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RADIOLOGICAL EFFLUENT AND ONSITE AREA MONITORING REPORT FOR THE NEVADA TEST SITE (JANUARY 1984 THROUGH DECEMBER 1984)

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JULY 1985

WORK PERFORMED UNDER
CONTRACT NO. DE-AC08-84NV10327

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Prepared for the

U.S. Department of Energy
Nevada Operations Office

Under Contract DE-AC08-84NV10327

ABSTRACT

This report documents the environmental surveillance program at the Nevada Test Site as conducted by the Department of Energy (DOE) onsite radiological safety contractor from January 1984 through December 1984. The results and evaluations of measurements of radioactivity in air and water, and of direct gamma radiation exposure rates are presented. Relevancy to DOE concentration guides (CG'S) is established. This report was formerly titled "Environmental Surveillance Report for the Nevada Test Site."

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ACKNOWLEDGMENTS

Credit must be given to D. Wilson and B. White for their excellent work in the program. I would also like to thank J. Morrison and the reviewers of this report for their cooperation and assistance.

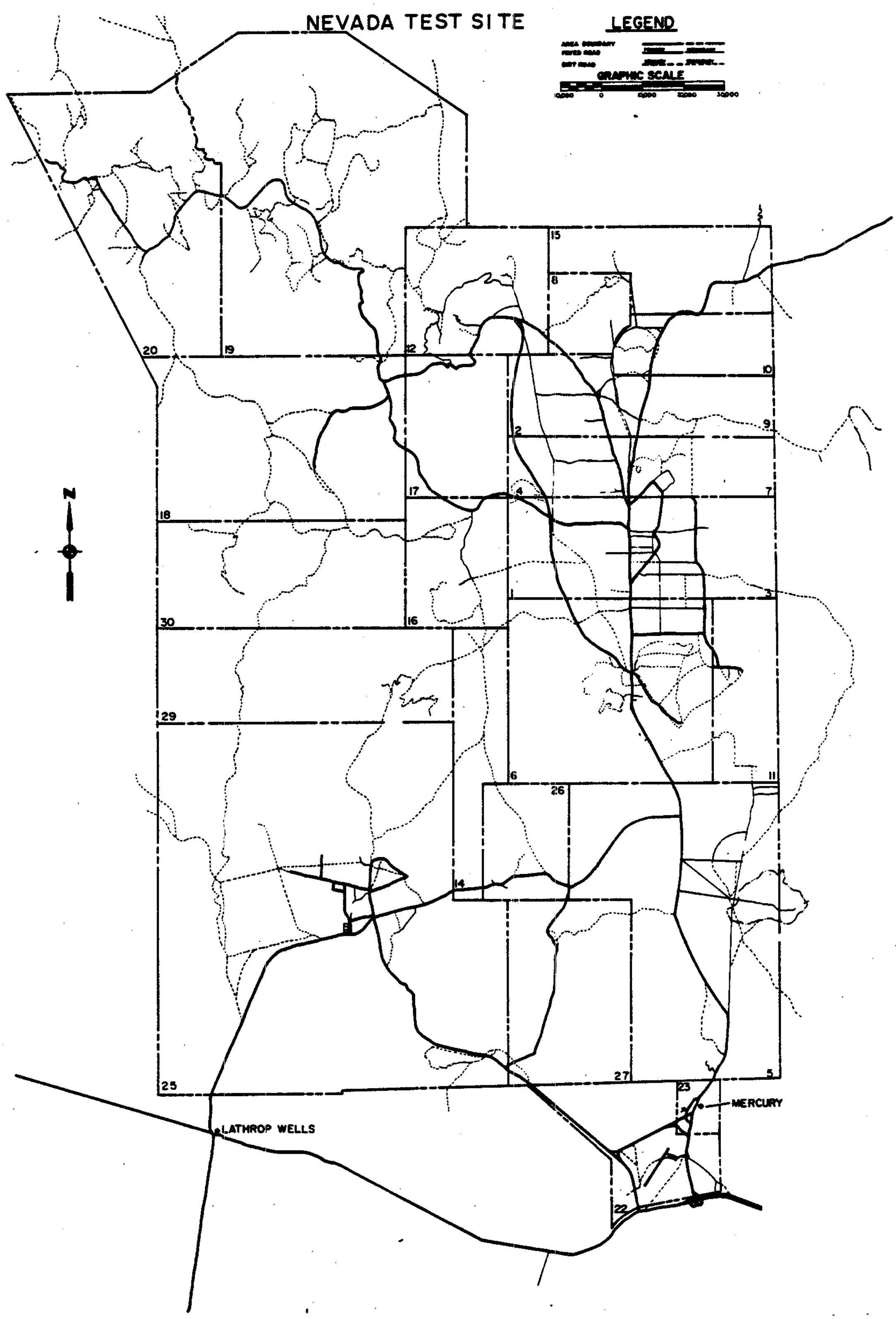
A. INTRODUCTION

This report documents the program conducted at the Nevada Test Site (NTS) for monitoring of radioactivity in the general onsite environment as performed by Reynolds Electrical and Engineering Co., Inc. (REECo) during the calendar year of 1984. As part of its contract, DE-AC08-84NV10327, REECo is responsible for providing radiological safety services within the confines of the test site. For a number of years, the environmental surveillance program has been part of a Department of Energy (DOE) program designed to control, minimize, and document exposures to the NTS working population.

The NTS covers an area of 3,711 square kilometers, with terrain and climate conditions typical of the high southwest desert region and mountainous areas. Temperatures vary from -20°C to 50°C. The area is subject to high winds, dust-laden atmosphere, and low humidity. Elevations range from dry lake beds to rugged mountains as high as 2,300 meters. The NTS, since 1951, has been the primary location for testing the nation's nuclear devices (Figure 1).

The monitoring program originally was designed to examine the environment for levels of radioactivity that are of interest in documenting the radiation exposure to NTS workers; i.e., a backup for the onsite personnel dosimetry system. This program also could provide data concerning onsite releases or be a monitoring locale for the detection of worldwide fallout in Nevada from foreign sources. The program follows the standards presented in "A Guide For Environmental Radiological Surveillance at U.S. Department of Energy Installations," DOE/EP-0023 (Reference 2). The standards dictate the following objectives for the protection of the public:

FIGURE 1


NEVADA TEST SITE
LEGEND
GRAPHIC SCALE
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(1) Evaluation of containment of radioactivity onsite.

(2) Detection of rapid changes and evaluation of long-term trends.

(3) Assessment of doses-to-man from radioactive releases as a result of DOE operations.

(4) Collection of data bearing on the movement of contaminants released to the environment, with the intent of discovering unknown pathways of exposure.

(5) Maintenance of a data base.

(6) Detection and evaluation of radioactivity from offsite sources.

(7) Demonstration of compliance with applicable regulations and legal requirements concerning releases to the environment.

These objectives are met through the operation of the environmental surveillance program. A summary of the environmental plan is shown in Table 1. Air and potable water samples are collected at specific areas where personnel spend significant amounts of time. Additional air sampling stations are located at sites throughout the NTS in support of the testing program and the radiological waste management program. Water sampling of supply wells, open reservoirs, natural springs, contaminated ponds, and sewage ponds is also done to evaluate the possibility of any movement of radioactive contaminants into the NTS water system. The rate of sampling for each of these surveillance networks is related to potential personnel exposure; i.e., weekly water samples at each cafeteria. Thermoluminescent dosimeters (TLD's) are used to survey the ambient NTS external gamma levels and are collected on a quarterly cycle. Except for removal of a station, inaccessibility of the location, or loss of data, sampling was continuous during this reporting period. A review of all analytical results from this sampling program relative to the DOE

TABLE 1

SUMMARY OF ENVIRONMENTAL PROGRAM

Sample Type	Description	Collection Frequency	Number of Samples	Analysis
Air	Continuous sampling through Whatman GF/A glass filter and a charcoal cartridge	Weekly	47	Gamma spectroscopy, gross beta, plutonium (monthly composite)
	Low-volume sampling through silica gel	Biweekly	17	HTO
	Continuous low volume sampling	Weekly	7	^{85}Kr and ^{133}Xe
Potable Water	1-liter grab sample	Weekly	8	Gross beta, tritium, plutonium (quarterly)
Supply Wells	1-liter grab sample	Monthly	12	Gamma spectroscopy, gross beta, tritium, plutonium (quarterly)
Open Reservoirs	1-liter grab sample	Monthly	17*	Gamma spectroscopy, gross beta, tritium, plutonium (quarterly)
Natural Springs	1-liter grab sample	Monthly	9*	Gamma spectroscopy, gross beta, tritium, plutonium (quarterly)
Contaminated Ponds	1-liter grab sample	Monthly	8*	Gamma spectroscopy, gross beta, tritium, plutonium (quarterly)

* All of these locations were not sampled due to inaccessibility or lack of water.

TABLE 1 (Continued)

SUMMARY OF ENVIRONMENTAL PROGRAM

Sample Type	Description	Collection Frequency	Number of Samples	Analysis
Effluent Ponds	3-liter grab sample	Quarterly	7	Gamma spectroscopy, gross beta, plutonium
External Gamma Radiation Levels	CaF_2:Dy Thermoluminescent Dosimeters	Quarterly	163	Total integrated exposure over field cycle

concentration guides were performed daily to insure that potential problems were noted in a timely fashion. Table 2 lists the CG's used in the evaluations of the results of this program (References 3 and 22).

All laboratory analyses appropriate to the environmental surveillance program are shown in Table 3. The analysis that provided the most information on the majority of test site samples has been the gross beta analysis. It allowed for rapid determinations of trends in gross radioactivity, and because of counting system characteristics, had a low detection limit. This meant that positive measurements were obtained down to the lowest limits of ambient radioactivity. The remaining analyses show their worth to the program in more specific instances. Gamma spectroscopy and noble gas sampling have proved their importance by indicating whether increases of radioactivity in air were caused by the Nevada Test Site or other offsite sources. TLD analysis of direct gamma radiation onsite has shown: (1) elevated exposure rates at the coordinates of the NTS atmospheric tests; and (2) consistent exposure rates at all radiation levels when the TLD's are integrated over a three month period. Plutonium analysis was primarily an indicator of the small amounts of Pu-239 in the air near areas with histories of safety shots. Tritium analysis was used principally as a check of the water in the ponds below the Area 12 tunnels.

TABLE 2

CONCENTRATION GUIDES (CGs) FOR CONTROLLED AREAS

Nuclide	CG for Air* (μCi/cc)	CG for Major NTS Waters*+ (μCi/ml)	CG for Drinking Water** (μCi/ml)
^{3}H	5×10^{-6}	1×10^{-1}	2×10^{-5}
^{7}Be	6×10^{-6}	5×10^{-2}	6×10^{-6}
^{60}Co	3×10^{-7}	1×10^{-3}	1×10^{-7}
^{85}Kr	1×10^{-5}	--------	--------
^{89}Sr	3×10^{-8}	3×10^{-4}	8×10^{-8}
^{90}Sr	1×10^{-9}	1×10^{-5}	8×10^{-9}
^{95}Zr	1×10^{-7}	2×10^{-3}	2×10^{-7}
^{131}I	4×10^{-9}	3×10^{-5}	3×10^{-9}
^{132}Te	2×10^{-7}	9×10^{-4}	9×10^{-8}
^{133}Xe	1×10^{-5}	--------	--------
^{137}Cs	6×10^{-8}	4×10^{-4}	2×10^{-7}
^{140}Ba	1×10^{-7}	8×10^{-4}	9×10^{-8}
^{152}Eu	1×10^{-8}	2×10^{-3}	2×10^{-7}
^{238}Pu	2×10^{-12}	1×10^{-4}	5×10^{-6}
^{239}Pu	2×10^{-12}	1×10^{-4}	5×10^{-6}
gross β***	1×10^{-9}	1×10^{-5}	1.5×10^{-8}

*This column contains the concentration guides for the predominant nuclides detected at the NTS, as listed in DOE Order 5480.1A, Chapter XI, Table 1.

+These concentrations are applicable to the discharge of liquid effluents to sanitary sewage systems.

**Drinking water concentration guides are as required by the National Interim Primary Drinking Water Regulations.

***Concentration guides for gross β are derived according to DOE ORDER 5480.1A, attachment XI-1.3, page 14.

TABLE 3
LABORATORY ANALYTICAL PROCEDURES

Type of Analysis	Type of Sample	Analytical Equipment	Counting Period (Min.)	Analytical Procedures	Sample Size	Detection Limit
Gross Beta	Air	Gas-flow Proportional Counter	20	Place filter on a 12.7 cm stainless steel planchet.	10^9 cc	2×10^{-16} µCi/cc
	Water	Gas-flow Proportional Counter	100	Evaporate, transfer residue to a 12.7 cm stainless steel planchet.	1000 ml	1×10^{-9} µCi/ml
Gamma Spectroscopy	Air (particulate)	GEM	20	Same as for gross beta.	10^9 cc	5×10^{-15} µCi/cc
	Air (gaseous)	GEM	20	Place charcoal cartridge in plastic bag.	10^9 cc	5×10^{-15} µCi/cc
	Water	GEM	20	Aliquot sample into Nalgene bottle.	500 ml	1×10^{-8} µCi/ml
Krypton-85	Air	Liquid Scintillation Counter	200	Cryogenic-gas chromatographic techniques used to collect krypton into liquid scintillation solution.	3×10^5 cc	4×10^{-12} µCi/cc
Plutonium-239	Air	Silicon Semiconductor	333	Filter is ashed and put in solution. Pu is purified by anion exchange resin column, then electrodeposited on a stainless steel disc.	4×10^9 cc	1×10^{-17} µCi/cc
	Water	Silicon Semiconductor	333	Pu is concentrated with $Fe(OH)_3$ and purified with anion resin column. Electrodeposited on a stainless steel disc.	1000 ml	4×10^{-11} µCi/ml
Tritium	Air	Liquid Scintillation Counter	100	Distill the H_2O and aliquot 5 ml into a scintillation solution.	6×10^6 cc	3×10^{-13} µCi/cc
	Water	Liquid Scintillation Counter	100	Aliquot 10 ml into a scintillation solution.	2 ml	9×10^{-7} µCi/ml
Xenon-133	Air	Liquid Scintillation Counter	200	Cryogenic-gas chromatographic techniques used to collect xenon into liquid scintillation solution.	3×10^5 cc	10×10^{-12} µCi/cc
Direct Gamma Radiation	TLD	Harshaw 2000		Post-anneal at 115°C for 15 minutes. Readout to 270° for 25 seconds.		10 mR/quarter

B. SUMMARY OF RESULTS

The results obtained from the environmental surveillance program for the reporting period of CY-1984 show that the radioactivity in air and water, and external gamma exposure levels in the NTS environments were low compared to DOE guidelines.

The highest CY-1984 average gross beta concentration in air was 2.0 X 10^{-14} μCi/cc at three of the forty-seven stations excluding samples collected at Gate 200 and the Area 5 communications tower, which were analyzed by a different procedure (see Section D). This average represents 0.002 percent of the applicable concentration guide of 1 X 10^{-9} μCi/cc as listed in Table 2. The other stations during this reporting period demonstrated similar results. One air sampler was added in February, 1984, at the Area 5 communications tower. The site average for the forty-seven stations was 1.8 X 10^{-14} μCi/cc with one standard deviation being 6.0 percent. This gross beta concentration is considered to be normal background for the Nevada Test Site. Pu-239 concentrations in air were primarily on the order of 10^{-17} μCi/cc as compared with the concentration guide of 2 X 10^{-12} μCi/cc (DOE Order 5480.1A, Chapter XI, Table 1). The highest average Pu-239 concentration occurred in Area 9 at the 9-300 Bunker 2. This Pu-239 concentration of 1.3 X 10^{-15} μCi/cc represents 0.07 percent of the concentration guide. The majority of NTS air sampling stations measured plutonium concentrations similar to those found in the basecamp (Mercury) and all were negligible in terms of exposure to NTS personnel. The highest average tritium concentration in air occurred at the Area 23 Building 650 roof. This concentration, 5.6 X 10^{-10} μCi/cc, represents 0.01 percent of the concentration guide.

The average concentration of Kr-85 for CY-1984 was 28 pCi/m^3, which was slightly higher than the CY-1984 average of 25 pCi/m^3. This increase in Kr-85 concentration in ambient air was expected since nuclear technologies, predominantly nuclear power generation, continue to generate and release small quantities of Kr-85 (Reference 25). Xe-133 concentrations continue to be nondetectable except for instances related to specific events (see Section D).

Measurements of radioactivity in the principal NTS water system showed that no release or movement of radionuclides occurred during the reporting period. One supply well sample was added in June, 1984, at Well 4. The highest average gross beta concentration in potable waters and supply wells was 8.0 X 10^{-9} µCi/ml from the Area 6 Cafeteria and 10.4 x 10^{-9} µCi/ml from Area 6 Well C1. Water from several of the open reservoirs showed gross beta activities believed to be associated with the occasional influx of radionuclides from surface contamination in the surrounding areas. There was no human consumption of this water, and the activity was still within the applicable concentration guides.

The highest average Pu-239 concentration from contaminated waters was 8.3 X 10^{-10} µCi/ml at Lower N Pond. This value represents 0.0008 percent of the concentration guide for Pu-239. For all other waters sampled, the highest Pu-239 concentration was 2.9 X 10^{-10} µCi/ml at Captain Jack Spring. This value represents 0.0003 percent of the concentration guide for Pu-239. However, all of the positive plutonium results have a high percentage error associated with them and are possibly due to statistical fluctuations of the counting system.

The highest average concentration of tritium in noncontaminated water occurred at the Area 27 Cafeteria. This concentration of 3.2×10^{-6} μCi/ml represents 16 percent of the limit allowed by the National Interim Primary Drinking Water Regulations. Positive results close to the detection limit may have been caused by statistical fluctuations in the counter.

Measurable amounts of tritium were present in the contaminated waste ponds. The amounts of effluent released to the environment for the year were calculated and reported to DOE Headquarters in accordance with DOE Order 5484.1, Chapter IV.

TLD measurements of the NTS gamma radiation rates at the 163 locations showed some variation during CY-1984. A nine station control network displayed lower results than previous years, attributable to a change in the methodology used during CY-1984. The remaining 154 stations recorded changes related to known effects. The maximum dose rate of 2300 mrem/y occurred at the 4-04 road station but the majority of NTS locations measured in the range of approximately 100-160 mrem/y.

The maximum dose to an individual living at the NTS boundary was calculated for CY-1984. The maximum calculated dose to the total body, bone, and lung was 0.20 mrem, 3.9 mrem, and 0.32 mrem respectively. Using the risk estimate values from Reference 17, these doses represent risks for radiation-induced cancers of 2×10^{-8} (total body), 2×10^{-8} (bone), and 6×10^{-9} (lung) to the individual.

C. SAMPLING AND ANALYSIS

1. Air Monitoring

Air sampling units were located at 47 stations on the NTS to measure the radionuclides in the form of particulates and halogens. All placements were chosen primarily to provide monitoring of radioactivity at sites with high occupational factors. Geographical coverage, access, and availability of commercial power were also considered.

The sampling units consist of a positive displacement pump drawing air at approximately 100 liters per minute through a 9-centimeter diameter Whatman GF/A filter for particulates, followed by a charcoal cartridge for radioiodines, and mounted on a plastic sample holder. A dry-gas meter was utilized to measure the volume of air displaced over the sampling period which was typically seven days. The total volume sampled was approximately 1000 cubic meters.

The samples were held for about seven days prior to analysis to allow naturally-occurring radon and its daughter products to decay. Gross beta counting was performed with a gas flow proportional counter for 20 minutes. The lower limit of detection for typical parameters involved was 2×10^{-16} μCi/cc. Gamma spectroscopy was accomplished using a lithium-drifted germanium detector with an input to 2000 channels which were calibrated at 1 keV per channel from 0 to 2 MeV.

The weekly air samples for a given sampling station were batched on a monthly basis and radiochemically analyzed for Pu-239. The procedure incorporated an acid dissolution and an ion exchange recovery on a resin bed. Plutonium was deposited by plating on a stainless steel disc. The chemical yield of the plutonium was determined with an internal Pu-236 tracer. Alpha spectroscopy was performed utilizing a solid state silicon surface barrier detector. The lower limit of detection for the parameters involved was 1×10^{-17} µCi/cc.

A separate sampler was designed for the collection of airborne tritiated water vapor (HTO) (Reference 4). The portable sampler was capable of unattended operation for up to two weeks in desert areas. A small electronic pump drew air into the apparatus at approximately 0.5 liters per minute, and the HTO was removed from the air stream by two silica gel drying columns. Appropriate aliquots of condensed moisture were obtained by heating the silica gel. Counting via liquid scintillation techniques allowed for the determination of the HTO activity. A lower limit of detection for this analysis was 3×10^{-13} µCi/cc.

Noble gas sampling units are housed in a metal tool box with three metal air bottles attached with quick disconnect hoses. A vacuum is maintained on the first bottle which causes a steady flow of air to be collected in the other two bottles. The flow rate is approximately 0.5 cubic centimeters per minute. The two collection bottles are exchanged weekly which yield a sample volume of about 3×10^{5} cubic centimeters.

The noble gases are separated and collected from the atmospheric sample by a series of cryogenic-gas chromatographic techniques. Water and carbon dioxide are removed at room temperature and the krypton and xenon are collected on charcoal at liquid nitrogen temperatures. These gases are transferred to a molecular sieve where they are separated from any remaining gases and each other. The krypton and xenon are transferred to separate scintillation vials and counted on a liquid scintillation counter. The lower limits of detection for the krypton and zenon are 4 X 10^{-12} and 10 X 10^{-12} μCi/cc, respectively.

2. Water Monitoring

Water samples were collected at various frequencies from selected potable water consumption points, supply wells, natural springs, open reservoirs, final effluent ponds, and contaminated ponds. Frequency was determined on the basis of a preliminary radiological pathways analysis; i.e., potable water weekly, supply wells monthly, etc. Samples were collected in 1-liter glass containers. All samples were analyzed for gross beta, tritium, and gamma emitting isotopes. Plutonium analyses were performed on a quarterly basis.

A 500-ml aliquot was taken from the original sample and counted in a Nalgene bottle for gamma activity in a Ge(Li) detector. A 5-ml aliquot was used for tritium analysis via liquid scintillation counting. The remainder of the original sample was evaporated to 15-ml, transferred to a stainless steel counting planchet, and evaporated to dryness after the addition of a wetting agent. Beta counting was accomplished as described in Section 1 except that the water samples were counted for 100 minutes. Lower limits of detection were: (1) gamma spectroscopy, 1 X 10^{-8} μCi/ml; (2) tritium, 9 X 10^{-7} μCi/ml; and (3) gross beta, 1 X 10^{-9} μCi/ml.

For the quarterly plutonium analysis, an additional 1-liter sample was collected. The radiochemical procedure was similar to that described in Section 1. As mentioned, alpha spectroscopy was used to measure any Pu-239. The lower limits of detection for this procedure was 4 X 10^{-11} μCi/ml.

3. Gamma Monitoring (TLD)

TLD's were located at 163 stations on the NTS to measure the external gamma radiation from the environment. These locations were chosen to: (1) provide a low-level control type network; (2) measure the residual activity from the atmospheric testing program; and (3) document the radiological conditions at the radioactive waste management sites (RWMS).

The dosimeters used were CaF_2:Dy (TLD-200) 0.6 cm X 0.6 cm x 0.09 cm chips from Harshaw Chemical Company. A badge consisting of two chips shielded by 0.12 cm cadmium (1030 mg/cm^2) inside a 0.13 cm plastic (140 mg/cm^2) holder was placed about one meter above the ground at each location during the first quarter. During the second and subsequent quarters the number of badges at each location was increased to two, i.e., four chips. The dosimeters detected gamma radiation above an energy cutoff of approximately 90 keV. The known systematic errors of the dosimeter in this application were the minimized detection of lower energy photons and fade of the phosphor's stored energy with time. Previous research indicated that only about 5-10% of the total exposure from natural background was from gamma emitters below 150 keV (Reference 5).

Fade in TLD-200 can be high when used in elevated temperatures such as those encountered at certain NTS locations. This loss of the phosphor's stored energy was minimized both physically and analytically by the REECo dosimetry group. Before readout, the chips were annealed at 115°C for 15 minutes to reduce the high-fade, low temperature traps.

Beginning in March, 1984, the responsibility for the issuance and analysis of environmental TLD's was transferred to the REECo group currently supplying calibration and readout services to the Nuclear Radiation Assessment Division, EMSL-LV. A detailed description of their facilities and methodology is presented in Reference 21.

4. Data Treatment

Each set of data obtained from this program underwent a thorough inspection as to its accuracy. Not only is the data analyzed automatically by computer, it is also verified by REECo Environmental Sciences Department (ESD) personnel prior to acceptance. If serious differences were found from the expected value, a review of the field handling, sample preparation, and processing was done. On the occasions when the problem could not be resolved by an environmental analyst, a recount or second sample was secured whenever possible.

All data were inspected on a daily basis and listed in tabular form. This treatment facilitated the data review process and revealed trends or periodicity. Each station's data were plotted against a logarithmic axis because of the possible magnitudes of variation in environmental data. The averaging plots in each section show arithmetic means and the range of data at each point. Arithmetic means, although severely affected by outliers (suspicious data), were those values compared to the CG's and listed in all tables. The plots provided reassurance to the means by graphically demonstrating the data file.

D. RADIOACTIVITY IN AIR

Ambient air monitoring was performed at the 47 locations shown in Figures 2 and 3. One air sampling station was added in February, 1984, at the Area 5 communications tower. Beginning in 1984, the samples collected at Gate 200 and the Area 5 communications tower were counted for gross β without allowing seven days for the decay of natural radioactivity, as with the other air samples. Although the results from these samples are higher and more variable due to the natural radioactivity, they serve as rapid indicators of unusual events, such as fallout from foreign sources. The computer plotted displays of the gross beta and Pu-239 activities for the entire air surveillance network are presented in Appendix A. In the first plot, weekly values were arithmetically averaged to show a smoothed presentation of the changes in airborne radioactivity over the surveillance period. The data ranges are included for each of these points. The remaining plots in Appendix A depict the actual measurements at each station.

Figures 2 and 3 summarize the 1984 gross beta and Pu-239 yearly locational averages, respectively. Tables 4 and 5 list these yearly averages along with half-year averages. The network average for the whole year for gross beta activity, excluding Gate 200 and the Area 5 communications tower, was 1.8×10^{-14} or 0.002 percent of the applicable concentration guide of 1×10^{-9} μCi/cc listed in DOE Order 5480.1A, Chapter XI.

Table 5 lists the Pu-239 concentrations for the year. All stations averaged below 10^{-14} μCi/cc for CY-1984, with the majority being on the order of 10^{-17} μCi/cc. The highest activity was found at 9-300 Bunker 2. The average

FIGURE 2

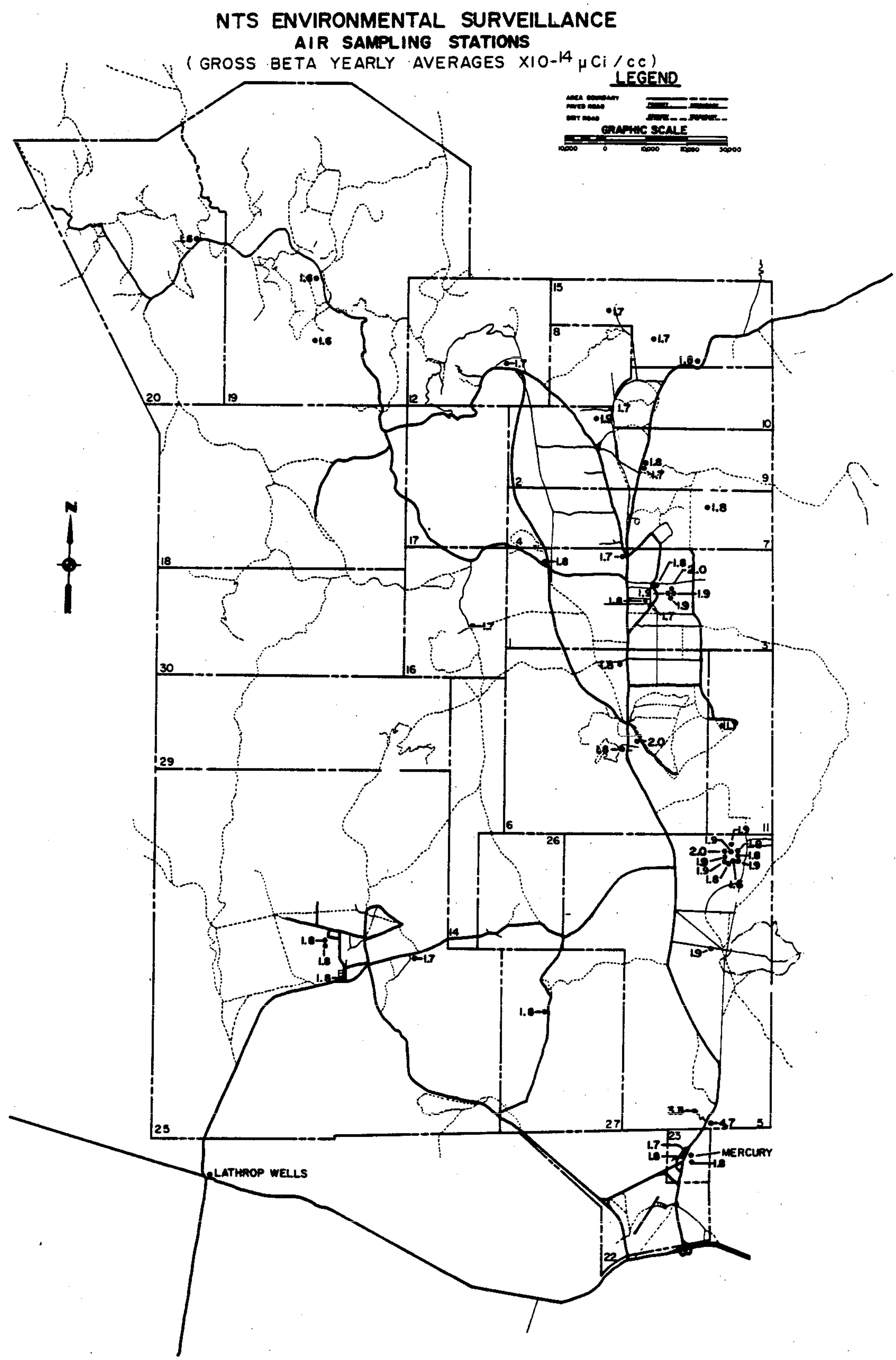

NTS ENVIRONMENTAL SURVEILLANCE
AIR SAMPLING STATIONS
(GROSS BETA YEARLY AVERAGES X10-14 μCi / cc)
LEGEND
GRAPHIC SCALE
LATHROP WELLS
MERCURY

FIGURE 3

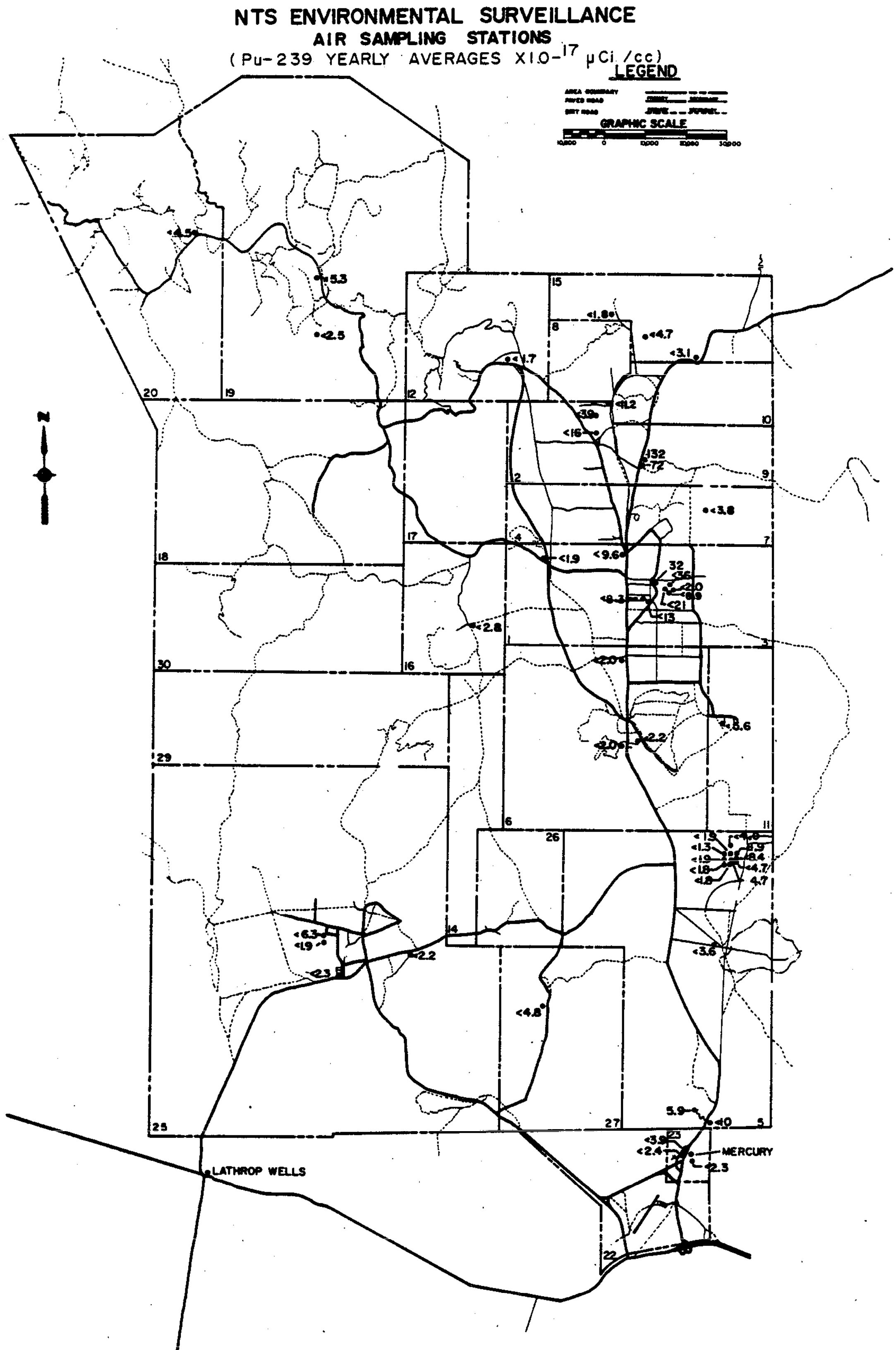

NTS ENVIRONMENTAL SURVEILLANCE
AIR SAMPLING STATIONS
(Pu-239 YEARLY AVERAGES X1.0-17 μCi /cc)
LEGEND
GRAPHIC SCALE
LATHROP WELLS
MERCURY

TABLE 4
AVERAGES OF AIR SURVEILLANCE DATA FOR GROSS BETA

($\times 10^{-14}$ µCi/cc)

Station	1/1/84-6/30/84	7/1/84-12/31/84	1/1/84-12/31/84
Area 1 BJY	2.1	1.4	1.7
Area 1 Gravel Pit	2.0	1.6	1.8
Area 2 Cable Yard	1.8	1.5	1.7
Area 2 Compound	2.3	1.6	1.9
Area 3 Compound	1.9	1.5	1.7
Area 3 Complex No. 2	2.2	1.5	1.8
Area 3 3-300 Bunker	2.1	1.6	1.8
Area 3 U3ax South	2.3	1.5	1.9
Area 3 U3ax East	2.2	1.7	1.9
Area 3 U3ax North	2.2	1.7	2.0
Area 3 U3ax West	2.1	1.6	1.9
Area 5 DOD Yard	2.2	1.6	1.9
Area 5 Gate 200	4.5	4.8	4.7*
Area 5 RWMS No. 1	2.1	1.6	1.8
Area 5 RWMS No. 2	2.2	1.6	1.9
Area 5 RWMS No. 3	2.2	1.6	1.9
Area 5 RWMS No. 4	2.1	1.8	2.0
Area 5 RWMS No. 5	2.0	1.7	1.9
Area 5 RWMS No. 6	2.0	1.7	1.8
Area 5 RWMS No. 7	2.0	1.7	1.8
Area 5 RWMS No. 8	2.0	1.7	1.9
Area 5 RWMS No. 9	2.1	1.0	1.6
Area 5 Well 5B	2.1	1.6	1.9
Area 5 Communications Tower	2.8	3.6	3.3*
Area 6 CP Complex	2.1	1.5	1.8
Area 6 Well 3 Complex	2.1	1.5	1.8
Area 6 Yucca Complex	2.2	1.7	2.0
Area 7 UE7ns	2.0	1.6	1.8
Area 9 9-300 Bunker	2.2	1.5	1.8
Area 9 9-300 Bunker No. 2	2.2	1.4	1.7
Area 11 Gate 293	2.0	1.3	1.7
Area 12 Compound	2.0	1.4	1.7
Area 15 EPA Farm	2.0	1.4	1.7
Area 15 Gate 700	2.1	1.5	1.8
Area 15 Piledriver	1.9	1.5	1.7
Area 16 Substation	1.8	1.3	1.6
Area 19 Echo Peak	1.9	1.4	1.6
Area 19 Substation	1.9	1.3	1.6
Area 20 Dispensary	1.8	1.4	1.6
Area 23 Bldg. 790	2.2	1.6	1.8
Area 23 Bldg. 790 No. 2	2.1	1.4	1.7
Area 23 H and S Roof	2.1	1.5	1.8
Area 25 E-MAD South	2.0	1.7	1.8
Area 25 E-MAD North	2.0	1.7	1.9
Area 25 NRDS Warehouse	2.1	1.5	1.8
Area 25 Henre Site	2.1	1.6	1.7
Area 27 Cafeteria	2.2	1.5	1.8

*Samples collected at these locations are not held for decay of natural radon daughters, in order to obtain an immediate indicator.

TABLE 5

AVERAGES OF AIR SURVEILLANCE DATA FOR PLUTONIUM

($X\ 10^{-17}\ \mu Ci/cc$)

Station	1/1/84-6/30/84	7/1/84-12/31/84	1/1/84-12/31/84
Area 1 Gravel Pit	<1.9	<2.0	<1.9
Area 2 Cable Yard	<31	<2.4	<16
Area 2 Compound	<2.4	<5.4	<3.9
Area 3 BJY	<12	<7.6	<9.6
Area 3 Compound	<8.7	<7.9	<8.3
Area 3 Complex No. 2	<10	<16	<13
Area 3 U3ax South	43	16	29
Area 3 U3ax East	<34	<4.9	<20
Area 3 U3ax North	<61	<10	<36
Area 3 U3ax West	<28	<13	<21
Area 3 3-300 Bunker	44	21	32
Area 5 DOD Yard	<1.6	<7.2	<4.4
Area 5 Gate 200	<1.2	<18	<10
Area 5 RWMS No. 1	<1.4	<2.0	<1.7
Area 5 RWMS No. 2	<2.4	<7.1	<4.7
Area 5 RWMS No. 3	<3.8	<13	<8.4
Area 5 RWMS No. 4	<1.4	<2.3	<1.9
Area 5 RWMS No. 5	<1.6	<2.1	<1.9
Area 5 RWMS No. 6	<1.4	<1.3	<1.3
Area 5 RWMS No. 7	<1.4	<2.4	<1.9
Area 5 RWMS No. 8	<1.5	<2.1	<1.8
Area 5 RWMS No. 9	<13	<2.8	<1.8
Area 5 Well 5B	<1.9	<5.4	<3.6
Area 5 Communications Tower	<10	<1.7	<5.9
Area 6 CP Complex	<1.6	<2.4	<2.0
Area 6 Well 3 Complex	<2.0	<2.0	<2.0
Area 6 Yucca Complex	<2.1	<2.3	<2.2
Area 7 UE7ns	<4.6	<3.0	<3.8
Area 9 9-300 Bunker	88	51	72
Area 9 9-300 Bunker No. 2	180	92	132
Area 11 Gate 293	<2.2	<8.9	<5.6
Area 12 Compound	<1.5	<1.8	<1.7
Area 15 EPA Farm	<5.6	<3.8	<4.7
Area 15 Gate 700	<2.6	<3.6	<3.1
Area 15 Piledriver	<2.0	<1.7	<1.8
Area 16 Substation	<2.2	<3.3	<2.8
Area 19 Echo Peak	<1.6	<3.3	<2.5
Area 19 Substation	<6.8	<3.8	<5.3
Area 20 Dispensary	<1.5	<7.6	<4.5
Area 23 Bldg. 790	<1.8	<2.9	<2.4
Area 23 Bldg. 790 No. 2	<1.6	<6.2	<3.9
Area 23 H and S Roof	<1.5	<3.1	<2.3
Area 25 E-MAD South	<1.9	<1.9	<1.9
Area 25 E-MAD North	<2.0	<11	<6.3
Area 25 Henre Site	<1.2	<3.2	<2.2
Area 25 NRDS Warehouse	<1.3	<3.3	<2.3
Area 27 Cafeteria	<7.2	<2.0	<4.8

concentration at this location was 132 X 10^{-17} µCi/cc, or 0.06 percent of the controlled area concentration guide of 2 X 10^{-12} µCi/cc. Figure 3 shows the Pu-239 yearly results at their respective locations. The radioactivity is primarily due to tests conducted before 1960 in which nuclear devices were detonated with high explosives (safety shots). These tests spread low-fired plutonium throughout the eastern and northeastern areas of the NTS. Two decades later, the effects of these tests are still demonstrated in increased plutonium concentrations in air in Areas 1, 2, 3, 7, 8, 9, 10, and 15.

The locations of all of the tritium samplers along with their yearly averages are shown in Figure 4. All of these stations were sampled for two week intervals. Substantial fluctuations occurred throughout the year with most of the samplers. This may be due to the small volumes of air sampled or mechanical problems with the sampler.

The highest average concentration of HTO was 5.6 x 10^{-10} µCi/cc at Building 650 representing 0.01 percent of the concentration guide. Both Buildings 650 and 790 release small amounts of tritium from processing samples. Due to the close proximity of the two tritium in air samplers, elevated concentrations of HTO are detected. Table 6 lists the maximums, minimums, and averages for each sampling location. Appendix B has the actual measurements plotted for each location.

The location and yearly average for each noble gas sampling station is shown in Figure 5. Two minor releases were detected during CY-1984 from drillback operations. The first occurred during the week of April 1, 1984, and was detected at the Area 1 BJY sampling location. The Xe-133 concentration was

FIGURE 4

NTS ENVIRONMENTAL SURVEILLANCE
TRITIUM IN AIR SAMPLING STATIONS
(HTO YEARLY AVERAGES x 10^{-11} µCi/cc)

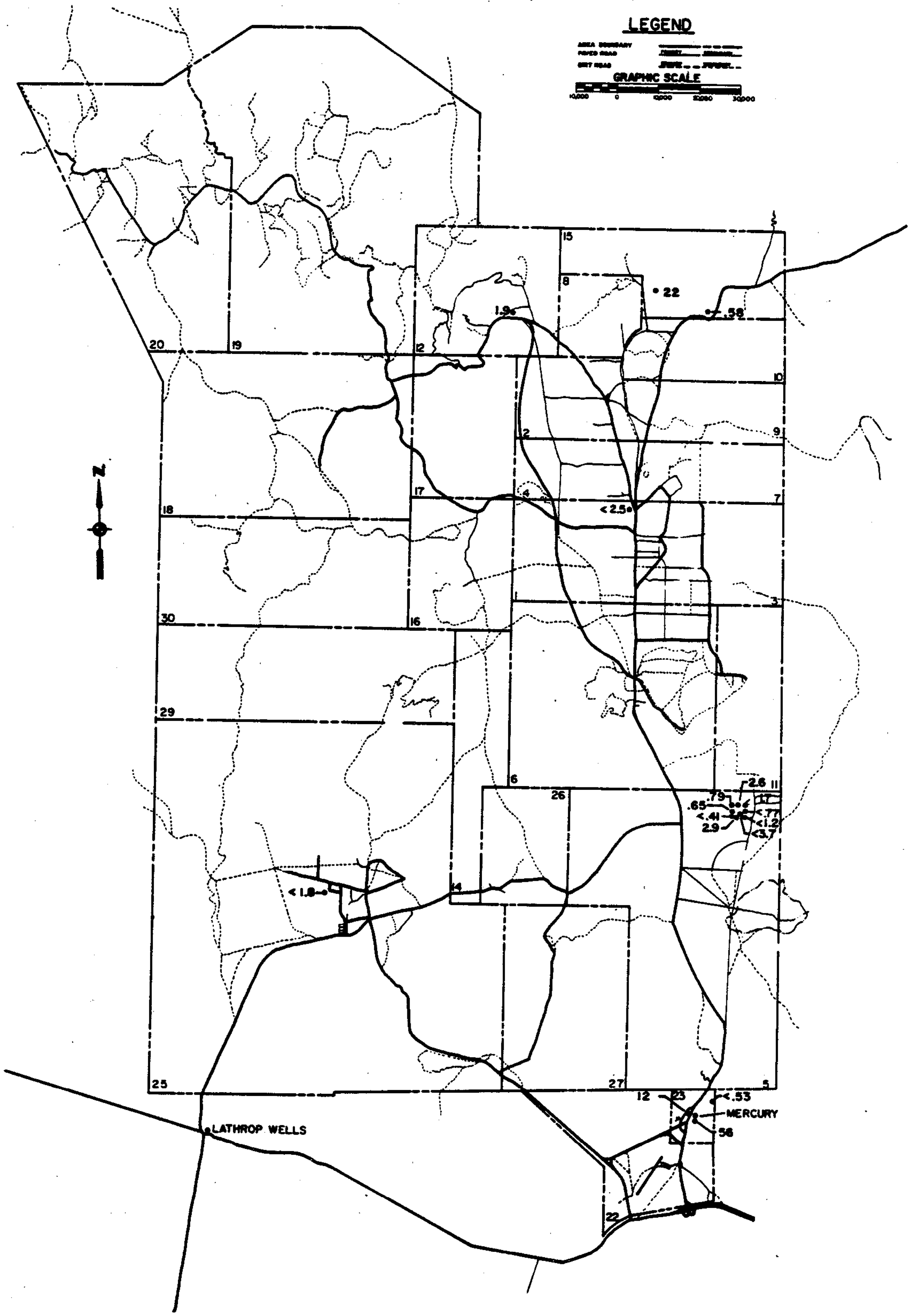


FIGURE 5

NTS ENVIRONMENTAL SURVEILLANCE
NOBLE GAS SAMPLING STATIONS
(^{85}Kr AND ^{133}Xe YEARLY AVERAGES x 10^{-12} µCi/cc)

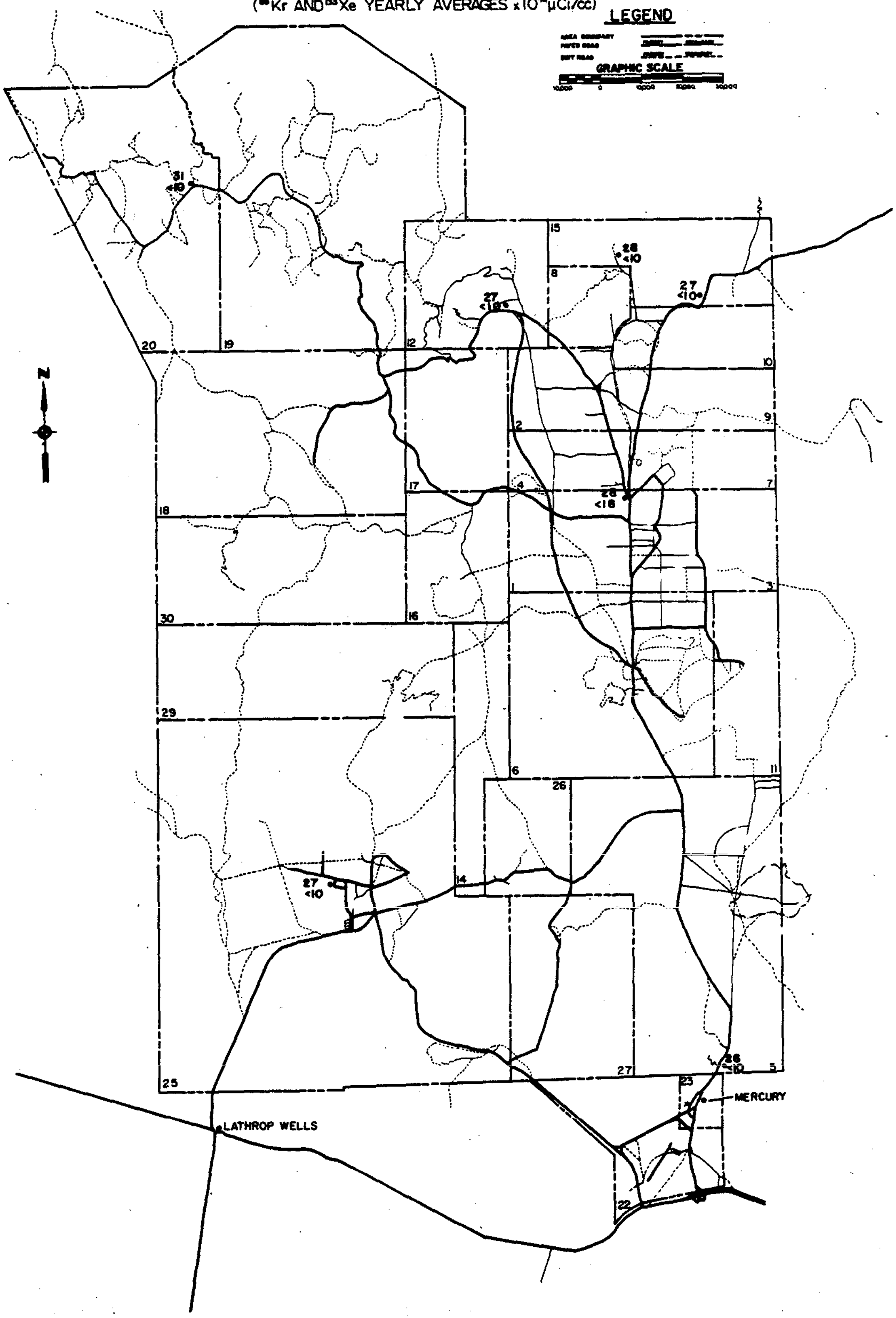


TABLE 6

TRITIUM IN AIR

Concentrations
(μCi/cc)

Stations	Maximum	Minimum	Average
Area 1 BJY	1.7×10^{-10}	1.6×10^{-12}	2.5×10^{-11}
Area 5 RWMS-1	2.0×10^{-10}	3.9×10^{-13}	3.7×10^{-11}
Area 5 RWMS-SE	6.2×10^{-11}	3.7×10^{-12}	1.2×10^{-11}
Area 5 RWMS-(SE-NE)	2.0×10^{-11}	2.3×10^{-12}	7.7×10^{-12}
Area 5 RWMS-NE	9.7×10^{-11}	$<1.4 \times 10^{-12}$	1.7×10^{-11}
Area 5 RWMS-(NE-NW)	1.4×10^{-10}	1.7×10^{-12}	2.6×10^{-11}
Area 5 RWMS-NW	4.8×10^{-11}	2.1×10^{-12}	7.9×10^{-12}
Area 5 RWMS-(NW-SW)	2.2×10^{-11}	$<3.3 \times 10^{-12}$	6.5×10^{-12}
Area 5 RWMS-SW	7.8×10^{-11}	3.7×10^{-12}	4.1×10^{-12}
Area 5 RWMS-(SW-SE)	1.8×10^{-10}	$<1.9 \times 10^{-12}$	2.9×10^{-11}
Area 12 Base Camp	3.3×10^{-11}	1.2×10^{-12}	1.9×10^{-11}
Area 15 EPA Farm	3.7×10^{-9}	2.7×10^{-12}	2.2×10^{-10}
Area 23 Bldg. 790	2.1×10^{-10}	$<1.6 \times 10^{-12}$	1.2×10^{-10}
Area 23 Bldg. 650	1.5×10^{-8}	$<1.8 \times 10^{-12}$	5.6×10^{-10}
Area 23 Site Boundary	1.7×10^{-11}	$<5.4 \times 10^{-13}$	5.3×10^{-12}
Area 25 EMAD	2.0×10^{-10}	1.7×10^{-12}	1.8×10^{-11}
Area 15 Gate 700	3.0×10^{-11}	$<1.6 \times 10^{-12}$	5.8×10^{-12}

412 x 10^{-12} μCi/cc or 0.004 percent of the concentration guide. The second release occurred during the week of June 18, 1984, and was detected at two locations - Area 400 and Gate 700. The xenon-133 concentration at Area 400 was 24 X 10^{-12} μCi/cc, while the xenon-133 concentration at Gate 700 was 19 X 10^{-12} μCi/cc. These values are less than 0.0002 percent of the concentration guide.

The average concentration of Kr-85 for the entire network was slightly higher in CY-1984, rising from an average of 25 pCi/m^3 in CY-1983 to an average of 28 pCi/m^3 in CY-1984. This increase was expected since all sources worldwide, predominantly nuclear power generation, continue to generate and release small quantities of Kr-85 (Reference 25). The network average of 28 pCi/m^3 includes some elevated measurements taken at the Area 20 camp in December, 1984. The Kr-85 concentrations during this period ranged from 31 pCi/m^3 to 99 pCi/m^3. These elevated concentrations continued into 1985, and have been determined to be related to a slight seepage from a Pahute Mesa event. The network average excluding these values was 27 pCi/m^3.

Table 7 lists the average Kr-85 and Xe-133 concentrations at each location along with the lowest and highest values detected.

TABLE 7

NOBLE GASES IN AIR

Concentrations (X 10^{-12} μCi/cc)

Stations	^{85}Kr			^{133}Xe		
	Max	Min	Avg	Max	Min	Avg
Area 1 BJY	37	17	28	412	<10	<18
Area 12 Base Camp	40	21	27	<10	<10	<10
Area 15 EPA Farm	41	20	28	<10	<10	<10
Area 5 Gate 200	32	17	26	<10	<10	<10
Area 25 EMAD	53	21	27	24	<10	<10
Area 15 Gate 700	41	20	27	19	<10	<10
Area 20 Dispensary	90	21	31	<10	<10	<10

E. RADIOACTIVITY IN SURFACE AND GROUND WATER

The principal water distribution system on the NTS consists of thirteen supply wells, eight potable water stations, and seventeen open reservoirs. One supply well was added to the sampling network in June, 1984, at Well 4. The wells feed directly to many of the reservoirs, and the drinking water was pumped from the wells to the points of consumption. This was the critical pathway for the ingestion of waterborne radionuclides, so the system was routinely sampled and evaluated. The supply wells and open reservoirs were sampled on a monthly basis. All drinking water was collected weekly to provide a constant check of the end use activity and to allow frequent comparisons to the radioactivity of the water in the wells. The identification of any radionuclides above natural background in the supply well system initiated a closer review of the drinking water. The surface and ground/water monitoring network creates a large data base to evaluate long-term trends or intermittent changes in activity.

The natural springs, contaminated ponds, and effluent ponds were also monitored. The springs and contaminated ponds were collected monthly when water was available for sampling. The effluent ponds were sampled quarterly.

1. Supply Wells

Water from thirteen supply wells was used for a variety of sanitary and industrial purposes. The criteria for collection was primarily based on potential for human consumption. The secondary purpose was to document the radiological characteristics of NTS ground water and analyze the data for trends or changes. The yearly gross beta averages are shown at their respective locations in Figure 6. Appendix C consists of the plots of each station for measured gross beta activity with 2σ error bars. An averaging plot is included which shows the trend of the mean of the network throughout the reporting period. The range at each point is also given. Table 8 lists the 1984 averages for each location. The highest average recorded was 10.4 X 10^{-9} μCi/ml at Well C1. This was 0.3 percent of the concentration guide. The lowest average gross beta activity for the onsite supply wells was <1.7 X 10^{-9} μCi/ml at Well U19c.

The activities of each well and the entire network average appeared consistent over this reporting period. In previous reports (References 8 and 23) it was shown that the majority of gross beta activity was attributable to naturally occurring potassium-40. No trends in the plots were discernible, verifying that no movement of radionuclides occurred in this NTS water system. The average of the entire network, as compared to previous years was:

Year	Mean (X 10^{-9} μCi/ml)
CY-1984	6.4
CY-1983	6.6
CY-1982	7.0
CY-1981	8.3
CY-1980	8.8
CY-1979	9.4
CY-1978	9.1
July-December 1977	10.9
FY-1977	10.4
FY-1976	9.1

FIGURE 6

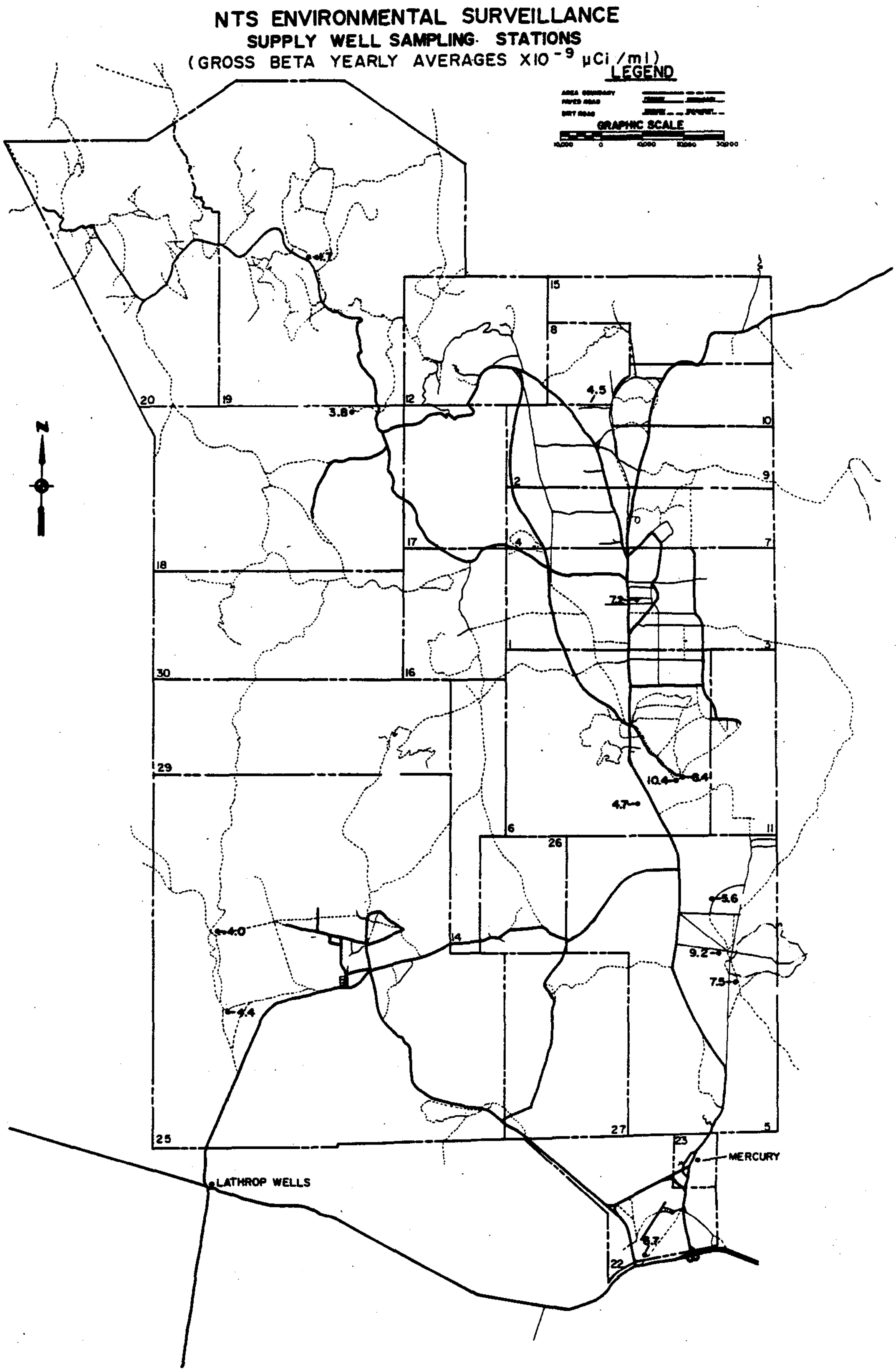

NTS ENVIRONMENTAL SURVEILLANCE
SUPPLY WELL SAMPLING STATIONS
(GROSS BETA YEARLY AVERAGES X10^{-9} μCi/ml)
LEGEND
GRAPHIC SCALE
MERCURY
LATHROP WELLS

TABLE 8

AVERAGES OF SUPPLY WELL DATA FOR GROSS BETA

Station	Gross Beta Yearly Average ($X 10^{-9}$ μCi/ml)
Area 2 Well 2	4.5
Area 3 Well A	7.2
Area 5 Well 5B	9.2
Area 5 Well 5C	7.5
Area 5 Well Ue5c	5.6
Area 6 Well C	8.4
Area 6 Well C1	10.4
Area 6 Well 4	4.7
Area 18 Well 8	3.8
Area 19 Well U19c	<1.7
Area 22 Army Well No. 1	6.7
Area 25 Well J12	4.4
Area 25 Well J13	4.0

Appendix C includes plots of the network monthly averages for tritium and plutonium. The positive tritium results for all noncontaminated NTS waters are given in Table 9. There were no positive tritium results for supply wells for CY-1984. There was one positive plutonium result for the supply wells for CY-1984, at Well C1. The concentration was 1.7×10^{-10} µCi/ml, which is 0.003 percent of the concentration guide for plutonium-239 in drinking water. This value is very near the detection limit and has a high percentage error.

2. Potable Water

As a check of any effect the water distribution system might have on end use activity, eight consumption points were sampled during the reporting period. The locations of all stations are shown in Figure 7 with their gross beta yearly averages.

Appendix D contains the computer plots of the measured gross beta activity with the 2σ error bars included. An average plot is provided which shows the network mean trend throughout the reporting period along with the range at each point. Table 10 contains a list of the average gross beta activity measured at each sample location for CY-1984. The highest average recorded was 8.0×10^{-9} µCi/ml at the Area 6 Cafeteria. This was 53.0 percent of the screening level for drinking water as required by the National Interim Primary Drinking Water Regulations. This value was 3.0 percent of the concentration guide for uncontrolled areas (Reference 3). The lowest average gross beta activity, excluding Cascade brand bottled water, was 3.1×10^{-9} µCi/ml at the Area 12 Cafeteria. The Cascade water

TABLE 9

TRITIUM VALUES ABOVE DETECTION LIMITS
FROM NONCONTAMINATED WATERS

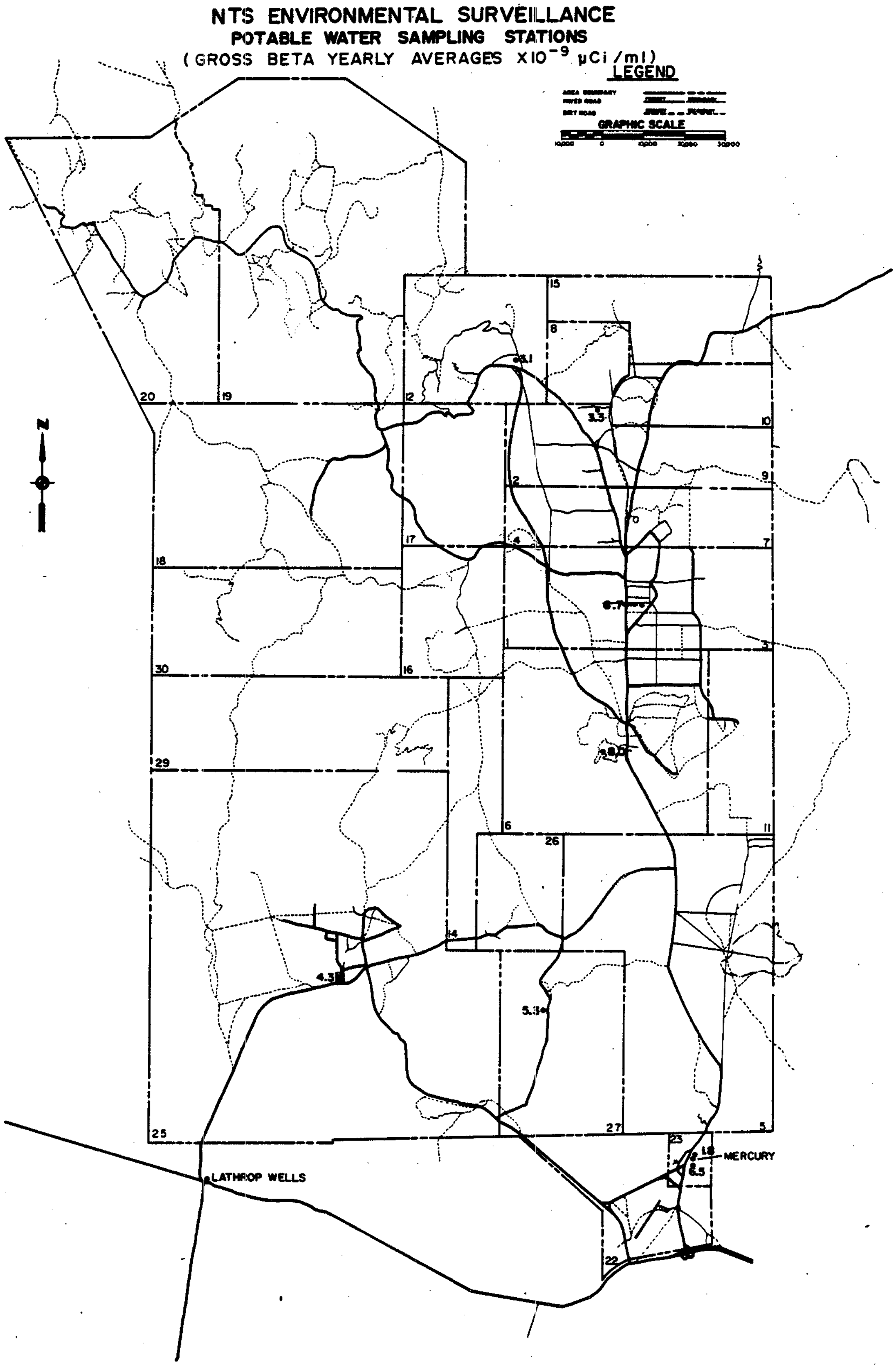
WATER TYPE	STATION	DATE	μCi/ml
Open Reservoir	Well J-11 Reservoir	07/31/84	9.9 x 10-6 = 30%
Potable Water	Area 2 Rest Room	07/31/84	$9.9 \times 10^{-7} \pm 31\%$
Potable Water	Area 12 Cafe	02/27/84	$1.0 \times 10^{-6} \pm 38\%$
Potable Water	Area 23 Cafe	01/23/84	$1.1 \times 10^{-6} \pm 28\%$
Potable Water	Area 27 Cafe	01/23/84	$3.2 \times 10^{-6} \pm 10\%$
		07/31/84	$1.4 \times 10^{-6} \pm 23\%$
Natural Spring	Tub Springs	09/14/84	$7.7 \times 10^{-7} \pm 26\%$
Natural Spring	Reitmann Seep	09/13/84	$7.8 \times 10^{-7} \pm 26\%$
Natural Spring	Tippipah Spring	09/14/84	$7.0 \times 10^{-7} \pm 28\%$
Open Reservoir	Well C-1 Reservoir	01/20/84	$1.6 \times 10^{-6} \pm 19\%$
Open Reservoir	Well J-11 Reservoir	09/13/84	$7.6 \times 10^{-7} \pm 26\%$
Open Reservoir	Well 8 Reservoir	09/14/84	$6.0 \times 10^{-7} \pm 32\%$
Open Reservoir	Area 5 Reservoir	03/02/84	$1.0 \times 10^{-6} \pm 30\%$
		04/06/84	$1.2 \times 10^{-6} \pm 26\%$
		05/04/84	$1.6 \times 10^{-6} \pm 21\%$
		06/08/84	$1.3 \times 10^{-6} \pm 29\%$
		07/03/84	$1.4 \times 10^{-6} \pm 27\%$

TABLE 10

AVERAGES OF POTABLE WATER DATA FOR GROSS BETA

Station	Gross Beta Yearly Average ($\times 10^{-9}$ µCi/ml)
Area 2 Rest Room	3.3
Area 3 Cafeteria	6.7
Area 6 Cafeteria	8.0
Area 12 Cafeteria	3.1
Area 23 Cafeteria	6.5
Area 23 Cascade Water	1.8
Area 25 Service Station	4.3
Area 27 Cafeteria	5.3

FIGURE 7


NTS ENVIRONMENTAL SURVEILLANCE
POTABLE WATER SAMPLING STATIONS
(GROSS BETA YEARLY AVERAGES X10^{-9} µCi /ml)
LEGEND
GRAPHIC SCALE
MERCURY
LATHROP WELLS
N

was demineralized water brought in from offsite and was used as a check ofthe laboratory system. It was included in the results listing because the bottles were stored onsite and the water was consumed by NTS personnel.

Gross beta measurements at these potable water stations demonstrated that no release or movement of radionuclides occurred in the NTS water system throughout CY-1984. No discernible trends were seen on the plotted data.

The average of the entire network, as compared to averages reported in previous environmental reports, was:

Year	Mean (X 10^{-9} µCi/ml)
CY-1984	5.3
CY-1983	5.3
CY-1982	5.8
CY-1981	7.9
CY-1980	5.8
CY-1979	6.5
CY-1978	6.7
July-December 1977	7.8
FY-1977	7.3
FY-1976	7.4

All potable water, except Cascade bottled water, was obtained from the supply wells. A comparison of these waters and their suppliers is shown in Table 11. In previous reports (References 8 and 23) it was shown that the majority of the radioactivity in supply well and potable water was from naturally occurring potassium.

Appendix D also includes the plots of the network averages for tritium and plutonium. The positive tritium results were given in Table 9. The highest value was 3.2 x 10^{-6} µCi/ml for Area 27 Cafe. This is 16 percent

TABLE 11

COMPARISON OF END USE AND SUPPLY WATER

FOR GROSS BETA AVERAGES

($X\ 10^{-9}\ \mu Ci/ml$)

Station (end use/supply)	CY-1984
Area 2 Rest Room	3.3
Area 18 Well 8	3.8
Area 3 Cafeteria	6.7
Area 3 Well A	7.2
Area 6 Cafeteria	8.0
Area 6 Well C/C1	8.4/10.4
Area 12 Cafeteria	3.1
Area 18 Well 8	3.8
Area 23 Cafeteria	6.5
Area 5 Well 5B/5C	9.2/7.5
Area 22 Army Well No. 1	6.7
Area 23 Cascade Water (Demineralized Bottled Water)	<1.8
Area 27 Cafeteria	5.3
Area 5 Well 5B/5C	9.2/7.5
Area 22 Army Well No. 1	6.7

of the concentration guide for tritium in drinking water. The majority of the five positive measurements are near the detection limit of the system and are believed to be caused by fluctuations in the counting system. There were no positive plutonium results for the CY-1984.

3. Safe Drinking Water Act Results

In accordance with the Safe Drinking Water Act of 1976, special water sampling was conducted during CY-1984 on all wells that supply potable water at the Tonopah Test Range and on eight distribution points on the NTS.

There were five wells sampled at the Tonopah Test Range. Since there are no nuclear facilities present, the monitoring requirements for community water systems were used. Samples were collected and analyzed quarterly for tritium, plutonium-239, gross alpha and gross beta. Strontium-90 analysis was performed annually. The plutonium-239 was included because of previous safety shots at the Tonopah Test Range. The results of these analyses are listed in Table 12. All concentrations were below the prescribed screening levels.

The eight NTS potable water locations were sampled according to the more stringent requirements for water systems near nuclear facilities, with the exception of iodine-131 which was excluded from the list of analyses since it is not seen as a potential contaminant to the NTS water supply. Potable water samples were collected and analyzed quarterly for tritium, gross alpha and gross beta. Strontium-90 analysis was performed on an

TABLE 12

TONOPAH TEST RANGE SUPPLY WELLS
SAFE DRINKING WATER ACT RESULTS

Type of Analysis	Location: Well 6	Well 3A	Well 1A	Well AF	Well 9
Gross Alpha* ($X\ 10^{-9}$ µCi/ml)					
Max	1.49	2.86	<0.85	<0.81	0.90
Min	<0.75	<0.81	<0.77	<0.72	0.12
Avg	1.03	1.82	<0.81	<0.76	0.57
Gross Beta** ($X\ 10^{-9}$ µCi/ml)					
Max	6.09	5.43	7.54	7.81	6.09
Min	1.66	2.09	2.11	1.75	5.89
Avg	4.01	4.07	5.31	5.49	4.73
^{3}H*** ($X\ 10^{-7}$ µCi/ml)					
Max	<8.40	<8.40	<8.40	<8.40	<8.40
Min	<7.40	<7.40	<7.40	<7.40	<7.40
Avg	<7.97	<7.97	<7.97	<7.97	<7.97
^{90}Sr*** ($X\ 10^{-9}$ µCi/ml)					
Max****	<0.36	<0.43	<0.36	<0.49	<0.39
^{239}Pu ($X\ 10^{-11}$ µCi/ml)					
Max	<5.80	<4.30	<6.30	<4.20	<5.60
Min	<3.50	<3.80	<4.60	<1.80	<3.90
Avg	<4.17	<4.13	<5.23	<3.13	<4.47

* Screening level for gross alpha activity is 5×10^{-9} µCi/ml.

** Screening level for gross beta activity in surface water is 5×10^{-8} µCi/ml

*** Maximum contaminant levels for ^{90}Sr and ^{3}H are 8×10^{-9} µCi/ml and 2×10^{-5} µCi/ml, respectively.

**** Strontium-90 analysis was performed once on an annual basis.

annual basis. These results are listed in Table 13. All concentrations were below the prescribed screening levels.

4. Open Reservoirs

Open reservoirs have been established at various locations on the NTS for industrial purposes. Fifteen locations were sampled during the report period. The locations are shown in Figure 8 along with their gross beta yearly averages.

Appendix E consists of the plots of each station of the measured gross beta activity with 2σ error bars. An averaging plot is included which shows the entire network mean trend throughout the reporting period. The range at each point is also given. These plots demonstrate consistent concentrations of gross beta activity at all locations throughout CY-1984.

Flat trends were seen for the network, although the data were more variable than the supply well data. The large variation could have been caused by real activity fluctuations or, simply, more variable sampling procedures since some of the open reservoirs are difficult to sample. The average of the entire network, as compared to previous years was:

Year	Mean (X 10^{-9} μCi/ml)
CY-1984	6.8
CY-1983	8.1
CY-1982	9.7
CY-1981	13.6
CY-1980	8.1
CY-1979	10.9
CY-1978	13.1
July-December 1977	19.4
FY-1977	19.6
FY-1976	22.0

TABLE 13

NTS POTABLE WATERS

SAFE DRINKING WATER ACT RESULTS

Type of Analysis	Location				
	A-3 Cafe	A-2 Restroom	A-12 Cafe	Mercury Cafe	A-27 Cafe
Gross Alpha* ($X\ 10^{-9}$ μCi/ml)					
Max	2.21	<0.86	<0.78	3.05	3.77
Min	1.23	<0.75	<0.62	1.35	0.83
Avg	1.86	<0.81	<0.70	2.12	2.01
Gross Beta** ($X\ 10^{-9}$ μCi/ml)					
Max	11.00	11.00	5.90	6.70	9.10
Min	1.50	1.40	1.60	<3.00	<2.00
Avg	3.30	6.70	8.00	3.10	5.30
^{3}H*** ($2\ X\ 10^{-7}$ μCi/ml)					
Max	<9.60	<10.00	<10.00	<11.00	<32.00
Min	<4.30	<4.20	<4.20	<4.30	<4.30
Avg	<6.94	<7.06	<7.03	<7.14	<7.66
^{90}Sr*** ($X\ 10^{-9}$ μCi/ml)					
Max****	<2.50	<2.50	<3.20	<3.10	<3.00

* Screening level for gross alpha activity is $5\ X\ 10^{-9}$ μCi/ml.

** Screening level for gross beta activity near a nuclear facility is $1.5\ X\ 10^{-8}$ μCi/ml.

*** Maximum contaminant levels for ^{3}H and ^{90}Sr are $2\ X\ 10^{-5}$ μCi/ml and $8\ X\ 10^{-9}$ μCi/ml, respectively.

**** Strontium-90 analysis was performed once on an annual basis.

Table 13, Continued

Type of Analysis	Location		
	Cascade Water	A-6 Cafe	A-25 Service Station
Gross Alpha* ($\times 10^{-9}$ µCi/ml)			
Max	1.11	3.28	0.98
Min	<0.59	<1.60	<0.78
Avg	<0.82	<2.06	<0.85
Gross Beta** ($\times 10^{-9}$ µCi/ml)			
Max	7.00	14.00	11.00
Min	<1.20	1.80	<1.50
Avg	1.80	8.00	4.30
^{3}H*** ($\times 10^{-7}$ µCi/ml)			
Max	<12.00	<12.00	<9.60
Min	<4.30	<4.20	<4.20
Avg	<7.11	<6.89	<6.87
^{90}Sr*** ($\times 10^{-9}$ µCi/ml)			
Max	<2.00	<2.20	<2.50

* Screening level for gross alpha activity is 5 X 10^{-9} µCi/ml.

** Screening level for gross beta activity near a nuclear facility is 1.5 X 10^{-8} µCi/ml.

*** Maximum contaminant levels for ^{3}H and ^{90}Sr are 2 X 10^{-5} µCi/ml and 8 X 10^{-9} µCi/ml, respectively.

FIGURE 8

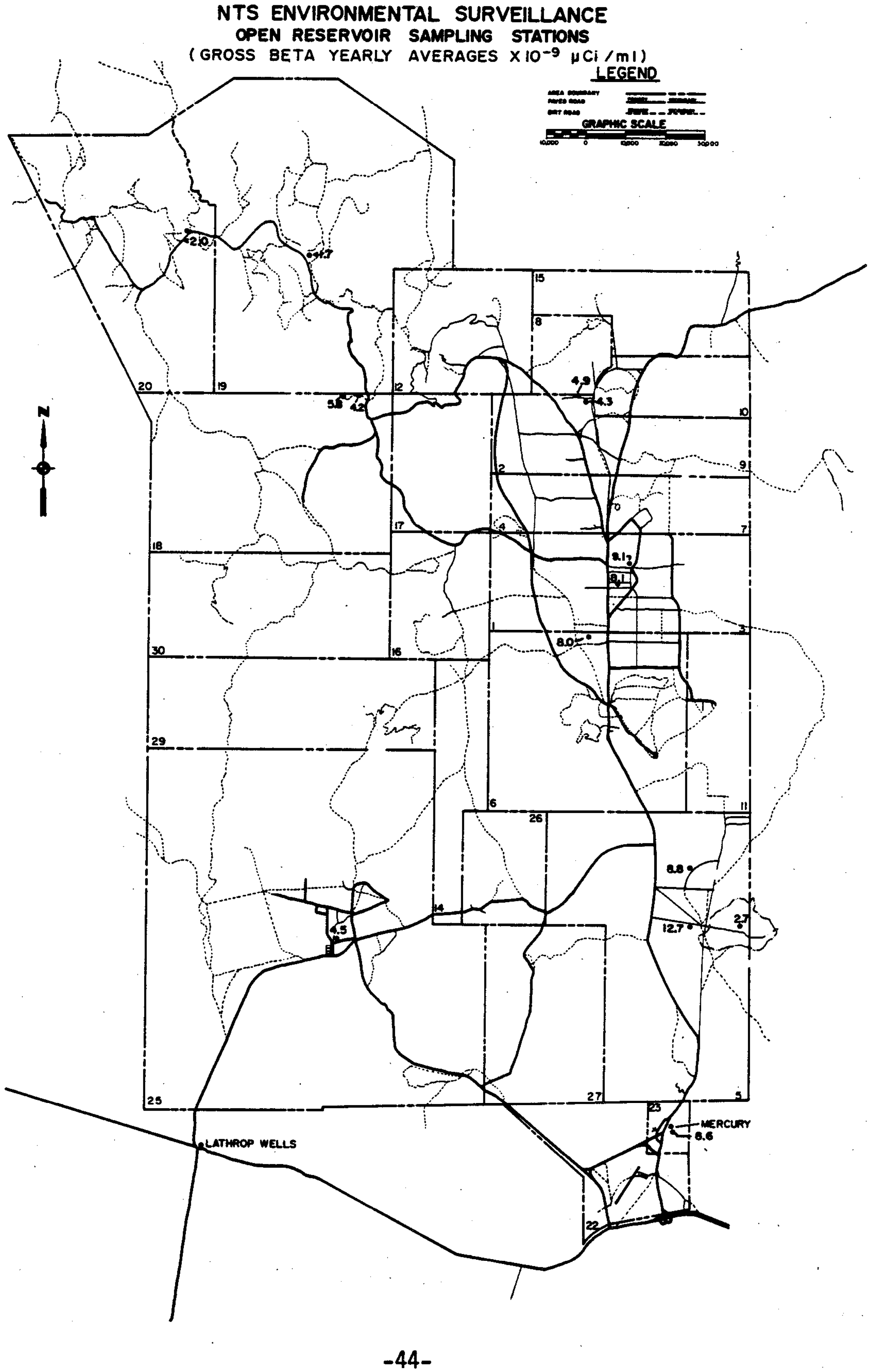

NTS ENVIRONMENTAL SURVEILLANCE
OPEN RESERVOIR SAMPLING STATIONS
(GROSS BETA YEARLY AVERAGES X10^{-9} μCi/ml)
LEGEND
GRAPHIC SCALE
LATHROP WELLS
MERCURY
8.6
12.7
2.7
8.8
4.5
8.0
8.1
9.1
4.9
4.3
5.8
4.2
21.0
4.7

Table 14 includes a list of the CY-1984 gross beta averages at each location. The highest average beta concentration was 12.7 X 10^{-9} μCi/ml at Area 5 Well 5B Reservoir. This result was 0.1 percent of the concentration guide. The lowest gross beta average was <1.7 X 10^{-9} μCi/ml at Well U19c and Well 20a Reservoir.

Table 15 shows the gross beta activities of the open reservoirs that were supplied by wells, along with the activities of the associated wells. The values for the reservoirs were in most cases slightly higher. This is most likely caused by resuspended contaminated material settling into the open reservoirs and/or run-off into the reservoirs from contaminated areas.

Appendix E also includes the plots of the network averages for tritium and plutonium. There were eight positive tritium values, the highest was 1.6 x 10^{-6} μCi/ml at the Area 5 Reservoir. This is 0.015 percent of the tritium concentration guide. There were six positive plutonium results. The highest plutonium concentration was 2.7 X 10^{-10} μCi/ml and occurred at A-5 Reservoir. This is 0.0003 percent of the concentration guide. The positive tritium and plutonium results can be seen in Tables 9 and 16.

5. Natural Springs

The term "natural springs" was a label given to the spring supplied pools located within the NTS. There was no known human consumption from these springs. Nine such locations were sampled on a monthly basis or when accessible, and are shown in Figure 9 along with their gross beta yearly averages.

TABLE 14

AVERAGES OF OPEN RESERVOIR DATA FOR GROSS BETA

Station	Gross Beta Yearly Average ($X\ 10^{-9}$ µCi/ml)
Area 2 Well 2 Reservoir	4.9
Area 2 Mud Plant Reservoir	4.3
Area 3 Well A Reservoir	8.1
Area 3 Mud Plant Reservoir	9.1
Area 5 Well 5B Reservoir	12.7
Area 5 Well Ue5c Reservoir	8.8
Area 5 Reservoir	2.7
Area 6 Well 3 Reservoir	8.0
Area 6 Well C1 Reservoir	6.8
Area 18 Camp 17 Reservoir	4.2
Area 18 Well 8 Reservoir	5.8
Area 19 Well 19c Reservoir	<1.7
Area 20 Well 20A Reservoir	<2.0
Area 23 Swimming Pool	8.6
Area 25 Well J-11 Reservoir	4.5

TABLE 15

COMPARISON OF OPEN RESERVOIRS AND SUPPLY WATER FOR GROSS BETA AVERAGES

($\times 10^{-9}$ μCi/ml)

Station (Reservoir/Supply)	CY-1983
Area 2 Well 2 Reservoir	4.9
Area 2 Well 2	4.5
Area 3 Well A Reservoir	8.1
Area 3 Well A	7.2
Area 5 Well 5B Reservoir	12.7
Area 5 Well 5B	9.2
Area 5 Well Ue5c Reservoir	8.8
Area 5 Well Ue5c	5.6
Area 6 Well C1 Reservoir	6.8
Area 6 Well C1	10.4
Area 19 Well U19c Reservoir	<1.7
Area 19 Well U19c	<1.7

FIGURE 9

NTS ENVIRONMENTAL SURVEILLANCE
NATURAL SPRING SAMPLING STATIONS
(GROSS BETA YEARLY AVERAGES X 10^{-9} $\mu Ci/ml$)

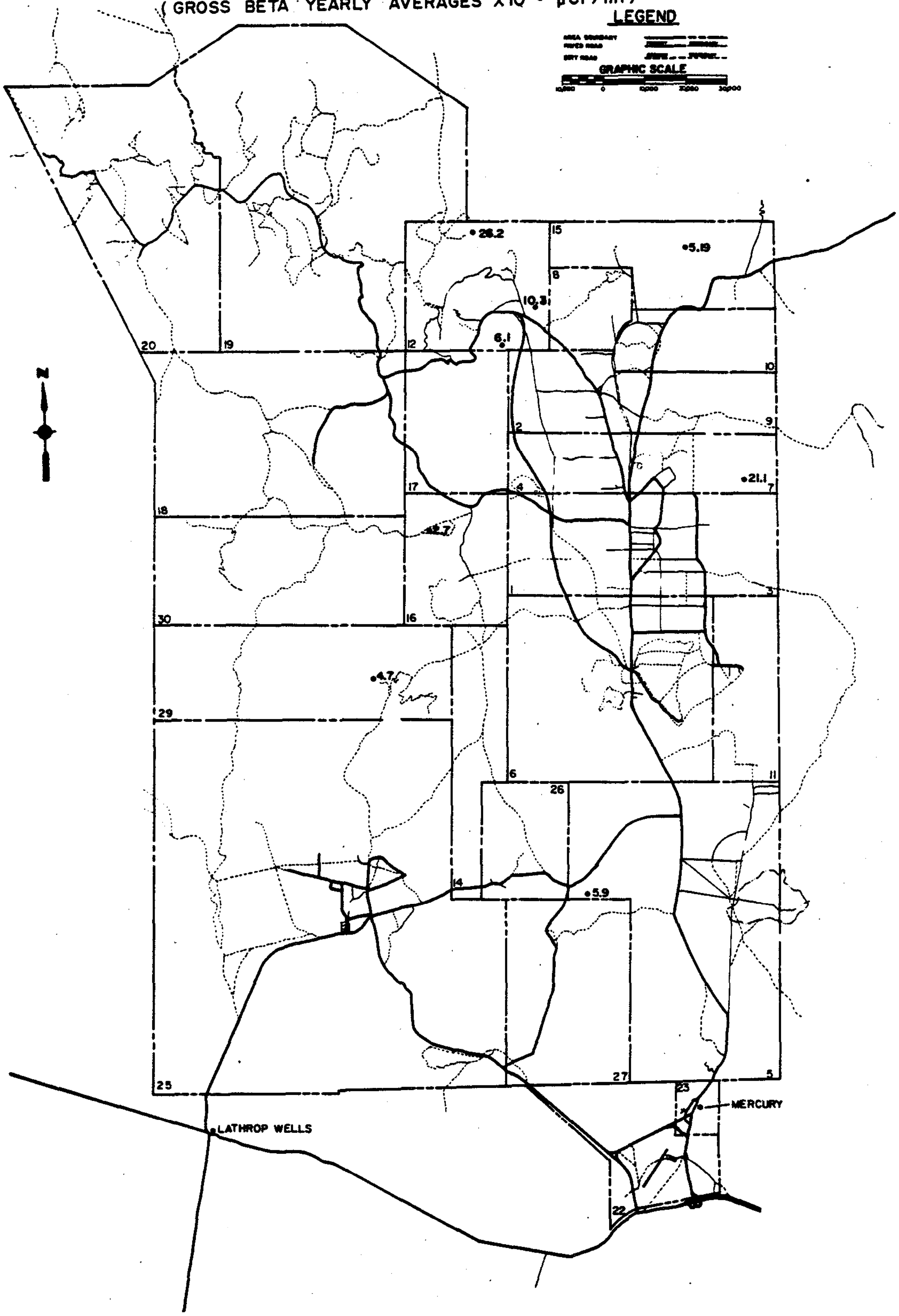


TABLE 16

PLUTONIUM VALUES ABOVE DETECTION LIMITS
FROM NONCONTAMINATED WATERS

WATER TYPE	STATION	DATE	µCi/ml
Natural Spring	Reitmann Seep	09/13/84	$1.5 \times 10^{-10} \pm 42\%$
Natural Spring	Tub Springs	12/12/84	$1.7 \times 10^{-10} \pm 29\%$
Natural Spring	Captain Jack	12/13/84	$2.9 \times 10^{-10} \pm 42\%$
Open Reservoir	Well A Reservoir	12/11/84	$1.8 \times 10^{-10} \pm 27\%$
Open Reservoir	Area 5 Reservoir	03/02/84 09/07/84	$2.7 \times 10^{-10} \pm 23\%$ $1.2 \times 10^{-10} \pm 40\%$
Supply Well	Well C-1	09/09/84	$1.7 \times 10^{-10} \pm 28\%$

Appendix F consists of the plots of all stations of the measured gross beta activity with 2σ error bars. An averaging plot is included which shows the trend of the network mean throughout the reporting period.

The range at each point is also given. Table 17 includes a list of the averages at each location. The highest average recorded was 26.2 X 10^{-9} µCi/ml at Gold Meadows Pond. This was 0.26 percent of the CG. The lowest beta concentration was 2.7 X 10^{-9} µCi/ml at Tippipah Spring. The network average, as compared to those presented in previous reports, was:

Year	Mean (X 10^{-9} µCi/ml)
CY-1984	10.3
CY-1983	7.6
CY-1982	9.0
CY-1981	10.5
CY-1980	16.7
CY-1979	22.1
CY-1978	23.7
July-December 1977	24.4
FY-1977	15.2
FY-1976	14.6

Appendix F includes plots of the network averages for tritium and plutonium. The highest value for tritium was 7.8 x 10^{-7} µCi/ml at Reitmann Seep. This represents 0.0008 percent of the concentration guide for tritium. The only positive plutonium value was 2.9 x 10^{-10} µCi/ml at Captain Jack Spring. This is 0.0002 percent of the concentration guide for plutonium. The positive results for tritium and plutonium are listed in Tables 9 and 16.

TABLE 17

AVERAGES OF NATURAL SPRINGS DATA FOR GROSS BETA

Station	Gross Beta Yearly Average ($\times 10^{-9}$ μCi/ml)
Area 5 Cane Spring	5.9
Area 7 Reitmann Seep	21.1
Area 12 White Rock Spring	10.3
Area 12 Captain Jack Spring	6.1
Area 12 Gold Meadows Pond	26.2
Area 15 Tub Spring	5.2
Area 16 Tippipah Spring	2.7
Area 29 Topopah Spring	4.7

6. Contaminated Ponds

Seven contaminated ponds were sampled on a special study basis. The gross beta concentration for each location is shown in Figure 10. These ponds were impound waters from tunnel test areas and a contaminated laundry release point. They are monitored in accordance with DOE Order 5484.1, Chapter IV, to provide a data base for calculations of any offsite releases. These calculations for tritium are reported to DOE Headquarters on an annual basis.

Table 18 is a list of the gross beta, tritium, and Pu-239 averages at the seven active stations. The first two pages of Appendix G contain the contaminated pond network averages and the remaining plots show the gross beta, Pu-239, and tritium concentrations at each station. The differences between CY-1983 and CY-1984 can be attributed to the decrease or increase in use of the ponds.

7. Effluent Ponds

Samples from seven effluent pond locations were collected during CY-1984. These ponds are closed systems which contain both sanitary and radioactive waste for evaporative treatment. Contact with the working population was minimal. The highest average gross beta value was 4.2×10^{-8} µCi/ml. Plutonium and tritium concentrations were less than detectable concentrations at all locations.

FIGURE 10

NTS ENVIRONMENTAL SURVEILLANCE
CONTAMINATED POND SAMPLING STATIONS
(GROSS BETA YEARLY AVERAGES X 10^{-6} µCi/ml)

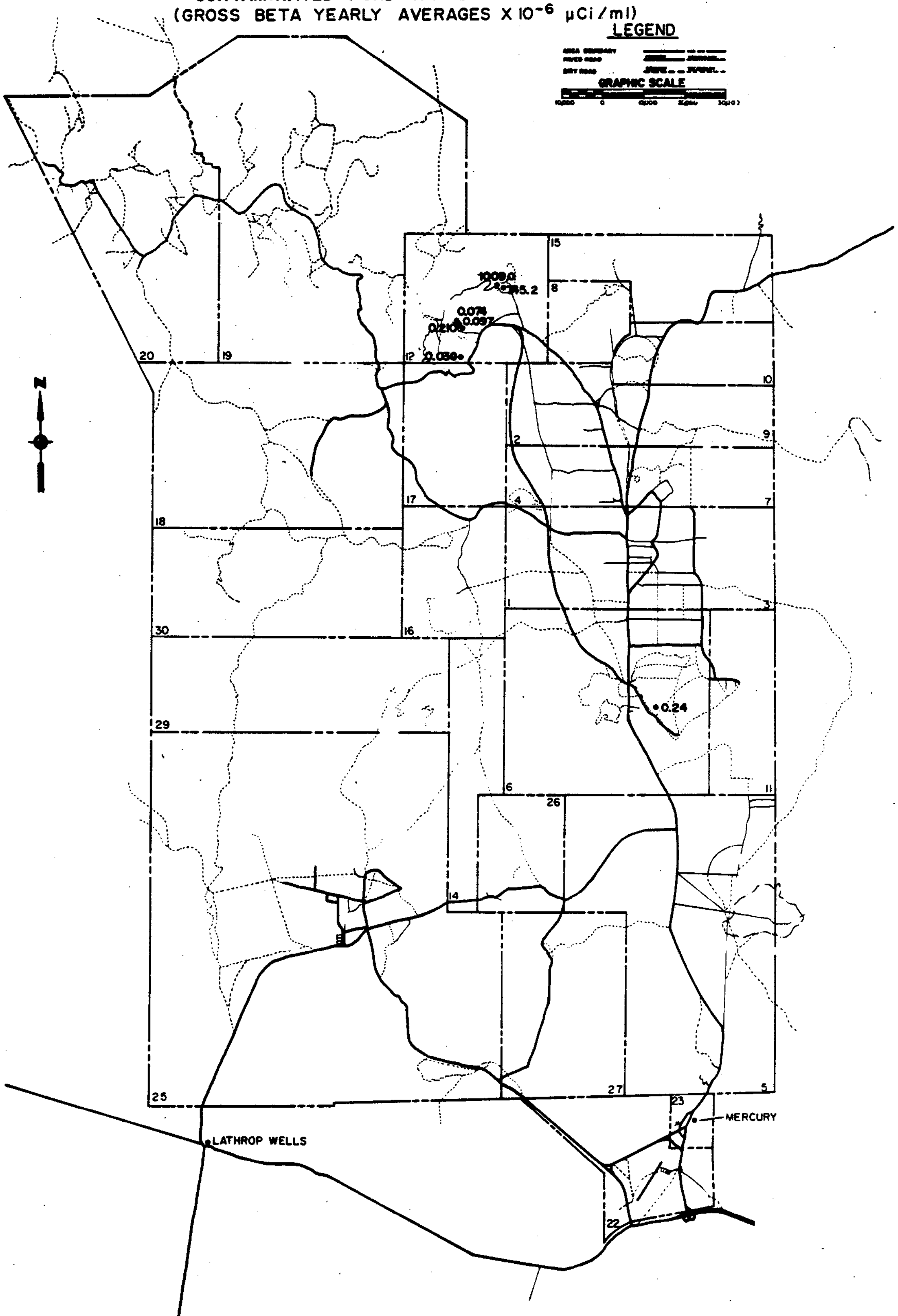


TABLE 18

CONTAMINATED POND YEARLY CONCENTRATION AVERAGES

(μCi/cc)

Station	Tritium Yearly Average	Gross Beta Yearly Average	^{239}Pu Yearly Average
Area 6 Yucca Waste Pond	8.4×10^{-6}	2.4×10^{-7}	$<2.9 \times 10^{-10}$
Area 12 N Upper	7.0×10^{-4}	7.1×10^{-8}	$<9.0 \times 10^{-11}$
Area 12 N Middle	6.7×10^{-4}	9.7×10^{-8}	$<8.3 \times 10^{-11}$
Area 12 N Lower	6.4×10^{-4}	2.1×10^{-7}	$<2.5 \times 10^{-10}$
Area 12 G Waste	3.6×10^{-4}	3.0×10^{-8}	$<8.5 \times 10^{-11}$
Area 12 Upper Mint Lake	2.1×10^{-2}	1.0×10^{-3}	$<5.6 \times 10^{-11}$
Area 12 Middle Mint Lake	1.7×10^{-2}	7.4×10^{-4}	$<7.2 \times 10^{-11}$

F. AMBIENT GAMMA MONITORING

A program to measure the ambient gamma exposure rates on the NTS was established in 1977 with 21 stations. In CY-1978, the program was expanded to 86 locations, 139 stations in CY-1979, 152 stations in CY-1980, and 163 stations since CY-1981. The TLD's are changed on a quarterly basis. Several TLD's were not collected for the fourth quarter in Areas 18, 19, and 20, due to impassable roads. Table 19 lists the maximum, minimum, and average dose rates, along with the adjusted annual dose for each monitoring station.

Table 20 lists the results for the nine locations that comprised the original control network. The CY-1984 results indicate reduced dose rates from previous years. This reduction is also seen in most of the external gamma dose rates listed in Table 19. As noted in Section C.3, the responsibility for the calibration and readout of environmental TLD's was shifted to another group within the Environmental Sciences Department. It is assumed that the reduction in dose rates experienced in CY-1984 is attributable to differences in the methodologies used by the respective groups, not a change in ambient conditions. Further tests are being run at this time to confirm this assumption.

The overall network range of the control stations was 0.14 mrem/d to 0.32 mrem/d, with an average natural background on NTS of approximately 0.28 mrem/d (100 mrem/y). The lower values measured in CY-1984 correspond favorably with rates measured at surrounding offsite Nevada locations by the Environmental Protection Agency in CY-1983 (Reference 24). The remaining 154 stations of the network yielded dose rates which ranged from 0.15 mrem/d to 6.30 mrem/d.

TABLE 19

GAMMA MONITORING RESULTS - SUMMARY OF 1984

STATION (AREA)	MEASUREMENT PERIOD	DOSE RATE (mrem/d) MAX.	MIN.	AVG.	1983 ADJUSTED ANNUAL DOSE (mrem/y)	1984 ADJUSTED ANNUAL DOSE (mrem/y)
A-90 Road (18)	01/05/84 - 10/25/84	0.32	0.29	0.31****	155	114
A-100 Road (18)	01/05/84 - 10/25/84	0.36	0.30	0.33****	155	119
A-108 Road (18)	01/05/84 - 10/25/84	0.48	0.32	0.37****	155	136
A-116 Road (20)	01/05/84 - 10/25/84	0.48	0.36	0.41****	180	148
A-130 Road (20)	01/05/84 - 10/25/84	0.36	0.33	0.34****	150	124
A-132 Road (20)	01/05/84 - 10/25/84	0.43	0.31	0.35****	165	128
A-136 Road (20)	01/05/84 - 10/25/84	0.41	0.32	0.35	165	128
Angle Road (3)	01/05/84 - 01/16/85	1.57	0.50	1.04***	535	379
Bldg. 190 (23)	01/04/84 - 01/16/85	0.24	0.14	0.19	80	68
Bldg. 610 Fence (23)	01/04/84 - 01/16/85	0.20	0.10	0.14	65	51
Bldg. 610 X-Ray Area (23)	01/04/84 - 01/16/85	3.99	1.71	2.24	3540	817
Bldg. 650 Dosimetry Room (23)	01/04/84 - 01/16/85	0.18	0.12	0.15	75	53
Bldg. 650 Roof (23)	01/04/84 - 01/16/85	0.18	0.10	0.14	65	50
Bldg. 650 Sample Storage (23)	01/04/84 - 01/16/85	3.81	0.95	2.14	740	781
B.J.Y. (1)	01/04/84 - 01/16/85	0.38	0.22	0.28	130	102
C-16 Road (19)	01/05/84 - 10/25/84	0.41	0.31	0.35****	145	128
C-25 Road (19)	01/05/84 - 10/25/84	0.43	0.32	0.37****	145	135
C-27 Road (19)	01/05/84 - 10/25/84	0.39	0.36	0.36****	160	131
C-31 Road (19)	01/05/84 - 10/25/84	0.42	0.33	0.37****	155	136
Cable Yard (2)	01/04/84 - 01/16/85	0.54	0.29	0.36	140	132
Cafeteria (27)	01/04/84 - 01/16/85	0.44	0.25	0.32	140	118
Campsite (20)	01/04/84 - 10/16/84	0.40	0.31	0.34	145	123
Circle & L Road (10)	01/04/84 - 10/16/84	0.48	0.28	0.34	140	123
Complex (3)	01/05/84 - 01/16/85	0.47	0.26	0.32	135	118
Complex (12)	01/04/84 - 01/17/85	0.49	0.26	0.34	140	122
CP Complex (6)	01/04/84 - 01/16/85	0.22	0.14	0.18	90	64
CP-50 Calibration Bench (6)	01/04/84 - 01/16/85	0.59	0.33	0.47	150	172
CP-50 Instrument Calib. Door (6)	01/04/84 - 01/16/85	0.88	0.37	0.53	205	193
CA-14 (10)	01/04/84 - 01/16/85	0.47	0.27	0.36	170	130
Decon Pad Front Office (6)	01/04/84 - 01/16/85	0.51	0.18	0.31	100	114
Decon Pad Back Office (6)	01/04/84 - 01/16/85	0.38	0.21	0.28	230	101
Desert Rock Weather Stn. (22)	01/04/84 - 01/16/85	0.21	0.12	0.16	70	58
E-MAD East (25)	01/04/84 - 01/16/85	0.42	0.22	0.31	125	113
E-MAD North (25)	01/04/84 - 01/16/85	0.80	0.46	0.63	265	231
E-MAD Tile Bed (25)	01/04/84 - 01/16/85	0.42	0.20	0.30	120	108
E-MAD West (25)	01/04/84 - 01/16/85	0.38	0.22	0.29	130	106
EPA Farm (15)	01/04/84 - 01/16/85	0.37	0.24	0.28	115	101
F-2 Road (20)	01/04/84 - 10/25/84	0.45	0.33	0.37****	170	134

*No sample collected 1st quarter
**No sample collected 2nd quarter
***No sample collected 3rd quarter
****No sample collected 4th quarter

Table 19 (Continued)

STATION (AREA)	MEASUREMENT PERIOD	DOSE RATE (mrem/d) MAX.	MIN.	AVG.	1983 ADJUSTED ANNUAL DOSE (mrem/y)	1984 ADJUSTED ANNUAL DOSE (mrem/y)
-8 Road (20)	01/04/84 - 10/25/84	0.42	0.33	0.38****	190	137
-12 Road (20)	01/04/84 - 10/25/84	0.45	0.31	0.36****	170	132
ate 100 (23)	01/04/84 - 01/16/85	0.23	0.11	0.16****	65	58
ate 700 (15)	01/04/84 - 01/16/85	0.33	0.24	0.26	115	96
ravel Pit (1)	01/04/84 - 10/26/84	0.34	0.22	0.28****	120	101
room Pass L43.5 (15)	01/04/84 - 10/26/84	0.38	0.26	0.29	130	108
enre Site (25)	01/04/84 - 01/16/85	0.37	0.23	0.30	130	110
-6 Road (20)	01/04/84 - 10/25/84	0.44	0.36	0.39****	180	142
-16 Road (20)	01/04/84 - 10/25/84	0.41	0.32	0.35****	170	128
-24 Road (20)	01/04/84 - 10/25/84	0.42	0.32	0.36****	170	130
-31 Road (20)	01/04/84 - 10/25/84	1.41	1.10	1.23****	655	449
-40 (15)	01/04/84 - 01/16/85	0.55	0.28	0.38	155	140
-49 (15)	01/04/84 - 01/16/85	0.40	0.22	0.28	115	102
amp Shack (15)	01/05/84 - 01/16/85	0.49	0.27	0.33	140	120
LL Trailer (15)	01/05/84 - 01/16/85	0.54	0.28	0.36	145	130
ogistics Desk (6)	01/04/84 - 01/16/85	0.29	0.16	0.20**	75	74
ower Mint Lake (12)	01/04/84 - 01/17/85	1.66	0.87	1.25	470	456
RDS Warehouse (25)	01/04/84 - 01/16/85	0.41	0.23	0.32	130	116
ffice (15)	01/04/84 - 01/16/85	0.35	0.21	0.25	105	91
ost Office (23)	01/04/84 - 01/16/85	0.18	0.10	0.14	65	50
-3 Road (19)	01/05/84 - 10/25/84	0.52	0.38	0.43****	170	158
-9 Road (19)	01/05/84 - 10/25/84	0.45	0.37	0.41****	165	150
-20 Road (19)	01/05/84 - 10/25/84	0.44	0.33	0.37****	155	135
-27 Road (19)	01/05/84 - 10/25/84	0.41	0.34	0.39****	155	142
-31 Road (19)	01/05/84 - 10/25/84	0.41	0.32	0.35****	150	129
amatrol (23)	01/04/84 - 01/16/85	0.44	0.22	0.34	150	123
WMS East 500' (5)	01/04/84 - 01/16/85	0.29	0.24	0.27	130	98
WMS East 1000' (5)	01/04/84 - 01/16/85	0.49	0.24	0.33	150	120
WMS East 1500' (5)	01/04/84 - 01/16/85	0.56	0.23	0.34	130	122
WMS East Gate (5)	01/04/84 - 01/16/85	0.36	0.27	0.31	185	114
WMS North 500' (5)	01/04/84 - 01/16/85	0.32	0.26	0.30	135	110
WMS North 1000' (5)	07/15/83 - 01/16/85	0.37	0.25	0.30	140	110
WMS North 1500' (5)	01/04/84 - 01/16/85	0.30	0.23	0.27	125	99
WMS Northeast Corner (5)	01/04/84 - 01/16/85	0.30	0.24	0.27	135	99
WMS Northwest Corner (5)	01/04/84 - 01/16/85	0.36	0.26	0.31	135	112
WMS Offices (5)	01/04/84 - 01/16/85	0.48	0.22	0.31	135	112
WMS South Gate (5)	01/04/84 - 01/16/85	0.42	0.19	0.27	105	99
WMS South 500' (5)	01/04/84 - 01/16/85	0.37	0.24	0.32	130	115
WMS Southwest Corner (5)	01/04/84 - 01/16/85	0.36	0.22	0.28	125	100
WMS West 500' (5)	01/04/84 - 01/16/85	0.44	0.25	0.32	155	115
WMS West 1000' (5)	01/04/84 - 01/16/85	0.48	0.25	0.34	140	123
WMS West 1500' (5)	01/04/84 - 01/16/85	0.41	0.25	0.32	130	115
ecurity Gate 293 (11)	01/04/84 - 01/16/85	0.38	0.26	0.31	140	112
edan Crater Visitor's Box (10)	01/04/84 - 01/16/85	0.62	0.35	0.43	185	156
edan Crater West Area (10)	01/04/84 - 01/16/85	2.67	1.52	1.82	835	665

*No sample collected 1st quarter
**No sample collected 2nd quarter
***No sample collected 3rd quarter
****No sample collected 4th quarter

Table 19 (Continued)

STATION (AREA)	MEASUREMENT PERIOD	DOSE RATE (mrem/d) MAX.	MIN.	AVG.	1983 ADJUSTED ANNUAL DOSE (mrem/y)	1984 ADJUSTED ANNUAL DOSE (mrem/y)
Storage Shed (15)	01/05/84 - 01/16/85	0.43	0.25	0.30	125	110
Substation Bus (15)	01/05/84 - 01/16/85	0.40	0.21	0.26	105	95
TH-1 (6)	01/04/84 - 01/17/85	0.25	0.14	0.18	75	67
TH-9 (6)	01/04/84 - 01/17/85	0.34	0.20	0.26	110	94
TH-18 (1)	01/04/84 - 01/17/85	0.30	0.17	0.22	100	80
TH-27 (1)	01/04/84 - 01/17/85	0.37	0.21	0.26	110	94
TH-37 (1)	01/04/84 - 01/17/85	0.38	0.26	0.30	130	109
TH-47 (4)	01/04/84 - 01/17/85	0.45	0.29	0.35	150	126
TH-57 (2)	01/04/84 - 01/17/85	0.30	0.20	0.24	105	87
TH-67.5 (12)	01/04/84 - 01/17/85	0.34	0.23	0.25	105	91
Upper Haines Lake No. 1 (12)	04/17/84 - 01/17/85	0.29	0.27	0.28	130	102
Upper N Tunnel Pond (12)	01/04/84 - 01/17/85	0.43	0.30	0.34	145	125
U3ax Northeast (3)	04/18/84 - 01/16/85	0.69	0.66	0.68*	370	248
U3ax Northwest (3)	01/05/84 - 01/16/85	0.86	0.45	0.55	440	199
U3ax South (3)	04/18/84 - 01/16/85	0.38	0.34	0.36*	185	131
U3ax Southeast (3)	01/05/84 - 01/16/85	0.76	0.39	0.50	215	182
U3by North (3)	01/04/84 - 01/16/85	1.04	0.69	0.79	365	287
U3by South (3)	01/04/84 - 01/16/85	0.49	0.35	0.39	180	142
U3bz North (3)	01/04/84 - 01/16/85	0.72	0.48	0.54	250	198
U3bz South (3)	04/18/84 - 01/16/85	0.32	0.30	0.31*	165	113
U3cj North (3)	04/18/84 - 01/16/85	0.52	0.39	0.35	170	129
U3co North (3)	04/18/84 - 01/16/85	4.84	2.87	3.42	1560	1248
U3co South (3)	04/18/84 - 01/16/85	1.78	1.30	1.65	1000	602
U3du North (3)	04/18/84 - 01/16/85	0.60	0.36	0.42	185	154
U3du South (3)	04/18/84 - 01/16/85	0.61	0.41	0.47	235	172
U3ey South (3)	04/18/84 - 01/16/85	0.43	0.29	0.34	160	122
Well 3 (6)	01/05/84 - 10/26/85	0.34	0.22	0.27****	115	97
Well 5B (5)	01/04/84 - 01/16/85	0.34	0.20	0.27	120	98
Well 19C Reservoir (19)	01/06/84 - 01/17/85	0.44	0.32	0.36	150	132
Yucca Complex (6)	01/06/84 - 01/17/85	0.30	0.20	0.23	105	85
2-04 Road (2)	01/05/84 - 01/16/85	6.36	4.80	5.12	2355	1868
2-07 Road (2)	01/05/84 - 01/16/85	1.06	0.62	0.75	405	273
3-03, O.B. Roads (3)	01/05/84 - 01/16/85	0.30	0.18	0.22	110	79
4-04 Road (4)	01/05/84 - 01/16/85	8.34	5.14	6.30	2975	2300
6-09, O.B. Roads (6)	01/05/84 - 01/16/85	0.42	0.25	0.30	125	110
7-300 Bunker (7)	01/05/84 - 01/16/85	1.08	0.67	0.90	360	327
8K 25 (8)	01/05/84 - 01/16/85	0.37	0.22	0.26	95	125
9-300 Bunker (9)	04/17/84 - 01/16/85	0.27	0.28	0.28*	135	102
10 A-24 (10)	04/17/84 - 01/16/85	1.03	0.56	0.59	310	253
18-1C Gate (18)	01/05/84 - 10/26/84	0.52	0.28	0.36****	150	133
18P 35 (18)	01/05/84 - 10/26/84	0.45	0.27	0.35	145	128
18P 39 (18)	01/05/84 - 10/26/84	0.34	0.30	0.32	145	116
19P 41 (19)	01/05/84 - 01/17/85	0.32	0.36	0.34	170	124
19P 46 (19)	01/05/84 - 01/17/85	0.33	0.29	0.31	145	113
19P 54 (19)	01/05/84 - 01/17/85	0.34	0.28	0.30	140	110

*No sample collected 1st quarter
**No sample collected 2nd quarter
***No sample collected 3rd quarter
****No sample collected 4th quarter

Table 19 (Continued)

STATION (AREA)	MEASUREMENT PERIOD	DOSE RATE (mrem/d) MAX.	MIN.	AVG.	1983 ADJUSTED ANNUAL DOSE (mrem/y)	1984 ADJUSTED ANNUAL DOSE (mrem/y)
9P 59 (19)	01/05/84 - 01/17/85	0.37	0.29	0.33	165	121
9P 66 (19)	01/05/84 - 01/17/85	0.35	0.31	0.33	165	121
9P 71 (19)	01/05/84 - 10/25/84	0.33	0.34	0.34****	155	124
9P 77 (19)	01/05/84 - 10/25/84	0.42	0.35	0.38	170	138
9P 87 (19)	01/05/84 - 10/25/84	0.46	0.40	0.42	170	156
9P 88 (19)	01/05/84 - 10/25/84	0.39	0.39	0.39	180	142
9P 91 (19)	01/05/84 - 10/25/84	0.37	0.34	0.36	165	130
0-4C Gate (20)	01/05/84 - 10/25/84	0.52	0.32	0.38****	165	139
5-4P Gate (25)	01/04/84 - 01/16/85	0.47	0.24	0.34	130	125
5-7P Gate (25)	01/04/84 - 01/16/85	0.46	0.23	0.33	175	121
0-1C Gate (30)	01/05/84 - 10/26/84	0.59	0.39	0.47****	185	173
30 M (4)	01/04/84 - 01/17/85	0.41	0.23	0.29	135	106
40 M (2)	01/04/84 - 01/17/85	0.47	0.28	0.33	140	121
50 M (2)	01/04/84 - 01/17/85	0.37	0.29	0.32	140	116
68 M (12)	01/04/84 - 01/17/85	0.43	0.26	0.32	140	117
70 M (12)	01/04/84 - 01/17/85	0.36	0.22	0.29***	115	107
75 M (12)	01/04/84 - 01/17/85	0.41	0.27	0.32	150	117
85 Holmes Road (17)	01/04/84 - 01/17/85	0.48	0.28	0.34	135	123
90 M (19)	01/04/84 - 01/17/85	0.39	0.32	0.35	155	129
96 M (19)	01/04/84 - 01/17/85	0.43	0.30	0.34	160	123

*No sample collected 1st quarter
**No sample collected 2nd quarter
***No sample collected 3rd quarter
****No sample collected 4th quarter

Table 19 (Continued)

STATION (AREA)	MEASUREMENT PERIOD	ELEVATION (FT)	DOSE RATE (mrem/d) MAX.	MIN.	AVG.	1983 ADJUSTED ANNUAL DOSE (mrem/y)	1984 ADJUSTED ANNUAL DOSE (mrem/y)
N670,600 E667,300 (22)	01/06/84 - 02/04/85	4000	0.22	0.14	0.16	60	60
N731,300 E638,700 (28)	01/06/84 - 02/04/85	5750	0.37	0.22	0.26	105	97
N754,000 E557,800 (31)	01/06/84 - 02/04/85	4800	0.42	0.13	0.30***	150	128
N849,500 E545,000 (30)	01/06/84 - 02/04/85	7100	0.46	0.28	0.38	155	139
N887,000 E558,000 (20)	01/06/84 - 02/04/85	6100	0.51	0.37	0.43	185	157
N948,800 E527,800 (20)	01/06/84 - 02/04/85	5650	0.46	0.32	0.39	185	144
N944,700 E563,300 (19)	01/06/84 - 02/04/85	6300	0.28	0.19	0.23	100	85
N955,500 E614,200 (19)	01/06/84 - 02/04/85	7200	0.42	0.34	0.37	155	136
N935,500 E639,750 (19)	01/06/84 - 02/04/85	6550	0.43	0.30	0.37	155	135
N903,800 E635,500 (12)	01/06/84 - 02/04/85	6900	0.35	0.20	0.28	115	100
N907,600 E686,200 (8)	01/06/84 - 02/04/85	5826	0.43	0.35	0.39	155	141
N874,600 E691,500 (10)	01/06/84 - 02/04/85	5000	0.24	0.17	0.20	80	71
N844,200 E704,900 (3)	01/06/84 - 02/04/85	5100	0.21	0.15	0.18	75	64
N788,800 E709,500 (11)	01/06/84 - 02/04/85	5200	0.43	0.31	0.36	140	131
N710,800 E720,000 (11)	01/06/84 - 02/04/85	4280	0.19	0.13	0.15	65	54

*No sample collected 1st quarter
**No sample collected 2nd quarter
***No sample collected 3rd quarter
****No sample collected 4th quarter

TABLE 20

TLD CONTROL STATION COMPARISON

Station	Dose Rate (mrem/d) 1978	1979	1980	1981	1982	1983	1984
Bldg. 650 Dosimetry Room	0.16	0.17	0.18	0.21	0.19	0.21	0.15
Bldg. 650 Roof	0.15	0.15	0.16	0.18	0.18	0.18	0.14
Area 27 Cafeteria	0.37	0.35	0.37	0.41	0.37	0.39	0.32
CP Complex	0.22	0.21	0.23	0.25	0.20	0.25	0.18
Henre Site	0.34	0.33	0.35	0.39	0.37	0.36	0.30
NRDS Warehouse	0.35	0.33	0.35	0.40	0.38	0.36	0.32
Post Office	0.15	0.15	0.16	0.20	0.18	0.18	0.14
Well 5B	0.32	0.31	0.34	0.38	0.33	0.33	0.27
Yucca Complex	0.31	0.30	0.30	0.32	0.29	0.29	0.23
Network Average	0.26	0.26	0.27	0.30	0.28	0.28	0.23

G. RADIOACTIVE WASTE MANAGEMENT SITE (RWMS)

The Radioactive Waste Management Site is located in Area 5 of the Nevada Test Site (Figure 11). RWMS consists of approximately 37.2 hectares (92 acres) of land which is devoted to surface storage and disposal of defense low-level radioactive wastes. Waste facilities at the site include trenches, pits, and asphalt pads. The type of waste disposed of at RWMS includes tritium contaminated waste, low-level waste, and equipment that is activated or contaminated. The stored waste consists of transuranic (TRU) contaminated waste only. For a more detailed description of RWMS see Reference 12.

Surveillance of the RWMS is accomplished by using eighteen air samplers, nine for tritium and nine for fission products and plutonium, and sixteen TLD's, for gamma monitoring, placed around the RWMS. Figures 12-14 show the locations of the stations and their yearly averages.

The tritium in air samplers are placed around the perimeter of RWMS. Results for the RWMS surveillance are summarized in Table 6. The highest average for HTO was 3.7×10^{-11} μCi/cc at RWMS-1 Station, which is 0.0008 percent of the concentration guide.

Gross beta and Pu-239 in air results for the site are summarized in Tables 4 and 5. The average gross beta concentration was 1.8×10^{-14} μCi/cc which was the same as the network average of 1.8 10^{-14} μCi/cc. This concentration represents 0.002 percent of the concentration guide. Results from the nine gross beta stations were grouped closely together and all were within two standard deviations from the average.

FIGURE 11

NEVADA TEST SITE
LOCATION OF THE RADIOACTIVE WASTE
MANAGEMENT SITE (RWMS)

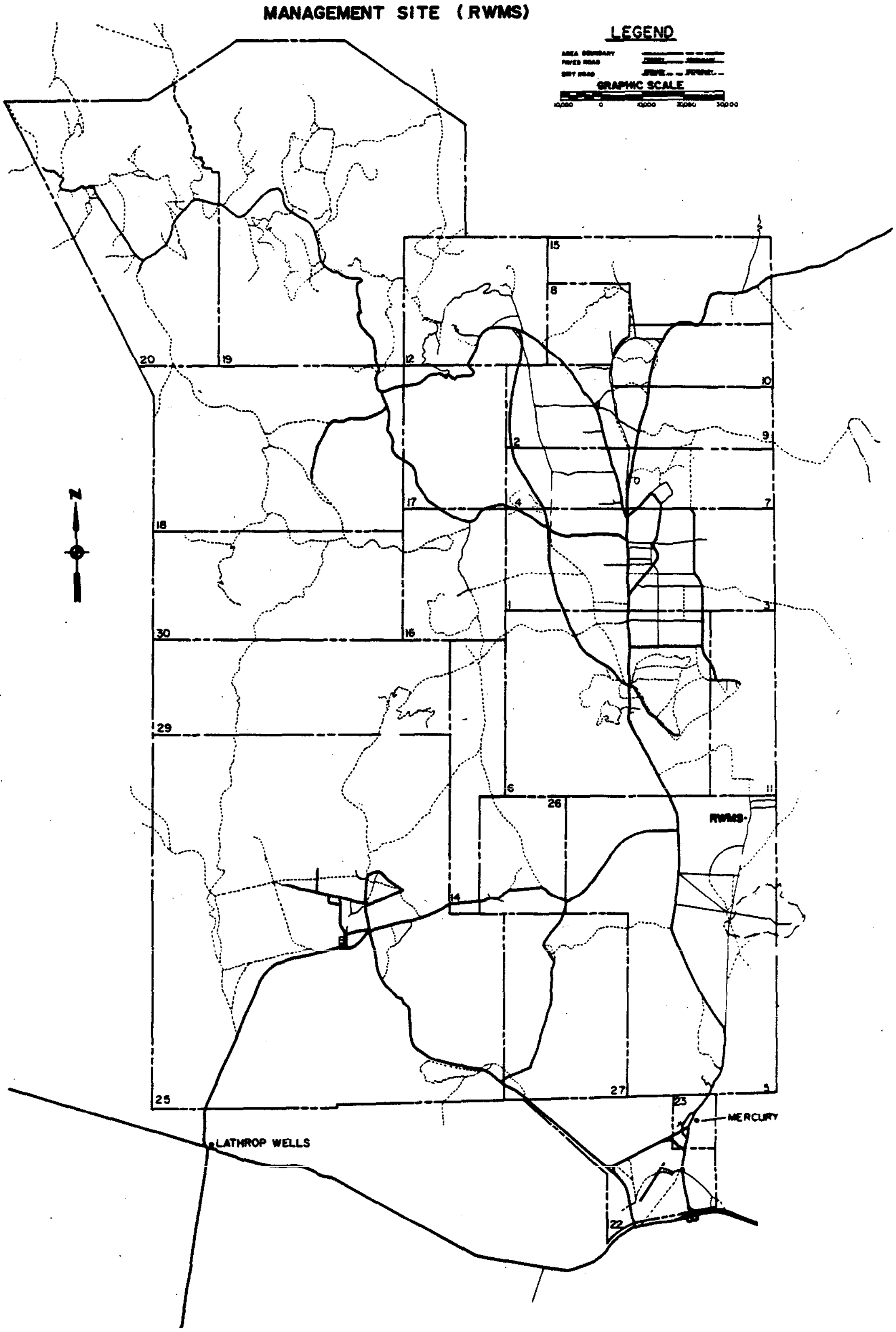


FIGURE 12

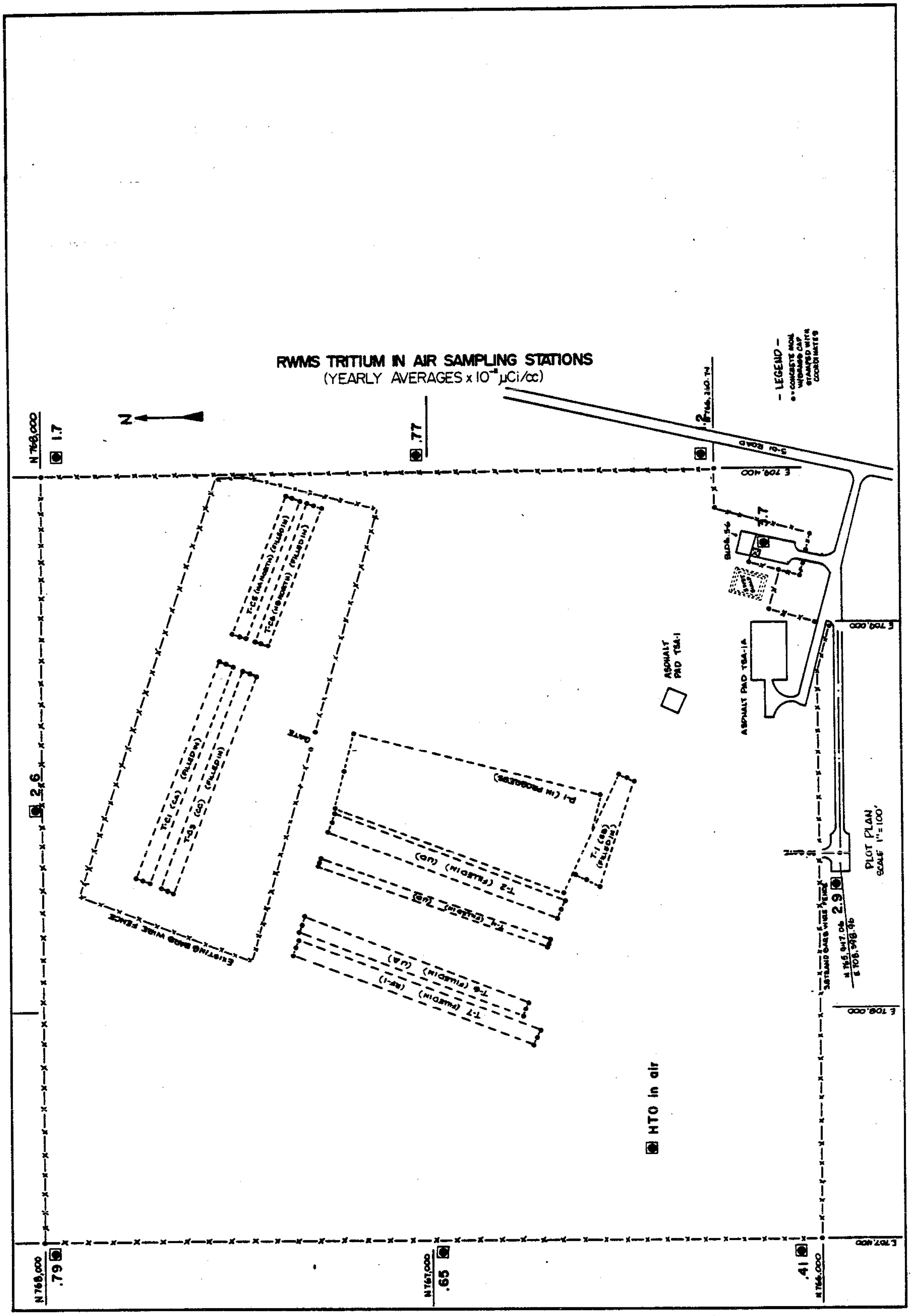

RWMS TRITIUM IN AIR SAMPLING STATIONS
N
1.7
.77
2.6
2.9
.79
.65
.41
HTO in air
ASPHALT PAD TSA-1
ASPHALT PAD TSA-1A
PLOT PLAN
- LEGEND -

FIGURE 13

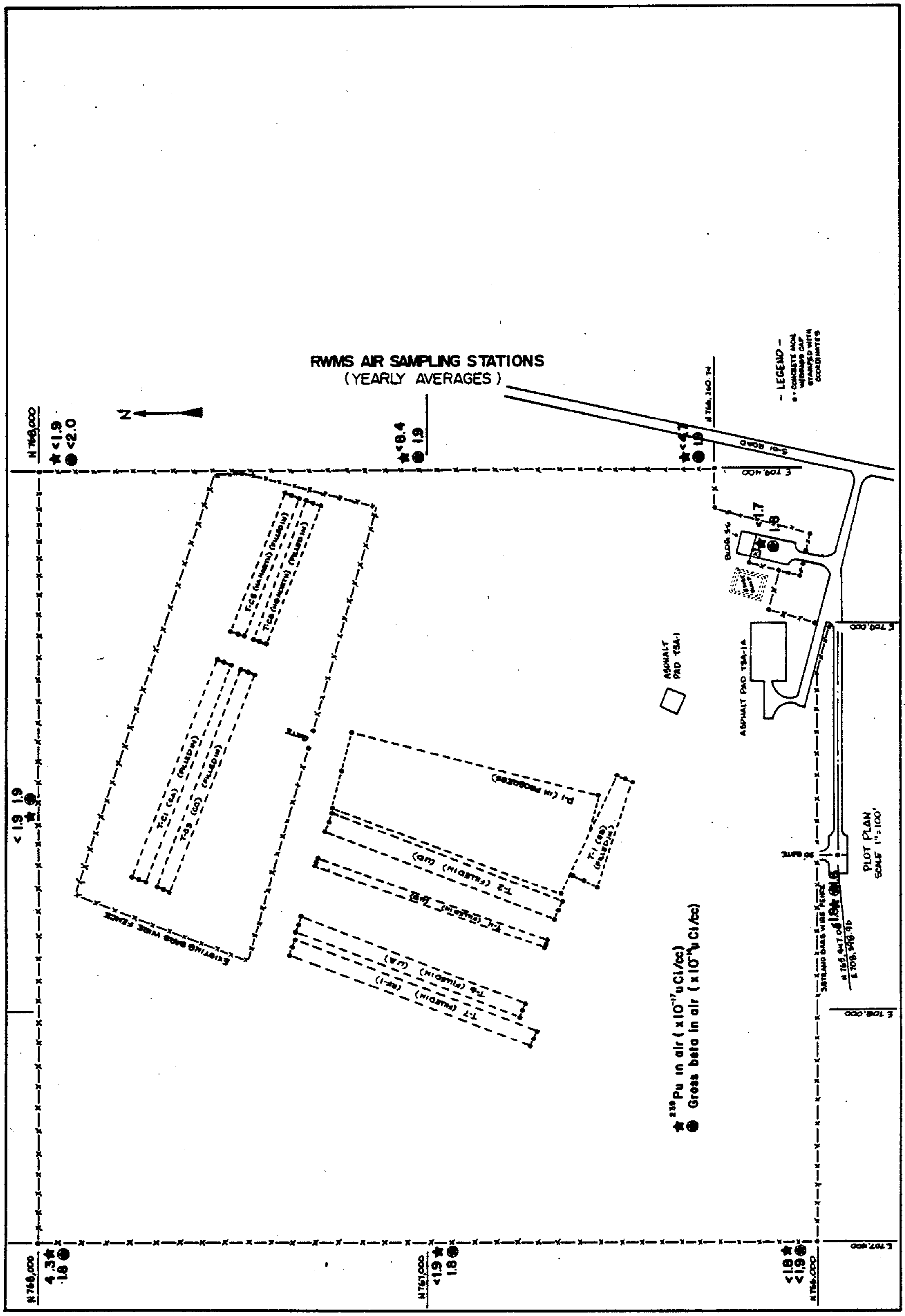
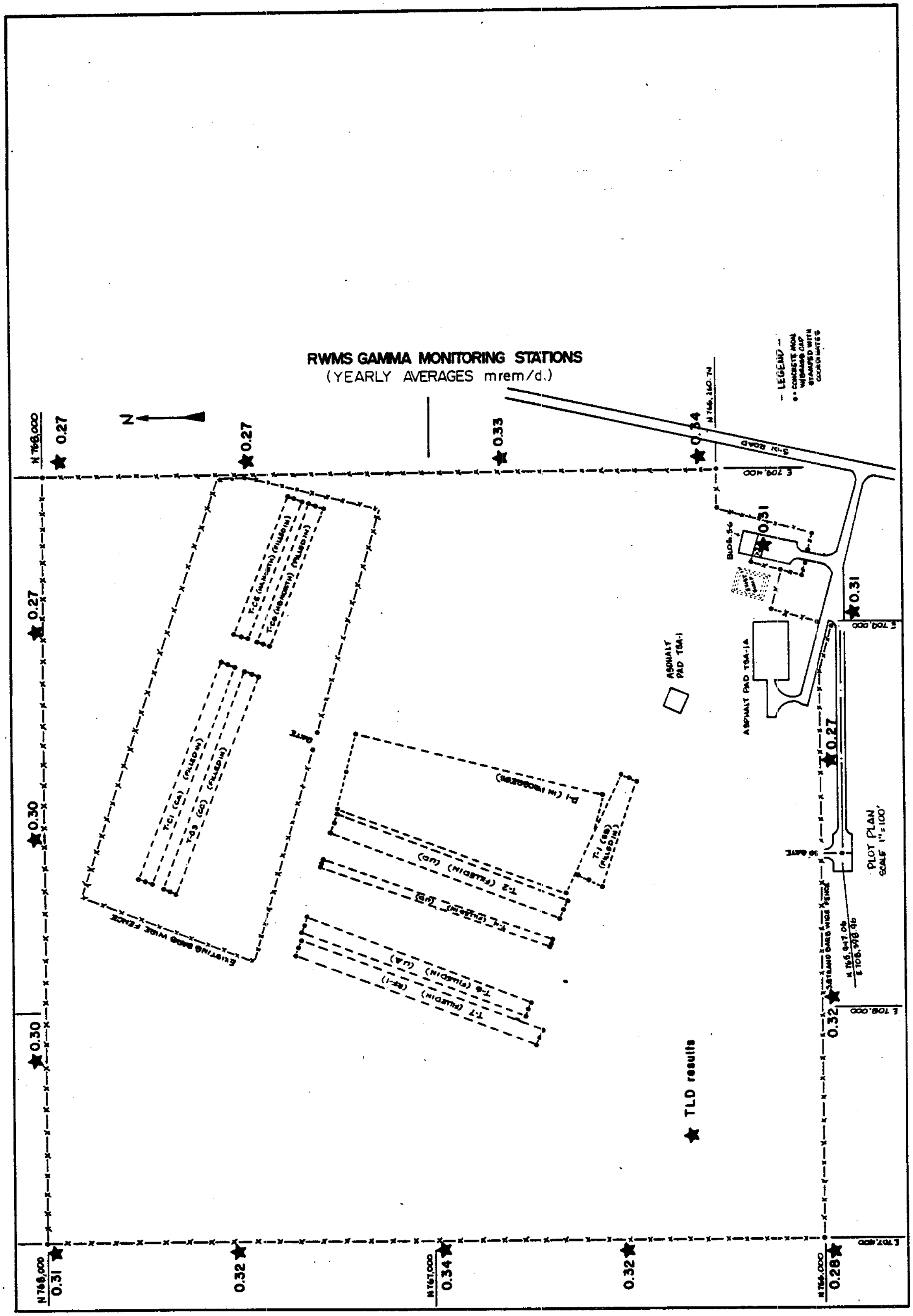


FIGURE 14



RWMS GAMMA MONITORING STATIONS
(YEARLY AVERAGES mrem/d.)
N
0.27
0.27
0.33
0.34
0.31
0.31
0.27
0.30
0.30
0.27
0.32
0.31
0.32
0.34
0.32
0.28
TLD results
PLOT PLAN
ASPHALT PAD TSA-1
ASPHALT PAD TSA-1A
- LEGEND -
N 768,000
N 767,000
N 766,000
E 707,400
E 708,000
E 709,000
E 709,400

The average concentration of Pu-239 in air at RWMS was 8.4 x 10^{-17} μCi/cc. This is 0.004 percent of the concentration guide for Pu-239.

Table 19 gives a summary of the gamma monitoring results for 1984. The average annual dose was 110 mrem/y or 13 μrem/h. This compared favorably with the natural background of Area 5 of 11-20 μR/h. (Reference 13). Another station, two miles south (Well 5B), had an annual dose rate of 98 mrem/y or 11 μrem/h.

In conclusion the results from this surveillance network around the RWMS indicate that there were no detectable releases of radioactive materials as a result of operations during 1984.

H. PERIMETER DOSE ASSESSMENT

The maximum postulated dose from the NTS operations was calculated for an individual residing at the site boundary during the entire CY-1984. This was done by calculating the fifty year cumulative dose, except for the dose from air immersion, for the individual receiving a one year intake from measured radionuclide concentrations onsite. The dose from air immersion was calculated for a one year exposure to a semi-infinite cloud. In the calculation the air immersion dose was treated like an external exposure and, therefore, once the radioactive source was considered removed, for the purposes of this calculation the end of CY-1984, there was no further exposure. The dose conversion factors used for calculating the cumulative dose came from References 14 and 20, and are tabulated in Table 21. Basically, these reports used models and parameters equivalent to those used in ICRP Publication 2 (Reference 16). The radionuclides considered for the dose calculations were tritium, Xe-133, Pu-239, and Sr-90 (assuming the gross beta concentration in air consists entirely of Sr-90). The critical organs considered for these radionuclides were the total body, bone, lung, and skin for Xe-133.

1. Dose From Ingestion of Radionuclides

The dose from the ingestion pathways was calculated for an individual living at the NTS boundary during CY-1984. The only pathway considered was the ingestion of water. Ingestion of foodstuffs was not considered because of the lack of locally grown food adjacent to the site boundary. The water was assumed to be similar to the potable water sampled onsite. The radionuclides

TABLE 21

DOSE CONVERSION FACTORS*

Organ	Inhalation (mrem/50 y per pCi inhaled) ^{3}H***	^{239}Pu****	^{90}Sr**	Ingestion (mrem/50 y per pCi ingested) ^{239}Pu****	^{3}H***	Air Immersion (mrem/y per $\mu Ci/m^3$) ^{133}Xe	^{85}Kr
Total Body	$9.35X10^{-8}$	$1.55X10^{-1}$	$7.62X-10^{-4}$	$3.82X-10^{-5}$	$6.18X-10^{-8}$	$2.19X10^{2}$	$1.9X10^{1}$
Bone	0.0	$6.38X10^{0}$	$1.24X-10^{-2}$	$1.57X-10^{-3}$	0.0	$2.19X10^{2}$	$1.9X10^{1}$
Lung	$9.35X10^{-8}$	$3.44X10^{-1}$	$1.20X-10^{-3}$	0.0	$6.18X-10^{-8}$	$2.37X10^{2}$	$3.6X10^{1}$
Skin	---	---	---	---	---	$6.04X10^{2}$	$1.4X10^{3}$

* Taken from References 14 and 20.

** Gross beta activity was assumed to be ^{90}Sr.

*** The dose conversion factor was divided by 1.7 to take into account the change in Quality Factor for weak beta emitters (DOE Order 5840.1, Chapter XI).

**** The dose conversion factor was multiplied by two to take into account the change in Quality Factor for alpha emitters (DOE Order 5840.1, Chapter XI).

considered for the calculation were Pu-239 and tritium. The gross beta concentration was not used in the calculation because it was shown earlier (Reference 23) that the gross beta concentration was primarily due to the naturally occurring K-40 content. The Cascade bottled water brought onsite was assumed to have natural background levels of Pu-239 and H-3. These background concentrations were subtracted from the potable water stations having the maximum average Pu-239 and tritium concentrations to obtain the net concentrations used in the dose calculations. These values are listed in Table 22. The assumed fluid intake for the individual was 1.6 liters per day and was derived from ICRP Publications 23 (Reference 15). The resulting ingestion doses to the total body, lung, and bone for Pu-239 and tritium are given in Table 23.

2. Dose from Inhalation of Radionuclides

The doses from the inhalation of tritium, gross beta activity, and Pu-239 were calculated for the individual living at the NTS boundary. The maximum average tritium in air and Pu-239 in air concentrations were used for the dose calculations after background concentrations were subtracted.

The highest average gross beta concentration onsite was used in the dose calculation after the average background concentration was subtracted. All of the gross beta activity was assumed to be Sr-90. The concentrations used for calculating the inhalation dose are listed in Table 22. The individual was assumed to breathe 8,400

TABLE 22

RADIONUCLIDE CONCENTRATIONS USED FOR DOSE ASSESSMENT

	Air (μCi/cc)					Potable Water (μCi/ml)	
	^{3}H	Gross ^{239}Pu	Beta	^{133}Xe	^{85}Kr	^{239}Pu	^{3}H
Onsite Concentration	$7.4X\text{-}10^{-11}$	$1.1X10^{-16}$	$2.0X10^{-14}$	$1.8X10^{-11}$	$3.1X10^{-11}$	$<1.2X10^{-10}$	$<7.6X10^{-7}$
Background Concentration	$4.0X10^{-12}$	$5.6X10^{-17}$	$1.8X10^{-14}$	0.0	$2.7X10^{-11}$	$<4.6X10^{-11}$	$<7.1X10^{-7}$
Net Concentration	$7.0X10^{-11}$	$5.4X10^{-17}$	$1.0X10^{-14}$	$1.8X10^{-11}$	$4.0X10^{-12}$	$<7.4X10^{-11}$	$<5.0X10^{-8}$

TABLE 23

50 YEAR CUMMULATIVE DOSES*

Organ	Inhalation (mrem)			Ingestion (mrem)		Air Immersion (mrem)		Total (mrem)
	^{3}H	^{239}Pu	^{90}Sr**	^{239}Pu	^{3}H	^{133}Xe	^{85}Kr	
Total Body	5.5×10^{-2}	7.0×10^{-2}	6.4×10^{-2}	$<1.6 \times 10^{-3}$	$<1.8 \times 10^{-3}$	3.9×10^{-3}	8.0×10^{-5}	$<2.0 \times 10^{-1}$
Bone	0.0	2.9×10^{0}	1.0×10^{0}	$<6.8 \times 10^{-2}$	0.0	3.9×10^{-3}	8.0×10^{-5}	$<3.9 \times 10^{0}$
Lung	5.5×10^{-2}	1.6×10^{-1}	1.0×10^{-1}	0.0	$<1.8 \times 10^{-3}$	4.2×10^{-3}	1.4×10^{-4}	$<3.2 \times 10^{-1}$
Skin	---	---	---	---	---	1.1×10^{-2}	5.6×10^{-3}	1.6×10^{-2}

* 50 year cummulative dose from inhalation and ingestion of radionuclides for one year. The air immersion dose rate was calculated for a one year exposure with no resulting exposure after CY-1984 ended.

** Assumed all of the gross beta activity was ^{90}Sr.

cubic meters of air in one year (Reference 15). The calculated fifty year cumulative doses to the whole body, lungs, and bone are given in Table 23.

3. Dose from Air Immersion

The air immersion dose from Xe-133 was calculated for an individual at the NTS boundary. The average Kr-85 concentration at the Area 20 dispensary was above the network average and was used in air immersion dose calculations, after subtraction of background. The highest average Xe-133 concentration was used to calculate the air immersion dose. These values are given in Table 22. The calculated doses to the whole body, lungs, bone, and skin are listed in Table 23.

4. Estimated Risk to Individual

The maximum estimated dose to the total body, bone, and lung from NTS operations during CY-1984 was 0.20 mrem, 3.9 mrem, and 0.32 mrem, respectively. Table 24 lists the estimated dose to an individual living at the NTS boundary for one year from natural background radiation. The calculated doses to the individual represent increases of 0.17 percent (total body), 2.55 percent (bone), and 0.15 percent (lung) over natural background at the NTS. ICRP Publication 26 (Reference 17) estimated the risk of fatal health effects per unit dose over the individual's lifetime. Using these values the risk for the total body, bone, and lung were 2×10^{-8}, 2×10^{-8}, and 6×10^{-9}, respectively.

TABLE 24

ESTIMATED NATURAL BACKGROUND DOSE AT THE NTS BOUNDARY*

Source	Total Body** (mrem/y)	Bone (mrem/y)	Lungs (mrem/y)
Cosmic Radiation***	36	36	36
Cosmic Radionuclides+	0.7	0.8	0.7
External Terrestrial++	56	56	56
Inhaled Radionuclides+++	--	--	100
Radionuclides in the Body+++	27	60	24
Total for One Year	120	153	217
U.S. Average Total	80	120	180

* These values were derived from References 13 and 20.

** The values for the total body are assumed to be the same as those for the gonads in Reference 18.

*** Assumed altitude of 1 km and a 10% reduction from structural shielding.

\+ Variation throughout U.S. very minimal, usually less then 1 mrem/y.

++ Value of 10 μrad/h assumed at the site boundary. Value reduced by 20% for shielding by housing and 20% for shielding by the body.

+++ Average values for the U.S.

Reference 17 estimates that an acceptable risk to any individual in the public is 10^{-6} to 10^{-5} per year. The maximum calculated risk to the individual at the NTS boundary is at least an order of magnitude below this acceptable risk. Due to the conservative assumptions used in the dose calculations and the comparison of risks, the postulated individual living at the NTS boundary during CY-1984 would have no observable ill effects from the operation of the NTS.

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A P P E N D I X   A

NTS Environmental Surveillance

Air Sampling Locations and Plots

Several symbols are used in Appendix A to denote the data points. In the first plot, the air network weekly averages, a square represents the arithmetic mean of all values at that point in time, and the vertical line is the range of the data.

The remaining plots of Appendix A show the gross beta and plutonium data of each station. A two-sigma error bar is also added to the data points, and, in all of the plots, a delta with the line to the bottom of the plot means below detection limit.

NTS ENVIRONMENTAL SURVEILLANCE
AIR SAMPLING LOCATIONS

Station Number	Location
1	Area 11 Gate 293
2	Area 6 Well 3 Complex
3	Area 3 Cafeteria
4	Area 9 9-300 Bunker
5	Area 10 Gate 700
6	Area 2 Cable Yard
7	Area 2 Compound
8	Area 12 Changehouse
9	Area 19 Echo Peak
10	Area 19 Substation
11	Area 16 Substation
12	Area 9 9-300 Bunker No. 2
13	Area 23 HαS Roof
14	Area 23 Building 790
15	Area 23 Bldg. 790 No. 2
16	Area 27 Cafeteria
17	Area 25 NRDS Warehouse
18	Area 28 Henre Site
19	Area 5 Well 5B
20	Area 5 RWMS No. 1
21	Area 5 DOD Yard
22	Area 6 Yucca Complex
23	Area 6 CP Complex
25	Area 1 Gravel Pit
26	Area 3 BJY
27	Area 3 3-300 Bunker

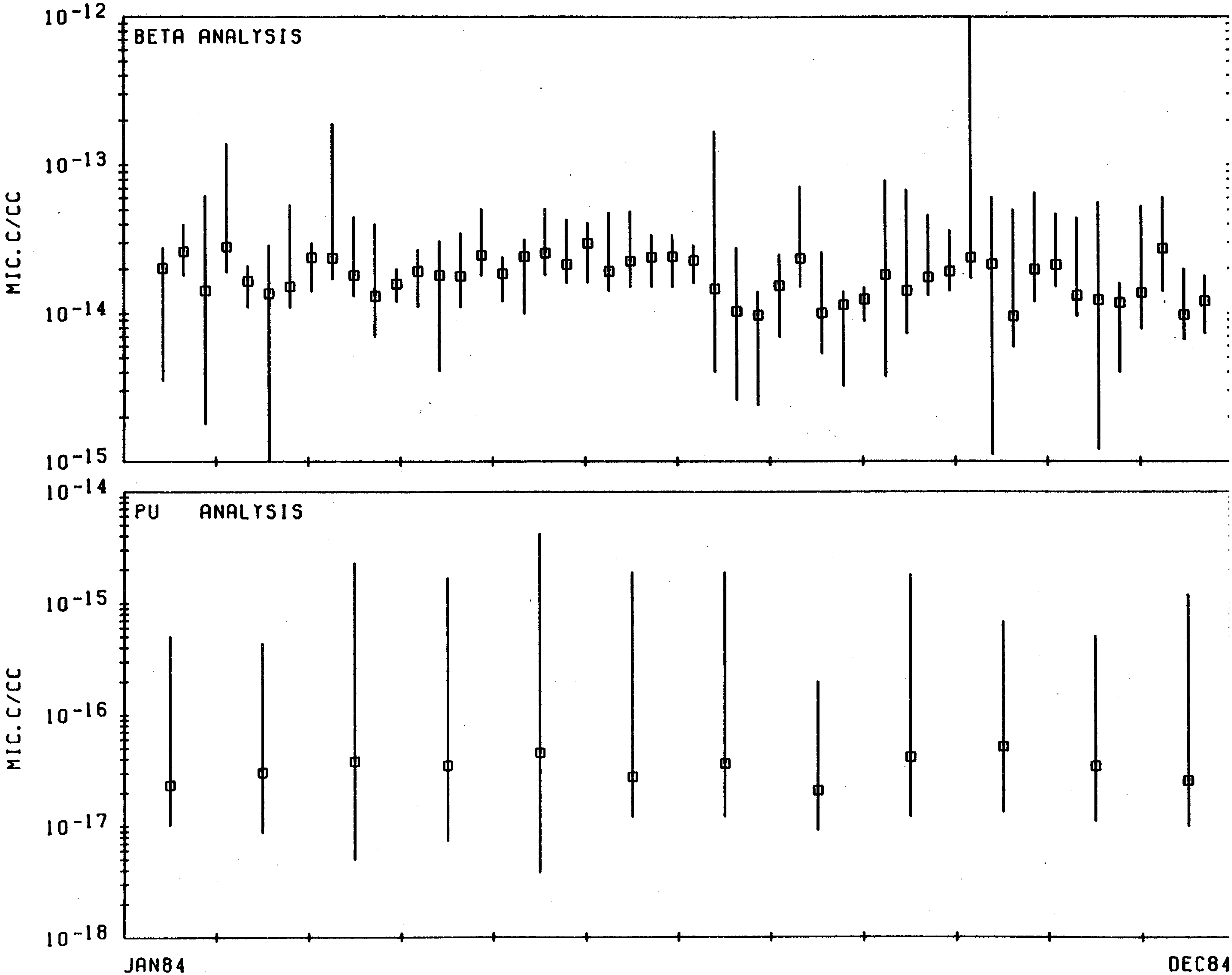
NTS ENVIRONMENTAL SURVEILLANCE
AIR SAMPLING LOCATIONS

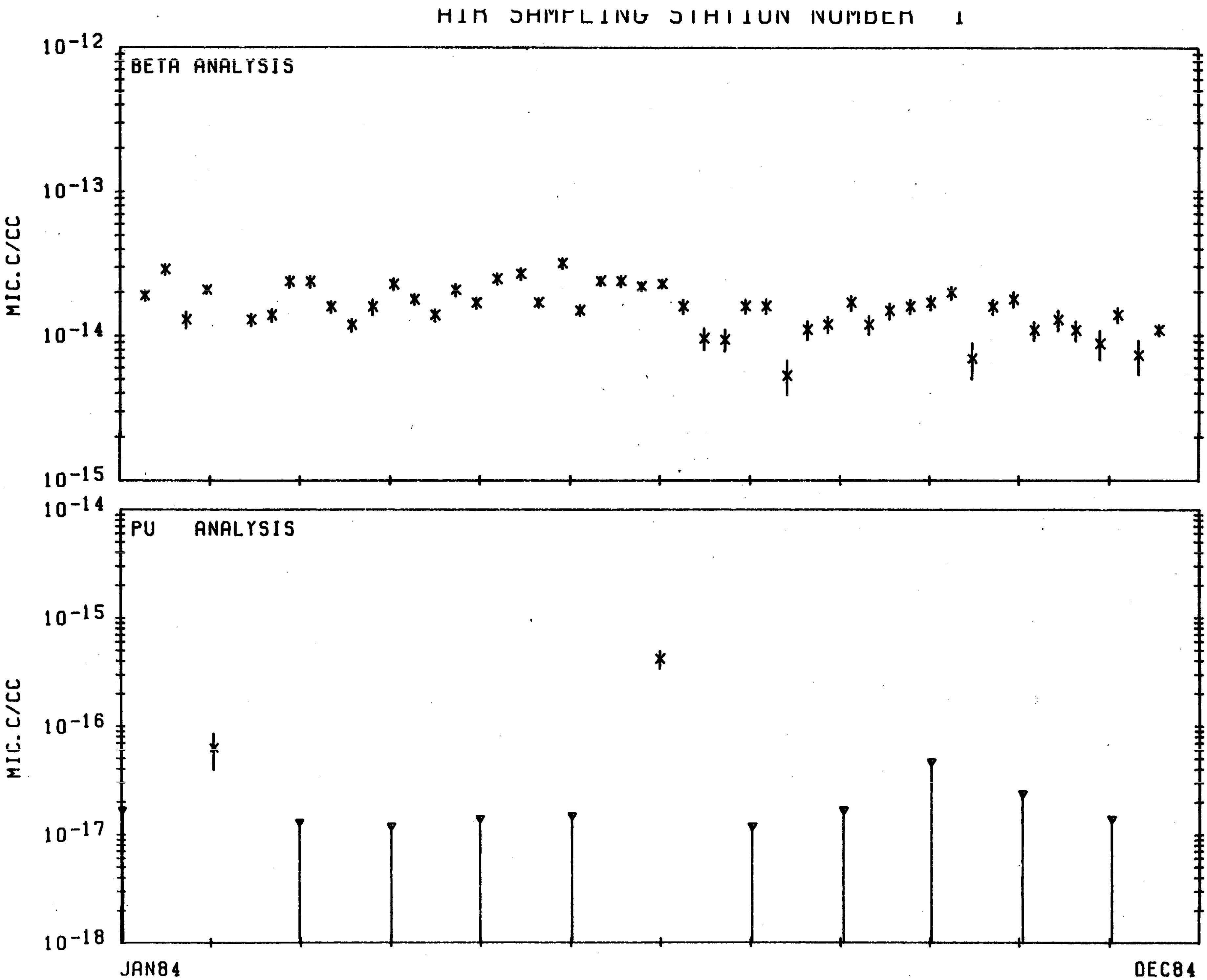
(Continued)

Station Number	Location
28	Area 5 RWMS No. 2
29	Area 5 RWMS No. 3
30	Area 25 E-MAD North
31	Area 25 E-MAD South
32	Area 5 RWMS No. 4
33	Area 3 U3ax South
34	Area 3 U3ax East
35	Area 3 U3ax North
36	Area 3 U3ax West
37	Area 7 UE7ns
38	Area 15 EPA Farm
39	Area 5 RWMS No. 5
40	Area 5 RWMS No. 6
41	Area 5 RWMS No. 7
42	Area 5 RWMS No. 8
43	Area 5 RWMS No. 9
44	Area 15 Pile Driver
46	Area 20 Dispensary
47	Area 3 Complex No. 2
48	Area 5 Gate 200
*49	Area 5 Communications Tower

*This sampling station was added in February, 1984.

AIR NETWORK AVERAGES




AIR SAMPLING STATION NUMBER 1
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10-12
10-13
10-14
10-15
10-14
10-15
10-16
10-17
10-18
JAN84
DEC84

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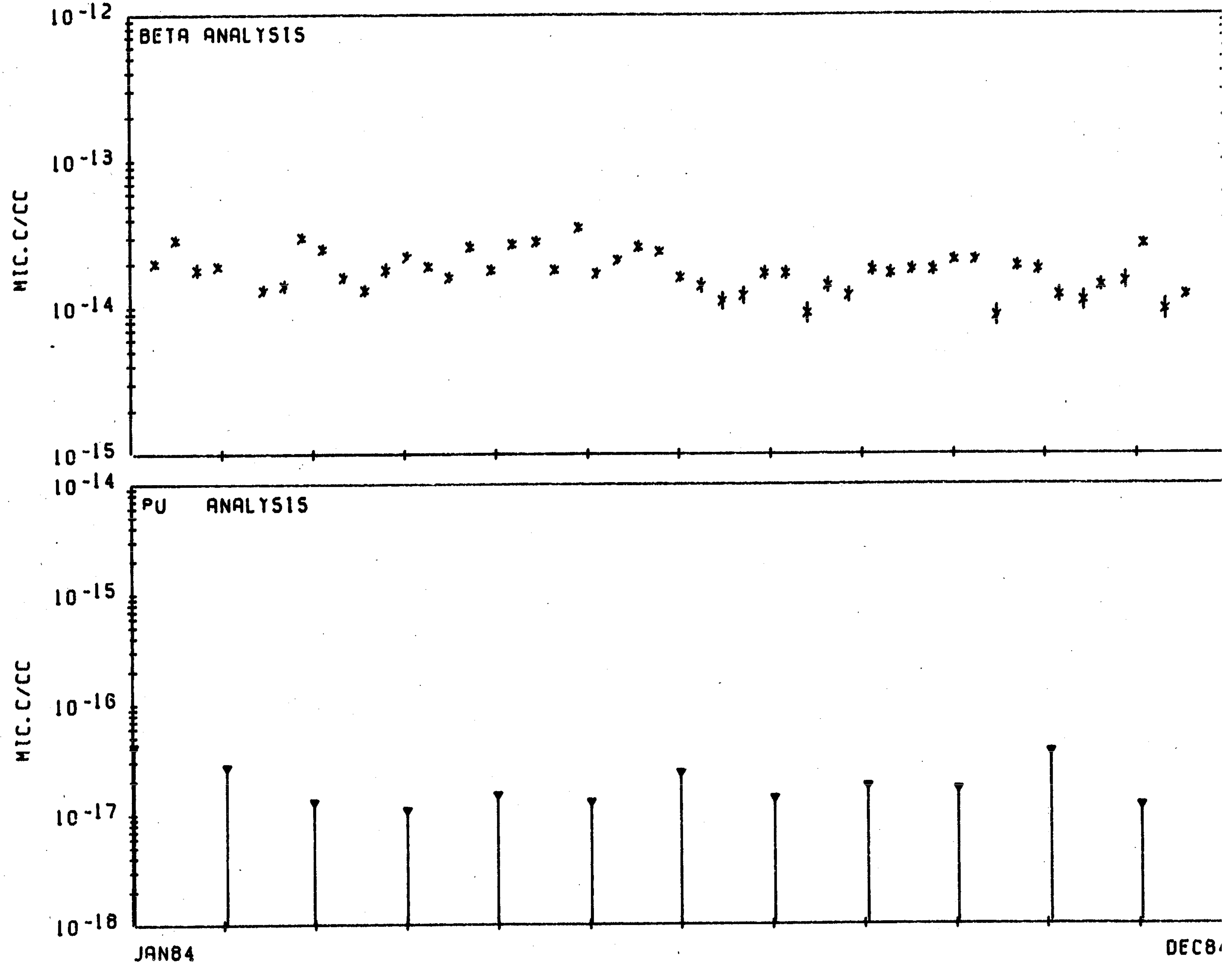

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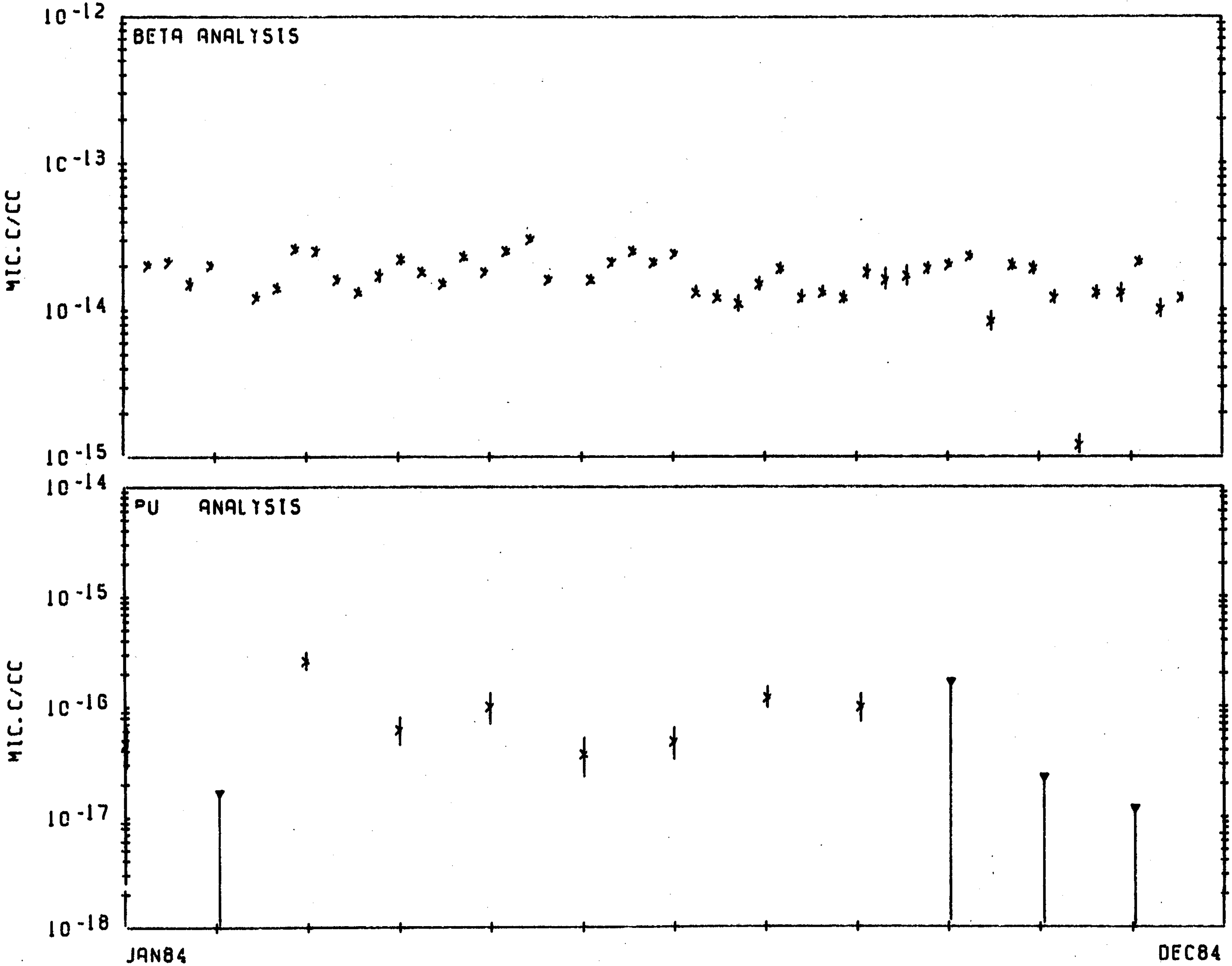
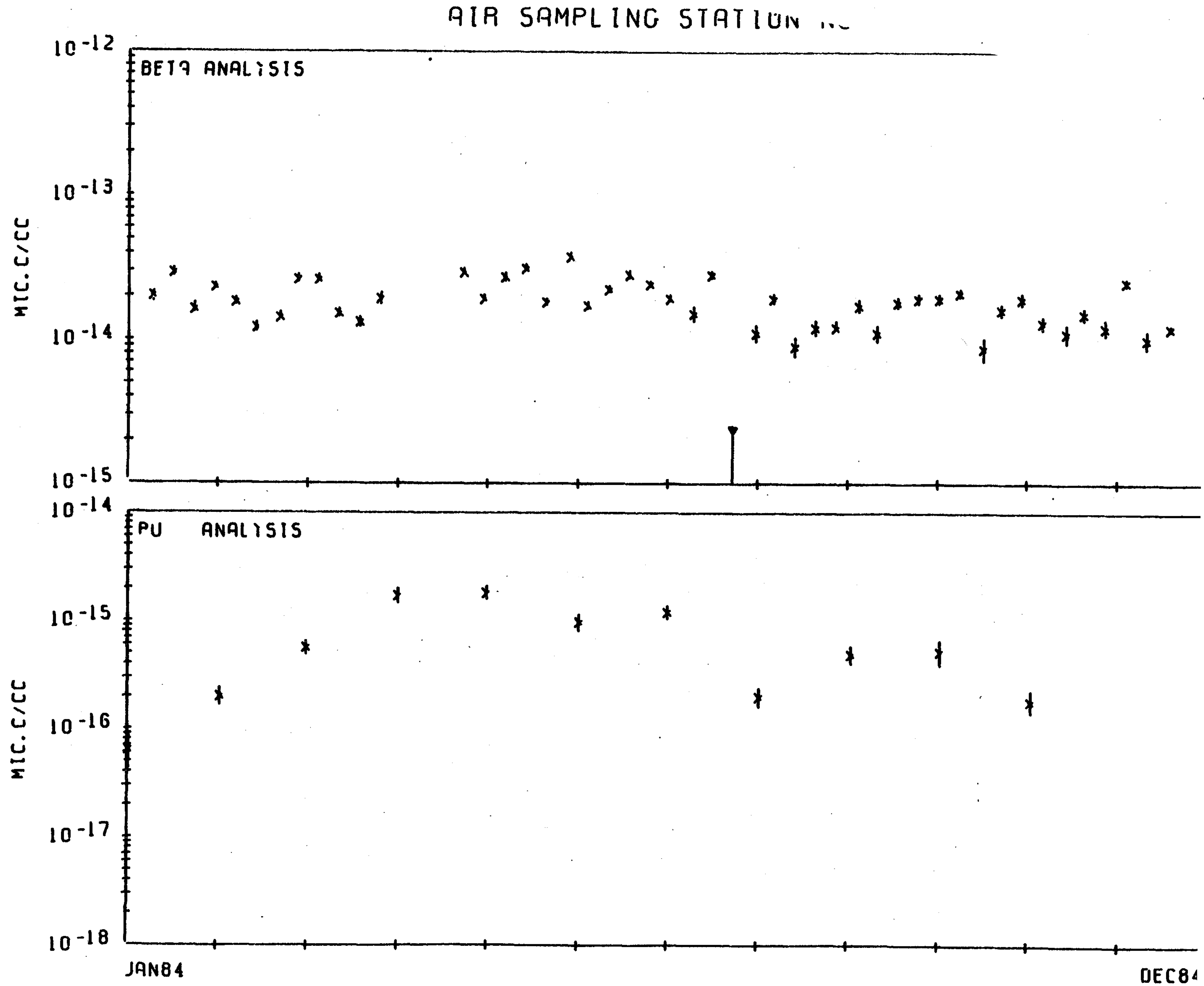
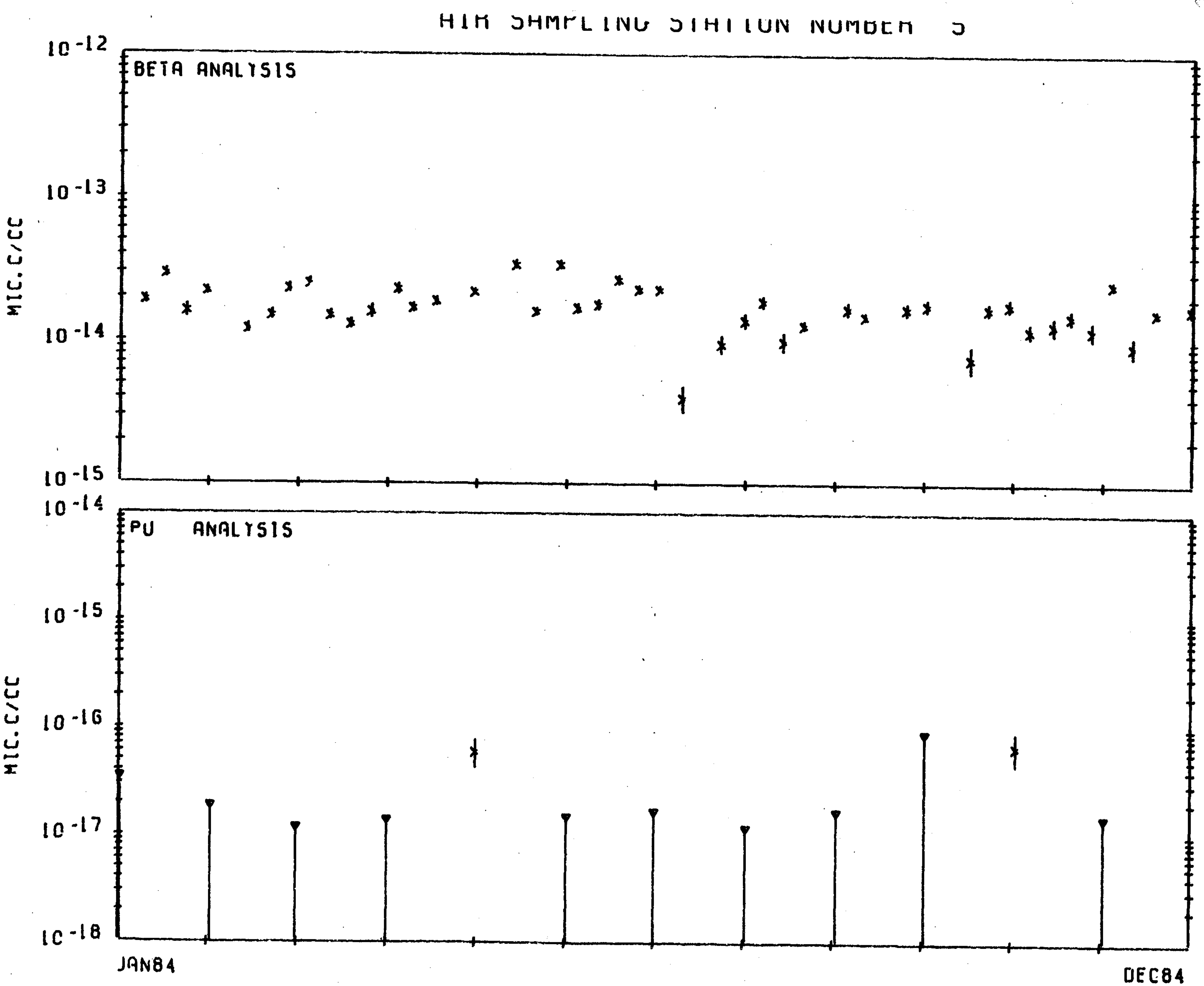




AIR SAMPLING STATION
10 -12
BETA ANALISIS
10 -13
MIC.C/CC
10 -14
10 -15
10 -14
PU ANALISIS
10 -15
MIC.C/CC
10 -16
10 -17
10 -18
JAN84
DEC84

-98-



AIR SAMPLING STATION NUMBER 5
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
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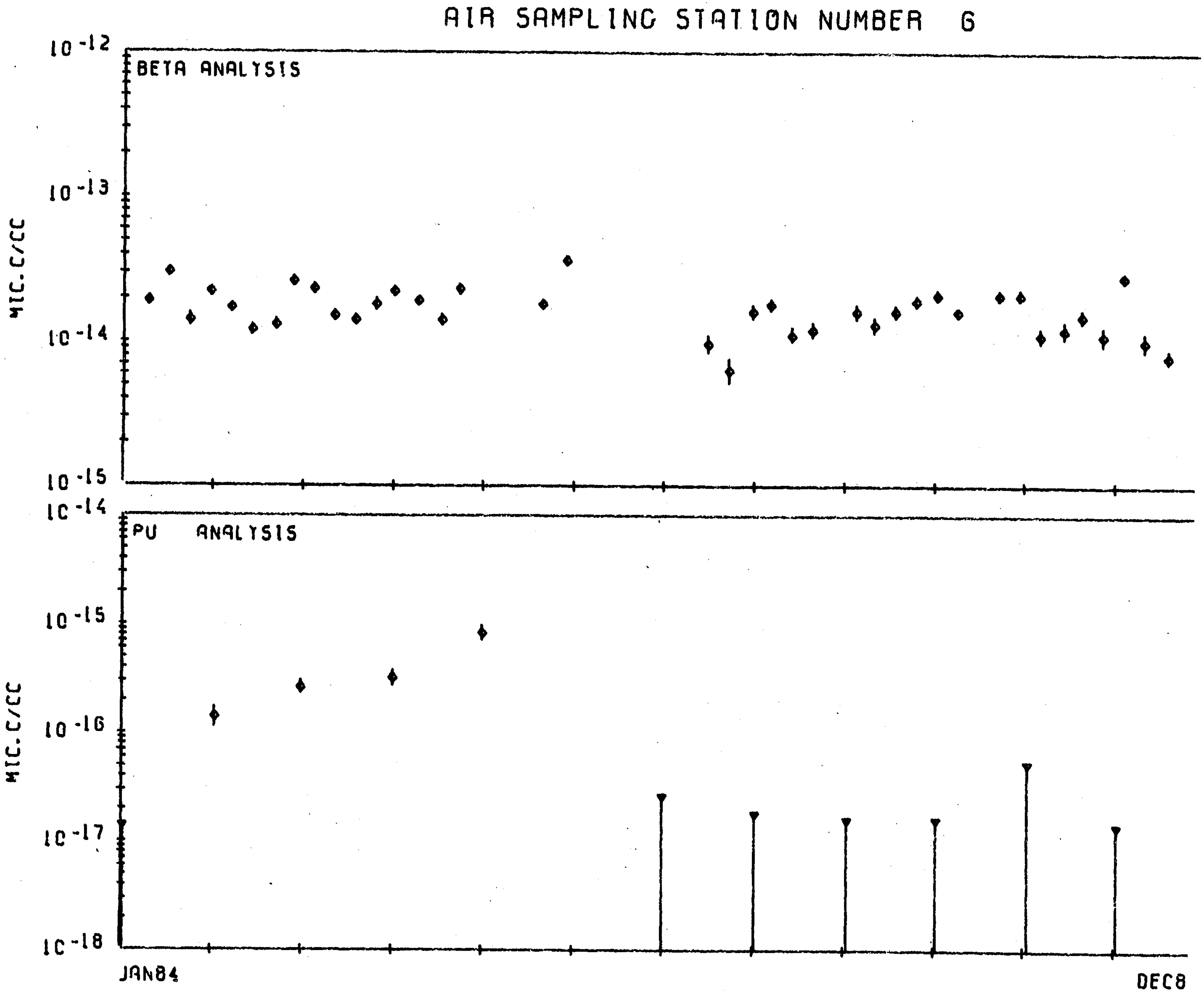
10 -14
10 -15
10 -14
10 -15
10 -16
10 -17
10 -18
JAN84
DEC84


AIR SAMPLING STATION NUMBER 6
BETA ANALYSIS
MIC.C/CC
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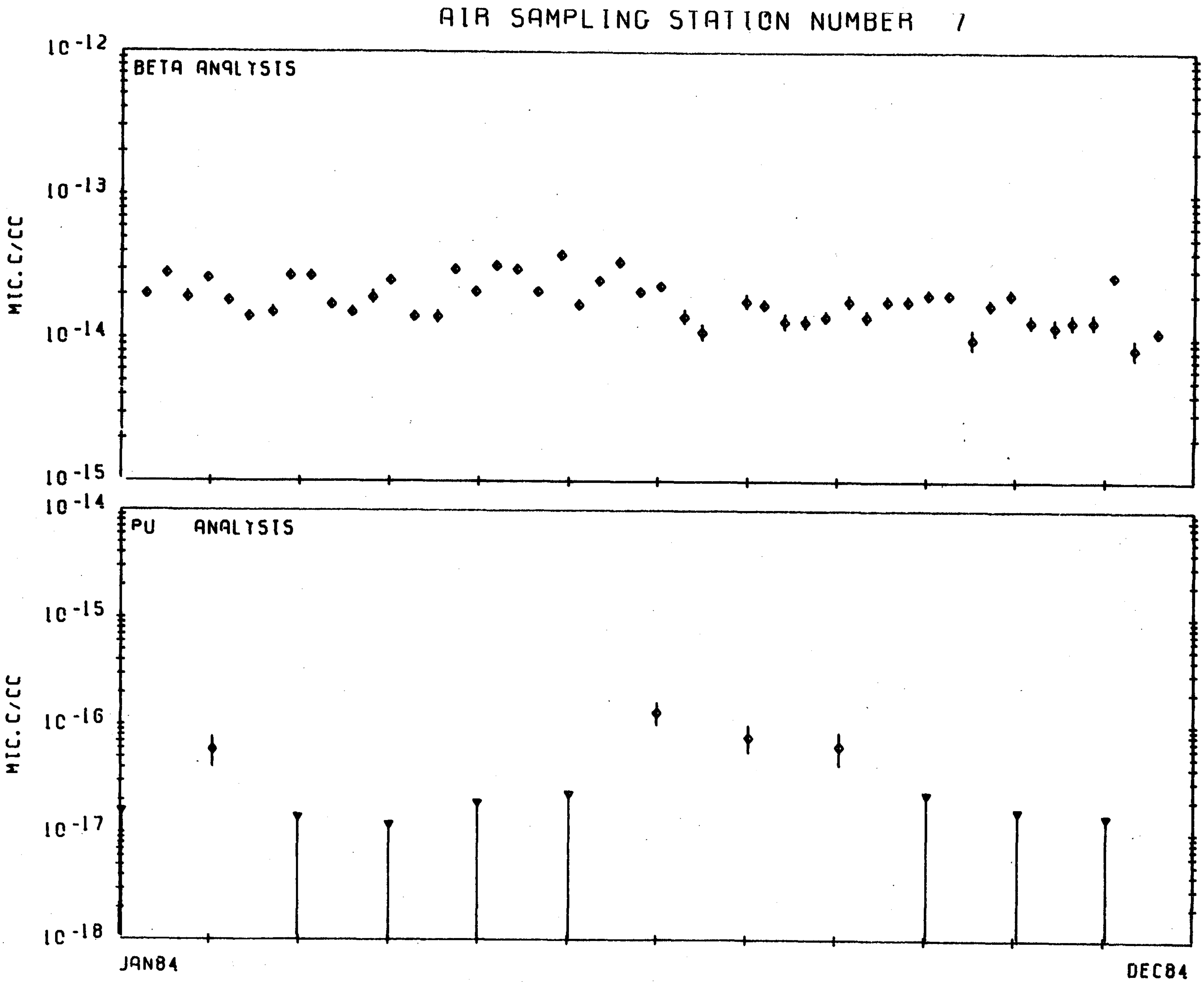
10 -15
PU ANALYSIS
10 -14
10 -15
10 -16
10 -17
10 -18
JAN84
DEC8


AIR SAMPLING STATION NUMBER 7
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
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10^{-13}
10^{-14}
10^{-15}
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^{-18}
JAN84
DEC84

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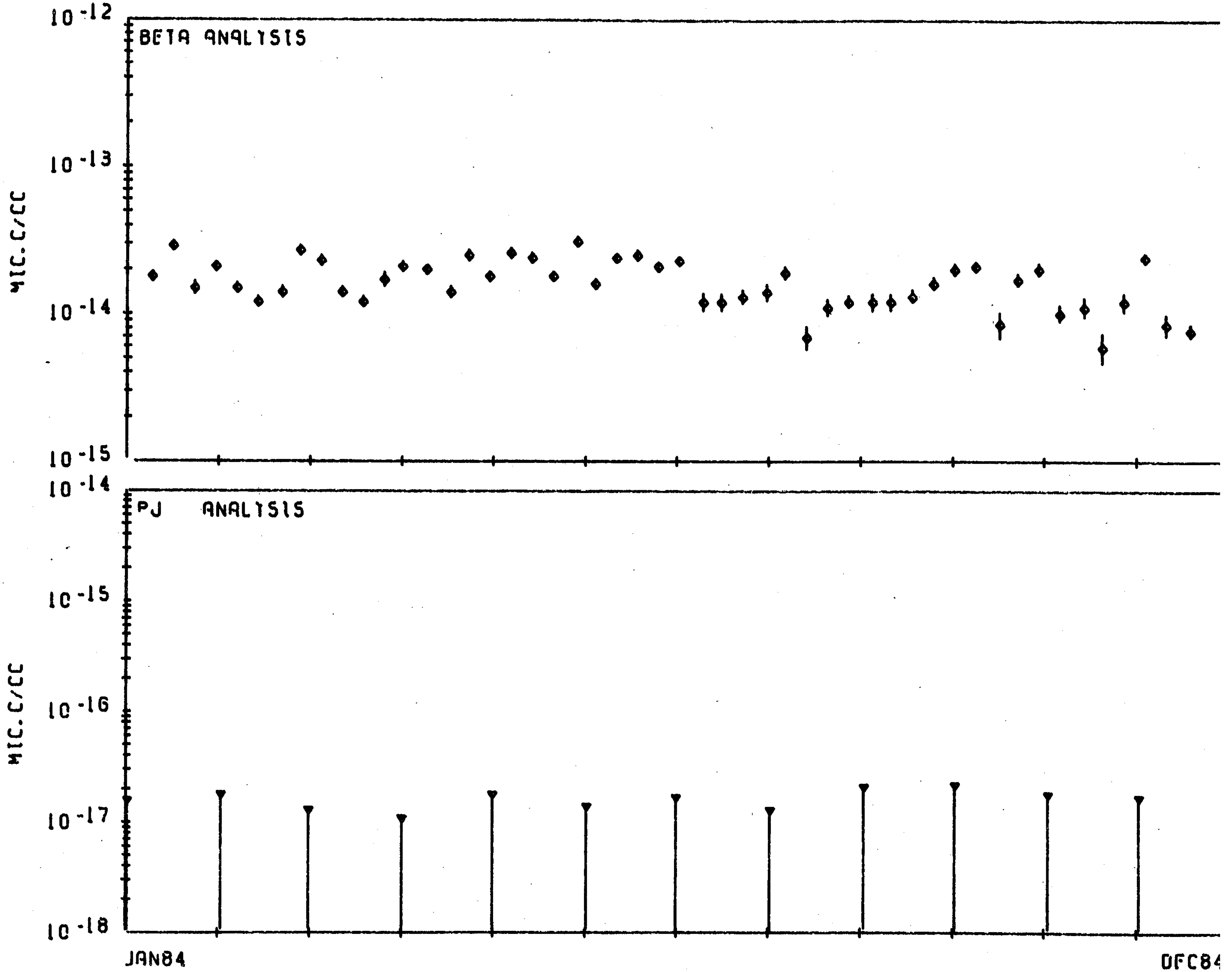

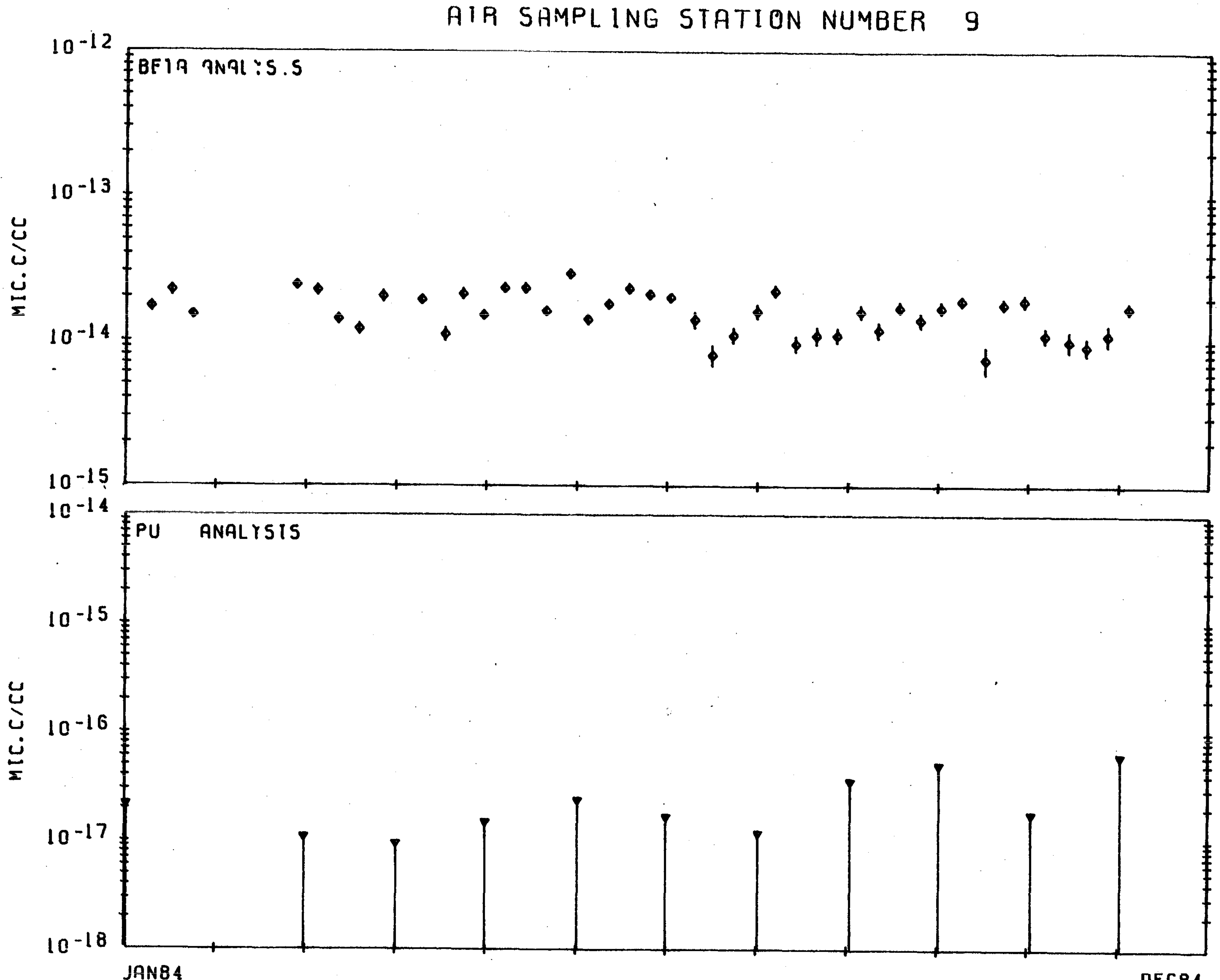

AIR SAMPLING STATION NUMBER 9
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10^{-12}
10^{-13}
10^{-14}
10^{-15}
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^{-18}
JAN84
DEC84

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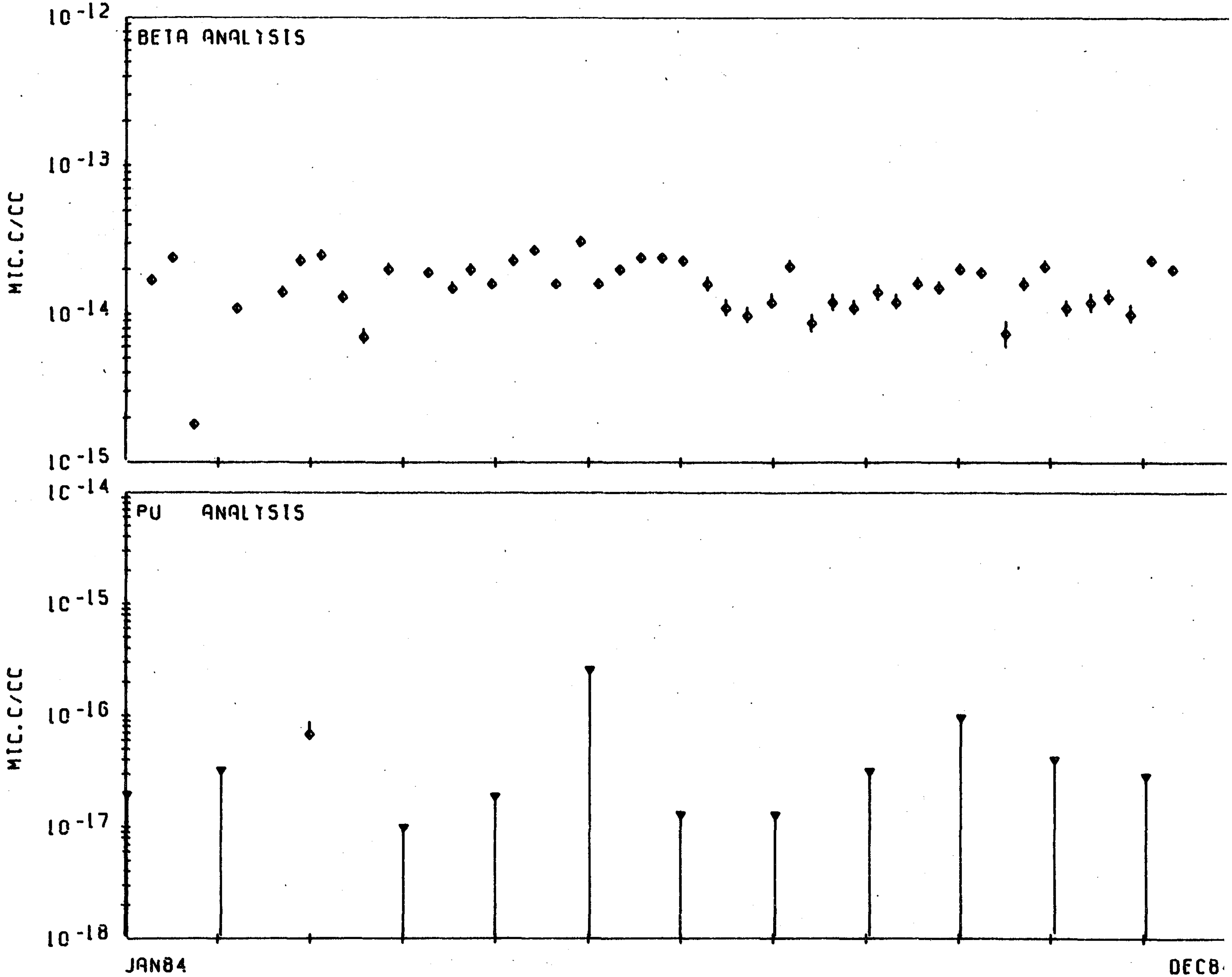

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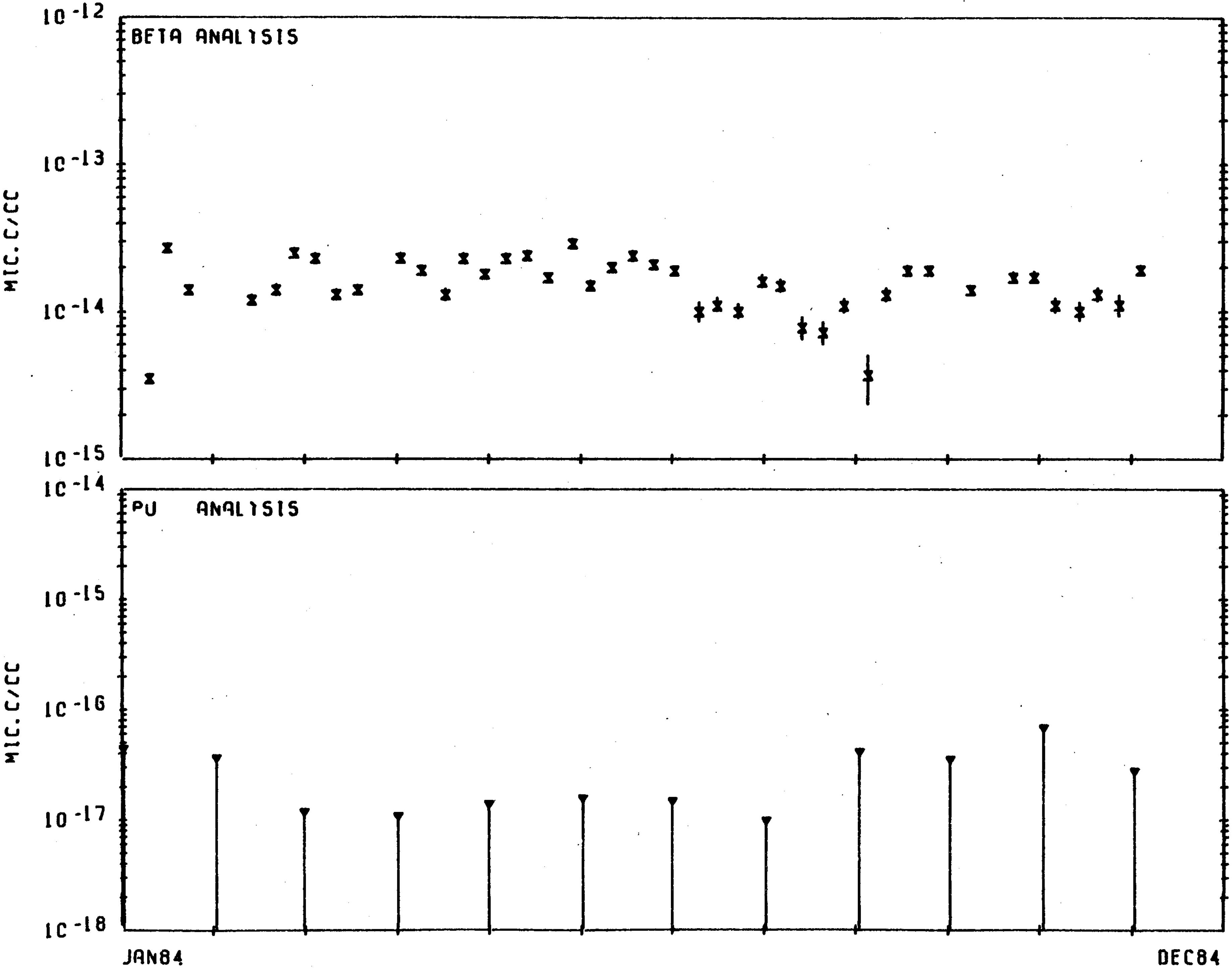

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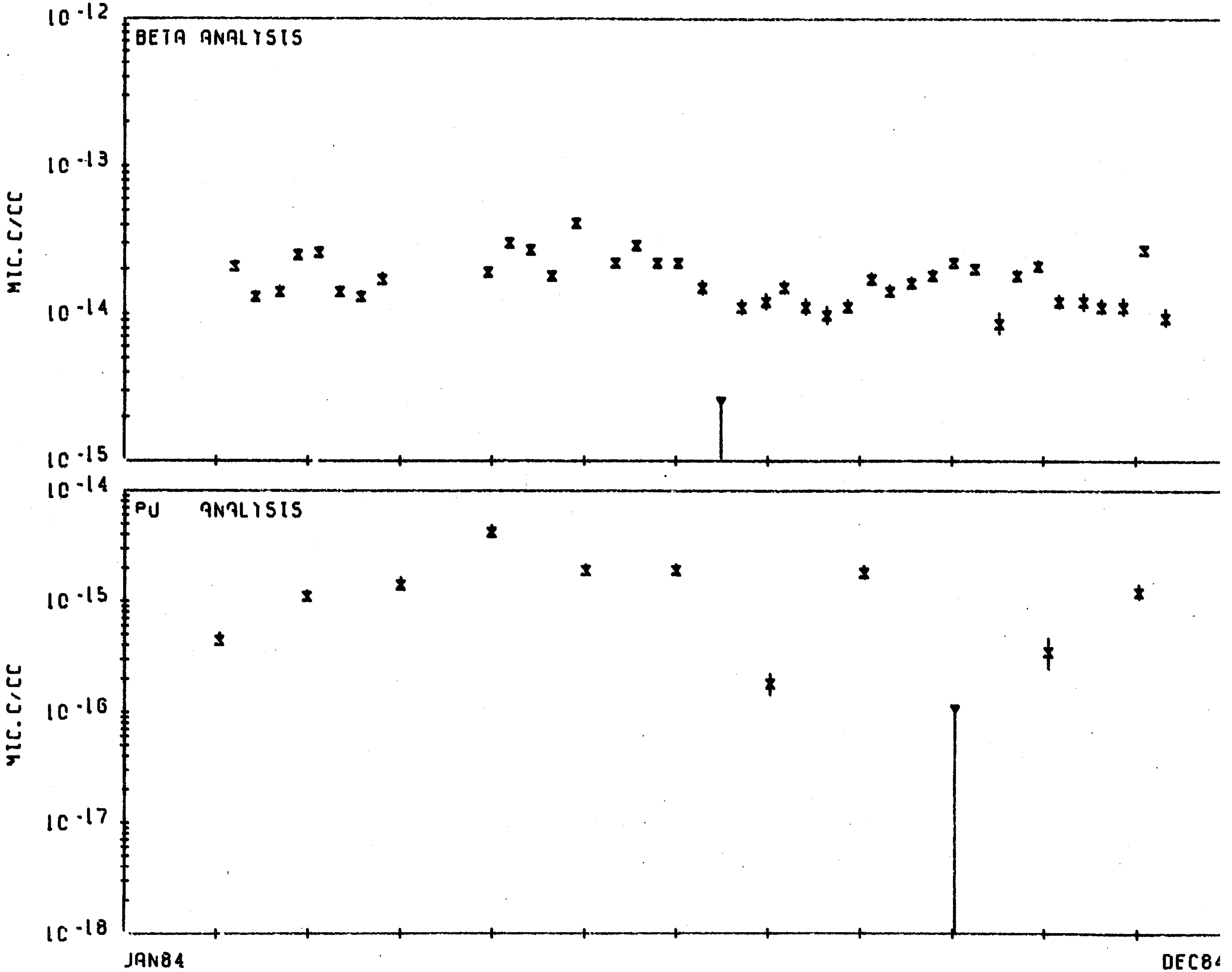
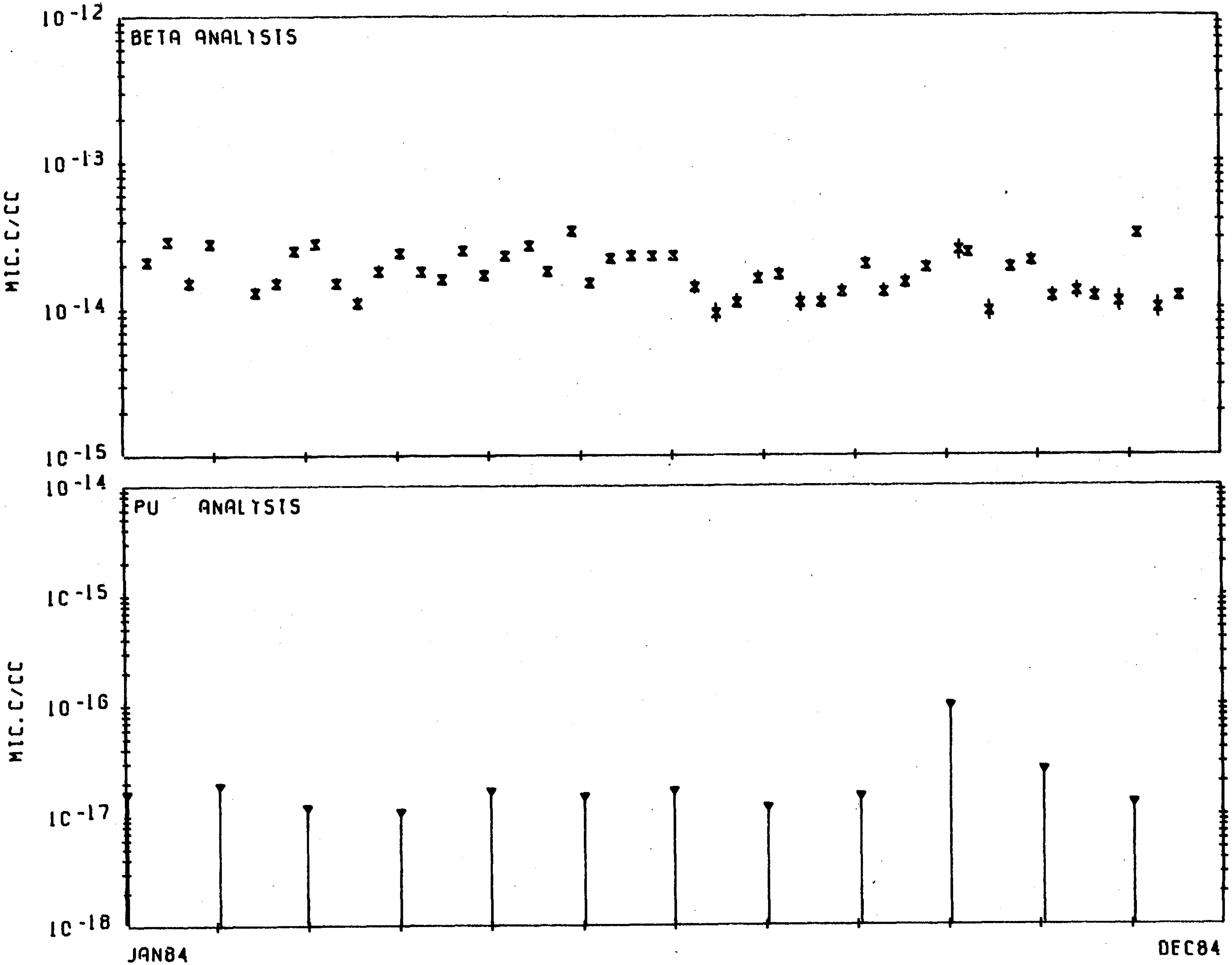
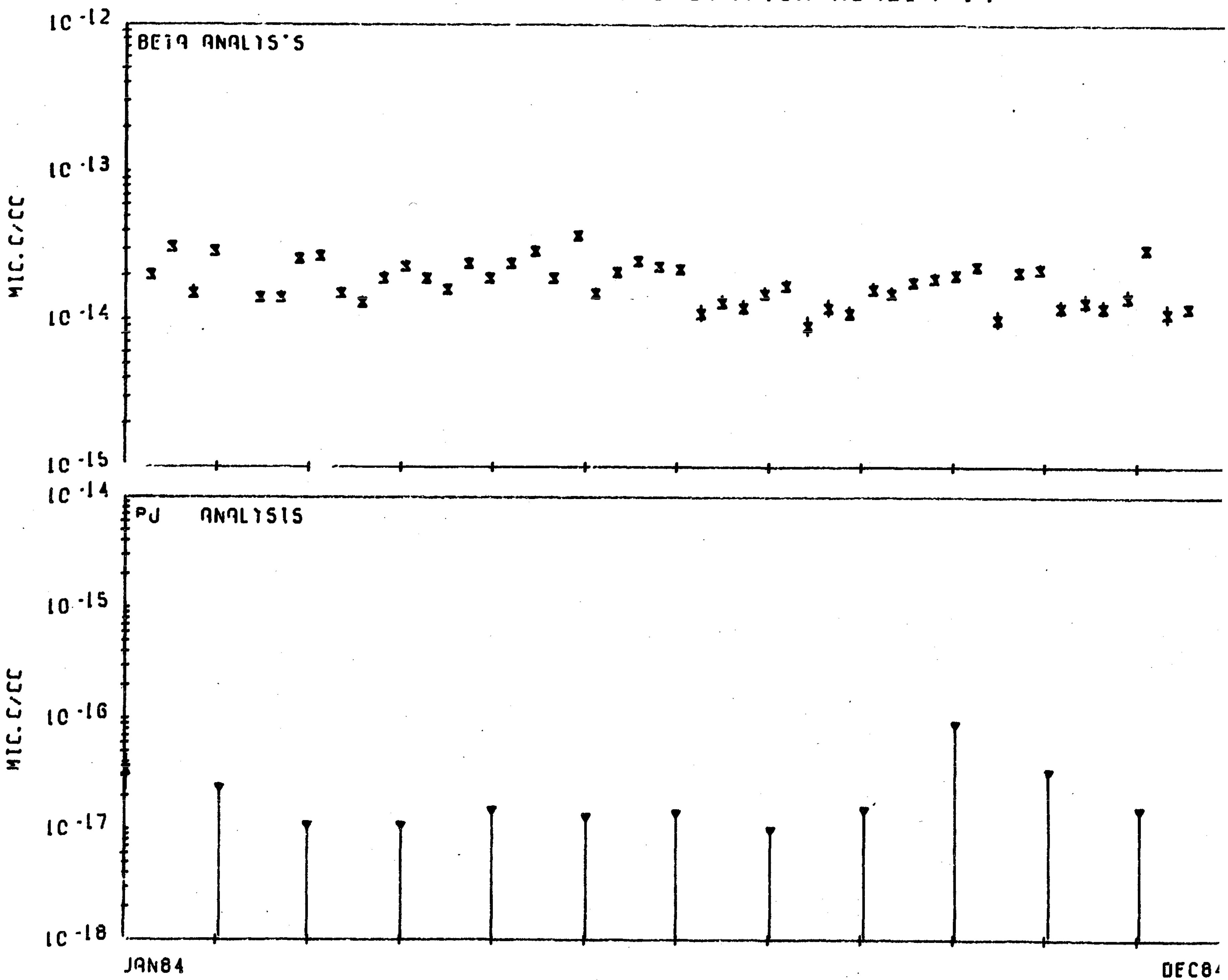


AIR SAMPLING STATION NUMBER 1[illegible]

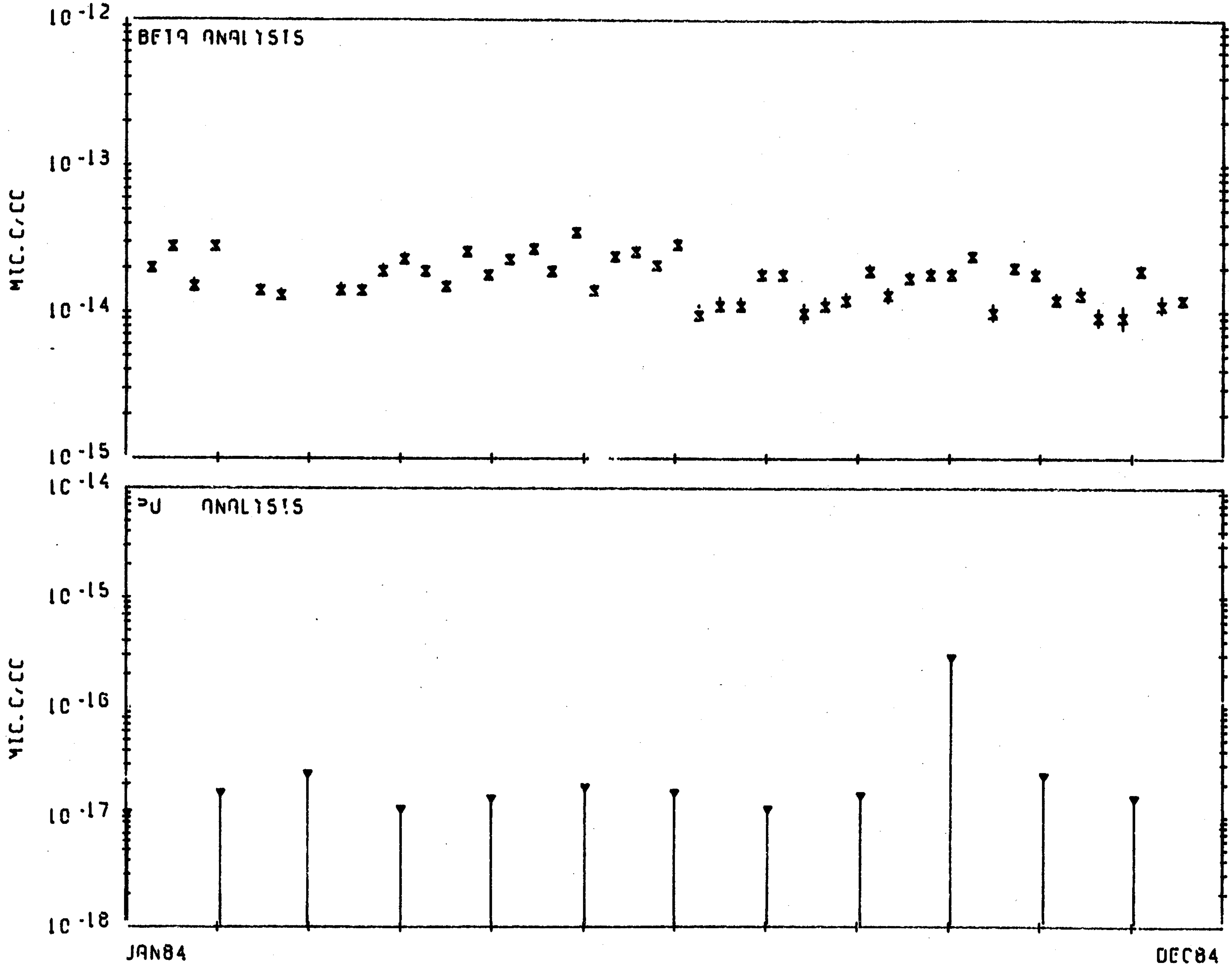


AIR SAMPLING STATION NUMBER 14

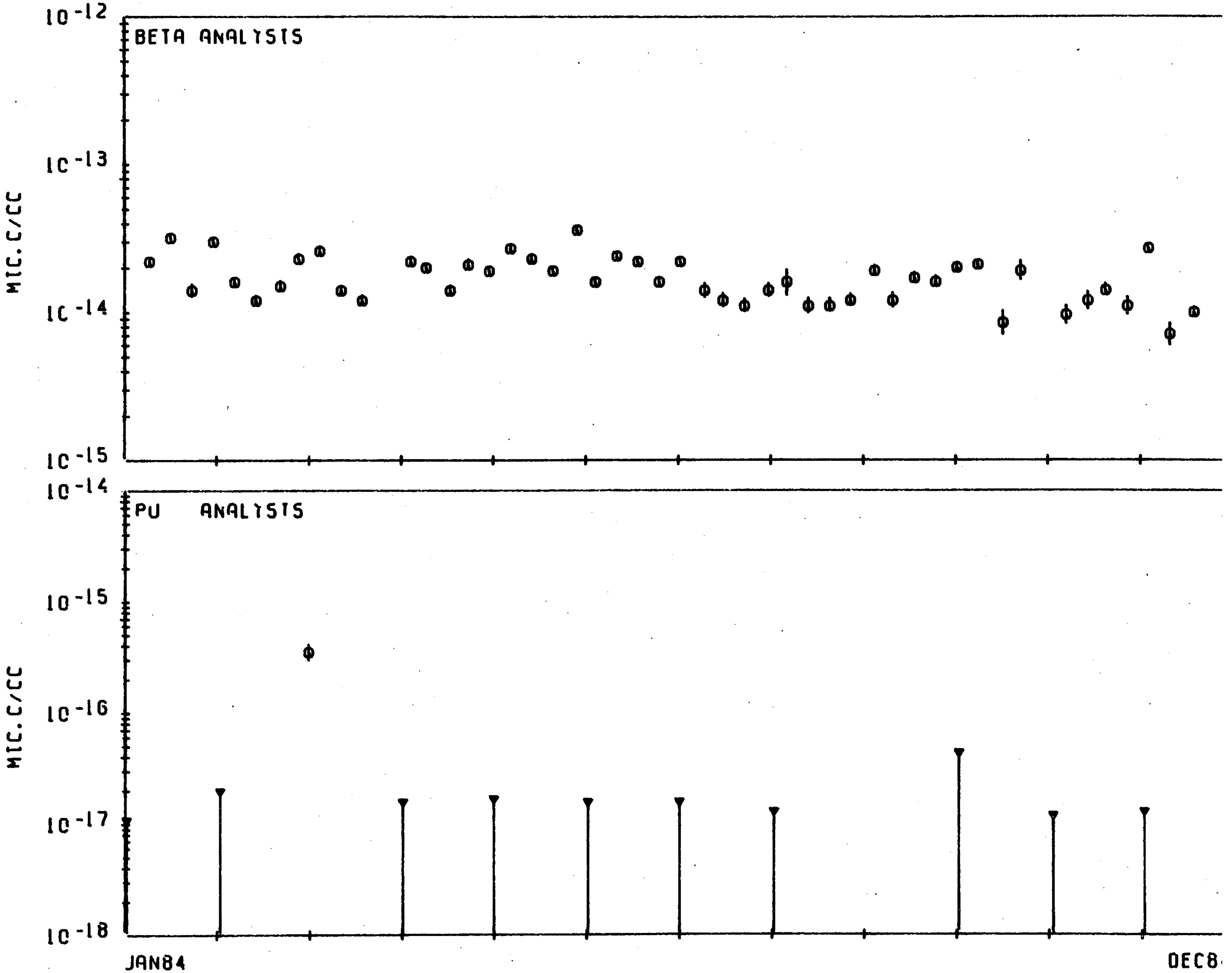


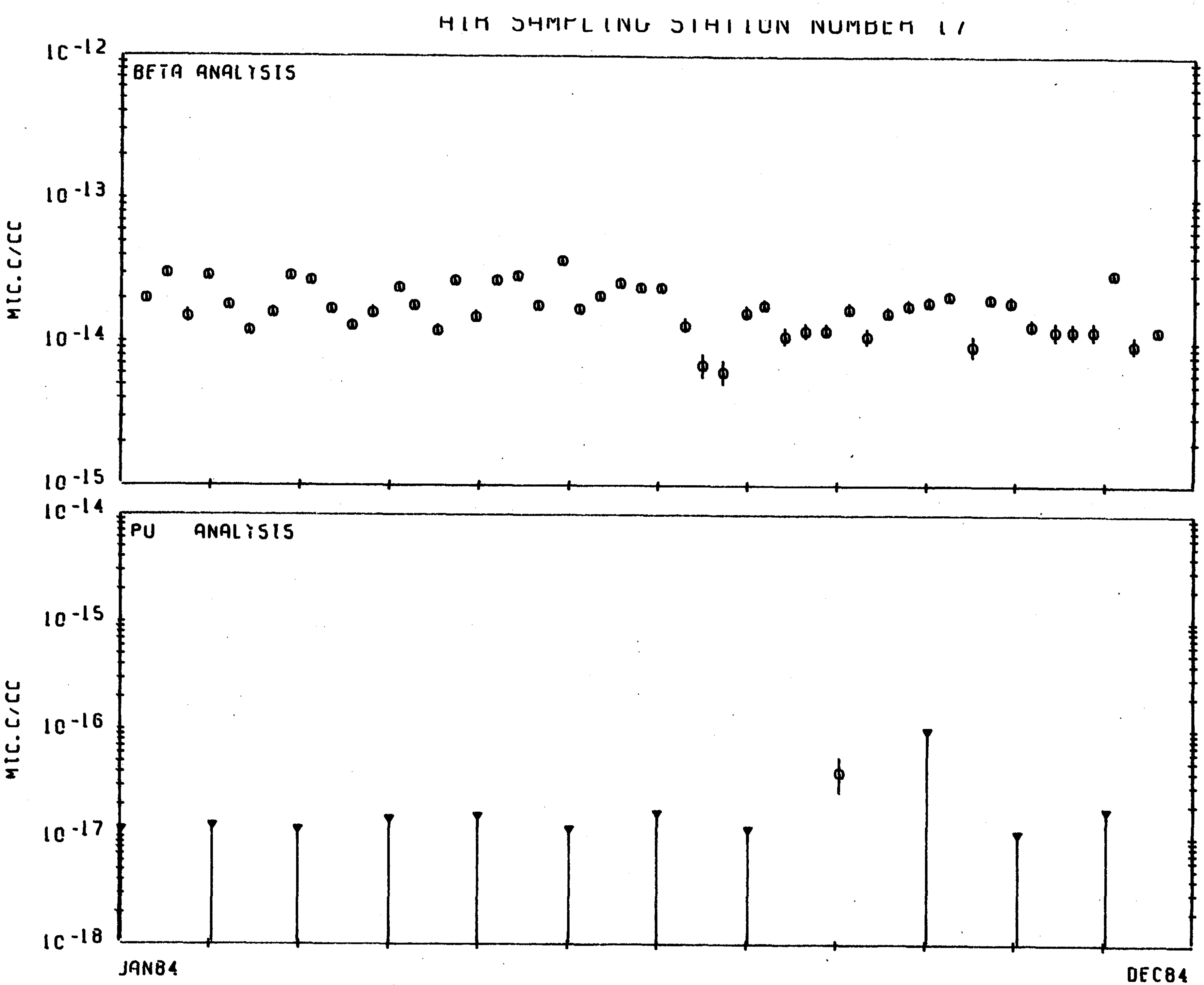
-96-

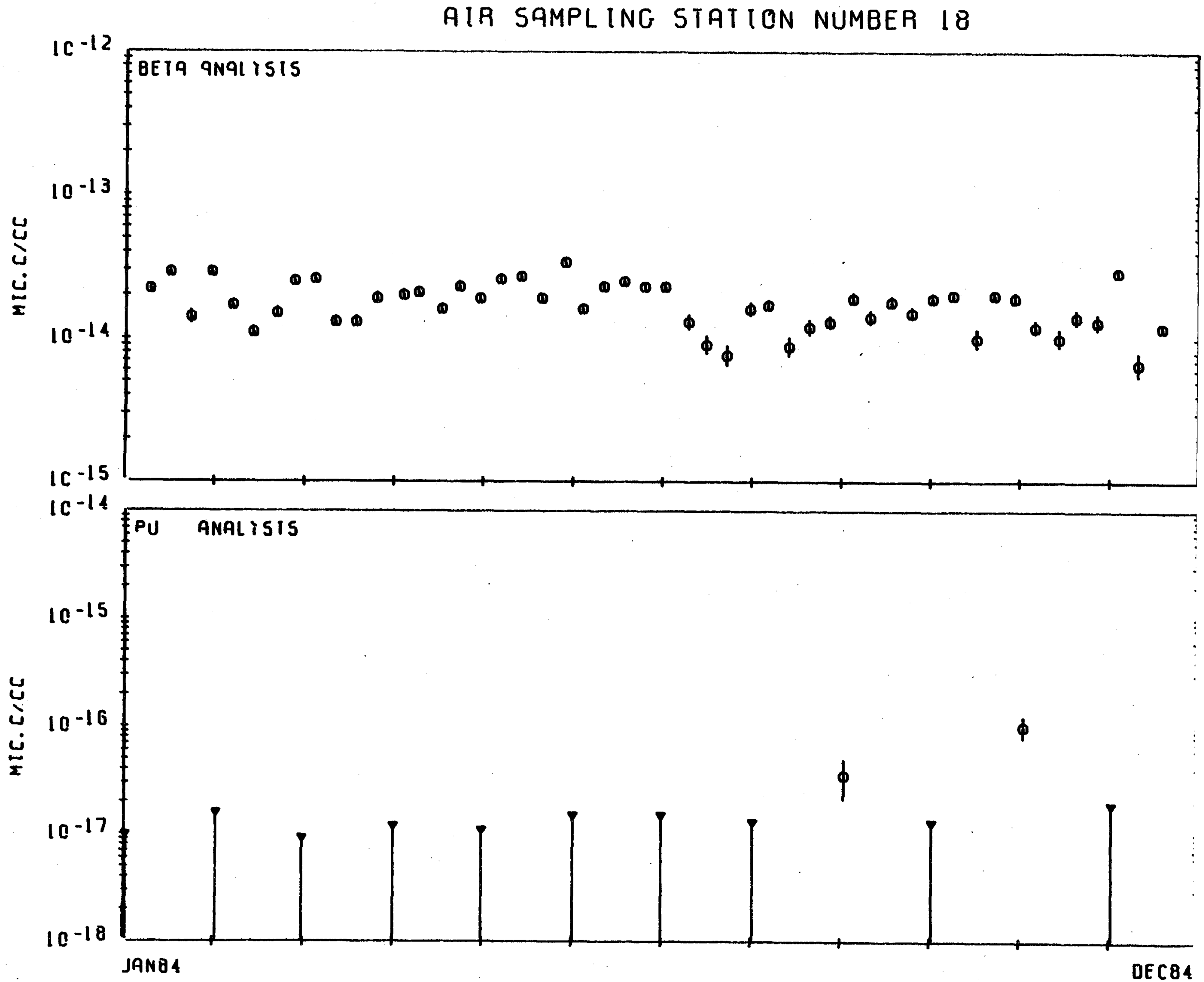
AIR SAMPLING STATION NUMBER 15

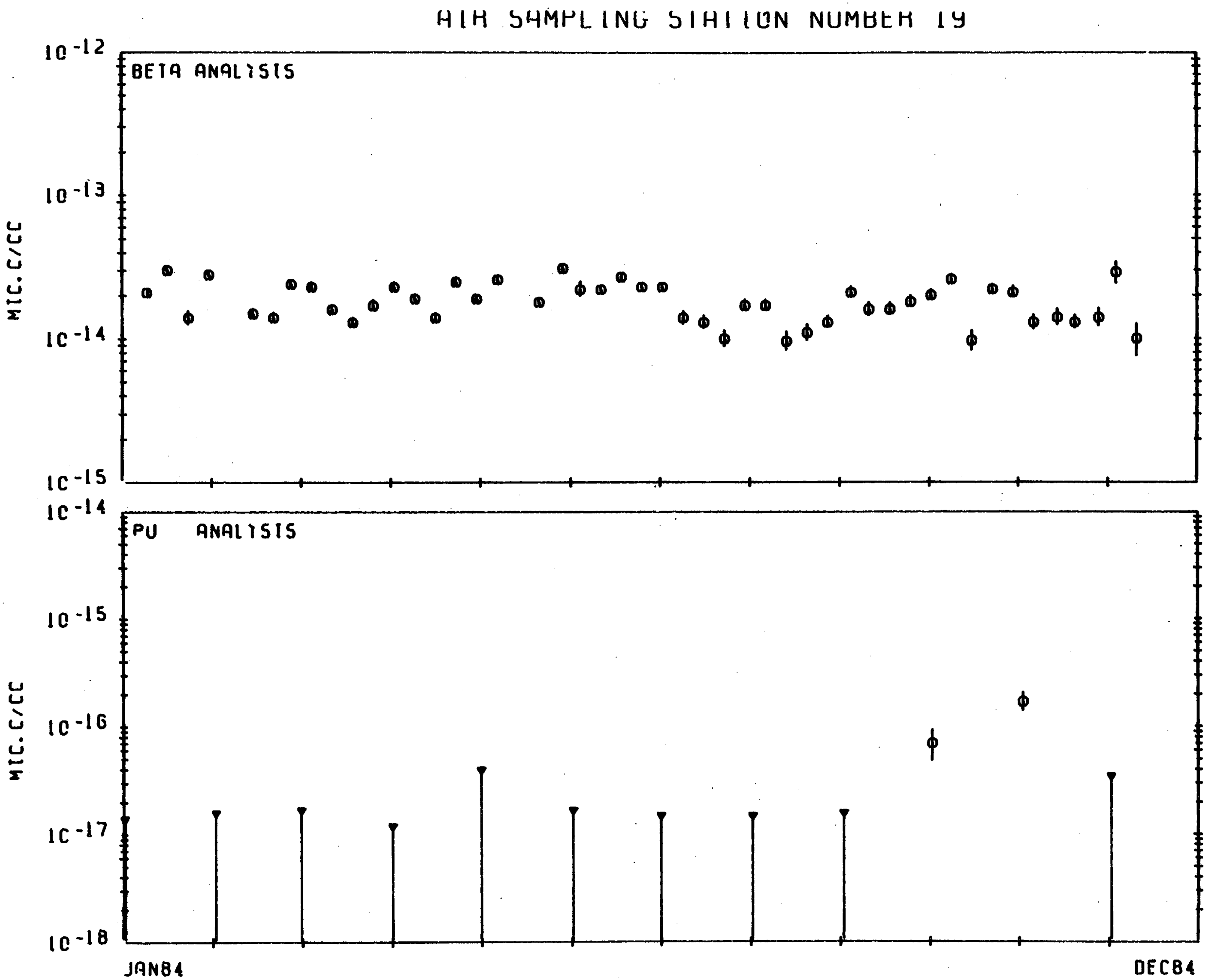


AIR SAMPLING STATION NUMBER 16

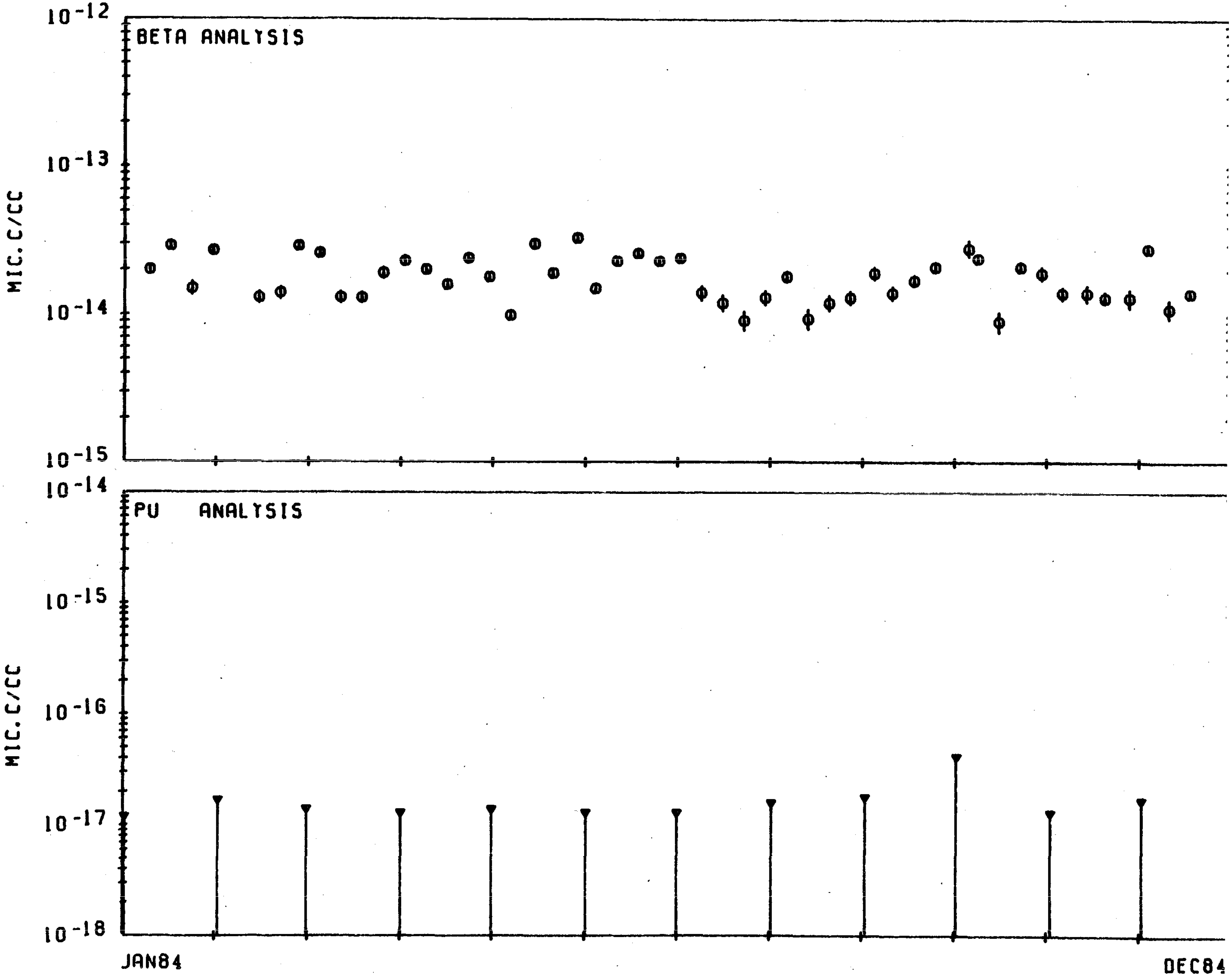


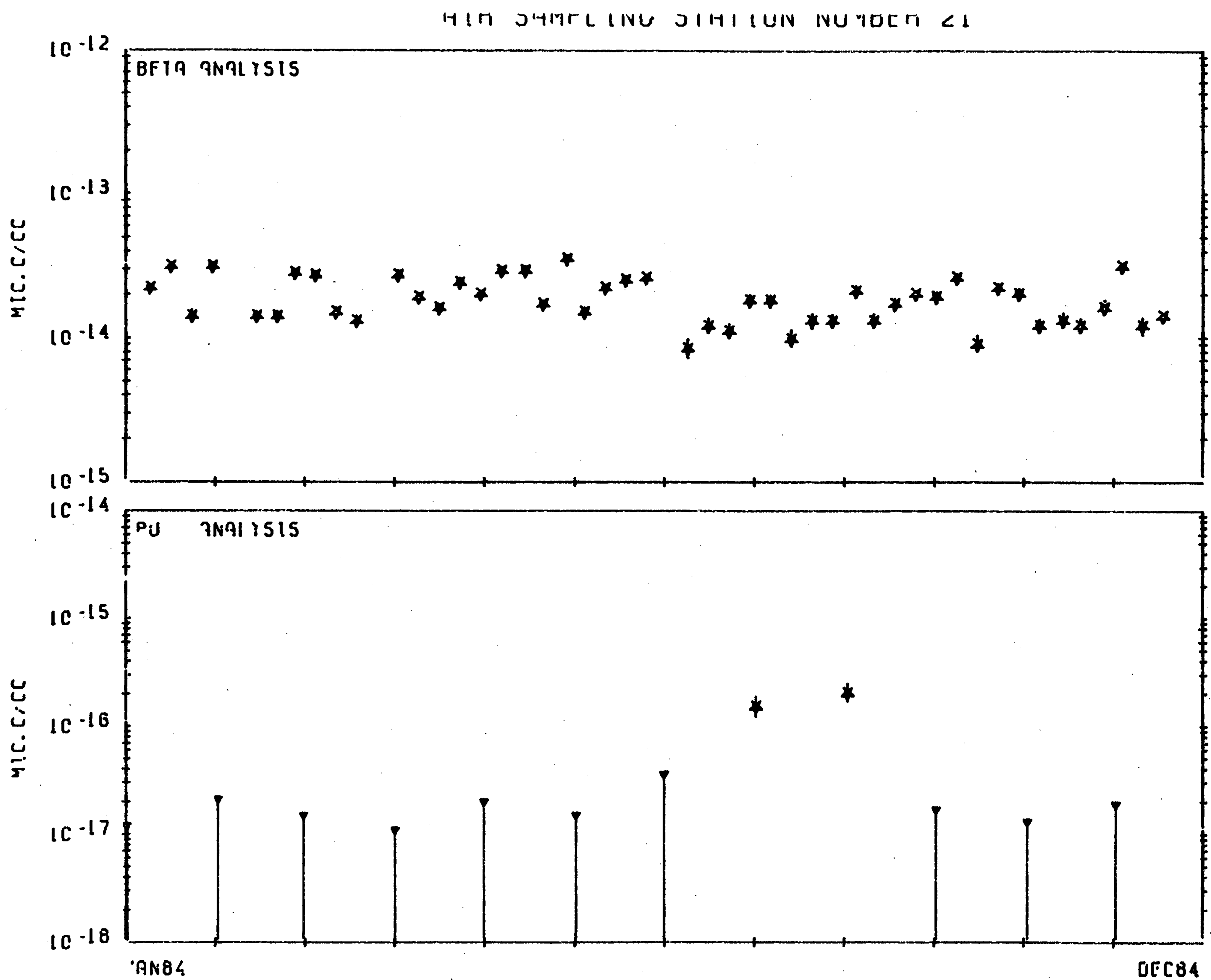

AIR SAMPLING STATION NUMBER 17
BETA ANALYSIS
MIC.C/CC
10^{-12}
10^{-13}
10^{-14}
10^{-15}
PU ANALYSIS
MIC.C/CC
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^{-18}
JAN84
DEC84

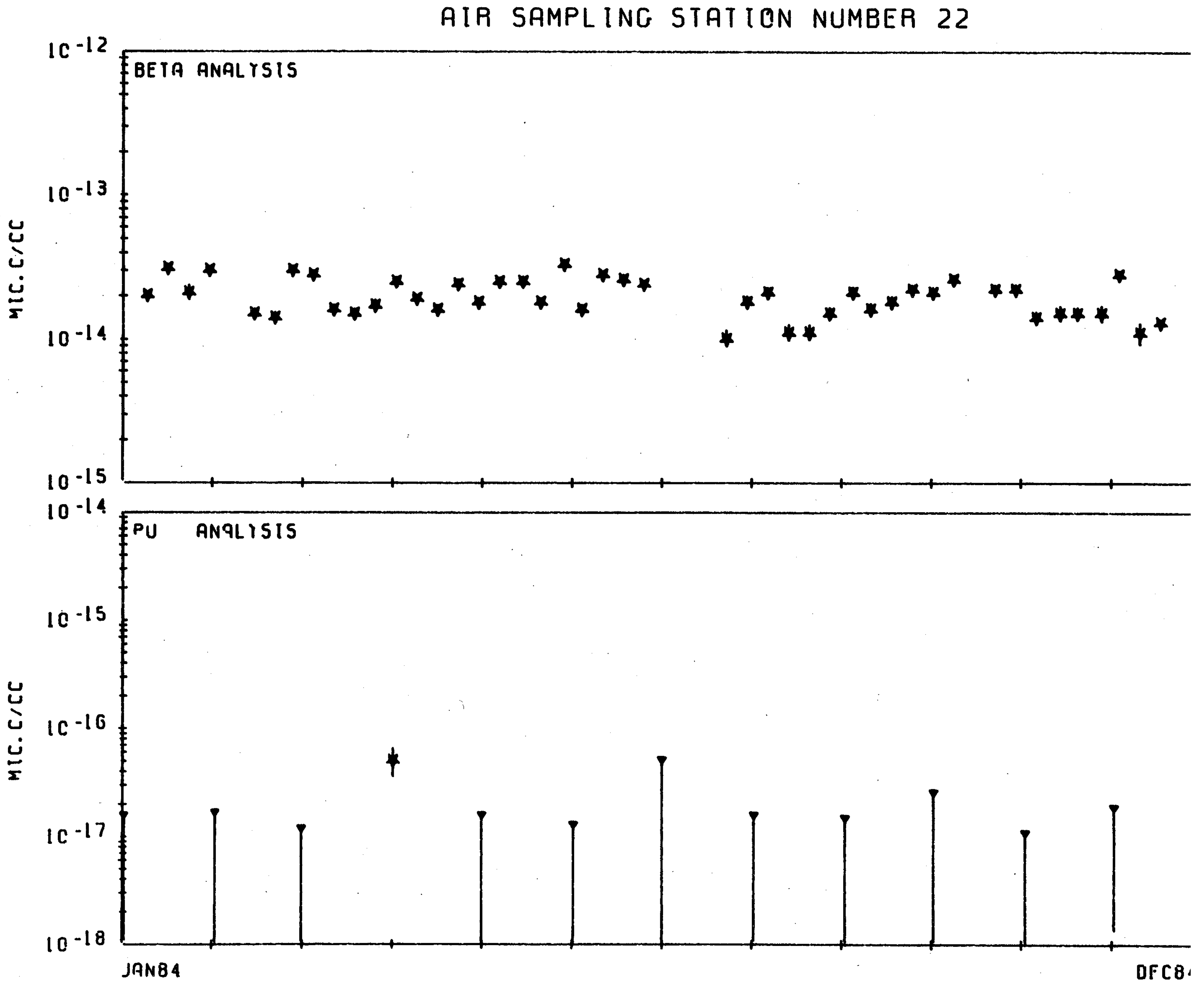

AIR SAMPLING STATION NUMBER 18
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10^{-12}
10^{-13}
10^{-14}
10^{-15}
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^{-18}
JAN84
DEC84


AIR SAMPLING STATION NUMBER 19
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10 -12
10 -13
10 -14
10 -15
10 -14
10 -15
10 -16
10 -17
10 -18
JAN84
DEC84

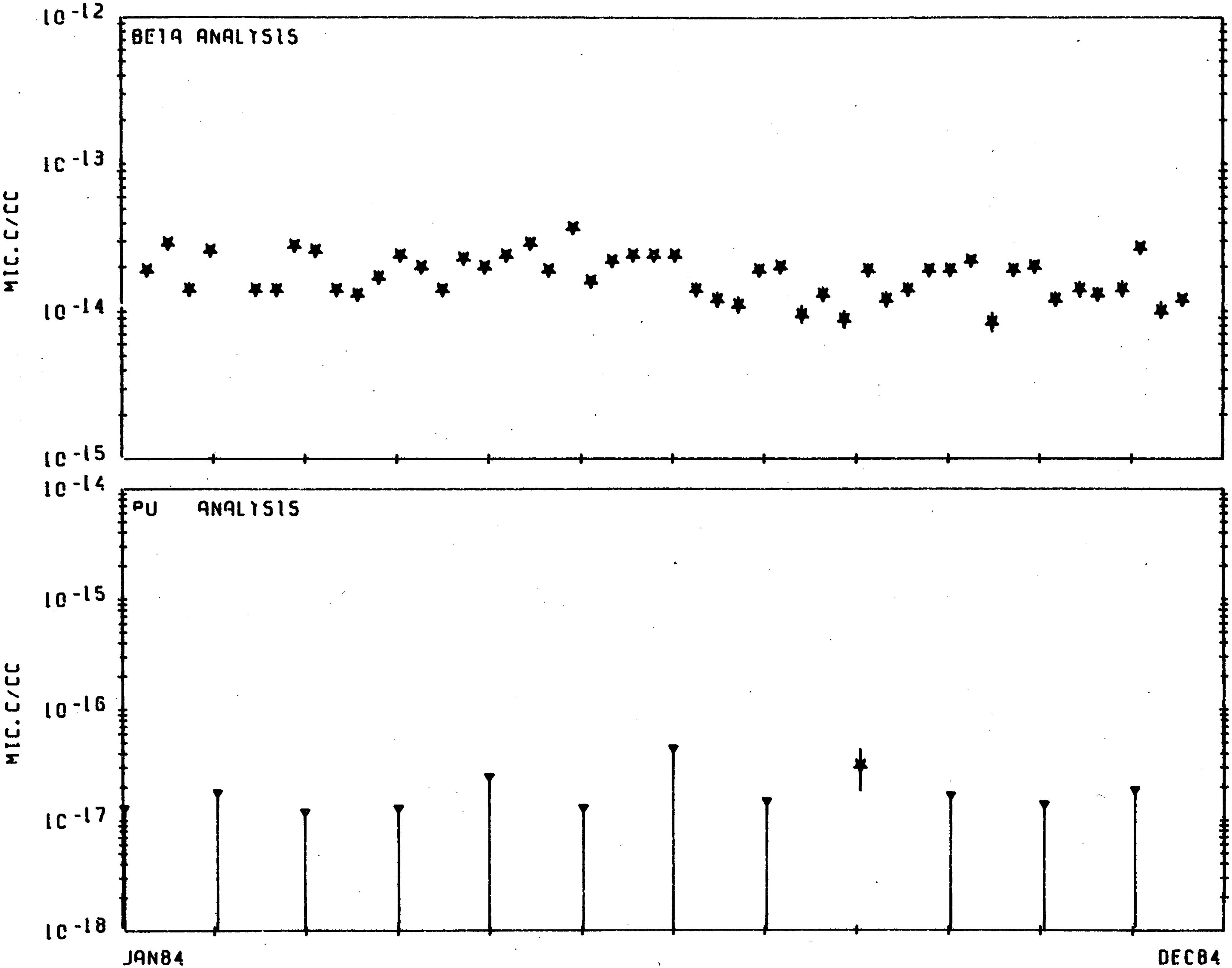
AIR SAMPLING STATION NUMBER 20



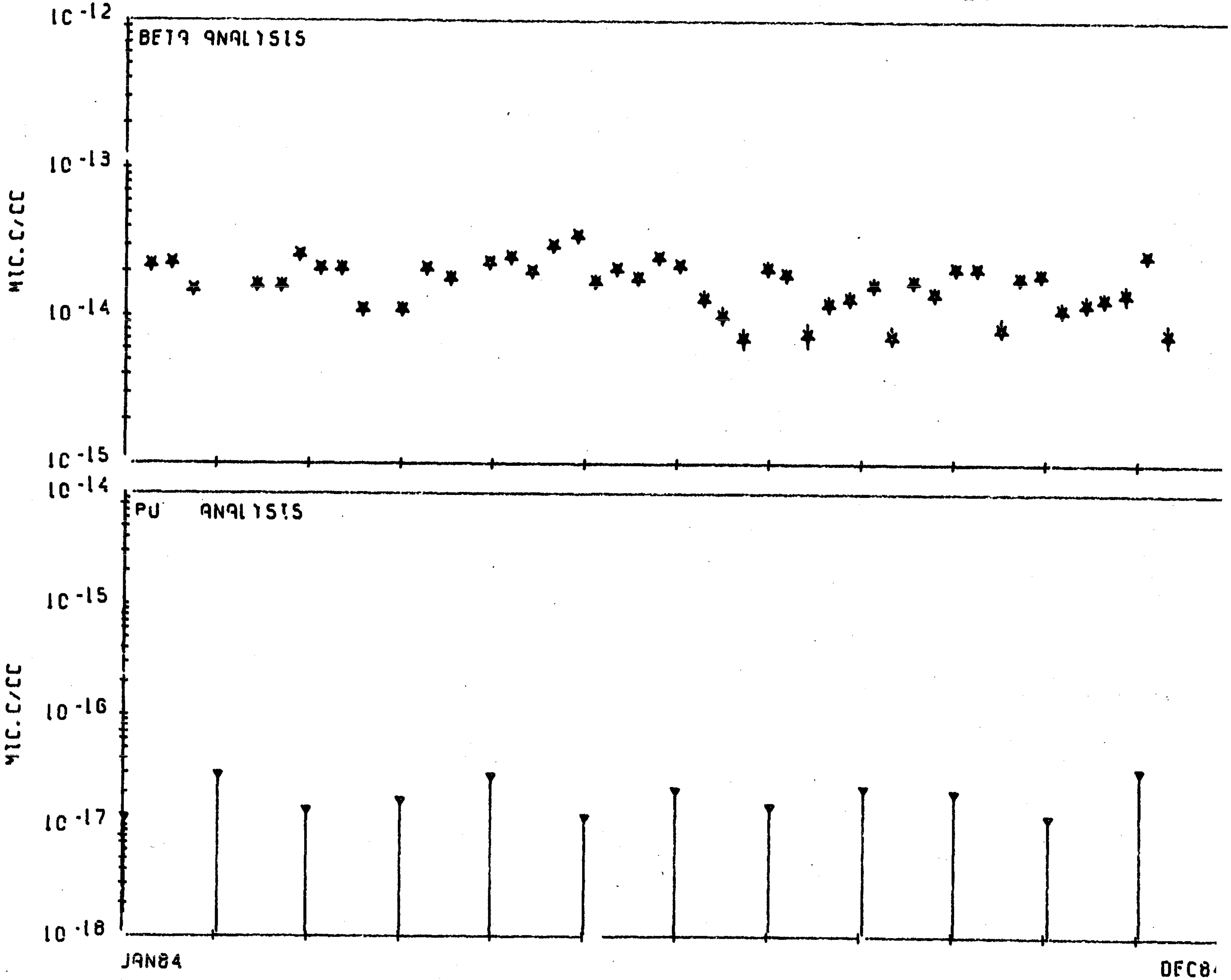

AIR SAMPLING STATION NUMBER 21
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10 -12
10 -13
10 -14
10 -15
10 -14
10 -15
10 -16
10 -17
10 -18
JAN84
DEC84

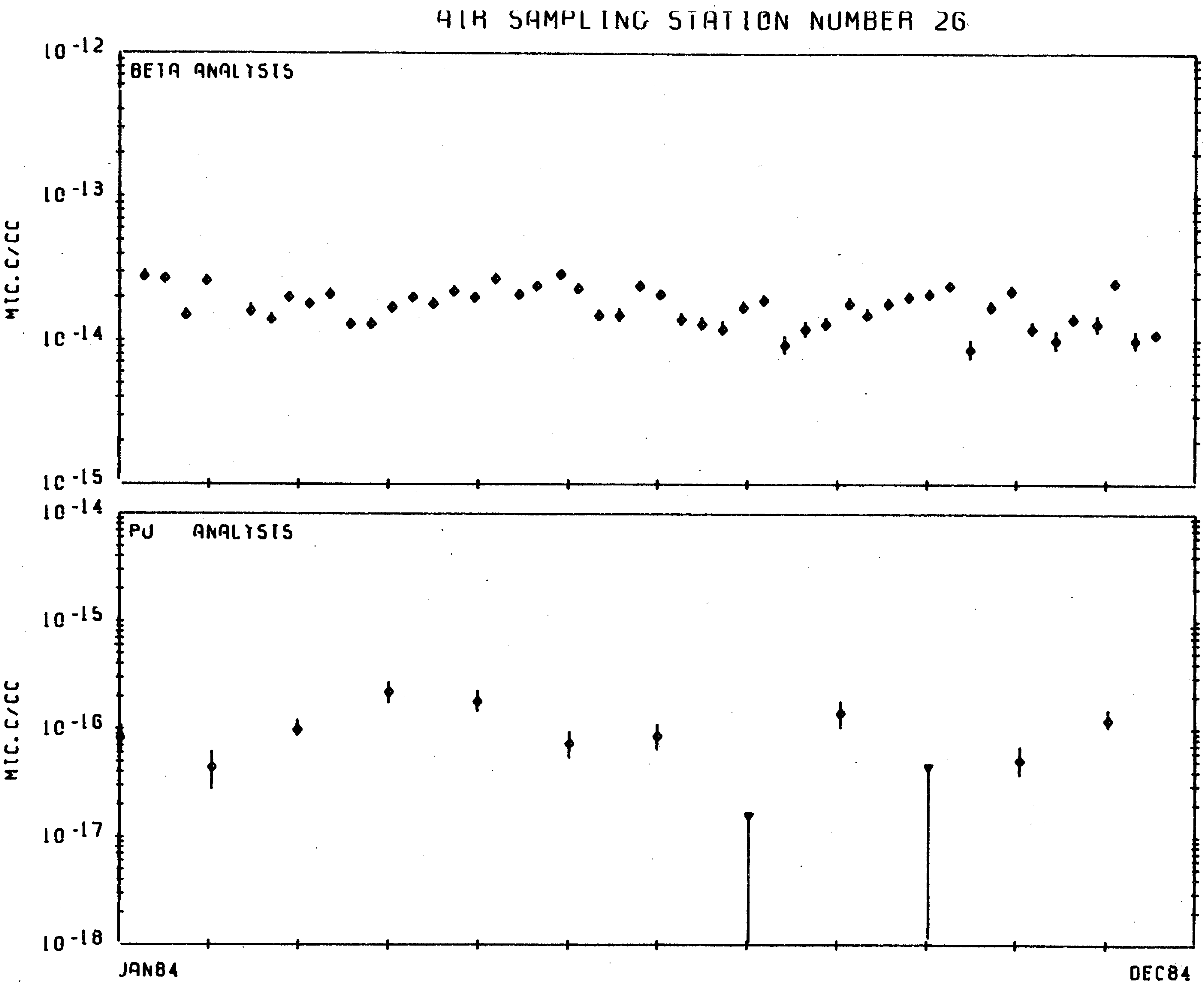

AIR SAMPLING STATION NUMBER 22
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10^{-12}
10^{-13}
10^{-14}
10^{-15}
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^{-18}
JAN84
DEC84

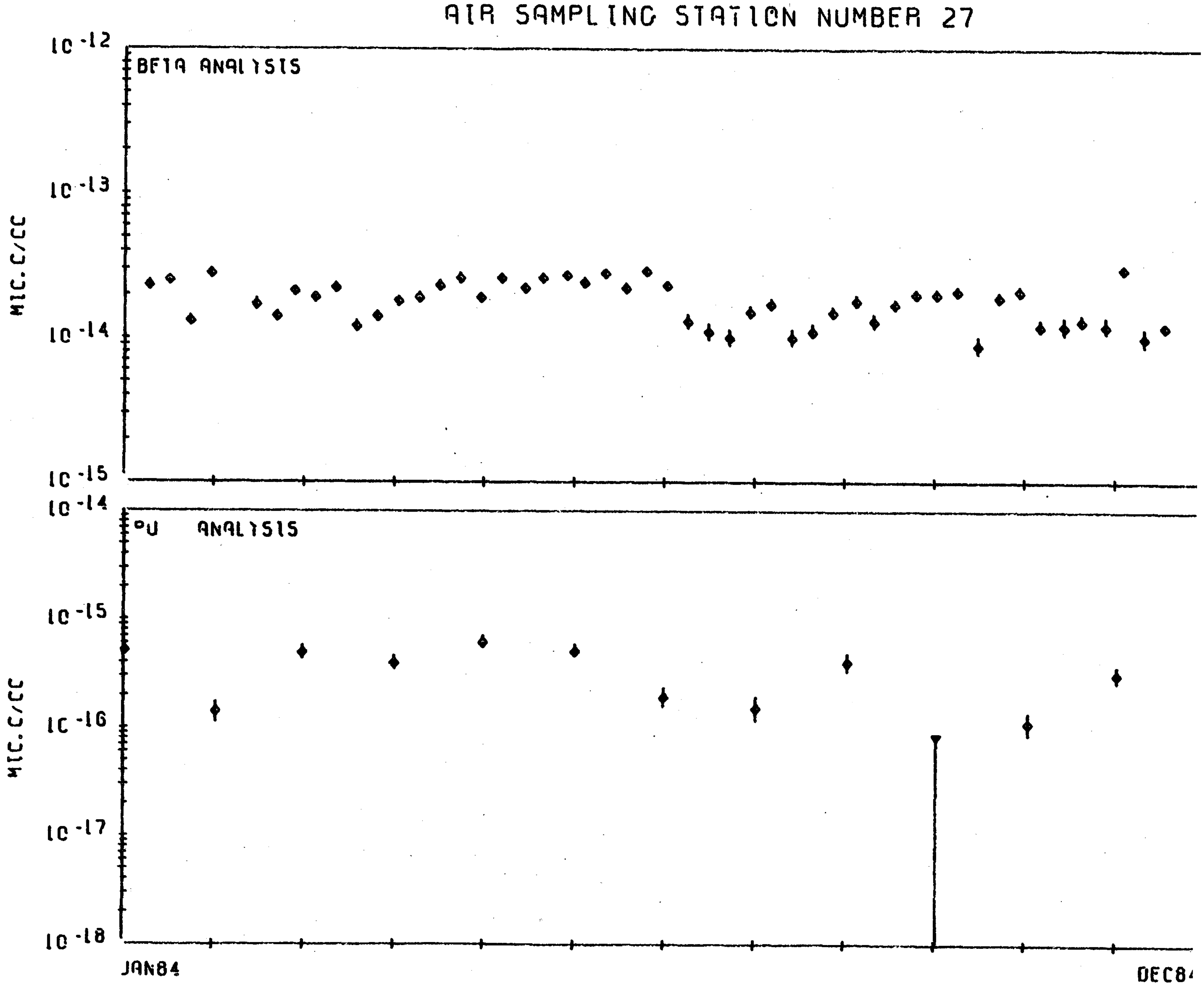
AIR SAMPLING STATION NUMBER 23

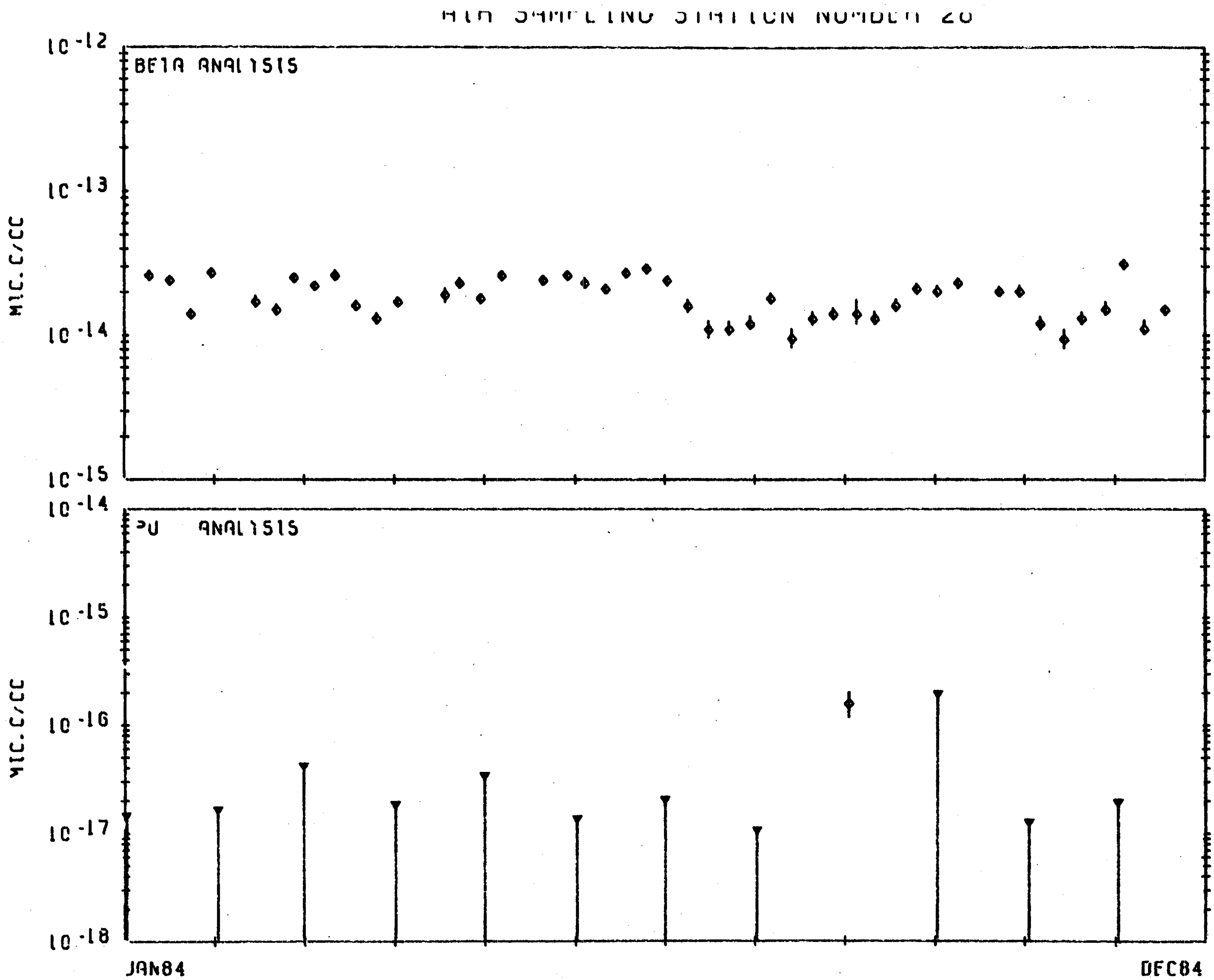


AIR SAMPLING STATION NUMBER 25

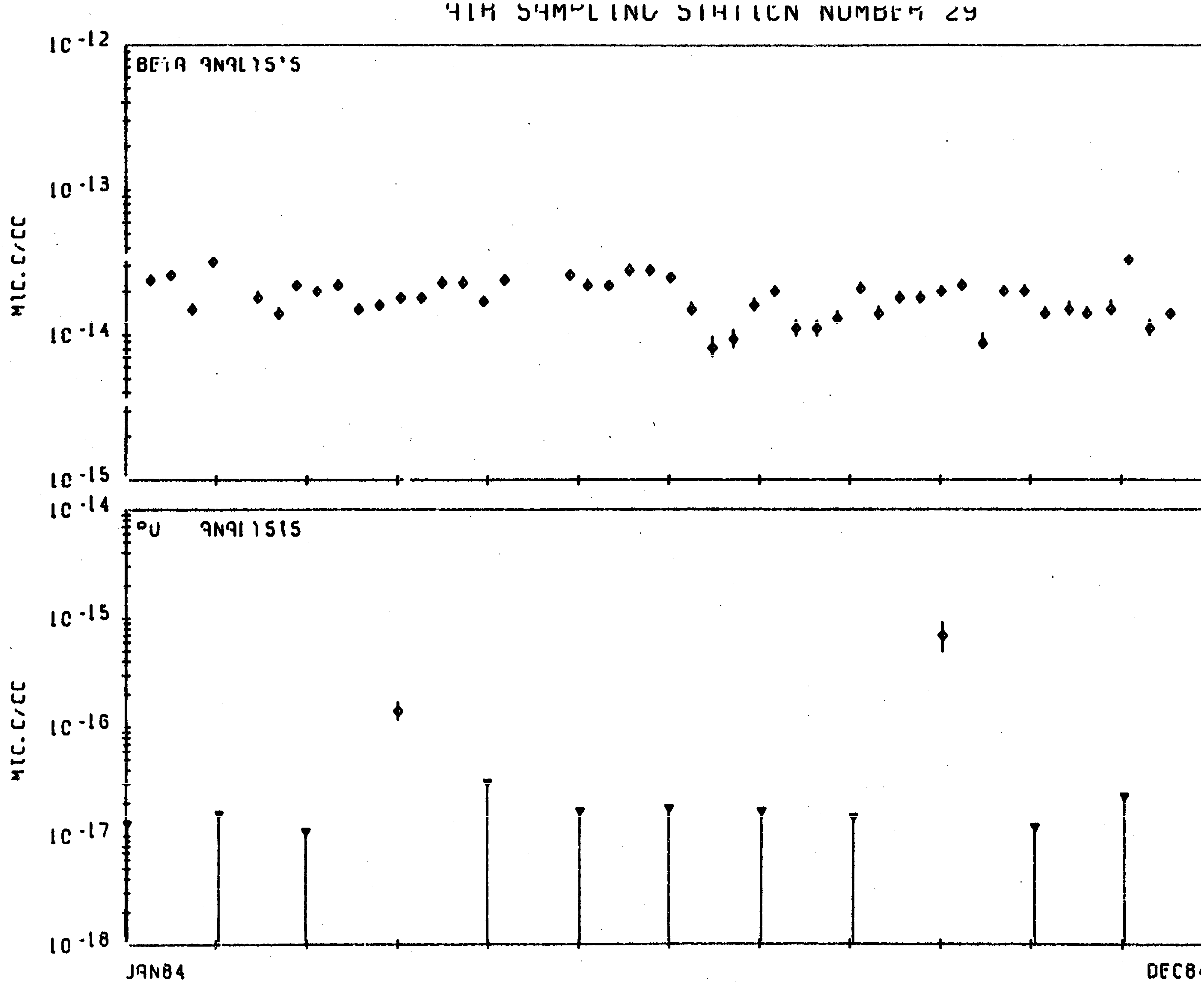



AIR SAMPLING STATION NUMBER 26
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10^{-12}
10^{-13}
10^{-14}
10^{-15}
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^{-18}
JAN84
DEC84

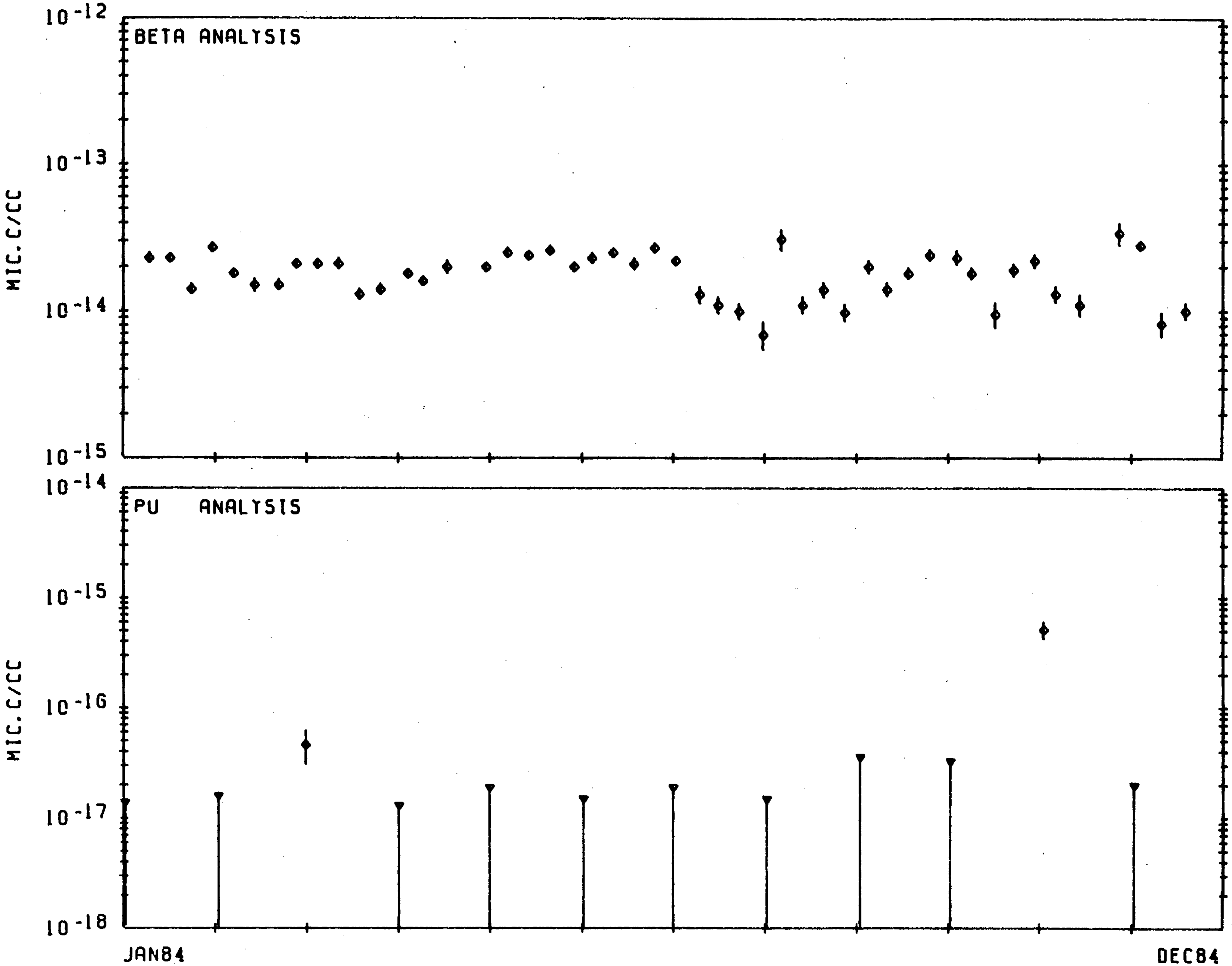

AIR SAMPLING STATION NUMBER 27
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10 -12
10 -13
10 -14
10 -15
10 -14
10 -15
10 -16
10 -17
10 -18
JAN84
DEC84



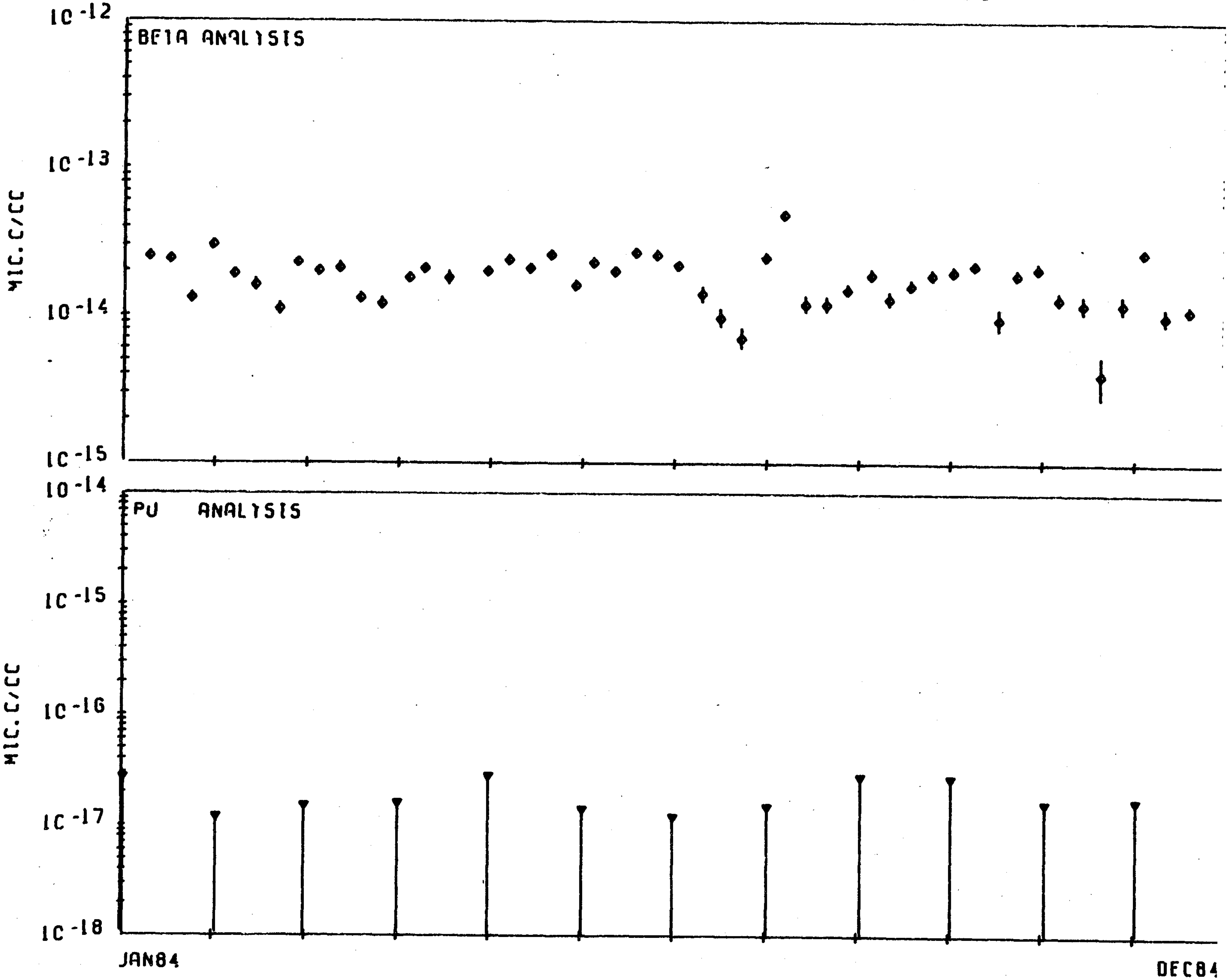
AIR SAMPLING STATION NUMBER
BETA ANALYSIS
MIC.C/CC
10 -12
10 -13
10 -14
10 -15
PU ANALYSIS
MIC.C/CC
10 -14
10 -15
10 -16
10 -17
10 -18
JAN84
DEC84


AIR SAMPLING STATION NUMBER 29
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10 -12
10 -13
10 -14
10 -15
10 -14
10 -15
10 -16
10 -17
10 -18
JAN84
DEC84

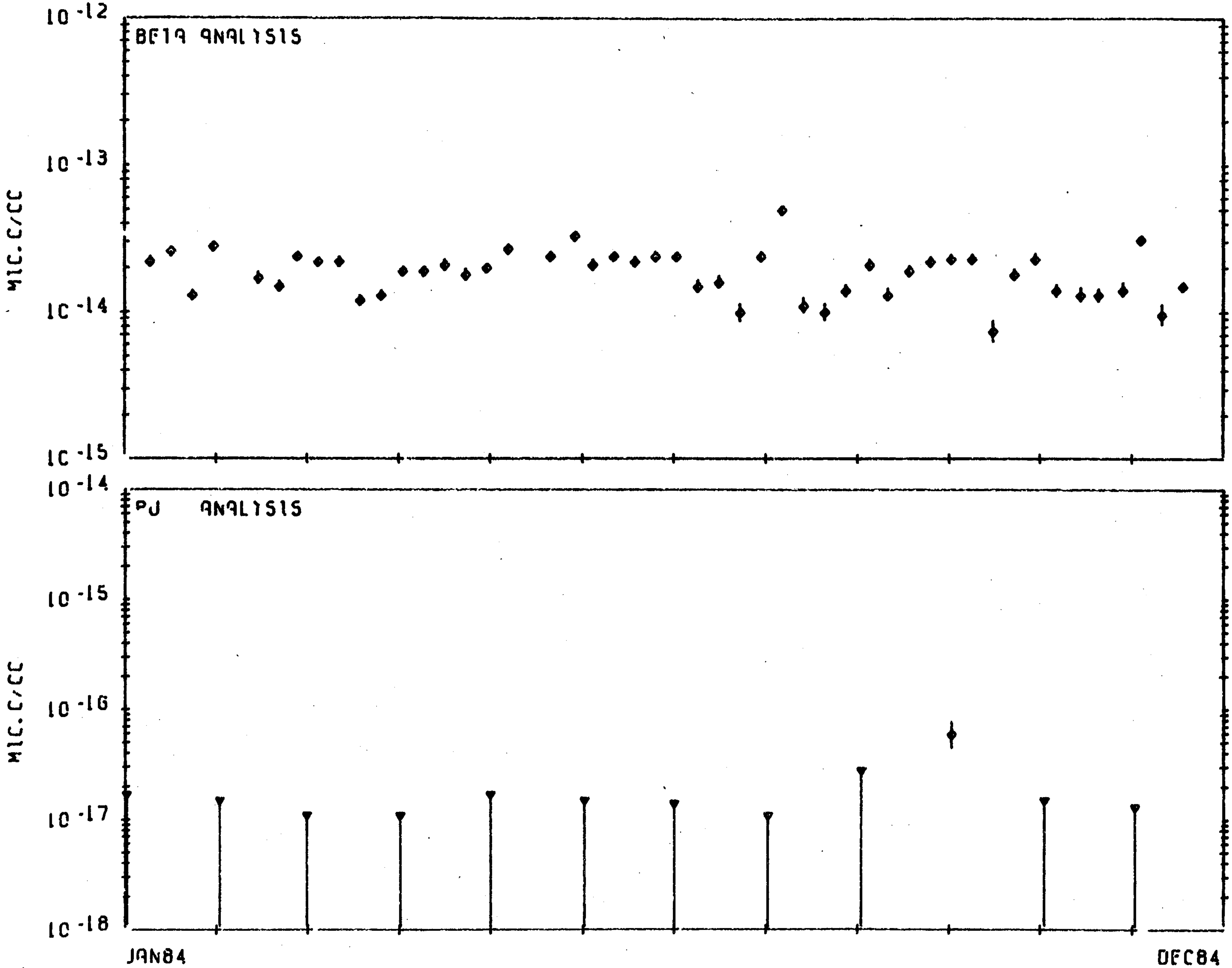
AIR SAMPLING STATION NUMBER 30

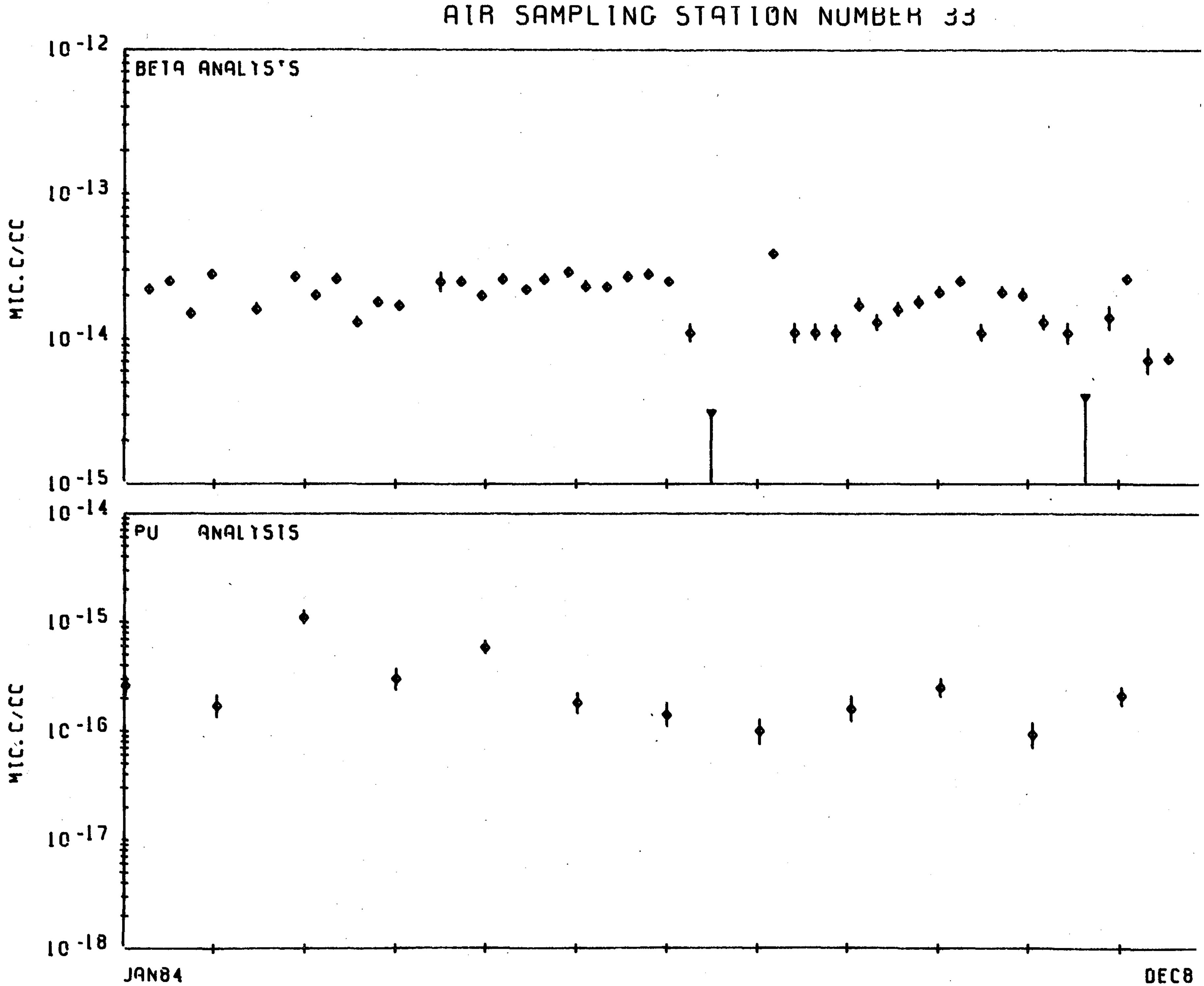


AIR SAMPLING STATION NUMBER 31



AIR SAMPLING STATION NUMBER 32




AIR SAMPLING STATION NUMBER 33
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
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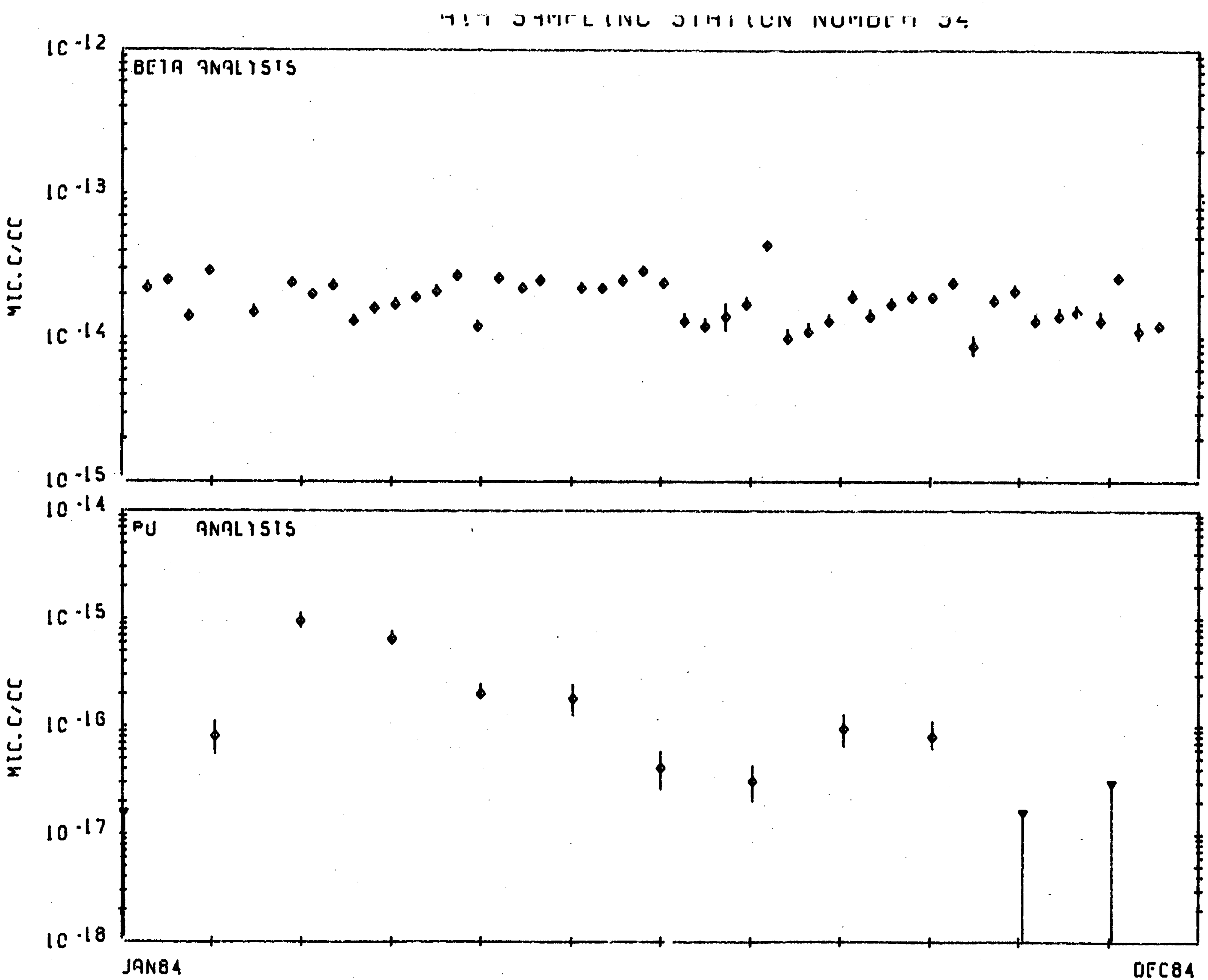
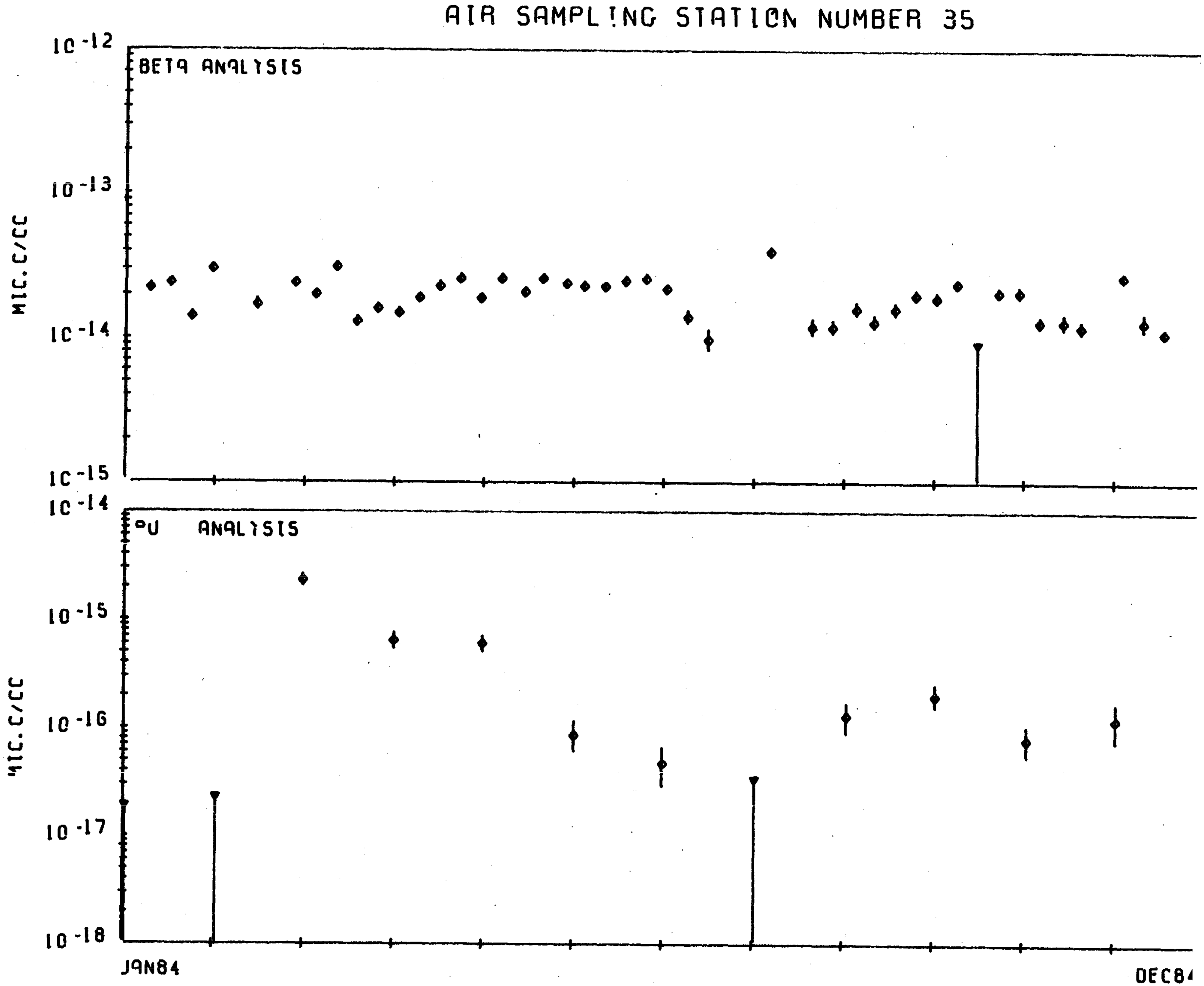
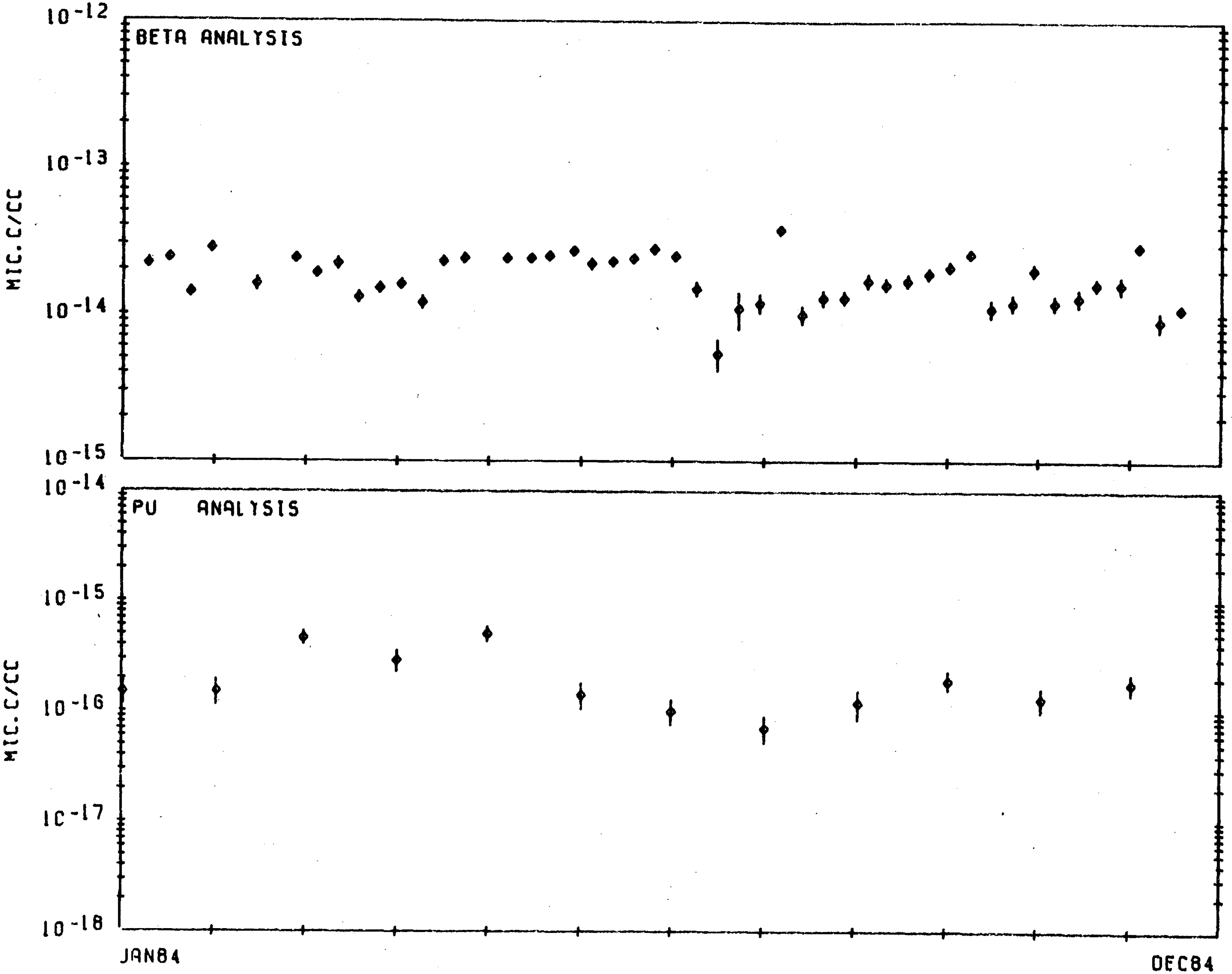
10^{-13}
10^{-14}
10^{-15}
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^{-18}
JAN84
DEC8

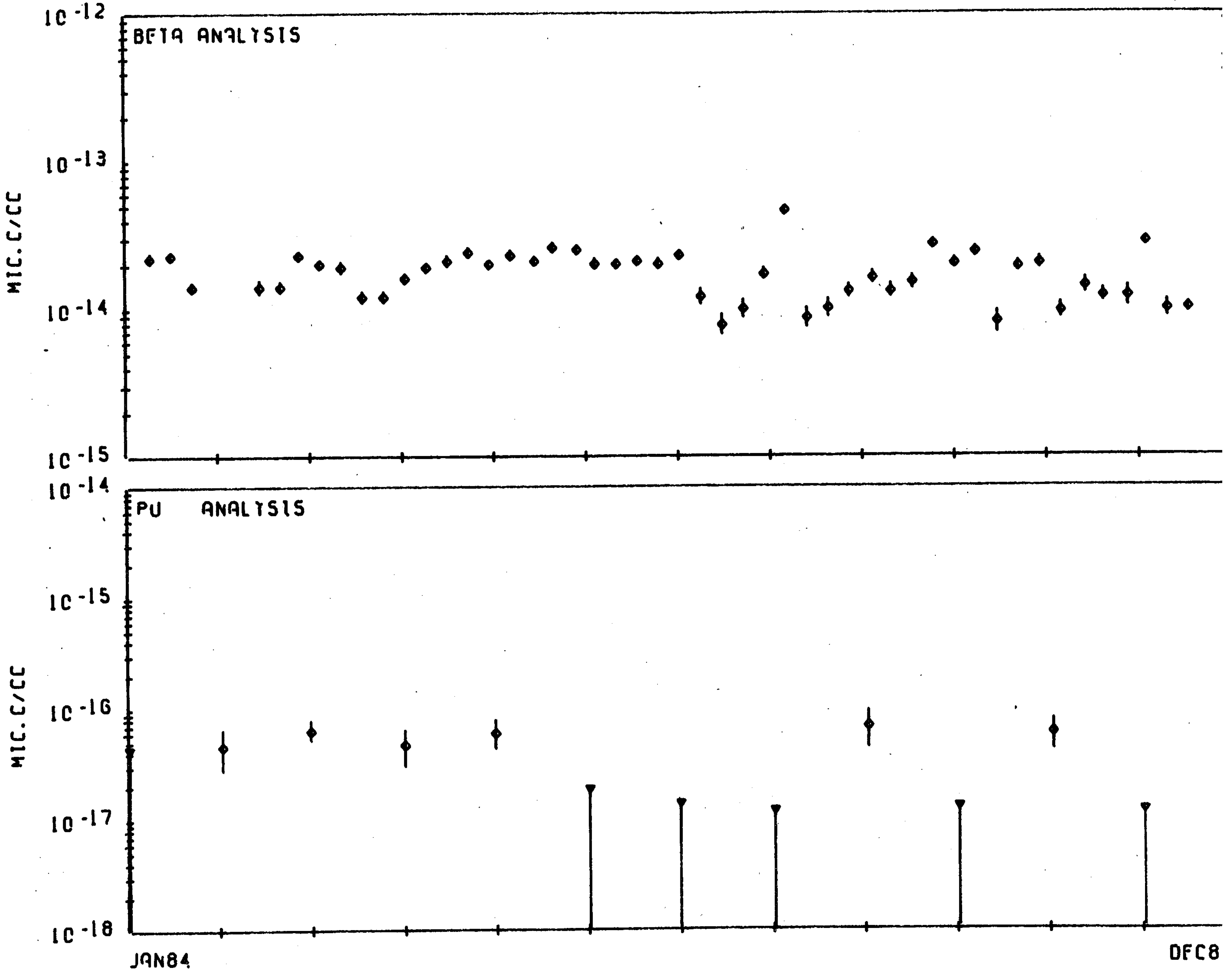

SAMPLING STATION NUMBER 54
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10^-12
10^-13
10^-14
10^-15
10^-14
10^-15
10^-16
10^-17
10^-18
JAN84
DEC84

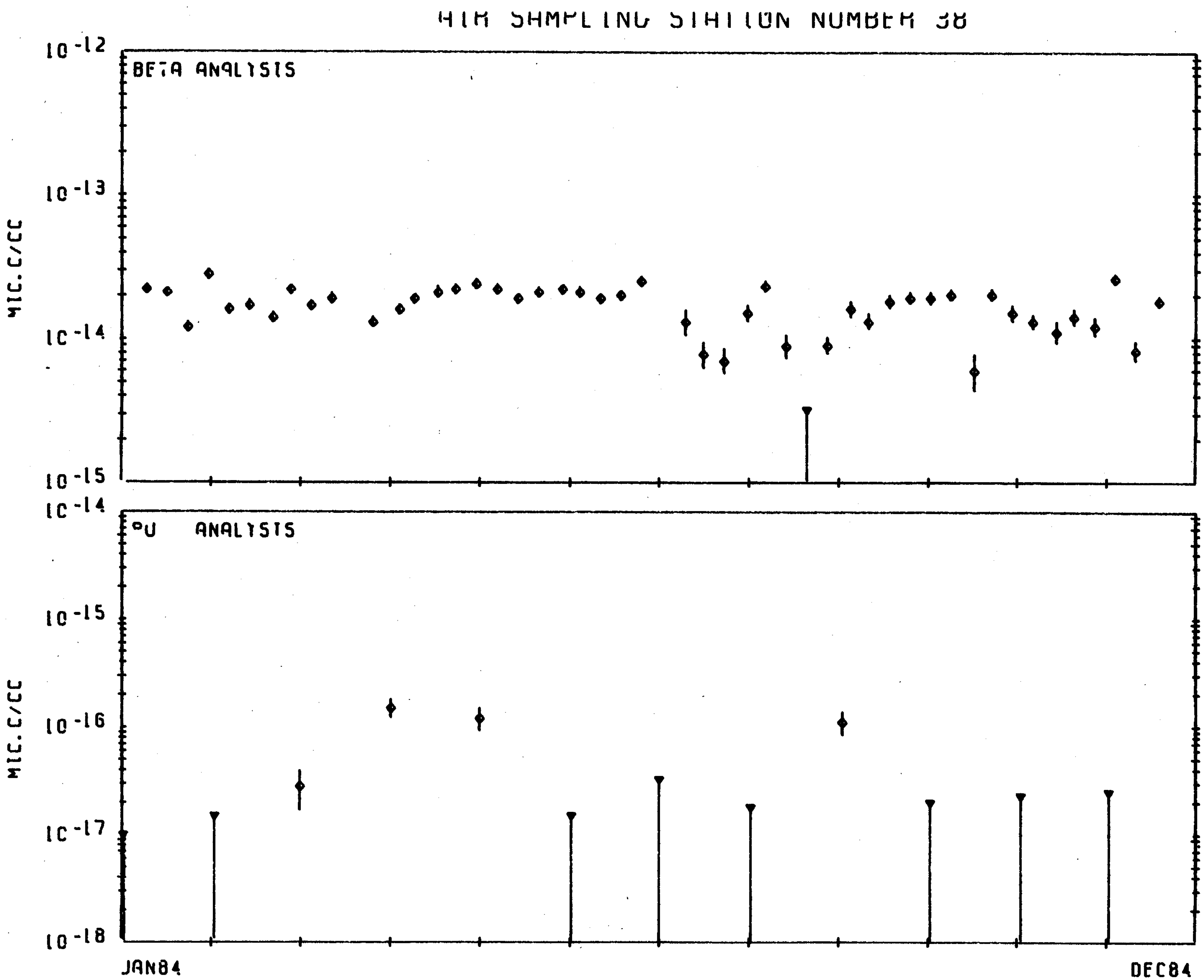

AIR SAMPLING STATION NUMBER 35
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10 -12
10 -13
10 -14
10 -15
10 -14
10 -15
10 -16
10 -17
10 -18
JAN84
DEC84

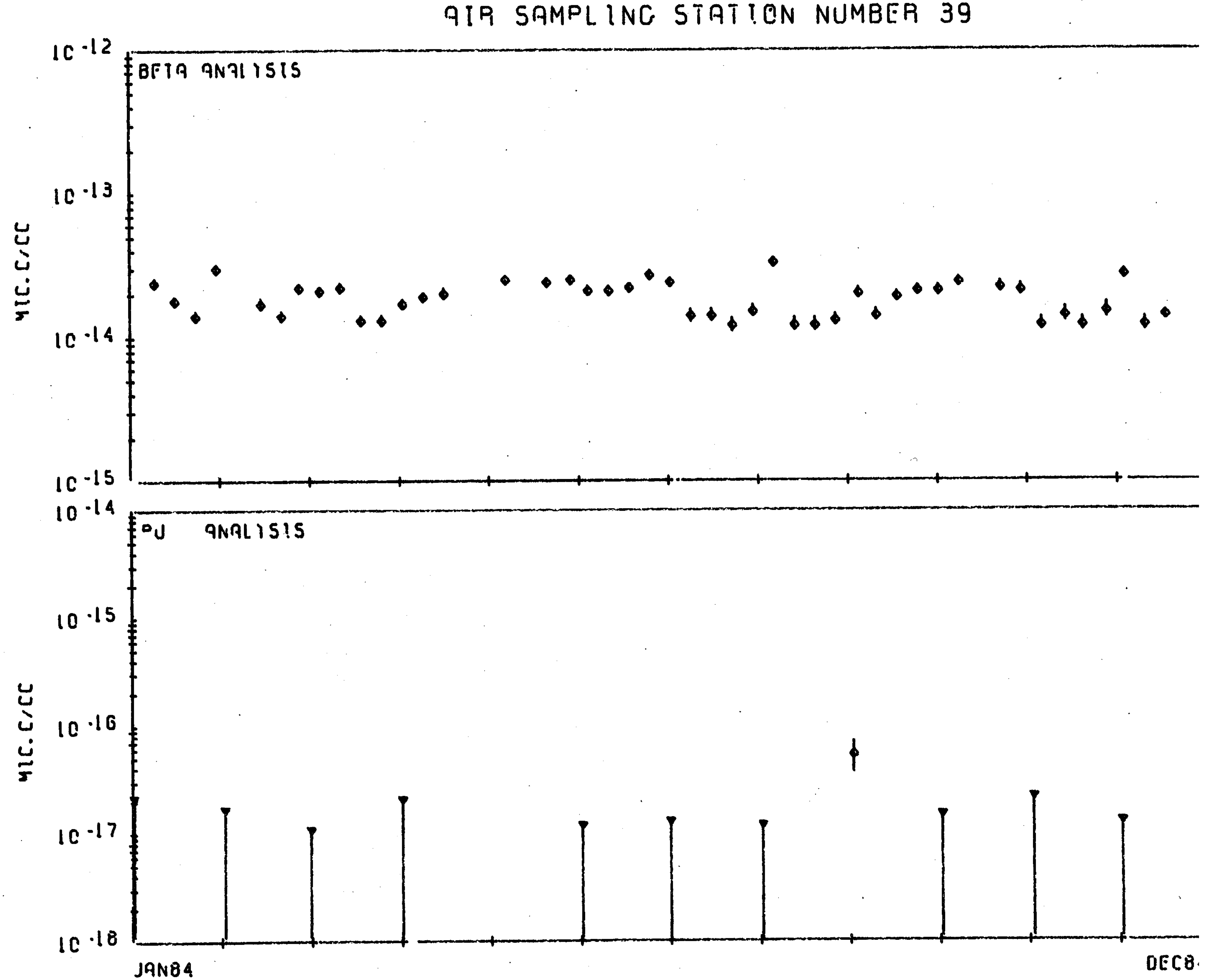
AIR SAMPLING STATION NUMBER 36

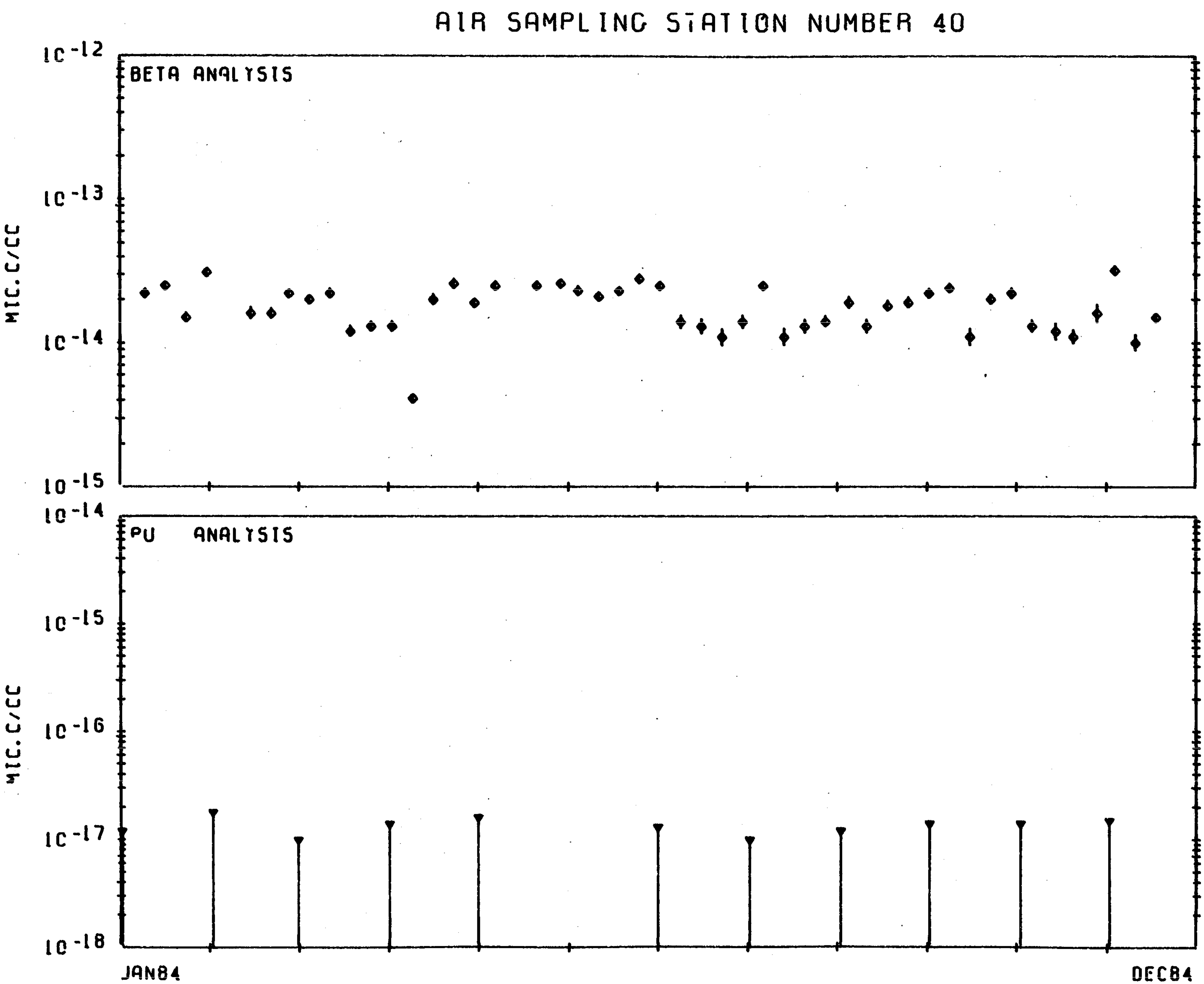


AIR SAMPLING STATION NUMBER 37

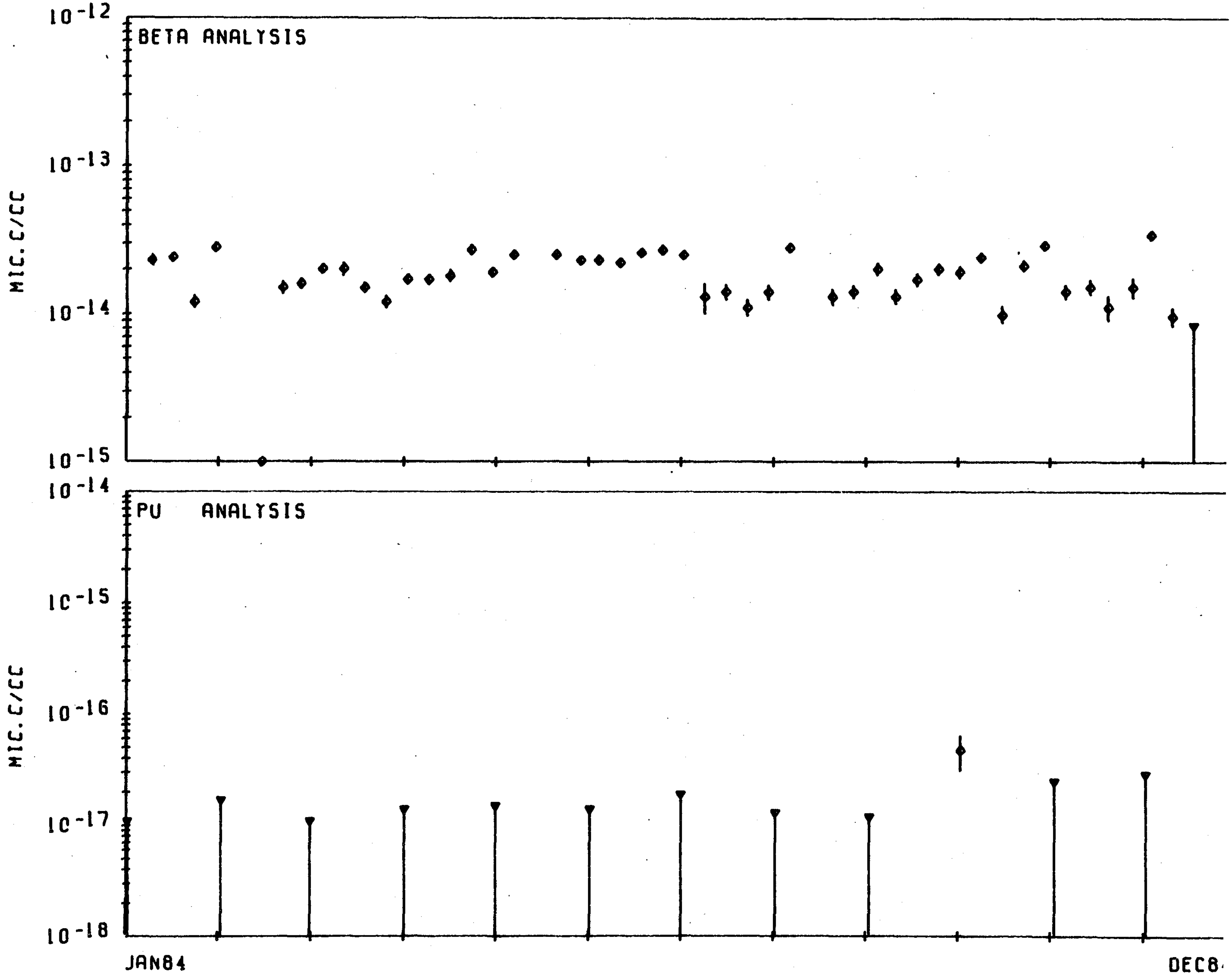



AIR SAMPLING STATION NUMBER 38
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10^{-12}
10^{-13}
10^{-14}
10^{-15}
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^{-18}
JAN84
DEC84

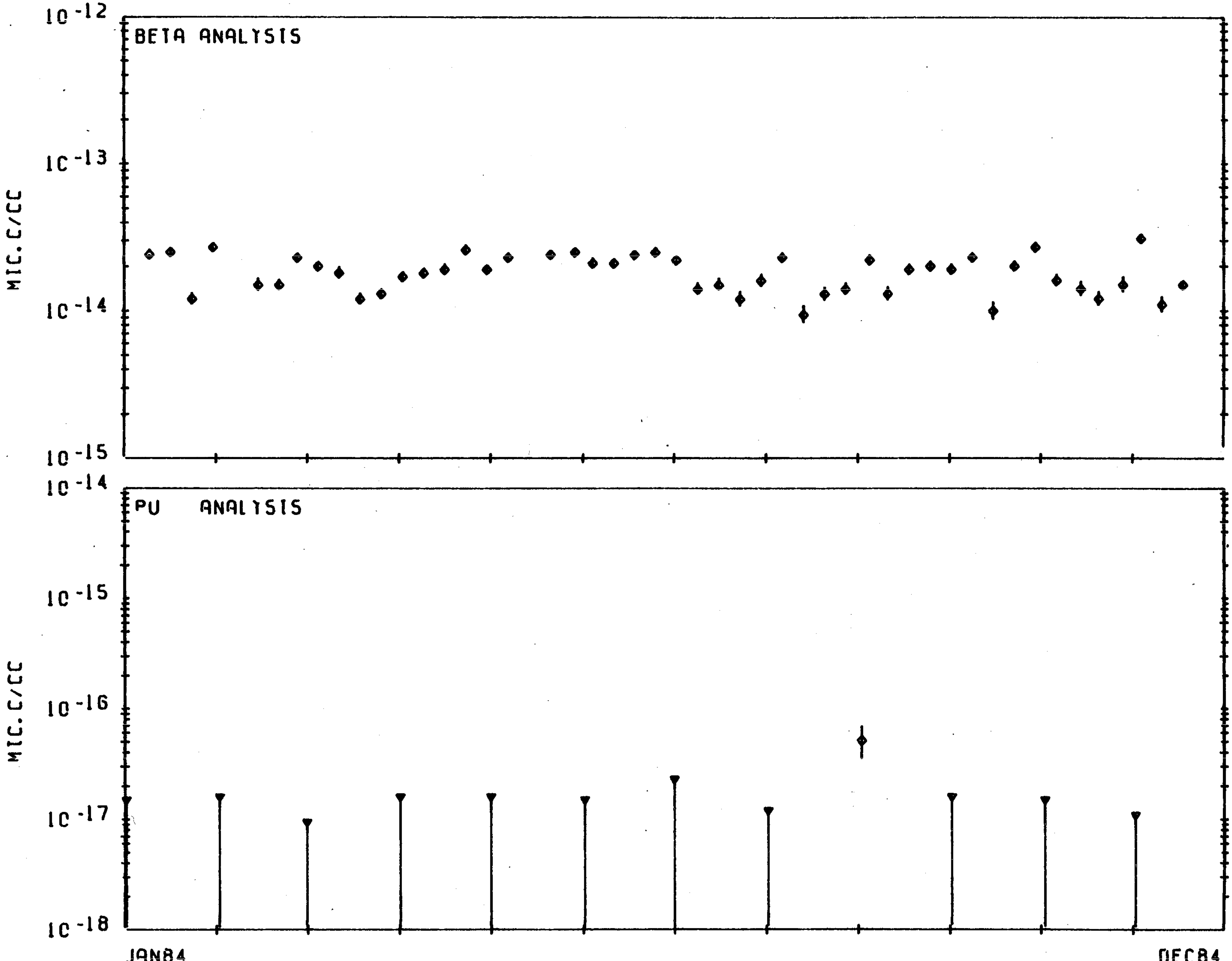

AIR SAMPLING STATION NUMBER 39
BETA ANALISIS
PU ANALISIS
MIC.C/CC
MIC.C/CC
10 -12
10 -13
10 -14
10 -15
10 -14
10 -15
10 -16
10 -17
10 -18
JAN84
DEC8

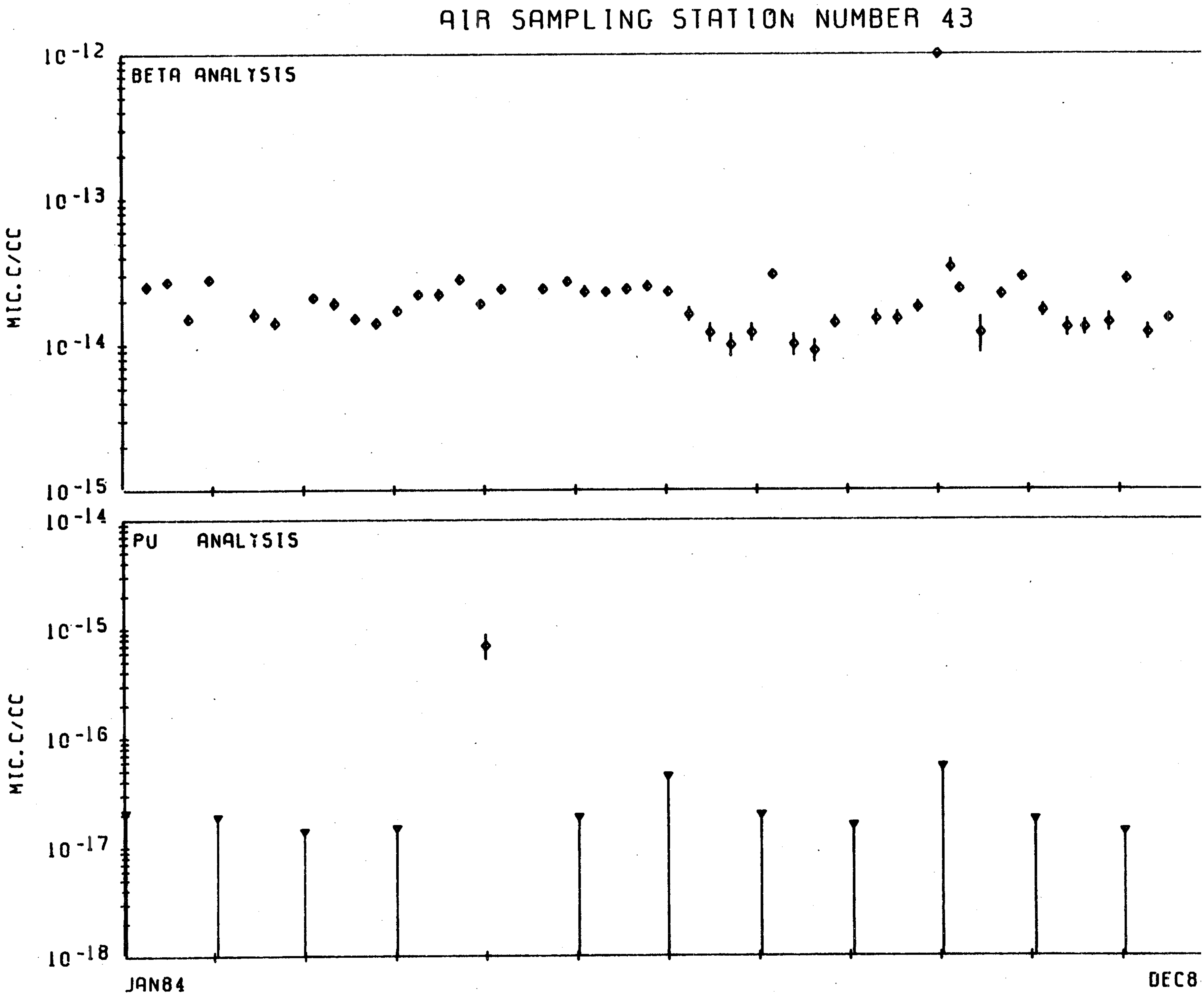

AIR SAMPLING STATION NUMBER 40
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10 -12
10 -13
10 -14
10 -15
10 -14
10 -15
10 -16
10 -17
10 -18
JAN84
DEC84

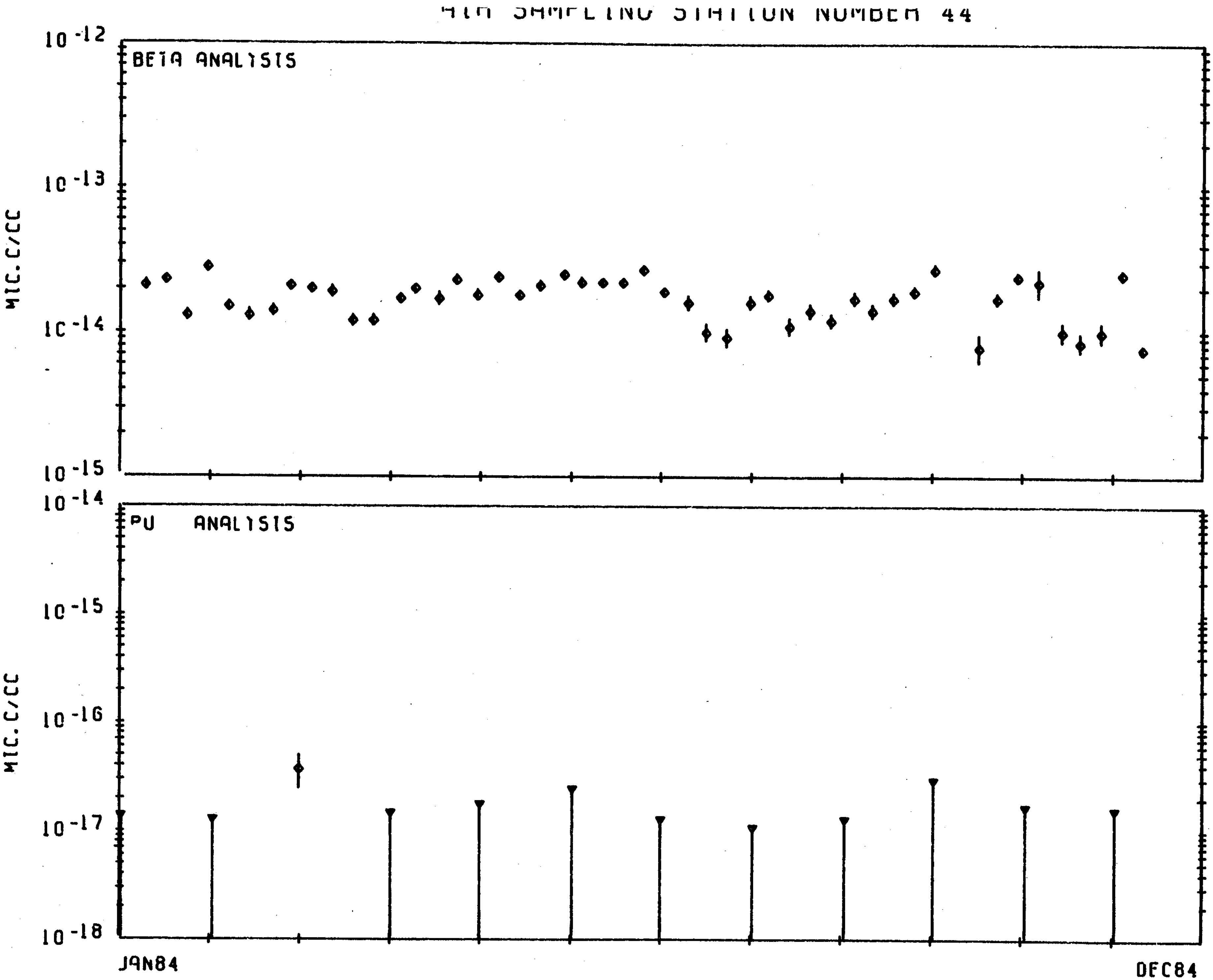
AIR SAMPLING STATION NUMBER 41

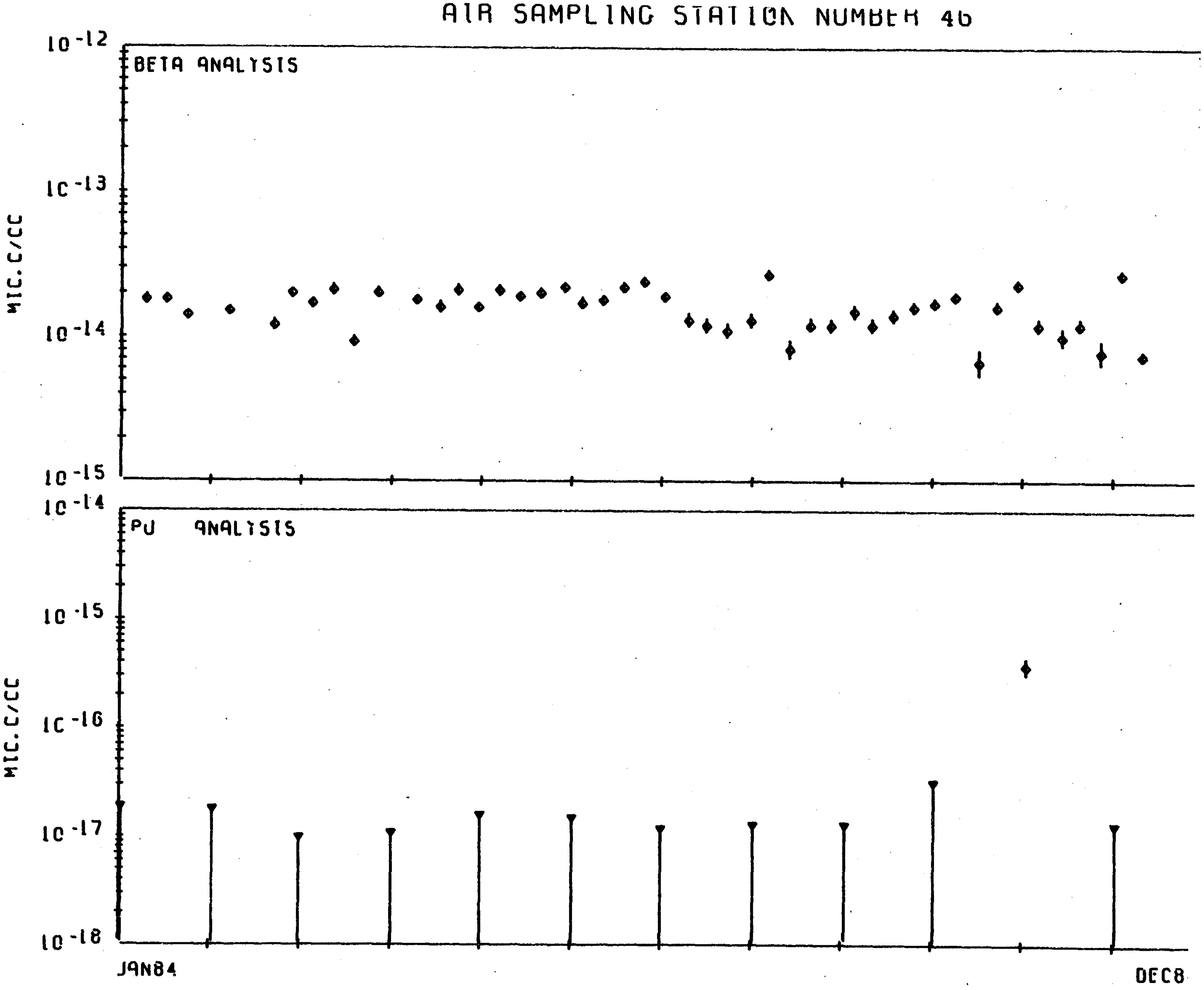


AIR SAMPLING STATION NUMBER 42



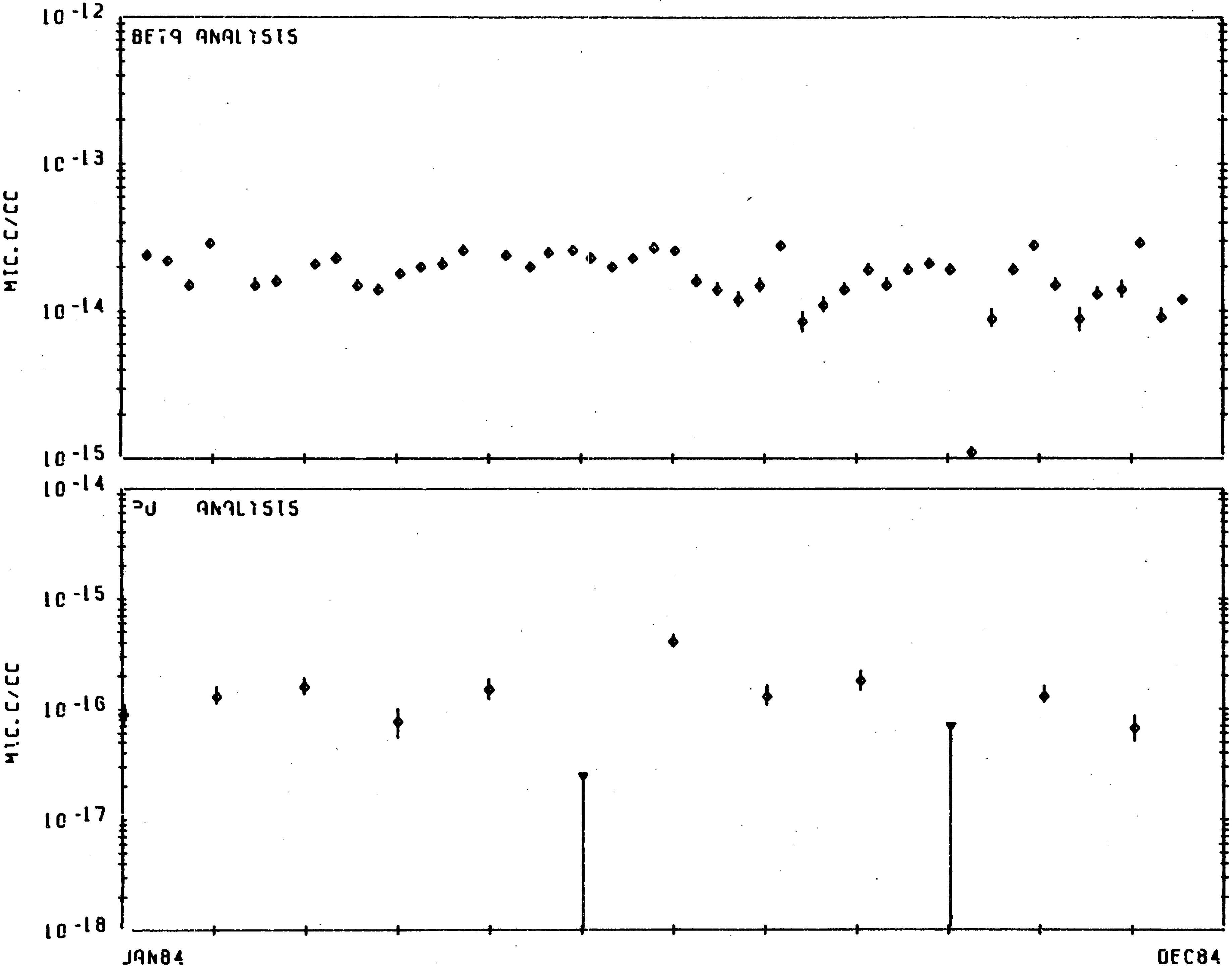

AIR SAMPLING STATION NUMBER 43
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10-12
10-13
10-14
10-15
10-14
10-15
10-16
10-17
10-18
JAN84
DEC8

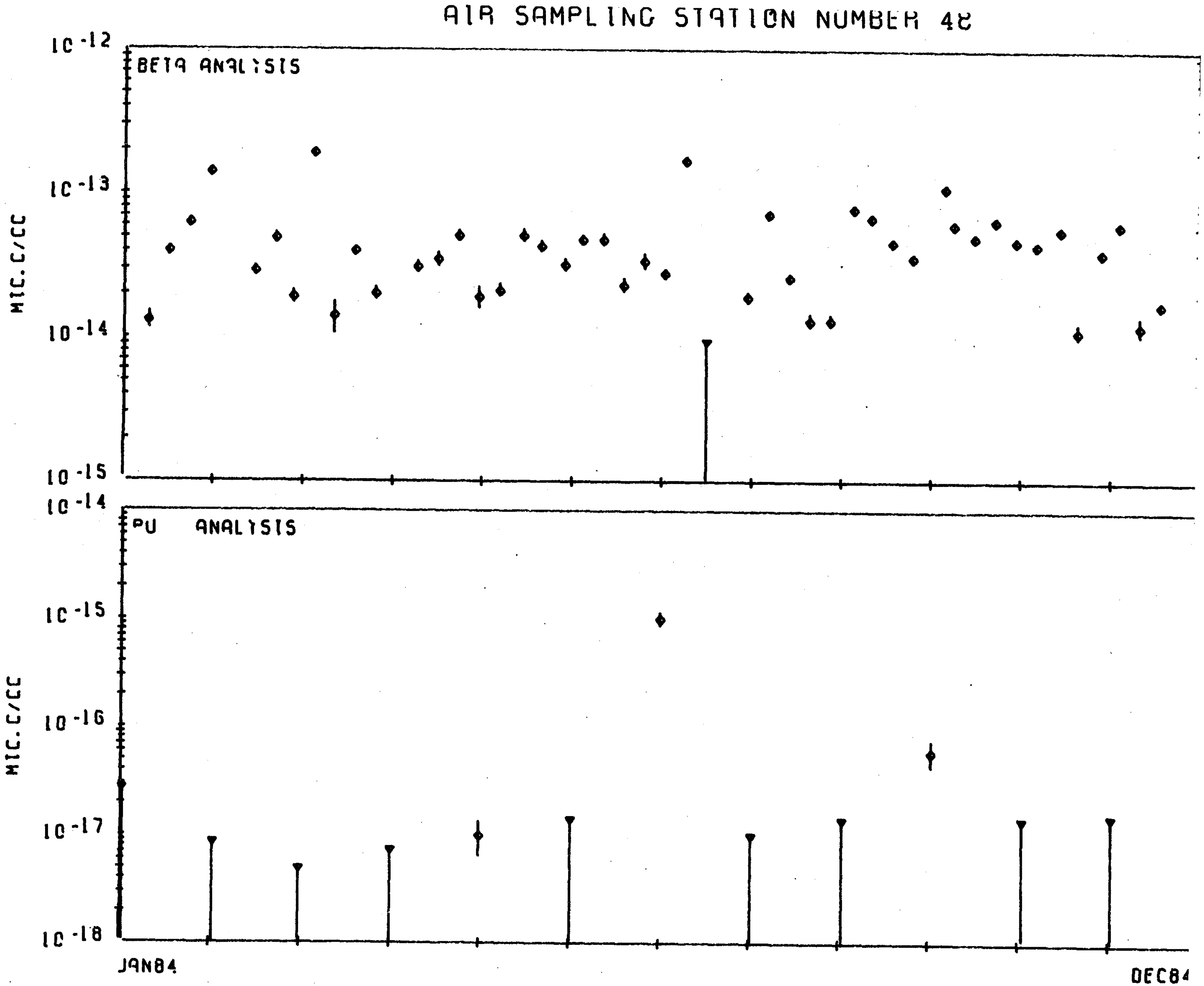

AIR SAMPLING STATION NUMBER 44
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10 -12
10 -13
10 -14
10 -15
10 -14
10 -15
10 -16
10 -17
10 -18
JAN84
DEC84



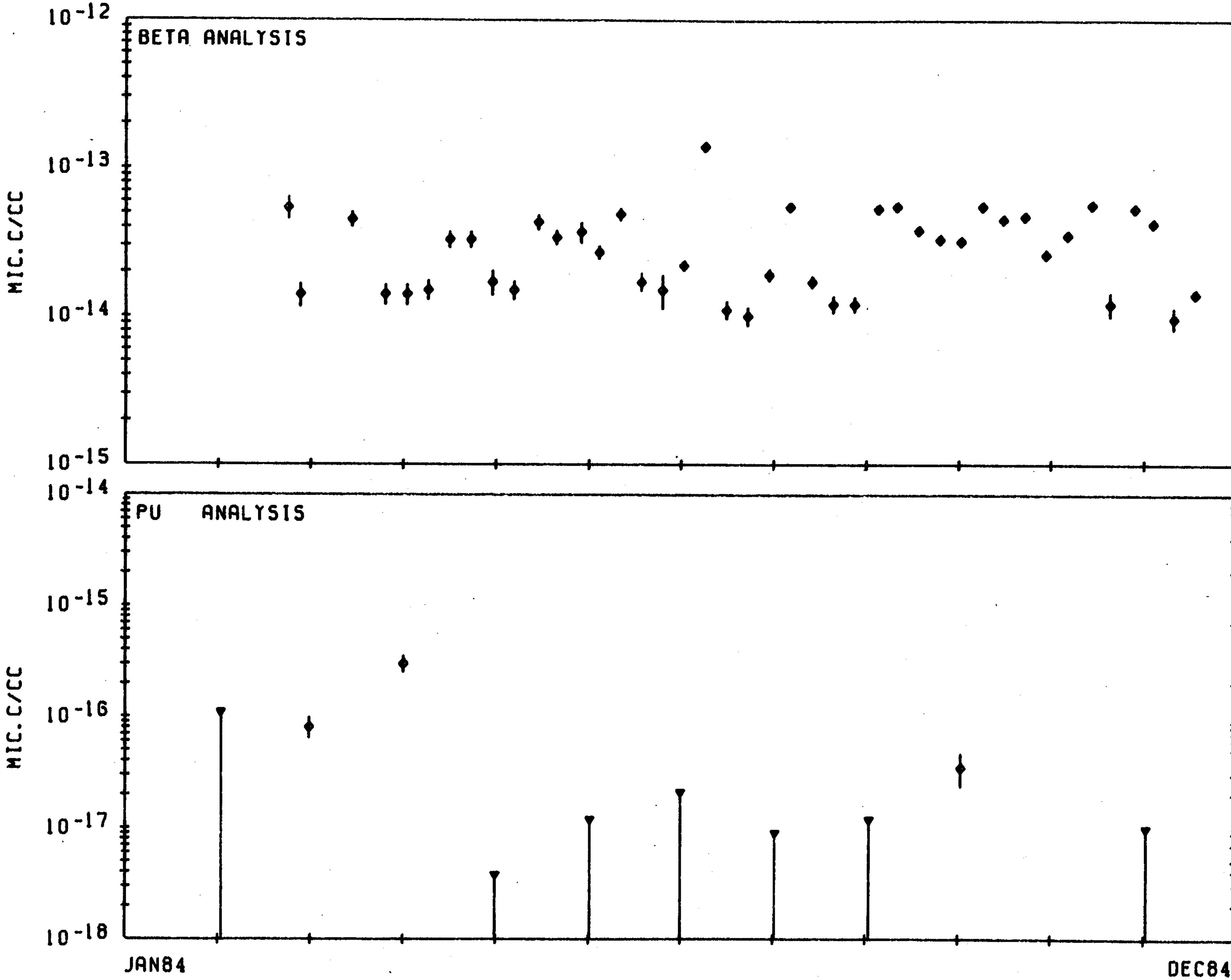
AIR SAMPLING STATION NUMBER 46
BETA ANALYSIS
PU ANALYSIS
MIC.C/CC
MIC.C/CC
10-12
10-13
10-14
10-15
10-14
10-15
10-16
10-17
10-18
JAN84
DEC8

AIR SAMPLING STATION NUMBER 47




AIR SAMPLING STATION NUMBER 48
BETA ANALYSIS
MIC.C/CC
10 -12
10 -13
10 -14
10 -15
PU ANALYSIS
10 -14
10 -15
10 -16
10 -17
10 -18
JAN84
DEC84

AIR SAMPLING STATION NUMBER 49



APPENDIX B

NTS Environmental Surveillance

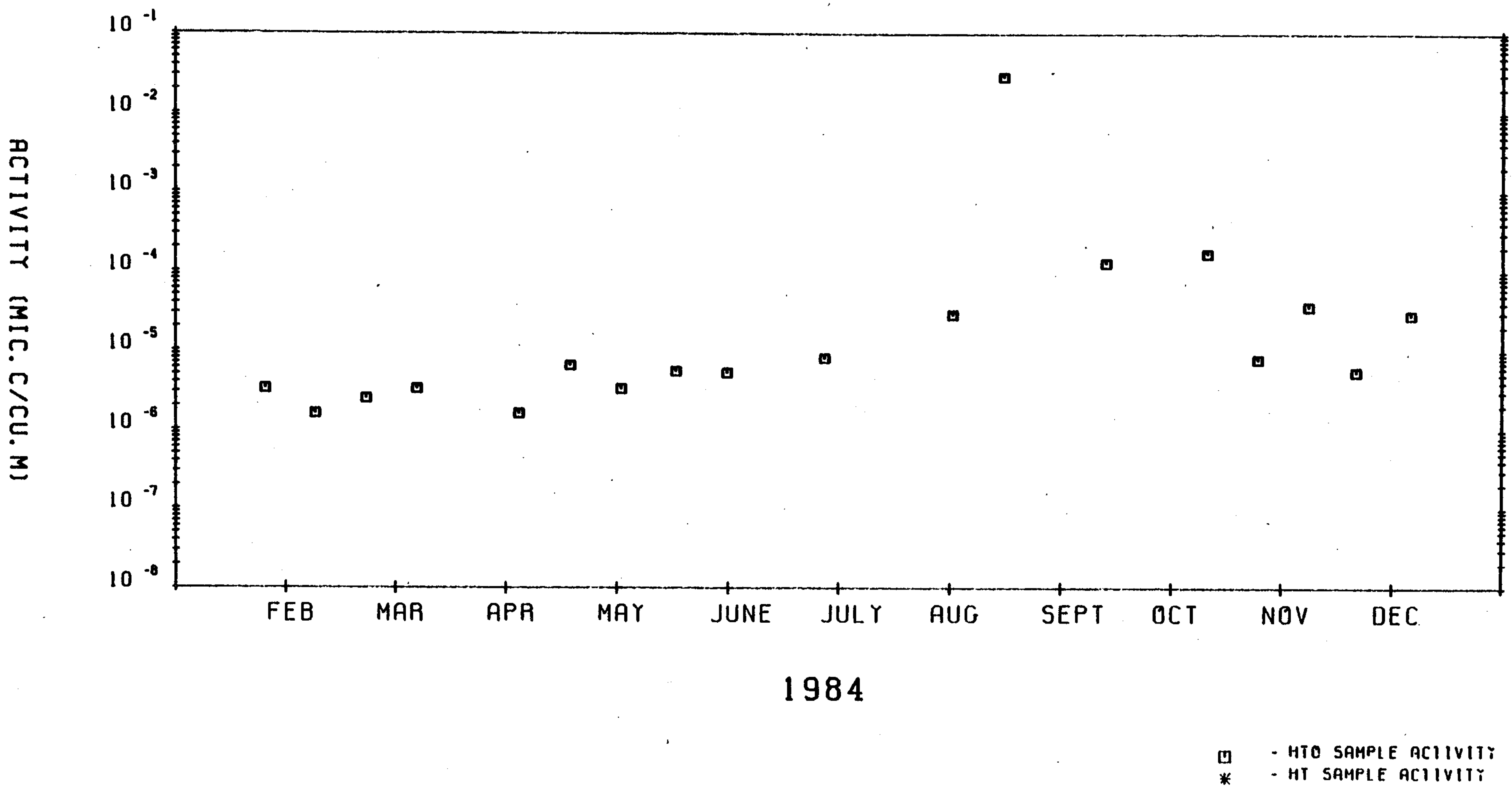
Tritium in Air Sampling Locations and Plots

The tritium in air data for each station is plotted in Appendix B for the entire year.

NTS ENVIRONMENTAL SURVEILLANCE
TRITIUM IN AIR SAMPLING LOCATIONS

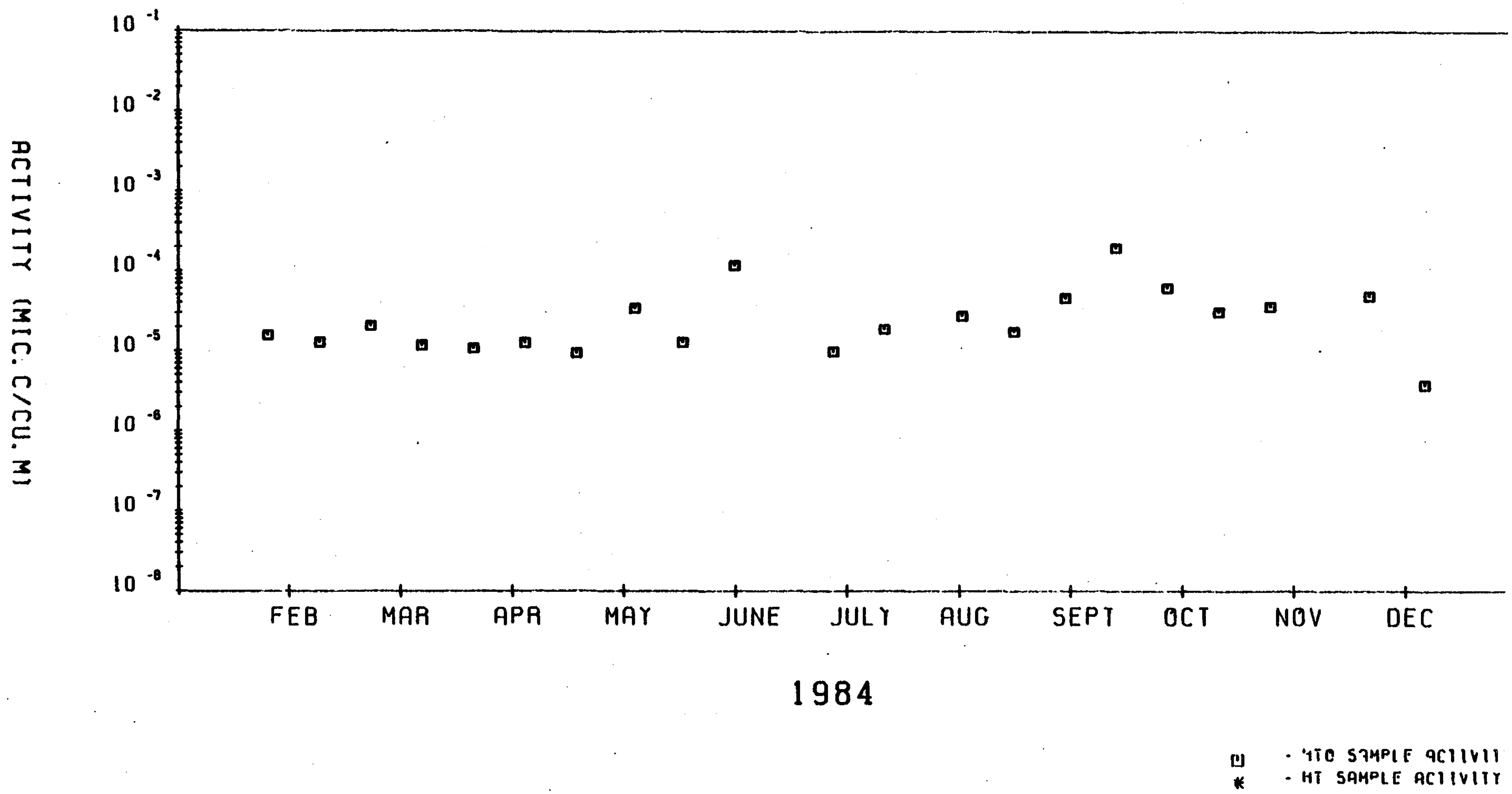
Area	Location
1	BJY
5	RWMS - 1
5	RWMS - SE
5	RWMS - (SE-NE)
5	RWMS - NE
5	RWMS - (NE-NW)
5	RWMS - NW
5	RWMS - (NW-SW)
5	RWMS - SW
5	RWMS - (SW-SE)
12	Base Camp
15	EPA Farm
15	Gate 700
23	Bldg. 790
23	Bldg. 650
23	Site Boundary
25	EMAD

BJY, AREA 1

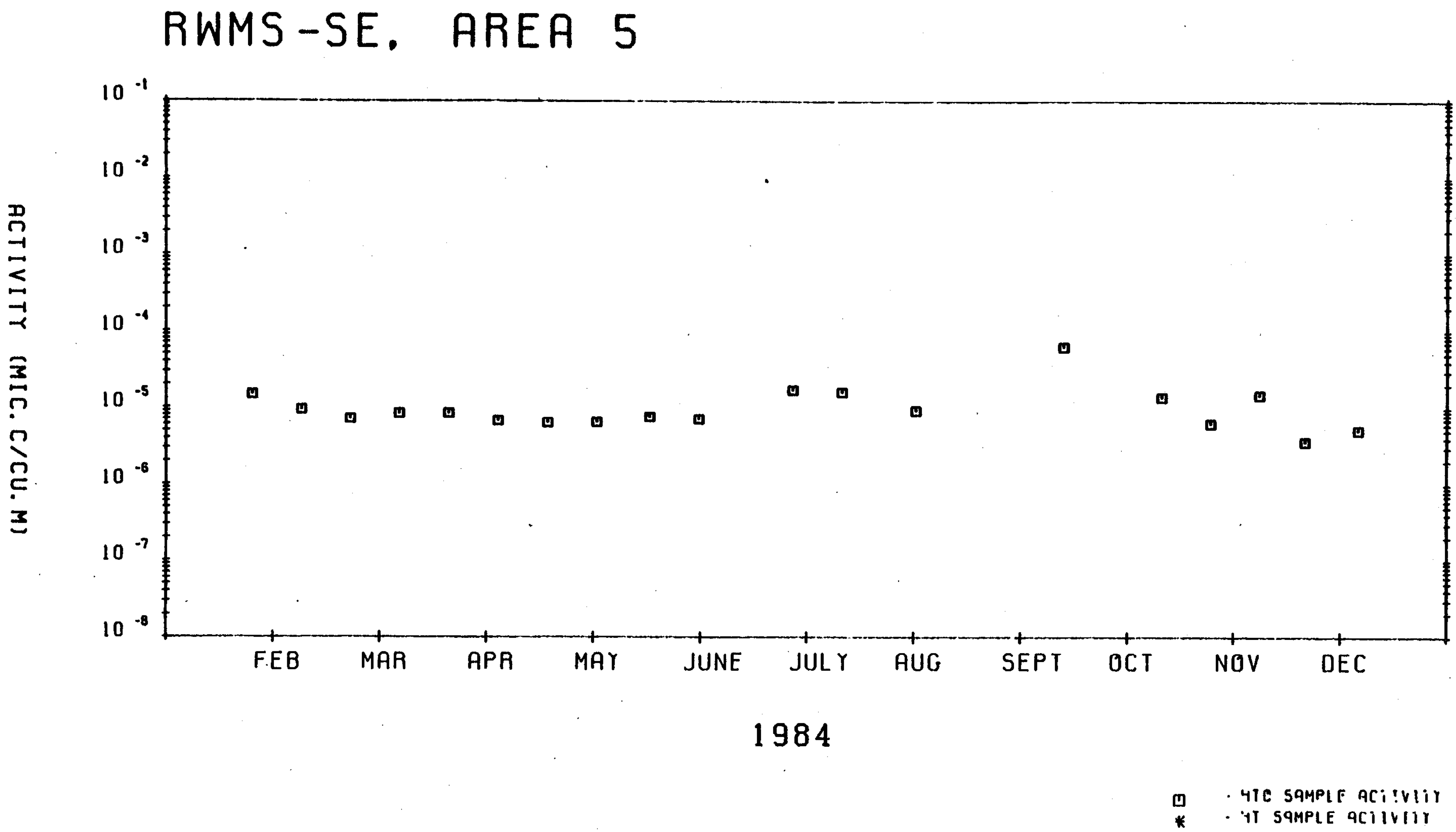


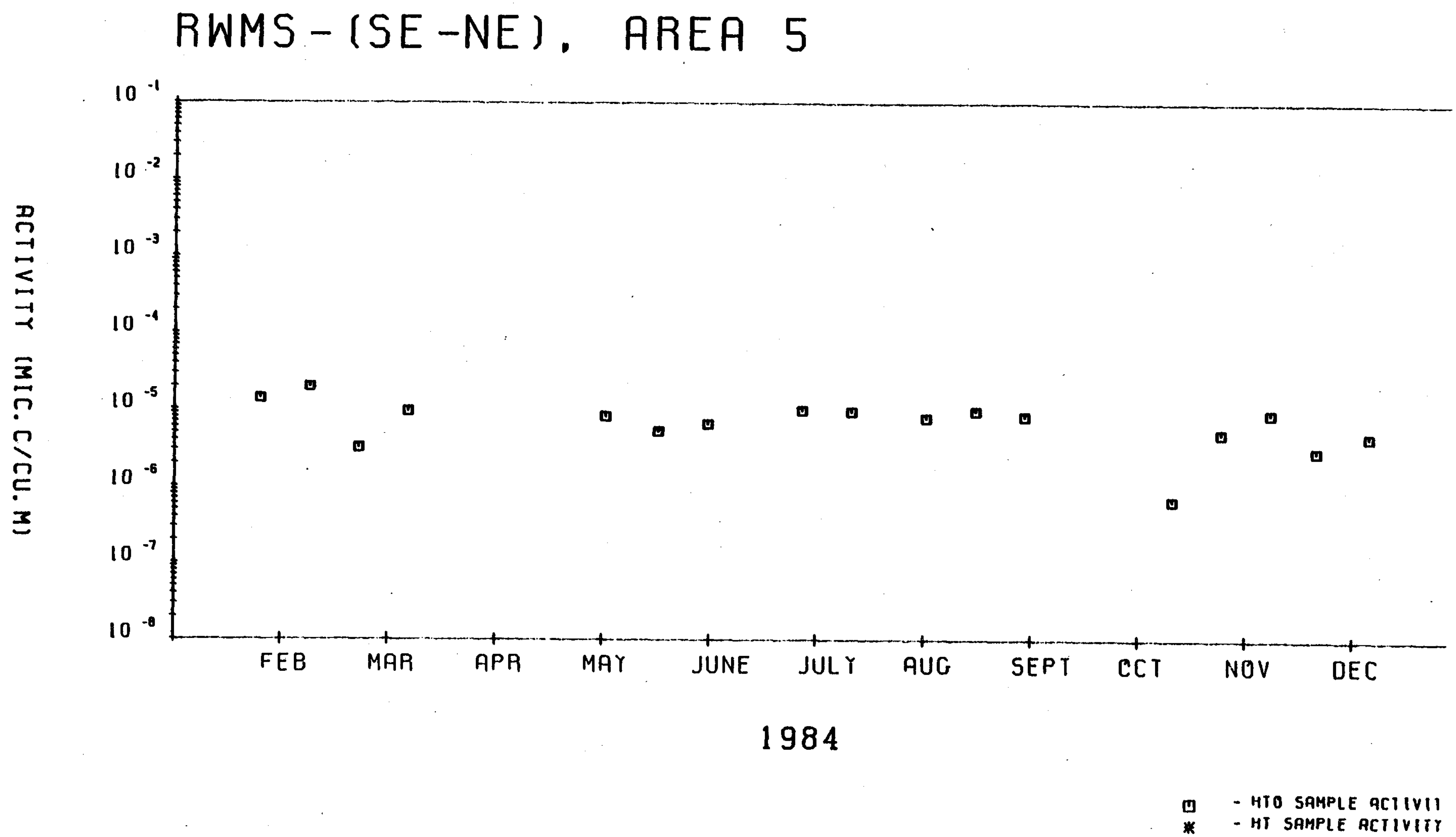
ACTIVITY (MIC.C/CU.M)
10 -1
10 -2
10 -3
10 -4
10 -5
10 -6
10 -7
10 -8
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
1984
- HTO SAMPLE ACTIVITY
- HT SAMPLE ACTIVITY

RWMS-1, AREA 5

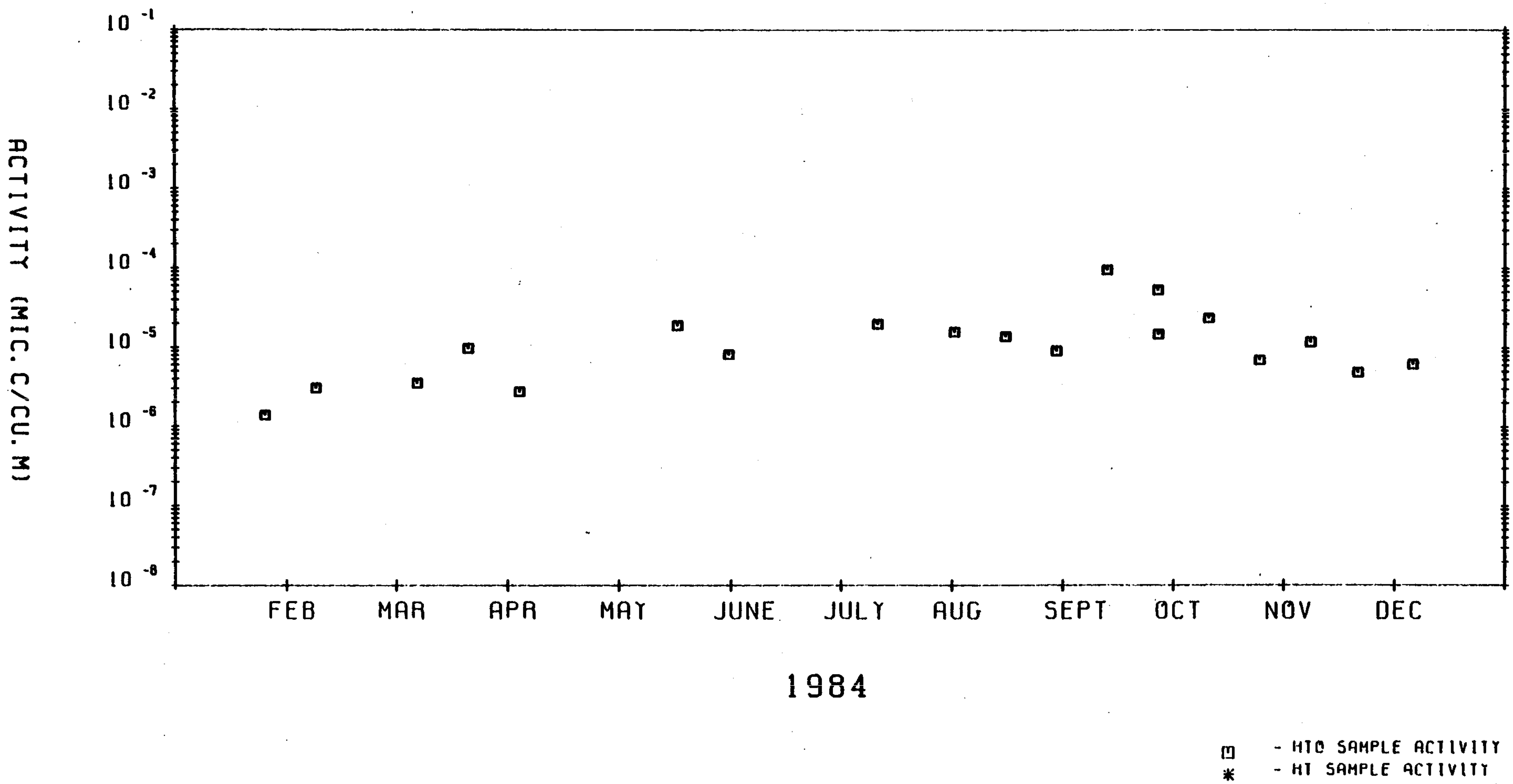


10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-7
10^-8
ACTIVITY (MIC.C/CU.M)
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
1984
- HTO SAMPLE ACTIVITY
- HT SAMPLE ACTIVITY

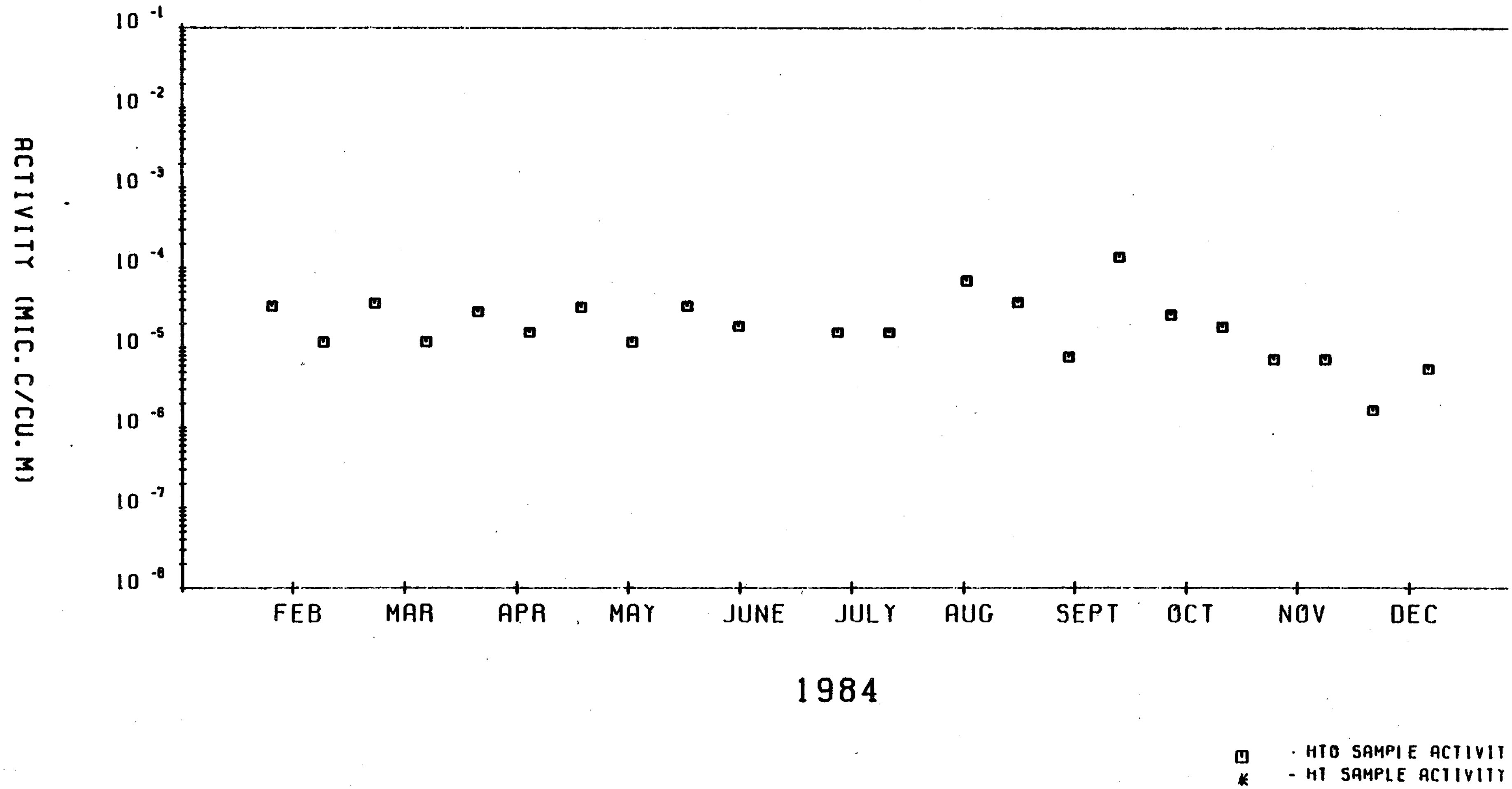

RWMS-SE, AREA 5
ACTIVITY (MIC.C/CU.M)
10 -1
10 -2
10 -3
10 -4
10 -5
10 -6
10 -7
10 -8
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
1984
HTO SAMPLE ACTIVITY
HT SAMPLE ACTIVITY


RWMS-(SE-NE), AREA 5
ACTIVITY (MIC.C/CU.M)
10 -1
10 -2
10 -3
10 -4
10 -5
10 -6
10 -7
10 -8
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
1984
- HTO SAMPLE ACTIVITY
- HT SAMPLE ACTIVITY

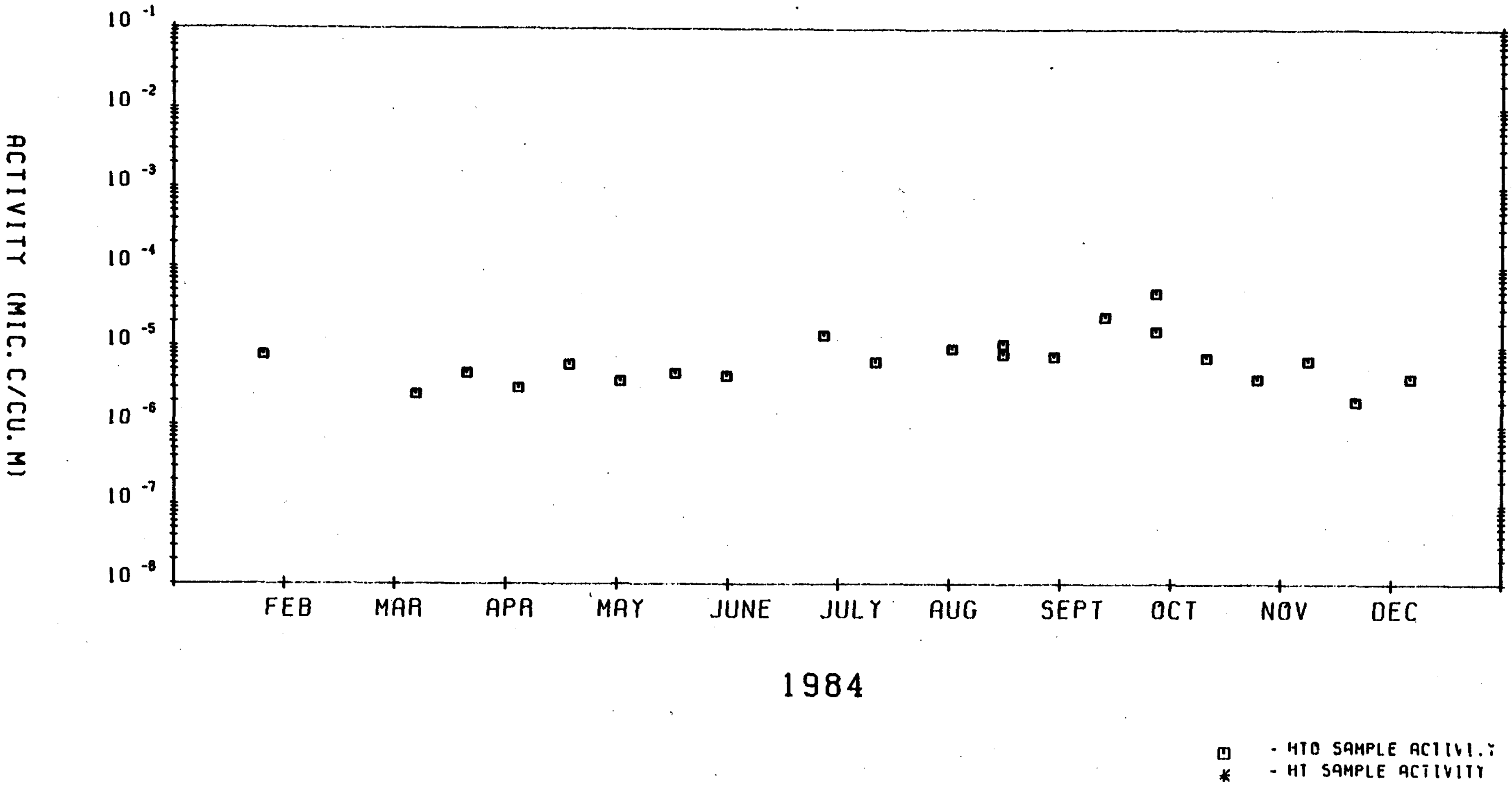
RWMS-NE, AREA 5



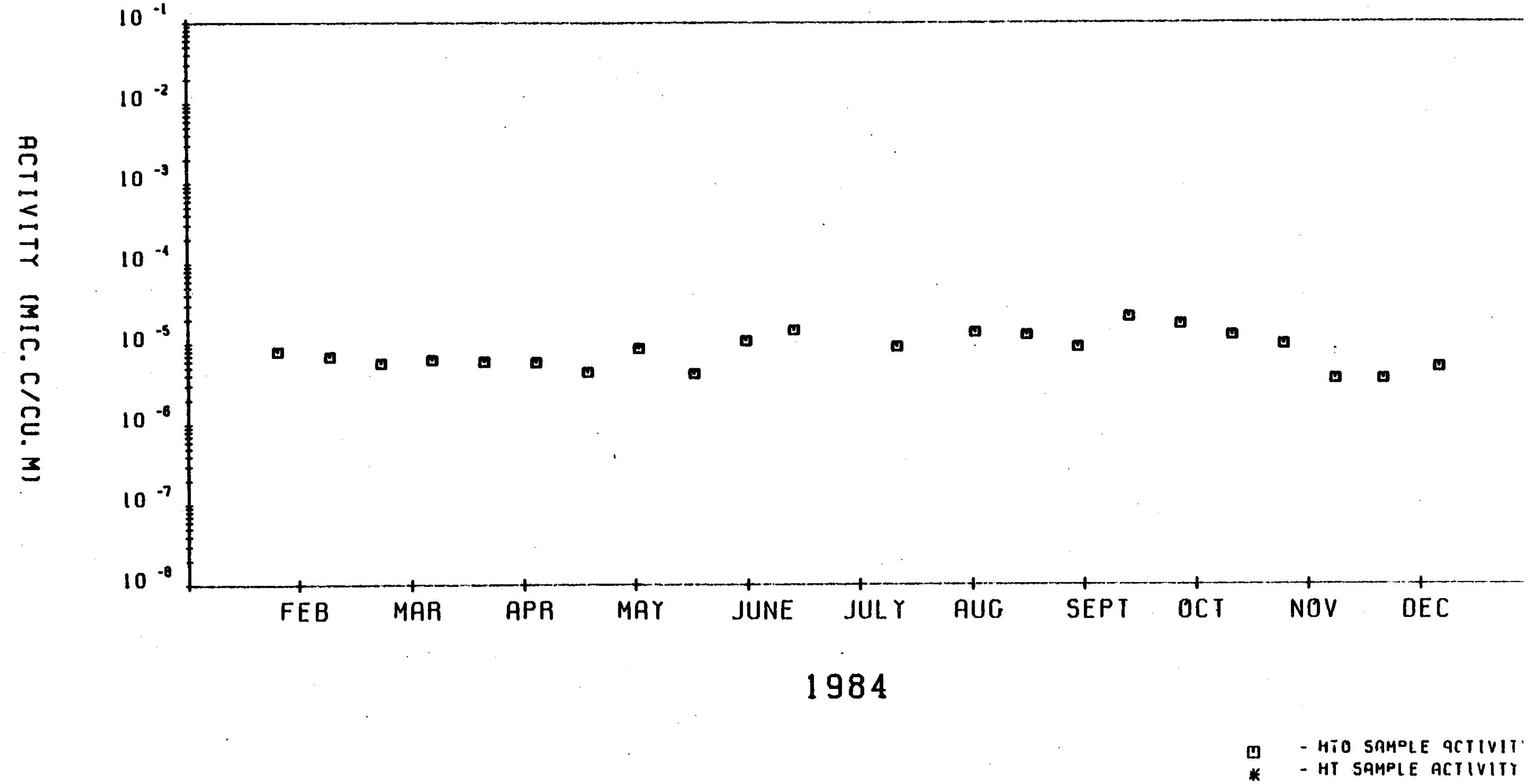
RWMS-(NE-NW), AREA 5

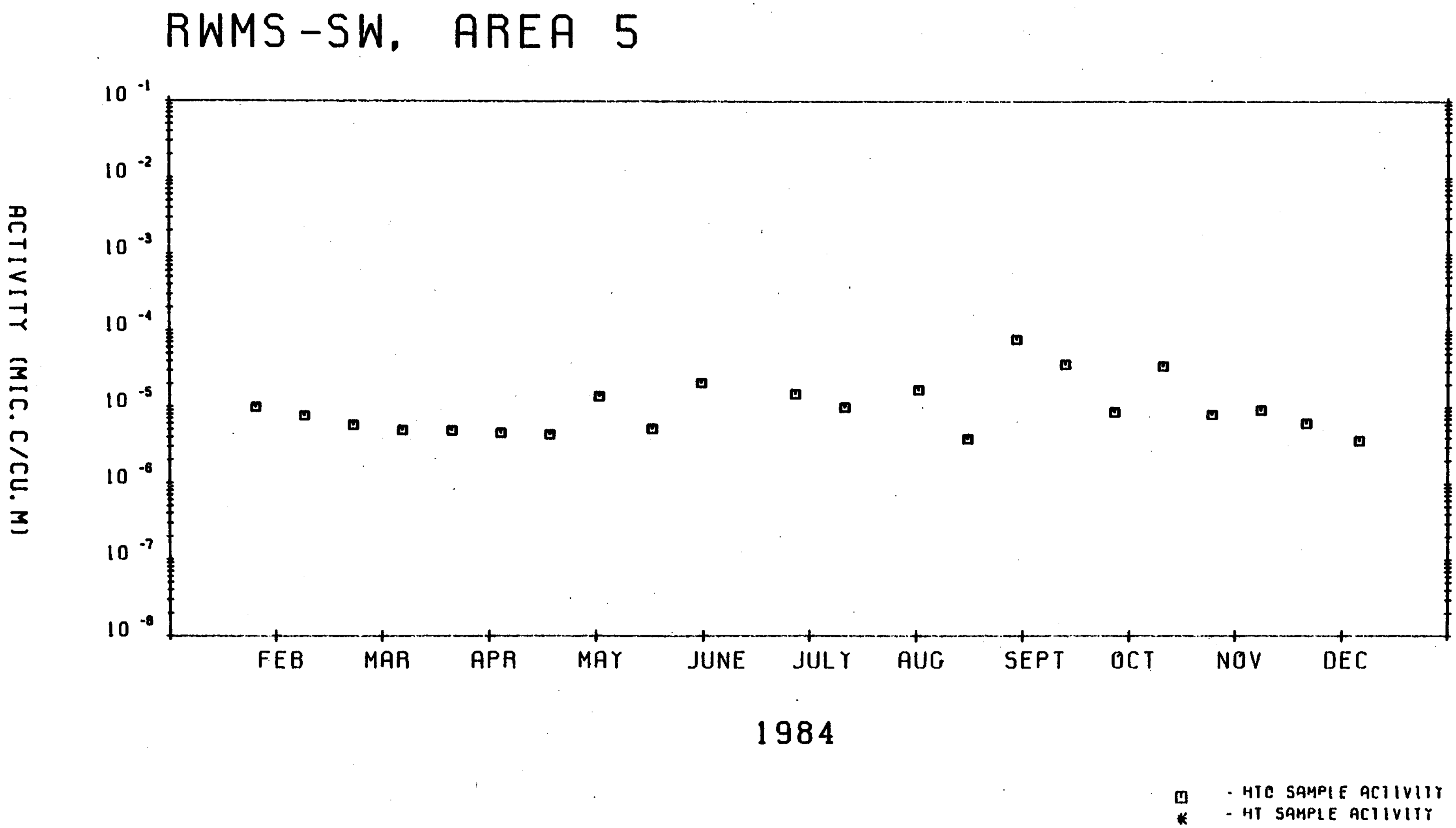


RWMS-NW, AREA 5

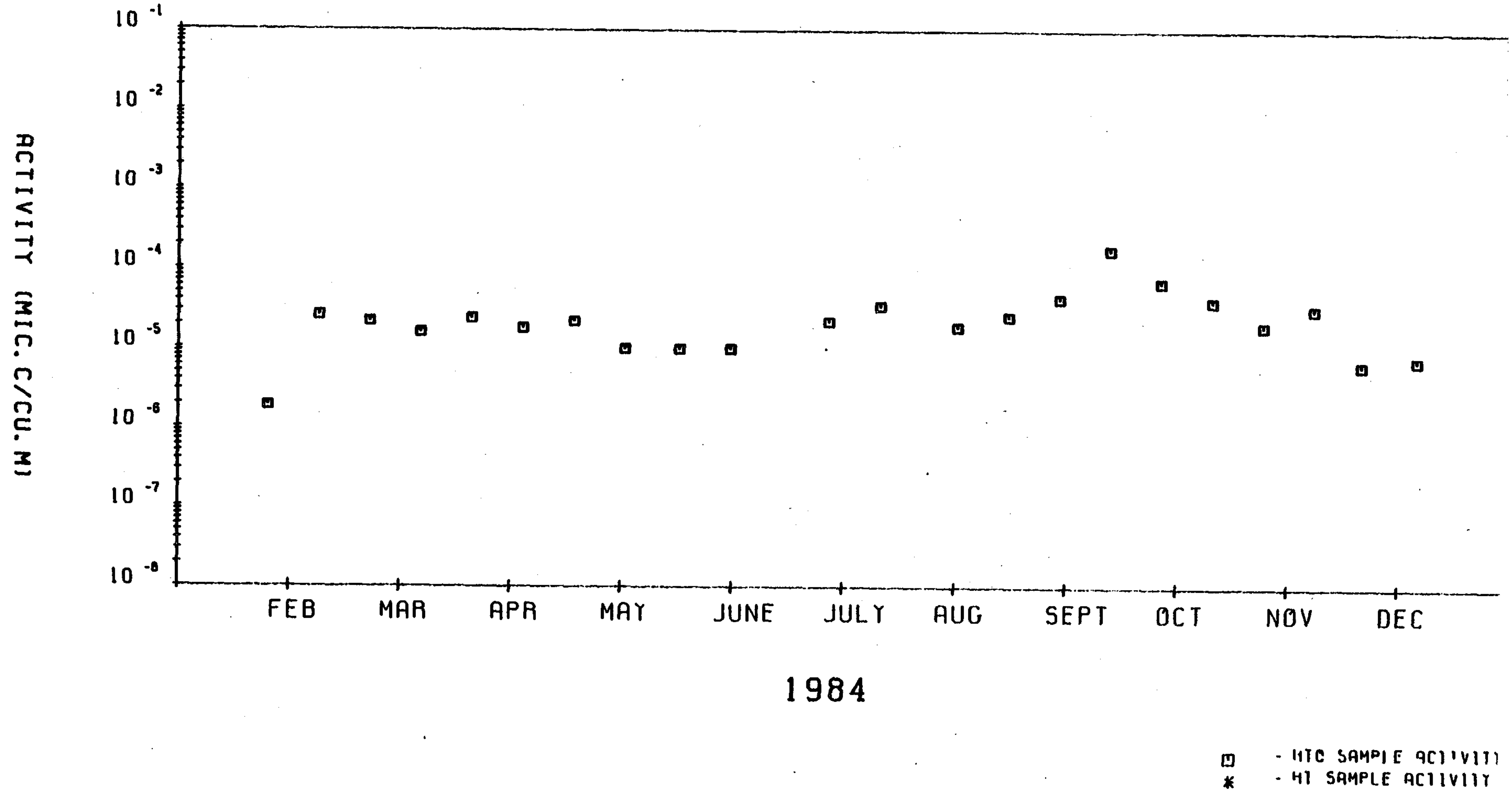


RWMS-(NW-SW), AREA 5

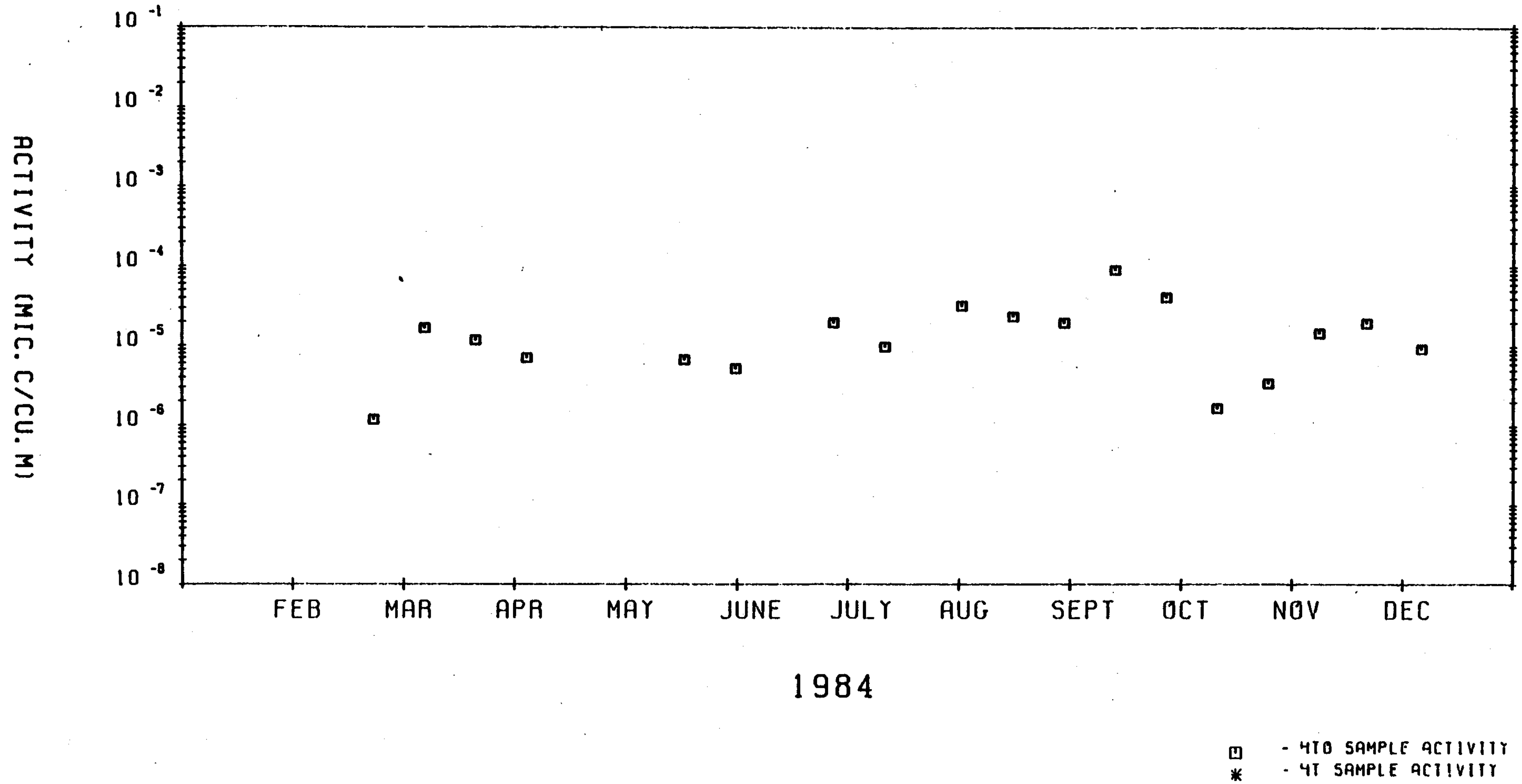



RWMS-SW, AREA 5
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
ACTIVITY (MIC.C/CU.M)
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
1984
- HTO SAMPLE ACTIVITY
- HT SAMPLE ACTIVITY

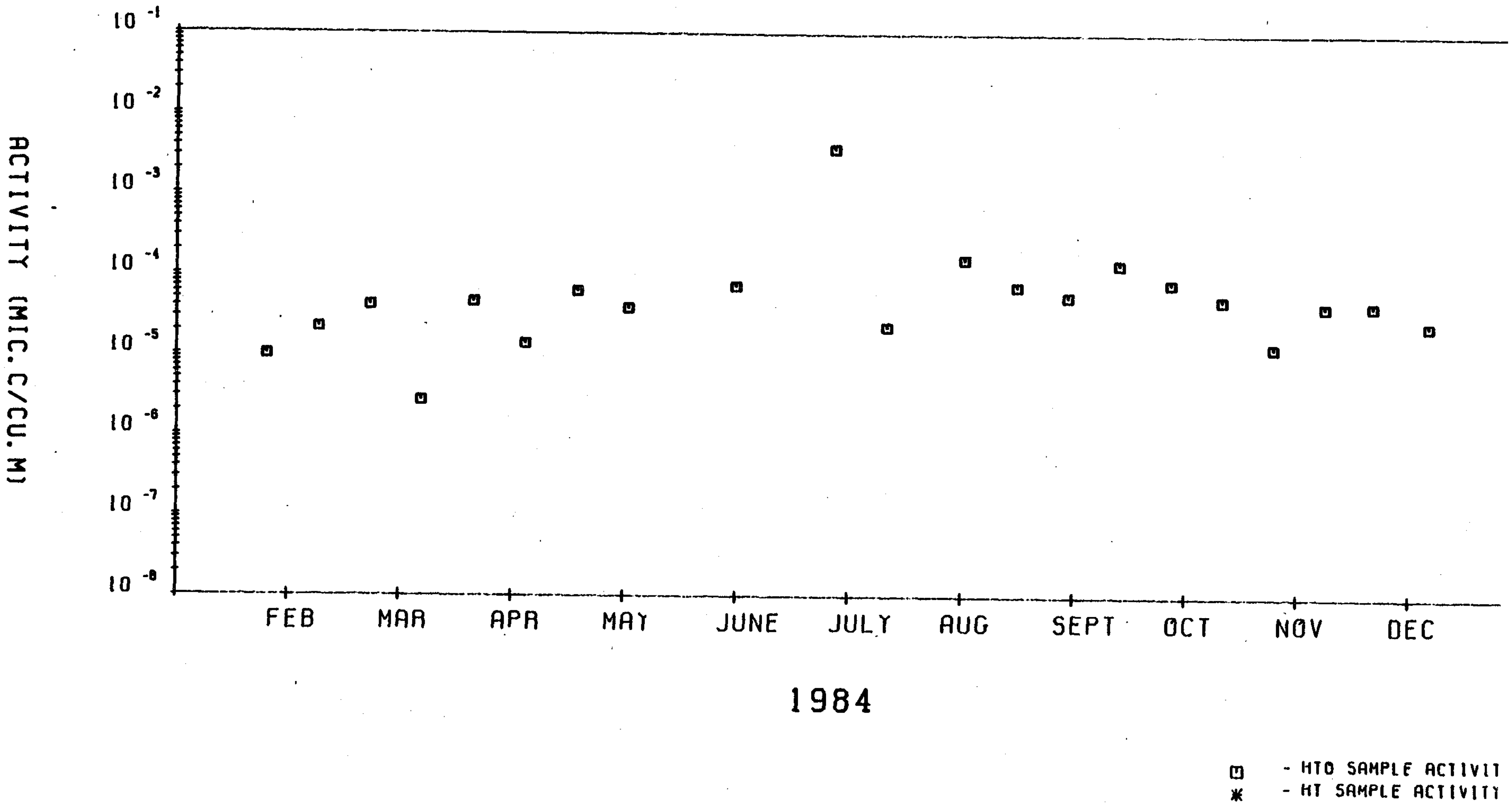
RWMS-(SW-SE), AREA 5

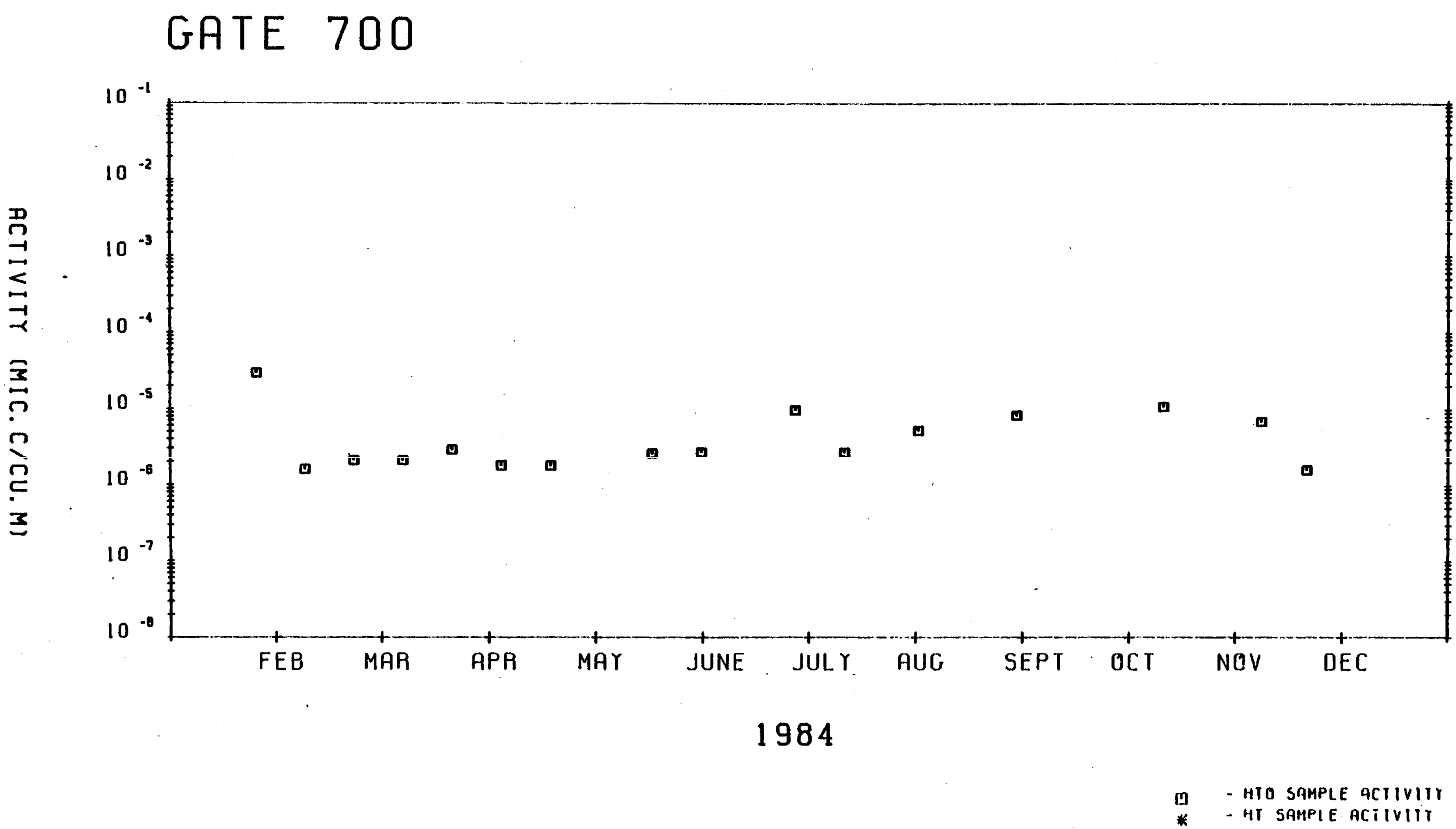


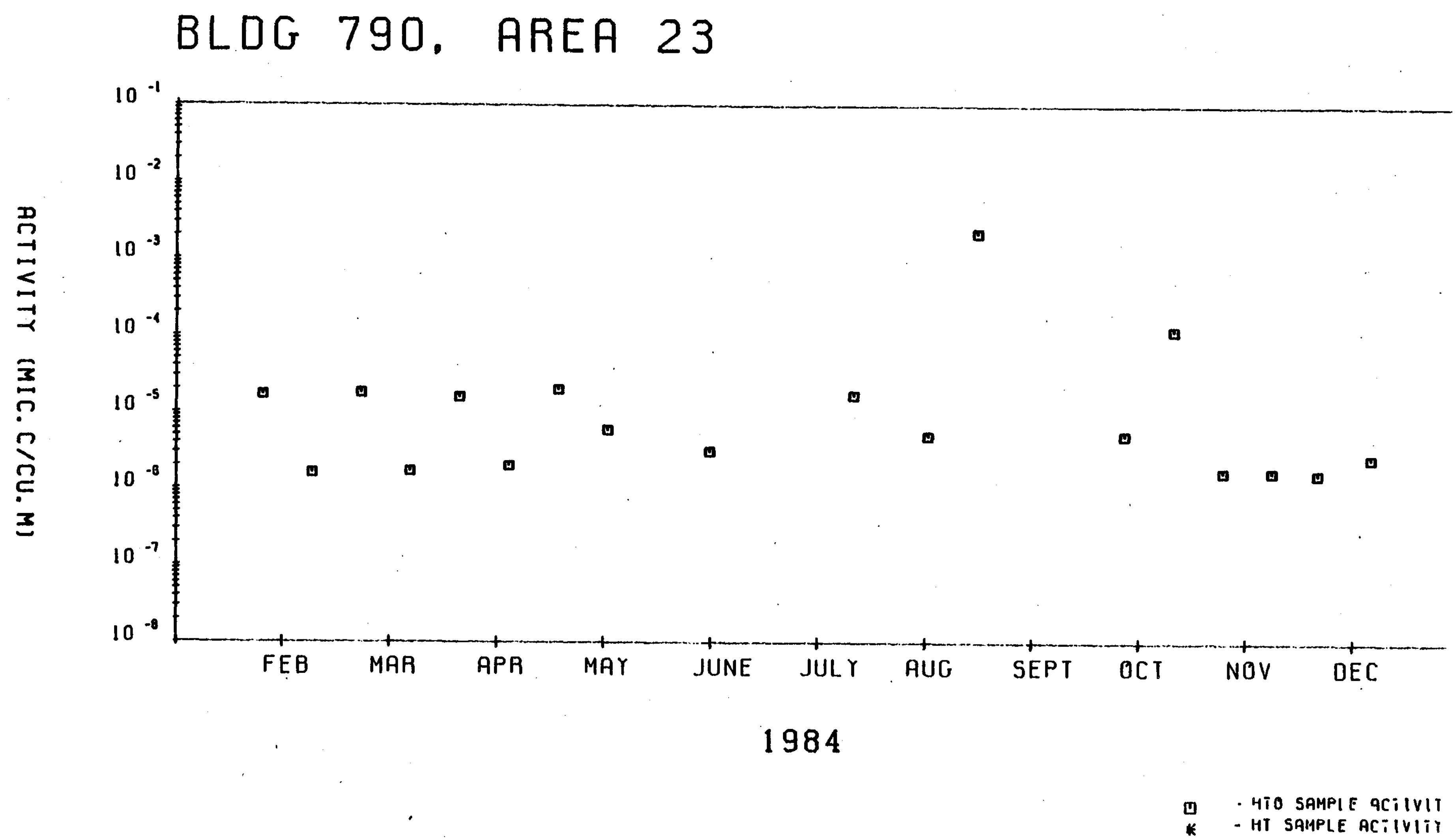
BASE CAMP, AREA 12



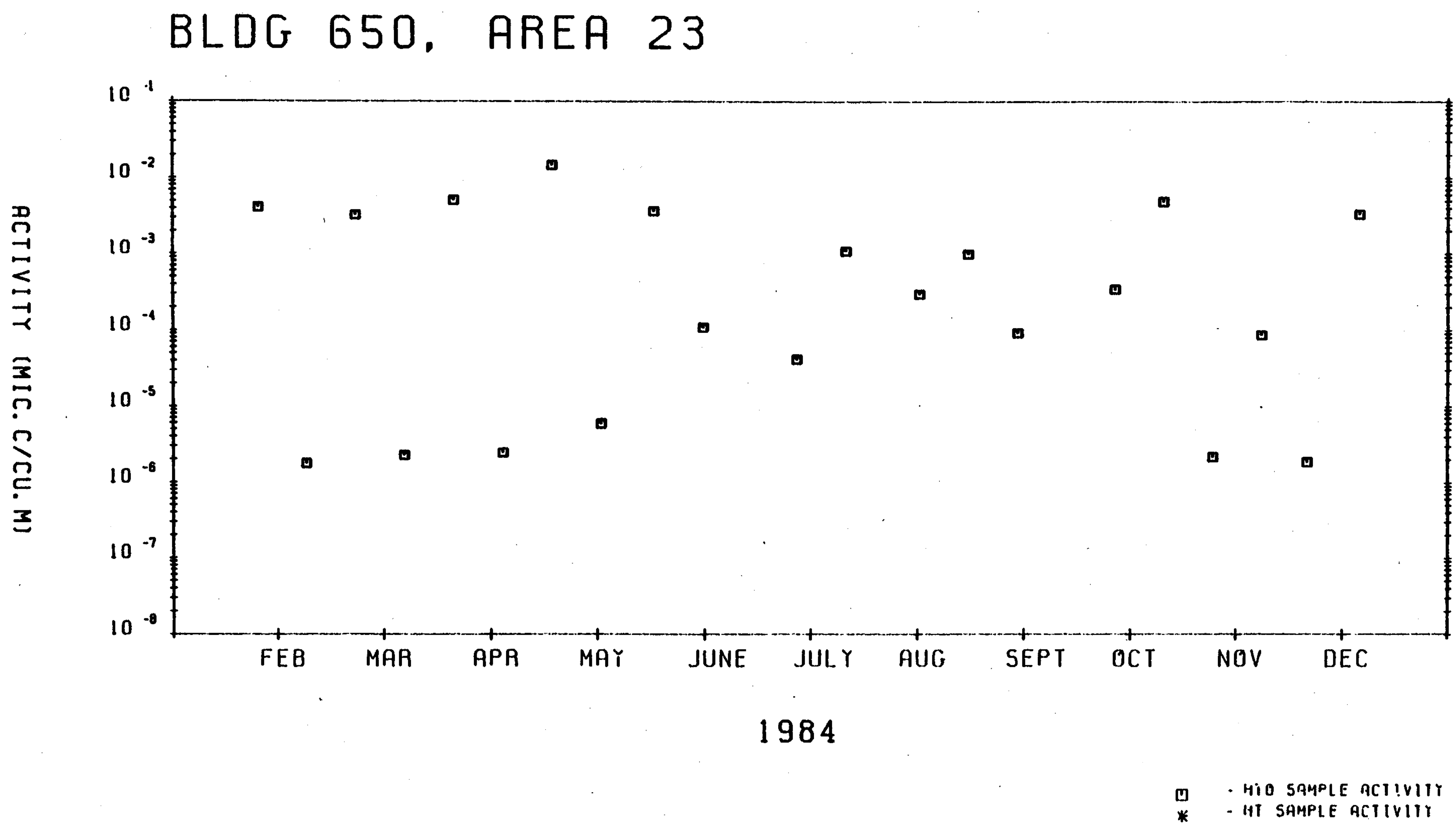
EPA FARM, AREA 15



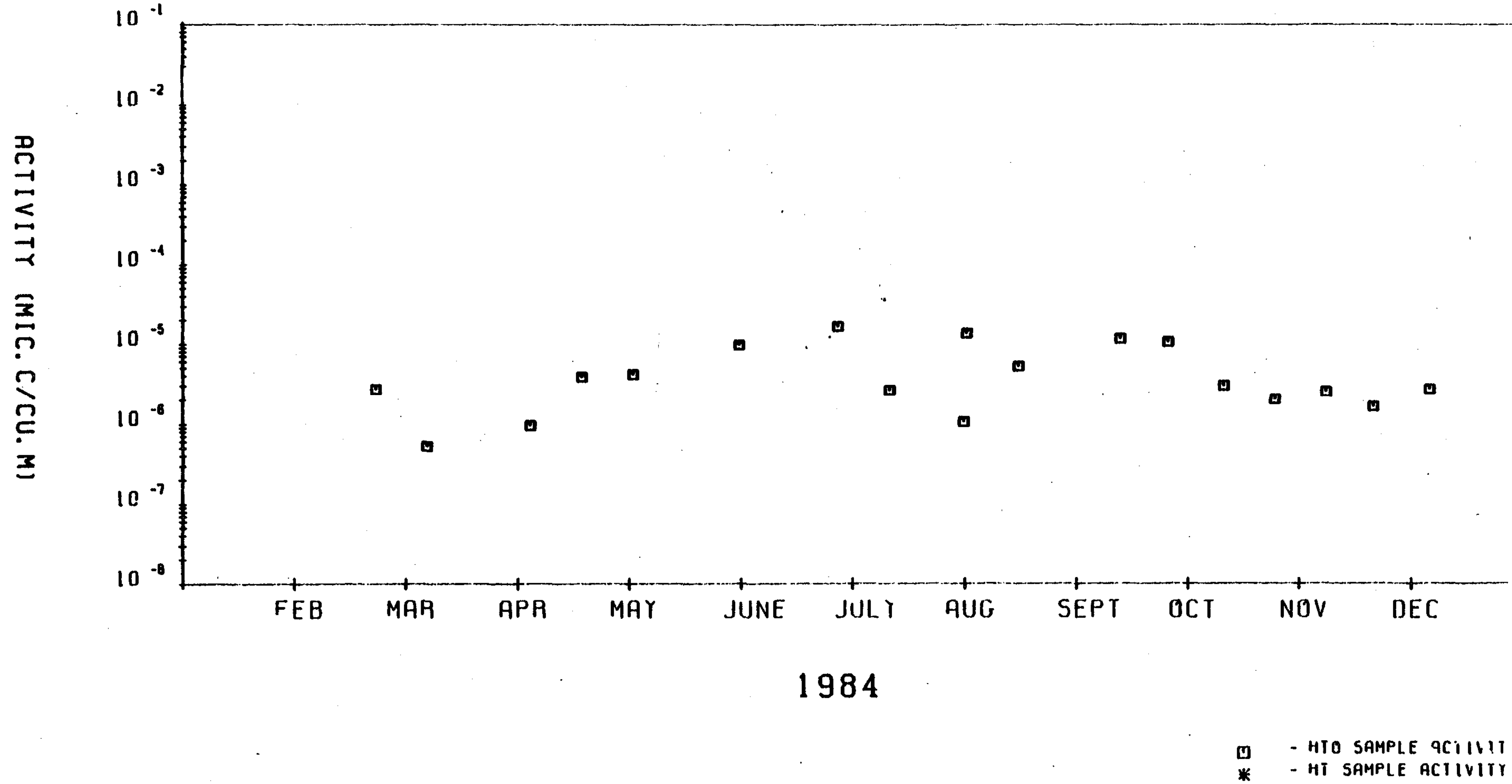

GATE 700
ACTIVITY (MIC.C/CU.M)
10 -1
10 -2
10 -3
10 -4
10 -5
10 -6
10 -7
10 -8
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
1984
- HTO SAMPLE ACTIVITY
- HT SAMPLE ACTIVITY

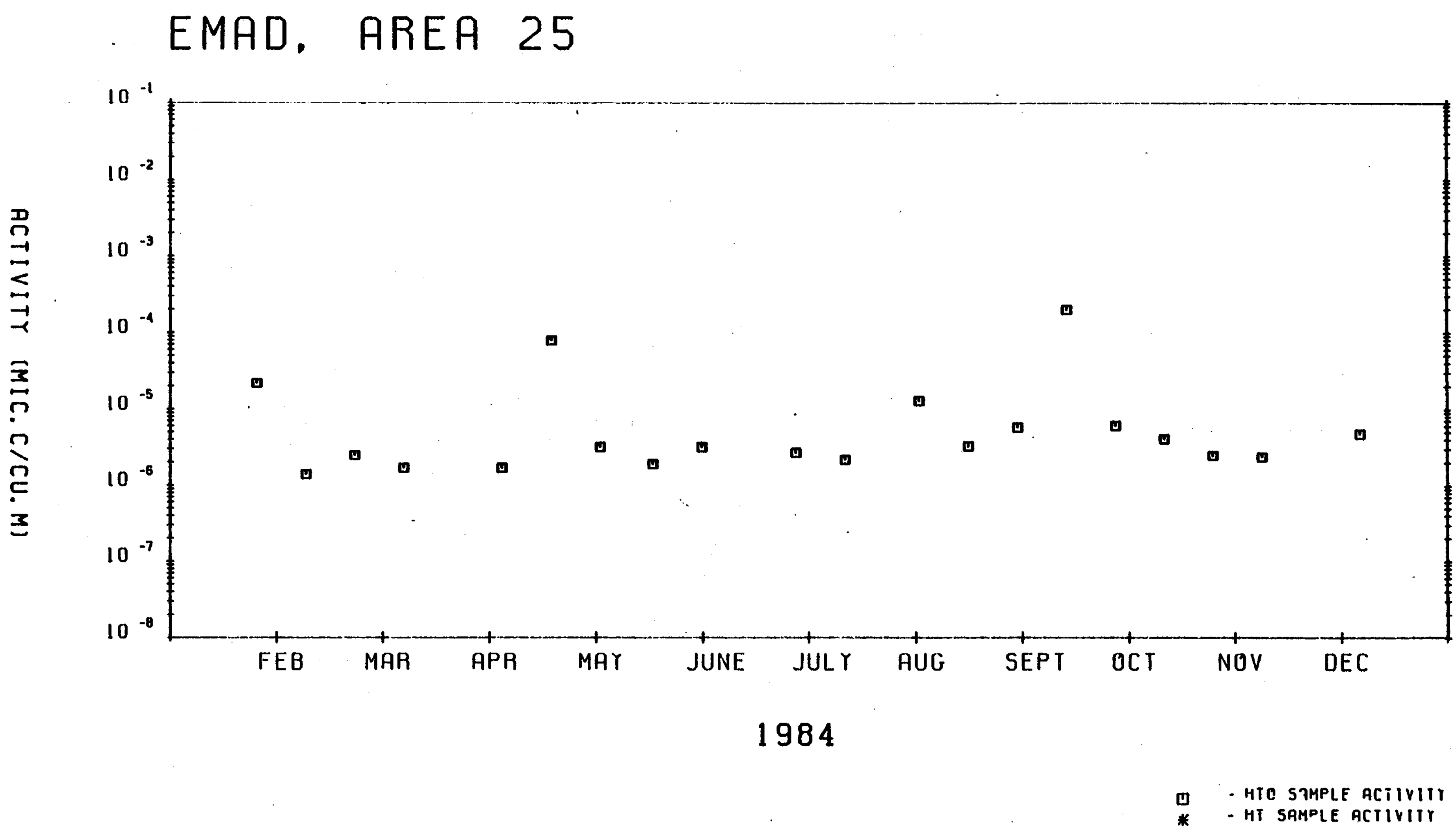

BLDG 790, AREA 23
ACTIVITY (MIC.C/CU.M)
10 -1
10 -2
10 -3
10 -4
10 -5
10 -6
10 -7
10 -8
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
1984
- HTO SAMPLE ACTIVIT
- HT SAMPLE ACTIVITY

-146-


BLDG 650, AREA 23
ACTIVITY (MIC.C/CU.M)
10 -1
10 -2
10 -3
10 -4
10 -5
10 -6
10 -7
10 -8
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
1984
- HTO SAMPLE ACTIVITY
- HT SAMPLE ACTIVITY

SITE BOUNDARY AREA 23





EMAD, AREA 25
ACTIVITY (MIC.C/CU.M)
10 -1
10 -2
10 -3
10 -4
10 -5
10 -6
10 -7
10 -8
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
1984
- HTO SAMPLE ACTIVITY
- HT SAMPLE ACTIVITY

APPENDIX C

NTS Environmental Surveillance

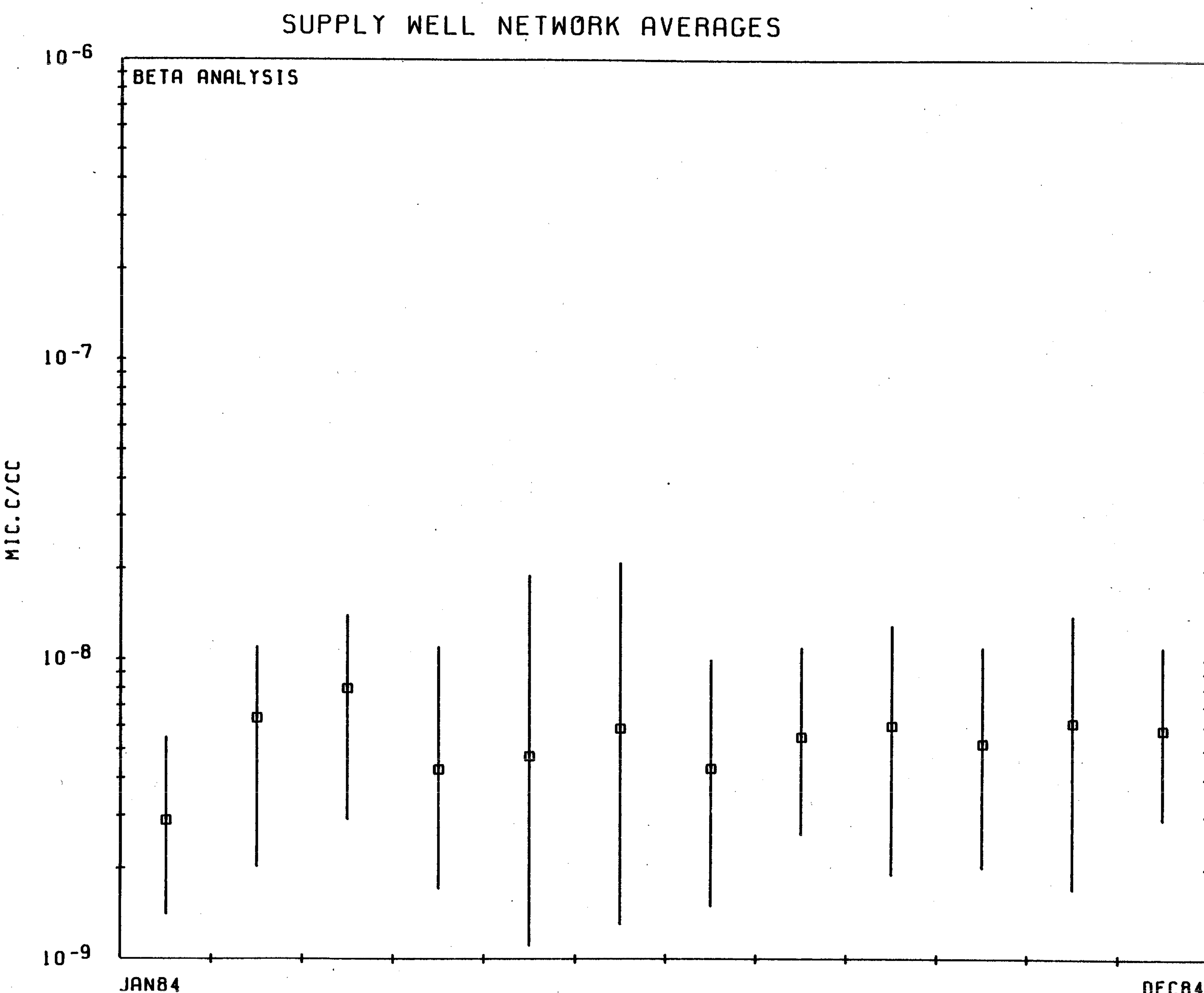
Supply Well Locations and Plots

Several symbols are used in Appendix C to denote the data points. In the first two pages of plots, the supply well network averages, a square represents the arithmetic mean of all values at that point in time, and the vertical line is the range of the data.

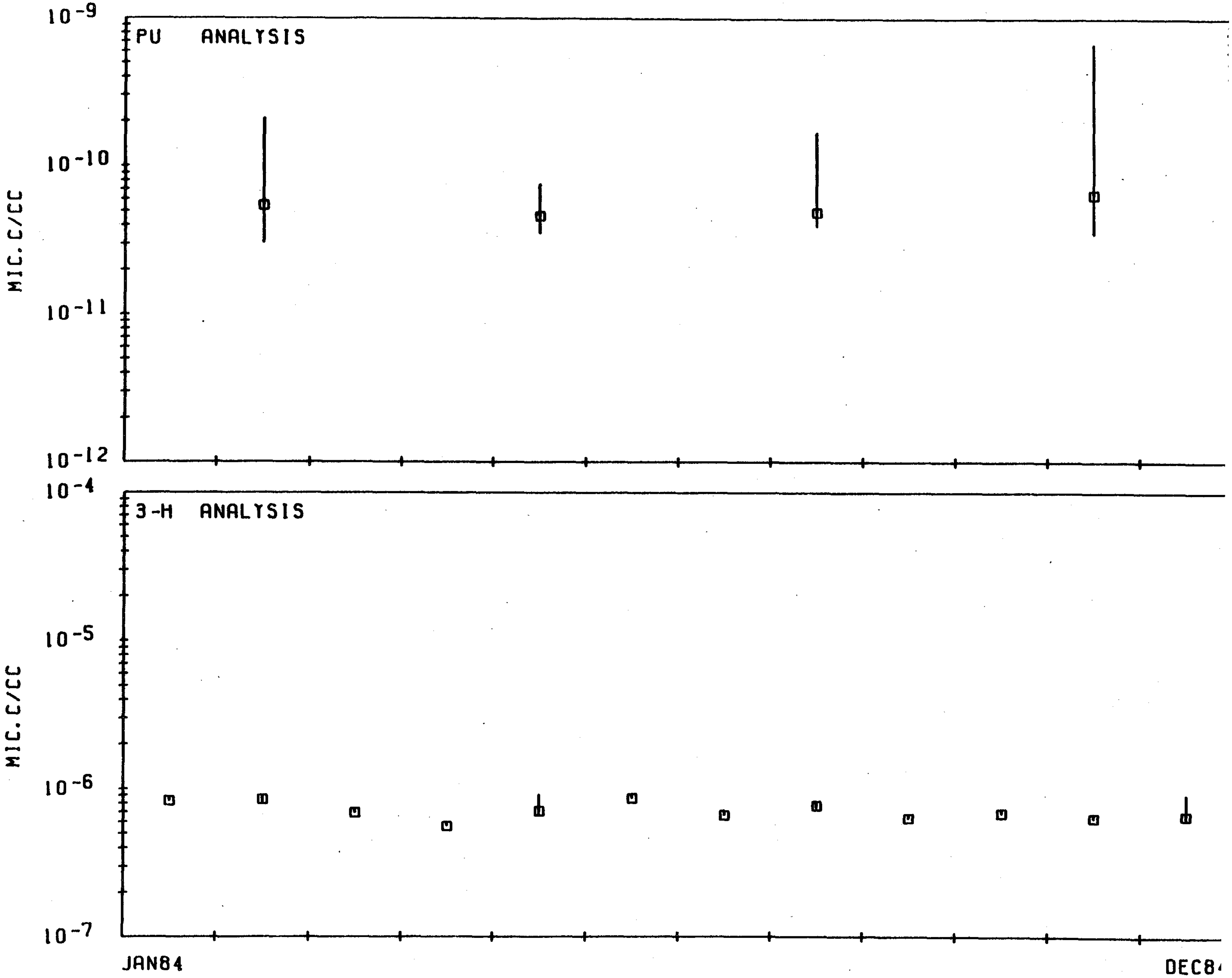
The remaining plots of Appendix B show the gross beta data of each station. A two-sigma error bar is also added to the data points, and, in all of the plots, a delta with the line to the bottom of the plot means below detection limit.

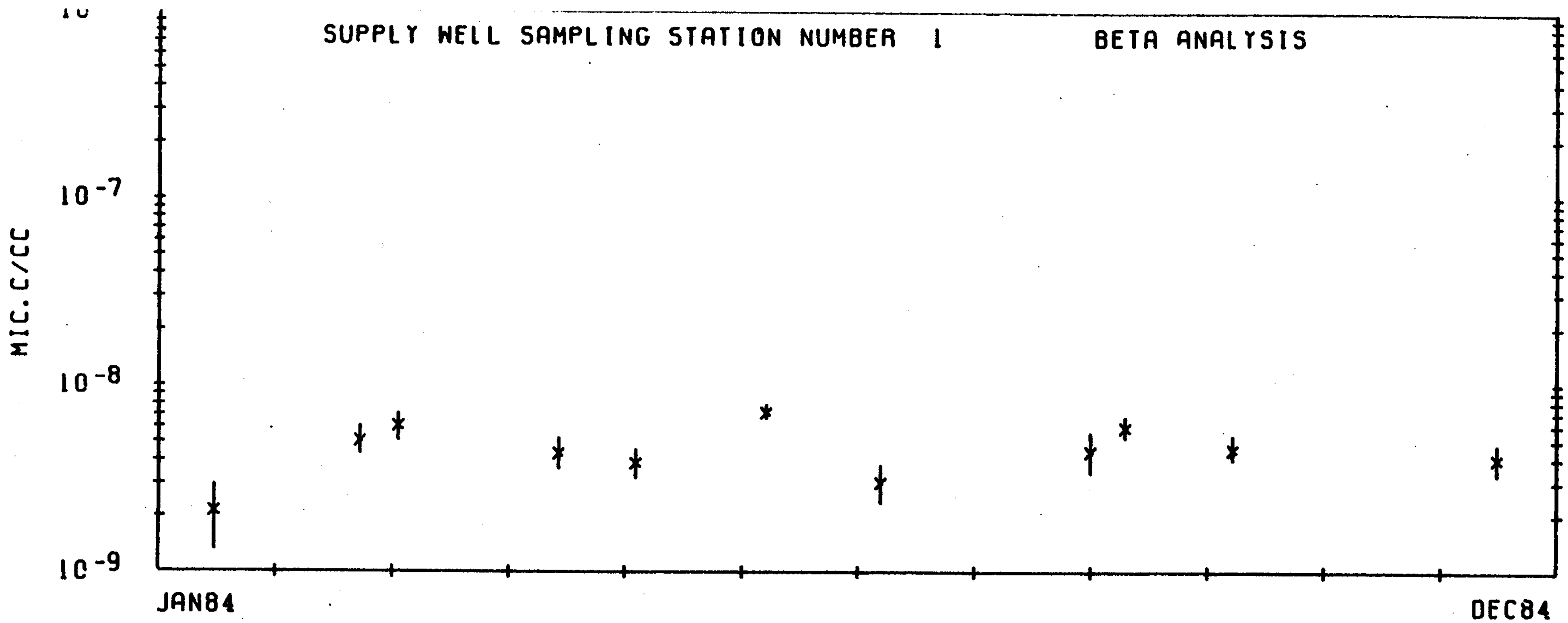
NTS ENVIRONMENTAL SURVEILLANCE
SUPPLY WELLS SAMPLING LOCATIONS

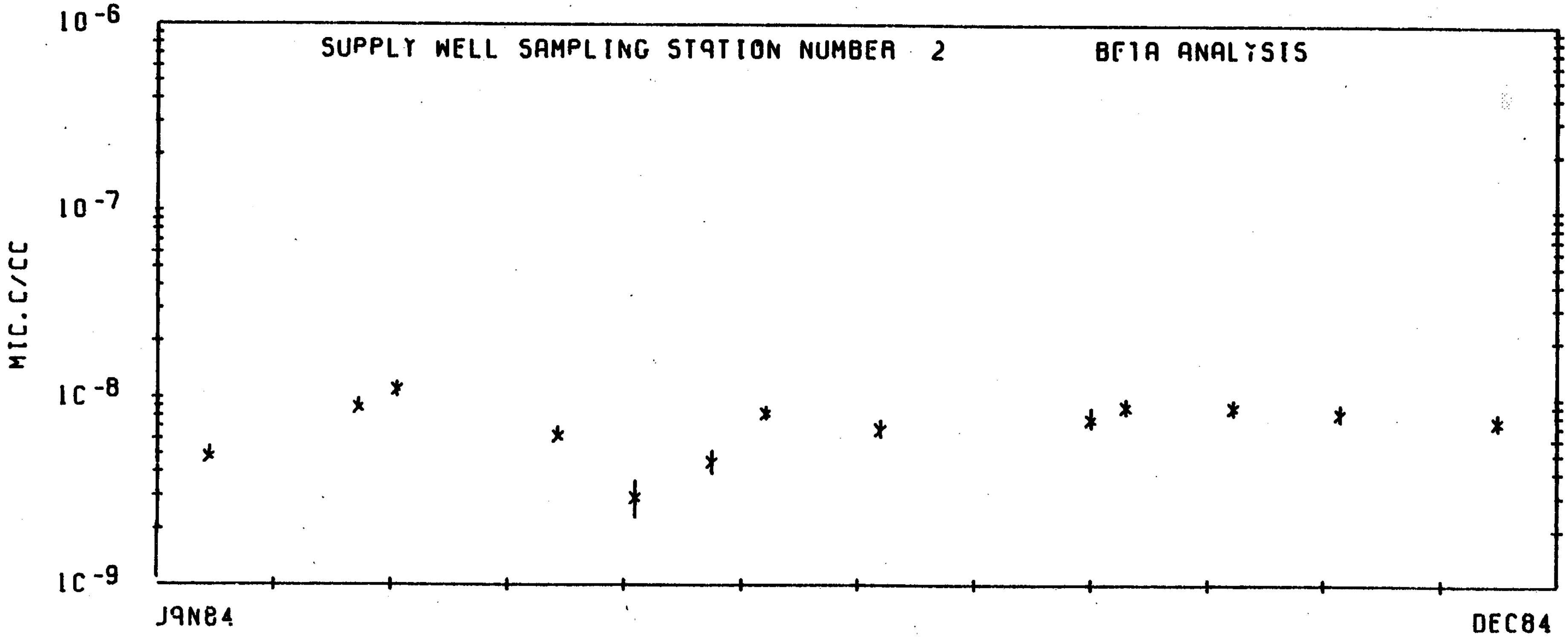
Station Number	Location
1	Area 2 Well 2
2	Area 3 Well A
3	Area 5 Well 5B
4	Area 5 Well 5C
5	Area 5 Well Ue5c
6	Area 6 Well C
7	Area 6 Well C1
9	Area 18 Well 8
13	Area 22 Army Well No. 1
14	Area 25 Well J12
15	Area 25 Well J13
18	Area 19 Well U19c
19	Area 6 Well 4

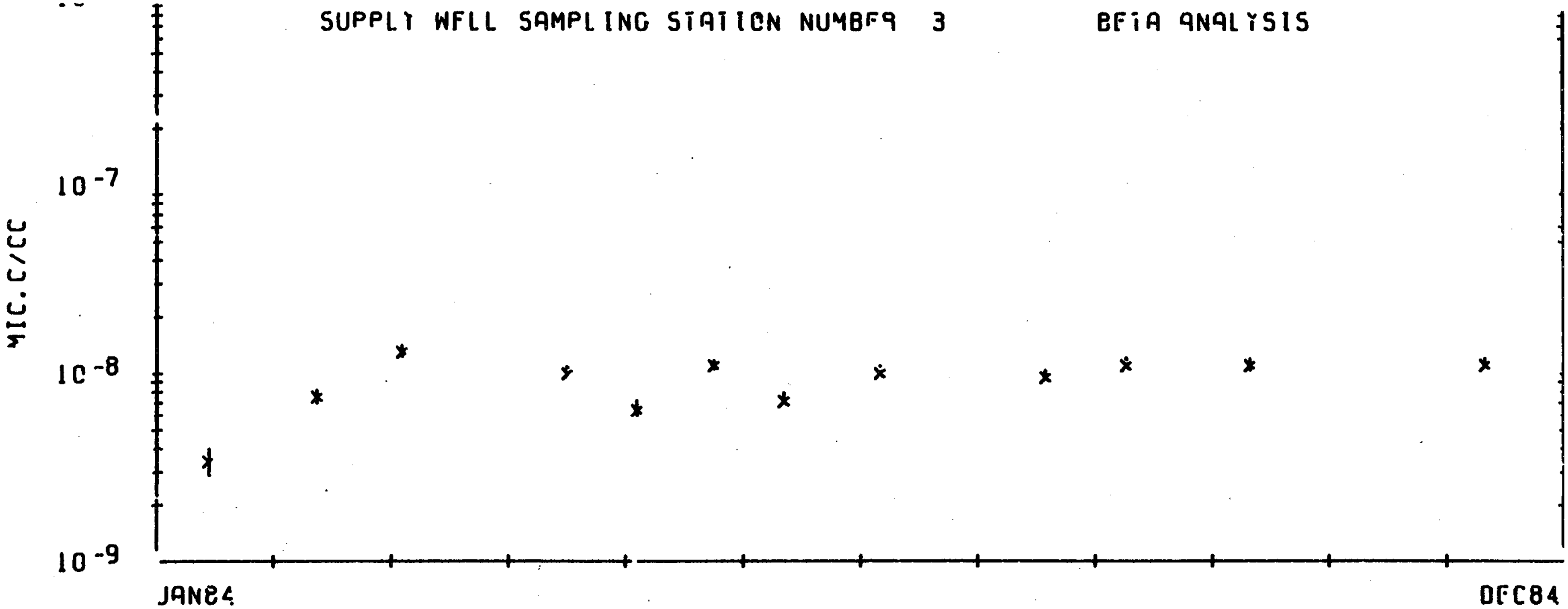

SUPPLY WELL NETWORK AVERAGES
BETA ANALYSIS
10^{-6}
10^{-7}
10^{-8}
10^{-9}
MIC.C/CC
JAN84
DEC84

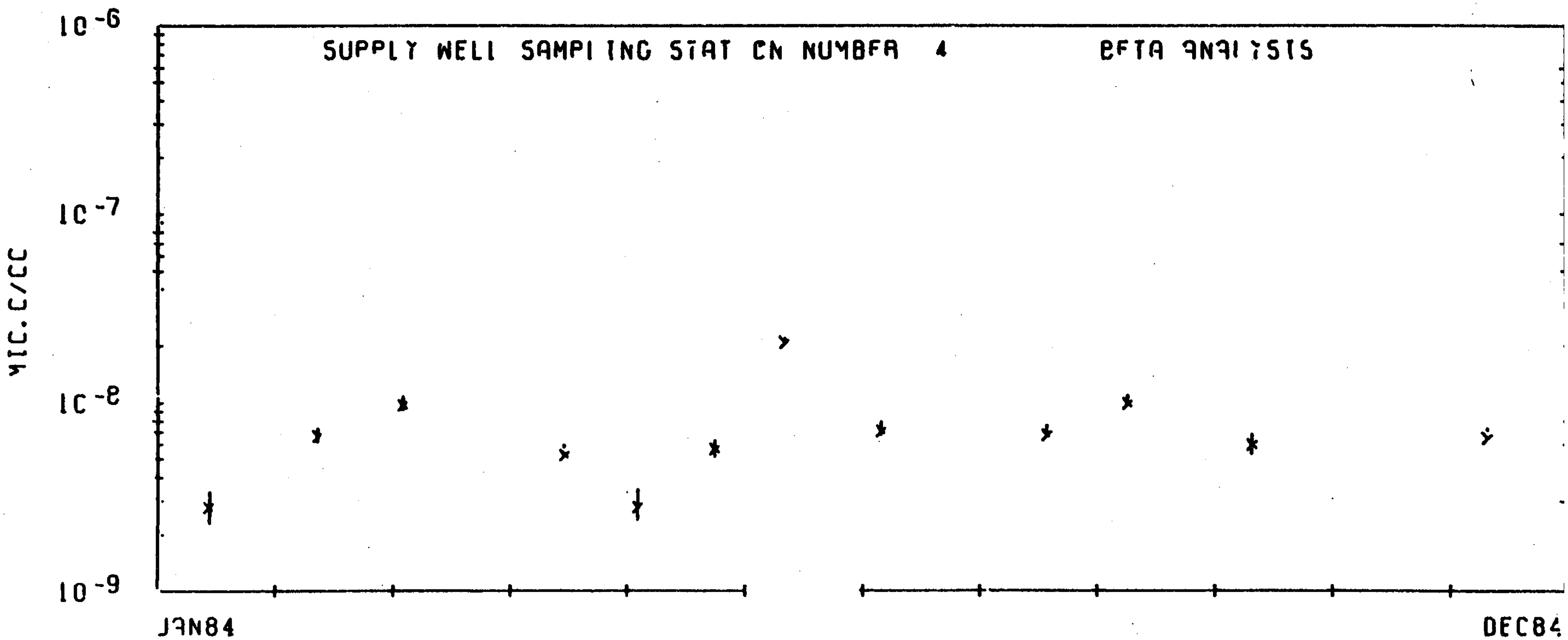
SUPPLY WELL NETWORK AVERAGES

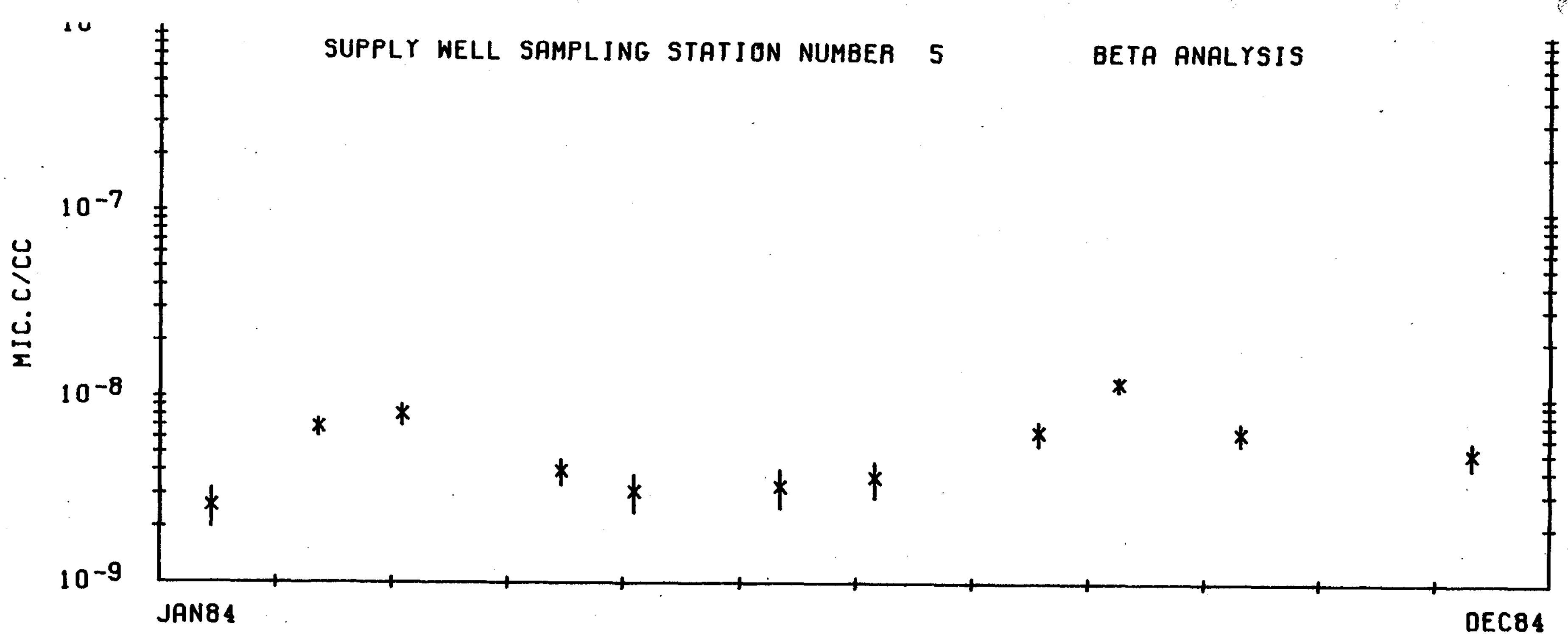


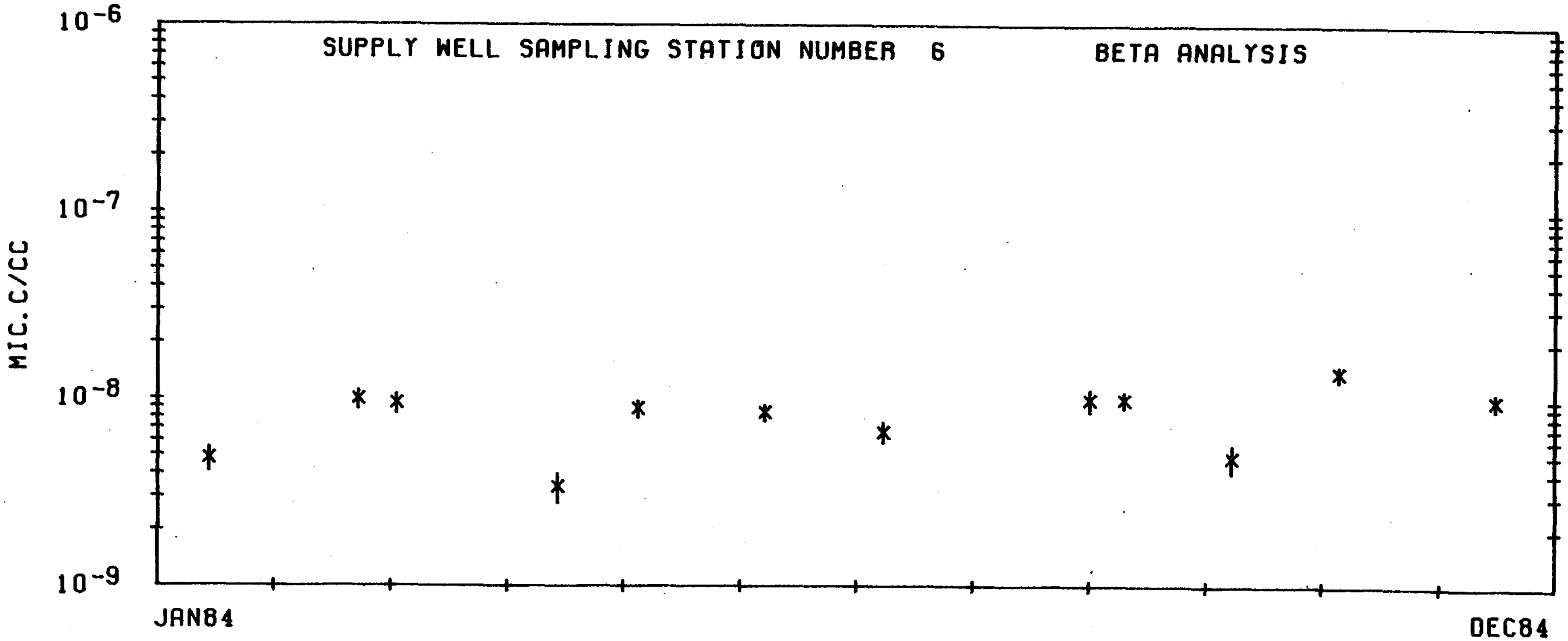

SUPPLY WELL SAMPLING STATION NUMBER 1
BETA ANALYSIS
MIC.C/CC
10 -7
10 -8
10 -9
JAN84
DEC84

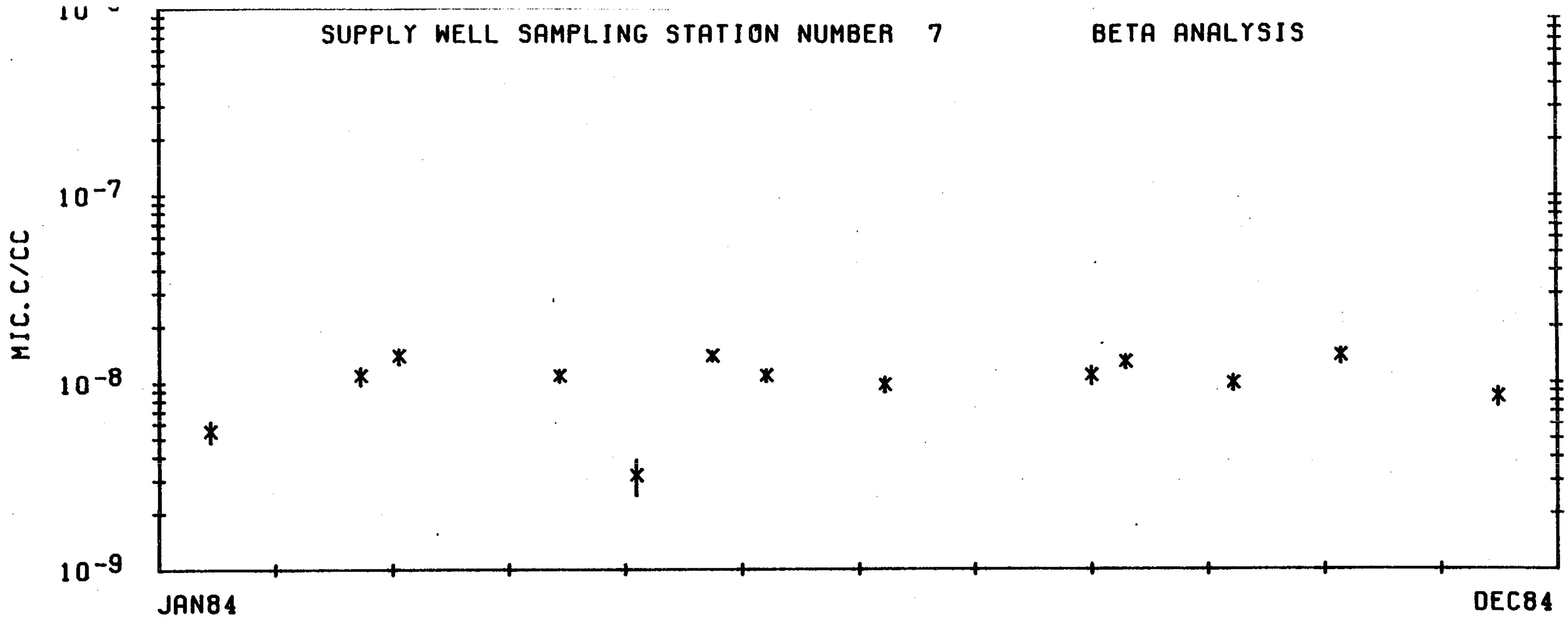

SUPPLY WELL SAMPLING STATION NUMBER 2
BETA ANALYSIS
MIC.C/CC
10 -6
10 -7
10 -8
10 -9
JAN84
DEC84

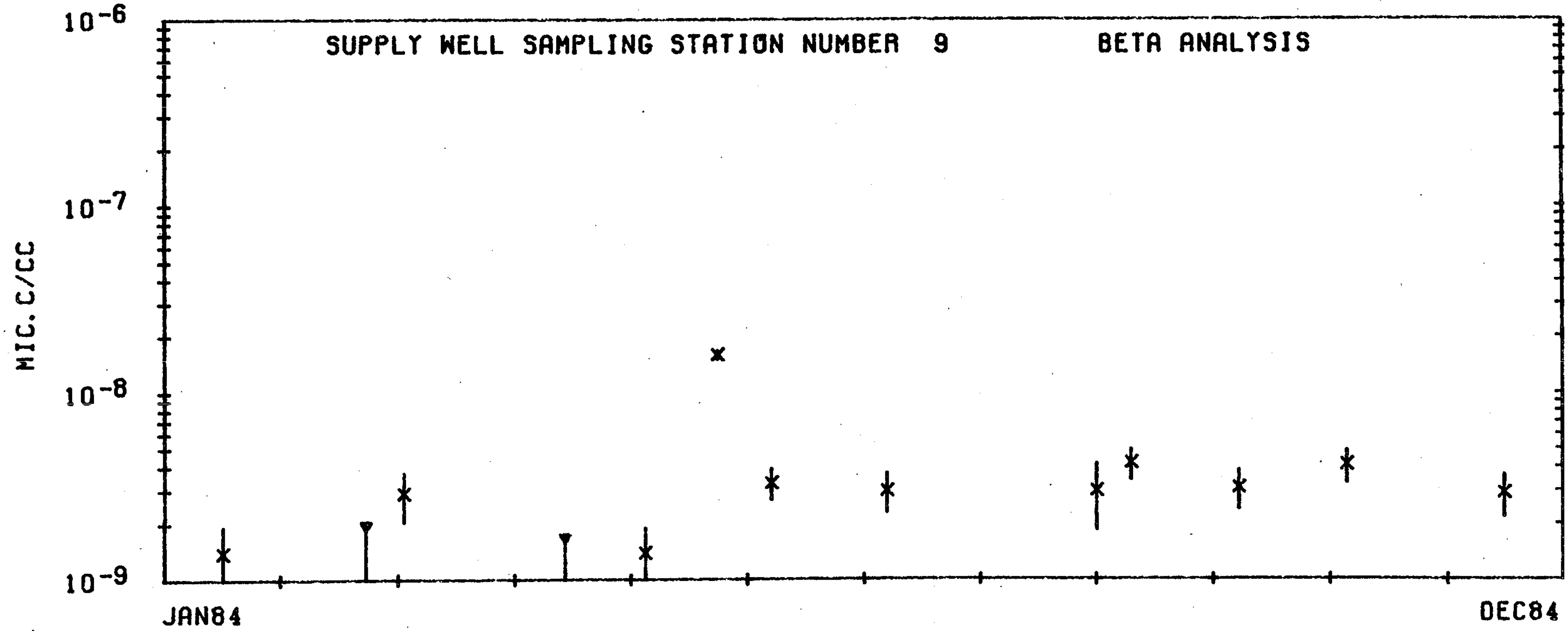

SUPPLY WELL SAMPLING STATION NUMBER 3
BETA ANALYSIS
MIC.C/CC
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84

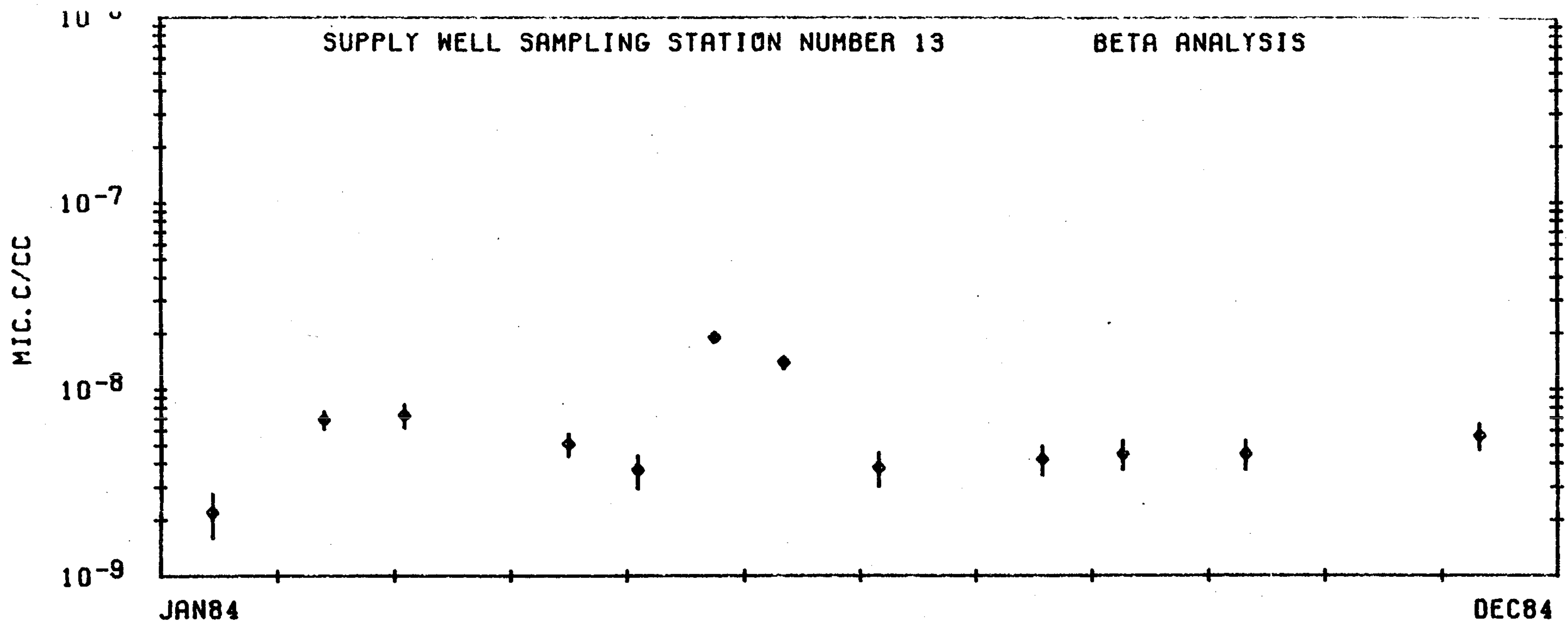

SUPPLY WELL SAMPLING STATION NUMBER 4
BETA ANALYSIS
MIC.C/CC
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84


SUPPLY WELL SAMPLING STATION NUMBER 5
BETA ANALYSIS
MIC.C/CC
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84

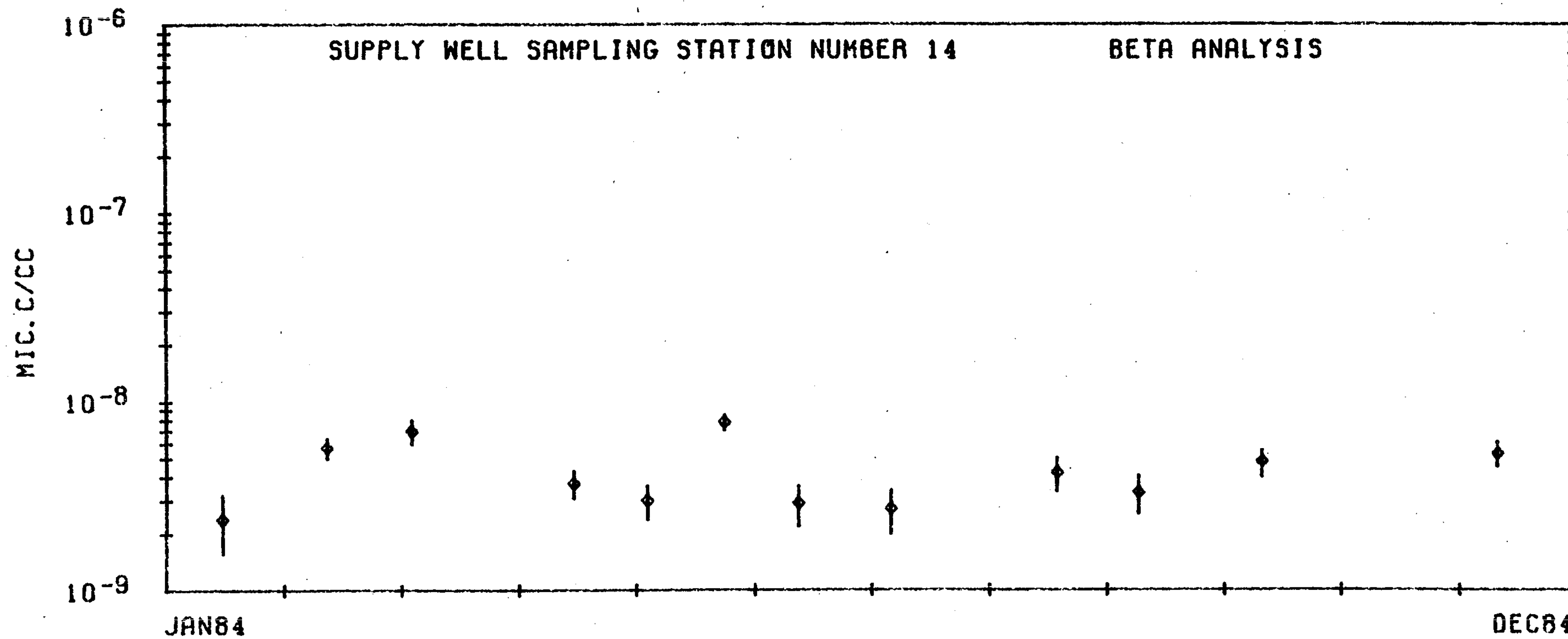

SUPPLY WELL SAMPLING STATION NUMBER 6
BETA ANALYSIS
MIC.C/CC
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84


SUPPLY WELL SAMPLING STATION NUMBER 7
BETA ANALYSIS
MIC.C/CC
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84

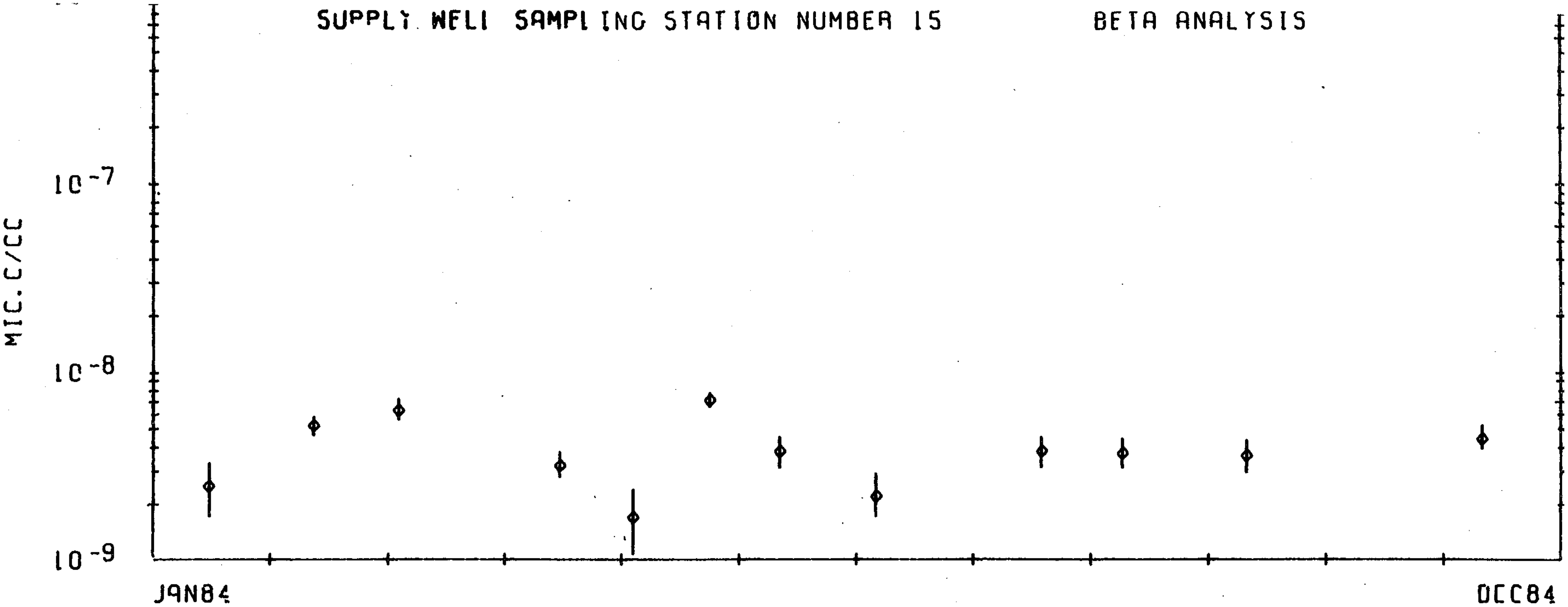

SUPPLY WELL SAMPLING STATION NUMBER 9
BETA ANALYSIS
MIC.C/CC
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84

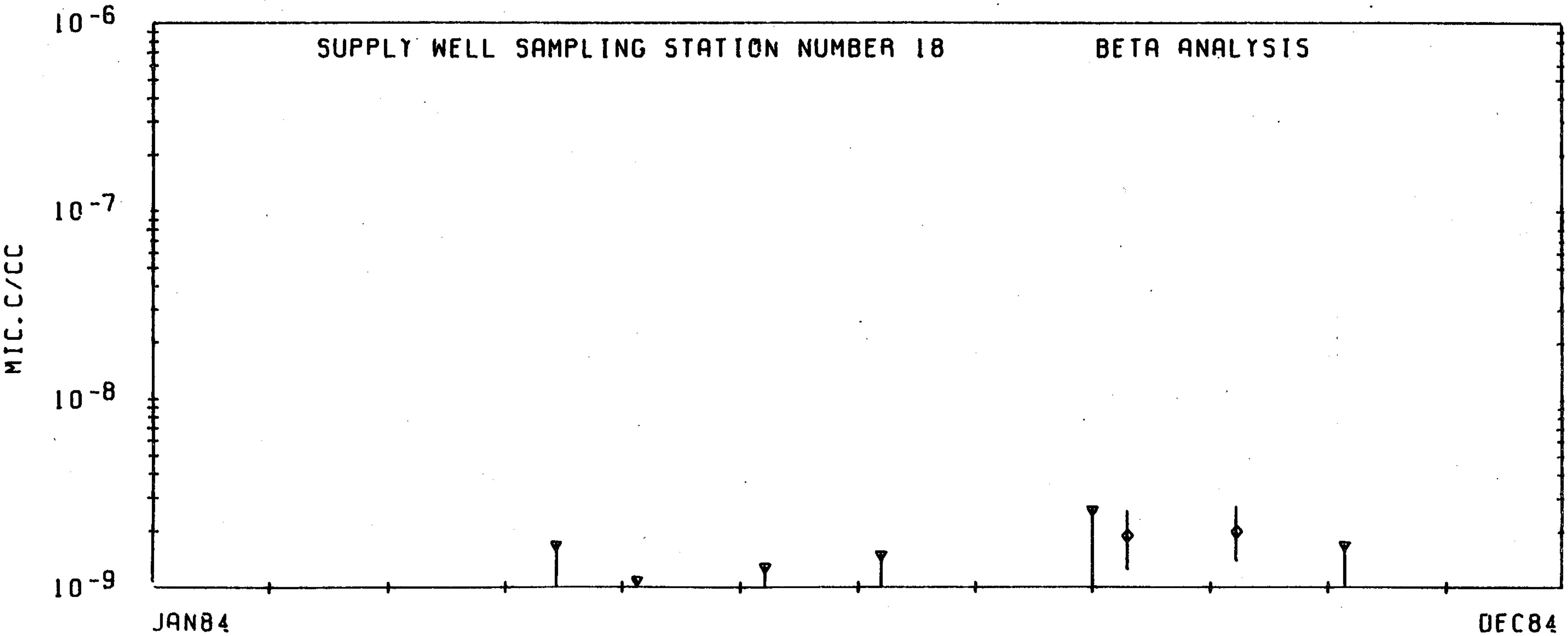


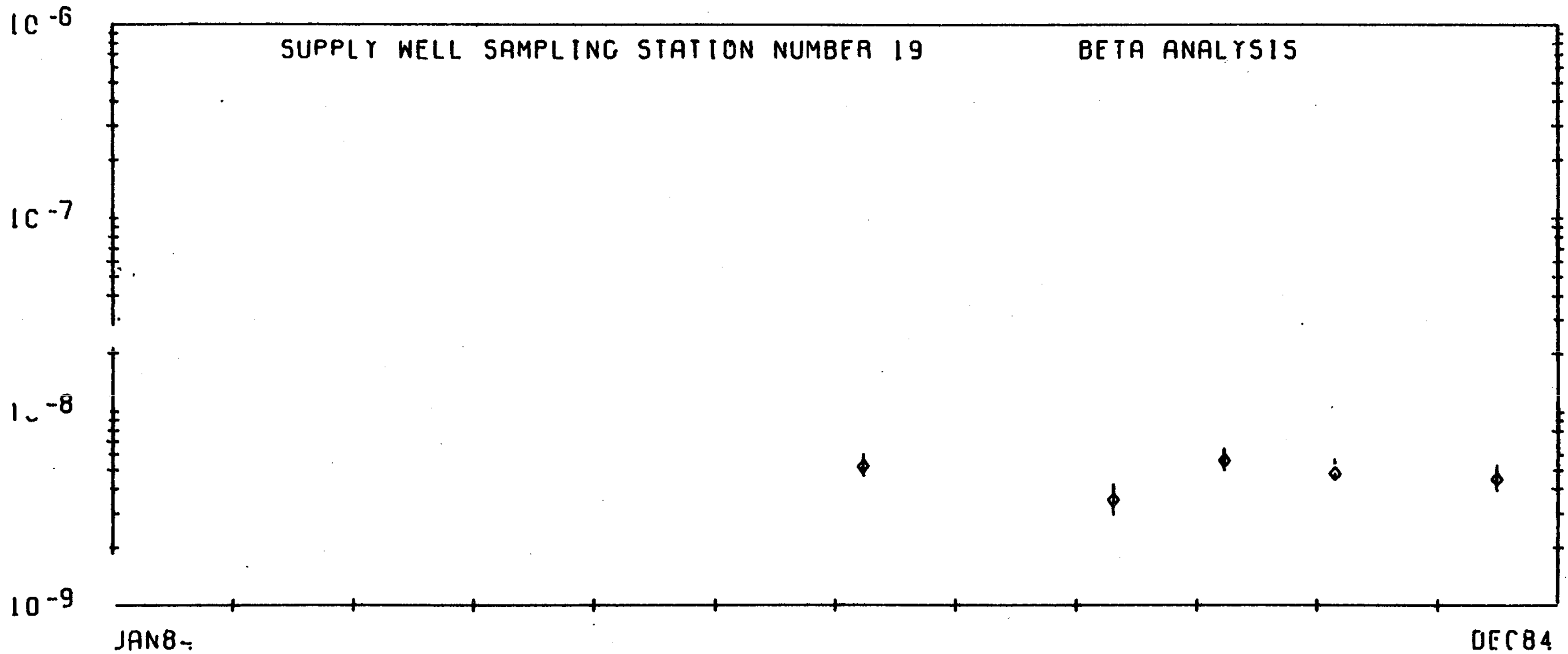
SUPPLY WELL SAMPLING STATION NUMBER 13
BETA ANALYSIS
MIC.C/CC
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84



SUPPLY WELL SAMPLING STATION NUMBER 14
BETA ANALYSIS
MIC.C/CC
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84


SUPPLY WELL SAMPLING STATION NUMBER 15
BETA ANALYSIS
MIC.C/CC
10⁻⁷
10⁻⁸
10⁻⁹
JAN84
DEC84


SUPPLY WELL SAMPLING STATION NUMBER 18
BETA ANALYSIS
MIC.C/CC
10⁻⁶
10⁻⁷
10⁻⁸
10⁻⁹
JAN84
DEC84


SUPPLY WELL SAMPLING STATION NUMBER 19
BETA ANALYSIS
MIC.C/CC
10 -6
10 -7
10 -8
10 -9
JAN84
DEC84

A P P E N D I X D

NTS Environmental Surveillance

Potable Water Locations and Plots

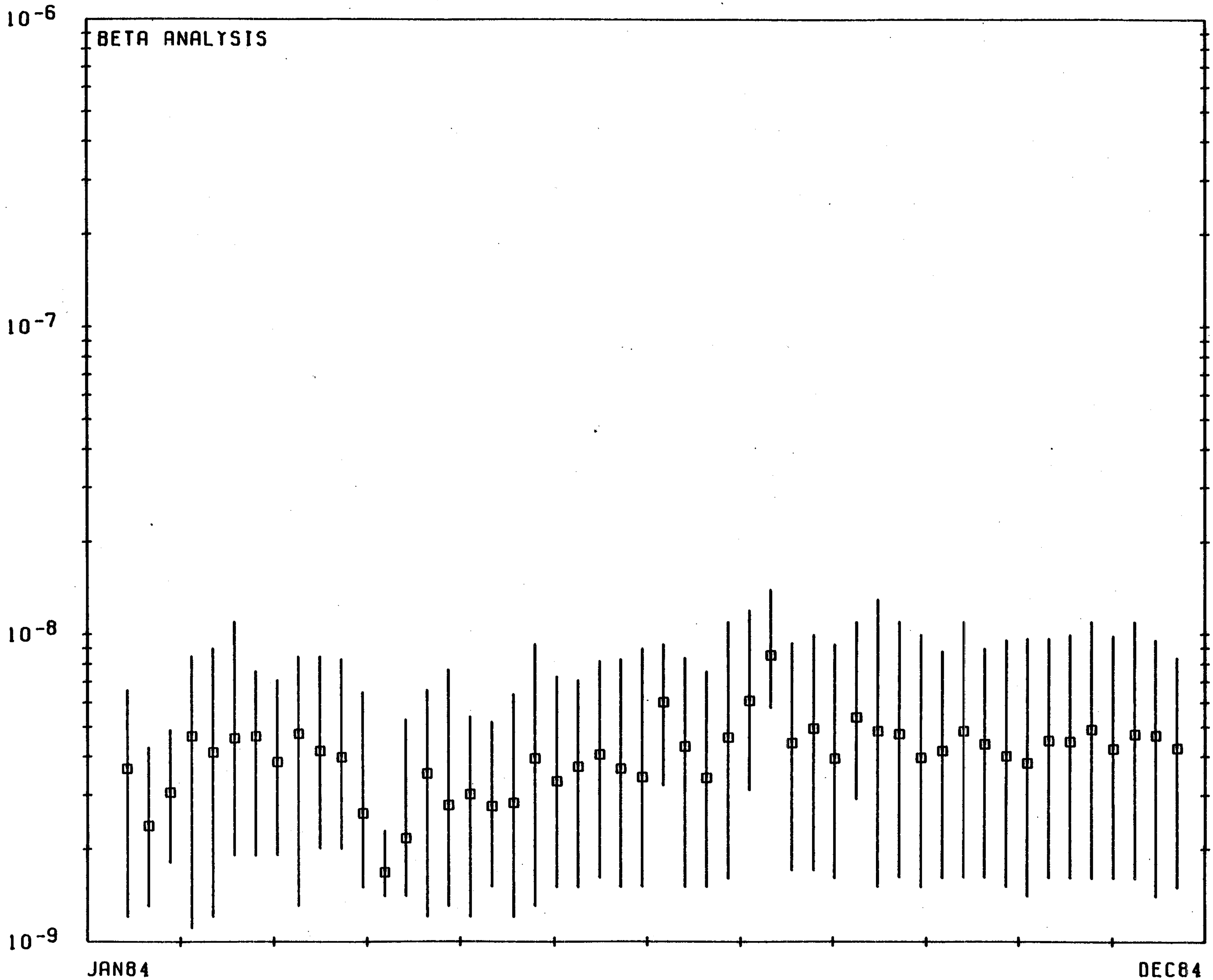
In the first two pages of plots in Appendix D, the potable water network averages, a square is used to represent the arithmetic mean of all values at that point in time, and the vertical line is the range of the data.

The remaining plots show the gross beta data of each station. A two-sigma error bar is also added to the data points, and, in all plots, a delta with a line to the bottom of the plot means below detection limit.

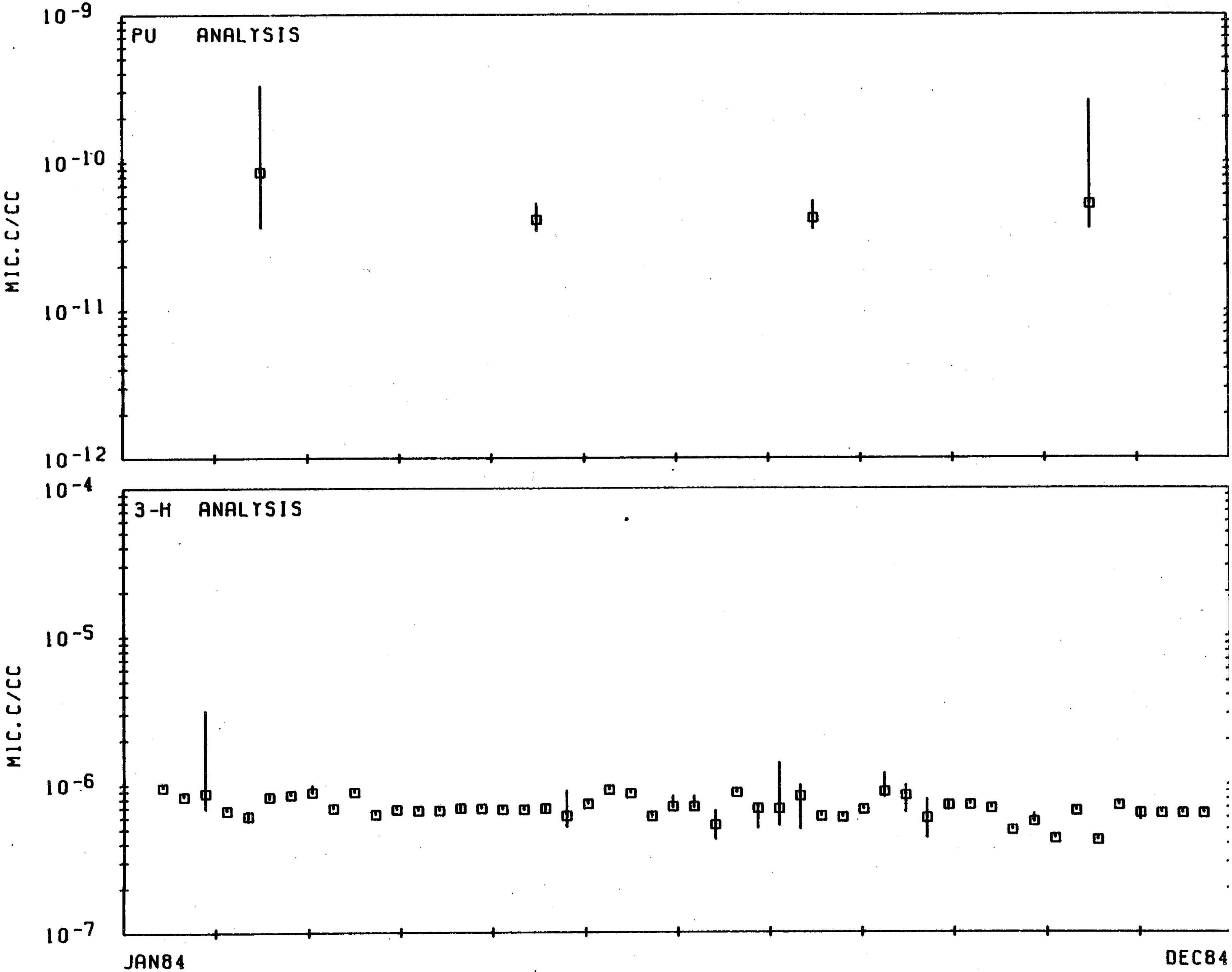
NTS ENVIRONMENTAL SURVEILLANCE
POTABLE WATER SAMPLING LOCATIONS

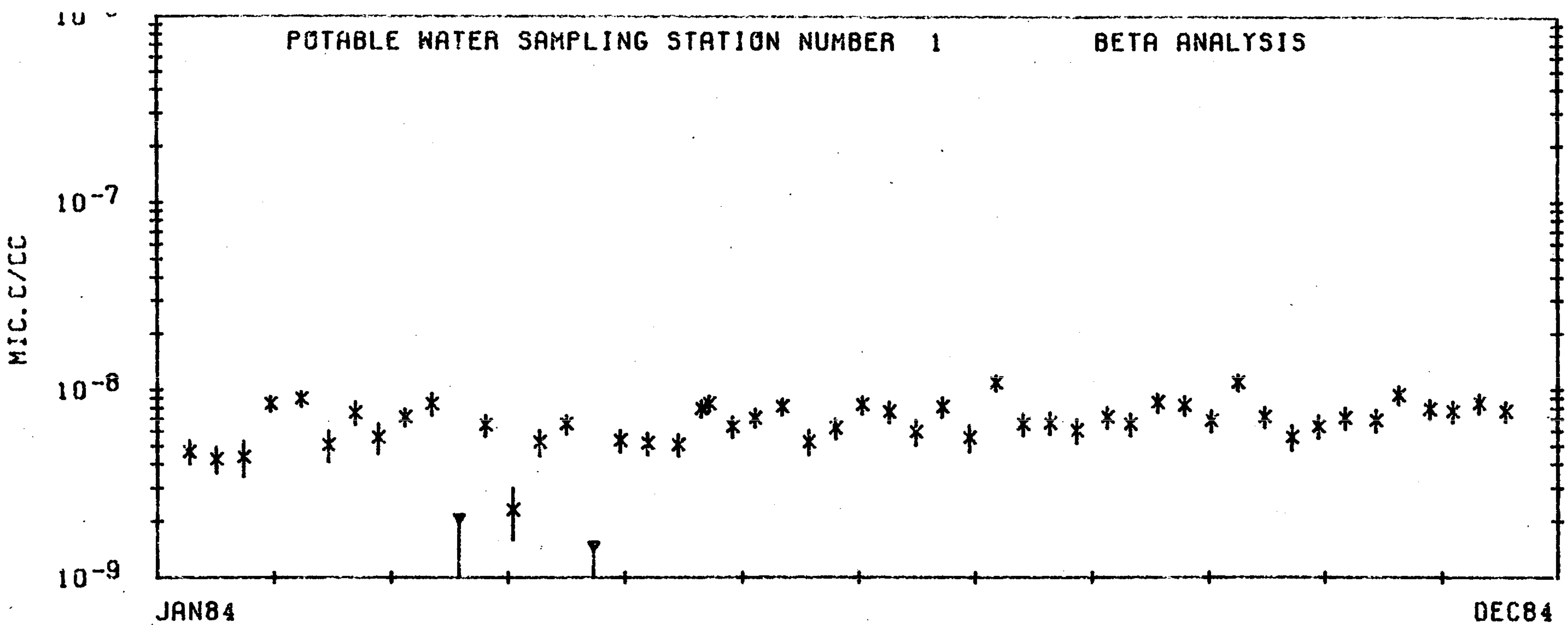
Station Number	Location
1	Area 3 Cafeteria
2	Area 2 Rest Room
3	Area 12 Cafeteria
4	Area 23 Cafeteria
5	Area 27 Cafeteria
6	Area 6 Cascade Water
7	Area 6 Cafeteria
10	Area 25 Service Station

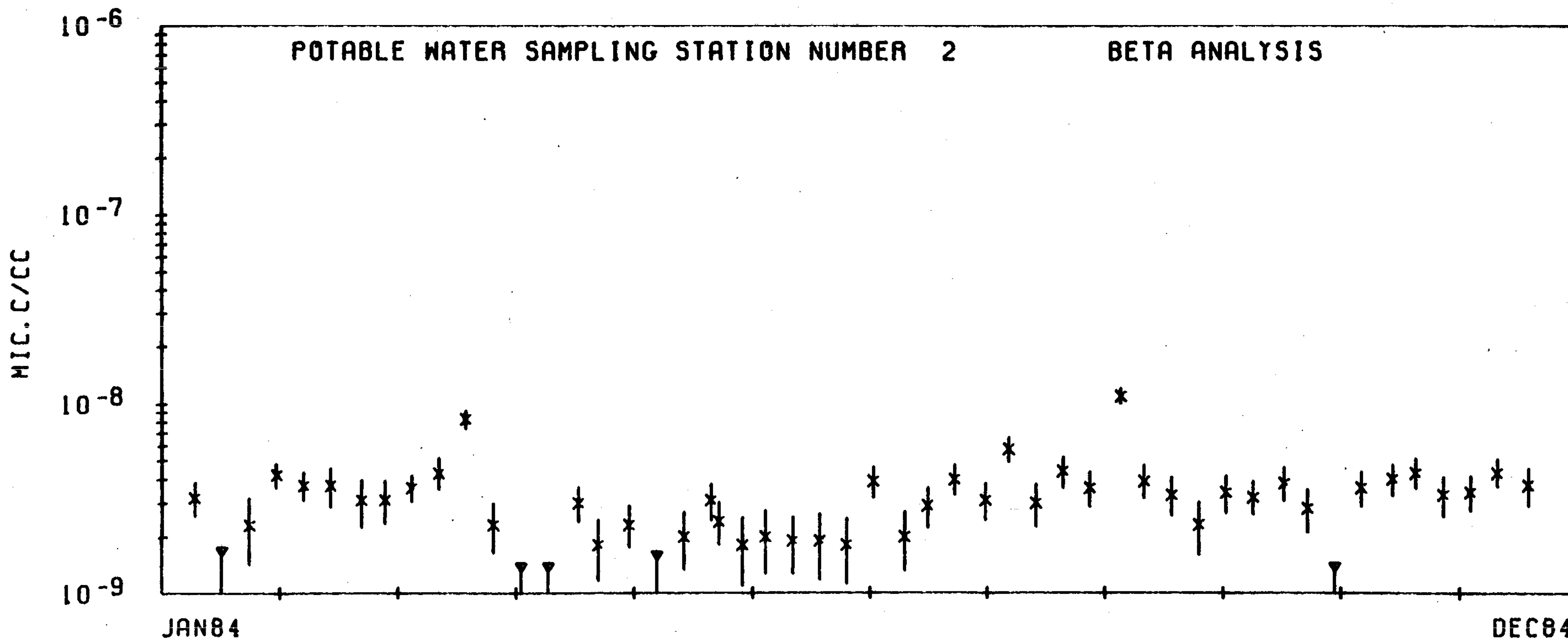
POTABLE WATER NETWORK AVERAGES

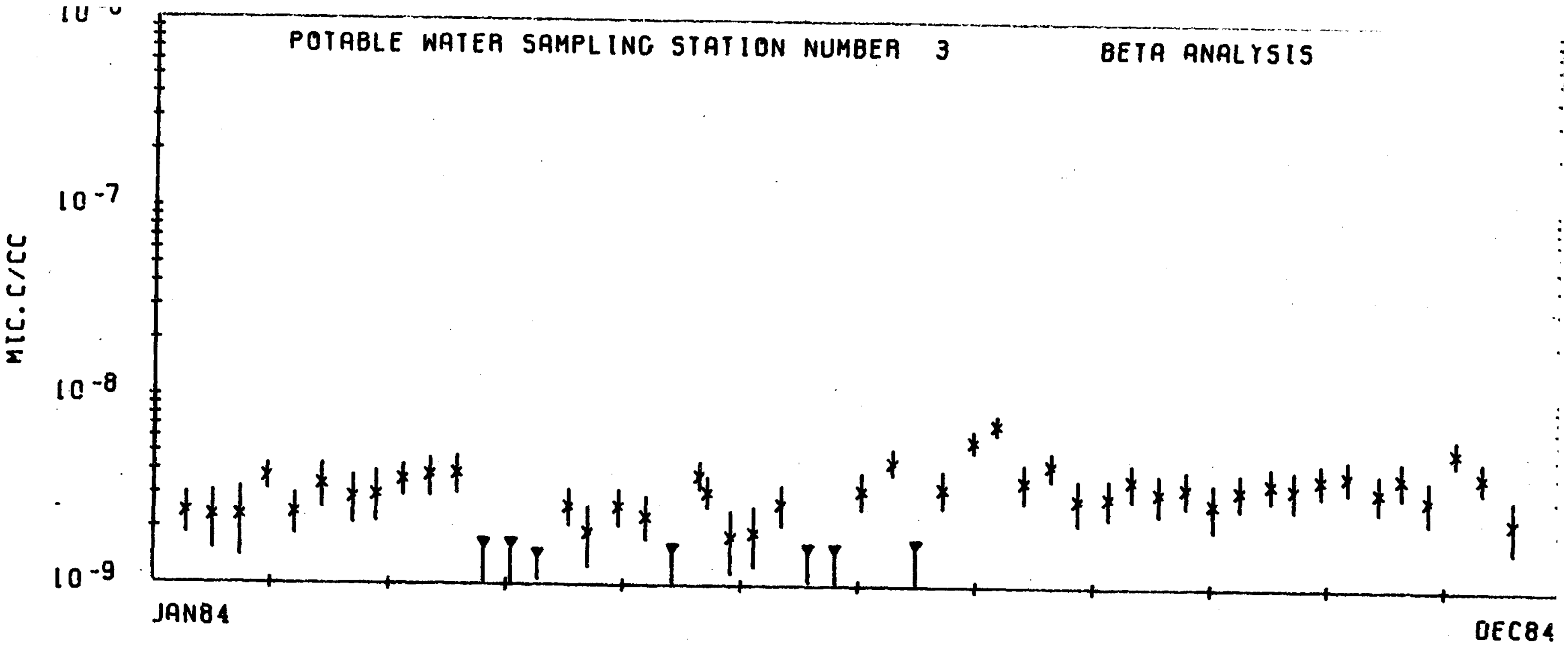


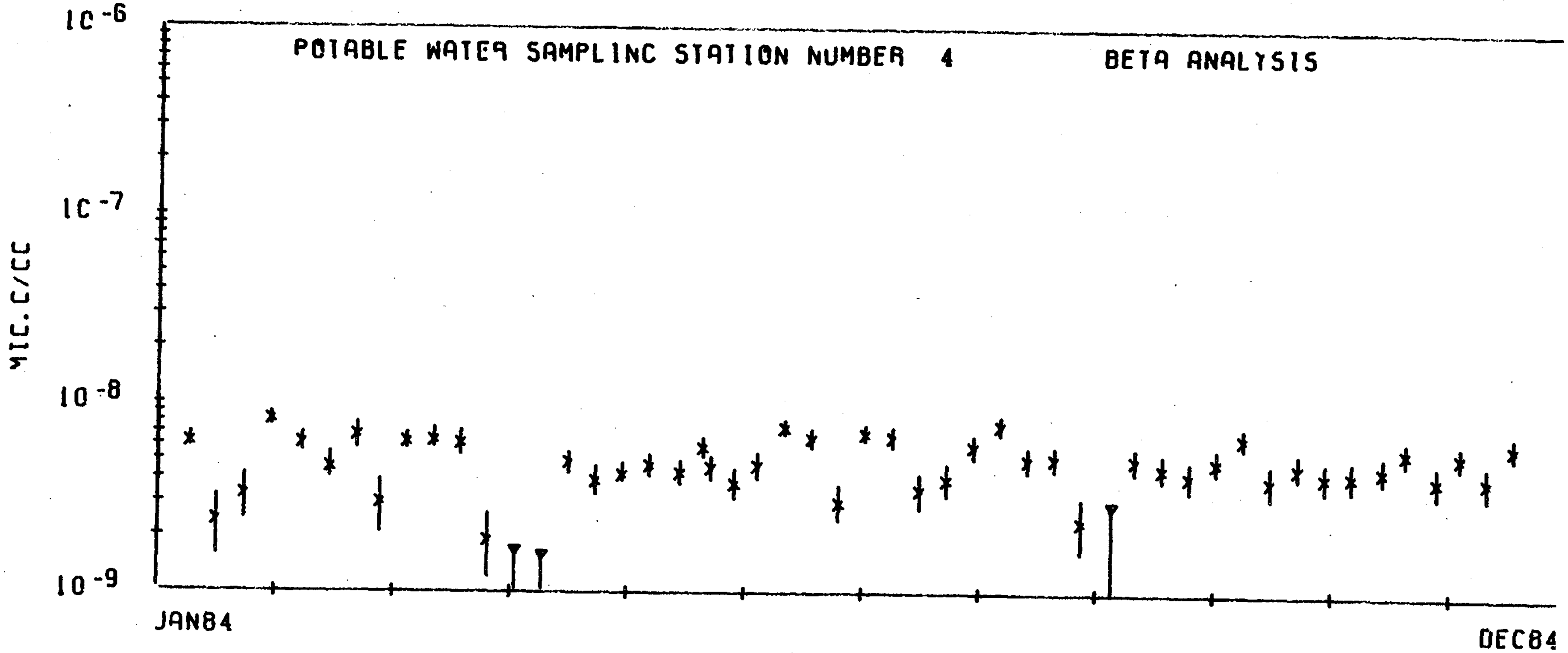
POTABLE WATER NETWORK AVERAGES

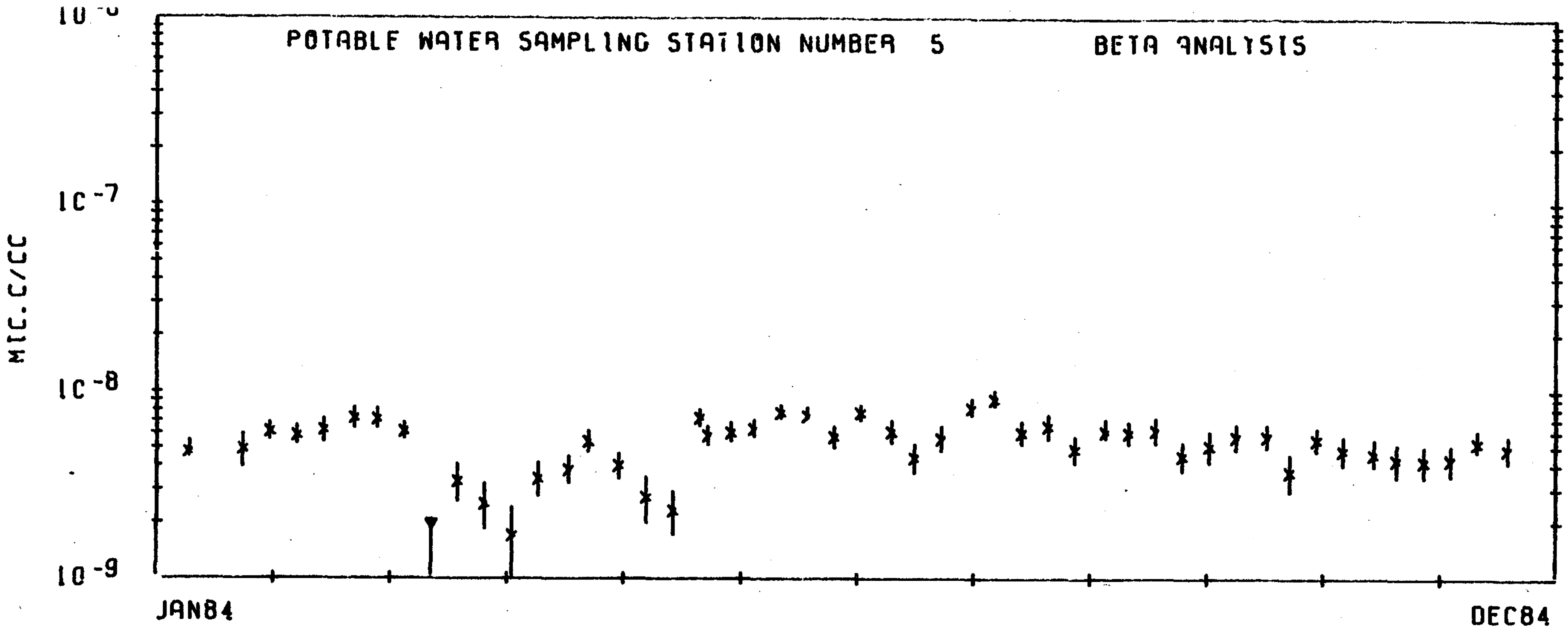


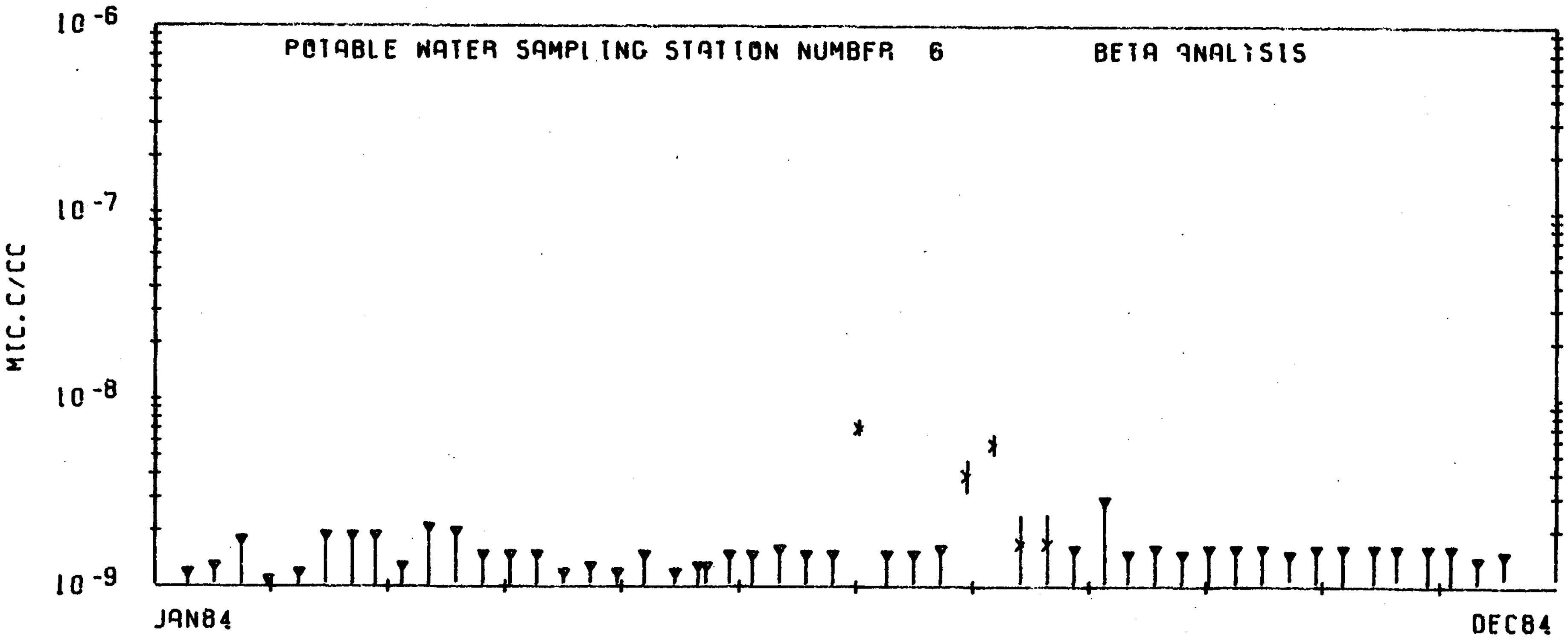

POTABLE WATER SAMPLING STATION NUMBER 1 BETA ANALYSIS
MIC.C/CC
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84

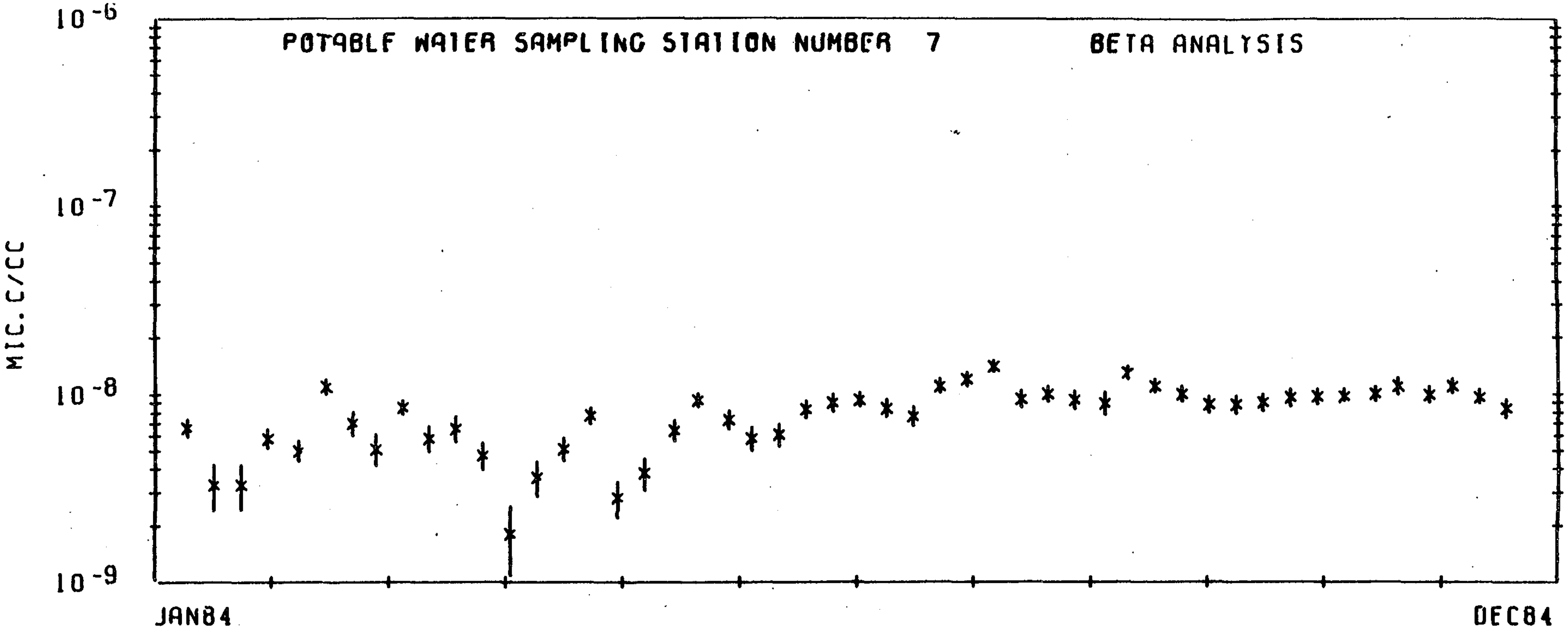

POTABLE WATER SAMPLING STATION NUMBER 2 BETA ANALYSIS
MIC.C/CC
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84

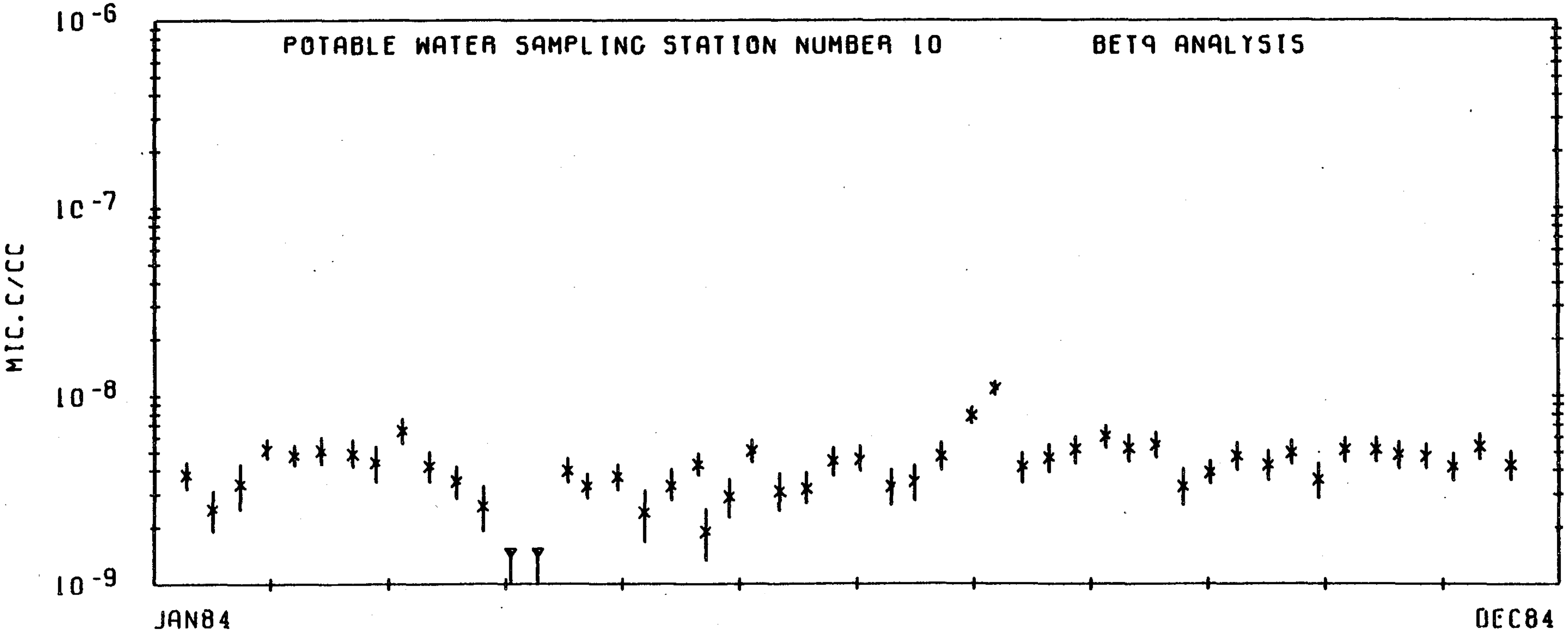

POTABLE WATER SAMPLING STATION NUMBER 3
BETA ANALYSIS
MIC.C/CC
10 -7
10 -8
10 -9
JAN84
DEC84


POTABLE WATER SAMPLING STATION NUMBER 4
BETA ANALYSIS
MIC.C/CC
10 -6
10 -7
10 -8
10 -9
JAN84
DEC84


POTABLE WATER SAMPLING STATION NUMBER 5
BETA ANALYSIS
MIC.C/CC
JAN84
DEC84


POTABLE WATER SAMPLING STATION NUMBER 6
BETA ANALYSIS
10 -6
10 -7
10 -8
10 -9
MIC.C/CC
JAN84
DEC84


POTABLF WATER SAMPLING STATION NUMBER 7
BETA ANALYSIS
MIC.C/CC
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84


POTABLE WATER SAMPLING STATION NUMBER 10
BETA ANALYSIS
MIC.C/CC
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84

A P P E N D I X E

NTS Environmental Surveillance

Open Reservoir Locations and Plots

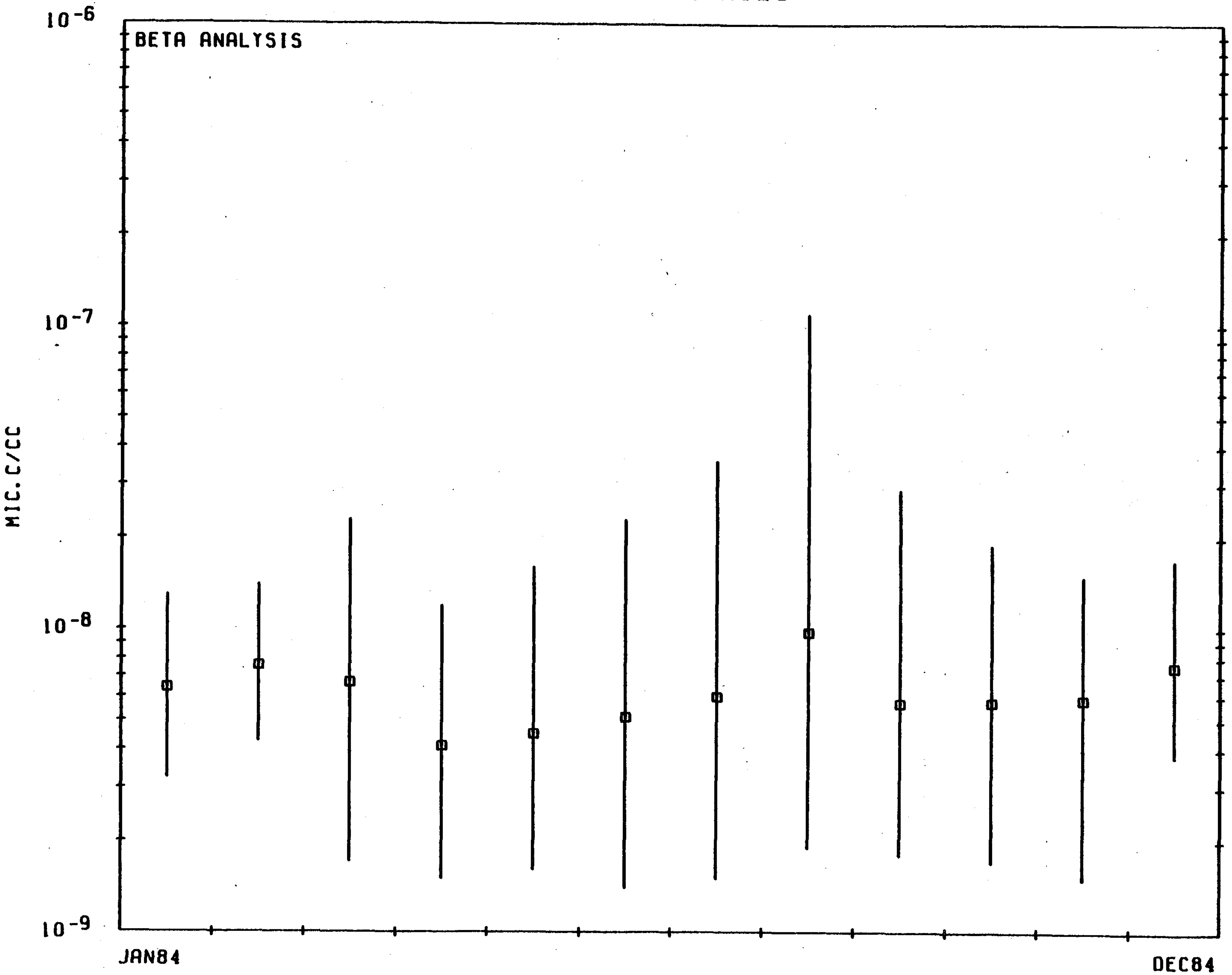
Several symbols are used in Appendix E to denote the data points. In the first two pages of plots, the open reservoir network averages, a square represents the arithmetic mean of all values at that point in time, and the vertical line is the range of the data. The remaining plots of Appendix E show the gross beta data of each station. A two-sigma error is also added to the data points, and, in all plots, a delta with the line to the bottom of the plot means below detection limit.

NTS ENVIRONMENTAL SURVEILLANCE
OPEN RESERVOIRS SAMPLING LOCATIONS

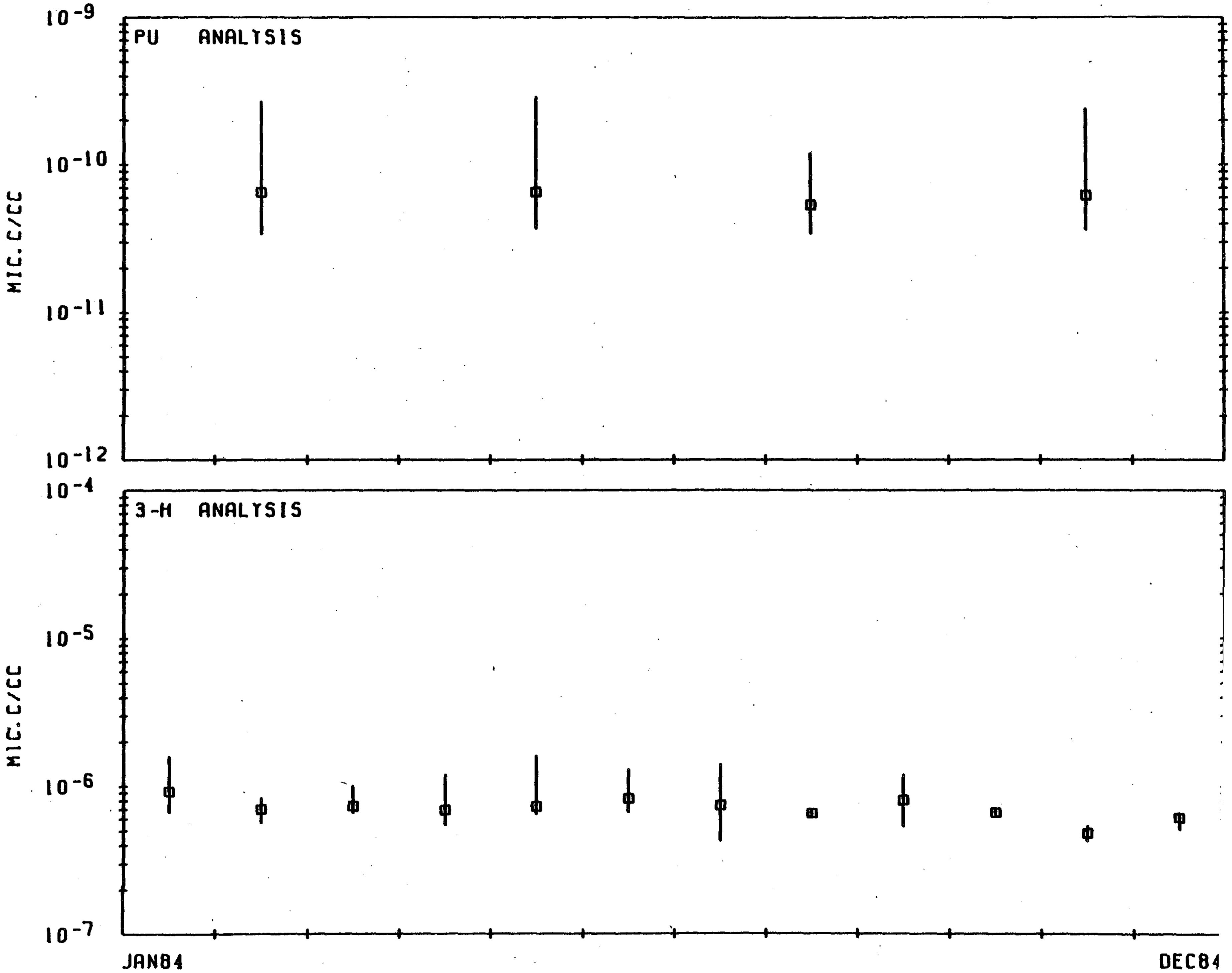
Station Number	Location
1	Area 2 Well 2 Reservoir
2	Area 3 Well A Reservoir
3	Area 5 Well 5B Reservoir
4	Area 5 Well Ue5c Reservoir
5	Area 6 Well 3 Reservoir
6	Area 6 Well C1 Reservoir
8	Area 18 Camp 17 Reservoir
11	Area 20 Well 20A Reservoir
12	Area 23 Swimming Pool
16	Area 19 Well U19c Reservoir
* 17	Area 25 Well J-12 Reservoir
18	Area 3 Mud Plant Reservoir
19	Area 2 Mud Plant Reservoir
20	Area 25 Well J-11 Reservoir
21	Area 18 Well 8 Reservoir
22	Area 5 Reservoir

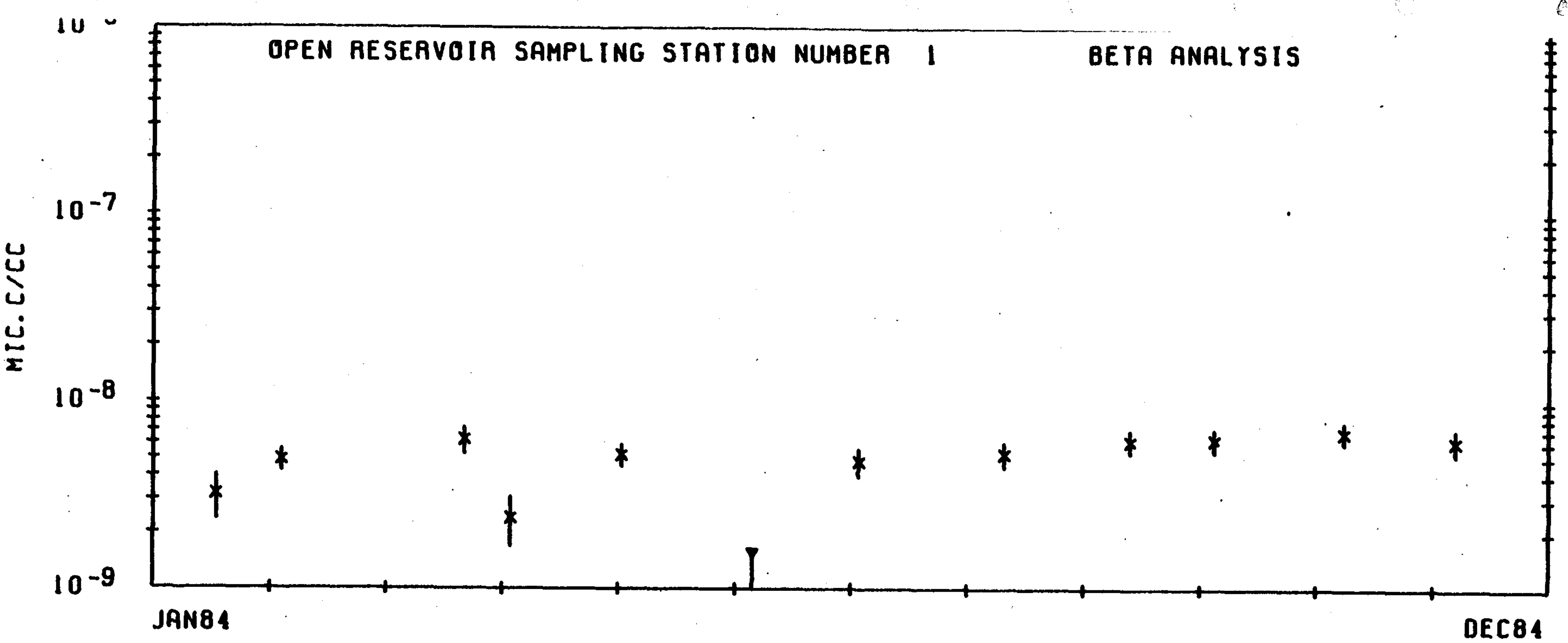
* Reservoir was dry.

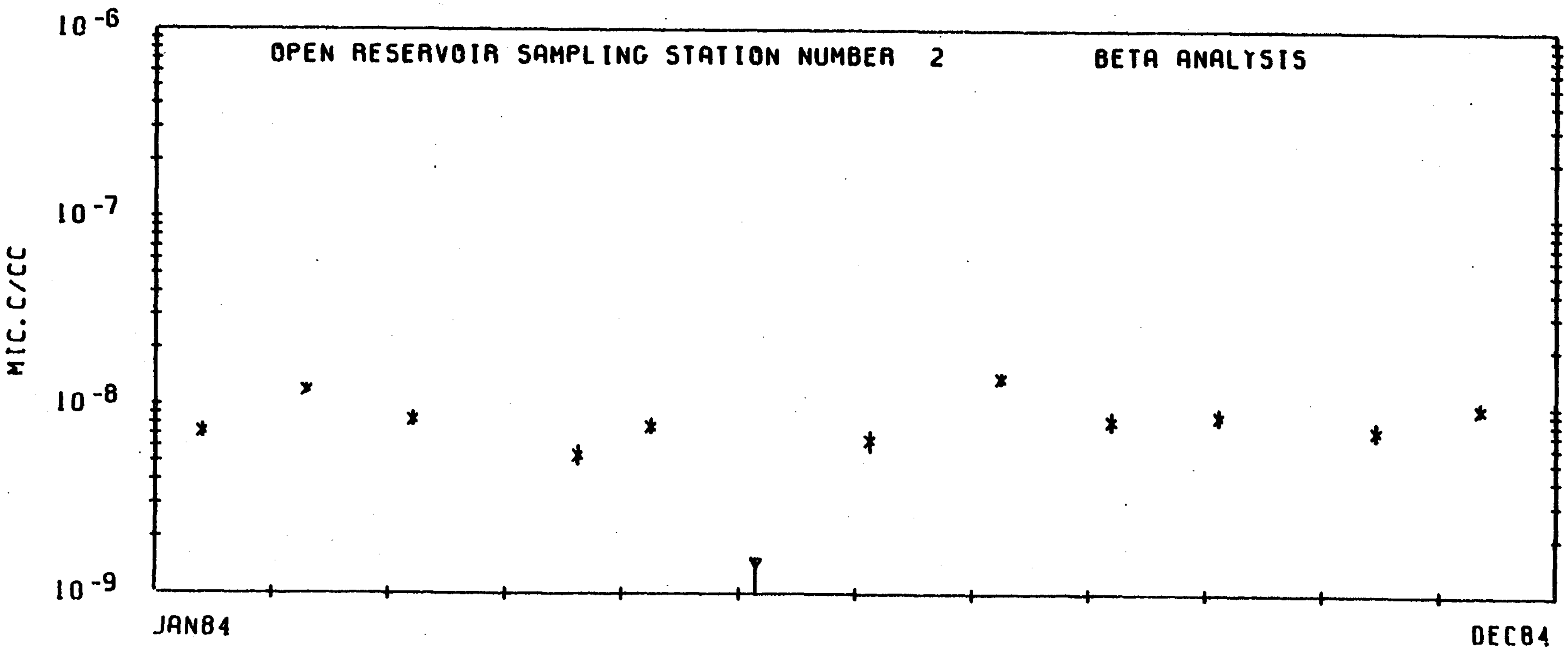
OPEN RESERVOIR NETWORK AVERAGES

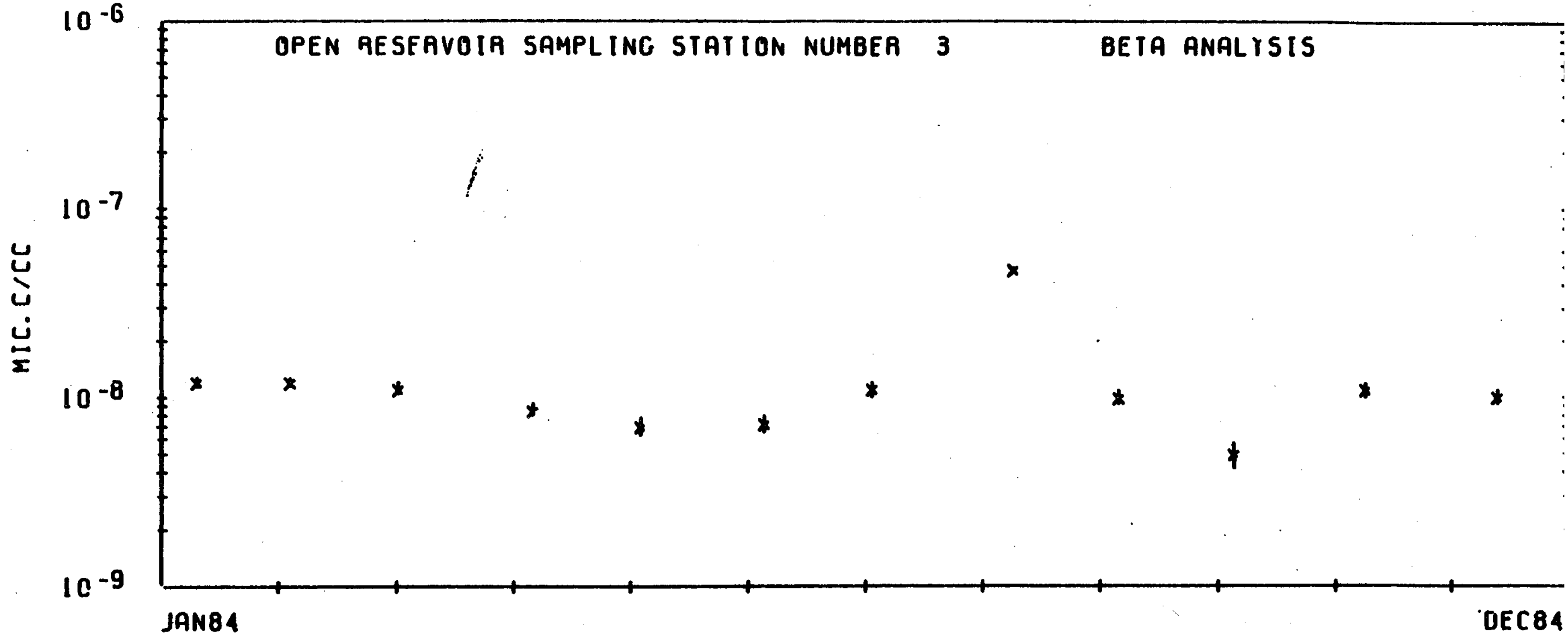


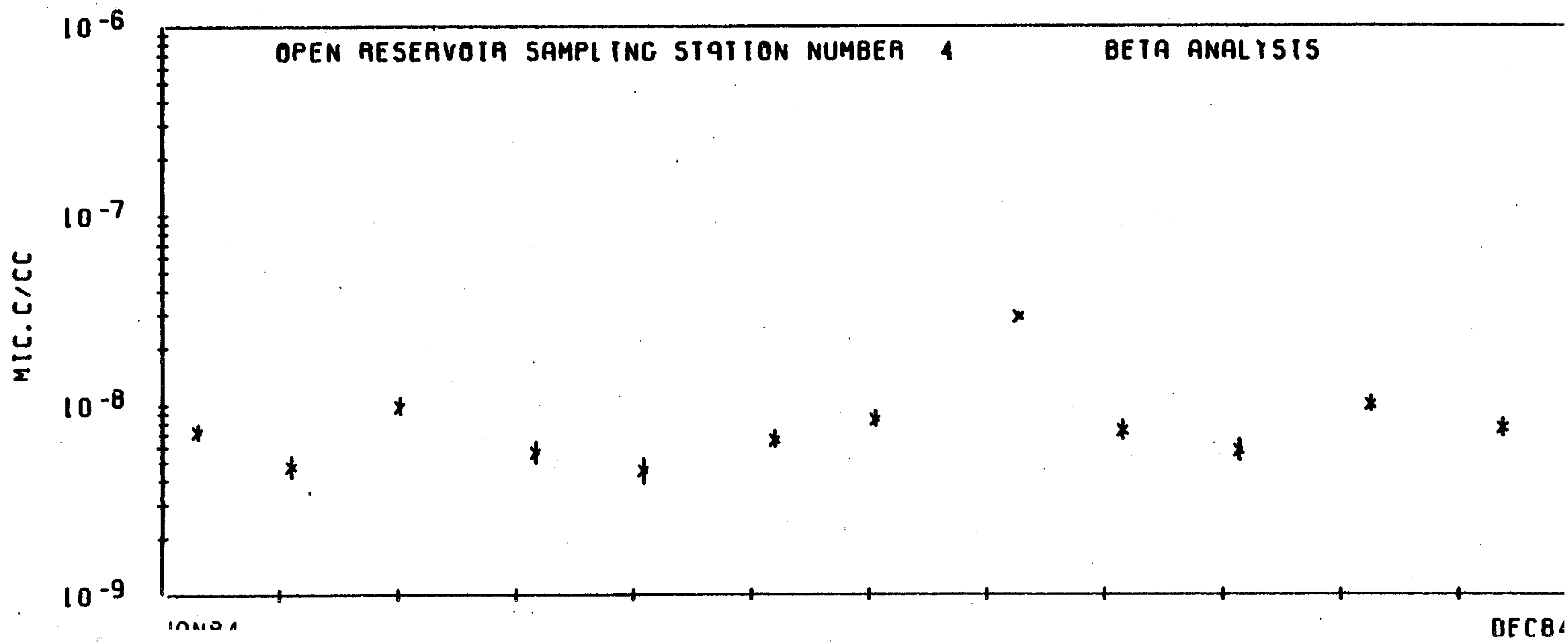
OPEN RESERVOIR NETWORK AVERAGES

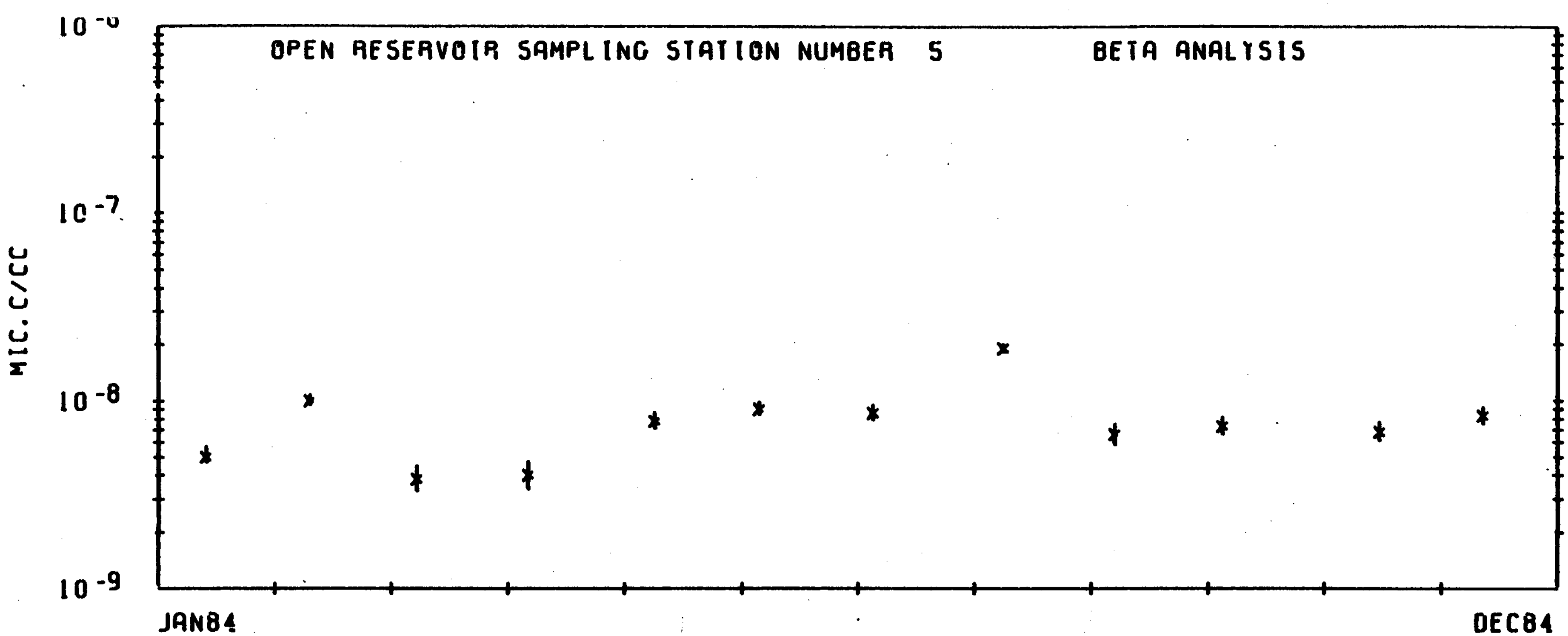


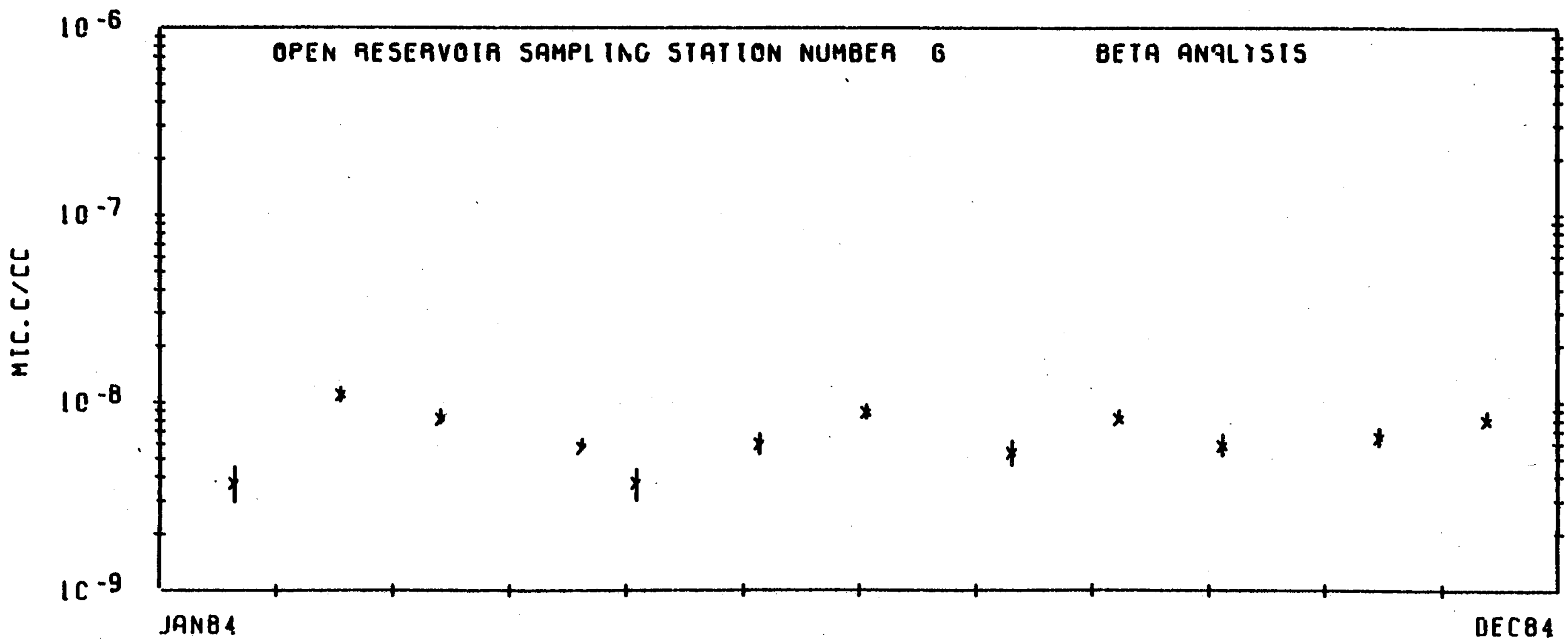

OPEN RESERVOIR SAMPLING STATION NUMBER 1
BETA ANALYSIS
10 -7
10 -8
10 -9
MIC.C/CC
JAN84
DEC84

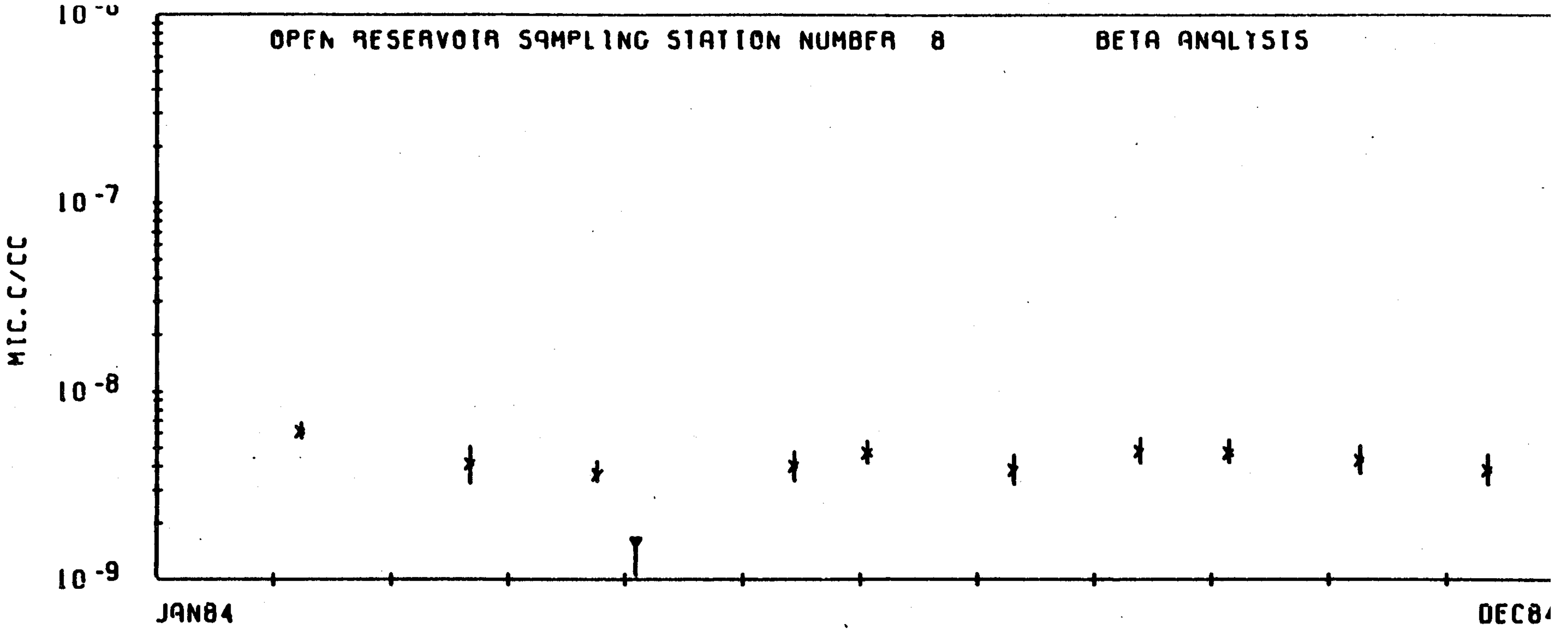

OPEN RESERVOIR SAMPLING STATION NUMBER 2
BETA ANALYSIS
10 -6
10 -7
10 -8
10 -9
MIC.C/CC
JAN84
DEC84


OPEN RESERVOIR SAMPLING STATION NUMBER 3
BETA ANALYSIS
MIC.C/CC
10 -6
10 -7
10 -8
10 -9
JAN84
DEC84


OPEN RESERVOIR SAMPLING STATION NUMBER 4
BETA ANALYSIS
MIC.C/CC
10 -6
10 -7
10 -8
10 -9


OPEN RESERVOIR SAMPLING STATION NUMBER 5
BETA ANALYSIS
MIC.C/CC
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84


OPEN RESERVOIR SAMPLING STATION NUMBER 6
BETA ANALYSIS
MIC.C/CC
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84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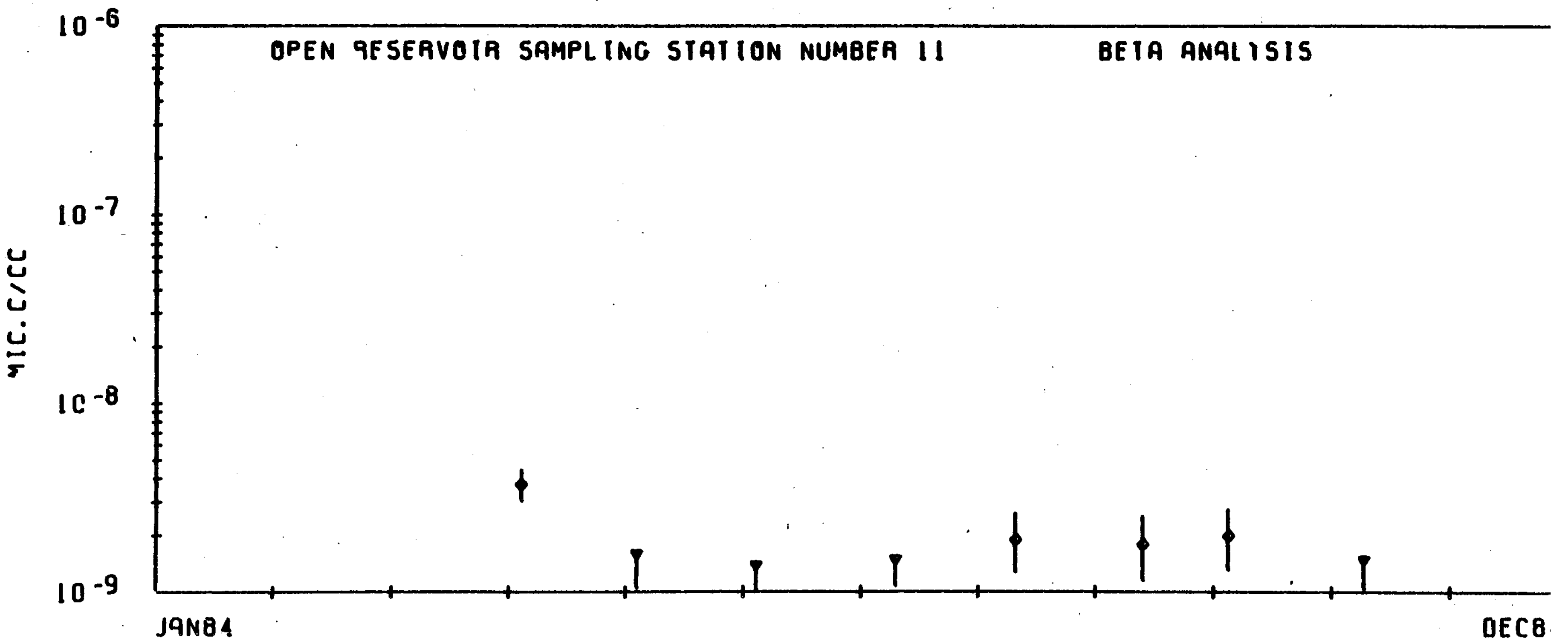
BETA ANALYSIS
MIC.C/CC
10 -6
10 -7
10 -8
10 -9
JAN84
DEC84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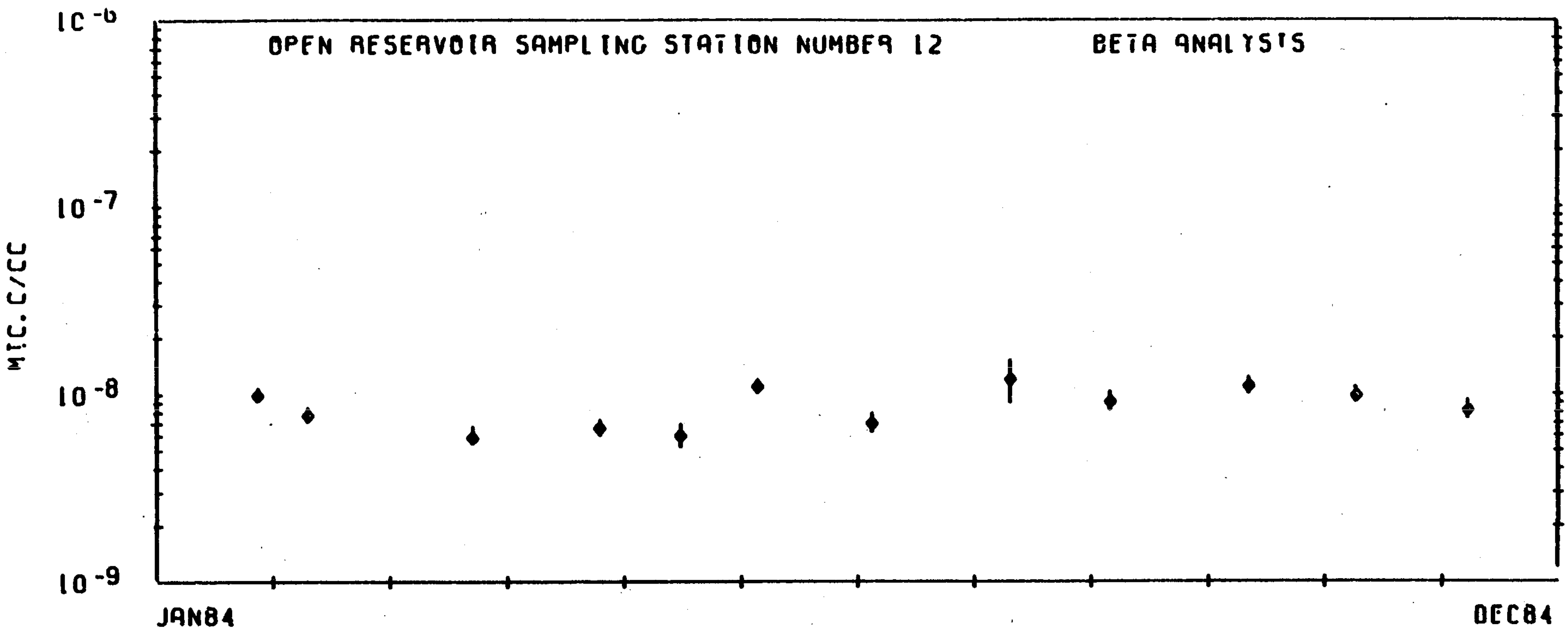
BETA ANALYSIS
MIC.C/CC
10 -6
10 -7
10 -8
10 -9
JAN84
DEC84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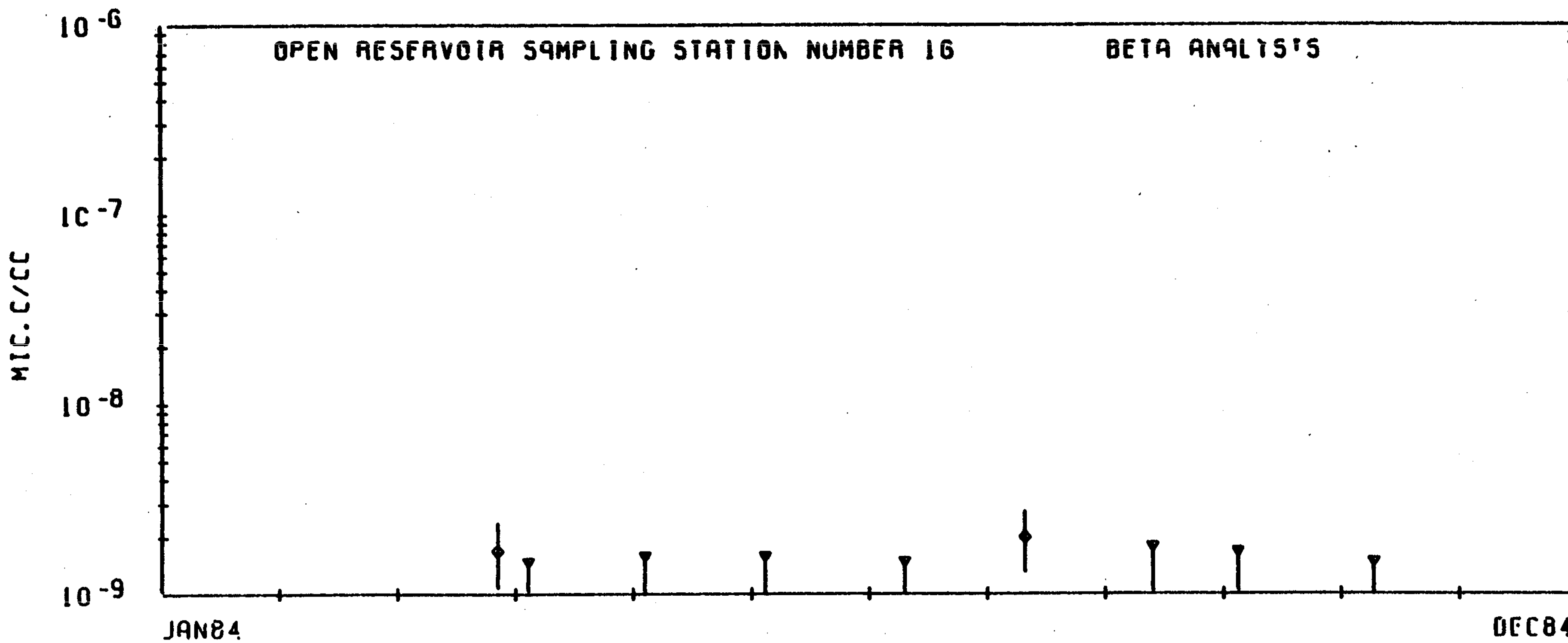
BETA ANALYSIS
MIC.C/CC
10 -6
10 -7
10 -8
10 -9
JAN84
DEC84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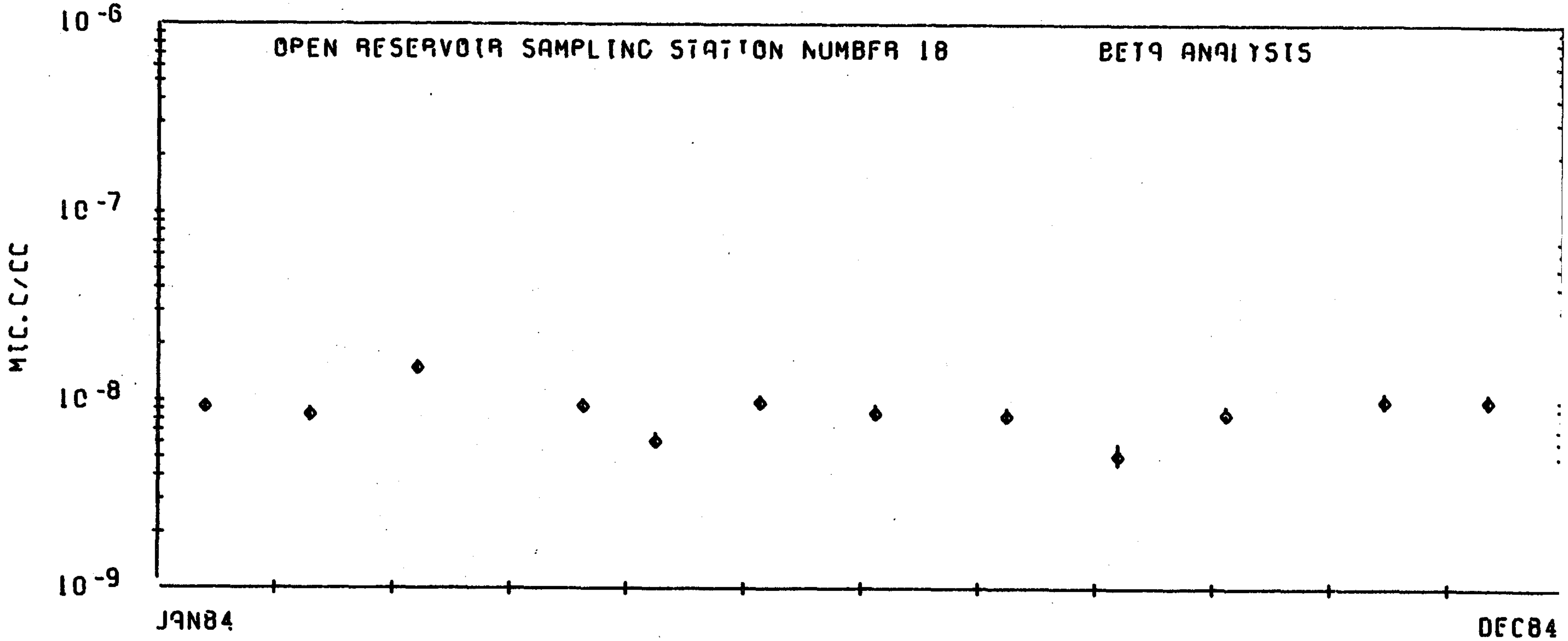
BETA ANALYSIS
MIC.C/CC
10 -6
10 -7
10 -8
10 -9
JAN84
DEC84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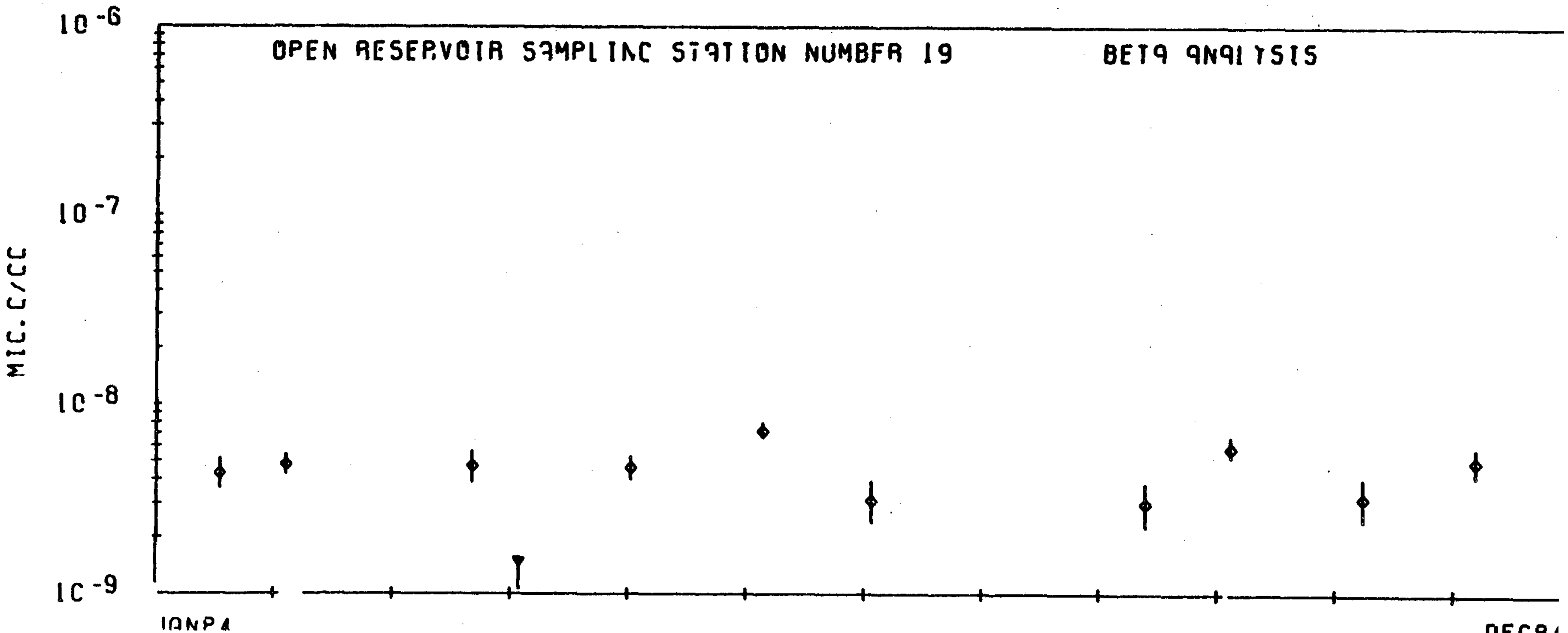
BETA ANALYSIS
MIC.C/CC
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84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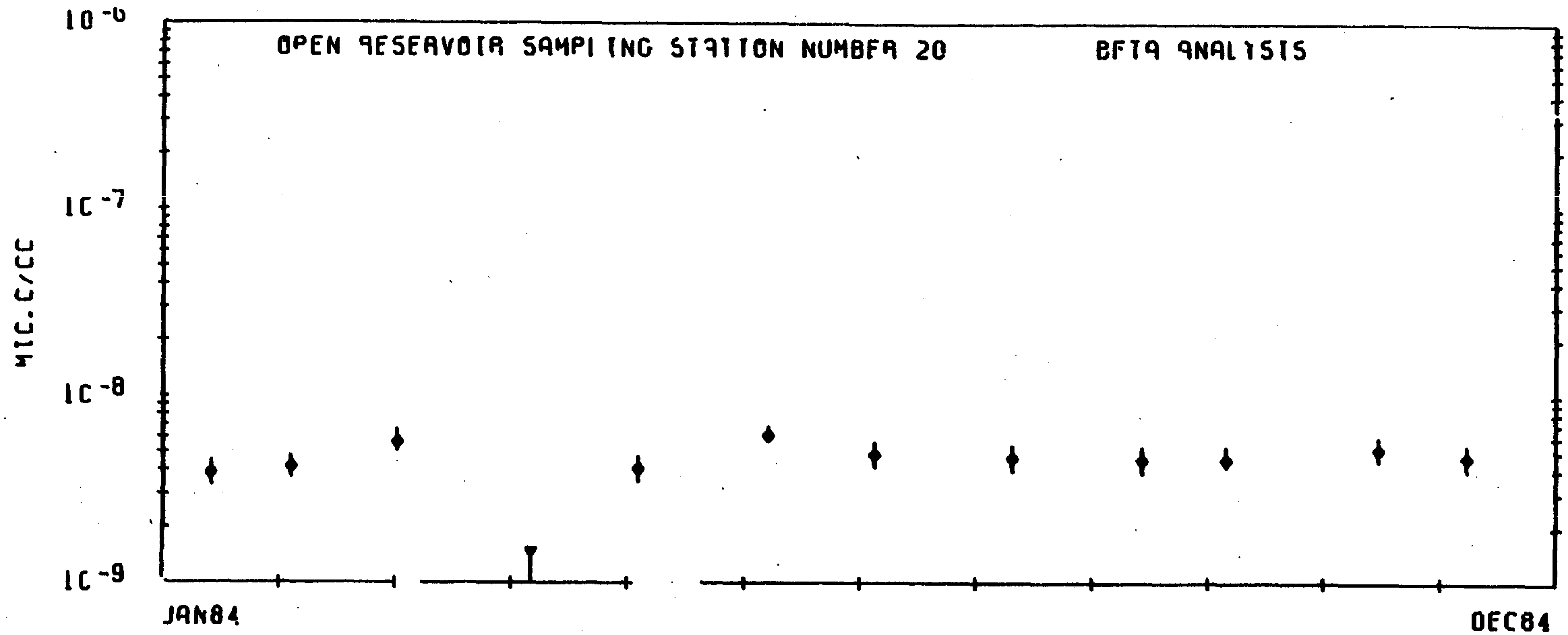
BETA ANALYSIS
MIC.C/CC
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84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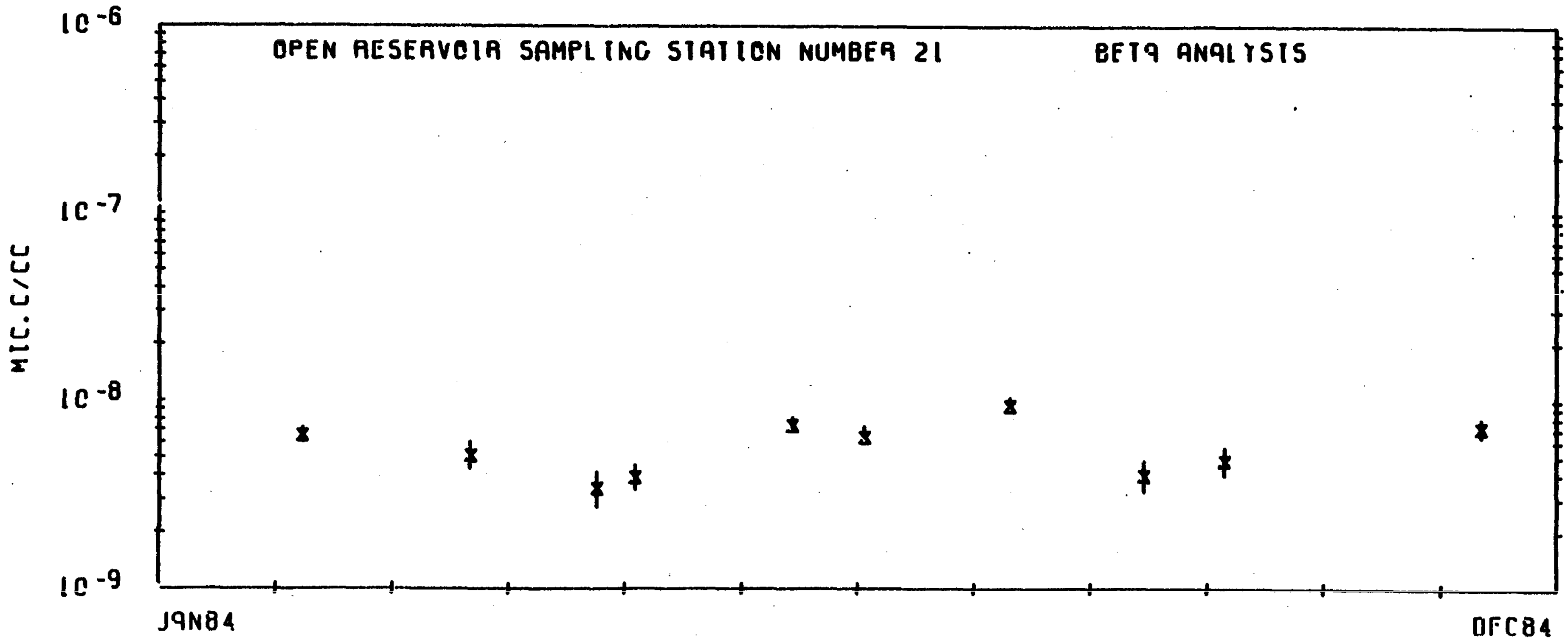
BETA ANALYSIS
MIC.C/CC
10 -6
10 -7
10 -8
10 -9
JAN84
DEC84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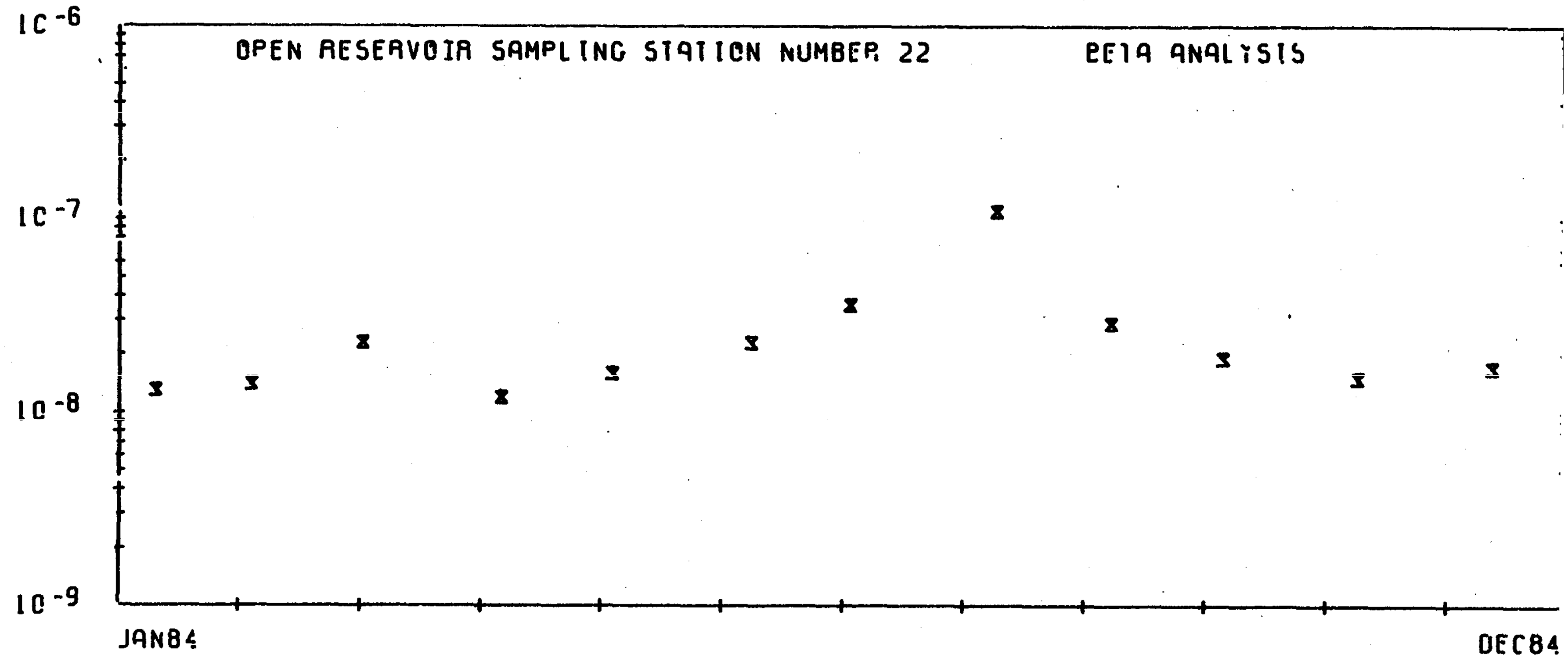
BETA ANALYSIS
MIC.C/CC
10 -6
10 -7
10 -8
10 -9
JAN84
DEC84



OPEN RESERVOIR SAMPLING STATION NUMBER 22
BETA ANALYSIS
MIC.C/CC
10 -6
10 -7
10 -8
10 -9
JAN84
DEC84

APPENDIX F

NTS Environmental Surveillance

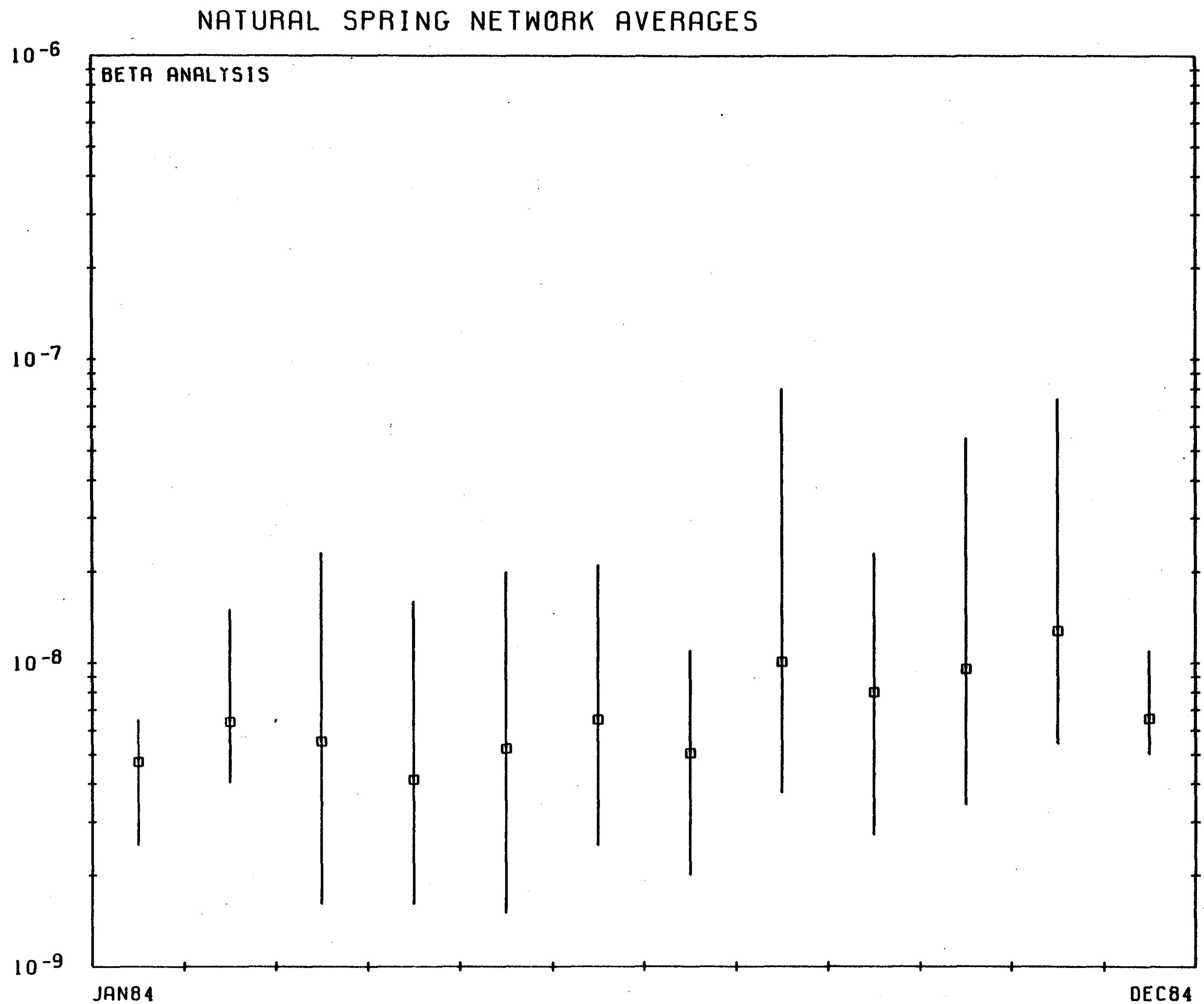
Natural Spring Locations and Plots

In the first two pages of plots in Appendix F, the natural springs network averages, a square is used to represent the arithmetic mean of all values at that point in time, and the vertical line is the range of the data. The remaining plots show the gross beta data of each station. A two-sigma error bar is also added to the data points, and, in all plots, a delta with a line to the bottom of the plot means below detection limit.

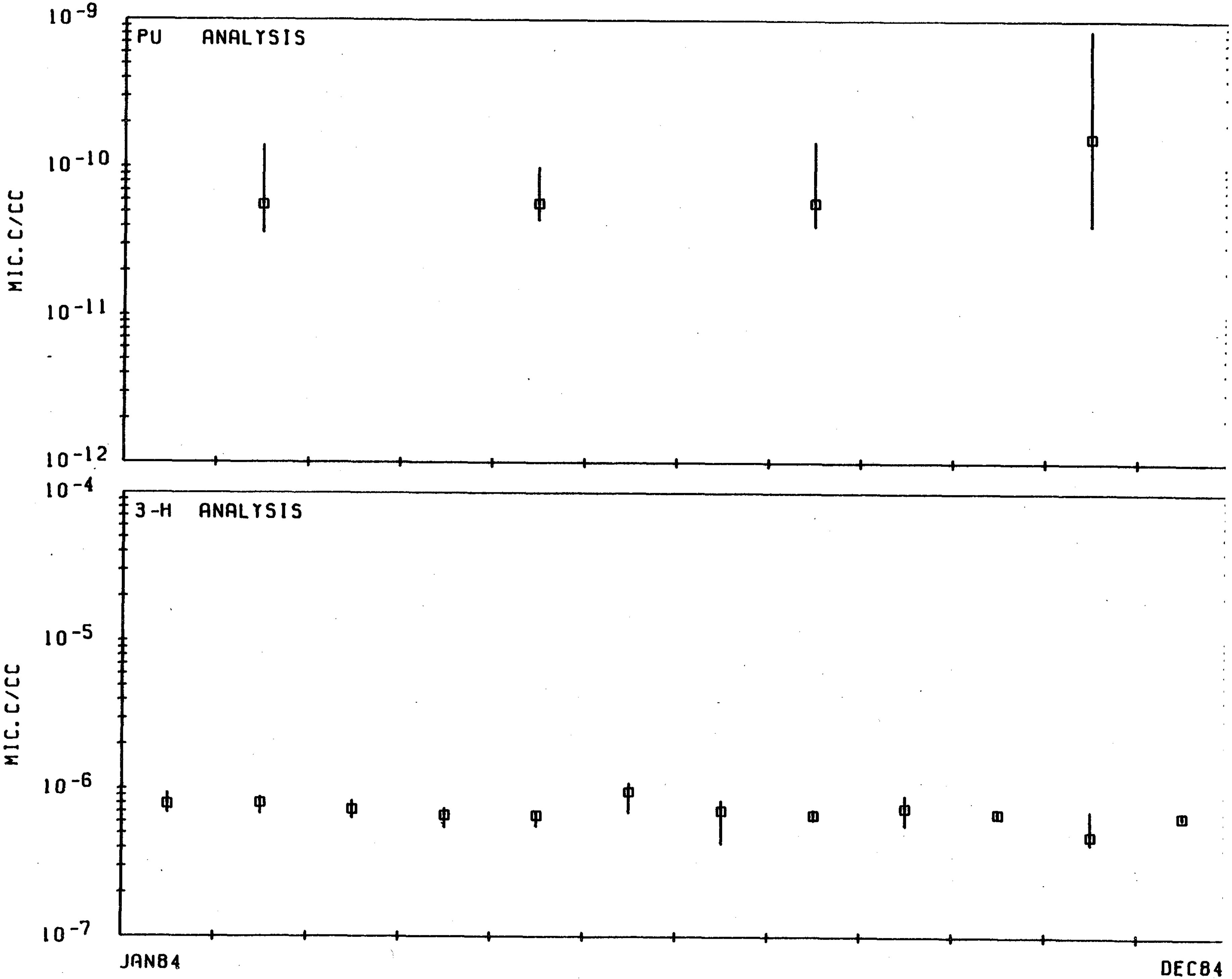
NTS ENVIRONMENTAL SURVEILLANCE
NATURAL SPRINGS SAMPLING LOCATIONS

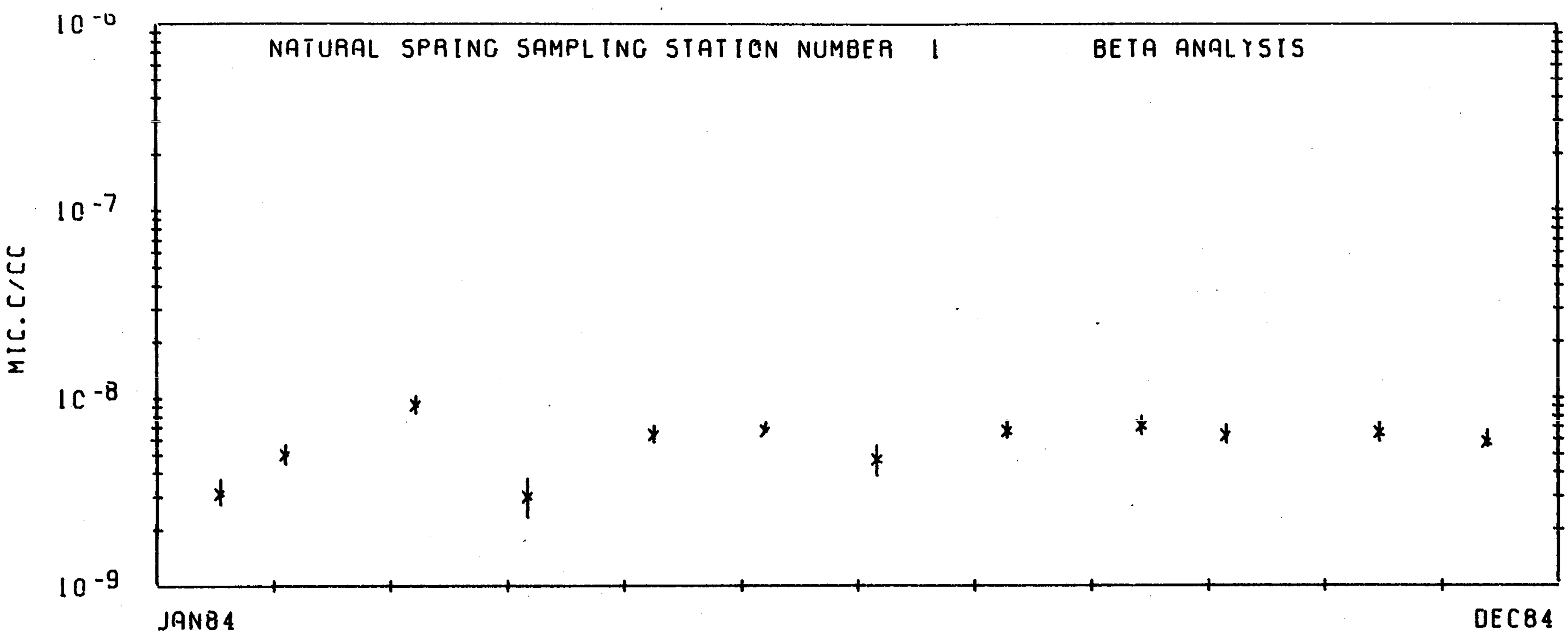
Station Number	Location
1	Area 5 Cane Springs
2	Area 12 White Rock Springs
3	Area 12 Captain Jack Spring
4	Area 12 Gold Meadows Pond
*5	Area 15 Oak Butte Spring
6	Area 15 Tub Spring
7	Area 29 Topopah Spring
8	Area 7 Reitmann Seep
9	Area 16 Tippipah Spring

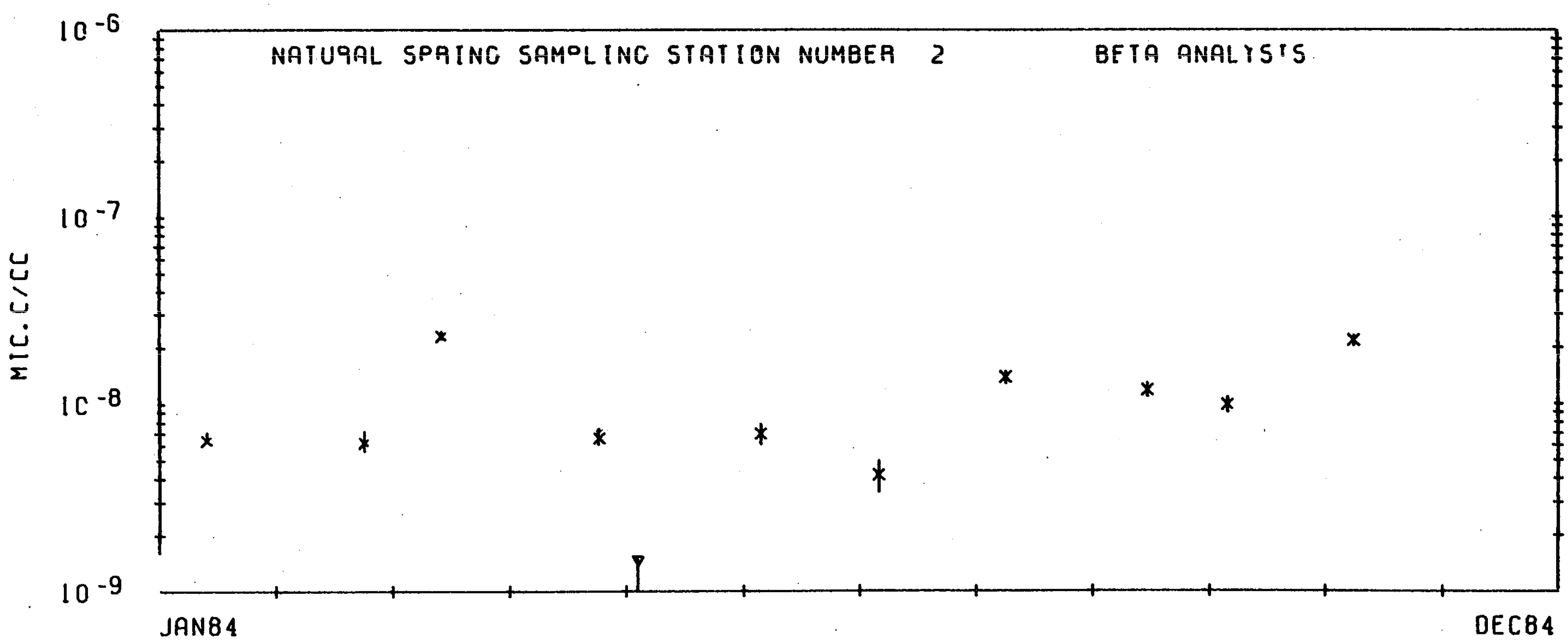
*Spring was dry.

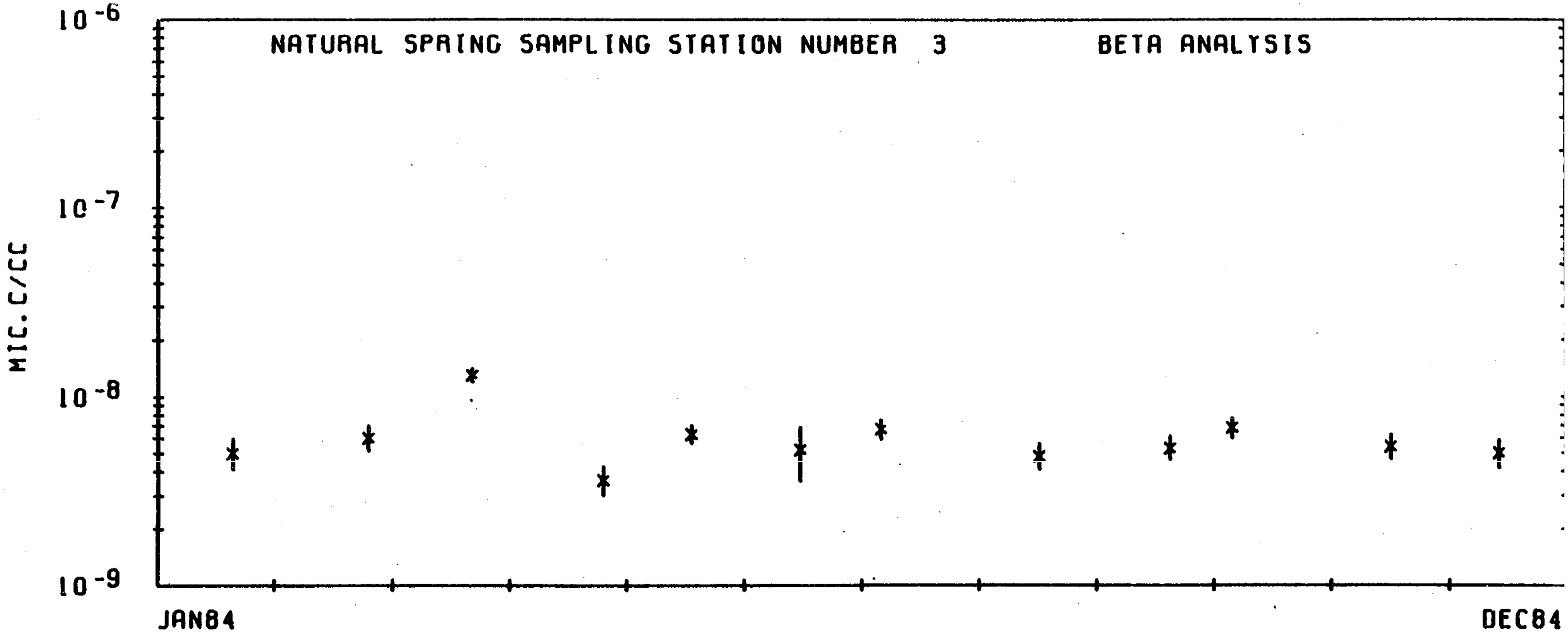

NATURAL SPRING NETWORK AVERAGES
BETA ANALYSIS
10^-6
10^-7
10^-8
10^-9
MIC.C/CC
JAN84
DEC84

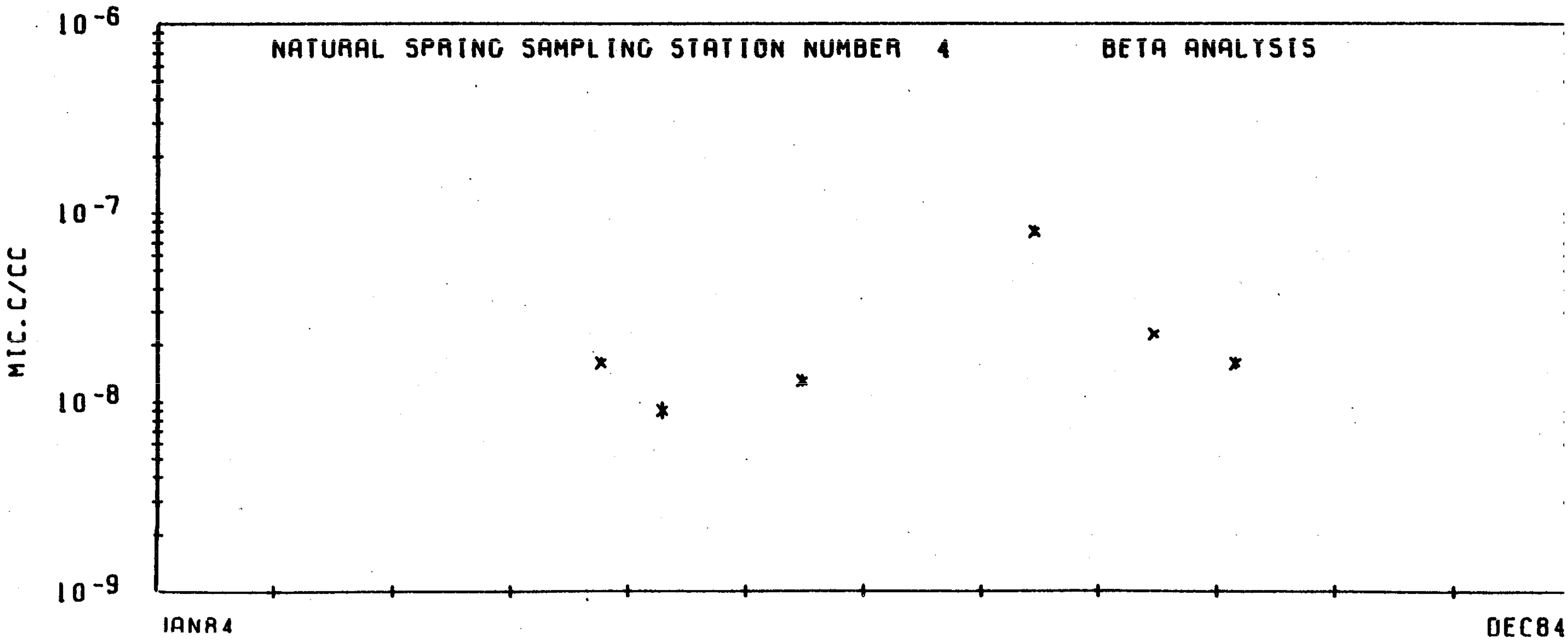
NATURAL SPRING NETWORK AVERAGES

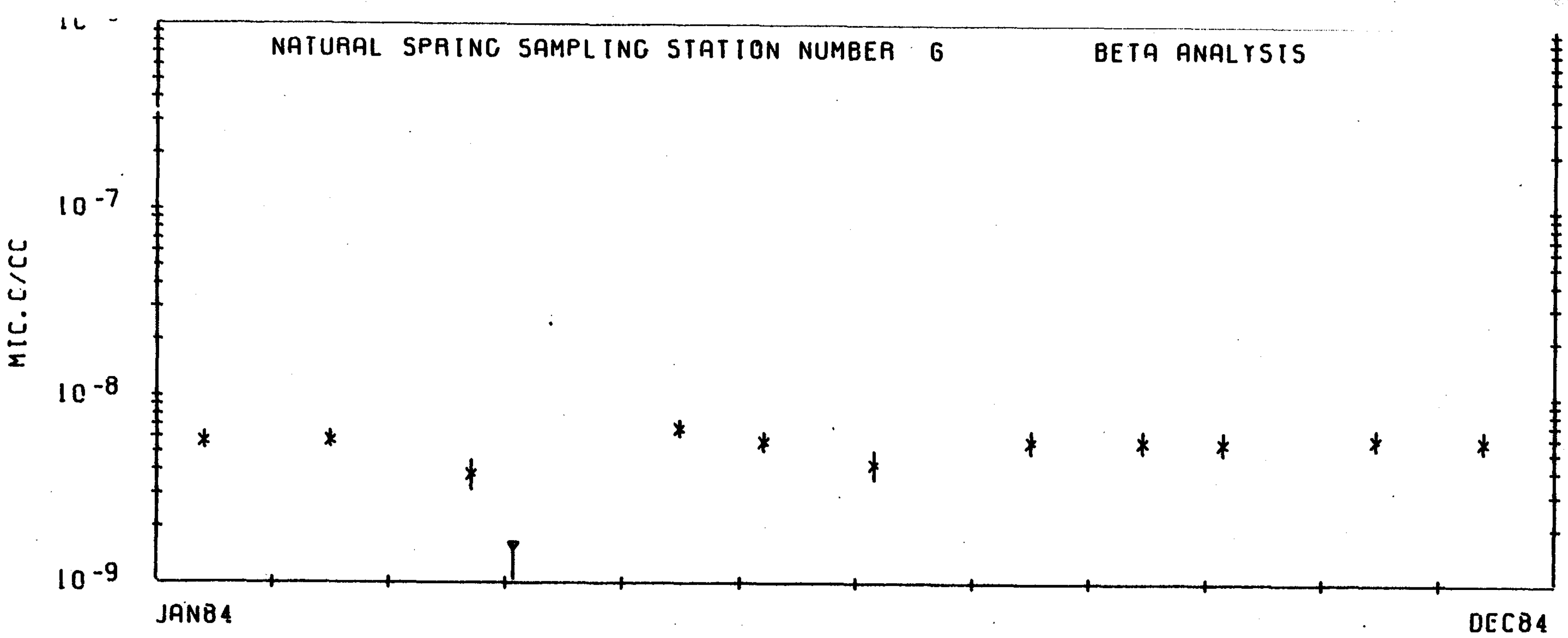


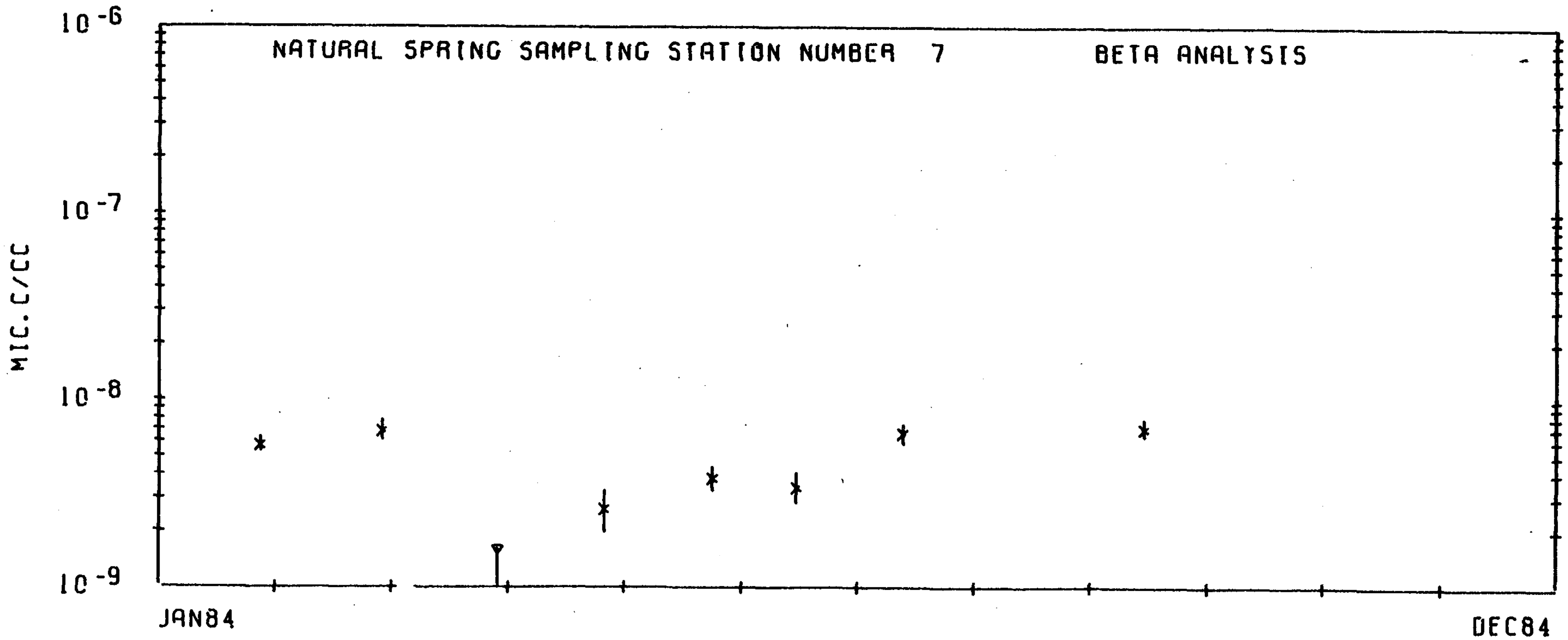

NATURAL SPRING SAMPLING STATION NUMBER 1 BETA ANALYSIS
10 -6
10 -7
10 -8
10 -9
MIC.C/CC
JAN84
DEC84

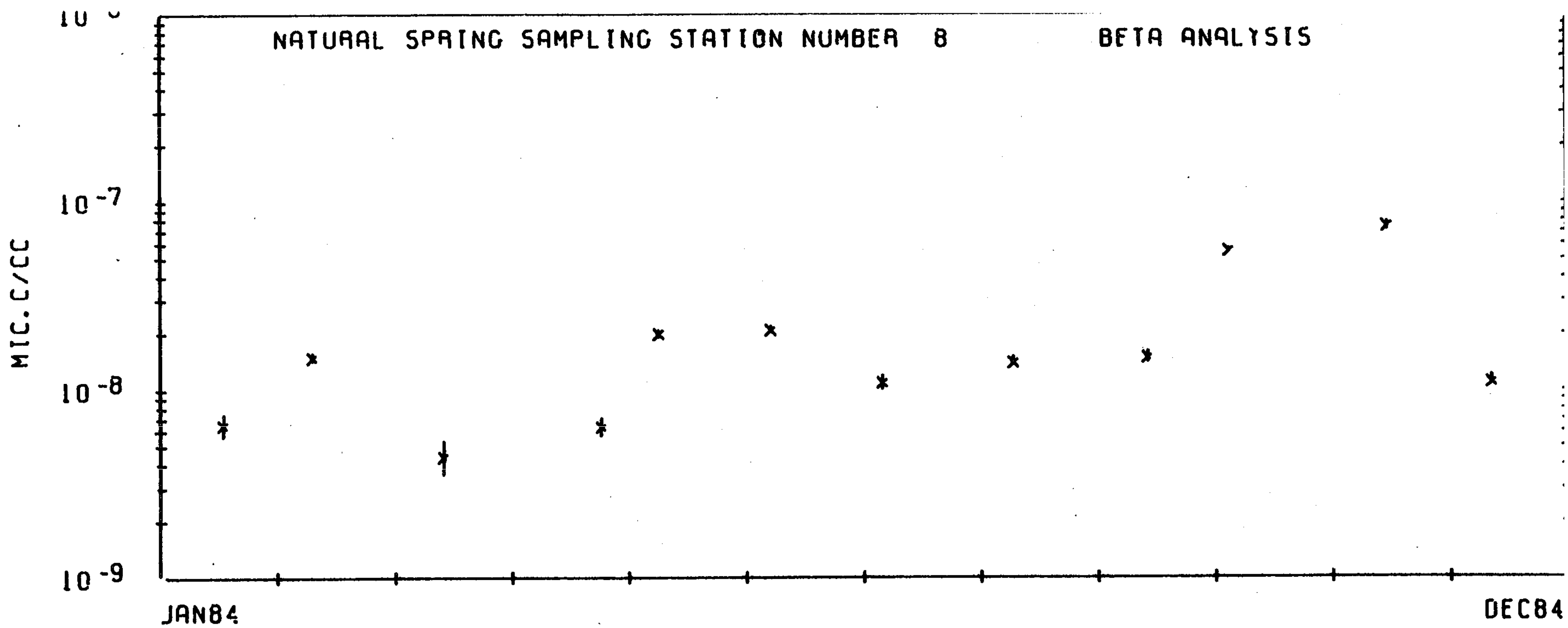

NATURAL SPRING SAMPLING STATION NUMBER 2 BETA ANALYSIS
10 -6
10 -7
10 -8
10 -9
MIC.C/CC
JAN84
DEC84

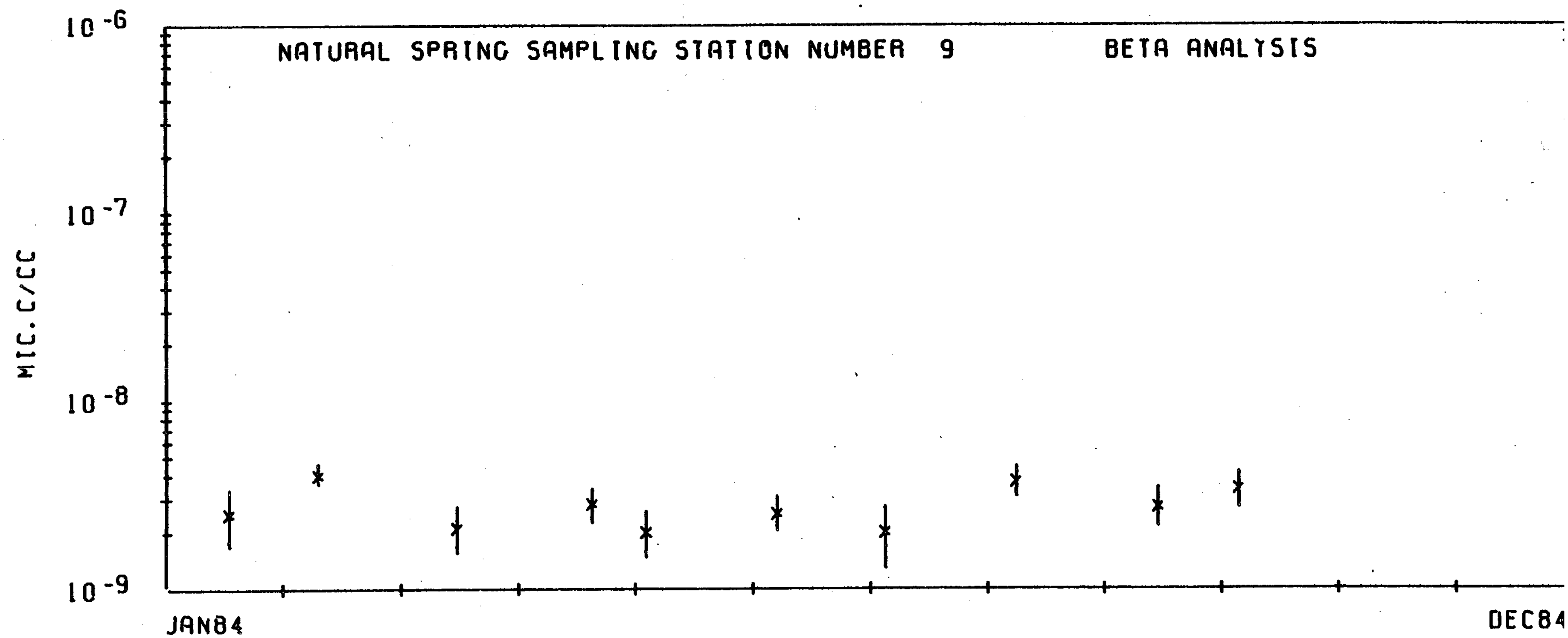

NATURAL SPRING SAMPLING STATION NUMBER 3
BETA ANALYSIS
MIC.C/CC
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84


NATURAL SPRING SAMPLING STATION NUMBER 4
BETA ANALYSIS
MIC.C/CC
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84


NATURAL SPRING SAMPLING STATION NUMBER 6
BETA ANALYSIS
MIC.C/CC
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84


NATURAL SPRING SAMPLING STATION NUMBER 7
BETA ANALYSIS
MIC.C/CC
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84


NATURAL SPRING SAMPLING STATION NUMBER 8
BETA ANALYSIS
MIC.C/CC
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84


NATURAL SPRING SAMPLING STATION NUMBER 9
BETA ANALYSIS
MIC.C/CC
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84

APPENDIX G

NTS Environmental Surveillance

Contaminated Pond Locations and Plots

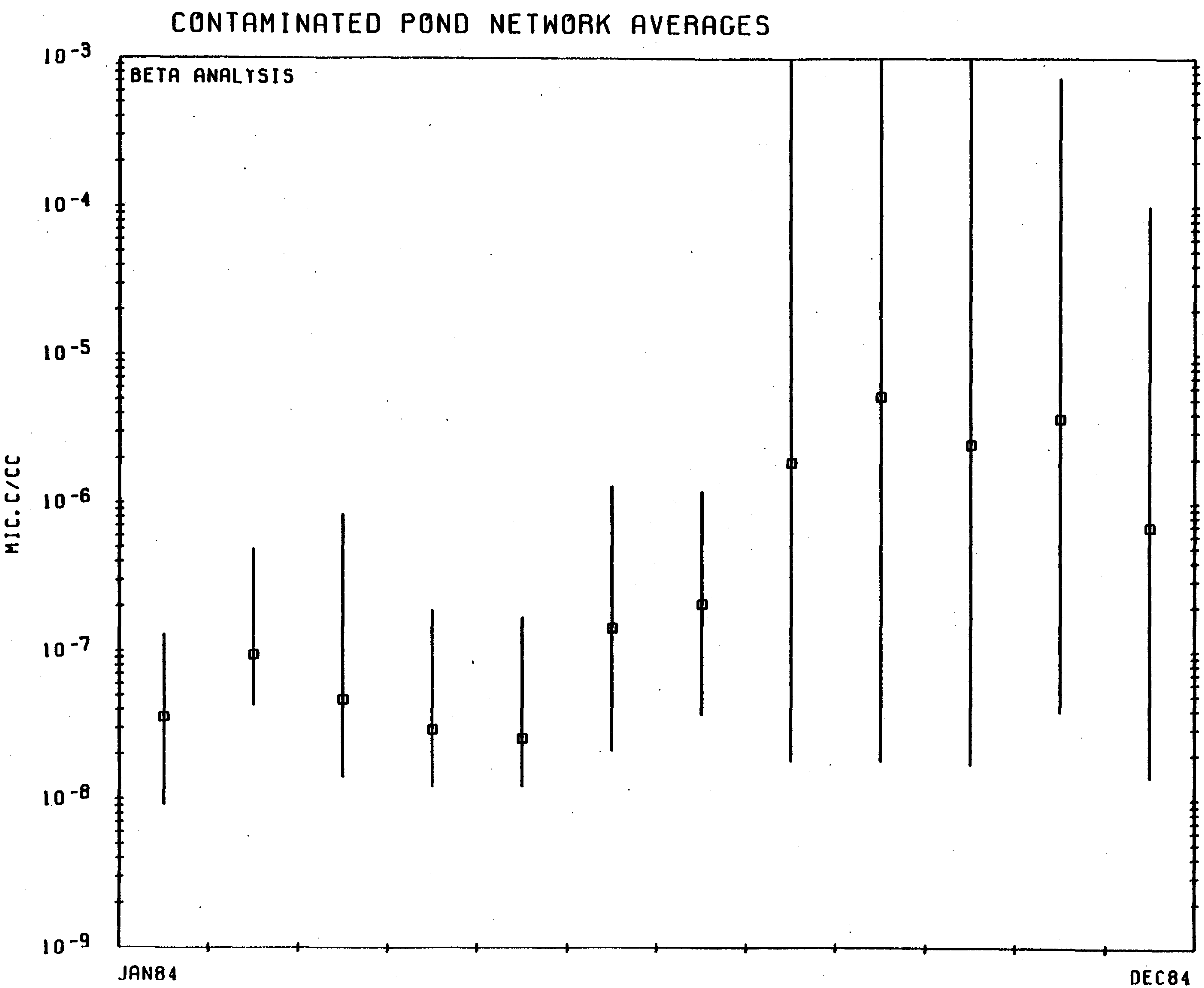
In the first two pages of plots in Appendix G, the contaminated pond network averages, a square is used to represent the arithmetic mean of all values at that point in time, and the vertical line is the range of the data.

The remaining plots show the gross beta of each station. A two-sigma error bar is also added to the data points, and, in all plots, a delta with a line to the bottom of the plot means below detection limit.

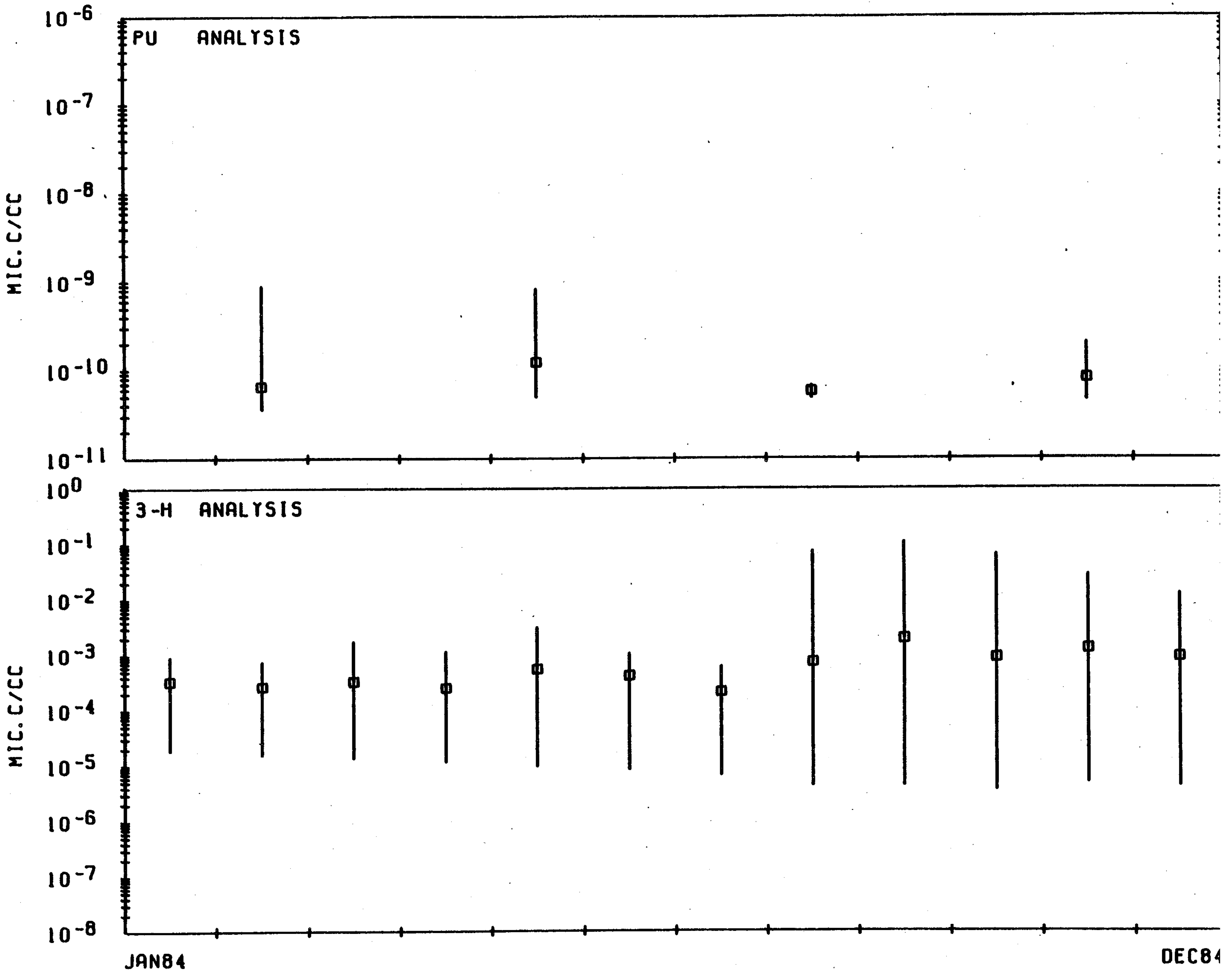
NTS ENVIRONMENTAL SURVEILLANCE
CONTAMINATED PONDS SAMPLING LOCATIONS

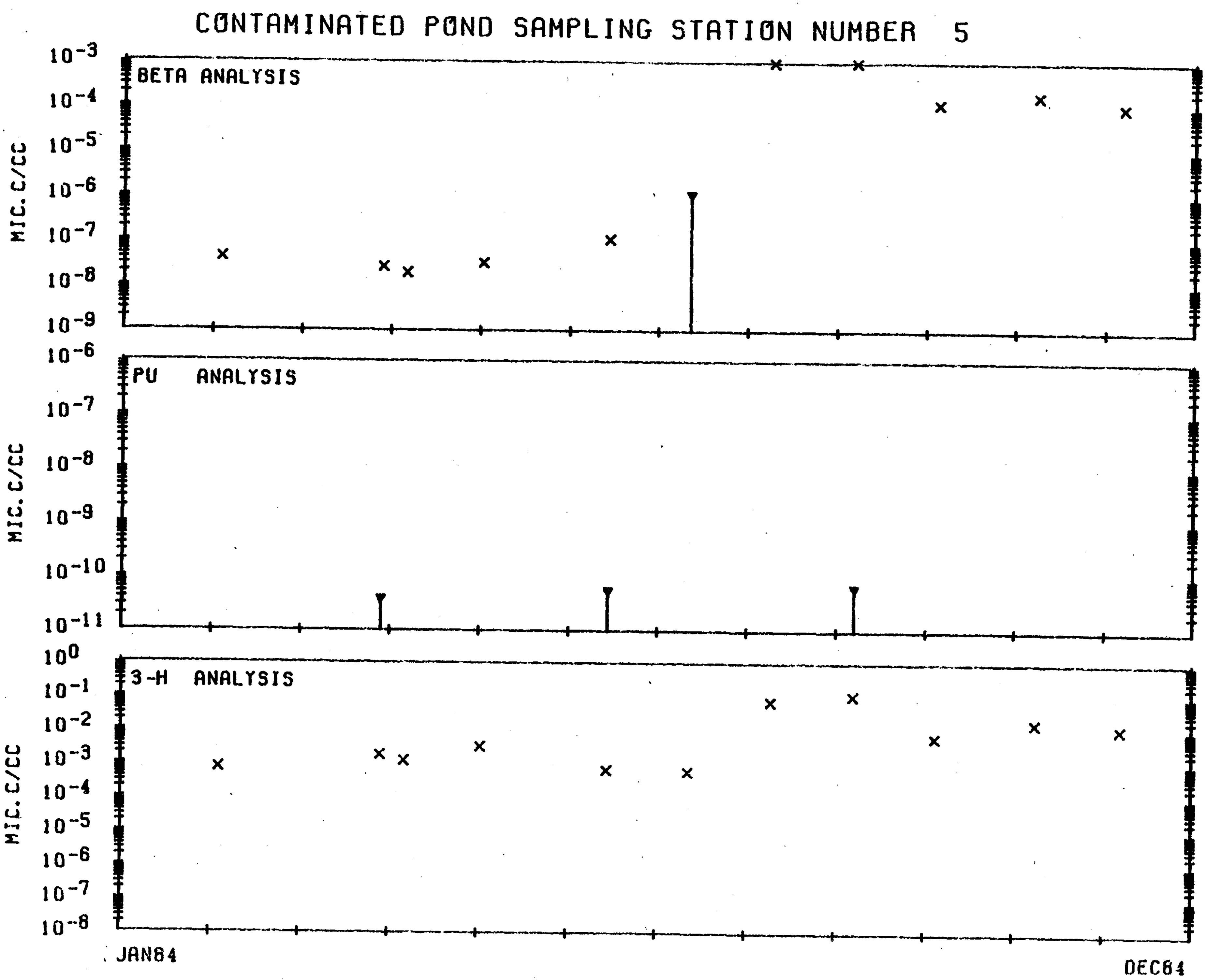
Station Number	Location
5	Area 12 Upper Mint Lake
6	Area 12 Middle Mint Lake
8	Area 12 N Upper
9	Area 12 N Mid
10	Area 12 N Lower
11	Area 12 G Tunnel
*12	Area 23 H&S Sump
13	Area 6 Yucca Decontamination Pond

*Pond was dry.


CONTAMINATED POND NETWORK AVERAGES
BETA ANALYSIS
MIC.C/CC
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
10^{-9}
JAN84
DEC84

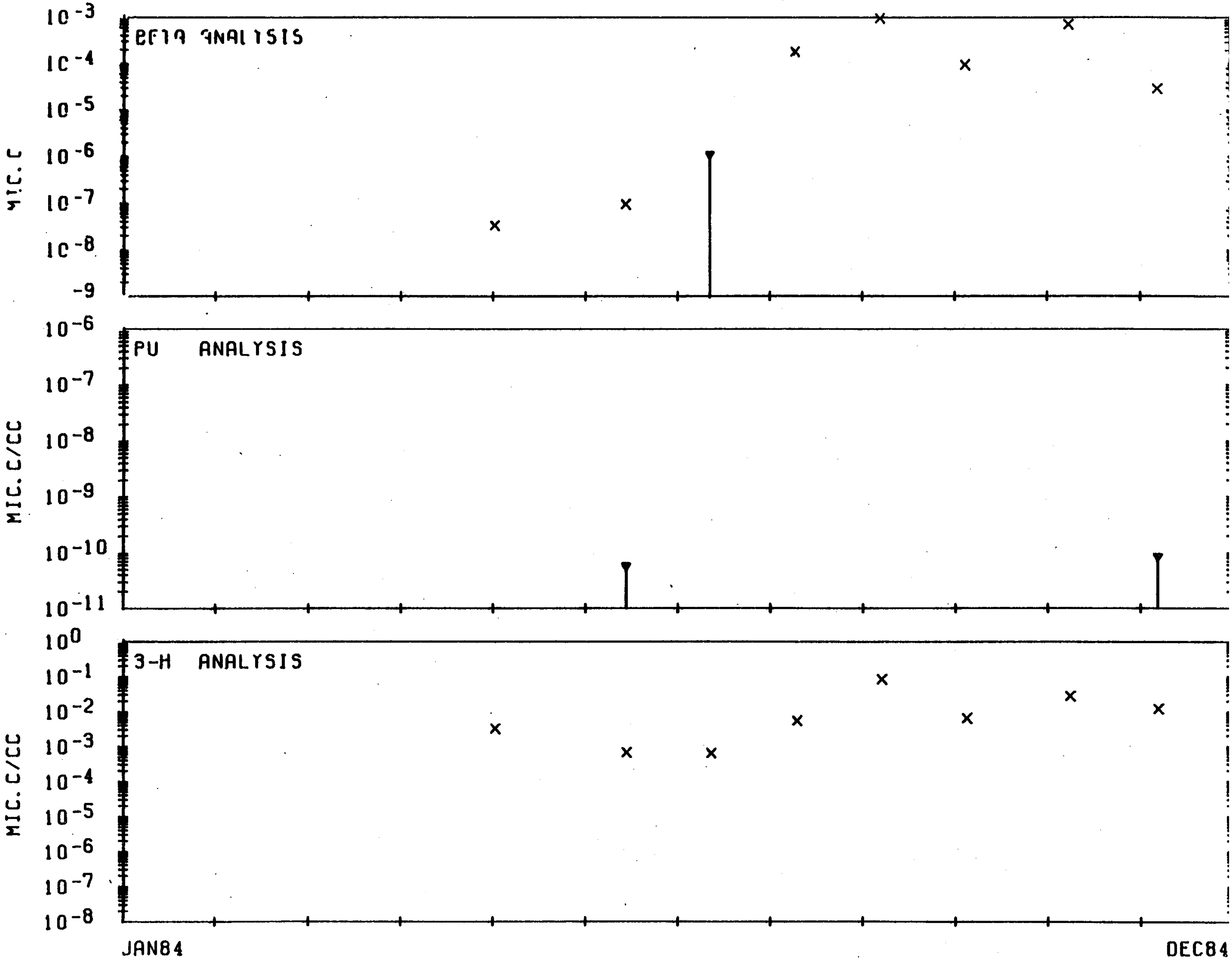
CONTAMINATED POND NETWORK AVERAGES



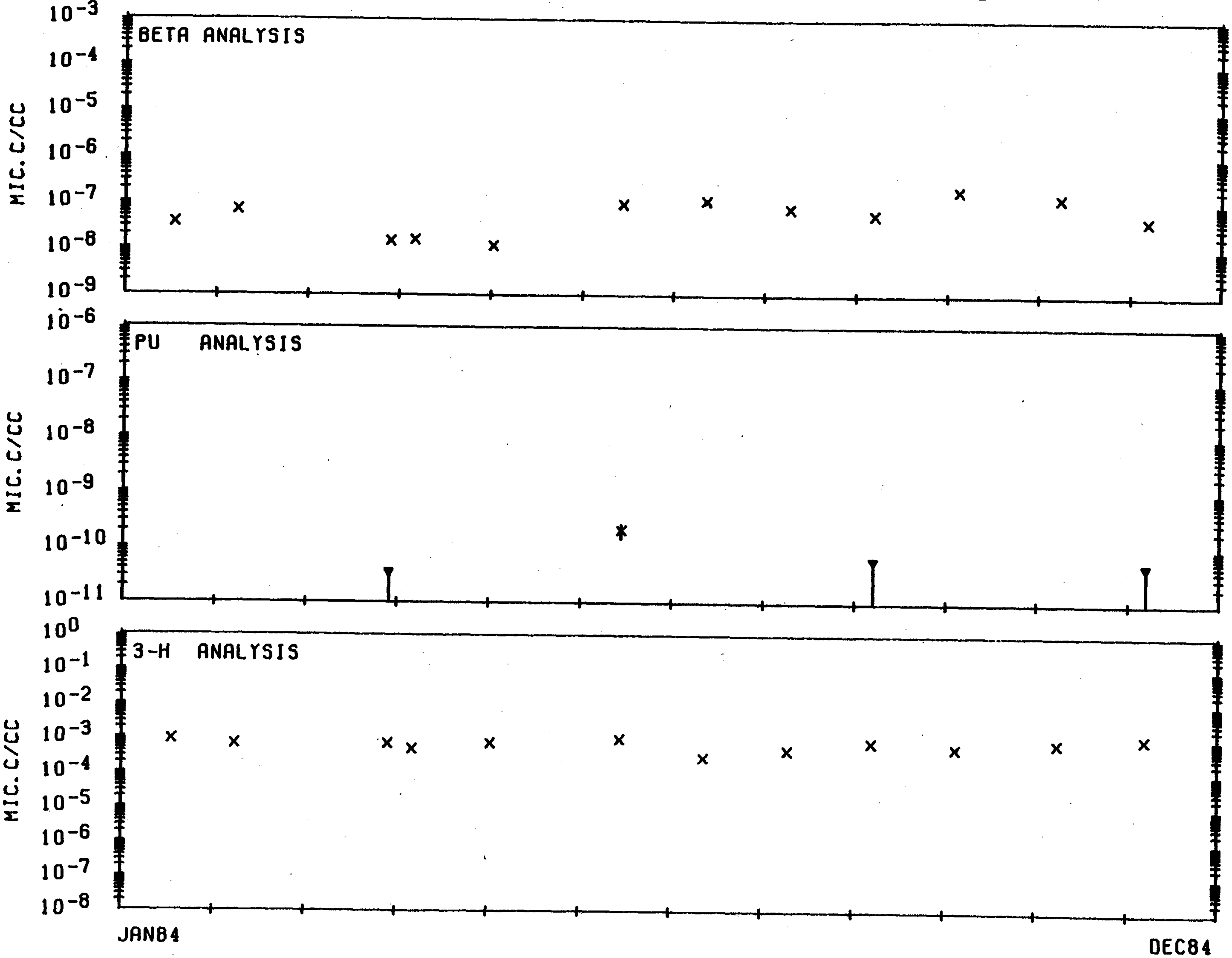


CONTAMINATED POND SAMPLING STATION NUMBER 5
BETA ANALYSIS
PU ANALYSIS
3-H ANALYSIS
MIC.C/CC
10-3
10-4
10-5
10-6
10-7
10-8
10-9
10-10
10-11
10-1
10-2
100
JAN84
DEC84

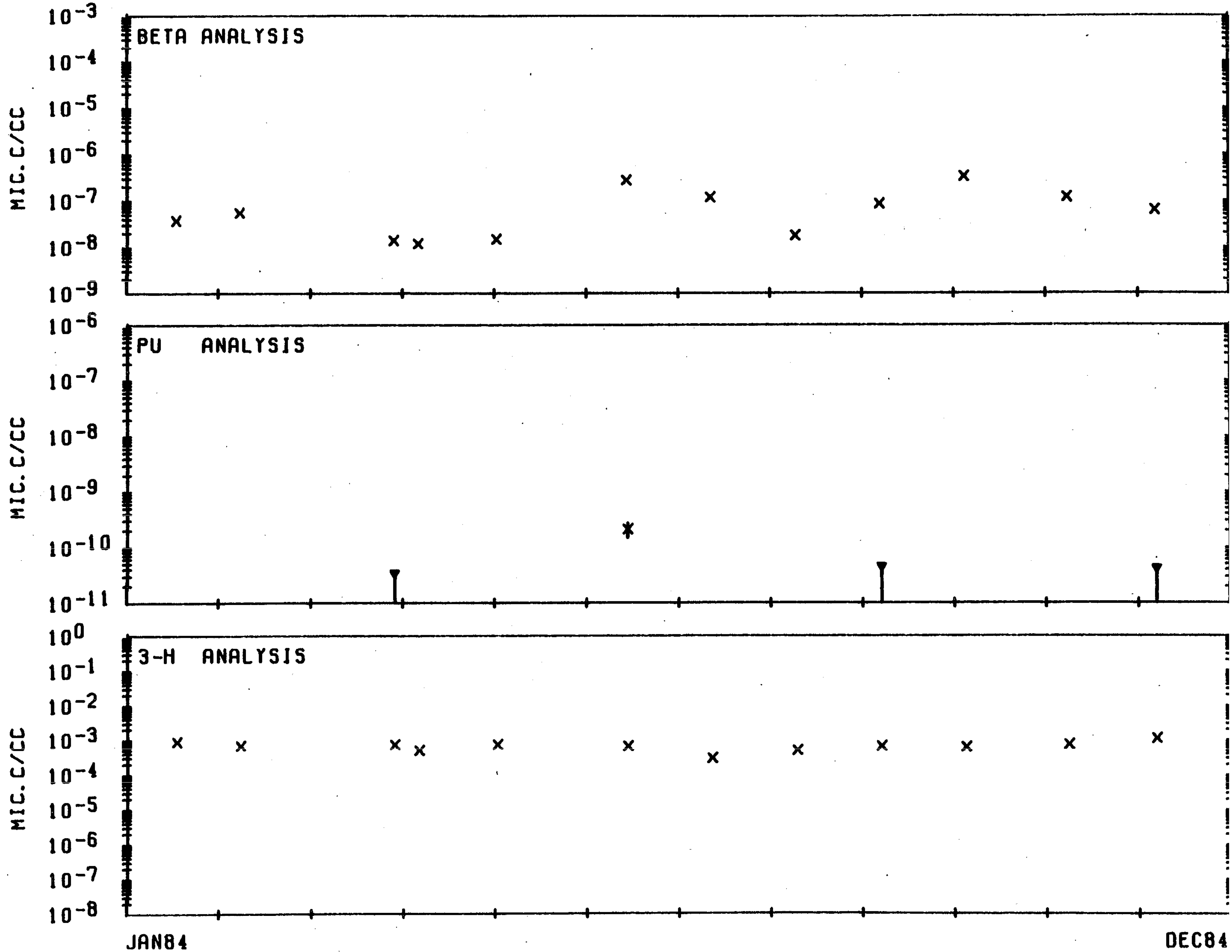
CONTAMINATED POND SAMPLING STATION NUMBER G

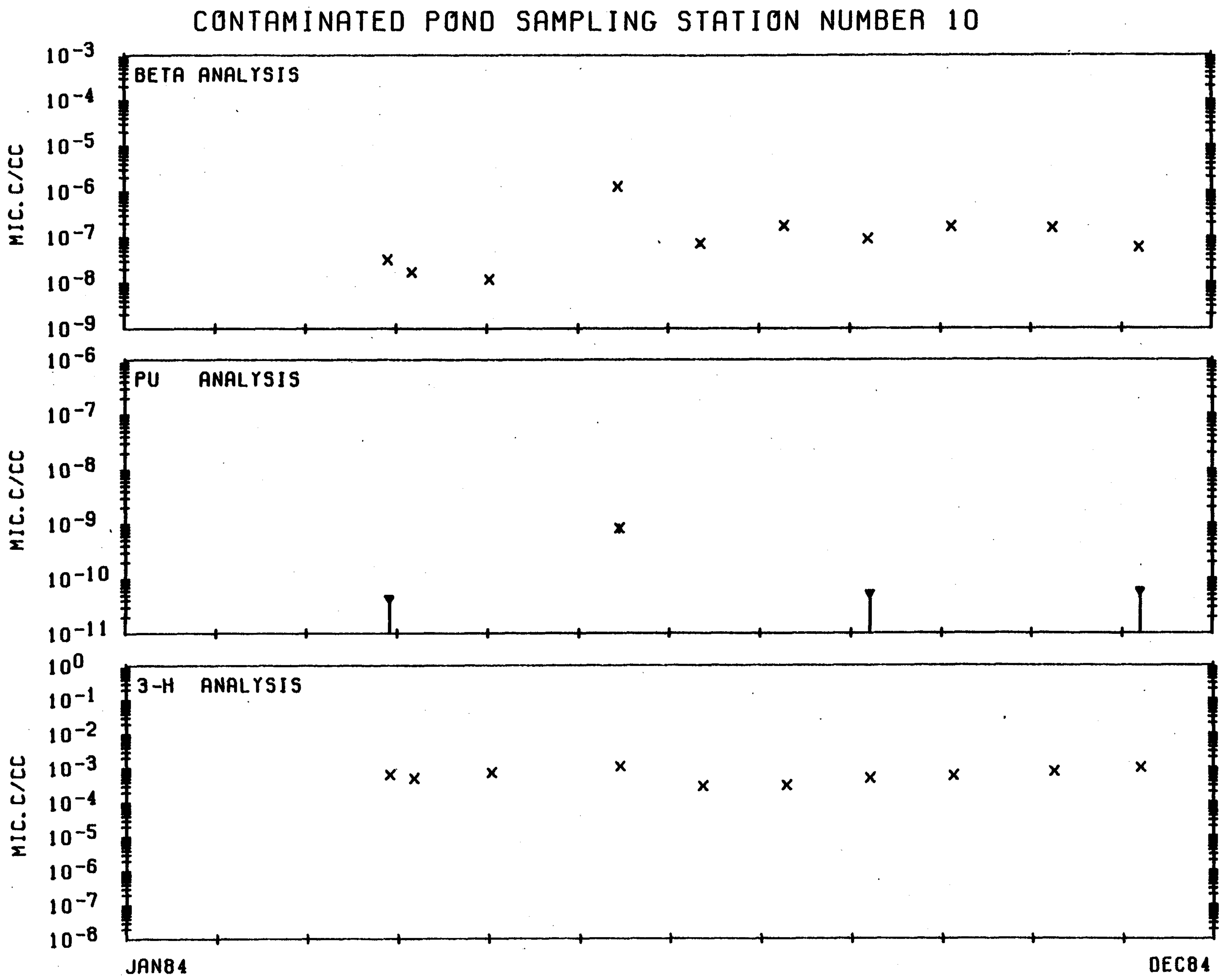


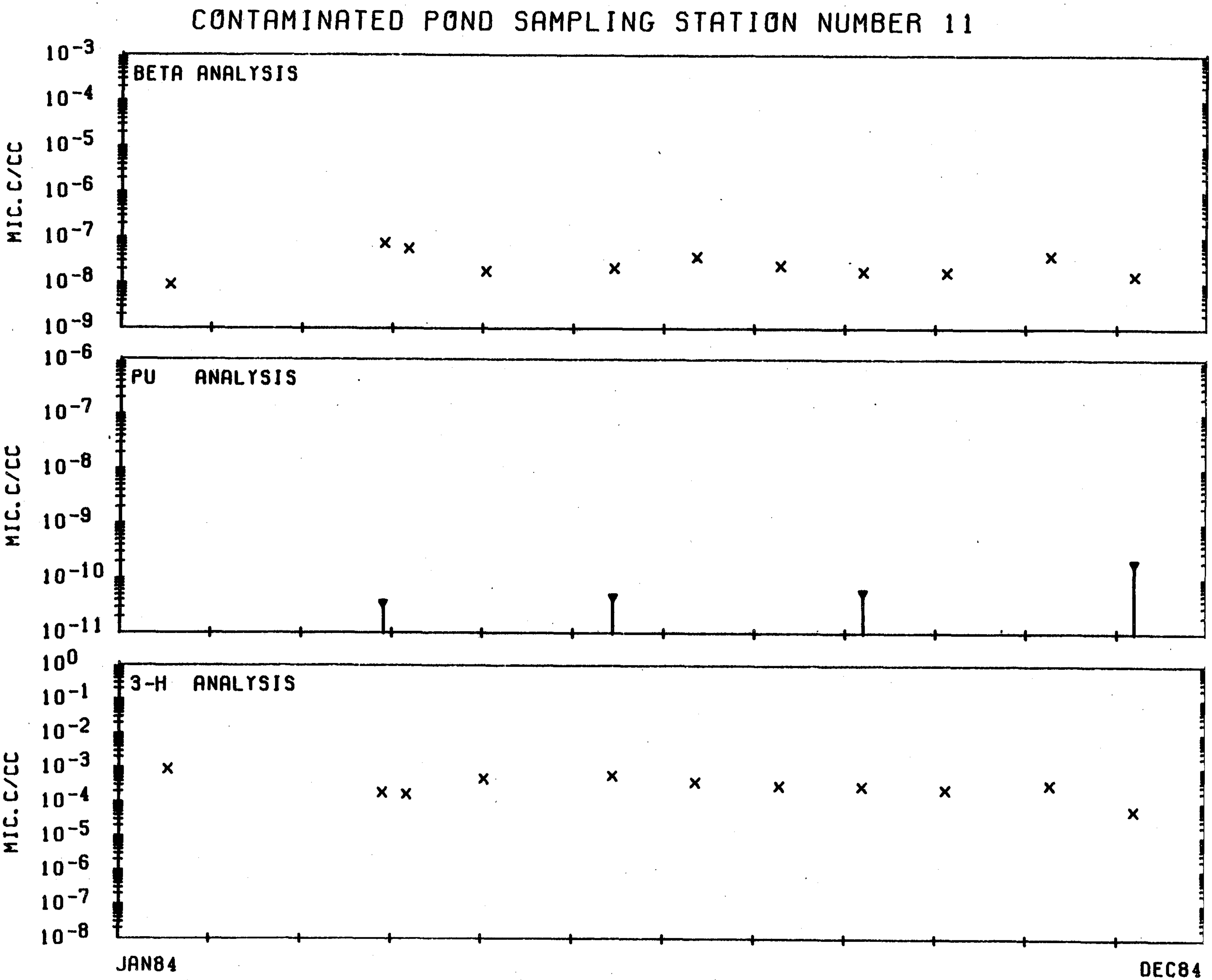
CONTAMINATED POND SAMPLING STATION NUMBER 8



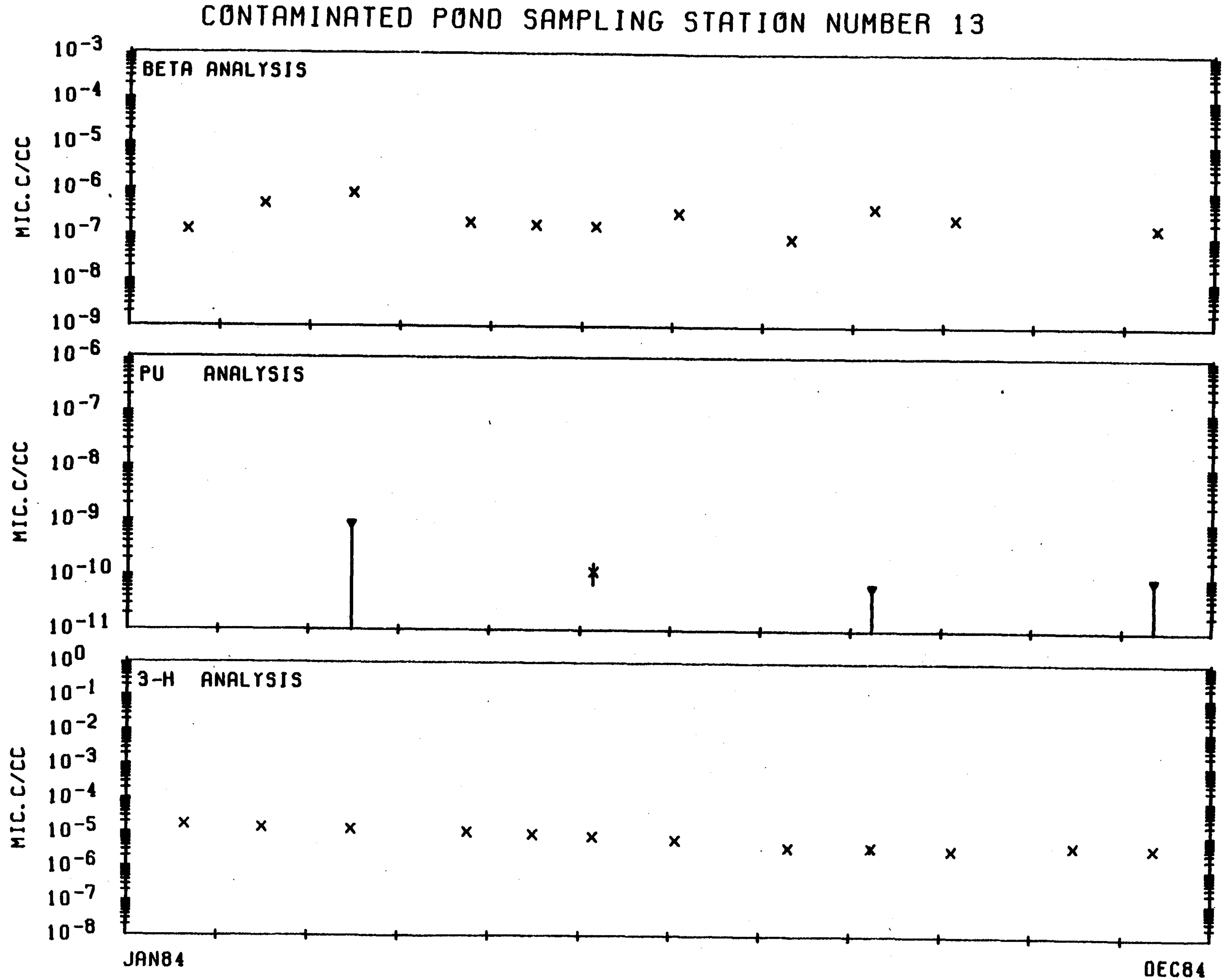
CONTAMINATED POND SAMPLING STATION NUMBER 9




CONTAMINATED POND SAMPLING STATION NUMBER 10
BETA ANALYSIS
PU ANALYSIS
3-H ANALYSIS
MIC.C/CC
JAN84
DEC84



CONTAMINATED POND SAMPLING STATION NUMBER 11
BETA ANALYSIS
PU ANALYSIS
3-H ANALYSIS
MIC.C/CC
JAN84
DEC84


CONTAMINATED POND SAMPLING STATION NUMBER 13
BETA ANALYSIS
PU ANALYSIS
3-H ANALYSIS
MIC.C/CC
JAN84
DEC84

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