DUQUESNE LIGHT COMPANY
BEAVER VALLEY POWER STATION
UNITS 1 AND 2
LICENSES DPR-66 AND NPF-73

1995 ANNUAL ENVIRONMENTAL REPORT
RADIOLOGICAL

EXECUTIVE SUMMARY

This report describes the Radiological Environmental Monitoring Program conducted during 1995 in the vicinity of the Beaver Valley Power Station Units 1 and 2. The Radiological Environmental Program consists of off-site monitoring of water, air, river sediments, soils, food pathway samples, and radiation levels in the vicinity of the site. This report discusses the results of this monitoring during 1995.

Duquesne Light Company operates the Beaver Valley Power Station Units 1 and 2 pressurized water reactors as part of the Central Area Power Coordination Group.

The Beaver Valley Power Station Unit 1 operated throughout 1995 except during a refueling outage January 3 through March 8, 1995 and maintenance outages August 19 through August 27 and December 18 through December 26, 1995. The high average daily output generated during the year, 840 megawatts net was reached in November 1995 and the total net electrical generation during the year was 5,442,920 megawatt-hours.

Beaver Valley Power Station Unit 2 operated throughout the year except during a refueling outage March 24 through May 9, 1995 and a maintenance outage August 13 through August 15, 1995. The highest average daily output generated during the year was 845 megawatts net in both November and December 1995 and the total net electrical generation during the year was 6,044,518 megawatt-hours.

In 1995, samples were taken from over 60 sites around Beaver Valley Power Station that included the aquatic, atmospheric and terrestrial environments. More than 3,000 analyses were performed on these samples.

During the year, the radioactive releases from BVPS Units 1 and 2 did not exceed the effluent limits identified in the Beaver Valley Power Station Operating License Technical Specifications/Offsite Dose Calculation Manual (ODCM) for Units 1 and 2. Based upon the estimated dose to individuals from the natural background radiation exposure, the incremental increase in total body dose to the 50-mile population (4 million people), from the operation of Beaver Valley Power Station - Unit No. 1 and No. 2, is less than 0.0003% of the annual background. See Section V.I for specific details. The National Academy of Sciences 1990 BEIR Report shows that the typical dose to an individual from background (natural radiation exposure including radon) is 296 mrem per year.

The environmental monitoring program outlined in the Beaver Valley Power Station Operating License Technical Specifications/ODCM for Units 1 and 2 was followed throughout 1995. The results for each media are contained in Section V of this report. Examination of effluents and environmental media show that the Beaver Valley Power Station Units 1 and 2 operations have not adversely affected the surrounding environment.

Duquesne Light Company
1995 Annual Radiological Environmental Report

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Section 1. INTRODUCTION

A. Scope and Objectives of the Program

The environmental program consists of environmental monitoring for radioactivity in the vicinity of the Beaver Valley Power Station. Environmental sampling and analyses included air, water, milk, vegetation, river sediments, fish, and ambient radiation levels in areas surrounding the site. The results of these media are assessed to determine impacts of the plant operation on the environment. The Annual Radiological Environmental Report for the Beaver Valley Power Station summarizes the radiological environmental program conducted by the Duquesne Light Company in 1995.

B. Description of the Beaver Valley Site

The Beaver Valley Power Station is located on the south bank of the Ohio River in the Borough of Shippingport, Beaver County, Pennsylvania, on a 501 acre tract of land. Figure 1-1 is a view of the Beaver Valley Power Station. The site is approximately one mile from Midland, Pennsylvania; 5 miles from East Liverpool, Ohio; and 25 miles from Pittsburgh, Pennsylvania. Figure 1-2 shows the site location in relation to the principal population centers. Population density in the immediate vicinity of the site is relatively low. The population within a 5 mile radius of the plant is approximately 18,000 and the only area within the radius of concentrated population is the Borough of Midland, Pennsylvania, with a population of approximately 3,500.

The site lies in a valley along the Ohio River. It extends from the river (elevation 665 feet above sea level) to a ridge along the border south of the Beaver Valley Power Station at an elevation of 1,160 feet. Plant ground level is approximately 735 feet above sea level.

The Beaver Valley Power Station is on the Ohio River at river mile 34.8, at a location on the New Cumberland Pool that is 3.3 river miles downstream from Montgomery Lock and Dam, and 19.4 miles upstream from New Cumberland Lock and Dam. The Pennsylvania-Ohio-West Virginia border is located 5.2 river miles downstream from the site. The river flow is regulated by a series of dams and reservoirs on the Beaver, Allegheny, Monongahela and Ohio Rivers and their tributaries. Flow ranges from a minimum of approximately 5000 cubic feet per second (CFS) to a maximum of approximately 100,000 CFS. The mean annual flow is approximately 25,000 CFS.

Water temperature of the Ohio River varies from 32°F to 84°F, the minimum temperatures occur in January and/or February and maximum temperatures in July and August. Water quality in the Ohio River at the site location is affected primarily by the water quality of the Allegheny, Monongahela, and Beaver rivers.

The climate of the area may be classified as humid continental. Annual precipitation is approximately 36 inches, typical yearly temperatures vary from approximately - 3°F to 95°F with an annual average temperature of 52.3°F. The predominant wind direction is typically from the southwest in summer and from the northwest in winter.

Figure 1-1. View of the Beaver Valley Power Station

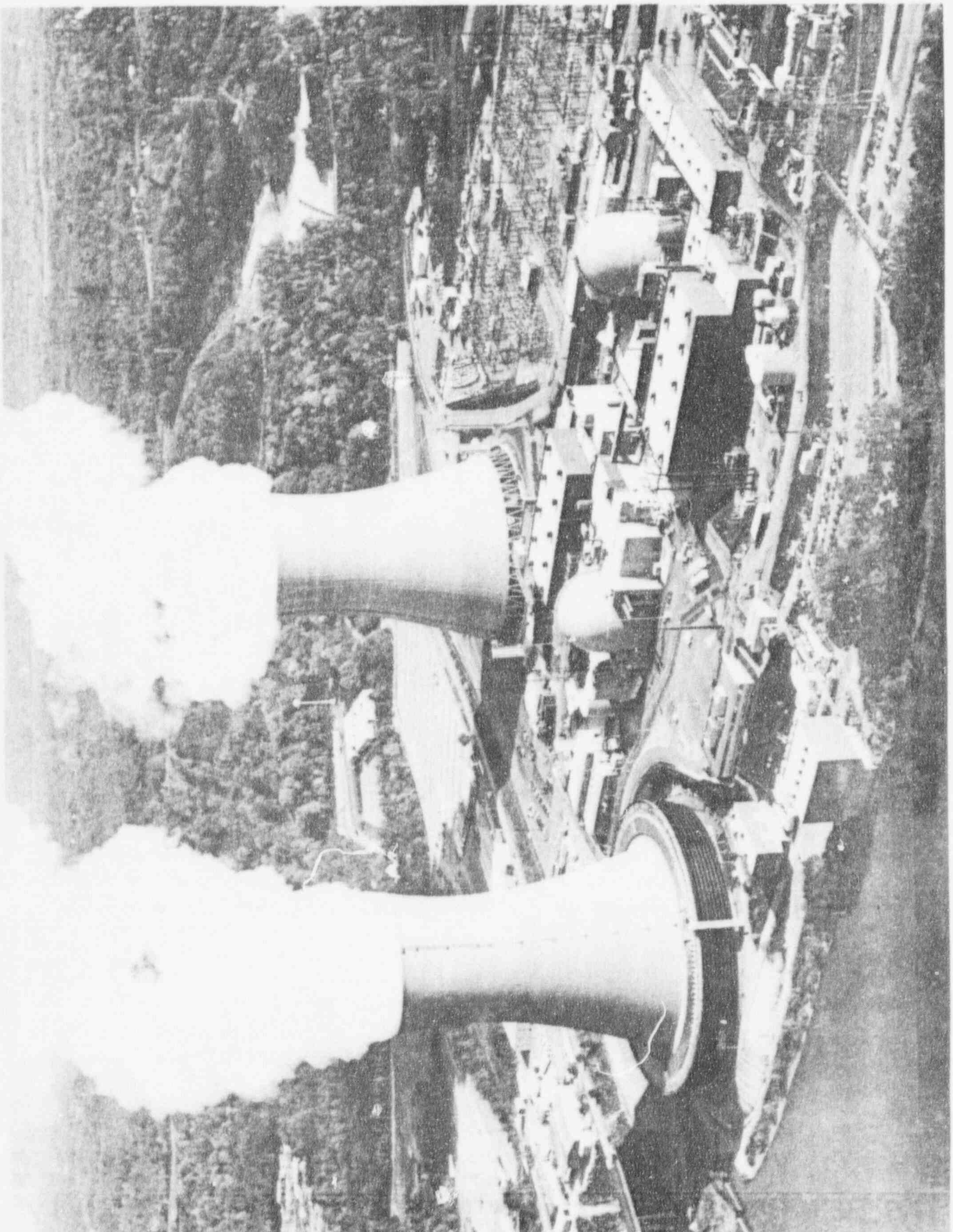
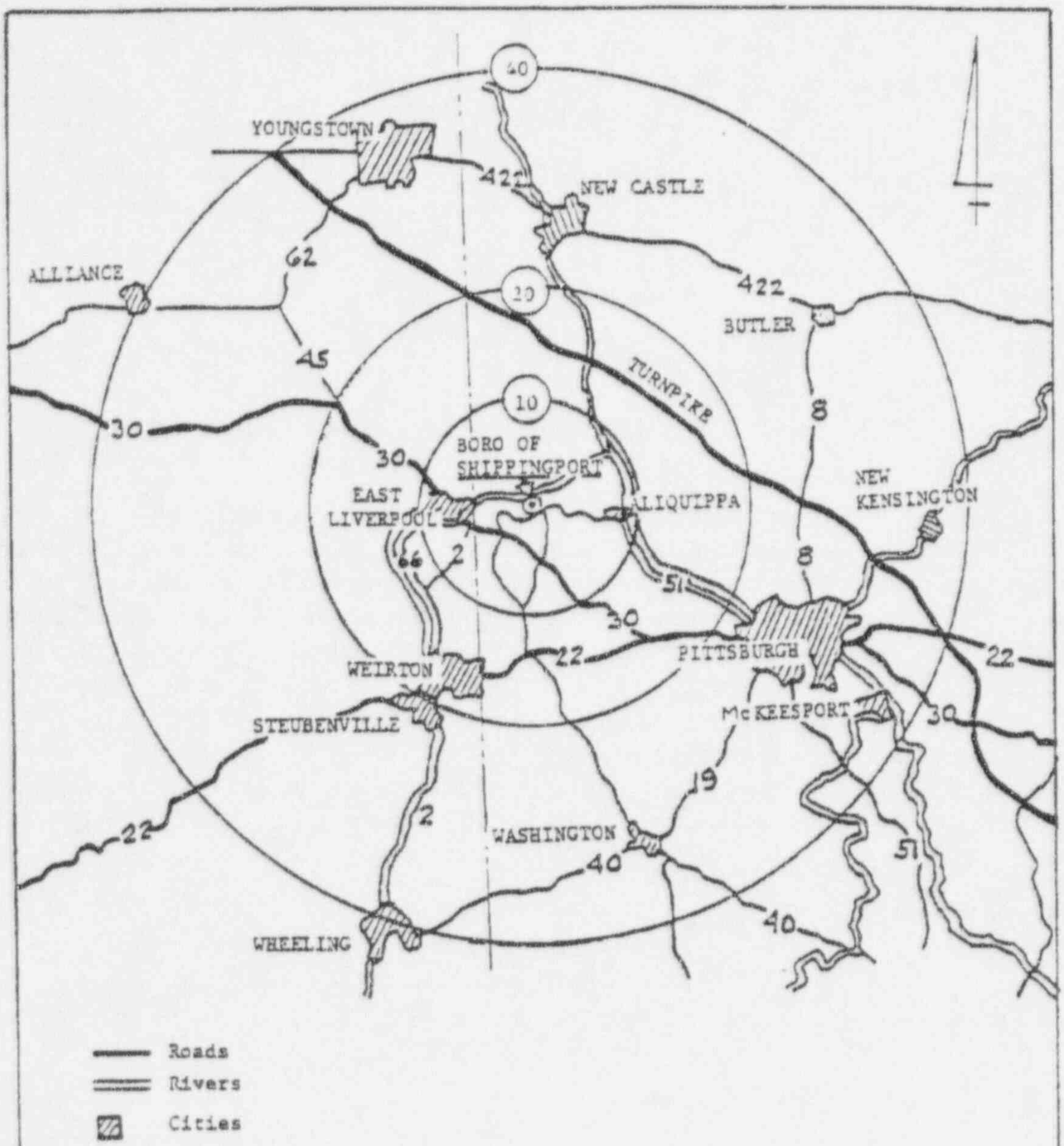


Figure 1-2. Geographical Map and Principal Communities in 40-mile Radius of the Beaver Valley Power Station



GEOGRAPHICAL MAP AND PRINCIPAL COMMUNITIES IN 40-MILE RADIUS OF THE BEAVER VALLEY POWER STATION

FIGURE 1-2

The design ratings and basic features of the Beaver Valley Power Station Units 1 and 2 are tabulated below:

	Beaver Valley Unit 1	Beaver Valley Unit 2
Thermal & Elec. Rating (Net MW_e)	2660 MW_t 835 MW_e	2660 MW_t 836 MW_e
Type of Power	PWR	PWR
No. of Reactor Coolant Loops	3	3
No. of Steam Generators & Type	3 - Vertical	3 - Vertical
Steam Used by Main Turbine	Saturated	Saturated

The units utilize two separate systems (primary and secondary) for transferring heat from the source (the reactor) to the receiving component (turbine-generator). Because the two systems are isolated from each other, primary and secondary waters do not mix; therefore, radioactivity in the primary system water is normally isolated from the secondary system. Reactor coolant in the primary system is pumped through the reactor core and steam generators by means of reactor coolant pumps. Heat is given up from the primary system to the secondary system in the steam generators, where steam is formed and delivered to the main unit turbine, which drives the electrical generator. The steam is condensed after passing through the turbine, and returned to the steam generators to begin another steam/water cycle.

NOTE: MW_t - megawatts thermal

MW_e - megawatts electrical

Section 2. RESULTS AND CONCLUSIONS

Plant operations at the Beaver Valley Power Station had no adverse effects on the environment as a result of activity at the station during 1995.

The Beaver Valley Power Station Unit 1 operated throughout 1995 except during a refueling outage January 3 through March 8, 1995 and maintenance outages August 19 through August 27 and December 18 through December 26, 1995. Unit 2 operated throughout the year except during a refueling outage March 24 through May 9, 1995 and a maintenance outage August 13 through August 15, 1996. During the year, the radioactive releases were below the limits of 10 CFR Part 50, Appendix I. The releases at Beaver Valley Power Station Units 1 and 2 did not exceed the limiting conditions identified in the Beaver Valley Power Station Operating License Technical Specifications/Offsite Dose Calculation Manual (ODCM) for Units 1 and 2.

The environmental program for 1995 was the same as in 1994 except several changes in dairy locations which were revised as required by the Beaver Valley Technical Specifications/ODCM. (Refer to Table 5-1 for the 1995 Radiological Monitoring Program Outline.)

The Beaver Valley Power Station Technical Specifications/ODCM require sampling of three (3) dairies which have the highest calculated milk pathway potential and one large local dairy. The three dairies are determined from calculations based on the meteorological data and the latest milch animal survey. However, these dairies are frequently small, consisting of as few as one cow or goat. The availability of milk from single cow dairies and revisions due to updated calculations and surveys normally result in sampling of several additional dairies during the year in different sampling periods.

The Environmental Monitoring Program also includes two larger dairies in order to provide continuity in the sampling/analyses program and a control location. Samples from each of these dairies are obtained in addition to the four dairies required by the Technical Specifications/ODCM. The collection periods associated with each of the locations are provided in the detailed summary of the milk monitoring program of this report (Section 5-E).

Activity detected was attributable to naturally occurring radionuclides, BVPS effluents, previous nuclear weapons tests, medical procedures or to the normal statistical fluctuation for activities near the lower limit of detection (LLD). The positive results attributable to the Beaver Valley Power Station were consistent with station data of authorized radioactive discharges and were within limits permitted by the NRC license.

The results and conclusions for each media of the 1995 Radiological Environmental Monitoring Program are contained in Section 5 of this report. A summary of the 1995 operational environmental data is found in Table 5-2 and a summary of preoperational data (1974-1975) environmental data is found in Table 5-3.

Evaluation of effluent release data from the Beaver Valley Power Station and environmental media demonstrated compliance with regulations and Station Technical Specifications/ODCM.

Section 3. ENVIRONMENTAL MONITORING CONSIDERATIONS

A. Environmental Quality Control Program

The Quality Control (QC) Program used for the Beaver Valley Environmental Radioactivity Monitoring Program consisted of seven (7) elements. It should be noted that the comparisons made were at very low levels of radioactivity and consequently, the activities at these levels are difficult to measure. See Section 3-B for discussion of comparison criteria for radiochemical determinations. Values in Table 3-2 through Table 3-12 identified with an asterisk (*) do not meet comparison criteria. However, acceptable correlation was achieved in most instances as outlined in the discussions and tables which follow.

1. TLD Monitoring (Duquesne Light Company (DLC) Contractor Laboratory and QC Laboratory)

   Thirteen (13) TLDs from the Contractor Laboratory and QC Laboratory are co-located, replaced quarterly and results compared. The average of the Contractor Laboratory and the average of the quality control laboratory agree within $\pm$ 4.0% of the mean of all results. This is well within the precision of typical TLD Systems. Summary data of the TLD Monitoring Program is provided in Table 3-1.

2. Split Sample Program (DLC Contractor Laboratory - DLC QC Laboratory)

   Samples of surface (river) water and drinking water were routinely split and analyzed by the DLC Contractor Laboratory and the DLC QC Laboratory. In addition, samples of other media, such as milk, sediment and feedcrop were also split with the DLC QC Laboratory.

   A summary of results of split water samples is provided in Table 3-2 and Table 3-3. There were two non-comparisons with surface water. One was for gross beta which was close to comparison and the other was a positive alpha by the QC Laboratory which was reported as LLD by the Contractor Laboratory. More variability in duplicate samples is expected in surface water due to entrained solids. There were no non-comparisons in all of the drinking water analysis.

   Summaries of milk, sediment and feed/food crop split samples are provided in Table 3-4 and Table 3-5. Good overall agreement was obtained with only one non-comparison observed of potassium-40 in feed and non-comparisons in sediment for cobalt-58 and 60 which were close to comparison. Some variation may be expected due to variations in duplicate samples, variations in analytical procedures and in calibration, source type, etc.

(Text continued on page 3-7)

Table 3-1. Quality Control Data - Contractor Quality Control Laboratory Comparison Thermoluminescent Dosimeters - mR/day

TABLE 3-1

QUALITY CONTROL DATA - CONTRACTOR QUALITY CONTROL LABORATORY COMPARISON THERMOLUMINESCENT DOSIMETERS - mR/day

1ST QUARTER		
Location No.	DLC Contractor ($CaSO_4$:Dy)	DLC - QC Lab ($CaSO_4$:Dy)
10	0.20	0.16
13	0.16	0.15
14	0.17	0.16
15	Lost	Lost
27	0.18	0.15
28	0.17	0.15
29B	0.20	0.21
32	0.18	0.19
45	0.18	0.17
46	0.17	0.15
47	0.20	0.19
48	0.18	0.17
51	0.18	0.19

2ND QUARTER		
Location No.	DLC Contractor ($CaSO_4$:Dy)	DLC - QC Lab ($CaSO_4$:Dy)
10	0.19	0.18
13	0.18	0.17
14	0.19	0.18
15	0.17	0.15
27	0.19	0.18
28	0.19	0.19
29B	0.21	0.23
32	0.21	0.18
45	0.20	0.18
46	0.19	0.17
47	0.21	0.21
48	0.20	0.18
51	0.19	0.19

3RD QUARTER		
Location No.	DLC Contractor ($CaSO_4$:Dy)	DLC - QC Lab ($CaSO_4$:Dy)
10	0.19	0.15
13	0.17	0.16
14	0.18	0.16
15	0.16	0.15
27	0.18	0.15
28	0.19	0.15
29B	0.23	0.19
32	0.19	0.17
45	0.18	0.16
46	0.16	0.15
47	0.20	0.17
48	0.18	0.17
51	0.17	0.16

4TH QUARTER		
Location No.	DLC Contractor ($CaSO_4$:Dy)	DLC - QC Lab ($CaSO_4$:Dy)
10	0.17	0.16
13	0.15	0.15
14	0.16	0.16
15	0.15	0.14
27	0.17	0.16
28	0.15	0.15
29B	0.20	0.20
32	0.18	0.16
45	0.18	0.16
46	0.19	0.14
47	0.19	0.18
48	0.13	0.16
51	0.17	0.17

ANNUAL		
Location No.	DLC Contractor ($CaSO_4$:Dy)	DLC - QC Lab ($CaSO_4$:Dy)
10	0.16	0.15
13	0.15	0.14
14	0.15	0.15
15	Lost	Lost
27	0.16	0.15
28	0.15	0.16
29B	0.20	0.18
32	0.18	0.16
45	0.16	0.16
46	0.15	0.15
47	0.19	0.17
48	0.18	0.14
51	0.17	0.15

Table 3-2. Quality Control Data - Contractor/Quality Control Laboratory Comparison Split Surface Water Samples

TABLE 3-2

QUALITY CONTROL DATA
CONTRACTOR/QUALITY CONTROL LABORATORY COMPARISON SPLIT SURFACE WATER SAMPLES

Media	Analysis	Sampling Period	DLC Contractor* Lab (1)	DLC - QC Lab (1)	Units
Surface Water	Gross Alpha	January	< 0.8	< 1.8	pCi/l
		April	< 1.8*	5.8 ± 1.3	pCi/l
		July	< 1.1	1.4 ± 1.0	pCi/l
		October	< 1.8	1.6 ± 1.1	pCi/l
Surface Water	Gross Beta	January	4.5 ± 1.1	3.5 ± 1.3	pCi/l
		April	4.3 ± 1.3	5.6 ± 0.9	pCi/l
		July	9.5 ± 1.7*	4.6 ± 1.0	pCi/l
		October	11.0 ± 1.0	7.9 ± 1.1	pCi/l
Surface Water	Co-60	January	< 4.0	< 2.4	pCi/l
		April	< 3.0	< 1.7	pCi/l
		July	< 3.0	< 1.2	pCi/l
		October	< 4.0	< 1.0	pCi/l
Surface Water	Cs-134	January	< 4.0	< 5.7	pCi/l
		April	< 4.0	< 1.4	pCi/l
		July	< 3.0	< 1.7	pCi/l
		October	< 4.0	< 0.6	pCi/l
Surface Water	Cs-137	January	< 4.0	< 6.1	pCi/l
		April	< 4.0	< 1.8	pCi/l
		July	< 3.0	< 0.9	pCi/l
		October	< 4.0	< 1.1	pCi/l
Surface Water	Tritium	1st Quarter Composite	1700 ± 200	1574 ± 144	pCi/l
		3rd Quarter Composite	< 200	< 152	pCi/l
Surface Water	Sr-89	2nd Quarter Composite	< 0.69	< 0.6	pCi/l
		4th Quarter Composite	< 0.94	< 0.6	pCi/l
Surface Water	Sr-90	2nd Quarter Composite	< 0.17	< 0.5	pCi/l
		4th Quarter Composite	< 0.22	< 0.4	pCi/l
Surface Water	Co-60 (high sensitivity anaylsis)	2nd Quarter Composite	< 0.9	< 1.2	pCi/l
		4th Quarter Composite	< 1.0	< 1.6	pCi/l

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

* See Section 3.A.2.

Table 3-3. Quality Control Data - Contractor/Quality Control Laboratory Comparison Split Drinking Water Samples

TABLE 3-3

QUALITY CONTROL DATA
CONTRACTOR/QUALITY CONTROL LABORATORY COMPARISON SPLIT DRINKING WATER SAMPLES

Media	Analysis	Sampling Period	DLC Contractor Lab (1)	DLC - QC Lab (1)	Units
Drinking Water (weekly split)	Cs-137	February	< 4	< 4.4	pCi/l
		May	< 3	< 2.4	pCi/l
		August	< 3	< 2.4	pCi/l
		November	< 5	< 3.3	pCi/l
Drinking Water (weekly split)	Cs-134	February	< 4	< 2.9	pCi/l
		May	< 4	< 2.4	pCi/l
		August	< 3	< 2.6	pCi/l
		November	< 4	< 2.9	pCi/l
Drinking Water (weekly split)	Co-60	February	< 3	< 2.6	pCi/l
		May	< 3	< 2.3	pCi/l
		August	< 3	< 2.0	pCi/l
		November	< 5	< 2.5	pCi/l
Drinking Water (monthly composite)	Gross Alpha	March	< 1.1	< 1.5	pCi/l
		June	< 1.8	< 1.1	pCi/l
		August	< 1.0	< 1.1	pCi/l
		November	< 1.0	< 1.0	pCi/l
Drinking Water (monthly composite)	Gross Beta	March	3.3 ± 1.1	6.0 ± 1.4	pCi/l
		June	2.0 ± 1.0	1.8 ± 0.9	pCi/l
		August	4.2 ± 1.3	3.1 ± 0.9	pCi/l
		November	4.3 ± 1.1	2.8 ± 0.8	pCi/l
Drinking Water	Tritium	2nd Quarter	< 200	< 154	pCi/l
		4th Quarter	< 200	< 152	pCi/l

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

Table 3-4. Quality Control Data - Contractor/Quality Control Laboratory Comparison Split Milk Samples

TABLE 3-4

QUALITY CONTROL DATA
CONTRACTOR/QUALITY CONTROL LABORATORY COMPARISON SPLIT MILK SAMPLES

Media	Sampling Period	Analysis	DLC Contractor Lab (1)	DLC - QC Lab (1)	Units
Milk (25)	3-20-95	Sr-89	< 0.81	< 1.0	pCi/l
		Sr-90	3.0 ± 0.2	4.0 ± 1.0	pCi/l
		I-131	< 0.17	< 0.1	pCi/l
		Cs-134	< 4	< 3.2	pCi/l
		Cs-137	< 4	< 3.6	pCi/l
		K-40	1250 ± 120	1360 ± 100	pCi/l
Milk (25)	6-12-95	Co-60	< 4	< 8.6	pCi/l
		I-131	< 0.23	< 0.3	pCi/l
		Cs-134	< 4	< 3.7	pCi/l
		Cs-137	< 4	< 5.7	pCi/l
		K-40	1310 ± 130	1440 ± 160	pCi/l
Milk (25)	9-18-95	Sr-89	< 0.82	< 0.5	pCi/l
		Sr-90	3.5 ± 0.2	3.2 ± 0.50	pCi/l
		I-131	< 0.28	< 0.2	pCi/l
		Cs-134	< 5	< 3.6	pCi/l
		Cs-137	< 5	< 3.5	pCi/l
		K-40	1220 ± 120	1470 ± 120	pCi/l
Milk (25)	12-11-95	Co-60	< 3.0	< 5.2	pCi/l
		I-131	< 0.2	< 0.5	pCi/l
		Cs-134	< 3.0	< 6.5	pCi/l
		Cs-137	< 3.0	< 5.8	pCi/l
		K-40	1310 ± 130	1220 ± 150	pCi/l

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

Table 3-5. Quality Control Data - Contractor/Quality Control Laboratory Comparison Split Feed, Food and Sediment Samples

TABLE 3-5

QUALITY CONTROL DATA
CONTRACTOR/QUALITY CONTROL LABORATORY
COMPARISON SPLIT FEED, FOOD AND SEDIMENT SAMPLES

Media	Sampling Period	Analysis	DLC Contractor Lab (1)	DLC - QC Lab (1)	Units
Feed (25)	6-12-95	Be-7	< 0.4	< 0.097	pCi/gm (dry)
		K-40	34.3 ± 0.3*	9.8 ± 0.5	pCi/gm (dry)
		Co-60	< 0.04	< 0.014	pCi/gm (dry)
		I-131	< 0.009	< 0.017	pCi/gm (dry)
		Cs-134	< 0.04	< 0.015	pCi/gm (dry)
		Cs-137	< 0.04	< 0.012	pCi/gm (dry)
Feed (25)	4/18 - 6/12	Sr-90	0.17 ± 0.02	0.004 ± 0.002	pCi/gm (dry)
Food (10)	10-31-95	K-40	2.3 ± 0.2	3.8 ± 0.6	pCi/gm (wet)
		Co-60	< 0.009	< 0.013	pCi/gm (wet)
		I-131	< 0.003	< 0.047	pCi/gm (wet)
		Cs-134	< 0.009	< 0.028	pCi/gm (wet)
		Cs-137	< 0.009	< 0.014	pCi/gm (wet)
Sediment (2A)	10-15-95	Gross Alpha	14.0 ± 6.0	25.1 ± 7.4	pCi/gm (dry)
		Gross Beta	43.0 ± 4.0	32.2 ± 4.8	pCi/gm (dry)
		Sr-89	< 0.081	< 0.031	pCi/gm (dry)
		Sr-90	< 0.024	< 0.024	pCi/gm (dry)
		Mn-54	0.42 ± 0.10	0.69 ± 0.13	pCi/gm (dry)
		Co-58	3.41 ± 0.34*	4.67 ± 0.24	pCi/gm (dry)
		Co-60	6.32 ± 0.63*	8.43 ± 0.16	pCi/gm (dry)
		Ag-110	0.93 ± 0.09	-	pCi/gm (dry)
		Sb-125	0.88 ± 0.21	-	pCi/gm (dry)
		Cs-134	< 0.1	< 0.13	pCi/gm (dry)
		Cs-137	0.153 ± 0.057	0.225 ± 0.77	pCi/gm (dry)
		Ra-226	2.81 ± 1.37	3.19 ± 0.83	pCi/gm (dry)
		Th-228	1.19 ± 0.12	-	pCi/gm (dry)
		K-40	11.40 ± 0.11	15.04 ± 1.14	pCi/gm (dry)

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

* See Section 3.A.2 and 3-B.

3. DLC QC Laboratory Program

   Spiked samples prepared by DLC QC Laboratory were routinely submitted to the Contractor Laboratory for analysis. Table 3-6 (water) and Table 3-7 (milk) provide data from this portion of the QC Program. See Section 3-B for evaluation of the data.

4. Comparisons of Similar Samples (DLC Contractor Laboratory - DLC QC Laboratory)

   Duplicate air particulate and charcoal filters (radioiodine) samples were collected at Location #30 and compared during the year on a weekly basis. Comparison of particulate and charcoal samples alternated from week to week. Duplicate monthly air particulate filters, composited from the weekly air particulate filters, were analyzed 6 months out of the year for gamma activity. Duplicate quarterly air particulate filters, composited from the weekly air particulate filters, were analyzed for Sr-89 and Sr-90 activity for each quarter of the year. Table 3-8, Table 3-9 and Table 3-10 provides data for this portion of the QC program.

5. Contractor and QC Laboratory - Internal QC Program

   The Contractor and QC Laboratory maintained their own QC program which included participation in the Environmental Protection Agency - Environmental Monitoring Safety Laboratory (EPA - EMSL) Interlaboratory Cross Check Program. This cross check program indicated that the Contractor and QC Laboratory results were in agreement with EPA EMSL. The Contractor data for 1994 and 1995 is presented with trending graphs from 1981. See Appendix I and II.

6. Special QC Program (DLC Contractor Laboratory - Independent Laboratory - DLC QC Laboratory)

   Low level spiked water and milk samples are prepared by a vendor noted for supplying quality primary standards with NIST traceability. The "spiked to" values are used for calculating comparison acceptance criteria. The prepared spiked samples are then split between the DLC Contractor Laboratory and the DLC QC Laboratory. A summary of results of this portion of the QC program is provided in Table 3-11 and Table 3-12. See Section 3-B for evaluation of this data.

(Text continued on page 3-16)

Table 3-6. Quality Control Data - Contractor/Quality Control Laboratory Comparison Spiked Water Samples

TABLE 3-6

**QUALITY CONTROL DATA
CONTRACTOR/QUALITY CONTROL
LABORATORY COMPARISON SPIKED WATER SAMPLES**

Sample Date	Identification No.	Sample Analysis	DLC Contractor Lab (1)	DLC - QC Lab (1)	Units
3-14-95	W-119	Sr-89 Sr-90	7.3 ± 1.5 39.0 ± 1.0	14.7 ± 5.0 39.1 ± 5.0	pCi/l pCi/l
4-10-95	W-120	H-3	8900 ± 300	9656 ± 292	pCi/l
4-13-95	W-121	Co-60 Cs-134 Cs-137	24.7 ± 3.6 29.1 ± 3.8 48.1 ± 4.8	23.8 ± 2.4 29.3 ± 2.3 42.3 ± 3.9	pCi/l pCi/l pCi/l
6-8-95	W-122	I-131	46.0 ± 1.0	48.2 ± 1.9	pCi/l
6-8-95	W-123	Gross Alpha Gross Beta	16.0 ± 4.0 29.0 ± 5.0*	17.3 ± 1.4 21.2 ± 1.0	pCi/l pCi/l
5-31-95	W-124A	Sr-89 Sr-90	21.0 ± 2.0 23.0 ± 1.0	18.7 ± 2.4 21.2 ± 1.1	pCi/l pCi/l
9/27/95	W-124B	Sr-89 Sr-90	43.0 ± 1.0 21.0 ± 1.0	34.6 ± 4.9 20.3 ± 1.3	pCi/l pCi/l
11-29-95	W-125	H-3	28000 ± 1000	27963 ± 445	pCi/l
11/29/95	W-126	Co-60 Cs-134 Cs-137	27.0 ± 3.7 45.5 ± 4.6 30.9 ± 4.1	22.0 ± 1.9 38.1 ± 2.0 27.2 ± 3.0	pCi/l pCi/l pCi/l
12-29-95	W-127	Gross Alpha Gross Beta	19.0 ± 5.0 31.0 ± 5.0	19.6 ± 3.0 21.0 ± 1.8	pCi/l pCi/l

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

* See Section 3-B.

Table 3-7. Quality Control Data - Contractor/Quality Control Laboratory Comparison Spiked Milk Samples

TABLE 3-7

**QUALITY CONTROL DATA
CONTRACTOR/QUALITY CONTROL
LABORATORY COMPARISON SPIKED MILK SAMPLES**

Sample Date	Identification No.	Sample Analysis	DLC Contractor Lab (1)	DLC - QC Lab (1)	Units
1-13-95	MI-58	Sr-89	31.0 ± 2.0	19.4 ± 3.4	pCi/l
		Sr-90	26.0 ± 1.0	26.2 ± 1.3	pCi/l
		Cs-137	60.3 ± 6.0	51.2 ± 7.5	pCi/l
		K-40	1380 ± 140	1250 ± 120	pCi/l
1-31-95	MI-59	I-131	81.0 ± 2.0	84.8 ± 10.4	pCi/l
4-26-95	MI-60	Cs-134	37.6 ± 3.8	37.7 ± 1.8	pCi/l
		Cs-137	68.5 ± 6.9	62.4 ± 3.1	pCi/l
		K-40	1310 ± 130	1426 ± 49	pCi/l
6-1-95	MI-61	I-131	83.0 ± 1.0	78.8 ± 2.3	pCi/l
7-5-95	MI-62	Sr-90	29.0 ± 1.0	28.0 ± 1.4	pCi/l
		I-131	50.0 ± 1.0	44.7 ± 5.4	pCi/l
		Cs-134	34.1 ± 4.6	31.5 ± 2.5	pCi/l
		Cs-137	54.8 ± 5.5	50.2 ± 4.0	pCi/l
		K-40	1470 ± 150	1350 ± 60	pCi/l
10-17-95	MI-63	I-131	76.0 ± 1.0	70.9 ± 0.8	pCi/l
		Cs-134	25.2 ± 4.3	27.9 ± 3.9	pCi/l
		Cs-137	47.9 ± 4.8	52.3 ± 6.9	pCi/l
		K-40	1320 ± 130	1340 ± 110	pCi/l

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

* See Section 3-B

Table 3-8. Quality Control Data - Contractor/Quality Control Laboratory Comparison Split Air Particulate and Charcoal Filter Samples

TABLE 3-8

QUALITY CONTROL DATA
CONTRACTOR/QUALITY CONTROL LABORATORY COMPARISON
SPLIT AIR PARTICULATE AND CHARCOAL FILTER SAMPLES

Air Particulates pCi/Cu. Meter (Beta)			Air Iodine pCi/Cu. Meter		
Sample Date	DLC Contractor Lab (1)	DLC - QC Lab (1)	Sample Date	DLC Contractor Lab	DLC - QC Lab
1/3 - 1/9	0.024 ± 0.004	0.021 ± 0.003	1/9 - 1/16	< 0.02	< 0.01
1/16 - 1/23	0.008 ± 0.003	0.011 ± 0.002	1/23 - 1/30	< 0.02	< 0.01
1/30 - 2/6	0.019 ± 0.003	0.019 ± 0.003	2/6 - 2/13	< 0.02	< 0.01
2/13 - 2/21	0.019 ± 0.003	0.021 ± 0.003	2/21 - 2/27	< 0.01	< 0.01
2/27 - 3/6	0.015 ± 0.003	0.015 ± 0.002	3/6 - 3/13	< 0.02	< 0.01
3/13 - 3/20	0.015 ± 0.003	0.017 ± 0.003	3/20 - 3/27	< 0.01	< 0.01
3/27 - 4/3	0.013 ± 0.003	0.013 ± 0.002	4/3 - 4/10	< 0.02	< 0.02
4/10 - 4/17	0.011 ± 0.003	0.012 ± 0.002	4/17 - 4/24	< 0.02	< 0.01
4/24 - 5/1	0.010 ± 0.003	0.015 ± 0.002	5/1 - 5/8	< 0.02	< 0.01
5/8 - 5/15	0.009 ± 0.003	0.012 ± 0.002	5/15 - 5/22	< 0.03	< 0.01
5/22 - 5/30	0.012 ± 0.003	0.011 ± 0.002	5/30 - 6/5	< 0.02	< 0.01
6/5 - 6/12	0.014 ± 0.003	0.010 ± 0.002	6/12 - 6/19	< 0.02	< 0.01
6/19 - 6/26	0.022 ± 0.003	0.021 ± 0.003	6/26 - 7/3	< 0.02	< 0.01

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

TABLE 3-8

QUALITY CONTROL DATA
CONTRACTOR/QUALITY CONTROL LABORATORY COMPARISON
SPLIT AIR PARTICULATE AND CHARCOAL FILTER SAMPLES

Air Particulates pCi/Cu. Meter (Beta)			Air Iodine pCi/Cu. Meter		
Sample Date	DLC Contractor Lab (1)	DLC - QC Lab (1)	Sample Date	DLC Contractor Lab	DLC - QC Lab
7/3 - 7/10	0.014 ± 0.003	0.013 ± 0.003	7/10 - 7/17	< 0.03	< 0.01
7/17 - 7/24	0.021 ± 0.003	0.021 ± 0.003	7/24 - 7/31	< 0.02	< 0.01
7/31 - 8/7	0.015 ± 0.003	0.018 ± 0.003	8/7 - 8/14	< 0.02	< 0.01
8/14 - 8/21	0.027 ± 0.003	0.027 ± 0.003	8/21 - 8/28	< 0.02	< 0.01
8/28 - 9/4	0.026 ± 0.003	0.024 ± 0.003	9/4 - 9/11	< 0.04	< 0.01
9/11 - 9/18	0.018 ± 0.003	0.018 ± 0.003	9/18 - 9/25	< 0.01	< 0.01
9/25 - 10/2	0.037 ± 0.004	0.038 ± 0.003	10/2 - 10/9	< 0.02	< 0.02
10/9 - 10/16	0.025 ± 0.003	0.030 ± 0.003	10/16 - 10/23	< 0.02	< 0.01
10/23 - 10/30	0.016 ± 0.003	0.014 ± 0.003	10/30 - 11/6	< 0.01	< 0.01
11/6 - 11/13	0.016 ± 0.003	0.019 ± 0.003	11/13 - 11/20	< 0.02	< 0.01
11/20 - 11/27	0.022 ± 0.003	0.025 ± 0.003	11/27 - 12/4	< 0.01	< 0.01
12/4 - 12/11	0.023 ± 0.003	0.027 ± 0.003	12/11 - 12/18	< 0.01	< 0.02
12/18 - 12/26	0.011 ± 0.003	0.014 ± 0.002	12/26 - 1/2	< 0.01	< 0.01

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

Table 3-9. Quality Control Data - Contractor/Quality Control Laboratory Comparison Split Air Particulate Samples (gamma) (pCi/m³)

TABLE 3-9

**QUALITY CONTROL DATA
CONTRACTOR/QUALITY CONTROL LABORATORY
COMPARISON SPLIT AIR PARTICULATE SAMPLES (GAMMA) (pCi/m³)**

Sample Date	Nuclide	DLC - Contractor Lab (1)	DLC - QC Lab (1)
January	Be-7	0.097 ± 0.010	0.079 ± 0.022
	Others	< LLD	< LLD
March	Be-7	0.137 ± 0.014	0.120 ± 0.022
	Others	< LLD	< LLD
May	Be-7	0.124 ± 0.012	0.153 ± 0.030
	Others	< LLD	< LLD
July	Be-7	0.186 ± 0.019	0.189 ± 0.037
	Others	< LLD	< LLD
September	Be-7	0.176 ± 0.018	0.125 ± 0.025
	Others	< LLD	< LLD
November	Be-7	0.116 ± 0.012	0.139 ± 0.031
	Others	< LLD	< LLD

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

LLD - Lower Limit of Detection

Table 3-10. Quality Control Data - Contractor/Quality Control Laboratory Air Particulate Composite Samples Comparison Split for Sr-89 and Sr-90 (pCi/m³)

TABLE 3-10

QUALITY CONTROL DATA CONTRACTOR/QUALITY CONTROL LABORATORY AIR PARTICULATE COMPOSITE SAMPLES COMPARISON SPLIT FOR Sr-89, 90 (pCi/m³)

Sample Date	Nuclide	DLC - Contractor Lab	DLC - QC Lab
1st Quarter Composite	Sr-89	< 7.4E-4	< 4E-4
	Sr-90	< 1.9E-4	< 3E-4
2nd Quarter Composite	Sr-89	< 1.1E-3	< 4E-4
	Sr-90	< 2.5E-4	< 3E-4
3rd Quarter Composite	Sr-89	< 7.9E-4	< 5E-4
	Sr-90	< 1.5E-4	< 3E-4
4th Quarter Composite	Sr-89	< 5.1E-4	< 5E-4
	Sr-90	< 9.5E-5	< 3E-4

Table 3-11. Quality Control Data - Independent Laboratory/Contractor/Quality Control Laboratory Comparison Spiked Water Samples (pCi/l)

TABLE 3-11

**QUALITY CONTROL DATA
INDEPENDENT LABORATORY/CONTRACTOR/QUALITY
CONTROL LABORATORY COMPARISON SPIKED WATER SAMPLES (pCi/l)**

Sample Date	Identification No.	Sample Type and Analyses	Independent Lab (1)	DLC CONTRACTOR LAB (1)	DLC - QC Lab (1)
3-14-95	Water 53-343	Sr-89	40.0 ± 2.0	36.5 ± 1.0	35.4 ± 1.9
		Sr-90	15.0 ± 1.0	13.5 ± 1.0	13.3 ± 0.6
		I-131	42.0 ± 2.0	39.5 ± 1.0	37.5 ± 1.5
		Cs-134	15.0 ± 1.0	15.4 ± 3.5	13.6 ± 1.4
		Cs-137	9.8 ± 0.5	11.4 ± 3.3*	11.1 ± 2.0
3-14-95	Water 53-344	H-3	608 ± 30	560 ± 50	657 ± 65
6-13-95	Water 53-345	Sr-89	14.5 ± 0.7	13.5 ± 5.0**	12.4 ± 1.1
		Sr-90	10.5 ± 0.5	9.9 ± 1.0**	10.1 ± 0.5
		Co-60	15.5 ± 0.8	18.7 ± 3.9	16.3 ± 1.1
		I-131	21.0 ± 1.0	20.5 ± 1.0	20.0 ± 0.4
		Cs-137	10.2 ± 0.5	8.2 ± 3.2	10.2 ± 1.3
6-13-95	Water 53-346	H-3	1490 ± 70	1400 ± 200	1514 ± 73
9-12-95	Water 53-347	Sr-89	19.0 ± 1.0	22.0 ± 2.0	13.8 ± 3.1*
		Sr-90	20.5 ± 1.0	20.5 ± 1.0	21.5 ± 0.7
		Mn-54	15.0 ± 0.8	18.1 ± 2.9	17.6 ± 1.5
		I-131	14.0 ± 0.7	16.5 ± 1.0	12.3 ± 0.3
		Cs-137	10.0 ± 0.5	12.8 ± 3.2	12.7 ± 1.5
9-12-95	Water 53-348	H-3	976 ± 49	930 ± 160	993 ± 65
12-12-95	Water 53-349	Sr-89	25.0 ± 1.3	24.5 ± 2.5	21.8 ± 2.7
		Sr-90	10.0 ± 0.5	9.9 ± 0.9	10.0 ± 0.5
		Co-58	16.0 ± 0.8	16.6 ± 2.8	15.8 ± 1.8
		Co-60	15.0 ± 0.8	18.1 ± 3.0	17.2 ± 1.4
		I-131	19.0 ± 1.0	22.0 ± 1.0	16.0 ± 0.3
12-12-95	Water 53-350	H-3	685 ± 34	720 ± 130**	726 ± 60

(1) Uncertainties are based on counting statistics and are reported at the 95% confidence coefficient.

* See Section 3-B.

** Re-analysis value

Table 3-12. Quality Control Data - Independent Laboratory/Contractor/Quality Control Laboratory Comparison Spiked Milk Samples (pCi/l)

TABLE 3-12

**QUALITY CONTROL DATA
INDEPENDENT LABORATORY/CONTRACTOR/QUALITY
CONTROL LABORATORY COMPARISON SPIKED MILK SAMPLES (pCi/l)**

Sample Date	Identification No.	Sample Type and Analyses	Independent Lab (1)	DLC CONTRACTOR LAB (1)	DLC - QC Lab (1)
3-14-95	Milk 52-274	Sr-89	51.0 ± 3.0	49.0 ± 2.0	45.4 ± 1.9
		Sr-90	20.0 ± 1.0	23.0 ± 1.0	18.5 ± 0.7
		I-131	50.0 ± 3.0	49.5 ± 1.0	47.0 ± 1.6
		Cs-134	10.0 ± 0.5	11.0 ± 3.8	8.9 ± 1.5
		Cs-137	15.0 ± 1.0	21.1 ± 4.0	18.1 ± 2.8
6-13-95	Milk 52-275	Sr-89	36.0 ± 2.0	37.5 ± 1.5	31.9 ± 1.9
		Sr-90	15.4 ± 0.6	16.0 ± 1.0	15.8 ± 0.6
		I-131	21.0 ± 1.0	25.0 ± 1.0	22.7 ± 0.4
		Cs-134	15.0 ± 0.8	13.1 ± 3.4	13.3 ± 1.2
		Cs-137	15.6 ± 0.8	16.3 ± 3.1	17.1 ± 2.1
9-12-95	Milk 52-276	Sr-89	24.0 ± 1.0	24.0 ± 1.0	13.6 ± 3.1*
		Sr-90	16.0 ± 0.8	16.5 ± 1.0	18.0 ± 0.7
		I-131	19.0 ± 1.0	20.0 ± 1.0	14.1 ± 0.8*
		Cs-134	10.0 ± 0.5	10.6 ± 3.2	9.6 ± 1.0
		Cs-137	15.0 ± 0.8	18.4 ± 3.8	16.8 ± 1.8
12-12-95	Milk 52-277	Sr-89	23.0 ± 1.2	26.0 ± 1.5	20.5 ± 3.9
		Sr-90	19.0 ± 1.0	20.5 ± 1.0	20.8 ± 0.8
		I-131	29.0 ± 1.5	31.0 ± 1.0	2[illegible]1 ± 2.3
		Cs-134	9.0 ± 0.5	8.3 ± 3.3	6.7 ± 1.2
		Cs-137	18.0 ± 0.9	21.6 ± 3.6	22.5 ± 2.0

(1) Uncertainties are based on counting statistics and are based on the 95% confidence coefficient.

* See Section 3-B.

7. Pennsylvania Department of Environmental Protection Program

The Pennsylvania Department of Environmental Protection (PDEP) also conducted a surveillance program in the vicinity of the site. Samples of air, river water, drinking water, sediment, milk, vegetation, fish and radiation monitoring are included in their program. Results were compared quarterly in 1995.

B. Evaluation of the Quality Control Program Data

The split and spiked sample program indicates that the Contractor and QC Laboratory are generally performing satisfactorily in accordance with "Criteria for Comparing Analytical Measurements from NRC Compliance Office." Comparisons between the QC and Contractor laboratories are generally acceptable and demonstrate a satisfactory performance by the DLC contractor. All media were in agreement in accordance with NRC criteria as listed in Inspection Guidance 84750-03 dated 12/04/90 with the exception of those media in Table 3-2 through Table 3-12 identified with an asterisk (*).

Comparisons are obtained by dividing the comparison standard by its associated uncertainty to obtain the resolution. The standard value is multiplied by the ratio values obtained from the following table to find the acceptance band for the result to be compared. Note that in the case where the counting precision of the standard yields a resolution of less than 4, a comparison cannot be calculated.

Resolution	Ratio
< 4	–
4 - 7	0.5 - 2.0
8 - 15	0.6 - 1.66
15 - 50	0.75 - 1.33
51 - 200	.8 - 1.25
> 200	.85 - 1.18

B. Evaluation of the Quality Control Program Data (Cont.)

- **Contractor Laboratory**

The Contactor Laboratory had a very satisfactory performance throughout the 1995 QC Laboratory Program. In the Independent Laboratory Program, with reference to the high quality spikes as reported in Table 3-11 and Table 3-12, excellent comparisons were achieved for all milk and water spikes. Re-analysis was required for the last H-3 in water spike of the year and for the strontium in water spike sample of June 13, 1995.

In the QC Laboratory spike sample program, as reported in Table 3-6 and Table 3-7 for water and milk, there was one non-comparison. The non-comparison, spike water sample W-123 for gross beta was very close to comparison. The following spike sample for gross beta, W-127, compared. Split drinking water samples for gross beta also compared.

Within the Contractor/QC Lab split sample program samples for feed and sediment are particularly subject to sample variability. One non-comparison was noted for potassium-40 in feed and in sediment cobalt-58 and cobalt-60 were non-comparisons although very close to comparison.

- **Quality Control Laboratory**

The QC Laboratory had satisfactory performance within the Independent Laboratory Program. One result for I-131 in milk was slightly out of comparison low in the third quarter and was followed by comparison for I-131 fourth quarter. Two non-comparisons for Sr-89 occurred in the third quarter, one in water and one in milk. In the fourth quarter, comparisons were achieved for Sr-89 in both milk and water.

Based on all available QC program data, the data from the Contractor and QC Laboratory's internal EPA Interlaboratory Cross Check Program, and comparisons with the PDEP, the Environmental Monitoring Program for 1995 is acceptable with respect to both accuracy and measurement.

C. Standard Requirements and Limitations for Radiological and Other Effluents

The Beaver Valley Power Station is governed by rules and regulations of the Federal Government and the Commonwealth of Pennsylvania. Effluent releases are controlled to ensure that limits set by Federal or State governments are not exceeded. In addition, self-imposed goals have been established to further limit discharges to the environment.

Beaver Valley Power Station is subject to regulations which include the Code of Federal Regulations 10 CFR (Energy), Gaseous Discharge Permits for auxiliary boilers and diesel generators, PA Code - Title 24, Part I, Ohio River Valley Water Sanitation Commission (ORSANCO) Standards No. 1-70 and 2-70, Environmental Protection Agency (EPA), National Pollution Discharge Elimination (NPDES) Permit #0025615, and the Beaver Valley Power Station Technical Specifications/ODCM.

D. Reporting Levels

A report is required to be submitted to the Nuclear Regulatory Commission when the level of radioactivity in an environmental sampling medium exceeds the limits specified in the Beaver Valley Power Station Technical Specifications/ODCM when averaged over any calendar quarter. Also, when more than one of the radionuclides are detected in the sampling medium, this report shall be submitted if:

$$\frac{Concentration\,(1)}{Limit\ Level\,(1)} + \frac{Concentration\,(2)}{Limit\ Level\,(2)} + \ldots \geq 1.0$$

There were no analytical results of environmental samples during 1995 which exceeded Beaver Valley Power Station reporting levels.

Section 4. MONITORING EFFLUENTS

A. Monitoring of Liquid Effluents

1. Description of Liquid Effluents at the Beaver Valley Power Station.

   Most of the water required for the operation of the Beaver Valley station is taken from the Ohio River, and returned to the river, used for makeup to various plant systems, consumed by station personnel, or discharged via a sanitary waste system. In addition, well water and liquid effluents are discharged to the Ohio River using discharge points shown in Figure 4-1. Schematic diagrams of liquid flow paths for the Beaver Valley Power Station are shown in Figure 4-2, Figure 4-3, Figure 4-4 and Figure 4-5

2. Radioactive Liquid Waste Sampling and Analysis Program

   See Table 4-1.

3. Results of Liquid Effluent Discharge to the Environment

   See Table 4-2.

Figure 4-1. Liquid Discharge Points to Ohio River

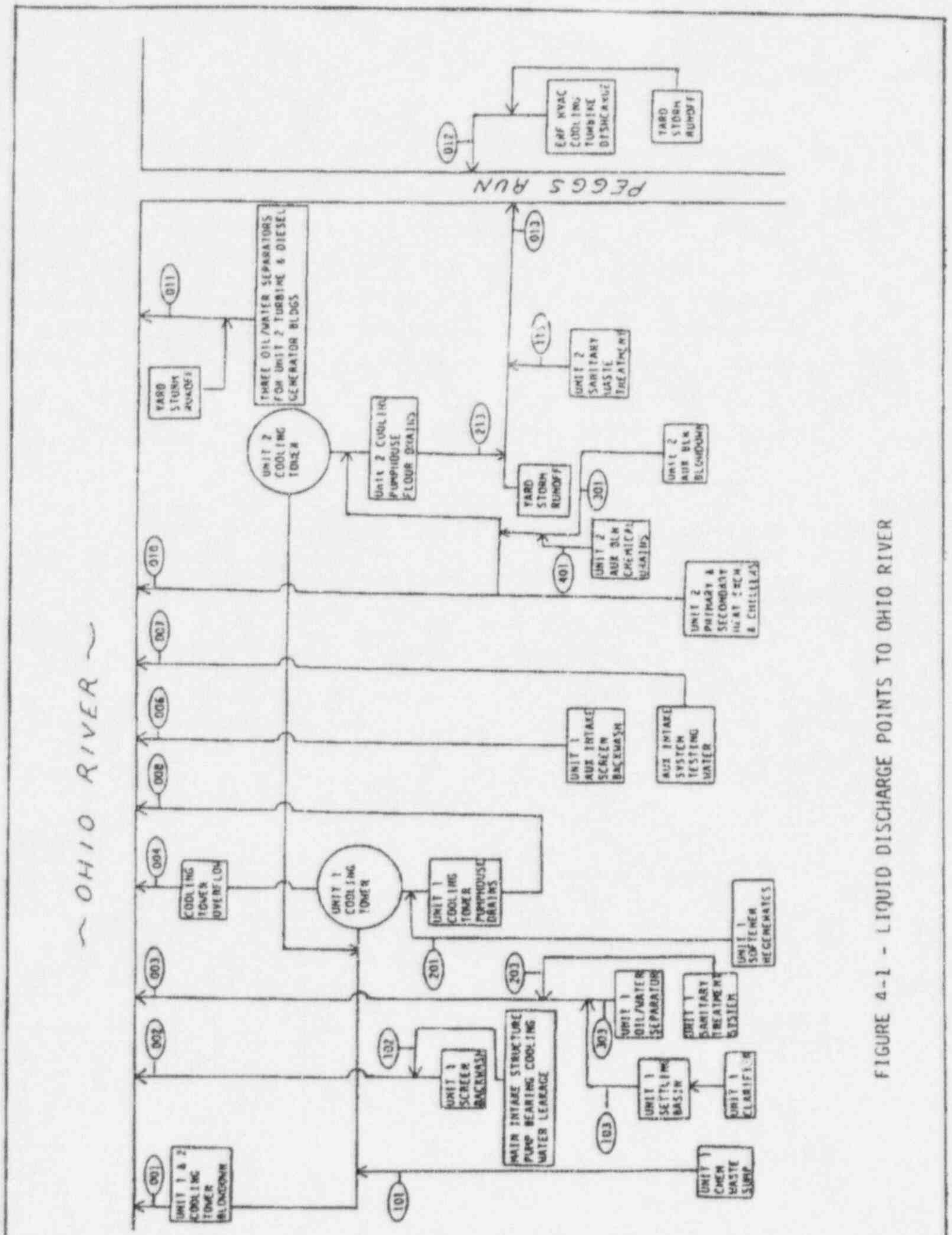


FIGURE 4-1 - LIQUID DISCHARGE POINTS TO OHIO RIVER

Figure 4-2. Unit 1 Water Flow Schematic

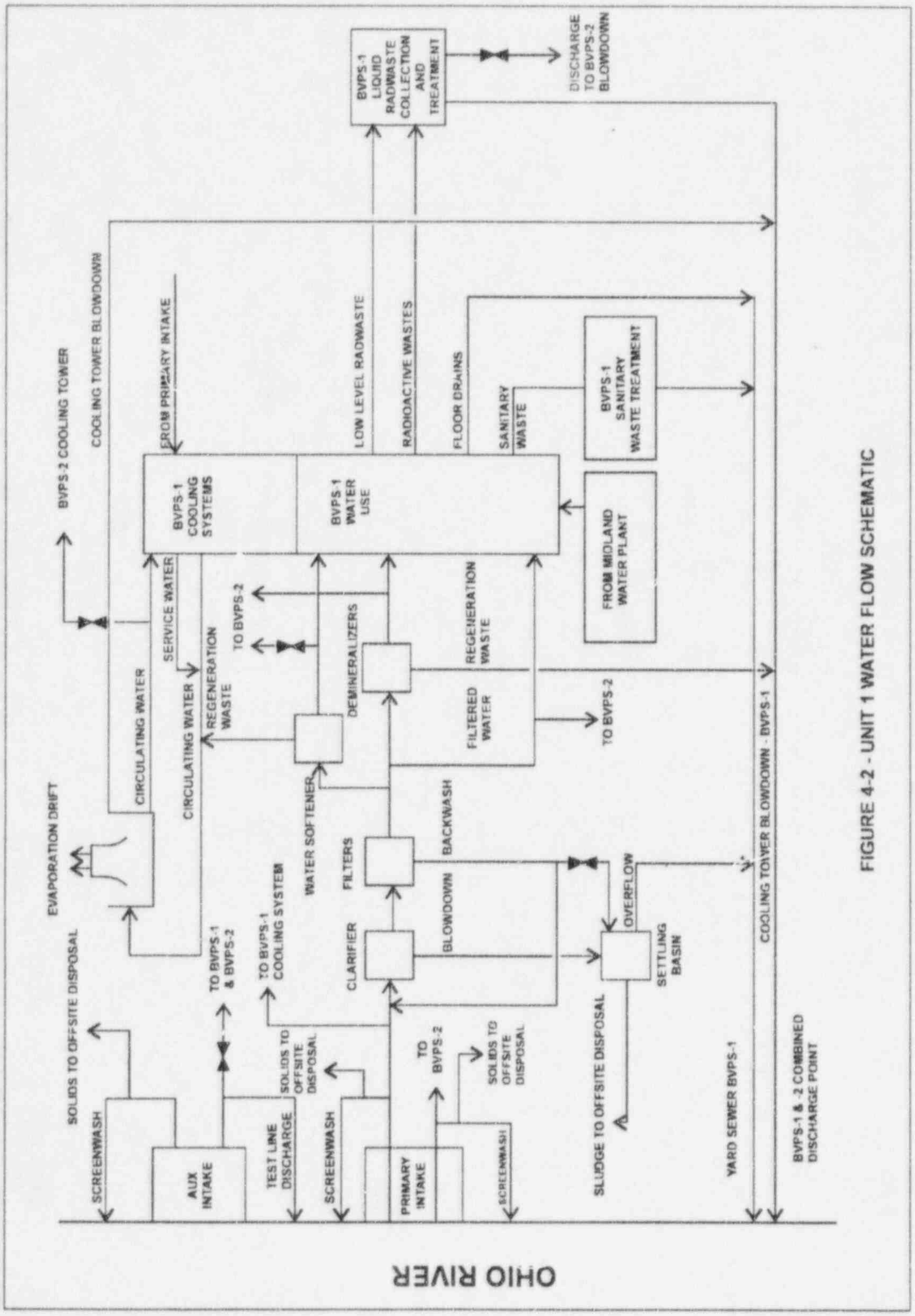


FIGURE 4-2 - UNIT 1 WATER FLOW SCHEMATIC

Figure 4-3. Unit 2 Water Flow Schematic

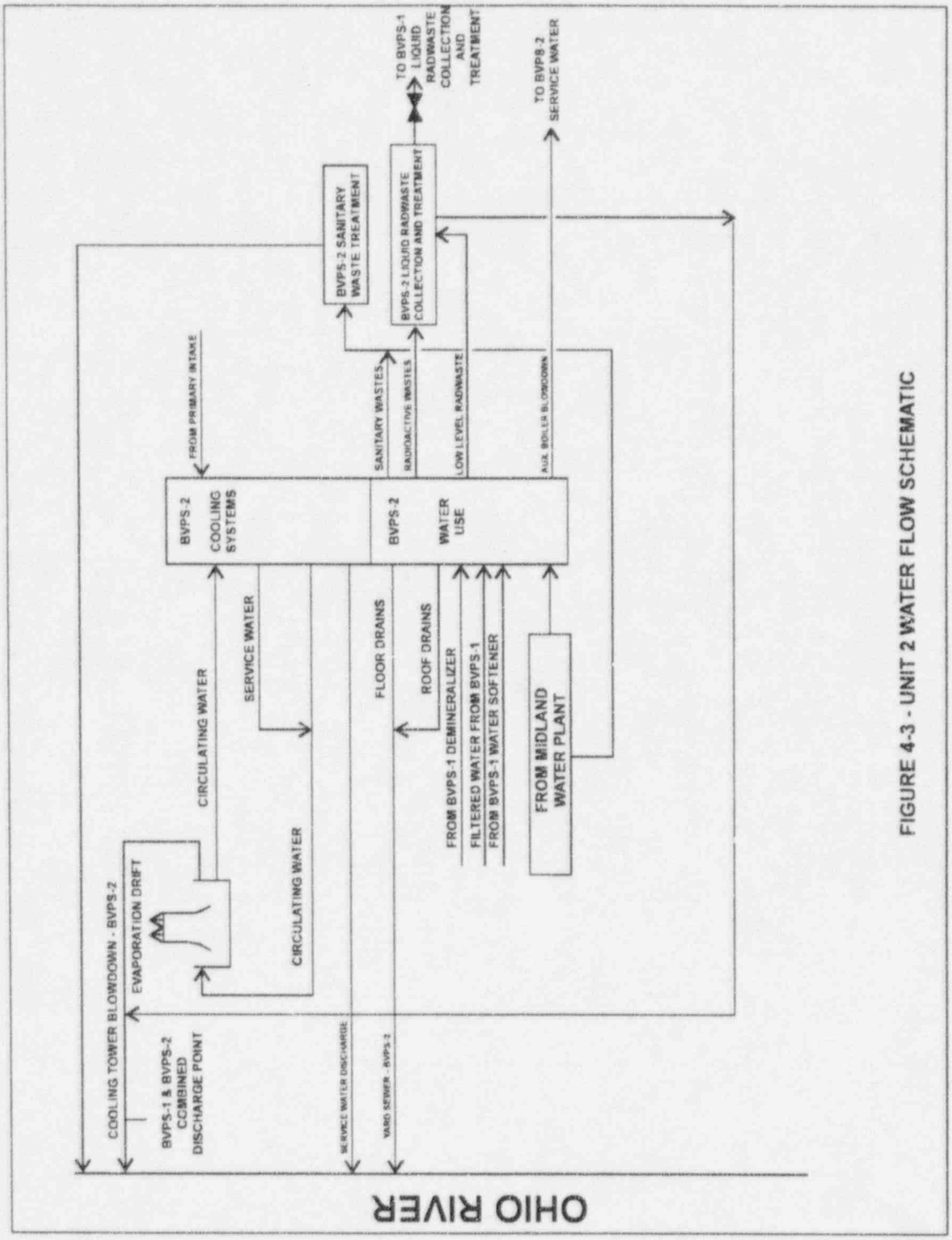


FIGURE 4-3 - UNIT 2 WATER FLOW SCHEMATIC

Figure 4-4. Unit 1 Liquid Waste System

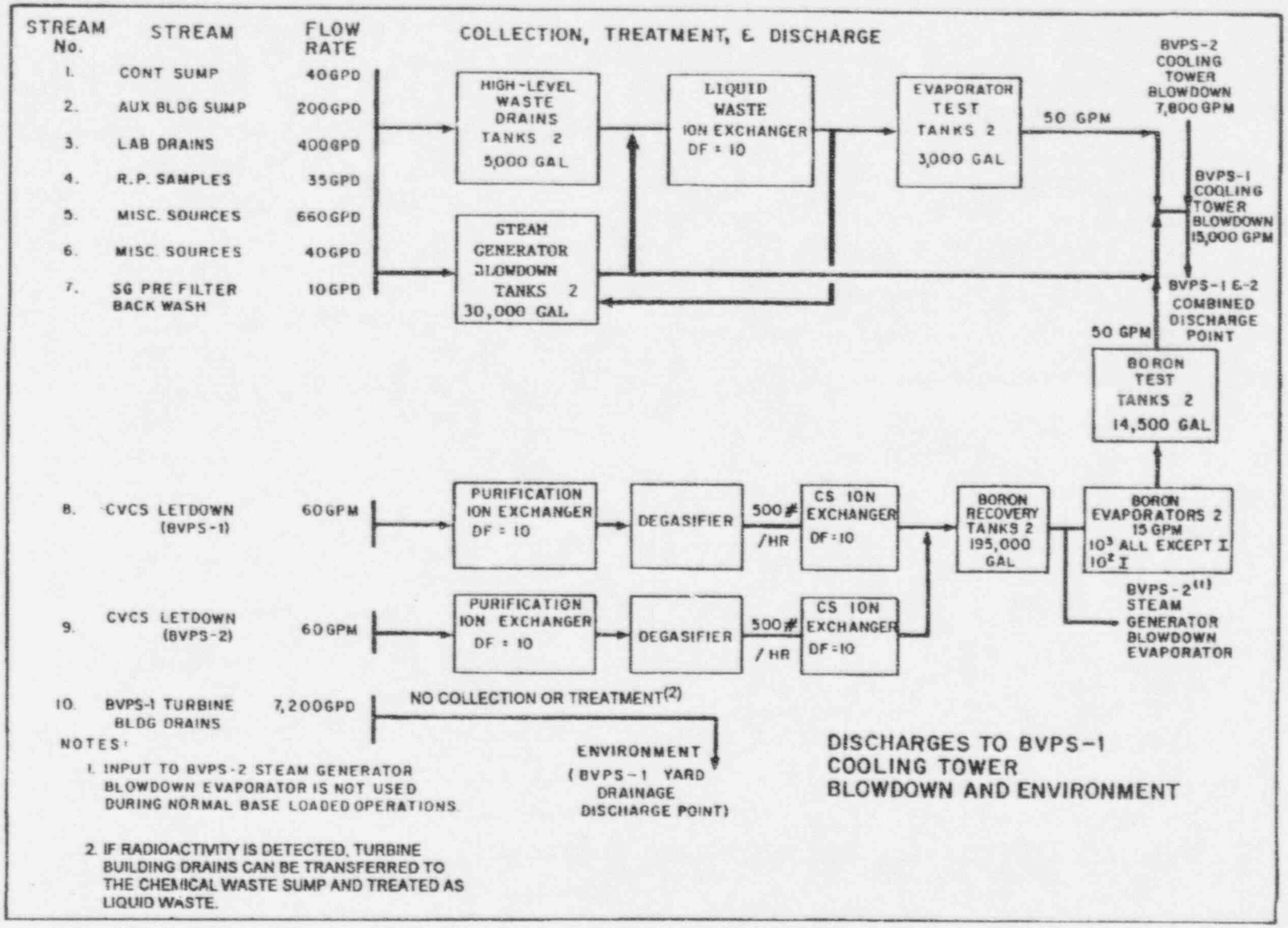


Figure 4-5. Unit 2 Liquid Waste System

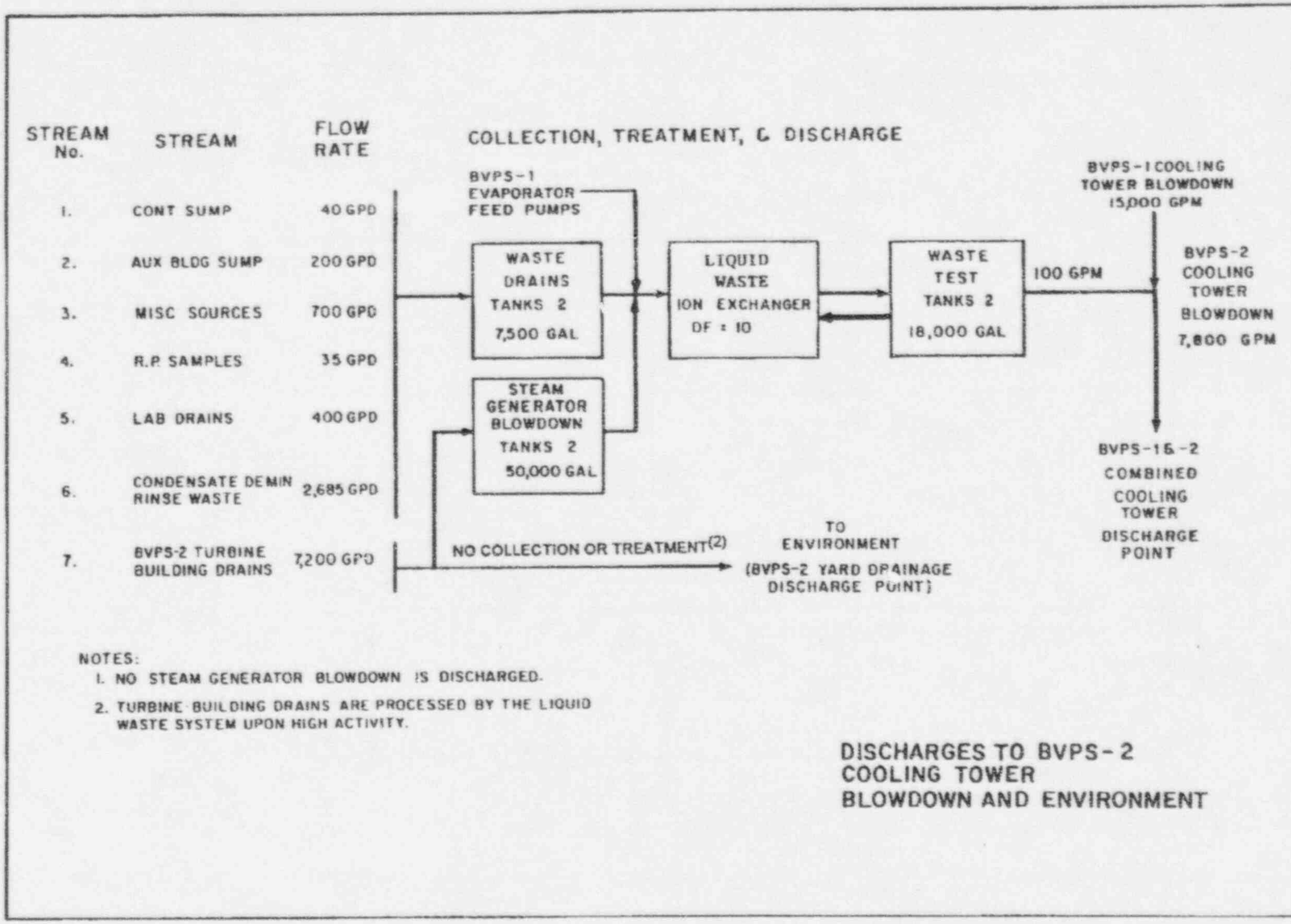


TABLE 4-1

Radioactive Liquid Waste Sampling and Analysis Program

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD) (μCi/ml)[a]
Batch Waste Release Tanks[d]	P Each Batch[h]	P Each Batch[h]	Principal Gamma Emitters[f]	5E-7
			I-131	1E-6
	P One Batch/M[h]	M	Dissolved and Entrained Gases (Gamma Emitters)	1E-5
	P Each Batch[h]	M Composite[b]	H-3	1E-5
			Gross Alpha	1E-7
	P Each Batch[h]	Q Composite[b]	Sr-89, Sr-90	5E-8
			Fe-55	1E-6
B. Continuous Releases[e,g]	Grab Sample[g]	W Composite[c]	Principal Gamma Emitters[f]	5E-7
			I-131	1E-6
	Grab Sample[g]	M	Dissolved and Entrained Gases (Gamma Emitters)	1E-5
	Grab Sample[g]	M Composite[c]	H-3	1E-5
			Gross Alpha	1E-7
	Grab Sample[g]	Q Composite[c]	Sr-89, Sr-90	5E-8
			Fe-55	1E-6

W - At least once per 7 days
M - At least once per 31 days
Q - At least once per 92 days
P - Completed prior to each release

TABLE 4-1 NOTATION

a. The Lower Limit of Detection (LLD).

b. A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.

c. To be representative of the quantities and concentrations of radioactive materials in liquid effluents, samples shall be collected continuously in proportion to the rate of flow of the effluent stream. Prior to analyses, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluent release.

d. A batch release exists when the discharge of liquid wastes is from a discrete volume. Prior to sampling for analyses, each batch shall be isolated, and then thoroughly mixed to assure representative sampling.

e. A continuous release exists when the discharge of liquid wastes is from a non-discrete volume; e.g., from a volume of a system having an input flow during the continuous release. Releases from the Turbine Building drains and the Auxiliary Feedwater Pump Bay Drain System and Chemical Waste Sump are considered continuous when the primary to secondary leak rate exceeds 0.1 gpm (142 gpd).

f. The principal gamma emitters for which the LLD specification will apply are exclusively the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141 and Ce-144. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should be reported as "less than" the nuclide's LLD, and should not be reported as being present at the LLD level for that nuclide. The "less than" values should not be used in the required dose calculations. When unusual circumstances result in LLD's higher than required, the reasons shall be documented in the Annual Radioactive Effluent Release Report.

g. When radioactivity is identified in the secondary system, a discharge permit should be prepared on a monthly basis to account for the radioactivity that will eventually be discharged to the Ohio River.

h. Whenever the BV-2 Recirculation Drain Pump(s) are discharging to catch basin 16, sampling will be performed by means of a grab sample taken every 4 hours during pump operation.

Table 4-2. Results of Liquid Effluent Discharges to the Environment

TABLE 4-2

RESULTS OF LIQUID EFFLUENT DISCHARGES TO THE ENVIRONMENT

Effluent Type	Results for 1995
Steam System Blowdown	The Steam System Blowdown was recycled when practicable.
Batch Radioactive Waste Liquids	Routine planned releases of liquid effluents from the Beaver Valley Power Station were released in accordance with conditions noted in Section 6.8.6a of the Technical Specifications and Appendix C of the ODCM. No limits were exceeded. These values have been reported in the Beaver Valley Power Station Annual Radioactive Effluent Release Report for 1995.
Continuous Radioactive Waste Liquids	Radioactive waste liquids were not discharged in a continuous mode during 1995.

B. Monitoring of Atmospheric Effluents

1. Description of Atmospheric Effluent Sources

Beaver Valley Power Station (Units 1 and 2)

The Beaver Valley Power Station identifies isotopes according to Section 6.8.6a of the Technical Specifications, Appendix C of the ODCM and Regulatory Guide 1.21. Prior to waste gas decay tank batch releases and containment purge releases, an analysis of the principal gamma emitters is performed. The principal gamma emitters include noble gases, iodines, and particulates. Figure 4-6 shows the gaseous radwaste system at Beaver Valley Power Station.

The environmental gaseous release points also require specific nuclide identification. These points include:

a. Unit 1 Release Points:

1) The Ventilation Vent located on top of the Unit 1 Primary Auxiliary Building.

2) The Supplementary Leak Collection and Release System (SLCRS) Vent located on top of the Unit 1 Containment Building.

b. Unit 2 Release Points;

1) The Ventilation Vent located on top of the Unit 2 Primary Auxiliary Building.

2) The Supplementary Leak Collection and Release System (SLCRS) Vent located on top of the Unit 2 Containment Building.

3) The Decontamination Building Vent located on top of the Unit 2 Decontamination Building.

4) The Waste Gas Storage Vault Vent located on top of the Unit 2 Decontamination Building.

5) The Condensate Polishing Building Vent located on top of the Unit 2 Condensate Polishing Building.

c. Unit 1 and Unit 2 shared release point;

1) The Process Vent located on top of the Unit 1 Cooling Tower.

These points are continuously monitored for particulates and gases. Grab samples are obtained on a weekly basis and are analyzed for noble gas gamma emitting isotopes. Grab samples are obtained on a monthly basis and analyzed for tritium. Weekly continuous samples are obtained on filter paper and charcoal cartridges. The filter papers are analyzed for particulate gamma emitting isotopes and gross alpha. Composites of the filter papers are analyzed monthly for Sr-89 and Sr-90. The charcoal cartridges are analyzed for I-131, I-133 and I-135.

Figure 4-7 shows these gaseous release points.

Figure 4-6. Units 1 and 2 Gaseous Radwaste System

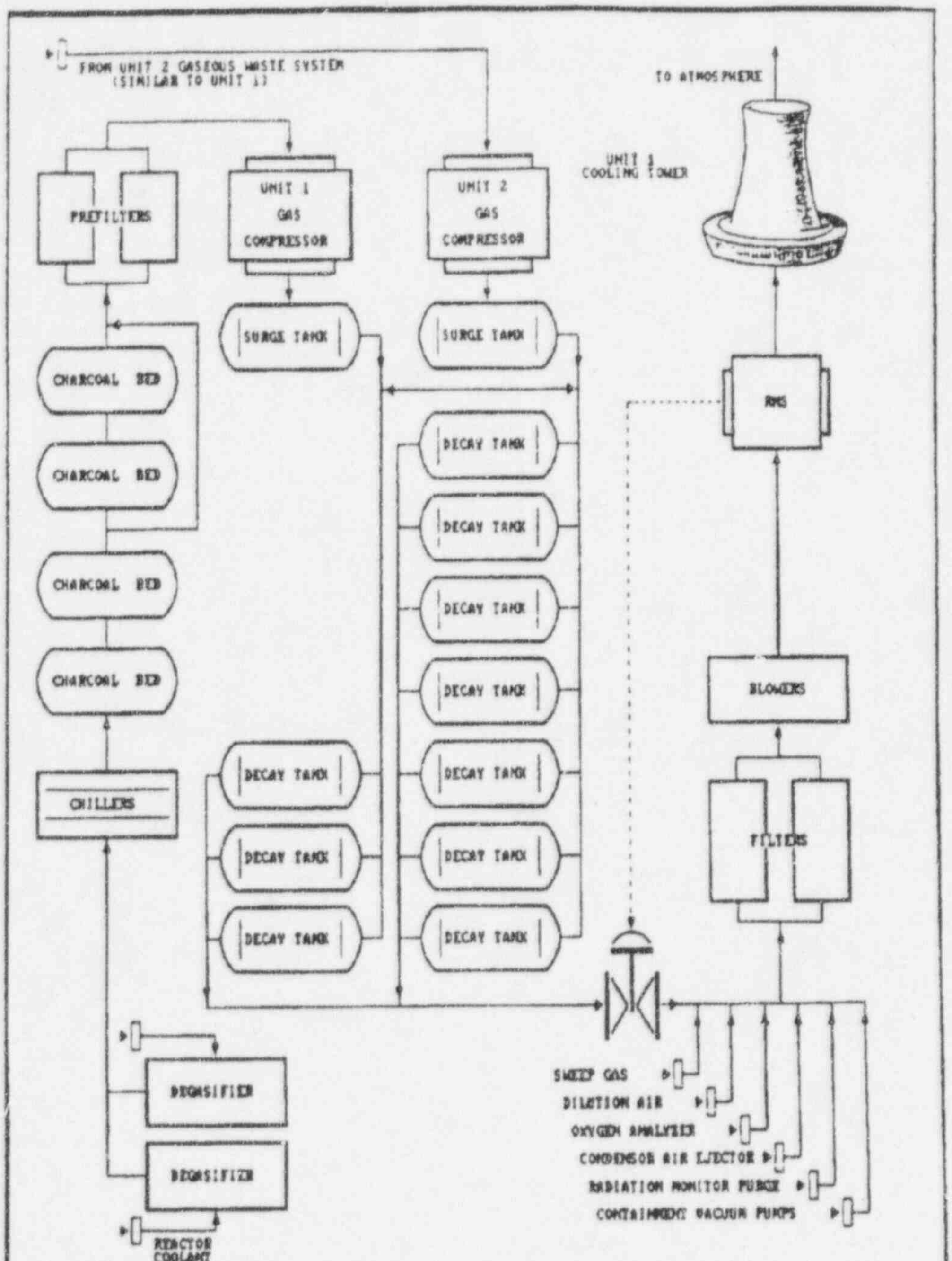
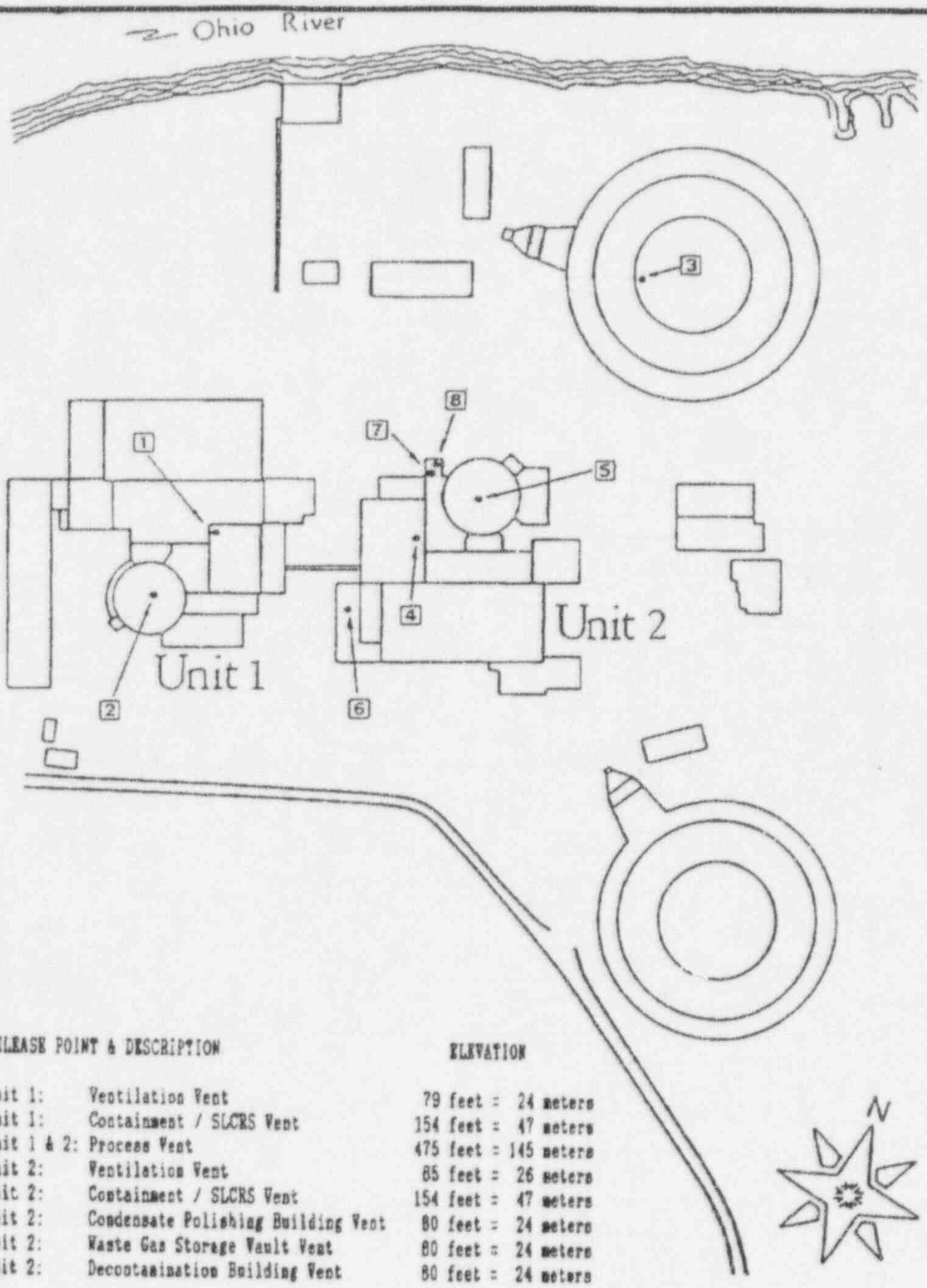


FIGURE 4-6 - UNITS 1 AND 2 GASEOUS RADWASTE SYSTEM

Figure 4-7. Units 1 and 2 Gaseous Release Points



RELEASE POINT & DESCRIPTION		ELEVATION
1. Unit 1:	Ventilation Vent	79 feet = 24 meters
2. Unit 1:	Containment / SLCRS Vent	154 feet = 47 meters
3. Unit 1 & 2:	Process Vent	475 feet = 145 meters
4. Unit 2:	Ventilation Vent	85 feet = 26 meters
5. Unit 2:	Containment / SLCRS Vent	154 feet = 47 meters
6. Unit 2:	Condensate Polishing Building Vent	80 feet = 24 meters
7. Unit 2:	Waste Gas Storage Vault Vent	80 feet = 24 meters
8. Unit 2:	Decontamination Building Vent	80 feet = 24 meters

FIGURE 4-7 - UNITS 1 AND 2 GASEOUS RELEASE POINTS

2. Atmospheric Effluent Treatment and Sampling

Beaver Valley Power Station (Units 1 and 2)

Radioactive gases enter the gaseous waste disposal system from the degasifier vent chiller of the boron recovery system, and are directed to the gaseous waste charcoal delay subsystem upstream of the overhead gas compressor where the gas is chilled to condense most of the water vapor. Gases from the degasifier vent chillers contain primarily hydrogen and water vapor. A small amount of nitrogen and radioisotopes consisting of noble gases, particulates and radioiodines are also present in this system.

The overhead gas compressor directs the radioactive gas stream to a gas surge tank. Gas is periodically transferred from the Unit 1 or Unit 2 surge tank to one of the three (3) decay tanks at Unit 1 or one of the seven (7) decay tanks at Unit 2. After the decay tanks are sampled and authorization obtained for discharge, the flow of the waste gases from the decay tanks (2 scfm) is rapidly diluted with about 1000 scfm of air in order to dilute hydrogen and radioactive effluent concentration. The gases are then combined with nitrogen purge from the oxygen analyzers, calibration gas from the oxygen analyzers, the main condenser air ejector exhaust, the containment vacuum system exhaust, aerated vents of the vent and drain system, discharge of the overhead gas compressor and the purge from the multi sample point radiation monitor. The mixture is then filtered through one of the gaseous waste disposal filters, each of which consists of a charcoal bed and a high efficiency filter. The filtered gases are then discharged by one of the gaseous waste disposal blowers to the atmosphere via the process vent on the top of the Unit 1 cooling tower. The radioactivity levels of the stream are monitored continuously.

Should the radioactivity release concentration of the stream go above the allowable setpoint, a signal from the radiation monitor will stop all flow from the Unit 1 or Unit 2 decay tanks being discharged.

During a shutdown period after the Unit 1 or Unit 2 containment has been sampled and the activity levels determined, purging may commence through the Ventilation Vent located on top of the Auxiliary Building or the Supplementary Leak Collection and Release System (SLCRS) Vent located on top of the Reactor Containment Building or the Process Vent located on top of the Cooling Tower.

Most areas in the Unit 1 Auxiliary Building are individually monitored for radioactivity prior to entering the common Ventilation Vent. These individual radiation monitors aid in identifying any sources of contaminated air. The normal exhaust is through the Ventilation Vent effluent pathway. This pathway is monitored continuously by several redundant channels of the Radiation Monitoring System (RMS) and is sampled periodically. However, upon a upper activity alarm, automatic dampers divert the system's exhaust air stream through one of the main filter banks in the Supplementary Leak Collection and Release System (SLCRS) and to the SLCRS Vent effluent pathway.

Areas in the Unit 2 Auxiliary Building (subject to radioactive contamination) are monitored for radioactivity prior to entering the filter banks for the Supplementary Leak Collection and Release System (SLCRS) Vent. This system is sampled periodically for determination of radioactive material and is monitored continuously by other channels of the Digital Radiation Monitoring System (DRMS).

Each Unit 1 and Unit 2 filter bank consists of roughing filters, charcoal filters, and pleated glass fiber type HEPA filters. The roughing filters remove large particulates to prevent excessive pressure drop buildup on the charcoal and HEPA filters. The charcoal filters are effective for radioactive iodine removal and the HEPA filters remove particulates and charcoal fines.

Release points for Unit 1 and Unit 2 of the Beaver Valley Power Station are shown in Figure 4-7. Some of these release points discharge small amounts of radioisotopes consisting of noble gases, particulates and radioiodines.

See Table 4-3 for Radioactive Gaseous Waste Sampling and Analysis Program.

Table 4-3. Radioactive Gaseous Waste Sampling and Analysis Program

TABLE 4-3

Radioactive Gaseous Waste Sampling and Analysis Program

GASEOUS RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD) (μCi/cc)
1. Waste Gas Storage Tank	P Each Tank Grab Sample	P Each Tank	Principal Gamma Emitters[g]	1×10^{-4}
			H-3	1×10^{-6}
2. Containment Purge	P Each Purge[b] Grab Sample	P Each Purge[b]	Principal Gamma Emitters[g]	1×10^{-4}
			H-3	1×10^{-6}
3. Ventilation Systems[h] a. Process Vent b. Aux. Bldg. Vents c. Containment Vents d. Decon. Bldg. Vent e. Waste Gas Vault Vent f. Cond. Polish. Bldg. Vent	M[b,c,e] Grab Sample	M[b]	Principal Gamma Emitters[g]	1×10^{-4}
			H-3	1×10^{-6}
	Continuous[f]	W[d] Charcoal Sample	I-131	1×10^{-12}
			I-133	1×10^{-10}
		W[d] Particulate Sample	Principal Gamma Emitters[g] (I-131, Others)	1×10^{-11}
		M Composite Particulate Sample	Gross alpha	1×10^{-11}
		Q Composite Particulate Sample	Sr-89, Sr-90	1×10^{-11}
		Noble Gas Monitor	Noble Gases Gross Beta and Gamma	1×10^{-6}

W - At least once per 7 days
M - At least once per 31 days
Q - At least once per 92 days
P - Completed prior to each release

TABLE 4-3 NOTATION

a. The Lower Limit of Detection (LLD).

b. Sampling and analysis shall also be performed following shutdown, startup, or a THERMAL POWER change exceeding 15% of RATED THERMAL POWER within a 1 hour period. This requirement does not apply if (1) analysis shows that the Dose Equivalent I-131 concentration in the primary coolant has not increased more than a factor of 3; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of 3.

c. Tritium grab samples shall be taken at least once per 24 hours (from the appropriate ventilation release path) when the refueling canal is flooded.

d. Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing or after removal from sampler. Sampling shall also be performed at least once per 24 hours for at least 7 days following each shutdown, startup, or THERMAL POWER change exceeding 15% of RATED THERMAL POWER within a 1 hour period and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement does not apply if: (1) analysis shows that the DOSE EQUIVALENT I-131 concentration in the reactor coolant has not increased more than a factor of 3; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of 3.

e. Tritium grab samples shall be taken at least once per 7 days from the ventilation exhaust from the spent fuel pool area, whenever spent fuel is in the spent fuel pool.

f. The average ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with ODCM Appendix C CONTROLS 3.11.2.1, 3.11.2.2 and 3.11.2.3.

g. The principal gamma emitters for which the LLD specification will apply are exclusively the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144 for particulate emissions. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in LLD's higher than required, the reasons shall be documented in the Annual Radioactive Effluent Release Report.

h. Only when release path is in use.

3. Results

Gaseous effluents from the Beaver Valley Power Station were released in accordance with conditions noted in Section 6.8.6a of the Technical Specifications and Appendix C of the ODCM. No limits were exceeded. These values have been reported in the Beaver Valley Power Station Annual Radioactive Effluent Release Report for 1995.

C. Solid Waste Disposal

During Beaver Valley Power Station normal operations and periodic maintenance, small quantities of solid radioactive waste materials were generated such as contaminated rags, paper, plastics, filters, spent ion-exchange resins, and miscellaneous tools and equipment. These were disposed of as solid radioactive waste.

The services of offsite processors were used to segregate, incinerate, and super-compact the waste. The volume reduced waste was then shipped for disposal.

All containers used for packaging, transport, and disposal of radioactive materials met the requirements of the United States Department of Transportation (DOT) and the Nuclear Regulatory Commission (NRC). Shipments offsite were made in accordance with DOT and NRC regulations. Figure 4-8 depicts solid waste handling at the site.

During 1995, 1,619 cubic feet of radioactive solid waste were buried offsite. Both units set record low disposal volumes for a refueling outage year. The shipments to the Offsite Processors and Disposal Facility contained a total activity of 500 curies.

Industrial solid wastes were collected in portable bins, and removed to an approved offsite burial ground. No burning or burial of wastes was conducted at the Beaver Valley Power Station site.

Figure 4-8. Solid Waste Disposal Diagram

RADIOACTIVE SOLID WASTE DISPOSAL

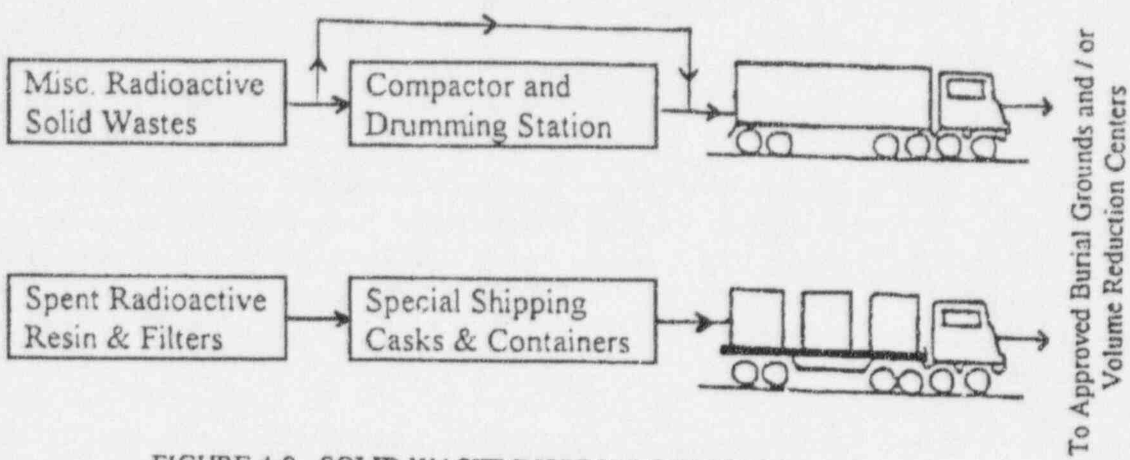


FIGURE 4-8 - SOLID WASTE DISPOSAL DIAGRAM

Section 5. ENVIRONMENTAL MONITORING PROGRAM

A. Environmental Radioactivity Monitoring Program

1. Program Description

The program consists of monitoring water, air, soil, river bottoms, vegetation and foodcrops, cows milk, ambient radiation levels in areas surrounding the site, and aquatic life as summarized in Table 5-1. Further description of each portion of the program (Sampling Methods of Sample Analysis, Discussion and Results) are included in sections 5-B through 5-I of this report.

5-B - Air Monitoring

5-C - Sediments and Soils Monitoring

5-D - Vegetation and Foodcrops

5-E - Cows Milk

5-F - Environmental Radiation Monitoring

5-G - Fish

5-H - Surface, Drinking, Well Waters and Precipitation

5-I - Estimates of Radiation Dose to Man

Table 5-1. Radiological Environmental Monitoring Program

TABLE 5-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Type of Sample		DLC Sample Points	Sector	Miles	Sample Point Description	Sample Frequency	Sample Preparation	Analysis[b]
1.	Air Particulate and Radioiodine	13	11	1.6	Meyer's Farm	Continuous Sampling with sample collection at least weekly	Weekly Composite[d]	Gross Beta, [c] I-131
		30	4	0.6	Shippingport, PA (S.S.)		Monthly Composite[d]	Gamma -scan
		46.1	3	2.4	Industry, PA		Quarterly Composite[d]	Sr-89,90
		32	15	0.8	Midland, PA (S.S.)			
		48(a)	10	16.5	Weirton, WV (a)			
		51	5	8.0	Aliquippa, PA (S.S.)			
		47	14	4.8	East Liverpool, OH			
		27	7	6.2	Brunton's Farm			
		28	1	8.7	Sherman's Farm			
		29B	3	8.1	Beaver County Hospital			
2.	Direct Radiation	30	4	0.6	Shippingport, PA (S.S.)	Continuous (TLD)	Quarterly[k]	Gamma-Dose
		13	11	1.6	Meyer's Farm		Annually[k]	
		46	3	2.5	Industry, PA (Church)			
		32	15	0.8	Midland, PA (S.S.)			
		48(a)	10	16.5	Weirton, WV (a)			
		45.1	6	2.0	Raccoon. Twp, PA Kennedy's Crnrs.			
		51	5	8.0	Aliquippa, PA (S.S.)			
		47	14	4.8	East Liverpool, OH			
		70	1	3.0	West. Bvr. School			
		80	9	8.4	Raccoon Park			
		81	9	3.9	Southside School			
		82	9	7.1	Hanover Municipal Bldg.			
		83	10	4.5	Mill Creek Rd			
		14	11	2.6	Hookstown			
		84	11	8.5	Hancock Co. Children Home			
		85	12	5.8	Rts. 8 & 30 Intersection			
		86	13	6.5	E. Liverpool Croxall House			
		92	12	3.0	Georgetown Rd.			
		87	14	7.0	Calcutta Road			
		88	15	3.1	Midland Heights			
		89	15	4.7	Ohioville			
		90	16	5.2	Fairview School			
		10	4	0.8	Shippingport Boro, PA			
		45	5	2.2	Mt. Pleasant Church			
		60	13	3.7	Haney's Farm			
		93	16	1.3	Sunset Hills, Midland			

TABLE 5-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

	Type of Sample	DLC Sample Points	Sector	Miles	Sample Point Description	Sample Frequency	Sample Preparation	Analysis(b)
2.	Direct Radiation (continued)	95	10	2.4	McCleary Rd, Hollie Williams	Continuous (TLD)	Quarterly(k) Annually(k)	Gamma-Dose
		28	1	8.7	Sherman's Farm			
		71	2	5.6	Brighton Twp. School			
		72	3	3.2	Site of Former Logan School			
		29B	3	8.1	Beaver County Hospital			
		73	4	2.2	Potter Twp. School			
		74	4	6.0	Comm. Col-Center Twp.			
		75	5	4.3	Holt Road			
		76	6	3.8	Raccoon Twp. School			
		77	6	5.8	Green Garden Rd (Wayne's)			
		59	7	1.1	Irons			
		78	7	2.3	Raccoon Mun. Bldg.			
		27	7	6.2	Brunton's Farm			
		79	8	4.6	Rt. 18 & Rt. 151			
		15	14	3.3	Georgetown			
		46.1	3	2.1	Industry, PA			
		91	2	3.7	Pine Grove Rd and Doyle Rd			
		94	8	2.4	McCleary Rd, Wilson			
3.	Surface Water	49.1(a) 2.1 2.0 2A 5	4 14 3 13 14	5.0 1.3 3.2 0.2 4.8	Arco Polymers Downstream (Midland) J&L Station Discharge BVPS Downstream BVPS Outfall East Liverpool (raw water)	Weekly, Intermittent Composite Samples(j) Collected Weekly Weekly Grab Samples Only Daily Grab Sample Only - Collected Weekly(j)	Weekly Sample from Arco only Monthly composite of Weekly Sample (d) Quarterly Composite	I-131 Gross Beta Gross Alpha Gamma-scan Co-60, H-3 Sr-89, Sr-90
4.	Groundwater	13 14 15 11	11 11 15 3	1.6 2.6 3.3 0.8	Meyer's Farm Hookstown, PA Georgetown, PA Shippingport Boro	Quarterly	Quarterly	Gamma-scan, Gross Beta, Gross Alpha, H-3
5.	Drinking	4 5	14 14	1.3 4.8	Midland, PA (Midland Water Treatment Plant) East Liverpool, OH (East Liverpool Water Treatment Plant)	Intermittent(e) Sample Collected Weekly Weekly Grab Sample	Weekly Composite of Daily Sample (d) Mnth. Composite (d) Quart. Composite (d)	Gamma-scan, I-131 Gross Alpha, Gross Beta H-3, Co-60, Sr-89, 90
6.	Shoreline Sediment	2A 3 49 50	13 13 3 13	0.2 0.2 3.2 8.2	Downstream BVPS Outfall Vicinity SAPS Discharge Upstream Side of Montgomery Dam(a) Upstream side of New Cumberland Dam	Semiannual	Semiannual	Gamma-scan, Gross Beta Gross Alpha Uranium Isotopic Sr-89, 90

TABLE 5-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Type of Sample		DLC Sample Points	Sector	Miles	Sample Point Description	Sample Frequency	Sample Preparation	Analysis[b]
7	Milk	25	10	2.1	Searight's Dairy	Weekly[i]	Weekly sample from Searight's only	I-131
		*				Biweekly[g] when animals are on pasture, monthly at other times	Biweekly (grazing) Monthly (indoors)	Gamma-scan Sr-89, 90 I-131, Cs-137
		*						
		*						
		96[a]	10	10.3	Windsheimer			
		27	7	6.2	Brunton's Dairy[h]	Monthly		
		29	3	8.2	Nicol's Dairy[h]		Monthly	Gamma-scan Sr-89, 90, I-131, Cs-137
*	BVPS Technical Specification Table 3.12-1 requires three (3) dairies to be selected on basis of highest potential thyroid dose using milch census data. See Section 5-E for specific locations sampled.							
8	Fish	2A	13	0.2	Vicinity of BVPS #1 Station Discharge	Semiannual	Composite of edible parts by species[i]	Gamma-scan on edible portions
		49[a]	3	4.7	Upstream Side of Montgomery Dam			
9	Food Crops					Annual at harvest if available	Composite of each sample species	Gamma-scan I-131 on green leafy vegetables
	(Shipp.)	10	4	0.8	(Three locations within			
	(Georg.)	15	14	3.3	5 miles Selected by			
	(Indus.)	46	3	2.5	Company)			
		48[a]	10	16.5	Weirton, WV			
10	Feedstuff and Summer Forage	25	10	2.1	Searight's Dairy Farm	Monthly Quarterly	Monthly Quarterly Composite	Gamma-scan Sr-90
11	Soil	13	11	1.6	Meyer's Farm	Every 3 years (1994, 1997, etc.)	12 Core Samples 3" Deep (3" Dia. at each location (approx. 10' radius)	Gamma-scan Sr-90 Gross Beta Gross Alpha Uranium Isotopic
		30	4	0.6	Shippingport, PA			
		46	3	2.6	Industry, PA			
		32	15	0.8	(North of Site) Midland			
		48[a]	10	16.5	Weirton, WV			
		51	5	8.0	Aliquippa, PA			
		47	14	4.8	E. Liverpool, OH			
		27	7	6.2	Brunton's Dairy			
		22	8	0.3	South of BVPS Site			
		29A	3	8.3	Nicol's Dairy			
12	Precipitation	30	4	0.6	Shippingport, PA	Weekly grab samples when available	Monthly Composite of grab samples	Gross β
		47	14	4.8	East Liverpool, OH			γ-scan
		48	10	16.5	Weirton, WV		Quarterly Composite	H-3, Sr-89, Sr-90

TABLE 5-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (continued)

Notes:

(a) Control sample station: These are locations which are presumed to be outside the influence of plant effluents.

(b) Typical LLDs for gamma spectrometry are shown in Table 5-4.

(c) Particulate samples are not counted for ≥ 24 hours after filter change. Perform gamma isotopic analysis on each sample when gross beta is > 10 times the yearly mean of control samples.

(d) Analysis composites are well mixed actual samples prepared of equal portions from each shorter term samples from each location.

(e) Composite samples are collected at intervals not exceeding 2 hours.

(f) Weekly milk sample from Searight's Dairy is analyzed for I-131 only.

(g) Milk samples are collected bi-weekly when animals are in pasture and monthly at other times. [Assume April - October for grazing season (pasture).]

(h) The milk samples from Brunton's and Nicol's Dairies are collected once per month.

(i). The fish samples will contain whatever species are available. If the available sample size permits, then the sample will be separated according to species and compositing will provide one sample of each species. If the available size is too small to make separation by species practical, then edible parts of all fish in the sample will be mixed to give one sample.

(j) Composite samples are collected at intervals not exceeding 2 hours at locations 49.1 and 2.1. Weekly grab samples are obtained at locations 49 and 2A. A weekly grab sample is also obtained from daily composited grab samples obtained by the water treatment plant operator at location 5.

(k) Two (2) TLDs are collected quarterly and annually from each monitoring location.

Additional Notes:

– Sample points correspond to site numbers shown on maps.

– All I-131 analyses are performed within 40 hours of sample collection if possible.

– All air samples are decayed for 72 hours before analyzing for Gross Beta.

2. Summary of Results

All results of this monitoring program are summarized in Table 5-2. This table is prepared in the format specified by NRC Regulatory Guide 4.8 and in accordance with Beaver Valley Power Station Operating License, (Appendix A, Technical Specifications/ODCM). Summaries of results of analysis of each media are discussed in Sections 5-B through 5-H and an assessment of radiation doses are given in Section 5-I. Table 5-3 summarizes Beaver Valley Power Station preoperational ranges for the various sampling media during the years 1974 and 1975. Comparisons of preoperational data with operational data indicate the ranges of values are generally in good agreement for both periods of time.

Activity detected was attributed to naturally occurring radionuclides, BVPS effluents, medical procedures, previous nuclear weapons tests or to the normal statistical fluctuation for activities near the lower limit of detection (LLD).

The conclusion from all program data is that the operation of the Beaver Valley Power Station has resulted in insignificant changes to the environment.

3. Quality Control Program

The Quality Control Program implemented by Duquesne Light Company to assure reliable performance by the DLC contractor and the supporting QC data are presented and discussed in Section 3 of this report. The lower limits of detection for various analysis for each media monitored by this program by the DLC Contractor Laboratory are provided in Table 5-2 and in Table 5-4.

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Unit 1 and 2 Docket No. 50-334/50-412

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1995

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations **Mean (f) **Range	Location with Highest Annual Mean Name Distance and Directions	Location with Highest Annual Mean **Mean (f) **Range	Control Locations **Mean (f) **Range (Weirton, WV No. 48)	Number of Nonroutine Reported Measurements***
Air Particulate and Radioiodine	Gross (520) Beta	2.5	17(520/520) (5.4-41)	48, Weirton, WV 16.05 mi SSW	18(52/52) (8.3-41)	Same as high location	0
($X10^{-3}$ pCi/Cu.M.)	Sr-89 (40)	5	LLD	--	--	--	-
	Sr-90 (40)	0.2	LLD	--	--	--	-
	I-131(520)	40	LLD	--	--	--	-
	Gamma (120)						
	Be-7	40	138(119/120) (73-202)	29B, Beaver Cty Hosp. 8.1 mi NE	143(12/12) (94-202)	139(12/12) (96-195)	0
	K-40	20	15(16/120) (5.4-52)	27, Brunton's Dairy 6.2 mi SE	24(2/12) (20-28)	24(3/12) (9.4-52)	0
	Others	Table V.A.	LLD	--	--	--	-

* Nominal Lower Limit of Detection (LLD)
** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)
*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975) and the Beaver Valley Power Station Specifications .

Table 5-2

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Unit 1 and 2 Docket No. 50-334/50-412

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1995

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Annual Mean: Name, Distance and Directions	Location with Highest Annual Mean: **Mean (f) **Range	Control Locations **Mean (f) **Range	Number of Nonroutine Reported Measurements***
						Weirton, WV No. 48	
External Radiation (mR/day)	Gamma (45) (180 quarterly)	0.05	0.18(180/180) (0.13-0.23)	84. Hancock County Children's Home 8.5 mi SW	0.22(4/4) (0.20-0.23)	0.19(4/4) (0.18-0.19)	0
	Gamma (44 annual)	0.05	0.17(44/44) (0.13-0.20)	29. Beaver Cty Hosp. 8.1 mi NE	0.20(1/1) --	0.18(1/1) --	0
Feed and Forage (pCi/g) (dry weight)	I-131 (12)	0.01	LLD	--	--	One Sample Location	-
	Sr-90 (4)	0.003	0.14(4/4) (0.061-0.20)	--	--	--	0
	Gamma (12)						
	Be-7	0.3	2.8(5/12) (0.98-3.9)	--	--	--	0
	K-40	0.5	21(12/12) (9.4-34)	--	--	--	0
	Th-228	0.08	0.28(1/12) --	--	--	--	0
	Others	Table V.A.	LLD	--	--	--	-

* Nominal Lower Limit of Detection (LLD)
** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)
*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975) and the Beaver Valley Power Station Specifications

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Unit 1 and 2   Docket No. 50-334/50-412

Location of Facility Beaver, Pennsylvania (County, State)   Reporting Period Annual 1995

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Annual Mean Name Distance and Directions	Location with Highest Annual Mean **Mean (f) **Range	Control Locations **Mean (f) **Range	Number of Nonroutine Reported Measurements***
						Montgomery Dam No. 49	
Fish (pCi/g) (wet weight)	Gamma (8) K-40	0.05	3.0(8/8) (2.2-4.0)	02A. BVPS Discharge 0.2 mi W	3.1(4/4) (3.0-3.1)	2.9(4/4) (2.2-4.0)	0
	Others	Table V.A.	LLD	-- --	--		-

* Nominal Lower Limit of Detection (LLD)
** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)
*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975) and the Beaver Valley Power Station Specifications .

Table 5-2

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Unit 1 and 2 Docket No. 50-334/50-412

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1995

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Annual Mean Name Distance and Directions	**Mean (f) **Range	Control Locations **Mean (f) **Range	Number of Nonroutine Reported Measurements***
						Weirton, WV No. 48	
Food and Garden Crops (pCi/g) (wet weight)	I-131 (4)	0.006	LLD	--	--	--	-
	Gamma (4)						
	K-40	0.5	2.4(4/4) (2.1-2.8)	46, Industry Ch. Area 2.6 mi NE	2.8(1/1) --	2.2(1/1) --	0
	Others	Table V.A.	LLD	--	--	--	-

* Nominal Lower Limit of Detection (LLD)
** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)
*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (MARCH 1975) and the Beaver Valley Power Station Specifications .

Table 5-2

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Unit 1 and 2 Docket No. 50-334/50-412

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1995

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)*	All Indicator Locations ** Mean (f) **Range	Location with Highest Annual Mean Name Distance and Directions	**Mean (f) **Range	Control Locations **Mean (f) **Range	Number of Nonroutine Reported Measurements***
						Brunton Dairy No. 27	
Milk (pCi/l)	I-131 (166)	0.2	LLD	--	--	--	-
	Sr-89 (133)	2	LLD	--	--	--	-
	Sr-90 (133)	1	2.3(133/133) (0.96-4.7)	102, Ferry Dairy (a)	3.2(12/12) (1.3-4.7)	1.6(19/19) (1.2-2.7)	0
	Gamma (133)						
	K-40	100	1372(133/133) (1180-1730)	102, Ferry Dairy (a)	1535(12/12) (1300-1730)	1362(19/19) (1260-1530)	0
	Cs-137	100	8.0(1/133) --	102, Ferry Dairy (a)	8.0(1/12) --	LLD	0
	Others	Table V.A.	LLD	--	--	--	-

(a) Goat Dairy

* Nominal Lower Limit of Detection (LLD)

** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)

*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975) and the Beaver Valley Power Station Specifications .

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Unit 1 and 2 Docket No. 50-334/50-412

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1995

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Name Distance and Directions	Annual Mean **Mean (f) **Range	Control Locations **Mean (f) **Range Montgomery Dam No. 49	Number of Nonroutine Reported Measurements***
Sediment (pCi/g) (dry weight)	Gross (6) Alpha	0.3	13(6/6) (8.7-17)	2A, BVPS Discharge 0.2 mi. W	16(2/2) (14-17)	9.4(2/2) (8.7-10)	0
	Gross (6) Beta	0.1	32(6/6) (19-43)	2A, BVPS Discharge 0.2 mi. W	40(2/2) (37-43)	24(2/2) (19-28)	0
	Sr-89 (6)	0.2	LLD	--	--	--	-
	Sr-90 (6)	0.04	0.037(2/6) (0.028-0.046)	50, Upstream N. Cumberland Dam 8.2 mi W	0.046(1/2) --	LLD	0
	Gamma (6) Be-7	0.2	1.7(1/6) --	2A, BVPS Discharge 0.2 mi. W	1.7(1/2) --	LLD	0
	K-40	0.5	12(6/6) (10-14)	2A, BVPS Discharge 0.2 mi. W	12(2/2) (11-13)	12(2/2) (10-14)	0
	Mn-54	0.03	0.42(1/6) --	2A, BVPS Discharge 0.2 mi. W	0.42(1/2) --	LLD	0
	Co-58	0.2	2.3(2/6) (1.2-3.4)	2A, BVPS Discharge 0.2 mi. W	2.3(2/2) (1.2-3.4)	LLD	0
	Co-60	0.2	3.9(2/6) (1.5-6.3)	2A, BVPS Discharge 0.2 mi. W	3.9(2/2) (1.5-6.3)	LLD	0
	Cs-137	0.02	0.28(6/6) (0.14-0.83)	50, Upstream N. Cumberland Dam 8.2 mi W	0.48(2/2) (0.14-0.83)	0.17(2/2) (0.16-0.19)	0
	Ra-226	0.1	2.4(6/6) (1.4-3.2)	2A, BVPS Discharge 0.2 mi. W	2.6(2/2) (2.3-2.8)	2.4(2/2) (1.7-3.2)	0
	Th-228	0.02	1.1(6/6) (0.86-1.3)	2A, BVPS Discharge 0.2 mi. W	1.3(2/2) (1.2-1.3)	1.1(2/2) (0.86-1.3)	0

* Nominal Lower Limit of Detection (LLD)

** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)

*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975) and the Beaver Valley Power Station Specifications .

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Unit 1 and 2 Docket No. 50-334/50-412

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1995

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Annual Mean: Name, Distance and Directions	Location with Highest Annual Mean: **Mean (f) **Range	Control Locations **Mean (f) **Range (Montgomery Dam No. 49)	Number of Nonroutine Reported Measurements***
Sediment (pCi/g) (dry weight)	Sb-125	<0.3	0.96(2/6) (0.88-1.0)	2A. BVPS Discharge 0.2 mi. W	0.96(2/2) (0.88-1.[illegible])	LLD	0
	Ag-110M	0.1	0.93(1/6) --	2A. BVPS Discharge 0.2 mi. W	0.93(1/2) --	LLD	0
	Others	Table V.A.	LLD	--	--	--	-

* Nominal Lower Limit of Detection (LLD)
** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)
*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975) and the Beaver Valley Power Station Specifications .

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Unit 1 and 2 Docket No. 50-334/50-412

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1995

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Annual Mean Name Distance and Directions	Location with Highest Annual Mean **Mean (f) **Range	Control Locations **Mean (f) **Range	Number of Nonroutine Reported Measurements***
Drinking Water (pCi/l)	I-131 (104)	0.5	0.63(71/104) (0.23-1.5)	04. Midland, PA 1.3 mi WNW	0.71(38/52) (0.25-1.5)	--	0
	Gross (24) Alpha	0.6	LLD	--	--		-
	Gross (24) Beta	1	4.3(24/24) (2.0-7.3)	05. E. Liverpool, OH 4.8 mi WNW	4.5(12/12) (3.2-7.3)	--	0
	Gamma (104)						
	Others Table V.A.		LLD	--	--	--	-
	Sr-89 (8)	1.5	LLD	--	--	--	-
	Sr-90 (8)	0.5	LLD	--	--	--	-
	Co-60 (8) (a)	1	LLD	--	--	--	-
	H-3 (8)	100	LLD	--	--	--	-

(a) Co-60 analyzed by high sensitivity method.

* Nominal Lower Limit of Detection (LLD)
** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)
*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975) and the Beaver Valley Power Station Specifications .

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Unit 1 and 2 Docket No. 50-334/50-412

Location of Facility Beaver, Pennsylvania Reporting Period Annual 1995
(County, State)

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Annual Mean Name Distance and Directions	 **Mean (f) **Range	Control Locations **Mean (f) **Range	Number of Nonroutine Reported Measurements***
						Georgetown, PA No. 15	
Groundwater (pCi/l)	Gross (14) Alpha	2	LLD	--	--	--	-
	Gross (14) Beta	1	4.7(13/14) (1.6-7.8)	11, Shippingport, PA 0.8 mi NE	5.6(4/4) (4.3-7.8)	2.2(4/4) (1.6-2.4)	0
	Gamma (14)						
	Others	TableV.A.	LLD	--	--	--	-
	H-3 (14)	90	LLD	--	--	--	-

* Nominal Lower Limit of Detection (LLD)
** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)
*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975) and the Beaver Valley Power Station Specifications .

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Unit 1 and 2 Docket No. 50-334/50-412

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1995

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Annual Mean Name Distance and Directions	Location with Highest Annual Mean **Mean (f) **Range	Control Locations **Mean (f) **Range	Number of Nonroutine Reported Measurements***
						Weirton, WV No.48	
Water Precipitation (pCi/l)	Gross (36) Beta	1	9.5(34/36) (1.2-47)	47, E. Liverpool, OH 4.8 mi WNW	13(10/12) (1.2-47)	9.4(12/12) (1.6-31)	0
	Gamma (36)						
	Be-7	40	100(26/36) (50-346)	48, Weirton, WV 16.05 mi SSW	114(9/12) (54-346)	Same as high location	0
	K-40	100	98(2/36) (62-134)	47, E. Liverpool, OH 4.8 mi WNW	134(1/12) --	62(1/12) --	0
	Others	Table V.A.	LLD	--	--	--	-
	Sr-89 (12)	2	LLD	--	--	--	-
	Sr-90 (12)	0.5	LLD	--	--	--	-
	H-3 (12)	100	420(2/12) (250-590)	30, Shippingport, PA 0.6 mi ENE	420(2/4) (250-590)	LLD	0

* Nominal Lower Limit of Detection (LLD)

** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)

*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975) and the Beaver Valley Power Station Specifications .

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Unit 1 and 2   Docket No. 50-334/50-412

Location of Facility Beaver, Pennsylvania (County, State)   Reporting Period Annual 1995

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Annual Mean: Name, Distance and Directions	Location with Highest Annual Mean: **Mean (f) **Range	Control Locations **Mean (f) **Range	Number of Nonroutine Reported Measurements***
						Upstream - ARCO Chemical No. 49.1	
Surface Water (pCi/l)	I-131 (52)	0.5	0.56(22/52) (0.21-1.1)	49.1, Upstream, ARCO Chemical 5.0 mi ENE		one sample location	0
	Gross (48) Alpha	2	1.8(1/48 --	2.1, J&L Steel 1.3 mi WNW	1.8(1/12) --	LLD	0
	Gross (48) Beta	1	4.9(48/48) (1.7-11)	02A, BVPS Discharge 0.2 mi W	7.0(12/12) (4.3-11)	3.7(12/12) (1.7-5.9)	0
	Gamma (48)						
	Others Table V.A.		LLD	--	--	--	-
	Sr-89 (16)	2	LLD	--	--	--	-
	Sr-90 (16)	0.5	LLD	--	--	--	-
	Co-60 (16) (a)	2	LLD	--	--	--	-
	H-3 (16)	100	950(2/16) (200-1700)	02A, BVPS Discharge 0.2 mi W	950(2/4) (200-1700)	--	0

(a) Co-60 analyzed by high sensitivity method.

* Nominal Lower Limit of Detection (LLD)
** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)
*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975) and the Beaver Valley Power Station Specifications .

Table 5-3. Pre-operational Environmental Radiological Monitoring Program Summary

TABLE 5-3

PRE-OPERATIONAL ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station **Docket No.** 50-334

Location of Facility Beaver, Pennsylvania **Reporting Level** CY 1974 - 1975

(County, State)

PRE-OPERATIONAL PROGRAM SUMMARY (COMBINED 1974 - 1975)

Medium or Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed		Lower Limit of Detection LLD	All Indicator Locations Mean, (f) Range		
Sediments pCi/g (dry)	Gross Alpha	(0)	--		--	
	Gross Beta	(33)	1	18	33/33	5 - 30
	Sr-90	(0)	--		--	
	U-234, 235, 238	(0)	--		--	
	Gamma	(33)	--	13	33/33	2 - 30
	K-40		1.5	13	33/33	2 - 30
	Cs-137		0.1	0.4	21/33	0.1 - 0.6
	Zr/Nb-95		0.05	0.8	12/33	0.2 - 3.2
	Ce-144		0.3	0.5	3/33	0.4 - 0.7
	Ru-106(b)		0.3	1.5	3/33	1.3 - 1.8
	Others		--		< LLD	
Foodstuff pCi/g (dry)	Gamma	(8)	--		--	
	K-40		1	33	8/8	10 - 53
	Cs-137		0.1	0.2	1/8	--
	Zr/Nb-95		0.05	0.2	1/8	--
	Ru-106(b)		0.3	0.8	1/8	--
	Others		--		< LLD	
Feedstuff pCi/g (dry)	Gross Beta	(80)	0.05	19	80/80	8 - 50
	Sr-89	(81)	0.025	0.2	33/81	0.04 - 0.93
	Sr-90	(81)	0.005	0.4	78/81	0.02 - 0.81
	Gamma	(81)	--		--	
	K-40		1	19	75/81	5 - 46
	Cs-137		0.1	0.5	6/81	0.2 - 1.6
	Ce-144		0.3	1.5	5/81	0.9 - 2.6
	Zr/Nb-95		0.05	0.8	13/81	0.2 - 1.8
	Ru-106(b)		0.3	1.4	12/81	0.6 - 2.3
	Others		--		< LLD	
Soil pCi/g (dry) (Template Samples)	Gross Alpha	(0)	--		--	
	Gross Beta	(64)	1	22	64/64	14 - 32
	Sr-89	(64)	0.25	0.4	1/64	--
	Sr-90	(64)	0.05	0.3	48/64	0.1 - 1.3
	U-234, 235, 238	(0)	--		--	
	Gamma	(64)	--		--	
	K-40		1.5	13	63/64	5 - 24
	Cs-137		0.1	1.5	56/64	0.1 - 6.8
	Ce-144		0.3	1.1	7/64	0.2 - 3
	Zr/Nb-95		0.05	0.3	13/64	0.1 - 2
	Ru-106(b)		0.3	1.1	3/64	0.5 - 2
	Others		--		< LLD	

(f) Fraction of detectable measurements at specified location.

TABLE 5-3

PRE-OPERATIONAL ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station **Docket No.** 50-334

Location of Facility Beaver, Pennsylvania **Reporting Level** CY 1974 - 1975

(County, State)

PRE-OPERATIONAL PROGRAM SUMMARY (COMBINED 1974 - 1975)

Medium or Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed		Lower Limit of Detection LLD	All Indicator Locations Mean, (f) Range		
Soil pCi/g (dry) (Core Samples)	Gross Alpha	(0)	--		--	
	Gross Beta	(8)	1	21	8/8	16 - 28
	Sr-89	(8)	0.25		< LLD	
	Sr-90	(8)	0.05	0.2	5/8	0.08 - 0.5
	Gamma	(8)	--		--	
	K-40		1.5	13	8/8	7 - 20
	Cs-137		0.1	1.2	7/8	0.2 - 2.4
	Co-60		0.1	0.2	1/8	--
	Others		--		< LLD	
Surface Water pCi/l	Gross Alpha	(40)	0.3	0.75	5/40	0.6 - 1.1
	Gross Beta	(120)	0.6	4.4	120/120	2.5 - 11.4
	Gamma	(1)	10 - 60		< LLD	
	Tritium	(121)	100	300	120/121	180 - 800
	Sr-89	(0)	--		--	
	Sr-90	(0)	--		--	
	C-14	(0)	--		--	
Drinking Water pCi/l	I-131	(0)	--		--	
	Gross Alpha	(50)	0.3	0.6	4/50	0.4 - 0.8
	Gross Beta	(208)	0.6	3.8	208/208	2.3 - 6.4
	Gamma	(0)	--		--	
	Tritium	(211)	100	310	211/211	130 - 1000
	C-14	(0)	--		--	
	Sr-89	(0)	--		--	
	Sr-90	(0)	--		--	
Ground Water pCi/l	Gross Alpha	(19)	0.3		< LLD	
	Gross Beta	(76)	0.6	2.9	73/75(a)	1.3 - 8.0
	Tritium	(81)	100	440	77/81	80 - 800
	Gamma	(1)	10 - 60		< LLD	
Air Particulates and Gaseous pCi/m3	Gross Alpha	(188)	0.001	0.003	35/188	0.002 - 0.004
	Gross Beta	(927)	0.006	0.07	927/927	0.02 - 0.32
	Sr-89	(0)	--		--	
	Sr-90	(0)	--		--	
	I-131	(816)	0.04	0.08	2/816	0.07 - 0.08
	Gamma	(197)	--		--	
	Zr/Nb-95		0.005	0.04	122/197	0.01 - 0.16
	Ru-106		0.010	0.04	50/197	0.02 - 0.09
	Ce-141		0.010	0.02	3/197	0.01 - 0.04
	Ce-144		0.010	0.02	44/197	0.01 - 0.04
	Others				< LLD	

(f) Fraction of detectable measurements at specified location.

TABLE 5-3

PRE-OPERATIONAL ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station **Docket No.** 50-334

Location of Facility Beaver, Pennsylvania **Reporting Level** CY 1974 - 1975

(County, State)

PRE-OPERATIONAL PROGRAM SUMMARY (COMBINED 1974 - 1975)

Medium or Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed		Lower Limit of Detection LLD	All Indicator Locations Mean, (f) Range		
Milk pCi/l	I-131	(91)	0.25	0.6	4/91	0.3 - 0.8
	Sr-89	(134)	5	7	4/134	6 - 11
	Sr-90	(134)	1	5.3	132/134	1.5 - 12.8
	Gamma	(134)	--		--	
	Cs-137		10	13	19/134	11 - 16
	Others				< LLD	
External Radiation mR/day	γ - Monthly	(599)	0.5 mR*	0.20	599/599	0.08 - 0.51
	γ - Quarterly	(195)	0.5 mR*	0.20	195/195	0.11 - 0.38
	γ - Annual	(48)	0.5 mR*	0.19	48/48	0.11 - 0.30
Fish pCi/g (wet)	Gross Beta	(17)	0.01	1.9	15/17	1.0 - 3.2
	Sr-90	(17)	0.005	0.14	17/17	0.02 - 0.50
	Gamma	(17)	0.5			
	K-40		--	2.4	17/17	1.0 - 3.7
	Others		--		< LLD	

* LLD in units of mR - Lower end of useful integrated exposure detectability range for a passive radiation detector (TLD).

(a) One outlier not included in mean. (Water taken from dried-up spring with high sediment and potassium content. Not considered typical groundwater sample).

(b) May include Ru-106, Ru-103, Be-7.

(f) Fraction of detectable measurements at specified location.

Table 5-4. Typical LLDs For Gamma Spectrometry

TABLE 5-4

TYPICAL LLDs * FOR GAMMA SPECTROSCOPY

Nuclide	Milk Water (pCi/liter)	Air Particulates (pCi)	Vegetation (pCi/kg dry)	Sediment & Soil (pCi/g dry)	Fish (pCi/g wet)
Be-7	50	20	200	0.2	0.02
K-40	80	50	400	0.4	0.4
Cr-51	50	20	200	0.2	0.2
Mn-54	5	2	20	0.02	0.02
Co-58	5	2	20	0.02	0.02
Fe-59	10	3	40	0.04	0.04
Co-60	5	2	20	0.02	0.02
Zn-65	10	5	40	0.04	0.04
Zr/Nb-95	5	3	40	0.04	0.04
Ru-103	5	3	30	0.03	0.03
Ru-106	50	20	200	0.2	0.2
Ag-110M	10	5	50	0.05	0.05
I-131	15	4	200	0.2	0.2
Te-132	8	4	20	0.02	0.02
I-133	8	4	20	0.02	0.02
Cs-134	5	2	20	0.02	0.02
Cs-136	8	4	50	0.05	0.05
Cs-137	5	2	20	0.02	0.02
Ba/La-140	10	3	200	0.2	0.02
Ce-141	10	20	100	0.1	0.1
Ce-144	40	10	200	0.2	0.2
Ra-226	80	10	100	0.1	0.1
Th-228	10	10	20	0.02	0.02

* At time of analysis (DLC Contractor Lab).

NOTE: Lower Level of Detection is defined in Beaver Valley Power Station ODCM.

B. Air Monitoring

1. Characterization of Air and Meteorology

The air in the vicinity of the site contains pollutants typical for an industrial area. Air flow is generally from the Southwest in summer and from the Northwest in the winter.

2. Air Sampling Program and Analytical Techniques

a. Program

The air is sampled for gaseous radioiodine and radioactive particulates at each of ten (1) offsite air sampling stations. The locations of these stations are listed in Table 5-1 and shown on a map in Figure 5-1.

Samples are collected at each of these stations by continuously drawing one cubic foot per minute of atmosphere air through a glass fiber filter and through a charcoal cartridge. The former collects airborne particulates; the latter is for radioiodine sampling. Samples are collected for analysis on a weekly basis.

The charcoal is used in the weekly analysis of airborne I-131. The filters are analyzed each week for gross beta, then composited by station for monthly analysis by gamma spectrometry. They are further composited in a quarterly sample from each station for Sr-89 and Sr-90 analysis. In order to reduce interference from natural radon and thoron radioactivities, all filters are allowed to decay for a few days after collection prior to counting for beta in a low background counting system.

b. Procedures

Gross Beta analysis is performed by placing the filter paper from the weekly air sample in a 2" x 1/4" planchet and counting it in a low background, gas flow proportional counter.

Gamma emitters are determined by stacking all the filter papers from each monitoring station collected during the month and scanning this composite on a high resolution germanium gamma spectrometer.

Radioiodine (I-131) analysis is performed by a gamma scan of the charcoal in a weekly charcoal cartridge. The activity is referenced to the mid-collection time.

Figure 5-1. Air Sampling Stations

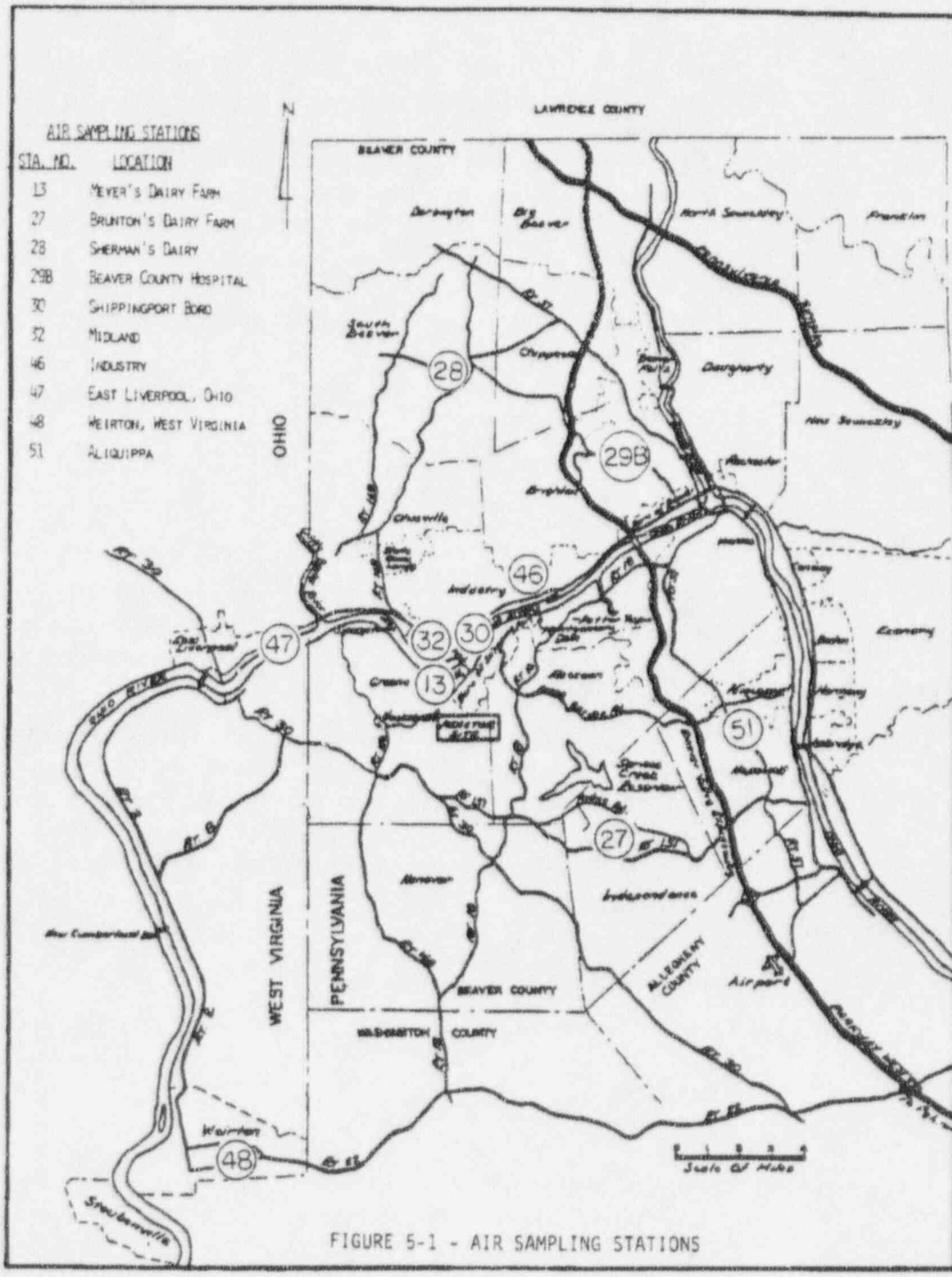


FIGURE 5-1 - AIR SAMPLING STATIONS

Strontium-89 and Strontium-90 activities are determined in quarterly composited air particulate filters. Stable strontium carrier is added to the sample and it is leached in nitric acid to bring deposits into solution. The mixture is then filtered. Half of the filtrate is taken for strontium analysis and is reduced in volume by evaporation. Strontium is precipitated as $Sr(NO_3)_2$ using fuming (90%) nitric acid. A barium scavenge is performed to remove radium and other natural nuclides. An iron (ferric hydroxide) scavenge is performed, followed by addition of stable yttrium carrier and a 5 to 7 day period for yttrium ingrowth. Yttrium is then precipitated as hydroxide, is dissolved and re-precipitated as oxalate. The yttrium oxalate is mounted on a nylon planchet and is counted in a low level beta counter to infer Sr-90 activity. Sr-89 activity is determined by precipitating $SrCO_3$ from the sample after yttrium separation. This precipitate is mounted on a nylon planchet and is covered with 80 mg/cm² aluminum absorber for low level beta counting.

3. Results and Conclusions

A summary of data is presented in Table 5-2.

a. Airborne Radioactive Particulates

A total of five hundred twenty (520) weekly samples from ten (10) locations were analyzed for gross beta. Results were comparable to previous years. Figure 5-2 illustrates the average concentration of gross beta in air particulates.

The weekly air particulate samples were composited to one hundred twenty (120) monthly samples which were analyzed by gamma spectrometry. Naturally occurring Be-7 was present in all but one sample. Naturally occurring K-40 was detected in twenty (20) of the one hundred twenty (120) monthly samples. Results are listed in the summary Table 5-2.

A total of forty (40) quarterly samples were each analyzed for Sr-89 and Sr-90. No Sr-89 or Sr-90 was detected.

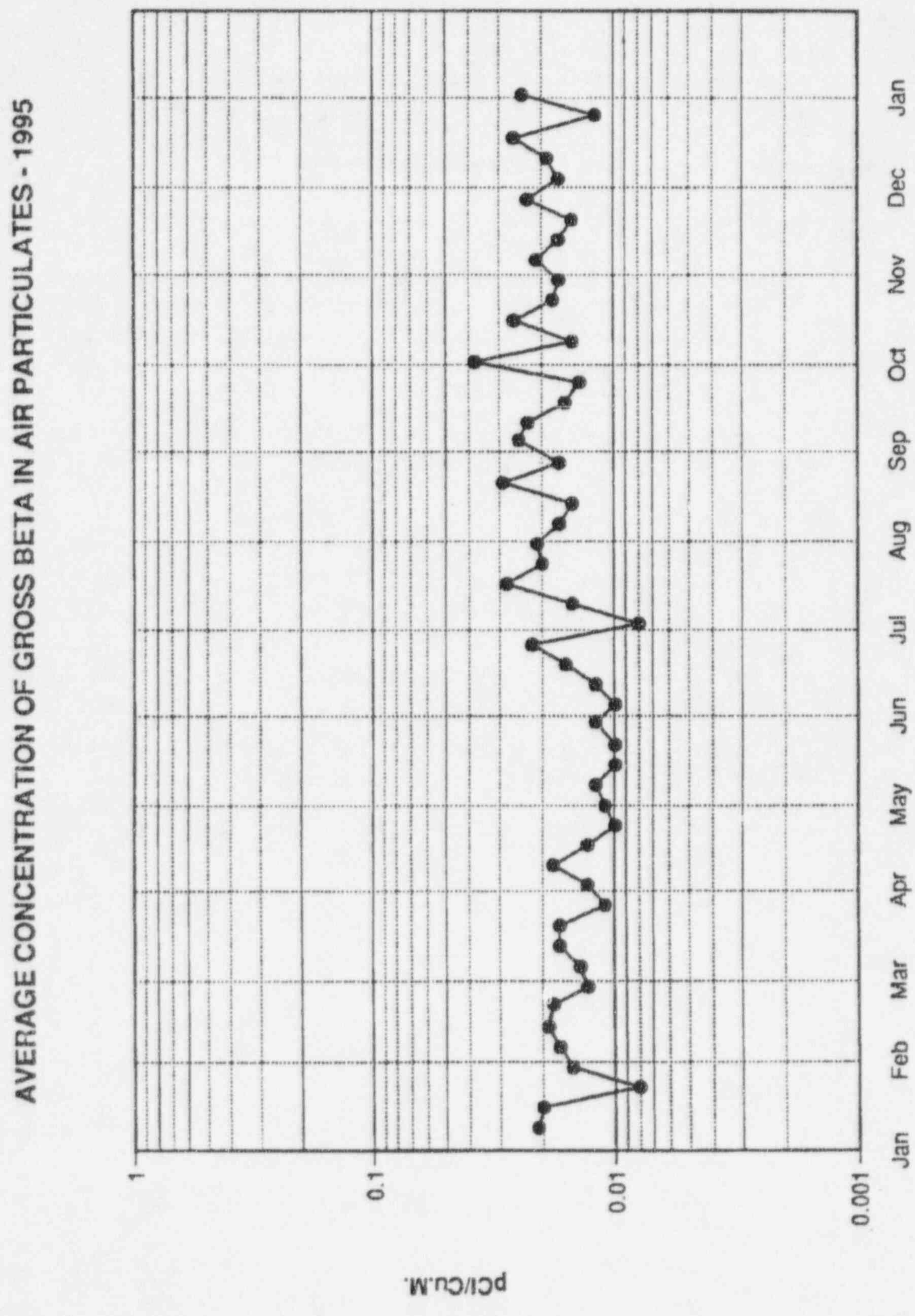
Based on the analytical results, the operation of Beaver Valley Power Station did not contribute to any increase in air particulate radioactivity during 1995.

b. Radioiodine

A total of five hundred twenty (520) weekly charcoal filter samples were analyzed for I-131. No detectable concentrations were present at any locations.

Based on analytical results, the operation of Beaver Valley Power Station did not contribute to any increase in airborne radioiodine during 1995.

Figure 5-2. Average Concentration of Gross Beta in Air Particulates



C. Monitoring of Sediments and Soils

(Soil Monitoring is required every 3 years and is required in 1997)

1. Characterization of Stream Sediments and Soils

The stream sediments consist largely of sand and silt. Soil samples may vary from sand and silt to a heavy clay with variable amounts of organic material.

2. Sampling Program and Analytical Techniques

a. Program

River bottom sediments were collected semi-annually above the Montgomery Dam, in the vicinities of the Beaver Valley discharge and above the New Cumberland Dam. A Ponar or Eckman dredge is used to collect the sample. The sampling locations are also listed in Table 5-1 and are shown in Figure 5-3.

Bottom sediments are analyzed for gross alpha and beta activity, strontium, and the gamma-emitting radionuclides.

b. Analytical Procedures

<u>Gross beta</u> - sediments and soils are analyzed for gross beta by mounting a 1 gram portion of dried sediment in a 2" planchet. The sample is counted in a low background, gas flow proportional counter. Self absorption corrections are made on the basis of sample weight.

<u>Gross alpha</u> activity of sediment or soil is analyzed in the same manner as gross beta except that the counter is set up to count only alpha.

<u>Gamma analysis</u> of sediment or soil is performed in a 300 ml plastic bottle which is counted by a gamma spectrometer.

Figure 5-3. Environmental Monitoring Locations - Shoreline Sediments and Soil

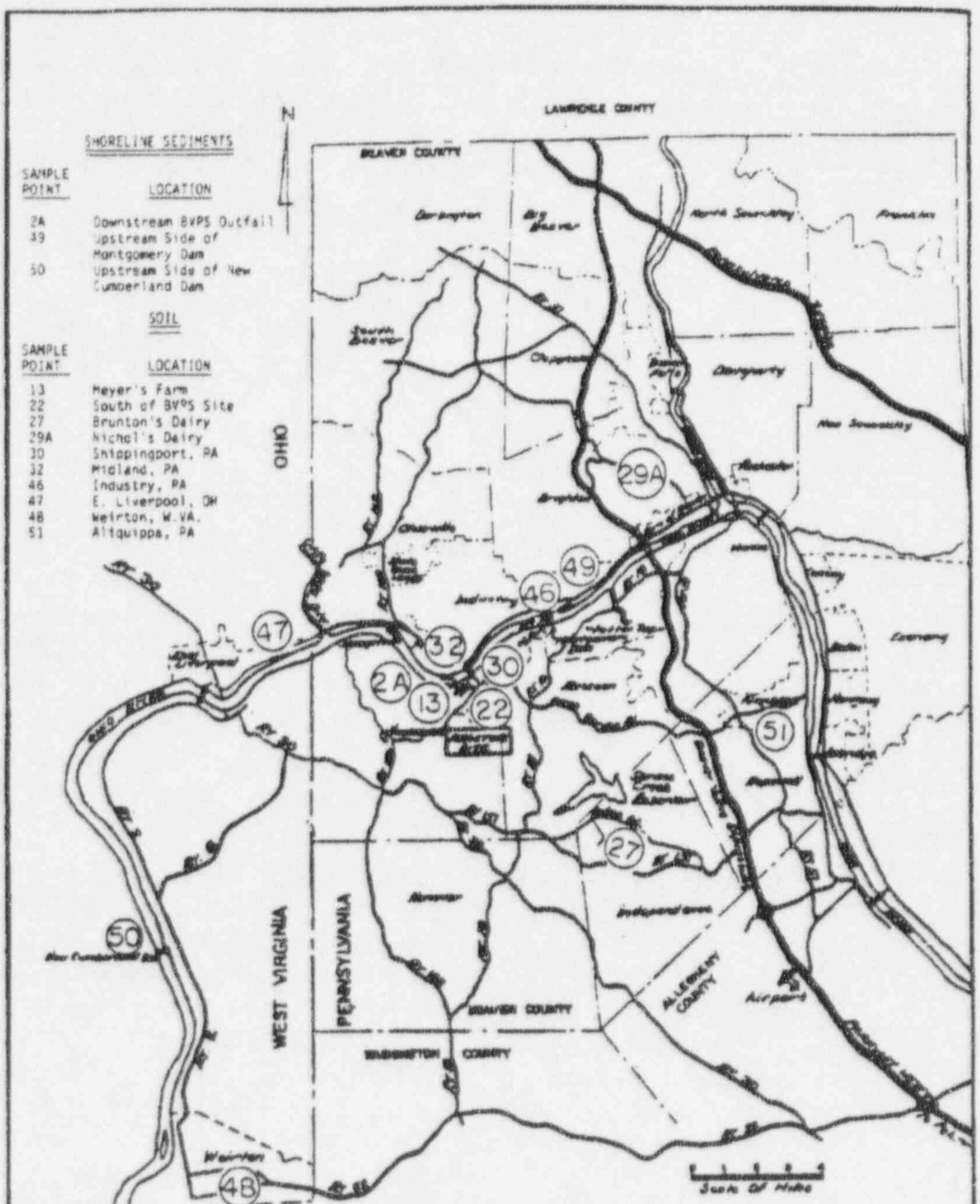


FIGURE 5-3 - ENVIRONMENTAL MONITORING LOCATIONS
SHORELINE SEDIMENTS AND SOIL

Strontium 89 and 90 are determined by radiochemistry. The sample is first dried and weighed. Stable strontium and calcium carriers are added and the sample is leached in hydrochloric acid. The sample is filtered. Calcium and strontium are precipitated as phosphates, collected by vacuum filtration, then dissolved in nitric acid. Strontium is separated by precipitating $Sr(NO_3)_2$ using nitric acid. A barium scavenge is performed to remove radium and other natural nuclides. Final purification of strontium is accomplished by precipitating $SrSO_4$ An iron scavenge is performed, followed by addition of stable yttrium carrier and a minimum 5-day period for Y-90 ingrowth. Yttrium is then precipitated as hydroxide, is dissolved and re-precipitated as oxalate. The yttrium oxalate is mounted on a nylon planchet and is counted in a low level beta counter to infer Sr-90 activity. Sr-89 activity is determined by precipitating $SrCO_3$ from the sample after yttrium separation. This precipitate is mounted on a nylon planchet and is covered with an 80 mg/cm² aluminum absorber for low level beta counting.

3. Results and Conclusions

A summary of sediment analysis is presented in Table 5-2.

a. Sediment

A total of six (6) samples were analyzed for gross alpha and gross beta. Results were comparable to previous years.

A total of six (6) samples were analyzed for Sr-89 and Sr-90. No Sr-89 was detected. Sr-90 was detected at low level on one sample in the Beaver Valley Discharge Area and one sample upstream of the New Cumberland Dam.

A total of six (6) sample were analyzed by gamma spectrometry. Naturally occurring K-40, Ra-226 and Th-228 was found in every sample. Be-7 was found in one sample. Small amounts of Cs-137 from previous nuclear weapons test were found in all six river sediment samples including two upstream above Montgomery Dam, which are unaffected by plant effluents. Small amounts of Mn-54, Co-58, Co-60, Ag-110M, Sb-125 and Cs-137 were detected in the Beaver Valley Power Station discharge area and are attributable to station releases. The activity found in the station discharge area is consistent with station data of authorized radioactive discharges which were within limits permitted by the NRC license.

The analyses demonstrate that the Beaver Valley Power Station did not contribute a significant increase of radioactivity in the Ohio River sediment. The positive results detected are attributable to authorized releases from the Beaver Valley Power Station and are characteristic of the effluent. These results confirm that the station assessments, prior to authorizing radioactive discharges, are adequate and that the environmental monitoring program is sufficiently sensitive.

D. Monitoring of Feedcrops and Foodcrops

1. Characterization of Vegetation and Foodcrops

According to the 1994 statistical summary of the Pennsylvania Department of Agriculture, there were approximately 575 farms in Beaver County. The total value of farm crops and livestock was $17,332,000. The principal source of revenue was in dairy products which were estimated at $6,693,000. Revenues from other farm products were estimated as follows:

Field Crops	$1,786,000
Fruits	$301,000
Horticulture and Mushrooms	$3,797,000
Meat and Animal Products	$3,893,000
Vegetables and Potatoes	$490,000
Poultry Products	$112,000

The total land in Beaver County is 279,020 acres. Approximately 147,900 acres are forested land and 57,960 acres are pasture and crop land.

2. Sampling Program and Analytical Techniques

a. Program

Representative samples of cattle feed are collected monthly from the nearest dairy (Searight). See Figure 5-4. Each sample is analyzed by gamma spectrometry. The monthly samples are composited into a quarterly sample which is analyzed for Sr-90.

A land use census was performed July/August 1995 to locate the nearest residence and nearest garden of greater than 500 square feet producing fresh leafy vegetables within a five (5) mile radius of the site. See Table 5-5 for results.

Foodcrops (vegetables) were collected at garden locations during the summer of 1995. Leafy vegetables, i.e., cabbage, were obtained from Shippingport, Georgetown, and Industry, PA, and Weirton, WV. All samples were analyzed for gamma emitters (including I-131 by gamma spectroscopy).

Figure 5-4. Environmental Monitoring Program - Feedcrop and Foodcrop Locations

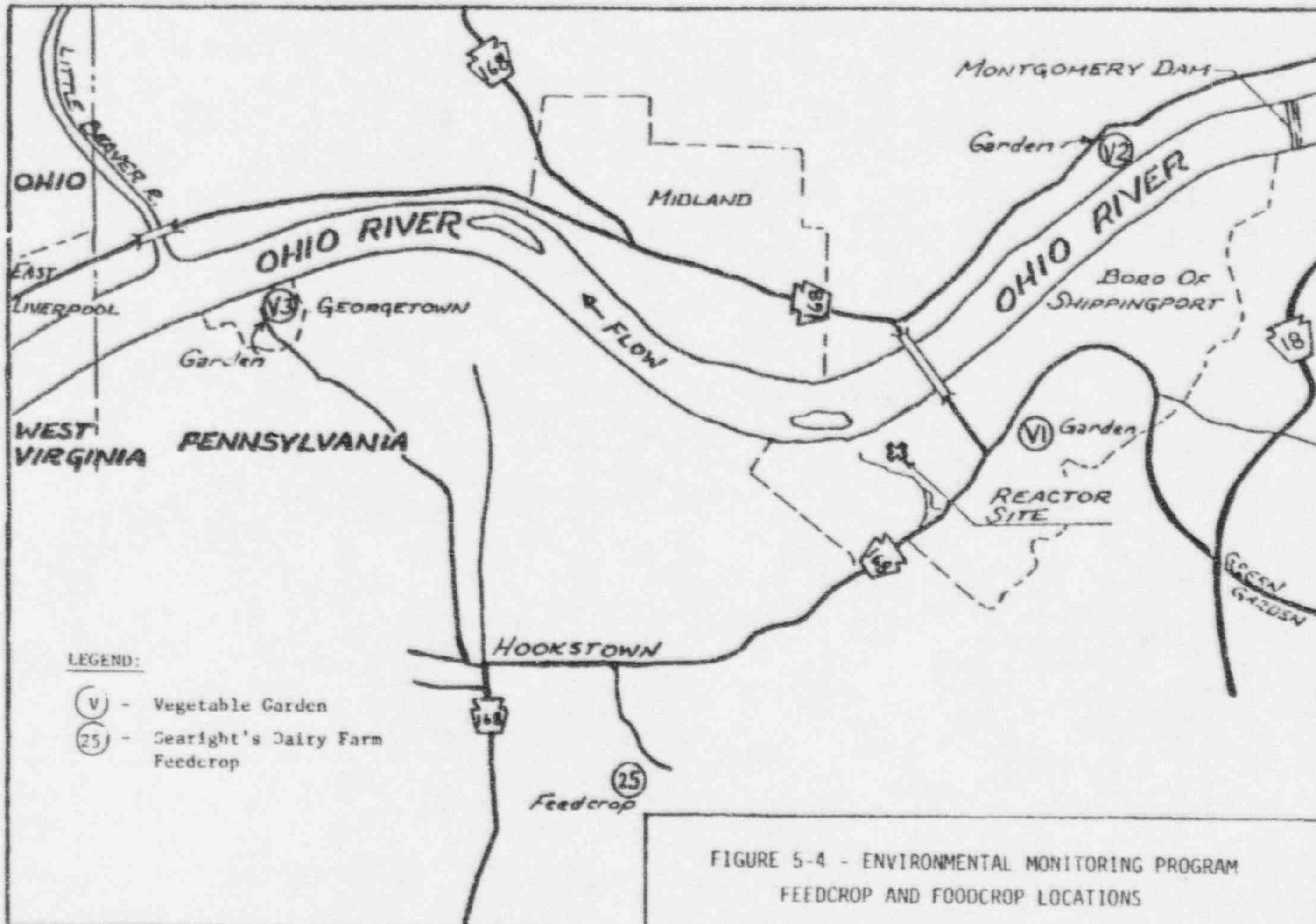


FIGURE 5-4 - ENVIRONMENTAL MONITORING PROGRAM
FEEDCROP AND FOODCROP LOCATIONS

Table 5-5. Closest Residence and Garden in Each Sector

TABLE 5-5

Closest Residence and Garden in Each Sector

Sector	Closest Residence*	Closest Garden*
1	1.55 mi N	1.55 mi N
2	1.59 mi NNE	1.61 mi NNE
3	0.42 mi NE	2.65 mi NE
4	0.38 mi ENE	0.98 mi ENE
5	0.42 mi E	2.06 mi E
6	0.87 mi ESE	1.63 mi ESE
7	1.10 mi SE	1.25 mi SE
8	1.10 mi SSE	2.16 mi SSE
9	1.40 mi S	2.31 mi S
10	0.80 mi SSW	1.55 mi SSW
11	1.67 mi SW	1.67 mi SW
12	1.46 mi WSW	1.55 mi WSW
13	2.27 mi W	2.27 mi W
14	2.84 mi WNW	3.18 mi WNW
15	0.91 mi NW	0.92 mi NW
16	0.91 mi NNW	1.36 mi NNW

*Direction and Distance from Midpoint between Reactors

b. Procedures

Gamma emitters, including I-131, are determined by scanning a dried, homogenized sample with the gamma spectroscopy system. A high resolution germanium detector is utilized with this system.

Strontium 90 analysis for feedstuff is performed by a procedure similar to that described in 5-C.2 after drying, weighing and ashing the sample.

Radioiodine (I-131) is determined by radiochemistry. Stable iodide carrier is first added to a chopped sample which is then leached with sodium hydroxide solution, evaporated to dryness and fused in a muffle furnace. The melt is dissolved in water, filtered and treated with sodium hypochlorite. The iodate is then reduced to iodine with hydroxylamine hydrochloride and is extracted into chloroform. It is then back-extracted as iodide into sodium bisulfite solution and is precipitated as palladium iodide. The precipitate is weighed for chemical yield and is mounted on a nylon planchet for low level beta counting.

3. Results and Conclusions

A summary of data is presented in Table 5-2.

a. Feed

A total twelve (12) samples were analyzed for I-131. No detectable concentrations were found.

A total of four (4) samples were analyzed for Sr-90. Small amounts of Sr-90 from previous nuclear weapons tests were present in all samples.

A total of twelve (12) samples were analyzed by gamma spectroscopy. Naturally occurring K-40 was present in all samples and Be-7 was detected in five (5) samples.

b. Food

A total of four (4) samples were analyzed for I-131. No detectable concentrations were present.

A total of four (4) samples were analyzed by gamma spectrometry. Naturally occurring K-40 was present in all samples.

c. The data from food and feed analyses were consistent with previous data. These data confirm that the Beaver Valley Power Station did not contribute to radioactivity in foods and feeds in the vicinity of the site.

E. Monitoring of Local Cows Milk

1. Description - Milch Animal Locations

During the seasons that animals producing milk (milch animals) for human consumption are on pasture, samples of fresh milk are obtained from these animals at locations and frequencies noted in Table 5-1. This milk is analyzed for its radioiodine content calculated as Iodine-131. The analyses are performed within eight (8) days of sampling.

Detailed field surveys are performed during the grazing season to locate and enumerate milch animals within a five (5) mile radius of the site. Goat herd locations out to fifteen (15) miles are identified. Survey data for the most recent survey conducted in is shown in Figure 5-5.

2. Sampling Program and Analytical Techniques

a. Program

Milk was collected from these (3) reference dairy farms (Searight's, Brunton's and Nicol's) within a 10-mile radius of the site and from one (1) control location (Windsheimer's) outside of the 10-mile radius. Additional dairies, which represent the highest potential milk pathway for radioiodine based on milch animal surveys and meteorological data were selected and sampled. These dairies are subject to change based upon availability of milk or when more recent data (milch animal census) indicate other locations are more appropriate. The location of each is shown in Figure 5-6 and described below.

Site	Dairy	Number of Milch Animals	Direction and Distance from Midpoint between Reactors	Collection Period
25	Searight	47 Cows	2.2 miles SSW	Jan. - Dec.
27	Brunton	93 Cows	7.3 miles SE	Jan. - Dec.
29A	Nicol	75 Cows	8.0 miles NE	Jan. - Dec.
96	Windsheimer	58 Cows	10.3 miles SSW	Jan. - Dec.
109**	Soissen	30 Cows	3.83 miles WSW	Jan. - Dec.
102**	Ferry	2 Goats*	3.3 miles SE	Apr. - Oct.
105**	Ambrose	25 Cows	3.86 miles WSW	Nov. - Dec.
106**	Conkle	32 Cows	3.75 miles WSW	Jan. - Dec.

* Milk Usage - Home Only.

** Highest potential pathway dairies.

Figure 5-5. Beaver Valley Power Station Milch Animal Census

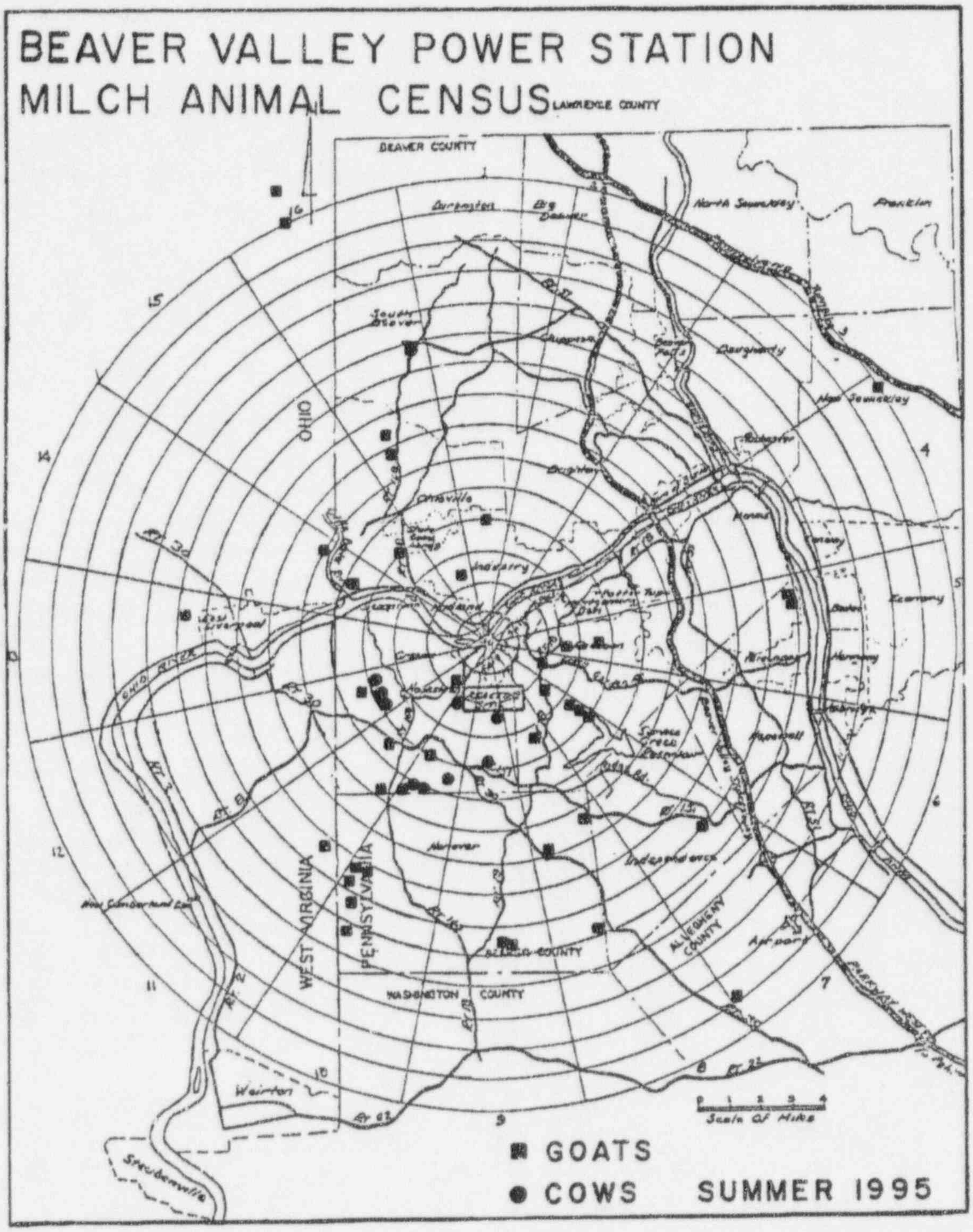


Figure 5-6. Environmental Monitoring Locations - Milk

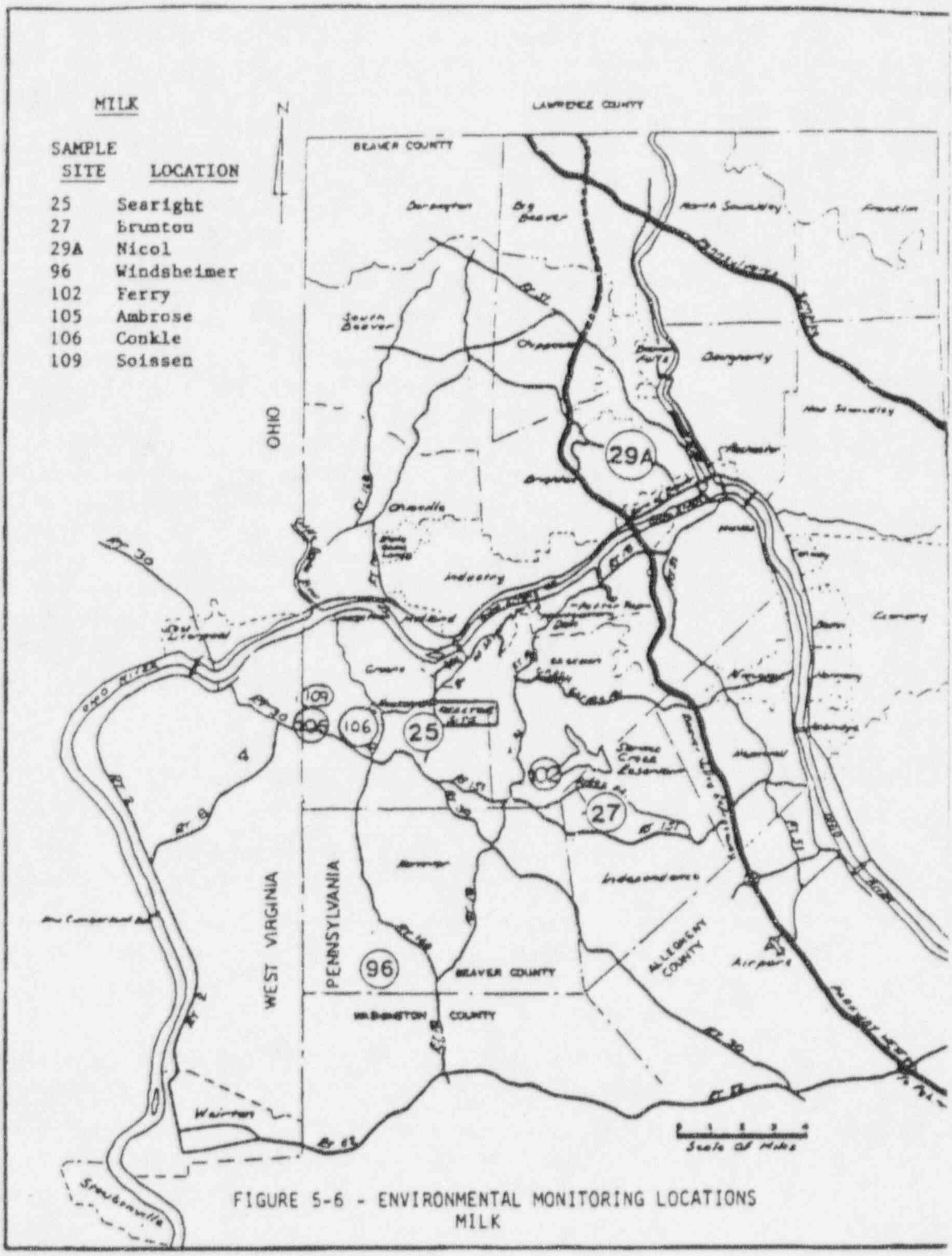


FIGURE 5-6 - ENVIRONMENTAL MONITORING LOCATIONS
MILK

The sample from Searight Dairy was collected and analyzed weekly for radioiodine using a procedure with a high sensitivity. Samples from each of the other selected dairies were collected monthly when cows are indoors, and bi-weekly when cows are grazing. This monthly or bi-weekly sample is analyzed for Sr-89, Sr-90, gamma emitters including Cs-137 (by high resolution germanium gamma spectroscopy) and I-131 (high sensitivity analysis).

b. Procedure

Radioiodine (I-131) analysis in milk was normally performed using chemically prepared samples and analyzed with a low-level beta counting system.

Gamma emitters are determined by gamma spectroscopy of a one liter Marinelli container of milk.

Strontium milk samples are prepared by adding stable strontium carrier and evaporating to dryness, then ashing in a muffle furnace, followed by precipitating phosphates. Strontium is purified in all samples in a chromatographic column. Stable yttrium carrier is added and the sample is allowed to stand for a minimum of 5 days for the ingrowth of Y-90. Yttrium is then precipitated as hydroxide, is dissolved and re-precipitated as oxalate. The yttrium oxalate is mounted on a nylon planchet and is counted in a low level beta counter to infer Sr-90 activity. Strontium-89 activity is determined by precipitating $SrCO_3$ from the sample after yttrium separation. This precipitate is mounted on a nylon planchet and is covered with an 80 mg/cm^2 aluminum absorber for low level beta counting. Chemical yields of strontium and yttrium are determined gravimetrically.

3. Results and Conclusions

A summary of data is presented in Table 5-2.

A total of one hundred sixty-six (166) samples were analyzed for I-131 during 1995. All I-131 activities in milk were below the minimum detectable level.

A total of one hundred thirty-three (133) samples were analyzed for Sr-89 and Sr-90. No Sr-89 was detected. Sr-90 levels attributable to previous nuclear weapons tests were detected in all samples and were within the normally expected range.

A total of one hundred thirty-three (133) samples were analyzed by gamma spectroscopy. Naturally occurring K-40 was present in all samples.

It was noted that the dairies with the highest annual mean activities were goat dairies, which are known to concentrate activities over a factor of two compared to a cow dairy.

All results were consistent with (or lower than) those obtained in the preoperational program. These data confirm that the Beaver Valley Power Station did not contribute to radioactivity in milk in the vicinity of the site.

F. Environmental Radiation Monitoring

1. Description of Regional Background Radiation and Sources

The terrain in the vicinity of the Beaver Valley Power Station generally consists of rough hills with altitude variations of 300-400 feet. Most of the land is wooded.

The principal geologic features of the region are nearly flat-laying sedimentary beds of the Pennsylvania Age. Beds of limestone alternate with sandstone and shale with abundant interbedded coal layers. Pleistocene glacial deposits partially cover the older sedimentary deposits in the northwest. Most of the region is underlain by shale, sandstone, and some coal beds of the Conemaugh Formation. Outcrops of sandstone, shale, and limestone of the Allegheny Formation exist within the Ohio River Valley and along major tributary streams.

Based on surveys reported in previous annual reports, exposure rates ranged from 6-12 μR/hr. Results for 1995 indicated that background radiation continued in this range.

2. Locations and Analytical Procedures

Ambient external radiation levels around the site were measured using thermoluminescent dosimeters (TLDs).

In 1995 there were a total of forty-four (44) off-site environmental TLD locations. The locations of the TLDs are shown in Figure 5-7 through Figure 5-10. Thirteen (13) locations also have QC Laboratory TLDs. Both laboratories use calcium sulfate dysprosium, ($CaSO_4$:Dy) in Teflon matrix.

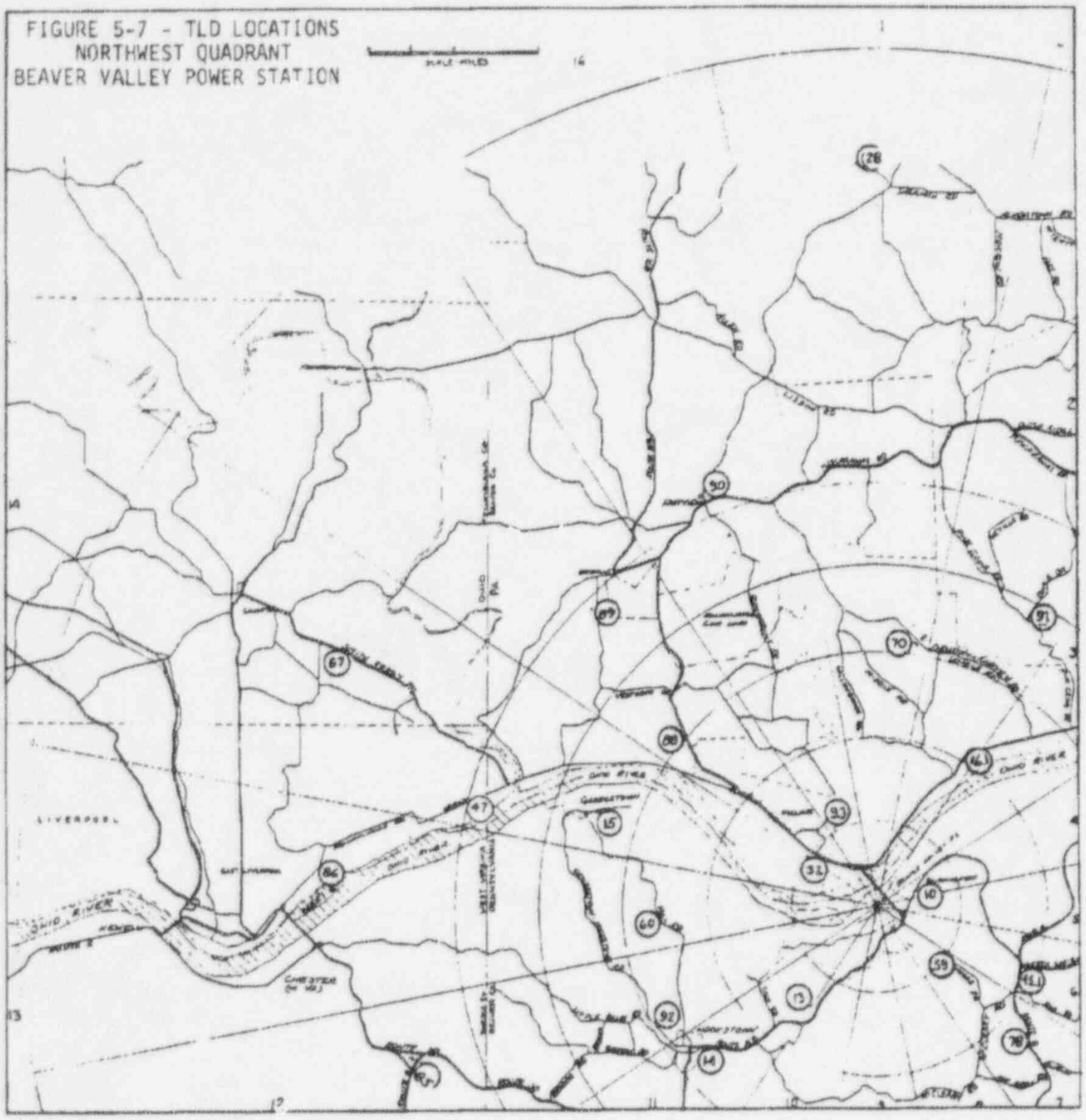
The calcium sulfate dysprosium ($CaSO_4$:Dy) TLDs were annealed at the Contractor Central Laboratory shortly before placing the TLDs in their field locations. The radiation dose accumulated in-transit between the Central Laboratory, the field location, and the Central Laboratory was corrected by transit controls maintained in lead shields at both the Central Laboratory and the field office. All dosimeters were exposed in the field in a special environmental holder. The dosimetry system was calibrated by reading calcium sulfate dosimeters which have been exposed in an accurately known gamma radiation field.

3. Results and Conclusions

Data obtained with the contractor TLD ($CaSO_4$:Dy in Teflon) during 1995 are summarized in Table 5-2, and the quality control TLD results are listed in Table 3-1.

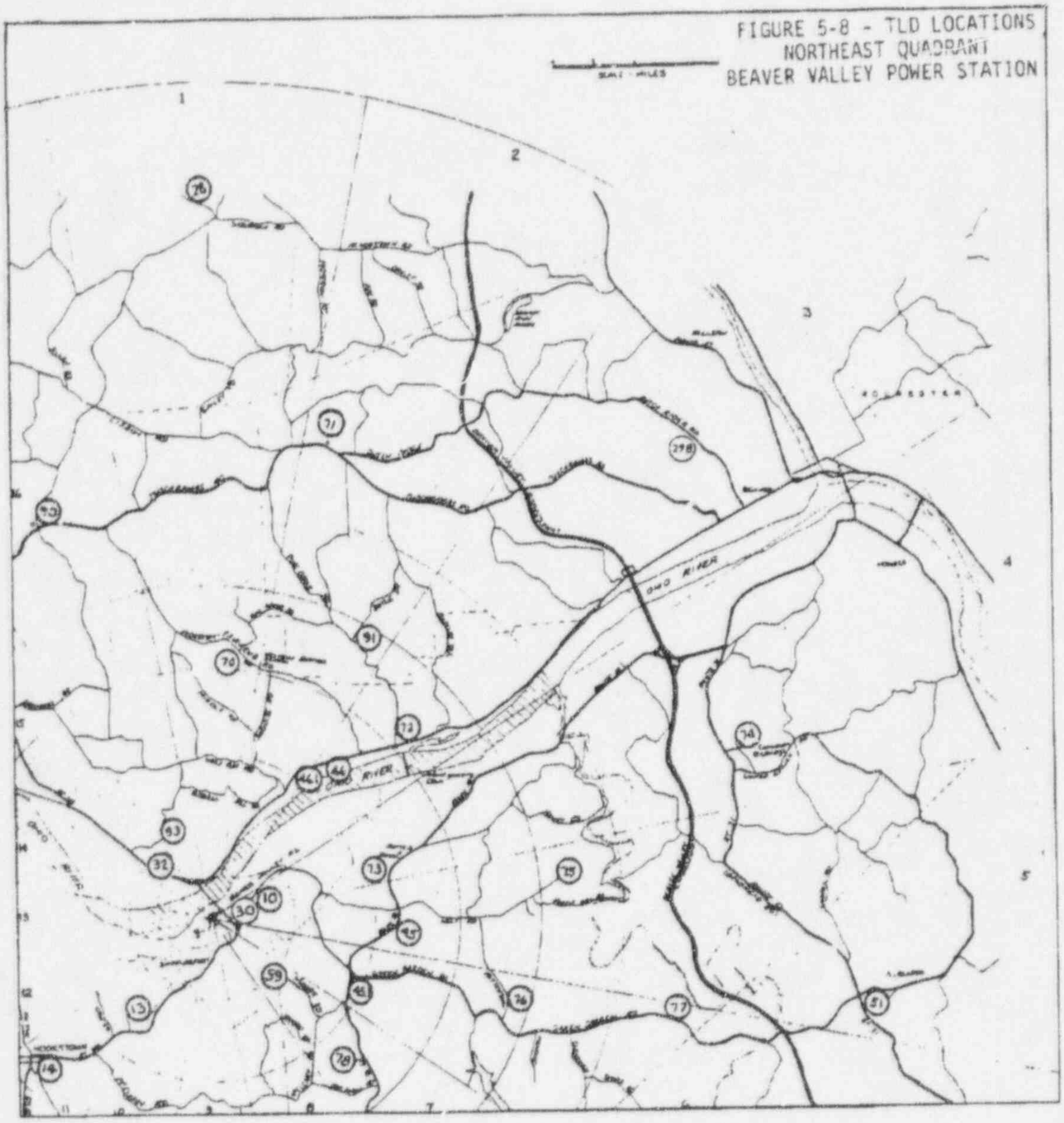
The annual exposure rate of all offsite TLDs averaged 0.179 mR/day in 1995. As in previous years, there was some variation among locations and seasons as would be expected. Four TLDs (two quarterly, two annual) were lost in the field during the year. Two quarterly TLDs were also lost in processing. In 1995, ionizing radiation dose determinations from TLDs averaged approximately 65.3 mR for the year. This is comparable to previous years. There was no evidence of anomalies that could be attributed to the operation of the Beaver Valley Power Station. The TLDs confirm that changes from natural radiation levels, if any, are negligible.

Figure 5-7. TLD Locations - Northwest Quadrant



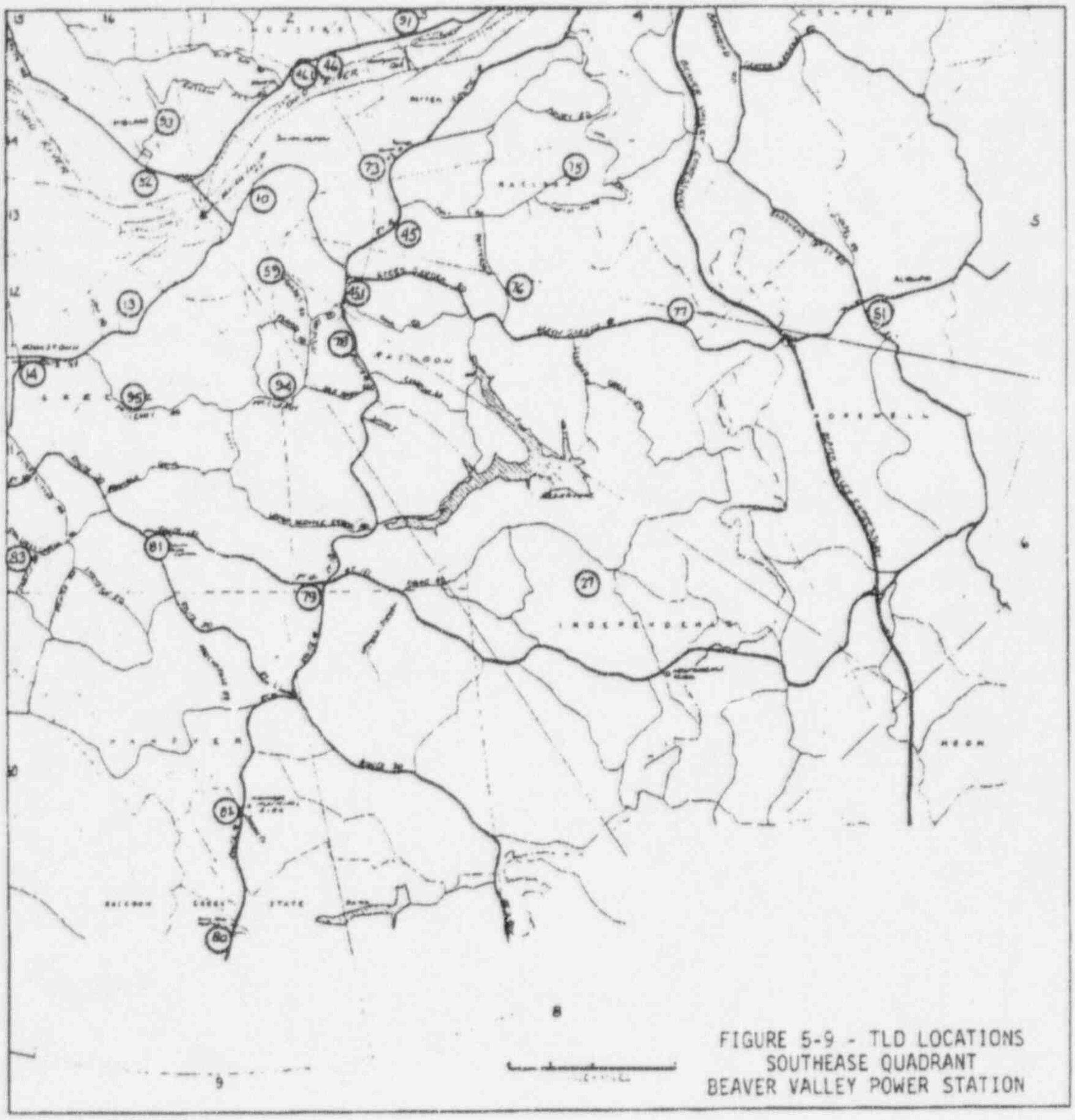
Sector	Site	Location
1	70	Western Beaver
1	28	Sherman's Farm
13	86	East Liverpool
13	60	Haney's Farm
14	15	Georgetown
14	87	Calcutta
14	47	E. Liverpool Water Co.
15	32	Midland S.S.
15	88	Midland Heights
15	89	Ohioville
16	90	Fairview School
16	93	Sunset Hills Midland

Figure 5-8. TLD Locations - Northeast Quadrant



Sector	Site	Location
1	70	Western Beaver
1	28	Sherman's Farm
2	91	Pine Grove & Doyle
2	71	Brighton Twp. School
3	46.1	Industry (Tire Co.)
3	46	Industry (Church)
3	72	Site of Former Logan School
3	29B	Beaver County Hosp.
4	10	Shippingport Post Office
4	30	Shippingport, PA (S.S.)
4	73	Potter Twp. School
4	74	Community College (Center Twp.)
5	51	Aliquippa
5	75	Holt Road
5	45	Mt. Pleasant Church

Figure 5-9. TLD Locations - Southeast Quadrant



Sector	Site	Location
5	51	Aliquippa
5	75	Holt Road
5	45	Mt. Pleasant Church
6	45.1	Raccoon Twp.
6	76	Raccoon Twp. School
6	77	Green Garden Road
7	59	Iron's Farm
7	78	Raccoon Municipal Bldg.
7	27	Brunton's Dairy
8	94	McCleary Road
8	79	Rt. 18 and Rt. 151
9	80	Raccoon Park
9	81	Southside School
9	82	Hanover Municipal Bldg.

Figure 5-10. TLD Locations - Southwest Quadrant

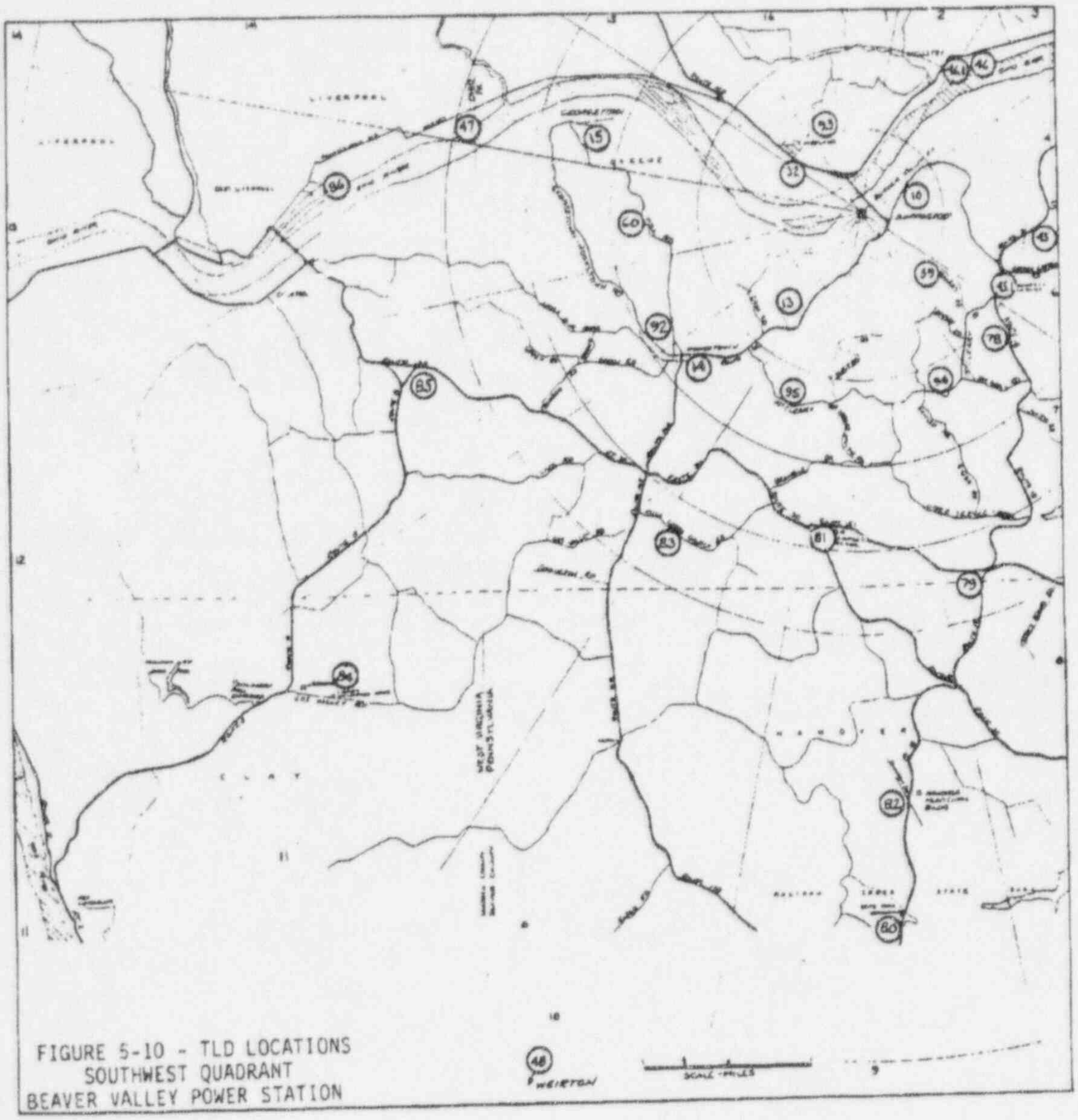


FIGURE 5-10 - TLD LOCATIONS
SOUTHWEST QUADRANT
BEAVER VALLEY POWER STATION

Sector	Site	Location
9	80	Raccoon Park
9	81	Southside School
9	82	Hanover Municipal Bldg.
10	48	Weirton Water Company
10	83	Mill Creek Road
10	95	McCleary Road
11	13	Meyer's Farm
11	14	Hookstown
11	84	Hancock Children's Home
12	92	Georgetown Road
12	85	Rt. 8 and Rt. 30
13	86	E. Liverpool
13	60	Haney's Farm

G. Monitoring of Fish

1. Description

During 1995, fish collected for the radiological monitoring program included carp and catfish.

2. Sampling Program and Analytical Techniques

a. Program

Fish samples are collected semi-annually in the New Cumberland pool of the Ohio River at the Beaver Valley effluent discharge point and upstream of the Montgomery Dam. The edible portion of each different species caught is analyzed by gamma spectroscopy. Fish sampling locations are shown in Figure 5-11.

b. Procedure

A sample is prepared in a standard tared 300 ml plastic bottle and scanned for gamma emitting nuclides with gamma spectrometry system which utilizes a high resolution germanium detector.

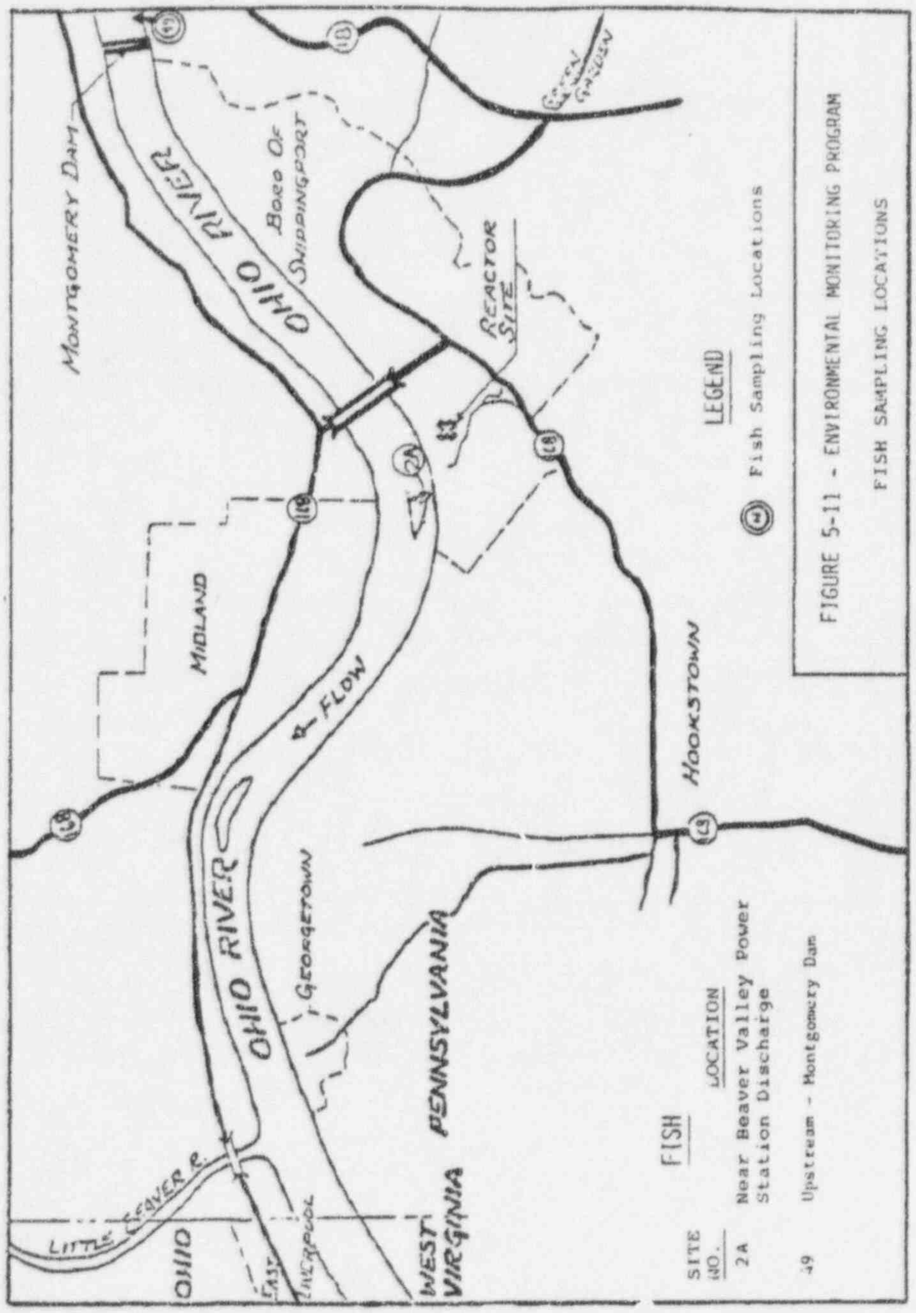
3. Results and Conclusions

A summary of the results of the fish monitoring data is provided in Table 5-2.

A total of eight (8) samples were analyzed by gamma spectroscopy. Naturally occurring K-40 was found in all samples. No other gamma emitting radionuclides were detected.

The analyses demonstrate that the Beaver Valley Power Station did not contribute a significant increase of radioactivity in the Ohio River fish population.

Figure 5-11. Environmental Monitoring Program - Fish Sampling Locations



H. Monitoring of Surface, Drinking, Well Waters and Precipitation

1. Description of Water Sources

The Ohio River is the main body of water in the area. It is used by the Beaver Valley Power Station for plant make-up for the cooling tower and for receiving plant liquid effluents.

Ohio River water is a source of water for some towns both upstream and downstream of the Beaver Valley Power Station site. It is used by several municipalities and industries downstream of the site. The nearest user of the Ohio River as a potable water source is Midland Borough Municipal Water Authority. The intake of the treatment plant is approximately 1.5 miles downstream and on the opposite side of the river. The next downstream user is East Liverpool, Ohio which is approximately 6 miles downstream. The heavy industries in Midland, as well as others downstream use river water for cooling purposes.

Groundwater occurs in large volumes in the gravel terraces which li e along the river, and diminishes considerably in the bedrock underlying the site. Normal well yields in the bedrock are less than 10 gallons per minute (gpm) with occasional wells yielding up to 60 gpm.

In general, the BVPS site experiences cool winters and moderately warm summers with ample annual precipitation evenly distributed throughout the year. The record mean annual precipitation for the area is 36.43 inches based on 1965 to 1994 data collected at the Pittsburgh International Airport.

2. Sampling and Analytical Techniques

a. Surface (Raw River) Water

The sampling program of river water includes five (5) sampling points along the Ohio River. Raw water samples are normally collected at the East Liverpool (Ohio) Water Treatment Plant [River Mile 41.2] daily and composited into a monthly sample. Weekly grab samples are taken from the Ohio River at the following locations: upstream of Montgomery Dam [River Mile 31.8]; and near the discharge from the Beaver Valley Power Station [River Mile 35.0]. Two automatic river water samplers are at the following locations: Upstream of Montgomery Dam [River Mile 29.6]; and at J&L Steel's river water intake [River Mile 36.2]. The automatic sampler takes a 20-40 ml sample every 15 minutes and samples are collected on a weekly basis. The weekly grab samples and automatic water samples are composited into monthly samples from each location. In addition, a quarterly composite sample is prepared for each sample point.

The weekly composites from the automatic river water sampler upstream at Montgomery Dam are analyzed for I-131.

The monthly composites are analyzed for gross alpha, gross beta, and gamma emitters. The quarterly composites are analyzed for H-3, Sr-89, Sr-90, and Co-60 (high sensitivity).

Locations of each sample point are shown in Figure 5-12.

b. Drinking Water (Public Supplies)

Drinking (treated) water is collected at both Midland (PA) and East Liverpool (OH) Water Treating Plants. An automatic sampler at each location collects 20-40 ml every 20 minutes. These intermittent samples are then composited into a weekly sample. The weekly sample from each location is analyzed by gamma spectroscopy. The weekly samples are also analyzed for I-131.

Monthly composites of the weekly samples are analyzed for gross alpha, gross beta, and by gamma spectrometry. Quarterly composites are analyzed for H-3, Sr-89, Sr-90 and Co-60 (high sensitivity). Locations of each sample point are shown in Figure 5-12.

c. Groundwater

Grab samples were collected each quarter (when occupied) from each of four (4) well locations (see Figure 5-12) within four (4) miles of the site. These locations are:

One (1) well in Shippingport, PA

One (1) well at Meyer's Farm

One (1) well in Hookstown, PA

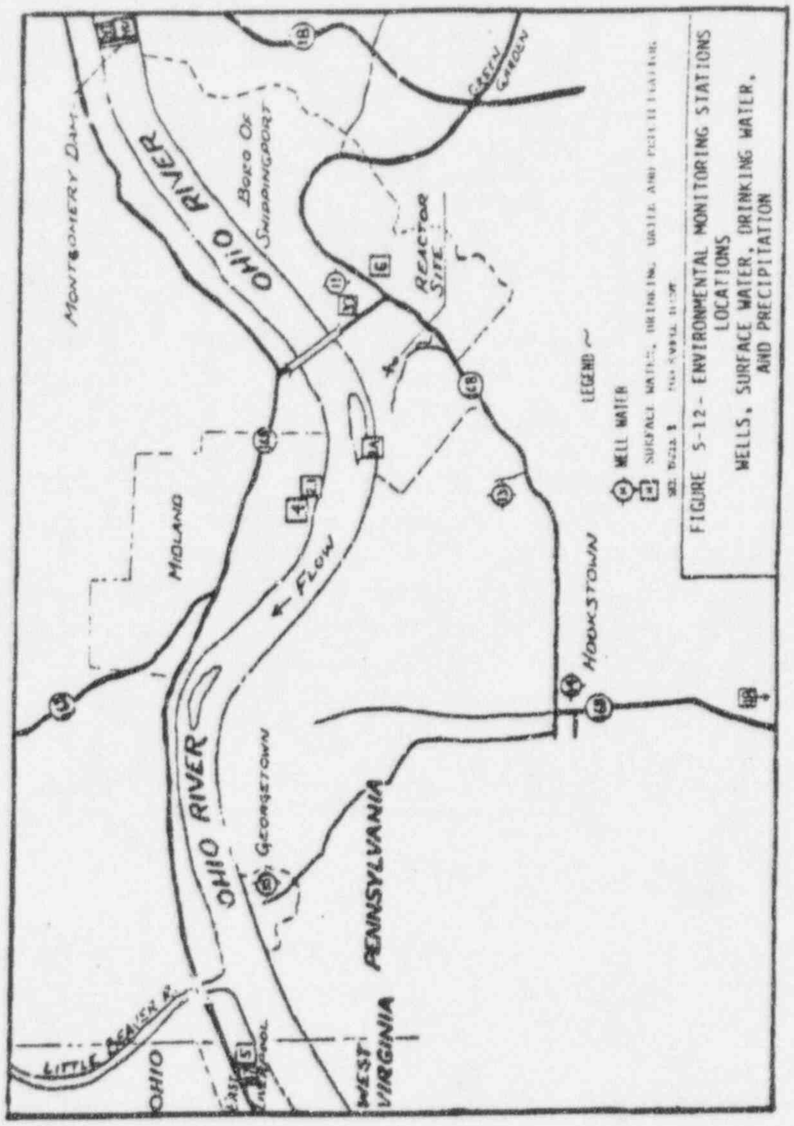
One (1) well in Georgetown, PA

Each ground water sample is analyzed for gross alpha, gross beta, tritium, and by gamma spectroscopy.

d. Precipitation

Precipitation is collected at Shippingport, PA, East Liverpool, OH and Weirton, WV. Precipitation when available is collected each week and then composited into monthly and quarterly samples. The monthly samples are analyzed for gross beta and gamma emitters and the quarterly composites are analyzed for H-3, Sr-89 and Sr-90. Locations of each sample point are shown in Figure 5-12.

Figure 5-12. Environmental Monitoring Stations Loca'ons - Wells, Surface Water, Drinking Water and Precipitation



SAMPLE TYPE	SAMPLE POINT	SAMPLING POINT DESCRIPTION
Surface Water	2A	Downstream - BVPS
	2.1	Downstream - J & L Intake
	5	East Liverpool Water Plant (Raw Water)
	49	Montgomery Dam (Upstream)
	49.1	Upstream - Arco Polymers Intake
Drinking Water	4	Midland Water Plant
	5	East Liverpool Water Plant
Well Water	11	Shippingport Boro
	13	Meyers Farm
	14	Hookstown, PA
	15	Georgstown, PA
Precipitation	30	Shippingport PA
	47	East Liverponl, OH
	48	Weirton, WV

e. Procedures

Gross alpha and gross beta activities are determined first by evaporating one liter of the sample on a hotplate. The residue is mounted and dried on a 2-inch stainless steel planchet. The sample is counted in a low background, gas flow proportional counter. Self-absorption corrections are made on the basis of sample weight.

Gamma analysis is performed on water sample by loading one liter of sample into a one liter Marinelli container and counting a high resolution germanium gamma spectrometry system.

Strontium-89 and 90 are determined on water samples by a procedure similar to that described in 5-C.2 except that the leaching step is eliminated.

Cobalt-60 is determined with a sensitivity of 1 pCi/liter by evaporating 2 liters of sample on a hotplate and transferring the residue to a 2-inch planchet. The planchet is counted on a high resolution germanium gamma spectrometry system.

Tritium is determined in water samples by liquid scintillation counting.

Radioiodine (I-131) analysis in water was normally performed using chemically prepared samples and analyzed with a low-level beta counting system.

3. Results and Conclusions

A summary of results of all analyses of water samples (surface, drinking, ground and precipitation) are provided by sample type and analysis in Table 5-2. These are discussed below.

a. Surface Water

A total of forty-eight (48) samples were analyzed for gross alpha and gross beta. Alpha activity was detected at the lower limit of detection in one of the samples. Surface water may contain sediment which contains naturally occuring alpha radioactivity. Positive beta results above preoperational levels were detected in the BVPS discharge area and are attributable to station releases. The beta activity found in the station discharge area is consistent with station data of authorized radioactive discharges and were within limits permitted by the NRC license.

A total of sixteen (16) samples were analyzed for H-3, Sr-89 and Sr-90 as well as a high sensitivity analysis for Co-58 and Co-60. Positive tritium results were detected in the BVPS discharge area and are attributable to station releases. The highest tritium results have been noted, however, to correspond to shore samples taken when mixing zone sampling by boat was not possible. All other samples taken upstream and downstream were within preoperational levels. The activity found in the station discharge area is consistent with station data of authorized radioactive discharges and were within limits permitted by the NRC license.

A total of forty-eight (48) samples were analyzed by gamma spectrometry. No gamma emitting radionuclides were detected.

A total of fifty-two (52) samples were analyzed for I-131 using a highly sensitive technique. Trace levels of I-131 were measured in twenty-two (22) of the weekly samples. The results were slightly above the minimum detectable activity. The positive results were detected at a control location above the BVPS discharge and could not be attributed to plant releases. The results may be attributed to medical procedures and the expected variability in the analyses results of very low levels of activity.

b. Drinking Water

A total of twenty-four (24) samples were analyzed for gross alpha and gross beta. All results were within a normal range.

A total of eight (8) samples were analyzed for H-3, Sr-89 and Sr-90 as well as a high sensitivity analysis for Co-60. No H-3, Sr-89, Sr-90, or Co-60 were detected.

A total of one hundred four (104) samples were analyzed by gamma spectrometry. No gamma emitting radionuclides were detected.

A total of one hundred four (104) samples were analyzed for I-131 using a highly sensitive technique. Trace levels of I-131 were measured in seventy-one (71) of the weekly samples. The results were slightly above the minimum detectable activity. The positive results were detected at Midland and East Liverpool and could not be attributed to plant releases. As noted under Surface Water above, I-131 has been observed upstream of the site. The results may be attributed to medical procedures and the expected variability in the analyses results of very low levels of activity.

c. Groundwater

A total of fourteen (14) samples were each analyzed for gross alpha, gross beta, H-3 and by gamma spectrometry. Only two samples were obtained at Meyer Farm because the farm was only occupied two quarters. Alpha and H-3 activity were not detected. The gross beta results are comparable to preoperational ranges. No gamma emitting radionuclides were detected.

d. Precipitation

A total of thirty-six (36) samples were analyzed for gross beta. All results were within a normal range.

A total of twelve (12) samples were analyzed for H-3, Sr-89 and Sr-90. Two (2) positive tritium results detected were within normal levels. No Sr-89 or Sr-90 was detected.

A total of thirty-six (36) samples were analyzed by gamma spectrometry. Naturally occurring Be-7 was detected in twenty-six (26) samples.

e. Summary

The data from water analyses demonstrates that the Beaver Valley Power Station did not contribute a significant increase of radioactivity in local river, drinking, well waters or precipitation. The few positive results which could be attributable to authorized releases from the Beaver Valley Power Station are characteristic of the effluent. These results confirm that the station assessments, prior to authorizing radioactive discharges, are adequate and that the environmental monitoring program is sufficiently sensitive.

Further, the actual detected concentration (averaged over the total batch discharge period during the year) attributable to Beaver Valley Power Station, was only 0.110% of the limits set forth in Appendix C of the ODCM for water discharged to the Ohio River. The Ohio River further reduced this concentration by a factor of ~ 600 prior to its potential use by members of the public.

I. Estimates of Radiation Dose to Man

1. Pathways to Man - Calculational Models

The radiation doses to man as a result of Beaver Valley operations were calculated for both gaseous and liquid effluent pathways using codes for the ARERAS/MIDAS computer system equivalent to NRC computer codes XOQDOQ2, GASPAR, and LADTAP. Dose factors listed in the ODCM were used to calculate doses to maximum individuals from radioactive noble gases in discharge plumes. Beaver Valley effluent data, based on sample analysis in accordance with the schedule set forth in Appendix A of the BVPS license, were used as the radionuclide activity input.

Each radionuclide contained in the Annual Radioactive Effluent Release Report (noble gases, particulates, radioiodines and tritium) were included as source terms when they were detected above the LLD values. All LLD values reported by Beaver Valley Power Station are equal to or lower than those required by the Technical Specifications/ODCM.

All gaseous effluent releases, including Auxiliary Building Ventilation, were included in dose assessments. The release activities are based on laboratory analysis. Meteorological data collected by the Beaver Valley Power Station Meteorology System was used as input to code equivalent to XOQDOQ2 which in turn provided input for the GASPAR equivalent. Except when more recent or specific data was available, all inputs were the same as used in the Beaver Valley Power Station Environmental Statements or in Regulatory Guide 1.109. The airborne pathways evaluated were beta and gamma doses from noble gas plumes inhalation, the "cow-milk-child", and other ingestion pathways.

All potentially radioactive liquid effluents, including steam generator blowdown, are released by batch mode after analysis by gamma spectrometry using Intrinsic Germanium detectors. Each batch is diluted by cooling tower blowdown water prior to discharge into the Ohio River at the Beaver Valley Power Station outfall (River Mile 35.0). The actual data from these analyses are tabulated and used as the radionuclide activity input term in code equivalent to LADTAP. A hypothetical real individual for liquid pathways is located at Midland. Except when more recent or specific data for the period is available, all other input are obtained from the Beaver Valley Power Station Environmental Statement or Regulatory Guide 1.109. Pathways, which were evaluated, are drinking water, fish consumption, shoreline recreation, swimming, and boating.

2. Results of Calculated Radiation Dose to Man - Liquid Releases

a. Individual Dose

The doses which are calculated by the model described above are to a hypothetical real individual located at Midland since this is the nearest location where significant exposure of a member of the public could potentially occur; therefore, this location is use to calculate the maximum exposure. A breakdown of doses by pathway and organ is provided in Table 5-6 for the maximum individual. Included in this table is a breakdown of a typical dose to individuals from natural radiation exposure. The results of calculated radiation dose to the hypothetical real individual are compared to BVPS annual limits in Table 5-7.

b. Upon implementation of the Unit 2 Technical Specifications and inception of the liquid discharge procedures at Unit 2 on July 24, 1987, the discharge limits were clarified to be reactor specific; i.e., Unit 1 and Unit 2 have reactor specific dose limits that are equal to the limits in 10 CFR Part 50, Appendix I. Therefore, the annual site limits listed in Table 5-8 are specific to this report only, and were derived by multiplying the individual Technical Specification reactor limits by a factor of two (2).

Table 5-6. Radiation Dose to Maximum Individual, mrem/yr - Liquid Releases

TABLE 5-6

Radiation Dose to Maximum Individual[a], mrem/yr - Liquid Releases[b]

PATHWAY	SKIN	ORGAN	THYROID	BONE	WHOLE BODY
Fish Consumption	N/A	0.000419 (Teen) (Liver)	0.0000542 (Adult)	0.000337 (Child)	0.000297 (Adult)
Drinking Water	N/A	0.00188 (Infant) (Thyroid)	0.00188 (Infant)	0.0000350 (Child)	0.00177 (Child)
Shoreline Activities	0.0000480 (Teen)	0.0000480 (Teen) (Skin)	0.0000408 (Teen)	0.0000408 (Teen)	0.0000408 (Teen)
mREM Maximum Individual	0.0000480 (Teen)	0.00216 (Child) (Liver)	0.00190 (Child)	0.000381 (Child)	0.00187 (Child)

TYPICAL DOSE TO INDIVIDUALS FROM NATURAL RADIATION EXPOSURE[c]

Ambient Gamma Radiation	:	58
Radionuclides in Body	:	40
Global Fallout	:	<1
Radon	:	198
TOTAL mrem	:	296

a Located at Midland Drinking Water Intake

b Total liquid releases are from Site (combined Units 1 and 2)

c National Academy of Sciences, "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation", BEIR Report, 1990

Table 5-7. Results of Calculated Radiation Dose to Man - Liquid Releases

TABLE 5-7

Results of Calculated Radiation
Dose to Man - Liquid Releases

Organ	Maximum Exposure Hypothetical Real Individual mrem	BVPS Annual Limits mrem	Percent of Annual Limit
TOTAL BODY			
Adult	0.00161	6.0	0.027
Teen	0.00114	6.0	0.019
Child	0.00187	6.0	0.031
Infant	0.00174	6.0	0.029
ANY ORGAN			
Adult	0.00173 (Liver)	20.0	0.0086
Teen	0.00139 (Liver)	20.0	0.0069
Child	0.00216 (Liver)	20.0	0.0110
Infant	0.00188 (Thyroid)	20.0	0.0094

Maximum Total Body Dose - Capsule Summary

	mrem
1995 Calculated	0.00187
Unit 2 Updated Final Safety Analysis Report	3.5

Highest Organ Dose

1995 Calculated	0.00216
Unit 2 Updated Final Safety Analysis Report	4.7

c. Population Dose

The 1995 calculated dose to the entire population of almost 4 million people within 50 miles of the plant was:

Organ	Man-Millirems	Largest Isotope Contributor
TOTAL BODY	128	H-3 126 mrem
THYROID	137	H-3 126 mrem

3. Results of Calculated Radiation Dose to Man - Atmospheric Releases

The results of calculated radiation dose to the maximum exposed individuals for BVPS airborne radioactive effluents during 1995 are provided in Table 5-8. The doses include the contribution of all pathways. A 50-mile population dose is also calculated and provided in Table 5-8. H-3 is the primary radionuclide contributions to these doses.

The results are compared to the BVPS annual limits in Table 5-8. As in the liquid discharge limits, the gaseous effluent limits are reactor specific; i.e., Unit 1 and Unit 2 have reactor specific dose limits that are equal to the limits in 10 CFR Part 50, Appendix I. Therefore, the annual limits listed in Table 5-8 are specific to this report only, and were derived by multiplying the individual Technical Specification reactor limits by a factor of two (2). The results show compliance with the BVPS annual limits.

4. Conclusions

Based upon the estimated dose to individuals from the natural background radiation exposure in Table 5-6, the incremental increase in total body dose to the 50-mile population (4 million people), from the operation of Beaver Valley Power Station - Unit 1 and 2, is less than 0.0003% of the annual background.

The calculated doses to the public from the operation of Beaver Valley Power Station - Unit 1 and 2, are below BVPS annual limits and resulted in only a small incremental dose to that which area residents already received as a result of natural background. The doses constituted no meaningful risk to the public.

Table 5-8. Results of Calculated Radiation Dose to Man - Atmospheric Releases

TABLE 5-8

Results of Calculated Radiation Dose to Man - Atmospheric Releases

ORGAN	MAXIMUM EXPOSURE INDIVIDUAL mrem	BVPS ANNUAL LIMIT mrem	PERCENT OF ANNUAL LIMIT	50-MILE POPULATION DOSE man rem
TOTAL BODY	.664	30	2.20	2.91
SKIN	.678	30	2.26	0.28
LUNG	.689	30	2.30	2.95
THYROID	.674	30	2.25	2.96

APPENDIX I

Contractor Laboratory

EPA Interlaboratory

Comparison Program

EPA INTERLABORATORY COMPARISON PROGRAM

Teledyne Brown Engineering Environmental Services participates in the US EPA Interlaboratory Comparison Program to the fullest extent possible. That is, we participate in the program for all radioactive isotopes prepared and at the maximum frequency of availability. In this section, trending graphs (since 1981) and the 1994 and 1995 data summary tables are presented for isotopes in the various sample media applicable to the Duquesne Light Company's Radiological Environmental Monitoring Program. The footnotes of the table discuss investigations of problems encountered in a few cases and the steps taken to prevent reoccurrence.

EPA INTERLABORATORY COMPARISON PROGRAM 1994
Environmental

Collection Date	Media	Nuclide	EPA Result(a)		Teledyne Brown Engineering Result(b)		Deviation(c)	
01/14/94	Water	Sr-89	25.0 ±	5.0	24.00 ±	1.00	-0.35	
		Sr-90	15.0 ±	5.0	15.67 ±	1.53	0.23	
01/28/94	Water	Gr-Alpha	15.0 ±	5.0	21.67 ±	0.58	2.31	(d)
		Gr-Beta	62.0 ±	10.0	72.33 ±	3.79	1.79	
02/04/94	Water	I-131	119.0 ±	12.0	110.33 ±	0.00	-1.30	
02/11/94	Water	Ra-226	19.9 ±	3.0	21.00 ±	1.00	0.64	
		Ra-228	14.7 ±	3.7	15.67 ±	1.53	0.45	
03/04/94	Water	H-3	4936.0 ±	494.0	4833.33 ±	152.75	-0.36	
04/19/94	Water	Gr-Beta	117.0 ±	18.0	102.67 ±	6.43	-1.38	
		Sr-89	20.0 ±	5.0	19.00 ±	1.00	-0.35	
		Sr-90	14.0 ±	5.0	13.00 ±	0.00	-0.35	
		Co-60	20.0 ±	5.0	23.67 ±	3.21	1.27	
		Cs-134	34.0 ±	5.0	34.00 ±	1.73	0.00	
		Cs-137	29.0 ±	5.0	34.00 ±	2.65	1.73	
		Gr-Alpha	86.0 ±	22.0	78.00 ±	3.00	-0.63	
		Ra-226	20.0 ±	3.0	15.67 ±	1.53	-2.50	(e)
		Ra-228	20.1 ±	5.0	15.33 ±	0.58	-1.65	
06/10/94	Water	Co-60	50.0 ±	5.0	43.00 ±	2.00	-2.42	(f)
		Zn-65	134.0 ±	13.0	13.33 ±	0.58	-16.08	(g)
		Ru-106	252.0 ±	25.0	201.33 ±	9.29	-3.51	(h)
		Cs-134	40.0 ±	5.0	29.33 ±	3.79	-3.70	(i)
		Cs-137	49.0 ±	5.0	49.67 ±	1.53	0.23	
		Ba-133	98.0 ±	10.0	85.00 ±	3.00	-2.25	(j)
06/17/94	Water	Ra-226	15.0 ±	2.3	15.33 ±	0.58	0.25	
		Ra-228	15.4 ±	3.9	16.33 ±	1.53	0.41	
07/15/94	Water	Sr-89	30.0 ±	5.0	26.00 ±	1.73	-1.39	
		Sr-90	20.0 ±	5.0	19.00 ±	0.00	-0.35	
07/22/94	Water	Gr-Alpha	32.0 ±	8.0	25.33 ±	2.89	-1.44	
		Gr-Beta	10.0 ±	5.0	16.00 ±	0.00	2.08	(k)
08/05/94	Water	H-3	9951.0 ±	995.0	9700.00 ±	100.04	-0.44	
08/26/94	Air Filter	Gr-Alpha	35.0 ±	9.0	31.33 ±	2.08	-0.71	
		Gr-Beta	56.0 ±	10.0	59.33 ±	3.21	0.58	
		Sr-90	20.0 ±	5.0	18.00 ±	1.00	-0.69	
		Cs-137	15.0 ±	5.0	17.00 ±	1.73	0.69	
09/16/94	Water	U	35.0 ±	3.0	38.67 ±	0.58	2.12	(l)
		Ra-226	10.0 ±	1.5	10.67 ±	0.58	0.77	
		Ra-228	10.2 ±	2.6	9.70 ±	0.52	-0.33	

EPA INTERLABORATORY COMPARISON PROGRAM 1994
Environmental

Collection Date	Media	Nuclide	EPA Result(a)		Teledyne Brown Engineering Result(b)		Deviation(c)	
09/30/94	Milk	Sr-89	25.0 ±	5.0	24.33 ±	2.52	-0.23	
		Sr-90	15.00 ±	5.0	17.67 ±	1.53	0.92	
		I-131	75.0 ±	8.0	81.67 ±	5.86	1.44	
		Cs-137	59.0 ±	5.0	70.33 ±	4.62	3.93	(m)
		K	1715.0 ±	86.0	1740.00 ±	153.95	0.50	
10/07/94	Water	I-131	79.0 ±	8.0	71.00 ±	3.00	-1.73	
10/18/94	Water	Gr-Beta	142.0 ±	21.0	120.00 ±	0.00	-1.81	
		Sr-89	25.0 ±	5.0	24.67 ±	2.08	-0.12	
		Sr-90	15.0 ±	5.0	14.33 ±	1.15	-0.23	
		Co-60	40.0 ±	5.0	41.00 ±	1.00	0.35	
		Cs-134	20.0 ±	5.0	21.67 ±	1.53	0.58	
		Cs-137	39.0 ±	5.0	41.67 ±	2.31	0.92	
		Gr-Alpha	57.0 ±	14.0	51.33 ±	1.53	-0.70	
		Ra-226	9.9 ±	1.5	11.33 ±	0.58	1.66	
		Ra-228	10.1 ±	2.5	9.33 ±	0.58	-0.53	
10/28/94	Water	Gr-Alpha	57.0 ±	14.0	47.00 ±	3.00	-1.24	
		Gr-Beta	23.0 ±	5.0	25.33 ±	1.53	0.81	
11/04/94	Water	Co-60	59.0 ±	5.0	52.00 ±	0.00	-2.42	(n)
		Zn-65	100.0 ±	10.0	81.33 ±	7.02	-3.23	(n)
		Cs-134	24.0 ±	5.0	19.67 ±	2.52	-1.50	
		Cs-137	49.0 ±	5.0	54.33 ±	2.31	1.85	
		Ba-133	73.0 ±	7.0	58.33 ±	2.89	-3.63	(n)

Footnotes:

(a) EPA Results-Expected laboratory precision (1 sigma). Units are pCi/liter for water and milk except K is in mg/liter. Units are total pCi for air particulate filters.

(b) Teledyne Results - Average ± one sigma. Units are pCi/liter for water and milk except K is in mg/liter. Units are total pCi for air particulate filters.

(c) Normalized deviation from the known.

(d) There appears to be variation in self-absorption matrix. The EPA confirms that the composition of their tap water from Lake Mead, varies seasonally which can cause variation in alpha, beta results. No corrective action required at this time since results are within ± 3 sigma control limits.

(e) No specific or apparent reason found. Data sheets verified and detector efficiencies calibrated. Will exert extra care in making dilutions and using correct sample type on concentration of acids. Will check future samples to see if a pattern develops.

EPA IN'ERLABORATORY COMPARISON PROGRAM 1994
Environmental

Collection Date	Media	Nuclide	EPA Result(a)	Teledyne Brown Engineering Result(b)	Deviation(c)

(f) A second aliquot was analyzed, paying particular attention to volume aliquoted. The result, 52 pCi/l, was in good agreement with the EPA. The three original results, each counted on a different detector, showed good precision. The measurement of Co-60 has not been a problem. Future EPA cross-checks will be weighed and results followed to check for a possible trend "out of control".

(g) The average value of three analyses on the "Report of Analysis" was 133 pCi/liter which is in good agreement with the EPA. Apparently, incorrect results were entered into the EPA computer. Future data will be printed from the computer screen to check entries.

(h) The EPA has indicated that the Radiation Quality Assurance Program has been experiencing problems with the ruthenium-106 analysis. See attached letter from EPA.

(i) The first aliquot, prepared according to EPA dilution instructions was counted on four detectors in the 1 liter Marinelli geometry with Cs-134 results (based on the 796 KeV peak) in pCi/l of 32.0, 25.1, 31.7, and 30.8. The 31.7 result was not reported. Had that been reported instead of 25.1, the average would have been 31.5 and the normalized deviation would have been -2.94 instead of -3.70. A second aliquot was prepared and a single measurement was made with the result of 31.1 pCi/l. An undiluted aliquot was measured in a 150 ml geometry with the result of 33.5 pCi/l. That result is comparable with the Marinelli results. Thus none of : sample preparation (dilution, volume determination, maintaining correct pH, etc.), sample geometry, or detector efficiency seem to be the cause of the low results.

(j) There is no apparent reason for the low result, however the average value, 85 pCi/l is in good agreement to the grand average (86.46). No corrective action planned.

(k) EPA results for gross beta in water were corrected for 20% crosstalk into the beta channel from the Th-230 alpha spike. Recent measurements show that the crosstalk can be much higher (37% for Tennelec counter #3 and 54% for gamma products counter #1). The normalized deviation from the grand average was only 0.38. Future results will be corrected with specific crosstalk values determined by counting Th-230 standards.

(l) Possible aliquoting error. The instrument calibration, spike, and blank results all appear normal. No procedural changes are planned. Previous results were well within one normalized deviation. Future measurements will be reviewed to determine if a trend in results above the two sigma warning limit is occurring.

(m) The milk sample was counted four times. The reported Cs-137 values were based on one aliquot of 1 liter volume and an aliquot of 0.865 liter counted two times. It is suspected that the 0.865 liter volume was incorrectly determined. If 1 liter (the usual volume for counting milk samples) is used in the calculation, then the average of three results equals 63.6 pCi/l which gives a normalized deviation to the Known of 1.59. The fourth count (a 1 liter aliquot) had a Cs-137 equal to 64.2 pCi/l which is in good agreement with the average of the other three. Teledyne will set up a log for recording aliquots used for EPA samples and record how the aliquot volume was determined.

Collection Date	Media	Nuclide	EPA Result(a)	Teledyne Brown Engineering Result(b)	Deviation(c)

(n) The EPA requires that water samples be diluted before gamma analysis. That imposes a feature not appropriate for the handling of environmental samples. As in the 06/10/94 water sample, it appears that the first aliquot may not have been accurately prepared. A second aliquot was prepared and counted three times with results in pCi/l and normalized deviation of:

Co-60	60.6	+0.55
Zn-65	100.	0.0
Cs-134	22.9	-0.38
Cs-137	58.5	+3.29
Ba-133	69.8	-0.79

Four of the five are now in good agreement with the EPA results. The Cs-137 is high, but within the control limits when compared to the grand average deviation of all laboratories of 2.89. The grand average was 51.9 pCi/l. For future samples of this type we will have two technicians each prepare an aliquot and compare the counting results to check for preparation technique differences.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
ENVIRONMENTAL MONITORING SYSTEMS LABORATORY-LAS VEGAS
P O BOX 93478
LAS VEGAS NEVADA 89193-3478
(702/798-2100 · FTS 545-2100)

Dear Participant:

The Radiation Quality Assurance Program has been experiencing problems with the Ruthenium-106 currently used in the Performance Evaluation (PE) Studies and in the Standards Distribution Program. If these problems can be satisfactorily resolved, this analyte will once again be placed into this PE Study. If the problems cannot be resolved, the Ruthenium-106 will be replaced.

Formal written notice will be given to all participants that are enrolled in the Gamma in Water PE Study before the Ruthenium-106 is reintroduced or replaced. At that time, new calibration standards will be available to all participants in the Gamma in Water PE Study.

Sincerely,

George Dilbeck

George Dilbeck
[illegible]st
P[illegible]mance Evaluation Program
Ra[illegible]alysis Branch (RSA-RADQA)

DUQUESNE

EPA INTERLABORATORY COMPARISON PROGRAM 1995

EPA Preparation	Date TI Mailed Re sults	Date EPA Issued Results	Media	Nuclide	EPA Results(a)	TI Results(b)	Norm Dev. (Known)(c)	**Warning ***Action
01/13/95	03/24/95	04/21/95	Water	Sr-89	20.0 ± 5.0	19.00 ± 2.65	-0.35	
				Sr-90	15.0 ± 5.0	14.00 ± 0.00	-0.35	
01/27/95	03/24/95	03/24/95	Water	Gr-Alpha	5.0 ± 5.0	5.00 ± 1.00	0.00	
				Gr-Beta	5.0 ± 5.0	6.00 ± 1.00	0.35	
02/03/95	03/20/95	04/21/95	Water	I-131	100.0 ± 10.0	88.33 ± 2.31	-2.02	** (d)
02/10/95	04/07/95	05/23/95	Water	Ra-226	19.1 ± 2.9	20.67 ± 0.58	0.94	
				Ra-228	20.0 ± 5.0	18.67 ± 0.58	-0.46	
03/10/95	04/06/95	05/19/95	Water	H-3	7435.0 ± 744.0	7066.67 ± 115.47	-0.86	
03/17/95	05/12/95	06/05/95	Water	Pu-239	11.1 ± 1.1	10.33 ± 0.58	-1.21	
04/18/95	06/30/95	08/18/95	Water	Gr-Beta	86.6 ± 10.0	80.33 ± 2.52	-1.09	
				Sr-89	20.0 ± 5.0	20.67 ± 1.15	0.23	
				Sr-90	15.0 ± 5.0	14.67 ± 0.58	-0.12	
				Co-60	29.0 ± 5.0	31.67 ± 2.08	0.92	
				Cs-134	20.0 ± 5.0	19.67 ± 1.73	-0.12	
				Cs-137	11.0 ± 5.0	11.67 ± 1.53	0.23	
				Gr-Alpha	47.5 ± 11.9	39.67 ± 2.52	-1.14	
				Ra-226	14.9 ± 2.2	15.67 ± 0.58	0.60	
				Ra-228	15.8 ± 4.0	13.00 ± 1.73	-1.21	
06/09/95	08/09/95	02/26/96	Water	Co-60	40.0 ± 5.0	42.33 ± 2.52	0.81	
				Zn-65	76.0 ± 8.0	82.33 ± 3.51	1.37	
				Cs-134	50.0 ± 5.0	46.67 ± 2.08	-1.15	
				Cs-137	35.0 ± 5.0	37.67 ± 1.15	0.92	
				Ba-133	79.0 ± 8.0	74.33 ± 2.08	-1.01	
06/16/95	08/09/95	09/05/95	Water	Ra-226	14.8 ± 2.2	15.00 ± 0.00	0.16	
				Ra-228	15.0 ± 3.8	14.00 ± 0.00	-0.46	
07/14/95	08/09/95	09/05/95	Water	Sr-89	20.0 ± 5.0	18.33 ± 1.53	-0.58	
				Sr-90	8.0 ± 5.0	8.0 ± 0.00	0.00	
07/21/95	08/18/95	09/27/95	Water	Gr-Alpha	27.5 ± 6.9	18.33 ± 1.53	-2.30	** (e)
				Gr-Beta	19.4 ± 5.0	19.33 ± 1.53	-0.02	
08/04/95	09/01/95	09/29/95	Water	H-3	4872.0 ± 487.0	4866.67 ± 152.75	-0.02	

Footnotes at end of table.

DUQUESNE

EPA INTERLABORATORY COMPARISON PROGRAM 1995

EPA Preparation	Date TI Mailed Results	Date EPA Issued Results	Media	Nuclide	EPA Results(a)	TI Results(b)	Norm Dev. (Known)	**Warning ***Action
08/25/95	10/21/95	02/29/96	Air Filter	Gr-Alpha	25.0 ± 6.3	23.67 ± 1.53	-0.37	
				Gr-Beta	86.6 ± 10.0	84.67 ± 1.53	-0.33	
				Sr-90	30.0 ± 5.0	25.33 ± 0.58	-1.62	
				Cs-137	25.0 ± 5.0	27.00 ± 1.00	0.69	
09/15/95	11/10/95	02/26/96	Water	Ra-226	24.8 ± 3.7	27.33 ± 1.15	1.19	
				Ra-228	20.0 ± 5.0	14.67 ± 0.58	-1.85	
09/29/95	11/28/95	02/29/96	Milk	Sr-89	20.0 ± 5.0	23.33 ± 3.06	1.15	
				Sr-90	15.00 ± 5.0	16.33 ± 0.58	0.46	
				I-131	99.0 ± 10.0	103.33 ± 5.77	0.75	
				Cs-137	50.0 ± 5.0	54.67 ± 2.52	1.62	
				Total K	1654.0 ± 83.0	1683.33 ± 136.50	0.61	
10/06/95	11/10/95	02/26/96	Water	I-131	148.0 ± 15.0	150.00 ± 0.00	0.23	
10/27/95	12/01/95	03/04/96	Water	Gr-Alpha	51.2 ± 12.8	37.00 ± 3.00	-1.92	
				Gr-Beta	24.8 ± 5.0	25.33 ± 1.53	0.18	

Footnotes:

(a) Average ± experimental sigma.

(b) Expected laboratory precision (1 sigma, 1 determ on)

(c) Normalized deviation from the known.

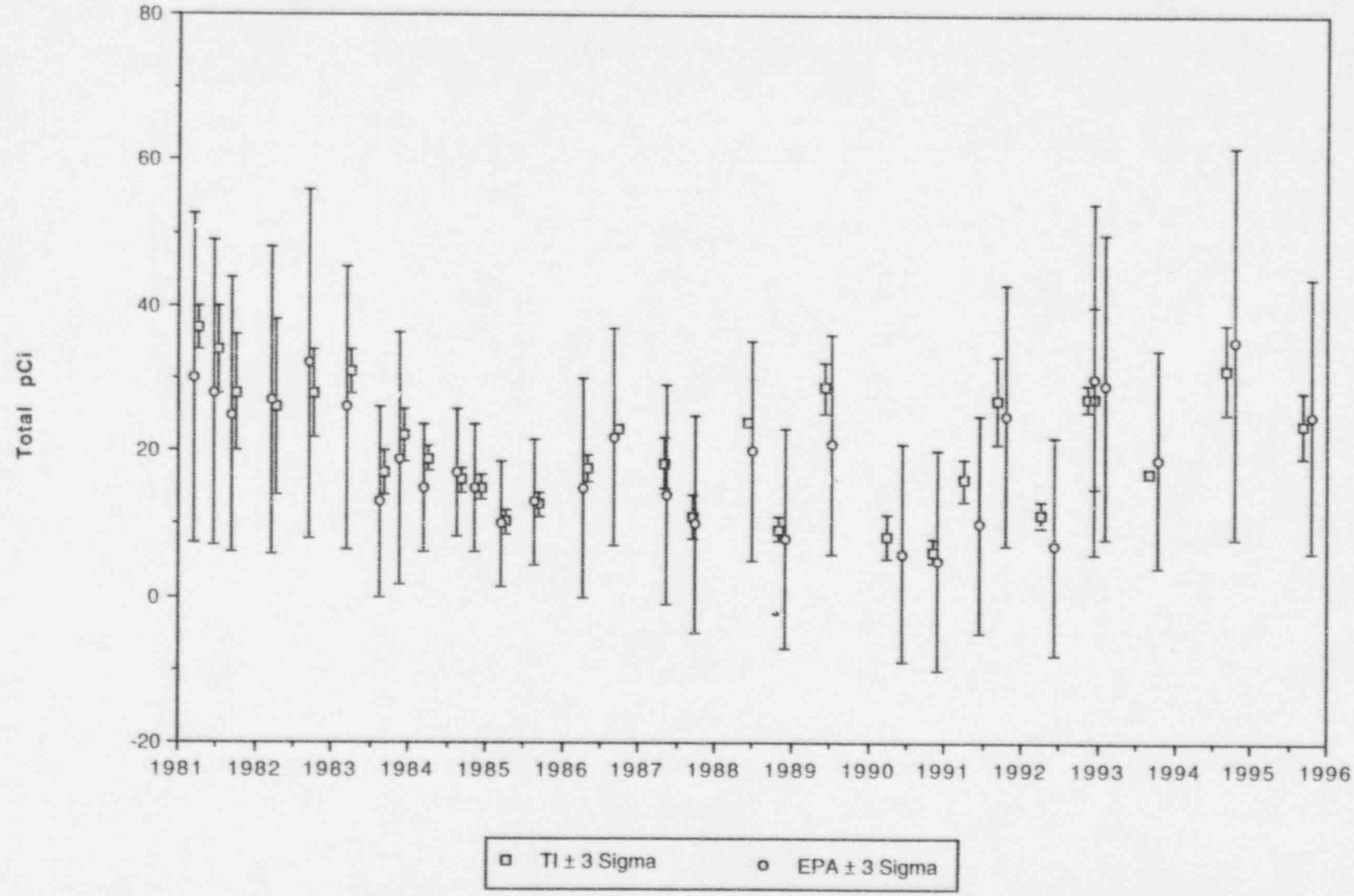
(d) An investigation is being conducted; results will be available shortly.

(d) The normalized deviation marginally exceeded the warning level and an apparent trend in the results appeared. The cause was a probable high bias in the beta counting efficiency. Check source control charts did not indicate any changes in the counting equipment, so the I-131 calibration was suspected. New I-131 calibrations were performed July 3 through 6, 1995 after receiving a new standard from the EPA. The intercomparison sample data sheets were recalculated with the new efficiencies and the average result was in excellent agreement with the EPA (96 pCi/l versus the EPA value of 100 pCi/l). The discrepancy in the I-131 efficiency between the current calibration and the previous one (aside from the uncertainty in the standard) appears to be an abnormally low yield in the preparation of the standard for the older calibration which created a high bias in the counter efficiencies. The bias was less than ten percent, therefore further corrective action or revision of previously reported data is deemed not necessary.

(e) The mineral salt content of the water used by the EPA to prepare the samples has been shown to vary substantially throughout the year. Absorption curves to account for mount weight may vary from the true absorption characteristics of a specific sample. Previous results do not indicate a trend toward "out of control" for gross alpha/beta analysis and the normalized deviation from the grand average is only -0.36. The normalized deviation from the known for TBE-ES does not exceed three standard deviation and internal spikes have been in control. No corrective action is planned at this time.

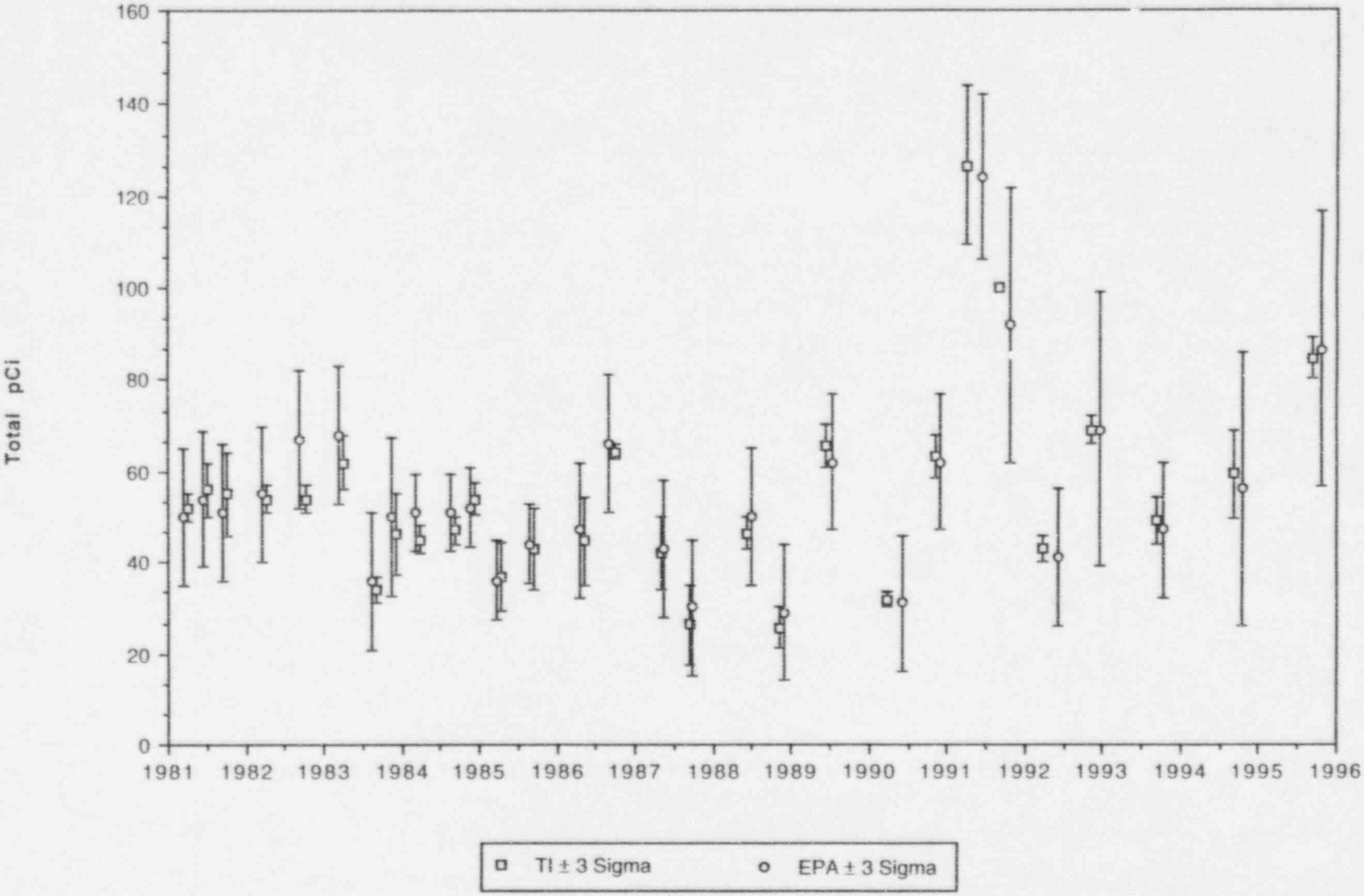
EPA CROSS CHECK PROGRAM

GROSS ALPHA IN AIR PARTICULATES (pg. 1 of 1)



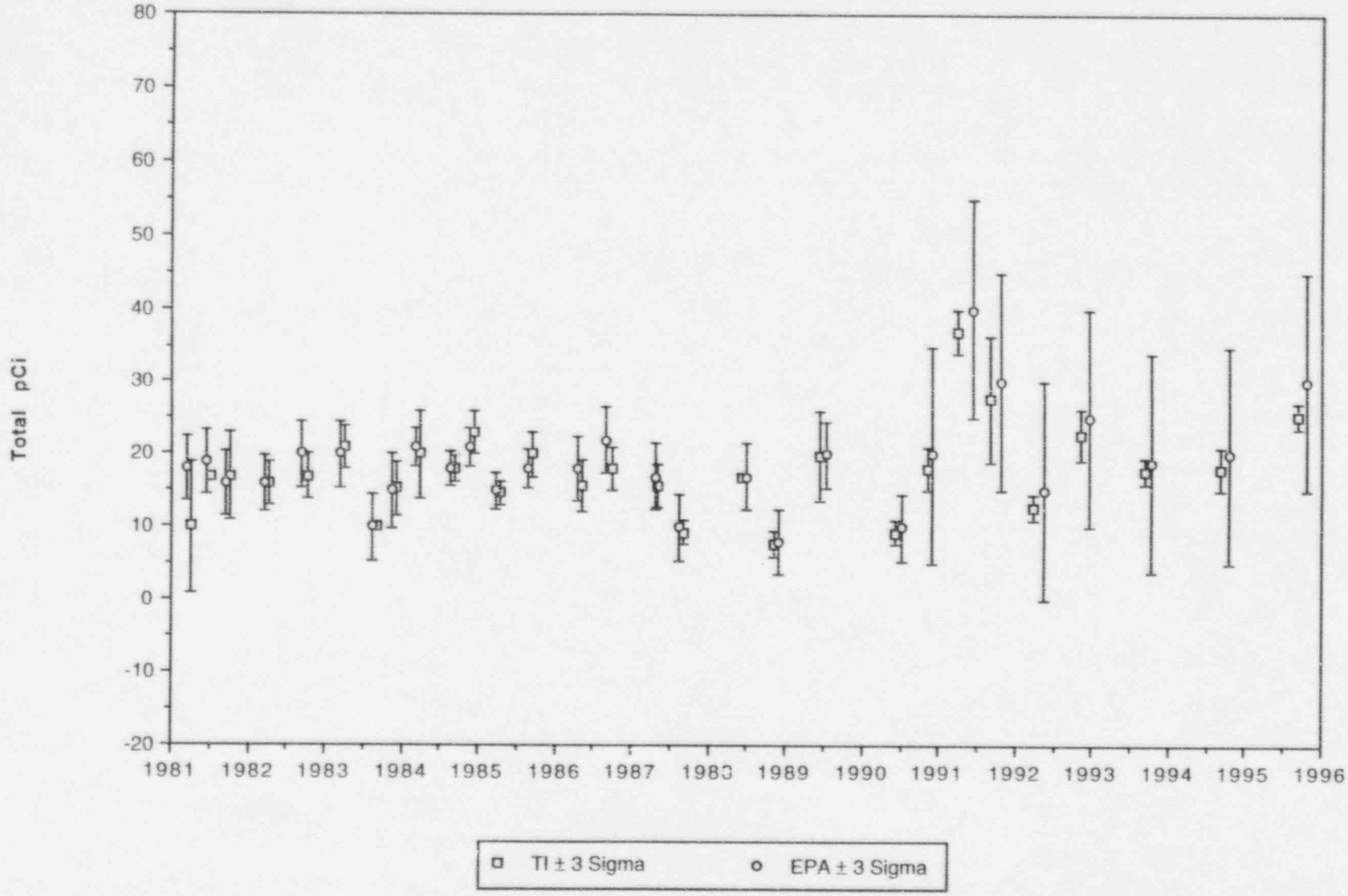
EPA CROSS CHECK PROGRAM

GROSS BETA IN AIR PARTICULATES (pg. 1 of 1)



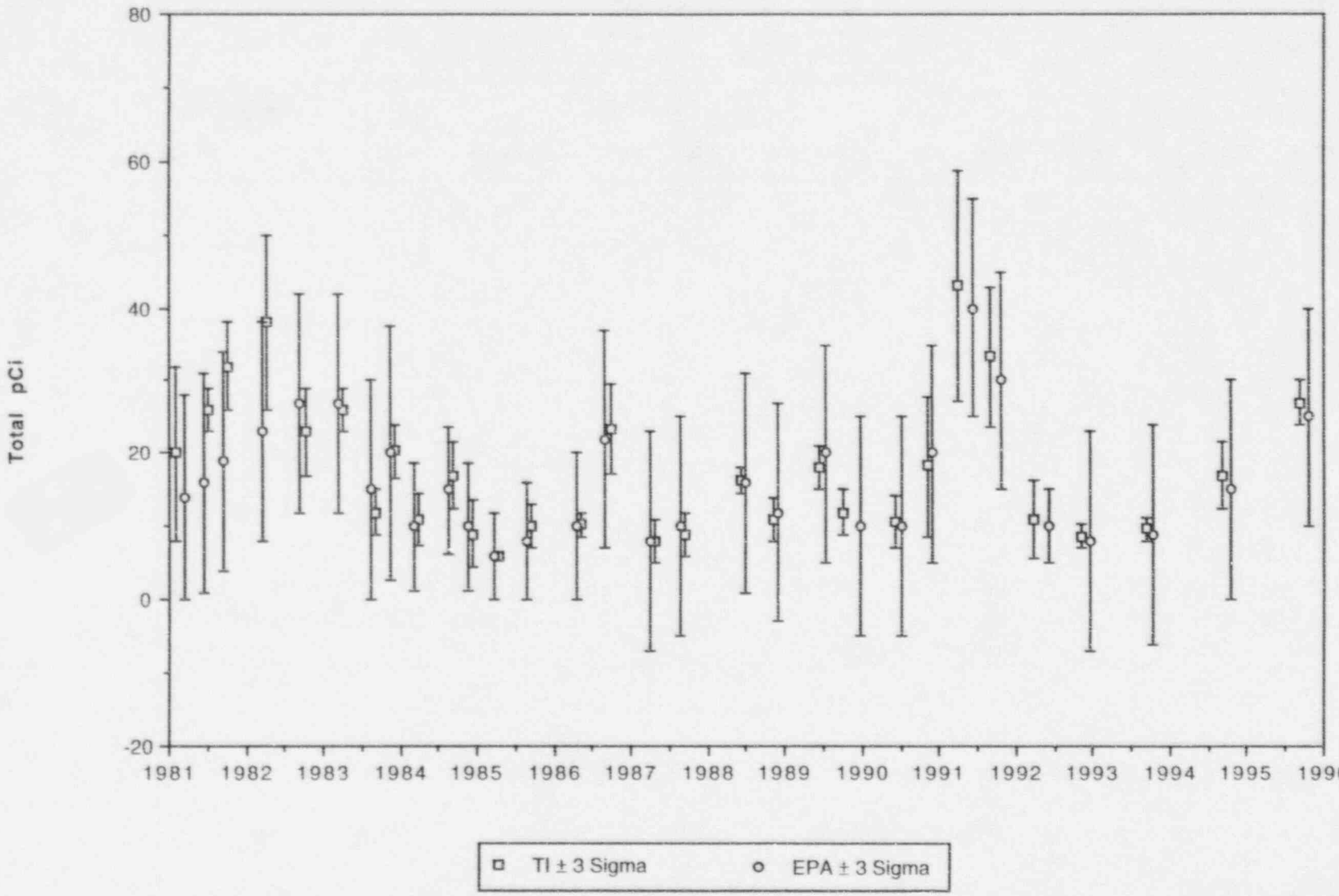
EPA CROSS CHECK PROGRAM

STRONTIUM-90 IN AIR PARTICULATES (pg. 1 of 1)



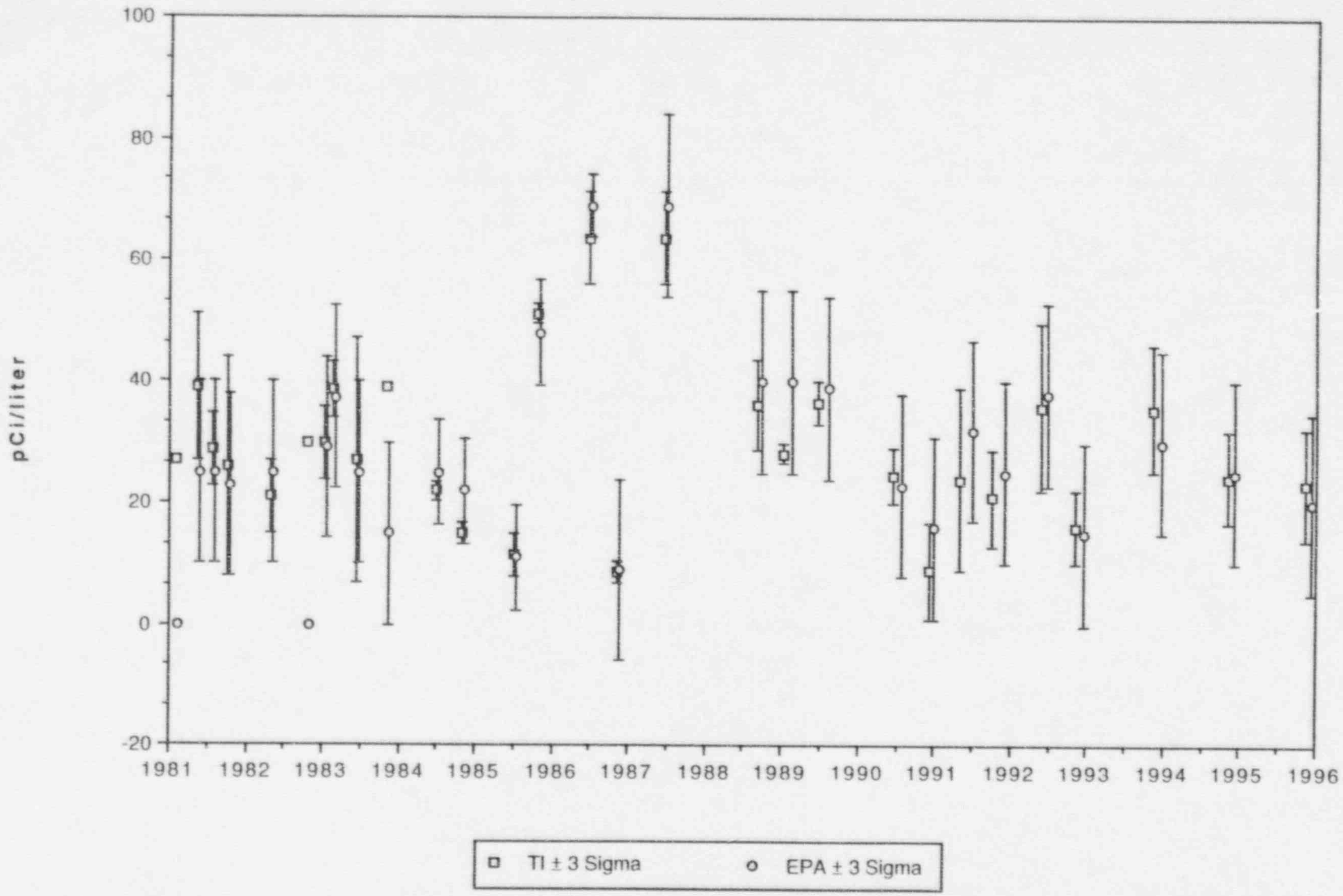
EPA CROSS CHECK PROGRAM

CESIUM-137 IN AIR PARTICULATES (pg. 1 of 1)



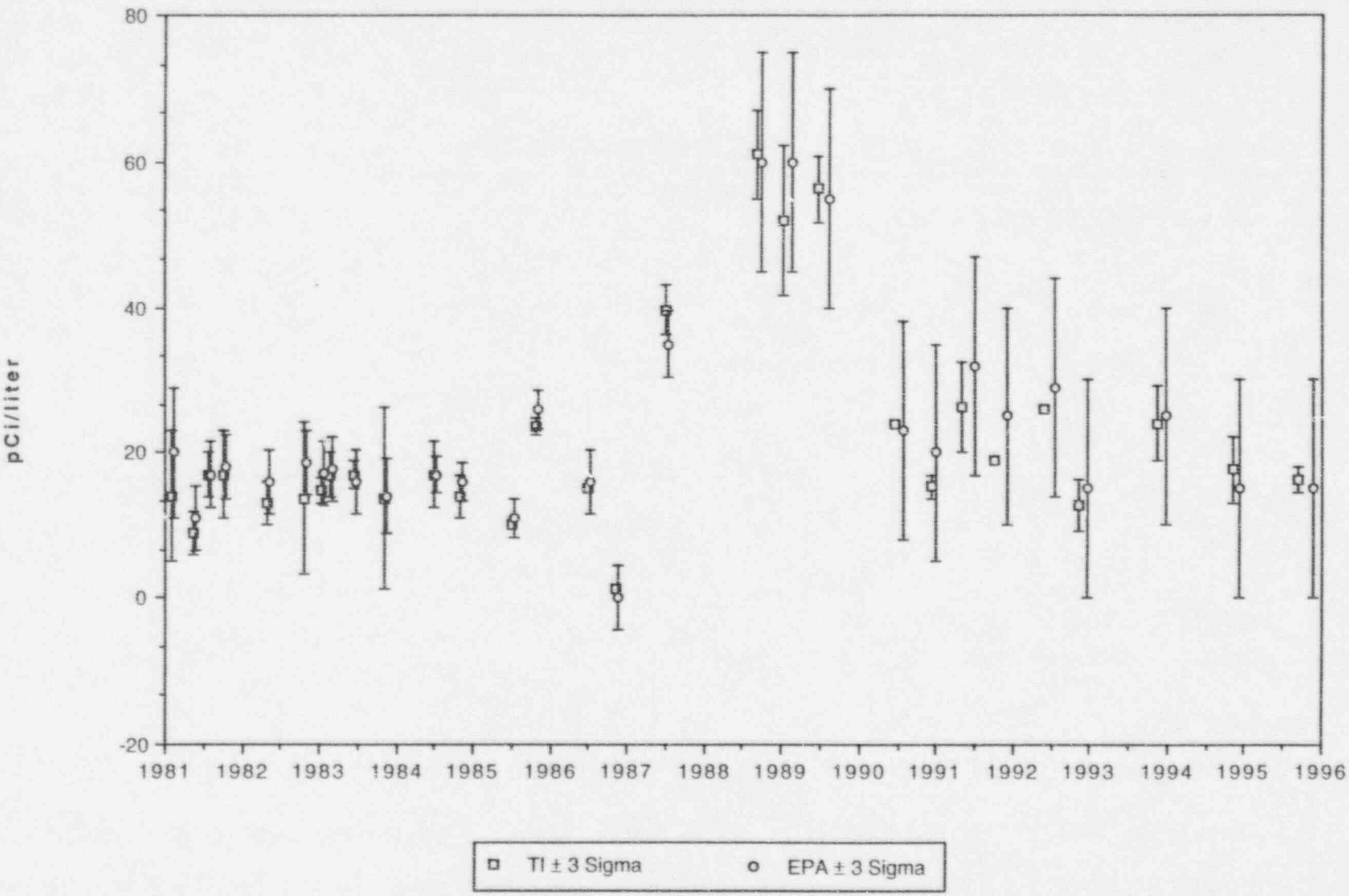
CROSS CHECK PROGRAM

STRONTIUM-89 IN MILK (pg. 1 of 1)



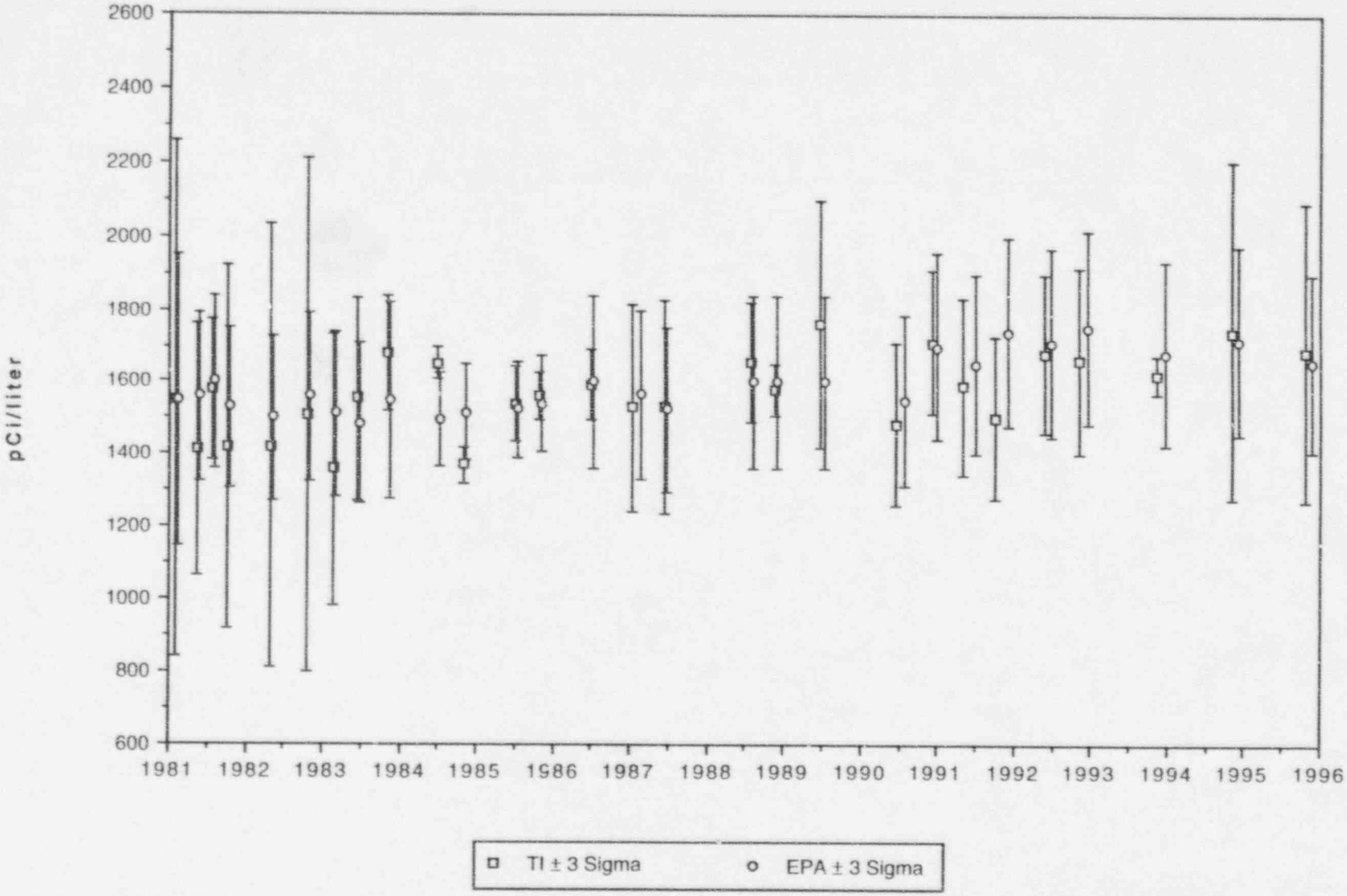
EPA CROSS CHECK PROGRAM

STRONTIUM-90 IN MILK (pg. 1 of 1)



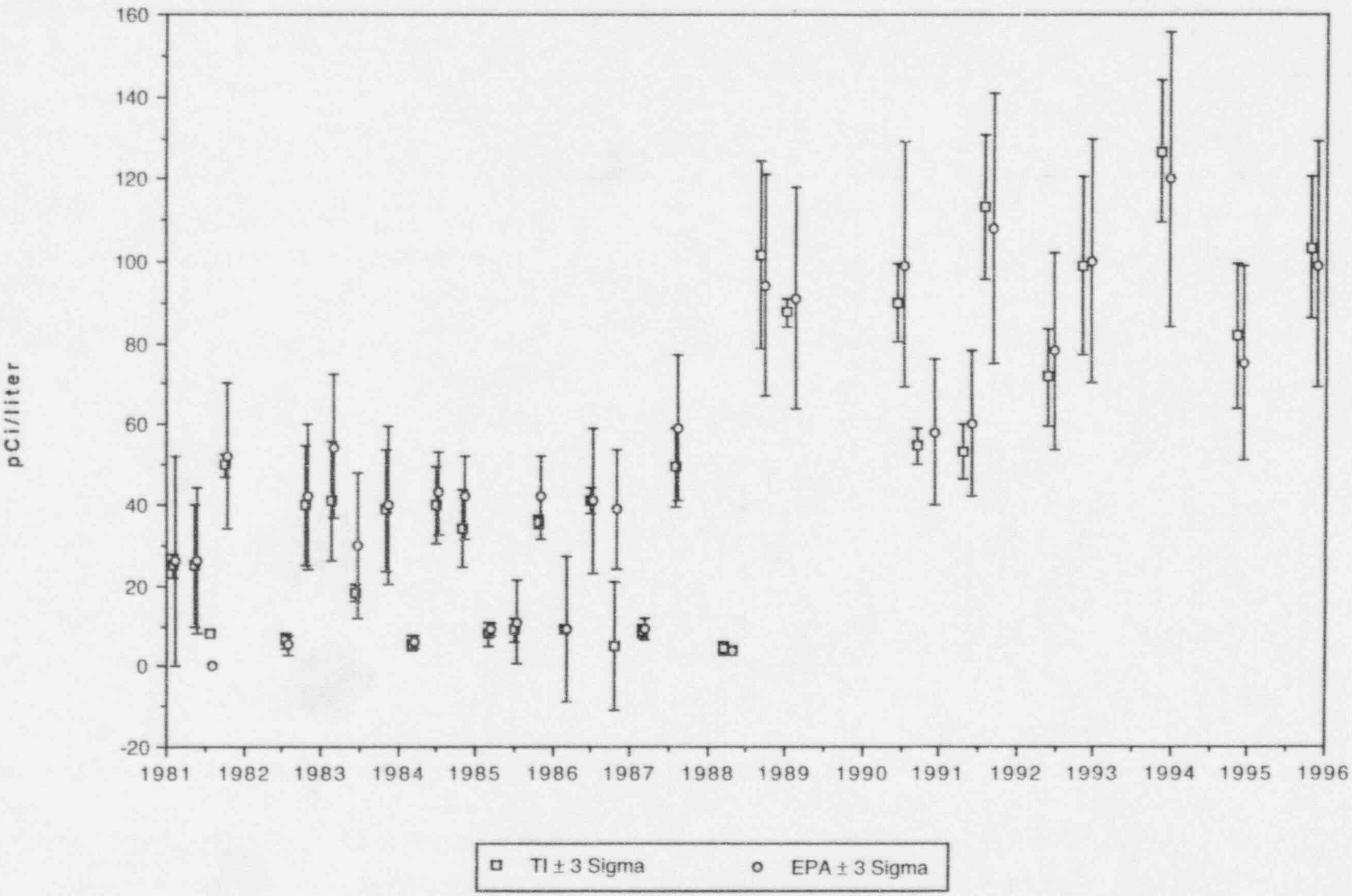
EPA CROSS CHECK PROGRAM

POTASSIUM-40 IN MILK (pg. 1 of 1)



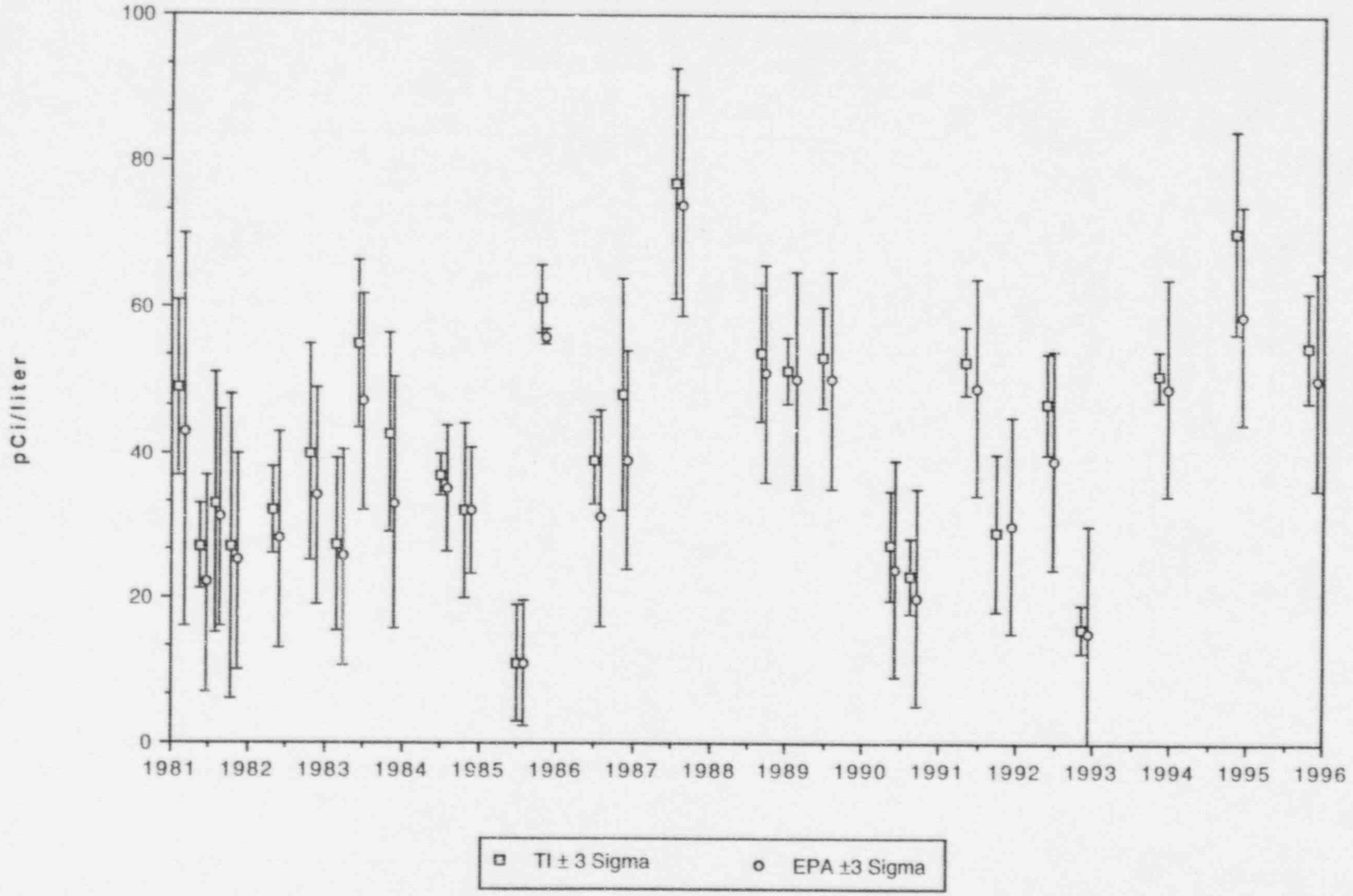
EPA CROSS CHECK PROGRAM

IODINE-131 IN MILK (pg. 1 of 1)



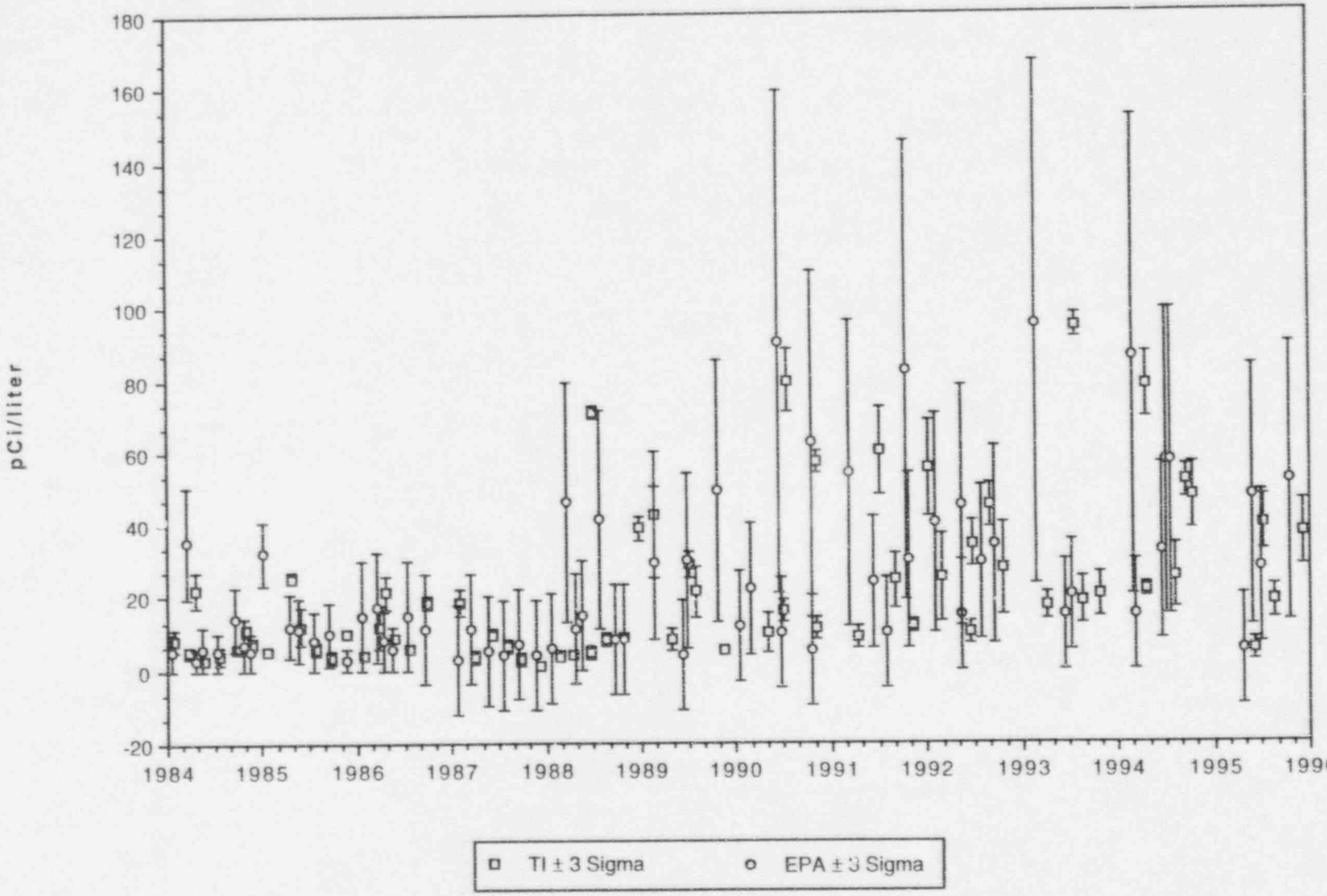
EPA CROSS CHECK PROGRAM

CESIUM-137 IN MILK (pg. 1 of 1)



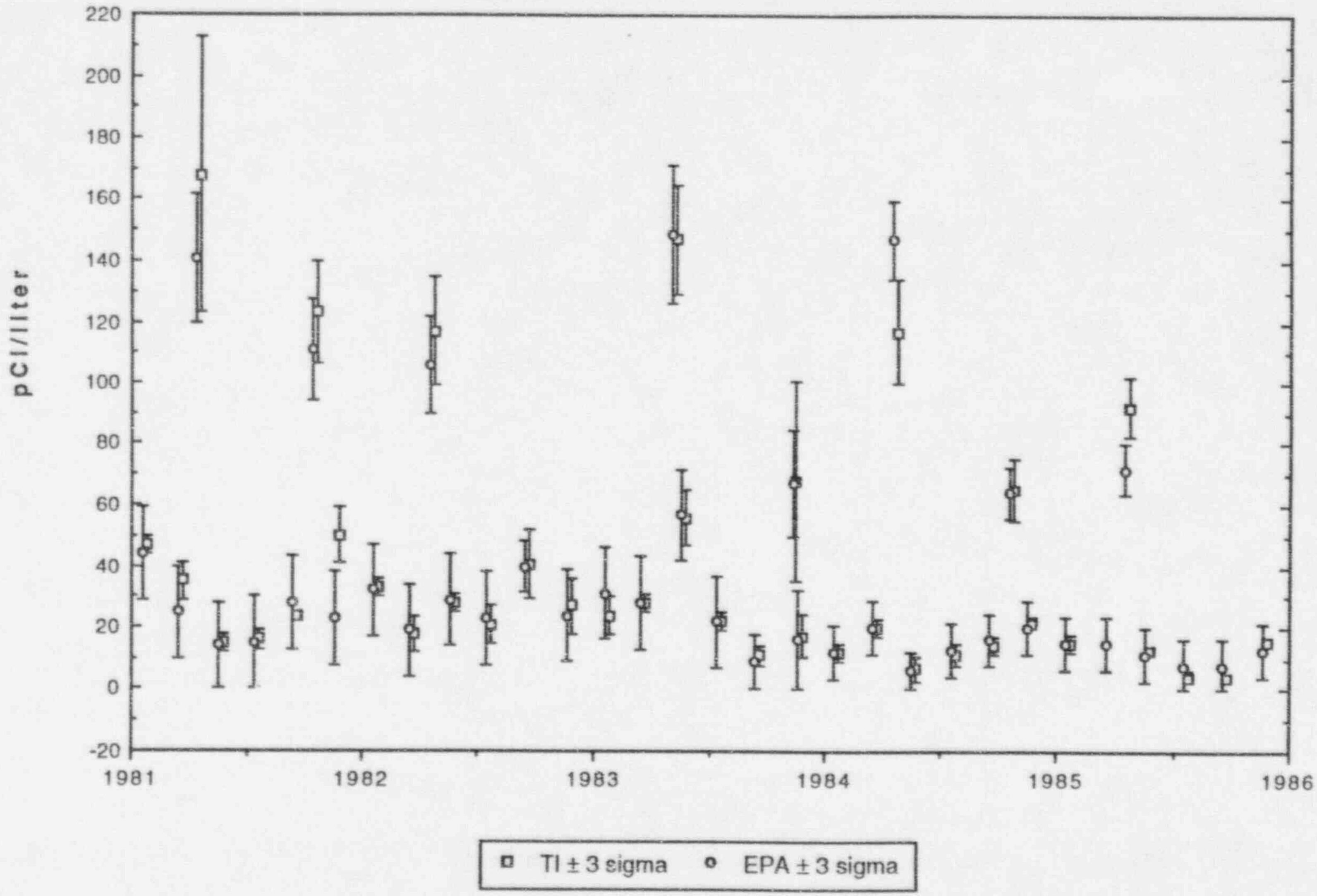
EPA CROSS CHECK PROGRAM

GROSS ALPHA IN WATER (pg. 1 of 1)



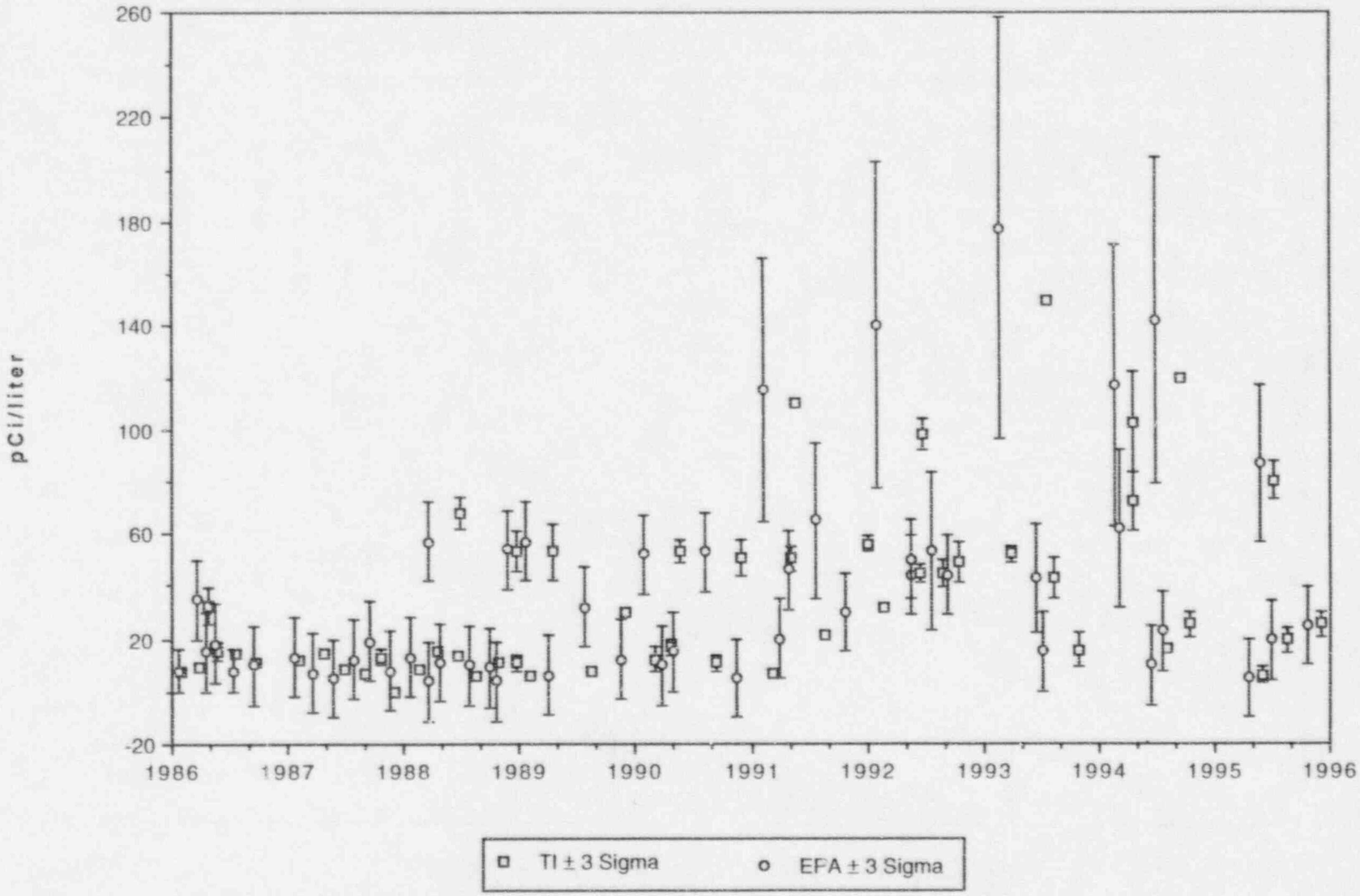
EPA CROSS CHECK PROGRAM

GROSS BETA IN WATER (pg. 1 of 2)



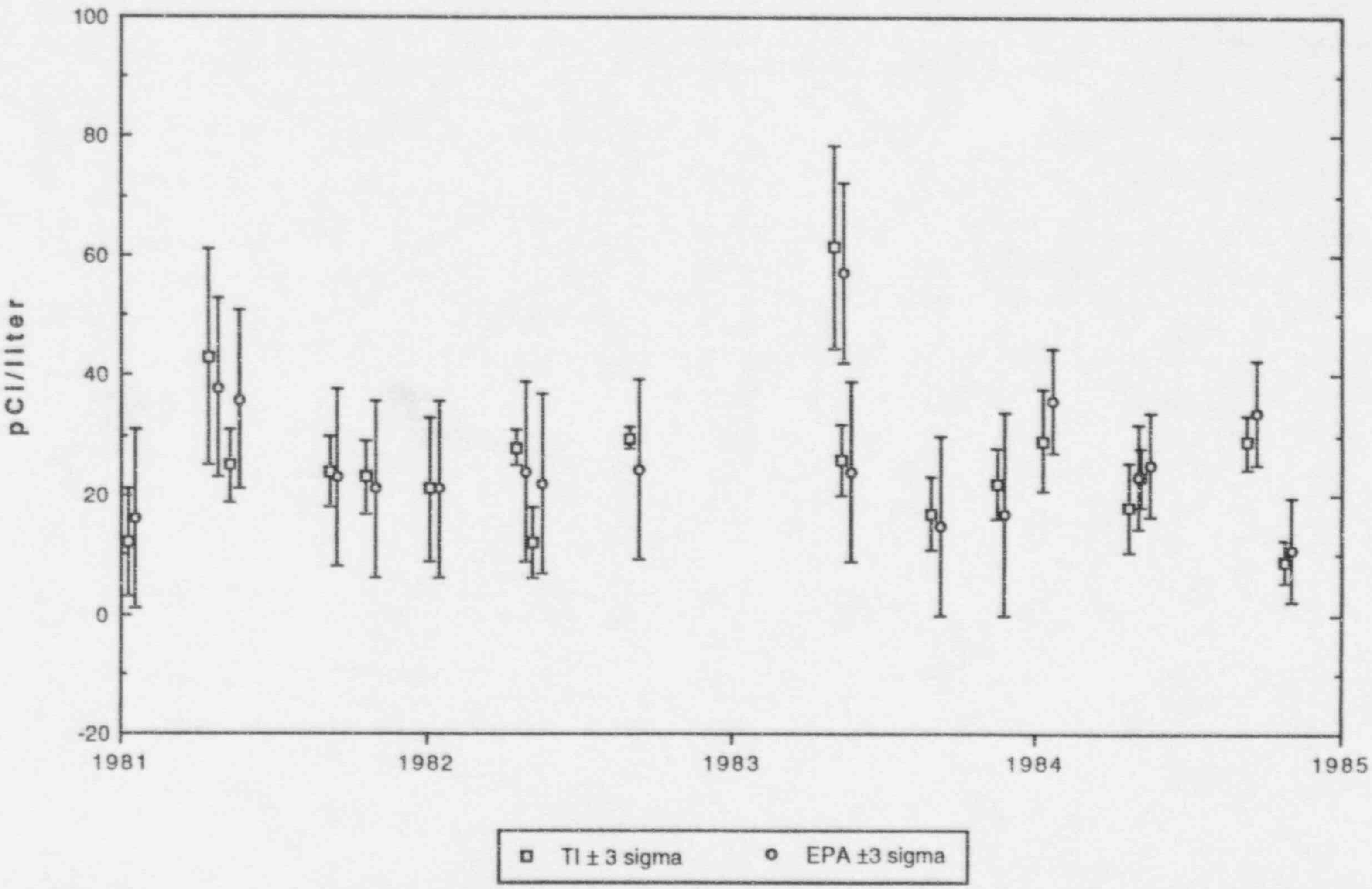
EPA CROSS CHECK PROGRAM

GROSS BETA IN WATER (pg. 2 of 2)



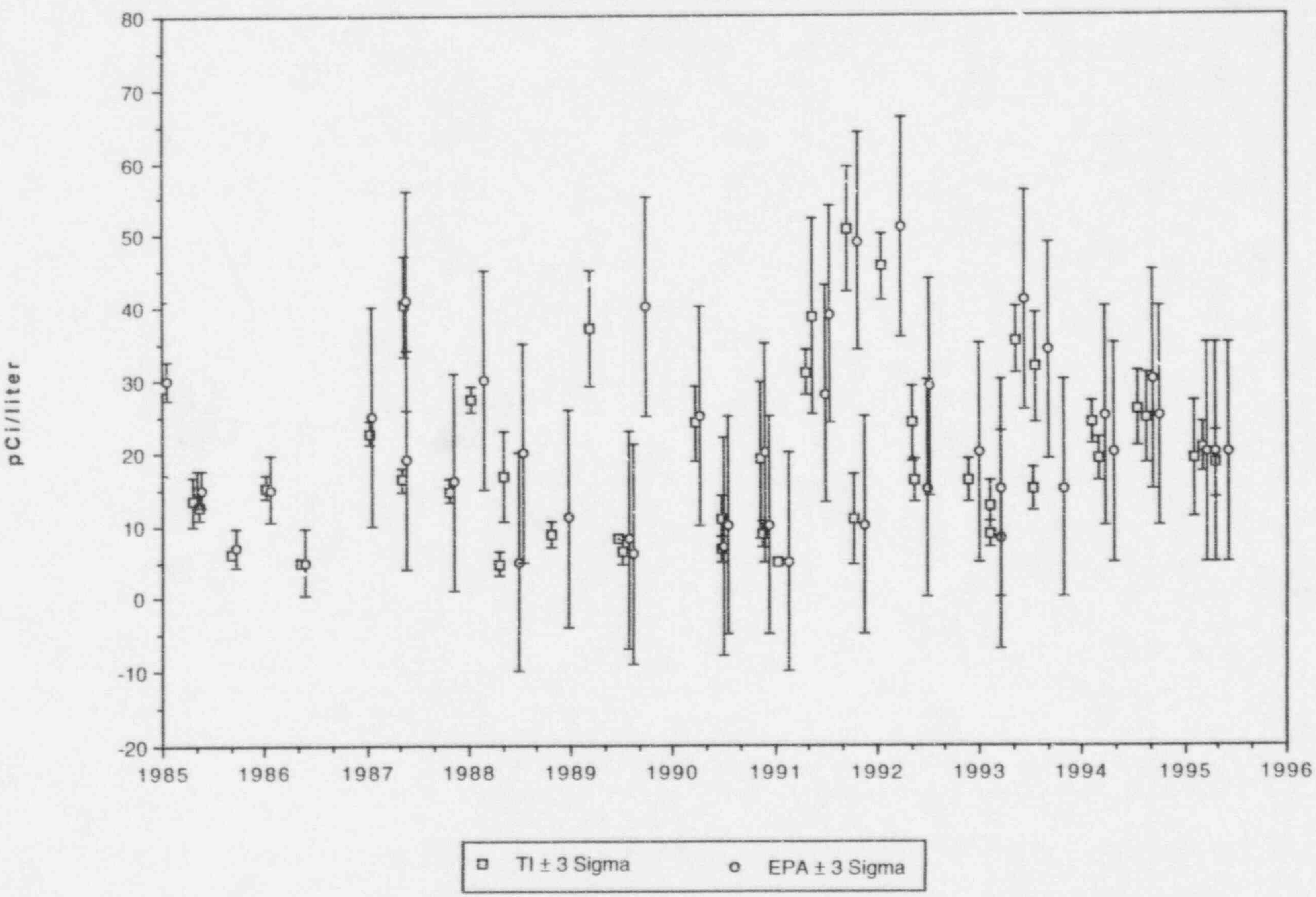
EPA CROSS CHECK PROGRAM

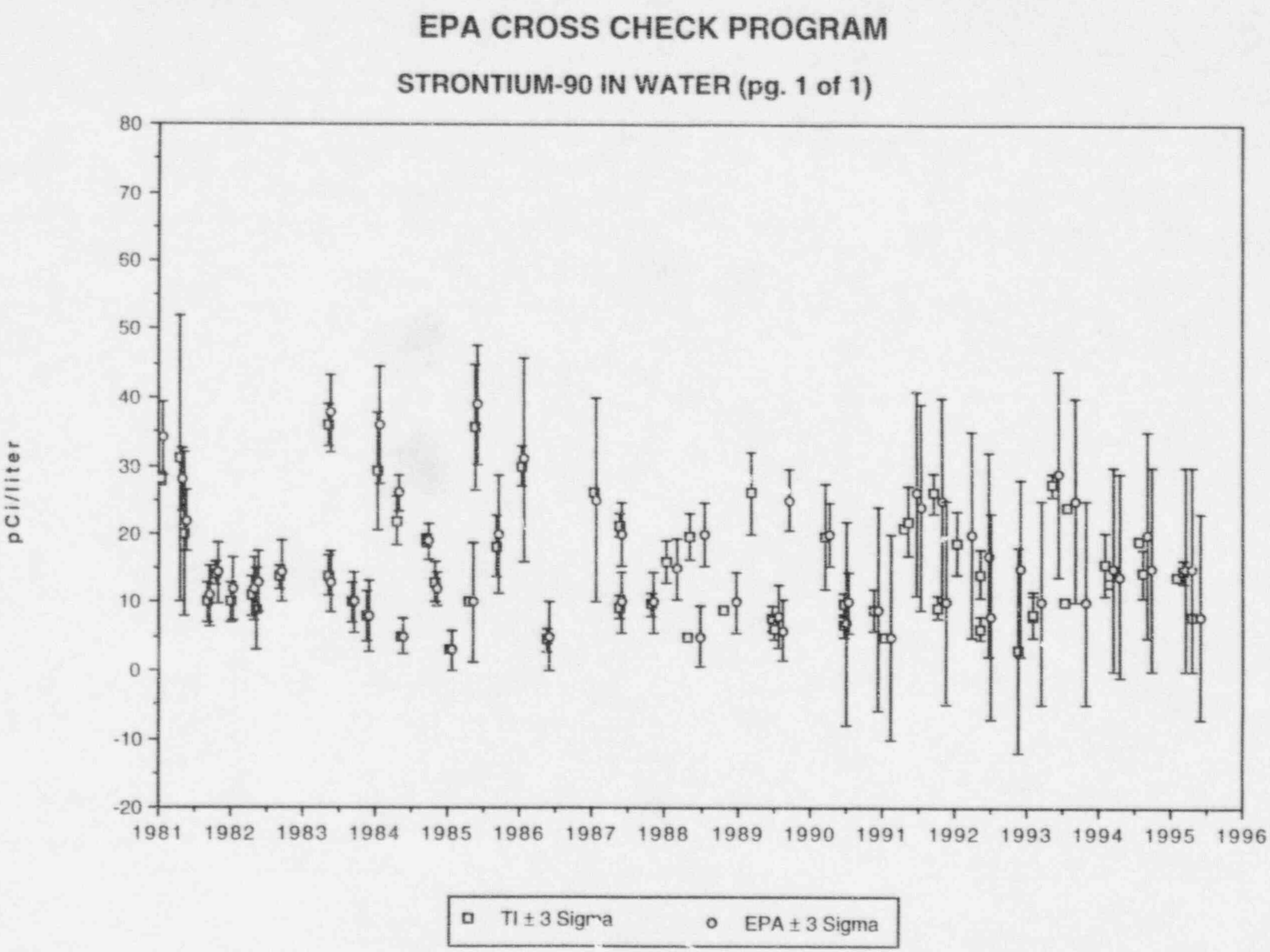
STRONTIUM-89 IN WATER (pg. 1 of 2)



EPA CROSS CHECK PROGRAM

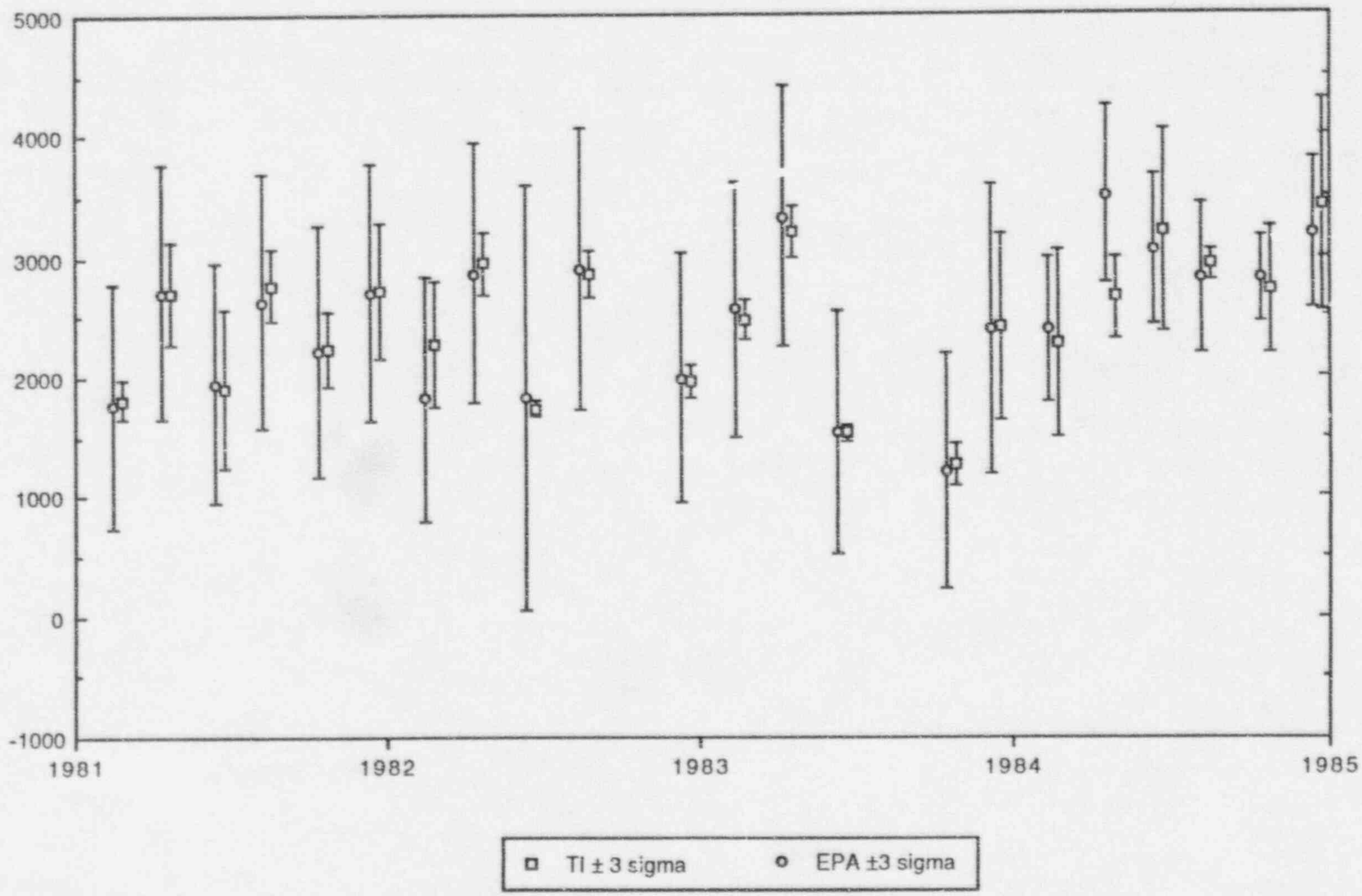
STRONTIUM-89 IN WATER (pg. 2 of 2)

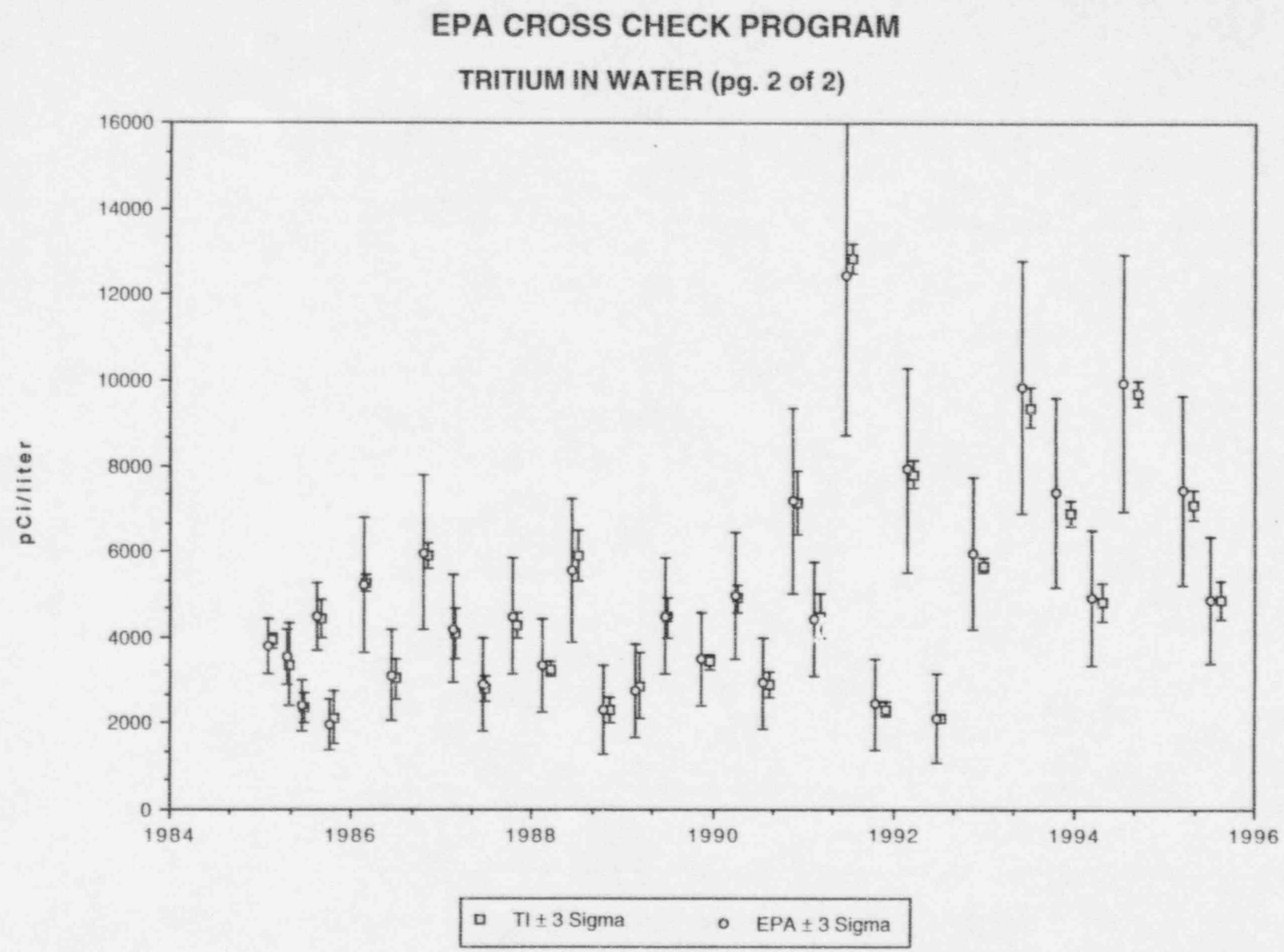



EPA CROSS CHECK PROGRAM
STRONTIUM-90 IN WATER (pg. 1 of 1)
pCi/liter
80
70
60
50
40
30
20
10
0
-10
-20
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
TI ± 3 Sigma
EPA ± 3 Sigma

EPA CROSS CHECK PROGRAM

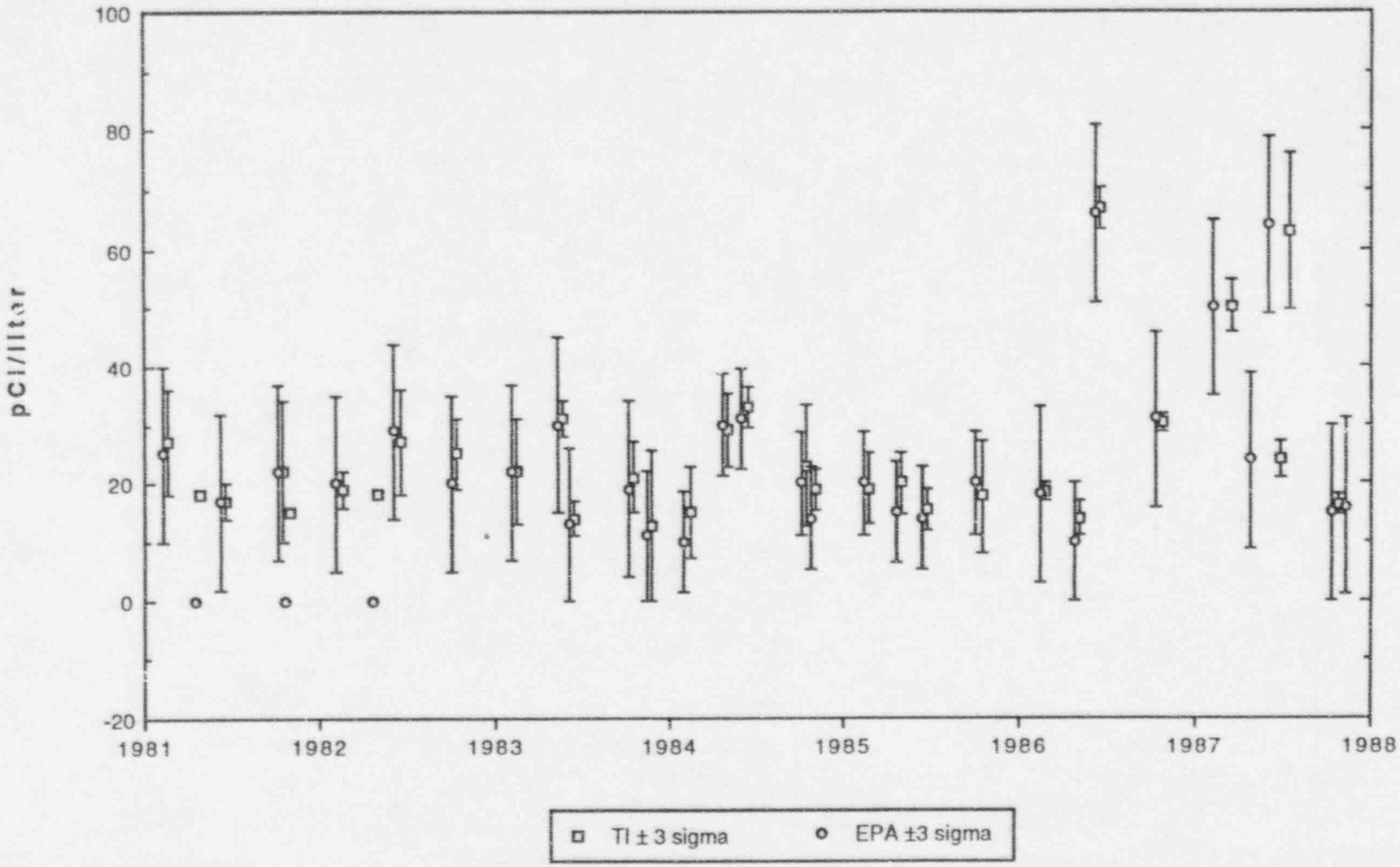
TRITIUM IN WATER (pg. 1 of 2)




EPA CROSS CHECK PROGRAM
TRITIUM IN WATER (pg. 2 of 2)
16000
14000
12000
10000
8000
6000
4000
2000
0
pCi/liter
1984
1986
1988
1990
1992
1994
1996
TI ± 3 Sigma
EPA ± 3 Sigma

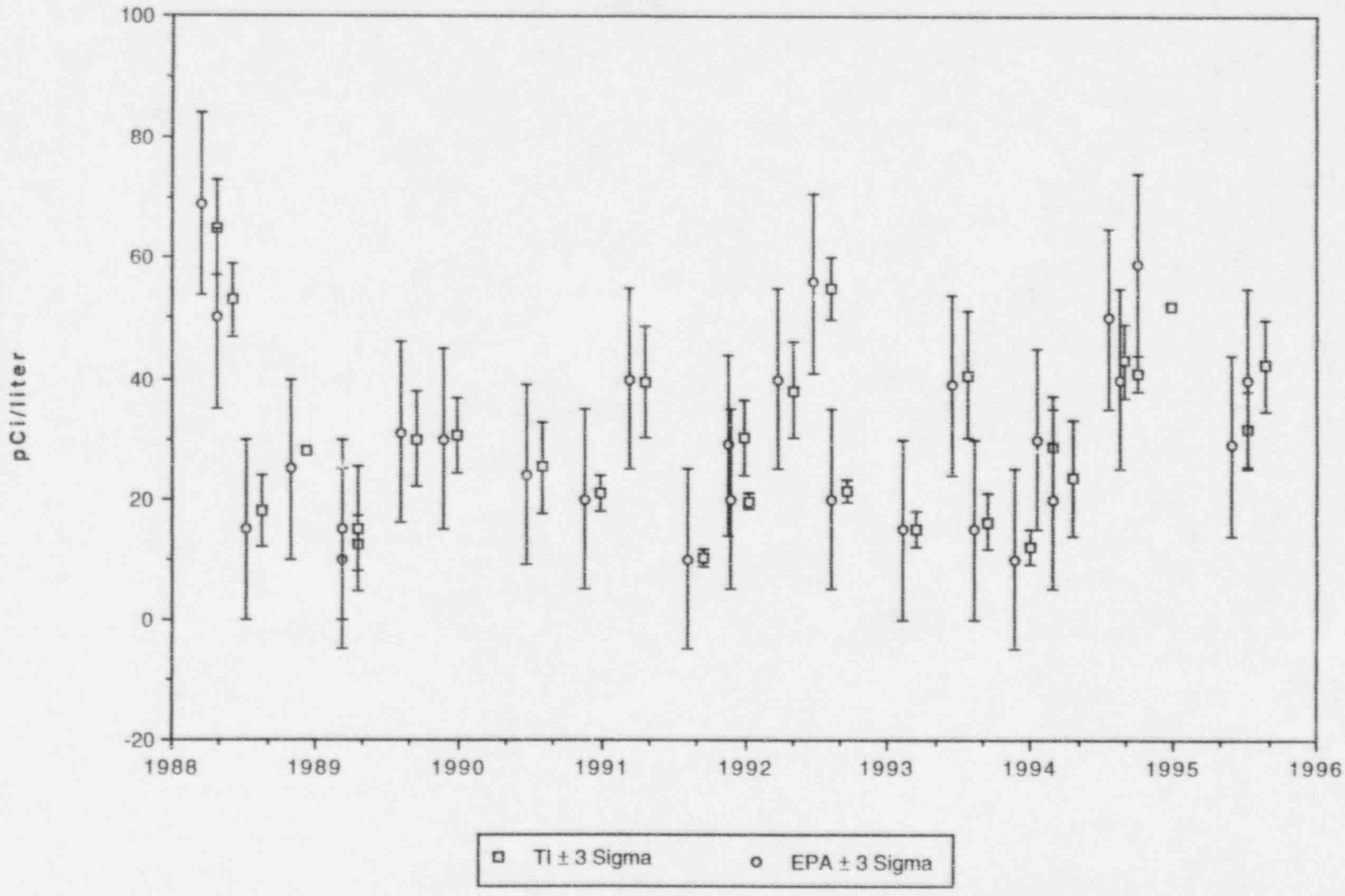
EPA CROSS CHECK PROGRAM

COBALT-60 IN WATER (pg 1 of 2)



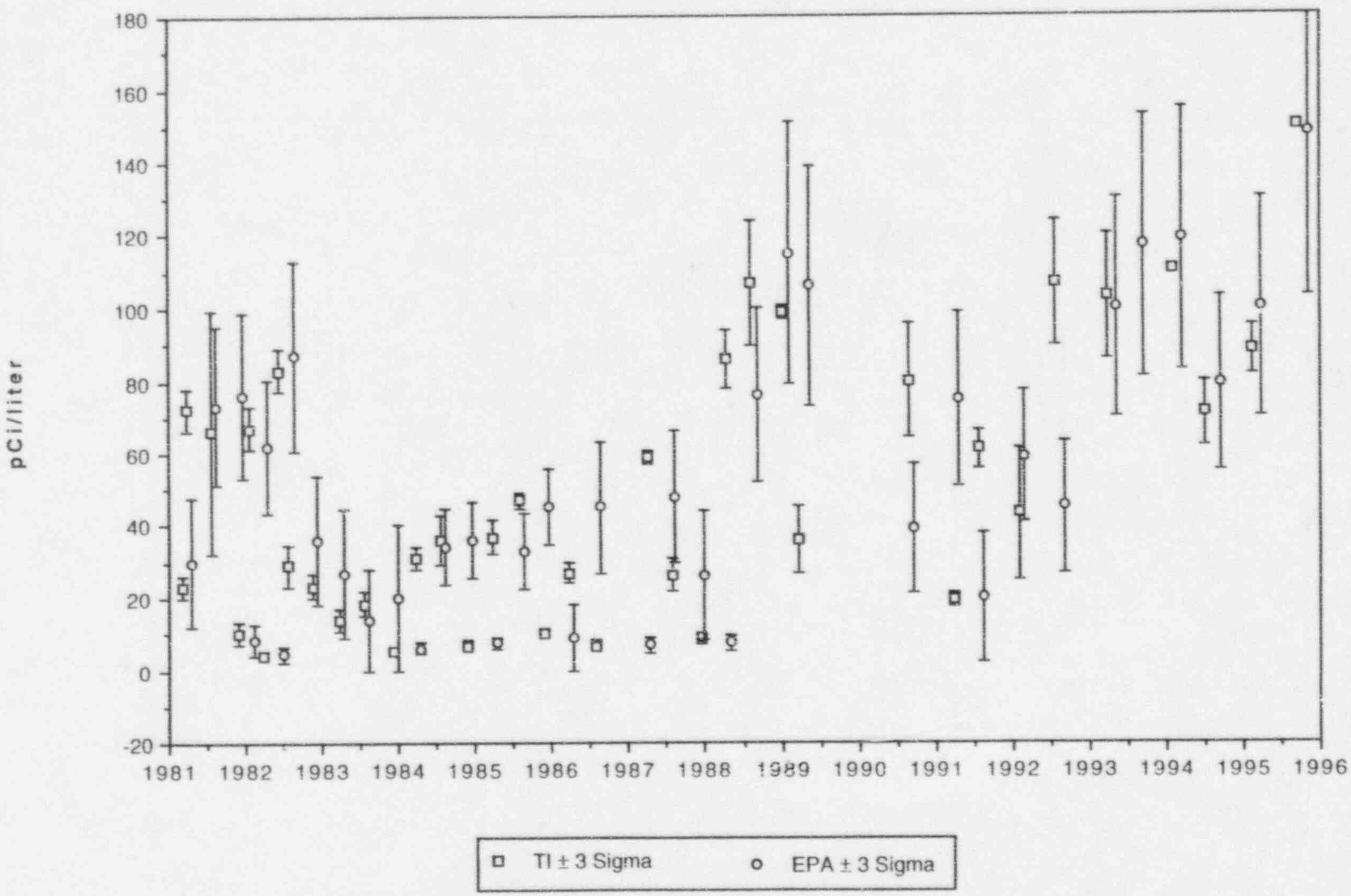
EPA CROSS CHECK PROGRAM

COBALT-60 IN WATER (pg. 2 of 2)



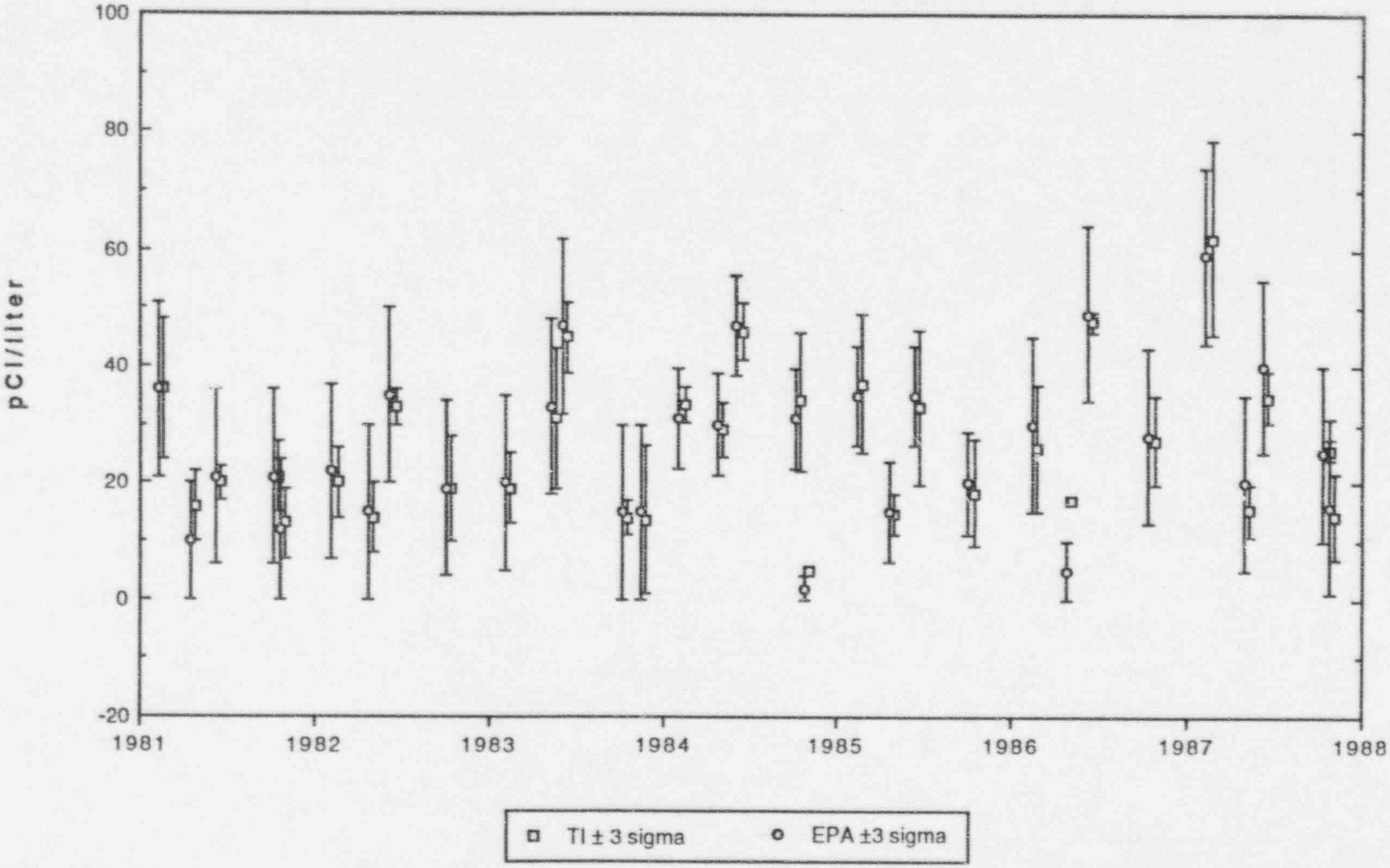
EPA CROSS CHECK PROGRAM

IODINE-131 IN WATER (pg. 1 of 1)



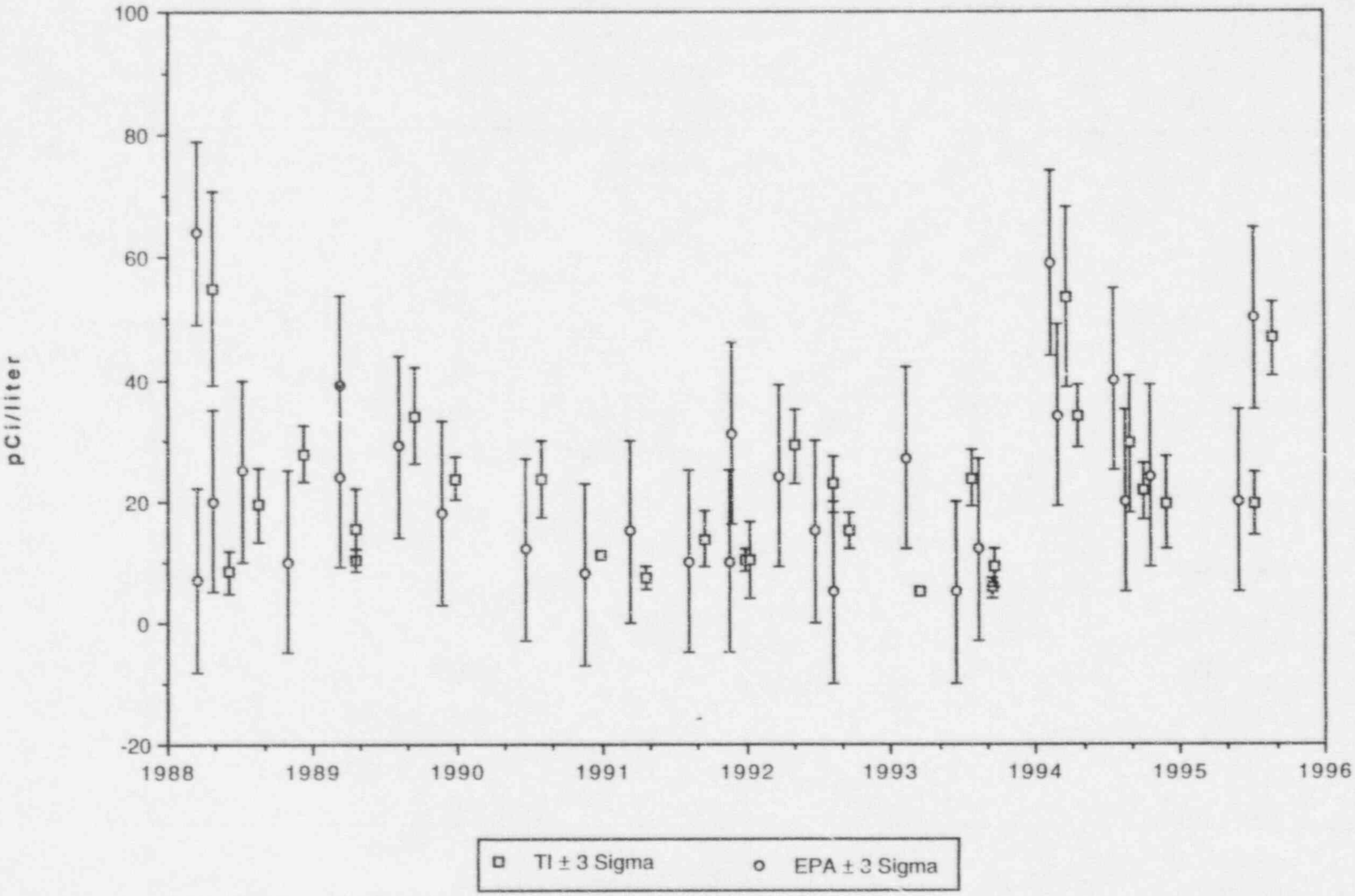
EPA CROSS CHECK PROGRAM

CESIUM-134 IN WATER (pg. 1 of 2)



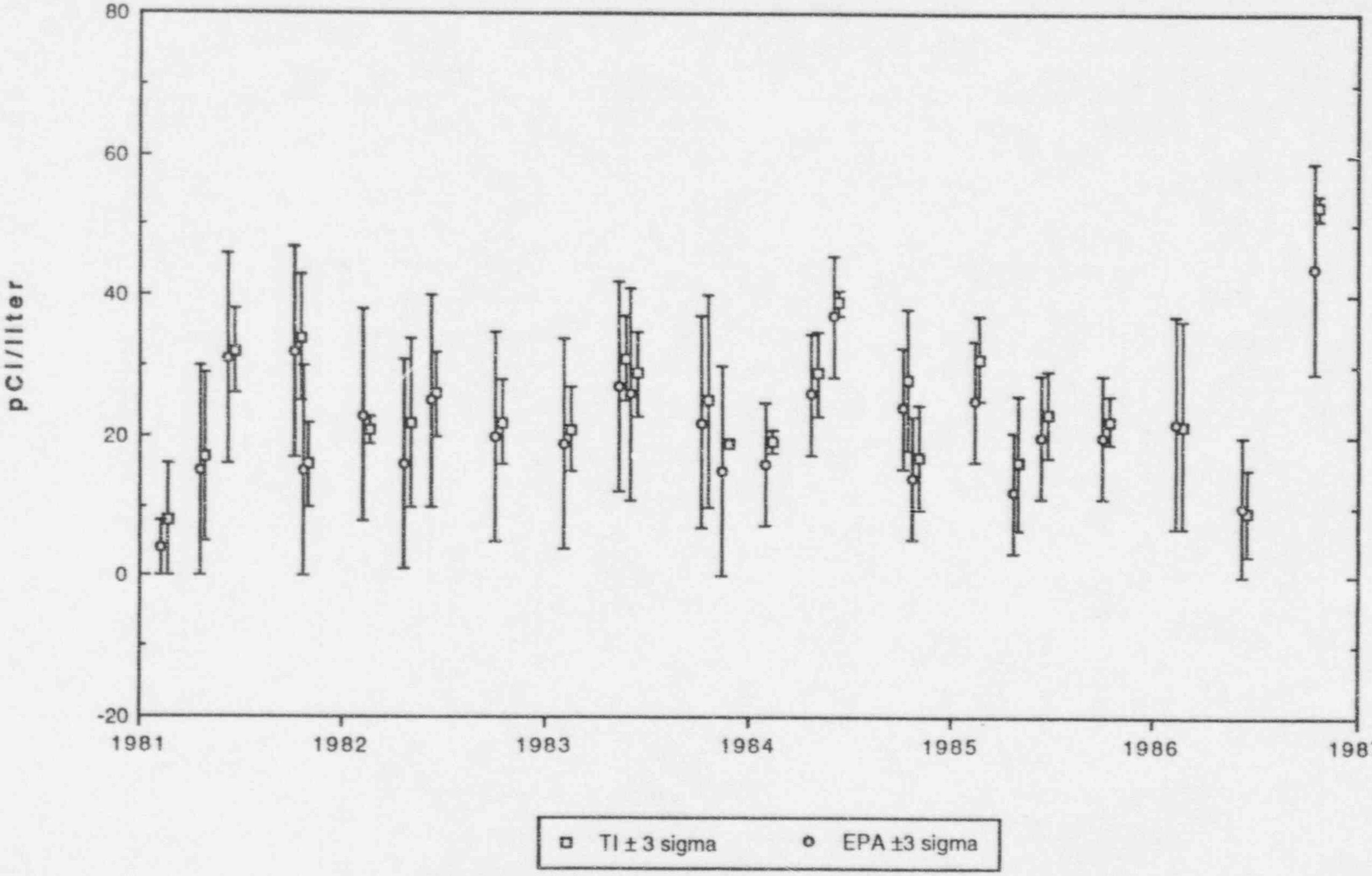
EPA CROSS CHECK PROGRAM

CESIUM-134 IN WATER (pg. 2 of 2)



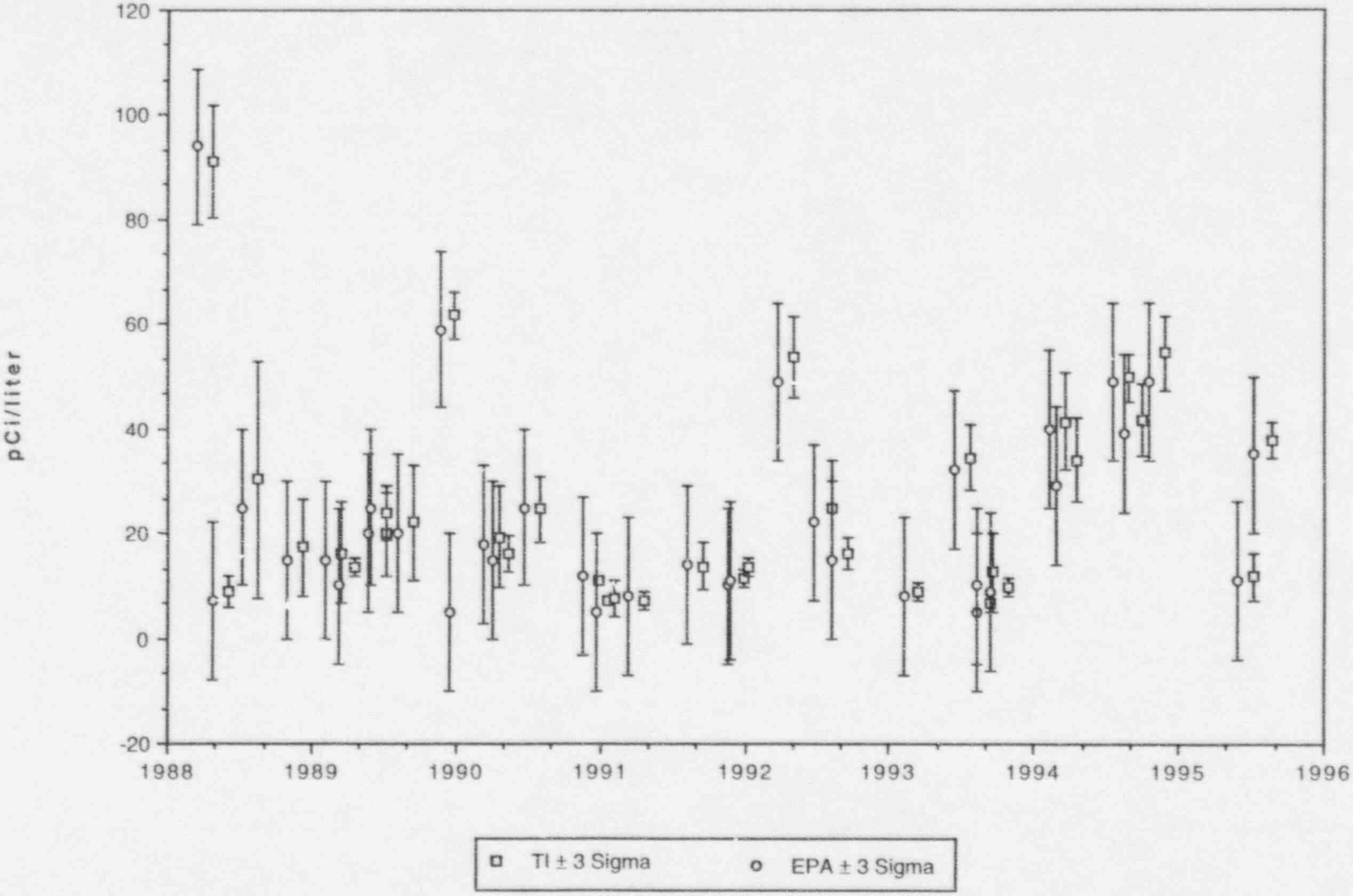
EPA CROSS CHECK PROGRAM

CESIUM-137 IN WATER (pg. 1 of 2)



EPA CROSS CHECK PROGRAM

CESIUM-137 IN WATER (pg. 2 of 2)



APPENDIX II

QC Laboratory

EPA Interlaboratory

Comparison Program

Appendix A

Interlaboratory Comparison Program Results

Teledyne's Midwest Laboratory (formerly Hazleton Environmental Sciences) has participated in interlaboratory comparison (crosscheck) programs since the formulation of it's quality control program in December 1971. These programs are operated by agencies which supply environmental type samples (e.g., milk or water) containing concentrations of radionuclides know to the issuing agency but not to participant laboratories. The purpose of such a program is to provide an independent check on the laboratory's analytical procedures and to alert it to any possible problems.

Participant laboratories measure the concentration of specified radionuclides and report them to the issuing agency. Several months later, the agency reports the known values to the participant laboratories and specifies control limits. Results consistently higher or lower than the known values or outside the control limits indicate a need to check the instruments or procedures used.

The results in Table A-1 were obtained through participation in the environmental sample crosscheck program for milk, water and air filters during the past twelve months. Data for previous years is available upon request.

This program is conducted by the U.S. Environmental Protection Agency Intercomparison and Calibration Section, Quality Assurance Branch, Environmental Monitoring and Support Laboratory, Las Vegas, Nevada.

The results in Table A-2 were obtained for Thermoluminescent Dosimeters (TLDs), since 1976 via various International Intercomparisons of Environmental Dosimeters under the sponsorships listed in Table A-2. Also Teledyne testing results are listed.

Table A-3 lists results of the analyses on in-house "spiked" samples for the past twelve months. Data for previous years available upon request.

Table A-4 lists results of the analyses on in-house "blank" samples for the past twelve months. Data for previous years available upon request.

Table A-5 list results of the in-house "duplicate" program for the past twelve months. Acceptance is based on the difference of the results being less than the sum of the errors. Data for previous years available upon request.

Attachment A lists acceptance criteria for "spiked" samples.

Out-of-limit results are explained directly below the result.

ATTACHMENT A

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

LABORATORY PRECISION: ONE STANDARD DEVIATION VALUES FOR VARIOUS ANALYSES[a]

Analysis	Level	One Standard Deviation for single determinations
Gamma Emitters	5 to 100 pCi/liter or kg >100 pCi/liter or kg	5.0 pCi/liter 5% of known value
Strontium-89[b]	5 to 50 pCi/liter or kg >50 pCi/liter or kg	5.0 pCi/liter 10% of known value
Strontium-90[b]	2 to 30 pCi/liter or kg >30 pCi/liter or kg	5.0 pCi/liter 10% of known value
Potassium	>0.1 g/liter or kg	5% of known value
Gross alpha	≤20 pCi/liter >20 pCi/liter	5.0 pCi/liter 25% of known value
Gross beta	≤100 pCi/liter >100 pCi/liter	5.0 pCi/liter 5% of known value
Tritium	≤4,000 pCi/liter >4,000 pCi/liter	1s = (pCi/liter) = $169.85 \times (\text{known})^{0.0933}$ 10% of known value
Radium-226,-228	<0.1 pCi/liter	15% of known value
Plutonium	0.1 pCi/liter, gram, or sample	10% of known value
Iodine-131, Iodine-129[b]	≤55 pCi/liter >55 pCi/liter	6.0 pCi/liter 10% of known value
Uranium-238, Nickel-64[b] Technetium-99[b]	≤35 pCi/liter >35 pCi/liter	6.0 pCi/liter 15% of known value
Iron-55[b]	50 to 100 pCi/liter >100 pCi/liter	10 pCi/liter 10% of known value
Others[b]	–	20% of known value

[a] From EPA publication, "Environmental Radioactivity Laboratory Intercomparison Studies Program, Fiscal Year, 1981-1982, EPA-600/4-81-004.

[b] Teledyne limit.

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] Teledyne Results ±2 Sigma[c]	EPA Result[d] 1s, N=1	Control Limits
STW-723	WATER	Jan, 1995	Sr-89	17.7 ± 1.5	20.0 ± 5.0	11.3 - 28.7
STW-723	WATER	Jan, 1995	Sr-90	13.7 ± 0.6	15.0 ± 5.0	6.3 - 23.7
STW-724	WATER	Jan, 1995	Gr. Alpha	4.3 ± 0.6	5.0 ± 5.0	0.0 - 13.7
STW-724	WATER	Jan, 1995	Gr. Beta	4.7 ± 0.6	5.0 ± 5.0	0.0 - 13.7
STW-725	WATER	Feb, 1995	I-131	99.0 ± 4.4	100.0 ± 10.0	82.7 - 117.3
STW-726	WATER	Feb, 1995	Ra-226	19.2 ± 0.4	19.1 ± 2.9	14.1 - 24.1
STW-726	WATER	Feb, 1995	Ra-228	19.2 ± 2.0	20.0 ± 5.0	11.3 - 28.7
STW-726	WATER	Feb, 1995	Uranium	24.9 ± 0.2	25.5 ± 3.0	20.3 - 30.7
STW-727	WATER	Mar, 1995	H-3	7,460.0 ± 87.2	7,435.0 ± 744.0	6,144.2 - 8,725.8
STW-728	WATER	Mar, 1995	Pu-239	11.0 ± 0.6	11.1 ± 1.1	9.2 - 13.0
STW-729	WATER	Apr, 1995	Gr. Alpha	41.7 ± 0.6	47.5 ± 11.9	26.9 - 68.1
STW-729	WATER	Apr, 1995	Ra-226	13.4 ± 0.5	14.9 ± 2.2	11.1 - 18.7
STW-729	WATER	Apr, 1995	Ra-228	13.1 ± 2.4	15.8 ± 4.0	8.9 - 22.7
STW-729	WATER	Apr, 1995	Uranium	9.5 ± 0.6	10.0 ± 3.0	4.8 - 15.2
STW-730	WATER	Apr, 1995	Co-60	29.0 ± 1.7	29.0 ± 5.0	20.3 - 37.7
STW-730	WATER	Apr, 1995	Cs-134	17.3 ± 1.2	20.0 ± 5.0	11.3 - 28.7
STW-730	WATER	Apr, 1995	Cs-137	11.0 ± 1.0	11.0 ± 5.0	2.3 - 19.7
STW-730	WATER	Apr, 1995	Gr. Beta	74.8 ± 3.2	86.6 ± 10.0	69.3 - 103.9
STW-730	WATER	Apr, 1995	Sr-89	17.0 ± 0.0	20.0 ± 5.0	11.3 - 28.7
STW-730	WATER	Apr, 1995	Sr-90	12.7 ± 1.2	15.0 ± 5.0	6.3 - 23.7
STW-732	WATER	Jun, 1995	Ra-226	14.7 ± 0.3	14.8 ± 2.2	11.0 - 18.6
STW-732	WATER	Jun, 1995	Ra-228	11.9 ± 0.6	15.0 ± 3.8	8.4 - 21.6
STW-732	WATER	Jun, 1995	Uranium	13.9 ± 0.3	15.2 ± 3.0	10.0 - 20.4
STW-735	WATER	Jul, 1995	Gr. Alpha	16.4 ± 2.4	27.5 ± 6.9	15.5 - 39.5
STW-735	WATER	Jul, 1995	Gr. Beta	16.8 ± 1.0	19.4 ± 5.0	10.7 - 28.1
STW-736	WATER	Aug, 1995	H-3	4,773.7 ± 49.9	4,872.0 ± 487.0	4,027.1 - 5,716.9

[a] Results obtained by Teledyne Brown Engineering Environmental Services Midwest Laboratory as a participant in the environmental sample crosscheck program operated by the Intercomparison and Calibration Section, Quality Assurance Branch, Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency (EPA), Las Vegas, Neveda.

[b] All results are in pCi/L, except for elemental potassium (K) data in milk, which are in mg/L; air filter samples, which are in pCi/Filter.

[c] Unless otherwise indicated, the TBEESML results are given as the mean ± 2 standard deviations for three determinations.

[d] USEPA results are presented as the known values and expected laboratory precision (1s, 1 determination) and control limits as defined by the EPA.

Table A-2. Crosscheck program results; Thermoluminescent Dosimeters. (TLDs).

Lab Code	TLD Type	Date	Measurement	mR Teledyne Results ± 2 Sigma	mR Known Value ± 2 Sigma	mR Average ± 2 Sigma (All Participants)
2nd International Intercomparison						
115-2	CaF_2: Mn Bulb	Apr, 1976	Field	17.0 ± 1.9	17.1	16.4 ± 7.7
115-2	CaF_2: Mn Bulb	Apr, 1976	Lab	20.8 ± 4.1	21.3	18.8 ± 7.6
Second International Intercomparison of Environmental Dosimeters conducted in April of 1976 by the Health and Safety Laboratory (HASL), New York, new York, and the School of Public Health of the University of Texas, Houston, Texas.						
3rd International Intercomparison						
115-3	CaF_2: Mn Bulb	Jun, 1977	Field	30.7 ± 3.2	34.9 ± 4.8	31.5 ± 3.0
115-3	CaF_2: Mn Bulb	Jun, 1977	Lab	89.6 ± 6.4	91.7 ± 14.6	86.2 ± 24.0
Third International Intercomparison of Environmental Dosimeters conducted in the summer of 1977 by Oak Ridge National Laboratory and the School of Public Health of the University of Texas, Houston, Texas.						
4th International Intercomparison						
115-4	CaF_2: Mn Bulb	Jun, 1979	Field	14.1 ± 1.1	14.1 ± 1.4	16.0 ± 9.0
115-4	CaF_2: Mn Bulb	Jun, 1979	Lab, High	40.4 ± 1.4	45.8 ± 9.2	43.9 ± 13.2
115-4	CaF_2: Mn Bulb	Jun, 1979	Lab, Low	9.8 ± 1.3	12.2 ± 2.4	12.0 ± 7.4
Fourth International Intercomparison of Environmental Dosimeters conducted in the summer of 1979 by the School of Public Health of the University of Texas, Houston, Texas.						
5th International Intercomparison						
115-5A	CaF_2: Mn Bulb	Oct, 1980	Field	31.4 ± 1.8	30.0 ± 6.0	30.2 ± 14.6
115-5A	CaF_2: Mn Bulb	Oct, 1980	Lab, End	96.6 ± 5.8	88.4 ± 8.8	90.7 ± 31.2
115-5A	CaF_2: Mn Bulb	Oct, 1980	Lab, Start	77.4 ± 5.8	75.2 ± 7.6	75.8 ± 40.4
Fifth International Intercomparison of Environmental Dosimeters conducted in the fall of 1980 at Idaho Falls, Idaho and sponsored by the School of Public Health of the University of Texas, Houston, Texas and the Environmental Measurements Laboratory, New York, New York, U.S. Department of Energy.						
5th International Intercomparison						
115-5B	LiF-100 Chips	Oct, 1980	Field	30.3 ± 4.8	30.0 ± 6.0	30.2 ± 14.6
115-5B	LiF-100 Chips	Oct, 1980	Lab, End	85.4 ± 11.7	88.4 ± 8.8	90.7 ± 31.2
115-5B	LiF-100 Chips	Oct, 1980	Lab, Start	81.1 ± 7.4	75.2 ± 7.6	75.8 ± 40.4
Fifth International Intercomparison of Environmental Dosimeters conducted in the fall of 1980 at Idaho Falls, Idaho and sponsored by the School of Public Health of the University of Texas, Houston, Texas and the Environmental Measurements Laboratory, New York, New York, U.S. Department of Energy.						
6th International Intercomparison						
115-6						
Teledyne did not participate in the Sixth International Intercomparison of Environmental Dosimeters.						
7th International Intercomparison						
115-7A	LiF-100 Chips	Jun, 1984	Field	75.4 ± 2.6	75.8 ± 6.0	75.1 ± 29.8

Table A-2. Crosscheck program results; Thermoluminescent Dosimeters. (TLDs).

Lab Code	TLD Type	Date	Measurement	mR Teledyne Results ± 2 Sigma	Known Value ± 2 Sigma	Average ± 2 Sigma (All Participants)
115-7A	LiF-100 Chips	Jun, 1984	Lab, Co-60	80.0 ± 3.5	79.9 ± 4.0	77.9 ± 27.6
115-7A	LiF-100 Chips	Jun, 1984	Lab, Cs-137	66.6 ± 2.5	75.0 ± 3.8	73.0 ± 22.2
Seventh International Intercomparison of Environmental Dosimeters conducted in the spring and summer of 1984 at Las Vegas, Nevada, and sponsored by the U.S. Department of Energy, The Nuclear Regulatory Commission, and the U.S. Environmental Protection Agency.						
7th International Intercomparison						
115-7B	LiF-100 Chips	Jun, 1984	Field	71.5 ± 2.6	75.8 ± 6.0	75.1 ± 29.8
115-7B	LiF-100 Chips	Jun, 1984	Lab, Co-60	84.8 ± 6.4	79.9 ± 4.0	77.9 ± 27.6
115-7B	LiF-100 Chips	Jun, 1984	Lab, Cs-137	78.8 ± 1.6	75.0 ± 3.8	73.0 ± 22.2
Seventh International Intercomparison of Environmental Dosimeters conducted in the spring and summer of 1984 at Las Vegas, Nevada, and sponsored by the U.S. Department of Energy, The Nuclear Regulatory Commission, and the U.S. Environmental Protection Agency.						
7th International Intercomparison						
115-7C	$CaSO_4$: Dy Cards	Jun, 1984	Field	76.8 ± 2.7	75.8 ± 6.0	75.1 ± 29.8
115-7C	$CaSO_4$: Dy Cards	Jun, 1984	Lab, Co-60	82.5 ± 3.7	79.9 ± 4.0	77.9 ± 27.6
115-7C	$CaSO_4$: Dy Cards	Jun, 1984	Lab, Cs-137	79.0 ± 3.2	75.0 ± 3.8	73.0 ± 22.2
Seventh International Intercomparison of Environmental Dosimeters conducted in the spring and summer of 1984 at Las Vegas, Nevada, and sponsored by the U.S. Department of Energy, The Nuclear Regulatory Commission, and the U.S. Environmental Protection Agency.						
8th International Intercomparison						
115-8A	LiF-100 Chips	Jan, 1986	Field, Site 1	29.5 ± 1.4	29.7 ± 1.5	28.9 ± 12.4
115-8A	LiF-100 Chips	Jan, 1986	Field, Site 2	11.3 ± 0.8	10.4 ± 0.5	10.1 ± 9.1
115-8A	LiF-100 Chips	Jan, 1986	Lab, Cs-137	13.7 ± 0.9	17.2 ± 0.9	16.2 ± 6.8
Eighth International Intercomparison of Environmental Dosimeters conducted in the fall and winter of 1985-1986 at New York, New York, and sponsored by the U.S. Department of Energy.						
8th International Intercomparison						
115-8B	LiF-100 Chips	Jan, 1986	Field, Site 1	32.3 ± 1.2	29.7 ± 1.5	28.9 ± 12.4
115-8B	LiF-100 Chips	Jan, 1986	Field, Site 2	9.0 ± 1.0	10.4 ± 0.5	10.1 ± 9.0
115-8B	LiF-100 Chips	Jan, 1986	Lab, Cs-137	15.8 ± 0.9	17.2 ± 0.9	16.2 ± 6.8
Eighth International Intercomparison of Environmental Dosimeters conducted in the fall and winter of 1985-1986 at New York, New York, and sponsored by the U.S. Department of Energy.						
8th International Intercomparison						
115-8C	$CaSO_4$: Dy Cards	Jan, 1986	Field, Site 1	32.2 ± 0.7	29.7 ± 1.5	28.9 ± 12.4

Table A-2. Crosscheck program results; Thermoluminescent Dosimeters. (TLDs).

Lab Code	TLD Type	Date	Measurement	mR Teledyne Results ± 2 Sigma	Known Value ± 2 Sigma	Average ± 2 Sigma (All Participants)
115-8C	$CaSO_4$: Dy Cards	Jan, 1986	Field, Site 2	10.6 ± 0.6	10.4 ± 0.5	10.1 ± 9.0
115-8C	$CaSO_4$: Dy Cards	Jan, 1986	Lab, Cs-137	18.1 ± 0.8	17.2 ± 0.9	16.2 ± 6.8

Eighth International Intercomparison of Environmental Dosimeters conducted in the fall and winter of 1985-1986 at New York, New York, and sponsored by the U.S. Department of Energy.

9th International Intercomparison

115-9

The Ninth International Intercomparison of Environmental Dosimeters was not available to Teledyne's Midwest Laboratory.

10th International Intercomparison

115-10A	LiF-100 Chips	Aug, 1993	Field	25.7 ± 1.4	27.0 ± 1.6	26.4 ± 10.2
115-10A	LiF-100 Chips	Aug, 1993	Lab, 1	22.7 ± 1.6	25.9 ± 1.3	25.0 ± 9.4
115-10A	LiF-100 Chips	Aug, 1993	Lab, 2	62.7 ± 2.6	72.7 ± 1.9	69.8 ± 20.3

The Tenth International Intercomparison of Environmental Dosimeters conducted in 1993 at Idaho State University and sponsored by the U.S. Department of Energy and the Idaho State University.

10th International Intercomparison

115-10B	$CaSO_4$: Dy Cards	Aug, 1993	Field	26.0 ± 2.3	27.0 ± 1.6	26.4 ± 10.2
115-10B	$CaSO_4$: Dy Cards	Aug, 1993	Lab, 1	24.1 ± 1.7	25.9 ± 1.3	25.0 ± 9.4
115-10B	$CaSO_4$: Dy Cards	Aug, 1993	Lab, 2	69.2 ± 3.0	72.7 ± 1.9	69.8 ± 20.3

The Tenth International Intercomparison of Environmental Dosimeters conducted in 1993 at Idaho Stat University and sponsored by the U.S. Department of Energy and the Idaho Stat University.

Teledyne Testing

89-1	LiF-100 Chips	Sep, 1989	Lab	21.0 ± 0.4	22.4	ND

ND = No Data; Teledyne Testing was only performed by Teledyne.
Chips were irradiated by Teledyne Isotopes, Inc., Westwood, New Jersey, in September, 1989.

Teledyne Testing

89-2	Teledyne $CaSo_4$: Dy Cards	Nov, 1989	Lab	20.9 ± 1.0	20.3	ND

ND = No Data; Teledyne Testing was only performed by Teledyne.
Cards were irradiated by Teledyne Isotopes, Inc., Westwood, New Jersey, in June, 1990

Table A-2. Crosscheck program results; Thermoluminescent Dosimeters. (TLDs).

Lab Code	TLD Type	Date	Measurement	mR Teledyne Results ± 2 Sigma	mR Known Value ± 2 Sigma	mR Average ± 2 Sigma (All Participants)
Teledyne Testing						
90-1	Teledyne $CaSo_4$: Dy Cards	Jun, 1990	Lab	20.6 ± 1.4	19.6	ND
ND = No Data, Teledyne Testing was only performed by Teledyne. Cards were irradiated by Teledyne Isotopes, Inc., Westwood, New Jersey, in June, 1990.						
Teledyne Testing						
90-2	Teledyne $CaSo_4$: Dy Cards	Jun, 1990	Lab	100.8 ± 4.3	100.0	ND
ND = No Data; Teledyne Testing was only performed by Teledyne. Cards were irradiated by Dosimetry Asssociates, Inc., Northville, MI, in October, 1990.						
Teledyne Testing						
91-1	Teledyne $CaSo_4$: Dy Cards	Oct, 1990	Lab, 1	33.4 ± 2.0	32.0	ND
91-1	Teledyne $CaSo_4$: Dy Cards	Oct, 1990	Lab, 2	55.2 ± 4.7	58.8	ND
91-1	Teledyne $CaSo_4$: Dy Cards	Oct, 1990	Lab, 3	87.8 ± 6.2	85.5	ND
ND = No Data; Teledyne Testing was only performed by Teledyne. Cards were irradiated by Teledyne Isotopes, Inc., Westwood, New Jersey, in October, 1991.						
Teledyne Testing						
92-1	LiF-100 Chips	Feb, 1992	Lab, 1	11.1 ± 0.2	10.7	ND
92-1	LiF-100 Chips	Feb, 1992	Lab, 2	25.6 ± 0.5	25.4	ND
92-1	LiF-100 Chips	Feb, 1992	Lab, 3	46.4 ± 0.5	46.3	ND
ND = No Data; Teledyne Testing was only performed by Teledyne. Chips were irradiated by Teledyne Isotopes, Inc., Westwood, New Jersey, in February, 1992.						
Teledyne Testing						
92-2	Teledyne $CaSo_4$: Dy Cards	Apr, 1992	Reader 1, #1	20.1 ± 0.1	20.1	ND
92-2	Teledyne $CaSo_4$: Dy Cards	Apr, 1992	Reader 1, #2	40.6 ± 0.1	40.0	ND

Table A-2. Crosscheck program results; Thermoluminescent Dosimeters. (TLDs).

Lab Code	TLD Type	Date	Measurement	mR Teledyne Results ± 2 Sigma	 Known Value ± 2 Sigma	 Average ± 2 Sigma (All Participants)
92-2	Teledyne $CaSo_4$: Dy Cards	Apr, 1992	Reader 1, #3	60.0 ± 1.3	60.3	ND
92-2	Teledyne $CaSo_4$: Dy Cards	Apr, 1992	Reader 2, #1	20.3 ± 0.3	20.1	ND
92-2	Teledyne $CaSo_4$: Dy Cards	Apr, 1992	Reader 2, #2	39.2 ± 0.3	40.0	ND
92-2	Teledyne $CaSo_4$: Dy Cards	Apr, 1992	Reader 2, #3	60.7 ± 0.4	60.3	ND

ND = No Data; Teledyne Testing was only performed by Teledyne.
Cards were irradiated by Teledyne Isotopes, Inc., Westwood, New Jersey, in April, 1992.

<u>Teledyne Testing</u>

Lab Code	TLD Type	Date	Measurement	Teledyne Results ± 2 Sigma	Known Value ± 2 Sigma	Average ± 2 Sigma (All Participants)
93-1	Teledyne LiF-100 Chips	Mar, 1993	Lab, 1	10.0 ± 1.0	10.2	ND
93-1	Teledyne LiF-100 Chips	Mar, 1993	Lab, 2	25.2 ± 2.2	25.5	ND
93-1	Teledyne LiF-100 Chips	Mar, 1993	Lab, 3	42.7 ± 5.7	45.9	ND

ND = No Data; Teledyne Testing was only performed by Teledyne.
Chips were irradiated by Teledyne Isotopes, Inc., Westwood, New Jersey, in March, 1993. Due to a potential error of 10-12% when cards where irradiated, results of the testing on the cards will not be published. Data is available upon request.

<u>Teledyne Testing</u>

Lab Code	TLD Type	Date	Measurement	Teledyne Results ± 2 Sigma	Known Value ± 2 Sigma	Average ± 2 Sigma (All Participants)
94-1	Teledyne LiF-100 Chips	Nov, 1994	Lab, 1	15.6 ± 0.4	14.9	ND
94-1	Teledyne LiF-100 Chips	Nov, 1994	Lab, 2	30.2 ± 0.4	29.8	ND
94-1	Teledyne LiF-100 Chips	Nov, 1994	Lab, 3	59.2 ± 0.3	59.7	ND
94-1	Teledyne $CaSo_4$: Dy Cards	Nov, 1994	Reader 1, #1	14.9 ± 0.1	14.9	ND
94-1	Teledyne $CaSo_4$: Dy Cards	Nov, 1994	Reader 1, #2	30.8 ± 0.1	29.8	ND

Table A-2. Crosscheck program results; Thermoluminescent Dosimeters. (TLDs).

Lab Code	TLD Type	Date	Measurement	mR Teledyne Results ± 2 Sigma	Known Value ± 2 Sigma	Average ± 2 Sigma (All Participants)
94-1	Teledyne $CaSo_4$: Dy Cards	Nov, 1994	Reader 1, #3	58.9 ± 0.3	59.7	ND
94-1	Teledyne $CaSo_4$: Dy Cards	Nov, 1994	Reader 2, #1	15.4 ± 0.2	14.9	ND
94-1	Teledyne $CaSo_4$: Dy Cards	Nov, 1994	Reader 2, #2	31.4 ± 0.2	29.8	ND
94-1	Teledyne $CaSo_4$: Dy Cards	Nov, 1994	Reader 2, #3	60.1 ± 0.3	59.7	ND

ND = No Data; Teledyne Testing was only performed by Teledyne.
Cards were irradiated by Teledyne Isotopes, Inc., Westwood, New Jersey, in November, 1994.

Table A-3. In-house "spike" samples.

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[a] Teledyne Results 2s, n=1[b]	Known Activity	Control[c] Limits
SPW-7569	WATER	Jul, 1995	H-3	25806.9 ± 447.7	26669.0	21335.2 - 32002.8
SPAP-10967	AIR FILTER	Nov, 1995	Gr. Beta	7.3 ± 0.0	8.0	0.0 - 18.0
SPAP-2513	AIR FILTER	Apr, 1995	Gr. Beta	7.5 ± 0.0	8.1	0.0 - 18.1
SPAP-2542	AIR FILTER	Apr, 1995	Cs-137	2.3 ± 2.1	1.9	1.2 - 2.7
SPAP-284	AIR FILTER	Jan, 1995	Cs-137	2.2 ± 0.0	1.9	1.2 - 2.7
SPAP-284	AIR FILTER	Jan, 1995	I-131(g)	2.2 ± 0.0	1.9	1.2 - 2.7
SPAP-408	AIR FILTER	Jan, 1995	Gr. Beta	7.5 ± 0.0	8.1	0.0 - 18.1
SPAP-7554	AIR FILTER	Jul, 1995	Gr. Beta	7.3 ± 0.0	8.1	0.0 - 18.1
SPAP-7557	AIR FILTER	Jul, 1995	Cs-137	2.3 ± 0.0	1.9	1.2 - 2.7
SPCH-11238	CHARCOAL CANISTER	Oct, 1995	I-131(g)	0.8 ± 0.0	0.8	0.5 - 1.1
SPCH-5964	CHARCOAL CANISTER	Jun, 1995	I-131(g)	2.2 ± 0.1	2.3	1.4 - 3.3
SPCH-717	CHARCOAL CANISTER	Jan, 1995	I-131(g)	2.9 ± 0.1	2.5	1.5 - 3.4
SPF-10921	FISH	Oct, 1995	Co-60	0.7 ± 0.0	0.8	0.5 - 1.1
SPF-10921	FISH	Oct, 1995	Cs-134	0.5 ± 0.0	0.6	0.3 - 0.8
SPF-10921	FISH	Oct, 1995	Cs-137	0.9 ± 0.1	0.9	0.5 - 1.2
SPF-3708	FISH	May, 1995	Cs-134	0.1 ± 0.0	0.1	0.1 - 0.2
SPF-3708	FISH	May, 1995	Cs-137	0.2 ± 0.0	0.2	0.1 - 0.2
SPMI-205	MILK	Jan, 1995	Cs-137	51.2 ± 7.5	49.4	39.4 - 59.4
SPMI-205	MILK	Jan, 1995	Sr-89	19.4 ± 3.4	23.1	13.1 - 33.1
SPMI-205	MILK	Jan, 1995	Sr-90	26.2 ± 1.3	28.1	18.1 - 38.1
SPMI-2988	MILK	Apr, 1995	Cs-134	37.0 ± 1.8	40.7	30.7 - 50.7
SPMI-2988	MILK	Apr, 1995	Cs-137	62.4 ± 3.1	54.5	44.5 - 64.5
SPMI-2988	MILK	Apr, 1995	Sr-89	32.6 ± 3.3	36.5	26.5 - 46.5
SPMI-2988	MILK	Apr, 1995	Sr-90	25.6 ± 1.6	24.9	14.9 - 34.9
SPMI-6838	MILK	Jun, 1995	I-131	38.5 ± 0.5	39.6	27.6 - 51.6
SPMI-707	MILK	Jan, 1995	I-131	80.3 ± 1.4	86.0	68.8 - 103.2
SPMI-707	MILK	Jan, 1995	I-131(g)	84.8 ± 10.4	86.0	51.6 - 96.0
SPMI-7525	MILK	Jul, 1995	Cs-134	31.5 ± 2.5	34.4	24.4 - 44.4
SPMI-7525	MILK	Jul, 1995	Cs-137	50.2 ± 4.0	43.4	33.4 - 53.4
SPMI-7525	MILK	Jul, 1995	I-131(g)	44.7 ± 5.4	45.6	27.4 - 55.6
SPMI-7525	MILK	Jul, 1995	Sr-90	28.0 ± 1.4	27.9	17.9 - 37.9
SPSO-5130	SOIL	May, 1995	Cs-134	0.3 ± 0.0	0.3	0.2 - 0.4
SPSO-5130	SOIL	May, 1995	Cs-137	0.5 ± 0.0	0.5	0.3 - 0.7

Table A-3. In-house "spike" samples.

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[a] Teledyne Results 2s, n=1[b]	Known Activity	Control[c] Limits
SPVE-6006	VEGETATION	Jun, 1995	I-131(g)	0.6 ± 0.0	0.5	0.3 - 0.8
SPVE-7190	VEGETATION	Jul, 1995	I-131(g)	1.1 ± 0.0	1.0	0.6 - 1.4
SPVE-729	VEGETATION	Feb, 1995	I-131(g)	1.9 ± 0.1	1.9	1.1 - 2.6
SPW-1204	WATER	Feb, 1995	Ra-226	6.9 ± 0.1	6.9	4.8 - 9.0
SPW-12079	WATER	Nov, 1995	H-3	27963.4 ± 445.5	29315.0	23452.0 - 35178.0
SPW-12084	WATER	Nov, 1995	Gr. Alpha	75.3 ± 3.2	82.8	41.4 - 124.2
SPW-12084	WATER	Nov, 1995	Gr. Beta	86.9 ± 2.5	86.3	76.3 - 96.3
SPW-1790	WATER	Mar, 1995	Sr-89	0.9 ± 3.9	42.7	32.7 - 52.7

The raw data was reviewed and found to be free of errors. The sample was repeated with similar results.An Investigation was conducted to determine the cause of this deviation. No apparent cause was found for this discrepancy. It was determined the "spike" was prepared improperly. Another "spike" was prepared and analyzed (See SPW-6388). No further action is planned.

Lab Code	Sample Type	Date Collected	Analysis	Teledyne Results 2s, n=1	Known Activity	Control Limits
SPW-1790	WATER	Mar, 1995	Sr-90	31.4 ± 1.8	39.1	31.3 - 46.9

The raw data was reviewed and found to be free of errors. The sample was repeated with similar results.An Investigation was conducted to determine the cause of this deviation. No apparent cause was found for this discrepancy. It was determined the "spike" was prepared improperly. Another "spike" was prepared and analyzed (See SPW-6388). No further action is planned.

Lab Code	Sample Type	Date Collected	Analysis	Teledyne Results 2s, n=1	Known Activity	Control Limits
SPW-2544	WATER	Apr, 1995	H-3	9656.2 ± 291.8	9333.0	7466.4 - 11199.6
SPW-2652	WATER	Apr, 1995	Co-60	23.8 ± 2.4	24.8	14.8 - 34.8
SPW-2652	WATER	Apr, 1995	Cs-134	29.3 ± 2.3	30.8	20.8 - 40.8
SPW-2652	WATER	Apr, 1995	Cs-137	42.3 ± 3.9	40.9	30.9 - 50.9
SPW-286	WATER	Jan, 1995	H-3	40929.9 ± 5594.5	40871.0	32696.8 - 49045.2
SPW-289	WATER	Jan, 1995	Co-60	250.5 ± 14.1	247.5	222.8 - 272.3
SPW-289	WATER	Jan, 1995	Cs-134	290.5 ± 14.4	321.3	289.2 - 353.4
SPW-289	WATER	Jan, 1995	Cs-137	387.7 ± 21.2	394.3	354.9 - 433.7
SPW-3051	WATER	Mar, 1995	Gr. Alpha	88.5 ± 3.7	82.9	41.5 - 124.4
SPW-3051	WATER	Apr, 1995	Gr. Alpha	88.0 ± 3.8	82.9	41.5 - 124.4
SPW-3051	WATER	Mar, 1995	Gr. Beta	83.0 ± 2.3	87.2	77.2 - 97.2
SPW-3051	WATER	Apr, 1995	Gr. Beta	79.6 ± 2.3	87.2	77.2 - 97.2
SPW-3589	WATER	May, 1995	Fe-55	2033.7 ± 500.2	2274.0	1819.2 - 2728.8
SPW-5608	WATER	Jun, 1995	I-131	78.8 ± 2.3	85.5	68.4 - 102.6
SPW-6005	WATER	Jun, 1995	I-131	48.2 ± 1.9	46.8	34.8 - 58.8
SPW-6008	WATER	May, 1995	Gr. Alpha	17.3 ± 1.4	20.7	10.4 - 31.1
SPW-6008	WATER	May, 1995	Gr. Beta	21.2 ± 1.0	21.8	11.8 - 31.8
SPW-6388	WATER	May, 1995	Sr-89	18.7 ± 2.4	21.2	11.2 - 31.2
SPW-6388	WATER	May, 1995	Sr-90	21.2 ± 1.1	23.2	13.2 - 33.2

Table A-3. In-house "spike" samples.

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[a] Teledyne Results 2s, n=1[b]	Known Activity	Control[c] Limits
SPW-6398	WATER	May, 1995	Sr-89	18.7 ± 2.4	21.2	11.2 - 31.2
SPW-6398	WATER	May, 1995	Sr-90	21.2 ± 1.1	23.2	13.2 - 33.2
SPW-6839	WATER	Jun, 1995	I-131	34.9 ± 0.5	39.5	27.5 - 51.5
SPW-8179	WATER	Jul, 1995	Fe-55	2.3 ± 0.4	2.1	0.0 - 22.1
SPW-9981	WATER	Sep, 1995	Sr-89	34.6 ± 4.9	39.0	29.0 - 49.0
SPW-9981	WATER	Sep, 1995	Sr-90	20.3 ± 1.3	20.0	10.0 - 30.0

[a] All results are in pCi/L, except for elemental potassium (K) in milk, which are in mg/L.; air filter samples, which are in pCi/Filter; and food products, which are in mg/kg.

[b] All samples are the results of single determinations.

[c] Control limits are based on Attachment A, page A2 of this report.

NOTE: For fish, Jello is used for the spike matrix. For vegetation, Sawdust is used for the spike matrix.

Table A-4. In-house "blank" samples.

Lab Code	Sample Type	Sample Date	Analysis	Concentration pCi/L[a] Teledyne Results (4.66 Sigma) LLD	Activity[b]	Acceptance Criteria (4.66 Sigma)
SPAP-10968	AIR FILTER	Nov 1995	Gr. Beta	<0.4	0.61 ± 0.26	< 3.2
SPAP-2514	AIR FILTER	Apr 1995	Gr. Beta	<0.3	0.03 ± 0.25	< 3.2
SPAP-2543	AIR FILTER	Apr 1995	Co-60	<4.4	0.39 ± 2.20	< 10.0
SPAP-2543	AIR FILTER	Apr 1995	Cs-134	<1.9	0.05 ± 2.11	< 10.0
SPAP-2543	AIR FILTER	Apr 1995	Cs-137	<1.1	-1.24 ± 1.83	< 10.0
SPAP-283	AIR FILTER	Jan 1995	Co-60	<2.7	-0.36 ± 1.40	< 10.0
SPAP-283	AIR FILTER	Jan 1995	Cs-134	<1.5	-0.67 ± 1.33	< 10.0
SPAP-283	AIR FILTER	Jan 1995	Cs-137	<2.4	0.46 ± 1.33	< 10.0
SPAP-409	AIR FILTER	Jan 1995	Gr. Beta	<0.5	0.02 ± 0.28	< 3.2
SPAP-7556	AIR FILTER	Jul 1995	Gr. Beta	<1.0	0.06 ± 0.55	< 3.2
SPAP-7558	AIR FILTER	Jul 1995	Co-60	<4.2	0.39 ± 3.06	< 10.0
SPAP-7558	AIR FILTER	Jul 1995	Co-60	<4.2	0.04 ± 3.07	< 10.0
SPAP-7558	AIR FILTER	Jul 1995	Cs-134	<3.0	-1.23 ± 2.45	< 10.0
SPAP-7558	AIR FILTER	Jul 1995	Cs-137	<3.5	1.18 ± 2.04	< 10.0
SPCH-11238	CHARCOAL CANISTER	Oct 1995	I-131(g)	<1.9	-0.00 ± 0.01	< 9.6
SPCH-287	CHARCOAL CANISTER	Jan 1995	I-131(g)	<2.3	-1.98 ± 3.12	< 9.6
SPCH-5975	CHARCOAL CANISTER	Jun 1995	I-131(g)	<3.0	-0.71 ± 2.68	< 9.6
SPF-10922	FISH	Oct 1995	Co-60	<5.4	5.74 ± 4.70	< 10.0
SPF-10922	FISH	Oct 1995	Cs-134	<8.9	2.47 ± 5.44	< 10.0
SPF-10922	FISH	Oct 1995	Cs-137	<5.4	-2.44 ± 5.08	< 10.0
SPF-3709	FISH	May 1995	Co-60	<8.4	2.21 ± 5.97	< 10.0
SPF-3709	FISH	May 1995	Cs-134	<1.3	6.79 ± 8.55	< 10.0
SPF-3709	FISH	May 1995	Cs-137	<1.3	3.61 ± 7.81	< 10.0
SPM-204	MILK	Jan 1995	Co-60	<5.3	0.41 ± 3.48	< 10.0
SPM-204	MILK	Jan 1995	Cs-134	<4.4	-0.07 ± 2.05	< 10.0
SPM-204	MILK	Jan 1995	Cs-137	<4.3	1.32 ± 2.53	< 10.0
SPM-204	MILK	Jan 1995	I-131	<0.5	-0.03 ± 0.22	< 0.5
SPM-204	MILK	Jan 1995	Sr-89	<0.8	0.14 ± 1.08	< 5.0
SPM-204	MILK	Jan 1995	Sr-90	N/A	1.46 ± 0.48	< 1.0
Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual.						
SPMI-10920	MILK	Oct 1995	Co-60	<3.8	-0.45 ± 5.05	< 10.0
SPMI-10920	MILK	Oct 1995	Cs-134	<3.5	-2.79 ± 4.35	< 10.0

Table A-4. In-house "blank" samples.

Lab Code	Sample Type	Sample Date	Analysis	Concentration pCi/L[a] Teledyne Results (4.66 Sigma) LLD	Activity[b]	Acceptance Criteria (4.66 Sigma)
SPMI-10920	MILK	Oct 1995	Cs-137	<6.0	1.55 ± 4.13	< 10.0
SPMI-2987	MILK	Apr 1995	Cs-134	<3.4	0.37 ± 1.89	< 10.0
SPMI-2987	MILK	Apr 1995	Cs-137	<3.3	1.29 ± 1.75	< 10.0
SPMI-2987	MILK	Apr 1995	Sr-89	<0.4	0.06 ± 0.62	< 5.0
SPMI-2987	MILK	Apr 1995	Sr-90	N/A	1.47 ± 0.38	< 1.0
Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual.						
SPMI-7526	MILK	Jul 1995	Co-60	<5.8	1.19 ± 3.34	< 10.0
SPMI-7526	MILK	Jul 1995	Cs-134	<5.1	0.48 ± 2.76	< 10.0
SPMI-7526	MILK	Jul 1995	Cs-137	<3.7	0.98 ± 2.39	< 10.0
SPMI-7526	MILK	Jul 1995	I-131	<0.5	0.00 ± 0.23	< 0.5
SPMI-7526	MILK	Jul 1995	Sr-89	<0.6	-0.19 ± 0.82	< 5.0
SPMI-7526	MILK	Jul 1995	Sr-90	N/A	1.35 ± 0.36	< 1.0
Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual.						
SPSO-11225	SOIL	Oct 1995	Cs-134	<0.034	0.00 ± 0.02	< 10.0
SPSO-11225	SOIL	Oct 1995	Cs-137	<0.019	-0.00 ± 0.01	< 10.0
SPSO-5131	SOIL	May 1995	Cs-134	<0.034	0.01 ± 0.01	< 10.0
SPSO-5131	SOIL	May 1995	Cs-137	<0.012	0.00 ± 0.01	< 10.0
SPVE-6007	VEGETATION	Jun 1995	I-131(g)	<0.009	0.00 ± 0.01	< 20.0
SPVE-7191	VEGETATION	Jul 1995	I-131(g)	<0.005	-0.00 ± 0.00	< 20.0
SPVE-728	VEGETATION	Jan 1995	I-131(g)	<12.0	2.33 ± 7.54	< 20.0
SPW-1106	WATER	Feb 1995	Ni-63	<12.0	0.25 ± 6.31	< 20.0
SPW-12080	WATER	Nov 1995	H-3	<149	23.01 ± 74.94	< 200.0
SPW-12082	WATER	Nov 1995	Co-60	<2.1	0.62 ± 1.13	< 10.0
SPW-12082	WATER	Nov 1995	Cs-134	<1.9	0.02 ± 1.28	< 10.0
SPW-12082	WATER	Nov 1995	Cs-137	<2.4	1.53 ± 1.22	< 10.0
SPW-12082	WATER	Nov 1995	Gr. Alpha	<0.6	0.19 ± 0.43	< 1.0
SPW-12082	WATER	Nov 1995	Gr. Beta	<1.7	0.06 ± 1.11	< 3.2
SPW-2545	WATER	Apr 1995	H-3	<169	97.76 ± 88.37	< 200.0
SPW-2651	WATER	Apr 1995	Co-60	<3.17	-1.08 ± 2.45	< 10.0
SPW-2651	WATER	Apr 1995	Cs-134	<3.32	0.29 ± 2.57	< 10.0
SPW-2651	WATER	Apr 1995	Cs-137	<3.56	-0.92 ± 2.64	< 10.0
SPW-285	WATER	Jan 1995	H-3	<165.0	-48.53 ± 84.76	< 200.0
SPW-288	WATER	Jan 1995	Co-60	<2.3	-0.11 ± 2.02	< 10.0
SPW-288	WATER	Jan 1995	Cs-134	<3.5	-0.19 ± 2.61	< 10.0

Table A-4. In-house "blank" samples.

Lab Code	Sample Type	Sample Date	Analysis	Concentration pCi/L[a] Teledyne Results (4.66 Sigma) LLD	Activity[b]	Acceptance Criteria (4.66 Sigma)
SPW-288	WATER	Jan 1995	Cs-137	<4.7	0.98 ± 2.54	< 10.0
SPW-3052	WATER	Mar 1995	Gr. Alpha	<0.6	0.49 ± 0.43	< 1.0
SPW-3052	WATER	Apr 1995	Gr. Alpha	<0.7	0.23 ± 0.47	< 1.0
SPW-3052	WATER	Mar 1995	Gr. Beta	<1.4	3.05 ± 0.98	< 3.2
SPW-3052	WATER	Apr 1995	Gr. Beta	<1.7	-0.02 ± 1.09	< 3.2
SPW-3590	WATER	May 1995	Fe-55	<602.0	0.00 ± 365.40	< 1000.0
SPW-6011	WATER	Jun 1995	I-131	<0.4	-0.03 ± 0.19	< 0.5
SPW-7570	WATER	Jul 1995	H-3	<164	51.58 ± 83.71	< 200.0
SPW-8180	WATER	Jul 1995	Fe-55	<0.4	0.00 ± 0.27	< 1000.0
SPW-8931	WATER	Aug 1995	Ra-228	<1.0	0.58 ± 0.61	< 1.0
SPW-957	WATER	Feb 1995	Co-60	<3.7	-1.25 ± 3.02	< 10.0
SPW-957	WATER	Feb 1995	Cs-134	<5.2	0.76 ± 2.77	< 10.0
SPW-957	WATER	Feb 1995	Cs-137	<3.6	-1.38 ± 2.65	< 10.0
SPW-9982	WATER	Sep 1995	Sr-89	<0.8	0.52 ± 0.76	< 5.0
SPW-9982	WATER	Sep 1995	Sr-90	<0.4	0.21 ± 0.21	< 1.0

[a] Liquid sample results are reported in pCi/Liter, air filter sample results are in pCi/filter, charcoal sample results are in pCi/charcoal, and solid sample results are in pCi/kilogram.
[b] The activity reported is the net activity result.

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
WW-62, 63	Jan, 1995	Gr. Beta	1.4160 ± 0.4220	1.2900 ± 0.4000	1.3530 ± 0.2907
WW-62, 63	Jan, 1995	H-3	22.5635 ± 80.8891	18.8029 ± 80.7140	20.6832 ± 57.1354
WW-41, 42	Jan, 1995	Gr. Alpha	5.0970 ± 2.5260	2.4790 ± 2.1920	3.7880 ± 1.6722
WW-41, 42	Jan, 1995	Gr. Beta	4.6720 ± 0.8260	4.9650 ± 0.8770	4.8185 ± 0.6024
WW-41, 42	Jan, 1995	H-3	30.0800 ± 81.2250	-47.0000 ± 77.7750	-8.4600 ± 56.2282
WW-41, 42	Jan, 1995	K-40	1.3840 ± 0.2076	1.7300 ± 0.2595	1.5570 ± 0.1662
WW-41, 42	Jan, 1995	Sr-89	-0.3474 ± 0.5730	-0.0685 ± 0.5382	-0.2079 ± 0.3931
WW-41, 42	Jan, 1995	Sr-90	0.2017 ± 0.2519	0.1389 ± 0.2174	0.1703 ± 0.1664
CF-20, 21	Jan, 1995	Be-7	0.4327 ± 0.1200	0.4741 ± 0.1250	0.4534 ± 0.0866
CF-20, 21	Jan, 1995	Gr. Beta	2.9120 ± 0.0930	2.9920 ± 0.0920	2.9520 ± 0.0654
CF-20, 21	Jan, 1995	K-40	4.0808 ± 0.3060	3.7714 ± 0.3050	3.9261 ± 0.2160
CF-20, 21	Jan, 1995	Sr-89	0.0013 ± 0.0043	0.0000 ± 0.0058	0.0007 ± 0.0036
CF-20, 21	Jan, 1995	Sr-90	0.0017 ± 0.0011	0.0026 ± 0.0015	0.0021 ± 0.0009
CW-105, 106	Jan, 1995	Gr. Beta	5.4370 ± 0.9970	6.1900 ± 1.0260	5.8135 ± 0.7153
CW-105, 106	Jan, 1995	Gr. Beta	0.0490 ± 0.4360	0.0590 ± 0.4360	0.0540 ± 0.3083
MI-83, 84	Jan, 1995	Co-60	-0.3330 ± 2.5300	0.6530 ± 2.1700	0.1600 ± 1.6666
MI-83, 84	Jan, 1995	Cs-137	-1.1400 ± 2.2700	0.0761 ± 1.8700	-0.5320 ± 1.4705
MI-83, 84	Jan, 1995	I-131(G)	-1.9100 ± 3.2000	1.4700 ± 2.4700	-0.2200 ± 2.0212
MI-187, 188	Jan, 1995	I-131	0.1496 ± 0.2574	0.2682 ± 0.3828	0.2089 ± 0.2306
MI-187, 188	Jan, 1995	K-40	1,573.0000 ± 138.0000	1,426.0000 ± 177.0000	1,499.5000 ± 112.2197
SW-213, 214	Jan, 1995	H-3	5,939.6340 ± 241.2390	6,091.2412 ± 232.8063	6,015.4376 ± 167.6269
WW-240, 241	Jan, 1995	H-3	39.8030 ± 80.3410	9.9510 ± 78.9420	24.8770 ± 56.3172
WW-316, 317	Jan, 1995	H-3	17,618.0000 ± 377.0000	17,390.0000 ± 381.0000	17,504.0000 ± 267.9972
MI-295, 296	Jan, 1995	Co-60	-1.0900 ± 2.3700	0.2510 ± 2.8000	-0.4195 ± 1.8342
MI-295, 296	Jan, 1995	Cs-134	-0.6360 ± 1.8100	0.7830 ± 2.4400	0.0735 ± 1.5190
MI-295, 296	Jan, 1995	Cs-137	0.5200 ± 1.8200	1.2900 ± 2.6800	0.9050 ± 1.6198
MI-295, 296	Jan, 1995	I-131	0.1300 ± 0.2600	0.2300 ± 0.3400	0.1800 ± 0.2140
MI-295, 296	Jan, 1995	I-131(g)	-0.3970 ± 2.3600	-0.0386 ± 4.3000	-0.2178 ± 2.4525
MI-295, 296	Jan, 1995	K-40	1,449.1000 ± 91.2000	1,311.8000 ± 108.0000	1,380.4500 ± 70.6779
MI-295, 296	Jan, 1995	La-140	0.6220 ± 1.6900	-1.1800 ± 2.5000	-0.2790 ± 1.5088
MI-295, 296	Jan, 1995	Sr-89	0.2267 ± 0.7985	0.1552 ± 0.9326	0.1909 ± 0.6139
MI-295, 296	Jan, 1995	Sr-90	1.3813 ± 0.3839	1.6174 ± 0.4296	1.4993 ± 0.2881
LW-609, 610	Jan, 1995	Gr. Beta	2.6380 ± 0.7310	1.6940 ± 0.6930	2.1660 ± 0.5036
LW-344, 345	Jan, 1995	Co-60	-0.1680 ± 1.8700	1.5200 ± 3.1100	0.6760 ± 1.8145
LW-344, 345	Jan, 1995	Cs-137	0.3820 ± 1.9200	-0.1570 ± 2.9500	0.1125 ± 1.7599
LW-344, 345	Jan, 1995	Gr. Beta	3.2810 ± 0.9440	3.3500 ± 0.9390	3.3155 ± 0.6657

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	First Result	Second Result	Averaged Result
			Concentration in pCi/L[a]		
MI-374, 375	Jan, 1995	I-131	-0.0572 ± 0.2162	-0.0743 ± 0.2780	-0.0658 ± 0.1761
MI-374, 375	Jan, 1995	K-40	1,250.0000 ± 150.0000	1,286.5000 ± 141.0000	1,268.2500 ± 102.9332
SW-463, 464	Jan, 1995	Gr. Beta	1.8970 ± 0.5970	1.9470 ± 0.6020	1.9220 ± 0.4239
SW-463, 464	Jan, 1995	H-3	35.5580 ± 80.3070	7.4860 ± 78.9880	21.5220 ± 56.3212
WWU-860, 861	Jan, 1995	Gr. Alpha	0.3000 ± 0.6000	0.2000 ± 0.3000	0.2500 ± 0.3354
WWU-860, 861	Jan, 1995	Gr. Beta	0.8450 ± 1.3200	1.7600 ± 1.3500	1.3025 ± 0.9440
WWU-860, 861	Jan, 1995	K-40	61.8050 ± 32.9000	70.9860 ± 36.2000	66.3955 ± 24.4584
SW-586, 587	Jan, 1995	Co-60	-2.1600 ± 2.2900	1.9400 ± 2.7500	-0.1100 ± 1.7893
SW-586, 587	Jan, 1995	Cs-137	0.5590 ± 2.3400	1.5000 ± 2.8800	1.0295 ± 1.8554
WW-547, 548	Jan, 1995	H-3	602.5630 ± 102.9290	619.5980 ± 103.5540	611.0805 ± 73.0031
SWT-715, 716	Jan, 1995	Gr. Beta	2.3000 ± 0.6000	2.3000 ± 0.5000	2.3000 ± 0.3905
SW-694, 695	Feb, 1995	Gr. Beta	3.9100 ± 0.7450	4.1790 ± 0.7550	4.0445 ± 0.5303
WW-736, 737	Feb, 1995	H-3	9,951.8722 ± 284.2655	10,200.7626 ± 287.5238	10,076.3174 ± 202.1613
WW-763, 764	Feb, 1995	H-3	584.4290 ± 101.0550	707.1020 ± 105.5380	645.7655 ± 73.0589
MI-881, 882	Feb, 1995	I-131	0.1760 ± 0.2567	0.1552 ± 0.2852	0.1656 ± 0.1919
MI-881, 882	Feb, 1995	K-40	1,340.4000 ± 164.0000	1,492.0000 ± 101.0000	1,416.2000 ± 96.3029
MI-838, 839	Feb, 1995	Co-60	0.9670 ± 2.6500	-0.4760 ± 3.8100	0.2455 ± 2.3205
MI-838, 839	Feb, 1995	Cs-134	-0.0557 ± 2.2800	-1.4200 ± 3.0900	-0.7379 ± 1.9201
MI-838, 839	Feb, 1995	Cs-137	-0.4380 ± 2.5500	-0.4370 ± 3.0900	-0.4375 ± 2.0032
MI-838, 839	Feb, 1995	I-131	0.1283 ± 0.1951	0.0880 ± 0.1984	0.1081 ± 0.1391
MI-838, 839	Feb, 1995	I-131(g)	-0.2560 ± 2.5800	-0.5630 ± 3.1800	-0.4095 ± 2.0475
MI-838, 839	Feb, 1995	K-40	1,298.6000 ± 99.4000	1,232.5000 ± 125.0000	1,265.5500 ± 79.8520
MI-838, 839	Feb, 1995	Sr-89	0.5302 ± 0.5774	0.5000 ± 0.6000	0.5151 ± 0.4164
MI-838, 839	Feb, 1995	Sr-90	0.8186 ± 0.2809	0.8000 ± 0.3000	0.8093 ± 0.2055
MI-937, 938	Feb, 1995	I-131	-0.0083 ± 0.1800	-0.0270 ± 0.1800	-0.0177 ± 0.1273
MI-937, 938	Feb, 1995	K-40	1,451.8000 ± 69.6000	1,456.6000 ± 141.0000	1,454.2000 ± 78.6212
SW-904, 905	Feb, 1995	H-3	640.3425 ± 104.5679	597.4040 ± 103.0233	618.8733 ± 73.3966
MI-1216, 1217	Feb, 1995	I-131	0.2640 ± 0.2740	0.1160 ± 0.2600	0.1900 ± 0.1889
MI-1216, 1217	Feb, 1995	K-40	1,583.0000 ± 131.0000	1,493.6000 ± 174.0000	1,538.3000 ± 108.9002
SW-1237, 1238	Feb, 1995	H-3	55.3942 ± 97.3964	4.8591 ± 95.3581	30.1267 ± 68.1528
SW-1264, 1265	Feb, 1995	H-3	67.0910 ± 81.1760	109.2630 ± 83.1440	88.1770 ± 58.1001
G-1343, 1344	Feb, 1995	Be-7	11.4490 ± 0.2850	11.8800 ± 0.2560	11.6645 ± 0.1915
G-1343, 1344	Feb, 1995	K-40	2.9844 ± 0.2420	3.0269 ± 0.2250	3.0057 ± 0.1652
SW-1494, 1495	Feb, 1995	Co-60	-2.1900 ± 4.1200	0.0565 ± 3.4400	-1.0668 ± 2.6837
SW-1494, 1495	Feb, 1995	Cs-137	3.4500 ± 3.6600	0.2430 ± 3.5700	1.8465 ± 2.5564
SW-1367, 1368	Feb, 1995	H-3	560.3183 ± 103.1109	606.1104 ± 104.7919	583.2144 ± 73.5072

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
WW-1394, 1395	Feb, 1995	H-3	47.8810 ± 80.1790	-24.8930 ± 76.6250	11.4940 ± 55.4528
SWT-1515, 1516	Feb, 1995	Gr. Beta	2.4460 ± 0.5250	1.6920 ± 0.5000	2.0690 ± 0.3625
WW-1536, 1537	Feb, 1995	H-3	2,874.3025 ± 167.5000	2,924.0574 ± 168.6330	2,899.1800 ± 118.8416
WW-1563, 1564	Mar, 1995	H-3	33.5160 ± 82.6640	39.5490 ± 82.9570	36.5325 ± 58.5560
WW-1618, 1619	Mar, 1995	Co-60	2.8000 ± 1.5000	2.2000 ± 4.6000	2.5000 ± 2.4192
WW-1618, 1619	Mar, 1995	Cs-137	-0.9000 ± 1.7000	-2.5000 ± 3.2000	-1.7000 ± 1.8118
WW-1618, 1619	Mar, 1995	H-3	4,333.0000 ± 204.0000	4,457.0000 ± 206.0000	4,395.0000 ± 144.9586
MI-1663, 1664	Mar, 1995	Co-60	1.9500 ± 3.2400	-1.5300 ± 2.7200	0.2100 ± 2.1152
MI-1663, 1664	Mar, 1995	Cs-134	0.1690 ± 2.7700	-1.1300 ± 2.0500	-0.4805 ± 1.7230
MI-1663, 1664	Mar, 1995	Cs-137	-0.0737 ± 2.7400	0.9210 ± 2.4100	0.4237 ± 1.8245
MI-1663, 1664	Mar, 1995	I-131	0.1226 ± 0.2720	0.2261 ± 0.3010	0.1744 ± 0.2028
MI-1663, 1664	Mar, 1995	I-131(g)	-0.4090 ± 3.7100	0.1220 ± 3.4200	-0.1435 ± 2.5229
MI-1663, 1664	Mar, 1995	K-40	1,592.1000 ± 124.0000	1,555.6000 ± 118.0000	1,573.8500 ± 85.5862
MI-1663, 1664	Mar, 1995	La-140	-1.6500 ± 3.1000	-0.2240 ± 2.6800	-0.9370 ± 2.0489
MI-1663, 1664	Mar, 1995	Sr-89	0.5984 ± 0.6672	0.5889 ± 0.7467	0.5937 ± 0.5007
MI-1663, 1664	Mar, 1995	Sr-90	1.3624 ± 0.3718	1.5034 ± 0.4517	1.4329 ± 0.2925
WW-1684, 1685	Mar, 1995	Gr. Beta	4.9280 ± 0.7420	5.0100 ± 0.7400	4.9690 ± 0.5240
WW-1684, 1685	Mar, 1995	H-3	81.7160 ± 84.9140	85.7340 ± 85.1040	83.7250 ± 60.1105
LW-1707, 1708	Mar, 1995	Co-58	0.4070 ± 3.0300	0.0486 ± 2.8500	0.2278 ± 2.0799
LW-1707, 1708	Mar, 1995	Co-60	1.0600 ± 2.8900	1.5000 ± 2.7000	1.2800 ± 1.9775
LW-1707, 1708	Mar, 1995	Cs-134	-1.8600 ± 3.0500	-1.5400 ± 2.8300	-1.7000 ± 2.0803
LW-1707, 1708	Mar, 1995	Cs-137	2.5900 ± 2.9600	-1.3700 ± 2.5100	0.6100 ± 1.9405
LW-1707, 1708	Mar, 1995	Fe-59	5.5200 ± 6.1500	-6.6900 ± 6.1500	-0.5850 ± 4.3487
LW-1707, 1708	Mar, 1995	Gr. Beta	1.9570 ± 0.4850	2.1270 ± 0.4760	2.0420 ± 0.3398
LW-1707, 1708	Mar, 1995	I-131	0.2350 ± 0.2925	-0.0500 ± 0.2859	0.0925 ± 0.2045
LW-1707, 1708	Mar, 1995	I-131(g)	-0.6900 ± 6.6800	-0.6210 ± 6.2000	-0.6555 ± 4.5569
LW-1707, 1708	Mar, 1995	K-40	79.3000 ± 42.8000	75.3000 ± 39.2000	77.3000 ± 29.0193
LW-1707, 1708	Mar, 1995	La-140	-3.5900 ± 5.0900	1.2800 ± 4.5800	-1.1550 ± 3.4236
LW-1707, 1708	Mar, 1995	Mn-54	-1.9300 ± 3.1200	0.7640 ± 2.5200	-0.5830 ± 2.0053
LW-1707, 1708	Mar, 1995	Ru-103	-0.1320 ± 3.3400	-0.7770 ± 2.9700	-0.4545 ± 2.2348
LW-1707, 1708	Mar, 1995	Zn-65	-2.6700 ± 6.4700	-1.7400 ± 5.7700	-2.2050 ± 4.3346
LW-1707, 1708	Mar, 1995	Zr-Nb-95	-0.2680 ± 3.0600	-3.2400 ± 2.7200	-1.7540 ± 2.0471
SW-1762, 1763	Mar, 1995	H-3	104.4150 ± 89.3960	92.2110 ± 88.8390	98.3130 ± 63.0159
SO-1861, 1862	Mar, 1995	Cs-137	0.2587 ± 0.0414	0.2481 ± 0.0248	0.2534 ± 0.0241
SO-1861, 1862	Mar, 1995	K-40	11.7290 ± 0.5530	11.2500 ± 0.4990	11.4895 ± 0.3724
SO-1861, 1862	Mar, 1995	Ra-226	1.6890 ± 0.3970	1.5274 ± 0.2730	1.6082 ± 0.2409

Table A-5. In-house "duplicate" samples.

				Concentration in pCi/L[a]	
Lab Codes[b]	Sample Date	Analysis	First Result	Second Result	Averaged Result
SW-1919, 1920	Mar, 1995	H-3	-9.1230 ± 85.2000	66.6680 ± 88.8670	28.7725 ± 61.5556
SW-1919, 1920	Mar, 1995	H-3	-9.1230 ± 85.2005	66.6679 ± 88.8672	28.7725 ± 61.5559
WWU-2031, 2032	Mar, 1995	Gr. Alpha	1.9830 ± 2.2510	3.0330 ± 2.4400	2.5080 ± 1.6599
WWU-2031, 2032	Mar, 1995	Gr. Beta	1.2540 ± 1.9270	2.1120 ± 1.9680	1.6830 ± 1.3772
CW-1997, 1998	Mar, 1995	Gr. Beta	2.6670 ± 0.9880	2.3100 ± 1.3570	2.4885 ± 0.8393
CW-1997, 1998	Mar, 1995	Gr. Beta	-0.5301 ± 0.9521	0.6351 ± 1.1355	0.0525 ± 0.7409
AP-2784, 2785	Mar, 1995	Co-60	-0.0004 ± 0.0006	-0.0003 ± 0.0005	-0.0003 ± 0.0004
AP-2784, 2785	Mar, 1995	Cs-137	-0.0003 ± 0.0006	0.0001 ± 0.0004	-0.0001 ± 0.0004
MI-2083, 2084	Mar, 1995	I-131	0.0210 ± 0.1920	0.0150 ± 0.1850	0.0180 ± 0.1333
MI-2083, 2084	Mar, 1995	K-40	1,273.9000 ± 69.7000	1,328.9000 ± 59.8000	1,301.4000 ± 45.9188
MI-2083, 2084	Mar, 1995	Sr-90	1.5850 ± 0.4530	1.8040 ± 0.5520	1.6945 ± 0.3570
SW-2104, 2105	Mar, 1995	Gr. Beta	1.6690 ± 0.5320	1.7090 ± 0.5640	1.6890 ± 0.3877
SW-2200, 2201	Mar, 1995	H-3	33.7710 ± 85.6270	54.0340 ± 86.5810	43.9025 ± 60.8857
SW-2355, 2356	Mar, 1995	Co-60	0.6430 ± 1.5100	0.8670 ± 1.5800	0.7550 ± 1.0928
SW-2355, 2356	Mar, 1995	Cs-137	2.2000 ± 1.5400	0.0533 ± 1.8500	1.1267 ± 1.2035
AP-2453, 2454	Mar, 1995	Sr-89	0.0002 ± 0.0006	-0.0001 ± 0.0006	0.0000 ± 0.0004
AP-2453, 2454	Mar, 1995	Sr-90	0.0000 ± 0.0002	0.0001 ± 0.0003	0.0001 ± 0.0002
AP-2805, 2806	Mar, 1995	Co-60	-0.0001 ± 0.0004	0.0002 ± 0.0003	0.0000 ± 0.0002
AP-2805, 2806	Mar, 1995	Cs-137	0.0002 ± 0.0004	0.0000 ± 0.0004	0.0001 ± 0.0003
SW-2221, 2222	Mar, 1995	K-40	149.6900 ± 74.4000	119.3800 ± 46.7000	134.5350 ± 43.9211
PW-2248, 2249	Mar, 1995	H-3	154.6240 ± 91.0610	164.7520 ± 91.5110	159.6880 ± 64.5491
PW-2271, 2272	Mar, 1995	Co-60	-0.4760 ± 1.9800	-1.2100 ± 2.8900	-0.8430 ± 1.7516
PW-2271, 2272	Mar, 1995	Cs-137	0.9590 ± 2.0500	0.8750 ± 3.4600	0.9170 ± 2.0109
MI-2149, 2150	Apr, 1995	Co-60	-1.2100 ± 2.2200	0.6560 ± 2.6900	-0.2770 ± 1.7439
MI-2149, 2150	Apr, 1995	Cs-137	0.1650 ± 2.0400	2.3100 ± 2.2200	1.2375 ± 1.5075
MI-2149, 2150	Apr, 1995	I-131(G)	0.0888 ± 2.2200	0.3000 ± 2.5100	0.1944 ± 1.6754
WW-2313, 2314	Apr, 1995	Gr. Beta	0.5850 ± 0.4990	0.9810 ± 0.5230	0.7830 ± 0.3614
CW-2401, 2402	Apr, 1995	Gr. Beta	1.7069 ± 1.2973	3.4661 ± 1.4515	2.5865 ± 0.9734
CW-2401, 2402	Apr, 1995	Gr. Beta	0.0096 ± 1.1238	0.4760 ± 1.1031	0.2428 ± 0.7874
SL-2567, 2568	Apr, 1995	K-40	1.4123 ± 0.4360	1.7225 ± 0.3760	1.5674 ± 0.2879
WW-2432, 2433	Apr, 1995	H-3	-21.5803 ± 82.7489	2.6975 ± 83.9276	-9.4414 ± 58.9305
WW-2659, 2660	Apr, 1995	Gr. Beta	0.5450 ± 0.6040	0.3970 ± 0.4440	0.4710 ± 0.3748
WW-2659, 2660	Apr, 1995	H-3	38.3900 ± 87.4520	133.3540 ± 91.7350	85.8720 ± 63.3703
MI-2713, 2714	Apr, 1995	I-131	0.3870 ± 0.5277	0.1686 ± 0.2430	0.2778 ± 0.2905
MI-2713, 2714	Apr, 1995	K-40	1,420.9000 ± 137.0000	1,420.0000 ± 137.0000	1,420.4500 ± 96.8736
CW-2739, 2740	Apr, 1995	Gr. Beta	13.7987 ± 2.0770	14.3132 ± 2.1038	14.0560 ± 1.4782

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
CW-2739, 2740	Apr, 1995	Gr. Beta	5.0526 ± 1.5206	2.2742 ± 1.3431	3.6634 ± 1.0144
SW-2686, 2687	Apr, 1995	H-3	52.6753 ± 86.9675	2.0260 ± 84.5748	27.3506 ± 60.6552
WW-3447, 3448	Apr, 1995	Gr. Alpha	-0.2920 ± 1.6860	-1.4650 ± 1.6480	-0.8785 ± 1.1788
WW-3447, 3448	Apr, 1995	Gr. Beta	1.2340 ± 1.7000	3.1840 ± 1.8140	2.2090 ± 1.2430
CW-2835, 2836	Apr, 1995	Gr. Beta	1.9571 ± 1.4080	2.7378 ± 1.4641	2.3474 ± 1.0157
CW-2835, 2836	Apr, 1995	Gr. Beta	0.1817 ± 1.1916	0.8185 ± 1.2403	0.5001 ± 0.8600
CW-2918, 2919	Apr, 1995	Gr. Beta	5.3065 ± 1.6254	4.2821 ± 1.5611	4.7943 ± 1.1268
CW-2918, 2919	Apr, 1995	Gr. Beta	2.0988 ± 1.3349	0.7752 ± 1.2404	1.4370 ± 0.9111
F-3552, 3553	Apr, 1995	K-40	3.1142 ± 0.4410	2.8860 ± 0.2410	3.0001 ± 0.2513
F-3552, 3553	Apr, 1995	Sr-89	-0.0061 ± 0.0064	0.0011 ± 0.0080	-0.0025 ± 0.0051
F-3552, 3553	Apr, 1995	Sr-90	0.0023 ± 0.0029	0.0005 ± 0.0036	0.0014 ± 0.0023
SWT-3343, 3344	Apr, 1995	Gr. Beta	2.3310 ± 0.5190	2.9830 ± 0.4800	2.6570 ± 0.3535
G-3133, 3134	Apr, 1995	K-40	6.5000 ± 0.1740	6.0532 ± 0.3120	6.2766 ± 0.1786
SW-3403, 3404	Apr, 1995	H-3	159.5512 ± 90.5914	72.7069 ± 86.6327	116.1290 ± 62.6738
WW-3424, 3425	Apr, 1995	H-3	442.5093 ± 116.7309	430.4409 ± 116.3142	436.4751 ± 82.3940
LW-3682, 3683	Apr, 1995	Gr. Beta	2.0500 ± 0.5760	1.5240 ± 0.5500	1.7870 ± 0.3982
LW-3682, 3683	Apr, 1995	Gr. Beta	2.0501 ± 0.6760	1.5244 ± 0.5500	1.7872 ± 0.4358
LW-3682, 3683	Apr, 1995	H-3	139.9350 ± 91.1490	75.0380 ± 88.2140	107.4865 ± 63.4229
LW-3682, 3683	Apr, 1995	H-3	75.0378 ± 88.2143	139.9353 ± 91.1494	107.4865 ± 63.4231
SO-3531, 3532	May, 1995	Cs-137	0.1624 ± 0.0246	0.1418 ± 0.0306	0.1521 ± 0.0196
SO-3531, 3532	May, 1995	Gr. Alpha	6.8662 ± 3.5751	9.2164 ± 3.8687	8.0413 ± 2.6338
SO-3531, 3532	May, 1995	Gr. Beta	17.0973 ± 3.0829	18.8034 ± 3.1329	17.9503 ± 2.1977
SO-3531, 3532	May, 1995	K-40	25.0380 ± 0.7710	23.8180 ± 0.6600	24.4280 ± 0.5075
SO-3531, 3532	May, 1995	Sr-89	-0.0129 ± 0.0215	0.0014 ± 0.0202	-0.0057 ± 0.0147
SO-3531, 3532	May, 1995	Sr-90	0.0261 ± 0.0109	0.0122 ± 0.0093	0.0191 ± 0.0072
WW-3577, 3578	May, 1995	Co-60	-0.2530 ± 2.2200	0.5410 ± 2.5800	0.1440 ± 1.7018
WW-3577, 3578	May, 1995	Cs-137	1.1500 ± 2.2000	-1.6400 ± 2.9200	-0.2450 ± 1.8280
WW-3577, 3578	May, 1995	H-3	33.5750 ± 90.9827	58.7563 ± 92.0487	46.1657 ± 64.7125
MI-3598, 3599	May, 1995	I-131	0.2288 ± 0.3515	0.2122 ± 0.3043	0.2205 ± 0.2324
MI-3598, 3599	May, 1995	K-40	1,349.0000 ± 112.0000	1,297.4000 ± 151.0000	1,323.2000 ± 94.0013
MI-3809, 3810	May, 1995	Co-60	-0.3700 ± 2.9600	0.1820 ± 2.9600	-0.0940 ± 2.0930
MI-3809, 3810	May, 1995	Cs-137	0.9060 ± 2.5000	0.1380 ± 2.3600	0.5220 ± 1.7190
MI-3809, 3810	May, 1995	I-131	0.1445 ± 0.1573	0.1738 ± 0.2057	0.1592 ± 0.1295
CW-3838, 3839	May, 1995	Gr. Beta	1.9922 ± 1.3549	3.4291 ± 1.4650	2.7106 ± 0.9977
CW-3838, 3839	May, 1995	Gr. Beta	-0.7347 ± 1.2274	-1.0782 ± 1.2004	-0.9064 ± 0.8584
F-4309, 4310	May, 1995	Co-60	-0.0017 ± 0.0093	-0.0032 ± 0.0166	-0.0024 ± 0.0095

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
F-4309, 4310	May, 1995	Cs-137	0.0028 ± 0.0089	0.0012 ± 0.0133	0.0020 ± 0.0080
F-4288, 4289	May, 1995	Co-60	0.0038 ± 0.0097	0.0012 ± 0.0088	0.0025 ± 0.0065
F-4288, 4289	May, 1995	Cs-137	0.0002 ± 0.0067	0.0022 ± 0.0062	0.0012 ± 0.0045
F-4330, 4331	May, 1995	Co-60	0.0018 ± 0.0046	0.0031 ± 0.0050	0.0024 ± 0.0034
F-4330, 4331	May, 1995	Cs-137	0.0001 ± 0.0042	-0.0007 ± 0.0038	-0.0003 ± 0.0028
MI-4377, 4378	May, 1995	Co-60	0.9480 ± 1.7400	2.2200 ± 2.6600	1.5840 ± 1.5893
MI-4377, 4378	May, 1995	Cs-134	0.7830 ± 1.4900	-0.2080 ± 2.3000	0.2875 ± 1.3702
MI-4377, 4378	May, 1995	Cs-137	0.8740 ± 1.3800	0.6430 ± 2.1400	0.7585 ± 1.2732
MI-4377, 4378	May, 1995	I-131	-0.0785 ± 0.1490	-0.0420 ± 0.1498	-0.0602 ± 0.1056
MI-4377, 4378	May, 1995	I-131(g)	0.1700 ± 1.3000	-1.1200 ± 2.6200	-0.4750 ± 1.4624
MI-4377, 4378	May, 1995	K-40	1,385.1000 ± 63.2000	1,344.3000 ± 92.5000	1,364.7000 ± 56.0145
MI-4377, 4378	May, 1995	Sr-89	-0.0069 ± 0.7313	0.0069 ± 1.1490	0.0000 ± 0.6810
MI-4377, 4378	May, 1995	Sr-90	1.2729 ± 0.4414	1.3229 ± 0.6414	1.2979 ± 0.3893
MI-4544, 4545	May, 1995	I-131	0.0524 ± 0.2867	0.0574 ± 0.2367	0.0549 ± 0.1859
MI-4544, 4545	May, 1995	K-40	1,410.0000 ± 72.3000	1,359.0000 ± 65.7000	1,384.5000 ± 48.8461
MI-4544, 4545	May, 1995	Sr-90	2.1444 ± 0.5153	1.2741 ± 0.4112	1.7093 ± 0.3296
G-4604, 4605	May, 1995	Be-7	1.9338 ± 0.3520	1.7467 ± 0.3580	1.8403 ± 0.2510
G-4604, 4605	May, 1995	Co-60	-0.0112 ± 0.0217	-0.0175 ± 0.0189	-0.0144 ± 0.0144
G-4604, 4605	May, 1995	Cs-134	0.0076 ± 0.0165	0.0079 ± 0.0163	0.0078 ± 0.0116
G-4604, 4605	May, 1995	Cs-137	0.1303 ± 0.0332	0.1283 ± 0.0420	0.1293 ± 0.0268
G-4604, 4605	May, 1995	Gr. Beta	3.9523 ± 0.1425	3.9500 ± 0.1562	3.9512 ± 0.1057
G-4604, 4605	May, 1995	I-131(g)	0.0101 ± 0.0227	0.0055 ± 0.0263	0.0078 ± 0.0174
G-4604, 4605	May, 1995	K-40	5.1487 ± 0.6580	5.1002 ± 0.6970	5.1245 ± 0.4793
CW-4575, 4576	May, 1995	Gr. Beta	1.9783 ± 1.1888	2.8278 ± 1.2558	2.4030 ± 0.8646
CW-4575, 4576	May, 1995	Gr. Beta	-0.2059 ± 1.0000	-0.5589 ± 0.9721	-0.3824 ± 0.6973
MI-4695, 4696	May, 1995	I-131	0.1049 ± 0.1737	0.0942 ± 0.1607	0.0995 ± 0.1183
MI-4695, 4696	May, 1995	K-40	1,568.8000 ± 114.0000	1,573.1000 ± 50.1000	1,570.9500 ± 62.2616
MI-4716, 4717	May, 1995	Sr-89	-0.2701 ± 0.7584	-0.0499 ± 0.8752	-0.1600 ± 0.5790
MI-4716, 4717	May, 1995	Sr-90	1.1720 ± 0.4391	1.6280 ± 0.4432	1.4000 ± 0.3119
G-4814, 4815	May, 1995	Be-7	0.6081 ± 0.2520	0.5837 ± 0.1750	0.5959 ± 0.1534
G-4814, 4815	May, 1995	K-40	5.8319 ± 0.6100	5.1295 ± 0.5050	5.4807 ± 0.3960
WW-4784, 4785	May, 1995	H-3	18,665.3086 ± 390.2155	18,274.9314 ± 386.3294	18,470.1200 ± 274.5535
SW-4759, 4760	May, 1995	H-3	3,679.8217 ± 213.9409	3,817.7847 ± 217.0401	3,748.8032 ± 152.3787
SO-5178, 5179	May, 1995	Cs-137	0.8481 ± 0.0691	0.8110 ± 0.0710	0.8296 ± 0.0495
SO-5178, 5179	May, 1995	K-40	19.9200 ± 1.0800	22.0860 ± 1.1800	21.0030 ± 0.7998
SWU-5663, 5664	May, 1995	Gr. Beta	2.4654 ± 0.6199	2.5106 ± 0.6258	2.4880 ± 0.4404

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
SWU-5663, 5664	May, 1995	H-3	867.2182 ± 104.9067	865.5032 ± 104.8506	866.3607 ± 74.1604
BS - 6983, 6984	May, 1995	Gr. Beta	7.3555 ± 1.2333	8.0347 ± 1.4183	7.6951 ± 0.9397
BS - 6983, 6984	May, 1995	Gr. Beta	7.3555 ± 1.2333	8.0347 ± 1.4183	7.6951 ± 0.9397
BS - 6983, 6984	May, 1995	K-40	8.3490 ± 0.3090	8.5309 ± 0.0683	8.4400 ± 0.1582
BS - 6983, 6984	May, 1995	K-40	8.3490 ± 0.3090	8.5309 ± 0.0683	8.4400 ± 0.1582
BS-6983, 6984	May, 1995	Cs-137	0.0074 ± 0.0008	0.0094 ± 0.0024	0.0084 ± 0.0013
BS-6983, 6984	May, 1995	Gr. Beta	7.3555 ± 1.2333	8.0347 ± 1.4183	7.6951 ± 0.9397
BS-6983, 6984	May, 1995	K-40	8.3490 ± 0.3090	8.5309 ± 0.0683	8.4400 ± 0.1582
BS - 5494, 5495	May, 1995	Cs-137	0.5929 ± 0.0319	0.5876 ± 0.0378	0.5903 ± 0.0247
BS - 5494, 5495	May, 1995	Cs-137	0.5929 ± 0.0319	0.5876 ± 0.0378	0.5903 ± 0.0247
BS - 5494, 5495	May, 1995	K-40	21.0920 ± 0.6570	21.3050 ± 0.7070	21.1985 ± 0.4826
BS - 5494, 5495	May, 1995	K-40	21.0920 ± 0.6570	21.3050 ± 0.7070	21.1985 ± 0.4826
BS-5494, 5495	May, 1995	Cs-137	0.5929 ± 0.0319	0.5876 ± 0.0378	0.5903 ± 0.0247
BS-5494, 5495	May, 1995	K-40	21.0920 ± 0.6570	21.3050 ± 0.7070	21.1985 ± 0.4826
F-5025, 5026	May, 1995	Co-60	0.0024 ± 0.0064	0.0028 ± 0.0077	0.0026 ± 0.0050
F-5025, 5026	May, 1995	Cs-137	-0.0006 ± 0.0050	-0.0038 ± 0.0063	-0.0022 ± 0.0040
F-5385, 5386	May, 1995	K-40	2.5044 ± 0.3450	2.5992 ± 0.3830	2.5518 ± 0.2577
F-5046, 5047	May, 1995	Co-60	0.0012 ± 0.0067	-0.0021 ± 0.0073	-0.0004 ± 0.0049
F-5046, 5047	May, 1995	Cs-137	0.0018 ± 0.0053	-0.0003 ± 0.0046	0.0007 ± 0.0035
WW-5244, 5245	May, 1995	H-3	608.3574 ± 96.3200	463.5639 ± 91.1176	535.9606 ± 66.2947
SW-6013, 6014	May, 1995	Co-60	0.8080 ± 2.2000	1.5300 ± 3.0300	1.1690 ± 1.8722
SW-6013, 6014	May, 1995	Cs-137	-0.6750 ± 2.3000	0.4560 ± 2.3200	-0.1095 ± 1.6334
MI-5620, 5621	May, 1995	I-131	0.1589 ± 0.1736	0.0147 ± 0.1644	0.0868 ± 0.1196
MI-5620, 5621	May, 1995	K-40	1,526.2000 ± 119.0000	1,449.3000 ± 162.0000	1,487.7500 ± 100.5050
WW - 5642, 5643	May, 1995	Gr. Alpha	2.3120 ± 2.3250	2.3120 ± 2.3250	2.3120 ± 1.6440
WW - 5642, 5643	May, 1995	Gr. Beta	2.3120 ± 3.2540	2.3120 ± 3.2540	2.3120 ± 2.3009
WW - 5642, 5643	May, 1995	K-40	94.3550 ± 19.8000	58.9910 ± 29.5000	76.6730 ± 17.7644
DW-5738, 5739	May, 1995	Gr. Beta	2.5151 ± 1.1685	3.5614 ± 1.2103	3.0383 ± 0.8411
DW-5738, 5739	May, 1995	I-131	-0.0458 ± 0.1650	-0.0284 ± 0.1486	-0.0371 ± 0.1110
LW-6327, 6328	May, 1995	Gr. Beta	6.4501 ± 1.0293	6.6100 ± 1.0327	6.5300 ± 0.7290
W-6398, 6399	May, 1995	Sr-89	15.1044 ± 3.8169	18.1475 ± 2.7239	16.6259 ± 2.3446
W-6398, 6399	May, 1995	Sr-90	25.0828 ± 1.8532	24.4207 ± 1.3058	24.7518 ± 1.1335
WW-6184, 6185	Jun, 1995	Gr. Beta	6.0148 ± 1.1147	7.4613 ± 1.3560	6.7380 ± 0.8777
WW-6184, 6185	Jun, 1995	H-3	86.1439 ± 78.3469	106.9572 ± 79.2631	96.5505 ± 55.7245
MI-5684, 5685	Jun, 1995	Co-60	0.0976 ± 2.9600	0.4260 ± 4.6300	0.2618 ± 2.7477
MI-5684, 5685	Jun, 1995	Cs-137	1.8400 ± 2.6500	-0.9210 ± 3.2400	0.4595 ± 2.0929

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
MI-5684, 5685	Jun, 1995	I-131	0.0829 ± 0.1477	-0.0025 ± 0.1466	0.0402 ± 0.1041
CW-5713, 5714	Jun, 1995	Gr. Beta	3.1068 ± 1.4397	3.2557 ± 1.4487	3.1812 ± 1.0212
CW-5713, 5714	Jun, 1995	Gr. Beta	0.0491 ± 1.4849	0.3925 ± 1.5076	0.2208 ± 1.0580
SL-5832, 5833	Jun, 1995	Co-60	0.0410 ± 0.0114	0.0585 ± 0.0182	0.0498 ± 0.0107
SL-5832, 5833	Jun, 1995	Cs-137	0.0550 ± 0.0124	0.0499 ± 0.0215	0.0525 ± 0.0124
SL-5832, 5833	Jun, 1995	Gr. Beta	4.6800 ± 0.4800	4.6800 ± 0.4800	4.6800 ± 0.3394
SL-5832, 5833	Jun, 1995	K-40	2.9035 ± 0.2750	2.4429 ± 0.3290	2.6732 ± 0.2144
SL-5832, 5833	Jun, 1995	Sr-89	0.0106 ± 0.0261	0.0048 ± 0.0336	0.0077 ± 0.0213
SL-5832, 5833	Jun, 1995	Sr-90	0.0102 ± 0.0114	0.0164 ± 0.0148	0.0133 ± 0.0093
WW-5992, 5993	Jun, 1995	Co-60	0.3950 ± 1.2200	0.9060 ± 2.6500	0.6505 ± 1.4587
WW-5992, 5993	Jun, 1995	Cs-137	-1.4000 ± 1.3800	-1.4400 ± 3.0300	-1.4200 ± 1.6647
WW-5992, 5993	Jun, 1995	H-3	67.0084 ± 76.1576	94.0370 ± 77.3473	80.5227 ± 54.2738
SL-6205, 6206	Jun, 1995	Co-60	0.0029 ± 0.0088	0.0111 ± 0.0120	0.0070 ± 0.0074
SL-6205, 6206	Jun, 1995	Cs-134	0.0033 ± 0.0070	0.0002 ± 0.0096	0.0018 ± 0.0059
SL-6205, 6206	Jun, 1995	Cs-137	0.0138 ± 0.0091	0.0174 ± 0.0104	0.0156 ± 0.0069
SL-6205, 6206	Jun, 1995	Gr. Beta	3.3400 ± 0.1000	3.3400 ± 0.1000	3.3400 ± 0.0707
SL-6205, 6206	Jun, 1995	I-131(g)	-0.0060 ± 0.0135	-0.0003 ± 0.0197	-0.0031 ± 0.0119
SL-6205, 6206	Jun, 1995	K-40	3.3386 ± 0.3100	3.3294 ± 0.3780	3.3340 ± 0.2444
SW-6256, 6257	Jun, 1995	H-3	423.9034 ± 92.0134	585.0329 ± 97.8935	504.4682 ± 67.1744
MI-6277, 6278	Jun, 1995	I-131	0.0926 ± 0.1619	0.0532 ± 0.2284	0.0729 ± 0.1400
MI-6277, 6278	Jun, 1995	K-40	1,285.5000 ± 152.0000	1,355.2000 ± 114.0000	1,320.3500 ± 95.0000
SW-6232, 6233	Jun, 1995	H-3	68.3732 ± 79.4680	136.7465 ± 82.4296	102.5599 ± 57.2490
VE-6348, 6349	Jun, 1995	Gr. Alpha	0.3230 ± 0.0990	0.1780 ± 0.0520	0.2505 ± 0.0559
VE-6348, 6349	Jun, 1995	Gr. Beta	3.2970 ± 0.1410	3.4170 ± 0.0920	3.3570 ± 0.0842
VE-6348, 6349	Jun, 1995	K-40	3.1425 ± 0.3310	2.9775 ± 0.3350	3.0600 ± 0.2355
MI-6419, 6420	Jun, 1995	I-131	0.1154 ± 0.1633	0.1197 ± 0.1806	0.1175 ± 0.1217
MI-6419, 6420	Jun, 1995	K-40	1,457.2000 ± 175.0000	1,339.3000 ± 150.0000	1,398.2500 ± 115.2443
MI-6521, 6522	Jun, 1995	I-131	0.0534 ± 0.1511	0.0344 ± 0.1784	0.0439 ± 0.1169
MI-6521, 6522	Jun, 1995	K-40	1,475.4000 ± 123.0000	1,274.6000 ± 160.0000	1,375.0000 ± 100.9071
SL-6500, 6501	Jun, 1995	K-40	1.8001 ± 0.4550	2.1667 ± 0.5460	1.9834 ± 0.3554
MI-6446, 6447	Jun, 1995	Co-60	0.1640 ± 4.8700	0.4440 ± 2.8200	0.3040 ± 2.8138
MI-6446, 6447	Jun, 1995	Cs-137	1.3000 ± 3.3600	0.0563 ± 2.1800	0.6782 ± 2.0026
MI-6446, 6447	Jun, 1995	I-131	-0.0433 ± 0.2077	0.0000 ± 0.2377	-0.0217 ± 0.1578
CW-6474, 6475	Jun, 1995	Gr. Beta	2.8423 ± 1.4039	3.1674 ± 1.4145	3.0049 ± 0.9965
CW-6474, 6475	Jun, 1995	Gr. Beta	0.0000 ± 1.1519	0.0909 ± 1.1588	0.0455 ± 0.8170
MI-6564, 6565	Jun, 1995	I-131	0.2460 ± 0.2607	0.0948 ± 0.2353	0.1704 ± 0.1756

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
BS-6960, 6961	Jun, 1995	Cs-137	0.0752 ± 0.0292	0.0475 ± 0.0274	0.0613 ± 0.0200
BS-6960, 6961	Jun, 1995	K-40	17.6680 ± 0.8700	17.0190 ± 1.0600	17.3435 ± 0.6857
WW-6861, 6862	Jun, 1995	H-3	1,422.4460 ± 128.0232	1,505.1361 ± 130.2761	1,463.7910 ± 91.3261
MI-6840, 6841	Jun, 1995	I-131	0.1583 ± 0.2131	0.0509 ± 0.1801	0.1046 ± 0.1395
LW-6889, 6890	Jun, 1995	Co-60	-2.4000 ± 3.4100	1.4300 ± 1.7400	-0.4850 ± 1.9141
LW-6889, 6890	Jun, 1995	Cs-137	-0.5210 ± 3.0300	0.1410 ± 2.1900	-0.1900 ± 1.8693
LW-6889, 6890	Jun, 1995	Gr. Beta	3.0131 ± 0.8315	3.0285 ± 0.8358	3.0208 ± 0.5895
SW-7053, 7054	Jun, 1995	H-3	73.2226 ± 75.6858	126.8001 ± 78.1734	100.0114 ± 54.4046
SW-7011, 7012	Jun, 1995	H-3	203.5633 ± 81.5943	226.7766 ± 82.6041	215.1699 ± 58.0540
MI-7032, 7033	Jun, 1995	I-131	0.2720 ± 0.2879	-0.0925 ± 0.2629	0.0897 ± 0.1949
MI-7032, 7033	Jun, 1995	K-40	1,577.6000 ± 127.0000	1,522.8000 ± 164.0000	1,550.2000 ± 103.7123
SWU-7101, 7102	Jun, 1995	Gr. Beta	1.9679 ± 0.4592	2.1339 ± 0.5061	2.0509 ± 0.3417
SWU-7101, 7102	Jun, 1995	H-3	118.5873 ± 85.7967	92.6463 ± 84.6688	105.6168 ± 60.2700
SWU - 7828, 7829	Jun, 1995	Sr-89	0.5896 ± 0.7987	0.0977 ± 0.6691	0.3436 ± 0.5210
SWU - 7828, 7829	Jun, 1995	Sr-90	0.2398 ± 0.3028	0.1937 ± 0.2742	0.2168 ± 0.2042
SWU - 7828, 7829	Jun, 1995	Sr-90	0.2398 ± 0.3028	0.1937 ± 0.2742	0.2168 ± 0.2042
SWU-7828, 7829	Jun, 1995	Sr-89	0.5896 ± 0.7987	0.0977 ± 0.6691	0.3436 ± 0.5210
SWU-7828, 7829	Jun, 1995	Sr-89	0.5896 ± 0.7987	0.0977 ± 0.6691	0.3436 ± 0.5210
SWU-7828, 7829	Jun, 1995	Sr-89	0.5896 ± 0.7987	0.0977 ± 0.6691	0.3436 ± 0.5210
SWU-7828, 7829	Jun, 1995	Sr-89	0.5896 ± 0.7987	0.0977 ± 0.6691	0.3436 ± 0.5210
SWU-7828, 7829	Jun, 1995	Sr-90	0.2398 ± 0.3028	0.1937 ± 0.2742	0.2168 ± 0.2042
SWU-7828, 7829	Jun, 1995	Sr-90	0.2398 ± 0.3028	0.1937 ± 0.2742	0.2168 ± 0.2042
SWU-7828, 7829	Jun, 1995	Sr-90	0.2398 ± 0.3028	0.1937 ± 0.2742	0.2168 ± 0.2042
SWU-7828, 7829	Jun, 1995	Sr-90	0.2398 ± 0.3028	0.1937 ± 0.2742	0.2168 ± 0.2042
AP-8111, 8112	Jun, 1995	Co-60	-0.0002 ± 0.0007	0.0004 ± 0.0007	0.0001 ± 0.0005
AP-8111, 8112	Jun, 1995	Cs-137	-0.0002 ± 0.0007	0.0004 ± 0.0005	0.0001 ± 0.0004
SW-7080, 7081	Jun, 1995	Gr. Beta	2.3011 ± 0.5921	2.6708 ± 0.6113	2.4860 ± 0.4255
SW-7080, 7081	Jun, 1995	K-40	61.2620 ± 28.3000	95.4390 ± 26.0000	78.3505 ± 19.2152
WWT-7122, 7123	Jun, 1995	H-3	3.8386 ± 81.4299	-13.4353 ± 80.6115	-4.7983 ± 57.2910
LW-7239, 7240	Jun, 1995	Gr. Beta	2.5177 ± 0.0580	2.4081 ± 0.6061	2.4629 ± 0.3044
WW-7143, 7144	Jun, 1995	H-3	539.1386 ± 103.3228	436.4159 ± 99.5398	487.7772 ± 71.7352
PW-7174, 7175	Jun, 1995	H-3	144.0732 ± 84.2861	121.4242 ± 83.2655	132.7487 ± 59.2395
SW-7216, 7217	Jun, 1995	H-3	20.3728 ± 81.4069	62.9704 ± 83.3227	41.6716 ± 58.2446
WW-7281, 7282	Jun, 1995	Gr. Beta	1.8051 ± 0.3271	2.1056 ± 0.5796	1.9553 ± 0.3328
WW-7281, 7282	Jun, 1995	H-3	-24.3250 ± 75.1716	10.3381 ± 76.8357	-6.9934 ± 53.7459
SW-7387, 7388	Jul, 1995	Co-60	1.0200 ± 1.9000	0.1530 ± 1.6700	0.5865 ± 1.2648

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
SW-7387, 7388	Jul, 1995	Cs-137	0.5600 ± 2.3400	-0.8650 ± 2.0400	-0.1525 ± 1.5522
AP-8133, 8134	Jul, 1995	Co-60	-0.0000 ± 0.0005	0.0003 ± 0.0006	0.0001 ± 0.0004
AP-8133, 8134	Jul, 1995	Cs-137	-0.0001 ± 0.0004	0.0000 ± 0.0005	-0.0001 ± 0.0003
AP-7600, 7601	Jul, 1995	Sr-89	0.0008 ± 0.0008	0.0010 ± 0.0008	0.0009 ± 0.0005
AP-7600, 7601	Jul, 1995	Sr-90	-0.0001 ± 0.0003	0.0005 ± 0.0003	0.0002 ± 0.0002
MI-7260, 7261	Jul, 1995	Co-60	0.3390 ± 2.9100	0.5630 ± 5.2400	0.4510 ± 2.9969
MI-7260, 7261	Jul, 1995	Cs-137	1.6600 ± 2.5900	-1.4600 ± 3.3700	0.1000 ± 2.1251
MI-7260, 7261	Jul, 1995	I-131	0.1745 ± 0.1944	0.1004 ± 0.1792	0.1374 ± 0.1322
WW-7454, 7455	Jul, 1995	H-3	7,142.7529 ± 243.6211	6,985.4236 ± 241.2186	7,064.0882 ± 171.4188
LW - 7487, 7488	Jul, 1995	K-40	48.0000 ± 14.4000	95.7520 ± 39.9000	71.8760 ± 21.2095
LW - 7487, 7488	Jul, 1995	K-40	48.0000 ± 14.4000	95.7520 ± 39.9000	71.8760 ± 21.2095
LW-7487, 7488	Jul, 1995	Co-60	0.4460 ± 1.0700	0.3830 ± 3.0000	0.4145 ± 1.5926
LW-7487, 7488	Jul, 1995	Cs-134	0.1230 ± 1.0600	-2.3900 ± 3.0100	-1.1335 ± 1.5956
LW-7487, 7488	Jul, 1995	Cs-137	0.4920 ± 1.1000	-2.2200 ± 2.8400	-0.8640 ± 1.5228
LW-7487, 7488	Jul, 1995	Gr. Beta	2.1095 ± 0.4725	1.8520 ± 0.4810	1.9807 ± 0.3371
LW-7487, 7488	Jul, 1995	I-131	0.2323 ± 0.2677	-0.0343 ± 0.2508	0.0990 ± 0.1834
LW-7487, 7488	Jul, 1995	I-131(g)	0.3390 ± 2.4400	0.9230 ± 10.5000	0.6310 ± 5.3899
LW-7487, 7488	Jul, 1995	K-40	48.0000 ± 14.4000	95.7520 ± 39.9000	71.8760 ± 21.2095
LW-7487, 7488	Jul, 1995	K-40	48.0000 ± 14.4000	95.7520 ± 39.9000	71.8760 ± 21.2095
LW-7487, 7488	Jul, 1995	K-40	48.0000 ± 14.4000	95.7520 ± 39.9000	71.8760 ± 21.2095
LW-7487, 7488	Jul, 1995	K-40	48.0000 ± 14.4000	95.7520 ± 39.9000	71.8760 ± 21.2095
SW-7323, 7324	Jul, 1995	Gr. Beta	2.3224 ± 0.7511	2.5774 ± 0.7631	2.4499 ± 0.5354
SW-7323, 7324	Jul, 1995	H-3	77.8879 ± 83.9931	48.4345 ± 82.6045	63.1612 ± 58.9032
F-7366, 7367	Jul, 1995	Co-60	0.0092 ± 0.0141	0.0061 ± 0.0119	0.0076 ± 0.0092
F-7366, 7367	Jul, 1995	Cs-137	0.0115 ± 0.0108	0.0019 ± 0.0111	0.0067 ± 0.0077
MI-7510, 7511	Jul, 1995	I-131	0.3443 ± 0.3987	0.1361 ± 0.3508	0.2402 ± 0.2655
F-7344, 7345	Jul, 1995	Co-60	0.0037 ± 0.0077	-0.0071 ± 0.0119	-0.0017 ± 0.0071
F-7344, 7345	Jul, 1995	Cs-137	0.0023 ± 0.0057	0.0024 ± 0.0097	0.0023 ± 0.0056
MI-7429, 7430	Jul, 1995	I-131	-0.1525 ± 0.3171	0.1594 ± 0.2283	0.0035 ± 0.1953
F-8154, 8155	Jul, 1995	Gr. Beta	2.3081 ± 0.0743	2.2522 ± 0.0730	2.2802 ± 0.0521
F-8154, 8155	Jul, 1995	K-40	2.2313 ± 0.2640	2.1161 ± 0.4420	2.1737 ± 0.2574
MI-7575, 7576	Jul, 1995	Co-60	-1.0000 ± 2.8600	1.6000 ± 3.1700	0.3000 ± 2.1347
MI-7575, 7576	Jul, 1995	Cs-134	1.7300 ± 2.4200	-0.6220 ± 2.3600	0.5540 ± 1.6901
MI-7575, 7576	Jul, 1995	Cs-137	-0.7550 ± 2.5100	1.2800 ± 2.3800	0.2625 ± 1.7295
MI-7575, 7576	Jul, 1995	I-131	0.1795 ± 0.2309	0.0704 ± 0.2260	0.1250 ± 0.1616
MI-7575, 7576	Jul, 1995	I-131(g)	0.8570 ± 2.2400	0.8540 ± 2.4400	0.8555 ± 1.6561

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	First Result	Second Result	Averaged Result
			Concentration in pCi/L[a]		
MI-7575, 7576	Jul, 1995	K-40	1,481.9000 ± 111.0000	1,398.8000 ± 106.0000	1,440.3500 ± 76.7414
MI-7575, 7576	Jul, 1995	Sr-89	0.6192 ± 0.9862	-0.5435 ± 0.9244	0.0378 ± 0.6758
MI-7575, 7576	Jul, 1995	Sr-90	1.2363 ± 0.4155	1.7902 ± 0.4124	1.5133 ± 0.2927
WWT-7621, 7622	Jul, 1995	I-131	0.0940 ± 0.2062	0.0628 ± 0.2223	0.0784 ± 0.1516
MI-7739, 7740	Jul, 1995	Co-60	0.8900 ± 4.9100	-0.5720 ± 4.5800	0.1590 ± 3.3572
MI-7739, 7740	Jul, 1995	Cs-137	0.8600 ± 3.7300	-0.4130 ± 3.1400	0.2235 ± 2.4379
MI-7739, 7740	Jul, 1995	I-131	0.1928 ± 0.2674	-0.0475 ± 0.2351	0.0727 ± 0.1780
G-7805, 7806	Jul, 1995	Co-60	-0.0049 ± 0.0159	0.0015 ± 0.0156	-0.0017 ± 0.0111
G-7805, 7806	Jul, 1995	Cs-134	-0.0076 ± 0.0157	0.0025 ± 0.0094	-0.0025 ± 0.0091
G-7805, 7806	Jul, 1995	Cs-137	0.0045 ± 0.0140	0.0006 ± 0.0118	0.0026 ± 0.0092
G-7805, 7806	Jul, 1995	Gr. Beta	5.0973 ± 0.1994	5.1127 ± 0.2103	5.1050 ± 0.1449
G-7805, 7806	Jul, 1995	I-131(g)	-0.0048 ± 0.0205	-0.0183 ± 0.0205	-0.0115 ± 0.0145
G-7805, 7806	Jul, 1995	K-40	6.0481 ± 0.5610	5.8484 ± 0.5100	5.9483 ± 0.3791
CW-7648, 7649	Jul, 1995	Gr. Beta	6.6883 ± 1.7265	6.7478 ± 1.7419	6.7181 ± 1.2263
CW-7648, 7649	Jul, 1995	Gr. Beta	0.7444 ± 1.2623	0.2325 ± 1.2230	0.4885 ± 0.8788
CW-7648, 7649	Jul, 1995	H-3	-64.4182 ± 97.4643	-70.1870 ± 97.2364	-67.3026 ± 68.8371
WW-7673, 7674	Jul, 1995	Gr. Beta	14.1451 ± 2.2254	14.2212 ± 2.2315	14.1831 ± 1.5757
WW-7673, 7674	Jul, 1995	H-3	15.3145 ± 81.7571	36.3720 ± 82.7373	25.8432 ± 58.1586
MI-7896, 7897	Jul, 1995	Sr-89	0.3508 ± 0.9697	0.1856 ± 0.8702	0.2682 ± 0.6514
MI-7896, 7897	Jul, 1995	Sr-90	1.7110 ± 0.4271	1.2961 ± 0.3929	1.5036 ± 0.2902
WW-7967, 7968	Jul, 1995	H-3	109.4679 ± 84.6270	70.8322 ± 82.8444	90.1500 ± 59.2134
MI-7922, 7923	Jul, 1995	Co-60	0.5680 ± 3.1300	-1.0500 ± 4.4600	-0.2410 ± 2.7244
MI-7922, 7923	Jul, 1995	Cs-137	1.2100 ± 2.8600	-0.5040 ± 3.4200	0.3530 ± 2.2291
MI-7922, 7923	Jul, 1995	I-131	0.0502 ± 0.1932	0.0416 ± 0.2336	0.0459 ± 0.1516
LW-7944, 7945	Jul, 1995	Co-60	0.0830 ± 2.2000	1.3000 ± 1.8900	0.6915 ± 1.4502
LW-7944, 7945	Jul, 1995	Cs-137	0.6400 ± 2.2200	-1.3800 ± 1.8200	-0.3700 ± 1.4353
LW-7944, 7945	Jul, 1995	Gr. Beta	4.1332 ± 0.9251	3.9971 ± 0.9393	4.0652 ± 0.6592
SW-8704, 8705	Jul, 1995	Co-60	0.1830 ± 2.4900	0.9840 ± 1.7900	0.5835 ± 1.5333
SW-8704, 8705	Jul, 1995	Cs-137	0.2640 ± 3.4500	-0.6630 ± 1.9100	-0.1995 ± 1.9717
WW-8196, 8197	Jul, 1995	H-3	51.4226 ± 87.9172	176.0234 ± 93.3551	113.7230 ± 64.1183
SWU-8318, 8319	Jul, 1995	Gr. Beta	1.9584 ± 0.4714	1.9228 ± 0.4731	1.9406 ± 0.3340
SWU-8318, 8319	Jul, 1995	H-3	102.7030 ± 103.6806	35.5141 ± 101.1620	69.1086 ± 72.4283
SWU-8318, 8319	Jul, 1995	K-40	93.2530 ± 39.7000	99.7420 ± 49.1000	96.4975 ± 31.5710
SP-8540, 8541	Jul, 1995	Gr. Alpha	5.1903 ± 1.3072	3.8567 ± 1.0701	4.5235 ± 0.8447
SP-8540, 8541	Jul, 1995	Sr-89	1,443.0886 ± 42.0809	1,419.4750 ± 35.3491	1,431.2818 ± 27.4789
SP-8540, 8541	Jul, 1995	Sr-90	15.7496 ± 3.7553	19.4328 ± 4.1309	17.5912 ± 2.7914

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
VE-8090, 8091	Jul, 1995	Gr. Beta	2.3819 ± 0.0781	2.3059 ± 0.0779	2.3439 ± 0.0552
VE-8090, 8091	Jul, 1995	K-40	2.8208 ± 0.1170	2.7639 ± 0.1330	2.7924 ± 0.0886
SW-8175, 8176	Jul, 1995	Gr. Alpha	0.5000 ± 0.6000	0.6583 ± 0.8198	0.5791 ± 0.5080
SW-8175, 8176	Jul, 1995	Gr. Beta	0.8100 ± 1.1000	0.8265 ± 1.0847	0.8182 ± 0.7724
SW-8175, 8176	Jul, 1995	K-40	89.8150 ± 23.8000	67.3590 ± 39.3000	78.5870 ± 22.9724
SW-8251, 8252	Jul, 1995	H-3	86.7952 ± 78.8856	43.9921 ± 76.9259	65.3937 ± 55.0921
SW-8606, 8607	Jul, 1995	Co-60	0.1320 ± 1.7100	-0.2180 ± 2.6000	-0.0430 ± 1.5560
SW-8606, 8607	Jul, 1995	Cs-137	-1.0400 ± 2.0400	-0.6580 ± 2.2400	-0.8490 ± 1.5149
G - 8272, 8273	Aug, 1995	K-40	6.7487 ± 0.6490	6.6636 ± 0.9730	6.7062 ± 0.5848
G - 8272, 8273	Aug, 1995	Sr-89	0.0014 ± 0.0091	-0.0007 ± 0.0029	0.0004 ± 0.0048
G - 8272, 8273	Aug, 1995	Sr-90	0.0053 ± 0.0029	0.0016 ± 0.0012	0.0034 ± 0.0016
G-8272, 8273	Aug, 1995	Gr. Beta	6.2167 ± 0.2594	5.9667 ± 0.2551	6.0917 ± 0.1819
MI-8293, 8294	Aug, 1995	I-131	-0.1058 ± 0.1908	0.0093 ± 0.2009	-0.0483 ± 0.1385
MI-8389, 8390	Aug, 1995	I-131	-0.0127 ± 0.1267	0.11[illegible] ± [illegible]1318	0.0513 ± 0.0914
MI-8389, 8390	Aug, 1995	K-40	1,543.8000 ± 120.0000	1,369[illegible] ± 162.0000	1,456.7000 ± 100.8018
MI-8413, 8414	Aug, 1995	Co-60	0.2940 ± 3.1400	-2.[illegible]500 ± 5.2200	-1.0280 ± 3.0458
MI-8413, 8414	Aug, 1995	Cs-137	-0.7370 ± 2.8900	-1.3600 ± 3.3100	-1.0485 ± 2.1971
MI-8413, 8414	Aug, 1995	I-131	0.1142 ± 0.2124	0.0598 ± 0.2344	0.0870 ± 0.1581
LW-8440, 8441	Aug, 1995	Co-60	0.1030 ± 2.3800	1.0300 ± 1.8100	0.5665 ± 1.4950
LW-8440, 8441	Aug, 1995	Cs-137	0.7760 ± 1.9900	-0.3890 ± 2.0500	0.1935 ± 1.4285
LW-8440, 8441	Aug, 1995	Gr. Beta	3.3064 ± 1.1388	4.6623 ± 1.2154	3.9844 ± 0.8327
WW-8518, 8519	Aug, 1995	Co-60	1.4700 ± 3.1400	-1.8100 ± 2.9800	-0.1700 ± 2.1645
WW-8518, 8519	Aug, 1995	Cs-137	1.7100 ± 2.8700	0.4430 ± 2.7700	1.0765 ± 1.9944
WW-8518, 8519	Aug, 1995	H-3	10.6795 ± 74.0469	-19.5791 ± 72.5777	-4.4498 ± 51.8422
VE-8564, 8565	Aug, 1995	Co-60	0.0053 ± 0.0122	0.0054 ± 0.0128	0.0053 ± 0.0088
VE-8564, 8565	Aug, 1995	Cs-137	0.0038 ± 0.0093	-0.0003 ± 0.0082	0.0018 ± 0.0062
MI-8585, 8586	Aug, 1995	Co-60	-0.4810 ± 4.0600	1.8800 ± 2.5900	0.6995 ± 2.4079
MI-8585, 8586	Aug, 1995	Cs-134	0.1220 ± 3.5000	0.9370 ± 2.2700	0.5295 ± 2.0858
MI-8585, 8586	Aug, 1995	Cs-137	1.7700 ± 3.6400	0.2160 ± 2.0700	0.9930 ± 2.0937
MI-8585, 8586	Aug, 1995	I-131	-0.2002 ± 0.2079	0.0732 ± 0.1900	-0.0635 ± 0.1408
MI-8585, 8586	Aug, 1995	I-131(g)	0.1360 ± 9.0300	2.4300 ± 6.8100	1.2830 ± 5.6550
MI-8585, 8586	Aug, 1995	K-40	1,454.6000 ± 150.0000	1,478.2000 ± 104.0000	1,466.4000 ± 91.2634
MI-8585, 8586	Aug, 1995	Sr-89	0.1158 ± 1.1111	-0.0833 ± 0.9491	0.0162 ± 0.7306
MI-8585, 8586	Aug, 1995	Sr-90	1.9078 ± 0.4296	1.6029 ± 0.3807	1.7553 ± 0.2870
MI-8674, 8675	Aug, 1995	Co-60	-0.7910 ± 3.2300	0.4890 ± 3.3400	-0.1510 ± 2.3232
MI-8674, 8675	Aug, 1995	Cs-137	0.7690 ± 2.4300	0.4160 ± 2.4000	0.5925 ± 1.7077

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
MI-8674, 8675	Aug, 1995	I-131	0.1471 ± 0.2525	-0.0869 ± 0.2167	0.0301 ± 0.1664
SW-8648, 8649	Aug, 1995	H-3	35.5546 ± 75.1429	21.3328 ± 74.4670	28.4437 ± 52.8956
F-8754, 8755	Aug, 1995	Co-60	0.0009 ± 0.0110	0.0031 ± 0.0106	0.0020 ± 0.0076
F-8754, 8755	Aug, 1995	Cs-134	-0.0026 ± 0.0090	-0.0022 ± 0.0087	-0.0024 ± 0.0063
F-8754, 8755	Aug, 1995	Cs-137	0.0528 ± 0.0207	0.0563 ± 0.0171	0.0546 ± 0.0134
F-8754, 8755	Aug, 1995	Gr. Beta	13.1178 ± 0.3041	12.6488 ± 0.2780	12.8833 ± 0.2060
F-8754, 8755	Aug, 1995	I-131(g)	0.0026 ± 0.0139	0.0013 ± 0.0121	0.0019 ± 0.0092
F-8754, 8755	Aug, 1995	K-40	2.8119 ± 0.3670	3.2605 ± 0.3670	3.0362 ± 0.2595
VE-8946, 8947	Aug, 1995	Gr. Alpha	0.2000 ± 0.0800	0.2018 ± 0.0786	0.2009 ± 0.0561
VE-8946, 8947	Aug, 1995	Gr. Beta	4.3000 ± 0.1500	4.3179 ± 0.1511	4.3089 ± 0.1065
VE-8946, 8947	Aug, 1995	K-40	3.9615 ± 0.2670	4.0418 ± 0.3300	4.0017 ± 0.2122
VE - 8802, 8803	Aug, 1995	Sr-89	-0.0001 ± 0.0018	-0.0004 ± 0.0022	-0.0002 ± 0.0014
VE - 8802, 8803	Aug, 1995	Sr-90	0.0011 ± 0.0006	0.0013 ± 0.0007	0.0012 ± 0.0005
VE-8802, 8803	Aug, 1995	K-40	2.3052 ± 0.2360	2.3039 ± 0.3070	2.3046 ± 0.1936
MI-8845, 8846	Aug, 1995	I-131	0.0098 ± 0.1785	0.0835 ± 0.1740	0.0467 ± 0.1246
CW-8873, 8874	Aug, 1995	Gr. Beta	1.8586 ± 1.3992	4.2592 ± 1.5511	3.0589 ± 1.0445
CW-8873, 8874	Aug, 1995	Gr. Beta	-0.6043 ± 1.1348	-0.0465 ± 1.1799	-0.3254 ± 0.8185
MI-8902, 8903	Aug, 1995	I-131	-0.0387 ± 0.2325	0.1320 ± 0.3198	0.0466 ± 0.1977
VE-9035, 9036	Aug, 1995	K-40	2.1934 ± 0.2790	2.3847 ± 0.3380	2.2891 ± 0.2191
SW-9056, 9057	Aug, 1995	H-3	140.7425 ± 79.5937	55.2281 ± 75.6687	97.9853 ± 54.9111
MI-9113, 9114	Aug, 1995	I-131	0.2205 ± 0.3289	0.2711 ± 0.2835	0.2458 ± 0.2171
LW-9079, 9080	Aug, 1995	Co-60	0.8410 ± 2.8400	0.1630 ± 2.9900	0.5020 ± 2.0619
LW-9079, 9080	Aug, 1995	Cs-137	0.7700 ± 2.7700	-0.5330 ± 2.6700	0.1185 ± 1.9237
LW-9079, 9080	Aug, 1995	Gr. Beta	2.7566 ± 0.8607	2.6961 ± 0.8549	2.7264 ± 0.6065
SW-9183, 9184	Aug, 1995	Co-60	-0.3280 ± 3.0000	2.2200 ± 4.0400	0.9460 ± 2.5160
SW-9183, 9184	Aug, 1995	Cs-137	0.8200 ± 3.4400	0.2580 ± 4.3700	0.5390 ± 2.7808
SWU-9162, 9163	Aug, 1995	Gr. Beta	2.5000 ± 0.5000	2.5094 ± 0.5480	2.5047 ± 0.3709
SWU-9162, 9163	Aug, 1995	H-3	152.0000 ± 88.0000	157.4341 ± 83.7394	154.7170 ± 60.7377
WW-9276, 9277	Aug, 1995	H-3	1,636.0299 ± 130.9904	1,680.8118 ± 132.2095	1,658.4209 ± 93.0562
VE-9210, 9211	Aug, 1995	Gr. Beta	4.1000 ± 0.2000	4.0920 ± 0.1675	4.0960 ± 0.1304
VE-9210, 9211	Aug, 1995	K-40	4.6449 ± 0.1090	4.6203 ± 0.1150	4.6326 ± 0.0792
DW-9371, 9372	Aug, 1995	Gr. Beta	4.9900 ± 1.1960	4.5327 ± 1.1679	4.7613 ± 0.8358
DW-9371, 9372	Aug, 1995	I-131	0.1312 ± 0.2093	0.1381 ± 0.1961	0.1346 ± 0.1434
MI-9297, 9298	Aug, 1995	I-131	0.0434 ± 0.1996	0.0510 ± 0.2134	0.0472 ± 0.1461
MI-9297, 9298	Aug, 1995	K-40	1,727.8000 ± 180.0000	1,602.7000 ± 172.0000	1,665.2500 ± 124.4829
WW-9252, 9253	Sep, 1995	H-3	530.8948 ± 98.7085	538.0449 ± 98.9671	534.4698 ± 69.8889

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
MI-9327, 9328	Sep, 1995	I-131	0.1442 ± 0.1680	0.0972 ± 0.1575	0.1207 ± 0.1151
WW-9396, 9397	Sep, 1995	Co-60	2.0600 ± 2.4700	0.6870 ± 2.9500	1.3735 ± 1.9238
WW-9396, 9397	Sep, 1995	Cs-137	2.6700 ± 2.7300	0.7790 ± 2.5900	1.7245 ± 1.8816
WW-9396, 9397	Sep, 1995	Gr. Beta	0.6947 ± 1.3597	1.7640 ± 1.3095	1.2293 ± 0.9439
WW-9396, 9397	Sep, 1995	H-3	14.9063 ± 76.6085	48.8927 ± 78.1795	31.8995 ± 54.7287
SW - 10075, 10076	Sep, 1995	H-3	262.0954 ± 87.9940	265.6857 ± 88.1404	263.8905 ± 62.2730
SW - 10075, 10076	Sep, 1995	Sr-89	-1.1140 ± 0.9865	0.7627 ± 0.9505	-0.1756 ± 0.6849
SW - 10075, 10076	Sep, 1995	Sr-90	0.6409 ± 0.2630	0.3425 ± 0.2113	0.4917 ± 0.1687
MI-9350, 9351	Sep, 1995	I-131	-0.0990 ± 0.1565	0.0745 ± 0.1638	-0.0123 ± 0.1133
MI-9350, 9351	Sep, 1995	K-40	1,335.3000 ± 163.0000	1,521.4000 ± 179.0000	1,428.3500 ± 121.0475
MI - 9463, 9464	Sep, 1995	I-131	0.1059 ± 0.1889	0.0550 ± 0.1695	0.0804 ± 0.1269
MI-9463, 9464	Sep, 1995	K-40	1,814.9000 ± 139.0000	1,743.1000 ± 180.0000	1,779.0000 ± 113.7113
BS - 9710, 9711	Sep, 1995	K-40	8.3415 ± 0.3890	8.7853 ± 0.3190	8.5634 ± 0.2515
CW - 9486, 9487	Sep, 1995	Gr. Beta	0.3695 ± 1.1728	-0.8827 ± 1.4122	-0.2566 ± 0.9179
CW-9486, 9487	Sep, 1995	Gr. Beta	3.1540 ± 1.5156	3.4306 ± 1.5908	3.2923 ± 1.0986
SO - 9562, 9563	Sep, 1995	Cs-137	0.4189 ± 0.0216	0.4786 ± 0.0443	0.4488 ± 0.0246
SO - 9562, 9563	Sep, 1995	K-40	14.9730 ± 0.4070	15.6780 ± 0.6540	15.3255 ± 0.3852
VE-9515, 9516	Sep, 1995	Co-60	-0.0018 ± 0.0107	-0.0046 ± 0.0074	-0.0032 ± 0.0065
VE-9515, 9516	Sep, 1995	Cs-137	-0.0003 ± 0.0080	-0.0017 ± 0.0071	-0.0010 ± 0.0054
MI-9611, 9612	Sep, 1995	I-131	0.1395 ± 0.2011	0.0905 ± 0.2020	0.1150 ± 0.1425
MI-9611, 9612	Sep, 1995	K-40	1,463.6000 ± 163.0000	1,381.6000 ± 117.0000	1,422.6000 ± 100.3220
SW-9583, 9584	Sep, 1995	H-3	191.7867 ± 84.3836	59.5611 ± 78.5845	125.6739 ± 57.6544
LW - 9632, 9633	Sep, 1995	Gr. Beta	4.9397 ± 0.8738	4.1679 ± 0.7956	4.5538 ± 0.5909
LW-9632, 9633	Sep, 1995	Co-60	0.2420 ± 2.5400	0.6900 ± 1.8800	0.4660 ± 1.5800
LW-9632, 9633	Sep, 1995	Cs-134	-0.9850 ± 2.5000	0.2670 ± 2.3000	-0.3590 ± 1.6985
LW-9632, 9633	Sep, 1995	Cs-137	0.7330 ± 2.7300	1.9600 ± 2.0000	1.3465 ± 1.6921
LW-9632, 9633	Sep, 1995	I-131	-0.0233 ± 0.1923	0.1754 ± 0.2465	0.0761 ± 0.1563
LW-9632, 9633	Sep, 1995	I-131(g)	-1.2000 ± 7.8600	-1.7800 ± 6.9200	-1.4900 ± 5.2361
LW-9632, 9633	Sep, 1995	K-40	73.2000 ± 35.1000	84.4840 ± 38.9000	78.8420 ± 26.1974
MI-9677, 9678	Sep, 1995	I-131	0.1492 ± 0.1575	-0.0782 ± 0.2124	0.0355 ± 0.1322
MI-9677, 9678	Sep, 1995	K-40	1,579.6000 ± 149.0000	1,387.5000 ± 150.0000	1,483.5500 ± 105.7131
CW-9654, 9655	Sep, 1995	Gr. Beta	3.8956 ± 1.4702	4.0324 ± 1.4561	3.9640 ± 1.0346
CW-9654, 9655	Sep, 1995	Gr. Beta	-0.4258 ± 1.0721	0.1637 ± 1.0778	-0.1311 ± 0.7601
MI-9758, 9759	Sep, 1995	Co-60	0.0531 ± 2.3000	-1.0600 ± 5.6200	-0.5035 ± 3.0362
MI-9758, 9759	Sep, 1995	Cs-137	0.1530 ± 2.1000	3.3300 ± 4.1300	1.7415 ± 2.3166
MI-9758, 9759	Sep, 1995	I-131	0.0357 ± 0.1262	0.1303 ± 0.1374	0.0830 ± 0.0933

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
VE-9781, 9782	Sep, 1995	K-40	3.6858 ± 0.3040	3.8621 ± 0.3830	3.7740 ± 0.2445
WW - 9917, 9918	Sep, 1995	Gr. Alpha	1.0000 ± 1.2000	0.1895 ± 1.3470	0.5948 ± 0.9020
WW - 9917, 9918	Sep, 1995	Gr. Beta	2.0000 ± 1.6000	1.4626 ± 1.5372	1.7313 ± 1.1094
WW - 9917, 9918	Sep, 1995	K-40	61.5990 ± 27.2000	55.4580 ± 30.1000	58.5285 ± 20.2845
SWU - 10054, 10055	Sep, 1995	Gr. Beta	2.8699 ± 0.6506	2.9815 ± 0.6273	2.9257 ± 0.4519
SWU - 10054, 10055	Sep, 1995	H-3	272.2258 ± 86.5578	186.8216 ± 82.9725	229.5237 ± 59.9514
CW-9848, 9849	Sep, 1995	Gr. Beta	10.0958 ± 2.0529	10.6091 ± 2.0035	10.3525 ± 1.4343
CW-9848, 9849	Sep, 1995	Gr. Beta	0.6483 ± 1.1139	0.0874 ± 1.0548	0.3678 ± 0.7670
CW-9848, 9849	Sep, 1995	H-3	2.3592 ± 75.6414	-2.9490 ± 75.3926	-0.2949 ± 53.3987
MI-9873, 9874	Sep, 1995	I-131	0.1317 ± 0.1666	0.2502 ± 0.2503	0.1909 ± 0.1503
SW - 10174, 10175	Sep, 1995	Co-60	-0.2100 ± 1.9300	0.0995 ± 3.2500	-0.0553 ± 1.8899
SW - 10174, 10175	Sep, 1995	Cs-137	-0.0756 ± 2.9100	-0.1070 ± 2.8500	-0.0913 ± 2.0366
WW-9988, 9989	Sep, 1995	H-3	126.1391 ± 81.1795	18.2725 ± 76.3358	72.2058 ± 55.7164
SWT - 10033, 10034	Sep, 1995	Gr. Beta	1.7710 ± 0.4680	1.9280 ± 0.4610	1.8495 ± 0.3285
P-10216, 10217	Sep, 1995	H-3	76.4356 ± 78.6697	74.6580 ± 78.5893	75.5468 ± 55.5994
SW-10261, 10262	Sep, 1995	H-3	279.1447 ± 88.4376	300.6173 ± 89.3023	289.8810 ± 62.8413
VE - 10012, 10013	Sep, 1995	Gr. Beta	5.6577 ± 0.3023	5.0000 ± 0.4415	5.3288 ± 0.2675
MI-10120, 10121	Sep, 1995	I-131	0.1055 ± 0.1292	0.0027 ± 0.1196	0.0541 ± 0.0880
MI-10120, 10121	Sep, 1995	K-40	1,446.6000 ± 163.0000	1,300.9000 ± 145.0000	1,373.7500 ± 109.0802
SW-10195, 10196	Sep, 1995	H-3	-19.5632 ± 74.6957	103.1512 ± 80.3270	41.7940 ± 54.8450
CW - 10240, 10241	Sep, 1995	Gr. Beta	2.7919 ± 1.4430	3.6514 ± 1.5144	3.2216 ± 1.0459
CW - 10240, 10241	Sep, 1995	Gr. Beta	0.5909 ± 1.1545	2.4180 ± 1.3151	1.5045 ± 0.8750
SW-10150, 10151	Sep, 1995	H-3	119.1208 ± 81.0078	129.7884 ± 81.4747	124.4546 ± 57.4465
SW - 10282, 10283	Oct, 1995	Gr. Beta	2.1771 ± 0.4791	1.8939 ± 0.4661	2.0355 ± 0.3342
WW - 10349, 10350	Oct, 1995	H-3	64.9002 ± 80.1767	47.3596 ± 79.4055	56.1299 ± 56.4215
WW-10349, 10350	Oct, 1995	Co-60	0.0850 ± 1.2400	1.4900 ± 2.0900	0.7875 ± 1.2151
WW-10349, 10350	Oct, 1995	Cs-137	0.7540 ± 1.1500	0.0703 ± 2.2400	0.4122 ± 1.2590
VE-10370, 10371	Oct, 1995	K-40	3.3443 ± 0.4620	3.2897 ± 0.4770	3.3170 ± 0.3320
F-10491, 10492	Oct, 1995	Co-60	-0.0087 ± 0.0120	0.0051 ± 0.0078	-0.0018 ± 0.0072
F-10491, 10492	Oct, 1995	Cs-137	-0.0053 ± 0.0105	-0.0009 ± 0.0056	-0.0031 ± 0.0059
AP - 10752, 10753	Oct, 1995	Co-60	-0.0006 ± 0.0006	-0.0007 ± 0.0005	-0.0007 ± 0.0004
AP - 10752, 10753	Oct, 1995	Cs-134	0.0007 ± 0.0004	0.0003 ± 0.0007	0.0005 ± 0.0004
AP - 10752, 10753	Oct, 1995	Cs-137	-0.0004 ± 0.0005	0.0000 ± 0.0005	-0.0002 ± 0.0003
AP - 10752, 10753	Oct, 1995	I-131(g)	0.0016 ± 0.0034	-0.0005 ± 0.0047	0.0005 ± 0.0029
AP - 10752, 10753	Oct, 1995	K-40	0.0344 ± 0.0103	0.0436 ± 0.0113	0.0390 ± 0.0076
AP - 11141, 11142	Oct, 1995	Co-60	0.0001 ± 0.0004	0.0002 ± 0.0002	0.0001 ± 0.0002

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
AP - 11141, 11142	Oct, 1995	Cs-137	0.0000 ± 0.0003	0.0003 ± 0.0004	0.0002 ± 0.0002
MI - 10324, 10325	Oct, 1995	Co-60	0.3420 ± 2.2000	-1.0200 ± 3.2000	-0.3390 ± 1.9416
MI - 10324, 10325	Oct, 1995	Cs-134	1.4400 ± 1.9300	-1.0300 ± 2.5800	0.2050 ± 1.6110
MI - 10324, 10325	Oct, 1995	Cs-137	0.3320 ± 2.0800	0.9930 ± 2.5600	0.6625 ± 1.6492
MI - 10324, 10325	Oct, 1995	I-131	0.1255 ± 0.1379	0.0629 ± 0.2061	0.0942 ± 0.1240
MI - 10324, 10325	Oct, 1995	I-131(g)	-0.8920 ± 2.6900	1.1700 ± 3.2900	0.1390 ± 2.1249
MI - 10324, 10325	Oct, 1995	K-40	1,440.7000 ± 88.9000	1,432.5000 ± 120.0000	1,436.6000 ± 74.6713
MI - 10324, 10325	Oct, 1995	Sr-89	-0.4912 ± 0.9456	-1.3268 ± 0.8323	-0.9090 ± 0.6466
MI - 10324, 10325	Oct, 1995	Sr-90	1.6952 ± 0.3864	1.7252 ± 0.3803	1.7102 ± 0.2711
WWU-10392, 10393	Oct, 1995	I-131	0.0442 ± 0.1674	0.0223 ± 0.1698	0.0333 ± 0.1192
F-10470, 10471	Oct, 1995	Co-60	0.0049 ± 0.0063	0.0037 ± 0.0052	0.0043 ± 0.0041
F-10470, 10471	Oct, 1995	Cs-137	0.0003 ± 0.0050	0.0020 ± 0.0037	0.0011 ± 0.0031
SW - 10413, 10414	Oct, 1995	H-3	41.1376 ± 77.3777	62.2941 ± 78.3358	51.7159 ± 55.0541
WW-10437, 10438	Oct, 1995	H-3	81.6446 ± 78.1486	-10.6493 ± 73.8374	35.4977 ± 53.7568
MI - 10512, 10513	Oct, 1995	I-131	0.0662 ± 0.1335	0.0996 ± 0.1517	0.0829 ± 0.1010
SO - 10577, 10578	Oct, 1995	Co-60	0.0033 ± 0.0117	0.0032 ± 0.0142	0.0033 ± 0.0092
SO - 10577, 10578	Oct, 1995	Cs-134	0.0204 ± 0.0110	0.0277 ± 0.0128	0.0241 ± 0.0084
SO - 10577, 10578	Oct, 1995	Cs-137	0.1528 ± 0.0249	0.1687 ± 0.0241	0.1608 ± 0.0173
SO - 10577, 10578	Oct, 1995	Gr. Beta	18.4120 ± 3.0080	20.0560 ± 3.0020	19.2340 ± 2.1249
SO - 10577, 10578	Oct, 1995	K-40	19.0300 ± 0.5920	18.4690 ± 0.6160	18.7495 ± 0.4272
MI - 10598, 10599	Oct, 1995	I-131	0.0233 ± 0.1528	-0.1143 ± 0.1290	-0.0455 ± 0.1000
F - 10666, 10667	Oct, 1995	Co-60	-0.0011 ± 0.0149	0.0022 ± 0.0134	0.0005 ± 0.0100
F - 10666, 10667	Oct, 1995	Cs-137	0.0062 ± 0.0109	0.0088 ± 0.0102	0.0075 ± 0.0075
WW - 11206, 11207	Oct, 1995	H-3	144.1480 ± 82.0522	298.7082 ± 106.1128	221.4281 ± 67.0681
F - 10687, 10688	Oct, 1995	Co-60	-0.0056 ± 0.0092	0.0052 ± 0.0111	-0.0002 ± 0.0072
F - 10687, 10688	Oct, 1995	Cs-137	0.0051 ± 0.0081	-0.0007 ± 0.0102	0.0022 ± 0.0065
MI - 10710, 10711	Oct, 1995	I-131	-0.0702 ± 0.1760	0.0060 ± 0.1746	-0.0321 ± 0.1240
WW - 10797, 10798	Oct, 1995	H-3	255.7388 ± 88.0244	190.9283 ± 85.4061	223.3336 ± 61.3239
F - 10882, 10883	Oct, 1995	K-40	2.4355 ± 0.2770	2.3158 ± 0.4530	2.3757 ± 0.2655
CW - 10826, 10827	Oct, 1995	Gr. Beta	1.9841 ± 1.3273	1.1082 ± 1.2551	1.5461 ± 0.9134
SWU - 10923, 10924	Oct, 1995	Gr. Beta	2.3790 ± 0.5752	2.7204 ± 0.5897	2.5497 ± 0.4119
SWU - 10923, 10924	Oct, 1995	H-3	908.5097 ± 108.7289	878.3050 ± 107.7372	893.4074 ± 76.5331
F - 10969, 10970	Oct, 1995	Cs-137	0.0391 ± 0.0173	0.0589 ± 0.0281	0.0490 ± 0.0165
F - 10969, 10970	Oct, 1995	Gr. Beta	2.3088 ± 0.0750	2.1970 ± 0.0758	2.2529 ± 0.0533
F - 10969, 10970	Oct, 1995	K-40	2.1279 ± 0.3500	1.8750 ± 0.4010	2.0015 ± 0.2661
CW - 10773, 10774	Oct, 1995	Gr. Beta	8.4208 ± 1.8580	9.9060 ± 2.0352	9.1634 ± 1.3779

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
CW - 10773, 10774	Oct, 1995	Gr. Beta	-0.2668 ± 1.0986	0.8745 ± 1.1142	0.3039 ± 0.7824
CW - 10773, 10774	Oct, 1995	H-3	51.6603 ± 77.7745	67.5106 ± 78.4891	59.5854 ± 55.2481
CW - 10858, 10859	Oct, 1995	Gr. Beta	3.8461 ± 1.5209	5.5313 ± 1.6346	4.6887 ± 1.1163
CW - 10858, 10859	Oct, 1995	Gr. Beta	0.1646 ± 1.1055	-0.2698 ± 1.0572	-0.0526 ± 0.7648
BS - 11056, 11057	Oct, 1995	Cs-137	0.3037 ± 0.0214	0.3183 ± 0.0167	0.3110 ± 0.0136
BS - 11056, 11057	Oct, 1995	K-40	18.5050 ± 0.4060	18.2890 ± 0.3850	18.3970 ± 0.2798
F - 11078, 11079	Oct, 1995	K-40	2.6694 ± 0.1700	2.7062 ± 0.1140	2.6878 ± 0.1023
CW - 11261, 11262	Oct, 1995	Gr. Beta	3.4182 ± 1.5101	3.8050 ± 1.4573	3.6116 ± 1.0493
CW - 11261, 11262	Oct, 1995	Gr. Beta	-0.9607 ± 0.9909	-0.1199 ± 1.1241	-0.5403 ± 0.7492
MI - 11162, 11163	Oct, 1995	I-131	0.2163 ± 0.2174	0.0872 ± 0.2019	0.1517 ± 0.1483
LW - 11185, 11186	Oct, 1995	Co-60	0.2560 ± 2.0000	0.0639 ± 3.9000	0.1600 ± 2.1915
LW - 11185, 11186	Oct, 1995	Cs-137	0.9690 ± 1.9600	1.3800 ± 3.2600	1.1745 ± 1.9019
LW - 11185, 11186	Oct, 1995	Gr. Beta	7.9276 ± 1.3579	6.7150 ± 1.2839	7.3213 ± 0.9344
MI - 11284, 11285	Oct, 1995	I-131	0.1805 ± 0.2626	0.1868 ± 0.2352	0.1837 ± 0.1763
MI - 11284, 11285	Oct, 1995	K-40	1,759.4000 ± 182.0000	1,581.9000 ± 164.0000	1,670.6500 ± 122.4949
DW - 11565, 11566	Oct, 1995	Gr. Beta	2.3856 ± 0.4715	2.6159 ± 0.5003	2.5008 ± 0.3437
DW - 11565, 11566	Oct, 1995	I-131	-0.1047 ± 0.3170	0.1835 ± 0.2833	0.0394 ± 0.2126
SW - 11309, 11310	Oct, 1995	Gr. Alpha	0.5829 ± 0.5262	1.1580 ± 0.6097	0.8705 ± 0.4027
SW - 11309, 11310	Oct, 1995	Gr. Beta	3.1323 ± 0.6596	2.5628 ± 0.6351	2.8475 ± 0.4579
MI - 11351, 11352	Oct, 1995	I-131	0.0319 ± 0.2455	0.0097 ± 0.2195	0.0208 ± 0.1647
MI - 11351, 11352	Oct, 1995	K-40	1,492.6000 ± 166.0000	1,431.8000 ± 160.0000	1,462.2000 ± 115.2779
SW - 11330, 11331	Oct, 1995	H-3	83.4709 ± 77.8239	106.3960 ± 78.8560	94.9335 ± 55.3959
MI - 11407, 11408	Oct, 1995	I-131	-0.1272 ± 0.1871	0.1059 ± 0.1876	-0.0106 ± 0.1325
MI - 11433, 11434	Nov, 1995	I-131	-0.0607 ± 0.1789	0.1317 ± 0.1462	0.0355 ± 0.1155
MI - 11433, 11434	Nov, 1995	K-40	1,446.0000 ± 167.0000	1,450.8000 ± 119.0000	1,448.4000 ± 102.5305
MI - 11433, 11434	Nov, 1995	Sr-89	-0.0542 ± 1.2560	-0.0961 ± 1.1700	-0.0752 ± 0.8583
MI - 11433, 11434	Nov, 1995	Sr-90	1.9383 ± 0.4889	1.8933 ± 0.4555	1.9158 ± 0.3341
BS - 11453, 11454	Nov, 1995	Gr. Beta	8.3022 ± 1.4598	7.0981 ± 1.3963	7.7002 ± 1.0100
BS - 11453, 11454	Nov, 1995	K-40	13.4130 ± 0.6950	14.3840 ± 1.0200	13.8985 ± 0.6171
MI - 11476, 11477	Nov, 1995	I-131	-0.0379 ± 0.1804	0.0878 ± 0.2013	0.0250 ± 0.1352
MI - 11476, 11477	Nov, 1995	K-40	1,425.6000 ± 155.0000	1,379.5000 ± 93.1000	1,402.5500 ± 90.4055
MI - 11476, 11477	Nov, 1995	Sr-89	0.1529 ± 1.5801	0.6656 ± 1.1518	0.4092 ± 0.9777
MI - 11476, 11477	Nov, 1995	Sr-90	1.5845 ± 0.6297	0.7492 ± 0.4308	1.1668 ± 0.3815
WW - 11657, 11658	Nov, 1995	Gr. Beta	0.3756 ± 0.4690	0.4697 ± 0.5060	0.4226 ± 0.3450
WW - 11657, 11658	Nov, 1995	H-3	110.2042 ± 79.0344	172.1940 ± 81.6909	141.1991 ± 56.8327
SW - 11519, 11520	Nov, 1995	H-3	86.0705 ± 77.9529	10.3285 ± 74.5326	48.1995 ± 53.9253

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
WW - 11837, 11838	Nov, 1995	Co-60	0.6630 ± 1.5100	0.0996 ± 3.2500	0.3813 ± 1.7918
WW - 11837, 11838	Nov, 1995	Cs-137	0.0882 ± 1.6800	-0.5360 ± 2.9800	-0.2239 ± 1.7105
MI - 11588, 11589	Nov, 1995	K-40	1,282.9000 ± 161.0000	1,390.4000 ± 145.0000	1,336.6500 ± 108.3351
MI - 11611, 11612	Nov, 1995	I-131	0.0368 ± 0.2007	0.1136 ± 0.2056	0.0752 ± 0.1437
MI - 11611, 11612	Nov, 1995	K-40	1,368.1000 ± 112.0000	1,291.1000 ± 158.0000	1,329.6000 ± 96.8349
CW - 11678, 11679	Nov, 1995	Gr. Beta	2.6565 ± 1.5123	2.0599 ± 1.3520	2.3582 ± 1.0143
MI - 11786, 11787	Nov, 1995	I-131	0.0519 ± 0.1914	-0.0830 ± 0.1791	-0.0156 ± 0.1311
MI - 11786, 11787	Nov, 1995	K-40	1,493.0000 ± 100.0000	1,459.1000 ± 170.0000	1,476.0500 ± 98.6154
CW - 11865, 11866	Nov, 1995	Gr. Beta	1.9803 ± 1.4093	1.1128 ± 1.3439	1.5466 ± 0.9737
LW - 11926, 11927	Nov, 1995	Co-60	-0.6990 ± 2.1700	-1.3700 ± 3.3200	-1.0345 ± 1.9831
LW - 11926, 11927	Nov, 1995	Cs-137	1.3600 ± 2.0100	1.6800 ± 2.6800	1.5200 ± 1.6750
LW - 11926, 11927	Nov, 1995	Gr. Beta	3.5794 ± 0.9059	4.2705 ± 0.9513	3.9250 ± 0.6568
PW - 12451, 12452	Nov, 1995	Co-60	0.1370 ± 1.6200	1.5900 ± 2.0000	0.8635 ± 1.2869
PW - 12451, 12452	Nov, 1995	Cs-137	-1.0900 ± 1.7200	0.8750 ± 2.5000	-0.1075 ± 1.5173
WW - 12659, 12660	Nov, 1995	H-3	10,454.1364 ± 283.5019	10,315.0095 ± 281.7458	10,384.5729 ± 199.8462
G - 12184, 12185	Nov, 1995	K-40	7.1257 ± 0.4820	7.2496 ± 0.5540	7.1877 ± 0.3672
DW - 12229, 12230	Nov, 1995	Gr. Beta	1.4868 ± 0.4353	1.5192 ± 0.4562	1.5030 ± 0.3153
DW - 12229, 12230	Nov, 1995	H-3	48.3898 ± 76.5630	70.8565 ± 77.5707	59.6232 ± 54.4957
SO - 12430, 12431	Dec, 1995	Cs-137	0.2060 ± 0.0696	0.1746 ± 0.0629	0.1903 ± 0.0469
SO - 12430, 12431	Dec, 1995	Gr. Alpha	15.7026 ± 4.4545	10.9075 ± 4.1010	13.3051 ± 3.0274
SO - 12430, 12431	Dec, 1995	Gr. Beta	22.3778 ± 2.8536	23.0769 ± 2.9630	22.7273 ± 2.0568
SO - 12430, 12431	Dec, 1995	K-40	16.6990 ± 1.3000	17.6620 ± 1.3500	17.1805 ± 0.9371
LW - 12152, 12153	Dec, 1995	Co-60	1.4300 ± 3.3200	3.3800 ± 2.1000	2.4050 ± 1.9642
LW - 12152, 12153	Dec, 1995	Cs-137	-0.1400 ± 3.1900	0.3640 ± 2.8500	0.1120 ± 2.1388
LW - 12152, 12153	Dec, 1995	Gr. Beta	5.1509 ± 1.3079	4.8804 ± 1.1924	5.0157 ± 0.8849
MI - 12250, 12251	Dec, 1995	I-131	0.1190 ± 0.1943	0.1981 ± 0.2178	0.1586 ± 0.1460
MI - 12250, 12251	Dec, 1995	K-40	1,470.3000 ± 163.0000	1,386.6000 ± 126.0000	1,428.4500 ± 103.0109
WW - 12298, 12299	Dec, 1995	Co-60	0.4210 ± 2.3800	0.1770 ± 4.0900	0.2990 ± 2.3660
WW - 12298, 12299	Dec, 1995	Cs-137	0.1580 ± 2.0500	1.5200 ± 2.7700	0.8390 ± 1.7230
WW - 12298, 12299	Dec, 1995	H-3	42.7622 ± 77.9643	99.7786 ± 80.5282	71.2704 ± 56.0429
LW - 12380, 12381	Dec, 1995	Co-60	1.2700 ± 2.4400	2.2300 ± 2.2300	1.7500 ± 1.6528
LW - 12380, 12381	Dec, 1995	Cs-134	0.5120 ± 2.1300	1.9500 ± 2.2200	1.2310 ± 1.5383
LW - 12380, 12381	Dec, 1995	Cs-137	0.8060 ± 2.5100	1.2200 ± 2.4400	1.0130 ± 1.7503
LW - 12380, 12381	Dec, 1995	I-131	0.0861 ± 0.1243	0.1222 ± 0.2055	0.1041 ± 0.1201
LW - 12380, 12381	Dec, 1995	I-131(g)	-7.3600 ± 13.8000	4.7100 ± 13.4000	-1.3250 ± 9.6177
LW - 12380, 12381	Dec, 1995	K-40	129.0000 ± 41.2000	133.0000 ± 34.7000	131.0000 ± 26.9329

Table A-5. In-house "duplicate" samples.

Lab Codes[b]	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
MI - 12325, 12326	Dec, 1995	I-131	-0.1263 ± 0.2456	0.1598 ± 0.2063	0.0167 ± 0.1604
MI - 12325, 12326	Dec, 1995	K-40	1,409.0000 ± 172.0000	1,438.6000 ± 169.0000	1,423.8000 ± 120.5664
WW - 12347, 12348	Dec, 1995	H-3	77.2534 ± 78.8630	87.6308 ± 79.3168	82.4421 ± 55.9252
F - 12688, 12689	Dec, 1995	Co-60	0.0009 ± 0.0117	0.0011 ± 0.0141	0.0010 ± 0.0092
F - 12688, 12689	Dec, 1995	Cs-134	0.0044 ± 0.0094	-0.0069 ± 0.0138	-0.0013 ± 0.0084
F - 12688, 12689	Dec, 1995	Cs-137	0.0366 ± 0.0179	0.0266 ± 0.0149	0.0316 ± 0.0116
F - 12688, 12689	Dec, 1995	I-131(g)	-0.0050 ± 0.0244	0.0254 ± 0.0422	0.0102 ± 0.0244
F - 12688, 12689	Dec, 1995	K-40	2.4139 ± 0.3400	2.5180 ± 0.3700	2.4660 ± 0.2512
PW - 12945, 12946	Dec, 1995	Co-60	0.2950 ± 2.7700	1.4000 ± 1.9600	0.8475 ± 1.6967
PW - 12945, 12946	Dec, 1995	Cs-137	1.4900 ± 2.5600	0.1240 ± 2.1900	0.8070 ± 1.6845

[a] All concentrations are reported in pCi/liter, except solid samples, which are reported in pCi/gram.

[b] Lab codes are comprised of the sample media and the sample numbers. Client codes have been eliminated to protect client anonymity.