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The 1990 Annual Environmental Report (Radiological - Volume #2) is hereby submitted in accordance with the requirements of Technical Specifications 6.9.1.10 and 6.9.1.11 for Beaver Valley Power Station Unit 1 License No. DPR-66 and Beaver Valley Power Station Unit 2 License No. NPF-73.

Sincerely,

J. D. Sieber
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JWM/laf

Enclosure

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1990 ANNUAL ENVIRONMENTAL REPORT
RADIOLOGICAL - VOLUME #2

DUQUESNE LIGHT COMPANY
BEAVER VALLEY POWER STATION

UNITS 1 AND 2

DUQUESNE LIGHT COMPANY
1990 Annual Radiological Environmental Report

EXECUTIVE SUMMARY

This report describes the Radiological Environmental Monitoring Program conducted during 1990 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 1990.

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 1990. The highest average daily output generated during the year was 838 megawatts net in January, 1990, and the total gross electrical generation during the year was 6,563,040 megawatt-hours.

Beaver Valley Power Station Unit 2 was shutdown on September 3, 1990 for the Second Refueling Outage. Unit 2 was returned to service on November 22, 1990 and operated throughout the year. The highest average daily output generated during the year was 823 megawatts net in December, 1990, and the total gross electrical generation during the year was 4,570,700 megawatt-hours.

EXECUTIVE SUMMARY (continued)

In 1990, 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 Limiting Conditions for Operation identified in the Beaver Valley Power Station Operating License Technical Specifications 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 0.0001% 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 Units 1 and 2 Technical Specifications was followed throughout 1990. 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
1990 Annual Radiological Environmental Report

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I. 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, soil, 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 1990.

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 1.0 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 1.1 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 that radius of concentrated population is the Borough of Midland, Pennsylvania, with a population of approximately 4,300.

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.

I. INTRODUCTION

B. Description of the Beaver Valley Site (continued)

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 52.8°F. The predominant wind direction is typically from the southwest in summer and from the northwest in winter.

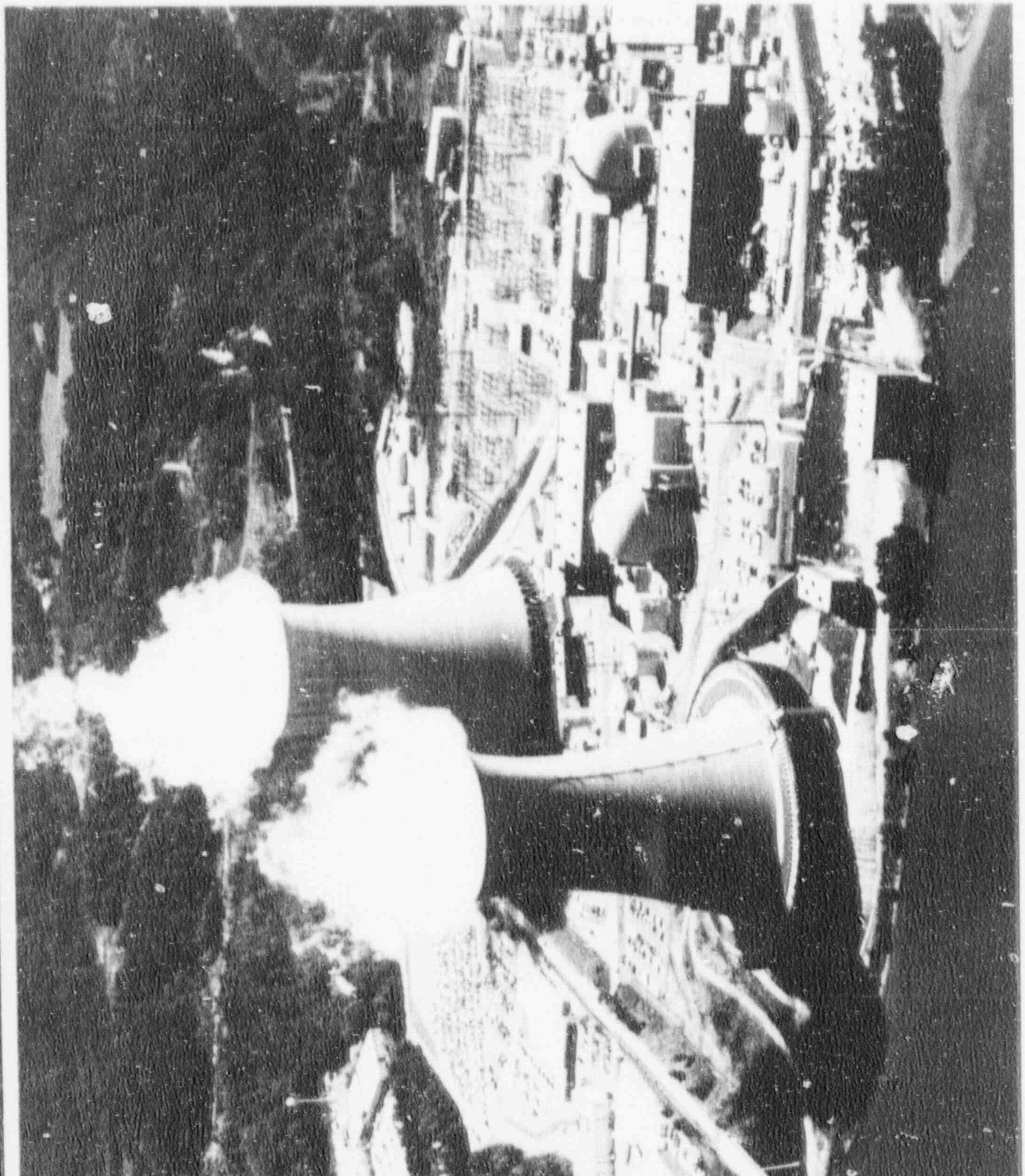
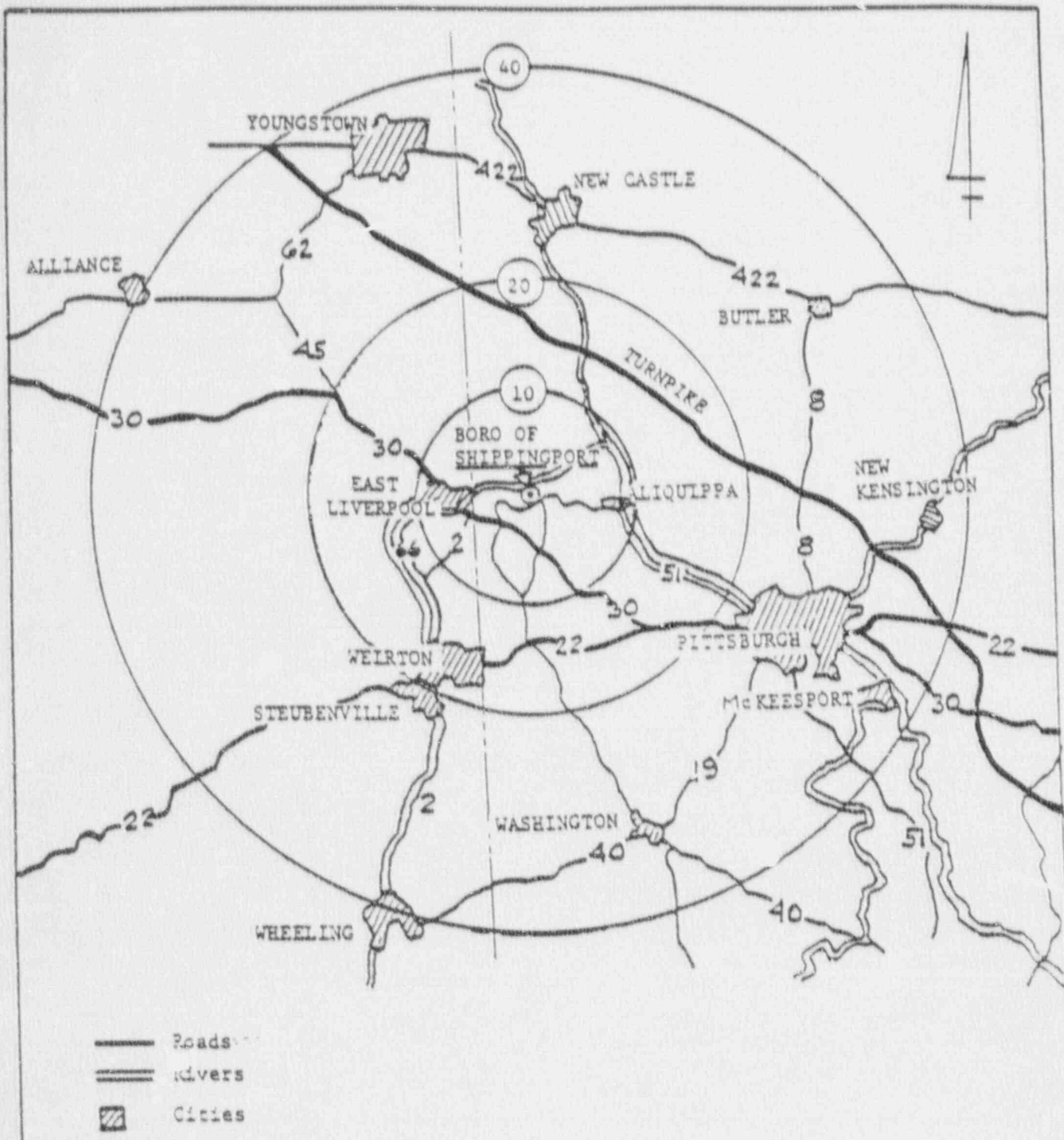


FIGURE 1.0

VIEW OF THE BEAVER VALLEY POWER STATION
BVPS



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

FIGURE 1.1

I. INTRODUCTION

B. Description of the Beaver Valley Site (continued)

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 Reactor	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

II. 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 1990.

The Beaver Valley Power Station Unit 1 operated throughout 1990. Beaver Valley Power Station Unit 2 was shutdown on September 3, 1990 for the Second Refueling Outage. Unit 2 was returned to service on November 22, 1990 and operated throughout the year. 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 Units 1 and 2 Operating License Technical Specifications.

The environmental program for 1990 was the same as in 1989 except for several changes in dairy locations which were revised as required by the Beaver Valley Technical Specifications. (Refer to Table V.A.1 for the 1990 Radiological Monitoring Program Outline).

The Beaver Valley Power Station Technical Specifications 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 Environmental Technical Specifications. The collection periods associated with each of the locations are provided in the detailed summary of the milk monitoring program of this report (Section V-E).

II. RESULTS AND CONCLUSIONS (continued)

Activity detected was attributable to naturally occurring radionuclides, BVPS effluents, previous nuclear weapons tests 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 1990 Radiological Environmental Monitoring Program are contained in Section V of this report. A summary of the 1990 operational environmental data is found in Table V.A.2 and a summary of preoperational data (1974-1975) environmental data is found in Table V.A.3.

Examination of effluents from the Beaver Valley Power Station and environmental media demonstrated compliance with regulations and Station Technical Specifications.

III. ENVIRONMENTAL MONITORING CONSIDERATIONS

A. Environmental Quality Control Programs

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. 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 ± 7.8% 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 III.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, soil, sediment and feedcrop were also split with the DLC QC Laboratory.

A summary of results of split water samples is provided in Table III.2. In 1989, five (5) of eight (8) split drinking and surface water samples analyzed for Gr-B were not in agreement. The disagreement in the Gr-B split water samples was attributed to differences in the analytical procedures used by the two laboratories. Subsequently, an investigation attributed the primary differences to the self absorbtion curves utilized by contractor and QC laboratories. See Appendix I. In 1990, two (2) of eight (8) split drinking and surface water samples analyzed for Gr-B were not in agreement which was an improvement over the 1989 results. The 1991 results will be closely monitored for unacceptable trends or results to assure the problem has been corrected. The two (2) spiked Gr-B water samples and EPA Interlaboratory Cross Check Program Gr-B results are in agreement. See Appendix I and II. A summary of milk, sediment and feed/food crop split samples is provided in Table III.3. Some variation may be expected due to small variations in duplicate samples, variations in analytical procedures, and in calibration, source type, etc.

TABLE III.1
QUALITY CONTROL RESULTS
TLD MONITORING mR/DAY

	1ST QUARTER		2ND QUARTER	
Location #	DLC Contractor ($CaSO_4$:Dy)	DLC - QC Lab ($CaSO_4$:Dy)	DLC Contractor ($CaSO_4$:Dy)	DLC - QC Lab ($CaSO_4$:Dy)
10	0.18	0.17	0.15	0.18
13	0.15	0.16	0.15	0.16
14	0.17	0.17	0.15	0.17
15	Lost	Lost	0.12	0.15
27	0.16	0.18	0.16	0.18
28	0.18	0.18	0.16	0.18
29B	0.20	0.21	0.19	0.20
32	0.18	0.19	0.18	0.20
45	0.16	0.19	0.15	0.20
46	0.13	0.14	0.14	0.14
47	0.19	0.21	0.17	0.23
48	0.17	0.22	0.15	0.19
51	0.18	0.19	0.16	0.19

	3RD QUARTER		4TH QUARTER	
Location #	DLC Contractor ($CaSO_4$:Dy)	DLC - QC Lab ($CaSO_4$:Dy)	DLC Contractor ($CaSO_4$:Dy)	DLC - QC Lab ($CaSO_4$:Dy)
10	0.14	0.17	0.15	0.16
13	0.15	0.17	0.15	0.15
14	0.15	0.17	0.16	0.16
15	0.12	0.15	0.12	0.13
27	0.14	0.15	0.15	0.16
28	0.16	0.17	0.16	0.16
29B	0.17	0.21	0.19	0.18
32	0.17	0.19	0.17	0.18
45	0.14	0.18	0.17	0.19
46	0.13	0.15	0.13	0.16
47	0.18	0.20	0.16	0.18
48	0.15	0.19	0.16	0.16
51	0.17	0.19	0.15	0.16

	ANNUAL	
Location #	DLC Contractor ($CaSO_4$:Dy)	DLC - QC Lab ($CaSO_4$:Dy)
10	0.15	0.15
13	0.14	0.14
14	0.14	0.15
15	0.12	Lost
27	0.14	0.15
28	0.15	0.15
29B	0.17	0.17
32	0.16	0.16
45	0.14	0.14
46	0.13	0.14
47	0.15	0.17
48	0.14	0.15
51	0.15	0.14

TABLE III.2
QUALITY CONTROL RESULTS
SPLIT SAMPLE ANALYSIS RESULTS

Comparison Of Contractor And DLC-QC Labs

Media	Analysis	Sampling Period	DLC Contractor Lab (1)	DLC - QC Lab (1)	Units
Surface Water	Gross Alpha	January	≤ 2.0	≤ 0.3	pCi/l
		April	≤ 1.6	≤ 0.5	pCi/l
		July	≤ 1.9	≤ 1.4	pCi/l
		October	≤ 2.0	≤ 0.9	pCi/l
Surface Water	Gross Beta	January	11 ± 2	4.2 ± 0.5*	pCi/l
		April	8.9 ± 1.6	3.0 ± 0.2	pCi/l
		July	9.0 ± 1.8	3.8 ± 0.7	pCi/l
		October	7.5 ± 1.3	4.0 ± 0.4	pCi/l
Surface Water	Co-60	January	≤ 3	≤ 4.1	pCi/l
		April	≤ 3	≤ 5.2	pCi/l
		July	≤ 3	≤ 1.6	pCi/l
		October	≤ 5	≤ 1.9	pCi/l
Surface Water	Cs-134	January	≤ 3	≤ 3.4	pCi/l
		April	≤ 3	± 3.7	pCi/l
		July	≤ 3	≤ 1.3	pCi/l
		October	≤ 5	≤ 2.0	pCi/l
Surface Water	Cs-137	January	≤ 4	≤ 4.5	pCi/l
		April	≤ 3	≤ 3.9	pCi/l
		July	≤ 3	≤ 1.6	pCi/l
		October	≤ 6	≤ 2.2	pCi/l
Surface Water	Tritium	1st Quarter Composite	190 ± 110	192 ± 69	pCi/l
		3rd Quarter Composite	11000 ± 1000	11373 ± 305	pCi/l
Surface Water	Sr-89	2nd Quarter Composite	≤ 1.3	≤ 0.9	pCi/l
		4th Quarter Composite	≤ 1.3	≤ 1.0	pCi/l
Surface Water	Sr-90	2nd Quarter Composite	≤ 0.24	0.6 ± 0.4	pCi/l
		4th Quarter Composite	≤ 0.2	≤ 0.5	pCi/l
Surface Water	Co-60 (high sensitivity analysis)	2nd Quarter Composite	≤ 1.0	≤ 1.8	pCi/l
		4th Quarter Composite	≤ 1.0	≤ 1.7	pCi/l

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

* See Section III A.2

TABLE III.2 (Continued)
QUALITY CONTROL RESULTS
SPLIT SAMPLE ANALYSIS RESULTS

Comparison Of Contractor And DLC-QC Labs

Media	Analysis	Sampling Period	DLC Contractor Lab (1)	DLC - QC Lab (1)	Units
Drinking Water (weekly split)	Cs-137	February	≤ 6	≤ 4.4	pCi/l
		May	≤ 6	≤ 6.0	pCi/l
		August	≤ 6	≤ 4.4	pCi/l
		November	≤ 3	≤ 2.5	pCi/l
Drinking Water (weekly split)	Cs-134	February	≤ 6	≤ 3.5	pCi/l
		May	≤ 6	≤ 5.2	pCi/l
		August	≤ 5	≤ 3.5	pCi/l
		November	≤ 3	≤ 2.2	pCi/l
Drinking Water (weekly split)	Co-60	February	≤ 6	≤ 3.4	pCi/l
		May	≤ 6	≤ 5.1	pCi/l
		August	≤ 5	≤ 3.2	pCi/l
		November	≤ 3	≤ 2.8	pCi/l
Drinking Water (monthly composite)	Gross Alpha	March	≤ 1.5	≤ 1.0	pCi/l
		June	≤ 1.7	≤ 0.6	pCi/l
		August	≤ 1.8	≤ 1.8	pCi/l
		November	≤ 1.6	≤ 1.8	pCi/l
Drinking Water (monthly composite)	Gross Beta	March	12 ± 2	2.8 ± 0.5*	pCi/l
		June	4.1 ± 0.7	2.3 ± 0.4	pCi/l
		August	4.6 ± 1.1	2.4 ± 1.0	pCi/l
		November	4.6 ± 1.4	2.1 ± 0.7	pCi/l
Drinking Water	Tritium	2nd Quarter	≤ 100	≤ 122	pCi/l
		4th Quarter	≤ 200	≤ 177	pCi/l

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence interval.
* See Section III A.2

TABLE III.3
QUALITY CONTROL RESULTS
SPLIT SAMPLE ANALYSIS RESULTS

Comparison Of Contractor And DLC-QC Labs

Media	Analysis	Sampling Period	DLC Contractor Lab (1)	DLC - QC Lab (1)	Units
Milk	Sr-89	3/19/90	≤ 1.5	≤ 0.6	pCi/l
(Location 25)	Sr-90	3/19/90	1.1 ± 0.3	2.0 ± 0.4	pCi/l
	I-131	3/19/90	≤ 0.16	≤ 0.3	pCi/l
	K-40	3/19/90	1270 ± 130	1230 ± 110	pCi/l
	Co-60	3/19/90	≤ 5	≤ 5.5	pCi/l
	Cs-134	3/19/90	≤ 4	≤ 4.2	pCi/l
	Cs-137	3/19/90	≤ 4	≤ 4.8	pCi/l
Feed	I-131	6/8/90	≤ 0.006	≤ 0.009	pCi/gm (dry)
(Location 25)	Be-7	6/8/90	2.63 ± 0.30	2.6 ± 0.1*	pCi/gm (dry)
	K-40	6/8/90	19.3 ± 1.9	17.6 ± 0.6*	pCi/gm (dry)
	Co-60	6/8/90	≤ 0.03	≤ 0.002	pCi/gm (dry)
	Cs-134	6/8/90	≤ 0.03	≤ 0.001	pCi/gm (dry)
	Cs-137	6/8/90	≤ 0.03	≤ 0.002	pCi/gm (dry)
Feed (Location 25)	Sr-90	6/8/90	0.11 ± 0.01	0.068 ± 0.015*	pCi/gm (wet)
Milk	I-131	6/12/90	≤ 0.26	≤ 0.3	pCi/l
(Location 25)	K-40	6/12/90	1250 ± 130	1236 ± 96	pCi/l
	Co-60	6/12/90	≤ 4	≤ 3.7	pCi/l
	Cs-134	6/12/90	≤ 4	≤ 3.4	pCi/l
	Cs-137	6/12/90	≤ 4	≤ 4.6	pCi/l
Food	I-131	9/14/90	≤ 0.042	≤ 0.049	pCi/gm (wet)
(Location 25)	K-40	9/14/90	1.95 ± 0.2	2.38 ± 0.28	pCi/gm (wet)
	Co-60	9/14/90	≤ 0.01	≤ 0.014	pCi/gm (wet)
	Cs-134	9/14/90	≤ 0.01	≤ 0.011	pCi/gm (wet)
	Cs-137	9/14/90	≤ 0.01	≤ 0.016	pCi/gm (wet)

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence interval.
* See Section III B

TABLE III.3 (continued)
QUALITY CONTROL RESULTS
SPLIT SAMPLE ANALYSIS RESULTS

Comparison Of Contractor And DLC-QC Labs

Media	Analysis	Sampling Period	DLC Contractor Lab (1)	DLC - QC Lab (1)	Units
Milk	I-131	9/18/90	≤ 0.2	≤ 0.2	pCi/l
(Location 25)	Sr-89	9/18/90	≤ 1.7	≤ 0.4	pCi/l
	Sr-90	9/18/90	2.8 ± 0.4	2.6 ± 0.4	pCi/l
	Cs-134	9/18/90	≤ 4	≤ 1.4	pCi/l
	Cs-137	9/18/90	≤ 4	≤ 2.0	pCi/l
	Co-60	9/18/90	≤ 4	≤ 1.6	pCi/l
	K-40	9/18/90	1280 ± 130	1244 ± 45	pCi/l
Sediment	Gross Alpha	10/28/90	17.0 ± 6	12.8 ± 3.9	pCi/gm (dry)
(Location 2A)	Gross Beta	10/28/90	59.0 ± 4	44.0 ± 3.8	pCi/gm (dry)
	Sr-89	10/28/90	≤ 0.13	≤ 0.011	pCi/gm (dry)
	Sr-90	10/28/90	≤ 0.18	0.025 ± 0.007	pCi/gm (dry)
	Co-58	10/28/90	33.2 ± 3.3	50.0 ± 0.2*	pCi/gm (dry)
	Co-60	10/28/90	3.67 ± 0.37	4.71 ± 0.05	pCi/gm (dry)
	Cs-134	10/28/90	≤ 0.1	≤ 0.045	pCi/gm (dry)
	Cs-137	10/28/90	0.28 ± 0.092	0.46 ± 0.04*	pCi/gm (dry)
	K-40	10/28/90	14.6 ± 1.5	15.8 ± 0.3	pCi/gm (dry)
	Ra-226	10/28/90	1.91 ≤ 2	4.3 ± 0.6*	pCi/gm (dry)
	Th-228	10/28/90	1.22 ± 0.12	1.9 ± 0.1	pCi/gm (dry)
Milk	I-131	12/11/90	≤ 0.15	≤ 0.3	pCi/l
(Location 25)	K-40	12/11/90	1380 ± 140	1310 ± 131	pCi/l
	Co-60	12/11/90	≤ 4	≤ 6.5	pCi/l
	Cs-134	12/11/90	≤ 4	≤ 6.9	pCi/l
	Cs-137	12/11/90	≤ 4	≤ 6.3	pCi/l

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

* See Section III B

III. ENVIRONMENTAL MONITORING PROGRAMS

A. Environmental Quality Control Programs (continued)

3. DLC QC Laboratory Program

Spiked samples prepared by DLC QC Laboratory were routinely submitted to the Contractor Laboratory for analysis. Tables III.4 (water) and III.5 (milk) provide data from this portion of the QC Program.

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 III.6 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. See Appendix I and II. DLC also audited the Contractor and QC Laboratory and determined that internal QC practices were in effect and that procedures and laboratory analytical techniques conformed to approved DLC procedures.

III. ENVIRONMENTAL MONITORING CONSIDERATIONS

A. Environmental Quality Control Programs (continued)

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

Milk and water samples were prepared by an Independent Laboratory. This included low level spiking of specified nuclides. The prepared samples were split three ways and analyzed by the DLC-QC Laboratory and Independent Laboratory as well as the Contractor Laboratory. A summary of results of this portion of the QC program is provided in Table III.7.

TABLE III.4
QUALITY CONTROL RESULTS
SPIKE SAMPLE ANALYSIS RESULTS

Sample Date	Ident. No.	Sample Type & Analysis	DLC Contractor Lab (1)	DLC - QC Lab (1)	Units
4/24/90	W-61	Water: Sr-89	21.0 ± 1.0	17.9 ± 5.5	pCi/1
		Sr-90	25.0 ± 2.0	19.4 ± 2.5	pCi/1
4/30/90	W-62	Water: Cs-134	20.7 ± 6.1	20.0 ± 0.2	pCi/1
		Cs-137	28.2 ± 4.5	28.7 ± 1.4	pCi/1
		Co-60	11.5 ± 4.3	8.7 ± 0.4	pCi/1
4/30/90	W-63	Water: I-131	44.0 ± 2.0	63.5 ± 8.0	pCi/1
4/30/90	W-64	Water: H-3	1900 ± 100	1941 ± 13	pCi/1
6/30/90	W-68	Water: Gross Alpha	10.0 ± 0.2	9.8 ± 0.3	pCi/1
		Gross Beta	12.0 ± 1	11.4 ± 0.6	pCi/1
9/28/90	W-69	Water: Sr-89	19 ± 1	17.7 ± 1.6	pCi/1
		Sr-90	17 ± 1	13.9 ± 1.6	pCi/1
10/15/90	W-70	Water: H-3	2400 ± 100	2355 ± 59	pCi/1
10/15/90	W-71	Water: I-131	40 ± 1	55.9 ± 0.9*	pCi/1
10/31/90	W-73	Water: Co-60	19.0 ± 4.5	18.3 ± 2.7	pCi/1
		Cs-134	24.6 ± 4.9	28.3 ± 2.3	pCi/1
		Cs-137	23.0 ± 4.1	22.7 ± 2.3	pCi/1
12/31/90	W-74	Water: Gross Alpha	24 ± 2	21.4 ± 1.0	pCi/1
		Gross Beta	20 ± 1	25.9 ± 1.0	pCi/1

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

* See Section III B

TABLE III.5
QUALITY CONTROL RESULTS
SPIKE SAMPLE ANALYSIS

Sample Date	Ident. No.	Sample Type & Analysis	DLC Contractor Lab (1)	DLC - QC Lab (1)	Units
1/30/90	MI-26	Milk: Sr-89	≤ 1.7	12.8 ± 1.6*	pCi/l
		Sr-90	3.2 ± 1.6	23.6 ± 5.0*	pCi/l
		K-40	1120 ± 110	1162 ± 29	pCi/l
		Cs-134	16.1 ± 4.0	19.3 ± 1.0	pCi/l
		Cs-137	26.2 ± 3.7	25.2 ± 1.2	pCi/l
3/5/90	MI-28	Milk: I-131	45 ± 1	63.8 ± 2.2*	pCi/l
4/30/90	MI-29	Milk: I-131	43.3 ± 3	90.7 ± 9.2*	pCi/l
		K-40	1220 ± 120	1213 ± 15	pCi/l
		Cs-134	20.4 ± 4.5	18.3 ± 1.0	pCi/l
		Cs-137	19.7 ± 4.2	20.3 ± 1.0	pCi/l
7/30/90	MI-30	Milk: Sr-89	19.0 ± 4.0	12.8 ± 0.4	pCi/l
		Sr-90	16.0 ± 3	18.2 ± 1.4	pCi/l
		K-40	1290 ± 130	1274 ± 32	pCi/l
		Cs-134	42.0 ± 4.2	46.0 ± 1.3	pCi/l
		Cs-137	28.7 ± 4.7	27.6 ± 1.3	pCi/l
8/7/90	MI-31	Milk: I-131	63.0 ± 1.0	68.8 ± 1.6	pCi/l
10/15/90	MI-32	Milk: I-131	27.0 ± 1	34.8 ± 0.2	pCi/l
		K-40	1170 ± 120	1207 ± 46	pCi/l
		Cs-134	26.3 ± 3.6	25.8 ± 1.2	pCi/l
		Cs-137	27.3 ± 4.9	25.3 ± 2.0	pCi/l

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

* See Section III B

TABLE III.6
QUALITY CONTROL RESULTS
AIR PARTICULATES AND CHARCOAL FILTER: COMPARABLE 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 (1)	DLC - QC Lab (1)
12/26/89 to 01/02/90	0.021 ± 0.003	0.021 ± 0.003	01/02/90 to 01/08/90	≤ 0.01	≤ 0.01
01/08/90 to 01/15/90	0.016 ± 0.003	0.021 ± 0.003	01/15/90 to 01/22/90	≤ 0.01	≤ 0.02
01/22/90 to 01/29/90	0.015 ± 0.003	0.017 ± 0.003	01/29/90 to 02/05/90	≤ 0.01	≤ 0.02
02/05/90 to 02/12/90	0.014 ± 0.003	0.019 ± 0.003	02/12/90 to 02/20/90	≤ 0.01	≤ 0.01
02/20/90 to 02/26/90	0.013 ± 0.003	0.012 ± 0.003	02/26/90 to 03/05/90	≤ 0.01	≤ 0.01
03/05/90 to 03/12/90	0.015 ± 0.003	0.016 ± 0.003	03/12/90 to 03/19/90	≤ 0.01	≤ 0.01
03/19/90 to 03/26/90	0.014 ± 0.003	0.018 ± 0.002	03/26/90 to 04/02/90	≤ 0.01	≤ 0.02
04/02/90 to 04/09/90	0.011 ± 0.003	0.010 ± 0.003	04/09/90 to 04/16/90	≤ 0.01	≤ 0.01
04/16/90 to 04/23/90	0.018 ± 0.003	0.015 ± 0.003	04/23/90 to 04/30/90	≤ 0.01	≤ 0.01
04/30/90 to 05/07/90	0.010 ± 0.002	0.014 ± 0.003	05/07/90 to 05/14/90	≤ 0.01	≤ 0.01
05/14/90 05/21/90	0.011 ± 0.003	0.014 ± 0.002	05/21/90 to 05/29/90	≤ 0.01	≤ 0.01
05/29/90 to 06/04/90	0.016 ± 0.003	0.014 ± 0.003	06/04/90 to 06/12/90	≤ 0.01	≤ 0.01
06/12/90 to 06/18/90	0.018 ± 0.003	0.017 ± 0.003	06/18/90 to 06/25/90	≤ 0.01	≤ 0.01
06/25/90 to 07/02/90	0.016 ± 0.003	0.021 ± 0.003	07/02/90 to 07/09/90	≤ 0.01	≤ 0.01

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

TABLE III.6 (continued)
QUALITY CONTROL RESULTS
AIR PARTICULATES AND CHARCOAL FILTER: COMPARABLE 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 (1)	DLC - QC Lab (1)
07/09/90 to 07/16/90	0.010 ± 0.002	0.007 ± 0.002	07/16/90 to 07/23/90	≤ 0.01	≤ 0.01
07/23/90 to 07/30/90	0.015 ± C.003	0.015 ± 0.004	07/30/90 to 08/06/90	≤ 0.01	≤ 0.01
08/06/90 to 08/13/90	0.021 ± 0.003	0.020 ± 0.003	08/13/90 to 08/20/90	≤ 0.01	≤ 0.01
08/20/90 to 08/27/90	0.009 ± 0.003	0.008 ± 0.003	08/27/90 to 09/04/90	≤ C.01	≤ 0.01
09/04/90 to 09/10/90	0.021 ± 0.003	0.022 ± 0.004	09/10/90 to 09/17/90	≤ 0.01	≤ 0.01
09/17/90 to 09/24/90	0.011 ± 0.003	0.016 ± 0.003	09/24/90 to 10/02/90	≤ 0.01	≤ 0.01
10/02/90 to 10/09/90	0.016 ± 0.003	0.027 ± 0.004	10/09/90 to 10/15/90	≤ 0.01	≤ 0.01
10/15/90 to 10/22/90	0.022 ± 0.003	0.019 ± 0.003	10/22/90 to 10/29/90	≤ 0.02	≤ 0.01
10/29/90 to 11/05/90	0.031 ± 0.003	0.034 ± 0.004	11/05/90 to 11/12/90	≤ 0.01	≤ 0.01
11/12/90 to 11/19/90	0.023 ± 0.003	0.025 ± 0.003	11/19/90 to 11/26/90	≤ 0.02	≤ 0.01
11/26/90 to 12/03/90	0.022 ± 0.003	0.023 ± 0.003	12/03/90 to 12/11/90	≤ 0.01	≤ 0.01
12/11/90 to 12/18/90	0.015 ± 0.003	0.019 ± 0.003	12/18/90 to 12/24/90	≤ 0.02	≤ 0.01
12/24/90 to 12/31/90	0.017 ± 0.003	0.020 ± 0.003			

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

TABLE III.6
QUALITY CONTROL
AIR PARTICULATES (pCi/m^3)

Sample Date	Nuclide	DLC Contractor Lab (1)	DLC - QC Lab (1)
January	Be-7	0.075 ± 0.013	0.072 ± 0.018
	Others	LLD	LLD
March	Be-7	0.095 ± 0.017	0.079 ± 0.012
	Others	LLD	LLD
May	Be-7	0.087 ± 0.015	0.087 ± 0.015
	Others	LLD	LLD
July	Be-7	0.089 ± 0.017	0.094 ± 0.018
	Others	LLD	LLD
September	Be-7	0.114 ± 0.015	0.055 ± 0.019
	Others	LLD	LLD
November	Be-7	0.130 ± 0.014	0.081 ± 0.016
	Others	LLD	LLD

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence interval.
LLD - Lower Limit of Detection

TABLE III.6
QUALITY CONTROL
AIR PARTICULATE AND CHARCOAL FILTER - COMPARABLE SAMPLES
LOCATION 30 - (pCi/m^3)

Sample Date	Nuclide	DLC Contractor Lab (1)	DLC - QC Lab (1)
1st Quarter Composite	Sr-89	≤ 0.0009	≤ 0.0004
	Sr-90	≤ 0.0001	≤ 0.0003
2nd Quarter Composite	Sr-89	≤ 0.0009	≤ 0.0006
	Sr-90	≤ 0.0002	≤ 0.0005
3rd Quarter Composite	Sr-89	≤ 0.0002	≤ 0.0003
	Sr-90	≤ 0.0002	≤ 0.0003
4th Quarter Composite	Sr-89	≤ 0.0006	≤ 0.0002
	Sr-90	≤ 0.0001	≤ 0.0002

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

TABLE III.7
QUALITY CONTROL DATA

QC Sample Comparisons
(All Analyses In pCi/l)

Sample Date	Ident. No.	Sample Type & Analyses	Independent Lab (1)	DLC Contractor Lab (1)	DLC - QC Lab (1)
2/28/90	53-303	Water: Sr-89	21 ± 2	16 ± 1	7.1 ± 1.4*
		Sr-90	21.3 ± 0.7	19 ± 2	16.0 ± 3.5
		I-131	9.0 ± 0.2	8.0 ± 0.5	11.3 ± 1.3
		Cs-134	17 ± 11	24.6 ± 3.7	22.7 ± 1.6
		Cs-137	29 ± 11	32.5 ± 4.4	32.3 ± 1.2
2/28/90	53-304	Water: H-3	1000 ± 200	940 ± 90	1058 ± 17
5/2/90	53-305	Water: Sr-89	13.0 ± 1.3	11 ± 1	7.9 ± 1.6
		Sr-90	13.0 ± 0.7	11 ± 2	12.2 ± 0.2
		I-131	18.9 ± 0.2	19 ± 1	25.6 ± 1.0
		Cs-137	11 ± 6	12.9 ± 3.7	16.1 ± 1.2
		Co-60	9 ± 8	19.9 ± 4.3	14.4 ± 0.9
5/2/90	53-306	Water: H-3	1700 ± 200	1200 ± 100	1578 ± 27
8/7/90	53-307	Water: Sr-89	20 ± 2	19.0 ± 1	15.4 ± 4.1
		Sr-90	22.7 ± 0.6	24.0 ± 1	25.3 ± 0.3
		I-131	13.7 ± 0.3	11 ± 1	17.3 ± 1.4
		Mn-54	31 ± 4	35.9 ± 4.7	40.6 ± 2.4
		Cs-137	19 ± 3	28.7 ± 4.3	28.9 ± 2.0
8/7/90	53-308	Water: H-3	2020 ± 80	2200 ± 200	2146 ± 40
10/30/90	53-309	Water: Sr-89	16.3 ± 1.2	15 ± 3	11.0 ± 1.2
		Sr-90	12.6 ± 0.6	14 ± 1	10.7 ± 1.0
		I-131	16.7 ± 0.4	20 ± 1	27.1 ± 0.8*
		Cs-137	10 ± 3	21.3 ± 3.7*	18.9 ± 1.6
		Co-60	12 ± 4	11.0 ± 3.7	13.2 ± 0.7
10/30/90	53-310	Water: H-3	480 ± 70	560 ± 60	498 ± 29

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

* See Section III B

TABLE III.7
QUALITY CONTROL DATA

QC Sample Comparisons
(All Analyses In pCi/l)

Sample Date	Ident. No.	Sample Type & Analyses	Independent Lab (1)	DLC Contractor Lab (1)	DLC - QC Lab (1)
2/28/90	52-254	Milk: Sr-89	10 ± 3	3.7 ± 1.7	4.0 ± 0.6
		Sr-90	16.3 ± 0.7	12 ± 2	12.6 ± 1.6
		I-131	10.2 ± 0.2	12 ± 1	12.4 ± 1.4
		Cs-134	25 ± 4	20.8 ± 5.6	23.9 ± 0.3
		Cs-137	21 ± 3	31.1 ± 5.2	32.8 ± 2.0
		K-40	1330 ± 90	1330 ± 130	1221 ± 36
5/2/90	52-255	Milk: Sr-89	24 ± 2	20 ± 2	21.5 ± 1.4
		Sr-90	23.7 ± 0.8	27 ± 1	24.4 ± 1.2
		I-131	16.8 ± 0.2	20 ± 1	25.8 ± 2.9*
		Cs-134	16 ± 2	20.1 ± 8.3	19.9 ± 0.2
		Cs-137	15 ± 2	17.5 ± 9.4	18.8 ± 0.8
		K-40	1290 ± 90	1350 ± 140	1187 ± 35
8/7/90	52-256	Milk: Sr-89	8 ± 2	7.6 ± 1.3	8.7 ± 2.3
		Sr-90	14.0 ± 0.5	10.0 ± 1	12.9 ± 0.4
		I-131	13.2 ± 0.2	13 ± 1	16.8 ± 0.1
		Cs-134	12 ± 3	14.4 ± 3.6	12.0 ± 0.6
		Cs-137	11 ± 3	14.0 ± 3.8	14.7 ± 1.0
		K-40	1180 ± 90	1290 ± 130	1229 ± 55
10/30/90	52-257	Milk: Sr-89	16 ± 2	16 ± 3	10.4 ± 1.8
		Sr-90	17.4 ± 0.5	13 ± 1	11.1 ± 0.1
		I-131	11.1 ± 0.13	6.7 ± 0.6	16.7 ± 0.4*
		Cs-134	11 ± 3	10.9 ± 4.4	12.0 ± 1.5
		Cs-137	15 ± 3	17.7 ± 3.5	17.8 ± 1.5
		K-40	1200 ± 90	1280 ± 130	1223 ± 14

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

* See Section III B

III. ENVIRONMENTAL MONITORING PROGRAM

A. Environmental Quality Control Programs (continued)

7. Pennsylvania Department of Environmental Resources Program

The Pennsylvania Department of Environmental Resources (PDER) 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. Comparison of results also indicated agreement between the PDER Laboratory and the Duquesne Light Company Contractor Laboratory.

B. Evaluation of the Quality Control (QC) 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." In addition, an independent laboratory is used to supplement the regular program. Comparisons between the independent, QC and Contractor laboratories are acceptable and demonstrate a satisfactory performance by the DLC contractor. All media were found to be in agreement in accordance with NRC criteria with the exception of those media in Tables III.2 - III.7 identified with an asterisk (*).

Based on all available QC data and the data from the Contractor and QC Laboratory's internal EPA Interlaboratory Cross Check Program, the Environmental Monitoring Program for 1990 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 limits have been established to further limit discharges to the environment.

III. ENVIRONMENTAL MONITORING PROGRAM

C. Standard Requirements and Limitations for Radiological and Other Effluents (continued)

Beaver Valley Power Station is subject to regulations which include the Code of Federal Regulations 10 CFR (Energy), Pennsylvania Department of Environmental Resources (PDER) Industrial Waste Permit #0473211, Gaseous Discharge Permit #04-306-001, 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.

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 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:

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

There were no analytical results of environmental samples during 1990 which exceeded Beaver Valley Power Station reporting levels.

IV. MONITORING EFFLUENTS

A. Monitoring of Liquid Effluents

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 iver, used for makeup to various plant systems, consumed by station personnel, or discharged via a sanitary waste system. In addition, small amounts of well water and liquid effluents are discharged to the Ohio River using discharge points shown in Figure 4.1. Figures 4.2, 4.3, 4.4 and 4.5 are schematic diagrams of liquid flow paths for the Beaver Valley Power Station. The following two (2) tables summarize radioactive liquid effluents at the Beaver Valley Power Station:

Table IV.A.1 - Effluent Treatment, Sampling, and Analytical Procedures - Beaver Valley

Table IV.A.2 - Results of Liquid Effluent Discharges to the Environment - Beaver Valley

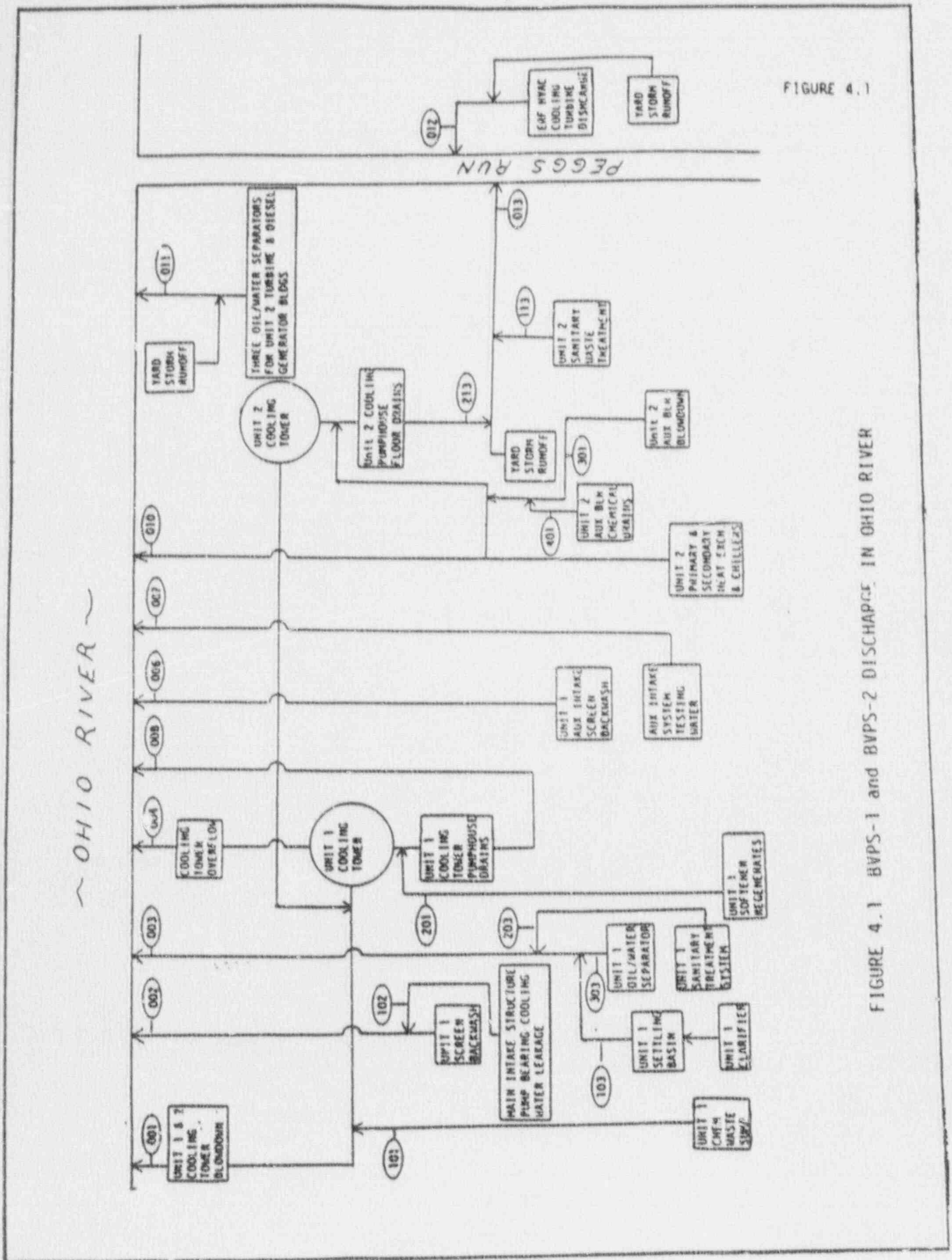


FIGURE 4.1 BVPS-1 and BVPS-2 DISCHARGE IN OHIO RIVER

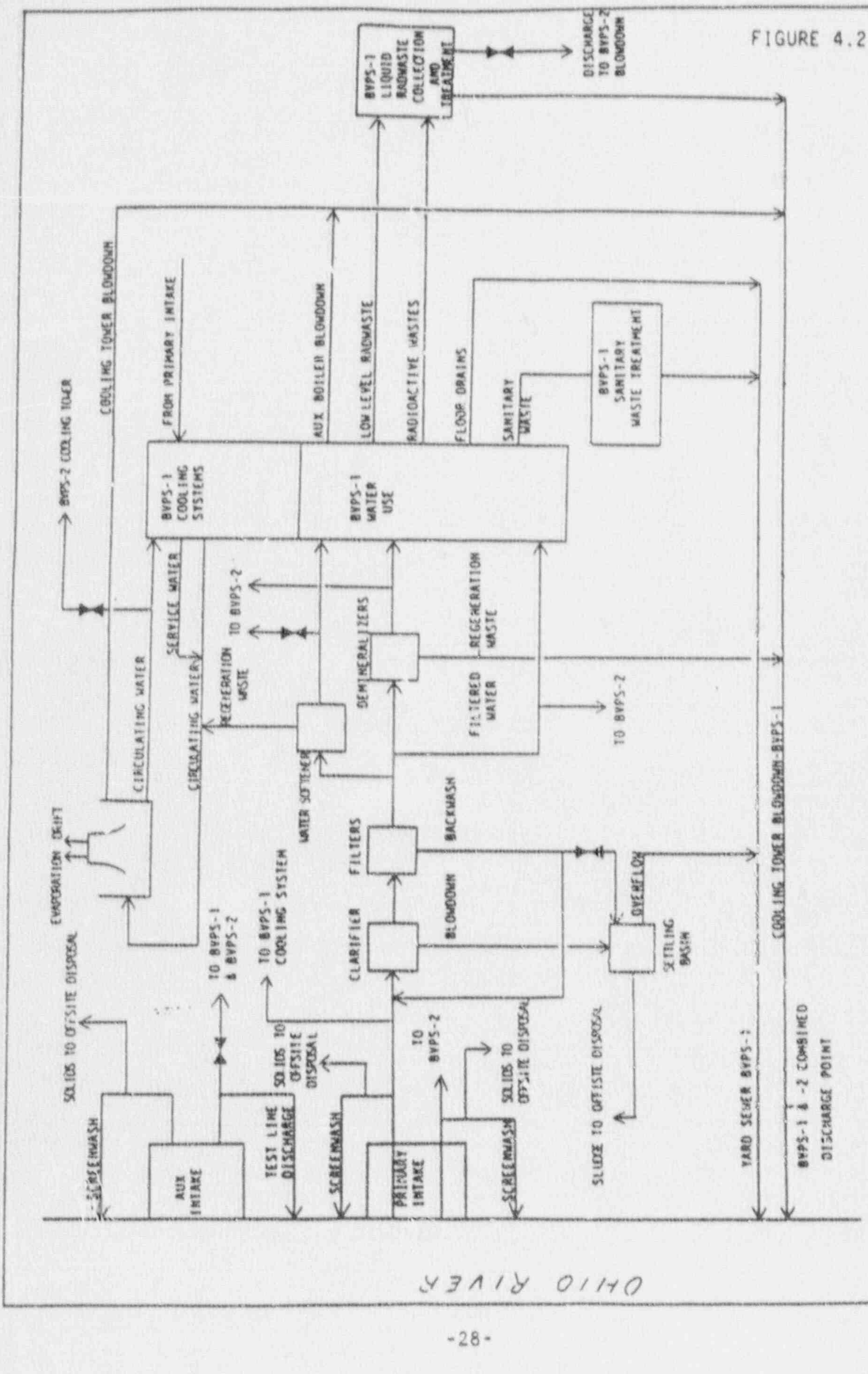


FIGURE 4.2 - WATER FLOW SCHEMATIC - BVPS UNIT 1

FIGURE 4.3

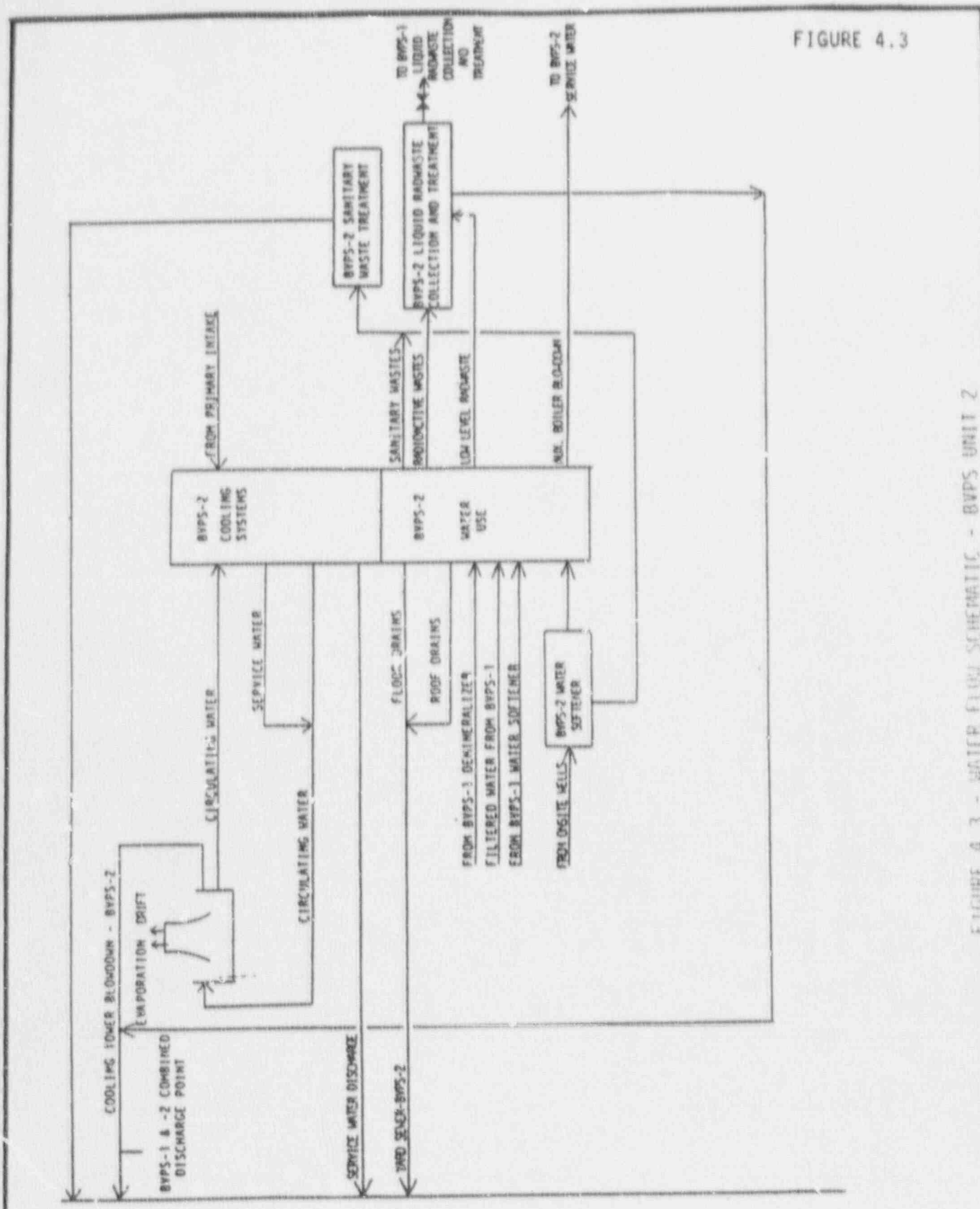


FIGURE 4.3 - WATER FLOW SCHEMATIC - BVPS UNIT 2

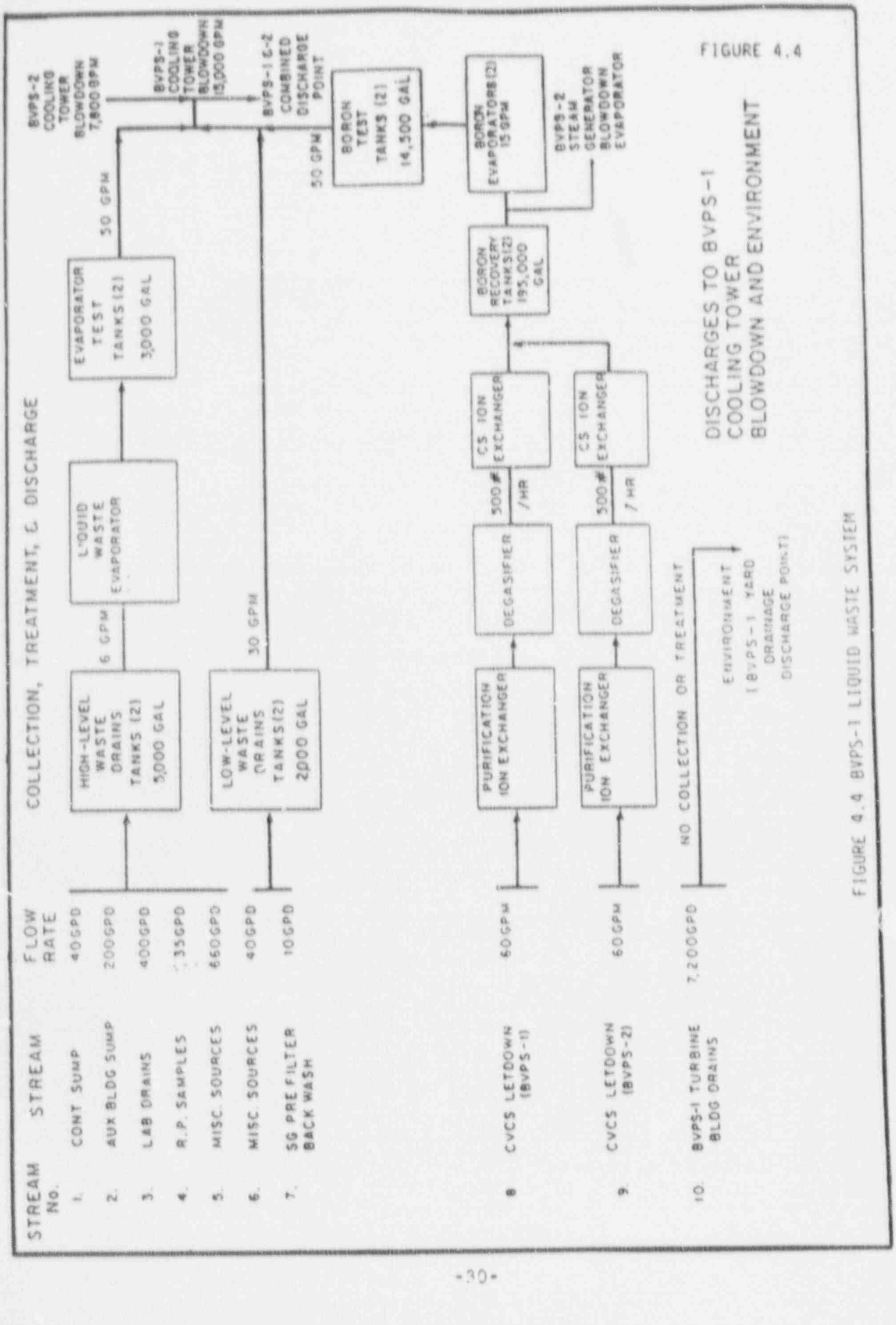


FIGURE 4.4 BVPS-1 LIQUID WASTE SYSTEM

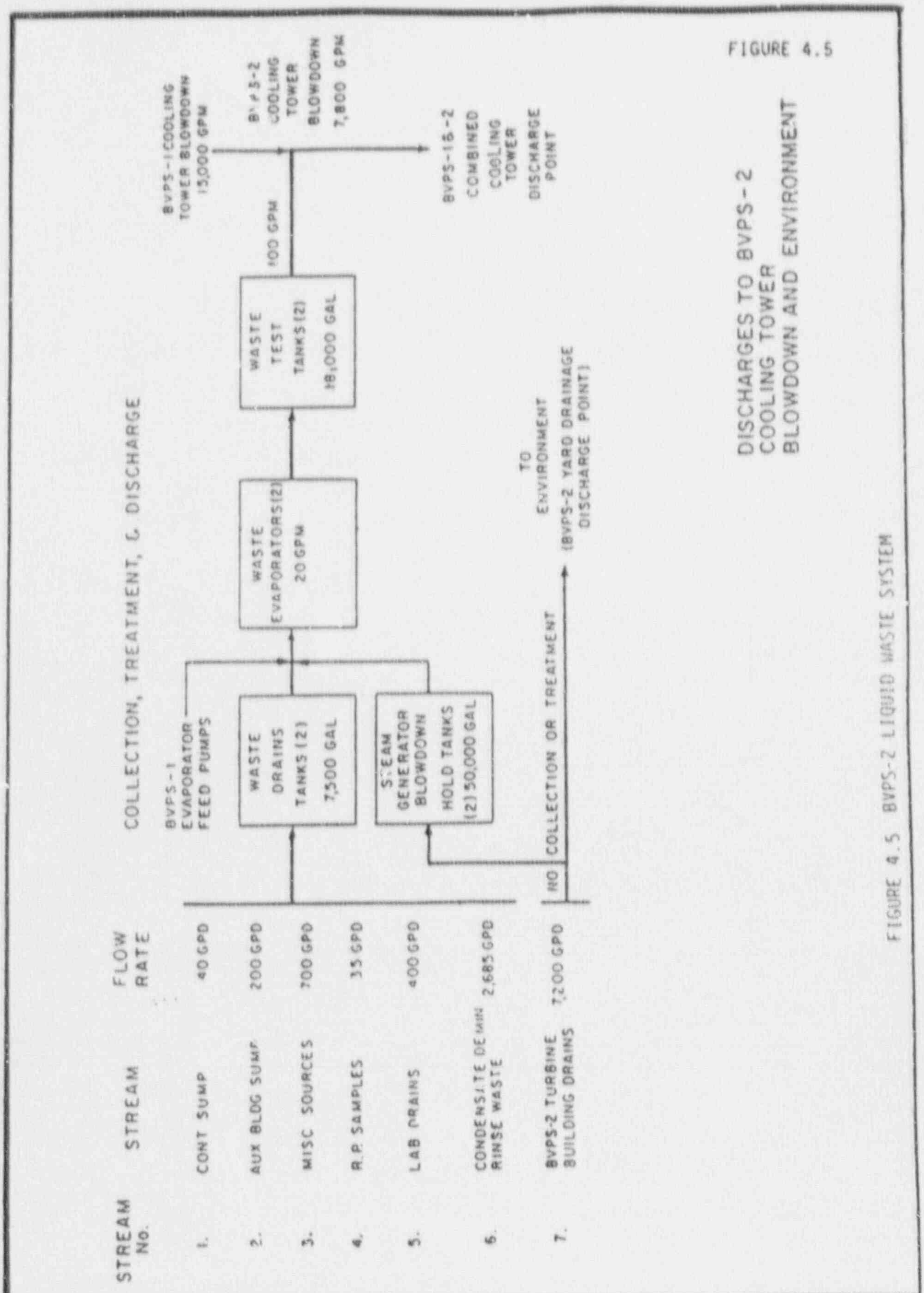


FIGURE 4.5 BVPS-2 LIQUID WASTE SYSTEM

TABLE IV.A.1

1. Effluent Treatment, Sampling and Analytical Procedures - Beaver Valley

Effluent Type	Treatment, Sampling and/or Monitoring	Standard and/or Analytical Procedures
(a) Steam System Blowdown	Recycled or directed to Radwaste System for discharge.	If discharged, procedures adhere to Technical Specifications.
(b) Radioactive Waste	Effluents shall not exceed values specified in the Technical Specifications. All discharges are performed in accordance with the Offsite Dose Calculation Manual (ODCM).	Procedures adhere to requirements of Technical Specifications.

TABLE IV.A.2

2. Results of Liquid Effluent Discharges to the Environment - Beaver Valley

Effluent Type	Results for 1990
(a) Steam System Blowdown	The Steam System Blowdown was recycled.
(b) Radioactive Waste Liquids	Routine planned releases of liquid effluents from the Beaver Valley Power Station were released in accordance with conditions noted in the Section 3/4.11.1 of the Technical Specifications for Units 1 and 2 and no limits were exceeded. These values have been reported in the Beaver Valley Power Station Semiannual Radioactive Effluent Release Reports for 1990.

IV. MONITORING EFFLUENTS

B. Monitoring of Airborne Effluents

1. Description of Airborne Effluent Sources

Beaver Valley Power Station (Units 1 and 2)

The Beaver Valley Power Station identifies isotopes according to the Technical Specifications 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 Condensate Polishing Building Vent located on top of the Unit 2 Condensate Polishing Building.

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

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

c. Unit 1 and Unit 2 shared release points;

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

IV. MONITORING EFFLUENTS

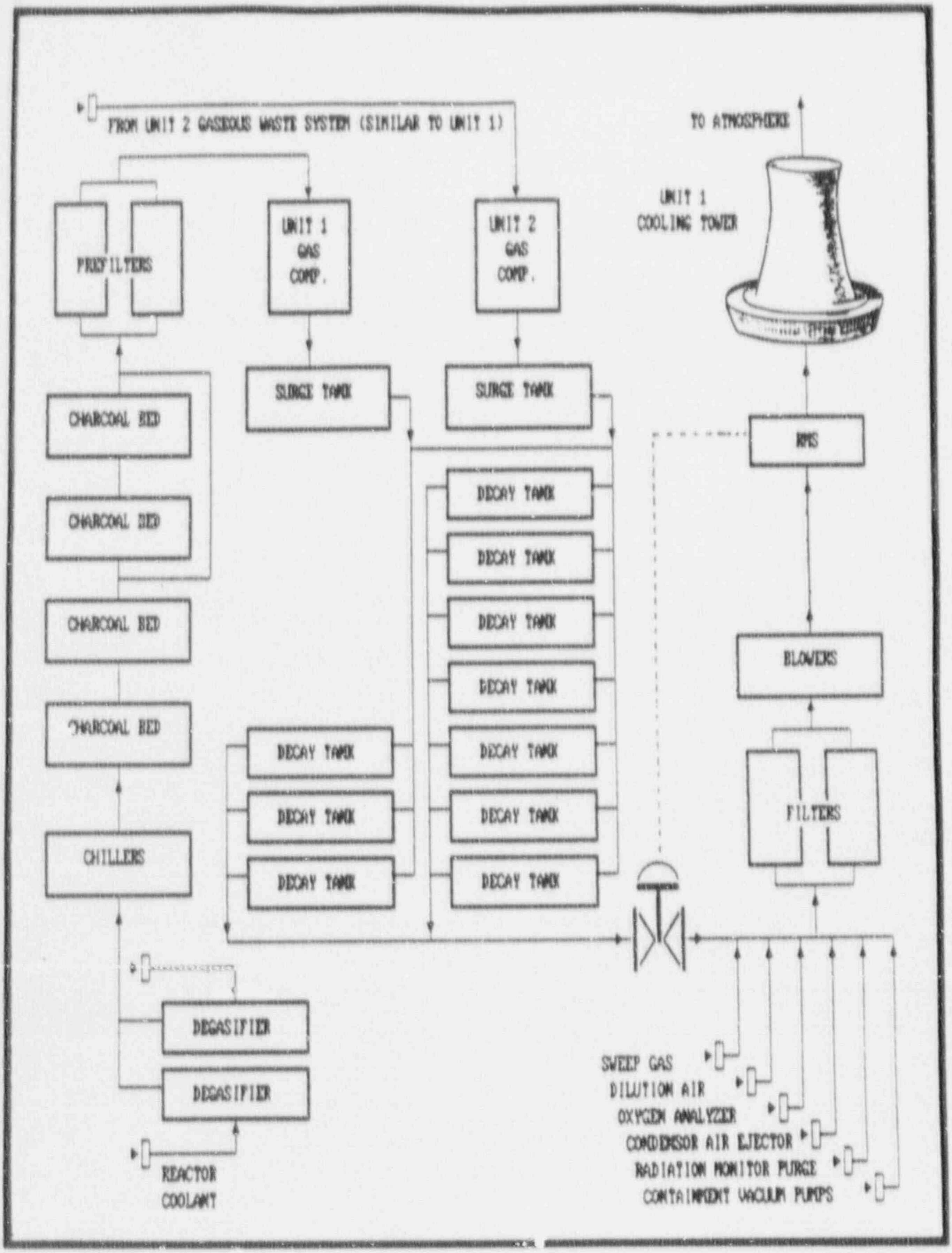
B. Monitoring of Airborne Effluents (continued)

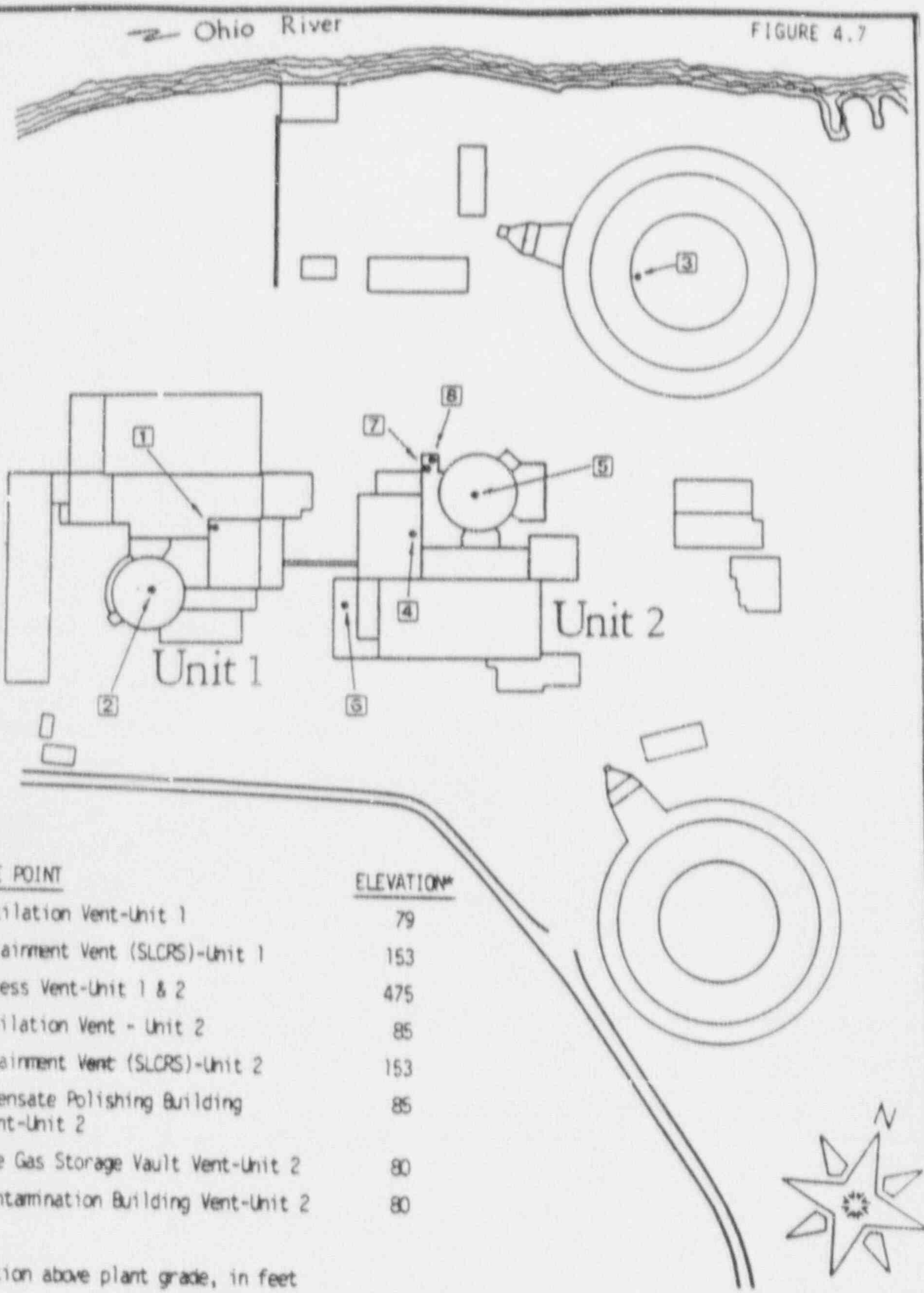
1. Description of Airborne Effluent Sources (continued)

Beaver Valley Power Station (Units 1 and 2) (continued)

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 and 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.


FROM UNIT 2 GASEOUS WASTE SYSTEM (SIMILAR TO UNIT 1)
TO ATMOSPHERE
UNIT 1 COOLING TOWER
PREFILTERS
UNIT 1 GAS COMP.
UNIT 2 GAS COMP.
SURGE TANK
SURGE TANK
RMS
CHARCOAL BED
CHARCOAL BED
CHARCOAL BED
CHARCOAL BED
DECAY TANK
BLOWERS
FILTERS
CHILLERS
DEGASIFIER
DEGASIFIER
REACTOR COOLANT
SWEEP GAS
DILUTION AIR
OXYGEN ANALYZER
CONDENSOR AIR EJECTOR
RADIATION MONITOR PURGE
CONTAINMENT VACUUM PUMPS



RELEASE POINT	ELEVATION*
1. Ventilation Vent-Unit 1	79
2. Containment Vent (SLCRS)-Unit 1	153
3. Process Vent-Unit 1 & 2	475
4. Ventilation Vent - Unit 2	85
5. Containment Vent (SLCRS)-Unit 2	153
6. Condensate Polishing Building Vent-Unit 2	85
7. Waste Gas Storage Vault Vent-Unit 2	80
8. Decontamination Building Vent-Unit 2	80

* Elevation above plant grade, in feet

FIGURE 4.7 GASEOUS RELEASE POINTS - BEAVER VALLEY POWER STATION UNIT 1 & 2

IV. MONITORING EFFLUENTS

B. Monitoring of Airborne Effluents (continued)

2. Airborne 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 the eight continuous ventilation system pathways.

The overhead gas compressor directs the radioactive gas stream to a gas surge tank. Gas is periodically discharged 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 recorded and 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.

IV. MONITORING EFFLUENTS

B. Monitoring of Airborne Effluents (continued)

2. Airborne Effluent Treatment and Sampling (continued)

Beaver Valley Power Station (continued)

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.

Areas in the Unit 1 Auxiliary Building (subject to radioactive contamination) are monitored for radioactivity prior to entering the common Ventilation Vent. These individual radiation monitors aid in identifying any sources of contaminated air. The Ventilation Vent is also monitored continuously by several redundant channels of the Radiation Monitoring System (RMS) and is sampled periodically. Upon a high 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.

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.

See Table IV.B.1 for Radioactive Gaseous Waste Sampling and Analysis Program.

TABLE IV.B.1

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/ml)[a]
A. Waste Gas Storage Tank	P Each Tank Grab Sample	P Each Tank	Principal Gamma Emitters[g]	1×10^{-4}
			H-3	1×10^{-6}
B. Containment Purge	P Each Purge[b] Grab Sample	P Each Purge[b]	Principal Gamma Emitters[g]	1×10^{-4}
			H-3	1×10^{-6}
C. Ventilation Systems[h] 1. Process Vent 2. Containment Vents 3. Aux. Bldg. Vents 4. Cond. Polish. Bldg. Vent 5. Decon. Bldg. Vent 6. Waste Gas Vault 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}
	Continuous[f]	W[d] Particulate Sample	Principal Gamma Emitters[g] (I-131, Others)	1×10^{-11}
	Continuous[f]	M Composite Particulate Sample	Gross alpha	1×10^{-11}
	Continuous[f]	Q Composite Particulate Sample	Sr-89, Sr-90	1×10^{-11}
	Continuous[f]	Noble Gas Monitor	Noble Gases Gross Beta and Gamma	1×10^{-6}

IV. MONITORING EFFLUENTS

TABLE NOTATION

a. The Lower Limit of Detection (LLD).

b. When reactor coolant system activity exceeds the limits stated in the BVPS Technical Specification, analyses shall be performed once every 24 hours during startup, shutdown and 25% load changes and 72 hours after achieving the maximum steady state power operation unless continuous monitoring is provided.

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 and analyses shall also be performed at least once per 24 hours, during startup, shutdown and 25% load changes and 72 hours after achieving the maximum steady state power operation when RCS activity exceeds the limits stated in the Technical Specification unless continuous monitoring is provided. When samples collected for 24 hours are analyzed, the corresponding LLD's may be increased by a factor of 10.

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 the BVPS Technical Specification.

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 semi-annual effluent report.

h. Only when release path is in use.

IV. MONITORING EFFLUENTS

B. Monitoring of Airborne Effluents (continued)

3. Results

Beaver Valley Power Station

Gaseous effluents from the Beaver Valley Power Station were released in accordance with conditions noted in Section 3/4.11.2 of the Technical Specifications. No limits were exceeded. These values have been reported in the Beaver Valley Power Station Semi-Annual Radioactive Effluent Release Reports for 1990.

IV. MONITORING EFFLUENTS

C. Solid Waste Disposal at the Beaver Valley Power Station

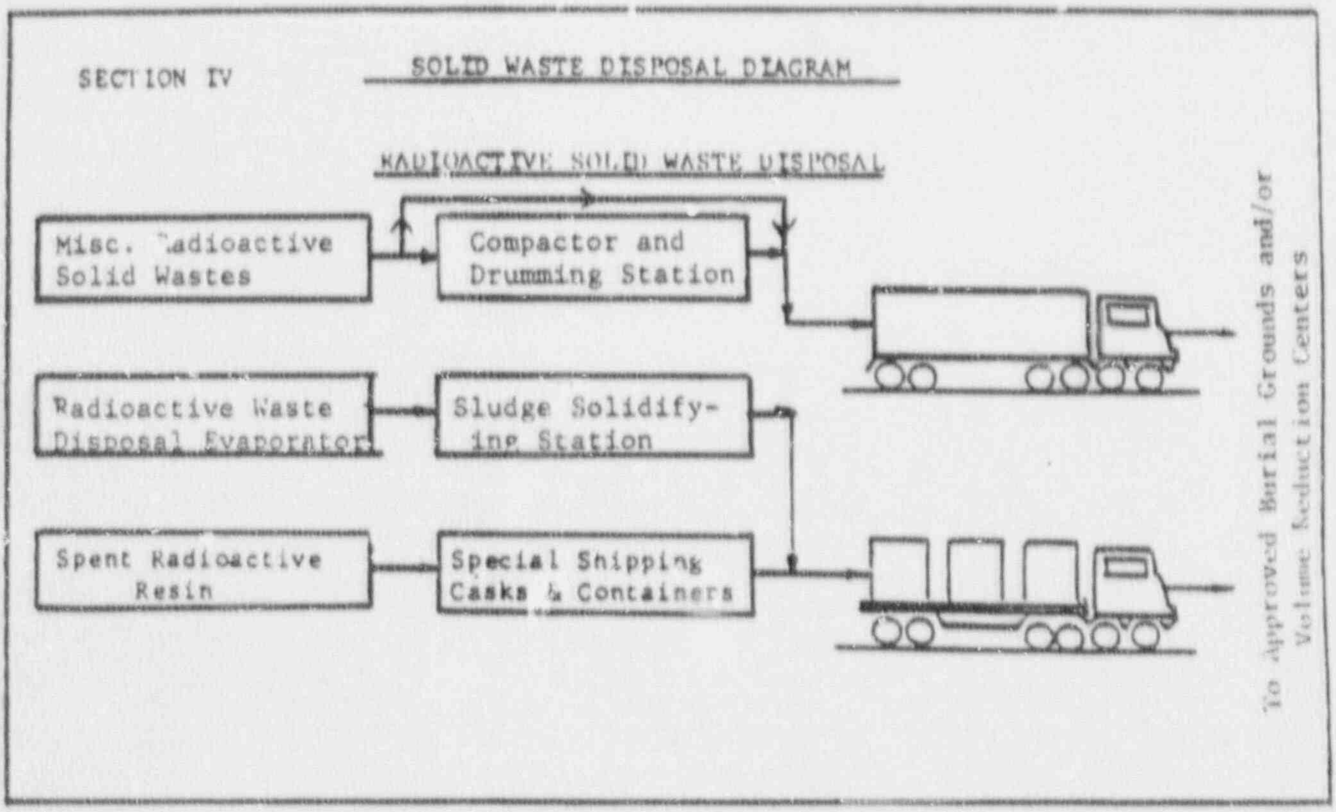
During Beaver Valley Power Station normal operations and periodic maintenance, small quantities of solid radioactive waste materials were generated such as evaporator concentrates, contaminated rags, paper, plastics, filters, spent ion-exchange resins, and miscellaneous tools and equipment. These were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

The services of offsite vendors were used to segregate, incinerate, and super-compact the waste. At the Beaver Valley Power Station, the compactable wastes are segregated and the capability exists to compress the waste in 55-gallon drums to minimize disposal volumes. The compressed waste is shipped for disposal at a commercial radioactive material burial site licensed by the Nuclear Regulatory Commission (NRC) or a state under agreement with the NRC. No radioactive waste material is buried at the Beaver Valley Power Station site.

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.

At Beaver Valley Power Station approximately 5,450 cubic feet of radioactive solid waste was buried offsite in 1990. The twenty-six (26) shipments contained a total activity of 544 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.


SECTION IV
SOLID WASTE DISPOSAL DIAGRAM
RADIOACTIVE SOLID WASTE DISPOSAL
Misc. Radioactive Solid Wastes
Compactor and Drumming Station
Radioactive Waste Disposal Evaporator
Sludge Solidifying Station
Spent Radioactive Resin
Special Shipping Casks & Containers
To Approved Burial Grounds and/or Volume Reduction Centers

V. ENVIRONMENTAL MONITORING

A. Environmental Radioactivity Monitoring Program

1. Program Description

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

V-B - Air Monitoring

V-C - Sediments and Soils Monitoring

V-D - Vegetation and Foodcrops

V-E - Cow's Milk

V-F - Environmental Radiation Monitoring

V-G - Fish

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

V-I - Estimates of Radiation Dose to Man

TABLE V.A.1

CONSOLIDATED RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Type of Sample	DLC Sample Points	Sector	Miles	Sample Point Description	Sample Frequency	Sample Preparation	Analysis Frequency	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				
	32	15	0.8	Midland, PA (S.S.)		Quarterly Composite [d]		Sr-89,90
	48(a)	10	16.5	Weirton, WV (a)				
	51	5	8.0	Aliquippa, PA (S.S.)				
	47	14	4.4	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] Annually [k]		Gamma-Dose
	13	11	1.6	Meyer's Farm				
	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 Cenrs.				
	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 Cahills 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				
	95	10	2.4	McCleary Rd, Hollie Williams				

S.S. - Substation

TABLE V.A.1

CONSOLIDATED RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
(Continued)

Type of Sample	DLC Sample Points	Sector	Miles	Sample Point Description	Sample Frequency	Sample Preparation	Analysis Frequency	Analysis (b)
2. Direct Radiation (Continued)	28	1	8.[illegible]	Sherman's Farm	Continuous (TLD)	Quarterly (k) Annually (k)		Gamma-Dose
	71	2	5.6	Brighton Twp. School				
	72	3	3.2	Logan School				
	29B	3	8.1	Beaver County Hospital				
	73	4	2.2	Potter Twp. School				
	74	4	6.8	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)	4	5.0	Arco Polymers	Intermittent Composite Samples (j) Collected Weekly	Monthly Composite of Weekly Sample (d)		Gross Beta Gross Alpha Gamma-scan
	2.1	14	1.3	Downstream (Midland) J & L		Quarterly Composite		Co-60, H-3 Sr-89, Sr-90
	3	13	0.7	Shippingport Atomic Power Station Discharge	Weekly Grab Samples Only			
	49 (a)	3	3.2	Montgomery Dam (Upstream)				
	2A	13	0.2	Downstream BVPS Outfall				
	5	14	4.8	East Liverpool (raw water)	Daily Grab Sample Only - Collected Weekly (j)			
4. Groundwater	13	11	1.6	Meyer's Farm				
	14	11	2.6	Hookstown, PA				
	15	15	3.3	Georgetown, PA				
	11	3	0.8	Shippingport Boro	Quarterly	Quarterly		Gamma-scan, Gross Beta, Gross Alpha, H-3
5. Drinking	4	14	1.3	Midland, PA (Midland Water Treatment Plant)	Intermittent (e) Sample Collected Weekly	Weekly Composite of Daily Sample (d)		Gamma-scan, I-131
						Monthly Composite (d)		Gross Alpha, Gross Beta
	5	14	4.8	East Liverpool, OH (East Liverpool Water Treatment Plant)		Quarterly Composite (d)		H-3, Co-60, Sr-89, 90
	6	5	0.5	DLC New Training Bldg.	Weekly Grab Sample			

TABLE V.A.1

CONSOLIDATED RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
(Continued)

Type of Sample	DLC Sample Points	Sector	Miles	Sample Point Description	Sample Frequency	Sample Preparation	Analysis Frequency	Analysis[b]
6. Shoreline Sediment	2A	13	0.2	Downstream BVPS Outfall	Semiannual	Semiannual		Gamma-scan, Gross Beta Gross Alpha Uranium Isotopic Sr-89, 90
	3	13	0.2	Vicinity SAPS Discharge				
	49	3	3.2	Upstream Side of Montgomery Dam (a)				
	50	13	8.2	Unstream side of New Cumberland Dam				
7. Milk	25	10	2.1	Searight's Dairy	Weekly [f]	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(e)	10	10.3	Windsheimer				
	27	7	6.2	Brunton's Dairy (h)				
	29	3	8.3	Nicol's Dairy (h)	Monthly	Monthly		Gamma-scan Sr-89, 90 I-131, Cs-137
8. Fish	2A	13	0.2	Vicinity of BVPS #1 Station Discharge and Shippingport Dis. Sta.	Semiannual	Composite of edible parts by species (i)		Gamma-scan on edible portions
	49(e)	3	4.7	Upstream Side of Montgomery Dam				
9. Food Crops (Shipp.)	10	4	0.8	(Three locations within 5 miles Selected by Company)	Annual at harvest if available	Composite of each sample species		Gamma-scan I-131 on green leafy vegetables
(Georg.)	15	14	3.3					
(Indus.)	46	3	2.5					
	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 (1988, 1991, 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, W. Va.				
	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	Nichol's Dairy				

* BVPS Technical Specification Table 3.12-1 requires three(3) dairies be selected on basis of highest potential thyroid dose using milch census data. See Section V.E. for specific locations sampled.

TABLE V.A.1

CONSOLIDATED RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

(Continued)

Type of Sample	DLC Sample Points	Sector	Miles	Sample Point Description	Sample Frequency	Sample Preparation	Analysis Frequency	Analysis (b)
12. Precipitation	30	4	0.6	Shippingport, PA	Weekly grab	Monthly Composite		Gross β
	47	14	4.8	East Liverpool, OH	samples when	of grab samples		γ-scan
	48	10	16.5	Weirton, WV	available	Quarterly Composite		H-3, Sr-89, Sr-90

TABLE V.A.1
CONSOLIDATED 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 LLD's for Gamma Spectrometry are shown in Table V.A.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 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 location 3, 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.

TABLE V.A.1
CONSOLIDATED RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
(Continued)

Additional Notes:

-- Sample points correspond to site numbers shown on maps.

-- All Iodine 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.

V. ENVIRONMENTAL MONITORING

A. Environmental Radioactivity Monitoring Program (continued)

2. Summary of Results

All results of this monitoring program are summarized in Table V.A.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). Summaries of results of analysis of each media are discussed in Sections V-B through V-H and an assessment of radiation doses are found in Section V-I. Table V.A.3 summarizes Beaver Valley Power Station pre-operational ranges for the various sampling media during the years 1974 and 1975. Comparisons of pre-operational 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, 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 III 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 V.A.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 1990

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed Measurements***	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
						Weirton, WV No. 48	
Air Particulate and Radioiodine	Gross (520) Beta	2.5	15(520/520) (4.8-33)	32. Midland, PA 0.8 mi NW	16(52/52) (8.0-31)	15(52/52) (5.3-28)	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	93(120/120) (50-151)	46. Industry, PA 2.4 mi NE	100(12/12) (65-136)	98(12/12) (63-151)	0
	K-40	20	35(5/120) (9.7-83)	27. Brunton's Dairy 6.2 mi SE	50(1/12) --	20(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 (MARCH 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 1990
(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	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 (44) (175 quarterly)	0.05	0.16(175/175) (0.12-0.19)	29, Beaver Cty Hosp 8.1 mi NE	0.19(4/4) (0.18-0.20)	15(4/4) (0.15-0.17)	0
	Gamma (44 annual)	0.05	0.15(44/44) (0.12-0.19)	84, Hancock Cty Children's Home 8.5 mi SW	0.19(1/1) --	0.14(1/1) --	0
Feed and Forage (pCi/g) (dry weight)	I-131 (12)	0.01	LLD	--	--	One Sample Location	
	Sr-90 (4)	0.003	0.074(4/4) (0.048-0.11)	--	--	--	
	Gamma (12)						
	Be-7	0.3	4.7(6/12) (0.41-11)	--	--	--	0
	K-40	0.5	21(12/12) (8.6-41)	--	--	--	0
	Th-228	0.08	0.21(4/12) (0.15-0.31)	--	--	--	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.

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 1990

Medium of Pathway Sampled (Unit of Measurement) Measurements***	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
						Montgomery Dam No. 49	
Fish (pCi/g) (wet weight)	Gamma (10)						
	K-40	0.05	3.0(9/9) (2.3-4.1)	2A. BVPS Discharge 0.2 mi W	3.2(5/5) (2.7-4.1)	2.8(4/4) (2.3-3.2)	0
	Co-58	0.02	0.23(1/9) —	2A. BVPS Discharge 0.2 mi W	0.23(1/5) —	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 (MARCH 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 1990

Medium of Pathway Sampled (Unit of Measurement) Measurements***	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)	Control Locations **Mean (f) **Range	Number of Nonroutine Reported **Range
						Weirton, WV No. 48	
Food and Garden Crops (pCi/g) (wet weight)	I-131 (4)	0.006	LLD	--	--	--	-
	Gamma (4)						
	K-40	0.5	2.1(4/4) (1.7-2.4)	15, Georgetown, PA 3.3 mi NW	2.4(1/1) --	1.7(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

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 1990

Medium of Pathway Sampled (Unit of Measurement) Measurements***	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
						Brunton Dairy No. 27	
Milk (pCi/l)	I-131 (167)	0.2	LLD	--	--	--	
	Sr-89 (133)	2	LLD	--	--	--	
	Sr-90 (133)	1	2.6(133/133) (0.24-8.4)	102. Ferry Dairy	5.0(8/8) (1.4-8.4)	1.8(19/19) (0.5-5.1)	0
	Gamma (134)						
	K-40	100	1339(134/134) (917-1830)	104. Fordyce Dairy	1523(13/13) (1060-1830)	1236(19/19) (1110-1390)	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

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 1990

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	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 (8) Alpha	0.3	16(8/8) (8.0-20)	2A. BVPS Discharge 0.2 mi. W	19(2/2) (17-20)	18(2/2) (17-18)	0
	Gross (8) Beta	0.1	40(8/8) (19-59)	2A. BVPS Discharge 0.2 mi. W	52(2/2) (45-59)	39(2/2) (36-42)	0
	Sr-89 (8)	0.2	LLD	--	--	--	-
	Sr-90 (8)	0.04	LLD	--	--	--	-
	Gamma (8)						
	Be-7	0.2	1.5(4/8) (0.66-2.5)	2A. BVPS Discharge 0.2 mi. W	2.3(2/2) (2.1-2.5)	0.66(1/2) --	0
	K-40	0.5	12(8/8) (7.1-17)	2A. BVPS Discharge 0.2 mi. W	16(2/2) (15-17)	13(2/2) (11-15)	0
	Mn-54	0.05	0.52(2/8) (0.46-0.58)	2A. BVPS Discharge 0.2 mi. W	0.52(2/2) (0.46-0.58)	LLD	0
	Co-58	0.2	9.2(4/8) (0.59-33)	2A. BVPS Discharge 0.2 mi. W	17(2/2) (0.59-33)	LLD	0
	Co-60	0.2	1.9(4/8) (0.31-3.7)	2A. BVPS Discharge 0.2 mi. W	3.2(2/2) (2.8-3.7)	LLD	0
	Cs-137	0.02	0.20(8/8) (0.071-0.28)	2A. BVPS Discharge 0.2 mi. W	0.27(2/2) (0.27-0.28)	0.22(2/2) (0.20-0.23)	0
	Ra-226	0.1	2.0(7/8) (1.4-2.6)	2A. BVPS Discharge 0.2 mi. W	2.1(1/2) --	2.1(2/2) (2.08-2.1)	0
	Th-228	0.02	1.3(8/8) (0.73-2.0)	2A. BVPS Discharge 0.2 mi. W	1.6(2/2) (1.2-2.0)	1.3(2/2) (0.97-1.7)	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

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 1990

Medium of Pathway Sampled (Unit of Measurement) Measurements***	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
Drinking Water (pCi/l)	I-131 (155)	0.2	0.45(8/155) (0.20-0.78)	05, E. Liverpool, OH 4.8 mi WNW	0.47(3/52) (0.29-0.59)	--	0
	Gross Alpha (36)	0.6	LLD	--	--	--	-
	Gross Beta (36)	1	4.1(36/36) (1.9-12)	04, Midland, PA 1.3 mi WNW	4.7(12/12) (2.9-12)	--	0
	Gamma (155)	Table V.A.	LLD	--	--	--	-
	Sr-89 (12)	1.5	LLD	--	--	--	-
	Sr-90 (12)	0.5	LLD	--	--	--	-
	Co-60 (12) (a)	1	LLD	--	--	--	-
	H-3 (12)	100	180(1/12) --	05, E. Liverpool, OH 4.8 mi WNW	180(1/4) --	--	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 (MARCH 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 1990

Medium of Pathway Sampled (Unit of Measurement) Measurements***	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
						Georgetown, PA No. 15	
Groundwater (pCi/l)	Gross (16) Alpha	2	LLD	--	--	--	-
	Gross (16) Beta	1	3.7(13/16) (1.9-5.2)	13. Meyers Farm 1.6 mi SW	5.2(1/4) --	2.6(4/4) (2.0-2.9)	0
	Gamma (16)	TableV.A.	LLD	--	--	--	-
	Tritium (16)	90	175(2/16) (140-210)	14. Hookstown, PA 2.6 mi SW	210(1/4) --	140(1/4) --	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 (MARCH 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 1990

Medium of Pathway Sampled (Unit of Measurement) Measurements***	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 Weirton, WV No.48	Number of Nonroutine Reported
Water Precipitation (pCi/l)	Gross (34) Beta	1	7.1(33/34) (1.9-14)	48, Weirton, WV 16.05 mi SSW	8.1(11/11) (3.2-14)	same as high location	0
	Gamma (34)						
	Be-7	40	66(11/34) (42-99)	30, Shippingport, PA 0.6 mi ENE	77(4/12) (63-99)	64(4/11) (43-77)	0
	Others	Table V.A.	LLD	--	--	--	-
	Sr-89 (12)	2	LLD	--	--	--	-
	Sr-90 (12)	0.5	LLD	--	--	--	-
	H-3 (12)	100	210(7/12) (120-310)	48, Weirton, WV 16.05 mi SSW	310(1/4) --	same as high location	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 (MARCH 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 1990

Medium of Pathway Sampled (Unit of Measurement) Measurements***	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
						Montgomery Dam No. 49	
Surface Water (pCi/l)	I-131 (52)	0.5	0.48(2/52) (0.42-0.53)	49.1. Upstream, ARCO Polymers 5.0 mi ENE		one sample location	0
	Gross (72) Alpha	2	LLD	--	--	--	-
	Gross (72) Beta	1	7.1(71/72) (3.0-28)	02A. BVPS Discharge 0.2 mi W	11(12/12) (7.1-28)	5.8(12/12) (4.1-10)	0
	Gamma (72)						
	Co-58		16(2/72) (15-17)	02A. BVPS Discharge 0.2 mi W	17(1/12) --	LLD	0
	Others Table V.A.		LLD	--	--	--	-
	Sr-89 (24)	2	LLD	--	--	--	-
	Sr-90 (24)	0.5	LLD	--	--	--	-
	Co-58 (24) (a)		5.2(2/24) (4.3-6.1)	02A. BVPS Discharge 0.2 mi W	6.1(1/4) --	LLD	0
	Co-60 (24) (a)	2	LLD	--	--	--	-
	Tritium (24)	100	2210(11/24) (190-11000)	02A. BVPS Discharge 0.2 mi W	5088(4/4) (190-11000)	220(1/4) --	0

(a) Co-60 and Co-58 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 (MARCH 1975) and the Beaver Valley Power Station Specifications

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Docket No. 50-334
Location of Facility Beaver, Pennsylvania (County, State) Reporting Level CY 1974 - 1975

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
	ZrNb-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	—
	ZrNb-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 - 0.31
	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
	ZrNb-95		0.05	0.8	13/81	0.2 - 1.3
	Ru-106 (b)		0.3	1.4	12/81	0.6 - 2.3
	Others				< LLD	

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Docket No. 50-334
Location of Facility Beaver, Pennsylvania (County, State) Reporting Period CY 1974 - 1975

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) (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
	ZrNb-95		0.05	0.3	13/64	0.1 - 2
	Ru-106 (b)		0.3	1.1	3/64	0.5 - 2
	Others				< LLD	
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.-
	Co-60		0.1	0.2	1/8	—
	Others				< LLD	

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period CY 1974 - 1975

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		
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 - [illegible]
	Gross Beta	(927)	0.006	0.07	927/927	0.02 - [illegible]
	Sr-89	(0)			—	
	Sr-90	(0)			—	
	I-131	(816)	0.04	0.08	2/816	0.07 - [illegible]
	Gamma	(197)				
	ZrNb-95		0.005	0.04	122/197	0.01 - [illegible]
	Ru-106		0.010	0.04	50/197	0.02 - [illegible]
	Ce-141		0.010	0.02	3/197	0.01 - [illegible]
	Ce-144		0.010	0.02	44/197	0.01 - [illegible]
	Others				< LLD	

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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

Location of Facility Beaver, Pennsylvania (County, State) Reporting Level CY 1974 - 1975

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)				
	K-40		0.5	2.4	17/17	1.0 - 3.7
	Other					< 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.

DUQUESNE LIGHT COMPANY

TABLE V.A.4

TYPICAL LLDs * FOR GAMMA SPECTROMETRY

Nuclide	Milk Water (pCi/liter)	Air Particulates (10^{-3} pCi/m^3)	Vegetation (pCi/kg dry)	Sediment & Soil (pCi/g dry)	Fish (pCi/g wet)
Be-7	30	20	50	0.03	0.05
K-40	60	20	**	**	**
Cr-51	40	10	100	0.05	0.1
Mn-54	3	0.5	30	0.02	0.03
Co-58	3	0.6	30	0.02	0.03
Fe-59	6	1	60	0.03	0.06
Co-60	3	0.6	30	0.02	0.03
Zn-65	8	1	70	0.04	0.07
Zr/Nb-95	5	2	50	0.03	0.05
Ru-103	3	2	40	0.03	0.04
Ru-106	30	5	30	0.02	0.03
Ag-110M	5	3	30	0.02	0.03
I-131	4	2	30	0.02	0.03
Te-132	4	2	20	0.01	0.02
I-133	4	2	20	0.01	0.02
Cs-134	4	0.6	30	0.02	0.03
Cs-136	6	0.6	50	0.03	0.05
Cs-137	4	0.6	20	0.02	0.03
Ba/La-140	10	6	40	0.02	0.04
Ce-141	6	2	60	0.03	0.06
Ce-144	30	5	200	0.1	0.2
Ra-226	60	6	600	0.3	0.6
Th-228	10	1	60	0.03	0.06

* At time of analysis (DLC Contractor Lab).
** Activity detected in all samples.
NOTE Lower Level of Detection is defined in Beaver Valley Power Station Technical Specifications.

V. ENVIRONMENTAL MONITORING

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 (10) off-site air sampling stations. The locations of these stations are listed in Table V.A.1 and shown on a map in Figure 5.B.1.

Samples are collected at each of these stations by continuously drawing about 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.

V. ENVIRONMENTAL MONITORING

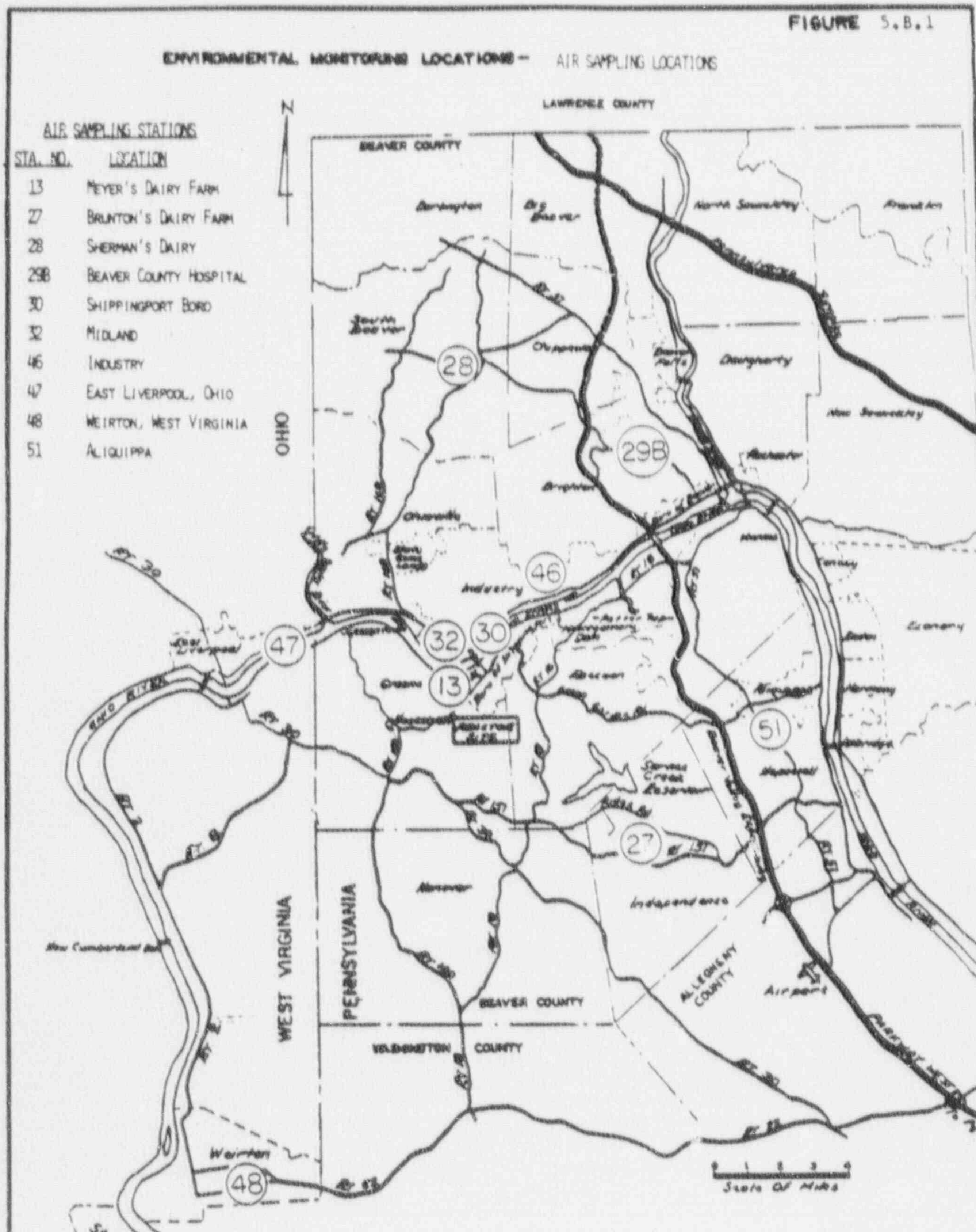
B. Air Monitoring (continued)

2. Air Sampling Program and Analytical Techniques (continued)

b. Procedures (continued)

Gamma emitters are determined by stacking all the filter papers from each monitoring station collected during the month and scanning this composite on a lithium drifted germanium (Ge(Li)) 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.



AIR SAMPLING STATIONS

FIGURE 5.B.1

V. ENVIRONMENTAL MONITORING

B. Air Monitoring (continued)

2. Air Sampling Program and Analytical Techniques (continued)

b. Procedures (continued)

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. 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/cm^2 aluminum absorber for level beta counting.

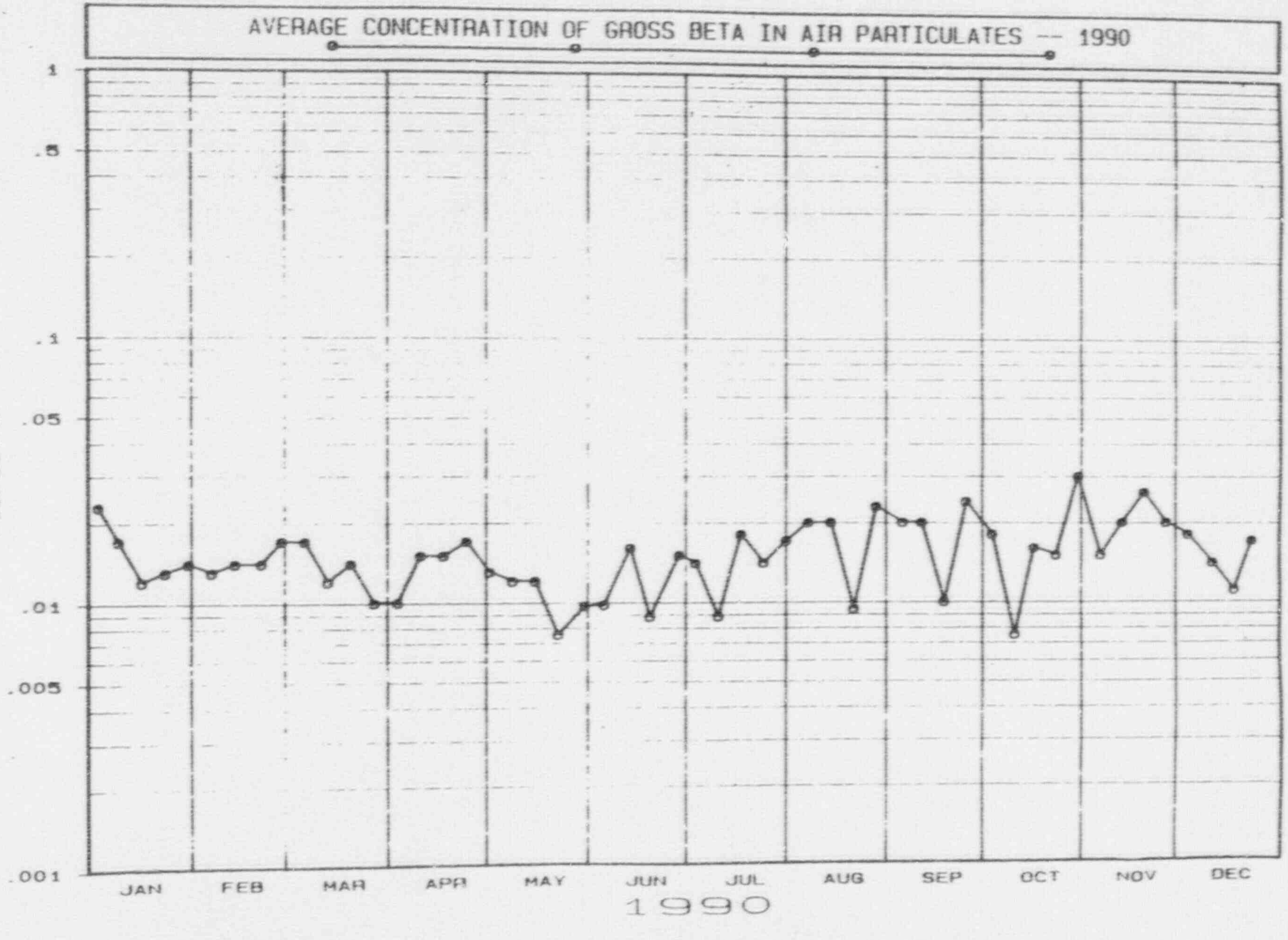
3. Results and Conclusions

A summary of data is presented in Table V.A.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.B.2 illustrates the average concentration of gross beta in air particulates.

FIGURE 5.B.2


AVERAGE CONCENTRATION OF GROSS BETA IN AIR PARTICULATES -- 1990
PCI/CU.M.
1
.5
.1
.05
.01
.005
.001
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1990

V. ENVIRONMENTAL MONITORING

B. Air Monitoring (continued)

3. Results and Conclusions (continued)

a. Airborne Radioactive Particulates (continued)

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 every sample. Occasional traces above detection levels of other naturally occurring nuclides such as K-40 were present. These are listed in the summary Table V.A.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 CY 1990.

b. Radioiodine

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

Based on analytical results, the operation of Beaver Valley Power Station did not contribute to any increase in airborne radioiodine during CY 1990.

V. ENVIRONMENTAL MONITORING

C. Monitoring of Sediments and Soils (Soil Monitoring is required every 3 years and was not required in 1990)

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 Shippingport 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 V.A.1 and are shown in Figure 5.C.1.

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

b. Analytical Procedures

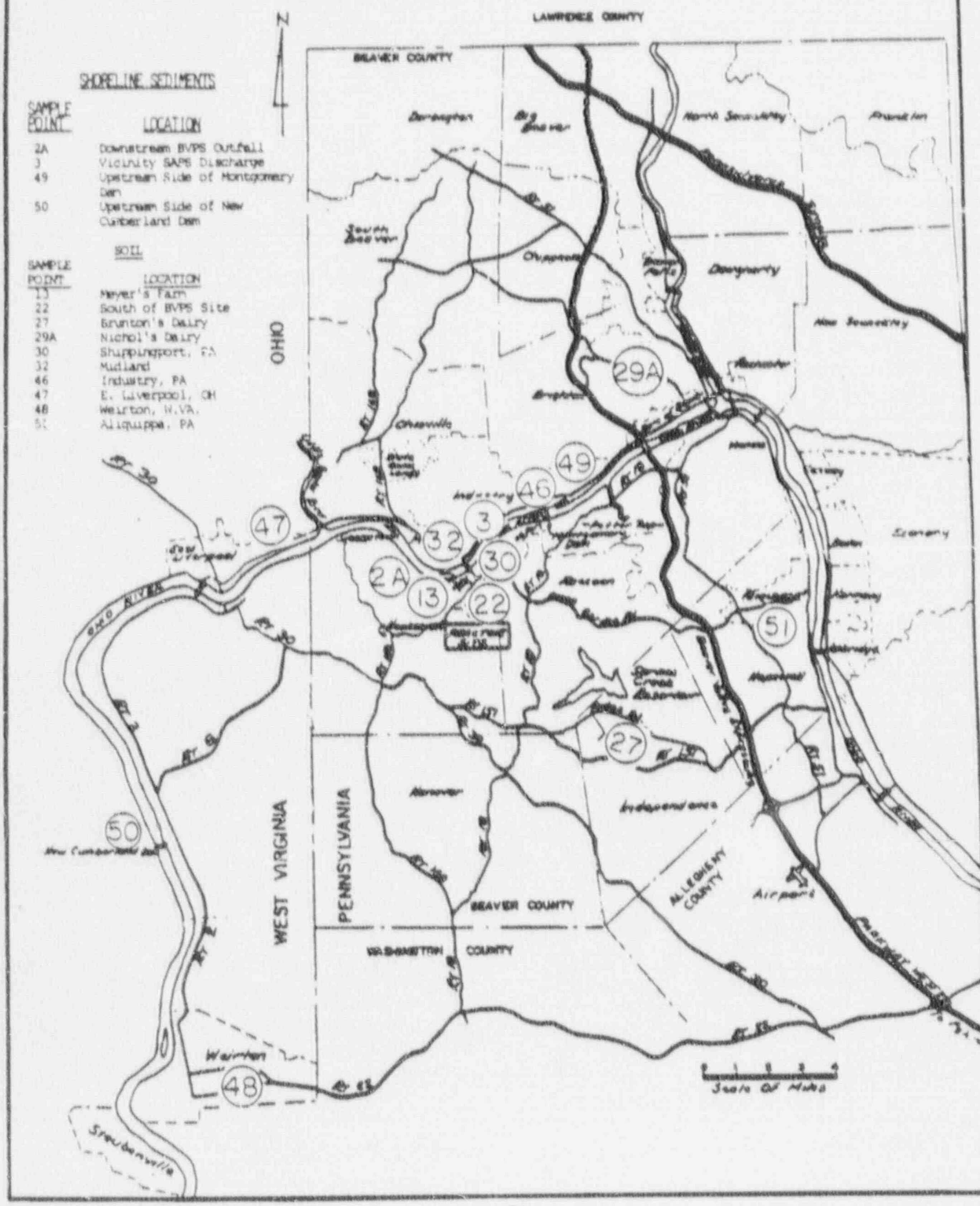
Gross beta - sediments and soils are analyzed for gross beta by mounting a 1 gram portion of dried sediment in a 2" planchet. The sample is counted in a low background, gas flow proportional counter. Self absorption corrections are made on the basis of sample weight.

Gross alpha 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.

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

FIGURE 5.C.1

ENVIRONMENTAL MONITORING LOCATIONS - SHORELINE SEDIMENTS & SOIL



V. ENVIRONMENTAL MONITORING

C. Monitoring of Sediments and Soils (Soil Monitoring is required every 3 years and was not required in 1990) (continued)

2. Sampling Program and Analytical Techniques (continued)

b. Analytical Procedures (continued)

Strontium 89 and 90 are determined by radiochemistry. A weighed sample of sediment or soil is leached with Nitric Acid HNO_3. A stable carrier is added for determination of recovery. Strontium concentration and purification is ultimately realized by precipitations of strontium nitrate in fuming nitric acid. Additional hydroxide precipitations and barium chromate separations are also used. The purified strontium is converted to a carbonate for weighing and counting. Samples are counted soon after separation (5 - 7 days is allowed for yttrium ingrowth). Activities are calculated on the basis of appropriate Sr-89 decay and Y-90. Separate mounts covered with a 80 mg/cm^2 aluminum absorber are used for counting in a low background beta counter.

Uranium isotopic analysis of sediment and soil samples were performed by alpha spectrometry after leaching and isolation of the uranium by an ion exchange chromatography plus mercury cathode electrolysis, then electroplated onto a planchet.

3. Results and Conclusions

A summary of data is presented in Table V.A.2.

a. Sediment

A total of (8) samples were analyzed for gross alpha and gross beta. Results were comparable to previous years.

A total of eight (8) samples were analyzed for Sr-89 and Sr-90. No Sr-89 or Sr-90 was detected.

V. ENVIRONMENTAL MONITORING

C. Monitoring of Sediments and Soils (Soil Monitoring is required every 3 years and was not required in 1990) (continued)

3. Results and Conclusion (continued)

a. Sediment (continued)

A total of eight (8) samples were analyzed by gamma spectrometry. Naturally occurring K-40 and Th-228 was found in every sample; Be-7 was found in four samples; and Ra-226 was found in all but one sample. Small amounts of Cs-137 from previous nuclear weapons tests were found in all river sediment samples including upstream above Montgomery Dam which are unaffected by plant effluents. A small amount of Co-58 was detected in one sample downstream of the plant at New Cumberland Dam. The result was slightly above the minimum detectable activity and may be attributed to station releases or from expected variability in the analyses results of very low activity. Small amounts of Mn-54, Co-58, Co-60 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.

V. ENVIRONMENTAL MONITORING

D. Monitoring of Feedcrops and Foodcrops

1. Characterization of Vegetation and Foodcrops

According to a survey made in 1985, there were approximately 610 farms in Beaver County. The principal source of revenue for the farms was in dairy products which amounted to nearly $5,998,000. Revenues from other farm products were as follows:

Field Crops.	$2,013,000
Fruits	$ 169,000
Horticulture and Mushrooms	$ 994,000
Meat and Animal Products.	$1,638,000
Vegetables and Potatoes.	$ 266,000
Poultry Products	$ 426,000

The total land in Beaver County is 218,600 acres. Approximately 134,592 acres are forested land and 61,176 acres are pasture and crop land.

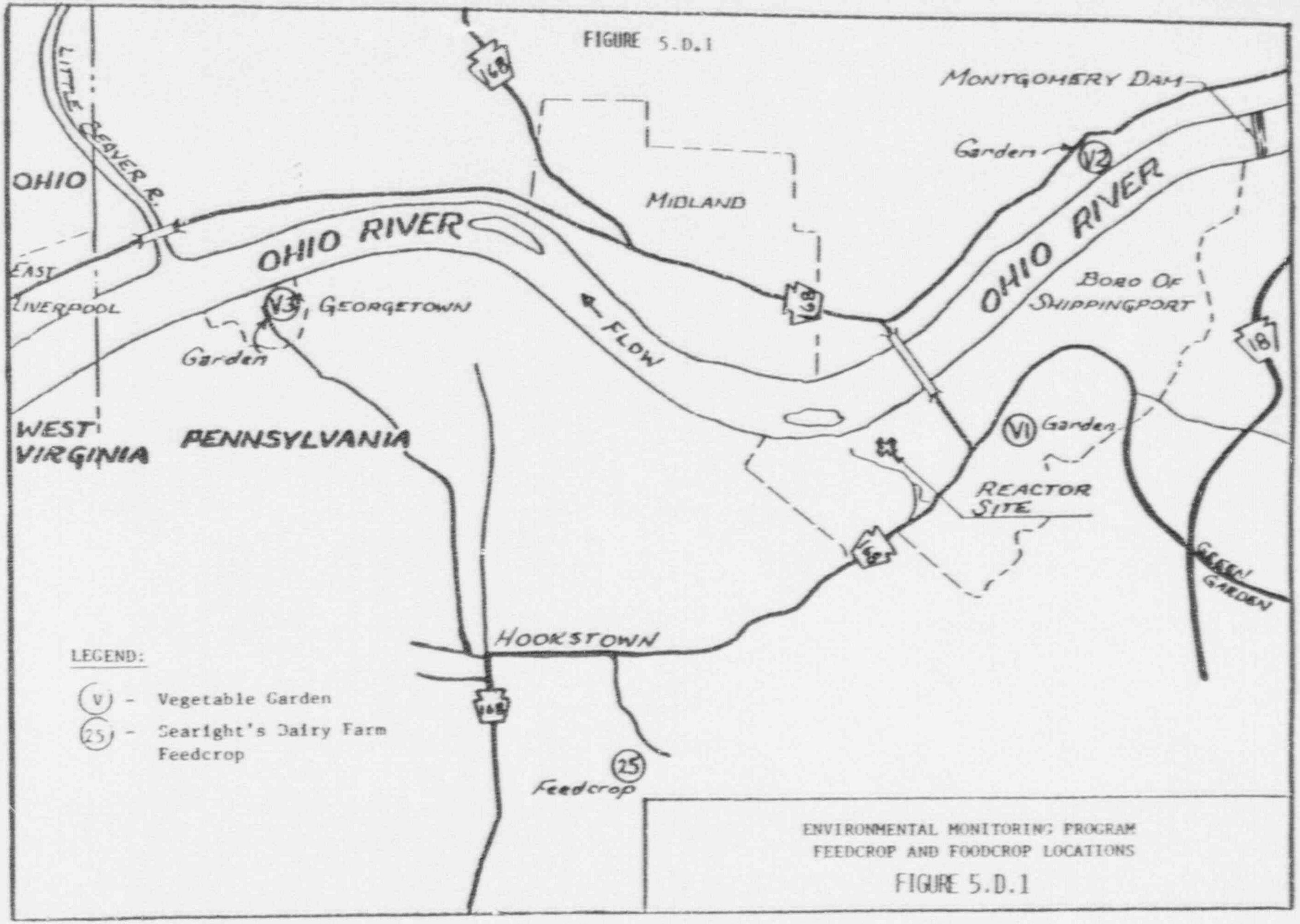
2. Sampling Program and Analytical Techniques

a. Program

Representative samples of cattle feed are collected monthly from the nearest dairy (Searight). See Figure 5.D.1. 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 August, 1990 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 V.D.1 for results.

Foodcrops (vegetables) were collected at garden locations during the summer of 1990. Leafy vegetables, i.e., cabbage were obtained from Shippingport, Georgetown, Industry, PA, and Weirton, WV. All samples were analyzed for gamma emitters (including I-131 by gamma spectrometry).



ENVIRONMENTAL MONITORING PROGRAM
FEEDCROP AND FOODCROP LOCATIONS
FIGURE 5.D.1

TABLE V.D.1

Closest Residence and Garden in Each Sector

Sector	Closest Residence*	Closest Garden*
1	1.55 mi N	2.54 mi N
2	1.59 mi NNE	1.61 mi NNE
3	0.42 mi NE	0.57 mi NE
4	0.38 mi ENE	0.98 mi ENE
5	0.42 mi E	1.93 mi E
6	0.87 mi ESE	1.00 mi ESE
7	1.10 mi SE	1.25 mi SE
8	1.10 mi SSE	2.84 mi SSE
9	1.40 mi S	1.99 mi S
10	0.80 mi SSW	1.55 mi SSW
11	1.46 mi SW	1.67 mi SW
12	1.46 mi WSW	1.46 mi WSW
13	2.27 mi W	2.27 mi W
14	2.77 mi WNW	2.92 mi WNW
15	0.91 mi NW	0.92 mi NW
16	0.91 mi NNW	1.29 mi NNW

*Direction and Distance from Midpoint between Reactors

V. ENVIRONMENTAL MONITORING

D. Monitoring of Feedcrops and Foodcrops (continued)

2. Sampling Program and Analytical Techniques (continued)

b. Procedures

Gamma emitters, including I-131, are determined by scanning a dried, homogenized sample with the gamma spectrometry system. A Ge(Li) detector is utilized with this system.

Strontium 90 analysis for feedstuff is performed by a procedure similar to that described in V.C.2.

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 V.A.2.

a. Feed

A total of 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 found in all samples.

A total of twelve (12) samples were analyzed by gamma spectrometry. Naturally occurring K-40 was found in all samples, Be-7 was detected in six (6) samples and Th-228 was detected in four (4) samples.

V. ENVIRONMENTAL MONITORING

D. Monitoring of Feedcrops and Foodcrops (continued)

3. Results and Conclusions (continued)

b. Food

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

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

c. The data from food and feed analyses were consistent with (or lower than) those obtained in the pre-operational program. These data confirm that the Beaver Valley Power Station did not contribute to radioactivity in foods and feeds in the vicinity of the site.

V. ENVIRONMENTAL MONITORING

E. Monitoring of Local Cow's 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 V.A.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 August, 1990 is shown in Figure 5.E.1.

2. Sampling Program and Analytical Techniques

a. Program

Milk was collected from three (3) reference dairy farms (Searights, Brunton 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.E.2 and described below.

Site	Dairy	Number of Milch Animals	Direction and Distance from Midpoint between Reactors	Collection Period
25	Searight	40 Cows	2.2 miles SSW	Jan. - Dec.
27	Brunton	90 Cows	7.3 miles SE	Jan. - Dec.
29A	Nichol	65 Cows	8.C miles NE	Jan. - Dec.
96	Windsheimer	45 Cows	10.3 miles SSW	Jan. - Dec.

V. ENVIRONMENTAL MONITORING

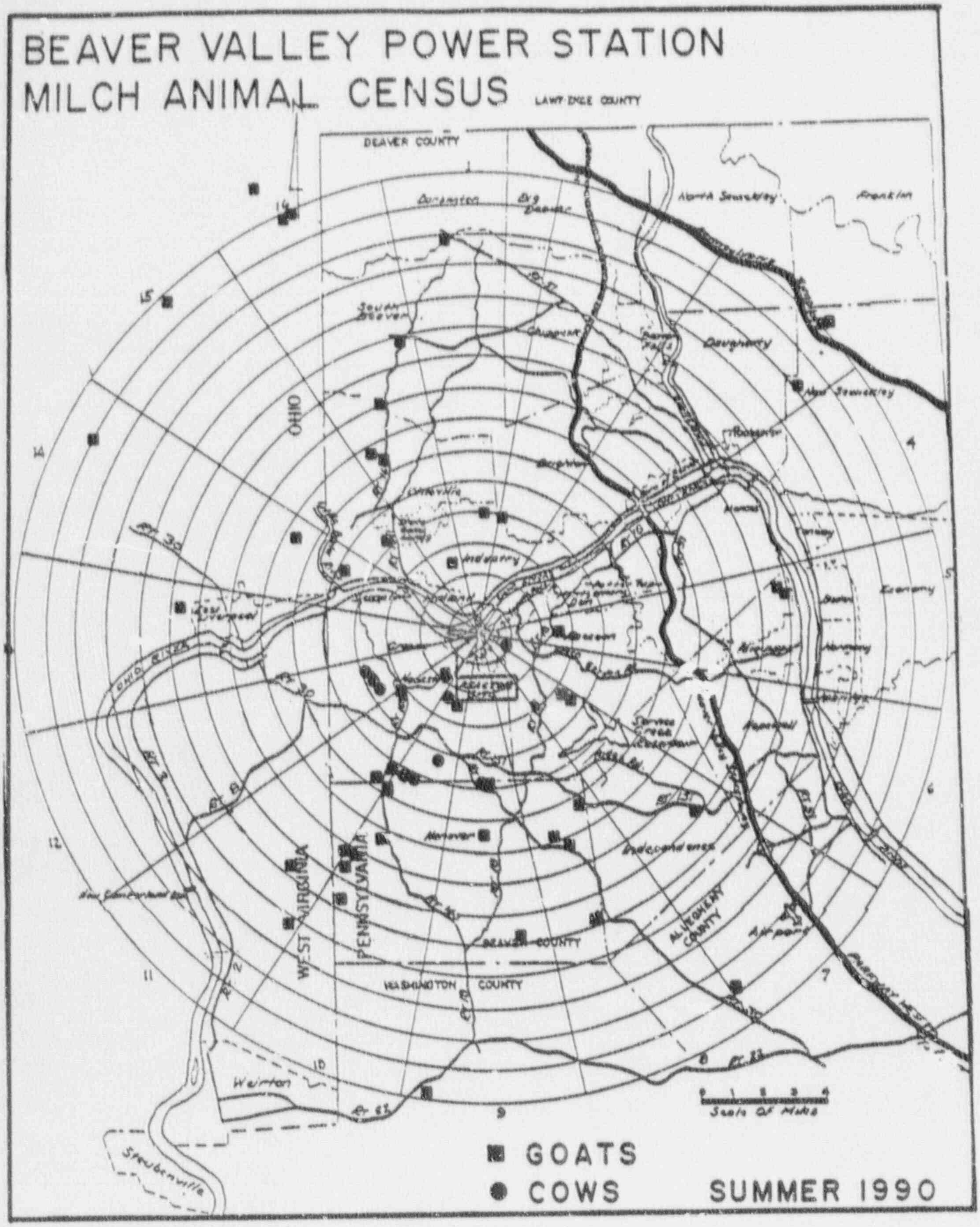
E. Monitoring of Local Cow's Milk (continued)

2. Sampling Program and Analytical Techniques (continued)

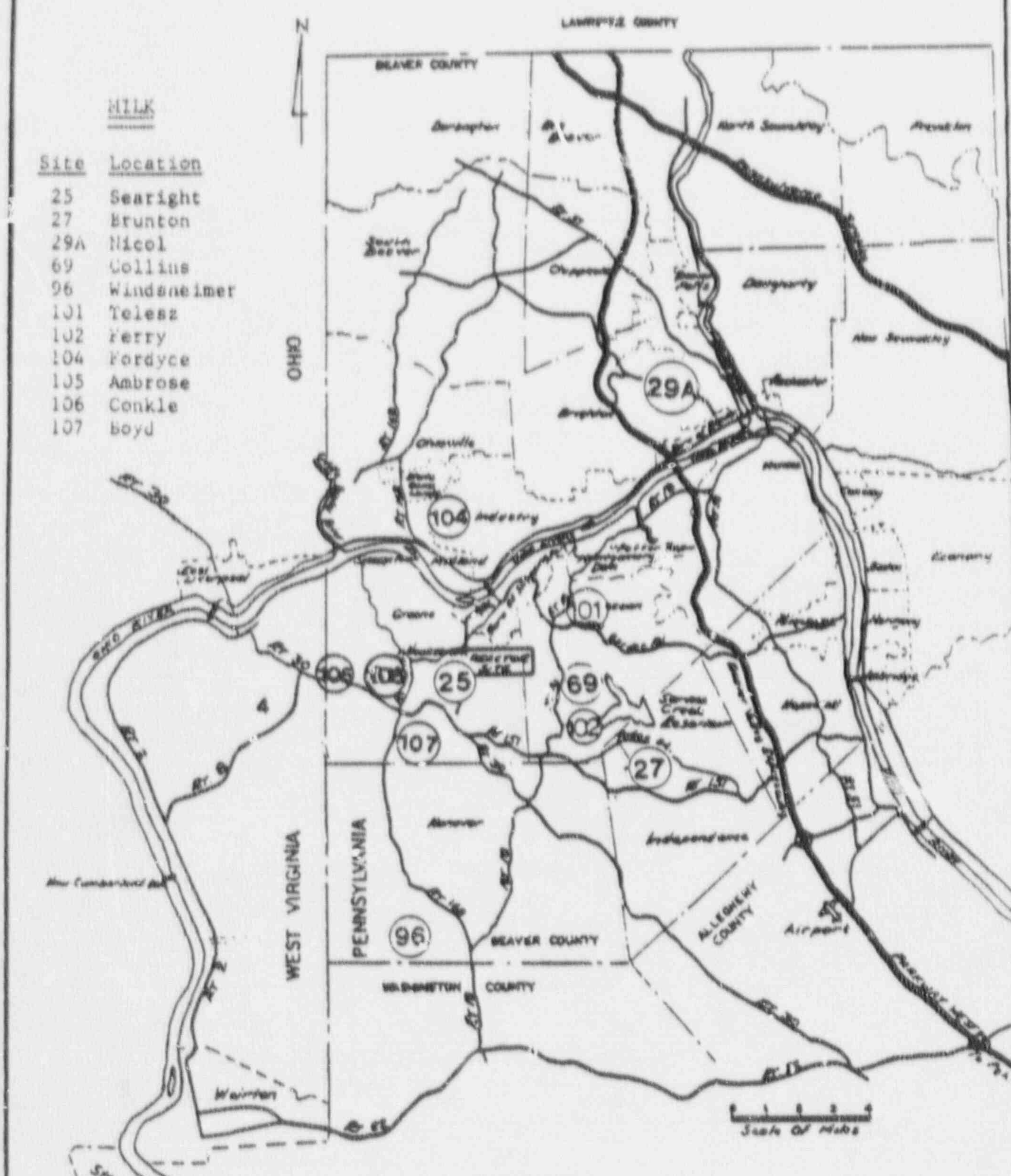
a. Program (continued)

Site	Dairy	Number of Milch Animals	Direction and Distance from Midpoint between Reactors	Collection Period
69**	Collins	2 Goats*	3.5 miles SE	July - Sept.
101**	Telesz	5 Goats*	2.6 miles E	Apr. - July
102**	Ferry	4 Goats*	3.3 miles SE	June - Sept.
104**	Fordyce	3 Goats*	2.50 miles NNW	May - Dec.
105**	Ambrose	45 Cows	3.86 miles WSW	Jan. - May Oct. - Dec.
106**	Conkle	41 Cows	3.75 miles WSW	Jan. - May Oct. - Dec.
107**	Boyd	45 Cows	5.11 miles SSW	Jan. - March

*Milk Usage - Home Only.
**Highest potential pathway dairies.


BEAVER VALLEY POWER STATION
MILCH ANIMAL CENSUS
LAWRENCE COUNTY
BEAVER COUNTY
OHIO
WEST VIRGINIA
PENNSYLVANIA
BEAVER COUNTY
WASHINGTON COUNTY
ALLEGHENY COUNTY
Industry
Hanover
Independence
Economy
Franklin
North Sewickley
New Sewickley
Daugherty
Weirton
Steubenville
Airport
Scale Of Miles
GOATS
COWS
SUMMER 1990

ENVIRONMENTAL MONITORING LOCATIONS - MILK



MILK LOCATIONS

FIGURE 5.E.2

V. ENVIRONMENTAL MONITORING

E. Monitoring of Local Cow's Milk (continued)

2 Samp[illegible]g Program and Analytical Techniques (continued)

a. Program (continued)

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 Spectrometry) 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 spectrometry of a one liter Marinelli container of milk.

Strontium analysis of milk is similar to that of other foods (refer to V.C.2) except that milk samples are prepared by addition of Trichloracetic Acid (TCA) to produce a curd which is removed by filtration and discarded. An oxalate precipitate is ashed for counting.

3. Results and Conclusions

A summary of data is presented in Table V.A.2.

A total of one hundred sixty-seven (167) samples were analyzed for I-131 during 1990. All I-131 activities in milk were below the minimum detectable level.

V. ENVIRONMENTAL MONITORING

E. Monitoring of Local Cow's Milk (continued)

3. Results and Conclusions (continued)

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-four (134) samples were analyzed by gamma spectrometry. The predominant isotope detected was naturally occurring K-40 and was found in all samples.

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.

V. ENVIRONMENTAL MONITORING

F. Environmental Radiation Monitoring

1. Description of Regional Background Radiation Levels 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 1990 indicated that background radiation continued in this range.

2. Locations & Analytical Procedures

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

In 1990 there were a total of forty-four (44) off-site environmental TLD locations. The locations of the TLDs are shown in Figures 5.F.1 thru 4. Thirteen (13) locations also have QC Laboratory TLDs. Both laboratories use calcium sulphate dysprosium, ($CaSO_4$:Dy) in teflon matrix.

V. ENVIRONMENTAL MONITORING

F. Environmental Radiation Monitoring (continued)

2. Locations & Analytical Procedures (continued)

The calcium sulfate ($CaSO_4$:Dy) TLDs were annealed shortly before placing the TLDs in their field locations. The radiation dose accumulated in-transit between the field location and the laboratory was corrected by annealing control dosimeters shortly before the field dosimeters were removed from the field location, when shipping the freshly annealed control dosimeters with the exposed field dosimeters to the laboratory for readout at the same time. 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.

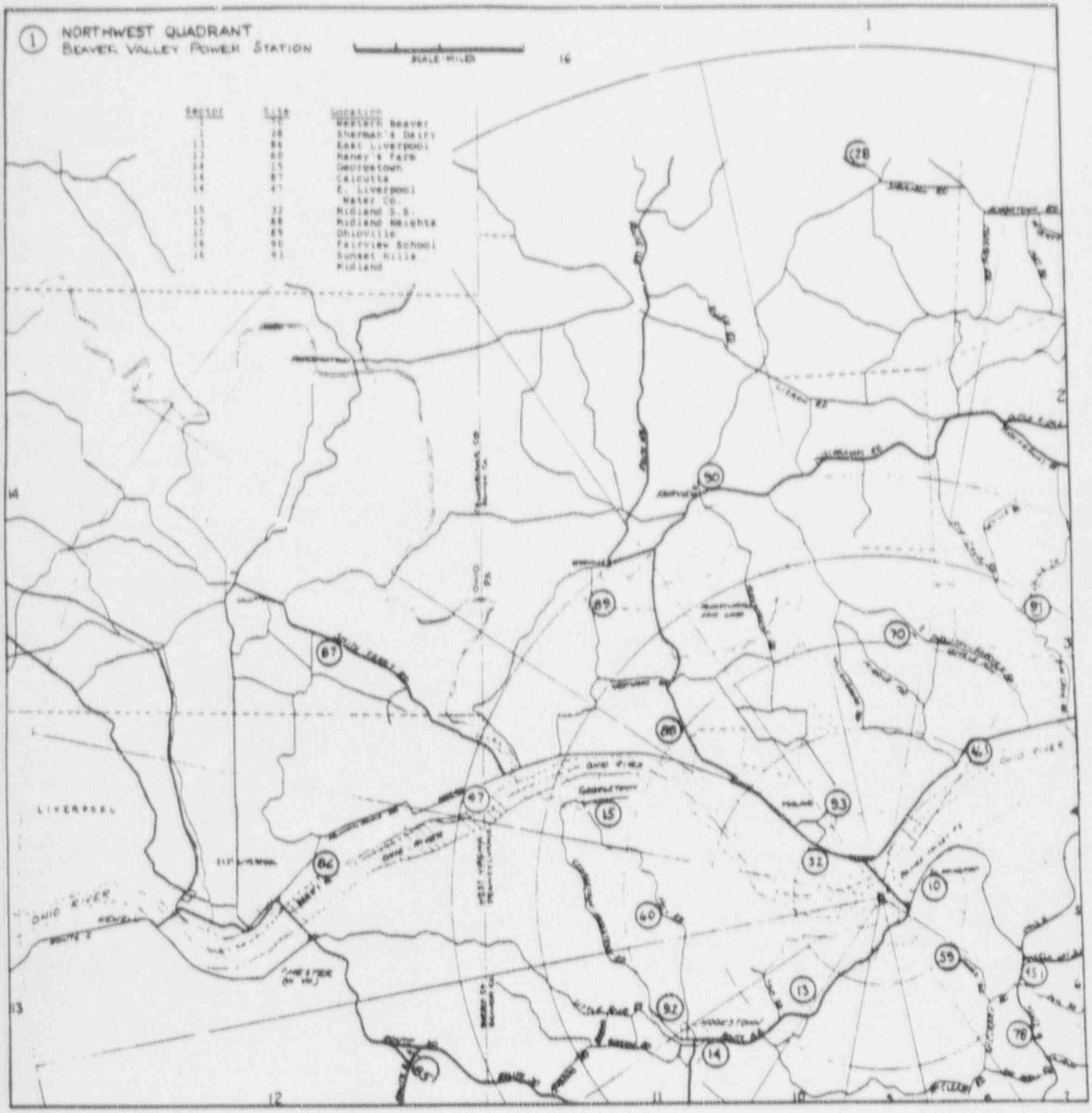
In addition to TLDs, Pressurized Ion Chambers (PIC) provide continuous integrating monitoring. Sixteen PICs (Sites 1-16) are part of the Sentri 1011 Radiation Monitoring System which is a microcomputer-based data acquisition system. Data from the stations are sent at regular intervals to the Central Processing Unit where integrated doses are calculated. In addition there are four PICs which are AC Radiation Monitors. These are inspected weekly for integrator readings. The locations of the PICs are shown in Figure 5.F.5.

3. Results and Conclusions

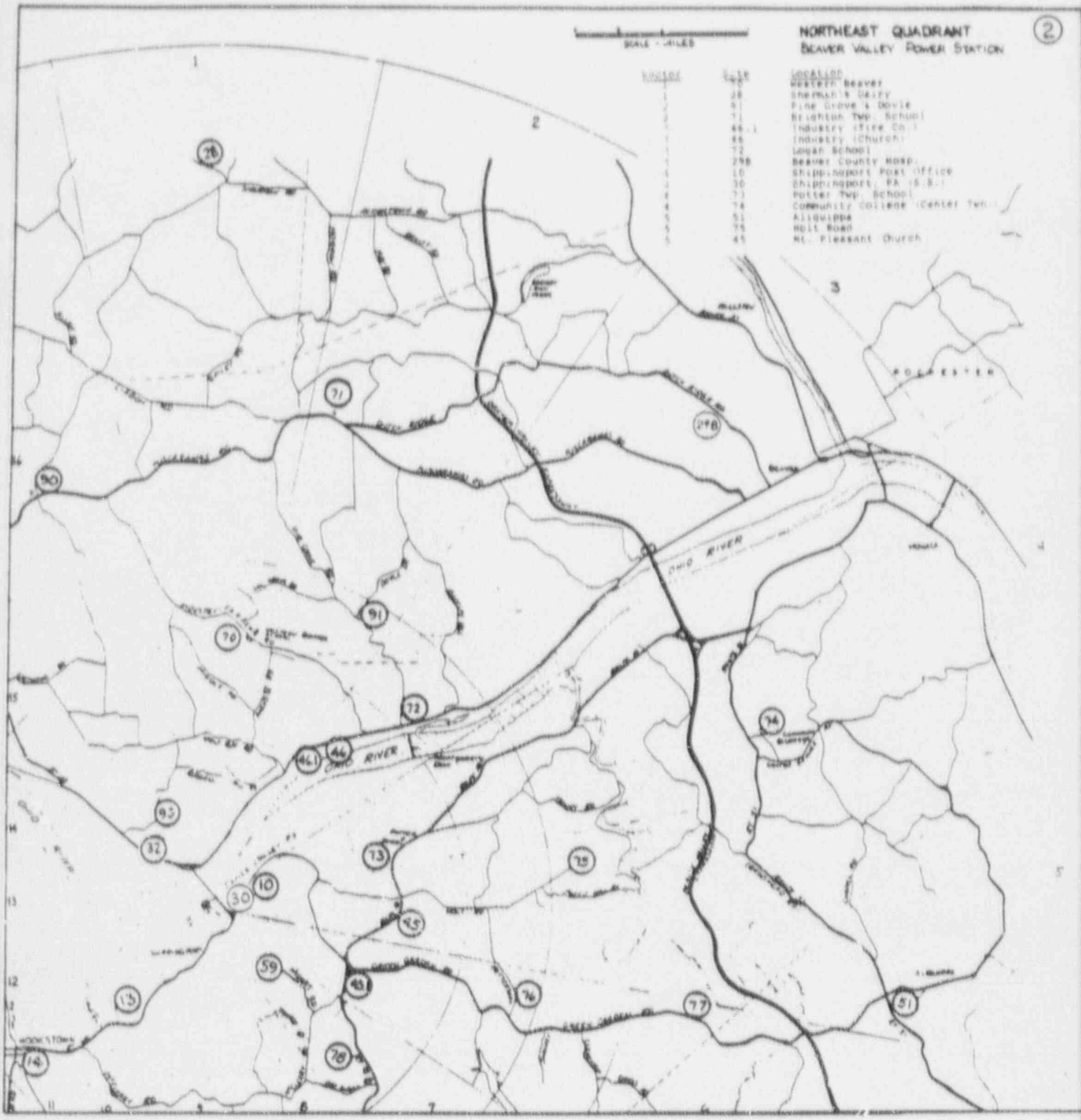
Data obtained with the contractor TLD ($CaSO_4$:Dy in teflon) during 1990 are summarized in Table V.A.2, and the quality control TLD results are listed in Table III.1. Results for the PICs are listed in Table V.F.1.

The annual exposure rate of all off-site TLDs averaged 0.15 mR/day in 1990. As in previous years, there was some variation among locations and seasons as would be expected.

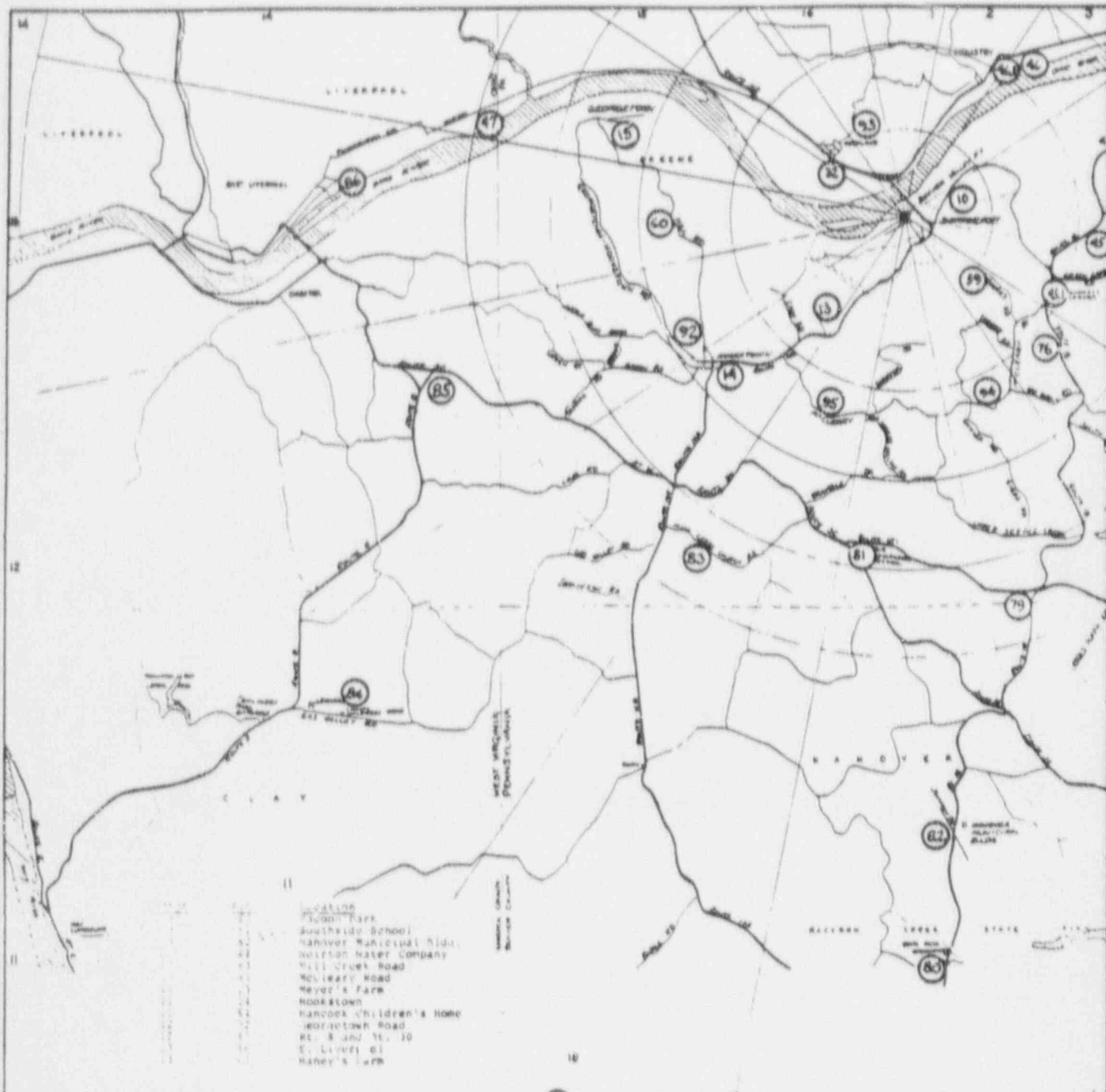
In 1990, ionizing radiation dose determinations from TLDs averaged approximately 55 mR for the year. This is comparable to previous years. There was no evidence of anomalies that could be attributed to the operation of the Beaver Valley Power Station. The TLDs confirm that changes from natural radiation levels, if any, are neglible.

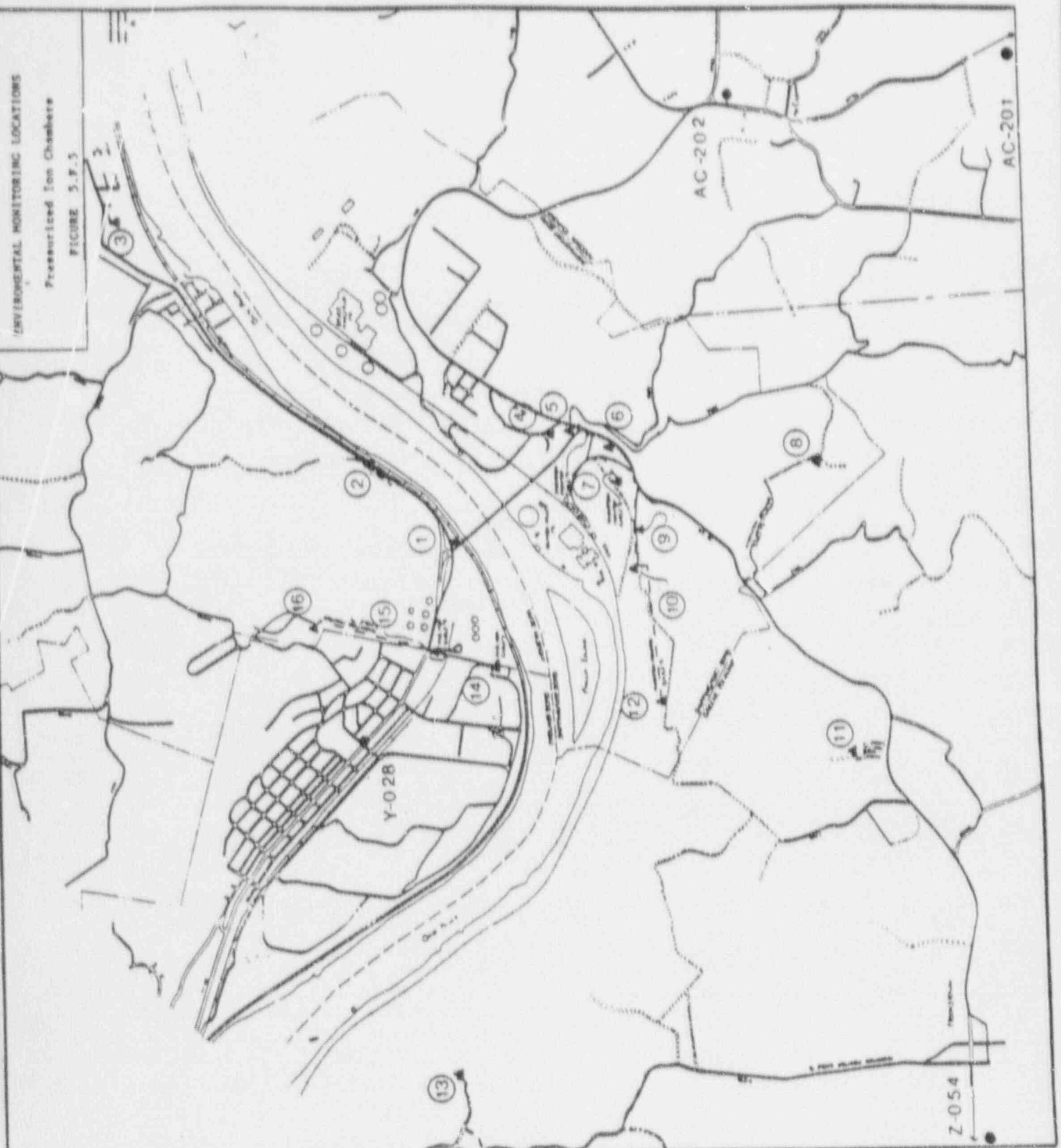


1 NORTHWEST QUADRANT
BEAVER VALLEY POWER STATION
SCALE-MILES
Sector Site Location
Western Beaver
1 28 Sherman's Dairy
13 86 East Liverpool
13 60 Haney's Farm
14 15 Georgetown
14 87 Calcutta
14 47 E. Liverpool Water Co.
15 32 Midland S.S.
15 88 Midland Heights
15 89 Ohioville
16 90 Fairview School
16 91 Sunset Hills Midland
OHIO RIVER
LIVERPOOL


NORTHEAST QUADRANT
BEAVER VALLEY POWER STATION
SCALE - MILES
Location
Western Beaver
28 Sherman's Dairy
Pine Grove & Doyle
Brighton Twp. School
46.1 Industry (Fire Co.)
46 Industry (Church)
72 Logan School
298 Beaver County Hosp.
10 Shippingport Post Office
30 Shippingport, PA (S.S.)
Potter Twp. School
Community College (Center Twp.)
51 Aliquippa
75 Holt Road
45 Mt. Pleasant Church
OHIO RIVER
OHIO RIVER
ROCHESTER
HOOKSTOWN


SOUTHEAST QUADRANT
BEAVER VALLEY POWER STATION
Sector Site Location
94 McCleary Road
80 Raccoon Park
81 Southside School


Hancock Children's Home
Weirton Water Company
Mill Creek Road
Meyer's Farm
Hookstown
SOUTHWEST QUADRANT
BEAVER VALLEY POWER STATION
SCALE - MILES
WEIRTON
CLAY
HANOVER



See Table V.F.1. for location identification and results.

TABLE V.F.1

Pressurized Ion Chambers - Results

Site	Location	Distance and Direction from Midpoint Between Reactors	Average (mR/day)
1	Industry Hill	0.5 mi N	0.193
2	Industry - Rt. 63	0.9 mi NNE	0.204
3	Industry	2.25 mi NE	0.196
4	Cooks Ferry	0.5 mi ENE	0.210
5	Shippingport Bridge South	0.45 mi E	0.219
6	BVPS Entrance	0.4 mi ESE	0.217
7	Unit #2 Laydown	0.3 mi SE	0.211
8	Birdhill Road	0.9 mi SSE	0.200
9	Past DLCO Microwave	0.35 mi S	0.213
10	DLCO Microwave	0.35 mi SSW	0.204
11	Meyer's Farm	1.45 mi SW	0.229
12	J & L Steel Tie	0.75 mi WSW	0.215
13	F. P. Microwave	1.5 mi W	0.176
14	Midland Substation South	0.6 mi WNW	0.225
15	Midland Substation North	0.75 mi NW	0.232
16	Sunrise Hills	1.1 mi NNW	0.211
AC-201	Raccoon Municipal Building	2.4 mi SE	0.247
AC-202	Kennedy's Corners	2.0 mi NE	0.228
Z-054	Hookstown Substation	2.9 mi WSW	0.243
Y-028	J&L	1.3 mi NW	0.180

V. ENVIRONMENTAL MONITORING

G. Monitoring of Fish

1. Description

During 1990, fish collected for the radiological monitoring program included carp, catfish, sheephead and walleye.

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 spectrometry. Fish sampling locations are shown in Figure 5.G.1.

b. Procedure

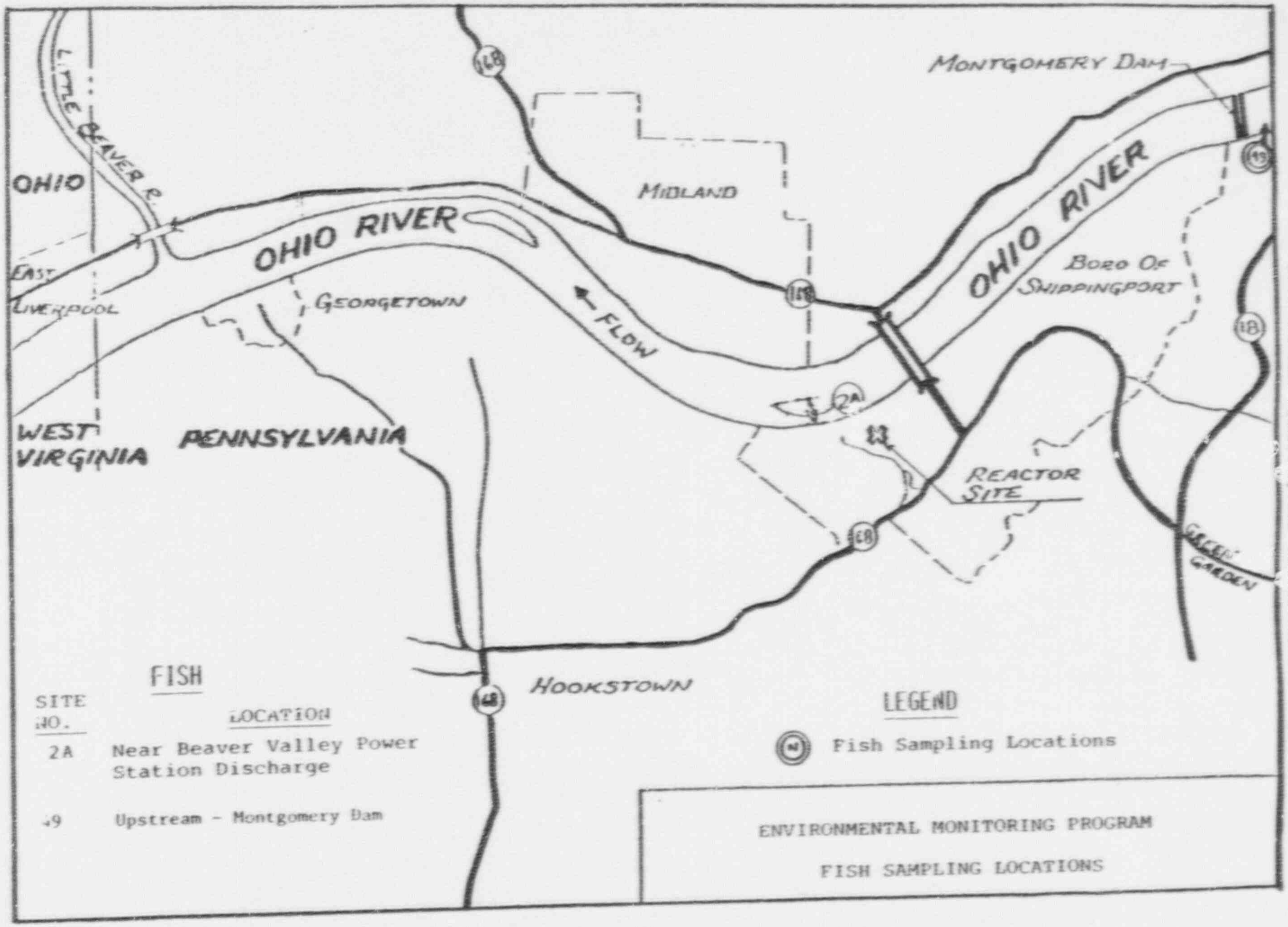
A sample is prepared in a standard tared 300 ml plastic bottle and scanned for gamma emitting nuclides with gamma spectrometry system which utilizes a Ge(Li) detector.

3. Results and Conclusions

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

A total of nine (9) samples were analyzed by gamma spectrometry. Naturally occurring K-40 was found in all samples. Co-58 was detected in one sample and is attributable to station releases. The activity found is consistent with station data of authorized radioactive discharges which were well within the 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 fish population.



ENVIRONMENTAL MONITORING PROGRAM

FISH SAMPLING LOCATIONS

V. ENVIRONMENTAL MONITORING

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. Some of these plants also have private treatment facilities for plant sanitary water.

Ground water occurs in large volumes in the gravel terraces which lie 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. Normal annual precipitation for the area is 36.20 inches based on 1958 to 1987 data collected at the Pittsburgh International Airport.

V. ENVIRONMENTAL MONITORING (continued)

H. Monitoring of Surface, Drinking, Well Waters, and Precipitation (continued)

2. Sampling and Analytical Techniques

a. Surface (Raw River) Water

The sampling program of river water includes six (6) 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 discharge following locations: upstream of Montgomery Dam [River Mile 31.8]; from Shippingport Station Decommissioning Project [River Mile 34.8]; 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 is 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.H.1.

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. A weekly grab sample is also taken at the DLC Training Building in Shippingport, PA. The weekly sample from each location is analyzed by gamma spectrometry. The weekly samples are also analyzed for I-131.

V. ENVIRONMENTAL MONITORING

H. Monitoring of Surface, Drinking, Well Waters, and Precipitation (continued)

2. Sampling and Analytical Techniques (continued)

b. Drinking Water (Public Supplies) (continued)

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.H.1.

c. Ground Water

Grab samples were collected each quarter from each of four (4) well locations (see Figure 5.H.1) within four (4) miles of the site. These locations are:

One (1) well at Shippingport, PA

One (1) well at Meyer's Farm (Hookstown, PA)

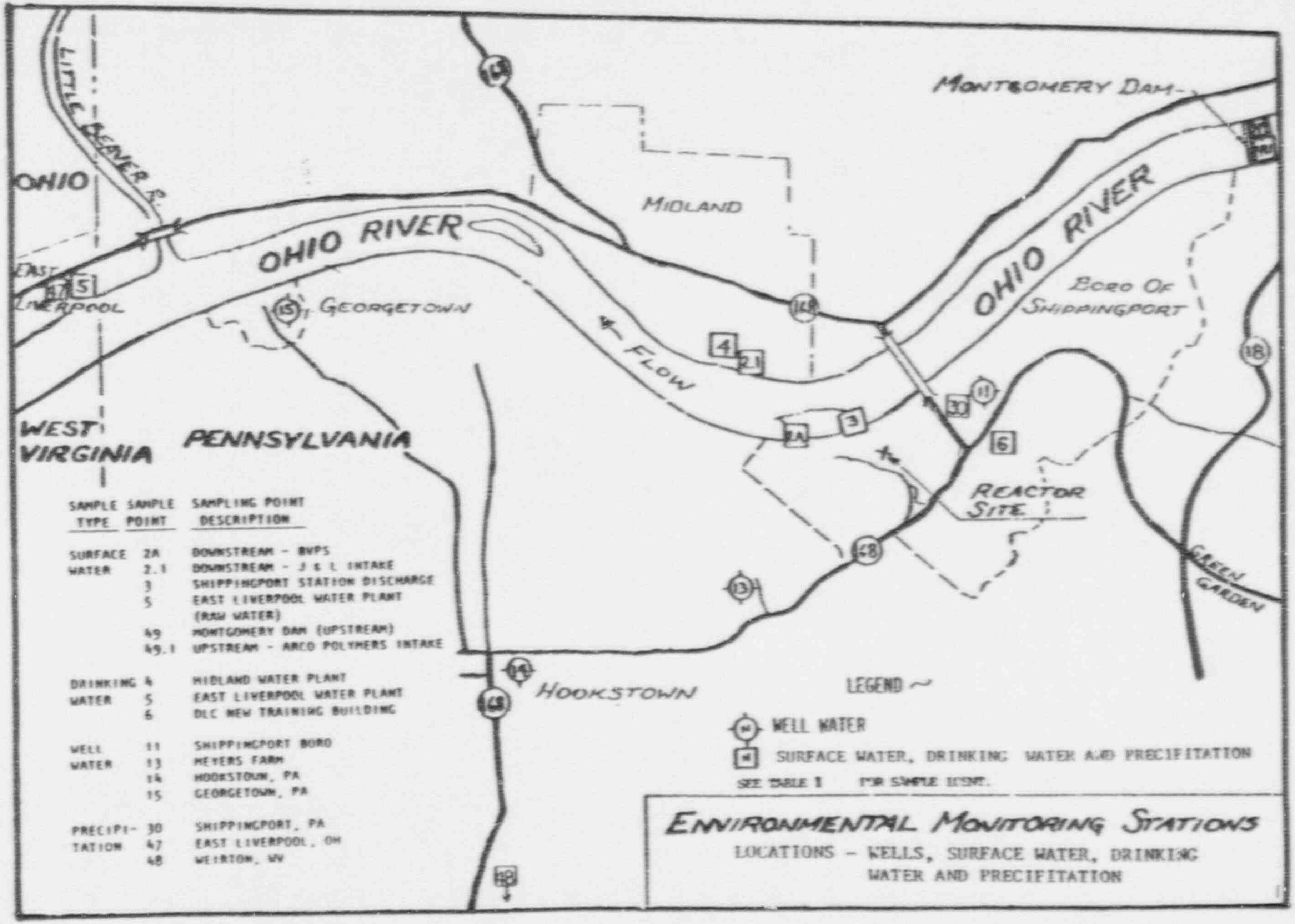
One (1) well in Hookstown, PA

One (1) well in Georgetown, PA

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

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.H.1.


OHIO
LITTLE BEAVER R.
EAST LIVERPOOL
OHIO RIVER
GEORGETOWN
MIDLAND
MONTGOMERY DAM
OHIO RIVER
BORO OF SHIPPINGPORT
FLOW
WEST VIRGINIA
PENNSYLVANIA
REACTOR SITE
GREEN GARDEN
HOOKSTOWN
SAMPLE TYPE | SAMPLE POINT | SAMPLING POINT DESCRIPTION
SURFACE WATER 2A DOWNSTREAM - BVPS
2.1 DOWNSTREAM - J & L INTAKE
3 SHIPPINGPORT STATION DISCHARGE
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
6 DLC NEW TRAINING BUILDING
WELL WATER 11 SHIPPINGPORT BORO
13 MEYERS FARM
14 HOOKSTOWN, PA
15 GEORGETOWN, PA
PRECIPITATION 30 SHIPPINGPORT, PA
47 EAST LIVERPOOL, OH
48 WEIRTON, WV
LEGEND ~
WELL WATER
SURFACE WATER, DRINKING WATER AND PRECIPITATION
SEE TABLE 1 FOR SAMPLE ICENT.
ENVIRONMENTAL MONITORING STATIONS
LOCATIONS - WELLS, SURFACE WATER, DRINKING WATER AND PRECIPITATION

V. ENVIRONMENTAL MONITORING

H. Monitoring of Surface, Drinking, Well Waters, and Precipitation (continued)

2. Sampling and Analytical Techniques (continued)

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 on a Ge(Li) gamma spectrometry system.

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

Cobalt-60 is determined with a sensitivity of 1 pCi/l by evaporating 2 liters of sample on a hotplate and transferring the residue to a 2-inch planchet. The planchet is counted on a Ge(Li) spectrometry system.

Tritium is determined in water samples by converting 2 ml of the sample to hydrogen and counting the activity in a 1 liter low level gas counter which is operated in the proportional range in anti-coincidence mode.

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 V.A.2. These are discussed below.

V. ENVIRONMENTAL MONITORING

H. Monitoring of Surface, Drinking, Well Waters, and Precipitation (continued)

3. Results and Conclusions (continued)

a. Surface Water

A total of seventy-two (72) samples were analyzed for gross alpha and gross beta. No alpha activity was detected in any of the samples. 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 twenty-four (24) 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 Co-58 and tritium results were detected in the BVPS discharge area and are attributable to station releases. All other samples taken upstream and downstream were within pre-operational 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 seventy-two (72) samples were anlayzed by gamma spectrometry. Positive Co-58 results were detected in the BVPS discharge area and are attributable to station releases. The Co-58 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. No other 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 two (2) 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 expected variability in the analyses results of very low levels of activity.

V. ENVIRONMENTAL MONITORING

H. Monitoring of Surface, Drinking, Well Waters, and Precipitation (continued)

3. Results and Conclusions (continued)

b. Drinking Water

A total of thirty-six (36) samples were analyzed for gross alpha and 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 as well as a high sensitivity analysis for Co-60. No Sr-89, Sr-90, or Co-60 were detected. The H-3 data were within the pre-operational range indicative of normal environmental levels.

A total of another one hundred fifty-five (155) samples were analyzed by gamma spectrometry. No gamma emitting radionuclides were detected.

A total of one hundred fifty-five (155) samples were analyzed for I-131 using a highly sensitive technique. Trace levels of I-131 were measured in eight (8) 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. The results may be attributed to expected variability in the analyses results of very low levels of activity.

c. Ground Water

A total of sixteen (16) samples were each analyzed for gross alpha, gross beta, H-3 and by gamma spectrometry. No alpha activity was detected in any of the samples. The gross beta and H-3 results are within pre-operational ranges. No gamma emitting radionuclides were detected.

V. ENVIRONMENTAL MONITORING (continued)

H. Monitoring of Surface, Drinking, Well Waters, and Precipitation (continued)

3. Results and Conclusions (continued)

d. Precipitation

A total of thirty-four (34) 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. Seven (7) positive tritium results detected were within normal levels. No Sr-89 or Sr-90 was detected.

A total of thirty-four (34) samples were analyzed by gamma spectrometry. Naturally occurring Be-7 was detected in eleven (11) 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 a year) attributable to Beaver Valley Power Station, was only 0.301% of the Maximum Permissible Concentration allowed by the Federal Regulations 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.

V. ENVIRONMENTAL MONITORING

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 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 Semi-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.

All gaseous effluent releases, including Auxiliary Building Ventilation, were included in dose assessments. The release activities are based on laboratory analysis. When the activity of noble gas was below detection sensitivity, either the inventory based on its MDL or an appropriate but conservative ratio to either measured activity of Kr-85 or Xe-133 was used. Meteorological data collected by the Beaver Valley Power Station Meteorology System was used as input to XOQDOQ2 which in turn provided input for GASPAR. 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.

V. ENVIRONMENTAL MONITORING

I. Estimates of Radiation Dose to Man (continued)

1. Pathways to Man - Calculational Models (continued)

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 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 to LADTAP 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 used to calculate the maximum exposure. A breakdown of doses by pathway and organ is provided in Table V.I.1 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 V.I.2.

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 individual (not combined) dose limits. Therefore, the annual limits listed in Table V.I.2 were derived by multiplying the individual Technical Specification reactor limits by a factor of two (2).

TABLE V.1.1
Radiation Dose to Maximum Individual[a], mrem/yr
Beaver Valley Power Station - Liquid Releases[b]

PATHWAY	MAXIMUM GROUP	USAGE FACTOR	SKIN	ORGAN	THYROID	BONE	WHOLE BODY
Fish Consumption	Adult	21.0 kg	N/A	0.00199 (GI-LLI)	0.0000453	0.000598	0.000827
Drinking Water[c]	Infant	510 liter	N/A	0.00336 (GI-LLI)	0.00279	0.000101	0.00326
Shoreline Activities	Teen	67 hr.	0.000474	--	--	--	0.000403
TOTAL	MREM MAXIMUM INDIVIDUAL		0.000474 (Teen)	0.00489 (Adult) (GI-LLI)	0.00279 (Infant)	0.000682 (Adult)	0.00326 (Infant)

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 V.I.2

Results of Calculated Radiation Dose to Man
Beaver Valley Power Station - Liquid Releases

	Maximum Exposure Hypothetical Real Individual mrem	BVPS Annual Limits mrem	Percent of Annual Limit
TOTAL BODY			
Adult	0.00277	6.0	0.046
Teen	0.00171	6.0	0.029
Child	0.00251	6.0	0.042
Infant	0.00326	6.0	0.054
ANY ORGAN			
Adult	0.00489 (GI-LLI)	20.0	0.025
Teen	0.00305 (GI-LLI)	20.0	0.0015
Child	0.00307 (Liver)	20.0	0.0015
Infant	0.00336 (GI-LLI)	20.0	0.017

Maximum Total Body Dose - Capsule Summary

	mrem
1990 Calculated	0.00326
Final Environmental Statement	3.5

Highest Organ Dose

1990 Calculated	0.00489
Final Environmental Statement	4.7

V. ENVIRONMENTAL MONITORING

I. Estimates of Radiation Dose to Man (continued)

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

c. Population Dose

The 1990 calculated dose to the entire population of almost 4 million people within 50 miles of the plant was:

	Man-Millirem	Largest Isotope Contributors
TOTAL BODY	108	H-3 95.7 mrem Co-58 5.5 mrem Fe-55 4.4 mrem
THYROID	95.7	H-3 95.7 mrem

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

The results of calculated radiation dose to the maximum exposed individual for BVPS airborne radioactive effluents during 1990 are provided in Table V.I.3. The doses include the contribution of all pathways. A 50-mile population dose is also calculated and provided in Table V.I.3. H-3 is the primary radionuclide contributions to these doses.

The results are compared to the BVPS annual limits in Table V.I.3. As in the liquid discharge limits, the gaseous effluent limits are reactor specific; i.e., Unit 1 and Unit 2 have individual (not combined) dose limits. Therefore, the annual limits listed in Table V.I.3 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.

V. ENVIRONMENTAL MONITORING

I. Estimates of Radiation Dose to Man (continued)

4. Conclusions - (Beaver Valley Power Station)

Based upon the estimated dose to individuals from the natural background radiation exposure in Table V.I.1., 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 0.0001% of the annual background.

The calculated doses to the public from the operation of Beaver Valley Power Station - Unit No. 1 and No. 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 V.I.3

Results of Calculated Radiation Dose to Man (1990)

Beaver Valley Power Station - Airborne Radioactivity

ORGAN	MAXIMUM EXPOSURE INDIVIDUAL, mrem	BVPS ANNUAL LIMIT mrem	PERCENT OF ANNUAL LIMIT	50-MILE POPULATION DOSE man rem
TOTAL BODY	0.0556	30	0.19	0.764
SKIN	0.0655	30	0.22	0.977
LUNG	0.0563	30	0.19	0.768
THYROID	0.0570	30	0.19	0.775

APPENDIX I

Contractor Laboratory

EPA Interlaboratory

Comparison Program

DUQUESNE LIGHT COMPANY - 1990

US EPA INTERLABORATORY COMPARISON PROGRAM 1990

(Page 1 of 3)

EPA Preparation	Date TI Mailed Results	Date EPA Issued Results	Media	Nuclide	EPA Results(a)	TI Results(b)	Norm Dev. (Known)	**Warning ***Action
01/12/90	03/21/90	04/09/90	Water	Sr-89	25.00 ± 5.00	24.00 ± 1.73	-0.35	
				Sr-90	20.00 ± 1.50	19.67 ± 2.52	-0.38	
01/26/90	02/23/90	03/30/90	Water	Gr-Alpha	12.0 ± 5.0	10.00 ± 1.73	-0.69	
				Gr-Beta	12.0 ± 5.0	12.33 ± 1.53	0.12	
02/09/90	03/23/90	04/09/90	Water	Co-60	15.00 ± 5.00	15.00 ± 3.46	0.00	
				Zn-65	139.00 ± 14.00	131.33 ± 9.07	-0.95	
				Ru-106	139.00 ± 14.00	113.67 ± 4.04	-3.13	***(c)
				Cs-134	18.00 ± 5.00	15.33 ± 2.31	-0.92	
				Cs-137	18.00 ± 5.00	19.33 ± 3.21	0.46	
				Ba-133	74.00 ± 7.00	66.00 ± 3.46	-1.98	
02/23/90	03/22/90	04/09/90	Water	H-3	4976.00 ± 498.00	4900.00 ± 100.00	-0.26	
03/09/90	05/03/90	05/21/90	Water	Ra-226	4.9 ± 0.7	4.73 ± 0.47	-0.41	
				Ra-228	12.7 ± 1.9	13.00 ± 1.00	0.27	
03/30/90	06/08/90	07/03/90	Air Filter	Gr-Alpha	5.0 ± 5.0	6.33 ± 0.58	0.46	
				Gr-Beta	31.0 ± 5.0	31.67 ± 0.58	0.23	
				Sr-90	10.0 ± 1.5	9.33 ± 0.58	-0.77	
				Cs-137	10.0 ± 5.0	10.67 ± 1.15	0.23	
04/17/90	06/22/90	07/20/90	Water	Gr-Alpha	90.00 ± 23.0	79.33 ± 2.89	-0.80	
				Ra-226	5.0 ± 0.8	5.67 ± 0.15	1.44	
				Ra-228	10.2 ± 1.5	9.37 ± 1.44	-0.96	
				Gr-Beta	52.0 ± 5.0	53.33 ± 1.53	0.46	
				Sr-89	10.0 ± 5.0	10.67 ± 1.15	0.23	
				Sr-90	10.0 ± 1.5	9.67 ± 0.58	-0.38	
				Cs-134	15.0 ± 5.0	12.67 ± 1.53	-0.81	
				Cs-137	15.0 ± 5.0	16.33 ± 1.15	0.46	
04/27/90	06/22/90	07/27/90	Milk	Sr-89	23.0 ± 5.0	24.67 ± 1.53	0.58	
				Sr-90	23.0 ± 5.0	24.00 ± 0.00	0.35	
				I-131	99.0 ± 10.0	89.67 ± 3.21	-1.62	
				Cs-137	24.0 ± 5.0	27.33 ± 2.52	1.15	
				K-40	1550.0 ± 78.0	1483.33 ± 75.06	-1.48	

- See footnotes at end of table.

DUQUESNE LIGHT COMPANY - 1990

US EPA INTERLABORATORY COMPARISON PROGRAM 1990

EPA Preparation	Date TI Mailed Results	Date EPA Issued Results	Media	Nuclide	EPA Results(a)		TI Results(b)		Norm Dev. (Known)	**Warning ***Action
05/04/90	06/22/90	07/31/90	Water	Sr-89	7.0 ±	5.0	6.67 ±	0.58	-0.12	
				Sr-90	7.0 ±	5.0	6.67 ±	0.58	-0.12	
05/11/90	06/08/90	07/03/90	Water	Gr-Alpha	22.0 ±	6.0	16.00 ±	1.00	-1.73	
				Gr-Beta	15.0 ±	5.0	17.00 ±	1.00	0.69	
06/08/90	07/17/90	08/14/90	Water	Co-60	24.0 ±	5.0	25.33 ±	2.52	0.46	
				Zn-65	148.0 ±	15.0	148.67 ±	3.06	0.08	
				Ru-106	210.0 ±	21.0	196.00 ±	20.66	-1.15	
				Cs-134	24.0 ±	5.0	23.67 ±	2.89	-0.12	
				Cs-137	25.0 ±	5.0	24.67 ±	2.08	-0.12	
				Ba-133	99.0 ±	10.0	93.00 ±	6.08	-1.04	
06/22/90	0[illegible]/19/90	08/14/90	Water	H-3	2933.0 ±	358.0	2900. ±	100.00	-0.16	
07/13/90	[illegible]9/06/90	10/09/9[illegible]	Water	Ra-226	12.1 ±	1.8	11.37 ±	0.60	-0.71	
				Ra-2[illegible]8	5.1 ±	1.3	4.20 ±	0.75	-1.20	
08/10/90	08/[illegible]0/90	10/26/90	Water	I-131	39.0 ±	6.0	36.00 ±	3.00	-0.[illegible]7	
08/31/90	11/06/[illegible]0	11/29/9[illegible]	Air Filter	Gr-Alpha	10.0 ±	5.0	16.00 ±	1.00	2.08	** (d)
				Gr-Beta	62.0 ±	5.0	63.33 ±	1.53	0.46	
				Sr-90	20.0 ±	5.0	18.00 ±	1.00	-0.69	
				Cs-137	20.0 ±	5.0	18.33 ±	3.21	-0.58	
09/14/90	11/20/90	12/11/90	Water	Sr-89	10.0 ±	5.0	8.67 ±	0.58	-0.46	
				Sr-90	9.0 ±	5.0	9.0 ±	1.00	0.00	
09/21/90	10/17/90	11/05/90	Water	Gr-Alpha	10.0 ±	5.0	11.00 ±	1.00	0.35	
				Gr-Beta	10.0 ±	5.0	11.00 ±	1.00	0.35	
09/28/90	12/04/90	12/24/90	Milk	Sr-89	16.0 ±	5.0	9.0 ±	2.65	-2.42	** (e)
				Sr-90	20.0 ±	5.0	15.33 ±	0.58	-1.62	
				I-1[illegible]	58.0 ±	6.0	54.67 ±	1.53	-0.96	
				Cs-137	20.0 ±	5.0	2[illegible].00 ±	1.73	1.04	
				K-40	1700.0 ±	85.0	1710.00 ±	65.51	0.20	

* See footnotes at end of table.

DUQUESNE LIGHT COMPANY - 1990

US EPA INTERLABORATORY COMPARISON PROGRAM 1990

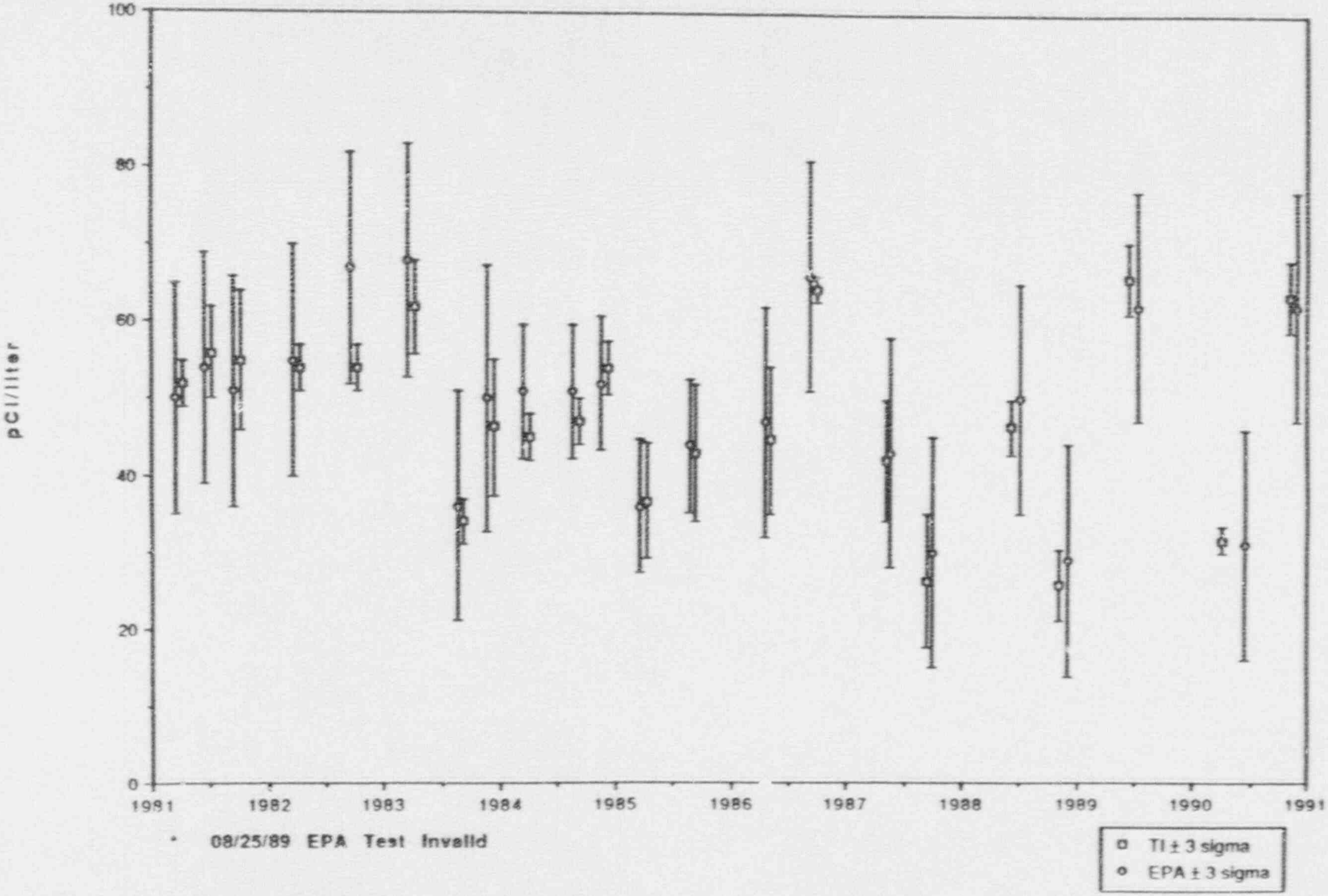
(Page 3 of 3)

EPA Preparation	Date TI Mailed Results	Date EPA Issued Results	Media	Nuclide	EPA Result (a)		TI Results(b)		Norm Dev. (Known)	**Warning ***Action
10/15/90	11/16/90	12/04/90	Water	Co-60	20.0 ±	5.0	21.00 ±	1.00	0.35	
				Zr-65	115.0 ±	12.0	115.00 ±	11.53	0.00	
				Ru-106	151.0 ±	15.0	142.00 ±	8.66	-1.04	
				Cs-134	12.0 ±	5.0	11.00 ±	0.00	-0.35	
				Cs-137	12.0 ±	5.0	16.33 ±	2.52	1.50	
				Ba-133	110.0 ±	11.0	94.67 ±	5.13	-2.41	** (f)
10/19/90	11/16/90	12/04/90	Water	H-3	7203.0 ±	720.0	7133.33 ±	251.66	-0.17	
10/30/90	01/10/91	02/04/91	Lab Perf. Sample A	Gr-Alpha	62.00 ±	16.00	57.00 ±	1.00	-0.54	
				Ra-226	13.6 ±	2.0	12.67 ±	1.27	-0.81	
				Ra-228	5.0 ±	1.3	4.87 ±	0.23	-0.18	
			Sample B	Gr-Beta	53.0 ±	5.0	51.00 ±	2.31	-0.12	
				Sr-89	20.0 ±	5.0	19.00 ±	3.61	-0.35	
				Sr-90	15.0 ±	5.0	14.33 ±	0.58	-0.23	
				Cs-134	7.0 ±	5.0	9.00 ±	0.00	0.69	
				Cs-137	5.0 ±	5.0	7.67 ±	1.15	0.92	
11/09/90	01/04/91	01/29/91	Water	Ra-226	7.4 ±	1.1	7.27 ±	0.38	-0.21	
				Ra-228	7.7 ±	1.9	7.57 ±	0.32	-0.12	

(a) Average ± experimental sigma.
(b) Expected laboratory precision (1 sigma, 1 determination).
(c) No apparent cause for the low results were found. Three aliquots of the sample were counted on three separate detectors. The results of all three were similar. The calibration curve fit is good (0.997). Ruthenium-106 was obtained from the EPA. Results of spikes were acceptable. Subsequent cross-checks from the EPA did not exceed two normalized standard deviation. No additional follow-up is necessary, but we will continue to monitor the results. New calibrations were completed March, 1991.
(d) The EPA deposit occupies a smaller area than our calibration planchet and hence has a higher counting efficiency. No further corrective action is required, since our calibration standard better represents an air particulate filter.
(e) Incomplete removal of calcium, lead to erroneously high strontium yields. More care is being taken in the strontium nitrate and strontium sulfate precipitation steps to ensure a final volume of at least 20 ml in the strontium sulfate step. Reanalysis of internal QC samples produced good results after implementing the corrective action.
(f) There is no apparent reason for the deviation between the EPA and Teledyne Isotopes values. Other isotopes in the sample were measured accurately. The calculations were reviewed and activities calculated from other Ba-133 gamma rays. Results were reproduced as reported.

US EPA CROSS CHECK PROGRAM

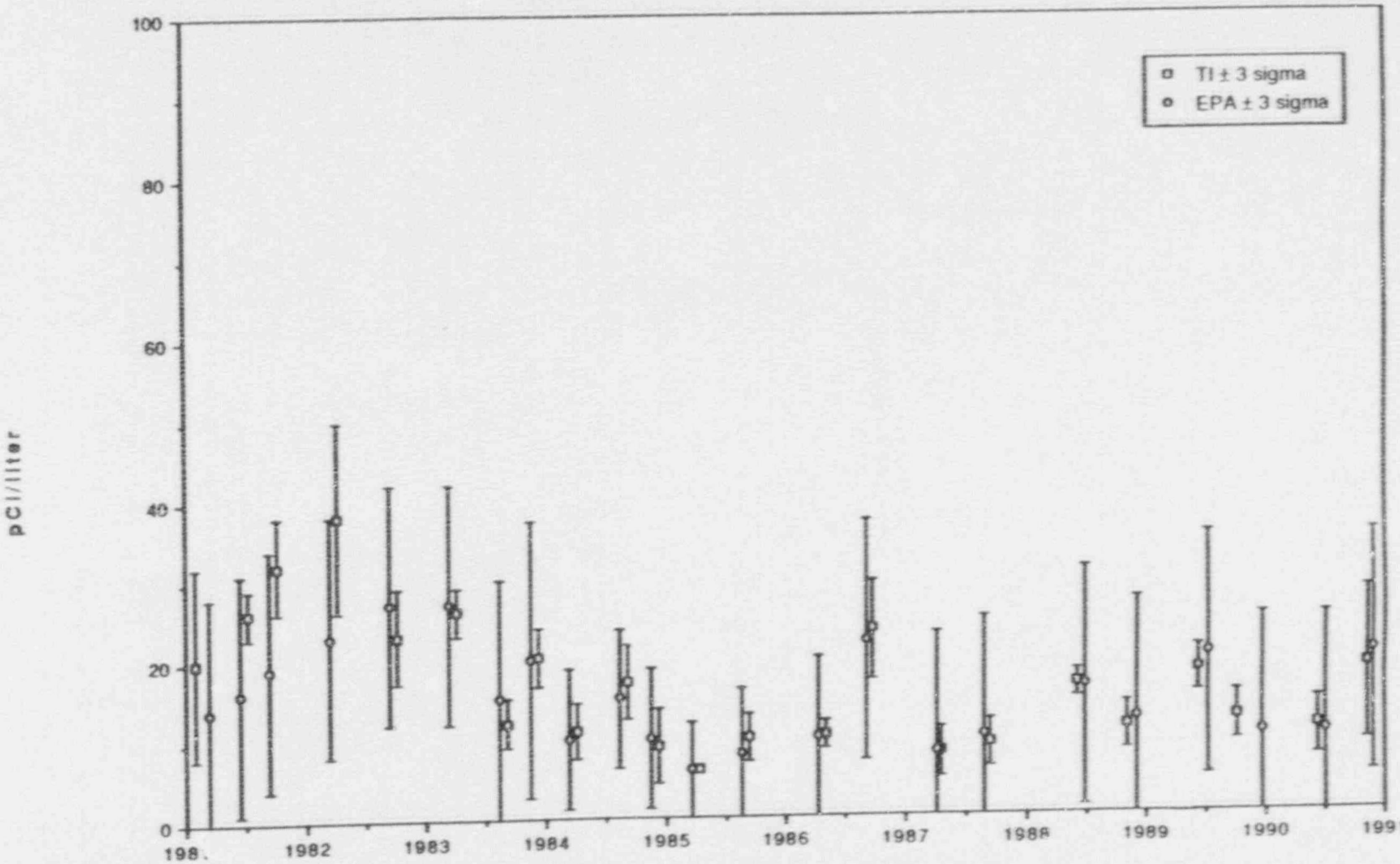
GROSS BETA IN AIR PARTICULATES



* 08/25/89 EPA Test Invalid

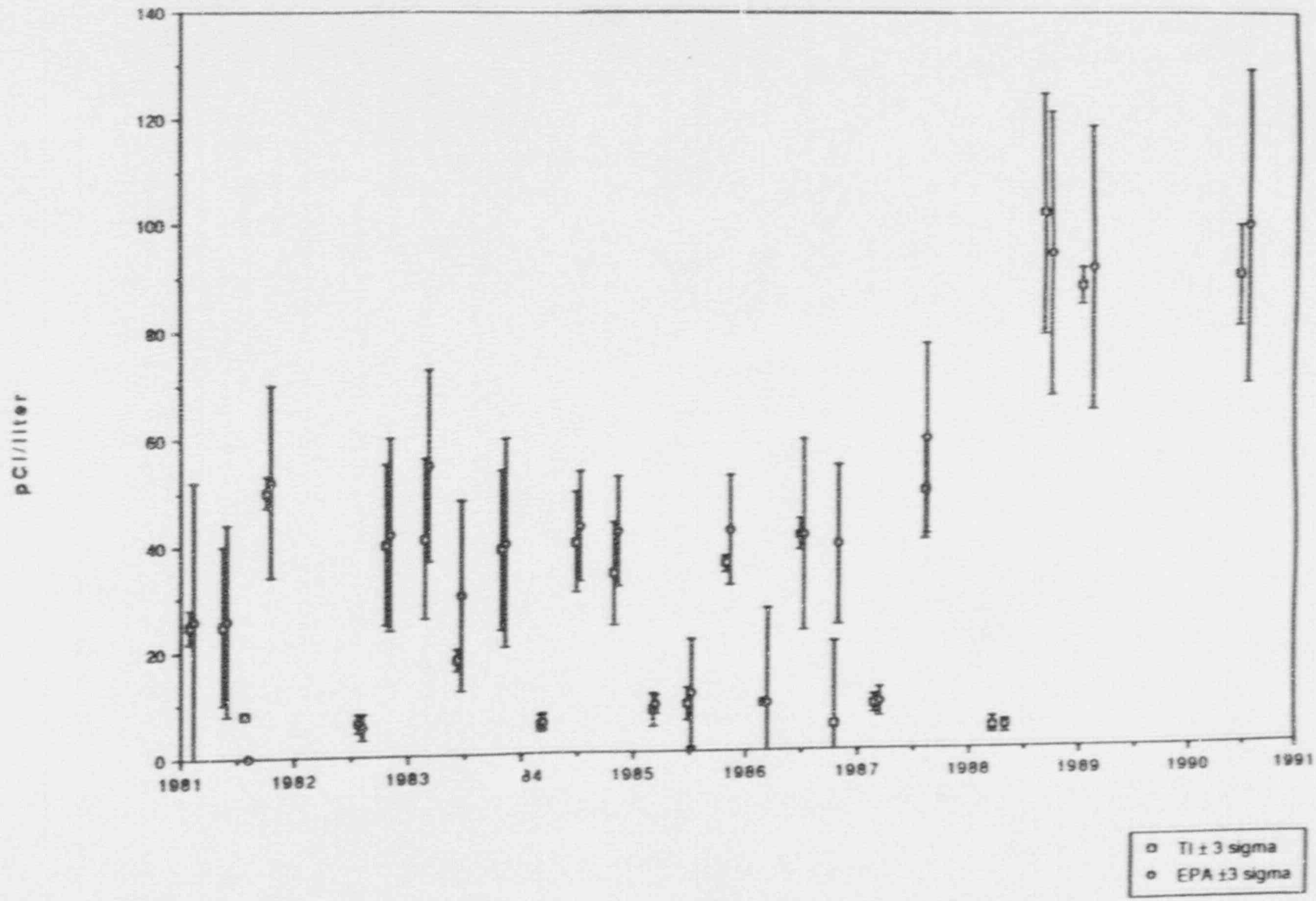
US EPA CROSS CHECK PROGRAM

CESIUM-137 IN AIR PARTICULATES



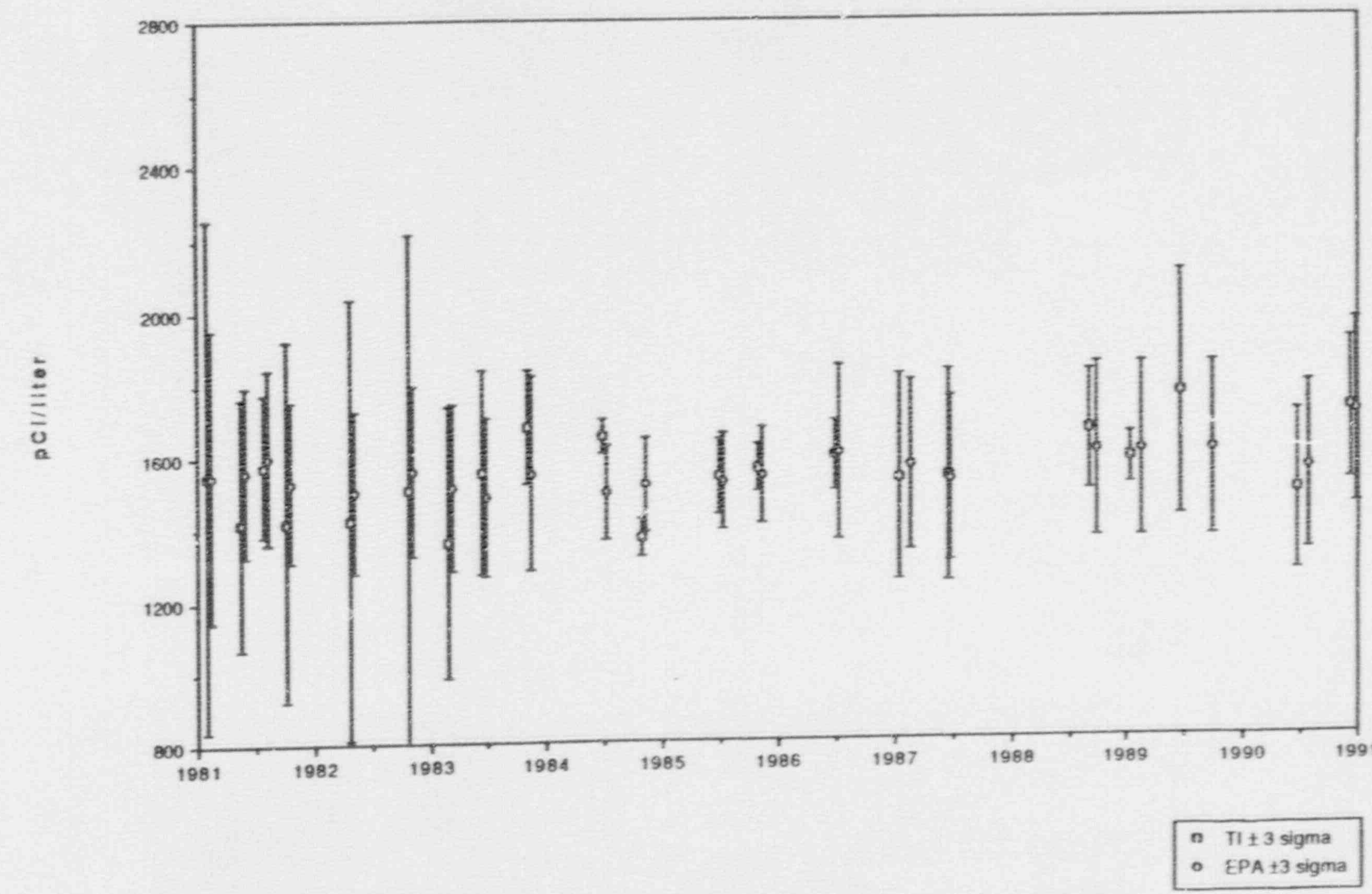
US EPA CROSS CHECK PROGRAM

IODINE-131 IN MILK



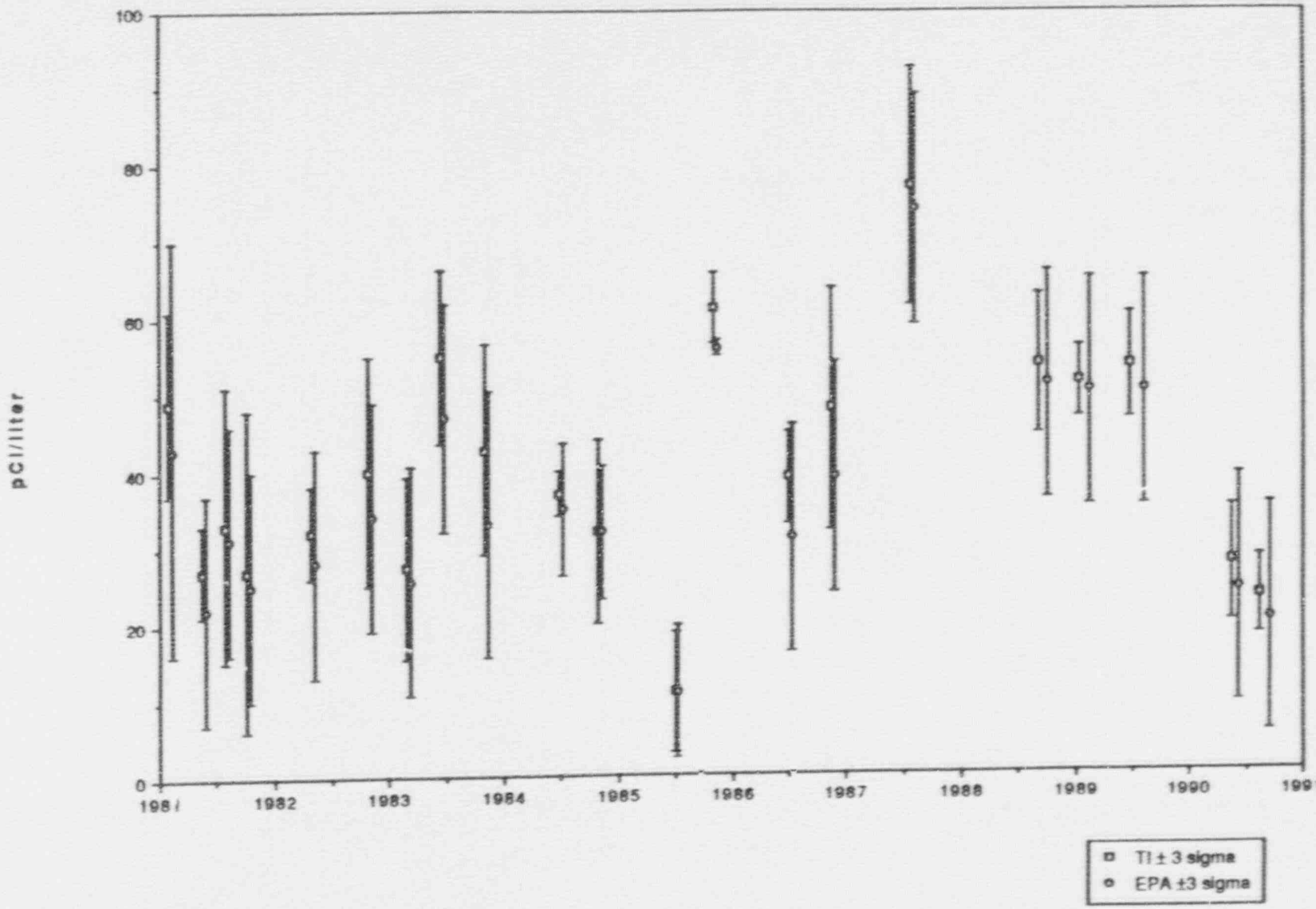
US EPA CROSS CHECK PROGRAM

POTASSIUM-40 IN MILK



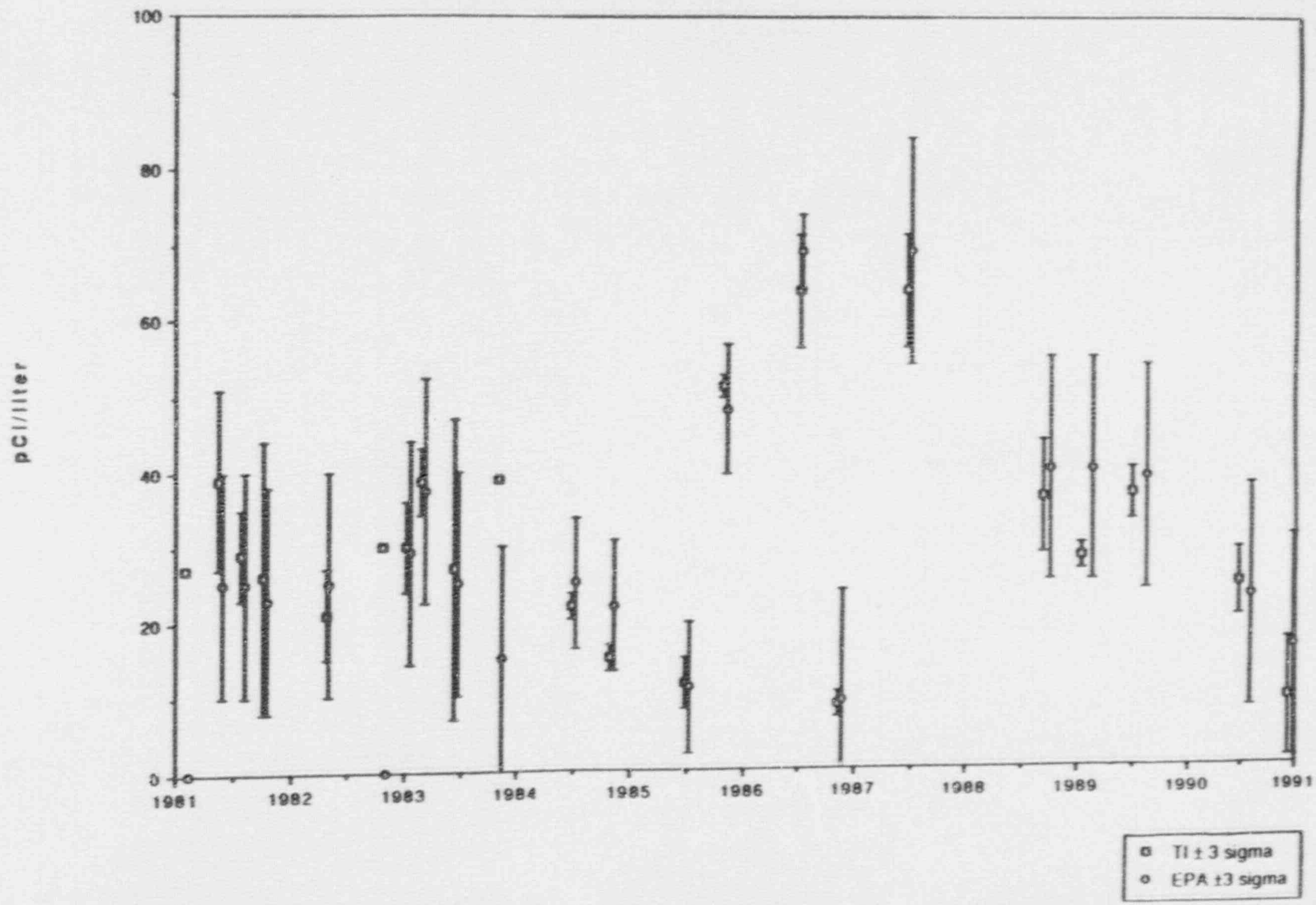
US EPA CROSS CHECK PROGRAM

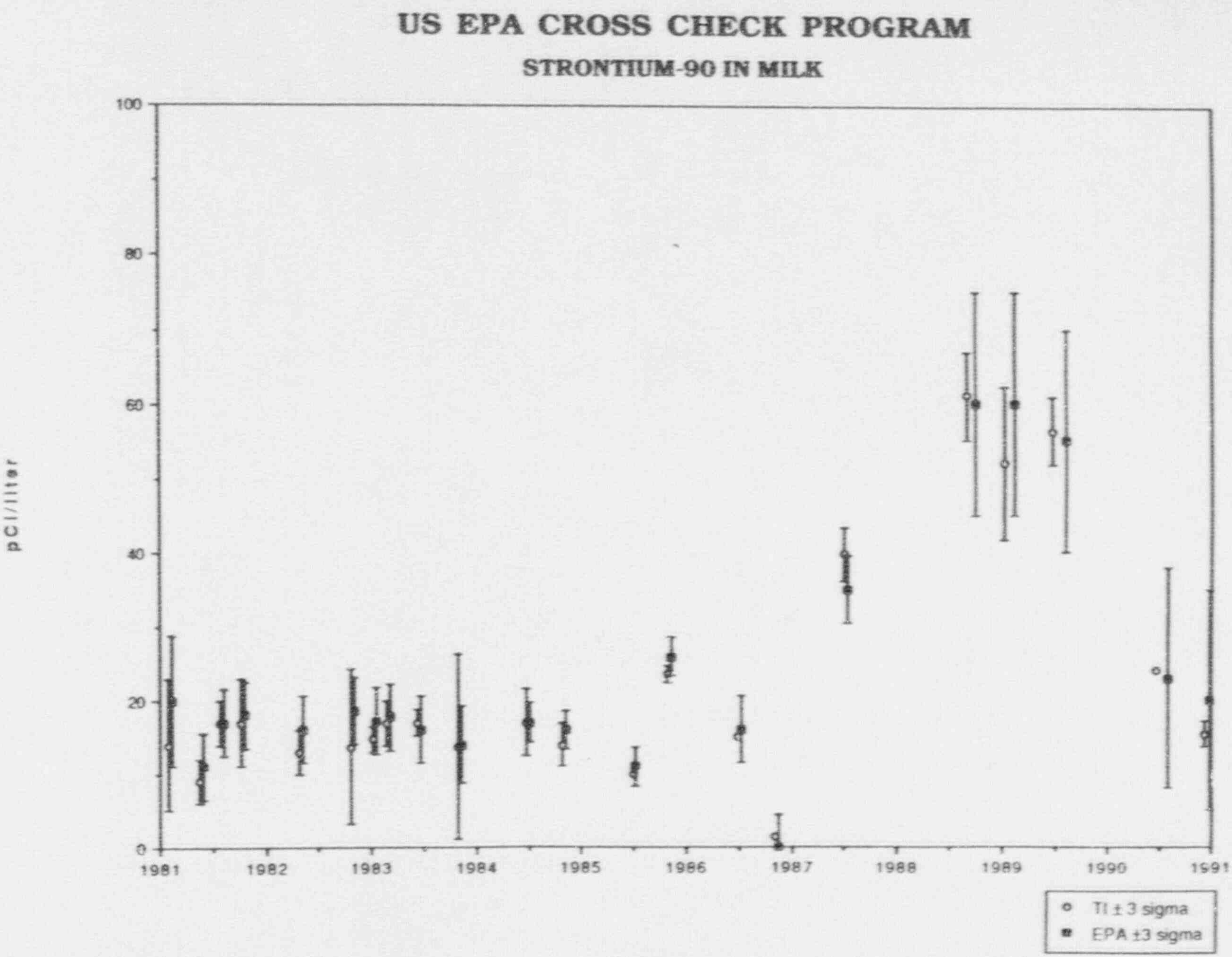
CESIUM-137 IN MILK



US EPA CROSS CHECK PROGRAM

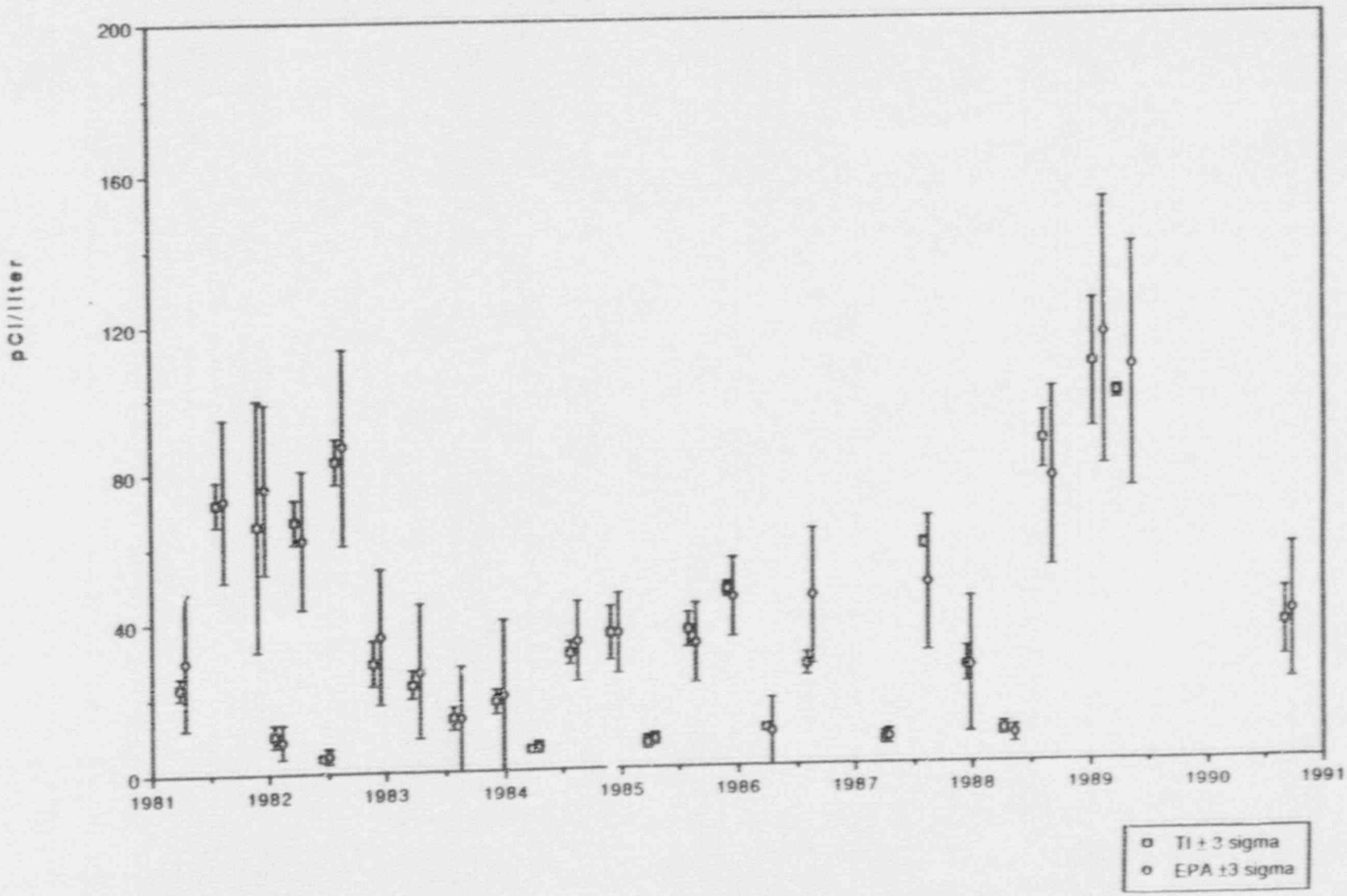
STRONTIUM-89 IN MILK




US EPA CROSS CHECK PROGRAM
STRONTIUM-90 IN MILK
pCi/liter
0
20
40
60
80
100
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
TI ± 3 sigma
EPA ±3 sigma

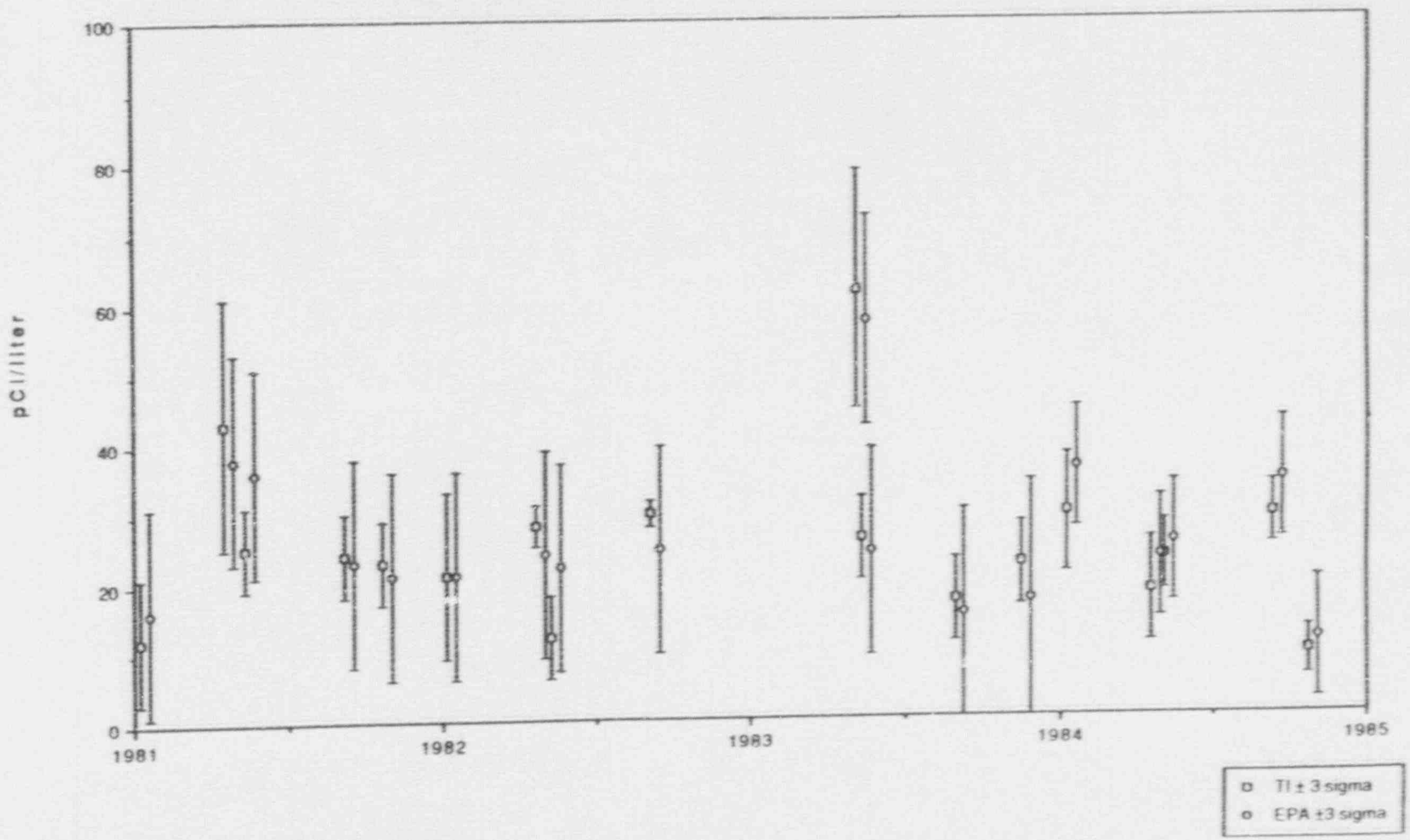
US EPA CROSS CHECK PROGRAM

IODINE-131 IN WATER



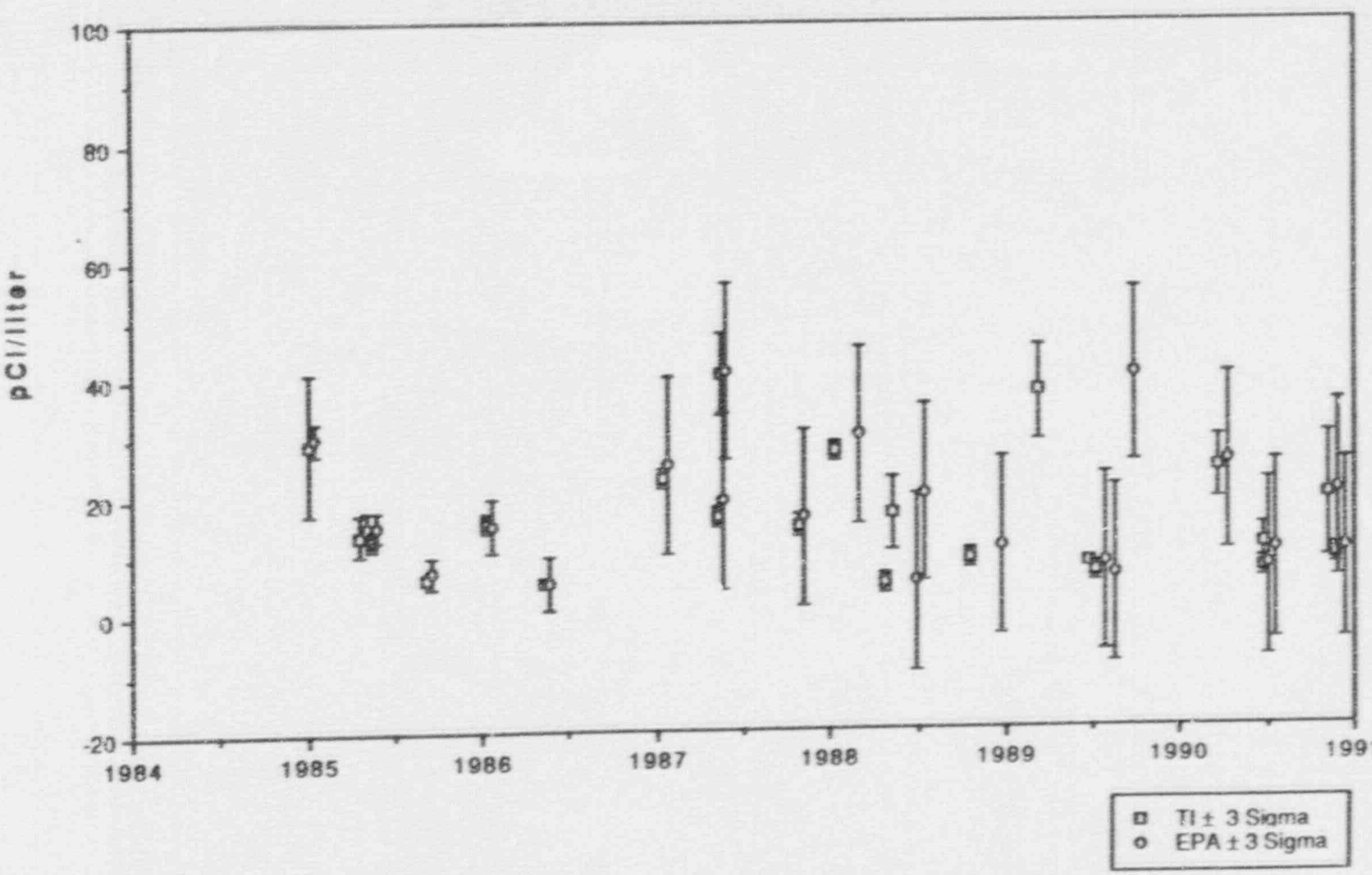
US EPA CROSS CHECK PROGRAM

STRONTIUM-89 IN WATER (pg. 1)



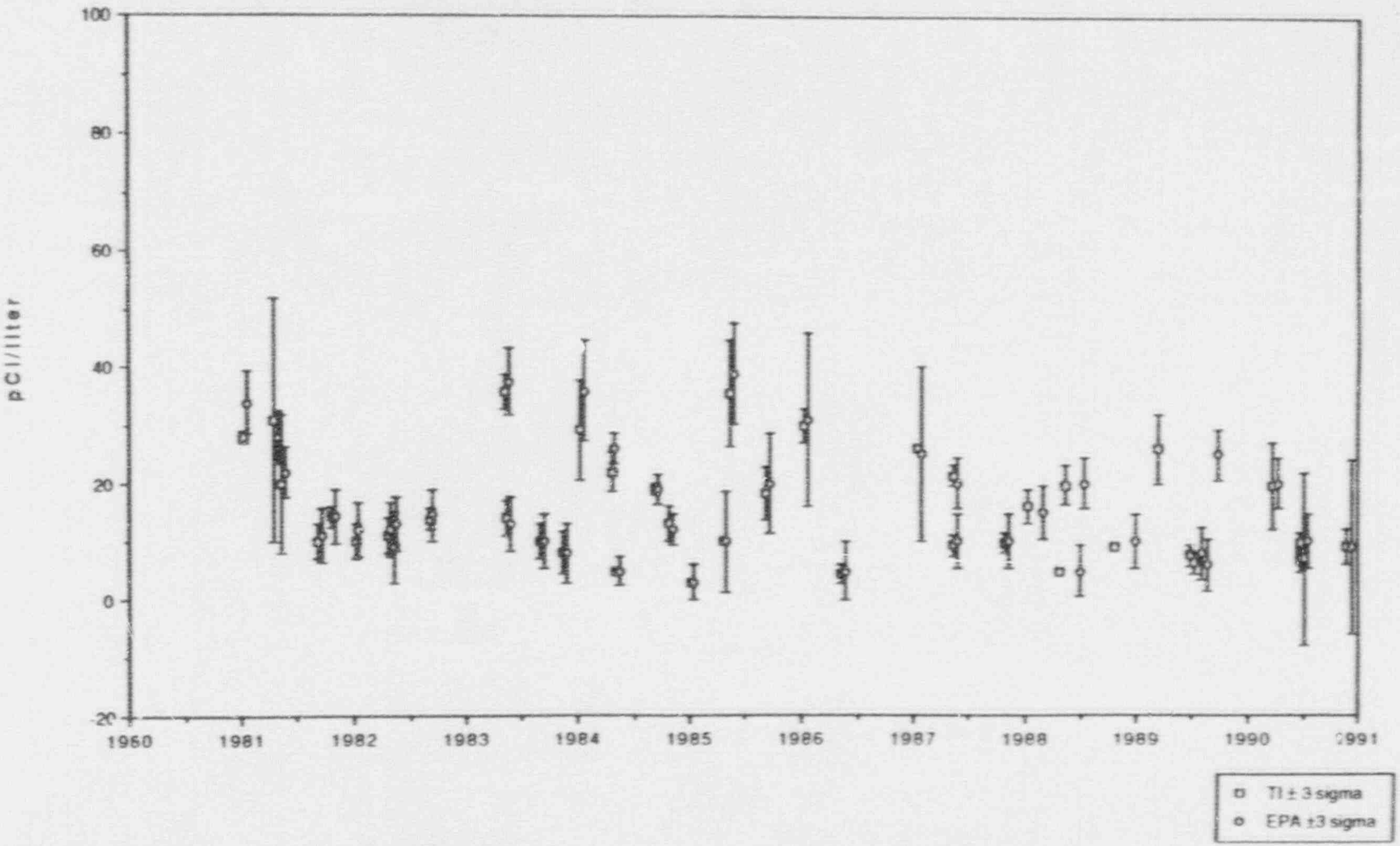
US EPA CROSS CHECK PROGRAM

STRONTIUM-89 IN WATER (pg. 2)



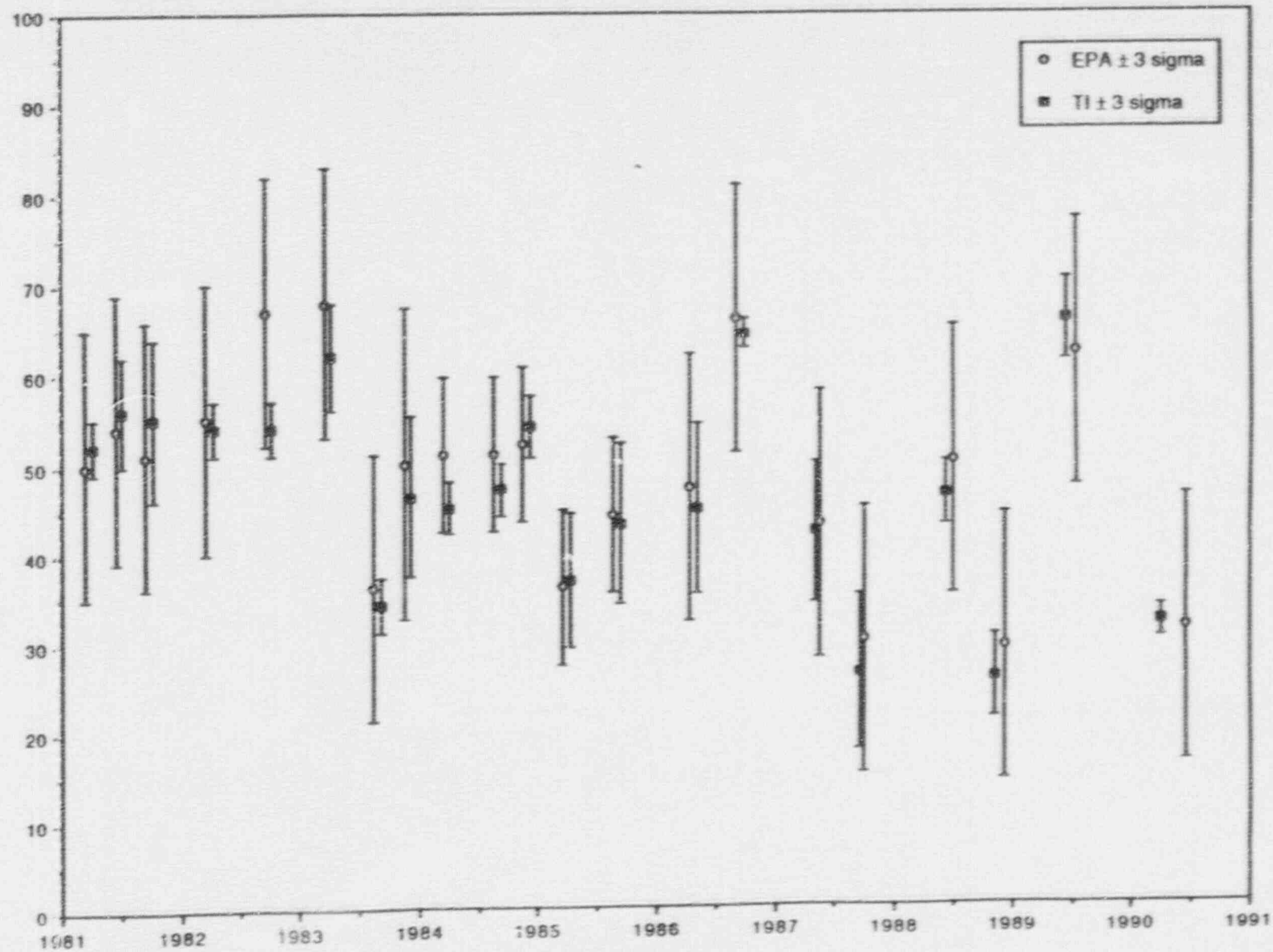
US EPA CROSS CHECK PROGRAM

STRONTIUM-90 IN WATER



US EPA CROSS CHECK PROGRAM

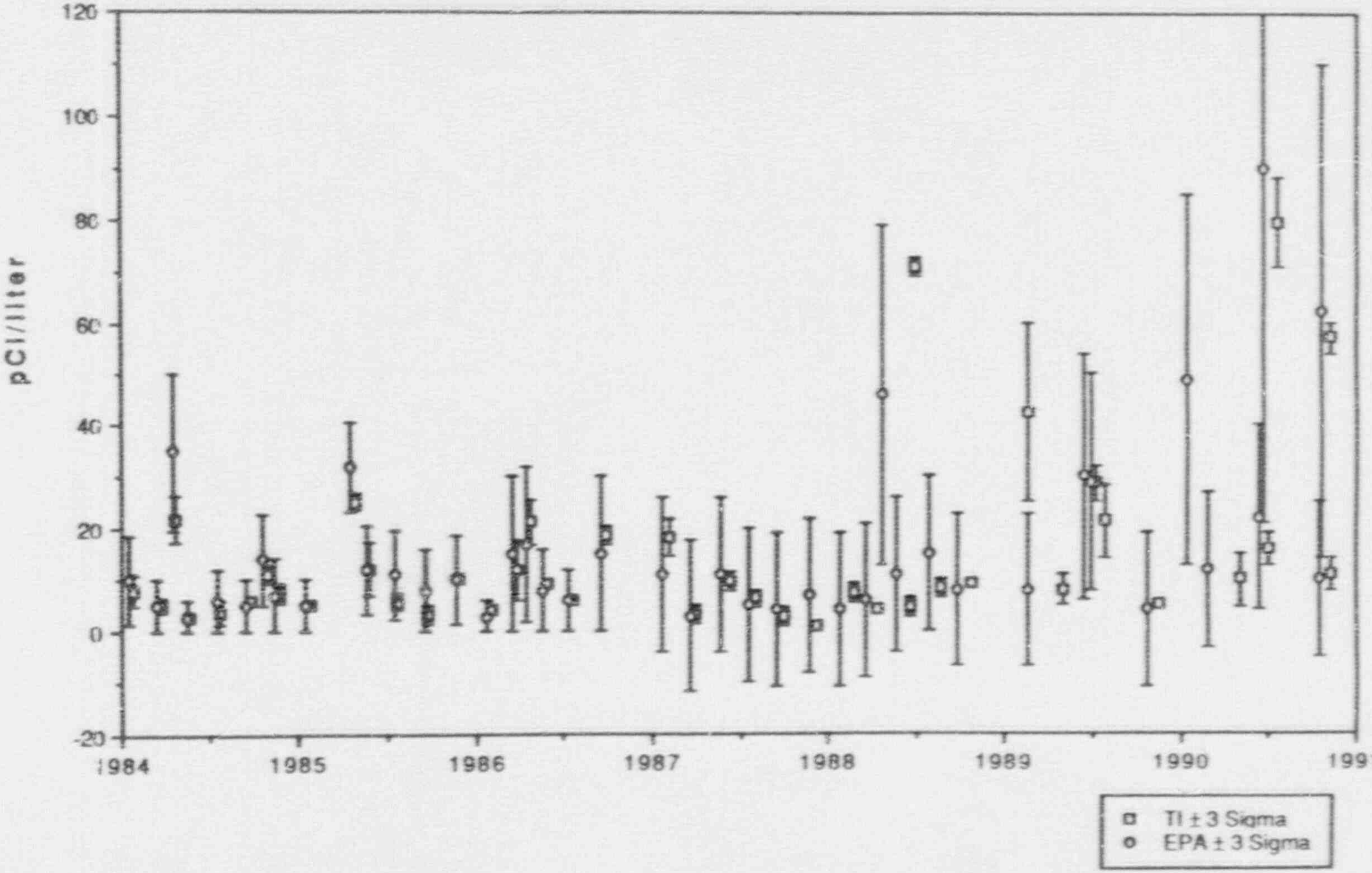
GROSS BETA IN AIR PARTICULATES



* 08/25/89 EPA test invalid.

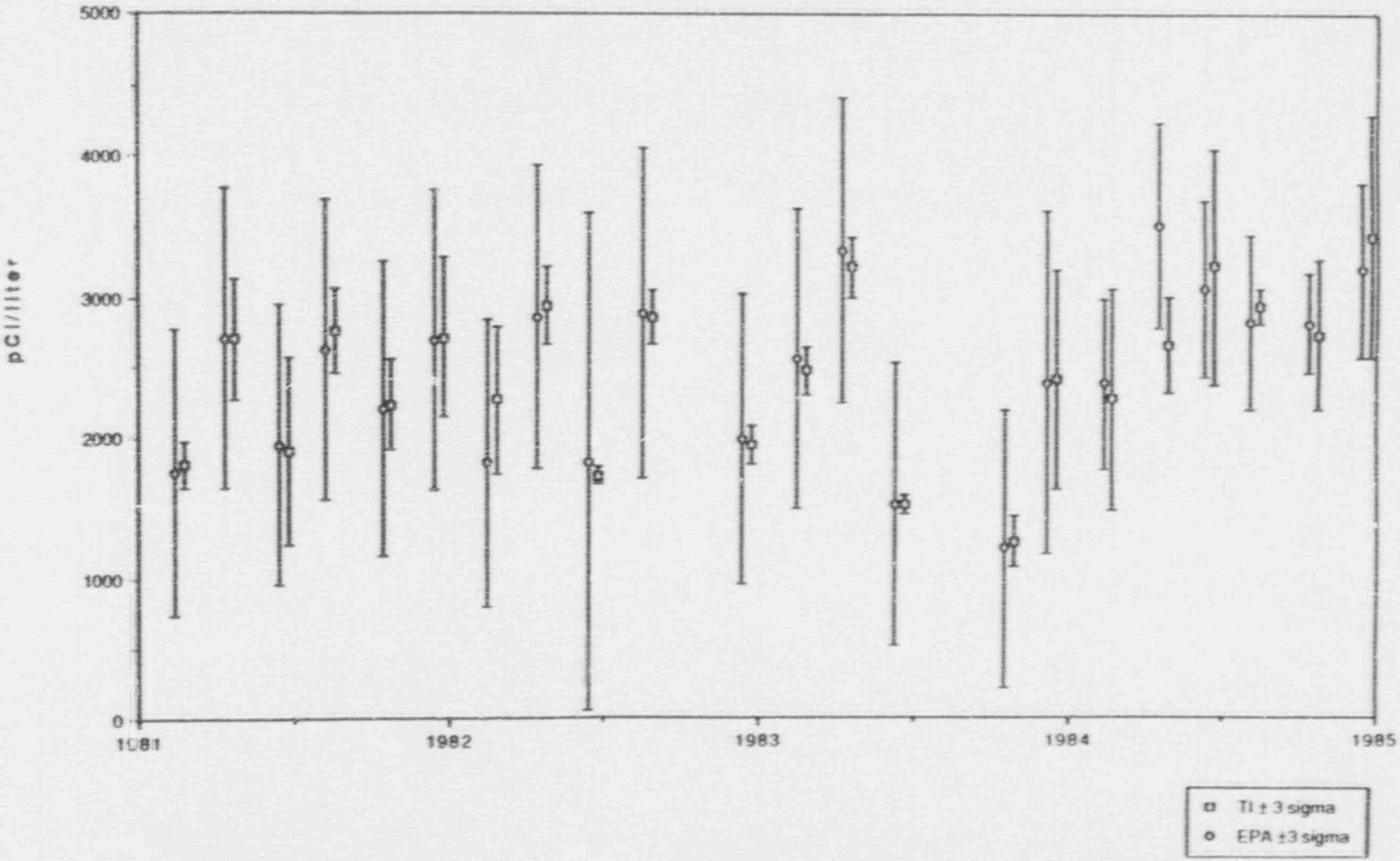
US EPA CROSS CHECK PROGRAM

GROSS ALPHA IN WATER



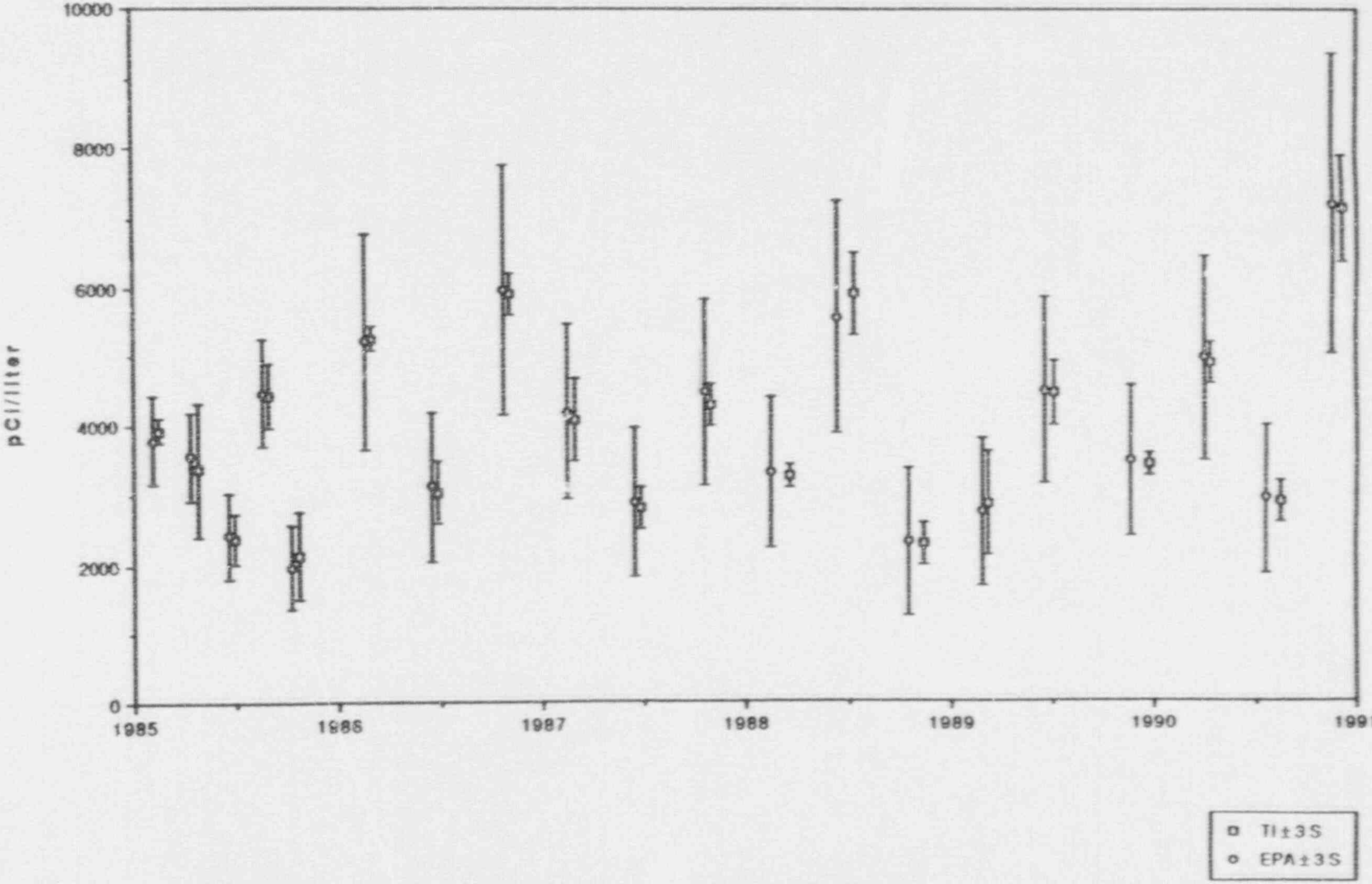
US EPA CROSS CHECK PROGRAM

TRITIUM IN WATER (pg. 1)



US EPA CROSS CHECK PROGRAM

TRITIUM IN WATER (pg. 2)



TELEDYNE ISOTOPES
50 VAN BUREN AVENUE
WESTWOOD, NEW JERSEY 07675
(201) 664-7070

November 27, 1990

Mr. J. W. McIntire
Duquesne Light Company
Beaver Valley Power Station
Post Office Box 4
Shippingport, PA 15077-0004

Dear Mr. McIntire:

We have made significant progress in resolving the differences in the measurement of gross beta in water samples between our laboratory and the midwest laboratory. The primary difference was due to separate self absorption curves for determining the detector efficiency as the function of the residue mass of the sample. The midwest laboratory uses Sr-90 and we use Cs-137. Both are considered acceptable isotopes by the EPA and at very low masses the two curves give essentially the same detector efficiency. Please see the attached figure. Our laboratory has chosen to use Cs-137 since that is the isotope the EPA uses for the preparation of intercomparison samples. Cesium-137 counts with an efficiency closer to the efficiency for Co-60, the one beta-emitter that we occasionally measure in water samples for your program, than the efficiency using Sr-90.

A second feature is that after the initial drying of the residue on the planchet the midwest laboratory "ashes" the residue on the planchet for 1 hour in a furnace at 400 degrees C.

Listed below is a comparison of the results of gross beta analysis (in pCi/l) for both laboratories using Cs-137 for determining the self absorption curve, counting for 50 minutes, and no final ashing of the planchet.

TI#	SAMPLE TYPE	WESTWOOD	MIDWEST
18459	WT	7.2 ± 2.1	6.3 ± 1.6
18460	WT	6.9 ± 2.0	5.1 ± 1.3
18464	WD	4.6 ± 1.9	4.4 ± 1.4

When we first started this intercomparison, the midwest laboratory, using Sr-90 for the self absorption curve, reported 4.4 ± 0.5, 3.1 ± 0.5, and 2.5 ± 0.4, respectively. Thus we have made good progress.

EasyLink 62877198 ·5586

TELEDYNE ISOTOPES

We suggest that for your program the midwest laboratory use the Cs-137 self absorption curve and not to perform the final ashing step. For the 1990 data the midwest laboratory could recalculate the results using the Cs-137 self absorption curve and the agreement between the two laboratories should be much better.

You had requested that we a alyze six samples, three surface and three drinking water samples. We did a total of six, but the results from the midwest laboratory of the three listed below included the ashing step (and 800 minutes counting times).

TI#	SAMPLE TYPE	WESTWOOD	MIDWEST
18461	WT	5.5 ± 2.0	4.7 ± 0.5
18462	WD	2.6 ± 1.6	3.6 ± 0.5
18463	WD	2.8 ± 1.6	3.4 ± 0.5

The agreement between the laboratories is good.

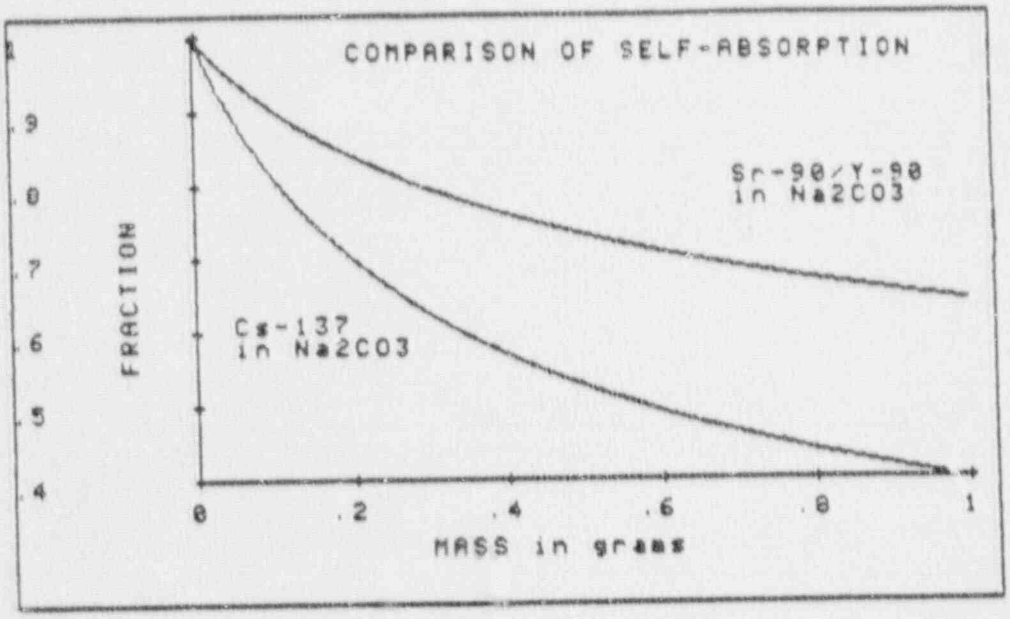
Sincerely,

J David Martin

J. David Martin, Ph.D
Vice President-Technical

JDM:cs

cc: L. Huebner


COMPARISON OF SELF-ABSORPTION
Sr-90/Y-90
in Na2CO3
Cs-137
in Na2CO3
FRACTION
1
.9
.8
.7
.6
.5
.4
0
.2
.4
.6
.8
1
MASS in grams

TELEDYNE
ISOTOPES
50 VAN BUREN AVENUE
WESTWOOD, NEW JERSEY 07675
(201) 664-7070

April 1, 1991

Mr. J. W. McIntire
Duquesne Light Company
Beaver Valley Power Station
Post Office Box 4
Shippingport, PA 15077-0004

Dear Mr. McIntire:

In reference to my letter, dated November 27, 1990, the TI midwest laboratory has, until recently, been "ashing" the residue of water samples as the final step in preparation for gross alpha/gross beta counting. In the Westwood laboratory we do not perform that step because we feel that some of the residue may be volatilized and consequently some of the radioactivity may be lost.

Sincerely,

J. David Martin

J. David Martin, Ph.D
Vice President-Technical

JDM:cs

TELEX 134474 TDYISOT WTWI FAX (201) 664-5586

APPENDIX II

QC Laboratory

EPA Interlaboratory

Comparison Program

INTERLABORATORY COMPARISON PROGRAM RESULTS

NOTE: TIML participates in intercomparison studies administered by U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada. The results are reported in Appendix A. Also reported are results of in-house spikes and blanks. Appendix A is updated twice a year; the complete Appendix is included in January and July monthly reports only. Please refer to January and July Reports for information.

January, 1991

Interlaboratory Comparison Program Results

Teledyne Isotopes Midwest Laboratory (formerly Hazleton Environmental Sciences) has participated in interlaboratory comparison (crosscheck) programs since the formulation of its 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 known 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 concentrations 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, air filters, and food samples during the period January 1986 through December, 1990. This program has been 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) during the period 1976, 1977, 1979, 1980, 1984, and 1985-1986 through participation in the Second, Third, Fourth, Fifth, Seventh, and Eighth International Intercomparison 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.

Table A-4 lists results of the analyses on in-house "blank" samples.

Attachment B lists acceptance criteria for "spiked" samples.

Addendum to Appendix A provides explanation for out-of-limit results.

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne Isotopes Midwest Laboratory results for milk, water, air filters, and food samples, 1986 through 1990.[a]

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STF-447	Food	Jan 1986	Sr-89	24.3±2.5	25.0±5.0	16.3-33.7
			Sr-90	17.3±0.6	10.0±1.5	7.4-12.6
			I-131	22.7±2.3	20.0±0.6	9.6-30.4
			Cs-137	16.3±0.6	15.0±5.0	6.3-23.7
			K	927±46	950±144	701-1199
STW-448	Water	Feb 1986	Cr-51	45.0±3.6	38.0±5.0	29.3-46.7
			Co-60	19.7±1.5	18.0±5.0	9.3-26.7
			Zn-65	44.0±3.5	40.0±5.0	31.3-48.7
			Ru-106	<9.0	0.0±5.0	0.0-8.7
			Cs-134	28.3±2.3	30.0±5.0	21.3-38.7
			Cs-137	23.7±0.6	22.0±5.0	13.3-30.7
STW-449	Water	Feb 1986	H-3	5176±48	5227±525	4317-6137
STW-450	Water	Feb 1986	U total	8.0±0.0	9.0±6.0	0.0-19.4
STM-451	Milk	Feb 1986	I-131	7.0±0.0	9.0±6.0	0.0-19.4
STW-452	Water	Mar 1986	Ra-226	3.8±0.1	4.1±0.6	3.0-5.2
			Ra-228	11.0±0.5	12.4±1.8	9.2-15.5
STW-453	Water	Mar 1986	Gr. alpha	6.7±0.6	15.0±5.0	6.3-23.7
			Gr. beta	7.3±0.6	8.0±5.0	0.0-16.7
STW-454	Water	Apr 1986	I-131	7.0±0.0	9.0±6.0	0.0-19.4
STW-455 456	Water (Blind)	Apr 1986				
	Sample A		Gr. alpha	15.0±1.0	17.0±5.0	8.3-25.7
			Ra-226	3.1±0.1	2.9±0.4	2.1-3.7
			Ra-228	1.5±0.2	2.0±0.3	1.5-2.5
			Uranium	4.7±0.6	5.0±6.0	0.0-15.4
	Sample B		Gr. beta	28.7±1.2	35.0±5.0	26.3-43.7
			Sr-89	5.7±0.6	7.0±5.0	0.0-15.7
			Sr-90	7.0±0.0	7.0±1.5	4.4-9.6
			Co-60	10.7±1.5	10.0±5.0	1.3-18.7
			Cs-134	4.0±1.7	5.0±5.0	0.0-13.7
			Cs-137	5.3±0.6	5.0±5.0	0.0-13.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b]: TIML Result ±2σ[c]	EPA Result[d]: 1s, N=1	EPA Result[d]: Control Limits
STAF-457	Air Filter	Apr 1986	Gr. alpha	13.7±0.6	15.0±5.0	6.3-23.7
			Gr. beta	46.3±0.6	47.0±5.0	38.3-55.7
			Sr-90	14.7±0.6	18.0±1.5	15.4-20.6
			Cs-137	10.7±0.6	10.0±5.0	1.3-18.7
STU-458	Urine	Apr 1986	Tritium	4313±70	4423±189	4096-4750
STW-459	Water	May 1986	Sr-89	4.3±0.6	5.0±5.0	0.0-13.7
			Sr-90	5.0±0.0	5.0±1.5	2.4-7.6
STW-460	Water	May 1986	Gr. alpha	5.3±0.6	8.0±5.0	0.0-16.7
			Gr. beta	11.3±1.2	15.0±5.0	6.3-23.7
STW-461	Water	Jun 1986	Cr-51	<9.0	0.0±5.0	0.0-8.7
			Co-60	66.0±1.0	66.0±5.0	57.3-74.7
			Zn-65	87.3±1.5	86.0±5.0	77.3-94.7
			Ru-106	39.7±2.5	50.0±5.0	41.3-58.7
			Cs-134	49.3±2.5	49.0±5.0	40.3-57.7
			Cs-137	10.3±1.5	10.0±5.0	1.3-18.7
STW-462	Water	Jun 1986	Tritium	3427±25	3125±361	2499-3751
STM-464	Milk	Jun 1986	Sr-89	<1.0	0.0±5.0	0.0-8.7
			Sr-90	15.3±0.6	16.0±1.5	13.4-18.6
			I-131	48.3±2.3	41.0±6.0	30.6-51.4
			Cs-137	43.7±1.5	31.0±5.0	22.3-39.7
			K	1567±114	1600±80	1461-1739
STW-465	Water	Jul 1986	Gr. alpha	4.7±0.6	6.0±5.0	0.0-14.7
			Gr. beta	18.7±1.2	18.0±5.0	9.3-26.7
STW-467	Water	Aug 1986	I-131	30.3±0.6	45.0±6.0	34.4-55.4
STW-468	Water	Aug 1986	Pu-239	11.3±0.6	10.1±1.0	8.3-11.9
STW-469	Water	Aug 1986	Uranium	4.0±0.0	4.0±6.0	0.0-14.4
STAF-470 471 472	Air Filter	Sep 1986	Gr. alpha	19.3±1.5	22.0±5.0	13.3-30.7
			Gr. beta	64.0±2.6	66.0±5.0	57.3-74.7
			Sr-90	22.0±1.0	22.0±5.0	19.4-24.6
			Cs-137	25.7±1.5	22.0±5.0	13.3-30.7
STW-473	Water	Sep 1986	Ra-226	6.0±0.1	6.1±0.9	4.5-7.7
			Ra-228	8.7±1.1	9.1±1.4	6.7-11.5

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STW-474	Water	Sep 1986	Gr. alpha	16.3±3.2	15.0±5.0	6.3-23.7
			Gr. beta	9.0±1.0	8.0±5.0	0.0-16.7
STW-475	Water	Oct 1986	Cr-51	63.3±5.5	59.0±5.0	50.3-67.7
			Co-60	31.0±2.0	31.0±5.0	22.3-39.7
			Zn-657	87.3±5.9	85.0±5.0	76.3-93.7
			Ru-106	74.7±7.4	74.0±5.0	65.3-82.7
			Cs-134	25.7±0.6	28.0±5.0	19.3-36.7
			Cs-137	46.3±1.5	44.0±5.0	35.3-52.7
STW-476	Water	Oct 1986	H-3	5918±60	5973±597	4938-7008
SPW-477	Water (Blind)	Oct 1986				
	Sample A		Gr. alpha	34.0±6.0	40.0±5.0	31.3-48.7
			Ra-226	5.8±0.2	6.0±0.9	4.4-7.6
			Ra-228	2.7±1.0	5.0±0.8	3.7-6.3
			Uranium	11.0±0.0	10.0±6.0	0.0-20.4
	Sample B		Gr. beta	38.7±1.2	51.0±5.0	42.3-59.7
			Sr-89	5.0±0.0	10.0±5.0	1.3-18.7
			Sr-90	3.0±0.0	4.0±1.5	1.4-6.6
			Co-60	24.7±1.2	24.0±5.0	15.3-32.7
			Cs-134	11.0±2.0	12.0±5.0	3.3-20.7
			Cs-137	9.3±1.2	8.0±5.0	0.0-20.4
STM-479	Milk	Nov 1986	Sr-89	7.7±1.2	9.0±5.0	0.3-17.7
			Sr-90	1.0±0.0	0.0±1.5	0.0-2.6
			I-131	52.3±3.1	49.0±6.0	38.6-59.4
			Cs-137	45.7±3.1	39.0±5.0	30.3-47.7
			K	1489±104	1565±78	1430-1700
STU-480	Urine	Nov 1986	H-3	5540±26	5257±912	4345-6169
STW-481	Water	Nov 1986	Gr. alpha	12.0±4.0	20.0±5.0	11.3-28.7
			Gr. beta	20.0±3.5	20.0±5.0	11.3-28.7
STW-482	Water	Dec 1986	Ra-226	6.7±0.2	6.8±1.0	5.0-8.6
			Ra-228	5.2±0.2	11.1±1.7	8.2-14.0
STW-483	Water	Jan 1987	Sr-89	19.7±5.0	25.0±5.0	16.3-33.7
			Sr-90	21.0±2.0	25.0±1.5	22.4-27.6

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b]: TIML Result ±2σ[c]	EPA Result[d]: 1s, N=1	EPA Result[d]: Control Limits
STW-484	Water	Jan 1987	Pu-239	17.0±2.0	16.7±1.7	13.8-19.6
STF-486	Food	Jan 1987	Sr-90	36.0±4.0	49.0±10.0	31.7-66.3
			I-131	78.0±3.4	78.0±8.0	64.1-91.9
			Cs-137	89.7±3.0	84.0±5.0	75.3-92.7
			K	942±56	980±49	895-1065
STF-487	Food (Blank)	Jan 1987	Sr-90	2.0±0.0	---	
			I-131	<3	---	
			Cs-137	<2	---	
			K	993±102	---	
STW-488	Water	Feb 1987	Co-60	49.0±0.0	50.0±5.0	41.3-58.7
			Zn-65	96.0±7.2	91.0±5.0	82.3-99.7
			Ru-106	92.0±20.2	100.0±5.0	91.3-108.7
			Cs-134	53.0±3.4	59.0±5.0	50.3-67.7
			Cs-137	89.3±4.6	87.0±5.0	78.3-95.7
STW-489	Water	Feb 1987	H-3	4130±140	4209±420	3479-4939
STW-490	Water	Feb 1987	Uranium	8.3±1.2	8.0±6.0	0.0-18.4
STM-491	Milk	Feb 1987	I-131	10.0±0.0	9.0±0.9	7.4-10.6
STW-492	Water	Mar 1987	Gr. alpha	3.7±1.2	3.0±5.0	0.0-11.7
			Gr. beta	11.3±1.2	13.0±5.0	4.3-21.7
STW-493	Water	Mar 1987	Ra-226	7.0±0.1	7.3±1.1	5.4-9.2
			Ra-228	7.1±2.3	7.5±1.1	5.5-9.5
STW-494	Water	Apr 1987	I-131	8.0±0.0	7.0±0.7	5.8-8.2
STAF-495	Air Filter	Apr 1987	Gr. alpha	15.0±0.0	14.0±5.0	5.3-22.7
			Gr. beta	41.0±2.0	43.0±5.0	34.3-51.7
			Sr-90	16.3±1.2	17.0±1.5	14.4-19.6
			Cs-137	7.0±0.0	8.0±5.0	0.0-16.7
STW-496 497	Water (Blind)	Apr 1987				
	Sample A		Gr. alpha	30.7±1.2	30.0±8.0	16.1-43.9
			Ra-226	3.9±0.2	3.9±0.6	2.9-4.9
			Ra-228	4.9±0.9	4.0±0.6	3.0-5.0
			Uranium	5.0±0.0	5.0±6.0	0.0-15.4

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	TIML Result $\pm 2\sigma$[c]	Concentration in pCi/L[b] EPA Result[d] 1s, N=1	Control Limits
STW-496 497	Water (Blind)	Apr 1987				
	Sample B		Gr. beta	69.3±9.4	66.0±5.0	57.3-74.7
			Sr-89	16.3±3.0	19.0±5.0	10.3-27.7
			Sr-90	10.0±0.0	10.0±1.5	7.4-12.6
			Co-60	8.3±3.0	8.0±5.0	0.0-16.7
			Cs-134	19.0±2.0	20.0±5.0	11.3-28.7
			Cs-137	14.7±1.2	15.0±5.0	6.3-23.7
STU-498	Urine	Apr 1987	H-3	6017±494	5620±795	4647-6593
STW-499	Water	May 1987	Sr-89	38.0±6.0	41.0±5.0	32.3-49.7
			Sr-90	21.0±2.0	20.0±1.5	17.4-22.6
STW-500	Water	May 1987	Gr. alpha	9.0±3.4	11.0±5.0	2.3-19.7
			Gr. beta	10.3±1.2	7.0±5.0	0.0-15.7
STW-501	Water	Jun 1987	Cr-51	40.0±8.0	41.0±5.0	32.3-49.7
			Co-60	60.3±3.0	64.0±5.0	55.3-72.7
			Zn-65	11.3±5.0	10.0±5.0	1.3-18.7
			Ru-106	78.3±6.4	75.0±5.0	66.3-83.7
			Cs-134	36.7±3.0	40.0±5.0	31.3-48.7
			Cs-137	80.3±4.2	80.0±5.0	71.3-88.7
STW-502	Water	Jun 1987	H-3	2906±86	2895±357	2277-3513
STW-503	Water	Jun 1987	Ra-226	6.9±0.1	7.3±1.1	5.4-9.2
			Ra-228	13.3±1.0	15.2±2.3	11.2-19.2
STM-504	Milk	Jun 1987	Sr-89	57.0±4.3	69.0±5.0	60.3-77.7
			Sr-90	32.0±1.0	35.0±5.0	32.4-37.6
			I-131	64.0±2.0	59.0±6.0	48.6-69.4
			Cs-137	77.7±0.6	74.0±5.0	65.3-82.7
			K	1383±17	1525±76	1393-1657
STW-505	Water	Jul 1987	Gr. alpha	2.3±0.7	5.0±5.0	0.0-13.7
			Gr. beta	4.0±1.0	5.0±5.0	0.0-13.7
STF-506	Food	Jul 1987	I-131	82.7±4.6	80.0±8.0	66.1-93.9
			Cs-137	53.7±3.0	50.0±5.0	41.3-58.7
			K	1548±57	1680±84	1534-1826
STW-507	Water	Aug 1987	I-131	45.7±4.2	48.0±6.0	37.6-58.4

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	EPA Result[d] Control Limits
STW-508	Water	Aug 1987	Pu-239	5.8±0.2	5.3±0.5	4.4-6.2
STW-509	Water	Aug 1987	Uranium	13.3±0.3	13.0±6.0	2.6-23.4
STAF-510	Air Filter	Aug 1987	Gr. alpha	9.7±0.4	10.0±5.0	1.3-18.7
			Gr. beta	28.3±0.6	30.0±5.0	21.3-38.7
			Sr-90	10.0±0.9	10.0±1.5	7.4-12.6
			Cs-137	10.0±1.0	10.0±5.0	1.3-18.7
STW-511	Water	Sep 1987	Ra-226	9.9±0.1	9.7±1.5	7.2-12.2
			Ra-228	8.1±1.4	6.3±1.0	4.6-8.0
STW-512	Water	Sep 1987	Gr. alpha	2.0±0.6	4.0±5.0	0.0-12.7
			Gr. beta	11.3±1.3	12.0±5.0	3.3-20.7
STW-513	Water	Sep 1987	H-3	4473±100	4492±449	3714-5270
STW-514	Water (Blind)	Oct 1987				
	Sample A		Gr. alpha	29.3±2.6	28.0±7.0	15.9-40.1
			Ra-226	4.9±0.1	4.8±0.7	3.6-6.1
			Ra-228	4.2±1.0	3.6±0.5	2.7-4.5
			Uranium	3.0±0.1	3.0±6.0	0.0-13.4
	Sample B		Sr-89	14.3±1.3	16.0±5.0	7.3-24.7
			Sr-90	9.7±0.4	10.0±1.5	7.4-12.6
			Co-60	16.7±3.0	16.0±5.0	7.3-24.7
			Cs-134	16.7±2.3	16.0±5.0	7.3-24.7
			Cs-137	24.3±3.3	24.0±5.0	15.3-32.7
STW-516	Water	Oct 1987	Cr-51	80.3±17.5	70.0±5.0	61.3-78.7
			Co-60	16.0±2.3	15.0±5.0	6.3-23.7
	Sample A		Zn-65	46.3±5.6	46.0±5.0	37.3-54.7
			Ru-106	57.3±15.4	61.0±5.0	52.3-69.7
			Cs-134	23.7±2.5	25.0±5.0	16.3-33.7
			Cs-137	51.7±3.2	51.0±5.0	42.3-59.7
STU-517	Urine	Nov 1987	H-3	7267±100	7432±743	6145-8719
STW-518	Water	Nov 1987	Gr. alpha	3.0±2.0	7.0±5.0	0.0-15.7
			Gr. beta	15.7±2.3	19.0±5.0	10.3-27.7
STW-519	Water	Dec 1987	I-131	26.0±3.0	25.0±6.0	15.6-36.4

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STW-520	Water	Dec 1987	Ra-226	5.1±0.8	4.8±0.7	3.6-6.0
			Ra-228	3.4±0.1	5.3±0.8	3.9-6.7
STW-521	Water	Jan 1988	Sr-89	27.3±5.0	30.0±5.0	21.3-38.7
			Sr-90	15.3±1.2	15.0±1.5	12.4-17.6
STW-523	Water	Jan 1988	Gr. alpha	2.3±1.2	4.0±5.0	0.0-12.7
			Gr. beta	7.7±1.2	8.0±5.0	0.0-16.7
STF-524	Food	Jan 1988	Sr-89	44.0±4.0	46.0±5.0	37.3-54.7
			Sr-90	53.0±2.0	55.0±2.8	50.2-59.8
			I-131	102.3±4.2	102.0±10.2	84.3-119.7
			Cs-137	95.7±6.4	91.0±5.0	82.3-99.7
			K	1011±158	1230±62	1124-1336
STW-525	Water	Feb 1988	Co-60	69.3±2.3	69.0±5.0	60.3-77.7
			Zn-65	99.0±3.4	94.0±9.4	77.7-110.3
			Ru-106	92.7±14.4	105.0±10.5	86.8-123.2
			Cs-134	61.7±8.0	64.0±5.0	55.3-72.7
			Cs-137	99.7±3.0	94.0±5.0	85.3-102.7
STW-526	Water	Feb 1988	H-3	3453±103	3327±362	2700-3954
STW-527	Water	Feb 1988	Uranium	3.0±0.0	3.0±6.0	0.0-13.4
STM-528	Milk	Feb 1988	I-131	4.7±1.2	4.0±0.4	3.3-4.7
STW-529	Water	Mar 1988	Ra-226	7.1±0.6	7.6±1.1	5.6-9.6
			Ra-228	NA[e]	7.7±1.2	5.7-9.7
STW-530	Water	Mar 1988	Gr. alpha	4.3±1.2	6.0±5.0	0.0-14.7
			Gr. beta	13.3±1.3	13.0±5.0	4.3-21.7
STAF-531	Air Filter	Mar 1988	Gr. alpha	21.0±2.0	20.0±5.0	11.3-28.7
			Gr. beta	48.0±0.0	50.0±5.0	41.3-58.7
			Sr-90	16.7±1.2	17.0±1.5	14.4-19.6
			Cs-137	18.7±1.3	16.0±5.0	7.3-24.7
STW-532	Water	Apr 1988	I-131	9.0±2.0	7.5±0.8	6.2-8.8

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	TIML Result ±2σ[c]	Concentration in pCi/L[b] EPA Result[d] 1s, N=1	Control Limits
STW-533 534	Water (Blind)	Apr 1988				
	Sample A		Gr. alpha	ND[f]	46.0±11.0	27.0-65.0
			Ra-226	ND	6.4±1.0	4.7-8.1
			Ra-228	ND	5.6±0.8	4.2-7.0
			Uranium	6.0±0.0	6.0±6.0	0.0-16.4
	Sample B		Gr. beta	ND	57.0±5.0	48.3-65.7
			Sr-89	3.3±1.2	5.0±5.0	0.0-13.7
			Sr-90	5.3±1.2	5.0±1.5	2.4-7.6
			Co-60	63.3±1.3	50.0±5.0	41.3-58.7
			Cs-134	7.7±1.2	7.0±5.0	0.0-15.7
			Cs-137	8.3±1.2	7.0±5.0	0.0-15.7
STU-535	Urine	Apr 1988	H-3	6483±155	6202±620	5128-7276
STW-536	Water	Apr 1988	Sr-89	14.7±1.3	20.0±5.0	11.3-28.7
			Sr-90	20.0±2.0	20.0±1.5	17.4-22.6
STW-538	Water	Jun 1988	Cr-51	331.7±13.0	302.0±30.0	250.0-354.0
			Co-60	16.0±2.0	15.0±5.0	6.3-23.7
			Zn-65	107.7±11.4	101.0±10.0	83.7-118.3
			Ru-106	191.3±11.0	195.0±20.0	160.4-229.6
			Cs-134	18.3±4.6	20.0±5.0	11.3-28.7
			Cs-137	26.3±1.2	25.0±5.0	16.3-33.7
STW-539	Water	Jun 1988	H-3	5586±92	5565±557	4600-6530
STM-541	Milk	Jun 1988	Sr-89	33.7±11.4	40.0±5.0	31.3-48.7
			Sr-90	55.3±5.8	60.0±3.0	54.8-65.2
			I-131	103.7±3.1	94.0±9.0	78.4-109.6
			Cs-137	52.7±3.1	51.0±5.0	42.3-59.7
			K	1587±23	1600±80	1461-1739
STW-542	Water	Jul 1988	Gr. alpha	8.7±4.2	15.0±5.0	6.3-23.7
			Gr. beta	5.3±1.2	4.0±5.0	0.0-12.7
STF-543	Food	Jul 1988	Sr-89	ND[f]	33.0±5.0	24.3-41.7
			Sr-90	ND	34.0±2.0	30.5-37.5
			I-131	115.0±5.3	107.0±11.0	88.0-126.0
			Cs-137	52.7±6.4	49.0±5.0	40.3-57.7
			K	1190±66	1240±62	1133-1347

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b]		
					EPA Result[d]	
				TIML Result ±2σ[c]	1s, N=1	Control Limits
STW-544	Water	Aug 1988	I-131	80.0±0.0	76.0±8.0	62.1-89.9
STW-545	Water	Aug 1988	Pu-239	11.0±0.2	10.2±1.0	8.5-11.9
STW-546	Water	Aug 1988	Uranium	6.0±0.0	6.0±6.0	0.0-16.4
STAF-547	Air Filter	Aug 1988	Gr. alpha	8.0±0.0	8.0±5.0	0.0-16.7
			Gr. beta	26.3±1.2	29.0±5.0	20.3-37.7
			Sr-90	8.0±2.0	8.0±1.5	5.4-10.6
			Cs-137	13.0±2.0	12.0±5.0	3.3-20.7
STW-548	Water	Sep 1988	Ra-226	9.3±0.5	8.4±2.6	6.2-10.6
			Ra-228	5.8±0.4	5.4±1.6	4.0-6.8
STW-549	Water	Sep 1988	Gr. alpha	7.0±2.0	8.0±5.0	0.0-16.7
			Gr. beta	11.3±1.2	10.0±5.0	1.3-18.7
STW-550	Water	Oct 1988	Cr-51	252.0±14.0	251.0±25.0	207.7-294.3
			Co-60	26.0±2.0	25.0±5.0	16.3-33.7
			Zn-65	158.3±10.2	151.0±15.0	125.0-177.0
			Ru-106	153.0±9.2	152.0±15.0	126.0-178.0
			Cs-134	28.7±5.0	25.0±5.0	16.3-33.7
			Cs-137	16.3±1.2	15.0±5.0	6.3-23.7
STW-551	Water	[illegible] 1988	H-3	2333±127	2316±350	1710-2927
STW-552 553	Water (Blind)	Oct 1988				
	Sample A		Gr. alpha	38.3±8.0	41.0±10.0	23.7-58.3
			Ra-226	4.5±0.5	5.0±0.8	3.6-6.4
			Ra-228	4.4±0.6	5.2±0.8	3.6-6.4
			Uranium	4.7±1.2	5.0±6.0	0.0-15.4
	Sample B		Gr. beta	51.3±3.0	54.0±5.0	45.3-62.7
			Sr-89	3.7±1.2	11.0±5.0	2.3-19.7
			Sr-90	10.7±1.2	10.0±1.5	7.4-12.6
			Cs-134	15.3±2.3	15.0±5.0	6.3-23.7
			Cs-137	16.7±1.2	15.0±5.0	6.3-23.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	EPA Result[d] Control Limits
STM-554	Milk	Oct 1988	Sr-89	40.3±7.0	40.0±5.0	31.3-48.7
			Sr-90	51.0±2.0	60.0±3.0	54.8-65.2
			I-131	94.0±3.4	91.0±9.0	75.4-106.6
			Cs-137	45.0±4.0	50.0±5.0	41.3-58.7
			K	1500±45	1600±80	1461-1739
STU-555	Urine	Nov 1988	H-3	3030±209	3025±359	2403-3647
STW-556	Water	Nov 1988	Gr. alpha	9.0±3.5	9.0±5.0	0.3-17.7
			Gr. beta	9.7±1.2	9.0±5.0	0.3-17.7
STW-557	Water	Dec 1988	I-131	108.7±3.0	115.0±12.0	94.2-135.8
STW-559	Water	Jan 1989	Sr-89	40.0±8.7	40.0±5.0	31.3-48.7
			Sr-90	24.3±3.1	25.0±1.5	24.4-27.6
STW-560	Water	Jan 1989	Pu-239	5.8±1.1	4.2±0.4	3.5-4.9
STW-561	Water	Jan 1989	Gr. alpha	7.3±1.2	8.0±5.0	0.0-16.7
			Gr. beta	5.3±1.2	4.0±5.0	0.0-12.7
STW-562	Water	Feb 1989	Cr-51	245±46	235±24	193.4-276.6
			Co-60	10.0±2.0	10.0±5.0	1.3-18.7
			Zn-65	170±10	159±16	139.2-186.7
			Ru-106	181±7.6	178±18	146.8-209.2
			Cs-134	9.7±3.0	10.0±5.0	1.3-18.7
			Cs-137	11.7±1.2	10.0±5.0	1.3-18.7
STW-563	Water	Feb 1989	I-131	109.0±4.0	106.0±11.0	86.9-125.1
STW-564	Water	Feb 1989	H-3	2820±20	2754±356	2137-3371
STW-565	Water	Mar 1989	Ra-226	4.2±0.3	4.9±0.7	3.7-6.1
			Ra-228	1.9±1.0	1.7±0.3	1.2-2.2
STW-566	Water	Mar 1989	U	5.0±0.0	5.0±6.0	0.0-15.4
STW-567	Air Filter	Mar 1989	Gr. alpha	21.7±1.2	21.0±5.0	12.3-29.7
			Gr. beta	68.3±4.2	62.0±5.0	53.3-70.7
			Sr-90	20.0±2.0	20.0±1.5	17.4-22.6
			Cs-137	21.3±1.2	20.0±5.0	11.3-28.7

Table A-1. (continued)

				Concentration in pCi/L[b]		
					EPA Result[d]	
Lab Code	Sample Type	Date Collected	Analysis	TIML Result ±2σ[c]	1s, N=1	Control Limits
STW-568 569	Water (Blind)	Apr 1989				
	Sample A		Gr. alpha	22.7±2.3	29.0±7.0	16.9-41.2
			Ra-226	3.6±0.6	3.5±0.5	2.6-4.4
			Ra-228	2.6±1.0	3.6±0.5	2.7-4.5
			U	3.0±0.0	3.0±6.0	0.0-13.4
	Sample B		Gr. beta	52.3±6.1	57.0±5.0	43.3-65.7
			Sr-89	9.3±5.4	8.0±5.0	0.0-16.7
			Sr-90	7.0±0.0	8.0±1.5	5.4-10.6
			Cs-134	21.0±5.2	20.0±5.0	11.3-28.7
			Cs-137	23.0±2.0	20.0±5.0	11.3-28.7
STW-570	Milk	Apr 1989	Sr-89	26.0±10.0	39.0±5.0	30.3-47.7
			Sr-90	45.7±4.2	55.0±3.0	49.8-60.2
			Cs-137	54.0±6.9	50.0±5.0	41.3-58.7
			K-40	1521±208	1600±80	1461-1739
STW-5719	Water	May 1989	Sr-89	<0.7	6.0±5.0	0.0-14.7
			Sr-90	5.0±1.0	6.0±1.5	3.4-8.6
STW-572	Water	May 1989	Gr. alpha	24.0±2.0	30.0±8.0	16.1-43.9
			Gr. beta	49.3±15.6	50.0±5.0	41.3-58.7
STW-573	Water	Jun 1989	Ba-133	50.7±1.2	49.0±5.0.	40.3-57.7
			Co-60	31.3±2.3	31.0±5.0	22.3-39.7
			Zn-65	167±10	165±17	135.6-194.4
			Ru-106	123±9.2	128±13	105.5-150.5
			Cs-134	40.3±1.2	39±5	30.3-47.7
			Cs-137	22.3±1.2	20±5	11.3-28.7
STW-574	Water	Jun 1989	H-3	4513±136	4503±450	3724-5282
STW-575	Water	Jul 1989	Ra-226	16.8±3.1	17.7±2.7	13.0-22.4
			Ra-228	13.8±3.7	18.3±2.7	13.6-23.0
STW-576	Water	Jul 1989	U	40.3±1.2	41.0±6.0	30.6-51.4
STW-577	Water	Aug 1989	I-131	84.7±5.8	83.0±8.0	69.1-96.9
STAF-579	Air Filter	Aug 1989	Gr. alpha	6.0±0.0	6.0±5.0	0.0-14.7
			Cs-137	10.3±2.3	10.0±5.0	1.3-18.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
				Concentration in pCi/L[b]		
STW-580	Water	Sep 1989	Sr-89	14.7±1.2	14.0±5.0	5.3-22.7
			Sr-90	9.7±1.2	10.0±1.5	7.4-12.6
STW-581	Water	Sep 1989	Gr. alpha	5.0±0.0	4.0±5.0	0.0-12.7
			Gr. Beta	8.7±2.3	6.0±5.0	0.0-14.7
STW-583	Water	Oct 1989	Ba-133	60.3±10.0	59.0±6.0	48.6-69.4
			Co-60	29.0±4.0	30.0±5.0	21.1-38.7
			Zn-65	132.3±6.0	129.0±13.0	106.5-151.5
			Ru-106	155.3±6.1	161.0±16.0	133.3-188.7
			Cs-134	30.7±6.1	29.0±5.0	20.3-37.7
			Cs-137	66.3±4.6	59.0±5.0	50.3-67.7
STW-584	Water	Oct 1989	H-3	3407±150	3496±364	2866-4126
STW-585 586	Water (Blind)	Oct 1989				
	Sample A		Gr. Alpha	41.7±9.4	49.0±12.0	28.2-69.8
			Ra-226	7.9±0.4	8.4±1.3	6.2-10.6
			Ra-228	4.4±0.8	4.1±0.6	3.1-5.1
			U	12.0±0.0	12.0±6.0	1.6-22.4
	Sample B		Gr. Beta	31.7±2.3	32.0±5.0	23.3-40.7
			Sr-89	13.3±4.2	15.0±5.0	6.3-23.7
			Sr-90	7.0±2.0	7.0±3.0	4.4-9.6
			Cs-134	5.0±0.0	5.0±5.0	0.0-13.7
			Cs-137	7.0±0.0	5.0±5.0	0.0-13.7
STW-587	Water	Nov 1989	Ra-226	7.9±0.4	8.7±1.3	6.4-11.0
			Ra-228	8.9±1.2	9.3±1.2	6.9-11.7
STW-588	Water	Nov 1989	U	15.0±0.09	15.0±6.0	4.6-25.4
STW-589	Water	Jan 1990	Sr-89	22.7±5.0	25.0±5.0	16.3-33.7
			Sr-90	17.3±1.2	20.0±1.5	17.4-22.6
STW-591	Water	Jan 1990	Gr. Alpha	10.3±3.0	12.0±5.0	3.3-20.7
			Gr. Beta	12.3±1.2	12.0±5.0	3.3-20.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STW-592	Water	Jan 1990	Co-60	14.7±2.3	15±5.0	6.3-23.7
			Zn-65	135.0±6.9	139.0±14.0	114.8-163.2
			Ru-106	133.3±13.4	139.0±14.0	114.8-163.2
			Cs-134	17.3±1.2	18.0±5.0	9.3-26.7
			Cs-137	19.3±1.2	18.0±5.0	9.3-26.7
			Ba-133	78.0±0.0	74.0±7.0	61.9-86.1
STW-593	Water	Feb 1990	H-3	4827±83	4976±498	4113-5839
STW-594	Water	Mar 1990	Ra-226	5.0±0.2	4.9±0.7	4.1-5.7
			Ra-228	13.5±0.7	12.7±1.9	9.4-16.0
STW-595	Water	Mar 1990	U	4.0±0.0	4.0±6.0	0.0-14.4
STW-596	Air Filter	Mar 1990	Gr. Alpha	7.3±1.2	5.0±5.0	0.0-13.7
			Gr. Beta	34.0±0.0	31.0±5.0	22.3-39.7
			Sr-90	10.0±0.0	10.0±1.5	7.4-12.6
			Cs-137	9.3±1.2	10.0±5.0	1.3-18.7
STW-597 598	Water (Blind)	Apr 1990				
	Sample A		Gr. Alpha	81.0±3.5	90.0±23.0	50.1-129.9
			Ra-226	4.9±0.4	5.0±0.8	3.6-6.4
			Ra-228	10.6±0.3	10.2±1.5	7.6-12.8
			U	18.7±3.0	20.0±6.0	9.6-30.4
	Sample B		Gr. Beta	51.0±10.1	52.0±5.0	43.3-60.7
			Sr-89	9.3±1.2	10.0±5.0	1.3-18.7
			Sr-90	10.3±3.1	10.0±1.5	8.3-11.7
			Cs-134	16.0±0.0	15.0±5.0	6.3-23.7
			Cs-137	19.0±2.0	15.0±5.0	6.3-23.7
STM-599	Milk	Apr 1990	Sr-89	21.7±3.1	23.0±5.0	14.3-31.7
			Sr-90	21.0±7.0	23.0±5.0	14.3-31.7
			I-131	98.7±1.2	99.0±10.0	81.7-116.3
			Cs-137	26.0±6.0	24.0±5.0	15.3-32.7
			K	1300.0±69.2	1550.0±78.0	1414.7-1685.3
STW-600	Water	May 1990	Sr-89	6.0±2.0	7.0±5.0	0.0-15.7
			Sr-90	6.7±1.2	7.0±5.0	0.0-15.7
STW-601	Water	May 1990	Gr. Alpha	11.0±2.0	22.0±6.0	11.6-32.4
			Gr. Beta	12.3±1.2	15.0±5.0	6.3-23.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	EPA Result[d] Control Limits
STW-602	Water	Jun 1990	Co-60	25.3±2.3	24.0±5.0	15.3-32.7
			Zn-65	155.0±10.6	148.0±15.0	130.6-165.4
			Ru-106	202.7±17.2	210.0±21.0	173.6-246.4
			Cs-134	23.7±1.2	24.0±5.0	18.2-29.8
			Cs-137	27.7±3.1	25.0±5.0	16.3-33.7
			Ba-133	100.7±8.1	99.0±10.0	81.7-116.3
STW-603	Water	Jun 1990	H-3	2927±306	2933±358	2312-3554
STW-604	Water	Jul 1990	Ra-226	11.8±0.9	12.1±1.8	9.0-15.2
			Ra-228	4.1±1.4	5.1±1.3	2.8-7.4
STW-605	Water	Jul 1990	U	20.3±1.7	20.8±3.0	15.6-26.0
STW-606	Water	Aug 1990	I-131	43.0±1.2	39.0±6.0	28.6-49.4
STW-607	Water	Aug 1990	Pu-239	10.0±1.7	9.1±0.9	7.5-10.7
STW-608	Air Filter	Aug 1990	Gr. alpha	14.0±0.0	10.0±5.0	1.3-18.7
			Gr. beta	65.3±1.2	62.0±5.0	53.3-70.7
			Sr-90	19.0±6.9	20.0±5.0	11.3-28.7
			Cs-137	19.0±2.0	20.0±5.0	11.3-28.7
STW-609	Water	Sep 1990	Sr-89	9.0±2.0	10.0±5.0	1.3-18.7
			Sr-90	9.0±2.0	9.0±5.0	0.3-17.7
STM-610	Water	Sep 1990	Gr. alpha	8.3±1.2	10.0±5.0	1.3-18.7
			Gr. beta	10.3±1.2	10.0±5.0	1.3-18.7
STM-611	Milk	Sep 1990	Sr-89	11.7±3.1	16.0±5.0	7.3-24.7
			Sr-90	15.0±0.0	20.0±5.0	11.3-28.7
			I-131	63.0±6.0	58.0±6.0	47.6-68.4
			Cs-137	20.0±2.0	20.0±5.0	11.3-28.7
			K	1673.3±70.2	1700.0±85.0	1552.5-1847.5
STW-612	Water	Oct 1990	Co-60	20.3±3.1	20.0±5.0	11.3-28.7
			Zn-65	115.3±12.2	115.0±12.0	94.2-135.8
			Ru-106	152.0±8.0	151.0±15.0	125.0-177.0
			Cs-134	11.0±0.0	12.0±5.0	3.3-20.7
			Cs-137	14.0±2.0	12.0±5.0	3.3-20.7
			Ba-133	116.7±9.9	110.0±11.0	90.9-129.1
STW-613	Water	Oct 1990	H-3	7167±330	7203±720	5954-8452

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STW-614 615	Water	Oct 1990				
	Sample A		Gr. alpha	68.7±7.2	62.0±16.0	34.2-89.8
			Ra-226	12.9±0.3	13.6±2.0	10.1-17.1
			Ra-228	4.2±0.6	5.0±1.3	2.7-7.3
			U	10.4±0.6	10.2±3.0	5.0-15.4
	Sample B		Gr. beta	55.0±8.7	53.0±5.0	44.3-61.7
			Sr-89	15.7±2.9	20.0±5.0	11.3-28.7
			Sr-90	12.0±2.0	15.0±5.0	6.3-23.7
			Cs-134	9.0±1.7	7.0±5.0	0.0-15.7
			Cs-137	7.7±1.2	5.0±5.0	0.0-13.7
STW-616	Water	Nov 1990	Ra-226	6.8±1.0	7.4±1.1	5.5-9.3
			Ra-228	5.3±1.7	7.7±1.9	4.4-11.0
STW-617[g]	Water	Nov 1990	U	35.0±0.4	35.5±3.6	29.3-41.7

[a] Results obtained by Teledyne Isotopes 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, Nevada.

[b] All results are in the pCi/l, except for elemental potassium (K) data in milk, which are in mg/l; air filter samples, which are in pCi/filter; and food, which is in mg/kg.

[c] Unless otherwise indicated, the TIML 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 EPA.

[e] NA = Not analyzed.

[f] ND = No data; not analyzed due to relocation of the lab.

[g] Sample was analyzed but the results not submitted to EPA because deadline was missed (all data on file).

Table A-2. Crosscheck program results, thermoluminescent dosimeters (TLDs).

Lab Code	TLD Type	Measurement	mR Teledyne Result ±2σ[a]	Known Value[c]	Average ±2σ[d] (All Participants)
2nd International Intercomparison[b]					
115-2	CaF_2:Mn Bulb	Field	17.0±1.9	17.1	16.4±7.7
		Lab	20.8±4.1	21.3	18.8±7.6
3rd International Intercomparison[e]					
115-3	CaF_2:Mn Bulb	Field	30.7±3.2	34.9±4.8	31.5±3.0
		Lab	89.6±6.4	91.7±14.6	86.2±24.0
4th International Intercomparison[f]					
115-4	CaF_2:Mn Bulb	Field	14.1±1.1	14.1±1.4	16.0±9.0
		Lab (Low)	9.3±1.3	12.2±2.4	12.0±7.4
		Lab (High)	40.4±1.4	45.8±9.2	43.9±13.2
5th International Intercomparison[g]					
115-5A	CaF_2:Mn Bulb	Field	31.4±1.8	30.0±6.0	30.2±14.6
		Lab at beginning	77.4±5.8	75.2±7.6	75.8±40.4
		Lab at the end	96.6±5.8	88.4±8.8	90.7±31.2
115-5B	LiF-100 Chips	Field	30.3±4.8	30.0±6.0	30.2±14.6
		Lab at beginning	81.1±7.4	75.2±7.6	75.8±40.4
		Lab at the end	85.4±11.7	88.4±8.8	90.7±31.2
7th International Intercomparison[h]					
115-7A	LiF-100 Chips	Field	75.4±2.6	75.8±6.0	75.1±29.8
		Lab (Co-60)	80.0±3.5	79.9±4.0	77.9±27.6
		Lab (Cs-137)	66.6±2.5	75.0±3.8	73.0±22.2

Table A-2. (continued)

Lab Code	TLD Type	Measurement	mR: Teledyne Result ±2σ[a]	mR: Known Value[c]	mR: Average ±2σ[d] (All Participants)
115-7B	CaF_2:Mn Bulbs	Field	71.5±2.6	75.8±6.0	75.1±29.8
		Lab (Co-60)	84.8±6.4	79.9±4.0	77.9±27.6
		Lab (Cs-137)	78.8±1.6	75.0±3.8	73.0±22.2
115-7C	$CaSO_4$:Dy Cards	Field	76.8±2.7	75.8±6.0	75.1±29.8
		Lab (Co-60)	82.5±3.7	79.9±4.0	77.9±27.6
		Lab (Cs-137)	79.0±3.2	75.0±3.8	73.0±22.2
<u>8th International Intercomparison</u>[i]					
115-8A	LiF-100 Chips	Field Site 1	29.5±1.4	29.7±1.5	28.9±12.4
		Field Site 2	11.3±0.8	10.4±0.5	10.1±9.06
		Lab (Cs-137)	13.7±0.9	17.2±0.9	16.2±6.8
115-8B	CaF_2:Mn Bulbs	Field Site 1	32.3±1.2	29.7±1.5	28.9±12.4
		Field Site 2	9.0±1.0	10.4±0.5	10.1±9.0
		Lab (Cs-137)	15.8±0.9	17.2±0.9	16.2±6.8
115-8C	$CaSO_4$:Dy Cards	Field Site 1	32.3±0.7	29.7±1.5	28.9±12.4
		Field Site 2	10.6±0.6	10.4±0.5	10.1±9.0
		Lab (Cs-137)	18.1±0.8	17.2±0.9	16.2±6.8
<u>Teledyne Testing</u>[j]					
89-1	LiF-100 Chips	Lab	21.0±0.4	22.4	--
89-2	Teledyne $CaSO_4$:Dy Cards	Lab	20.9±1.0	20.3	--

Table A-2. (continued)

Lab Code	TLD Type	Measurement	mR Teledyne Result ±2σ[a]	Known Value[c]	Average ±2σ[d] (All Participants)
Teledyne Testing[j]					
90-1[k]	Teledyne $CaSO_4$:Dy Cards	Lab	20.6±1.4	19.6	--
90-1[l]	Teledyne $CaSO_4$:Dy Cards	Lab	100.8±4.3	100.0	--

a Lab result given is the mean ±2 standard deviations of three determinations.

b Second International Intercomparison of Environmental Dosimeters conducted in April of 1976 by the Health and Safety Laboratory (GASL), New York, New York, and the School of Public Health of the University of Texas, Houston, Texas.

c Value determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.

d Mean ±2 standard deviations of results obtained by all laboratories participating in the program.

e Third International Intercomparison of Environmental Dosimeters conducted in summer of 1977 by Oak Ridge National Laboratory and the School of Public Health of the University of Texas, Houston, Texas.

f Fourth International Intercomparison of Environmental Dosimeters conducted in summer of 1979 by the School of Public Health of the University of Texas, Houston, Texas.

g Fifth International Intercomparison of Environmental Dosimeter conducted in fall of 1980 at Idaho Falls, Idaho and sponsored by the School of Public Health of the University of Texas, Houston, Texas and Environmental Measurements Laboratory, New York, New York, U.S. Department of Energy.

h 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 U.S. Nuclear Regulatory Commission, and the U.S. Environmental Protection Agency.

i 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.

j Chips were submitted in September 1989 and cards were submitted in November 1989 to Teledyne Isotopes, Inc., Westwood, NJ for irradiation.

k Cards were irradiated by Teledyne Isotopes, Inc., Westwood, NJ on June 19, 1990.

l Cards were irradiated by Dosimetry Associates, Inc., Northville, MI on October 30, 1990.

Table A-3. In-house spiked samples.

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L) TIML Result n=3	Known Activity	Expected Precision 1s, n=3[a]
QC-MI-6	Milk	Feb 1986	Sr-89	6.0±1.9	6.4±3.0	8.7
			Sr-90	14.2±1.7	12.9±2.0	5.2
			I-131	34.2±3.8	35.2±3.5	10.4
			Cs-134	32.0±1.8	27.3±5.0	8.7
			Cs-137	35.8±2.1	35.0±5.0	8.7
QC-W-14	Water	Mar 1986	Sr-89	1.6±0.4	1.6±1.0	7.1
			Sr-90	2.4±0.2	2.4±2.0	4.2
QC-W-15	Water	Apr 1986	I-131	44.9±2.4	41.5±7.0	10.6
			Co-60	10.6±1.7	12.1±5.0	7.1[b]
			Cs-134	30.2±2.4	25.8±8.0	7.1[b]
			Cs-137	21.9±1.9	19.9±5.0	7.1[b]
QC-MI-7	Milk	Apr 1986	I-131	39.7±3.3	41.5±7.0	10.4
			Cs-134	28.7±2.8	25.8±8.0	8.7
			Cs-137	21.2±2.8	19.9±5.0	8.7
SPW-1	Water	May 1986	Gr. alpha	15.8±1.8	18.0±5.0	5[c]
QC-W-16	Water	Jun 1986	Gr. alpha	16.2±0.7	16.9±2.5	8.7
			Gr. beta	38.4±3.5	30.2±5.0	8.7
QC-MI-9	Milk	Jun 1986	Sr-89	<1.0	0.0	7.1[b]
			Sr-90	12.6±1.8	13.3±3.0	4.2[b]
			I-131	38.9±7.0	34.8±7.0	10.4
			Cs-134	33.0±3.4	36.1±5.0	8.7
			Cs-137	38.5±2.8	39.0±5.0	8.7
SPW-2	Water	Jun 1986	Gr. alpha	16.8±1.8	18.0±5.0	5[c]
SPW-3	Water	Jun 1986	Gr. alpha	17.7±0.8	18.0±5.0	5[c]
QC-W-18	Water	Sep 1986	Cs-134	34.7±5.6	31.3±5.0	8.7
			Cs-137	51.1±7.0	43.3±8.0	8.7
QC-W-19	Water	Sep 1986	Sr-89	13.6±4.1	15.6±3.5	7.1[b]
			Sr-90	6.4±1.6	6.2±2.0	4.2[b]

Table A-3. In-house spiked samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L) TIML Result n=3	Known Activity	Expected Precision 1s, n=3[a]
QC-W-21	Water	Oct 1986	Co-60	19.2±2.2	18.5±3.0	8.7
			Cs-134	31.7±5.2	25.6±8.0	8.7
			Cs-137	23.8±1.0	21.6±5.0	8.7
QC-MI-11	Milk	Oct 1986	Sr-89	12.3±1.8	14.3±3.0	8.7
QC-W-20	Water	Nov 1986	H-3	3855±180	3960±350	520[b]
QC-W-22	Water	Dec 1986	Gr. alpha	9.8±1.4	11.2±4.0	8.7
			Gr. beta	21.7±2.0	23.8±5.0	8.7
QC-W-23	Water	Jan 1987	I-131	29.8±2.5	27.9±3.0	10.4
QC-MI-12	Milk	Jan 1987	I-131	36.5±1.3	32.6±5.0	10.4
			Cs-137	32.6±4.2	27.4±8.0	8.7
QC-MI-13	Milk	Jan 1987	Sr-89	10.4±2.1	12.2±4.0	8.7
			Sr-90	14.6±1.6	12.6±3.0	5.2
			I-131	49.5±1.2	54.9±8.0	10.4
			Cs-134	<1.6	0.0	8.7
			Cs-137	33.3±0.6	27.4±8.0	8.7
QC-W-24	Water	Mar 1987	Sr-89	24.7±3.6	25.9±5.0	8.7
			Sr-90	23.9±3.8	22.8±8.0	5.2
QC-W-25	Water	Apr 1987	I-131	28.0±1.9	29.3±5.0	10.6
QC-MI-14	Milk	Apr 1987	I-131	25.0±2.2	23.9±5.0	10.4
			Cs-134	<2.1	0.0	8.7
			Cs-137	34.2±2.0	27.2±7.0	8.7
QC-W-26	Water	Jun 1987	H-3	3422±100	3362±300	520
			Co-60	24.8±1.4	26.5±7.0	8.7
			Cs-134	<2.0	0.0	8.7
			Cs-137	21.2±0.5	21.6±7.0	8.7
QC-W-27	Water	Jun 1987	Gr. alpha	8.5±1.9	10.1±4.0	8.7
			Gr. beta	22.6±1.9	21.2±5.0	8.7
QC-W-28	Water	Jun 1987	Gr. alpha	8.7±1.3	10.1±4.0	8.7
			Gr. beta	12.2±5.2	9.4±3.0	8.7

Table A-3. In-house spiked samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L) TIML Result n=3	Known Activity	Expected Precision 1s, n=3[a]
QC-W-29	Water	Jun 1987	Gr. alpha	16.4±1.3	18.9±5.0	8.7
			Gr. beta	15.9±4.0	11.8±4.0	8.7
QC-MI-15	Milk	Jul 1987	Sr-90	19.4±1.6	18.8±3.5	5.2
			I-131	43.5±0.7	45.3±7.0	10.4
			Cs-134	17.9±2.2	16.0±5.3	8.7
			Cs-137	25.4±1.8	22.7±5.0	8.7
QC-W-30	Water	Sep 1987	Sr-89	17.5±3.0	14.3±5.0	8.7
			Sr-90	18.4±2.2	17.5±2.2	5.2
QC-W-31	Water	Oct 1987	H-3	2053±939	2059±306	520
QC-W-32	Water	Dec 1987	Gr. alpha	8.6±1.0	10.1±5.0	8.7
			Gr. beta	15.2±0.1	13.1±3.0	8.7
QC-W-33	Water	Dec 1987	Gr. alpha	7.7±1.4	10.1±5.0	8.7
			Gr. beta	10.9±1.0	7.9±3.0	8.7
QC-W-34	Water	Dec 1987	Gr. alpha	4.0±0.9	5.1±3.0	8.7
			Gr. beta	9.4±0.9	7.9±3.0	8.7
QC-MI-16	Milk	Feb 1988	Sr-89	31.8±4.7	31.7±6.0	8.7
			Sr-90	25.5±2.7	27.8±3.5	5.2
			I-131	26.4±0.5	23.2±5.0	10.4
			Cs-134	23.8±2.3	24.2±6.0	8.7
			Cs-137	26.5±0.8	25.1±6.0	8.7
QC-MI-17	Milk	Feb 1988	I-131	10.6±1.2	14.3±1.6	10.4
QC-W-35	Water	Feb 1988	I-131	9.7±1.1	11.6±1.1	10.4
QC-W-36	Water	Feb 1988	I-131	10.5±1.3	11.6±1.0	10.4
QC-W-37	Water	Mar 1988	Sr-89	17.1±2.0	19.8±8.0	8.7
			Sr-90	18.7±0.9	17.3±5.0	5.2
QC-MI-18	Milk	Mar 1988	I-131	33.2±2.3	26.7±5.0	10.4
			Cs-134	[illegible]1.3±2.1	30.2±5.0	8.7
			Cs-137	29.9±1.4	26.2±5.0	8.7

Table A-3. In-house spiked samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L) TIML Result n=3	Known Activity	Expected Precision 1s, n=3[a]
QC-W-38	Water	Apr 1988	I-131	17.1±1.1	14.2±5.0	10.4
QC-W-39	Water	Apr 1988	H-3	4439±31	4176±500	724
QC-W-40	Water	Apr 1988	Co-60	23.7±0.5	26.1±4.0	8.7
			Cs-134	25.4±2.6	29.2±4.5	8.7
			Cs-137	26.6±2.3	26.2±4.0	8.7
QC-W-41	Water	Jun 1988	Gr. alpha	12.3±0.4	13.1±5.0	8.7
			Gr. beta	22.6±1.0	20.1±5.0	8.7
QC-MI-19	Milk	Jul 1988	Sr-89	15.1±1.6	16.4±5.0	8.7
			Sr-90	18.0±0.6	18.3±5.0	5.2
			I-131	88.4±4.9	86.6±8.0	10.4
			Cs-137	22.7±0.8	20.8±6.0	8.7
QC-W-42	Water	Sep 1988	Sr-89	48.5±3.3	50.8±8.0	8.7
			Sr-90	10.9±1.0	11.4±3.5	5.2
QC-W-43	Water	Oct 1988	Co-60	20.9±3.2	21.4±3.5	8.7
			Cs-134	38.7±1.6	38.0±6.0	8.7
			Cs-137	19.0±2.4	21.0±3.5	8.7
QC-W-44	Water	Oct 1988	I-131	22.2±0.6	23.3±3.5	10.4
QC-W-45	Water	Oct 1988	H-3	4109±43	4153±500	724
QC-MI-20	Milk	Oct 1988	I-131	59.8±0.9	60.6±9.0	10.4
			Cs-134	49.6±1.8	48.6±7.5	8.7
			Cs-137	25.8±4.6	24.7±4.0	8.7
QC-W-46	Water	Dec 1988	Gr. alpha	11.5±2.3	15.2±5.0	8.7
			Gr. beta	26.5±2.0	25.7±5.0	8.7
QC-MI-21	Milk	Jan 1989	Sr-89	25.5±10.3	34.0±10.0	8.7
			Sr-90	28.3±3.2	27.1±3.0	5.2
			I-131	540±13	550±20	10.4
			Cs-134	24.5±2.6	22.6±5.5	8.7
			Cs-137	24.0±0.6	20.5±5.0	8.7

Table A-3. In-house spiked samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L) TIML Result n=3	Known Activity	Expected Precision 1s, n=3[a]
QC-W-47	Water	Mar 1989	Sr-89	15.2±3.8	16.1±5.0	8.7
			Sr-90	16.4±1.7	16.9±3.0	5.2
QC-MI-22	Milk	Apr 1989	I-131	36.3±1.1	37.2±5.0	10.4
			Cs-134	20.8±2.8	20.7±8.0	8.7
			Cs-137	22.2±2.4	20.4±8.0	8.7
QC-W-48	Water	Apr 1989	Co-60	23.5±2.0	25.1±8.0	8.7
			Cs-134	24.2±1.1	25.9±8.0	8.7
			Cs-137	23.6±1.2	23.0±8.0	8.7
QC-W-49	Water	Apr 1989	I-131	37.2±3.7	37.2±5.0	10.4
QC-W-50	Water	Apr 1989	H-3	3011±59	3089±500	724
QC-W-51	Water	Jun 1989	Gr. alpha	13.0±1.8	15.0±5.0	8.7
			Gr. beta	26.0±1.2	25.5±8.0	8.7
QC-MI-23	Milk	Jul 1989	Sr-89	19.4±6.5	22.0±10.0	8.7
			Sr-90	27.6±3.5	28.6±3.0	5.2
			I-131	46.8±3.2	43.4±5.0	10.4
			Cs-134	27.4±1.8	28.3±6.0	8.7
			Cs-137	24.1±1.8	20.8±6.0	8.7
QC-MI-24	Milk	Aug 1989	Sr-89	25.4±2.7	27.2±10.0	8.7
			Sr-90	46.0±1.1	47.8±9.6	8.3
QC-W-52	Water	Sep 1989	I-131	9.6±0.3	9.7±1.9	10.4
QC-W-53	Water	Sep 1989	I-131	19.0±0.2	20.9±4.2	10.4
QC-W-54	Water	Sep 1989	Sr-89	25.8±4.6	24.7±4.0	8.7
			Sr-90	26.5±5.3	29.7±5.0	5.2
QC-MI-25	Milk	Oct 1989	I-131	70.0±3.3	73.5±20.0	10.4
			Cs-134	22.1±2.6	22.6±8.0	8.7
			Cs-137	29.4±1.5	27.5±8.0	8.7
QC-W-55	Water	Oct 1989	I-131	33.3±1.3	35.3±10.0	10.4

Table A-3. In-house spiked samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L) TIML Result n=3	Known Activity	Expected Precision 1s, n=3[a]
QC-W-56	Water	Oct 1989	Co-60	15.2±0.9	17.4±5.0	8.7
			Cs-134	22.1±4.4	18.9±8.0	8.7
			Cs-137	27.2±1.2	22.9±8.0	8.7
QC-W-57	Water	Oct 1989	H-3	3334±22	3379±500	724
QC-W-58	Water	Nov 1989	Sr-89	10.9±1.4[d]	11.1±1.0[d]	8.7
			Sr-90	10.4±1.0[d]	10.3±1.0[d]	5.2
QC-W-59	Water	Nov 1989	Sr-89	101.0±6.0[d]	104.1±10.5[d]	17.5
			Sr-90	98.0±3.0[d]	95.0±10.0[d]	17.0
QC-W-60	Water	Dec 1989	Gr. alpha	10.8±1.1	10.6±4.0	8.7
			Gr. beta	11.6±0.5	11.4±4.0	8.7
QC-MI-26	Milk	Jan 1990	Cs-134	19.3±1.0	20.8±8.0	8.7
			Cs-137	25.2±1.2	22.8±8.0	8.7
QC-MI-27	Milk	Feb 1990	Sr-90	18.0±1.6	18.8±5.0	5.2
QC-MI-28	Milk	Mar 1990	I-131	63.8±2.2	62.6±6.0	6.3
QC-MI-61	Water	Apr 1990	Sr-89	17.9±5.5	23.1±8.7	8.7
			Sr-90	19.4±2.5	23.5±5.2	5.2
QC-MI-29	Milk	Apr 1990	I-131	90.7±9.2	82.5±8.5	10.4
			Cs-134	18.3±1.0	19.7±5.0	8.7
			Cs-137	20.3±1.0	18.2±5.0	8.7
QC-W-62	Water	Apr 1990	Co-60	8.7±0.4	9.4±5.0	8.7
			Cs-134	20.0±0.2	19.7±5.0	8.7
			Cs-137	28.7±1.4	22.7±5.0	8.7
QC-W-63	Water	Apr 1990	I-131	63.5±8.0	66.0±6.7	6.6
QC-W-64	Water	Apr 1990	H-3	1941±130	1826.0±350.0	724
QC-W-65	Water	Jun 1990	Ra-226	6.4±0.2	6.9±1.0	1.0
QC-W-66	Water	Jun 1990	U	6.2±0.2	6.0±6.0	6.0

Table A-3. In-house spiked samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L) TIML Result n=3	Known Activity	Expected Precision 1s, n=3[a]
QC-MI-30	Milk	Jul 1990	Sr-89	12.8±0.4	18.4±10.0	8.7
			Sr-90	18.2±1.4	18.7±6.0	5.2
			Cs-134	46.0±1.3	49.0±5.0	8.7
			Cs-137	27.6±1.3	25.3±5.0	8.7
QC-W-68	Water	Jun 1990	Gr. alpha	9.8±0.3	10.6±6.0	8.7
			Gr. beta	11.4±0.6	11.3±7.0	8.7
QC-MI-31	Milk	Aug 1990	I-131	68.8±1.6	61.4±12.3	10.4
QC-W-69	Water	Sep 1990	Sr-89	17.7±1.6	19.2±10.0	8.7
			Sr-90	13.9±1.6	17.4±10.0	5.2
QC-MI-32	Milk	Oct 1990	I-131	34.8±0.2	32.4±6.5	8.7
			Cs-134	25.8±1.2	27.3±10.0	8.7
			Cs-137	25.3±2.0	22.4±10.0	8.7
QC-W-70	Water	Oct 1990	H-3	2355±59	2276±455	605
QC-W-71	Water	Oct 1990	I-131	55.9±0.9	51.8±10.4	10.4
QC-W-73	Water	Oct 1990	Co-60	18.3±2.7	16.8±5.0	8.7
			Cs-134	28.3±2.3	27.0±5.0	8.7
			Cs-137	22.7±1.3	22.4±5.0	8.7
QC-W-74	Water	Dec 1990	Gr. alpha	21.4±1.0	26.1±6.5	11.3
			Gr. beta	25.9±1.0	22.3±5.6	9.7

[a] n = 3 unless noted otherwise.
[b] n = 2 unless noted otherwise.
[c] n = 1 unless noted otherwise.
[d] Concentration in pCi/ml.

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L) Results (4.66 σ)	Acceptance Criteria (4.66 σ)
BL-1	D.I. Water	Nov 1985	Gross alpha	<0.1	<1
			Gross beta	<0.4	<4
BL-2	D.I. Water	Nov 1985	Cs-137 (gamma)	<1.9	<10
BL-3	D.I. Water	Nov 1985	Sr-89	<0.5	<5
			Sr-90	<0.6	<1
BL-5	D.I. Water	Nov 1985	Ra-226	<0.4	<1
			Ra-228	<0.4	<1
SPW-2265	D.I. Water	Apr 1985	Gross alpha	<0.6	<1
			Gross beta	<2.2	<4
			Sr-89	<0.2	<5
			Sr-90	<0.4	<1
			I-131	<0.2	<1
			Cs-137 (gamma)	<7.4	<10
BL-6	D.I. Water	Apr 1986	Gross alpha	<0.4	<1
BL-7	D.I. Water	Apr 1986	Gross alpha	<0.4	<1
BL-8	D.I. Water	Jun 1986	Gross alpha	<0.4	<1
BL-9	D.I. Water	Jun 1986	Gross alpha	<0.3	<1
SPW-3185	D.I. Water	Jan 1987	Ra-226	<0.1	<1
			Ra-228	<0.9	<1
SPS-3292	Milk	Jan 1987	I-131	<0.1	<1
			Cs-134	<6.2	<10
			Cs-137	<6.4	<10
SPW-3554	D.I. Water	Feb 1987	H-3	<180	<300
			Gross beta	<2.6	<4
SPS-3555	Milk	Feb 1987	Sr-89	<0.6	<5
			Sr-90	1.9±0.4[a]	<1
SPS-3731	Milk	Mar 1987	Cs-134	<2.2	<10
			Cs-137	<2.5	<10

Table A-4. In-house "blank" samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L) Results (4.66 σ)	Acceptance Criteria (4.66 σ)
SPS-3732	D.I. Water	Mar 1987	Sr-89	<0.9	<5
			Sr-90	<0.8	<1
			I-131	<0.3	<1
			Co-60	<2.3	<10
			Cs-134	<2.2	<10
			Cs-137	<2.4	<10
			Ra-226	<0.1	<1
			Ra-228	<1.0	<1
			Np-237	<0.04	<1
			Th-230	<0.05	<0.1
			Th-232	<0.02	<0.1
			U-234	<0.05	<0.1
			U-235	<0.03	<0.1
			U-238	<0.03	<0.1
SPS-4023	Milk	May 1987	I-131	<0.1	<1
SPS-4203	D.I. Water	May 1987	Gross alpha	<0.7	<1
			Gross beta	<1.7	<4
SPS-4204	Milk	May 1987	Sr-89	<0.5	<5
			Sr-90	2.4±0.6[a]	<1
SPS-4390	Milk	Jun 1987	Cs-134	<4.7	<10
			Cs-137	<5.2	<10
SPS-4391	D.I. Water	Jun 1987	Sr-89	<0.4	<5
			Sr-90	<0.4	<1
			I-121	<0.1	<1
			Co-60	<3.8	<10
			Cs-137	<5.7	<10
			Ra-226	<0.1	<1
			Ra-228	<0.9	<1
SPW-4627	D.I. Water	Aug 1987	Gross alpha	<0.6	<1
			Gross beta	<1.4	<4
			Tritium	<150	<300
SPS-4628	Milk	Aug 1987	Sr-89	<0.6	<5
			Sr-90	2.4±0.6[a]	<1

Table A-4. In-house "blank" samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L) Results (4.66 σ)	Acceptance Criteria (4.66 σ)
SPS-4847	Milk	Sep 1987	Cs-134	<4.4	<10
			Cs-137	<5.3	<10
SPS-4848	D.I. Water	Sep 1987	I-131	<0.2	<1
SPW-4849	D.I. Water	Sep 1987	Co-60	<4.1	<10
			Cs-134	<4.8	<10
			Cs-137	<4.0	<10
			Sr-89	<0.7	<5
			Sr-90	<0.7	<1
SPW-4850	D.I. Water	Sep 1987	Th-228	<0.04	<1
			Th-232	<0.3	<1
			U-234	<0.03	<1
			U-235	<0.03	<1
			U-238	<0.02	<1
			Am-241	<0.06	<1
			Cm-242	<0.04	<1
			Ra-226	<0.1	<1
			Ra-228	<1.0	<2
SPW-4859	D.I. Water	Oct 1987	Fe-55	<0.5	<1
SPS-5348	Milk	Dec 1987	Cs-134	<2.3	<10
			Cs-137	<2.5	<10
SPW-5384	D.I. Water	Dec 1987	Co-60	<2.8	<10
			Cs-134	<2.6	<10
			Cs-137	<2.8	<10
			I-131	<0.2	<1
			Ra-226	<0.1	<1
			Ra-228	<1.2	<2
			Sr-89	<0.5	<1
			Sr-90	<0.4	<1
SPW-5385	D.I. Water	Nov 1987	Gross alpha	<0.4	<1
			Gross beta	<2.2	<4
			Fe-55	<0.3	<1
SPS-5386	Milk	Jan 1988	I-131	<0.1	<1
SPW-5448	"Dead" Water	Jan 1988	H-3	<177	<300

Table A-4. In-house "blank" samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L) Results (4.66 σ)	Acceptance Criteria (4.66 σ)
SPS-5615	Milk	Mar 1988	Cs-134	<2.4	<10
			Cs-137	<2.5	<10
			I-131	<0.3	<1
			Sr-89	<0.4	<5
			Sr-90	2.4±0.5[a]	<1
SPS-5650	D.I. Water	Mar 1988	Th-228	<0.3	<1
			Th-230	<0.04	<1
			Th-232	<0.05	<1
			U-234	<0.03	<1
			U-235	<0.03	<1
			U-238	<0.03	<1
			Am-241	<0.06	<1
			Cm-242	<0.01	<1
			Pu-238	<0.08	<1
			Pu-240	<0.02	<1
SPS-6090	Milk	Jul 1988	Sr-89	<0.5	<1
			Sr-90	1.8±0.5	<1
			I-131	<0.4	<1
			Cs-137	<0.4	<10
SPW-6209	Water	Jul 1988	Fe-55	<0.8	<1
SPW-6292	Water	Sep 1988	Sr-89	<0.7	<1
			Sr-90	<0.7	<1
SPS-6477	Milk	Oct 1988	I-131	<0.2	<1
			Cs-134	<6.1	<10
			Cs-137	<5.9	<10
SPW-6478	Water	Oct 1988	I-131	<0.2	<1
SPW-6479	Water	Oct 1988	Co-60	<5.7	<10
			Cs-134	<3.7	<10
			Cs-137	<4.3	<10
SPW-6480	Water	Oct 1988	H-3	<170	<300
SPW-6625	Water	Dec 1988	Gross alpha	<0.7	<1
			Gross beta	<1.9	<4

Table A-1. In-house "blank" samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L) Results (4.66 σ)	Acceptance Criteria (4.66 σ)
SPS-6723	Milk	Jan 1989	Sr-89	<0.6	<5
			Sr-90	1.9±0.5[a]	<1
			I-131	<0.2	<1
			Cs-134	<4.3	<10
			Cs-137	<4.4	<10
SPW-6877	Water	Mar 1989	Sr-89	<0.4	<5
			Sr-90	<0.6	<1
SPS-6963	Milk	Apr 1989	I-131	<0.3	<1
			Cs-134	<5.9	<10
			Cs-137	<6.2	<10
SPW-7561	Water	Apr 1989	H-3	<150	<300
SPW-7207	Water	Jun 1989	Ra-226	<0.2	<1
			Ra-228	<0.6	<1
SPS-7208	Milk	Jun 1989	Sr-89	<0.6	<5
			Sr-90	2.1±0.5[a]	<1
			I-131	<0.3	<1
			Cs-134	<6.4	<10
			Cs-137	<7.2	<10
SPW-7558	Water	Jun 1989	Gross alpha	<0.2	<1
			Gross beta	<1.0	<4
SPS-7322	Milk	Aug 1989	Sr-89	<1.4	<5
			Sr-90	4.8±1.0[a]	<1
			I-131	<0.2	<1
			Cs-134	<6.9	<10
			Cs-137	<8.2	<10
SPW-7559	Water	Sep 1989	Sr-89	<2.0	<5
			Sr-90	<0.7	<1
SPW-7560	Water	Oct 1989	I-131	<0.1	<1
SPW-7562	Water	Oct 1989	H-3	<140	<300

Table A-4. In-house "blank" samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L) Results (4.66 σ)	Acceptance Criteria (4.66 σ)
SPS-7605	Milk	Nov 1989	I-131	<0.2	<1
			Cs-134	<8.6	<10
			Cs-137	<10	<10
SPW-7971	Water	Dec 1989	Gross alpha	<0.4	<1
			Gross beta	<0.8	<4
SPW-8039	Water	Jan 1990	Ra-226	<0.2	<1
SPS-8040	Milk	Jan 1990	Sr-89	<0.8	<5
			Sr-90	<1.0	<1
SPS-8208	Milk	Jan 1990	Sr-89	<0.8	<5
			Sr-90	1.6±0.5[a]	<1
			Cs-134	<3.6	<10
			Cs-137	<4.7	<10
SPS-8312	Milk	Feb 1990	Sr-89	<0.3	<5
			Sr-90	1.2±0.3[a]	<1
SPW-8312A	Water	Feb 1990	Sr-89	<0.5	<5
			Sr-90	<0.7	<1
SPS-8314	Milk	Mar 1990	I-131	<0.3	<1
SPS-8510	Milk	May 1990	I-131	<0.2	<1
			Cs-134	<4.6	<10
			Cs-137	<4.8	<10
SPW-8511A	Water	May 1990	H-3	<200	<300
SPS-8600	Milk	Jul 1990	Sr-89	<0.8	<5
			Sr-90	1.7±0.6[a]	<1
			I-131	<0.3	<1
			Cs-134	<5.0	<10
			Cs-137	<7.0	<10
SPM-8877	Milk	Aug 1990	I-131	<0.2	<1
SPW-8925	Water	Aug 1990	H-3	<200	<300

Table A-4. In-house "blank" samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L) Results (4.66 σ)	Acceptance Criteria (4.66 σ)
SPW-8926	Water	Aug 1990	Gross alpha	<0.3	<1
			Gross beta	<0.7	<4
SPW-8927	Water	Aug 1990	U-234	<0.01	<1
			U-235	<0.02	<1
			U-238	<0.01	<1
SPW-8928	Water	Aug 1990	Mn-54	<4.0	<5
			Co-58	<4.1	<5
			Co-60	<2.4	<5
			Cs-134	<3.3	<5
			Cs-137	<3.7	<5
SPW-8929	Water	Aug 1990	Sr-89	<1.4	<5
			Sr-89	<0.6	<1
SPW-69	Water	Sep 1990	Sr-89	<1.8	<5
			Sr-90	<0.8	<1
SPW-106	Water	Oct 1990	H-3	<180	<300
SPM-107	Milk	Oct 1990	I-131	<0.4	<1
			Cs-134	<3.3	<5
			Cs-137	<4.3	<5
SPW-370	Water	Oct 1990	Mn-54	<1.7	<5
			Co-58	<2.6	<5
			Co-60	<1.6	<5
			Cs-134	<1.7	<5
			Cs-137	<1.8	<5
SPW-372	Water	Dec 1990	Gross alpha	<0.3	<1
			Gross beta	<0.8	<4

[a] Low level of Sr-90 concentration in milk (1 - 5 pCi/L) is not unusual.

ATTACHMENT B

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

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

Analysis	Level	One Standard Deviation for Single Determination
Gamma Emitters	5 to 100 pCi/liter or kg >100 pCi/liter or kg	5 pCi/liter 5% of known value
Strontium-89[b]	5 to 50 pCi/liter or kg >50 pCi/liter or kg	5 pCi/liter 10% of known value
Strontium-90[b]	2 to 30 pCi/liter or kg >30 pCi/liter of kg	3.0 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 pCi/liter 25% of known value
Gross Beta	<100 pCi/liter >100 pCi/liter	5 pCi/liter 5% of known value
Tritium	<4,000 pCi/liter >4,000 pCi/liter	1s = (pCi/liter) = $169.85 \times (\text{known})^{.0933}$ 10% of known value
Radium-226, Radium-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 pCi/liter 10% of known value
Uranium-238, Nickel-63[b], Technetium-99[b]	<35 pCi/liter >35 pCi/liter	6 pCi/liter 15% of known value
Iron-55[b]	50 to 100 pCi/liter >100 pCi/liter	10 pCi/liter 10% of known value

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

[b] TIML limit.

ADDENDUM TO APPENDIX A

The following is an explanation of the reasons why certain samples were outside the control limit specified by the Environmental Protection Agency for the Interlaboratory Comparison Program starting January 1987.

Lab Code	Analysis	TIML Result (pCi/L)[a]	EPA Control Limit (pCi/L)[a]	Explanation
STM-504	Sr-89 Sr-90	57.0±4.3 32.0±1.0	60.3-77.7 32.4-37.6	Milk had high fat content which made analyses difficult. Addition of errors to TIML result would put values within EPA control limits. EPA also had the same problem in analyzing its own sample.
STW-511	Ra-228	8.1±1.4	4.6-8.0	TIML results are usually within EPA control limits. Analysis of the next sample was within EPA control limits. No further action is planned.
STW-516	Cr-51	80.3±17.5	61.3-78.7	Results in the past have been within EPA control limits and TIML will monitor the situation in the future.
STF-524	K	1010.7±158.5[b]	1123.5-1336.5[b]	Error in transference of data. Correct data was 1105±33 mg/kg. Results in the past have been within the limits and TIML will monitor the situation in the future.
STW-532	I-131	9.0±2.0	6.2-8.8	Sample recounted after 12 days. The average result was 8.8±1.7 pCi/L (within EPA control limits). The sample was recounted in order to check the decay. Results in the past have been within the limits and TIML will continue to monitor the situation in the future.

[a] Reported in pCi/L unless otherwise noted.
[b] Concentrations are reported in mg/kg.

ADDENDUM TO APPENDIX A (continued)

Lab Code	Analysis	TIML Result (pCi/L)[a]	EPA Control Limit (pCi/L)[a]	Explanation
STW-534	Co-60	63.3±1.3	41.3-58.7	High level of Co-60 was due to contamination of beaker. Beaker was discarded upon discovery of contamination and sample was recounted. Recount results 53.2±3.6 and 50.9±2.4 pCi/L.
STM-554	Sr-90	51.0±2.0	54.8-65.2	The cause of low result was due to very high fat content in the milk. It should be noted that 63% of all participants failed this test. Also, the average for all participants was 54.0 pCi/L before the Grubb and 55.8 pCi/L after the Grubb.
STW-560	Pu-239	5.8±1.1	3.5-4.9	The cause of high results is not known it is suspected that the standard was not properly calibrated by supplier and is under investigation. New Pu-236 standard was obtained and will be used for the next test.
STW-568	Ra-228	2.6±1.0	2.7-4.5	The cause of low results is not known. Next EPA crosscheck results were within the control limits. No further action is planned.
STM-570	Sr-89 Sr-90	26.0±10.0 45.7±4.2	30.3-47.7 49.8-60.2	The cause of low results was falsely high recovery due to suspected incomplete calcium removal. Since EPA sample was used up, internal spike was prepared and analyzed. The results were within control limits (See table A-3, sample QC-MI-24). No further action is planned.

[a] Reported in pCi/L unless otherwise noted.

ADDENDUM TO APPENDIX A (continued)

Lab Code	Analysis	TIML Result (pCi/L)[a]	EPA Control Limit (pCi/L)[a]	Explanation
STW-589	Sr-90	17.3±1.2	17.4-22.6	Sample was reanalyzed in triplicate; results of reanalyses 18.8±1.5 pCi/L. No further action is planned.
STM-599	K	1300.0±69.2[c]	1414.7-1685.3[c]	Sample was reanalyzed in triplicate. Results of reanalyses, 1421.7±95.3 mg/L. The cause of low results is unknown.
STW-601	Gross Alpha	11.0±2.0	11.6-32.4	Sample was reanalyzed in triplicate. Results of reanalyses, 13.4±1.0 pCi/L.

[a] Reported in pCi/L unless otherwise noted.
[c] Concentrations are reported in mg/L.