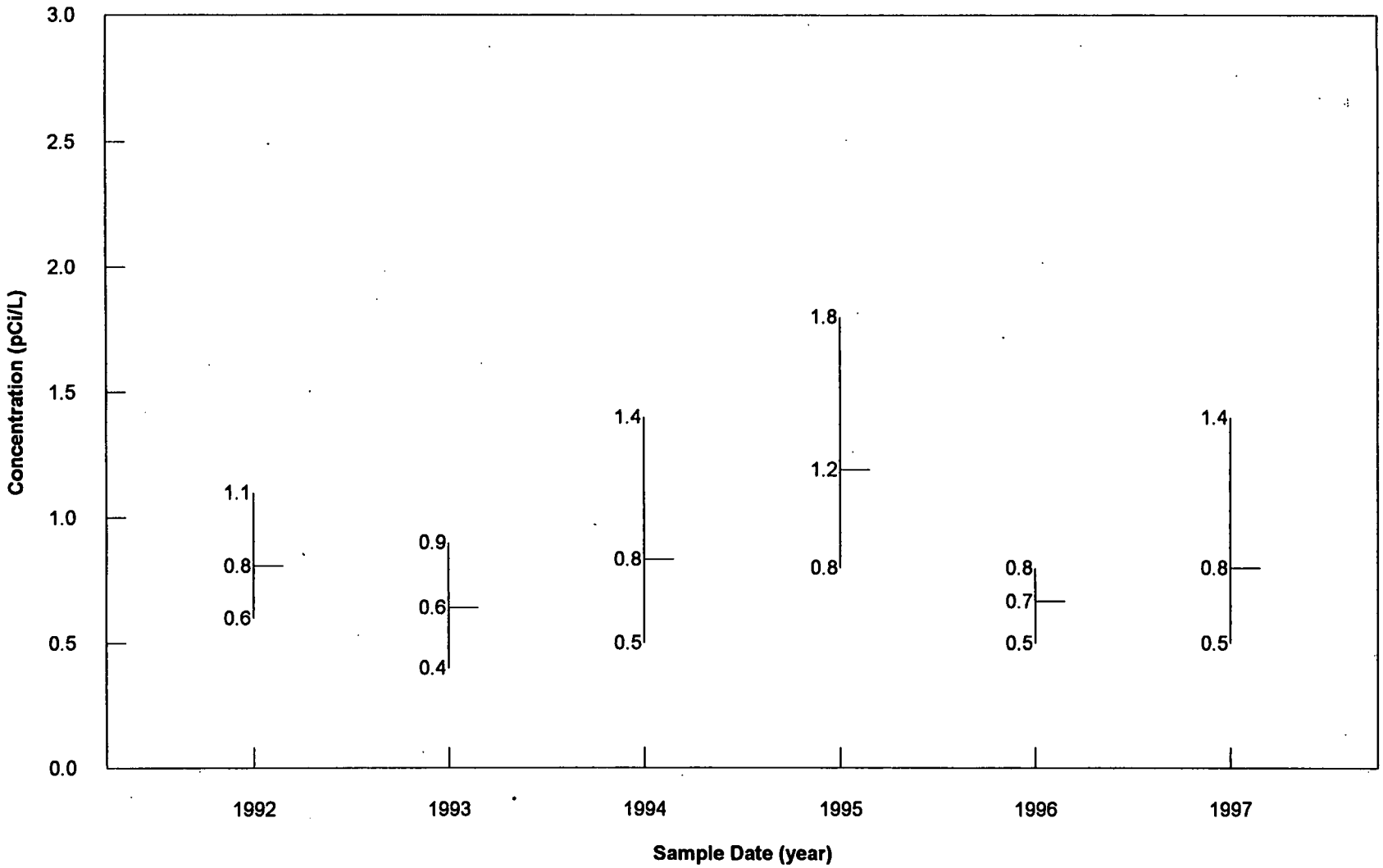


FIGURE C.2-40. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR PILOT PLANT WAREHOUSE

000567

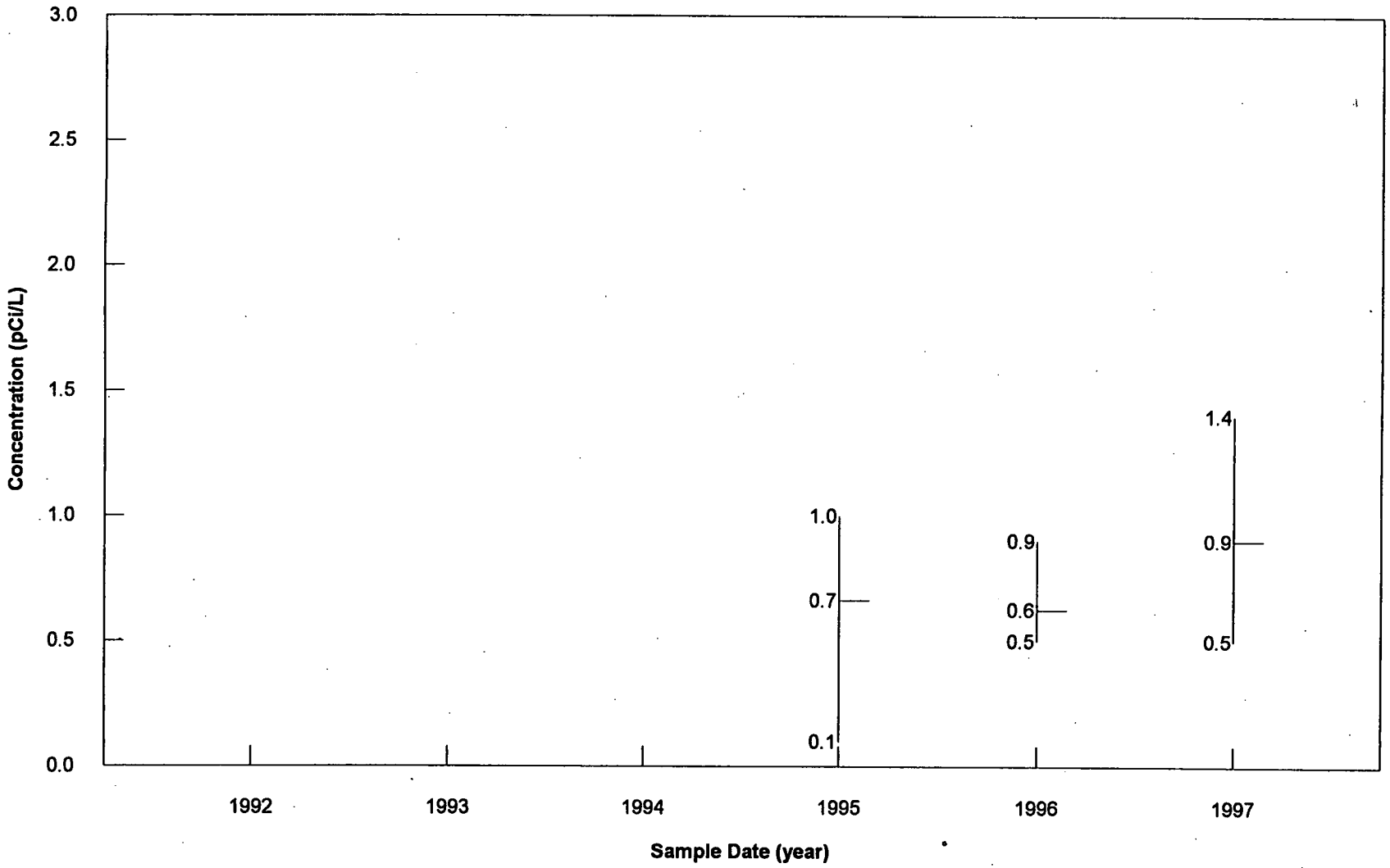


FIGURE C.2-41. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR PIT 5

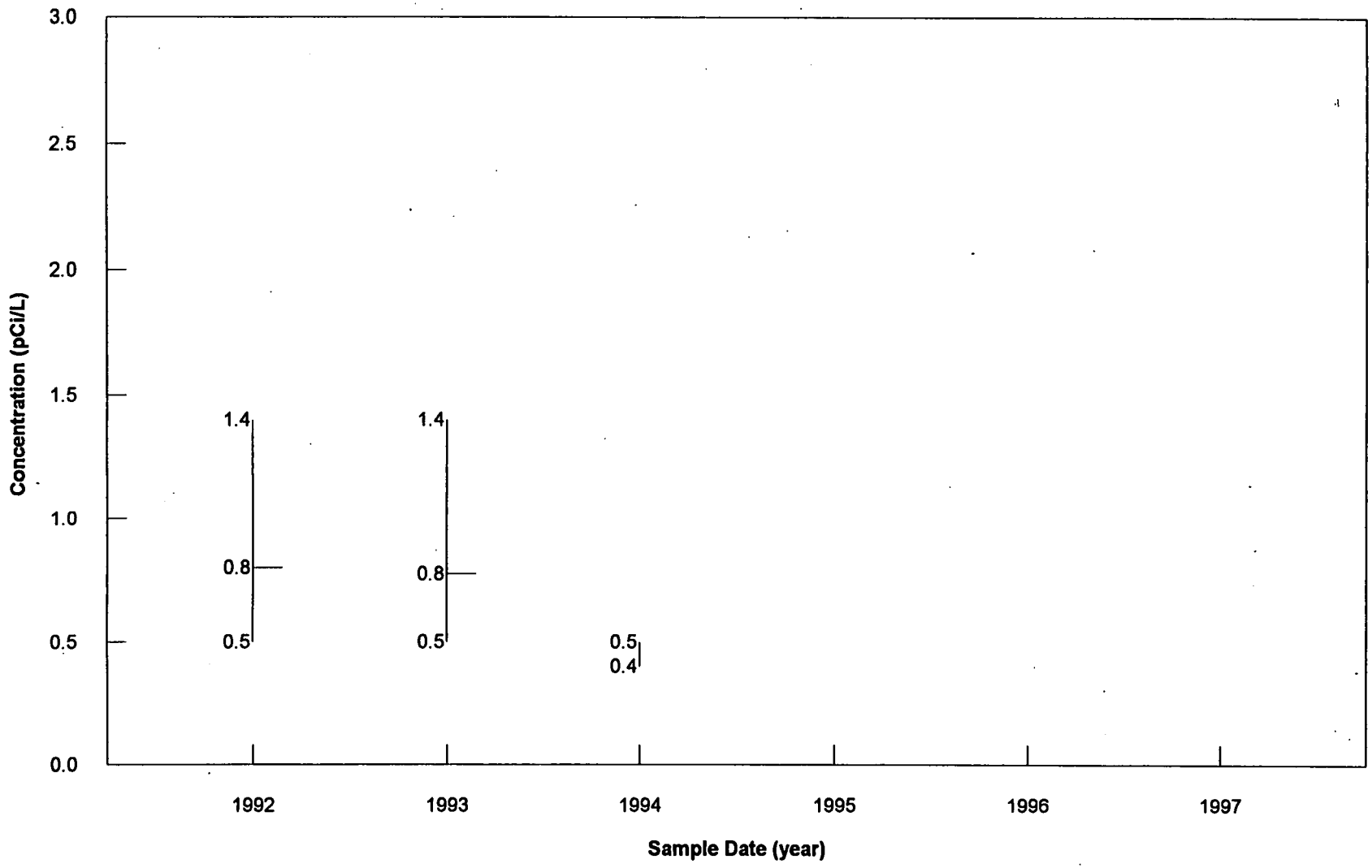


FIGURE C.2-42. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR PLANT 2/3

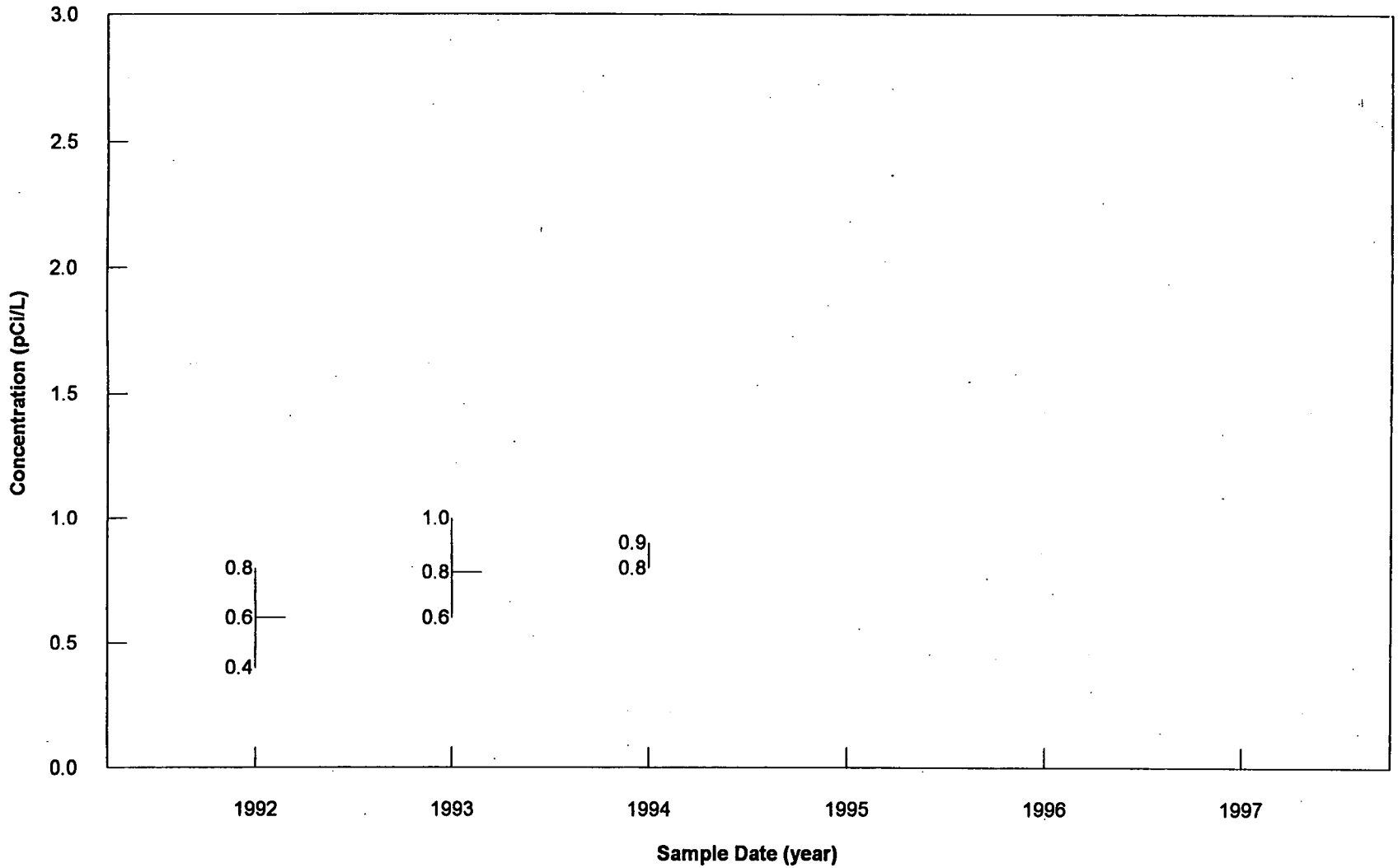


FIGURE C.2-43. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR PLANT 5

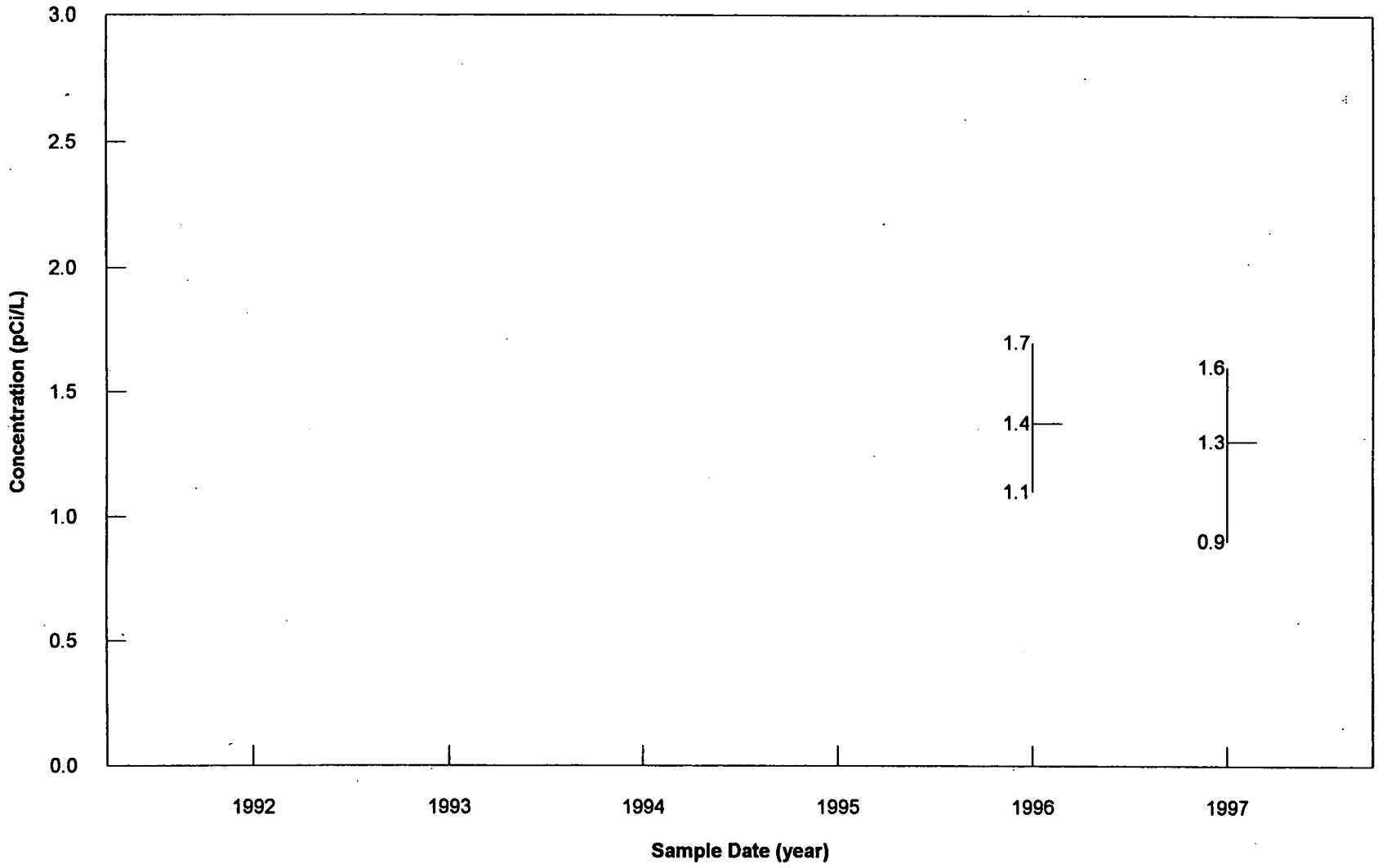


FIGURE C.2-44. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR RALLY POINT 4

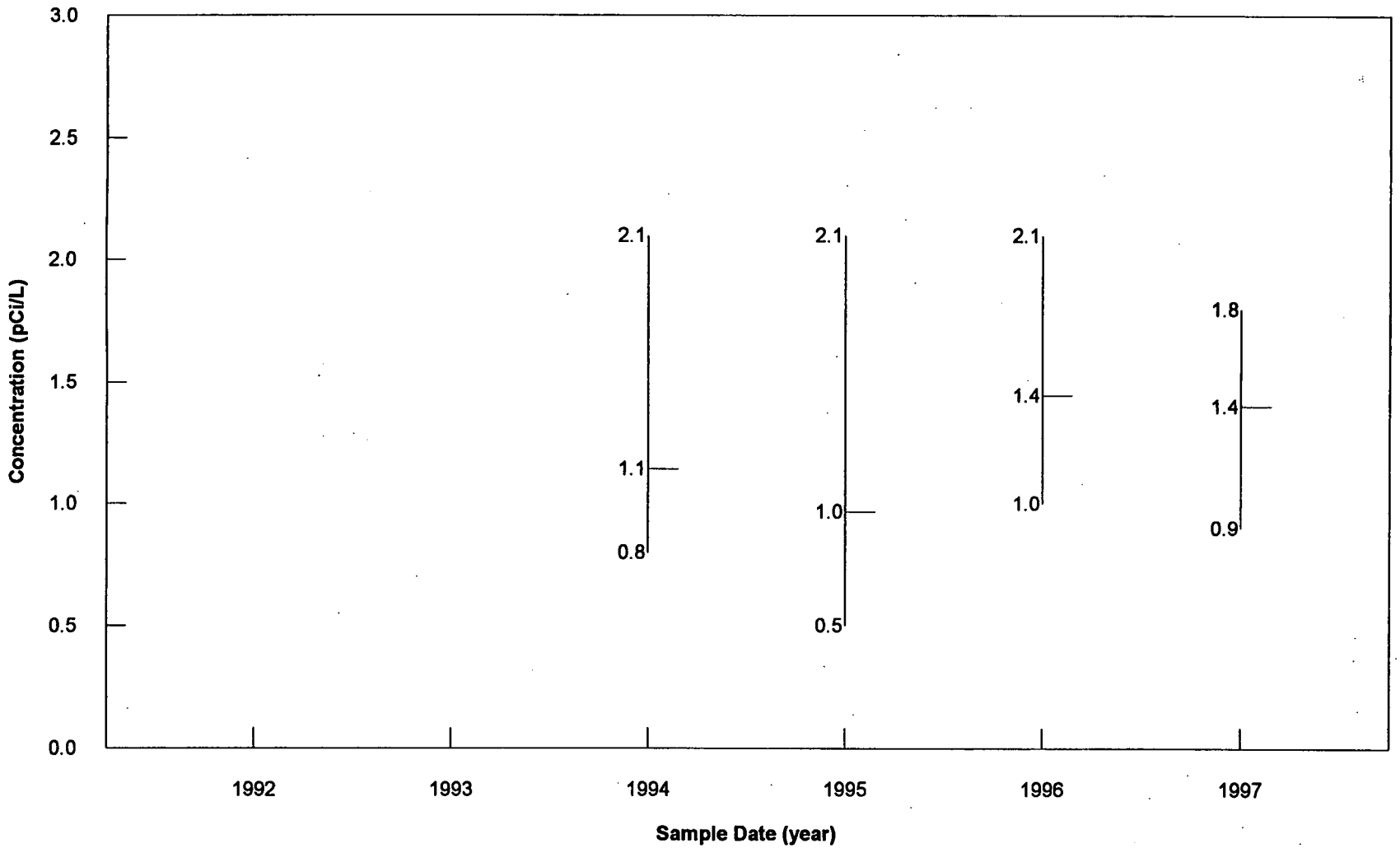


FIGURE C.2-45. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR SURGE LAGOON

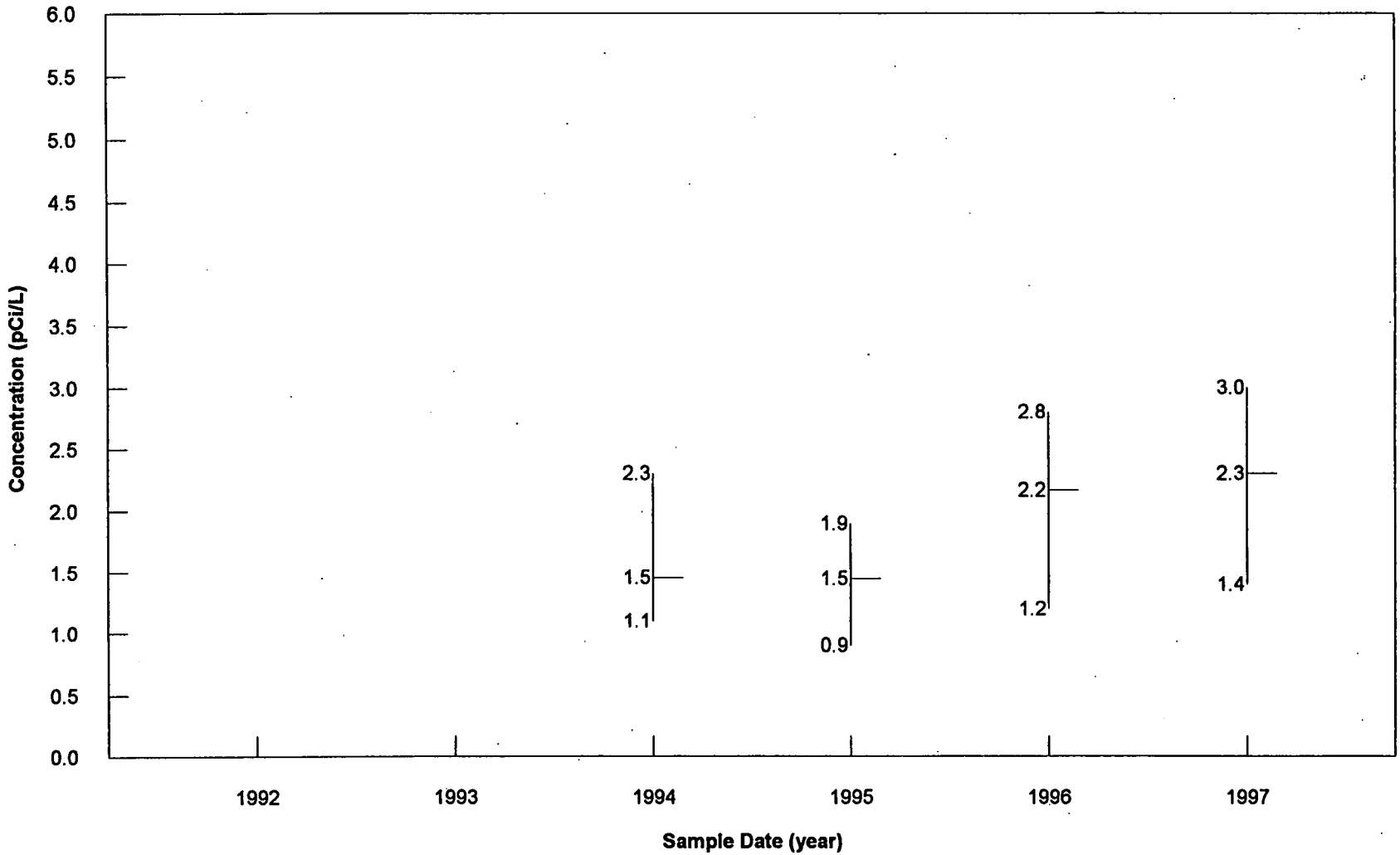


FIGURE C.2-46. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR T 28

000573

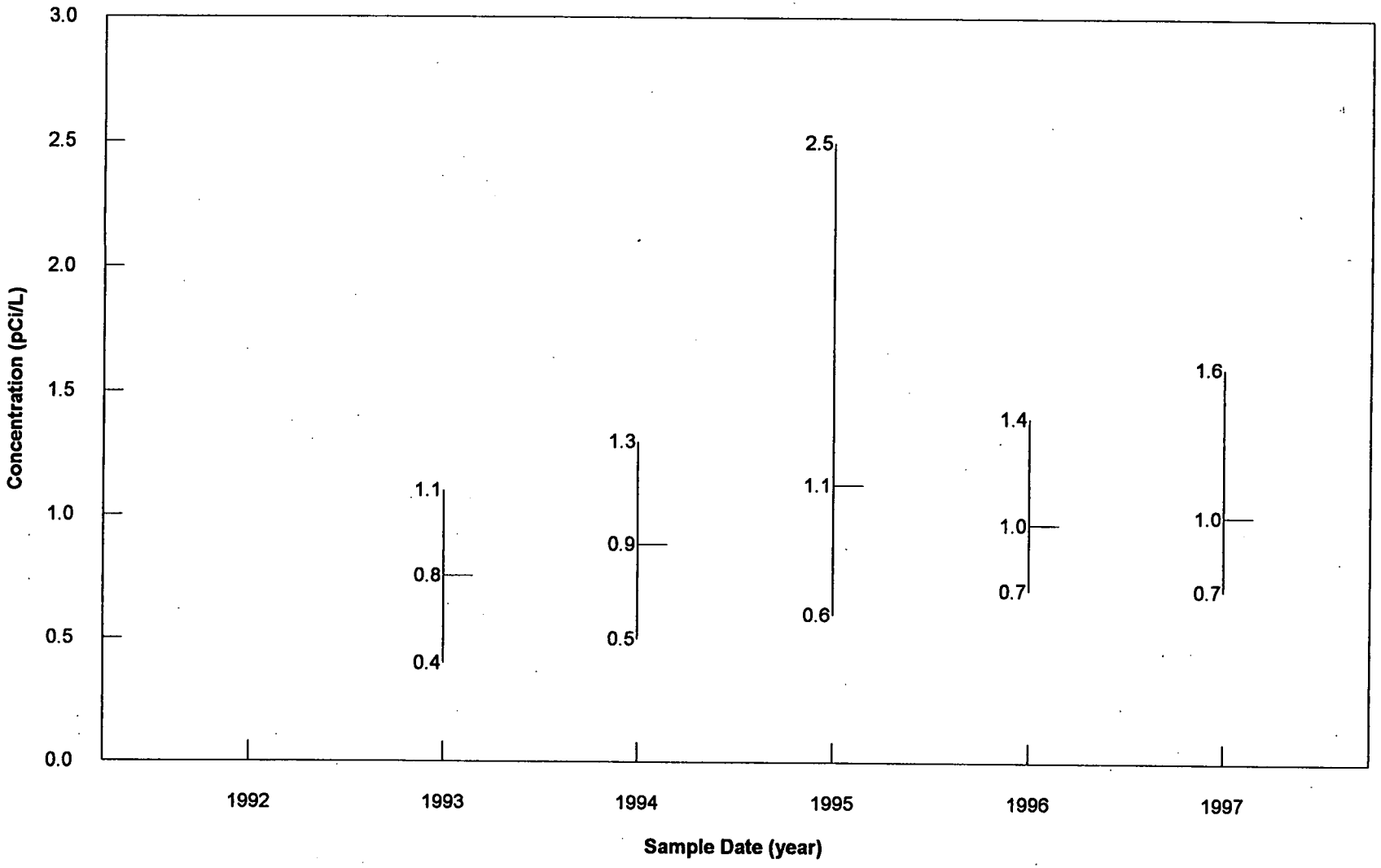
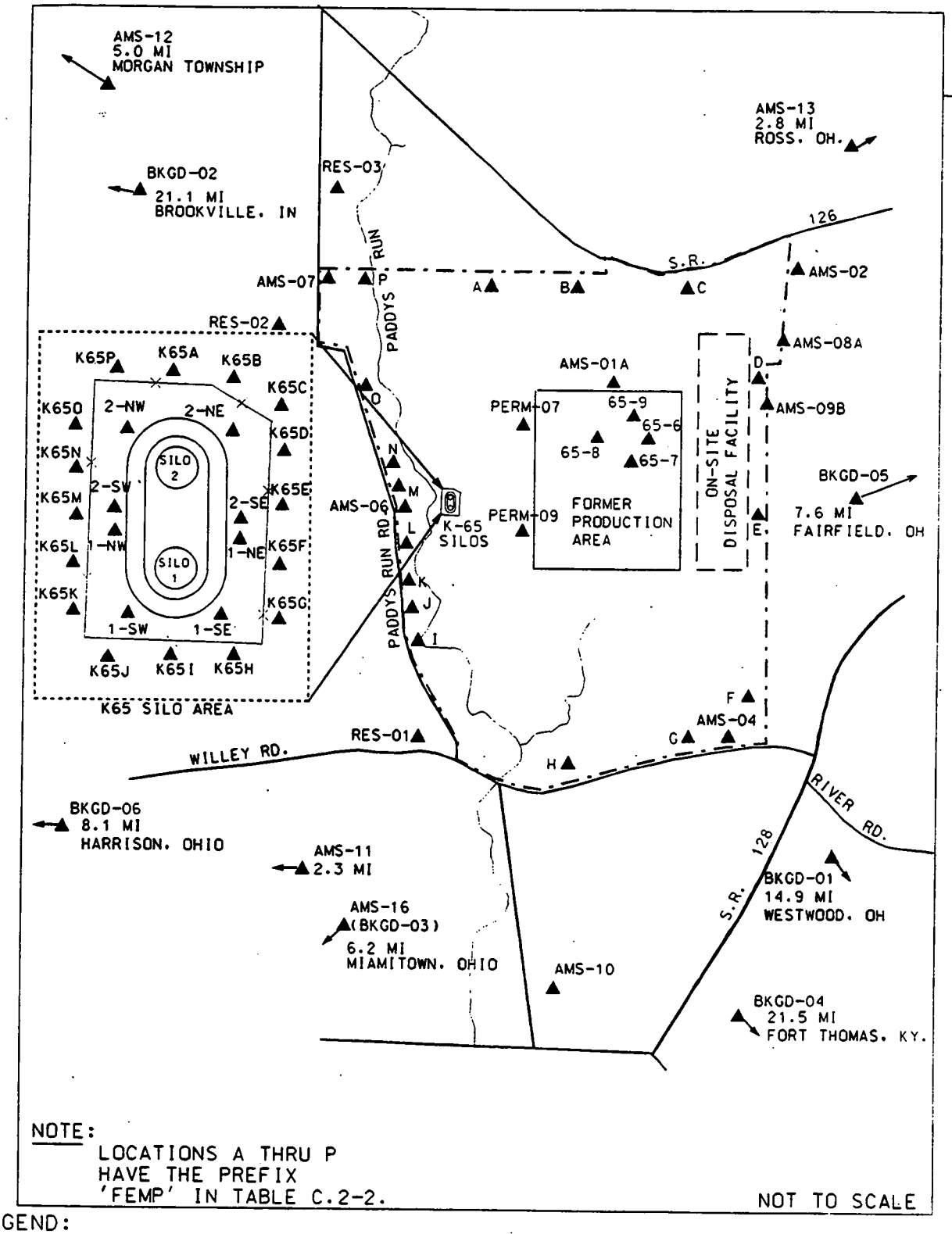


FIGURE C.2-47. CONTINUOUS RADON MONITORING RESULTS
MINIMUM, MAXIMUM AND ANNUAL AVERAGE CONCENTRATION (UNCORRECTED) FOR WP-17A

000574



LEGEND:

- - - - FEMP BOUNDARY

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

RADON MONITORING-ALPHA TRACK-ETCH CUP MONITORING LOCATION

FIGURE C.2-48. RADON MONITORING-ALPHA TRACK-ETCH CUP MONITORING LOCATIONS

Attachment C.3

ATTACHMENT C.3

DIRECT RADIATION

ATTACHMENT C.3

Direct radiation measurements were conducted at 30 thermoluminescent dosimeter (TLD) locations during 1997. Figure C.3-1 identifies all TLD locations collected during 1997. Eight additional locations were added during fourth quarter at the new IEMP air monitoring locations (34 through 41). Three TLDs are deployed at each location and the measurements from each TLD are averaged on a quarterly basis. These measurements are used to determine any changing conditions from FEMP activities at locations near the K-65 Silos, other selected on-site locations, at the site fenceline, and at off-site and background locations.

Table C.3-1 provides the data collected and averaged for four quarters in 1997. For comparison, annual average data collected during 1996 has been included. As discussed in Chapter Five of the 1997 Integrated Site Environmental Report, a slight increasing trend has been identified at the locations around the K-65 Silos 1 and 2 exclusion fence (locations 22 through 26). This trend is associated with the increasing headspace concentrations within the K-65 Silos. However, the results are still less than the levels observed prior to the addition of bentonite to the silos. These locations will continue to be monitored during 1998.

Data collected along the site fenceline and off-site locations remain within established historical ranges. There does not appear to be a corresponding positive trend at these locations as identified around the K-65 Silos.

TABLE C.3-1

DIRECT RADIATION (TLD) MEASUREMENTS

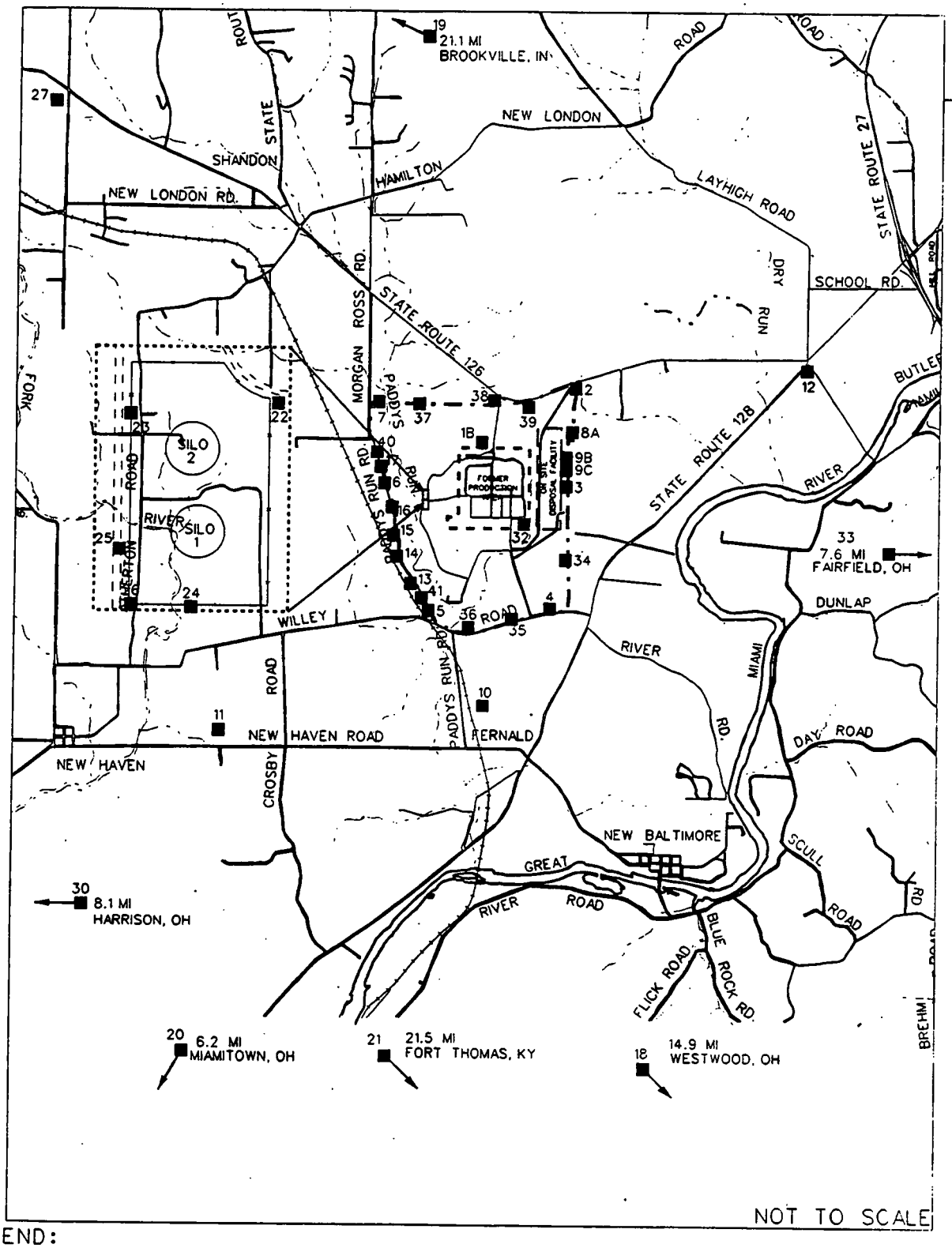
TLD Location #	Direct Radiation ± Uncertainty[a] (mrem)	
	Summary of 1997 Results	Summary of 1996 Results[b]
Fenceline		
2	72 ± 10	73 ± 7.0
3	65 ± 9.0	67 ± 6.4
4	65 ± 9.1	64 ± 6.1
5	67 ± 9.3	67 ± 6.5
6	79 ± 11	75 ± 7.2
7	65 ± 9.0	67 ± 6.5
8A	74 ± 10	77 ± 7.5
9B/C	79 ± 11	83 ± 8.0[c]
13	71 ± 9.9	71 ± 6.9
14	70 ± 9.8	71 ± 6.9
15	74 ± 10	73 ± 7.0
16	77 ± 11	78 ± 7.5
17	70 ± 9.7	70 ± 6.8
34[d]	73 ± 14	NA
35[d]	67 ± 13	NA
36[d]	60 ± 12	NA
37[d]	75 ± 14	NA
38[d]	60 ± 11	NA
39[d]	76 ± 14	NA
40[d]	65 ± 12	NA
41[d]	70 ± 13	NA
Minimum	**60 ± 12**	**64 ± 6.1**
Maximum	**79 ± 11**	**83 ± 8.0**
Onsite		
1B	84 ± 12	82 ± 7.9[e]
22	778 ± 108	630 ± 60
23	712 ± 99	630 ± 61
24	512 ± 71	460 ± 44
25	641 ± 89	560 ± 54
26	425 ± 59	330 ± 32
32	54 ± 7.5	55 ± 5.4
Minimum	**54 ± 7.5**	**55 ± 5.4**
Maximum	**778 ± 108**	**630 ± 61**

000578

TABLE C.3-1
(Continued)

TLD Location #	Direct Radiation ± Uncertainty[a](mrem) Summary of 1997 Results	Summary of 1996 Results[b]
Offsite		
10	52 ± 7.3	55 ± 5.3
11	65 ± 9.1	67 ± 6.5
12	59 ± 8.2	60 ± 5.8
30	59 ± 8.2	60 ± 5.8
Minimum	**52 ± 7.3**	**55 ± 5.3**
Maximum	**65 ± 9.1**	**67 ± 6.5**
Background		
18	74 ± 10	74 ± 7.2
19	60 ± 8.4	63 ± 6.0
20	57 ± 8.0	59 ± 5.7
21	67 ± 9.4	68 ± 6.6
27	60 ± 8.3	62 ± 5.9
33	65 ± 9.1	69 ± 6.7
Minimum	**57 ± 8.0**	**59 ± 5.7**
Maximum	**74 ± 10**	**74 ± 7.2**
Average	**66 ± 12**	**66 ± 11[f]**

[a]Associated laboratory uncertainty
[b]NA = not applicable
[c]Summary results for 1996 are collected from location 9B.
[d]Annual total for location 34 through 41 calculated from fourth quarter (October through December) measurement. These locations were established during fourth quarter 1997.
[e]1996 year end results for 1B are extrapolated from third and fourth quarter measurements.
[f]Due to a change in the method used to calculate the average uncertainty, the average background uncertainty is slightly different than was reported in the 1996 Site Environmental Report.



LEGEND:

— · — · — FEMP BOUNDARY

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

DIRECT RADIATION (TLD) MONITORING LOCATION

FIGURE C.3-1. DIRECT RADIATION (THERMOLUMINESCENT DOSIMETERS) MONITORING LOCATIONS

Attachment C.4

ATTACHMENT C.4

BIOTA (PRODUCE)

ATTACHMENT C.4

Biota (produce) were collected at 14 locations identified on Figure C.4-1 during 1997. Produce is analyzed to determine if total uranium concentrations in produce grown near the FEMP (0 to 3 miles [mi]) are higher than concentrations in produce grown at distant locations (7 to 26 mi). Total uranium detected in produce may be uranium that is deposited from the air pathway, naturally occurring in the soil, or added by fertilizers.

The results of the produce sampling program are reported in Table C.4-1. In general, total uranium concentrations varied greatly for each type of produce. Comparisons between the average total uranium concentrations in corn, squash, soybeans, and tomatoes grown near the FEMP with concentrations not grown near the FEMP indicate very little difference in average concentrations. In addition, when compared to historical background ranges for each of the produce listed, the data for 1997 are within the range reported for 1990 to 1996. These comparisons suggest that there is no substantial impact from past or current FEMP emissions on produce grown in the area.

Produce will be monitored on a three-year basis; that is, the next reporting year will be in calendar year 2000.

TABLE C.4-1

TOTAL URANIUM RESULTS FROM THE BIOTA (PRODUCE) MONITORING PROGRAM (Annual)

Sample Location[a]	Distance from Center of the FEMP (km)	1997 Total Uranium Results Plus Uncertainty Concentration (pCi/g dry weight)	1990 - 1996 Historical Background Range[b] Minimum (pCi/g dry weight)	Maximum (pCi/g dry weight)
Corn[c]			ND	2.0E-01
19	1.4	3.0E-04 ± 2.7E-04		
23	1.6	2.4E-04 ± 3.4E-05		
4	1.9	1.8E-03 ± 8.1E-05		
18[d]	1.9	6.8E-04 ± 4.1E-04		
18[d]	1.9	1.4E-03 ± 6.1E-05		
18[d]	1.9	4.7E-04 ± 2.7E-05		
20	2.1	6.8E-04 ± 4.4E-04		
21	2.4	2.8E-04 ± 2.7E-05		
17[e]	16.0	4.2E-03 ± 1.8E-04		
Squash[f]			ND	3.4E-01
5	2.9	3.8E-02 ± 1.9E-03		
17[e]	16.0	1.9E-02 ± 9.5E-04		
Soybean			ND	1.2E+00
14	1.6	4.9E-03 ± 2.4E-04		
24	1.6	5.0E-03 ± 2.3E-04		
18[e]	1.9	2.1E-02 ± 8.8E-04		
18[e]	1.9	7.4E-03 ± 3.0E-04		
21	2.4	1.8E-03 ± 1.1E-04		
Tomatoes			1.8E-004	6.1E-01
9	1.6	5.3E-02 ± 2.4E-03		
5	2.9	5.9E-02 ± 2.6E-03		
12	3.6	5.6E-03 ± 2.6E-04		
13	3.8	1.0E-01 ± 1.0E-02		
7	4.9	1.3E-01 ± 1.1E-02		
17[e]	16.0	2.4E-02 ± 1.0E-03		

[a]Refer to Figure C.4-1 for produce monitoring locations.
[b]ND indicates less than blank values or less than background.
[c]The corn family includes sweet corn for human consumption and field corn for livestock feed.
[d]There were multiple samples at location 18.
[e]Background location
[f]The term squash includes squash, zucchini, and eggplant.

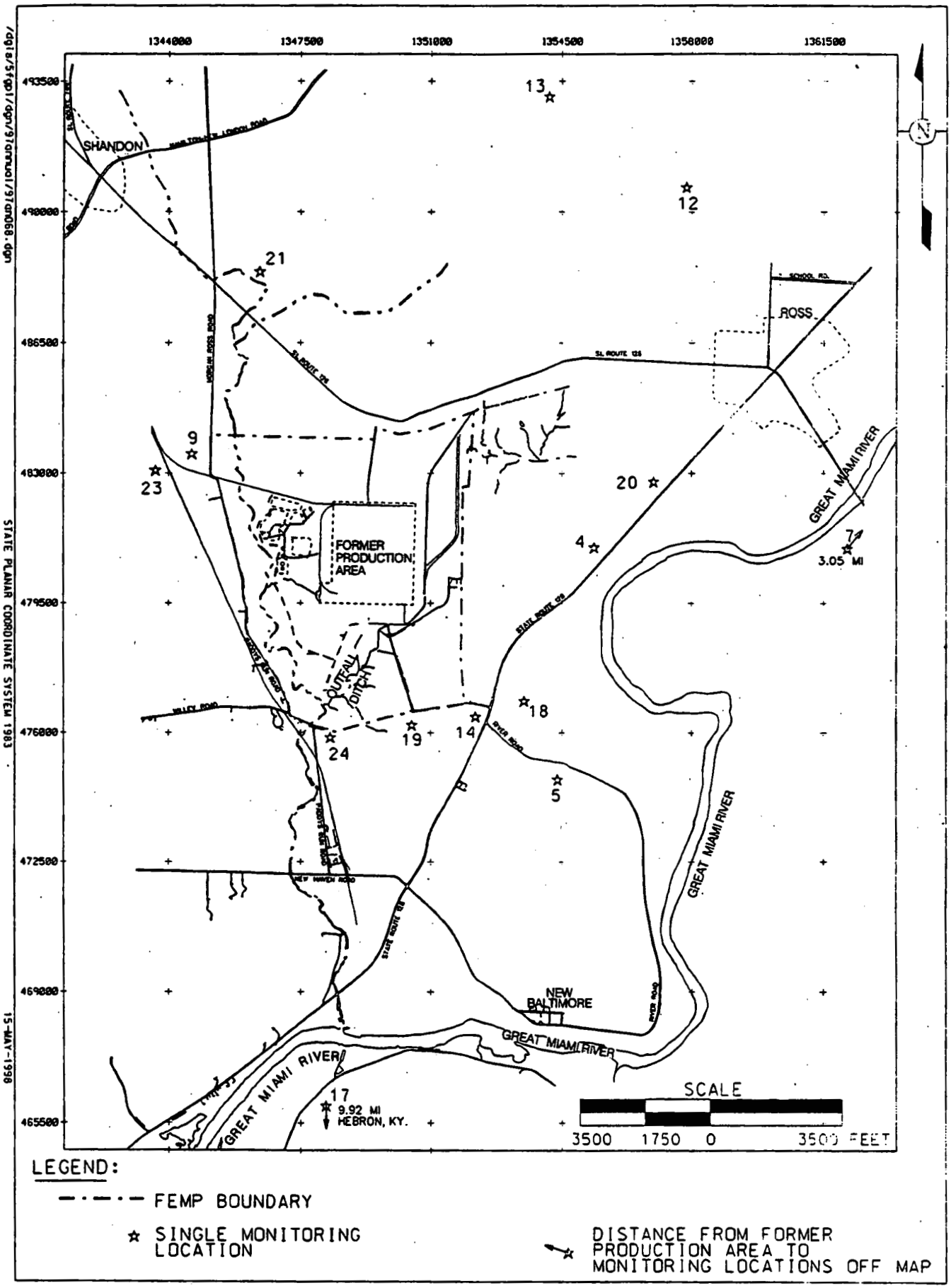


FIGURE C.4-1. PRODUCE MONITORING LOCATIONS

ATTACHMENT C.5

METEOROLOGICAL DATA

ATTACHMENT C.5

Meteorological data were recorded at the site meteorological station during 1997. Meteorological data recovery for calendar year 1997 were 98.5 percent. As shown in Table C.5-1, data from the 10-meter and 60-meter elevations are reported here as a monthly maximum hourly average and a monthly minimum hourly average. Ambient air temperature is provided which includes monthly average temperature, and daily maximum and minimum values per month. The precipitation totals include the monthly total and daily maximum values recorded during 1997. The 1997 average wind speed and percent of time from direction at the 10-meter and 60-meter elevations are presented in Table C.5-2.

For 1997, the highest hourly average wind speed at the 10-meter elevation was measured at 39.6 miles per hour during July 1997. At the 60-meter elevation, the highest hourly average wind speed was measured at 34.5 miles per hour during January 1997. The prevailing winds were from directions west through southwest approximately 30 to 40 percent of the time at both elevations. The winds out of the southeast were least predominant, occurring less than 3 percent of the time.

Total precipitation for 1997 measured 40.11 inches, slightly below the annual average precipitation of 41 inches from 1987 through 1996. For comparison, the total annual precipitation in 1996 was 58.6 inches. The highest amount of precipitation was measured during May 1997 (7.25 inches). The daily maximum amount of precipitation was recorded in August 1997 (2.31 inches). Five months out of the year were at or above the historical monthly average.

The monthly average temperatures during 1997 ranged from 27.9 degrees Fahrenheit (°F) in January to 73°F in July. The coldest day was -2.4°F recorded in January and the warmest day was 95.7°F recorded in July.

TABLE C.5-1

1997 METEOROLOGICAL DATA

	Units	January	February	March	April	May	June	July	August	September	October	November	December
10 Meter Wind Speed													
Maximum hourly average	mph	17.5	17.5	17.6	18.8	16.9	12.9	39.6	11.90	16.2	15	15	14.0
	kph	28.2	28.2	28.3	30.3	27.2	20.8	63.7	19.15	26.1	24	24	22.5
Minimum hourly average	mph	0.5	0.6	0.68	0.6	0.68	0.6	0.6	0.4	0.4	0.2	0.68	0.6
	kph	0.8	1	1.1	1	1.1	1	1	0.6	0.6	0.3	1.1	1
60 Meter Wind Speed													
Maximum hourly average	mph	34.5	34	33.5	32.0	30	18.3	20.0	20.0	29.4	24.1	23.4	22.3
	kph	55.5	55	53.9	51.5	48	29.5	32.2	32.2	47.3	38.8	37.7	35.9
Minimum hourly average	mph	0.68	0.81	0.81	0.68	1.2	0.3	0.2	0.2	0.2	0.5	1.1	0.81
	kph	1.1	1.3	1.3	1.1	1.9	0.5	0.3	0.3	0.3	0.8	1.8	1.3
Ambient Air Temperature													
Average	°F	27.9	36.9	44.1	48.6	56.8	66.7	73.0	69.3	63.0	53.2	40.5	33.6
	°C	-2.3	2.7	6.7	9.2	13.8	19.3	22.8	20.7	17.2	11.8	4.7	0.9
Maximum daily	°F	66.4	68.2	73.0	78.3	83.5	88.5	95.7	90.0	87.4	84.4	65.5	57.0
	°C	19.1	20.1	22.8	25.7	28.6	31.4	35.4	32.2	30.8	29.1	18.6	13.9
Minimum daily	°F	-2.4	15.1	18.0	20.5	32.5	44.4	47.1	45.3	35.8	21.7	13.5	10.4
	°C	-19.1	-9.4	-7.8	-6.4	0.3	6.9	8.4	7.4	2.1	-5.7	-10.3	-12
Precipitation													
Monthly total	in	2.98	2.28	5.57	2.29	7.25	6.79	0.97	4.84	0.80	1.75	2.58	2.18
	cm	7.57	5.79	14.15	5.82	18.42	17.25	2.46	12.29	2.03	4.46	6.55	5.54
Daily maximum	in	1.24	1.37	2.12	0.76	2.12	1.83	0.57	2.31	0.46	0.87	0.87	0.69
	cm	3.15	3.48	5.38	1.93	5.38	4.65	1.45	5.87	1.17	2.21	2.21	1.75

TABLE C.5-2

1997 AVERAGE WIND SPEED AND PERCENT OF TIME FROM DIRECTION AT TEN AND SIXTY METERS ABOVE GROUND LEVEL

Direction	Average 10-meter Wind Speed (mph)	Average 10-meter Wind Speed (kph)	Percent of Time from Direction	Average 60-meter Wind Speed (mph)	Average 60-meter Wind Speed (kph)	Percent of Time from Direction
N	5.38	8.66	3.80	7.70	12.4	4.66
NNE	6.00	9.66	3.88	7.99	12.9	4.71
NE	6.04	9.72	4.91	7.34	11.8	8.13
ENE	5.56	8.95	8.01	7.66	12.3	7.93
E	3.90	6.28	4.52	6.19	10.0	3.43
ESE	3.20	5.15	2.48	6.04	9.72	2.29
SE	3.07	4.94	2.18	6.04	9.72	2.26
SSE	3.80	6.12	2.48	6.58	10.6	2.61
S	5.28	8.50	4.74	9.50	15.3	5.50
SSW	5.70	9.17	8.28	9.60	15.4	11.2
SW	5.14	8.27	11.2	9.17	14.8	11.8
WSW	4.69	7.55	10.7	10.1	16.3	10.7
W	5.39	8.67	11.9	10.8	17.4	9.45
WNW	4.94	7.95	8.61	9.19	14.8	5.52
NW	4.62	7.43	7.46	9.00	14.5	5.41
NNW	4.70	7.56	4.86	7.80	12.6	4.34

Appendix D

APPENDIX D

SPLIT SAMPLING COMPARISON WITH OEPA

TABLE OF CONTENTS

Appendix D Split Sampling Comparison with OEPA D-1

LIST OF ACRONYMS

FEMP	Fernald Environmental Management Project
OEPA	Ohio Environmental Protection Agency
pCi/L	picoCuries per liter
pCi/g	picoCuries per gram
μg/g	micrograms per gram
μg/L	micrograms per liter

APPENDIX D

Appendix D presents split sample data in support of Chapter Two of the 1997 Integrated Site Environmental Report. The data reflects results from samples split for analysis between the U.S. Department of Energy (DOE) and the Ohio Environmental Protection Agency (OEPA) for groundwater, surface water, sediment, and produce. The results are provided in Table D-1.

The data from the split sampling program show close agreement between DOE and OEPA results for the groundwater and surface water samples. However, a greater degree of variability exists between DOE and OEPA results for sediment and produce samples. This is not unusual for these types of sample matrix based on the potential variability within the samples themselves. In addition, variability in the sample results may be affected by incomplete sample homogenization in the field and differences in sample preparation methods at the analytical laboratories. DOE and OEPA have discussed these issues and will continue to work together to ensure the highest degree of quality in the split sampling program. Differences in the DOE and OEPA sample results presented for 1997 do not impact the FEMP's compliance with federal or state regulations.

TABLE D-1

1997 FEMP-OEPA SPLIT SAMPLING COMPARISON

Media	Location	Sampling Date	Constituent	FEMP Result	OEPA Result
Groundwater[a]				(μg/L)	(μg/L)
	12	January	Total Uranium	119	130
	12	April	Total Uranium	141	140
	12	July	Total Uranium	100	95
	12	October	Total Uranium	103	93
	13	January	Total Uranium	40	49
	13	April	Total Uranium	43	43
	13	July	Total Uranium	61	42
	13	October	Total Uranium	59	38
	14	January	Total Uranium	2.8	3.2
	14	April	Total Uranium	2.7	2.9
	14	July	Total Uranium	3.2	3.3
	14	October	Total Uranium	3.1	2.6
Surface Water[b]				(pCi/L)	(pCi/L)
	W3	February	Radium-226	0.2[c]	<0.15[c]
	W3	June	Radium-226	0.25[c]	0.44[c]
	W7	February	Radium-226	0.086[c]	<0.17[c]
	W7	June	Radium-226	0.021[c]	0.56[c]
	W3	February	Radium-228	<2.6[c]	2.3[c]
	W3	June	Radium-228	<2.8[c]	2.8[c]
	W7	February	Radium-228	<2.6[c]	2.5[c]
	W7	June	Radium-228	3.9[c]	1.9[c]
				(μg/L)	(μg/L)
	W3	February	Total Uranium	1.7	1.9
	W3	June	Total Uranium	1.0	1.0
	W7	February	Total Uranium	2	2.2
	W7	June	Total Uranium	18	15
	W9	February	Total Uranium	1.6	1.6
	W9	June	Total Uranium	1.4	1.4
	W10	Feburary	Total Uranium	6.1	6.2
	W11	February	Total Uranium	2.1	2.2
	W11	June	Total Uranium	17	18
Sediment[d]				(pCi/g)	(pCi/g)
	G7	July	Radium-226	0.57	0.59
	PS1	July	Radium-226	0.49	0.49
	G7	July	Thorium-228	0.37	0.7
	PS1	July	Thorium-228	0.36	0.63
	G7	July	Thorium-230	0.68	0.85
	PS1	July	Thorium-230	0.56	0.94
	PS1	July	Thorium-232	0.37	0.55
	PS1	July	Thorium-232	0.33	0.58
				(μg/g)	(μg/g)
	G7	July	Total Uranium	1.6	1.9
	PS1	July	Total Uranium	1.7	3.4

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TABLE D-1
(Continued)

Media	Location	Sampling Date	Constituent	FEMP Result	OEPA Result
Produce[e]				(μg/g)	(μg/g)
	4 (corn)	August	Total Uranium	0.0026	0.305
	5 (tomato)	August	Total Uranium	0.088	0.554

[a]See Figure 42 of the 1996 Site Environmental Report for groundwater locations.
[b]See Figure 4-2 for surface water locations.
[c]FEMP results for radium-226 and radium-228 are based on a monthly composite sample. OEPA results for radium-226 and radium-228 are based on a single grab sample.
[d]See Figure 4-9 for sediment locations.
[e]See Figure 5-8 for produce locations.

REFERENCES

U.S. Dept. of Energy, 1997, "1996 Site Environmental Report," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

Appendix E

1470

1997 INTEGRATED SITE ENVIRONMENTAL REPORT

1997 ENVIRONMENTAL SUMMARY
(Appendix E)

VOLUME II

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

MAY 1998

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

000596

51350-RP-0001
FINAL

1997 ENVIRONMENTAL SUMMARY

VOLUME II

(Appendix E)

APPENDIX E

NATIONAL EMISSIONS STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP)

ANNUAL REPORT FOR THE FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

APPENDIX E

Appendix E contains the National Emissions Standards For Hazardous Air Pollutants (NESHAP) Annual Report for the Fernald Environmental Management Project (FEMP) as required by 40 CFR 61.94(a). This appendix consists of three attachments as follows:

- Attachment E.1 contains the National Emissions Standards For Hazardous Air Pollutants (NESHAP) Annual Report.
- Attachment E.2 contains the meteorological data file and the CAP88-PC files used to assess individual dose.
- Attachment E.3 contains supplemental information requested in DOE-EH 23 guidance and the CAP88-PC files used to assess population dose.

Attachment E.1

ATTACHMENT E.1

NATIONAL EMISSIONS STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) ANNUAL REPORT

U.S. Department of Energy
Radionuclide Air Emissions Annual Report
(under Subpart H of 40 CFR Part 61)
Calendar Year 1997

Site Name: Fernald Environmental Management Project (FEMP), Fernald, Ohio

Field Office Information:

Office: Fernald Area Office (FN), U. S. Department of Energy
Address: Post Office Box 538705
Mail Stop 45
Cincinnati, Ohio 45253-8705

Contact: Mr. Ed Skintik Phone: (513) 648-3151

Site Information

Operating Contractor: Fluor Daniel Fernald

Address: 7400 Willey Road
Fernald, Ohio 45030 (Site location)

Post Office Box 538704
Cincinnati, Ohio 45253-8704 (mailing address)

Contact: Kip Klee Phone: (513) 648-5289

SUMMARY

For CY-1997 twenty-one radionuclide emission sources were identified as being subject to the reporting requirements of 40 CFR 61, Subpart H. The overall dose to the maximally exposed individual (MEI) is estimated to be 1.4 mrem (1.4E-02 mSv) which is in compliance with the Subpart H standard of 10 mrem. Of this dose, 1.7E-03 mrem (1.7E-05 mSv) came from point sources and 1.4 mrem (1.4E-02 mSv) came from diffuse sources.

SECTION I: FACILITY INFORMATION

A. Site Description

The Fernald Environmental Management Project (FEMP) is located on a 425 hectare (1050 acre) area approximately 27 km (17 miles) northwest of Cincinnati, Ohio. The Production area covers approximately 136 acres (55 hectares) in the center of the FEMP. The facility is sited just north of the small farming community of Fernald, Ohio.

The area immediately surrounding the FEMP is primarily rural in nature, characterized by the predominance of agriculture, with some light industry and private residences. The FEMP is located on a relatively level plain, outside of the 500-year flood plain of the Great Miami River, in an ancestral river valley known as the New Haven Trough.

The climate is characterized as continental, with average temperatures ranging from approximately 29°F (-1.7°C) in January, to 76°F (24.4°C) in July. Average annual precipitation is approximately 40 inches (102 cm) per year. Prevailing wind flow is from the south-southwest.

For 37 years, the former Feed Materials Production Center (Fernald site) produced uranium metals for the United States Department of Energy (DOE) and its predecessors. On July 10, 1989, uranium metals production was suspended. Management responsibilities of the Fernald site were transferred from the Defense Programs organization to the DOE's Office of Environmental Restoration and Waste Management.

Currently, most activities at the FEMP are conducted under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). These activities include sample analysis, waste characterization, the management, treatment, storage, and disposal of hazardous, mixed, low-level and solid wastes, and the decontamination and cleanup of radioactively contaminated buildings, equipment, soils, and waters. The site also manages thorium wastes, and K-65 silo waste material which contains radium and produces radon gas.

B. Source Descriptions

The majority of the radioactive contamination at the FEMP is due to uranium, uranium compounds, and thorium. Additional contamination comes from the daughter products of uranium and thorium.

Calendar year 1997 (CY-1997) radionuclide emission sources at the FEMP include:

- Plant 1: Fugitive emissions generated from the implosion and cleanup activities of the Plant 1 building;
- Plant 6: Emissions from repackaging operations;
- Plant 8: Radionuclide releases via entrainment in mists generated during vacuum filtration operations;
- Building 11: Emissions from the laundry facilities resulting from the processing of contaminated clothing used at the FEMP, and from the Respirator Washing Facility located in the building;
- Building 15: Emissions from laboratory operations;
- Building 20: Emissions resulting from laboratory operations, and emissions from the Cooling Water Tower via mist loss (due to dissolved radionuclides in the cooling water);
- Building 51: Emissions from the Advanced Waste Water Treatment facility;
- Building 53: Emissions from laboratory operations;
- Building 65: Emissions from thorium repackaging operations;
- Building 71: Emissions from material sorting and repackaging operations;
- Building 78: Emissions from repackaging operations;
- Other sources: Fugitive emissions from the Waste Pit Remedial Action Project (WPRAP), Waste Pit 5, and various stockpiles around the FEMP site, generated via wind erosion, earth moving equipment and material handling operations;

SECTION II: AIR EMISSIONS DATA

Tables 1 and 2 list the monitoring status, control equipment information, and the distance and direction to the nearest receptor for the point and grouped point sources at the FEMP. Table 3 lists the annual quantities (in Curies) of Point Source radionuclides likely to contribute to more than 10% of the effective dose equivalent (EDE) from the specific source.

Table 4 identifies the FEMPs non-point sources and lists the annual quantities of radionuclides likely to contribute to more than 10% of the EDE from those sources.

Particulate samples were collected from monitored stacks via isokinetic samplers. Due to the high efficiency of the HEPA filters, the amount of particulate sample collected from each stack was small. Composite samples were generated from these filters for each stack and analyzed for those radionuclides likely to contribute to more than 10% of the EDE.

For unmonitored sources, engineering calculations were used to develop estimates of total uranium emissions. The total uranium emission estimates were used to calculate radionuclide-specific emission rates, using radionuclide-specific activity to mass total uranium values (Ci/kg U) developed from past source sampling activities at the FEMP.

SECTION III: DOSE ASSESSMENT

A. Description of Dose Model

1. Dose Model

The radionuclide dose calculations were performed using the CAP88-PC Version 1.0 computer code. This package contains the AIRDOS-EPA (Mo79) computer code, which implements a steady-state, Gaussian plume, atmospheric dispersion model to calculate environmental concentrations of released radionuclides, and U. S. Nuclear Regulatory Commission Regulatory Guide 1.109 food chain models to calculate human exposures, both internal and external, to radionuclides deposited in the environment. The human exposure values are then used by the DARTAB computer code to calculate radiation doses to man from radionuclides released during the year. The dose calculations use dose conversion factors found in the RADRISK data file provided with the CAP88-PC package.

2. Maximally Exposed Individual

Estimates of the EDE from each FEMP source were made at the locations of forty (40) off-site receptors surrounding the FEMP. The maximally exposed individual (MEI) was determined to be an individual at the receptor location with the highest collective EDE.

B. Summary of Input Parameters

Unless otherwise discussed, the input parameter values used were the default values provided with the CAP88-PC computer codes and databases by the EPA.

1. Source Data

Source information was gathered from site records, and is provided in the attached CAP88-PC Synopsis files. All point source emissions occur at or near ambient temperatures; plume rise is momentum dominated. Source to receptor distances were calculated using information from site maps using Ohio State Planar Coordinate System coordinates.

2. Meteorological Data

Meteorological data was obtained from the on-site FEMP meteorological station. The CY-1997 data recovery rate was 98.5%, considered acceptable for running the CAP88-PC code. Wind speed and direction data were compiled in a Statistical Array (STAR) format and converted using the GETWIND utility provided with the CAP88-PC package. The STAR formatted data is provided in Table 5. Additional site station data includes:

Annual Average Temperature: 51.1°F (10.61°C)
Annual Rainfall: 40.26 in. (102.3 cm)

An estimate for the average mixing height for the FEMP site was obtained from the book *Potential for Urban Air Pollution Throughout the Contiguous United States*, by George Holzworth. This estimate was:

Annual Average Mixing Height: 950 meters

3. Other Input Parameters

The CAP88-PC code provides dose estimates from radionuclides ingested. Beef, milk, and food crop production were assumed to be the maximum possible for the available ground area, an assumption that overstates these activities in the area. It was further assumed that 100% of the foodstuffs consumed by the local population were grown within the 80km/50mi radius, which also provides a conservative estimate for the impact. The default values used were:

Fraction of foodstuffs	Local Area	50-mile radius	Beyond 50 miles
Vegetables &	0.700	0.300	0.00
Meat:	0.442	0.558	0.00
Milk:	0.399	0.601	0.00

C. Compliance Assessment

The results of the CAP88-PC modeling are summarized in Table 6. For CY-1997, the dose from point sources to the MEI is estimated to have been 1.7E-03 mrem (1.7E-05 mSv). The total estimated dose received by the MEI for CY-1997 is 1.4 mrem (1.4E-02 mSv). This individual is located 1011 meters east-southeast of the center of the FEMP.

These results indicate that, during CY-1997, the FEMP was in compliance with the 10 mrem dose limitation of 40 CFR 61, Subpart H.

SECTION IV: ADDITIONAL INFORMATION

A. Construction/Modifications at the FEMP

No projects were completed in CY-1997 for which the requirements to apply to the EPA for approval to construct or modify were waived due to the provisions of 40 CFR 61.96.

B. Unplanned Releases of Radionuclides

For CY-1997, no unplanned releases of radionuclides were identified in a review of the 379 notifications received by the site's release evaluators.

C. Diffuse Sources - Dose assessment

In CY-1997 there were eight (8) diffuse emission sources at the FEMP. These sources are listed in Table 4. Engineering calculations were used to develop estimates of total uranium emissions. The total uranium emission estimates were used to calculate radionuclide-specific emission rates, using radionuclide-specific activity to mass total uranium values (Ci/kg U) developed from past source sampling activities at the FEMP. These emission rates were used to estimate EDEs to offsite receptors and are listed in Table 6. Descriptions of the diffuse sources are provided below.

(1) PLANT 1 - Emissions generated from the implosion and cleanup activities related to the Plant 1 building. Data from four ambient air monitoring stations were used to determine the average airborne radionuclide activity due to Plant 1 cleanup operations. This activity, along with the average annual wind speed, duration of the cleanup operations, and an estimated plane of dispersion were used to estimate the amount of Uranium released. It was assumed that all of the activity in the Plant 1 monitors was due only to Uranium.

(2) COOLING WATER TOWER - Due to the large diameter of the cell fans, emissions from the cooling water tower are assumed to be fugitive in nature. Estimates of cooling water loss were made using emission factors found in AP-42, Section 13.4-4, Table 13.4-1. It was assumed that the uranium loss was proportional to the uranium concentration in the water.

(3) BUILDING 51 - Fugitive emissions were estimated from a group of tanks outside the Advanced Waste Water Treatment facility building;

(4) WASTE PIT 5 - An estimate of Uranium emissions from Waste Pit 5, was made by summing the calculated daily releases of Uranium from the waste pit. Equation 25 from A METHOD FOR ESTIMATING FUGITIVE PARTICULATE EMISSIONS FROM HAZARDOUS WASTE SITES, by James H. Turner, et. al. (EPA/600/2-87/066), was modified to calculate a daily release rate. Emissions were assumed to be zero for days with greater than or equal to 0.01 inches of precipitation. Emissions were also assumed to occur only when wind speeds were greater than 12 mph.

(5) WASTE PIT REMEDIATION ACTION PROJECT (WPRAP) - Railyard - This project involves grading, scraping, and bulldozing of several acres of land. This work also created soil storage piles. Fugitive emissions were generated via wind erosion of barren areas, vehicle traffic, and material handling activities. Estimates of fugitive dust emissions were made using equations available in AP-42 and the State of Ohio's Reasonably Available Control Measures for Fugitive Dust Sources (RACM) manual. Soil concentrations of uranium were used to estimate the amount of uranium released in the dust emissions.

(6) STOCKPILE AREA #1 - Estimates of fugitive dust emissions were made using equations available in the State of Ohio's Reasonably Available Control Measures for Fugitive Dust Sources (RACM) manual. Average surface uranium concentrations were calculated using uranium analyses made on the materials deposited into the stockpile. This concentration was used to estimate the amount of uranium released in the dust emissions.

(7) STOCKPILE AREA #2 - Estimates of radionuclide emissions for Stockpile Area #2 were made in a manner similar to that of Stockpile Area #1. However, specific data for stockpiles in this area was not available. Therefore, estimates of surface area radionuclide concentrations were based on data used in the Stockpile Area #1 calculations. However, since it is known that soils deposited in this area did not exceed the Waste Acceptance Criteria of 1030 ppm of uranium, data above this value was not included in the determination of average surface area concentration for this area.

(8) STOCKPILE AREA #3 - Estimates of radionuclide emissions for Stockpile Area #3 were made in a manner similar to that of Stockpile Area #2.

The estimated dose received by the MEI from the eight sources described above was 1.4 mrem (1.4E-02 mSv). The location of this individual was 1011 meters east-southeast of the center of the FEMP.

SECTION V: CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. (see 18 U.S.C. 1001).

Name: GLENN GRIFFITHS
DEPUTY DIRECTOR - FEMP

Signature: Glenn Griffiths Date: 5-28-98

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Table 6: SUMMARY OF CY-1997 CAP88-PC DOSE CALCULATIONS

TABLE 1: POINT SOURCES

POINT SOURCE	MONITORED STACK ? (YES/NO)	TYPE CONTROL	CONTROL EFFICIENCY	DISTANCE & DIRECTION FROM SOURCE TO NEAREST RECEPTOR
PLANT 8:				
Oliver Filter	NO	NONE	N/A	969m WSW
BUILDING 11:				
Laundry Dryer Exhaust	YES	HEPA	99.97%	1016m WSW
Respirator Wash. Facility	NO	HEPA	99.97%	1017m WSW
BUILDING 71:				
Process vent	YES	HEPA	99.97%	944m N
BUILDING 78:				
Process vent	NO	HEPA	99.97%	833m N

TABLE 2: GROUPED SOURCES

GROUPED SOURCES	MONITORED STACK ? (YES/NO)	TYPE OF CONTROL	CONTROL EFFICIENCY	DISTANCE & DIRECTION FROM SOURCE TO NEAREST RECEPTOR
PLANT 6:				
Process vents (2)	NO	HEPA	99.97%	854m ESE
PLANT 8:				
Eimco Filters(2)	NO	NONE	N/A	947m WSW
BUILDING 15:				
Perchloric Stacks (12 hoods)	NO	NONE	N/A	921m WSW
HEPA Exhaust (32 hoods)	YES	HEPA	99.97%	921m WSW
General Exhaust (101 hoods)	NO	NONE	N/A	921m WSW
BUILDING 20:				
Water Plant Lab (2 hoods)	NO	NONE	N/A	858m N
BUILDING 53:				
Bio-Assay/Low-Level Lab (6 hoods)	NO	NONE	N/A	939m ESE

TABLE 3: POINT SOURCE RADIONUCLIDES

POINT SOURCE	U-234 (Ci)	U-235 (Ci)	U-236 (Ci)	U-238 (Ci)	Ra-226 (Ci)	Ra-228 (Ci)	Th-228 (Ci)	Th-230 (Ci)	Th-232 (Ci)	Th-234 (Ci)
PLANT 6:										
Process vents (2)	3.610E-07	1.910E-08	1.402E-08	4.033E-07	2.563E-10	1.028E-09	1.084E-08	3.192E-08	1.705E-09	1.595E-06
PLANT 8:										
Oliver Filter	1.44E-07	7.73E-09	5.28E-09	1.91E-07	1.29E-10	5.18E-10	5.47E-09	3.84E-10	8.59E-10	8.04E-07
Eimco Filters (2 filters)	1.76E-06	9.41E-08	6.43E-08	2.32E-06	1.57E-09	6.30E-09	6.65E-08	4.67E-09	1.05E-08	9.78E-06
BUILDING 11:										
Laundry Dryer Exhaust	9.85E-08	1.50E-08	1.50E-08	7.03E-08	3.16E-11	1.27E-10	1.66E-08	6.65E-08	2.36E-08	1.97E-07
Respirator Wash. Facility	6.95E-07	3.68E-08	2.70E-08	7.77E-07	4.94E-10	1.98E-09	2.09E-08	6.15E-08	3.28E-09	3.07E-06
BUILDING 15:										
Perchloric Stacks (12 hoods)	8.66E-05	4.58E-06	3.36E-06	9.67E-05	6.15E-08	2.47E-07	2.60E-06	7.66E-06	4.09E-07	3.83E-04
HEPA Exhaust (32 hoods)	7.48E-08	1.90E-08	1.90E-08	8.64E-08	3.63E-11	1.45E-10	1.10E-08	5.47E-08	1.22E-08	2.26E-07
General Exhaust (101 hoods)	5.91E-06	3.13E-07	2.30E-07	6.61E-06	4.20E-09	1.68E-08	1.78E-07	5.23E-07	2.79E-08	2.61E-05
BUILDING 20:										
Water Plant Lab (2 hoods)	4.65E-10	2.49E-11	1.70E-11	6.15E-10	4.17E-13	1.67E-12	1.76E-11	1.24E-12	2.77E-12	2.59E-09
BUILDING 53:										
Bio-Assay/Low-Level Lab (6 hoods)	1.64E-08	8.69E-10	6.38E-10	1.83E-08	1.17E-11	4.68E-11	4.93E-10	1.45E-09	7.76E-11	7.25E-08
BUILDING 71:										
Process vent	5.26E-06	2.78E-07	2.04E-07	5.87E-06	3.73E-09	1.50E-08	1.58E-07	4.65E-07	2.48E-08	2.32E-05
BUILDING 78:										
Process vent	2.64E-06	1.40E-07	1.03E-07	2.95E-06	1.88E-09	7.52E-09	7.93E-08	2.34E-07	1.25E-08	1.17E-05
TOTALS	1.04E-04	5.51E-06	4.05E-06	1.16E-04	7.40E-08	2.97E-07	3.15E-06	9.12E-06	5.27E-07	4.61E-04

NOTE: To convert from Curies to Becquerels, use 1 Ci = 3.7×10^{10} Bq.

TABLE 4: NON-POINT SOURCE RADIONUCLIDE

NON-POINT SOURCE	U-234 (Ci)	U-235 (Ci)	U-236 (Ci)	U-238 (Ci)	Ra-226 (Ci)	Ra-228 (Ci)	Th-228 (Ci)	Th-230 (Ci)	Th-232 (Ci)	Th-234 (Ci)
PLANT 1: Demolition	2.210E-05	1.170E-06	8.600E-07	2.470E-05	1.570E-08	6.300E-08	6.650E-07	1.960E-06	1.040E-07	9.770E-05
BUILDING 20: Cooling Water Tower	6.764E-08	3.627E-09	2.478E-09	8.943E-08	6.059E-11	2.429E-10	2.564E-09	1.800E-10	4.030E-10	3.770E-07
BUILDING 51: Advanced Wastewater Treatment Facility	1.260E-08	6.760E-10	4.620E-10	1.670E-08	1.130E-11	4.530E-11	4.780E-10	3.350E-11	7.510E-11	7.020E-08
BUILDING 65: Fugitive Emissions	----	----	----	----	----	1.062E-07	1.053E-07	----	1.077E-07	----
WASTE PITS: Waste Pit 5	4.180E-07	1.720E-8	4.310E-08	3.130E-07	2.720E-07	3.350E-08	4.32E-08	4.860E-06	3.350E-08	3.160E-07
WPRAP: Railyard	5.670E-04	3.000E-05	2.200E-05	6.340E-04	4.030E-07	1.620E-06	1.700E-05	5.020E-05	2.680E-06	2.510E-03
STOCKPILES: Stockpile #1	8.330E-04	4.410E-05	3.240E-05	9.310E-04	5.920E-07	2.370E-06	2.500E-05	7.370E-05	3.940E-06	3.680E-03
Stockpile #2	5.950E-04	3.150E-05	2.310E-05	6.650E-04	4.230E-07	1.690E-06	1.790E-05	5.260E-05	2.810E-06	2.630E-03
Stockpile #3	5.150E-04	2.730E-05	2.000E-05	5.760E-04	3.660E-07	1.470E-06	1.550E-05	4.560E-05	2.430E-06	2.280E-03
TOTALS	2.53E-03	1.34E-04	9.84E-05	2.83E-03	2.07E-06	7.35E-06	7.62E-05	2.29E-04	1.21E-05	1.12E-02
ADDITIONAL RADIONUCLIDES	Ac-228 (Ci)	Bi-212 (Ci)	Pb-212 (Ci)	Po-212 (Ci)	Po-216 (Ci)	Ra-224 (Ci)	Tl-208 (Ci)			
BUILDING 65: Fugitive Emissions	1.062E-07	1.053E-07	1.053E-07	6.734E-08	1.053E-07	1.053E-07	3.792E-08			
TOTALS	1.062E-07	1.053E-07	1.053E-07	6.734E-08	1.053E-07	1.053E-07	3.792E-08			

NOTE: To convert from Curies to Becquerels, use 1 Ci = 3.7 x 10^{10} Bq.

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TABLE 5: CY-1997 STAR FORMAT METEOROLOGICAL FILE

N	A	0.00000	0.00012	0.00117	0.00023	0.00000	0.00000
NNE	A	0.00000	0.00141	0.00199	0.00035	0.00000	0.00000
NE	A	0.00023	0.00105	0.00199	0.00070	0.00000	0.00000
ENE	A	0.00047	0.00187	0.00176	0.00047	0.00000	0.00000
E	A	0.00023	0.00000	0.00012	0.00000	0.00000	0.00000
ESE	A	0.00012	0.00012	0.00000	0.00000	0.00000	0.00000
SE	A	0.00012	0.00000	0.00012	0.00000	0.00000	0.00000
SSE	A	0.00012	0.00000	0.00000	0.00000	0.00000	0.00000
S	A	0.00035	0.00023	0.00012	0.00023	0.00000	0.00000
SSW	A	0.00012	0.00047	0.00199	0.00000	0.00000	0.00000
SW	A	0.00035	0.00082	0.00363	0.00012	0.00000	0.00000
WSW	A	0.00023	0.00023	0.00258	0.00059	0.00000	0.00000
W	A	0.00047	0.00129	0.00468	0.00059	0.00000	0.00000
WNW	A	0.00012	0.00023	0.00059	0.00023	0.00000	0.00000
NW	A	0.00000	0.00012	0.00117	0.00035	0.00000	0.00000
NNW	A	0.00000	0.00012	0.00094	0.00059	0.00000	0.00000
N	B	0.00000	0.00012	0.00141	0.00000	0.00000	0.00000
NNE	B	0.00000	0.00082	0.00129	0.00070	0.00000	0.00000
NE	B	0.00012	0.00105	0.00199	0.00012	0.00000	0.00000
ENE	B	0.00023	0.00176	0.00304	0.00035	0.00000	0.00000
E	B	0.00012	0.00059	0.00070	0.00023	0.00000	0.00000
ESE	B	0.00000	0.00047	0.00035	0.00000	0.00000	0.00000
SE	B	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
SSE	B	0.00000	0.00012	0.00000	0.00000	0.00000	0.00000
S	B	0.00000	0.00023	0.00070	0.00023	0.00000	0.00000
SSW	B	0.00000	0.00164	0.00363	0.00059	0.00000	0.00000
SW	B	0.00023	0.00433	0.00258	0.00023	0.00000	0.00000
WSW	B	0.00023	0.00246	0.00199	0.00047	0.00000	0.00000
W	B	0.00023	0.00141	0.00316	0.00070	0.00000	0.00000
WNW	B	0.00000	0.00070	0.00246	0.00035	0.00000	0.00000
NW	B	0.00012	0.00047	0.00316	0.00035	0.00000	0.00000
NNW	B	0.00000	0.00035	0.00129	0.00059	0.00000	0.00000
N	C	0.00023	0.00199	0.00199	0.00000	0.00000	0.00000
NNE	C	0.00059	0.00223	0.00223	0.00000	0.00000	0.00000
NE	C	0.00035	0.00293	0.00258	0.00000	0.00000	0.00000
ENE	C	0.00082	0.00422	0.00340	0.00070	0.00000	0.00000
E	C	0.00094	0.00281	0.00070	0.00012	0.00000	0.00000
ESE	C	0.00047	0.00211	0.00035	0.00000	0.00000	0.00000
SE	C	0.00035	0.00129	0.00035	0.00000	0.00000	0.00000
SSE	C	0.00059	0.00141	0.00000	0.00000	0.00000	0.00000
S	C	0.00023	0.00211	0.00152	0.00023	0.00000	0.00000
SSW	C	0.00023	0.00269	0.00328	0.00047	0.00000	0.00000
SW	C	0.00000	0.00468	0.00258	0.00070	0.00000	0.00000
WSW	C	0.00047	0.00445	0.00164	0.00000	0.00000	0.00000
W	C	0.00000	0.00457	0.00269	0.00117	0.00000	0.00000
WNW	C	0.00000	0.00176	0.00375	0.00023	0.00000	0.00000
NW	C	0.00023	0.00269	0.00363	0.00059	0.00000	0.00000
NNW	C	0.00035	0.00234	0.00211	0.00000	0.00000	0.00000
N	D	0.00117	0.00925	0.00668	0.00035	0.00000	0.00000
NNE	D	0.00105	0.00913	0.00586	0.00059	0.00000	0.00000
NE	D	0.00386	0.00960	0.00808	0.00082	0.00000	0.00000
ENE	D	0.00621	0.01651	0.01230	0.00047	0.00000	0.00000
E	D	0.00433	0.00890	0.00293	0.00012	0.00000	0.00000
ESE	D	0.00293	0.00468	0.00047	0.00000	0.00000	0.00000
SE	D	0.00269	0.00316	0.00059	0.00000	0.00000	0.00000
SSE	D	0.00293	0.00410	0.00105	0.00023	0.00000	0.00000
S	D	0.00304	0.00691	0.00468	0.00234	0.00012	0.00000
SSW	D	0.00586	0.01347	0.01077	0.00176	0.00000	0.00000
SW	D	0.00562	0.01792	0.01230	0.00234	0.00000	0.00000
WSW	D	0.00773	0.01581	0.01195	0.00316	0.00000	0.00000
W	D	0.00597	0.01722	0.01850	0.00492	0.00000	0.00000
WNW	D	0.00480	0.01464	0.01171	0.00211	0.00000	0.00012
NW	D	0.00445	0.01031	0.00773	0.00082	0.00000	0.00000
NNW	D	0.00152	0.00785	0.00504	0.00105	0.00000	0.00000
N	E	0.00304	0.00223	0.00023	0.00000	0.00000	0.00000
NNE	E	0.00223	0.00269	0.00023	0.00000	0.00000	0.00000
NE	E	0.00293	0.00363	0.00117	0.00000	0.00000	0.00000
ENE	E	0.00468	0.00796	0.00141	0.00000	0.00000	0.00000
E	E	0.00597	0.00340	0.00070	0.00000	0.00000	0.00000
ESE	E	0.00328	0.00164	0.00000	0.00000	0.00000	0.00000
SE	E	0.00398	0.00199	0.00000	0.00000	0.00000	0.00000
SSE	E	0.00316	0.00351	0.00070	0.00012	0.00000	0.00000
S	E	0.00351	0.00632	0.00304	0.00012	0.00000	0.00000
SSW	E	0.00539	0.01159	0.00351	0.00105	0.00000	0.00000
SW	E	0.01054	0.00995	0.00691	0.00023	0.00000	0.00000
WSW	E	0.01195	0.00761	0.00211	0.00035	0.00000	0.00000
W	E	0.00984	0.00750	0.00152	0.00047	0.00000	0.00000
WNW	E	0.00668	0.00527	0.00293	0.00000	0.00000	0.00000
NW	E	0.00504	0.00457	0.00117	0.00012	0.00000	0.00000
NNW	E	0.00527	0.00269	0.00012	0.00000	0.00000	0.00000
N	F	0.00223	0.00047	0.00000	0.00000	0.00000	0.00000
NNE	F	0.00187	0.00023	0.00047	0.00012	0.00000	0.00000
NE	F	0.00105	0.00105	0.00129	0.00012	0.00000	0.00000
ENE	F	0.00375	0.00293	0.00094	0.00000	0.00000	0.00000
E	F	0.00375	0.00094	0.00023	0.00000	0.00000	0.00000
ESE	F	0.00316	0.00000	0.00000	0.00000	0.00000	0.00000
SE	F	0.00340	0.00012	0.00000	0.00000	0.00000	0.00000
SSE	F	0.00293	0.00035	0.00000	0.00000	0.00000	0.00000
S	F	0.00468	0.00059	0.00000	0.00000	0.00000	0.00000
SSW	F	0.00562	0.00105	0.00023	0.00000	0.00000	0.00000
SW	F	0.01136	0.00199	0.00000	0.00000	0.00000	0.00000
WSW	F	0.01452	0.00234	0.00000	0.00000	0.00000	0.00000
W	F	0.01159	0.00082	0.00000	0.00000	0.00000	0.00000
WNW	F	0.00656	0.00035	0.00000	0.00000	0.00000	0.00000
NW	F	0.00726	0.00070	0.00023	0.00000	0.00000	0.00000
NNW	F	0.00492	0.00094	0.00000	0.00000	0.00000	0.00000
N	G	0.00410	0.00000	0.00000	0.00000	0.00000	0.00000
NNE	G	0.00269	0.00012	0.00000	0.00000	0.00000	0.00000
NE	G	0.00246	0.00012	0.00000	0.00000	0.00000	0.00000
ENE	G	0.00340	0.00023	0.00000	0.00000	0.00000	0.00000
E	G	0.00714	0.00012	0.00000	0.00000	0.00000	0.00000
ESE	G	0.00457	0.00000	0.00000	0.00000	0.00000	0.00000
SE	G	0.00340	0.00000	0.00000	0.00000	0.00000	0.00000
SSE	G	0.00328	0.00000	0.00000	0.00000	0.00000	0.00000
S	G	0.00539	0.00000	0.00000	0.00000	0.00000	0.00000
SSW	G	0.00691	0.00023	0.00000	0.00000	0.00000	0.00000
SW	G	0.01253	0.00000	0.00000	0.00000	0.00000	0.00000
WSW	G	0.01499	0.00012	0.00000	0.00000	0.00000	0.00000
W	G	0.01956	0.00000	0.00000	0.00000	0.00000	0.00000
WNW	G	0.02049	0.00000	0.00000	0.00000	0.00000	0.00000
NW	G	0.01944	0.00012	0.00000	0.00000	0.00000	0.00000
NNW	G	0.01077	0.00012	0.00000	0.00000	0.00000	0.00000

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TABLE 6: SUMMARY OF CAP88-PC RESULTS

SOURCES> RECEPTORS	PLANT 1 (Demo)	PLANT 6 (Vents)	PLANT 8 Oliver	PLANT 8 Elmcos	BLDG. 11 Laundry	BLDG. 11 RWF	BLDG. 15 Perc	BLDG. 15 HEPA	BLDG. 15 Gen.	BLDG 20 Wtr Plt	BLDG 20 CWT	BLDG 51 AWWT	BLDG 53 Bio labs	BLDG 65 Fugitive	BLDG 71 Vent	BLDG 78 Vent	PIT 5 Fugitive	WPRAP (Railyard)	PILE1 Fugitive	PILE2 Fugitive	PILE3 Fugitive	CUMULATIVE DOSE POINT SOURCES	DIFFUSE SOURCES	ALL SOURCES
R1	8.9E-03	1.4E-04	1.3E-05	1.5E-04	1.9E-05	1.0E-04	1.1E-02	9.1E-06	2.6E-04	7.8E-08	2.1E-06	2.1E-06	1.5E-06	7.2E-05	8.8E-04	3.6E-04	3.2E-03	2.9E-01	1.6E-01	3.6E-01	4.3E-02	1.4E-03	8.7E-01	8.8E-01
R2	6.9E-03	9.2E-05	1.3E-05	1.5E-04	2.0E-05	1.1E-04	1.1E-02	9.5E-06	2.7E-04	8.1E-08	2.1E-06	1.5E-06	1.5E-06	4.6E-05	9.4E-04	3.5E-04	4.3E-03	2.4E-01	1.4E-01	4.6E-01	4.5E-02	1.4E-03	9.0E-01	9.1E-01
R3	1.9E-03	4.6E-05	5.2E-06	6.4E-05	7.5E-06	4.2E-05	4.5E-03	4.0E-06	1.1E-04	2.4E-08	5.3E-07	6.9E-07	6.3E-07	1.2E-05	2.8E-04	1.3E-04	5.3E-04	4.3E-02	4.0E-02	5.8E-02	2.2E-02	4.6E-04	1.7E-01	1.7E-01
R4	3.0E-03	6.2E-05	6.6E-06	8.2E-05	9.5E-06	5.3E-05	6.0E-03	4.4E-06	1.2E-04	2.8E-08	6.6E-07	9.6E-07	7.6E-07	1.7E-05	3.9E-04	1.4E-04	1.2E-03	7.6E-02	4.9E-02	9.5E-02	3.0E-02	6.0E-04	2.5E-01	2.6E-01
R5	4.2E-03	7.5E-05	8.1E-06	1.0E-04	1.2E-05	6.4E-05	7.9E-03	5.6E-06	1.5E-04	3.4E-08	7.2E-07	1.3E-06	9.1E-07	3.6E-05	5.1E-04	3.1E-04	3.3E-03	9.0E-02	9.2E-02	2.2E-01	4.2E-02	9.0E-04	4.5E-01	4.6E-01
R6	3.7E-03	1.5E-04	2.7E-05	3.4E-04	4.5E-05	2.3E-04	2.3E-02	2.6E-05	6.8E-04	7.3E-08	3.1E-06	3.8E-06	2.0E-06	3.5E-05	1.1E-03	4.6E-04	6.6E-04	4.3E-02	9.3E-02	8.6E-02	1.4E-01	1.9E-03	3.7E-01	3.9E-01
R7	2.5E-03	8.2E-05	1.3E-05	1.5E-04	2.3E-05	1.2E-04	1.1E-02	1.5E-05	4.0E-04	3.3E-08	1.8E-06	2.4E-06	1.4E-06	1.7E-05	5.0E-04	2.2E-04	4.4E-04	3.5E-02	5.0E-02	4.9E-02	5.6E-01	8.8E-04	7.0E-01	7.1E-01
R8	2.2E-03	8.0E-05	9.0E-06	1.1E-04	2.1E-05	1.1E-04	1.1E-02	1.4E-05	3.8E-04	2.5E-08	1.1E-06	1.6E-06	1.4E-06	1.6E-05	7.5E-04	2.1E-04	3.6E-04	2.8E-02	4.8E-02	4.2E-02	6.5E-01	1.1E-03	7.7E-01	7.8E-01
R9	2.1E-03	7.8E-05	8.7E-06	1.1E-04	2.0E-05	1.1E-04	8.4E-03	8.8E-06	2.4E-04	2.4E-08	1.1E-06	1.5E-06	1.3E-06	1.5E-05	7.2E-04	2.0E-04	3.4E-04	2.8E-02	4.7E-02	4.0E-02	6.2E-01	1.1E-03	7.4E-01	7.5E-01
R10	1.8E-03	7.1E-05	7.5E-06	9.2E-05	1.3E-05	7.1E-05	7.3E-03	7.7E-06	2.1E-04	2.2E-08	1.0E-06	1.3E-06	9.5E-07	1.2E-05	6.2E-04	1.4E-04	2.7E-04	2.5E-02	4.3E-02	4.0E-02	2.8E-01	8.5E-04	3.9E-01	4.0E-01
R11	1.8E-03	6.3E-05	7.5E-06	9.3E-05	1.4E-05	7.1E-05	7.3E-03	7.7E-06	2.1E-04	2.2E-08	1.0E-06	1.4E-06	9.6E-07	1.2E-05	6.2E-04	1.4E-04	2.7E-04	2.5E-02	3.8E-02	4.0E-02	2.7E-01	8.5E-04	3.8E-01	3.8E-01
R12	2.1E-03	6.6E-05	7.9E-06	9.7E-05	1.4E-05	7.6E-05	8.2E-03	7.4E-06	2.0E-04	2.4E-08	9.7E-07	1.3E-06	1.0E-06	1.2E-05	9.5E-04	1.5E-04	2.4E-04	2.5E-02	4.1E-02	3.8E-02	3.2E-01	1.2E-03	4.3E-01	4.4E-01
R13	2.3E-03	9.2E-05	8.5E-06	1.0E-04	1.6E-05	8.5E-05	8.7E-03	7.9E-06	2.2E-04	2.6E-08	1.0E-06	2.4E-06	1.3E-06	1.8E-05	1.0E-03	1.7E-04	4.7E-04	3.4E-02	4.9E-02	7.8E-02	9.6E-01	1.3E-03	1.1E+00	1.1E+00
R14	4.7E-03	9.4E-05	1.3E-05	1.5E-04	1.6E-05	8.5E-05	1.6E-02	9.4E-06	2.4E-04	2.6E-08	1.0E-06	2.3E-06	1.3E-06	1.8E-05	1.1E-03	1.8E-04	4.7E-04	3.5E-02	5.1E-02	7.8E-02	8.3E-01	1.4E-03	1.0E+00	1.0E+00
R15	2.7E-03	1.2E-04	8.1E-06	1.0E-04	1.5E-05	8.3E-05	1.1E-02	6.0E-06	1.6E-04	3.4E-08	8.0E-07	2.5E-06	1.4E-06	2.2E-05	4.0E-04	1.2E-04	2.7E-04	4.4E-02	4.2E-02	4.5E-02	1.9E-01	6.3E-04	3.2E-01	3.4E-01
R16	6.8E-03	1.9E-04	1.5E-05	1.9E-04	2.9E-05	1.6E-04	2.1E-02	1.2E-05	3.3E-04	4.3E-08	1.0E-06	3.0E-06	2.7E-06	4.0E-05	9.3E-04	2.9E-04	6.3E-04	7.4E-02	7.7E-02	1.1E-01	2.8E-01	1.4E-03	5.5E-01	5.7E-01
R17	9.7E-03	4.0E-04	2.0E-05	2.4E-04	3.8E-05	2.0E-04	2.5E-02	1.7E-05	4.7E-04	7.8E-08	2.8E-06	4.1E-06	3.6E-06	1.2E-04	1.3E-03	6.6E-04	8.8E-04	2.3E-01	3.9E-01	1.7E-01	2.1E-01	2.2E-03	1.0E+00	1.0E+00
R18	9.9E-03	4.1E-04	2.0E-05	2.5E-04	5.6E-05	3.0E-04	3.2E-02	2.3E-05	6.2E-04	8.6E-08	2.9E-06	4.0E-06	5.3E-06	1.3E-04	1.3E-03	7.0E-04	9.0E-04	2.4E-01	7.4E-01	1.7E-01	2.0E-01	2.4E-03	1.4E+00	1.4E+00
R19	7.5E-03	2.7E-04	2.0E-05	2.7E-04	3.3E-05	1.8E-04	1.8E-02	1.5E-05	4.1E-04	1.1E-07	3.1E-06	2.3E-06	2.9E-06	1.0E-04	1.2E-03	1.0E-03	8.8E-04	3.3E-01	5.8E-01	1.7E-01	7.1E-02	2.4E-03	1.2E+00	1.2E+00
R20	7.4E-03	1.6E-04	2.0E-05	2.5E-04	2.2E-05	1.2E-04	1.8E-02	1.5E-05	4.2E-04	1.1E-07	3.6E-06	2.3E-06	1.8E-06	5.8E-05	1.2E-03	6.9E-04	1.2E-03	3.9E-01	3.2E-01	1.9E-01	4.5E-02	2.1E-03	9.5E-01	9.7E-01
R21	8.2E-03	1.5E-04	2.0E-05	2.4E-04	3.1E-05	1.7E-04	1.6E-02	1.6E-05	4.4E-04	1.2E-07	3.6E-06	2.0E-06	1.5E-06	8.2E-05	1.3E-03	6.2E-04	2.3E-03	5.6E-01	2.2E-01	4.6E-01	5.3E-02	2.1E-03	1.3E+00	1.3E+00
R22	4.4E-03	6.6E-05	9.7E-06	1.2E-04	1.5E-05	8.0E-05	8.5E-03	7.2E-06	2.0E-04	3.5E-08	9.0E-07	1.2E-06	7.9E-07	2.4E-05	6.3E-04	2.3E-04	1.7E-03	9.6E-02	7.9E-02	1.6E-01	3.0E-02	9.6E-04	3.7E-01	3.8E-01
R23	2.7E-03	4.4E-05	4.7E-06	5.9E-05	7.0E-06	4.0E-05	4.8E-03	3.3E-06	9.3E-05	3.2E-08	1.0E-06	8.2E-07	6.1E-07	1.5E-05	4.1E-04	1.7E-04	6.5E-04	4.0E-02	4.6E-02	6.7E-02	2.2E-02	6.3E-04	1.8E-01	1.8E-01
R24	5.8E-03	2.9E-04	1.7E-05	2.1E-04	3.0E-05	1.7E-04	1.9E-02	1.3E-05	3.5E-04	6.3E-08	2.0E-06	2.5E-06	2.9E-06	5.9E-05	8.9E-04	4.1E-04	5.1E-04	1.4E-01	3.3E-01	9.2E-02	8.6E-02	1.5E-03	6.5E-01	6.8E-01
R25	3.8E-03	1.7E-04	1.4E-05	1.7E-04	2.3E-05	1.3E-04	1.2E-02	1.0E-05	2.7E-04	6.3E-08	2.0E-06	1.6E-06	2.1E-06	3.9E-05	6.0E-04	4.0E-04	4.2E-04	1.0E-01	2.0E-01	7.2E-02	4.8E-02	1.2E-03	4.2E-01	4.4E-01
R26	1.8E-03	5.9E-05	6.7E-06	8.3E-05	1.1E-05	5.9E-05	6.7E-03	5.8E-06	1.6E-04	2.9E-08	1.6E-06	1.1E-06	8.7E-07	1.1E-05	3.4E-04	1.8E-04	3.7E-04	2.9E-01	3.7E-02	4.4E-02	2.4E-02	6.0E-04	4.0E-01	4.0E-01
R27	3.3E-03	1.6E-04	9.6E-06	1.2E-04	1.7E-05	1.0E-04	1.3E-02	6.6E-06	1.8E-04	4.7E-08	1.2E-06	1.8E-06	1.8E-06	2.8E-05	4.8E-04	1.6E-04	3.2E-04	3.7E-02	7.0E-02	5.4E-02	8.8E-02	7.7E-04	2.5E-01	2.7E-01
R28	4.0E-03	6.0E-05	6.1E-06	1.1E-04	9.1E-06	5.0E-05	8.0E-03	6.8E-06	1.9E-04	3.2E-08	8.8E-07	1.1E-06	7.4E-07	2.1E-05	3.8E-04	2.0E-04	1.0E-03	7.9E-02	6.8E-02	1.4E-01	2.9E-02	6.5E-04	3.2E-01	3.3E-01
R29	6.3E-03	2.9E-04	1.4E-05	1.7E-04	2.7E-05	1.5E-04	2.0E-02	1.1E-05	3.0E-04	6.3E-08	1.7E-06	3.0E-06	2.5E-06	3.8E-05	8.6E-04	2.8E-04	5.9E-04	7.1E-02	1.5E-01	1.0E-01	2.5E-01	1.3E-03	5.8E-01	6.0E-01
R30	4.4E-03	2.2E-04	1.4E-05	1.7E-04	2.7E-05	1.5E-04	1.5E-02	1.2E-05	3.1E-04	6.9E-08	2.3E-06	1.9E-06	2.5E-06	4.8E-05	7.0E-04	4.7E-04	4.8E-04	1.2E-01	2.6E-01	8.5E-02	5.8E-02	1.4E-03	5.3E-01	5.5E-01
R31	4.3E-03	2.0E-04	1.5E-05	1.9E-04	2.6E-05	1.4E-04	1.4E-02	1.1E-05	3.0E-04	6.8E-08	2.2E-06	1.8E-06	2.4E-06	4.5E-05	6.7E-04	4.5E-04	4.7E-04	1.2E-01	2.4E-01	8.2E-02	5.6E-02	1.3E-03	5.0E-01	5.2E-01
R32	2.4E-03	5.7E-05	5.8E-06	7.2E-05	8.7E-06	4.8E-05	5.0E-03	4.4E-06	1.2E-04	3.0E-08	8.6E-07	1.1E-06	7.0E-07	1.9E-05	3.6E-04	1.9E-04	9.6E-04	7.0E-02	6.2E-02	1.2E-01	2.7E-02	6.1E-04	2.8E-01	2.9E-01
R-A	1.8E-03	5.7E-05	6.5E-06	8.1E-05	1.0E-05	5.8E-05	6.5E-03	5.6E-06	1.6E-04	2.8E-08	9.0E-07	1.1E-06	8.5E-07	1.1E-05	3.3E-04	1.8E-04	3.6E-04	2.8E-02	3.6E-02	4.2E-02	2.3E-02	5.8E-04	1.3E-01	1.4E-01
R-B	2.9E-03	6.0E-05	6.2E-06	7.3E-05	9.1E-06	5.0E-05	5.7E-03	4.2E-06	1.1E-04	2.8E-08	6.4E-07	9.1E-07	7.3E-07	1.7E-05	3.8E-04	1.3E-04	1.1E-03	4.7E-02	4.7E-02	9.1E-02	2.4E-02	5.8E-04	2.1E-01	2.2E-01
R-C	1.9E-03	4.6E-05	5.0E-06	6.3E-05	7.4E-06	4.1E-05	4.4E-03	3.9E-06	1.1E-04	2.4E-08	5.1E-07	6.8E-07	6.2E-07	1.2E-05	2.8E-04	1.3E-04	5.4E-04	4.2E-02	4.2E-02	5.8E-02	1.7E-02	4.6E-04	1.6E-01	1.7E-01
R-D	1.8E-03	4.3E-05	4.8E-06	5.9E-05	7.0E-06	3.9E-05	4.3E-03	3.3E-06	9.0E-05	2.2E-08	5.0E-07	6.4E-07	5.9E-07	1.1E-05	2.6E-04	1.2E-04	4.8E-04	3.8E-02	3.9E-02	5.1E-02	1.6E-02	4.3E-04	1.5E-01	1.5E-01
R-E	1.8E-03	4.4E-05	4.9E-06	6.1E-05	7.2E-06	4.0E-05	4.4E-03	3.4E-06	9.2E-05	2.3E-08	5.1E-07	6.6E-07	6.0E-07	1.2E-05	2.7E-04	1.2E-04	5.1E-04	4.0E-02	4.0E-02	5.4E-02	1.7E-02	4.4E-04	1.5E-01	1.6E-01
R-F	1.4E-03	7.2E-05	1.1E-05	1.4E-04	1.8E-05	9.6E-05	9.2E-03	1.2E-05	3.3E-04	1.9E-08	1.2E-06	1.6E-06	1.2E-06	8.3E-06	2.5E-04	1.2E-04	2.3E-04	2.0E-02	4.6E-02	3.0E-02	8.8E-02	5.0E-04	1.9E-01	2.0E-01
R-G	1.3E-03	7.1E-05	1.1E-05	1.3E-04	1.8E-05	9.3E-05	8.9E-03	1.2E-05	3.2E-04	1.9E-08	1.2E-06	1.6E-06	1.2E-06	8.1E-06	2.4E-04	2.2E-04	2.3E-04	2.0E-02	4.5E-02	2.9E-02	8.4E-02	5.8E-04	1.8E-01	1.9E-01
R-H	6.7E-03	1.4E-04	1.2E-05	1.5E-04	2.0E-05	1.1E-04	1.0E-02	1.0E-05	2.9E-04	9.9E-08	3.4E-06	2.1E-06	1.6E-06	4.9E-05	1.1E-03	5.9E-04	9.6E-04	3.2E-01	2.5E-01	1.7E-01	3.6E-02	1.8E-03	7.8E-01	8.0E-01
Totals =	1.6E-01	5.0E-03	4.5E-04	5.5E-03	7.7E-04	4.2E-03	4.6E-01	3.9E-04	1.1E-02	1.9E-06	6.1E-05	7.2E-05	6.1E-05	1.4E-03	2.7E-02	1.2E-02	3.5E-02	4.6E+00	5.4E+00	4.5E+00	6.9E+00			
Maximum =	9.9E-03	4.1E-04	2.7E-05	3.1E-04	5.6E-05	3.0E-04	3.2E-02	2.6E-05	6.8E-04	1.2E-07	3.6E-06	4.1E-06	5.3E-06	1.3E-04	1.3E-03	1.0E-03	4.3E-03	5.6E-01	7.4E-01	4.6E-01	9.6E-01	2.4E-03	1.4E+00	1.4E+00

ATTACHMENT E.2

METEOROLOGICAL DATA FILE AND INDIVIDUAL DOSE CAP88-PC FILES

CAP88-PC File: WEATHER DATA - 97-Z025-G1

NON-RADON INDIVIDUAL ASSESSMENTS

SYNOPSIS REPORTS		DOSE AND RISK EQUIVALENT SUMMARIES	
97-Z025-G1	97-AWWT-G1	97-Z025-G1	97-AWWT-G1
97-Z025-G2	97-AWWT-G2	97-Z025-G2	97-AWWT-G2
97-Z022-VENT-G1	97-Z006-G1	97-Z022-VENT-G1	97-Z006-G1
97-Z022-VENT-G2	97-Z006-G2	97-Z022-VENT-G2	97-Z006-G2
97-P239-G1	97-Z024-G1	97-P239-G1	97-Z024-G1
97-P239-G2	97-Z024-G2	97-P239-G2	97-Z024-G2
97-P240-G1	97-Z026-VENT-G1	97-P240-G1	97-Z026-VENT-G1
97-P240-G2	97-Z026-VENT-G2	97-P240-G2	97-Z026-VENT-G2
97-P274-G1	97-Z030-VENT-G1	97-P274-G1	97-Z030-VENT-G1
97-P274-G2	97-Z030-VENT-G2	97-P274-G2	97-Z030-VENT-G2
97-P284-G1	97-Z016-G1	97-P284-G1	97-Z016-G1
97-P284-G2	97-Z016-G2	97-P284-G2	97-Z016-G2
97-Z003-G1	97-Z036a-RR-G1	97-Z003-G1	97-Z036a-RR-G1
97-Z003-G2	97-Z036a-RR-G2	97-Z003-G2	97-Z036a-RR-G2
97-Z004-G1	97-PILE1-G1	97-Z004-G1	97-PILE1-G1
97-Z004-G2	97-PILE1-G2	97-Z004-G2	97-PILE1-G2
97-Z005-G1	97-PILE2-G1	97-Z005-G1	97-PILE2-G1
97-Z005-G2	97-PILE2-G2	97-Z005-G2	97-PILE2-G2
97-Z010-G1	97-PILE3-G1	97-Z010-G1	97-PILE3-G1
97-Z010-G2	97-PILE3-G2	97-Z010-G2	97-PILE3-G2
97-Z012-G1		97-Z012-G1	
97-Z012-G2		97-Z012-G2	

NOTES: (1) The CAP88-PC files listed above have either a G1 or G2 designation. The G1 designation corresponds to receptors 1 through 20. The G2 designation corresponds to receptors 21 through 32 and A through H.

(2) The DOSE AND RISK EQUIVALENT SUMMARIES contain tables of Individual Effective Equivalent Dose Rates. Proceeding from left to right in the tables on pages 5 and 6 in the DOSE AND RISK EQUIVALENT SUMMARIES, the highlighted numbers correspond to receptors 1-20 for the G1 files, and receptors 21-32 and A-H for the G2 files. The highlighted numbers have been tabulated in Table 6 of the annual report.

(3) The distance and direction given for the highlighted EDE corresponds to the receptor's distance and direction from the source.

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Clean Air Act Assessment Package - 1988

W E A T H E R D A T A

Non-Radon Individual Assessment
Apr 7, 1998 4:05 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Plant 1 Demolition Activities [G1]

Dataset Name: 97-Z025-G1
Dataset Date: Apr 7, 1998 12:09 am
Wind File: WNDFILES\97STAR.WND

Apr 7, 1998 4:05 pm

HARMONIC AVERAGE WIND SPEEDS (WIND TOWARDS)

Dir	Pasquill Stability Class A	B	C	D	E	F	G	Wind Frequency
N	1.541	4.105	2.728	2.124	1.683	0.837	0.772	0.047
NNW	0.772	2.572	1.524	1.467	1.329	0.834	0.772	0.025
NW	1.312	0.000	1.922	1.328	1.007	0.791	0.772	0.022
WNW	1.187	3.121	1.941	1.412	1.007	0.772	0.772	0.025
W	1.075	2.837	1.837	1.668	1.092	0.932	0.781	0.045
WSW	2.530	3.114	2.552	2.046	1.482	1.226	0.807	0.080
SW	3.145	3.166	2.685	2.090	1.412	1.687	0.798	0.049
SSW	3.559	3.932	2.358	2.625	1.291	1.020	0.795	0.039
S	4.376	4.145	2.757	2.608	1.132	0.879	0.772	0.037
SSE	4.761	4.321	2.600	2.444	1.022	0.869	0.778	0.049
SE	4.498	3.689	3.161	1.999	1.268	0.841	0.775	0.075
ESE	2.833	3.966	3.645	2.240	1.308	0.800	0.772	0.086
E	3.103	3.294	3.293	2.406	1.202	0.809	0.772	0.119
ENE	3.417	2.898	2.417	1.997	1.160	0.855	0.776	0.108
NE	3.037	2.830	3.171	2.194	1.444	0.862	0.772	0.112
NNE	3.252	3.774	3.086	2.049	1.731	0.891	0.789	0.083

ARITHMETIC AVERAGE WIND SPEEDS (WIND TOWARDS)

Dir	Pasquill Stability Class A	B	C	D	E	F	G
N	3.208	4.526	3.386	3.394	2.547	0.973	0.772
NNW	0.772	2.572	2.041	2.286	2.051	0.964	0.772
NW	2.572	0.000	2.572	1.985	1.372	0.833	0.772
WNW	1.672	3.341	2.498	2.024	1.372	0.772	0.772
W	2.006	3.822	2.592	2.450	1.630	1.284	0.801
WSW	3.530	3.797	3.415	2.939	2.153	1.908	0.886
SW	4.141	3.759	3.257	3.072	2.162	2.845	0.855
SSW	3.936	4.488	3.157	3.248	1.873	1.830	0.849
S	4.620	4.232	3.325	3.228	1.652	1.085	0.772
SSE	5.162	4.771	3.232	3.279	1.425	1.060	0.792
SE	4.790	4.281	3.791	2.979	1.981	1.027	0.783
ESE	4.155	4.270	3.924	3.255	2.118	0.863	0.772
E	4.017	4.088	3.754	3.518	1.904	0.891	0.772
ENE	4.449	3.587	2.893	3.126	1.837	1.022	0.786
NE	3.879	3.283	3.540	3.155	2.372	1.040	0.772
NNE	3.877	4.128	3.704	3.091	2.628	1.166	0.830

FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	0.0198	0.0247	0.0872	0.3642	0.2769	0.1123	0.1149
NNW	0.0049	0.0049	0.0813	0.3378	0.3045	0.1333	0.1333
NW	0.0111	0.0000	0.0923	0.2987	0.2769	0.1633	0.1577
WNW	0.0097	0.0332	0.1185	0.3269	0.1990	0.1278	0.1849
W	0.0078	0.0364	0.1014	0.3611	0.2233	0.1091	0.1610
WSW	0.0572	0.0674	0.1144	0.4443	0.1759	0.0954	0.0454
SW	0.0805	0.0665	0.1189	0.4536	0.1568	0.0712	0.0523
SSW	0.0964	0.0723	0.1299	0.4276	0.1324	0.0692	0.0723
S	0.0411	0.0413	0.1138	0.4715	0.1486	0.0730	0.1108
SSE	0.0337	0.0455	0.0980	0.3157	0.1650	0.1197	0.2224
SE	0.0219	0.0548	0.0954	0.3115	0.1456	0.1094	0.2614
ESE	0.0136	0.0408	0.0667	0.3878	0.1729	0.0803	0.2380
E	0.0591	0.0463	0.0709	0.3921	0.1626	0.1044	0.1645
ENE	0.0336	0.0477	0.0608	0.3579	0.2039	0.1561	0.1399
NE	0.0440	0.0658	0.0711	0.3411	0.2468	0.1193	0.1119
NNE	0.0313	0.0710	0.0808	0.3859	0.2609	0.0836	0.0865
TOT	0.0383	0.0505	0.0872	0.3758	0.1984	0.1072	0.1424

ADDITIONAL WEATHER INFORMATION

Average Air Temperature:	10.6 degrees C
	283.8 K
Precipitation:	102.3 cm/y
Lid Height:	950 meters
Surface Roughness Length:	0.010 meters
Height Of Wind Measurements:	10.0 meters
Average Wind Speed:	2.452 m/s

Vertical Temperature Gradients:

STABILITY E	0.073 k/m
STABILITY F	0.109 k/m
STABILITY G	0.146 k/m

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S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 4:05 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

1.96E-02

At This Location: 930 Meters East

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Plant 1 Demolition Activities [G1]

Dataset Name: 97-Z025-G1
Dataset Date: Apr 7, 1998 12:09 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 930 Meters East
Lifetime Fatal Cancer Risk: 2.50E-07

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	5.53E-05
BREAST	6.29E-05
R MAR	2.57E-03
LUNGS	1.49E-01
THYROID	5.39E-05
ENDOST	3.38E-02
RMNDR	1.41E-03
EFFEC	1.96E-02

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	2.2E-05	2.2E-05
U-235	Y	1.00	1.2E-06	1.2E-06
U-236	Y	1.00	8.6E-07	8.6E-07
U-238	Y	1.00	2.5E-05	2.5E-05
RA-226	W	1.00	1.6E-08	1.6E-08
RA-228	W	1.00	6.3E-08	6.3E-08
TH-228	Y	1.00	6.7E-07	6.7E-07
TH-230	Y	1.00	2.0E-06	2.0E-06
TH-232	Y	1.00	1.0E-07	1.0E-07
TH-234	Y	1.00	9.8E-05	9.8E-05

SITE INFORMATION

Temperature:	11 degrees C
Precipitation:	102 cm/y
Mixing Height:	950 m

SOURCE INFORMATION

Source Number: 1

Source Height (m): 5.00
Area (sq m): 1.60E+04

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Zero:	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

991	930	1644	1327	1071	1017	1241	1344	1383	1549
1553	1592	1530	1530	2142	1655	1380	1360	1672	1537

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Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 4:05 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Plant 1 Demolition Activities [G1]

Dataset Name: 97-Z025-G1
Dataset Date: Apr 7, 1998 12:09 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	5.53E-05
BREAST	6.29E-05
R MAR	2.57E-03
LUNGS	1.49E-01
THYROID	5.39E-05
ENDOST	3.38E-02
RMNDR	1.41E-03
EFFEC	1.96E-02

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.01E-03
INHALATION	1.86E-02
AIR IMMERSION	1.56E-09
GROUND SURFACE	1.09E-05
INTERNAL	1.96E-02
EXTERNAL	1.09E-05
TOTAL	1.96E-02

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	8.48E-03
U-235	4.25E-04
U-236	3.12E-04
U-238	8.43E-03
RA-226	7.84E-07
RA-228	1.24E-06
TH-228	4.67E-04
TH-230	1.37E-03
TH-232	1.04E-04
TH-234	2.11E-05
TOTAL	1.96E-02

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	2.50E-09
BONE	1.66E-09
THYROID	1.24E-11
BREAST	1.40E-10
LUNG	2.42E-07
STOMACH	9.34E-11
BOWEL	2.48E-10
LIVER	1.17E-10
PANCREAS	5.43E-11
URINARY	2.93E-09
OTHER	6.63E-11
TOTAL	2.50E-07

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	5.35E-09
INHALATION	2.45E-07
AIR IMMERSION	3.47E-14
GROUND SURFACE	2.50E-10
INTERNAL	2.50E-07
EXTERNAL	2.50E-10
TOTAL	2.50E-07

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	1.09E-07
U-235	5.59E-09
U-236	4.02E-09
U-238	1.10E-07
RA-226	1.07E-11
RA-228	1.29E-11
TH-228	9.36E-09
TH-230	1.12E-08
TH-232	5.88E-10
TH-234	6.89E-10
TOTAL	2.50E-07

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	991	930	1644	1327	1071	1017	1241
N	6.3E-03	6.9E-03	2.9E-03	4.1E-03	5.6E-03	6.0E-03	4.5E-03
NNW	4.1E-03	4.5E-03	1.9E-03	2.6E-03	3.6E-03	3.9E-03	2.9E-03
NW	4.2E-03	4.6E-03	1.9E-03	2.7E-03	3.7E-03	4.0E-03	3.0E-03
WNW	4.7E-03	5.1E-03	2.2E-03	3.0E-03	4.2E-03	4.5E-03	3.4E-03
W	7.3E-03	8.1E-03	3.4E-03	4.8E-03	6.6E-03	7.1E-03	5.3E-03
WSW	6.7E-03	7.4E-03	3.0E-03	4.3E-03	5.9E-03	6.4E-03	4.7E-03
SW	3.9E-03	4.3E-03	1.8E-03	2.5E-03	3.5E-03	3.7E-03	2.8E-03
SSW	3.5E-03	3.8E-03	1.6E-03	2.3E-03	3.1E-03	3.3E-03	2.5E-03
S	4.3E-03	4.8E-03	2.0E-03	2.8E-03	3.9E-03	4.2E-03	3.1E-03
SSE	9.0E-03	9.8E-03	4.2E-03	5.9E-03	8.1E-03	8.6E-03	6.5E-03
SE	1.5E-02	1.6E-02	6.9E-03	9.7E-03	1.3E-02	1.4E-02	1.1E-02
ESE	1.6E-02	1.7E-02	7.3E-03	1.0E-02	1.4E-02	1.5E-02	1.1E-02
E	1.8E-02	2.0E-02	8.2E-03	1.2E-02	1.6E-02	1.7E-02	1.3E-02
ENE	1.7E-02	1.9E-02	7.7E-03	1.1E-02	1.5E-02	1.6E-02	1.2E-02
NE	1.5E-02	1.6E-02	6.7E-03	9.4E-03	1.3E-02	1.4E-02	1.0E-02
NNE	8.9E-03	9.8E-03	4.1E-03	5.7E-03	8.0E-03	8.6E-03	6.4E-03

	Distance (m)						
Direction	1344	1383	1549	1553	1592	1530	1530
N	4.0E-03	3.8E-03	3.2E-03	3.2E-03	3.0E-03	3.2E-03	3.2E-03
NNW	2.6E-03	2.5E-03	2.1E-03	2.1E-03	2.0E-03	2.1E-03	2.1E-03
NW	2.7E-03	2.5E-03	2.1E-03	2.1E-03	2.0E-03	2.2E-03	2.2E-03
WNW	3.0E-03	2.8E-03	2.4E-03	2.4E-03	2.3E-03	2.4E-03	2.4E-03
W	4.7E-03	4.5E-03	3.7E-03	3.7E-03	3.6E-03	3.8E-03	3.8E-03
WSW	4.2E-03	4.0E-03	3.3E-03	3.3E-03	3.2E-03	3.4E-03	3.4E-03
SW	2.5E-03	2.4E-03	2.0E-03	2.0E-03	1.9E-03	2.0E-03	2.0E-03
SSW	2.2E-03	2.1E-03	1.8E-03	1.8E-03	1.7E-03	1.8E-03	1.8E-03
S	2.8E-03	2.7E-03	2.2E-03	2.2E-03	2.1E-03	2.3E-03	2.3E-03
SSE	5.8E-03	5.5E-03	4.6E-03	4.6E-03	4.4E-03	4.7E-03	4.7E-03
SE	9.5E-03	9.1E-03	7.6E-03	7.5E-03	7.2E-03	7.7E-03	7.7E-03
ESE	1.0E-02	9.6E-03	8.0E-03	8.0E-03	7.7E-03	8.2E-03	8.2E-03
E	1.1E-02	1.1E-02	9.1E-03	9.0E-03	8.7E-03	9.2E-03	9.2E-03
ENE	1.1E-02	1.0E-02	8.5E-03	8.5E-03	8.1E-03	8.7E-03	8.7E-03
NE	9.2E-03	8.8E-03	7.3E-03	7.3E-03	7.0E-03	7.5E-03	7.5E-03
NNE	5.6E-03	5.4E-03	4.5E-03	4.5E-03	4.3E-03	4.6E-03	4.6E-03

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 991	930	1644	1327	1071	1017	1241
N	7.9E-08	8.8E-08	3.6E-08	5.1E-08	7.1E-08	7.6E-08	5.7E-08
NNW	5.1E-08	5.7E-08	2.3E-08	3.3E-08	4.6E-08	4.9E-08	3.7E-08
NW	5.3E-08	5.8E-08	2.4E-08	3.4E-08	4.7E-08	5.1E-08	3.8E-08
WNW	5.9E-08	6.4E-08	2.7E-08	3.8E-08	5.2E-08	5.6E-08	4.2E-08
W	9.3E-08	1.0E-07	4.3E-08	6.0E-08	8.3E-08	9.0E-08	6.7E-08
WSW	8.5E-08	9.4E-08	3.8E-08	5.4E-08	7.5E-08	8.1E-08	6.0E-08
SW	4.9E-08	5.4E-08	2.2E-08	3.1E-08	4.4E-08	4.7E-08	3.5E-08
SSW	4.3E-08	4.8E-08	2.0E-08	2.8E-08	3.9E-08	4.2E-08	3.1E-08
S	5.4E-08	6.0E-08	2.5E-08	3.5E-08	4.9E-08	5.2E-08	3.9E-08
SSE	1.1E-07	1.2E-07	5.3E-08	7.4E-08	1.0E-07	1.1E-07	8.3E-08
SE	1.9E-07	2.0E-07	8.7E-08	1.2E-07	1.7E-07	1.8E-07	1.4E-07
ESE	2.0E-07	2.2E-07	9.3E-08	1.3E-07	1.8E-07	1.9E-07	1.4E-07
E	2.3E-07	2.5E-07	1.0E-07	1.5E-07	2.0E-07	2.2E-07	1.6E-07
ENE	2.2E-07	2.4E-07	9.8E-08	1.4E-07	1.9E-07	2.1E-07	1.5E-07
NE	1.9E-07	2.1E-07	8.4E-08	1.2E-07	1.7E-07	1.8E-07	1.3E-07
NNE	1.1E-07	1.3E-07	5.1E-08	7.3E-08	1.0E-07	1.1E-07	8.1E-08

Direction	Distance (m) 1344	1383	1549	1553	1592	1530	1530
N	5.0E-08	4.8E-08	4.0E-08	4.0E-08	3.8E-08	4.1E-08	4.1E-08
NNW	3.2E-08	3.1E-08	2.6E-08	2.6E-08	2.5E-08	2.6E-08	2.6E-08
NW	3.3E-08	3.2E-08	2.6E-08	2.6E-08	2.5E-08	2.7E-08	2.7E-08
WNW	3.7E-08	3.6E-08	3.0E-08	2.9E-08	2.8E-08	3.0E-08	3.0E-08
W	5.9E-08	5.6E-08	4.7E-08	4.7E-08	4.5E-08	4.8E-08	4.8E-08
WSW	5.3E-08	5.0E-08	4.2E-08	4.2E-08	4.0E-08	4.3E-08	4.3E-08
SW	3.1E-08	2.9E-08	2.4E-08	2.4E-08	2.3E-08	2.5E-08	2.5E-08
SSW	2.7E-08	2.6E-08	2.2E-08	2.2E-08	2.1E-08	2.2E-08	2.2E-08
S	3.5E-08	3.3E-08	2.8E-08	2.7E-08	2.6E-08	2.8E-08	2.8E-08
SSE	7.3E-08	7.0E-08	5.8E-08	5.8E-08	5.6E-08	5.9E-08	5.9E-08
SE	1.2E-07	1.2E-07	9.6E-08	9.6E-08	9.2E-08	9.8E-08	9.8E-08
ESE	1.3E-07	1.2E-07	1.0E-07	1.0E-07	9.7E-08	1.0E-07	1.0E-07
E	1.5E-07	1.4E-07	1.1E-07	1.1E-07	1.1E-07	1.2E-07	1.2E-07
ENE	1.4E-07	1.3E-07	1.1E-07	1.1E-07	1.0E-07	1.1E-07	1.1E-07
NE	1.2E-07	1.1E-07	9.3E-08	9.2E-08	8.9E-08	9.5E-08	9.5E-08
NNE	7.1E-08	6.8E-08	5.6E-08	5.6E-08	5.4E-08	5.8E-08	5.8E-08

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2142	1655	1380	1360	1672	1537
N	1.9E-03	2.9E-03	3.8E-03	3.9E-03	2.8E-03	3.2E-03
NNW	1.2E-03	1.9E-03	2.5E-03	2.5E-03	1.8E-03	2.1E-03
NW	1.3E-03	1.9E-03	2.5E-03	2.6E-03	1.9E-03	2.1E-03
WNW	1.4E-03	2.1E-03	2.9E-03	2.9E-03	2.1E-03	2.4E-03
W	2.2E-03	3.4E-03	4.5E-03	4.6E-03	3.3E-03	3.8E-03
WSW	2.0E-03	3.0E-03	4.0E-03	4.1E-03	3.0E-03	3.4E-03
SW	1.2E-03	1.8E-03	2.4E-03	2.4E-03	1.8E-03	2.0E-03
SSW	1.1E-03	1.6E-03	2.1E-03	2.2E-03	1.6E-03	1.8E-03
S	1.3E-03	2.0E-03	2.7E-03	2.7E-03	2.0E-03	2.2E-03
SSE	2.7E-03	4.1E-03	5.5E-03	5.7E-03	4.1E-03	4.7E-03
SE	4.4E-03	6.8E-03	9.1E-03	9.3E-03	6.7E-03	7.7E-03
ESE	4.7E-03	7.2E-03	9.7E-03	9.9E-03	7.1E-03	8.1E-03
E	5.3E-03	8.1E-03	1.1E-02	1.1E-02	8.0E-03	9.2E-03
ENE	4.9E-03	7.6E-03	1.0E-02	1.1E-02	7.5E-03	8.6E-03
NE	4.3E-03	6.6E-03	8.8E-03	9.1E-03	6.5E-03	7.4E-03
NNE	2.6E-03	4.0E-03	5.4E-03	5.5E-03	4.0E-03	4.5E-03

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2142	1655	1380	1360	1672	1537
N	2.3E-08	3.6E-08	4.8E-08	4.9E-08	3.5E-08	4.0E-08
NNW	1.5E-08	2.3E-08	3.1E-08	3.2E-08	2.3E-08	2.6E-08
NW	1.5E-08	2.4E-08	3.2E-08	3.2E-08	2.3E-08	2.7E-08
WNW	1.7E-08	2.7E-08	3.6E-08	3.7E-08	2.6E-08	3.0E-08
W	2.7E-08	4.2E-08	5.7E-08	5.8E-08	4.1E-08	4.7E-08
WSW	2.4E-08	3.7E-08	5.0E-08	5.2E-08	3.7E-08	4.2E-08
SW	1.4E-08	2.2E-08	2.9E-08	3.0E-08	2.2E-08	2.5E-08
SSW	1.3E-08	2.0E-08	2.6E-08	2.7E-08	1.9E-08	2.2E-08
S	1.6E-08	2.5E-08	3.3E-08	3.4E-08	2.4E-08	2.8E-08
SSE	3.4E-08	5.2E-08	7.0E-08	7.2E-08	5.1E-08	5.9E-08
SE	5.6E-08	8.6E-08	1.2E-07	1.2E-07	8.5E-08	9.7E-08
ESE	5.9E-08	9.2E-08	1.2E-07	1.3E-07	9.0E-08	1.0E-07
E	6.6E-08	1.0E-07	1.4E-07	1.4E-07	1.0E-07	1.2E-07
ENE	6.2E-08	9.7E-08	1.3E-07	1.3E-07	9.5E-08	1.1E-07
NE	5.4E-08	8.3E-08	1.1E-07	1.1E-07	8.2E-08	9.4E-08
NNE	3.3E-08	5.1E-08	6.8E-08	7.0E-08	5.0E-08	5.7E-08

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 4:06 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)
1.66E-02

At This Location: 1044 Meters East

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Plant 1 Demolition Activities [G2]

Dataset Name: 97-Z025-G2
Dataset Date: Apr 7, 1998 12:11 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1044 Meters East
Lifetime Fatal Cancer Risk: 2.12E-07

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	4.63E-05
BREAST	5.27E-05
R MAR	2.16E-03
LUNGS	1.26E-01
THYROID	4.51E-05
ENDOST	2.84E-02
RMNDR	1.17E-03
EFFEC	1.66E-02

Apr 7, 1998 4:06 pm

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	2.2E-05	2.2E-05
U-235	Y	1.00	1.2E-06	1.2E-06
U-236	Y	1.00	8.6E-07	8.6E-07
U-238	Y	1.00	2.5E-05	2.5E-05
RA-226	W	1.00	1.6E-08	1.6E-08
RA-228	W	1.00	6.3E-08	6.3E-08
TH-228	Y	1.00	6.7E-07	6.7E-07
TH-230	Y	1.00	2.0E-06	2.0E-06
TH-232	Y	1.00	1.0E-07	1.0E-07
TH-234	Y	1.00	9.8E-05	9.8E-05

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number: 1

Source Height (m): 5.00
Area (sq m): 1.60E+04

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Zero:	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1044	1247	1861	2014	2604	2227	2559	1338	1730	2361
2421	1405	2285	1356	1635	1728	1684	1933	1961	1635

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 4:06 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Plant 1 Demolition Activities [G2]

Dataset Name: 97-Z025-G2
Dataset Date: Apr 7, 1998 12:11 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	4.63E-05
BREAST	5.27E-05
R MAR	2.16E-03
LUNGS	1.26E-01
THYROID	4.51E-05
ENDOST	2.84E-02
RMNDR	1.17E-03
EFFEC	1.66E-02

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	8.37E-04
INHALATION	1.57E-02
AIR IMMERSION	1.32E-09
GROUND SURFACE	9.22E-06
INTERNAL	1.66E-02
EXTERNAL	9.22E-06
TOTAL	1.66E-02

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	7.16E-03
U-235	3.59E-04
U-236	2.64E-04
U-238	7.12E-03
RA-226	6.57E-07
RA-228	1.04E-06
TH-228	3.95E-04
TH-230	1.16E-03
TH-232	8.83E-05
TH-234	1.77E-05
TOTAL	1.66E-02

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	2.10E-09
BONE	1.39E-09
THYROID	1.04E-11
BREAST	1.17E-10
LUNG	2.05E-07
STOMACH	7.82E-11
BOWEL	2.07E-10
LIVER	9.81E-11
PANCREAS	4.54E-11
URINARY	2.43E-09
OTHER	5.55E-11
TOTAL	2.12E-07

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	4.44E-09
INHALATION	2.07E-07
AIR IMMERSION	2.94E-14
GROUND SURFACE	2.12E-10
INTERNAL	2.11E-07
EXTERNAL	2.12E-10
TOTAL	2.12E-07

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	9.23E-08
U-235	4.72E-09
U-236	3.40E-09
U-238	9.26E-08
RA-226	8.99E-12
RA-228	1.08E-11
TH-228	7.92E-09
TH-230	9.51E-09
TH-232	4.97E-10
TH-234	5.81E-10
TOTAL	2.12E-07

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1044	1247	1861	2014	2604	2227	2559
N	5.8E-03	4.4E-03	2.3E-03	2.0E-03	1.3E-03	1.7E-03	1.4E-03
NNW	3.7E-03	2.9E-03	1.5E-03	1.3E-03	8.9E-04	1.1E-03	9.1E-04
NW	3.8E-03	2.9E-03	1.5E-03	1.4E-03	9.0E-04	1.2E-03	9.3E-04
WNW	4.3E-03	3.3E-03	1.7E-03	1.5E-03	1.0E-03	1.3E-03	1.0E-03
W	6.8E-03	5.2E-03	2.7E-03	2.4E-03	1.6E-03	2.0E-03	1.6E-03
WSW	6.1E-03	4.7E-03	2.4E-03	2.1E-03	1.4E-03	1.8E-03	1.5E-03
SW	3.6E-03	2.7E-03	1.5E-03	1.3E-03	8.6E-04	1.1E-03	8.8E-04
SSW	3.2E-03	2.4E-03	1.3E-03	1.1E-03	7.7E-04	9.8E-04	7.9E-04
S	4.0E-03	3.1E-03	1.6E-03	1.4E-03	9.5E-04	1.2E-03	9.8E-04
SSE	8.3E-03	6.4E-03	3.4E-03	2.9E-03	1.9E-03	2.5E-03	2.0E-03
SE	1.4E-02	1.1E-02	5.6E-03	4.8E-03	3.2E-03	4.1E-03	3.3E-03
ESE	1.5E-02	1.1E-02	5.9E-03	5.1E-03	3.3E-03	4.4E-03	3.4E-03
E	1.7E-02	1.3E-02	6.6E-03	5.8E-03	3.8E-03	4.9E-03	3.9E-03
ENE	1.6E-02	1.2E-02	6.2E-03	5.4E-03	3.5E-03	4.6E-03	3.6E-03
NE	1.4E-02	1.0E-02	5.4E-03	4.7E-03	3.1E-03	4.0E-03	3.1E-03
NNE	8.2E-03	6.3E-03	3.3E-03	2.9E-03	1.9E-03	2.4E-03	1.9E-03

	Distance (m)						
Direction	1338	1730	2361	2421	1405	2285	1356
N	4.0E-03	2.6E-03	1.6E-03	1.5E-03	3.7E-03	1.7E-03	3.9E-03
NNW	2.6E-03	1.7E-03	1.0E-03	1.0E-03	2.4E-03	1.1E-03	2.5E-03
NW	2.6E-03	1.7E-03	1.1E-03	1.0E-03	2.4E-03	1.1E-03	2.6E-03
WNW	3.0E-03	2.0E-03	1.2E-03	1.1E-03	2.7E-03	1.2E-03	2.9E-03
W	4.7E-03	3.1E-03	1.8E-03	1.8E-03	4.3E-03	2.0E-03	4.6E-03
WSW	4.2E-03	2.8E-03	1.7E-03	1.6E-03	3.9E-03	1.8E-03	4.1E-03
SW	2.5E-03	1.6E-03	1.0E-03	9.6E-04	2.3E-03	1.1E-03	2.4E-03
SSW	2.2E-03	1.5E-03	9.0E-04	8.6E-04	2.0E-03	9.4E-04	2.1E-03
S	2.8E-03	1.8E-03	1.1E-03	1.1E-03	2.6E-03	1.2E-03	2.7E-03
SSE	5.8E-03	3.8E-03	2.3E-03	2.2E-03	5.3E-03	2.4E-03	5.7E-03
SE	9.5E-03	6.3E-03	3.7E-03	3.6E-03	8.8E-03	3.9E-03	9.3E-03
ESE	1.0E-02	6.7E-03	4.0E-03	3.8E-03	9.4E-03	4.2E-03	9.9E-03
E	1.1E-02	7.5E-03	4.4E-03	4.3E-03	1.1E-02	4.7E-03	1.1E-02
ENE	1.1E-02	7.0E-03	4.2E-03	4.0E-03	9.9E-03	4.4E-03	1.1E-02
NE	9.3E-03	6.1E-03	3.6E-03	3.5E-03	8.6E-03	3.8E-03	9.1E-03
NNE	5.6E-03	3.7E-03	2.2E-03	2.1E-03	5.2E-03	2.3E-03	5.5E-03

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1635	1728	1684	1933	1961	1635
N	2.9E-03	2.6E-03	2.7E-03	2.2E-03	2.1E-03	2.9E-03
NNW	1.9E-03	1.7E-03	1.8E-03	1.4E-03	1.4E-03	1.9E-03
NW	1.9E-03	1.8E-03	1.8E-03	1.5E-03	1.4E-03	1.9E-03
WNW	2.2E-03	2.0E-03	2.1E-03	1.6E-03	1.6E-03	2.2E-03
W	3.4E-03	3.1E-03	3.2E-03	2.6E-03	2.5E-03	3.4E-03
WSW	3.0E-03	2.8E-03	2.9E-03	2.3E-03	2.2E-03	3.0E-03
SW	1.8E-03	1.6E-03	1.7E-03	1.4E-03	1.3E-03	1.8E-03
SSW	1.6E-03	1.5E-03	1.5E-03	1.2E-03	1.2E-03	1.6E-03
S	2.0E-03	1.8E-03	1.9E-03	1.5E-03	1.5E-03	2.0E-03
SSE	4.2E-03	3.8E-03	4.0E-03	3.2E-03	3.1E-03	4.2E-03
SE	6.9E-03	6.3E-03	6.6E-03	5.2E-03	5.1E-03	6.9E-03
ESE	7.3E-03	6.7E-03	7.0E-03	5.5E-03	5.4E-03	7.3E-03
E	8.3E-03	7.5E-03	7.9E-03	6.2E-03	6.0E-03	8.3E-03
ENE	7.7E-03	7.1E-03	7.4E-03	5.8E-03	5.7E-03	7.7E-03
NE	6.7E-03	6.1E-03	6.4E-03	5.0E-03	4.9E-03	6.7E-03
NNE	4.1E-03	3.7E-03	3.9E-03	3.1E-03	3.0E-03	4.1E-03

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1044	1247	1861	2014	2604	2227	2559
N	7.3E-08	5.6E-08	2.9E-08	2.5E-08	1.7E-08	2.2E-08	1.7E-08
NNW	4.7E-08	3.6E-08	1.9E-08	1.6E-08	1.1E-08	1.4E-08	1.1E-08
NW	4.8E-08	3.7E-08	1.9E-08	1.7E-08	1.1E-08	1.4E-08	1.1E-08
WNW	5.4E-08	4.2E-08	2.2E-08	1.9E-08	1.2E-08	1.6E-08	1.3E-08
W	8.6E-08	6.6E-08	3.4E-08	3.0E-08	1.9E-08	2.5E-08	2.0E-08
WSW	7.8E-08	5.9E-08	3.1E-08	2.7E-08	1.7E-08	2.3E-08	1.8E-08
SW	4.5E-08	3.4E-08	1.8E-08	1.6E-08	1.0E-08	1.3E-08	1.1E-08
SSW	4.0E-08	3.1E-08	1.6E-08	1.4E-08	9.2E-09	1.2E-08	9.5E-09
S	5.0E-08	3.9E-08	2.0E-08	1.8E-08	1.2E-08	1.5E-08	1.2E-08
SSE	1.1E-07	8.2E-08	4.3E-08	3.7E-08	2.4E-08	3.1E-08	2.5E-08
SE	1.7E-07	1.4E-07	7.0E-08	6.1E-08	4.0E-08	5.2E-08	4.1E-08
ESE	1.9E-07	1.4E-07	7.5E-08	6.5E-08	4.2E-08	5.5E-08	4.3E-08
E	2.1E-07	1.6E-07	8.4E-08	7.3E-08	4.7E-08	6.2E-08	4.9E-08
ENE	2.0E-07	1.5E-07	7.9E-08	6.9E-08	4.4E-08	5.8E-08	4.6E-08
NE	1.7E-07	1.3E-07	6.8E-08	5.9E-08	3.8E-08	5.0E-08	4.0E-08
NNE	1.0E-07	8.0E-08	4.1E-08	3.6E-08	2.3E-08	3.1E-08	2.4E-08

	Distance (m)						
Direction	1338	1730	2361	2421	1405	2285	1356
N	5.0E-08	3.3E-08	2.0E-08	1.9E-08	4.6E-08	2.1E-08	4.9E-08
NNW	3.2E-08	2.1E-08	1.3E-08	1.2E-08	3.0E-08	1.3E-08	3.2E-08
NW	3.3E-08	2.2E-08	1.3E-08	1.2E-08	3.1E-08	1.4E-08	3.2E-08
WNW	3.7E-08	2.4E-08	1.5E-08	1.4E-08	3.4E-08	1.5E-08	3.7E-08
W	5.9E-08	3.9E-08	2.3E-08	2.2E-08	5.5E-08	2.4E-08	5.8E-08
WSW	5.3E-08	3.5E-08	2.1E-08	2.0E-08	4.9E-08	2.2E-08	5.2E-08
SW	3.1E-08	2.0E-08	1.2E-08	1.2E-08	2.8E-08	1.3E-08	3.0E-08
SSW	2.7E-08	1.8E-08	1.1E-08	1.0E-08	2.5E-08	1.1E-08	2.7E-08
S	3.5E-08	2.3E-08	1.4E-08	1.3E-08	3.2E-08	1.4E-08	3.4E-08
SSE	7.3E-08	4.8E-08	2.8E-08	2.7E-08	6.8E-08	3.0E-08	7.2E-08
SE	1.2E-07	8.0E-08	4.7E-08	4.5E-08	1.1E-07	5.0E-08	1.2E-07
ESE	1.3E-07	8.5E-08	5.0E-08	4.8E-08	1.2E-07	5.3E-08	1.3E-07
E	1.5E-07	9.6E-08	5.6E-08	5.4E-08	1.3E-07	5.9E-08	1.4E-07
ENE	1.4E-07	9.0E-08	5.3E-08	5.0E-08	1.3E-07	5.6E-08	1.3E-07
NE	1.2E-07	7.7E-08	4.5E-08	4.3E-08	1.1E-07	4.8E-08	1.2E-07
NNE	7.1E-08	4.7E-08	2.8E-08	2.7E-08	6.6E-08	2.9E-08	7.0E-08

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1635	1728	1684	1933	1961	1635
N	3.6E-08	3.3E-08	3.5E-08	2.7E-08	2.7E-08	3.6E-08
NNW	2.3E-08	2.1E-08	2.2E-08	1.8E-08	1.7E-08	2.3E-08
NW	2.4E-08	2.2E-08	2.3E-08	1.8E-08	1.8E-08	2.4E-08
WNW	2.7E-08	2.5E-08	2.6E-08	2.0E-08	2.0E-08	2.7E-08
W	4.3E-08	3.9E-08	4.1E-08	3.2E-08	3.1E-08	4.3E-08
WSW	3.8E-08	3.5E-08	3.6E-08	2.9E-08	2.8E-08	3.8E-08
SW	2.2E-08	2.0E-08	2.1E-08	1.7E-08	1.6E-08	2.2E-08
SSW	2.0E-08	1.8E-08	1.9E-08	1.5E-08	1.5E-08	2.0E-08
S	2.5E-08	2.3E-08	2.4E-08	1.9E-08	1.8E-08	2.5E-08
SSE	5.3E-08	4.8E-08	5.0E-08	4.0E-08	3.9E-08	5.3E-08
SE	8.8E-08	8.0E-08	8.4E-08	6.6E-08	6.4E-08	8.8E-08
ESE	9.3E-08	8.5E-08	8.9E-08	7.0E-08	6.8E-08	9.3E-08
E	1.1E-07	9.6E-08	1.0E-07	7.9E-08	7.7E-08	1.1E-07
ENE	9.8E-08	9.0E-08	9.4E-08	7.4E-08	7.2E-08	9.8E-08
NE	8.5E-08	7.7E-08	8.1E-08	6.4E-08	6.2E-08	8.5E-08
NNE	5.1E-08	4.7E-08	4.9E-08	3.9E-08	3.8E-08	5.1E-08

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 16, 1998 12:08 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

5.76E-04

At This Location: 854 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Plant 6 - Stack Emissions [G1]

Dataset Name: 97-Z022-VENT-G1
Dataset Date: Apr 16, 1998 12:07 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 854 Meters East Northeast
Lifetime Fatal Cancer Risk: 7.45E-09

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.10E-06
BREAST	1.24E-06
R MAR	6.25E-05
LUNGS	4.46E-03
THYROID	1.07E-06
ENDOST	8.14E-04
RMNDR	2.69E-05
EFFEC	5.76E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	Source #2 Ci/y	Source #3 Ci/y	TOTAL Ci/y
U-234	Y	0.30	1.8E-07	1.8E-07	1.7E-07	5.4E-07
U-235	Y	1.00	9.6E-09	9.6E-09	9.2E-09	2.8E-08
U-236	Y	1.00	7.0E-09	7.0E-09	6.8E-09	2.1E-08
U-238	Y	0.30	2.0E-07	2.0E-07	1.9E-07	6.0E-07
RA-226	W	0.30	1.3E-10	1.3E-10	1.2E-10	3.8E-10
RA-228	W	0.30	5.1E-10	5.1E-10	5.0E-10	1.5E-09
TH-228	Y	0.30	5.4E-09	5.4E-09	5.2E-09	1.6E-08
TH-230	Y	0.30	1.6E-08	1.6E-08	1.5E-08	4.7E-08
TH-232	Y	0.30	8.5E-10	8.5E-10	8.2E-10	2.5E-09
TH-234	Y	0.30	8.0E-07	8.0E-07	7.7E-07	2.4E-06

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1	2	3
Stack Height (m):	8.00	8.00	1.00
Diameter (m):	0.30	0.30	0.15
Plume Rise Momentum (m/s): (Exit Velocity)	9.44E-01	9.44E-01	2.59E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1229	1230	2117	1835	1574	1319	1358	1386	1413	1513
1496	1432	1266	1240	1752	1203	871	854	1428	1485

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 16, 1998 12:08 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Plant 6 - Stack Emissions [G1]

Dataset Name: 97-Z022-VENT-G1
Dataset Date: Apr 16, 1998 12:07 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.10E-06
BREAST	1.24E-06
R MAR	6.25E-05
LUNGS	4.46E-03
THYROID	1.07E-06
ENDOST	8.14E-04
RMNDR	2.69E-05
EFFEC	5.76E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.88E-05
INHALATION	5.57E-04
AIR IMMERSION	2.74E-11
GROUND SURFACE	2.01E-07
INTERNAL	5.75E-04
EXTERNAL	2.01E-07
TOTAL	5.76E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	2.53E-04
U-235	7.51E-06
U-236	5.50E-06
U-238	2.52E-04
RA-226	1.83E-08
RA-228	2.65E-08
TH-228	1.41E-05
TH-230	4.03E-05
TH-232	3.13E-06
TH-234	4.68E-07
TOTAL	5.76E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	5.90E-11
BONE	3.90E-11
THYROID	2.41E-13
BREAST	2.68E-12
LUNG	7.28E-09
STOMACH	1.82E-12
BOWEL	4.68E-12
LIVER	2.61E-12
PANCREAS	1.07E-12
URINARY	5.55E-11
OTHER	1.31E-12
TOTAL	7.45E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	9.99E-11
INHALATION	7.34E-09
AIR IMMERSION	6.10E-16
GROUND SURFACE	4.63E-12
INTERNAL	7.44E-09
EXTERNAL	4.63E-12
TOTAL	7.45E-09

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	3.30E-09
U-235	9.85E-11
U-236	7.07E-11
U-238	3.31E-09
RA-226	2.97E-13
RA-228	3.13E-13
TH-228	2.85E-10
TH-230	3.38E-10
TH-232	1.78E-11
TH-234	1.91E-11
TOTAL	7.45E-09

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1229	1230	2117	1835	1574	1319	1358
N	1.4E-04	1.4E-04	6.9E-05	8.5E-05	1.0E-04	1.3E-04	1.2E-04
NNW	9.2E-05	9.2E-05	4.5E-05	5.5E-05	6.8E-05	8.5E-05	8.2E-05
NW	9.4E-05	9.4E-05	4.6E-05	5.7E-05	6.9E-05	8.7E-05	8.4E-05
WNW	1.0E-04	1.0E-04	5.1E-05	6.2E-05	7.5E-05	9.3E-05	9.0E-05
W	1.6E-04	1.6E-04	8.1E-05	9.8E-05	1.2E-04	1.5E-04	1.4E-04
WSW	1.7E-04	1.7E-04	7.5E-05	9.3E-05	1.2E-04	1.5E-04	1.4E-04
SW	9.4E-05	9.4E-05	4.4E-05	5.4E-05	6.7E-05	8.5E-05	8.2E-05
SSW	8.0E-05	8.0E-05	3.9E-05	4.8E-05	5.9E-05	7.4E-05	7.1E-05
S	9.5E-05	9.5E-05	4.8E-05	5.8E-05	7.1E-05	8.7E-05	8.4E-05
SSE	1.8E-04	1.8E-04	9.8E-05	1.2E-04	1.4E-04	1.7E-04	1.7E-04
SE	2.9E-04	2.9E-04	1.6E-04	1.9E-04	2.3E-04	2.7E-04	2.7E-04
ESE	3.1E-04	3.1E-04	1.7E-04	2.0E-04	2.4E-04	2.9E-04	2.8E-04
E	3.8E-04	3.8E-04	1.9E-04	2.4E-04	2.9E-04	3.5E-04	3.4E-04
ENE	3.8E-04	3.8E-04	1.9E-04	2.3E-04	2.8E-04	3.5E-04	3.4E-04
NE	3.3E-04	3.3E-04	1.6E-04	2.0E-04	2.4E-04	3.0E-04	2.9E-04
NNE	2.1E-04	2.1E-04	9.9E-05	1.2E-04	1.5E-04	1.9E-04	1.8E-04

	Distance (m)						
Direction	1386	1413	1513	1496	1432	1266	1240
N	1.2E-04	1.2E-04	1.1E-04	1.1E-04	1.2E-04	1.4E-04	1.4E-04
NNW	8.0E-05	7.8E-05	7.1E-05	7.2E-05	7.7E-05	8.9E-05	9.1E-05
NW	8.1E-05	8.0E-05	7.3E-05	7.4E-05	7.8E-05	9.1E-05	9.3E-05
WNW	8.8E-05	8.6E-05	7.9E-05	8.0E-05	8.5E-05	9.7E-05	1.0E-04
W	1.4E-04	1.4E-04	1.3E-04	1.3E-04	1.4E-04	1.6E-04	1.6E-04
WSW	1.4E-04	1.4E-04	1.2E-04	1.3E-04	1.3E-04	1.6E-04	1.6E-04
SW	8.0E-05	7.8E-05	7.1E-05	7.2E-05	7.6E-05	9.0E-05	9.3E-05
SSW	6.9E-05	6.7E-05	6.2E-05	6.3E-05	6.6E-05	7.7E-05	7.9E-05
S	8.2E-05	8.1E-05	7.4E-05	7.5E-05	7.9E-05	9.2E-05	9.4E-05
SSE	1.6E-04	1.6E-04	1.5E-04	1.5E-04	1.6E-04	1.8E-04	1.8E-04
SE	2.6E-04	2.6E-04	2.4E-04	2.4E-04	2.5E-04	2.8E-04	2.9E-04
ESE	2.8E-04	2.7E-04	2.5E-04	2.6E-04	2.7E-04	3.0E-04	3.1E-04
E	3.3E-04	3.2E-04	3.0E-04	3.0E-04	3.2E-04	3.7E-04	3.7E-04
ENE	3.3E-04	3.2E-04	2.9E-04	3.0E-04	3.2E-04	3.7E-04	3.8E-04
NE	2.8E-04	2.8E-04	2.5E-04	2.6E-04	2.7E-04	3.2E-04	3.3E-04
NNE	1.8E-04	1.7E-04	1.6E-04	1.6E-04	1.7E-04	2.0E-04	2.1E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1752	1203	871	854	1428	1485
N	9.0E-05	1.4E-04	2.1E-04	2.1E-04	1.2E-04	1.1E-04
NNW	5.9E-05	9.5E-05	1.4E-04	1.4E-04	7.7E-05	7.3E-05
NW	6.0E-05	9.7E-05	1.4E-04	1.4E-04	7.8E-05	7.5E-05
WNW	6.6E-05	1.0E-04	1.4E-04	1.5E-04	8.5E-05	8.1E-05
W	1.0E-04	1.7E-04	2.3E-04	2.4E-04	1.4E-04	1.3E-04
WSW	1.0E-04	1.7E-04	2.7E-04	2.8E-04	1.3E-04	1.3E-04
SW	5.8E-05	9.6E-05	1.5E-04	1.5E-04	7.7E-05	7.3E-05
SSW	5.1E-05	8.2E-05	1.2E-04	1.2E-04	6.6E-05	6.3E-05
S	6.2E-05	9.7E-05	1.4E-04	1.4E-04	8.0E-05	7.6E-05
SSE	1.2E-04	1.9E-04	2.5E-04	2.5E-04	1.6E-04	1.5E-04
SE	2.0E-04	3.0E-04	3.8E-04	3.8E-04	2.5E-04	2.4E-04
ESE	2.1E-04	3.2E-04	4.0E-04	4.1E-04	2.7E-04	2.6E-04
E	2.5E-04	3.9E-04	5.3E-04	5.3E-04	3.2E-04	3.1E-04
ENE	2.4E-04	3.9E-04	5.6E-04	5.8E-04	3.2E-04	3.0E-04
NE	2.1E-04	3.4E-04	4.9E-04	5.0E-04	2.7E-04	2.6E-04
NNE	1.3E-04	2.1E-04	3.2E-04	3.2E-04	1.7E-04	1.6E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1229	1230	2117	1835	1574	1319	1358
N	1.8E-09	1.8E-09	8.8E-10	1.1E-09	1.3E-09	1.7E-09	1.6E-09
NNW	1.2E-09	1.2E-09	5.7E-10	7.0E-10	8.6E-10	1.1E-09	1.0E-09
NW	1.2E-09	1.2E-09	5.8E-10	7.1E-10	8.8E-10	1.1E-09	1.1E-09
WNW	1.3E-09	1.3E-09	6.5E-10	7.9E-10	9.6E-10	1.2E-09	1.1E-09
W	2.1E-09	2.1E-09	1.0E-09	1.3E-09	1.5E-09	1.9E-09	1.8E-09
WSW	2.1E-09	2.1E-09	9.6E-10	1.2E-09	1.5E-09	1.9E-09	1.9E-09
SW	1.2E-09	1.2E-09	5.5E-10	6.8E-10	8.5E-10	1.1E-09	1.0E-09
SSW	1.0E-09	1.0E-09	4.9E-10	6.0E-10	7.4E-10	9.3E-10	9.0E-10
S	1.2E-09	1.2E-09	6.0E-10	7.4E-10	9.0E-10	1.1E-09	1.1E-09
SSE	2.4E-09	2.4E-09	1.2E-09	1.5E-09	1.8E-09	2.2E-09	2.1E-09
SE	3.8E-09	3.8E-09	2.0E-09	2.5E-09	2.9E-09	3.5E-09	3.4E-09
ESE	4.0E-09	4.0E-09	2.2E-09	2.6E-09	3.1E-09	3.7E-09	3.6E-09
E	4.9E-09	4.9E-09	2.5E-09	3.0E-09	3.7E-09	4.5E-09	4.4E-09
ENE	4.9E-09	4.9E-09	2.4E-09	2.9E-09	3.6E-09	4.5E-09	4.4E-09
NE	4.3E-09	4.3E-09	2.1E-09	2.5E-09	3.1E-09	3.9E-09	3.8E-09
NNE	2.7E-09	2.7E-09	1.3E-09	1.6E-09	1.9E-09	2.4E-09	2.4E-09

	Distance (m)						
Direction	1386	1413	1513	1496	1432	1266	1240
N	1.6E-09	1.5E-09	1.4E-09	1.4E-09	1.5E-09	1.7E-09	1.8E-09
NNW	1.0E-09	9.9E-10	9.1E-10	9.2E-10	9.7E-10	1.1E-09	1.2E-09
NW	1.0E-09	1.0E-09	9.3E-10	9.4E-10	1.0E-09	1.2E-09	1.2E-09
WNW	1.1E-09	1.1E-09	1.0E-09	1.0E-09	1.1E-09	1.2E-09	1.3E-09
W	1.8E-09	1.8E-09	1.6E-09	1.6E-09	1.7E-09	2.0E-09	2.1E-09
WSW	1.8E-09	1.8E-09	1.6E-09	1.6E-09	1.7E-09	2.1E-09	2.1E-09
SW	1.0E-09	9.9E-10	9.0E-10	9.1E-10	9.7E-10	1.1E-09	1.2E-09
SSW	8.8E-10	8.5E-10	7.8E-10	7.9E-10	8.4E-10	9.8E-10	1.0E-09
S	1.1E-09	1.0E-09	9.4E-10	9.6E-10	1.0E-09	1.2E-09	1.2E-09
SSE	2.1E-09	2.1E-09	1.9E-09	1.9E-09	2.0E-09	2.3E-09	2.4E-09
SE	3.4E-09	3.3E-09	3.1E-09	3.1E-09	3.3E-09	3.7E-09	3.7E-09
ESE	3.6E-09	3.5E-09	3.3E-09	3.3E-09	3.5E-09	3.9E-09	4.0E-09
E	4.3E-09	4.2E-09	3.9E-09	3.9E-09	4.1E-09	4.7E-09	4.8E-09
ENE	4.2E-09	4.1E-09	3.8E-09	3.9E-09	4.1E-09	4.7E-09	4.9E-09
NE	3.7E-09	3.6E-09	3.3E-09	3.3E-09	3.5E-09	4.1E-09	4.2E-09
NNE	2.3E-09	2.2E-09	2.0E-09	2.1E-09	2.2E-09	2.6E-09	2.6E-09

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1752	1203	871	854	1428	1485
N	1.1E-09	1.9E-09	2.7E-09	2.7E-09	1.5E-09	1.4E-09
NNW	7.5E-10	1.2E-09	1.8E-09	1.8E-09	9.8E-10	9.3E-10
NW	7.6E-10	1.2E-09	1.8E-09	1.8E-09	1.0E-09	9.5E-10
WNW	8.4E-10	1.3E-09	1.8E-09	1.9E-09	1.1E-09	1.0E-09
W	1.3E-09	2.1E-09	3.0E-09	3.1E-09	1.7E-09	1.7E-09
WSW	1.3E-09	2.2E-09	3.5E-09	3.6E-09	1.7E-09	1.6E-09
SW	7.3E-10	1.2E-09	1.9E-09	1.9E-09	9.8E-10	9.2E-10
SSW	6.4E-10	1.0E-09	1.6E-09	1.6E-09	8.4E-10	8.0E-10
S	7.8E-10	1.2E-09	1.8E-09	1.8E-09	1.0E-09	9.7E-10
SSE	1.6E-09	2.4E-09	3.2E-09	3.2E-09	2.0E-09	1.9E-09
SE	2.6E-09	3.8E-09	4.9E-09	4.9E-09	3.3E-09	3.1E-09
ESE	2.8E-09	4.1E-09	5.2E-09	5.2E-09	3.5E-09	3.3E-09
E	3.2E-09	5.0E-09	6.8E-09	6.9E-09	4.1E-09	3.9E-09
ENE	3.1E-09	5.0E-09	7.3E-09	7.4E-09	4.1E-09	3.9E-09
NE	2.7E-09	4.4E-09	6.4E-09	6.5E-09	3.5E-09	3.4E-09
NNE	1.7E-09	2.7E-09	4.1E-09	4.2E-09	2.2E-09	2.1E-09

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 16, 1998 12:09 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

4.05E-04

At This Location: 1163 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Plant 6 - Stack Emissions [G2]

Dataset Name: 97-Z022-VENT-G2
Dataset Date: Apr 16, 1998 12:07 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1163 Meters East Northeast
Lifetime Fatal Cancer Risk: 5.24E-09

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	7.71E-07
BREAST	8.71E-07
R MAR	4.40E-05
LUNGS	3.14E-03
THYROID	7.53E-07
ENDOST	5.72E-04
RMNDR	1.88E-05
EFFEC	4.05E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	Source #2 Ci/y	Source #3 Ci/y	TOTAL Ci/y
U-234	Y	0.30	1.8E-07	1.8E-07	1.7E-07	5.4E-07
U-235	Y	1.00	9.6E-09	9.6E-09	9.2E-09	2.8E-08
U-236	Y	1.00	7.0E-09	7.0E-09	6.8E-09	2.1E-08
U-238	Y	0.30	2.0E-07	2.0E-07	1.9E-07	6.0E-07
RA-226	W	0.30	1.3E-10	1.3E-10	1.2E-10	3.8E-10
RA-228	W	0.30	5.1E-10	5.1E-10	5.0E-10	1.5E-09
TH-228	Y	0.30	5.4E-09	5.4E-09	5.2E-09	1.6E-08
TH-230	Y	0.30	1.6E-08	1.6E-08	1.5E-08	4.7E-08
TH-232	Y	0.30	8.5E-10	8.5E-10	8.2E-10	2.5E-09
TH-234	Y	0.30	8.0E-07	8.0E-07	7.7E-07	2.4E-06

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1	2	3
Stack Height (m):	8.00	8.00	1.00
Diameter (m):	0.30	0.30	0.15
Plume Rise Momentum (m/s): (Exit Velocity)	9.44E-01	9.44E-01	2.59E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1163	1595	2340	1543	2221	2630	2078	1707	1258	1950
2017	1781	2690	1864	2115	2209	2168	2164	2196	1616

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 16, 1998 12:09 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Plant 6 - Stack Emissions [G2]

Dataset Name: 97-Z022-VENT-G2
Dataset Date: Apr 16, 1998 12:07 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	7.71E-07
BREAST	8.71E-07
R MAR	4.40E-05
LUNGS	3.14E-03
THYROID	7.53E-07
ENDOST	5.72E-04
RMNDR	1.88E-05
EFFEC	4.05E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.32E-05
INHALATION	3.92E-04
AIR IMMERSION	1.93E-11
GROUND SURFACE	1.42E-07
INTERNAL	4.05E-04
EXTERNAL	1.42E-07
TOTAL	4.05E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.78E-04
U-235	5.29E-06
U-236	3.87E-06
U-238	1.77E-04
RA-226	1.28E-08
RA-228	1.86E-08
TH-228	9.91E-06
TH-230	2.84E-05
TH-232	2.20E-06
TH-234	3.29E-07
TOTAL	4.05E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	4.14E-11
BONE	2.74E-11
THYROID	1.69E-13
BREAST	1.89E-12
LUNG	5.13E-09
STOMACH	1.28E-12
BOWEL	3.29E-12
LIVER	1.83E-12
PANCREAS	7.50E-13
URINARY	3.89E-11
OTHER	9.17E-13
TOTAL	5.24E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	7.00E-11
INHALATION	5.17E-09
AIR IMMERSION	4.30E-16
GROUND SURFACE	3.27E-12
INTERNAL	5.24E-09
EXTERNAL	3.27E-12
TOTAL	5.24E-09

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	2.33E-09
U-235	6.94E-11
U-236	4.98E-11
U-238	2.33E-09
RA-226	2.09E-13
RA-228	2.20E-13
TH-228	2.00E-10
TH-230	2.38E-10
TH-232	1.25E-11
TH-234	1.34E-11
TOTAL	5.24E-09

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1163	1595	2340	1543	2221	2630	2078
N	1.5E-04	1.0E-04	5.9E-05	1.1E-04	6.4E-05	5.0E-05	7.0E-05
NNW	9.8E-05	6.6E-05	3.9E-05	6.9E-05	4.2E-05	3.3E-05	4.6E-05
NW	1.0E-04	6.7E-05	4.0E-05	7.0E-05	4.3E-05	3.3E-05	4.7E-05
WNW	1.1E-04	7.3E-05	4.4E-05	7.6E-05	4.7E-05	3.7E-05	5.2E-05
W	1.7E-04	1.2E-04	7.0E-05	1.2E-04	7.5E-05	5.9E-05	8.2E-05
WSW	1.8E-04	1.1E-04	6.4E-05	1.2E-04	6.9E-05	5.3E-05	7.7E-05
SW	1.0E-04	6.5E-05	3.7E-05	6.8E-05	4.0E-05	3.1E-05	4.5E-05
SSW	8.5E-05	5.7E-05	3.3E-05	5.9E-05	3.6E-05	2.8E-05	3.9E-05
S	1.0E-04	6.9E-05	4.1E-05	7.2E-05	4.4E-05	3.5E-05	4.8E-05
SSE	1.9E-04	1.4E-04	8.5E-05	1.4E-04	9.1E-05	7.2E-05	9.9E-05
SE	3.1E-04	2.2E-04	1.4E-04	2.3E-04	1.5E-04	1.2E-04	1.6E-04
ESE	3.2E-04	2.4E-04	1.5E-04	2.5E-04	1.6E-04	1.2E-04	1.7E-04
E	4.0E-04	2.8E-04	1.7E-04	2.9E-04	1.8E-04	1.4E-04	2.0E-04
ENE	4.1E-04	2.7E-04	1.6E-04	2.9E-04	1.7E-04	1.3E-04	1.9E-04
NE	3.5E-04	2.4E-04	1.4E-04	2.5E-04	1.5E-04	1.2E-04	1.6E-04
NNE	2.2E-04	1.5E-04	8.5E-05	1.5E-04	9.2E-05	7.1E-05	1.0E-04

	Distance (m)						
Direction	1707	1258	1950	2017	1781	2690	1864
N	9.2E-05	1.4E-04	7.7E-05	7.3E-05	8.7E-05	4.8E-05	8.2E-05
NNW	6.0E-05	8.9E-05	5.0E-05	4.8E-05	5.7E-05	3.2E-05	5.3E-05
NW	6.2E-05	9.1E-05	5.1E-05	4.9E-05	5.8E-05	3.2E-05	5.5E-05
WNW	6.7E-05	9.7E-05	5.6E-05	5.4E-05	6.4E-05	3.6E-05	6.0E-05
W	1.1E-04	1.6E-04	9.0E-05	8.6E-05	1.0E-04	5.7E-05	9.6E-05
WSW	1.0E-04	1.6E-04	8.4E-05	8.0E-05	9.7E-05	5.2E-05	9.0E-05
SW	5.9E-05	9.0E-05	4.9E-05	4.6E-05	5.6E-05	3.0E-05	5.2E-05
SSW	5.2E-05	7.7E-05	4.3E-05	4.1E-05	4.9E-05	2.7E-05	4.6E-05
S	6.3E-05	9.1E-05	5.3E-05	5.0E-05	6.0E-05	3.4E-05	5.6E-05
SSE	1.3E-04	1.8E-04	1.1E-04	1.0E-04	1.2E-04	6.9E-05	1.1E-04
SE	2.1E-04	2.9E-04	1.8E-04	1.7E-04	2.0E-04	1.1E-04	1.9E-04
ESE	2.2E-04	3.0E-04	1.9E-04	1.8E-04	2.1E-04	1.2E-04	2.0E-04
E	2.6E-04	3.7E-04	2.2E-04	2.1E-04	2.4E-04	1.4E-04	2.3E-04
ENE	2.5E-04	3.7E-04	2.1E-04	2.0E-04	2.4E-04	1.3E-04	2.2E-04
NE	2.2E-04	3.2E-04	1.8E-04	1.7E-04	2.0E-04	1.1E-04	1.9E-04
NNE	1.3E-04	2.0E-04	1.1E-04	1.1E-04	1.3E-04	6.9E-05	1.2E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2115	2209	2168	2164	2196	1616
N	6.9E-05	6.5E-05	6.6E-05	6.6E-05	6.5E-05	9.9E-05
NNW	4.5E-05	4.2E-05	4.3E-05	4.3E-05	4.2E-05	6.5E-05
NW	4.6E-05	4.3E-05	4.4E-05	4.4E-05	4.3E-05	6.6E-05
WNW	5.1E-05	4.8E-05	4.9E-05	4.9E-05	4.8E-05	7.2E-05
W	8.0E-05	7.6E-05	7.8E-05	7.8E-05	7.6E-05	1.2E-04
WSW	7.5E-05	7.0E-05	7.2E-05	7.2E-05	7.1E-05	1.1E-04
SW	4.3E-05	4.1E-05	4.2E-05	4.2E-05	4.1E-05	6.4E-05
SSW	3.8E-05	3.6E-05	3.7E-05	3.7E-05	3.6E-05	5.6E-05
S	4.7E-05	4.5E-05	4.6E-05	4.6E-05	4.5E-05	6.8E-05
SSE	9.7E-05	9.2E-05	9.4E-05	9.4E-05	9.2E-05	1.4E-04
SE	1.6E-04	1.5E-04	1.5E-04	1.5E-04	1.5E-04	2.2E-04
ESE	1.7E-04	1.6E-04	1.6E-04	1.6E-04	1.6E-04	2.3E-04
E	1.9E-04	1.8E-04	1.9E-04	1.9E-04	1.8E-04	2.8E-04
ENE	1.9E-04	1.7E-04	1.8E-04	1.8E-04	1.8E-04	2.7E-04
NE	1.6E-04	1.5E-04	1.5E-04	1.5E-04	1.5E-04	2.3E-04
NNE	9.9E-05	9.3E-05	9.5E-05	9.5E-05	9.3E-05	1.4E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1163	1595	2340	1543	2221	2630	2078
N	1.9E-09	1.3E-09	7.6E-10	1.4E-09	8.2E-10	6.4E-10	9.0E-10
NNW	1.3E-09	8.4E-10	4.9E-10	8.8E-10	5.3E-10	4.1E-10	5.8E-10
NW	1.3E-09	8.6E-10	5.0E-10	9.0E-10	5.4E-10	4.2E-10	5.9E-10
WNW	1.4E-09	9.4E-10	5.6E-10	9.8E-10	6.0E-10	4.7E-10	6.6E-10
W	2.2E-09	1.5E-09	8.9E-10	1.6E-09	9.6E-10	7.5E-10	1.1E-09
WSW	2.3E-09	1.5E-09	8.2E-10	1.5E-09	8.9E-10	6.8E-10	9.8E-10
SW	1.3E-09	8.3E-10	4.7E-10	8.7E-10	5.1E-10	3.9E-10	5.6E-10
SSW	1.1E-09	7.2E-10	4.2E-10	7.6E-10	4.5E-10	3.5E-10	5.0E-10
S	1.3E-09	8.8E-10	5.2E-10	9.2E-10	5.6E-10	4.4E-10	6.1E-10
SSE	2.5E-09	1.8E-09	1.1E-09	1.9E-09	1.2E-09	9.2E-10	1.3E-09
SE	4.0E-09	2.9E-09	1.8E-09	3.0E-09	1.9E-09	1.5E-09	2.1E-09
ESE	4.2E-09	3.1E-09	1.9E-09	3.2E-09	2.0E-09	1.6E-09	2.2E-09
E	5.2E-09	3.6E-09	2.2E-09	3.8E-09	2.3E-09	1.8E-09	2.6E-09
ENE	5.2E-09	3.5E-09	2.1E-09	3.7E-09	2.2E-09	1.7E-09	2.4E-09
NE	4.5E-09	3.1E-09	1.8E-09	3.2E-09	1.9E-09	1.5E-09	2.1E-09
NNE	2.9E-09	1.9E-09	1.1E-09	2.0E-09	1.2E-09	9.1E-10	1.3E-09

	Distance (m)						
Direction	1707	1258	1950	2017	1781	2690	1864
N	1.2E-09	1.8E-09	9.8E-10	9.4E-10	1.1E-09	6.1E-10	1.1E-09
NNW	7.7E-10	1.1E-09	6.4E-10	6.1E-10	7.2E-10	4.0E-10	6.8E-10
NW	7.9E-10	1.2E-09	6.5E-10	6.2E-10	7.4E-10	4.0E-10	6.9E-10
WNW	8.6E-10	1.2E-09	7.2E-10	6.9E-10	8.1E-10	4.5E-10	7.7E-10
W	1.4E-09	2.0E-09	1.2E-09	1.1E-09	1.3E-09	7.2E-10	1.2E-09
WSW	1.3E-09	2.1E-09	1.1E-09	1.0E-09	1.2E-09	6.6E-10	1.2E-09
SW	7.5E-10	1.2E-09	6.2E-10	5.9E-10	7.1E-10	3.8E-10	6.6E-10
SSW	6.6E-10	9.9E-10	5.4E-10	5.2E-10	6.2E-10	3.4E-10	5.8E-10
S	8.1E-10	1.2E-09	6.7E-10	6.4E-10	7.6E-10	4.2E-10	7.2E-10
SSE	1.7E-09	2.3E-09	1.4E-09	1.3E-09	1.6E-09	8.9E-10	1.5E-09
SE	2.7E-09	3.7E-09	2.3E-09	2.2E-09	2.5E-09	1.5E-09	2.4E-09
ESE	2.8E-09	3.9E-09	2.4E-09	2.3E-09	2.7E-09	1.5E-09	2.6E-09
E	3.3E-09	4.8E-09	2.8E-09	2.7E-09	3.1E-09	1.8E-09	3.0E-09
ENE	3.2E-09	4.8E-09	2.7E-09	2.6E-09	3.1E-09	1.7E-09	2.9E-09
NE	2.8E-09	4.1E-09	2.3E-09	2.2E-09	2.6E-09	1.4E-09	2.5E-09
NNE	1.7E-09	2.6E-09	1.4E-09	1.4E-09	1.6E-09	8.8E-10	1.5E-09

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2115	2209	2168	2164	2196	1616
N	8.8E-10	8.3E-10	8.5E-10	8.5E-10	8.3E-10	1.3E-09
NNW	5.7E-10	5.3E-10	5.5E-10	5.5E-10	5.4E-10	8.3E-10
NW	5.8E-10	5.4E-10	5.6E-10	5.6E-10	5.5E-10	8.5E-10
WNW	6.4E-10	6.0E-10	6.2E-10	6.2E-10	6.1E-10	9.2E-10
W	1.0E-09	9.7E-10	9.9E-10	1.0E-09	9.7E-10	1.5E-09
WSW	9.5E-10	8.9E-10	9.2E-10	9.2E-10	9.0E-10	1.4E-09
SW	5.5E-10	5.2E-10	5.3E-10	5.3E-10	5.2E-10	8.2E-10
SSW	4.8E-10	4.6E-10	4.7E-10	4.7E-10	4.6E-10	7.1E-10
S	6.0E-10	5.6E-10	5.8E-10	5.8E-10	5.7E-10	8.6E-10
SSE	1.2E-09	1.2E-09	1.2E-09	1.2E-09	1.2E-09	1.8E-09
SE	2.0E-09	1.9E-09	2.0E-09	2.0E-09	1.9E-09	2.9E-09
ESE	2.2E-09	2.0E-09	2.1E-09	2.1E-09	2.1E-09	3.0E-09
E	2.5E-09	2.3E-09	2.4E-09	2.4E-09	2.4E-09	3.6E-09
ENE	2.4E-09	2.2E-09	2.3E-09	2.3E-09	2.3E-09	3.5E-09
NE	2.1E-09	1.9E-09	2.0E-09	2.0E-09	1.9E-09	3.0E-09
NNE	1.3E-09	1.2E-09	1.2E-09	1.2E-09	1.2E-09	1.9E-09

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:45 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)
4.36E-05

At This Location: 969 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1977

Comments: 1997 NESHAP Demonstration
Plant 8 Oliver Filter [G1]

Dataset Name: 97-P239-G1
Dataset Date: Apr 7, 1998 12:24 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 969 Meters East Northeast
Lifetime Fatal Cancer Risk: 5.68E-10

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.47E-07
BREAST	1.67E-07
R MAR	3.59E-06
LUNGS	3.37E-04
THYROID	1.43E-07
ENDOST	4.97E-05
RMNDR	4.05E-06
EFFEC	4.36E-05

Apr 7, 1998 3:45 pm

RADIONUCLIDE EMISSIONS DURING THE YEAR 1977

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	1.4E-07	1.4E-07
U-235	Y	1.00	7.7E-09	7.7E-09
U-236	Y	1.00	5.3E-09	5.3E-09
U-238	Y	1.00	1.9E-07	1.9E-07
RA-226	W	1.00	1.3E-10	1.3E-10
RA-228	W	1.00	5.2E-10	5.2E-10
TH-228	Y	1.00	5.5E-09	5.5E-09
TH-230	Y	1.00	3.8E-10	3.8E-10
TH-232	Y	1.00	8.6E-10	8.6E-10
TH-234	Y	1.00	8.0E-07	8.0E-07

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	13.72
Diameter (m):	0.25
Plume Rise Momentum (m/s): (Exit Velocity)	1.12E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1252	1207	1926	1561	1265	969	1070	1137	1171	1312
1308	1318	1238	1236	1850	1382	1190	1186	1731	1695

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:45 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1977

Comments: 1997 NESHAP Demonstration
Plant 8 Oliver Filter [G1]

Dataset Name: 97-P239-G1
Dataset Date: Apr 7, 1998 12:24 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.47E-07
BREAST	1.67E-07
R MAR	3.59E-06
LUNGS	3.37E-04
THYROID	1.43E-07
ENDOST	4.97E-05
RMNDR	4.05E-06
EFFEC	4.36E-05

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	2.89E-06
INHALATION	4.07E-05
AIR IMMERSION	4.07E-12
GROUND SURFACE	2.88E-08
INTERNAL	4.36E-05
EXTERNAL	2.88E-08
TOTAL	4.36E-05

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.85E-05
U-235	9.45E-07
U-236	6.42E-07
U-238	2.18E-05
RA-226	2.39E-09
RA-228	3.91E-09
TH-228	1.27E-06
TH-230	8.91E-08
TH-232	2.86E-07
TH-234	6.47E-08
TOTAL	4.36E-05

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	4.03E-12
BONE	2.64E-12
THYROID	3.29E-14
BREAST	3.74E-13
LUNG	5.51E-10
STOMACH	2.57E-13
BOWEL	7.49E-13
LIVER	2.33E-13
PANCREAS	1.45E-13
URINARY	8.46E-12
OTHER	1.77E-13
TOTAL	5.68E-10

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.55E-11
INHALATION	5.52E-10
AIR IMMERSION	9.05E-17
GROUND SURFACE	6.61E-13
INTERNAL	5.68E-10
EXTERNAL	6.61E-13
TOTAL	5.68E-10

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	2.36E-10
U-235	1.24E-11
U-236	8.21E-12
U-238	2.82E-10
RA-226	3.03E-14
RA-228	3.89E-14
TH-228	2.55E-11
TH-230	7.30E-13
TH-232	1.61E-12
TH-234	1.96E-12
TOTAL	5.68E-10

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1252	1207	1926	1561	1265	969	1070
N	1.3E-05	1.3E-05	7.5E-06	9.6E-06	1.2E-05	1.7E-05	1.5E-05
NNW	8.7E-06	9.1E-06	5.2E-06	6.6E-06	8.6E-06	1.2E-05	1.1E-05
NW	8.5E-06	8.9E-06	5.1E-06	6.6E-06	8.4E-06	1.1E-05	1.0E-05
WNW	8.2E-06	8.5E-06	5.0E-06	6.3E-06	8.1E-06	1.1E-05	9.8E-06
W	1.4E-05	1.5E-05	8.2E-06	1.0E-05	1.4E-05	1.9E-05	1.7E-05
WSW	1.9E-05	2.0E-05	1.0E-05	1.4E-05	1.9E-05	2.7E-05	2.3E-05
SW	1.0E-05	1.1E-05	5.8E-06	7.7E-06	1.0E-05	1.5E-05	1.3E-05
SSW	7.9E-06	8.3E-06	4.6E-06	6.0E-06	7.8E-06	1.1E-05	9.8E-06
S	8.4E-06	8.8E-06	5.0E-06	6.4E-06	8.3E-06	1.2E-05	1.0E-05
SSE	1.2E-05	1.3E-05	7.8E-06	9.6E-06	1.2E-05	1.6E-05	1.5E-05
SE	1.7E-05	1.8E-05	1.1E-05	1.4E-05	1.7E-05	2.3E-05	2.1E-05
ESE	1.9E-05	2.0E-05	1.2E-05	1.5E-05	1.9E-05	2.6E-05	2.3E-05
E	2.8E-05	2.9E-05	1.7E-05	2.2E-05	2.8E-05	3.8E-05	3.4E-05
ENE	3.2E-05	3.4E-05	1.9E-05	2.5E-05	3.2E-05	4.4E-05	3.9E-05
NE	2.9E-05	3.1E-05	1.7E-05	2.2E-05	2.9E-05	4.0E-05	3.6E-05
NNE	2.0E-05	2.1E-05	1.2E-05	1.5E-05	2.0E-05	2.8E-05	2.5E-05

	Distance (m)						
Direction	1137	1171	1312	1308	1318	1238	1236
N	1.4E-05	1.4E-05	1.2E-05	1.2E-05	1.2E-05	1.3E-05	1.3E-05
NNW	9.8E-06	9.4E-06	8.2E-06	8.2E-06	8.2E-06	8.8E-06	8.8E-06
NW	9.5E-06	9.2E-06	8.0E-06	8.1E-06	8.0E-06	8.6E-06	8.6E-06
WNW	9.1E-06	8.8E-06	7.7E-06	7.8E-06	7.7E-06	8.3E-06	8.3E-06
W	1.6E-05	1.5E-05	1.3E-05	1.3E-05	1.3E-05	1.4E-05	1.4E-05
WSW	2.2E-05	2.1E-05	1.8E-05	1.8E-05	1.8E-05	1.9E-05	1.9E-05
SW	1.2E-05	1.1E-05	9.8E-06	9.8E-06	9.7E-06	1.1E-05	1.1E-05
SSW	9.0E-06	8.7E-06	7.5E-06	7.5E-06	7.4E-06	8.1E-06	8.1E-06
S	9.5E-06	9.1E-06	7.9E-06	7.9E-06	7.9E-06	8.5E-06	8.5E-06
SSE	1.4E-05	1.3E-05	1.2E-05	1.2E-05	1.2E-05	1.2E-05	1.3E-05
SE	1.9E-05	1.9E-05	1.6E-05	1.6E-05	1.6E-05	1.7E-05	1.7E-05
ESE	2.1E-05	2.1E-05	1.8E-05	1.8E-05	1.8E-05	1.9E-05	1.9E-05
E	3.1E-05	3.0E-05	2.6E-05	2.7E-05	2.6E-05	2.8E-05	2.8E-05
ENE	3.6E-05	3.5E-05	3.1E-05	3.1E-05	3.1E-05	3.3E-05	3.3E-05
NE	3.3E-05	3.2E-05	2.8E-05	2.8E-05	2.8E-05	3.0E-05	3.0E-05
NNE	2.3E-05	2.2E-05	1.9E-05	1.9E-05	1.9E-05	2.0E-05	2.0E-05

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1850	1382	1190	1186	1731	1695
N	7.9E-06	1.1E-05	1.3E-05	1.3E-05	8.5E-06	8.7E-06
NNW	5.4E-06	7.7E-06	9.2E-06	9.3E-06	5.9E-06	6.0E-06
NW	5.4E-06	7.6E-06	9.0E-06	9.0E-06	5.8E-06	6.0E-06
WNW	5.2E-06	7.3E-06	8.7E-06	8.7E-06	5.6E-06	5.8E-06
W	8.6E-06	1.2E-05	1.5E-05	1.5E-05	9.3E-06	9.5E-06
WSW	1.1E-05	1.6E-05	2.0E-05	2.0E-05	1.2E-05	1.2E-05
SW	6.1E-06	9.1E-06	1.1E-05	1.1E-05	6.7E-06	6.9E-06
SSW	4.8E-06	7.0E-06	8.5E-06	8.5E-06	5.3E-06	5.4E-06
S	5.2E-06	7.4E-06	8.9E-06	9.0E-06	5.6E-06	5.8E-06
SSE	8.1E-06	1.1E-05	1.3E-05	1.3E-05	8.7E-06	8.9E-06
SE	1.2E-05	1.5E-05	1.8E-05	1.8E-05	1.2E-05	1.3E-05
ESE	1.3E-05	1.7E-05	2.0E-05	2.0E-05	1.3E-05	1.4E-05
E	1.8E-05	2.5E-05	3.0E-05	3.0E-05	1.9E-05	2.0E-05
ENE	2.0E-05	2.9E-05	3.4E-05	3.5E-05	2.2E-05	2.3E-05
NE	1.8E-05	2.6E-05	3.1E-05	3.2E-05	2.0E-05	2.0E-05
NNE	1.2E-05	1.8E-05	2.1E-05	2.1E-05	1.3E-05	1.4E-05

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1252	1207	1926	1561	1265	969	1070
N	1.6E-10	1.7E-10	9.5E-11	1.2E-10	1.6E-10	2.2E-10	2.0E-10
NNW	1.1E-10	1.2E-10	6.4E-11	8.4E-11	1.1E-10	1.5E-10	1.3E-10
NW	1.1E-10	1.1E-10	6.4E-11	8.3E-11	1.1E-10	1.5E-10	1.3E-10
WNW	1.0E-10	1.1E-10	6.2E-11	7.9E-11	1.0E-10	1.4E-10	1.3E-10
W	1.8E-10	1.9E-10	1.0E-10	1.3E-10	1.8E-10	2.5E-10	2.2E-10
WSW	2.4E-10	2.6E-10	1.3E-10	1.8E-10	2.4E-10	3.5E-10	3.0E-10
SW	1.3E-10	1.4E-10	7.3E-11	9.8E-11	1.3E-10	1.9E-10	1.7E-10
SSW	1.0E-10	1.1E-10	5.7E-11	7.5E-11	9.9E-11	1.4E-10	1.2E-10
S	1.1E-10	1.1E-10	6.2E-11	8.0E-11	1.1E-10	1.5E-10	1.3E-10
SSE	1.6E-10	1.6E-10	9.9E-11	1.2E-10	1.6E-10	2.1E-10	1.9E-10
SE	2.2E-10	2.3E-10	1.4E-10	1.7E-10	2.2E-10	3.0E-10	2.7E-10
ESE	2.5E-10	2.6E-10	1.5E-10	1.9E-10	2.4E-10	3.4E-10	3.0E-10
E	3.6E-10	3.8E-10	2.2E-10	2.8E-10	3.6E-10	4.9E-10	4.4E-10
ENE	4.2E-10	4.4E-10	2.5E-10	3.2E-10	4.2E-10	5.7E-10	5.1E-10
NE	3.8E-10	4.0E-10	2.2E-10	2.9E-10	3.8E-10	5.2E-10	4.6E-10
NNE	2.6E-10	2.7E-10	1.5E-10	1.9E-10	2.6E-10	3.6E-10	3.2E-10

	Distance (m)						
Direction	1137	1171	1312	1308	1318	1238	1236
N	1.8E-10	1.8E-10	1.5E-10	1.5E-10	1.5E-10	1.6E-10	1.6E-10
NNW	1.2E-10	1.2E-10	1.0E-10	1.0E-10	1.0E-10	1.1E-10	1.1E-10
NW	1.2E-10	1.2E-10	1.0E-10	1.0E-10	1.0E-10	1.1E-10	1.1E-10
WNW	1.2E-10	1.1E-10	9.8E-11	9.8E-11	9.7E-11	1.1E-10	1.1E-10
W	2.0E-10	1.9E-10	1.7E-10	1.7E-10	1.7E-10	1.8E-10	1.8E-10
WSW	2.8E-10	2.7E-10	2.3E-10	2.3E-10	2.3E-10	2.5E-10	2.5E-10
SW	1.5E-10	1.5E-10	1.3E-10	1.3E-10	1.2E-10	1.4E-10	1.4E-10
SSW	1.1E-10	1.1E-10	9.5E-11	9.5E-11	9.4E-11	1.0E-10	1.0E-10
S	1.2E-10	1.2E-10	1.0E-10	1.0E-10	1.0E-10	1.1E-10	1.1E-10
SSE	1.8E-10	1.7E-10	1.5E-10	1.5E-10	1.5E-10	1.6E-10	1.6E-10
SE	2.5E-10	2.4E-10	2.1E-10	2.1E-10	2.1E-10	2.2E-10	2.3E-10
ESE	2.8E-10	2.7E-10	2.3E-10	2.3E-10	2.3E-10	2.5E-10	2.5E-10
E	4.1E-10	3.9E-10	3.4E-10	3.4E-10	3.4E-10	3.7E-10	3.7E-10
ENE	4.7E-10	4.6E-10	4.0E-10	4.0E-10	4.0E-10	4.3E-10	4.3E-10
NE	4.3E-10	4.2E-10	3.6E-10	3.6E-10	3.6E-10	3.9E-10	3.9E-10
NNE	2.9E-10	2.8E-10	2.4E-10	2.4E-10	2.4E-10	2.6E-10	2.6E-10

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m)					
	1850	1382	1190	1186	1731	1695
N	1.0E-10	1.4E-10	1.7E-10	1.7E-10	1.1E-10	1.1E-10
NNW	6.8E-11	9.7E-11	1.2E-10	1.2E-10	7.3E-11	7.5E-11
NW	6.7E-11	9.6E-11	1.1E-10	1.2E-10	7.3E-11	7.5E-11
WNW	6.5E-11	9.2E-11	1.1E-10	1.1E-10	7.0E-11	7.2E-11
W	1.1E-10	1.6E-10	1.9E-10	1.9E-10	1.2E-10	1.2E-10
WSW	1.4E-10	2.1E-10	2.6E-10	2.6E-10	1.6E-10	1.6E-10
SW	7.7E-11	1.2E-10	1.4E-10	1.4E-10	8.4E-11	8.7E-11
SSW	6.0E-11	8.8E-11	1.1E-10	1.1E-10	6.5E-11	6.7E-11
S	6.5E-11	9.4E-11	1.1E-10	1.1E-10	7.0E-11	7.2E-11
SSE	1.0E-10	1.4E-10	1.7E-10	1.7E-10	1.1E-10	1.1E-10
SE	1.5E-10	2.0E-10	2.4E-10	2.4E-10	1.6E-10	1.6E-10
ESE	1.6E-10	2.2E-10	2.6E-10	2.6E-10	1.7E-10	1.7E-10
E	2.3E-10	3.2E-10	3.9E-10	3.9E-10	2.5E-10	2.5E-10
ENE	2.6E-10	3.7E-10	4.5E-10	4.5E-10	2.8E-10	2.9E-10
NE	2.3E-10	3.4E-10	4.1E-10	4.1E-10	2.5E-10	2.6E-10
NNE	1.6E-10	2.3E-10	2.8E-10	2.8E-10	1.7E-10	1.7E-10

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:46 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)
3.19E-05

At This Location: 1265 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Plant 8 Oliver Filter [G2]

Dataset Name: 97-P239-G2
Dataset Date: Apr 7, 1998 12:25 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1265 Meters East Northeast
Lifetime Fatal Cancer Risk: 4.16E-10

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.07E-07
BREAST	1.22E-07
R MAR	2.61E-06
LUNGS	2.46E-04
THYROID	1.04E-07
ENDOST	3.61E-05
RMNDR	2.95E-06
EFFEC	3.19E-05

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	1.4E-07	1.4E-07
U-235	Y	1.00	7.7E-09	7.7E-09
U-236	Y	1.00	5.3E-09	5.3E-09
U-238	Y	1.00	1.9E-07	1.9E-07
RA-226	W	1.00	1.3E-10	1.3E-10
RA-228	W	1.00	5.2E-10	5.2E-10
TH-228	Y	1.00	5.5E-09	5.5E-09
TH-230	Y	1.00	3.8E-10	3.8E-10
TH-232	Y	1.00	8.6E-10	8.6E-10
TH-234	Y	1.00	8.0E-07	8.0E-07

SITE INFORMATION

Temperature:	11 degrees C
Precipitation:	102 cm/y
Mixing Height:	950 m

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 13.72
Diameter (m): 0.25

Plume Rise
Momentum (m/s): 1.12E+01
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1265	1537	2001	1897	2573	2273	2298	1631	1468	2305
2372	1699	2333	1596	1913	2005	1958	1839	1870	1809

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:46 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Plant 8 Oliver Filter [G2]

Dataset Name: 97-P239-G2
Dataset Date: Apr 7, 1998 12:25 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.07E-07
BREAST	1.22E-07
R MAR	2.61E-06
LUNGS	2.46E-04
THYROID	1.04E-07
ENDOST	3.61E-05
RMNDR	2.95E-06
EFFEC	3.19E-05

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	2.10E-06
INHALATION	2.98E-05
AIR IMMERSION	2.98E-12
GROUND SURFACE	2.12E-08
INTERNAL	3.19E-05
EXTERNAL	2.12E-08
TOTAL	3.19E-05

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.35E-05
U-235	6.91E-07
U-236	4.69E-07
U-238	1.60E-05
RA-226	1.74E-09
RA-228	2.85E-09
TH-228	9.30E-07
TH-230	6.52E-08
TH-232	2.09E-07
TH-234	4.72E-08
TOTAL	3.19E-05

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	2.93E-12
BONE	1.92E-12
THYROID	2.40E-14
BREAST	2.74E-13
LUNG	4.03E-10
STOMACH	1.87E-13
BOWEL	5.45E-13
LIVER	1.71E-13
PANCREAS	1.06E-13
URINARY	6.14E-12
OTHER	1.29E-13
TOTAL	4.16E-10

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.13E-11
INHALATION	4.04E-10
AIR IMMERSION	6.62E-17
GROUND SURFACE	4.88E-13
INTERNAL	4.15E-10
EXTERNAL	4.88E-13
TOTAL	4.16E-10

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	1.73E-10
U-235	9.04E-12
U-236	6.00E-12
U-238	2.06E-10
RA-226	2.22E-14
RA-228	2.83E-14
TH-228	1.86E-11
TH-230	5.34E-13
TH-232	1.18E-12
TH-234	1.43E-12
TOTAL	4.16E-10

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1265	1537	2001	1897	2573	2273	2298
N	1.2E-05	9.7E-06	7.0E-06	7.5E-06	5.3E-06	6.1E-06	6.0E-06
NNW	8.4E-06	6.6E-06	4.8E-06	5.1E-06	3.6E-06	4.1E-06	4.1E-06
NW	8.2E-06	6.5E-06	4.8E-06	5.1E-06	3.6E-06	4.2E-06	4.1E-06
WNW	7.9E-06	6.3E-06	4.7E-06	5.0E-06	3.6E-06	4.1E-06	4.1E-06
W	1.4E-05	1.1E-05	7.7E-06	8.2E-06	5.9E-06	6.7E-06	6.6E-06
WSW	1.8E-05	1.4E-05	9.8E-06	1.1E-05	7.0E-06	8.3E-06	8.1E-06
SW	1.0E-05	7.7E-06	5.4E-06	5.8E-06	3.9E-06	4.6E-06	4.5E-06
SSW	7.7E-06	6.0E-06	4.3E-06	4.6E-06	3.2E-06	3.7E-06	3.6E-06
S	8.1E-06	6.4E-06	4.6E-06	4.9E-06	3.5E-06	4.0E-06	4.0E-06
SSE	1.2E-05	9.7E-06	7.4E-06	7.8E-06	6.0E-06	6.6E-06	6.6E-06
SE	1.7E-05	1.4E-05	1.1E-05	1.1E-05	8.9E-06	9.7E-06	9.6E-06
ESE	1.9E-05	1.5E-05	1.2E-05	1.2E-05	9.5E-06	1.0E-05	1.0E-05
E	2.8E-05	2.2E-05	1.6E-05	1.7E-05	1.3E-05	1.4E-05	1.4E-05
ENE	3.2E-05	2.5E-05	1.8E-05	2.0E-05	1.4E-05	1.6E-05	1.6E-05
NE	2.9E-05	2.3E-05	1.6E-05	1.7E-05	1.2E-05	1.4E-05	1.4E-05
NNE	2.0E-05	1.5E-05	1.1E-05	1.2E-05	8.0E-06	9.3E-06	9.2E-06

	Distance (m)						
Direction	1631	1468	2305	2372	1699	2333	1596
N	9.0E-06	1.0E-05	6.0E-06	5.8E-06	8.5E-06	5.9E-06	9.2E-06
NNW	6.1E-06	7.0E-06	4.1E-06	4.0E-06	5.8E-06	4.0E-06	6.3E-06
NW	6.1E-06	6.9E-06	4.1E-06	4.0E-06	5.8E-06	4.0E-06	6.2E-06
WNW	5.9E-06	6.6E-06	4.1E-06	3.9E-06	5.6E-06	4.0E-06	6.0E-06
W	9.8E-06	1.1E-05	6.6E-06	6.4E-06	9.3E-06	6.5E-06	1.0E-05
WSW	1.3E-05	1.5E-05	8.1E-06	7.8E-06	1.2E-05	8.0E-06	1.3E-05
SW	7.1E-06	8.2E-06	4.5E-06	4.3E-06	6.7E-06	4.4E-06	7.3E-06
SSW	5.5E-06	6.3E-06	3.6E-06	3.5E-06	5.2E-06	3.6E-06	5.7E-06
S	5.9E-06	6.7E-06	4.0E-06	3.9E-06	5.6E-06	3.9E-06	6.1E-06
SSE	9.1E-06	1.0E-05	6.6E-06	6.4E-06	8.7E-06	6.5E-06	9.3E-06
SE	1.3E-05	1.4E-05	9.6E-06	9.4E-06	1.2E-05	9.5E-06	1.3E-05
ESE	1.4E-05	1.6E-05	1.0E-05	1.0E-05	1.3E-05	1.0E-05	1.4E-05
E	2.0E-05	2.3E-05	1.4E-05	1.4E-05	1.9E-05	1.4E-05	2.1E-05
ENE	2.3E-05	2.7E-05	1.6E-05	1.5E-05	2.2E-05	1.5E-05	2.4E-05
NE	2.1E-05	2.4E-05	1.4E-05	1.3E-05	2.0E-05	1.4E-05	2.2E-05
NNE	1.4E-05	1.6E-05	9.1E-06	8.8E-06	1.3E-05	9.0E-06	1.4E-05

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1913	2005	1958	1839	1870	1809
N	7.4E-06	7.0E-06	7.2E-06	7.8E-06	7.6E-06	7.9E-06
NNW	5.1E-06	4.8E-06	4.9E-06	5.3E-06	5.2E-06	5.4E-06
NW	5.0E-06	4.8E-06	4.9E-06	5.3E-06	5.2E-06	5.4E-06
WNW	4.9E-06	4.7E-06	4.8E-06	5.1E-06	5.0E-06	5.2E-06
W	8.1E-06	7.7E-06	7.9E-06	8.5E-06	8.3E-06	8.6E-06
WSW	1.0E-05	9.8E-06	1.0E-05	1.1E-05	1.1E-05	1.1E-05
SW	5.7E-06	5.4E-06	5.6E-06	6.0E-06	5.9E-06	6.2E-06
SSW	4.5E-06	4.3E-06	4.4E-06	4.7E-06	4.6E-06	4.8E-06
S	4.9E-06	4.6E-06	4.8E-06	5.1E-06	5.0E-06	5.2E-06
SSE	7.7E-06	7.4E-06	7.6E-06	8.0E-06	7.9E-06	8.2E-06
SE	1.1E-05	1.1E-05	1.1E-05	1.1E-05	1.1E-05	1.2E-05
ESE	1.2E-05	1.2E-05	1.2E-05	1.2E-05	1.2E-05	1.3E-05
E	1.7E-05	1.6E-05	1.7E-05	1.8E-05	1.7E-05	1.8E-05
ENE	1.9E-05	1.8E-05	1.9E-05	2.0E-05	2.0E-05	2.1E-05
NE	1.7E-05	1.6E-05	1.7E-05	1.8E-05	1.8E-05	1.9E-05
NNE	1.1E-05	1.1E-05	1.1E-05	1.2E-05	1.2E-05	1.2E-05

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1265	1537	2001	1897	2573	2273	2298
N	1.6E-10	1.2E-10	9.0E-11	9.6E-11	6.7E-11	7.8E-11	7.7E-11
NNW	1.1E-10	8.4E-11	6.1E-11	6.5E-11	4.5E-11	5.2E-11	5.1E-11
NW	1.1E-10	8.3E-11	6.1E-11	6.5E-11	4.5E-11	5.2E-11	5.2E-11
WNW	1.0E-10	8.0E-11	5.9E-11	6.3E-11	4.6E-11	5.2E-11	5.1E-11
W	1.8E-10	1.4E-10	9.8E-11	1.0E-10	7.4E-11	8.5E-11	8.4E-11
WSW	2.4E-10	1.8E-10	1.3E-10	1.4E-10	8.9E-11	1.1E-10	1.0E-10
SW	1.3E-10	9.9E-11	6.8E-11	7.4E-11	4.9E-11	5.8E-11	5.7E-11
SSW	9.9E-11	7.6E-11	5.4E-11	5.7E-11	4.0E-11	4.6E-11	4.5E-11
S	1.0E-10	8.1E-11	5.9E-11	6.2E-11	4.4E-11	5.1E-11	5.0E-11
SSE	1.6E-10	1.2E-10	9.5E-11	1.0E-10	7.6E-11	8.5E-11	8.4E-11
SE	2.2E-10	1.8E-10	1.4E-10	1.4E-10	1.1E-10	1.2E-10	1.2E-10
ESE	2.4E-10	1.9E-10	1.5E-10	1.6E-10	1.2E-10	1.3E-10	1.3E-10
E	3.6E-10	2.8E-10	2.1E-10	2.2E-10	1.6E-10	1.9E-10	1.8E-10
ENE	4.2E-10	3.3E-10	2.4E-10	2.5E-10	1.8E-10	2.1E-10	2.0E-10
NE	3.8E-10	2.9E-10	2.1E-10	2.3E-10	1.6E-10	1.8E-10	1.8E-10
NNE	2.5E-10	2.0E-10	1.4E-10	1.5E-10	1.0E-10	1.2E-10	1.2E-10

	Distance (m)						
Direction	1631	1468	2305	2372	1699	2333	1596
N	1.2E-10	1.3E-10	7.6E-11	7.4E-11	1.1E-10	7.5E-11	1.2E-10
NNW	7.8E-11	9.0E-11	5.1E-11	5.0E-11	7.4E-11	5.1E-11	8.0E-11
NW	7.8E-11	8.8E-11	5.1E-11	5.0E-11	7.4E-11	5.1E-11	8.0E-11
WNW	7.5E-11	8.5E-11	5.1E-11	4.9E-11	7.1E-11	5.0E-11	7.7E-11
W	1.3E-10	1.4E-10	8.4E-11	8.1E-11	1.2E-10	8.3E-11	1.3E-10
WSW	1.7E-10	1.9E-10	1.0E-10	1.0E-10	1.6E-10	1.0E-10	1.7E-10
SW	9.1E-11	1.1E-10	5.7E-11	5.5E-11	8.6E-11	5.6E-11	9.4E-11
SSW	7.0E-11	8.1E-11	4.5E-11	4.4E-11	6.6E-11	4.5E-11	7.2E-11
S	7.5E-11	8.6E-11	5.0E-11	4.8E-11	7.1E-11	4.9E-11	7.7E-11
SSE	1.2E-10	1.3E-10	8.4E-11	8.2E-11	1.1E-10	8.3E-11	1.2E-10
SE	1.7E-10	1.8E-10	1.2E-10	1.2E-10	1.6E-10	1.2E-10	1.7E-10
ESE	1.8E-10	2.0E-10	1.3E-10	1.3E-10	1.7E-10	1.3E-10	1.9E-10
E	2.6E-10	3.0E-10	1.8E-10	1.8E-10	2.5E-10	1.8E-10	2.7E-10
ENE	3.0E-10	3.5E-10	2.0E-10	2.0E-10	2.9E-10	2.0E-10	3.1E-10
NE	2.7E-10	3.1E-10	1.8E-10	1.7E-10	2.6E-10	1.8E-10	2.8E-10
NNE	1.8E-10	2.1E-10	1.2E-10	1.1E-10	1.7E-10	1.2E-10	1.9E-10

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1913	2005	1958	1839	1870	1809
N	9.5E-11	9.0E-11	9.2E-11	1.0E-10	9.8E-11	1.0E-10
NNW	6.4E-11	6.1E-11	6.2E-11	6.7E-11	6.6E-11	6.9E-11
NW	6.4E-11	6.0E-11	6.2E-11	6.7E-11	6.6E-11	6.8E-11
WNW	6.2E-11	5.9E-11	6.1E-11	6.5E-11	6.4E-11	6.6E-11
W	1.0E-10	9.8E-11	1.0E-10	1.1E-10	1.1E-10	1.1E-10
WSW	1.3E-10	1.3E-10	1.3E-10	1.4E-10	1.4E-10	1.5E-10
SW	7.3E-11	6.8E-11	7.0E-11	7.7E-11	7.5E-11	7.9E-11
SSW	5.7E-11	5.4E-11	5.5E-11	6.0E-11	5.9E-11	6.1E-11
S	6.2E-11	5.8E-11	6.0E-11	6.5E-11	6.3E-11	6.6E-11
SSE	9.9E-11	9.5E-11	9.7E-11	1.0E-10	1.0E-10	1.0E-10
SE	1.4E-10	1.4E-10	1.4E-10	1.5E-10	1.5E-10	1.5E-10
ESE	1.5E-10	1.5E-10	1.5E-10	1.6E-10	1.6E-10	1.6E-10
E	2.2E-10	2.1E-10	2.2E-10	2.3E-10	2.3E-10	2.3E-10
ENE	2.5E-10	2.4E-10	2.4E-10	2.6E-10	2.6E-10	2.7E-10
NE	2.2E-10	2.1E-10	2.2E-10	2.4E-10	2.3E-10	2.4E-10
NNE	1.5E-10	1.4E-10	1.4E-10	1.6E-10	1.5E-10	1.6E-10

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:48 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

5.51E-04

At This Location: 947 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Plant 8 Eimco Filters [G1]

Dataset Name: 97-P240-G1
Dataset Date: Apr 7, 1998 12:29 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 947 Meters East Northeast
Lifetime Fatal Cancer Risk: 7.18E-09

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.84E-06
BREAST	2.10E-06
R MAR	4.51E-05
LUNGS	4.26E-03
THYROID	1.80E-06
ENDOST	6.25E-04
RMNDR	5.09E-05
EFFEC	5.51E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	1.8E-06	1.8E-06
U-235	Y	1.00	9.4E-08	9.4E-08
U-236	Y	1.00	6.4E-08	6.4E-08
U-238	Y	1.00	2.3E-06	2.3E-06
RA-226	W	1.00	1.6E-09	1.6E-09
RA-228	W	1.00	6.3E-09	6.3E-09
TH-228	Y	1.00	6.7E-08	6.7E-08
TH-230	Y	1.00	4.7E-09	4.7E-09
TH-232	Y	1.00	1.0E-08	1.0E-08
TH-234	Y	1.00	9.8E-06	9.8E-06

SITE INFORMATION

Temperature:	11 degrees C
Precipitation:	102 cm/y
Mixing Height:	950 m

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 13.72
Diameter (m): 0.20

Plume Rise
Momentum (m/s): 1.31E+01
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1255	1207	1913	1543	1245	947	1055	1125	1159	1304
1301	1315	1241	1242	1861	1397	1212	1208	1750	1708

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:48 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Plant 8 Eimco Filters [G1]

Dataset Name: 97-P240-G1
Dataset Date: Apr 7, 1998 12:29 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.84E-06
BREAST	2.10E-06
R MAR	4.51E-05
LUNGS	4.26E-03
THYROID	1.80E-06
ENDOST	6.25E-04
RMNDR	5.09E-05
EFFEC	5.51E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	3.62E-05
INHALATION	5.15E-04
AIR IMMERSION	5.14E-11
GROUND SURFACE	3.62E-07
INTERNAL	5.51E-04
EXTERNAL	3.62E-07
TOTAL	5.51E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	2.35E-04
U-235	1.19E-05
U-236	8.11E-06
U-238	2.75E-04
RA-226	3.00E-08
RA-228	4.91E-08
TH-228	1.60E-05
TH-230	1.12E-06
TH-232	3.62E-06
TH-234	8.14E-07
TOTAL	5.51E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	5.06E-11
BONE	3.32E-11
THYROID	4.13E-13
BREAST	4.70E-12
LUNG	6.97E-09
STOMACH	3.23E-12
BOWEL	9.40E-12
LIVER	2.94E-12
PANCREAS	1.82E-12
URINARY	1.06E-10
OTHER	2.23E-12
TOTAL	7.18E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.95E-10
INHALATION	6.98E-09
AIR IMMERSION	1.14E-15
GROUND SURFACE	8.32E-12
INTERNAL	7.17E-09
EXTERNAL	8.32E-12
TOTAL	7.18E-09

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	3.00E-09
U-235	1.56E-10
U-236	1.04E-10
U-238	3.55E-09
RA-226	3.83E-13
RA-228	4.89E-13
TH-228	3.21E-10
TH-230	9.21E-12
TH-232	2.04E-11
TH-234	2.47E-11
TOTAL	7.18E-09

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1255	1207	1913	1543	1245	947	1055
N	1.5E-04	1.6E-04	9.3E-05	1.2E-04	1.6E-04	2.2E-04	1.9E-04
NNW	1.1E-04	1.1E-04	6.4E-05	8.3E-05	1.1E-04	1.5E-04	1.3E-04
NW	1.0E-04	1.1E-04	6.4E-05	8.2E-05	1.1E-04	1.4E-04	1.3E-04
WNW	1.0E-04	1.0E-04	6.3E-05	7.9E-05	1.0E-04	1.4E-04	1.2E-04
W	1.7E-04	1.8E-04	1.0E-04	1.3E-04	1.7E-04	2.4E-04	2.1E-04
WSW	2.3E-04	2.4E-04	1.3E-04	1.7E-04	2.3E-04	3.4E-04	2.9E-04
SW	1.3E-04	1.3E-04	7.2E-05	9.6E-05	1.3E-04	1.9E-04	1.6E-04
SSW	9.7E-05	1.0E-04	5.7E-05	7.4E-05	9.8E-05	1.4E-04	1.2E-04
S	1.0E-04	1.1E-04	6.2E-05	7.9E-05	1.0E-04	1.5E-04	1.3E-04
SSE	1.5E-04	1.6E-04	9.8E-05	1.2E-04	1.5E-04	2.1E-04	1.8E-04
SE	2.1E-04	2.2E-04	1.4E-04	1.7E-04	2.1E-04	2.9E-04	2.6E-04
ESE	2.3E-04	2.5E-04	1.5E-04	1.9E-04	2.4E-04	3.3E-04	2.9E-04
E	3.4E-04	3.6E-04	2.1E-04	2.7E-04	3.5E-04	4.8E-04	4.2E-04
ENE	4.0E-04	4.2E-04	2.4E-04	3.1E-04	4.0E-04	5.5E-04	4.9E-04
NE	3.6E-04	3.8E-04	2.1E-04	2.8E-04	3.6E-04	5.1E-04	4.5E-04
NNE	2.4E-04	2.6E-04	1.4E-04	1.9E-04	2.5E-04	3.5E-04	3.1E-04

	Distance (m)						
Direction	1125	1159	1304	1301	1315	1241	1242
N	1.8E-04	1.7E-04	1.5E-04	1.5E-04	1.5E-04	1.6E-04	1.6E-04
NNW	1.2E-04	1.2E-04	1.0E-04	1.0E-04	1.0E-04	1.1E-04	1.1E-04
NW	1.2E-04	1.1E-04	1.0E-04	1.0E-04	9.9E-05	1.1E-04	1.1E-04
WNW	1.1E-04	1.1E-04	9.6E-05	9.6E-05	9.5E-05	1.0E-04	1.0E-04
W	2.0E-04	1.9E-04	1.6E-04	1.6E-04	1.6E-04	1.7E-04	1.7E-04
WSW	2.7E-04	2.6E-04	2.2E-04	2.2E-04	2.2E-04	2.3E-04	2.3E-04
SW	1.5E-04	1.4E-04	1.2E-04	1.2E-04	1.2E-04	1.3E-04	1.3E-04
SSW	1.1E-04	1.1E-04	9.2E-05	9.3E-05	9.1E-05	9.8E-05	9.8E-05
S	1.2E-04	1.1E-04	9.8E-05	9.8E-05	9.7E-05	1.0E-04	1.0E-04
SSE	1.7E-04	1.7E-04	1.4E-04	1.5E-04	1.4E-04	1.5E-04	1.5E-04
SE	2.4E-04	2.3E-04	2.0E-04	2.0E-04	2.0E-04	2.1E-04	2.1E-04
ESE	2.7E-04	2.6E-04	2.2E-04	2.2E-04	2.2E-04	2.4E-04	2.4E-04
E	3.9E-04	3.8E-04	3.3E-04	3.3E-04	3.3E-04	3.5E-04	3.5E-04
ENE	4.5E-04	4.4E-04	3.8E-04	3.8E-04	3.8E-04	4.0E-04	4.0E-04
NE	4.1E-04	4.0E-04	3.4E-04	3.5E-04	3.4E-04	3.7E-04	3.7E-04
NNE	2.8E-04	2.7E-04	2.3E-04	2.3E-04	2.3E-04	2.5E-04	2.5E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1861	1397	1212	1208	1750	1708
N	9.6E-05	1.4E-04	1.6E-04	1.6E-04	1.0E-04	1.1E-04
NNW	6.6E-05	9.3E-05	1.1E-04	1.1E-04	7.1E-05	7.3E-05
NW	6.6E-05	9.2E-05	1.1E-04	1.1E-04	7.1E-05	7.3E-05
WNW	6.4E-05	8.9E-05	1.0E-04	1.0E-04	6.9E-05	7.1E-05
W	1.0E-04	1.5E-04	1.8E-04	1.8E-04	1.1E-04	1.2E-04
WSW	1.3E-04	2.0E-04	2.4E-04	2.4E-04	1.5E-04	1.5E-04
SW	7.5E-05	1.1E-04	1.3E-04	1.3E-04	8.1E-05	8.3E-05
SSW	5.9E-05	8.4E-05	1.0E-04	1.0E-04	6.4E-05	6.6E-05
S	6.4E-05	9.0E-05	1.1E-04	1.1E-04	6.8E-05	7.0E-05
SSE	1.0E-04	1.3E-04	1.6E-04	1.6E-04	1.1E-04	1.1E-04
SE	1.4E-04	1.9E-04	2.2E-04	2.2E-04	1.5E-04	1.5E-04
ESE	1.5E-04	2.1E-04	2.4E-04	2.5E-04	1.6E-04	1.7E-04
E	2.2E-04	3.0E-04	3.6E-04	3.6E-04	2.3E-04	2.4E-04
ENE	2.5E-04	3.5E-04	4.2E-04	4.2E-04	2.7E-04	2.7E-04
NE	2.2E-04	3.2E-04	3.8E-04	3.8E-04	2.4E-04	2.5E-04
NNE	1.5E-04	2.1E-04	2.6E-04	2.6E-04	1.6E-04	1.6E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1255	1207	1913	1543	1245	947	1055
N	2.0E-09	2.1E-09	1.2E-09	1.5E-09	2.0E-09	2.8E-09	2.5E-09
NNW	1.4E-09	1.4E-09	8.0E-10	1.0E-09	1.4E-09	1.9E-09	1.7E-09
NW	1.3E-09	1.4E-09	8.0E-10	1.0E-09	1.3E-09	1.8E-09	1.6E-09
WNW	1.3E-09	1.3E-09	7.8E-10	9.9E-10	1.3E-09	1.8E-09	1.6E-09
W	2.2E-09	2.3E-09	1.3E-09	1.7E-09	2.2E-09	3.1E-09	2.7E-09
WSW	3.0E-09	3.1E-09	1.7E-09	2.2E-09	3.0E-09	4.4E-09	3.8E-09
SW	1.6E-09	1.7E-09	9.0E-10	1.2E-09	1.6E-09	2.4E-09	2.1E-09
SSW	1.2E-09	1.3E-09	7.1E-10	9.3E-10	1.2E-09	1.8E-09	1.6E-09
S	1.3E-09	1.4E-09	7.7E-10	1.0E-09	1.3E-09	1.9E-09	1.6E-09
SSE	1.9E-09	2.0E-09	1.2E-09	1.5E-09	2.0E-09	2.7E-09	2.4E-09
SE	2.7E-09	2.8E-09	1.8E-09	2.2E-09	2.7E-09	3.8E-09	3.3E-09
ESE	3.0E-09	3.2E-09	1.9E-09	2.4E-09	3.0E-09	4.2E-09	3.7E-09
E	4.5E-09	4.7E-09	2.7E-09	3.5E-09	4.5E-09	6.2E-09	5.5E-09
ENE	5.2E-09	5.4E-09	3.1E-09	4.0E-09	5.2E-09	7.2E-09	6.4E-09
NE	4.7E-09	4.9E-09	2.8E-09	3.6E-09	4.7E-09	6.6E-09	5.8E-09
NNE	3.2E-09	3.3E-09	1.8E-09	2.4E-09	3.2E-09	4.6E-09	4.0E-09

	Distance (m)						
Direction	1125	1159	1304	1301	1315	1241	1242
N	2.3E-09	2.2E-09	1.9E-09	1.9E-09	1.9E-09	2.0E-09	2.0E-09
NNW	1.6E-09	1.5E-09	1.3E-09	1.3E-09	1.3E-09	1.4E-09	1.4E-09
NW	1.5E-09	1.5E-09	1.3E-09	1.3E-09	1.3E-09	1.3E-09	1.3E-09
WNW	1.5E-09	1.4E-09	1.2E-09	1.2E-09	1.2E-09	1.3E-09	1.3E-09
W	2.5E-09	2.4E-09	2.1E-09	2.1E-09	2.1E-09	2.2E-09	2.2E-09
WSW	3.5E-09	3.3E-09	2.8E-09	2.8E-09	2.8E-09	3.0E-09	3.0E-09
SW	1.9E-09	1.8E-09	1.5E-09	1.5E-09	1.5E-09	1.7E-09	1.7E-09
SSW	1.4E-09	1.4E-09	1.2E-09	1.2E-09	1.2E-09	1.2E-09	1.2E-09
S	1.5E-09	1.4E-09	1.2E-09	1.2E-09	1.2E-09	1.3E-09	1.3E-09
SSE	2.2E-09	2.1E-09	1.9E-09	1.9E-09	1.8E-09	2.0E-09	2.0E-09
SE	3.1E-09	3.0E-09	2.6E-09	2.6E-09	2.6E-09	2.8E-09	2.8E-09
ESE	3.4E-09	3.3E-09	2.9E-09	2.9E-09	2.9E-09	3.1E-09	3.1E-09
E	5.1E-09	4.9E-09	4.3E-09	4.3E-09	4.2E-09	4.5E-09	4.5E-09
ENE	5.9E-09	5.7E-09	4.9E-09	5.0E-09	4.9E-09	5.2E-09	5.2E-09
NE	5.4E-09	5.2E-09	4.5E-09	4.5E-09	4.4E-09	4.8E-09	4.7E-09
NNE	3.7E-09	3.5E-09	3.0E-09	3.0E-09	3.0E-09	3.2E-09	3.2E-09

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1861	1397	1212	1208	1750	1708
N	1.2E-09	1.7E-09	2.1E-09	2.1E-09	1.3E-09	1.4E-09
NNW	8.3E-10	1.2E-09	1.4E-09	1.4E-09	8.9E-10	9.2E-10
NW	8.2E-10	1.2E-09	1.4E-09	1.4E-09	8.9E-10	9.1E-10
WNW	8.0E-10	1.1E-09	1.3E-09	1.3E-09	8.6E-10	8.8E-10
W	1.3E-09	1.9E-09	2.3E-09	2.3E-09	1.4E-09	1.5E-09
WSW	1.7E-09	2.6E-09	3.1E-09	3.1E-09	1.9E-09	1.9E-09
SW	9.4E-10	1.4E-09	1.7E-09	1.7E-09	1.0E-09	1.1E-09
SSW	7.3E-10	1.1E-09	1.3E-09	1.3E-09	7.9E-10	8.2E-10
S	8.0E-10	1.1E-09	1.4E-09	1.4E-09	8.6E-10	8.8E-10
SSE	1.3E-09	1.7E-09	2.0E-09	2.0E-09	1.3E-09	1.4E-09
SE	1.8E-09	2.4E-09	2.8E-09	2.8E-09	1.9E-09	2.0E-09
ESE	2.0E-09	2.7E-09	3.1E-09	3.2E-09	2.1E-09	2.2E-09
E	2.8E-09	3.9E-09	4.6E-09	4.7E-09	3.0E-09	3.1E-09
ENE	3.2E-09	4.5E-09	5.4E-09	5.4E-09	3.5E-09	3.6E-09
NE	2.9E-09	4.1E-09	4.9E-09	4.9E-09	3.1E-09	3.2E-09
NNE	1.9E-09	2.7E-09	3.3E-09	3.3E-09	2.0E-09	2.1E-09

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:48 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

3.90E-04

At This Location: 1272 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Plant 8 Eimco Filters [G2]

Dataset Name: 97-P240-G2
Dataset Date: Apr 7, 1998 12:30 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1272 Meters East Northeast
Lifetime Fatal Cancer Risk: 5.08E-09

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.31E-06
BREAST	1.49E-06
R MAR	3.18E-05
LUNGS	3.01E-03
THYROID	1.27E-06
ENDOST	4.41E-04
RMNDR	3.60E-05
EFFEC	3.90E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	1.8E-06	1.8E-06
U-235	Y	1.00	9.4E-08	9.4E-08
U-236	Y	1.00	6.4E-08	6.4E-08
U-238	Y	1.00	2.3E-06	2.3E-06
RA-226	W	1.00	1.6E-09	1.6E-09
RA-228	W	1.00	6.3E-09	6.3E-09
TH-228	Y	1.00	6.7E-08	6.7E-08
TH-230	Y	1.00	4.7E-09	4.7E-09
TH-232	Y	1.00	1.0E-08	1.0E-08
TH-234	Y	1.00	9.8E-06	9.8E-06

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	13.72
Diameter (m):	0.20
Plume Rise Momentum (m/s): (Exit Velocity)	1.31E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1272	1534	1980	1919	2595	2251	2314	1627	1485	2328
2394	1694	2311	1578	1900	1992	1945	1820	1850	1821

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:48 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Plant 8 Eimco Filters [G2]

Dataset Name: 97-P240-G2
Dataset Date: Apr 7, 1998 12:30 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.31E-06
BREAST	1.49E-06
R MAR	3.18E-05
LUNGS	3.01E-03
THYROID	1.27E-06
ENDOST	4.41E-04
RMNDR	3.60E-05
EFFEC	3.90E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	2.56E-05
INHALATION	3.64E-04
AIR IMMERSION	3.63E-11
GROUND SURFACE	2.59E-07
INTERNAL	3.90E-04
EXTERNAL	2.59E-07
TOTAL	3.90E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.66E-04
U-235	8.44E-06
U-236	5.73E-06
U-238	1.95E-04
RA-226	2.12E-08
RA-228	3.47E-08
TH-228	1.13E-05
TH-230	7.95E-07
TH-232	2.56E-06
TH-234	5.75E-07
TOTAL	3.90E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	3.58E-11
BONE	2.35E-11
THYROID	2.93E-13
BREAST	3.34E-12
LUNG	4.93E-09
STOMACH	2.29E-12
BOWEL	6.65E-12
LIVER	2.08E-12
PANCREAS	1.29E-12
URINARY	7.50E-11
OTHER	1.58E-12
TOTAL	5.08E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.38E-10
INHALATION	4.94E-09
AIR IMMERSION	8.08E-16
GROUND SURFACE	5.94E-12
INTERNAL	5.07E-09
EXTERNAL	5.94E-12
TOTAL	5.08E-09

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	2.12E-09
U-235	1.10E-10
U-236	7.33E-11
U-238	2.51E-09
RA-226	2.71E-13
RA-228	3.46E-13
TH-228	2.27E-10
TH-230	6.51E-12
TH-232	1.44E-11
TH-234	1.75E-11
TOTAL	5.08E-09

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1272	1534	1980	1919	2595	2251	2314
N	1.5E-04	1.2E-04	8.8E-05	9.1E-05	6.5E-05	7.6E-05	7.4E-05
NNW	1.0E-04	8.1E-05	6.0E-05	6.2E-05	4.4E-05	5.2E-05	5.0E-05
NW	1.0E-04	8.1E-05	6.0E-05	6.2E-05	4.4E-05	5.2E-05	5.0E-05
WNW	9.7E-05	7.8E-05	5.9E-05	6.1E-05	4.5E-05	5.1E-05	5.0E-05
W	1.7E-04	1.3E-04	9.6E-05	9.9E-05	7.2E-05	8.3E-05	8.1E-05
WSW	2.2E-04	1.7E-04	1.2E-04	1.3E-04	8.5E-05	1.0E-04	9.9E-05
SW	1.2E-04	9.5E-05	6.7E-05	7.0E-05	4.8E-05	5.7E-05	5.5E-05
SSW	9.4E-05	7.3E-05	5.3E-05	5.5E-05	3.9E-05	4.6E-05	4.4E-05
S	9.9E-05	7.8E-05	5.8E-05	6.0E-05	4.3E-05	5.0E-05	4.9E-05
SSE	1.5E-04	1.2E-04	9.3E-05	9.6E-05	7.4E-05	8.3E-05	8.1E-05
SE	2.1E-04	1.7E-04	1.3E-04	1.4E-04	1.1E-04	1.2E-04	1.2E-04
ESE	2.3E-04	1.9E-04	1.5E-04	1.5E-04	1.2E-04	1.3E-04	1.3E-04
E	3.4E-04	2.7E-04	2.0E-04	2.1E-04	1.6E-04	1.8E-04	1.7E-04
ENE	3.9E-04	3.1E-04	2.3E-04	2.4E-04	1.7E-04	2.0E-04	1.9E-04
NE	3.5E-04	2.8E-04	2.0E-04	2.1E-04	1.5E-04	1.8E-04	1.7E-04
NNE	2.4E-04	1.9E-04	1.4E-04	1.4E-04	9.8E-05	1.2E-04	1.1E-04

	Distance (m)						
Direction	1627	1485	2328	2394	1694	2311	1578
N	1.1E-04	1.2E-04	7.3E-05	7.1E-05	1.1E-04	7.4E-05	1.1E-04
NNW	7.6E-05	8.5E-05	5.0E-05	4.8E-05	7.2E-05	5.0E-05	7.9E-05
NW	7.5E-05	8.4E-05	5.0E-05	4.8E-05	7.2E-05	5.0E-05	7.8E-05
WNW	7.3E-05	8.1E-05	5.0E-05	4.8E-05	6.9E-05	5.0E-05	7.5E-05
W	1.2E-04	1.4E-04	8.0E-05	7.8E-05	1.2E-04	8.1E-05	1.3E-04
WSW	1.6E-04	1.8E-04	9.8E-05	9.4E-05	1.5E-04	9.9E-05	1.7E-04
SW	8.7E-05	9.9E-05	5.4E-05	5.3E-05	8.3E-05	5.5E-05	9.1E-05
SSW	6.8E-05	7.6E-05	4.4E-05	4.3E-05	6.4E-05	4.4E-05	7.1E-05
S	7.3E-05	8.1E-05	4.9E-05	4.7E-05	6.9E-05	4.9E-05	7.6E-05
SSE	1.1E-04	1.2E-04	8.1E-05	7.9E-05	1.1E-04	8.1E-05	1.2E-04
SE	1.6E-04	1.7E-04	1.2E-04	1.2E-04	1.5E-04	1.2E-04	1.6E-04
ESE	1.7E-04	1.9E-04	1.3E-04	1.3E-04	1.7E-04	1.3E-04	1.8E-04
E	2.5E-04	2.8E-04	1.7E-04	1.7E-04	2.4E-04	1.8E-04	2.6E-04
ENE	2.9E-04	3.2E-04	1.9E-04	1.9E-04	2.8E-04	1.9E-04	3.0E-04
NE	2.6E-04	2.9E-04	1.7E-04	1.6E-04	2.5E-04	1.7E-04	2.7E-04
NNE	1.7E-04	1.9E-04	1.1E-04	1.1E-04	1.6E-04	1.1E-04	1.8E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1900	1992	1945	1820	1850	1821
N	9.2E-05	8.7E-05	9.0E-05	9.7E-05	9.5E-05	9.7E-05
NNW	6.3E-05	5.9E-05	6.1E-05	6.6E-05	6.5E-05	6.6E-05
NW	6.3E-05	5.9E-05	6.1E-05	6.6E-05	6.5E-05	6.6E-05
WNW	6.1E-05	5.8E-05	6.0E-05	6.4E-05	6.3E-05	6.4E-05
W	1.0E-04	9.5E-05	9.8E-05	1.1E-04	1.0E-04	1.1E-04
WSW	1.3E-04	1.2E-04	1.2E-04	1.4E-04	1.3E-04	1.4E-04
SW	7.1E-05	6.7E-05	6.9E-05	7.5E-05	7.3E-05	7.5E-05
SSW	5.6E-05	5.3E-05	5.4E-05	5.9E-05	5.8E-05	5.9E-05
S	6.1E-05	5.7E-05	5.9E-05	6.4E-05	6.3E-05	6.4E-05
SSE	9.6E-05	9.2E-05	9.4E-05	1.0E-04	9.9E-05	1.0E-04
SE	1.4E-04	1.3E-04	1.4E-04	1.4E-04	1.4E-04	1.4E-04
ESE	1.5E-04	1.4E-04	1.5E-04	1.6E-04	1.5E-04	1.6E-04
E	2.1E-04	2.0E-04	2.1E-04	2.2E-04	2.2E-04	2.2E-04
ENE	2.4E-04	2.3E-04	2.3E-04	2.5E-04	2.5E-04	2.5E-04
NE	2.1E-04	2.0E-04	2.1E-04	2.3E-04	2.2E-04	2.3E-04
NNE	1.4E-04	1.3E-04	1.4E-04	1.5E-04	1.5E-04	1.5E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1272	1534	1980	1919	2595	2251	2314
N	1.9E-09	1.5E-09	1.1E-09	1.2E-09	8.2E-10	9.7E-10	9.4E-10
NNW	1.3E-09	1.0E-09	7.6E-10	7.9E-10	5.5E-10	6.5E-10	6.3E-10
NW	1.3E-09	1.0E-09	7.6E-10	7.8E-10	5.6E-10	6.5E-10	6.3E-10
WNW	1.2E-09	9.9E-10	7.4E-10	7.7E-10	5.6E-10	6.5E-10	6.3E-10
W	2.1E-09	1.7E-09	1.2E-09	1.3E-09	9.1E-10	1.1E-09	1.0E-09
WSW	2.9E-09	2.2E-09	1.6E-09	1.6E-09	1.1E-09	1.3E-09	1.3E-09
SW	1.6E-09	1.2E-09	8.5E-10	8.9E-10	6.0E-10	7.2E-10	6.9E-10
SSW	1.2E-09	9.3E-10	6.7E-10	7.0E-10	4.8E-10	5.7E-10	5.5E-10
S	1.3E-09	1.0E-09	7.3E-10	7.6E-10	5.4E-10	6.3E-10	6.1E-10
SSE	1.9E-09	1.5E-09	1.2E-09	1.2E-09	9.4E-10	1.1E-09	1.0E-09
SE	2.7E-09	2.2E-09	1.7E-09	1.8E-09	1.4E-09	1.6E-09	1.5E-09
ESE	3.0E-09	2.4E-09	1.9E-09	1.9E-09	1.5E-09	1.7E-09	1.7E-09
E	4.4E-09	3.5E-09	2.6E-09	2.7E-09	2.0E-09	2.3E-09	2.3E-09
ENE	5.1E-09	4.0E-09	3.0E-09	3.1E-09	2.2E-09	2.6E-09	2.5E-09
NE	4.6E-09	3.6E-09	2.6E-09	2.8E-09	1.9E-09	2.3E-09	2.2E-09
NNE	3.1E-09	2.4E-09	1.7E-09	1.8E-09	1.3E-09	1.5E-09	1.4E-09

	Distance (m)						
Direction	1627	1485	2328	2394	1694	2311	1578
N	1.4E-09	1.6E-09	9.3E-10	9.0E-10	1.4E-09	9.4E-10	1.5E-09
NNW	9.7E-10	1.1E-09	6.3E-10	6.1E-10	9.2E-10	6.3E-10	1.0E-09
NW	9.6E-10	1.1E-09	6.3E-10	6.1E-10	9.1E-10	6.3E-10	9.9E-10
WNW	9.2E-10	1.0E-09	6.2E-10	6.1E-10	8.8E-10	6.3E-10	9.6E-10
W	1.6E-09	1.7E-09	1.0E-09	1.0E-09	1.5E-09	1.0E-09	1.6E-09
WSW	2.1E-09	2.3E-09	1.3E-09	1.2E-09	1.9E-09	1.3E-09	2.2E-09
SW	1.1E-09	1.3E-09	6.9E-10	6.6E-10	1.1E-09	6.9E-10	1.2E-09
SSW	8.6E-10	9.7E-10	5.5E-10	5.3E-10	8.2E-10	5.5E-10	9.0E-10
S	9.3E-10	1.0E-09	6.1E-10	5.9E-10	8.8E-10	6.1E-10	9.6E-10
SSE	1.4E-09	1.6E-09	1.0E-09	1.0E-09	1.4E-09	1.0E-09	1.5E-09
SE	2.1E-09	2.3E-09	1.5E-09	1.5E-09	2.0E-09	1.5E-09	2.1E-09
ESE	2.2E-09	2.5E-09	1.6E-09	1.6E-09	2.2E-09	1.7E-09	2.3E-09
E	3.3E-09	3.6E-09	2.2E-09	2.2E-09	3.1E-09	2.3E-09	3.4E-09
ENE	3.8E-09	4.2E-09	2.5E-09	2.4E-09	3.6E-09	2.5E-09	3.9E-09
NE	3.4E-09	3.8E-09	2.2E-09	2.1E-09	3.2E-09	2.2E-09	3.5E-09
NNE	2.2E-09	2.5E-09	1.4E-09	1.4E-09	2.1E-09	1.4E-09	2.3E-09

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1900	1992	1945	1820	1850	1821
N	1.2E-09	1.1E-09	1.1E-09	1.2E-09	1.2E-09	1.2E-09
NNW	8.0E-10	7.5E-10	7.7E-10	8.4E-10	8.2E-10	8.4E-10
NW	7.9E-10	7.5E-10	7.7E-10	8.4E-10	8.2E-10	8.4E-10
WNW	7.7E-10	7.4E-10	7.5E-10	8.1E-10	8.0E-10	8.1E-10
W	1.3E-09	1.2E-09	1.3E-09	1.4E-09	1.3E-09	1.4E-09
WSW	1.7E-09	1.6E-09	1.6E-09	1.8E-09	1.7E-09	1.8E-09
SW	9.0E-10	8.4E-10	8.7E-10	9.5E-10	9.3E-10	9.5E-10
SSW	7.0E-10	6.6E-10	6.8E-10	7.4E-10	7.3E-10	7.4E-10
S	7.7E-10	7.3E-10	7.5E-10	8.1E-10	7.9E-10	8.1E-10
SSE	1.2E-09	1.2E-09	1.2E-09	1.3E-09	1.3E-09	1.3E-09
SE	1.8E-09	1.7E-09	1.7E-09	1.9E-09	1.8E-09	1.8E-09
ESE	1.9E-09	1.9E-09	1.9E-09	2.0E-09	2.0E-09	2.0E-09
E	2.8E-09	2.6E-09	2.7E-09	2.9E-09	2.8E-09	2.9E-09
ENE	3.1E-09	3.0E-09	3.0E-09	3.3E-09	3.2E-09	3.3E-09
NE	2.8E-09	2.6E-09	2.7E-09	2.9E-09	2.9E-09	2.9E-09
NNE	1.8E-09	1.7E-09	1.8E-09	1.9E-09	1.9E-09	1.9E-09

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:49 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

7.41E-05

At This Location: 1016 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 11 Laundry Facility [G1]

Dataset Name: 97-P274-G1
Dataset Date: Apr 7, 1998 1:31 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1016 Meters East Northeast
Lifetime Fatal Cancer Risk: 8.47E-10

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	2.20E-07
BREAST	2.42E-07
R MAR	2.60E-05
LUNGS	5.02E-04
THYROID	2.16E-07
ENDOST	3.28E-04
RMNDR	2.83E-06
EFFEC	7.41E-05

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	0.30	9.9E-08	9.9E-08
U-235	Y	1.00	1.5E-08	1.5E-08
U-236	Y	1.00	1.5E-08	1.5E-08
U-238	Y	0.30	7.0E-08	7.0E-08
RA-226	W	1.00	3.2E-11	3.2E-11
RA-228	W	1.00	1.3E-10	1.3E-10
TH-228	Y	1.00	1.7E-08	1.7E-08
TH-230	Y	1.00	6.7E-08	6.7E-08
TH-232	Y	1.00	2.4E-08	2.4E-08
TH-234	Y	1.00	2.0E-07	2.0E-07

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	3.68
Diameter (m):	0.56
Plume Rise Momentum (m/s): (Exit Velocity)	1.30E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1343	1308	2048	1680	1378	1016	1057	1102	1132	1256
1247	1232	1131	1126	1730	1260	1093	1094	1728	1734

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:49 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 11 Laundry Facility [G1]

Dataset Name: 97-P274-G1
Dataset Date: Apr 7, 1998 1:31 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.20E-07
BREAST	2.42E-07
R MAR	2.60E-05
LUNGS	5.02E-04
THYROID	2.16E-07
ENDOST	3.28E-04
RMNDR	2.83E-06
EFFEC	7.41E-05

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	2.19E-06
INHALATION	7.18E-05
AIR IMMERSION	2.43E-12
GROUND SURFACE	5.46E-08
INTERNAL	7.40E-05
EXTERNAL	5.46E-08
TOTAL	7.41E-05

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	2.40E-05
U-235	2.06E-06
U-236	2.05E-06
U-238	1.53E-05
RA-226	6.47E-10
RA-228	1.05E-09
TH-228	4.36E-06
TH-230	1.74E-05
TH-232	8.86E-06
TH-234	1.75E-08
TOTAL	7.41E-05

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	2.27E-11
BONE	1.50E-11
THYROID	5.23E-14
BREAST	5.41E-13
LUNG	8.01E-10
STOMACH	3.33E-13
BOWEL	4.86E-13
LIVER	9.23E-13
PANCREAS	2.15E-13
URINARY	5.46E-12
OTHER	2.63E-13
TOTAL	8.47E-10

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.07E-11
INHALATION	8.35E-10
AIR IMMERSION	5.53E-17
GROUND SURFACE	1.26E-12
INTERNAL	8.46E-10
EXTERNAL	1.26E-12
TOTAL	8.47E-10

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	3.13E-10
U-235	2.70E-11
U-236	2.63E-11
U-238	2.01E-10
RA-226	8.32E-15
RA-228	1.06E-14
TH-228	8.73E-11
TH-230	1.43E-10
TH-232	4.99E-11
TH-234	5.37E-13
TOTAL	8.47E-10

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1343	1308	2048	1680	1378	1016	1057
N	1.9E-05	2.0E-05	1.1E-05	1.4E-05	1.9E-05	2.8E-05	2.7E-05
NNW	1.3E-05	1.4E-05	7.5E-06	9.7E-06	1.3E-05	1.9E-05	1.8E-05
NW	1.3E-05	1.3E-05	7.5E-06	9.5E-06	1.2E-05	1.8E-05	1.7E-05
WNW	1.2E-05	1.2E-05	7.4E-06	9.1E-06	1.2E-05	1.7E-05	1.6E-05
W	2.1E-05	2.2E-05	1.3E-05	1.6E-05	2.1E-05	3.2E-05	3.0E-05
WSW	2.9E-05	3.0E-05	1.6E-05	2.1E-05	2.8E-05	4.5E-05	4.2E-05
SW	1.6E-05	1.6E-05	8.5E-06	1.1E-05	1.5E-05	2.4E-05	2.3E-05
SSW	1.2E-05	1.3E-05	6.9E-06	8.9E-06	1.2E-05	1.8E-05	1.7E-05
S	1.3E-05	1.3E-05	7.3E-06	9.3E-06	1.2E-05	1.9E-05	1.8E-05
SSE	1.9E-05	2.0E-05	1.2E-05	1.5E-05	1.9E-05	2.8E-05	2.6E-05
SE	2.7E-05	2.8E-05	1.8E-05	2.2E-05	2.6E-05	3.9E-05	3.7E-05
ESE	2.9E-05	3.0E-05	1.9E-05	2.3E-05	2.8E-05	4.2E-05	3.9E-05
E	4.3E-05	4.4E-05	2.6E-05	3.3E-05	4.2E-05	6.2E-05	5.9E-05
ENE	5.1E-05	5.3E-05	3.0E-05	3.8E-05	4.9E-05	7.4E-05	7.0E-05
NE	4.6E-05	4.8E-05	2.6E-05	3.4E-05	4.4E-05	6.7E-05	6.4E-05
NNE	3.1E-05	3.2E-05	1.8E-05	2.3E-05	3.0E-05	4.6E-05	4.4E-05

	Distance (m)						
Direction	1102	1132	1256	1247	1232	1131	1126
N	2.5E-05	2.4E-05	2.1E-05	2.1E-05	2.2E-05	2.4E-05	2.4E-05
NNW	1.7E-05	1.6E-05	1.4E-05	1.4E-05	1.5E-05	1.6E-05	1.7E-05
NW	1.6E-05	1.6E-05	1.4E-05	1.4E-05	1.4E-05	1.6E-05	1.6E-05
WNW	1.5E-05	1.5E-05	1.3E-05	1.3E-05	1.3E-05	1.5E-05	1.5E-05
W	2.8E-05	2.7E-05	2.3E-05	2.4E-05	2.4E-05	2.7E-05	2.7E-05
WSW	3.9E-05	3.8E-05	3.2E-05	3.3E-05	3.3E-05	3.8E-05	3.8E-05
SW	2.1E-05	2.0E-05	1.7E-05	1.8E-05	1.8E-05	2.0E-05	2.1E-05
SSW	1.6E-05	1.6E-05	1.3E-05	1.4E-05	1.4E-05	1.6E-05	1.6E-05
S	1.7E-05	1.6E-05	1.4E-05	1.4E-05	1.4E-05	1.6E-05	1.6E-05
SSE	2.5E-05	2.4E-05	2.1E-05	2.1E-05	2.2E-05	2.4E-05	2.4E-05
SE	3.5E-05	3.4E-05	3.0E-05	3.0E-05	3.0E-05	3.4E-05	3.4E-05
ESE	3.7E-05	3.6E-05	3.2E-05	3.2E-05	3.2E-05	3.6E-05	3.6E-05
E	5.5E-05	5.4E-05	4.7E-05	4.7E-05	4.8E-05	5.4E-05	5.4E-05
ENE	6.6E-05	6.4E-05	5.6E-05	5.6E-05	5.7E-05	6.4E-05	6.5E-05
NE	6.0E-05	5.8E-05	5.0E-05	5.1E-05	5.2E-05	5.8E-05	5.9E-05
NNE	4.1E-05	3.9E-05	3.4E-05	3.4E-05	3.5E-05	3.9E-05	4.0E-05

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1730	1260	1093	1094	1728	1734
N	1.4E-05	2.1E-05	2.5E-05	2.5E-05	1.4E-05	1.4E-05
NNW	9.3E-06	1.4E-05	1.7E-05	1.7E-05	9.3E-06	9.3E-06
NW	9.1E-06	1.4E-05	1.6E-05	1.6E-05	9.2E-06	9.1E-06
WNW	8.8E-06	1.3E-05	1.5E-05	1.5E-05	8.8E-06	8.8E-06
W	1.5E-05	2.3E-05	2.9E-05	2.9E-05	1.5E-05	1.5E-05
WSW	2.0E-05	3.2E-05	4.0E-05	4.0E-05	2.0E-05	2.0E-05
SW	1.1E-05	1.7E-05	2.1E-05	2.1E-05	1.1E-05	1.1E-05
SSW	8.6E-06	1.3E-05	1.6E-05	1.6E-05	8.6E-06	8.5E-06
S	9.0E-06	1.4E-05	1.7E-05	1.7E-05	9.0E-06	9.0E-06
SSE	1.5E-05	2.1E-05	2.5E-05	2.5E-05	1.5E-05	1.5E-05
SE	2.1E-05	2.9E-05	3.5E-05	3.5E-05	2.1E-05	2.1E-05
ESE	2.2E-05	3.1E-05	3.8E-05	3.8E-05	2.2E-05	2.2E-05
E	3.2E-05	4.7E-05	5.6E-05	5.6E-05	3.2E-05	3.2E-05
ENE	3.7E-05	5.6E-05	6.7E-05	6.7E-05	3.7E-05	3.7E-05
NE	3.3E-05	5.0E-05	6.1E-05	6.1E-05	3.3E-05	3.2E-05
NNE	2.2E-05	3.4E-05	4.1E-05	4.1E-05	2.2E-05	2.2E-05

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 1343	1308	2048	1680	1378	1016	1057
N	2.2E-10	2.3E-10	1.3E-10	1.6E-10	2.1E-10	3.2E-10	3.0E-10
NNW	1.5E-10	1.5E-10	8.4E-11	1.1E-10	1.4E-10	2.2E-10	2.1E-10
NW	1.4E-10	1.5E-10	8.4E-11	1.1E-10	1.4E-10	2.0E-10	1.9E-10
WNW	1.3E-10	1.4E-10	8.2E-11	1.0E-10	1.3E-10	1.9E-10	1.8E-10
W	2.4E-10	2.5E-10	1.4E-10	1.8E-10	2.3E-10	3.6E-10	3.4E-10
WSW	3.3E-10	3.5E-10	1.8E-10	2.4E-10	3.2E-10	5.1E-10	4.8E-10
SW	1.8E-10	1.8E-10	9.6E-11	1.3E-10	1.7E-10	2.7E-10	2.6E-10
SSW	1.4E-10	1.4E-10	7.7E-11	1.0E-10	1.3E-10	2.1E-10	2.0E-10
S	1.4E-10	1.5E-10	8.2E-11	1.0E-10	1.4E-10	2.1E-10	2.0E-10
SSE	2.2E-10	2.3E-10	1.4E-10	1.7E-10	2.1E-10	3.2E-10	3.0E-10
SE	3.1E-10	3.2E-10	2.1E-10	2.4E-10	3.0E-10	4.4E-10	4.2E-10
ESE	3.3E-10	3.4E-10	2.2E-10	2.6E-10	3.2E-10	4.7E-10	4.5E-10
E	4.9E-10	5.1E-10	3.0E-10	3.7E-10	4.7E-10	7.1E-10	6.7E-10
ENE	5.8E-10	6.0E-10	3.4E-10	4.3E-10	5.6E-10	8.5E-10	8.0E-10
NE	5.2E-10	5.4E-10	3.0E-10	3.9E-10	5.0E-10	7.7E-10	7.3E-10
NNE	3.5E-10	3.7E-10	2.0E-10	2.6E-10	3.4E-10	5.3E-10	5.0E-10

Direction	Distance (m) 1102	1132	1256	1247	1232	1131	1126
N	2.9E-10	2.8E-10	2.4E-10	2.4E-10	2.5E-10	2.8E-10	2.8E-10
NNW	1.9E-10	1.9E-10	1.6E-10	1.6E-10	1.7E-10	1.9E-10	1.9E-10
NW	1.8E-10	1.8E-10	1.5E-10	1.6E-10	1.6E-10	1.8E-10	1.8E-10
WNW	1.7E-10	1.7E-10	1.5E-10	1.5E-10	1.5E-10	1.7E-10	1.7E-10
W	3.2E-10	3.1E-10	2.7E-10	2.7E-10	2.7E-10	3.1E-10	3.1E-10
WSW	4.5E-10	4.3E-10	3.7E-10	3.7E-10	3.8E-10	4.3E-10	4.4E-10
SW	2.4E-10	2.3E-10	2.0E-10	2.0E-10	2.0E-10	2.3E-10	2.3E-10
SSW	1.8E-10	1.8E-10	1.5E-10	1.5E-10	1.6E-10	1.8E-10	1.8E-10
S	1.9E-10	1.8E-10	1.6E-10	1.6E-10	1.6E-10	1.8E-10	1.8E-10
SSE	2.8E-10	2.7E-10	2.4E-10	2.4E-10	2.5E-10	2.7E-10	2.8E-10
SE	4.0E-10	3.8E-10	3.4E-10	3.4E-10	3.4E-10	3.8E-10	3.9E-10
ESE	4.3E-10	4.1E-10	3.6E-10	3.6E-10	3.7E-10	4.1E-10	4.1E-10
E	6.3E-10	6.1E-10	5.3E-10	5.4E-10	5.5E-10	6.1E-10	6.2E-10
ENE	7.6E-10	7.3E-10	6.4E-10	6.4E-10	6.5E-10	7.3E-10	7.4E-10
NE	6.9E-10	6.6E-10	5.7E-10	5.8E-10	5.9E-10	6.6E-10	6.7E-10
NNE	4.7E-10	4.5E-10	3.9E-10	3.9E-10	4.0E-10	4.5E-10	4.5E-10

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1730	1260	1093	1094	1728	1734
N	1.6E-10	2.4E-10	2.9E-10	2.9E-10	1.6E-10	1.6E-10
NNW	1.0E-10	1.6E-10	2.0E-10	2.0E-10	1.0E-10	1.0E-10
NW	1.0E-10	1.5E-10	1.9E-10	1.9E-10	1.0E-10	1.0E-10
WNW	9.9E-11	1.5E-10	1.7E-10	1.7E-10	9.9E-11	9.9E-11
W	1.7E-10	2.7E-10	3.3E-10	3.3E-10	1.7E-10	1.7E-10
WSW	2.3E-10	3.7E-10	4.6E-10	4.6E-10	2.3E-10	2.3E-10
SW	1.2E-10	2.0E-10	2.4E-10	2.4E-10	1.2E-10	1.2E-10
SSW	9.6E-11	1.5E-10	1.9E-10	1.9E-10	9.6E-11	9.6E-11
S	1.0E-10	1.6E-10	1.9E-10	1.9E-10	1.0E-10	1.0E-10
SSE	1.7E-10	2.4E-10	2.9E-10	2.9E-10	1.7E-10	1.7E-10
SE	2.4E-10	3.4E-10	4.0E-10	4.0E-10	2.4E-10	2.4E-10
ESE	2.5E-10	3.6E-10	4.3E-10	4.3E-10	2.5E-10	2.5E-10
E	3.6E-10	5.3E-10	6.4E-10	6.4E-10	3.6E-10	3.6E-10
ENE	4.2E-10	6.3E-10	7.7E-10	7.7E-10	4.2E-10	4.2E-10
NE	3.7E-10	5.7E-10	7.0E-10	7.0E-10	3.7E-10	3.7E-10
NNE	2.5E-10	3.9E-10	4.7E-10	4.7E-10	2.5E-10	2.5E-10

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:50 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

5.13E-05

At This Location: 1336 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 11 Laundry Facility [G2]

Dataset Name: 97-P274-G2
Dataset Date: Apr 7, 1998 1:32 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1336 Meters East Northeast
Lifetime Fatal Cancer Risk: 5.86E-10

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.53E-07
BREAST	1.69E-07
R MAR	1.80E-05
LUNGS	3.47E-04
THYROID	1.50E-07
ENDOST	2.27E-04
RMNDR	1.96E-06
EFFEC	5.13E-05

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	0.30	9.9E-08	9.9E-08
U-235	Y	1.00	1.5E-08	1.5E-08
U-236	Y	1.00	1.5E-08	1.5E-08
U-238	Y	0.30	7.0E-08	7.0E-08
RA-226	W	1.00	3.2E-11	3.2E-11
RA-228	W	1.00	1.3E-10	1.3E-10
TH-228	Y	1.00	1.7E-08	1.7E-08
TH-230	Y	1.00	6.7E-08	6.7E-08
TH-232	Y	1.00	2.4E-08	2.4E-08
TH-234	Y	1.00	2.0E-07	2.0E-07

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	3.68
Diameter (m):	0.56
Plume Rise Momentum (m/s): (Exit Velocity)	1.30E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1336	1645	2100	1821	2528	2342	2177	1742	1347	2252
2320	1811	2402	1716	2036	2128	2081	1855	1887	1855

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:50 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 11 Laundry Facility [G2]

Dataset Name: 97-P274-G2
Dataset Date: Apr 7, 1998 1:32 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.53E-07
BREAST	1.69E-07
R MAR	1.80E-05
LUNGS	3.47E-04
THYROID	1.50E-07
ENDOST	2.27E-04
RMNDR	1.96E-06
EFFEC	5.13E-05

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.51E-06
INHALATION	4.97E-05
AIR IMMERSION	1.68E-12
GROUND SURFACE	3.84E-08
INTERNAL	5.12E-05
EXTERNAL	3.84E-08
TOTAL	5.12E-05

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.66E-05
U-235	1.43E-06
U-236	1.42E-06
U-238	1.06E-05
RA-226	4.47E-10
RA-228	7.29E-10
TH-228	3.01E-06
TH-230	1.21E-05
TH-232	6.13E-06
TH-234	1.21E-08
TOTAL	5.12E-05

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.57E-11
BONE	1.04E-11
THYROID	3.65E-14
BREAST	3.78E-13
LUNG	5.54E-10
STOMACH	2.32E-13
BOWEL	3.37E-13
LIVER	6.40E-13
PANCREAS	1.50E-13
URINARY	3.78E-12
OTHER	1.83E-13
TOTAL	5.86E-10

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	7.39E-12
INHALATION	5.78E-10
AIR IMMERSION	3.83E-17
GROUND SURFACE	8.91E-13
INTERNAL	5.85E-10
EXTERNAL	8.91E-13
TOTAL	5.86E-10

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	2.17E-10
U-235	1.87E-11
U-236	1.82E-11
U-238	1.39E-10
RA-226	5.76E-15
RA-228	7.31E-15
TH-228	6.04E-11
TH-230	9.87E-11
TH-232	3.45E-11
TH-234	3.72E-13
TOTAL	5.86E-10

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1336	1645	2100	1821	2528	2342	2177
N	1.9E-05	1.5E-05	1.1E-05	1.3E-05	8.6E-06	9.4E-06	1.0E-05
NNW	1.3E-05	9.8E-06	7.2E-06	8.6E-06	5.8E-06	6.3E-06	6.9E-06
NW	1.3E-05	9.6E-06	7.1E-06	8.5E-06	5.8E-06	6.3E-06	6.8E-06
WNW	1.2E-05	9.2E-06	7.0E-06	8.2E-06	5.8E-06	6.3E-06	6.8E-06
W	2.1E-05	1.6E-05	1.2E-05	1.4E-05	9.8E-06	1.1E-05	1.2E-05
WSW	2.9E-05	2.1E-05	1.5E-05	1.8E-05	1.2E-05	1.3E-05	1.4E-05
SW	1.6E-05	1.1E-05	8.1E-06	9.9E-06	6.3E-06	7.0E-06	7.7E-06
SSW	1.2E-05	9.0E-06	6.6E-06	7.9E-06	5.2E-06	5.7E-06	6.3E-06
S	1.3E-05	9.5E-06	7.0E-06	8.3E-06	5.7E-06	6.2E-06	6.7E-06
SSE	1.9E-05	1.5E-05	1.2E-05	1.4E-05	1.0E-05	1.1E-05	1.2E-05
SE	2.7E-05	2.2E-05	1.8E-05	2.0E-05	1.5E-05	1.6E-05	1.7E-05
ESE	2.9E-05	2.3E-05	1.9E-05	2.1E-05	1.6E-05	1.7E-05	1.8E-05
E	4.3E-05	3.3E-05	2.6E-05	3.0E-05	2.1E-05	2.3E-05	2.5E-05
ENE	5.1E-05	3.9E-05	2.9E-05	3.4E-05	2.3E-05	2.5E-05	2.8E-05
NE	4.6E-05	3.5E-05	2.5E-05	3.0E-05	2.0E-05	2.2E-05	2.4E-05
NNE	3.1E-05	2.3E-05	1.7E-05	2.0E-05	1.3E-05	1.5E-05	1.6E-05

	Distance (m)						
Direction	1742	1347	2252	2320	1811	2402	1716
N	1.4E-05	1.9E-05	9.9E-06	9.6E-06	1.3E-05	9.2E-06	1.4E-05
NNW	9.1E-06	1.3E-05	6.6E-06	6.4E-06	8.7E-06	6.1E-06	9.3E-06
NW	8.9E-06	1.2E-05	6.6E-06	6.4E-06	8.5E-06	6.1E-06	9.1E-06
WNW	8.6E-06	1.2E-05	6.6E-06	6.4E-06	8.3E-06	6.1E-06	8.8E-06
W	1.5E-05	2.1E-05	1.1E-05	1.1E-05	1.4E-05	1.0E-05	1.5E-05
WSW	2.0E-05	2.9E-05	1.4E-05	1.3E-05	1.9E-05	1.2E-05	2.0E-05
SW	1.1E-05	1.5E-05	7.4E-06	7.1E-06	1.0E-05	6.8E-06	1.1E-05
SSW	8.4E-06	1.2E-05	6.0E-06	5.8E-06	7.9E-06	5.6E-06	8.5E-06
S	8.8E-06	1.2E-05	6.5E-06	6.3E-06	8.4E-06	6.0E-06	9.0E-06
SSE	1.4E-05	1.9E-05	1.1E-05	1.1E-05	1.4E-05	1.1E-05	1.5E-05
SE	2.1E-05	2.7E-05	1.7E-05	1.6E-05	2.0E-05	1.6E-05	2.1E-05
ESE	2.2E-05	2.9E-05	1.8E-05	1.7E-05	2.1E-05	1.7E-05	2.2E-05
E	3.1E-05	4.3E-05	2.4E-05	2.3E-05	3.0E-05	2.2E-05	3.2E-05
ENE	3.6E-05	5.1E-05	2.7E-05	2.6E-05	3.5E-05	2.5E-05	3.7E-05
NE	3.2E-05	4.6E-05	2.3E-05	2.2E-05	3.1E-05	2.2E-05	3.3E-05
NNE	2.2E-05	3.1E-05	1.5E-05	1.5E-05	2.0E-05	1.4E-05	2.2E-05

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2036	2128	2081	1855	1887	1855
N	1.1E-05	1.1E-05	1.1E-05	1.3E-05	1.2E-05	1.3E-05
NNW	7.5E-06	7.1E-06	7.3E-06	8.4E-06	8.2E-06	8.4E-06
NW	7.4E-06	7.0E-06	7.2E-06	8.3E-06	8.1E-06	8.3E-06
WNW	7.3E-06	6.9E-06	7.1E-06	8.0E-06	7.9E-06	8.0E-06
W	1.2E-05	1.2E-05	1.2E-05	1.4E-05	1.4E-05	1.4E-05
WSW	1.6E-05	1.5E-05	1.5E-05	1.8E-05	1.8E-05	1.8E-05
SW	8.5E-06	8.0E-06	8.2E-06	9.7E-06	9.4E-06	9.7E-06
SSW	6.8E-06	6.5E-06	6.6E-06	7.7E-06	7.5E-06	7.7E-06
S	7.3E-06	6.9E-06	7.1E-06	8.1E-06	8.0E-06	8.1E-06
SSE	1.2E-05	1.2E-05	1.2E-05	1.4E-05	1.3E-05	1.4E-05
SE	1.8E-05	1.8E-05	1.8E-05	2.0E-05	1.9E-05	2.0E-05
ESE	1.9E-05	1.8E-05	1.9E-05	2.1E-05	2.0E-05	2.1E-05
E	2.6E-05	2.5E-05	2.6E-05	2.9E-05	2.9E-05	2.9E-05
ENE	3.0E-05	2.8E-05	2.9E-05	3.4E-05	3.3E-05	3.4E-05
NE	2.6E-05	2.5E-05	2.6E-05	3.0E-05	2.9E-05	3.0E-05
NNE	1.8E-05	1.7E-05	1.7E-05	2.0E-05	1.9E-05	2.0E-05

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1336	1645	2100	1821	2528	2342	2177
N	2.2E-10	1.7E-10	1.2E-10	1.5E-10	9.8E-11	1.1E-10	1.2E-10
NNW	1.5E-10	1.1E-10	8.1E-11	9.7E-11	6.5E-11	7.1E-11	7.8E-11
NW	1.4E-10	1.1E-10	8.1E-11	9.6E-11	6.5E-11	7.1E-11	7.7E-11
WNW	1.3E-10	1.0E-10	7.9E-11	9.3E-11	6.5E-11	7.1E-11	7.6E-11
W	2.4E-10	1.8E-10	1.4E-10	1.6E-10	1.1E-10	1.2E-10	1.3E-10
WSW	3.3E-10	2.4E-10	1.7E-10	2.1E-10	1.3E-10	1.5E-10	1.6E-10
SW	1.8E-10	1.3E-10	9.2E-11	1.1E-10	7.1E-11	7.9E-11	8.7E-11
SSW	1.4E-10	1.0E-10	7.4E-11	8.9E-11	5.9E-11	6.4E-11	7.1E-11
S	1.4E-10	1.1E-10	7.9E-11	9.4E-11	6.4E-11	7.0E-11	7.6E-11
SSE	2.2E-10	1.7E-10	1.4E-10	1.6E-10	1.2E-10	1.2E-10	1.3E-10
SE	3.1E-10	2.5E-10	2.0E-10	2.3E-10	1.8E-10	1.9E-10	2.0E-10
ESE	3.3E-10	2.6E-10	2.1E-10	2.4E-10	1.8E-10	2.0E-10	2.1E-10
E	4.9E-10	3.8E-10	2.9E-10	3.4E-10	2.4E-10	2.6E-10	2.8E-10
ENE	5.9E-10	4.5E-10	3.3E-10	3.9E-10	2.7E-10	2.9E-10	3.2E-10
NE	5.3E-10	4.0E-10	2.9E-10	3.5E-10	2.3E-10	2.5E-10	2.8E-10
NNE	3.5E-10	2.6E-10	1.9E-10	2.3E-10	1.5E-10	1.7E-10	1.8E-10

	Distance (m)						
Direction	1742	1347	2252	2320	1811	2402	1716
N	1.5E-10	2.2E-10	1.1E-10	1.1E-10	1.5E-10	1.0E-10	1.6E-10
NNW	1.0E-10	1.5E-10	7.4E-11	7.2E-11	9.8E-11	6.9E-11	1.1E-10
NW	1.0E-10	1.4E-10	7.4E-11	7.2E-11	9.6E-11	6.9E-11	1.0E-10
WNW	9.8E-11	1.3E-10	7.4E-11	7.2E-11	9.3E-11	6.9E-11	9.9E-11
W	1.7E-10	2.4E-10	1.3E-10	1.2E-10	1.6E-10	1.2E-10	1.7E-10
WSW	2.2E-10	3.3E-10	1.5E-10	1.5E-10	2.1E-10	1.4E-10	2.3E-10
SW	1.2E-10	1.8E-10	8.3E-11	8.0E-11	1.1E-10	7.6E-11	1.2E-10
SSW	9.5E-11	1.4E-10	6.8E-11	6.5E-11	9.0E-11	6.2E-11	9.7E-11
S	1.0E-10	1.4E-10	7.3E-11	7.0E-11	9.5E-11	6.8E-11	1.0E-10
SSE	1.6E-10	2.2E-10	1.3E-10	1.3E-10	1.6E-10	1.2E-10	1.7E-10
SE	2.4E-10	3.1E-10	1.9E-10	1.9E-10	2.3E-10	1.8E-10	2.4E-10
ESE	2.5E-10	3.3E-10	2.0E-10	2.0E-10	2.4E-10	1.9E-10	2.5E-10
E	3.6E-10	4.9E-10	2.7E-10	2.6E-10	3.4E-10	2.6E-10	3.6E-10
ENE	4.1E-10	5.8E-10	3.0E-10	2.9E-10	3.9E-10	2.8E-10	4.2E-10
NE	3.7E-10	5.2E-10	2.7E-10	2.6E-10	3.5E-10	2.5E-10	3.7E-10
NNE	2.5E-10	3.5E-10	1.8E-10	1.7E-10	2.3E-10	1.6E-10	2.5E-10

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2036	2128	2081	1855	1887	1855
N	1.3E-10	1.2E-10	1.2E-10	1.4E-10	1.4E-10	1.4E-10
NNW	8.4E-11	8.0E-11	8.2E-11	9.5E-11	9.3E-11	9.5E-11
NW	8.4E-11	7.9E-11	8.1E-11	9.4E-11	9.2E-11	9.4E-11
WNW	8.2E-11	7.8E-11	8.0E-11	9.1E-11	8.9E-11	9.1E-11
W	1.4E-10	1.3E-10	1.4E-10	1.6E-10	1.6E-10	1.6E-10
WSW	1.8E-10	1.7E-10	1.7E-10	2.0E-10	2.0E-10	2.0E-10
SW	9.6E-11	9.0E-11	9.3E-11	1.1E-10	1.1E-10	1.1E-10
SSW	7.7E-11	7.3E-11	7.5E-11	8.7E-11	8.5E-11	8.7E-11
S	8.2E-11	7.8E-11	8.0E-11	9.2E-11	9.0E-11	9.2E-11
SSE	1.4E-10	1.4E-10	1.4E-10	1.5E-10	1.5E-10	1.5E-10
SE	2.1E-10	2.0E-10	2.0E-10	2.2E-10	2.2E-10	2.2E-10
ESE	2.2E-10	2.1E-10	2.1E-10	2.4E-10	2.3E-10	2.4E-10
E	3.0E-10	2.9E-10	3.0E-10	3.3E-10	3.3E-10	3.3E-10
ENE	3.4E-10	3.2E-10	3.3E-10	3.8E-10	3.8E-10	3.8E-10
NE	3.0E-10	2.8E-10	2.9E-10	3.4E-10	3.3E-10	3.4E-10
NNE	2.0E-10	1.9E-10	1.9E-10	2.3E-10	2.2E-10	2.3E-10

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:47 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

3.96E-04

At This Location: 1017 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 11 Respirator Washing Facility [G1]

Dataset Name: 97-P284-G1
Dataset Date: Apr 7, 1998 1:20 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1017 Meters East Northeast
Lifetime Fatal Cancer Risk: 5.12E-09

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	8.21E-07
BREAST	9.27E-07
R MAR	4.45E-05
LUNGS	3.06E-03
THYROID	8.02E-07
ENDOST	5.81E-04
RMNDR	2.05E-05
EFFEC	3.96E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	0.30	6.9E-07	6.9E-07
U-235	Y	1.00	3.7E-08	3.7E-08
U-236	Y	1.00	2.7E-08	2.7E-08
U-238	Y	0.30	7.8E-07	7.8E-07
RA-226	W	0.30	4.9E-10	4.9E-10
RA-228	W	0.30	2.0E-09	2.0E-09
TH-228	Y	0.30	2.1E-08	2.1E-08
TH-230	Y	0.30	6.2E-08	6.2E-08
TH-232	Y	0.30	3.3E-09	3.3E-09
TH-234	Y	0.30	3.1E-06	3.1E-06

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	4.88
Diameter (m):	0.20
Plume Rise Momentum (m/s): (Exit Velocity)	2.91E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1337	1301	2043	1677	1375	1017	1061	1106	1137	1261
1252	1238	1137	1132	1735	1264	1094	1095	1724	1729

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:47 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 11 Respirator Washing Facility [G1]

Dataset Name: 97-P284-G1
Dataset Date: Apr 7, 1998 1:20 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	8.21E-07
BREAST	9.27E-07
R MAR	4.45E-05
LUNGS	3.06E-03
THYROID	8.02E-07
ENDOST	5.81E-04
RMNDR	2.05E-05
EFFEC	3.96E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.44E-05
INHALATION	3.82E-04
AIR IMMERSION	1.88E-11
GROUND SURFACE	1.50E-07
INTERNAL	3.96E-04
EXTERNAL	1.50E-07
TOTAL	3.96E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.74E-04
U-235	5.20E-06
U-236	3.80E-06
U-238	1.73E-04
RA-226	1.31E-08
RA-228	1.94E-08
TH-228	9.67E-06
TH-230	2.77E-05
TH-232	2.14E-06
TH-234	3.38E-07
TOTAL	3.96E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	4.23E-11
BONE	2.79E-11
THYROID	1.80E-13
BREAST	2.01E-12
LUNG	4.99E-09
STOMACH	1.36E-12
BOWEL	3.51E-12
LIVER	1.89E-12
PANCREAS	7.99E-13
URINARY	4.23E-11
OTHER	9.77E-13
TOTAL	5.12E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	7.66E-11
INHALATION	5.04E-09
AIR IMMERSION	4.19E-16
GROUND SURFACE	3.46E-12
INTERNAL	5.11E-09
EXTERNAL	3.46E-12
TOTAL	5.12E-09

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	2.27E-09
U-235	6.80E-11
U-236	4.86E-11
U-238	2.28E-09
RA-226	2.07E-13
RA-228	2.23E-13
TH-228	1.95E-10
TH-230	2.32E-10
TH-232	1.22E-11
TH-234	1.33E-11
TOTAL	5.12E-09

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1337	1301	2043	1677	1375	1017	1061
N	1.0E-04	1.1E-04	6.2E-05	7.9E-05	1.0E-04	1.5E-04	1.4E-04
NNW	7.1E-05	7.3E-05	4.2E-05	5.3E-05	6.8E-05	1.0E-04	9.6E-05
NW	6.9E-05	7.2E-05	4.2E-05	5.3E-05	6.7E-05	9.8E-05	9.3E-05
WNW	6.6E-05	6.8E-05	4.2E-05	5.1E-05	6.4E-05	9.3E-05	8.8E-05
W	1.2E-04	1.2E-04	7.0E-05	8.7E-05	1.1E-04	1.7E-04	1.6E-04
WSW	1.5E-04	1.6E-04	8.4E-05	1.1E-04	1.5E-04	2.3E-04	2.2E-04
SW	8.3E-05	8.7E-05	4.6E-05	6.0E-05	8.0E-05	1.3E-04	1.2E-04
SSW	6.5E-05	6.8E-05	3.8E-05	4.8E-05	6.3E-05	9.6E-05	9.1E-05
S	6.8E-05	7.1E-05	4.1E-05	5.1E-05	6.6E-05	9.9E-05	9.3E-05
SSE	1.1E-04	1.1E-04	7.2E-05	8.5E-05	1.0E-04	1.5E-04	1.4E-04
SE	1.5E-04	1.6E-04	1.1E-04	1.2E-04	1.5E-04	2.1E-04	2.0E-04
ESE	1.6E-04	1.7E-04	1.1E-04	1.3E-04	1.6E-04	2.2E-04	2.1E-04
E	2.4E-04	2.4E-04	1.5E-04	1.8E-04	2.3E-04	3.3E-04	3.2E-04
ENE	2.8E-04	2.9E-04	1.7E-04	2.1E-04	2.7E-04	4.0E-04	3.7E-04
NE	2.5E-04	2.6E-04	1.5E-04	1.8E-04	2.4E-04	3.6E-04	3.4E-04
NNE	1.7E-04	1.7E-04	9.6E-05	1.2E-04	1.6E-04	2.4E-04	2.3E-04

	Distance (m)						
Direction	1106	1137	1261	1252	1238	1137	1132
N	1.3E-04	1.3E-04	1.1E-04	1.1E-04	1.2E-04	1.3E-04	1.3E-04
NNW	9.1E-05	8.8E-05	7.6E-05	7.7E-05	7.8E-05	8.8E-05	8.8E-05
NW	8.8E-05	8.5E-05	7.4E-05	7.5E-05	7.6E-05	8.5E-05	8.5E-05
WNW	8.3E-05	8.1E-05	7.1E-05	7.2E-05	7.3E-05	8.1E-05	8.1E-05
W	1.5E-04	1.4E-04	1.2E-04	1.3E-04	1.3E-04	1.4E-04	1.4E-04
WSW	2.1E-04	2.0E-04	1.7E-04	1.7E-04	1.7E-04	2.0E-04	2.0E-04
SW	1.1E-04	1.1E-04	9.1E-05	9.2E-05	9.3E-05	1.1E-04	1.1E-04
SSW	8.5E-05	8.2E-05	7.1E-05	7.1E-05	7.3E-05	8.2E-05	8.2E-05
S	8.8E-05	8.5E-05	7.4E-05	7.4E-05	7.6E-05	8.5E-05	8.5E-05
SSE	1.3E-04	1.3E-04	1.1E-04	1.2E-04	1.2E-04	1.3E-04	1.3E-04
SE	1.9E-04	1.8E-04	1.6E-04	1.6E-04	1.7E-04	1.8E-04	1.8E-04
ESE	2.0E-04	2.0E-04	1.7E-04	1.7E-04	1.8E-04	2.0E-04	2.0E-04
E	3.0E-04	2.9E-04	2.5E-04	2.6E-04	2.6E-04	2.9E-04	2.9E-04
ENE	3.5E-04	3.4E-04	3.0E-04	3.0E-04	3.1E-04	3.4E-04	3.4E-04
NE	3.2E-04	3.1E-04	2.7E-04	2.7E-04	2.7E-04	3.1E-04	3.1E-04
NNE	2.2E-04	2.1E-04	1.8E-04	1.8E-04	1.8E-04	2.1E-04	2.1E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1735	1264	1094	1095	1724	1729
N	7.5E-05	1.1E-04	1.4E-04	1.4E-04	7.6E-05	7.6E-05
NNW	5.1E-05	7.6E-05	9.3E-05	9.2E-05	5.1E-05	5.1E-05
NW	5.0E-05	7.4E-05	8.9E-05	8.9E-05	5.1E-05	5.1E-05
WNW	4.9E-05	7.1E-05	8.4E-05	8.4E-05	5.0E-05	5.0E-05
W	8.4E-05	1.2E-04	1.5E-04	1.5E-04	8.5E-05	8.4E-05
WSW	1.1E-04	1.7E-04	2.1E-04	2.1E-04	1.1E-04	1.1E-04
SW	5.8E-05	9.0E-05	1.1E-04	1.1E-04	5.8E-05	5.8E-05
SSW	4.6E-05	7.1E-05	8.7E-05	8.6E-05	4.7E-05	4.7E-05
S	4.9E-05	7.3E-05	8.9E-05	8.9E-05	5.0E-05	5.0E-05
SSE	8.3E-05	1.1E-04	1.4E-04	1.4E-04	8.3E-05	8.3E-05
SE	1.2E-04	1.6E-04	1.9E-04	1.9E-04	1.2E-04	1.2E-04
ESE	1.3E-04	1.7E-04	2.0E-04	2.0E-04	1.3E-04	1.3E-04
E	1.8E-04	2.5E-04	3.0E-04	3.0E-04	1.8E-04	1.8E-04
ENE	2.0E-04	3.0E-04	3.6E-04	3.6E-04	2.0E-04	2.0E-04
NE	1.8E-04	2.7E-04	3.2E-04	3.2E-04	1.8E-04	1.8E-04
NNE	1.2E-04	1.8E-04	2.2E-04	2.2E-04	1.2E-04	1.2E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 1337	1301	2043	1677	1375	1017	1061
N	1.3E-09	1.4E-09	7.9E-10	1.0E-09	1.3E-09	1.9E-09	1.8E-09
NNW	9.0E-10	9.3E-10	5.3E-10	6.7E-10	8.7E-10	1.3E-09	1.2E-09
NW	8.8E-10	9.1E-10	5.2E-10	6.6E-10	8.5E-10	1.2E-09	1.2E-09
WNW	8.4E-10	8.7E-10	5.2E-10	6.5E-10	8.1E-10	1.2E-09	1.1E-09
W	1.5E-09	1.5E-09	8.9E-10	1.1E-09	1.4E-09	2.2E-09	2.0E-09
WSW	2.0E-09	2.1E-09	1.1E-09	1.4E-09	1.9E-09	3.0E-09	2.8E-09
SW	1.1E-09	1.1E-09	5.8E-10	7.7E-10	1.0E-09	1.6E-09	1.5E-09
SSW	8.3E-10	8.6E-10	4.8E-10	6.1E-10	8.0E-10	1.2E-09	1.2E-09
S	8.7E-10	9.0E-10	5.2E-10	6.5E-10	8.3E-10	1.3E-09	1.2E-09
SSE	1.4E-09	1.4E-09	9.1E-10	1.1E-09	1.3E-09	1.9E-09	1.8E-09
SE	2.0E-09	2.0E-09	1.4E-09	1.6E-09	1.9E-09	2.7E-09	2.5E-09
ESE	2.1E-09	2.1E-09	1.4E-09	1.7E-09	2.0E-09	2.9E-09	2.7E-09
E	3.0E-09	3.1E-09	1.9E-09	2.4E-09	2.9E-09	4.3E-09	4.1E-09
ENE	3.6E-09	3.7E-09	2.1E-09	2.7E-09	3.4E-09	5.1E-09	4.8E-09
NE	3.2E-09	3.3E-09	1.9E-09	2.4E-09	3.1E-09	4.6E-09	4.4E-09
NNE	2.1E-09	2.2E-09	1.2E-09	1.6E-09	2.1E-09	3.1E-09	3.0E-09

Direction	Distance (m) 1106	1137	1261	1252	1238	1137	1132
N	1.7E-09	1.7E-09	1.4E-09	1.5E-09	1.5E-09	1.7E-09	1.7E-09
NNW	1.2E-09	1.1E-09	9.7E-10	9.8E-10	1.0E-09	1.1E-09	1.1E-09
NW	1.1E-09	1.1E-09	9.5E-10	9.6E-10	9.7E-10	1.1E-09	1.1E-09
WNW	1.1E-09	1.0E-09	9.0E-10	9.1E-10	9.2E-10	1.0E-09	1.0E-09
W	1.9E-09	1.8E-09	1.6E-09	1.6E-09	1.6E-09	1.8E-09	1.9E-09
WSW	2.6E-09	2.5E-09	2.2E-09	2.2E-09	2.2E-09	2.5E-09	2.6E-09
SW	1.4E-09	1.4E-09	1.2E-09	1.2E-09	1.2E-09	1.4E-09	1.4E-09
SSW	1.1E-09	1.0E-09	9.0E-10	9.1E-10	9.2E-10	1.0E-09	1.1E-09
S	1.1E-09	1.1E-09	9.4E-10	9.5E-10	9.6E-10	1.1E-09	1.1E-09
SSE	1.7E-09	1.7E-09	1.5E-09	1.5E-09	1.5E-09	1.7E-09	1.7E-09
SE	2.4E-09	2.3E-09	2.1E-09	2.1E-09	2.1E-09	2.3E-09	2.4E-09
ESE	2.6E-09	2.5E-09	2.2E-09	2.2E-09	2.3E-09	2.5E-09	2.5E-09
E	3.9E-09	3.7E-09	3.3E-09	3.3E-09	3.3E-09	3.7E-09	3.7E-09
ENE	4.6E-09	4.4E-09	3.9E-09	3.9E-09	3.9E-09	4.4E-09	4.4E-09
NE	4.1E-09	4.0E-09	3.5E-09	3.5E-09	3.5E-09	4.0E-09	4.0E-09
NNE	2.8E-09	2.7E-09	2.3E-09	2.3E-09	2.4E-09	2.7E-09	2.7E-09

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1735	1264	1094	1095	1724	1729
N	9.6E-10	1.4E-09	1.7E-09	1.7E-09	9.7E-10	9.6E-10
NNW	6.4E-10	9.7E-10	1.2E-09	1.2E-09	6.5E-10	6.4E-10
NW	6.4E-10	9.4E-10	1.1E-09	1.1E-09	6.4E-10	6.4E-10
WNW	6.2E-10	9.0E-10	1.1E-09	1.1E-09	6.3E-10	6.3E-10
W	1.1E-09	1.6E-09	1.9E-09	1.9E-09	1.1E-09	1.1E-09
WSW	1.4E-09	2.2E-09	2.7E-09	2.7E-09	1.4E-09	1.4E-09
SW	7.3E-10	1.2E-09	1.4E-09	1.4E-09	7.4E-10	7.3E-10
SSW	5.8E-10	9.0E-10	1.1E-09	1.1E-09	5.9E-10	5.9E-10
S	6.2E-10	9.3E-10	1.1E-09	1.1E-09	6.3E-10	6.3E-10
SSE	1.1E-09	1.5E-09	1.7E-09	1.7E-09	1.1E-09	1.1E-09
SE	1.5E-09	2.1E-09	2.5E-09	2.4E-09	1.5E-09	1.5E-09
ESE	1.6E-09	2.2E-09	2.6E-09	2.6E-09	1.6E-09	1.6E-09
E	2.3E-09	3.3E-09	3.9E-09	3.9E-09	2.3E-09	2.3E-09
ENE	2.6E-09	3.8E-09	4.6E-09	4.6E-09	2.6E-09	2.6E-09
NE	2.3E-09	3.4E-09	4.2E-09	4.2E-09	2.3E-09	2.3E-09
NNE	1.5E-09	2.3E-09	2.8E-09	2.8E-09	1.5E-09	1.5E-09

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:47 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

2.78E-04

At This Location: 1330 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 11 Respirator Washing Facility [G2]

Dataset Name: 97-P284-G2
Dataset Date: Apr 7, 1998 1:21 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1330 Meters East Northeast
Lifetime Fatal Cancer Risk: 3.59E-09

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	5.78E-07
BREAST	6.53E-07
R MAR	3.12E-05
LUNGS	2.15E-03
THYROID	5.64E-07
ENDOST	4.08E-04
RMNDR	1.43E-05
EFFEC	2.78E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	0.30	6.9E-07	6.9E-07
U-235	Y	1.00	3.7E-08	3.7E-08
U-236	Y	1.00	2.7E-08	2.7E-08
U-238	Y	0.30	7.8E-07	7.8E-07
RA-226	W	0.30	4.9E-10	4.9E-10
RA-228	W	0.30	2.0E-09	2.0E-09
TH-228	Y	0.30	2.1E-08	2.1E-08
TH-230	Y	0.30	6.2E-08	6.2E-08
TH-232	Y	0.30	3.3E-09	3.3E-09
TH-234	Y	0.30	3.1E-06	3.1E-06

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 4.88
Diameter (m): 0.20

Plume Rise
Momentum (m/s): 2.91E+01
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1330	1639	2098	1821	2526	2342	2181	1736	1351	2250
2319	1805	2402	1712	2031	2123	2076	1858	1890	1850

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:47 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 11 Respirator Washing Facility [G2]

Dataset Name: 97-P284-G2
Dataset Date: Apr 7, 1998 1:21 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	5.78E-07
BREAST	6.53E-07
R MAR	3.12E-05
LUNGS	2.15E-03
THYROID	5.64E-07
ENDOST	4.08E-04
RMNDR	1.43E-05
EFFEC	2.78E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.01E-05
INHALATION	2.68E-04
AIR IMMERSION	1.32E-11
GROUND SURFACE	1.07E-07
INTERNAL	2.78E-04
EXTERNAL	1.07E-07
TOTAL	2.78E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.22E-04
U-235	3.65E-06
U-236	2.67E-06
U-238	1.22E-04
RA-226	9.22E-09
RA-228	1.36E-08
TH-228	6.79E-06
TH-230	1.94E-05
TH-232	1.51E-06
TH-234	2.37E-07
TOTAL	2.78E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	2.97E-11
BONE	1.96E-11
THYROID	1.27E-13
BREAST	1.42E-12
LUNG	3.51E-09
STOMACH	9.59E-13
BOWEL	2.47E-12
LIVER	1.33E-12
PANCREAS	5.63E-13
URINARY	2.97E-11
OTHER	6.88E-13
TOTAL	3.59E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	5.36E-11
INHALATION	3.54E-09
AIR IMMERSION	2.94E-16
GROUND SURFACE	2.47E-12
INTERNAL	3.59E-09
EXTERNAL	2.47E-12
TOTAL	3.59E-09

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	1.59E-09
U-235	4.78E-11
U-236	3.41E-11
U-238	1.60E-09
RA-226	1.45E-13
RA-228	1.57E-13
TH-228	1.37E-10
TH-230	1.63E-10
TH-232	8.57E-12
TH-234	9.33E-12
TOTAL	3.59E-09

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1330	1639	2098	1821	2526	2342	2181
N	1.0E-04	8.0E-05	6.0E-05	7.0E-05	4.8E-05	5.3E-05	5.7E-05
NNW	7.0E-05	5.4E-05	4.0E-05	4.7E-05	3.2E-05	3.5E-05	3.8E-05
NW	6.9E-05	5.3E-05	4.0E-05	4.7E-05	3.2E-05	3.5E-05	3.8E-05
WNW	6.6E-05	5.2E-05	4.0E-05	4.6E-05	3.3E-05	3.6E-05	3.8E-05
W	1.2E-04	8.9E-05	6.7E-05	7.9E-05	5.5E-05	5.9E-05	6.4E-05
WSW	1.6E-04	1.1E-04	8.1E-05	9.8E-05	6.2E-05	6.9E-05	7.6E-05
SW	8.3E-05	6.2E-05	4.4E-05	5.3E-05	3.5E-05	3.8E-05	4.2E-05
SSW	6.5E-05	4.9E-05	3.6E-05	4.3E-05	2.9E-05	3.2E-05	3.4E-05
S	6.8E-05	5.2E-05	3.9E-05	4.6E-05	3.2E-05	3.5E-05	3.8E-05
SSE	1.1E-04	8.6E-05	6.9E-05	7.8E-05	5.9E-05	6.3E-05	6.7E-05
SE	1.5E-04	1.3E-04	1.0E-04	1.1E-04	9.0E-05	9.6E-05	1.0E-04
ESE	1.6E-04	1.3E-04	1.1E-04	1.2E-04	9.5E-05	1.0E-04	1.1E-04
E	2.4E-04	1.9E-04	1.5E-04	1.7E-04	1.2E-04	1.3E-04	1.4E-04
ENE	2.8E-04	2.1E-04	1.6E-04	1.9E-04	1.3E-04	1.4E-04	1.5E-04
NE	2.5E-04	1.9E-04	1.4E-04	1.7E-04	1.1E-04	1.2E-04	1.3E-04
NNE	1.7E-04	1.3E-04	9.2E-05	1.1E-04	7.4E-05	8.1E-05	8.8E-05

	Distance (m)						
Direction	1736	1351	2250	2319	1805	2402	1712
N	7.5E-05	1.0E-04	5.5E-05	5.3E-05	7.1E-05	5.1E-05	7.6E-05
NNW	5.0E-05	6.9E-05	3.7E-05	3.5E-05	4.8E-05	3.4E-05	5.1E-05
NW	5.0E-05	6.7E-05	3.7E-05	3.6E-05	4.7E-05	3.4E-05	5.0E-05
WNW	4.9E-05	6.5E-05	3.7E-05	3.6E-05	4.7E-05	3.5E-05	4.9E-05
W	8.3E-05	1.1E-04	6.2E-05	6.0E-05	7.9E-05	5.8E-05	8.4E-05
WSW	1.1E-04	1.5E-04	7.3E-05	7.0E-05	1.0E-04	6.7E-05	1.1E-04
SW	5.7E-05	8.1E-05	4.0E-05	3.9E-05	5.4E-05	3.7E-05	5.8E-05
SSW	4.6E-05	6.4E-05	3.3E-05	3.2E-05	4.3E-05	3.1E-05	4.6E-05
S	4.9E-05	6.7E-05	3.6E-05	3.5E-05	4.6E-05	3.4E-05	4.9E-05
SSE	8.2E-05	1.1E-04	6.5E-05	6.4E-05	7.9E-05	6.2E-05	8.3E-05
SE	1.2E-04	1.5E-04	9.8E-05	9.6E-05	1.2E-04	9.4E-05	1.2E-04
ESE	1.3E-04	1.6E-04	1.0E-04	1.0E-04	1.2E-04	9.9E-05	1.3E-04
E	1.8E-04	2.3E-04	1.4E-04	1.3E-04	1.7E-04	1.3E-04	1.8E-04
ENE	2.0E-04	2.7E-04	1.5E-04	1.4E-04	1.9E-04	1.4E-04	2.0E-04
NE	1.8E-04	2.4E-04	1.3E-04	1.2E-04	1.7E-04	1.2E-04	1.8E-04
NNE	1.2E-04	1.6E-04	8.5E-05	8.2E-05	1.1E-04	7.8E-05	1.2E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2031	2123	2076	1858	1890	1850
N	6.2E-05	5.9E-05	6.0E-05	6.9E-05	6.7E-05	6.9E-05
NNW	4.1E-05	3.9E-05	4.0E-05	4.6E-05	4.5E-05	4.6E-05
NW	4.1E-05	3.9E-05	4.0E-05	4.6E-05	4.5E-05	4.6E-05
WNW	4.1E-05	4.0E-05	4.0E-05	4.5E-05	4.4E-05	4.5E-05
W	6.9E-05	6.6E-05	6.8E-05	7.7E-05	7.5E-05	7.7E-05
WSW	8.4E-05	7.9E-05	8.2E-05	9.6E-05	9.3E-05	9.6E-05
SW	4.6E-05	4.3E-05	4.5E-05	5.2E-05	5.1E-05	5.2E-05
SSW	3.7E-05	3.6E-05	3.7E-05	4.2E-05	4.1E-05	4.2E-05
S	4.1E-05	3.9E-05	4.0E-05	4.5E-05	4.4E-05	4.5E-05
SSE	7.1E-05	6.9E-05	7.0E-05	7.7E-05	7.6E-05	7.7E-05
SE	1.1E-04	1.0E-04	1.0E-04	1.1E-04	1.1E-04	1.1E-04
ESE	1.1E-04	1.1E-04	1.1E-04	1.2E-04	1.2E-04	1.2E-04
E	1.5E-04	1.4E-04	1.5E-04	1.6E-04	1.6E-04	1.7E-04
ENE	1.7E-04	1.6E-04	1.6E-04	1.8E-04	1.8E-04	1.9E-04
NE	1.5E-04	1.4E-04	1.4E-04	1.6E-04	1.6E-04	1.6E-04
NNE	9.6E-05	9.1E-05	9.4E-05	1.1E-04	1.1E-04	1.1E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1330	1639	2098	1821	2526	2342	2181
N	1.3E-09	1.0E-09	7.6E-10	9.0E-10	6.1E-10	6.7E-10	7.3E-10
NNW	9.0E-10	6.9E-10	5.0E-10	6.0E-10	4.0E-10	4.4E-10	4.8E-10
NW	8.8E-10	6.8E-10	5.0E-10	6.0E-10	4.1E-10	4.4E-10	4.8E-10
WNW	8.4E-10	6.6E-10	5.1E-10	5.9E-10	4.2E-10	4.5E-10	4.9E-10
W	1.5E-09	1.1E-09	8.6E-10	1.0E-09	7.0E-10	7.6E-10	8.2E-10
WSW	2.0E-09	1.5E-09	1.0E-09	1.3E-09	7.9E-10	8.8E-10	9.8E-10
SW	1.1E-09	7.9E-10	5.6E-10	6.8E-10	4.4E-10	4.8E-10	5.3E-10
SSW	8.3E-10	6.2E-10	4.6E-10	5.4E-10	3.6E-10	4.0E-10	4.3E-10
S	8.7E-10	6.6E-10	5.0E-10	5.8E-10	4.0E-10	4.4E-10	4.8E-10
SSE	1.4E-09	1.1E-09	8.9E-10	1.0E-09	7.5E-10	8.1E-10	8.6E-10
SE	2.0E-09	1.6E-09	1.3E-09	1.5E-09	1.2E-09	1.2E-09	1.3E-09
ESE	2.1E-09	1.7E-09	1.4E-09	1.6E-09	1.2E-09	1.3E-09	1.4E-09
E	3.1E-09	2.4E-09	1.9E-09	2.2E-09	1.6E-09	1.7E-09	1.8E-09
ENE	3.6E-09	2.8E-09	2.1E-09	2.4E-09	1.7E-09	1.8E-09	2.0E-09
NE	3.2E-09	2.4E-09	1.8E-09	2.1E-09	1.4E-09	1.6E-09	1.7E-09
NNE	2.1E-09	1.6E-09	1.2E-09	1.4E-09	9.4E-10	1.0E-09	1.1E-09

	Distance (m)						
Direction	1736	1351	2250	2319	1805	2402	1712
N	9.5E-10	1.3E-09	7.0E-10	6.8E-10	9.1E-10	6.5E-10	9.7E-10
NNW	6.4E-10	8.8E-10	4.6E-10	4.5E-10	6.1E-10	4.3E-10	6.5E-10
NW	6.3E-10	8.6E-10	4.7E-10	4.5E-10	6.0E-10	4.3E-10	6.4E-10
WNW	6.2E-10	8.3E-10	4.7E-10	4.6E-10	5.9E-10	4.4E-10	6.3E-10
W	1.1E-09	1.5E-09	7.9E-10	7.7E-10	1.0E-09	7.4E-10	1.1E-09
WSW	1.4E-09	2.0E-09	9.4E-10	9.0E-10	1.3E-09	8.5E-10	1.4E-09
SW	7.3E-10	1.0E-09	5.1E-10	4.9E-10	6.9E-10	4.7E-10	7.4E-10
SSW	5.8E-10	8.1E-10	4.2E-10	4.0E-10	5.5E-10	3.9E-10	5.9E-10
S	6.2E-10	8.5E-10	4.6E-10	4.4E-10	5.9E-10	4.3E-10	6.3E-10
SSE	1.0E-09	1.4E-09	8.3E-10	8.1E-10	1.0E-09	7.9E-10	1.1E-09
SE	1.5E-09	1.9E-09	1.3E-09	1.2E-09	1.5E-09	1.2E-09	1.5E-09
ESE	1.6E-09	2.1E-09	1.3E-09	1.3E-09	1.6E-09	1.3E-09	1.6E-09
E	2.3E-09	3.0E-09	1.8E-09	1.7E-09	2.2E-09	1.6E-09	2.3E-09
ENE	2.6E-09	3.5E-09	1.9E-09	1.8E-09	2.5E-09	1.8E-09	2.6E-09
NE	2.3E-09	3.1E-09	1.7E-09	1.6E-09	2.2E-09	1.5E-09	2.3E-09
NNE	1.5E-09	2.1E-09	1.1E-09	1.0E-09	1.4E-09	1.0E-09	1.5E-09

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2031	2123	2076	1858	1890	1850
N	7.9E-10	7.5E-10	7.7E-10	8.8E-10	8.6E-10	8.8E-10
NNW	5.2E-10	5.0E-10	5.1E-10	5.9E-10	5.7E-10	5.9E-10
NW	5.2E-10	5.0E-10	5.1E-10	5.8E-10	5.7E-10	5.9E-10
WNW	5.2E-10	5.0E-10	5.1E-10	5.8E-10	5.7E-10	5.8E-10
W	8.9E-10	8.5E-10	8.7E-10	9.8E-10	9.6E-10	9.9E-10
WSW	1.1E-09	1.0E-09	1.0E-09	1.2E-09	1.2E-09	1.2E-09
SW	5.8E-10	5.5E-10	5.7E-10	6.6E-10	6.4E-10	6.6E-10
SSW	4.7E-10	4.5E-10	4.6E-10	5.3E-10	5.2E-10	5.3E-10
S	5.2E-10	4.9E-10	5.0E-10	5.7E-10	5.6E-10	5.7E-10
SSE	9.1E-10	8.8E-10	8.9E-10	9.9E-10	9.7E-10	9.9E-10
SE	1.4E-09	1.3E-09	1.3E-09	1.5E-09	1.4E-09	1.5E-09
ESE	1.4E-09	1.4E-09	1.4E-09	1.5E-09	1.5E-09	1.5E-09
E	1.9E-09	1.9E-09	1.9E-09	2.1E-09	2.1E-09	2.1E-09
ENE	2.1E-09	2.0E-09	2.1E-09	2.4E-09	2.3E-09	2.4E-09
NE	1.9E-09	1.8E-09	1.8E-09	2.1E-09	2.0E-09	2.1E-09
NNE	1.2E-09	1.2E-09	1.2E-09	1.4E-09	1.4E-09	1.4E-09

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:51 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

4.44E-02

At This Location: 921 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 15 Perchloric Hood Stacks [G1]

Dataset Name: 97-Z003-G1
Dataset Date: Apr 7, 1998 1:24 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 921 Meters East Northeast
Lifetime Fatal Cancer Risk: 5.65E-07

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.36E-04
BREAST	1.54E-04
R MAR	6.05E-03
LUNGS	3.35E-01
THYROID	1.33E-04
ENDOST	8.00E-02
RMNDR	3.51E-03
EFFEC	4.44E-02

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	8.7E-05	8.7E-05
U-235	Y	1.00	4.6E-06	4.6E-06
U-236	Y	1.00	3.4E-06	3.4E-06
U-238	Y	1.00	9.7E-05	9.7E-05
RA-226	W	1.00	6.2E-08	6.2E-08
RA-228	W	1.00	2.5E-07	2.5E-07
TH-228	Y	1.00	2.6E-06	2.6E-06
TH-230	Y	1.00	7.7E-06	7.7E-06
TH-232	Y	1.00	4.1E-07	4.1E-07
TH-234	Y	1.00	3.8E-04	3.8E-04

SITE INFORMATION

Temperature:	11 degrees C
Precipitation:	102 cm/y
Mixing Height:	950 m

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 5.94
Diameter (m): 0.41

Plume Rise
Momentum (m/s): 5.46E+00
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1363	1317	2008	1617	1305	921	979	1035	1068	1204
1199	1207	1133	1135	1763	1317	1182	1186	1811	1796

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D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:51 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 15 Perchloric Hood Stacks [G1]

Dataset Name: 97-Z003-G1
Dataset Date: Apr 7, 1998 1:24 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.36E-04
BREAST	1.54E-04
R MAR	6.05E-03
LUNGS	3.35E-01
THYROID	1.33E-04
ENDOST	8.00E-02
RMNDR	3.51E-03
EFFEC	4.44E-02

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	2.52E-03
INHALATION	4.19E-02
AIR IMMERSION	3.51E-09
GROUND SURFACE	2.65E-05
INTERNAL	4.44E-02
EXTERNAL	2.65E-05
TOTAL	4.44E-02

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.92E-02
U-235	9.65E-04
U-236	7.06E-04
U-238	1.91E-02
RA-226	1.87E-06
RA-228	3.01E-06
TH-228	1.05E-03
TH-230	3.09E-03
TH-232	2.36E-04
TH-234	5.03E-05
TOTAL	4.44E-02

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	5.93E-09
BONE	3.93E-09
THYROID	3.03E-11
BREAST	3.42E-10
LUNG	5.46E-07
STOMACH	2.29E-10
BOWEL	6.09E-10
LIVER	2.79E-10
PANCREAS	1.33E-10
URINARY	7.30E-09
OTHER	1.63E-10
TOTAL	5.65E-07

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.34E-08
INHALATION	5.51E-07
AIR IMMERSION	7.83E-14
GROUND SURFACE	6.08E-10
INTERNAL	5.65E-07
EXTERNAL	6.08E-10
TOTAL	5.65E-07

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	2.47E-07
U-235	1.26E-08
U-236	9.06E-09
U-238	2.47E-07
RA-226	2.46E-11
RA-228	3.06E-11
TH-228	2.11E-08
TH-230	2.53E-08
TH-232	1.33E-09
TH-234	1.59E-09
TOTAL	5.65E-07

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1363	1317	2008	1617	1305	921	979
N	1.1E-02	1.1E-02	6.8E-03	8.8E-03	1.1E-02	1.7E-02	1.5E-02
NNW	7.1E-03	7.4E-03	4.5E-03	5.9E-03	7.5E-03	1.1E-02	1.0E-02
NW	7.2E-03	7.5E-03	4.6E-03	6.0E-03	7.6E-03	1.1E-02	1.0E-02
WNW	7.6E-03	7.8E-03	5.0E-03	6.3E-03	7.9E-03	1.1E-02	1.0E-02
W	1.2E-02	1.3E-02	7.8E-03	1.0E-02	1.3E-02	1.8E-02	1.7E-02
WSW	1.3E-02	1.4E-02	7.7E-03	1.1E-02	1.4E-02	2.3E-02	2.1E-02
SW	7.5E-03	7.8E-03	4.5E-03	6.0E-03	7.9E-03	1.2E-02	1.1E-02
SSW	6.3E-03	6.6E-03	4.0E-03	5.2E-03	6.6E-03	1.0E-02	9.3E-03
S	7.2E-03	7.5E-03	4.7E-03	6.0E-03	7.5E-03	1.1E-02	1.0E-02
SSE	1.3E-02	1.4E-02	9.2E-03	1.1E-02	1.4E-02	1.8E-02	1.8E-02
SE	2.1E-02	2.1E-02	1.5E-02	1.8E-02	2.1E-02	2.7E-02	2.6E-02
ESE	2.2E-02	2.3E-02	1.5E-02	1.9E-02	2.3E-02	2.9E-02	2.8E-02
E	2.8E-02	2.9E-02	1.8E-02	2.3E-02	2.9E-02	4.0E-02	3.8E-02
ENE	2.9E-02	3.0E-02	1.8E-02	2.4E-02	3.0E-02	4.4E-02	4.1E-02
NE	2.5E-02	2.6E-02	1.6E-02	2.0E-02	2.6E-02	3.9E-02	3.6E-02
NNE	1.6E-02	1.7E-02	9.8E-03	1.3E-02	1.7E-02	2.6E-02	2.4E-02

	Distance (m)						
Direction	1035	1068	1204	1199	1207	1133	1135
N	1.5E-02	1.4E-02	1.2E-02	1.2E-02	1.2E-02	1.3E-02	1.3E-02
NNW	9.7E-03	9.4E-03	8.2E-03	8.3E-03	8.2E-03	8.8E-03	8.8E-03
NW	9.8E-03	9.5E-03	8.3E-03	8.4E-03	8.3E-03	8.9E-03	8.9E-03
WNW	9.9E-03	9.6E-03	8.6E-03	8.6E-03	8.5E-03	9.1E-03	9.1E-03
W	1.6E-02	1.6E-02	1.4E-02	1.4E-02	1.4E-02	1.5E-02	1.5E-02
WSW	1.9E-02	1.8E-02	1.6E-02	1.6E-02	1.6E-02	1.7E-02	1.7E-02
SW	1.1E-02	1.0E-02	8.7E-03	8.8E-03	8.7E-03	9.4E-03	9.4E-03
SSW	8.7E-03	8.4E-03	7.3E-03	7.3E-03	7.3E-03	7.8E-03	7.8E-03
S	9.6E-03	9.3E-03	8.2E-03	8.2E-03	8.2E-03	8.7E-03	8.7E-03
SSE	1.7E-02	1.6E-02	1.5E-02	1.5E-02	1.5E-02	1.6E-02	1.6E-02
SE	2.5E-02	2.5E-02	2.3E-02	2.3E-02	2.3E-02	2.4E-02	2.4E-02
ESE	2.7E-02	2.6E-02	2.4E-02	2.4E-02	2.4E-02	2.5E-02	2.5E-02
E	3.6E-02	3.5E-02	3.1E-02	3.1E-02	3.1E-02	3.3E-02	3.3E-02
ENE	3.9E-02	3.8E-02	3.3E-02	3.3E-02	3.3E-02	3.5E-02	3.5E-02
NE	3.4E-02	3.3E-02	2.9E-02	2.9E-02	2.9E-02	3.1E-02	3.1E-02
NNE	2.2E-02	2.1E-02	1.9E-02	1.9E-02	1.9E-02	2.0E-02	2.0E-02

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1763	1317	1182	1186	1811	1796
N	8.0E-03	1.1E-02	1.3E-02	1.3E-02	7.7E-03	7.8E-03
NNW	5.3E-03	7.4E-03	8.4E-03	8.4E-03	5.1E-03	5.2E-03
NW	5.4E-03	7.5E-03	8.5E-03	8.5E-03	5.2E-03	5.3E-03
WNW	5.8E-03	7.8E-03	8.7E-03	8.7E-03	5.6E-03	5.6E-03
W	9.2E-03	1.3E-02	1.4E-02	1.4E-02	8.9E-03	9.0E-03
WSW	9.3E-03	1.4E-02	1.6E-02	1.6E-02	9.0E-03	9.1E-03
SW	5.4E-03	7.8E-03	8.9E-03	8.9E-03	5.2E-03	5.2E-03
SSW	4.6E-03	6.6E-03	7.4E-03	7.4E-03	4.5E-03	4.5E-03
S	5.5E-03	7.5E-03	8.4E-03	8.3E-03	5.3E-03	5.3E-03
SSE	1.1E-02	1.4E-02	1.5E-02	1.5E-02	1.0E-02	1.0E-02
SE	1.7E-02	2.1E-02	2.3E-02	2.3E-02	1.6E-02	1.6E-02
ESE	1.8E-02	2.3E-02	2.5E-02	2.4E-02	1.7E-02	1.7E-02
E	2.1E-02	2.9E-02	3.2E-02	3.2E-02	2.1E-02	2.1E-02
ENE	2.1E-02	3.0E-02	3.4E-02	3.3E-02	2.0E-02	2.1E-02
NE	1.8E-02	2.6E-02	2.9E-02	2.9E-02	1.8E-02	1.8E-02
NNE	1.2E-02	1.7E-02	1.9E-02	1.9E-02	1.1E-02	1.1E-02

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 1363	1317	2008	1617	1305	921	979
N	1.3E-07	1.4E-07	8.4E-08	1.1E-07	1.4E-07	2.1E-07	2.0E-07
NNW	8.9E-08	9.2E-08	5.5E-08	7.2E-08	9.3E-08	1.4E-07	1.3E-07
NW	9.0E-08	9.3E-08	5.6E-08	7.3E-08	9.4E-08	1.4E-07	1.3E-07
WNW	9.4E-08	9.7E-08	6.1E-08	7.8E-08	9.8E-08	1.4E-07	1.3E-07
W	1.5E-07	1.6E-07	9.7E-08	1.3E-07	1.6E-07	2.3E-07	2.2E-07
WSW	1.7E-07	1.7E-07	9.6E-08	1.3E-07	1.8E-07	2.9E-07	2.6E-07
SW	9.3E-08	9.7E-08	5.5E-08	7.4E-08	9.8E-08	1.6E-07	1.4E-07
SSW	7.8E-08	8.1E-08	4.8E-08	6.3E-08	8.2E-08	1.3E-07	1.2E-07
S	8.9E-08	9.3E-08	5.7E-08	7.4E-08	9.4E-08	1.4E-07	1.3E-07
SSE	1.7E-07	1.7E-07	1.1E-07	1.4E-07	1.8E-07	2.3E-07	2.2E-07
SE	2.6E-07	2.7E-07	1.8E-07	2.3E-07	2.7E-07	3.4E-07	3.3E-07
ESE	2.8E-07	2.9E-07	1.9E-07	2.4E-07	2.9E-07	3.7E-07	3.5E-07
E	3.5E-07	3.6E-07	2.3E-07	2.9E-07	3.7E-07	5.1E-07	4.8E-07
ENE	3.6E-07	3.8E-07	2.3E-07	3.0E-07	3.8E-07	5.7E-07	5.3E-07
NE	3.2E-07	3.3E-07	2.0E-07	2.6E-07	3.3E-07	5.0E-07	4.6E-07
NNE	2.0E-07	2.1E-07	1.2E-07	1.6E-07	2.1E-07	3.3E-07	3.0E-07

Direction	Distance (m) 1035	1068	1204	1199	1207	1133	1135
N	1.8E-07	1.8E-07	1.5E-07	1.6E-07	1.5E-07	1.7E-07	1.7E-07
NNW	1.2E-07	1.2E-07	1.0E-07	1.0E-07	1.0E-07	1.1E-07	1.1E-07
NW	1.2E-07	1.2E-07	1.0E-07	1.0E-07	1.0E-07	1.1E-07	1.1E-07
WNW	1.2E-07	1.2E-07	1.1E-07	1.1E-07	1.1E-07	1.1E-07	1.1E-07
W	2.0E-07	2.0E-07	1.7E-07	1.8E-07	1.7E-07	1.9E-07	1.9E-07
WSW	2.4E-07	2.3E-07	2.0E-07	2.0E-07	2.0E-07	2.2E-07	2.1E-07
SW	1.3E-07	1.3E-07	1.1E-07	1.1E-07	1.1E-07	1.2E-07	1.2E-07
SSW	1.1E-07	1.0E-07	9.0E-08	9.1E-08	9.0E-08	9.7E-08	9.7E-08
S	1.2E-07	1.2E-07	1.0E-07	1.0E-07	1.0E-07	1.1E-07	1.1E-07
SSE	2.1E-07	2.1E-07	1.9E-07	1.9E-07	1.9E-07	2.0E-07	2.0E-07
SE	3.2E-07	3.1E-07	2.9E-07	2.9E-07	2.9E-07	3.0E-07	3.0E-07
ESE	3.4E-07	3.3E-07	3.1E-07	3.1E-07	3.1E-07	3.2E-07	3.2E-07
E	4.5E-07	4.4E-07	3.9E-07	4.0E-07	3.9E-07	4.2E-07	4.2E-07
ENE	4.9E-07	4.8E-07	4.2E-07	4.2E-07	4.2E-07	4.5E-07	4.5E-07
NE	4.3E-07	4.2E-07	3.6E-07	3.7E-07	3.6E-07	3.9E-07	3.9E-07
NNE	2.8E-07	2.7E-07	2.3E-07	2.4E-07	2.3E-07	2.5E-07	2.5E-07

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1763	1317	1182	1186	1811	1796
N	9.9E-08	1.4E-07	1.6E-07	1.6E-07	9.6E-08	9.7E-08
NNW	6.5E-08	9.2E-08	1.0E-07	1.0E-07	6.3E-08	6.3E-08
NW	6.6E-08	9.3E-08	1.1E-07	1.1E-07	6.4E-08	6.5E-08
WNW	7.1E-08	9.7E-08	1.1E-07	1.1E-07	6.9E-08	6.9E-08
W	1.1E-07	1.6E-07	1.8E-07	1.8E-07	1.1E-07	1.1E-07
WSW	1.2E-07	1.7E-07	2.0E-07	2.0E-07	1.1E-07	1.1E-07
SW	6.6E-08	9.7E-08	1.1E-07	1.1E-07	6.3E-08	6.4E-08
SSW	5.7E-08	8.1E-08	9.2E-08	9.2E-08	5.5E-08	5.5E-08
S	6.7E-08	9.3E-08	1.0E-07	1.0E-07	6.5E-08	6.5E-08
SSE	1.3E-07	1.7E-07	1.9E-07	1.9E-07	1.3E-07	1.3E-07
SE	2.1E-07	2.7E-07	2.9E-07	2.9E-07	2.0E-07	2.1E-07
ESE	2.2E-07	2.9E-07	3.1E-07	3.1E-07	2.2E-07	2.2E-07
E	2.7E-07	3.6E-07	4.0E-07	4.0E-07	2.6E-07	2.6E-07
ENE	2.7E-07	3.8E-07	4.3E-07	4.3E-07	2.6E-07	2.6E-07
NE	2.3E-07	3.3E-07	3.7E-07	3.7E-07	2.2E-07	2.3E-07
NNE	1.5E-07	2.1E-07	2.4E-07	2.4E-07	1.4E-07	1.4E-07

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Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:51 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

2.83E-02

At This Location: 1374 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 15 Perchloric Hood Stacks [G2]

Dataset Name: 97-Z003-G2
Dataset Date: Apr 7, 1998 1:24 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1374 Meters East Northeast
Lifetime Fatal Cancer Risk: 3.59E-07

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	8.67E-05
BREAST	9.85E-05
R MAR	3.85E-03
LUNGS	2.13E-01
THYROID	8.45E-05
ENDOST	5.09E-02
RMNDR	2.24E-03
EFFEC	2.83E-02

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	8.7E-05	8.7E-05
U-235	Y	1.00	4.6E-06	4.6E-06
U-236	Y	1.00	3.4E-06	3.4E-06
U-238	Y	1.00	9.7E-05	9.7E-05
RA-226	W	1.00	6.2E-08	6.2E-08
RA-228	W	1.00	2.5E-07	2.5E-07
TH-228	Y	1.00	2.6E-06	2.6E-06
TH-230	Y	1.00	7.7E-06	7.7E-06
TH-232	Y	1.00	4.1E-07	4.1E-07
TH-234	Y	1.00	3.8E-04	3.8E-04

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 5.94
Diameter (m): 0.41

Plume Rise
Momentum (m/s): 5.46E+00
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1374	1643	2013	1916	2622	2247	2239	1735	1411	2347
2415	1802	2307	1654	1993	2083	2035	1766	1798	1913

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:51 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 15 Perchloric Hood Stacks [G2]

Dataset Name: 97-Z003-G2
Dataset Date: Apr 7, 1998 1:24 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	8.67E-05
BREAST	9.85E-05
R MAR	3.85E-03
LUNGS	2.13E-01
THYROID	8.45E-05
ENDOST	5.09E-02
RMNDR	2.24E-03
EFFEC	2.83E-02

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.61E-03
INHALATION	2.66E-02
AIR IMMERSION	2.23E-09
GROUND SURFACE	1.69E-05
INTERNAL	2.82E-02
EXTERNAL	1.69E-05
TOTAL	2.83E-02

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.22E-02
U-235	6.14E-04
U-236	4.49E-04
U-238	1.22E-02
RA-226	1.19E-06
RA-228	1.92E-06
TH-228	6.68E-04
TH-230	1.96E-03
TH-232	1.50E-04
TH-234	3.21E-05
TOTAL	2.83E-02

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	3.78E-09
BONE	2.50E-09
THYROID	1.94E-11
BREAST	2.18E-10
LUNG	3.47E-07
STOMACH	1.46E-10
BOWEL	3.88E-10
LIVER	1.78E-10
PANCREAS	8.50E-11
URINARY	4.66E-09
OTHER	1.04E-10
TOTAL	3.59E-07

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	8.53E-09
INHALATION	3.50E-07
AIR IMMERSION	4.98E-14
GROUND SURFACE	3.88E-10
INTERNAL	3.59E-07
EXTERNAL	3.88E-10
TOTAL	3.59E-07

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	1.57E-07
U-235	8.04E-09
U-236	5.76E-09
U-238	1.57E-07
RA-226	1.56E-11
RA-228	1.95E-11
TH-228	1.34E-08
TH-230	1.61E-08
TH-232	8.47E-10
TH-234	1.01E-09
TOTAL	3.59E-07

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1374	1643	2013	1916	2622	2247	2239
N	1.0E-02	8.5E-03	6.6E-03	7.1E-03	4.7E-03	5.8E-03	5.8E-03
NNW	6.9E-03	5.6E-03	4.4E-03	4.7E-03	3.1E-03	3.8E-03	3.8E-03
NW	7.0E-03	5.7E-03	4.4E-03	4.7E-03	3.2E-03	3.9E-03	3.9E-03
WNW	7.4E-03	6.1E-03	4.8E-03	5.1E-03	3.5E-03	4.2E-03	4.2E-03
W	1.2E-02	9.8E-03	7.7E-03	8.2E-03	5.5E-03	6.7E-03	6.7E-03
WSW	1.3E-02	1.0E-02	7.6E-03	8.1E-03	5.2E-03	6.5E-03	6.5E-03
SW	7.3E-03	5.7E-03	4.4E-03	4.7E-03	3.0E-03	3.8E-03	3.8E-03
SSW	6.1E-03	4.9E-03	3.8E-03	4.1E-03	2.7E-03	3.3E-03	3.3E-03
S	7.0E-03	5.8E-03	4.5E-03	4.8E-03	3.3E-03	4.0E-03	4.0E-03
SSE	1.3E-02	1.1E-02	9.0E-03	9.5E-03	6.6E-03	7.9E-03	8.0E-03
SE	2.1E-02	1.8E-02	1.4E-02	1.5E-02	1.1E-02	1.3E-02	1.3E-02
ESE	2.2E-02	1.9E-02	1.5E-02	1.6E-02	1.1E-02	1.4E-02	1.4E-02
E	2.7E-02	2.3E-02	1.8E-02	1.9E-02	1.3E-02	1.6E-02	1.6E-02
ENE	2.8E-02	2.3E-02	1.8E-02	1.9E-02	1.2E-02	1.5E-02	1.5E-02
NE	2.5E-02	2.0E-02	1.5E-02	1.6E-02	1.1E-02	1.3E-02	1.3E-02
NNE	1.6E-02	1.3E-02	9.7E-03	1.0E-02	6.7E-03	8.3E-03	8.4E-03

	Distance (m)						
Direction	1735	1411	2347	2415	1802	2307	1654
N	8.0E-03	1.0E-02	5.5E-03	5.2E-03	7.6E-03	5.6E-03	8.5E-03
NNW	5.3E-03	6.7E-03	3.6E-03	3.5E-03	5.0E-03	3.7E-03	5.6E-03
NW	5.4E-03	6.8E-03	3.7E-03	3.5E-03	5.1E-03	3.7E-03	5.7E-03
WNW	5.7E-03	7.2E-03	4.0E-03	3.9E-03	5.5E-03	4.1E-03	6.0E-03
W	9.2E-03	1.2E-02	6.3E-03	6.1E-03	8.8E-03	6.5E-03	9.7E-03
WSW	9.4E-03	1.3E-02	6.1E-03	5.8E-03	8.9E-03	6.2E-03	1.0E-02
SW	5.3E-03	7.0E-03	3.6E-03	3.4E-03	5.1E-03	3.6E-03	5.7E-03
SSW	4.6E-03	5.9E-03	3.1E-03	3.0E-03	4.4E-03	3.2E-03	4.9E-03
S	5.4E-03	6.8E-03	3.8E-03	3.6E-03	5.2E-03	3.8E-03	5.7E-03
SSE	1.1E-02	1.3E-02	7.5E-03	7.3E-03	1.0E-02	7.7E-03	1.1E-02
SE	1.7E-02	2.0E-02	1.2E-02	1.2E-02	1.6E-02	1.2E-02	1.8E-02
ESE	1.8E-02	2.1E-02	1.3E-02	1.2E-02	1.7E-02	1.3E-02	1.9E-02
E	2.1E-02	2.7E-02	1.5E-02	1.4E-02	2.1E-02	1.5E-02	2.3E-02
ENE	2.1E-02	2.7E-02	1.5E-02	1.4E-02	2.0E-02	1.5E-02	2.3E-02
NE	1.9E-02	2.4E-02	1.3E-02	1.2E-02	1.8E-02	1.3E-02	2.0E-02
NNE	1.2E-02	1.5E-02	7.9E-03	7.6E-03	1.1E-02	8.0E-03	1.2E-02

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1993	2083	2035	1766	1798	1913
N	6.7E-03	6.4E-03	6.5E-03	7.8E-03	7.6E-03	7.1E-03
NNW	4.4E-03	4.2E-03	4.3E-03	5.2E-03	5.0E-03	4.7E-03
NW	4.5E-03	4.3E-03	4.4E-03	5.2E-03	5.1E-03	4.7E-03
WNW	4.9E-03	4.6E-03	4.8E-03	5.6E-03	5.5E-03	5.1E-03
W	7.8E-03	7.4E-03	7.6E-03	9.0E-03	8.8E-03	8.2E-03
WSW	7.7E-03	7.2E-03	7.5E-03	9.2E-03	8.9E-03	8.2E-03
SW	4.4E-03	4.2E-03	4.3E-03	5.2E-03	5.1E-03	4.7E-03
SSW	3.9E-03	3.6E-03	3.8E-03	4.5E-03	4.4E-03	4.1E-03
S	4.6E-03	4.4E-03	4.5E-03	5.3E-03	5.2E-03	4.8E-03
SSE	9.1E-03	8.7E-03	8.9E-03	1.0E-02	1.0E-02	9.5E-03
SE	1.5E-02	1.4E-02	1.4E-02	1.7E-02	1.6E-02	1.5E-02
ESE	1.5E-02	1.5E-02	1.5E-02	1.7E-02	1.7E-02	1.6E-02
E	1.8E-02	1.7E-02	1.8E-02	2.1E-02	2.1E-02	1.9E-02
ENE	1.8E-02	1.7E-02	1.8E-02	2.1E-02	2.1E-02	1.9E-02
NE	1.6E-02	1.5E-02	1.5E-02	1.8E-02	1.8E-02	1.6E-02
NNE	9.8E-03	9.2E-03	9.5E-03	1.1E-02	1.1E-02	1.0E-02

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 1374	1643	2013	1916	2622	2247	2239
N	1.3E-07	1.1E-07	8.3E-08	8.9E-08	5.8E-08	7.2E-08	7.2E-08
NNW	8.7E-08	7.0E-08	5.4E-08	5.8E-08	3.8E-08	4.7E-08	4.7E-08
NW	8.8E-08	7.1E-08	5.5E-08	5.9E-08	3.9E-08	4.8E-08	4.8E-08
WNW	9.2E-08	7.6E-08	6.0E-08	6.4E-08	4.3E-08	5.2E-08	5.3E-08
W	1.5E-07	1.2E-07	9.6E-08	1.0E-07	6.8E-08	8.4E-08	8.4E-08
WSW	1.6E-07	1.3E-07	9.5E-08	1.0E-07	6.4E-08	8.1E-08	8.1E-08
SW	9.1E-08	7.2E-08	5.4E-08	5.8E-08	3.7E-08	4.6E-08	4.7E-08
SSW	7.6E-08	6.1E-08	4.7E-08	5.0E-08	3.3E-08	4.1E-08	4.1E-08
S	8.8E-08	7.2E-08	5.6E-08	6.0E-08	4.0E-08	4.9E-08	4.9E-08
SSE	1.7E-07	1.4E-07	1.1E-07	1.2E-07	8.2E-08	1.0E-07	1.0E-07
SE	2.6E-07	2.2E-07	1.8E-07	1.9E-07	1.3E-07	1.6E-07	1.6E-07
ESE	2.8E-07	2.4E-07	1.9E-07	2.0E-07	1.4E-07	1.7E-07	1.7E-07
E	3.5E-07	2.9E-07	2.3E-07	2.4E-07	1.6E-07	2.0E-07	2.0E-07
ENE	3.6E-07	2.9E-07	2.3E-07	2.4E-07	1.6E-07	1.9E-07	2.0E-07
NE	3.1E-07	2.5E-07	1.9E-07	2.1E-07	1.4E-07	1.7E-07	1.7E-07
NNE	2.0E-07	1.6E-07	1.2E-07	1.3E-07	8.4E-08	1.0E-07	1.1E-07

Direction	Distance (m) 1735	1411	2347	2415	1802	2307	1654
N	1.0E-07	1.3E-07	6.8E-08	6.5E-08	9.6E-08	7.0E-08	1.1E-07
NNW	6.6E-08	8.4E-08	4.4E-08	4.2E-08	6.2E-08	4.5E-08	7.0E-08
NW	6.7E-08	8.6E-08	4.5E-08	4.3E-08	6.4E-08	4.6E-08	7.1E-08
WNW	7.2E-08	9.0E-08	4.9E-08	4.8E-08	6.8E-08	5.1E-08	7.6E-08
W	1.2E-07	1.5E-07	7.9E-08	7.6E-08	1.1E-07	8.1E-08	1.2E-07
WSW	1.2E-07	1.6E-07	7.6E-08	7.3E-08	1.1E-07	7.8E-08	1.3E-07
SW	6.7E-08	8.8E-08	4.4E-08	4.2E-08	6.3E-08	4.5E-08	7.1E-08
SSW	5.7E-08	7.4E-08	3.8E-08	3.7E-08	5.4E-08	3.9E-08	6.1E-08
S	6.8E-08	8.5E-08	4.6E-08	4.5E-08	6.5E-08	4.7E-08	7.1E-08
SSE	1.3E-07	1.6E-07	9.5E-08	9.1E-08	1.3E-07	9.7E-08	1.4E-07
SE	2.1E-07	2.6E-07	1.5E-07	1.5E-07	2.1E-07	1.6E-07	2.2E-07
ESE	2.3E-07	2.7E-07	1.6E-07	1.6E-07	2.2E-07	1.7E-07	2.4E-07
E	2.7E-07	3.4E-07	1.9E-07	1.8E-07	2.6E-07	1.9E-07	2.9E-07
ENE	2.7E-07	3.5E-07	1.8E-07	1.8E-07	2.6E-07	1.9E-07	2.9E-07
NE	2.4E-07	3.0E-07	1.6E-07	1.5E-07	2.2E-07	1.6E-07	2.5E-07
NNE	1.5E-07	1.9E-07	9.9E-08	9.5E-08	1.4E-07	1.0E-07	1.6E-07

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1993	2083	2035	1766	1798	1913
N	8.4E-08	7.9E-08	8.2E-08	9.8E-08	9.6E-08	8.9E-08
NNW	5.5E-08	5.2E-08	5.3E-08	6.4E-08	6.3E-08	5.8E-08
NW	5.6E-08	5.3E-08	5.4E-08	6.5E-08	6.4E-08	5.9E-08
WNW	6.1E-08	5.7E-08	5.9E-08	7.0E-08	6.9E-08	6.4E-08
W	9.8E-08	9.2E-08	9.5E-08	1.1E-07	1.1E-07	1.0E-07
WSW	9.6E-08	9.0E-08	9.4E-08	1.2E-07	1.1E-07	1.0E-07
SW	5.5E-08	5.2E-08	5.3E-08	6.5E-08	6.3E-08	5.8E-08
SSW	4.8E-08	4.5E-08	4.6E-08	5.6E-08	5.5E-08	5.0E-08
S	5.7E-08	5.4E-08	5.6E-08	6.6E-08	6.5E-08	6.0E-08
SSE	1.1E-07	1.1E-07	1.1E-07	1.3E-07	1.3E-07	1.2E-07
SE	1.8E-07	1.8E-07	1.8E-07	2.1E-07	2.1E-07	1.9E-07
ESE	2.0E-07	1.9E-07	1.9E-07	2.2E-07	2.2E-07	2.0E-07
E	2.3E-07	2.2E-07	2.3E-07	2.7E-07	2.6E-07	2.4E-07
ENE	2.3E-07	2.2E-07	2.2E-07	2.7E-07	2.6E-07	2.4E-07
NE	2.0E-07	1.9E-07	1.9E-07	2.3E-07	2.3E-07	2.1E-07
NNE	1.2E-07	1.2E-07	1.2E-07	1.4E-07	1.4E-07	1.3E-07

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:52 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)
3.32E-05

At This Location: 921 Meters Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 15 MEPA/HEPA Stacks [G1]

Dataset Name: 97-Z004-G1
Dataset Date: Apr 7, 1998 1:37 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 921 Meters Northeast
Lifetime Fatal Cancer Risk: 3.89E-10

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.23E-07
BREAST	1.38E-07
R MAR	1.05E-05
LUNGS	2.28E-04
THYROID	1.21E-07
ENDOST	1.32E-04
RMNDR	1.70E-06
EFFEC	3.32E-05

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	0.30	7.5E-08	7.5E-08
U-235	Y	1.00	1.9E-08	1.9E-08
U-236	Y	1.00	1.9E-08	1.9E-08
U-238	Y	0.30	8.6E-08	8.6E-08
RA-226	W	1.00	3.6E-11	3.6E-11
RA-228	W	1.00	1.4E-10	1.4E-10
TH-228	Y	1.00	1.1E-08	1.1E-08
TH-230	Y	1.00	5.5E-08	5.5E-08
TH-232	Y	1.00	1.2E-08	1.2E-08
TH-234	Y	1.00	2.3E-07	2.3E-07

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	14.75
Diameter (m):	0.91
Plume Rise Momentum (m/s): (Exit Velocity)	1.73E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1363	1317	2008	1617	1305	921	979	1035	1068	1204
1199	1207	1133	1135	1763	1317	1182	1186	1811	1796

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:52 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 15 MEPA/HEPA Stacks [G1]

Dataset Name: 97-Z004-G1
Dataset Date: Apr 7, 1998 1:37 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.23E-07
BREAST	1.38E-07
R MAR	1.05E-05
LUNGS	2.28E-04
THYROID	1.21E-07
ENDOST	1.32E-04
RMNDR	1.70E-06
EFFEC	3.32E-05

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.31E-06
INHALATION	3.18E-05
AIR IMMERSION	1.51E-12
GROUND SURFACE	4.22E-08
INTERNAL	3.31E-05
EXTERNAL	4.22E-08
TOTAL	3.32E-05

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	9.47E-06
U-235	1.37E-06
U-236	1.36E-06
U-238	9.73E-06
RA-226	4.30E-10
RA-228	7.17E-10
TH-228	1.49E-06
TH-230	7.39E-06
TH-232	2.36E-06
TH-234	1.17E-08
TOTAL	3.32E-05

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	9.28E-12
BONE	6.10E-12
THYROID	3.33E-14
BREAST	3.48E-13
LUNG	3.68E-10
STOMACH	2.03E-13
BOWEL	2.93E-13
LIVER	4.23E-13
PANCREAS	1.29E-13
URINARY	3.39E-12
OTHER	1.58E-13
TOTAL	3.89E-10

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	6.55E-12
INHALATION	3.81E-10
AIR IMMERSION	3.45E-17
GROUND SURFACE	9.79E-13
INTERNAL	3.88E-10
EXTERNAL	9.79E-13
TOTAL	3.89E-10

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	1.23E-10
U-235	1.79E-11
U-236	1.72E-11
U-238	1.27E-10
RA-226	5.17E-15
RA-228	6.90E-15
TH-228	2.97E-11
TH-230	6.04E-11
TH-232	1.33E-11
TH-234	3.33E-13
TOTAL	3.89E-10

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1363	1317	2008	1617	1305	921	979
N	9.1E-06	9.5E-06	5.7E-06	7.4E-06	9.6E-06	1.5E-05	1.4E-05
NNW	6.2E-06	6.5E-06	4.0E-06	5.1E-06	6.5E-06	9.6E-06	9.0E-06
NW	5.3E-06	5.5E-06	3.5E-06	4.4E-06	5.5E-06	7.7E-06	7.3E-06
WNW	5.3E-06	5.5E-06	3.4E-06	4.4E-06	5.6E-06	8.1E-06	7.6E-06
W	1.0E-05	1.1E-05	6.7E-06	8.6E-06	1.1E-05	1.6E-05	1.5E-05
WSW	1.6E-05	1.7E-05	1.0E-05	1.3E-05	1.7E-05	2.6E-05	2.4E-05
SW	9.8E-06	1.0E-05	5.8E-06	7.9E-06	1.0E-05	1.6E-05	1.5E-05
SSW	6.7E-06	6.9E-06	4.2E-06	5.4E-06	7.0E-06	1.0E-05	9.7E-06
S	6.4E-06	6.6E-06	4.0E-06	5.2E-06	6.7E-06	1.0E-05	9.3E-06
SSE	7.8E-06	8.1E-06	5.3E-06	6.6E-06	8.2E-06	1.1E-05	1.1E-05
SE	1.2E-05	1.2E-05	7.5E-06	9.5E-06	1.2E-05	1.8E-05	1.7E-05
ESE	1.4E-05	1.5E-05	8.6E-06	1.1E-05	1.5E-05	2.3E-05	2.1E-05
E	1.9E-05	2.0E-05	1.2E-05	1.6E-05	2.0E-05	3.1E-05	2.9E-05
ENE	2.1E-05	2.2E-05	1.4E-05	1.8E-05	2.2E-05	3.2E-05	3.0E-05
NE	2.1E-05	2.2E-05	1.3E-05	1.7E-05	2.2E-05	3.3E-05	3.1E-05
NNE	1.6E-05	1.7E-05	9.9E-06	1.3E-05	1.7E-05	2.6E-05	2.4E-05

	Distance (m)						
Direction	1035	1068	1204	1199	1207	1133	1135
N	1.3E-05	1.2E-05	1.1E-05	1.1E-05	1.1E-05	1.1E-05	1.1E-05
NNW	8.5E-06	8.2E-06	7.2E-06	7.2E-06	7.1E-06	7.7E-06	7.7E-06
NW	7.0E-06	6.8E-06	6.0E-06	6.0E-06	6.0E-06	6.4E-06	6.4E-06
WNW	7.2E-06	7.0E-06	6.1E-06	6.1E-06	6.1E-06	6.5E-06	6.5E-06
W	1.4E-05	1.4E-05	1.2E-05	1.2E-05	1.2E-05	1.3E-05	1.3E-05
WSW	2.3E-05	2.2E-05	1.9E-05	1.9E-05	1.9E-05	2.0E-05	2.0E-05
SW	1.4E-05	1.3E-05	1.2E-05	1.2E-05	1.1E-05	1.2E-05	1.2E-05
SSW	9.1E-06	8.8E-06	7.7E-06	7.7E-06	7.7E-06	8.3E-06	8.2E-06
S	8.8E-06	8.5E-06	7.4E-06	7.4E-06	7.4E-06	7.9E-06	7.9E-06
SSE	1.0E-05	1.0E-05	8.8E-06	8.9E-06	8.8E-06	9.4E-06	9.4E-06
SE	1.6E-05	1.5E-05	1.3E-05	1.3E-05	1.3E-05	1.4E-05	1.4E-05
ESE	2.0E-05	1.9E-05	1.6E-05	1.7E-05	1.6E-05	1.8E-05	1.8E-05
E	2.7E-05	2.6E-05	2.2E-05	2.2E-05	2.2E-05	2.4E-05	2.4E-05
ENE	2.9E-05	2.8E-05	2.4E-05	2.4E-05	2.4E-05	2.6E-05	2.6E-05
NE	2.9E-05	2.8E-05	2.4E-05	2.4E-05	2.4E-05	2.6E-05	2.6E-05
NNE	2.2E-05	2.2E-05	1.9E-05	1.9E-05	1.9E-05	2.0E-05	2.0E-05

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1763	1317	1182	1186	1811	1796
N	6.7E-06	9.5E-06	1.1E-05	1.1E-05	6.5E-06	6.6E-06
NNW	4.6E-06	6.5E-06	7.3E-06	7.3E-06	4.5E-06	4.5E-06
NW	4.0E-06	5.5E-06	6.1E-06	6.1E-06	3.9E-06	3.9E-06
WNW	4.0E-06	5.5E-06	6.2E-06	6.2E-06	3.8E-06	3.9E-06
W	7.8E-06	1.1E-05	1.2E-05	1.2E-05	7.6E-06	7.7E-06
WSW	1.2E-05	1.7E-05	1.9E-05	1.9E-05	1.2E-05	1.2E-05
SW	7.0E-06	1.0E-05	1.2E-05	1.2E-05	6.7E-06	6.8E-06
SSW	4.9E-06	6.9E-06	7.9E-06	7.8E-06	4.7E-06	4.8E-06
S	4.7E-06	6.6E-06	7.5E-06	7.5E-06	4.6E-06	4.6E-06
SSE	6.0E-06	8.1E-06	9.0E-06	9.0E-06	5.9E-06	5.9E-06
SE	8.7E-06	1.2E-05	1.4E-05	1.4E-05	8.4E-06	8.5E-06
ESE	1.0E-05	1.5E-05	1.7E-05	1.7E-05	9.8E-06	9.9E-06
E	1.4E-05	2.0E-05	2.3E-05	2.3E-05	1.4E-05	1.4E-05
ENE	1.6E-05	2.2E-05	2.5E-05	2.5E-05	1.6E-05	1.6E-05
NE	1.6E-05	2.2E-05	2.5E-05	2.5E-05	1.5E-05	1.5E-05
NNE	1.2E-05	1.7E-05	1.9E-05	1.9E-05	1.1E-05	1.1E-05

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1363	1317	2008	1617	1305	921	979
N	1.1E-10	1.1E-10	6.6E-11	8.6E-11	1.1E-10	1.7E-10	1.6E-10
NNW	7.2E-11	7.5E-11	4.5E-11	5.9E-11	7.5E-11	1.1E-10	1.0E-10
NW	6.1E-11	6.3E-11	4.0E-11	5.0E-11	6.3E-11	8.9E-11	8.5E-11
WNW	6.1E-11	6.3E-11	3.9E-11	5.0E-11	6.4E-11	9.4E-11	8.8E-11
W	1.2E-10	1.3E-10	7.8E-11	1.0E-10	1.3E-10	1.8E-10	1.7E-10
WSW	1.9E-10	2.0E-10	1.2E-10	1.6E-10	2.0E-10	3.0E-10	2.8E-10
SW	1.1E-10	1.2E-10	6.7E-11	9.1E-11	1.2E-10	1.9E-10	1.7E-10
SSW	7.7E-11	8.0E-11	4.8E-11	6.3E-11	8.1E-11	1.2E-10	1.1E-10
S	7.4E-11	7.7E-11	4.6E-11	6.0E-11	7.8E-11	1.2E-10	1.1E-10
SSE	9.0E-11	9.3E-11	6.0E-11	7.6E-11	9.4E-11	1.3E-10	1.3E-10
SE	1.3E-10	1.4E-10	8.6E-11	1.1E-10	1.4E-10	2.1E-10	2.0E-10
ESE	1.6E-10	1.7E-10	1.0E-10	1.3E-10	1.7E-10	2.7E-10	2.5E-10
E	2.2E-10	2.3E-10	1.4E-10	1.8E-10	2.4E-10	3.6E-10	3.3E-10
ENE	2.5E-10	2.6E-10	1.6E-10	2.1E-10	2.6E-10	3.8E-10	3.5E-10
NE	2.5E-10	2.6E-10	1.6E-10	2.0E-10	2.6E-10	3.9E-10	3.6E-10
NNE	1.9E-10	2.0E-10	1.2E-10	1.5E-10	2.0E-10	3.0E-10	2.8E-10

	Distance (m)						
Direction	1035	1068	1204	1199	1207	1133	1135
N	1.5E-10	1.4E-10	1.2E-10	1.2E-10	1.2E-10	1.3E-10	1.3E-10
NNW	9.9E-11	9.5E-11	8.3E-11	8.3E-11	8.3E-11	8.9E-11	8.9E-11
NW	8.0E-11	7.8E-11	6.9E-11	6.9E-11	6.9E-11	7.3E-11	7.3E-11
WNW	8.3E-11	8.0E-11	7.0E-11	7.1E-11	7.0E-11	7.5E-11	7.5E-11
W	1.6E-10	1.6E-10	1.4E-10	1.4E-10	1.4E-10	1.5E-10	1.5E-10
WSW	2.7E-10	2.6E-10	2.2E-10	2.2E-10	2.2E-10	2.4E-10	2.4E-10
SW	1.6E-10	1.6E-10	1.3E-10	1.3E-10	1.3E-10	1.4E-10	1.4E-10
SSW	1.1E-10	1.0E-10	8.9E-11	9.0E-11	8.9E-11	9.6E-11	9.6E-11
S	1.0E-10	9.8E-11	8.5E-11	8.6E-11	8.5E-11	9.2E-11	9.2E-11
SSE	1.2E-10	1.2E-10	1.0E-10	1.0E-10	1.0E-10	1.1E-10	1.1E-10
SE	1.8E-10	1.8E-10	1.5E-10	1.6E-10	1.5E-10	1.7E-10	1.7E-10
ESE	2.3E-10	2.2E-10	1.9E-10	1.9E-10	1.9E-10	2.1E-10	2.1E-10
E	3.1E-10	3.0E-10	2.6E-10	2.6E-10	2.6E-10	2.8E-10	2.8E-10
ENE	3.3E-10	3.2E-10	2.8E-10	2.8E-10	2.8E-10	3.0E-10	3.0E-10
NE	3.4E-10	3.3E-10	2.9E-10	2.9E-10	2.8E-10	3.1E-10	3.1E-10
NNE	2.6E-10	2.5E-10	2.2E-10	2.2E-10	2.2E-10	2.4E-10	2.4E-10

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1763	1317	1182	1186	1811	1796
N	7.7E-11	1.1E-10	1.3E-10	1.3E-10	7.5E-11	7.6E-11
NNW	5.3E-11	7.5E-11	8.5E-11	8.4E-11	5.1E-11	5.2E-11
NW	4.6E-11	6.3E-11	7.0E-11	7.0E-11	4.5E-11	4.5E-11
WNW	4.5E-11	6.3E-11	7.2E-11	7.2E-11	4.4E-11	4.4E-11
W	9.1E-11	1.3E-10	1.4E-10	1.4E-10	8.8E-11	8.9E-11
WSW	1.4E-10	2.0E-10	2.3E-10	2.3E-10	1.3E-10	1.4E-10
SW	8.1E-11	1.2E-10	1.4E-10	1.4E-10	7.8E-11	7.9E-11
SSW	5.6E-11	8.0E-11	9.1E-11	9.1E-11	5.4E-11	5.5E-11
S	5.4E-11	7.7E-11	8.7E-11	8.7E-11	5.2E-11	5.3E-11
SSE	6.9E-11	9.3E-11	1.0E-10	1.0E-10	6.7E-11	6.8E-11
SE	1.0E-10	1.4E-10	1.6E-10	1.6E-10	9.7E-11	9.8E-11
ESE	1.2E-10	1.7E-10	2.0E-10	1.9E-10	1.1E-10	1.1E-10
E	1.6E-10	2.3E-10	2.7E-10	2.7E-10	1.6E-10	1.6E-10
ENE	1.9E-10	2.6E-10	2.9E-10	2.9E-10	1.8E-10	1.8E-10
NE	1.8E-10	2.6E-10	2.9E-10	2.9E-10	1.8E-10	1.8E-10
NNE	1.4E-10	2.0E-10	2.2E-10	2.2E-10	1.3E-10	1.3E-10

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:52 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

2.09E-05

At This Location: 1374 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 15 MEPA/HEPA Stacks [G2]

Dataset Name: 97-Z004-G2
Dataset Date: Apr 7, 1998 2:53 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1374 Meters East Northeast
Lifetime Fatal Cancer Risk: 2.45E-10

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	8.08E-08
BREAST	9.03E-08
R MAR	6.63E-06
LUNGS	1.44E-04
THYROID	7.90E-08
ENDOST	8.39E-05
RMNDR	1.12E-06
EFFEC	2.09E-05

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	0.30	7.5E-08	7.5E-08
U-235	Y	1.00	1.9E-08	1.9E-08
U-236	Y	1.00	1.9E-08	1.9E-08
U-238	Y	0.30	8.6E-08	8.6E-08
RA-226	W	1.00	3.6E-11	3.6E-11
RA-228	W	1.00	1.4E-10	1.4E-10
TH-228	Y	1.00	1.1E-08	1.1E-08
TH-230	Y	1.00	5.5E-08	5.5E-08
TH-232	Y	1.00	1.2E-08	1.2E-08
TH-234	Y	1.00	2.3E-07	2.3E-07

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	14.75
Diameter (m):	0.91
Plume Rise Momentum (m/s): (Exit Velocity)	1.73E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1374	1643	2013	1916	2622	2247	2239	1735	1411	2347
2415	1802	2307	1654	1993	2083	2035	1766	1798	1913

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:52 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 15 MEPA/HEPA Stacks [G2]

Dataset Name: 97-Z004-G2
Dataset Date: Apr 7, 1998 2:53 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	8.08E-08
BREAST	9.03E-08
R MAR	6.63E-06
LUNGS	1.44E-04
THYROID	7.90E-08
ENDOST	8.39E-05
RMNDR	1.12E-06
EFFEC	2.09E-05

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	8.65E-07
INHALATION	2.00E-05
AIR IMMERSION	9.49E-13
GROUND SURFACE	2.81E-08
INTERNAL	2.09E-05
EXTERNAL	2.81E-08
TOTAL	2.09E-05

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	5.97E-06
U-235	8.67E-07
U-236	8.57E-07
U-238	6.14E-06
RA-226	2.79E-10
RA-228	4.68E-10
TH-228	9.35E-07
TH-230	4.65E-06
TH-232	1.48E-06
TH-234	7.60E-09
TOTAL	2.09E-05

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	5.89E-12
BONE	3.87E-12
THYROID	2.19E-14
BREAST	2.30E-13
LUNG	2.32E-10
STOMACH	1.33E-13
BOWEL	1.92E-13
LIVER	2.72E-13
PANCREAS	8.47E-14
URINARY	2.24E-12
OTHER	1.04E-13
TOTAL	2.45E-10

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	4.33E-12
INHALATION	2.40E-10
AIR IMMERSION	2.17E-17
GROUND SURFACE	6.53E-13
INTERNAL	2.44E-10
EXTERNAL	6.53E-13
TOTAL	2.45E-10

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	7.72E-11
U-235	1.13E-11
U-236	1.09E-11
U-238	8.01E-11
RA-226	3.29E-15
RA-228	4.46E-15
TH-228	1.87E-11
TH-230	3.80E-11
TH-232	8.35E-12
TH-234	2.12E-13
TOTAL	2.45E-10

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1374	1643	2013	1916	2622	2247	2239
N	9.0E-06	7.2E-06	5.7E-06	6.0E-06	4.1E-06	5.0E-06	5.0E-06
NNW	6.1E-06	4.9E-06	3.9E-06	4.1E-06	2.8E-06	3.4E-06	3.4E-06
NW	5.2E-06	4.3E-06	3.4E-06	3.6E-06	2.6E-06	3.0E-06	3.0E-06
WNW	5.2E-06	4.2E-06	3.3E-06	3.5E-06	2.4E-06	2.9E-06	2.9E-06
W	1.0E-05	8.4E-06	6.6E-06	7.0E-06	4.8E-06	5.8E-06	5.8E-06
WSW	1.6E-05	1.3E-05	1.0E-05	1.1E-05	7.0E-06	8.6E-06	8.7E-06
SW	9.7E-06	7.6E-06	5.8E-06	6.2E-06	3.9E-06	4.9E-06	4.9E-06
SSW	6.5E-06	5.3E-06	4.1E-06	4.3E-06	2.9E-06	3.5E-06	3.6E-06
S	6.2E-06	5.0E-06	3.9E-06	4.2E-06	2.8E-06	3.4E-06	3.5E-06
SSE	7.7E-06	6.4E-06	5.2E-06	5.5E-06	3.9E-06	4.6E-06	4.6E-06
SE	1.1E-05	9.3E-06	7.4E-06	7.8E-06	5.5E-06	6.5E-06	6.6E-06
ESE	1.4E-05	1.1E-05	8.5E-06	9.1E-06	6.1E-06	7.4E-06	7.5E-06
E	1.9E-05	1.5E-05	1.2E-05	1.3E-05	8.7E-06	1.1E-05	1.1E-05
ENE	2.1E-05	1.7E-05	1.4E-05	1.5E-05	1.0E-05	1.2E-05	1.2E-05
NE	2.1E-05	1.7E-05	1.3E-05	1.4E-05	9.7E-06	1.2E-05	1.2E-05
NNE	1.6E-05	1.3E-05	9.8E-06	1.0E-05	7.0E-06	8.5E-06	8.6E-06

	Distance (m)						
Direction	1735	1411	2347	2415	1802	2307	1654
N	6.8E-06	8.7E-06	4.7E-06	4.5E-06	6.5E-06	4.8E-06	7.2E-06
NNW	4.6E-06	5.9E-06	3.2E-06	3.1E-06	4.4E-06	3.3E-06	4.9E-06
NW	4.0E-06	5.0E-06	2.9E-06	2.8E-06	3.9E-06	2.9E-06	4.2E-06
WNW	3.9E-06	5.0E-06	2.8E-06	2.7E-06	3.8E-06	2.8E-06	4.2E-06
W	7.9E-06	1.0E-05	5.5E-06	5.3E-06	7.6E-06	5.6E-06	8.3E-06
WSW	1.2E-05	1.6E-05	8.1E-06	7.8E-06	1.2E-05	8.3E-06	1.3E-05
SW	7.1E-06	9.3E-06	4.6E-06	4.4E-06	6.7E-06	4.7E-06	7.5E-06
SSW	4.9E-06	6.3E-06	3.3E-06	3.2E-06	4.7E-06	3.4E-06	5.2E-06
S	4.7E-06	6.1E-06	3.3E-06	3.1E-06	4.5E-06	3.3E-06	5.0E-06
SSE	6.1E-06	7.5E-06	4.4E-06	4.3E-06	5.8E-06	4.5E-06	6.4E-06
SE	8.7E-06	1.1E-05	6.2E-06	6.0E-06	8.4E-06	6.3E-06	9.2E-06
ESE	1.0E-05	1.3E-05	7.0E-06	6.8E-06	9.8E-06	7.2E-06	1.1E-05
E	1.4E-05	1.8E-05	1.0E-05	9.6E-06	1.4E-05	1.0E-05	1.5E-05
ENE	1.6E-05	2.0E-05	1.2E-05	1.1E-05	1.6E-05	1.2E-05	1.7E-05
NE	1.6E-05	2.0E-05	1.1E-05	1.1E-05	1.5E-05	1.1E-05	1.7E-05
NNE	1.2E-05	1.5E-05	8.1E-06	7.8E-06	1.1E-05	8.2E-06	1.3E-05

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1993	2083	2035	1766	1798	1913
N	5.7E-06	5.4E-06	5.6E-06	6.6E-06	6.5E-06	6.0E-06
NNW	3.9E-06	3.7E-06	3.8E-06	4.5E-06	4.4E-06	4.1E-06
NW	3.5E-06	3.3E-06	3.4E-06	3.9E-06	3.9E-06	3.6E-06
WNW	3.4E-06	3.2E-06	3.3E-06	3.9E-06	3.8E-06	3.5E-06
W	6.7E-06	6.4E-06	6.5E-06	7.7E-06	7.6E-06	7.0E-06
WSW	1.0E-05	9.5E-06	9.8E-06	1.2E-05	1.2E-05	1.1E-05
SW	5.8E-06	5.5E-06	5.7E-06	6.9E-06	6.7E-06	6.2E-06
SSW	4.1E-06	3.9E-06	4.0E-06	4.8E-06	4.7E-06	4.4E-06
S	4.0E-06	3.8E-06	3.9E-06	4.6E-06	4.5E-06	4.2E-06
SSE	5.2E-06	5.0E-06	5.1E-06	5.9E-06	5.8E-06	5.5E-06
SE	7.5E-06	7.1E-06	7.3E-06	8.6E-06	8.4E-06	7.8E-06
ESE	8.6E-06	8.2E-06	8.4E-06	1.0E-05	9.8E-06	9.1E-06
E	1.2E-05	1.1E-05	1.2E-05	1.4E-05	1.4E-05	1.3E-05
ENE	1.4E-05	1.3E-05	1.4E-05	1.6E-05	1.6E-05	1.5E-05
NE	1.3E-05	1.3E-05	1.3E-05	1.6E-05	1.5E-05	1.4E-05
NNE	9.9E-06	9.4E-06	9.7E-06	1.2E-05	1.1E-05	1.0E-05

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 1374	1643	2013	1916	2622	2247	2239
N	1.0E-10	8.4E-11	6.6E-11	7.0E-11	4.7E-11	5.7E-11	5.8E-11
NNW	7.1E-11	5.7E-11	4.5E-11	4.7E-11	3.2E-11	3.9E-11	3.9E-11
NW	6.0E-11	4.9E-11	3.9E-11	4.1E-11	2.9E-11	3.5E-11	3.5E-11
WNW	6.0E-11	4.9E-11	3.8E-11	4.0E-11	2.8E-11	3.3E-11	3.4E-11
W	1.2E-10	9.8E-11	7.7E-11	8.2E-11	5.5E-11	6.7E-11	6.7E-11
WSW	1.9E-10	1.5E-10	1.2E-10	1.2E-10	8.1E-11	1.0E-10	1.0E-10
SW	1.1E-10	8.9E-11	6.7E-11	7.2E-11	4.5E-11	5.7E-11	5.7E-11
SSW	7.6E-11	6.1E-11	4.7E-11	5.0E-11	3.3E-11	4.1E-11	4.1E-11
S	7.3E-11	5.8E-11	4.5E-11	4.8E-11	3.2E-11	4.0E-11	4.0E-11
SSE	8.9E-11	7.4E-11	6.0E-11	6.3E-11	4.5E-11	5.3E-11	5.3E-11
SE	1.3E-10	1.1E-10	8.6E-11	9.1E-11	6.3E-11	7.6E-11	7.6E-11
ESE	1.6E-10	1.3E-10	9.9E-11	1.1E-10	7.1E-11	8.6E-11	8.6E-11
E	2.2E-10	1.8E-10	1.4E-10	1.5E-10	1.0E-10	1.2E-10	1.2E-10
ENE	2.4E-10	2.0E-10	1.6E-10	1.7E-10	1.2E-10	1.4E-10	1.4E-10
NE	2.4E-10	2.0E-10	1.6E-10	1.6E-10	1.1E-10	1.4E-10	1.4E-10
NNE	1.9E-10	1.5E-10	1.1E-10	1.2E-10	8.1E-11	9.9E-11	1.0E-10

Direction	Distance (m) 1735	1411	2347	2415	1802	2307	1654
N	7.9E-11	1.0E-10	5.4E-11	5.3E-11	7.5E-11	5.6E-11	8.3E-11
NNW	5.3E-11	6.8E-11	3.7E-11	3.6E-11	5.1E-11	3.8E-11	5.7E-11
NW	4.6E-11	5.8E-11	3.3E-11	3.2E-11	4.4E-11	3.4E-11	4.9E-11
WNW	4.5E-11	5.8E-11	3.2E-11	3.1E-11	4.3E-11	3.2E-11	4.8E-11
W	9.2E-11	1.2E-10	6.4E-11	6.1E-11	8.8E-11	6.5E-11	9.7E-11
WSW	1.4E-10	1.8E-10	9.5E-11	9.1E-11	1.3E-10	9.7E-11	1.5E-10
SW	8.2E-11	1.1E-10	5.4E-11	5.1E-11	7.8E-11	5.5E-11	8.8E-11
SSW	5.7E-11	7.4E-11	3.8E-11	3.7E-11	5.4E-11	3.9E-11	6.1E-11
S	5.5E-11	7.0E-11	3.7E-11	3.6E-11	5.2E-11	3.8E-11	5.8E-11
SSE	7.0E-11	8.7E-11	5.1E-11	4.9E-11	6.7E-11	5.2E-11	7.4E-11
SE	1.0E-10	1.3E-10	7.2E-11	7.0E-11	9.7E-11	7.3E-11	1.1E-10
ESE	1.2E-10	1.6E-10	8.1E-11	7.9E-11	1.1E-10	8.3E-11	1.3E-10
E	1.7E-10	2.1E-10	1.2E-10	1.1E-10	1.6E-10	1.2E-10	1.8E-10
ENE	1.9E-10	2.4E-10	1.4E-10	1.3E-10	1.8E-10	1.4E-10	2.0E-10
NE	1.9E-10	2.4E-10	1.3E-10	1.2E-10	1.8E-10	1.3E-10	2.0E-10
NNE	1.4E-10	1.8E-10	9.4E-11	9.0E-11	1.3E-10	9.6E-11	1.5E-10

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1993	2083	2035	1766	1798	1913
N	6.6E-11	6.3E-11	6.5E-11	7.7E-11	7.5E-11	7.0E-11
NNW	4.5E-11	4.3E-11	4.4E-11	5.2E-11	5.1E-11	4.8E-11
NW	4.0E-11	3.8E-11	3.9E-11	4.5E-11	4.4E-11	4.2E-11
WNW	3.9E-11	3.7E-11	3.8E-11	4.5E-11	4.4E-11	4.0E-11
W	7.8E-11	7.4E-11	7.6E-11	9.0E-11	8.8E-11	8.2E-11
WSW	1.2E-10	1.1E-10	1.1E-10	1.4E-10	1.4E-10	1.2E-10
SW	6.8E-11	6.4E-11	6.6E-11	8.0E-11	7.8E-11	7.2E-11
SSW	4.8E-11	4.5E-11	4.6E-11	5.6E-11	5.4E-11	5.0E-11
S	4.6E-11	4.3E-11	4.5E-11	5.3E-11	5.2E-11	4.8E-11
SSE	6.1E-11	5.8E-11	5.9E-11	6.9E-11	6.8E-11	6.3E-11
SE	8.7E-11	8.2E-11	8.5E-11	1.0E-10	9.7E-11	9.1E-11
ESE	1.0E-10	9.5E-11	9.8E-11	1.2E-10	1.1E-10	1.1E-10
E	1.4E-10	1.3E-10	1.4E-10	1.6E-10	1.6E-10	1.5E-10
ENE	1.6E-10	1.6E-10	1.6E-10	1.9E-10	1.8E-10	1.7E-10
NE	1.6E-10	1.5E-10	1.5E-10	1.8E-10	1.8E-10	1.7E-10
NNE	1.2E-10	1.1E-10	1.1E-10	1.4E-10	1.3E-10	1.2E-10

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:53 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)
8.80E-04

At This Location: 921 Meters Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 15 General Exhaust Stacks [G1]

Dataset Name: 97-Z005-G1
Dataset Date: Apr 7, 1998 1:26 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 921 Meters Northeast
Lifetime Fatal Cancer Risk: 1.10E-08

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	3.57E-06
BREAST	4.06E-06
R MAR	1.39E-04
LUNGS	6.48E-03
THYROID	3.48E-06
ENDOST	1.85E-03
RMNDR	9.44E-05
EFFEC	8.80E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	Source #2 Ci/y	TOTAL Ci/y
U-234	Y	1.00	3.0E-06	3.0E-06	5.9E-06
U-235	Y	1.00	1.6E-07	1.6E-07	3.1E-07
U-236	Y	1.00	1.1E-07	1.1E-07	2.3E-07
U-238	Y	1.00	3.3E-06	3.3E-06	6.6E-06
RA-226	W	1.00	2.1E-09	2.1E-09	4.2E-09
RA-228	W	1.00	8.4E-09	8.4E-09	1.7E-08
TH-228	Y	1.00	8.9E-08	8.9E-08	1.8E-07
TH-230	Y	1.00	2.6E-07	2.6E-07	5.2E-07
TH-232	Y	1.00	1.4E-08	1.4E-08	2.8E-08
TH-234	Y	1.00	1.3E-05	1.3E-05	2.6E-05

SITE INFORMATION

Temperature:	11 degrees C
Precipitation:	102 cm/y
Mixing Height:	950 m

SOURCE INFORMATION

Source Number:	1	2
Stack Height (m):	16.79	16.28
Diameter (m):	1.32	1.22
Plume Rise Momentum (m/s): (Exit Velocity)	1.72E+01	1.52E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1363	1317	2008	1617	1305	921	979	1035	1068	1204
1199	1207	1133	1135	1763	1317	1182	1186	1811	1796

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:53 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 15 General Exhaust Stacks [G1]

Dataset Name: 97-Z005-G1
Dataset Date: Apr 7, 1998 1:26 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	3.57E-06
BREAST	4.06E-06
R MAR	1.39E-04
LUNGS	6.48E-03
THYROID	3.48E-06
ENDOST	1.85E-03
RMNDR	9.44E-05
EFFEC	8.80E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	6.87E-05
INHALATION	8.11E-04
AIR IMMERSION	6.80E-11
GROUND SURFACE	7.09E-07
INTERNAL	8.79E-04
EXTERNAL	7.09E-07
TOTAL	8.80E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	3.81E-04
U-235	1.93E-05
U-236	1.40E-05
U-238	3.79E-04
RA-226	4.39E-08
RA-228	7.43E-08
TH-228	2.04E-05
TH-230	6.01E-05
TH-232	4.59E-06
TH-234	1.20E-06
TOTAL	8.80E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.39E-10
BONE	9.22E-11
THYROID	8.01E-13
BREAST	9.06E-12
LUNG	1.06E-08
STOMACH	6.02E-12
BOWEL	1.58E-11
LIVER	6.75E-12
PANCREAS	3.51E-12
URINARY	1.97E-10
OTHER	4.29E-12
TOTAL	1.10E-08

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	3.65E-10
INHALATION	1.07E-08
AIR IMMERSION	1.52E-15
GROUND SURFACE	1.63E-11
INTERNAL	1.10E-08
EXTERNAL	1.63E-11
TOTAL	1.10E-08

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	4.82E-09
U-235	2.51E-10
U-236	1.77E-10
U-238	4.84E-09
RA-226	5.16E-13
RA-228	7.06E-13
TH-228	4.08E-10
TH-230	4.91E-10
TH-232	2.58E-11
TH-234	3.32E-11
TOTAL	1.10E-08

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1363	1317	2008	1617	1305	921	979
N	2.6E-04	2.7E-04	1.6E-04	2.1E-04	2.7E-04	4.0E-04	3.7E-04
NNW	1.7E-04	1.8E-04	1.1E-04	1.4E-04	1.8E-04	2.5E-04	2.4E-04
NW	1.4E-04	1.5E-04	9.7E-05	1.2E-04	1.5E-04	1.9E-04	1.8E-04
WNW	1.5E-04	1.5E-04	9.7E-05	1.2E-04	1.5E-04	2.1E-04	2.0E-04
W	2.8E-04	2.9E-04	1.9E-04	2.3E-04	2.9E-04	4.0E-04	3.8E-04
WSW	4.5E-04	4.7E-04	2.9E-04	3.7E-04	4.7E-04	6.8E-04	6.4E-04
SW	2.8E-04	2.9E-04	1.7E-04	2.3E-04	2.9E-04	4.2E-04	4.0E-04
SSW	1.8E-04	1.9E-04	1.2E-04	1.5E-04	1.9E-04	2.8E-04	2.6E-04
S	1.8E-04	1.8E-04	1.2E-04	1.5E-04	1.9E-04	2.7E-04	2.5E-04
SSE	2.1E-04	2.1E-04	1.4E-04	1.7E-04	2.1E-04	2.9E-04	2.8E-04
SE	3.2E-04	3.3E-04	2.1E-04	2.6E-04	3.3E-04	4.8E-04	4.6E-04
ESE	4.0E-04	4.1E-04	2.5E-04	3.2E-04	4.2E-04	6.1E-04	5.8E-04
E	5.3E-04	5.5E-04	3.3E-04	4.3E-04	5.6E-04	8.2E-04	7.7E-04
ENE	5.6E-04	5.8E-04	3.7E-04	4.7E-04	5.9E-04	8.4E-04	7.9E-04
NE	5.7E-04	6.0E-04	3.7E-04	4.7E-04	6.0E-04	8.8E-04	8.3E-04
NNE	4.5E-04	4.6E-04	2.8E-04	3.6E-04	4.7E-04	6.9E-04	6.5E-04

	Distance (m)						
Direction	1035	1068	1204	1199	1207	1133	1135
N	3.5E-04	3.4E-04	3.0E-04	3.0E-04	3.0E-04	3.2E-04	3.2E-04
NNW	2.3E-04	2.2E-04	2.0E-04	2.0E-04	2.0E-04	2.1E-04	2.1E-04
NW	1.8E-04	1.7E-04	1.6E-04	1.6E-04	1.6E-04	1.7E-04	1.7E-04
WNW	1.9E-04	1.8E-04	1.7E-04	1.7E-04	1.6E-04	1.7E-04	1.7E-04
W	3.6E-04	3.5E-04	3.1E-04	3.2E-04	3.1E-04	3.3E-04	3.3E-04
WSW	6.0E-04	5.8E-04	5.1E-04	5.2E-04	5.1E-04	5.5E-04	5.5E-04
SW	3.8E-04	3.6E-04	3.2E-04	3.2E-04	3.2E-04	3.4E-04	3.4E-04
SSW	2.5E-04	2.4E-04	2.1E-04	2.1E-04	2.1E-04	2.2E-04	2.2E-04
S	2.4E-04	2.3E-04	2.0E-04	2.0E-04	2.0E-04	2.2E-04	2.2E-04
SSE	2.7E-04	2.6E-04	2.3E-04	2.3E-04	2.3E-04	2.5E-04	2.4E-04
SE	4.3E-04	4.2E-04	3.6E-04	3.7E-04	3.6E-04	3.9E-04	3.9E-04
ESE	5.4E-04	5.2E-04	4.6E-04	4.6E-04	4.6E-04	4.9E-04	4.9E-04
E	7.3E-04	7.0E-04	6.1E-04	6.2E-04	6.1E-04	6.6E-04	6.6E-04
ENE	7.5E-04	7.3E-04	6.4E-04	6.5E-04	6.4E-04	6.9E-04	6.8E-04
NE	7.8E-04	7.6E-04	6.6E-04	6.7E-04	6.6E-04	7.1E-04	7.1E-04
NNE	6.1E-04	5.9E-04	5.2E-04	5.2E-04	5.2E-04	5.5E-04	5.5E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1763	1317	1182	1186	1811	1796
N	1.9E-04	2.7E-04	3.0E-04	3.0E-04	1.8E-04	1.8E-04
NNW	1.3E-04	1.8E-04	2.0E-04	2.0E-04	1.3E-04	1.3E-04
NW	1.1E-04	1.5E-04	1.6E-04	1.6E-04	1.1E-04	1.1E-04
WNW	1.1E-04	1.5E-04	1.7E-04	1.7E-04	1.1E-04	1.1E-04
W	2.1E-04	2.9E-04	3.2E-04	3.2E-04	2.1E-04	2.1E-04
WSW	3.3E-04	4.7E-04	5.2E-04	5.2E-04	3.2E-04	3.3E-04
SW	2.0E-04	2.9E-04	3.3E-04	3.2E-04	2.0E-04	2.0E-04
SSW	1.4E-04	1.9E-04	2.1E-04	2.1E-04	1.4E-04	1.4E-04
S	1.3E-04	1.8E-04	2.1E-04	2.1E-04	1.3E-04	1.3E-04
SSE	1.6E-04	2.1E-04	2.4E-04	2.3E-04	1.6E-04	1.6E-04
SE	2.4E-04	3.3E-04	3.7E-04	3.7E-04	2.3E-04	2.3E-04
ESE	2.9E-04	4.1E-04	4.7E-04	4.7E-04	2.8E-04	2.8E-04
E	3.9E-04	5.5E-04	6.3E-04	6.2E-04	3.8E-04	3.8E-04
ENE	4.3E-04	5.8E-04	6.6E-04	6.5E-04	4.1E-04	4.2E-04
NE	4.3E-04	6.0E-04	6.8E-04	6.7E-04	4.1E-04	4.2E-04
NNE	3.3E-04	4.6E-04	5.3E-04	5.3E-04	3.2E-04	3.2E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1363	1317	2008	1617	1305	921	979
N	3.2E-09	3.3E-09	2.0E-09	2.6E-09	3.3E-09	4.9E-09	4.6E-09
NNW	2.1E-09	2.2E-09	1.3E-09	1.7E-09	2.2E-09	3.1E-09	3.0E-09
NW	1.7E-09	1.8E-09	1.1E-09	1.4E-09	1.8E-09	2.3E-09	2.2E-09
WNW	1.8E-09	1.8E-09	1.1E-09	1.5E-09	1.8E-09	2.5E-09	2.4E-09
W	3.4E-09	3.6E-09	2.3E-09	2.9E-09	3.6E-09	5.0E-09	4.7E-09
WSW	5.6E-09	5.8E-09	3.5E-09	4.6E-09	5.9E-09	8.5E-09	8.0E-09
SW	3.4E-09	3.6E-09	2.1E-09	2.8E-09	3.6E-09	5.3E-09	5.0E-09
SSW	2.3E-09	2.3E-09	1.4E-09	1.9E-09	2.4E-09	3.4E-09	3.2E-09
S	2.2E-09	2.3E-09	1.4E-09	1.8E-09	2.3E-09	3.3E-09	3.1E-09
SSE	2.5E-09	2.6E-09	1.7E-09	2.1E-09	2.6E-09	3.6E-09	3.4E-09
SE	3.9E-09	4.1E-09	2.5E-09	3.2E-09	4.1E-09	6.0E-09	5.6E-09
ESE	4.9E-09	5.1E-09	3.0E-09	4.0E-09	5.2E-09	7.6E-09	7.2E-09
E	6.6E-09	6.9E-09	4.1E-09	5.4E-09	7.0E-09	1.0E-08	9.6E-09
ENE	7.0E-09	7.3E-09	4.6E-09	5.8E-09	7.4E-09	1.1E-08	9.9E-09
NE	7.2E-09	7.5E-09	4.5E-09	5.9E-09	7.6E-09	1.1E-08	1.0E-08
NNE	5.6E-09	5.8E-09	3.5E-09	4.5E-09	5.9E-09	8.7E-09	8.2E-09

	Distance (m)						
Direction	1035	1068	1204	1199	1207	1133	1135
N	4.4E-09	4.2E-09	3.7E-09	3.7E-09	3.7E-09	3.9E-09	3.9E-09
NNW	2.8E-09	2.7E-09	2.4E-09	2.4E-09	2.4E-09	2.6E-09	2.6E-09
NW	2.2E-09	2.1E-09	1.9E-09	1.9E-09	1.9E-09	2.0E-09	2.0E-09
WNW	2.3E-09	2.2E-09	2.0E-09	2.0E-09	2.0E-09	2.1E-09	2.1E-09
W	4.5E-09	4.4E-09	3.9E-09	3.9E-09	3.9E-09	4.1E-09	4.1E-09
WSW	7.6E-09	7.3E-09	6.4E-09	6.5E-09	6.4E-09	6.9E-09	6.9E-09
SW	4.7E-09	4.5E-09	4.0E-09	4.0E-09	4.0E-09	4.3E-09	4.2E-09
SSW	3.0E-09	2.9E-09	2.6E-09	2.6E-09	2.6E-09	2.8E-09	2.8E-09
S	2.9E-09	2.8E-09	2.5E-09	2.5E-09	2.5E-09	2.7E-09	2.7E-09
SSE	3.3E-09	3.2E-09	2.8E-09	2.8E-09	2.8E-09	3.0E-09	3.0E-09
SE	5.3E-09	5.1E-09	4.5E-09	4.5E-09	4.5E-09	4.8E-09	4.8E-09
ESE	6.8E-09	6.5E-09	5.7E-09	5.7E-09	5.7E-09	6.1E-09	6.1E-09
E	9.1E-09	8.8E-09	7.7E-09	7.7E-09	7.6E-09	8.2E-09	8.2E-09
ENE	9.4E-09	9.1E-09	8.0E-09	8.1E-09	8.0E-09	8.6E-09	8.6E-09
NE	9.8E-09	9.5E-09	8.3E-09	8.3E-09	8.3E-09	8.9E-09	8.9E-09
NNE	7.7E-09	7.4E-09	6.5E-09	6.5E-09	6.4E-09	6.9E-09	6.9E-09

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1763	1317	1182	1186	1811	1796
N	2.3E-09	3.3E-09	3.7E-09	3.7E-09	2.2E-09	2.3E-09
NNW	1.6E-09	2.2E-09	2.5E-09	2.4E-09	1.5E-09	1.5E-09
NW	1.3E-09	1.8E-09	1.9E-09	1.9E-09	1.3E-09	1.3E-09
WNW	1.3E-09	1.8E-09	2.0E-09	2.0E-09	1.3E-09	1.3E-09
W	2.6E-09	3.6E-09	4.0E-09	4.0E-09	2.5E-09	2.6E-09
WSW	4.1E-09	5.8E-09	6.6E-09	6.6E-09	4.0E-09	4.1E-09
SW	2.5E-09	3.6E-09	4.1E-09	4.0E-09	2.4E-09	2.4E-09
SSW	1.7E-09	2.3E-09	2.6E-09	2.6E-09	1.6E-09	1.6E-09
S	1.6E-09	2.3E-09	2.5E-09	2.5E-09	1.6E-09	1.6E-09
SSE	1.9E-09	2.6E-09	2.9E-09	2.9E-09	1.9E-09	1.9E-09
SE	2.9E-09	4.1E-09	4.6E-09	4.6E-09	2.8E-09	2.8E-09
ESE	3.5E-09	5.1E-09	5.8E-09	5.8E-09	3.4E-09	3.5E-09
E	4.8E-09	6.9E-09	7.8E-09	7.8E-09	4.7E-09	4.7E-09
ENE	5.3E-09	7.3E-09	8.2E-09	8.2E-09	5.1E-09	5.2E-09
NE	5.3E-09	7.5E-09	8.5E-09	8.4E-09	5.1E-09	5.2E-09
NNE	4.1E-09	5.8E-09	6.6E-09	6.6E-09	3.9E-09	4.0E-09

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:54 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)
5.65E-04

At This Location: 1374 Meters Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 15 General Exhaust Stacks [G2]

Dataset Name: 97-Z005-G2
Dataset Date: Apr 7, 1998 1:27 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1374 Meters Northeast
Lifetime Fatal Cancer Risk: 7.10E-09

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	2.32E-06
BREAST	2.64E-06
R MAR	8.94E-05
LUNGS	4.16E-03
THYROID	2.26E-06
ENDOST	1.20E-03
RMNDR	6.12E-05
EFFEC	5.65E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	Source #2 Ci/y	TOTAL Ci/y
U-234	Y	1.00	3.0E-06	3.0E-06	5.9E-06
U-235	Y	1.00	1.6E-07	1.6E-07	3.1E-07
U-236	Y	1.00	1.1E-07	1.1E-07	2.3E-07
U-238	Y	1.00	3.3E-06	3.3E-06	6.6E-06
RA-226	W	1.00	2.1E-09	2.1E-09	4.2E-09
RA-228	W	1.00	8.4E-09	8.4E-09	1.7E-08
TH-228	Y	1.00	8.9E-08	8.9E-08	1.8E-07
TH-230	Y	1.00	2.6E-07	2.6E-07	5.2E-07
TH-232	Y	1.00	1.4E-08	1.4E-08	2.8E-08
TH-234	Y	1.00	1.3E-05	1.3E-05	2.6E-05

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1	2
Stack Height (m):	16.79	16.28
Diameter (m):	1.32	1.22
Plume Rise Momentum (m/s): (Exit Velocity)	1.72E+01	1.52E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1374	1643	2013	1916	2622	2247	2239	1735	1411	2347
2415	1802	2307	1654	1993	2083	2035	1766	1798	1913

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:54 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 15 General Exhaust Stacks [G2]

Dataset Name: 97-Z005-G2
Dataset Date: Apr 7, 1998 1:27 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.32E-06
BREAST	2.64E-06
R MAR	8.94E-05
LUNGS	4.16E-03
THYROID	2.26E-06
ENDOST	1.20E-03
RMNDR	6.12E-05
EFFEC	5.65E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	4.46E-05
INHALATION	5.20E-04
AIR IMMERSION	4.37E-11
GROUND SURFACE	4.61E-07
INTERNAL	5.65E-04
EXTERNAL	4.61E-07
TOTAL	5.66E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	2.45E-04
U-235	1.24E-05
U-236	9.00E-06
U-238	2.44E-04
RA-226	2.84E-08
RA-228	4.80E-08
TH-228	1.31E-05
TH-230	3.86E-05
TH-232	2.95E-06
TH-234	7.74E-07
TOTAL	5.66E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	8.98E-11
BONE	5.95E-11
THYROID	5.20E-13
BREAST	5.89E-12
LUNG	6.79E-09
STOMACH	3.91E-12
BOWEL	1.03E-11
LIVER	4.37E-12
PANCREAS	2.28E-12
URINARY	1.28E-10
OTHER	2.78E-12
TOTAL	7.10E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.36E-10
INHALATION	6.85E-09
AIR IMMERSION	9.73E-16
GROUND SURFACE	1.06E-11
INTERNAL	7.08E-09
EXTERNAL	1.06E-11
TOTAL	7.10E-09

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	3.09E-09
U-235	1.62E-10
U-236	1.14E-10
U-238	3.11E-09
RA-226	3.32E-13
RA-228	4.56E-13
TH-228	2.62E-10
TH-230	3.15E-10
TH-232	1.66E-11
TH-234	2.14E-11
TOTAL	7.10E-09

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1374	1643	2013	1916	2622	2247	2239
N	2.5E-04	2.0E-04	1.6E-04	1.7E-04	1.2E-04	1.4E-04	1.4E-04
NNW	1.7E-04	1.4E-04	1.1E-04	1.1E-04	8.0E-05	9.6E-05	9.6E-05
NW	1.4E-04	1.1E-04	9.3E-05	9.8E-05	7.1E-05	8.3E-05	8.3E-05
WNW	1.4E-04	1.2E-04	9.3E-05	9.8E-05	6.9E-05	8.2E-05	8.2E-05
W	2.7E-04	2.3E-04	1.8E-04	1.9E-04	1.3E-04	1.6E-04	1.6E-04
WSW	4.4E-04	3.6E-04	2.8E-04	3.0E-04	2.0E-04	2.5E-04	2.5E-04
SW	2.7E-04	2.2E-04	1.7E-04	1.8E-04	1.2E-04	1.5E-04	1.5E-04
SSW	1.8E-04	1.5E-04	1.2E-04	1.2E-04	8.5E-05	1.0E-04	1.0E-04
S	1.7E-04	1.4E-04	1.1E-04	1.2E-04	8.2E-05	9.8E-05	9.8E-05
SSE	2.0E-04	1.7E-04	1.4E-04	1.4E-04	1.1E-04	1.2E-04	1.2E-04
SE	3.1E-04	2.5E-04	2.0E-04	2.1E-04	1.5E-04	1.8E-04	1.8E-04
ESE	3.9E-04	3.1E-04	2.4E-04	2.6E-04	1.7E-04	2.1E-04	2.1E-04
E	5.2E-04	4.2E-04	3.3E-04	3.5E-04	2.4E-04	2.9E-04	2.9E-04
ENE	5.5E-04	4.6E-04	3.6E-04	3.8E-04	2.7E-04	3.2E-04	3.2E-04
NE	5.7E-04	4.6E-04	3.6E-04	3.8E-04	2.6E-04	3.2E-04	3.2E-04
NNE	4.4E-04	3.5E-04	2.7E-04	2.9E-04	2.0E-04	2.4E-04	2.4E-04

	Distance (m)						
Direction	1735	1411	2347	2415	1802	2307	1654
N	1.9E-04	2.4E-04	1.3E-04	1.3E-04	1.8E-04	1.3E-04	2.0E-04
NNW	1.3E-04	1.6E-04	9.1E-05	8.8E-05	1.2E-04	9.3E-05	1.4E-04
NW	1.1E-04	1.3E-04	7.9E-05	7.7E-05	1.0E-04	8.1E-05	1.1E-04
WNW	1.1E-04	1.4E-04	7.8E-05	7.6E-05	1.1E-04	8.0E-05	1.2E-04
W	2.1E-04	2.6E-04	1.5E-04	1.5E-04	2.0E-04	1.6E-04	2.2E-04
WSW	3.4E-04	4.3E-04	2.3E-04	2.2E-04	3.2E-04	2.4E-04	3.6E-04
SW	2.0E-04	2.6E-04	1.4E-04	1.3E-04	1.9E-04	1.4E-04	2.2E-04
SSW	1.4E-04	1.7E-04	9.7E-05	9.4E-05	1.3E-04	9.9E-05	1.5E-04
S	1.3E-04	1.7E-04	9.3E-05	9.0E-05	1.3E-04	9.5E-05	1.4E-04
SSE	1.6E-04	2.0E-04	1.2E-04	1.1E-04	1.5E-04	1.2E-04	1.7E-04
SE	2.4E-04	3.0E-04	1.7E-04	1.6E-04	2.3E-04	1.7E-04	2.5E-04
ESE	2.9E-04	3.8E-04	2.0E-04	1.9E-04	2.8E-04	2.0E-04	3.1E-04
E	3.9E-04	5.1E-04	2.7E-04	2.6E-04	3.8E-04	2.8E-04	4.2E-04
ENE	4.3E-04	5.4E-04	3.1E-04	3.0E-04	4.1E-04	3.1E-04	4.5E-04
NE	4.3E-04	5.5E-04	3.0E-04	2.9E-04	4.1E-04	3.1E-04	4.5E-04
NNE	3.3E-04	4.2E-04	2.3E-04	2.2E-04	3.1E-04	2.3E-04	3.5E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1993	2083	2035	1766	1798	1913
N	1.6E-04	1.5E-04	1.6E-04	1.8E-04	1.8E-04	1.7E-04
NNW	1.1E-04	1.0E-04	1.1E-04	1.3E-04	1.2E-04	1.1E-04
NW	9.4E-05	9.0E-05	9.2E-05	1.1E-04	1.0E-04	9.8E-05
WNW	9.4E-05	8.9E-05	9.2E-05	1.1E-04	1.1E-04	9.8E-05
W	1.8E-04	1.7E-04	1.8E-04	2.1E-04	2.0E-04	1.9E-04
WSW	2.8E-04	2.7E-04	2.8E-04	3.3E-04	3.2E-04	3.0E-04
SW	1.7E-04	1.6E-04	1.7E-04	2.0E-04	1.9E-04	1.8E-04
SSW	1.2E-04	1.1E-04	1.1E-04	1.3E-04	1.3E-04	1.2E-04
S	1.1E-04	1.1E-04	1.1E-04	1.3E-04	1.3E-04	1.2E-04
SSE	1.4E-04	1.3E-04	1.4E-04	1.6E-04	1.5E-04	1.4E-04
SE	2.0E-04	1.9E-04	2.0E-04	2.3E-04	2.3E-04	2.1E-04
ESE	2.4E-04	2.3E-04	2.4E-04	2.8E-04	2.8E-04	2.6E-04
E	3.3E-04	3.1E-04	3.2E-04	3.9E-04	3.8E-04	3.5E-04
ENE	3.7E-04	3.5E-04	3.6E-04	4.2E-04	4.1E-04	3.9E-04
NE	3.6E-04	3.5E-04	3.6E-04	4.2E-04	4.1E-04	3.8E-04
NNE	2.8E-04	2.6E-04	2.7E-04	3.2E-04	3.2E-04	2.9E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 1374	1643	2013	1916	2622	2247	2239
N	3.1E-09	2.5E-09	1.9E-09	2.1E-09	1.4E-09	1.7E-09	1.7E-09
NNW	2.1E-09	1.7E-09	1.3E-09	1.4E-09	9.6E-10	1.2E-09	1.2E-09
NW	1.7E-09	1.4E-09	1.1E-09	1.2E-09	8.4E-10	9.9E-10	1.0E-09
WNW	1.7E-09	1.4E-09	1.1E-09	1.2E-09	8.2E-10	9.8E-10	9.9E-10
W	3.4E-09	2.8E-09	2.2E-09	2.4E-09	1.6E-09	2.0E-09	2.0E-09
WSW	5.5E-09	4.5E-09	3.5E-09	3.7E-09	2.5E-09	3.1E-09	3.1E-09
SW	3.4E-09	2.7E-09	2.1E-09	2.2E-09	1.4E-09	1.8E-09	1.8E-09
SSW	2.2E-09	1.8E-09	1.4E-09	1.5E-09	1.0E-09	1.2E-09	1.2E-09
S	2.1E-09	1.7E-09	1.3E-09	1.4E-09	9.8E-10	1.2E-09	1.2E-09
SSE	2.5E-09	2.1E-09	1.7E-09	1.8E-09	1.3E-09	1.5E-09	1.5E-09
SE	3.8E-09	3.1E-09	2.5E-09	2.6E-09	1.8E-09	2.2E-09	2.2E-09
ESE	4.8E-09	3.9E-09	3.0E-09	3.2E-09	2.1E-09	2.6E-09	2.6E-09
E	6.5E-09	5.2E-09	4.1E-09	4.3E-09	3.0E-09	3.6E-09	3.6E-09
ENE	6.9E-09	5.7E-09	4.5E-09	4.8E-09	3.4E-09	4.0E-09	4.0E-09
NE	7.1E-09	5.7E-09	4.5E-09	4.8E-09	3.3E-09	4.0E-09	4.0E-09
NNE	5.5E-09	4.4E-09	3.4E-09	3.6E-09	2.4E-09	3.0E-09	3.0E-09

Direction	Distance (m) 1735	1411	2347	2415	1802	2307	1654
N	2.3E-09	3.0E-09	1.6E-09	1.6E-09	2.2E-09	1.6E-09	2.5E-09
NNW	1.6E-09	2.0E-09	1.1E-09	1.1E-09	1.5E-09	1.1E-09	1.7E-09
NW	1.3E-09	1.6E-09	9.5E-10	9.2E-10	1.3E-09	9.7E-10	1.4E-09
WNW	1.3E-09	1.7E-09	9.3E-10	9.0E-10	1.3E-09	9.5E-10	1.4E-09
W	2.6E-09	3.3E-09	1.9E-09	1.8E-09	2.5E-09	1.9E-09	2.8E-09
WSW	4.2E-09	5.4E-09	2.9E-09	2.8E-09	4.0E-09	3.0E-09	4.5E-09
SW	2.5E-09	3.3E-09	1.7E-09	1.6E-09	2.4E-09	1.7E-09	2.7E-09
SSW	1.7E-09	2.1E-09	1.2E-09	1.1E-09	1.6E-09	1.2E-09	1.8E-09
S	1.6E-09	2.1E-09	1.1E-09	1.1E-09	1.5E-09	1.1E-09	1.7E-09
SSE	1.9E-09	2.4E-09	1.4E-09	1.4E-09	1.9E-09	1.5E-09	2.0E-09
SE	2.9E-09	3.7E-09	2.1E-09	2.0E-09	2.8E-09	2.1E-09	3.1E-09
ESE	3.6E-09	4.7E-09	2.4E-09	2.4E-09	3.4E-09	2.5E-09	3.8E-09
E	4.9E-09	6.3E-09	3.4E-09	3.3E-09	4.7E-09	3.5E-09	5.2E-09
ENE	5.4E-09	6.7E-09	3.8E-09	3.7E-09	5.1E-09	3.9E-09	5.6E-09
NE	5.4E-09	6.9E-09	3.8E-09	3.6E-09	5.1E-09	3.8E-09	5.7E-09
NNE	4.1E-09	5.3E-09	2.8E-09	2.7E-09	3.9E-09	2.9E-09	4.4E-09

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1993	2083	2035	1766	1798	1913
N	2.0E-09	1.9E-09	1.9E-09	2.3E-09	2.2E-09	2.1E-09
NNW	1.3E-09	1.3E-09	1.3E-09	1.5E-09	1.5E-09	1.4E-09
NW	1.1E-09	1.1E-09	1.1E-09	1.3E-09	1.3E-09	1.2E-09
WNW	1.1E-09	1.1E-09	1.1E-09	1.3E-09	1.3E-09	1.2E-09
W	2.3E-09	2.1E-09	2.2E-09	2.6E-09	2.5E-09	2.4E-09
WSW	3.5E-09	3.4E-09	3.5E-09	4.1E-09	4.0E-09	3.7E-09
SW	2.1E-09	2.0E-09	2.0E-09	2.5E-09	2.4E-09	2.2E-09
SSW	1.4E-09	1.4E-09	1.4E-09	1.7E-09	1.6E-09	1.5E-09
S	1.4E-09	1.3E-09	1.3E-09	1.6E-09	1.5E-09	1.4E-09
SSE	1.7E-09	1.6E-09	1.7E-09	1.9E-09	1.9E-09	1.8E-09
SE	2.5E-09	2.4E-09	2.4E-09	2.9E-09	2.8E-09	2.6E-09
ESE	3.0E-09	2.8E-09	2.9E-09	3.5E-09	3.4E-09	3.2E-09
E	4.1E-09	3.9E-09	4.0E-09	4.8E-09	4.7E-09	4.3E-09
ENE	4.6E-09	4.4E-09	4.5E-09	5.3E-09	5.1E-09	4.8E-09
NE	4.6E-09	4.3E-09	4.4E-09	5.3E-09	5.2E-09	4.8E-09
NNE	3.5E-09	3.3E-09	3.4E-09	4.0E-09	3.9E-09	3.6E-09

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:57 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

2.12E-07

At This Location: 858 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 20 Water Plant Lab Hoods [G1]

Dataset Name: 97-Z010-G1
Dataset Date: Apr 7, 1998 1:03 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 858 Meters East Northeast
Lifetime Fatal Cancer Risk: 2.77E-12

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	6.60E-10
BREAST	7.53E-10
R MAR	1.61E-08
LUNGS	1.65E-06
THYROID	6.42E-10
ENDOST	2.24E-07
RMNDR	1.81E-08
EFFEC	2.12E-07

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	Source #2 Ci/y	TOTAL Ci/y
U-234	Y	1.00	2.3E-10	2.3E-10	4.7E-10
U-235	Y	1.00	1.3E-11	1.3E-11	2.5E-11
U-236	Y	1.00	8.5E-12	8.5E-12	1.7E-11
U-238	Y	1.00	3.1E-10	3.1E-10	6.2E-10
RA-226	W	1.00	2.1E-13	2.1E-13	4.2E-13
RA-228	W	1.00	8.3E-13	8.3E-13	1.7E-12
TH-228	Y	1.00	8.8E-12	8.8E-12	1.8E-11
TH-230	Y	1.00	6.2E-13	6.2E-13	1.2E-12
TH-232	Y	1.00	1.4E-12	1.4E-12	2.8E-12
TH-234	Y	1.00	1.3E-09	1.3E-09	2.6E-09

SITE INFORMATION

Temperature:	11 degrees C
Precipitation:	102 cm/y
Mixing Height:	950 m

SOURCE INFORMATION

Source Number:	1	2
Stack Height (m):	8.53	8.53
Diameter (m):	0.30	0.30
Plume Rise Momentum (m/s): (Exit Velocity)	9.43E+00	8.87E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

886	858	1711	1466	1244	1225	1417	1501	1537	1686
1683	1687	1583	1572	2137	1607	1248	1218	1459	1345

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:57 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 20 Water Plant Lab Hoods [G1]

Dataset Name: 97-Z010-G1
Dataset Date: Apr 7, 1998 1:03 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	6.60E-10
BREAST	7.53E-10
R MAR	1.61E-08
LUNGS	1.65E-06
THYROID	6.42E-10
ENDOST	2.24E-07
RMNDR	1.81E-08
EFFEC	2.12E-07

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.28E-08
INHALATION	1.99E-07
AIR IMMERSION	1.99E-14
GROUND SURFACE	1.32E-10
INTERNAL	2.12E-07
EXTERNAL	1.32E-10
TOTAL	2.12E-07

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	9.00E-08
U-235	4.59E-09
U-236	3.12E-09
U-238	1.06E-07
RA-226	1.11E-11
RA-228	1.78E-11
TH-228	6.20E-09
TH-230	4.34E-10
TH-232	1.40E-09
TH-234	3.00E-10
TOTAL	2.12E-07

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.81E-14
BONE	1.19E-14
THYROID	1.48E-16
BREAST	1.69E-15
LUNG	2.69E-12
STOMACH	1.16E-15
BOWEL	3.38E-15
LIVER	1.06E-15
PANCREAS	6.53E-16
URINARY	3.76E-14
OTHER	7.98E-16
TOTAL	2.77E-12

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	6.88E-14
INHALATION	2.70E-12
AIR IMMERSION	4.43E-19
GROUND SURFACE	3.02E-15
INTERNAL	2.77E-12
EXTERNAL	3.02E-15
TOTAL	2.77E-12

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	1.15E-12
U-235	6.02E-14
U-236	4.00E-14
U-238	1.37E-12
RA-226	1.45E-16
RA-228	1.81E-16
TH-228	1.24E-13
TH-230	3.56E-15
TH-232	7.87E-15
TH-234	9.39E-15
TOTAL	2.77E-12

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	886	858	1711	1466	1244	1225	1417
N	7.8E-08	8.1E-08	3.5E-08	4.2E-08	5.1E-08	5.2E-08	4.4E-08
NNW	5.3E-08	5.5E-08	2.4E-08	2.8E-08	3.5E-08	3.5E-08	3.0E-08
NW	5.2E-08	5.4E-08	2.4E-08	2.9E-08	3.4E-08	3.5E-08	3.0E-08
WNW	5.0E-08	5.2E-08	2.4E-08	2.8E-08	3.4E-08	3.4E-08	2.9E-08
W	8.6E-08	9.0E-08	4.0E-08	4.7E-08	5.6E-08	5.7E-08	4.8E-08
WSW	1.2E-07	1.2E-07	4.6E-08	5.7E-08	7.1E-08	7.3E-08	6.0E-08
SW	6.3E-08	6.7E-08	2.6E-08	3.1E-08	3.9E-08	4.0E-08	3.3E-08
SSW	4.9E-08	5.1E-08	2.1E-08	2.5E-08	3.1E-08	3.2E-08	2.6E-08
S	5.1E-08	5.3E-08	2.4E-08	2.8E-08	3.3E-08	3.4E-08	2.9E-08
SSE	7.7E-08	8.0E-08	4.1E-08	4.7E-08	5.4E-08	5.5E-08	4.8E-08
SE	1.1E-07	1.1E-07	6.2E-08	6.9E-08	7.8E-08	7.9E-08	7.1E-08
ESE	1.2E-07	1.2E-07	6.6E-08	7.4E-08	8.4E-08	8.5E-08	7.6E-08
E	1.7E-07	1.8E-07	8.7E-08	1.0E-07	1.2E-07	1.2E-07	1.0E-07
ENE	2.0E-07	2.1E-07	9.4E-08	1.1E-07	1.3E-07	1.4E-07	1.2E-07
NE	1.8E-07	1.9E-07	8.2E-08	9.8E-08	1.2E-07	1.2E-07	1.0E-07
NNE	1.2E-07	1.3E-07	5.4E-08	6.4E-08	7.9E-08	8.0E-08	6.7E-08

	Distance (m)						
Direction	1501	1537	1686	1683	1687	1583	1572
N	4.1E-08	4.0E-08	3.6E-08	3.6E-08	3.6E-08	3.9E-08	3.9E-08
NNW	2.8E-08	2.7E-08	2.4E-08	2.4E-08	2.4E-08	2.6E-08	2.6E-08
NW	2.8E-08	2.7E-08	2.5E-08	2.5E-08	2.4E-08	2.6E-08	2.6E-08
WNW	2.8E-08	2.7E-08	2.5E-08	2.5E-08	2.5E-08	2.6E-08	2.7E-08
W	4.5E-08	4.4E-08	4.0E-08	4.0E-08	4.0E-08	4.3E-08	4.3E-08
WSW	5.5E-08	5.4E-08	4.7E-08	4.7E-08	4.7E-08	5.1E-08	5.2E-08
SW	3.0E-08	3.0E-08	2.6E-08	2.6E-08	2.6E-08	2.8E-08	2.9E-08
SSW	2.5E-08	2.4E-08	2.2E-08	2.2E-08	2.2E-08	2.3E-08	2.3E-08
S	2.7E-08	2.6E-08	2.4E-08	2.4E-08	2.4E-08	2.6E-08	2.6E-08
SSE	4.6E-08	4.5E-08	4.2E-08	4.2E-08	4.2E-08	4.4E-08	4.4E-08
SE	6.8E-08	6.7E-08	6.3E-08	6.3E-08	6.3E-08	6.5E-08	6.6E-08
ESE	7.2E-08	7.1E-08	6.7E-08	6.7E-08	6.7E-08	7.0E-08	7.0E-08
E	9.8E-08	9.6E-08	8.8E-08	8.8E-08	8.8E-08	9.3E-08	9.4E-08
ENE	1.1E-07	1.1E-07	9.5E-08	9.5E-08	9.5E-08	1.0E-07	1.0E-07
NE	9.6E-08	9.3E-08	8.4E-08	8.4E-08	8.4E-08	9.0E-08	9.1E-08
NNE	6.3E-08	6.1E-08	5.5E-08	5.5E-08	5.5E-08	5.9E-08	5.9E-08

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2137	1607	1248	1218	1459	1345
N	2.8E-08	3.8E-08	5.1E-08	5.2E-08	4.2E-08	4.6E-08
NNW	1.9E-08	2.6E-08	3.4E-08	3.5E-08	2.9E-08	3.1E-08
NW	1.9E-08	2.6E-08	3.4E-08	3.5E-08	2.9E-08	3.1E-08
WNW	2.0E-08	2.6E-08	3.4E-08	3.4E-08	2.9E-08	3.1E-08
W	3.1E-08	4.2E-08	5.6E-08	5.7E-08	4.7E-08	5.1E-08
WSW	3.4E-08	5.0E-08	7.1E-08	7.4E-08	5.7E-08	6.4E-08
SW	2.0E-08	2.8E-08	3.9E-08	4.0E-08	3.2E-08	3.5E-08
SSW	1.7E-08	2.3E-08	3.1E-08	3.2E-08	2.6E-08	2.8E-08
S	1.9E-08	2.5E-08	3.3E-08	3.4E-08	2.8E-08	3.1E-08
SSE	3.4E-08	4.3E-08	5.4E-08	5.5E-08	4.7E-08	5.0E-08
SE	5.3E-08	6.5E-08	7.8E-08	7.9E-08	6.9E-08	7.3E-08
ESE	5.6E-08	6.9E-08	8.4E-08	8.6E-08	7.4E-08	7.9E-08
E	7.0E-08	9.2E-08	1.2E-07	1.2E-07	1.0E-07	1.1E-07
ENE	7.3E-08	1.0E-07	1.3E-07	1.4E-07	1.1E-07	1.2E-07
NE	6.4E-08	8.8E-08	1.2E-07	1.2E-07	9.9E-08	1.1E-07
NNE	4.1E-08	5.8E-08	7.9E-08	8.1E-08	6.5E-08	7.2E-08

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	886	858	1711	1466	1244	1225	1417
N	1.0E-12	1.1E-12	4.5E-13	5.4E-13	6.6E-13	6.7E-13	5.6E-13
NNW	6.8E-13	7.1E-13	3.0E-13	3.6E-13	4.4E-13	4.5E-13	3.8E-13
NW	6.7E-13	7.0E-13	3.0E-13	3.6E-13	4.4E-13	4.5E-13	3.8E-13
WNW	6.4E-13	6.7E-13	3.1E-13	3.6E-13	4.3E-13	4.4E-13	3.7E-13
W	1.1E-12	1.2E-12	5.1E-13	6.0E-13	7.2E-13	7.3E-13	6.2E-13
WSW	1.5E-12	1.6E-12	6.0E-13	7.4E-13	9.3E-13	9.5E-13	7.7E-13
SW	8.2E-13	8.6E-13	3.3E-13	4.0E-13	5.0E-13	5.1E-13	4.2E-13
SSW	6.3E-13	6.6E-13	2.7E-13	3.2E-13	3.9E-13	4.0E-13	3.4E-13
S	6.6E-13	6.9E-13	3.0E-13	3.5E-13	4.3E-13	4.3E-13	3.7E-13
SSE	1.0E-12	1.0E-12	5.3E-13	6.0E-13	7.0E-13	7.1E-13	6.2E-13
SE	1.4E-12	1.5E-12	8.0E-13	8.9E-13	1.0E-12	1.0E-12	9.1E-13
ESE	1.5E-12	1.6E-12	8.5E-13	9.5E-13	1.1E-12	1.1E-12	9.8E-13
E	2.3E-12	2.4E-12	1.1E-12	1.3E-12	1.5E-12	1.6E-12	1.3E-12
ENE	2.7E-12	2.8E-12	1.2E-12	1.4E-12	1.8E-12	1.8E-12	1.5E-12
NE	2.4E-12	2.5E-12	1.1E-12	1.3E-12	1.6E-12	1.6E-12	1.3E-12
NNE	1.6E-12	1.7E-12	6.9E-13	8.3E-13	1.0E-12	1.0E-12	8.7E-13

	Distance (m)						
Direction	1501	1537	1686	1683	1687	1583	1572
N	5.3E-13	5.1E-13	4.6E-13	4.6E-13	4.6E-13	4.9E-13	5.0E-13
NNW	3.5E-13	3.4E-13	3.1E-13	3.1E-13	3.1E-13	3.3E-13	3.3E-13
NW	3.5E-13	3.4E-13	3.1E-13	3.1E-13	3.1E-13	3.3E-13	3.4E-13
WNW	3.5E-13	3.4E-13	3.1E-13	3.1E-13	3.1E-13	3.3E-13	3.4E-13
W	5.8E-13	5.7E-13	5.1E-13	5.2E-13	5.1E-13	5.5E-13	5.5E-13
WSW	7.1E-13	6.9E-13	6.1E-13	6.1E-13	6.1E-13	6.6E-13	6.7E-13
SW	3.9E-13	3.8E-13	3.3E-13	3.3E-13	3.3E-13	3.6E-13	3.6E-13
SSW	3.1E-13	3.0E-13	2.7E-13	2.7E-13	2.7E-13	2.9E-13	3.0E-13
S	3.4E-13	3.4E-13	3.0E-13	3.0E-13	3.0E-13	3.2E-13	3.3E-13
SSE	5.9E-13	5.8E-13	5.4E-13	5.4E-13	5.4E-13	5.6E-13	5.7E-13
SE	8.8E-13	8.6E-13	8.1E-13	8.1E-13	8.1E-13	8.4E-13	8.5E-13
ESE	9.4E-13	9.2E-13	8.6E-13	8.6E-13	8.6E-13	9.0E-13	9.1E-13
E	1.3E-12	1.2E-12	1.1E-12	1.1E-12	1.1E-12	1.2E-12	1.2E-12
ENE	1.4E-12	1.4E-12	1.2E-12	1.2E-12	1.2E-12	1.3E-12	1.3E-12
NE	1.2E-12	1.2E-12	1.1E-12	1.1E-12	1.1E-12	1.2E-12	1.2E-12
NNE	8.1E-13	7.9E-13	7.0E-13	7.1E-13	7.0E-13	7.6E-13	7.7E-13

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2137	1607	1248	1218	1459	1345
N	3.5E-13	4.9E-13	6.5E-13	6.7E-13	5.4E-13	6.0E-13
NNW	2.3E-13	3.3E-13	4.4E-13	4.5E-13	3.6E-13	4.0E-13
NW	2.4E-13	3.3E-13	4.4E-13	4.5E-13	3.7E-13	4.0E-13
WNW	2.5E-13	3.3E-13	4.3E-13	4.4E-13	3.6E-13	4.0E-13
W	4.0E-13	5.4E-13	7.2E-13	7.4E-13	6.0E-13	6.6E-13
WSW	4.4E-13	6.5E-13	9.2E-13	9.5E-13	7.4E-13	8.3E-13
SW	2.4E-13	3.5E-13	5.0E-13	5.1E-13	4.0E-13	4.5E-13
SSW	2.1E-13	2.9E-13	3.9E-13	4.1E-13	3.2E-13	3.6E-13
S	2.4E-13	3.2E-13	4.2E-13	4.4E-13	3.5E-13	3.9E-13
SSE	4.4E-13	5.6E-13	6.9E-13	7.1E-13	6.0E-13	6.5E-13
SE	6.8E-13	8.4E-13	1.0E-12	1.0E-12	8.9E-13	9.5E-13
ESE	7.2E-13	8.9E-13	1.1E-12	1.1E-12	9.6E-13	1.0E-12
E	9.1E-13	1.2E-12	1.5E-12	1.6E-12	1.3E-12	1.4E-12
ENE	9.5E-13	1.3E-12	1.7E-12	1.8E-12	1.5E-12	1.6E-12
NE	8.3E-13	1.1E-12	1.5E-12	1.6E-12	1.3E-12	1.4E-12
NNE	5.3E-13	7.5E-13	1.0E-12	1.1E-12	8.4E-13	9.3E-13

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:58 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

2.02E-07

At This Location: 890 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 20 Water Plant Lab Hoods [G2]

Dataset Name: 97-Z010-G2
Dataset Date: Apr 7, 1998 1:06 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 890 Meters East Northeast
Lifetime Fatal Cancer Risk: 2.64E-12

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	6.21E-10
BREAST	7.11E-10
R MAR	1.52E-08
LUNGS	1.57E-06
THYROID	6.04E-10
ENDOST	2.10E-07
RMNDR	1.69E-08
EFFEC	2.02E-07

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	Source #2 Ci/y	TOTAL Ci/y
U-234	Y	1.00	2.3E-10	2.3E-10	4.7E-10
U-235	Y	1.00	1.3E-11	1.3E-11	2.5E-11
U-236	Y	1.00	8.5E-12	8.5E-12	1.7E-11
U-238	Y	1.00	3.1E-10	3.1E-10	6.2E-10
RA-226	W	1.00	2.1E-13	2.1E-13	4.2E-13
RA-228	W	1.00	8.3E-13	8.3E-13	1.7E-12
TH-228	Y	1.00	8.8E-12	8.8E-12	1.8E-11
TH-230	Y	1.00	6.2E-13	6.2E-13	1.2E-12
TH-232	Y	1.00	1.4E-12	1.4E-12	2.8E-12
TH-234	Y	1.00	1.3E-09	1.3E-09	2.6E-09

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1	2
Stack Height (m):	8.53	8.53
Diameter (m):	0.30	0.30
Plume Rise Momentum (m/s): (Exit Velocity)	9.43E+00	8.87E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

890	1209	2052	1834	2397	2438	2485	1314	1655	2160
2217	1387	2496	1490	1711	1806	1766	2135	2164	1451

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E . A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:58 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 20 Water Plant Lab Hoods [G2]

Dataset Name: 97-Z010-G2
Dataset Date: Apr 7, 1998 1:06 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	6.21E-10
BREAST	7.11E-10
R MAR	1.52E-08
LUNGS	1.57E-06
THYROID	6.04E-10
ENDOST	2.10E-07
RMNDR	1.69E-08
EFFEC	2.02E-07

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.20E-08
INHALATION	1.90E-07
AIR IMMERSION	1.90E-14
GROUND SURFACE	1.26E-10
INTERNAL	2.02E-07
EXTERNAL	1.26E-10
TOTAL	2.02E-07

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	8.58E-08
U-235	4.37E-09
U-236	2.97E-09
U-238	1.01E-07
RA-226	1.04E-11
RA-228	1.68E-11
TH-228	5.91E-09
TH-230	4.14E-10
TH-232	1.33E-09
TH-234	2.83E-10
TOTAL	2.02E-07

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.70E-14
BONE	1.12E-14
THYROID	1.40E-16
BREAST	1.60E-15
LUNG	2.57E-12
STOMACH	1.09E-15
BOWEL	3.18E-15
LIVER	1.00E-15
PANCREAS	6.15E-16
URINARY	3.52E-14
OTHER	7.52E-16
TOTAL	2.64E-12

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	6.44E-14
INHALATION	2.57E-12
AIR IMMERSION	4.23E-19
GROUND SURFACE	2.89E-15
INTERNAL	2.64E-12
EXTERNAL	2.89E-15
TOTAL	2.64E-12

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	1.10E-12
U-235	5.74E-14
U-236	3.81E-14
U-238	1.31E-12
RA-226	1.38E-16
RA-228	1.71E-16
TH-228	1.19E-13
TH-230	3.39E-15
TH-232	7.51E-15
TH-234	8.93E-15
TOTAL	2.64E-12

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	890	1209	2052	1834	2397	2438	2485
N	7.7E-08	5.2E-08	2.9E-08	3.3E-08	2.4E-08	2.4E-08	2.3E-08
NNW	5.2E-08	3.5E-08	1.9E-08	2.2E-08	1.6E-08	1.6E-08	1.6E-08
NW	5.1E-08	3.5E-08	1.9E-08	2.2E-08	1.6E-08	1.6E-08	1.6E-08
WNW	4.9E-08	3.4E-08	2.0E-08	2.3E-08	1.7E-08	1.7E-08	1.7E-08
W	8.5E-08	5.7E-08	3.2E-08	3.6E-08	2.8E-08	2.7E-08	2.6E-08
WSW	1.2E-07	7.4E-08	3.6E-08	4.2E-08	2.9E-08	2.9E-08	2.8E-08
SW	6.3E-08	4.0E-08	2.0E-08	2.3E-08	1.7E-08	1.6E-08	1.6E-08
SSW	4.8E-08	3.2E-08	1.7E-08	1.9E-08	1.4E-08	1.4E-08	1.4E-08
S	5.0E-08	3.4E-08	1.9E-08	2.2E-08	1.6E-08	1.6E-08	1.6E-08
SSE	7.6E-08	5.5E-08	3.5E-08	3.9E-08	3.1E-08	3.0E-08	3.0E-08
SE	1.1E-07	8.0E-08	5.4E-08	5.9E-08	4.8E-08	4.7E-08	4.7E-08
ESE	1.2E-07	8.6E-08	5.8E-08	6.3E-08	5.1E-08	5.0E-08	4.9E-08
E	1.7E-07	1.2E-07	7.3E-08	8.1E-08	6.3E-08	6.1E-08	6.0E-08
ENE	2.0E-07	1.4E-07	7.6E-08	8.6E-08	6.4E-08	6.3E-08	6.1E-08
NE	1.8E-07	1.2E-07	6.7E-08	7.6E-08	5.6E-08	5.5E-08	5.3E-08
NNE	1.2E-07	8.1E-08	4.3E-08	4.9E-08	3.6E-08	3.5E-08	3.4E-08

	Distance (m)						
Direction	1314	1655	2160	2217	1387	2496	1490
N	4.7E-08	3.6E-08	2.7E-08	2.6E-08	4.5E-08	2.3E-08	4.1E-08
NNW	3.2E-08	2.5E-08	1.8E-08	1.8E-08	3.0E-08	1.5E-08	2.8E-08
NW	3.2E-08	2.5E-08	1.8E-08	1.8E-08	3.0E-08	1.6E-08	2.8E-08
WNW	3.1E-08	2.5E-08	1.9E-08	1.9E-08	3.0E-08	1.7E-08	2.8E-08
W	5.2E-08	4.1E-08	3.1E-08	3.0E-08	4.9E-08	2.6E-08	4.5E-08
WSW	6.6E-08	4.8E-08	3.4E-08	3.2E-08	6.1E-08	2.8E-08	5.6E-08
SW	3.6E-08	2.7E-08	1.9E-08	1.8E-08	3.3E-08	1.6E-08	3.0E-08
SSW	2.9E-08	2.2E-08	1.6E-08	1.6E-08	2.7E-08	1.4E-08	2.5E-08
S	3.1E-08	2.4E-08	1.8E-08	1.8E-08	2.9E-08	1.6E-08	2.7E-08
SSE	5.1E-08	4.2E-08	3.4E-08	3.3E-08	4.9E-08	3.0E-08	4.6E-08
SE	7.4E-08	6.3E-08	5.2E-08	5.1E-08	7.1E-08	4.6E-08	6.8E-08
ESE	8.0E-08	6.7E-08	5.5E-08	5.4E-08	7.7E-08	4.9E-08	7.3E-08
E	1.1E-07	8.9E-08	6.9E-08	6.8E-08	1.1E-07	6.0E-08	9.9E-08
ENE	1.3E-07	9.7E-08	7.2E-08	7.0E-08	1.2E-07	6.1E-08	1.1E-07
NE	1.1E-07	8.5E-08	6.3E-08	6.1E-08	1.0E-07	5.3E-08	9.6E-08
NNE	7.3E-08	5.5E-08	4.0E-08	3.9E-08	6.9E-08	3.4E-08	6.3E-08

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1711	1806	1766	2135	2164	1451
N	3.5E-08	3.3E-08	3.4E-08	2.8E-08	2.7E-08	4.2E-08
NNW	2.4E-08	2.2E-08	2.3E-08	1.8E-08	1.8E-08	2.9E-08
NW	2.4E-08	2.2E-08	2.3E-08	1.9E-08	1.8E-08	2.9E-08
WNW	2.4E-08	2.3E-08	2.3E-08	1.9E-08	1.9E-08	2.8E-08
W	3.9E-08	3.7E-08	3.8E-08	3.1E-08	3.1E-08	4.7E-08
WSW	4.6E-08	4.3E-08	4.4E-08	3.4E-08	3.4E-08	5.8E-08
SW	2.6E-08	2.4E-08	2.5E-08	1.9E-08	1.9E-08	3.2E-08
SSW	2.1E-08	2.0E-08	2.0E-08	1.6E-08	1.6E-08	2.5E-08
S	2.3E-08	2.2E-08	2.3E-08	1.9E-08	1.8E-08	2.8E-08
SSE	4.1E-08	3.9E-08	4.0E-08	3.4E-08	3.4E-08	4.7E-08
SE	6.2E-08	5.9E-08	6.0E-08	5.3E-08	5.2E-08	6.9E-08
ESE	6.6E-08	6.3E-08	6.4E-08	5.6E-08	5.5E-08	7.4E-08
E	8.7E-08	8.2E-08	8.4E-08	7.0E-08	6.9E-08	1.0E-07
ENE	9.3E-08	8.8E-08	9.0E-08	7.3E-08	7.2E-08	1.1E-07
NE	8.2E-08	7.7E-08	7.9E-08	6.4E-08	6.3E-08	9.9E-08
NNE	5.3E-08	5.0E-08	5.1E-08	4.1E-08	4.0E-08	6.5E-08

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 890	1209	2052	1834	2397	2438	2485
N	1.0E-12	6.8E-13	3.7E-13	4.2E-13	3.1E-13	3.0E-13	3.0E-13
NNW	6.8E-13	4.6E-13	2.4E-13	2.8E-13	2.0E-13	2.0E-13	1.9E-13
NW	6.6E-13	4.5E-13	2.5E-13	2.8E-13	2.1E-13	2.0E-13	2.0E-13
WNW	6.3E-13	4.4E-13	2.6E-13	2.9E-13	2.2E-13	2.1E-13	2.1E-13
W	1.1E-12	7.4E-13	4.2E-13	4.7E-13	3.5E-13	3.4E-13	3.4E-13
WSW	1.5E-12	9.6E-13	4.6E-13	5.4E-13	3.7E-13	3.6E-13	3.5E-13
SW	8.1E-13	5.2E-13	2.6E-13	3.0E-13	2.1E-13	2.0E-13	2.0E-13
SSW	6.2E-13	4.1E-13	2.1E-13	2.4E-13	1.8E-13	1.7E-13	1.7E-13
S	6.5E-13	4.4E-13	2.4E-13	2.8E-13	2.1E-13	2.0E-13	2.0E-13
SSE	9.9E-13	7.1E-13	4.5E-13	5.0E-13	3.9E-13	3.9E-13	3.8E-13
SE	1.4E-12	1.0E-12	7.0E-13	7.6E-13	6.2E-13	6.1E-13	6.0E-13
ESE	1.5E-12	1.1E-12	7.5E-13	8.1E-13	6.6E-13	6.5E-13	6.4E-13
E	2.3E-12	1.6E-12	9.5E-13	1.1E-12	8.1E-13	8.0E-13	7.8E-13
ENE	2.6E-12	1.8E-12	9.9E-13	1.1E-12	8.3E-13	8.1E-13	7.9E-13
NE	2.4E-12	1.6E-12	8.6E-13	9.8E-13	7.2E-13	7.1E-13	6.9E-13
NNE	1.6E-12	1.1E-12	5.5E-13	6.3E-13	4.6E-13	4.5E-13	4.4E-13

Direction	Distance (m) 1314	1655	2160	2217	1387	2496	1490
N	6.1E-13	4.7E-13	3.5E-13	3.4E-13	5.7E-13	2.9E-13	5.3E-13
NNW	4.1E-13	3.1E-13	2.3E-13	2.2E-13	3.9E-13	1.9E-13	3.5E-13
NW	4.1E-13	3.1E-13	2.3E-13	2.3E-13	3.9E-13	2.0E-13	3.5E-13
WNW	4.0E-13	3.2E-13	2.4E-13	2.4E-13	3.8E-13	2.1E-13	3.5E-13
W	6.8E-13	5.2E-13	3.9E-13	3.8E-13	6.4E-13	3.4E-13	5.9E-13
WSW	8.6E-13	6.2E-13	4.3E-13	4.2E-13	7.9E-13	3.5E-13	7.2E-13
SW	4.6E-13	3.4E-13	2.4E-13	2.3E-13	4.3E-13	2.0E-13	3.9E-13
SSW	3.7E-13	2.8E-13	2.0E-13	1.9E-13	3.4E-13	1.7E-13	3.1E-13
S	4.0E-13	3.1E-13	2.3E-13	2.2E-13	3.7E-13	2.0E-13	3.4E-13
SSE	6.6E-13	5.4E-13	4.3E-13	4.2E-13	6.3E-13	3.8E-13	5.9E-13
SE	9.6E-13	8.2E-13	6.7E-13	6.6E-13	9.3E-13	6.0E-13	8.8E-13
ESE	1.0E-12	8.7E-13	7.2E-13	7.0E-13	9.9E-13	6.4E-13	9.4E-13
E	1.5E-12	1.2E-12	9.0E-13	8.8E-13	1.4E-12	7.8E-13	1.3E-12
ENE	1.6E-12	1.3E-12	9.3E-13	9.1E-13	1.5E-12	7.9E-13	1.4E-12
NE	1.5E-12	1.1E-12	8.1E-13	7.9E-13	1.4E-12	6.9E-13	1.2E-12
NNE	9.5E-13	7.2E-13	5.2E-13	5.0E-13	8.9E-13	4.4E-13	8.2E-13

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1711	1806	1766	2135	2164	1451
N	4.5E-13	4.2E-13	4.4E-13	3.5E-13	3.5E-13	5.4E-13
NNW	3.0E-13	2.8E-13	2.9E-13	2.3E-13	2.3E-13	3.6E-13
NW	3.0E-13	2.8E-13	2.9E-13	2.4E-13	2.3E-13	3.7E-13
WNW	3.1E-13	2.9E-13	3.0E-13	2.5E-13	2.4E-13	3.6E-13
W	5.1E-13	4.8E-13	4.9E-13	4.0E-13	3.9E-13	6.0E-13
WSW	5.9E-13	5.5E-13	5.7E-13	4.4E-13	4.3E-13	7.5E-13
SW	3.2E-13	3.0E-13	3.1E-13	2.4E-13	2.4E-13	4.0E-13
SSW	2.7E-13	2.5E-13	2.6E-13	2.0E-13	2.0E-13	3.2E-13
S	3.0E-13	2.8E-13	2.9E-13	2.3E-13	2.3E-13	3.6E-13
SSE	5.3E-13	5.1E-13	5.1E-13	4.4E-13	4.3E-13	6.1E-13
SE	8.0E-13	7.7E-13	7.8E-13	6.8E-13	6.7E-13	9.0E-13
ESE	8.5E-13	8.2E-13	8.3E-13	7.2E-13	7.2E-13	9.6E-13
E	1.1E-12	1.1E-12	1.1E-12	9.1E-13	9.0E-13	1.3E-12
ENE	1.2E-12	1.1E-12	1.2E-12	9.5E-13	9.3E-13	1.5E-12
NE	1.1E-12	1.0E-12	1.0E-12	8.2E-13	8.1E-13	1.3E-12
NNE	6.9E-13	6.5E-13	6.6E-13	5.3E-13	5.2E-13	8.4E-13

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 4:00 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)
4.50E-06

At This Location: 924 Meters East

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 20 Cooling Water Tower [G1]

Dataset Name: 97-Z012-G1
Dataset Date: Apr 7, 1998 1:13 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 924 Meters East
Lifetime Fatal Cancer Risk: 5.65E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	2.82E-08
BREAST	3.22E-08
R MAR	6.60E-07
LUNGS	3.25E-05
THYROID	2.74E-08
ENDOST	9.22E-06
RMNDR	7.89E-07
EFFEC	4.50E-06

Apr 7, 1998 4:00 pm

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	6.8E-08	6.8E-08
U-235	Y	1.00	3.6E-09	3.6E-09
U-236	Y	1.00	2.5E-09	2.5E-09
U-238	Y	1.00	8.9E-08	8.9E-08
RA-226	W	1.00	6.1E-11	6.1E-11
RA-228	W	1.00	2.4E-10	2.4E-10
TH-228	Y	1.00	2.6E-09	2.6E-09
TH-230	Y	1.00	1.8E-10	1.8E-10
TH-232	Y	1.00	4.0E-10	4.0E-10
TH-234	Y	1.00	3.8E-07	3.8E-07

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	14.86
Diameter (m):	8.69
Plume Rise Momentum (m/s): (Exit Velocity)	7.16E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

948	924	1778	1520	1287	1218	1385	1462	1496	1639
1634	1630	1519	1506	2068	1538	1189	1161	1460	1374

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 4:00 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 20 Cooling Water Tower [G1]

Dataset Name: 97-Z012-G1
Dataset Date: Apr 7, 1998 1:13 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.82E-08
BREAST	3.22E-08
R MAR	6.60E-07
LUNGS	3.25E-05
THYROID	2.74E-08
ENDOST	9.22E-06
RMNDR	7.89E-07
EFFEC	4.50E-06

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	5.73E-07
INHALATION	3.93E-06
AIR IMMERSION	3.92E-13
GROUND SURFACE	5.67E-09
INTERNAL	4.50E-06
EXTERNAL	5.67E-09
TOTAL	4.51E-06

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.91E-06
U-235	1.00E-07
U-236	6.64E-08
U-238	2.25E-06
RA-226	3.68E-10
RA-228	6.58E-10
TH-228	1.23E-07
TH-230	8.74E-09
TH-232	2.79E-08
TH-234	1.02E-08
TOTAL	4.51E-06

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	7.49E-13
BONE	4.91E-13
THYROID	6.36E-15
BREAST	7.26E-14
LUNG	5.32E-11
STOMACH	4.89E-14
BOWEL	1.38E-13
LIVER	4.24E-14
PANCREAS	2.79E-14
URINARY	1.66E-12
OTHER	3.41E-14
TOTAL	5.65E-11

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	3.08E-12
INHALATION	5.32E-11
AIR IMMERSION	8.73E-18
GROUND SURFACE	1.30E-13
INTERNAL	5.63E-11
EXTERNAL	1.30E-13
TOTAL	5.65E-11

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	2.35E-11
U-235	1.28E-12
U-236	8.14E-13
U-238	2.80E-11
RA-226	3.66E-15
RA-228	5.75E-15
TH-228	2.46E-12
TH-230	7.08E-14
TH-232	1.56E-13
TH-234	2.33E-13
TOTAL	5.65E-11

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	948	924	1778	1520	1287	1218	1385
N	2.1E-06	2.1E-06	1.4E-06	1.6E-06	1.8E-06	1.9E-06	1.7E-06
NNW	9.3E-07	9.2E-07	8.0E-07	8.6E-07	9.1E-07	9.3E-07	9.0E-07
NW	6.2E-07	6.2E-07	5.3E-07	5.6E-07	5.9E-07	6.0E-07	5.8E-07
WNW	7.9E-07	7.9E-07	6.1E-07	6.6E-07	7.2E-07	7.3E-07	6.9E-07
W	1.6E-06	1.7E-06	1.2E-06	1.3E-06	1.5E-06	1.5E-06	1.4E-06
WSW	3.6E-06	3.6E-06	2.3E-06	2.6E-06	3.0E-06	3.1E-06	2.8E-06
SW	2.3E-06	2.3E-06	1.4E-06	1.7E-06	1.9E-06	2.0E-06	1.8E-06
SSW	1.6E-06	1.6E-06	9.4E-07	1.1E-06	1.3E-06	1.3E-06	1.2E-06
S	1.5E-06	1.5E-06	9.0E-07	1.0E-06	1.2E-06	1.2E-06	1.1E-06
SSE	1.5E-06	1.6E-06	9.1E-07	1.0E-06	1.2E-06	1.3E-06	1.1E-06
SE	2.5E-06	2.5E-06	1.6E-06	1.8E-06	2.1E-06	2.2E-06	2.0E-06
ESE	3.2E-06	3.2E-06	2.1E-06	2.4E-06	2.7E-06	2.8E-06	2.5E-06
E	4.4E-06	4.5E-06	2.7E-06	3.1E-06	3.6E-06	3.7E-06	3.4E-06
ENE	4.0E-06	4.0E-06	2.6E-06	3.0E-06	3.3E-06	3.5E-06	3.2E-06
NE	4.3E-06	4.3E-06	2.9E-06	3.3E-06	3.7E-06	3.8E-06	3.5E-06
NNE	3.6E-06	3.6E-06	2.4E-06	2.8E-06	3.1E-06	3.2E-06	3.0E-06

	Distance (m)						
Direction	1462	1496	1639	1634	1630	1519	1506
N	1.6E-06	1.6E-06	1.5E-06	1.5E-06	1.5E-06	1.6E-06	1.6E-06
NNW	8.8E-07	8.7E-07	8.3E-07	8.4E-07	8.4E-07	8.6E-07	8.7E-07
NW	5.7E-07	5.7E-07	5.5E-07	5.5E-07	5.5E-07	5.6E-07	5.6E-07
WNW	6.8E-07	6.7E-07	6.4E-07	6.4E-07	6.4E-07	6.6E-07	6.7E-07
W	1.4E-06	1.3E-06	1.3E-06	1.3E-06	1.3E-06	1.3E-06	1.3E-06
WSW	2.7E-06	2.6E-06	2.4E-06	2.4E-06	2.4E-06	2.6E-06	2.6E-06
SW	1.7E-06	1.7E-06	1.6E-06	1.6E-06	1.6E-06	1.7E-06	1.7E-06
SSW	1.1E-06	1.1E-06	1.0E-06	1.0E-06	1.0E-06	1.1E-06	1.1E-06
S	1.1E-06	1.0E-06	9.6E-07	9.6E-07	9.7E-07	1.0E-06	1.0E-06
SSE	1.1E-06	1.1E-06	9.8E-07	9.8E-07	9.8E-07	1.0E-06	1.0E-06
SE	1.9E-06	1.9E-06	1.7E-06	1.7E-06	1.7E-06	1.8E-06	1.9E-06
ESE	2.4E-06	2.4E-06	2.2E-06	2.2E-06	2.2E-06	2.4E-06	2.4E-06
E	3.2E-06	3.1E-06	2.9E-06	2.9E-06	2.9E-06	3.1E-06	3.1E-06
ENE	3.1E-06	3.0E-06	2.8E-06	2.8E-06	2.8E-06	3.0E-06	3.0E-06
NE	3.4E-06	3.4E-06	3.1E-06	3.1E-06	3.2E-06	3.3E-06	3.3E-06
NNE	2.9E-06	2.8E-06	2.6E-06	2.6E-06	2.6E-06	2.8E-06	2.8E-06

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2068	1538	1189	1161	1460	1374
N	1.2E-06	1.6E-06	1.9E-06	1.9E-06	1.6E-06	1.7E-06
NNW	7.3E-07	8.6E-07	9.3E-07	9.3E-07	8.8E-07	9.0E-07
NW	4.9E-07	5.6E-07	6.1E-07	6.1E-07	5.7E-07	5.8E-07
WNW	5.6E-07	6.6E-07	7.4E-07	7.5E-07	6.8E-07	7.0E-07
W	1.1E-06	1.3E-06	1.5E-06	1.5E-06	1.4E-06	1.4E-06
WSW	1.9E-06	2.6E-06	3.1E-06	3.2E-06	2.7E-06	2.8E-06
SW	1.3E-06	1.6E-06	2.0E-06	2.0E-06	1.7E-06	1.8E-06
SSW	8.1E-07	1.1E-06	1.3E-06	1.4E-06	1.1E-06	1.2E-06
S	7.8E-07	1.0E-06	1.3E-06	1.3E-06	1.1E-06	1.1E-06
SSE	8.0E-07	1.0E-06	1.3E-06	1.3E-06	1.1E-06	1.1E-06
SE	1.4E-06	1.8E-06	2.2E-06	2.2E-06	1.9E-06	2.0E-06
ESE	1.8E-06	2.3E-06	2.8E-06	2.9E-06	2.4E-06	2.5E-06
E	2.3E-06	3.1E-06	3.8E-06	3.9E-06	3.2E-06	3.4E-06
ENE	2.3E-06	3.0E-06	3.5E-06	3.6E-06	3.1E-06	3.2E-06
NE	2.6E-06	3.3E-06	3.9E-06	3.9E-06	3.4E-06	3.6E-06
NNE	2.1E-06	2.7E-06	3.3E-06	3.3E-06	2.9E-06	3.0E-06

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	948	924	1778	1520	1287	1218	1385
N	2.6E-11	2.6E-11	1.7E-11	2.0E-11	2.2E-11	2.3E-11	2.1E-11
NNW	1.1E-11	1.1E-11	9.6E-12	1.0E-11	1.1E-11	1.1E-11	1.1E-11
NW	7.0E-12	7.0E-12	6.0E-12	6.4E-12	6.7E-12	6.8E-12	6.6E-12
WNW	9.1E-12	9.1E-12	7.0E-12	7.7E-12	8.3E-12	8.5E-12	8.1E-12
W	2.0E-11	2.0E-11	1.5E-11	1.6E-11	1.8E-11	1.8E-11	1.7E-11
WSW	4.5E-11	4.6E-11	2.8E-11	3.3E-11	3.7E-11	3.9E-11	3.5E-11
SW	2.9E-11	2.9E-11	1.8E-11	2.1E-11	2.4E-11	2.5E-11	2.2E-11
SSW	2.0E-11	2.0E-11	1.1E-11	1.3E-11	1.5E-11	1.6E-11	1.4E-11
S	1.8E-11	1.8E-11	1.1E-11	1.2E-11	1.4E-11	1.5E-11	1.4E-11
SSE	1.9E-11	1.9E-11	1.1E-11	1.2E-11	1.4E-11	1.5E-11	1.3E-11
SE	3.0E-11	3.1E-11	2.0E-11	2.3E-11	2.6E-11	2.7E-11	2.4E-11
ESE	3.9E-11	4.0E-11	2.6E-11	2.9E-11	3.3E-11	3.4E-11	3.2E-11
E	5.6E-11	5.6E-11	3.4E-11	3.9E-11	4.5E-11	4.7E-11	4.2E-11
ENE	5.0E-11	5.0E-11	3.3E-11	3.7E-11	4.2E-11	4.3E-11	4.0E-11
NE	5.4E-11	5.4E-11	3.7E-11	4.2E-11	4.7E-11	4.8E-11	4.5E-11
NNE	4.6E-11	4.6E-11	3.1E-11	3.5E-11	4.0E-11	4.1E-11	3.8E-11

	Distance (m)						
Direction	1462	1496	1639	1634	1630	1519	1506
N	2.0E-11	2.0E-11	1.9E-11	1.9E-11	1.9E-11	2.0E-11	2.0E-11
NNW	1.1E-11	1.0E-11	1.0E-11	1.0E-11	1.0E-11	1.0E-11	1.0E-11
NW	6.5E-12	6.4E-12	6.2E-12	6.2E-12	6.2E-12	6.4E-12	6.4E-12
WNW	7.9E-12	7.8E-12	7.4E-12	7.4E-12	7.4E-12	7.7E-12	7.7E-12
W	1.6E-11	1.6E-11	1.5E-11	1.5E-11	1.5E-11	1.6E-11	1.6E-11
WSW	3.4E-11	3.3E-11	3.1E-11	3.1E-11	3.1E-11	3.3E-11	3.3E-11
SW	2.1E-11	2.1E-11	1.9E-11	2.0E-11	2.0E-11	2.1E-11	2.1E-11
SSW	1.4E-11	1.3E-11	1.2E-11	1.2E-11	1.2E-11	1.3E-11	1.3E-11
S	1.3E-11	1.3E-11	1.2E-11	1.2E-11	1.2E-11	1.2E-11	1.3E-11
SSE	1.3E-11	1.3E-11	1.2E-11	1.2E-11	1.2E-11	1.2E-11	1.3E-11
SE	2.3E-11	2.3E-11	2.1E-11	2.1E-11	2.1E-11	2.3E-11	2.3E-11
ESE	3.0E-11	3.0E-11	2.8E-11	2.8E-11	2.8E-11	2.9E-11	3.0E-11
E	4.0E-11	3.9E-11	3.6E-11	3.7E-11	3.7E-11	3.9E-11	3.9E-11
ENE	3.8E-11	3.8E-11	3.5E-11	3.5E-11	3.5E-11	3.7E-11	3.7E-11
NE	4.3E-11	4.2E-11	4.0E-11	4.0E-11	4.0E-11	4.2E-11	4.2E-11
NNE	3.6E-11	3.5E-11	3.3E-11	3.3E-11	3.3E-11	3.5E-11	3.5E-11

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2068	1538	1189	1161	1460	1374
N	1.5E-11	2.0E-11	2.4E-11	2.4E-11	2.0E-11	2.1E-11
NNW	8.7E-12	1.0E-11	1.1E-11	1.1E-11	1.1E-11	1.1E-11
NW	5.6E-12	6.4E-12	6.9E-12	6.9E-12	6.5E-12	6.6E-12
WNW	6.4E-12	7.6E-12	8.6E-12	8.7E-12	7.9E-12	8.1E-12
W	1.3E-11	1.6E-11	1.8E-11	1.9E-11	1.7E-11	1.7E-11
WSW	2.5E-11	3.2E-11	4.0E-11	4.0E-11	3.4E-11	3.6E-11
SW	1.6E-11	2.1E-11	2.5E-11	2.6E-11	2.2E-11	2.3E-11
SSW	9.8E-12	1.3E-11	1.7E-11	1.7E-11	1.4E-11	1.5E-11
S	9.4E-12	1.2E-11	1.5E-11	1.6E-11	1.3E-11	1.4E-11
SSE	9.5E-12	1.2E-11	1.5E-11	1.6E-11	1.3E-11	1.4E-11
SE	1.7E-11	2.2E-11	2.7E-11	2.7E-11	2.3E-11	2.4E-11
ESE	2.2E-11	2.9E-11	3.5E-11	3.6E-11	3.0E-11	3.2E-11
E	2.9E-11	3.9E-11	4.8E-11	4.8E-11	4.0E-11	4.2E-11
ENE	2.9E-11	3.7E-11	4.4E-11	4.5E-11	3.8E-11	4.0E-11
NE	3.2E-11	4.2E-11	4.9E-11	5.0E-11	4.3E-11	4.5E-11
NNE	2.6E-11	3.5E-11	4.2E-11	4.2E-11	3.6E-11	3.8E-11

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 4:00 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

4.44E-06

At This Location: 940 Meters East

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 20 Cooling Water Tower [G2]

Dataset Name: 97-Z012-G2
Dataset Date: Apr 7, 1998 1:15 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 940 Meters East
Lifetime Fatal Cancer Risk: 5.58E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	2.72E-08
BREAST	3.12E-08
R MAR	6.34E-07
LUNGS	3.22E-05
THYROID	2.65E-08
ENDOST	8.85E-06
RMNDR	7.57E-07
EFFEC	4.44E-06

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	6.8E-08	6.8E-08
U-235	Y	1.00	3.6E-09	3.6E-09
U-236	Y	1.00	2.5E-09	2.5E-09
U-238	Y	1.00	8.9E-08	8.9E-08
RA-226	W	1.00	6.1E-11	6.1E-11
RA-228	W	1.00	2.4E-10	2.4E-10
TH-228	Y	1.00	2.6E-09	2.6E-09
TH-230	Y	1.00	1.8E-10	1.8E-10
TH-232	Y	1.00	4.0E-10	4.0E-10
TH-234	Y	1.00	3.8E-07	3.8E-07

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	14.86
Diameter (m):	8.69
Plume Rise Momentum (m/s): (Exit Velocity)	7.16E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

940	1277	2087	1792	2376	2453	2418	1383	1597	2132
2191	1456	2512	1545	1776	1871	1830	2121	2150	1485

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 4:00 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 20 Cooling Water Tower [G2]

Dataset Name: 97-Z012-G2
Dataset Date: Apr 7, 1998 1:15 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.72E-08
BREAST	3.12E-08
R MAR	6.34E-07
LUNGS	3.22E-05
THYROID	2.65E-08
ENDOST	8.85E-06
RMNDR	7.57E-07
EFFEC	4.44E-06

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	5.49E-07
INHALATION	3.89E-06
AIR IMMERSION	3.89E-13
GROUND SURFACE	5.59E-09
INTERNAL	4.44E-06
EXTERNAL	5.59E-09
TOTAL	4.45E-06

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.89E-06
U-235	9.87E-08
U-236	6.55E-08
U-238	2.22E-06
RA-226	3.56E-10
RA-228	6.34E-10
TH-228	1.22E-07
TH-230	8.65E-09
TH-232	2.76E-08
TH-234	9.84E-09
TOTAL	4.45E-06

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	7.19E-13
BONE	4.72E-13
THYROID	6.17E-15
BREAST	7.07E-14
LUNG	5.27E-11
STOMACH	4.72E-14
BOWEL	1.33E-13
LIVER	4.11E-14
PANCREAS	2.69E-14
URINARY	1.59E-12
OTHER	3.29E-14
TOTAL	5.58E-11

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.95E-12
INHALATION	5.28E-11
AIR IMMERSION	8.65E-18
GROUND SURFACE	1.28E-13
INTERNAL	5.57E-11
EXTERNAL	1.28E-13
TOTAL	5.58E-11

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	2.32E-11
U-235	1.27E-12
U-236	8.05E-13
U-238	2.76E-11
RA-226	3.58E-15
RA-228	5.57E-15
TH-228	2.44E-12
TH-230	7.01E-14
TH-232	1.55E-13
TH-234	2.29E-13
TOTAL	5.58E-11

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	940	1277	2087	1792	2376	2453	2418
N	2.1E-06	1.8E-06	1.2E-06	1.4E-06	1.0E-06	1.0E-06	1.0E-06
NNW	9.1E-07	9.0E-07	7.1E-07	7.8E-07	6.4E-07	6.2E-07	6.3E-07
NW	6.1E-07	5.8E-07	4.8E-07	5.1E-07	4.4E-07	4.4E-07	4.4E-07
WNW	7.7E-07	7.0E-07	5.4E-07	5.9E-07	4.9E-07	4.8E-07	4.8E-07
W	1.6E-06	1.4E-06	1.0E-06	1.2E-06	9.4E-07	9.2E-07	9.3E-07
WSW	3.6E-06	3.0E-06	1.9E-06	2.2E-06	1.7E-06	1.6E-06	1.6E-06
SW	2.3E-06	1.9E-06	1.2E-06	1.4E-06	1.1E-06	1.0E-06	1.1E-06
SSW	1.6E-06	1.2E-06	7.9E-07	9.1E-07	6.9E-07	6.7E-07	6.8E-07
S	1.5E-06	1.2E-06	7.6E-07	8.7E-07	6.7E-07	6.5E-07	6.6E-07
SSE	1.5E-06	1.2E-06	7.8E-07	8.9E-07	7.0E-07	6.8E-07	6.9E-07
SE	2.5E-06	2.1E-06	1.4E-06	1.6E-06	1.2E-06	1.2E-06	1.2E-06
ESE	3.2E-06	2.7E-06	1.8E-06	2.0E-06	1.6E-06	1.5E-06	1.5E-06
E	4.4E-06	3.6E-06	2.3E-06	2.7E-06	2.0E-06	2.0E-06	2.0E-06
ENE	4.0E-06	3.3E-06	2.3E-06	2.6E-06	2.0E-06	2.0E-06	2.0E-06
NE	4.3E-06	3.7E-06	2.5E-06	2.9E-06	2.2E-06	2.2E-06	2.2E-06
NNE	3.6E-06	3.1E-06	2.1E-06	2.4E-06	1.8E-06	1.7E-06	1.8E-06

	Distance (m)						
Direction	1383	1597	2132	2191	1456	2512	1545
N	1.7E-06	1.5E-06	1.2E-06	1.1E-06	1.6E-06	9.8E-07	1.6E-06
NNW	8.8E-07	8.3E-07	6.9E-07	6.8E-07	8.6E-07	6.1E-07	8.4E-07
NW	5.6E-07	5.4E-07	4.7E-07	4.6E-07	5.5E-07	4.3E-07	5.4E-07
WNW	6.8E-07	6.3E-07	5.3E-07	5.2E-07	6.6E-07	4.7E-07	6.4E-07
W	1.4E-06	1.3E-06	1.0E-06	1.0E-06	1.3E-06	9.0E-07	1.3E-06
WSW	2.8E-06	2.5E-06	1.9E-06	1.8E-06	2.7E-06	1.6E-06	2.5E-06
SW	1.8E-06	1.6E-06	1.2E-06	1.2E-06	1.7E-06	1.0E-06	1.6E-06
SSW	1.2E-06	1.0E-06	7.7E-07	7.5E-07	1.1E-06	6.6E-07	1.1E-06
S	1.1E-06	9.7E-07	7.4E-07	7.2E-07	1.0E-06	6.4E-07	9.9E-07
SSE	1.1E-06	9.8E-07	7.7E-07	7.5E-07	1.1E-06	6.7E-07	1.0E-06
SE	2.0E-06	1.7E-06	1.4E-06	1.3E-06	1.9E-06	1.2E-06	1.8E-06
ESE	2.5E-06	2.3E-06	1.7E-06	1.7E-06	2.4E-06	1.5E-06	2.3E-06
E	3.3E-06	3.0E-06	2.3E-06	2.2E-06	3.2E-06	1.9E-06	3.0E-06
ENE	3.2E-06	2.9E-06	2.2E-06	2.2E-06	3.1E-06	1.9E-06	2.9E-06
NE	3.5E-06	3.2E-06	2.5E-06	2.4E-06	3.4E-06	2.1E-06	3.3E-06
NNE	3.0E-06	2.6E-06	2.0E-06	2.0E-06	2.8E-06	1.7E-06	2.7E-06

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1776	1871	1830	2121	2150	1485
N	1.4E-06	1.3E-06	1.3E-06	1.2E-06	1.2E-06	1.6E-06
NNW	7.8E-07	7.6E-07	7.7E-07	7.0E-07	6.9E-07	8.6E-07
NW	5.1E-07	5.0E-07	5.1E-07	4.7E-07	4.7E-07	5.5E-07
WNW	5.9E-07	5.7E-07	5.8E-07	5.3E-07	5.2E-07	6.5E-07
W	1.2E-06	1.1E-06	1.2E-06	1.0E-06	1.0E-06	1.3E-06
WSW	2.2E-06	2.1E-06	2.2E-06	1.9E-06	1.9E-06	2.6E-06
SW	1.4E-06	1.4E-06	1.4E-06	1.2E-06	1.2E-06	1.7E-06
SSW	9.2E-07	8.8E-07	9.0E-07	7.8E-07	7.7E-07	1.1E-06
S	8.8E-07	8.4E-07	8.6E-07	7.5E-07	7.4E-07	1.0E-06
SSE	9.0E-07	8.6E-07	8.7E-07	7.7E-07	7.6E-07	1.0E-06
SE	1.6E-06	1.5E-06	1.6E-06	1.4E-06	1.3E-06	1.9E-06
ESE	2.1E-06	2.0E-06	2.0E-06	1.7E-06	1.7E-06	2.4E-06
E	2.7E-06	2.6E-06	2.6E-06	2.3E-06	2.2E-06	3.2E-06
ENE	2.6E-06	2.5E-06	2.6E-06	2.3E-06	2.2E-06	3.0E-06
NE	2.9E-06	2.8E-06	2.9E-06	2.5E-06	2.5E-06	3.4E-06
NNE	2.4E-06	2.3E-06	2.3E-06	2.0E-06	2.0E-06	2.8E-06

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	940	1277	2087	1792	2376	2453	2418
N	2.6E-11	2.2E-11	1.5E-11	1.7E-11	1.3E-11	1.2E-11	1.3E-11
NNW	1.1E-11	1.1E-11	8.5E-12	9.4E-12	7.7E-12	7.5E-12	7.6E-12
NW	6.9E-12	6.7E-12	5.5E-12	5.9E-12	5.1E-12	5.0E-12	5.0E-12
WNW	9.0E-12	8.3E-12	6.2E-12	6.9E-12	5.7E-12	5.5E-12	5.6E-12
W	2.0E-11	1.8E-11	1.3E-11	1.4E-11	1.2E-11	1.1E-11	1.1E-11
WSW	4.5E-11	3.8E-11	2.4E-11	2.8E-11	2.1E-11	2.0E-11	2.1E-11
SW	2.9E-11	2.4E-11	1.5E-11	1.8E-11	1.3E-11	1.3E-11	1.3E-11
SSW	2.0E-11	1.6E-11	9.6E-12	1.1E-11	8.4E-12	8.1E-12	8.2E-12
S	1.8E-11	1.4E-11	9.2E-12	1.1E-11	8.1E-12	7.8E-12	7.9E-12
SSE	1.9E-11	1.4E-11	9.3E-12	1.1E-11	8.3E-12	8.0E-12	8.2E-12
SE	3.0E-11	2.6E-11	1.7E-11	2.0E-11	1.5E-11	1.4E-11	1.5E-11
ESE	3.9E-11	3.3E-11	2.2E-11	2.6E-11	1.9E-11	1.9E-11	1.9E-11
E	5.6E-11	4.5E-11	2.9E-11	3.3E-11	2.5E-11	2.4E-11	2.5E-11
ENE	5.0E-11	4.2E-11	2.9E-11	3.3E-11	2.5E-11	2.5E-11	2.5E-11
NE	5.4E-11	4.7E-11	3.2E-11	3.7E-11	2.8E-11	2.7E-11	2.7E-11
NNE	4.6E-11	4.0E-11	2.6E-11	3.0E-11	2.3E-11	2.2E-11	2.2E-11

	Distance (m)						
Direction	1383	1597	2132	2191	1456	2512	1545
N	2.1E-11	1.9E-11	1.4E-11	1.4E-11	2.0E-11	1.2E-11	2.0E-11
NNW	1.1E-11	1.0E-11	8.4E-12	8.2E-12	1.0E-11	7.3E-12	1.0E-11
NW	6.5E-12	6.2E-12	5.4E-12	5.3E-12	6.4E-12	4.9E-12	6.3E-12
WNW	8.0E-12	7.4E-12	6.2E-12	6.0E-12	7.8E-12	5.4E-12	7.5E-12
W	1.7E-11	1.6E-11	1.3E-11	1.2E-11	1.6E-11	1.1E-11	1.6E-11
WSW	3.5E-11	3.1E-11	2.4E-11	2.3E-11	3.4E-11	2.0E-11	3.2E-11
SW	2.2E-11	2.0E-11	1.5E-11	1.5E-11	2.1E-11	1.3E-11	2.0E-11
SSW	1.4E-11	1.3E-11	9.4E-12	9.1E-12	1.4E-11	7.9E-12	1.3E-11
S	1.3E-11	1.2E-11	9.0E-12	8.8E-12	1.3E-11	7.6E-12	1.2E-11
SSE	1.3E-11	1.2E-11	9.1E-12	8.9E-12	1.3E-11	7.9E-12	1.2E-11
SE	2.4E-11	2.2E-11	1.7E-11	1.6E-11	2.3E-11	1.4E-11	2.2E-11
ESE	3.1E-11	2.8E-11	2.2E-11	2.1E-11	3.0E-11	1.8E-11	2.9E-11
E	4.2E-11	3.7E-11	2.8E-11	2.7E-11	4.0E-11	2.4E-11	3.8E-11
ENE	4.0E-11	3.6E-11	2.8E-11	2.7E-11	3.8E-11	2.4E-11	3.7E-11
NE	4.5E-11	4.0E-11	3.1E-11	3.0E-11	4.3E-11	2.6E-11	4.1E-11
NNE	3.8E-11	3.3E-11	2.5E-11	2.5E-11	3.6E-11	2.1E-11	3.4E-11

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1776	1871	1830	2121	2150	1485
N	1.7E-11	1.6E-11	1.7E-11	1.5E-11	1.4E-11	2.0E-11
NNW	9.5E-12	9.2E-12	9.3E-12	8.4E-12	8.3E-12	1.0E-11
NW	5.9E-12	5.8E-12	5.8E-12	5.4E-12	5.4E-12	6.4E-12
WNW	6.9E-12	6.7E-12	6.8E-12	6.2E-12	6.1E-12	7.7E-12
W	1.4E-11	1.4E-11	1.4E-11	1.3E-11	1.3E-11	1.6E-11
WSW	2.8E-11	2.7E-11	2.8E-11	2.4E-11	2.3E-11	3.3E-11
SW	1.8E-11	1.7E-11	1.7E-11	1.5E-11	1.5E-11	2.1E-11
SSW	1.1E-11	1.1E-11	1.1E-11	9.5E-12	9.3E-12	1.3E-11
S	1.1E-11	1.0E-11	1.0E-11	9.1E-12	8.9E-12	1.3E-11
SSE	1.1E-11	1.0E-11	1.0E-11	9.2E-12	9.1E-12	1.3E-11
SE	2.0E-11	1.9E-11	1.9E-11	1.7E-11	1.6E-11	2.3E-11
ESE	2.6E-11	2.5E-11	2.5E-11	2.2E-11	2.1E-11	3.0E-11
E	3.4E-11	3.2E-11	3.3E-11	2.8E-11	2.8E-11	4.0E-11
ENE	3.3E-11	3.1E-11	3.2E-11	2.8E-11	2.8E-11	3.8E-11
NE	3.7E-11	3.5E-11	3.6E-11	3.1E-11	3.1E-11	4.3E-11
NNE	3.0E-11	2.9E-11	3.0E-11	2.6E-11	2.5E-11	3.6E-11

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 8, 1998 1:30 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

9.19E-06

At This Location: 671 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
AWWT (Tank emissions) [G1]

Dataset Name: 97-AWWT-G1
Dataset Date: Apr 8, 1998 1:21 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 671 Meters East Northeast
Lifetime Fatal Cancer Risk: 1.20E-10

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	2.75E-08
BREAST	3.14E-08
R MAR	6.75E-07
LUNGS	7.16E-05
THYROID	2.68E-08
ENDOST	9.34E-06
RMNDR	7.52E-07
EFFEC	9.19E-06

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	1.3E-08	1.3E-08
U-235	Y	1.00	6.8E-10	6.8E-10
U-236	Y	1.00	4.6E-10	4.6E-10
U-238	Y	1.00	1.7E-08	1.7E-08
RA-226	W	1.00	1.1E-11	1.1E-11
RA-228	W	1.00	4.5E-11	4.5E-11
TH-228	Y	1.00	4.8E-10	4.8E-10
TH-230	Y	1.00	3.4E-11	3.4E-11
TH-232	Y	1.00	7.5E-11	7.5E-11
TH-234	Y	1.00	7.0E-08	7.0E-08

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number: 1

Source Height (m): 10.00
Area (sq m): 1.50E+03

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m): (Fixed Rise)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1510	1441	1991	1529	1185	671	742	826	864	1030
1035	1103	1105	1127	1804	1434	1399	1412	2062	2018

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E. A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 8, 1998 1:30 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
AWWT (Tank emissions) [G1]

Dataset Name: 97-AWWT-G1
Dataset Date: Apr 8, 1998 1:21 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.75E-08
BREAST	3.14E-08
R MAR	6.75E-07
LUNGS	7.16E-05
THYROID	2.68E-08
ENDOST	9.34E-06
RMNDR	7.52E-07
EFFEC	9.19E-06

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	5.32E-07
INHALATION	8.66E-06
AIR IMMERSION	8.64E-13
GROUND SURFACE	5.49E-09
INTERNAL	9.19E-06
EXTERNAL	5.49E-09
TOTAL	9.20E-06

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	3.90E-06
U-235	1.99E-07
U-236	1.35E-07
U-238	4.60E-06
RA-226	4.70E-10
RA-228	7.53E-10
TH-228	2.70E-07
TH-230	1.89E-08
TH-232	6.06E-08
TH-234	1.27E-08
TOTAL	9.20E-06

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	7.58E-13
BONE	4.96E-13
THYROID	6.19E-15
BREAST	7.06E-14
LUNG	1.17E-10
STOMACH	4.83E-14
BOWEL	1.41E-13
LIVER	4.45E-14
PANCREAS	2.72E-14
URINARY	1.56E-12
OTHER	3.33E-14
TOTAL	1.20E-10

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.86E-12
INHALATION	1.17E-10
AIR IMMERSION	1.92E-17
GROUND SURFACE	1.26E-13
INTERNAL	1.20E-10
EXTERNAL	1.26E-13
TOTAL	1.20E-10

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	5.01E-11
U-235	2.61E-12
U-236	1.74E-12
U-238	5.96E-11
RA-226	6.26E-15
RA-228	7.71E-15
TH-228	5.41E-12
TH-230	1.55E-13
TH-232	3.41E-13
TH-234	4.03E-13
TOTAL	1.20E-10

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1510	1441	1991	1529	1185	671	742
N	1.4E-06	1.5E-06	1.0E-06	1.4E-06	1.9E-06	3.5E-06	3.1E-06
NNW	9.6E-07	1.0E-06	6.9E-07	9.4E-07	1.3E-06	2.4E-06	2.1E-06
NW	9.8E-07	1.0E-06	7.0E-07	9.6E-07	1.3E-06	2.4E-06	2.1E-06
WNW	1.0E-06	1.1E-06	7.6E-07	1.0E-06	1.3E-06	2.4E-06	2.1E-06
W	1.6E-06	1.7E-06	1.2E-06	1.6E-06	2.1E-06	3.8E-06	3.4E-06
WSW	1.7E-06	1.8E-06	1.2E-06	1.6E-06	2.3E-06	5.0E-06	4.3E-06
SW	9.6E-07	1.0E-06	6.8E-07	9.4E-07	1.3E-06	2.7E-06	2.4E-06
SSW	8.2E-07	8.6E-07	5.9E-07	8.1E-07	1.1E-06	2.1E-06	1.8E-06
S	9.8E-07	1.0E-06	7.2E-07	9.7E-07	1.3E-06	2.3E-06	2.0E-06
SSE	1.8E-06	1.9E-06	1.4E-06	1.8E-06	2.3E-06	3.5E-06	3.2E-06
SE	2.9E-06	3.0E-06	2.2E-06	2.9E-06	3.5E-06	5.0E-06	4.6E-06
ESE	3.1E-06	3.2E-06	2.4E-06	3.1E-06	3.7E-06	5.6E-06	5.1E-06
E	3.8E-06	4.0E-06	2.8E-06	3.7E-06	4.8E-06	8.1E-06	7.3E-06
ENE	3.8E-06	4.0E-06	2.7E-06	3.8E-06	5.0E-06	9.2E-06	8.2E-06
NE	3.3E-06	3.5E-06	2.4E-06	3.3E-06	4.4E-06	8.2E-06	7.3E-06
NNE	2.1E-06	2.2E-06	1.5E-06	2.0E-06	2.8E-06	5.4E-06	4.8E-06

	Distance (m)						
Direction	826	864	1030	1035	1103	1105	1127
N	2.8E-06	2.6E-06	2.2E-06	2.2E-06	2.0E-06	2.0E-06	2.0E-06
NNW	1.9E-06	1.8E-06	1.5E-06	1.5E-06	1.4E-06	1.4E-06	1.3E-06
NW	1.9E-06	1.8E-06	1.5E-06	1.5E-06	1.4E-06	1.4E-06	1.3E-06
WNW	1.9E-06	1.8E-06	1.5E-06	1.5E-06	1.4E-06	1.4E-06	1.4E-06
W	3.0E-06	2.9E-06	2.4E-06	2.4E-06	2.2E-06	2.2E-06	2.2E-06
WSW	3.7E-06	3.5E-06	2.8E-06	2.7E-06	2.5E-06	2.5E-06	2.5E-06
SW	2.0E-06	1.9E-06	1.5E-06	1.5E-06	1.4E-06	1.4E-06	1.4E-06
SSW	1.6E-06	1.5E-06	1.3E-06	1.2E-06	1.2E-06	1.2E-06	1.1E-06
S	1.8E-06	1.7E-06	1.4E-06	1.4E-06	1.3E-06	1.3E-06	1.3E-06
SSE	3.0E-06	2.9E-06	2.5E-06	2.5E-06	2.4E-06	2.4E-06	2.3E-06
SE	4.3E-06	4.2E-06	3.8E-06	3.8E-06	3.6E-06	3.6E-06	3.6E-06
ESE	4.7E-06	4.6E-06	4.1E-06	4.1E-06	3.9E-06	3.9E-06	3.9E-06
E	6.6E-06	6.3E-06	5.4E-06	5.4E-06	5.1E-06	5.1E-06	5.0E-06
ENE	7.3E-06	6.9E-06	5.8E-06	5.7E-06	5.4E-06	5.4E-06	5.2E-06
NE	6.5E-06	6.2E-06	5.1E-06	5.0E-06	4.7E-06	4.7E-06	4.6E-06
NNE	4.2E-06	4.0E-06	3.2E-06	3.2E-06	3.0E-06	3.0E-06	2.9E-06

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1804	1434	1399	1412	2062	2018
N	1.2E-06	1.5E-06	1.6E-06	1.5E-06	9.9E-07	1.0E-06
NNW	7.8E-07	1.0E-06	1.0E-06	1.0E-06	6.6E-07	6.8E-07
NW	7.9E-07	1.0E-06	1.1E-06	1.1E-06	6.8E-07	6.9E-07
WNW	8.6E-07	1.1E-06	1.1E-06	1.1E-06	7.3E-07	7.5E-07
W	1.3E-06	1.7E-06	1.8E-06	1.7E-06	1.1E-06	1.2E-06
WSW	1.3E-06	1.8E-06	1.9E-06	1.8E-06	1.1E-06	1.1E-06
SW	7.7E-07	1.0E-06	1.1E-06	1.0E-06	6.5E-07	6.7E-07
SSW	6.7E-07	8.7E-07	8.9E-07	8.8E-07	5.7E-07	5.8E-07
S	8.1E-07	1.0E-06	1.1E-06	1.0E-06	6.9E-07	7.1E-07
SSE	1.5E-06	1.9E-06	2.0E-06	2.0E-06	1.3E-06	1.4E-06
SE	2.5E-06	3.0E-06	3.1E-06	3.1E-06	2.1E-06	2.2E-06
ESE	2.6E-06	3.2E-06	3.3E-06	3.3E-06	2.3E-06	2.3E-06
E	3.1E-06	4.0E-06	4.1E-06	4.0E-06	2.7E-06	2.7E-06
ENE	3.1E-06	4.0E-06	4.1E-06	4.1E-06	2.6E-06	2.7E-06
NE	2.7E-06	3.5E-06	3.6E-06	3.6E-06	2.3E-06	2.3E-06
NNE	1.7E-06	2.2E-06	2.3E-06	2.2E-06	1.4E-06	1.4E-06

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 1510	1441	1991	1529	1185	671	742
N	1.8E-11	1.9E-11	1.3E-11	1.8E-11	2.4E-11	4.5E-11	4.0E-11
NNW	1.2E-11	1.3E-11	8.6E-12	1.2E-11	1.6E-11	3.1E-11	2.7E-11
NW	1.2E-11	1.3E-11	8.8E-12	1.2E-11	1.6E-11	3.1E-11	2.8E-11
WNW	1.3E-11	1.4E-11	9.6E-12	1.3E-11	1.7E-11	3.0E-11	2.7E-11
W	2.1E-11	2.2E-11	1.5E-11	2.1E-11	2.7E-11	4.9E-11	4.4E-11
WSW	2.1E-11	2.3E-11	1.5E-11	2.1E-11	3.0E-11	6.5E-11	5.6E-11
SW	1.2E-11	1.3E-11	8.4E-12	1.2E-11	1.6E-11	3.5E-11	3.1E-11
SSW	1.0E-11	1.1E-11	7.3E-12	1.0E-11	1.4E-11	2.7E-11	2.4E-11
S	1.2E-11	1.3E-11	9.0E-12	1.2E-11	1.6E-11	3.0E-11	2.6E-11
SSE	2.4E-11	2.5E-11	1.8E-11	2.3E-11	2.9E-11	4.6E-11	4.2E-11
SE	3.8E-11	3.9E-11	2.9E-11	3.7E-11	4.5E-11	6.5E-11	6.0E-11
ESE	4.0E-11	4.2E-11	3.1E-11	4.0E-11	4.9E-11	7.3E-11	6.6E-11
E	4.9E-11	5.2E-11	3.6E-11	4.9E-11	6.2E-11	1.1E-10	9.5E-11
ENE	5.0E-11	5.2E-11	3.5E-11	4.9E-11	6.5E-11	1.2E-10	1.1E-10
NE	4.3E-11	4.6E-11	3.1E-11	4.2E-11	5.7E-11	1.1E-10	9.6E-11
NNE	2.7E-11	2.8E-11	1.9E-11	2.6E-11	3.6E-11	7.1E-11	6.2E-11

Direction	Distance (m) 826	864	1030	1035	1103	1105	1127
N	3.6E-11	3.4E-11	2.8E-11	2.8E-11	2.6E-11	2.6E-11	2.5E-11
NNW	2.4E-11	2.3E-11	1.9E-11	1.9E-11	1.7E-11	1.7E-11	1.7E-11
NW	2.4E-11	2.3E-11	1.9E-11	1.9E-11	1.8E-11	1.8E-11	1.7E-11
WNW	2.4E-11	2.3E-11	1.9E-11	1.9E-11	1.8E-11	1.8E-11	1.8E-11
W	3.9E-11	3.7E-11	3.1E-11	3.1E-11	2.9E-11	2.9E-11	2.8E-11
WSW	4.8E-11	4.6E-11	3.6E-11	3.5E-11	3.3E-11	3.3E-11	3.2E-11
SW	2.6E-11	2.5E-11	2.0E-11	1.9E-11	1.8E-11	1.8E-11	1.8E-11
SSW	2.1E-11	2.0E-11	1.6E-11	1.6E-11	1.5E-11	1.5E-11	1.4E-11
S	2.3E-11	2.2E-11	1.8E-11	1.8E-11	1.7E-11	1.7E-11	1.7E-11
SSE	3.8E-11	3.7E-11	3.3E-11	3.2E-11	3.1E-11	3.1E-11	3.0E-11
SE	5.6E-11	5.5E-11	5.0E-11	4.9E-11	4.7E-11	4.7E-11	4.7E-11
ESE	6.1E-11	6.0E-11	5.4E-11	5.3E-11	5.1E-11	5.1E-11	5.0E-11
E	8.6E-11	8.2E-11	7.1E-11	7.0E-11	6.6E-11	6.6E-11	6.5E-11
ENE	9.5E-11	9.1E-11	7.5E-11	7.5E-11	7.0E-11	7.0E-11	6.8E-11
NE	8.5E-11	8.0E-11	6.6E-11	6.6E-11	6.1E-11	6.1E-11	6.0E-11
NNE	5.5E-11	5.2E-11	4.2E-11	4.2E-11	3.9E-11	3.9E-11	3.8E-11

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1804	1434	1399	1412	2062	2018
N	1.5E-11	2.0E-11	2.0E-11	2.0E-11	1.3E-11	1.3E-11
NNW	9.8E-12	1.3E-11	1.3E-11	1.3E-11	8.2E-12	8.5E-12
NW	1.0E-11	1.3E-11	1.4E-11	1.3E-11	8.4E-12	8.6E-12
WNW	1.1E-11	1.4E-11	1.4E-11	1.4E-11	9.2E-12	9.4E-12
W	1.7E-11	2.2E-11	2.3E-11	2.2E-11	1.4E-11	1.5E-11
WSW	1.7E-11	2.3E-11	2.4E-11	2.4E-11	1.4E-11	1.4E-11
SW	9.6E-12	1.3E-11	1.3E-11	1.3E-11	8.0E-12	8.3E-12
SSW	8.3E-12	1.1E-11	1.1E-11	1.1E-11	7.0E-12	7.2E-12
S	1.0E-11	1.3E-11	1.3E-11	1.3E-11	8.6E-12	8.8E-12
SSE	2.0E-11	2.5E-11	2.5E-11	2.5E-11	1.7E-11	1.8E-11
SE	3.2E-11	3.9E-11	4.0E-11	4.0E-11	2.8E-11	2.8E-11
ESE	3.4E-11	4.2E-11	4.3E-11	4.3E-11	2.9E-11	3.0E-11
E	4.1E-11	5.2E-11	5.3E-11	5.3E-11	3.5E-11	3.6E-11
ENE	4.0E-11	5.3E-11	5.4E-11	5.3E-11	3.4E-11	3.5E-11
NE	3.5E-11	4.6E-11	4.7E-11	4.7E-11	2.9E-11	3.0E-11
NNE	2.1E-11	2.9E-11	2.9E-11	2.9E-11	1.8E-11	1.9E-11

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 8, 1998 1:31 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

3.78E-06

At This Location: 1511 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
AWWT (Tank emissions) [G2]

Dataset Name: 97-AWWT-G2
Dataset Date: Apr 8, 1998 1:23 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1511 Meters East Northeast
Lifetime Fatal Cancer Risk: 4.93E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.17E-08
BREAST	1.33E-08
R MAR	2.89E-07
LUNGS	2.93E-05
THYROID	1.14E-08
ENDOST	4.00E-06
RMNDR	3.23E-07
EFFEC	3.78E-06

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	1.3E-08	1.3E-08
U-235	Y	1.00	6.8E-10	6.8E-10
U-236	Y	1.00	4.6E-10	4.6E-10
U-238	Y	1.00	1.7E-08	1.7E-08
RA-226	W	1.00	1.1E-11	1.1E-11
RA-228	W	1.00	4.5E-11	4.5E-11
TH-228	Y	1.00	4.8E-10	4.8E-10
TH-230	Y	1.00	3.4E-11	3.4E-11
TH-232	Y	1.00	7.5E-11	7.5E-11
TH-234	Y	1.00	7.0E-08	7.0E-08

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number: 1

Source Height (m): 10.00
Area (sq m): 1.50E+03

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m): (Fixed Rise)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1558	1735	1828	2156	2876	2011	2362	1812	1546	2599
2668	1873	2071	1572	1967	2053	2001	1511	1542	2127

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 8, 1998 1:31 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
AWWT (Tank emissions) [G2]

Dataset Name: 97-AWWT-G2
Dataset Date: Apr 8, 1998 1:23 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.17E-08
BREAST	1.33E-08
R MAR	2.89E-07
LUNGS	2.93E-05
THYROID	1.14E-08
ENDOST	4.00E-06
RMNDR	3.23E-07
EFFEC	3.78E-06

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	2.30E-07
INHALATION	3.54E-06
AIR IMMERSION	3.54E-13
GROUND SURFACE	2.26E-09
INTERNAL	3.77E-06
EXTERNAL	2.26E-09
TOTAL	3.78E-06

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.60E-06
U-235	8.15E-08
U-236	5.56E-08
U-238	1.89E-06
RA-226	1.98E-10
RA-228	3.19E-10
TH-228	1.10E-07
TH-230	7.72E-09
TH-232	2.48E-08
TH-234	5.33E-09
TOTAL	3.78E-06

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	3.24E-13
BONE	2.13E-13
THYROID	2.61E-15
BREAST	2.96E-14
LUNG	4.80E-11
STOMACH	2.05E-14
BOWEL	6.02E-14
LIVER	1.88E-14
PANCREAS	1.16E-14
URINARY	6.74E-13
OTHER	1.41E-14
TOTAL	4.93E-11

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.23E-12
INHALATION	4.81E-11
AIR IMMERSION	7.87E-18
GROUND SURFACE	5.19E-14
INTERNAL	4.93E-11
EXTERNAL	5.19E-14
TOTAL	4.93E-11

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	2.05E-11
U-235	1.07E-12
U-236	7.13E-13
U-238	2.44E-11
RA-226	2.59E-15
RA-228	3.24E-15
TH-228	2.21E-12
TH-230	6.33E-14
TH-232	1.40E-13
TH-234	1.67E-13
TOTAL	4.93E-11

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1558	1735	1828	2156	2876	2011	2362
N	1.4E-06	1.2E-06	1.1E-06	9.1E-07	6.2E-07	1.0E-06	8.1E-07
NNW	9.0E-07	7.9E-07	7.4E-07	6.0E-07	4.1E-07	6.6E-07	5.4E-07
NW	9.2E-07	8.1E-07	7.6E-07	6.1E-07	4.2E-07	6.7E-07	5.5E-07
WNW	9.8E-07	8.7E-07	8.2E-07	6.7E-07	4.6E-07	7.3E-07	6.0E-07
W	1.5E-06	1.4E-06	1.3E-06	1.1E-06	7.2E-07	1.1E-06	9.4E-07
WSW	1.6E-06	1.4E-06	1.3E-06	1.0E-06	6.6E-07	1.1E-06	8.9E-07
SW	9.0E-07	7.8E-07	7.3E-07	5.9E-07	4.0E-07	6.4E-07	5.2E-07
SSW	7.7E-07	6.7E-07	6.3E-07	5.1E-07	3.5E-07	5.6E-07	4.6E-07
S	9.2E-07	8.2E-07	7.7E-07	6.3E-07	4.3E-07	6.9E-07	5.6E-07
SSE	1.8E-06	1.6E-06	1.5E-06	1.2E-06	8.7E-07	1.4E-06	1.1E-06
SE	2.8E-06	2.5E-06	2.4E-06	2.0E-06	1.4E-06	2.2E-06	1.8E-06
ESE	3.0E-06	2.7E-06	2.6E-06	2.1E-06	1.5E-06	2.3E-06	1.9E-06
E	3.6E-06	3.2E-06	3.1E-06	2.5E-06	1.7E-06	2.7E-06	2.2E-06
ENE	3.6E-06	3.2E-06	3.0E-06	2.4E-06	1.6E-06	2.7E-06	2.2E-06
NE	3.2E-06	2.8E-06	2.6E-06	2.1E-06	1.4E-06	2.3E-06	1.9E-06
NNE	2.0E-06	1.7E-06	1.6E-06	1.3E-06	8.7E-07	1.4E-06	1.2E-06

	Distance (m)						
Direction	1812	1546	2599	2668	1873	2071	1572
N	1.1E-06	1.4E-06	7.1E-07	6.9E-07	1.1E-06	9.6E-07	1.3E-06
NNW	7.5E-07	9.1E-07	4.7E-07	4.6E-07	7.2E-07	6.3E-07	8.9E-07
NW	7.7E-07	9.3E-07	4.8E-07	4.6E-07	7.3E-07	6.5E-07	9.1E-07
WNW	8.3E-07	9.9E-07	5.3E-07	5.1E-07	8.0E-07	7.0E-07	9.7E-07
W	1.3E-06	1.6E-06	8.3E-07	8.0E-07	1.3E-06	1.1E-06	1.5E-06
WSW	1.3E-06	1.6E-06	7.7E-07	7.4E-07	1.2E-06	1.1E-06	1.6E-06
SW	7.4E-07	9.1E-07	4.6E-07	4.4E-07	7.1E-07	6.2E-07	8.9E-07
SSW	6.4E-07	7.7E-07	4.0E-07	3.9E-07	6.1E-07	5.4E-07	7.6E-07
S	7.8E-07	9.3E-07	5.0E-07	4.8E-07	7.5E-07	6.6E-07	9.1E-07
SSE	1.5E-06	1.8E-06	9.9E-07	9.6E-07	1.5E-06	1.3E-06	1.8E-06
SE	2.4E-06	2.8E-06	1.6E-06	1.6E-06	2.3E-06	2.1E-06	2.8E-06
ESE	2.6E-06	3.0E-06	1.7E-06	1.7E-06	2.5E-06	2.2E-06	3.0E-06
E	3.1E-06	3.7E-06	2.0E-06	1.9E-06	3.0E-06	2.6E-06	3.6E-06
ENE	3.0E-06	3.7E-06	1.9E-06	1.8E-06	2.9E-06	2.6E-06	3.6E-06
NE	2.6E-06	3.2E-06	1.6E-06	1.6E-06	2.5E-06	2.2E-06	3.1E-06
NNE	1.6E-06	2.0E-06	1.0E-06	9.7E-07	1.6E-06	1.4E-06	2.0E-06

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1967	2053	2001	1511	1542	2127
N	1.0E-06	9.7E-07	1.0E-06	1.4E-06	1.4E-06	9.3E-07
NNW	6.8E-07	6.4E-07	6.6E-07	9.3E-07	9.1E-07	6.1E-07
NW	6.9E-07	6.5E-07	6.8E-07	9.5E-07	9.3E-07	6.3E-07
WNW	7.5E-07	7.1E-07	7.3E-07	1.0E-06	9.9E-07	6.8E-07
W	1.2E-06	1.1E-06	1.2E-06	1.6E-06	1.6E-06	1.1E-06
WSW	1.1E-06	1.1E-06	1.1E-06	1.6E-06	1.6E-06	1.0E-06
SW	6.6E-07	6.3E-07	6.5E-07	9.3E-07	9.1E-07	6.0E-07
SSW	5.8E-07	5.5E-07	5.7E-07	7.9E-07	7.8E-07	5.2E-07
S	7.0E-07	6.7E-07	6.9E-07	9.5E-07	9.3E-07	6.4E-07
SSE	1.4E-06	1.3E-06	1.4E-06	1.8E-06	1.8E-06	1.3E-06
SE	2.2E-06	2.1E-06	2.2E-06	2.9E-06	2.8E-06	2.0E-06
ESE	2.4E-06	2.3E-06	2.3E-06	3.1E-06	3.0E-06	2.2E-06
E	2.8E-06	2.7E-06	2.7E-06	3.8E-06	3.7E-06	2.5E-06
ENE	2.7E-06	2.6E-06	2.7E-06	3.8E-06	3.7E-06	2.5E-06
NE	2.4E-06	2.2E-06	2.3E-06	3.3E-06	3.2E-06	2.1E-06
NNE	1.5E-06	1.4E-06	1.4E-06	2.1E-06	2.0E-06	1.3E-06

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 1558	1735	1828	2156	2876	2011	2362
N	1.8E-11	1.5E-11	1.5E-11	1.2E-11	7.9E-12	1.3E-11	1.0E-11
NNW	1.2E-11	1.0E-11	9.5E-12	7.6E-12	5.1E-12	8.4E-12	6.8E-12
NW	1.2E-11	1.0E-11	9.7E-12	7.8E-12	5.2E-12	8.5E-12	6.9E-12
WNW	1.3E-11	1.1E-11	1.0E-11	8.5E-12	5.8E-12	9.3E-12	7.6E-12
W	2.0E-11	1.8E-11	1.7E-11	1.4E-11	9.1E-12	1.5E-11	1.2E-11
WSW	2.0E-11	1.8E-11	1.6E-11	1.3E-11	8.4E-12	1.4E-11	1.1E-11
SW	1.1E-11	1.0E-11	9.3E-12	7.4E-12	4.9E-12	8.2E-12	6.5E-12
SSW	9.8E-12	8.6E-12	8.0E-12	6.5E-12	4.3E-12	7.1E-12	5.7E-12
S	1.2E-11	1.0E-11	9.8E-12	8.0E-12	5.4E-12	8.7E-12	7.1E-12
SSE	2.3E-11	2.1E-11	1.9E-11	1.6E-11	1.1E-11	1.7E-11	1.4E-11
SE	3.7E-11	3.3E-11	3.1E-11	2.6E-11	1.8E-11	2.8E-11	2.4E-11
ESE	3.9E-11	3.5E-11	3.3E-11	2.8E-11	1.9E-11	3.0E-11	2.5E-11
E	4.8E-11	4.2E-11	4.0E-11	3.3E-11	2.2E-11	3.6E-11	2.9E-11
ENE	4.8E-11	4.2E-11	3.9E-11	3.2E-11	2.1E-11	3.5E-11	2.8E-11
NE	4.1E-11	3.6E-11	3.4E-11	2.7E-11	1.8E-11	3.0E-11	2.4E-11
NNE	2.6E-11	2.2E-11	2.1E-11	1.7E-11	1.1E-11	1.8E-11	1.5E-11

Direction	Distance (m) 1812	1546	2599	2668	1873	2071	1572
N	1.5E-11	1.8E-11	9.1E-12	8.8E-12	1.4E-11	1.2E-11	1.7E-11
NNW	9.6E-12	1.2E-11	5.9E-12	5.7E-12	9.2E-12	8.1E-12	1.1E-11
NW	9.8E-12	1.2E-11	6.0E-12	5.8E-12	9.4E-12	8.2E-12	1.2E-11
WNW	1.1E-11	1.3E-11	6.7E-12	6.4E-12	1.0E-11	9.0E-12	1.2E-11
W	1.7E-11	2.0E-11	1.1E-11	1.0E-11	1.6E-11	1.4E-11	2.0E-11
WSW	1.7E-11	2.1E-11	9.8E-12	9.5E-12	1.6E-11	1.4E-11	2.0E-11
SW	9.4E-12	1.2E-11	5.7E-12	5.5E-12	9.0E-12	7.8E-12	1.1E-11
SSW	8.1E-12	9.9E-12	5.0E-12	4.8E-12	7.8E-12	6.8E-12	9.7E-12
S	9.9E-12	1.2E-11	6.2E-12	6.0E-12	9.5E-12	8.4E-12	1.2E-11
SSE	2.0E-11	2.3E-11	1.3E-11	1.2E-11	1.9E-11	1.7E-11	2.3E-11
SE	3.2E-11	3.7E-11	2.1E-11	2.0E-11	3.1E-11	2.7E-11	3.6E-11
ESE	3.4E-11	3.9E-11	2.2E-11	2.1E-11	3.3E-11	2.9E-11	3.9E-11
E	4.0E-11	4.8E-11	2.6E-11	2.5E-11	3.9E-11	3.4E-11	4.7E-11
ENE	4.0E-11	4.8E-11	2.4E-11	2.4E-11	3.8E-11	3.3E-11	4.7E-11
NE	3.4E-11	4.2E-11	2.1E-11	2.0E-11	3.3E-11	2.9E-11	4.1E-11
NNE	2.1E-11	2.6E-11	1.3E-11	1.2E-11	2.0E-11	1.8E-11	2.5E-11

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1967	2053	2001	1511	1542	2127
N	1.3E-11	1.2E-11	1.3E-11	1.8E-11	1.8E-11	1.2E-11
NNW	8.6E-12	8.1E-12	8.4E-12	1.2E-11	1.2E-11	7.8E-12
NW	8.8E-12	8.3E-12	8.6E-12	1.2E-11	1.2E-11	7.9E-12
WNW	9.6E-12	9.1E-12	9.4E-12	1.3E-11	1.3E-11	8.7E-12
W	1.5E-11	1.4E-11	1.5E-11	2.1E-11	2.0E-11	1.4E-11
WSW	1.5E-11	1.4E-11	1.4E-11	2.1E-11	2.1E-11	1.3E-11
SW	8.4E-12	7.9E-12	8.2E-12	1.2E-11	1.2E-11	7.6E-12
SSW	7.3E-12	6.9E-12	7.1E-12	1.0E-11	9.9E-12	6.6E-12
S	9.0E-12	8.5E-12	8.8E-12	1.2E-11	1.2E-11	8.1E-12
SSE	1.8E-11	1.7E-11	1.8E-11	2.4E-11	2.3E-11	1.6E-11
SE	2.9E-11	2.8E-11	2.8E-11	3.8E-11	3.7E-11	2.7E-11
ESE	3.1E-11	3.0E-11	3.0E-11	4.0E-11	3.9E-11	2.8E-11
E	3.7E-11	3.5E-11	3.6E-11	4.9E-11	4.8E-11	3.3E-11
ENE	3.6E-11	3.4E-11	3.5E-11	4.9E-11	4.8E-11	3.2E-11
NE	3.1E-11	2.9E-11	3.0E-11	4.3E-11	4.2E-11	2.8E-11
NNE	1.9E-11	1.8E-11	1.9E-11	2.7E-11	2.6E-11	1.7E-11

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:55 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

6.13E-06

At This Location: 939 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 53 Bio-Assay & Low-Level Lab Hoods [G1]

Dataset Name: 97-Z006-G1
Dataset Date: Apr 7, 1998 12:35 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 939 Meters East Northeast
Lifetime Fatal Cancer Risk: 7.79E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.97E-08
BREAST	2.24E-08
R MAR	8.55E-07
LUNGS	4.61E-05
THYROID	1.92E-08
ENDOST	1.13E-05
RMNDR	5.10E-07
EFFEC	6.13E-06

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	1.6E-08	1.6E-08
U-235	Y	1.00	8.7E-10	8.7E-10
U-236	Y	1.00	6.4E-10	6.4E-10
U-238	Y	1.00	1.8E-08	1.8E-08
RA-226	W	1.00	1.2E-11	1.2E-11
RA-228	W	1.00	4.7E-11	4.7E-11
TH-228	Y	1.00	4.9E-10	4.9E-10
TH-230	Y	1.00	1.5E-09	1.5E-09
TH-232	Y	1.00	7.8E-11	7.8E-11
TH-234	Y	1.00	7.3E-08	7.3E-08

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	11.89
Diameter (m):	0.28
Plume Rise Momentum (m/s): (Exit Velocity)	4.62E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1368	1351	2156	1815	1523	1161	1163	1185	1212	1312
1296	1244	1101	1083	1646	1143	939	940	1627	1681

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:55 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 53 Bio-Assay & Low-Level Lab Hoods [G1]

Dataset Name: 97-Z006-G1
Dataset Date: Apr 7, 1998 12:35 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.97E-08
BREAST	2.24E-08
R MAR	8.55E-07
LUNGS	4.61E-05
THYROID	1.92E-08
ENDOST	1.13E-05
RMNDR	5.10E-07
EFFEC	6.13E-06

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	3.68E-07
INHALATION	5.76E-06
AIR IMMERSION	4.84E-13
GROUND SURFACE	3.87E-09
INTERNAL	6.13E-06
EXTERNAL	3.87E-09
TOTAL	6.14E-06

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	2.66E-06
U-235	1.34E-07
U-236	9.78E-08
U-238	2.64E-06
RA-226	2.66E-10
RA-228	4.31E-10
TH-228	1.45E-07
TH-230	4.25E-07
TH-232	3.26E-08
TH-234	7.16E-09
TOTAL	6.14E-06

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	8.42E-13
BONE	5.57E-13
THYROID	4.41E-15
BREAST	4.98E-14
LUNG	7.52E-11
STOMACH	3.33E-14
BOWEL	8.80E-14
LIVER	3.98E-14
PANCREAS	1.93E-14
URINARY	1.06E-12
OTHER	2.37E-14
TOTAL	7.79E-11

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.95E-12
INHALATION	7.58E-11
AIR IMMERSION	1.08E-17
GROUND SURFACE	8.90E-14
INTERNAL	7.78E-11
EXTERNAL	8.90E-14
TOTAL	7.79E-11

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	3.40E-11
U-235	1.75E-12
U-236	1.25E-12
U-238	3.41E-11
RA-226	3.44E-15
RA-228	4.33E-15
TH-228	2.90E-12
TH-230	3.48E-12
TH-232	1.84E-13
TH-234	2.21E-13
TOTAL	7.79E-11

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1368	1351	2156	1815	1523	1161	1163
N	1.5E-06	1.5E-06	9.2E-07	1.1E-06	1.3E-06	1.8E-06	1.8E-06
NNW	1.0E-06	1.0E-06	6.2E-07	7.5E-07	9.1E-07	1.2E-06	1.2E-06
NW	1.0E-06	1.0E-06	6.3E-07	7.6E-07	9.2E-07	1.2E-06	1.2E-06
WNW	1.0E-06	1.0E-06	6.5E-07	7.7E-07	9.1E-07	1.2E-06	1.2E-06
W	1.6E-06	1.7E-06	1.0E-06	1.2E-06	1.5E-06	2.0E-06	2.0E-06
WSW	2.1E-06	2.1E-06	1.1E-06	1.4E-06	1.8E-06	2.6E-06	2.6E-06
SW	1.1E-06	1.2E-06	6.5E-07	8.0E-07	9.9E-07	1.4E-06	1.4E-06
SSW	9.0E-07	9.2E-07	5.4E-07	6.6E-07	8.0E-07	1.1E-06	1.1E-06
S	9.9E-07	1.0E-06	6.3E-07	7.4E-07	8.9E-07	1.2E-06	1.2E-06
SSE	1.6E-06	1.6E-06	1.1E-06	1.3E-06	1.5E-06	1.9E-06	1.9E-06
SE	2.3E-06	2.4E-06	1.7E-06	1.9E-06	2.2E-06	2.7E-06	2.7E-06
ESE	2.5E-06	2.6E-06	1.8E-06	2.1E-06	2.3E-06	2.9E-06	2.9E-06
E	3.6E-06	3.6E-06	2.3E-06	2.7E-06	3.2E-06	4.2E-06	4.2E-06
ENE	4.0E-06	4.0E-06	2.4E-06	2.9E-06	3.5E-06	4.8E-06	4.8E-06
NE	3.5E-06	3.6E-06	2.1E-06	2.6E-06	3.1E-06	4.3E-06	4.3E-06
NNE	2.3E-06	2.3E-06	1.4E-06	1.7E-06	2.0E-06	2.8E-06	2.8E-06

	Distance (m)						
Direction	1185	1212	1312	1296	1244	1101	1083
N	1.8E-06	1.7E-06	1.6E-06	1.6E-06	1.7E-06	1.9E-06	2.0E-06
NNW	1.2E-06	1.2E-06	1.1E-06	1.1E-06	1.1E-06	1.3E-06	1.4E-06
NW	1.2E-06	1.2E-06	1.1E-06	1.1E-06	1.2E-06	1.3E-06	1.4E-06
WNW	1.2E-06	1.2E-06	1.1E-06	1.1E-06	1.1E-06	1.3E-06	1.3E-06
W	1.9E-06	1.9E-06	1.7E-06	1.8E-06	1.8E-06	2.1E-06	2.2E-06
WSW	2.5E-06	2.4E-06	2.2E-06	2.2E-06	2.3E-06	2.8E-06	2.8E-06
SW	1.4E-06	1.3E-06	1.2E-06	1.2E-06	1.3E-06	1.5E-06	1.5E-06
SSW	1.1E-06	1.0E-06	9.5E-07	9.6E-07	1.0E-06	1.2E-06	1.2E-06
S	1.2E-06	1.1E-06	1.0E-06	1.1E-06	1.1E-06	1.3E-06	1.3E-06
SSE	1.8E-06	1.8E-06	1.7E-06	1.7E-06	1.8E-06	2.0E-06	2.0E-06
SE	2.6E-06	2.6E-06	2.4E-06	2.4E-06	2.5E-06	2.8E-06	2.9E-06
ESE	2.9E-06	2.8E-06	2.6E-06	2.7E-06	2.8E-06	3.1E-06	3.1E-06
E	4.1E-06	4.0E-06	3.7E-06	3.7E-06	3.9E-06	4.5E-06	4.5E-06
ENE	4.7E-06	4.5E-06	4.2E-06	4.2E-06	4.4E-06	5.1E-06	5.2E-06
NE	4.2E-06	4.1E-06	3.7E-06	3.7E-06	3.9E-06	4.5E-06	4.6E-06
NNE	2.8E-06	2.7E-06	2.4E-06	2.5E-06	2.6E-06	3.0E-06	3.1E-06

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1646	1143	939	940	1627	1681
N	1.2E-06	1.9E-06	2.3E-06	2.3E-06	1.2E-06	1.2E-06
NNW	8.3E-07	1.3E-06	1.6E-06	1.6E-06	8.5E-07	8.2E-07
NW	8.4E-07	1.3E-06	1.6E-06	1.6E-06	8.5E-07	8.2E-07
WNW	8.5E-07	1.2E-06	1.5E-06	1.5E-06	8.6E-07	8.3E-07
W	1.4E-06	2.0E-06	2.6E-06	2.6E-06	1.4E-06	1.3E-06
WSW	1.6E-06	2.6E-06	3.4E-06	3.4E-06	1.6E-06	1.6E-06
SW	9.0E-07	1.4E-06	1.9E-06	1.9E-06	9.1E-07	8.7E-07
SSW	7.3E-07	1.1E-06	1.4E-06	1.4E-06	7.4E-07	7.1E-07
S	8.2E-07	1.2E-06	1.5E-06	1.5E-06	8.3E-07	8.0E-07
SSE	1.4E-06	1.9E-06	2.3E-06	2.3E-06	1.4E-06	1.4E-06
SE	2.1E-06	2.7E-06	3.3E-06	3.3E-06	2.1E-06	2.0E-06
ESE	2.2E-06	3.0E-06	3.6E-06	3.6E-06	2.2E-06	2.2E-06
E	3.0E-06	4.3E-06	5.3E-06	5.3E-06	3.0E-06	2.9E-06
ENE	3.2E-06	4.9E-06	6.1E-06	6.1E-06	3.3E-06	3.2E-06
NE	2.9E-06	4.3E-06	5.5E-06	5.5E-06	2.9E-06	2.8E-06
NNE	1.9E-06	2.9E-06	3.7E-06	3.7E-06	1.9E-06	1.8E-06

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1368	1351	2156	1815	1523	1161	1163
N	1.9E-11	1.9E-11	1.1E-11	1.4E-11	1.7E-11	2.3E-11	2.3E-11
NNW	1.3E-11	1.3E-11	7.6E-12	9.2E-12	1.1E-11	1.5E-11	1.5E-11
NW	1.3E-11	1.3E-11	7.7E-12	9.3E-12	1.1E-11	1.5E-11	1.5E-11
WNW	1.3E-11	1.3E-11	8.0E-12	9.5E-12	1.1E-11	1.5E-11	1.5E-11
W	2.1E-11	2.1E-11	1.3E-11	1.5E-11	1.8E-11	2.5E-11	2.5E-11
WSW	2.6E-11	2.6E-11	1.4E-11	1.8E-11	2.2E-11	3.2E-11	3.2E-11
SW	1.4E-11	1.4E-11	7.8E-12	9.8E-12	1.2E-11	1.8E-11	1.8E-11
SSW	1.1E-11	1.1E-11	6.5E-12	8.0E-12	9.8E-12	1.4E-11	1.4E-11
S	1.2E-11	1.2E-11	7.6E-12	9.1E-12	1.1E-11	1.5E-11	1.5E-11
SSE	2.0E-11	2.0E-11	1.4E-11	1.6E-11	1.8E-11	2.3E-11	2.3E-11
SE	3.0E-11	3.0E-11	2.2E-11	2.4E-11	2.7E-11	3.4E-11	3.4E-11
ESE	3.2E-11	3.2E-11	2.3E-11	2.6E-11	3.0E-11	3.7E-11	3.7E-11
E	4.5E-11	4.5E-11	2.9E-11	3.4E-11	4.0E-11	5.3E-11	5.3E-11
ENE	5.0E-11	5.1E-11	3.0E-11	3.7E-11	4.4E-11	6.1E-11	6.0E-11
NE	4.4E-11	4.5E-11	2.7E-11	3.2E-11	3.9E-11	5.4E-11	5.4E-11
NNE	2.9E-11	2.9E-11	1.7E-11	2.1E-11	2.5E-11	3.6E-11	3.6E-11

	Distance (m)						
Direction	1185	1212	1312	1296	1244	1101	1083
N	2.2E-11	2.2E-11	2.0E-11	2.0E-11	2.1E-11	2.4E-11	2.5E-11
NNW	1.5E-11	1.5E-11	1.3E-11	1.4E-11	1.4E-11	1.7E-11	1.7E-11
NW	1.5E-11	1.5E-11	1.3E-11	1.4E-11	1.4E-11	1.7E-11	1.7E-11
WNW	1.5E-11	1.4E-11	1.3E-11	1.3E-11	1.4E-11	1.6E-11	1.6E-11
W	2.4E-11	2.4E-11	2.2E-11	2.2E-11	2.3E-11	2.7E-11	2.7E-11
WSW	3.2E-11	3.1E-11	2.7E-11	2.8E-11	2.9E-11	3.5E-11	3.6E-11
SW	1.7E-11	1.7E-11	1.5E-11	1.5E-11	1.6E-11	1.9E-11	1.9E-11
SSW	1.3E-11	1.3E-11	1.2E-11	1.2E-11	1.3E-11	1.5E-11	1.5E-11
S	1.5E-11	1.4E-11	1.3E-11	1.3E-11	1.4E-11	1.6E-11	1.6E-11
SSE	2.3E-11	2.3E-11	2.1E-11	2.1E-11	2.2E-11	2.5E-11	2.5E-11
SE	3.3E-11	3.2E-11	3.0E-11	3.1E-11	3.2E-11	3.5E-11	3.6E-11
ESE	3.6E-11	3.5E-11	3.3E-11	3.3E-11	3.5E-11	3.9E-11	3.9E-11
E	5.2E-11	5.1E-11	4.7E-11	4.7E-11	4.9E-11	5.6E-11	5.7E-11
ENE	5.9E-11	5.8E-11	5.3E-11	5.3E-11	5.6E-11	6.4E-11	6.6E-11
NE	5.3E-11	5.1E-11	4.7E-11	4.7E-11	5.0E-11	5.8E-11	5.9E-11
NNE	3.5E-11	3.4E-11	3.1E-11	3.1E-11	3.3E-11	3.8E-11	3.9E-11

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1646	1143	939	940	1627	1681
N	1.5E-11	2.3E-11	3.0E-11	3.0E-11	1.6E-11	1.5E-11
NNW	1.0E-11	1.6E-11	2.0E-11	2.0E-11	1.0E-11	1.0E-11
NW	1.0E-11	1.6E-11	2.0E-11	2.0E-11	1.1E-11	1.0E-11
WNW	1.0E-11	1.5E-11	1.9E-11	1.9E-11	1.1E-11	1.0E-11
W	1.7E-11	2.5E-11	3.2E-11	3.2E-11	1.7E-11	1.7E-11
WSW	2.0E-11	3.3E-11	4.4E-11	4.4E-11	2.0E-11	2.0E-11
SW	1.1E-11	1.8E-11	2.4E-11	2.4E-11	1.1E-11	1.1E-11
SSW	8.9E-12	1.4E-11	1.8E-11	1.8E-11	9.0E-12	8.7E-12
S	1.0E-11	1.5E-11	1.9E-11	1.9E-11	1.0E-11	9.8E-12
SSE	1.7E-11	2.4E-11	2.9E-11	2.9E-11	1.7E-11	1.7E-11
SE	2.6E-11	3.4E-11	4.1E-11	4.1E-11	2.6E-11	2.6E-11
ESE	2.8E-11	3.7E-11	4.6E-11	4.6E-11	2.8E-11	2.8E-11
E	3.8E-11	5.4E-11	6.8E-11	6.7E-11	3.8E-11	3.7E-11
ENE	4.1E-11	6.2E-11	7.8E-11	7.8E-11	4.1E-11	4.0E-11
NE	3.6E-11	5.5E-11	7.0E-11	7.0E-11	3.6E-11	3.5E-11
NNE	2.3E-11	3.6E-11	4.7E-11	4.7E-11	2.4E-11	2.3E-11

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 3:56 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)
4.49E-06

At This Location: 1220 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 53 Bio-Assay & Low-Level Lab Hoods [G2]

Dataset Name: 97-Z006-G2
Dataset Date: Apr 7, 1998 12:35 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1220 Meters East Northeast
Lifetime Fatal Cancer Risk: 5.71E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.44E-08
BREAST	1.64E-08
R MAR	6.24E-07
LUNGS	3.38E-05
THYROID	1.40E-08
ENDOST	8.26E-06
RMNDR	3.71E-07
EFFEC	4.49E-06

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	1.6E-08	1.6E-08
U-235	Y	1.00	8.7E-10	8.7E-10
U-236	Y	1.00	6.4E-10	6.4E-10
U-238	Y	1.00	1.8E-08	1.8E-08
RA-226	W	1.00	1.2E-11	1.2E-11
RA-228	W	1.00	4.7E-11	4.7E-11
TH-228	Y	1.00	4.9E-10	4.9E-10
TH-230	Y	1.00	1.5E-09	1.5E-09
TH-232	Y	1.00	7.8E-11	7.8E-11
TH-234	Y	1.00	7.3E-08	7.3E-08

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	11.89
Diameter (m):	0.28
Plume Rise Momentum (m/s): (Exit Velocity)	4.62E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1330	1703	2253	1670	2391	2493	2050	1807	1220	2110
2180	1879	2553	1849	2147	2240	2196	1980	2013	1809

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 3:56 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 53 Bio-Assay & Low-Level Lab Hoods [G2]

Dataset Name: 97-Z006-G2
Dataset Date: Apr 7, 1998 12:35 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.44E-08
BREAST	1.64E-08
R MAR	6.24E-07
LUNGS	3.38E-05
THYROID	1.40E-08
ENDOST	8.26E-06
RMNDR	3.71E-07
EFFEC	4.49E-06

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	2.67E-07
INHALATION	4.23E-06
AIR IMMERSION	3.54E-13
GROUND SURFACE	2.86E-09
INTERNAL	4.49E-06
EXTERNAL	2.86E-09
TOTAL	4.50E-06

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.95E-06
U-235	9.80E-08
U-236	7.16E-08
U-238	1.93E-06
RA-226	1.94E-10
RA-228	3.14E-10
TH-228	1.06E-07
TH-230	3.12E-07
TH-232	2.39E-08
TH-234	5.22E-09
TOTAL	4.50E-06

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	6.14E-13
BONE	4.07E-13
THYROID	3.23E-15
BREAST	3.65E-14
LUNG	5.51E-11
STOMACH	2.43E-14
BOWEL	6.41E-14
LIVER	2.92E-14
PANCREAS	1.41E-14
URINARY	7.72E-13
OTHER	1.73E-14
TOTAL	5.71E-11

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.42E-12
INHALATION	5.56E-11
AIR IMMERSION	7.90E-18
GROUND SURFACE	6.58E-14
INTERNAL	5.70E-11
EXTERNAL	6.58E-14
TOTAL	5.71E-11

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	2.49E-11
U-235	1.28E-12
U-236	9.18E-13
U-238	2.50E-11
RA-226	2.52E-15
RA-228	3.16E-15
TH-228	2.13E-12
TH-230	2.55E-12
TH-232	1.35E-13
TH-234	1.62E-13
TOTAL	5.71E-11

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1330	1703	2253	1670	2391	2493	2050
N	1.5E-06	1.2E-06	8.6E-07	1.2E-06	8.1E-07	7.7E-07	9.6E-07
NNW	1.0E-06	7.9E-07	5.8E-07	8.0E-07	5.4E-07	5.1E-07	6.4E-07
NW	1.0E-06	7.9E-07	5.8E-07	8.1E-07	5.5E-07	5.2E-07	6.5E-07
WNW	1.0E-06	8.0E-07	6.1E-07	8.2E-07	5.7E-07	5.5E-07	6.7E-07
W	1.7E-06	1.3E-06	9.7E-07	1.3E-06	9.1E-07	8.7E-07	1.1E-06
WSW	2.1E-06	1.5E-06	1.1E-06	1.6E-06	9.7E-07	9.2E-07	1.2E-06
SW	1.2E-06	8.4E-07	5.9E-07	8.6E-07	5.5E-07	5.2E-07	6.7E-07
SSW	9.2E-07	6.9E-07	5.0E-07	7.0E-07	4.7E-07	4.5E-07	5.6E-07
S	1.0E-06	7.7E-07	5.8E-07	7.9E-07	5.5E-07	5.2E-07	6.4E-07
SSE	1.6E-06	1.3E-06	1.1E-06	1.4E-06	1.0E-06	9.8E-07	1.2E-06
SE	2.4E-06	2.0E-06	1.7E-06	2.0E-06	1.6E-06	1.5E-06	1.8E-06
ESE	2.6E-06	2.2E-06	1.8E-06	2.2E-06	1.7E-06	1.6E-06	1.9E-06
E	3.6E-06	2.9E-06	2.2E-06	2.9E-06	2.1E-06	2.0E-06	2.4E-06
ENE	4.1E-06	3.1E-06	2.3E-06	3.2E-06	2.1E-06	2.0E-06	2.5E-06
NE	3.6E-06	2.7E-06	2.0E-06	2.8E-06	1.9E-06	1.8E-06	2.2E-06
NNE	2.4E-06	1.8E-06	1.3E-06	1.8E-06	1.2E-06	1.1E-06	1.4E-06

	Distance (m)						
Direction	1807	1220	2110	2180	1879	2553	1849
N	1.1E-06	1.7E-06	9.3E-07	8.9E-07	1.1E-06	7.5E-07	1.1E-06
NNW	7.4E-07	1.2E-06	6.2E-07	6.0E-07	7.0E-07	5.0E-07	7.2E-07
NW	7.4E-07	1.2E-06	6.3E-07	6.1E-07	7.1E-07	5.1E-07	7.3E-07
WNW	7.6E-07	1.1E-06	6.5E-07	6.3E-07	7.3E-07	5.4E-07	7.4E-07
W	1.2E-06	1.9E-06	1.0E-06	1.0E-06	1.2E-06	8.5E-07	1.2E-06
WSW	1.4E-06	2.4E-06	1.1E-06	1.1E-06	1.3E-06	8.9E-07	1.4E-06
SW	7.8E-07	1.3E-06	6.5E-07	6.2E-07	7.4E-07	5.1E-07	7.6E-07
SSW	6.4E-07	1.0E-06	5.4E-07	5.2E-07	6.1E-07	4.3E-07	6.2E-07
S	7.3E-07	1.1E-06	6.2E-07	6.0E-07	7.0E-07	5.1E-07	7.1E-07
SSE	1.3E-06	1.8E-06	1.1E-06	1.1E-06	1.2E-06	9.5E-07	1.3E-06
SE	1.9E-06	2.5E-06	1.7E-06	1.7E-06	1.9E-06	1.5E-06	1.9E-06
ESE	2.1E-06	2.8E-06	1.9E-06	1.8E-06	2.0E-06	1.6E-06	2.0E-06
E	2.7E-06	4.0E-06	2.4E-06	2.3E-06	2.6E-06	2.0E-06	2.7E-06
ENE	2.9E-06	4.5E-06	2.5E-06	2.4E-06	2.8E-06	2.0E-06	2.8E-06
NE	2.6E-06	4.0E-06	2.1E-06	2.1E-06	2.4E-06	1.7E-06	2.5E-06
NNE	1.6E-06	2.6E-06	1.4E-06	1.3E-06	1.6E-06	1.1E-06	1.6E-06

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2147	2240	2196	1980	2013	1809
N	9.1E-07	8.7E-07	8.9E-07	9.9E-07	9.7E-07	1.1E-06
NNW	6.1E-07	5.8E-07	5.9E-07	6.6E-07	6.5E-07	7.4E-07
NW	6.2E-07	5.9E-07	6.0E-07	6.7E-07	6.6E-07	7.4E-07
WNW	6.4E-07	6.1E-07	6.3E-07	6.9E-07	6.8E-07	7.6E-07
W	1.0E-06	9.7E-07	9.9E-07	1.1E-06	1.1E-06	1.2E-06
WSW	1.1E-06	1.1E-06	1.1E-06	1.2E-06	1.2E-06	1.4E-06
SW	6.3E-07	6.0E-07	6.1E-07	7.0E-07	6.8E-07	7.8E-07
SSW	5.3E-07	5.0E-07	5.1E-07	5.8E-07	5.7E-07	6.4E-07
S	6.1E-07	5.8E-07	6.0E-07	6.6E-07	6.5E-07	7.3E-07
SSE	1.1E-06	1.1E-06	1.1E-06	1.2E-06	1.2E-06	1.3E-06
SE	1.7E-06	1.7E-06	1.7E-06	1.8E-06	1.8E-06	1.9E-06
ESE	1.8E-06	1.8E-06	1.8E-06	1.9E-06	1.9E-06	2.1E-06
E	2.3E-06	2.2E-06	2.3E-06	2.5E-06	2.5E-06	2.7E-06
ENE	2.4E-06	2.3E-06	2.3E-06	2.6E-06	2.6E-06	2.9E-06
NE	2.1E-06	2.0E-06	2.1E-06	2.3E-06	2.3E-06	2.6E-06
NNE	1.3E-06	1.3E-06	1.3E-06	1.5E-06	1.4E-06	1.6E-06

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1330	1703	2253	1670	2391	2493	2050
N	1.9E-11	1.5E-11	1.1E-11	1.5E-11	1.0E-11	9.6E-12	1.2E-11
NNW	1.3E-11	9.8E-12	7.1E-12	1.0E-11	6.6E-12	6.3E-12	7.9E-12
NW	1.3E-11	9.9E-12	7.2E-12	1.0E-11	6.7E-12	6.4E-12	8.0E-12
WNW	1.3E-11	1.0E-11	7.5E-12	1.0E-11	7.1E-12	6.8E-12	8.3E-12
W	2.1E-11	1.6E-11	1.2E-11	1.7E-11	1.1E-11	1.1E-11	1.3E-11
WSW	2.7E-11	1.9E-11	1.3E-11	2.0E-11	1.2E-11	1.1E-11	1.5E-11
SW	1.5E-11	1.0E-11	7.3E-12	1.1E-11	6.8E-12	6.4E-12	8.3E-12
SSW	1.1E-11	8.5E-12	6.1E-12	8.7E-12	5.7E-12	5.4E-12	6.8E-12
S	1.3E-11	9.6E-12	7.1E-12	9.8E-12	6.7E-12	6.4E-12	7.9E-12
SSE	2.1E-11	1.7E-11	1.3E-11	1.7E-11	1.3E-11	1.2E-11	1.4E-11
SE	3.0E-11	2.5E-11	2.1E-11	2.6E-11	2.0E-11	1.9E-11	2.2E-11
ESE	3.3E-11	2.7E-11	2.2E-11	2.8E-11	2.1E-11	2.0E-11	2.4E-11
E	4.6E-11	3.6E-11	2.8E-11	3.7E-11	2.6E-11	2.5E-11	3.1E-11
ENE	5.2E-11	3.9E-11	2.9E-11	4.0E-11	2.7E-11	2.6E-11	3.2E-11
NE	4.6E-11	3.5E-11	2.5E-11	3.5E-11	2.4E-11	2.2E-11	2.8E-11
NNE	3.0E-11	2.2E-11	1.6E-11	2.3E-11	1.5E-11	1.4E-11	1.8E-11

	Distance (m)						
Direction	1807	1220	2110	2180	1879	2553	1849
N	1.4E-11	2.1E-11	1.2E-11	1.1E-11	1.3E-11	9.3E-12	1.3E-11
NNW	9.1E-12	1.4E-11	7.6E-12	7.4E-12	8.7E-12	6.1E-12	8.9E-12
NW	9.2E-12	1.5E-11	7.8E-12	7.5E-12	8.8E-12	6.2E-12	9.0E-12
WNW	9.4E-12	1.4E-11	8.0E-12	7.8E-12	9.0E-12	6.6E-12	9.2E-12
W	1.5E-11	2.3E-11	1.3E-11	1.3E-11	1.5E-11	1.1E-11	1.5E-11
WSW	1.8E-11	3.0E-11	1.4E-11	1.4E-11	1.7E-11	1.1E-11	1.7E-11
SW	9.7E-12	1.6E-11	8.0E-12	7.6E-12	9.2E-12	6.2E-12	9.4E-12
SSW	7.9E-12	1.3E-11	6.6E-12	6.4E-12	7.6E-12	5.3E-12	7.7E-12
S	9.0E-12	1.4E-11	7.7E-12	7.4E-12	8.7E-12	6.2E-12	8.8E-12
SSE	1.6E-11	2.2E-11	1.4E-11	1.4E-11	1.5E-11	1.2E-11	1.6E-11
SE	2.4E-11	3.2E-11	2.2E-11	2.1E-11	2.4E-11	1.9E-11	2.4E-11
ESE	2.6E-11	3.5E-11	2.3E-11	2.3E-11	2.5E-11	2.0E-11	2.6E-11
E	3.4E-11	5.0E-11	3.0E-11	2.9E-11	3.3E-11	2.5E-11	3.4E-11
ENE	3.7E-11	5.7E-11	3.1E-11	3.0E-11	3.5E-11	2.5E-11	3.6E-11
NE	3.2E-11	5.1E-11	2.7E-11	2.6E-11	3.1E-11	2.2E-11	3.1E-11
NNE	2.1E-11	3.3E-11	1.7E-11	1.7E-11	2.0E-11	1.4E-11	2.0E-11

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2147	2240	2196	1980	2013	1809
N	1.1E-11	1.1E-11	1.1E-11	1.2E-11	1.2E-11	1.4E-11
NNW	7.5E-12	7.1E-12	7.3E-12	8.2E-12	8.1E-12	9.1E-12
NW	7.6E-12	7.3E-12	7.4E-12	8.3E-12	8.2E-12	9.2E-12
WNW	7.9E-12	7.6E-12	7.7E-12	8.6E-12	8.4E-12	9.4E-12
W	1.3E-11	1.2E-11	1.2E-11	1.4E-11	1.4E-11	1.5E-11
WSW	1.4E-11	1.3E-11	1.4E-11	1.6E-11	1.5E-11	1.8E-11
SW	7.8E-12	7.4E-12	7.6E-12	8.6E-12	8.5E-12	9.7E-12
SSW	6.5E-12	6.2E-12	6.3E-12	7.1E-12	7.0E-12	7.9E-12
S	7.5E-12	7.2E-12	7.3E-12	8.2E-12	8.0E-12	9.0E-12
SSE	1.4E-11	1.3E-11	1.4E-11	1.5E-11	1.5E-11	1.6E-11
SE	2.2E-11	2.1E-11	2.1E-11	2.3E-11	2.3E-11	2.4E-11
ESE	2.3E-11	2.2E-11	2.3E-11	2.4E-11	2.4E-11	2.6E-11
E	2.9E-11	2.8E-11	2.9E-11	3.2E-11	3.1E-11	3.4E-11
ENE	3.0E-11	2.9E-11	3.0E-11	3.3E-11	3.3E-11	3.7E-11
NE	2.7E-11	2.5E-11	2.6E-11	2.9E-11	2.9E-11	3.2E-11
NNE	1.7E-11	1.6E-11	1.6E-11	1.9E-11	1.8E-11	2.1E-11

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 4:03 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)
2.11E-04

At This Location: 908 Meters East

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 65 Fugitive Emissions [G1]

Dataset Name: 97-Z024-G1
Dataset Date: Apr 7, 1998 12:16 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 908 Meters East
Lifetime Fatal Cancer Risk: 2.44E-09

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.59E-06
BREAST	1.60E-06
R MAR	9.89E-05
LUNGS	1.34E-03
THYROID	1.58E-06
ENDOST	1.22E-03
RMNDR	3.08E-06
EFFEC	2.11E-04

Apr 7, 1998 4:03 pm

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
AC-228	Y	1.00	1.1E-07	1.1E-07
BI-212	W	1.00	1.1E-07	1.1E-07
PB-212	D	1.00	1.1E-07	1.1E-07
PO-212	W	1.00	6.7E-08	6.7E-08
PO-216	W	1.00	1.1E-07	1.1E-07
RA-224	W	1.00	1.1E-07	1.1E-07
RA-228	W	1.00	1.1E-07	1.1E-07
TH-228	Y	1.00	1.1E-07	1.1E-07
TH-232	Y	1.00	1.1E-07	1.1E-07
TL-208	D	1.00	3.8E-08	3.8E-08

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	1.00
Diameter (m):	0.30
Plume Rise Momentum (m/s): (Exit Velocity)	1.00E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

908	913	1855	1648	1437	1388	1534	1597	1630	1759
1749	1719	1576	1555	2072	1510	1088	1051	1289	1233

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 4:03 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 65 Fugitive Emissions [G1]

Dataset Name: 97-Z024-G1
Dataset Date: Apr 7, 1998 12:16 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.59E-06
BREAST	1.60E-06
R MAR	9.89E-05
LUNGS	1.34E-03
THYROID	1.58E-06
ENDOST	1.22E-03
RMNDR	3.08E-06
EFFEC	2.11E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	2.90E-06
INHALATION	2.08E-04
AIR IMMERSION	2.76E-10
GROUND SURFACE	4.73E-09
INTERNAL	2.11E-04
EXTERNAL	5.01E-09
TOTAL	2.11E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
AC-228	2.83E-08
BI-212	9.44E-09
PB-212	5.53E-08
PO-212	0.00E+00
PO-216	0.00E+00
RA-224	1.18E-06
RA-228	2.32E-06
TH-228	8.44E-05
TH-232	1.23E-04
TL-208	1.90E-11
TOTAL	2.11E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	8.79E-11
BONE	5.75E-11
THYROID	2.66E-13
BREAST	2.25E-12
LUNG	2.28E-09
STOMACH	1.93E-12
BOWEL	2.05E-12
LIVER	5.85E-12
PANCREAS	1.39E-12
URINARY	8.49E-13
OTHER	1.70E-12
TOTAL	2.44E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.57E-11
INHALATION	2.42E-09
AIR IMMERSION	6.61E-15
GROUND SURFACE	1.03E-13
INTERNAL	2.44E-09
EXTERNAL	1.10E-13
TOTAL	2.44E-09

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
AC-228	5.72E-13
BI-212	1.21E-13
PB-212	9.48E-13
PO-212	0.00E+00
PO-216	0.00E+00
RA-224	2.66E-11
RA-228	2.44E-11
TH-228	1.69E-09
TH-232	6.95E-10
TL-208	4.66E-16
TOTAL	2.44E-09

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	908	913	1855	1648	1437	1388	1534
N	7.2E-05	7.1E-05	1.9E-05	2.4E-05	3.0E-05	3.3E-05	2.7E-05
NNW	4.6E-05	4.6E-05	1.2E-05	1.5E-05	2.0E-05	2.1E-05	1.7E-05
NW	4.7E-05	4.7E-05	1.2E-05	1.5E-05	2.0E-05	2.1E-05	1.8E-05
WNW	5.4E-05	5.3E-05	1.4E-05	1.7E-05	2.2E-05	2.4E-05	2.0E-05
W	8.5E-05	8.4E-05	2.2E-05	2.8E-05	3.6E-05	3.8E-05	3.2E-05
WSW	7.5E-05	7.5E-05	2.1E-05	2.6E-05	3.3E-05	3.5E-05	2.9E-05
SW	4.4E-05	4.4E-05	1.2E-05	1.5E-05	1.9E-05	2.0E-05	1.7E-05
SSW	3.9E-05	3.9E-05	1.1E-05	1.3E-05	1.7E-05	1.8E-05	1.5E-05
S	5.0E-05	4.9E-05	1.3E-05	1.6E-05	2.1E-05	2.2E-05	1.9E-05
SSE	1.1E-04	1.1E-04	2.7E-05	3.4E-05	4.4E-05	4.7E-05	3.9E-05
SE	1.8E-04	1.8E-04	4.4E-05	5.6E-05	7.3E-05	7.8E-05	6.4E-05
ESE	1.9E-04	1.9E-04	4.7E-05	5.9E-05	7.7E-05	8.3E-05	6.8E-05
E	2.1E-04	2.1E-04	5.4E-05	6.7E-05	8.8E-05	9.4E-05	7.7E-05
ENE	2.0E-04	1.9E-04	5.1E-05	6.4E-05	8.2E-05	8.8E-05	7.3E-05
NE	1.7E-04	1.7E-04	4.4E-05	5.5E-05	7.1E-05	7.6E-05	6.3E-05
NNE	1.0E-04	1.0E-04	2.7E-05	3.4E-05	4.4E-05	4.7E-05	3.9E-05

	Distance (m)						
Direction	1597	1630	1759	1749	1719	1576	1555
N	2.5E-05	2.4E-05	2.1E-05	2.1E-05	2.2E-05	2.6E-05	2.6E-05
NNW	1.6E-05	1.6E-05	1.3E-05	1.4E-05	1.4E-05	1.6E-05	1.7E-05
NW	1.6E-05	1.6E-05	1.4E-05	1.4E-05	1.4E-05	1.7E-05	1.7E-05
WNW	1.8E-05	1.8E-05	1.5E-05	1.5E-05	1.6E-05	1.9E-05	1.9E-05
W	2.9E-05	2.8E-05	2.4E-05	2.5E-05	2.6E-05	3.0E-05	3.1E-05
WSW	2.7E-05	2.6E-05	2.3E-05	2.3E-05	2.4E-05	2.8E-05	2.8E-05
SW	1.6E-05	1.5E-05	1.3E-05	1.3E-05	1.4E-05	1.6E-05	1.7E-05
SSW	1.4E-05	1.3E-05	1.2E-05	1.2E-05	1.2E-05	1.4E-05	1.4E-05
S	1.7E-05	1.7E-05	1.4E-05	1.5E-05	1.5E-05	1.8E-05	1.8E-05
SSE	3.6E-05	3.4E-05	3.0E-05	3.0E-05	3.1E-05	3.7E-05	3.8E-05
SE	5.9E-05	5.7E-05	4.9E-05	5.0E-05	5.1E-05	6.1E-05	6.2E-05
ESE	6.3E-05	6.0E-05	5.2E-05	5.3E-05	5.5E-05	6.4E-05	6.6E-05
E	7.1E-05	6.9E-05	5.9E-05	6.0E-05	6.2E-05	7.3E-05	7.5E-05
ENE	6.7E-05	6.5E-05	5.6E-05	5.7E-05	5.9E-05	6.9E-05	7.1E-05
NE	5.8E-05	5.6E-05	4.9E-05	4.9E-05	5.1E-05	6.0E-05	6.1E-05
NNE	3.6E-05	3.5E-05	3.0E-05	3.0E-05	3.1E-05	3.7E-05	3.8E-05

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2072	1510	1088	1051	1289	1233
N	1.5E-05	2.8E-05	5.1E-05	5.4E-05	3.7E-05	4.1E-05
NNW	9.9E-06	1.8E-05	3.3E-05	3.5E-05	2.4E-05	2.6E-05
NW	1.0E-05	1.8E-05	3.3E-05	3.5E-05	2.5E-05	2.7E-05
WNW	1.1E-05	2.0E-05	3.8E-05	4.0E-05	2.8E-05	3.0E-05
W	1.8E-05	3.2E-05	6.0E-05	6.4E-05	4.4E-05	4.8E-05
WSW	1.7E-05	3.0E-05	5.4E-05	5.7E-05	4.0E-05	4.3E-05
SW	9.9E-06	1.7E-05	3.1E-05	3.3E-05	2.3E-05	2.5E-05
SSW	8.6E-06	1.5E-05	2.8E-05	3.0E-05	2.1E-05	2.2E-05
S	1.1E-05	1.9E-05	3.5E-05	3.8E-05	2.6E-05	2.8E-05
SSE	2.2E-05	4.0E-05	7.5E-05	8.0E-05	5.4E-05	5.9E-05
SE	3.5E-05	6.6E-05	1.2E-04	1.3E-04	9.0E-05	9.8E-05
ESE	3.8E-05	7.0E-05	1.3E-04	1.4E-04	9.6E-05	1.0E-04
E	4.3E-05	7.9E-05	1.5E-04	1.6E-04	1.1E-04	1.2E-04
ENE	4.1E-05	7.5E-05	1.4E-04	1.5E-04	1.0E-04	1.1E-04
NE	3.6E-05	6.5E-05	1.2E-04	1.3E-04	8.8E-05	9.5E-05
NNE	2.2E-05	4.0E-05	7.3E-05	7.7E-05	5.4E-05	5.8E-05

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	908	913	1855	1648	1437	1388	1534
N	8.3E-10	8.2E-10	2.2E-10	2.7E-10	3.5E-10	3.7E-10	3.1E-10
NNW	5.3E-10	5.3E-10	1.4E-10	1.7E-10	2.2E-10	2.4E-10	2.0E-10
NW	5.4E-10	5.4E-10	1.4E-10	1.8E-10	2.3E-10	2.4E-10	2.0E-10
WNW	6.2E-10	6.1E-10	1.6E-10	2.0E-10	2.6E-10	2.8E-10	2.3E-10
W	9.8E-10	9.7E-10	2.5E-10	3.2E-10	4.1E-10	4.4E-10	3.6E-10
WSW	8.7E-10	8.6E-10	2.4E-10	2.9E-10	3.8E-10	4.0E-10	3.3E-10
SW	5.1E-10	5.0E-10	1.4E-10	1.7E-10	2.2E-10	2.3E-10	1.9E-10
SSW	4.5E-10	4.5E-10	1.2E-10	1.5E-10	1.9E-10	2.1E-10	1.7E-10
S	5.7E-10	5.7E-10	1.5E-10	1.9E-10	2.4E-10	2.6E-10	2.1E-10
SSE	1.2E-09	1.2E-09	3.1E-10	3.9E-10	5.1E-10	5.4E-10	4.4E-10
SE	2.0E-09	2.0E-09	5.1E-10	6.4E-10	8.4E-10	9.0E-10	7.3E-10
ESE	2.2E-09	2.1E-09	5.4E-10	6.8E-10	8.9E-10	9.6E-10	7.8E-10
E	2.4E-09	2.4E-09	6.2E-10	7.8E-10	1.0E-09	1.1E-09	8.9E-10
ENE	2.3E-09	2.2E-09	5.9E-10	7.3E-10	9.5E-10	1.0E-09	8.4E-10
NE	2.0E-09	1.9E-09	5.1E-10	6.4E-10	8.2E-10	8.8E-10	7.2E-10
NNE	1.2E-09	1.2E-09	3.1E-10	3.9E-10	5.0E-10	5.4E-10	4.4E-10

	Distance (m)						
Direction	1597	1630	1759	1749	1719	1576	1555
N	2.9E-10	2.8E-10	2.4E-10	2.4E-10	2.5E-10	2.9E-10	3.0E-10
NNW	1.8E-10	1.8E-10	1.5E-10	1.6E-10	1.6E-10	1.9E-10	1.9E-10
NW	1.9E-10	1.8E-10	1.6E-10	1.6E-10	1.6E-10	1.9E-10	2.0E-10
WNW	2.1E-10	2.0E-10	1.7E-10	1.8E-10	1.8E-10	2.2E-10	2.2E-10
W	3.4E-10	3.2E-10	2.8E-10	2.8E-10	2.9E-10	3.5E-10	3.5E-10
WSW	3.1E-10	3.0E-10	2.6E-10	2.6E-10	2.7E-10	3.2E-10	3.3E-10
SW	1.8E-10	1.7E-10	1.5E-10	1.5E-10	1.6E-10	1.8E-10	1.9E-10
SSW	1.6E-10	1.5E-10	1.3E-10	1.3E-10	1.4E-10	1.6E-10	1.7E-10
S	2.0E-10	1.9E-10	1.6E-10	1.7E-10	1.7E-10	2.0E-10	2.1E-10
SSE	4.1E-10	4.0E-10	3.4E-10	3.5E-10	3.6E-10	4.2E-10	4.3E-10
SE	6.8E-10	6.5E-10	5.6E-10	5.7E-10	5.9E-10	7.0E-10	7.2E-10
ESE	7.2E-10	7.0E-10	6.0E-10	6.1E-10	6.3E-10	7.4E-10	7.6E-10
E	8.2E-10	7.9E-10	6.8E-10	6.9E-10	7.2E-10	8.4E-10	8.7E-10
ENE	7.8E-10	7.5E-10	6.5E-10	6.6E-10	6.8E-10	8.0E-10	8.2E-10
NE	6.7E-10	6.5E-10	5.6E-10	5.7E-10	5.9E-10	6.9E-10	7.1E-10
NNE	4.1E-10	4.0E-10	3.5E-10	3.5E-10	3.6E-10	4.2E-10	4.3E-10

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2072	1510	1088	1051	1289	1233
N	1.8E-10	3.2E-10	5.9E-10	6.3E-10	4.3E-10	4.7E-10
NNW	1.1E-10	2.0E-10	3.8E-10	4.0E-10	2.8E-10	3.0E-10
NW	1.1E-10	2.1E-10	3.8E-10	4.1E-10	2.8E-10	3.1E-10
WNW	1.3E-10	2.3E-10	4.3E-10	4.6E-10	3.2E-10	3.5E-10
W	2.0E-10	3.7E-10	6.9E-10	7.4E-10	5.1E-10	5.5E-10
WSW	1.9E-10	3.4E-10	6.2E-10	6.6E-10	4.6E-10	5.0E-10
SW	1.1E-10	2.0E-10	3.6E-10	3.8E-10	2.7E-10	2.9E-10
SSW	9.7E-11	1.7E-10	3.2E-10	3.4E-10	2.4E-10	2.6E-10
S	1.2E-10	2.2E-10	4.1E-10	4.3E-10	3.0E-10	3.2E-10
SSE	2.5E-10	4.6E-10	8.6E-10	9.2E-10	6.3E-10	6.8E-10
SE	4.1E-10	7.6E-10	1.4E-09	1.5E-09	1.0E-09	1.1E-09
ESE	4.3E-10	8.0E-10	1.5E-09	1.6E-09	1.1E-09	1.2E-09
E	5.0E-10	9.1E-10	1.7E-09	1.8E-09	1.3E-09	1.4E-09
ENE	4.7E-10	8.6E-10	1.6E-09	1.7E-09	1.2E-09	1.3E-09
NE	4.1E-10	7.5E-10	1.4E-09	1.5E-09	1.0E-09	1.1E-09
NNE	2.5E-10	4.6E-10	8.4E-10	8.9E-10	6.2E-10	6.7E-10

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 7, 1998 4:04 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)
2.41E-04

At This Location: 851 Meters East

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1977

Comments: 1997 NESHAP Demonstration
Building 65 Fugitive Emissions [G2]

Dataset Name: 97-Z024-G2
Dataset Date: Apr 7, 1998 12:18 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 851 Meters East
Lifetime Fatal Cancer Risk: 2.78E-09

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.77E-06
BREAST	1.79E-06
R MAR	1.12E-04
LUNGS	1.53E-03
THYROID	1.76E-06
ENDOST	1.39E-03
RMNDR	3.45E-06
EFFEC	2.41E-04

Apr 7, 1998 4:04 pm

RADIONUCLIDE EMISSIONS DURING THE YEAR 1977

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
AC-228	Y	1.00	1.1E-07	1.1E-07
BI-212	W	1.00	1.1E-07	1.1E-07
PB-212	D	1.00	1.1E-07	1.1E-07
PO-212	W	1.00	6.7E-08	6.7E-08
PO-216	W	1.00	1.1E-07	1.1E-07
RA-224	W	1.00	1.1E-07	1.1E-07
RA-228	W	1.00	1.1E-07	1.1E-07
TH-228	Y	1.00	1.1E-07	1.1E-07
TH-232	Y	1.00	1.1E-07	1.1E-07
TL-208	D	1.00	3.8E-08	3.8E-08

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	1.00
Diameter (m):	0.30
Plume Rise Momentum (m/s): (Exit Velocity)	1.00E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

851	1282	2246	1643	2205	2626	2361	1398	1553	1965
2023	1474	2684	1669	1859	1955	1918	2286	2316	1352

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 7, 1998 4:04 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1977

Comments: 1997 NESHAP Demonstration
Building 65 Fugitive Emissions [G2]

Dataset Name: 97-Z024-G2
Dataset Date: Apr 7, 1998 12:18 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.77E-06
BREAST	1.79E-06
R MAR	1.12E-04
LUNGS	1.53E-03
THYROID	1.76E-06
ENDOST	1.39E-03
RMNDR	3.45E-06
EFFEC	2.41E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	3.17E-06
INHALATION	2.37E-04
AIR IMMERSION	3.17E-10
GROUND SURFACE	5.37E-09
INTERNAL	2.41E-04
EXTERNAL	5.69E-09
TOTAL	2.41E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
AC-228	3.23E-08
BI-212	1.09E-08
PB-212	6.31E-08
PO-212	0.00E+00
PO-216	0.00E+00
RA-224	1.35E-06
RA-228	2.57E-06
TH-228	9.61E-05
TH-232	1.40E-04
TL-208	2.37E-11
TOTAL	2.41E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	9.99E-11
BONE	6.54E-11
THYROID	2.97E-13
BREAST	2.51E-12
LUNG	2.59E-09
STOMACH	2.15E-12
BOWEL	2.28E-12
LIVER	6.61E-12
PANCREAS	1.55E-12
URINARY	9.50E-13
OTHER	1.89E-12
TOTAL	2.78E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.72E-11
INHALATION	2.76E-09
AIR IMMERSION	7.61E-15
GROUND SURFACE	1.17E-13
INTERNAL	2.78E-09
EXTERNAL	1.25E-13
TOTAL	2.78E-09

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
AC-228	6.52E-13
BI-212	1.40E-13
PB-212	1.08E-12
PO-212	0.00E+00
PO-216	0.00E+00
RA-224	3.03E-11
RA-228	2.72E-11
TH-228	1.93E-09
TH-232	7.92E-10
TL-208	5.82E-16
TOTAL	2.78E-09

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	851	1282	2246	1643	2205	2626	2361
N	8.2E-05	3.8E-05	1.3E-05	2.4E-05	1.4E-05	1.0E-05	1.2E-05
NNW	5.2E-05	2.4E-05	8.6E-06	1.5E-05	8.8E-06	6.5E-06	7.8E-06
NW	5.4E-05	2.5E-05	8.7E-06	1.5E-05	8.9E-06	6.5E-06	7.9E-06
WNW	6.1E-05	2.8E-05	9.6E-06	1.7E-05	9.9E-06	7.2E-06	8.8E-06
W	9.7E-05	4.5E-05	1.5E-05	2.8E-05	1.6E-05	1.2E-05	1.4E-05
WSW	8.5E-05	4.0E-05	1.5E-05	2.6E-05	1.5E-05	1.1E-05	1.3E-05
SW	5.0E-05	2.3E-05	8.5E-06	1.5E-05	8.8E-06	6.5E-06	7.8E-06
SSW	4.5E-05	2.1E-05	7.4E-06	1.3E-05	7.6E-06	5.6E-06	6.8E-06
S	5.7E-05	2.6E-05	9.1E-06	1.6E-05	9.4E-06	6.9E-06	8.3E-06
SSE	1.2E-04	5.5E-05	1.9E-05	3.4E-05	1.9E-05	1.4E-05	1.7E-05
SE	2.0E-04	9.1E-05	3.0E-05	5.6E-05	3.1E-05	2.3E-05	2.8E-05
ESE	2.1E-04	9.7E-05	3.2E-05	5.9E-05	3.4E-05	2.4E-05	3.0E-05
E	2.4E-04	1.1E-04	3.7E-05	6.8E-05	3.9E-05	2.8E-05	3.4E-05
ENE	2.2E-04	1.0E-04	3.6E-05	6.4E-05	3.7E-05	2.7E-05	3.2E-05
NE	1.9E-04	8.9E-05	3.1E-05	5.5E-05	3.2E-05	2.3E-05	2.8E-05
NNE	1.2E-04	5.4E-05	1.9E-05	3.4E-05	2.0E-05	1.4E-05	1.7E-05

	Distance (m)						
Direction	1398	1553	1965	2023	1474	2684	1669
N	3.2E-05	2.6E-05	1.7E-05	1.6E-05	2.9E-05	9.6E-06	2.3E-05
NNW	2.1E-05	1.7E-05	1.1E-05	1.0E-05	1.9E-05	6.2E-06	1.5E-05
NW	2.1E-05	1.7E-05	1.1E-05	1.0E-05	1.9E-05	6.3E-06	1.5E-05
WNW	2.4E-05	1.9E-05	1.2E-05	1.2E-05	2.1E-05	7.0E-06	1.7E-05
W	3.8E-05	3.1E-05	2.0E-05	1.9E-05	3.4E-05	1.1E-05	2.7E-05
WSW	3.4E-05	2.8E-05	1.9E-05	1.8E-05	3.1E-05	1.1E-05	2.5E-05
SW	2.0E-05	1.7E-05	1.1E-05	1.0E-05	1.8E-05	6.3E-06	1.5E-05
SSW	1.8E-05	1.4E-05	9.3E-06	8.9E-06	1.6E-05	5.4E-06	1.3E-05
S	2.2E-05	1.8E-05	1.2E-05	1.1E-05	2.0E-05	6.6E-06	1.6E-05
SSE	4.6E-05	3.8E-05	2.4E-05	2.2E-05	4.2E-05	1.3E-05	3.3E-05
SE	7.7E-05	6.2E-05	3.9E-05	3.7E-05	6.9E-05	2.2E-05	5.4E-05
ESE	8.2E-05	6.6E-05	4.2E-05	3.9E-05	7.3E-05	2.3E-05	5.8E-05
E	9.3E-05	7.5E-05	4.8E-05	4.5E-05	8.3E-05	2.7E-05	6.6E-05
ENE	8.7E-05	7.1E-05	4.5E-05	4.3E-05	7.8E-05	2.6E-05	6.2E-05
NE	7.5E-05	6.1E-05	3.9E-05	3.7E-05	6.8E-05	2.2E-05	5.4E-05
NNE	4.6E-05	3.8E-05	2.4E-05	2.3E-05	4.1E-05	1.4E-05	3.3E-05

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1859	1955	1918	2286	2316	1352
N	1.9E-05	1.7E-05	1.8E-05	1.3E-05	1.3E-05	3.4E-05
NNW	1.2E-05	1.1E-05	1.1E-05	8.3E-06	8.1E-06	2.2E-05
NW	1.2E-05	1.1E-05	1.2E-05	8.4E-06	8.2E-06	2.2E-05
WNW	1.4E-05	1.2E-05	1.3E-05	9.3E-06	9.1E-06	2.5E-05
W	2.2E-05	2.0E-05	2.1E-05	1.5E-05	1.5E-05	4.0E-05
WSW	2.1E-05	1.9E-05	1.9E-05	1.4E-05	1.4E-05	3.7E-05
SW	1.2E-05	1.1E-05	1.1E-05	8.3E-06	8.1E-06	2.1E-05
SSW	1.0E-05	9.4E-06	9.8E-06	7.2E-06	7.0E-06	1.9E-05
S	1.3E-05	1.2E-05	1.2E-05	8.8E-06	8.6E-06	2.4E-05
SSE	2.7E-05	2.4E-05	2.5E-05	1.8E-05	1.8E-05	5.0E-05
SE	4.4E-05	3.9E-05	4.1E-05	2.9E-05	2.9E-05	8.2E-05
ESE	4.7E-05	4.2E-05	4.4E-05	3.1E-05	3.1E-05	8.7E-05
E	5.3E-05	4.8E-05	5.0E-05	3.6E-05	3.5E-05	9.9E-05
ENE	5.1E-05	4.6E-05	4.8E-05	3.4E-05	3.4E-05	9.3E-05
NE	4.4E-05	4.0E-05	4.1E-05	3.0E-05	2.9E-05	8.0E-05
NNE	2.7E-05	2.5E-05	2.5E-05	1.9E-05	1.8E-05	4.9E-05

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	851	1282	2246	1643	2205	2626	2361
N	9.5E-10	4.3E-10	1.5E-10	2.7E-10	1.6E-10	1.1E-10	1.4E-10
NNW	6.0E-10	2.8E-10	9.8E-11	1.7E-10	1.0E-10	7.4E-11	8.9E-11
NW	6.2E-10	2.8E-10	9.9E-11	1.8E-10	1.0E-10	7.4E-11	9.0E-11
WNW	7.0E-10	3.2E-10	1.1E-10	2.0E-10	1.1E-10	8.2E-11	1.0E-10
W	1.1E-09	5.1E-10	1.8E-10	3.2E-10	1.8E-10	1.3E-10	1.6E-10
WSW	9.9E-10	4.6E-10	1.7E-10	3.0E-10	1.7E-10	1.3E-10	1.5E-10
SW	5.7E-10	2.7E-10	9.7E-11	1.7E-10	1.0E-10	7.4E-11	8.9E-11
SSW	5.1E-10	2.4E-10	8.4E-11	1.5E-10	8.7E-11	6.4E-11	7.7E-11
S	6.5E-10	3.0E-10	1.0E-10	1.9E-10	1.1E-10	7.8E-11	9.5E-11
SSE	1.4E-09	6.3E-10	2.1E-10	3.9E-10	2.2E-10	1.6E-10	1.9E-10
SE	2.3E-09	1.1E-09	3.5E-10	6.4E-10	3.6E-10	2.6E-10	3.2E-10
ESE	2.5E-09	1.1E-09	3.7E-10	6.9E-10	3.9E-10	2.8E-10	3.4E-10
E	2.8E-09	1.3E-09	4.3E-10	7.8E-10	4.4E-10	3.2E-10	3.9E-10
ENE	2.6E-09	1.2E-09	4.1E-10	7.4E-10	4.2E-10	3.1E-10	3.7E-10
NE	2.2E-09	1.0E-09	3.6E-10	6.4E-10	3.7E-10	2.7E-10	3.2E-10
NNE	1.3E-09	6.2E-10	2.2E-10	3.9E-10	2.3E-10	1.7E-10	2.0E-10

	Distance (m)						
Direction	1398	1553	1965	2023	1474	2684	1669
N	3.7E-10	3.0E-10	1.9E-10	1.8E-10	3.3E-10	1.1E-10	2.6E-10
NNW	2.4E-10	1.9E-10	1.2E-10	1.2E-10	2.1E-10	7.1E-11	1.7E-10
NW	2.4E-10	2.0E-10	1.3E-10	1.2E-10	2.2E-10	7.1E-11	1.7E-10
WNW	2.7E-10	2.2E-10	1.4E-10	1.3E-10	2.4E-10	7.9E-11	1.9E-10
W	4.3E-10	3.5E-10	2.3E-10	2.1E-10	3.9E-10	1.3E-10	3.1E-10
WSW	4.0E-10	3.3E-10	2.1E-10	2.0E-10	3.6E-10	1.2E-10	2.9E-10
SW	2.3E-10	1.9E-10	1.2E-10	1.2E-10	2.1E-10	7.1E-11	1.7E-10
SSW	2.0E-10	1.7E-10	1.1E-10	1.0E-10	1.8E-10	6.1E-11	1.5E-10
S	2.5E-10	2.1E-10	1.3E-10	1.3E-10	2.3E-10	7.5E-11	1.8E-10
SSE	5.3E-10	4.3E-10	2.7E-10	2.6E-10	4.8E-10	1.5E-10	3.8E-10
SE	8.9E-10	7.2E-10	4.5E-10	4.2E-10	7.9E-10	2.5E-10	6.2E-10
ESE	9.4E-10	7.6E-10	4.8E-10	4.5E-10	8.4E-10	2.7E-10	6.6E-10
E	1.1E-09	8.7E-10	5.5E-10	5.2E-10	9.6E-10	3.1E-10	7.6E-10
ENE	1.0E-09	8.2E-10	5.2E-10	4.9E-10	9.0E-10	2.9E-10	7.2E-10
NE	8.7E-10	7.1E-10	4.5E-10	4.3E-10	7.8E-10	2.6E-10	6.2E-10
NNE	5.3E-10	4.3E-10	2.8E-10	2.6E-10	4.8E-10	1.6E-10	3.8E-10

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1859	1955	1918	2286	2316	1352
N	2.2E-10	2.0E-10	2.0E-10	1.5E-10	1.4E-10	3.9E-10
NNW	1.4E-10	1.3E-10	1.3E-10	9.5E-11	9.2E-11	2.5E-10
NW	1.4E-10	1.3E-10	1.3E-10	9.6E-11	9.3E-11	2.6E-10
WNW	1.6E-10	1.4E-10	1.5E-10	1.1E-10	1.0E-10	2.9E-10
W	2.5E-10	2.3E-10	2.4E-10	1.7E-10	1.7E-10	4.6E-10
WSW	2.4E-10	2.2E-10	2.2E-10	1.6E-10	1.6E-10	4.2E-10
SW	1.4E-10	1.2E-10	1.3E-10	9.4E-11	9.2E-11	2.4E-10
SSW	1.2E-10	1.1E-10	1.1E-10	8.1E-11	8.0E-11	2.2E-10
S	1.5E-10	1.3E-10	1.4E-10	1.0E-10	9.8E-11	2.7E-10
SSE	3.1E-10	2.8E-10	2.9E-10	2.1E-10	2.0E-10	5.7E-10
SE	5.0E-10	4.5E-10	4.7E-10	3.4E-10	3.3E-10	9.5E-10
ESE	5.4E-10	4.8E-10	5.0E-10	3.6E-10	3.5E-10	1.0E-09
E	6.1E-10	5.5E-10	5.8E-10	4.2E-10	4.1E-10	1.1E-09
ENE	5.8E-10	5.3E-10	5.5E-10	4.0E-10	3.9E-10	1.1E-09
NE	5.0E-10	4.6E-10	4.8E-10	3.4E-10	3.4E-10	9.2E-10
NNE	3.1E-10	2.8E-10	2.9E-10	2.1E-10	2.1E-10	5.6E-10

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 27, 1998 8:51 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

2.46E-03

At This Location: 944 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 71 - Vent [G1]

Dataset Name: 97-Z026-VENT-G1
Dataset Date: Apr 27, 1998 8:47 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 944 Meters East Northeast
Lifetime Fatal Cancer Risk: 3.13E-08

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	7.55E-06
BREAST	8.58E-06
R MAR	3.35E-04
LUNGS	1.85E-02
THYROID	7.36E-06
ENDOST	4.43E-03
RMNDR	1.95E-04
EFFEC	2.46E-03

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	Source #2 Ci/y	TOTAL Ci/y
U-234	Y	1.00	2.4E-06	2.9E-06	5.3E-06
U-235	Y	1.00	1.3E-07	1.5E-07	2.8E-07
U-236	Y	1.00	9.3E-08	1.1E-07	2.0E-07
U-238	Y	1.00	2.7E-06	3.2E-06	5.9E-06
RA-226	W	1.00	1.7E-09	2.0E-09	3.7E-09
RA-228	W	1.00	6.8E-09	8.2E-09	1.5E-08
TH-228	Y	1.00	7.2E-08	8.6E-08	1.6E-07
TH-230	Y	1.00	2.1E-07	2.5E-07	4.6E-07
TH-232	Y	1.00	1.1E-08	1.4E-08	2.5E-08
TH-234	Y	1.00	1.1E-05	1.3E-05	2.3E-05

SITE INFORMATION

Temperature:	11 degrees C
Precipitation:	102 cm/y
Mixing Height:	950 m

SOURCE INFORMATION

Source Number:	1	2
Stack Height (m):	4.60	2.00
Diameter (m):	0.46	1.67
Plume Rise Momentum (m/s): (Exit Velocity)	2.08E+00	9.31E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

996	944	1689	1380	1126	1050	1255	1350	1388	1548
1549	1578	1504	1502	2105	1610	1326	1305	1633	1513

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 27, 1998 8:51 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 71 - Vent [G1]

Dataset Name: 97-Z026-VENT-G1
Dataset Date: Apr 27, 1998 8:47 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	7.55E-06
BREAST	8.58E-06
R MAR	3.35E-04
LUNGS	1.85E-02
THYROID	7.36E-06
ENDOST	4.43E-03
RMNDR	1.95E-04
EFFEC	2.46E-03

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.40E-04
INHALATION	2.32E-03
AIR IMMERSION	1.95E-10
GROUND SURFACE	1.48E-06
INTERNAL	2.46E-03
EXTERNAL	1.48E-06
TOTAL	2.46E-03

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.06E-03
U-235	5.33E-05
U-236	3.91E-05
U-238	1.06E-03
RA-226	1.03E-07
RA-228	1.66E-07
TH-228	5.82E-05
TH-230	1.71E-04
TH-232	1.31E-05
TH-234	2.80E-06
TOTAL	2.46E-03

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	3.28E-10
BONE	2.17E-10
THYROID	1.69E-12
BREAST	1.90E-11
LUNG	3.02E-08
STOMACH	1.27E-11
BOWEL	3.38E-11
LIVER	1.55E-11
PANCREAS	7.40E-12
URINARY	4.05E-10
OTHER	9.05E-12
TOTAL	3.13E-08

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	7.42E-10
INHALATION	3.05E-08
AIR IMMERSION	4.34E-15
GROUND SURFACE	3.40E-11
INTERNAL	3.12E-08
EXTERNAL	3.40E-11
TOTAL	3.13E-08

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	1.37E-08
U-235	6.99E-10
U-236	5.01E-10
U-238	1.37E-08
RA-226	1.36E-12
RA-228	1.69E-12
TH-228	1.17E-09
TH-230	1.40E-09
TH-232	7.37E-11
TH-234	8.80E-11
TOTAL	3.13E-08

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	996	944	1689	1380	1126	1050	1255
N	8.8E-04	9.4E-04	4.3E-04	5.7E-04	7.5E-04	8.2E-04	6.5E-04
NNW	5.8E-04	6.3E-04	2.9E-04	3.8E-04	5.0E-04	5.5E-04	4.3E-04
NW	5.6E-04	6.0E-04	2.8E-04	3.7E-04	4.8E-04	5.3E-04	4.2E-04
WNW	6.0E-04	6.4E-04	3.0E-04	3.9E-04	5.1E-04	5.6E-04	4.5E-04
W	1.0E-03	1.1E-03	5.1E-04	6.7E-04	8.8E-04	9.7E-04	7.7E-04
WSW	1.2E-03	1.3E-03	5.5E-04	7.5E-04	1.0E-03	1.1E-03	8.7E-04
SW	6.9E-04	7.5E-04	3.2E-04	4.3E-04	5.8E-04	6.4E-04	5.0E-04
SSW	5.6E-04	6.0E-04	2.7E-04	3.6E-04	4.7E-04	5.2E-04	4.1E-04
S	6.0E-04	6.5E-04	3.0E-04	4.0E-04	5.2E-04	5.7E-04	4.5E-04
SSE	1.1E-03	1.1E-03	5.5E-04	7.2E-04	9.3E-04	1.0E-03	8.2E-04
SE	1.7E-03	1.8E-03	8.7E-04	1.1E-03	1.5E-03	1.6E-03	1.3E-03
ESE	1.8E-03	1.9E-03	9.2E-04	1.2E-03	1.6E-03	1.7E-03	1.4E-03
E	2.2E-03	2.4E-03	1.1E-03	1.5E-03	1.9E-03	2.1E-03	1.7E-03
ENE	2.3E-03	2.5E-03	1.1E-03	1.5E-03	2.0E-03	2.2E-03	1.7E-03
NE	2.1E-03	2.2E-03	1.0E-03	1.3E-03	1.8E-03	1.9E-03	1.5E-03
NNE	1.4E-03	1.5E-03	6.5E-04	8.7E-04	1.2E-03	1.3E-03	1.0E-03

	Distance (m)						
Direction	1350	1388	1548	1549	1578	1504	1502
N	5.9E-04	5.7E-04	4.9E-04	4.9E-04	4.8E-04	5.1E-04	5.1E-04
NNW	3.9E-04	3.8E-04	3.3E-04	3.3E-04	3.2E-04	3.4E-04	3.4E-04
NW	3.8E-04	3.7E-04	3.2E-04	3.2E-04	3.1E-04	3.3E-04	3.3E-04
WNW	4.1E-04	3.9E-04	3.4E-04	3.4E-04	3.3E-04	3.5E-04	3.5E-04
W	6.9E-04	6.7E-04	5.7E-04	5.7E-04	5.6E-04	6.0E-04	6.0E-04
WSW	7.8E-04	7.4E-04	6.3E-04	6.3E-04	6.1E-04	6.6E-04	6.6E-04
SW	4.5E-04	4.3E-04	3.6E-04	3.6E-04	3.5E-04	3.8E-04	3.8E-04
SSW	3.7E-04	3.5E-04	3.0E-04	3.0E-04	2.9E-04	3.1E-04	3.1E-04
S	4.1E-04	3.9E-04	3.4E-04	3.4E-04	3.3E-04	3.5E-04	3.5E-04
SSE	7.5E-04	7.2E-04	6.2E-04	6.2E-04	6.1E-04	6.5E-04	6.5E-04
SE	1.2E-03	1.1E-03	9.8E-04	9.8E-04	9.5E-04	1.0E-03	1.0E-03
ESE	1.3E-03	1.2E-03	1.0E-03	1.0E-03	1.0E-03	1.1E-03	1.1E-03
E	1.5E-03	1.5E-03	1.3E-03	1.3E-03	1.2E-03	1.3E-03	1.3E-03
ENE	1.5E-03	1.5E-03	1.3E-03	1.3E-03	1.2E-03	1.3E-03	1.3E-03
NE	1.4E-03	1.3E-03	1.1E-03	1.1E-03	1.1E-03	1.2E-03	1.2E-03
NNE	9.0E-04	8.7E-04	7.4E-04	7.4E-04	7.2E-04	7.7E-04	7.7E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2105	1610	1326	1305	1633	1513
N	3.1E-04	4.6E-04	6.0E-04	6.2E-04	4.5E-04	5.0E-04
NNW	2.1E-04	3.1E-04	4.0E-04	4.1E-04	3.0E-04	3.4E-04
NW	2.1E-04	3.0E-04	3.9E-04	4.0E-04	3.0E-04	3.3E-04
WNW	2.2E-04	3.2E-04	4.2E-04	4.2E-04	3.1E-04	3.5E-04
W	3.6E-04	5.4E-04	7.1E-04	7.3E-04	5.3E-04	5.9E-04
WSW	3.9E-04	5.9E-04	8.0E-04	8.2E-04	5.8E-04	6.5E-04
SW	2.3E-04	3.4E-04	4.6E-04	4.7E-04	3.3E-04	3.8E-04
SSW	1.9E-04	2.8E-04	3.8E-04	3.8E-04	2.8E-04	3.1E-04
S	2.2E-04	3.2E-04	4.2E-04	4.3E-04	3.2E-04	3.5E-04
SSE	4.0E-04	5.9E-04	7.6E-04	7.8E-04	5.8E-04	6.4E-04
SE	6.3E-04	9.3E-04	1.2E-03	1.2E-03	9.1E-04	1.0E-03
ESE	6.7E-04	9.8E-04	1.3E-03	1.3E-03	9.7E-04	1.1E-03
E	8.0E-04	1.2E-03	1.6E-03	1.6E-03	1.2E-03	1.3E-03
ENE	8.2E-04	1.2E-03	1.6E-03	1.6E-03	1.2E-03	1.3E-03
NE	7.2E-04	1.1E-03	1.4E-03	1.4E-03	1.1E-03	1.2E-03
NNE	4.7E-04	7.0E-04	9.3E-04	9.5E-04	6.8E-04	7.6E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	996	944	1689	1380	1126	1050	1255
N	1.1E-08	1.2E-08	5.4E-09	7.2E-09	9.4E-09	1.0E-08	8.2E-09
NNW	7.3E-09	7.9E-09	3.5E-09	4.7E-09	6.2E-09	6.8E-09	5.4E-09
NW	7.1E-09	7.6E-09	3.5E-09	4.6E-09	6.0E-09	6.6E-09	5.2E-09
WNW	7.5E-09	8.0E-09	3.7E-09	4.9E-09	6.4E-09	7.0E-09	5.6E-09
W	1.3E-08	1.4E-08	6.3E-09	8.5E-09	1.1E-08	1.2E-08	9.7E-09
WSW	1.5E-08	1.7E-08	6.9E-09	9.4E-09	1.3E-08	1.4E-08	1.1E-08
SW	8.7E-09	9.5E-09	3.9E-09	5.4E-09	7.3E-09	8.1E-09	6.2E-09
SSW	6.9E-09	7.5E-09	3.2E-09	4.4E-09	5.9E-09	6.5E-09	5.0E-09
S	7.6E-09	8.1E-09	3.7E-09	4.9E-09	6.5E-09	7.1E-09	5.6E-09
SSE	1.4E-08	1.4E-08	6.9E-09	9.1E-09	1.2E-08	1.3E-08	1.0E-08
SE	2.1E-08	2.3E-08	1.1E-08	1.4E-08	1.9E-08	2.0E-08	1.6E-08
ESE	2.3E-08	2.4E-08	1.2E-08	1.5E-08	2.0E-08	2.2E-08	1.7E-08
E	2.8E-08	3.0E-08	1.4E-08	1.9E-08	2.4E-08	2.7E-08	2.1E-08
ENE	2.9E-08	3.1E-08	1.4E-08	1.9E-08	2.5E-08	2.7E-08	2.2E-08
NE	2.6E-08	2.8E-08	1.3E-08	1.7E-08	2.2E-08	2.4E-08	1.9E-08
NNE	1.7E-08	1.9E-08	8.2E-09	1.1E-08	1.5E-08	1.6E-08	1.3E-08

	Distance (m)						
Direction	1350	1388	1548	1549	1578	1504	1502
N	7.4E-09	7.1E-09	6.1E-09	6.1E-09	5.9E-09	6.3E-09	6.4E-09
NNW	4.9E-09	4.7E-09	4.0E-09	4.0E-09	3.9E-09	4.2E-09	4.2E-09
NW	4.7E-09	4.6E-09	3.9E-09	3.9E-09	3.8E-09	4.1E-09	4.1E-09
WNW	5.0E-09	4.8E-09	4.2E-09	4.2E-09	4.1E-09	4.3E-09	4.3E-09
W	8.7E-09	8.4E-09	7.2E-09	7.2E-09	7.0E-09	7.5E-09	7.5E-09
WSW	9.8E-09	9.4E-09	7.9E-09	7.9E-09	7.7E-09	8.3E-09	8.3E-09
SW	5.5E-09	5.3E-09	4.5E-09	4.5E-09	4.4E-09	4.7E-09	4.7E-09
SSW	4.5E-09	4.4E-09	3.7E-09	3.7E-09	3.6E-09	3.9E-09	3.9E-09
S	5.1E-09	4.9E-09	4.2E-09	4.2E-09	4.1E-09	4.4E-09	4.4E-09
SSE	9.4E-09	9.0E-09	7.8E-09	7.8E-09	7.6E-09	8.1E-09	8.1E-09
SE	1.5E-08	1.4E-08	1.2E-08	1.2E-08	1.2E-08	1.3E-08	1.3E-08
ESE	1.6E-08	1.5E-08	1.3E-08	1.3E-08	1.3E-08	1.4E-08	1.4E-08
E	1.9E-08	1.9E-08	1.6E-08	1.6E-08	1.5E-08	1.7E-08	1.7E-08
ENE	2.0E-08	1.9E-08	1.6E-08	1.6E-08	1.6E-08	1.7E-08	1.7E-08
NE	1.7E-08	1.7E-08	1.4E-08	1.4E-08	1.4E-08	1.5E-08	1.5E-08
NNE	1.1E-08	1.1E-08	9.3E-09	9.3E-09	9.0E-09	9.7E-09	9.7E-09

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2105	1610	1326	1305	1633	1513
N	3.9E-09	5.8E-09	7.6E-09	7.7E-09	5.6E-09	6.3E-09
NNW	2.6E-09	3.8E-09	5.0E-09	5.1E-09	3.7E-09	4.1E-09
NW	2.5E-09	3.7E-09	4.9E-09	5.0E-09	3.6E-09	4.0E-09
WNW	2.7E-09	3.9E-09	5.2E-09	5.3E-09	3.9E-09	4.3E-09
W	4.5E-09	6.8E-09	9.0E-09	9.2E-09	6.6E-09	7.4E-09
WSW	4.9E-09	7.4E-09	1.0E-08	1.0E-08	7.3E-09	8.2E-09
SW	2.8E-09	4.2E-09	5.7E-09	5.8E-09	4.1E-09	4.6E-09
SSW	2.3E-09	3.5E-09	4.7E-09	4.8E-09	3.4E-09	3.8E-09
S	2.7E-09	4.0E-09	5.2E-09	5.3E-09	3.9E-09	4.3E-09
SSE	5.0E-09	7.4E-09	9.6E-09	9.8E-09	7.2E-09	8.0E-09
SE	7.9E-09	1.2E-08	1.5E-08	1.5E-08	1.1E-08	1.3E-08
ESE	8.3E-09	1.2E-08	1.6E-08	1.7E-08	1.2E-08	1.4E-08
E	1.0E-08	1.5E-08	2.0E-08	2.0E-08	1.5E-08	1.6E-08
ENE	1.0E-08	1.5E-08	2.0E-08	2.1E-08	1.5E-08	1.7E-08
NE	9.1E-09	1.4E-08	1.8E-08	1.8E-08	1.3E-08	1.5E-08
NNE	5.8E-09	8.8E-09	1.2E-08	1.2E-08	8.6E-09	9.6E-09

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 27, 1998 8:51 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

2.18E-03

At This Location: 1035 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 71 - Vent [G2]

Dataset Name: 97-Z026-VENT-G2
Dataset Date: Apr 27, 1998 8:49 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1035 Meters East Northeast
Lifetime Fatal Cancer Risk: 2.78E-08

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	6.62E-06
BREAST	7.54E-06
R MAR	2.95E-04
LUNGS	1.65E-02
THYROID	6.44E-06
ENDOST	3.89E-03
RMNDR	1.69E-04
EFFEC	2.18E-03

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	Source #2 Ci/y	TOTAL Ci/y
U-234	Y	1.00	2.4E-06	2.9E-06	5.3E-06
U-235	Y	1.00	1.3E-07	1.5E-07	2.8E-07
U-236	Y	1.00	9.3E-08	1.1E-07	2.0E-07
U-238	Y	1.00	2.7E-06	3.2E-06	5.9E-06
RA-226	W	1.00	1.7E-09	2.0E-09	3.7E-09
RA-228	W	1.00	6.8E-09	8.2E-09	1.5E-08
TH-228	Y	1.00	7.2E-08	8.6E-08	1.6E-07
TH-230	Y	1.00	2.1E-07	2.5E-07	4.6E-07
TH-232	Y	1.00	1.1E-08	1.4E-08	2.5E-08
TH-234	Y	1.00	1.1E-05	1.3E-05	2.3E-05

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1	2
Stack Height (m):	4.60	2.00
Diameter (m):	0.46	1.67
Plume Rise Momentum (m/s): (Exit Velocity)	2.08E+00	9.31E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1035	1271	1915	1960	2555	2274	2511	1365	1683	2311
2370	1433	2333	1409	1681	1774	1730	1962	1990	1615

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 27, 1998 8:51 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 71 - Vent [G2]

Dataset Name: 97-Z026-VENT-G2
Dataset Date: Apr 27, 1998 8:49 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	6.62E-06
BREAST	7.54E-06
R MAR	2.95E-04
LUNGS	1.65E-02
THYROID	6.44E-06
ENDOST	3.89E-03
RMNDR	1.69E-04
EFFEC	2.18E-03

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.21E-04
INHALATION	2.06E-03
AIR IMMERSION	1.73E-10
GROUND SURFACE	1.32E-06
INTERNAL	2.18E-03
EXTERNAL	1.32E-06
TOTAL	2.18E-03

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	9.45E-04
U-235	4.74E-05
U-236	3.47E-05
U-238	9.40E-04
RA-226	9.09E-08
RA-228	1.45E-07
TH-228	5.17E-05
TH-230	1.52E-04
TH-232	1.16E-05
TH-234	2.46E-06
TOTAL	2.18E-03

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	2.89E-10
BONE	1.91E-10
THYROID	1.48E-12
BREAST	1.68E-11
LUNG	2.69E-08
STOMACH	1.12E-11
BOWEL	2.95E-11
LIVER	1.36E-11
PANCREAS	6.50E-12
URINARY	3.52E-10
OTHER	7.94E-12
TOTAL	2.78E-08

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	6.44E-10
INHALATION	2.71E-08
AIR IMMERSION	3.86E-15
GROUND SURFACE	3.04E-11
INTERNAL	2.78E-08
EXTERNAL	3.04E-11
TOTAL	2.78E-08

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	1.21E-08
U-235	6.22E-10
U-236	4.46E-10
U-238	1.22E-08
RA-226	1.21E-12
RA-228	1.49E-12
TH-228	1.04E-09
TH-230	1.24E-09
TH-232	6.55E-11
TH-234	7.79E-11
TOTAL	2.78E-08

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1035	1271	1915	1960	2555	2274	2511
N	8.3E-04	6.3E-04	3.6E-04	3.4E-04	2.3E-04	2.8E-04	2.4E-04
NNW	5.5E-04	4.2E-04	2.4E-04	2.3E-04	1.6E-04	1.8E-04	1.6E-04
NW	5.3E-04	4.1E-04	2.3E-04	2.2E-04	1.5E-04	1.8E-04	1.6E-04
WNW	5.6E-04	4.3E-04	2.5E-04	2.4E-04	1.6E-04	1.9E-04	1.7E-04
W	9.8E-04	7.5E-04	4.1E-04	4.0E-04	2.7E-04	3.2E-04	2.8E-04
WSW	1.1E-03	8.4E-04	4.5E-04	4.3E-04	2.9E-04	3.4E-04	2.9E-04
SW	6.5E-04	4.8E-04	2.6E-04	2.5E-04	1.7E-04	2.0E-04	1.7E-04
SSW	5.2E-04	3.9E-04	2.2E-04	2.1E-04	1.4E-04	1.7E-04	1.4E-04
S	5.7E-04	4.4E-04	2.5E-04	2.4E-04	1.6E-04	1.9E-04	1.7E-04
SSE	1.0E-03	8.0E-04	4.5E-04	4.4E-04	3.0E-04	3.5E-04	3.1E-04
SE	1.6E-03	1.3E-03	7.2E-04	6.9E-04	4.7E-04	5.6E-04	4.8E-04
ESE	1.7E-03	1.3E-03	7.6E-04	7.3E-04	4.9E-04	5.9E-04	5.1E-04
E	2.1E-03	1.6E-03	9.2E-04	8.9E-04	6.0E-04	7.1E-04	6.1E-04
ENE	2.2E-03	1.7E-03	9.4E-04	9.0E-04	6.1E-04	7.2E-04	6.2E-04
NE	2.0E-03	1.5E-03	8.3E-04	8.0E-04	5.3E-04	6.4E-04	5.5E-04
NNE	1.3E-03	9.8E-04	5.3E-04	5.1E-04	3.4E-04	4.1E-04	3.5E-04

	Distance (m)						
Direction	1365	1683	2311	2370	1433	2333	1409
N	5.8E-04	4.3E-04	2.7E-04	2.6E-04	5.4E-04	2.7E-04	5.5E-04
NNW	3.8E-04	2.8E-04	1.8E-04	1.7E-04	3.6E-04	1.8E-04	3.7E-04
NW	3.7E-04	2.8E-04	1.8E-04	1.7E-04	3.5E-04	1.8E-04	3.6E-04
WNW	3.9E-04	3.0E-04	1.9E-04	1.8E-04	3.7E-04	1.9E-04	3.8E-04
W	6.8E-04	5.0E-04	3.1E-04	3.0E-04	6.3E-04	3.1E-04	6.5E-04
WSW	7.6E-04	5.5E-04	3.4E-04	3.2E-04	7.0E-04	3.3E-04	7.2E-04
SW	4.3E-04	3.1E-04	1.9E-04	1.9E-04	4.0E-04	1.9E-04	4.1E-04
SSW	3.6E-04	2.6E-04	1.6E-04	1.6E-04	3.3E-04	1.6E-04	3.4E-04
S	4.0E-04	3.0E-04	1.9E-04	1.8E-04	3.7E-04	1.8E-04	3.8E-04
SSE	7.3E-04	5.5E-04	3.5E-04	3.3E-04	6.8E-04	3.4E-04	7.0E-04
SE	1.2E-03	8.6E-04	5.4E-04	5.2E-04	1.1E-03	5.3E-04	1.1E-03
ESE	1.2E-03	9.2E-04	5.8E-04	5.5E-04	1.1E-03	5.7E-04	1.2E-03
E	1.5E-03	1.1E-03	7.0E-04	6.7E-04	1.4E-03	6.9E-04	1.4E-03
ENE	1.5E-03	1.1E-03	7.1E-04	6.8E-04	1.4E-03	7.0E-04	1.5E-03
NE	1.4E-03	1.0E-03	6.2E-04	6.0E-04	1.3E-03	6.1E-04	1.3E-03
NNE	8.8E-04	6.5E-04	4.0E-04	3.9E-04	8.2E-04	4.0E-04	8.4E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1681	1774	1730	1962	1990	1615
N	4.3E-04	4.0E-04	4.1E-04	3.4E-04	3.4E-04	4.5E-04
NNW	2.9E-04	2.6E-04	2.7E-04	2.3E-04	2.2E-04	3.0E-04
NW	2.8E-04	2.6E-04	2.7E-04	2.2E-04	2.2E-04	3.0E-04
WNW	3.0E-04	2.7E-04	2.8E-04	2.4E-04	2.3E-04	3.1E-04
W	5.0E-04	4.7E-04	4.8E-04	4.0E-04	3.9E-04	5.3E-04
WSW	5.5E-04	5.1E-04	5.3E-04	4.3E-04	4.2E-04	5.9E-04
SW	3.2E-04	2.9E-04	3.0E-04	2.5E-04	2.4E-04	3.4E-04
SSW	2.6E-04	2.4E-04	2.5E-04	2.1E-04	2.0E-04	2.8E-04
S	3.0E-04	2.8E-04	2.9E-04	2.4E-04	2.3E-04	3.1E-04
SSE	5.5E-04	5.1E-04	5.3E-04	4.4E-04	4.3E-04	5.8E-04
SE	8.7E-04	8.0E-04	8.3E-04	6.9E-04	6.7E-04	9.2E-04
ESE	9.2E-04	8.5E-04	8.8E-04	7.3E-04	7.2E-04	9.7E-04
E	1.1E-03	1.0E-03	1.1E-03	8.9E-04	8.7E-04	1.2E-03
ENE	1.1E-03	1.0E-03	1.1E-03	9.0E-04	8.8E-04	1.2E-03
NE	1.0E-03	9.3E-04	9.6E-04	8.0E-04	7.8E-04	1.1E-03
NNE	6.5E-04	6.0E-04	6.2E-04	5.1E-04	5.0E-04	6.9E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1035	1271	1915	1960	2555	2274	2511
N	1.1E-08	8.0E-09	4.4E-09	4.3E-09	2.9E-09	3.4E-09	2.9E-09
NNW	6.9E-09	5.3E-09	2.9E-09	2.8E-09	1.9E-09	2.3E-09	1.9E-09
NW	6.7E-09	5.1E-09	2.9E-09	2.8E-09	1.9E-09	2.2E-09	1.9E-09
WNW	7.1E-09	5.4E-09	3.0E-09	2.9E-09	2.0E-09	2.4E-09	2.0E-09
W	1.2E-08	9.5E-09	5.2E-09	5.0E-09	3.3E-09	4.0E-09	3.4E-09
WSW	1.4E-08	1.1E-08	5.6E-09	5.4E-09	3.6E-09	4.3E-09	3.7E-09
SW	8.2E-09	6.0E-09	3.2E-09	3.1E-09	2.0E-09	2.4E-09	2.1E-09
SSW	6.6E-09	4.9E-09	2.6E-09	2.6E-09	1.7E-09	2.0E-09	1.7E-09
S	7.2E-09	5.5E-09	3.0E-09	2.9E-09	2.0E-09	2.3E-09	2.0E-09
SSE	1.3E-08	1.0E-08	5.7E-09	5.5E-09	3.7E-09	4.4E-09	3.8E-09
SE	2.0E-08	1.6E-08	9.0E-09	8.7E-09	5.8E-09	7.0E-09	6.0E-09
ESE	2.2E-08	1.7E-08	9.6E-09	9.3E-09	6.2E-09	7.4E-09	6.4E-09
E	2.7E-08	2.1E-08	1.2E-08	1.1E-08	7.5E-09	9.0E-09	7.7E-09
ENE	2.8E-08	2.1E-08	1.2E-08	1.1E-08	7.6E-09	9.1E-09	7.8E-09
NE	2.5E-08	1.9E-08	1.0E-08	1.0E-08	6.7E-09	8.0E-09	6.9E-09
NNE	1.6E-08	1.2E-08	6.7E-09	6.5E-09	4.3E-09	5.1E-09	4.4E-09

	Distance (m)						
Direction	1365	1683	2311	2370	1433	2333	1409
N	7.2E-09	5.4E-09	3.3E-09	3.2E-09	6.8E-09	3.3E-09	6.9E-09
NNW	4.8E-09	3.5E-09	2.2E-09	2.1E-09	4.5E-09	2.2E-09	4.6E-09
NW	4.6E-09	3.5E-09	2.2E-09	2.1E-09	4.3E-09	2.1E-09	4.4E-09
WNW	4.9E-09	3.7E-09	2.3E-09	2.2E-09	4.6E-09	2.3E-09	4.7E-09
W	8.6E-09	6.3E-09	3.9E-09	3.7E-09	8.0E-09	3.8E-09	8.2E-09
WSW	9.6E-09	6.9E-09	4.2E-09	4.0E-09	8.9E-09	4.1E-09	9.1E-09
SW	5.4E-09	3.9E-09	2.4E-09	2.3E-09	5.0E-09	2.3E-09	5.2E-09
SSW	4.4E-09	3.2E-09	2.0E-09	1.9E-09	4.1E-09	1.9E-09	4.2E-09
S	5.0E-09	3.7E-09	2.3E-09	2.2E-09	4.6E-09	2.3E-09	4.8E-09
SSE	9.2E-09	6.9E-09	4.3E-09	4.1E-09	8.6E-09	4.2E-09	8.8E-09
SE	1.5E-08	1.1E-08	6.8E-09	6.6E-09	1.4E-08	6.7E-09	1.4E-08
ESE	1.6E-08	1.2E-08	7.2E-09	7.0E-09	1.5E-08	7.1E-09	1.5E-08
E	1.9E-08	1.4E-08	8.8E-09	8.4E-09	1.8E-08	8.6E-09	1.8E-08
ENE	1.9E-08	1.4E-08	8.9E-09	8.6E-09	1.8E-08	8.8E-09	1.8E-08
NE	1.7E-08	1.3E-08	7.9E-09	7.6E-09	1.6E-08	7.7E-09	1.6E-08
NNE	1.1E-08	8.2E-09	5.0E-09	4.8E-09	1.0E-08	4.9E-09	1.1E-08

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1681	1774	1730	1962	1990	1615
N	5.4E-09	5.0E-09	5.2E-09	4.3E-09	4.2E-09	5.7E-09
NNW	3.5E-09	3.3E-09	3.4E-09	2.8E-09	2.7E-09	3.8E-09
NW	3.5E-09	3.2E-09	3.3E-09	2.8E-09	2.7E-09	3.7E-09
WNW	3.7E-09	3.4E-09	3.5E-09	2.9E-09	2.9E-09	3.9E-09
W	6.3E-09	5.8E-09	6.1E-09	5.0E-09	4.9E-09	6.7E-09
WSW	6.9E-09	6.4E-09	6.6E-09	5.4E-09	5.3E-09	7.4E-09
SW	3.9E-09	3.6E-09	3.7E-09	3.1E-09	3.0E-09	4.2E-09
SSW	3.2E-09	3.0E-09	3.1E-09	2.5E-09	2.5E-09	3.4E-09
S	3.7E-09	3.4E-09	3.5E-09	2.9E-09	2.9E-09	3.9E-09
SSE	6.9E-09	6.4E-09	6.6E-09	5.5E-09	5.4E-09	7.3E-09
SE	1.1E-08	1.0E-08	1.1E-08	8.7E-09	8.5E-09	1.2E-08
ESE	1.2E-08	1.1E-08	1.1E-08	9.2E-09	9.0E-09	1.2E-08
E	1.4E-08	1.3E-08	1.4E-08	1.1E-08	1.1E-08	1.5E-08
ENE	1.4E-08	1.3E-08	1.4E-08	1.1E-08	1.1E-08	1.5E-08
NE	1.3E-08	1.2E-08	1.2E-08	1.0E-08	9.8E-09	1.3E-08
NNE	8.2E-09	7.6E-09	7.9E-09	6.5E-09	6.3E-09	8.7E-09

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
May 8, 1998 2:23 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

1.35E-03

At This Location: 931 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 78 Vents [G1]

Dataset Name: 97-Z030-VENT-G1
Dataset Date: May 8, 1998 2:21 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 931 Meters East Northeast
Lifetime Fatal Cancer Risk: 1.74E-08

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	2.86E-06
BREAST	3.24E-06
R MAR	1.53E-04
LUNGS	1.04E-02
THYROID	2.80E-06
ENDOST	2.00E-03
RMNDR	7.11E-05
EFFEC	1.35E-03

May 8, 1998 2:23 pm

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	0.30	2.6E-06	2.6E-06
U-235	Y	1.00	1.4E-07	1.4E-07
U-236	Y	1.00	1.0E-07	1.0E-07
U-238	Y	0.30	2.9E-06	2.9E-06
RA-226	W	0.30	1.9E-09	1.9E-09
RA-228	W	0.30	7.5E-09	7.5E-09
TH-228	Y	0.30	7.9E-08	7.9E-08
TH-230	Y	0.30	2.3E-07	2.3E-07
TH-232	Y	0.30	1.3E-08	1.3E-08
TH-234	Y	0.30	1.2E-05	1.2E-05

SITE INFORMATION

Temperature:	11 degrees C
Precipitation:	102 cm/y
Mixing Height:	950 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	2.00
Diameter (m):	0.47
Plume Rise Momentum (m/s): (Exit Velocity)	2.56E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

931	960	1953	1774	1573	1519	1640	1691	1722	1837
1824	1772	1604	1575	2052	1469	994	948	1162	1151

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
May 8, 1998 2:23 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 78 Vents [G1]

Dataset Name: 97-Z030-VENT-G1
Dataset Date: May 8, 1998 2:21 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.86E-06
BREAST	3.24E-06
R MAR	1.53E-04
LUNGS	1.04E-02
THYROID	2.80E-06
ENDOST	2.00E-03
RMNDR	7.11E-05
EFFEC	1.35E-03

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	5.03E-05
INHALATION	1.30E-03
AIR IMMERSION	6.41E-11
GROUND SURFACE	5.38E-07
INTERNAL	1.35E-03
EXTERNAL	5.38E-07
TOTAL	1.35E-03

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	5.93E-04
U-235	1.78E-05
U-236	1.30E-05
U-238	5.90E-04
RA-226	4.53E-08
RA-228	6.70E-08
TH-228	3.29E-05
TH-230	9.43E-05
TH-232	7.32E-06
TH-234	1.17E-06
TOTAL	1.35E-03

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.45E-10
BONE	9.61E-11
THYROID	6.33E-13
BREAST	7.08E-12
LUNG	1.70E-08
STOMACH	4.76E-12
BOWEL	1.22E-11
LIVER	6.53E-12
PANCREAS	2.79E-12
URINARY	1.47E-10
OTHER	3.42E-12
TOTAL	1.74E-08

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.67E-10
INHALATION	1.71E-08
AIR IMMERSION	1.43E-15
GROUND SURFACE	1.24E-11
INTERNAL	1.74E-08
EXTERNAL	1.24E-11
TOTAL	1.74E-08

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	7.73E-09
U-235	2.33E-10
U-236	1.66E-10
U-238	7.75E-09
RA-226	7.07E-13
RA-228	7.67E-13
TH-228	6.64E-10
TH-230	7.91E-10
TH-232	4.17E-11
TH-234	4.55E-11
TOTAL	1.74E-08

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	931	960	1953	1774	1573	1519	1640
N	5.3E-04	5.1E-04	2.0E-04	2.3E-04	2.7E-04	2.8E-04	2.5E-04
NNW	3.6E-04	3.5E-04	1.4E-04	1.5E-04	1.8E-04	1.9E-04	1.7E-04
NW	3.2E-04	3.1E-04	1.3E-04	1.5E-04	1.7E-04	1.8E-04	1.6E-04
WNW	3.0E-04	2.9E-04	1.2E-04	1.4E-04	1.6E-04	1.7E-04	1.5E-04
W	6.4E-04	6.2E-04	2.2E-04	2.6E-04	3.1E-04	3.2E-04	2.9E-04
WSW	9.7E-04	9.3E-04	3.1E-04	3.6E-04	4.3E-04	4.6E-04	4.0E-04
SW	5.4E-04	5.1E-04	1.7E-04	1.9E-04	2.3E-04	2.5E-04	2.2E-04
SSW	4.0E-04	3.8E-04	1.3E-04	1.5E-04	1.8E-04	1.9E-04	1.7E-04
S	3.7E-04	3.5E-04	1.3E-04	1.5E-04	1.8E-04	1.9E-04	1.7E-04
SSE	5.1E-04	4.9E-04	2.0E-04	2.2E-04	2.6E-04	2.7E-04	2.5E-04
SE	7.1E-04	6.9E-04	2.7E-04	3.1E-04	3.6E-04	3.8E-04	3.5E-04
ESE	7.9E-04	7.5E-04	2.9E-04	3.3E-04	3.9E-04	4.1E-04	3.7E-04
E	1.1E-03	1.1E-03	4.3E-04	4.9E-04	5.7E-04	6.0E-04	5.4E-04
ENE	1.4E-03	1.3E-03	5.2E-04	5.9E-04	7.0E-04	7.3E-04	6.6E-04
NE	1.3E-03	1.2E-03	4.7E-04	5.4E-04	6.4E-04	6.7E-04	6.0E-04
NNE	9.4E-04	8.9E-04	3.2E-04	3.7E-04	4.4E-04	4.6E-04	4.1E-04

	Distance (m)						
Direction	1691	1722	1837	1824	1772	1604	1575
N	2.4E-04	2.4E-04	2.2E-04	2.2E-04	2.3E-04	2.6E-04	2.7E-04
NNW	1.7E-04	1.6E-04	1.5E-04	1.5E-04	1.5E-04	1.8E-04	1.8E-04
NW	1.5E-04	1.5E-04	1.4E-04	1.4E-04	1.5E-04	1.6E-04	1.7E-04
WNW	1.4E-04	1.4E-04	1.3E-04	1.3E-04	1.4E-04	1.5E-04	1.6E-04
W	2.7E-04	2.7E-04	2.4E-04	2.5E-04	2.6E-04	3.0E-04	3.0E-04
WSW	3.9E-04	3.7E-04	3.4E-04	3.4E-04	3.6E-04	4.2E-04	4.3E-04
SW	2.1E-04	2.0E-04	1.8E-04	1.9E-04	1.9E-04	2.3E-04	2.3E-04
SSW	1.6E-04	1.6E-04	1.4E-04	1.4E-04	1.5E-04	1.7E-04	1.8E-04
S	1.6E-04	1.6E-04	1.4E-04	1.5E-04	1.5E-04	1.7E-04	1.8E-04
SSE	2.4E-04	2.3E-04	2.1E-04	2.2E-04	2.2E-04	2.6E-04	2.6E-04
SE	3.3E-04	3.2E-04	3.0E-04	3.0E-04	3.1E-04	3.6E-04	3.6E-04
ESE	3.5E-04	3.4E-04	3.2E-04	3.2E-04	3.3E-04	3.8E-04	3.9E-04
E	5.2E-04	5.1E-04	4.7E-04	4.7E-04	4.9E-04	5.6E-04	5.7E-04
ENE	6.3E-04	6.2E-04	5.6E-04	5.7E-04	5.9E-04	6.8E-04	7.0E-04
NE	5.8E-04	5.6E-04	5.1E-04	5.2E-04	5.4E-04	6.2E-04	6.4E-04
NNE	4.0E-04	3.9E-04	3.5E-04	3.5E-04	3.7E-04	4.3E-04	4.4E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2052	1469	994	948	1162	1151
N	1.9E-04	2.9E-04	4.9E-04	5.2E-04	4.0E-04	4.0E-04
NNW	1.3E-04	2.0E-04	3.3E-04	3.6E-04	2.7E-04	2.8E-04
NW	1.2E-04	1.8E-04	2.9E-04	3.1E-04	2.5E-04	2.5E-04
WNW	1.1E-04	1.7E-04	2.8E-04	3.0E-04	2.3E-04	2.3E-04
W	2.1E-04	3.4E-04	5.9E-04	6.3E-04	4.7E-04	4.8E-04
WSW	2.9E-04	4.8E-04	8.8E-04	9.5E-04	6.9E-04	7.0E-04
SW	1.5E-04	2.6E-04	4.8E-04	5.3E-04	3.8E-04	3.8E-04
SSW	1.2E-04	2.0E-04	3.6E-04	3.8E-04	2.8E-04	2.9E-04
S	1.2E-04	2.0E-04	3.4E-04	3.6E-04	2.7E-04	2.8E-04
SSE	1.9E-04	2.9E-04	4.7E-04	5.0E-04	3.9E-04	3.9E-04
SE	2.6E-04	4.0E-04	6.6E-04	7.0E-04	5.4E-04	5.5E-04
ESE	2.7E-04	4.3E-04	7.2E-04	7.7E-04	5.8E-04	5.9E-04
E	4.0E-04	6.3E-04	1.0E-03	1.1E-03	8.5E-04	8.6E-04
ENE	4.9E-04	7.6E-04	1.2E-03	1.3E-03	1.0E-03	1.0E-03
NE	4.4E-04	7.0E-04	1.2E-03	1.3E-03	9.6E-04	9.7E-04
NNE	3.0E-04	4.9E-04	8.5E-04	9.1E-04	6.8E-04	6.9E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 931	960	1953	1774	1573	1519	1640
N	6.8E-09	6.6E-09	2.5E-09	2.9E-09	3.4E-09	3.6E-09	3.2E-09
NNW	4.7E-09	4.5E-09	1.7E-09	2.0E-09	2.3E-09	2.4E-09	2.2E-09
NW	4.1E-09	3.9E-09	1.6E-09	1.8E-09	2.1E-09	2.2E-09	2.0E-09
WNW	3.9E-09	3.7E-09	1.5E-09	1.7E-09	2.0E-09	2.1E-09	1.9E-09
W	8.3E-09	7.9E-09	2.8E-09	3.3E-09	3.9E-09	4.1E-09	3.7E-09
WSW	1.3E-08	1.2E-08	3.9E-09	4.6E-09	5.5E-09	5.9E-09	5.2E-09
SW	7.0E-09	6.6E-09	2.1E-09	2.5E-09	3.0E-09	3.1E-09	2.8E-09
SSW	5.1E-09	4.8E-09	1.6E-09	1.9E-09	2.3E-09	2.4E-09	2.1E-09
S	4.7E-09	4.5E-09	1.7E-09	1.9E-09	2.3E-09	2.4E-09	2.1E-09
SSE	6.5E-09	6.3E-09	2.5E-09	2.8E-09	3.3E-09	3.5E-09	3.2E-09
SE	9.2E-09	8.8E-09	3.5E-09	4.0E-09	4.7E-09	4.9E-09	4.4E-09
ESE	1.0E-08	9.7E-09	3.7E-09	4.2E-09	5.0E-09	5.2E-09	4.7E-09
E	1.5E-08	1.4E-08	5.5E-09	6.3E-09	7.4E-09	7.7E-09	7.0E-09
ENE	1.7E-08	1.7E-08	6.7E-09	7.6E-09	9.0E-09	9.4E-09	8.5E-09
NE	1.7E-08	1.6E-08	6.0E-09	6.9E-09	8.2E-09	8.6E-09	7.7E-09
NNE	1.2E-08	1.2E-08	4.1E-09	4.7E-09	5.7E-09	5.9E-09	5.3E-09

Direction	Distance (m) 1691	1722	1837	1824	1772	1604	1575
N	3.1E-09	3.0E-09	2.7E-09	2.8E-09	2.9E-09	3.3E-09	3.4E-09
NNW	2.1E-09	2.0E-09	1.9E-09	1.9E-09	2.0E-09	2.2E-09	2.3E-09
NW	1.9E-09	1.9E-09	1.7E-09	1.8E-09	1.8E-09	2.1E-09	2.1E-09
WNW	1.8E-09	1.8E-09	1.6E-09	1.6E-09	1.7E-09	1.9E-09	2.0E-09
W	3.5E-09	3.4E-09	3.1E-09	3.1E-09	3.3E-09	3.8E-09	3.9E-09
WSW	4.9E-09	4.8E-09	4.3E-09	4.4E-09	4.6E-09	5.4E-09	5.5E-09
SW	2.6E-09	2.6E-09	2.3E-09	2.3E-09	2.5E-09	2.9E-09	3.0E-09
SSW	2.0E-09	2.0E-09	1.8E-09	1.8E-09	1.9E-09	2.2E-09	2.3E-09
S	2.0E-09	2.0E-09	1.8E-09	1.8E-09	1.9E-09	2.2E-09	2.3E-09
SSE	3.0E-09	3.0E-09	2.7E-09	2.7E-09	2.8E-09	3.3E-09	3.3E-09
SE	4.2E-09	4.1E-09	3.8E-09	3.8E-09	4.0E-09	4.5E-09	4.7E-09
ESE	4.5E-09	4.4E-09	4.0E-09	4.1E-09	4.2E-09	4.8E-09	5.0E-09
E	6.7E-09	6.5E-09	6.0E-09	6.0E-09	6.3E-09	7.2E-09	7.4E-09
ENE	8.1E-09	7.9E-09	7.2E-09	7.3E-09	7.6E-09	8.7E-09	8.9E-09
NE	7.4E-09	7.2E-09	6.6E-09	6.6E-09	6.9E-09	8.0E-09	8.2E-09
NNE	5.1E-09	4.9E-09	4.5E-09	4.5E-09	4.7E-09	5.5E-09	5.6E-09

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2052	1469	994	948	1162	1151
N	2.3E-09	3.7E-09	6.3E-09	6.7E-09	5.1E-09	5.2E-09
NNW	1.6E-09	2.5E-09	4.3E-09	4.6E-09	3.5E-09	3.5E-09
NW	1.5E-09	2.3E-09	3.8E-09	4.0E-09	3.1E-09	3.2E-09
WNW	1.4E-09	2.2E-09	3.6E-09	3.8E-09	2.9E-09	3.0E-09
W	2.6E-09	4.3E-09	7.5E-09	8.1E-09	6.1E-09	6.1E-09
WSW	3.6E-09	6.2E-09	1.1E-08	1.2E-08	8.9E-09	9.0E-09
SW	1.9E-09	3.3E-09	6.2E-09	6.8E-09	4.9E-09	4.9E-09
SSW	1.5E-09	2.5E-09	4.6E-09	4.9E-09	3.6E-09	3.7E-09
S	1.5E-09	2.5E-09	4.3E-09	4.6E-09	3.5E-09	3.5E-09
SSE	2.3E-09	3.7E-09	6.0E-09	6.4E-09	5.0E-09	5.0E-09
SE	3.3E-09	5.1E-09	8.4E-09	9.0E-09	6.9E-09	7.0E-09
ESE	3.5E-09	5.5E-09	9.2E-09	9.9E-09	7.5E-09	7.6E-09
E	5.2E-09	8.1E-09	1.3E-08	1.4E-08	1.1E-08	1.1E-08
ENE	6.2E-09	9.8E-09	1.6E-08	1.7E-08	1.3E-08	1.3E-08
NE	5.6E-09	9.0E-09	1.5E-08	1.6E-08	1.2E-08	1.3E-08
NNE	3.8E-09	6.3E-09	1.1E-08	1.2E-08	8.8E-09	8.9E-09

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
May 8, 1998 2:24 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

1.54E-03

At This Location: 833 Meters East Northeast

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 78 Vents [G2]

Dataset Name: 97-Z030-VENT-G2
Dataset Date: May 8, 1998 2:22 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 833 Meters East Northeast
Lifetime Fatal Cancer Risk: 1.99E-08

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	3.17E-06
BREAST	3.60E-06
R MAR	1.72E-04
LUNGS	1.19E-02
THYROID	3.09E-06
ENDOST	2.24E-03
RMNDR	7.77E-05
EFFEC	1.54E-03

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	0.30	2.6E-06	2.6E-06
U-235	Y	1.00	1.4E-07	1.4E-07
U-236	Y	1.00	1.0E-07	1.0E-07
U-238	Y	0.30	2.9E-06	2.9E-06
RA-226	W	0.30	1.9E-09	1.9E-09
RA-228	W	0.30	7.5E-09	7.5E-09
TH-228	Y	0.30	7.9E-08	7.9E-08
TH-230	Y	0.30	2.3E-07	2.3E-07
TH-232	Y	0.30	1.3E-08	1.3E-08
TH-234	Y	0.30	1.2E-05	1.2E-05

SITE INFORMATION

Temperature:	11 degrees C
Precipitation:	102 cm/y
Mixing Height:	950 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	2.00
Diameter (m):	0.47
Plume Rise Momentum (m/s): (Exit Velocity)	2.56E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

833	1335	2386	1511	2064	2765	2292	1456	1499	1825
1883	1534	2824	1794	1961	2056	2022	2408	2439	1278

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
May 8, 1998 2:24 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Stack
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
Building 78 Vents [G2]

Dataset Name: 97-Z030-VENT-G2
Dataset Date: May 8, 1998 2:22 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	3.17E-06
BREAST	3.60E-06
R MAR	1.72E-04
LUNGS	1.19E-02
THYROID	3.09E-06
ENDOST	2.24E-03
RMNDR	7.77E-05
EFFEC	1.54E-03

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	5.47E-05
INHALATION	1.48E-03
AIR IMMERSION	7.32E-11
GROUND SURFACE	6.11E-07
INTERNAL	1.54E-03
EXTERNAL	6.11E-07
TOTAL	1.54E-03

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	6.76E-04
U-235	2.02E-05
U-236	1.48E-05
U-238	6.72E-04
RA-226	5.06E-08
RA-228	7.43E-08
TH-228	3.75E-05
TH-230	1.08E-04
TH-232	8.36E-06
TH-234	1.30E-06
TOTAL	1.54E-03

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.63E-10
BONE	1.08E-10
THYROID	7.04E-13
BREAST	7.92E-12
LUNG	1.94E-08
STOMACH	5.28E-12
BOWEL	1.35E-11
LIVER	7.33E-12
PANCREAS	3.10E-12
URINARY	1.61E-10
OTHER	3.79E-12
TOTAL	1.99E-08

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.90E-10
INHALATION	1.96E-08
AIR IMMERSION	1.63E-15
GROUND SURFACE	1.41E-11
INTERNAL	1.99E-08
EXTERNAL	1.41E-11
TOTAL	1.99E-08

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	8.81E-09
U-235	2.65E-10
U-236	1.90E-10
U-238	8.84E-09
RA-226	8.02E-13
RA-228	8.60E-13
TH-228	7.58E-10
TH-230	9.02E-10
TH-232	4.76E-11
TH-234	5.17E-11
TOTAL	1.99E-08

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	833	1335	2386	1511	2064	2765	2292
N	6.2E-04	3.3E-04	1.5E-04	2.8E-04	1.8E-04	1.2E-04	1.6E-04
NNW	4.2E-04	2.3E-04	1.0E-04	1.9E-04	1.2E-04	8.4E-05	1.1E-04
NW	3.6E-04	2.1E-04	9.8E-05	1.8E-04	1.2E-04	8.2E-05	1.0E-04
WNW	3.5E-04	1.9E-04	9.3E-05	1.6E-04	1.1E-04	7.8E-05	9.8E-05
W	7.5E-04	3.9E-04	1.7E-04	3.2E-04	2.0E-04	1.4E-04	1.8E-04
WSW	1.2E-03	5.6E-04	2.3E-04	4.6E-04	2.8E-04	1.8E-04	2.4E-04
SW	6.5E-04	3.0E-04	1.2E-04	2.5E-04	1.5E-04	9.8E-05	1.3E-04
SSW	4.7E-04	2.3E-04	9.5E-05	1.9E-04	1.2E-04	7.8E-05	1.0E-04
S	4.3E-04	2.2E-04	9.9E-05	1.9E-04	1.2E-04	8.1E-05	1.0E-04
SSE	5.7E-04	3.2E-04	1.5E-04	2.8E-04	1.8E-04	1.3E-04	1.6E-04
SE	8.2E-04	4.5E-04	2.1E-04	3.8E-04	2.5E-04	1.8E-04	2.2E-04
ESE	9.2E-04	4.8E-04	2.3E-04	4.1E-04	2.7E-04	1.9E-04	2.4E-04
E	1.3E-03	7.1E-04	3.3E-04	6.0E-04	4.0E-04	2.8E-04	3.5E-04
ENE	1.5E-03	8.6E-04	3.9E-04	7.3E-04	4.8E-04	3.2E-04	4.2E-04
NE	1.5E-03	8.0E-04	3.5E-04	6.7E-04	4.3E-04	2.9E-04	3.7E-04
NNE	1.1E-03	5.6E-04	2.4E-04	4.7E-04	2.9E-04	2.0E-04	2.5E-04

	Distance (m)						
Direction	1456	1499	1825	1883	1534	2824	1794
N	2.9E-04	2.8E-04	2.2E-04	2.1E-04	2.7E-04	1.2E-04	2.2E-04
NNW	2.0E-04	1.9E-04	1.5E-04	1.4E-04	1.9E-04	8.2E-05	1.5E-04
NW	1.8E-04	1.8E-04	1.4E-04	1.3E-04	1.7E-04	8.0E-05	1.4E-04
WNW	1.7E-04	1.7E-04	1.3E-04	1.2E-04	1.6E-04	7.6E-05	1.3E-04
W	3.4E-04	3.3E-04	2.4E-04	2.3E-04	3.2E-04	1.3E-04	2.5E-04
WSW	4.9E-04	4.6E-04	3.4E-04	3.2E-04	4.5E-04	1.8E-04	3.5E-04
SW	2.6E-04	2.5E-04	1.8E-04	1.7E-04	2.4E-04	9.5E-05	1.9E-04
SSW	2.0E-04	1.9E-04	1.4E-04	1.3E-04	1.8E-04	7.6E-05	1.4E-04
S	2.0E-04	1.9E-04	1.4E-04	1.4E-04	1.8E-04	7.9E-05	1.5E-04
SSE	2.9E-04	2.8E-04	2.1E-04	2.1E-04	2.7E-04	1.3E-04	2.2E-04
SE	4.0E-04	3.9E-04	3.0E-04	2.9E-04	3.8E-04	1.8E-04	3.1E-04
ESE	4.3E-04	4.1E-04	3.2E-04	3.0E-04	4.0E-04	1.9E-04	3.2E-04
E	6.3E-04	6.1E-04	4.7E-04	4.5E-04	5.9E-04	2.7E-04	4.8E-04
ENE	7.7E-04	7.4E-04	5.7E-04	5.4E-04	7.2E-04	3.2E-04	5.8E-04
NE	7.1E-04	6.8E-04	5.2E-04	4.9E-04	6.6E-04	2.8E-04	5.3E-04
NNE	4.9E-04	4.7E-04	3.5E-04	3.4E-04	4.6E-04	1.9E-04	3.6E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1961	2056	2022	2408	2439	1278
N	2.0E-04	1.8E-04	1.9E-04	1.5E-04	1.5E-04	3.5E-04
NNW	1.3E-04	1.2E-04	1.3E-04	1.0E-04	9.9E-05	2.4E-04
NW	1.3E-04	1.2E-04	1.2E-04	9.7E-05	9.6E-05	2.2E-04
WNW	1.2E-04	1.1E-04	1.1E-04	9.2E-05	9.1E-05	2.0E-04
W	2.2E-04	2.1E-04	2.1E-04	1.6E-04	1.6E-04	4.1E-04
WSW	3.0E-04	2.8E-04	2.9E-04	2.2E-04	2.2E-04	6.0E-04
SW	1.6E-04	1.5E-04	1.6E-04	1.2E-04	1.2E-04	3.2E-04
SSW	1.3E-04	1.2E-04	1.2E-04	9.4E-05	9.2E-05	2.4E-04
S	1.3E-04	1.2E-04	1.2E-04	9.7E-05	9.6E-05	2.4E-04
SSE	1.9E-04	1.8E-04	1.9E-04	1.5E-04	1.5E-04	3.4E-04
SE	2.7E-04	2.6E-04	2.6E-04	2.1E-04	2.1E-04	4.8E-04
ESE	2.9E-04	2.7E-04	2.8E-04	2.2E-04	2.2E-04	5.1E-04
E	4.3E-04	4.0E-04	4.1E-04	3.3E-04	3.2E-04	7.5E-04
ENE	5.1E-04	4.8E-04	4.9E-04	3.9E-04	3.8E-04	9.1E-04
NE	4.7E-04	4.4E-04	4.5E-04	3.5E-04	3.4E-04	8.5E-04
NNE	3.2E-04	3.0E-04	3.0E-04	2.4E-04	2.3E-04	5.9E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 833	1335	2386	1511	2064	2765	2292
N	7.9E-09	4.2E-09	1.9E-09	3.6E-09	2.3E-09	1.6E-09	2.0E-09
NNW	5.4E-09	2.9E-09	1.3E-09	2.4E-09	1.6E-09	1.0E-09	1.4E-09
NW	4.7E-09	2.6E-09	1.2E-09	2.2E-09	1.5E-09	1.0E-09	1.3E-09
WNW	4.5E-09	2.5E-09	1.2E-09	2.1E-09	1.4E-09	9.7E-10	1.2E-09
W	9.6E-09	5.0E-09	2.1E-09	4.1E-09	2.6E-09	1.7E-09	2.2E-09
WSW	1.5E-08	7.2E-09	2.9E-09	5.9E-09	3.6E-09	2.3E-09	3.1E-09
SW	8.4E-09	3.9E-09	1.5E-09	3.2E-09	1.9E-09	1.2E-09	1.6E-09
SSW	6.0E-09	2.9E-09	1.2E-09	2.4E-09	1.5E-09	9.7E-10	1.3E-09
S	5.5E-09	2.9E-09	1.2E-09	2.4E-09	1.5E-09	1.0E-09	1.3E-09
SSE	7.4E-09	4.1E-09	1.9E-09	3.5E-09	2.3E-09	1.6E-09	2.0E-09
SE	1.1E-08	5.8E-09	2.7E-09	4.9E-09	3.2E-09	2.3E-09	2.8E-09
ESE	1.2E-08	6.2E-09	2.9E-09	5.2E-09	3.4E-09	2.4E-09	3.0E-09
E	1.7E-08	9.1E-09	4.2E-09	7.8E-09	5.1E-09	3.5E-09	4.5E-09
ENE	2.0E-08	1.1E-08	5.1E-09	9.4E-09	6.2E-09	4.2E-09	5.3E-09
NE	1.9E-08	1.0E-08	4.5E-09	8.7E-09	5.6E-09	3.7E-09	4.8E-09
NNE	1.4E-08	7.2E-09	3.1E-09	6.0E-09	3.8E-09	2.5E-09	3.2E-09

Direction	Distance (m) 1456	1499	1825	1883	1534	2824	1794
N	3.8E-09	3.6E-09	2.8E-09	2.6E-09	3.5E-09	1.5E-09	2.8E-09
NNW	2.6E-09	2.5E-09	1.9E-09	1.8E-09	2.4E-09	1.0E-09	1.9E-09
NW	2.3E-09	2.3E-09	1.8E-09	1.7E-09	2.2E-09	9.9E-10	1.8E-09
WNW	2.2E-09	2.1E-09	1.6E-09	1.6E-09	2.1E-09	9.5E-10	1.7E-09
W	4.4E-09	4.2E-09	3.1E-09	3.0E-09	4.0E-09	1.7E-09	3.2E-09
WSW	6.2E-09	6.0E-09	4.4E-09	4.2E-09	5.8E-09	2.2E-09	4.5E-09
SW	3.4E-09	3.2E-09	2.3E-09	2.2E-09	3.1E-09	1.2E-09	2.4E-09
SSW	2.5E-09	2.4E-09	1.8E-09	1.7E-09	2.3E-09	9.4E-10	1.8E-09
S	2.5E-09	2.4E-09	1.8E-09	1.7E-09	2.3E-09	9.8E-10	1.9E-09
SSE	3.7E-09	3.6E-09	2.7E-09	2.6E-09	3.4E-09	1.6E-09	2.8E-09
SE	5.2E-09	5.0E-09	3.8E-09	3.7E-09	4.8E-09	2.3E-09	3.9E-09
ESE	5.5E-09	5.3E-09	4.1E-09	3.9E-09	5.1E-09	2.4E-09	4.1E-09
E	8.2E-09	7.9E-09	6.0E-09	5.8E-09	7.6E-09	3.4E-09	6.2E-09
ENE	9.9E-09	9.5E-09	7.3E-09	7.0E-09	9.3E-09	4.0E-09	7.5E-09
NE	9.1E-09	8.8E-09	6.6E-09	6.3E-09	8.5E-09	3.6E-09	6.8E-09
NNE	6.3E-09	6.1E-09	4.5E-09	4.3E-09	5.9E-09	2.4E-09	4.6E-09

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1961	2056	2022	2408	2439	1278
N	2.5E-09	2.3E-09	2.4E-09	1.9E-09	1.8E-09	4.5E-09
NNW	1.7E-09	1.6E-09	1.6E-09	1.3E-09	1.2E-09	3.1E-09
NW	1.6E-09	1.5E-09	1.5E-09	1.2E-09	1.2E-09	2.8E-09
WNW	1.5E-09	1.4E-09	1.4E-09	1.1E-09	1.1E-09	2.6E-09
W	2.8E-09	2.6E-09	2.7E-09	2.1E-09	2.0E-09	5.3E-09
WSW	3.9E-09	3.6E-09	3.7E-09	2.8E-09	2.8E-09	7.7E-09
SW	2.1E-09	1.9E-09	2.0E-09	1.5E-09	1.5E-09	4.2E-09
SSW	1.6E-09	1.5E-09	1.5E-09	1.2E-09	1.2E-09	3.1E-09
S	1.6E-09	1.5E-09	1.6E-09	1.2E-09	1.2E-09	3.0E-09
SSE	2.5E-09	2.3E-09	2.4E-09	1.9E-09	1.9E-09	4.4E-09
SE	3.5E-09	3.3E-09	3.3E-09	2.7E-09	2.6E-09	6.1E-09
ESE	3.7E-09	3.5E-09	3.5E-09	2.8E-09	2.8E-09	6.6E-09
E	5.5E-09	5.1E-09	5.3E-09	4.2E-09	4.1E-09	9.7E-09
ENE	6.6E-09	6.2E-09	6.3E-09	5.0E-09	4.9E-09	1.2E-08
NE	6.0E-09	5.6E-09	5.7E-09	4.5E-09	4.4E-09	1.1E-08
NNE	4.1E-09	3.8E-09	3.9E-09	3.0E-09	3.0E-09	7.7E-09

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 8, 1998 2:26 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

8.14E-03

At This Location: 641 Meters East

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
WASTE PIT 5 [G1]

Dataset Name: 97-Z016-G1
Dataset Date: Apr 8, 1998 2:20 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 641 Meters East
Lifetime Fatal Cancer Risk: 7.05E-08

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	2.66E-05
BREAST	2.79E-05
R MAR	7.39E-03
LUNGS	3.70E-02
THYROID	2.64E-05
ENDOST	9.20E-02
RMNDR	1.08E-04
EFFEC	8.14E-03

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	4.2E-07	4.2E-07
U-235	Y	1.00	1.7E-08	1.7E-08
U-236	Y	1.00	4.3E-08	4.3E-08
U-238	Y	1.00	3.1E-07	3.1E-07
RA-226	W	1.00	2.7E-07	2.7E-07
RA-228	W	1.00	3.4E-08	3.4E-08
TH-228	Y	1.00	4.3E-08	4.3E-08
TH-230	Y	1.00	4.9E-06	4.9E-06
TH-232	Y	1.00	3.4E-08	3.4E-08
TH-234	Y	1.00	3.2E-07	3.2E-07

SITE INFORMATION

Temperature:	11 degrees C
Precipitation:	102 cm/y
Mixing Height:	950 m

SOURCE INFORMATION

Source Number: 1

Source Height (m): 1.00
Area (sq m): 1.82E+03

Plume Rise
Momentum (m/s): 0.00E+00
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

915	789	1198	855	641	980	1372	1528	1572	1777
1795	1904	1907	1921	2571	2116	1849	1825	1948	1669

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 8, 1998 2:26 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
WASTE PIT 5 [G1]

Dataset Name: 97-Z016-G1
Dataset Date: Apr 8, 1998 2:20 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.66E-05
BREAST	2.79E-05
R MAR	7.39E-03
LUNGS	3.70E-02
THYROID	2.64E-05
ENDOST	9.20E-02
RMNDR	1.08E-04
EFFEC	8.14E-03

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.35E-04
INHALATION	8.00E-03
AIR IMMERSION	3.25E-11
GROUND SURFACE	9.43E-07
INTERNAL	8.13E-03
EXTERNAL	9.43E-07
TOTAL	8.13E-03

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	3.45E-04
U-235	1.34E-05
U-236	3.36E-05
U-238	2.30E-04
RA-226	2.79E-05
RA-228	1.34E-06
TH-228	6.56E-05
TH-230	7.35E-03
TH-232	7.27E-05
TH-234	1.40E-07
TOTAL	8.13E-03

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	6.24E-09
BONE	4.10E-09
THYROID	4.47E-12
BREAST	4.22E-11
LUNG	5.97E-08
STOMACH	3.05E-11
BOWEL	3.16E-11
LIVER	1.92E-10
PANCREAS	2.18E-11
URINARY	1.04E-10
OTHER	2.67E-11
TOTAL	7.05E-08

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	5.19E-10
INHALATION	7.00E-08
AIR IMMERSION	7.37E-16
GROUND SURFACE	2.12E-11
INTERNAL	7.05E-08
EXTERNAL	2.12E-11
TOTAL	7.05E-08

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	4.46E-09
U-235	1.77E-10
U-236	4.35E-10
U-238	2.99E-09
RA-226	3.92E-10
RA-228	1.42E-11
TH-228	1.31E-09
TH-230	6.03E-08
TH-232	4.10E-10
TH-234	4.73E-12
TOTAL	7.05E-08

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	915	789	1198	855	641	980	1372
N	1.4E-03	1.8E-03	8.2E-04	1.6E-03	2.8E-03	1.2E-03	6.4E-04
NNW	8.7E-04	1.2E-03	5.3E-04	1.0E-03	1.8E-03	7.6E-04	4.1E-04
NW	8.9E-04	1.2E-03	5.4E-04	1.0E-03	1.8E-03	7.7E-04	4.2E-04
WNW	1.0E-03	1.4E-03	6.0E-04	1.2E-03	2.1E-03	8.7E-04	4.6E-04
W	1.6E-03	2.2E-03	9.7E-04	1.8E-03	3.3E-03	1.4E-03	7.5E-04
WSW	1.5E-03	2.0E-03	9.0E-04	1.7E-03	2.9E-03	1.3E-03	7.0E-04
SW	8.5E-04	1.1E-03	5.2E-04	9.7E-04	1.7E-03	7.5E-04	4.1E-04
SSW	7.5E-04	1.0E-03	4.6E-04	8.6E-04	1.5E-03	6.6E-04	3.6E-04
S	9.4E-04	1.3E-03	5.6E-04	1.1E-03	1.9E-03	8.2E-04	4.4E-04
SSE	2.0E-03	2.7E-03	1.2E-03	2.3E-03	4.1E-03	1.7E-03	9.0E-04
SE	3.3E-03	4.4E-03	1.9E-03	3.8E-03	6.8E-03	2.8E-03	1.5E-03
ESE	3.5E-03	4.7E-03	2.1E-03	4.0E-03	7.2E-03	3.0E-03	1.6E-03
E	3.9E-03	5.3E-03	2.3E-03	4.5E-03	8.1E-03	3.4E-03	1.8E-03
ENE	3.7E-03	5.0E-03	2.2E-03	4.3E-03	7.6E-03	3.2E-03	1.7E-03
NE	3.2E-03	4.3E-03	1.9E-03	3.7E-03	6.6E-03	2.8E-03	1.5E-03
NNE	2.0E-03	2.6E-03	1.2E-03	2.2E-03	4.0E-03	1.7E-03	9.2E-04

	Distance (m)						
Direction	1528	1572	1777	1795	1904	1907	1921
N	5.2E-04	4.9E-04	3.9E-04	3.9E-04	3.4E-04	3.4E-04	3.4E-04
NNW	3.3E-04	3.2E-04	2.5E-04	2.5E-04	2.2E-04	2.2E-04	2.2E-04
NW	3.4E-04	3.2E-04	2.6E-04	2.5E-04	2.3E-04	2.3E-04	2.2E-04
WNW	3.8E-04	3.6E-04	2.8E-04	2.8E-04	2.5E-04	2.5E-04	2.4E-04
W	6.1E-04	5.8E-04	4.6E-04	4.5E-04	4.0E-04	4.0E-04	3.9E-04
WSW	5.8E-04	5.5E-04	4.4E-04	4.4E-04	3.9E-04	3.9E-04	3.9E-04
SW	3.4E-04	3.2E-04	2.6E-04	2.5E-04	2.3E-04	2.3E-04	2.2E-04
SSW	2.9E-04	2.8E-04	2.2E-04	2.2E-04	2.0E-04	2.0E-04	1.9E-04
S	3.6E-04	3.4E-04	2.7E-04	2.7E-04	2.4E-04	2.4E-04	2.3E-04
SSE	7.3E-04	6.9E-04	5.5E-04	5.4E-04	4.8E-04	4.7E-04	4.7E-04
SE	1.2E-03	1.1E-03	8.9E-04	8.7E-04	7.7E-04	7.7E-04	7.6E-04
ESE	1.3E-03	1.2E-03	9.5E-04	9.3E-04	8.2E-04	8.2E-04	8.1E-04
E	1.5E-03	1.4E-03	1.1E-03	1.1E-03	9.5E-04	9.5E-04	9.4E-04
ENE	1.4E-03	1.3E-03	1.1E-03	1.0E-03	9.2E-04	9.2E-04	9.0E-04
NE	1.2E-03	1.1E-03	9.1E-04	9.0E-04	8.0E-04	8.0E-04	7.9E-04
NNE	7.5E-04	7.1E-04	5.7E-04	5.6E-04	5.0E-04	5.0E-04	4.9E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2571	2116	1849	1825	1948	1669
N	2.0E-04	2.8E-04	3.6E-04	3.7E-04	3.3E-04	4.4E-04
NNW	1.3E-04	1.9E-04	2.4E-04	2.4E-04	2.1E-04	2.9E-04
NW	1.3E-04	1.9E-04	2.4E-04	2.4E-04	2.2E-04	2.9E-04
WNW	1.5E-04	2.1E-04	2.6E-04	2.7E-04	2.4E-04	3.2E-04
W	2.3E-04	3.3E-04	4.2E-04	4.4E-04	3.8E-04	5.2E-04
WSW	2.3E-04	3.3E-04	4.1E-04	4.2E-04	3.8E-04	5.0E-04
SW	1.4E-04	1.9E-04	2.4E-04	2.5E-04	2.2E-04	2.9E-04
SSW	1.2E-04	1.6E-04	2.1E-04	2.1E-04	1.9E-04	2.5E-04
S	1.4E-04	2.0E-04	2.5E-04	2.6E-04	2.3E-04	3.0E-04
SSE	2.7E-04	3.9E-04	5.0E-04	5.2E-04	4.5E-04	6.2E-04
SE	4.4E-04	6.3E-04	8.2E-04	8.4E-04	7.4E-04	1.0E-03
ESE	4.7E-04	6.7E-04	8.8E-04	9.0E-04	7.9E-04	1.1E-03
E	5.5E-04	7.8E-04	1.0E-03	1.0E-03	9.1E-04	1.2E-03
ENE	5.3E-04	7.6E-04	9.7E-04	1.0E-03	8.8E-04	1.2E-03
NE	4.7E-04	6.6E-04	8.5E-04	8.7E-04	7.7E-04	1.0E-03
NNE	2.9E-04	4.1E-04	5.3E-04	5.4E-04	4.8E-04	6.4E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	915	789	1198	855	641	980	1372
N	1.2E-08	1.6E-08	7.1E-09	1.3E-08	2.4E-08	1.0E-08	5.5E-09
NNW	7.5E-09	1.0E-08	4.5E-09	8.6E-09	1.5E-08	6.5E-09	3.5E-09
NW	7.7E-09	1.0E-08	4.6E-09	8.8E-09	1.6E-08	6.7E-09	3.6E-09
WNW	8.7E-09	1.2E-08	5.2E-09	9.9E-09	1.8E-08	7.5E-09	4.0E-09
W	1.4E-08	1.9E-08	8.3E-09	1.6E-08	2.9E-08	1.2E-08	6.4E-09
WSW	1.3E-08	1.7E-08	7.7E-09	1.4E-08	2.5E-08	1.1E-08	6.1E-09
SW	7.4E-09	9.8E-09	4.5E-09	8.4E-09	1.5E-08	6.4E-09	3.5E-09
SSW	6.5E-09	8.7E-09	3.9E-09	7.4E-09	1.3E-08	5.6E-09	3.0E-09
S	8.1E-09	1.1E-08	4.9E-09	9.3E-09	1.7E-08	7.0E-09	3.8E-09
SSE	1.7E-08	2.3E-08	1.0E-08	2.0E-08	3.6E-08	1.5E-08	7.8E-09
SE	2.8E-08	3.8E-08	1.7E-08	3.3E-08	5.9E-08	2.4E-08	1.3E-08
ESE	3.0E-08	4.1E-08	1.8E-08	3.5E-08	6.3E-08	2.6E-08	1.4E-08
E	3.4E-08	4.6E-08	2.0E-08	3.9E-08	7.0E-08	2.9E-08	1.6E-08
ENE	3.2E-08	4.3E-08	1.9E-08	3.7E-08	6.6E-08	2.8E-08	1.5E-08
NE	2.8E-08	3.7E-08	1.7E-08	3.2E-08	5.7E-08	2.4E-08	1.3E-08
NNE	1.7E-08	2.3E-08	1.0E-08	1.9E-08	3.4E-08	1.5E-08	7.9E-09

	Distance (m)						
Direction	1528	1572	1777	1795	1904	1907	1921
N	4.4E-09	4.2E-09	3.4E-09	3.3E-09	2.9E-09	2.9E-09	2.9E-09
NNW	2.9E-09	2.7E-09	2.2E-09	2.1E-09	1.9E-09	1.9E-09	1.9E-09
NW	2.9E-09	2.8E-09	2.2E-09	2.2E-09	1.9E-09	1.9E-09	1.9E-09
WNW	3.2E-09	3.1E-09	2.4E-09	2.4E-09	2.1E-09	2.1E-09	2.1E-09
W	5.2E-09	4.9E-09	3.9E-09	3.9E-09	3.4E-09	3.4E-09	3.4E-09
WSW	5.0E-09	4.7E-09	3.8E-09	3.7E-09	3.4E-09	3.3E-09	3.3E-09
SW	2.9E-09	2.7E-09	2.2E-09	2.2E-09	1.9E-09	1.9E-09	1.9E-09
SSW	2.5E-09	2.4E-09	1.9E-09	1.9E-09	1.7E-09	1.7E-09	1.6E-09
S	3.0E-09	2.9E-09	2.3E-09	2.3E-09	2.0E-09	2.0E-09	2.0E-09
SSE	6.3E-09	5.9E-09	4.7E-09	4.6E-09	4.1E-09	4.1E-09	4.0E-09
SE	1.0E-08	9.7E-09	7.7E-09	7.5E-09	6.7E-09	6.7E-09	6.6E-09
ESE	1.1E-08	1.0E-08	8.2E-09	8.0E-09	7.1E-09	7.1E-09	7.0E-09
E	1.3E-08	1.2E-08	9.4E-09	9.3E-09	8.2E-09	8.2E-09	8.1E-09
ENE	1.2E-08	1.1E-08	9.1E-09	8.9E-09	7.9E-09	7.9E-09	7.8E-09
NE	1.0E-08	9.9E-09	7.9E-09	7.7E-09	6.9E-09	6.9E-09	6.8E-09
NNE	6.5E-09	6.1E-09	4.9E-09	4.8E-09	4.3E-09	4.3E-09	4.2E-09

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2571	2116	1849	1825	1948	1669
N	1.7E-09	2.4E-09	3.1E-09	3.2E-09	2.8E-09	3.8E-09
NNW	1.1E-09	1.6E-09	2.0E-09	2.1E-09	1.8E-09	2.4E-09
NW	1.1E-09	1.6E-09	2.0E-09	2.1E-09	1.8E-09	2.5E-09
WNW	1.2E-09	1.7E-09	2.2E-09	2.3E-09	2.0E-09	2.7E-09
W	2.0E-09	2.8E-09	3.6E-09	3.7E-09	3.3E-09	4.4E-09
WSW	2.0E-09	2.8E-09	3.5E-09	3.6E-09	3.2E-09	4.3E-09
SW	1.1E-09	1.6E-09	2.0E-09	2.1E-09	1.9E-09	2.5E-09
SSW	9.7E-10	1.4E-09	1.8E-09	1.8E-09	1.6E-09	2.1E-09
S	1.2E-09	1.7E-09	2.1E-09	2.2E-09	1.9E-09	2.6E-09
SSE	2.3E-09	3.3E-09	4.3E-09	4.5E-09	3.9E-09	5.3E-09
SE	3.8E-09	5.4E-09	7.1E-09	7.3E-09	6.4E-09	8.7E-09
ESE	4.0E-09	5.8E-09	7.5E-09	7.7E-09	6.8E-09	9.2E-09
E	4.7E-09	6.7E-09	8.7E-09	9.0E-09	7.9E-09	1.1E-08
ENE	4.6E-09	6.5E-09	8.4E-09	8.6E-09	7.6E-09	1.0E-08
NE	4.0E-09	5.7E-09	7.3E-09	7.5E-09	6.6E-09	8.9E-09
NNE	2.5E-09	3.5E-09	4.6E-09	4.7E-09	4.1E-09	5.5E-09

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 8, 1998 2:27 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)
4.24E-03

At This Location: 882 Meters East

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
WASTE PIT 5 [G2]

Dataset Name: 97-Z016-G2
Dataset Date: Apr 8, 1998 2:22 pm
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 882 Meters East
Lifetime Fatal Cancer Risk: 3.67E-08

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.40E-05
BREAST	1.47E-05
R MAR	3.86E-03
LUNGS	1.93E-02
THYROID	1.39E-05
ENDOST	4.80E-02
RMNDR	5.76E-05
EFFEC	4.24E-03

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	4.2E-07	4.2E-07
U-235	Y	1.00	1.7E-08	1.7E-08
U-236	Y	1.00	4.3E-08	4.3E-08
U-238	Y	1.00	3.1E-07	3.1E-07
RA-226	W	1.00	2.7E-07	2.7E-07
RA-228	W	1.00	3.4E-08	3.4E-08
TH-228	Y	1.00	4.3E-08	4.3E-08
TH-230	Y	1.00	4.9E-06	4.9E-06
TH-232	Y	1.00	3.4E-08	3.4E-08
TH-234	Y	1.00	3.2E-07	3.2E-07

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number:	1
Source Height (m):	1.00
Area (sq m):	1.82E+03
Plume Rise Momentum (m/s): (Exit Velocity)	0.00E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1086	989	1469	2446	2959	1948	3028	1043	2198	2743
2795	1095	2003	882	1182	1272	1225	1885	1906	1730

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 8, 1998 2:27 pm

Facility: FERNALD ENVIRONMENTAL.MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
WASTE PIT 5 [G2]

Dataset Name: 97-Z016-G2
Dataset Date: Apr 8, 1998 2:22 pm
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.40E-05
BREAST	1.47E-05
R MAR	3.86E-03
LUNGS	1.93E-02
THYROID	1.39E-05
ENDOST	4.80E-02
RMNDR	5.76E-05
EFFEC	4.24E-03

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	7.35E-05
INHALATION	4.17E-03
AIR IMMERSION	1.69E-11
GROUND SURFACE	5.01E-07
INTERNAL	4.24E-03
EXTERNAL	5.01E-07
TOTAL	4.24E-03

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.80E-04
U-235	7.02E-06
U-236	1.76E-05
U-238	1.20E-04
RA-226	1.49E-05
RA-228	7.17E-07
TH-228	3.42E-05
TH-230	3.83E-03
TH-232	3.79E-05
TH-234	7.46E-08
TOTAL	4.24E-03

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	3.26E-09
BONE	2.14E-09
THYROID	2.36E-12
BREAST	2.23E-11
LUNG	3.11E-08
STOMACH	1.61E-11
BOWEL	1.69E-11
LIVER	1.00E-10
PANCREAS	1.15E-11
URINARY	5.65E-11
OTHER	1.41E-11
TOTAL	3.67E-08

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.83E-10
INHALATION	3.64E-08
AIR IMMERSION	3.84E-16
GROUND SURFACE	1.13E-11
INTERNAL	3.67E-08
EXTERNAL	1.13E-11
TOTAL	3.67E-08

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	2.32E-09
U-235	9.23E-11
U-236	2.27E-10
U-238	1.56E-09
RA-226	2.06E-10
RA-228	7.54E-12
TH-228	6.85E-10
TH-230	3.14E-08
TH-232	2.13E-10
TH-234	2.49E-12
TOTAL	3.67E-08

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1086	989	1469	2446	2959	1948	3028
N	9.8E-04	1.2E-03	5.6E-04	2.2E-04	1.6E-04	3.3E-04	1.5E-04
NNW	6.3E-04	7.4E-04	3.6E-04	1.4E-04	1.0E-04	2.1E-04	9.8E-05
NW	6.4E-04	7.6E-04	3.6E-04	1.4E-04	1.0E-04	2.1E-04	9.9E-05
WNW	7.2E-04	8.5E-04	4.0E-04	1.6E-04	1.1E-04	2.4E-04	1.1E-04
W	1.2E-03	1.4E-03	6.5E-04	2.5E-04	1.8E-04	3.8E-04	1.7E-04
WSW	1.1E-03	1.3E-03	6.2E-04	2.5E-04	1.8E-04	3.7E-04	1.7E-04
SW	6.2E-04	7.3E-04	3.6E-04	1.5E-04	1.1E-04	2.2E-04	1.0E-04
SSW	5.4E-04	6.4E-04	3.1E-04	1.3E-04	9.0E-05	1.9E-04	8.7E-05
S	6.7E-04	8.0E-04	3.8E-04	1.5E-04	1.1E-04	2.3E-04	1.0E-04
SSE	1.4E-03	1.7E-03	7.8E-04	3.0E-04	2.1E-04	4.5E-04	2.0E-04
SE	2.3E-03	2.8E-03	1.3E-03	4.8E-04	3.4E-04	7.4E-04	3.2E-04
ESE	2.5E-03	2.9E-03	1.4E-03	5.1E-04	3.6E-04	7.8E-04	3.4E-04
E	2.8E-03	3.3E-03	1.6E-03	6.0E-04	4.2E-04	9.1E-04	4.0E-04
ENE	2.7E-03	3.2E-03	1.5E-03	5.8E-04	4.1E-04	8.8E-04	3.9E-04
NE	2.3E-03	2.7E-03	1.3E-03	5.1E-04	3.6E-04	7.6E-04	3.4E-04
NNE	1.4E-03	1.7E-03	8.1E-04	3.2E-04	2.3E-04	4.8E-04	2.2E-04

	Distance (m)						
Direction	1043	2198	2743	2795	1095	2003	882
N	1.0E-03	2.6E-04	1.8E-04	1.7E-04	9.6E-04	3.1E-04	1.5E-03
NNW	6.7E-04	1.7E-04	1.2E-04	1.1E-04	6.2E-04	2.0E-04	9.4E-04
NW	6.9E-04	1.7E-04	1.2E-04	1.1E-04	6.3E-04	2.0E-04	9.6E-04
WNW	7.7E-04	1.9E-04	1.3E-04	1.2E-04	7.1E-04	2.2E-04	1.1E-03
W	1.2E-03	3.1E-04	2.1E-04	2.0E-04	1.1E-03	3.6E-04	1.7E-03
WSW	1.1E-03	3.0E-04	2.1E-04	2.0E-04	1.0E-03	3.6E-04	1.6E-03
SW	6.6E-04	1.8E-04	1.2E-04	1.2E-04	6.1E-04	2.1E-04	9.2E-04
SSW	5.8E-04	1.5E-04	1.0E-04	9.9E-05	5.3E-04	1.8E-04	8.1E-04
S	7.2E-04	1.8E-04	1.2E-04	1.2E-04	6.6E-04	2.1E-04	1.0E-03
SSE	1.5E-03	3.6E-04	2.4E-04	2.3E-04	1.4E-03	4.3E-04	2.1E-03
SE	2.5E-03	5.9E-04	3.9E-04	3.8E-04	2.3E-03	6.9E-04	3.5E-03
ESE	2.7E-03	6.3E-04	4.2E-04	4.0E-04	2.4E-03	7.4E-04	3.7E-03
E	3.0E-03	7.3E-04	4.8E-04	4.7E-04	2.8E-03	8.6E-04	4.2E-03
ENE	2.9E-03	7.0E-04	4.7E-04	4.6E-04	2.6E-03	8.3E-04	4.0E-03
NE	2.5E-03	6.1E-04	4.1E-04	4.0E-04	2.3E-03	7.2E-04	3.4E-03
NNE	1.5E-03	3.9E-04	2.6E-04	2.5E-04	1.4E-03	4.5E-04	2.1E-03

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1182	1272	1225	1885	1906	1730
N	8.4E-04	7.3E-04	7.8E-04	3.5E-04	3.4E-04	4.1E-04
NNW	5.4E-04	4.7E-04	5.0E-04	2.3E-04	2.2E-04	2.7E-04
NW	5.5E-04	4.8E-04	5.1E-04	2.3E-04	2.2E-04	2.7E-04
WNW	6.1E-04	5.3E-04	5.7E-04	2.5E-04	2.5E-04	3.0E-04
W	9.9E-04	8.6E-04	9.2E-04	4.1E-04	4.0E-04	4.8E-04
WSW	9.2E-04	8.0E-04	8.6E-04	4.0E-04	3.9E-04	4.6E-04
SW	5.3E-04	4.7E-04	5.0E-04	2.3E-04	2.3E-04	2.7E-04
SSW	4.7E-04	4.1E-04	4.4E-04	2.0E-04	1.9E-04	2.3E-04
S	5.8E-04	5.0E-04	5.4E-04	2.4E-04	2.4E-04	2.8E-04
SSE	1.2E-03	1.0E-03	1.1E-03	4.8E-04	4.7E-04	5.7E-04
SE	2.0E-03	1.7E-03	1.9E-03	7.9E-04	7.7E-04	9.4E-04
ESE	2.1E-03	1.8E-03	2.0E-03	8.4E-04	8.2E-04	1.0E-03
E	2.4E-03	2.1E-03	2.2E-03	9.7E-04	9.5E-04	1.2E-03
ENE	2.3E-03	2.0E-03	2.1E-03	9.4E-04	9.2E-04	1.1E-03
NE	2.0E-03	1.7E-03	1.8E-03	8.2E-04	8.0E-04	9.6E-04
NNE	1.2E-03	1.1E-03	1.1E-03	5.1E-04	5.0E-04	6.0E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1086	989	1469	2446	2959	1948	3028
N	8.4E-09	1.0E-08	4.8E-09	1.9E-09	1.3E-09	2.8E-09	1.3E-09
NNW	5.4E-09	6.4E-09	3.1E-09	1.2E-09	8.6E-10	1.8E-09	8.2E-10
NW	5.5E-09	6.5E-09	3.1E-09	1.2E-09	8.6E-10	1.8E-09	8.2E-10
WNW	6.2E-09	7.3E-09	3.5E-09	1.3E-09	9.4E-10	2.0E-09	9.0E-10
W	1.0E-08	1.2E-08	5.6E-09	2.2E-09	1.5E-09	3.3E-09	1.5E-09
WSW	9.2E-09	1.1E-08	5.3E-09	2.2E-09	1.5E-09	3.2E-09	1.5E-09
SW	5.3E-09	6.3E-09	3.1E-09	1.2E-09	8.9E-10	1.8E-09	8.5E-10
SSW	4.7E-09	5.5E-09	2.7E-09	1.1E-09	7.5E-10	1.6E-09	7.2E-10
S	5.8E-09	6.9E-09	3.3E-09	1.3E-09	9.0E-10	1.9E-09	8.6E-10
SSE	1.2E-08	1.4E-08	6.8E-09	2.6E-09	1.8E-09	3.9E-09	1.7E-09
SE	2.0E-08	2.4E-08	1.1E-08	4.2E-09	2.9E-09	6.4E-09	2.8E-09
ESE	2.1E-08	2.5E-08	1.2E-08	4.4E-09	3.1E-09	6.8E-09	2.9E-09
E	2.4E-08	2.9E-08	1.4E-08	5.2E-09	3.6E-09	7.9E-09	3.5E-09
ENE	2.3E-08	2.7E-08	1.3E-08	5.0E-09	3.5E-09	7.6E-09	3.4E-09
NE	2.0E-08	2.4E-08	1.1E-08	4.4E-09	3.1E-09	6.6E-09	2.9E-09
NNE	1.2E-08	1.4E-08	7.0E-09	2.7E-09	1.9E-09	4.1E-09	1.9E-09

	Distance (m)						
Direction	1043	2198	2743	2795	1095	2003	882
N	9.1E-09	2.3E-09	1.5E-09	1.5E-09	8.3E-09	2.7E-09	1.3E-08
NNW	5.8E-09	1.5E-09	9.8E-10	9.5E-10	5.3E-09	1.7E-09	8.1E-09
NW	5.9E-09	1.5E-09	9.9E-10	9.5E-10	5.4E-09	1.7E-09	8.3E-09
WNW	6.6E-09	1.6E-09	1.1E-09	1.0E-09	6.1E-09	1.9E-09	9.3E-09
W	1.1E-08	2.6E-09	1.8E-09	1.7E-09	9.8E-09	3.1E-09	1.5E-08
WSW	9.9E-09	2.6E-09	1.8E-09	1.7E-09	9.1E-09	3.0E-09	1.4E-08
SW	5.7E-09	1.5E-09	1.0E-09	9.8E-10	5.2E-09	1.8E-09	7.9E-09
SSW	5.0E-09	1.3E-09	8.6E-10	8.3E-10	4.6E-09	1.5E-09	7.0E-09
S	6.2E-09	1.5E-09	1.0E-09	1.0E-09	5.7E-09	1.8E-09	8.7E-09
SSE	1.3E-08	3.1E-09	2.1E-09	2.0E-09	1.2E-08	3.7E-09	1.8E-08
SE	2.2E-08	5.1E-09	3.3E-09	3.2E-09	2.0E-08	6.0E-09	3.1E-08
ESE	2.3E-08	5.4E-09	3.6E-09	3.4E-09	2.1E-08	6.4E-09	3.2E-08
E	2.6E-08	6.3E-09	4.2E-09	4.0E-09	2.4E-08	7.4E-09	3.7E-08
ENE	2.5E-08	6.1E-09	4.1E-09	3.9E-09	2.3E-08	7.2E-09	3.5E-08
NE	2.1E-08	5.3E-09	3.5E-09	3.4E-09	2.0E-08	6.2E-09	3.0E-08
NNE	1.3E-08	3.3E-09	2.2E-09	2.2E-09	1.2E-08	3.9E-09	1.8E-08

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1182	1272	1225	1885	1906	1730
N	7.2E-09	6.3E-09	6.8E-09	3.0E-09	2.9E-09	3.5E-09
NNW	4.6E-09	4.1E-09	4.3E-09	1.9E-09	1.9E-09	2.3E-09
NW	4.7E-09	4.1E-09	4.4E-09	2.0E-09	1.9E-09	2.3E-09
WNW	5.3E-09	4.6E-09	4.9E-09	2.2E-09	2.1E-09	2.5E-09
W	8.5E-09	7.4E-09	8.0E-09	3.5E-09	3.4E-09	4.1E-09
WSW	7.9E-09	6.9E-09	7.4E-09	3.4E-09	3.3E-09	4.0E-09
SW	4.6E-09	4.0E-09	4.3E-09	2.0E-09	1.9E-09	2.3E-09
SSW	4.0E-09	3.5E-09	3.8E-09	1.7E-09	1.6E-09	2.0E-09
S	5.0E-09	4.3E-09	4.7E-09	2.1E-09	2.0E-09	2.4E-09
SSE	1.0E-08	9.0E-09	9.7E-09	4.2E-09	4.1E-09	4.9E-09
SE	1.7E-08	1.5E-08	1.6E-08	6.8E-09	6.7E-09	8.1E-09
ESE	1.8E-08	1.6E-08	1.7E-08	7.2E-09	7.1E-09	8.6E-09
E	2.1E-08	1.8E-08	1.9E-08	8.4E-09	8.2E-09	9.9E-09
ENE	2.0E-08	1.7E-08	1.8E-08	8.1E-09	7.9E-09	9.5E-09
NE	1.7E-08	1.5E-08	1.6E-08	7.0E-09	6.9E-09	8.3E-09
NNE	1.0E-08	9.1E-09	9.8E-09	4.4E-09	4.3E-09	5.1E-09

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 20, 1998 7:57 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

1.19E+00

At This Location: 609 Meters East

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
WPRAP - Railyard [G1]

Dataset Name: 97-Z036a-RR-G1
Dataset Date: Apr 20, 1998 7:50 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 609 Meters East
Lifetime Fatal Cancer Risk: 1.53E-05

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	3.11E-03
BREAST	3.55E-03
R MAR	1.50E-01
LUNGS	9.09E+00
THYROID	3.02E-03
ENDOST	1.96E+00
RMNDR	7.73E-02
EFFEC	1.19E+00

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	5.7E-04	5.7E-04
U-235	Y	1.00	3.0E-05	3.0E-05
U-236	Y	1.00	2.2E-05	2.2E-05
U-238	Y	1.00	6.3E-04	6.3E-04
RA-226	W	1.00	4.0E-07	4.0E-07
RA-228	W	1.00	1.6E-06	1.6E-06
TH-228	Y	1.00	1.7E-05	1.7E-05
TH-230	Y	1.00	5.0E-05	5.0E-05
TH-232	Y	1.00	2.7E-06	2.7E-06
TH-234	Y	1.00	2.5E-03	2.5E-03

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number: 1

Source Height (m): 1.00
Area (sq m): 9.78E+04

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Zero:	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

609	648	1693	1601	1461	1602	1811	1891	1926	2067
2060	2040	1899	1876	2373	1791	1288	1234	1125	952

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 20, 1998 7:57 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
WPRAP - Railyard [G1]

Dataset Name: 97-Z036a-RR-G1
Dataset Date: Apr 20, 1998 7:50 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	3.11E-03
BREAST	3.55E-03
R MAR	1.50E-01
LUNGS	9.09E+00
THYROID	3.02E-03
ENDOST	1.96E+00
RMNDR	7.73E-02
EFFEC	1.19E+00

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	5.49E-02
INHALATION	1.14E+00
AIR IMMERSION	9.53E-08
GROUND SURFACE	6.35E-04
INTERNAL	1.19E+00
EXTERNAL	6.35E-04
TOTAL	1.19E+00

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	5.15E-01
U-235	2.58E-02
U-236	1.89E-02
U-238	5.12E-01
RA-226	4.53E-05
RA-228	7.07E-05
TH-228	2.84E-02
TH-230	8.36E-02
TH-232	6.40E-03
TH-234	1.22E-03
TOTAL	1.19E+00

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.45E-07
BONE	9.57E-08
THYROID	7.00E-10
BREAST	7.97E-09
LUNG	1.48E-05
STOMACH	5.26E-09
BOWEL	1.39E-08
LIVER	6.76E-09
PANCREAS	3.05E-09
URINARY	1.60E-07
OTHER	3.73E-09
TOTAL	1.53E-05

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.91E-07
INHALATION	1.50E-05
AIR IMMERSION	2.12E-12
GROUND SURFACE	1.46E-08
INTERNAL	1.52E-05
EXTERNAL	1.46E-08
TOTAL	1.53E-05

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	6.66E-06
U-235	3.40E-07
U-236	2.45E-07
U-238	6.68E-06
RA-226	6.39E-10
RA-228	7.52E-10
TH-228	5.70E-07
TH-230	6.86E-07
TH-232	3.61E-08
TH-234	4.14E-08
TOTAL	1.53E-05

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	609	648	1693	1601	1461	1602	1811
N	4.2E-01	3.7E-01	5.9E-02	6.5E-02	7.7E-02	6.5E-02	5.2E-02
NNW	2.9E-01	2.5E-01	3.9E-02	4.3E-02	5.1E-02	4.3E-02	3.5E-02
NW	2.8E-01	2.4E-01	3.9E-02	4.3E-02	5.1E-02	4.3E-02	3.5E-02
WNW	3.3E-01	2.8E-01	4.3E-02	4.8E-02	5.7E-02	4.8E-02	3.9E-02
W	4.7E-01	4.2E-01	6.9E-02	7.6E-02	9.0E-02	7.6E-02	6.1E-02
WSW	4.2E-01	3.8E-01	6.6E-02	7.3E-02	8.6E-02	7.3E-02	5.9E-02
SW	2.7E-01	2.4E-01	3.9E-02	4.3E-02	5.1E-02	4.3E-02	3.5E-02
SSW	2.4E-01	2.1E-01	3.4E-02	3.8E-02	4.4E-02	3.8E-02	3.1E-02
S	3.2E-01	2.8E-01	4.1E-02	4.6E-02	5.4E-02	4.6E-02	3.7E-02
SSE	6.2E-01	5.5E-01	8.2E-02	9.1E-02	1.1E-01	9.1E-02	7.2E-02
SE	9.8E-01	8.7E-01	1.3E-01	1.5E-01	1.8E-01	1.5E-01	1.2E-01
ESE	1.1E+00	9.6E-01	1.4E-01	1.6E-01	1.9E-01	1.6E-01	1.2E-01
E	1.2E+00	1.1E+00	1.6E-01	1.8E-01	2.1E-01	1.8E-01	1.4E-01
ENE	1.1E+00	9.9E-01	1.6E-01	1.7E-01	2.0E-01	1.7E-01	1.4E-01
NE	9.5E-01	8.4E-01	1.4E-01	1.5E-01	1.8E-01	1.5E-01	1.2E-01
NNE	6.2E-01	5.4E-01	8.5E-02	9.4E-02	1.1E-01	9.4E-02	7.5E-02

	Distance (m)						
Direction	1891	1926	2067	2060	2040	1899	1876
N	4.9E-02	4.7E-02	4.1E-02	4.2E-02	4.2E-02	4.8E-02	4.9E-02
NNW	3.2E-02	3.1E-02	2.8E-02	2.8E-02	2.8E-02	3.2E-02	3.3E-02
NW	3.3E-02	3.1E-02	2.8E-02	2.8E-02	2.9E-02	3.2E-02	3.3E-02
WNW	3.6E-02	3.4E-02	3.0E-02	3.1E-02	3.1E-02	3.5E-02	3.6E-02
W	5.6E-02	5.4E-02	4.8E-02	4.8E-02	4.9E-02	5.6E-02	5.7E-02
WSW	5.5E-02	5.3E-02	4.7E-02	4.7E-02	4.8E-02	5.5E-02	5.6E-02
SW	3.3E-02	3.2E-02	2.8E-02	2.8E-02	2.9E-02	3.3E-02	3.3E-02
SSW	2.8E-02	2.8E-02	2.5E-02	2.5E-02	2.5E-02	2.8E-02	2.9E-02
S	3.4E-02	3.3E-02	2.9E-02	2.9E-02	3.0E-02	3.4E-02	3.5E-02
SSE	6.6E-02	6.4E-02	5.6E-02	5.6E-02	5.7E-02	6.6E-02	6.7E-02
SE	1.1E-01	1.0E-01	9.0E-02	9.0E-02	9.2E-02	1.1E-01	1.1E-01
ESE	1.1E-01	1.1E-01	9.5E-02	9.6E-02	9.8E-02	1.1E-01	1.2E-01
E	1.3E-01	1.3E-01	1.1E-01	1.1E-01	1.1E-01	1.3E-01	1.3E-01
ENE	1.3E-01	1.2E-01	1.1E-01	1.1E-01	1.1E-01	1.3E-01	1.3E-01
NE	1.1E-01	1.1E-01	9.4E-02	9.4E-02	9.6E-02	1.1E-01	1.1E-01
NNE	7.0E-02	6.7E-02	5.9E-02	6.0E-02	6.1E-02	6.9E-02	7.1E-02

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2373	1791	1288	1234	1125	952
N	3.3E-02	5.4E-02	9.7E-02	1.1E-01	1.2E-01	1.7E-01
NNW	2.2E-02	3.5E-02	6.3E-02	6.9E-02	8.1E-02	1.1E-01
NW	2.2E-02	3.6E-02	6.4E-02	6.9E-02	8.2E-02	1.1E-01
WNW	2.4E-02	3.9E-02	7.2E-02	7.8E-02	9.2E-02	1.2E-01
W	3.8E-02	6.2E-02	1.1E-01	1.2E-01	1.5E-01	2.0E-01
WSW	3.8E-02	6.0E-02	1.1E-01	1.2E-01	1.4E-01	1.8E-01
SW	2.3E-02	3.6E-02	6.3E-02	6.8E-02	8.0E-02	1.1E-01
SSW	2.0E-02	3.1E-02	5.5E-02	6.0E-02	7.0E-02	9.4E-02
S	2.3E-02	3.7E-02	6.8E-02	7.3E-02	8.6E-02	1.2E-01
SSE	4.4E-02	7.4E-02	1.4E-01	1.5E-01	1.8E-01	2.4E-01
SE	7.0E-02	1.2E-01	2.3E-01	2.4E-01	2.9E-01	4.0E-01
ESE	7.5E-02	1.3E-01	2.4E-01	2.6E-01	3.1E-01	4.3E-01
E	8.7E-02	1.5E-01	2.7E-01	3.0E-01	3.5E-01	4.8E-01
ENE	8.4E-02	1.4E-01	2.6E-01	2.8E-01	3.3E-01	4.6E-01
NE	7.4E-02	1.2E-01	2.3E-01	2.4E-01	2.9E-01	3.9E-01
NNE	4.7E-02	7.7E-02	1.4E-01	1.5E-01	1.8E-01	2.4E-01

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 609	648	1693	1601	1461	1602	1811
N	5.4E-06	4.7E-06	7.3E-07	8.1E-07	9.6E-07	8.1E-07	6.5E-07
NNW	3.6E-06	3.2E-06	4.8E-07	5.3E-07	6.2E-07	5.3E-07	4.2E-07
NW	3.5E-06	3.1E-06	4.8E-07	5.3E-07	6.3E-07	5.3E-07	4.3E-07
WNW	4.2E-06	3.6E-06	5.3E-07	5.9E-07	7.0E-07	5.9E-07	4.7E-07
W	6.0E-06	5.3E-06	8.6E-07	9.5E-07	1.1E-06	9.5E-07	7.6E-07
WSW	5.4E-06	4.8E-06	8.3E-07	9.1E-07	1.1E-06	9.1E-07	7.3E-07
SW	3.5E-06	3.0E-06	4.8E-07	5.3E-07	6.2E-07	5.3E-07	4.3E-07
SSW	3.0E-06	2.7E-06	4.2E-07	4.6E-07	5.4E-07	4.6E-07	3.7E-07
S	4.1E-06	3.5E-06	5.1E-07	5.6E-07	6.6E-07	5.6E-07	4.5E-07
SSE	8.0E-06	7.0E-06	1.0E-06	1.1E-06	1.4E-06	1.1E-06	9.0E-07
SE	1.3E-05	1.1E-05	1.7E-06	1.9E-06	2.2E-06	1.9E-06	1.5E-06
ESE	1.4E-05	1.2E-05	1.8E-06	2.0E-06	2.4E-06	2.0E-06	1.6E-06
E	1.5E-05	1.3E-05	2.0E-06	2.3E-06	2.7E-06	2.3E-06	1.8E-06
ENE	1.4E-05	1.3E-05	2.0E-06	2.2E-06	2.6E-06	2.2E-06	1.7E-06
NE	1.2E-05	1.1E-05	1.7E-06	1.9E-06	2.2E-06	1.9E-06	1.5E-06
NNE	7.9E-06	6.9E-06	1.1E-06	1.2E-06	1.4E-06	1.2E-06	9.4E-07

Direction	Distance (m) 1891	1926	2067	2060	2040	1899	1876
N	6.0E-07	5.8E-07	5.1E-07	5.1E-07	5.2E-07	5.9E-07	6.1E-07
NNW	3.9E-07	3.8E-07	3.3E-07	3.3E-07	3.4E-07	3.9E-07	4.0E-07
NW	3.9E-07	3.8E-07	3.3E-07	3.4E-07	3.4E-07	3.9E-07	4.0E-07
WNW	4.3E-07	4.2E-07	3.7E-07	3.7E-07	3.8E-07	4.3E-07	4.4E-07
W	7.0E-07	6.7E-07	5.9E-07	5.9E-07	6.0E-07	6.9E-07	7.1E-07
WSW	6.8E-07	6.6E-07	5.8E-07	5.8E-07	5.9E-07	6.7E-07	6.9E-07
SW	4.0E-07	3.8E-07	3.4E-07	3.4E-07	3.5E-07	3.9E-07	4.0E-07
SSW	3.4E-07	3.3E-07	2.9E-07	2.9E-07	3.0E-07	3.4E-07	3.5E-07
S	4.1E-07	4.0E-07	3.5E-07	3.5E-07	3.6E-07	4.1E-07	4.2E-07
SSE	8.3E-07	8.0E-07	6.9E-07	7.0E-07	7.1E-07	8.2E-07	8.4E-07
SE	1.3E-06	1.3E-06	1.1E-06	1.1E-06	1.2E-06	1.3E-06	1.4E-06
ESE	1.4E-06	1.4E-06	1.2E-06	1.2E-06	1.2E-06	1.4E-06	1.5E-06
E	1.7E-06	1.6E-06	1.4E-06	1.4E-06	1.4E-06	1.6E-06	1.7E-06
ENE	1.6E-06	1.5E-06	1.3E-06	1.4E-06	1.4E-06	1.6E-06	1.6E-06
NE	1.4E-06	1.3E-06	1.2E-06	1.2E-06	1.2E-06	1.4E-06	1.4E-06
NNE	8.7E-07	8.4E-07	7.4E-07	7.4E-07	7.5E-07	8.6E-07	8.8E-07

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2373	1791	1288	1234	1125	952
N	4.0E-07	6.6E-07	1.2E-06	1.3E-06	1.6E-06	2.1E-06
NNW	2.6E-07	4.3E-07	7.9E-07	8.5E-07	1.0E-06	1.4E-06
NW	2.6E-07	4.4E-07	8.0E-07	8.7E-07	1.0E-06	1.4E-06
WNW	2.9E-07	4.8E-07	8.9E-07	9.7E-07	1.1E-06	1.6E-06
W	4.6E-07	7.7E-07	1.4E-06	1.6E-06	1.8E-06	2.5E-06
WSW	4.6E-07	7.5E-07	1.3E-06	1.5E-06	1.7E-06	2.3E-06
SW	2.7E-07	4.4E-07	7.8E-07	8.5E-07	1.0E-06	1.3E-06
SSW	2.3E-07	3.8E-07	6.8E-07	7.4E-07	8.7E-07	1.2E-06
S	2.8E-07	4.6E-07	8.4E-07	9.1E-07	1.1E-06	1.5E-06
SSE	5.4E-07	9.2E-07	1.7E-06	1.9E-06	2.3E-06	3.1E-06
SE	8.8E-07	1.5E-06	2.9E-06	3.1E-06	3.7E-06	5.1E-06
ESE	9.3E-07	1.6E-06	3.0E-06	3.3E-06	3.9E-06	5.4E-06
E	1.1E-06	1.8E-06	3.5E-06	3.8E-06	4.5E-06	6.2E-06
ENE	1.1E-06	1.8E-06	3.3E-06	3.6E-06	4.2E-06	5.8E-06
NE	9.2E-07	1.5E-06	2.9E-06	3.1E-06	3.7E-06	5.0E-06
NNE	5.8E-07	9.6E-07	1.8E-06	1.9E-06	2.3E-06	3.1E-06

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 20, 1998 7:57 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

1.58E+00

At This Location: 528 Meters East

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
WPRAP - Railyard [G2]

Dataset Name: 97-Z036a-RR-G2
Dataset Date: Apr 20, 1998 7:52 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 528 Meters East
Lifetime Fatal Cancer Risk: 2.02E-05

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	4.04E-03
BREAST	4.62E-03
R MAR	1.96E-01
LUNGS	1.20E+01
THYROID	3.93E-03
ENDOST	2.57E+00
RMNDR	9.98E-02
EFFEC	1.58E+00

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	5.7E-04	5.7E-04
U-235	Y	1.00	3.0E-05	3.0E-05
U-236	Y	1.00	2.2E-05	2.2E-05
U-238	Y	1.00	6.3E-04	6.3E-04
RA-226	W	1.00	4.0E-07	4.0E-07
RA-228	W	1.00	1.6E-06	1.6E-06
TH-228	Y	1.00	1.7E-05	1.7E-05
TH-230	Y	1.00	5.0E-05	5.0E-05
TH-232	Y	1.00	2.7E-06	2.7E-06
TH-234	Y	1.00	2.5E-03	2.5E-03

SITE INFORMATION

Temperature:	11 degrees C
Precipitation:	102 cm/y
Mixing Height:	950 m

SOURCE INFORMATION

Source Number: 1

Source Height (m): 1.00
Area (sq m): 9.78E+04

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Zero:	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

528	1024	2294	1709	2138	2754	2604	1148	1818	1936
1983	1227	2811	1612	1708	1804	1774	2520	2548	1057

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 20, 1998 7:57 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
WPRAP - Railyard [G2]

Dataset Name: 97-Z036a-RR-G2
Dataset Date: Apr 20, 1998 7:52 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	4.04E-03
BREAST	4.62E-03
R MAR	1.96E-01
LUNGS	1.20E+01
THYROID	3.93E-03
ENDOST	2.57E+00
RMNDR	9.98E-02
EFFEC	1.58E+00

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	7.08E-02
INHALATION	1.50E+00
AIR IMMERSION	1.26E-07
GROUND SURFACE	8.34E-04
INTERNAL	1.58E+00
EXTERNAL	8.35E-04
TOTAL	1.58E+00

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	6.81E-01
U-235	3.41E-02
U-236	2.50E-02
U-238	6.78E-01
RA-226	5.92E-05
RA-228	9.21E-05
TH-228	3.76E-02
TH-230	1.11E-01
TH-232	8.48E-03
TH-234	1.59E-03
TOTAL	1.58E+00

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.89E-07
BONE	1.25E-07
THYROID	9.12E-10
BREAST	1.04E-08
LUNG	1.96E-05
STOMACH	6.84E-09
BOWEL	1.80E-08
LIVER	8.86E-09
PANCREAS	3.97E-09
URINARY	2.06E-07
OTHER	4.86E-09
TOTAL	2.02E-05

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	3.76E-07
INHALATION	1.98E-05
AIR IMMERSION	2.81E-12
GROUND SURFACE	1.92E-08
INTERNAL	2.02E-05
EXTERNAL	1.92E-08
TOTAL	2.02E-05

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	8.81E-06
U-235	4.50E-07
U-236	3.24E-07
U-238	8.84E-06
RA-226	8.42E-10
RA-228	9.85E-10
TH-228	7.55E-07
TH-230	9.08E-07
TH-232	4.78E-08
TH-234	5.45E-08
TOTAL	2.02E-05

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

Direction	Distance (m) 528	1024	2294	1709	2138	2754	2604
N	5.6E-01	1.5E-01	3.4E-02	5.8E-02	3.9E-02	2.5E-02	2.8E-02
NNW	3.9E-01	9.4E-02	2.3E-02	3.8E-02	2.6E-02	1.7E-02	1.9E-02
NW	3.7E-01	9.6E-02	2.3E-02	3.8E-02	2.6E-02	1.7E-02	1.9E-02
WNW	4.5E-01	1.1E-01	2.5E-02	4.2E-02	2.8E-02	1.9E-02	2.1E-02
W	6.0E-01	1.7E-01	4.0E-02	6.7E-02	4.5E-02	2.9E-02	3.2E-02
WSW	5.5E-01	1.6E-01	3.9E-02	6.5E-02	4.4E-02	2.9E-02	3.2E-02
SW	3.7E-01	9.3E-02	2.4E-02	3.8E-02	2.6E-02	1.8E-02	1.9E-02
SSW	3.2E-01	8.2E-02	2.0E-02	3.3E-02	2.3E-02	1.5E-02	1.7E-02
S	4.4E-01	1.0E-01	2.4E-02	4.0E-02	2.7E-02	1.8E-02	2.0E-02
SSE	8.4E-01	2.1E-01	4.6E-02	8.0E-02	5.2E-02	3.4E-02	3.7E-02
SE	1.3E+00	3.5E-01	7.4E-02	1.3E-01	8.4E-02	5.3E-02	5.9E-02
ESE	1.5E+00	3.7E-01	7.9E-02	1.4E-01	8.9E-02	5.7E-02	6.3E-02
E	1.6E+00	4.2E-01	9.2E-02	1.6E-01	1.0E-01	6.6E-02	7.3E-02
ENE	1.5E+00	3.9E-01	8.9E-02	1.5E-01	1.0E-01	6.4E-02	7.1E-02
NE	1.3E+00	3.4E-01	7.8E-02	1.3E-01	8.8E-02	5.6E-02	6.2E-02
NNE	8.4E-01	2.1E-01	5.0E-02	8.3E-02	5.6E-02	3.6E-02	4.0E-02

Direction	Distance (m) 1148	1818	1936	1983	1227	2811	1612
N	1.2E-01	5.2E-02	4.6E-02	4.4E-02	1.1E-01	2.5E-02	6.4E-02
NNW	7.7E-02	3.4E-02	3.0E-02	2.9E-02	6.9E-02	1.7E-02	4.2E-02
NW	7.9E-02	3.4E-02	3.1E-02	2.9E-02	7.0E-02	1.7E-02	4.3E-02
WNW	8.8E-02	3.8E-02	3.4E-02	3.2E-02	7.8E-02	1.8E-02	4.7E-02
W	1.4E-01	6.0E-02	5.3E-02	5.1E-02	1.2E-01	2.8E-02	7.5E-02
WSW	1.3E-01	5.8E-02	5.2E-02	5.0E-02	1.2E-01	2.8E-02	7.2E-02
SW	7.6E-02	3.5E-02	3.1E-02	3.0E-02	6.8E-02	1.7E-02	4.2E-02
SSW	6.7E-02	3.0E-02	2.7E-02	2.6E-02	6.0E-02	1.5E-02	3.7E-02
S	8.3E-02	3.6E-02	3.2E-02	3.1E-02	7.3E-02	1.7E-02	4.5E-02
SSE	1.7E-01	7.1E-02	6.3E-02	6.0E-02	1.5E-01	3.2E-02	8.9E-02
SE	2.8E-01	1.1E-01	1.0E-01	9.6E-02	2.5E-01	5.1E-02	1.4E-01
ESE	3.0E-01	1.2E-01	1.1E-01	1.0E-01	2.6E-01	5.5E-02	1.5E-01
E	3.4E-01	1.4E-01	1.2E-01	1.2E-01	3.0E-01	6.3E-02	1.8E-01
ENE	3.2E-01	1.4E-01	1.2E-01	1.1E-01	2.8E-01	6.2E-02	1.7E-01
NE	2.8E-01	1.2E-01	1.0E-01	1.0E-01	2.5E-01	5.4E-02	1.5E-01
NNE	1.7E-01	7.4E-02	6.6E-02	6.3E-02	1.5E-01	3.5E-02	9.2E-02

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1708	1804	1774	2520	2548	1057
N	5.8E-02	5.2E-02	5.4E-02	2.9E-02	2.9E-02	1.4E-01
NNW	3.8E-02	3.5E-02	3.6E-02	2.0E-02	2.0E-02	8.9E-02
NW	3.8E-02	3.5E-02	3.6E-02	2.0E-02	2.0E-02	9.1E-02
WNW	4.2E-02	3.8E-02	4.0E-02	2.2E-02	2.1E-02	1.0E-01
W	6.7E-02	6.1E-02	6.3E-02	3.4E-02	3.3E-02	1.6E-01
WSW	6.5E-02	5.9E-02	6.1E-02	3.4E-02	3.3E-02	1.5E-01
SW	3.8E-02	3.5E-02	3.6E-02	2.0E-02	2.0E-02	8.8E-02
SSW	3.3E-02	3.0E-02	3.1E-02	1.8E-02	1.7E-02	7.7E-02
S	4.0E-02	3.7E-02	3.8E-02	2.1E-02	2.0E-02	9.6E-02
SSE	8.0E-02	7.2E-02	7.4E-02	3.9E-02	3.9E-02	2.0E-01
SE	1.3E-01	1.2E-01	1.2E-01	6.3E-02	6.1E-02	3.3E-01
ESE	1.4E-01	1.2E-01	1.3E-01	6.7E-02	6.5E-02	3.5E-01
E	1.6E-01	1.4E-01	1.5E-01	7.7E-02	7.6E-02	3.9E-01
ENE	1.5E-01	1.4E-01	1.4E-01	7.5E-02	7.4E-02	3.7E-01
NE	1.3E-01	1.2E-01	1.2E-01	6.6E-02	6.5E-02	3.2E-01
NNE	8.3E-02	7.5E-02	7.8E-02	4.2E-02	4.1E-02	2.0E-01

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	528	1024	2294	1709	2138	2754	2604
N	7.2E-06	1.9E-06	4.2E-07	7.2E-07	4.8E-07	3.1E-07	3.4E-07
NNW	5.0E-06	1.2E-06	2.8E-07	4.7E-07	3.1E-07	2.0E-07	2.2E-07
NW	4.7E-06	1.2E-06	2.8E-07	4.7E-07	3.1E-07	2.0E-07	2.2E-07
WNW	5.7E-06	1.4E-06	3.0E-07	5.2E-07	3.4E-07	2.2E-07	2.4E-07
W	7.7E-06	2.2E-06	4.9E-07	8.4E-07	5.5E-07	3.5E-07	3.9E-07
WSW	7.1E-06	2.0E-06	4.8E-07	8.1E-07	5.4E-07	3.5E-07	3.9E-07
SW	4.8E-06	1.2E-06	2.8E-07	4.7E-07	3.2E-07	2.1E-07	2.3E-07
SSW	4.1E-06	1.0E-06	2.4E-07	4.1E-07	2.7E-07	1.8E-07	2.0E-07
S	5.7E-06	1.3E-06	2.9E-07	5.0E-07	3.3E-07	2.1E-07	2.3E-07
SSE	1.1E-05	2.7E-06	5.7E-07	1.0E-06	6.5E-07	4.1E-07	4.6E-07
SE	1.6E-05	4.4E-06	9.3E-07	1.6E-06	1.1E-06	6.6E-07	7.4E-07
ESE	1.9E-05	4.7E-06	9.9E-07	1.7E-06	1.1E-06	7.1E-07	7.8E-07
E	2.0E-05	5.3E-06	1.2E-06	2.0E-06	1.3E-06	8.2E-07	9.1E-07
ENE	1.9E-05	5.0E-06	1.1E-06	1.9E-06	1.3E-06	8.0E-07	8.9E-07
NE	1.6E-05	4.3E-06	9.7E-07	1.7E-06	1.1E-06	7.0E-07	7.8E-07
NNE	1.1E-05	2.7E-06	6.1E-07	1.0E-06	6.9E-07	4.4E-07	4.9E-07

	Distance (m)						
Direction	1148	1818	1936	1983	1227	2811	1612
N	1.5E-06	6.4E-07	5.7E-07	5.4E-07	1.3E-06	2.9E-07	8.0E-07
NNW	9.7E-07	4.2E-07	3.7E-07	3.5E-07	8.6E-07	1.9E-07	5.2E-07
NW	9.9E-07	4.2E-07	3.7E-07	3.6E-07	8.7E-07	1.9E-07	5.2E-07
WNW	1.1E-06	4.6E-07	4.1E-07	3.9E-07	9.8E-07	2.1E-07	5.8E-07
W	1.8E-06	7.5E-07	6.6E-07	6.3E-07	1.6E-06	3.4E-07	9.4E-07
WSW	1.6E-06	7.3E-07	6.5E-07	6.2E-07	1.5E-06	3.4E-07	9.0E-07
SW	9.6E-07	4.2E-07	3.8E-07	3.6E-07	8.5E-07	2.0E-07	5.2E-07
SSW	8.4E-07	3.6E-07	3.2E-07	3.1E-07	7.4E-07	1.7E-07	4.5E-07
S	1.0E-06	4.4E-07	3.9E-07	3.7E-07	9.2E-07	2.0E-07	5.5E-07
SSE	2.2E-06	8.9E-07	7.8E-07	7.5E-07	1.9E-06	4.0E-07	1.1E-06
SE	3.6E-06	1.4E-06	1.3E-06	1.2E-06	3.1E-06	6.4E-07	1.8E-06
ESE	3.8E-06	1.5E-06	1.4E-06	1.3E-06	3.3E-06	6.8E-07	1.9E-06
E	4.3E-06	1.8E-06	1.6E-06	1.5E-06	3.8E-06	7.9E-07	2.2E-06
ENE	4.1E-06	1.7E-06	1.5E-06	1.4E-06	3.6E-06	7.7E-07	2.2E-06
NE	3.5E-06	1.5E-06	1.3E-06	1.3E-06	3.1E-06	6.7E-07	1.9E-06
NNE	2.2E-06	9.3E-07	8.3E-07	7.9E-07	1.9E-06	4.3E-07	1.2E-06

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1708	1804	1774	2520	2548	1057
N	7.2E-07	6.5E-07	6.7E-07	3.6E-07	3.5E-07	1.7E-06
NNW	4.7E-07	4.2E-07	4.4E-07	2.3E-07	2.3E-07	1.1E-06
NW	4.7E-07	4.3E-07	4.4E-07	2.4E-07	2.3E-07	1.1E-06
WNW	5.2E-07	4.7E-07	4.9E-07	2.6E-07	2.5E-07	1.3E-06
W	8.4E-07	7.6E-07	7.8E-07	4.1E-07	4.1E-07	2.1E-06
WSW	8.1E-07	7.4E-07	7.6E-07	4.1E-07	4.0E-07	1.9E-06
SW	4.7E-07	4.3E-07	4.4E-07	2.4E-07	2.4E-07	1.1E-06
SSW	4.1E-07	3.7E-07	3.8E-07	2.1E-07	2.0E-07	9.7E-07
S	5.0E-07	4.5E-07	4.6E-07	2.5E-07	2.4E-07	1.2E-06
SSE	1.0E-06	9.0E-07	9.3E-07	4.8E-07	4.8E-07	2.5E-06
SE	1.6E-06	1.5E-06	1.5E-06	7.8E-07	7.7E-07	4.2E-06
ESE	1.7E-06	1.6E-06	1.6E-06	8.3E-07	8.2E-07	4.4E-06
E	2.0E-06	1.8E-06	1.9E-06	9.7E-07	9.5E-07	5.0E-06
ENE	1.9E-06	1.7E-06	1.8E-06	9.4E-07	9.2E-07	4.7E-06
NE	1.7E-06	1.5E-06	1.6E-06	8.2E-07	8.1E-07	4.1E-06
NNE	1.0E-06	9.5E-07	9.8E-07	5.2E-07	5.1E-07	2.5E-06

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 20, 1998 9:29 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)
8.89E-01

At This Location: 853 Meters East

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
STOCKPILE W800057 [G1]

Dataset Name: 97-PILE1-G1
Dataset Date: Apr 20, 1998 9:16 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 853 Meters East
Lifetime Fatal Cancer Risk: 1.14E-05

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	2.41E-03
BREAST	2.75E-03
R MAR	1.14E-01
LUNGS	6.76E+00
THYROID	2.35E-03
ENDOST	1.50E+00
RMNDR	6.07E-02
EFFEC	8.89E-01

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	8.3E-04	8.3E-04
U-235	Y	1.00	4.4E-05	4.4E-05
U-236	Y	1.00	3.2E-05	3.2E-05
U-238	Y	1.00	9.3E-04	9.3E-04
RA-226	W	1.00	5.9E-07	5.9E-07
RA-228	W	1.00	2.4E-06	2.4E-06
TH-228	Y	1.00	2.5E-05	2.5E-05
TH-230	Y	1.00	7.4E-05	7.4E-05
TH-232	Y	1.00	3.9E-06	3.9E-06
TH-234	Y	1.00	3.7E-03	3.7E-03

SITE INFORMATION

Temperature:	11 degrees C
Precipitation:	102 cm/y
Mixing Height:	950 m

SOURCE INFORMATION

Source Number: 1

Source Height (m): 1.00
Area (sq m): 2.85E+04

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Zero:	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

964	1027	2082	1954	1773	1736	1838	1877	1905	2006
1988	1910	1711	1673	2087	1477	913	853	950	1007

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 20, 1998 9:29 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
STOCKPILE W800057 [G1]

Dataset Name: 97-PILE1-G1
Dataset Date: Apr 20, 1998 9:16 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.41E-03
BREAST	2.75E-03
R MAR	1.14E-01
LUNGS	6.76E+00
THYROID	2.35E-03
ENDOST	1.50E+00
RMNDR	6.07E-02
EFFEC	8.89E-01

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	4.33E-02
INHALATION	8.45E-01
AIR IMMERSION	7.08E-08
GROUND SURFACE	4.83E-04
INTERNAL	8.89E-01
EXTERNAL	4.83E-04
TOTAL	8.89E-01

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	3.84E-01
U-235	1.93E-02
U-236	1.41E-02
U-238	3.82E-01
RA-226	3.47E-05
RA-228	5.43E-05
TH-228	2.12E-02
TH-230	6.22E-02
TH-232	4.77E-03
TH-234	9.31E-04
TOTAL	8.89E-01

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.11E-07
BONE	7.31E-08
THYROID	5.41E-10
BREAST	6.13E-09
LUNG	1.10E-05
STOMACH	4.07E-09
BOWEL	1.08E-08
LIVER	5.17E-09
PANCREAS	2.37E-09
URINARY	1.26E-07
OTHER	2.89E-09
TOTAL	1.14E-05

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.30E-07
INHALATION	1.11E-05
AIR IMMERSION	1.58E-12
GROUND SURFACE	1.11E-08
INTERNAL	1.14E-05
EXTERNAL	1.11E-08
TOTAL	1.14E-05

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	4.96E-06
U-235	2.53E-07
U-236	1.83E-07
U-238	4.98E-06
RA-226	4.80E-10
RA-228	5.72E-10
TH-228	4.25E-07
TH-230	5.10E-07
TH-232	2.69E-08
TH-234	3.10E-08
TOTAL	1.14E-05

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

Direction	Distance (m)						
	964	1027	2082	1954	1773	1736	1838
N	2.4E-01	2.1E-01	6.0E-02	6.7E-02	8.0E-02	8.3E-02	7.4E-02
NNW	1.6E-01	1.4E-01	4.0E-02	4.4E-02	5.2E-02	5.4E-02	4.9E-02
NW	1.6E-01	1.4E-01	4.0E-02	4.4E-02	5.3E-02	5.5E-02	5.0E-02
WNW	1.8E-01	1.6E-01	4.4E-02	4.9E-02	5.8E-02	6.1E-02	5.5E-02
W	2.8E-01	2.5E-01	6.9E-02	7.7E-02	9.2E-02	9.6E-02	8.6E-02
WSW	2.6E-01	2.3E-01	6.8E-02	7.6E-02	9.0E-02	9.3E-02	8.4E-02
SW	1.5E-01	1.4E-01	4.1E-02	4.5E-02	5.3E-02	5.5E-02	5.0E-02
SSW	1.3E-01	1.2E-01	3.5E-02	3.9E-02	4.6E-02	4.8E-02	4.3E-02
S	1.7E-01	1.5E-01	4.2E-02	4.7E-02	5.5E-02	5.8E-02	5.2E-02
SSE	3.5E-01	3.1E-01	8.1E-02	9.1E-02	1.1E-01	1.1E-01	1.0E-01
SE	5.7E-01	5.1E-01	1.3E-01	1.5E-01	1.8E-01	1.8E-01	1.6E-01
ESE	6.1E-01	5.4E-01	1.4E-01	1.6E-01	1.9E-01	2.0E-01	1.8E-01
E	6.9E-01	6.1E-01	1.6E-01	1.8E-01	2.2E-01	2.3E-01	2.0E-01
ENE	6.5E-01	5.8E-01	1.5E-01	1.7E-01	2.1E-01	2.2E-01	2.0E-01
NE	5.6E-01	5.0E-01	1.4E-01	1.5E-01	1.8E-01	1.9E-01	1.7E-01
NNE	3.5E-01	3.1E-01	8.6E-02	9.6E-02	1.1E-01	1.2E-01	1.1E-01

Direction	Distance (m)						
	1877	1905	2006	1988	1910	1711	1673
N	7.2E-02	7.0E-02	6.3E-02	6.4E-02	6.9E-02	8.5E-02	8.8E-02
NNW	4.7E-02	4.6E-02	4.2E-02	4.3E-02	4.6E-02	5.6E-02	5.8E-02
NW	4.8E-02	4.7E-02	4.2E-02	4.3E-02	4.6E-02	5.6E-02	5.9E-02
WNW	5.2E-02	5.1E-02	4.6E-02	4.7E-02	5.1E-02	6.2E-02	6.5E-02
W	8.3E-02	8.1E-02	7.3E-02	7.5E-02	8.0E-02	9.9E-02	1.0E-01
WSW	8.1E-02	7.9E-02	7.2E-02	7.3E-02	7.9E-02	9.5E-02	9.9E-02
SW	4.8E-02	4.7E-02	4.3E-02	4.4E-02	4.7E-02	5.6E-02	5.9E-02
SSW	4.2E-02	4.1E-02	3.7E-02	3.8E-02	4.1E-02	4.9E-02	5.1E-02
S	5.0E-02	4.9E-02	4.4E-02	4.5E-02	4.9E-02	5.9E-02	6.1E-02
SSE	9.8E-02	9.5E-02	8.6E-02	8.8E-02	9.5E-02	1.2E-01	1.2E-01
SE	1.6E-01	1.5E-01	1.4E-01	1.4E-01	1.5E-01	1.9E-01	2.0E-01
ESE	1.7E-01	1.6E-01	1.5E-01	1.5E-01	1.6E-01	2.0E-01	2.1E-01
E	1.9E-01	1.9E-01	1.7E-01	1.7E-01	1.9E-01	2.3E-01	2.4E-01
ENE	1.9E-01	1.8E-01	1.6E-01	1.7E-01	1.8E-01	2.2E-01	2.3E-01
NE	1.6E-01	1.6E-01	1.4E-01	1.5E-01	1.6E-01	1.9E-01	2.0E-01
NNE	1.0E-01	1.0E-01	9.1E-02	9.3E-02	1.0E-01	1.2E-01	1.3E-01

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2087	1477	913	853	950	1007
N	5.9E-02	1.1E-01	2.7E-01	3.1E-01	2.5E-01	2.2E-01
NNW	4.0E-02	7.2E-02	1.7E-01	2.0E-01	1.6E-01	1.4E-01
NW	4.0E-02	7.3E-02	1.8E-01	2.0E-01	1.6E-01	1.5E-01
WNW	4.3E-02	8.1E-02	2.0E-01	2.3E-01	1.8E-01	1.6E-01
W	6.9E-02	1.3E-01	3.2E-01	3.6E-01	2.9E-01	2.6E-01
WSW	6.8E-02	1.2E-01	2.9E-01	3.3E-01	2.7E-01	2.4E-01
SW	4.0E-02	7.2E-02	1.7E-01	1.9E-01	1.6E-01	1.4E-01
SSW	3.5E-02	6.3E-02	1.5E-01	1.7E-01	1.4E-01	1.2E-01
S	4.2E-02	7.7E-02	1.9E-01	2.1E-01	1.7E-01	1.5E-01
SSE	8.0E-02	1.5E-01	3.9E-01	4.5E-01	3.6E-01	3.2E-01
SE	1.3E-01	2.5E-01	6.4E-01	7.4E-01	5.9E-01	5.2E-01
ESE	1.4E-01	2.7E-01	6.8E-01	7.9E-01	6.3E-01	5.6E-01
E	1.6E-01	3.1E-01	7.7E-01	8.9E-01	7.1E-01	6.3E-01
ENE	1.5E-01	2.9E-01	7.3E-01	8.4E-01	6.7E-01	6.0E-01
NE	1.3E-01	2.5E-01	6.3E-01	7.2E-01	5.8E-01	5.2E-01
NNE	8.5E-02	1.6E-01	3.9E-01	4.4E-01	3.6E-01	3.2E-01

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	964	1027	2082	1954	1773	1736	1838
N	3.1E-06	2.7E-06	7.3E-07	8.2E-07	9.9E-07	1.0E-06	9.2E-07
NNW	2.0E-06	1.7E-06	4.8E-07	5.4E-07	6.4E-07	6.7E-07	6.0E-07
NW	2.0E-06	1.8E-06	4.8E-07	5.4E-07	6.5E-07	6.7E-07	6.1E-07
WNW	2.3E-06	2.0E-06	5.3E-07	5.9E-07	7.2E-07	7.4E-07	6.7E-07
W	3.6E-06	3.2E-06	8.5E-07	9.6E-07	1.2E-06	1.2E-06	1.1E-06
WSW	3.3E-06	2.9E-06	8.4E-07	9.4E-07	1.1E-06	1.2E-06	1.0E-06
SW	1.9E-06	1.7E-06	4.9E-07	5.4E-07	6.5E-07	6.7E-07	6.1E-07
SSW	1.7E-06	1.5E-06	4.2E-07	4.7E-07	5.6E-07	5.8E-07	5.2E-07
S	2.1E-06	1.9E-06	5.0E-07	5.7E-07	6.8E-07	7.1E-07	6.4E-07
SSE	4.4E-06	3.9E-06	1.0E-06	1.1E-06	1.4E-06	1.4E-06	1.3E-06
SE	7.3E-06	6.4E-06	1.6E-06	1.8E-06	2.2E-06	2.3E-06	2.1E-06
ESE	7.8E-06	6.8E-06	1.7E-06	2.0E-06	2.4E-06	2.5E-06	2.2E-06
E	8.8E-06	7.8E-06	2.0E-06	2.3E-06	2.8E-06	2.9E-06	2.6E-06
ENE	8.3E-06	7.3E-06	1.9E-06	2.2E-06	2.6E-06	2.8E-06	2.5E-06
NE	7.2E-06	6.3E-06	1.7E-06	1.9E-06	2.3E-06	2.4E-06	2.1E-06
NNE	4.4E-06	3.9E-06	1.1E-06	1.2E-06	1.4E-06	1.5E-06	1.3E-06

	Distance (m)						
Direction	1877	1905	2006	1988	1910	1711	1673
N	8.9E-07	8.6E-07	7.8E-07	7.9E-07	8.6E-07	1.1E-06	1.1E-06
NNW	5.8E-07	5.6E-07	5.1E-07	5.2E-07	5.6E-07	6.8E-07	7.1E-07
NW	5.8E-07	5.7E-07	5.1E-07	5.2E-07	5.6E-07	6.9E-07	7.2E-07
WNW	6.4E-07	6.2E-07	5.6E-07	5.7E-07	6.2E-07	7.7E-07	8.0E-07
W	1.0E-06	1.0E-06	9.1E-07	9.2E-07	1.0E-06	1.2E-06	1.3E-06
WSW	1.0E-06	9.8E-07	8.9E-07	9.1E-07	9.8E-07	1.2E-06	1.2E-06
SW	5.9E-07	5.7E-07	5.2E-07	5.3E-07	5.7E-07	6.9E-07	7.2E-07
SSW	5.0E-07	4.9E-07	4.5E-07	4.5E-07	4.9E-07	6.0E-07	6.2E-07
S	6.1E-07	5.9E-07	5.4E-07	5.5E-07	5.9E-07	7.3E-07	7.6E-07
SSE	1.2E-06	1.2E-06	1.1E-06	1.1E-06	1.2E-06	1.5E-06	1.5E-06
SE	2.0E-06	1.9E-06	1.7E-06	1.8E-06	1.9E-06	2.4E-06	2.5E-06
ESE	2.1E-06	2.1E-06	1.9E-06	1.9E-06	2.1E-06	2.6E-06	2.7E-06
E	2.5E-06	2.4E-06	2.2E-06	2.2E-06	2.4E-06	2.9E-06	3.1E-06
ENE	2.4E-06	2.3E-06	2.1E-06	2.1E-06	2.3E-06	2.8E-06	2.9E-06
NE	2.1E-06	2.0E-06	1.8E-06	1.8E-06	2.0E-06	2.5E-06	2.6E-06
NNE	1.3E-06	1.3E-06	1.1E-06	1.2E-06	1.2E-06	1.5E-06	1.6E-06

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2087	1477	913	853	950	1007
N	7.3E-07	1.4E-06	3.4E-06	3.9E-06	3.2E-06	2.8E-06
NNW	4.8E-07	8.9E-07	2.2E-06	2.5E-06	2.0E-06	1.8E-06
NW	4.8E-07	9.0E-07	2.2E-06	2.6E-06	2.1E-06	1.8E-06
WNW	5.3E-07	1.0E-06	2.5E-06	2.9E-06	2.3E-06	2.1E-06
W	8.5E-07	1.6E-06	4.0E-06	4.6E-06	3.7E-06	3.3E-06
WSW	8.3E-07	1.5E-06	3.7E-06	4.2E-06	3.4E-06	3.0E-06
SW	4.9E-07	9.0E-07	2.1E-06	2.4E-06	2.0E-06	1.8E-06
SSW	4.2E-07	7.8E-07	1.9E-06	2.2E-06	1.7E-06	1.6E-06
S	5.0E-07	9.5E-07	2.4E-06	2.7E-06	2.2E-06	1.9E-06
SSE	1.0E-06	1.9E-06	5.0E-06	5.7E-06	4.6E-06	4.0E-06
SE	1.6E-06	3.2E-06	8.2E-06	9.5E-06	7.6E-06	6.7E-06
ESE	1.7E-06	3.4E-06	8.7E-06	1.0E-05	8.0E-06	7.1E-06
E	2.0E-06	3.9E-06	9.9E-06	1.1E-05	9.1E-06	8.1E-06
ENE	1.9E-06	3.7E-06	9.3E-06	1.1E-05	8.6E-06	7.6E-06
NE	1.7E-06	3.2E-06	8.0E-06	9.2E-06	7.4E-06	6.6E-06
NNE	1.1E-06	2.0E-06	4.9E-06	5.6E-06	4.5E-06	4.0E-06

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 20, 1998 9:29 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

9.98E-01

At This Location: 805 Meters East

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
STOCKPILE W800057 [G2]

Dataset Name: 97-PILE1-G2
Dataset Date: Apr 20, 1998 9:17 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 805 Meters East
Lifetime Fatal Cancer Risk: 1.28E-05

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	2.64E-03
BREAST	3.02E-03
R MAR	1.26E-01
LUNGS	7.60E+00
THYROID	2.57E-03
ENDOST	1.66E+00
RMNDR	6.60E-02
EFFEC	9.98E-01

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	8.3E-04	8.3E-04
U-235	Y	1.00	4.4E-05	4.4E-05
U-236	Y	1.00	3.2E-05	3.2E-05
U-238	Y	1.00	9.3E-04	9.3E-04
RA-226	W	1.00	5.9E-07	5.9E-07
RA-228	W	1.00	2.4E-06	2.4E-06
TH-228	Y	1.00	2.5E-05	2.5E-05
TH-230	Y	1.00	7.4E-05	7.4E-05
TH-232	Y	1.00	3.9E-06	3.9E-06
TH-234	Y	1.00	3.7E-03	3.7E-03

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number: 1

Source Height (m): 1.00
Area (sq m): 2.85E+04

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Zero:	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

805	1401	2593	1332	1847	2984	2242	1528	1483	1614
1670	1607	3043	1970	2096	2191	2161	2620	2651	1146

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 20, 1998 9:29 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
STOCKPILE W800057 [G2]

Dataset Name: 97-PILE1-G2
Dataset Date: Apr 20, 1998 9:17 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.64E-03
BREAST	3.02E-03
R MAR	1.26E-01
LUNGS	7.60E+00
THYROID	2.57E-03
ENDOST	1.66E+00
RMNDR	6.60E-02
EFFEC	9.98E-01

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	4.69E-02
INHALATION	9.50E-01
AIR IMMERSION	7.96E-08
GROUND SURFACE	5.40E-04
INTERNAL	9.97E-01
EXTERNAL	5.40E-04
TOTAL	9.98E-01

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	4.31E-01
U-235	2.16E-02
U-236	1.59E-02
U-238	4.29E-01
RA-226	3.83E-05
RA-228	5.97E-05
TH-228	2.38E-02
TH-230	6.99E-02
TH-232	5.36E-03
TH-234	1.03E-03
TOTAL	9.98E-01

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.22E-07
BONE	8.08E-08
THYROID	5.96E-10
BREAST	6.78E-09
LUNG	1.24E-05
STOMACH	4.47E-09
BOWEL	1.18E-08
LIVER	5.72E-09
PANCREAS	2.60E-09
URINARY	1.37E-07
OTHER	3.18E-09
TOTAL	1.28E-05

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.49E-07
INHALATION	1.25E-05
AIR IMMERSION	1.77E-12
GROUND SURFACE	1.24E-08
INTERNAL	1.28E-05
EXTERNAL	1.24E-08
TOTAL	1.28E-05

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	5.57E-06
U-235	2.85E-07
U-236	2.05E-07
U-238	5.59E-06
RA-226	5.36E-10
RA-228	6.33E-10
TH-228	4.77E-07
TH-230	5.74E-07
TH-232	3.02E-08
TH-234	3.46E-08
TOTAL	1.28E-05

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	805	1401	2593	1332	1847	2984	2242
N	3.4E-01	1.2E-01	4.0E-02	1.3E-01	7.3E-02	3.2E-02	5.2E-02
NNW	2.2E-01	7.8E-02	2.7E-02	8.6E-02	4.8E-02	2.1E-02	3.4E-02
NW	2.3E-01	7.9E-02	2.7E-02	8.7E-02	4.8E-02	2.1E-02	3.4E-02
WNW	2.5E-01	8.8E-02	2.9E-02	9.7E-02	5.3E-02	2.3E-02	3.8E-02
W	4.1E-01	1.4E-01	4.6E-02	1.6E-01	8.5E-02	3.6E-02	6.0E-02
WSW	3.7E-01	1.3E-01	4.6E-02	1.5E-01	8.2E-02	3.7E-02	5.9E-02
SW	2.2E-01	7.8E-02	2.8E-02	8.6E-02	4.8E-02	2.2E-02	3.5E-02
SSW	1.9E-01	6.8E-02	2.4E-02	7.5E-02	4.2E-02	1.9E-02	3.0E-02
S	2.4E-01	8.4E-02	2.8E-02	9.2E-02	5.0E-02	2.2E-02	3.6E-02
SSE	5.0E-01	1.7E-01	5.4E-02	1.9E-01	1.0E-01	4.2E-02	7.0E-02
SE	8.3E-01	2.8E-01	8.6E-02	3.1E-01	1.6E-01	6.6E-02	1.1E-01
ESE	8.8E-01	3.0E-01	9.2E-02	3.3E-01	1.7E-01	7.1E-02	1.2E-01
E	1.0E+00	3.4E-01	1.1E-01	3.7E-01	2.0E-01	8.2E-02	1.4E-01
ENE	9.4E-01	3.2E-01	1.0E-01	3.6E-01	1.9E-01	8.0E-02	1.3E-01
NE	8.1E-01	2.8E-01	9.1E-02	3.1E-01	1.7E-01	7.1E-02	1.2E-01
NNE	4.9E-01	1.7E-01	5.8E-02	1.9E-01	1.1E-01	4.5E-02	7.5E-02

	Distance (m)						
Direction	1528	1483	1614	1670	1607	3043	1970
N	1.0E-01	1.1E-01	9.3E-02	8.7E-02	9.4E-02	3.1E-02	6.4E-02
NNW	6.7E-02	7.0E-02	6.1E-02	5.7E-02	6.1E-02	2.1E-02	4.2E-02
NW	6.8E-02	7.1E-02	6.1E-02	5.8E-02	6.2E-02	2.1E-02	4.3E-02
WNW	7.5E-02	7.9E-02	6.8E-02	6.4E-02	6.8E-02	2.2E-02	4.7E-02
W	1.2E-01	1.3E-01	1.1E-01	1.0E-01	1.1E-01	3.5E-02	7.5E-02
WSW	1.1E-01	1.2E-01	1.0E-01	9.8E-02	1.1E-01	3.6E-02	7.3E-02
SW	6.7E-02	7.1E-02	6.1E-02	5.8E-02	6.2E-02	2.1E-02	4.3E-02
SSW	5.8E-02	6.1E-02	5.3E-02	5.0E-02	5.3E-02	1.8E-02	3.7E-02
S	7.1E-02	7.5E-02	6.4E-02	6.1E-02	6.5E-02	2.2E-02	4.5E-02
SSE	1.4E-01	1.5E-01	1.3E-01	1.2E-01	1.3E-01	4.1E-02	8.8E-02
SE	2.3E-01	2.5E-01	2.1E-01	2.0E-01	2.1E-01	6.4E-02	1.4E-01
ESE	2.5E-01	2.6E-01	2.2E-01	2.1E-01	2.3E-01	6.8E-02	1.5E-01
E	2.9E-01	3.0E-01	2.6E-01	2.4E-01	2.6E-01	8.0E-02	1.8E-01
ENE	2.7E-01	2.9E-01	2.5E-01	2.3E-01	2.5E-01	7.8E-02	1.7E-01
NE	2.4E-01	2.5E-01	2.2E-01	2.0E-01	2.2E-01	6.9E-02	1.5E-01
NNE	1.5E-01	1.6E-01	1.3E-01	1.3E-01	1.4E-01	4.4E-02	9.3E-02

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2096	2191	2161	2620	2651	1146
N	5.8E-02	5.4E-02	5.5E-02	4.0E-02	3.9E-02	1.7E-01
NNW	3.8E-02	3.5E-02	3.6E-02	2.6E-02	2.6E-02	1.1E-01
NW	3.8E-02	3.6E-02	3.7E-02	2.7E-02	2.6E-02	1.1E-01
WNW	4.2E-02	3.9E-02	4.0E-02	2.9E-02	2.8E-02	1.3E-01
W	6.7E-02	6.2E-02	6.4E-02	4.6E-02	4.5E-02	2.1E-01
WSW	6.6E-02	6.1E-02	6.3E-02	4.6E-02	4.5E-02	1.9E-01
SW	3.9E-02	3.6E-02	3.7E-02	2.7E-02	2.7E-02	1.1E-01
SSW	3.4E-02	3.1E-02	3.2E-02	2.3E-02	2.3E-02	9.8E-02
S	4.0E-02	3.7E-02	3.8E-02	2.8E-02	2.7E-02	1.2E-01
SSE	7.9E-02	7.3E-02	7.5E-02	5.3E-02	5.2E-02	2.5E-01
SE	1.3E-01	1.2E-01	1.2E-01	8.5E-02	8.3E-02	4.1E-01
ESE	1.4E-01	1.2E-01	1.3E-01	9.0E-02	8.8E-02	4.4E-01
E	1.6E-01	1.4E-01	1.5E-01	1.0E-01	1.0E-01	5.0E-01
ENE	1.5E-01	1.4E-01	1.4E-01	1.0E-01	1.0E-01	4.7E-01
NE	1.3E-01	1.2E-01	1.3E-01	8.9E-02	8.8E-02	4.1E-01
NNE	8.4E-02	7.8E-02	7.9E-02	5.7E-02	5.6E-02	2.5E-01

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m)						
	805	1401	2593	1332	1847	2984	2242
N	4.4E-06	1.5E-06	4.9E-07	1.7E-06	9.1E-07	3.8E-07	6.4E-07
NNW	2.8E-06	9.8E-07	3.2E-07	1.1E-06	5.9E-07	2.5E-07	4.2E-07
NW	2.9E-06	1.0E-06	3.2E-07	1.1E-06	5.9E-07	2.5E-07	4.2E-07
WNW	3.2E-06	1.1E-06	3.5E-07	1.2E-06	6.6E-07	2.7E-07	4.6E-07
W	5.2E-06	1.8E-06	5.7E-07	2.0E-06	1.1E-06	4.4E-07	7.4E-07
WSW	4.7E-06	1.7E-06	5.7E-07	1.9E-06	1.0E-06	4.5E-07	7.3E-07
SW	2.7E-06	9.8E-07	3.3E-07	1.1E-06	6.0E-07	2.6E-07	4.3E-07
SSW	2.4E-06	8.5E-07	2.8E-07	9.4E-07	5.1E-07	2.2E-07	3.6E-07
S	3.0E-06	1.0E-06	3.4E-07	1.2E-06	6.2E-07	2.6E-07	4.4E-07
SSE	6.4E-06	2.2E-06	6.7E-07	2.4E-06	1.3E-06	5.1E-07	8.7E-07
SE	1.1E-05	3.6E-06	1.1E-06	3.9E-06	2.1E-06	8.3E-07	1.4E-06
ESE	1.1E-05	3.8E-06	1.2E-06	4.2E-06	2.2E-06	8.8E-07	1.5E-06
E	1.3E-05	4.3E-06	1.3E-06	4.8E-06	2.5E-06	1.0E-06	1.8E-06
ENE	1.2E-05	4.1E-06	1.3E-06	4.5E-06	2.4E-06	1.0E-06	1.7E-06
NE	1.0E-05	3.6E-06	1.1E-06	3.9E-06	2.1E-06	8.8E-07	1.5E-06
NNE	6.3E-06	2.2E-06	7.2E-07	2.4E-06	1.3E-06	5.6E-07	9.3E-07

Direction	Distance (m)						
	1528	1483	1614	1670	1607	3043	1970
N	1.3E-06	1.4E-06	1.2E-06	1.1E-06	1.2E-06	3.7E-07	8.0E-07
NNW	8.3E-07	8.8E-07	7.5E-07	7.1E-07	7.6E-07	2.4E-07	5.2E-07
NW	8.4E-07	8.9E-07	7.6E-07	7.2E-07	7.7E-07	2.4E-07	5.3E-07
WNW	9.4E-07	9.9E-07	8.5E-07	7.9E-07	8.5E-07	2.7E-07	5.8E-07
W	1.5E-06	1.6E-06	1.4E-06	1.3E-06	1.4E-06	4.3E-07	9.3E-07
WSW	1.4E-06	1.5E-06	1.3E-06	1.2E-06	1.3E-06	4.3E-07	9.2E-07
SW	8.4E-07	8.8E-07	7.6E-07	7.2E-07	7.7E-07	2.5E-07	5.3E-07
SSW	7.2E-07	7.6E-07	6.6E-07	6.2E-07	6.6E-07	2.2E-07	4.6E-07
S	8.9E-07	9.4E-07	8.0E-07	7.5E-07	8.1E-07	2.6E-07	5.5E-07
SSE	1.8E-06	1.9E-06	1.6E-06	1.5E-06	1.7E-06	5.0E-07	1.1E-06
SE	3.0E-06	3.2E-06	2.7E-06	2.5E-06	2.7E-06	8.0E-07	1.8E-06
ESE	3.2E-06	3.4E-06	2.9E-06	2.7E-06	2.9E-06	8.5E-07	1.9E-06
E	3.6E-06	3.9E-06	3.3E-06	3.1E-06	3.3E-06	1.0E-06	2.2E-06
ENE	3.5E-06	3.7E-06	3.1E-06	3.0E-06	3.2E-06	9.7E-07	2.1E-06
NE	3.0E-06	3.2E-06	2.7E-06	2.6E-06	2.8E-06	8.5E-07	1.9E-06
NNE	1.9E-06	2.0E-06	1.7E-06	1.6E-06	1.7E-06	5.4E-07	1.2E-06

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2096	2191	2161	2620	2651	1146
N	7.2E-07	6.6E-07	6.8E-07	4.8E-07	4.7E-07	2.2E-06
NNW	4.7E-07	4.3E-07	4.4E-07	3.2E-07	3.1E-07	1.4E-06
NW	4.7E-07	4.4E-07	4.5E-07	3.2E-07	3.1E-07	1.4E-06
WNW	5.2E-07	4.8E-07	4.9E-07	3.5E-07	3.4E-07	1.6E-06
W	8.4E-07	7.7E-07	7.9E-07	5.6E-07	5.5E-07	2.6E-06
WSW	8.2E-07	7.6E-07	7.8E-07	5.6E-07	5.5E-07	2.4E-06
SW	4.8E-07	4.4E-07	4.5E-07	3.3E-07	3.2E-07	1.4E-06
SSW	4.1E-07	3.8E-07	3.9E-07	2.8E-07	2.7E-07	1.2E-06
S	4.9E-07	4.6E-07	4.7E-07	3.3E-07	3.3E-07	1.5E-06
SSE	9.9E-07	9.1E-07	9.3E-07	6.6E-07	6.4E-07	3.2E-06
SE	1.6E-06	1.5E-06	1.5E-06	1.1E-06	1.0E-06	5.3E-06
ESE	1.7E-06	1.6E-06	1.6E-06	1.1E-06	1.1E-06	5.6E-06
E	2.0E-06	1.8E-06	1.9E-06	1.3E-06	1.3E-06	6.4E-06
ENE	1.9E-06	1.8E-06	1.8E-06	1.3E-06	1.3E-06	6.0E-06
NE	1.7E-06	1.5E-06	1.6E-06	1.1E-06	1.1E-06	5.2E-06
NNE	1.0E-06	9.7E-07	9.9E-07	7.1E-07	6.9E-07	3.2E-06

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 20, 1998 9:30 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

9.24E-01

At This Location: 710 Meters East

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
STOCKPILE CON-017 [G1]

Dataset Name: 97-PILE2-G1
Dataset Date: Apr 20, 1998 9:20 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 710 Meters East
Lifetime Fatal Cancer Risk: 1.18E-05

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	2.45E-03
BREAST	2.80E-03
R MAR	1.17E-01
LUNGS	7.04E+00
THYROID	2.38E-03
ENDOST	1.54E+00
RMNDR	6.13E-02
EFFEC	9.24E-01

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	5.9E-04	5.9E-04
U-235	Y	1.00	3.1E-05	3.1E-05
U-236	Y	1.00	2.3E-05	2.3E-05
U-238	Y	1.00	6.6E-04	6.6E-04
RA-226	W	1.00	4.2E-07	4.2E-07
RA-228	W	1.00	1.7E-06	1.7E-06
TH-228	Y	1.00	1.8E-05	1.8E-05
TH-230	Y	1.00	5.3E-05	5.3E-05
TH-232	Y	1.00	2.8E-06	2.8E-06
TH-234	Y	1.00	2.6E-03	2.6E-03

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number: 1

Source Height (m): 1.00
Area (sq m): 2.04E+04

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Zero:	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

795	710	1398	1133	930	1105	1411	1537	1578	1760
1769	1829	1782	1784	2397	1902	1581	1552	1680	1452

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Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 20, 1998 9:30 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
STOCKPILE CON-017 [G1]

Dataset Name: 97-PILE2-G1
Dataset Date: Apr 20, 1998 9:20 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.45E-03
BREAST	2.80E-03
R MAR	1.17E-01
LUNGS	7.04E+00
THYROID	2.38E-03
ENDOST	1.54E+00
RMNDR	6.13E-02
EFFEC	9.24E-01

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	4.36E-02
INHALATION	8.80E-01
AIR IMMERSION	7.38E-08
GROUND SURFACE	4.96E-04
INTERNAL	9.24E-01
EXTERNAL	4.96E-04
TOTAL	9.24E-01

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	3.99E-01
U-235	2.00E-02
U-236	1.47E-02
U-238	3.97E-01
RA-226	3.55E-05
RA-228	5.53E-05
TH-228	2.21E-02
TH-230	6.47E-02
TH-232	4.96E-03
TH-234	9.54E-04
TOTAL	9.24E-01

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.13E-07
BONE	7.49E-08
THYROID	5.51E-10
BREAST	6.26E-09
LUNG	1.15E-05
STOMACH	4.14E-09
BOWEL	1.09E-08
LIVER	5.30E-09
PANCREAS	2.41E-09
URINARY	1.27E-07
OTHER	2.94E-09
TOTAL	1.18E-05

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.31E-07
INHALATION	1.16E-05
AIR IMMERSION	1.64E-12
GROUND SURFACE	1.14E-08
INTERNAL	1.18E-05
EXTERNAL	1.14E-08
TOTAL	1.18E-05

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	5.16E-06
U-235	2.64E-07
U-236	1.90E-07
U-238	5.18E-06
RA-226	4.97E-10
RA-228	5.86E-10
TH-228	4.43E-07
TH-230	5.31E-07
TH-232	2.79E-08
TH-234	3.21E-08
TOTAL	1.18E-05

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

Direction	Distance (m) 795	710	1398	1133	930	1105	1411
N	2.5E-01	3.2E-01	8.8E-02	1.3E-01	1.9E-01	1.3E-01	8.6E-02
NNW	1.6E-01	2.0E-01	5.7E-02	8.3E-02	1.2E-01	8.7E-02	5.6E-02
NW	1.7E-01	2.1E-01	5.8E-02	8.5E-02	1.2E-01	8.8E-02	5.7E-02
WNW	1.9E-01	2.4E-01	6.4E-02	9.5E-02	1.4E-01	9.9E-02	6.3E-02
W	3.0E-01	3.8E-01	1.0E-01	1.5E-01	2.2E-01	1.6E-01	1.0E-01
WSW	2.7E-01	3.4E-01	9.7E-02	1.4E-01	2.0E-01	1.5E-01	9.6E-02
SW	1.6E-01	2.0E-01	5.7E-02	8.2E-02	1.2E-01	8.6E-02	5.6E-02
SSW	1.4E-01	1.8E-01	5.0E-02	7.2E-02	1.0E-01	7.6E-02	4.9E-02
S	1.8E-01	2.2E-01	6.1E-02	8.9E-02	1.3E-01	9.3E-02	6.0E-02
SSE	3.7E-01	4.7E-01	1.2E-01	1.8E-01	2.7E-01	1.9E-01	1.2E-01
SE	6.1E-01	7.7E-01	2.0E-01	3.0E-01	4.4E-01	3.2E-01	2.0E-01
ESE	6.5E-01	8.2E-01	2.1E-01	3.2E-01	4.7E-01	3.4E-01	2.1E-01
E	7.3E-01	9.2E-01	2.4E-01	3.6E-01	5.3E-01	3.8E-01	2.4E-01
ENE	6.9E-01	8.7E-01	2.3E-01	3.4E-01	5.0E-01	3.6E-01	2.3E-01
NE	5.9E-01	7.5E-01	2.0E-01	3.0E-01	4.3E-01	3.1E-01	2.0E-01
NNE	3.6E-01	4.6E-01	1.3E-01	1.8E-01	2.7E-01	1.9E-01	1.2E-01

Direction	Distance (m) 1537	1578	1760	1769	1829	1782	1784
N	7.3E-02	7.0E-02	5.8E-02	5.7E-02	5.4E-02	5.7E-02	5.6E-02
NNW	4.8E-02	4.6E-02	3.8E-02	3.8E-02	3.6E-02	3.7E-02	3.7E-02
NW	4.9E-02	4.7E-02	3.9E-02	3.8E-02	3.6E-02	3.8E-02	3.8E-02
WNW	5.4E-02	5.1E-02	4.2E-02	4.2E-02	4.0E-02	4.1E-02	4.1E-02
W	8.6E-02	8.2E-02	6.7E-02	6.7E-02	6.3E-02	6.6E-02	6.6E-02
WSW	8.2E-02	7.8E-02	6.5E-02	6.5E-02	6.1E-02	6.4E-02	6.4E-02
SW	4.8E-02	4.6E-02	3.9E-02	3.8E-02	3.6E-02	3.8E-02	3.8E-02
SSW	4.2E-02	4.0E-02	3.4E-02	3.3E-02	3.1E-02	3.3E-02	3.3E-02
S	5.1E-02	4.9E-02	4.0E-02	4.0E-02	3.8E-02	4.0E-02	3.9E-02
SSE	1.0E-01	9.8E-02	8.0E-02	7.9E-02	7.4E-02	7.8E-02	7.8E-02
SE	1.7E-01	1.6E-01	1.3E-01	1.3E-01	1.2E-01	1.3E-01	1.3E-01
ESE	1.8E-01	1.7E-01	1.4E-01	1.4E-01	1.3E-01	1.3E-01	1.3E-01
E	2.0E-01	1.9E-01	1.6E-01	1.6E-01	1.5E-01	1.5E-01	1.5E-01
ENE	1.9E-01	1.9E-01	1.5E-01	1.5E-01	1.4E-01	1.5E-01	1.5E-01
NE	1.7E-01	1.6E-01	1.3E-01	1.3E-01	1.2E-01	1.3E-01	1.3E-01
NNE	1.1E-01	1.0E-01	8.3E-02	8.2E-02	7.8E-02	8.1E-02	8.1E-02

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2397	1902	1581	1552	1680	1452
N	3.4E-02	5.0E-02	7.0E-02	7.2E-02	6.3E-02	8.2E-02
NNW	2.3E-02	3.3E-02	4.6E-02	4.7E-02	4.1E-02	5.3E-02
NW	2.3E-02	3.4E-02	4.6E-02	4.8E-02	4.2E-02	5.4E-02
WNW	2.5E-02	3.7E-02	5.1E-02	5.3E-02	4.6E-02	6.0E-02
W	3.9E-02	5.8E-02	8.1E-02	8.4E-02	7.3E-02	9.5E-02
WSW	3.9E-02	5.7E-02	7.8E-02	8.1E-02	7.1E-02	9.1E-02
SW	2.3E-02	3.4E-02	4.6E-02	4.8E-02	4.2E-02	5.4E-02
SSW	2.0E-02	2.9E-02	4.0E-02	4.2E-02	3.6E-02	4.7E-02
S	2.4E-02	3.5E-02	4.9E-02	5.0E-02	4.4E-02	5.7E-02
SSE	4.5E-02	6.9E-02	9.7E-02	1.0E-01	8.7E-02	1.1E-01
SE	7.2E-02	1.1E-01	1.6E-01	1.6E-01	1.4E-01	1.9E-01
ESE	7.7E-02	1.2E-01	1.7E-01	1.7E-01	1.5E-01	2.0E-01
E	8.9E-02	1.4E-01	1.9E-01	2.0E-01	1.7E-01	2.3E-01
ENE	8.7E-02	1.3E-01	1.8E-01	1.9E-01	1.7E-01	2.2E-01
NE	7.6E-02	1.1E-01	1.6E-01	1.7E-01	1.4E-01	1.9E-01
NNE	4.9E-02	7.2E-02	1.0E-01	1.0E-01	9.0E-02	1.2E-01

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	795	710	1398	1133	930	1105	1411
N	3.2E-06	4.1E-06	1.1E-06	1.6E-06	2.4E-06	1.7E-06	1.1E-06
NNW	2.1E-06	2.6E-06	7.1E-07	1.0E-06	1.5E-06	1.1E-06	7.0E-07
NW	2.1E-06	2.7E-06	7.2E-07	1.1E-06	1.5E-06	1.1E-06	7.1E-07
WNW	2.4E-06	3.0E-06	8.0E-07	1.2E-06	1.7E-06	1.2E-06	7.9E-07
W	3.8E-06	4.8E-06	1.3E-06	1.9E-06	2.8E-06	2.0E-06	1.3E-06
WSW	3.5E-06	4.3E-06	1.2E-06	1.8E-06	2.5E-06	1.9E-06	1.2E-06
SW	2.0E-06	2.5E-06	7.1E-07	1.0E-06	1.5E-06	1.1E-06	7.0E-07
SSW	1.8E-06	2.2E-06	6.2E-07	9.0E-07	1.3E-06	9.4E-07	6.1E-07
S	2.2E-06	2.8E-06	7.6E-07	1.1E-06	1.6E-06	1.2E-06	7.4E-07
SSE	4.7E-06	6.0E-06	1.6E-06	2.3E-06	3.4E-06	2.4E-06	1.5E-06
SE	7.8E-06	9.9E-06	2.6E-06	3.8E-06	5.7E-06	4.0E-06	2.5E-06
ESE	8.3E-06	1.0E-05	2.7E-06	4.1E-06	6.0E-06	4.3E-06	2.7E-06
E	9.4E-06	1.2E-05	3.1E-06	4.6E-06	6.8E-06	4.9E-06	3.1E-06
ENE	8.8E-06	1.1E-05	3.0E-06	4.4E-06	6.4E-06	4.6E-06	2.9E-06
NE	7.6E-06	9.5E-06	2.6E-06	3.8E-06	5.5E-06	4.0E-06	2.5E-06
NNE	4.6E-06	5.8E-06	1.6E-06	2.3E-06	3.4E-06	2.4E-06	1.6E-06

	Distance (m)						
Direction	1537	1578	1760	1769	1829	1782	1784
N	9.2E-07	8.7E-07	7.2E-07	7.1E-07	6.7E-07	7.0E-07	7.0E-07
NNW	5.9E-07	5.7E-07	4.7E-07	4.6E-07	4.3E-07	4.6E-07	4.5E-07
NW	6.0E-07	5.7E-07	4.7E-07	4.7E-07	4.4E-07	4.6E-07	4.6E-07
WNW	6.7E-07	6.4E-07	5.2E-07	5.1E-07	4.8E-07	5.1E-07	5.1E-07
W	1.1E-06	1.0E-06	8.4E-07	8.3E-07	7.8E-07	8.2E-07	8.2E-07
WSW	1.0E-06	9.8E-07	8.1E-07	8.0E-07	7.5E-07	7.9E-07	7.9E-07
SW	6.0E-07	5.7E-07	4.7E-07	4.7E-07	4.4E-07	4.6E-07	4.6E-07
SSW	5.2E-07	4.9E-07	4.1E-07	4.0E-07	3.8E-07	4.0E-07	4.0E-07
S	6.3E-07	6.0E-07	4.9E-07	4.9E-07	4.6E-07	4.8E-07	4.8E-07
SSE	1.3E-06	1.2E-06	1.0E-06	9.9E-07	9.2E-07	9.7E-07	9.7E-07
SE	2.1E-06	2.0E-06	1.6E-06	1.6E-06	1.5E-06	1.6E-06	1.6E-06
ESE	2.2E-06	2.1E-06	1.7E-06	1.7E-06	1.6E-06	1.7E-06	1.7E-06
E	2.6E-06	2.5E-06	2.0E-06	2.0E-06	1.9E-06	1.9E-06	1.9E-06
ENE	2.5E-06	2.3E-06	1.9E-06	1.9E-06	1.8E-06	1.9E-06	1.9E-06
NE	2.1E-06	2.0E-06	1.7E-06	1.7E-06	1.5E-06	1.6E-06	1.6E-06
NNE	1.3E-06	1.3E-06	1.0E-06	1.0E-06	9.7E-07	1.0E-06	1.0E-06

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2397	1902	1581	1552	1680	1452
N	4.1E-07	6.2E-07	8.7E-07	9.0E-07	7.8E-07	1.0E-06
NNW	2.7E-07	4.0E-07	5.7E-07	5.8E-07	5.1E-07	6.6E-07
NW	2.7E-07	4.1E-07	5.7E-07	5.9E-07	5.1E-07	6.7E-07
WNW	3.0E-07	4.5E-07	6.3E-07	6.6E-07	5.7E-07	7.4E-07
W	4.8E-07	7.2E-07	1.0E-06	1.1E-06	9.1E-07	1.2E-06
WSW	4.7E-07	7.0E-07	9.8E-07	1.0E-06	8.8E-07	1.1E-06
SW	2.8E-07	4.1E-07	5.7E-07	5.9E-07	5.1E-07	6.6E-07
SSW	2.4E-07	3.5E-07	4.9E-07	5.1E-07	4.4E-07	5.7E-07
S	2.8E-07	4.3E-07	6.0E-07	6.2E-07	5.4E-07	7.0E-07
SSE	5.6E-07	8.5E-07	1.2E-06	1.3E-06	1.1E-06	1.4E-06
SE	9.0E-07	1.4E-06	2.0E-06	2.1E-06	1.8E-06	2.4E-06
ESE	9.6E-07	1.5E-06	2.1E-06	2.2E-06	1.9E-06	2.5E-06
E	1.1E-06	1.7E-06	2.4E-06	2.5E-06	2.2E-06	2.9E-06
ENE	1.1E-06	1.7E-06	2.3E-06	2.4E-06	2.1E-06	2.7E-06
NE	9.5E-07	1.4E-06	2.0E-06	2.1E-06	1.8E-06	2.4E-06
NNE	6.0E-07	9.0E-07	1.3E-06	1.3E-06	1.1E-06	1.5E-06

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 20, 1998 9:31 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

5.65E-01

At This Location: 903 Meters East

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
STOCKPILE CON-017 [G2]

Dataset Name: 97-PILE2-G2
Dataset Date: Apr 20, 1998 9:21 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 903 Meters East
Lifetime Fatal Cancer Risk: 7.22E-06

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.53E-03
BREAST	1.75E-03
R MAR	7.23E-02
LUNGS	4.30E+00
THYROID	1.49E-03
ENDOST	9.51E-01
RMNDR	3.85E-02
EFFEC	5.65E-01

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	5.9E-04	5.9E-04
U-235	Y	1.00	3.1E-05	3.1E-05
U-236	Y	1.00	2.3E-05	2.3E-05
U-238	Y	1.00	6.6E-04	6.6E-04
RA-226	W	1.00	4.2E-07	4.2E-07
RA-228	W	1.00	1.7E-06	1.7E-06
TH-228	Y	1.00	1.8E-05	1.8E-05
TH-230	Y	1.00	5.3E-05	5.3E-05
TH-232	Y	1.00	2.8E-06	2.8E-06
TH-234	Y	1.00	2.6E-03	2.6E-03

SITE INFORMATION.

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number: 1

Source Height (m): 1.00
Area (sq m): 2.04E+04

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Zero:	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

903	1003	1754	2158	2675	2200	2798	1089	1971	2454
2507	1154	2256	1156	1392	1486	1444	2030	2055	1531

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 20, 1998 9:31 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
STOCKPILE CON-017 [G2]

Dataset Name: 97-PILE2-G2
Dataset Date: Apr 20, 1998 9:21 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.53E-03
BREAST	1.75E-03
R MAR	7.23E-02
LUNGS	4.30E+00
THYROID	1.49E-03
ENDOST	9.51E-01
RMNDR	3.85E-02
EFFEC	5.65E-01

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	2.74E-02
INHALATION	5.37E-01
AIR IMMERSION	4.50E-08
GROUND SURFACE	3.08E-04
INTERNAL	5.65E-01
EXTERNAL	3.08E-04
TOTAL	5.65E-01

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	2.44E-01
U-235	1.22E-02
U-236	8.97E-03
U-238	2.43E-01
RA-226	2.20E-05
RA-228	3.44E-05
TH-228	1.35E-02
TH-230	3.95E-02
TH-232	3.03E-03
TH-234	5.91E-04
TOTAL	5.65E-01

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	7.01E-08
BONE	4.64E-08
THYROID	3.44E-10
BREAST	3.90E-09
LUNG	7.01E-06
STOMACH	2.59E-09
BOWEL	6.84E-09
LIVER	3.28E-09
PANCREAS	1.50E-09
URINARY	7.98E-08
OTHER	1.84E-09
TOTAL	7.22E-06

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.45E-07
INHALATION	7.07E-06
AIR IMMERSION	1.00E-12
GROUND SURFACE	7.08E-09
INTERNAL	7.22E-06
EXTERNAL	7.08E-09
TOTAL	7.22E-06

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	3.15E-06
U-235	1.61E-07
U-236	1.16E-07
U-238	3.16E-06
RA-226	3.05E-10
RA-228	3.62E-10
TH-228	2.70E-07
TH-230	3.24E-07
TH-232	1.71E-08
TH-234	1.97E-08
TOTAL	7.22E-06

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	903	1003	1754	2158	2675	2200	2798
N	2.0E-01	1.6E-01	5.7E-02	4.0E-02	2.8E-02	3.8E-02	2.6E-02
NNW	1.3E-01	1.0E-01	3.8E-02	2.6E-02	1.9E-02	2.5E-02	1.7E-02
NW	1.3E-01	1.0E-01	3.8E-02	2.6E-02	1.9E-02	2.6E-02	1.7E-02
WNW	1.4E-01	1.2E-01	4.2E-02	2.9E-02	2.0E-02	2.8E-02	1.9E-02
W	2.3E-01	1.9E-01	6.7E-02	4.6E-02	3.2E-02	4.4E-02	2.9E-02
WSW	2.1E-01	1.7E-01	6.5E-02	4.5E-02	3.2E-02	4.4E-02	2.9E-02
SW	1.2E-01	1.0E-01	3.8E-02	2.7E-02	1.9E-02	2.6E-02	1.8E-02
SSW	1.1E-01	8.9E-02	3.3E-02	2.3E-02	1.6E-02	2.2E-02	1.5E-02
S	1.4E-01	1.1E-01	4.0E-02	2.8E-02	1.9E-02	2.7E-02	1.8E-02
SSE	2.8E-01	2.3E-01	7.9E-02	5.4E-02	3.7E-02	5.2E-02	3.4E-02
SE	4.7E-01	3.8E-01	1.3E-01	8.6E-02	5.8E-02	8.3E-02	5.4E-02
ESE	5.0E-01	4.0E-01	1.4E-01	9.2E-02	6.2E-02	8.9E-02	5.7E-02
E	5.6E-01	4.5E-01	1.6E-01	1.1E-01	7.2E-02	1.0E-01	6.7E-02
ENE	5.3E-01	4.3E-01	1.5E-01	1.0E-01	7.1E-02	1.0E-01	6.5E-02
NE	4.6E-01	3.7E-01	1.3E-01	9.0E-02	6.2E-02	8.7E-02	5.7E-02
NNE	2.8E-01	2.3E-01	8.3E-02	5.7E-02	4.0E-02	5.5E-02	3.7E-02

	Distance (m)						
Direction	1089	1971	2454	2507	1154	2256	1156
N	1.4E-01	4.6E-02	3.2E-02	3.1E-02	1.2E-01	3.7E-02	1.2E-01
NNW	8.9E-02	3.1E-02	2.1E-02	2.1E-02	8.0E-02	2.4E-02	8.0E-02
NW	9.0E-02	3.1E-02	2.1E-02	2.1E-02	8.1E-02	2.5E-02	8.1E-02
WNW	1.0E-01	3.4E-02	2.3E-02	2.3E-02	9.1E-02	2.7E-02	9.1E-02
W	1.6E-01	5.4E-02	3.7E-02	3.5E-02	1.5E-01	4.2E-02	1.5E-01
WSW	1.5E-01	5.3E-02	3.7E-02	3.5E-02	1.4E-01	4.2E-02	1.3E-01
SW	8.7E-02	3.1E-02	2.2E-02	2.1E-02	7.9E-02	2.5E-02	7.9E-02
SSW	7.7E-02	2.7E-02	1.9E-02	1.8E-02	6.9E-02	2.2E-02	6.9E-02
S	9.5E-02	3.2E-02	2.2E-02	2.2E-02	8.6E-02	2.6E-02	8.5E-02
SSE	2.0E-01	6.3E-02	4.3E-02	4.1E-02	1.8E-01	5.0E-02	1.8E-01
SE	3.2E-01	1.0E-01	6.8E-02	6.6E-02	2.9E-01	8.0E-02	2.9E-01
ESE	3.4E-01	1.1E-01	7.3E-02	7.0E-02	3.1E-01	8.5E-02	3.1E-01
E	3.9E-01	1.3E-01	8.5E-02	8.2E-02	3.5E-01	9.9E-02	3.5E-01
ENE	3.7E-01	1.2E-01	8.2E-02	7.9E-02	3.3E-01	9.6E-02	3.3E-01
NE	3.2E-01	1.1E-01	7.2E-02	6.9E-02	2.9E-01	8.4E-02	2.9E-01
NNE	2.0E-01	6.7E-02	4.6E-02	4.4E-02	1.8E-01	5.3E-02	1.8E-01

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1392	1486	1444	2030	2055	1531
N	8.8E-02	7.7E-02	8.2E-02	4.4E-02	4.3E-02	7.3E-02
NNW	5.7E-02	5.0E-02	5.3E-02	2.9E-02	2.8E-02	4.8E-02
NW	5.8E-02	5.1E-02	5.4E-02	2.9E-02	2.9E-02	4.8E-02
WNW	6.4E-02	5.7E-02	6.0E-02	3.2E-02	3.1E-02	5.4E-02
W	1.0E-01	9.0E-02	9.6E-02	5.1E-02	5.0E-02	8.6E-02
WSW	9.7E-02	8.6E-02	9.1E-02	5.0E-02	4.9E-02	8.2E-02
SW	5.7E-02	5.1E-02	5.3E-02	3.0E-02	2.9E-02	4.8E-02
SSW	5.0E-02	4.4E-02	4.6E-02	2.6E-02	2.5E-02	4.2E-02
S	6.1E-02	5.4E-02	5.7E-02	3.1E-02	3.0E-02	5.1E-02
SSE	1.2E-01	1.1E-01	1.1E-01	6.0E-02	5.9E-02	1.0E-01
SE	2.0E-01	1.8E-01	1.9E-01	9.6E-02	9.4E-02	1.7E-01
ESE	2.1E-01	1.9E-01	2.0E-01	1.0E-01	1.0E-01	1.8E-01
E	2.5E-01	2.2E-01	2.3E-01	1.2E-01	1.2E-01	2.0E-01
ENE	2.3E-01	2.1E-01	2.2E-01	1.1E-01	1.1E-01	2.0E-01
NE	2.0E-01	1.8E-01	1.9E-01	1.0E-01	9.8E-02	1.7E-01
NNE	1.3E-01	1.1E-01	1.2E-01	6.3E-02	6.2E-02	1.1E-01

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 903	1003	1754	2158	2675	2200	2798
N	2.5E-06	2.0E-06	7.2E-07	4.9E-07	3.4E-07	4.7E-07	3.1E-07
NNW	1.6E-06	1.3E-06	4.6E-07	3.2E-07	2.2E-07	3.1E-07	2.0E-07
NW	1.6E-06	1.3E-06	4.7E-07	3.2E-07	2.2E-07	3.1E-07	2.0E-07
WNW	1.8E-06	1.5E-06	5.2E-07	3.5E-07	2.4E-07	3.4E-07	2.2E-07
W	3.0E-06	2.4E-06	8.4E-07	5.7E-07	3.9E-07	5.5E-07	3.6E-07
WSW	2.7E-06	2.2E-06	8.1E-07	5.6E-07	3.9E-07	5.4E-07	3.6E-07
SW	1.6E-06	1.3E-06	4.7E-07	3.3E-07	2.3E-07	3.2E-07	2.1E-07
SSW	1.4E-06	1.1E-06	4.0E-07	2.8E-07	1.9E-07	2.7E-07	1.8E-07
S	1.7E-06	1.4E-06	4.9E-07	3.4E-07	2.3E-07	3.3E-07	2.1E-07
SSE	3.6E-06	2.9E-06	1.0E-06	6.7E-07	4.5E-07	6.5E-07	4.2E-07
SE	6.0E-06	4.8E-06	1.6E-06	1.1E-06	7.3E-07	1.0E-06	6.7E-07
ESE	6.4E-06	5.1E-06	1.7E-06	1.2E-06	7.8E-07	1.1E-06	7.2E-07
E	7.2E-06	5.8E-06	2.0E-06	1.3E-06	9.1E-07	1.3E-06	8.4E-07
ENE	6.8E-06	5.5E-06	1.9E-06	1.3E-06	8.8E-07	1.3E-06	8.1E-07
NE	5.9E-06	4.7E-06	1.7E-06	1.1E-06	7.7E-07	1.1E-06	7.1E-07
NNE	3.6E-06	2.9E-06	1.0E-06	7.1E-07	4.9E-07	6.9E-07	4.5E-07

Direction	Distance (m) 1089	1971	2454	2507	1154	2256	1156
N	1.7E-06	5.7E-07	3.9E-07	3.8E-07	1.6E-06	4.5E-07	1.6E-06
NNW	1.1E-06	3.7E-07	2.6E-07	2.5E-07	1.0E-06	3.0E-07	1.0E-06
NW	1.1E-06	3.8E-07	2.6E-07	2.5E-07	1.0E-06	3.0E-07	1.0E-06
WNW	1.3E-06	4.1E-07	2.8E-07	2.7E-07	1.1E-06	3.3E-07	1.1E-06
W	2.1E-06	6.7E-07	4.5E-07	4.4E-07	1.8E-06	5.3E-07	1.8E-06
WSW	1.9E-06	6.6E-07	4.5E-07	4.3E-07	1.7E-06	5.2E-07	1.7E-06
SW	1.1E-06	3.8E-07	2.6E-07	2.5E-07	9.9E-07	3.0E-07	9.9E-07
SSW	9.7E-07	3.3E-07	2.2E-07	2.2E-07	8.7E-07	2.6E-07	8.7E-07
S	1.2E-06	3.9E-07	2.7E-07	2.6E-07	1.1E-06	3.1E-07	1.1E-06
SSE	2.5E-06	7.9E-07	5.3E-07	5.1E-07	2.2E-06	6.2E-07	2.2E-06
SE	4.1E-06	1.3E-06	8.6E-07	8.3E-07	3.7E-06	1.0E-06	3.7E-06
ESE	4.4E-06	1.4E-06	9.2E-07	8.8E-07	3.9E-06	1.1E-06	3.9E-06
E	5.0E-06	1.6E-06	1.1E-06	1.0E-06	4.5E-06	1.2E-06	4.5E-06
ENE	4.7E-06	1.5E-06	1.0E-06	1.0E-06	4.2E-06	1.2E-06	4.2E-06
NE	4.1E-06	1.3E-06	9.0E-07	8.7E-07	3.7E-06	1.1E-06	3.7E-06
NNE	2.5E-06	8.4E-07	5.7E-07	5.5E-07	2.3E-06	6.6E-07	2.3E-06

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1392	1486	1444	2030	2055	1531
N	1.1E-06	9.7E-07	1.0E-06	5.4E-07	5.3E-07	9.2E-07
NNW	7.1E-07	6.3E-07	6.6E-07	3.5E-07	3.5E-07	5.9E-07
NW	7.2E-07	6.4E-07	6.7E-07	3.6E-07	3.5E-07	6.0E-07
WNW	8.0E-07	7.1E-07	7.5E-07	3.9E-07	3.8E-07	6.7E-07
W	1.3E-06	1.1E-06	1.2E-06	6.3E-07	6.2E-07	1.1E-06
WSW	1.2E-06	1.1E-06	1.1E-06	6.2E-07	6.1E-07	1.0E-06
SW	7.1E-07	6.3E-07	6.6E-07	3.6E-07	3.5E-07	6.0E-07
SSW	6.2E-07	5.5E-07	5.8E-07	3.1E-07	3.0E-07	5.2E-07
S	7.6E-07	6.7E-07	7.1E-07	3.7E-07	3.7E-07	6.3E-07
SSE	1.6E-06	1.4E-06	1.5E-06	7.5E-07	7.3E-07	1.3E-06
SE	2.6E-06	2.2E-06	2.4E-06	1.2E-06	1.2E-06	2.1E-06
ESE	2.7E-06	2.4E-06	2.5E-06	1.3E-06	1.3E-06	2.3E-06
E	3.1E-06	2.7E-06	2.9E-06	1.5E-06	1.5E-06	2.6E-06
ENE	3.0E-06	2.6E-06	2.8E-06	1.5E-06	1.4E-06	2.5E-06
NE	2.6E-06	2.3E-06	2.4E-06	1.3E-06	1.2E-06	2.2E-06
NNE	1.6E-06	1.4E-06	1.5E-06	7.9E-07	7.8E-07	1.3E-06

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 20, 1998 9:32 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)
1.83E+00

At This Location: 472 Meters East

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
STOCKPILE SWU-004/FLYASH [G1]

Dataset Name: 97-PILE3-G1
Dataset Date: Apr 20, 1998 9:24 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 472 Meters East
Lifetime Fatal Cancer Risk: 2.34E-05

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	4.81E-03
BREAST	5.48E-03
R MAR	2.31E-01
LUNGS	1.40E+01
THYROID	4.68E-03
ENDOST	3.04E+00
RMNDR	1.20E-01
EFFEC	1.83E+00

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	5.2E-04	5.2E-04
U-235	Y	1.00	2.7E-05	2.7E-05
U-236	Y	1.00	2.0E-05	2.0E-05
U-238	Y	1.00	5.8E-04	5.8E-04
RA-226	W	1.00	3.7E-07	3.7E-07
RA-228	W	1.00	1.5E-06	1.5E-06
TH-228	Y	1.00	1.5E-05	1.5E-05
TH-230	Y	1.00	4.6E-05	4.6E-05
TH-232	Y	1.00	2.4E-06	2.4E-06
TH-234	Y	1.00	2.3E-03	2.3E-03

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number: 1

Source Height (m): 1.00
Area (sq m): 2.85E+04

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Zero:	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

2032	1976	2526	2019	1652	864	546	472	485	551
536	551	597	642	1352	1143	1386	1431	2370	2439

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 20, 1998 9:32 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
STOCKPILE SWU-004/FLYASH [G1]

Dataset Name: 97-PILE3-G1
Dataset Date: Apr 20, 1998 9:24 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	4.81E-03
BREAST	5.48E-03
R MAR	2.31E-01
LUNGS	1.40E+01
THYROID	4.68E-03
ENDOST	3.04E+00
RMNDR	1.20E-01
EFFEC	1.83E+00

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	8.56E-02
INHALATION	1.75E+00
AIR IMMERSION	1.46E-07
GROUND SURFACE	9.65E-04
INTERNAL	1.83E+00
EXTERNAL	9.65E-04
TOTAL	1.83E+00

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	7.91E-01
U-235	3.97E-02
U-236	2.91E-02
U-238	7.88E-01
RA-226	7.00E-05
RA-228	1.09E-04
TH-228	4.38E-02
TH-230	1.28E-01
TH-232	9.81E-03
TH-234	1.88E-03
TOTAL	1.83E+00

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	2.24E-07
BONE	1.48E-07
THYROID	1.08E-09
BREAST	1.22E-08
LUNG	2.28E-05
STOMACH	8.13E-09
BOWEL	2.15E-08
LIVER	1.04E-08
PANCREAS	4.72E-09
URINARY	2.49E-07
OTHER	5.77E-09
TOTAL	2.34E-05

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	4.54E-07
INHALATION	2.30E-05
AIR IMMERSION	3.26E-12
GROUND SURFACE	2.22E-08
INTERNAL	2.34E-05
EXTERNAL	2.22E-08
TOTAL	2.34E-05

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	1.02E-05
U-235	5.23E-07
U-236	3.76E-07
U-238	1.03E-05
RA-226	9.83E-10
RA-228	1.16E-09
TH-228	8.79E-07
TH-230	1.05E-06
TH-232	5.53E-08
TH-234	6.36E-08
TOTAL	2.34E-05

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	2032	1976	2526	2019	1652	864	546
N	4.3E-02	4.5E-02	3.1E-02	4.3E-02	6.0E-02	1.9E-01	4.7E-01
NNW	3.0E-02	3.1E-02	2.2E-02	3.0E-02	4.1E-02	1.2E-01	3.0E-01
NW	3.0E-02	3.1E-02	2.3E-02	3.0E-02	4.2E-02	1.3E-01	3.1E-01
WNW	3.3E-02	3.4E-02	2.4E-02	3.3E-02	4.5E-02	1.4E-01	3.5E-01
W	4.9E-02	5.1E-02	3.5E-02	4.9E-02	6.9E-02	2.2E-01	5.6E-01
WSW	4.8E-02	5.0E-02	3.5E-02	4.9E-02	6.7E-02	2.0E-01	4.9E-01
SW	3.1E-02	3.2E-02	2.3E-02	3.1E-02	4.1E-02	1.2E-01	2.9E-01
SSW	2.7E-02	2.8E-02	2.1E-02	2.7E-02	3.7E-02	1.1E-01	2.6E-01
S	3.1E-02	3.3E-02	2.3E-02	3.2E-02	4.3E-02	1.3E-01	3.3E-01
SSE	5.7E-02	5.9E-02	4.0E-02	5.7E-02	8.2E-02	2.7E-01	6.9E-01
SE	8.8E-02	9.3E-02	6.1E-02	8.9E-02	1.3E-01	4.5E-01	1.1E+00
ESE	9.3E-02	9.8E-02	6.5E-02	9.4E-02	1.4E-01	4.8E-01	1.2E+00
E	1.1E-01	1.1E-01	7.5E-02	1.1E-01	1.6E-01	5.4E-01	1.4E+00
ENE	1.0E-01	1.1E-01	7.3E-02	1.1E-01	1.5E-01	5.1E-01	1.3E+00
NE	9.2E-02	9.6E-02	6.4E-02	9.3E-02	1.3E-01	4.4E-01	1.1E+00
NNE	6.0E-02	6.2E-02	4.3E-02	6.0E-02	8.5E-02	2.7E-01	6.7E-01

	Distance (m)						
Direction	472	485	551	536	551	597	642
N	6.3E-01	5.9E-01	4.6E-01	4.9E-01	4.6E-01	3.9E-01	3.4E-01
NNW	4.0E-01	3.8E-01	3.0E-01	3.1E-01	3.0E-01	2.5E-01	2.2E-01
NW	4.1E-01	3.9E-01	3.0E-01	3.2E-01	3.0E-01	2.6E-01	2.3E-01
WNW	4.7E-01	4.4E-01	3.4E-01	3.6E-01	3.4E-01	2.9E-01	2.5E-01
W	7.4E-01	7.0E-01	5.5E-01	5.8E-01	5.5E-01	4.7E-01	4.0E-01
WSW	6.5E-01	6.2E-01	4.8E-01	5.1E-01	4.8E-01	4.1E-01	3.6E-01
SW	3.8E-01	3.6E-01	2.8E-01	3.0E-01	2.8E-01	2.4E-01	2.1E-01
SSW	3.4E-01	3.2E-01	2.5E-01	2.7E-01	2.5E-01	2.2E-01	1.9E-01
S	4.3E-01	4.1E-01	3.2E-01	3.4E-01	3.2E-01	2.7E-01	2.4E-01
SSE	9.3E-01	8.7E-01	6.8E-01	7.2E-01	6.8E-01	5.8E-01	5.0E-01
SE	1.5E+00	1.5E+00	1.1E+00	1.2E+00	1.1E+00	9.6E-01	8.3E-01
ESE	1.6E+00	1.5E+00	1.2E+00	1.3E+00	1.2E+00	1.0E+00	8.7E-01
E	1.8E+00	1.7E+00	1.3E+00	1.4E+00	1.3E+00	1.1E+00	9.8E-01
ENE	1.7E+00	1.6E+00	1.3E+00	1.3E+00	1.3E+00	1.1E+00	9.2E-01
NE	1.5E+00	1.4E+00	1.1E+00	1.1E+00	1.1E+00	9.2E-01	7.9E-01
NNE	8.9E-01	8.4E-01	6.5E-01	6.9E-01	6.5E-01	5.6E-01	4.8E-01

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1352	1143	1386	1431	2370	2439
N	8.5E-02	1.1E-01	8.1E-02	7.7E-02	3.4E-02	3.3E-02
NNW	5.7E-02	7.5E-02	5.5E-02	5.2E-02	2.4E-02	2.4E-02
NW	5.8E-02	7.6E-02	5.5E-02	5.2E-02	2.5E-02	2.4E-02
WNW	6.4E-02	8.5E-02	6.1E-02	5.8E-02	2.6E-02	2.5E-02
W	9.9E-02	1.3E-01	9.5E-02	8.9E-02	3.9E-02	3.7E-02
WSW	9.3E-02	1.2E-01	9.0E-02	8.5E-02	3.8E-02	3.7E-02
SW	5.7E-02	7.5E-02	5.5E-02	5.2E-02	2.5E-02	2.4E-02
SSW	5.0E-02	6.6E-02	4.8E-02	4.6E-02	2.2E-02	2.1E-02
S	6.0E-02	8.0E-02	5.8E-02	5.5E-02	2.5E-02	2.4E-02
SSE	1.2E-01	1.6E-01	1.1E-01	1.1E-01	4.4E-02	4.2E-02
SE	1.9E-01	2.6E-01	1.8E-01	1.7E-01	6.8E-02	6.5E-02
ESE	2.0E-01	2.8E-01	1.9E-01	1.8E-01	7.2E-02	6.9E-02
E	2.3E-01	3.1E-01	2.2E-01	2.1E-01	8.3E-02	7.9E-02
ENE	2.2E-01	3.0E-01	2.1E-01	2.0E-01	8.1E-02	7.7E-02
NE	1.9E-01	2.6E-01	1.8E-01	1.7E-01	7.1E-02	6.8E-02
NNE	1.2E-01	1.6E-01	1.2E-01	1.1E-01	4.7E-02	4.5E-02

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	2032	1976	2526	2019	1652	864	546
N	5.0E-07	5.2E-07	3.5E-07	5.0E-07	7.2E-07	2.4E-06	6.0E-06
NNW	3.3E-07	3.5E-07	2.4E-07	3.4E-07	4.7E-07	1.5E-06	3.8E-06
NW	3.3E-07	3.5E-07	2.4E-07	3.4E-07	4.8E-07	1.6E-06	3.9E-06
WNW	3.7E-07	3.8E-07	2.6E-07	3.7E-07	5.3E-07	1.8E-06	4.4E-06
W	5.7E-07	6.0E-07	4.0E-07	5.8E-07	8.4E-07	2.8E-06	7.1E-06
WSW	5.6E-07	5.9E-07	4.0E-07	5.7E-07	8.1E-07	2.6E-06	6.2E-06
SW	3.4E-07	3.5E-07	2.4E-07	3.4E-07	4.8E-07	1.5E-06	3.6E-06
SSW	2.9E-07	3.1E-07	2.1E-07	3.0E-07	4.2E-07	1.3E-06	3.3E-06
S	3.5E-07	3.7E-07	2.5E-07	3.5E-07	5.0E-07	1.7E-06	4.1E-06
SSE	6.7E-07	7.1E-07	4.6E-07	6.8E-07	1.0E-06	3.5E-06	8.8E-06
SE	1.1E-06	1.1E-06	7.3E-07	1.1E-06	1.6E-06	5.7E-06	1.5E-05
ESE	1.1E-06	1.2E-06	7.8E-07	1.2E-06	1.7E-06	6.1E-06	1.6E-05
E	1.3E-06	1.4E-06	9.0E-07	1.3E-06	2.0E-06	6.9E-06	1.7E-05
ENE	1.3E-06	1.3E-06	8.8E-07	1.3E-06	1.9E-06	6.5E-06	1.6E-05
NE	1.1E-06	1.2E-06	7.7E-07	1.1E-06	1.6E-06	5.6E-06	1.4E-05
NNE	7.1E-07	7.5E-07	4.9E-07	7.2E-07	1.0E-06	3.4E-06	8.5E-06

	Distance (m)						
Direction	472	485	551	536	551	597	642
N	8.0E-06	7.5E-06	5.9E-06	6.2E-06	5.9E-06	5.0E-06	4.3E-06
NNW	5.1E-06	4.8E-06	3.8E-06	4.0E-06	3.8E-06	3.2E-06	2.8E-06
NW	5.2E-06	4.9E-06	3.8E-06	4.1E-06	3.8E-06	3.3E-06	2.8E-06
WNW	5.9E-06	5.6E-06	4.4E-06	4.6E-06	4.4E-06	3.7E-06	3.2E-06
W	9.5E-06	8.9E-06	7.0E-06	7.3E-06	7.0E-06	5.9E-06	5.1E-06
WSW	8.3E-06	7.8E-06	6.1E-06	6.5E-06	6.1E-06	5.3E-06	4.6E-06
SW	4.8E-06	4.6E-06	3.6E-06	3.8E-06	3.6E-06	3.1E-06	2.7E-06
SSW	4.4E-06	4.1E-06	3.2E-06	3.4E-06	3.2E-06	2.7E-06	2.4E-06
S	5.5E-06	5.2E-06	4.1E-06	4.3E-06	4.1E-06	3.5E-06	3.0E-06
SSE	1.2E-05	1.1E-05	8.7E-06	9.2E-06	8.7E-06	7.4E-06	6.3E-06
SE	2.0E-05	1.9E-05	1.4E-05	1.5E-05	1.4E-05	1.2E-05	1.1E-05
ESE	2.1E-05	2.0E-05	1.5E-05	1.6E-05	1.5E-05	1.3E-05	1.1E-05
E	2.3E-05	2.2E-05	1.7E-05	1.8E-05	1.7E-05	1.5E-05	1.3E-05
ENE	2.2E-05	2.1E-05	1.6E-05	1.7E-05	1.6E-05	1.4E-05	1.2E-05
NE	1.9E-05	1.8E-05	1.4E-05	1.5E-05	1.4E-05	1.2E-05	1.0E-05
NNE	1.1E-05	1.1E-05	8.3E-06	8.8E-06	8.3E-06	7.1E-06	6.2E-06

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	1352	1143	1386	1431	2370	2439
N	1.0E-06	1.4E-06	9.9E-07	9.3E-07	3.9E-07	3.7E-07
NNW	6.8E-07	9.1E-07	6.5E-07	6.1E-07	2.6E-07	2.5E-07
NW	6.9E-07	9.3E-07	6.6E-07	6.2E-07	2.6E-07	2.5E-07
WNW	7.6E-07	1.0E-06	7.3E-07	6.9E-07	2.8E-07	2.7E-07
W	1.2E-06	1.7E-06	1.2E-06	1.1E-06	4.4E-07	4.2E-07
WSW	1.1E-06	1.5E-06	1.1E-06	1.0E-06	4.4E-07	4.2E-07
SW	6.7E-07	9.0E-07	6.5E-07	6.1E-07	2.7E-07	2.6E-07
SSW	5.9E-07	7.9E-07	5.7E-07	5.3E-07	2.3E-07	2.2E-07
S	7.2E-07	9.8E-07	6.9E-07	6.5E-07	2.7E-07	2.6E-07
SSE	1.5E-06	2.0E-06	1.4E-06	1.3E-06	5.2E-07	4.9E-07
SE	2.4E-06	3.3E-06	2.3E-06	2.1E-06	8.2E-07	7.8E-07
ESE	2.5E-06	3.5E-06	2.4E-06	2.3E-06	8.7E-07	8.3E-07
E	2.9E-06	4.0E-06	2.8E-06	2.6E-06	1.0E-06	9.6E-07
ENE	2.8E-06	3.8E-06	2.6E-06	2.5E-06	9.8E-07	9.3E-07
NE	2.4E-06	3.3E-06	2.3E-06	2.1E-06	8.6E-07	8.2E-07
NNE	1.5E-06	2.0E-06	1.4E-06	1.3E-06	5.5E-07	5.2E-07

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Apr 20, 1998 9:32 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent
(mrem/year)

2.47E-01

At This Location: 1286 Meters East

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
STOCKPILE SWU-004/FLYASH [G2]

Dataset Name: 97-PILE3-G2
Dataset Date: Apr 20, 1998 9:25 am
Wind File: WNDFILES\97STAR.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 1286 Meters East
Lifetime Fatal Cancer Risk: 3.16E-06

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	6.89E-04
BREAST	7.86E-04
R MAR	3.21E-02
LUNGS	1.88E+00
THYROID	6.71E-04
ENDOST	4.23E-01
RMNDR	1.74E-02
EFFEC	2.47E-01

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	5.2E-04	5.2E-04
U-235	Y	1.00	2.7E-05	2.7E-05
U-236	Y	1.00	2.0E-05	2.0E-05
U-238	Y	1.00	5.8E-04	5.8E-04
RA-226	W	1.00	3.7E-07	3.7E-07
RA-228	W	1.00	1.5E-06	1.5E-06
TH-228	Y	1.00	1.5E-05	1.5E-05
TH-230	Y	1.00	4.6E-05	4.6E-05
TH-232	Y	1.00	2.4E-06	2.4E-06
TH-234	Y	1.00	2.3E-03	2.3E-03

SITE INFORMATION

Temperature: 11 degrees C
Precipitation: 102 cm/y
Mixing Height: 950 m

SOURCE INFORMATION

Source Number: 1

Source Height (m): 1.00
Area (sq m): 2.04E+04

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Zero:	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

2046	2283	2160	2196	3025	2157	2032	2364	1286	2719
2797	2425	2215	2067	2498	2580	2527	1391	1427	2564

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Apr 20, 1998 9:32 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P.O. BOX 398704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: REMEDIATION SITE
Source Type: Area
Emission Year: 1997

Comments: 1997 NESHAP Demonstration
STOCKPILE SWU-004/FLYASH [G2]

Dataset Name: 97-PILE3-G2
Dataset Date: Apr 20, 1998 9:25 am
Wind File: WNDFILES\97STAR.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	6.89E-04
BREAST	7.86E-04
R MAR	3.21E-02
LUNGS	1.88E+00
THYROID	6.71E-04
ENDOST	4.23E-01
RMNDR	1.74E-02
EFFEC	2.47E-01

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.24E-02
INHALATION	2.35E-01
AIR IMMERSION	1.97E-08
GROUND SURFACE	1.38E-04
INTERNAL	2.47E-01
EXTERNAL	1.38E-04
TOTAL	2.48E-01

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.07E-01
U-235	5.37E-03
U-236	3.93E-03
U-238	1.06E-01
RA-226	9.79E-06
RA-228	1.55E-05
TH-228	5.90E-03
TH-230	1.73E-02
TH-232	1.32E-03
TH-234	2.64E-04
TOTAL	2.48E-01

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	3.12E-08
BONE	2.07E-08
THYROID	1.55E-10
BREAST	1.75E-09
LUNG	3.06E-06
STOMACH	1.17E-09
BOWEL	3.08E-09
LIVER	1.46E-09
PANCREAS	6.77E-10
URINARY	3.61E-08
OTHER	8.28E-10
TOTAL	3.16E-06

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	6.59E-08
INHALATION	3.09E-06
AIR IMMERSION	4.39E-13
GROUND SURFACE	3.18E-09
INTERNAL	3.16E-06
EXTERNAL	3.18E-09
TOTAL	3.16E-06

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	1.38E-06
U-235	7.06E-08
U-236	5.07E-08
U-238	1.38E-06
RA-226	1.34E-10
RA-228	1.62E-10
TH-228	1.18E-07
TH-230	1.42E-07
TH-232	7.45E-09
TH-234	8.68E-09
TOTAL	3.16E-06

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

Direction	Distance (m) 2046	2283	2160	2196	3025	2157	2032
N	3.7E-02	3.0E-02	3.3E-02	3.2E-02	1.9E-02	3.4E-02	3.7E-02
NNW	2.4E-02	2.0E-02	2.2E-02	2.1E-02	1.2E-02	2.2E-02	2.4E-02
NW	2.4E-02	2.0E-02	2.2E-02	2.1E-02	1.2E-02	2.2E-02	2.4E-02
WNW	2.7E-02	2.2E-02	2.4E-02	2.3E-02	1.3E-02	2.4E-02	2.7E-02
W	4.3E-02	3.5E-02	3.9E-02	3.8E-02	2.1E-02	3.9E-02	4.3E-02
WSW	4.2E-02	3.5E-02	3.8E-02	3.7E-02	2.2E-02	3.8E-02	4.2E-02
SW	2.5E-02	2.0E-02	2.2E-02	2.2E-02	1.3E-02	2.2E-02	2.5E-02
SSW	2.1E-02	1.8E-02	1.9E-02	1.9E-02	1.1E-02	1.9E-02	2.1E-02
S	2.5E-02	2.1E-02	2.3E-02	2.2E-02	1.3E-02	2.3E-02	2.6E-02
SSE	5.0E-02	4.1E-02	4.6E-02	4.4E-02	2.5E-02	4.6E-02	5.1E-02
SE	8.1E-02	6.7E-02	7.4E-02	7.2E-02	3.9E-02	7.4E-02	8.2E-02
ESE	8.7E-02	7.1E-02	7.9E-02	7.6E-02	4.2E-02	7.9E-02	8.8E-02
E	1.0E-01	8.3E-02	9.1E-02	8.9E-02	4.9E-02	9.2E-02	1.0E-01
ENE	9.7E-02	8.0E-02	8.8E-02	8.6E-02	4.8E-02	8.9E-02	9.9E-02
NE	8.5E-02	7.0E-02	7.7E-02	7.5E-02	4.2E-02	7.7E-02	8.6E-02
NNE	5.3E-02	4.4E-02	4.9E-02	4.7E-02	2.7E-02	4.9E-02	5.4E-02

Direction	Distance (m) 2364	1286	2719	2797	2425	2215	2067
N	2.9E-02	8.7E-02	2.2E-02	2.1E-02	2.7E-02	3.2E-02	3.6E-02
NNW	1.9E-02	5.6E-02	1.5E-02	1.4E-02	1.8E-02	2.1E-02	2.4E-02
NW	1.9E-02	5.7E-02	1.5E-02	1.4E-02	1.8E-02	2.1E-02	2.4E-02
WNW	2.1E-02	6.4E-02	1.6E-02	1.5E-02	2.0E-02	2.3E-02	2.6E-02
W	3.3E-02	1.0E-01	2.6E-02	2.5E-02	3.2E-02	3.7E-02	4.2E-02
WSW	3.3E-02	9.6E-02	2.6E-02	2.5E-02	3.1E-02	3.7E-02	4.1E-02
SW	1.9E-02	5.6E-02	1.5E-02	1.5E-02	1.8E-02	2.1E-02	2.4E-02
SSW	1.7E-02	4.9E-02	1.3E-02	1.2E-02	1.6E-02	1.8E-02	2.1E-02
S	2.0E-02	6.0E-02	1.6E-02	1.5E-02	1.9E-02	2.2E-02	2.5E-02
SSE	3.9E-02	1.2E-01	3.0E-02	2.9E-02	3.7E-02	4.4E-02	4.9E-02
SE	6.3E-02	2.0E-01	4.8E-02	4.6E-02	6.0E-02	7.0E-02	8.0E-02
ESE	6.7E-02	2.2E-01	5.2E-02	4.9E-02	6.4E-02	7.5E-02	8.5E-02
E	7.8E-02	2.5E-01	6.0E-02	5.7E-02	7.4E-02	8.7E-02	9.9E-02
ENE	7.5E-02	2.4E-01	5.8E-02	5.6E-02	7.2E-02	8.5E-02	9.6E-02
NE	6.6E-02	2.0E-01	5.1E-02	4.9E-02	6.3E-02	7.4E-02	8.3E-02
NNE	4.2E-02	1.3E-01	3.3E-02	3.1E-02	4.0E-02	4.7E-02	5.2E-02

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2498	2580	2527	1391	1427	2564
N	2.6E-02	2.5E-02	2.5E-02	7.5E-02	7.2E-02	2.5E-02
NNW	1.7E-02	1.6E-02	1.7E-02	4.9E-02	4.6E-02	1.6E-02
NW	1.7E-02	1.6E-02	1.7E-02	4.9E-02	4.7E-02	1.6E-02
WNW	1.9E-02	1.8E-02	1.8E-02	5.5E-02	5.2E-02	1.8E-02
W	3.0E-02	2.8E-02	2.9E-02	8.8E-02	8.4E-02	2.9E-02
WSW	3.0E-02	2.8E-02	2.9E-02	8.3E-02	8.0E-02	2.9E-02
SW	1.8E-02	1.7E-02	1.7E-02	4.9E-02	4.6E-02	1.7E-02
SSW	1.5E-02	1.4E-02	1.5E-02	4.2E-02	4.0E-02	1.4E-02
S	1.8E-02	1.7E-02	1.8E-02	5.2E-02	4.9E-02	1.7E-02
SSE	3.5E-02	3.3E-02	3.4E-02	1.1E-01	1.0E-01	3.4E-02
SE	5.7E-02	5.3E-02	5.5E-02	1.7E-01	1.7E-01	5.4E-02
ESE	6.0E-02	5.7E-02	5.9E-02	1.9E-01	1.8E-01	5.7E-02
E	7.0E-02	6.6E-02	6.9E-02	2.1E-01	2.0E-01	6.7E-02
ENE	6.8E-02	6.4E-02	6.7E-02	2.0E-01	1.9E-01	6.5E-02
NE	6.0E-02	5.6E-02	5.8E-02	1.8E-01	1.7E-01	5.7E-02
NNE	3.8E-02	3.6E-02	3.7E-02	1.1E-01	1.0E-01	3.6E-02

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 2046	2283	2160	2196	3025	2157	2032
N	4.6E-07	3.8E-07	4.2E-07	4.1E-07	2.3E-07	4.2E-07	4.7E-07
NNW	3.0E-07	2.5E-07	2.7E-07	2.6E-07	1.5E-07	2.7E-07	3.0E-07
NW	3.0E-07	2.5E-07	2.7E-07	2.7E-07	1.5E-07	2.7E-07	3.0E-07
WNW	3.3E-07	2.7E-07	3.0E-07	2.9E-07	1.6E-07	3.0E-07	3.3E-07
W	5.4E-07	4.4E-07	4.9E-07	4.7E-07	2.6E-07	4.9E-07	5.4E-07
WSW	5.3E-07	4.4E-07	4.8E-07	4.7E-07	2.7E-07	4.8E-07	5.3E-07
SW	3.0E-07	2.5E-07	2.8E-07	2.7E-07	1.5E-07	2.8E-07	3.1E-07
SSW	2.6E-07	2.2E-07	2.4E-07	2.3E-07	1.3E-07	2.4E-07	2.6E-07
S	3.2E-07	2.6E-07	2.9E-07	2.8E-07	1.6E-07	2.9E-07	3.2E-07
SSE	6.3E-07	5.2E-07	5.8E-07	5.6E-07	3.1E-07	5.8E-07	6.4E-07
SE	1.0E-06	8.5E-07	9.4E-07	9.1E-07	5.0E-07	9.4E-07	1.0E-06
ESE	1.1E-06	9.0E-07	1.0E-06	9.7E-07	5.3E-07	1.0E-06	1.1E-06
E	1.3E-06	1.0E-06	1.2E-06	1.1E-06	6.2E-07	1.2E-06	1.3E-06
ENE	1.2E-06	1.0E-06	1.1E-06	1.1E-06	6.1E-07	1.1E-06	1.3E-06
NE	1.1E-06	8.9E-07	9.8E-07	9.5E-07	5.3E-07	9.8E-07	1.1E-06
NNE	6.7E-07	5.6E-07	6.1E-07	5.9E-07	3.4E-07	6.1E-07	6.8E-07

Direction	Distance (m) 2364	1286	2719	2797	2425	2215	2067
N	3.6E-07	1.1E-06	2.8E-07	2.6E-07	3.4E-07	4.0E-07	4.5E-07
NNW	2.3E-07	7.1E-07	1.8E-07	1.7E-07	2.2E-07	2.6E-07	2.9E-07
NW	2.3E-07	7.2E-07	1.8E-07	1.7E-07	2.2E-07	2.6E-07	3.0E-07
WNW	2.6E-07	8.1E-07	2.0E-07	1.9E-07	2.4E-07	2.9E-07	3.2E-07
W	4.1E-07	1.3E-06	3.2E-07	3.1E-07	4.0E-07	4.7E-07	5.3E-07
WSW	4.1E-07	1.2E-06	3.2E-07	3.1E-07	3.9E-07	4.6E-07	5.2E-07
SW	2.4E-07	7.1E-07	1.9E-07	1.8E-07	2.3E-07	2.7E-07	3.0E-07
SSW	2.0E-07	6.2E-07	1.6E-07	1.5E-07	1.9E-07	2.3E-07	2.6E-07
S	2.4E-07	7.6E-07	1.9E-07	1.8E-07	2.3E-07	2.7E-07	3.1E-07
SSE	4.9E-07	1.6E-06	3.8E-07	3.6E-07	4.7E-07	5.5E-07	6.2E-07
SE	7.9E-07	2.6E-06	6.1E-07	5.8E-07	7.6E-07	8.9E-07	1.0E-06
ESE	8.5E-07	2.8E-06	6.5E-07	6.2E-07	8.1E-07	9.5E-07	1.1E-06
E	9.8E-07	3.2E-06	7.6E-07	7.2E-07	9.4E-07	1.1E-06	1.3E-06
ENE	9.5E-07	3.0E-06	7.4E-07	7.0E-07	9.1E-07	1.1E-06	1.2E-06
NE	8.3E-07	2.6E-06	6.5E-07	6.1E-07	7.9E-07	9.4E-07	1.1E-06
NNE	5.2E-07	1.6E-06	4.1E-07	3.9E-07	5.0E-07	5.9E-07	6.6E-07

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	2498	2580	2527	1391	1427	2564
N	3.2E-07	3.1E-07	3.2E-07	9.5E-07	9.1E-07	3.1E-07
NNW	2.1E-07	2.0E-07	2.1E-07	6.1E-07	5.8E-07	2.0E-07
NW	2.1E-07	2.0E-07	2.1E-07	6.2E-07	5.9E-07	2.0E-07
WNW	2.3E-07	2.2E-07	2.3E-07	6.9E-07	6.6E-07	2.2E-07
W	3.8E-07	3.5E-07	3.7E-07	1.1E-06	1.1E-06	3.6E-07
WSW	3.7E-07	3.5E-07	3.7E-07	1.1E-06	1.0E-06	3.6E-07
SW	2.2E-07	2.0E-07	2.1E-07	6.1E-07	5.8E-07	2.1E-07
SSW	1.8E-07	1.7E-07	1.8E-07	5.3E-07	5.1E-07	1.8E-07
S	2.2E-07	2.1E-07	2.2E-07	6.5E-07	6.2E-07	2.1E-07
SSE	4.4E-07	4.2E-07	4.3E-07	1.4E-06	1.3E-06	4.2E-07
SE	7.2E-07	6.7E-07	7.0E-07	2.2E-06	2.1E-06	6.8E-07
ESE	7.6E-07	7.2E-07	7.5E-07	2.4E-06	2.2E-06	7.3E-07
E	8.9E-07	8.4E-07	8.7E-07	2.7E-06	2.6E-06	8.5E-07
ENE	8.6E-07	8.1E-07	8.5E-07	2.6E-06	2.5E-06	8.2E-07
NE	7.5E-07	7.1E-07	7.4E-07	2.2E-06	2.1E-06	7.2E-07
NNE	4.7E-07	4.5E-07	4.6E-07	1.4E-06	1.3E-06	4.5E-07