ORNL/TM-8879

ornl

OAK RIDGE NATIONAL LABORATORY

UNION CARBIDE

Results of the Groundwater Monitoring Program Performed At the Former St. Louis Airport Storage Site for the Period of January 1981 Through January 1983

C. Clark
B. A. Berven

OPERATED BY
UNION CARBIDE CORPORATION
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

ORNL/TM-8879
Distribution Category UC-70

Contract No. W-7405-eng-26

HEALTH AND SAFETY RESEARCH DIVISION

NUCLEAR WASTE PROGRAMS
(Activity AH 10 05 00 0, Task ONLWC01)

RESULTS OF THE GROUNDWATER MONITORING PROGRAM PERFORMED AT THE FORMER ST. LOUIS AIRPORT STORAGE SITE FOR THE PERIOD OF JANUARY 1981 THROUGH JANUARY 1983

C. Clark
B. A. Berven

Date Published - March 1984

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37830
operated by
UNION CARBIDE CORPORATION
for the
U.S. DEPARTMENT OF ENERGY

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

The authors wish to acknowledge the contributions of the people involved in the production of this report. The following people at Evaluation Research Corporation in Oak Ridge, Tennessee were responsible for preparation of the initial draft of this report, well measurements, and sample collection: L. E. Boing, J. M. Mahathy, and R. R. Rose. Tom Scott and J. Emory were responsible for sample analyses. We also acknowledge the meticulous preparation of this report by S. E. Huckaba and O. V. Jennings.

RESULTS OF THE GROUNDWATER MONITORING PROGRAM PERFORMED AT THE FORMER ST. LOUIS AIRPORT STORAGE SITE FOR THE PERIOD OF JANUARY 1981 THROUGH JANUARY 1983

C. Clark
B. A. Berven

ABSTRACT

Results of a two-year groundwater monitoring program performed at the former St. Louis Airport Storage Site in January 1981 through January 1983 are presented in this report. Data indicate that radionuclides stored onsite are leaching into the groundwater; however, the radionuclide concentrations are well below the maximum permissible concentration (MPC) for effluents to unrestricted areas.

The only radionuclide detected in measurable amounts in the groundwater at these wells was ^{238}U. One well averaged approximately 1860 pCi/L of ^{238}U during the two-year period. The maximum concentration of ^{238}U observed at this well was 2230 pCi/L. This well water sample exceeded the maximum background ^{238}U concentration (45 pCi/L) measured in groundwater throughout the state of Missouri by a factor of 50. Based on the results of the ^{238}U concentration measured (in well water) at the former St. Louis Airport Storage Site, leaching of radionuclides is occurring, resulting in concentrations of ^{238}U in the groundwater above background levels. However, the concentration of the radionuclides analyzed did not exceed the MPC for effluents as given in Appendix B, Table II, Column 2 of 10 CFR 20. Although there appears to be some movement of the groundwater into Coldwater Creek, adjacent to the site, due to dilution of the creek water, the concentrations of radionuclides in Coldwater Creek are expected to be substantially below MPC.

1. INTRODUCTION

The Department of Energy (DOE) is conducting a program to identify and remedy potentially unacceptable radiological conditions at sites utilized by the Manhattan Engineer District (MED), and later the Atomic Energy Commission (AEC), during the early development of nuclear energy in the United States. One such site, acquired by the MED in 1946, was the St. Louis Airport Storage Site, which was used for storing waste residues generated during uranium processing operations (Fig. 1).[1] Between 1946 and 1967, the 8.8 ha (21.7-acre) tract was actively used as a storage/dump site for radioactive material. During 1966 and 1967, most of the stored residues were sold for their mineral content and removed from the site.[2]

In November 1969, title to the site was transferred from the U.S. Government to the Lambert-St. Louis Airport Authority, and all of the site's structures and buildings were razed and buried onsite. Although various clean-up programs were conducted until 1971, there was insufficient data for radiological characterization purposes. Therefore, in 1976 and 1978, Oak Ridge National Laboratory (ORNL) performed a comprehensive radiological survey. The survey indicated that although the bulk of the stored wastes had been removed, some residual materials remained at surface and subsurface depths.[3]

At the request of DOE, the Radiological Survey Activities (RASA) group at ORNL initiated a groundwater monitoring program at the former St. Louis Airport Storage Site (SLAPSS) in January 1981. The objective of this program was to monitor six wells to determine: (1) is leaching of radionuclides occurring, and (2) if so, how much is being channeled into the groundwater.

2. SITE HISTORY AND DESCRIPTION

The former St. Louis Airport Storage Site is located about 24 km from downtown St. Louis, and is adjacent to the northern boundary of the Lambert-St. Louis International Airport. The site was operated by the

MED and AEC from 1946 to 1953 to store residues generated during uranium processing operations at the Destrehan Street Refinery and Metals Plant. In 1953, operation of the airport storage site was contracted to Mallinckrodt Chemical Works.[4]

Pitchblende ores were processed at the Drestrehan Street plant until 1955. Via the procurement arrangements with African Metals, an ore supplier, storage of the pitchblende ore and radium-bearing residues became the responsibility of the government. Various materials were stored as follows: pitchblende raffinate - stored uncovered on the ground surface; radium-bearing ores - stored in drums; and non-pitchblende feedstock and barium cake residues - also stored uncovered at the site. Because of the nature of the process involved in extracting radium and uranium from the ores, the barium cake and similar residues contained most of the ^{230}Th, ^{231}Pa, and ^{227}Ac from the original ore.

In addition to dolomite liner and recycled magnesium fluoride liner generated as scrap, other wastes stored at the site included: tailings from an Interim Residue Plant built in 1955 to recover uranium from the magnesium fluoride slag; 2400 drums containing miscellaneous residues and other scrap materials; 3500 tons of contaminated steel and alloy scrap (primarily buried in low areas on the west end of the airport and covered with fill dirt). Fig. 2 shows the locations of the stored residual materials as of 1965.[5] The approximate amounts of uranium residues stored as of 1965 are shown in Table 1.

After the ore residues stored at the site were sold to Continental Mining and Milling Company (1966), the remaining residues were moved to the Latty Avenue site in Hazelwood, Missouri. The barium sulfate residues, however, were taken to the Interim Storage Site at Weldon Springs, Missouri. The onsite structures were then dismantled, buried on the site, and covered over with a layer of clean fill dirt. The City of St. Louis assumed ownership of the site in 1973, with the Lambert-St. Louis Airport Authority being responsible for access and maintenance of the site.[5]

Comprehensive radiological surveys were conducted at the site by the Health Physics Division of ORNL in 1976 and by the Health and Safety Research Division of ORNL in 1978. The ORNL surveys indicated that at the time when the stored residues were sold and removed, some remaining barium sulfate cake was covered with fill. Subsurface examination of the site indicated that contamination extended to depths of 6.2 m.

The site slopes from east to west and has a gradual cross-site elevation drop of approximately 6 m. A drainage ditch runs along the northern border of the site. Coldwater Creek, which captures some of the groundwater flow from the site, forms the west boundary and lies roughly 6 m below the site surface. The surface cover consists of up to 2.5 m of non-select fill material, distributed as shown in Fig. 3.[5] Particle sizes range from fine clay to boulders. Since the 1976 survey, large amounts of fill, mainly rubble from road construction, have been added to the southwest end. Settling has occurred in the northwest portion of the site, and erosion has produced gullies at the west end.[3]

Based on the results of investigations by Weston Environmental Consultants-Designers, the direction of groundwater flow through the fill material is from the topographic high area in the east corner toward Coldwater Creek in the west corner.[4] The flow pattern is shown in Fig. 4.

There are no known users of groundwater within the immediate vicinity of the former St. Louis Airport Storage Site. There is no population residing within 0.4 km and 75 to 100 persons within 0.8 km of the site.[4] Use of the groundwater for drinking purposes is highly unlikely due to its low quality. The groundwater in the St. Louis area contains more than 1000 ppm of dissolved solids and is classified as being saline. The nearest well is approximately 2.5 km north of the site and is not used for obtaining drinking water. The drinking water for the metropolitan St. Louis area is acquired from municipal water purification plants, which receive their water from the Mississippi River.[4] The groundwater which flows through the former St. Louis Airport Storage Site into Coldwater Creek empties into the Missouri River at a point 6.5 km above the junction of the Missouri and the Mississippi rivers. The

amount of SLAPSS groundwater moving into Coldwater Creek is considered insignificant compared to the average stream flow.[4]

3. MONITORING METHODS

In September/October 1979, a network of six wells was installed by Weston Environmental Consultants-Designers specifically for obtaining groundwater samples. The well locations are shown in Fig. 5.

In January 1981, a two-year well monitoring program was begun by Evaluation Research Corporation (ERC) under subcontract with ORNL. The wells were monitored on a monthly basis through January 1983. Groundwater elevation, pH, and temperature were determined at the time of sample collection. The samples that were extracted from the wells were analyzed for ^{226}Ra, ^{230}Th, ^{210}Pb, ^{238}U, ^{231}Pa, and ^{227}Ac. The filters that were used were also analyzed for radionuclides, which could have been present on suspended particulates. All wells were flushed (to rid the well of any particulate build-up) prior to obtaining water samples. Based on the diameter of the PVC pipe and the water column height, it was determined that flushing could be conducted by pumping a volume of water equal to that contained in each well.

3.1 POST-SAMPLING PROCEDURE

Two liters of water were pumped from each well and collected in a polyethylene container. Each sample was filtered onsite through a 0.45-μm membrane filter. To prevent the precipitation of radionuclides, 5 ml of concentrated nitric acid were added to each sample before returning the sample to ORNL for analysis.

4. MONITORING RESULTS

Applicable guideline values for radionuclides measured in water at the site for unrestricted use are presented in Table 2. The radionuclide concentration ranges measured for wells A-F during the monitoring period of January 1981-January 1983 are presented in Table 3.

After analyzing the radionuclide data obtained from the two-year well-monitoring program at SLAPSS, two significant trends were observed. The first trend was that the ^{238}U concentration measured in all the monitoring wells was high in comparison to the other radionuclides analyzed for each month during the monitoring period. The average ^{238}U concentration for the monitoring period ranged from 8.6 pCi/L (Well C) to 1860 pCi/L (Well B). The concentrations of the other radionuclides analyzed were at or near the reported limits of analysis. The second trend that was observed was that the ^{238}U concentration measured in Well B was significantly higher than the ^{238}U concentration measured in the other five wells over the entire monitoring period. The average ^{238}U concentration (1860 pCi/L) measured in well B was 12 times higher than the average ^{238}U concentration (157 pCi/L) measured in the other wells. As to the significance of the ^{238}U concentration measured during this monitoring period, the ^{238}U concentration measured from water samples taken from the site exceeded the maximum ^{238}U concentration (45 pCi/L) measured in groundwater throughout the state of Missouri by a factor of 50.[7] The background ^{238}U concentration measured in the state of Missouri groundwater ranged from 0.01 to 45 pCi/L.[7] There appeared to be no relationship between radionuclide concentration in the wells with time or any physical parameters (e.g. well water depth, pH, temperature, etc.).[6]

The ^{238}U concentrations measured in Well F ranged from 0.8 to 70 pCi/L between January 1981 and November 1982. However, in December 1982, the maximum ^{238}U concentration measured in Well F was 256 pCi/L. Since Well F is hydrologically up-gradient from the other wells, and the maximum value is four standard deviation units greater than the mean, it is believed that the measurement of 256 pCi/L may be an anomaly in the data. However, on the same sampling date for which the ^{238}U concentration value of 256 pCi/L was reported for Well F, Wells A, B, C, and E also showed some increase in ^{238}U concentration. This increase in the ^{238}U concentration for the wells previously mentioned indicates leaching of contamination was occurring. In the two months that followed (January/February 1983), the elevated concentration of ^{238}U measured in Well F decreased by a factor of 4.

The concentrations of the other radionuclides analyzed were at or near the reported limits of analysis. The reported limits of analysis are influenced by the differences in the analytical process in instrument background, counting time, sample size, and recovery rate from chemical separation. The concentration of ^{226}Ra measured in Well C ranged from <0.03 - 9 pCi/L, and averaged 0.8 pCi/L over the sampling period. The higher concentration of ^{226}Ra measured in the water sample extracted from Well C may have been caused by a particle suspended in the filtrate. Water samples extracted from Wells D and E were measured as having the highest concentration of ^{231}Pa, that is, 0.8 pCi/L, which is approximately 900 times below the Nuclear Regulatory Commission (NRC) guidelines (Table 4). Analytical and field measurements for each monthly sampling period at the site is given in Appendix I (Tables I.1 through I.24).

The concentration values for ^{238}U, ^{226}Ra, and ^{210}Pb for the monitoring period are plotted in Figs. 6-8, respectively. The measurements below detection limits of analysis are depicted with the downward-pointing arrows. Also, for comparison purposes, the maximum permissible concentration (MPC) levels for ^{226}Ra and ^{210}Pb are plotted in Figs. 7 and 8. The maximum radionuclide concentrations measured in samples extracted from the well water and that measured on the filters are reported in Tables 4 and 5, respectively.

Based on the well elevation data presented in Figs. 9-11,[6] the hydrologic responses to the rainfall were not the same at all of the wells. Wells A through C and E were most similar to water elevation with respect to time as compared to water elevations at Wells D and F. Wells A-C are located in close proximity to one another on the west end of the site as shown in Fig. 5 and are hydrologically down-gradient at the site. Water elevations at Wells D and F, however, showed different patterns in comparison to the other four wells. Radionuclide concentrations and water elevations measured during the monitoring period are plotted in Appendix II (Figs. II.1 through II.18).[6]

There was no apparent relationship between the changes in the radionuclide concentrations and the water elevations. Well B, which had

the highest ^{238}U concentration, showed the least variation for water elevation (2 m). However, Well D, which measured to have the next highest ^{238}U concentration (1000 pCi/L), also had the greatest fluctuation in water elevations (4 m).

5. SIGNIFICANCE OF FINDINGS

The only radionuclide detected in significant concentrations was ^{238}U, with a maximum concentration of 2230 pCi/L. The concentration of ^{238}U in well water from three wells (A, B, and D) at the former St. Louis Airport Storage Site consistently exceeded the maximum ^{238}U concentration (45 pCi/L) measured in groundwater from the state of Missouri. Well B, where the maximum ^{238}U concentration was detected, is located on the west side of the site where radioactive materials were known to be buried. The concentration of other radionuclides analyzed (^{226}Ra, ^{230}Th, ^{210}Pb, ^{231}Pa, and ^{227}Ac) were at or near the reported limits of analysis.

Based on the results of the ^{238}U concentration measured (in well water) at the former St. Louis Airport Storage Site, leaching of radionuclides is occurring, resulting in concentrations of ^{238}U in the groundwater significantly above background levels. However, the concentration of the radionuclides measured during this monitoring period at all sampling locations was below NRC guideline values.

REFERENCES

1. Formerly Utilized MED/AEC Sites Remedial Action Program, Radiological Survey of the St. Louis Airport Storage Site, DOE/EV-0005/16 (September 1979).

2. Roy F. Weston, Inc., Stability Concept and Method Testing Project, St. Louis Airport Site, Draft Progress Report prepared for ORNL (February 1981).

3. Roy F. Weston, Inc., Formerly Utilized Sites Remedial Action Program, St. Louis Airport Storage Site (SLAPSS), Vol. 1, No. 1 (June 1981).

4. Roy F. Weston, Inc., Environmental Impact Assessment of the Former Airport Storage Site of the Atomic Energy Commission, Draft Report prepared for ORNL (October 1978).

5. Roy F. Weston, Inc., Formerly Utilized Site Remedial Action Program, St. Louis Airport Storage Site (SLAPSS), Vol. 2, No. 2 (June 1981).

6. R. R. Rose, L. E. Boing, and J. M. Mahathy, Former St. Louis Airport Storage Site Ground Water Monitoring Program: Summary Report for the Period of January 1981 through January 1983, Report prepared for ORNL (May 1983).

7. J. S. Drury et al., Uranium in U.S. Surface, Ground, and Domestic Waters, ORNL/EIS-192/V1, EPA-570/9-81-001/Volume 1 (April 1981).

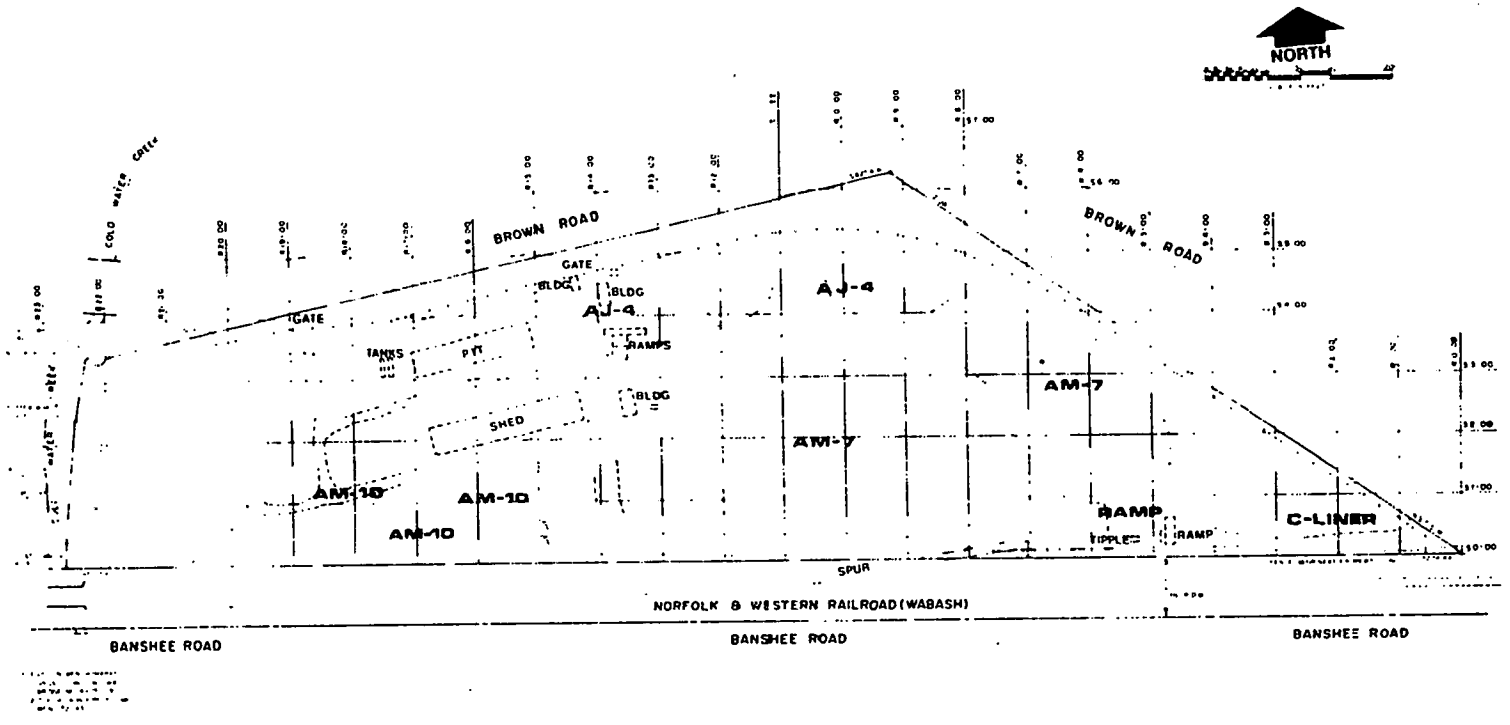


Fig. 2. Schematic of the location of structures and residual piles as of 1965 at the former St. Louis Airport Storage Site.

[SOURCE: Roy F. Weston, Inc., Formerly Utilized Sites Remedial Action Program, St. Louis Airport Site (SLAPSS), Vol. 1, No. 1 (June 1981)]

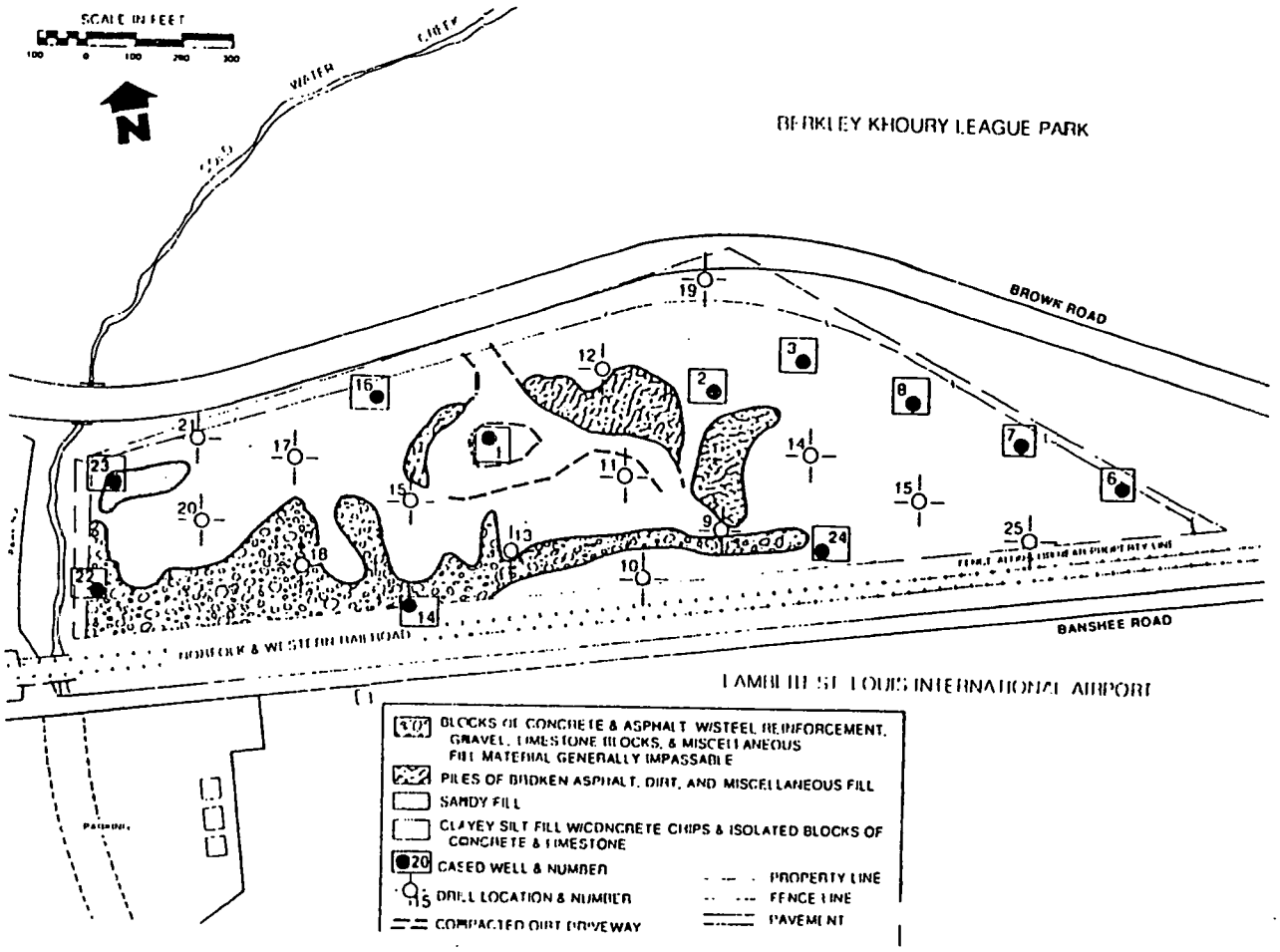


Fig. 3. Distribution of surface fill materials at the former St. Louis Airport Storage Site, September 1978.

[SOURCE: Roy F. Weston, Inc., Environmental Impact Assessment of the Former Airport Storage Site of the Atomic Energy Commission, Draft Report prepared for ORNL (October 1978)]

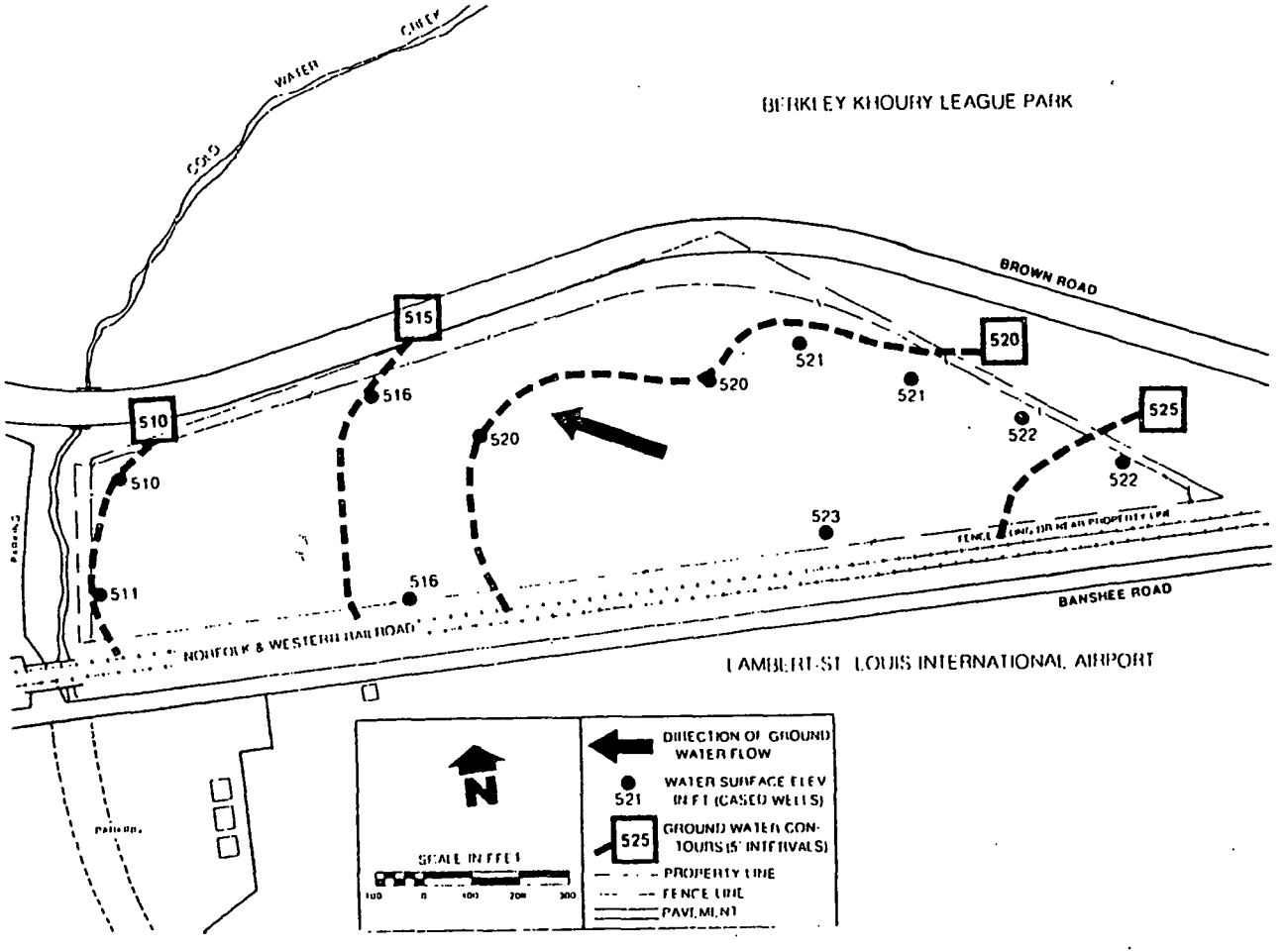
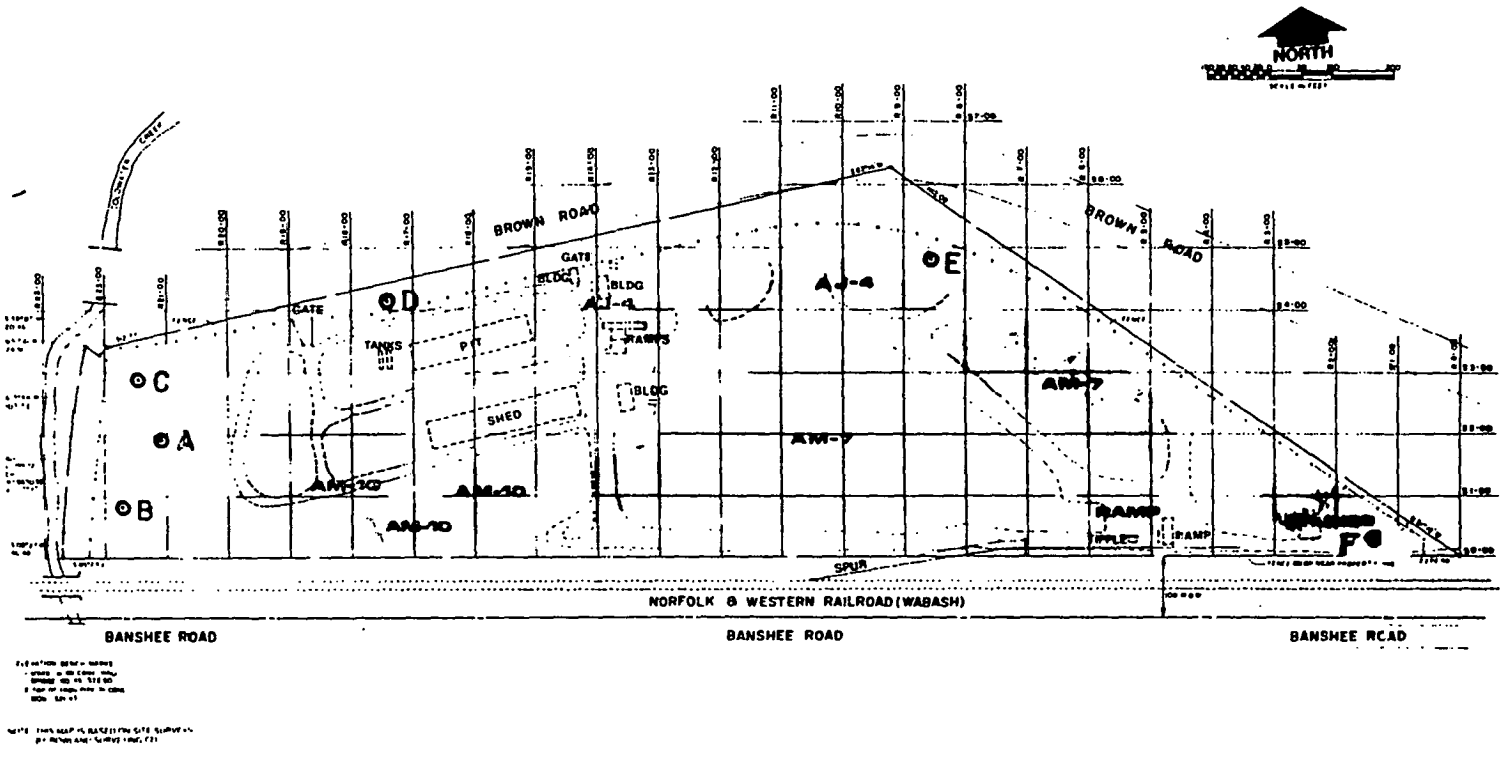


Fig. 4. Groundwater flow characteristics at the former St. Louis Airport Storage Site.

[SOURCE: Roy F. Weston, Inc., Environmental Impact Assessment of the Former Airport Storage Site of the Atomic Energy Commission, Draft Report prepared for ORNL (October 1978)]



⊙Monitor Wells

ST. LOUIS AIRPORT STORAGE SITE
PLATE 2
WASTE PILES (AS OF 1985), BUILDING AND ROAD LOCATIONS

Fig. 5. Location of the six monitoring wells at the former St. Louis Airport Storage Site.

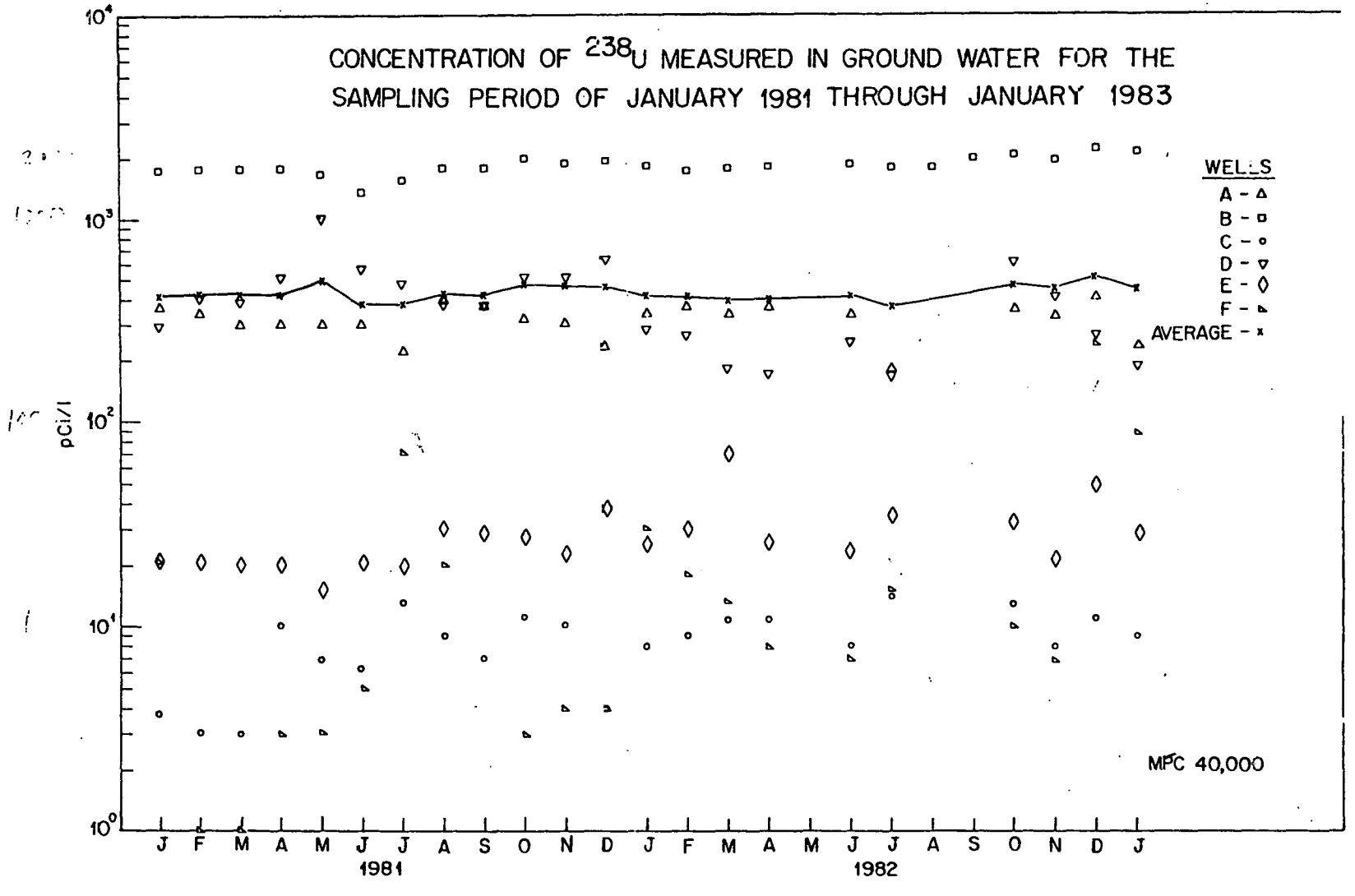


Fig. 6. ^{238}U concentrations measured in groundwater at the former St. Louis Airport Storage Site.

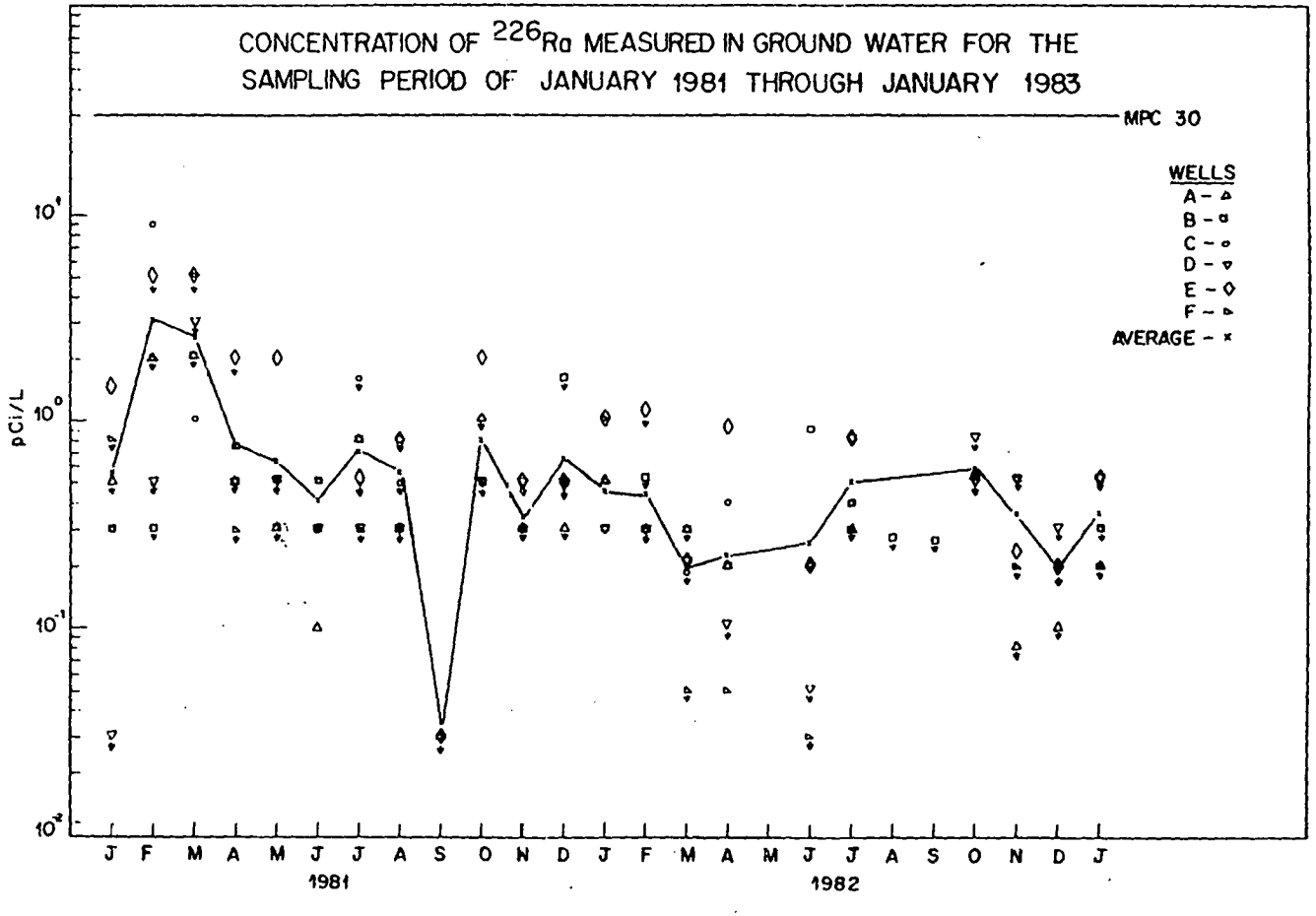


Fig. 7. ^{226}Ra concentration measured in groundwater at the former St. Louis Airport Storage Site.

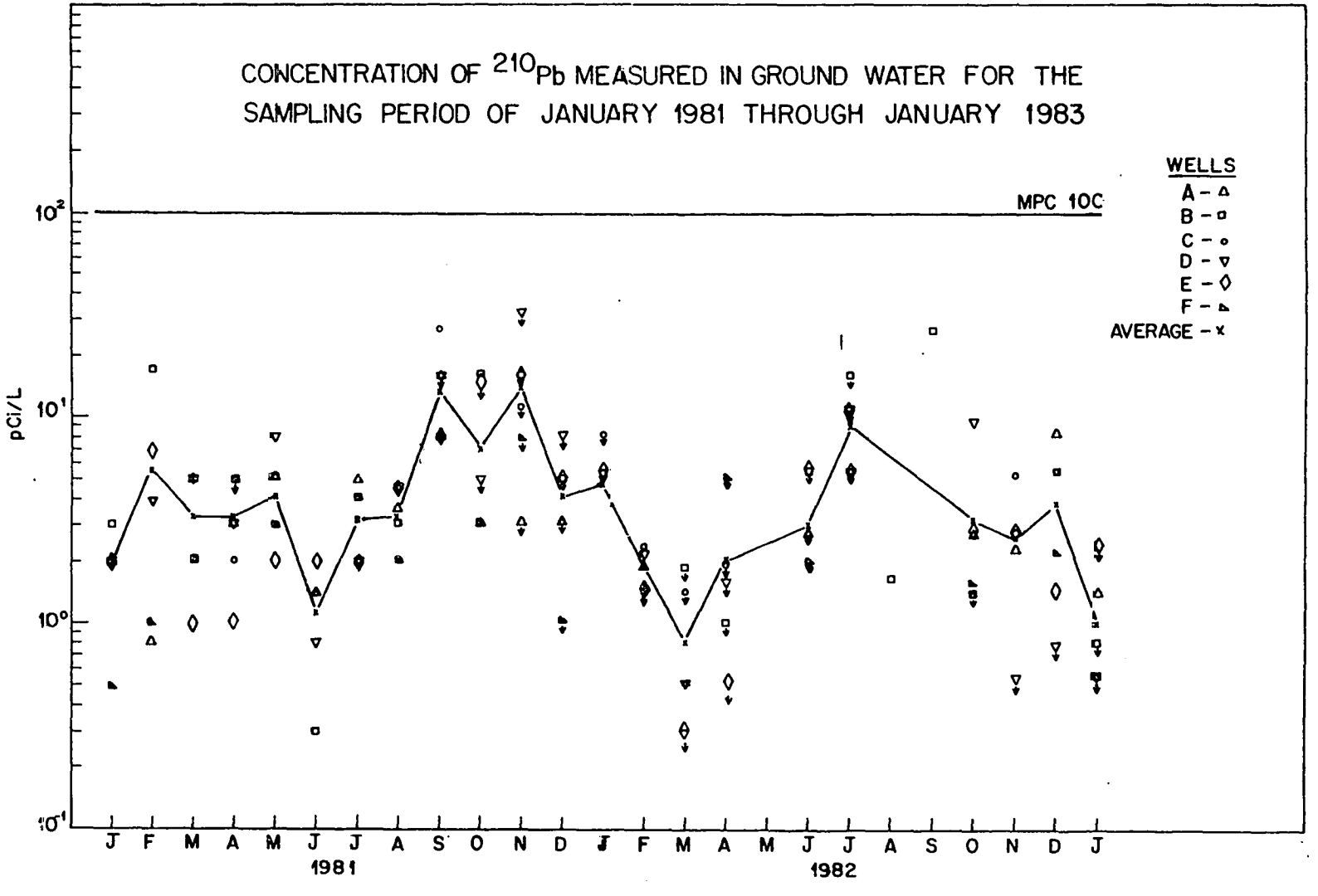


Fig. 8. ^{210}Pb concentrations measured in groundwater at the former St. Louis Airport Storage Site.

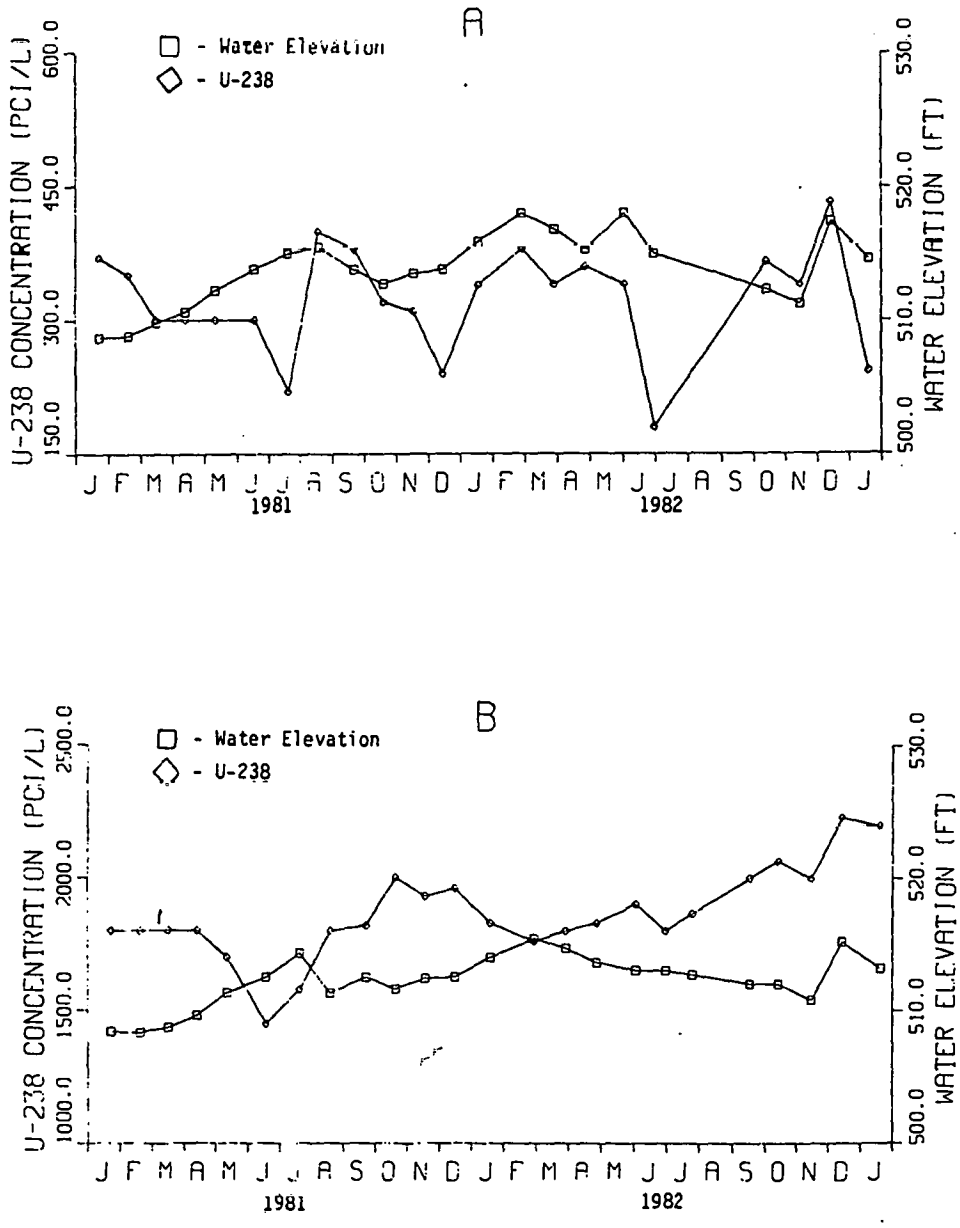


Fig. 9. ^{238}U concentrations (pCi/L) and water elevations (ft) at Wells A and B measured at the former St. Louis Airport Storage Site.

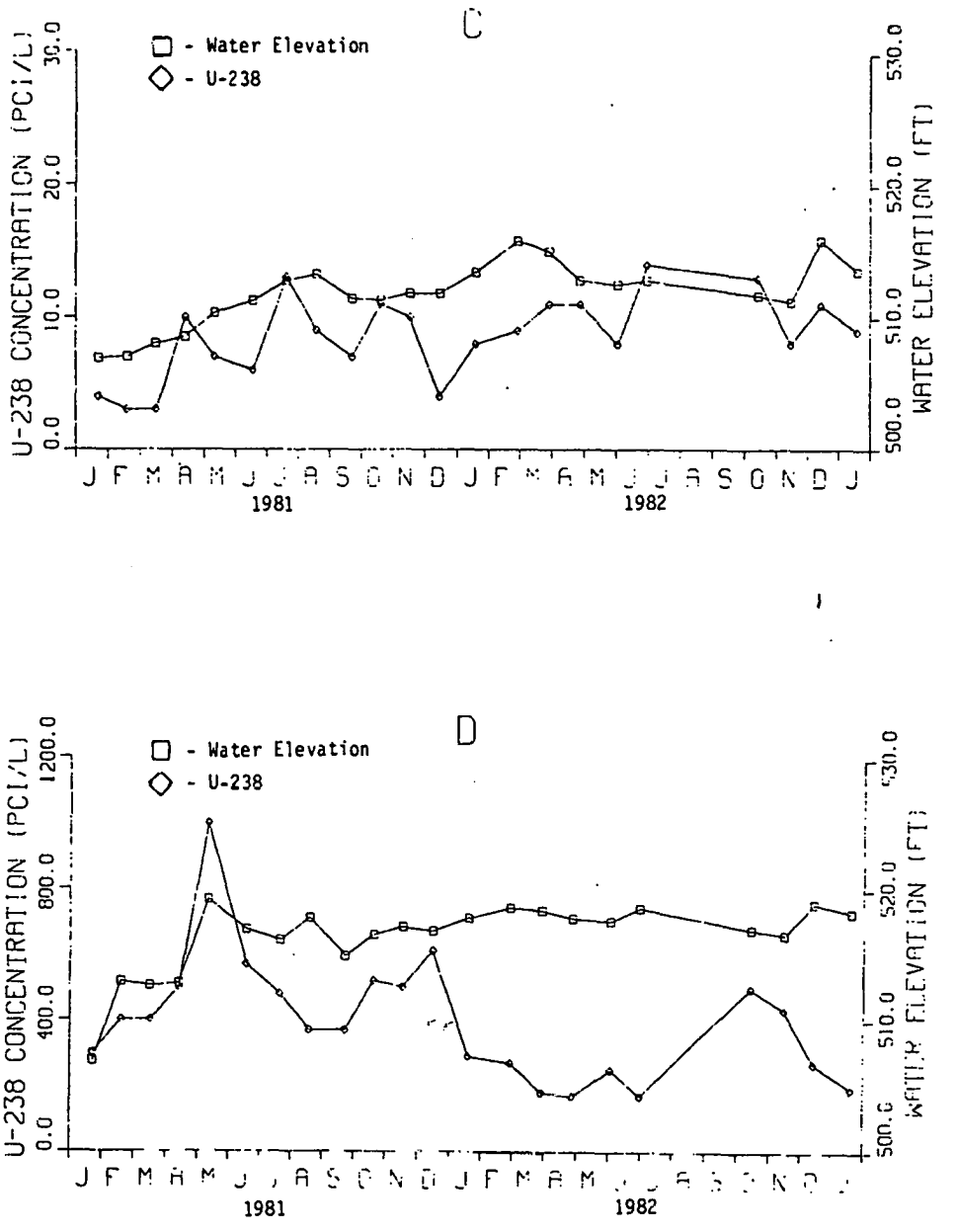


Fig. 10. ^{238}U concentrations (pCi/L) and water elevations (ft) at Wells C and D measured at the former St. Louis Airport Storage Site.

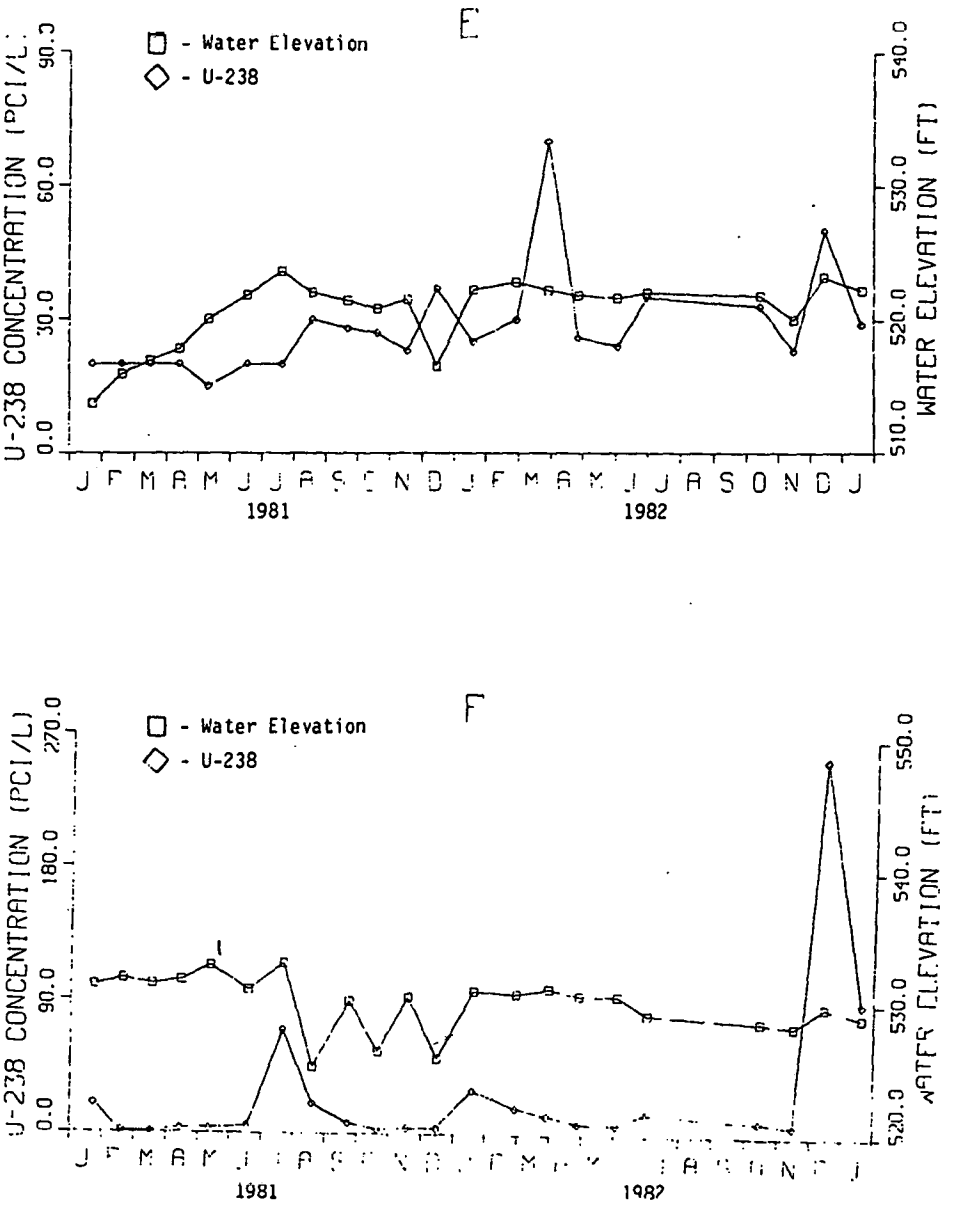


Fig. 11. ^{238}U concentrations (pCi/L) and water elevations (ft) at Wells E and F measured at the former St. Louis Airport Storage Site.

Table 1. Residues stored at the former St. Louis Airport Storage Site (November 1965)

Waste material	Code name	Tonnage	Uranium tonnage
Pitchblende raffinate	AM-7[a]	74,000	113
Colorado raffinate	AM-10[a]	32,500	48
Barium sulfate cake, unleached	AJ-4[a]	1,500	22
Barium sulfate cake, leached	AJ-4[a]	8,700	7
C-liner slag		4,000	49
Radium-bearing residue	K-65[b]		
Total		120,700	239

[a]AM-7, AM-10, and AJ-4 were stored at the site on the ground and in the open.

[b]K-65 was stored at the site in drums and was transferred from the site in 1948.

Table 2. Applicable guidelines for radionuclides analyzed from water samples at the former St. Louis Airport Storage Site

Radionuclide	Solubility	Guideline Value (pCi/L)[a]
^{226}Ra	Soluble	3×10^{1}
	Insoluble	3×10^{4}
^{230}Th	Soluble	2×10^{3}
	Insoluble	3×10^{4}
^{210}Pb	Soluble	1×10^{2}
	Insoluble	2×10^{5}
^{238}U	Soluble	4×10^{4}
	Insoluble	4×10^{4}
^{231}Pa	Soluble	9×10^{2}
	Insoluble	2×10^{4}
^{227}Ac	Soluble	2×10^{3}
	Insoluble	3×10^{5}

[a]Guideline values for water for unrestricted use (10 CFR 20.103, Appendix B, Table II).

Table 3. Range of radiochemical concentrations measured from water samples from the former St. Louis Airport Storage Site monitoring Wells A-F for period of January 1981 - January 1983

	Well A	Well B	Well C	Well D	Well E	Well F
Filtrate (pCi/1):						
^{226}Ra	<0.03-<2	<0.03-<2	<0.03-9	<0.03-<3	<0.03-<5	<0.03-<5
^{230}Th	<0.03-6	<0.03-18	<0.05-2	<0.03-2	<0.03-<2.2	<0.01-<2.2
^{210}Pb	<0.3-8.4	0.3-27	<0.5-<27	<0.5-<32	<0.3-<16	<0.5-<16
^{238}U	180-433	1450-2231	3-14	170-1000	15-70	0.8-256
^{231}Pa	<0.03-<0.5	<0.05-<.27	<.05-0.5	<0.05-<0.8	<0.05-<0.8	<0.03-<0.3
^{227}Ac	<0.03-<8	<0.03-<15	<0.03-<2	<0.03-<2	<0.05-<1	<0.03-<2
Filters (pCi):						
^{226}Ra	<0.03-<50	<0.1-130	<0.08-1	<0.03-190	<0.03-5	<0.03-<0.8
^{230}Th	<0.1-90	<0.27-25	0.27-<1	<0.05-3.5	0.05-20	0.01-6
^{231}Pa	<0.03-<0.08	<0.05-<0.3	<0.03-<0.1	<0.03-<0.1	<0.03-<0.5	<0.05-<0.2
^{227}Ac	<0.3[a]	<0.03-<0.3	<0.03-<0.3	<0.03-<0.5	<0.03-<0.3	<0.03-<0.3

[a]Because of the recommendation received from the chemistry department, ^{227}Ac was only measured once during filter analysis.

Table 4. Comparison of St. Louis Airport Storage Site maximum concentrations in water samples to the NRC water guidelines

Radionuclide	Maximum radionuclide concentration in water samples during the sampling period (pCi/L)	NRC guidelines 10 CFR Part 20 Appendix B Table 2 (pCi/L)	Factor (x) below guideline levels
^{226}Ra	9	30	3
^{230}Th	18	2000	100
^{210}Pb	<32	100	>3
^{238}U	2231	40000	18
^{231}Pa	<0.8	900	>900
^{227}Ac	<15	2000	>100

Table 5. Comparison of St. Louis Airport Storage Site maximum radionuclide concentrations on filters to the NRC water guidelines

Radiochemical analysis - filters	Maximum monthly concentration on filters during the sampling period (pCi/L)	NRC guidelines 10 CFR Part 20 Appendix B Table 2 (pCi/L)	Factor (x) below guideline levels
^{226}Ra	190	30,000	160
^{230}Th	90	30,000	330
^{231}Pa	<0.5	2,000	>4,000
^{228}Ac	<0.3	300,000	>1,000,000

APPENDIX I

RADIOCHEMICAL RESULTS AND ENVIRONMENTAL CONDITIONS IN THE WELLS

Table I-1. Radiochemical results of well water samples for January 1981

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.5	0.3	0.3	<0.03	1.4	<0.8
^{230}Th	2	7	2	2	<0.8	<0.8
^{210}Pb	2	3	2	2	2	0.5
^{238}U	370	1800	4	300	20	20
^{231}Pa	<0.5	<0.3	<0.05	<0.3	<0.3	<0.3
^{227}Ac	<0.05	<0.1	<0.05	<0.03	<0.8	<0.8
pCi/filter Total[a]						
^{226}Ra	<0.05	<0.2	<0.08	<0.1	<0.1	<0.03
^{230}Th	1.8	0.8	0.2	0.5	0.4	0.1
^{231}Pa	<0.05	<0.05	<0.05	<0.05	<0.5	<0.05

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	508.7	508.4	506.9	506.9	513.7	531.1
pH	6.7	6.5	6.9	6.8	6.8	7.4
Temperature, °C	13.2	13.2	12.5	13.8	13.3	14.8

[a]Radionuclide content of suspended solids contained in 2 liters of sample.

Table I-2. Radiochemical results of well water samples for February 1981

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<2	<0.3	9	<0.5	<5	<2
^{230}Th	6	1	<0.08	2	0.1	<0.01
^{210}Pb	0.8	17	4	4	7	1
^{238}U	350	1800	3	400	20	1
^{231}Pa	<0.3	<0.5	<0.5	<0.8	<0.5	<0.3
^{227}Ac	<8	<15	<0.1	<0.05	0.2	<0.03
pCi/filter Total[a]						
^{226}Ra	<.05	2.2	<0.2	<0.2	1.2	0.1
^{230}Th	1	0.9	<.1	<.1	.2	.01
^{231}Pa	<0.08	<0.3	<0.1	<0.1	<0.2	<0.2

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	508.8	508.3	507.0	512.9	515.9	531.6
pH	6.6	6.4	6.8	6.7	6.5	7.1
Temperature, °C	15.8	16.0	15.1	14.3	14.0	15.4

[a]Radionuclide content of suspended solids contained in 2 liters of sample.

Table I-3. Radiochemical results of well water samples for March 1981

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<2	<2	1	<3	<2	<5
^{230}Th	0.4	18	0.1	0.4	0.5	0.05
^{210}Pb	5	2	5	5	1	2
^{238}U	300	1800	3	400	20	0.8
^{231}Pa	0.08	0.05	0.1	0.1	0.5	0.2
^{227}Ac	<0.34	<0.05	<0.1	<0.03	0.05	0.05
pCi/filter Total[a]						
^{226}Ra	<1	2	<0.5	<0.5	<0.5	<0.5
^{230}Th	90	25	<0.5	3.5	20	6
^{231}Pa	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	509.8	508.7	508.0	512.6	516.9	531.2
pH	6.6	6.6	6.8	6.9	6.5	7.2
Temperature, °C	14.0	13.8	13.1	12.8	13.0	13.7

[a]Radionuclide content of suspended solids contained in 2 liters of sample.

Table I-4. Radiochemical results of well water samples for April 1981

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.5	<0.8	<0.5	<0.5	<2	<0.3
^{230}Th	<1	<2	<2	<2	<1	<0.3
^{210}Pb	3	<5	2	3	1	5
^{238}U	300	1800	10	500	20	3
^{227}Ac	<1	<2	<2	<2	<1	<0.3
pCi/filter Total[a]						
^{226}Ra	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
^{230}Th	1	2	<0.5	0.1	1	0.5

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	510.6	509.6	508.5	512.8	517.8	531.5
pH	6.4	6.4	6.7	6.7	6.5	7.2
Temperature, °C	15.0	16.0	12.9	12.0	13.9	14.2

[a]Radionuclide content of suspended solids contained in 2 liters of sample.

Table I-5. Radiochemical results of well water samples for May 1981

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.3	0.3	0.3	<0.5	2	<0.5
^{230}Th	0.3	0.3	0.3	0.3	<0.3	0.3
^{210}Pb	5	5	3	8	2	3
^{238}U	300	1700	7	1000	15	3
^{227}Ac	0.3	0.3	0.3	0.3	0.3	0.3
pCi/filter Total[a]						
^{226}Ra	<0.03	0.5	0.3	<0.03	0.2	0.3
^{230}Th	0.2	0.5	0.03	0.3	0.05	0.1

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	512.2	511.3	510.3	519.2	520.0	532.6
pH	6.5	6.4	6.8	6.8	6.5	7.3
Temperature, °C	14.1	14.6	13.1	13.1	13.0	13.3

[a]Radionuclide content of suspended solids contained in 2 liters of sample.

Table I-6. Radiochemical results of well water samples for June 1981

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	0.1	0.5	0.5	0.3	0.8	0.3
^{230}Th	0.5	1.1	0.05	0.3	<0.1	<0.3
^{210}Pb	0.9	0.3	1.4	0.8	2	1.4
^{238}U	300	1450	6	570	20	5
^{227}Ac	<0.03	0.05	<0.03	0.5	0.03	0.3
pCi/filter Total[a]						
^{226}Ra	50	130	1	190	5	0.4
^{230}Th	0.4	<0.3	<0.3	<0.3	<0.3	<0.3
^{227}Ac	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	513.8	512.5	511.2	516.9	521.8	530.8
pH	6.5	6.3	6.6	6.6	6.5	7.0
Temperature, °C	14.6	16.0	14.0	15.8	14.4	14.7

[a]Radionuclide content of suspended solids contained in 2 liters of sample.

Table I-7. Radiochemical results of well water samples for July 1981

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	0.8	<0.8	<1.6	<0.3	0.5	0.3
^{230}Th	<1	0.7	<1	0.8	<1	<1
^{210}Pb	5	4	<2	<2	2	4
^{238}U	220	1580	13	480	20	70
^{227}Ac	<1	<0.3	<1	<0.3	<1	<1
pCi/filter Total[a]						
^{226}Ra	b	0.2	0.3	<0.03	<0.03	<0.3
^{230}Th	b	0.4	0.3	3	0.5	0.3
^{227}Ac	b	<0.03	<0.03	<0.03	<0.03	<0.03

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	515.0	514.3	512.7	516.1	523.6	532.8
pH	6.4	6.4	6.6	6.6	5.3	7.3
Temperature, °C	16.0	16.5	16.2	16.3	15.2	16.1

[a]Radionuclide content of suspended solids contained in 2 liters of sample.

[b]Sample lost in lab analysis.

Table I-8. Radiochemical results of well water samples for August 1981

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.3	<0.8	<0.8	<0.3	0.8	<0.3
^{230}Th	<0.8	<0.8	<0.5	<0.3	<0.3	<0.3
^{210}Pb	3.5	3	2	4.6	5	2
^{238}U	400	1800	9	370	30	20
^{227}Ac	<0.8	<0.8	<0.5	<0.3	<0.3	<0.3
pCi/filter Total[a]						
^{226}Ra	<0.1	<0.3	<0.3	<0.3	<0.3	<0.3
^{230}Th	17	0.4	0.2	0.1	0.1	<0.05

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	515.5	511.3	513.2	517.8	522.0	525.0
pH	4.6	4.6	6.6	5.5	6.0	6.4
Temperature, °C	15.2	16.2	15.2	16.8	14.0	15.0

[a]Radionuclide content of suspended solids contained in 2 liters of sample.

Table I-9. Radiochemical results of well water samples for September 1981

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
^{230}Th	<0.2	<0.03	<0.2	<0.3	<0.8	<0.03
^{220}Pb	<8	<8	<27	<16	<8	<16
^{238}U	380	1820	7	370	28	7
^{227}Ac	<0.2	<0.03	<0.2	<0.3	<0.8	<0.03
pCi/filter Total[a]						
^{226}Ra	<0.3	<0.3	<0.3	<0.3	<0.3	<0.8
^{230}Th	<0.5	<0.5	<0.3	<0.3	<0.3	<0.3

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	513.8	512.5	511.4	514.9	521.4	530.0
pH	6.6	6.5	6.8	6.6	6.6	7.5
Temperature, °C	17	18	17	18	17	17

[a]Radionuclide content of suspended solids contained in 2 liters of sample.

Table I-10. Radiochemical results of well water samples for October 1981

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<1	<0.5	<0.5	<0.5	2	<0.5
^{230}Th	<0.3	<0.3	<0.3	<0.5	<0.3	<0.3
^{210}Pb	<3	<16	<3	<5	<14	<3
^{238}U	320	2000	11	520	27	3
^{227}Ac	<0.3	<0.3	<0.3	<0.5	<0.3	<0.3
pCi/filter Total[a]						
^{226}Ra	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
^{230}Th	5	2	<0.3	<0.3	<0.3	<0.3

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	512.7	511.6	511.3	516.5	520.8	526.2
pH	6.9	6.7	7.0	7.0	6.9	7.7
Temperature, °C	15	17	16	16	15	16

[a]Radionuclide content of suspended solids contained in 2 liters of sample.

Table I-11. Radiochemical results of well water samples for November 1981

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.3	<0.3	<0.3	<0.5	<0.5	<0.3
^{230}Th	<0.8	<0.5	<0.3	<0.3	<0.5	<0.3
^{210}Pb	<3	<16	<11	<32	<16	<8
^{238}U	310	1930	10	500	23	4
^{227}Ac	<0.8	<0.5	<0.3	<0.3	<0.5	<0.3
pCi/filter Total[a]						
^{226}Ra	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
^{230}Th	5	1	<0.5	<0.8	<0.5	<0.3

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	513.5	512.4	511.8	517.1	521.5	530.3
pH	6.5	6.7	6.9	6.8	6.7	7.7
Temperature, °C	15.0	16.0	15.0	16.0	15.0	16.0

[a]Radionuclide content of suspended solids contained in 2 liters of sample.

Table I-12. Radiochemical results of well water samples for December 1981

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.3	<1.6	<0.5	<0.5	<0.5	<0.5
^{230}Th	<0.5	<0.5	<0.3	<0.03	<0.5	<0.5
^{210}Pb	<3	<5	<3	<8	<5	<1
^{238}U	240	1960	4	612	37	4
^{227}Ac	<0.5	<0.5	<0.3	<0.03	<0.5	<0.5
pCi/filter Total[a]						
^{226}Ra	<0.5	<0.5	<0.3	<0.3	<0.3	<0.3
^{230}Th	4	<0.5	<0.5	<0.3	<0.3	<0.3

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	513.8	512.5	511.8	516.8	516.5	525.7
pH	6.8	6.8	7.1	6.9	6.9	7.7
Temperature, °C	14	15	14	13	13	14

[a]Radionuclide content of suspended solids contained in 2 liters of sample.

Table I-13. Radiochemical results of well water samples for January 1982

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.5	<0.3	<0.5	<0.3	1	<0.3
^{230}Th	<0.03	<0.5	<0.1	<0.1	<0.8	<0.2
^{210}Pb	<2.7	<5.4	<8.3	<5.4	<5.4	<2.7
^{238}U	340	1830	8	290	25	30
^{227}Ac	<0.03	<0.5	<0.05	<0.05	<0.8	<0.2

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	515.9	514.0	513.4	517.8	522.2	530.8
pH	6.6	6.4	6.8	6.6	6.9	7.9
Temperature, °C	11	13	10	10	11	12

Table I-14. Radiochemical results of well water samples for February 1982

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.3	<0.5	<0.3	<0.3	<1.1	<0.3
^{230}Th	<0.5	<0.8	<0.2	<0.1	<0.5	<0.5
^{210}Pb	<1.9	<1.9	<2.4	<2.2	<1.4	<1.4
^{238}U	380	1760	9	270	30	18
^{227}Ac	<1.5	<0.8	<0.2	<0.1	<0.5	<0.5

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	518.0	515.4	515.8	518.6	522.8	530.6
pH	6.7	6.7	6.8	7.2	7.3	7.9
Temperature, °C	14	15	13	12	13	14

Table I-15. Radiochemical results of well water samples for March 1982

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.3	<0.3	<0.19	<0.2	<0.2	<0.05
^{210}Pb	<0.3	<1.9	<1.4	<0.5	<0.3	<0.5
^{238}U	340	1800	11	180	70	13

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	516.8	514.7	515.0	518.4	522.2	531.0
pH	6.6	6.5	6.8	6.7	6.8	7.5
Temperature, °C	13	14	11	12	11	13

Table I-16. Radiochemical results of well water samples for April 1982

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	0.2	0.2	0.4	<0.1	0.9	<0.05
^{210}Pb	<1.9	<1	<1.9	<1.6	<0.5	<5.4
^{238}U	360	1830	11	170	26	8

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	515.3	513.6	512.8	517.8	21.8	530.5
pH	6.7	6.6	6.9	6.7	6.8	7.6
Temperature, °C	12	13	11	11	12	12

Table I-17. Radiochemical results of well water samples for June 1982

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.2	0.9	0.2	<0.05	0.2	<0.03
^{210}Pb	<2.7	<5.4	<2.7	<5.4	<5.4	<2
^{238}U	340	1900	8	250	24	7

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	514.0	513.0	512.5	517.6	521.6	530.5
pH	6.7	6.6	6.9	6.8	6.7	7.7
Temperature, °C	15	15	14	14	14	15

Table I-18. Radiochemical results of well water samples for July 1982

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.3	0.4	0.4	0.8	0.8	<0.3
^{210}Pb	<5.4	<16	<5.4	<11	<11	<5.4
^{238}U	180	1800	14	170	35	15

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	515.0	513.0	512.8	518.6	522.0	529.1
pH	6.8	6.9	6.8	6.7	7.6	7.4
Temperature, ^{o}C	18	17	14	15	17	17

Table I-19. Radionuclide results of well water samples for August 1982

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	a	<0.27	a	a	a	a
^{210}Pb	a	1.6	a	a	a	a
^{238}U	a	1865	a	a	a	a
pCi/filter Total[b]						
^{226}Ra	a	<0.27	a	a	a	a
^{230}Th	a	5.7	a	a	a	a

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	a	512.7	a	a	a	a
pH	a	6.6	a	a	a	a
Temperature, °C	a	17	a	a	a	a

[a]Wells were accidentally damaged in July 1982.

[b]Radionuclide content of suspended solids contained in 2 liters of sample.

Table I-20. Radionuclide results of well water samples for September 1982

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	a	<0.27	a	a	a	a
^{210}Pb	a	27	a	a	a	a
^{238}U	a	2000	a	a	a	a

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	a	512.0	a	a	a	a
pH	a	b	a	a	a	a
Temperature, °C	a	15	a	a	a	a

[a]Wells were accidentally damaged in July 1982.

[b]pH measurement not made on sample.

Table I-21. Radionuclide results of well water samples for October 1982[a]

Concentration (pCi/L)	Radionuclide					
	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.54	<0.54	<0.54	<0.81	<0.54	<0.54
^{230}Th	<0.54	<0.54	<0.27	<0.54	<0.03	<0.08
^{210}Pb	<2.7	<1.4	<1.4	9.7	<2.7	<1.6
^{238}U	366	2064	13	500	33	10
^{231}Pa	<0.03	<0.11	<0.14	<0.05	<0.11	<0.03
^{227}Ac	<0.54	<0.54	<0.3	<0.54	<0.03	<0.08

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	512.3	512.0	511.7	5170	521.8	528.6
pH	6.7	6.8	6.8	6.9	6.7	7.4
Temperature, °C	16	17	17	17	16	16

[a]Wells A and C-F, which were inadvertently plugged in July of 1982, were repaired in October by Eberline Instrument Corp.

Table I-22. Radionuclide results of well water samples for November 1982

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.08	<0.54	<0.54	<0.54	0.24	<0.22
^{230}Th	1.1	<0.27	<0.22	0.11	<0.14	<0.19
^{210}Pb	2.2	<2.7	<5.4	<0.54	<2.7	<2.7
^{238}U	340	1998	8	433	23	7
^{231}Pa	<0.24	<0.27	<0.27	<0.14	<0.05	<0.03
^{227}Ac	<0.03	<0.27	<0.22	<0.05	<0.14	<0.19
pCi/filter Total[a]						
^{226}Ra	<0.05	<0.11	<0.16	<0.08	<0.11	<0.14
^{230}Th	<0.11	<0.27	<0.27	<0.05	<0.34	<0.27
^{231}Pa	<0.03	<0.08	<0.14	<0.03	<0.03	<0.08

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	511.2	510.8	511.2	516.6	520.0	528.3
pH	6.9	6.9	7.2	7.2	6.9	7.5
Temperature, °C	14	15	15	14	14	15

[a]Radionuclide content of suspended solids contained in 2 liters of sample.

Table I-23. Radionuclide results of well water samples for December 1982

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.1	<0.2	<0.2	<0.3	<0.2	<0.2
^{230}Th	<1.1	<2.2	<0.5	<0.8	<2.2	<2.2
^{210}Pb	8.4	5.4	5.4	<0.8	1.4	2.2
^{238}U	433	2231	11	270	50	256[a]
^{231}Pa	<0.2	<0.2	<0.1	<0.2	<0.8	<0.1
^{227}Ac	<1.1	<2.2	<0.5	<0.8	<2.2	<2.2
pCi/filter Total[b]						
^{226}Ra	<0.03	<0.2	<0.2	<0.1	<0.03	<0.03
^{230}Th	<0.3	<0.3	<1.4	<0.5	<1.1	<1.1
^{231}Pa	<0.08	<0.2	<0.03	<0.05	<0.03	<0.05

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	517.4	515.2	515.9	519.0	523.2	529.8
pH	6.7	6.7	6.7	6.5	6.8	7.4
Temperature, °C	13	14	13	13	12	13

[a]It is believed that the measurement of 256 pCi/L may be an anomaly in the data as discussed in the text.

[b]Radionuclide content of suspended solids contained in two liters of sample.

Table I-24. Radionuclide results of well water samples for January 1983

Radionuclide Concentration (pCi/L)	Well A	Well B	Well C	Well D	Well E	Well F
^{226}Ra	<0.2	<0.3	<0.3	<0.54	<0.54	<0.3
^{230}Th	<0.1	<0.1	<0.08	<0.16	0.1	<0.2
^{210}Pb	1.4	<0.8	<0.54	<0.54	<2.4	<0.54
^{238}U	243	2198	9	193	29	90

Summary of environmental conditions in wells

	Well A	Well B	Well C	Well D	Well E	Well F
Water Elevation, ft	514.6	513.2	513.6	518.3	522.2	529.0
pH	7.0	6.8	6.9	6.4	6.8	7.9
Temperature, °C	12	12	12	11	11	12

APPENDIX II

PLOTS OF WATER ELEVATION AND RADIONUCLIDE CONCENTRATIONS

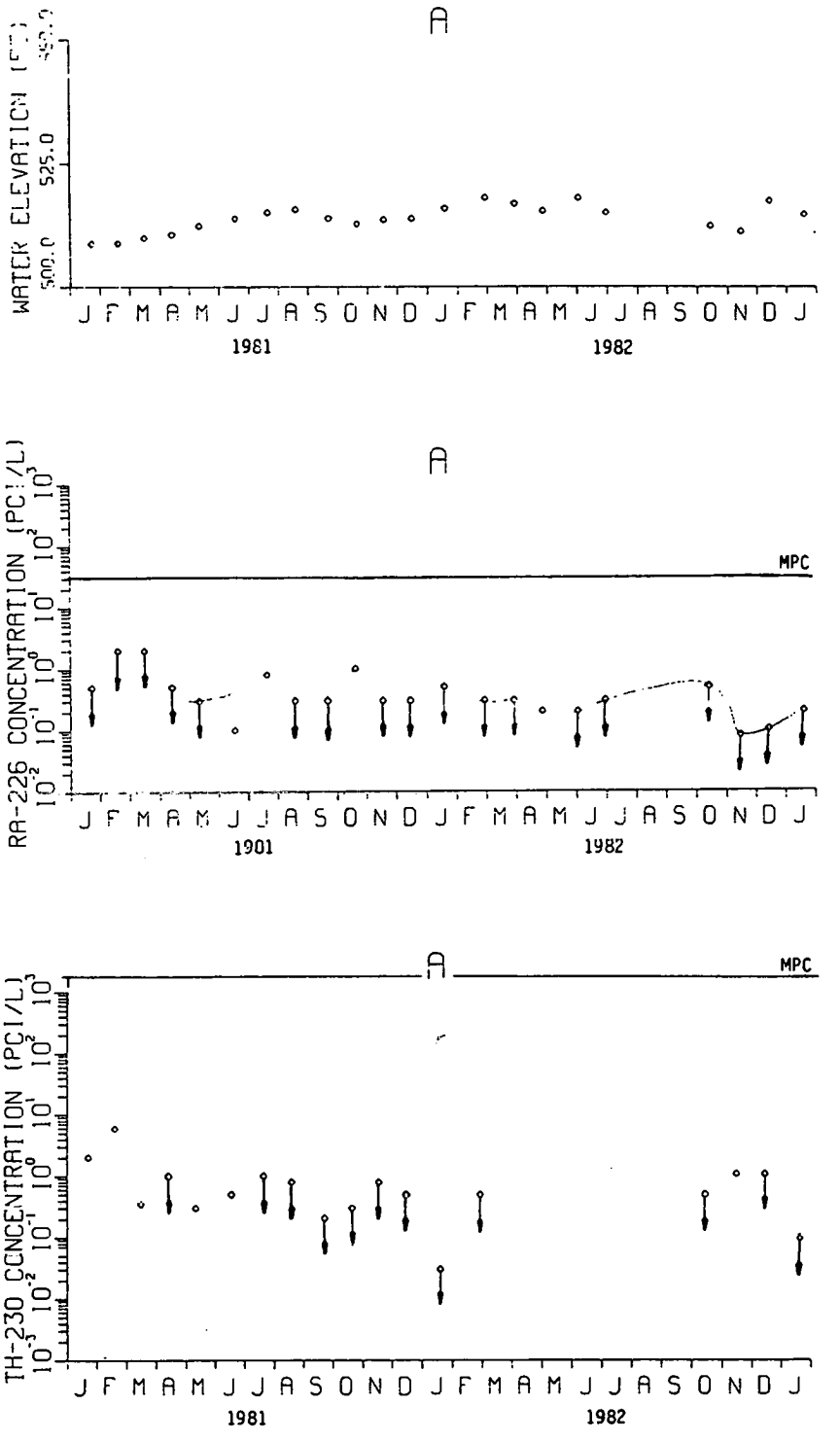


Fig. II.1. Plots of water elevations (ft) and ^{226}Ra and ^{230}Th concentrations (pCi/L) at Well A.

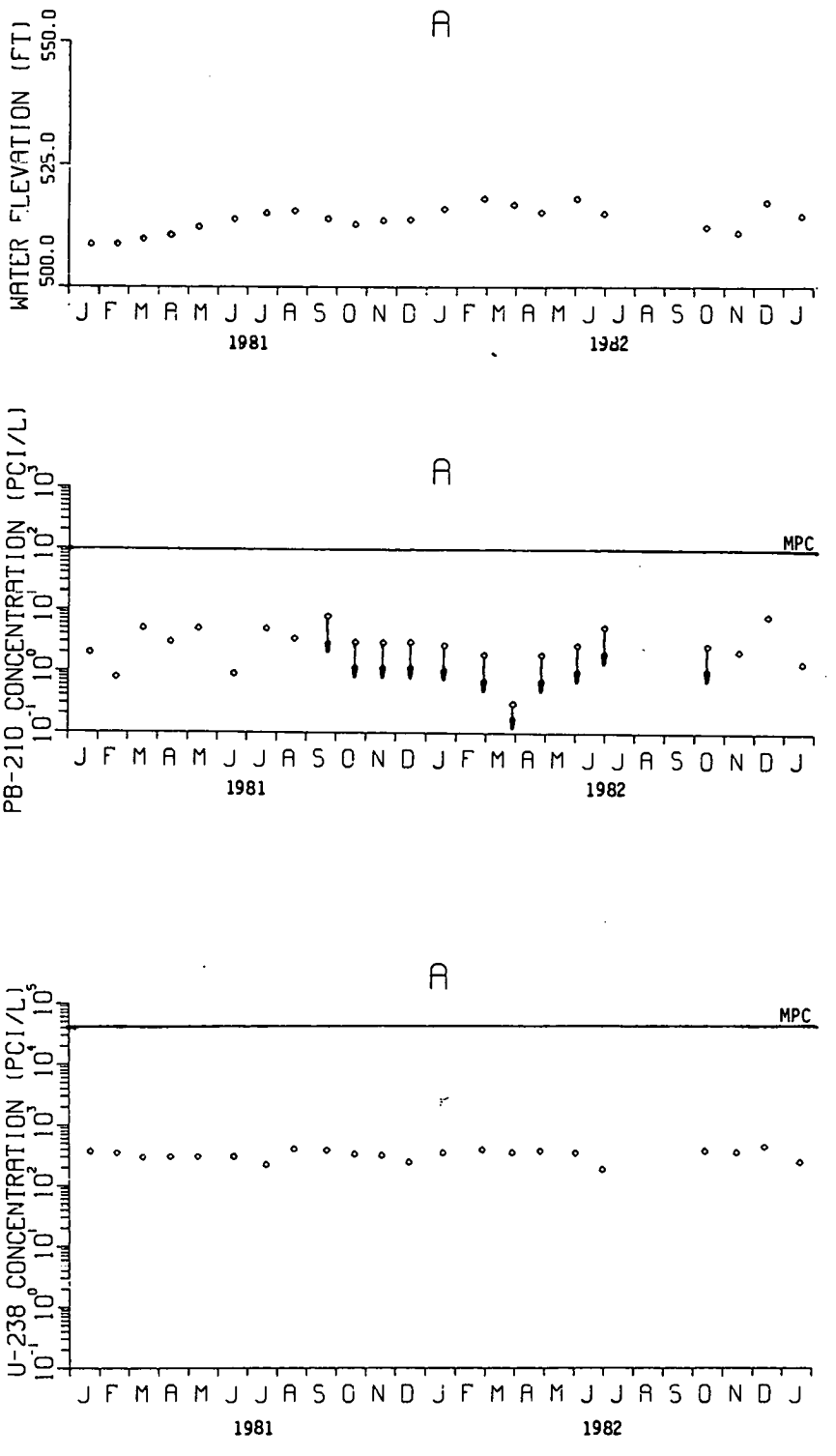


Fig. II.2. Plots of water elevations (ft) and ^{210}Pb and ^{238}U concentrations (pCi/L) at Well A.

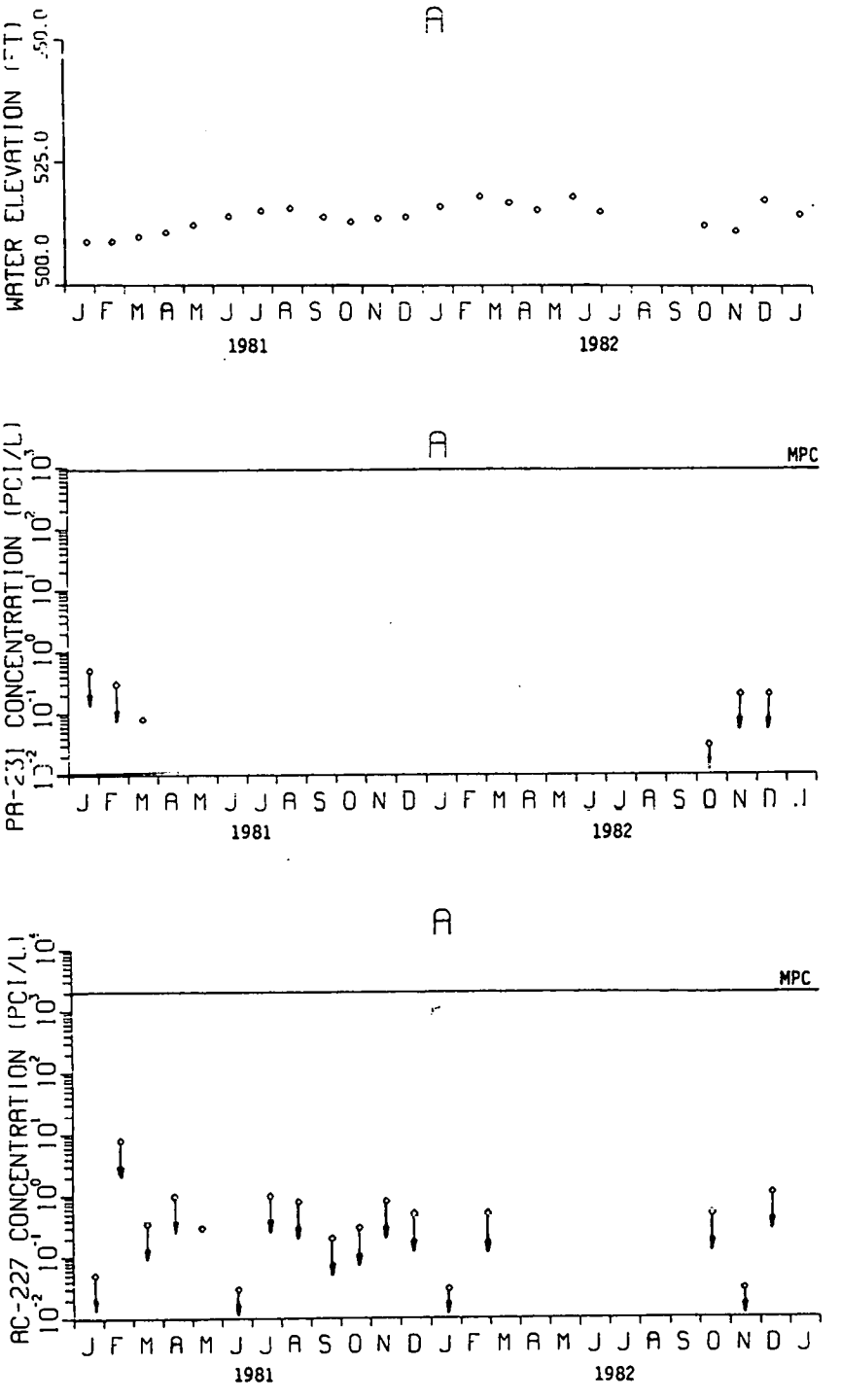


Fig. II.3. Plots of water elevations (ft) and ^{231}Pa and ^{227}Ac concentrations (pCi/L) at Well A.

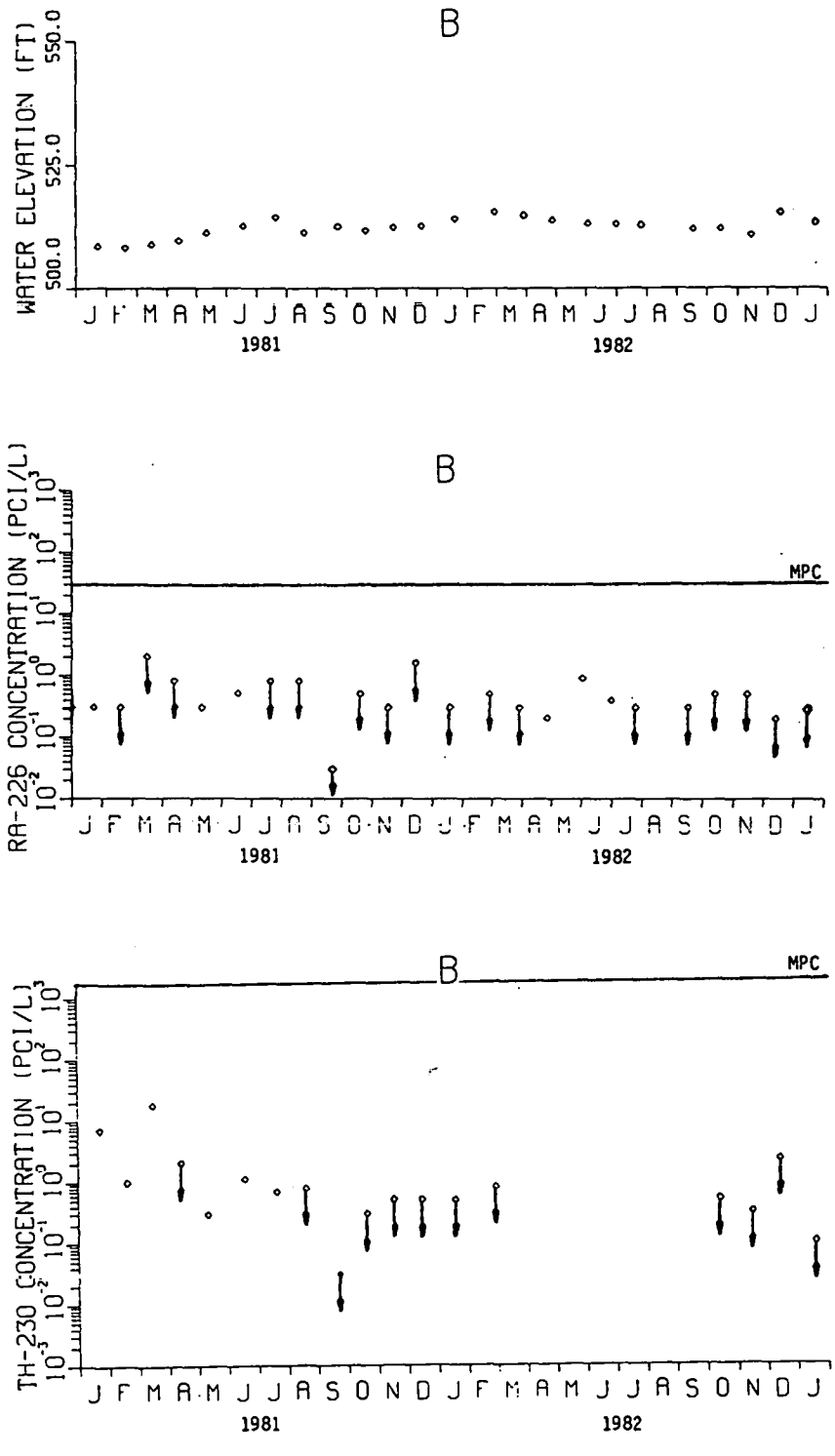


Fig. II.4. Plots of water elevations (ft) and ^{226}Ra and ^{230}Th concentrations (pCi/L) at Well B.

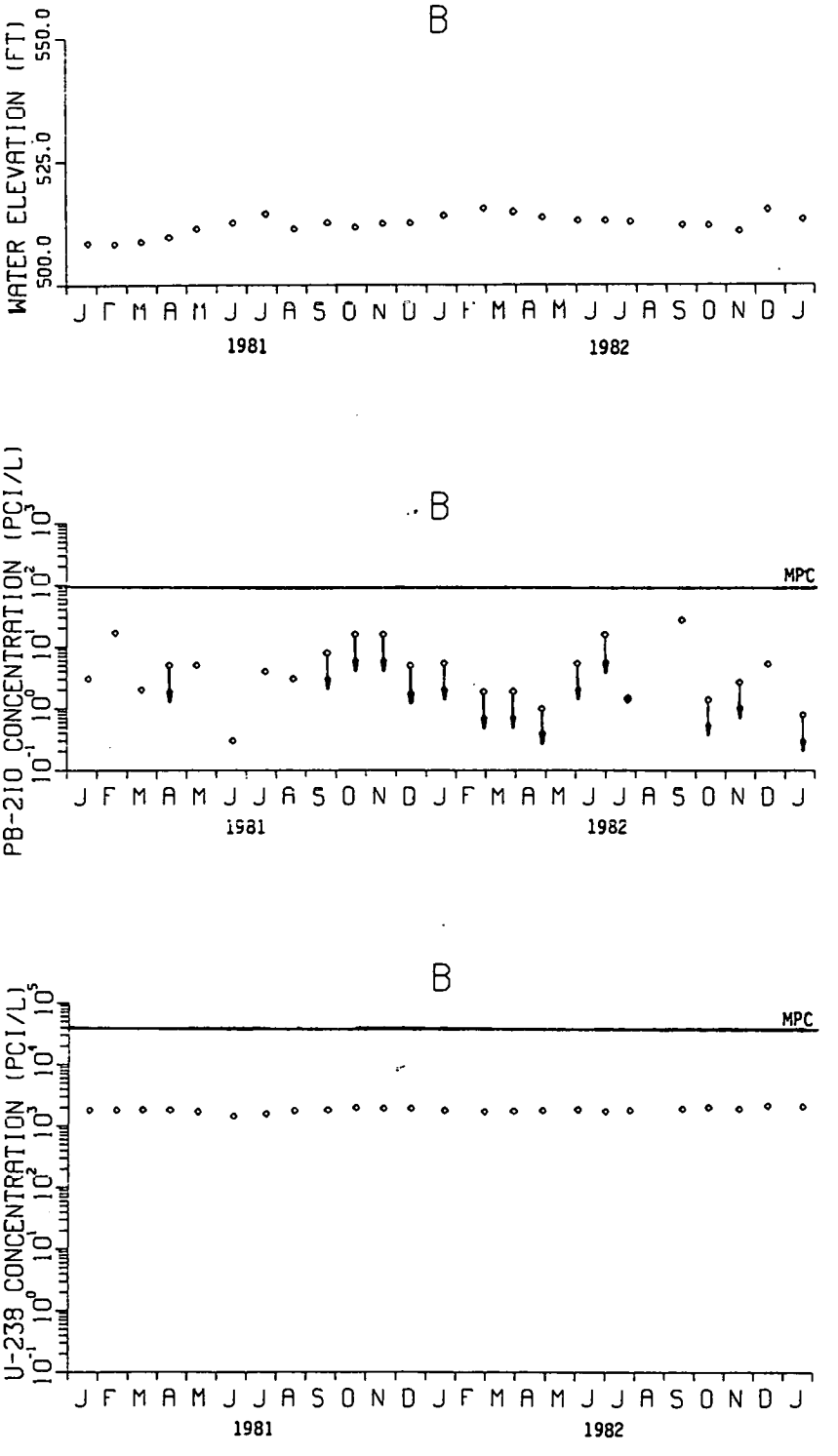


Fig. II.5. Plots of water elevations (ft) and ^{210}Pb and ^{238}U concentrations (pCi/L) at Well B.

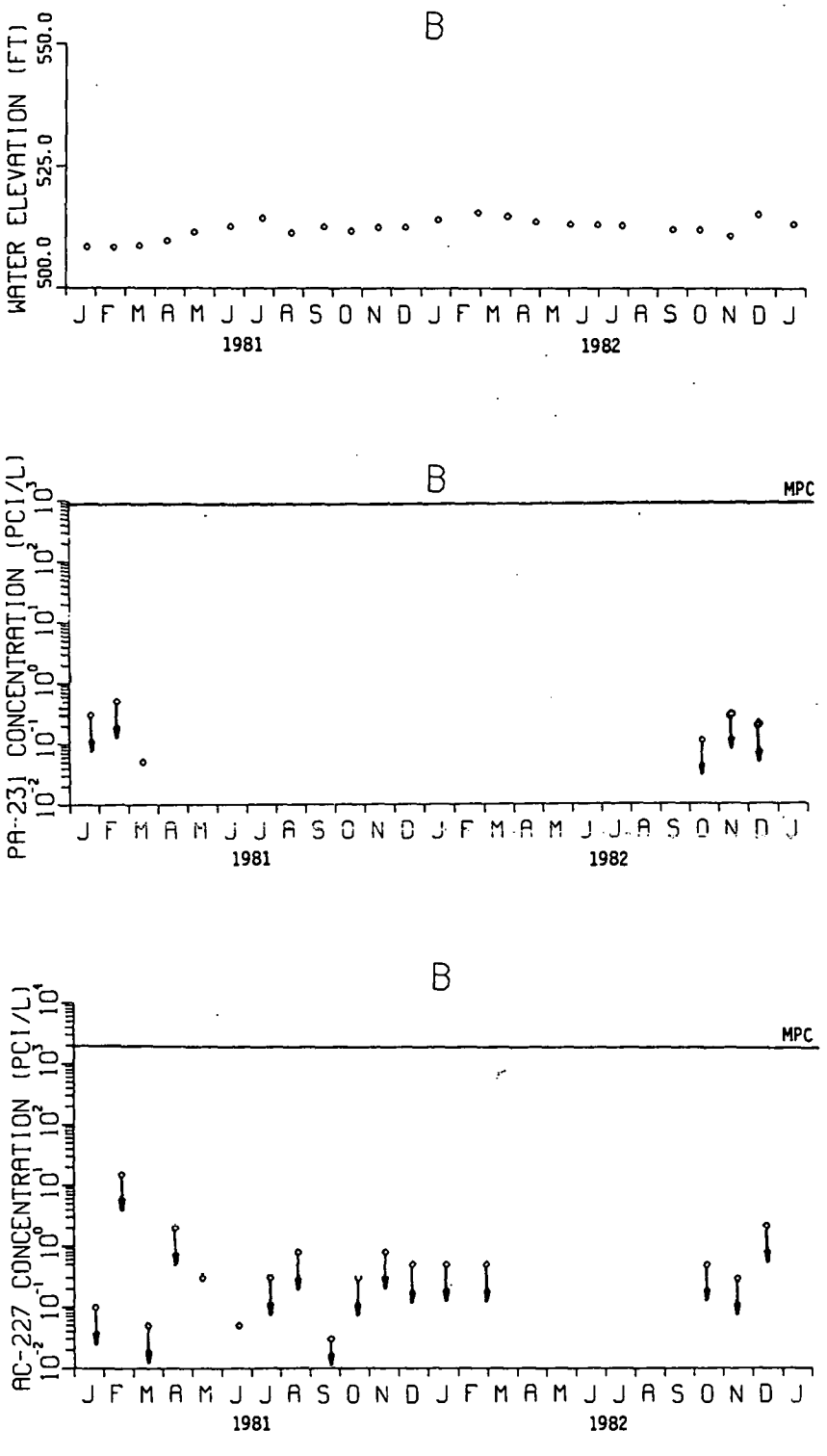


Fig. II.6. Plots of water elevations (ft) and ^{231}Pa and ^{227}Ac concentrations (pCi/L) at Well B.

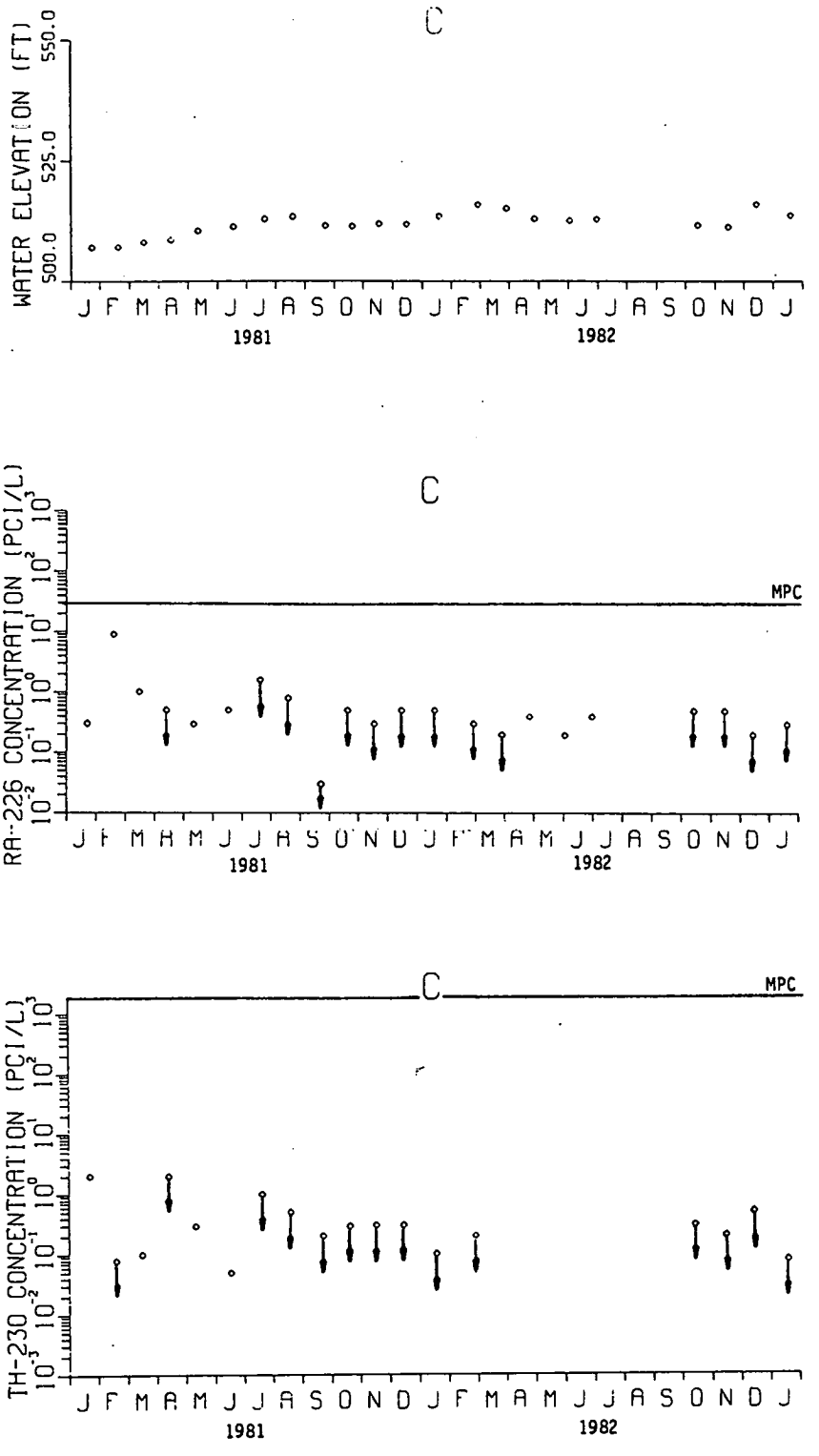


Fig. II.7. Plots of water elevations (ft) and ^{226}Ra and ^{230}Th concentrations (pCi/L) at Well C.

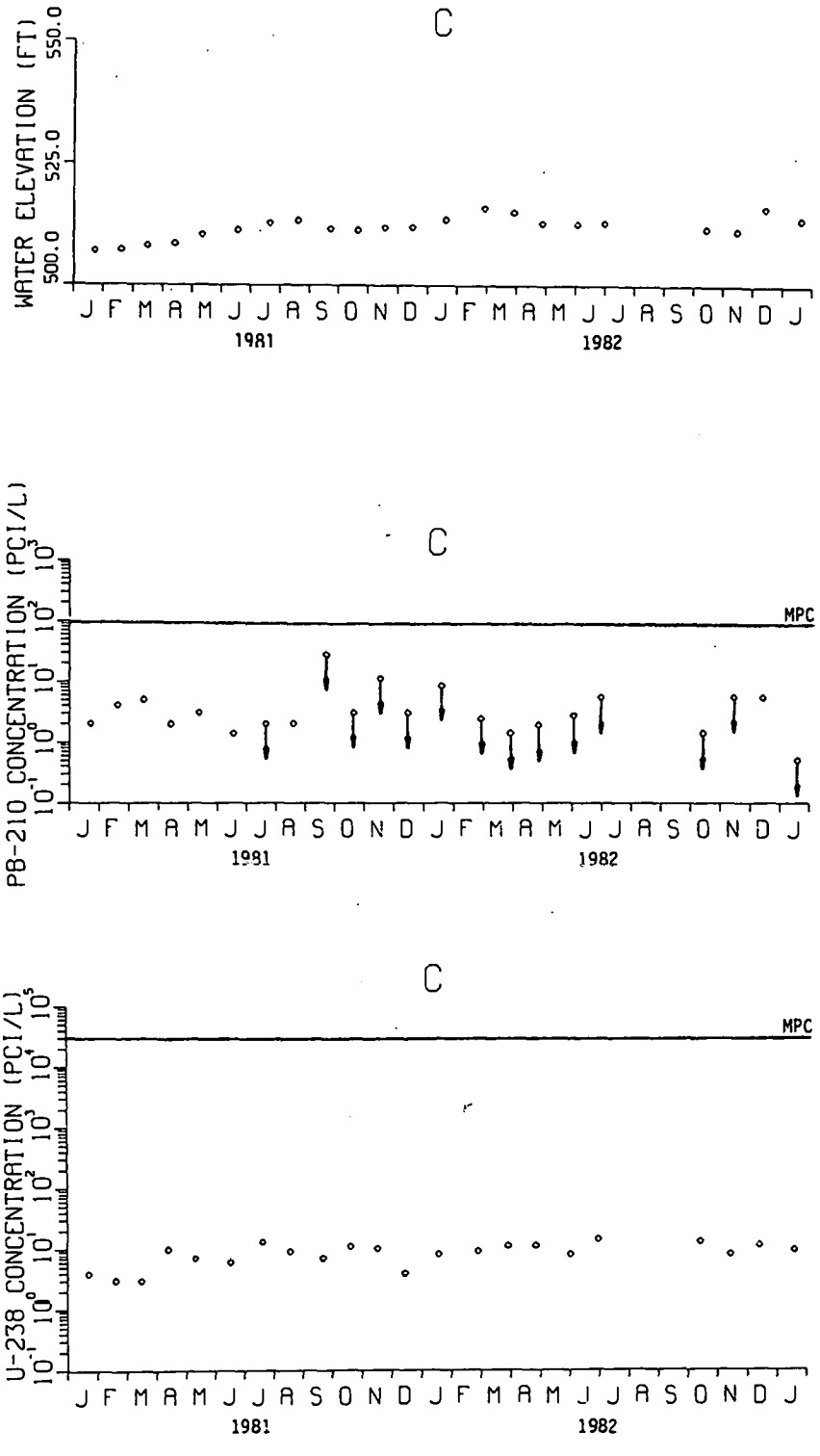


Fig. II.8. Plots of water elevations (ft) and ^{210}Pb and ^{238}U concentrations (pCi/L) at Well C.

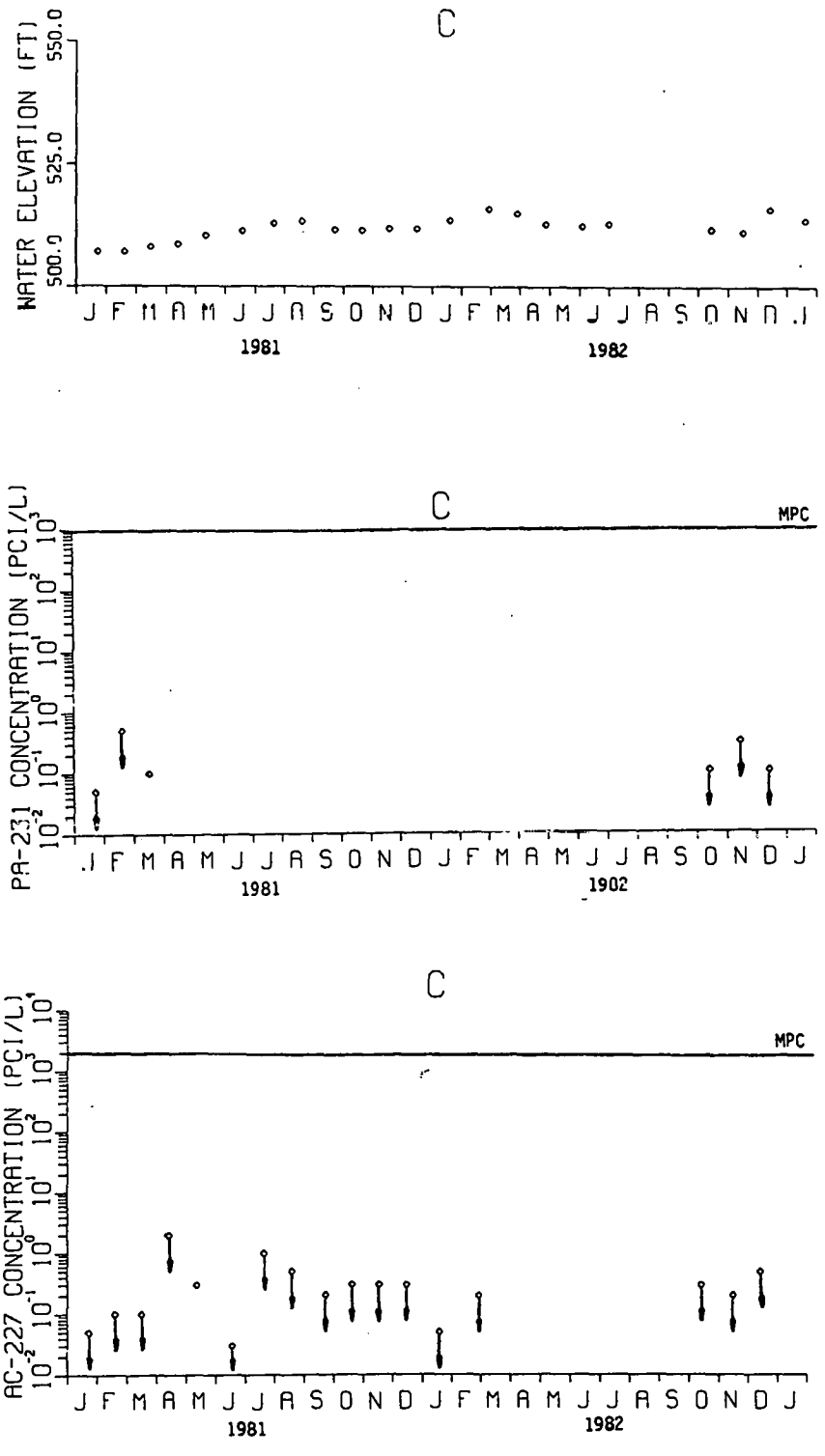


Fig. II.9. Plots of water elevations (ft.) and ^{231}Pa and ^{227}Ac concentrations (pCi/L) at Well C.

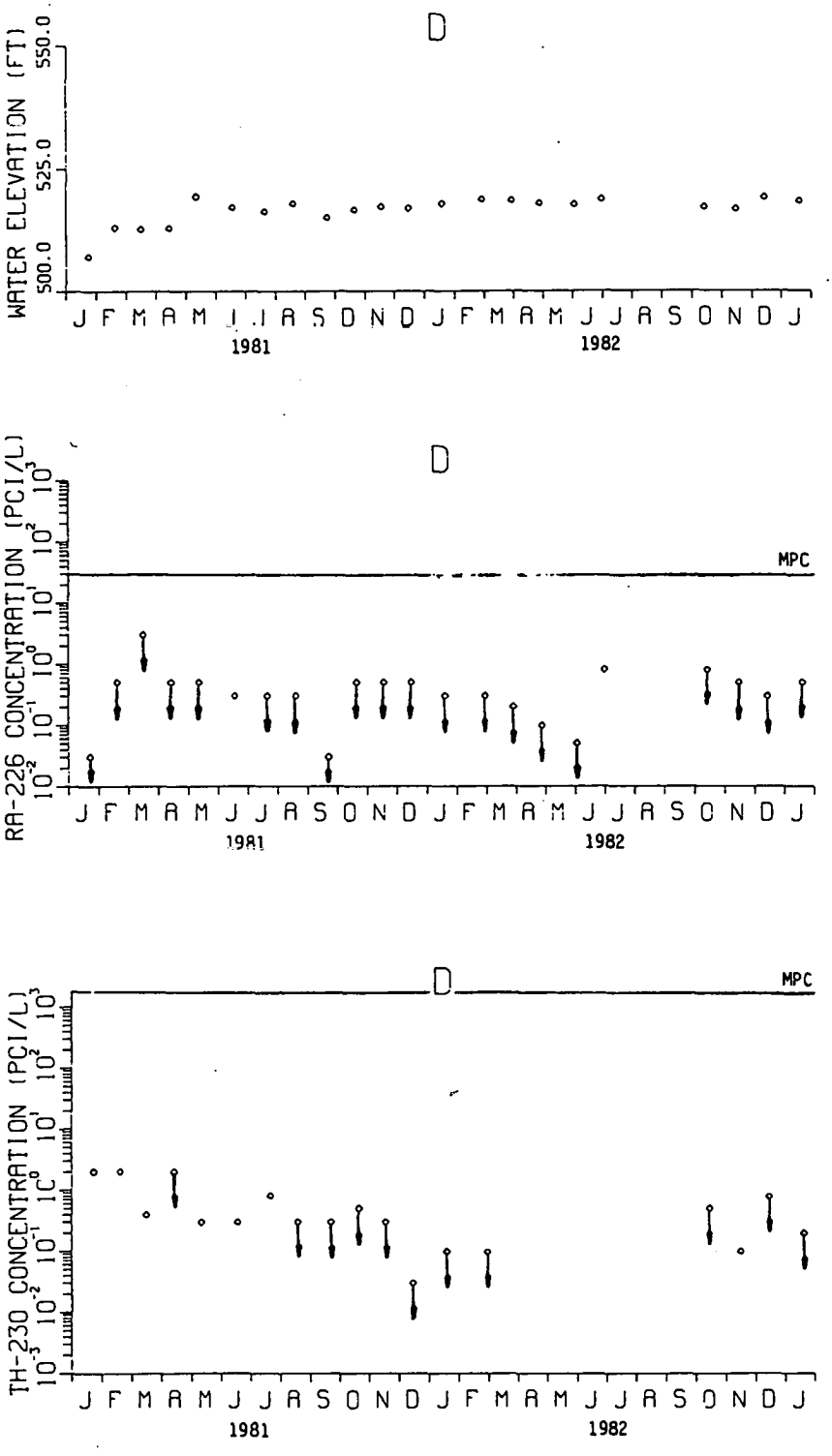


Fig. II.10. Plots of water elevations (ft) and ^{226}Ra and ^{230}Th concentrations (pCi/l) at Well D.

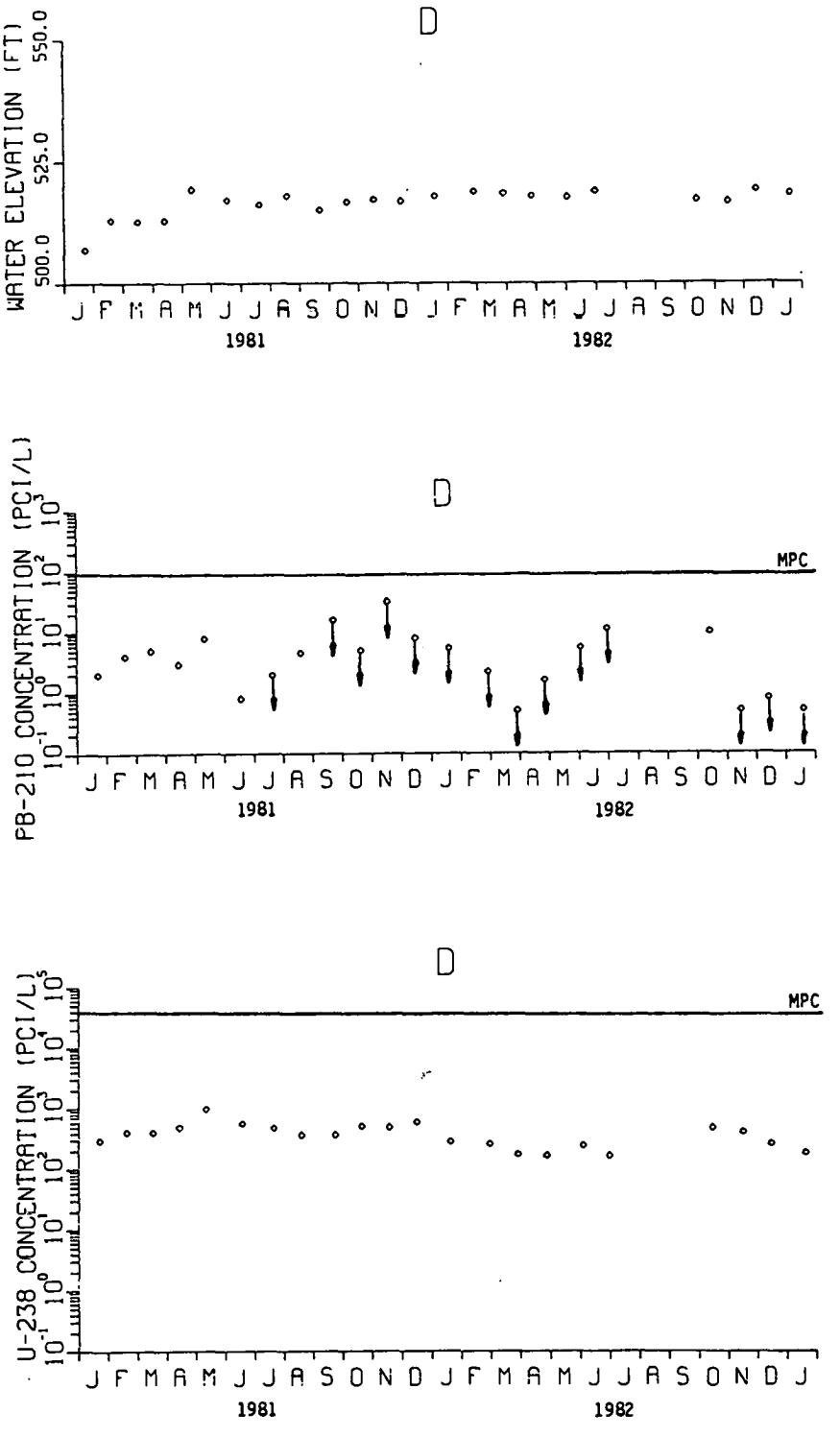


Fig. II.11. Plots of water elevations (ft) and ^{210}Pb and ^{238}U concentrations (pCi/L) at Well D.

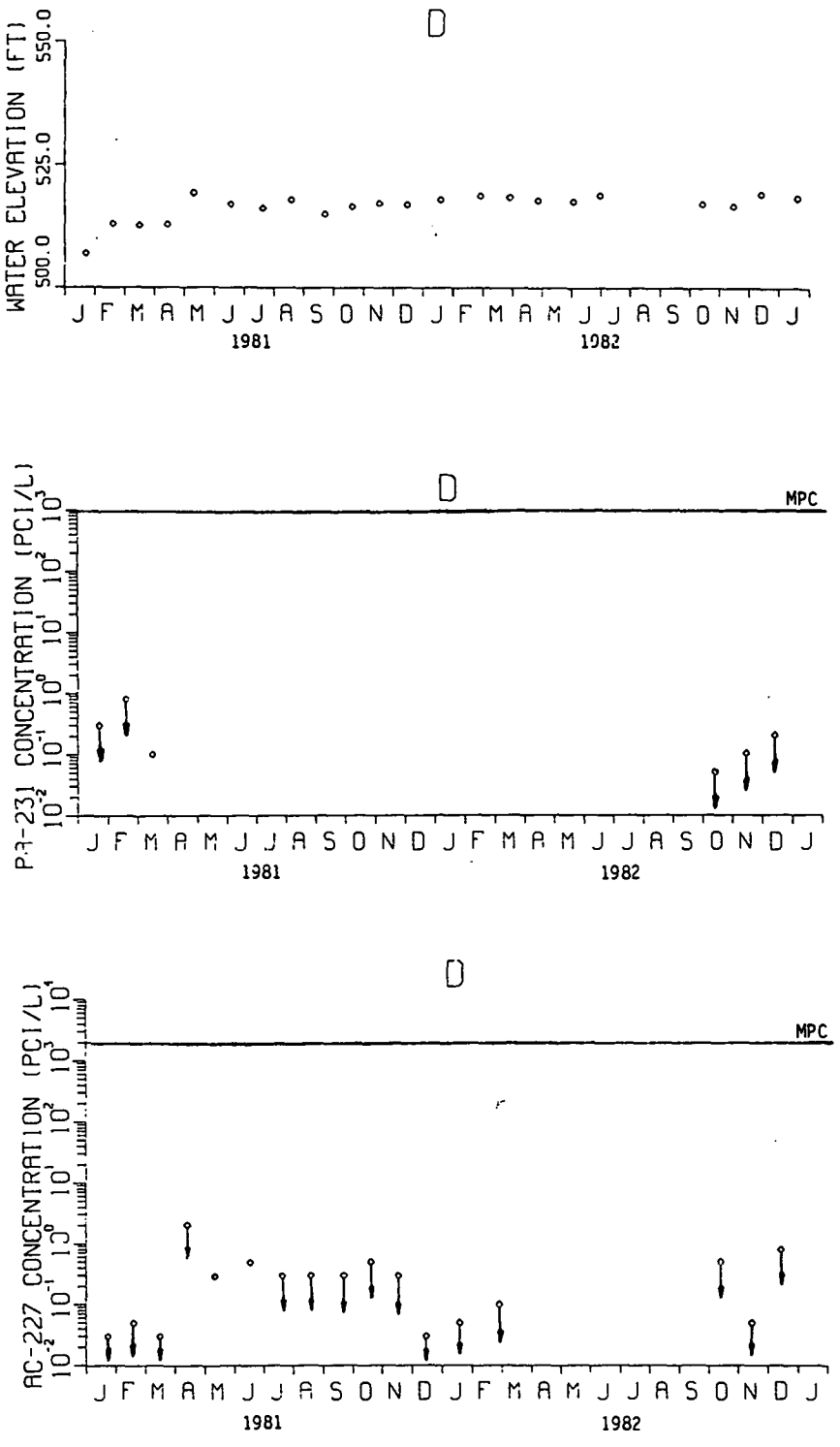


Fig. II.12. Plots of water elevations (ft) and ^{231}Pa and ^{227}Ac concentrations (pCi/L) at Well D.

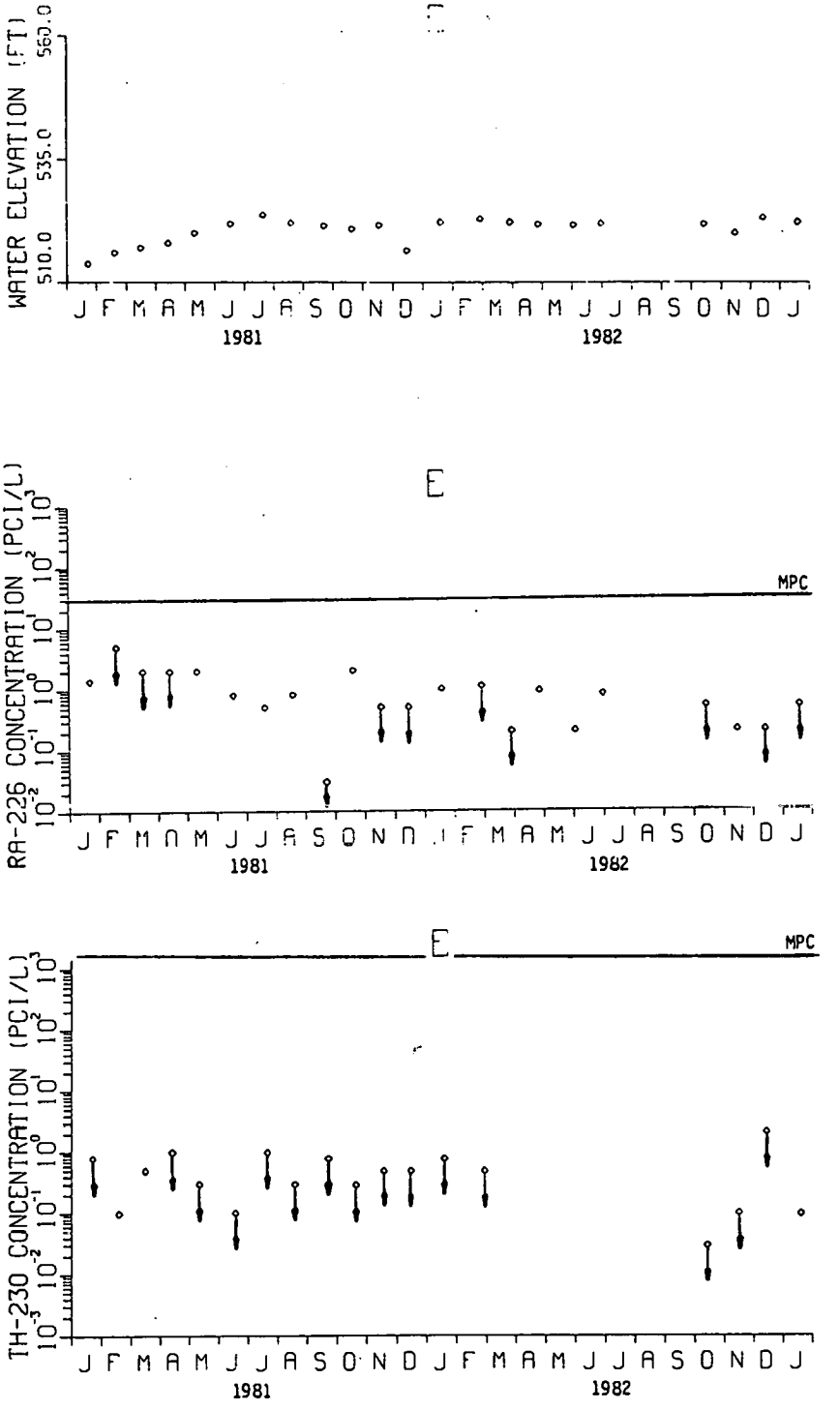


Fig. II.13. Plots of water elevations (ft) and ^{226}Ra and ^{230}Th concentrations (pCi/L) at Well E.

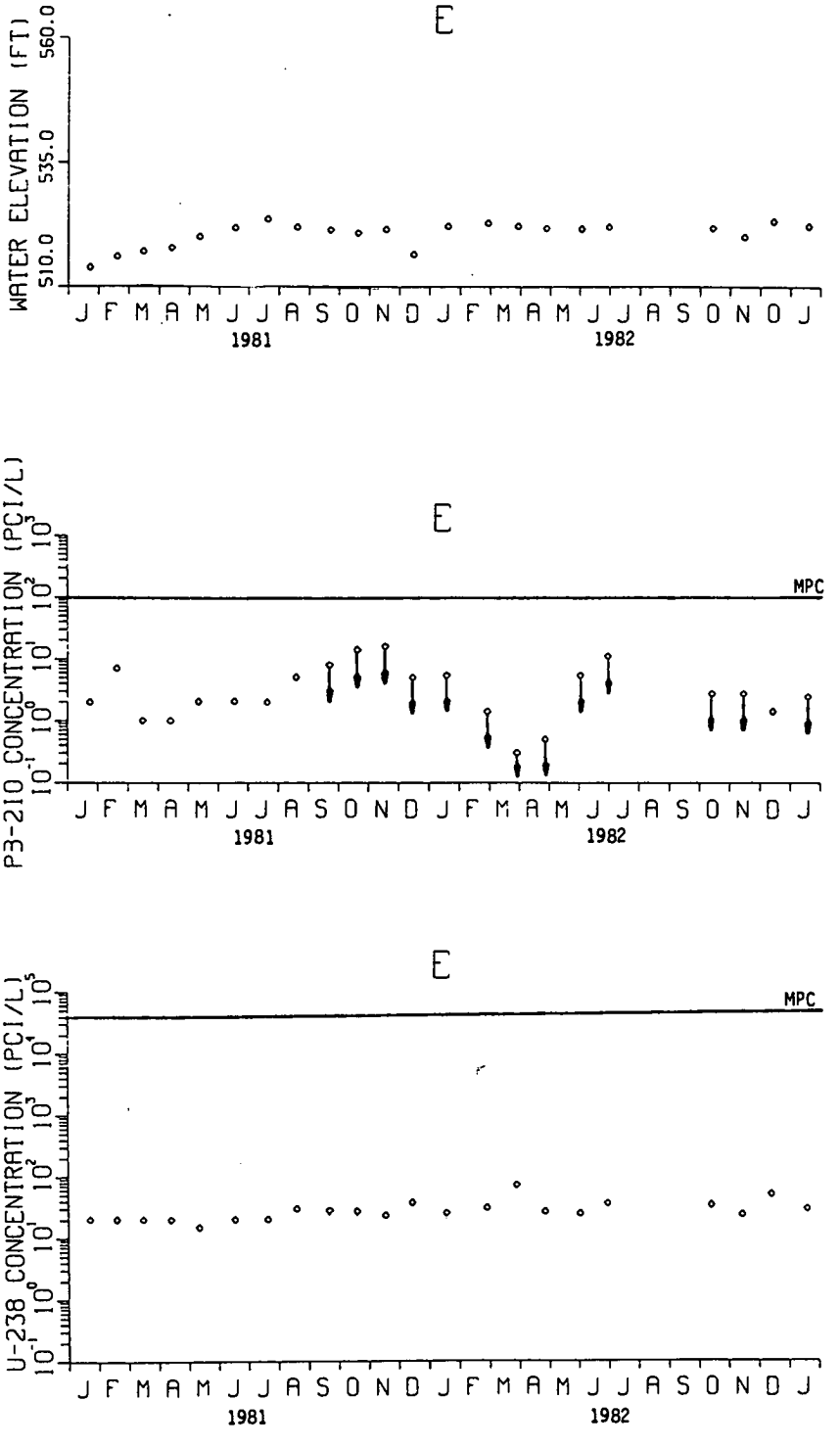


Fig. II.14. Plots of water elevations (ft) and ^{210}Pb and ^{238}U concentrations (pCi/L) at Well E.

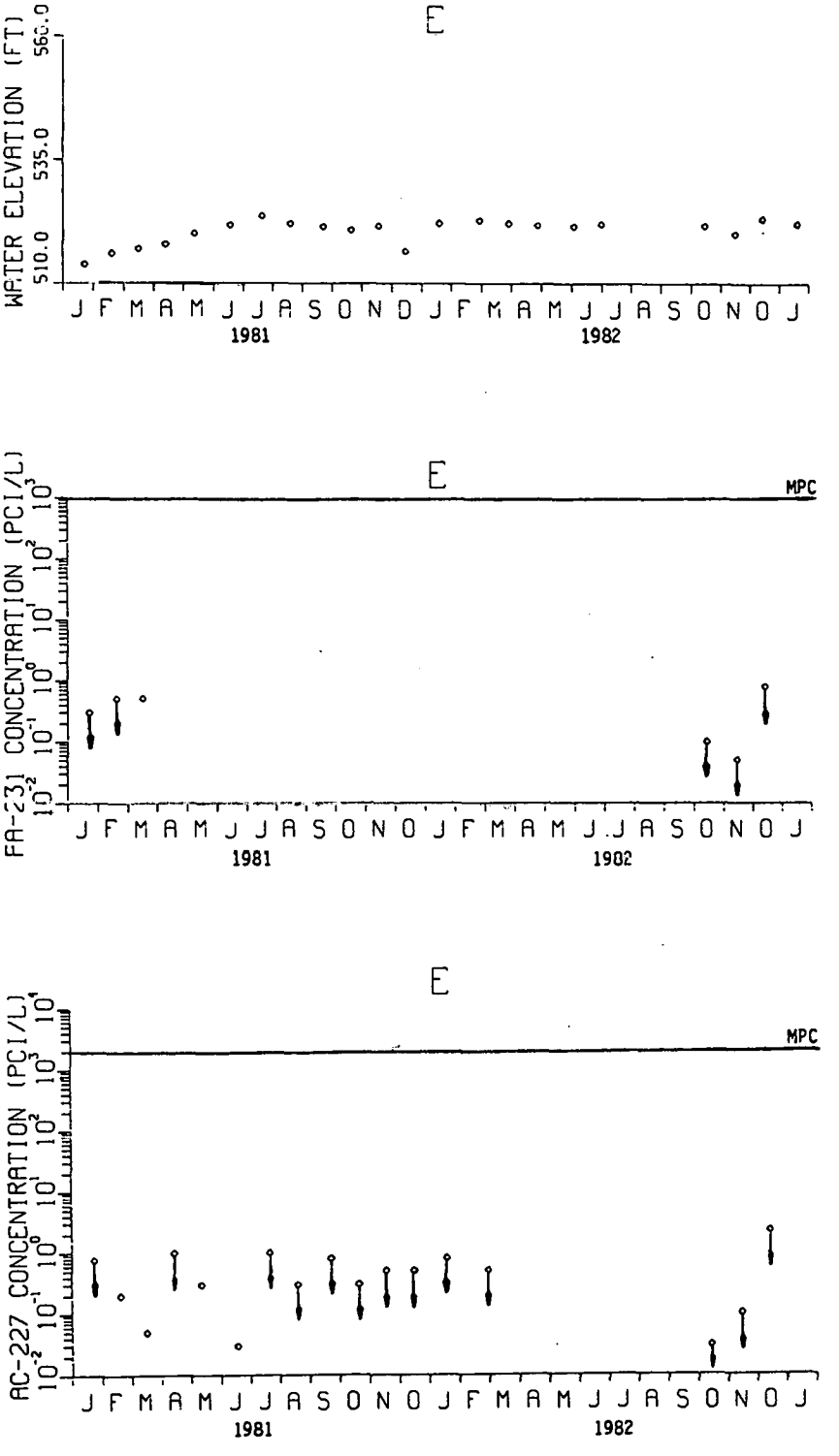


Fig. II.15. Plots of water elevations (ft) and ^{210}Pb and ^{238}U concentrations (pCi/L) at Well E.

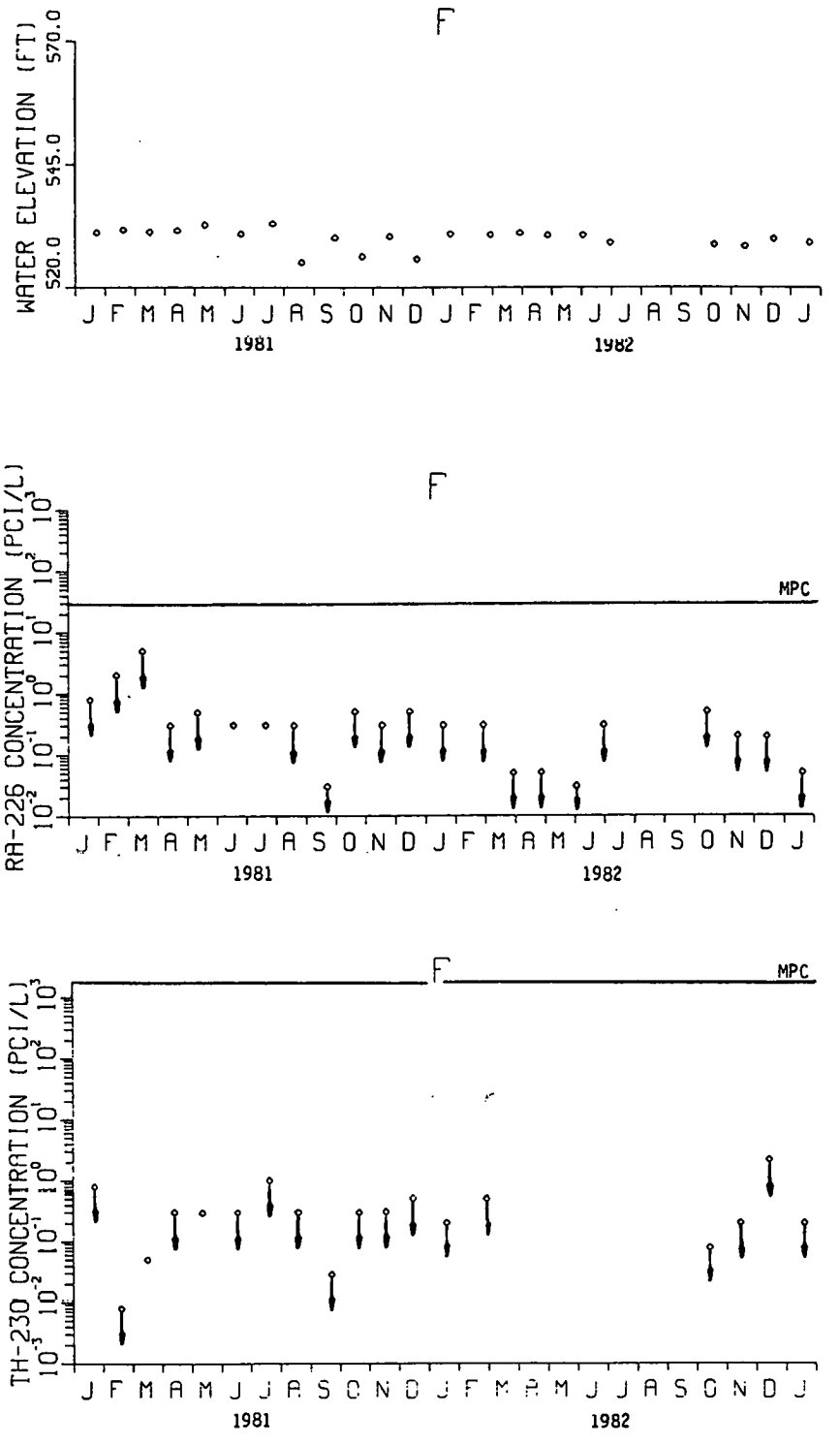


Fig. II.16. Plots of water elevations (ft) and ^{226}Ra and ^{230}Th concentrations (pCi/L) at Well F.

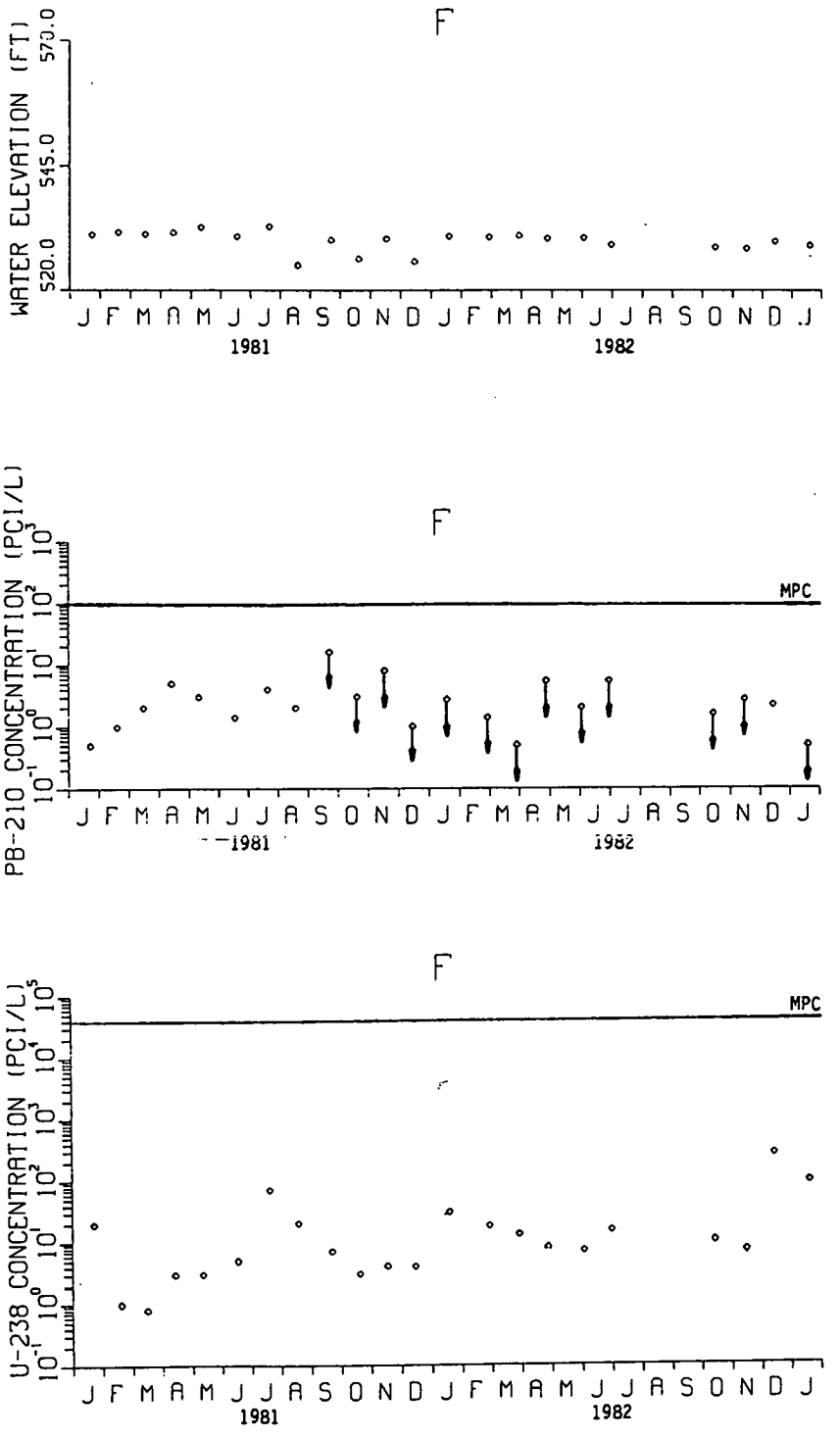


Fig. II.17. Plots of water elevations (ft) and ^{210}Pb and ^{238}U concentrations (pCi/L at Well F.

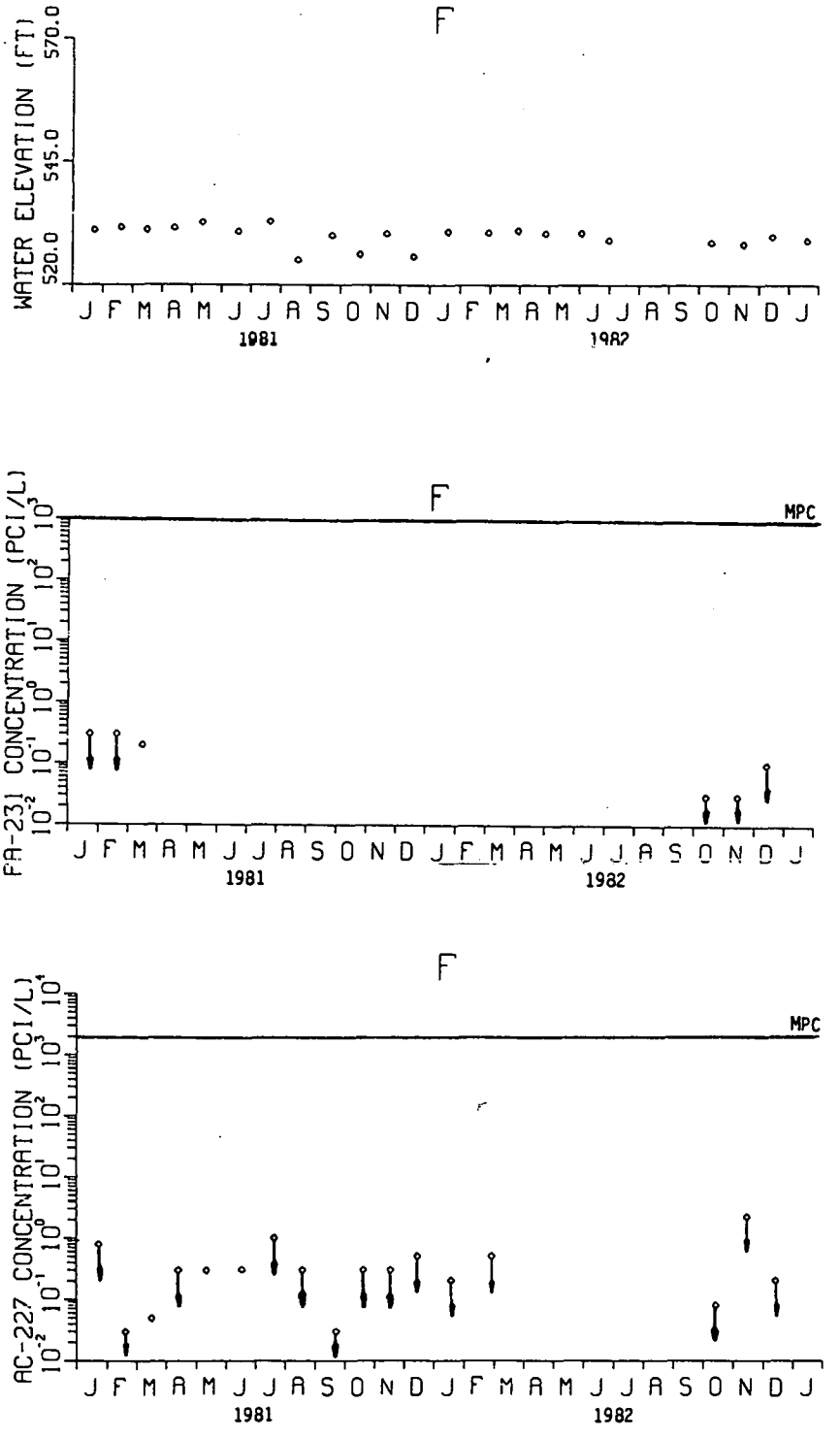


Fig. II.18. Plots of water elevations (ft) and ^{231}Pa and ^{227}Ac concentrations (pCi/L) at Well F.