7591 R-009-106.8

TRANSMITTAL OF SOUTH PLUME REMOVAL ACTION SYSTEM EVALUATION REPORT FOR JULY 1, 1995, THROUGH DECEMBER 31, 1995

03/29/96

DOE-0710-96
DOE-FN EPAS
100
REPORT

Fernald Environmental

FERMCO

Restoration Management Corporation P. O. Box 538704 Cincinnati, Ohio 45253-8704 (513) 738-6200

7591

March 28, 1996

Fernald Environmental Management Project
Letter No. C:OP:96-0202

Mr. Jack R. Craig, Director
Department of Energy
Fernald Area Office
P.O. Box 538705
Cincinnati, Ohio 45253-8705

Dear Mr. Craig:

CONTRACT DE-AC24-92OR21972, TRANSMITTAL OF REVISED SOUTH PLUME REMOVAL ACTION SYSTEM EVALUATION REPORT

Reference: Letter from John Bradburne to Jack R. Craig dated February 29, 1996, Subject: Transmittal of South Plume Groundwater Recovery System Evaluation Re

Enclosed is t tion System Evaluation Report covering the period July 1, 199 95. This report has been revised to incorporate comments m enced draft document. This document meets the reporting requ sign, Monitoring, and Evaluation Program Plan (DMEPP) by s and operational activities and assessing the effectiveness o vellfield.

The report follow previous South Plume Removal Action System Evaluation Report

The subject docum the U.S. and Ohio Environmental Protection Agencies by March enience, a draft transmittal letter for the agencies is attached

If you have any quest ron White (648-5920) or Bill Hertel (648-3894).

7591

R-009-106

Sincerely,

Robert C. Hertel

John Bradburne for
President

JCB:RDW:rdb
Attachment

Fernald Environmental
FERMCO
Restoration Management Corporation

c w/o att.:

L. E. Parsons, DOE Contract Specialist
R. D. Bowser, FERMCO
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7591

Department of Energy

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MAR 29 1996

DOE-0710-96

Mr. James A. Saric, Remedial Project Director
U.S. Environmental Protection Agency
Region V - SRF-5J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

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 SOUTH PLUME REMOVAL ACTION SYSTEM EVALUATION REPORT FOR JULY 1, 1995, THROUGH DECEMBER 31, 1995

Enclosed for your review is the South Plume Removal Action System Evaluation Report covering the period July 1, 1995, through December 31, 1995. This document meets the reporting requirements defined in the Design, Monitoring, and Evaluation Program Plan (DMEPP) by summarizing the monitoring and operational activities and assessing the effectiveness of the South Plume recovery wellfield. The report follows the format established in the previous South Plume Removal Action System Evaluation Report (October 1995).

Please note that the analytical data (i.e., Appendix A) used to prepare this System Evaluation Report is on a computer disk enclosed with the report. The Appendix A data is compatible with any x-based program and Oracle. The computer disk is being supplied only to the U.S. Environmental Protection Agency (U.S. EPA), Ohio Environmental Protection Agency (OEPA), and their technical support subcontractors.

Recycled and Recyclable

If you have any questions, please contact John Kappa at (513) 648-3149, or Robert Janke at (513) 648-3124.

Sincerely,

Johnny Reising

FN:Kappa

Johnny W. Reising
Fernald Remedial Action
Project Manager

Enclosure: As Stated

cc w/enc:

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7591

SOUTH PLUME REMOVAL ACTION DESIGN MONITORING EVALUATION PROGRAM PLAN

SYSTEM EVALUATION REPORT FOR JULY 1, 1995 - DECEMBER 31, 1995

OPERABLE UNIT 5

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

APRIL 1996

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

DRAFT

000005

7591

SOUTH PLUME REMOVAL ACTION
DESIGN MONITORING EVALUATION PROGRAM PLAN

SYSTEM EVALUATION REPORT
FOR JULY 1, 1995 - DECEMBER 31, 1995

OPERABLE UNIT 5

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

APRIL 1996

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

DRAFT

000005-A

TABLE OF CONTENTS

	Page
List of Tables	i
List of Figures	ii
Executive Summary	ES-1
1.0 Operational Summary	1-1
2.0 Monitoring Well Summary	2-1
3.0 Analytical Data Summary	3-1
4.0 Capture Assessment	4-1
5.0 Summary and Conclusions	5-1

Appendix

A Summary of Analytical Detections (on disk; see pocket in front of binder)
B Concentration Plots for DMEPP Monitoring and Recovery Wells
C Mann-Kendall Trend Calculation

LIST OF TABLES

Table		Page
2-1	DMEPP Monitoring Wells for the Groundwater Elevation Program	2-2
2-2	DMEPP Monitoring Wells and Analytical Parameters for the Groundwater Sampling Program	2-3
3-1	Statistics for Total Uranium	3-6
3-2	Statistics for Arsenic	3-8
3-3	Statistics for Phosphorus	3-9
3-4	Statistics for Potassium	3-10
3-5	Statistics for Sodium	3-11
3-6	Summary of Significant Mann-Kendall Trend Test Results for Select Analytes (August 27, 1993 - December 31, 1995)	3-12

LIST OF FIGURES

Figure

1-1 Monitoring Wells that Provide Data for the DMEPP
1-2 Daily Total Uranium Concentration in South Plume Discharge Water, 1/95-12/95
1-3 Monthly Average Total Uranium Concentration in South Plume Discharge Water, 8/93-12/95
1-4 Total Uranium Removed vs Water Pumped, 8/93-12/95
4-1 Total Uranium Plume, Type 2 Monitoring Wells, October 1995
4-2 Total Uranium Plume, Type 3 Monitoring Wells, October 1995
4-3 Extent of Capture Zone Fluctuations at Type 2 Wells, July 1995 - December 1995
4-4 Groundwater Elevation, Type 2 Wells, December 1995
4-5 Modeled 1400 gpm Pumping Scenario, Type 2 Well Interval
4-6 Groundwater Elevations, Type 3 Wells, December 1995
4-7 Modeled 1400 gpm Pumping Scenario, Type 3 Well Interval
5-1 Proposed Locations of South Plume Optimization Wells

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Executive Summary

EXECUTIVE SUMMARY

This System Evaluation Report summarizes the performance of the South Plume recovery wellfield during the period July 1, 1995 through December 31, 1995. This document fulfills the reporting requirements defined in the South Plume Groundwater Recovery System Design, Monitoring, and Evaluation Program Plan (DMEPP) of April 1993. The reporting schedule was amended by correspondence between the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) and the Ohio EPA (OEPA); reports are due in April and October of each year. As in the last report, a disk containing the analytical data for this reporting period is included in the front binder pocket.

The South Plume wellfield is currently operated with Recovery Wells 3924, 3925, 3926, and 3927 pumping at a combined rate of 1400 gpm. During the reporting period, this pumping configuration was maintained 86 percent of the time. A total of 342 million gallons of water was pumped and 53.4 pounds of uranium were removed from the aquifer. Individual pump outages due to scheduled maintenance, power interruptions and the South Field injection test affected the system approximately 14 percent of the total operating time. The entire system was shut down only six percent of the time due to scheduled maintenance.

The capture zone of the recovery wellfield is consistent with that of the last reporting period. The main body of the 20 μg/L uranium plume continues to be captured while the southernmost lobe of the plume has decreased in size and still extends outside of the capture zone, based on October 1995 data. The extent of the southern lobe of the plume is defined by total uranium concentrations in Monitoring Well 2552; those concentrations continued to fluctuate around 20 μg/L in 1995. Results of the Mann-Kendall test for trend on the data set for Well 2552 continue to identify the data as exhibiting a significant decrease in trend.

A colloidal borescope was used at Well 2552 to measure flow directions on December 13, 1995. At a depth of 3 feet below the water level in the well, the flow direction was to the northeast while at a depth of 8 feet below the water level, the flow direction was to the east-southeast. These results suggest that Well 2552 is located in proximity to the capture flow divide. More detailed observations of flow direction and velocity are scheduled at this well and in the vicinity of the recovery wellfield to further refine the extent of the capture zone.

The northeastern lobe of the total uranium plume is defined at the Type 2 and Type 3 well-depth intervals with plume indications at the Type 3 depth interval derived from data obtained from Well 3069. Although concentrations of total uranium in Well 3069 above 20 μg/L are documented in the Operable Unit 5 Remedial Investigation Report (see Plate E-80), the results from this well are discussed for the first time in this report because total uranium concentrations continue to increase. Because Well 3069 is the only Type 3 well in this area to show total uranium concentrations above background, the shape of the plume at that depth is assumed to be similar to the plume shape shown on Plate E-80. Therefore, Wells 3069 and 3398 will be added to the DMEPP system and analytical information will be included in subsequent DMEPP reports.

The hydraulic, chemical, and radiological data collected during the reporting period are, in general, consistent with past reports. Evaluation of the data indicates that the South Plume recovery wells are exerting a negligible influence on the Paddys Run Road Site (PRRS) plume. Concentrations of arsenic in several monitoring wells located south of the recovery wellfield continue to fluctuate. Data collected south of the recovery wellfield and north of the PRRS show one anomaly; Monitoring Well 3898 exhibited increased sodium concentrations, a PRRS contaminant of concern. The Mann-Kendall test on the data shows a significant upward trend. Because Monitoring Well 3898 is located southeast of and close to the recovery wellfield it will continue to be monitored and the results discussed in the next report.

As presented to EPA and OEPA during the summer of 1995, modeling has been performed to evaluate possible improvements to the existing system that would accelerate uranium mass removal from off-property portions of the plume. The results of the optimization study indicate that the installation of three extraction wells south of Willey Road, in a line parallel to and offset downgradient from the center of the plume, would increase uranium removal efficiency. Installation of a fourth well near the northeastern lobe of the plume would achieve optimal capture of that lobe. These proposed wells would be operated concurrently with Recovery Wells 3924 and 3925. This information was presented in detail at meetings among the DOE, EPA, OEPA and the Fernald Environmental Restoration Management Corporation (FERMCO) on July 25 and September 5, 1995; further study and discussion on how these plans can be integrated into the final remedial alternative is needed before the study's recommendations are implemented. It is currently envisioned that optimization of the South Plume groundwater recovery system would occur according to the remedial design/remedial action schedules for Operable Unit 5.

1.0 OPERATIONAL SUMMARY

This section summarizes the operation of the recovery wellfield from July 1 through December 31, 1995. Under current operating conditions, Wells 3924 and 3925 are each pumped at a rate of 300 gpm and Wells 3926 and 3927 are each pumped at 400 gpm for a total system flow of 1400 gpm. This is the same pumping scenario used during the previous DMEPP reporting period (January 1 through June 30, 1995) and summarized in the October 1995 DMEPP report. Figure 1-1 shows the locations of all the DMEPP wells.

Over the entire reporting period the individual recovery wells operated from 89.0 to 94.1 percent of the time. The recovery system operated at the four-well, 1400-gpm configuration 86 percent of the time (159 out of 184 days). The entire system was shut down only 6 percent of the time due to scheduled maintenance.

The recovery system was shut down from September 9 to September 18 for scheduled maintenance at Wells 3924 and 3926 to replace well screens and pumps. New 40-foot stainless steel screens were telescoped inside the existing damaged well screens and the existing pumps in these two wells were replaced with new optimally sized pumps for the 300 to 400 gpm pumping rates used in the South Plume system. Routine maintenance was also performed at the valve house during this scheduled downtime. The recovery system was also shut down on October 25 for electrical system maintenance and pressure switch replacement at the well heads.

The system pumping configuration was temporarily changed for the South Field injection test from October 11 to October 17: Recovery Wells 3924 and 3925 were shut off while pumping rates at Recovery Wells 3926 and 3927 were increased from 400 gpm to 500 gpm each to provide water for the injection test.

On the following pages are operational summary sheets prepared for Recovery Wells 3924, 3925, 3926, 3927 and 3928. Monitoring data for these wells were collected at the individual well location. Data representative of the entire recovery wellfield were collected at the storm water retention basin (SWRB) valve house; a wellfield operational summary sheet follows those for the individual recovery wells. Due to the different flow measurement points, minor differences in the cumulative wellhead totals and the valve house measurements for total flow are common. Data from the valve house were

used to plot daily total uranium concentrations in the South Plume discharge water for the reporting period (Figure 1-2), monthly average total uranium concentrations since the start-up of the recovery wellfield in 1993 (Figure 1-3), and the cumulative pounds of uranium removed versus the cumulative gallons pumped by the recovery wells (Figure 1-4).

A total of 342 million gallons of water was pumped during this reporting period and accounted for 53.4 pounds of uranium being removed from the aquifer; the average daily total uranium concentration in the South Plume discharge water was 17.3 μg/L. While there were a number of short-term exceedances of this average, as shown in Figure 1-2, only one (from October 19 to October 27) was significant and occurred immediately following the South Field injection test when Recovery Wells 3924 and 3925 were turned on after being off for seven days.

WELL 3924
OPERATIONAL SUMMARY SHEET

Reference Elevation (AMSL) - 531.9 (top of casing)
Northing Coordinate ('27) - 474,190.37
Easting Coordinate ('27) - 1,379,783.13

Hours in reporting period - 4416 Hours pumped - 4000 Target pumping rate - 300 gpm
Hours not pumped - 416 Operational percent - 90.6

Monthly Measurements at Wellfield

Month	Average Pumping Rate (gpm)	Million Gallons Pumped	Uranium Concentration (μg/L)	Well Efficiency (lbs/M gal)
7/95	299	13.3	49.0	.41
8/95	294	13.1	51.0	.43
9/95	206[a]	8.9	45.0	.37
10/95	219[b,c]	9.8	44.0	.37
11/95	303	13.1	[d]	[d]
12/95	304	13.6	49.0	.41
		Total 71.8	Average 47.6	Average .40

[a]System shut down from 9/9 to 9/18 for installation of new screen and pump in Well 3924, as discussed in DOE's letter to EPA and OEPA dated November 3, 1995, "Completion of Well Screen Repairs in the South Plume Recovery Wells 3924 and 3926."
[b]Well shut down from 10/11 to 10/17 for South Field injection test.
[c]Well shut down 10/22, 10/23 and 10/25 for electrical system maintenance and pressure switch replacement.
[d]No sample collected due to well maintenance during scheduled sampling period.

WELL 3925
OPERATIONAL SUMMARY SHEET

Reference Elevation (AMSL) - 540.3 (top of casing)
Northing Coordinate ('27) - 474,290.32
Easting Coordinate ('27) - 1,380,034.28

Hours in reporting period - 4416
Hours not pumped - 451
Hours pumped - 3965
Operational percent - 89.8
Target pumping rate - 300 gpm

Monthly Measurements at Wellfield

Month	Average Pumping Rate (gpm)	Million Gallons Pumped	Uranium Concentration (μg/L)	Well Efficiency (lbs/M gal)
7/95	298	13.3	29.0	.24
8/95	302	13.5	31.0	.26
9/95	198[a]	8.6	28.0	.23
10/95	243[b,c]	10.8	29.0	.24
11/95	305	13.2	30.0	.25
12/95	304	13.6	30.0	.25
		Total 73.0	Average 29.5	Average .25

[a]System shut down from 9/9 to 9/18 for installation of new screen and pump in Well 3924, as discussed in DOE's letter to EPA and OEPA dated November 3, 1995, "Completion of Well Screen Repairs in the South Plume Recovery Wells 3924 and 3926."
[b]Well shut down from 10/11 to 10/17 for South Field injection test.
[c]Well shut down 10/18, 10/19, 10/21, 10/22, and 10/25 for electrical system maintenance and pressure switch replacement.

WELL 3926
OPERATIONAL SUMMARY SHEET

Reference Elevation (AMSL) - 585.0 (top of casing)
Northing Coordinate ('27) - 474,399.22
Easting Coordinate ('27) - 1,380,306.40

Hours in reporting period - 4416
Hours not pumped - 483
Hours pumped - 3933
Operational percent - 89.0
Target pumping rate - 400 gpm

Monthly Measurements at Wellfield

Month	Average Pumping Rate (gpm)	Million Gallons Pumped	Uranium Concentration (μg/L)	Well Efficiency (lbs/M gal)
7/95	399	17.8	6.2	.05
8/95	395	17.6	6.9	.06
9/95	190[a]	8.1	7.5	.06
10/95	357[b,c]	15.9	6.5	.05
11/95	403	17.4	6.6	.05
12/95	405	18.1	7.0	.06
		Total 94.9	Average 6.8	Average .06

[a]Well shut down from 9/9 to 9/25 for installation of new screen and pump, as discussed in DOE's letter to EPA and OEPA dated November 3, 1995, "Completion of Well Screen Repairs in the South Plume Recovery Wells 3924 and 3926."
[b]Well operated at approximately 500 gpm from 10/11 to 10/17 for South Field injection test.
[c]Well shut down 10/19 to 10/25 for electrical system maintenance and pressure switch replacement.

WELL 3927
OPERATIONAL SUMMARY SHEET

Reference Elevation (AMSL) - 589.0 (top of casing)
Northing Coordinate ('27) - 474,512.49
Easting Coordinate ('27) - 1,380,596.15

Hours in reporting period - 4416 Hours pumped - 4154 Target pumping rate - 400 gpm
Hours not pumped - 262 Operational percent - 94.1

Monthly Measurements at Wellfield

Month	Average Pumping Rate (gpm)	Million Gallons Pumped	Uranium Concentration (μg/L)	Well Efficiency (lbs/M gal)
7/95	401	17.9	1.3	.01
8/95	370[a]	16.5	1.2	.01
9/95	275[b]	11.9	1.2	.01
10/95	449[c,d]	20.0	1.2	.01
11/95	413	17.8	1.1	.01
12/95	404	18.0	1.2	.01
		Total 102.1	Average 1.2	Average .01

[a]Well shut down 8/2 to 8/3 due to power surge during thunderstorm.
[b]System shut down from 9/9 to 9/18 for installation of new screen and pump in Well 3924, as discussed in DOE's letter to EPA and OEPA dated November 3, 1995, "Completion of Well Screen Repairs in the South Plume Recovery Wells 3924 and 3926."
[c]Well operated at approximately 500 gpm from 10/11 to 10/17 for South Field injection test.
[d]Well shut down 10/22 and 10/25 for electrical system maintenance and pressure switch replacement.

WELL 3928
OPERATIONAL SUMMARY SHEET

Reference Elevation (AMSL) - 588.3 (top of casing)
Northing Coordinate ('27) - 474,608.92
Easting Coordinate ('27) - 1,380,841.74

Hours in reporting period - 4416 Hours pumped - 0 Target pumping rate - 0
Hours not pumped - 4416 Operational percent - 0

Monthly Measurements at Wellfield[a]

Month	Average Pumping Rate[a] (gpm)	Million Gallons Pumped[a]	Uranium Concentration[a] (μg/L)	Well Efficiency[a] (lbs/M gal)
7/95	0	0	—	—
8/95	0	0	—	—
9/95	0	0	—	—
10/95	0	0	—	—
11/95	0	0	—	—
12/95	0	0	—	—
		Total 0	Average —	Average —

[a]This recovery well is shut down because it is currently not needed to meet system objectives due to observed low concentrations of uranium in this well's discharge water when the system was in operation. Recovery Well 3928 will be on standby in the event of future need.

WELLFIELD OPERATIONAL SUMMARY SHEET

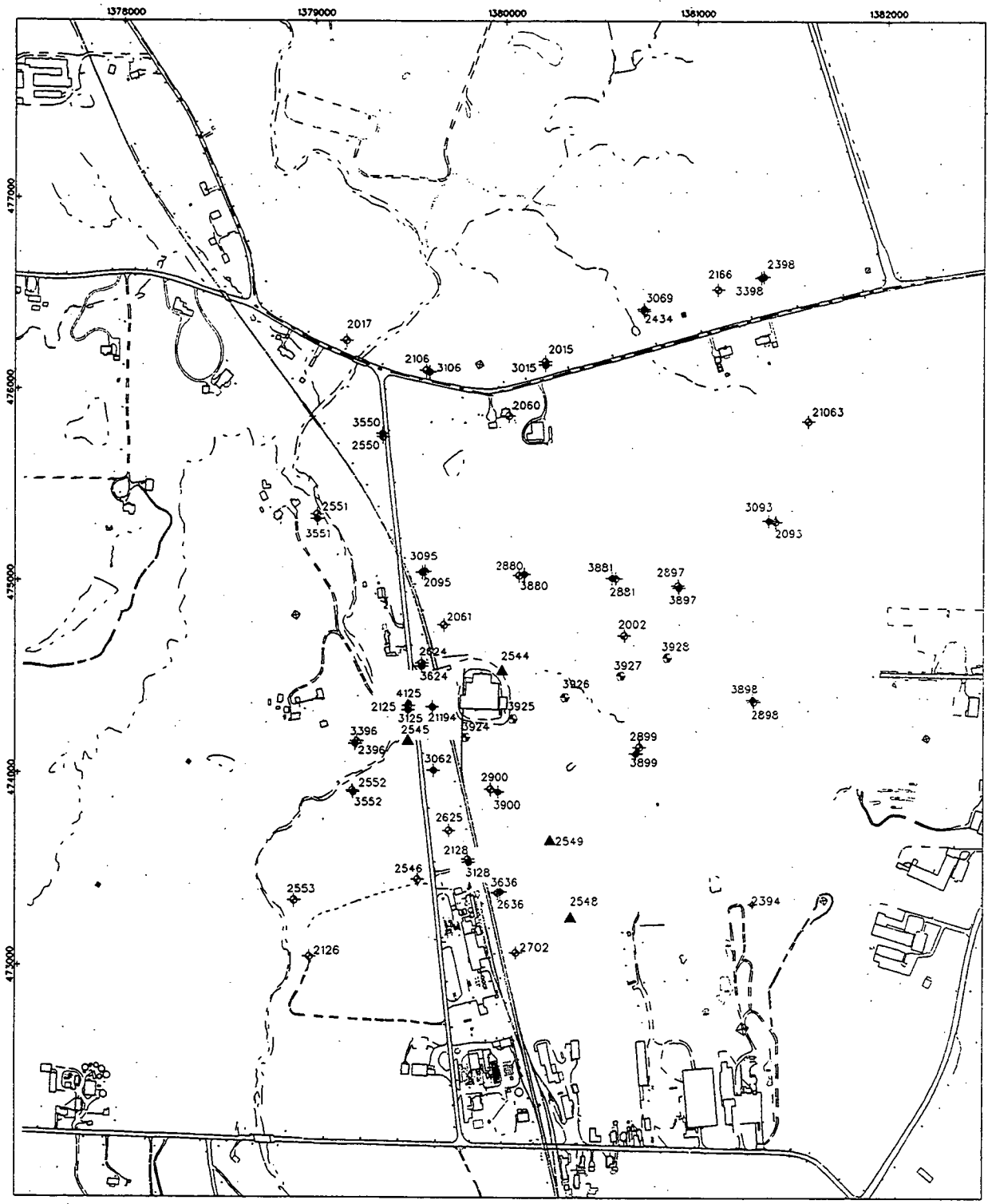
Total gallons pumped this reporting period (M gal) - 342
Total uranium recovered this reporting period (lbs) - 53.4
Average system efficiency this reporting period - .16
Gallons pumped from August 1993 to December 1995 (billion gal) - 1.6
Uranium recovered from August 1993 to December 1995 (lbs) - 222.8
System efficiency from August 1993 to December 1995 (lbs/M gal) - .14

Monthly Measurements at Storm Water Retention Basin Valve House

	Average Well Pumping Rates (gpm)					Total System Pumping Rate (gpm)	Total System Average Uranium Concentration (μg/L)
Month	3924	3925	3926	3927	3928		
7/95	299	298	399	401	0	1397	16.8
8/95	294	302	395	370	0	1361	16.9
9/95	206	198	190	275	0	869[a]	17.6
10/95	219	243	357	449	0	1268[b,c]	16.6
11/95	303	305	403	413	0	1424	18.6
12/95	304	304	405	404	0	1417	17.4
							Average 17.3

[a]System shut down from 9/9 to 9/18 for installation of new screen and pump in Well 3924, and for valve house maintenance, as discussed in DOE's letter to EPA and OEPA dated November 3, 1995, "Completion of Well Screen Repairs in the South Plume Recovery Wells 3924 and 3926."
[b]Wells 3924 and 3925 were shut down from 10/11 to 10/17 during the South Field injection test while the pumping rates for Wells 3926 and 3927 were increased to approximately 500 gpm each. System total pumping rate was approximately 1000 gpm during this time.
[c]System was shut down on 10/25 for pressure switch replacement at each well.

/USR/ERMA1/CRU5/DGN/MAP/HOR/DPTH/CSDMPREF.DGN FER OU5 3/20/96 STATE PLANAR COORDINATE SYSTEM 1927



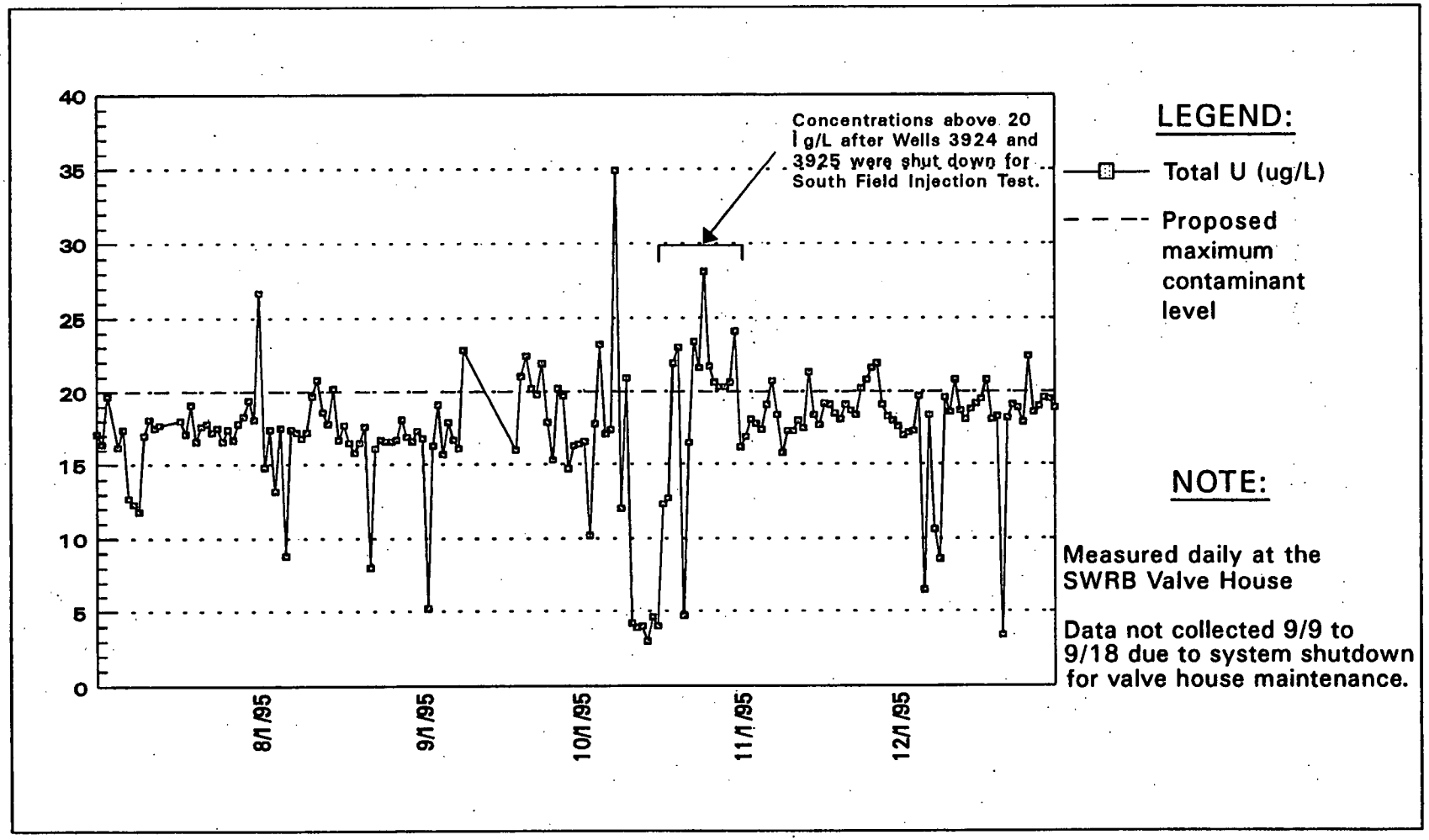
LEGEND:

- FEMP BOUNDARY
- 3900 — TYPE 3 MONITORING WELL
- 2900 — TYPE 2 MONITORING WELL
- 2545 — TYPE 2 PADDYS RUN ROAD SITE PIEZOMETER
- 3926 — RECOVERY WELL

SCALE

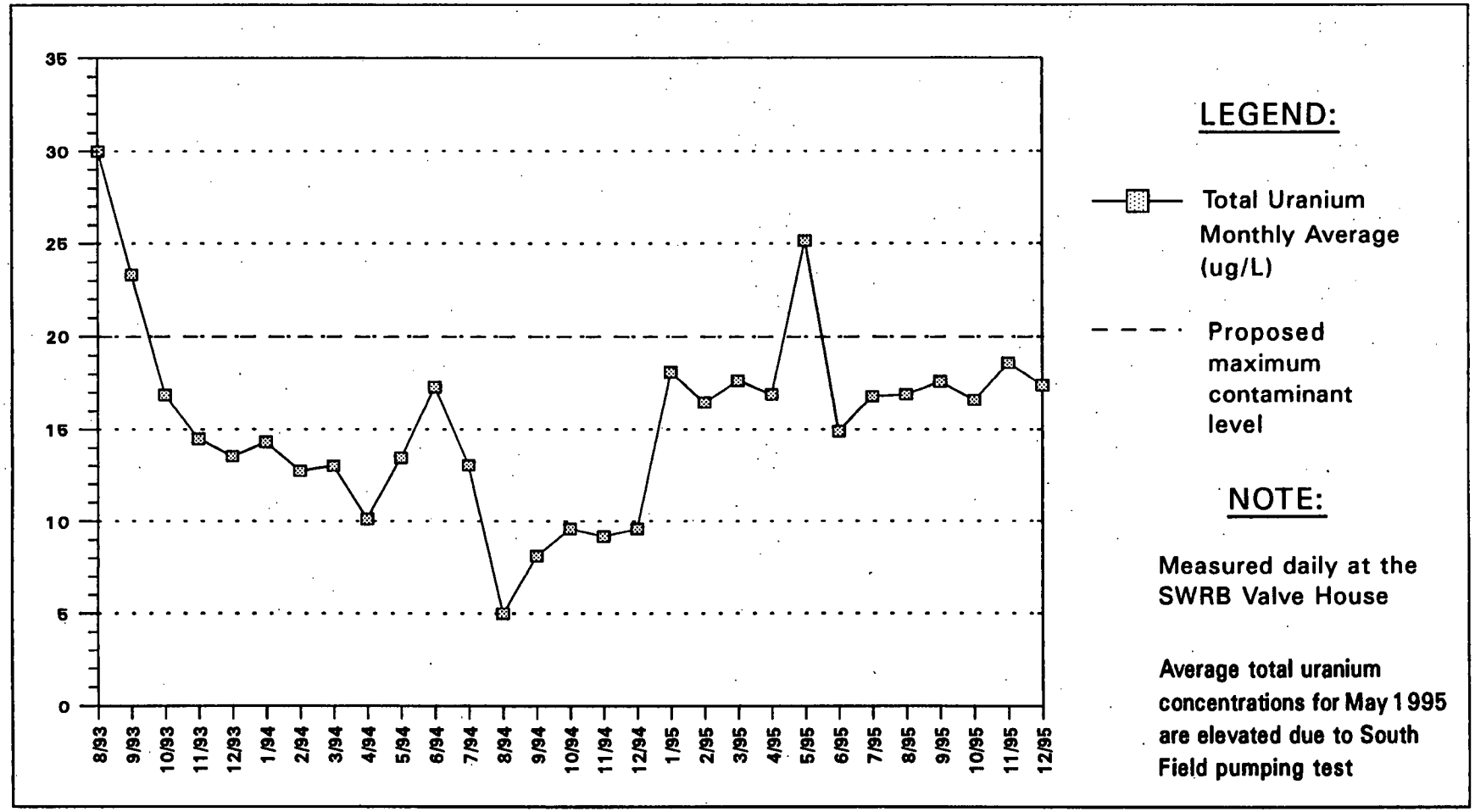
800 400 0 800 FEET

FIGURE 1-1. MONITORING WELLS THAT PROVIDE DATA FOR THE DMEPP



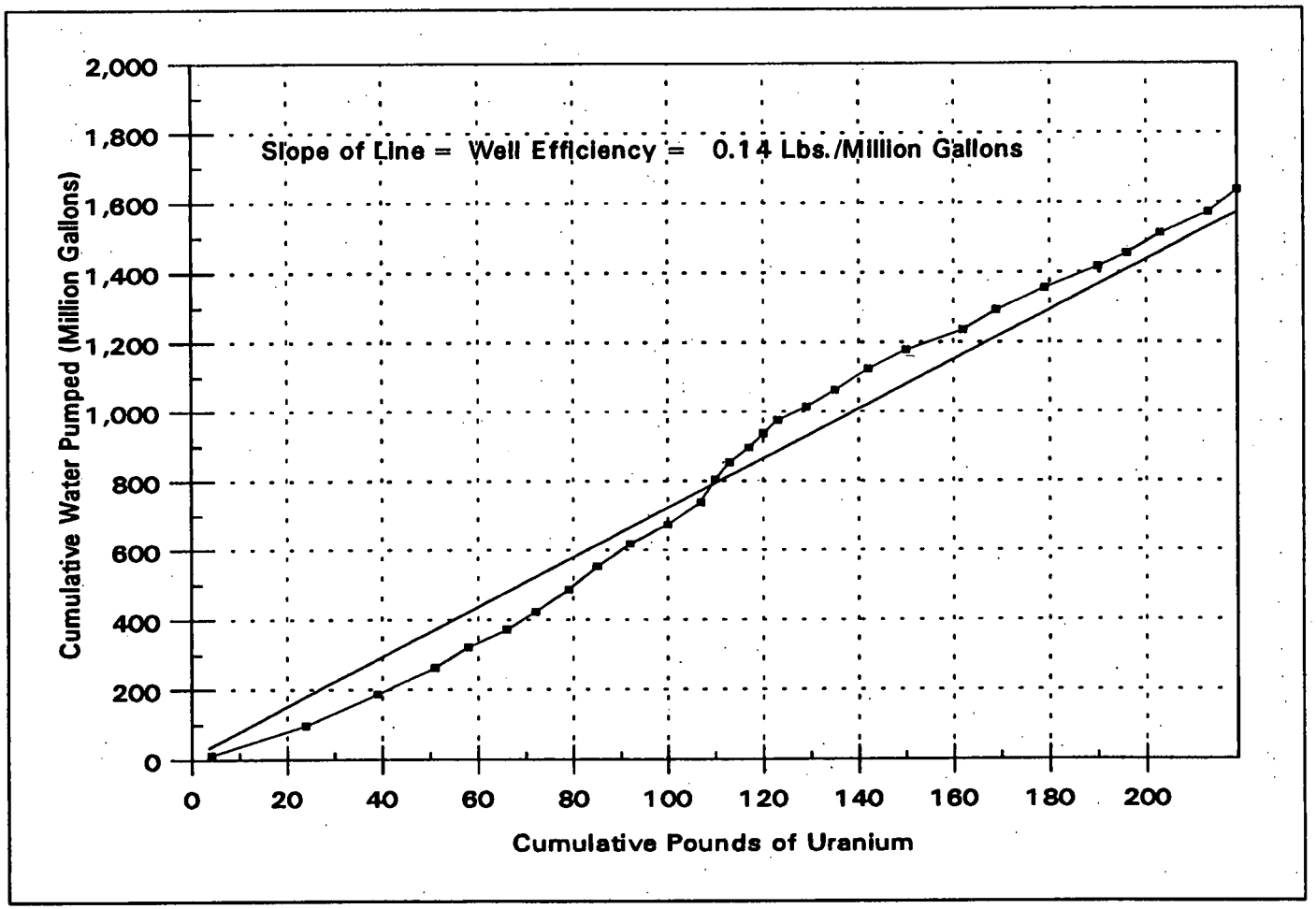
G:\DMEPP\APRIL96\SEC1\FIGURES\FIG1_2.CH3\

Figure 1-2. Daily Total Uranium Concentration in South Plume Discharge Water, 7/95 - 12/95



G:\DMEPP\APRIL96\SEC1\FIGURES\FIG1_3.CH3\

Figure 1-3. Monthly Average Total Uranium Concentration in South Plume Discharge Water, 8/93 - 12/95



G:\DMEPP\APRIL96\SEC1\FIGURES\FIG1_4.CH3\

Figure 1-4. Total Uranium Removed vs Water Pumped, 8/93 - 12/95

2.0 MONITORING WELL SUMMARY

Currently, water elevation data is collected from 41 DMEPP monitoring wells (Table 2-1); for the period covered by this report these measurements were collected monthly. Due to the stability of the recovery wellfield pumping rates, these measurement will be collected quarterly during subsequent reporting periods. The change from monthly to quarterly data collection was intended for the July to December 1995 period, but due to the temporary change in pumping configuration for the South Field injection test, the change was postponed for six months. However, if significant operational changes (e.g., pumping rates) occur within the recovery system, data will be collected more frequently as warranted. These elevation data are used to assess the effective capture of uranium-contaminated groundwater by the recovery wellfield, as reported in Section 4.0.

Currently, groundwater quality data is collected from 56 monitoring wells (Table 2-2). Figure 1-1 shows the location of all wells that provide analytical results for the DMEPP and Table 2-2 identifies the constituents analyzed for. This information is used to prepare statistical summary tables (Section 3.0) and to provide contour maps of the uranium plume at the Type 2- and Type 3-well-depth intervals (Section 4.0). Groundwater quality sampling of the DMEPP wells occurs on a quarterly basis. Additional sampling is performed based on data needs determined by analytical review of the data as results become available.

TABLE 2-1

DMEPP MONITORING WELLS FOR THE GROUNDWATER ELEVATION PROGRAM

35 Original Wells	6 Supplemental Wells/Date Added
2002	2126 / 2/94
2061	2545 / 2/94
2093	2546 / 2/94
2095	2553 / 2/94
2125	2702 / 2/94
2128	3927 / 12/94
2394	
2396	
2543	
2544	
2548	
2552	
2624	
2625	
2636	
2880	
2881	
2897	
2898	
2899	
2900	
3062	
3093	
3095	
3125	
3128	
3396	
3624	
3636	
3880	
3881	
3897	
3898	
3899	
3900	

TABLE 2-2

DMEPP MONITORING WELLS AND ANALYTICAL PARAMETERS FOR THE GROUNDWATER SAMPLING PROGRAM

34 Original Wells	Analytical Parameters[a]	22 Supplemental Wells/Date Added[b]	Analytical Parameters[a]
2002	A,B	2015 / 2/94 (5/95)	A,B
2061	A,B	2017 / 2/94 (5/95)	A,B
2093	A,B	2060 / 2/95 (2/95)	A,B
2095	A,B	2106 / 2/94[c]	A,B
2125	A,B	21063 / 5/94 (5/95)	A,B
2128	A,B,C,D,E	2166 / 5/95 (5/95)	A,B
2544	A,B	2396 / 5/95 (5/95)	A,B
2545	A,B	2398 / 1/94[c]	A,B
2548	A,B,C,D,E	2434 / 1/94[c]	A,B
2624	A,B	2550 / 2/94 (5/95)	A,B
2625	A,B,C,D,E	2551 / 2/94 (5/95)	A,B
2636	A,B,C,D,E	2552 / 2/94 (5/95)	A,B
2880	A,B	2553 / 2/94 (5/95)	A,B
2881	A,B	3015 / 2/94 (5/95)	A,B
2897	A,B	3062 / (6/95)	A,B
2898	A,B,C,D	3106 / 2/94[c]	A,B
2899	A,B,C,D	3396 / (6/95)	A,B
2900	A,B,C,D,E	3550 / 2/94 (5/95)	A,B
3093	A,B	3551 / 2/94 (5/95)	A,B
3095	A,B	3552 / 2/94 (5/95)	A,B
3125	A,B	21194 / 2/95 (2/95)	A,B
3128	A,B,C,D	4125 / (6/95)	A,B
3624	A,B		
3636	A,B,C,D		
3880	A,B		
3881	A,B		
3897	A,B		
3898	A,B,C,D		
3899	A,B,C,D		
3900	A,B,C,D		
3924	A,B,E		
3925	A,B,E		
3926	A,B		
3927	A,B		

TABLE 2-2
(Continued)

[a]A Dissolved oxygen, pH, specific conductance, temperature (analyzed in the field)
B Total uranium (analyzed at the on-site laboratory)
C Arsenic, phosphorus (total), potassium, sodium (Paddys Run Road Site [PRRS] inorganics)
D Benzene, cumene (isopropyl benzene), ethyl benzene, toluene, xylene (PRRS organics)
E Arsenic (collected on a weekly basis; see results in Appendix A for exact sample collection dates)
[b]Date added is when analytical results were first used in support of findings for the DMEPP. The date in parentheses is when the monitoring well was formally added to the DMEPP sampling program.
[c]Monitoring well is sampled under a separate program but provides the necessary analytical results on a sampling schedule compatible with the DMEPP.

3.0 ANALYTICAL DATA SUMMARY

Statistical summaries (minimum, maximum, average, standard deviation, and trend) from unfiltered samples for data from individual wells are presented in Tables 3-1 through 3-5 for total uranium, arsenic, phosphorus, potassium and sodium, respectively. Appendix A consists of validation qualifiers and a disk containing the analytical data used to prepare this report. Appendix B contains concentration plots for each monitoring well over time for total uranium data from unfiltered samples. The calculation for the Mann-Kendall trend test is in Appendix C.

While no outliers were found in the data for this reporting period, two wells were determined to have outliers in their sampling data from the August 27, 1993 through June 30, 1995 time frame. Phosphorus data obtained from Well 3128 (13.0 mg/L on September 8, 1993) and Well 3900 (1.26 mg/L on February 4, 1994) show concentrations which are considered to be outliers based on much lower concentrations typically reported from these wells. These two outliers are in addition to the five wells with outliers discussed in the October 1995 DMEPP Report.

For completeness, the outliers were included in the calculation of minimum, maximum, average, standard deviation and trend in Tables 3-1 through 3-5. While the outliers may tend to skew the calculated averages and standard deviations, they will have negligible effect on the calculated trends.

As in the previous System Evaluation Report (October 1995) the Mann-Kendall trend test was performed on total uranium, arsenic, phosphorus, potassium, and sodium sampling results from August 27, 1993 through December 31, 1995. Tables 3-1 through 3-5 include summaries of the Mann-Kendall test results by analyte and location, the number of distinct sampling events used in the calculation, and the probability that the trend calculated is due to chance. In preparing these tables only data with validation qualifiers "-," "J," "NV," "U," and "UJ" were used (see Appendix A). All "U" and "UJ" qualified data were used at one-half the reported value. Details of the Mann-Kendall trend calculation are given in Appendix C.

The Mann-Kendall probability value gives the probability that the apparent trend is due to chance and not a real trend. A probability value of .05 indicates that there is only a five percent chance that the observed trend is simply an artifact of random fluctuation (random error) and not a trend at all. In other words, there is a five percent chance of declaring that there is a trend (upward or downward)

when in actuality there is no trend. In Tables 3-1 through 3-5 a probability value less than or equal to five percent (.05) was interpreted as a significant trend and a probability value less than or equal to 10 percent (.10) but greater than five (.05) percent was interpreted as a marginally significant trend.

No statistical summaries or Mann-Kendall trend tests were performed on the volatile organic constituents (benzene, cumene, ethylbenzene, toluene and xylene) sampled for under the DMEPP because no detections were noted for the reporting period.

Toluene has been sporadically detected from August 27, 1993 through June 30, 1995 as follows:

Well 2128 - 1.3 μg/L on October 26, 1993
Well 2398 - 0.4 μg/L on September 7, 1994
Well 2898 - 2.9 μg/L on October 29, 1993
Well 2900 - 0.7 μg/L on June 19, 1995
Well 2900 - 2.0 μg/L and 4.0 μg/L on February 2, 1994
Well 2900 - 2.4 μg/L on October 26, 1993
Well 3900 - 0.8 μg/L on June 21, 1995.

Also detected in Well 2900 were benzene - 1 μg/L on February 2, 1994 - and xylene - 3.0 μg/L on February 2, 1994 and 0.3 μg/L on June 19, 1995. Xylene was detected once in Well 3900 - 0.3 μg/L on June 21, 1995.

In order to assist in the assessment of data collected since system start-up, Mann-Kendall test results with significant upward or downward trends identified from August 27, 1993 through December 31, 1995 have been compiled in Table 3-6 for total uranium, arsenic, phosphorus, potassium and sodium, along with specific explanations for each trend.

An examination of the trend values for total uranium data (Table 3-6) shows that 16 wells have significant downward trends while 11 wells have significant upward trends; 14 of the 16 wells exhibiting significant downward trends are located within the extent of the total uranium plume. The two wells outside the plume with significant downward trends, Well 2553 and Well 3881, had total uranium concentration values for this reporting period of 1.1 μg/L and 0.1 μg/L, respectively. Both wells have consistently had total uranium concentrations within the background range (0.1 to 3.1 μg/L). Of particular note is Well 2552, identified as showing a significant downward trend. This

well was used to define the extent of the southern lobe of the 20 μg/L isopleth of the total uranium plume at the Type 2 well-depth interval.

Of 11 wells exhibiting significant upward trends for total uranium, two (3925 and 3926) are recovery wells and two (3095 and 3125) are within the capture zone. Well 2398 shows an increasing trend with an average concentration of 7.4 μg/L for the August 27, 1993 to June 30, 1995 period and an average concentration of 11.4 μg/L for the July 1, 1995 to December 31, 1995 reporting period. A review of the plot of total uranium concentration versus time for this well (see Appendix B) shows that the concentration seems to have peaked at 12 μg/L in July, 1995. This well is near the northeastern lobe of the total uranium plume (see Figure 4-1) and is within the capture zone as shown in Figure 4-5. The well is also upgradient of one of the four planned South Plume optimization wells which were presented to the EPA and OEPA at meetings on July 25 and September 5, 1995 (Figure 5-1 shows the proposed locations of the four wells). Total uranium concentrations in Well 2398 will continue to be monitored and results presented in subsequent system evaluation reports.

Well 2128 is the only well outside the capture zone to show a significant upward trend for total uranium. Because Well 2625, which is upgradient of Well 2128 and downgradient of the recovery wells, exhibits no significant trend, it is believed that the upward trend in uranium concentrations in Well 2128 is not due to an excursion past the recovery wellfield. As shown in Plate E-77 of the Operable Unit 5 RI Report, Well 2128 is on the eastern edge of the portion of the uranium plume embedded within the PRRS plume. The increase in uranium concentrations in Well 2128 is explained by the southeastern migration of this plume. Although the trend has been upward, uranium concentrations in this well are still below 20 μg/L. Furthermore, the concentration of 11.0 μg/L for this reporting period is less than the maximum value of 12.0 μg/L for the period August 27, 1993 to June 30, 1995. This well will continue to be monitored and results presented in subsequent system evaluation reports.

Wells 2880 and 3624 show significant upward trends even though the total uranium concentrations are below 1 μg/L. The upward trend, if real, is attributed to the arrival of the leading edge of the total uranium plume as it moves toward the recovery system. Although Well 3898 exhibits a significant upward trend, the total uranium concentrations are below 1 μg/L for all samples except the outlier of 180 μg/L obtained on July 19, 1994 and discussed in the October 1995 DMEPP report.

Wells 2899 and 2900 exhibit significant upward trends with average total uranium concentrations of 1.7 and 3.1 μg/L, respectively, for this reporting period; these concentrations are within the background range. Both of these wells are south of the recovery system and within the interpreted capture zone, as shown in Figure 4-3. These wells will continue to be monitored as part of the DMEPP system and any significant changes noted in future reports.

While Well 21063 shows no significant trend in total uranium concentrations, concentrations in this well decreased from 15 μg/L on June 27, 1995 to 2.9 and 3.0 μg/L in the two samples taken during this reporting period. This is significant in that this well is used to indicate the leading edge of the northeastern lobe of the plume.

An examination of the arsenic trend values in Table 3-6 shows a significant upward trend only in Well 2636 (which is within the PRRS plume) that is not attributed to the operation of the recovery wellfield. Wells upgradient of Well 2636 with arsenic detections (2128 and 2625) that are closer to the recovery system wells exhibited a downward trend in arsenic concentrations. Well 2900, which is used as an early warning for potential capture of PRRS constituents, exhibited no significant trend in arsenic concentrations.

Mann-Kendall trend results for the remaining PRRS constituents (phosphorus, potassium and sodium) are also presented in Table 3-6. No significant increasing trends were noted for phosphorus or potassium. However, Well 3898 exhibited a significant upward trend for sodium with a value of 8.89 mg/L for this reporting period, which is less than the maximum of 9.72 mg/L reported for the period August 27, 1993 to June 30, 1995. Sodium concentrations in this well will continue to be monitored and results presented in subsequent system evaluation reports.

As discussed in the October 1995 System Evaluation Report (Section 3.0, pg. 22), Well 2900 showed a 32 percent increase in sodium during the period from January 1, 1995 to June 30, 1995. Although the Mann-Kendall test results show no trend, this well continues to exhibit an elevated level of sodium, as shown in Table 3-5. After a sodium concentration of 30.9 mg/L on January 31, 1995, the concentrations decreased to 27.3 mg/L in the sample taken on May 2, 1995, then increased to 39.8 mg/L in the sample taken on June 19, 1995. The sample taken for this reporting period on October 4, 1995 showed a concentration of 39.5 mg/L, down slightly from the June value but still above the 27.83 mg/L average concentration for the well. The background value for sodium from

unfiltered samples ranges from 3.08 to 50.4 mg/L for the Great Miami Aquifer (see Operable Unit 5 RI Report, Table 4-8). As discussed in Section 1.0 of this report, there have been no changes in the system pumping configuration which would explain these observed short-term increases. Because sodium is a PRRS constituent, Well 2900 will continue to be monitored for sodium and the results presented in the next scheduled system evaluation report (October 1996).

TABLE 3-1

STATISTICS FOR TOTAL URANIUM

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - June 30, 1995					July 1, 1995 - December 31, 1995					August 27, 1993 - December 31, 1995		
Well No.	No. of Samples[a]	Min. (µg/L)	Max. (µg/L)	Avg. (µg/L)	SD	No. of Samples[a]	Min. (µg/L)	Max. (µg/L)	Avg. (µg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2002	19	1.8	2.7	2.3	0.2	2	2.4	2.5	2.4	0.0	19	0.500	No Trend
2015	6	140.0	170.0	156.6	10.3	2	130.0	140.0	135.0	7.0	8	0.001	Down, Sig.
2017	3	4.0	5.0	4.6	0.5	2	2.7	4.6	3.6	1.3	5	0.242	No Trend
2060	6	30.0	75.0	53.8	14.8	2	32.0	34.0	33.0	1.4	8	0.016	Down, Sig.
2061	18	160.0	380.0	261.6	64.5	1	170.0	170.0	170.0	0.0	19	0.001	Down, Sig.
2093	11	0.3	0.9	0.5	0.1	2	0.3	0.5	0.4	0.1	12	0.500	No Trend
2095	11	110.0	200.0	154.5	24.2	1	170.0	170.0	170.0	0.0	12	0.339	No Trend
2106	11	2.1	70.0	46.7	23.3	3	48.0	56.1	52.3	4.1	9	0.130	No Trend
21063	6	2.1	15.0	6.4	6.5	2	2.9	3.0	2.9	0.0	7	0.119	No Trend
21194	d	d	d	d	d	2	2.5	3.3	2.9	0.5	2	-	Insuf. Data
2125	11	8.8	41.0	22.1	12.4	1	10.0	10.0	10.0	0.0	12	0.001	Down, Sig.
2128	12	0.8	12.0	6.9	3.5	1	11.0	11.0	11.0	0.0	12	0.002	Up, Sig.
2166	1	72.0	72.0	72.0	0.0	2	64.0	75.0	69.5	7.7	3	-	Insuf. Data
2396	7	0.8	1.3	1.0	0.2	1	0.8	0.8	0.8	0.0	8	0.138	No Trend
2398	9	0.6	13.0	7.4	4.3	3	11.0	12.0	11.4	0.5	9	0.038	Up, Sig.
2434	9	1.1	4.4	1.4	1.0	2	1.1	1.5	1.3	0.2	9	0.179	No Trend
2544	18	0.6	21.0	8.8	5.8	1	9.0	9.0	9.0	0.0	19	0.117	No Trend
2545	13	20.0	81.0	47.0	19.3	1	19.0	19.0	19.0	0.0	12	0.043	Down, Sig.
2548	12	0.3	5.5	2.9	1.5	1	2.3	2.3	2.3	0.0	12	0.121	No Trend
2550	7	72.0	82.0	77.1	3.9	1	74.0	74.0	74.0	0.0	8	0.237	No Trend
2551	7	12.0	30.0	20.4	6.8	1	7.5	7.5	7.5	0.0	8	0.548	No Trend
2552	7	18.0	24.0	21.1	1.8	1	17.0	17.0	17.0	0.0	8	0.007	Down, Sig.
2553	6	0.8	1.9	1.4	0.4	1	1.1	1.1	1.1	0.0	7	0.005	Down, Sig.
2624	20	7.5	160.0	80.5	30.2	1	39.0	39.0	39.0	0.0	19	0.005	Down, Sig.
2625	10	0.8	8.2	3.1	1.9	1	4.1	4.1	4.1	0.0	11	0.107	No Trend
2636	10	0.5	3.9	1.7	1.1	1	1.0	1.0	1.0	0.0	10	0.271	No Trend
2880	19	0.4	1.0	0.6	0.1	1	0.8	0.8	0.8	0.0	19	0.033	Up, Sig.
2881	19	0.1	4.1	3.1	0.9	1	3.3	3.3	3.3	0.0	19	0.190	No Trend
2897	11	0.7	1.4	0.9	0.2	1	0.7	0.7	0.7	0.0	12	0.001	Down, Sig.
2898	12	1.7	3.6	2.6	0.7	1	2.4	2.4	2.4	0.0	12	0.315	No Trend
2899	11	0.9	2.0	1.6	0.3	2	1.7	1.8	1.7	0.0	12	0.002	Up, Sig.
2900	12	0.5	5.6	2.1	1.5	1	[illegible]	3.1	3.1	0.0	12	0.004	Up, Sig.

TABLE 3-1
(Continued)

Well No.	Sampling Period: August 27, 1993 - June 30, 1995					Sampling Period: July 1, 1995 - December 31, 1995					Mann-Kendall Trend Analysis: August 27, 1993 - December 31, 1995		
	No. of Samples[a]	Min. (µg/L)	Max. (µg/L)	Avg. (µg/L)	SD	No. of Samples[a]	Min. (µg/L)	Max. (µg/L)	Avg. (µg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
3015	6	0.9	1.3	1.1	0.1	2	1.1	1.2	1.1	0.0	8	0.317	No Trend
3062	d	d	d	d	d	2	51.0	69.0	60.0	12.7	2	-	Insuf. Data
3093	11	0.2	0.8	0.4	0.1	1	0.3	0.3	0.3	0.0	12	0.317	No Trend
3095	11	5.8	11.0	8.0	2.1	1	11.0	11.0	11.0	0.0	12	0.001	Up, Sig.
3106	8	1.0	13.4	3.1	4.3	3	1.3	1.5	1.4	0.0	9	0.179	No Trend
3125	13	43.0	82.0	55.0	12.9	1	56.0	56.0	56.0	0.0	12	0.016	Up, Sig.
3128	11	0.0	1.0	0.4	0.2	1	0.6	0.6	0.6	0.0	12	0.445	No Trend
3396	d	d	d	d	d	2	0.5	0.6	0.5	0.0	2	-	Insuf. Data
3550	8	3.6	6.1	5.2	0.9	1	2.8	2.8	2.8	0.0	8	0.002	Down, Sig.
3551	11	0.6	1.3	0.7	0.2	1	0.6	0.6	0.6	0.0	8	0.500	No Trend
3552	d	d	d	d	d	2	0.6	0.7	0.6	0.0	2	-	Insuf. Data
3624	12	0.2	0.8	0.4	0.1	1	0.5	0.5	0.5	0.0	13	0.029	Up, Sig.
3636	12	0.2	0.6	0.4	0.1	1	0.4	0.4	0.4	0.0	12	0.126	No Trend
3880	11	0.1	2.3	0.6	0.6	1	0.2	0.2	0.2	0.0	12	0.146	No Trend
3881	11	0.0	0.4	0.1	0.0	1	0.1	0.1	0.1	0.0	12	0.020	Down, Sig.
3897	19	0.3	0.8	0.5	0.1	1	0.4	0.4	0.4	0.0	19	0.003	Down, Sig.
3898	13	0.1	180.0	27.2	65.5	1	0.7	0.7	0.7	0.0	12	0.045	Up, Sig.
3899	13	0.7	1.2	0.9	0.1	1	0.7	0.7	0.7	0.0	12	0.052	Down, Mar.
3900	14	0.0	0.5	0.1	0.1	1	0.2	0.2	0.2	0.0	12	0.179	No Trend
3924	22	44.0	180.0	83.6	34.3	6	44.0	51.0	47.5	2.6	26	0.001	Down, Sig.
3925	27	0.5	33.0	14.7	11.5	7	28.0	31.0	29.7	1.1	34	0.001	Up, Sig.
3926	28	1.5	6.5	3.4	1.5	7	6.2	7.5	6.8	0.4	35	0.001	Up, Sig.
3927	22	1.2	5.4	2.6	1.3	7	1.1	1.3	1.2	0.0	28	0.001	Down, Sig.
4125	2	0.5	0.6	0.5	0.0	2	0.8	0.8	0.8	0.0	3	-	Insuf. Data

[a]Variation in number of samples is due to resampling events, different sampling frequencies, and/or number of sampling events in reporting period.
[b]Number of samples used for trend analysis is a count of the number of unique sampling dates.
[c]Up, Sig. = Up, Significant
Up, Mar. = Up, Marginal
No Trend = No Significant Trend
Down, Sig. = Down, Significant
Down, Mar. = Down, Marginal
Insuf. Data = Insufficient Data. The blank in the Probability column indicates insufficient data to perform the Mann-Kendall analysis.
[d]Well was added to DMEPP system in June 1995 and not sampled until after July 1, 1995.

TABLE 3-2

STATISTICS FOR ARSENIC

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - June 30, 1995					July 1, 1995 - December 31, 1995					August 27, 1993 - December 31, 1995		
Well No.	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2128	144	0.002	0.200	0.026	0.036	54	0.002	0.108	0.012	0.013	110	0.001	Down, Sig.
2548	140	0.001	0.706	0.032	0.069	82	0.010	0.094	0.019	0.018	101	0.186	No Trend
2625	145	0.007	0.100	0.017	0.015	71	0.006	0.040	0.011	0.004	102	0.003	Down, Sig.
2636	81	0.015	0.100	0.062	0.030	48	0.033	0.100	0.059	0.018	92	0.004	Up, Sig.
2898	11	0.001	0.006	0.002	0.002	1	0.002	0.002	0.002	0.000	11	0.500	No Trend
2899	11	0.001	0.006	0.002	0.002	2	0.002	0.002	0.002	0.000	12	0.225	No Trend
2900	92	0.002	0.100	0.011	0.011	27	0.004	0.020	0.010	0.002	110	0.106	No Trend
3128	12	0.001	0.234	0.021	0.067	1	0.002	0.002	0.002	0.000	12	0.007	Down, Sig.
3636	11	0.002	0.006	0.002	0.002	1	0.002	0.002	0.002	0.000	12	0.050	Down, Sig.
3898	13	0.002	0.006	0.002	0.001	1	0.004	0.004	0.004	0.000	12	0.065	Down, Mar.
3899	14	0.001	0.006	0.002	0.002	1	0.002	0.002	0.002	0.000	12	0.225	No Trend
3900	13	0.002	0.006	0.003	0.001	1	0.002	0.002	0.002	0.000	12	0.419	No Trend
3924	53	0.010	0.010	0.010	0.000	22	0.010	0.020	0.010	0.002	74	0.227	No Trend
3925	67	0.010	0.010	0.010	0.000	22	0.010	0.010	0.010	0.000	87	0.324	No Trend

[a]Variation in number of samples is due to resampling events, different sampling frequencies, and/or number of sampling events in reporting period.
[b]Number of samples used for trend analysis is a count of the number of unique sampling dates.
[c]Up, Sig. = Up, Significant
Up, Mar. = Up, Marginal
No Trend = No Significant Trend
Down, Sig. = Down, Significant
Down, Mar. = Down, Marginal
Insuf. Data = Insufficient Data

TABLE 3-3

STATISTICS FOR PHOSPHORUS

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - June 30, 1995					July 1, 1995 - December 31, 1995					August 27, 1993 - December 31, 1995		
Well No.	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2128	10	0.09	6.40	2.63	2.10	1	0.14	0.14	0.14	0.00	11	0.022	Down, Sig.
2548	12	0.10	6.20	2.17	1.86	1	0.34	0.34	0.34	0.00	12	0.187	No Trend
2625	10	0.70	12.30	4.02	4.22	1	2.45	2.45	2.45	0.00	10	0.500	No Trend
2636	11	8.97	170.00	102.72	59.96	1	147.00	147.00	147.00	0.00	10	0.431	No Trend
2898	12	0.01	0.10	0.03	0.02	1	0.16	0.16	0.16	0.00	12	0.237	No Trend
2899	12	0.01	0.10	0.03	0.02	2	0.12	0.13	0.13	0.01	12	0.409	No Trend
2900	12	0.10	0.96	0.51	0.32	1	0.25	0.25	0.25	0.00	12	0.152	No Trend
3128	11	0.01	13.00	1.21	3.91	1	0.18	0.18	0.18	0.00	11	0.221	No Trend
3636	12	0.02	0.23	0.07	0.06	1	0.10	0.10	0.10	0.00	12	0.118	No Trend
3898	13	0.02	0.34	0.10	0.09	1	0.18	0.18	0.18	0.00	12	0.031	Down, Sig.
3899	14	0.05	0.83	0.19	0.20	1	0.15	0.15	0.15	0.00	12	0.419	No Trend
3900	14	0.01	1.26	0.13	0.32	1	0.13	0.13	0.13	0.00	12	0.417	No Trend

[a]Variation in number of samples is due to resampling events, different sampling frequencies, and/or number of sampling events in reporting period.
[b]Number of samples used for trend analysis is a count of the number of unique sampling dates.
[c]Up, Sig. = Up, Significant
Up, Mar. = Up, Marginal
No Trend = No Significant Trend
Down, Sig. = Down, Significant
Down, Mar. = Down, Marginal
Insuf. Data = Insufficient Data

TABLE 3-4

STATISTICS FOR POTASSIUM

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - June 30, 1995					July 1, 1995 - December 31, 1995					August 27, 1993 - December 31, 1995		
Well No.	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2128	12	1.69	18.00	7.59	6.52	1	2.01	2.01	2.01	0.00	12	0.032	Down, Sig.
2548	12	2.72	40.00	13.05	11.06	1	7.38	7.38	7.38	0.00	12	0.075	Down, Mar.
2625	10	1.28	6.00	2.36	1.77	1	1.81	1.81	1.81	0.00	10	0.300	No Trend
2636	10	62.20	169.00	120.22	37.38	1	218.00	218.00	218.00	0.00	10	0.190	No Trend
2898	12	3.32	5.05	3.63	0.68	1	4.29	4.29	4.29	0.00	12	0.225	No Trend
2899	12	2.72	5.00	3.14	0.79	2	3.98	4.00	3.99	0.01	13	0.148	No Trend
2900	13	0.71	6.00	2.27	1.64	1	1.35	1.35	1.35	0.00	13	0.010	Down, Sig.
3128	12	2.01	5.00	2.81	0.97	1	2.85	2.85	2.85	0.00	12	0.500	No Trend
3636	11	2.31	5.00	2.65	0.96	1	2.79	2.79	2.79	0.00	12	0.168	No Trend
3898	13	1.83	5.00	2.38	1.08	1	2.57	2.57	2.57	0.00	12	0.445	No Trend
3899	14	1.69	5.00	2.47	0.95	1	2.51	2.51	2.51	0.00	12	0.292	No Trend
3900	13	1.42	5.00	1.81	1.21	1	1.67	1.67	1.67	0.00	12	0.108	No Trend

[a]Variation in number of samples is due to resampling events, different sampling frequencies, and/or number of sampling events in reporting period.
[b]Number of samples used for trend analysis is a count of the number of unique sampling dates.
[c]Up, Sig. = Up, Significant
Up, Mar. = Up, Marginal
No Trend = No Significant Trend
Down, Sig. = Down, Significant
Down, Mar. = Down, Marginal
Insuf. Data = Insufficient Data

TABLE 3-5

STATISTICS FOR SODIUM

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - June 30, 1995					July 1, 1995 - December 31, 1995					August 27, 1993 - December 31, 1995		
Well No.	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2128	12	28.10	63.70	40.71	9.95	1	29.20	29.20	29.20	0.00	12	0.316	No Trend
2548	12	18.20	35.00	25.69	6.12	1	20.00	20.00	20.00	0.00	12	0.032	Down, Sig.
2625	10	30.70	49.30	38.14	6.59	1	50.70	50.70	50.70	0.00	10	0.108	No Trend
2636	10	48.40	79.90	60.60	9.36	1	55.50	55.50	55.50	0.00	10	0.168	No Trend
2898	12	17.00	29.20	22.21	4.18	1	19.00	19.00	19.00	0.00	12	0.366	No Trend
2899	11	11.20	22.90	15.51	4.46	2	18.40	18.40	18.40	0.00	12	0.065	Up, Mar.
2900	12	23.40	39.80	27.83	4.91	1	39.50	39.50	39.50	0.00	12	0.366	No Trend
3128	12	5.36	13.50	9.97	2.69	1	4.57	4.57	4.57	0.00	12	0.001	Down, Sig.
3636	11	9.14	15.10	11.72	1.63	1	9.08	9.08	9.08	0.00	12	0.017	Down, Sig.
3898	13	7.00	14.60	9.72	2.54	1	8.89	8.89	8.89	0.00	12	0.023	Up, Sig.
3899	14	6.74	14.60	10.32	2.18	1	6.24	6.24	6.24	0.00	12	0.057	Down, Mar.
3900	13	5.00	10.80	7.79	2.17	1	5.38	5.38	5.38	0.00	12	0.226	No Trend

[a]Variation in number of samples is due to resampling events, different sampling frequencies, and/or number of sampling events in reporting period.
[b]Number of samples used for trend analysis is a count of the number of unique sampling dates.
[c]Up, Sig. = Up, Significant
Up, Mar. = Up, Marginal
No Trend = No Significant Trend
Down, Sig. = Down, Significant
Down, Mar. = Down, Marginal
Insuf. Data = Insufficient Data

TABLE 3-6

SUMMARY OF SIGNIFICANT MANN-KENDALL TREND TEST RESULTS FOR SELECT ANALYTES (AUGUST 27, 1993 - DECEMBER 31, 1995)

Well No.	No. of Samples	Probability	Trend[a]	Average Concentration[b] (μg/L)	Explanation
Total Uranium					
2015	8	0.001	Down, Sig.	135.0	Source removal and effectiveness of recovery wellfield[c]
2060	8	0.016	Down, Sig.	33.0	Source removal and effectiveness of recovery wellfield[c]
2061	19	0.001	Down, Sig.	170.0	Source removal and effectiveness of recovery wellfield[c]
2125	12	0.001	Down, Sig.	10.0	Source removal and effectiveness of recovery wellfield[c]
2128	12	0.002	Up, Sig.	11.0	Natural migration of the uranium plume that is embedded within the PRRS plume
2398	9	0.038	Up, Sig.	11.4	Continued migration of the northeastern lobe of the plume will be addressed by optimization of the South Plume recovery system
2545	12	0.043	Down, Sig.	19.0	Source removal and effectiveness of recovery wellfield[c]
2552	8	0.007	Down, Sig.	17.0	Source removal and effectiveness of recovery wellfield[c]
2553	7		Down, Sig.	1.1	Source removal and effectiveness of recovery wellfield[c]
2624	19	0.005	Down, Sig.	39.0	Source removal and effectiveness of recovery wellfield[c]
2880	19	0.033	Up, Sig.	0.8	Concentration within the background range
2897	12	0.001	Down, Sig.	0.7	Source removal and effectiveness of recovery wellfield[c]
2899	12	0.002	Up, Sig.	1.7	Concentration within background range
2900	12	0.004	Up, Sig.	3.1	Concentration within background range
3095	12	0.001	Up, Sig.	11.0	Screened interval of recovery wells and induced capture
3125	12	0.016	Up, Sig.	56.0	Screened interval of recovery wells and induced capture
3550	8	0.002	Down, Sig.	2.8	Source removal and effectiveness of recovery wellfield[c]
3624	13	0.029	Up, Sig.	0.5	Screened interval of recovery wells and induced capture
3881	12	0.020	Down, Sig.	0.1	Concentration within the background range

TABLE 3-6
(Continued)

Well No.	No. of Samples	Probability	Trend[a]	Average Concentration[b] (μg/L)	Explanation
Total Uranium (Contd.)					
3897	19	0.003	Down, Sig.	0.4	Well is within the range of background
3898	12	0.045	Up, Sig.	0.7	Concentration within the background range
3924	26	0.001	Down, Sig.	47.5	Source removal and effectiveness of recovery wellfield[c]
3925	34	0.001	Up, Sig.	29.7	Recovery of area of plume with higher concentrations than originally at recovery well
3926	35	0.001	Up, Sig.	6.8	Recovery of area of plume with higher concentrations than originally at recovery well
3927	28	0.001	Down, Sig.	1.2	Source removal and effectiveness of recovery wellfield[c]
Arsenic				(mg/L)	
2128	110	0.001	Down, Sig.	.012	Natural migration of PRRS plume
2625	102	0.003	Down, Sig.	.011	Natural migration of PRRS plume
2636	92	0.004	Up, Sig.	.059	Natural migration of PRRS plume
3128	12	0.007	Down, Sig.	.002	Natural migration of PRRS plume
3636	12	0.050	Down, Sig.	.002	Natural migration of PRRS plume
Phosphorous					
2128	11	0.022	Down, Sig.	0.14	Natural migration of PRRS plume
3898	12	0.031	Down, Sig.	0.18	Unknown; will continue to evaluate
Potassium					
2128	12	0.032	Down, Sig.	2.01	Natural migration of PRRS plume
2900	13	0.010	Down, Sig.	1.35	Effective operation of recovery wellfield
Sodium					
2548	12	0.032	Down, Sig.	20.00	Natural migration of PRRS plume
3128	12	0.001	Down, Sig.	4.57	Natural migration of PRRS plume
3636	12	0.017	Down, Sig.	9.08	Natural migration of PRRS plume
3898	12	0.023	Up, Sig.	8.89	Unknown; will continue to evaluate

[a]Up, Sig. = Up, Significant
Down, Sig. = Down, Significant
[b]Average concentration for July 1 - December 31, 1995
[c]Source removal refers to the 1986 installation of the SWRB which effectively reduced uranium loading to the aquifer by Paddys Run. The term "effectiveness of recovery wellfield" is a reference to the mass removal of uranium from the plume by the recovery system.

4.0 CAPTURE ASSESSMENT

One of the requirements of the DMEPP is to determine if the recovery wellfield is serving as a complete hydraulic barrier to migration of the total uranium plume, preventing uranium north of the recovery wellfield from migrating past it. This is accomplished by performing capture zone analyses using actual and modeled data and comparing the results. This comparison allows the use of modeled results to predict future capture based on hypothetical changes to the recovery well pumping rates and to assist in assessing various pumping configurations as needed. The optimal 1400-gpm pumping scenario used during the last reporting period (i.e., Wells 3924 and 3925 pumped at 300 gpm each, Wells 3926 and 3927 pumped at 400 gpm each, and Well 3928 shut down) was not changed except during periods of scheduled maintenance and to support the South Field injection test.

Figures 4-1 and 4-2 show the October 1995 total uranium plume at the Type 2 and Type 3 well intervals, respectively. The data used to create the figures were from late September and early October 1995 (the fourth quarter sampling event). The uranium plume depicted in Figure 4-1 compares favorably to the uranium plume depicted in Figure 4-1 of the October 1995 DMEPP System Evaluation Report. However, two significant changes should be pointed out: for this reporting period the southwestern tip of the plume at the Type 2 well interval does not extend as far to the southwest because concentrations of uranium have decreased from 21 to 17 μg/L in Well 2552 and from 35 to 19 μg/L in Well 2545; and uranium concentrations at Well 2551 have decreased from 28 μg/L during the last reporting period to 7.5 μg/L, moving the western boundary of the plume to the east. Results of the Mann-Kendall test for trend on the complete data set for Wells 2552 and 2545 identify these wells as exhibiting significant downward trends. As discussed in the previous system evaluation report and at technical information exchange meetings held during the summer of 1995 among EPA, OEPA, DOE, and FERMCO, these results were expected due to plume dissipation and flushing from Paddys Run.

Figure 4-2 shows the total uranium plume for the Type 3 monitoring wells. The northeastern lobe of the plume is depicted as a dashed line because Well 3069 is the only Type 3 well in this area to show total uranium concentrations above background. Well 3015 to the west of Well 3069 and Well 3398 to the east of Well 3069 both have total uranium concentrations within the background range (0.1 to 3.1 μg/L). Although concentrations of total uranium in Well 3069 above 20 μg/L are documented in the Operable Unit 5 Remedial Investigation Report (see Plate E-80), the results from this well are

discussed for the first time in this report because its total uranium concentrations continue to increase (from 22.3 μg/L in 1993 to 129.8 μg/L in 1995). Due to the spatial singularity of the data from Well 3069, the shape of the plume at the Type 3 depth interval is assumed to be similar to the plume shape shown on Plate E-80. While Wells 3069 and 3398 are not currently part of the South Plume groundwater system, they are sampled under another site program (i.e., RCRA), and they will be added to the list of wells that provide analytical information for subsequent DMEPP reports. Well 3398 is being added because it is the closest Type 3 well to the east of Well 3069 and will provide early warning of any further plume migration.

In December, 1995 a preliminary flow direction determination was made in Well 2552 with the recently acquired colloidal borescope. The results showed that the flow direction in Well 2552 at a depth of three feet below the top of the water table was in a northeasterly direction (approximately 40° east of true north), or in the approximate direction of the South Plume recovery system. At a depth of eight feet below the water table, the flow direction shifted to an east-southeasterly direction (approximately 100° east of true north). Based on this preliminary data, it would appear that the optimum 1400-gpm pumping scenario induces a capture zone at or immediately south of Well 2552. Acquisition of additional flow direction and velocity data at Well 2552 is planned to confirm these results.

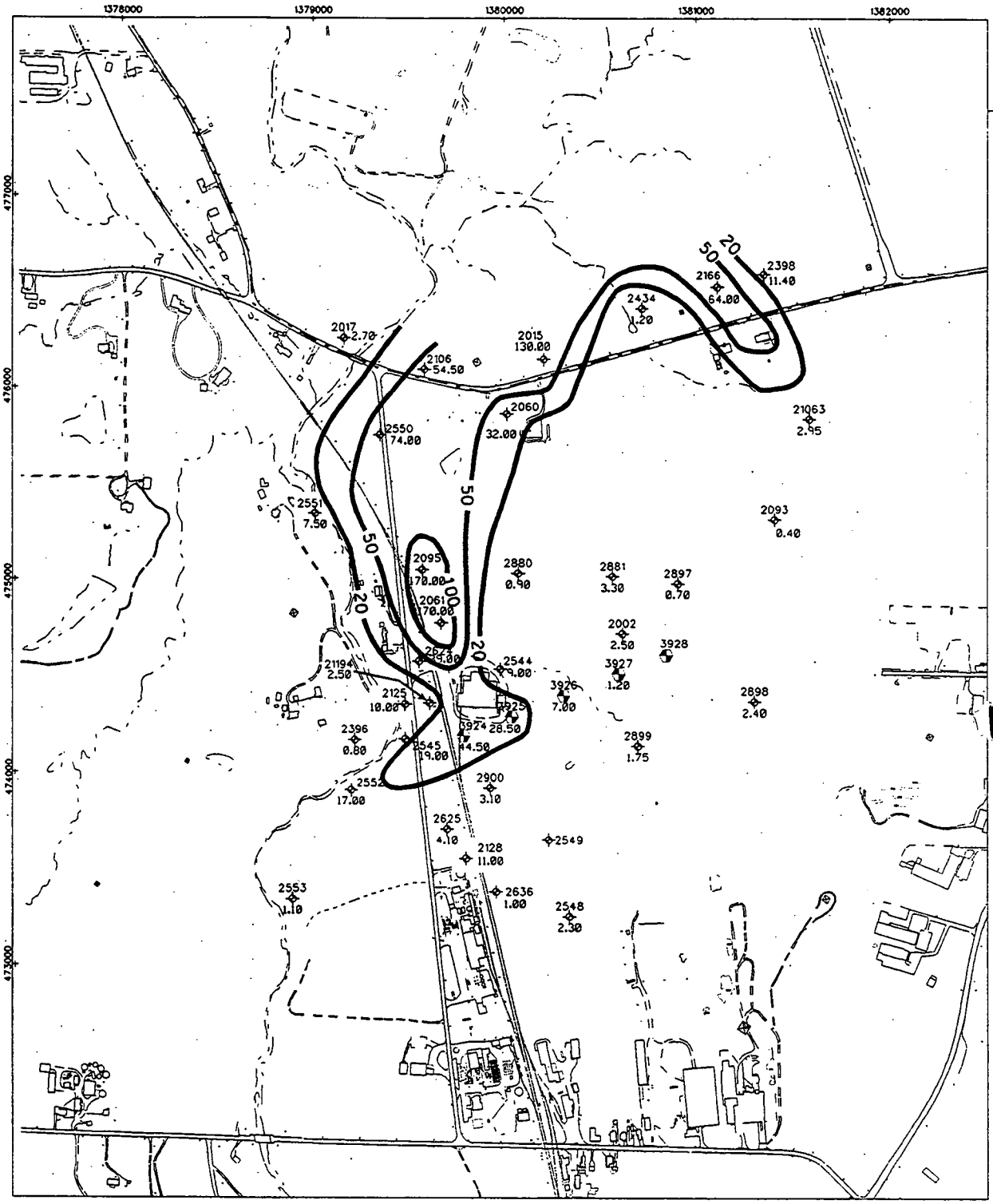
Figure 4-3 shows the range of the capture zone fluctuation over this entire reporting period in relation to the December 1995 capture zone at the water table; groundwater elevation contours for Type 2 wells using the December water elevation data and a determination of the capture zone are presented in Figure 4-4. The December groundwater elevation data were used to assess the effectiveness of the recovery wellfield in creating a hydraulic barrier across the width of the 20 μg/L total uranium isopleth. A modeled capture zone for the 1400-gpm optimum pumping scenario (current scenario) for the Type 2 well interval is presented in Figure 4-5. The extent of capture shown in Figures 4-4 and 4-5 is similar. These results show that the width of the main body of the plume continues to be captured and that the model is making realistic predictions of groundwater elevation.

Groundwater elevation contours for Type 3 wells and an interpreted capture zone map using December water elevation data are presented in Figure 4-6. A modeled capture zone for the 1400-gpm optimum pumping scenario for the Type 3 well interval is presented in Figure 4-7. While analysis of the modeled data (Figure 4-7) shows some of the 20 μg/L uranium isopleth is not captured

at the Type 3 well interval, the measured data (Figure 4-6) show complete capture. The interpreted capture zone in Figure 4-6 is based primarily on the water elevations from Well 3900 which are higher than the water elevations in Well 3128 to the south. This interpretation will be verified with the colloidal borescope tool. All Type 2 and Type 3 wells along the edge of the southern capture zone (including Well 3900) are scheduled for monitoring with the borescope.

An eastern lobe of the uranium plume is migrating off FEMP property to the southeast (Figure 4-1) and the question has been raised as to whether capture of this lobe is feasible without Recovery Well 3928 in operation. Modeled results presented and discussed in the October 1995 System Evaluation Report indicate capture is feasible based on the current 1400-gpm pumping scenario. However, the DOE plans to install an additional recovery well within this lobe to optimize remediation efficiency. The schedule for installation of this well will be provided in the Operable Unit 5 remedial action work plan.

/USR/ERMA1/CRU5/DGN/MAP/HOR/DPTH/C5DMP031.DGN FER OU5 3/20/96 STATE PLANAR COORDINATE SYSTEM 1927



NOTE: BASED ON FOURTH QUARTER 1995 DATA

LEGEND:

FEMP BOUNDARY

20 TOTAL URANIUM CONCENTRATION CONTOUR

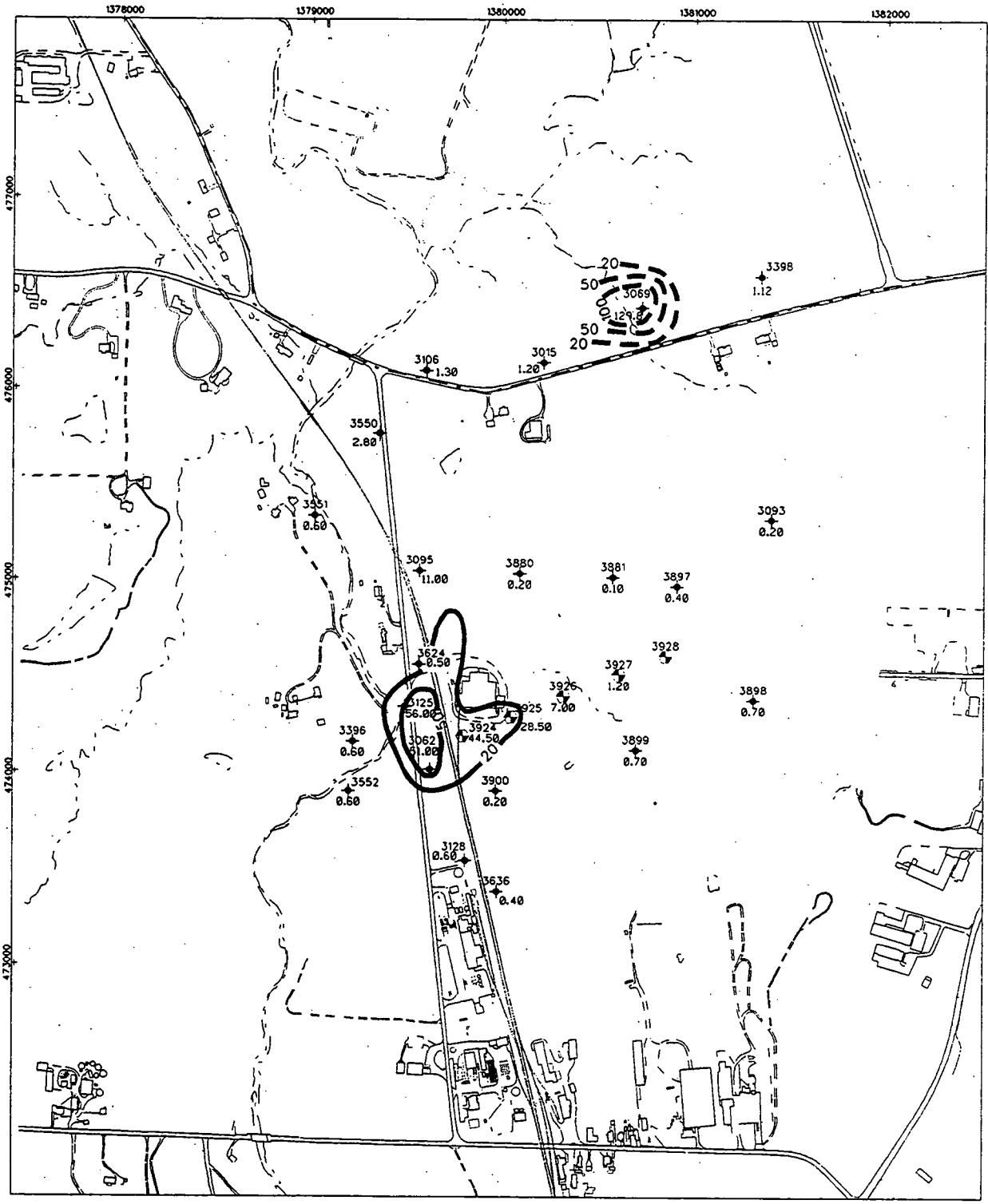
2553 WELL NUMBER
1.1 TOTAL URANIUM CONCENTRATION (μg/L)

SCALE

800 400 0 800 FEET

FIGURE 4-1.
TOTAL URANIUM PLUME, TYPE 2 MONITORING WELLS, OCTOBER 1995

/USR/ERMA1/CRU5/DGN/MAP/HOR/DPTH/C5DMP032.DGN FER OU5 3/20/96 STATE PLANAR COORDINATE SYSTEM 1927



NOTE: BASED ON FOURTH QUARTER 1995 DATA. DASHED CONTOURS BASED ON ONE DATA POINT

LEGEND:

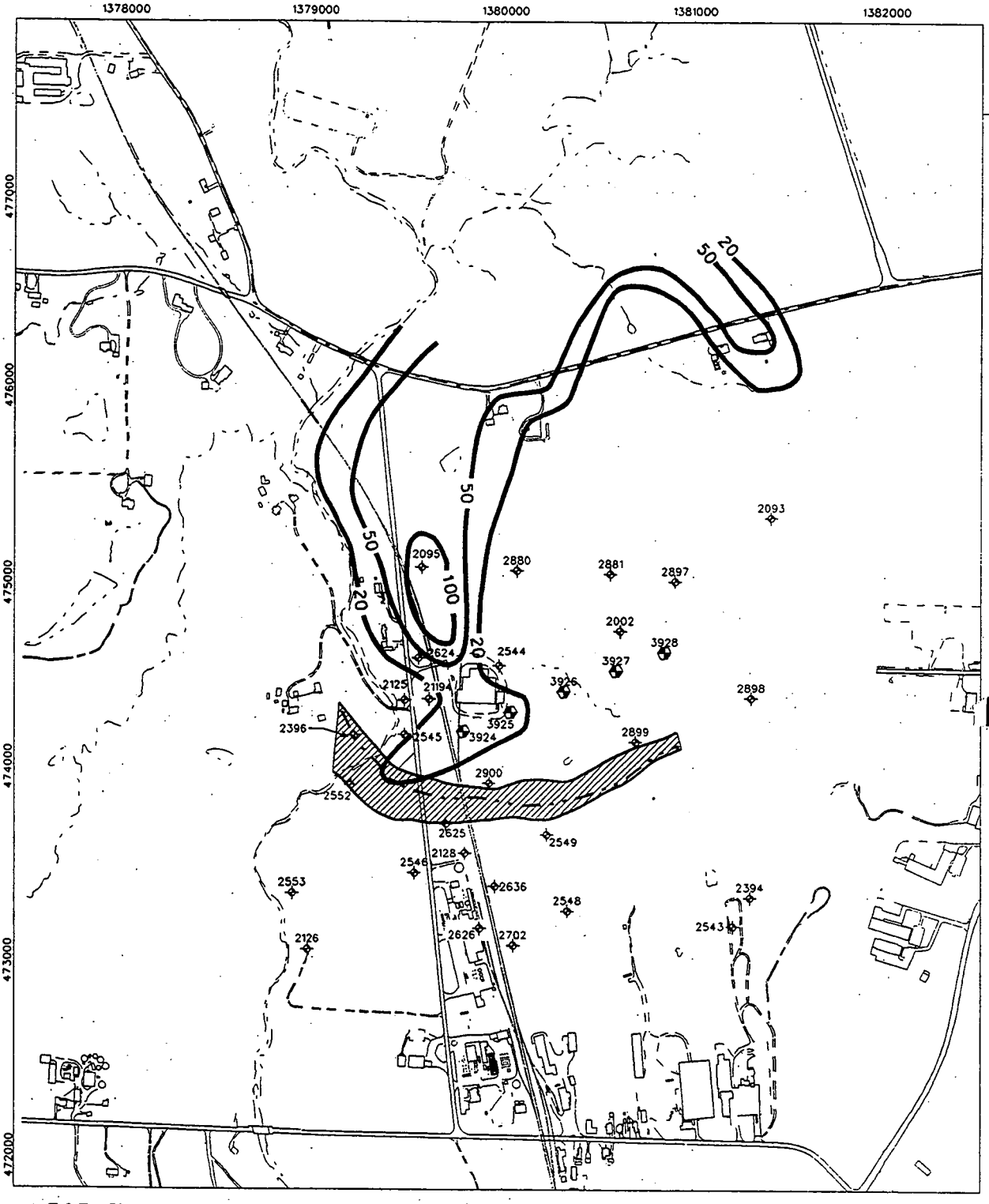
- FEMP BOUNDARY
- 20 TOTAL URANIUM CONCENTRATION CONTOUR
- 3553 / 1.1 WELL NUMBER / TOTAL URANIUM CONCENTRATION (μg/L)

SCALE

800 400 0 800 FEET

FIGURE 4-2.
TOTAL URANIUM PLUME, TYPE 3 MONITORING WELLS, OCTOBER 1995

/USR/ERMA1/CRU5/DGN/MAP/HOR/DPTH/C5DMPO30.DGN FER OU5 3/20/96 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

CAPTURE ZONE FLUCTUATION DURING ENTIRE REPORTING PERIOD BASED ON MONTHLY WATER ELEVATION MEASUREMENTS IN TYPE 2 WELLS

DECEMBER 1995 CAPTURE ZONE

FEMP BOUNDARY

20 TOTAL URANIUM CONCENTRATION CONTOUR FOR OCTOBER 1995

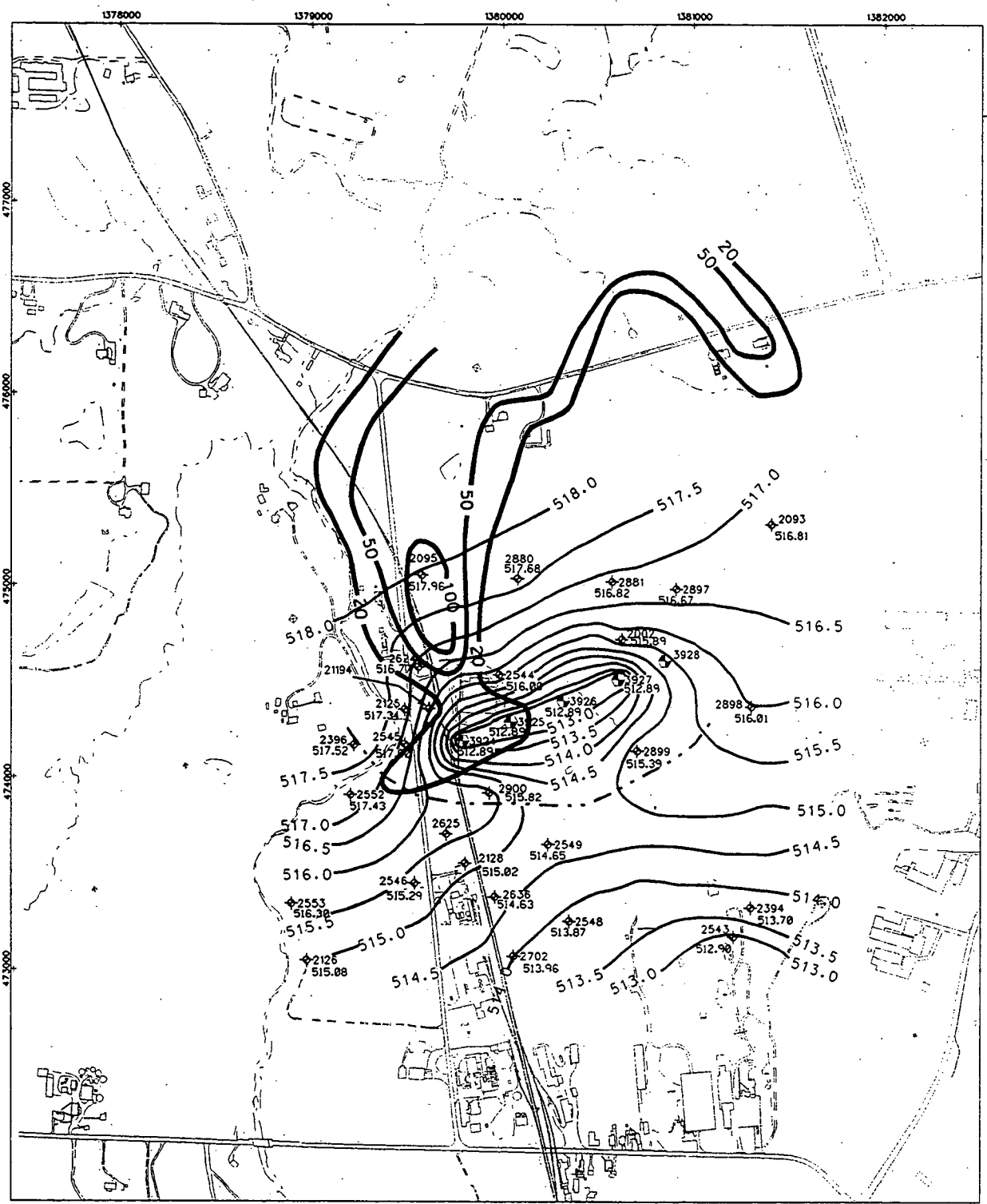
SCALE

800 400 0 800 FEET

FIGURE 4-3.
EXTENT OF CAPTURE ZONE FLUCTUATIONS AT TYPE 2 WELLS
JULY 1995 - DECEMBER 1995

000041

/USR/ERMA1/CRU5/DGN/MAP/HOR/DPTH/C5DMP034.DGN FER OU5 1/25/96 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

- - - - FEMP BOUNDARY

2900 TYPE 2 MONITORING WELL
513.96 GROUNDWATER ELEVATION (AMSL)

3926 RECOVERY WELL

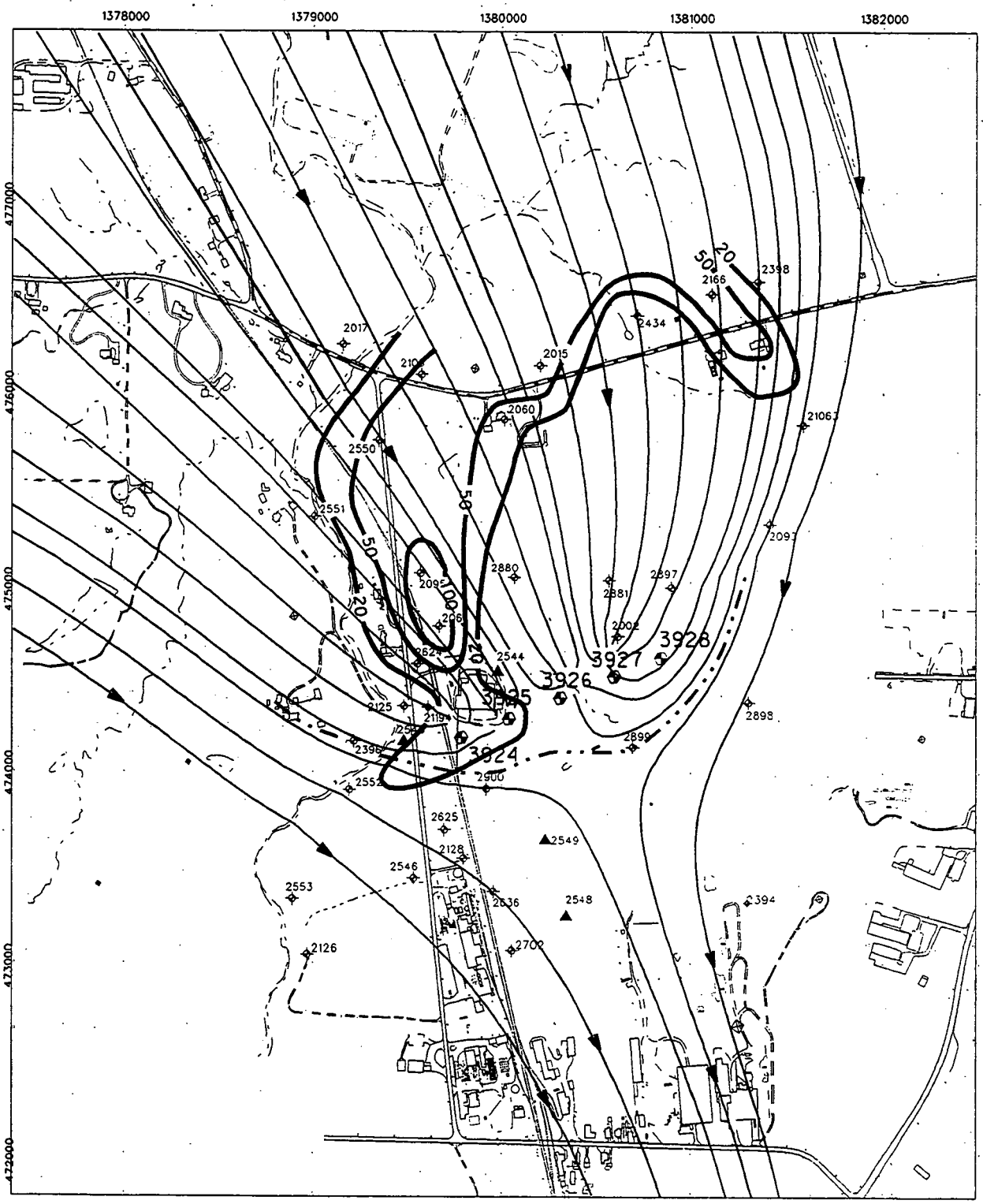
20 TOTAL URANIUM CONCENTRATION CONTOUR FOR OCTOBER 1995

— · · — CAPTURE ZONE

SCALE

800 400 0 800 FEET

FIGURE 4-4. GROUNDWATER ELEVATION, TYPE 2 WELLS, DECEMBER 1995



LEGEND:

FEMP BOUNDARY

CAPTURE ZONE

MODELED FLOW PATH
(ARROW INDICATES DIRECTION)

20 TOTAL URANIUM CONCENTRATION CONTOUR FOR OCTOBER 1995

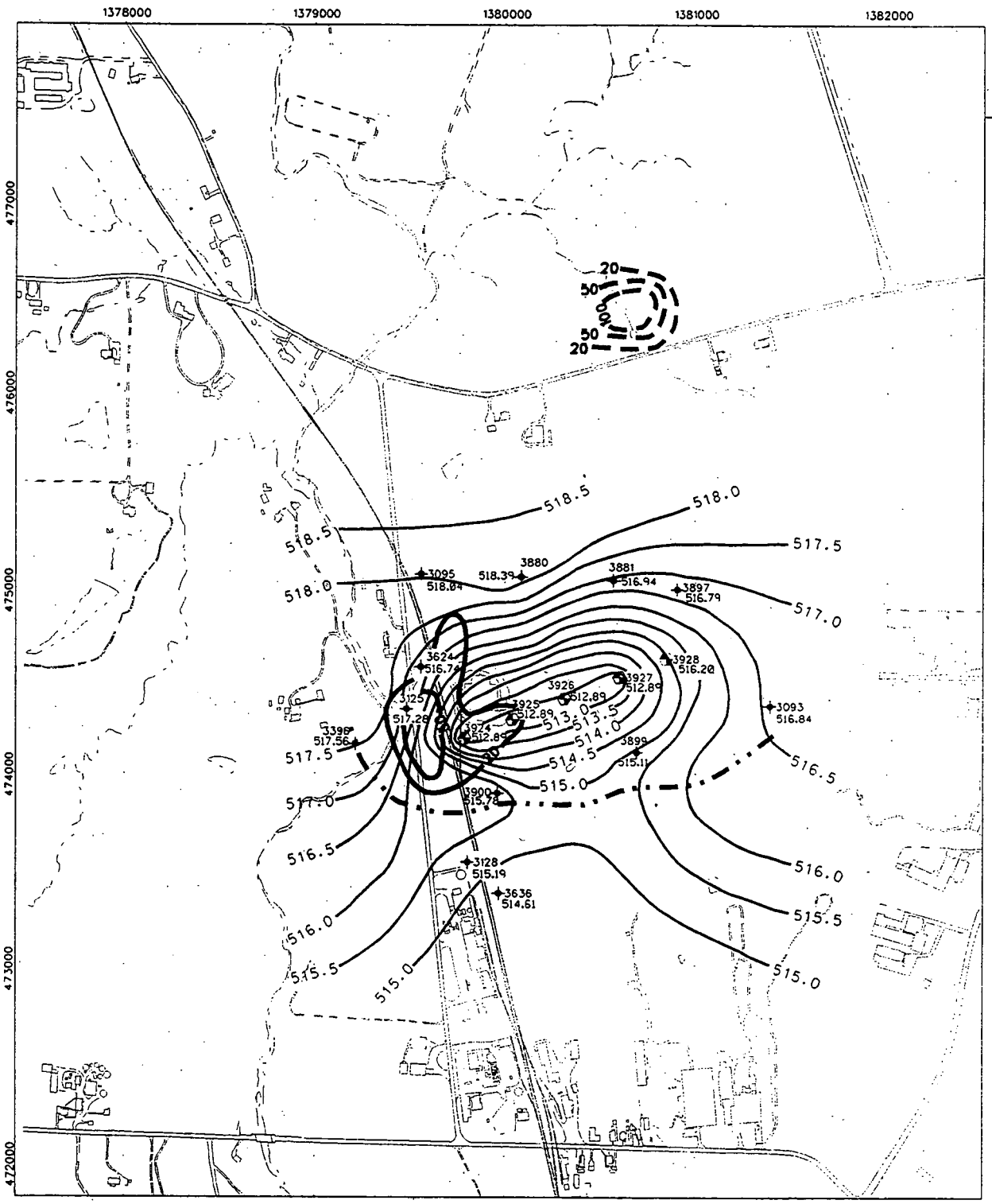
SCALE

800 400 0 800 FEET

/USR/ERMAT/CRU5/DGN/MAP/HOR/DPTH/C50MP013.DGN FER OU5 3/20/96 STATE PLANAR COORDINATE SYSTEM 1927

FIGURE 4-5.
MODELED 1400 GPM PUMPING
SCENARIO, TYPE 2 WELL INTERVAL

/USR/ERMA1/CRU5/DGN/MAP/HOR/DPTH/C5DMP033.DGN FER 0U5 1/25/96 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

FEMP BOUNDARY

CAPTURE ZONE

514.5 GROUNDWATER ELEVATION CONTOURS (AMSL)

20 TOTAL URANIUM CONCENTRATION CONTOUR FOR OCTOBER 1995

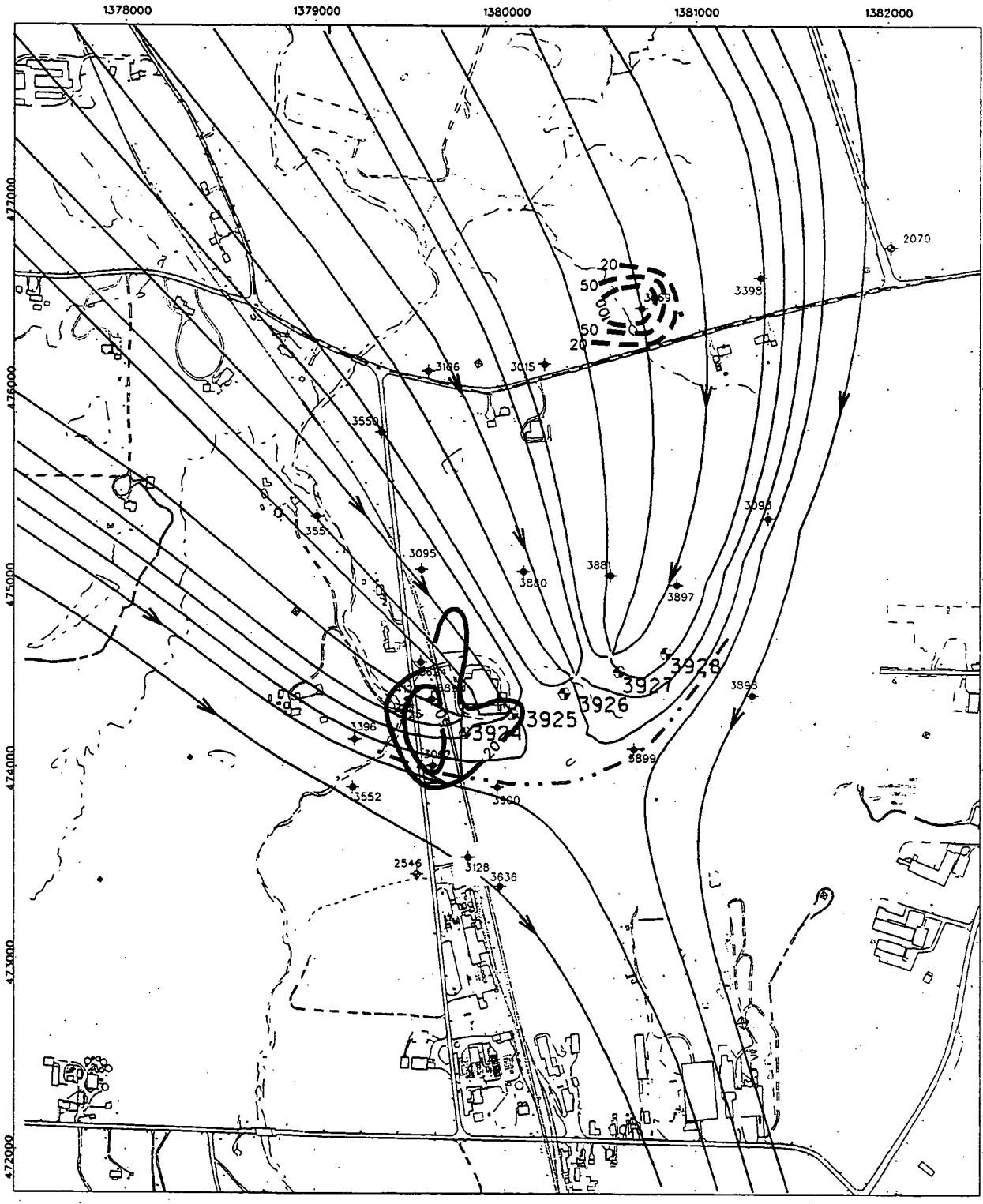
NOTE: DASHED CONTOURS BASED ON ONE DATA POINT.

SCALE

800 400 0 800 FEET

FIGURE 4-6.
GROUNDWATER ELEVATIONS, TYPE 3 WELLS, DECEMBER 1995

/USR/ERMA1/CRU5/DGN/MAP/HOR/OPTH/C5DMP014.DGN FER 0U5 3/20/96 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

3925 RECOVERY WELL

FEMP BOUNDARY

CAPTURE ZONE

MODELED FLOW PATH (ARROW INDICATES DIRECTION)

20 TOTAL URANIUM CONCENTRATION CONTOUR FOR OCTOBER 1995

NOTE: DASHED CONTOURS BASED ON ONE DATA POINT.

SCALE

800 400 0 800 FEET

000048

FIGURE 4-7.
MODELED 1400 GPM PUMPING SCENARIO
TYPE 3 WELL INTERVAL

5.0 SUMMARY AND CONCLUSIONS

A total of 342 million gallons of water was pumped and 53.4 pounds of uranium were removed from the aquifer during the reporting period (July 1, 1995 through December 31, 1995); the average system efficiency was 0.16 pounds of uranium removed per million gallons of water pumped. Since operations began in August 1993, a total of 1.6 billion gallons of water have been pumped and 222.8 pounds of uranium have been removed from the aquifer. The net system efficiency (August 1993 to December 1995) is 0.14. No change has occurred in the capture zone created by the recovery wellfield; full capture of the width of the uranium plume north of the recovery wellfield continues to be achieved. The recovery wellfield continues to show a negligible influence on the PRRS plume to the south.

As defined by the total uranium concentration of 17 μg/L in Monitoring Well 2552, the extent of the southernmost lobe of the plume has decreased since the last reporting period and, as shown in Figure 4-4, the main body of the 20 μg/L total uranium plume continues to be captured. The area within the 20 μg/L isopleth decreased between the last two reporting periods as evidenced by lower total uranium concentrations at Well 2551 (from 28 to 7.5 μg/L), Well 2552 (21 to 17 μg/L), and Well 2545 (35 to 19 μg/L).

As discussed in the October 1995 report, the southernmost lobe of the plume cannot be fully recovered by the existing recovery wellfield without adversely impacting the PRRS plume. Groundwater modeling done for the October 1995 report indicated that the small area of uranium contamination not being captured will dissipate naturally in approximately two to three years to a point where total uranium concentrations are well below the EPA-proposed maximum contaminant level of 20 μg/L. These modeled results are independently supported by the measured total uranium at Well 2552 (17 μg/L) for this reporting period. Initial observations made in Well 2552 in December 1995 with the colloidal borescope indicate the flow direction just beneath the water surface is to the north toward the recovery wellfield while the flow direction gradually shifts to the east with depth, indicating that this well is within the capture zone of the recovery system. Additional measurements will be made with the borescope at this location and at other monitoring wells along the southern capture zone boundary to supplement the current capture zone interpretation derived from measured water levels and modeling.

The northeastern lobe of the total uranium plume is shown in Figures 4-1 and 4-2 at the Type 2 and Type 3 well-depth intervals, respectively. The presence of the northeastern lobe at the Type 3 well-depth interval was identified in the Operable Unit 5 Remedial Investigation Report, based on data from Well 3069; concentrations of total uranium above 20 μg/L in Well 3069 are documented on Plate E-80. Well 3069 is included here because its total uranium concentrations continue to increase, as indicated by data obtained from the RCRA groundwater monitoring program. Because Well 3069 is the only Type 3 well in this area to show total uranium concentrations above background, the shape of the plume at that depth is interpreted as being similar to the plume shape shown on Plate E-80. Therefore, Wells 3069 and 3398 (the early warning well) will be added to the DMEPP system and analytical information will be included in subsequent DMEPP reports.

As discussed in the October 1995 System Evaluation Report, groundwater modeling results predict that the northeastern lobe of the uranium plume, which is migrating off property, is within the capture zone of the existing recovery wellfield. Potential improvements to the existing system of pumping wells that would accelerate uranium mass removal from off-property portions of the plume were presented to EPA and OEPA during the summer of 1995. Specifically, four additional off-property extraction wells are being considered as part of the South Plume optimization (Figure 5-1). Three extraction wells would be installed south of Willey Road in a line parallel to and offset downgradient from the center of the plume to increase mass removal efficiency and a fourth well would be installed near the northeastern lobe so that optimal recovery of the lobe can be achieved. These four wells would be operated concurrently with existing Recovery Wells 3924 and 3925. This optimization scenario was presented in detail at meetings among the DOE, EPA, OEPA, and FERMCO on July 25 and September 5, 1995. It is currently envisioned that optimization of the South Plume groundwater recovery system would occur according to the remedial design/remedial action schedules for Operable Unit 5.

With the approval of the Operable Unit 5 Record of Decision (ROD) in January 1996, final remediation levels (FRLs) for constituents of concern (COCs) in the Great Miami Aquifer were established. As part of the remedial design/remedial action for the Operable Unit 5 groundwater remedy, a site-wide evaluation of the occurrence of COCs above FRLs in groundwater will be performed. The DMEPP analytical suite may be revised as a result of this evaluation. The schedule for this evaluation will be provided in the Operable Unit 5 remedial design/remedial action documents.

In conclusion, significant changes for this reporting period and recommendations for the next reporting period are bulleted below.

Operational changes of note during this reporting period include:

- A uranium recovery efficiency of 0.16 pounds per million gallons pumped for the reporting period is up from the average recovery efficiency of 0.14 pounds per million gallons pumped since system startup
- New pumps and screens were installed in Recovery Wells 3924 and 3926
- An optimization study has been performed to evaluate the benefit of additional recovery wells on uranium removal efficiency.

Significant changes in data analysis results include:

- Trend analysis indicates 11 wells show increasing uranium, as discussed in Section 3.0
- Trend analysis indicates 16 wells show decreasing uranium, as discussed in Section 3.0
- Analysis of data from Well 2552 supports the overall downward trend of uranium concentrations within the small southern lobe that at times resides outside the recovery wellfield capture zone
- The presence of the northeastern lobe of the total uranium plume shown only at the Type 2 well depth in previous system evaluation reports is now shown to extend to the Type 3 well-depth interval, as indicated by the Operable Unit 5 Remedial Investigation and subsequent data obtained at Well 3069. Although Well 3069 is currently within the capture zone, the aquifer restoration in this area of the plume will be enhanced by the South Plume optimization activities to be completed as part of the Operable Unit 5 remedial action.

Recommendations and areas of focus for the next reporting period include:

- Collect groundwater level measurements quarterly with provisions for monthly measurements if necessary
- Continue operating the recovery wellfield at the established 1400 gpm rate
- Continue monitoring the recovery wellfield to ensure negligible influence to the PRRS plume

- Continue to evaluate capture of contiguous 20 μg/L uranium plume at the Type 2 and Type 3 well depths

- Continue to seek ways to improve the mechanical reliability of the system and to enhance the operating time of the system as remedial design of the South Plume optimization system progresses

- Continue to evaluate dissipation of the southern lobe of the uranium plume which at times resides outside the capture zone of the recovery wellfield (Monitoring Well 2552)

- Continue using the colloidal borescope to refine understanding of the capture zone

- Add Wells 3069 and 3398 to the list of wells from which data are evaluated for the South Plume groundwater recovery system in order to monitor the northeastern lobe of the plume at the Type 3 well-depth interval

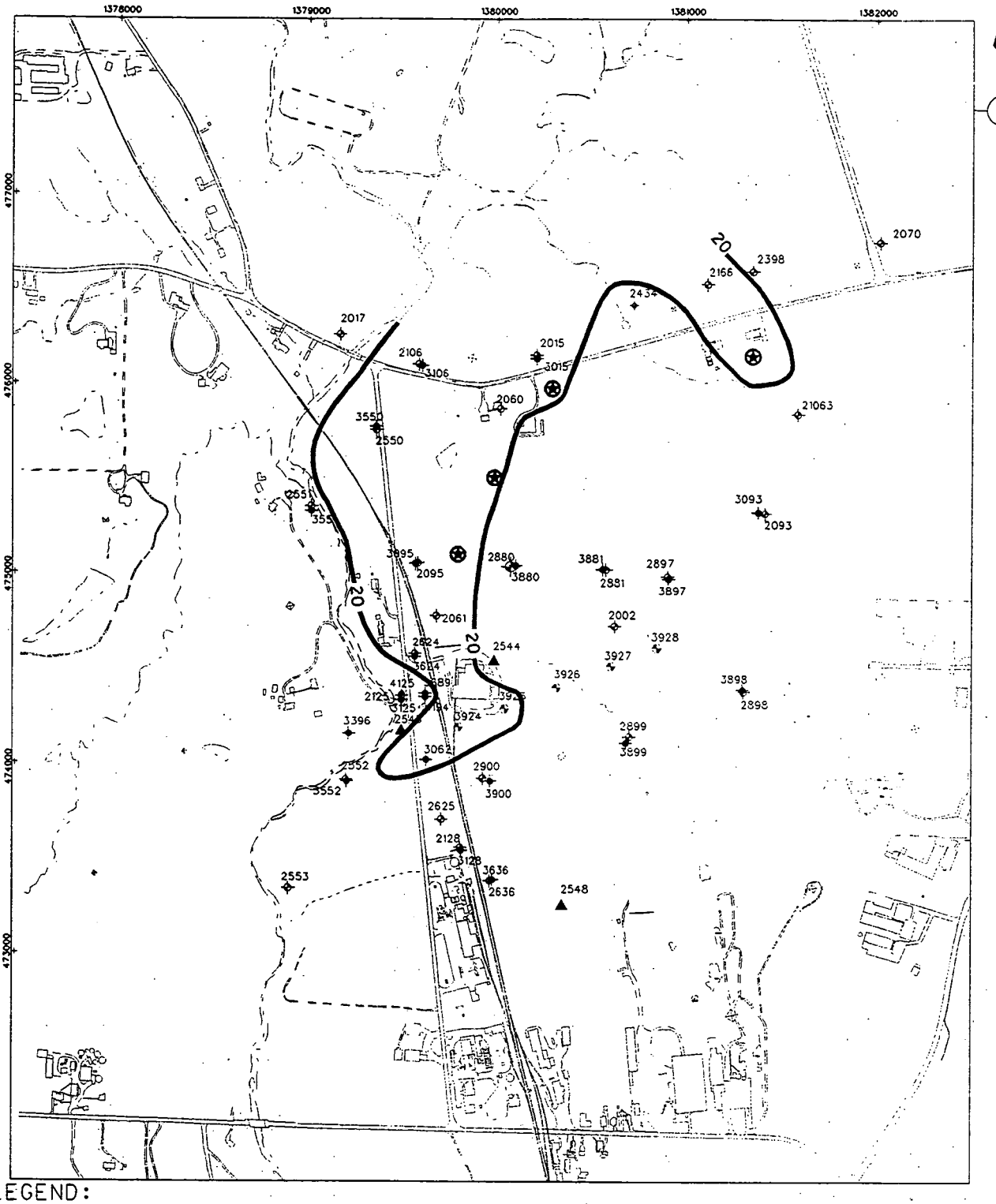
- Continue to monitor concentrations in the northeastern lobe of the uranium plume (Monitoring Well 21063)

- Continue to monitor Wells 2900 and 3898 for sodium concentrations

- Increase flexibility in scheduling sampling events so that maintenance activities do not preclude the collection of prescribed samples

- Continue to refine the streamlined reporting approach as necessary, based on agency input.

/USR/ERMA1/CRU5/DGN/MAP/HOR/DPTH/C5DMP027.DGN FER OU5 3/20/96 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

- FEMP BOUNDARY
- 3900 TYPE 3 MONITORING WELL
- 2900 TYPE 2 MONITORING WELL
- 2545 TYPE 2 PRRS PIEZOMETER
- 3926 RECOVERY WELL
- PROPOSED EXTRACTION WELL LOCATION
- 20 TOTAL URANIUM CONCENTRATION CONTOUR FOR OCTOBER 1995

SCALE

800 400 0 800 FEET

FIGURE 5-1. PROPOSED LOCATIONS OF SOUTH PLUME OPTIMIZATION WELLS

Appendix A

APPENDIX A

SUMMARY OF ANALYTICAL DETECTIONS

(See disk in front pocket of binder)

VALIDATION QUALIFIERS

J — These data are considered quantitatively estimated, and may be biased due to effects reflected in the associated quality control results. Analyte identification is reliable, however, and EPA guidance allows the use of "J" qualified data to be used in baseline evaluation of risk assessment as well as nature and extent of contamination. This qualifier is also applied to organic data when the actual result is less than the contract required detection limit; these data are also considered quantitatively estimated. "J" may carry additional meaning when used in radiochemical validation; the Data Validation Summary Report further defines the use of this qualifier.

NV — These data are not validated. Reasons for nonvalidation can be found in the Data Validation Summary Report associated with the data set. These data cannot be used in risk assessment evaluation.

-(dash) — A dash (-) indicates that the result is CONFIDENT AS REPORTED; the validator did NOT assign any of the above qualifiers to the positive result. (NOTE: When an undetected result is not further qualified, the validator will still enter the "U" qualifier in the qualifier column.)

U — Data that were observed at levels less than the corresponding limit of detection were qualified as U, meaning not detected above the associated value. This qualifier is assigned by the laboratory, and it was also used as a validation qualifier when common field or laboratory blank contaminants were detected in a sample less than action level as defined by the validation criteria. For nature and extent, the U qualifier establishes the lowest concentration of an analyte that can confidently be defined as nondetect. If an analyte was not detected in a certain media of a specific waste area, the calculation for concentration source terms did not include one-half the sample quantitation limits. Like the laboratory qualifier U, one-half of the sample quantitation limit has been used as a surrogate in calculating the concentration term in risk calculations.

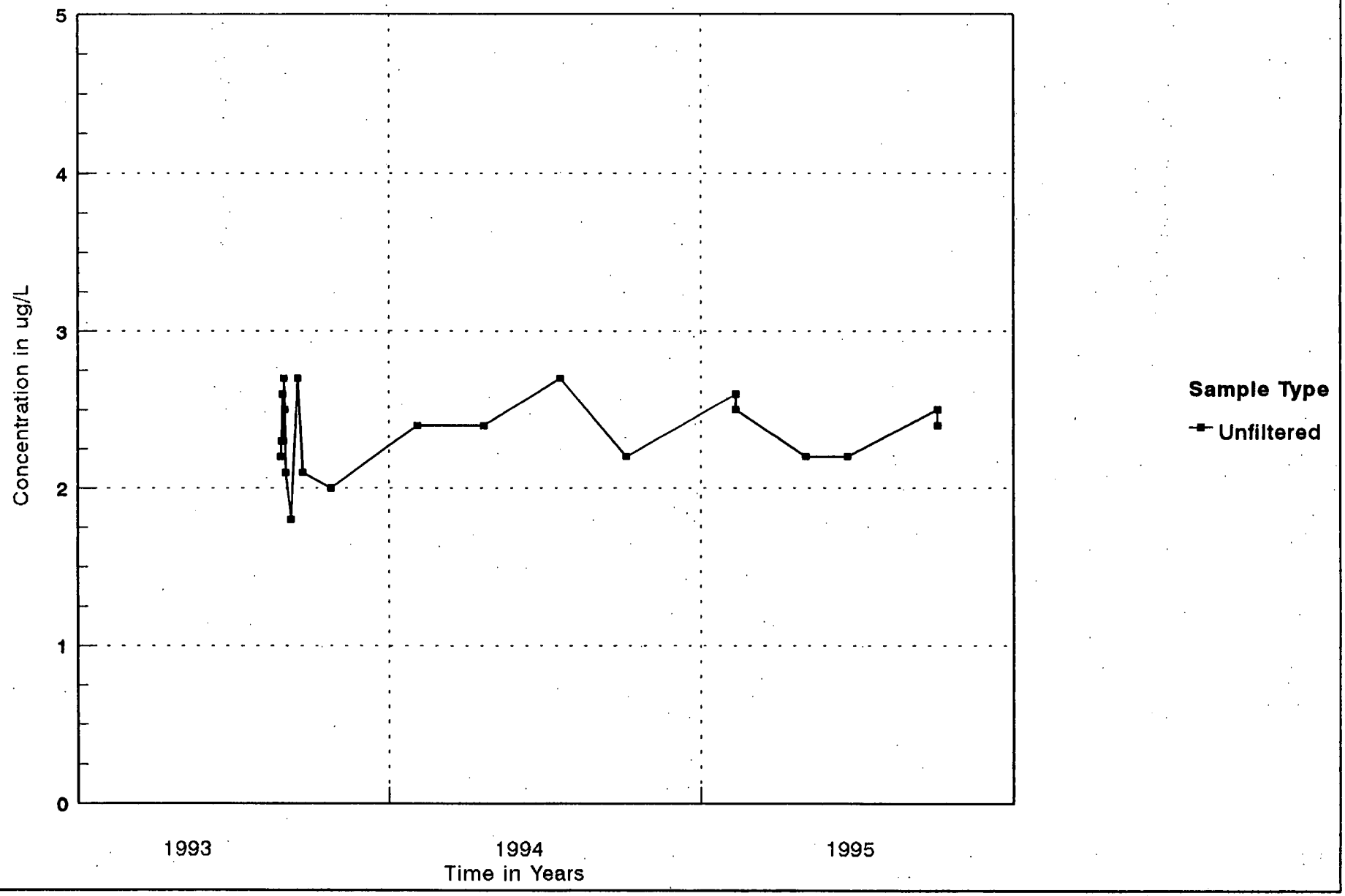
UJ — Data that were quantitatively estimated at levels less than the corresponding limit of detection.

Appendix B

APPENDIX B

CONCENTRATION PLOTS
FOR DMEPP MONITORING AND RECOVERY WELLS

(Data are for total uranium from unfiltered samples)



Monitoring Well 2002 Uranium Concentration

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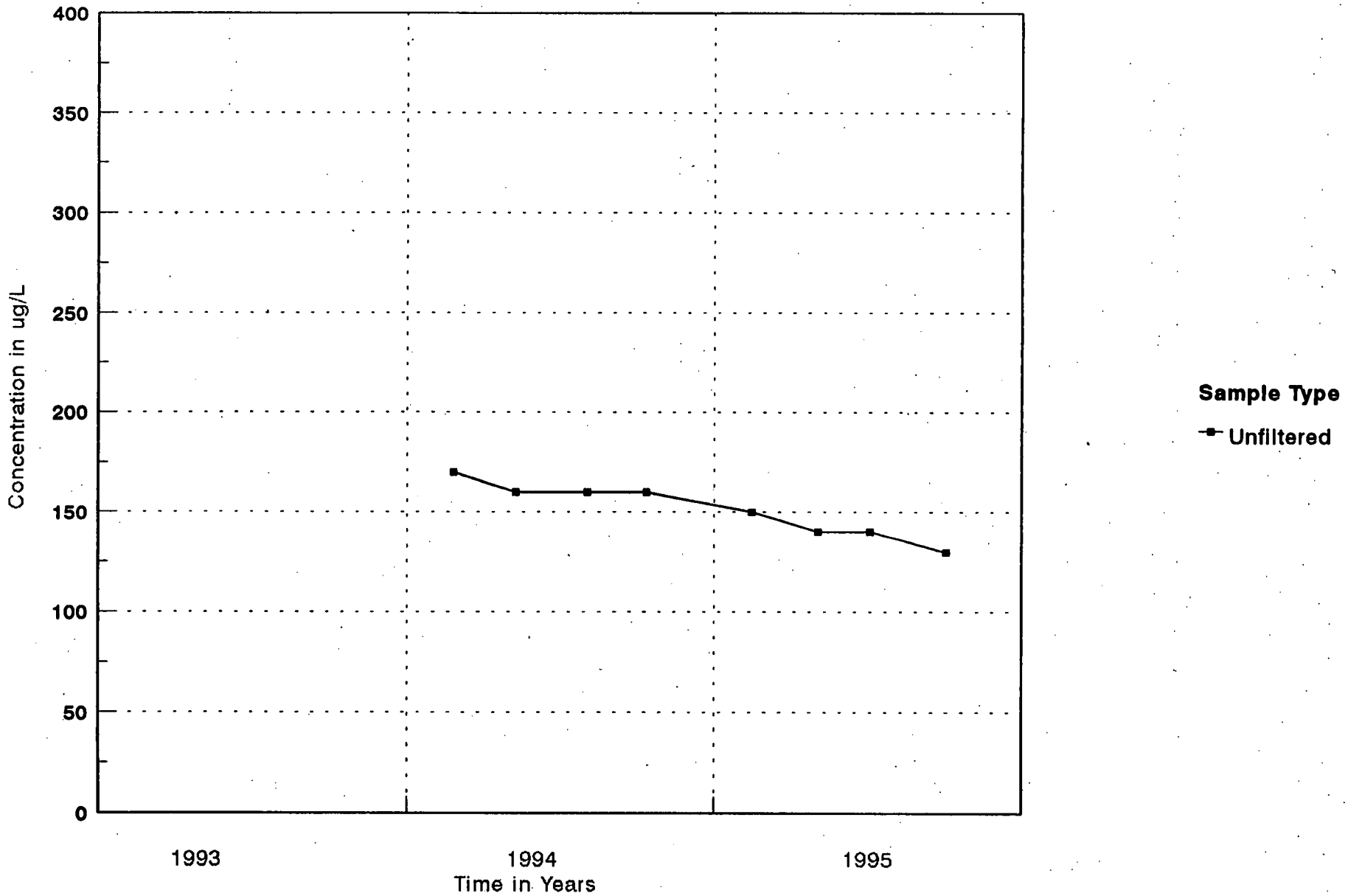
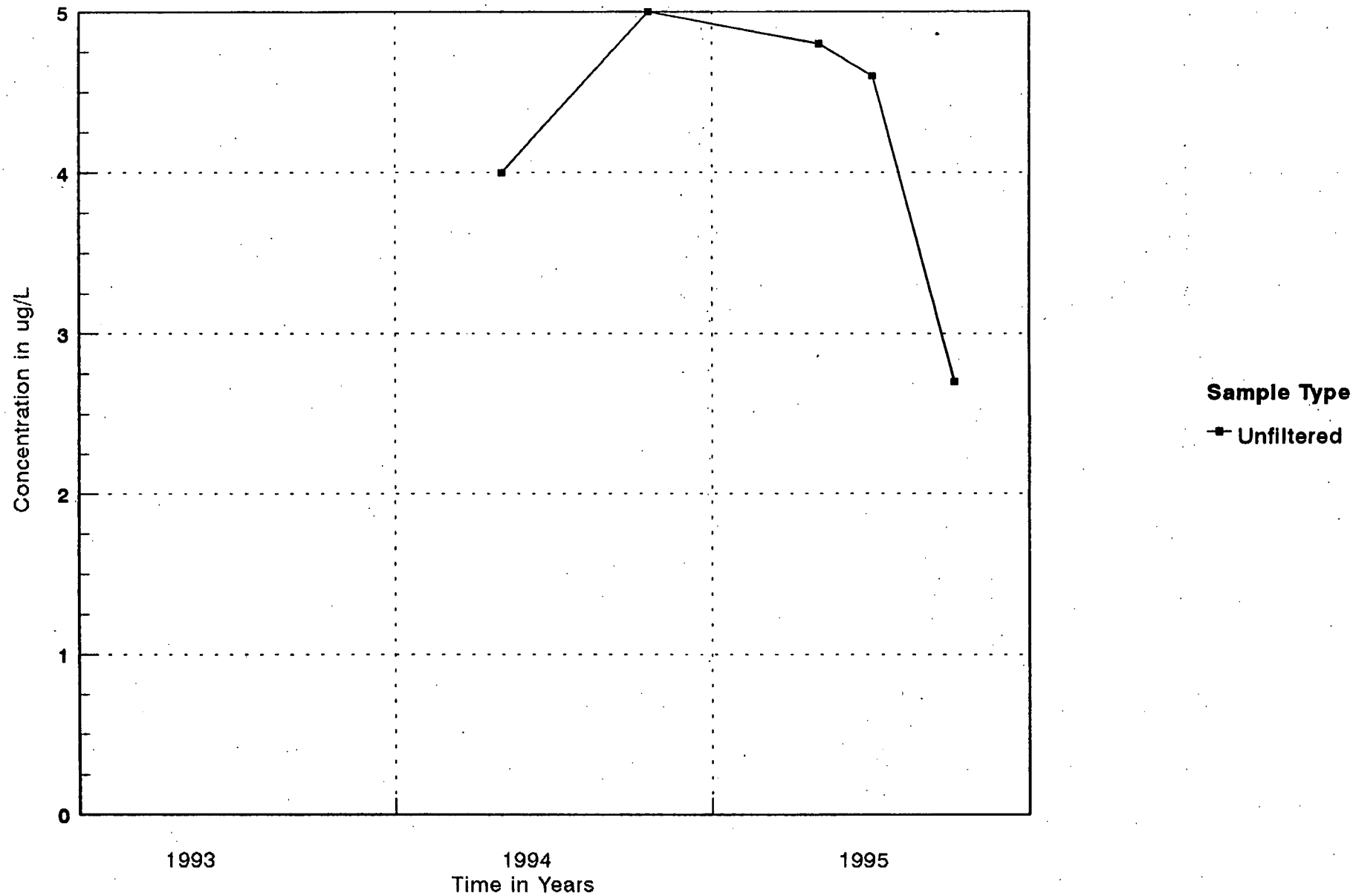


Monitoring Well 2015 Uranium Concentration



Monitoring Well 2017 Uranium Concentrations

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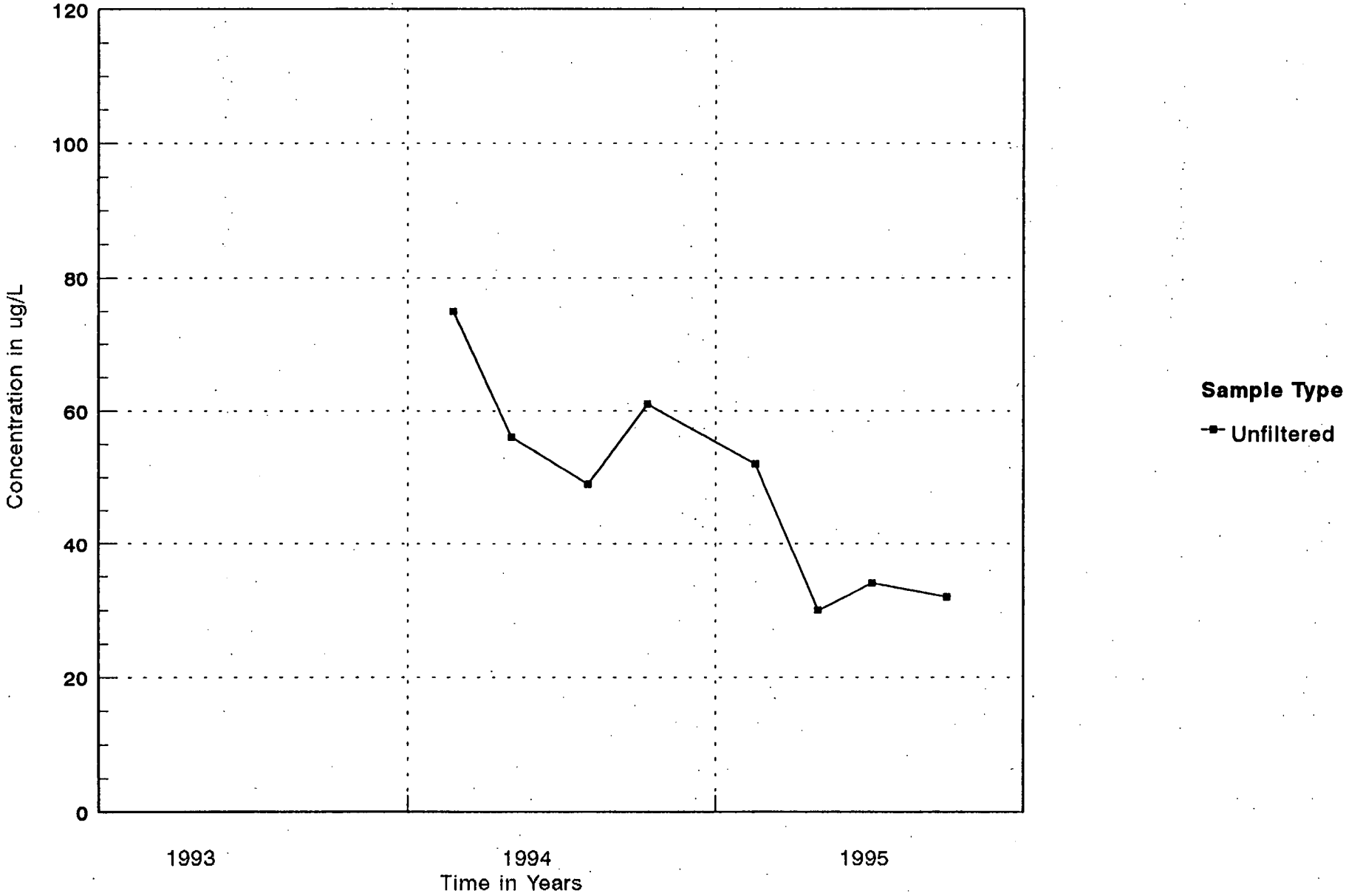
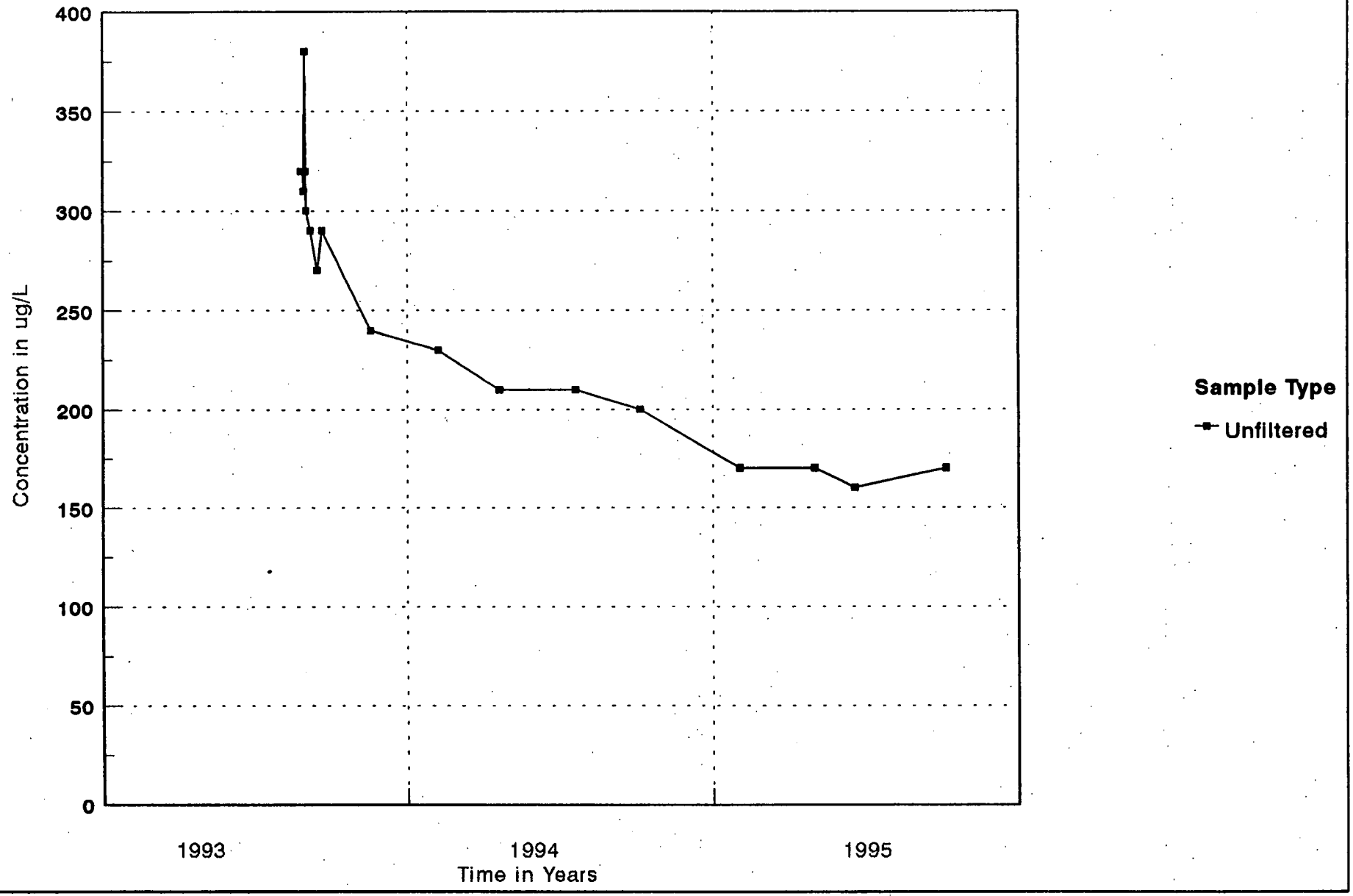


Monitoring Well 2060 Uranium Concentration



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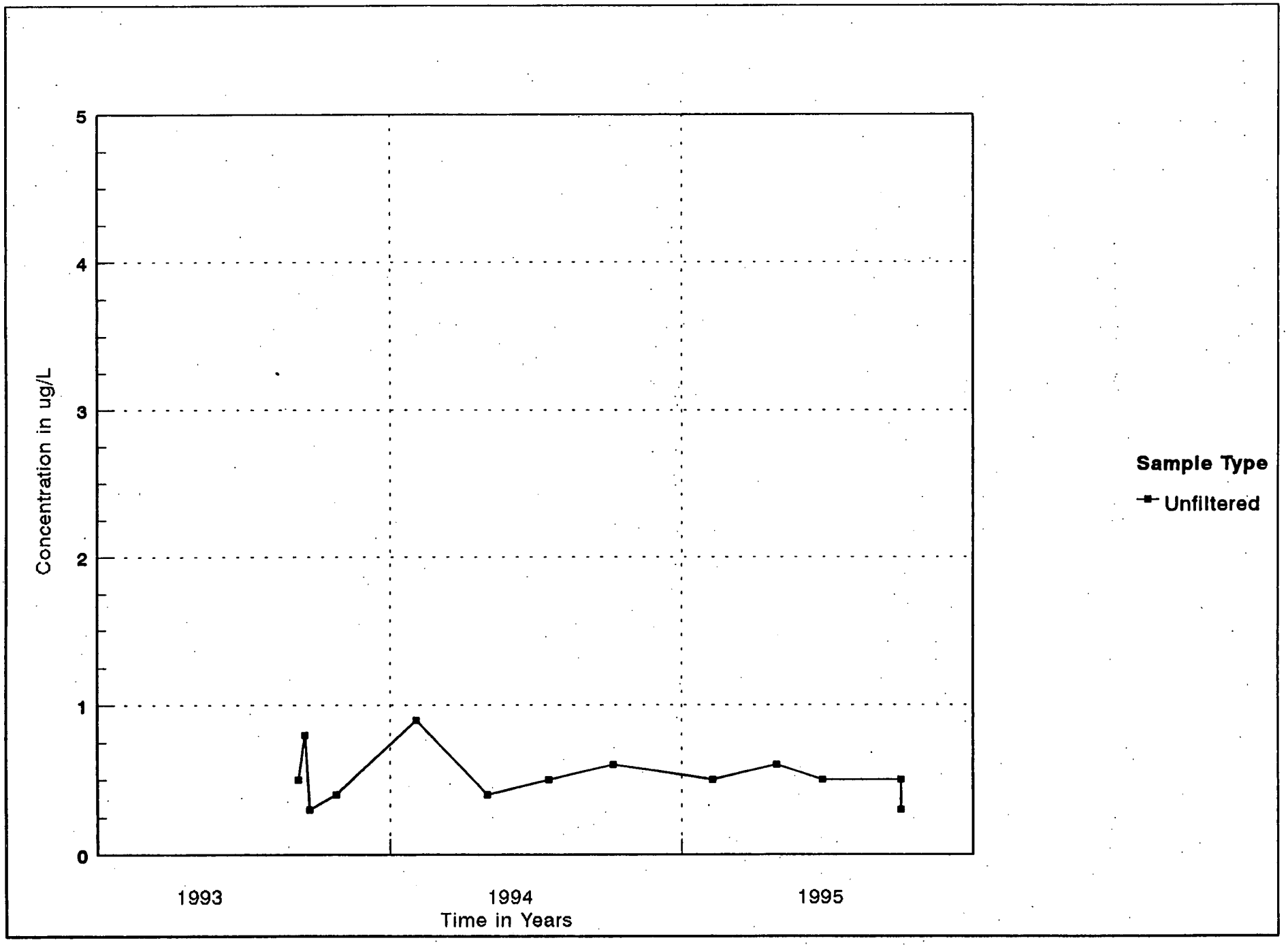
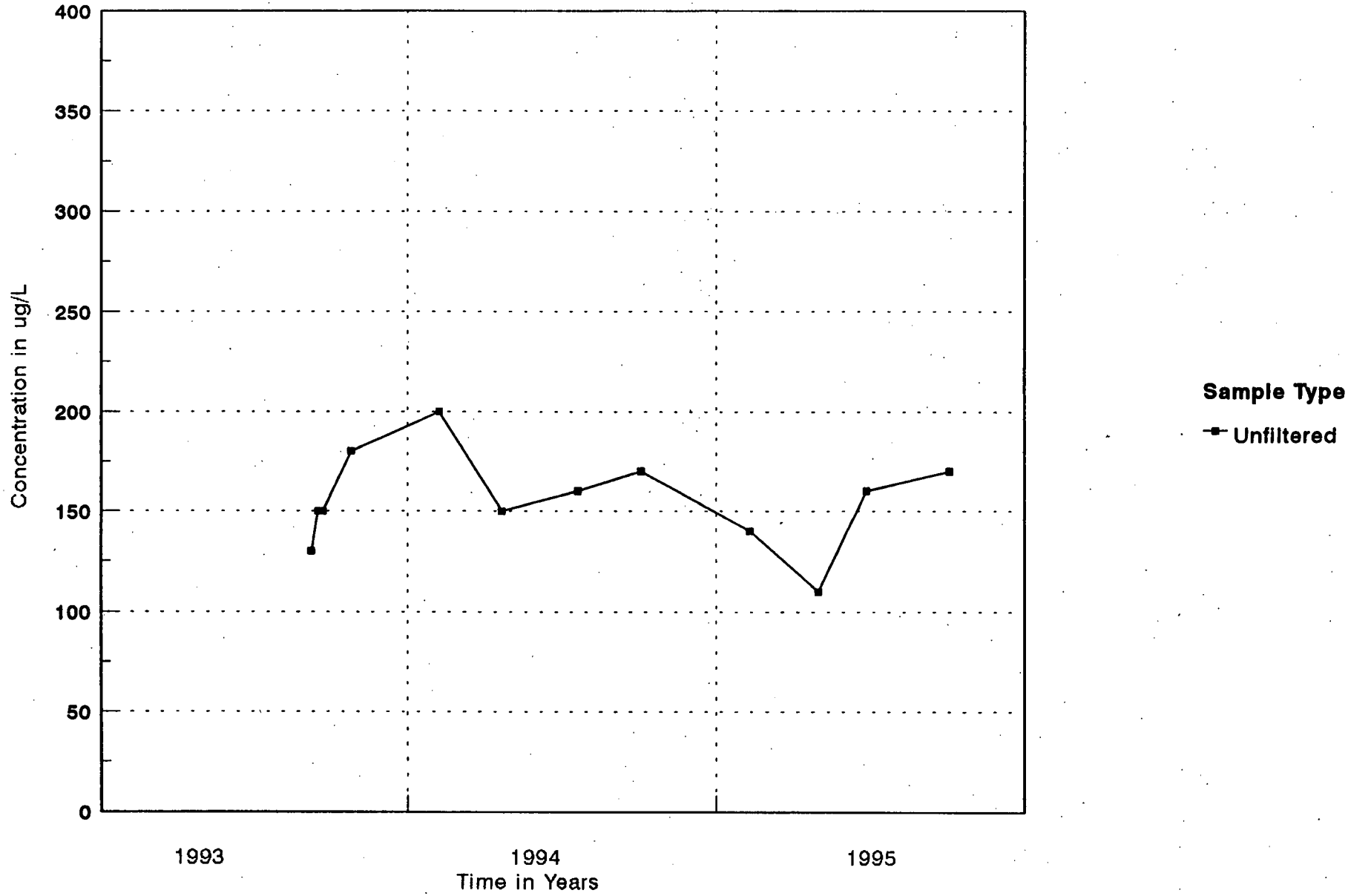


Monitoring Well 2093 Uranium Concentrations



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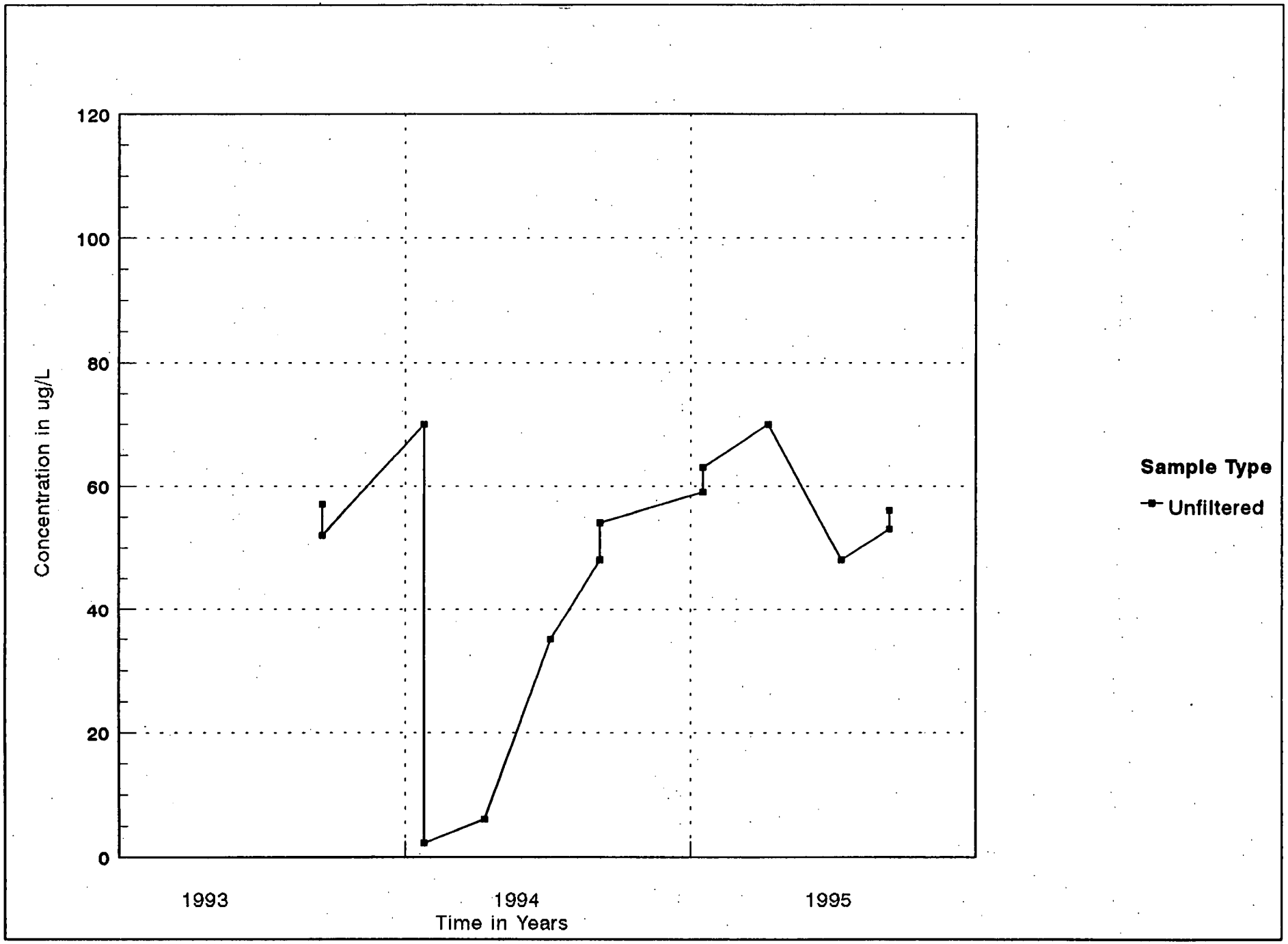
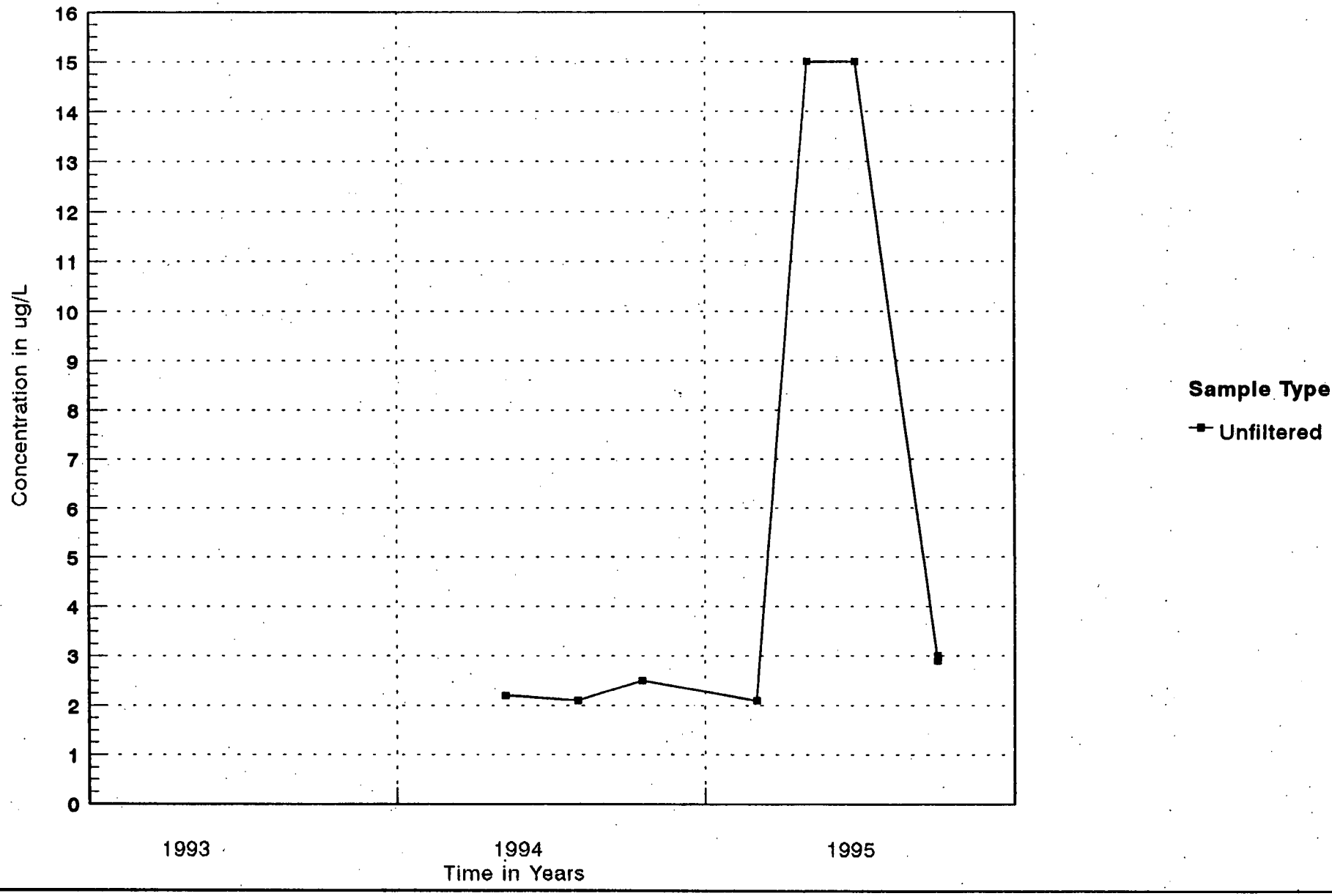


Monitoring Well 2106 Uranium Concentration



Monitoring Well 21063 Uranium Concentration

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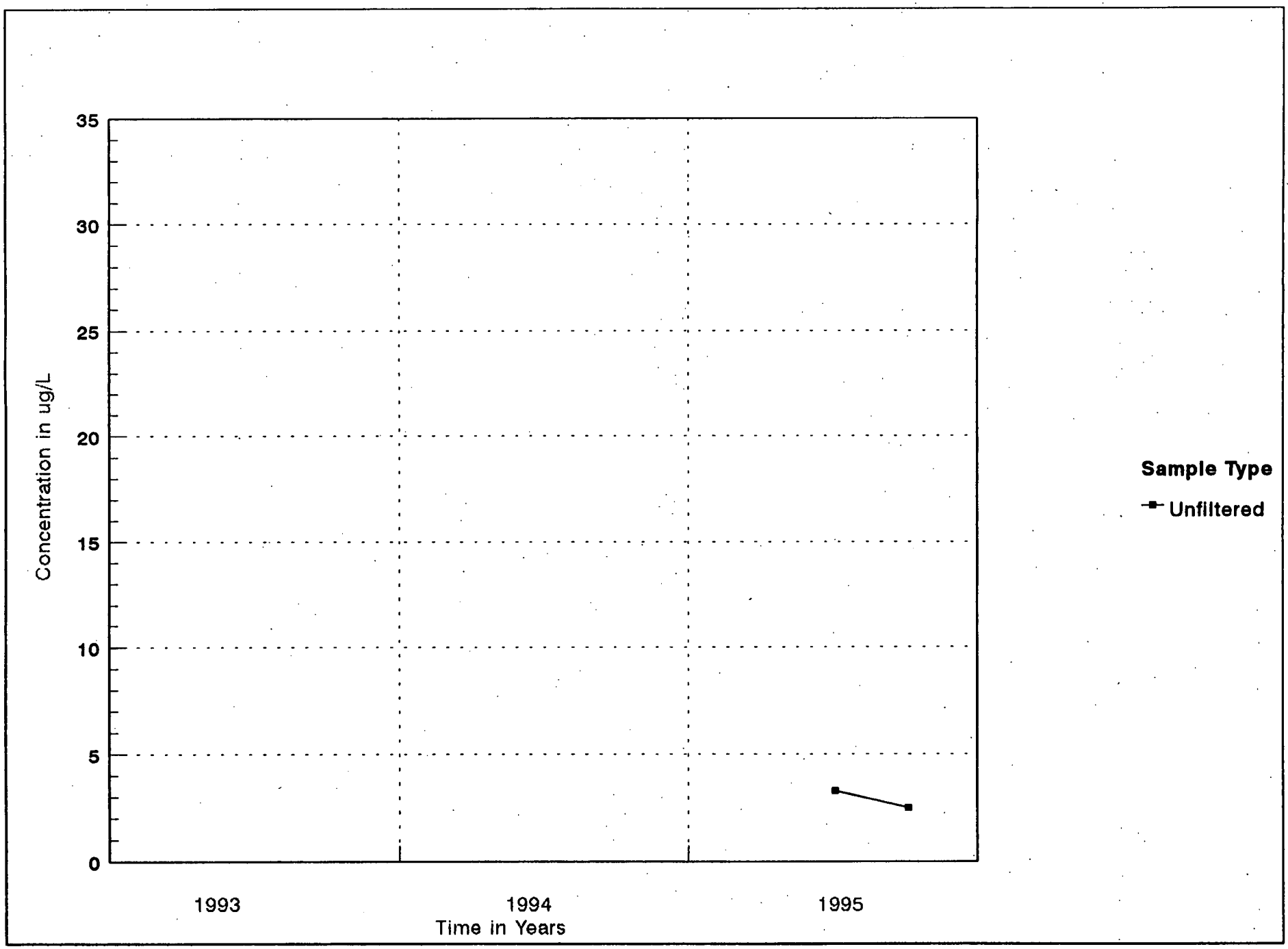

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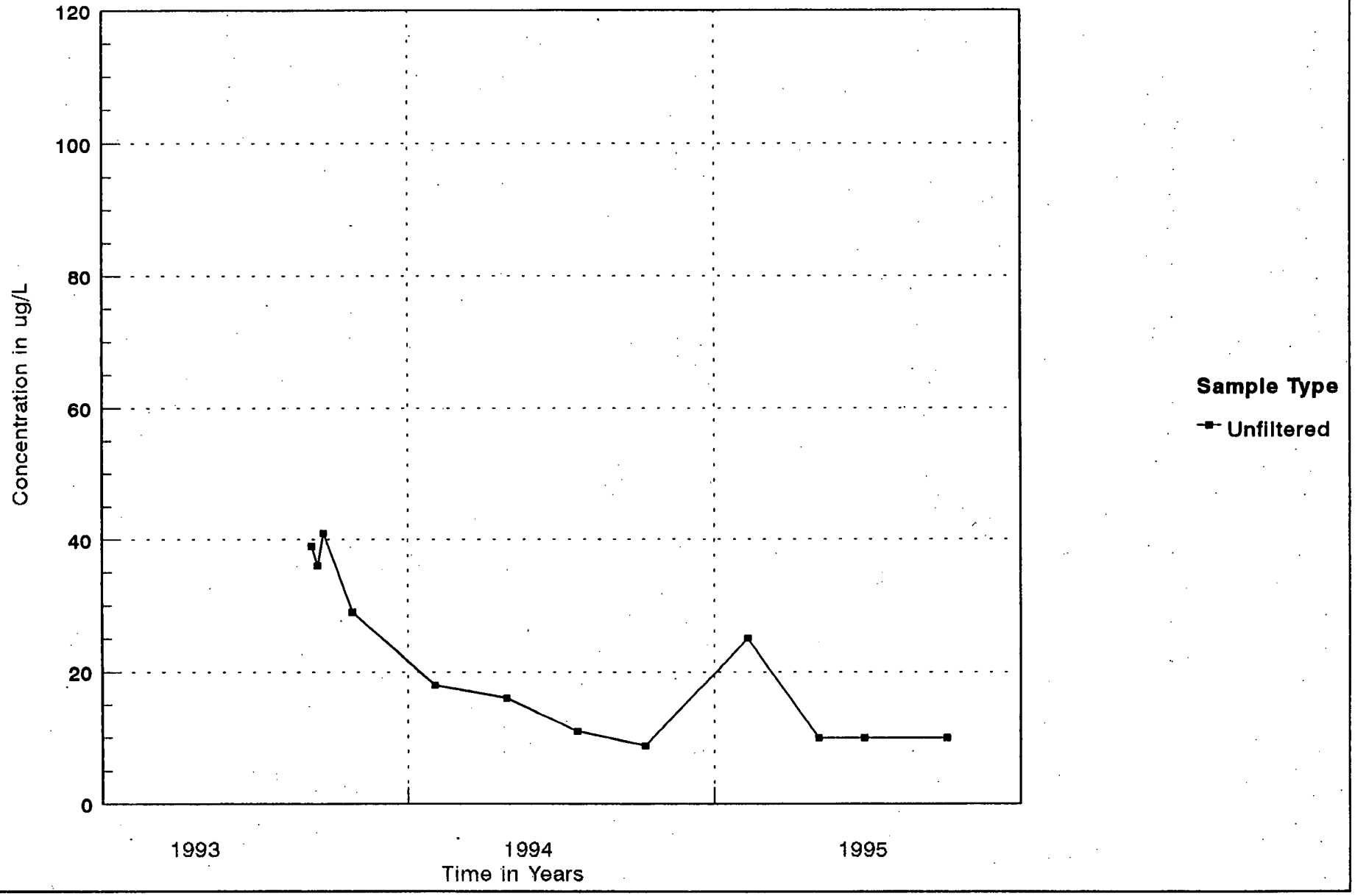

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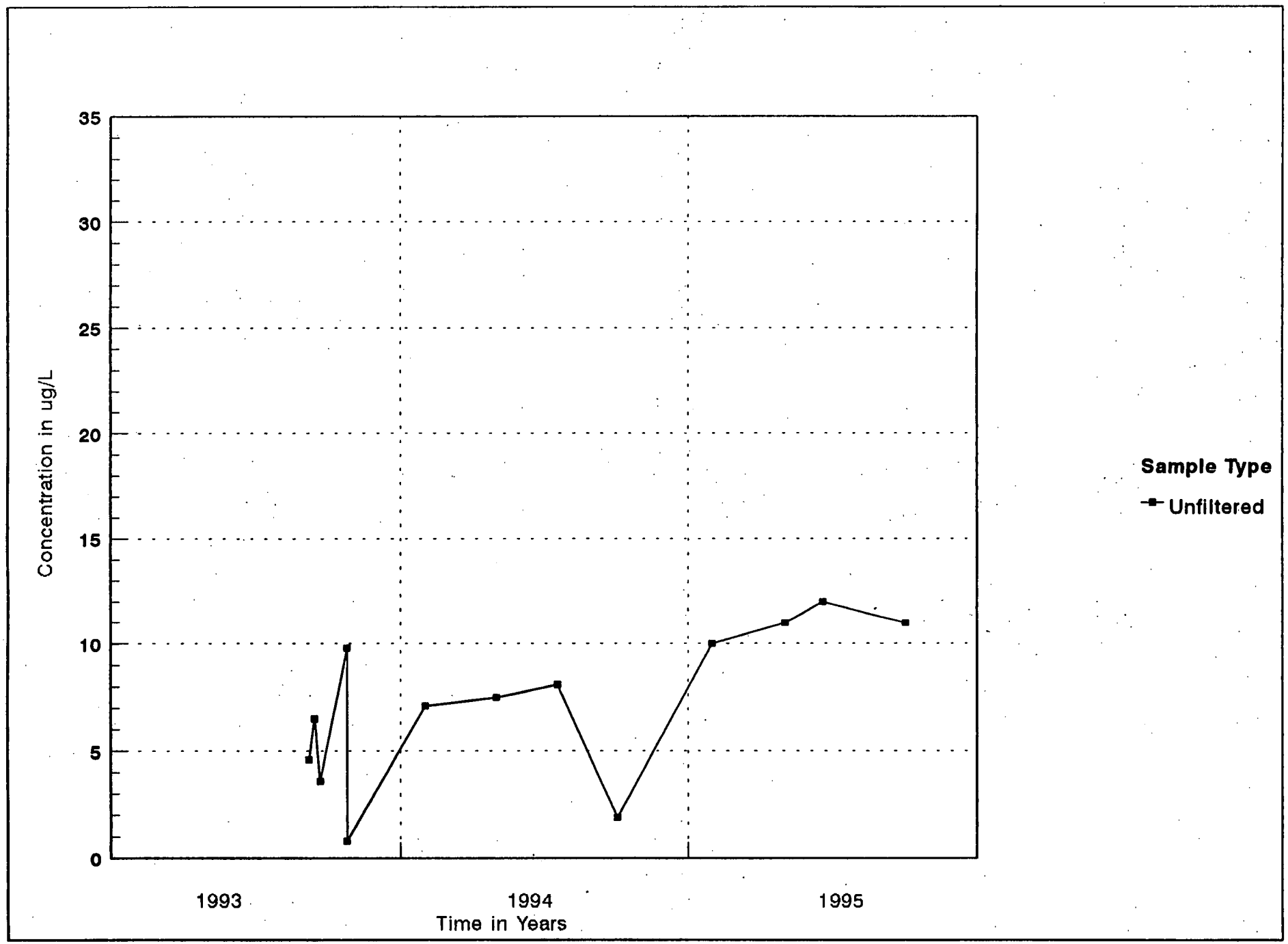

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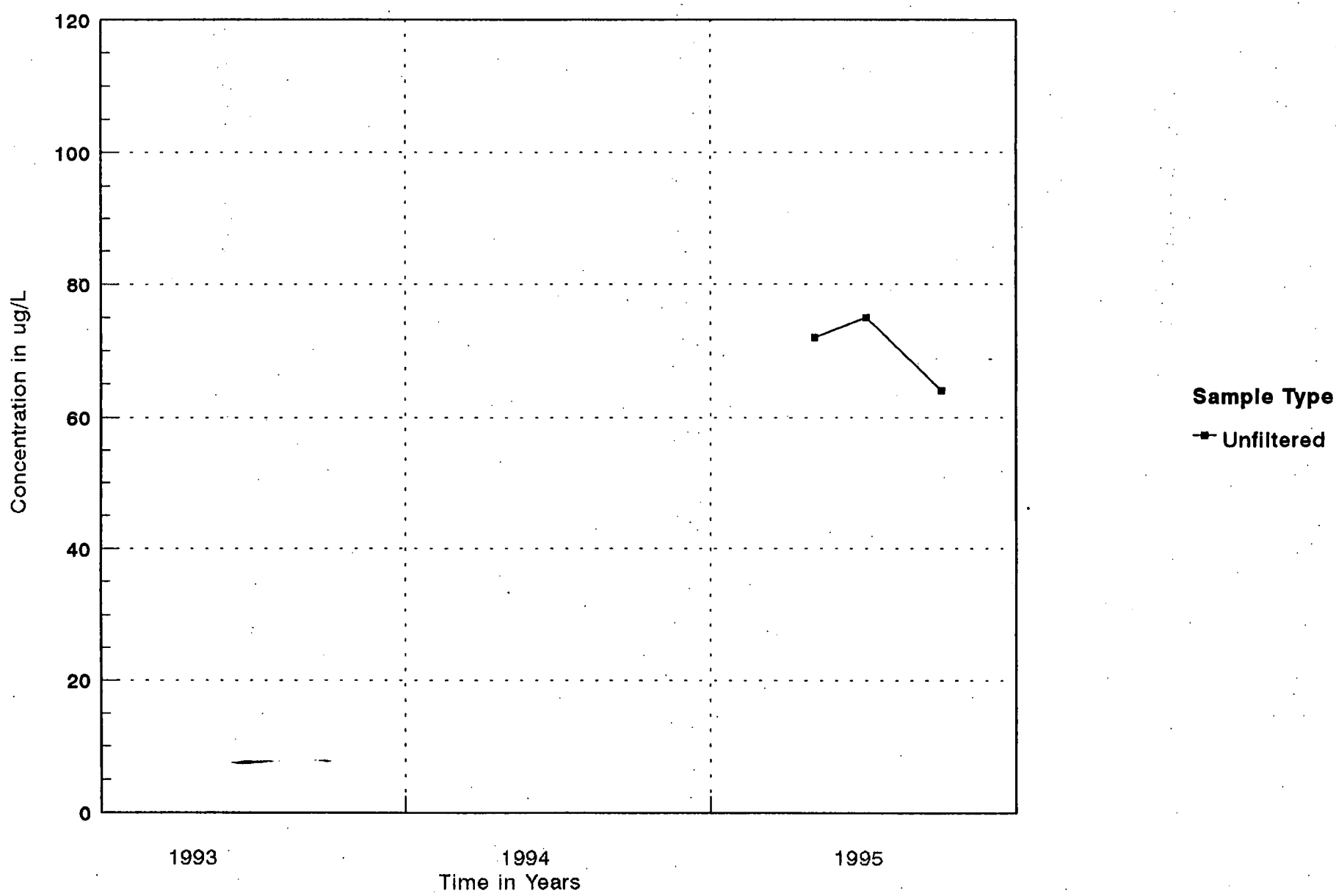

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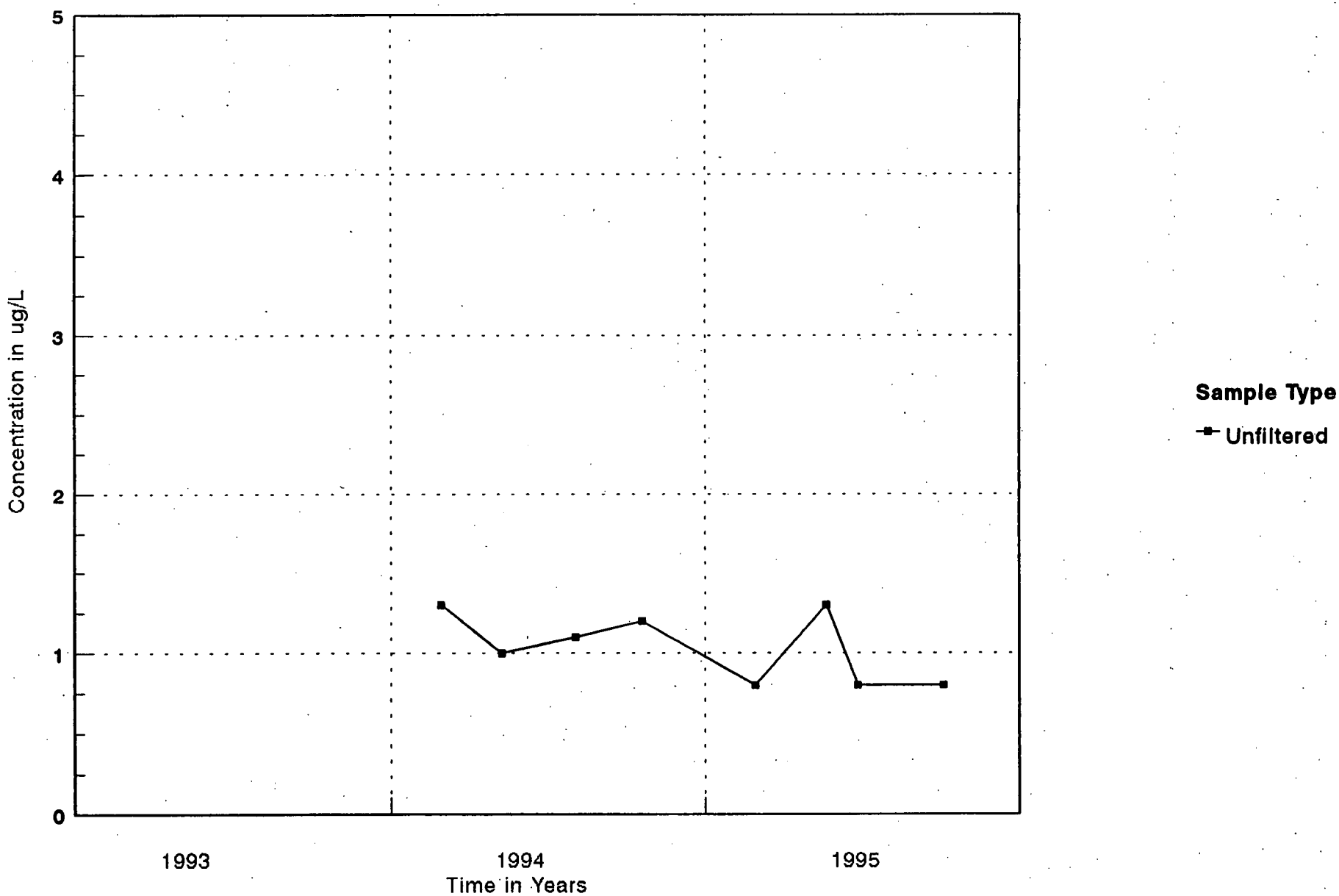

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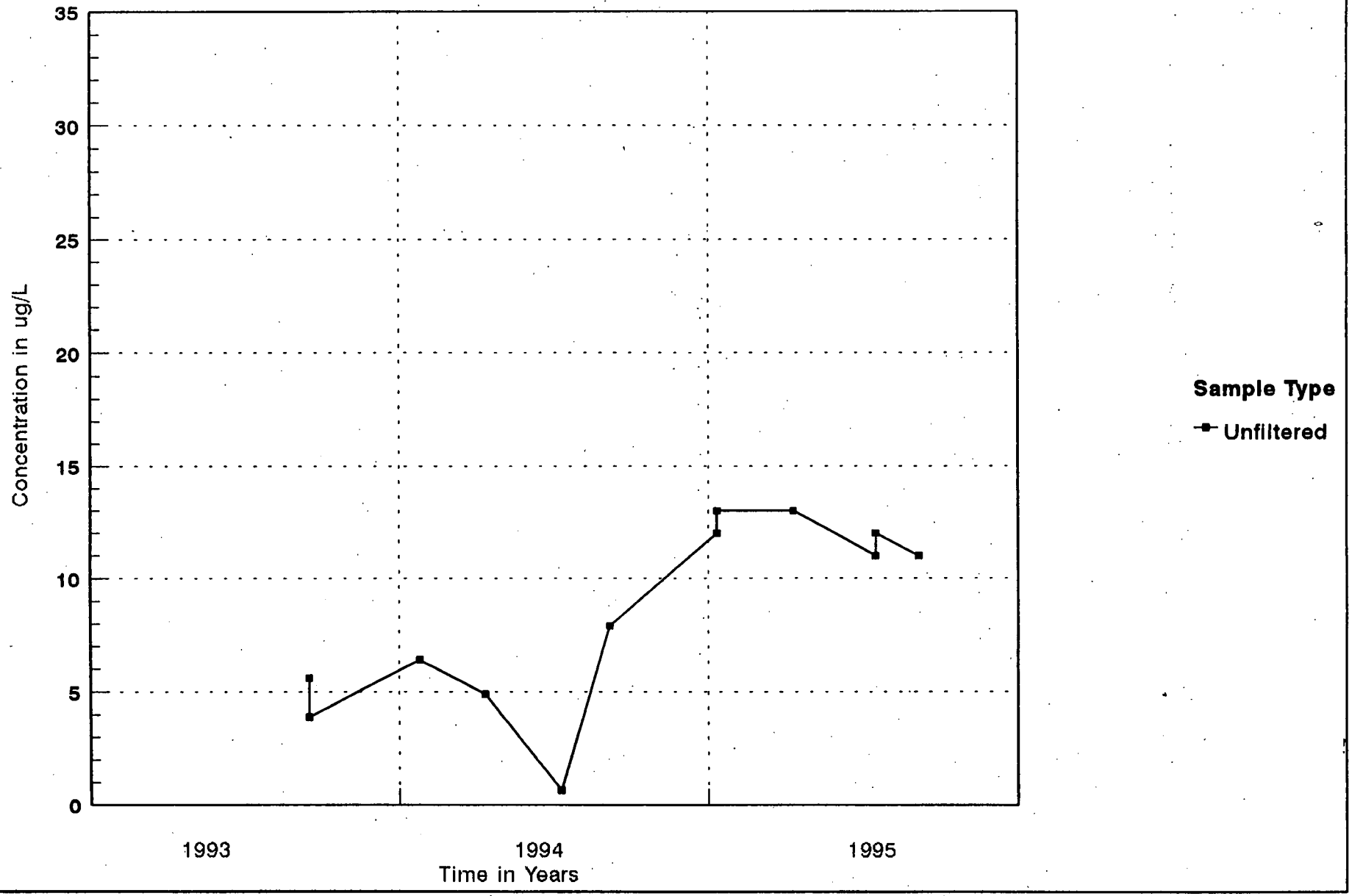

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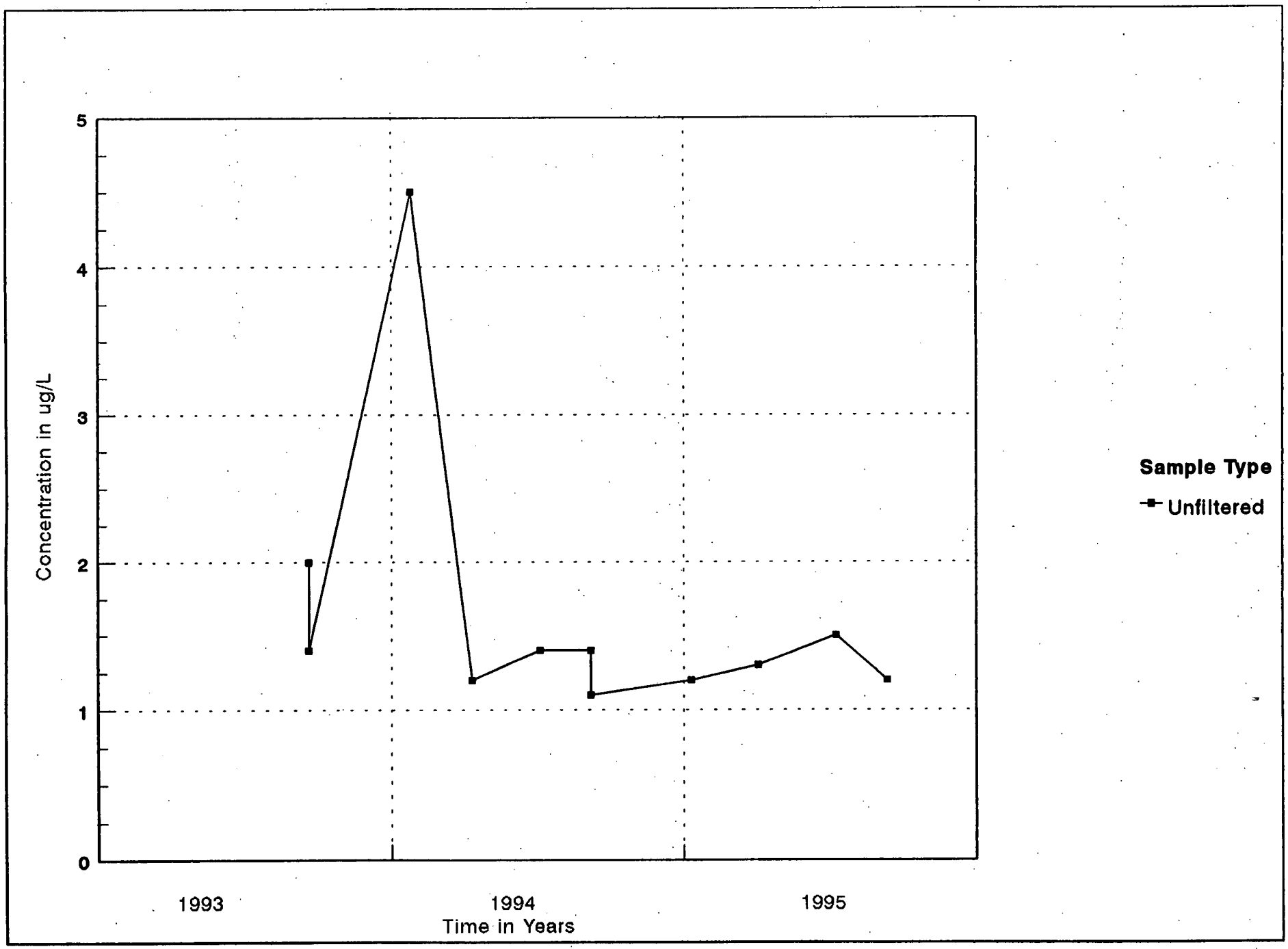

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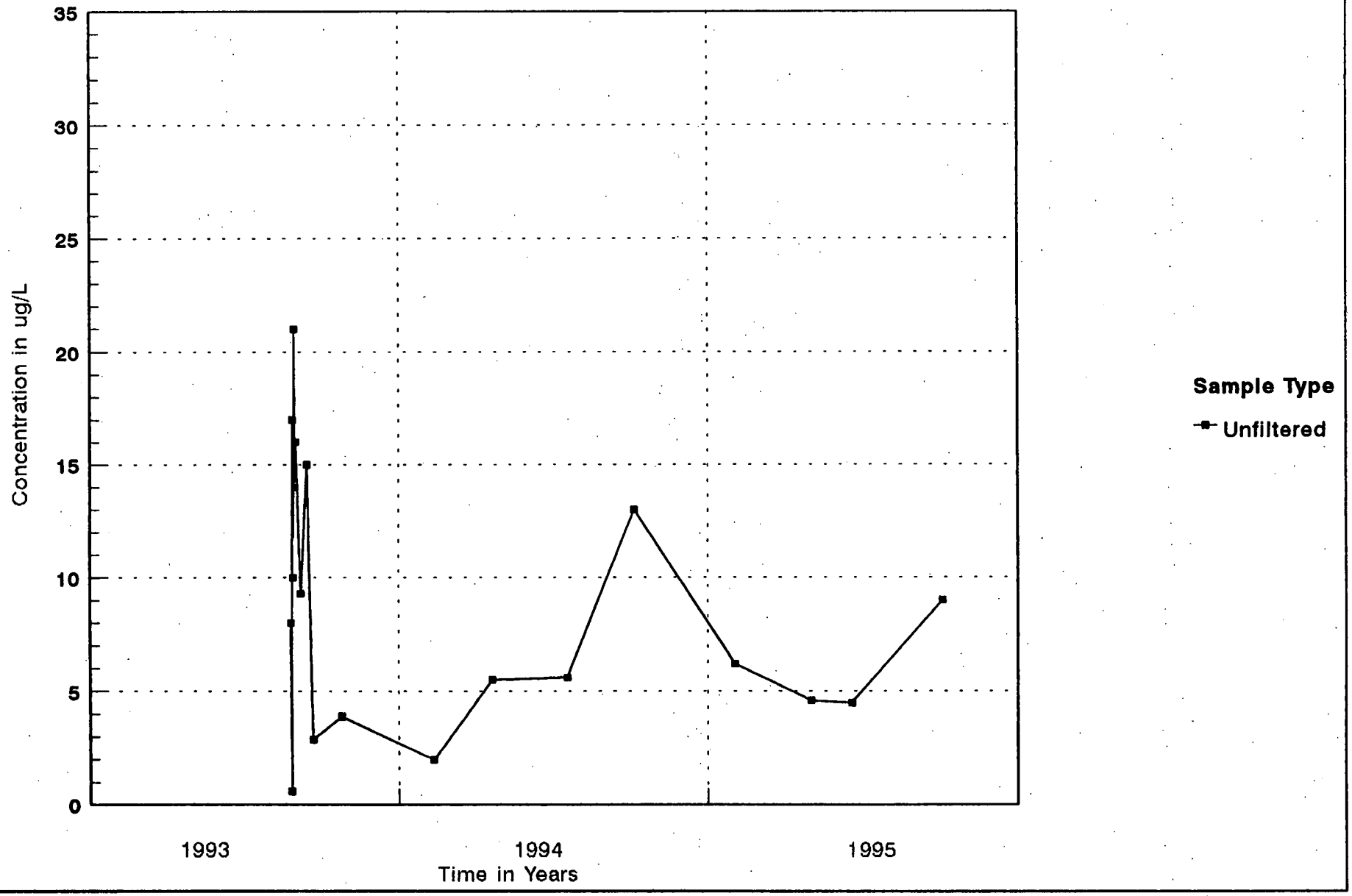

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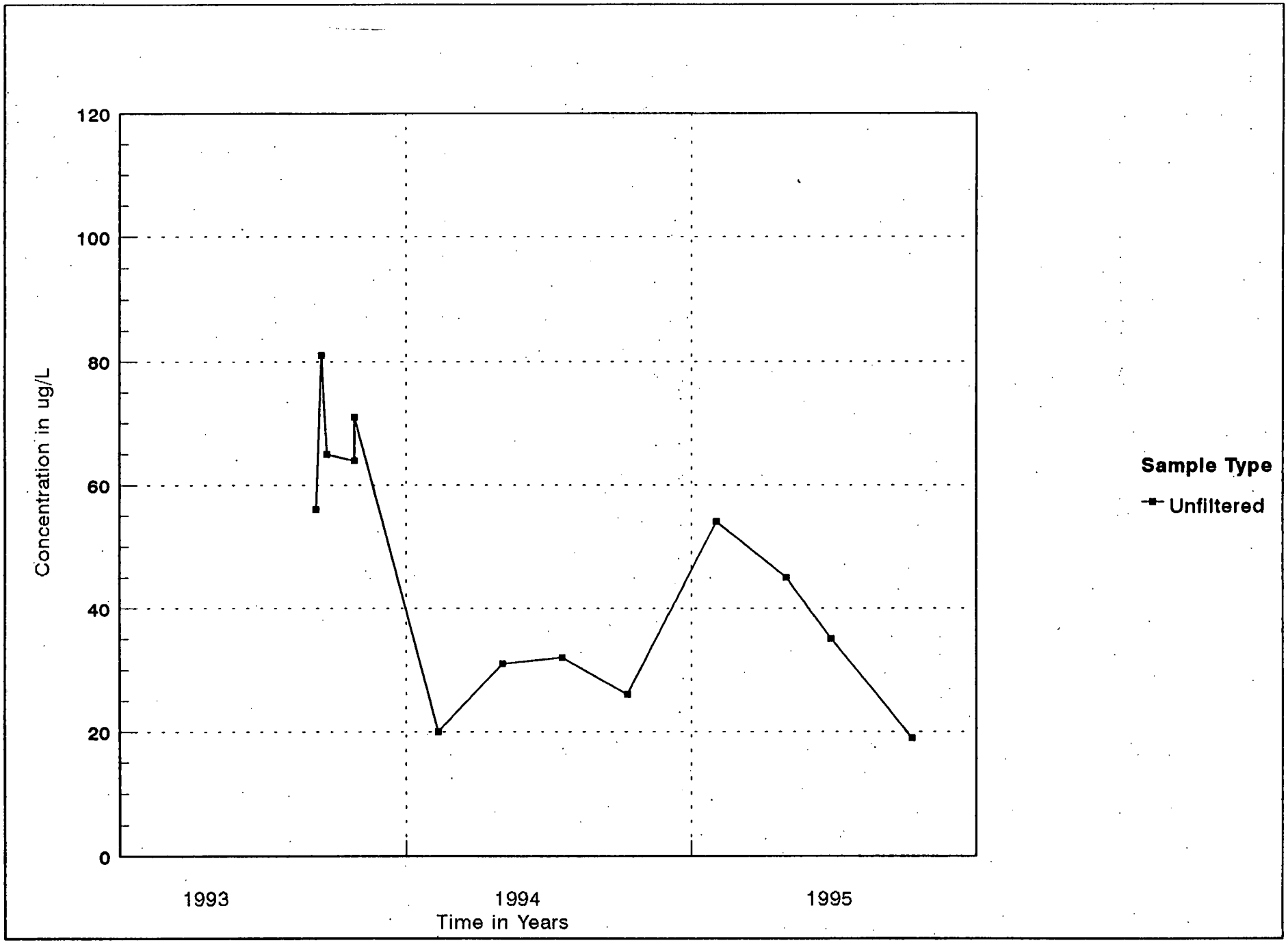

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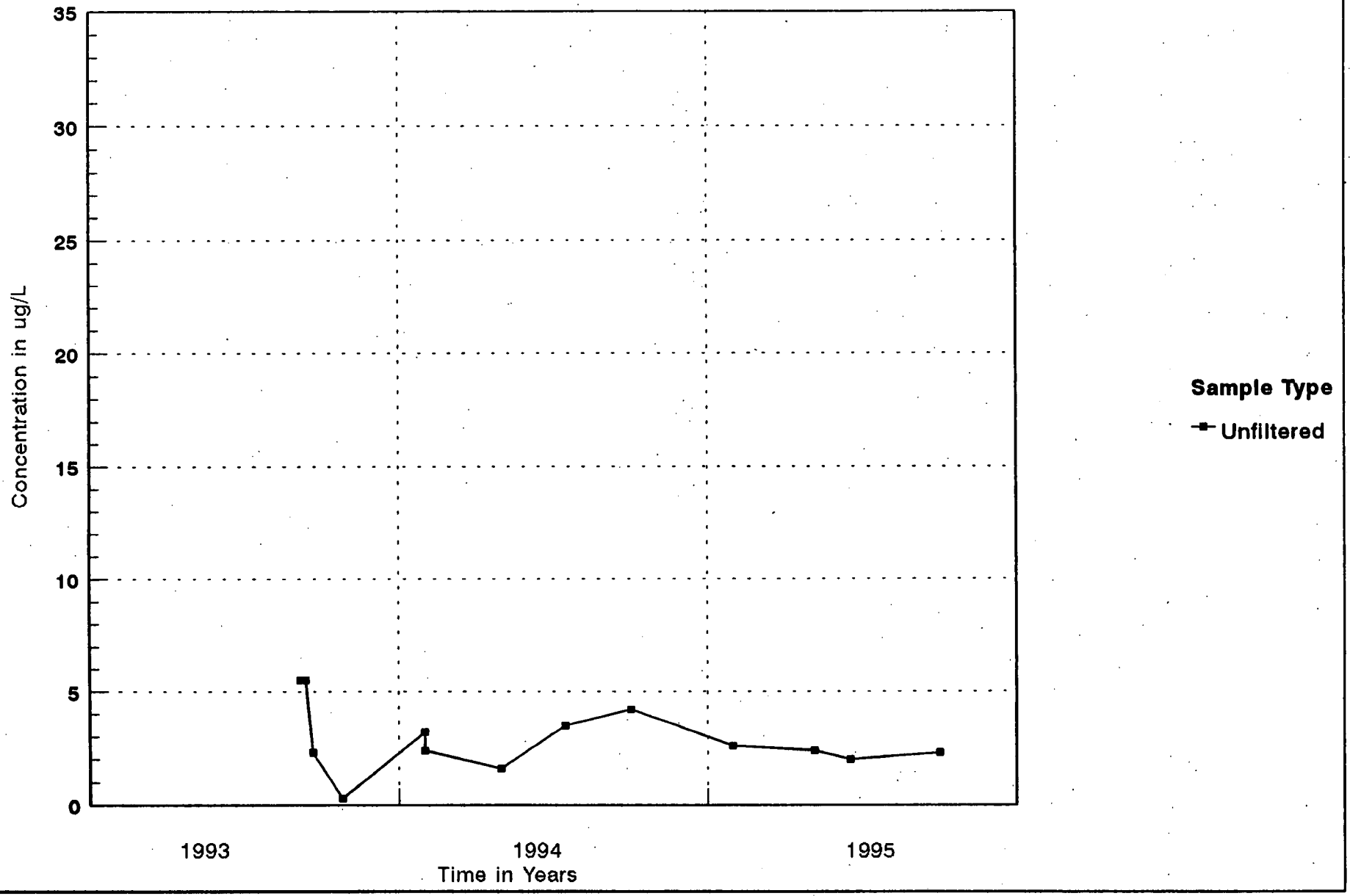

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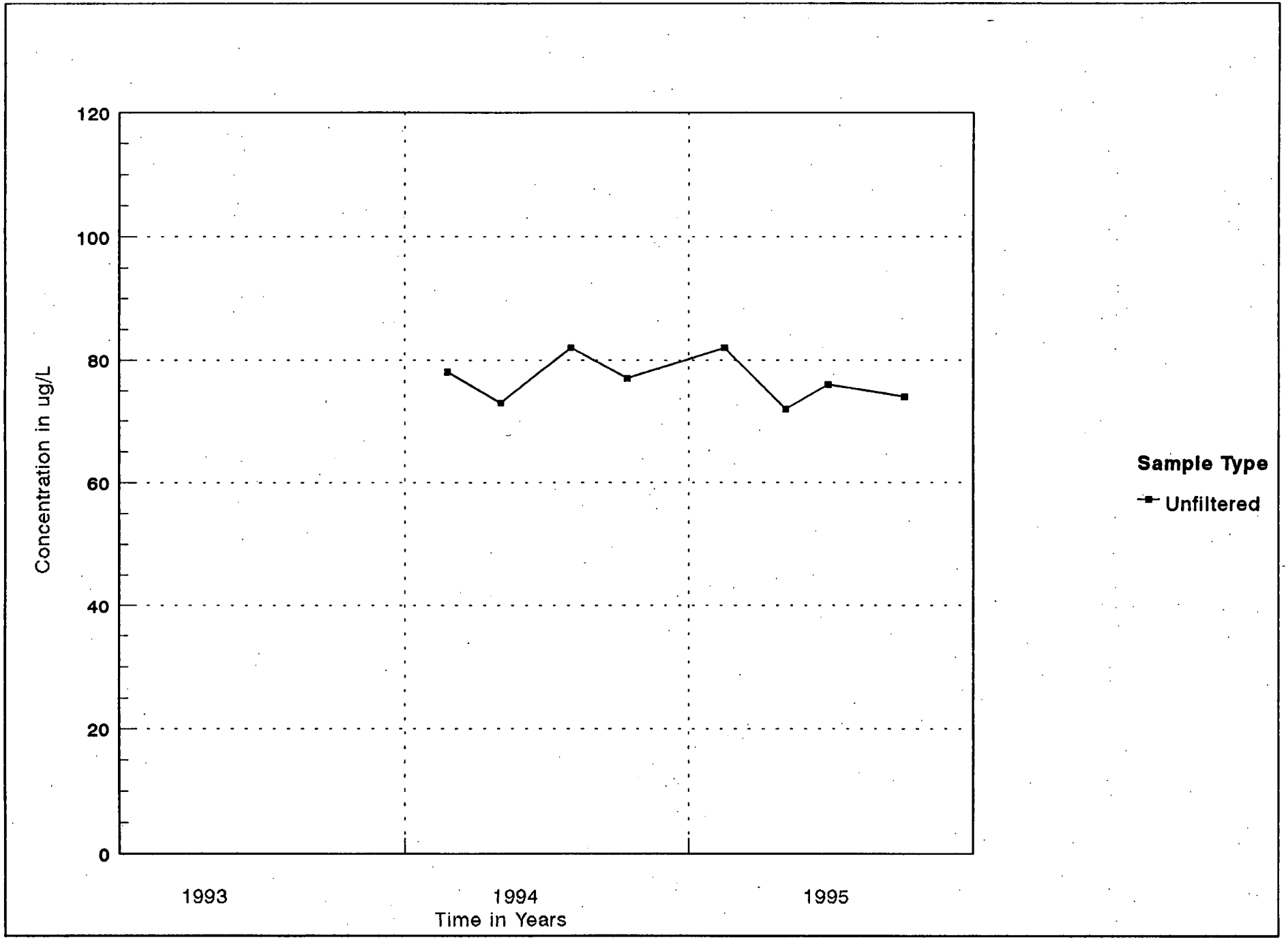

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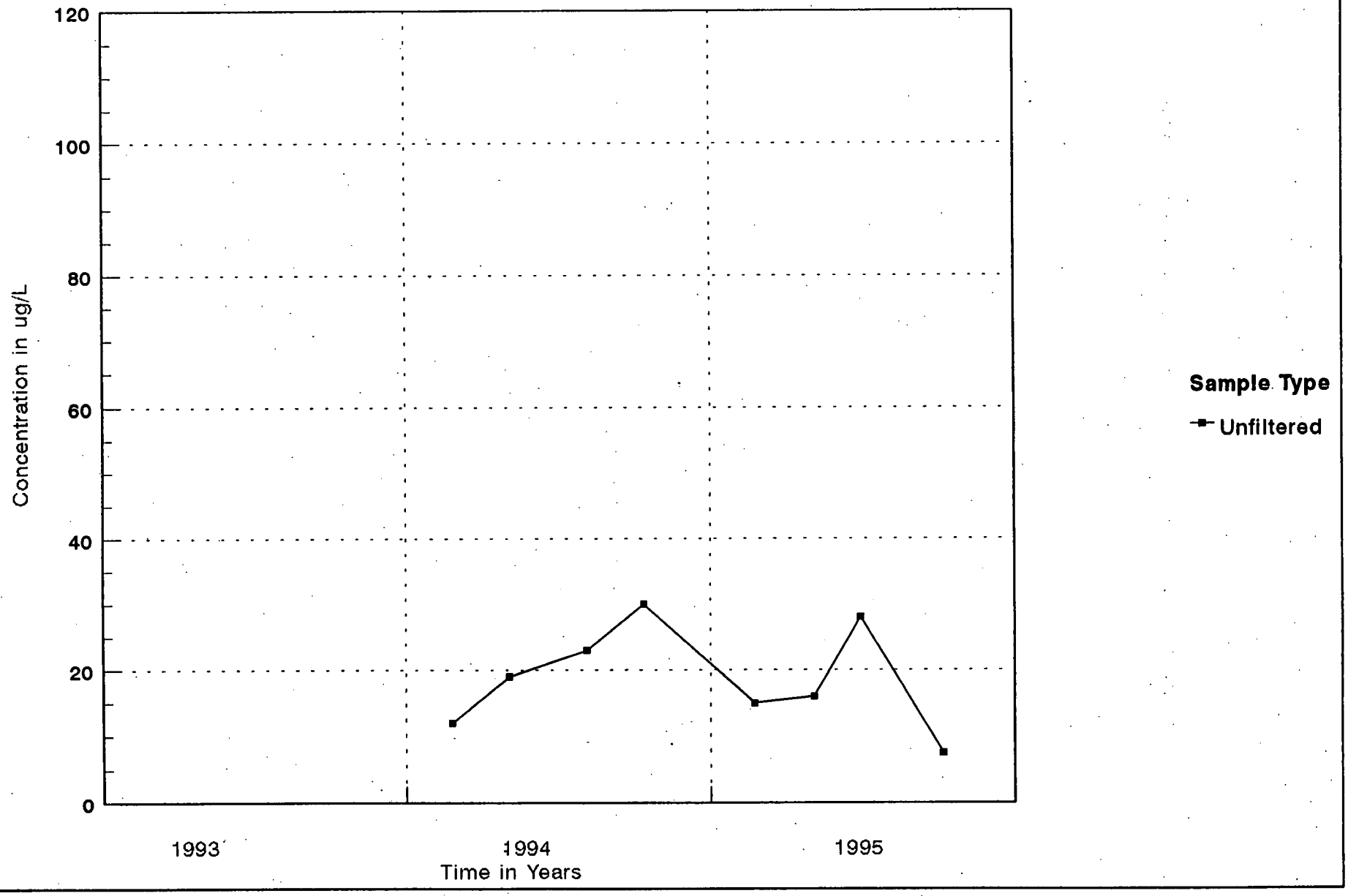

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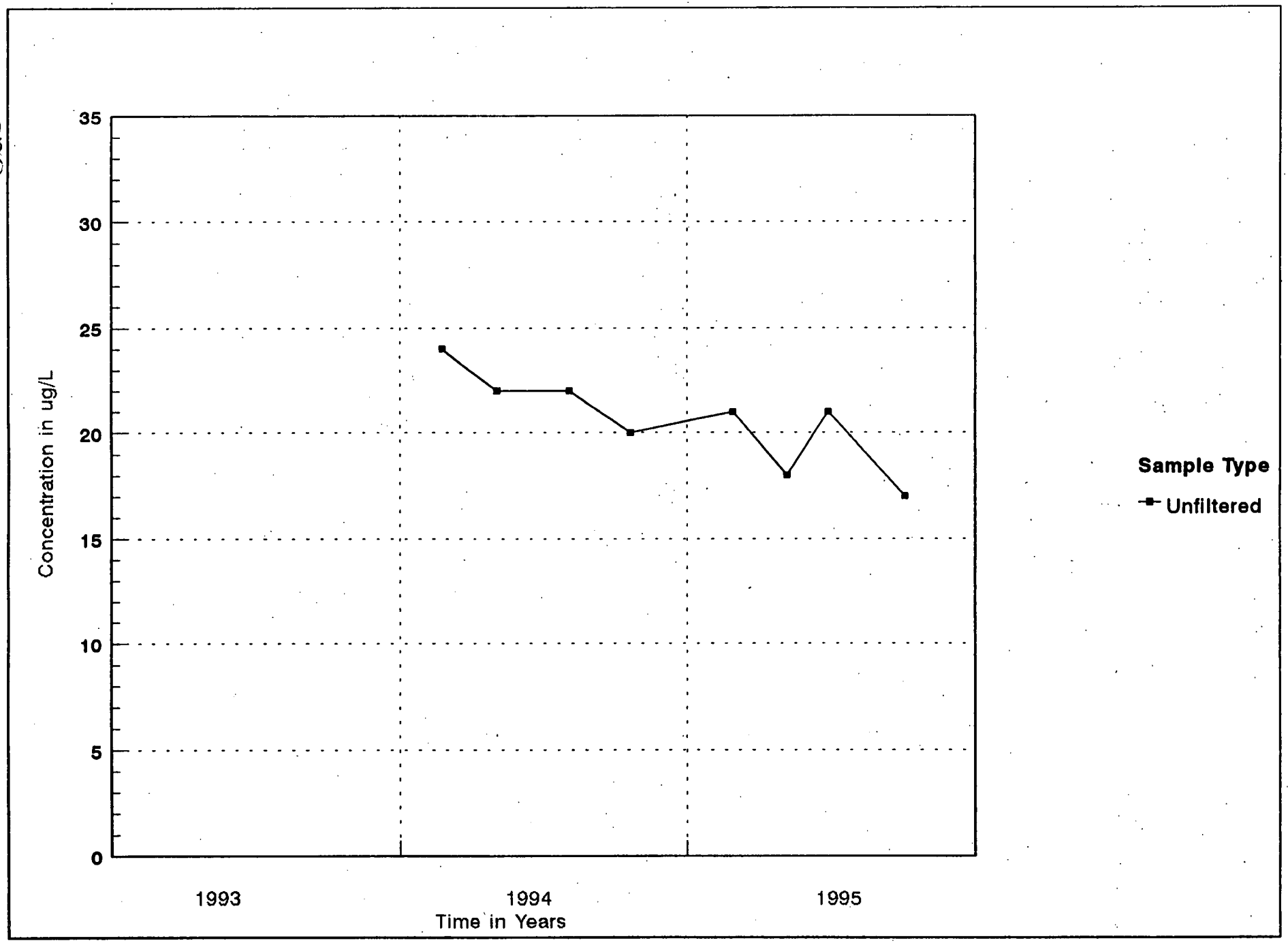

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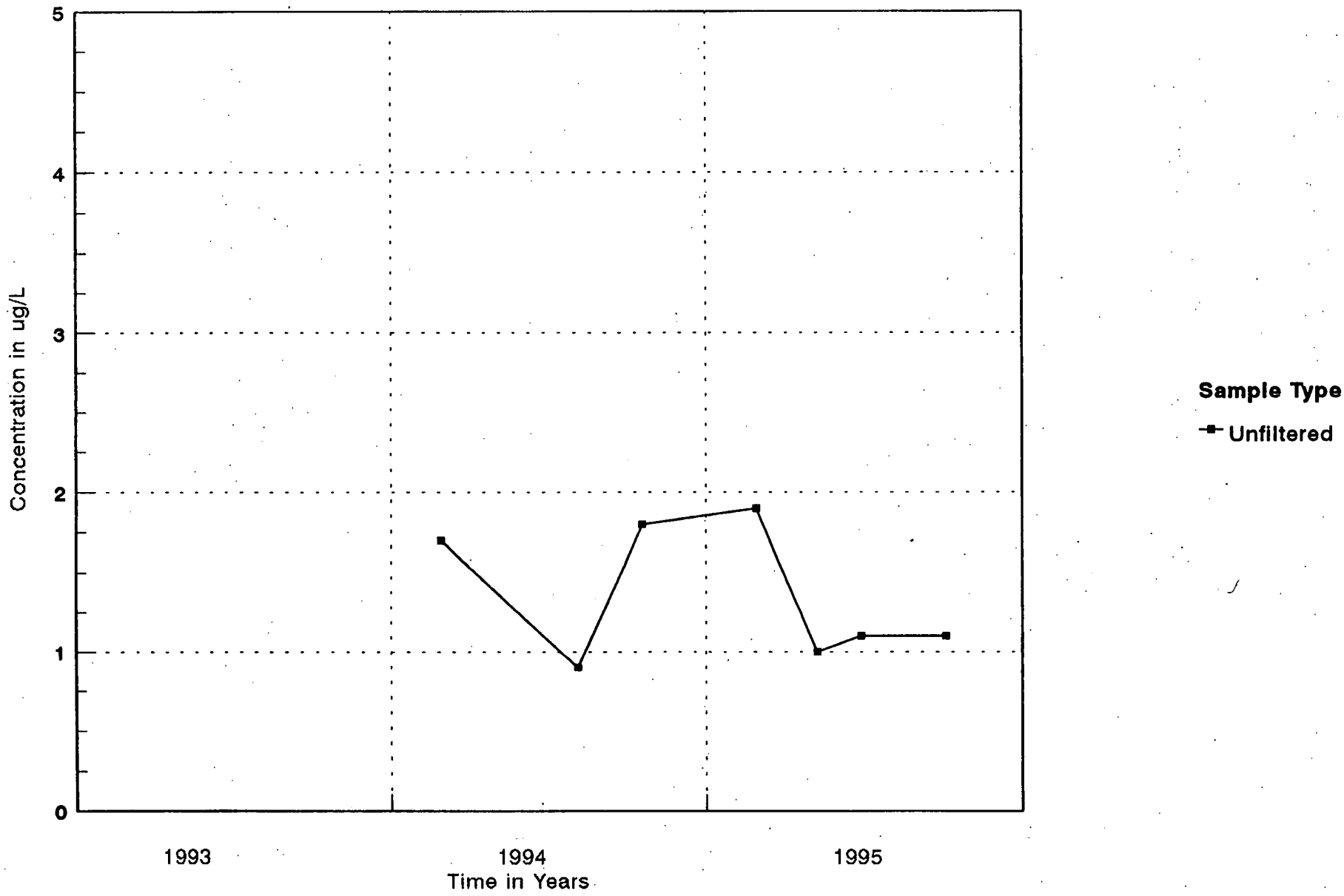

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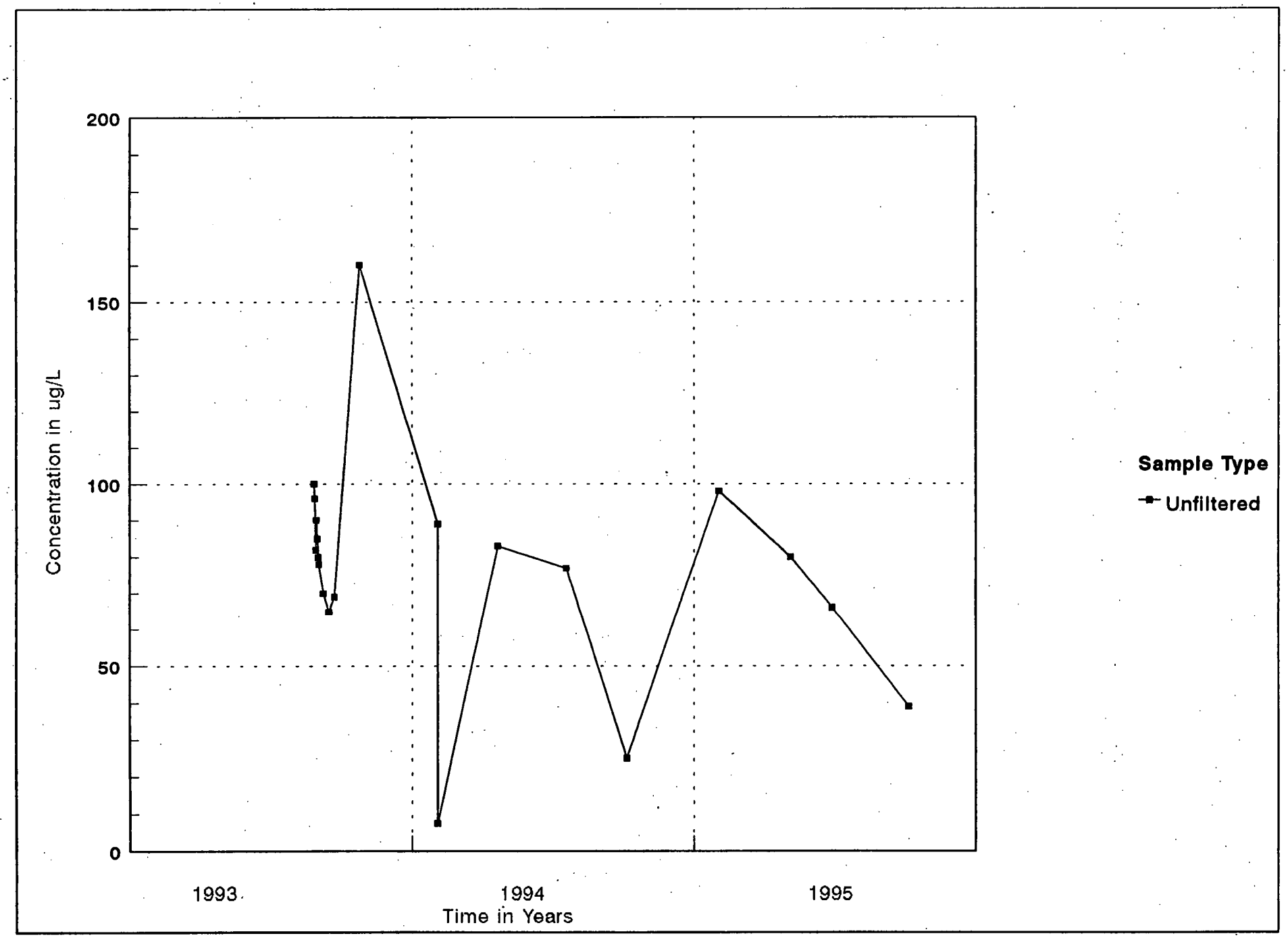

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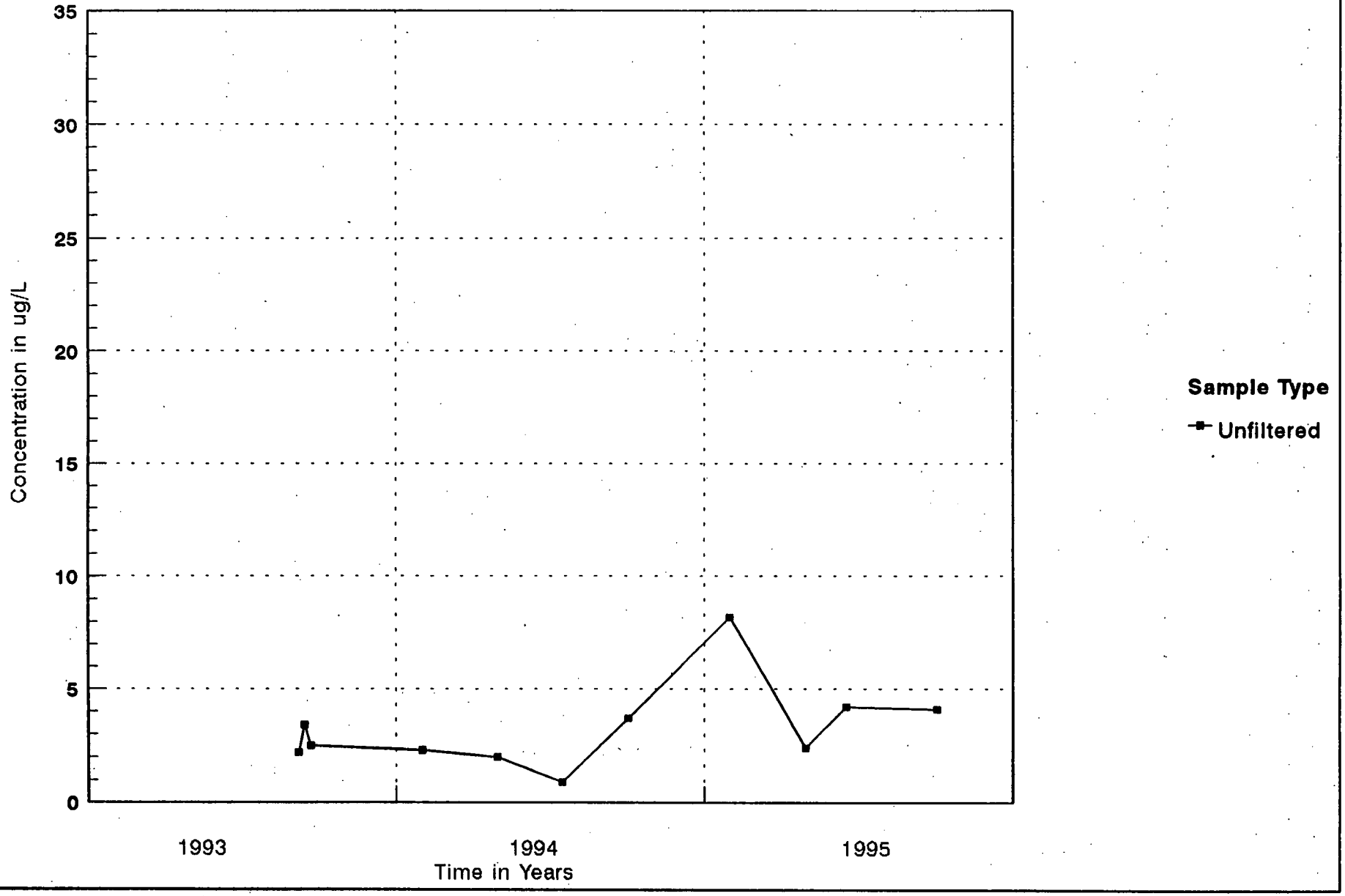

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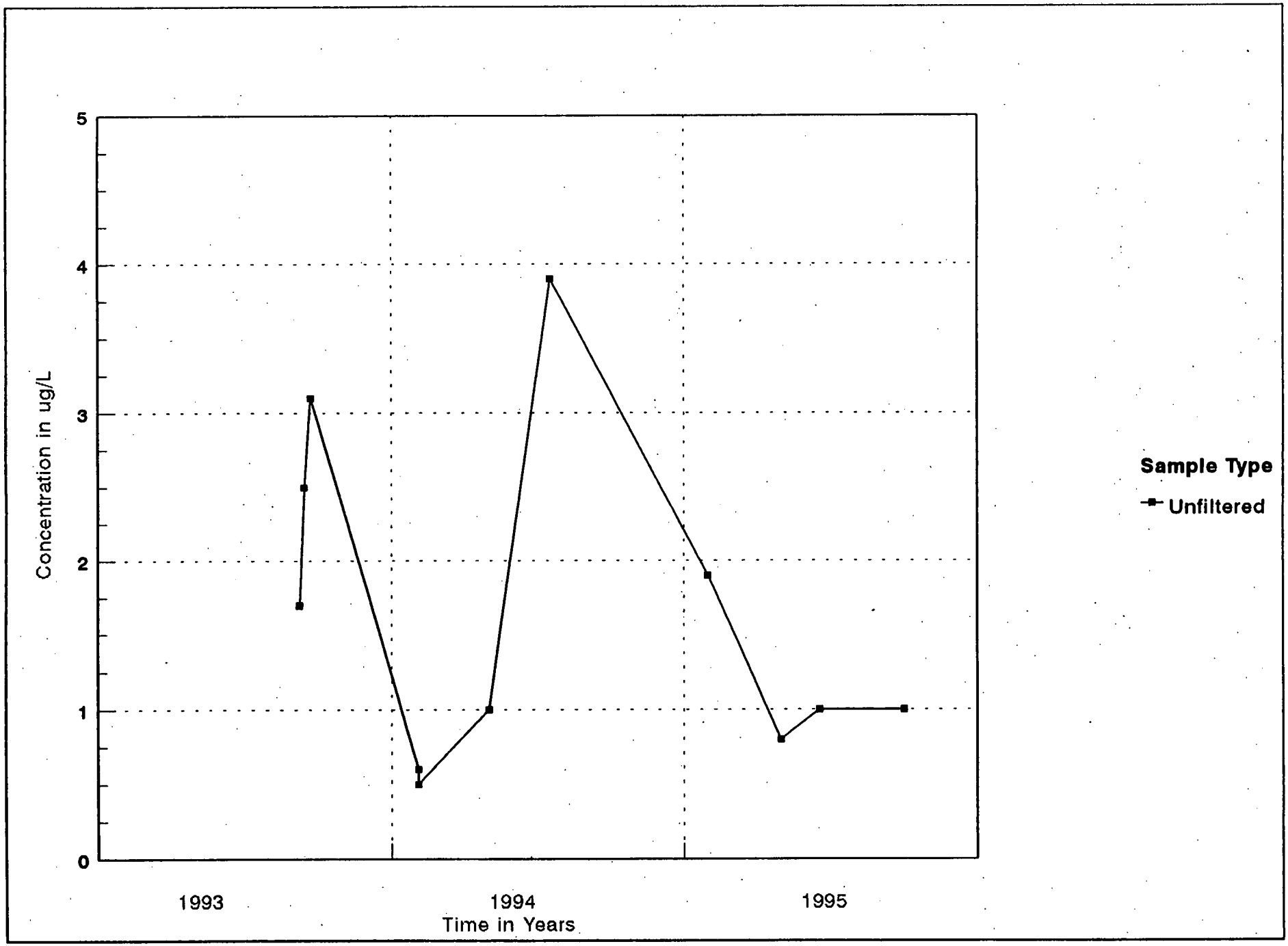

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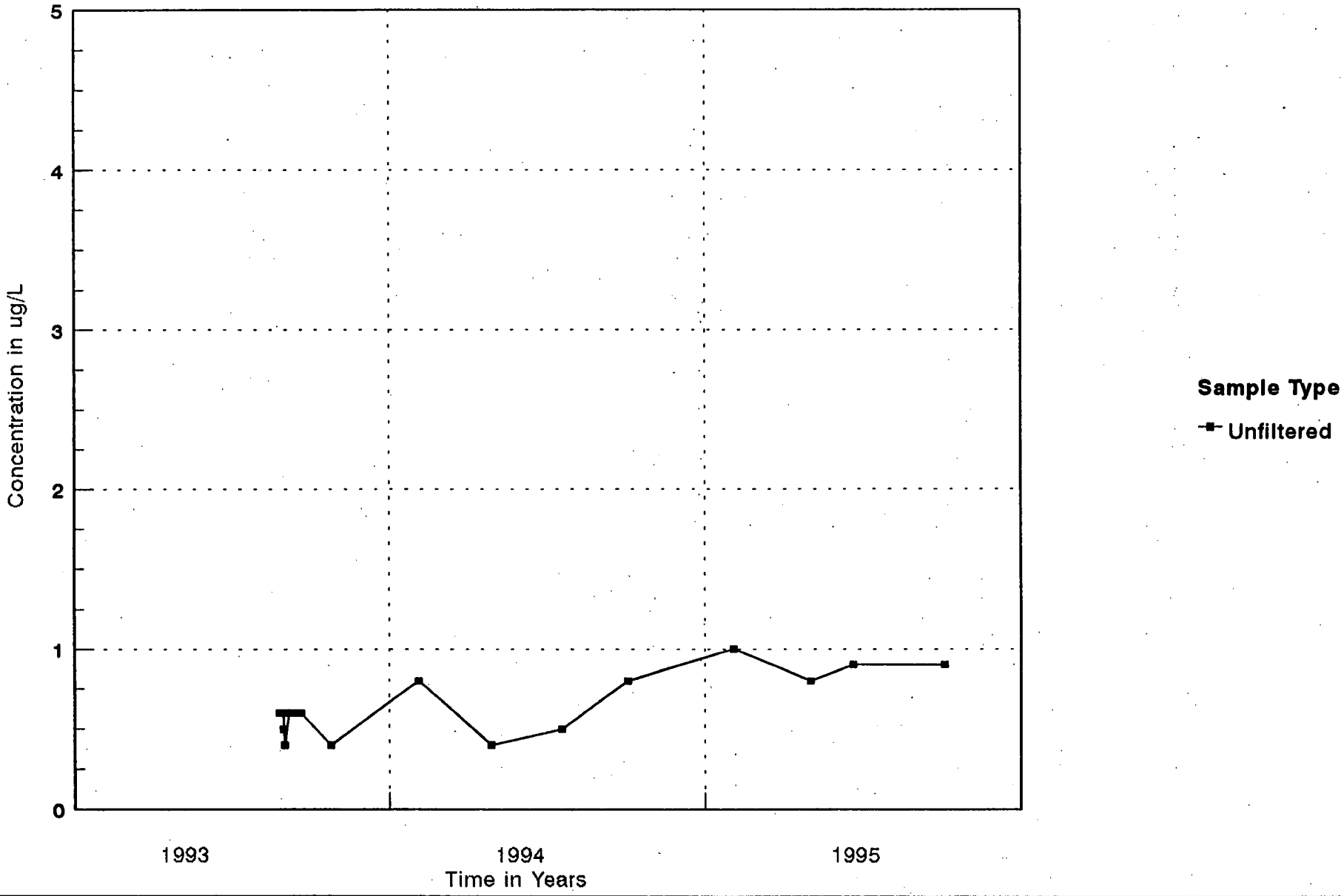
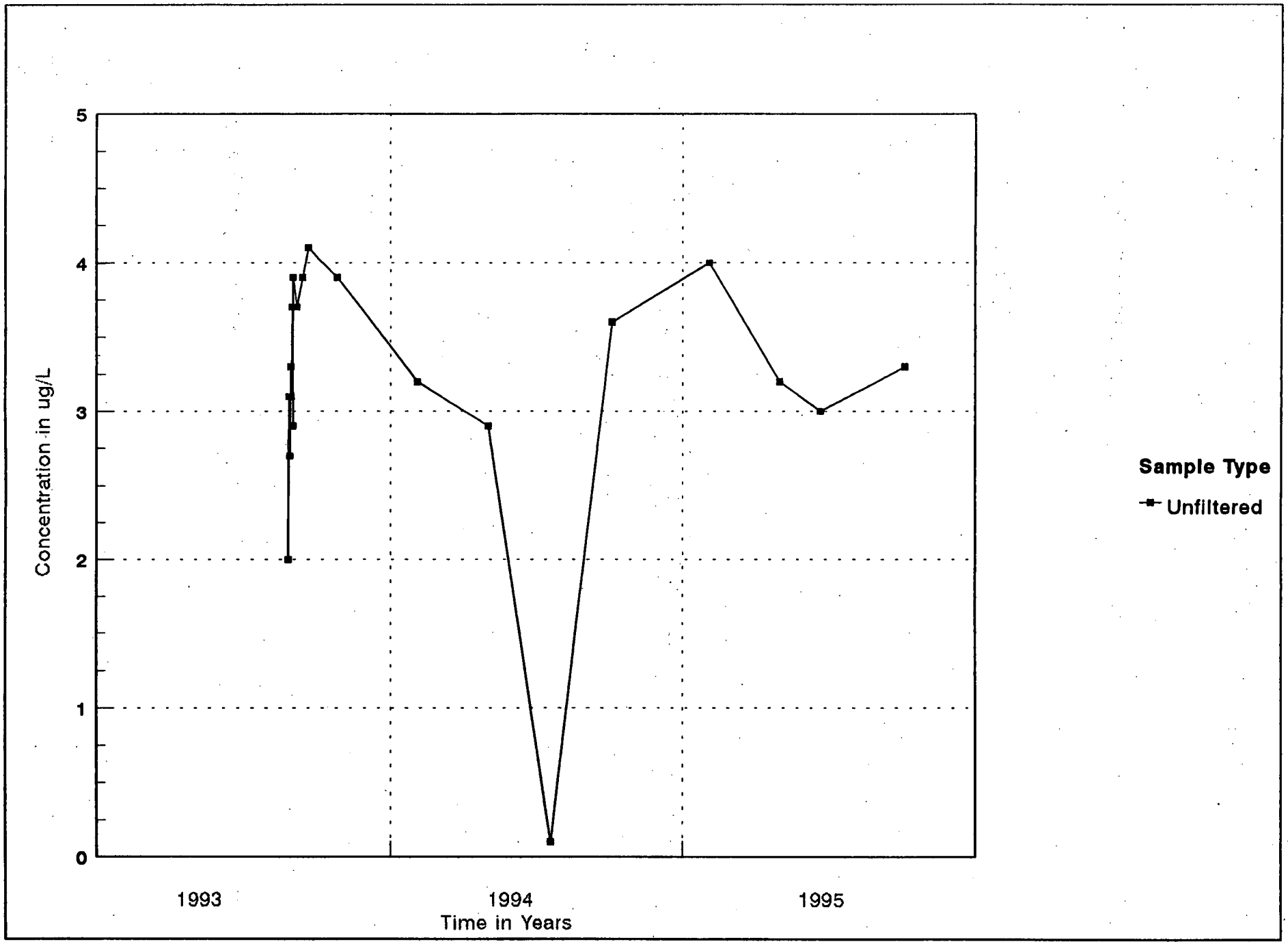


Monitoring Well 2880 Uranium Concentrations



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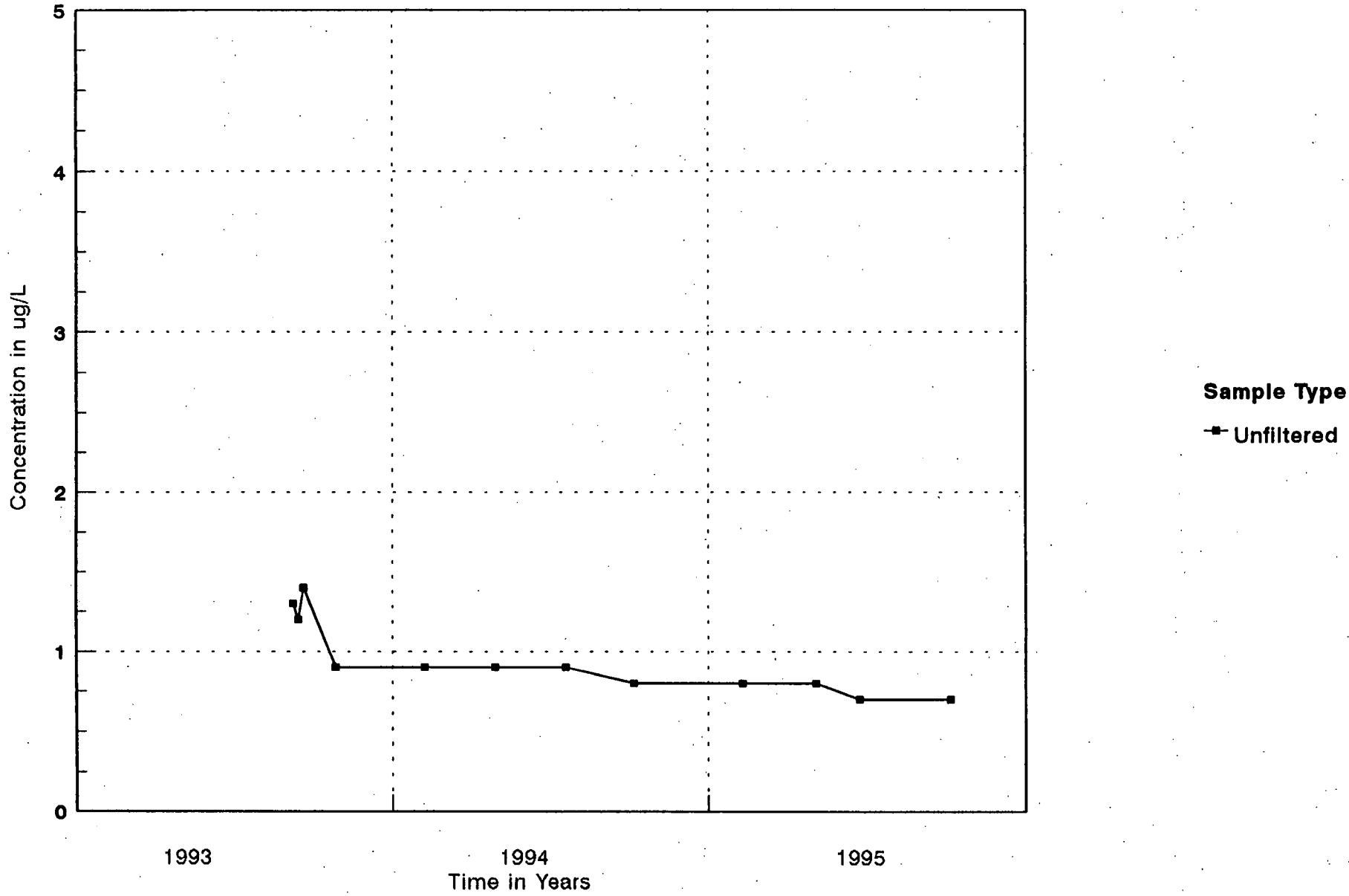

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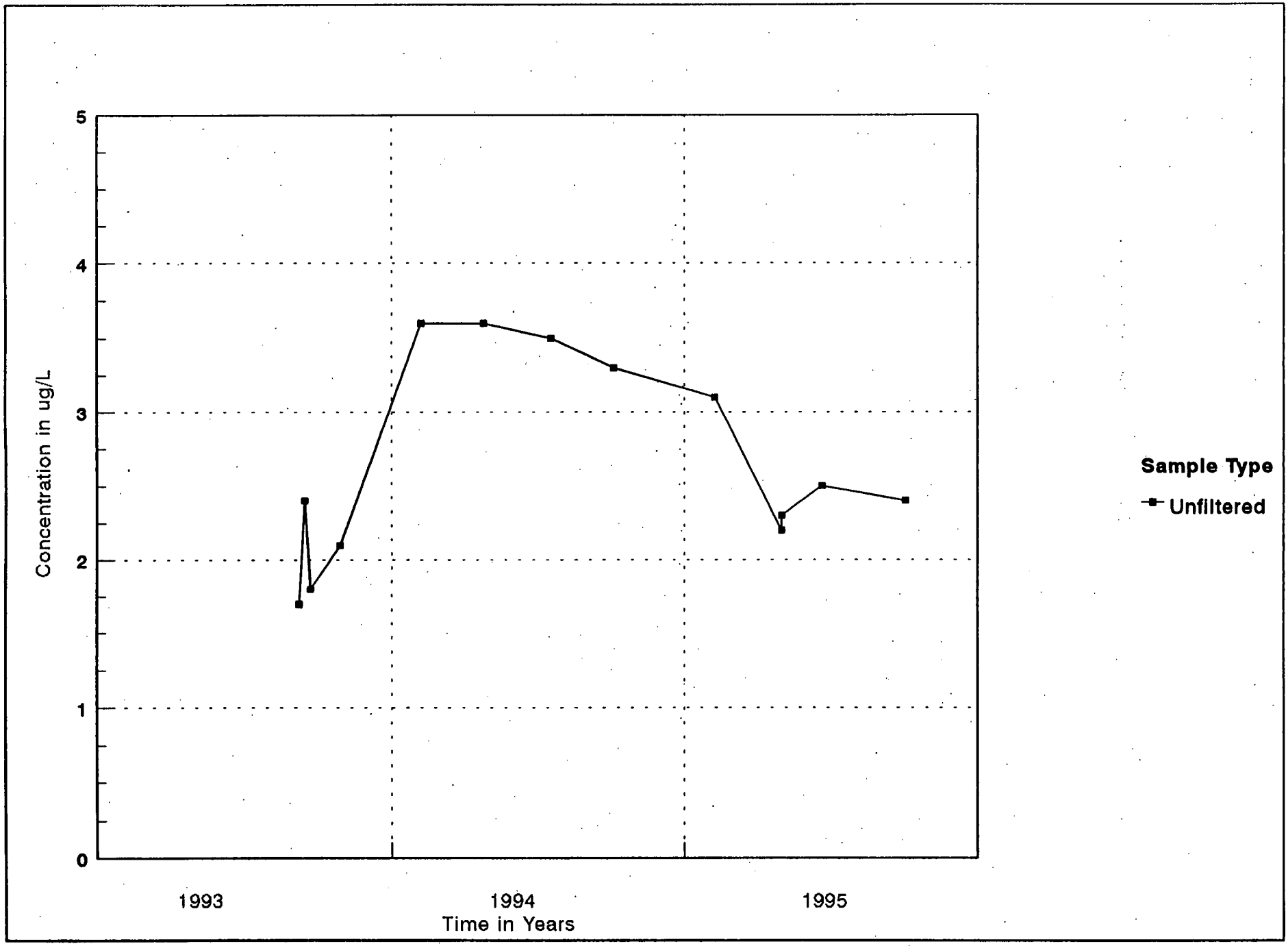

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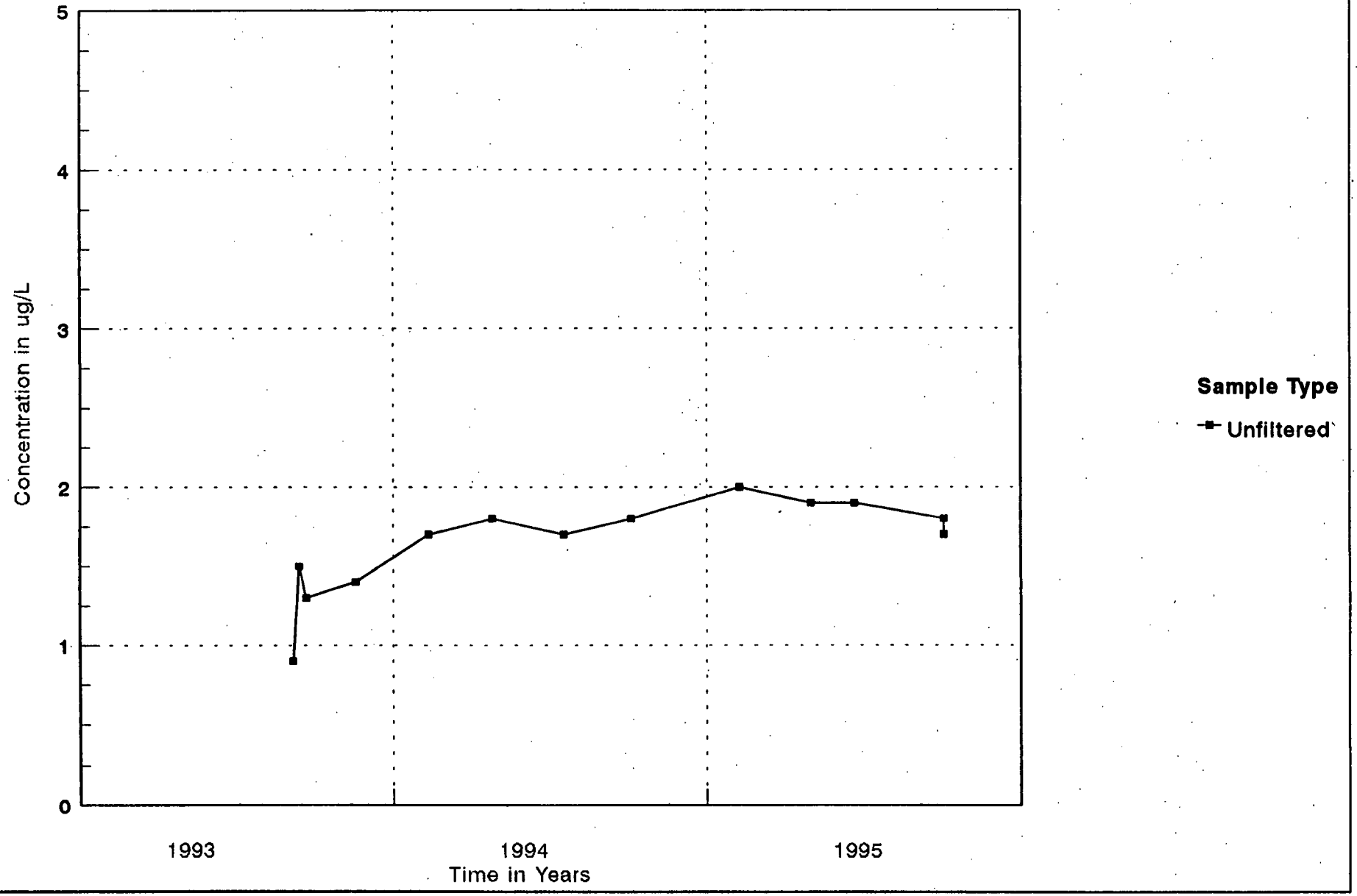

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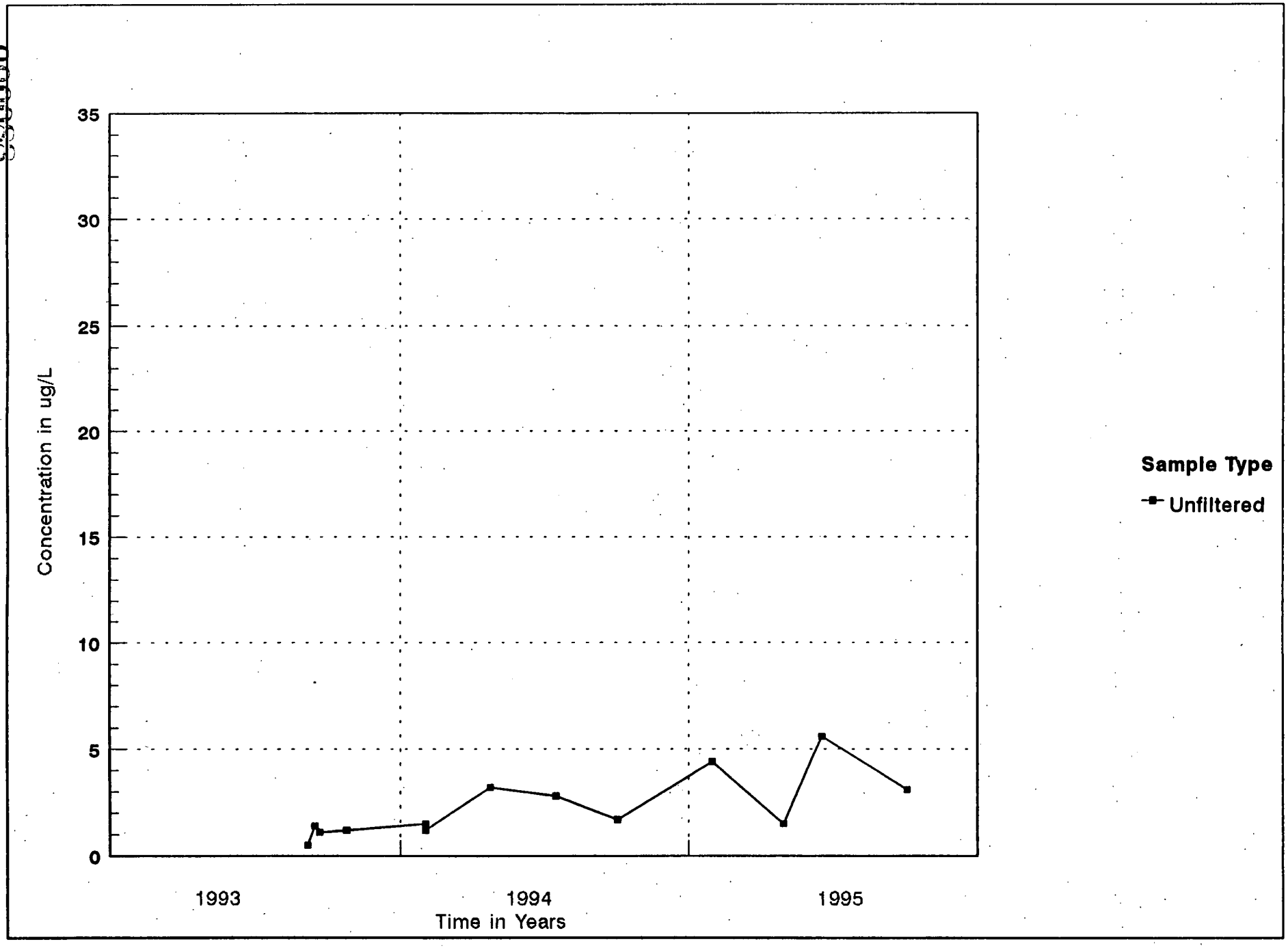

Monitoring Well 2900 Uranium Concentrations

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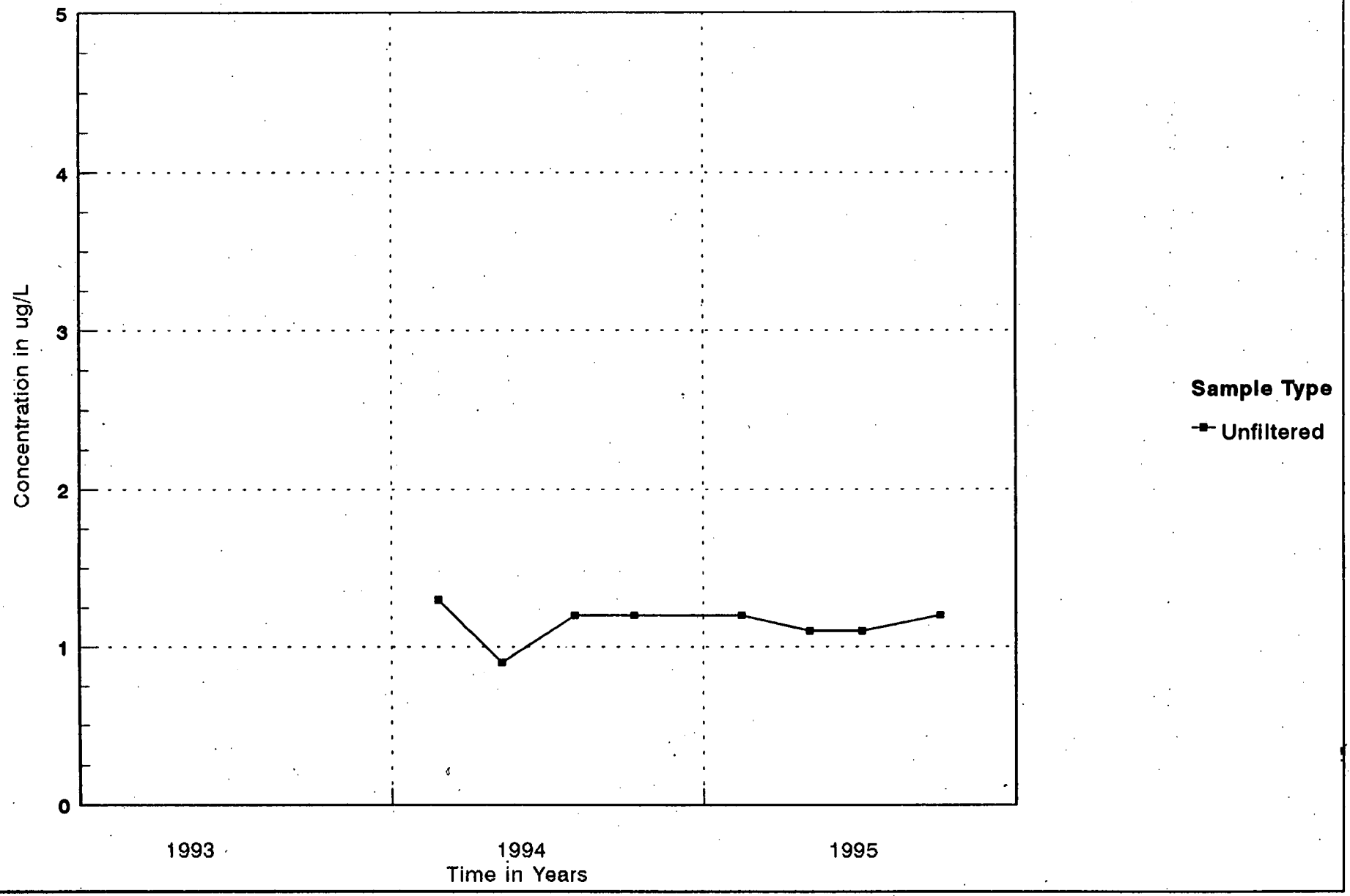
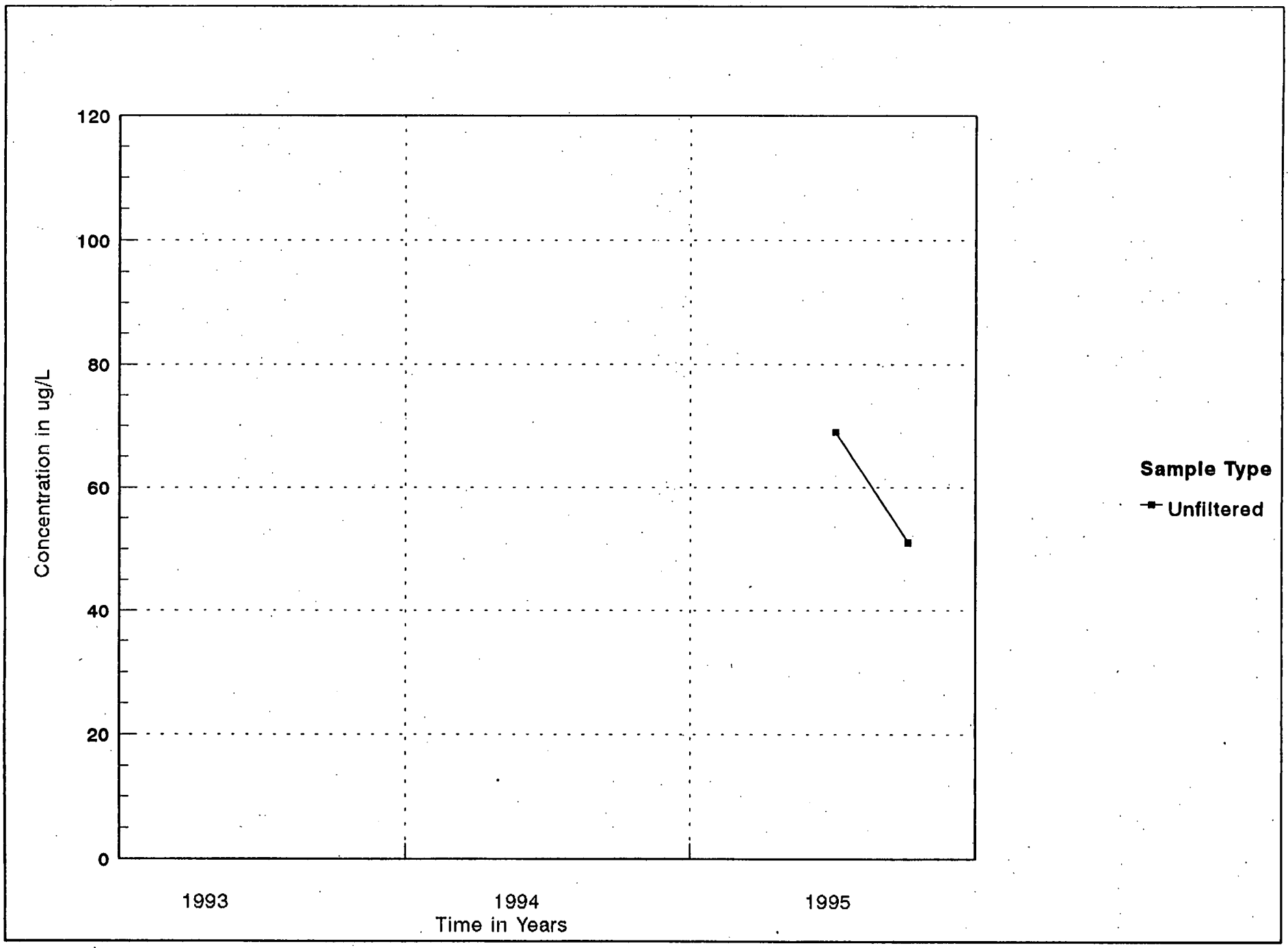


Monitoring Well 3015 Uranium Concentrations



Monitoring Well 3062 Uranium Concentration

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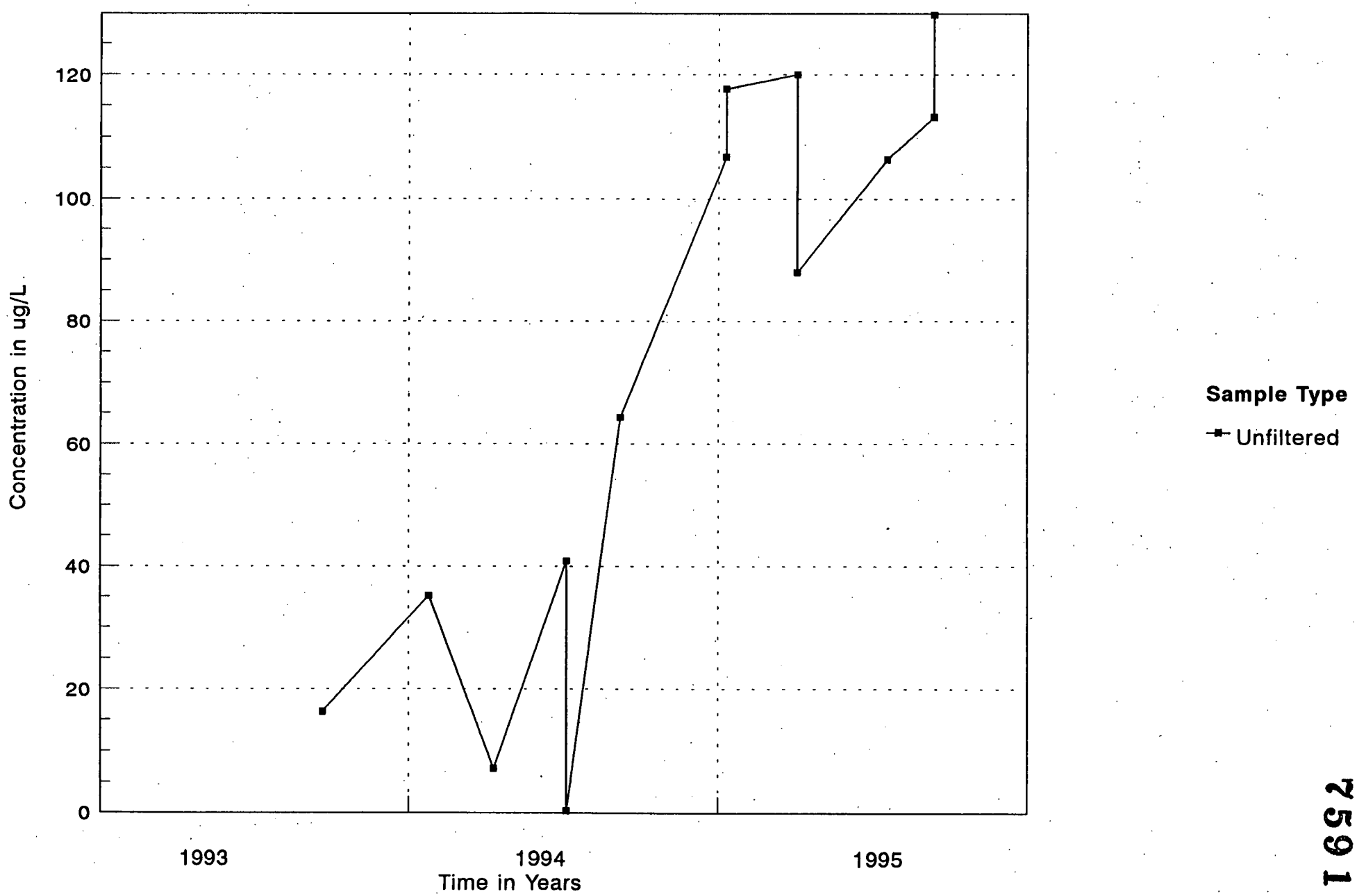

Monitoring Well 3069 Uranium Concentrations

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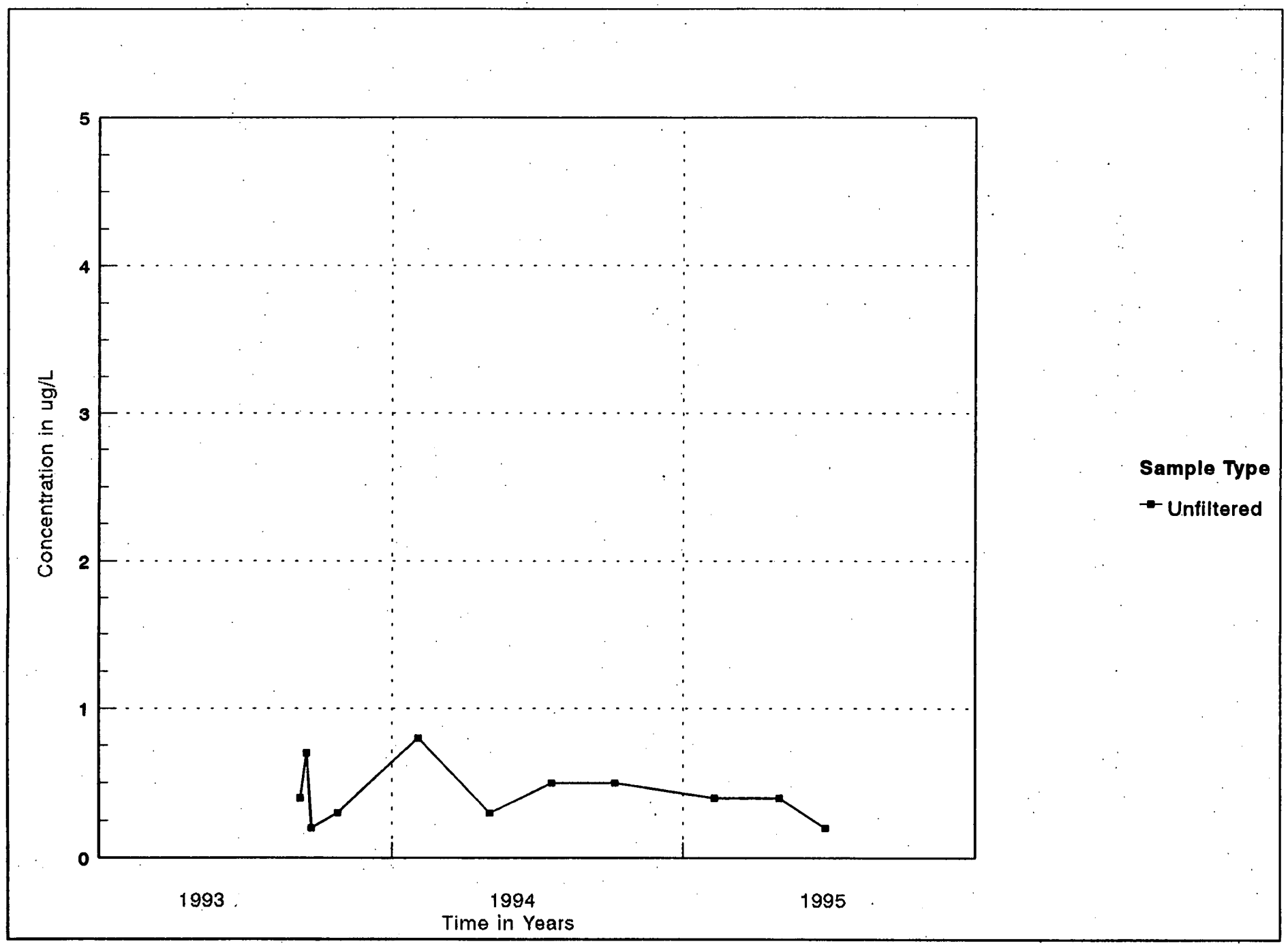

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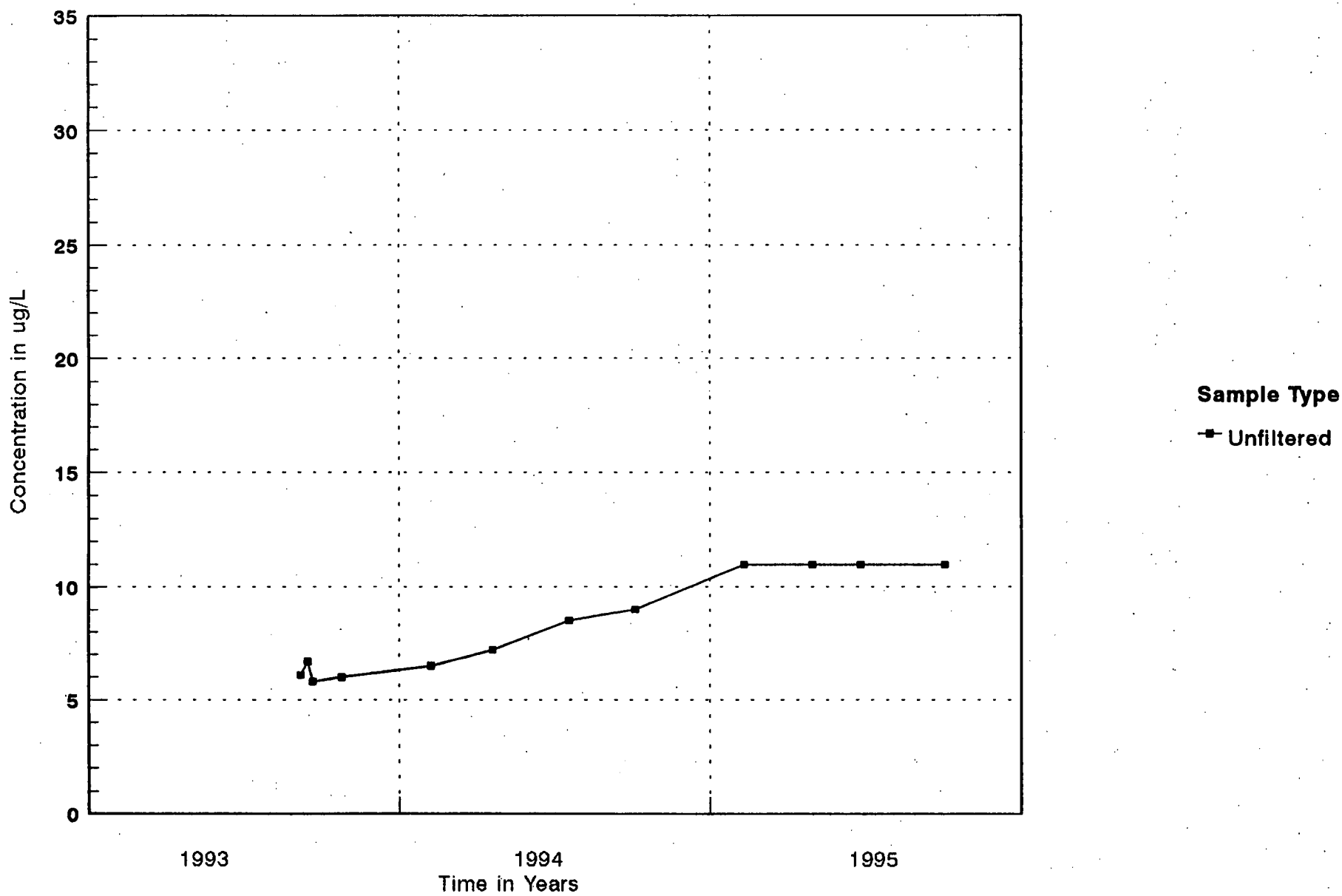

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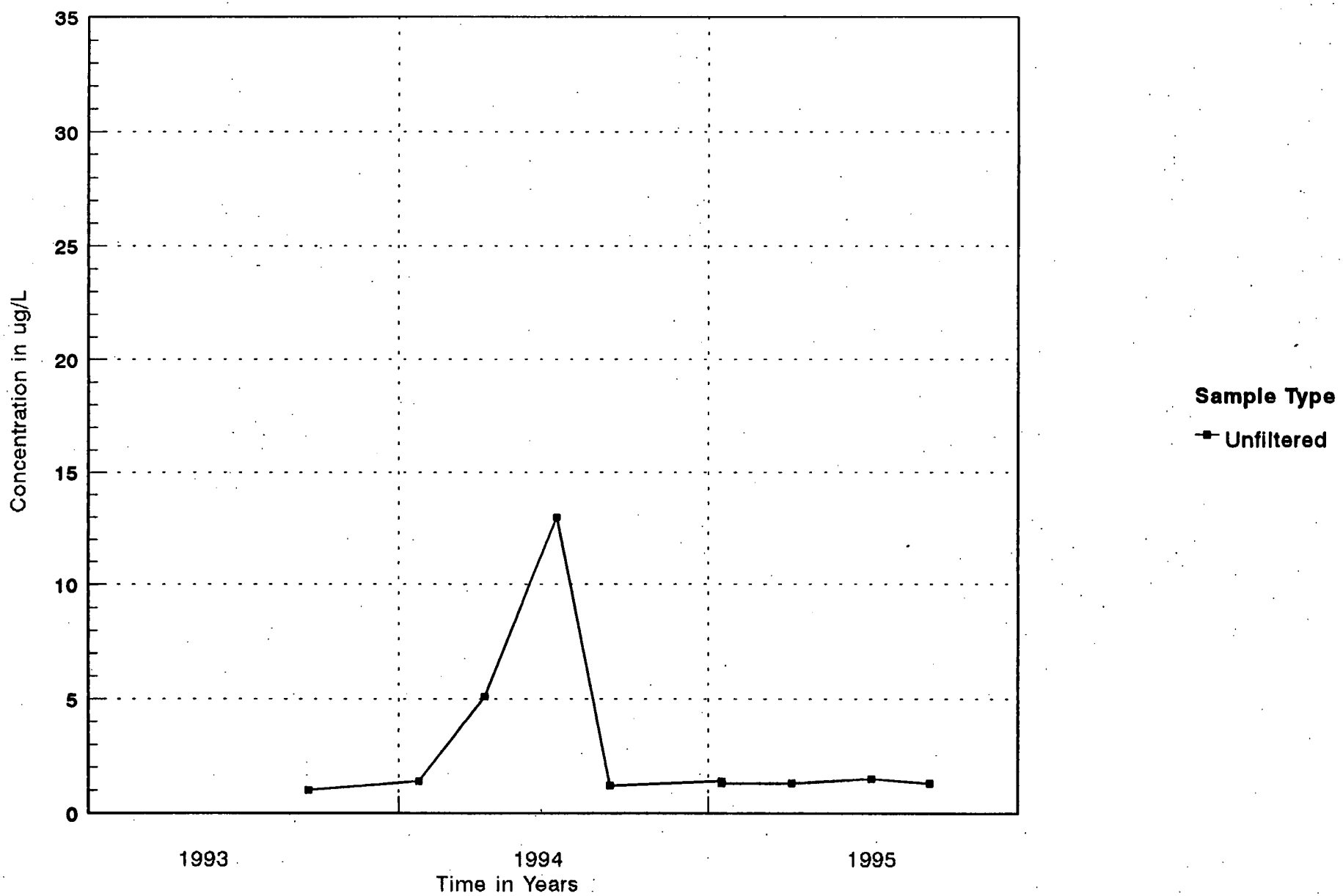

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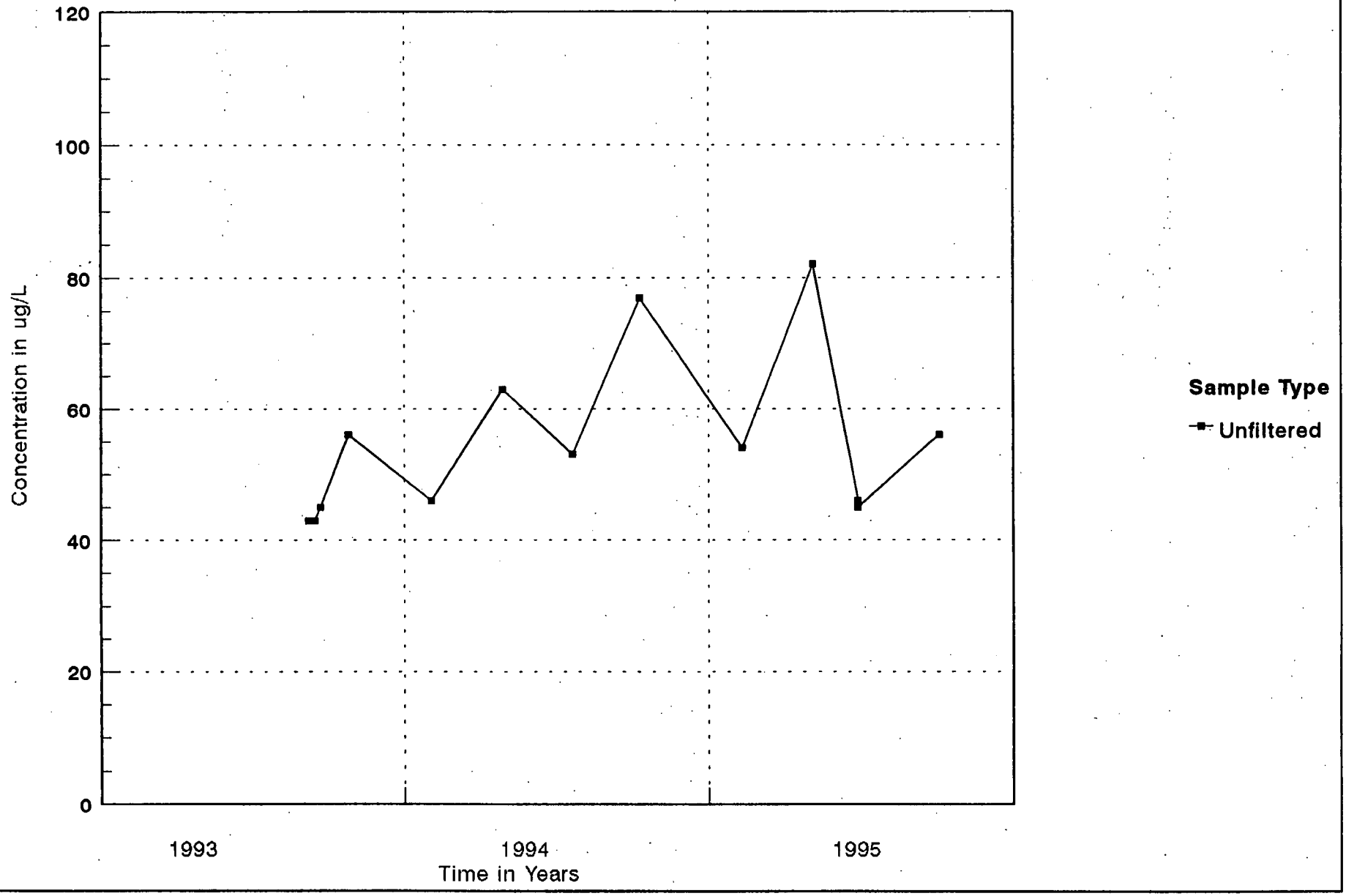

Monitoring Well 3125 Uranium Concentration

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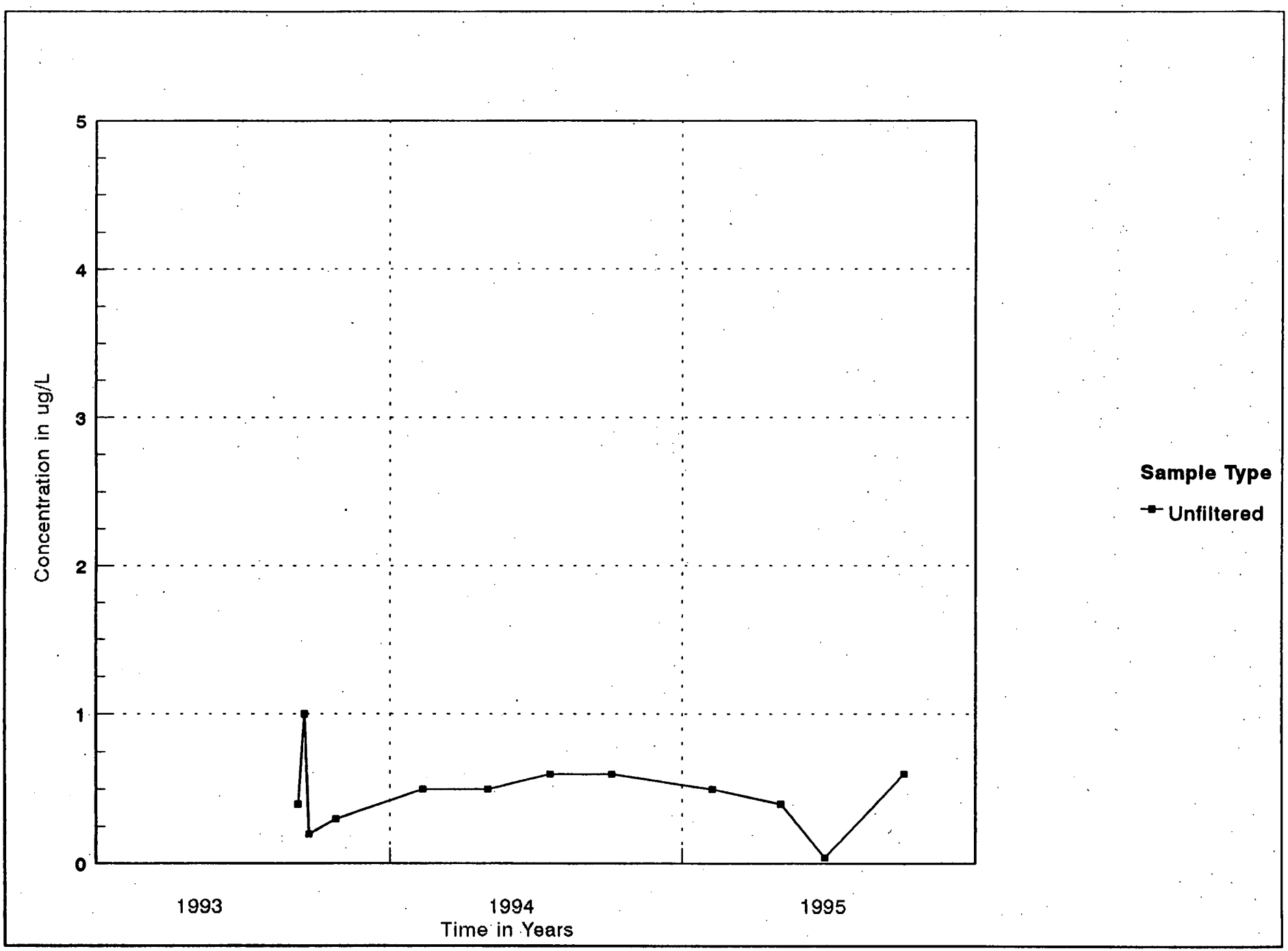

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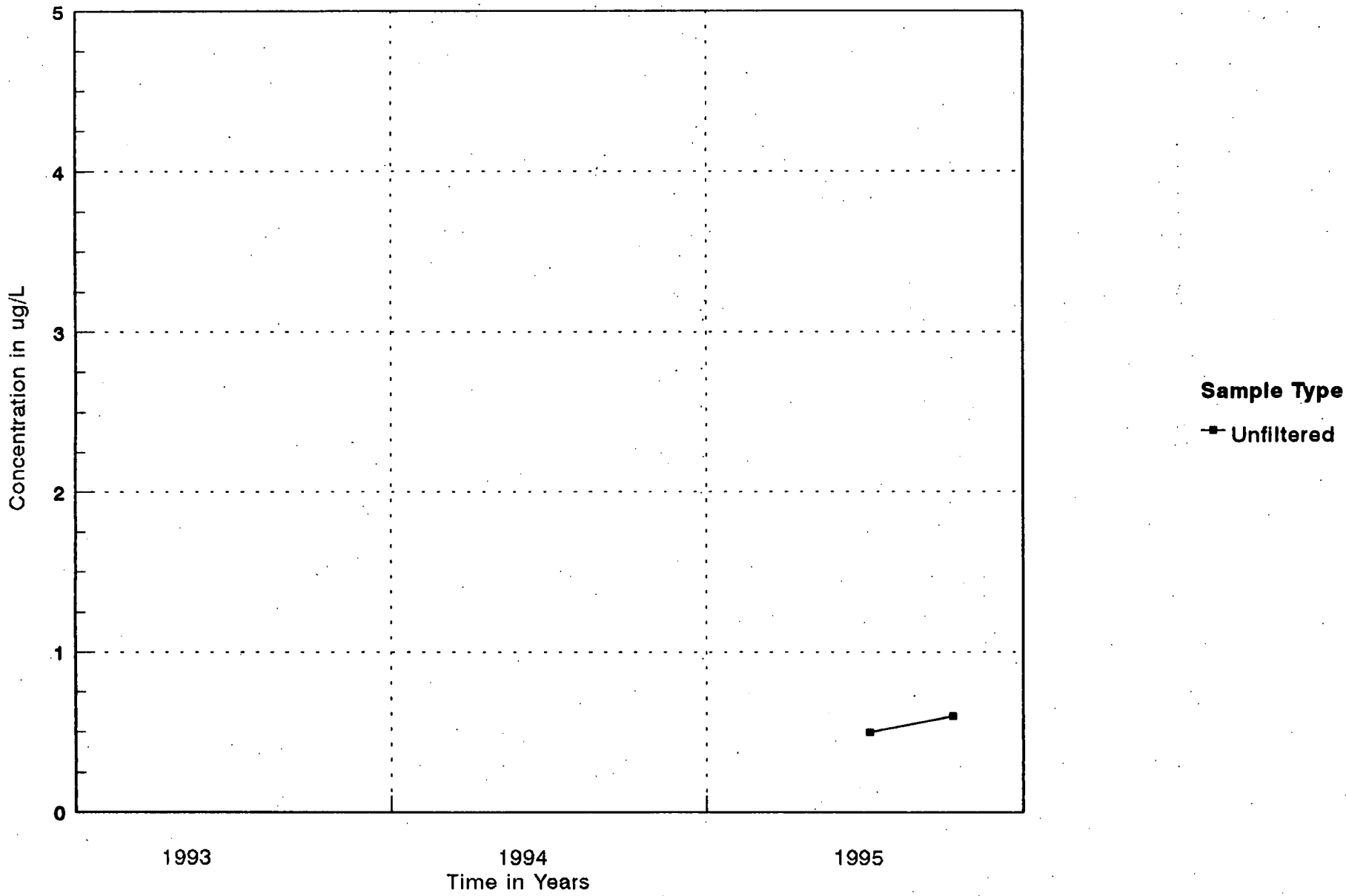

Monitoring Well 3396 Uranium Concentrations

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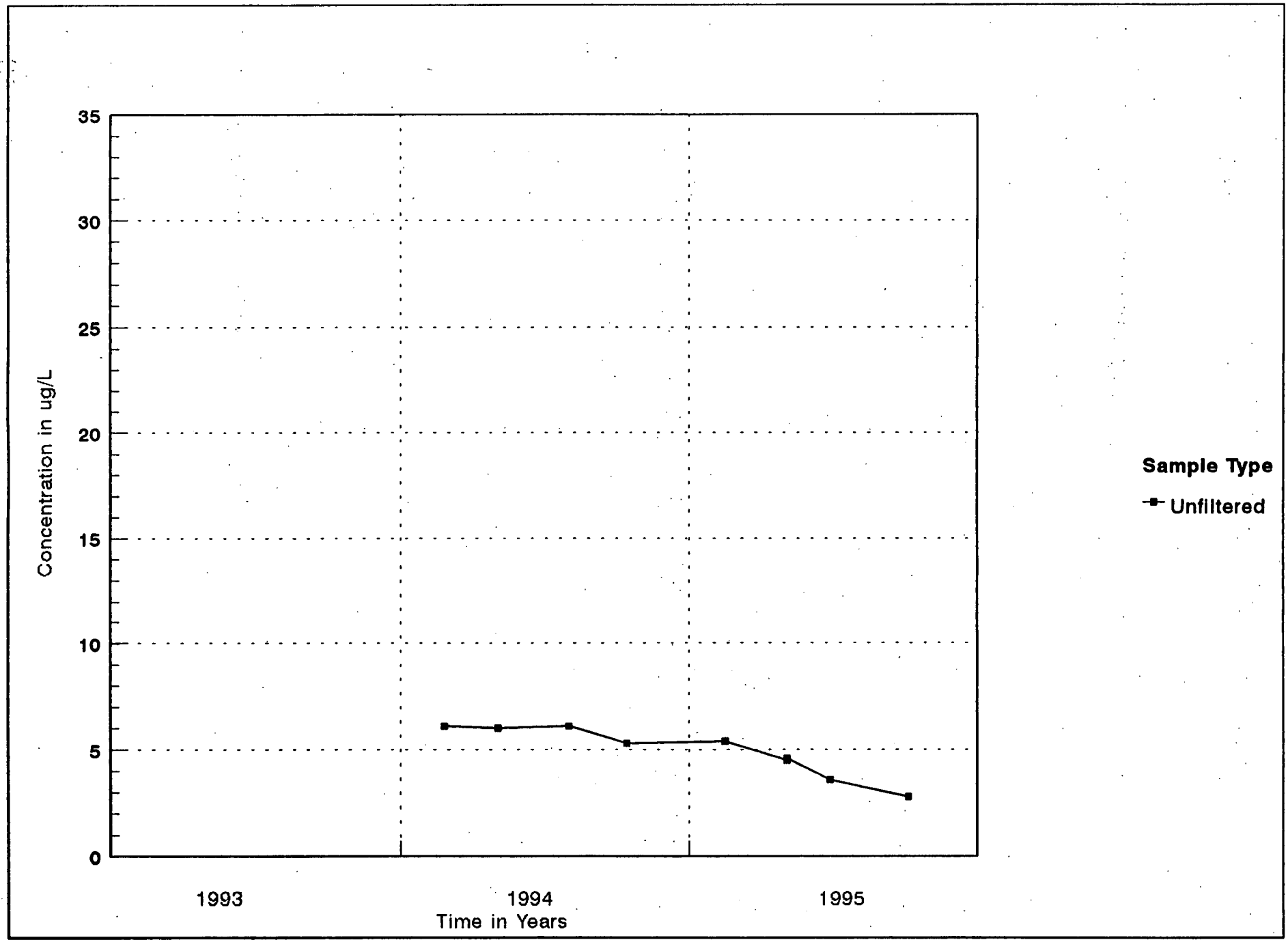
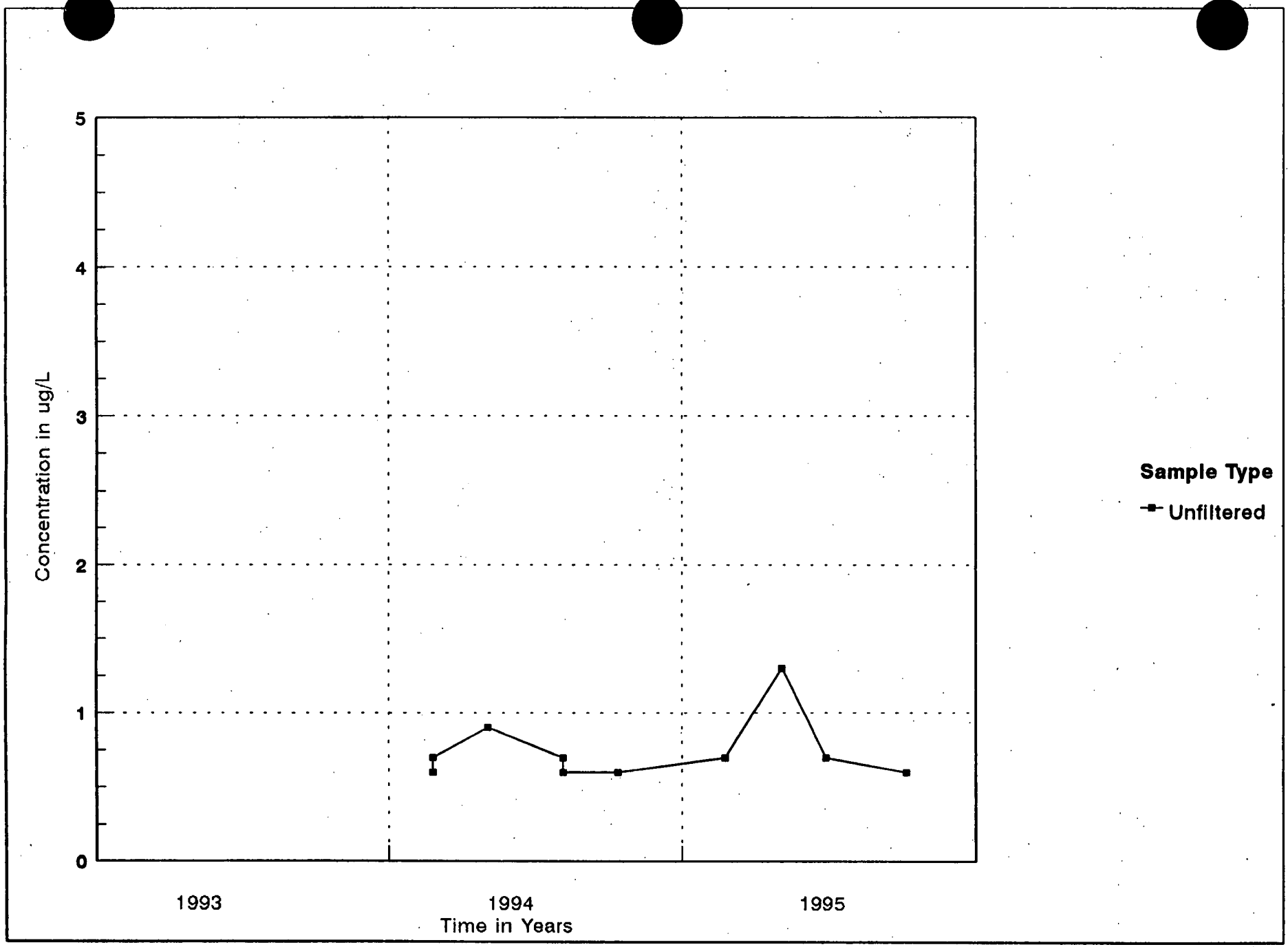


Monitoring Well 3550 Uranium Concentrations

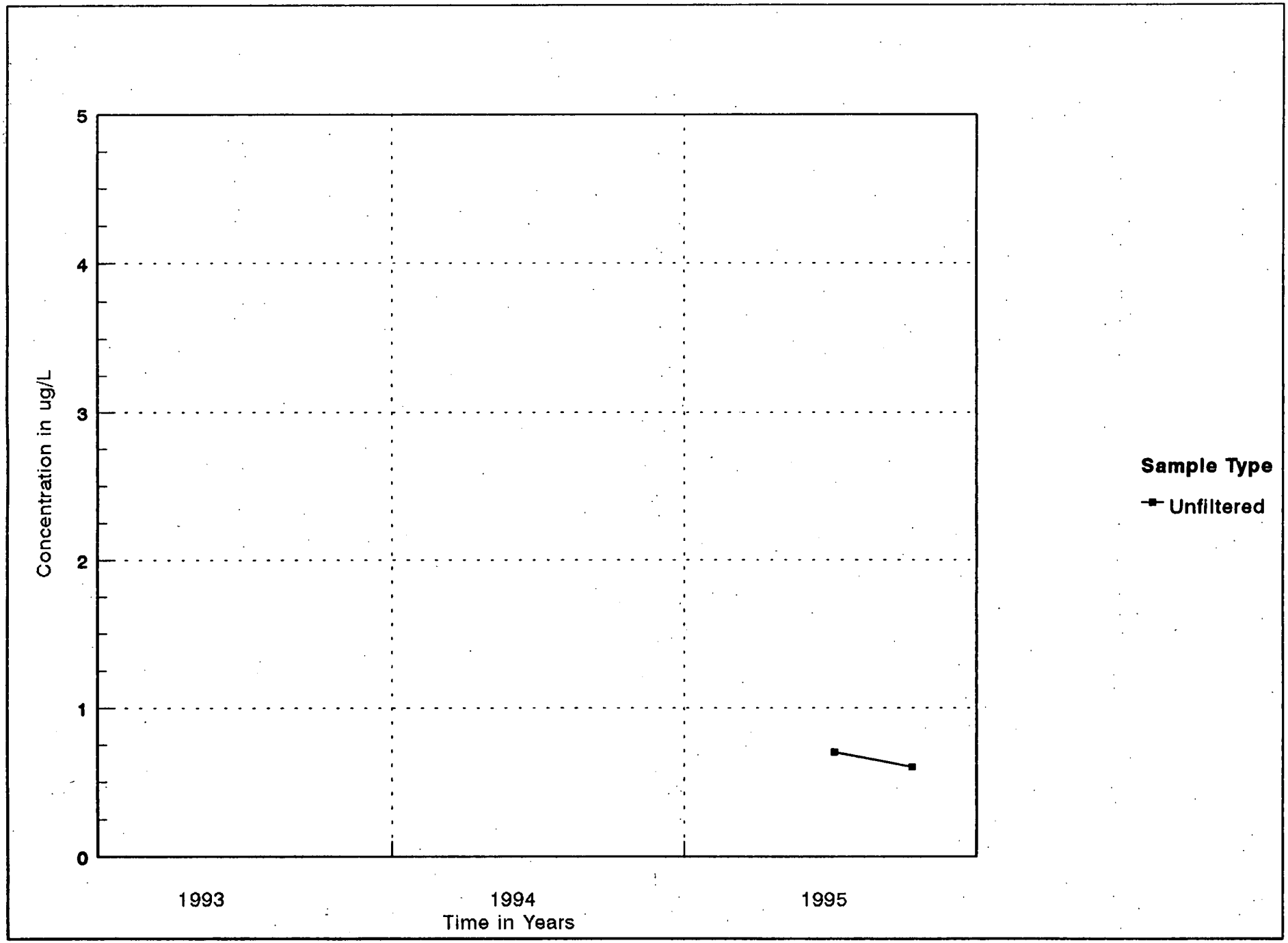


Monitoring Well 3551 Uranium Concentrations

000099

T 652

000100



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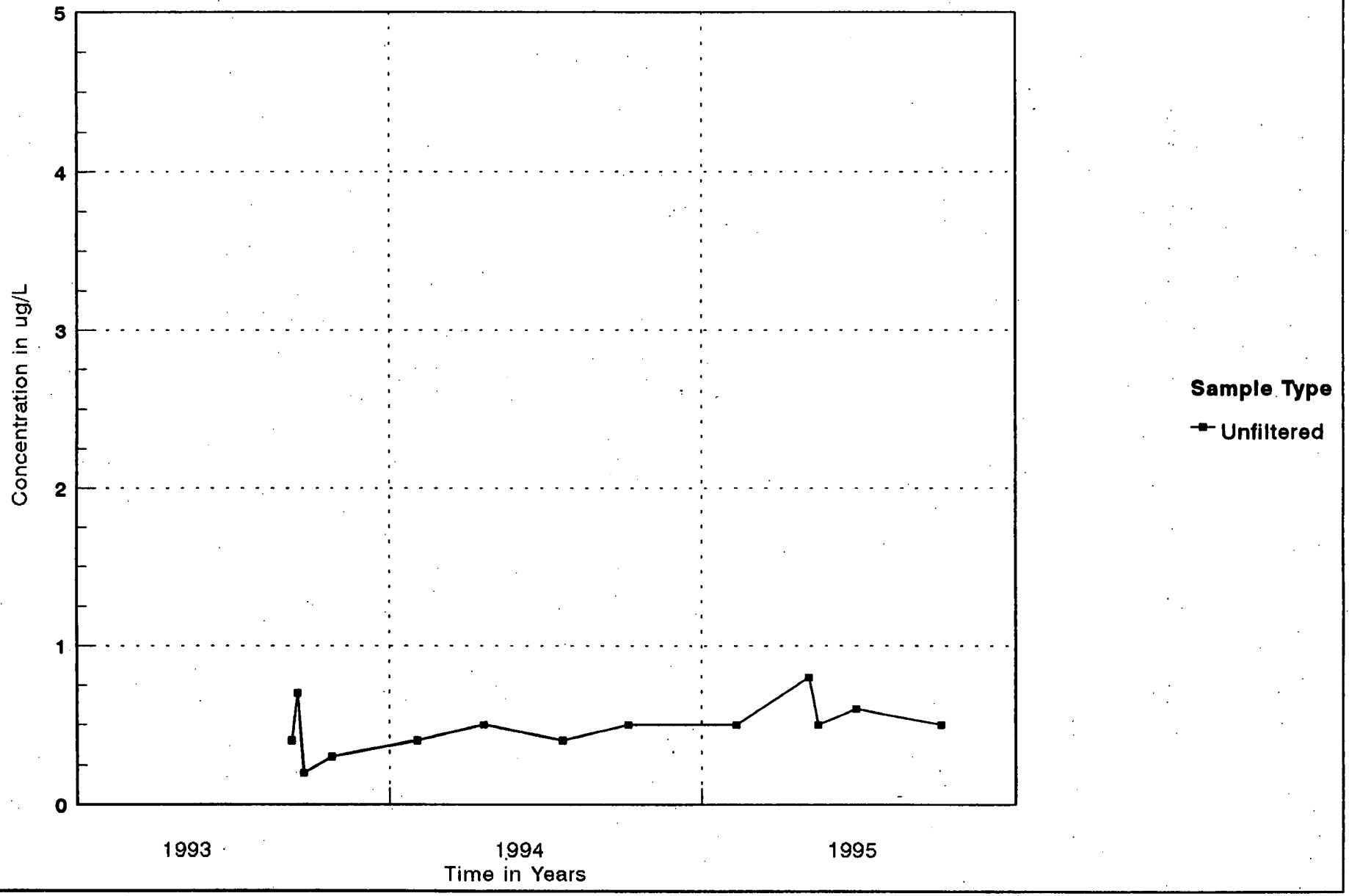

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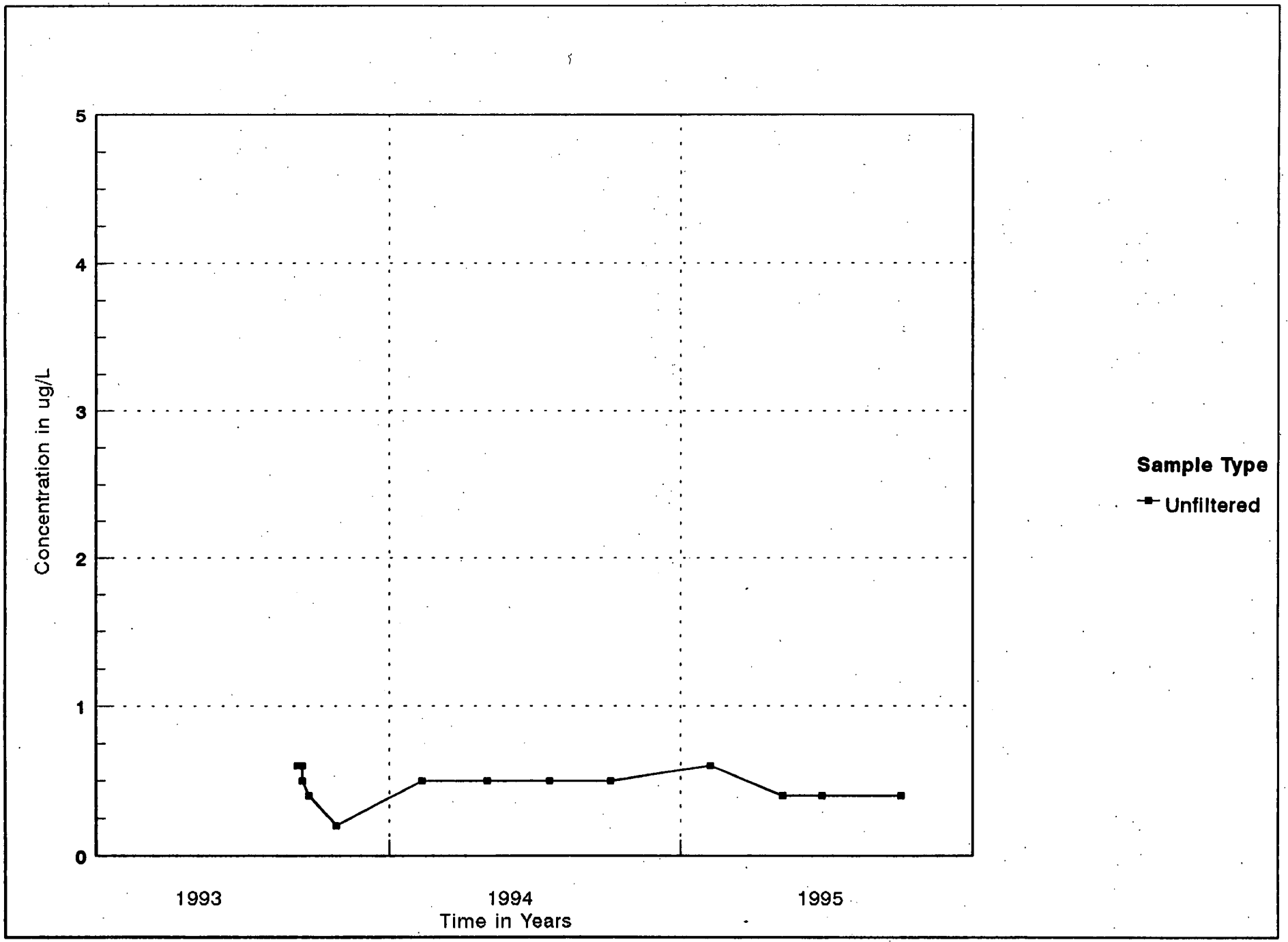

Monitoring Well 3636 Uranium Concentrations

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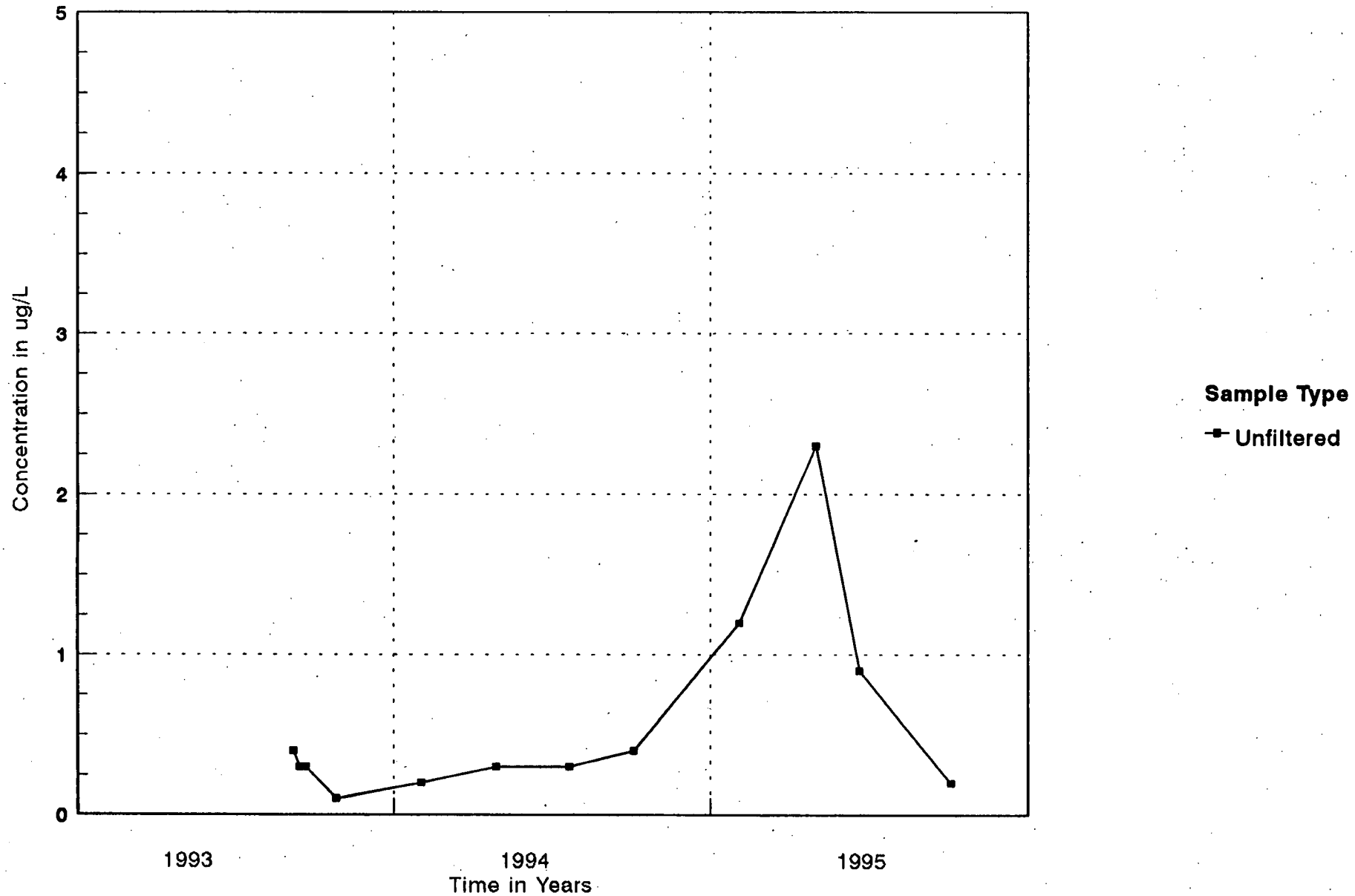
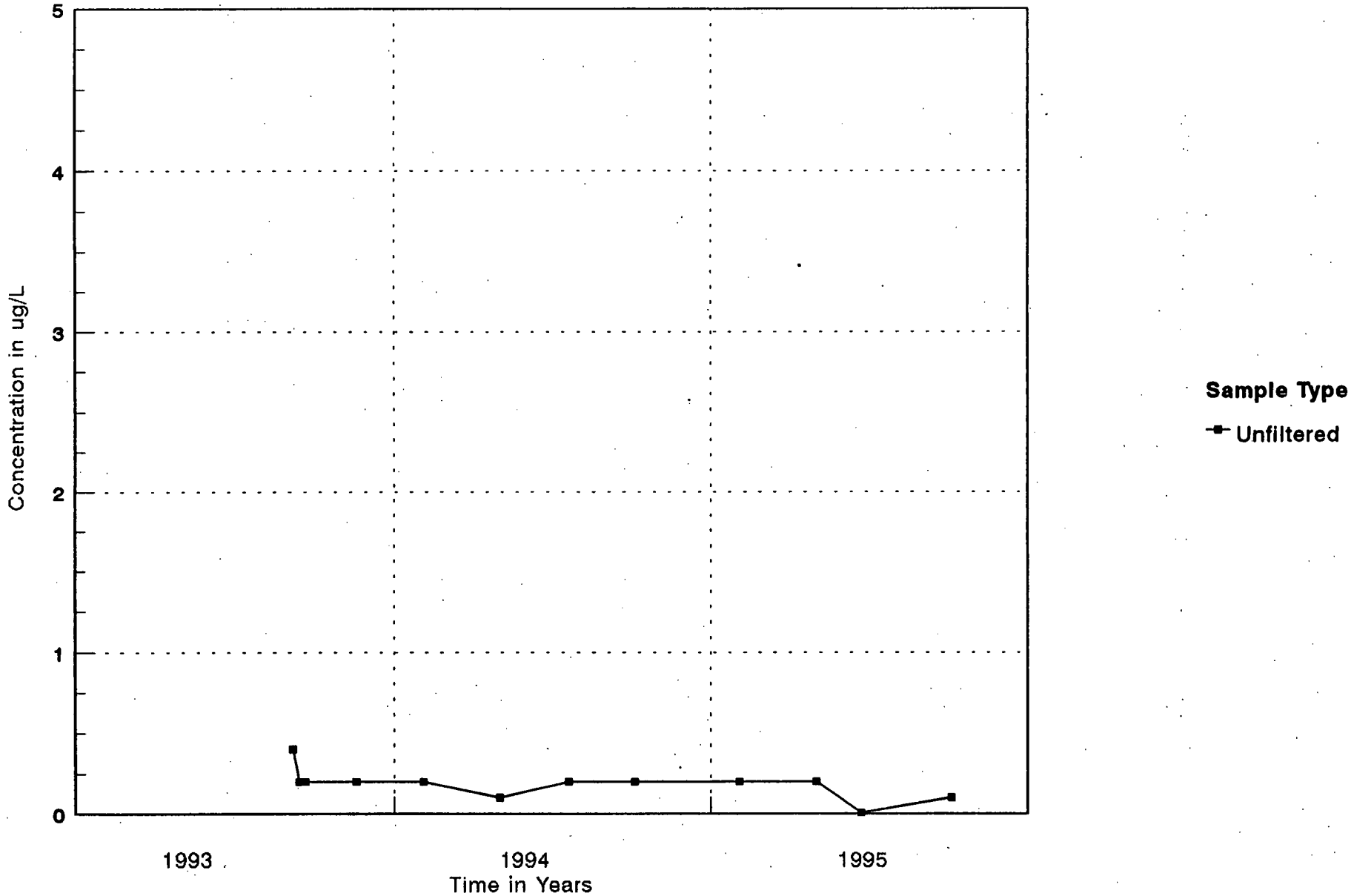


Monitoring Well 3880 Uranium Concentrations



Monitoring Well 3881 Uranium Concentrations

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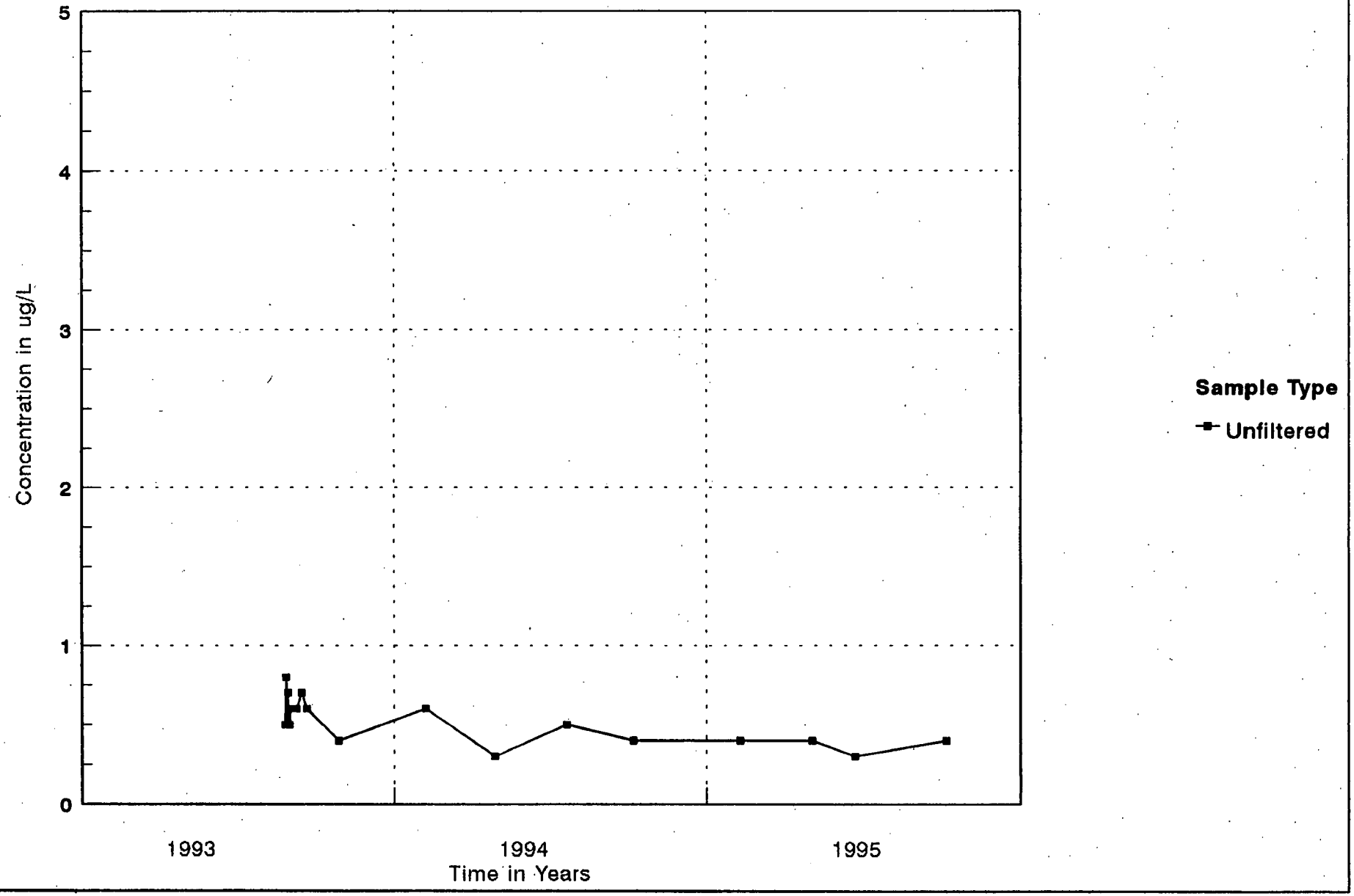
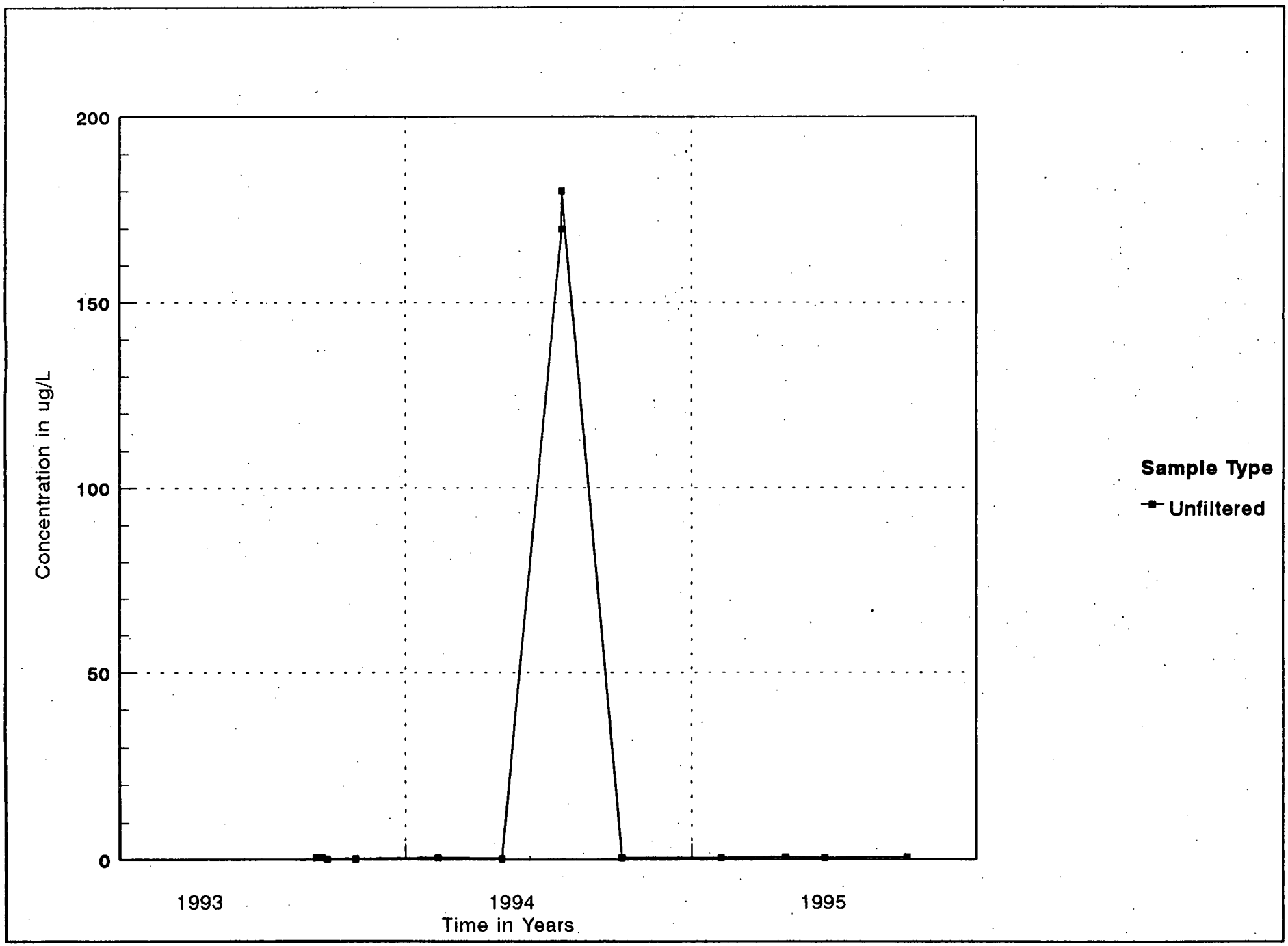
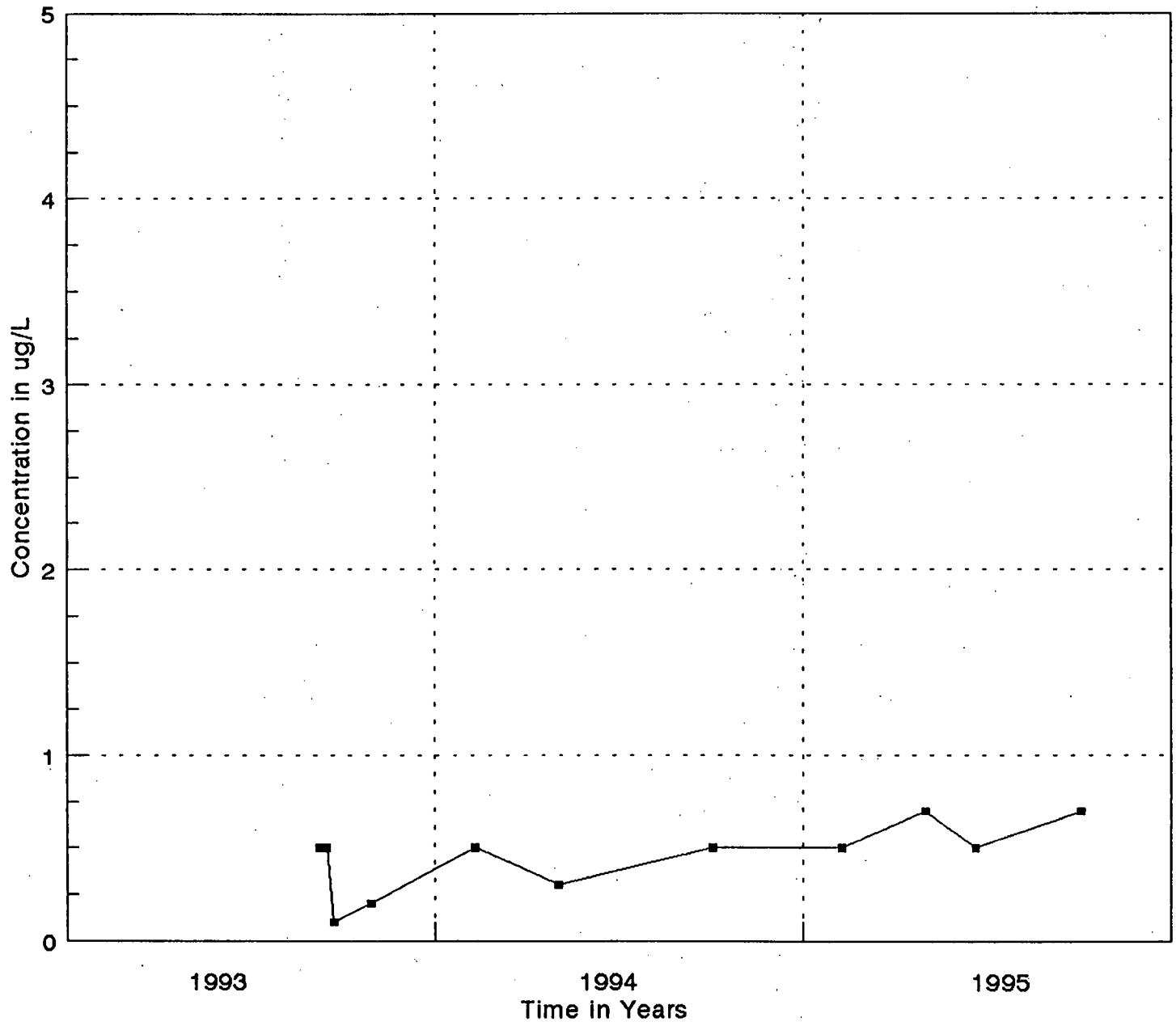


Monitoring Well 3897 Uranium Concentrations



Monitoring Well 3898 Uranium Concentrations

000106

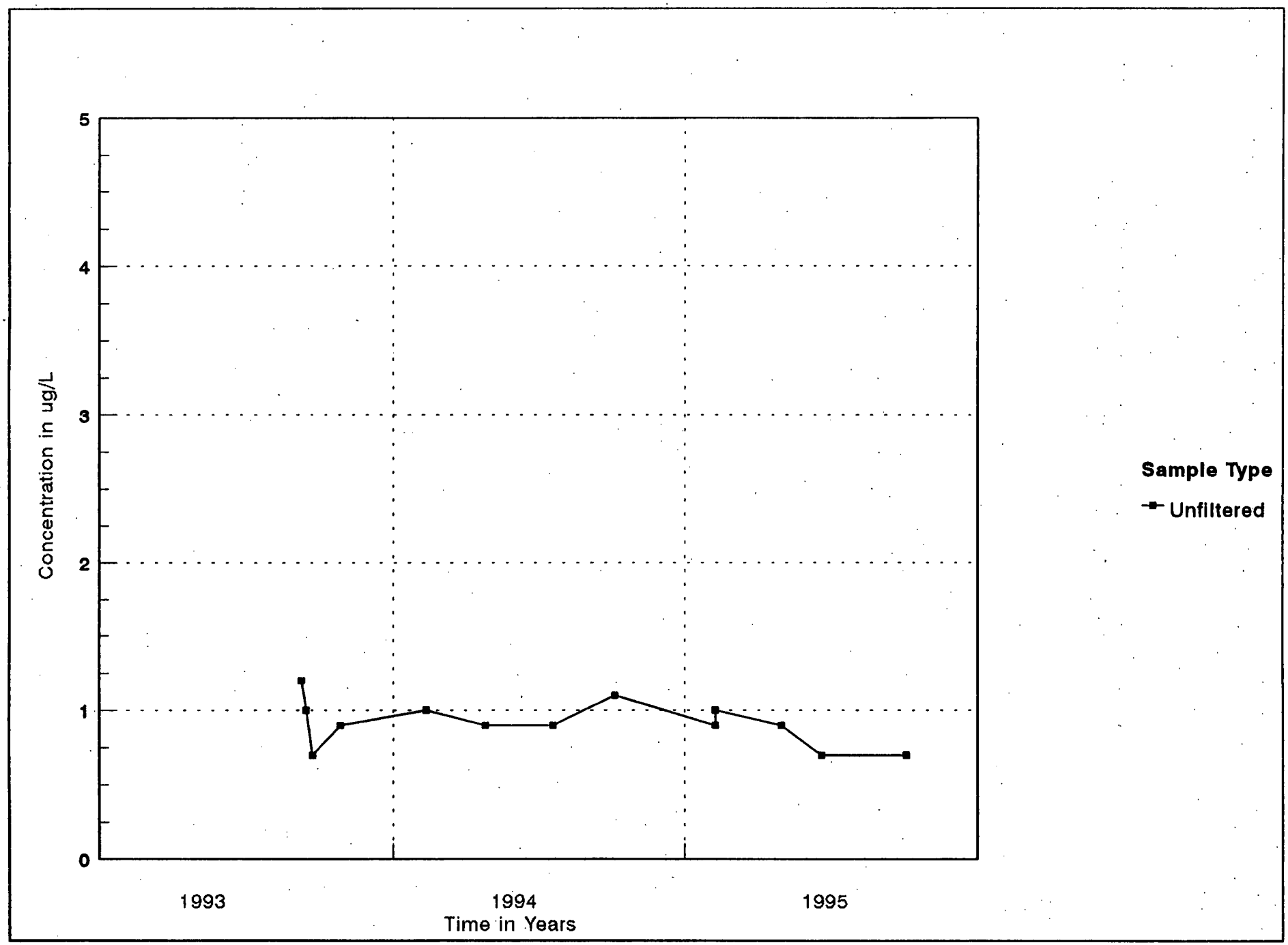


Sample Type

Unfiltered

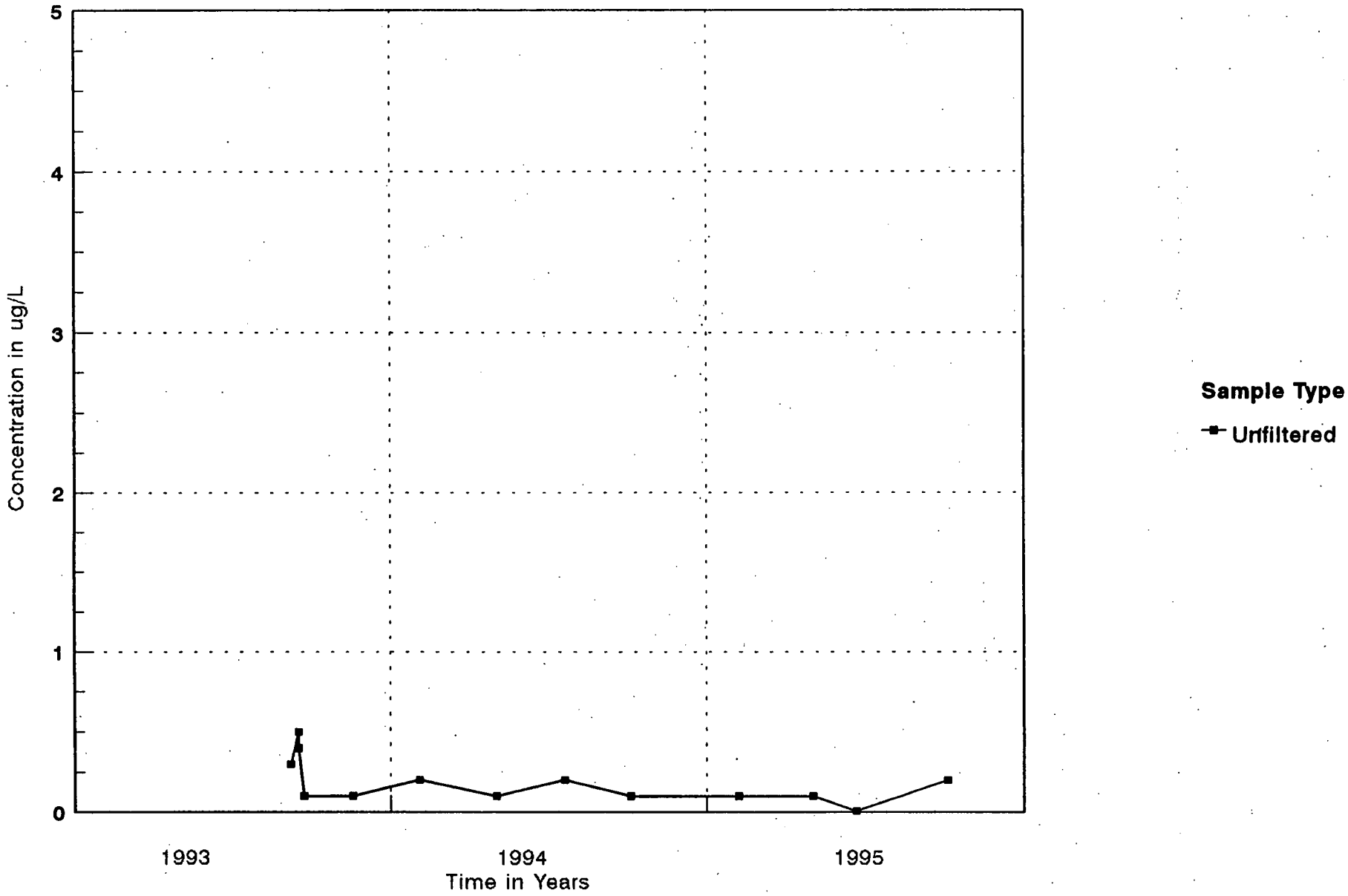
Note:
Outliers of 170 ug/L and 180 ug/L from July 19, 1994 have been omitted from this graph
(see October 1995 DMEPP, p.19)

Monitoring Well 3898 Uranium Concentrations



Monitoring Well 3899 Uranium Concentrations

000108

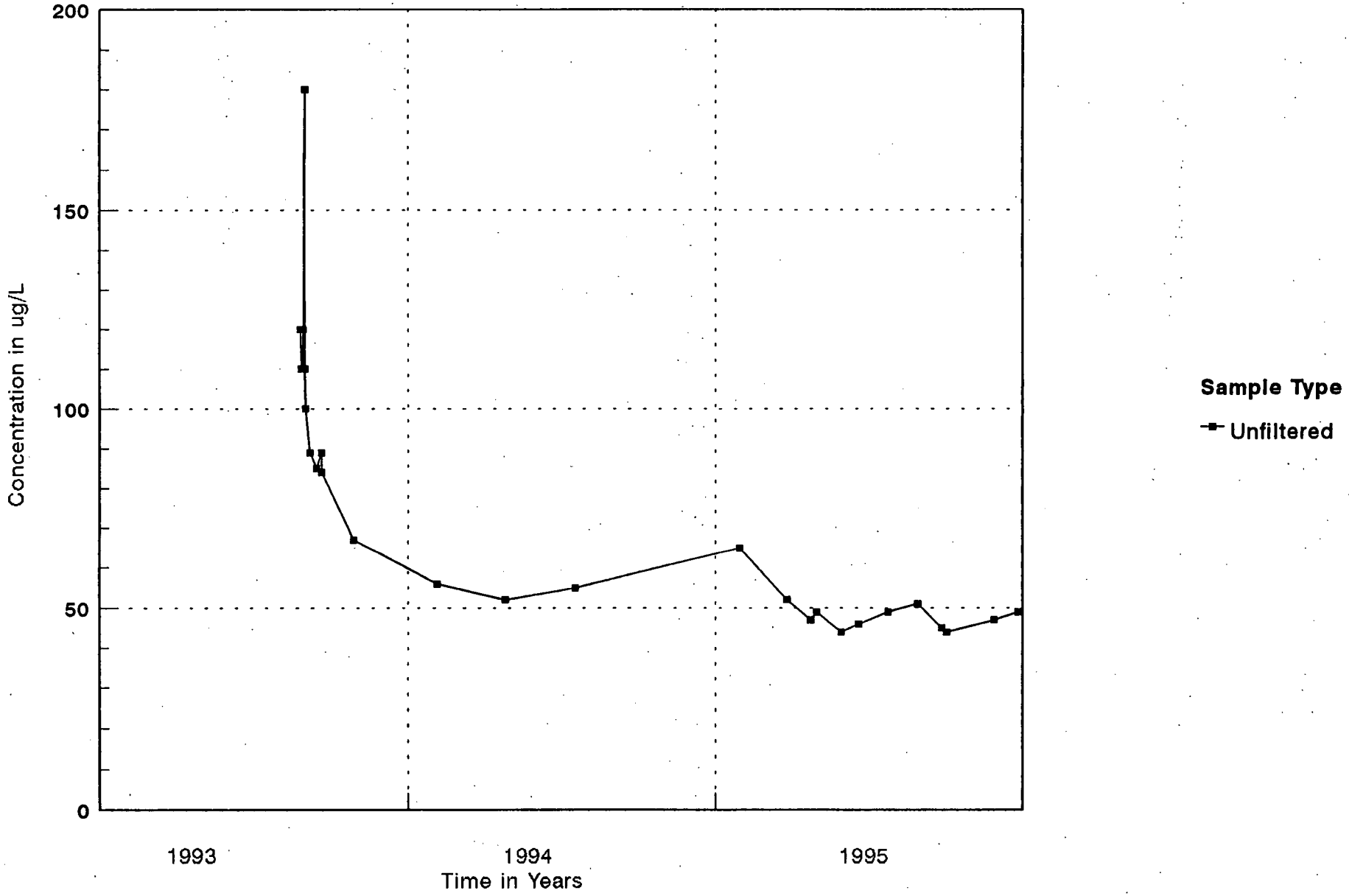


Monitoring Well 3900 Uranium Concentrations

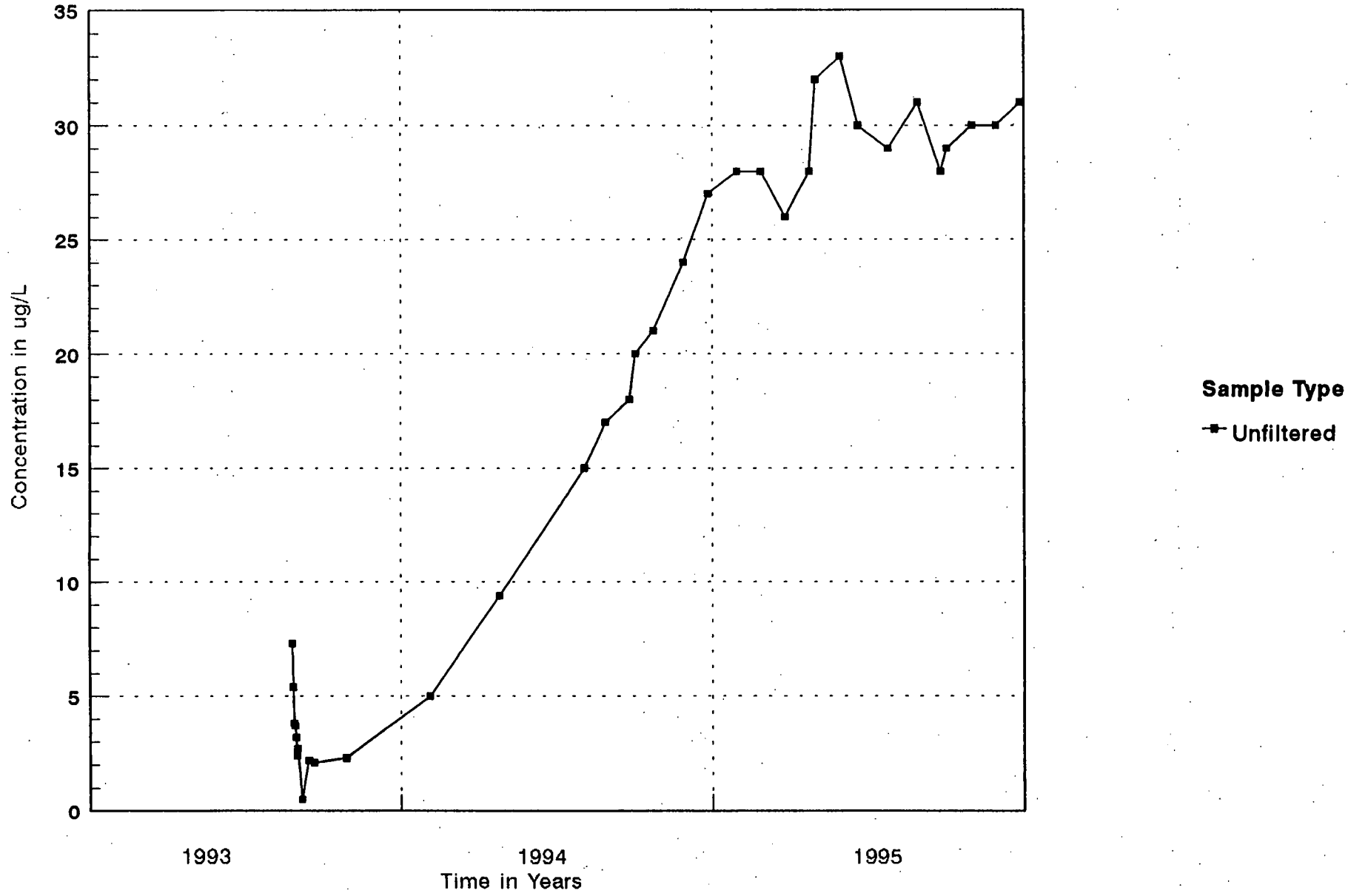
FIG 2

000109

000110

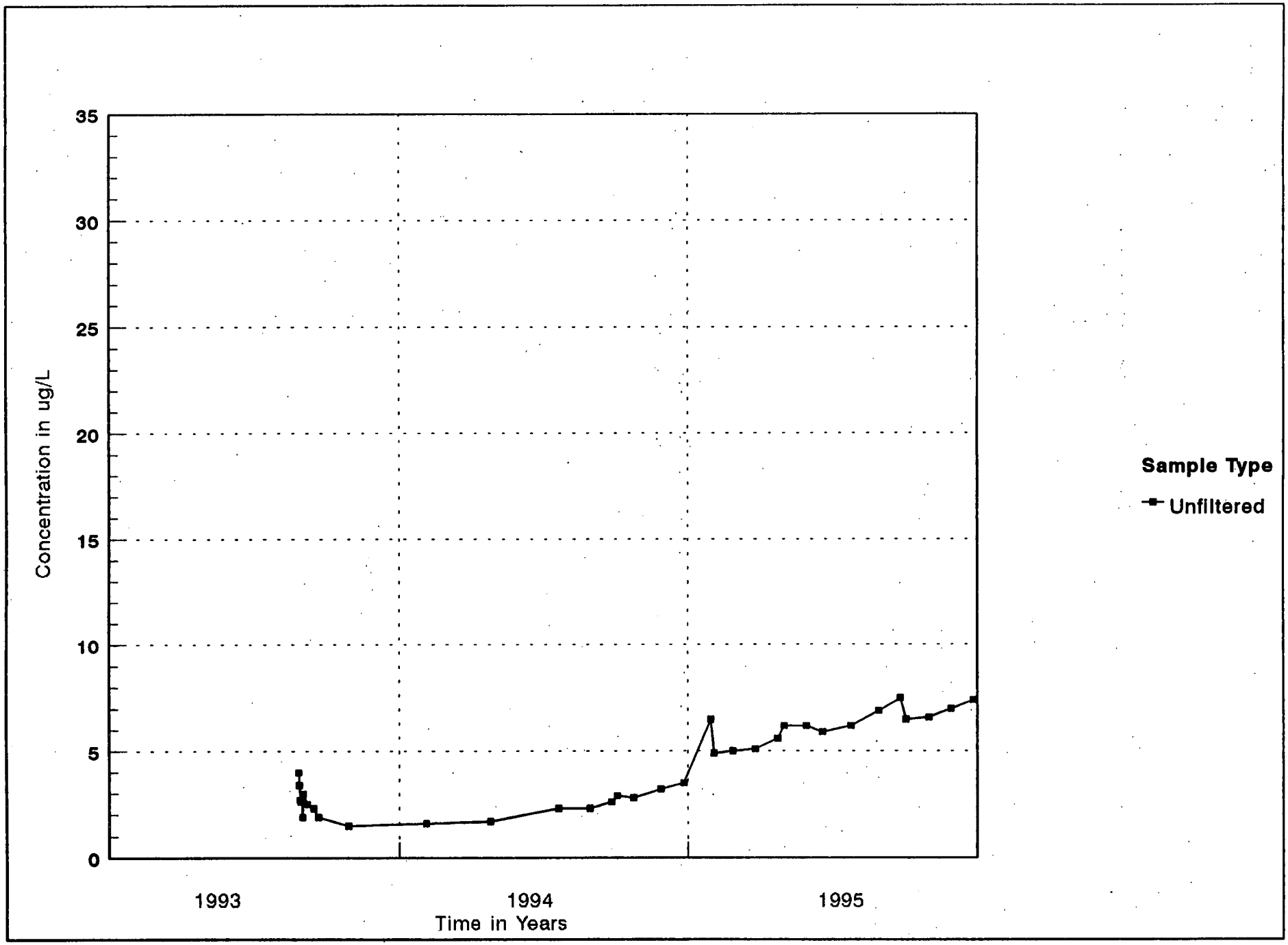


Recovery Well 3924 Uranium Concentrations

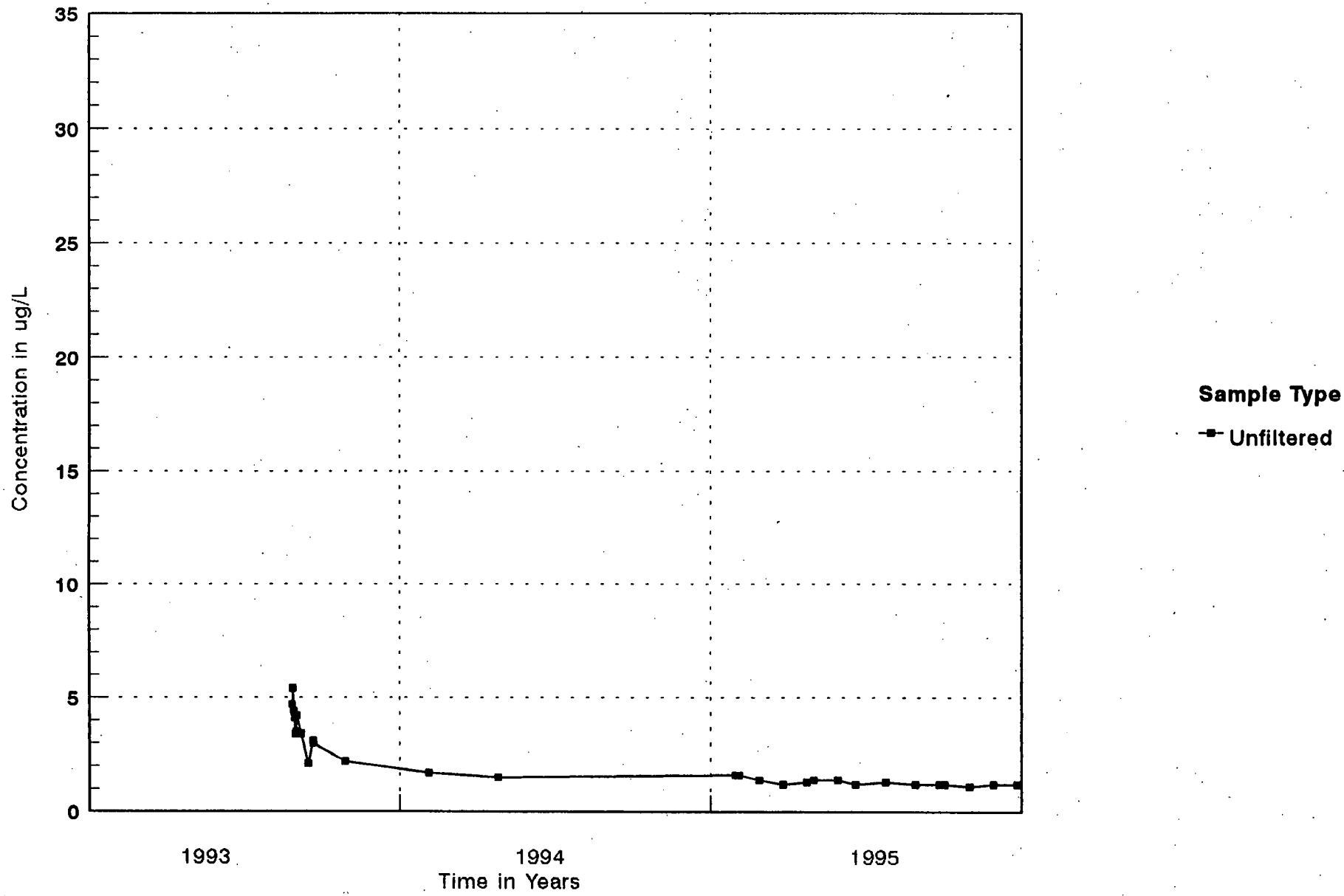


Recovery Well 3925 Uranium Concentrations

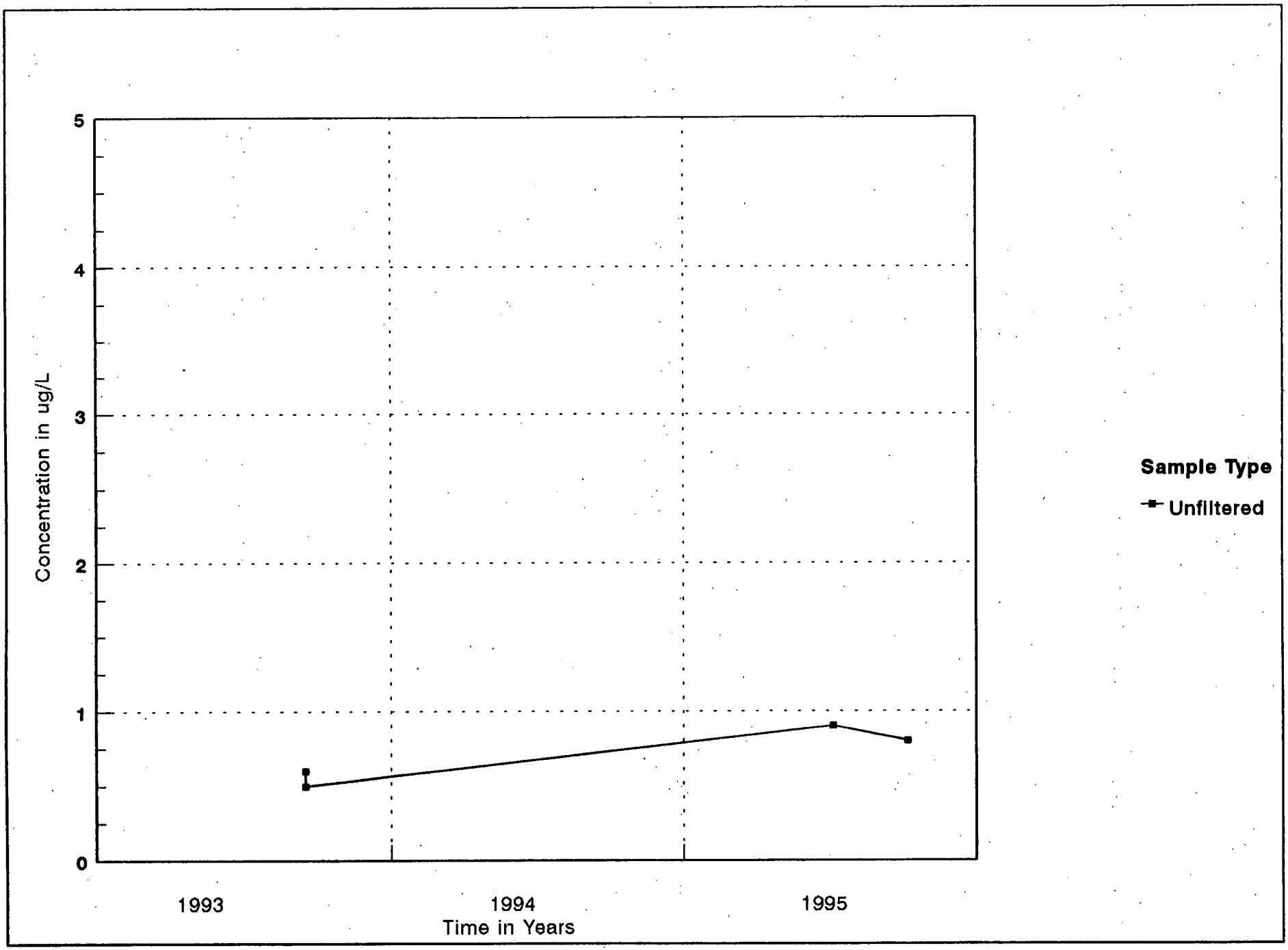
000112



Recovery Well 3926 Uranium Concentrations



Recovery Well 3927 Uranium Concentrations



Monitoring Well 412 anium Concentrations

000114

7591

Appendix C

APPENDIX C

MANN-KENDALL TREND CALCULATION

CALCULATION

The time-ordered data are represented as x_i, x_2, ... x_n, where x_k is the datum at time interval k. All possible differences are represented as $x_i - x_j$, where $i < j$. The Mann-Kendall test for trend assigns an integer (-1, 0, or 1) such that:

$$\text{sgn}(x_j - x_i) = \begin{cases} -1 & x_i > x_j \\ 0 & x_i = xj \\ 1 & x_i < x_j \end{cases}$$

The Mann-Kendall statistic is then calculated as:

$$S = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} sgn\,(x_j - x_i)$$

A value for S greater than one implies a possible upward trend, a value for S less than one implies a possible downward trend, and a value of S = 0 implies no trend.