ANNUAL ENVIRONMENTAL MONITORING REPORT FOR CALENDAR YEAR 1994

US ECOLOGY RICHLAND, WASHINGTON LOW-LEVEL RADIOACTIVE WASTE DISPOSAL FACILITY

JUNE 1, 1995

Prepared by: _____
Mark R. Ledoux

Reviewed by: _____
Arthur J. Palmer, CHP

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLES

TABLES *(Cont.)*

TABLES *(Cont.)*

TABLES *(Cont.)*

TABLES *(Cont.)*

FIGURES

FIGURES *(Cont.)*

FIGURES *(Cont.)*

FIGURES *(Cont.)*

1.0 INTRODUCTION

The US Ecology Low-Level Radioactive Waste Disposal Facility (LLRWDF) occupies 100 acres in north-central Benton County in south-central Washington State, about 20 miles northwest of the city of Richland (Figure 1.1). The facility is situated within the U.S. Department of Energy (DOE) Hanford Site on 100 acres of land leased by the DOE to the State of Washington. US Ecology subleases those 100 acres from the State. The facility is located just southwest of the 200-East (200-E) Area and about 2.5 miles east of the 200-West (200-W) Area within the separations area of the Hanford Site (see Figure 1.1). The separations areas cover 82 square miles near the center of the Hanford Site and include the 200-East and 200-West Areas where irradiated uranium fuel processing facilities, plutonium separation facilities and major radioactive waste storage and disposal facilities are located.

The US Ecology LLRWDF began operating in 1965 and since that time has received a total of approximately 12.8 million cubic feet of low-level waste through December 31, 1994. This waste contains solid or solidified materials, contaminated equipment, cleaning wastes, tools, protective clothing, gloves, laboratory wastes and naturally occurring or accelerator produced radioactive material (N.A.R.M.), and is estimated to contain a total radioactivity of approximately 2.2 million curies (Ci).

All waste and waste containers have been emplaced in trenches excavated into the surficial sediments. When completely filled, each trench is covered with at least eight feet of soil and capped with a layer of gravel. Older trenches were covered with three feet of soil prior to gravel placement. At present, the waste is contained in 19 separate trenches located on about 32 acres in the southeast and east-central part of the facilities (Figure 1.2). Trench size is variable but the larger trenches are up to 150 feet wide, 1300 feet long and 45 feet deep.

Potential pathways through which individuals living outside the Hanford site could be exposed to radiation or radioactive materials released from the site include direct exposure, atmospheric exposure, biotic exposure and from radionuclide releases into the groundwater.

The current monitoring of potential environmental pathways of exposure include nine fixed environmental air stations, routine monitoring of both soil and live vegetation (when available), environmental thermoluminescent dosimeters and five groundwater wells (see

Figure 1.2). The specific requirements for environmental monitoring are defined in the Facility Standards Manual and are described in Section 4 of this report.

The results from the 1994 environmental monitoring demonstrate that disposal operations at the facility have not resulted in the release of radionuclides causing measurable increases on a long-term basis in the concentration of radioactivity in air, soil, vegetation or groundwater in the vicinity of the facility. However, some of the media may occasionally exhibit apparent short-term increases from time to time. Due to the location of the facility, the origin of such increases is not easily determined and, therefore, may not be associated with activities at the US Ecology facility.

Penetrating radiation exposure rates at the site fence lines were measured, as expected, at statistically significant levels. However, exposure to humans is minimal since access to the areas near the site is controlled. Exposures from the penetration radiation pathway would not be measurable at the nearest residence, which is located off-site from the Hanford Reservation.

Environmental monitoring at the Richland disposal facility also serves to alert of any trends which might indicate the need for specific actions to prevent the release of radioactivity or to perform further study of conditions (such as additional sampling). Impacts on the general public and on the environment can be assessed by performing dose calculations. The information gathered in the environmental monitoring program can also be utilized to inform the public concerning the impact of US Ecology operations and as a basis for further study by researchers.

The location of the US Ecology disposal facility within the Hanford reservation and near sources of potential radioactive effluents from Hanford operations poses a challenge insofar as determination of the true radiological impact of the disposal facility. The siting of environmental monitoring points at locations surrounding the disposal facility will assist should significant quantities of radioactive materials ever be detected in environmental samples.

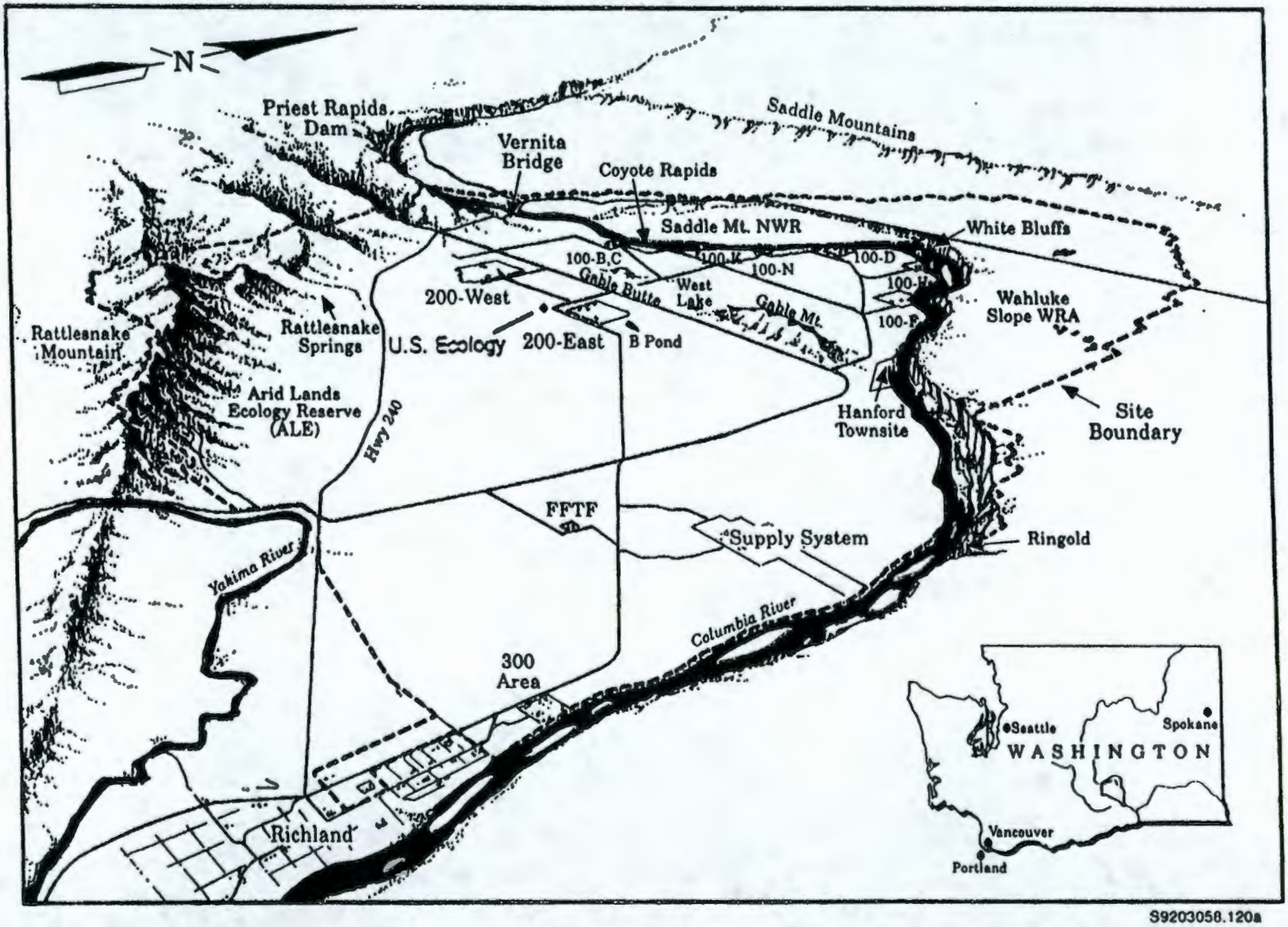
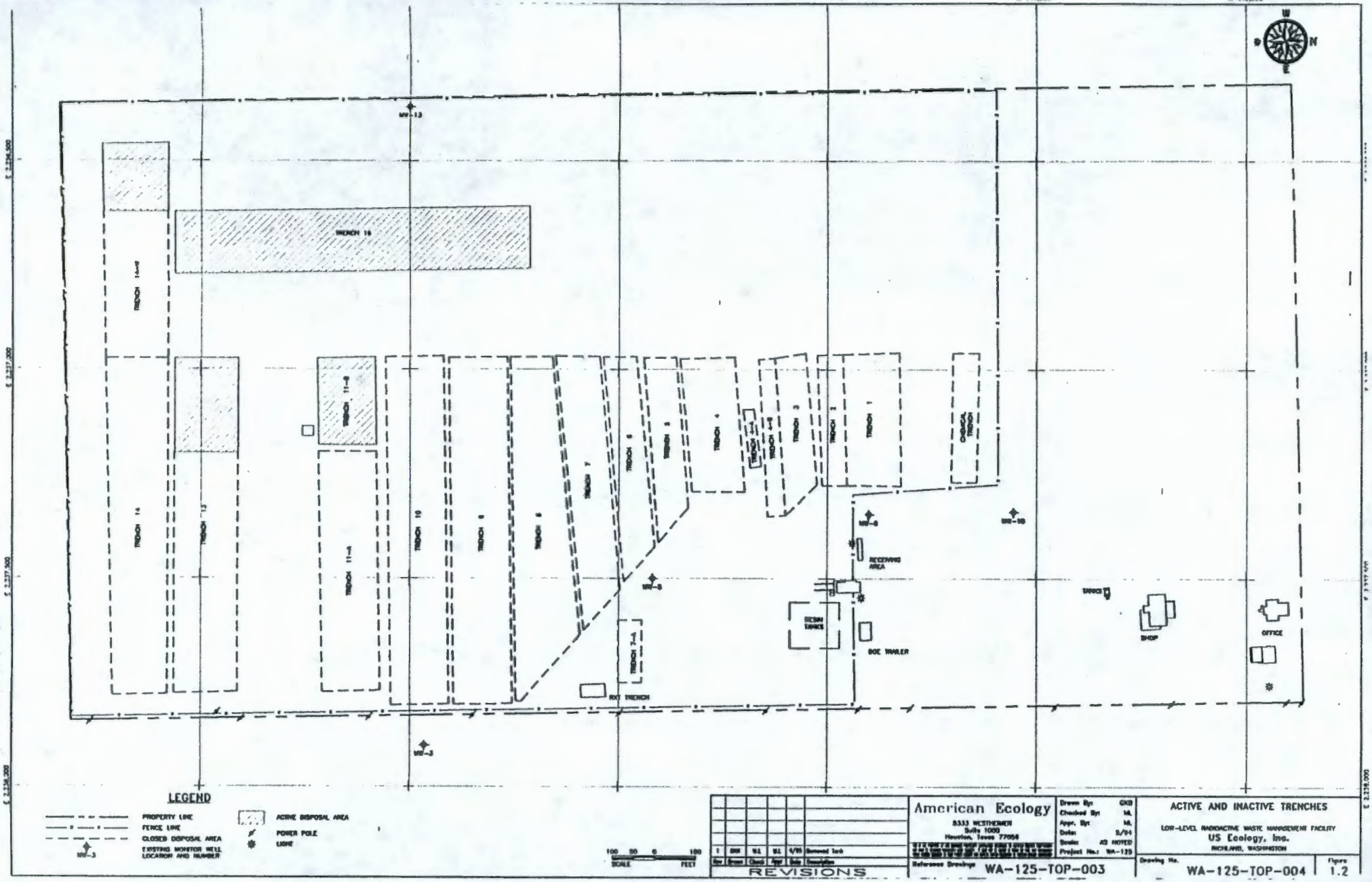


Figure 1.1. DOE's Hanford Site

Source: Hanford Site Environmental Report 1991.



9613441-0614

2.0 SUMMARY

This section summarizes both the environmental monitoring program information presented in Section 4 and the environmental data results and evaluation presented in Sections 5 and 7 of this report. Readers desiring more detailed information are directed to those sections. This summary concludes that the facility has negligible impact on population dose based upon the lack of effluent release due to operations.

2.1 Air Monitoring Program

The environmental air monitoring program involves continuous sampling of airborne particulates, airborne iodine (I-125) and airborne tritium. Particulate and iodine are continuously sampled at the nine environmental stations located around the facility; tritium is sampled continuously at three stations. Station 1 is located in the upwind direction and is the most distant from disposal operations. It is used as the control station. Weekly samples are collected for airborne particulates and I-125, while monthly composites are collected for tritium. Analyses performed on samples include gross beta, gross alpha, I-125, tritium (in collected air moisture) and gamma spectroscopy. Gamma spectroscopy is performed monthly on a composite of weekly air particulate filters. Tritium analyses are performed on monthly samples of air moisture collected on silica gel columns.

Gross alpha, gross beta, I-125, tritium and gamma spectroscopy measurements were at normal historical levels during 1994. Accordingly, the dose from site operations due to the above radiological parameters is not statistically greater than zero. No releases from the facility were detected for these parameters in air.

No tritium samples exceeded the investigation level. Comparison with data from surrounding airborne tritium monitoring programs indicates results were consistent with others obtained throughout the region.

US Ecology also monitors the ventilation exhaust from the onsite package inspection facility. Samples are evaluated for gross beta, gross alpha and I-125 concentrations. All samples were below action levels during 1994. Negligible onsite and offsite doses are projected for this facility.

More in depth evaluation and discussion of the 1994 air program data can be found in Section 5.1. The package inspection facility dose assessment is provided in Appendix A of this report.

2.2 Soil Monitoring Program

During 1994, all required soil samples were collected and analyzed. Samples were collected from Stations 1 through 9 and at the northeast and northwest corners. Analysis was performed for gross beta, total uranium, isotopic plutonium (Pu-238 and Pu-239/240) and gamma emitters. Samples were below action levels for gross beta, total uranium and isotopic plutonium.

None of the man-made isotopes found in soil was identified in the air sampling program. Also, dose to the general public via soil pathways is very unlikely from the US Ecology facility due to its remoteness from populated areas. These factors allow one to conclude that the presence of these radionuclides in some of the samples is not significant insofar as dose to the general population.

Additional detailed information on the soil monitoring program during 1994 can be found in Section 5.2.

2.3 Vegetation Monitoring Program

Vegetation is sampled in the vicinity of the nine environmental air monitoring stations and at the northeast and northwest corners of the site on a quarterly basis whenever there is sufficient vegetation. Vegetation samples are also collected annually from trench caps when sufficient vegetation is available. Collection procedures require the collection of new growth whenever it is available. Vegetation samples are analyzed for gross beta activity, total uranium, isotopic plutonium (Pu-238 and Pu-239/240), gamma emitters and tritium.

The control location for vegetation monitoring, as for all sample media except groundwater, is at Station 1. This station is in the predominant upwind location and is located away from the operations area.

Only deep rooted vegetation was collected for sampling throughout 1994. All samples were collected during the second and third quarters of the year, since these were the only times when growth was present.

Gross beta concentrations were below action levels and were consistent with historical concentrations.

Total uranium in vegetation occurred at normally expected concentrations during 1994. All samples were below the minimum detectable concentration for uranium.

All plutonium-238 and plutonium-239/240 concentrations in vegetation were less than the minimum detectable concentration.

Europium-155 was the only gamma emitting radioisotope which was positively identified. It exceeded the minimum detectable concentration but was less than the action level.

Tritium in vegetation determinations is made on the annual trench cap samples for trending purposes. Results ranged from 4.2 E-1 pCi/g to 2.24 E2 pCi/g. At this time, the vegetation tritium monitoring program is an experimental program. However, it is known that dose consequences of these measurements are negligible as there is no pathway for exposure.

Sixteen trench cap vegetation samples were not analyzed for tritium due to laboratory error. Due to the season, it was not possible to recover additional samples. The Washington Department of Health (WDOH) was notified and NCR No. 95-02 issued for corrective action.

Evaluation and discussion of the vegetation monitoring program can be found in Section 5.3.

2.4 Penetrating Radiation Monitoring

External radiation monitoring was made using thermoluminescent dosimeters (TLDs) which surround the facility. TLDs are changed monthly at locations on the north, south, east and west fence lines and at fenceline positions nearest each active disposal trench. Quarterly dosimeters are placed at the north, south, east and west fence lines (same as monthly) and at the northeast, northwest, southeast and southwest corners of the facility. Two control dosimeters (one monthly, one quarterly) are located at environmental air monitoring Station 1.

Investigation levels specified in the Facility Standards Manual (FSM) of 40 millirem per month and 120 millirem per quarter for penetrating radiation were not exceeded at any locations in 1994. The highest annual total occurred at the west fence adjacent to Trench 16. The net annual exposure for this location was 144 millirem. This value is 29 percent of the site unrestricted area exposure limit as specified in the FSM in effect during 1994.

Detailed evaluation of the program is provided in Section 5.4.

2.5 Groundwater Monitoring

Groundwater samples are collected quarterly from wells 3, 5, 8, 10 and 13. Well 13 is the upgradient or control well. Groundwater samples are analyzed for radiological as well as nonradiological constituents. Radiological analyses include gross alpha, gross beta, tritium, C-14, gamma emitters, isotopic plutonium (Pu-238 and Pu-239/240), and total uranium (U-234, U-235 and U-238). Nonradiological parameters include temperature, specific conductivity, total organic carbon (TOC), nitrates and total dissolved solids (TDS).

Gross alpha and gross beta concentrations were at normal background concentration throughout 1994. Tritium in groundwater is present chiefly due to past operations by the Department of Energy. All concentrations were below the investigation level of 3600 pCi/l. Carbon-14 was reported below the minimum detectable concentration of 200 pCi/l throughout 1994.

Gamma spectroscopy of groundwater samples did not reveal the presence of any man-made gamma emitters above minimum detectable concentrations. Isotopic plutonium concentrations for various samples reported positive results but all were less than the investigation level.

Total uranium occurred at normally expected concentrations throughout 1994.

Offsite doses due to the groundwater pathway are nonexistent based upon the above measurements showing no facility impact during 1994. Nonradiological parameters occurred at expected values and support the above conclusion.

Additional information on the groundwater program is provided in Section 7 of this report.

3.0 COMPLIANCE SUMMARY

This environmental monitoring report is required to be submitted each year in accordance with the Washington Administrative Code (WAC 246-250-600 (7)) and the Code of Federal Regulations (10 CFR 61.80). In addition, environmental monitoring is required by regulations in WAC 246-250-340 and 10 CFR 61.53 (c). These regulations require that the monitoring system must be capable of providing early warning of releases of radionuclides from the disposal site before they leave the site boundary. In support of the regulations, our radioactive materials licenses from the State of Washington (WN-IO19-2) and Nuclear Regulatory Commission (16-19204-01) both require administration of the environmental monitoring program through the US Ecology Richland Operational Procedures. The environmental monitoring program complies with the requirements in the Washington Administrative Code, the Code of Federal Regulations, and US Ecology's radioactive materials licenses.

The format and content of this environmental report complies with the requirements prescribed by the Washington Department of Health in the document titled "Recommended Content and Format for Environmental Reports," dated January 9, 1992.

3.1 Air Sampling Program Compliance

During 1994, all of the required environmental air samples were collected. Compliance with the program also requires that samples exceeding action levels be evaluated and that telephone and written notification be provided to regulators.

The gross beta investigation level is 1.0 E-13 uCi/ml and the reporting level is 2.6 E-11 uCi/ml. During 1994, no samples exceeded the investigation level.

The investigation level for gross alpha activity is 1.0 E-14 uCi/ml and the reporting level is 1.7 E-14 uCi/ml. No samples exceeded the investigation level in 1994.

Tritium in air concentration did not exceed the investigation level of 2.0 E-11 uCi/ml in any samples. Sample results compare favorably with analytical data provided by other tritium in air monitoring programs.

With regard to gamma spectroscopy of composite air samples, no samples during 1994 exceeded the investigation/reporting level of five times the minimum detectable concentration (MDC), listed in Table 6.3 of the Facility Standards Manual (see Table 4.3 of this report).

Air samples collected from the ventilation exhaust outside the package inspection facility are subject to an action level of 3.0 E-13 uCi/ml (gross alpha), 1.0 E-12 uCi/ml (gross beta) and 5.0 E-10 uCi/ml (I-125). No samples exceeded these action levels.

3.2 Soil Compliance Summary

Soil samples were collected at all required locations in 1994. All samples were below action levels for gross beta.

No soil samples exceeded the action level of 1.0 pCi/g for total uranium. Concentrations of total uranium are comparable to those found throughout the region.

All soil samples were below the action level of 0.03 pCi/g for isotopic plutonium and were consistent with the concentration for the region.

Photon emitting radionuclides in soil have an action level of five times the theoretical MDC with the exception of Cs-137 and Co-60 which are set at 0.25 pCi/g and 0.3 pCi/g, respectively. No soil samples exceeded their respective action levels.

3.3 Vegetation Compliance Summary

Vegetation is required to be sampled and analyzed in accordance with the Facility Standards Manual. Deviation from the prescribed sampling frequencies was necessary as sufficient live deep rooted vegetation for sampling was not present during all quarters during 1994. It was not possible to collect deep rooted samples at any stations during the first and fourth quarters. Annual samples were available from all filled and capped trenches.

All vegetation samples were below the action level of 100 pCi/g for gross beta.

All vegetation samples were below the action level of 0.25 pCi/g for total uranium.

All vegetation samples were below the action level of 0.02 pCi/g for isotopic plutonium.

Sixteen trench cap vegetation samples were not analyzed for tritium due to laboratory error. Due to the season, it was not possible to recover additional samples. No action levels have been established for tritium in vegetation as the program is still in a research stage. The Washington Department of Health (WDOH) was notified and NCR No. 95-02 issued for corrective action.

All vegetation samples were below action level for gamma spectroscopy analysis.

3.4 Groundwater Compliance Summary

Quarterly grab samples are required to be collected at the five monitoring locations. All required samples were collected in 1994. Gross alpha, gross beta, tritium, C-14, Pu-238, Pu-239/240, total uranium and gamma emitting radioisotopes were all below action levels.

Nonradiological analyses on groundwater samples were all performed as required. While no action levels exist for these parameters, results were consistent with prior years' measurements.

3.5 Penetrating Radiation Monitoring Compliance Summary

All dosimeters were placed as required by the Facility Standards Manual. The facility was below the regulatory limit of 500 millirem per year at all fenceline stations as required per the Facility Standards Manual (FSM) in effect during 1994. No TLDs exceeded the investigation levels of 40 millirem per month or 120 millirem per quarter.

4.0 ENVIRONMENTAL PROGRAM INFORMATION

4.1 Description of the Environmental Program

The Richland facility is required to perform environmental monitoring to show that it is in compliance with the Washington Administrative Code WAC 246-250-170 and the Code of Federal Regulations, Chapter 10, Part 61.41. These regulations require that effluents to the general environment be maintained ALARA and that annual doses due to effluents not exceed 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public.

The environmental monitoring program at the Richland facility monitors all pathways which could result in measurable offsite dose. The pathways also include direct radiation. Due to the location of the facility within the Hanford Reservation, there is an extremely low probability of any effluents reaching the general population. Monitoring of the milk pathway is not possible as there are no farms or cattle near the facility. Wildlife is not monitored as hunting on the Hanford Reservation is not permitted. Analysis of vegetation samples serves to provide an indication of any radionuclides which could be included in the diet of wildlife.

Table 4.1 describes the environmental monitoring program and action levels as required by our licenses. Actions required whenever environmental action levels are exceeded are given in Table 4.2. Table 4.3 summarizes the requirements for minimum detectable concentrations for gamma spectroscopy of environmental samples. Figure 4.1 shows all environmental monitoring stations and locations which are described in Table 4.1. Sections 5 and 7 of this report present the results and evaluation of the environmental program at the facility.

4.2 Anticipated Changes to the Environmental Monitoring Program

In October 1994, US Ecology initiated vadose zone tritium vapor concentration measurements using in-ground solar stills. This program is expected to continue through 1995.

The airborne radon monitoring program initiated in 1993 continued through 1994.

In 1995, US Ecology will be constructing Trench 18 along the west side of the restricted area. In response to this trench, thermoluminescent dosimeters (TLDs) will be positioned on the fenceline adjacent to the trench for monitoring exposure.

On April 12, 1995, the Richland Facility Standards Manual (FSM) revision was approved by the Washington Department of Health (WDOH). The direct gamma dose limit along the restricted area fence was changed from 500 mrem/year to 400 mrem/year. This change was required by new 10 CFR 20 and WAC 246-221 revisions.

In addition, FSM Table 6.3, Required Minimum Detectable Concentration (MDCs) for Gamma Spectroscopy Analyses of Environmental Samples, was revised. Five short-lived radionuclides; Na-24, As-76, Mo-99, I-131 and I-133, were removed and the vegetation MDCs were increased by a factor of three.

Two new groundwater monitoring wells will be installed at the Richland facility. One well (upgradient) will be installed near environmental air Station 9 and the other well (downgradient) near environmental air Station 5.

Also in April 1995, all groundwater monitoring well internals were visually inspected using a video camera. No well defects were found.

In January 1995, the tank farm trench cap soil and vegetation were analyzed by gamma spectroscopy. All results were less than minimum detectable concentration.

TABLE 4.1

Environmental/Occupational Monitoring Requirements

Medium	Location	Type, Frequency	Analysis	ACTION LEVELS: Investigation Level	ACTION LEVELS: Reporting Level	ACTION LEVELS: Action Category[1]
Environmental Air	Envir. Monitoring Stations 1-9	Continuous, changed weekly	Gross Alpha	1×10^{-14} uCi/cc	1.7×10^{-14} uCi/cc	3 , 4
			Gross Beta	1×10^{-13} uCi/cc	2.6×10^{-11} uCi/cc	3, 4
			I-125	3.5×10^{-14} uCi/cc	2.3×10^{-10} uCi/cc	3, 4
	Envir. Monitoring Stations 1-9	Continuous, Monthly Composite of weekly samples	Co-60	5×10^{-14} uCi/cc	2.6×10^{-11} uCi/cc	3, 4
			Cs-137	5×10^{-14} uCi/cc	1.9×10^{-10} uCi/cc	3, 4
			Gamma Spec	5 X MDC[3]	5 X MDC[3]	3, 4
	Envir. Monitoring Stations 1, 2, 5	Continuous, Changed monthly	H-3	2×10^{-11} uCi/cc	6.1×10^{-8} uCi/cc	3, 4
Occupational Air	One downwind plus one at each location of potential exposure	Continuous during operations or 1 hour/day; whichever is greater	Gross Alpha	NA[4]	3×10^{-13} uCi/cc	1
			Gross Beta	NA[4]	1×10^{-12} uCi/cc[2]	1
			I-125	NA[4]	5×10^{-10} uCi/cc	1

TABLE 4.1

Medium	Location	Type, Frequency	Analysis	ACTION LEVELS: Investigation Level	ACTION LEVELS: Reporting Level	ACTION LEVELS: Action Category[1]
Groundwater	Wells	Grab, Quarterly	Gross Alpha	12 pCi/L	15 pCi/L	3,4
	#013 (upgradient)		Gross Beta	12 pCi/L	50 pCi/L	3,4
	#010		H-3	3,600 pCi/L	20,000 pCi/L	3,4
	#008		C-14	250 pCi/L	2,000 pCi/L	3,4
	#005		Total Uranium[6]	4.5 pCi/L	30 pCi/L	3,4
	#003		Pu-238	0.03 pCi/L	See Pu-239/240	3,4
			Pu-239/240	0.03 pCi/L	40 pCi/L (Total Pu)	3,4
			Co-60	6 pCi/L	100 pCi/L	3,4
			Cs-137	7 pCi/L	200 pCi/L	3,4
			Gamma Spec	5 X MDC[3]	5 X MDC[3,7]	3,4
			Specific Conductance	NA[4,8]	NA[4,8]	NA[4]
			TDS	NA[4,8]	NA[4,8]	NA[4]
			TOC	NA[4,8]	NA[4,8]	NA[4]
			Nitrates	NA[4,8]	NA[4,8]	NA[4]
			Temperature	NA[4,8]	NA[4,8]	NA[4]
Field Blank Deionized Water		1 blank per 10 samples collected	Note[9]	NA[4,10]	NA[4,10]	NA[4]

TABLE 4.1

Medium	Location	Type, Frequency	Analysis	ACTION LEVELS: Investigation Level	ACTION LEVELS: Reporting Level	Action Category[1]
Soil[5]	Envir. Monitoring Stations 1-9 and NE, NW Corners	Grab, Quarterly	Gross Beta	35 pCi/g (dry)	35 pCi/g (dry)[7]	3, 4
			Total Uranium[6]	1 pCi/g (dry)	1 pCi/g (dry)[7]	3, 4
			Pu-238	0.03 pCi/g (dry)	0.03 pCi/g (dry)[7]	3, 4
			Pu-239/240	0.03 pCi/g (dry)	0.03 pCi/g (dry)[7]	3, 4
			Co-60	0.3 pCi/g (dry)	0.3 pCi/g (dry)[7]	3, 4
			Cs-137	0.25 pCi/g (dry)	0.25 pCi/g (dry)[7]	3, 4
			Gamma Spec	5 X MDC[3]	5 X MDC[3,7]	3, 4
Vegetation[5]	Envir. Monitoring Stations 1-9 and NE, NW Corners	Grab, Quarterly for deep rooted	Gross Beta	100 pCi/g (dry)	100 pCi/g (dry)[7]	3, 4
			Total Uranium[6]	0.25 pCi/g (dry)	0.25 pCi/g (dry)[7]	3, 4
			Pu-238	0.02 pCi/g (dry)	0.02 pCi/g (dry)[7]	3, 4
			Pu-239/240	0.02 pCi/g (dry)	0.02 pCi/g (dry)[7]	3, 4
			Co-60	0.1 pCi/g (dry)	0.1 pCi/g (dry)[7]	3, 4
			Cs-137	0.2 pCi/g (dry)	0.2 pCi/g (dry)[7]	3, 4
			Gamma Spec	5 X MDC[3]	5 X MDC[3,7]	3, 4
	Filled and capped trenches	Grab, Annually	Gross Beta	100 pCi/g (dry)	100 pCi/g (dry)[7]	3, 4
			Total Uranium[6]	0.25 pCi/g (dry)	0.25 pCi/g (dry)[7]	3, 4
			Pu-238	0.02 pCi/g (dry)	0.02 pCi/g (dry)[7]	3, 4
			Pu-239/240	0.02 pCi/g (dry)	0.02 pCi/g (dry)[7]	3, 4
			Co-60	0.1 pCi/g (dry)	0.1 pCi/g (dry)[7]	3, 4
			Cs-137	0.2 pCi/g (dry)	0.2 pCi/g (dry)[7]	3, 4
			Gamma Spec	5 X MDC[3]	5 X MDC[3,7]	3, 4
			H-3	NA[4,8]	NA[4,8]	3, 4

TABLE 4.1

Medium	Location	Type, Frequency	Analysis	ACTION LEVELS: Investigation Level	ACTION LEVELS: Reporting Level	ACTION LEVELS: Action Category[1]
Direct Gamma Dose (TLD)	NW, NE, SW, SE Corners and N, S, E, W Fencelines	Continuous, Quarterly	Tissue dose using thermoluminescent dosimeter	120 mrem/qtr	500 mrem/year	3, 4
	N, S, E, W Fencelines and Fenceline position(s) nearest each active disposal trench	Continuous, Monthly	Tissue dose using thermoluminescent dosimeters	40 mrem/month	500 mrem/year	3, 4

NOTES:
1. Table 6.4 presents the action required based upon action categories.
2. IF Ac-227 is listed on manifest or known to be present, the reporting level is 3.0×10^{-13} uCi/cc.
3. The required minimum detection concentrations (MDCs) are listed in Table 4.3.
4. NA = Not applicable or none established.
5. Dry to wet ratio will be obtained.
6. Total uranium analysis is defined as the sum of the concentrations of uranium isotopes reported.
7. These are interim reporting levels.
8. Concentrations will be evaluated and reported annually in the environmental report.
9. Field blank analysis is the same as well sample analysis.
10. Used for sample QA.

TABLE 4.2

Action Categories

Actions Required When Action Level Met or Exceeded

1. Type 1 Event
   Follow Reporting Level requirements
   Potential for bioassay examined by FRC&SO.

2. Type 2 Event
   Immediate notification of on-site inspector
   Take corrective action

3. Investigation Level
   Notify the FRC&SO and the CRC&SO
   Take corrective actions described in FSM 6.1.5

4. Report Level
   Notify the FRC&SO, CRC&SO, the Department, the US NRC within 24 hours upon confirmation
   Take corrective actions described in FSM 6.1.5
   Make reports in accordance with FSM 6.1.4.C

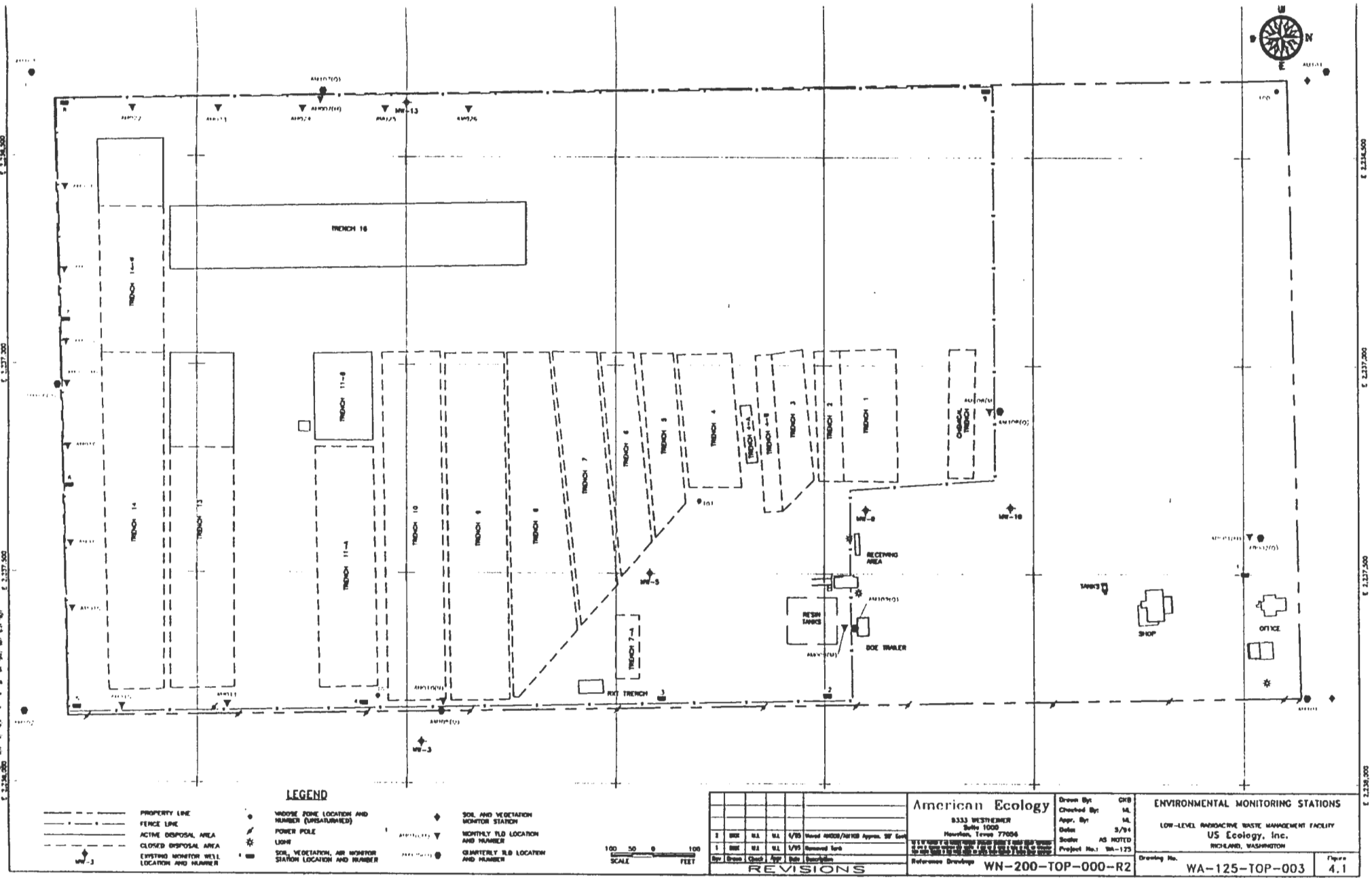
5. Resurvey with dose rate instrument for fixed contamination/radiation level and smears for loose contamination. If dose rate < 0.1 mR/hr and loose contamination < 220 dpm/100 cm^2, no further action is required. If dose rate is ≥ 0.1 mR/hr or loose contamination is ≥ 220 dpm/100 cm^2, then take action per #2 above.

TABLE 4.3

Required Minimum Detectable Concentration (MDCs) for Gamma Spectroscopy Analyses of Environmental Samples

Radionuclide	Water (pCi/l)	Airborne Activity (pCi/m^3)	Soil (pCi/g - dry)	Vegetation (pCi/g - dry)
As-76	16	0.02	0.03	0.05
Ba/La-140	24	0.02	0.05	0.07
Ce-141	10	0.01	0.02	0.03
Ce/Pr-144	92	0.09	0.18	0.10
Co-58	10	0.01	0.02	0.03
Co-60	11	0.01	0.02	0.03
Cs-134	11	0.01	0.02	0.03
Cs-137	10	0.01	0.02	0.03
Eu-152	56	0.06	0.11	0.17
Eu-154	27	0.03	0.05	0.08
Eu-155	24	0.02	0.05	0.07
Fe-59	17	0.02	0.03	0.05
I-131	10	0.02	0.02	0.03
I-133	11	0.01	0.02	0.03
Mn-54	10	0.01	0.02	0.03
Mo-99	69	0.07	0.14	0.21
Na-22	10	0.01	0.02	0.03
Ru-103	10	0.01	0.02	0.03
Ru-106	85	0.09	0.17	0.26
Sb-124	10	0.01	0.02	0.03
Sb-125	24	0.02	0.05	0.07
Zn-65	21	0.02	0.04	0.06
Zr/Nb-95	17	0.02	0.03	0.05

NOTE: The gamma nuclide library used by the analytical laboratory will contain additional radionuclides as specified by US Ecology. Naturally occurring gamma ray emitters which will be monitored and reported in the annual environmental report are not included in this listing.



LEGEND

- PROPERTY LINE
- FENCE LINE
- ACTIVE DISPOSAL AREA
- CLOSED DISPOSAL AREA
- EXISTING MONITOR WELL LOCATION AND NUMBER
- VADOSE ZONE LOCATION AND NUMBER (UNSATURATED)
- POWER POLE
- LIGHT
- SOIL, VEGETATION, AIR MONITOR STATION LOCATION AND NUMBER
- SOIL AND VEGETATION MONITOR STATION
- MONTHLY TLD LOCATION AND NUMBER
- QUARTERLY TLD LOCATION AND NUMBER

SCALE: 100 50 0 100 FEET

By	Drawn	Check	App	Date	Description
3	BRR	WJ	WL	4/95	Moved AM009/AM103 Approx. 50' East
2	BRR	WJ	WL	1/95	Removed Sand
1	BRR	WJ	WL	1/95	Removed Sand

REVISIONS

American Ecology
9333 WESTHEIMER
Suite 1000
Houston, Texas 77036

Reference Drawings: WN-200-TOP-000-R2

Drawn By: CKB
Checked By: ML
Appr. By: ML
Date: 3/96
Scale: AS NOTED
Project No.: WA-125

ENVIRONMENTAL MONITORING STATIONS

LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT FACILITY
US Ecology, Inc.
RICHLAND, WASHINGTON

Drawing No. WA-125-TOP-003

Figure 4.1

5.0 ENVIRONMENTAL RADIOLOGICAL PROGRAM INFORMATION

This section discusses the collection process and the results from the analysis of air, soil, vegetation and ambient radiation dose rates. Results of the groundwater monitoring program are presented in Section 7. The sample results are compared with site historical data, Hanford site data and offsite data when available. Results are evaluated and their implications are discussed in this report. Some measurements in this report are written in an exponential format, e.g., the powers of ten are expressed as (E $\pm$ X) where X is the power of ten. Most measurements include the two sigma counting errors.

Where possible, comparison of results from the 1994 samples are made with previously reported data contained in the US Ecology Historical Environmental Report, 1992 and 1993 Annual Environmental Monitoring Reports, the Washington Public Power Supply System Annual Environmental Monitoring Report for 1993, and the Hanford Site Environmental Reports for 1992 and 1993. These reports will, henceforth, be referred to as the Historical Report, the 1992 and 1993 Annual Reports, the 1993 WPPSS Report, and the 1992 and 1993 Hanford Reports, respectively.

5.1 Airborne Radioactivity

Air was sampled continuously during 1994 at the facility to determine concentrations of radionuclides in airborne particulates and to detect significant trends in concentrations. Nine low-volume air samplers, each operating at approximately 7.1 E-4 m^3/s (1.5 cfm) are located around the perimeter of the US Ecology LLRWDF. Particulate air filters were collected weekly such that a minimum of six days and a maximum of eight days were accumulated. During 1994, sample analysis was performed by US Ecology, Inc. (gross alpha, beta, and I-125), and Teledyne Isotopes Midwest Laboratories (gamma spectroscopy and tritium).

Station 1, which is located approximately 1000 feet north of the current receiving area, is the control station for the facility. However, it also serves as an indicator location for activity which may not be attributable to the US Ecology facility. Accordingly, while Station 1 can be described as a background sampling location for the US Ecology facility, it may not represent background for locations unaffected by operations on the Hanford Reservation.

Sampling locations are depicted on Figure 4.1 in Section 4 of this report.

5.1.1 Gross Beta In Air Particulate Samples

The purpose of gross beta analysis is primarily to indicate any increases in sample radioactivity that may require more in-depth analysis by gamma spectroscopy or radiochemical analysis. Gross beta analysis is thus used as a relatively quick and inexpensive screening tool. The results may also be used to indicate any trends in environmental radioactivity. The gross beta concentrations measured in air particulates at the facility are presented in Table 5.1 and are depicted graphically in Figures 5.1 through 5.9. The sample date in Table 5.1 represents the date of collection. Error values in the tables represent the 95 percent confidence interval due to counting.

The annual arithmetic mean for the gross beta concentration at each of the nine air sample stations ranged from 2.12 E-14 microcuries per milliliter (uCi/ml), or equivalently, 2.12 E-2 picocuries per cubic meter (pCi/m^3) at Station 2 to 2.26 E-14 uCi/ml (2.26 E-2 pCi/m^3) at Station 4. Individual samples ranged from a low of 8.8

+/- 2.3 E-15 uCi/ml (8.8 +/- 2.3 E-3 pCi/m^3) at Station 1 on December 5, 1994 to a high of 8.19 +/- 5.70 E-14 uCi/ml (8.19 +/- 5.70 E-2 pCi/m^3) at Station 3 on January 3, 1994.

Comparisons of results from 1994 were made with data available from the 1993 Annual Report, the 1992 Annual Report, the Historical Report, the 1993 Hanford report and the 1993 WPPSS Report. Reported gross beta concentrations ranged from 9.0 E-15 uCi/ml (9.0 E-3 pCi/m^3) to 9.63 E-14 uCi/ml (9.63 E-2 pCi/m^3) in the 1993 Annual Report; from 5.4 E-15 uCi/ml (5.4 E-3 pCi/m^3) to 7.11 E-14 uCi/ml (7.11 E-2 pCi/m^3) in the 1992 Annual Report; from 3.0 E-15 uCi/ml (3.0 E-3 pCi/m^3) to 2.1E-10 uCi/ml (2.1 E 2 pCi/m^3) in the Historical Report. The 1993 WPPSS report indicated a range of results from 3.0 E-15 uCi/ml (3.0 E-3 pCi/m^3) to 7.1 E-14 uCi/ml (7.1 E-2 pCi/m^3). For 1993, the Hanford site reported an average value of 2.1 E-14 uCi/ml (2.1 E-2 pCi/m^3) and a maximum value of 6.4 E-14 uCi/ml (6.4 E-2 pCi/m^3) for total beta activity for 483 samples taken onsite.

The range and average values of the 1994 concentrations are consistent with the historical data presented above. There does not appear to be any significant difference in the data from normal background concentrations at locations surrounding the facility. No trends are evident upon inspection of the graphical presentations in Figures 5.1 through 5.9. However, some seasonal fluctuations which are normally present due to atmospheric conditions (e.g. temperature inversions) are evident. These inversions usually occur during the fall and winter months and result in increased airborne activity from naturally occurring radon and radon daughters.

The investigation level for gross beta activity is 1.0 E-13 uCi/ml (1.0 E-1 pCi/m^3). There were no air samples which exceeded this action level in 1994.

Figures 5.10 through 5.18 compare monthly averages for 1992 through 1994. The figures allow one to make a historical comparison between results. Results from year-to-year are similar and do not indicate any trends toward increasing concentrations.

5.1.2 Gross Alpha Particulate Activity

Gross alpha particulate activity in air is measured to provide a relatively inexpensive and quick screening tool and to indicate trends, analogous to the gross beta particulate analysis. Results are presented in Table 5.2 and are graphed in Figures 5.19 through 5.27. The error terms in the tables represent the counting error at the 95 percent confidence interval.

The annual arithmetic mean value for the gross alpha concentration at each of the nine air stations ranged from 1.23 E-15 uCi/ml (1.23 E-3 pCi/m^3) at Station 8 to 1.62 E-15 uCi/ml (1.62 E-3 pCi/m^3) at Station 4. Individual sample results ranged from -1.92 E-15 uCi/ml (-1.92 E-3 pCi/m^3) at Stations 1, 2 and 9 on February 28, 1994 to 7.83 E-15 uCi/ml (7.83 E-3 pCi/m^3) at Station 1 on January 3, 1994. Negative data are reported so that appropriate statistical analysis can be performed on the data.

The Historical Report gives a range for gross alpha measurements from "background" to 6.5 E-13 uCi/ml (6.5 E-1 pCi/m^3) while the 1992 and 1993 Annual Reports give ranges from -1.00 E-16 uCi/ml (-1.00 E-4 pCi/m^3) to 3.31 E-15 uCi/ml (3.31 E-3 pCi/m^3) and -1.75 E-15 uCi/ml (-1.75 E-3 pCi/m^3) to 5.25 E-15 uCi/ml (5.25 E-3 pCi/m^3), respectively. Environmental air samples taken for the WPPSS site for 1993 were not analyzed for gross alpha activity. For 1993, the Hanford site reported an average value of 5.2 E-16 uCi/ml (5.2 E-4 pCi/m^3) and a maximum value of 2.3 E-15 uCi/ml (2.3 E-3 pCi/m^3) for total alpha activity for 457 samples taken onsite.

The gross alpha concentrations measured at the US Ecology facility appear to be reasonable in comparison to, and consistent with, previous years measurements.

Inspection of the graphical presentations in Figures 5.19 through 5.27 does not reveal any apparent trends throughout 1994. Figures 5.28 through 5.36 show the gross alpha concentrations from 1992 through 1994.

No differences from normal background concentrations in previous reports are apparent during 1994; furthermore, no trends which would indicate a contribution from the site were evident. Consequently, the dose contribution due to airborne alpha emitters released from the facility is expected to be essentially zero.

5.1.3 Specific Radionuclide Analysis

Tables 5.3 and 5.5 list the results of specific radionuclide analysis of US Ecology LLRWDF charcoal cartridges, air filters, and silica gel columns collected during 1994. Table 5.3 shows the concentration of I-125 derived from measurements of the weekly iodine vapor charcoal cartridges. Figures 5.37 through 5.45 graphically present the I-125 results in Table 5.3. Error terms represent the counting error at the 95 percent confidence interval.

For 1994, the annual mean concentration for I-125 at all nine stations was 8.90 E-15 uCi/ml (8.90 E-3 pCi/m^3). This concentration is approximately 0.003 percent of the effluent air limit for unrestricted areas (3.0 E-10 uCi/ml), referenced in WAC 246-221-290, Appendix A, Table II, column 1. The mean annual concentration of I-125 for the different monitoring stations varied from a low of 7.7 E-15 uCi/ml (7.7 E-3 pCi/m^3) at Station 2 to a high of 1.03 E-14 uCi/ml (1.03 E-2 pCi/m^3) at Station 3.

The annual mean concentration during 1993 varied from 9.7 E-15 uCi/ml (9.7 E-3 pCi/m^3) at Station 9 to 1.3 E-14 uCi/ml (1.3 E-2 pCi/m^3) at Station 6. The concentrations of I-125 at the facility were not statistically different during 1994 when compared to previous years. Graphical presentation of 1992 through 1994 data are provided in Figures 5.46 through 5.54. Concentrations of I-125 in air are not reported in the Hanford reports or WPPSS reports, therefore, comparison is not possible.

Table 5.4 presents the required minimum detectable concentrations for gamma emitting radionuclides measured by contractor laboratories. Laboratories are required to report the results of any gamma emitters detected.

Table 5.5 lists the results of gamma spectrometry analysis of the monthly composites of the weekly particulate air samples. Sample results are not shown for any laboratory results which were reported at levels less than the required minimum detectable concentration. The sample dates represent the date of collection of the last weekly sample which was added to the composite for analysis. Error terms represent the counting error at the 95 percent confidence interval.

Of the 108 composite samples, no man-made radionuclides were detected at concentrations above the required laboratory detection level. Naturally occurring Be-7 was detected in expected concentrations.

Table 5.6 lists the results of the tritium analysis for the water vapor collected in the monthly silica gel cartridges. Results ranged from 9.9 E-13 uCi/ml (9.9 E-1 pCi/m^3) to 9.98 E-12 uCi/ml (9.98 pCi/m^3) and are presented graphically in Figure 5.55. The annual mean values measured at the three environmental monitoring stations (1, 2, and 5) were 2.04 E-12 uCi/ml (2.04 pCi/m^3), 2.61 E-12 uCi/ml (2.61 pCi/m^3), and 5.04 E-12 uCi/ml (5.04 pCi/m^3), respectively. The mean concentration at Station 5 represents less than .005 % of the effluent air limit, (1.0 E-7 uCi/ml) in WAC 246-221-290, Appendix A, Table II, column 1.

The 1992 and 1993 Annual Reports give ranges for air moisture tritium concentration of 5.8 E-13 uCi/ml (0.58 pCi/m^3) to 2.45 E-11 (24.5 pCi/m^3) and 3.0 E-14 uCi/ml (3.0 E-2 pCi/m^3) to 1.98 E-11 uCi/ml (19.8 pCi/m^3), respectively. The 1993 Hanford Report gives a maximum value of 6.0 E-10 uCi/ml (600 pCi/m^3) and an average value of 1.2 E-11 uCi/ml (12 pCi/m^3) for onsite areas.

US Ecology's results for 1994 are consistent with the range of values reported for onsite locations in the Hanford Report. Based on the tritium concentrations reported throughout 1994, site operations have not had any discernible impact on airborne tritium concentrations.

5.1.4 Air Emissions from Package Inspection Facility

As part of its package confirmation program, US Ecology is required to confirm the contents of at least one shipment per week or one shipment out of every 15 shipments, whichever is more frequent. This program involves a complete inspection of all drums associated with the shipment. At least one package from each confirmation shipment is opened or evaluated destructively. Destructive evaluation usually entails punching the drum to inspect for freestanding liquid.

Packages which are opened or evaluated destructively are examined in the package inspection facility whenever possible. In addition, waste which is found not to be packaged in accordance with the facility license is also repackaged inside the inspection tent.

A description of the facility and the results of the dose assessment performed to determine compliance with applicable standards is presented in Appendix A. The dose assessment indicates that the facility is in compliance with applicable regulations. The concentrations measured, while greater than background concentrations, would result in negligible offsite and onsite dose. The concentrations at the vent exhaust are all well below the action levels for gross beta, gross alpha and iodine.

The average of the measured gross beta concentrations during 1994 was 4.66 E-13 uCi/ml (0.47 pCi/m^3). This is 5 E-3 percent of the derived air concentration (DAC) for restricted areas as given in WAC 246-221-290, Appendix A, Table 1, Column 3 for Cobalt-60. Co-60 is the beta emitting isotope with the most restrictive DAC that was present in waste packages inspected/remediated.

The average of the measured gross alpha concentrations during 1994 was 9.9 E-14 uCi/ml (9.9 E-2 pCi/m^3). This is 19.8 percent of the DAC for restricted areas for Th-232. Thorium-232 was the alpha emitting isotope with the most restrictive DAC that was present in waste packages inspected/remediated. In addition, it should be recognized, that air emissions from the facility only occurred during package evolution activities. Therefore, the true annual average would be well below the reported value.

For I-125, the average concentration of 7.95 E-13 uCi/ml (0.79 pCi/m^3) during 1994 was less than 3.0 E-3 percent of the derived air concentration (DAC).

Additionally, none of the nine environmental air monitoring stations exceeded the effluent air limits for unrestricted areas.

TABLE 5.1

Gross Beta Measurements of Environmental Particulate Air Samples- 1994 (xE-14 uCi/ml)

Sample Date	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9
Jan 3	8 ± 0.6	6.6 ± 0.5	8.2 ± 0.6	6.1 ± 0.5	7.9 ± 0.6	7.3 ± 0.5	7.3 ± 0.5	7.8 ± 0.6	6.3 ± 0.5
Jan 10	1.5 ± 0.3	1.6 ± 0.3	1.6 ± 0.3	1.7 ± 0.3	1.5 ± 0.3	1.6 ± 0.3	1.6 ± 0.3	1.5 ± 0.3	1.8 ± 0.3
Jan 17	1.8 ± 0.3	1.6 ± 0.3	1.7 ± 0.3	1.9 ± 0.3	1.6 ± 0.3	1.8 ± 0.3	1.5 ± 0.3	1.6 ± 0.3	1.5 ± 0.3
Jan 24	5 ± 0.4	4.8 ± 0.4	4.4 ± 0.4	4.7 ± 0.4	4.3 ± 0.4	4.8 ± 0.4	4.4 ± 0.4	5 ± 0.4	4.6 ± 0.4
Jan 31	3.7 ± 0.4	4.1 ± 0.4	4.3 ± 0.4	4.1 ± 0.4	3.4 ± 0.4	3.9 ± 0.4	3.4 ± 0.4	3.7 ± 0.4	4.1 ± 0.4
Feb 7	4.4 ± 0.4	4.4 ± 0.4	4.4 ± 0.4	4.1 ± 0.4	4.3 ± 0.4	4.4 ± 0.4	3.5 ± 0.4	4.9 ± 0.5	4.7 ± 0.4
Feb 14	2.2 ± 0.3	2.8 ± 0.3	2.4 ± 0.3	2.3 ± 0.3	2 ± 0.3	2.1 ± 0.3	2 ± 0.3	2.1 ± 0.3	1.9 ± 0.3
Feb 22	1.2 ± 0.3	1.2 ± 0.3	1.1 ± 0.2	1.4 ± 0.3	1.4 ± 0.3	1.1 ± 0.2	1.1 ± 0.3	1.1 ± 0.2	1.1 ± 0.3
Feb 28	1.5 ± 0.4	1.6 ± 0.4	2.3 ± 0.4	2 ± 0.4	2.1 ± 0.4	1.9 ± 0.4	1.4 ± 0.4	1.9 ± 0.4	2 ± 0.4
Mar 7	1.8 ± 0.3	1.7 ± 0.3	1.9 ± 0.3	1.4 ± 0.3	1.8 ± 0.3	1.7 ± 0.3	1.7 ± 0.3	1.7 ± 0.3	1.7 ± 0.3
Mar 14	1.8 ± 0.3	1.8 ± 0.3	2.1 ± 0.3	1.8 ± 0.3	1.9 ± 0.3	2 ± 0.3	2 ± 0.3	1.8 ± 0.3	2 ± 0.3
Mar 21	1.3 ± 0.3	1.7 ± 0.3	1.5 ± 0.3	1.5 ± 0.3	1.1 ± 0.2	1.3 ± 0.3	1.3 ± 0.3	1.3 ± 0.3	1.3 ± 0.3
Mar 28	1.4 ± 0.3	1.4 ± 0.3	1.5 ± 0.3	1.9 ± 0.3	1.4 ± 0.3	1.5 ± 0.3	1.7 ± 0.3	1.2 ± 0.3	1.3 ± 0.3
Apr 4	1.9 ± 0.3	1.5 ± 0.3	1.7 ± 0.3	2 ± 0.3	2 ± 0.3	2 ± 0.3	2.1 ± 0.3	2.1 ± 0.3	2 ± 0.3
Apr 11	1.3 ± 0.3	1 ± 0.2	1 ± 0.2	1 ± 0.2	1.7 ± 0.3	1.2 ± 0.3	1.2 ± 0.3	0.9 ± 0.2	1.2 ± 0.3
Apr 18	1.9 ± 0.3	2 ± 0.3	1.8 ± 0.3	1.8 ± 0.3	1.8 ± 0.3	2 ± 0.3	1.9 ± 0.3	1.8 ± 0.3	1.8 ± 0.3
Apr 25	1.6 ± 0.3	1.4 ± 0.3	1.6 ± 0.3	1.8 ± 0.3	1.5 ± 0.3	1.6 ± 0.3	1.5 ± 0.3	1.8 ± 0.3	1.6 ± 0.3

NOTE: 1 pCi/m3 = 1 E-12 uCi/ml.

TABLE 5.1

Gross Beta Measurements of Environmental Particulate Air Samples- 1994 (xE-14 uCi/ml)

Sample Date	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9
May 2	1.9 ± 0.3	1.6 ± 0.3	1.8 ± 0.3	2 ± 0.3	1.8 ± 0.3	1.8 ± 0.3	2.1 ± 0.3	1.6 ± 0.3	1.8 ± 0.3
May 9	2 ± 0.3	2.1 ± 0.3	2.2 ± 0.3	2.5 ± 0.3	2.1 ± 0.3	2.1 ± 0.3	2.6 ± 0.3	2.1 ± 0.3	2 ± 0.3
May 16	2 ± 0.3	1.8 ± 0.3	1.9 ± 0.3	1.9 ± 0.3	1.5 ± 0.3	1.8 ± 0.3	1.9 ± 0.3	1.7 ± 0.3	1.6 ± 0.3
May 23	1.3 ± 0.3	1 ± 0.3	1.2 ± 0.3	1.3 ± 0.3	1.3 ± 0.3	1.2 ± 0.3	1.1 ± 0.3	1.2 ± 0.3	1.4 ± 0.3
May 31	1.9 ± 0.3	1.8 ± 0.3	2.2 ± 0.3	1.9 ± 0.3	2 ± 0.3	1.8 ± 0.3	2 ± 0.3	1.4 ± 0.2	1.5 ± 0.2
Jun 6	1.6 ± 0.3	1.5 ± 0.3	1.5 ± 0.3	1.6 ± 0.3	1.6 ± 0.3	1.5 ± 0.3	1.6 ± 0.3	1.3 ± 0.3	1.5 ± 0.3
Jun 13	1.7 ± 0.3	1.3 ± 0.3	1.7 ± 0.3	1.7 ± 0.3	1.5 ± 0.3	1.3 ± 0.3	1.4 ± 0.3	1.4 ± 0.3	1.6 ± 0.3
Jun 20	0.9 ± 0.2	1.3 ± 0.3	1.5 ± 0.3	1.2 ± 0.3	1 ± 0.3	1.1 ± 0.3	0.9 ± 0.2	1.1 ± 0.3	1.3 ± 0.3
Jun 27	1.9 ± 0.3	1.8 ± 0.3	1.9 ± 0.3	2.1 ± 0.3	2.2 ± 0.3	1.9 ± 0.3	1.8 ± 0.3	1.8 ± 0.3	2.3 ± 0.3
Jul 5	1.3 ± 0.2	1.5 ± 0.3	1.6 ± 0.3	1.8 ± 0.3	1.7 ± 0.3	1.6 ± 0.3	1.4 ± 0.2	1.2 ± 0.2	1.5 ± 0.3
Jul 11	2 ± 0.4	1.6 ± 0.3	2.2 ± 0.4	1.8 ± 0.3	1.7 ± 0.3	1.7 ± 0.3	1.8 ± 0.3	1.5 ± 0.3	1.8 ± 0.3
Jul 18	1.7 ± 0.3	1.5 ± 0.3	2 ± 0.3	1.9 ± 0.3	2 ± 0.3	2 ± 0.3	2 ± 0.3	1.7 ± 0.3	2.1 ± 0.3
Jul 25	2.2 ± 0.3	2.2 ± 0.3	2.1 ± 0.3	2.3 ± 0.3	2.8 ± 0.3	2.2 ± 0.3	2.2 ± 0.3	2.1 ± 0.3	2.4 ± 0.3
Aug 1	1.8 ± 0.3	1.9 ± 0.3	2.1 ± 0.3	2 ± 0.3	2 ± 0.3	2.1 ± 0.3	2 ± 0.3	2 ± 0.3	2.3 ± 0.3
Aug 8	1.8 ± 0.3	1.9 ± 0.3	1.5 ± 0.3	2.1 ± 0.3	1.8 ± 0.3	1.6 ± 0.3	1.6 ± 0.3	1.3 ± 0.3	1.9 ± 0.3
Aug 15	1.9 ± 0.3	1.8 ± 0.3	2.1 ± 0.3	2.1 ± 0.3	1.9 ± 0.3	2.1 ± 0.3	2.1 ± 0.3	1.7 ± 0.3	2.1 ± 0.3
Aug 22	2 ± 0.3	1.9 ± 0.3	1.9 ± 0.3	2.1 ± 0.3	2.5 ± 0.3	2.1 ± 0.3	2 ± 0.3	1.9 ± 0.3	2 ± 0.3
Aug 29	2.1 ± 0.3	1.9 ± 0.3	2.1 ± 0.3	2.1 ± 0.3	2.3 ± 0.3	2.2 ± 0.3	2.1 ± 0.3	2 ± 0.3	1.8 ± 0.3

NOTE: 1 pCi/m3 = 1 E-12 uCi/ml.

TABLE 5.1

Gross Beta Measurements of Environmental Particulate Air Samples- 1994 (xE-14 uCi/ml)

Sample Date	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9
Sep 6	1.8 ± 0.3	1.8 ± 0.3	1.6 ± 0.3	1.7 ± 0.3	1.8 ± 0.3	1.7 ± 0.3	1.8 ± 0.3	2 ± 0.3	1.7 ± 0.3
Sep 12	1.6 ± 0.3	1.8 ± 0.3	1.8 ± 0.3	2.4 ± 0.6	2 ± 0.4	1.8 ± 0.3	1.5 ± 0.3	2 ± 0.3	1.6 ± 0.3
Sep 19	2.5 ± 0.3	2.1 ± 0.3	2.2 ± 0.3	2.1 ± 0.3	2.1 ± 0.3	2.3 ± 0.3	2.2 ± 0.3	2.3 ± 0.3	2.1 ± 0.3
Sep 26	3.7 ± 0.4	3.4 ± 0.4	3.8 ± 0.4	3.7 ± 0.4	3.5 ± 0.4	3.6 ± 0.4	3.5 ± 0.4	3.9 ± 0.4	3.6 ± 0.4
Oct 3	2.7 ± 0.4	2.1 ± 0.3	2.5 ± 0.3	2.3 ± 0.3	2.4 ± 0.3	2.5 ± 0.3	2.5 ± 0.3	2.6 ± 0.3	2.4 ± 0.3
Oct 10	3 ± 0.4	2.9 ± 0.4	2.8 ± 0.3	3.5 ± 0.4	3.6 ± 0.4	3.3 ± 0.4	3.3 ± 0.4	1.9 ± 0.3	2.9 ± 0.4
Oct 17	2 ± 0.3	2.2 ± 0.3	2.3 ± 0.3	2.2 ± 0.3	2.2 ± 0.3	2.2 ± 0.3	1.9 ± 0.3	2.3 ± 0.3	2.2 ± 0.3
Oct 24	2.5 ± 0.3	1.9 ± 0.3	2.3 ± 0.3	2.1 ± 0.3	2.2 ± 0.3	2.3 ± 0.3	2 ± 0.3	2 ± 0.3	2.2 ± 0.3
Oct 31	1.7 ± 0.3	1.9 ± 0.3	1.8 ± 0.3	1.9 ± 0.3	1.9 ± 0.3	1.4 ± 0.3	1.6 ± 0.3	1.9 ± 0.3	1.9 ± 0.3
Nov 7	1.5 ± 0.3	1.4 ± 0.3	2 ± 0.3	1.4 ± 0.3	1.6 ± 0.3	1.6 ± 0.3	1.5 ± 0.3	1.7 ± 0.3	1.3 ± 0.3
Nov 14	1.7 ± 0.3	1.8 ± 0.3	1.7 ± 0.3	1.8 ± 0.3	1.7 ± 0.3	1.5 ± 0.3	1.7 ± 0.3	1.8 ± 0.3	1.9 ± 0.3
Nov 21	1.9 ± 0.3	1.7 ± 0.3	1.7 ± 0.3	1.8 ± 0.3	1.4 ± 0.3	1.6 ± 0.3	1.7 ± 0.3	1.8 ± 0.3	1.7 ± 0.3
Nov 28	2.3 ± 0.3	1.9 ± 0.3	2.1 ± 0.3	2.1 ± 0.3	1.9 ± 0.3	1.9 ± 0.3	1.8 ± 0.3	1.8 ± 0.3	2.1 ± 0.3
Dec 5	0.9 ± 0.2	2.2 ± 0.3	2.1 ± 0.3	1.9 ± 0.3	1.7 ± 0.3	1.6 ± 0.3	1.7 ± 0.3	2 ± 0.3	2 ± 0.3
Dec 12	4.9 ± 0.4	3.9 ± 0.4	4.2 ± 0.4	4.2 ± 0.4	4.5 ± 0.4	4.1 ± 0.4	4.2 ± 0.4	4.2 ± 0.4	3.9 ± 0.4
Dec 19	3.4 ± 0.4	3.1 ± 0.4	3.8 ± 0.4	3.2 ± 0.4	3.7 ± 0.4	3.7 ± 0.4	3.6 ± 0.4	3.6 ± 0.4	3.9 ± 0.4
Dec 27	2.5 ± 0.3	2.8 ± 0.3	2.5 ± 0.3	3.3 ± 0.3	3 ± 0.3	2.4 ± 0.3	2.3 ± 0.3	2.7 ± 0.3	2.8 ± 0.3

NOTE: 1 pCi/m3 = 1 E-12 uCi/ml.

TABLE 5.2

Gross Alpha Measurements of Environmental Particulate Air Samples- 1994 (xE-15 uCi/ml)

Sample Date	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9
Jan 3	7.83 ± 1.9	4.78 ± 1.56	5.8 ± 1.68	5.49 ± 1.65	4.98 ± 1.58	5.59 ± 1.66	6 ± 1.71	4.07 ± 1.47	3.76 ± 1.43
Jan 10	1.41 ± 0.97	1.61 ± 1.01	1.41 ± 0.97	1.01 ± 0.88	2.31 ± 1.13	0.3 ± 0.71	2.11 ± 1.1	0.7 ± 0.81	1.51 ± 0.99
Jan 17	0.81 ± 0.89	0.71 ± 0.86	0.91 ± 0.91	0.4 ± 0.79	0.3 ± 0.77	0.51 ± 0.82	0.91 ± 0.91	0.98 ± 1.07	0.91 ± 0.91
Jan 24	2.47 ± 1.28	1.93 ± 1.19	2.04 ± 1.21	1.82 ± 1.17	1.29 ± 1.07	2.36 ± 1.26	1.39 ± 1.09	1.93 ± 1.19	1.93 ± 1.19
Jan 31	0.88 ± 1.1	1.65 ± 1.24	2.43 ± 1.37	2.1 ± 1.31	1.1 ± 1.14	0.66 ± 1.06	0.77 ± 1.08	2.54 ± 1.38	1.32 ± 1.18
Feb 7	2.06 ± 1.54	1.41 ± 1.45	1.73 ± 1.5	2.17 ± 1.56	2.27 ± 1.57	1.73 ± 1.5	0.22 ± 1.27	2.92 ± 1.66	2.81 ± 1.64
Feb 14	0.55 ± 0.72	2.76 ± 1.21	1.55 ± 0.97	1.99 ± 1.06	1.33 ± 0.92	1.99 ± 1.06	1.55 ± 0.97	1.44 ± 0.94	1.55 ± 0.97
Feb 22	0.74 ± 0.73	0.93 ± 0.77	1.57 ± 0.91	0.93 ± 0.77	0.83 ± 0.75	0.83 ± 0.75	1.39 ± 0.87	0.93 ± 0.77	1.3 ± 0.85
Feb 28	-1.9 ± 1.49	-1.9 ± 1.49	-0.8 ± 1.67	-0.5 ± 1.7	-0.6 ± 1.69	-1.7 ± 1.53	-0.8 ± 1.67	-1.4 ± 1.57	-1.9 ± 1.49
Mar 7	0.77 ± 0.94	2.09 ± 1.2	1.65 ± 1.12	1.1 ± 1.01	1.54 ± 1.1	1.1 ± 1.01	1.21 ± 1.04	0.22 ± 0.81	0.66 ± 0.92
Mar 14	0.54 ± 0.82	0.87 ± 0.9	1.3 ± 1	1.52 ± 1.04	0.54 ± 0.82	1.09 ± 0.95	0.98 ± 0.93	1.41 ± 1.02	1.3 ± 1
Mar 21	1.08 ± 0.85	1.95 ± 1.04	1.62 ± 0.97	1.95 ± 1.04	0.43 ± 0.67	0.97 ± 0.82	0.87 ± 0.79	0.97 ± 0.82	0.87 ± 0.79
Mar 28	0.43 ± 0.85	1.4 ± 1.06	2.16 ± 1.2	0.97 ± 0.97	0.65 ± 0.9	0.97 ± 0.97	1.73 ± 1.12	0.97 ± 0.97	0.54 ± 0.87
Apr 4	1.22 ± 0.89	0.61 ± 0.75	1.22 ± 0.89	1.83 ± 1.02	0.51 ± 0.72	1.83 ± 1.02	1.22 ± 0.89	1.02 ± 0.85	0.82 ± 0.8
Apr 11	0.76 ± 0.98	0.76 ± 0.98	2.07 ± 1.23	1.2 ± 1.07	0.87 ± 1	0.65 ± 0.96	1.2 ± 1.07	-0.1 ± 0.77	0.65 ± 0.96
Apr 18	1.85 ± 0.98	1.09 ± 0.8	1.09 ± 0.8	1.19 ± 0.82	1.52 ± 0.9	1.19 ± 0.82	1.74 ± 0.95	0.33 ± 0.56	0.98 ± 0.77
Apr 25	0.76 ± 0.64	0.98 ± 0.71	1.3 ± 0.8	1.41 ± 0.82	0.98 ± 0.71	1.19 ± 0.77	1.95 ± 0.95	1.41 ± 0.82	1.63 ± 0.88

NOTE: 1 pCi/m3 = 1 E-12 uCi/ml

TABLE 5.2

Gross Alpha Measurements of Environmental Particulate Air Samples- 1994 (xE-15 uCi/ml)

Sample Date	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9
May 2	1.72 ± 1.08	1.08 ± 0.94	1.29 ± 0.99	1.4 ± 1.01	1.72 ± 1.08	1.4 ± 1.01	1.08 ± 0.94	1.51 ± 1.03	1.83 ± 1.1
May 9	0.65 ± 1.28	0.76 ± 1.3	0 ± 1.17	0.98 ± 1.33	0 ± 1.17	0.65 ± 1.28	0.43 ± 1.24	0.76 ± 1.3	0.43 ± 1.24
May 16	1.63 ± 1.06	1.3 ± 1	1.74 ± 1.09	2.39 ± 1.2	1.41 ± 1.02	1.3 ± 1	1.74 ± 1.09	1.2 ± 0.98	1.74 ± 1.09
May 23	0.22 ± 0.74	1.2 ± 0.98	0.65 ± 0.86	1.53 ± 1.05	0.76 ± 0.88	1.75 ± 1.09	0.55 ± 0.83	1.75 ± 1.09	0.44 ± 0.8
May 31	0.47 ± 0.81	1.04 ± 0.93	1.52 ± 1.02	1.42 ± 1	1.04 ± 0.93	0.76 ± 0.87	0.38 ± 0.79	0.47 ± 0.81	0.85 ± 0.89
Jun 6	0.76 ± 0.99	1.39 ± 1.14	1.64 ± 1.19	1.9 ± 1.24	0.51 ± 0.93	1.64 ± 1.19	0.51 ± 0.93	0.63 ± 0.96	1.77 ± 1.21
Jun 13	0.54 ± 1.02	1.19 ± 1.15	0.98 ± 1.11	0.54 ± 1.02	0.98 ± 1.11	0.33 ± 0.98	0.43 ± 1	0.33 ± 0.98	0.87 ± 1.09
Jun 20	0.65 ± 0.73	1.42 ± 0.99	1.4 ± 0.92	2.16 ± 1.08	1.62 ± 0.97	1.62 ± 0.97	1.08 ± 0.85	0.76 ± 0.76	1.3 ± 0.9
Jun 27	0.97 ± 0.87	1.3 ± 0.95	0.87 ± 0.85	1.73 ± 1.04	2.16 ± 1.12	1.19 ± 0.92	0.65 ± 0.79	2.16 ± 1.12	1.3 ± 0.95
Jul 5	0.75 ± 0.74	1.03 ± 0.8	1.97 ± 0.99	1.5 ± 0.9	1.6 ± 0.92	0.66 ± 0.71	1.03 ± 0.8	1.22 ± 0.84	1.22 ± 0.84
Jul 11	2.08 ± 1.08	1.04 ± 0.8	1.43 ± 0.92	1.3 ± 0.88	1.69 ± 0.99	1.69 ± 0.99	3.77 ± 1.42	1.69 ± 0.99	1.95 ± 1.05
Jul 18	1.72 ± 0.94	1.83 ± 0.97	1.29 ± 0.84	2.8 ± 1.16	2.37 ± 1.08	1.72 ± 0.94	1.51 ± 0.9	1.62 ± 0.92	2.15 ± 1.03
Jul 25	1.84 ± 1.06	0.65 ± 0.8	1.08 ± 0.9	1.3 ± 0.95	1.52 ± 1	1.73 ± 1.04	1.84 ± 1.06	1.63 ± 1.02	0.98 ± 0.88
Aug 1	2.36 ± 1.22	1.5 ± 1.07	1.18 ± 1.01	1.82 ± 1.13	1.07 ± 0.98	0.96 ± 0.96	1.39 ± 1.05	1.71 ± 1.11	1.5 ± 1.07
Aug 8	1.36 ± 1.04	1.02 ± 0.97	0.57 ± 0.86	2.6 ± 1.27	1.81 ± 1.13	2.71 ± 1.29	1.47 ± 1.06	1.24 ± 1.02	1.42 ± 1.06
Aug 15	1.08 ± 1.12	0.54 ± 1.02	0.65 ± 1.04	0.76 ± 1.06	0.65 ± 1.04	0.87 ± 1.08	1.19 ± 1.14	0.76 ± 1.06	1.08 ± 1.12
Aug 22	1.51 ± 1.12	1.08 ± 1.04	1.83 ± 1.18	1.19 ± 1.06	2.48 ± 1.29	2.16 ± 1.23	1.19 ± 1.06	1.08 ± 1.04	0.97 ± 1.01
Aug 29	0.65 ± 0.74	1.41 ± 0.93	1.73 ± 1	2.17 ± 1.08	1.73 ± 1	2.06 ± 1.06	0.87 ± 0.79	1.73 ± 1	2.27 ± 1.1

NOTE: 1 pCi/m3 = 1 E-12 uCi/ml

TABLE 5.2

Gross Alpha Measurements of Environmental Particulate Air Samples- 1994 (xE-15 uCi/ml)

Sample Date	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9
Sep 6	0.93 ± 0.78	1.4 ± 0.88	0.37 ± 0.63	2.24 ± 1.04	1.12 ± 0.82	1.03 ± 0.8	0.65 ± 0.71	1.03 ± 0.8	0.75 ± 0.73
Sep 12	2.29 ± 1.17	1.02 ± 0.86	2.8 ± 1.27	3.58 ± 2.13	1.78 ± 1.06	1.27 ± 0.93	1.4 ± 0.97	1.65 ± 1.03	2.04 ± 1.11
Sep 19	0.78 ± 1	1.23 ± 1.09	2.01 ± 1.24	0.89 ± 1.02	0.45 ± 0.93	1.67 ± 1.18	1.67 ± 1.18	1 ± 1.05	1.45 ± 1.14
Sep 26	1.61 ± 1.09	1.29 ± 1.03	1.93 ± 1.15	1.72 ± 1.11	1.18 ± 1.01	1.61 ± 1.09	1.07 ± 0.99	3.22 ± 1.36	2.15 ± 1.19
Oct 3	1.41 ± 1.11	0.87 ± 1	1.63 ± 1.15	0.98 ± 1.02	1.74 ± 1.17	0.76 ± 0.98	1.74 ± 1.17	1.74 ± 1.17	0.87 ± 1
Oct 10	2.53 ± 1.31	2.42 ± 1.29	1.32 ± 1.1	1.43 ± 1.12	1.98 ± 1.22	1.43 ± 1.12	1.98 ± 1.22	1.32 ± 1.1	1.54 ± 1.14
Oct 17	0.97 ± 1.06	0.97 ± 1.06	0.65 ± 0.99	1.41 ± 1.14	1.95 ± 1.24	1.41 ± 1.14	0.76 ± 1.02	0.76 ± 1.02	1.51 ± 1.16
Oct 24	1.94 ± 1.08	0.97 ± 0.87	1.73 ± 1.04	1.19 ± 0.92	1.3 ± 0.95	1.4 ± 0.97	1.08 ± 0.9	1.51 ± 0.99	1.62 ± 1.01
Oct 31	0.97 ± 0.97	1.08 ± 0.99	1.4 ± 1.06	2.27 ± 1.22	1.19 ± 1.02	0.86 ± 0.95	0.76 ± 0.92	0.32 ± 0.82	0.43 ± 0.85
Nov 7	1.49 ± 0.93	0.75 ± 0.75	0.75 ± 0.75	1.71 ± 0.98	1.71 ± 0.98	1.07 ± 0.84	0.43 ± 0.66	0.53 ± 0.69	0.64 ± 0.72
Nov 14	0.45 ± 0.54	2.24 ± 1.03	1.57 ± 0.88	1.12 ± 0.76	1.57 ± 0.88	0.9 ± 0.69	0.9 ± 0.69	1.68 ± 0.91	1.23 ± 0.79
Nov 21	0.43 ± 0.85	0.98 ± 0.97	0.43 ± 0.85	0.87 ± 0.95	0.33 ± 0.82	-0.1 ± 0.71	1.19 ± 1.02	0.87 ± 0.95	0.65 ± 0.9
Nov 28	1.07 ± 0.84	0.97 ± 0.82	1.61 ± 0.97	0.54 ± 0.7	2.04 ± 1.05	0.64 ± 0.73	1.5 ± 0.94	1.07 ± 0.84	0.75 ± 0.76
Dec 5	0.65 ± 0.73	2.81 ± 1.2	1.83 ± 1.01	2.48 ± 1.14	1.51 ± 0.95	0.97 ± 0.82	0.86 ± 0.79	0.86 ± 0.79	1.83 ± 1.01
Dec 12	1.98 ± 1.05	1.87 ± 1.03	2.2 ± 1.1	1.43 ± 0.94	2.86 ± 1.22	2.75 ± 1.2	3.4 ± 1.31	0.99 ± 0.83	1.87 ± 1.03
Dec 19	2.06 ± 1.1	1.95 ± 1.08	0.76 ± 0.82	2.06 ± 1.1	1.08 ± 0.9	1.3 ± 0.95	0.97 ± 0.87	1.08 ± 0.9	1.3 ± 0.95
Dec 27	1.76 ± 0.81	2.35 ± 0.94	1.57 ± 0.77	2.45 ± 0.96	1.47 ± 0.74	1.37 ± 0.72	1.67 ± 0.79	1.76 ± 0.81	1.67 ± 0.79

NOTE: 1 pCi/m3 = 1 E-12 uCi/ml

TABLE 5.3

Environmental Air Samples Iodine 125 Measurements- 1994 (xE-14 uCi/ml)

Sample Date	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9
Jan 3	0.66 ± 1.35	0.83 ± 1.27	0.84 ± 1.36	1.08 ± 1.28	0.25 ± 1.34	1.33 ± 1.28	2.03 ± 1.38	0.85 ± 1.27	0.81 ± 1.35
Jan 10	0.38 ± 1.39	0.89 ± 1.36	-0.8 ± 1.37	1.77 ± 1.38	0.25 ± 1.39	2.24 ± 1.39	-0.4 ± 1.38	0.48 ± 1.35	-0.3 ± 1.38
Jan 17	1.16 ± 1.38	0.82 ± 1.34	1.63 ± 1.39	0.97 ± 1.34	1.27 ± 1.38	1.54 ± 1.35	1.81 ± 1.39	2.06 ± 1.64	-0.1 ± 1.34
Jan 24	2.48 ± 1.29	1.52 ± 1.37	2.38 ± 1.29	1.57 ± 1.37	1.54 ± 1.35	0.87 ± 1.35	0.5 ± 1.32	0.94 ± 1.36	0.78 ± 1.33
Jan 31	-0.2 ± 1.44	1.82 ± 1.44	1.65 ± 1.48	1.63 ± 1.44	0.93 ± 1.46	2.05 ± 1.45	0.55 ± 1.45	1.8 ± 1.44	0.73 ± 1.46
Feb 7	0.86 ± 1.38	-1.9 ± 1.45	1.21 ± 1.39	-1.2 ± 1.47	0.2 ± 1.36	-1.1 ± 1.47	0.73 ± 1.38	-0 ± 1.49	1.54 ± 1.4
Feb 14	2.13 ± 1.36	0.61 ± 1.34	1.91 ± 1.36	0.6 ± 1.34	2.64 ± 1.38	0.99 ± 1.35	1.48 ± 1.35	0.61 ± 1.34	1.59 ± 1.35
Feb 22	0.47 ± 1.15	-1.3 ± 1.16	0.88 ± 1.16	-1.2 ± 1.17	1.23 ± 1.17	-1 ± 1.17	0.17 ± 1.14	-1.3 ± 1.16	-0.1 ± 1.14
Feb 28	2.25 ± 1.66	0.49 ± 1.66	2.37 ± 1.66	-0.5 ± 1.64	1.24 ± 1.63	-0.6 ± 1.64	1.44 ± 1.64	-0.4 ± 1.64	1.24 ± 1.63
Mar 7	0.58 ± 1.37	1.27 ± 1.35	0.69 ± 1.38	1.31 ± 1.35	-0.2 ± 1.35	1.81 ± 1.36	-0.8 ± 1.34	1.64 ± 1.36	-0.1 ± 1.36
Mar 14	1.29 ± 1.44	-0.5 ± 1.46	0.81 ± 1.43	-1.5 ± 1.43	-0.3 ± 1.41	-2.2 ± 1.42	0.2 ± 1.42	-2.2 ± 1.43	0.09 ± 1.42
Mar 21	-0.5 ± 1.37	-0.6 ± 1.33	0.05 ± 1.38	0.18 ± 1.35	-1 ± 1.36	0.02 ± 1.35	-0.8 ± 1.36	0.42 ± 1.36	-0.4 ± 1.37
Mar 28	1.5 ± 1.35	1.69 ± 1.36	0.43 ± 1.33	0.16 ± 1.32	1.16 ± 1.35	0.84 ± 1.34	2.55 ± 1.38	1.55 ± 1.36	1.28 ± 1.35
Apr 4	0.65 ± 1.4	0.16 ± 1.38	-0.1 ± 1.38	0.27 ± 1.39	0.27 ± 1.39	0.59 ± 1.39	0.67 ± 1.4	0.99 ± 1.4	0.4 ± 1.39
Apr 11	0.29 ± 1.38	0.45 ± 1.39	-0.2 ± 1.37	1.53 ± 1.41	0.4 ± 1.39	0.09 ± 1.38	0.83 ± 0.14	0.07 ± 1.38	1.44 ± 1.41
Apr 18	0.34 ± 1.35	-0.1 ± 1.34	0.25 ± 1.35	2.31 ± 1.4	0.23 ± 1.35	0.7 ± 1.36	1.38 ± 1.38	-0.1 ± 1.34	0.04 ± 1.34
Apr 25	-0 ± 1.34	-0.8 ± 1.32	0.54 ± 1.35	1.41 ± 1.38	0.43 ± 1.35	0.61 ± 1.35	0.95 ± 1.36	0.34 ± 1.35	1.2 ± 1.37

NOTE: 1 pCi/m3 = 1 E-12 uCi/ml.

TABLE 5.3

Environmental Air Samples Iodine 125 Measurements- 1994 (xE-14 uCi/ml)

Sample Date	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9
May 2	0.14 ± 1.4	0.25 ± 1.4	0.3 ± 1.4	0 ± 1.4	-0 ± 1.4	-0.6 ± 1.38	1.28 ± 1.43	0.53 ± 1.41	-0.5 ± 1.39
May 9	1.86 ± 1.4	2.97 ± 1.43	2.24 ± 1.41	0.75 ± 1.38	0.88 ± 1.38	0.97 ± 1.38	1.36 ± 1.39	1.7 ± 1.4	2.06 ± 1.41
May 16	1.05 ± 1.42	0.48 ± 1.4	0.51 ± 1.4	0.21 ± 1.4	-0.1 ± 1.39	0.14 ± 1.4	0.87 ± 1.41	1.05 ± 1.42	1.43 ± 1.42
May 23	2.17 ± 1.43	2.05 ± 1.43	1.86 ± 1.42	1.1 ± 1.41	0.84 ± 1.4	1.84 ± 1.42	2.36 ± 1.44	1.96 ± 1.43	1 ± 1.41
May 31	-0.2 ± 1.21	0.18 ± 1.22	0.01 ± 1.22	0.34 ± 1.23	-0.3 ± 1.21	0.14 ± 1.22	-0.6 ± 1.2	0.27 ± 1.22	-0.6 ± 1.21
Jun 6	0.19 ± 1.55	0.51 ± 1.56	0.43 ± 1.55	0.79 ± 1.56	1.37 ± 1.58	-0.2 ± 1.54	0.64 ± 1.56	1.02 ± 1.57	0.19 ± 1.55
Jun 13	1.37 ± 1.21	0 ± 1.18	0.5 ± 1.19	0.64 ± 1.19	0.34 ± 1.21	0.31 ± 1.21	0.89 ± 1.22	1.53 ± 1.24	1.16 ± 1.23
Jun 20	1.95 ± 1.21	1.7 ± 1.32	1.25 ± 1.19	1.02 ± 1.19	0.74 ± 1.18	1.46 ± 1.2	0.86 ± 1.18	1.66 ± 1.2	1.82 ± 1.21
Jun 27	0.56 ± 1.19	0.91 ± 1.2	0.8 ± 1.2	0.14 ± 1.18	2.21 ± 1.23	1.68 ± 1.22	1.35 ± 1.21	1.14 ± 1.21	0.05 ± 1.18
Jul 5	1.65 ± 1.03	1.81 ± 1.03	0.95 ± 1.01	0.85 ± 1.01	0.52 ± 1	1.63 ± 1.03	1.27 ± 1.02	0.87 ± 1.01	0.77 ± 1.01
Jul 11	1.08 ± 1.42	1.51 ± 1.29	1.98 ± 1.44	1.62 ± 1.29	0.58 ± 1.41	2.1 ± 1.3	1.62 ± 1.43	1.72 ± 1.29	1.58 ± 1.43
Jul 18	-0.4 ± 1.24	0.33 ± 1.16	-0.6 ± 1.24	0.47 ± 1.16	-0.3 ± 1.24	-0.4 ± 1.14	-1.1 ± 1.23	-0.5 ± 1.14	-0.1 ± 1.25
Jul 25	0.35 ± 1.31	0.16 ± 1.18	0.08 ± 1.3	-0.2 ± 1.17	0.45 ± 1.3	0.58 ± 1.19	0.48 ± 1.31	0.53 ± 1.19	0.03 ± 1.3
Aug 1	1.33 ± 1.26	1.11 ± 1.11	0.64 ± 1.25	0.43 ± 1.09	0.68 ± 1.25	1.23 ± 1.12	0.86 ± 1.26	0.61 ± 1.1	1.73 ± 1.28
Aug 8	1.17 ± 1.19	1.86 ± 1.31	2.17 ± 1.21	1.39 ± 1.3	0.88 ± 1.18	1.22 ± 1.3	1.28 ± 1.19	1.54 ± 1.3	1.35 ± 1.19
Aug 15	2.12 ± 1.25	1.66 ± 1.12	3.04 ± 1.27	0.63 ± 1.08	1.13 ± 1.22	1.63 ± 0.11	0.85 ± 1.22	2.28 ± 1.13	3.15 ± 1.27
Aug 22	1.34 ± 1.25	0.61 ± 1.12	1.39 ± 1.25	2.01 ± 1.16	1.84 ± 1.26	0.73 ± 1.12	1.82 ± 1.26	1.57 ± 1.15	1.87 ± 1.26
Aug 29	1.54 ± 1.26	1.35 ± 1.1	1.65 ± 1.26	0.51 ± 1.07	1.11 ± 1.25	2.1 ± 1.12	2.02 ± 1.27	1.49 ± 1.11	0.56 ± 1.24

NOTE: 1 pCi/m3 = 1 E-12 uCi/ml.

TABLE 5.3

Environmental Air Samples Iodine 125 Measurements- 1994 (xE-14 uCi/ml)

Sample Date	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9
Sep 6	1 ± 0.92	1.05 ± 1.06	1.75 ± 0.94	2.02 ± 1.09	2.19 ± 0.95	1.4 ± 1.07	0.91 ± 0.91	0.64 ± 1.05	1.55 ± 0.93
Sep 12	2.02 ± 1.49	2.2 ± 1.23	1.27 ± 1.47	4.04 ± 1.83	1.08 ± 1.47	2.22 ± 1.23	0.93 ± 1.46	2.41 ± 1.23	1.34 ± 1.47
Sep 19	1.64 ± 1.31	1.33 ± 1.12	1.37 ± 1.3	2.43 ± 1.15	2.03 ± 1.32	2.23 ± 1.15	0.89 ± 1.29	1.21 ± 1.12	1.92 ± 1.31
Sep 26	2.96 ± 1.26	1.46 ± 1.07	2.64 ± 1.25	2.62 ± 1.11	1.24 ± 1.22	1.39 ± 1.07	2.21 ± 1.24	1.2 ± 1.07	1.53 ± 1.23
Oct 3	1.16 ± 1.17	1.53 ± 1.31	1.46 ± 1.18	0.97 ± 1.3	0.69 ± 1.15	1.79 ± 1.32	0.28 ± 1.14	1.42 ± 1.31	0.76 ± 1.16
Oct 10	0.78 ± 1.16	1.27 ± 1.31	1.03 ± 1.16	1.55 ± 1.32	1.62 ± 1.18	0.92 ± 1.31	0.73 ± 1.16	1.91 ± 1.33	1.01 ± 1.16
Oct 17	0.71 ± 1.29	0.66 ± 1.11	1.22 ± 1.31	1.78 ± 1.15	0.34 ± 1.28	1.94 ± 1.15	1.41 ± 1.31	1.27 ± 1.13	1.91 ± 1.32
Oct 24	1.4 ± 1.16	0.89 ± 1.14	1.62 ± 1.16	1.19 ± 1.15	1.31 ± 1.16	0.66 ± 1.14	1.48 ± 1.16	1.43 ± 1.16	1.03 ± 1.15
Oct 31	0.23 ± 1.14	1.08 ± 1.16	1.24 ± 1.17	0.7 ± 1.15	0.91 ± 1.16	1.83 ± 1.19	0.56 ± 1.15	2.2 ± 1.2	1.34 ± 1.17
Nov 7	0.81 ± 1.13	1.84 ± 1.16	2.05 ± 1.17	2.62 ± 1.19	1.41 ± 1.15	1.57 ± 1.16	1.72 ± 1.16	0.92 ± 1.14	0.97 ± 1.14
Nov 14	1.45 ± 1.23	0.29 ± 1.2	-0.1 ± 1.19	0.11 ± 1.2	0.83 ± 1.22	-0.2 ± 1.19	0.2 ± 1.2	0.83 ± 1.22	0.63 ± 1.21
Nov 21	-0.1 ± 1.21	-0.9 ± 1.19	2.89 ± 1.29	-0.5 ± 1.2	-0.6 ± 1.19	-0.2 ± 1.21	-0.6 ± 1.2	-0.9 ± 1.19	-0.6 ± 1.19
Nov 28	1.48 ± 1.18	1.01 ± 1.17	0.82 ± 1.16	1.13 ± 1.17	0.4 ± 1.15	0.68 ± 1.16	-0.8 ± 1.12	1.13 ± 1.17	2.64 ± 1.22
Dec 5	1.92 ± 1.23	0.46 ± 1.47	1.12 ± 1.21	2.02 ± 1.51	1.71 ± 1.23	0.29 ± 1.47	1.78 ± 1.23	0.44 ± 1.47	1.94 ± 1.23
Dec 12	1.67 ± 1.3	0.9 ± 1.28	-0.7 ± 1.51	0.78 ± 1.28	1.4 ± 1.56	1.52 ± 1.3	0.02 ± 1.53	1.21 ± 1.29	0.64 ± 1.27
Dec 19	-1 ± 1.26	-0.8 ± 1.5	-1.1 ± 1.25	-0.1 ± 1.51	0.53 ± 1.3	0.1 ± 1.51	-1.1 ± 1.25	-0.4 ± 1.51	0.33 ± 1.29
Dec 27	0.75 ± 1.02	0.9 ± 1.26	1.37 ± 1.03	0.62 ± 1.25	1.13 ± 1.03	0.81 ± 1.26	1.75 ± 1.04	0.9 ± 1.26	1.99 ± 1.05

NOTE: 1 pCi/m3 = 1 E-12 uCi/ml.

TABLE 5.4

Required Minimum Detectable Concentration (MDCs) for Selected Gamma Emitters in Air.

Nuclide	Required MDC uCi/ml	pCi/m^3
Na-22	1.0 E-14	0.010
Mn-54	1.0 E-14	0.010
Co-58	1.0 E-14	0.010
Co-60	1.0 E-14	0.010
Fe-59	2.0 E-14	0.020
Zn-65	2.0 E-14	0.020
As-76	2.0 E-14	0.020
Zr/Nb-95	2.0 E-14	0.020
Mo-99	7.0 E-14	0.070
Ru-103	1.0 E-14	0.010
Ru-106	9.0 E-14	0.090
Sb-124	1.0 E-14	0.010
Sb-125	2.0 E-14	0.020
I-131	2.0 E-14	0.020
I-133	1.0 E-14	0.010
Cs-134	1.0 E-14	0.010
Cs-137	1.0 E-14	0.010
Ba/La-140	2.0 E-14	0.020
Ce-141	1.0 E-14	0.010
Ce/Pr-144	9.0 E-14	0.090
Eu-152	6.0 E-14	0.060
Eu-154	3.0 E-14	0.030
Eu-155	2.0 E-14	0.020

NOTE:

1. Only results above the MDC are reported. All others are reported at less than the specific MDCs shown above.

2. The Minimum Detectable Concentration (MDC) is defined as the concentration at which a 5% risk of false detection and false non-detection exists.

TABLE 5.5

Results of Gamma Spectroscopy of Monthly Gamma Composite Samples

NOTE: Only results reported above the MDC are shown, all others are reported by the vendor as less than the specific MDC.

Sample Period	Station #	Nuclide	Concentration +/- Error (pCi/m^3)	
01/03/94	1	Be-7	0.05	0.03
01/31/94	2	Be-7	0.06	0.03
	3	Be-7	0.04	0.02
	4	Be-7	0.06	0.05
	5	Be-7	0.05	0.02
	6	Be-7	0.05	0.02
	7	Be-7	0.05	0.02
	8	Be-7	0.05	0.02
	9	Be-7	0.06	0.02
01/31/94	1	Be-7	0.08	0.02
02/28/94	2	Be-7	0.08	0.02
	3	Be-7	0.09	0.02
	4	Be-7	0.09	0.03
	5	Be-7	0.09	0.03
	6	Be-7	0.07	0.02
	7	Be-7	0.08	0.02
	8	Be-7	0.09	0.02
	9	Be-7	0.06	0.02
02/28/94	1	Be-7	0.08	0.02
04/04/94	2	Be-7	0.09	0.02
	3	Be-7	0.10	0.02
	4	Be-7	0.09	0.02
	5	Be-7	0.08	0.02
	6	Be-7	0.10	0.02
	7	Be-7	0.09	0.02
	8	Be-7	0.08	0.02
	9	Be-7	0.08	0.02
04/04/94	1	Be-7	0.10	0.02
05/02/94	2	Be-7	0.10	0.02
	3	Be-7	0.09	0.03
	4	Be-7	0.10	0.03
	5	Be-7	0.10	0.02
	6	Be-7	0.11	0.02
	7	Be-7	0.10	0.03
	8	Be-7	0.08	0.02
	9	Be-7	0.09	0.02

TABLE 5.5

Sample Period	Station #	Nuclide	Concentration +/- Error (pCi/m^3)	
05/02/94	1	Be-7	0.12	0.02
05/31/94	2	Be-7	0.11	0.02
	3	Be-7	0.13	0.02
	4	Be-7	0.14	0.03
	5	Be-7	0.12	0.02
	6	Be-7	0.13	0.03
	7	Be-7	0.10	0.02
	8	Be-7	0.11	0.03
	9	Be-7	0.12	0.03
05/31/94	1	Be-7	0.12	0.02
06/27/94	2	Be-7	0.11	0.03
	3	Be-7	0.11	0.02
	4	Be-7	0.12	0.02
	5	Be-7	0.12	0.02
	6	Be-7	0.12	0.02
	7	Be-7	0.13	0.02
	8	Be-7	0.13	0.03
	9	Be-7	0.09	0.05
06/27/94	1	Be-7	0.18	0.03
08/01/94	2	Be-7	0.16	0.03
	3	Be-7	0.18	0.02
	4	Be-7	0.20	0.04
	5	Be-7	0.18	0.02
	6	Be-7	0.17	0.02
	7	Be-7	0.18	0.03
	8	Be-7	0.18	0.02
	9	Be-7	0.19	0.03
08/01/94	1	Be-7	0.13	0.04
08/29/94	2	Be-7	0.13	0.02
	3	Be-7	0.13	0.02
	4	Be-7	0.15	0.03
	5	Be-7	0.15	0.03
	6	Be-7	0.14	0.04
	7	Be-7	0.15	0.03
	8	Be-7	0.16	0.04
	9	Be-7	0.13	0.03

TABLE 5.5

Sample Period	Station #	Nuclide	Concentration +/- Error (pCi/m^3)	
08/29/94	1	Be-7	0.15	0.02
10/03/94	2	Be-7	0.13	0.02
	3	Be-7	0.15	0.02
	4	Be-7	0.16	0.03
	5	Be-7	0.14	0.03
	6	Be-7	0.13	0.03
	7	Be-7	0.14	0.02
	8	Be-7	0.15	0.02
	9	Be-7	0.14	0.02
10/03/94	1	Be-7	0.10	0.02
10/31/94	2	Be-7	0.07	0.02
	3	Be-7	0.11	0.03
	4	Be-7	0.09	0.02
	5	Be-7	0.11	0.02
	6	Be-7	0.08	0.02
	7	Be-7	0.11	0.02
	8	Be-7	0.09	0.03
	9	Be-7	0.10	0.02
10/31/94	1	Be-7	0.07	0.01
11/28/94	2	Be-7	0.06	0.01
	3	Be-7	0.05	0.02
	4	Be-7	0.06	0.02
	5	Be-7	0.05	0.02
	6	Be-7	0.06	0.02
	7	Be-7	0.06	0.02
	8	Be-7	0.05	0.01
	9	Be-7	0.06	0.02
11/28/94	1	Be-7	0.06	0.02
01/03/95	2	Be-7	0.07	0.02
	3	Be-7	0.05	0.02
	4	Be-7	0.07	0.02
	5	Be-7	0.06	0.02
	6	Be-7	0.06	0.02
	7	Be-7	0.05	0.02
	8	Be-7	0.06	0.02
	9	Be-7	0.07	0.02

TABLE 5.6

Tritium Air Moisture Concentrations at Environmental Monitoring Stations 1, 2, and 5

TRITIUM AIR CONCENTRATIONS ($\times 10^{-12}$ uCi/ml)

Sample Period	Station 1	Station 2	Station 5
Jan. 3, 1994 Jan. 31, 1994	3.32 +/- 0.95	2.22 +/- 0.63	4.42 +/- 0.52
Jan. 31, 1994 Feb. 28, 1994	2.07 +/- 0.58	1.66 +/- 0.48	2.20 +/- 0.54
Feb. 28, 1994 April 4, 1994	0.99 +/- 0.65	1.21 +/- 0.62	3.89 +/- 0.84
April 4, 1994 May 2, 1994	2.05 +/- 0.87	4.68 +/- 0.84	5.98 +/- 0.95
May 2, 1994 May 31, 1994	2.80 +/- 0.91	2.30 +/- 0.86	4.35 +/- 0.99
May 31, 1994 July 5, 1994	1.62 +/- 0.62	1.37 +/- 0.62	5.17 +/- 0.80
July 5, 1994 August 1, 1994	3.20 +/- 0.79	4.61 +/- 0.95	8.55 +/- 1.09
August 1, 1994 Sept. 6, 1994	1.59 +/- 0.60	1.38 +/- 0.56	4.89 +/- 0.69
Sept. 6, 1994 Oct. 3, 1994	1.03 +/- 0.69	5.32 +/- 0.76	9.98 +/- 0.91
Oct. 3, 1994 Oct. 31, 1994	2.05 +/- 0.83	1.83 +/- 0.77	4.72 +/- 0.86
Oct. 31, 1994 Nov. 28, 1994	1.42 +/- 0.50	2.07 +/- 0.60	3.61 +/- 0.68
Nov. 28, 1994 Jan. 3, 1995	2.39 +/- 0.62	2.63 +/- 0.65	2.67 +/- 0.65

FIGURE 5.1

GROSS BETA ACTIVITY IN AIR - 1994
AT STATION 1 -- RICHLAND,WA

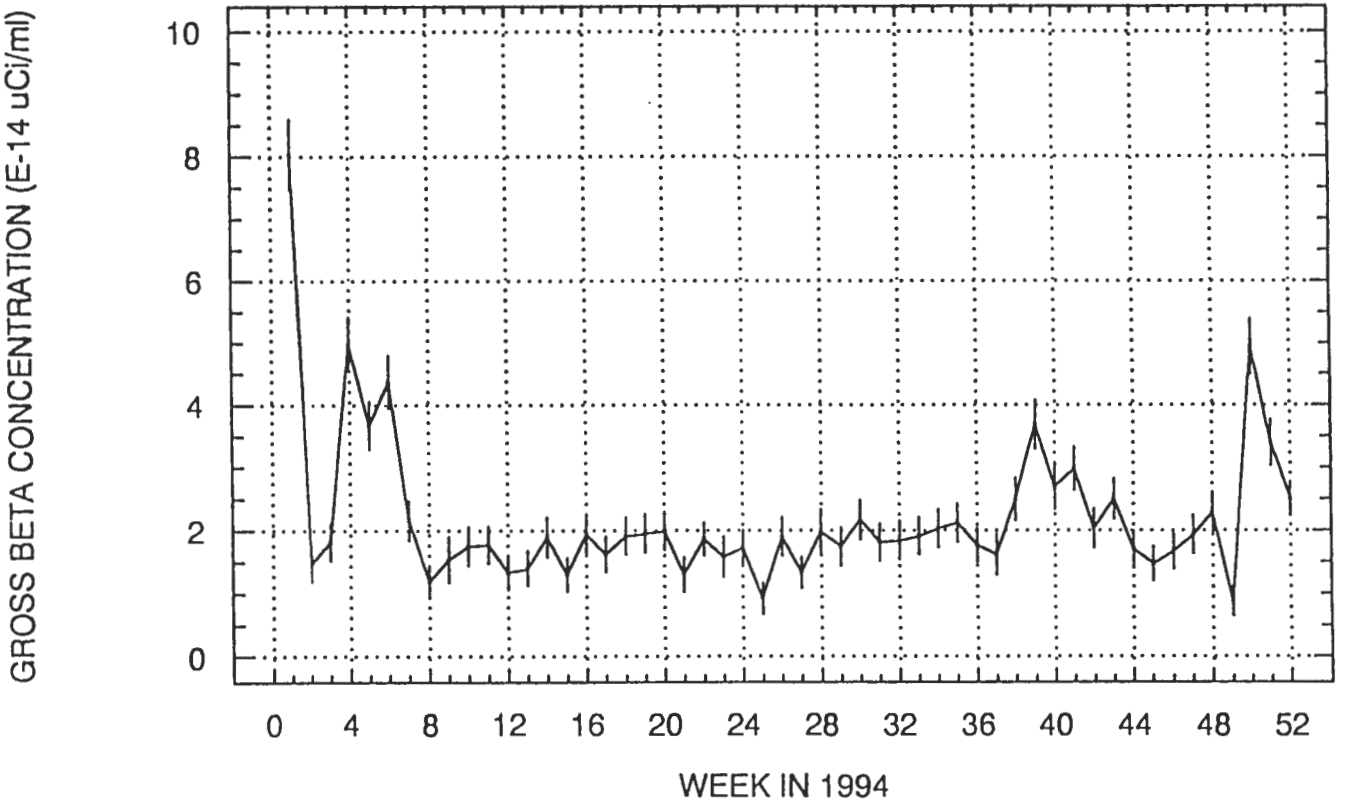
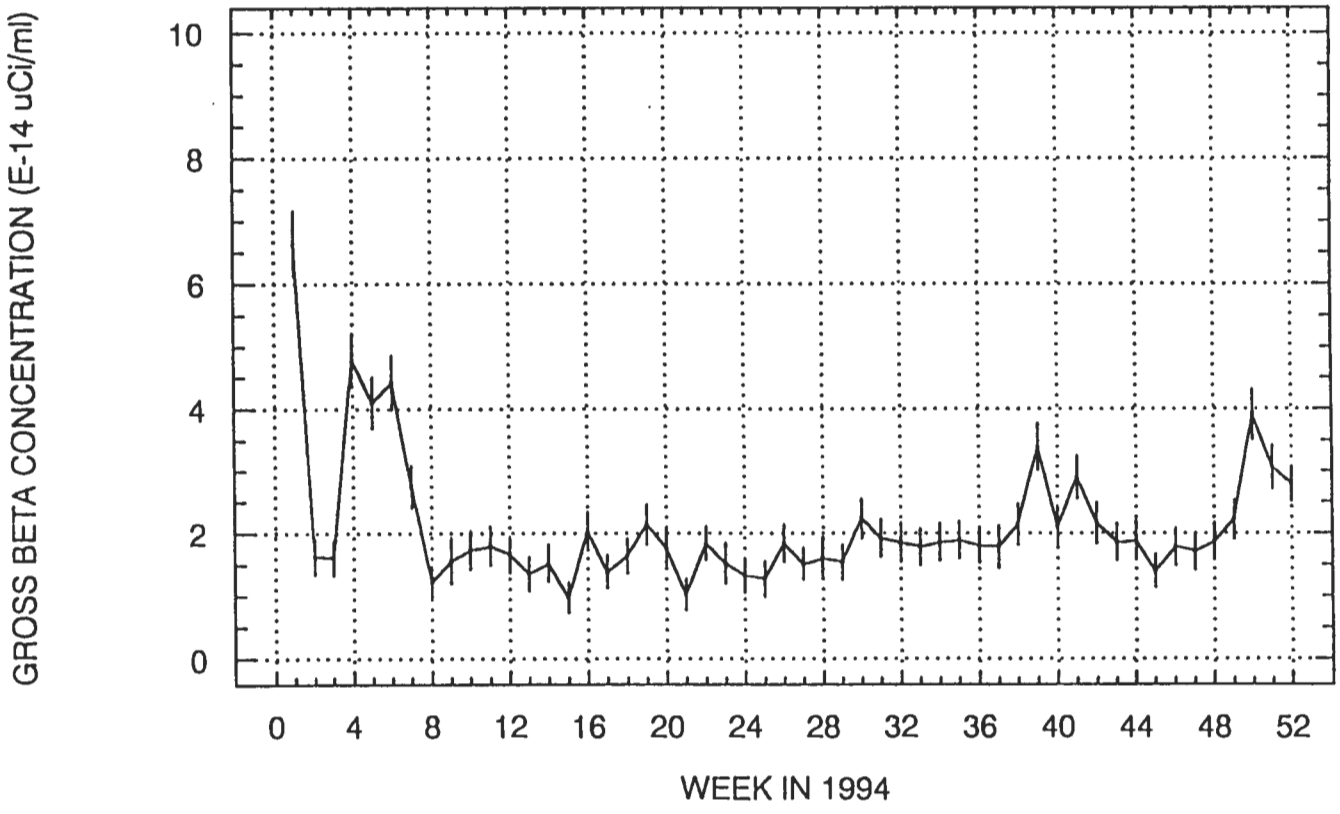


FIGURE 5.2

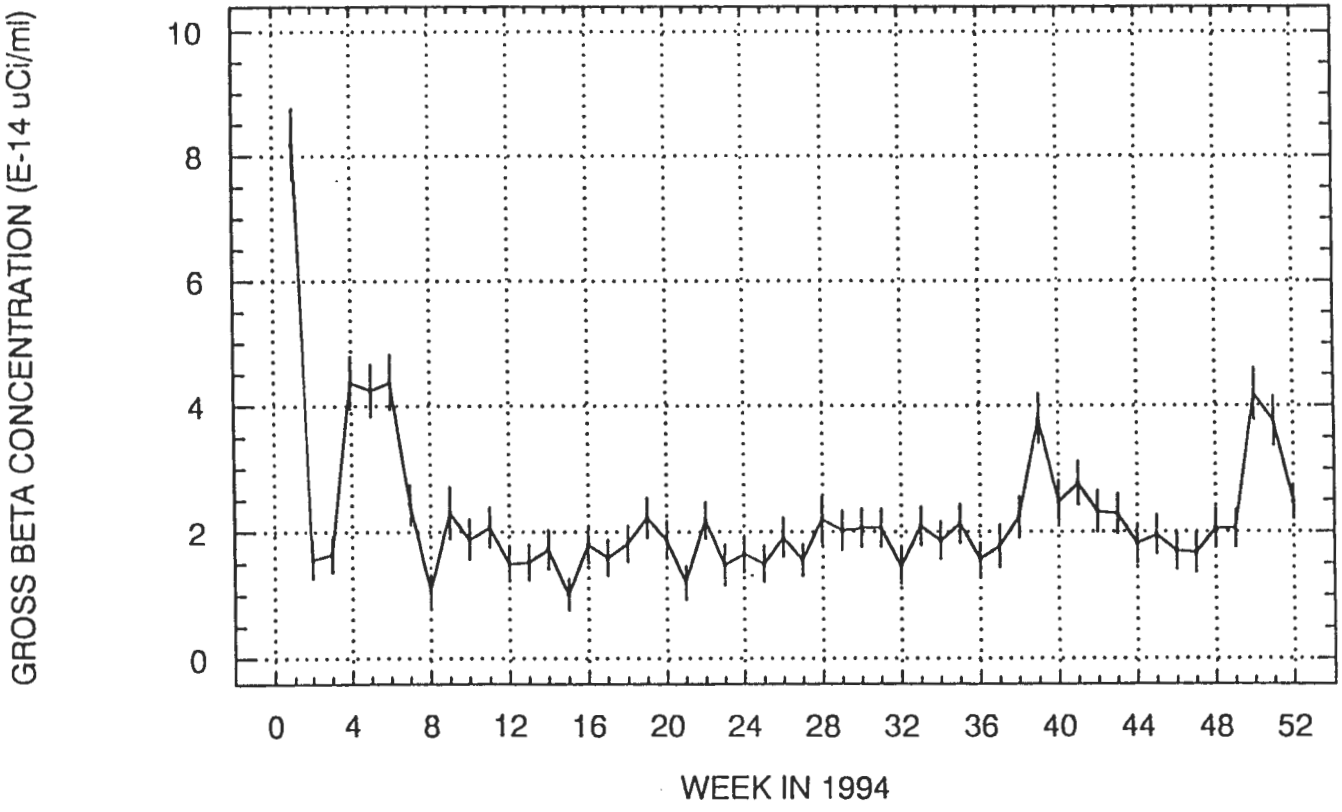
GROSS BETA ACTIVITY IN AIR - 1994
AT STATION 2 -- RICHLAND,WA



4-17-95

FIGURE 5.3

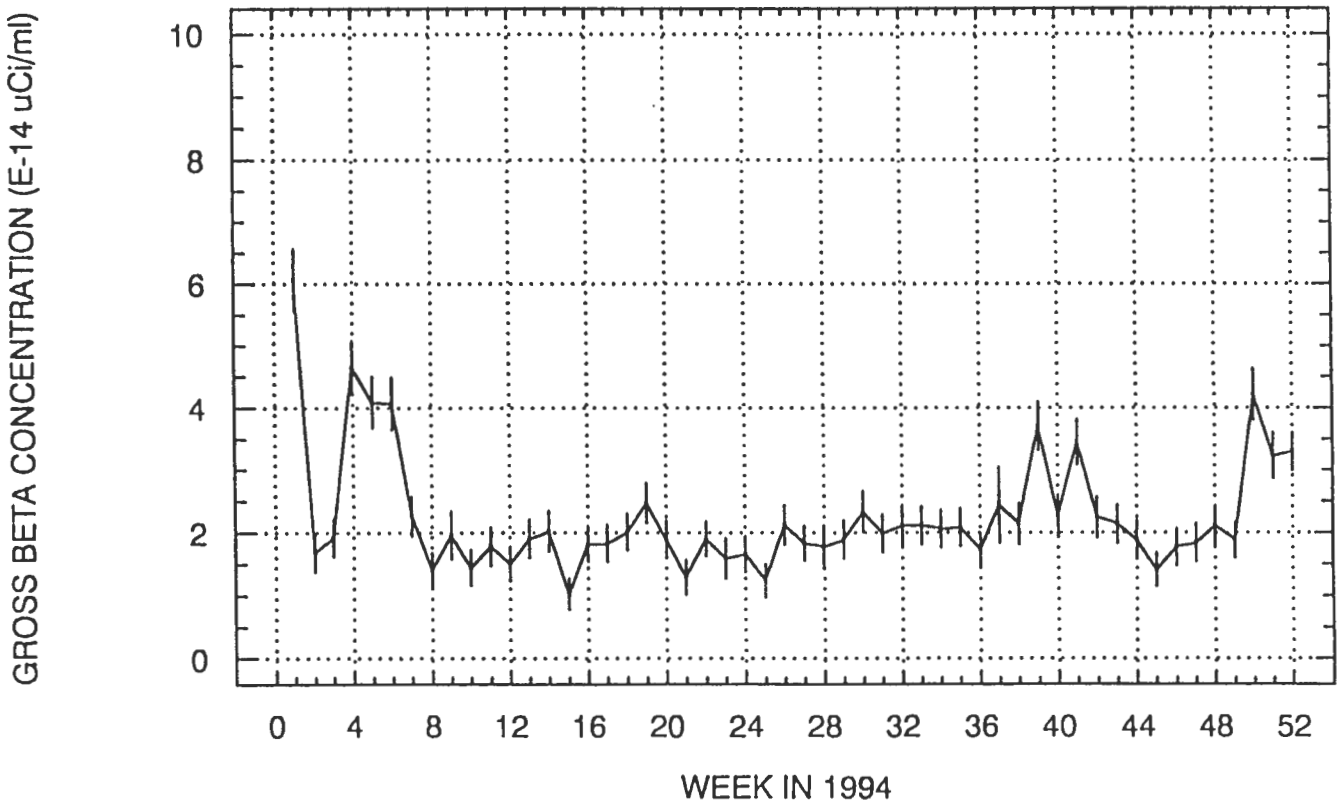
GROSS BETA ACTIVITY IN AIR - 1994
AT STATION 3 -- RICHLAND,WA



4-17-95

FIGURE 5.4

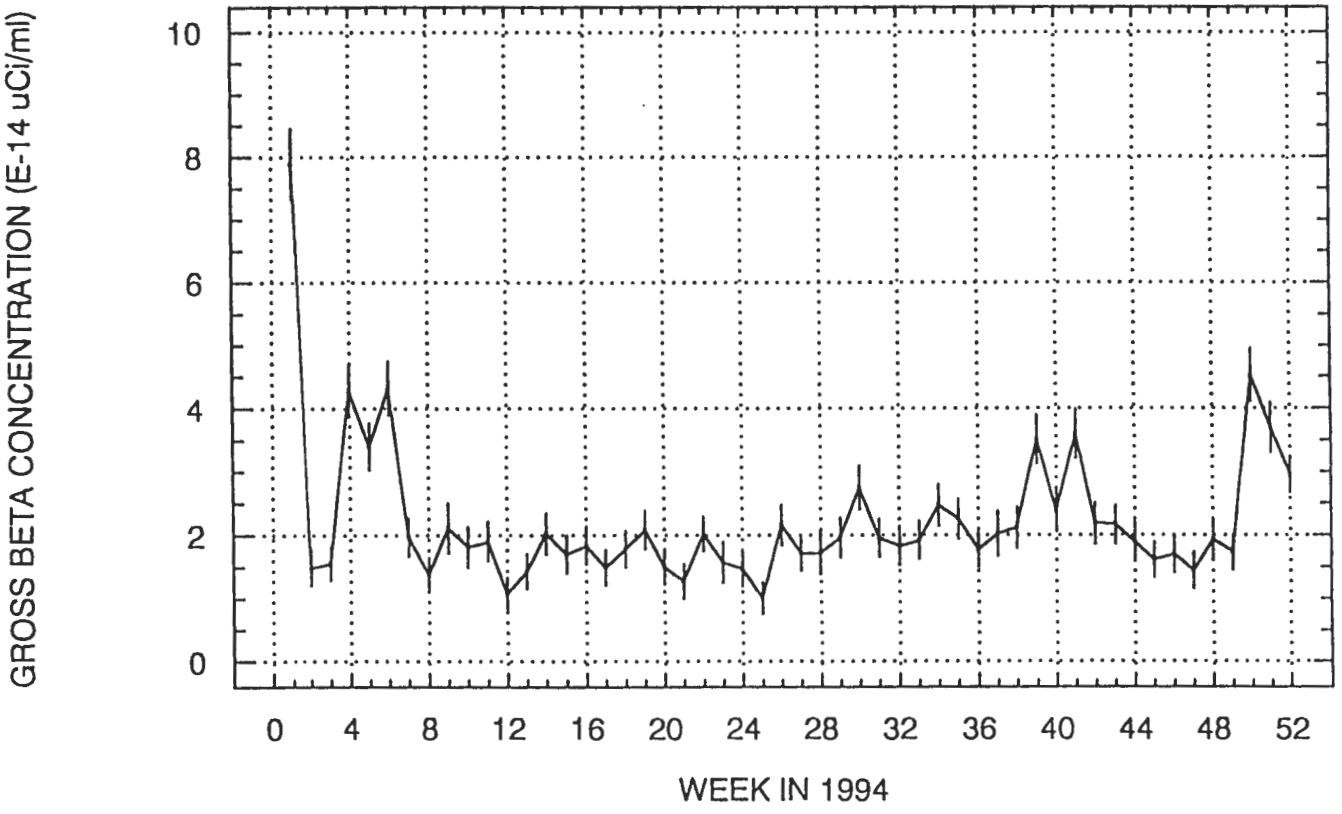
GROSS BETA ACTIVITY IN AIR - 1994
AT STATION 4 -- RICHLAND,WA



4-17-95

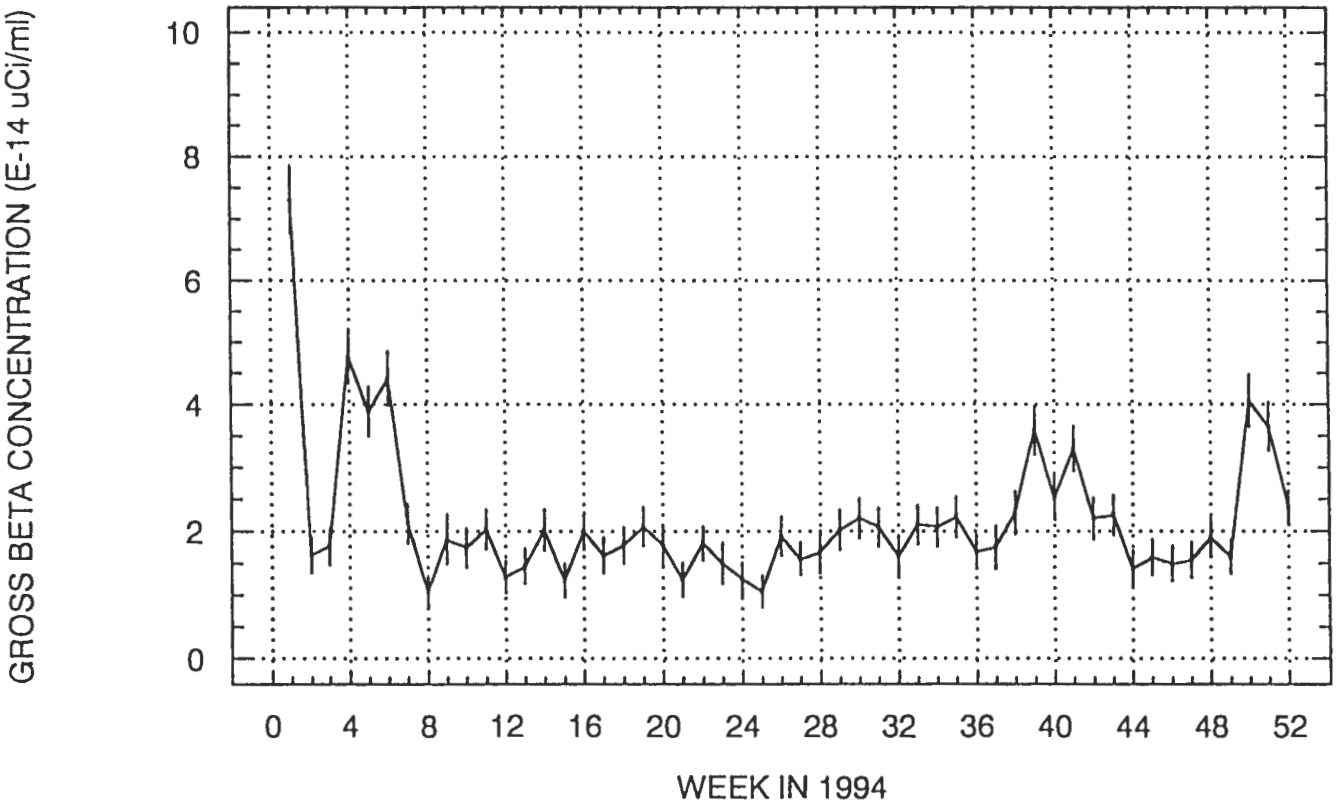
FIGURE 5.5

GROSS BETA ACTIVITY IN AIR - 1994
AT STATION 5 -- RICHLAND,WA



4-17-95

FIGURE 5.6
GROSS BETA ACTIVITY IN AIR - 1994
AT STATION 6 -- RICHLAND,WA



4-17-95

FIGURE 5.7
GROSS BETA ACTIVITY IN AIR - 1994
AT STATION 7 -- RICHLAND,WA

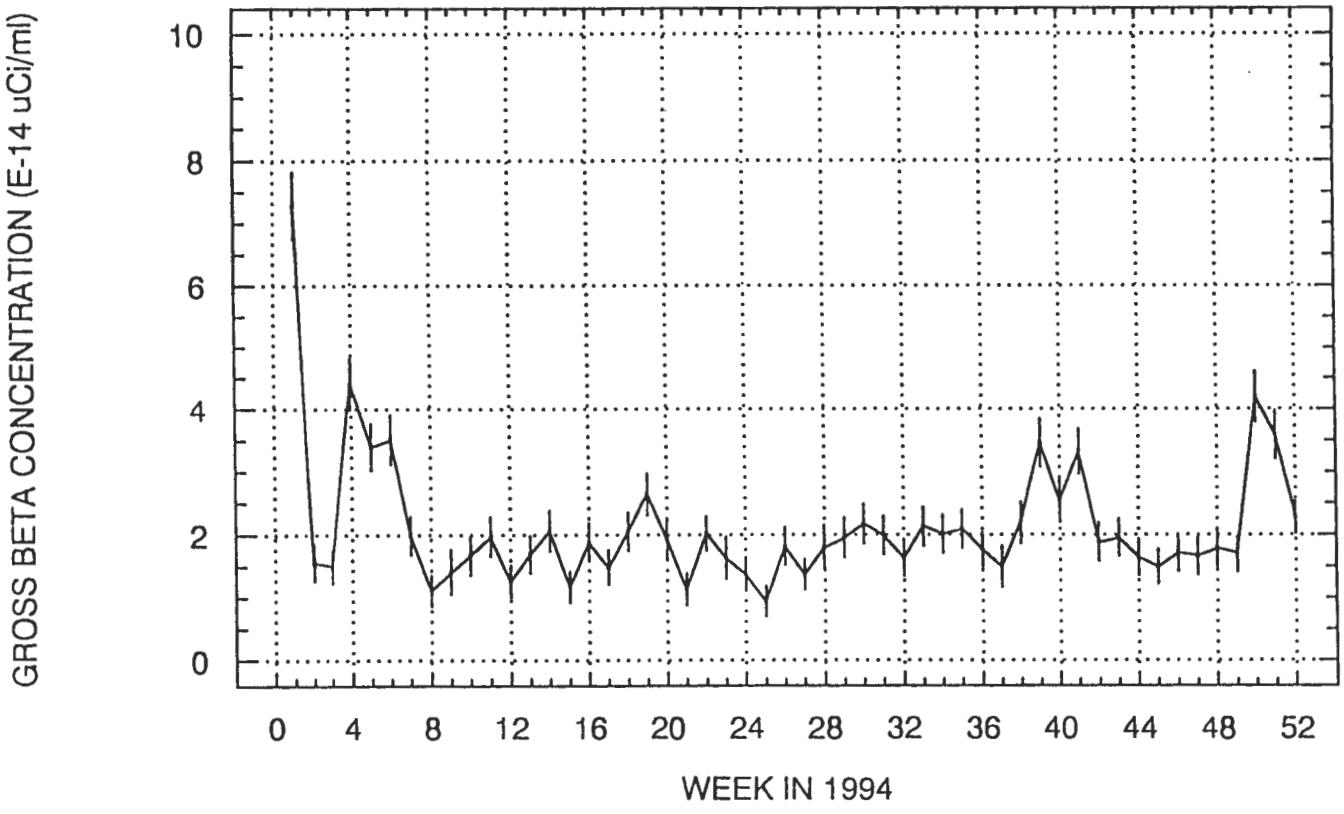
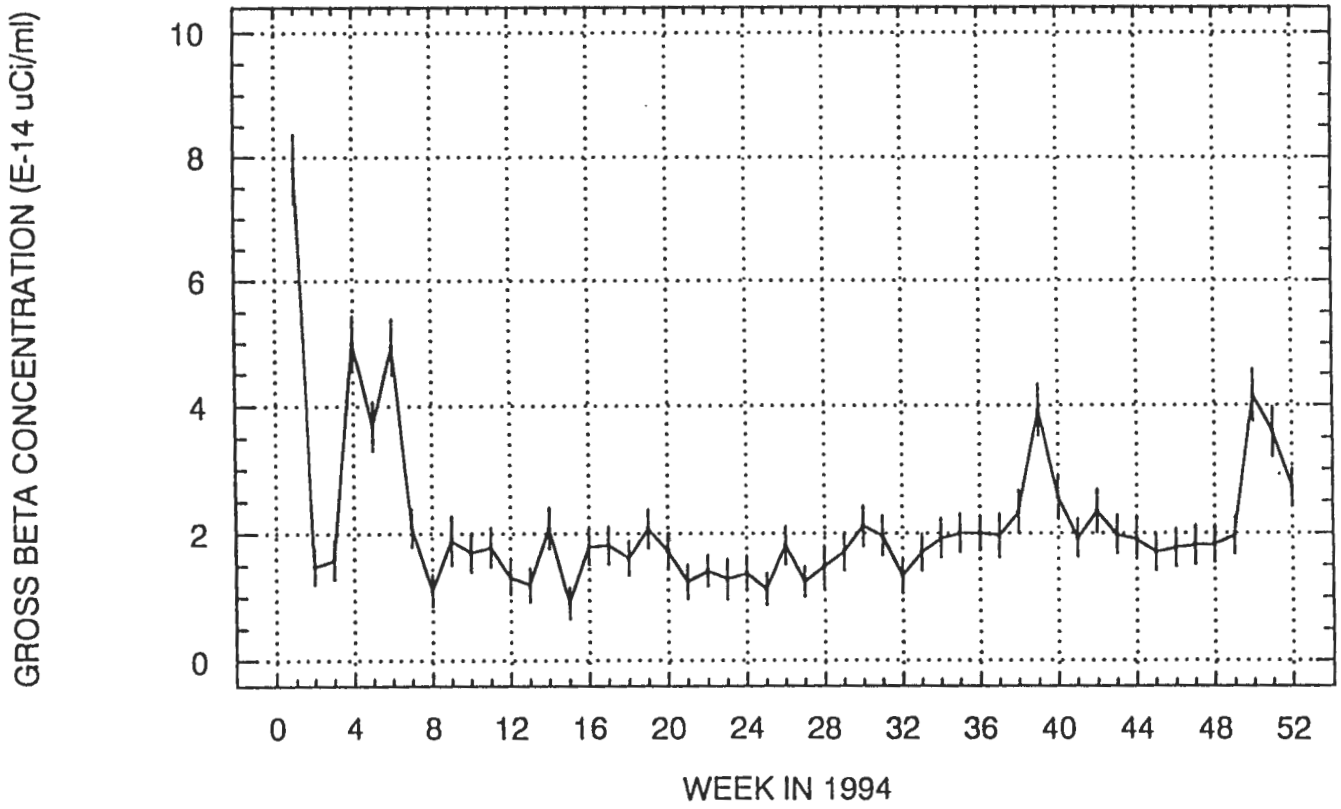


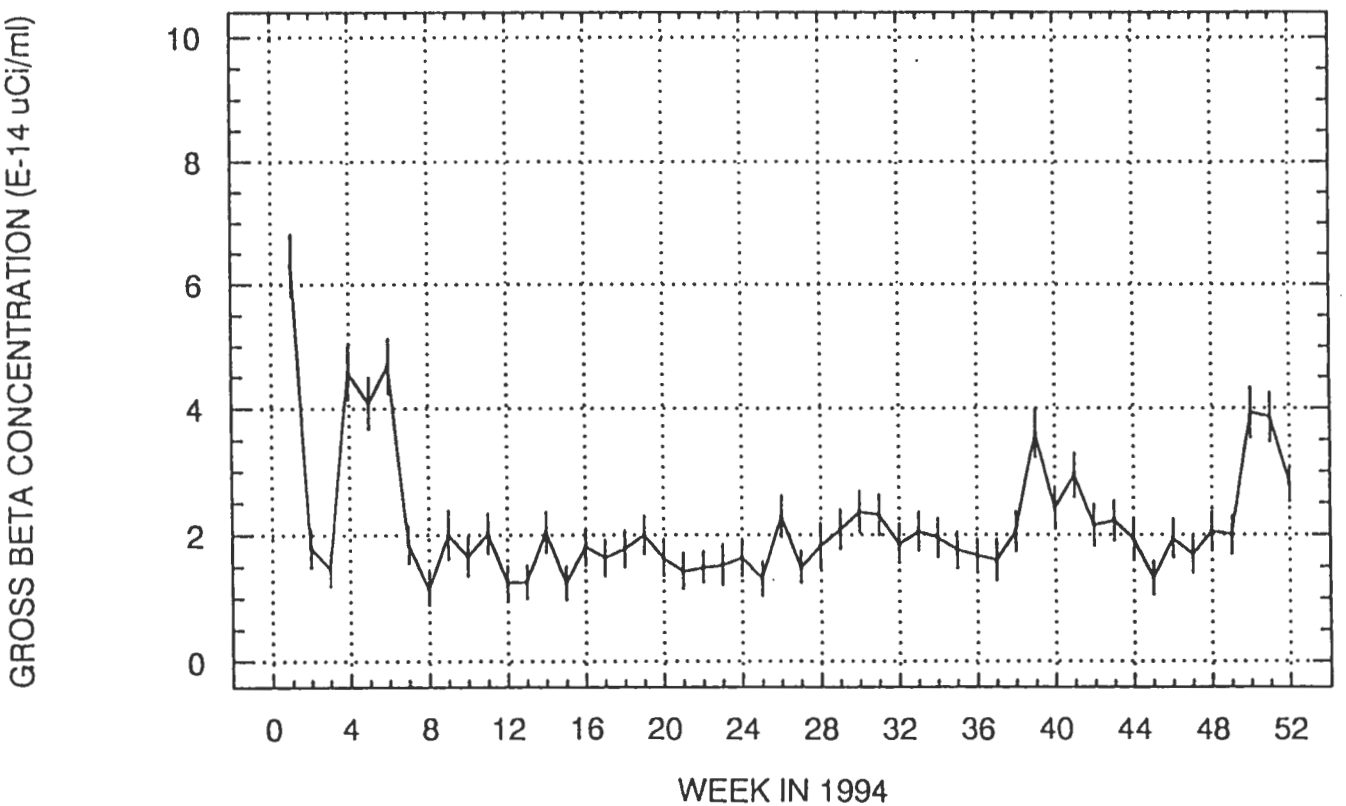
FIGURE 5.8
GROSS BETA ACTIVITY IN AIR - 1994
AT STATION 8 -- RICHLAND,WA



4-17-95

FIGURE 5.9

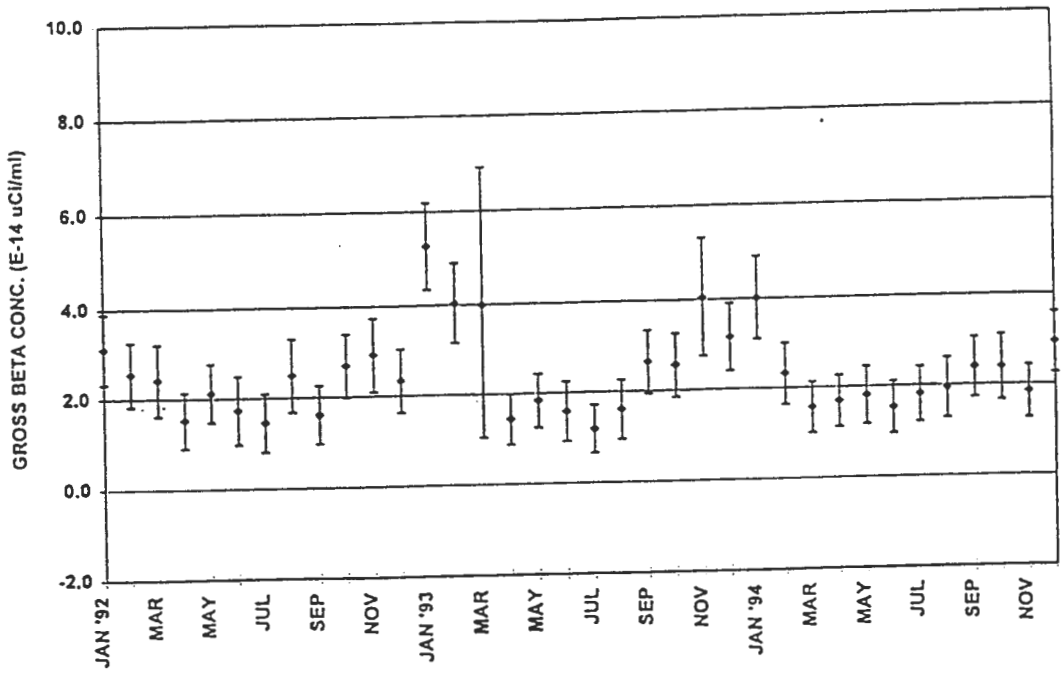
GROSS BETA ACTIVITY IN AIR - 1994
AT STATION 9 -- RICHLAND,WA



4-17-95

FIGURE 5.10

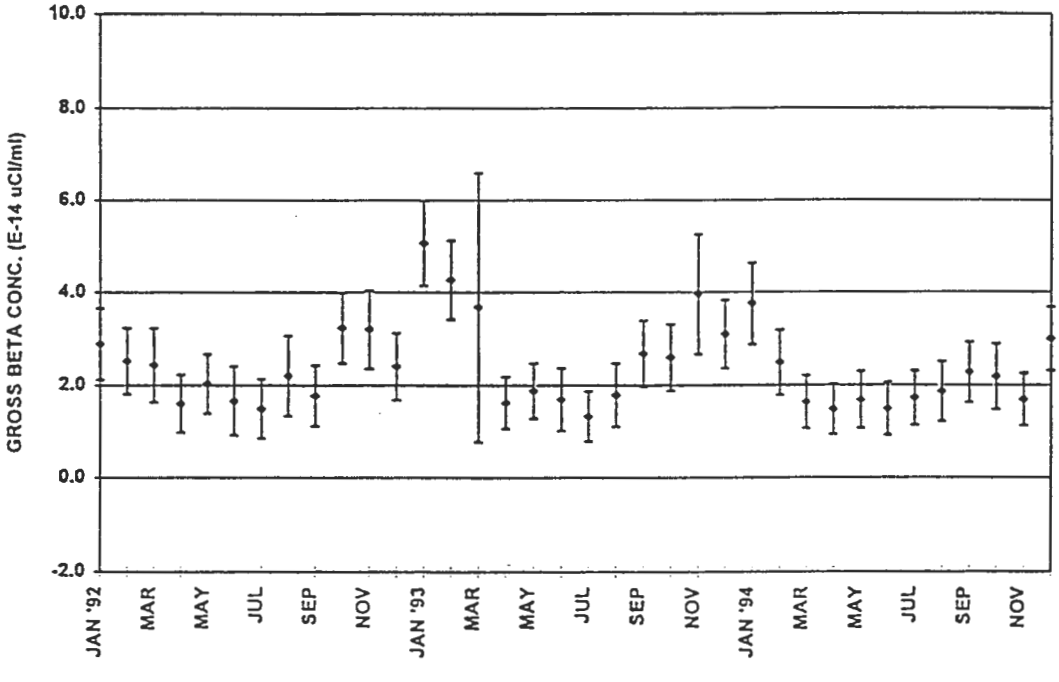
MONTHLY AVERAGE GROSS BETA ACTIVITY IN AIR
STATION 1 -- 1992-94



5/26/95

FIGURE 5.11

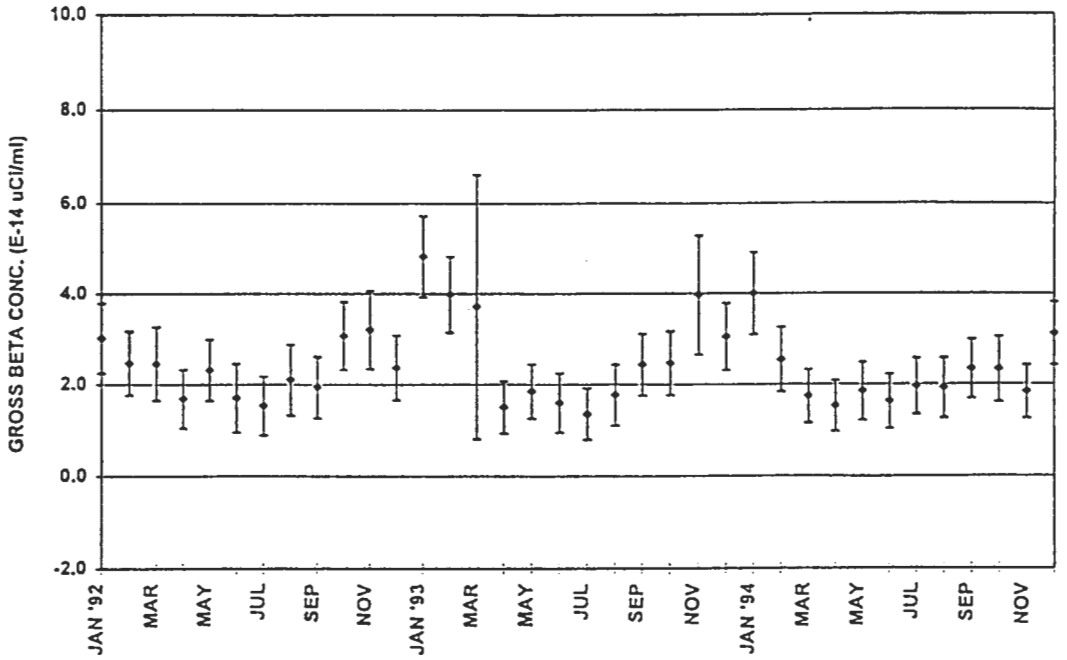
MONTHLY AVERAGE GROSS BETA ACTIVITY IN AIR
STATION 2 -- 1992-94



5/26/95

FIGURE 5.12

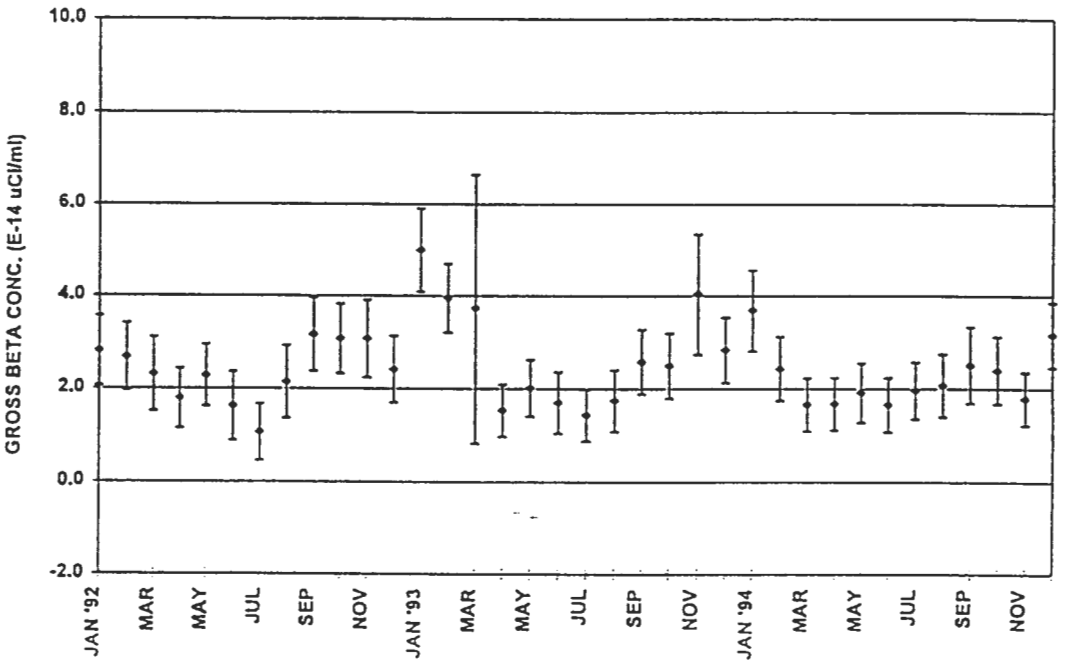
MONTHLY AVERAGE GROSS BETA ACTIVITY IN AIR
STATION 3 -- 1992-94



5/26/95

FIGURE 5.13

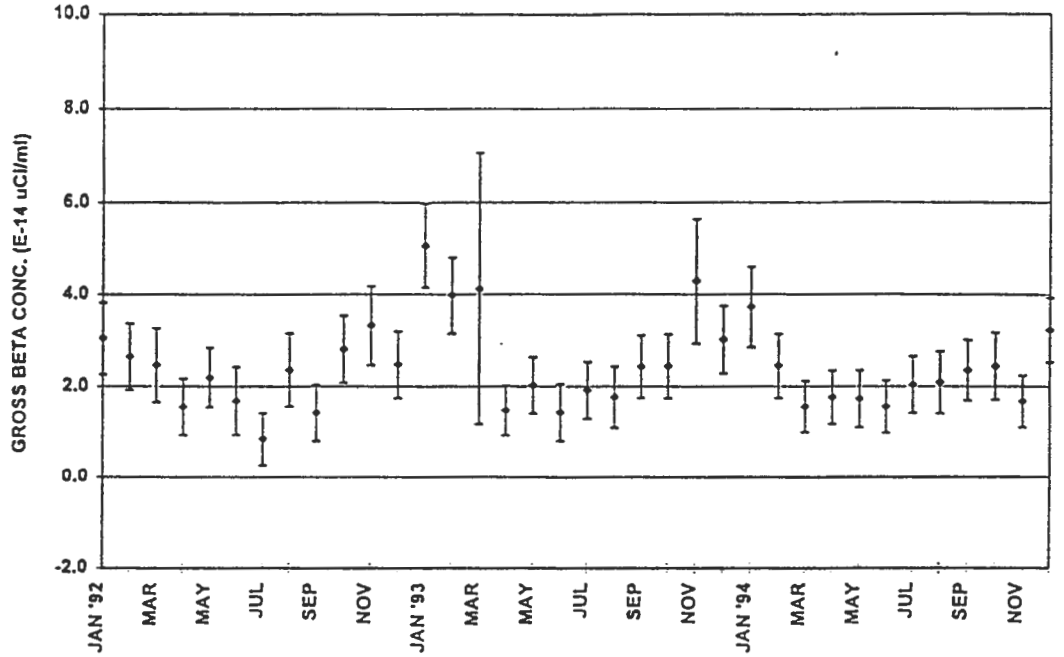
MONTHLY AVERAGE GROSS BETA ACTIVITY IN AIR
STATION 4 -- 1992-94



5/26/95

FIGURE 5.14

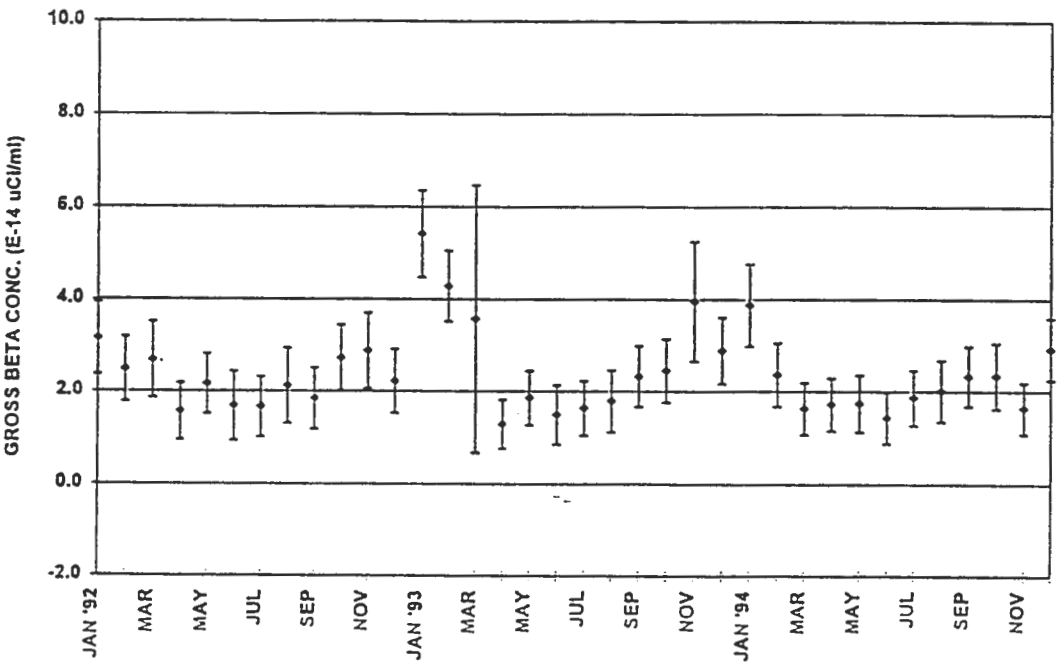
MONTHLY AVERAGE GROSS BETA ACTIVITY IN AIR
STATION 5 -- 1992-94



5/26/95

FIGURE 5.15

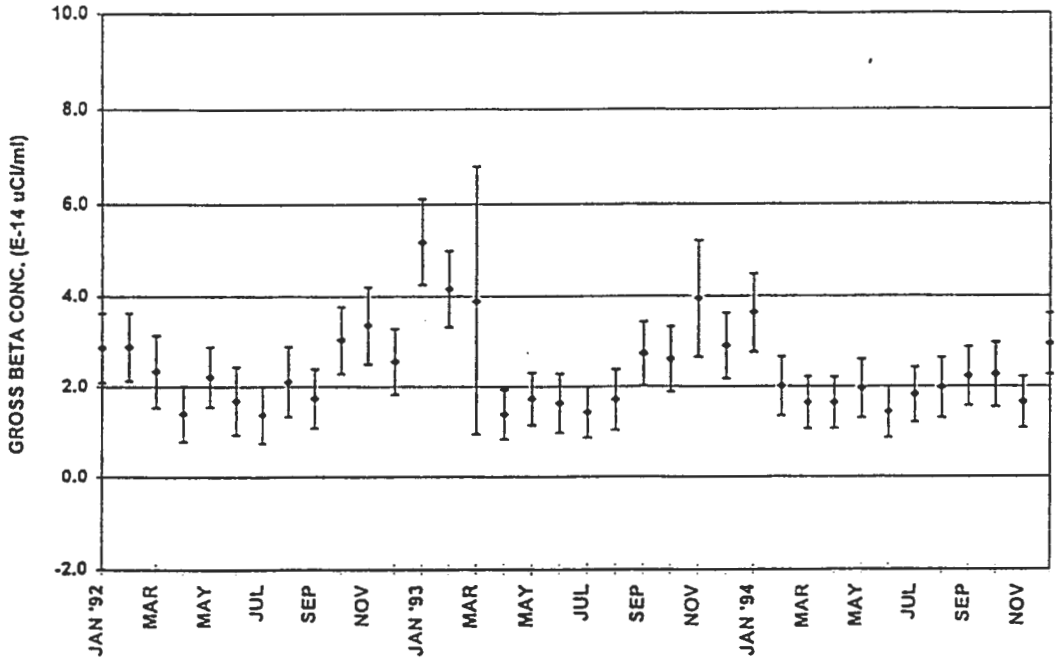
MONTHLY AVERAGE GROSS BETA ACTIVITY IN AIR
STATION 6 -- 1992-94



5/26/95

FIGURE 5.16

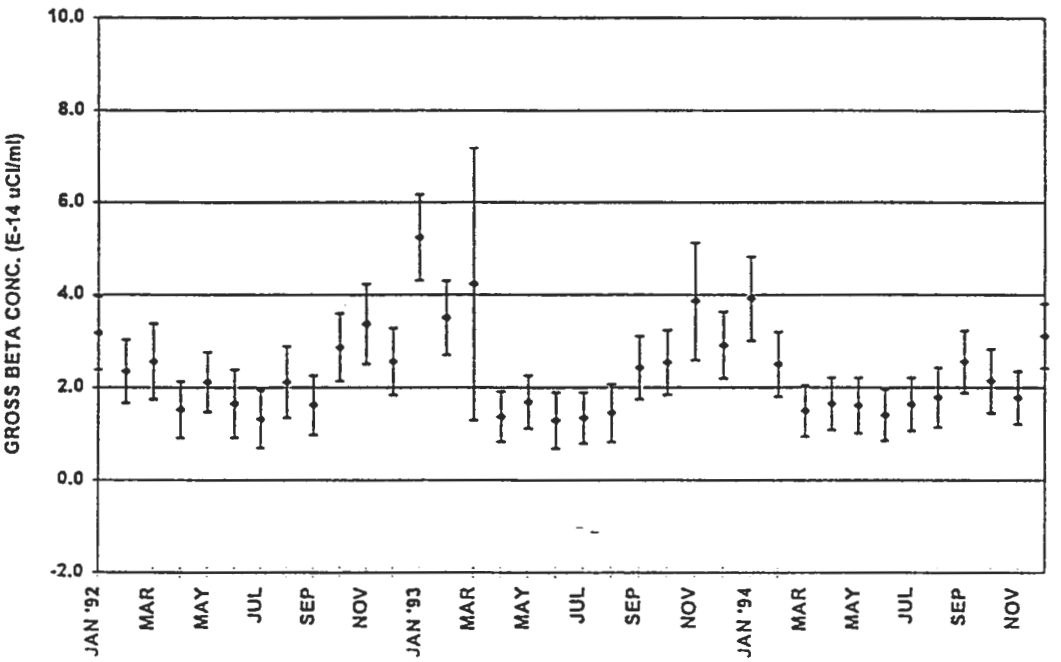
MONTHLY AVERAGE GROSS BETA ACTIVITY IN AIR
STATION 7 -- 1992-94



5/26/95

FIGURE 5.17

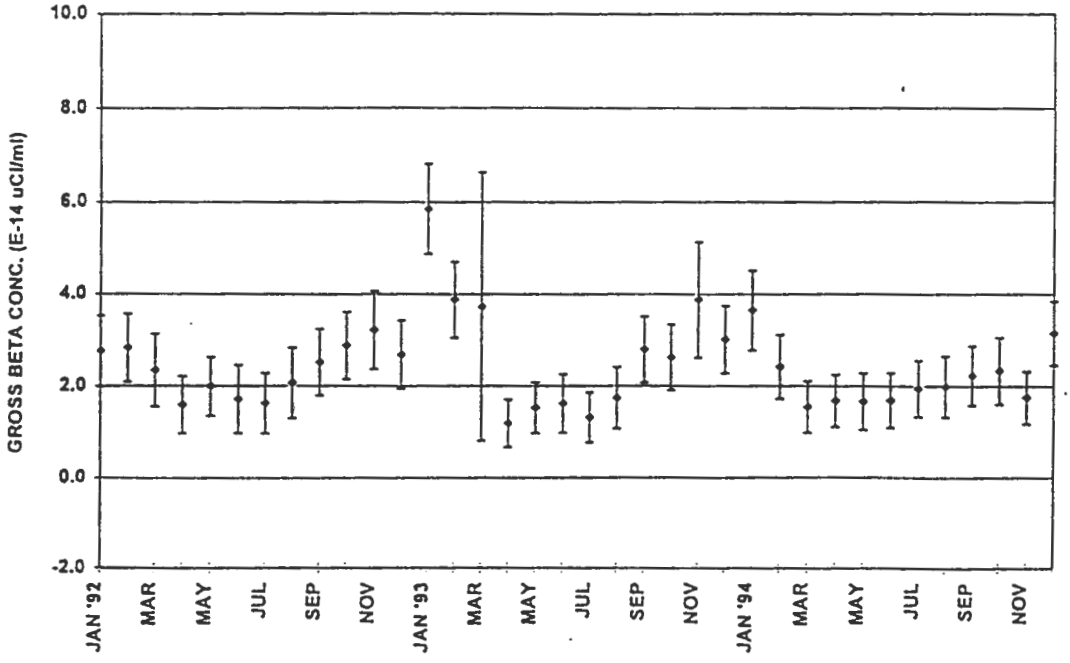
MONTHLY AVERAGE GROSS BETA ACTIVITY IN AIR
STATION 8 -- 1992-94



5/26/95

FIGURE 5.18

MONTHLY AVERAGE GROSS BETA ACTIVITY IN AIR
STATION 9 – 1992-94



5/26/95

FIGURE 5.19
GROSS ALPHA ACTIVITY IN AIR - 1994
AT STATION 1 -- RICHLAND,WA

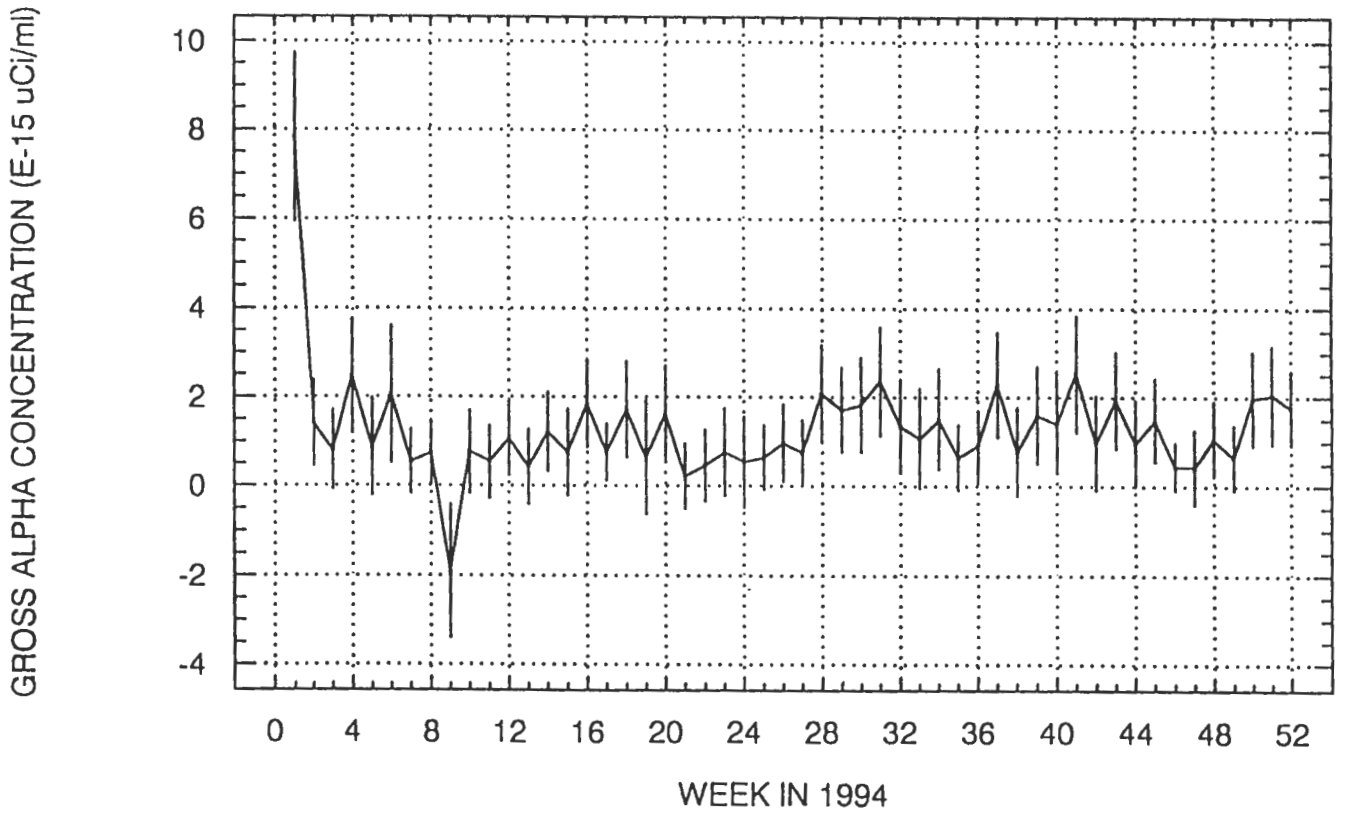
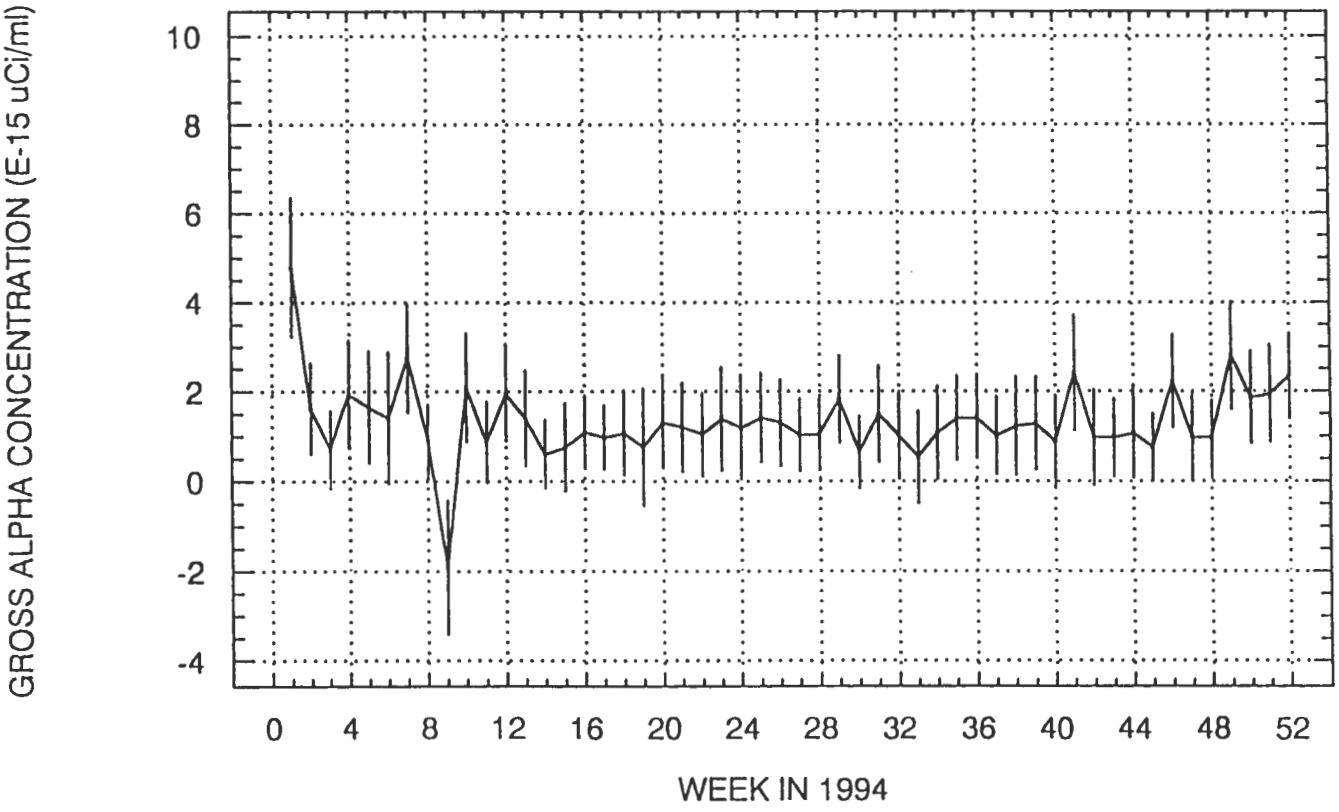


FIGURE 5.20
GROSS ALPHA ACTIVITY IN AIR - 1994
AT STATION 2 -- RICHLAND,WA



4-17-95

FIGURE 5.21

GROSS ALPHA ACTIVITY IN AIR - 1994
AT STATION 3 -- RICHLAND,WA

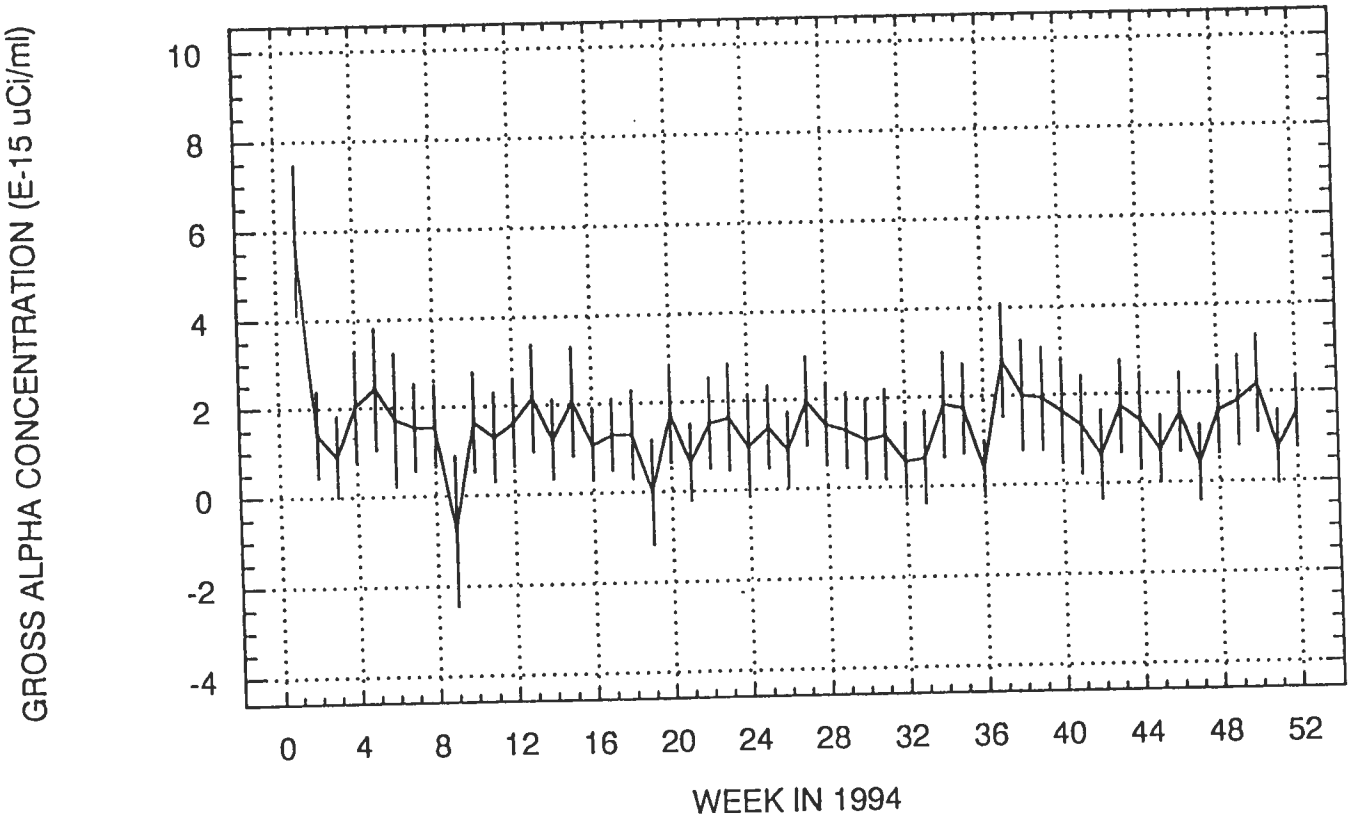
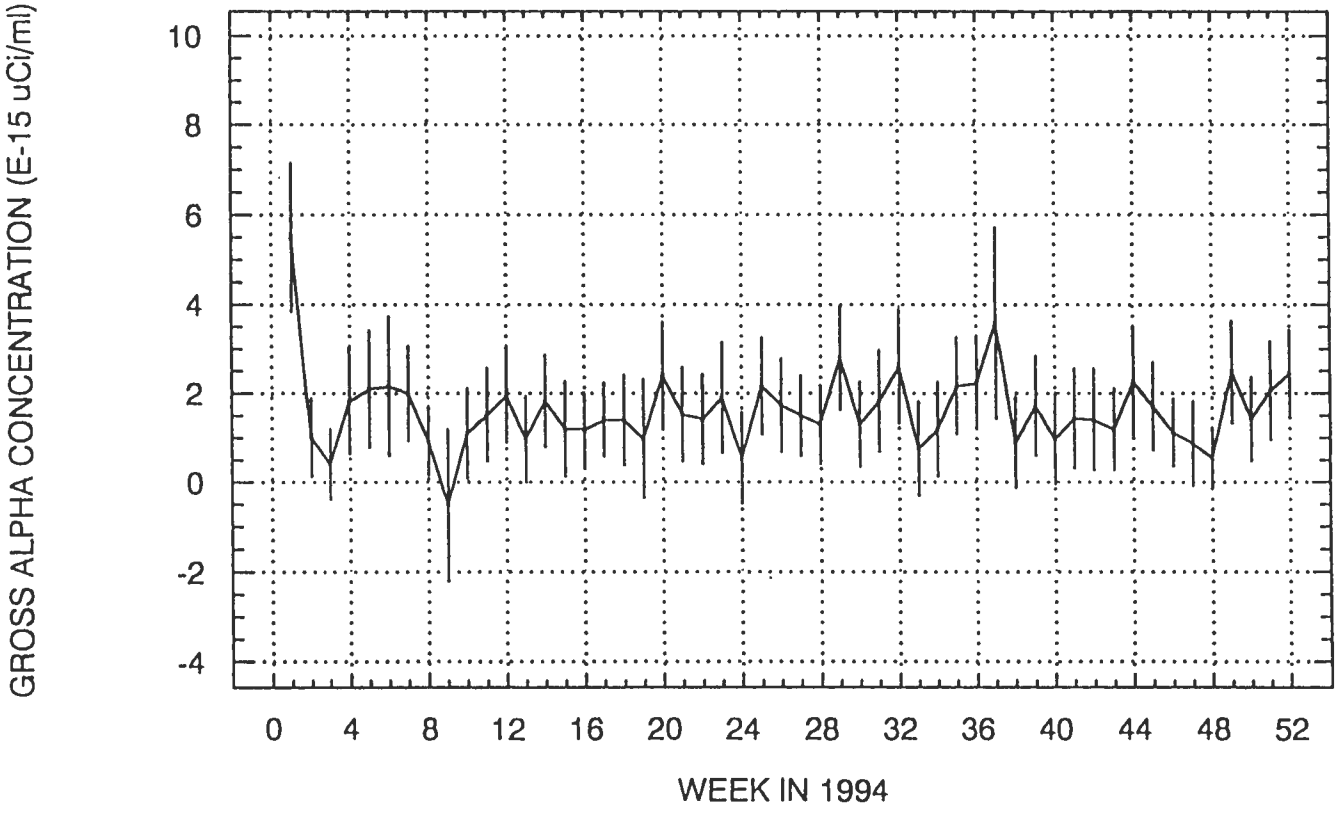


FIGURE 5.22

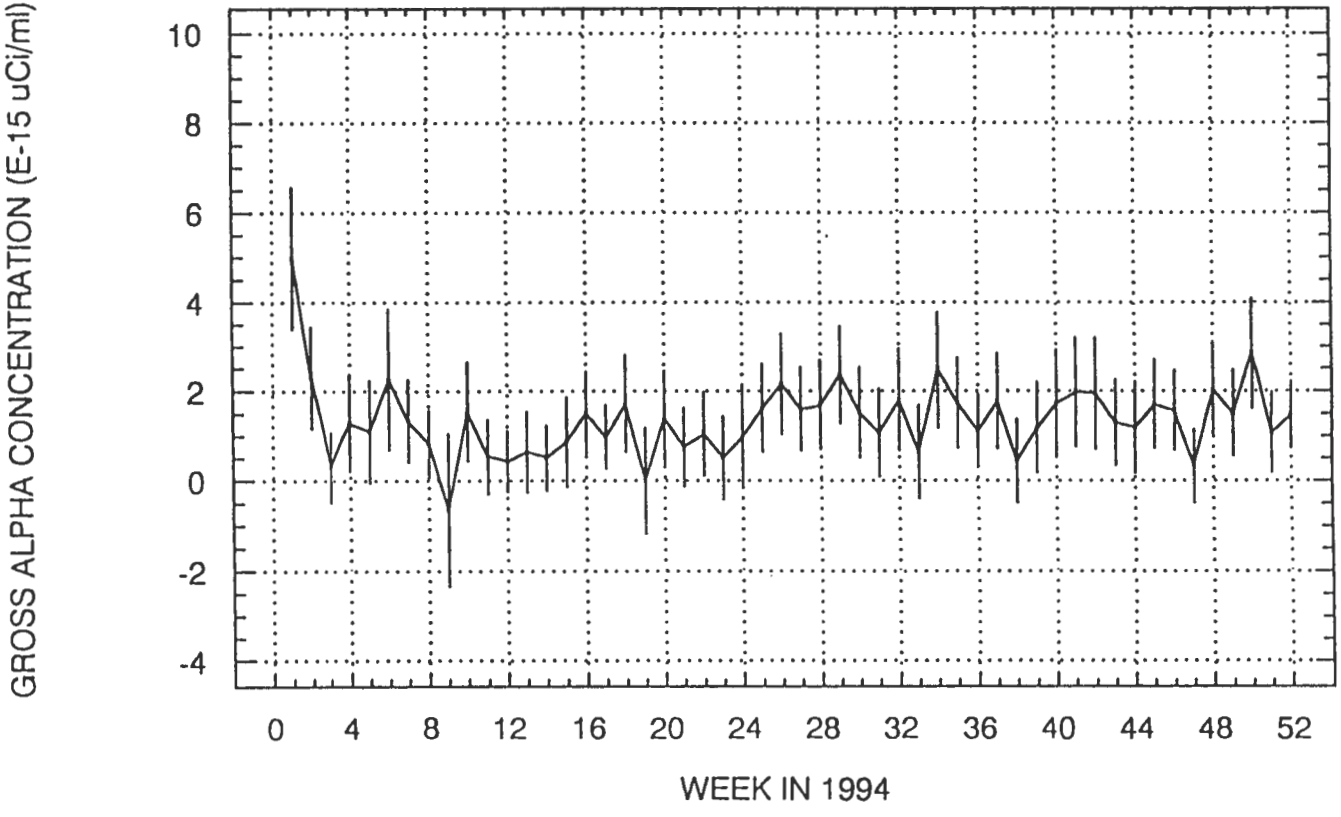
GROSS ALPHA ACTIVITY IN AIR - 1994
AT STATION 4 -- RICHLAND,WA



4-17-95

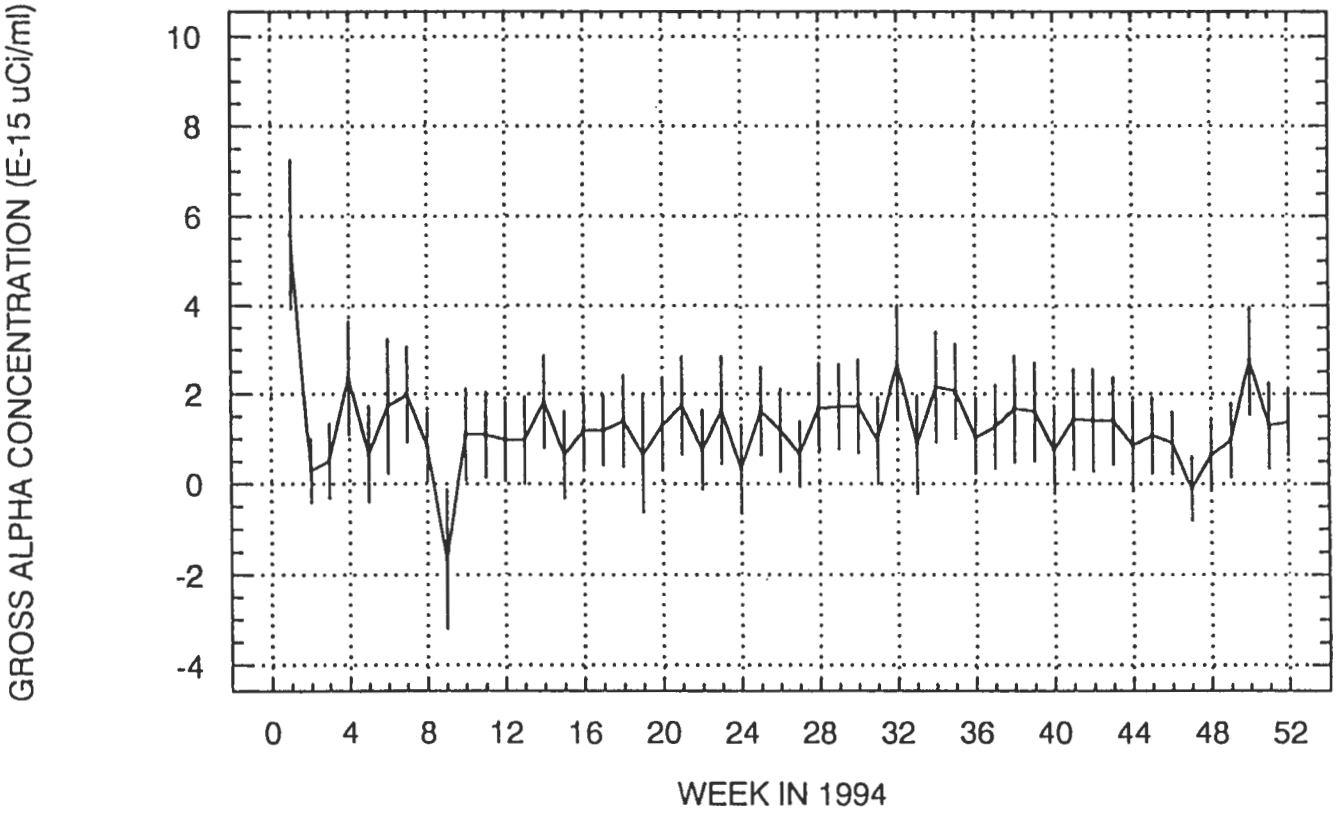
FIGURE 5.23

GROSS ALPHA ACTIVITY IN AIR - 1994
AT STATION 5 -- RICHLAND,WA



4-17-95

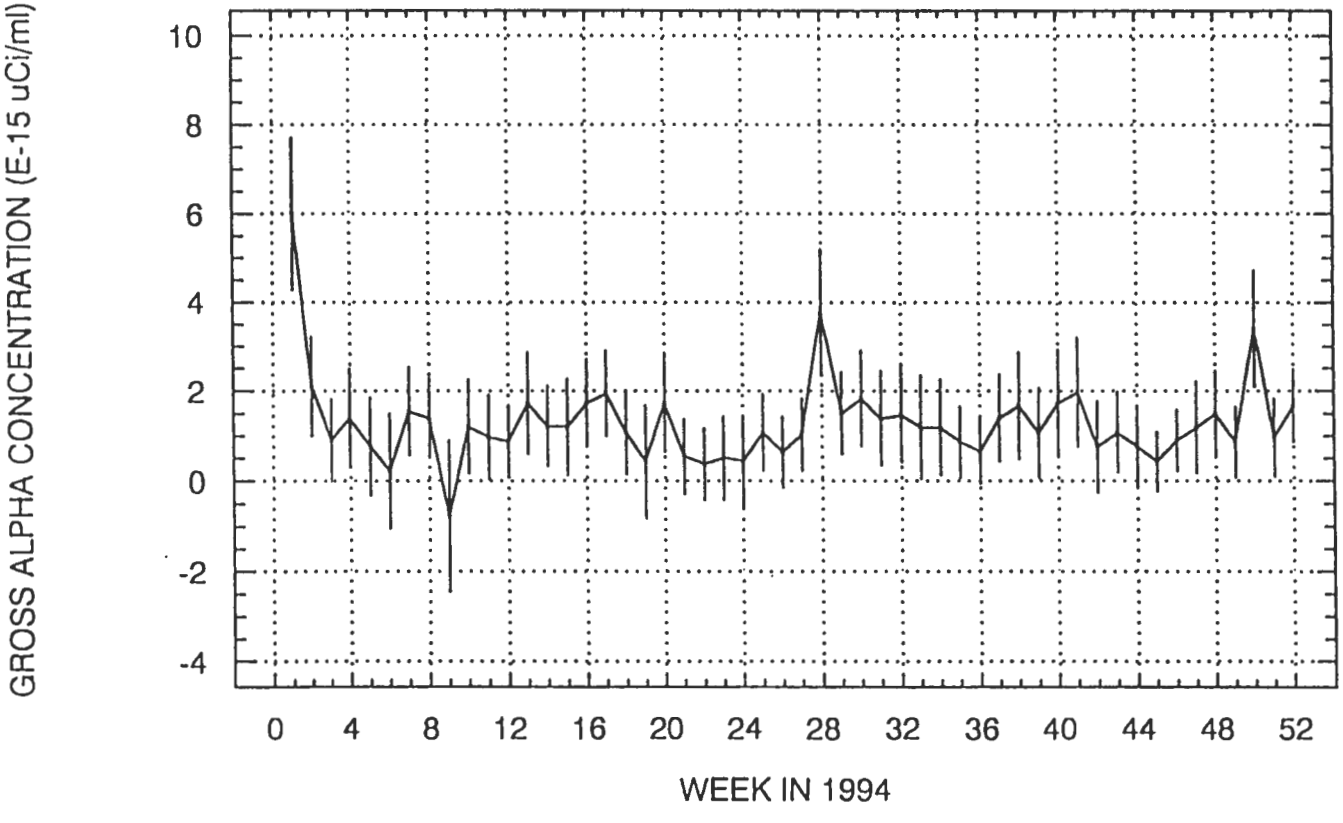
FIGURE 5.24
GROSS ALPHA ACTIVITY IN AIR - 1994
AT STATION 6 -- RICHLAND,WA



4-17-95

FIGURE 5.25

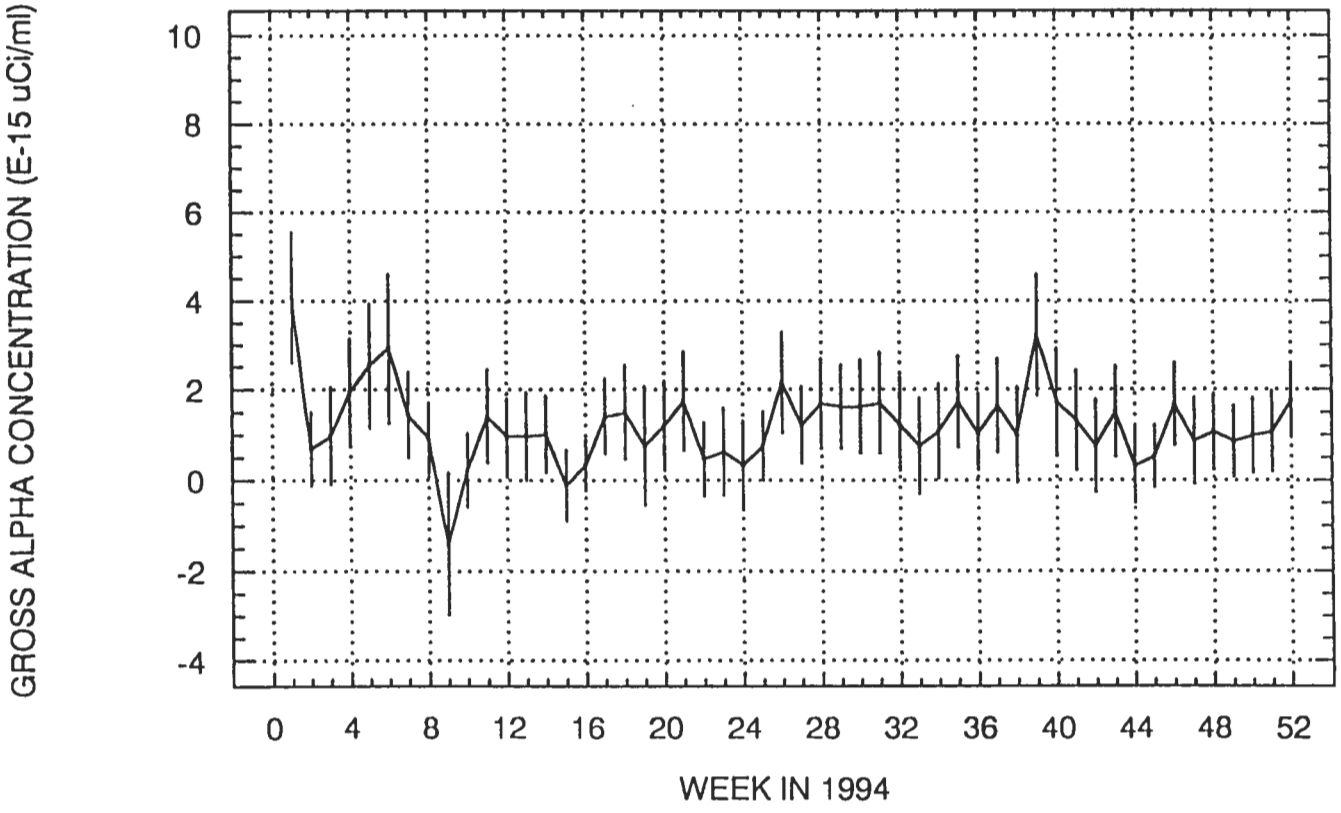
GROSS ALPHA ACTIVITY IN AIR - 1994
AT STATION 7 -- RICHLAND,WA



4-17-95

FIGURE 5.26

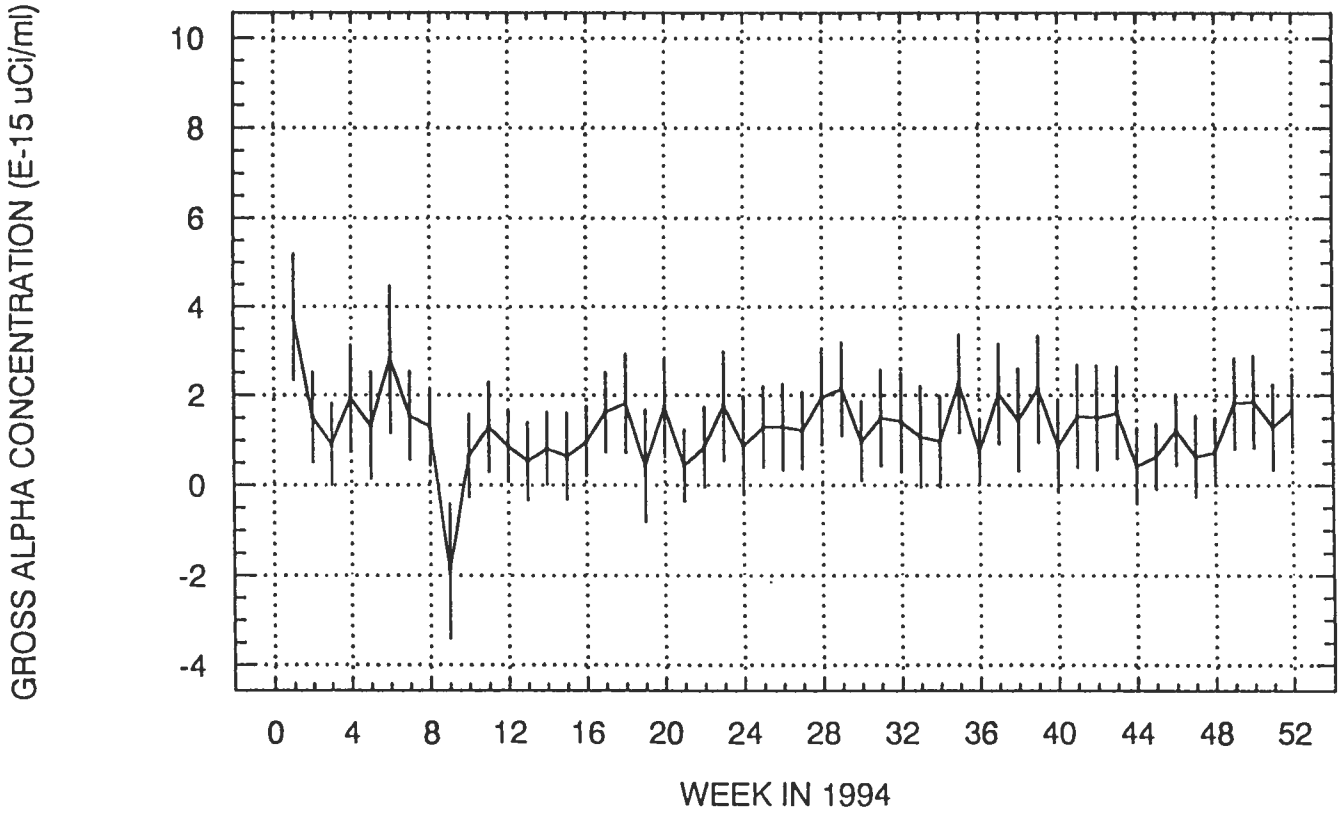
GROSS ALPHA ACTIVITY IN AIR - 1994
AT STATION 8 -- RICHLAND,WA



4-17-95

FIGURE 5.27

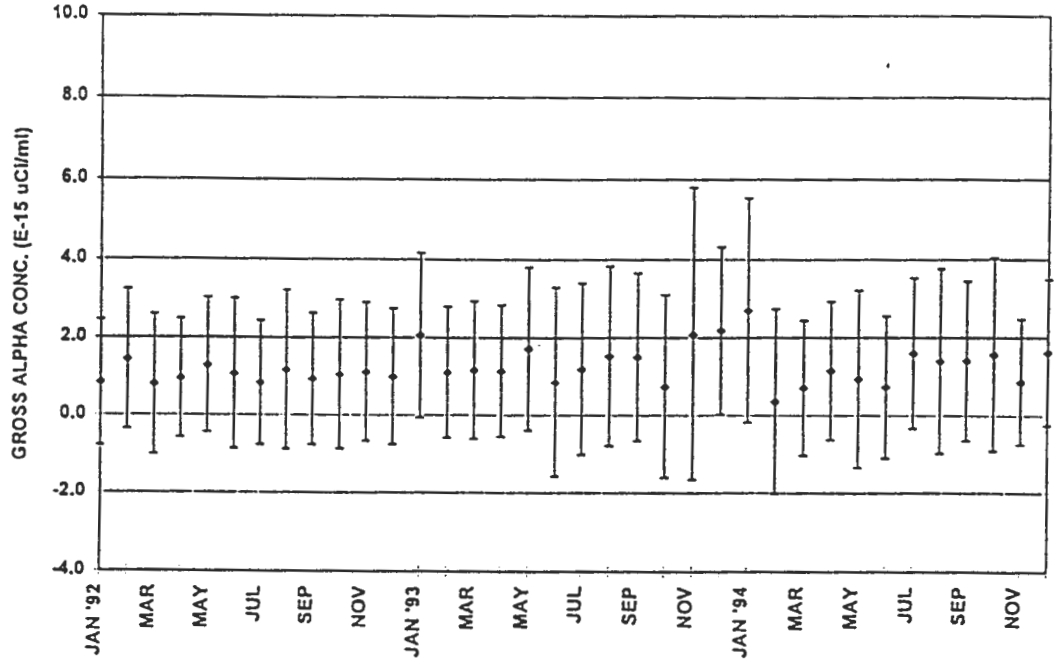
GROSS ALPHA ACTIVITY IN AIR - 1994
AT STATION 9 -- RICHLAND,WA



4-17-95

FIGURE 5.28

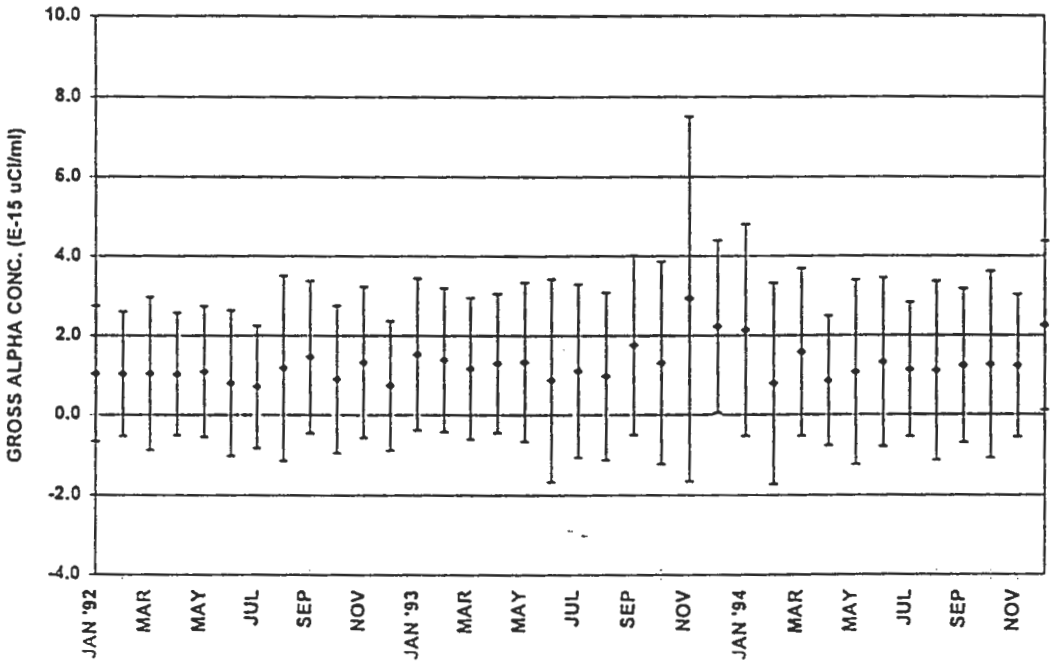
MONTHLY AVERAGE GROSS ALPHA ACTIVITY IN AIR
STATION 1 -- 1992-94



5/26/95

FIGURE 5.29

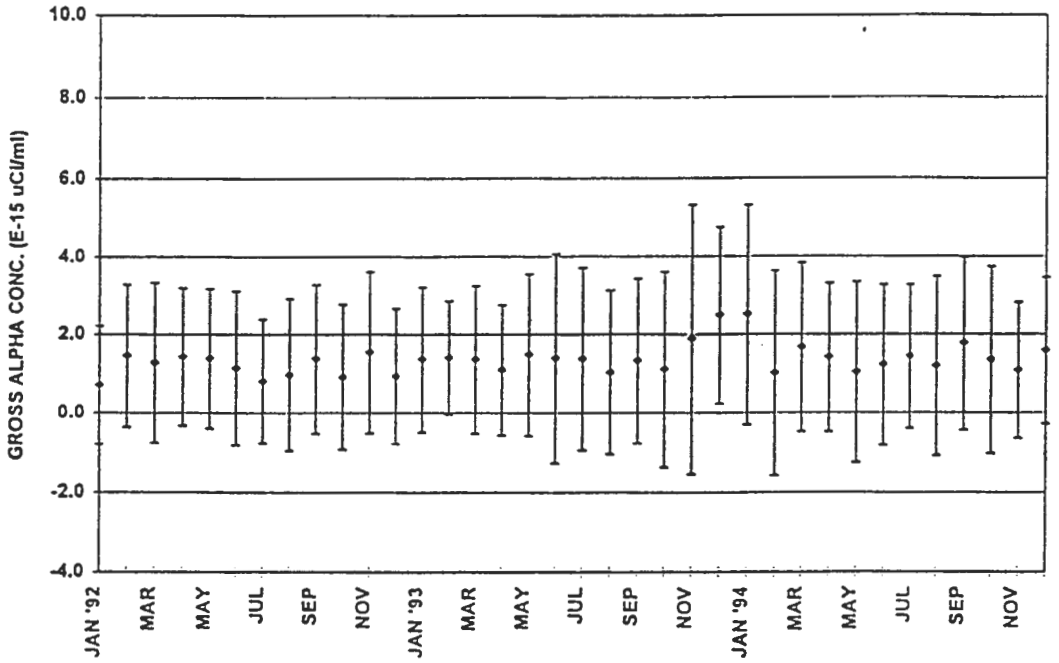
MONTHLY AVERAGE GROSS ALPHA ACTIVITY IN AIR
STATION 2 -- 1992-94



5/26/95

FIGURE 5.30

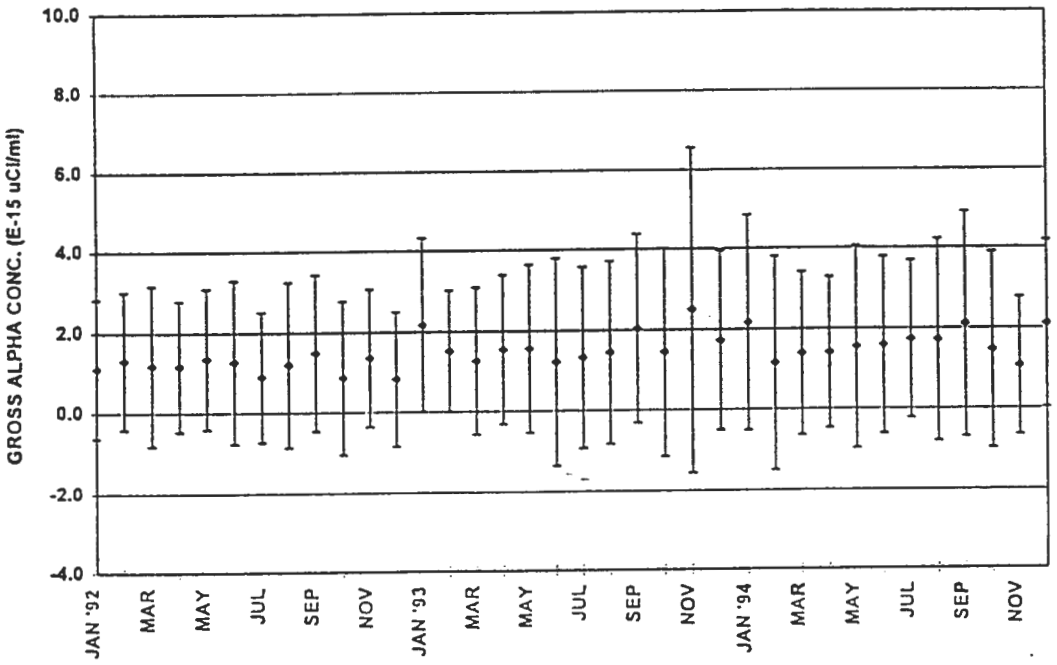
MONTHLY AVERAGE GROSS ALPHA ACTIVITY IN AIR
STATION 3 -- 1992-94



5/26/95

FIGURE 5.31

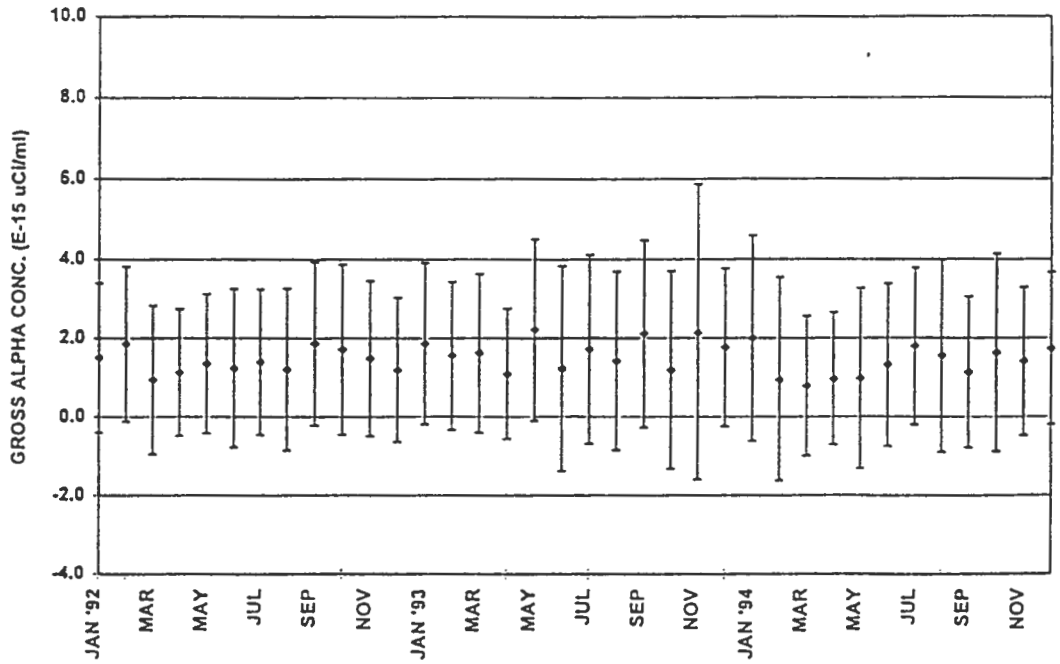
MONTHLY AVERAGE GROSS ALPHA ACTIVITY IN AIR
STATION 4 -- 1992-94



5/26/95

FIGURE 5.32

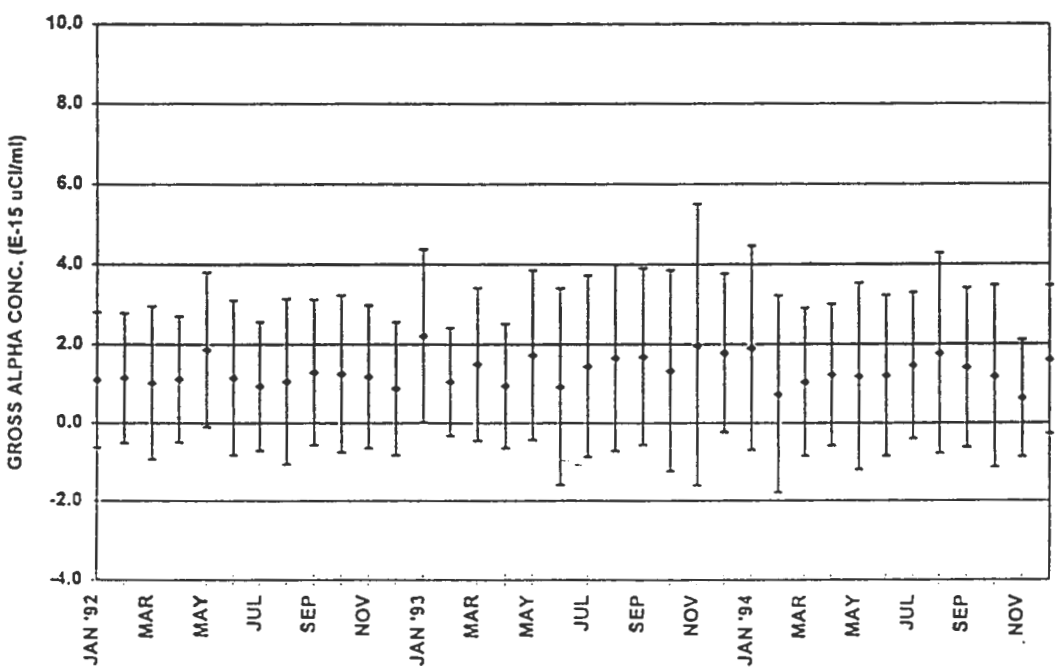
MONTHLY AVERAGE GROSS ALPHA ACTIVITY IN AIR
STATION 5 -- 1992-94



5/26/95

FIGURE 5.33

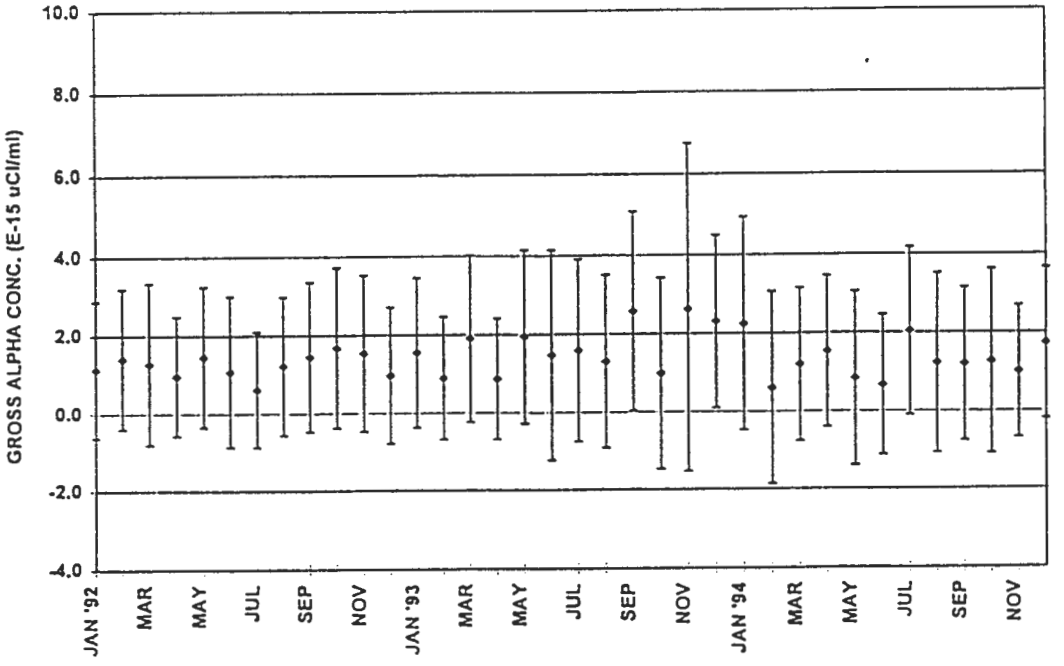
MONTHLY AVERAGE GROSS ALPHA ACTIVITY IN AIR
STATION 6 -- 1992-94



5/26/95

FIGURE 5.34

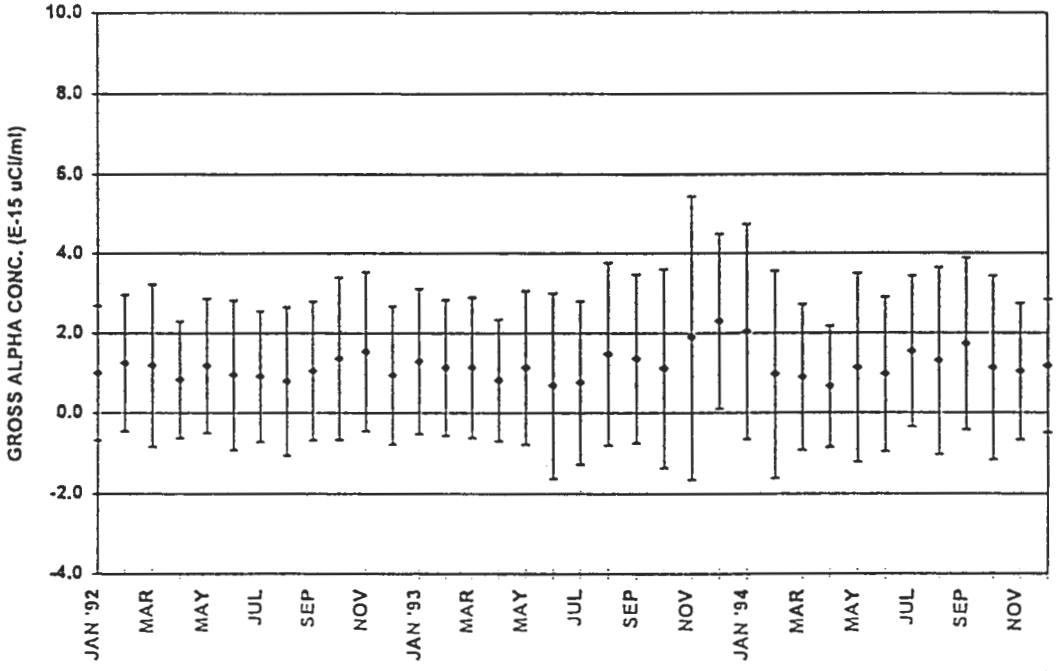
MONTHLY AVERAGE GROSS ALPHA ACTIVITY IN AIR
STATION 7 – 1992-94



5/26/95

FIGURE 5.35

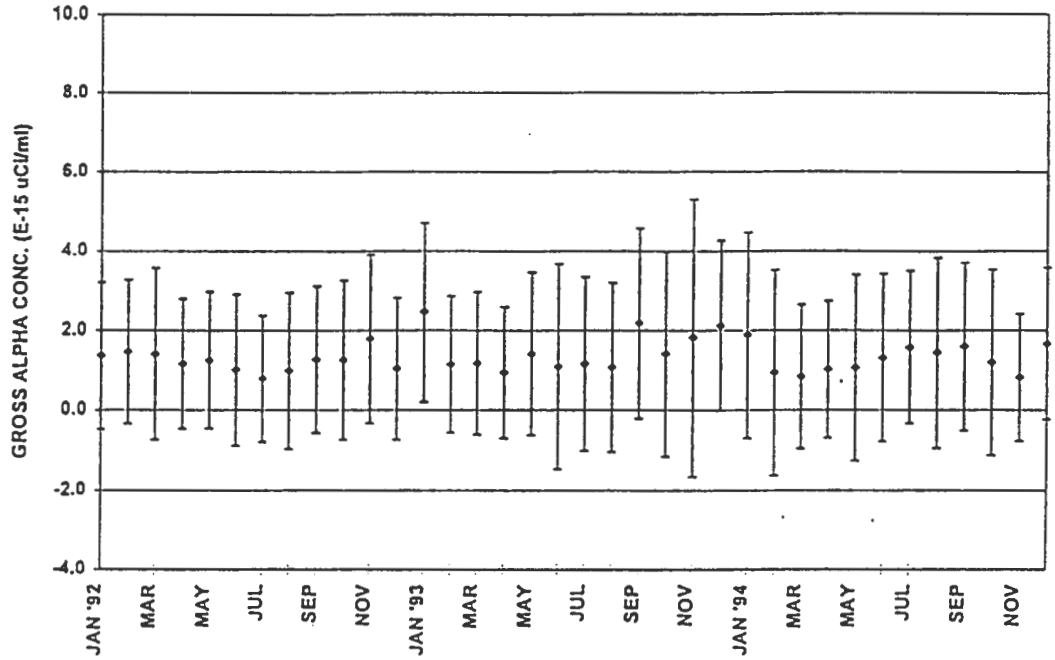
MONTHLY AVERAGE GROSS ALPHA ACTIVITY IN AIR
STATION 8 – 1992-94



5/26/95

FIGURE 5.36

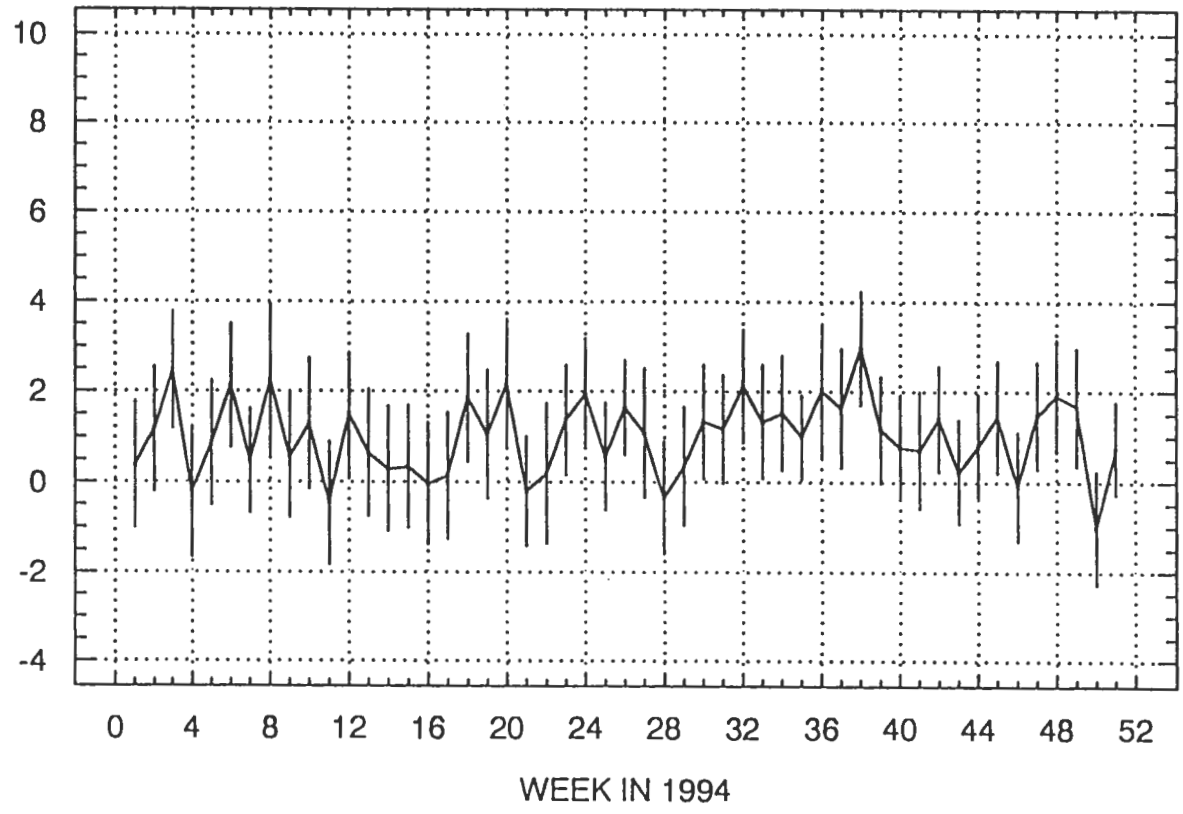
MONTHLY AVERAGE GROSS ALPHA ACTIVITY IN AIR
STATION 9 -- 1992-94



5/26/95

FIGURE 5.37

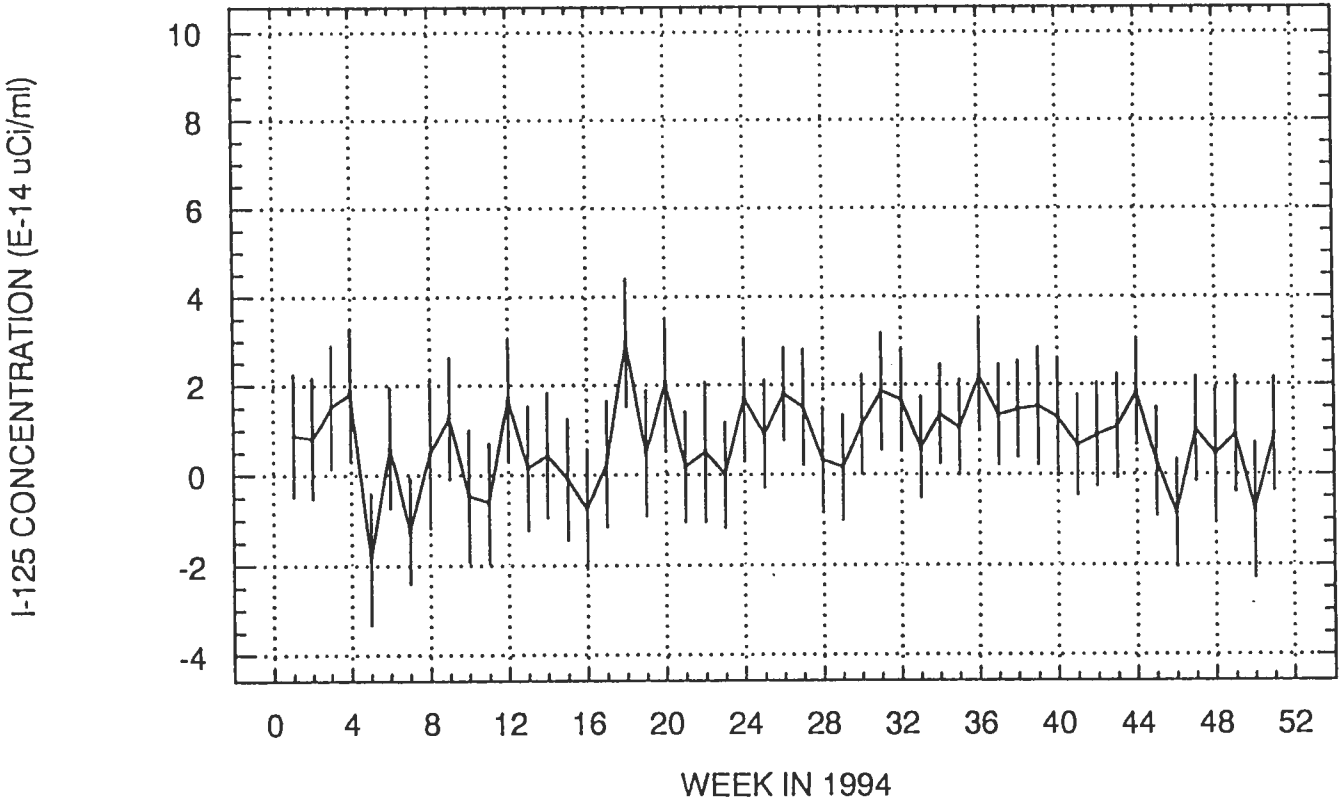
I-125 ACTIVITY IN AIR - 1994
AT STATION 1 -- RICHLAND,WA



4-17-95

FIGURE 5.38

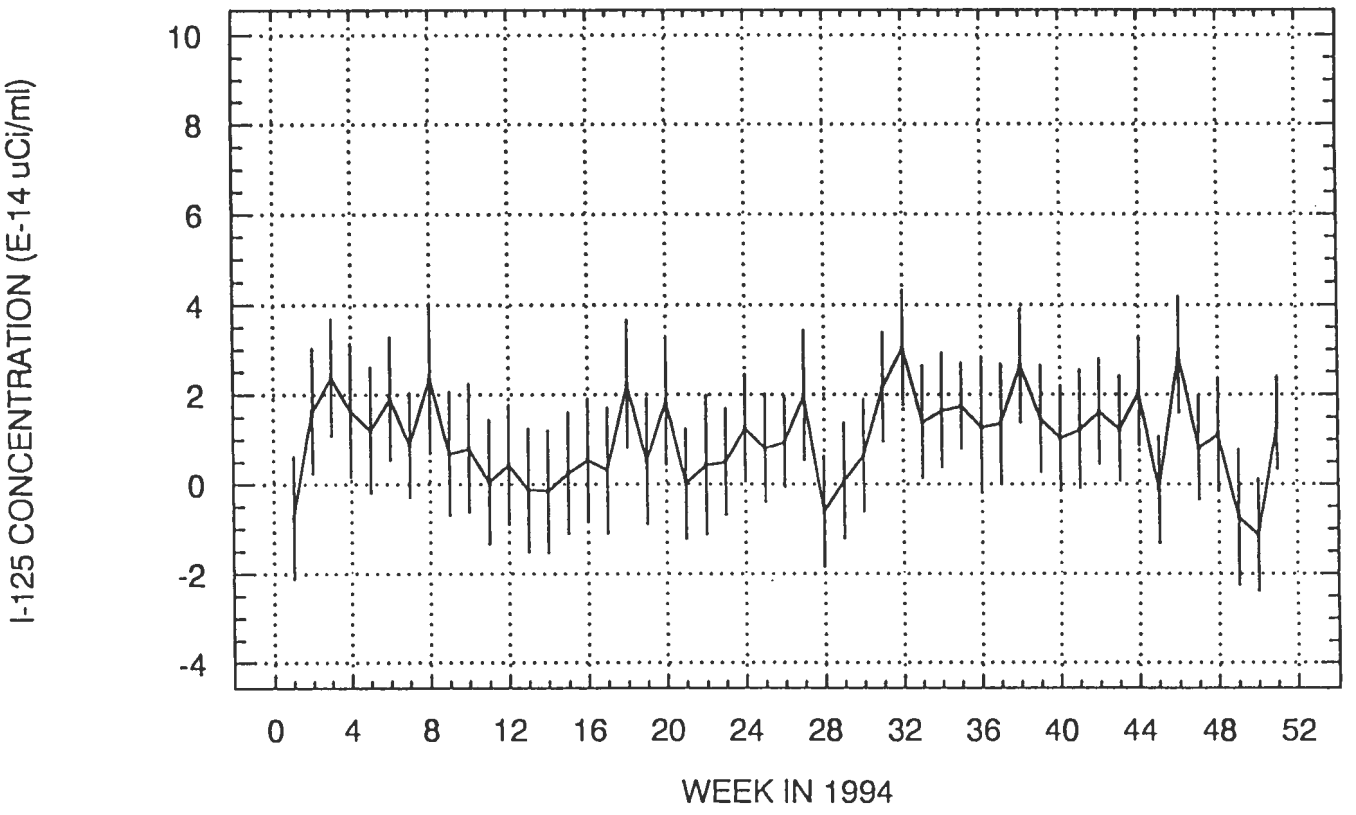
I-125 ACTIVITY IN AIR - 1994
AT STATION 2 -- RICHLAND,WA



4-17-95

FIGURE 5.39

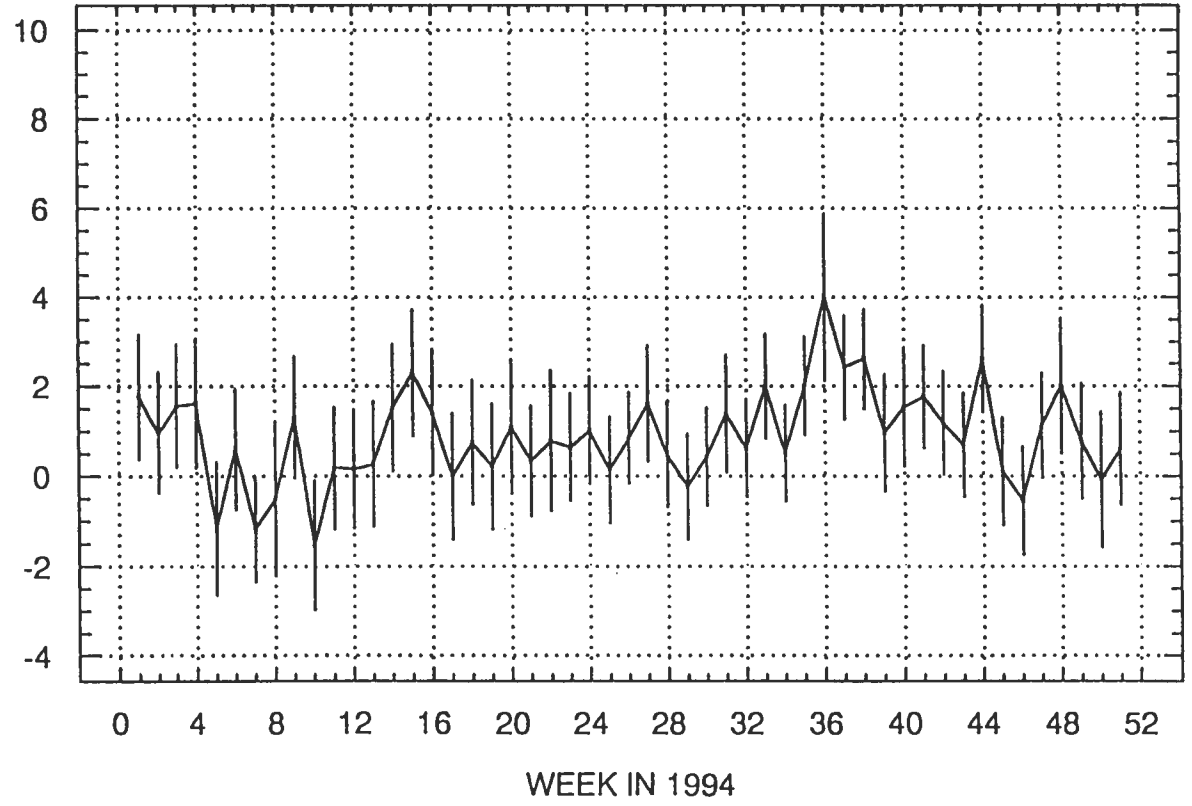
I-125 ACTIVITY IN AIR - 1994
AT STATION 3 -- RICHLAND,WA



4-17-95

FIGURE 5.40

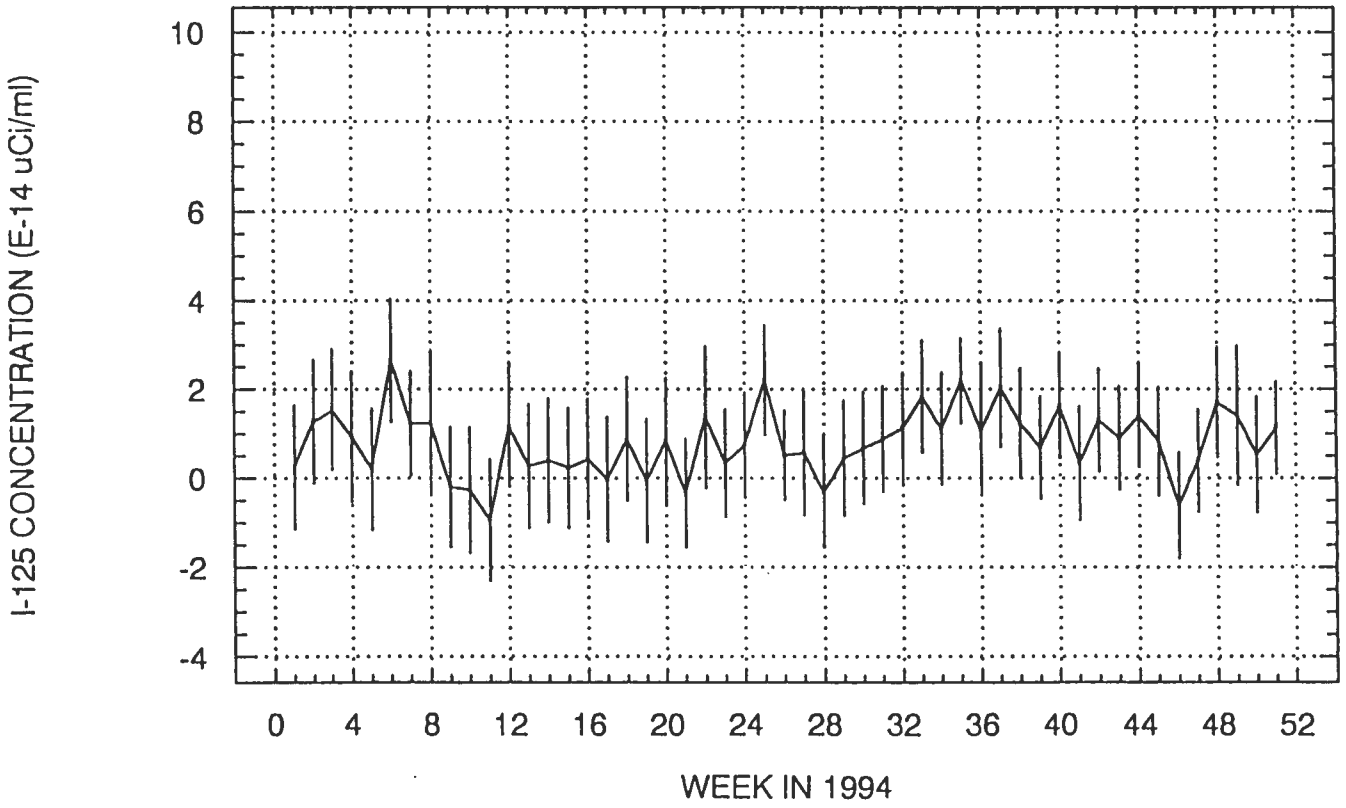
I-125 ACTIVITY IN AIR - 1994
AT STATION 4 -- RICHLAND,WA



4-17-95

FIGURE 5.41

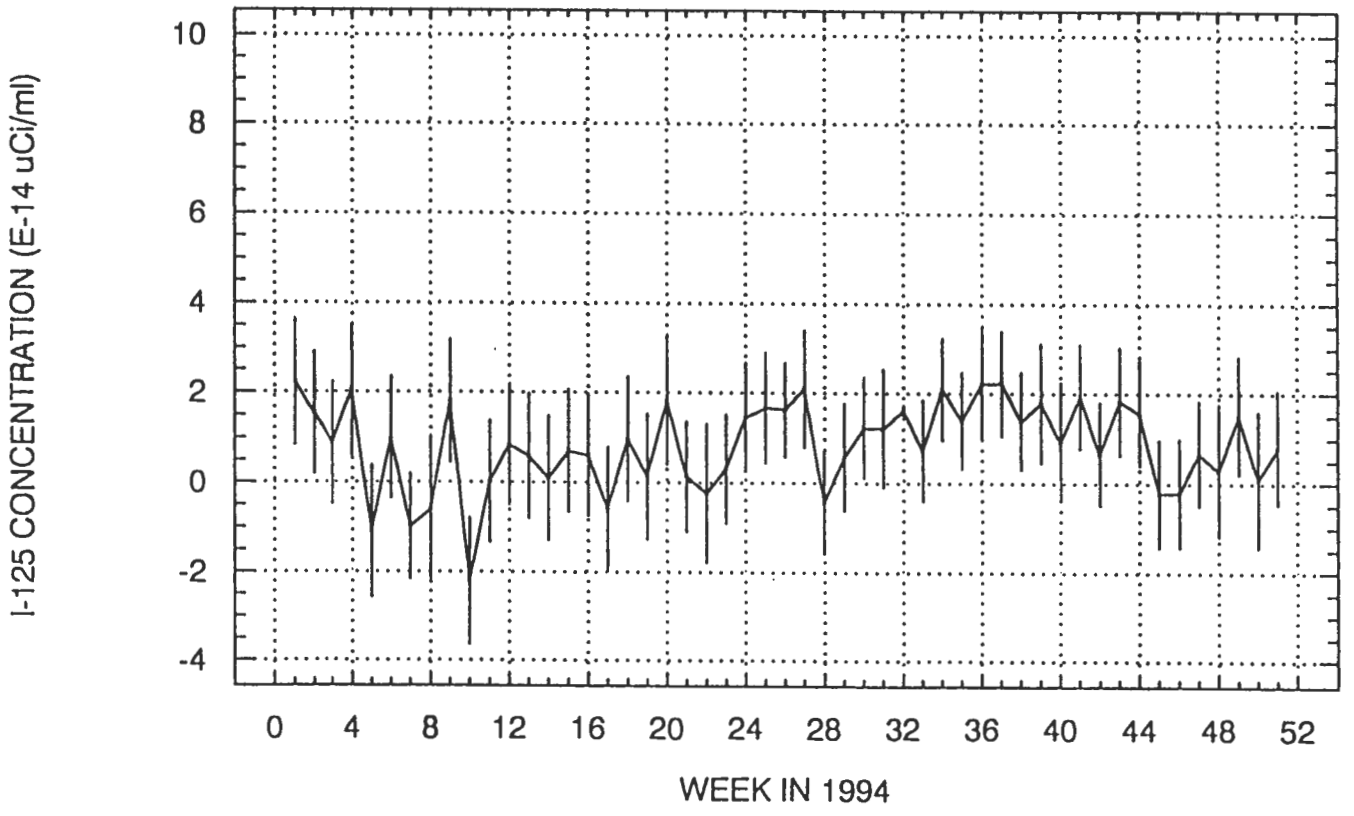
I-125 ACTIVITY IN AIR - 1994
AT STATION 5 -- RICHLAND,WA



4-17-95

FIGURE 5.42

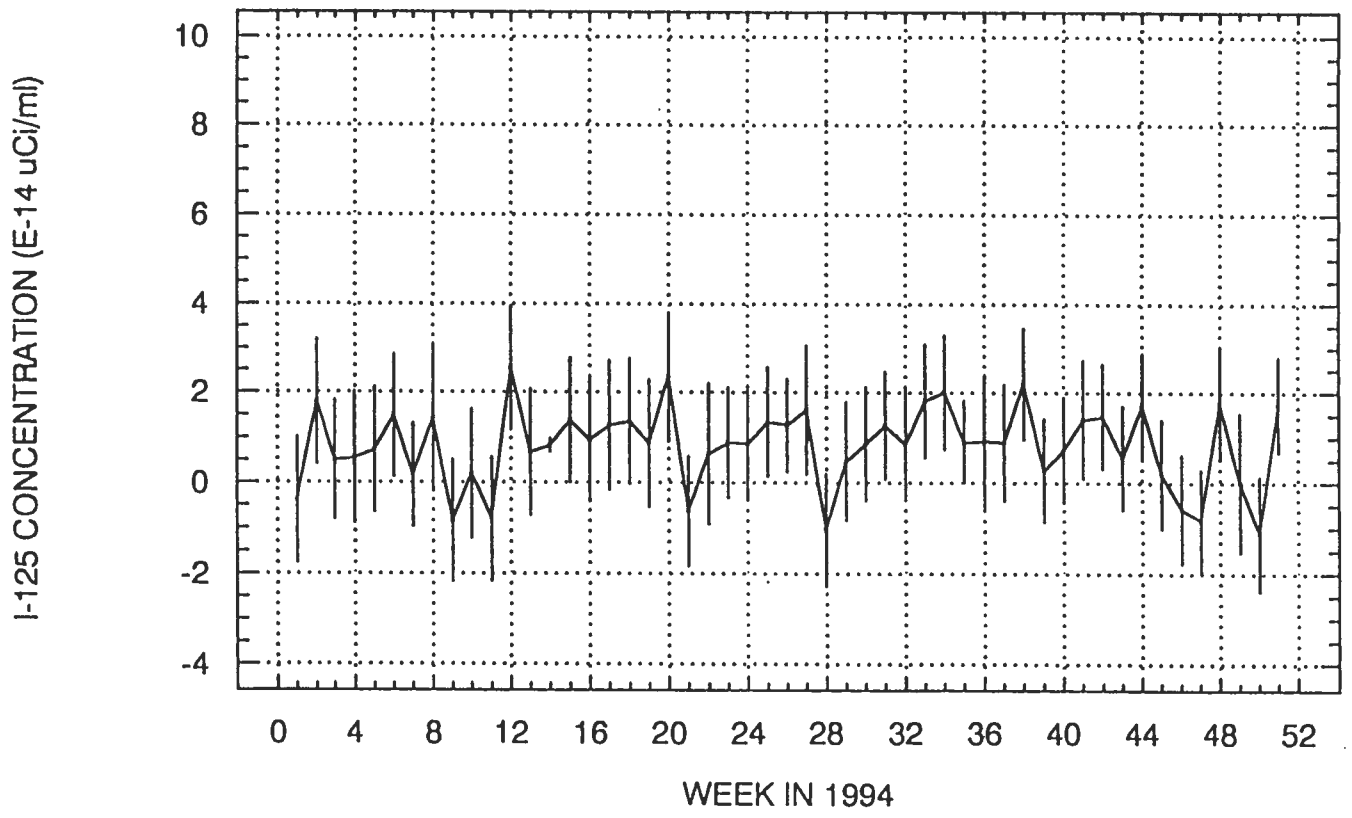
I-125 ACTIVITY IN AIR - 1994
AT STATION 6 -- RICHLAND,WA



4-17-95

FIGURE 5.43

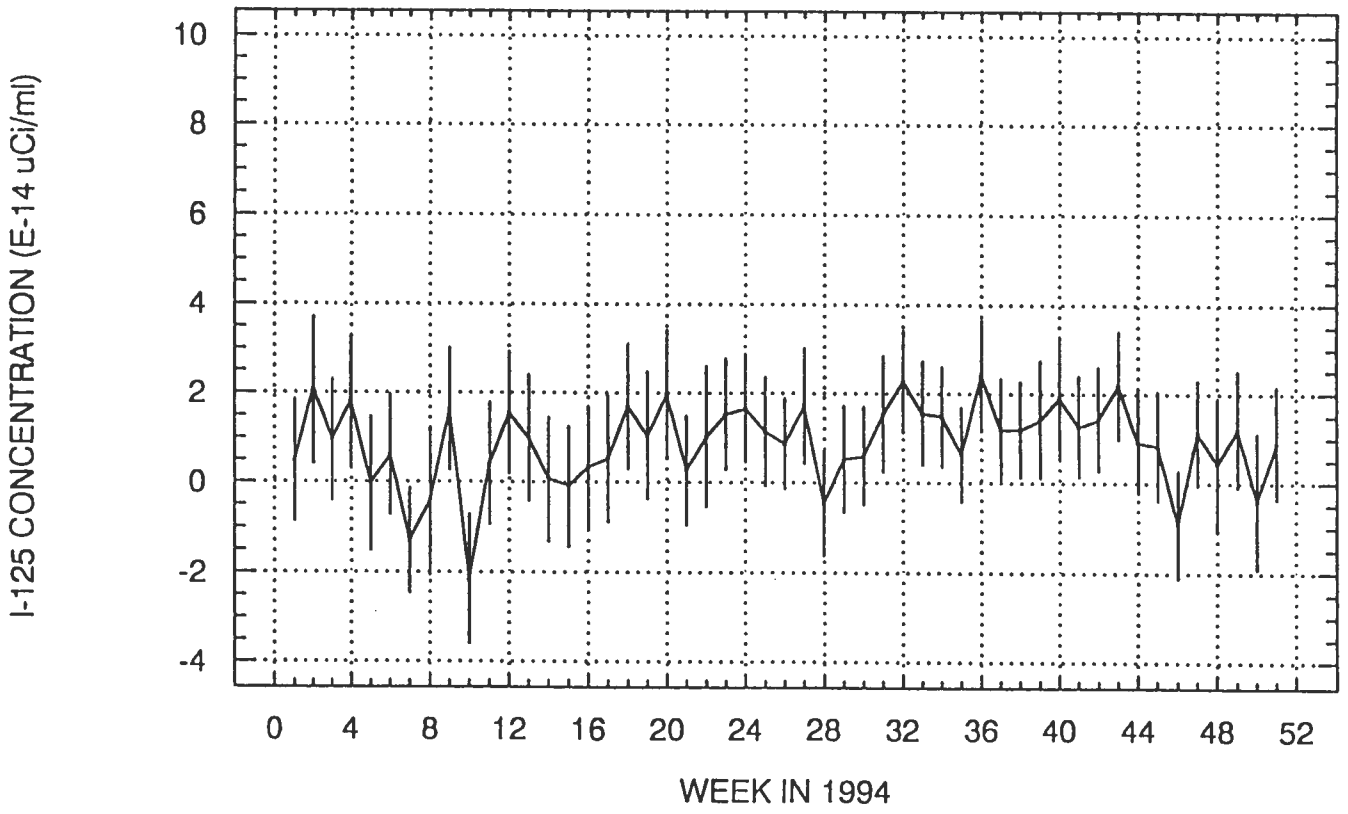
I-125 ACTIVITY IN AIR - 1994
AT STATION 7 -- RICHLAND,WA



4-17-95

FIGURE 5.44

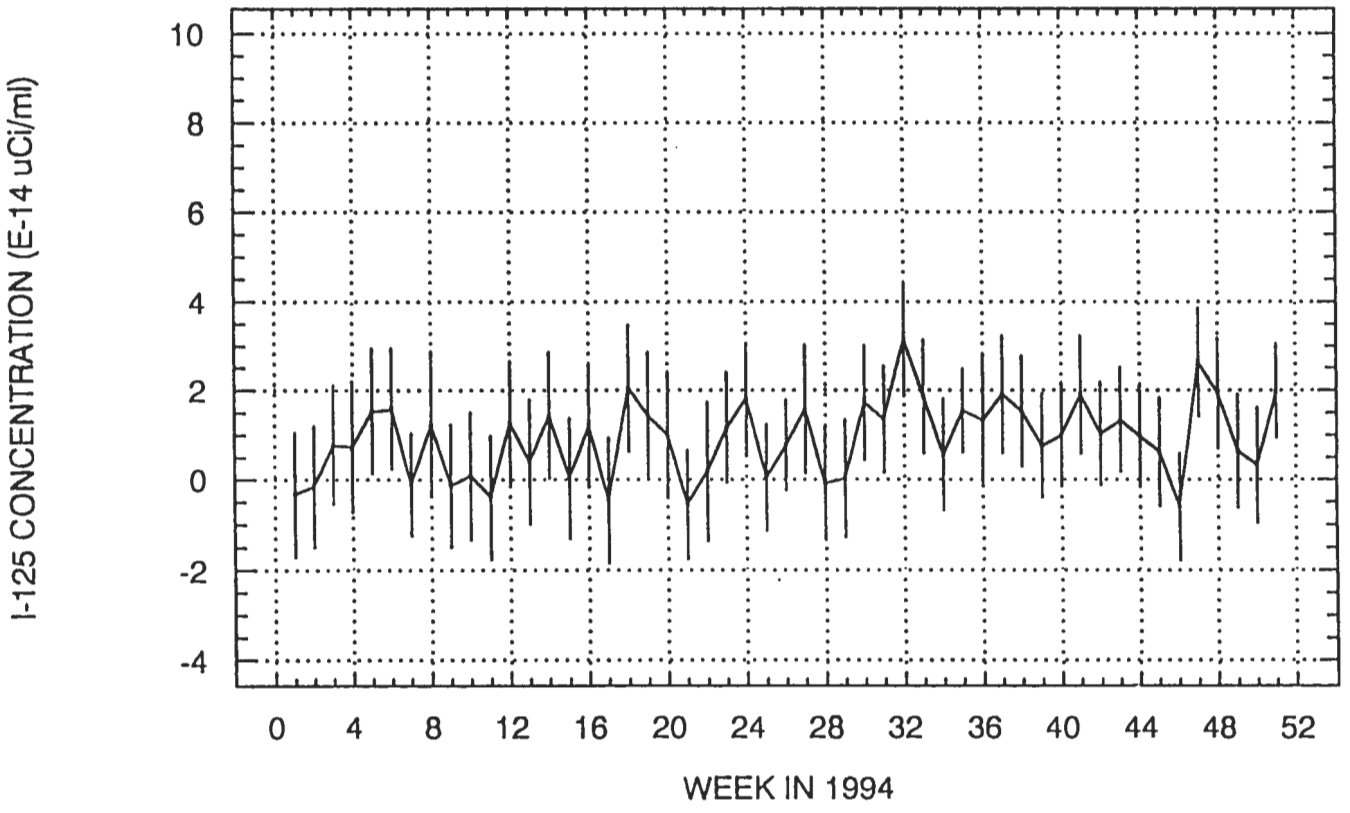
I-125 ACTIVITY IN AIR - 1994
AT STATION 8 -- RICHLAND,WA



4-17-95

FIGURE 5.45

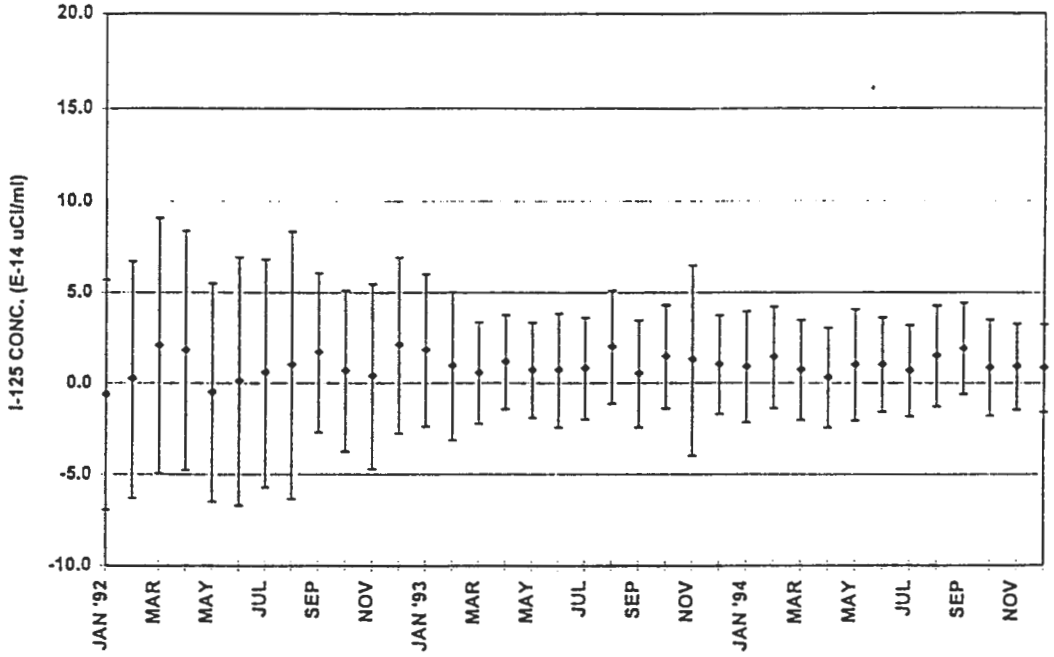
I-125 ACTIVITY IN AIR - 1994
AT STATION 9 -- RICHLAND,WA



4-17-95

FIGURE 5.46

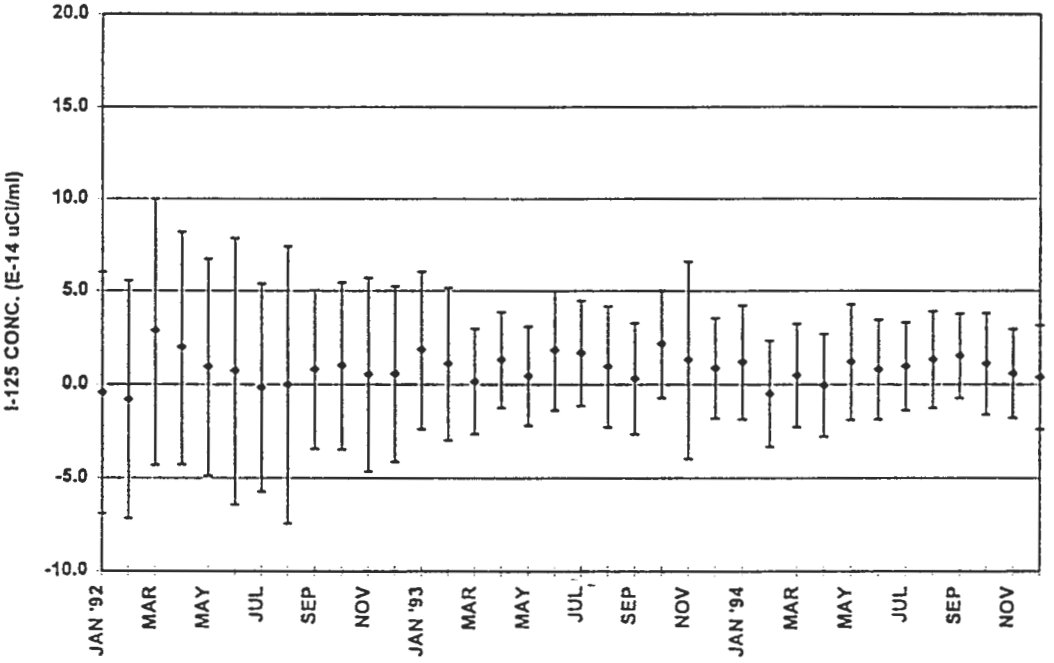
MONTHLY AVERAGE IODINE-125 ACTIVITY IN AIR
STATION 1 – 1992-94



5/30/95

FIGURE 5.47

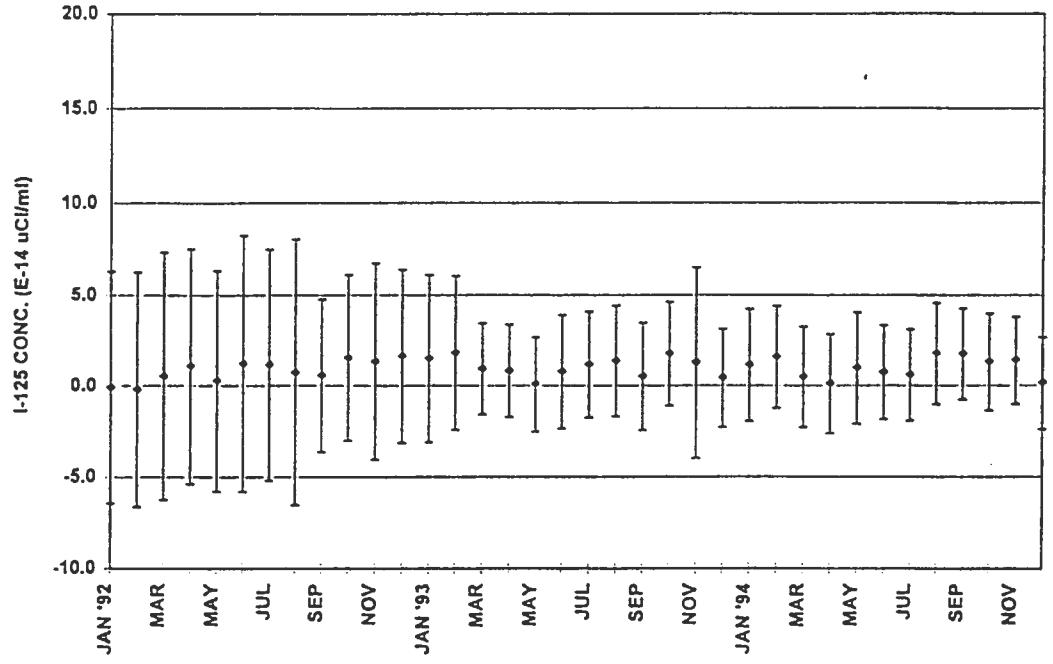
MONTHLY AVERAGE IODINE-125 ACTIVITY IN AIR
STATION 2 – 1992-94



5/30/95

FIGURE 5.48

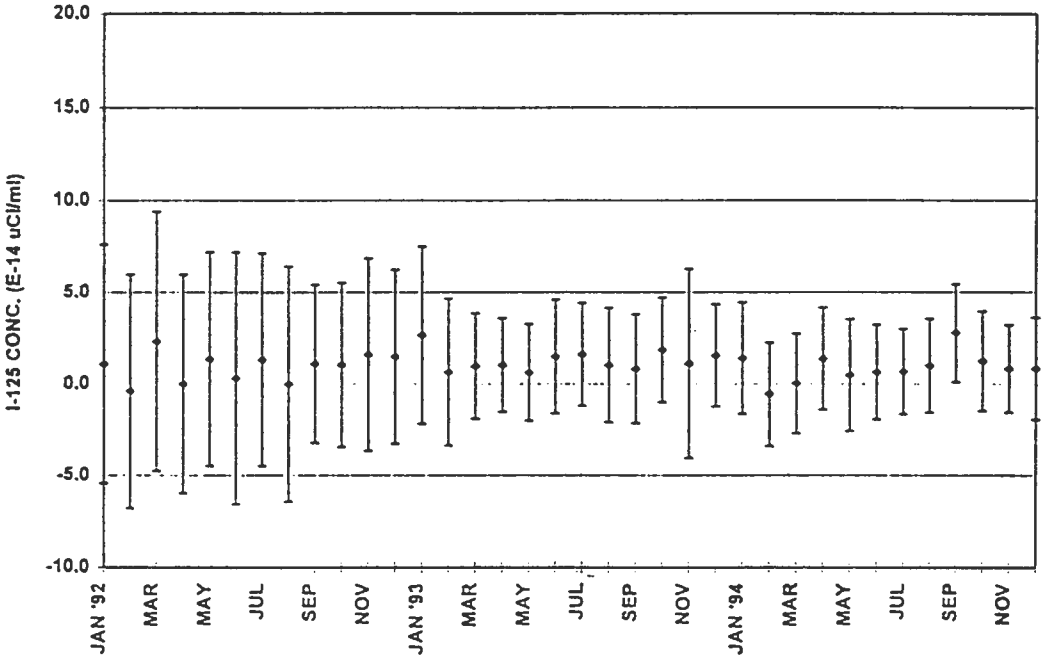
MONTHLY AVERAGE IODINE-125 ACTIVITY IN AIR
STATION 3 – 1992-94



5/30/95

FIGURE 5.49

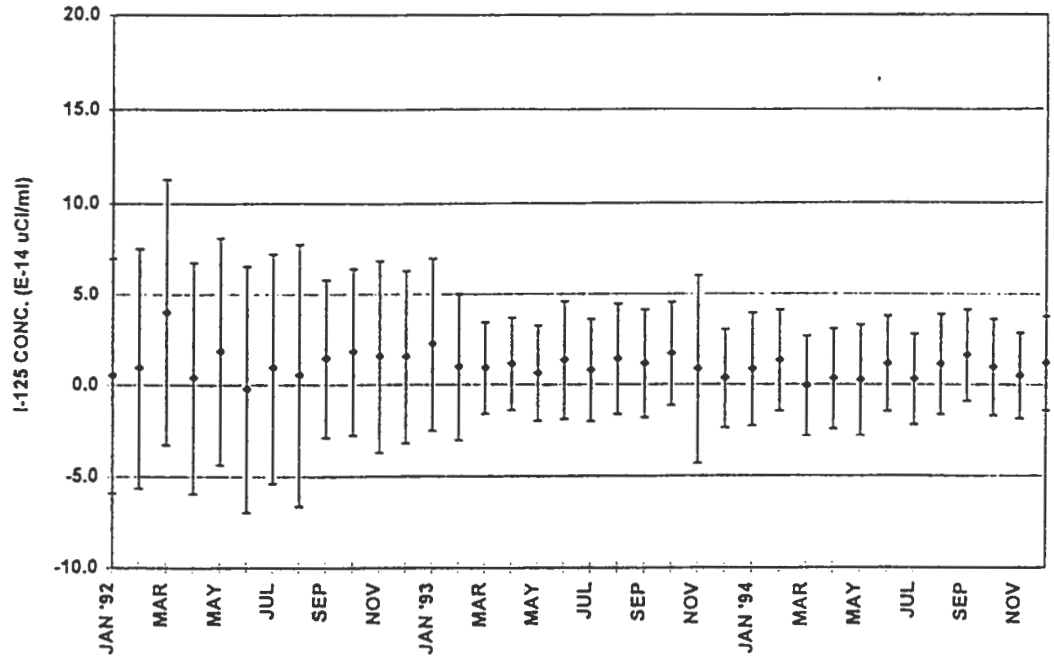
MONTHLY AVERAGE IODINE-125 ACTIVITY IN AIR
STATION 4 – 1992-94



5/30/95

FIGURE 5.50

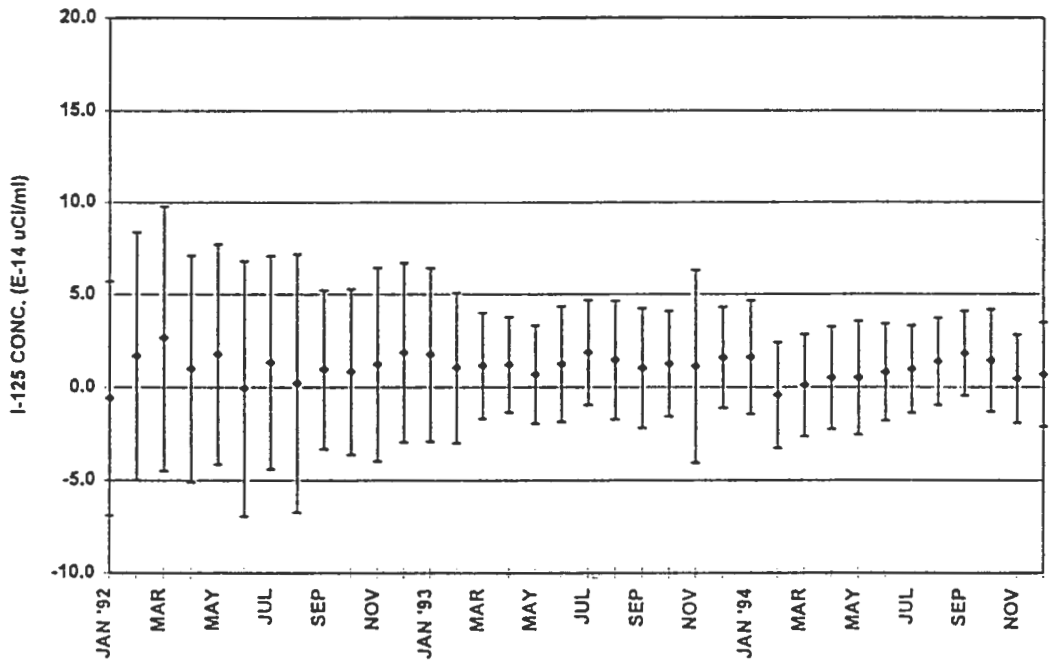
MONTHLY AVERAGE IODINE-125 ACTIVITY IN AIR
STATION 5 – 1992-94



5/30/95

FIGURE 5.51

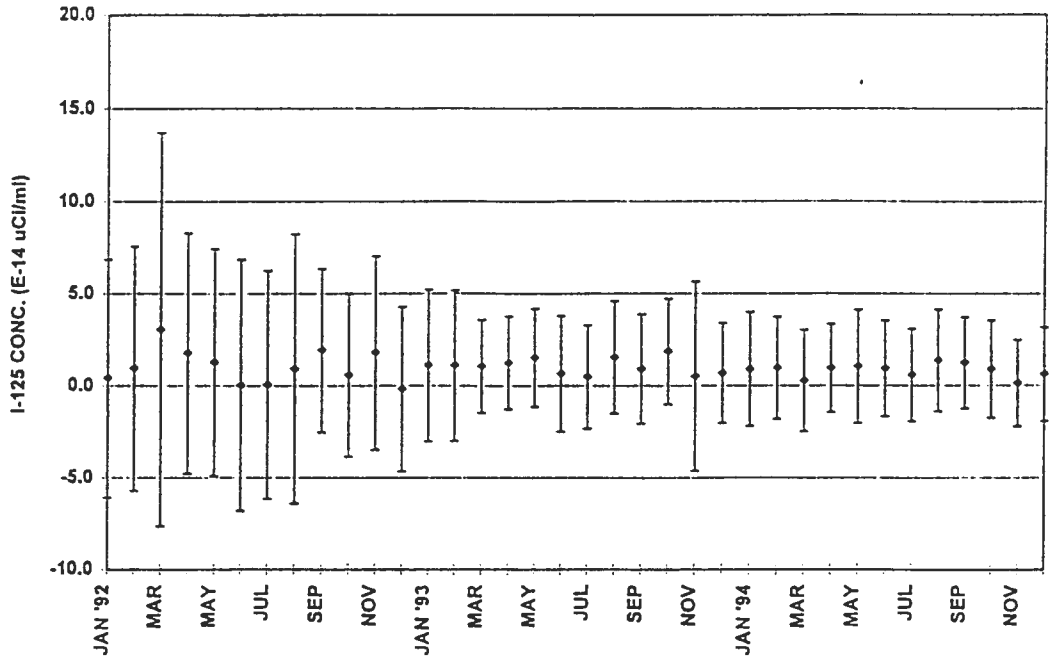
MONTHLY AVERAGE IODINE-125 ACTIVITY IN AIR
STATION 6 – 1992-94



5/30/95

FIGURE 5.52

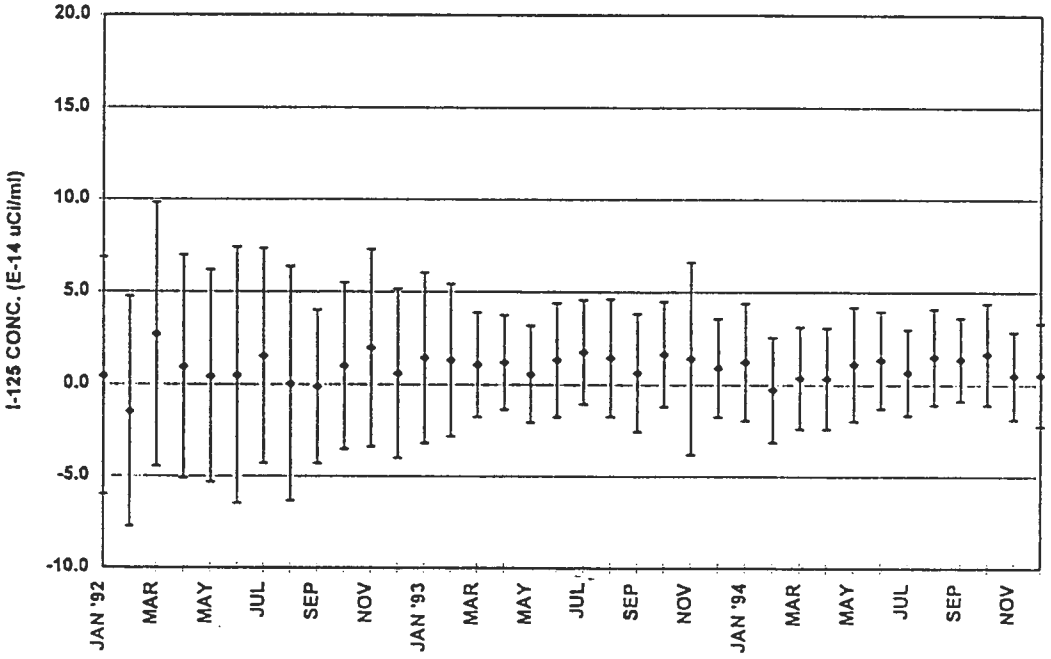
MONTHLY AVERAGE IODINE-125 ACTIVITY IN AIR
STATION 7 -- 1992-94



5/30/95

FIGURE 5.53

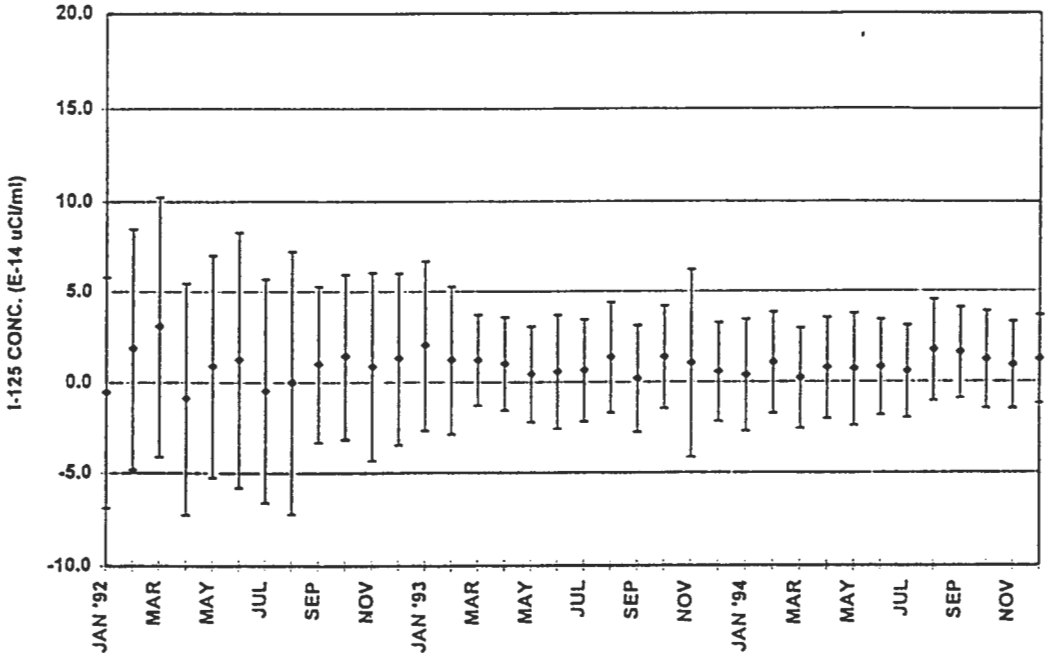
MONTHLY AVERAGE IODINE-125 ACTIVITY IN AIR
STATION 8 -- 1992-94



5/30/95

FIGURE 5.54

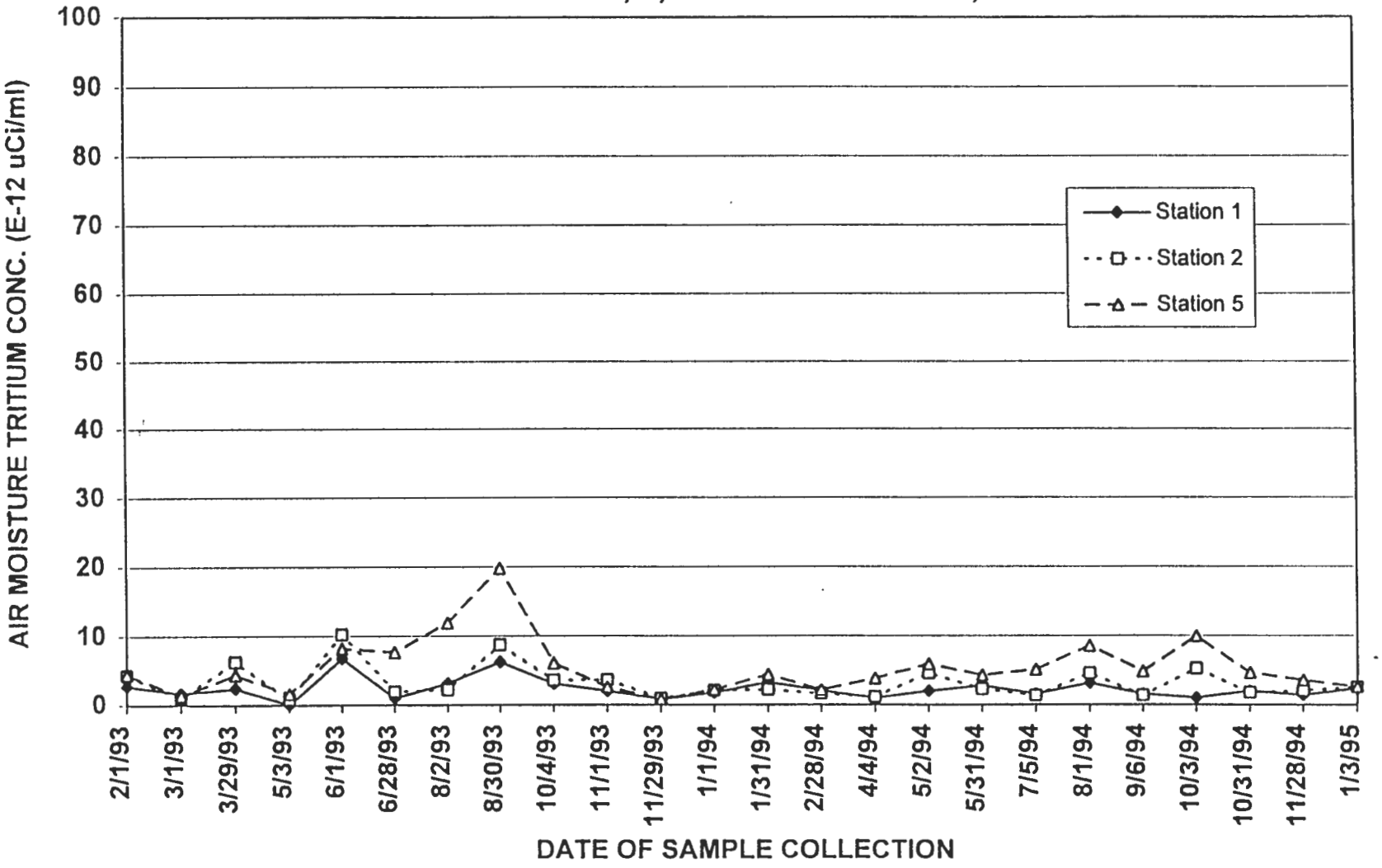
MONTHLY AVERAGE IODINE-125 ACTIVITY IN AIR
STATION 9 -- 1992-94



5/30/95

FIGURE 5.55

TRITIUM IN AIR MOISTURE 1993-94
STATIONS 1, 2, AND 5 -- RICHLAND, WA



5.2 Radioactivity in Soil

Soil samples are collected quarterly at the nine environmental air monitoring stations and at the northeast and northwest site corners. The samples are collected from undisturbed soil from an area of 12 inches by 12 inches by one inch deep. The soil is analyzed for gross beta, total uranium, isotopic plutonium, and gamma emitting radionuclides.

5.2.1 Gross Beta Analysis

The results of the quarterly soil analysis for gross beta activity are presented in Table 5.7. No soil samples taken during 1994 exceeded the gross beta activity action level of 35 pCi/g (dry) as defined in Table 6.1 of the Facility Standards Manual.

For 1994, the lowest value reported was 1.32 E+1 $\pm$ 2.2 E0 pCi/g at Station 7 during the first quarter. The greatest value reported was 2.20 E+1 $\pm$ 2.0 E0 pCi/g at Station 6 in the second quarter. The mean concentration of all samples reported is 17.2 pCi/g.

The US Ecology Historical Environmental Monitoring Report gives values of gross beta in soil ranging from 1.16 E+1 pCi/g to 1.06 E+02 pCi/g while the 1993 Annual Report gives values ranging from 1.53 E+1 $\pm$ 1.8 E0 pCi/g to 2.13 E+1 $\pm$ 2.9 E0 pCi/g. The 1993 Hanford Report does not present analytical results concerning gross beta activity in soil.

Figures 5.56 through 5.66 compare the 1992 through 1994 results and indicate no increasing trend. The values reported for gross beta activity are consistent with typical values found in the region; therefore, no contribution from the site is apparent for gross beta in the soil.

5.2.2 Total Uranium

The results of the quarterly analysis for uranium activity in soil are presented in Table 5.8. The soil is analyzed for uranium on a mass basis. The mass of uranium is then converted to an activity using the conversion factor of 6.77 E-7 Ci/g from 10 CFR 20, Appendix B, Note 3.

None of the samples taken during 1994 exceeded the action level of 1 pCi/g for total uranium in soil.

Total uranium concentrations in 1994 ranged from a low of 2.0 E-1 ± 1.0 E-2 pCi/g at Station 9 in the first quarter to a high of 7.4 E-1 ± 1.2 E-1 pCi/g at Station 1 in the fourth quarter. The mean concentration for samples reported is 4.0 E-1 pCi/g.

In the 1993 US Ecology Annual Environmental Report, the results of this analysis ranged from less than minimum detectable concentration to 7.80 E-1 ± 4.1 E-1 pCi/g. The 1993 Hanford Report lists total onsite uranium from a low of 3.0 E-1 pCi/g to a high of 1.50 E0 pCi/g. The Hanford Report also reports an average total uranium value of soil samples collected outside of the Hanford site at 6.50 E-1 pCi/g.

Figures 5.67 through 5.77 compare the 1992 through 1994 results with no indication of an increasing trend. The concentrations of uranium measured in US Ecology's samples are consistent with typical samples taken in the region. Consequently, no contribution from site activities is apparent for uranium in soil.

5.2.3 Isotopic Plutonium

The results of soil sample analysis for Pu-238 and Pu-239/240 are presented in Table 5.9 and Table 5.10, respectively.

5.2.3.1 Plutonium-238

All Pu-238 soil sample results were less than the minimum detectable concentration of 1.0 E-2 pCi/g-dry.

The 1993 Hanford Environmental Report lists plutonium-238 concentrations from a low of less than 5.93 E-5 ± 1.33 E-4 pCi/g south of 200 West to a high of 3.86 E-3 ± 6.33 E-4 pCi/g east of 200 West. The average value reported for plutonium-238 is 4.96 E-4 pCi/g.

5.2.3.2 Plutonium-239/240

All Pu-239/240 soil sample results were less than the minimum detectable concentration of 1.0 E-2 pCi/g-dry except Station 1 during the second quarter at a concentration of 1.0 E-2 $\pm$ 1.4 E-2 pCi/g-dry.

For plutonium-239/240, the 1993 Hanford Environmental Report lists a low of 5.66 E-4 $\pm$ 3.40 E-4 pCi/g at the west end of Fir Road. The highest value reported is 2.83 E-1 $\pm$ 5.37 E-3 pCi/g located east of the 200 West gate. The average value reported for plutonium-239/240 samples in the Hanford Environmental Report is 1.74 E-2 pCi/g.

Based on the results reported in the Hanford Environmental Report for 1993, US Ecology results appear to be consistent with plutonium-239/240 concentrations in soil in the area.

It can be concluded that site operations had no impact on isotopic plutonium concentrations in soil.

5.2.4 Spectrometry Analysis of Gamma Emitters in Soil

The results of gamma ray spectrometry for photon emitting radionuclides in soil are presented in Tables 5.12 through 5.22. Table 5.11 presents minimum detectable concentration (MDC) for various radionuclides in soil. Action levels in the US Ecology Facility Standard Manual (FSM) are set at five times the theoretical MDC with the exception of Cs-137 and Co-60. Action levels for Cs-137 and Co-60 are 0.25 pCi/g dry and 0.30 pCi/g dry, respectively. There were no radionuclides which exceeded the action levels in the Richland Facility Standards Manual (FSM).

Radionuclides which were identified at concentrations less than action level include beryllium-7, potassium-40, cobalt-60, cesium-137 and europium-155.

Beryllium-7 is a cosmogenically produced naturally occurring radionuclide. Values reported in 1994 soil samples ranged from less than the minimum detectable concentration to 2.5 E-1 $\pm$ 4.0 E-2 pCi/g at Station 3 during the second quarter.

Potassium-40 was reported for all locations during all quarters. Concentrations of potassium-40 in soil samples ranged from 9.57 E0 ± 1.7 E-1 pCi/g at Station 7 during the third quarter to 1.29 E+1 ± 1.6 E-1 pCi/g at Station 3 during the fourth quarter. These values are consistent with the range of naturally occurring potassium-40 typically found in soils.

Cobalt-60 was reported above the minimum detectable concentration of 2.0 E-2 pCi/g-dry in three samples. The maximum cobalt-60 concentration in soil was 8.0 E-2 + 1.0 E-2 pCi/g-dry at Station 2 during the second quarter.

Cesium-137 was reported as present at or slightly above the detection limit in 17 samples. The detection limit for cesium-137 is 0.02 pCi/g. The highest concentration reported was 9.2 E-2 ± 6.0 E-3 pCi/g in the fourth quarter at the northeast site corner.

Europium-155 was reported as detectable in twenty-four soil samples. The highest concentration was 1.7 E-1 ± 3.0 E-2 pCi/g at Station 6 and the northeast site corner during the first quarter. The minimum detectable concentration is 5.0 E-2 pCi/g.

Based on the infrequent occurrences of positive values together with their small magnitude, it can be concluded these results contribute negligible radiation exposure to any individual.

TABLE 5.7

Gross Beta Measurements in Soil at the Eleven Environmental Stations During 1994.

Station Number	GROSS BETA CONCENTRATION (pCi/g, dry) 1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1	19.6 ± 2.0	19.6 ± 1.8	17.7 ± 1.9	17.8 ± 1.9
2	15.5 ± 2.5	16.2 ± 1.9	17.2 ± 1.7	18.6 ± 2.1
3	14.5 ± 1.8	17.2 ± 1.6	18.3 ± 1.8	18.8 ± 2.0
4	16.4 ± 2.4	16.7 ± 1.6	15.7 ± 1.7	17.4 ± 2.1
5	16.1 ± 1.9	16.9 ± 1.8	14.7 ± 1.7	16.1 ± 1.7
6	16.7 ± 2.5	22.0 ± 2.0	18.0 ± 1.9	18.1 ± 1.8
7	13.2 ± 2.2	17.1 ± 1.8	19.8 ± 1.8	15.8 ± 1.7
8	19.2 ± 2.6	17.8 ± 1.7	14.3 ± 1.7	18.4 ± 1.8
9	16.1 ± 2.5	19.1 ± 1.9	17.9 ± 1.8	17.0 ± 1.8
NE	16.4 ± 2.4	17.3 ± 1.8	13.6 ± 1.6	17.7 ± 1.8
NW	18.2 ± 2.6	16.9 ± 1.7	16.3 ± 1.7	19.0 ± 1.9

NOTE: Minimum detectable concentration: 0.1 pCi/g-dry.

TABLE 5.8

Total Uranium Measured in Soil at the Eleven Environmental Monitoring Stations During 1994.

Station Number	TOTAL URANIUM (pCi/g-dry) 1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1	0.25 ± 0.01	0.50 ± 0.10	0.25 ± 0.06	0.74 ± 0.12
2	0.26 ± 0.01	0.40 ± 0.10	0.47 ± 0.07	0.39 ± 0.09
3	0.26 ± 0.01	0.55 ± 0.20	0.38 ± 0.09	0.52 ± 0.25
4	0.29 ± 0.01	0.47 ± 0.10	0.36 ± 0.09	0.45 ± 0.08
5	0.29 ± 0.01	0.60 ± 0.07	0.27 ± 0.07	0.41 ± 0.09
6	0.29 ± 0.01	0.48 ± 0.10	0.32 ± 0.09	0.69 ± 0.11
7	0.26 ± 0.03	0.50 ± 0.10	0.36 ± 0.10	0.36 ± 0.07
8	0.29 ± 0.01	0.53 ± 0.10	0.45 ± 0.10	0.63 ± 0.10
9	0.20 ± 0.01	0.41 ± 0.10	0.35 ± 0.08	0.43 ± 0.10
NE	0.29 ± 0.01	0.40 ± 0.09	0.34 ± 0.09	0.57 ± 0.06
NW	0.27 ± 0.01	0.35 ± 0.06	0.42 ± 0.08	0.40 ± 0.07

NOTE: (a) Minimum detectable concentration: 0.2 pCi/g-dry.

TABLE 5.9

Plutonium-238 Measured in Soil at the Eleven Environmental Monitoring Stations During 1994.

Station Number	PLUTONIUM-238 CONCENTRATION (pCi/g, dry) 1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1	0.001 ± 0.002	-0.006 ± 0.020	0.001 ± 0.003	0.002 ± 0.002
2	0.002 ± 0.003	-0.002 ± 0.017	0.000 ± 0.002	0.000 ± 0.001
3	0.004 ± 0.003	-0.001 ± 0.010	0.001 ± 0.008	0.001 ± 0.002
4	-0.003 ± 0.006	-0.008 ± 0.008	-0.001 ± 0.003	0.000 ± 0.002
5	0.000 ± 0.002	-0.003 ± 0.011	0.000 ± 0.007	0.000 ± 0.003
6	-0.002 ± 0.002	-0.002 ± 0.004	-0.003 ± 0.010	0.000 ± 0.004
7	0.002 ± 0.003	0.001 ± 0.004	-0.002 ± 0.003	0.001 ± 0.002
8	0.003 ± 0.005	-0.008 ± 0.019	0.000 ± 0.001	0.000 ± 0.001
9	0.000 ± 0.002	0.002 ± 0.006	0.001 ± 0.001	0.001 ± 0.001
NE	0.001 ± 0.009	-0.001 ± 0.004	0.000 ± 0.001	0.000 ± 0.001
NW	0.001 ± 0.004	-0.002 ± 0.004	0.000 ± 0.002	0.000 ± 0.001

NOTE: (a) Minimum detectable concentration: 0.01 pCi/g-dry.

TABLE 5.10

Plutonium-239/240 Measured in Soil at the Eleven Environmental Monitoring Stations During 1994.

Station Number	PLUTONIUM-239/240 CONCENTRATION (pCi/g, dry) 1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1	0.004 ± 0.002	0.010 ± 0.014	0.000 ± 0.002	0.000 ± 0.001
2	0.002 ± 0.002	-0.005 + 0.024	0.000 ± 0.001	0.000 ± 0.001
3	0.005 ± 0.003	-0.002 ± 0.007	0.000 ± 0.005	0.000 ± 0.002
4	0.003 ± 0.005	0.002 ± 0.003	0.002 ± 0.004	0.000 ± 0.001
5	0.003 ± 0.001	0.006 ± 0.013	0.003 ± 0.007	0.002 ± 0.004
6	0.003 ± 0.002	0.003 ± 0.005	0.002 ± 0.006	-0.003 ± 0.006
7	-0.002 ± 0.005	0.004 ± 0.006	0.000 ± 0.002	0.001 ± 0.002
8	0.003 ± 0.005	0.002 ± 0.002	0.000 ± 0.002	0.000 ± 0.002
9	0.003 ± 0.002	0.000 ± 0.006	0.001 ± 0.001	0.000 ± 0.001
NE	0.002 ± 0.007	0.000 ± 0.006	0.002 ± 0.001	0.002 ± 0.002
NW	0.005 ± 0.005	0.005 ± 0.006	0.002 ± 0.002	0.001 ± 0.001

NOTE: (a) Minimum detectable concentration: 0.01 pCi/g-dry.

TABLE 5.11

Required Minimum Detectable Concentrations for Gamma Spectroscopy Analysis of Soil Samples During 1994.

Nuclide	Limit (pCi/g, dry)
Na-22	0.02
Mn-54	0.02
Co-58	0.02
Co-60	0.02
Fe-59	0.03
Zn-65	0.04
As-76	0.03
Zr/Nb-95	0.03
Mo-99	0.14
Ru-103	0.02
Ru-106	0.17
Sb-124	0.02
Sb-125	0.05
I-131	0.02
I-133	0.02
Cs-134	0.02
Cs-137	0.02
Ba/La-140	0.05
Ce-141	0.02
Ce/Pr-144	0.18
Eu-152	0.11
Eu-154	0.05
Eu-155	0.05

TABLE 5.12

Gamma Spectrometry Analysis of Soil Samples During 1994 at Environmental Monitoring Station Number 1 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	0.07 ± 0.03	0.14 ± 0.04		
K-40	10.78 ± 0.13	10.55 ± 0.17	10.35 ± 0.18	12.28 ± 0.17
Co-60	0.006 ± 0.004			
Cs-137	0.04 ± 0.01	0.03 ± 0.01	0.015 ± 0.006	0.014 ± 0.005
Eu-155		0.15 ± 0.04	0.13 ± 0.04	

NOTE: See Table 5.11 for other nuclides and specific MDC values for each.

TABLE 5.13

Gamma Spectrometry Analysis of Soil Samples During 1994 at Environmental Monitoring Station Number 2 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	0.05 ± 0.03			
K-40	10.28 ± 0.12	10.48 ± 0.19	10.52 ± 0.17	11.84 ± 0.19
Co-60	0.05 ± 0.01	0.08 ± 0.01	0.013 ± 0.005	0.046 ± 0.008
Cs-137	0.06 ± 0.01	0.08 ± 0.01	0.018 ± 0.004	0.054 ± 0.008
Eu-155	0.10 ± 0.03	0.16 ± 0.03	0.13 ± 0.03	

NOTE: See Table 5.11 for other nuclides and specific MDC values for each.

TABLE 5.14

Gamma Spectrometry Analysis of Soil Samples During 1994 at Environmental Monitoring Station Number 3 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	0.11 ± 0.03	0.25 ± 0.04		
K-40	11.67 ± 0.14	12.57 ± 0.16	10.29 ± 0.18	12.91 ± 0.16
Co-60				0.019 ± 0.005
Cs-137	0.007 ± 0.003			0.023 ± 0.005
Eu-155			0.14 ± 0.04	

NOTE: See Table 5.11 for other nuclides and specific MDC values for each.

TABLE 5.15

Gamma Spectrometry Analysis of Soil Samples During 1994 at Environmental Monitoring Station Number 4 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	0.12 ± 0.05	0.24 ± 0.03		0.12 ± 0.05
K-40	10.2 ± 0.18	10.02 ± 0.12	11.02 ± 0.19	11.13 ± 0.17
Eu-155	0.14 ± 0.04		0.16 ± 0.04	0.028 ± 0.016

NOTE: See Table 5.11 for other nuclides and specific MDC values for each.

TABLE 5.16

Gamma Spectrometry Analysis of Soil Samples During 1994 at Environmental Monitoring Station Number 5 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	0.06 ± 0.02	0.14 ± 0.03	0.09 ± 0.05	0.13 ± 0.05
K-40	10.53 ± 0.12	10.10 ± 0.11	10.17 ± 0.16	11.32 ± 0.18
Cs-137	0.013 ± 0.003	0.008 ± 0.003		
Eu-155			0.12 ± 0.03	0.030 ± 0.017

NOTE: See Table 5.11 for other nuclides and specific MDC values for each.

TABLE 5.17

Gamma Spectrometry Analysis of Soil Samples During 1994 at Environmental Monitoring Station Number 6 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
K-40	10.66 ± 0.14	10.04 ± 0.16	10.12 ± 0.12	10.57 ± 0.17
Cs-137	0.008 ± 0.004	0.017 ± 0.005	0.008 ± 0.004	
Eu-155	0.17 ± 0.03	0.15 ± 0.04	0.14 ± 0.02	0.031 ± 0.018

NOTE: See Table 5.11 for other nuclides and specific MDC values for each.

TABLE 5.18

Gamma Spectrometry Analysis of Soil Samples During 1994 at Environmental Monitoring Station Number 7 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7				0.10 ± 0.04
K-40	10.09 ± 0.18	10.41 ± 0.12	9.57 ± 0.17	11.77 ± 0.14
Cs-137	0.012 ± 0.005		0.009 ± 0.006	0.009 ± 0.004
Eu-155	0.13 ± 0.04		0.14 ± 0.03	0.028 ± 0.014

NOTE: See Table 5.11 for other nuclides and specific MDC values for each.

TABLE 5.19

Gamma Spectrometry Analysis of Soil Samples During 1994 at Environmental Monitoring Station Number 8 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	0.06 ± 0.03	0.08 ± 0.03		
K-40	10.91 ± 0.13	11.10 ± 0.12	10.40 ± 0.12	12.69 ± 0.21
Cs-137	0.026 ± 0.004	0.024 ± 0.004	0.011 ± 0.004	
Eu-155	0.11 ± 0.03	0.15 ± 0.03	0.15 ± 0.03	

NOTE: See Table 5.11 for other nuclides and specific MDC values for each.

TABLE 5.20

Gamma Spectrometry Analysis of Soil Samples During 1994 at Environmental Monitoring Station Number 9 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	0.05 ± 0.03			
K-40	11.17 ± 0.13	10.84 ± 0.12	10.67 ± 0.17	10.62 ± 0.19
Cs-137	0.026 ± 0.004	0.019 ± 0.003	0.028 ± 0.005	
Eu-155	0.14 ± 0.03	0.14 ± 0.03	0.15 ± 0.04	

NOTE: See Table 5.11 for other nuclides and specific MDC values for each.

TABLE 5.21

Gamma Spectrometry Analysis of Soil Samples During 1994 at the NE Site Corner (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	0.07 ± 0.05	0.10 ± 0.03		
K-40	11.20 ± 0.17	10.41 ± 0.10	10.25 ± 0.18	10.42 ± 0.17
Cs-137	0.022 ± 0.005	0.015 ± 0.003	0.086 ± 0.007	0.092 ± 0.006
Eu-155	0.17 ± 0.03		0.15 ± 0.03	0.028 ± 0.014

NOTE: See Table 5.11 for other nuclides and specific MDC values for each.

TABLE 5.22

Gamma Spectrometry Analysis of Soil Samples During 1994 at the NW Site Corner (pCi/g, dry)

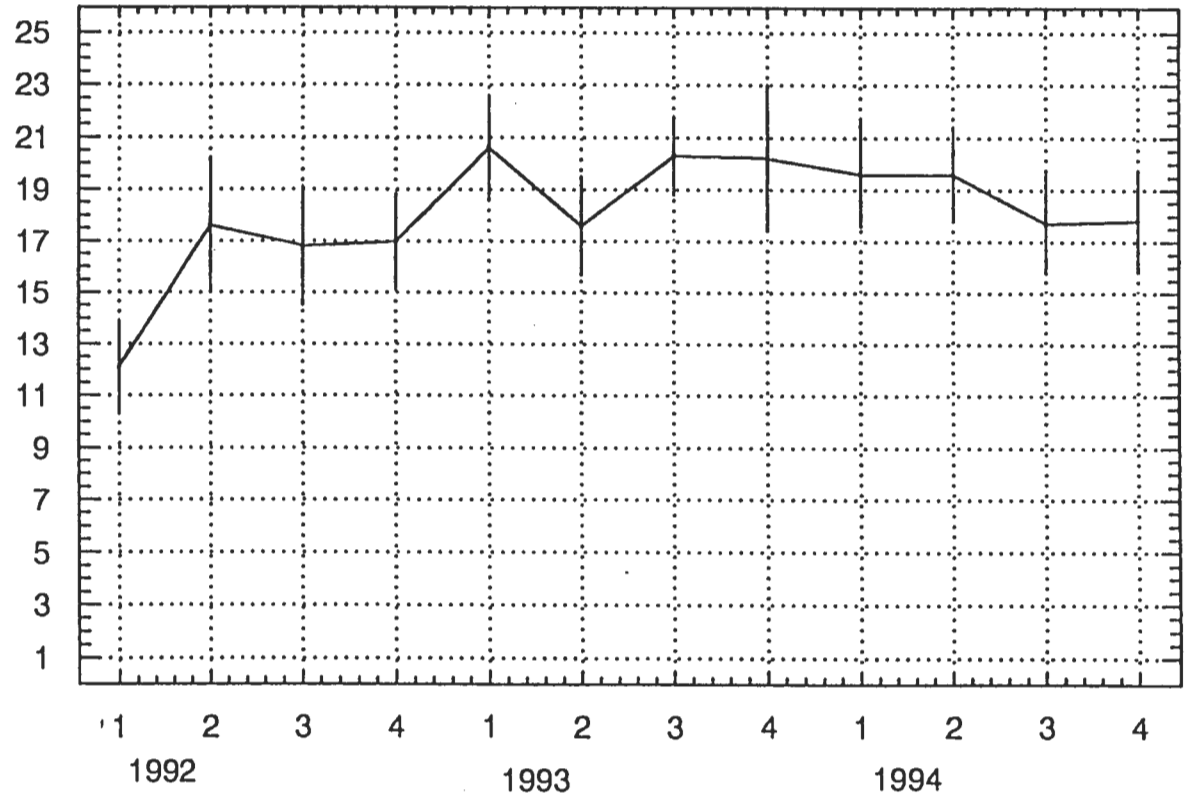
CALENDAR QUARTER 1994

Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7		0.08 ± 0.02		
K-40	10.68 ± 0.13	10.76 ± 0.11	10.86 ± 0.17	10.81 ± 0.17
Cs-137	0.068 ± 0.005	0.08 ± 0.01	0.059 ± 0.005	0.030 ± 0.005
Eu-155	0.15 ± 0.03		0.14 ± 0.03	0.026 ± 0.015

NOTE: See Table 5.11 for other nuclides and specific MDC values for each.

FIGURE 5.56

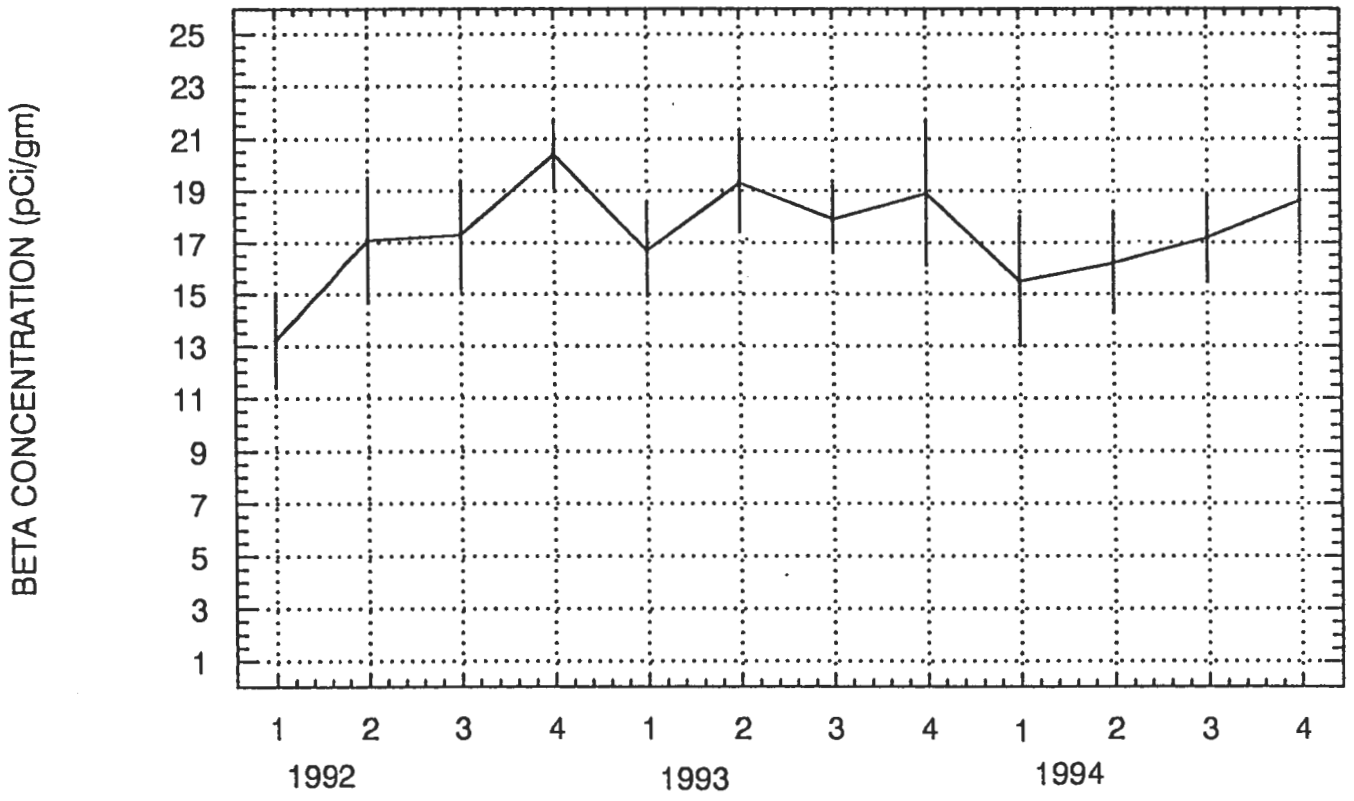
GROSS BETA IN SOIL
STATION 1- RICHLAND, WASHINGTON



4-26-95

FIGURE 5.57

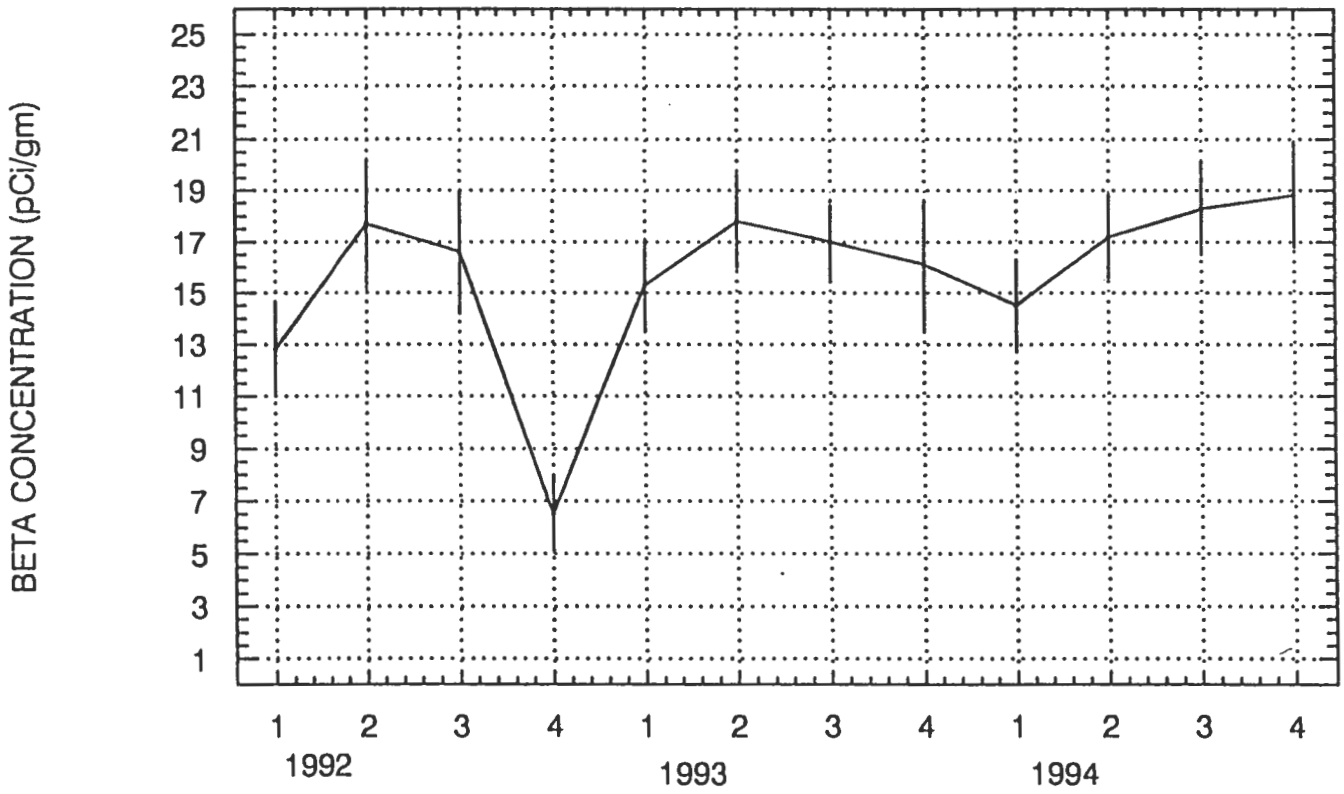
GROSS BETA IN SOIL
STATION 2- RICHLAND, WASHINGTON



4-26-95

FIGURE 5.58

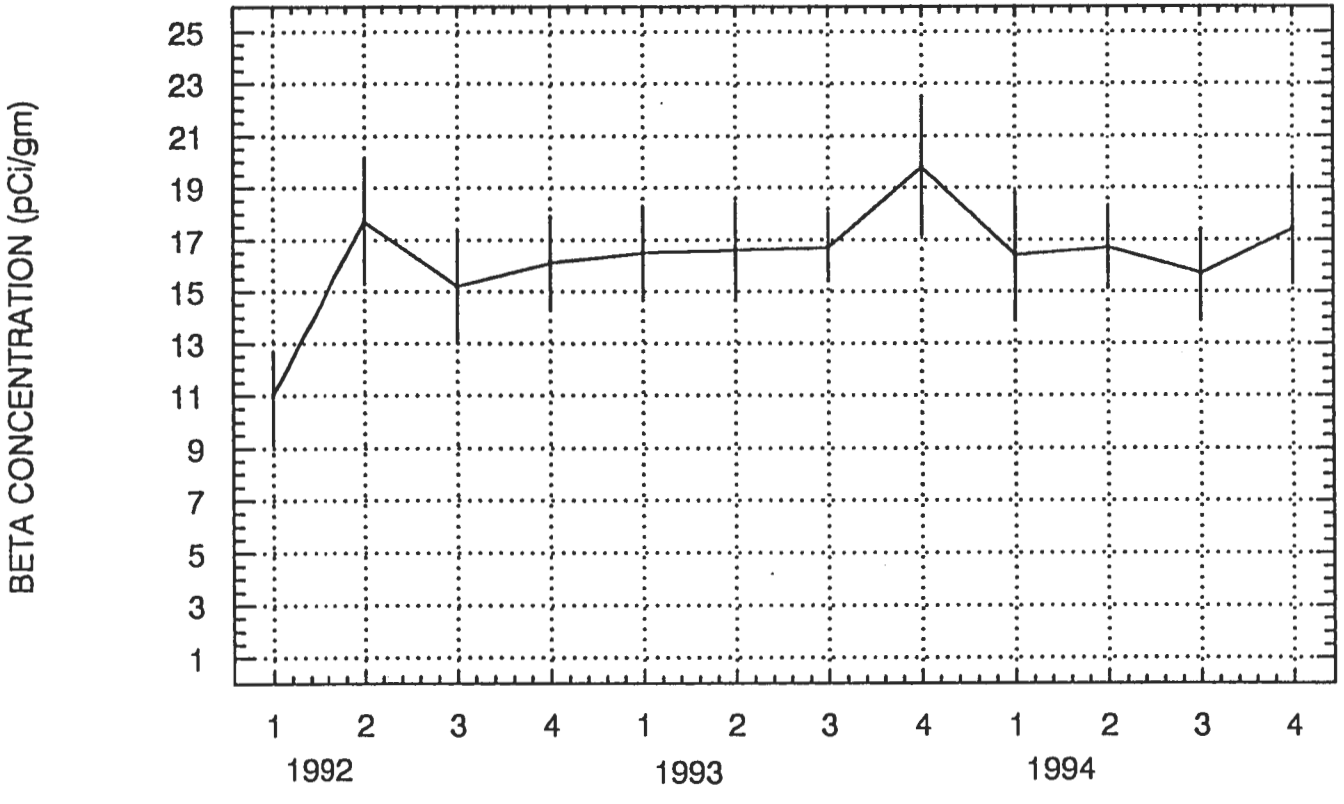
GROSS BETA IN SOIL
STATION 3- RICHLAND, WASHINGTON



4-26-95

FIGURE 5.59

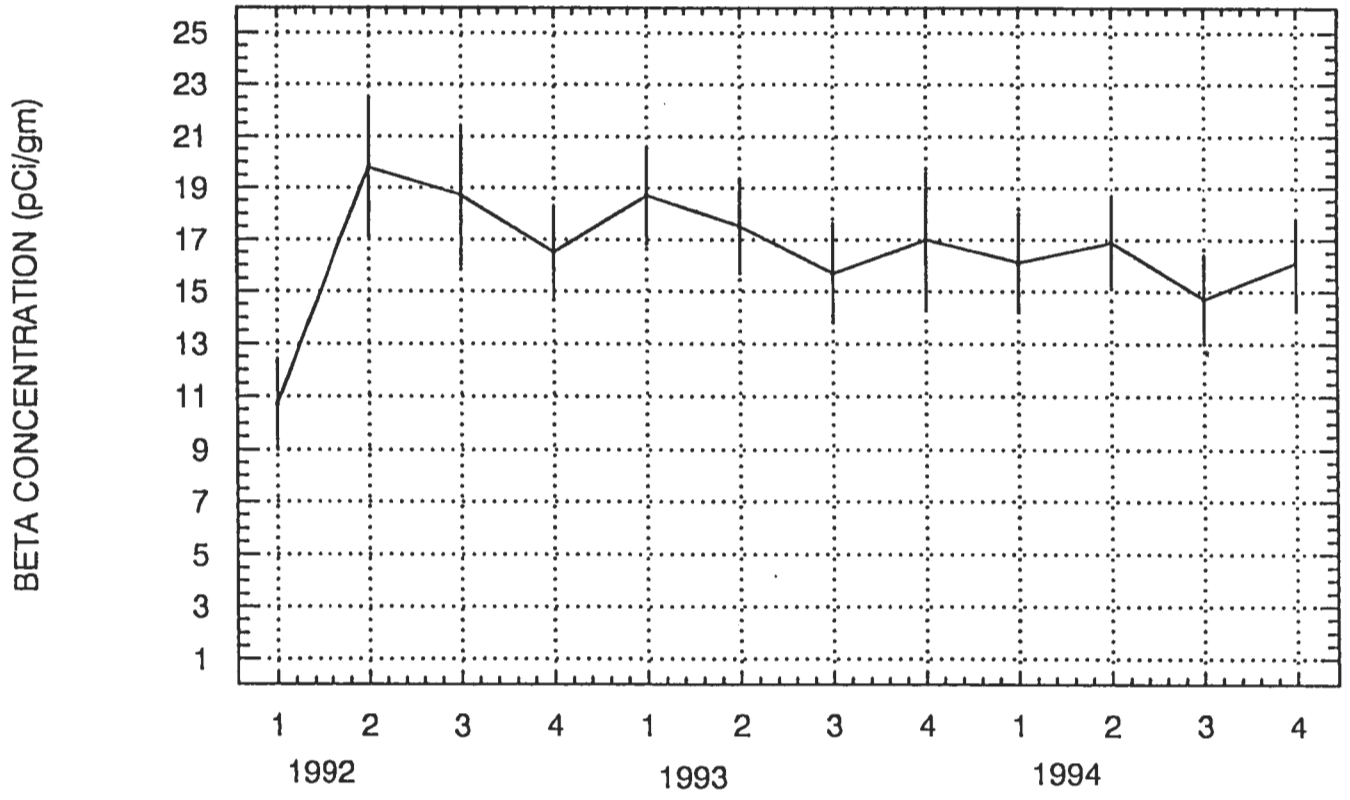
GROSS BETA IN SOIL
STATION 4- RICHLAND, WASHINGTON



4-26-95

FIGURE 5.60

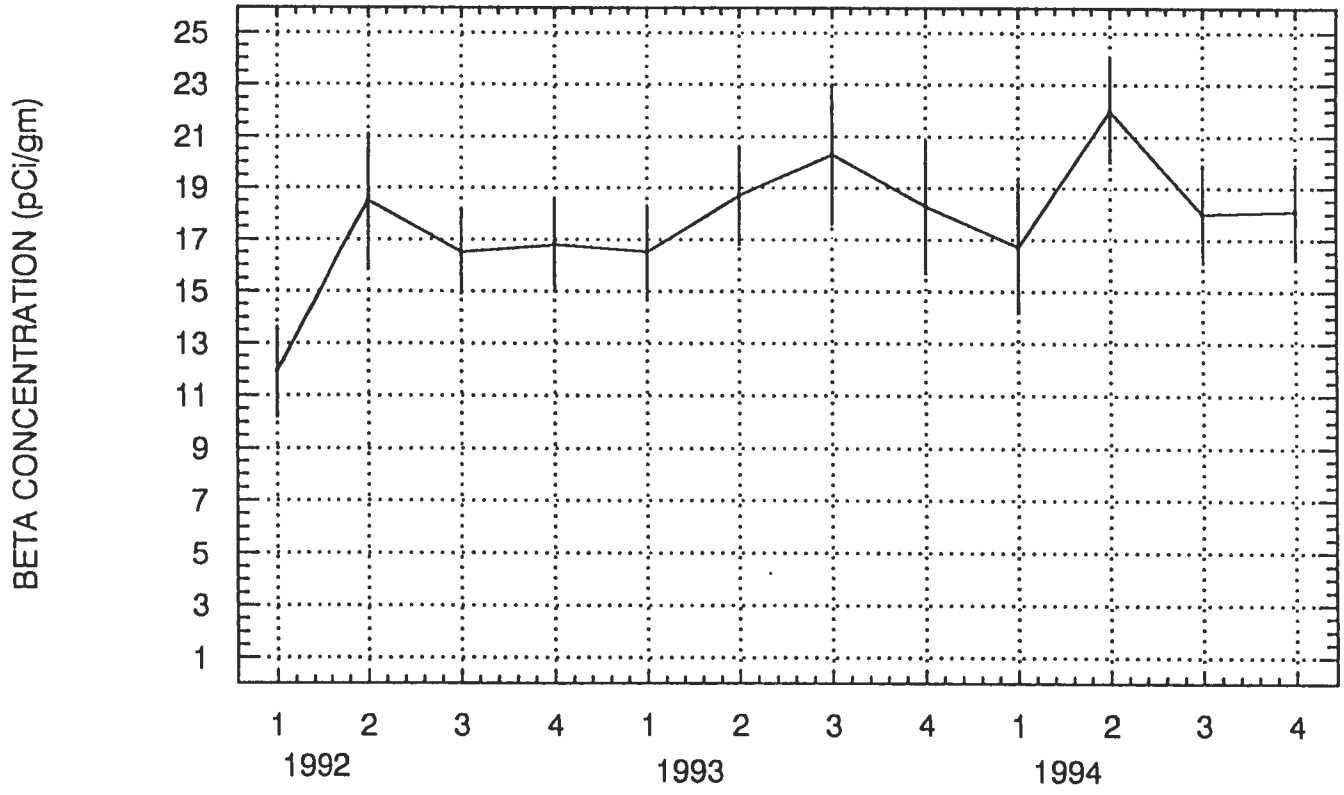
GROSS BETA IN SOIL
STATION 5- RICHLAND, WASHINGTON



4-26-95

FIGURE 5.61

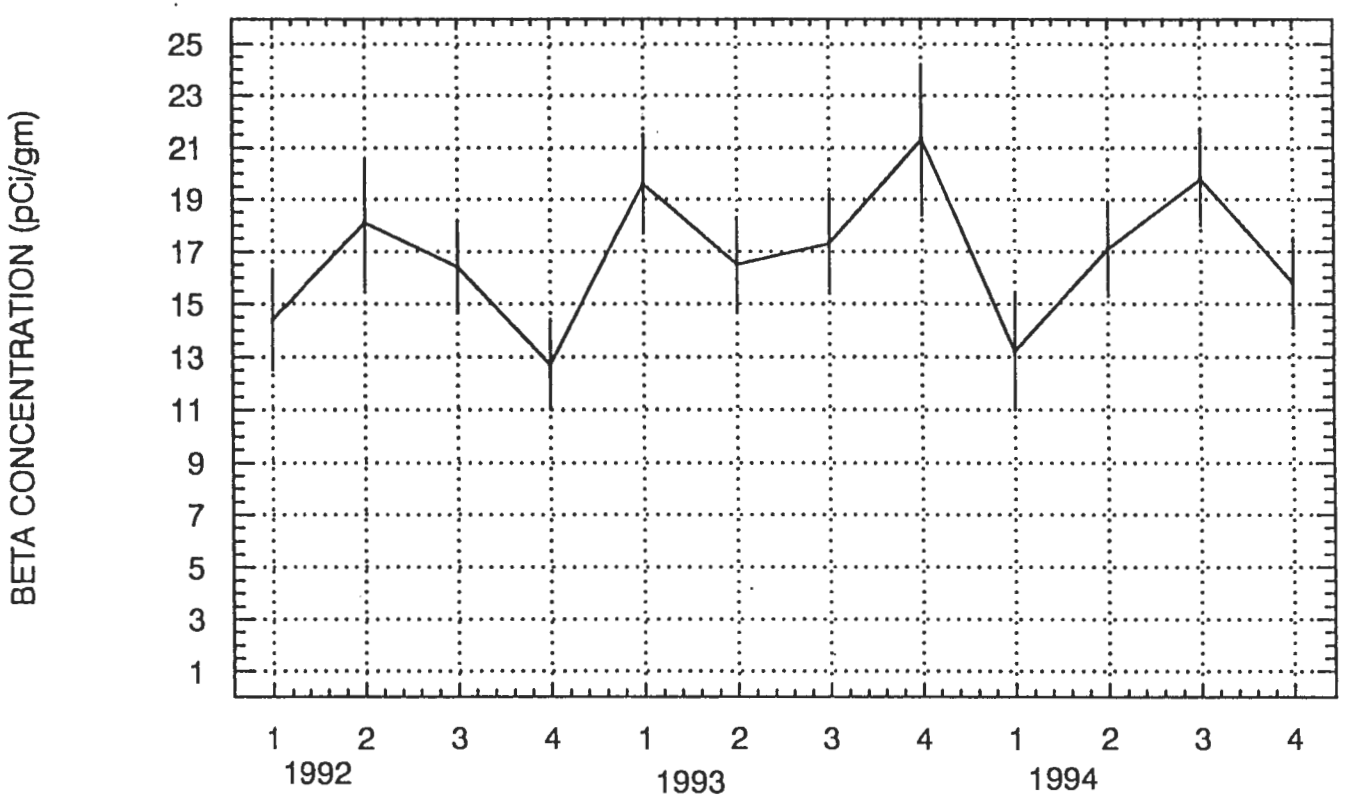
GROSS BETA IN SOIL
STATION 6- RICHLAND, WASHINGTON



4-26-95

FIGURE 5.62

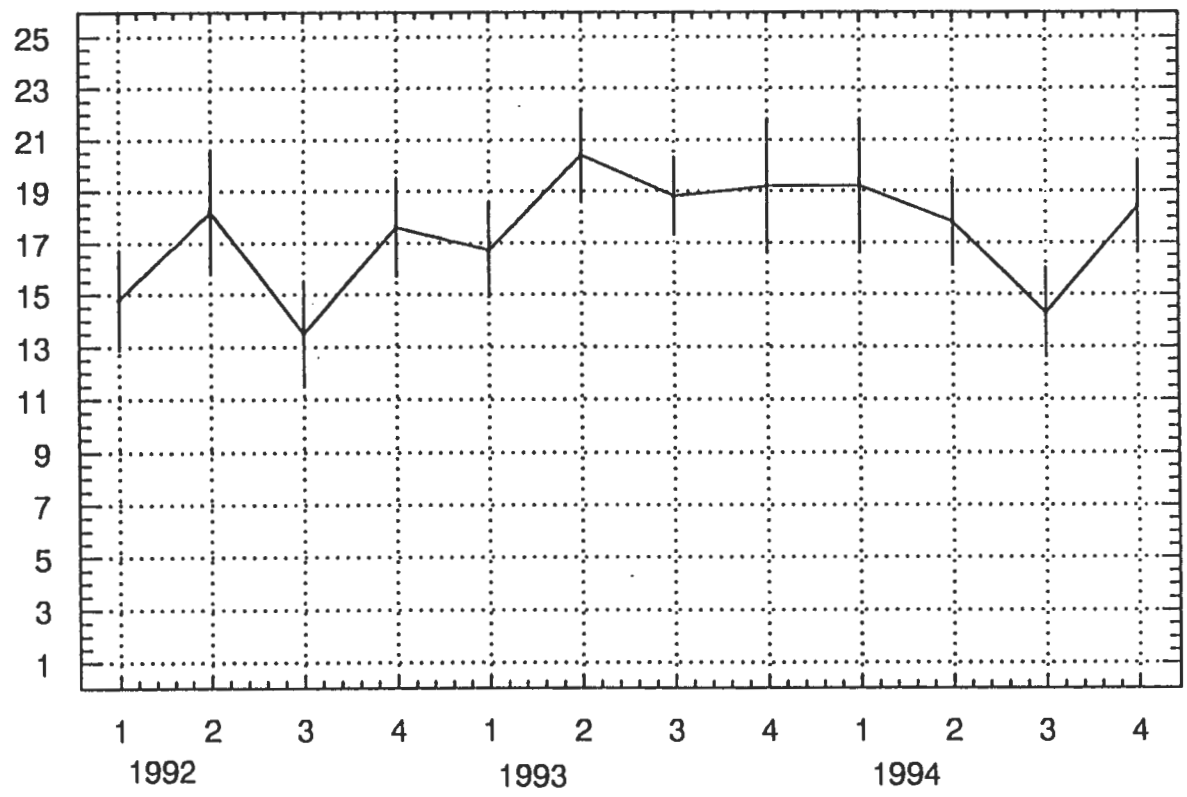
GROSS BETA IN SOIL
STATION 7- RICHLAND, WASHINGTON



4-26-95

FIGURE 5.63

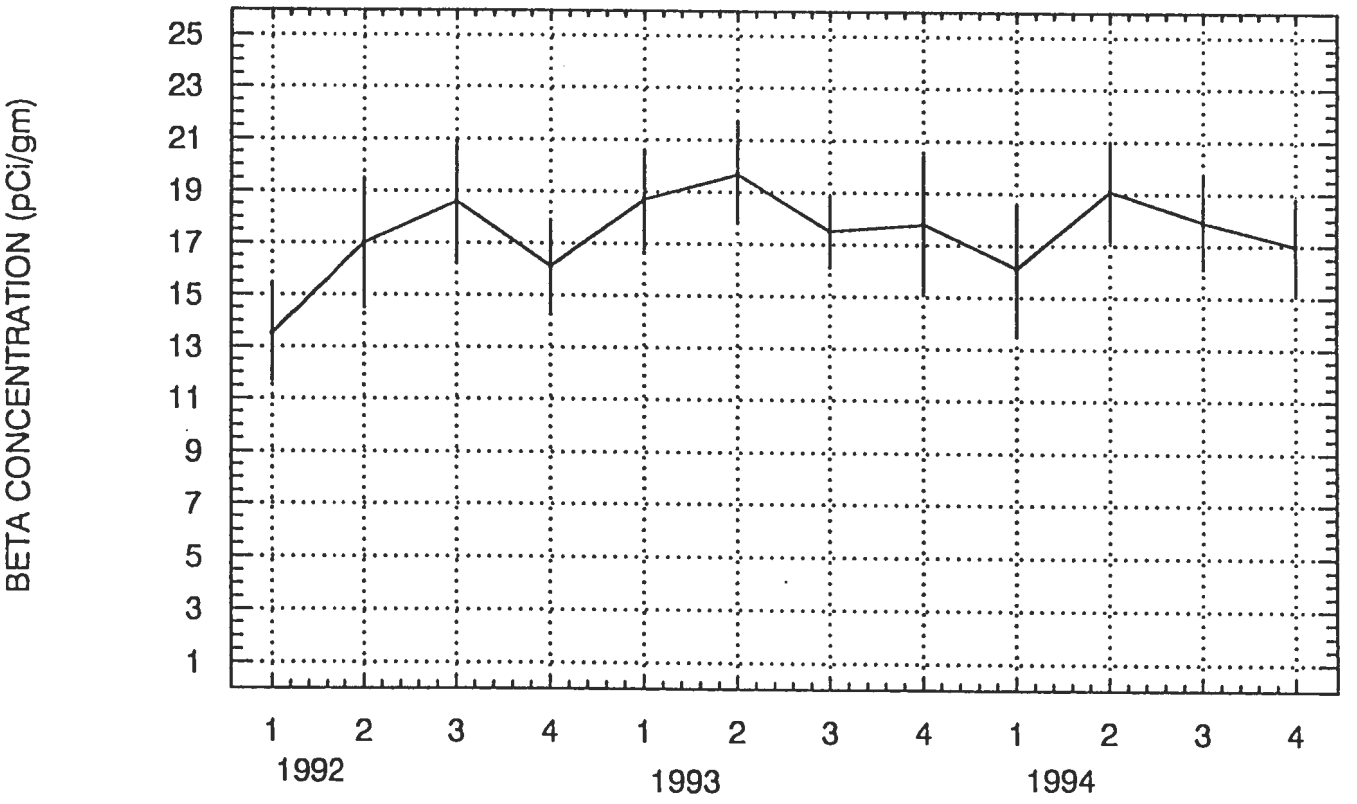
GROSS BETA IN SOIL
STATION 8- RICHLAND, WASHINGTON



4-26-95

FIGURE 5.64

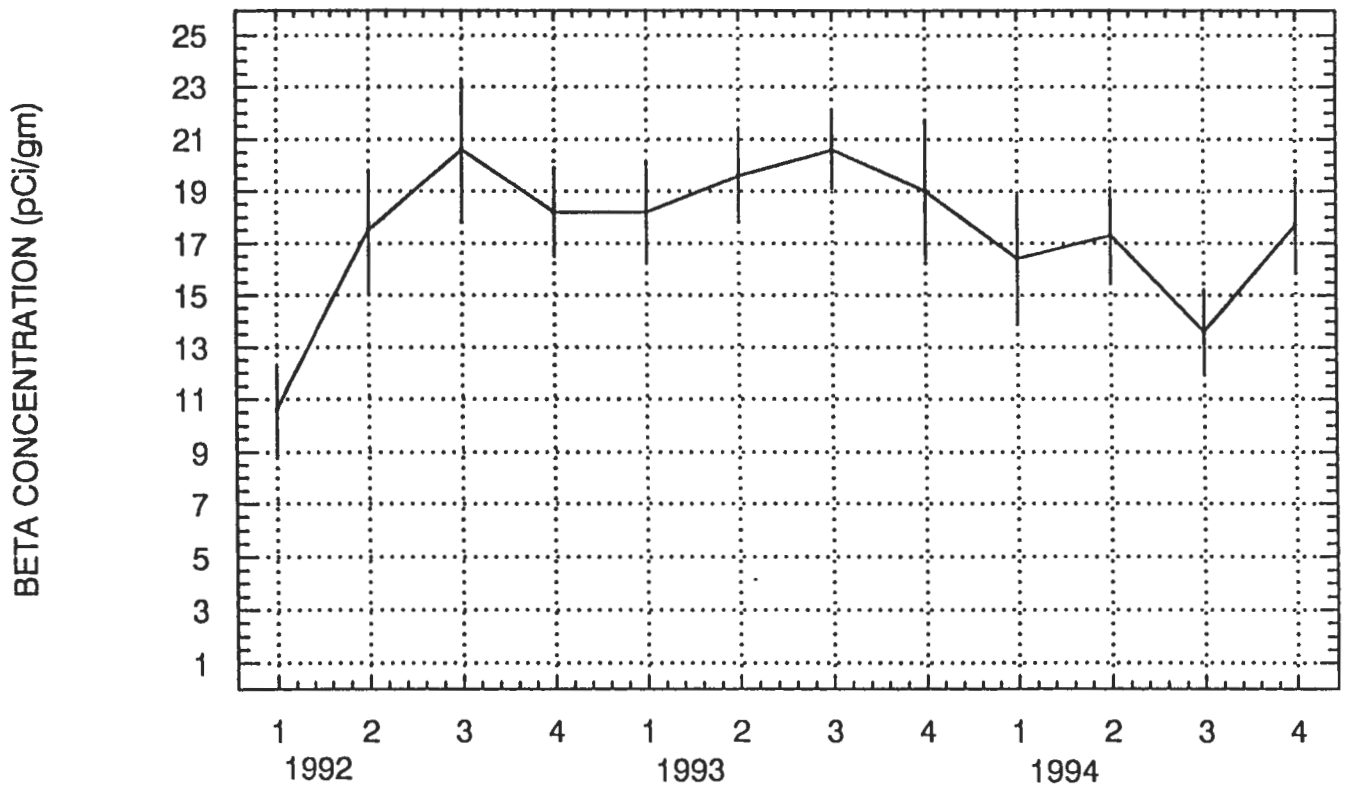
GROSS BETA IN SOIL
STATION 9- RICHLAND, WASHINGTON



4-26-95

FIGURE 5.65

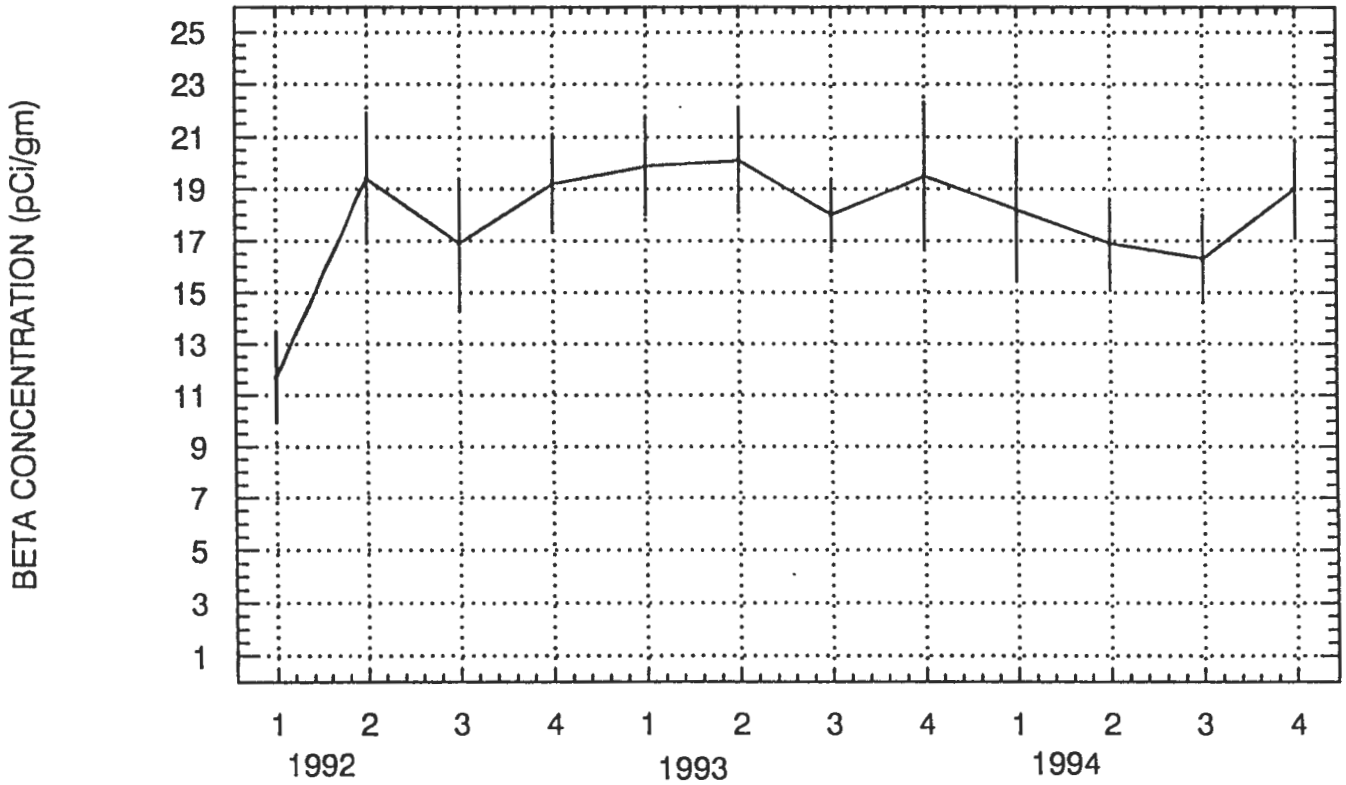
GROSS BETA IN SOIL
NORTHEAST STATION- RICHLAND, WASHINGTON



4-26-95

FIGURE 5.66

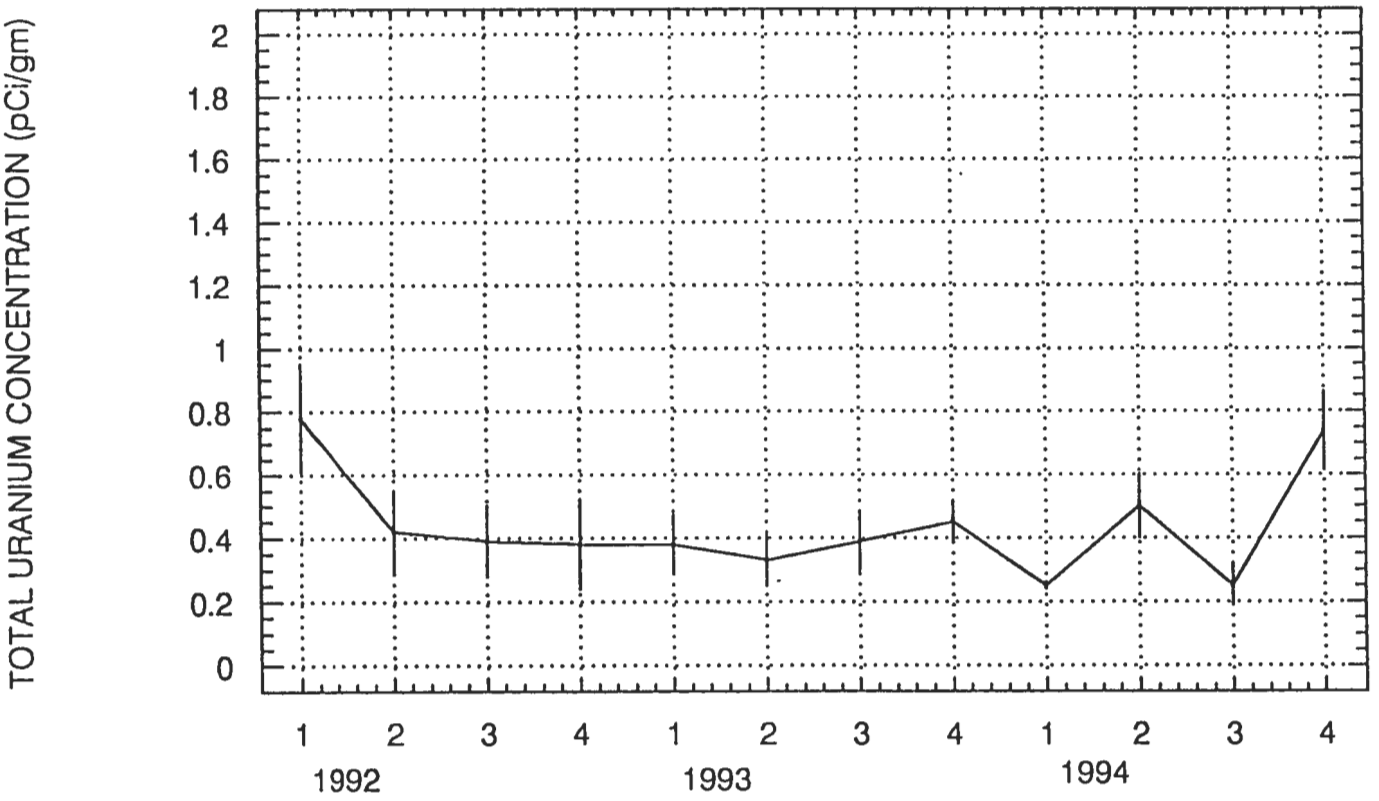
GROSS BETA IN SOIL
NORTHWEST STATION- RICHLAND, WASHINGTON



4-27-95

FIGURE 5.67

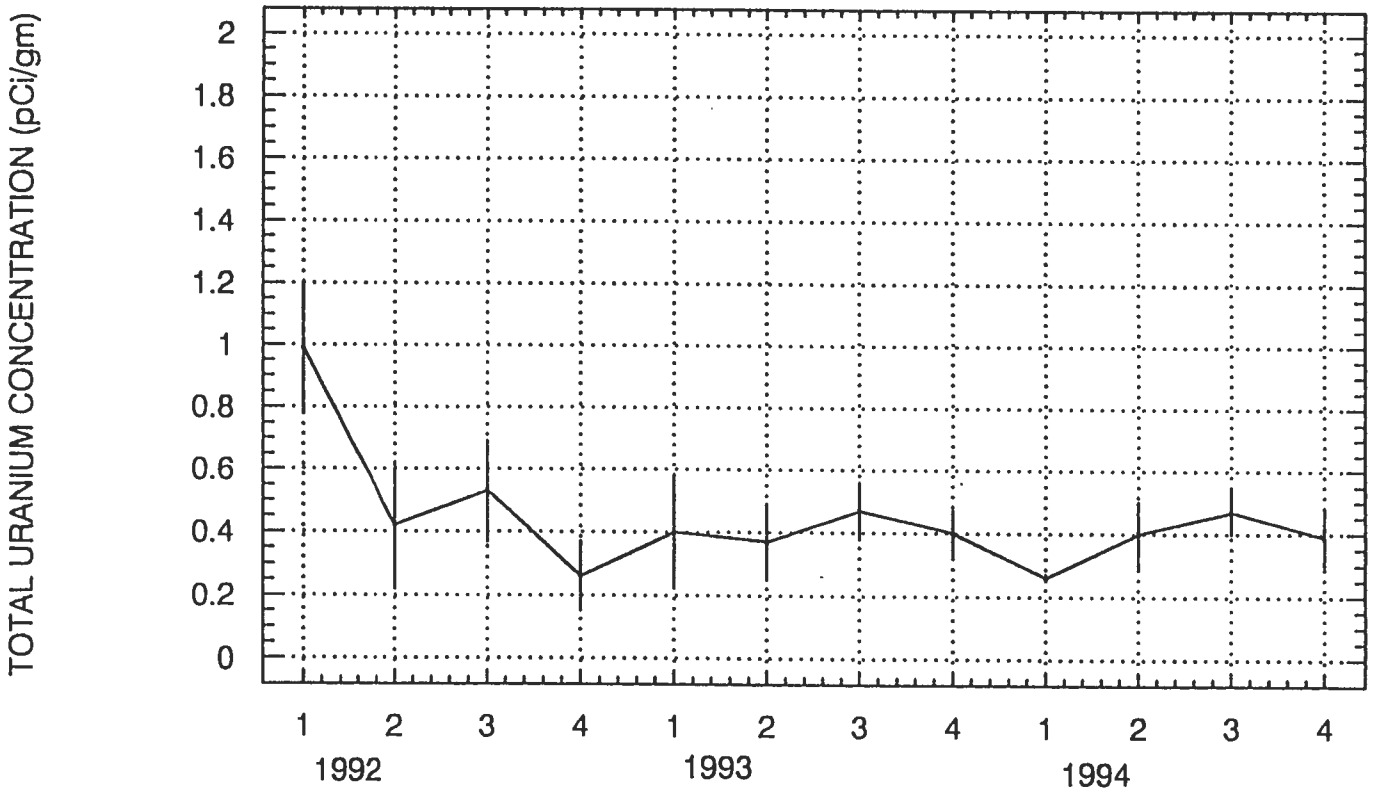
TOTAL URANIUM IN SOIL
STATION 1- RICHLAND, WASHINGTON



4-27-95

FIGURE 5.68

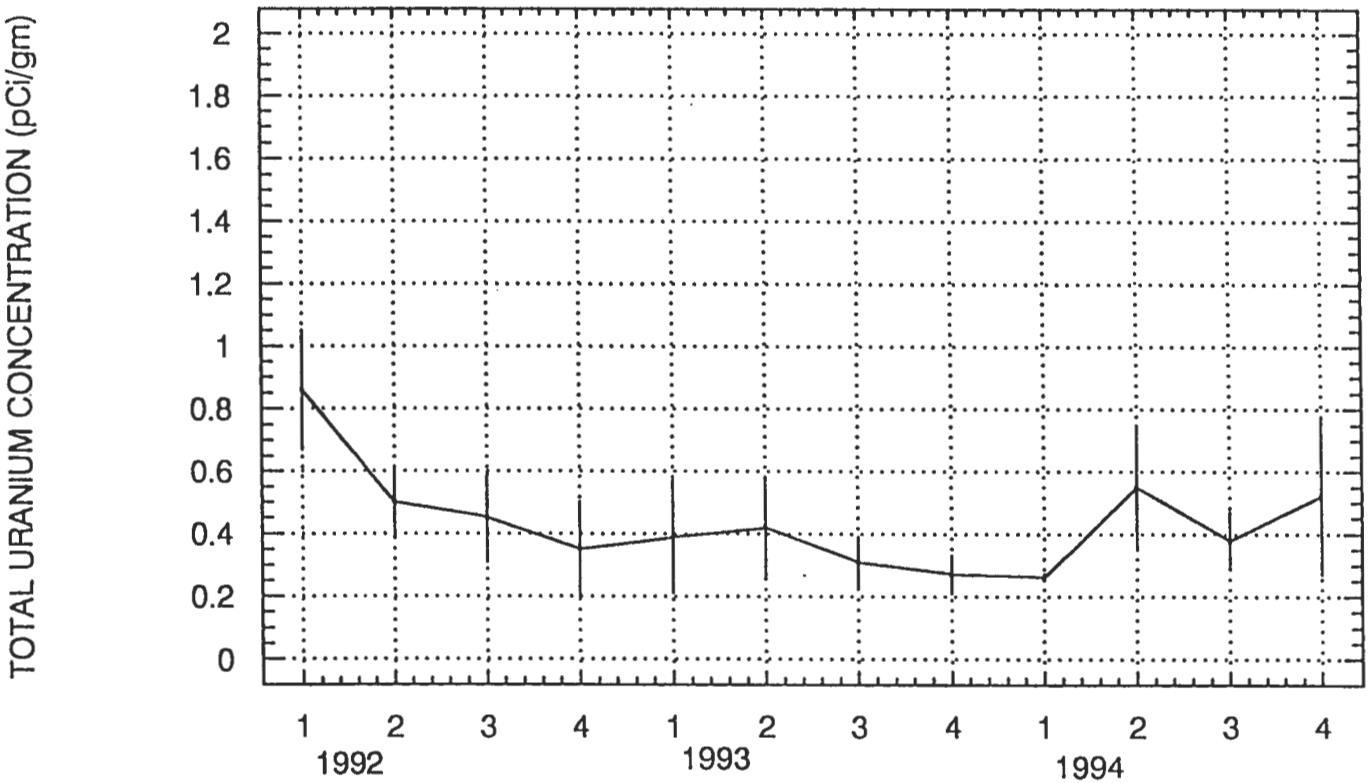
TOTAL URANIUM IN SOIL
STATION 2- RICHLAND, WASHINGTON



4-27-95

FIGURE 5.69

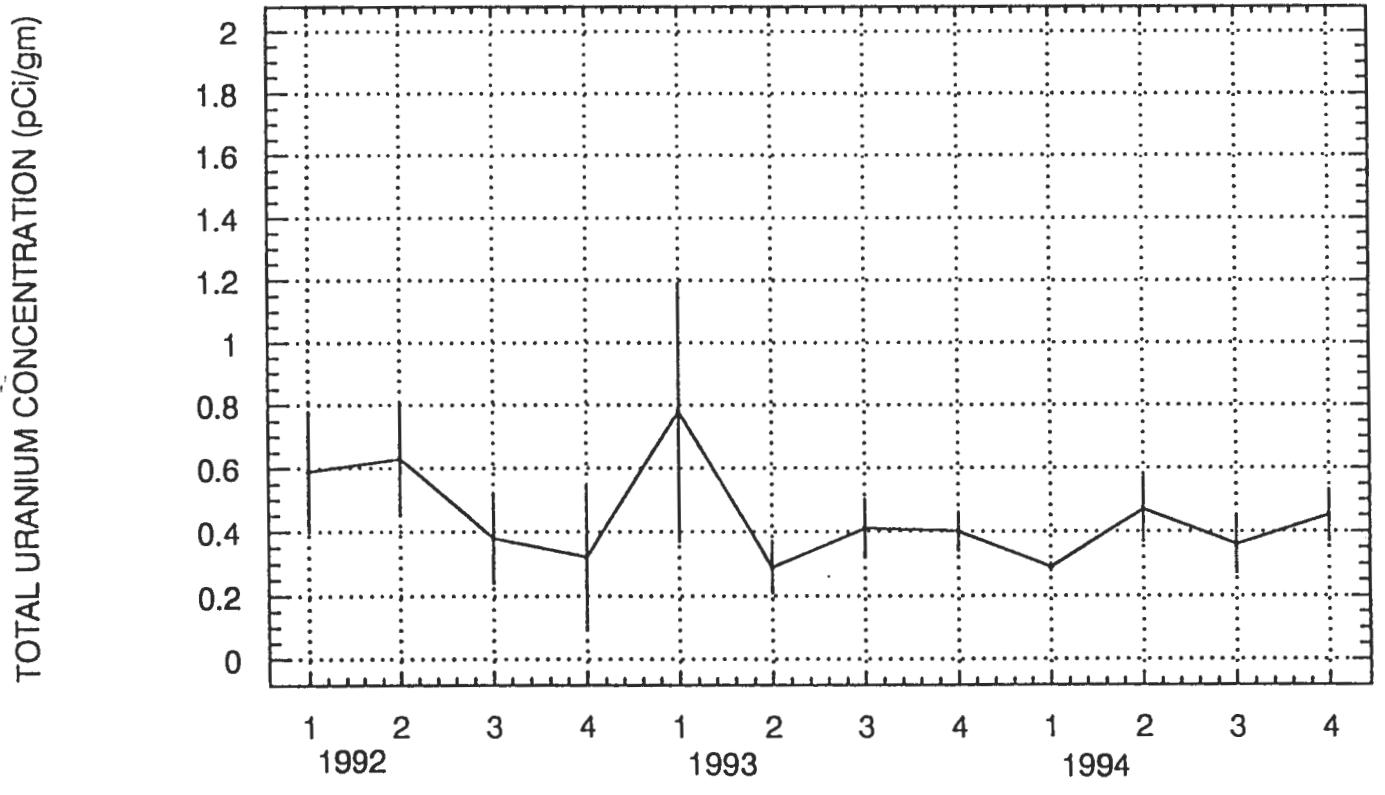
TOTAL URANIUM IN SOIL
STATION 3- RICHLAND, WASHINGTON



4-27-95

FIGURE 5.70

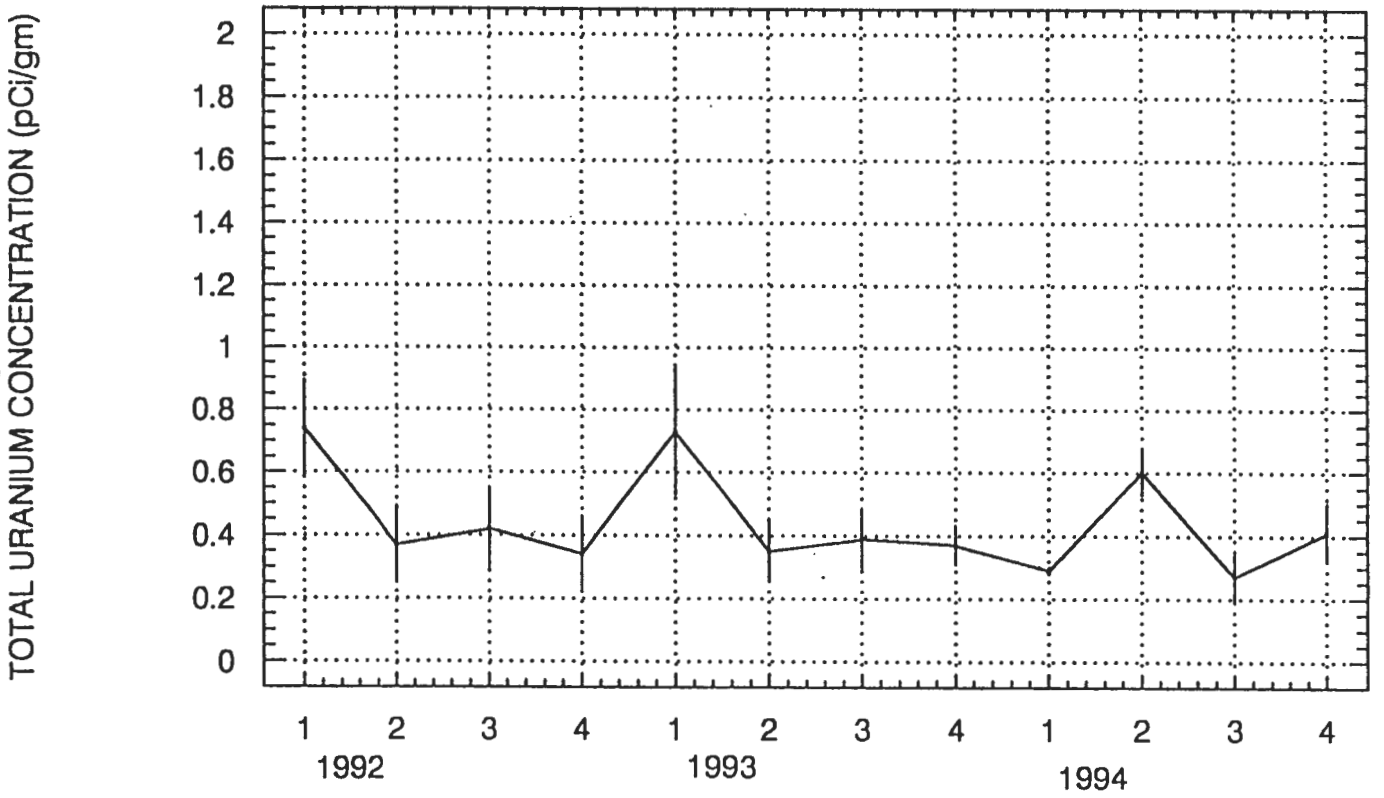
TOTAL URANIUM IN SOIL
STATION 4- RICHLAND, WASHINGTON



4-27-95

FIGURE 5.71

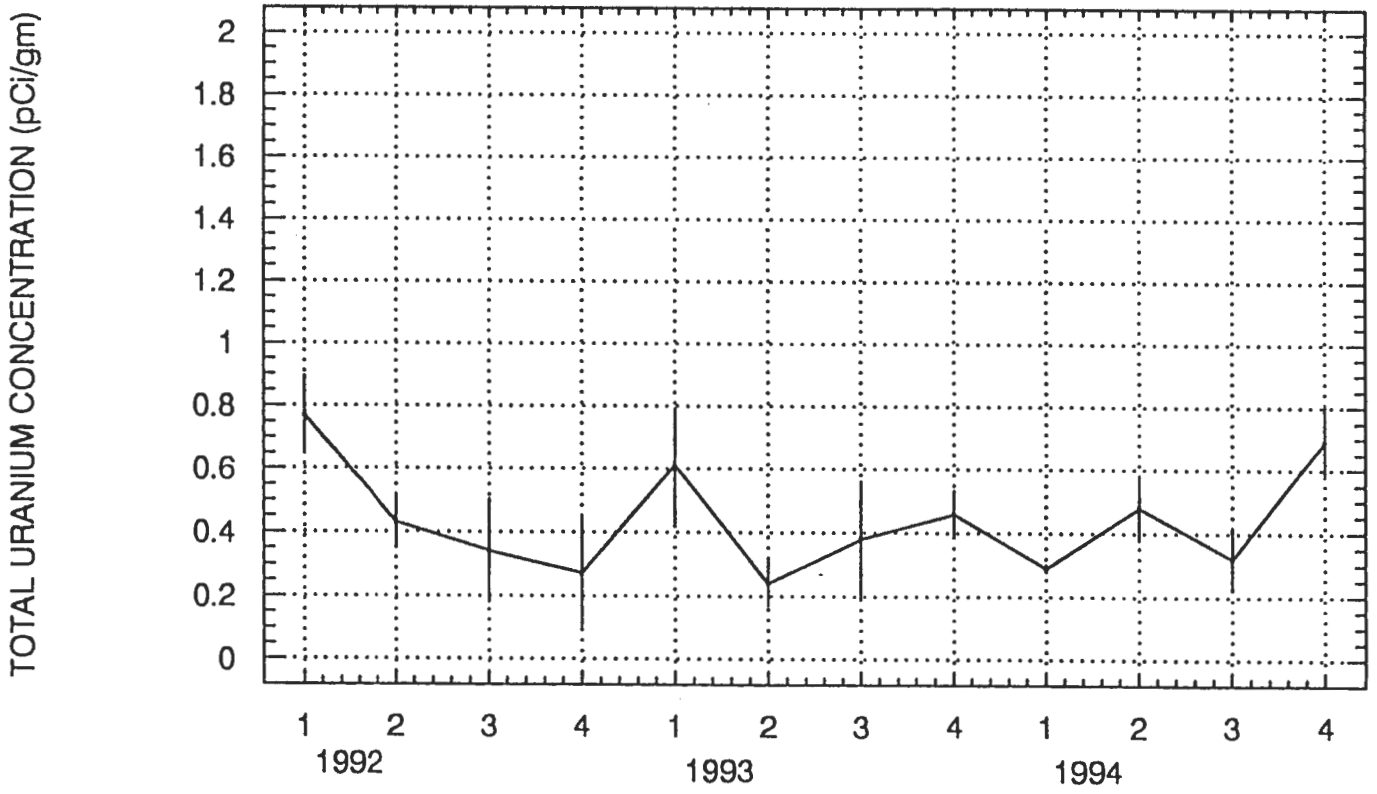
TOTAL URANIUM IN SOIL
STATION 5- RICHLAND, WASHINGTON



4-27-95

FIGURE 5.72

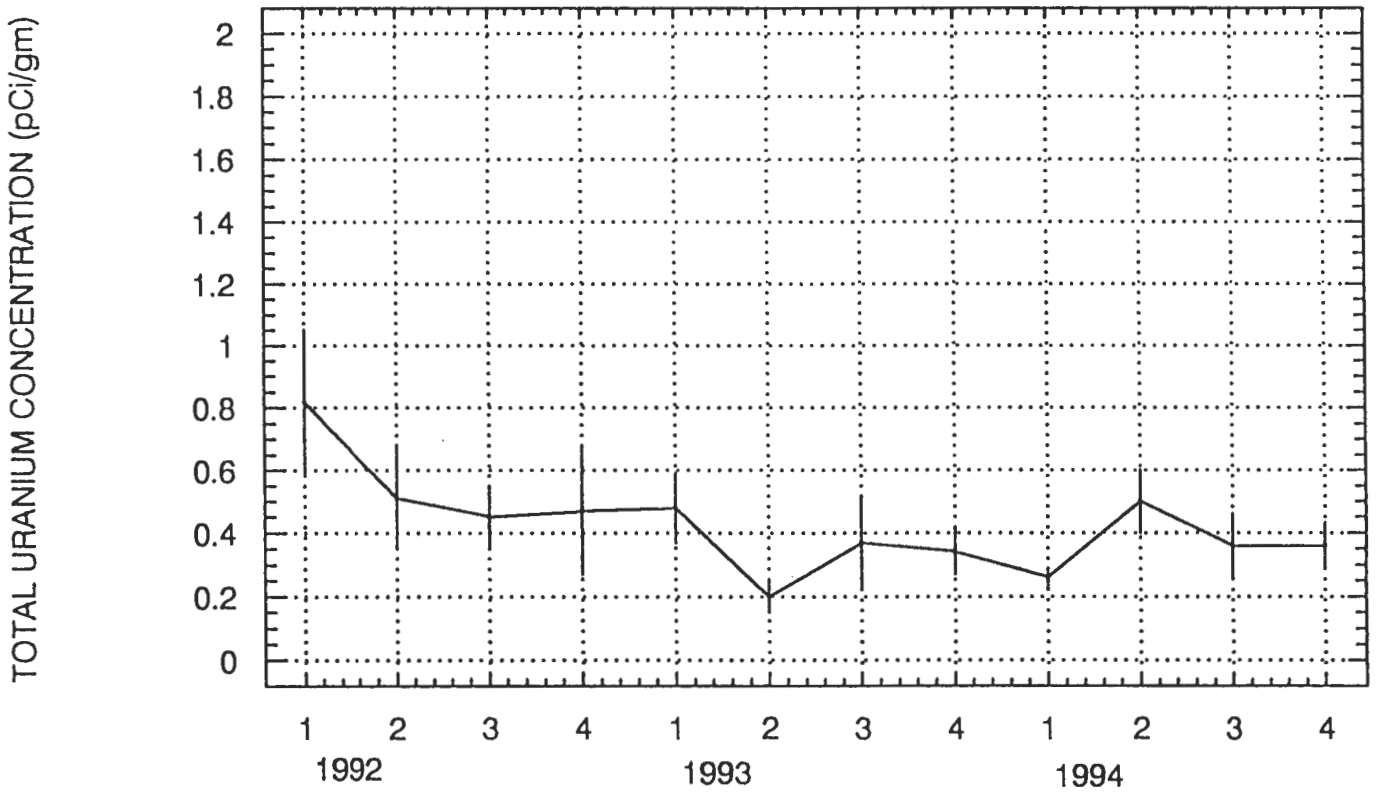
TOTAL URANIUM IN SOIL
STATION 6- RICHLAND, WASHINGTON



4-27-95

FIGURE 5.73

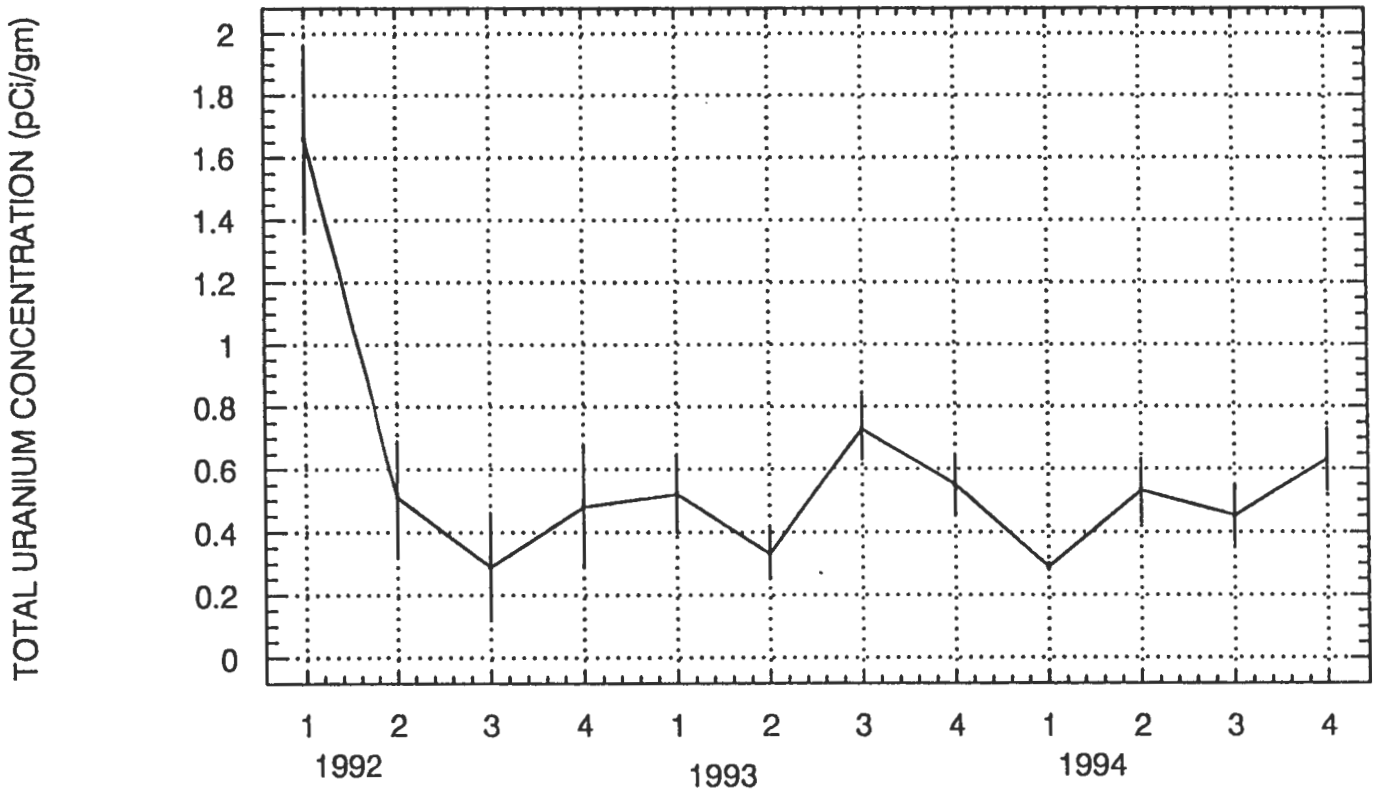
TOTAL URANIUM IN SOIL
STATION 7- RICHLAND, WASHINGTON



4-27-95

FIGURE 5.74

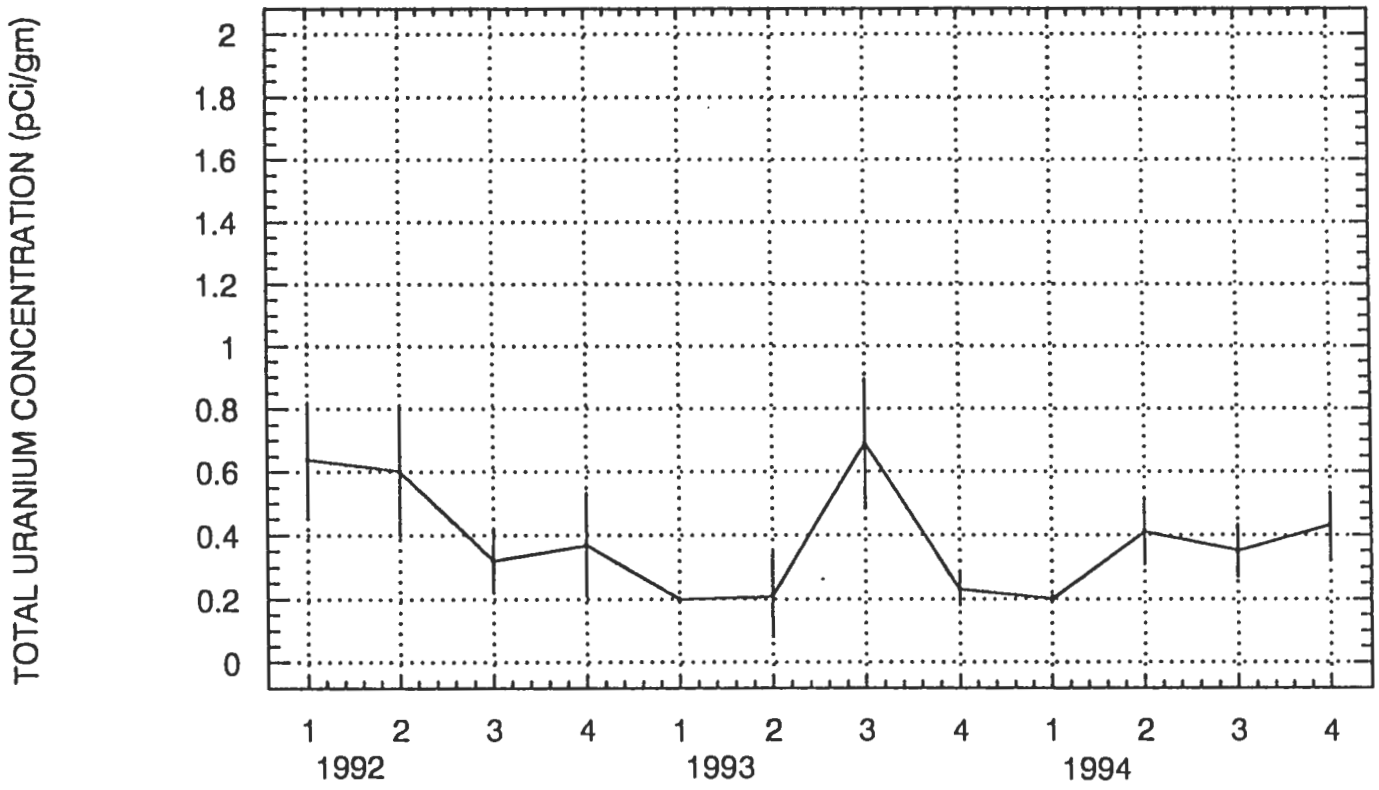
TOTAL URANIUM IN SOIL
STATION 8- RICHLAND, WASHINGTON



4-27-95

FIGURE 5.75

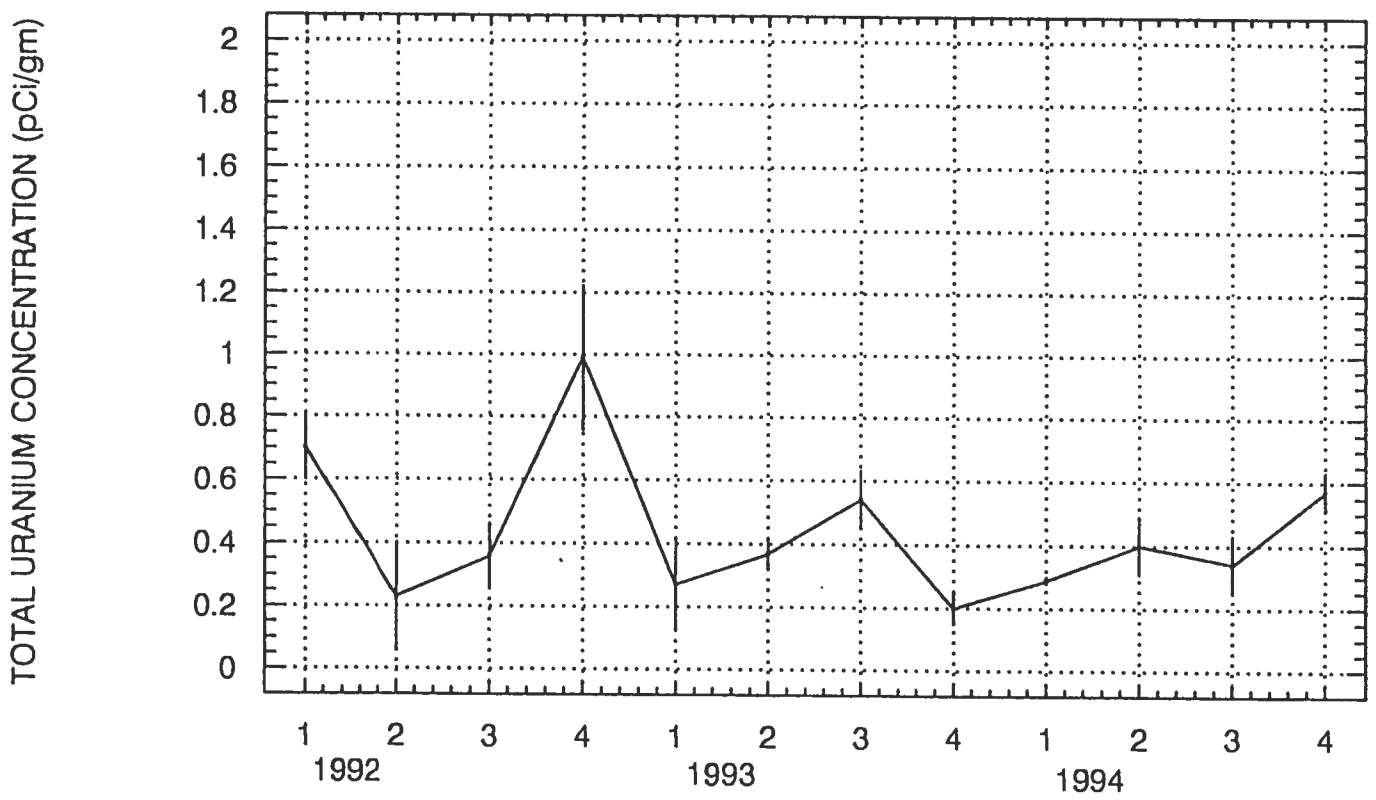
TOTAL URANIUM IN SOIL
STATION 9- RICHLAND, WASHINGTON



4-27-95

FIGURE 5.76

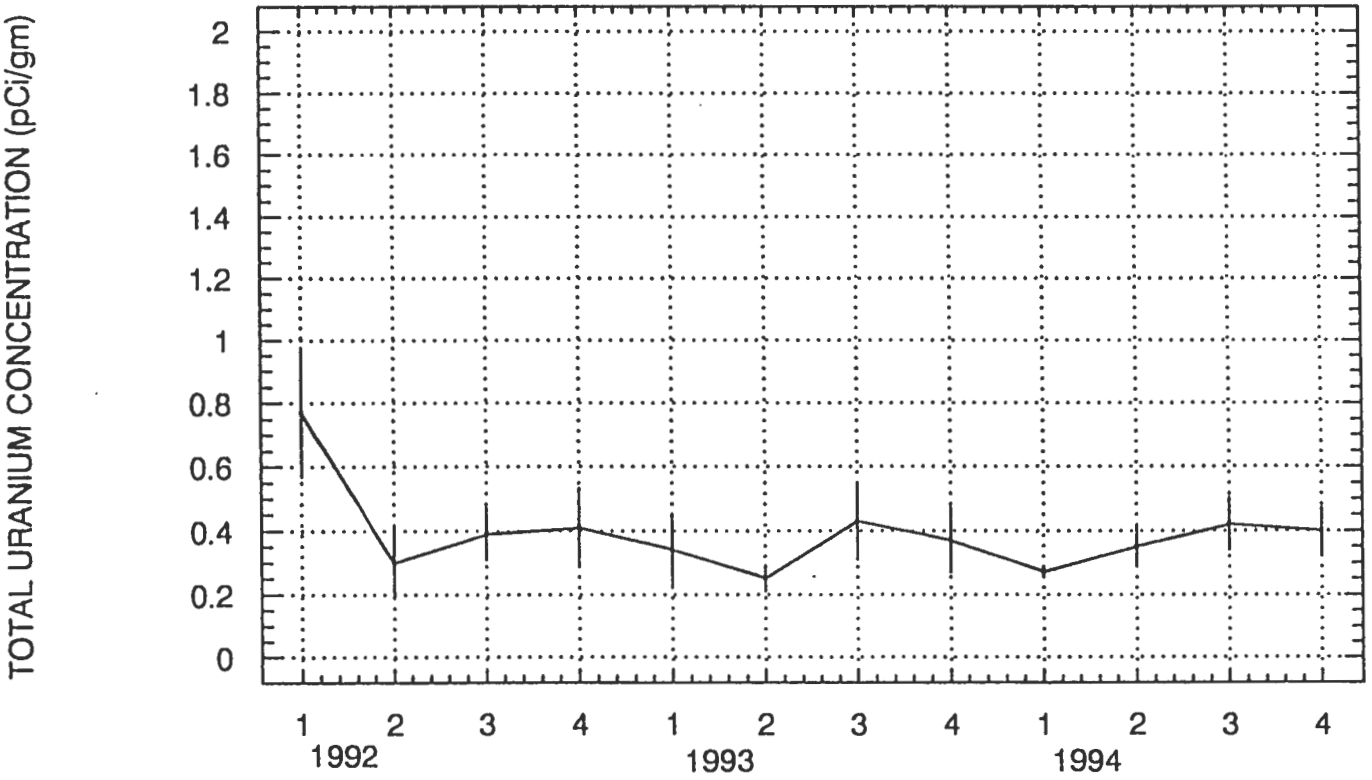
TOTAL URANIUM IN SOIL
NORTHEAST STATION- RICHLAND, WASHINGTON



4-27-95

FIGURE 5.77

TOTAL URANIUM IN SOIL
NORTHWEST STATION- RICHLAND, WASHINGTON



4-27-95

5.3 Vegetation Sampling

Vegetation is sampled in the vicinity of the nine environmental air monitoring stations and at the northeast and northwest corners of the site on a quarterly basis whenever there is sufficient vegetation. Vegetation samples are also collected annually from the trench caps when sufficient vegetation is available. The procedures used in taking vegetation samples emphasize that new growth be collected when it is available.

5.3.1 Gross Beta Activity in Vegetation

The results of gross beta activity analysis of vegetation are presented in Table 5.23 for samples taken at environmental monitoring stations and in Table 5.38 for samples taken from trench caps.

With respect to vegetation samples taken at monitoring stations, only deep rooted samples were taken. Deep rooted vegetation was sampled during the second and third quarters. There was insufficient vegetation for sampling in the first and fourth quarters.

Results of gross beta analysis of vegetation samples taken at environmental monitoring stations range from a low of 1.34 E+1 $\pm$ 5.0 E-1 pCi/g at Station 1 in the third quarter to a high of 7.81 E+1 $\pm$ 2.3 E0 pCi/g at Station 6 in the second quarter of 1994. The mean value for all environmental monitoring station vegetation samples was 4.32 E+1 pCi/g. No vegetation samples exceeded the action level for gross beta activity of 100 pCi/g.

Annual trench cap deep rooted vegetation samples were taken in the third quarter of 1994. Results for gross beta activity ranged from a low of 1.95 E+1 $\pm$ 8.0 E-1 pCi/g on Trench 7 to a high of 4.67 E+1 $\pm$ 1.4 E0 pCi/g on Trench 1. Figures 5.78 through 5.104 compare gross beta concentrations from 1992 through 1994 for all vegetation samples and do not indicate any increasing trends.

Gross beta concentrations in vegetation is not monitored at the Hanford Reservation by the Department of Energy or by their contractors. Typical values worldwide for gross beta concentration in vegetation are approximately 8.0 E0 pCi/g to 1.23 E+2 pCi/g of gross weight and are mainly due to potassium-40, lead-210, bismuth-210

and the uranium and thorium series according to the National Council on Radiation Protection and Measurements in Environmental Radiation Measurements (NCRP-50).

The US Ecology Historical Report gives a range for gross beta activity in vegetation of 2.36 E0 pCi/g to 1.17 E+2 pCi/g, with a mean concentration of 2.53 E+1 pCi/g. The gross beta in vegetation results presented in the 1993 Annual Environmental Report ranged from 1.78 E+1 $\pm$ 9.0 E-1 pCi/g to 8.04 E+1 $\pm$ 2.3 E0 pCi/g at the environmental monitoring stations. Trench cap vegetation samples for 1993 ranged from 1.37 E+1 $\pm$ 1.1 E0 pCi/g to 6.14 E+1 $\pm$ 2.0 E0 pCi/g.

On comparison of 1994 trench cap and environmental monitoring station vegetation sample results for gross beta activity with both historical results for the facility and expected values throughout the world, it appears that 1994 results are consistent with those previously reported.

5.3.2 Total Uranium Concentration in Vegetation

Total uranium concentration in vegetation is measured on a mass basis then transformed to an activity by using the relationship of 6.77 E-7 Ci/g from 10 CFR 20, Appendix B, Note 3. Table 5.24 presents the analytical results for the total uranium concentration in vegetation samples collected at the US Ecology facility environmental monitoring locations. The results from trench cap samples are presented in Table 5.38.

Monitoring station vegetation samples were taken in the second and third quarters. There was insufficient vegetation for sampling in the first and fourth quarters.

The total uranium concentration results for all environmental vegetation samples were less than the minimum detectable concentration of 1.0 E-1 pCi/g.

Only one trench cap vegetation sample met or exceeded the 1.0 E-1 pCi/g minimum detectable concentration. Trench 4 had a total uranium concentration of 1.0 E-1 $\pm$ 2.0 E-2 pCi/g. Since the action level for total uranium is 2.5 E-1 pCi/g, no samples exceeded this level.

The maximum total uranium concentration for 1993 on and off the Hanford Site was 1.88 E-2 ± 4.8 E-3 pCi/g with a mean concentration of 5.82 E-3 pCi/g.

Total uranium concentrations for samples taken on the US Ecology site compare favorably with regional environmental samples. Based on this comparison, it can be concluded that site operations did not impact uranium concentrations in vegetation.

5.3.3 Plutonium Concentration in Vegetation

Vegetation samples from environmental monitoring stations and trench caps were analyzed for plutonium-238 and plutonium 239/240. The results of environmental monitoring samples are presented in Table 5.25. The results from trench cap samples are on Table 5.38.

Quarterly environmental samples were only taken in the second and third quarters due to insufficient live vegetation being available during the first and fourth quarters. All environmental and trench cap vegetation samples were less than the minimum detectable concentration of 1.0 E-2 pCi/g for plutonium-238 and plutonium 239/240.

The 1993 Hanford Environmental Report provides data for plutonium 238 and 239/240 analyses. The value for plutonium-238 was less than detectable at all locations in the region. Plutonium-239/240 sample concentrations range from a low of less than detectable to a high of 6.84 E-4 ± 2.72 E-4 pCi/g.

US Ecology facility results for 1994 are roughly an order of magnitude larger than those reported in the 1993 Hanford report, however, associated analytical errors are large compared to the reported results. This indicates that the results are close to the sensitivity limit of the analysis.

In conclusion, analytical results of samples from environmental monitoring locations and trench caps on the LLRW site are consistent with those obtained from the Department of Energy Hanford Monitoring Program. Consequently, no increase in vegetation plutonium-238, plutonium-239/240 due to LLRW facility operations is discernible.

5.3.4 Spectrometry Analysis of Gamma Emitters in Vegetation

Vegetation samples were taken in the second and third quarters from environmental monitoring locations. Sufficient vegetation was not available for sampling at these locations during the first and fourth quarters. Trench cap vegetation samples for gamma spectrometry were taken in the third quarter. Table 5.39 presents results of gamma spectroscopy of trench vegetation.

Europium-155 met or exceeded the minimum detectable concentration of 7.0 E-2 pCi/g in two environmental vegetation samples. Both samples were in the third quarter, Station 3 at 7.0 E-2 $\pm$ 3.0 E-2 pCi/g and Station 4 at 1.6 E-1 $\pm$ 4.0 E-2 pCi/g. The investigation level for Eu-155 is 0.35 pCi/gm dry. All other gamma emitters were less than the minimum detectable concentrations.

Table 5.26 presents minimum detectable concentrations for various radionuclides measurable via gamma spectrometry. Results of analysis for samples taken from environmental monitoring stations are presented in Tables 5.27 through 5.37.

5.3.4.1 Other Radionuclides

Beryllium-7, a cosmogenically produced radionuclide, was identified in all vegetation samples analyzed. Concentrations measured ranged from 4.1 E-1 $\pm$ 1.7 E-1 pCi/g in the third quarter at Station 8 to a high of 3.1 E0 $\pm$ 3.7 E-1 pCi/g at Station 1 in the second quarter. The mean value for all samples was 1.22 pCi/g. The 1993 mean results were 5.2 E-1 pCi/g. These results are also consistent with natural background levels typical of the region.

Potassium-40 was identified in all vegetation samples analyzed. Concentrations measured ranged from a low of 1.17 E+1 $\pm$ 2.8 E-1 pCi/g at Station 1 in the third quarter to a high of 6.98 E+1 $\pm$ 8.2 E-1 pCi/g from Station 6 in the second quarter. The mean value for all samples was 4.09 E+1 pCi/g. The 1993 mean results were 9.95 pCi/g. Results reported are consistent with natural background levels of the region.

5.3.4.2 Gamma Emitters in Trench Cap Vegetation

Potassium-40 was identified above action level in all trench cap vegetation samples. The sample concentrations ranged from a low of 1.51 E+1 ± 6.5 E-1 pCi/g to a high of 4.58 E+1 ± 5.0 E-1 pCi/g. The average concentration of potassium-40 in the trench cap vegetation was 3.0 E+1 pCi/g.

Beryllium-7, a natural radionuclide, was positively identified in all trench cap vegetation samples and above action level in seven samples. Concentrations ranged from 2.7 E-1 ± 6.0 E-2 pCi/g to 3.24 E0 ± 3.3 E-1 pCi/g. The average concentration of beryllium-7 in the trench cap vegetation was 1.3 E0 pCi/g.

Europium-155 was present in one trench cap vegetation sample at 9.0 E-2 ± 3.0 E-2 pCi/g. The minimum detectable concentration for europium-155 is 7.0 E-2 pCi/g. Since there was only one sample which identified europium-155 and its value is just slightly above the minimum detectable concentration, no further investigation was performed. The investigation level for Eu-155 is 0.35 pCi/g.

5.3.5 Tritium in Vegetation

Trench cap vegetation is monitored annually for tritium content. Results are provided in Table 5.38 in units of pCi/g, wet of water extracted from the plant mass. The trench cap vegetation results vary from a low of 4.2 E-1 ± 7.0 E-2 pCi/g in Trench 7A to a high of 2.24 E+2 ± 1.01 E0 pCi/g on Trench 11A. Only five of the 16 capped trenches were analyzed for tritium due to laboratory error.

Presently, tritium concentrations in vegetation are being measured to gather information on trends. Tritium in trench cap vegetation for 1993 ranged from less than the minimum detectable concentration of 3.0 E-1 pCi/g to a high of 1.53 E1 ± 3.0 E-1 pCi/g at Trench 11A.

At this time, tritium monitoring of vegetation is an experimental program and there is not a consensus opinion as to interpretation of results. It is known that dose

consequences of these measurements are negligible. Results continue to be reviewed with the Department of Health and the Quality Assurance Task Force of the Pacific Northwest in order to develop further information concerning the significance of these results.

TABLE 5.23

Gross Beta Analysis of Vegetation During 1994 at Eleven Environmental Monitoring Stations

GROSS BETA CONCENTRATION (pCi/g, dry)

Station Number	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1	N/S	16.6 ± 0.6	13.4 ± 0.5	N/S
2	N/S	43.1 ± 1.4	42.2 ±1.4	N/S
3	N/S	31.6 ± 1.3	29.4 ± 1.2	N/S
4	N/S	27.9 ± 1.3	47.1 ± 1.6	N/S
5	N/S	49.6 ± 1.7	40.7 ± 1.2	N/S
6	N/S	78.1 ± 2.3	47.4 ± 1.4	N/S
7	N/S	59.8 ± 2.0	50.2 ± 1.3	N/S
8	N/S	32.6 ± 1.2	47.8 ± 1.5	N/S
9	N/S	53.9 ± 1.7	35.4 ± 1.0	N/S
NE	N/S	53.5 ± 1.7	60.7 ± 1.3	N/S
NW	N/S	45.0 ± 1.4	44.8 ± 1.4	N/S

NOTE: All vegetation was deep rooted.

See Table 5.40, Vegetation Addendum, for sample weights.

(a) Minimum detectable concentration: 1.0 pCi/g.

N/S - No sample taken due to lack of sufficient vegetation.

TABLE 5.24

Total Uranium in Vegetation During 1994 at Eleven Environmental Monitoring Stations

TOTAL URANIUM (pCi/g, dry)

Station Number	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1	N/S	0.01 + 0.004	0.009 ± 0.003	N/S
2	N/S	0.013 ± 0.008	0.036 ± 0.012	N/S
3	N/S	0.009 ± 0.009	0.035 ± 0.015	N/S
4	N/S	0.076 ± 0.028	0.051 ± 0.011	N/S
5	N/S	0.025 ± 0.009	0.008 ± 0.005	N/S
6	N/S	0.025 ± 0.025	0.022 ± 0.009	N/S
7	N/S	0.019 ± 0.014	0.021 ± 0.010	N/S
8	N/S	0.035 ± 0.015	0.009 + 0.006	N/S
9	N/S	0.012 ± 0.014	0.01 ± 0.007	N/S
NE	N/S	0.004 ± 0.008	0.006 ± 0.006	N/S
NW	N/S	0.017 ± 0.010	0.013 ± 0.014	N/S

NOTE: All vegetation was deep rooted.

See Table 5.40, Vegetation Addendum, for sample weights.

(a) Minimum detectable concentration: 1.0 E-1 pCi/g.

N/S - No sample taken due to lack of sufficient vegetation.

TABLE 5.25

Plutonium Concentrations in Vegetation During 1994 at Eleven Environmental Monitoring Stations

PLUTONIUM CONCENTRATION (pCi/g, dry)

	Station Number		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1		Pu-239/240	N/S	0.000 ± 0.001	0.000 ± 0.006	N/S
		Pu-238	N/S	-0.001 ± 0.002	0.005 ± 0.008	N/S
2		Pu-239/240	N/S	-0.001 ± 0.004	0.001 ± 0.006	N/S
		Pu-238	N/S	-0.017 ± 0.009	-0.003 ± 0.008	N/S
3		Pu-239/240	N/S	0.004 ± 0.008	0.002 ± 0.004	N/S
		Pu-238	N/S	-0.002 ± 0.007	0.002 ± 0.006	N/S
4		Pu-239/240	N/S	0.005 ± 0.002	0.000 ± 0.003	N/S
		Pu-238	N/S	0.003 ± 0.004	0.001 ± 0.006	N/S
5		Pu-239/240	N/S	0.000 ± 0.002	0.000 ± 0.004	N/S
		Pu-238	N/S	-0.001 ± 0.003	0.000 ± 0.009	N/S
6		Pu-239/240	N/S	-0.005 ± 0.002	-0.004 ± 0.011	N/S
		Pu-238	N/S	-0.003 ± 0.004	0.001 ± 0.009	N/S
7		Pu-239/240	N/S	0.000 ± 0.003	0.000 ± 0.003	N/S
		Pu-238	N/S	0.000 ± 0.003	0.001 ± 0.003	N/S
8		Pu-239/240	N/S	0.000 ± 0.010	0.000 ± 0.006	N/S
		Pu-238	N/S	-0.001 ± 0.010	-0.002 ± 0.001	N/S
9		Pu-239/240	N/S	0.000 ± 0.004	0.000 ± 0.002	N/S
		Pu-238	N/S	0.003 ± 0.0005	0.000 ± 0.0003	N/S
NE		Pu-239/240	N/S	0.002 ± 0.005	0.002 ± 0.006	N/S
		Pu-238	N/S	- 0.001 ± 0.004	0.000 ± 0.005	N/S
NW		Pu-239/240	N/S	0.000 ± 0.003	0.001 ± 0.002	N/S
		Pu-238	N/S	-0.001 ± 0.004	-0.001 ± 0.003	N/S

NOTE: All vegetation was deep rooted.

See Table 5.40, Vegetation Addendum, for sample weights.

(a) Minimum detectable concentration: Pu-238 is 1.0 E-2 pCi/g.

Pu-239/240 is 1.0 E-2 pCi/g.

N/S - No sample taken due to lack of sufficient vegetation.

TABLE 5.26

Required Minimum Detectable Concentrations for Gamma Spectrometry Analysis of Vegetation During 1994

Nuclide	pCi/g - dry
Na-22	0.03
Mn-54	0.03
Co-58	0.03
Co-60	0.03
Fe-59	0.05
Zn-65	0.06
As-76	0.05
Zr/Nb-95	0.05
Mo-99	0.21
Ru-103	0.03
Ru-106	0.26
Sb-124	0.03
Sb-125	0.07
I-131	0.03
I-133	0.03
Cs-134	0.03
Cs-137	0.03
Ba/La-140	0.07
Ce-141	0.03
Ce/Pr-144	0.10
Eu-152	0.17
Eu-154	0.08
Eu-155	0.07

TABLE 5.27

Gamma Spectrometry Analysis of Vegetation During 1994 at Environmental Monitoring Station Number 1 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	N/S	3.10 ± 0.37	0.72 ± 0.13	N/S
K-40	N/S	15.43 ± 0.66	11.68 ± 0.28	N/S

NOTES: All vegetation was deep rooted.

See Table 5.40, Vegetation Addendum for sample weights.

N/S - No sample taken due to lack of sufficient vegetation.

See Table 5.36 for other nuclides and specific MDC values for each.

TABLE 5.28

Gamma Spectrometry Analysis of Vegetation During 1994 at Environmental Monitoring Station Number 2 (pCi/g)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	N/S	1.27 ± 0.32	0.51 ± 0.12	N/S
K-40	N/S	40.81 ± 1.03	36.67 ± 0.47	N/S

NOTES: All vegetation was deep rooted.

See Table 5.40, Vegetation Addendum for sample weights.

N/S - No sample taken due to lack of sufficient vegetation.

See Table 5.26 for other nuclides and specific MDC values for each.

TABLE 5.29

Gamma Spectrometry Analysis of Vegetation During 1994 at Environmental Monitoring Station Number 3 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	N/S	2.99 ± 0.30	1.59 ± 0.18	N/S
K-40	N/S	32.00 ± 0.80	29.87 ± 0.52	N/S
Eu-155	N/S		0.07 + 0.03	N/S

NOTES: All vegetation was deep rooted.

See Table 5.40, Vegetation Addendum for sample weights.

N/S - No sample taken due to lack of sufficient vegetation.

See Table 5.26 for other nuclides and specific MDC values for each.

TABLE 5.30

Gamma Spectrometry Analysis of Vegetation During 1994 at Environmental Monitoring Station Number 4 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	N/S	2.25 ± 0.38	1.37 ± 0.29	N/S
K-40	N/S	31.08 ± 0.96	45.55 ± 0.73	N/S
Eu-155	N/S		0.16 ± 0.04	N/S

NOTES: All vegetation was deep rooted.

See Table 5.40, Vegetation Addendum for sample weights.

N/S - No sample taken due to lack of sufficient vegetation.

See Table 5.26 for other nuclides and specific MDC values for each.

TABLE 5.31

Gamma Spectrometry Analysis of Vegetation During 1994 at Environmental Monitoring Station Number 5 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	N/S	1.23 ± 0.26	0.47 ± 0.18	N/S
K-40	N/S	48.98 ± 0.98	39.70 ± 0.58	N/S

NOTES: All vegetation was deep rooted.

See Table 5.40, Vegetation Addendum for sample weights.

N/S - No sample taken due to lack of sufficient vegetation.

See Table 5.26 for other nuclides and specific MDC values for each.

TABLE 5.32

Gamma Spectrometry Analysis of Vegetation During 1994 at Environmental Monitoring Station Number 6 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	N/S	0.78 ± 0.19	0.49 ± 0.20	N/S
K-40	N/S	69.80 ± 0.82	53.57 ± 0.75	N/S

NOTES: All vegetation was deep rooted.

See Table 5.40, Vegetation Addendum for sample weights.

N/S - No sample taken due to lack of sufficient vegetation.

See Table 5.26 for other nuclides and specific MDC values for each.

TABLE 5.33

Gamma Spectrometry Analysis of Vegetation During 1994 at Environmental Monitoring Station Number 7 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	N/S	0.85 ± 0.27	0.56 ± 0.23	N/S
K-40	N/S	63.65 ± 0.96	48.26 ± 0.71	N/S

NOTES: All vegetation was deep rooted.

See Table 5.40, Vegetation Addendum for sample weights.

N/S - No sample taken due to lack of sufficient vegetation.

See Table 5.26 for other nuclides and specific MDC values for each.

TABLE 5.34

Gamma Spectrometry Analysis of Vegetation During 1994 at Environmental Monitoring Station Number 8 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	N/S	1.87 ± 0.24	0.41 ± 0.17	N/S
K-40	N/S	32.02 ± 0.70	46.98 ± 0.83	N/S

NOTES: All vegetation was deep rooted.

See Table 5.40, Vegetation Addendum for sample weights.

N/S - No sample taken due to lack of sufficient vegetation.

See Table 5.26 for other nuclides and specific MDC values for each.

TABLE 5.35

Gamma Spectrometry Analysis of Vegetation During 1994 at Environmental Monitoring Station Number 9 (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	N/S	1.09 ± 0.18	0.91 ± 0.19	N/S
K-40	N/S	49.54 ± 0.80	30.28 ± 0.60	N/S

NOTES: All vegetation was deep rooted.

See Table 5.40, Vegetation Addendum for sample weights.

N/S - No sample taken due to lack of sufficient vegetation.

See Table 5.26 for other nuclides and specific MDC values for each.

TABLE 5.36

Gamma Spectrometry Analysis of Vegetation During 1994 at Environmental Northeast Site Corner (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	N/S	1.66 ± 0.33	0.62 ± 0.15	N/S
K-40	N/S	45.96 ± 1.05	51.93 ± 0.58	N/S

NOTES: All vegetation was deep rooted.

See Table 5.40, Vegetation Addendum for sample weights.

N/S - No sample taken due to lack of sufficient vegetation.

See Table 5.26 for other nuclides and specific MDC values for each.

TABLE 5.37

Gamma Spectrometry Analysis of Vegetation During 1994 at Environmental Northwest Site Corner (pCi/g, dry)

	CALENDAR QUARTER 1994			
Radionuclide	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	N/S	1.38 ± 0.25	0.61 ± 0.22	N/S
K-40	N/S	37.61 ± 0.73	38.25 ± 0.86	N/S

NOTES: All vegetation was deep rooted.

See Table 5.40, Vegetation Addendum for sample weights.

N/S - No sample taken due to lack of sufficient vegetation.

See Table 5.26 for other nuclides and specific MDC values for each.

TABLE 5.38

Radioanalytical Measurements of Trench Vegetation During 1994 (pCi/g, dry)

Trench	Date	Gross Beta	Total Uranium	Pu-239/240	Pu-238	Tritium[1] Wet	Weights (in grams) Ash	Wet	Dry
1	9-28	46.7 ± 1.4	0.07 ± 0.01	0.001 ± 0.005	0.001 ± 0.010	Note 2	22.2	545.6	136.4
2	9-28	38.5 ± 1.3	0.019 ± 0.01	- 0.001 ± 0.005	-0.003 ± 0.007	Note 2	23.6	537.7	153.2
3	9-28	38.2 ± 1.3	0.017 ± 0.01	-0.002 ± 0.006	0.002 ± 0.004	Note 2	22.5	372.1	130.1
4	9-28	22.4 ± 1.3	0.1 ± 0.02	0.005 ± 0.006	0.005 ± 0.006	Note 2	38.7	319.4	152.8
4A	9-28	30.6 ± 1.0	0.018 ± 0.01	0.002 ± 0.005	0.002 ± 0.005	Note 2	17.6	427.5	139.3
4B	9-28	26.0 ± 1.0	0.019 ± 0.01	0.000 ± 0.006	0.001 ± 0.007	Note 2	13.8	292.7	103.1
5	9-28	41.3 ± 1.3	0.01 ± 0.01	0.002 ± 0.007	0.001 ± 0.006	Note 2	24.4	644.9	160.4
6	9-28	22.9 ± 1.1	0.089 ± 0.02	-0.003 ± 0.008	-0.003 ± 0.008	Note 2	24.6	353.2	125.2
7	9-28	19.5 ± 0.8	0.029 ± 0.01	0.001 ± 0.005	0.000 ± 0.004	Note 2	13.3	346.1	129.1
7A	7-19	24.7 ± 1.2	0.026 ± 0.01	0.003 ± 0.004	-0.009 ± 0.009	0.42 ± 0.07	17.3	310.5	96.1
8	9-28	21.0 ± 1.0	0.077 ± 0.02	0.004 ± 0.011	0.004 ± 0.011	Note 2	31.1	400.3	174.8
9	9-28	21.5 ± 1.0	0.065 ± 0.02	0.001 ± 0.013	-0.001 ± 0.007	Note 2	24.8	353.7	151.2
10	7-19	30.4 ± 1.2	0.061 ± 0.02	-0.003 ± 0.010	0.002 ± 0.013	20.78 ± 0.30	25.6	371.5	148.6
11A	7-19	34.5 ± 1.3	0.038 ± 0.01	-0.001 ± 0.005	0.002 + 0.005	224.27 ± 1.01	19.6	314.4	111.9
Tank Farm	7-19	25.0 ± 1.0	0.032 ± 0.01	-0.003 ± 0.009	0.000 ± 0.007	2.30 ± 0.11	13.6	244.5	96.3
RX Head	7-19	40.2 ± 1.6	0.045 ± 0.02	0.000 ± 0.009	0.001 ± 0.009	3.88 ± 0.13	18.3	211.0	87.9

Where positive analytical results are reported they are followed by the 2 sigma error.

NOTE 1: Results are in pCi/g "wet" of moisture extracted from vegetation sample.

NOTE 2: Laboratory error - did not analyze for tritium.

TABLE 5.39

Gamma Spectrometry Analysis of Trench Vegetation During 1994 (pCi/g, dry)

Trench	Be-7	K-40	Cs-137	Eu-155
1	0.27 ± 0.06	42.53 ± 0.29		
2	0.42 ± 0.16	32.27 ± 0.54		
3	0.52 ± 0.09	38.24 ± 0.36		
4	1.08 ± 0.16	15.89 ± 0.49		0.09 ± 0.03
4A	0.34 ± 0.16	33.97 ± 0.77		
4B	0.56 ± 0.20	24.47 ± 0.57		
5	0.36 ± 0.11	45.79 ± 0.50		
6	1.06 ± 0.18	20.71 ± 0.50		
7	0.48 ± 0.17	15.13 ± 0.65		
7A	2.04 ± 0.17	25.07 ± 0.38		
8	1.29 ± 0.22	20.21 ± 0.63		
9	1.98 ± 0.19	22.28 ± 0.53		
10	2.03 ± 0.15	28.20 ± 0.38		
11A	2.30 ± 0.18	36.75 ± 0.48	0.02 ± 0.01	
Tank Farm	3.24 ± 0.33	35.82 ± 0.73		
RX Head	2.77 ± 0.22	43.43 ± 0.61		

NOTE: Only results greater than or equal to MDC are reported.

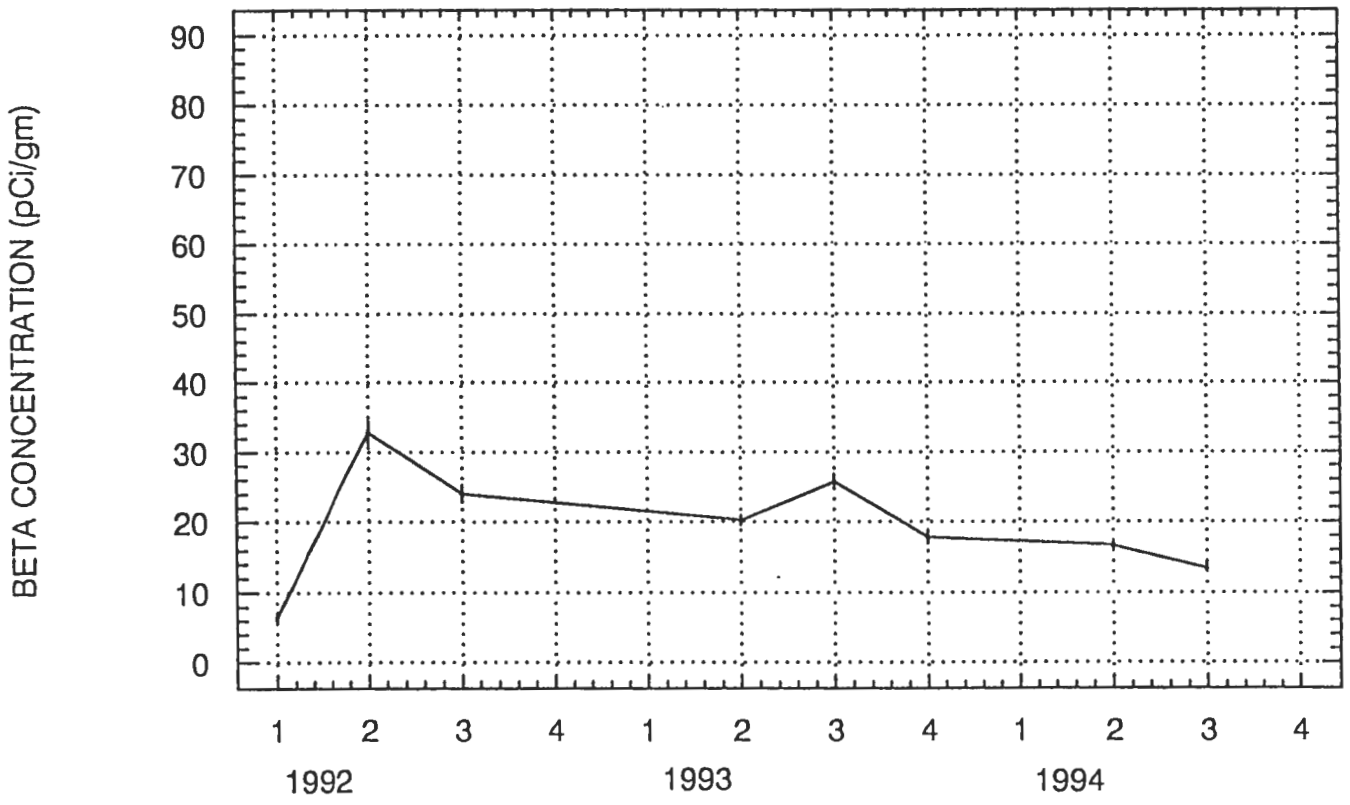
TABLE 5.40

Addendum to Vegetation Tables. Sample Weights for All Monitoring Stations Sampled During 1994

Sample # Location	Sample Date	Sample Weight (grams) Wet	Dry	Ash
Station 1	6-28-94	329.4	154.7	11.96
	9-14-94	710.3	324.3	17.57
Station 2	6-28-94	522.4	130.6	21.41
	9-13-94	514.6	165.5	26.89
Station 3	6-28-94	307.5	97.3	17.82
	9-13-94	456.5	136.7	24.15
Station 4	6-28-94	316.4	91.98	19.16
	9-13-94	411.4	106.03	20.00
Station 5	6-28-94	499.6	119.52	22.75
	9-13-94	393.5	115.06	15.58
Station 6	6-28-94	408.4	120.83	28.67
	9-14-94	468.7	87.94	15.70
Station 7	6-28-94	374.8	79.07	16.71
	9-14-94	498.7	105.21	19.40
Station 8	6-28-94	391.2	110.20	19.03
	9-14-94	559.8	143.91	25.22
Station 9	6-28-94	351.6	133.69	26.35
	9-14-94	519.2	126.02	20.60
NE Corner	6-28-94	433.1	147.82	25.60
	9-14-94	705.9	159.35	28.65
NW Corner	6-28-94	553.5	182.67	30.29
	9-14-94	594.0	154.69	24.04

FIGURE 5.78

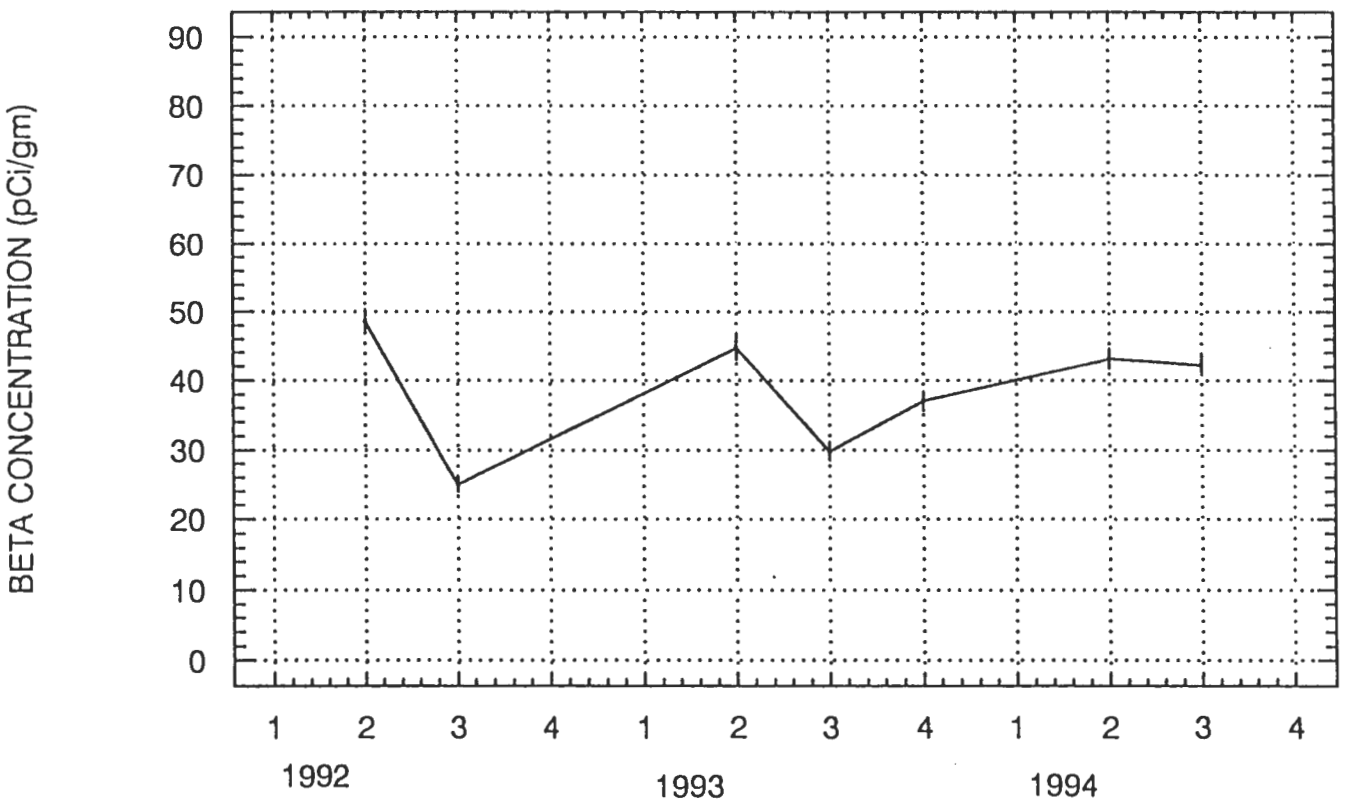
GROSS BETA IN VEGETATION
STATION 1- RICHLAND, WASHINGTON



4-25-95

FIGURE 5.79

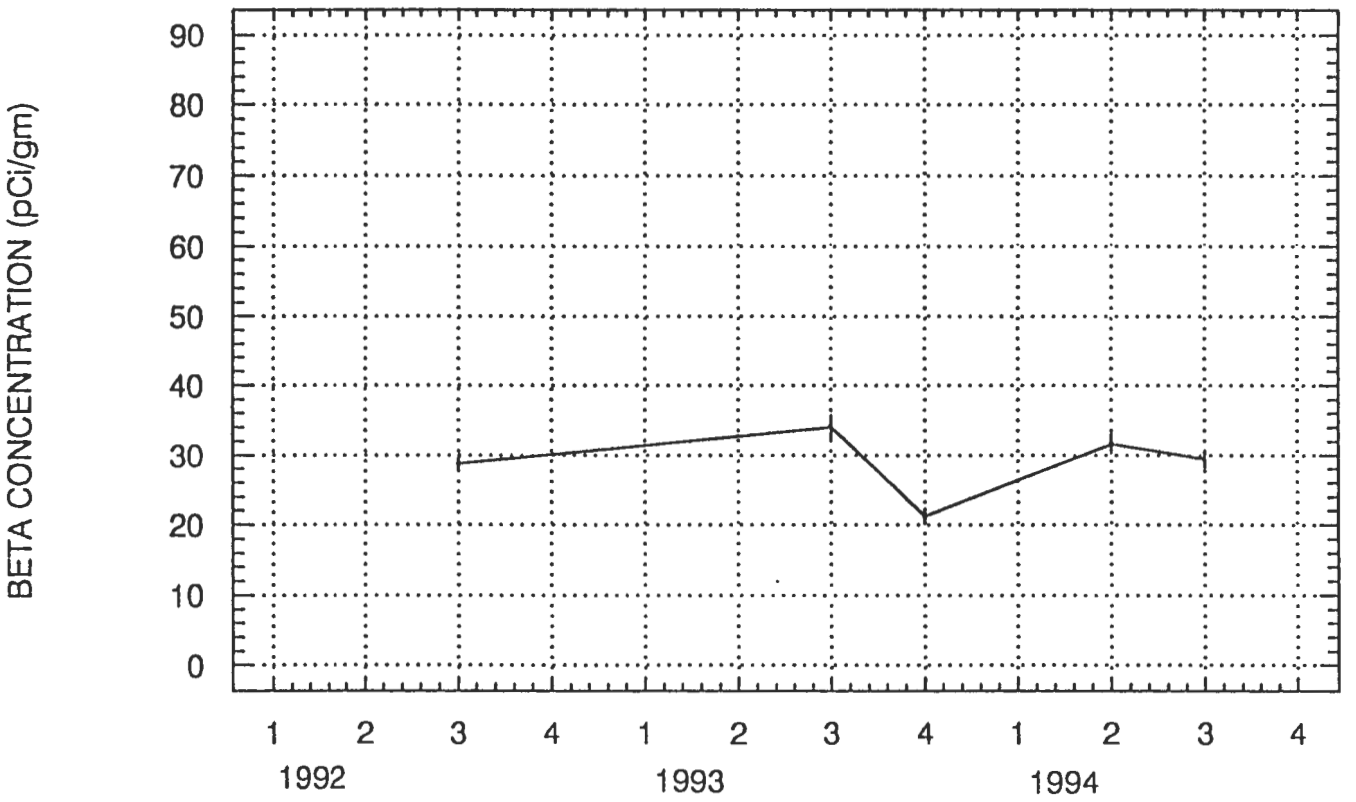
GROSS BETA IN VEGETATION
STATION 2- RICHLAND, WASHINGTON



4-25-95

FIGURE 5.80

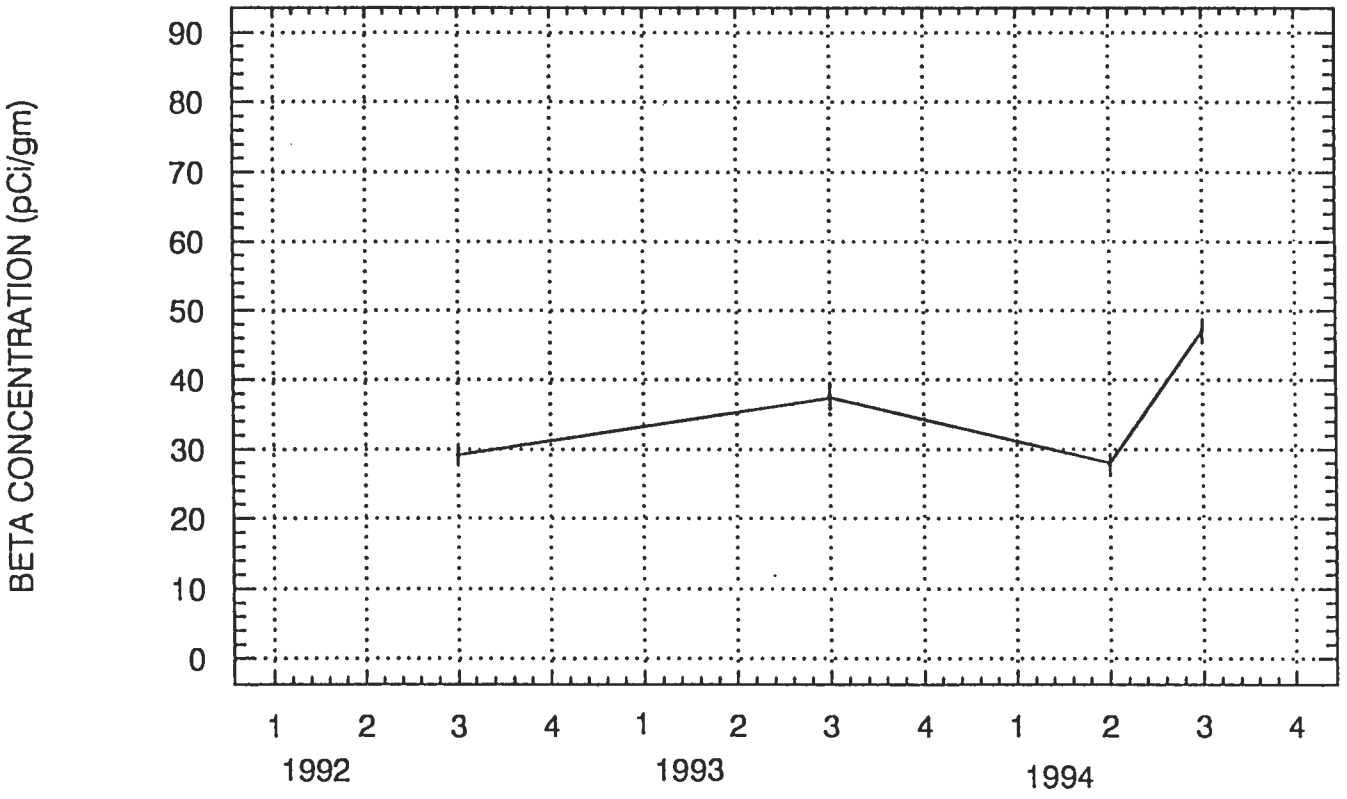
GROSS BETA IN VEGETATION
STATION 3- RICHLAND, WASHINGTON



4-25-95

FIGURE 5.81

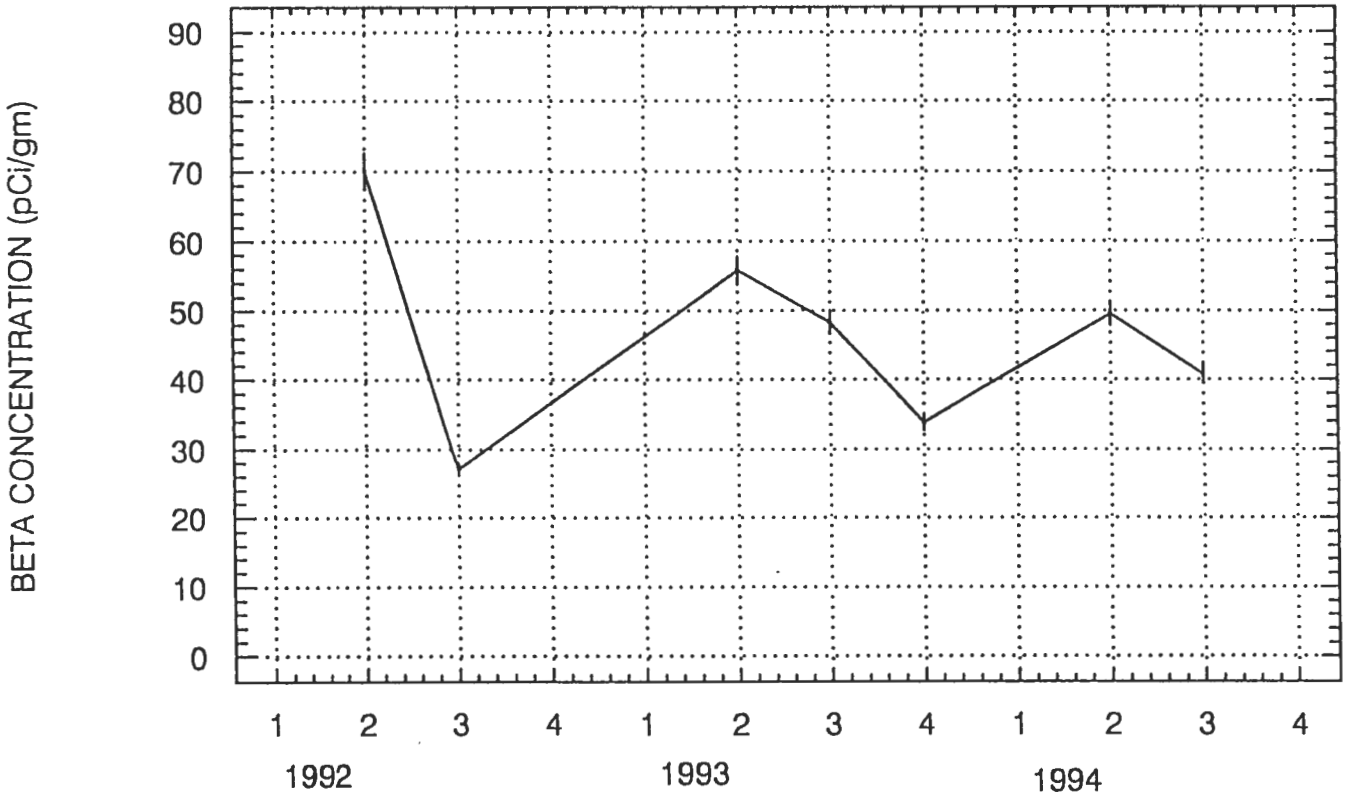
GROSS BETA IN VEGETATION
STATION 4- RICHLAND, WASHINGTON



4-25-95

FIGURE 5.82

GROSS BETA IN VEGETATION
STATION 5- RICHLAND, WASHINGTON



4-25-95

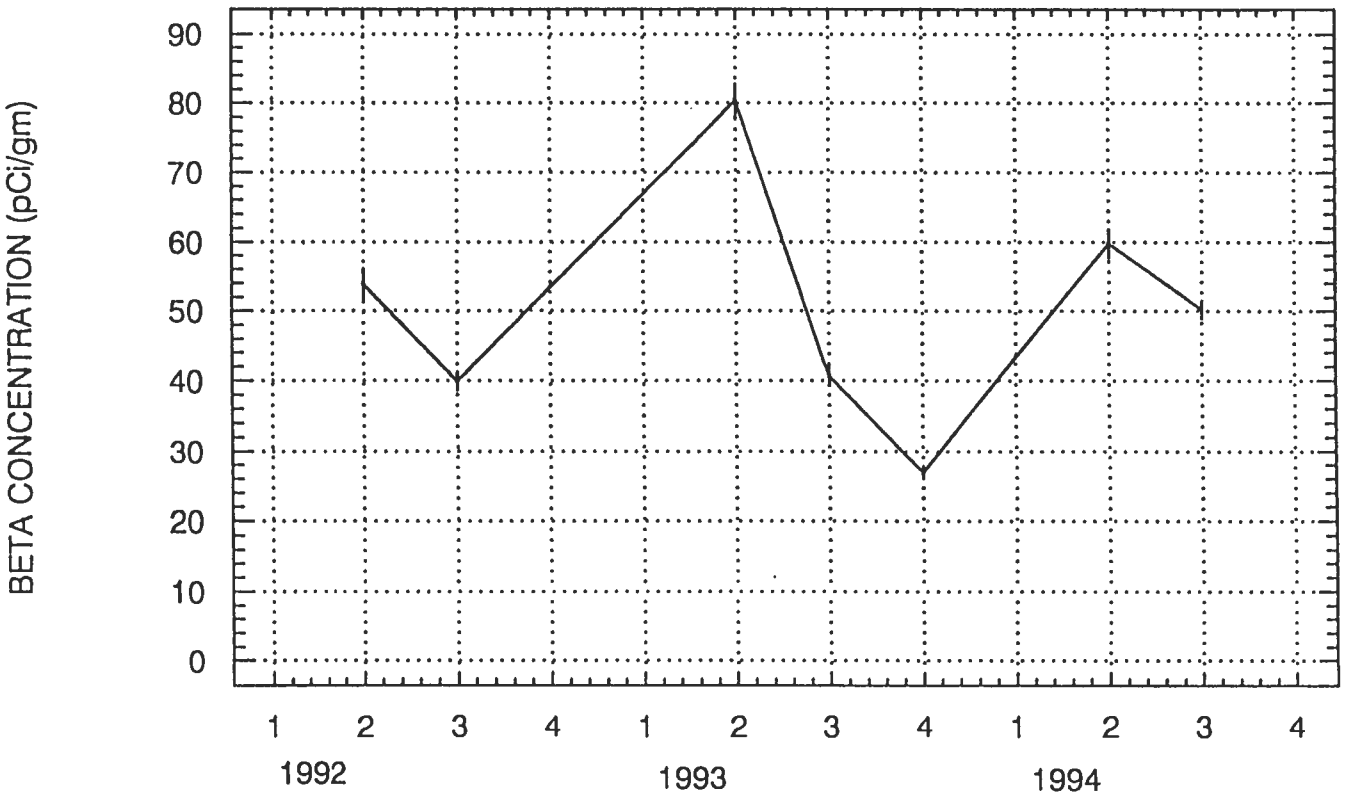
FIGURE 5.83

GROSS BETA IN VEGETATION
STATION 6- RICHLAND, WASHINGTON

4-25-95

FIGURE 5.84

GROSS BETA IN VEGETATION
STATION 7- RICHLAND, WASHINGTON



4-25-95

FIGURE 5.85

GROSS BETA IN VEGETATION
STATION 8- RICHLAND, WASHINGTON

4-25-95

FIGURE 5.86

GROSS BETA IN VEGETATION
STATION 9- RICHLAND, WASHINGTON

4-25-95

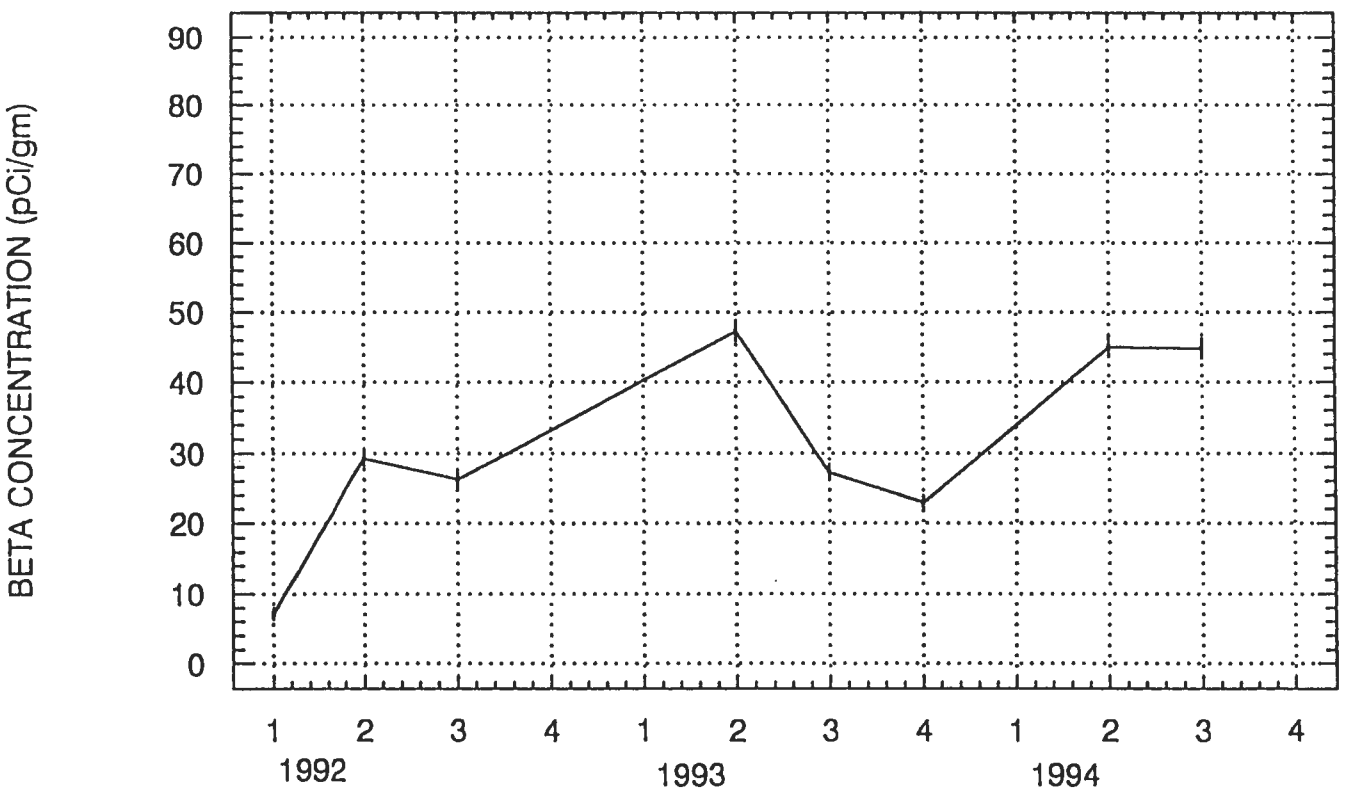
FIGURE 5.87

GROSS BETA IN VEGETATION
NORTHEAST STATION- RICHLAND, WASHINGTON

4-25-95

FIGURE 5.88

GROSS BETA IN VEGETATION
NORTHWEST STATION- RICHLAND, WASHINGTON



4-25-95

FIGURE 5.89

ANNUAL GROSS BETA TRENCH CAP VEGETATION
TRENCH 1- RICHLAND, WASHINGTON

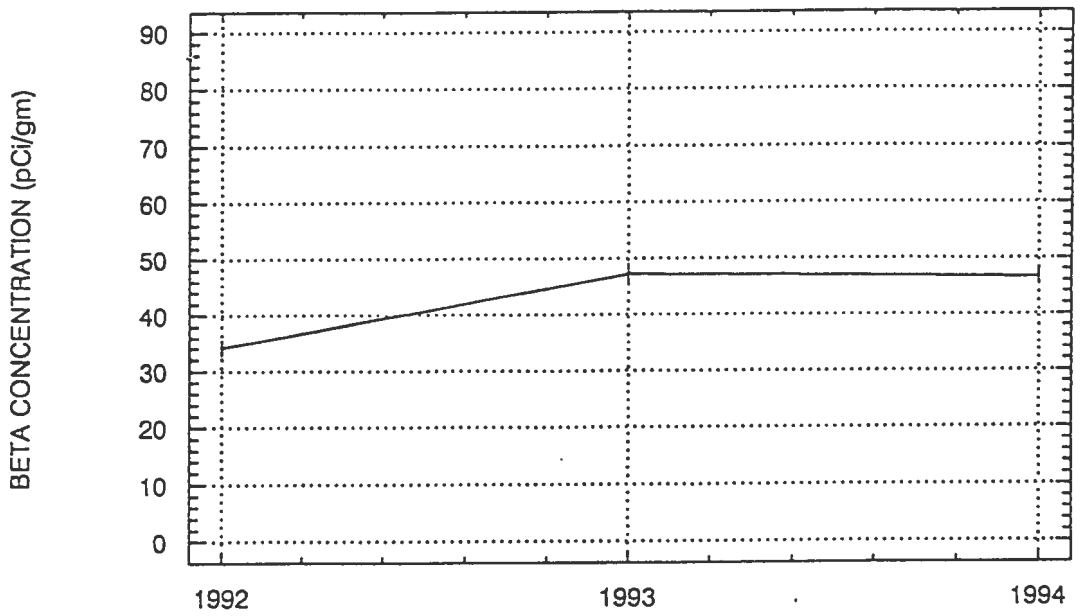


FIGURE 5.90

ANNUAL GROSS BETA TRENCH CAP VEGETATION
TRENCH 2- RICHLAND, WASHINGTON

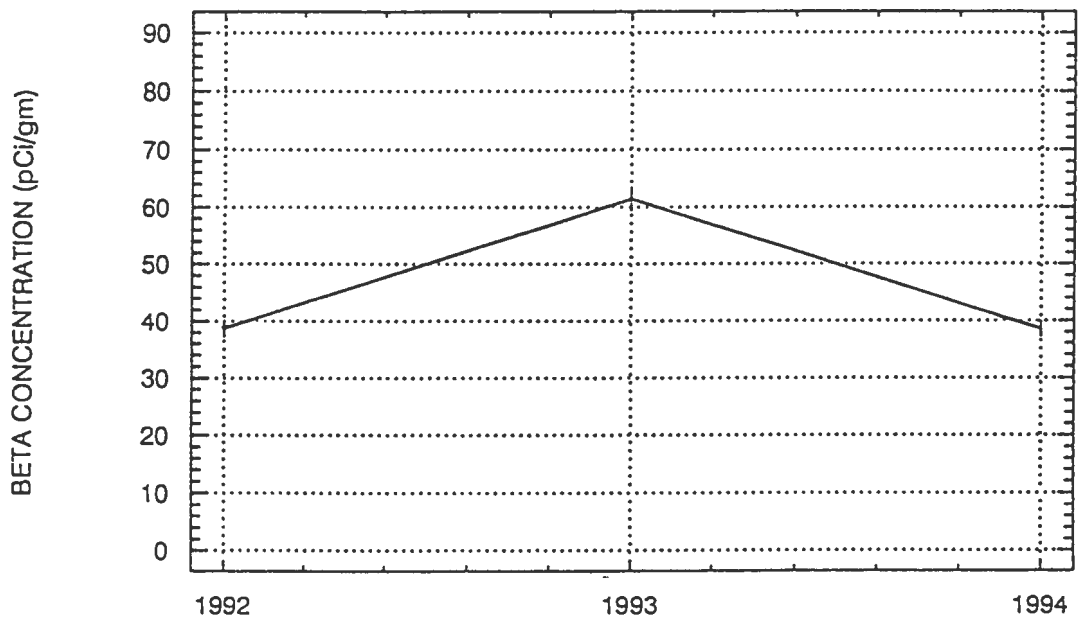


FIGURE 5.91

ANNUAL GROSS BETA TRENCH CAP VEGETATION
TRENCH 3- RICHLAND, WASHINGTON

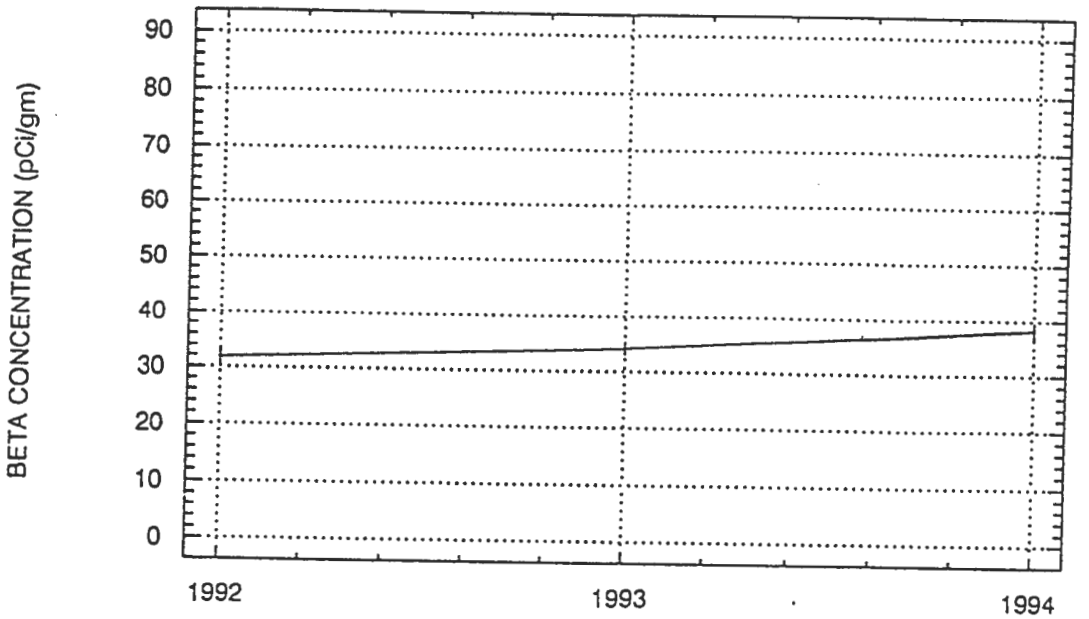


FIGURE 5.92

ANNUAL GROSS BETA TRENCH CAP VEGETATION
TRENCH 4- RICHLAND, WASHINGTON

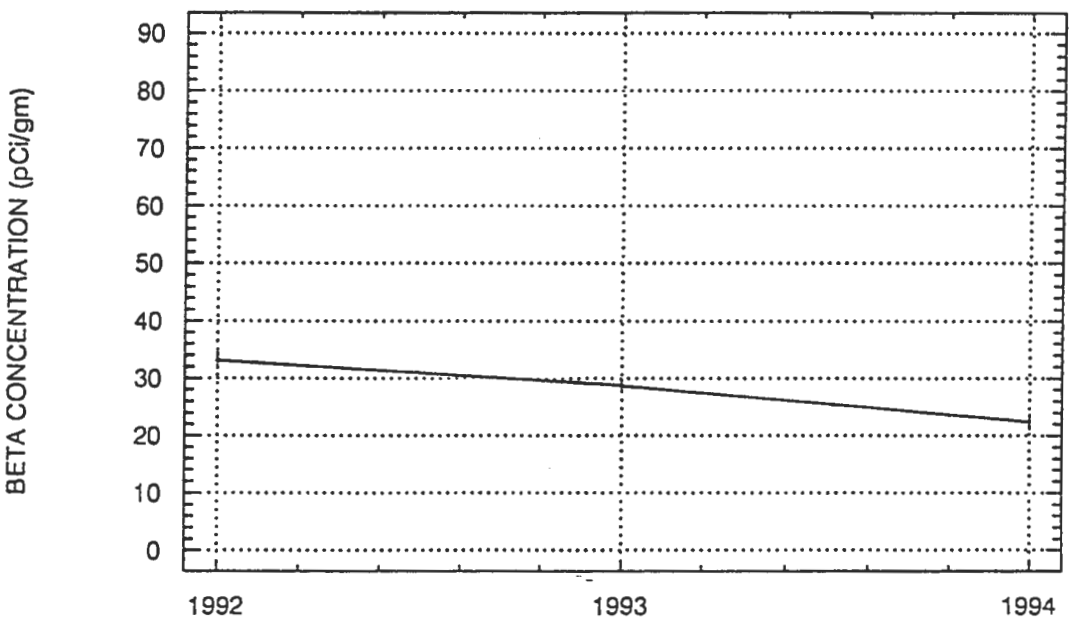


FIGURE 5.93

ANNUAL GROSS BETA TRENCH CAP VEGETATION
TRENCH 4A- RICHLAND, WASHINGTON

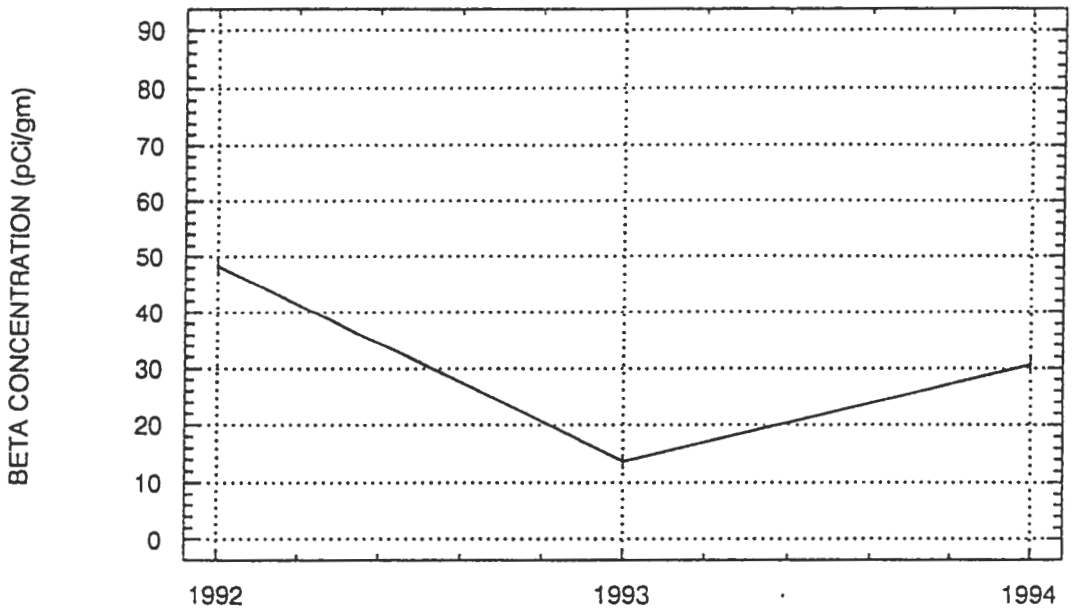


FIGURE 5.94

ANNUAL GROSS BETA TRENCH CAP VEGETATION
TRENCH 4B- RICHLAND, WASHINGTON

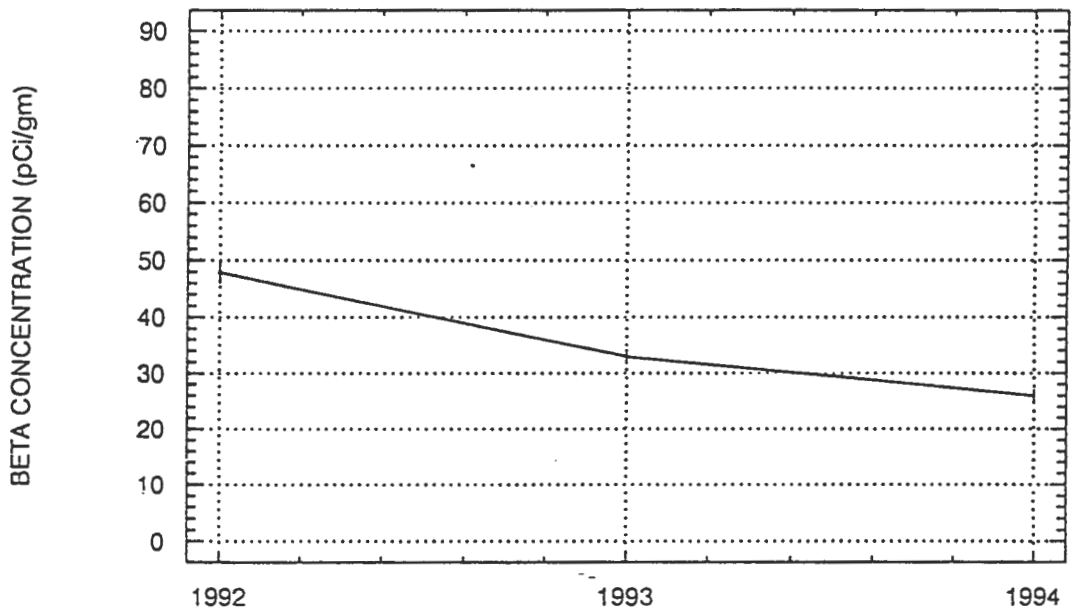


FIGURE 5.95

ANNUAL GROSS BETA TRENCH CAP VEGETATION
TRENCH 5- RICHLAND, WASHINGTON

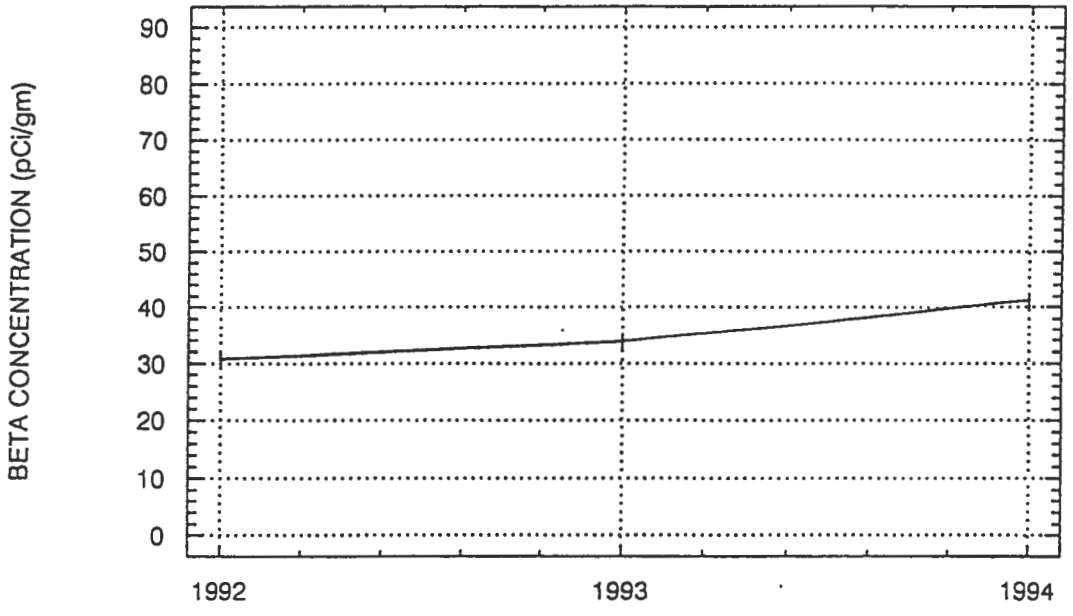


FIGURE 5.96

ANNUAL GROSS BETA TRENCH CAP VEGETATION
TRENCH 6- RICHLAND, WASHINGTON

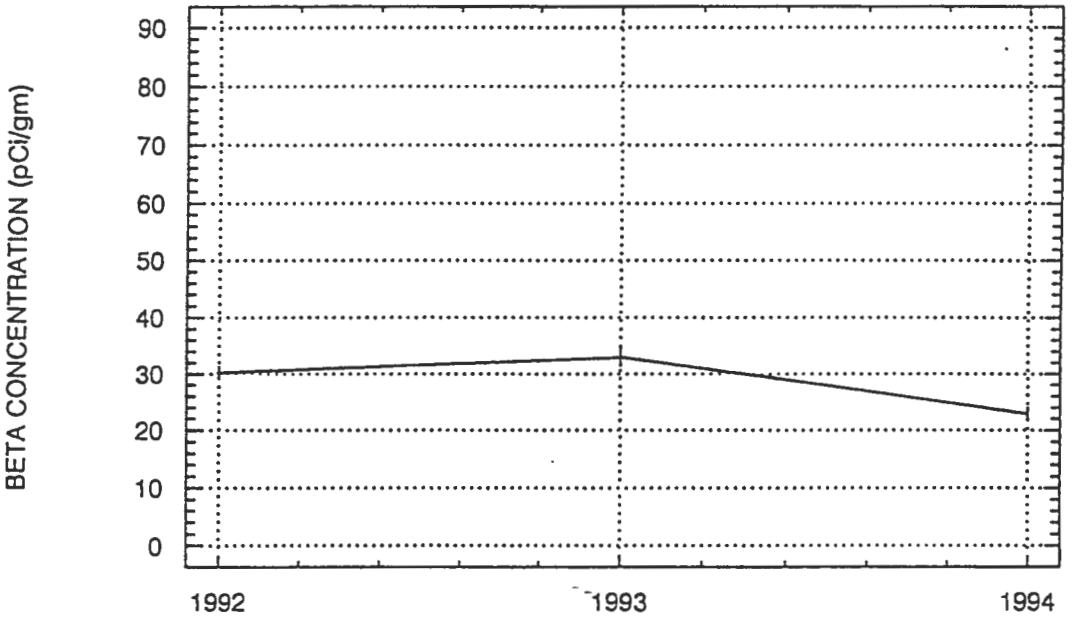


FIGURE 5.97

ANNUAL GROSS BETA TRENCH CAP VEGETATION
TRENCH 7- RICHLAND, WASHINGTON

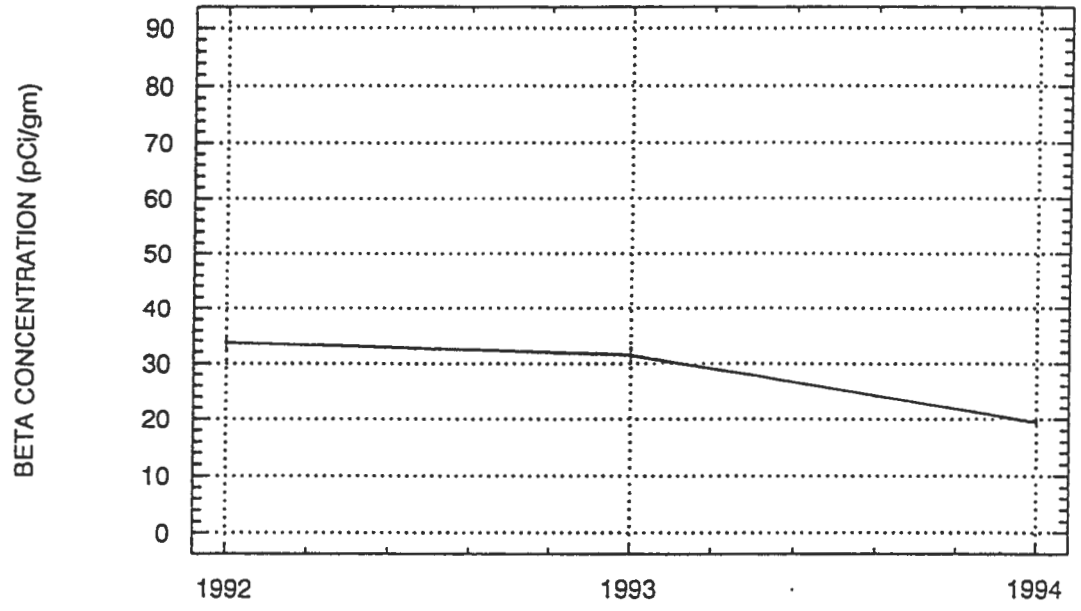


FIGURE 5.98

ANNUAL GROSS BETA TRENCH CAP VEGETATION
TRENCH 7A- RICHLAND, WASHINGTON

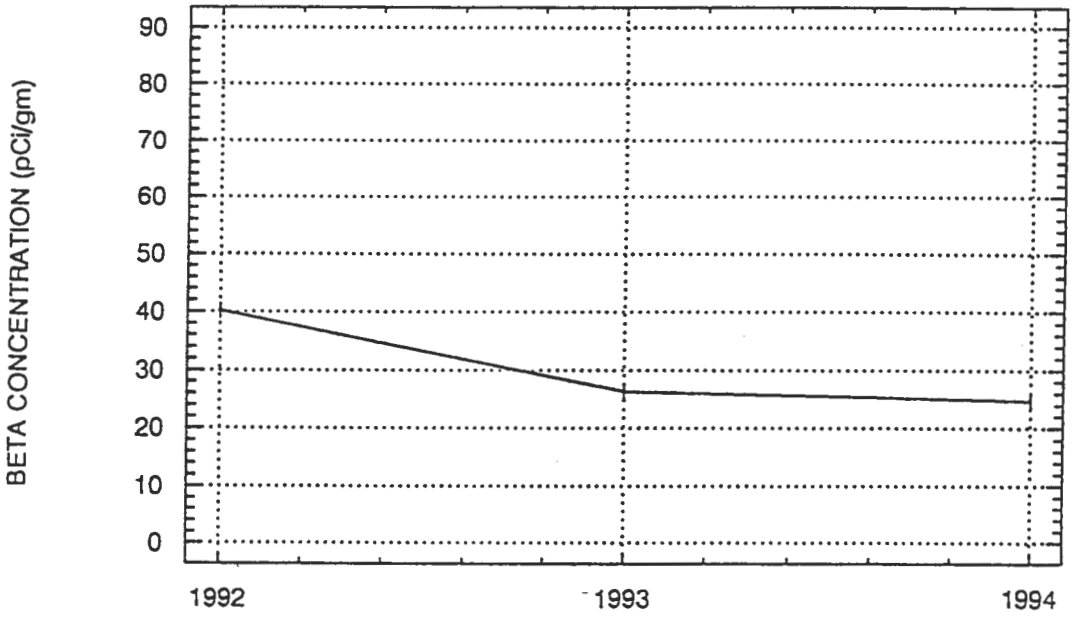


FIGURE 5.99

ANNUAL GROSS BETA TRENCH CAP VEGETATION
TRENCH 8- RICHLAND, WASHINGTON

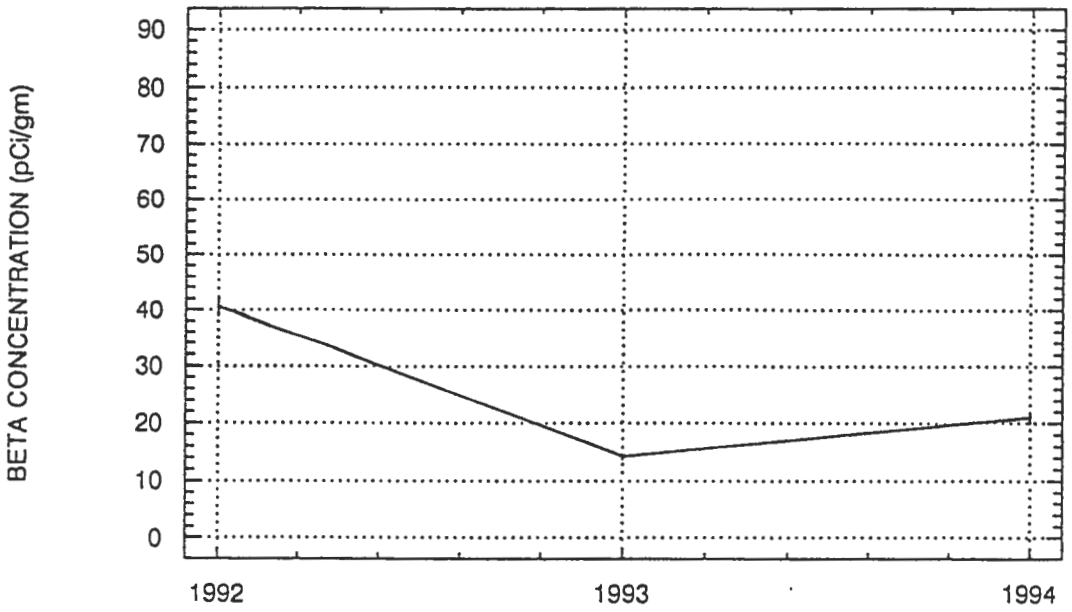


FIGURE 5.100

ANNUAL GROSS BETA TRENCH CAP VEGETATION
TRENCH 9- RICHLAND, WASHINGTON

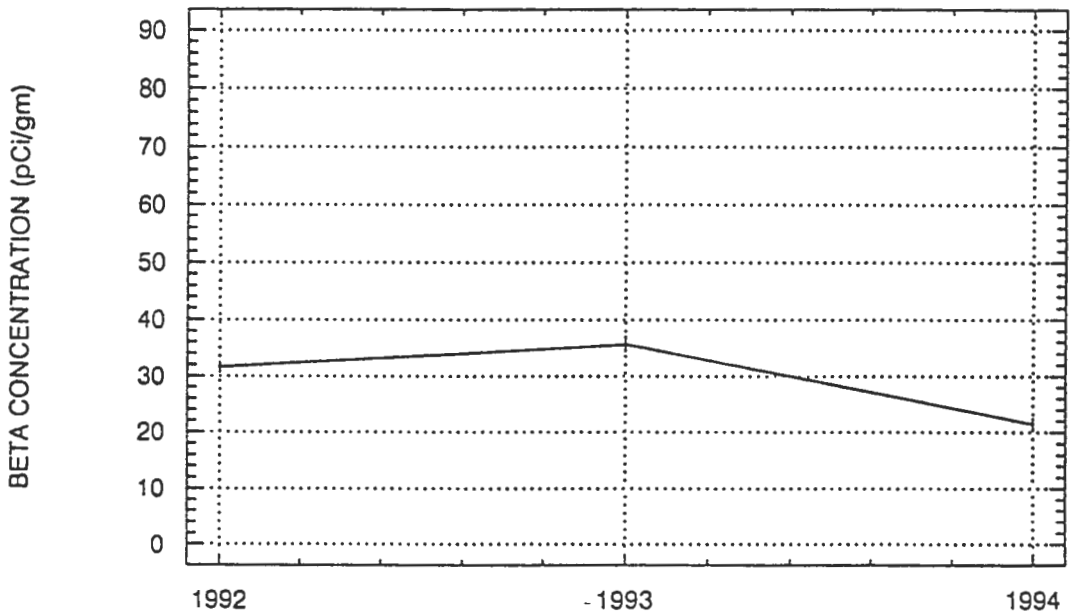


FIGURE 5.101

ANNUAL GROSS BETA TRENCH CAP VEGETATION
TRENCH 10- RICHLAND, WASHINGTON

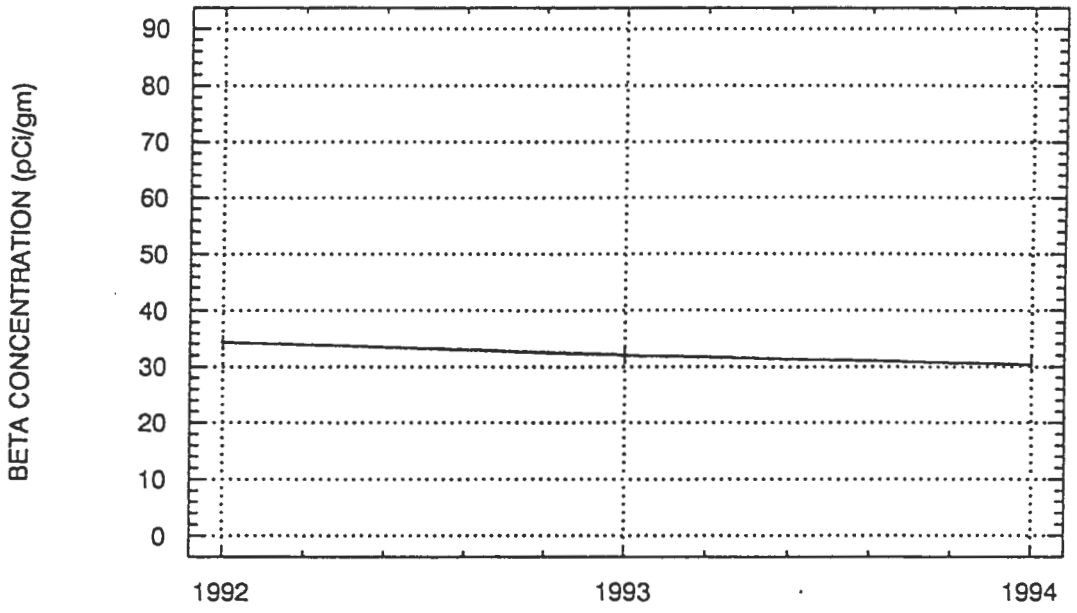
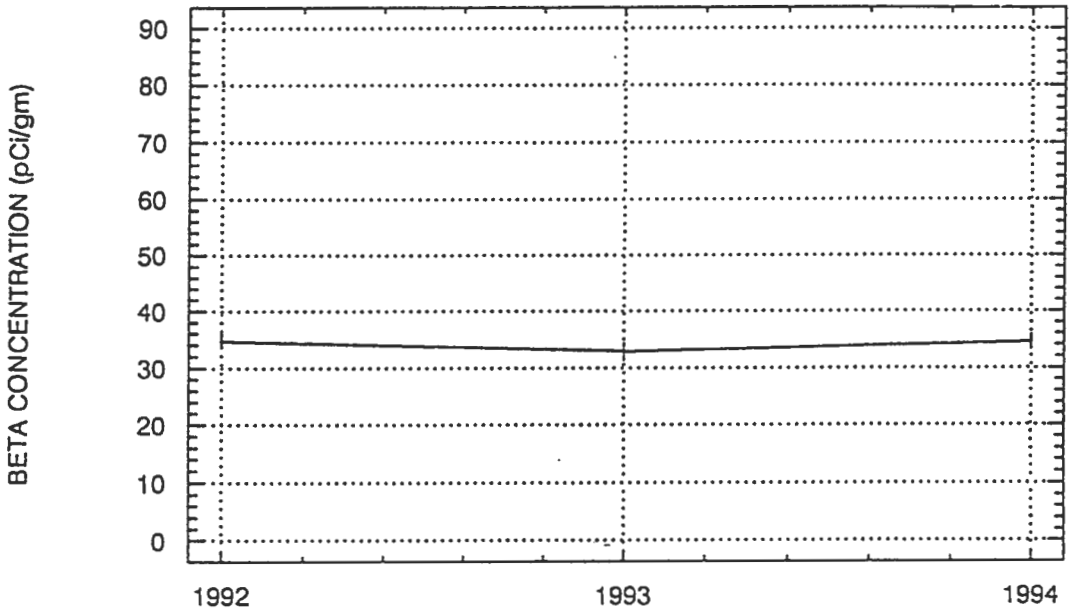


FIGURE 5.102

ANNUAL GROSS BETA TRENCH CAP VEGETATION
TRENCH 11A- RICHLAND, WASHINGTON



4-28-95

FIGURE 5.103

ANNUAL GROSS BETA TRENCH CAP VEGETATION
TANK FARM- RICHLAND, WASHINGTON

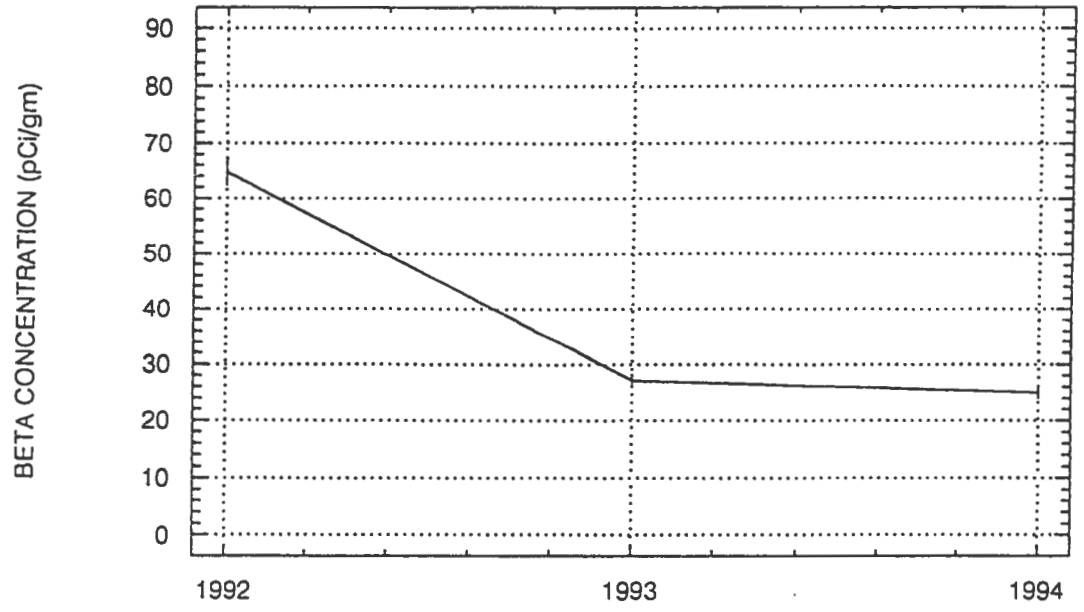
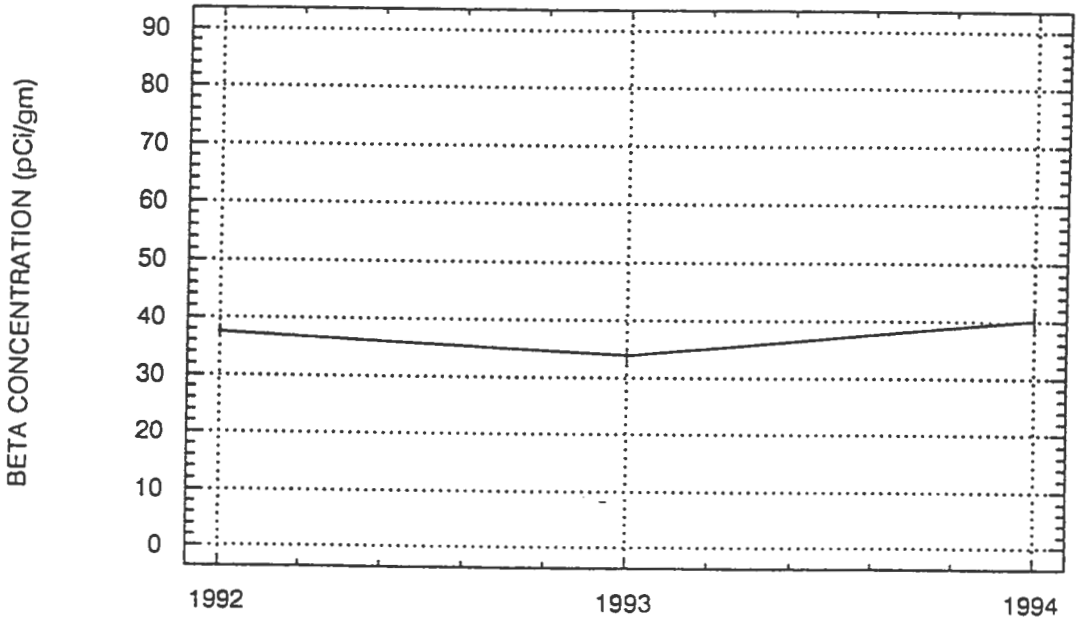


FIGURE 5.104

ANNUAL GROSS BETA TRENCH CAP VEGETATION
REACTOR HEAD- RICHLAND, WASHINGTON



5.4 Penetrating Radiation Monitoring

External radiation measurements were made using thermoluminescent dosimeters (TLDs) placed as described below.

- One on each of the east, west and south fencelines and two on the north fenceline. These are changed monthly.
- A second TLD is placed at each of the above locations that is changed quarterly.
- One at each of the northeast, northwest, southeast and southwest facility corners, also changed quarterly.
- One on the fenceline at the closest point to each active disposal unit; changed monthly.
- One every 200 feet on the fenceline closest to Trench 14; changed monthly.
- One every 200 feet on the portion of the west site fence adjacent to Trench 16; changed monthly.
- Two background TLDs are positioned at environmental air monitoring station number one. One of these provides monthly background readings, the other provides quarterly background.

The result of monthly and quarterly environmental monitoring TLDs are presented in Table 5.41 and 5.42 respectively. The results obtained from the TLD monitoring program confirm compliance with the 500 mrem/year limit as required by the Richland Facility Standards Manual (FSM) dated May 1992. This limit was changed to 400 mrem/year in the revised FSM dated December 1994 (approved April 12, 1995). The TLD monitoring program was also in compliance with the new limits.

The highest annual total for monthly badges was 144 mrem at the AM-007 location at the west fence. The equivalent average daily exposure rate is 0.39 mrem/day. The annual unrestricted area limit for the US Ecology facility is 500 mrem/year. The greatest monthly badge total was 28.8% of this limit.

The highest total for quarterly badges was 170 mrem. This was located on the west fence. This includes a background contribution of 27 mrem. Consequently, exposure attributable to site operations is 143 mrem. The equivalent daily exposure rate is 0.39 mrem/day. This value is 28.6% of the site unrestricted area exposure limit.

TABLE 5.41

Monthly Fenceline Environmental TLD Summary - 1994

Issue Month		Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	%Limit
# Days Posted		33	28	34	28	30	30	31	31	32	29	30	29	
AB001	month	3.00	2.00	2.00	2.00	2.00	3.00	2.00	2.00	2.00	3.00	3.00	2.00	
BKGD	total	3.00	5.00	7.00	9.00	11.00	14.00	16.00	18.00	20.00	23.00	26.00	28.00	5.6%
	ave/day	0.09	0.07	0.06	0.07	0.07	0.10	0.06	0.06	0.06	0.10	0.10	0.07	
AM006	month	12.00	10.00	13.00	11.00	9.00	12.00	9.00	10.00	11.00	11.00	5.00	4.00	
S. FENCE	total	12.00	22.00	35.00	46.00	55.00	67.00	76.00	86.00	97.00	108.00	113.00	117.00	23.4%
	ave/day	0.36	0.36	0.38	0.39	0.30	0.40	0.29	0.32	0.34	0.38	0.17	0.14	
AM007	month	15.00	11.00	14.00	11.00	10.00	11.00	10.00	13.00	16.00	15.00	10.00	8.00	
W. FENCE	total	15.00	26.00	40.00	51.00	61.00	72.00	82.00	95.00	111.00	126.00	136.00	144.00	28.8%
	ave/day	0.45	0.39	0.41	0.39	0.33	0.37	0.32	0.42	0.50	0.52	0.33	0.28	
AM008	month	0.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	
NE FENCE	total	0.00	1.00	2.00	3.00	4.00	4.00	5.00	5.00	6.00	7.00	8.00	9.00	1.8%
	ave/day	0.00	0.04	0.03	0.04	0.03	0.00	0.03	0.00	0.03	0.03	0.03	0.03	
AM009	month	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00	
NE FENCE	total	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	2.00	3.00	4.00	4.00	0.8%
	ave/day	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.03	0.03	0.00	
AM010	month	0.00	1.00	2.00	2.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	
E. FENCE	total	0.00	1.00	3.00	5.00	6.00	6.00	7.00	8.00	9.00	10.00	11.00	11.00	2.2%
	ave/day	0.00	0.04	0.06	0.07	0.03	0.00	0.03	0.03	0.03	0.03	0.03	0.00	

NOTES:
1. All readings are in mrem unless otherwise noted and are less background (AB-001).
2. Average readings are in mrem/day.
3. "total" is the cumulative monthly total since the beginning of the year.

9613341.0788

TABLE 5.41

Issue Month		Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	%Limit
# Days Posted		33	28	34	28	30	30	31	31	32	29	30	29	
AM011	month	1.00	2.00	2.00	1.00	1.00	1.00	2.00	1.00	2.00	2.00	1.00	0.00	
E. TR-13	total	1.00	3.00	5.00	6.00	7.00	8.00	10.00	11.00	13.00	15.00	16.00	16.00	3.2%
	ave/day	0.03	0.07	0.06	0.04	0.03	0.03	0.06	0.03	0.06	0.07	0.03	0.00	
AM015	month	0.00	2.00	3.00	2.00	1.00	0.00	2.00	1.00	2.00	1.00	1.00	1.00	
E. TR-14	total	0.00	2.00	5.00	7.00	8.00	8.00	10.00	11.00	13.00	14.00	15.00	16.00	3.2%
	ave/day	0.00	0.07	0.09	0.07	0.03	0.00	0.06	0.03	0.06	0.03	0.03	0.03	
AM016	month	2.00	2.00	4.00	2.00	2.00	2.00	2.00	2.00	3.00	2.00	1.00	0.00	
S. TR-14	total	2.00	4.00	8.00	10.00	12.00	14.00	16.00	18.00	21.00	23.00	24.00	24.00	4.8%
200'	ave/day	0.06	0.07	0.12	0.07	0.07	0.07	0.06	0.06	0.09	0.07	0.03	0.00	
AM017	month	3.00	4.00	5.00	4.00	5.00	4.00	4.00	4.00	5.00	5.00	2.00	1.00	
S. TR-14	total	3.00	7.00	12.00	16.00	21.00	25.00	29.00	33.00	38.00	43.00	45.00	46.00	9.2%
400'	ave/day	0.09	0.14	0.15	0.14	0.17	0.13	0.13	0.13	0.16	0.17	0.07	0.03	
AM018	month	8.00	9.00	11.00	8.00	8.00	8.00	9.00	8.00	8.00	10.00	4.00	2.00	
S. TR-14	total	8.00	17.00	28.00	36.00	44.00	52.00	61.00	69.00	77.00	87.00	91.00	93.00	18.6%
600'	ave/day	0.24	0.32	0.32	0.29	0.27	0.27	0.29	0.26	0.25	0.34	0.13	0.07	
AM019	month	14.00	12.00	14.00	11.00	10.00	10.00	11.00	10.00	11.00	12.00	6.00	4.00	
S. TR-14	total	14.00	26.00	40.00	51.00	61.00	71.00	82.00	92.00	103.00	115.00	121.00	125.00	25.0%
800'	ave/day	0.42	0.43	0.41	0.39	0.33	0.33	0.35	0.32	0.34	0.41	0.20	0.14	
AM020	month	14.00	13.00	18.00	11.00	12.00	11.00	10.00	10.00	11.00	12.00	8.00	6.00	
S. TR-14	total	14.00	27.00	45.00	56.00	68.00	79.00	89.00	99.00	110.00	122.00	130.00	136.00	27.2%
1000'	ave/day	0.42	0.46	0.53	0.39	0.40	0.37	0.32	0.32	0.34	0.41	0.27	0.21	

NOTES:
1. All readings are in mrem unless otherwise noted and are less background (AB-001).
2. Average readings are in mrem/day.
3. "total" is the cumulative monthly total since the beginning of the year.

TABLE 5.41

Issue Month		Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	%Limit
# Days Posted		33	28	34	28	30	30	31	31	32	29	30	29	
AM021	month	9.00	9.00	10.00	7.00	9.00	7.00	7.00	7.00	8.00	8.00	6.00	6.00	
S. TR-14	total	9.00	18.00	28.00	35.00	44.00	51.00	58.00	65.00	73.00	81.00	87.00	93.00	18.6%
1200'	ave/day	0.27	0.32	0.29	0.25	0.30	0.23	0.23	0.23	0.25	0.28	0.20	0.21	
AM022	month	11.00	11.0	13.00	10.00	9.00	9.00	8.00	9.00	9.00	11.00	8.00	8.00	
W. TR-14	total	11.00	22.00	35.00	45.00	54.00	63.00	71.00	80.00	89.00	100.00	108.00	116.00	23.2%
	ave/day	0.33	0.39	0.38	0.36	0.30	0.30	0.26	0.29	0.28	0.38	0.27	0.28	
AM023	month	15.00	11.00	14.00	9.00	9.00	9.00	9.00	10.00	10.00	11.00	7.00	8.00	
W. TR-16	total	15.00	26.00	40.00	49.00	58.00	67.00	76.00	86.00	96.00	107.00	114.00	122.00	24.4%
100'	ave/day	0.45	0.39	0.41	0.32	0.30	0.30	0.29	0.32	0.31	0.38	0.23	0.28	
AM024	month	13.00	11.00	14.00	10.00	11.00	11.00	10.00	12.00	15.00	13.00	9.00	7.00	
W. TR-16	total	13.00	24.00	38.00	48.00	59.00	70.00	80.00	92.00	107.00	120.00	129.00	136.00	27.2%
300'	ave/day	0.39	0.39	0.41	0.36	0.37	0.37	0.32	0.39	0.47	0.45	0.30	0.24	
AM025	month	9.00	9.00	13.00	9.00	10.00	10.00	9.00	12.00	14.00	14.00	11.00	8.00	
W. TR-16	total	9.00	18.00	31.00	40.00	50.00	60.00	69.00	81.00	95.00	109.00	120.00	128.00	25.6%
500'	ave/day	0.27	0.32	0.38	0.32	0.33	0.33	0.29	0.39	0.44	0.48	0.37	0.28	
AM026	month	5.00	6.00	10.00	8.00	7.00	8.00	6.00	8.00	11.00	11.00	8.00	7.00	
W. TR-16	total	5.00	11.00	21.00	29.00	36.00	44.00	50.00	58.00	69.00	80.00	88.00	95.00	19.0%
700'	ave/day	0.15	0.21	0.29	0.29	0.23	0.27	0.19	0.26	0.34	0.38	0.27	0.24	

NOTES:
1. All readings are in mrem unless otherwise noted and are less background (AB-001).
2. Average readings are in mrem/day.
3. "total" is the cumulative monthly total since the beginning of the year.

TABLE 5.42

Quarterly Environmental TLDs

# Days		89	85	98	92	% Limit
AB002	quarter	6.00	6.00	6.00	9.00	
	total	6.00	12.00	18.00	27.00	5.4%
	ave/day	0.07	0.07	0.06	0.10	
AM101	quarter	8.00	6.00	8.00	9.00	
	total	8.00	14.00	22.00	31.00	6.2%
	ave/day	0.09	0.07	0.08	0.10	
AM102	quarter	9.00	9.00	9.00	11.00	
	total	9.00	18.00	27.00	38.00	7.6%
	ave/day	0.10	0.11	0.09	0.12	
AM103	quarter	21.00	17.00	19.00	19.00	
	total	21.00	38.00	57.00	76.00	15.2%
	ave/day	0.24	0.20	0.19	0.21	
AM104	quarter	7.00	7.00	9.00	10.00	
	total	7.00	14.00	23.00	33.00	6.6%
	ave/day	0.08	0.08	0.09	0.11	
AM105	quarter	9.00	9.00	10.00	10.00	
	total	9.00	18.00	28.00	38.00	7.6%
	ave/day	0.10	0.11	0.10	0.11	
AM106	quarter	38.00	39.00	43.00	28.00	
	total	38.00	77.00	120.00	148.00	29.6%
	ave/day	0.43	0.46	0.44	0.30	
AM107	quarter	44.00	41.00	47.00	38.00	
	total	44.00	85.00	132.00	170.00	34.0%
	ave/day	0.49	0.48	0.48	0.41	
AM108	quarter	8.00	8.00	9.00	10.00	
	total	8.00	16.00	25.00	35.00	7.0%
	ave/day	0.09	0.09	0.09	0.11	
AM109	quarter	6.00	8.00	7.00	9.00	
	total	6.00	14.00	21.00	30.00	6.0%
	ave/day	0.07	0.09	0.07	0.10	

NOTES:
1. All readings are in mrem unless otherwise noted and include background (AB-002).
2. Average readings are in mrem/day.
3. "Total" is the cumulative quarterly total since the beginning of the year.

5.5 Special Environmental Sampling

US Ecology added one new element to its environmental monitoring program in 1994, in-ground solar stills for measurement of vadose tritium. Results for this program and the ongoing monitoring programs for trench cap soil gas radon, vadose zone organic vapor, radon and tritium and radon air measurements are presented and discussed in this section.

5.5.1 Trench Cap Radon Soil Gas Monitoring

Starting in August 1992, a trial program was initiated to measure radon soil gas concentrations near the surfaces of trench caps. The trenches selected for monitoring were Trench 7 and Trench 5.

Based on site disposal records, Trench 7 contained 131,803 mCi of Ra-226; Trench 5 contains 4,227 mCi Ra-226. Other site disposal trenches contain between 0 and 10,000 mCi Ra-226.

Radium-226 decays to the radioactive noble gas radon-222 through a single alpha decay. As a noble gas, radon is free to diffuse through soil. Radon-222 also decays via a single alpha decay to polonium-218. Since it is a non-gaseous isotope, the polonium is unable to continue to diffuse through soil.

Measurements were made by placing soil gas track etch detectors at three locations along the long axis of each trench. A background detector was placed in soil at the site background monitoring station.

The first sampling period was August and September of 1992. Subsequently, monitoring periods were shortened from two months to one month. Analytical results are presented in Table 5.43.

Measured soil gas radon concentrations in the trench caps ranged from a low of 46.3 pCi/l measured at the center of Trench 5 in April 1994 to a high of 311.3 pCi/l at the east end of Trench 5 in February 1994. Average concentrations ranged from 69.4 pCi/l at Trench 5 center to 173.8 pCi/l at Trench 5 east. The average concentration measured at the background station was 69.3 pCi/l.

Soil gas radon sampling was temporarily suspended on Trench 5 from December 1994 to February 1995 to allow removal of soil for backfill.

There are no environmental standards or limits applicable to soil gas radon concentrations at the Richland site. US Ecology plans to continue to gather data on trench cap soil gas radon concentrations throughout 1995.

5.5.2 Vadose Zone Monitoring Program

In November 1991, US Ecology installed three wells into the unsaturated soil zone as part of a two-year research project conducted at the request of the Washington State Department of Health. Well VW-101 was placed between Trenches 4 and 5 at the east end. Well VW-102 was placed between Trenches 10 and 11A, also on the east end. A background Well VW-100 was placed away from current disposal areas in the northwest corner of the site.

A complete description of the design and installation of the wells is contained in the "Vadose Zone Monitoring Program" submitted to the state on March 31, 1992. Proposed sampling procedures were also included as a part of that submittal.

The soil gas constituents tested for as a part of this program include organic vapors of xylene, toluene and methane/combustible gasses. Radiological parameters to be analyzed include tritium and radon.

Organic vapor sampling entails withdrawing a gas sample from the well into an evacuated chamber. The chamber is then sent to an offsite laboratory for analysis. Sampling for tritium vapor is performed by placing silica gel in a perforated cylinder into the well so that it can absorb water vapor present in the vadose zone. Radon measurements are made by attaching an airborne radon track etch detector to the cylinder containing the silica gel.

Under this program, soil gas samples are taken quarterly for a minimum two-year period. Following procedure approval, the first organic samples were taken in the third quarter of 1992. Media for radiological samples was placed in the well following the fourth quarter, 1991 organic samples.

Results for the organic vapor sampling for all three wells are presented in Table 5.44. Vadose zone radon and tritium measurements are presented in Tables 5.45 and 5.46, respectively.

5.5.2.1 Vadose Zone Radon

Measured vadose zone radon ranged from a low of 312.8 pCi/l at VW #102 in the first quarter to a high of greater than 1556 pCi/l at VW #101 in the first quarter. The average concentration ranged from 366.7 pCi/l to 859.8 pCi/l. The average concentration measured at the background well was 312.9 pCi/l.

5.5.2.2 Vadose Zone Tritium

Vadose zone tritium concentrations ranged from a low of 2.26 E-4 uCi/cc at VW #101 during the third quarter to a high of 4.97 E-4 uCi/cc at VW #102 during the first quarter. The average concentration ranged from 2.49 E-4 uCi/cc to 4.45 E-4 uCi/cc. The background well average concentration was 7.43 E-8 uCi/cc.

As with the trench cap radon concentrations, there are no applicable environmental standards or limits for vadose zone radon or tritium.

5.5.3 Radon Air Monitoring

Beginning in May 1993, the radon gas concentration was monitored monthly. Three gas track etch detectors were installed at air environmental Stations 1, 2 and 5. Radon air measurements are presented in Table 5.47.

Radon air concentration ranged from a low of less than minimum detectable to a high of 2.0 pCi/l at Station 5 during January.

5.5.4 40 CFR 264, Appendix IX

The fourth quarter groundwater monitoring wells were sampled and analyzed for the following 40 CFR 264, Appendix IX constituents: barium, cadmium, chromium, mercury and silver. Samples results are presented on Table 5.48.

In comparison of groundwater Wells 3, 5, 8 and 10 to the upgradient Well 13 results, it can be concluded that the US Ecology disposal site has not contributed any hazardous waste contamination to the groundwater.

5.5.5 In-Ground Solar Stills

Starting in October 1994, a trial program was initiated to measure the tritium vapor released from soil. Three solar stills were placed adjacent to each vadose monitoring well (100, 101, 102).

A solar still consists of a 55-gallon drum with the bottom removed. The drum is placed approximately 12-18 inches into the ground and covered with a sheet of plastic. As the soil vapor condenses on the inside surface of the plastic, it is collected and then analyzed for tritium concentration.

This system is being evaluated to determine if it may be a better indication of tritium gas emanating from the trench cap. Sample results for October, November and December of 1994 were as follows:

	SS100 (pCi/l)	SS101 (pCi/l)	SS102 (pCi/l)
October	50 ± 81	4177 ± 187	2381 ± 150
November	74 ± 81	3345 ± 171	2345 ± 159
December	163 ± 88	3288 ± 176	2065 ± 148

As with the vadose well tritium, there are no applicable environmental standards or limits.

TABLE 5.43

Trench Cap Soil Gas Radon Measurements

Location	January	February	March	April	May	June	July	August	September	October	November	December	Average
BKGD	73.8	81.2	77.5	86.1	98.4	60.3	47.7	61.7	58.2	39.4	80.5	66.7	69.3
T5E	274.6	311.3	212.1	127.0	218.9	145.6	109.8	115.1	103.3	122.2	171.8	*	173.8
T5C	78.4	66.1	46.5	46.3	59.3	72.3	61.3	62.4	75.5	85.8	110.0	*	69.4
T5W	109.5	94.1	111.1	99.0	96.4	111.5	99.1	67.9	85.3	74.2	87.0	*	94.1
T7E	164.6	200.6	121.8	101.2	192.8	116.5	81.7	79.5	92.3	99.0	179.6	134.4	130.3
T7C	138.6	150.0	147.5	125.9	101.4	125.5	111.8	71.7	80.8	81.7	122.2	114.7	114.3
T7W	73.2	137.1	62.4	63.5	87.4	67.3	67.1	56.2	79.3	56.8	87.8	63.0	75.1

NOTES: 1. Readings provided in units of pCi/liter of soil gas.

*Trial radon monitoring was temporarily suspended from Trench 5 to remove surcharge for backfill material.

TABLE 5.44

Vadose Zone Organic Vapor Results (quarterly)

Parameter	VW-100				VW-101				VW-102			
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
Benzene (mg/m^3)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ethyl Benzene (mg/m^3)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Toluene (mg/m^3)	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Xylene (mg/m^3)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Total Petroleum Hydrocarbons (mg/m^3)	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500
Carbon Monoxide (ppm)	< 100	< 10	< 10	< 500	< 100	< 10	< 10	< 500	< 100	< 10	< 10	< 500
Carbon Dioxide (ppm)	1600	1400	1500	1600	37,000	20,000	26,000	39,000	18,000	15,000	18,000	9,200
Methane (ppm)	< 100	< 10	< 10	< 500	< 100	22	52	< 500	< 100	38	35	< 500
Nitrogen (%)	78	77	76	79	80	79	79	82	76	80	80	80
Oxygen (%)	22	23	20	22	16	20	17	16	22	19	17	20

TABLE 5.45

Vadose Zone Radon Measurements

Location	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Average
VW#100	280.7	311.0	315.8	344.0	312.9
VW#101	> 1556	1007.1	512.3	1060.1	859.8[2]
VW#102	312.8	439.6	354.3	360.2	366.7

1. Units of pCi/liter of soil gas.
2. Average of second, third and fourth quarters only.

TABLE 5.46

Vadose Zone Tritium Measurements

Location	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Average
VW#100	1.66 ± 1.02 E-7	1.22 ± 0.96 E-8	1.56 ± 0.81 E-7	-3.70 ± 8.21 E-8	7.43 ± 15.4 E-8
VW#101	2.46 ± 0.01 E-4	2.40 ± 0.01 E-4	2.26 ± 0.01 E-4	2.83 ± 0.01 E-4	2.49 ± 0.02 E-4
VW#102	4.97 ± 0.01 E-4	4.12 ± 0.01 E-4	3.96 ± 0.02 E-4	4.76 ± 0.02 E-4	4.45 ± 0.03 E-4

1. Units of uCi/cc.

TABLE 5.47

Radon Air Measurements

Location	January	February	March	April	May	June	July	August	September	October	November	December
Station #1	< 1.0	< 1.1	< 0.9	< 1.1	< 1.0	< 0.9	1.8	1.6	1.2	1.4	< 1.1	< 0.8
Station #2	< 1.0	< 1.1	< 0.9	< 1.1	< 1.0	< 0.9	< 1.1	1.2	< 1.1	< 1.1	< 1.1	< 0.8
Station #5	2.0	< 1.1	< 0.9	< 1.1	< 1.0	0.9	< 1.1	1.0	1.7	1.3	< 1.1	1.1

1. Units of pCi/liter air.

TABLE 5.48

40 CFR 264, Appendix IX Metals

	GROUNDWATER MONITORING WELLS				
	3	5	8	10	13 (upgradient)
Barium (ppb)	36	39	42	39	37
Cadmium (ppb)	< 3	< 3	< 3	< 3	<3
Chromium (ppb)	112	68	66	42	49
Mercury (ppb)	< 2	< 2	< 2	< 2	<2
Silver (ppb)	< 10	< 10	< 10	< 10	<10

6.0 ENVIRONMENTAL NON-RADIOLOGICAL PROGRAM INFORMATION

US Ecology performs groundwater monitoring at five wells located on or adjacent to the facility. These wells are sampled and analyzed for radiological as well as nonradiological constituents. A description of nonradiological parameter monitoring and results are presented in Section 7, Radioanalytical Analysis of Well Water Samples.

In addition, all groundwater monitoring wells were sampled and analyzed for selected 40 CFR 264, Appendix IX constituents in 1994. The results and description of these nonradiological parameters are presented in Section 5.5, Special Environmental Sampling

The only other nonradiological environmental monitoring conducted at the facility is an experimental vadose zone soil gas monitoring program. This program is also described in Section 5.5, Special Environmental Sampling.

7.0 RADIOANALYTICAL ANALYSES OF WELL WATER SAMPLES

Groundwater samples are collected quarterly and analyzed to determine the presence of possible contamination from facility operations or other activities on the Hanford Reservation. Samples were collected from Wells 3, 5, 8 and 10 that are downgradient of the disposal units and Well 13 which is upgradient. The groundwater samples were analyzed for potential radiological and chemical contaminants. Results from radiological analysis are presented in Tables 7.1 through 7.4. Nonradiological analysis results are presented in Table 7.5. Groundwater elevations for each well are presented in Table 7.6.

7.1 Gross Alpha and Beta Activity

Gross alpha and beta activity measurements in groundwater may be used to determine the presence of radionuclide contamination, used as a screening method for initiating further analysis or used to verify any trends in radionuclide concentrations in the groundwater.

Analytical results for groundwater samples are presented in Table 7.1 The gross alpha activity concentration in groundwater samples varied from 6.0 E-1 ± 5.0 E-1 pCi/l in Well 3 in the second quarter to a maximum of 2.5 E0 ± 7.0 E-1 pCi/l at Well 3 in the first quarter of 1994. The investigation level for gross alpha activity is 12 pCi/l.

Gross beta activity varied from a low of 4.6 E0 ± 5.0 E-1 pCi/l at Well 10 during the fourth quarter to a high of 8.6 E0 ± 9.0 E-1 pCi/l at Well 3 in the first quarter. The mean beta concentration was 6.7 pCi/l. The investigation level for gross beta activity is also 12 pCi/l. Figures 7.1 through 7.5 compare 1992 through 1994 gross beta results.

The range of results for gross alpha and beta activity analysis in groundwater at the US Ecology site during previous years is presented below:

Year	Gross Alpha Activity Range (pCi/l)	Gross Beta Activity Range (pCi/l)
1991	< 2.0 to 4.0 E0 ± 2.0 E0	< 3.0 to 7.0 E0 ± 4.0 E0
1992	< 2.0 to 5.0 E0 ± 2.0 E0	4.2 E0 ± 7.0 E-1 to 1.0 E+1 ± 3.0 E0
1993	<2.0 to 2.4 E0 ± 8.0 E-1	4.40 E0 ± 7.0 E-1 to 7.60 E0 ± 8.0 E-1

Gross beta and alpha activity results for 1994 compare favorably with those for previous years. Results from upgradient and downgradient wells are also similar. It can be concluded from upgradient and downgradient groundwater monitoring well results, in addition to those of previous years, that site operations have not resulted in any discernible trends in these analyses.

7.2 Tritium and Carbon-14

Tritium is present in groundwater at the Hanford site due to both natural processes and due to tritium contaminated liquid waste discharged to the ground from Hanford Department of Energy facilities in the past.

Tritium concentrations measured in groundwater samples are presented in Table 7.1. Concentrations in 1994 ranged from 1.54 E+3 $\pm$ 1.28 E+2 pCi/l at Well 10 during the second quarter to a high of 3.56 E+3 $\pm$ 1.78 E+2 pCi/l at Well 13 during the third quarter.

Since the investigation level for tritium in groundwater well samples is 3600 pCi/l, no analytical results exceeded investigation levels.

Tritium in groundwater sample results for 1993 ranged from 1.23 E+3 $\pm$ 1.3 E+2 pCi/l to 3.11 E+3 $\pm$ 1.87 E+2 pCi/l. Figures 7.6 through 7.10 compare 1992 through 1994 groundwater tritium results.

It should be noted that the US Ecology LLRW disposal facility is located adjacent to the 200 East and 200 West facilities of the Department of Energy Hanford Reservation. As presented in DOE's Hanford Site Environmental Report 1993, tritium concentrations in the unconfined aquifer exceed 2 E+5 pCi/l in the regions surrounding the 200 East and 200 West areas. As expected, tritium contamination from these plumes is increasing the levels observed in US Ecology monitoring wells. US Ecology has submitted a request to the Washington Department of Health to adjust tritium inground water action levels to an appropriate level above the concentration seen in upgradient wells.

Analyses for carbon-14 in groundwater are also presented in Table 7.1. All samples for 1994 were reported as being less than the minimum detectable concentration of 200 pCi/l. These results are the same as those seen for carbon-14 in 1993.

The investigation level for carbon-14 in groundwater is 250 pCi/l. Analytical results do not indicate any trends in carbon-14 concentrations.

7.3 Gamma Emitting Radioisotopes in Groundwater

Water samples from the five site environmental monitoring wells were analyzed by gamma spectrometry for the presence of gamma emitting radionuclides. No positive values were reported for man-made radioisotopes in groundwater. Minimum detectable concentrations for various isotopes are presented in Table 7.2.

These results are consistent with values reported for 1993. Based on comparison of 1994 analyses with results reported for 1993, no trends are apparent in the data and it may be concluded that site operations had no effect on groundwater gamma emitting isotope concentrations.

7.4 Plutonium in Groundwater

Groundwater samples taken from site monitoring wells were analyzed for plutonium-238 and plutonium-239/240. The results of these analyses are presented in Table 7.3. Plutonium-238 groundwater sample concentrations ranged from less than the minimum detectable concentration of 1.0 E-2 pCi/l to a maximum of 1.0 E-2 $\pm$ 2.0 E-2 pCi/l at Well 8 during the first quarter. All plutonium-239/240 samples were less than the minimum detectable concentration of 1.0 E-2 pCi/l. The plutonium-238 and plutonium-239/240 investigation levels are 3.0 E-2 pCi/l. No samples exceeded investigation levels.

The results reported for isotopic plutonium are consistent with those reported in 1993.

7.5 Uranium in Groundwater

Analytical results for total uranium are presented in Table 7.4. Total uranium consists of the sum of uranium-234, 235 and 238 concentrations. Reported values for total uranium varied from 1.66 E0 $\pm$ 0.47 E-1 pCi/l at Well 3 during the third quarter to a maximum of 3.10 E0 $\pm$ 1.06 E0 pCi/l in Well 8 in the third quarter with a mean concentration of 2.46 pCi/l. All total uranium sample concentrations were less than the investigation level of 4.5 E0 pCi/l.

Figures 7.11 through 7.15 compare 1992 through 1994 groundwater total uranium results. Considering results reported, no discernible trends in total uranium concentrations are evident.

7.6 Nonradiological Analysis

Groundwater monitoring for nonradiological constituents is performed quarterly. The procedure for gathering these samples is the same as that for radiological samples with the exception that nonradiological samples are placed in an ice chest and maintained at 4° C. In 1994, groundwater samples were analyzed for specific conductivity, total organic carbon, nitrates and total dissolved solids. The results of these analyses are listed in Table 7.5.

The specific conductivity of groundwater samples varied from 406 umho/cm in Well 13 in the first quarter to 446 umho/cm in Well 3 in the second quarter and Well 8 in fourth quarter. Specific conductivity of well water samples has not changed appreciably since analysis began in 1987.

The results of split samples for organic carbon (TOC) samples are provided in Table 7.5 also. Nine split samples reported concentrations in excess of the minimum detectable concentration of 1000 ppb. Samples above MDC ranged from 1000 ppb to 2000 ppb at Well 3 in the third quarter. Other split samples and subsequent sampling did not confirm these results.

Reported results for nitrate analysis ranged from 3.2 parts per million (ppm) to 5.0 ppm. Nitrate concentrations in the region surrounding Hanford's 200 East and 200 West regions range from 20 to 45 ppm. These concentrations reflect the influence of past purex operations and nitrate waste disposed of in the 200 W cribs.

Total dissolved solids (TDS) ranged from a low of 241 ppm in Well 8 in the first quarter to a high of 442 ppm in Well 5 in the first quarter. The mean of values reported was 282 ppm. This value is consistent with results for TDS in 1993. The 1993 mean value was 278 ppm.

7.7 Groundwater Elevations

Depth to bottom for the fourth quarter for each well and depth to water for each well in each quarter of 1994 is presented in Table 7.6.

TABLE 7.1

Gross Alpha, Gross Beta, Tritium, and Carbon-14 Analytical Results for 1994

Well Number	Sample Date	ANALYTICAL RESULT Gross Alpha pCi/l	Gross Beta pCi/l	Tritium pCi/l	Carbon-14 pCi/l
3	March 16	2.5 ± 0.7	8.6 ± 0.9	3242 ± 187	-61.4 ± 113
	June 15	0.6 ± 0.5	8.4 ± 0.8	2544 ± 152	-28 ± 49
	Sept. 20	1.6 ± 0.7	7.2 ± 0.7	2737 ± 161	21 ± 36
	Nov. 30	1.1 ± 0.5	6.8 ± 0.6	3250 ± 177	12 ± 39
5	March 15	1.3 ± 0.5	6.4 ± 0.7	1749 ± 152	109 ± 112
	June 14	1.5 ± 0.6	5.4 ± 0.7	1678 ± 132	11 ± 47
	Sept. 19	1.6 ± 0.6	6.2 ± 0.7	1789 ± 138	35 ± 42
	Nov. 29	1.1 ± 0.5	5.4 ± 0.5	1920 ± 139	-1 ± 34
8	March 15	1.6 ± 0.8	6.4 ±0.8	1900 ± 156	86 ± 89
	June 14	1.8 ± 0.7	6.2 ± 0.7	1912 ± 138	-2 ± 58
	Sept. 19	1.4 ± 0.8	7.8 ± 0.8	2006 ± 144	18 ± 39
	Nov. 29	1.5 ± 0.5	5.9 ± 0.6	2091 ± 151	20 ± 37
10	March 16	1.1 ± 0.6	6.1 ± 0.8	1604 ± 147	95 ± 84
	June 15	1.1 ± 0.7	6.3 ± 0.7	1538 ± 128	1 ± 60
	Sept. 19	1.4 ± 0.6	7.6 ± 0.7	1728 ± 137	-15 ± 50
	Nov. 30	1.1 ± 0.4	4.6 ± 0.5	1698 ± 142	-22 ± 43
13[b]	March 15	1.5 ± 0.6	6.6 ± 0.8	3010 ± 181	52 ± 108
	June 14	2.0 ± 0.8	7.6 ± 0.7	3108 ± 164	-17 ± 42
	Sept. 19	1.3 ± 0.7	8.6 ± 0.8	3559 ± 178	0 ± 49
	Nov. 29	1.4 ± 0.6	5.9 ± 0.6	3477 ± 173	-46 ± 45

a. Analytical uncertainties presented are two sigma of sample analytical result.

b. Well 13 is the upgradient well - representative of background concentrations.

TABLE 7.2

Minimum Detectable Concentrations for Low Level Gamma Spectroscopy Analyses of Groundwater Samples

Radionuclide	Water (pCi/l)
Na-22	10
Mn-54	10
Co-58	10
Co-60	11
Fe-59	17
Zn-65	21
As-76	16
Zr/Nb-95	17
Mo-99	69
Ru-103	10
Ru-106	85
Sb-124	10
Sb-125	24
I-131	10
I-133	11
Cs-134	11
Cs-137	10
Ba/La-140	24
Ce-141	10
Ce/Pr-144	92
Eu-152	56
Eu-154	27
Eu-155	24

TABLE 7.3

Isotopic Plutonium in Groundwater 1994

Well Number	Sample Date	Pu-238 pCi/l	Pu-239/240 pCi/l
3	March 16	-0.01 ± 0.02	0.00 ± 0.01
	June 15	0.003 ± 0.007	0.001 ± 0.009
	Sept. 20	0.004 ± 0.009	0.001 ± 0.008
	Nov. 30	-0.002 ± 0.005	-0.001 ± 0.005
5	March 15	0.00 ± 0.02	0.00 ± 0.01
	June 14	0.008 ± 0.013	0.008 ± 0.009
	Sept. 19	0.005 ± 0.007	-0.004 ± 0.006
	Nov. 29	0.000 ± 0.011	0.006 ± 0.009
8	March 15	0.01 ± 0.02	0.00 ± 0.01
	June 14	0.008 ± 0.013	0.005 ± 0.012
	Sept. 19	-0.001 ± 0.013	0.002 ± 0.013
	Nov. 29	0.004 ± 0.008	-0.001 ± 0.010
10	March 16	0.01 ± 0.01	0.00 ± 0.01
	June 15	0.001 ± 0.011	-0.004 ± 0.010
	Sept. 19	0.002 ± 0.007	0.005 ± 0.007
	Nov. 30	0.000 ± 0.006	0.002 ± 0.008
13	March 15	0.00 ± 0.01	0.00 ± 0.01
	June 14	-0.001 ± 0.009	0.002 ± 0.008
	Sept. 19	0.002 ± 0.008	0.005 ± 0.009
	Nov. 29	0.007 ± 0.016	0.000 ± 0.014

TABLE 7.4

Total Uranium Concentration in Groundwater 1994

Well Number	Sample Date	Total Uranium[1] pCi/l
3	March 16	2.84 ± 0.35
	June 15	2.45 ± 0.26
	Sept. 20	1.66 ± 0.47
	Nov. 30	2.27 ± 0.44
5	March 15	2.79 ± 0.43
	June 14	2.74 ± 0.18
	Sept. 19	2.10 ± 0.42
	Nov. 29	2.99 ± 0.57
8	March 15	2.63 ± 0.33
	June 14	2.82 ± 0.42
	Sept. 19	3.10 ± 1.06
	Nov. 29	1.94 ± 0.43
10	March 16	2.26 ± 0.29
	June 15	2.19 ± 0.38
	Sept. 19	1.87 ± 0.40
	Nov. 30	2.22 ± 0.42
13	March 15	2.52 ± 0.38
	June 14	2.77 ± 0.47
	Sept. 19	2.55 ± 0.55
	Nov. 29	2.50 ± 0.40

NOTE 1 : Total uranium is the sum of U-234, U-235 and U-238 concentrations.

TABLE 7.5

Chemical Analysis of Well Samples During 1994

Well Number	Qtr.	Temp °C	Specific Conductivity (umho/cm)	TOC (ppb) P1	P2	P3	P4	Nitrates (ppm)	TDS (ppm)
3	1	19.2	442	B	B	B	B	5.0	267
	2	20.8	446	B	B	B	B	4.6	260
	3	22.3	408	2000	1700	1100	1500	4.4	251
	4	19.8	441	B	B	B	B	4.4	267
5	1	20.2	440	B	B	B	B	3.9	442
	2	20.1	420	B	B	B	B	3.9	282
	3	21.8	424	B	1100	B	B	3.4	292
	4	18.3	436	B	B	B	B	3.7	275
8	1	20.7	425	B	B	B	B	4.1	241
	2	20.8	436	B	B	B	B	4.3	256
	3	22.4	419	B	B	B	B	3.8	279
	4	19.5	446	B	B	1200	B	4.0	262
10	1	18.3	427	B	B	B	B	3.7	261
	2	20.2	423	B	B	B	B	3.6	264
	3	22.4	416	B	B	B	B	3.2	294
	4	18.9	436	B	1200	B	1100	3.9	274
13[C]	1	19.9	406	B	B	B	B	4.3	379
	2	19.9	419	B	B	B	B	4.3	243
	3	21.2	414	B	B	B	B	4.0	295
	4	18.4	438	1000	B	B	B	4.3	261

B - TOC results reported as less than 1000 ppb minimum detectable concentration.

C - Upgradient well.

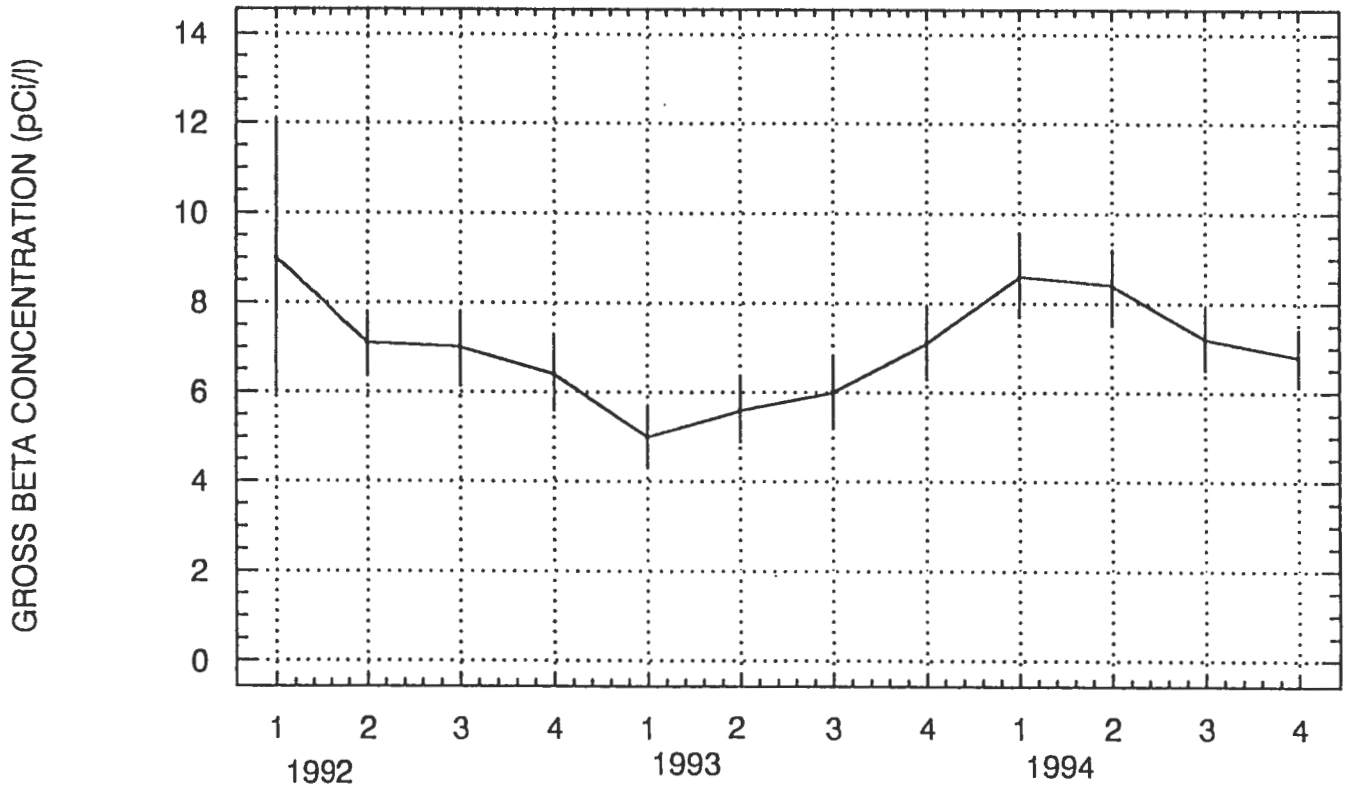
TABLE 7.6

Groundwater Elevations (ft.)

Well #	Depth to Bottom 4th Quarter	Depth to Water 1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
3	353.78	322.36	322.56	322.67	322.36
5	353.70	320.47	320.76	320.87	320.52
8	354.54	323.90	324.15	324.21	323.93
10	364.24	333.92	334.01	334.14	333.90
13	353.18	317.40	317.85	317.93	317.78

FIGURE 7.1

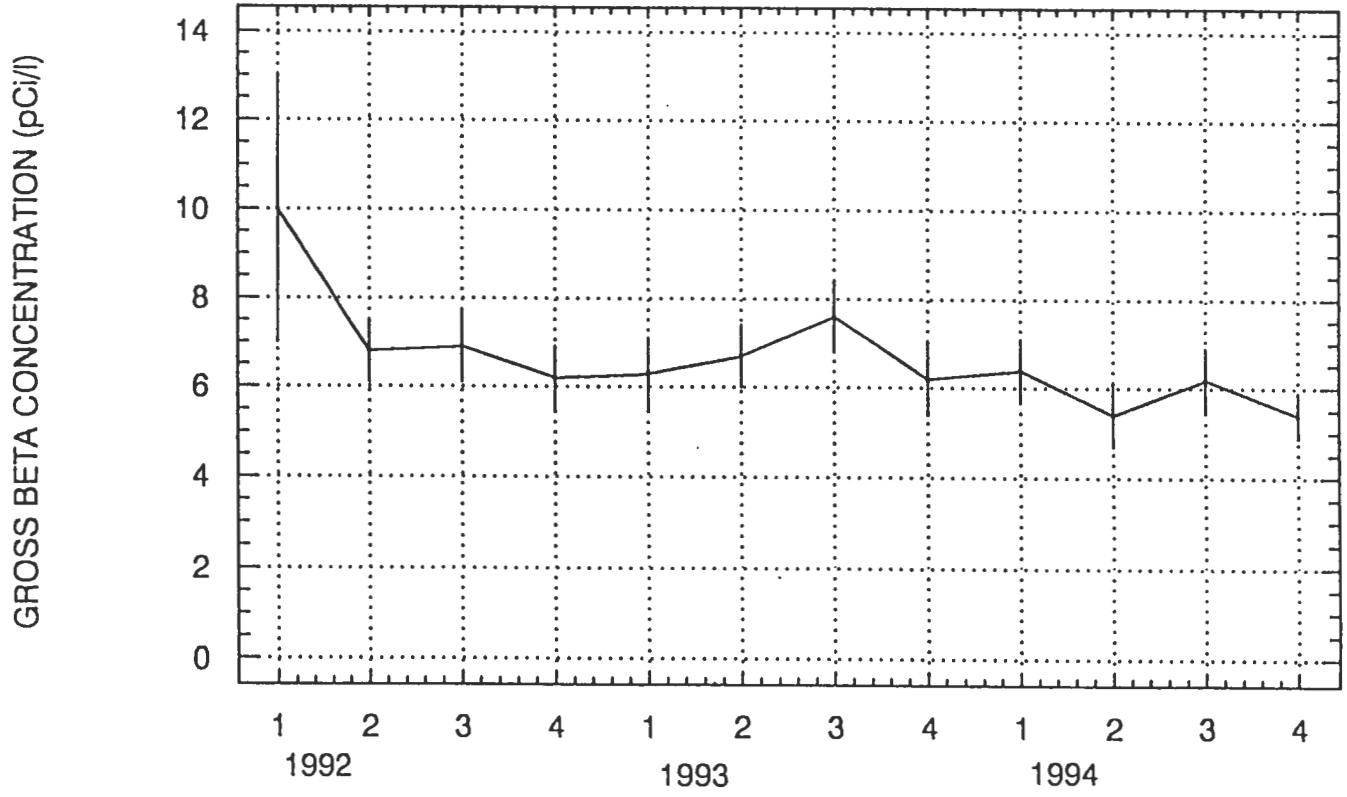
GROSS BETA IN GROUNDWATER
WELL 3- RICHLAND, WASHINGTON



4-28-95

FIGURE 7.2

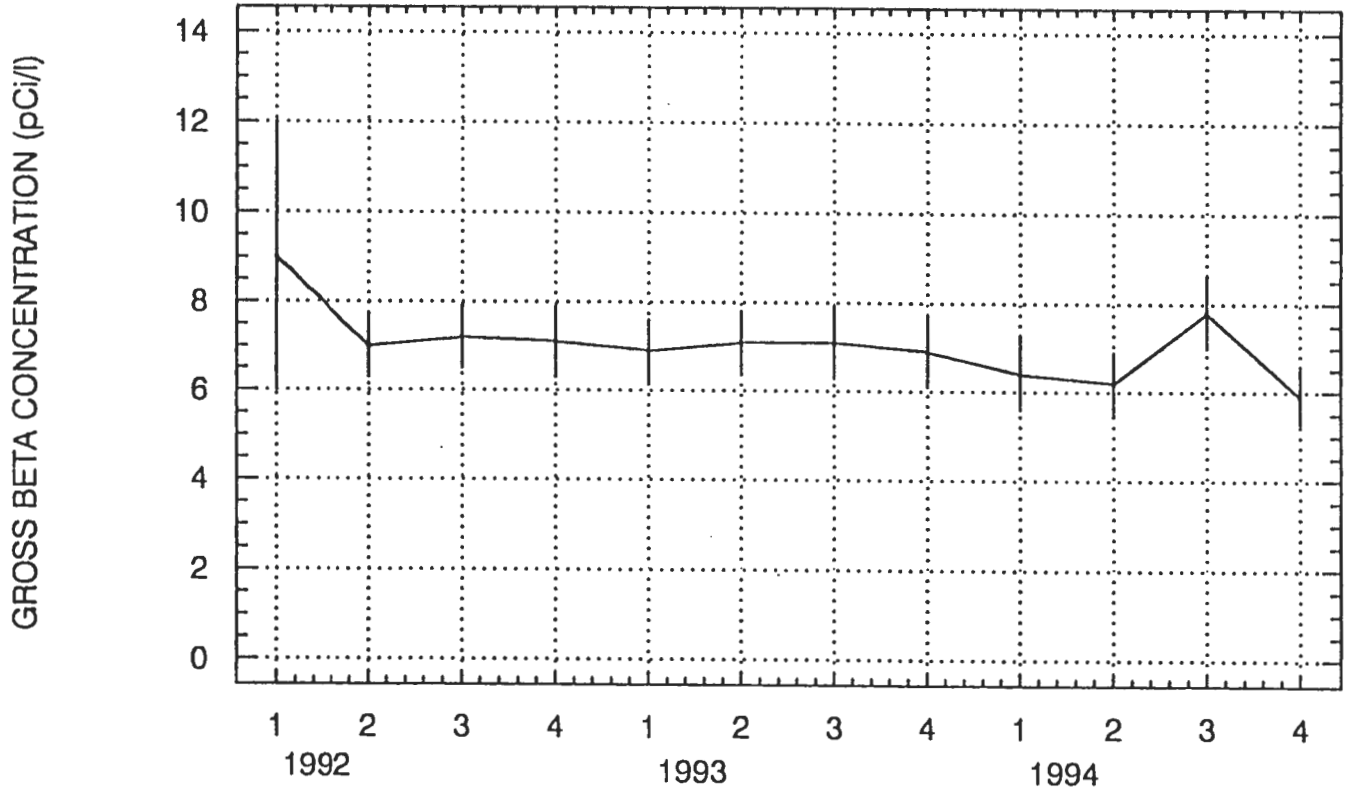
GROSS BETA IN GROUNDWATER
WELL 5- RICHLAND, WASHINGTON



4-28-95

FIGURE 7.3

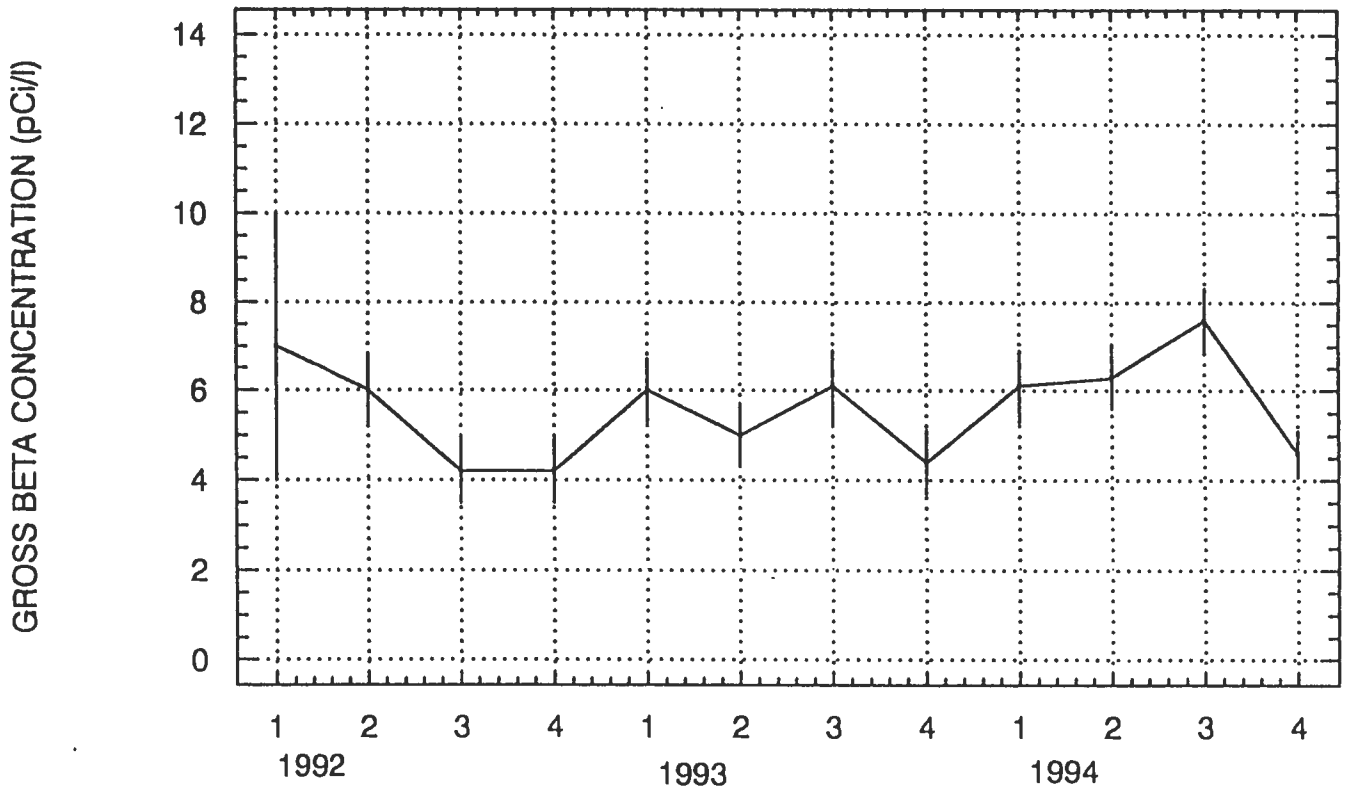
GROSS BETA IN GROUNDWATER
WELL 8- RICHLAND, WASHINGTON



4-28-95

FIGURE 7.4

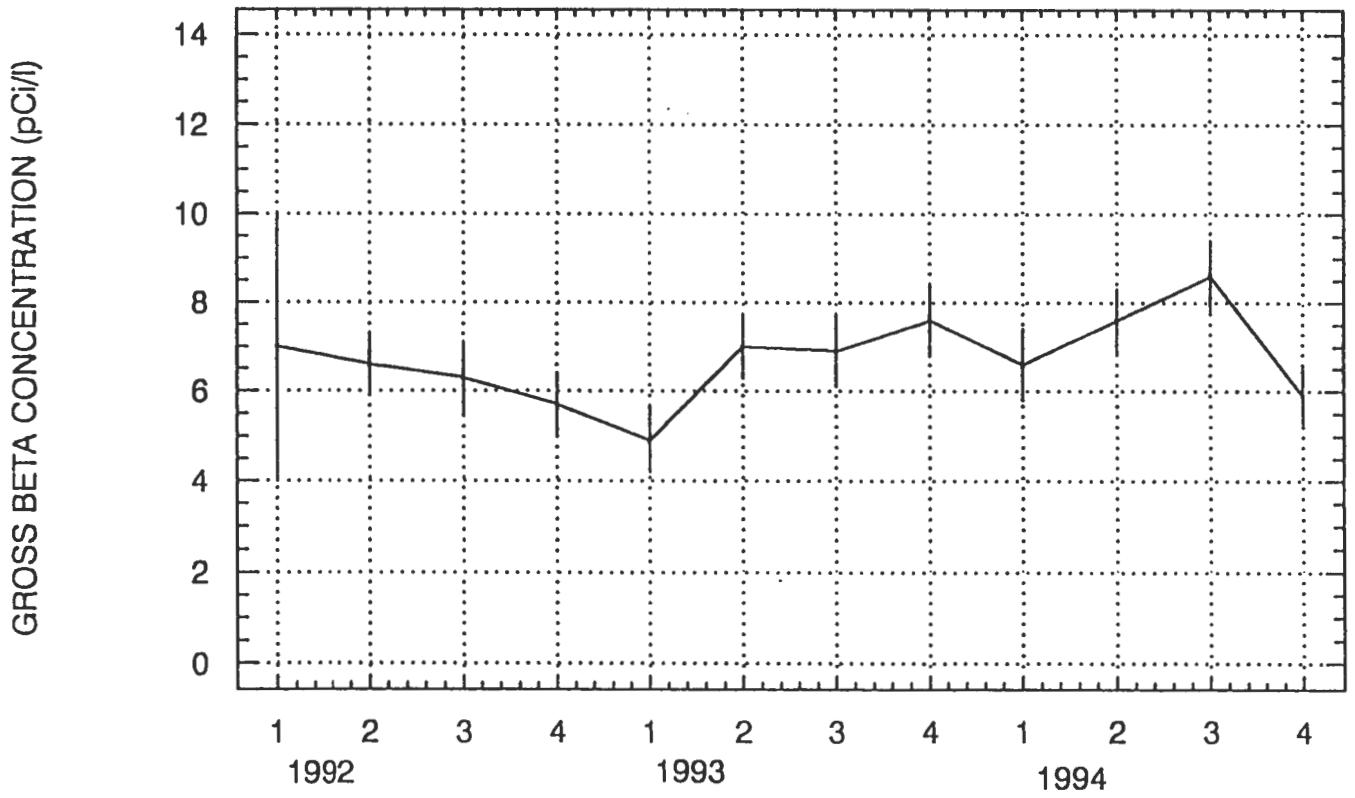
GROSS BETA IN GROUNDWATER
WELL 10- RICHLAND, WASHINGTON



4-28-95

FIGURE 7.5

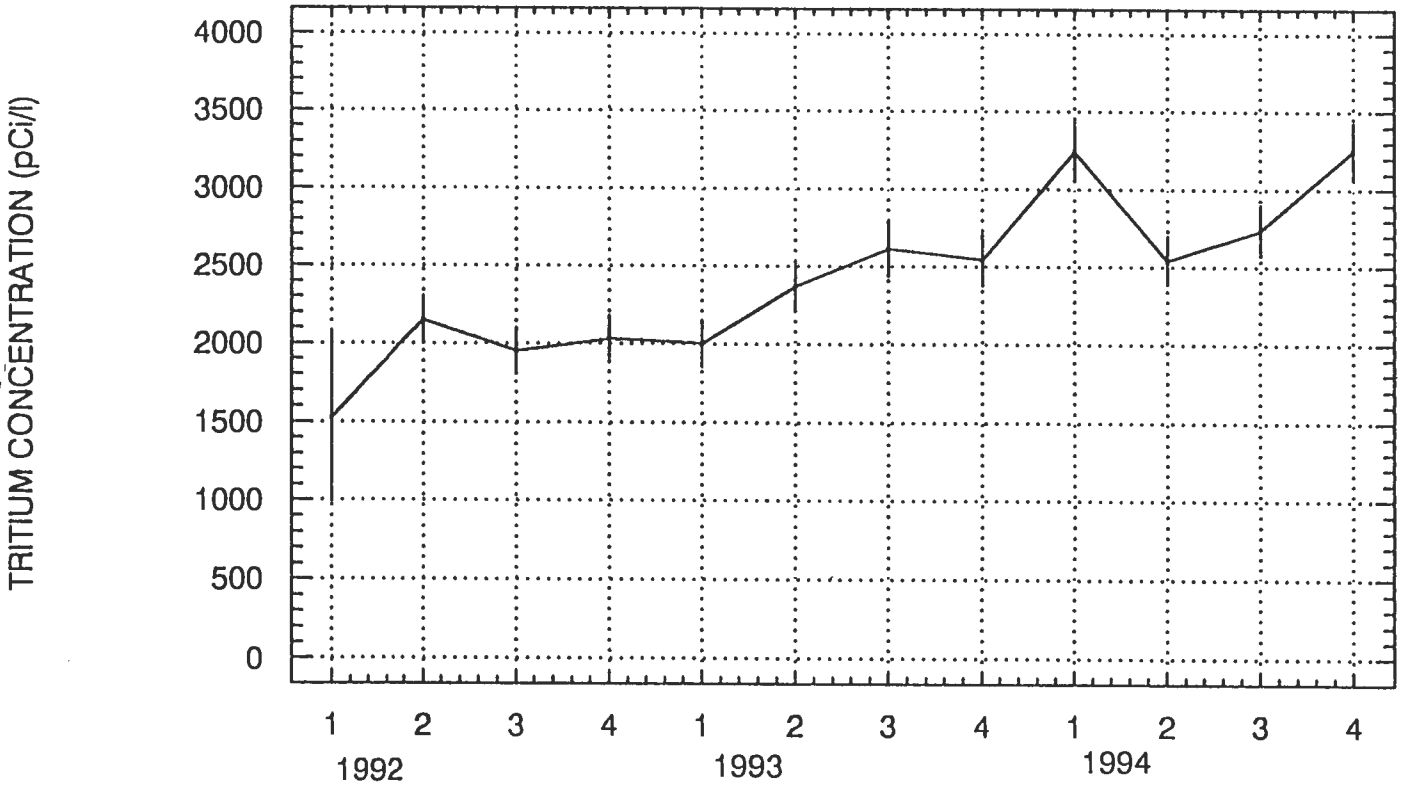
GROSS BETA IN GROUNDWATER
WELL 13- RICHLAND, WASHINGTON



4-28-95

FIGURE 7.6

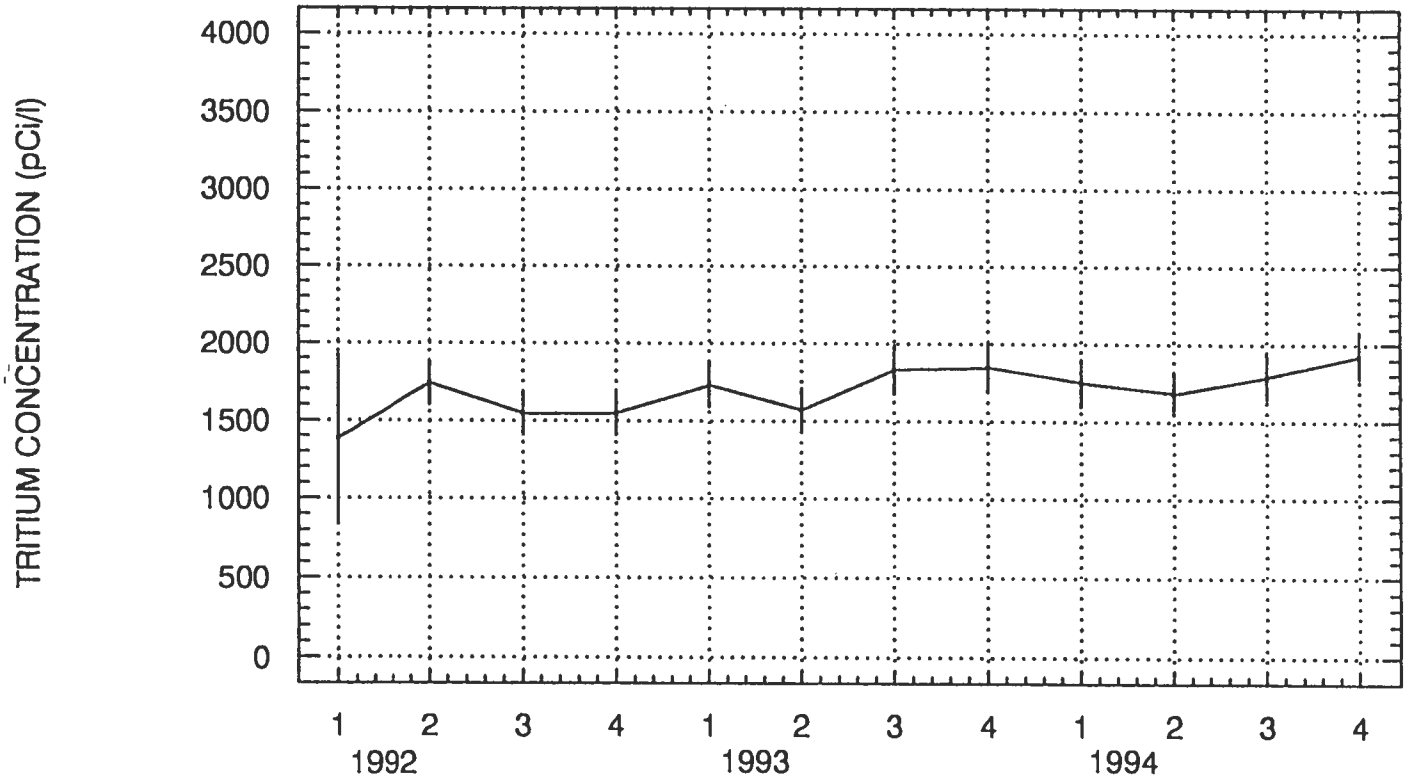
TRITIUM IN GROUNDWATER
WELL 3- RICHLAND, WASHINGTON



4-28-95

FIGURE 7.7

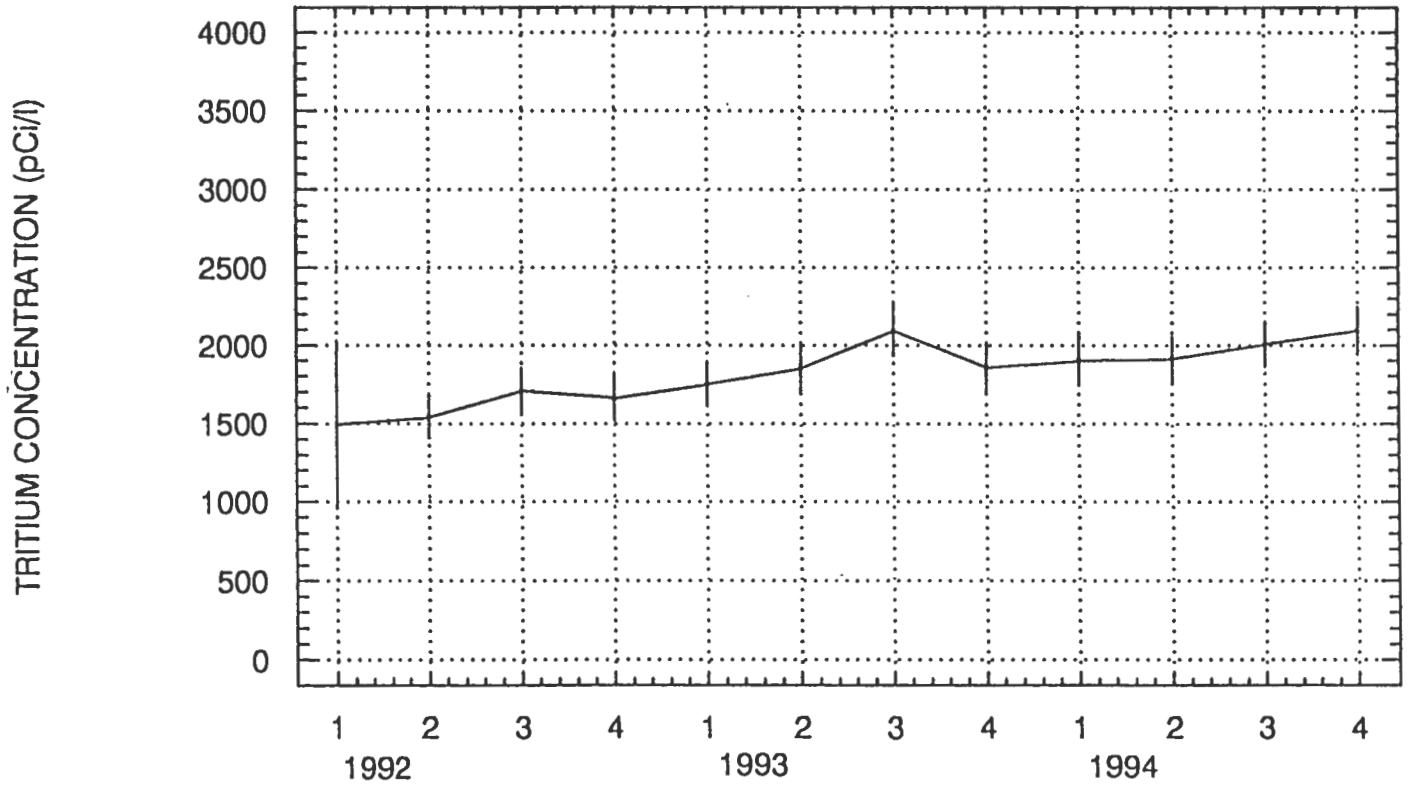
TRITIUM IN GROUNDWATER
WELL 5- RICHLAND, WASHINGTON



4-28-95

FIGURE 7.8

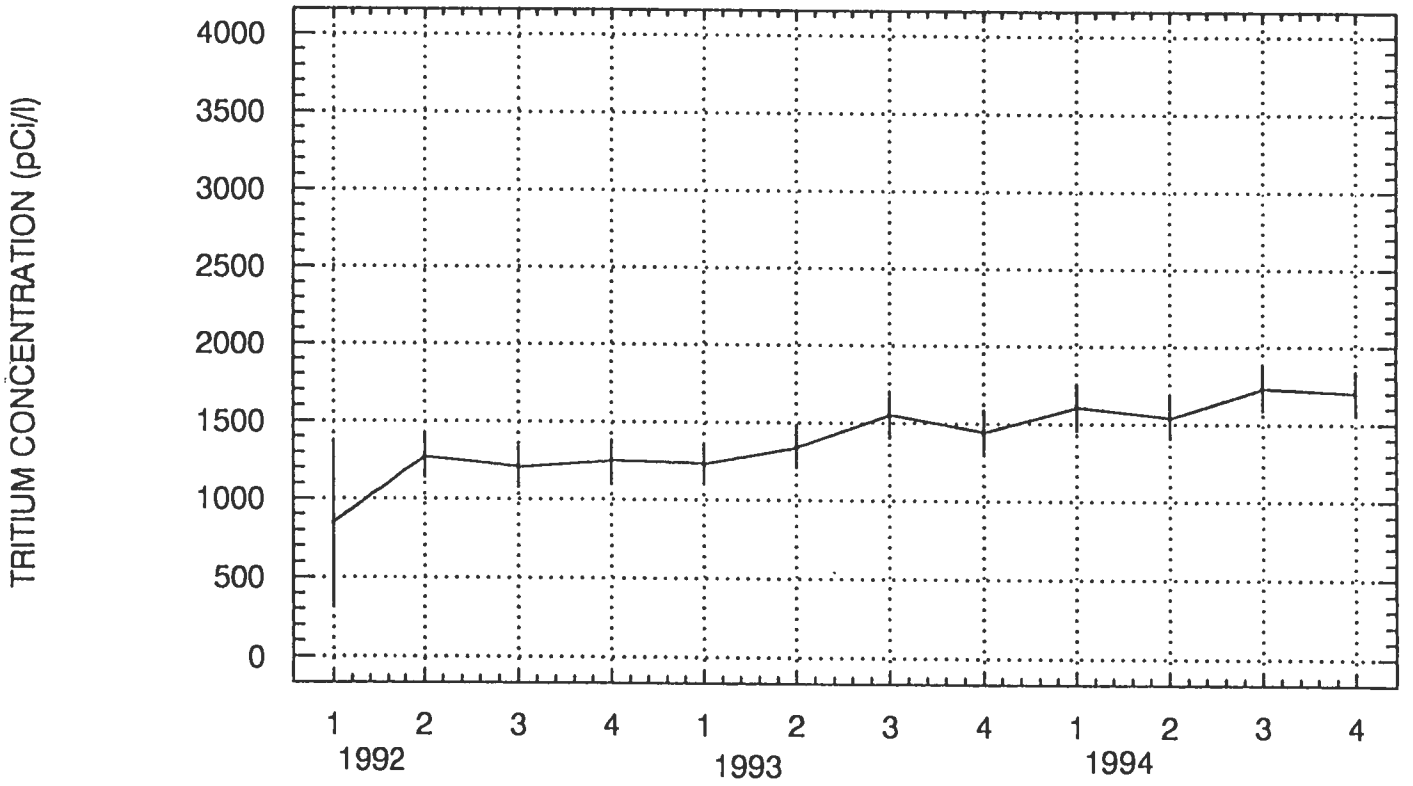
TRITIUM IN GROUNDWATER
WELL 8- RICHLAND, WASHINGTON



4-28-95

FIGURE 7.9

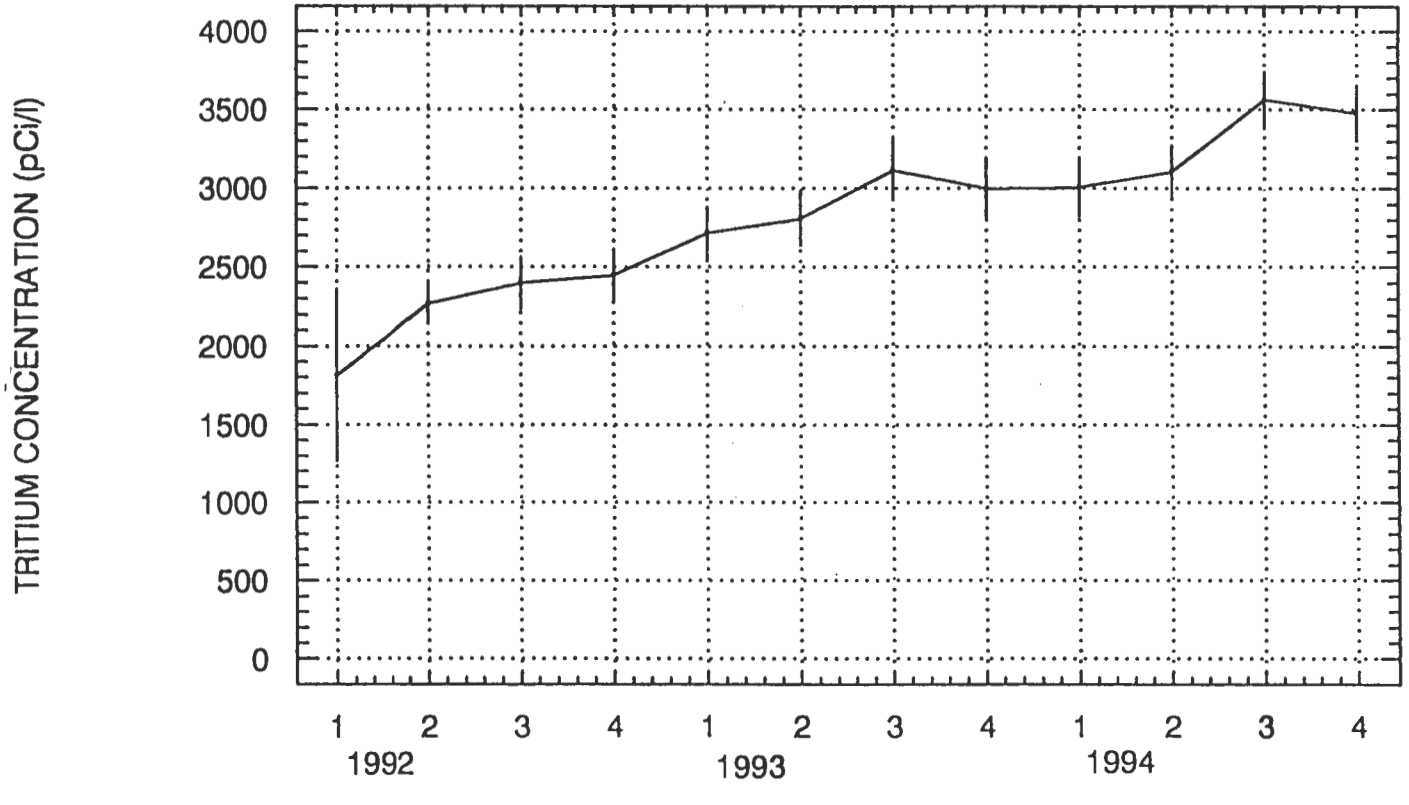
TRITIUM IN GROUNDWATER
WELL 10- RICHLAND, WASHINGTON



4-28-95

FIGURE 7.10

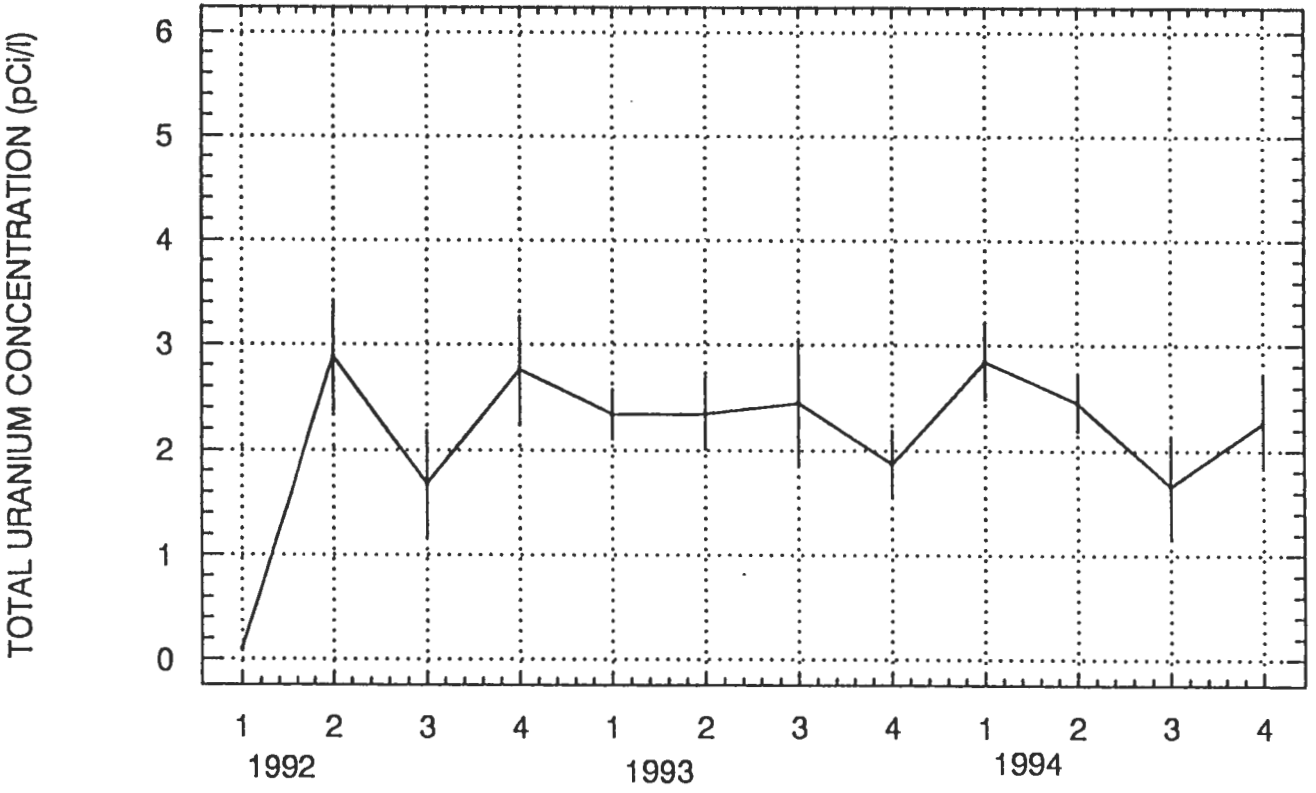
TRITIUM IN GROUNDWATER
WELL 13- RICHLAND, WASHINGTON



4-28-95

FIGURE 7.11

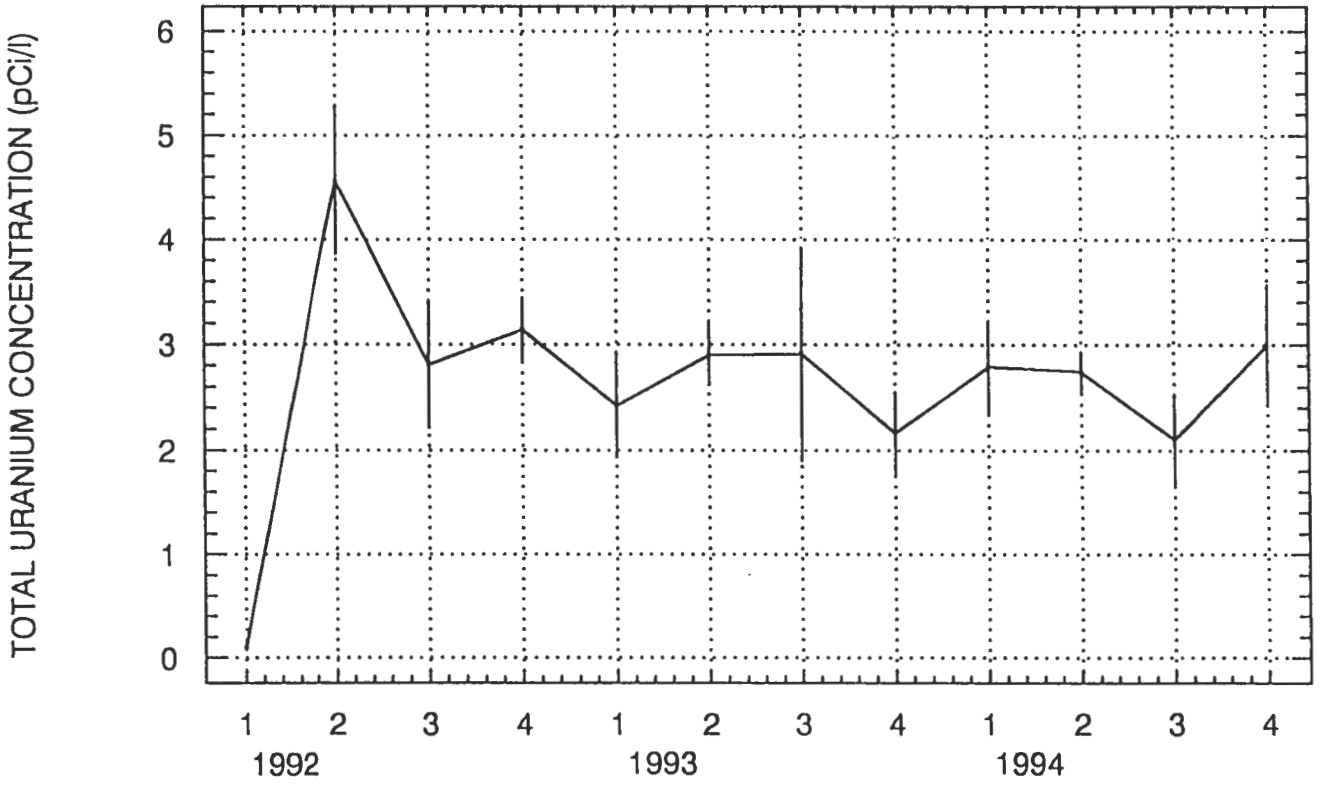
TOTAL URANIUM IN GROUNDWATER
WELL 3- RICHLAND, WASHINGTON



4-28-95

FIGURE 7.12

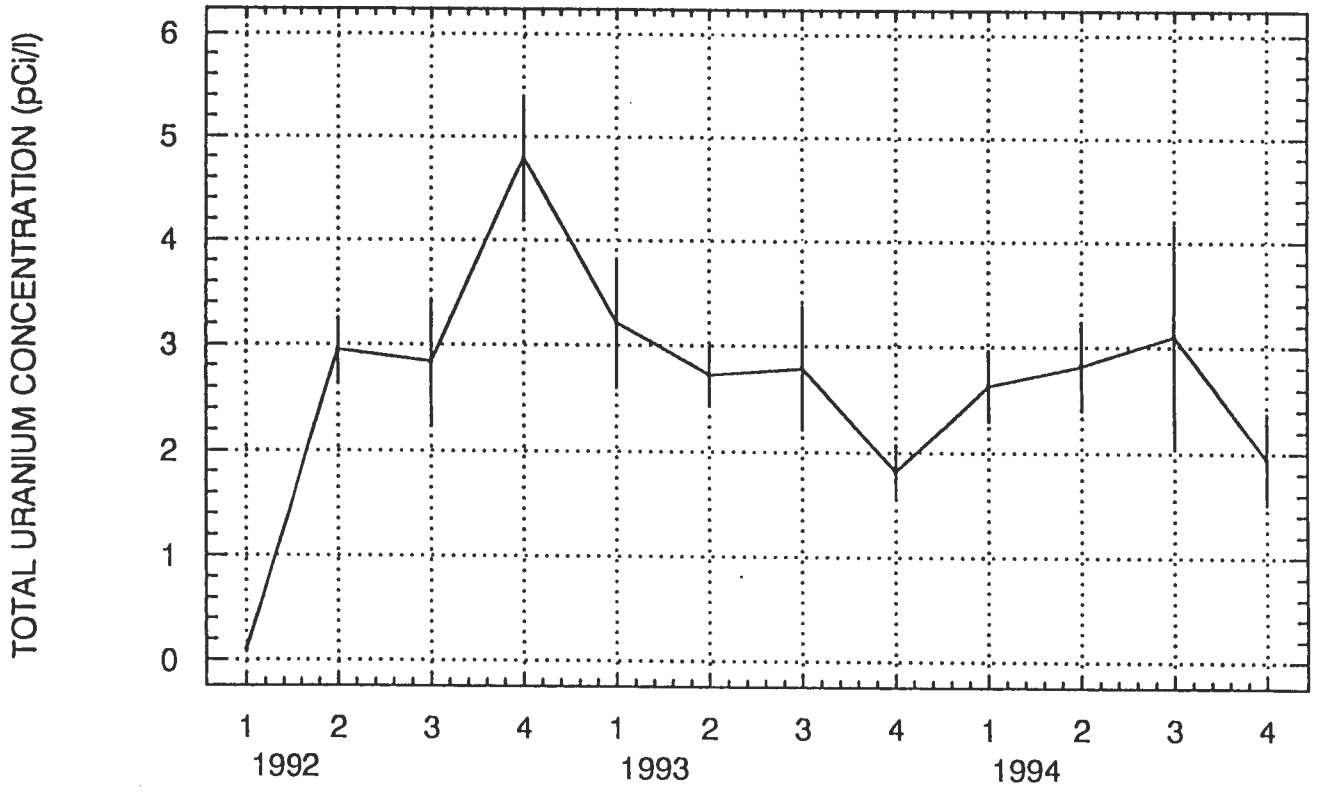
TOTAL URANIUM IN GROUNDWATER
WELL 5- RICHLAND, WASHINGTON



5-1-95

FIGURE 7.13

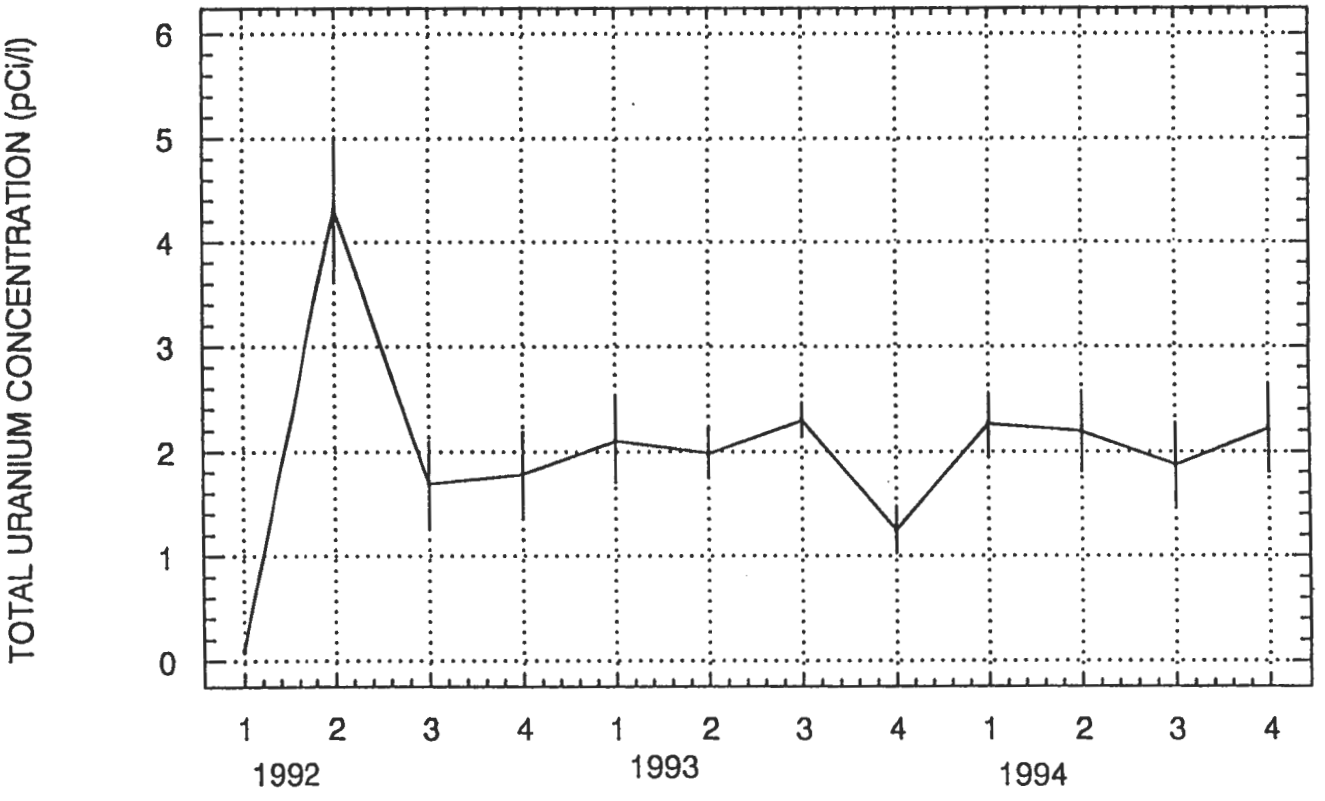
TOTAL URANIUM IN GROUNDWATER
WELL 8- RICHLAND, WASHINGTON



5-1-95

FIGURE 7.14

TOTAL URANIUM IN GROUNDWATER
WELL 10- RICHLAND, WASHINGTON



5-1-95

FIGURE 7.15

TOTAL URANIUM IN GROUNDWATER
WELL 13- RICHLAND, WASHINGTON

5-1-95

8.0 QUALITY ASSURANCE

Environmental samples are collected by trained and tested radiation control and safety technicians following approved written procedures contained in the US Ecology Richland Operating Procedures manual.

Routine radiochemical analysis for the environmental monitoring program was performed under contract by Teledyne Isotopes Midwest Laboratory (TIML) of Illinois. This laboratory maintains an internal quality assurance program that involves routine calibration of counting instruments, daily source and background checks, yield determinations of radiochemical procedures, replicate analysis to check precision and analyses of reagents to ensure purity of chemicals. Calibration standards traceable to the National Institute of Standards and Technology (NIST) are used for radiochemical calibrations when available.

TIML participates in the Environmental Protection Agency's (EPA) Laboratory Intercomparison Studies Program. These programs provide standard samples of various environmental media (water, milk, air filters, soil, food stuffs and tissue ash) containing one or more radionuclides in known amounts. After samples are analyzed, results are forwarded to EPA for comparison with known values and with results from other laboratories. EPA has established criteria for evaluating the accuracy of results. These programs provide a regular means of evaluating laboratory analytical performance.

In the second quarter 1994, US Ecology participated in a laboratory intercomparison using one soil sample and two groundwater samples. The intercomparison was sponsored by the Environmental Radiation Quality Assurance Task Force of the Pacific Northwest (QATF). US Ecology results compared favorably with the other Environmental Radiation Quality Assurance Task Force participants.

Ambient gamma radiation measurements are made with thermoluminescent dosimeters (TLDs) over periods of months and quarters and are confirmed by radiation surveys of site boundaries. These surveys are performed with calibrated portable radiation detectors.

Site fenceline TLDs are supplied by and processed by Radiation Detection Company. Radiation Detection Company is accredited by the National Voluntary Laboratory Accreditation Program for dosimetry processors. This program is administered by NIST for the purpose of ensuring accuracy and precision of TLD results.

Radiation detection instruments used to perform fenceline dose rate measurements in support of TLD monitoring are calibrated by an independent calibration facility. The company contracted to perform calibration services is Ludlum Measurements, Inc.

An integral part of supplier selection and qualification is auditing of vendor quality assurance programs. Each supplier of environmental, laboratory or calibration services is required to maintain an internal quality assurance program and to conduct operations in accordance with approved procedures. The implementation of quality assurance programs and operational procedures is reviewed during quality assurance and technical audits.

Radiation Detection Company, the supplier and processor of fenceline TLDs, was audited in November 1994. Teledyne Isotopes Midwest Laboratories (TIML) was audited in August of 1994. Ludlum Measurements, Inc. was last audited in January 1994.

These audits focus on implementation of quality assurance programs, calibration and processing procedures, and analysis of samples including air, soil, water, vegetation and TLD materials as appropriate.

These audits indicated that acceptable quality assurance programs are being maintained by these vendors.

9.0 REFERENCES

Annual Environmental Monitoring Report, US Ecology Richland, Washington LLRW Disposal Facility for 1993, US Ecology, Inc., 1994.

Annual Environmental Monitoring Report, US Ecology Richland, Washington LLRW Disposal Facility for 1992, US Ecology, Inc., 1993.

Annual Environmental Monitoring Report, US Ecology Richland, Washington LLRW Disposal Facility for 1991, US Ecology, Inc., 1992.

Annual Environmental Monitoring Report, US Ecology Richland, Washington LLRW Disposal Facility for 1990, US Ecology, Inc. 1991.

Annual Environmental Report at US Ecology's Low-Level Radioactive Waste Facility for 1989, US Ecology, Inc., 1990.

Annual Environmental Report at US Ecology's Low-Level Radioactive Waste Disposal Facility for 1988, US Ecology, Inc. 1989.

Code of Federal Regulations Chapter 10.

Code of Federal Regulations Chapter 40.

Environmental Radiation Quality Assurance Task Force 1994 Water/Sediment Intercomparison, State of Washington Department of Health, 1994.

Hanford Site Environmental Report for Calendar Year 1993, Pacific Northwest Laboratory, Richland, Washington, 1994.

Hanford Site Environmental Report for Calendar Year 1992, Pacific Northwest Laboratory, Richland, Washington, 1993.

Hanford Site Environmental Report for Calendar year 1991, Pacific Northwest Laboratory, Richland, Washington, 1992.

Hanford Site Environmental Report for Calendar year 1990, Pacific Northwest Laboratory, Richland, Washington, 1991.

Hanford Site Environmental Report for Calendar year 1989, Pacific Northwest Laboratory, Richland, Washington, 1990.

Historical Environmental Monitoring Report of the US Ecology Low-Level Radioactive Waste Disposal Facility, US Ecology, Inc., 1988.

Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion, Federal Guidance Report No. 11, US Environmental Protection Agency, Office of Radiation Programs, 1988.

National Council on Radiation Protection and Measurements, Report No. 50.

National Council on Radiation Protection and Measurements, Report No. 76.

1993 Annual Report for Nuclear Plant 2, Washington Public Power Supply System, April 1994.

1992 Annual Report for Nuclear Plant 2, Washington Public Power Supply System, April 1993.

1991 Annual Report for Nuclear Plant 2, Washington Public Power Supply System, April 1992.

Price, K. R., Environmental Monitoring at Hanford for 1985, Pacific Northwest Laboratory, Richland, Washington, 1986.

"Recommended Content and Format for Environmental Reports", Washington Department of Health, January 9, 1992.

US Ecology Richland Facility Standards Manual, US Ecology, Inc., 1994.

US Ecology Richland Facility Standards Manual, US Ecology, Inc., 1992.

US Ecology Richland Operational Procedures Manual, US Ecology, Inc.

US Nuclear Regulatory Commission Special Nuclear Materials License No. 16-19204-1.

State of Washington Radioactive Materials License No. WN-IO19-2.

Vadose Zone Monitoring Program for Low-Level Radioactive Waste Management Facility, US Ecology, Inc. 1992.

Washington Administrative Code (WAC) Chapter 246.

10.0 DISTRIBUTION LIST

10.1 External Distribution

No. of Copies	Name/Address
3	Mr. Gary Robertson, Head Waste Management Section DOH - Division of Radiation Protection P. O. Box 47827 Olympia, WA 98504-7827
1	Mr. John T. Greeves, Director Division of Waste Management US NRC Mail Stop TWFN-T7J9 Washington, DC 20555
1	Mr. Emilio M. Garcia US NRC Region IV 1450 Maria Lane, Suite 210 Walnut Creek, CA 94596
1	Mr. Robert Hogg Division of Low Level Waste Management US NRC Mail Stop TWFN-8F37 Washington, DC 20555
1	Ms. Tammy Love Chemistry Manager Washington Public Power Supply System P. O. Box 968 3000 George Washington Way Richland, WA 99352

No. of Copies	Name/Address
1	Mr. Gregory W. Patton, Ph.D. Environmental Sciences Department Pacific Northwest Labs Battelle Boulevard P. O. Box 999 Richland, WA 99352
1	Mr. P. Evan Dresel, Ph.D. Earth and Environmental Services Center Pacific Northwest Laboratory Battelle Boulevard Richland, WA 99352
1	Mr. Kim Welch Westinghouse Hanford P. O. Box 1970 Mail Stop H6-26 Richland, WA 99352
1	Mr. Jamie Granger Westinghouse Hanford P. O. Box 1970 Mail Stop H6-26 Richland, WA 99352

10.2 Internal Distribution

No. of Copies	Name/Location
1	Mr. Tom R. Hayes US Ecology, Inc. Hanford Reservation 200 East Area Richland, WA 99352
1	Mr. Dan A. Tallman US Ecology, Inc. Hanford Reservation 200 East Area Richland, WA 99352
1	Mr. Mike Ault US Ecology, Inc. Hanford Reservation 200 East Area Richland, WA 99352
1	Mr. Arthur J. Palmer, III American Ecology Corp. 120 Franklin Road Oak Ridge, TN 37830
1	Mr. Mark R. Ledoux American Ecology Corp. 120 Franklin Road Oak Ridge, TN 37830
1	Mr. Barry C. Bede US Ecology, Inc. 509 E. 12th Street Suite 14 Olympia, WA 98501

APPENDIX A

ASSESSMENT OF US ECOLOGY, RICHLAND, WASHINGTON INSPECTION FACILITY VENTILATION EXHAUST

Summary

The US Ecology inspection facility exhaust ventilation stack is evaluated to verify compliance with Clean Air Act emissions standards. Results of air sampling performed in 1994 are used together with a conservative isotopic distribution of waste inspected to develop an upper bound for a source term.

This source term is then input to the US Environmental Protection Agency (EPA) "Comply" Code and National Council on Radiation Protection and Measurements (NCRP) Commentary 3, "Screening Techniques for Determining Compliance with Environmental Standards" to demonstrate compliance. In spite of a number of conservative assumptions and the conservative nature of the models themselves, the ventilation exhaust is shown to have a negligible dose contribution.

Description of Facility

The package inspection facility at US Ecology's Richland, Washington Low-Level Radioactive Waste (LLRW) disposal site is a concrete block room in the south end of the laboratory building approximately 16' by 23' in size. The room is equipped with a 12' ceiling. Located in roughly the center of the room is a ventilated hood which is used to control airborne radioactive contamination which may be generated during waste package inspections or remediation evolutions.

The hood dimensions are 8' wide by 8' long; it is approximately 7' to 8' tall. The hood has flexible sides constructed of heavy gauge sheet plastic. The inspection hood is ventilated by two 1000 cfm axial fans (one normally operating) located in the second floor mechanical room of the laboratory building.

Air from the inspection room is drawn under the inspection hood skirt, around the package being inspected and up to an exhaust duct located in the top-center of the hood. The air then passes through roughing, charcoal and HEPA filters before entering the exhaust fans. Downstream of the fans, the air exits the building through a 16" square duct attached to louvers on the east side of the building.

Normal operation of the facility involves placing a package selected at random by Washington State Department of Health (WDOH) site inspector under the hood for waste form verification. Waste form verification may include opening and/or punching a hole in the package, followed by package contents inspection. After confirmation, the package is closed and/or patched as necessary prior to disposal. In addition, packages are also remediated inside the inspection tent.

Portable air samplers are used to monitor airborne activity during these inspections. Typically, samplers are located in three spots; one is inside the hood, one is in the inspection room outside the hood and one is located at the air exhaust in the side of the building. These samplers are started before the package is opened and are changed and counted after the evolution is complete.

In 1994, 196 package inspection/remediation evolutions were performed in the inspection facility. In some cases, more than one package was done at a time; therefore, one air sample may cover more than one package. The typical duration of each evolution was 5 to 15 minutes.

Source Term Evaluation

In order to demonstrate compliance with Clean Air Act emissions standards with regard to potential airborne radioactive releases, the results of airborne monitoring performed in 1994 were combined with data on isotopic content of waste received and were reviewed using the methodology contained in NCRP Commentary 3 and the EPA "Comply " Code, Version 1.5d.

Attachment 1 contains the results of airborne radioactivity monitoring conducted at the inspection facility ventilation exhaust during the 196 package evolutions of 1994.

To develop a conservative basis for estimating concentration at the stack, the results of samples taken during the year were averaged. In the averaging process, actual calculated values, both positive and negative were utilized. This methodology minimizes the introduction of bias.

As samples were taken at the ventilation facility exhaust, no credit was given in this analysis for activity removal by the roughing, charcoal and HEPA filters. To determine which isotopes should be considered, waste receipts by isotope for 1994 were consulted in conjunction with the dose conversion factors contained in the addendum to NCRP Commentary 3. Attachment 2 contains an isotopic breakdown of waste received in 1994.

From the addendum to Commentary 3, it was determined that the alpha emitter with the highest Level I Screening Factor (LISF) that had also been inspected at Richland in 1994 was Th-232 (LISF = 1.6 E16 mrem-Ci/yr-m^3). Of the radioiodine in packages inspected, 71 percent was I-125 with a LISF of 8.0 E13 mrem-Ci-yr/m^3. Co-60 was chosen to represent all beta emitters, the LISF for Co-60 is 6.0 E14 mrem-Ci/yr.-m^3.

To provide a bounding condition as well as to simplify the analysis, all air sample activity was assigned to one of these three isotopes. That is, the average alpha air sample activity was 9.9 E-14 uCi/cc, this was assumed to be entirely due to the presence of Th-232. Similarly, all beta activity was assumed to be Co-60 and all iodine activity was assumed to be I-125. This assignment likely adds an additional factor of 10 to 100 to the conservatism already contained in the analysis.

Development of the source term also required estimation of the duration of each release. Logs and records of package inspections indicate that during a typical inspection, the package would be opened from 5 to 15 minutes. For purposes of this evaluation, each inspection was assumed to be one-half hour in duration. Therefore, the 196 package evolutions of 1994 would be considered to

be 196 one-half hour releases at the average concentrations. This time estimate is conservative by a factor of 2 to 5.

The final source term was considered to be 98 hours of release comprised of the following isotopes and concentrations (refer to Attachment 3 for supporting calculations):

Th-232	9.90 E-14 uCi/cc
Co-60	4.66 E-13 uCi/cc
I-125	7.95 E-13 uCi/cc

The source term was then averaged over a one year period (3.2 E7 seconds) to arrive at an equivalent constant release concentration. The equivalent annual concentrations were:

Th-232	1.09 E-15 uCi/cc
Co-60	5.14 E-15 uCi/cc
I-125	8.76 E-15 uCi/cc

These concentrations were then used as input for the "Comply" code. The "Comply" code output sheets are included as Attachment 4.

Results

The "Comply" Code Level 2 estimates doses at 100 meters from the stack exhaust to the receptor. The actual distance from source to nearest resident is greater than ten miles.

The dose results based on NCRP LISFs are:

Effective dose equivalent: 3.3 E-3 mrem/yr. due to alpha and beta emitters
Effective dose equivalent: 1.1 E-4 mrem/yr. to iodine

In this case, in spite of the conservative assumptions above and the inherent conservatism of the models, compliance is demonstrated at this level.

APPENDIX A

ATTACHMENT 1

Inspection Facility Air Vent Exhaust

Date	Gross Alpha ($x10^{-13}$uCi/cc)	Gross Beta-Gamma ($x10^{-13}$uCi/cc)	Iodine ($x10^{-13}$uCi/cc)
Jan. 4	2.38	5.07	14.20
Jan 5	0.54	2.66	15.80
Jan. 19	2.19	8.07	14.10
Jan. 28	0.15	2.31	16.60
Feb. 3	1.64	6.69	4.55
Feb. 10	1.09	5.57	25.60
Feb. 18	0.16	2.22	4.06
Feb. 25	-0.13	1.71	4.48
Mar. 3	2.02	6.91	9.00
Mar. 7	0.83	4.08	8.01
Mar. 8	0.74	6.99	13.40
Mar. 9	1.31	6.45	10.70
Mar. 23	0.63	4.14	1.56
Apr. 5	0.33	6.27	1.46
Apr. 8	1.78	7.76	7.89
Apr. 14	1.22	4.35	10.70
Apr. 20	2.24	9.15	3.97
Apr. 27	1.56	6.31	2.17
May 9	0.82	4.31	24.60
May 11	0.99	7.06	13.00
May 17	0.16	4.10	3.38
May 27	0.93	5.72	16.80
May 31	1.07	5.88	7.31
June 6	0.81	4.39	8.50
July 22	0.13	3.50	2.28
July 25	1.89	5.81	-0.13
July 26	2.97	8.93	6.03
July 27	1.78	6.08	0.00
Aug. 3	0.83	5.30	2.33
Aug. 4	1.74	5.74	3.35
Aug. 10	1.53	7.66	7.79
Aug. 16	0.54	2.61	3.17
Aug. 18	1.35	3.20	3.20
Aug. 19	0.24	1.46	1.68
Aug. 23	2.49	6.12	2.89
Aug. 25	1.53	5.71	0.06
Aug. 30	0.72	8.16	14.50
Aug. 31	0.76	3.39	1.15

Date	Gross Alpha ($x10^{-13}$uCi/cc)	Gross Beta-Gamma ($x10^{-13}$uCi/cc)	Iodine ($x10^{-13}$uCi/cc)
Sept. 1	1.01	4.03	1.60
Sept. 6	0.92	4.10	1.81
Sept. 6	2.06	6.35	30.30
Sept. 9	0.83	9.08	31.00
Sept. 12	0.32	2.27	1.67
Sept. 15	0.33	3.48	4.46
Sept. 16	0.57	2.19	4.21
Sept. 19	0.73	4.76	7.13
Sept. 23	1.50	6.82	9.08
Oct. 4	2.28	6.55	30.50
Oct. 13	0.97	3.67	2.38
Oct. 13	1.50	4.05	5.32
Oct. 17	0.55	3.94	49.00
Oct. 19	1.48	3.73	2.43
Oct. 21	0.55	2.55	3.09
Oct. 26	0.27	2.25	2.27
Nov. 1	0.32	1.29	1.39
Nov. 2	0.55	2.79	6.10
Nov. 11	0.29	1.44	1.11
Nov. 14	0.31	1.12	1.14
Nov. 16	0.54	4.86	11.50
Nov. 17	0.77	5.84	16.80
Nov. 22	0.79	2.52	-0.26
Nov. 23	1.45	4.98	1.73
Nov. 28	0.21	6.49	-1.64
Nov. 30	0.37	1.57	3.31
Dec. 2	0.04	1.61	2.01
Dec. 5	1.58	4.03	4.95
Dec. 6	0.75	3.22	1.81
Dec. 9	0.54	4.47	13.00
Dec. 13	0.36	6.10	19.40
Dec. 21	0.66	2.51	-2.32
Average Concentration	0.99	4.66	7.95

APPENDIX A

ATTACHMENT 2

Major Isotopes Received at the Richland Facility

			% of Total
IODINE:	I-125	2,977.3 mCi	70.7%
	I-131	1,234.0 mCi	29.3%
	TOTAL	4,211.3 mCi	100.0%
BETA EMITTERS:	C-14	23,857.7 mCi	0.4%
	Cd-109	16,058.5 mCi	0.3%
	Co-58	35,315.3 mCi	0.6%
	Co-60	1,405,520.6 mCi	23.3%
	Cr-51	93,528.1 mCi	1.5%
	Cs-134	10,434.8 mCi	0.2%
	Cs-137	86,603.4 mCi	1.4%
	Eu-152	292,124.5 mCi	4.8%
	Eu-154	199,236.7 mCi	3.3%
	Eu-155	8,594.5 mCi	0.1%
	Fe-55	1,928,511.7 mCi	32.0%
	H-3	1,531,116.9 mCi	25.4%
	Mn-54	36,253.2 mCi	0.6%
	Ni-63	116,994.9 mCi	1.9%
	Ru-106	20,834.3 mCi	0.3%
	Zn-65	229,668.7 mCi	3.8%
	TOTAL	6,034,653.8 mCi	99.9%
ALPHA EMITTERS:	Ra-226	1,953.8 mCi	27.3%
	Th-232	939.8 mCi	13.1%
	U-235	2,921.0 mCi	40.8%
	U-Nat	1,340.9 mCi	18.7%
	TOTAL	7,155.5 mCi	99.9%

Input for Comply Code
Level 2

From 1994 records, it was determined that 196 package evolutions were conducted in the inspection facility.

The average air concentrations measured at the inspection facility ventilation exhaust were 9.9 E-14 uCi/cc for alpha samples, 4.66 E-13 uCi/cc for beta emitters and 7.95 E-13 uCi/cc for iodines. See Attachment 1 for air sample results for 1994.

Assume each package takes 0.5 hours to complete. Records indicated .10 - .25 hour is typical. Therefore, it is assumed there were 98 hours of release in 1994.

Nominal ventilation flow rate is 1000 cfm.

Review isotopes received at Richland facility in 1994. See Attachment 2.

Select the isotopes with the highest dose conversation factors. For beta emitters, this is Co-60; for alpha emitters, it is Th-232; for iodine, it is I-125.

Assume all air sample activity is due to these isotopes. Calculate average release rate:

$$\frac{\text{Vent. Flow X Concentration X Duration}}{\text{1 Year}}$$

For alpha emitters:

$$\frac{1000\ ft^3\ \text{min X } 2.83\ E4\ cc/ft^3\ \text{X } 9.90\ E\text{-}14\ uCi/cc\ \text{X } 98\ hr/yr\ \text{X } 60\ min/hr}{3.2 \text{ X } 10^7\ sec/yr}$$

= 5.15 E-10 uCi/sec or 5.15 E-16 Ci/sec
(Assumed to be Th-232)

For beta emitters:

$$\frac{1000\ ft^3\ \text{min X } 2.83\ E4\ cc/ft^3\ \text{X } 4.66\ E\text{-}13\ uCi/cc\ \text{X } 98\ hr/yr\ \text{X } 60\ min/hr}{3.2 \text{ X } 10^7\ sec/yr}$$

= 2.42 E-9 uCi/sec or 2.42 E-15 Ci/sec
(Assumed to be Co-60)

For iodines:

$$\frac{1000\ ft^3\ \text{min X } 2.83\ E4\ cc/ft^3\ \text{X } 7.95\ E\text{-}13\ uCi/cc\ \text{X } 98\ hr/yr\ \text{X } 60\ min/hr}{3.2 \text{ X } 10^7\ sec/yr}$$

= 4.13 E-9 uCi/sec or 4.13 E-15 Ci/sec
(Assumed to be I-125)

40 CFR Part 61
National Emission Standards
for Hazardous Air Pollutants

REPORT ON COMPLIANCE WITH

THE CLEAN AIR ACT LIMITS FOR RADIONUCLIDE EMISSIONS

FROM THE COMPLY CODE, VERSION 1.5d

Prepared by:

US Ecology, Inc.

Richland, Washington

Mark Ledoux
1-615-483-8768

Prepared for:

U.S. Environmental Protection Agency
Office of Radiation Programs
Washington, D.C. 20460

COMPLY: V1.5d. 5/30/95 11:37

SCREENING LEVEL 2

DATA ENTERED:

Nuclide		Release Rate (curies/SECOND)
I-125	D	4.130E-15
TH-232	W	5.150E-16
CO-60	Y	2.420E-15

Release height 3 meters.

Building height 6 meters.

The source and receptor are not on the same building.

Distance from the source to the receptor is 100 meters.

Building width 15 meters.

Default mean wind speed used (2.0 m/sec).

NOTES:

Input parameters outside the "normal" range:

None.

RESULTS:

Effective dose equivalent: 3.3E-03 mrem/yr.

Effective dose equivalent: 1.1E-04 mrem/yr due to Iodine.

*** Comply at level 2.

This facility is in COMPLIANCE.

It may or may not be EXEMPT from reporting to the EPA.

You may contact your regional EPA office for more information.

********** END OF COMPLIANCE REPORT **********