1981 ANNUAL ENVIRONMENTAL REPORT
RADIOLOGICAL - VOLUME #2

DUQUESNE LIGHT COMPANY
BEAVER VALLEY POWER STATION
AND
SHIPPINGPORT ATOMIC POWER STATION

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report

ABSTRACT

This report describes the Radiological Environmental Monitoring Program conducted during 1981 in the vicinity of the Beaver Valley Power Station and the Shippingport Atomic Power Station. The Radiological Environmental Program consists of on-site sampling of water and gaseous effluents and 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 1981.

The environmental program outlined in the Beaver Valley Power Station Technical Specifications was followed throughout 1981. There were no radioactive liquid effluents released from the Shippingport Atomic Power Station since radioactive liquids are processed and re-cycled within the plant systems.

The results of this environmental monitoring program show that Shippingport Atomic Power Station and Beaver Valley Power Station operations have not adversely affected the surrounding environment.

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report

TABLE OF CONTENTS

	Page
Abstract	i
I. INTRODUCTION	1
A. Scope and Objectives of the Program	1
B. Description of the Shippingport and Beaver Valley Site	2
II. RESULTS & CONCLUSIONS	6
III. ENVIRONMENTAL MONITORING CONSIDERATIONS	8
A. Environmental Quality Control Programs	8
B. Evaluation of the Quality Control (QC) Program Data	26
C. Standard Requirements and Limitations for Radiological and Other Effluents	27
D. Significant Changes and Reporting Levels	27
IV. MONITORING EFFLUENTS	30
A. Monitoring of Liquid Effluents	30
1. Effluent Treatment, Sampling, and Analytical Procedures	36
2. Results	37
B. Monitoring of Airborne Effluents	38
1. Description of Airborne Effluent Sources	38
2. Airborne Effluent Treatment and Sampling	43
3. Analytical Procedures for Sampling Airborne Effluents	47
4. Results	50
C. Solid Waste Disposal	52

TABLE OF CONTENTS (Continued)

			Page
V.	ENVIRONMENTAL MONITORING PROGRAM		
	A.	Environmental Radioactivity Monitoring Program	54
		1. Program Description	54
		2. China's Nuclear Test Fallout	54
		3. Summary of Results	74
		4. Quality Control Program	74
	B.	Air Monitoring	80
		1. Characterization of Air and Meteorology	80
		2. Air Sampling Program and Analytical Techniques	80
		3. Results and Conclusions	83
	C.	Monitoring of Sediments	86
		1. Characterization of Stream Sediments	86
		2. Sampling Program and Analytical Techniques	86
		3. Results and Conclusions	88
	D.	Monitoring of Feedcrops and Foodcrops	90
		1. Characterization of Vegetation and Foodcrops	90
		2. Sampling Program and Analytical Techniques	90
		3. Results and Conclusions	92
	E.	Monitoring of Local Cow's Milk	93
		1. Description - Milch Animal Locations	93
		2. Sampling Program and Analytical Techniques	93
		3. Results and Conclusions	96

TABLE OF CONTENTS (continued)

V. ENVIRONMENTAL MONITORING PROGRAM (continued) Page

F. Environmental Radiation Monitoring 98

1. Description of Regional Background Radiation Levels and Sources 98

2. Locations & Analytical Procedures 98

3. Results and Conclusions 103

G. Monitoring of Fish 105

1. Description 105

2. Sampling Program and Analytical Techniques 105

3. Results and Conclusions 105

H. Monitoring of Surface, Drinking, and Well Waters 107

1. Description of Water Sources 107

2. Sampling Program and Analytical Techniques 107

3. Results and Conclusions 112

I. Estimates of Radiation Dose to Man 115

1. Pathways to Man - Beaver Valley Power Station 115

a. Calculational Models - Beaver Valley Power Station 115

2. Results of Calculated Radiation Dose to Man - Beaver Valley Power Station Liquid Releases 116

3. Airborne Pathway 119

4. Conclusions - Beaver Valley Power Station 119

5. Dose Pathways to Man - Shippingport Atomic Power Station 121

a. Calculational Model - Shippingport Atomic Power Station 121

6. Results and Conclusions - Shippingport Atomic Power Station 122

LIST OF FIGURES

Figure No.		Page
1.0	View of the Shippingport and Beaver Valley Site	3
1.1	Geographical Map - 40 Mile Radius	4
4.1	Liquid Discharge Points to Ohio River	31
4.2	Water Flow Schematic - Shippingport Atomic Power Station	32
4.3	Water Flow Schematic - Beaver Valley Power Station	33
4.4	Liquid Radwaste Systems - Shippingport Atomic Power Station	34
4.5	Liquid Radwaste Systems - Beaver Valley Power Station	35
4.6	Gaseous Waste Processing - Shippingport Atomic Power Station	40
4.7	Gaseous Waste Processing - Beaver Valley Power Station	42
4.8	Gaseous Release Points - Shippingport Atomic Power Station and Beaver Valley Power Station	44
4.9	Solid Waste Disposal Diagram	53
5.B.1	Environmental Monitoring Locations - Air Sampling Stations	82
5.B.2	Concentrations of Gross Beta in Air Particulates	84
5.C.1	Environmental Monitoring Locations - Sediments	87
5.D.1	Environmental Monitoring Locations - Feedcrop and Foodcrop	91
5.E.1	Dairy Farm Locations (August - September 1981 Survey)	94
5.E.2	Environmental Monitoring Locations - Milk	95
5.F.1	Environmental Monitoring Locations - Radiation Monitoring	99
5.F.2	Environmental Monitoring Locations - Radiation Monitoring	100
5.F.3	Environmental Monitoring Locations - Radiation Monitoring	101
5.F.4	Environmental Monitoring Locations - Radiation Monitoring	102
5.G.1	Environmental Monitoring Locations - Fish	106
5.H.1	Surface Water and Wells - Locations	110

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report

LIST OF TABLES

Table Number		Page
III.1	Quality Control Data - TLD Comparisons	10
III.2	Quality Control Data - Water Split Samples	11
III.3	Quality Control Data - Split Samples - Miscellaneous	13
III.4	Quality Control Data - Spiked Samples	17
III.5	Quality Control Data - Spiked Samples	18
III.6	Quality Control Data - Air Particulates and I-131	19
III.7	Quality Control Data - Milk and Water	24
III.8	Anomalous Measurements During 1981	29
IV.A.1	Effluent Treatment, Sampling and Analytical Procedures Shippingport Atomic Power Station	36
IV.A.2	Effluent Treatment, Sampling and Analytical Procedures Beaver Valley Power Station	36
IV.A.3	Results - Liquid Effluents - Shippingport Atomic Power Station	37
IV.A.4	Results - Liquid Effluents - Beaver Valley Power Station	37
V.A.1	Environmental Monitoring Program Summary	55
V.A.2	Environmental Data - Chinese Nuclear Test (10-16-80) Fallout	60
V.A.3	Environmental Monitoring Program Results (1981)	63
V.A.4	Pre-Operational Monitoring Program Results (1974-1975)	75
V.A.5	Typical LLDs for Gamma Spectrometry - DLC Contractor	79
V.I.1	Radiation Dose to Man - Beaver Valley Power Station - Liquid Releases	117
V.I.2	Radiation Dose to Man - Beaver Valley Power Station - Airborne Releases	120

SECTION I DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report

I. INTRODUCTION

The 1981 Annual Radiological Environmental Report for the Beaver Valley Power Station and the Shippingport Atomic Power Station summarizes the radiological environmental program conducted by the Duquesne Light Company in 1981.

The Duquesne Light Company operates the Shippingport Atomic Power Station for the United States Department of Energy and the Beaver Valley Power Station pressurized water reactor - Unit No. 1 as part of the Central Area Power Coordination group. Beaver Valley No. 2 Unit was under construction in 1981 and is scheduled to start-up in 1986.

The Shippingport Atomic Power Station operated throughout 1981, with the gross electrical generation during the year of 397,516 megawatthours. The plant has been in operation utilizing a light water breeder reactor (LWBR) core since September 21, 1977.

The Shippingport Atomic Power Station was the first large-scale central station nuclear reactor in the United States. Since initial power generation in December 1957, operation of the pressurized water reactor at the Shippingport plant has supplied power to the Duquesne Light Company system in addition to providing technology which has served as a basis for the development of pressurized water reactors in the nuclear industry.

The highest average daily output generated at the Beaver Valley Power Station during the year was 821 megawatts net in May, 1981. The total gross electrical generation during the year was 5,023,100. megawatt-hours.

A. Scope and Objectives of the Program

The environmental program consists of effluent and environmental monitoring for radioactivity. Liquid and gaseous effluents from the Beaver Valley Power Station and gaseous effluents from the Shippingport Atomic Power Station were collected, processed, sampled, and analyzed to ensure conformance with the applicable regulations and permits prior to their release to the environment. Environmental sampling and analyses included air, water, milk, soil, vegetation, river sediments, fish, and ambient radiation levels in areas surrounding both plants.

I. INTRODUCTION

B. Description of the Shippingport and Beaver Valley Site

The Shippingport Atomic Power Station and the Beaver Valley Power Station are located on the south bank of the Ohio River in the Borough of Shippingport, Beaver County, Pennsylvania, on a 486.8 acre tract of land which is owned by the Duquesne Light Company. Figure 1.0 is an artist's view of both stations. 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. There are no residents within a 1/2 mile radius of either plant. 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.

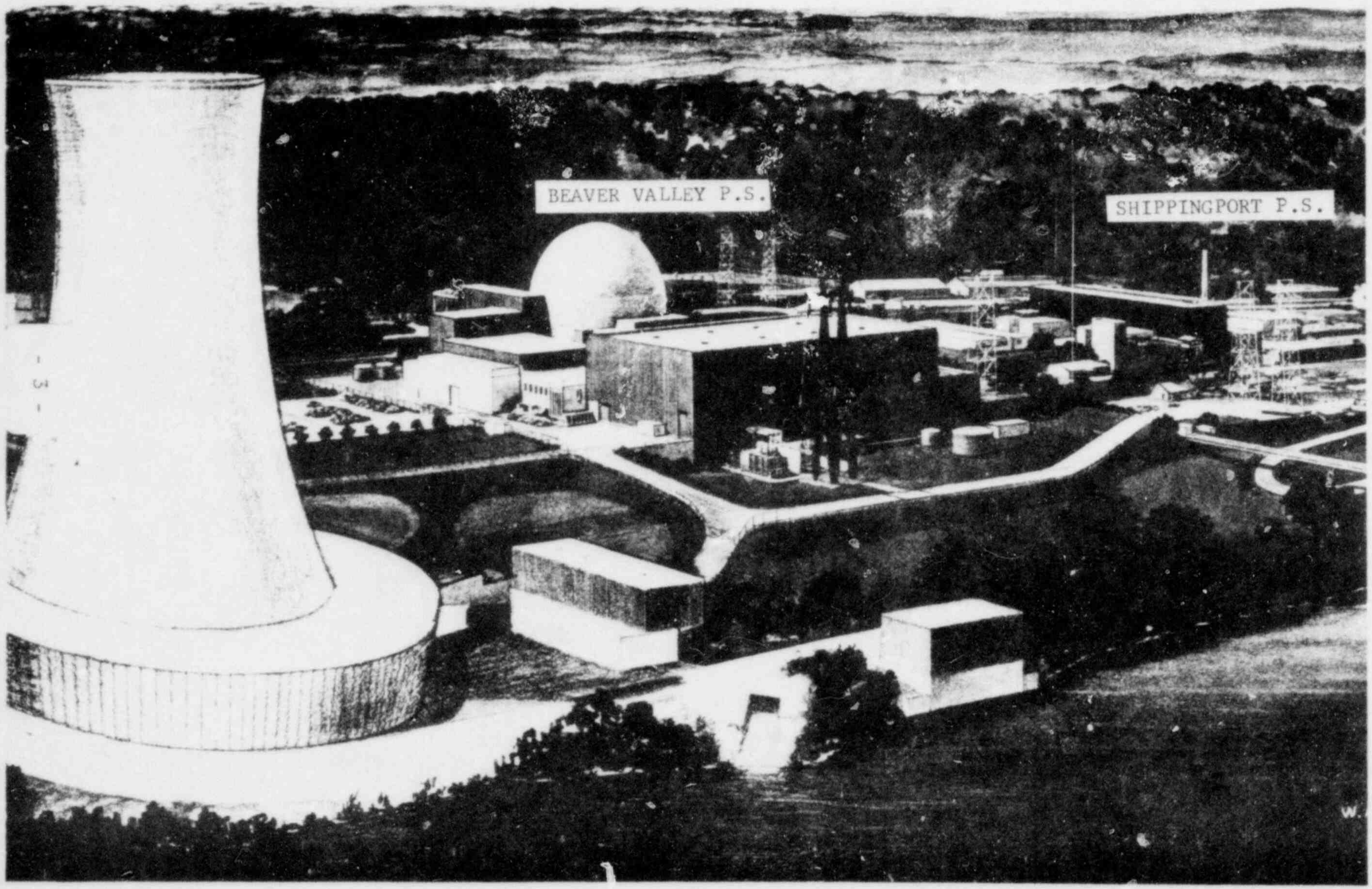
The site lies in a valley along the Ohio River. It extends from the river (elevation 665 feet above sea level) to a ridge along the border south of the Shippingport and Beaver Valley Power Stations at an elevation of 1,160 feet. Plant ground level at both stations is approximately 735 feet above sea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

The two (2) stations are situated 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 5000 cubic feet per second (CFS) to a maximum of 100,000 CFS. The mean annual flow is approximately 25,000 CFS.

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

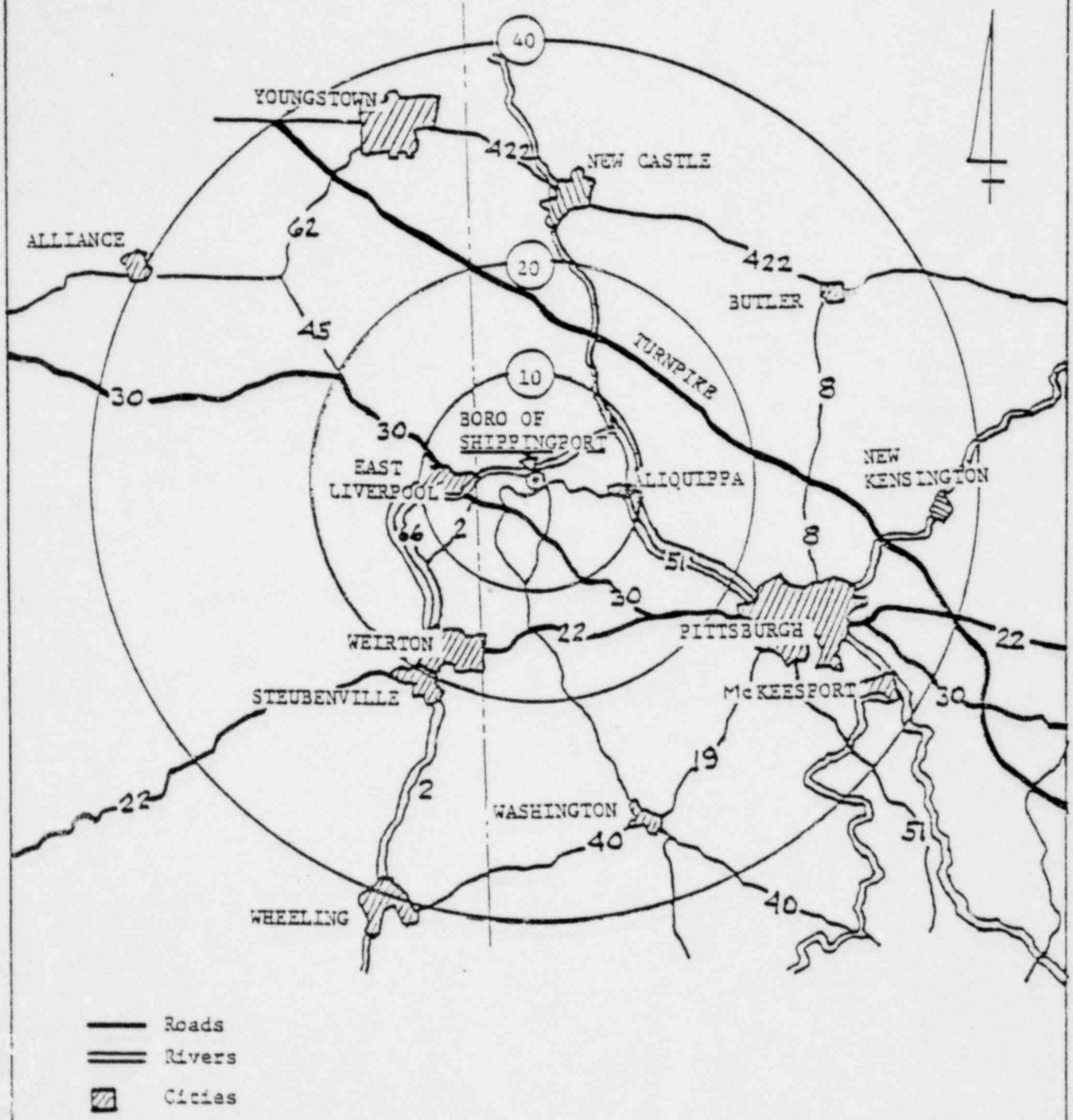
The climate of the area may be classified as humid continental. Annual precipitation is approximately 33 inches, typical yearly temperatures vary from approximately -3 F to 95 F with an annual average temperature of 52.8 F. The predominant wind direction is typically from the southwest in summer and from the northwest in winter.

FIGURE 1.0



VIEW OF THE BEAVER VALLEY POWER STATION AND THE SHIPPINGPORT ATOMIC POWER STATION

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report



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

FIGURE 1.1

I. INTRODUCTION

B. (continued) Description of the Shippingport and Beaver Valley Site

The design ratings and basic features of the Beaver Valley Power Station and the Shippingport Atomic Power Station are tabulated below:

	Beaver Valley	Shippingport
Thermal & Elec. Rating - MW-Each Reactor	2660 MW_t 852 MW_e	236.6 MW_t 72 MW_e
Type of Reactor	PWR	PWR*
Number of Reactor Coolant Loops	3	4
Number of Steam Generators and Type	3 - Vertical	4 - Horizontal
Steam Used by Main Turbine	Saturated	Saturated

Both stations utilize two (2) 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

*Light Water Breeder Core

II. RESULTS AND CONCLUSIONS

Plant operations at both the Beaver Valley Power Station and the Shippingport Atomic Power Station had no adverse effects on the environment as a result of activities at either of the stations during 1981. Comparisons of pre-operational data with operational data indicates the ranges of values are in good agreement for both periods of time.

The Beaver Valley Power Station and Shippingport Atomic Power Station operated throughout 1981. During the year, the radioactive releases from both stations were below the limits of 10 CFR Part 50, Appendix I and applicable permits for each station. The releases at Beaver Valley Power Station did not exceed the limiting conditions identified in the Beaver Valley Power Station Operating License Technical Specifications.

The environmental program for 1981 was the same as in 1980 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 1981 Radiological Monitoring Program outline).

The results of the 1981 Radiological Environmental Monitoring Program are consistent with those of previous years. The only radioactivity above normal ambient levels in the environs other than world-wide fallout from Nuclear weapons tests is noted in Table III.8. This radioactivity was only detected near the Beaver Valley Power Station discharge and resulted in negligible exposure to members of the public. A summary of the 1981 operational environmental data (ranges and means) for each sampling media is found in Table V.A.3. A summary of preoperational (1974 - 1975) environmental data is found in Table V.A.4

During January - August, 1981, some media showed slight increased radioactivity which is attributable to the fallout radioactivity from the nuclear weapons test conducted by the Republic of China on October 16, 1980. The weapons testing fallout radioactivity observed was typical of weapons testing fallout observed nationally. The impact of fallout on some media analyses were sometimes delayed. For example, these tests contributed to the elevated levels of strontium in milk collected at several dairies later in the year. Since farming practices, pasture conditions, and the use of stored feed are variables, not all dairies exhibited the same results. Also, the milk production of several dairies is very limited resulting in wider variations since random

II. RESULTS AND CONCLUSIONS (continued)

fluctuations in a few cows are not averaged as in larger herds. Some radionuclides from weapons tests, such as Cesium and strontium, are longer lived than others and could be detected in spite of the variables that affect the radioactivity found in milk.

Examination of effluents from the Shippingport Atomic Power Station and the Beaver Valley Power Station and environmental media demonstrated compliance with regulations and Station Technical Specifications. While there were three (3) results during the year which exceeded the reporting levels of the Nuclear Regulatory Commission, these analyses after evaluation were below limits identified in the Code of Federal Regulations or the Beaver Valley Technical Specifications. They included three (3) surface water tritium values at the outfall of the Beaver Valley Power Station and resulted from small quantities of tritium released from the Beaver Valley Power Station which were well below limits noted in 10CFR20. Shippingport Atomic Power Station did not release any liquid radioactive effluents during 1981.

III. ENVIRONMENTAL MONITORING CONSIDERATIONS

A. Environmental Quality Control Programs

The Quality Control (QC) Program used for the Beaver Valley - Shippingport 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. Radiation Monitoring (Duquesne Light Company (DLC) Contractor Laboratory - DLC QC Laboratory - Independent Laboratory)

   An independent program of external radiation monitoring was conducted by the QC Laboratory using lithium fluoride TLDs sharing the same location as the DLC Contractor Laboratory TLDs and Independent Laboratory TLDs. Summary data of the QC Laboratory program is provided in Table III.1.

   Duplicate contractor TLD, QC TLD, Annual TLD, and Independent Lab TLD and continuous integrating monitoring by a Pressurized Ion Chamber (PIC) show generally good agreement and demonstrate acceptable performance by the DLC Contractor Laboratory. The arithmetic mean of each laboratory agrees within ± 5.3% of the arithmetic mean of the three laboratories. This is well within the precision of a typical TLD system.

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 laboratory of the Department of Energy).

   A summary of results of split water samples is provided in Table III.2. A summary of milk, sediment, and feed/food crop split samples is provided in Table III.3. Some variation is expected due to small variations in duplicate samples, variations in analytical procedures, and in calibration, source type, etc.

Some contractor and QC laboratory feed/food sample analyses were not in good agreement. A review of the contractor and QC laboratory sample preparation procedures determined that differences could occur which would account for the poor comparisons. Subsequently, a change has been made to the contractor procedure to have the samples dried to a constant weight utilizing the same technique as the QC laboratory.

Because of the overall uniformity of comparable results, it is concluded that the two laboratories are consistent and in agreement.

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

Location No.	1ST QUARTER DLC Contractot ($CaSO_4$:Dy)	DLC QC Lab (LiF)	Independent Lab #3 ($CaSO_4$:Tm)	PDER (2)	DLC PIC (3)	2ND QUARTER DLC Contractor ($CaSO_4$:Dy)	DLC QC Lab (LiF)	Independent Lab #3 ($CaSO_4$:Tm)	PDER (2)	DLC PIC (3)
10	0.17	0.19	0.19	0.24	0.26[1]	0.17	0.15	0.19	0.21	0.26[1]
13	0.19	0.20	0.21	0.26		0.18	0.17	0.18	0.21	
14	0.19	0.20	0.20			0.18	0.16	0.18		
15	0.15	0.13	0.14			0.13	0.11	0.13		
27	0.19	0.20	0.19			0.16	0.16	0.19		
28	0.20	0.22	0.21			0.18	0.18	0.19		
29	0.22	0.24	0.23			0.20	0.21	0.20		
32	0.20	0.23	0.22	0.25	0.26	0.18	0.20	0.19	0.26	0.26
45	0.21	0.22	0.22	0.27	0.23[1]	*	*	*	0.23	0.24[1]
46	0.17	0.18	0.19	0.23	0.22[1]	0.15	0.15	0.17	0.19	0.20[1]
47	0.20	0.20	0.22			0.18	0.18	0.20		
48	0.18	0.19	0.19			0.17	0.16	0.17		
51	0.22	0.19	0.20	0.25		0.18	0.18	0.19	0.25	

Location No.	3RD QUARTER DLC Contractor ($CaSO_4$:Dy)	DLC QC Lab (LiF)	Independent Lab #3 ($CaSO_4$:Tm)	PDER (2)	DLC PIC (3)	4TH QUARTER DLC Contractor ($CaSO_4$:Dy)	DLC QC Lab (LiF)	Independent Lab #3 ($CaSO_4$:Tm)	PDER (2)	DLC PIC (3)
10	0.18	0.18	0.18	0.24	0.26[1]	0.17	0.18	0.21	0.18	0.26[1]
13	0.20	0.21	0.20	0.25		0.19	0.20	0.24	0.18	
14	0.19	0.19	0.20			0.17	0.19	0.20		
15	0.16	0.13	0.15			0.14	0.15	0.19		
27	0.19	0.19	0.18			0.18	0.13	0.20		
28	0.21	0.20	0.20			0.18	0.17	0.24		
29	0.23	0.23	0.23			0.20	0.24	0.23		
32	0.20	0.20	0.21	0.28	0.26	0.19	0.21	0.24	0.20	0.26
45	0.19	0.19	0.21	0.28	0.24[1]	0.18	0.20	0.23	0.20	0.22[1]
46	0.16	0.17	*	0.22	0.21[1]	0.16	0.18	0.20	0.18	0.21[1]
47	0.20	0.21	0.22			0.19	*	0.24		
48	0.17	0.17	0.17			0.17	0.18	0.20		
51	0.20	0.19	0.19	0.23		0.18	0.20	0.22	0.15	

(1) PIC Reading at Location 10 taken in DLC Substation in Shippingport Boro, Location 45 taken at Kennedy's Corners, Location 46 taken at Industry Tire Shop.

(2) NRC results from Pennsylvania Department of Environmental Resources.

(3) In this consolidated environmental program the pressurized ion chamber (PIC) continuous monitor readings tend to be slightly higher than the TLD readings due to the differences in the inherent physics of each system. No compensatory measures have been taken to make both systems agree exactly because both systems were installed to monitor relative radiation levels rather than absolute levels. Each system provides a reasonably accurate measure of the absolute radiation levels.

* TLD lost or stolen.

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 α	January	≤ 1.9	≤ 1.8	pCi/l
		April	≤ 2.0	4.2 ± 2.6	pCi/l
		July	≤ 1.8	≤ 1.8	pCi/l
		October	≤ 1.1	≤ 1.3	pCi/l
Surface Water	Gross β	January	6.3 ± 1.3	6.1 ± 4.2	pCi/l
		April	5.2 ± 1.5	8.7 ± 2.1	pCi/l
		July	6.4 ± 1.6	7.4 ± 2.0	pCi/l
		October	4.2 ± 1.2	5.4 ± 1.8	
Surface Water	Co-60	January	≤ 2.0	≤ 2.4	pCi/l
		April	≤ 2.0	≤ 3.5	pCi/l
		July	≤ 3.0	≤ 4.4	pCi/l
		October	≤ 2.0	≤ 1.8	
Surface Water	Cs-134	January	≤ 3.0	≤ 2.7	pCi/l
		April	≤ 3.0	≤ 4.3	pCi/l
		July	≤ 3.0	≤ 5.0	pCi/l
		October	≤ 2.0	≤ 2.0	pCi/l
Surface Water	Cs-137	January	≤ 3.0	≤ 2.5	pCi/l
		April	≤ 3.0	≤ 4.5	pCi/l
		July	≤ 4.0	≤ 5.0	pCi/l
		October	≤ 2.0	≤ 2.1	pCi/l
Surface Water	Tritium	1st Quarter Composite	150 ± 70	≤ 190	pCi/l
		3rd Quarter Composite	160 ± 70	≤ 175	pCi/l
Suface Water	Sr-89	2nd Quarter Composite	≤ 1.1	≤ 0.69	pCi/l
		4th Quarter Composite	≤ 1.8	≤ 0.71	pCi/l
Surface Water	Sr-90	2nd Quarter Composite	≤ 0.33	≤ 0.40	pCi/l
		4th Quarter Composite	0.73 ±0.71	≤ 0.40	pCi/l
Surface Water	Co-60 (high sensitivity analysis)	2nd Quarter Composite	≤ 0.4	≤ 2.1	pCi/l
		4th Quarter Composite	≤ 0.7	≤ 4.1	pCi/l

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

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	Cs-137	February	≤ 3.0	≤ 3.6	pCi/l
		May	≤ 2.0	≤ 4.3	pCi/l
		August	≤ 3.0	≤ 4.1	pCi/l
		November	≤ 2.0	≤ 5.0	pCi/l
Drinking Water	Cs-134	February	≤ 3.0	≤ 3.8	pCi/l
		May	≤ 2.0	≤ 4.0	pCi/l
		August	≤ 3.0	≤ 4.2	pCi/l
		November	≤ 2.0	≤ 4.7	pCi/l
Drinking Water	Co-60	February	≤ 3.0	≤ 8.6	pCi/l
		May	≤ 2.0	≤ 3.2	pCi/l
		August	≤ 3.0	≤ 5.3	pCi/l
		November	≤ 2.0	≤ 4.2	pCi/l
Drinking Water	Gross α	March	≤ 0.46	≤ 1.6	pCi/l
		June	≤ 0.46	≤ 1.5	pCi/l
		August	≤ 0.55	≤ 1.7	pCi/l
		December	≤ 0.55	≤ 0.61	pCi/l
Drinking Water	Gross β	March	7.0 ± 1.6	6.2 ± 1.7	pCi/l
		June	1.7 ± 1.4	4.4 ± 1.4	pCi/l
		August	7.0 ± 1.6	7.2 ± 1.8	pCi/l
		December	3.5 ± 1.2	4.3 ± 2.1	pCi/l
Drinking Water	Tritium	2nd Quarter	230 ± 80**	≤ 185	pCi/l
		4th Quarter	230 ± 70	± 160	pCi/l
Drinking Water	Nb-95/Zr-95	February	≤ 2.0	≤ 15.4*	pCi/l

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

* Reanalysis, first analysis showed 15.7 ± 7.4, which is similar to L.T. result of the second analysis.
** Reanalysis, first analysis showed 270 ± 70, which is similar to the second analysis.

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 (Location 25)	I-131	3-17-81	≤ .16	≤ 0.37	pCi/l	
	Sr-89	3-17-81	≤ 1.4	≤ 3.7	pCi/l	
	Sr-90	3-17-81	0.71 ± .45	2.58 ± 2.50	pCi/l	
	Cs-134	3-17-81	≤ 2.0	≤ 4.9	pCi/l	
	Cs-137	3-17-81	≤ 2.0	≤ 4.7	pCi/l	
	Co-60	3-17-81	≤ 2.0	≤ 8.4	pCi/l	
	K-40	3-17-81	1480 ± 150	1300 ± 250	pCi/l	
Milk (Location 25)	I-131	6-16-81	≤ 0.09	≤ 0.35	pCi/l	
	K-40	6-16-81	1260 ± 130	--	pCi/l	
	Cs-134	6-16-81	≤ 3.0	≤ 4.6	pCi/l	
	Cs-137	6-16-81	≤ 3.0	≤ 4.9	pCi/l	
	Co-60	6-16-81	≤ 2.0	≤ 4.1	pCi/l	
Feed (Location 25)	Be-7	6-16-81	2.35 ± 0.38	0.62 ± 0.12	pCi/gm Dry	*
	K-40	6-16-81	14.9 ± 1.5	--	pCi/gm Dry	
	Mn-54	6-16-81	0.04 ± 0.037	--	pCi/gm Dry	
	Nb-95/Zr-95	6-16-81	0.83 ± 0.083	0.34 ± 0.05	pCi/gm Dry	*
	Ru-103	6-16-81	0.092 ± 0.035	0.020 ± 0.015	pCi/gm Dry	*
	Cs-137	6-16-81	0.070 ± 0.034	0.021 ± 0.011	pCi/gm Dry	*
	Ce-141	6-16-81	0.084 ± 0.051	--	pCi/gm Dry	
	Ce-144	6-16-81	0.86 ± 0.13	0.21 ± 0.08	pCi/gm Dry	*
Feed (Location 25)	Sr-90	4-22-81 to 6-16-81	0.10 ± 0.012	0.22 ± 0.07	pCi/gm Dry	**
Food (Cabbage)	I-131	9-8-81	≤ 0.0057	≤ 0.037	pCi/gm Wet	***
	Be-7	9-8-81	0.745 ± 0.194	--	pCi/gm Wet	
	K-40	9-8-81	4.38 ± 0.44	--	pCi/gm Wet	
	Co-60	9-8-81	≤ 0.01	≤ 0.015	pCi/gm Wet	
	Cs-134	9-8-81	≤ 0.01	≤ 0.018	pCi/gm Wet	
	Cs-137	9-8-81	≤ 0.01	≤ 0.018	pCi/gm Wet	

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

* Analyses are not in good agreement. Refer to Section III.A.2. (Split Sample Program) for an explanation in the cause and the corrective action taken.

** Reanalyses, the first analyses results were 0.075 ± 0.012 and 0.53 ± 0.07, which are not in good agreement. This was attributed to the difference in laboratory technique used to obtain constant weight prior to analysis.

*** DLC QC Lab Units are in pCi/gm Dry

-- Analyses not performed nor required.

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
Food (Lettuce)	I-131	9-21-81	≤ 0.0046	≤ 0.043	pCi/gm Wet **
	Be-7	9-21-81	0.315 ± 0.172	--	pCi/gm Wet
	K-40	9-21-81	3.03 ± 0.30	--	pCi/gm Wet
	Co-60	9-21-81	≤ 0.01	≤ 0.03	pCi/gm Wet
	Cs-134	9-21-81	≤ 0.01	≤ 0.033	pCi/gm Wet
	Cs-137	9-21-81	≤ 0.01	≤ 0.033	pCi/gm Wet
Milk	Sr-89	9-20-81	≤ 1.3	≤ 7.5 *	pCi/l
	Sr-90	9-20-81	3.5 ± 0.6	5.0 ± 3.3	pCi/l
	Co-60	9-20-81	≤ 2.0	≤ 4.7	pCi/l
	Cs-134	9-20-81	≤ 2.0	≤ 5.0	pCi/l
	Cs-137	9-20-81	6.40 ± 4.75	≤ 5.0	pCi/l
	I-131	9-20-81	≤ 0.12	≤ 0.27	pCi/l
	K-40	9-20-81	1310.0 ± 130.0	--	pCi/l
Sediment	Gr-A	10-22-81	17.0 ± 8.0	30.0 ± 9.0	pCi/gm Dry
	Gr-B	10-22-81	34.0 ± 3.0	44 ± 5.0	pCi/gm Dry
	U-235	10-22-81	.037 ± .008	≤ 0.03	pCi/gm Dry
	U-234	10-22-81	0.69 ± 0.17	0.87 ± 0.07	pCi/gm Dry
	U-238	10-22-81	0.48 ± 0.10	0.40 ± 0.04	pCi/gm Dry
	Sr-89	10-22-81	≤ 0.17	≤ 1.2 ***	pCi/gm Dry
	Sr-90	10-22-81	0.048 ± 0.046	≤ 0.09	pCi/gm Dry
	K-40	10-22-81	13.7 ± 1.4	--	pCi/gm Dry
	Cs-134	10-22-81	≤ 0.02	≤ 0.16	pCi/gm Dry
	Cs-137	10-22-81	0.276 ± 0.030	0.48 ± 0.09	pCi/gm Dry
	Co-60	10-22-81	0.306 ± 0.036	0.23 ± 0.17	pCi/gm Dry
	Be-7	10-22-81	≤ 0.1	--	pCi/gm Dry
	Ce-144	10-22-81	≤ 0.09	--	pCi/gm Dry
	Nb-95/Zr-95	10-22-81	0.0498 ± 0.0327	--	pCi/gm Dry
	Ra-226	10-22-81	1.97 ± 0.20	--	pCi/gm Dry
	Th-228	10-22-81	1.20 ± 0.12	--	pCi/gm Dry
Milk	I-131	12-15-81	≤ 0.12	≤ 0.36	pCi/l
	K-40	12-15-81	1050 ± 300	--	pCi/l
	Cs-134	12-15-81	≤ 3.0	≤ 5.0	pCi/l
	[illegible]7	12-15-81	≤ 3.0	≤ 5.0	pCi/l
	[illegible]60	12-15-81	≤ 3.0	≤ 4.7	pCi/l

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

* The higher than normal Sr-89 MDC was due to a low chemical yield obtained as a result of the $NaHSO_3$ preservative present in the milk samples.

** DLC QC Lab Units are in pCi/gm Dry

*** Higher LLD than normal due to delay of sample in transit to the QC Lab

-- Analysis not performed nor required.

III. ENVIRONMENTAL MONITORING CONSIDERATIONS

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. The results demonstrate that the contractor performed acceptably in the 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 . .e 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 month out cf the year for gamma activity. Duplicate quarterl, air particulate filters, composited from the weekly air particulate filters, were analyzed for Sr-89 and Sr-90 activity for the second and third quarters of the year. Table III.6 provides data for this portion of the Q.C. program. The results show generally good agreement between the laboratories and demonstrate that the contractor performed acceptably in the program.

5. Contractor Internal QC Program

The Contractor Laboratory maintained its 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 results were in agreement with EPA EMSL. DLC also audited the Contractor Laboratory and determined that internal QC practices were in effect and that procedures and laboratory analytical techniques conformed to approved DLC procedures.

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

Milk and water samples were prepared quarterly 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. The results show generally good agreement between the laboratories and demonstrate that the contractor performed acceptably in the program.

TABLE III.4
QUALITY CONTROL RESULTS
SPIKE SAMPLE ANALYSIS RESULTS

Sample Date	Ident. No.	Sample Type and Analysis		DLC Contractor Lab (1)	DLC - QC Lab (1)	Units
3-1-81	53-39	Water:	Sr-89	4.8 ± 4.2	5.2 ± 1.4	pCi/l
			Sr-90	3.1 ± 1.0	4.4 ± 1.1	pCi/l
5-20-81	53-40	Water:	I-131	5.3 ± 0.2	10.6 ± 1.0	pCi/l **
			Cs-137	30.6 ± 4.9	36.7 ± 8.1	pCi/l
			Co-60	30.3 ± 6.7	38.3 ± 7.2	pCi/l
7-20-81	53-41	Water:	Gross Alpha	11 ± 2	17 ± 4	pCi/l
			Gross Beta	32 ± 2	51 ± 4	pCi/l *
10-16-81	53-42	Water	Sr-89	≤ 2.5	≤ 0.85	pCi/l
			Sr-90	10 ± 1	11 ± 1.1	pCi/l
			Co-60	35.6 ± 5.6	38.0 ± 4.2	pCi/l
			Mn-54	44.6 ± 4.7	35.0 ± 4.3	pCi/l
			Cs-137	15.8 ± 5.0	17.0 ± 3.7	pCi/l
11-25-81	53-43	Water	I-131	0.67 ± 0.22	0.60 ± 0.55	pCi/l
			Co-60	36.9 ± 6.1	37.0 ± 3.8	pCi/l
			Cs-137	19.6 ± 5.9	21.0 ± 3.9	pCi/l
			Mn-54	36.6 ± 6.3	39.0 ± 3.9	pCi/l
1-8-82	53-44	Water	H-3	1120 ± 100	810 ± 170	pCi/l ***
	53-45	Water	Gross Alpha	≤ 0.83	≤ 0.4	pCi/l
			Gross Beta	25 ± 2	28 ± 2.5	pCi/l

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

* The Gross Beta results were not in good agreement for this sample. The results of the analysis were reviewed and no errors could be found. Other Gross Beta analysis shown in drinking and surface water samples have yielded good agreement between the laboratory results.

** The I-131 results were not in good agreement for this sample. A subsequent 53-40-1 spiked water sample which was to be used to verify the first result was delayed in transit to the contractor laboratory and thus could not be used for verification due to the short half life of the isotope. However, subsequent laboratory I-131 analyses have yielded good agreement.

*** The tritium results were not in good agreement for this sample. The results of the analysis were reviewed and no errors could be found. Other tritium analyses results shown in drinking and surface water results have yielded good agreement between the laboratories.

TABLE III.5
QUALITY CONTROL RESULTS
SPIKE SAMPLE ANALYSIS

Sample Date	Ident. No.	Sample Type and Analysis		DLC Contractor Lab (1)	DLC - QC Lab (1)	Units
2-20-81	52-49	Milk:	Sr-90	7.2 ± 0.7	14.4 ± 1.1	pCi/l *
			I-131	19 ± 1	22.6 ± 4.1	pCi/l
			Cs-137	51.4 ± 7.2	47.8 ± 8.6	pCi/l
5-28-81	52-50	Milk:	I-131	4.8 ± 0.3	5.6 ± 0.9	pCi/l
			K-40	1230 ± 120	— —	pCi/l
			Cs-137	57.4 ± 6.9	55.9 ± 8.6	pCi/l
8-25-81	52-51	Milk	Sr-89	11 ± 3	13 ± 2	pCi/l
			Sr-90	5.7 ± 0.8	6.6 ± 1.5	pCi/l
			I-131	7.7 ± 0.2	8.6 ± 1.0	pCi/l
			K-40	1210 ± 120	— —	
			Cs-137	44.1 ± 7.0	51 ± 4.4	pCi/l
1-8-82	52-52	Milk	I-131	8.4 ± 0.3	9.4 ± 1.2	pCi/l
			Cs-137	40.6 ± 5.3	35 ± 3.9	pCi/l
			K-40	927 ± 93	— —	pCi/l

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

* The Sr-90 results are not in good agreement. Refer to Section III.B (Evaluation of the Quality Control Program Data) for an explanation into the cause and the corrective action taken.

— — Analysis not performed nor required.

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)
1/05/81 to 1/12/81	0.18 ± 0.01	0.081 ± 0.004 *	1/12/81 to 1/19/81	≤ 0.010	≤ 0.035
1/19/81 to 1/26/81	0.17 ± 0.01	0.20 ± 0.01	1/26/81 to 2/02/81	≤ 0.010	≤ 0.021
2/02/81 to 2/09/81	0.091 ± 0.006	0.11 ± 0.004	2/09/81 to 2/16/81	≤ 0.009	≤ 0.022
2/16/81 to 2/23/81	0.12 ± 0.01	0.13 ± 0.005	2/23/81 to 3/02/81	≤ 0.008	≤ 0.019
3/03/81 to 3/09/81	0.12 ± 0.01	0.15 ± 0.006	3/9/81 to 3/16/81	≤ 0.009	≤ 0.022
3/16/81 to 3/23/81	0.11 ± 0.01	0.14 ± 0.005	3/23/81 to 3/30/81	≤ 0.009	≤ 0.022
3/30/81 to 4/06/81	0.35 ± 0.01	0.34 ± 0.008	4/06/81 to 4/13/81	≤ 0.009	≤ 0.0046
4/13/81 to 4/20/81	0.25 ± 0.01	0.29 ± 0.007	4/20/81 to 4/27/81	≤ 0.009	≤ 0.021
4/27/81 to 5/04/81	0.26 ± 0.01	0.30 ± 0.007	5/04/81 to 5/11/81	≤ 0.009	≤ 0.025
5/11/81 to 5/18/81	0.29 ± 0.01	0.32 ± 0.007	5/18/81 to 5/26/81	≤ 0.010	≤ 0.023
5/26/81 to 6/01/81	0.16 ± 0.01	0.16 ± 0.006	6/01/81 to 6/08/81	≤ 0.009	≤ 0.020
6/08/81 to 6/15/81	0.15 ± 0.01	0.15 ± 0.005	6/15/81 to 6/22/81	≤ 0.009	≤ 0.021
6/22/81 to 6/29/81	0.15 ± 0.01	0.16 ± 0.006	6/29/81 to 7/06/81	≤ 0.009	≤ 0.017
7/06/81 to 7/13/81	0.17 ± 0.01	0.18 ± 0.006	7/13/81 to 7/20/81	≤ 0.010	≤ 0.014
7/20/81 to 7/27/81	0.08 ± 0.006	0.09 ± 0.004	7/27/81 to 8/03/81	≤ 0.008	≤ 0.018
8/3/81 to 8/10/81	0.059 ± 0.005	0.067 ± 0.004	8/10/81 to 8/17/81	≤ 0.009	≤ 0.021
8/17/81 to 8/24/81	0.061 ± 0.005	0.083 ± 0.004	8/24/81 to 8/31/81	≤ 0.009	≤ 0.022
8/31/81 to 9/8/81	0.026 ± 0.003	0.033 ± 0.002	9/8/81 to 9/14/81	≤ 0.010	≤ 0.025
9/14/81 to 9/21/81	0.030 ± 0.003	0.031 ± 0.003	9/21/81 to 9/28/81	≤ 0.009	≤ 0.028

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

* The Gross Beta results are not in good agreement for this sample. The results of the analysis were reviewed and no errors could be found. The contractor lab reanalyzed the sample and duplicated the the original result. Subsequent analyses have yielded good agreement between the laboratory results.

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)
9/28/81 to 10/5/81	0.020 ± 0.003	0.031 ± 0.003	10/5/81 to 10/12/81	≤ 0.009	≤ 0.018
10/12/81 to 10/19/81	0.034 ± 0.004	0.038 ± 0.003	10/19/81 to 10/26/81	≤ 0.010	≤ 0.021
10/26/81 to 11/2/81	0.028 ± 0.003	0.029 ± 0.003	11/2/81 to 11/9/81	≤ 0.009	≤ 0.020
11/9/81 to 11/16/81	0.034 ± 0.004	0.039 ± 0.003	11/16/81 to 11/23/81	≤ 0.01	≤ 0.018
11/23/81 to 11/30/81	0.027 ± 0.003	0.031 ± 0.003	11/30/81 to 12/7/81	≤ 0.01	≤ 0.019
12/7/81 to 12/14/81	0.019 ± 0.003	0.022 ± 0.002	12/14/81 to 12/21/81	≤ 0.01	≤ 0.018
12/21/81 to 12/28/81	0.032 ± 0.004	0.025 ± 0.002	12/28/81 to 1/4/82	≤ 0.01	≤ 0.021

(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)
April	Be-7	0.127 ± 0.023	0.095 ± 0.016
3/30/81 to 4/27/81 Bettis 3/30/81 to 4/27/81 Teledyne	Nb/Zr-95	0.069 ± 0.007 *	0.150 ± 0.006
	Ru-103	0.028 ± 0.003	0.020 ± 0.003
	Ru-106	0.022 ± 0.018	0.019 ± 0.009
	Cs-137	0.004 ± 0.002	0.0015 ± 0.0011
	Ce-144	0.064 ± 0.010	0.056 ± 0.005
	Ce-141	0.016 ± 0.003	--
	K-40	0.030 ± 0.029	--
	Th-228	0.006 ± 0.003	--
	Others	LLD	LLD
June			
6/01/81 to 6/29/81 Bettis 6/01/81 to 6/29/81 Teledyne	Be-7	0.109 ± 0.022	0.050 ± 0.026
	Nb/Zr-95	0.048 ± 0.005	0.052 ± 0.004
	Ru-103	0.007 ± 0.003	≤ 0.003
	Cs-137	0.0035 ± 0.0019	0.0025 ± 0.0015
	Ce-141	0.004 ± 0.003	≤ 0.003
	Ce-144	0.061 ± 0.015 *	0.025 ± 0.005
	Others	LLD	LLD
July			
6/29/81 to 8/3/81 Bettis 6/29/81 to 8/3/81 Teledyne	Be-7	0.124 ± 0.02	0.11 ± 0.02
	Mn-54	0.002 ± 0.001	≤ 0.002
	Nb/Zr-95	0.029 ± 0.003 *	0.053 ± 0.004
	Ru-103	0.003 ± 0.002	≤ 0.003
	Ru-106	≤ 0.007 *	0.040 ± 0.019
	Cs-137	0.0038 ± 0.0018	0.004 ± 0.002
	Ce-144	0.027 ± 0.007 *	0.067 ± 0.012
	Others	LLD	LLD

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

* Analyses are not in good agreement. Refer to Section III.B. (Evaluation of the Quality Control Program Data) for an explanation in the cause and the corrective action taken.

-- Analysis not performed nor required.

LLD Lower limit of detector.

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

Sample Date	Nuclide	DLC Contractor Lab (1)	DLC - QC Lab (1)
August			
8/3/81 to 8/31/81 Bettis	Be-7	0.164 ± 0.022 *	0.095 ± 0.008
8/3/81 to 8/31/81 Teledyne	Ce-144	≤ 0.004	0.011 ± 0.006
	Nb/Zr-95	≤ 0.002 *	0.013 ± 0.002
	Others	LLD	LLD
September			
8/31/81 to 9/28/81 Bettis	Be-7	0.117 ± 0.021	0.102 ± 0.019
8/31/81 to 9/[illegible]/81 Teledyne	Nb/Zr-95	≤ 0.001	0.003 ± 0.002
	Th-228	0.002 ± 0.001	– –
	Others	LLD	LLD
November			
11/2/81 to 11/30/81 Bettis	Be-7	0.102 ± 0.018	0.083 ± 0.013
	Others	LLD	LLD

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

* Analysis is not in good agreement. Refer to Section III. 5. (Evaluation of the Quality Control Program Data) for an explanation in the cause and corrective action taken.

– – Analysis not performed nor required.

LLD Lower limit of detector.

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)
2nd Quarter Composite 3/30/81 to 6/29/81	Sr-89	0.012 ± 0.002	0.0096 ± 0.0016
	Sr-90	0.0014 ± 0.0003	0.0020 ± 0.0007
3rd Quarter Composite Air Filter	Sr-89	≤ 0.0024	≤ 0.0007
6-29-81 to 9-28-81	Sr-90	0.0005 ± 0.00023	0.0011 ± 0.0005

(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 and Analysis		Independent Lab (1)	DLC Contractor Lab (1)	DLC - QC Lab (1)	
2-18-81	53-231	Water:	Sr-90	16.1 ± .5	14 ± 1	14.2 ± 1.4	
			Co-60	21 ± 7	20.7 ± 5	28.0 ± 8.5	
			Fe-59	25 ± 15	14.8 ± 8.9*	≤ 20	
			Cs-137	26 ± 8	24.6 ± 4.2	34.6 ± 7.6	
			Cs-134	29 ± 10	23.4 ± 6.1	32.5 ± 7.4	
2-18-81	53-232	Water:	H-3	1500 ± 70	1500 ± 110	1560 ± 270*	
5-13-81	53-233	Water:	Sr-89	4.9 ± .9	3.5 ± 2.7	5.0 ± 1.9	
			Sr-90	15.7 ± .4	11 ± 1	16.4 ± 1.5	**
			Fe-59	50 ± 20	42.1 ± 12.6	37.9 ± 7.6	
			Co-60	27 ± 9	36.2 ± 7.2	31.9 ± 3.8	
			Cs-137	19 ± 8	26.2 ± 6.8	26.3 ± 3.6	
			Cs-134	17 ± 9	15.7 ± 6.0	13.0 ± 3.3	
5-13-81	53-234	Water:	H-3	990 ± 60	1070 ± 90	730 ± 270	
9-16-81	53-235	Water:	Sr-89	10 ± 2	13.0 ± 3.0	9.2 ± 4.0	
			Sr-90	10 ± 0.5	8.5 ± 0.8	10.7 ± 2.4	
			Mn-54	21 ± 9	29.5 ± 5.8	20.5 ± 5.0	
			Co-60	12 ± 8	17.0 ± 5.9	11.0 ± 5.5	
			Cs-134	13 ± 9	15.2 ± 5.0	12.5 ± 4.8	
			Cs-137	14 ± 8	15.7 ± 5.5	21.0 ± 5.2	
9-16-81	53-236	Water:	H-3	1350 ± 60	1320 ± 90.0	940 ± 300	
12-2-81	53-237	Water:	Sr-89	18 ± 2	20 ± 3.0	17.5 ± 3.1	
			Sr-90	21.5 ± 0.6	20 ± 1.0	21.8 ± 2.3	
			Co-60	27 ± 8	23.1 ± 5.2	23.4 ± 3.8	
			I-131	≤ 50	17.1 ± 4.8	14.3 ± 2.2	
			Cs-134	18 ± 9	12.1 ± 4.7	12.1 ± 2.9	
			Cs-137	28 ± 8	39.4 ± 5.6	30.7 ± 3.3	
12-2-81	53-238	Water:	H-3	1420 ± 70	1410 ± 100	1370 ± 205	

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

* Based on reanalysis as the first analysis, although in general agreement with the DLC Contractor Lab, appeared to be biased low.

** The Sr-90 results are not in good agreement. Refer to Section III.B. (Evaluation of the Quality Control Program Data) for an explanation into the cause and the corrective action taken.

TABLE III.7
QUALITY CONTROL DATA

QC Sample Comparisons
(All Analyses in pCi/l)

Sample Date	Ident. No.	Sample Type and Analysis		Independent Lab (1)	DLC Contractor Lab (1)	DLC - QC Lab (1)
2-18-81	52-218	Milk:	Sr-89	16 ± 2	16 ± 2*	13.8 ± 2.5
			Sr-90	15.7 ± .4	14 ± 1*	12.0 ± 1.5
			I-131	7.9 ± .7	4.4 ± 0.2*	4.7 ± 0.6
			Cs-137	36 ± 4	27.2 ± 4.4	32.6 ± 10.3
			Cs-134	27 ± 5	30.1 ± 6.6	38.3 ± 8.5
5-13-81	52-219	Milk:	Sr-89	lost	≤ 1.5**	4.2 ± 2.9
			Sr-90	lost	4.4 ± 0.8**	14.3 ± 2.1
			I-131	11.1 ± 1.2	9.6 ± 0.3	6.6 ± 1.2
			Cs-137	37 ± 4	43.6 ± 7.0	29.2 ± 4.6
			Cs-134	18 ± 4	18.0 ± 7.2	21.5 ± 3.5
9-16-81	52-220	Milk:	Sr-89	10 ± 2	9.0 ± 0.8	9.9 ± 5.6
			Sr-90	9.3 ± 0.6	8.2 ± 2.9	10.1 ± 3.3
			I-131	14.5 ± 1.0	13.0 ± 1.0	14.7 ± 3.0
			Cs-134	21 ± 5	28.4 ± 6.2	21.0 ± 10.3
			Cs-137	22 ± 5	32.8 ± 5.9	36.2 ± 5.8
12-2-81	52-221	Milk:	Sr-89	14 ± 2	18 ± 5	12.1 ± 2.7
			Sr-90	23.4 ± 0.6	19 ± 1	22.6 ± 2.3
			I-131	14.1 ± 1.3	19 ± 1	16.3 ± 1.2
			Cs-134	20 ± 5	20.8 ± 5.8	21.4 ± 3.7
			Cs-137	35 ± 5	42.2 ± 5.8	38.6 ± 4.1

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

* Reanalysis, first analysis were not in good agreement. Spiked samples from first analysis had not been chemically stabilized.

** The Sr-89 and Sr-90 results were not in good agreement. Refer to Section (Evaluation of the Quality Control Program Data) for an explanation into the cause and the corrective action taken.

III. ENVIRONMENTAL MONITORING CONSIDERATIONS

7. Nuclear Regulatory Commission (NRC) Program

The Nuclear Regulatory Commission (NRC) 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. The Commonwealth of Pennsylvania's radiological laboratory is utilized by the NRC for analyzing these samples. Comparison of results also indicated agreement between the NRC Laboratory and the Duquesne Light Company Contractor laboratory.

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

The split sample program indicates that the Contractor laboratory is performing satisfactorily. In addition, three (3) independent laboratories are used to supplement the regular program. Comparisons between the independent laboratories and the Contractor laboratory is acceptable, and demonstrates a satisfactory performance by the DLC contractor.

Some contractor and QC laboratory spiked radiostrontium analyses were not in good agreement. That was attributed to incomplete separation of calcium from strontium in the $Sr(NO_3)$ precipitation step of the radiostrontium procedure and by incomplete mixing of the strontium carrier with the sample. An improved technique for more complete strontium separation from calcium and for longer strontium carrier mixing time with the sample has been put into effect by the Contractor laboratory.

Some contractor and QC laboratory duplicate monthly air particulate filter samples were not in good agreement. A review of the contractor and QC laboratory sample preparation procedures determined that differences could occur which would account for the poor comparisons. Subsequently, a change has been made to the contractor procedure to position the composite filter paper samples in front of the detector in a progressive order of oldest to newest with the oldest sample being located closest to the detector, which is the same technique utilized by the QC laboratory.

Based on all available Q.C. data and the data from the Contractor's internal EPA Interlaboratory Cross Check Program, the Environmental Monitoring Program for 1981 is acceptable with respect to both accuracy and measurement.

C. Standard Requirements and Limitations for Radiological and Other Effluents

The Shippingport Atomic Power Station and Beaver Valley Power Station are governed by rules and regulations of the Federal Government and the Commonwealth of Pennsylvania. Effluent releases at both stations 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.

Shippingport Atomic Power Station is operated in compliance with regulations and permits involving radioactive and other effluents. Limits noted in Department of Energy (DOE) Orders 5484.1 and 5480.1, Ohio River Valley Water Sanitation Commission (ORSANCO) Standards No. 1-70 and 2-70, Pennsylvania Department of Environmental Resources - Industrial Waste Permit #1832, and Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Permit #PA-0001589, Pennsylvania Department of Environmental Resources Industrial Waste Permit #0472205, and Pennsylvania Department of Environmental Resources Radioactive Gaseous Discharge Permit are observed and followed.

Beaver Valley Power Station is subject to regulations which include the Code of Federal Regulations 10 CFR, Pennsylvania Department of Environmental Resources (PDER) Industrial Waste Permit #0473211, Sewage Treatment Facilities Permit #0479403, 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 System (NPDES) Permit #0025615, and the Beaver Valley Power Station Technical Specifications.

D. Significant Changes and Reporting Levels

Statistically significant changes in radiological environmental monitoring results are defined as the median value (M) plus two (2) times the 95% confidence interval (N), or ten (10) times the lower limit of detection (LLD) for each sampling media analyzed during the preoperational period 1972 - 1975. Analytical results for sampling media noted in the Beaver Valley Power Station Environmental Technical Specifications, which were greater than the statistically significant values determined in the preoperational program (M + 2N or 10 x LLD), are values which require reporting as an anomalous measurement. This report is forwarded to the Nuclear Regulatory Commission within 10 (ten) days after the completion of a confirming analysis.

D. Significant Changes and Reporting Levels (continued)

There were three (3) analytical results of environmental samples during 1981 which exceeded Beaver Valley Power Station reporting levels and are summarized in Table III.8. The surface water tritium results were attributable to Beaver Valley discharges; however, all releases were well below limits noted in 10 CFR 20.

TABLE III.8
Anomalous Measurements* During 1981

Sample Date	Environmental Media	Site Location	Reporting Level	Level Found (Analyt. Results)
1st Quarter 1981	Tritium in Surface Water (1)	2A	1390 pCi/l	2290 pCi/l
2nd Quarter 1981	Tritium in Surface Water (1)	2A	1390 pCi/l	3870 pCi/l
4th Quarter 1981	Tritium in Surface Water (1)	2A	1390 pCi/l	1430 pCi/l

NOTE (1): Attributable to BVPS releases. (There were no releases which exceeded effluent limits for tritium as identified in 10 CFR 20).

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* Measurements which exceed the reporting levels in the Beaver Valley Power Station Environmental Technical Specifications.

IV. MONITORING EFFLUENTS

A. Monitoring of Liquid Effluents

Description of Liquid Effluents at the Shippingport Atomic Power Station and the Beaver Valley Power Station.

Most of the water required for the operation of the Beaver Valley and Shippingport stations is taken from the Ohio River, and returned to the river, used for makeup to various plant systems, consumed by station personnel, or discharged to a septic 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 through 4.5 are schematic diagrams of liquid flow paths for Shippingport and Beaver Valley respectively. The following four (4) tables summarize radioactive liquid effluents at both the Shippingport and Beaver Valley Power Stations:

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

Table IV.A.2 - Effluent Treatment, Sampling, and Analytical Procedures - Beaver Valley

Table IV.A.3 - Results of Liquid Effluent Discharges to the Environment - Shippingport

Table IV.A.4 - Results of Liquid Effluent Discharges to the Environment - Beaver Valley

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1981 Annual Radiological Environmental Report

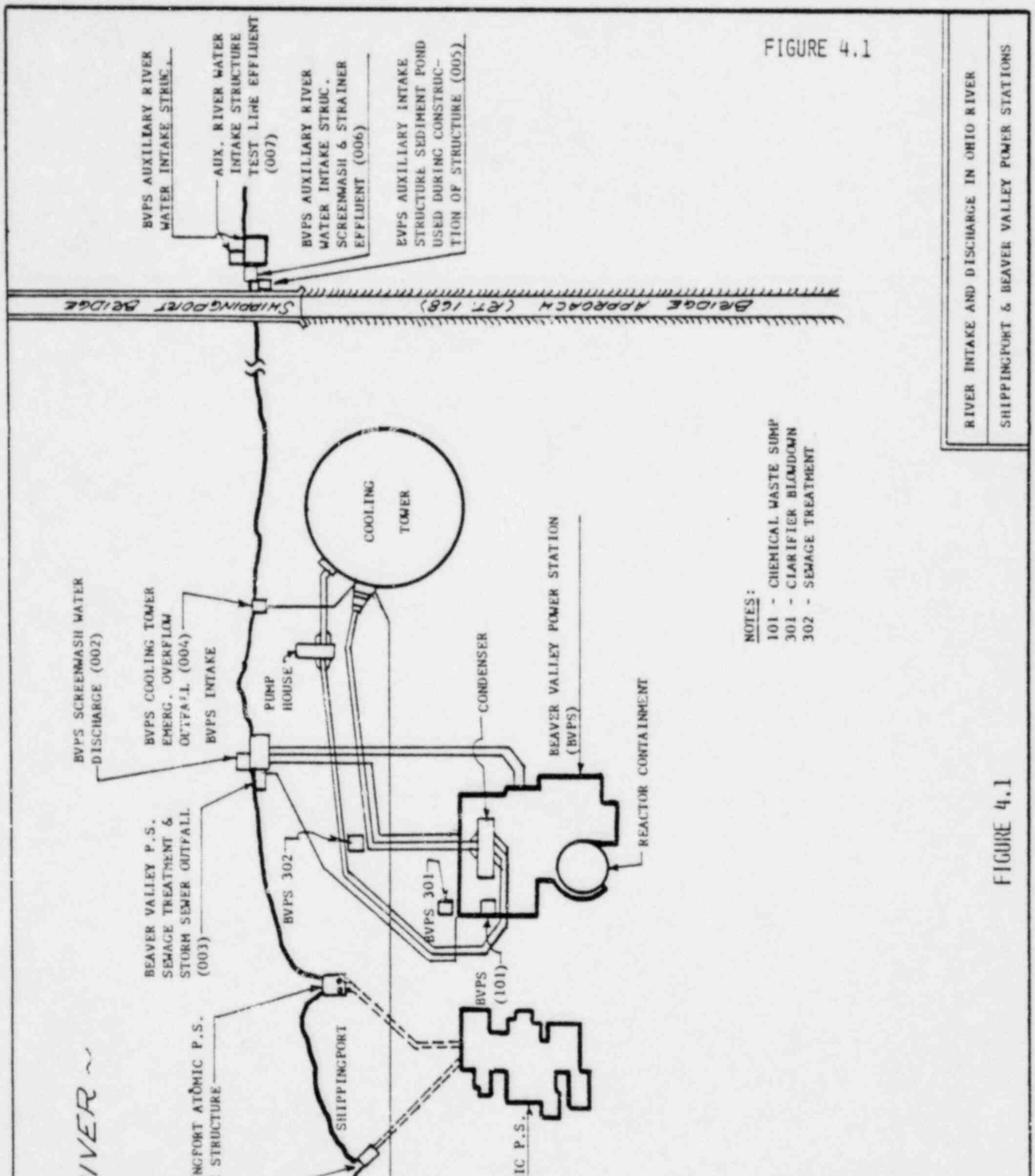

FIGURE 4.1

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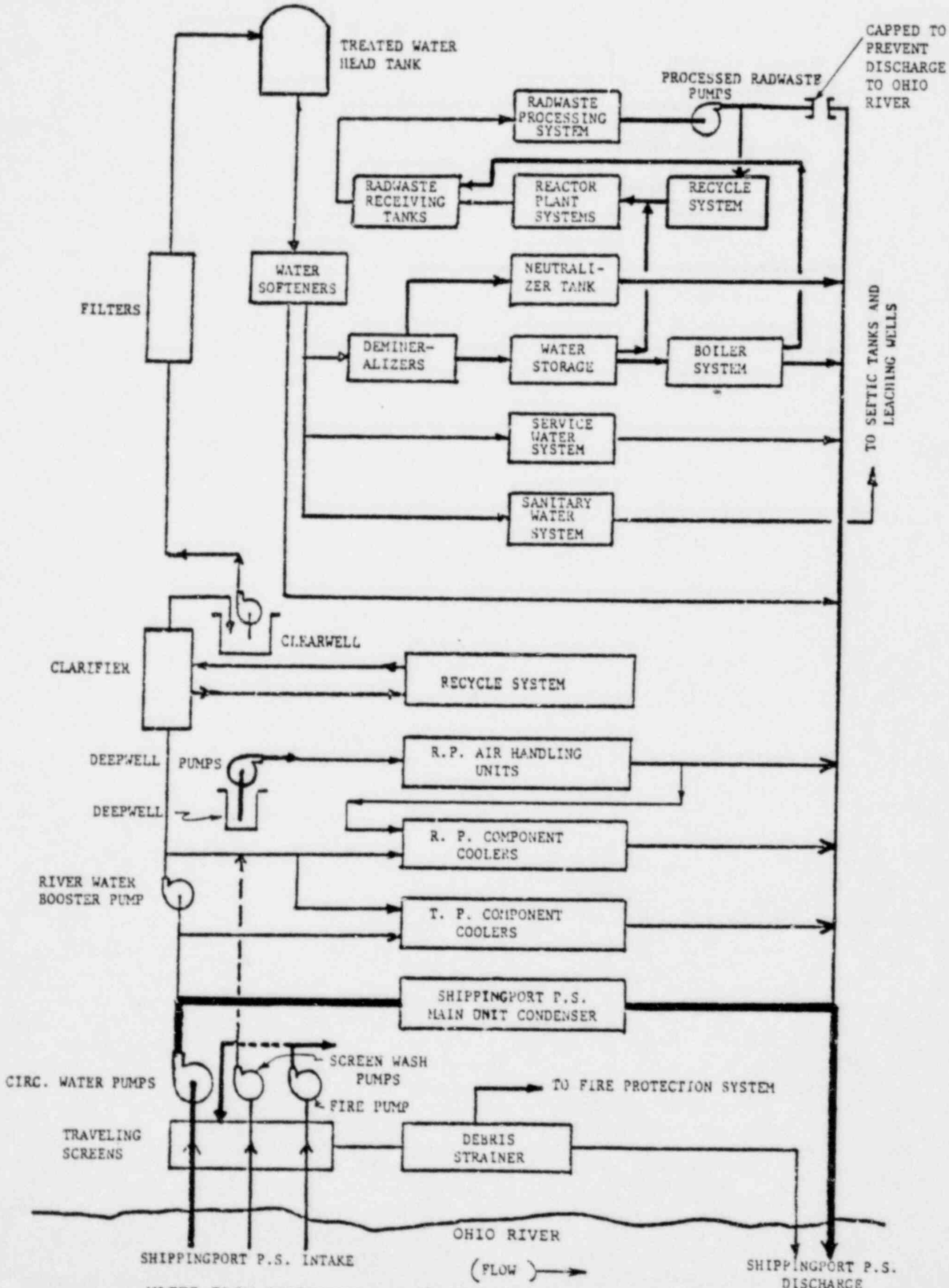
SECTION IV

FIGURE 4.2



WATER FLOW SCHEMATIC - SHIPPINGPORT ATOMIC POWER STATION

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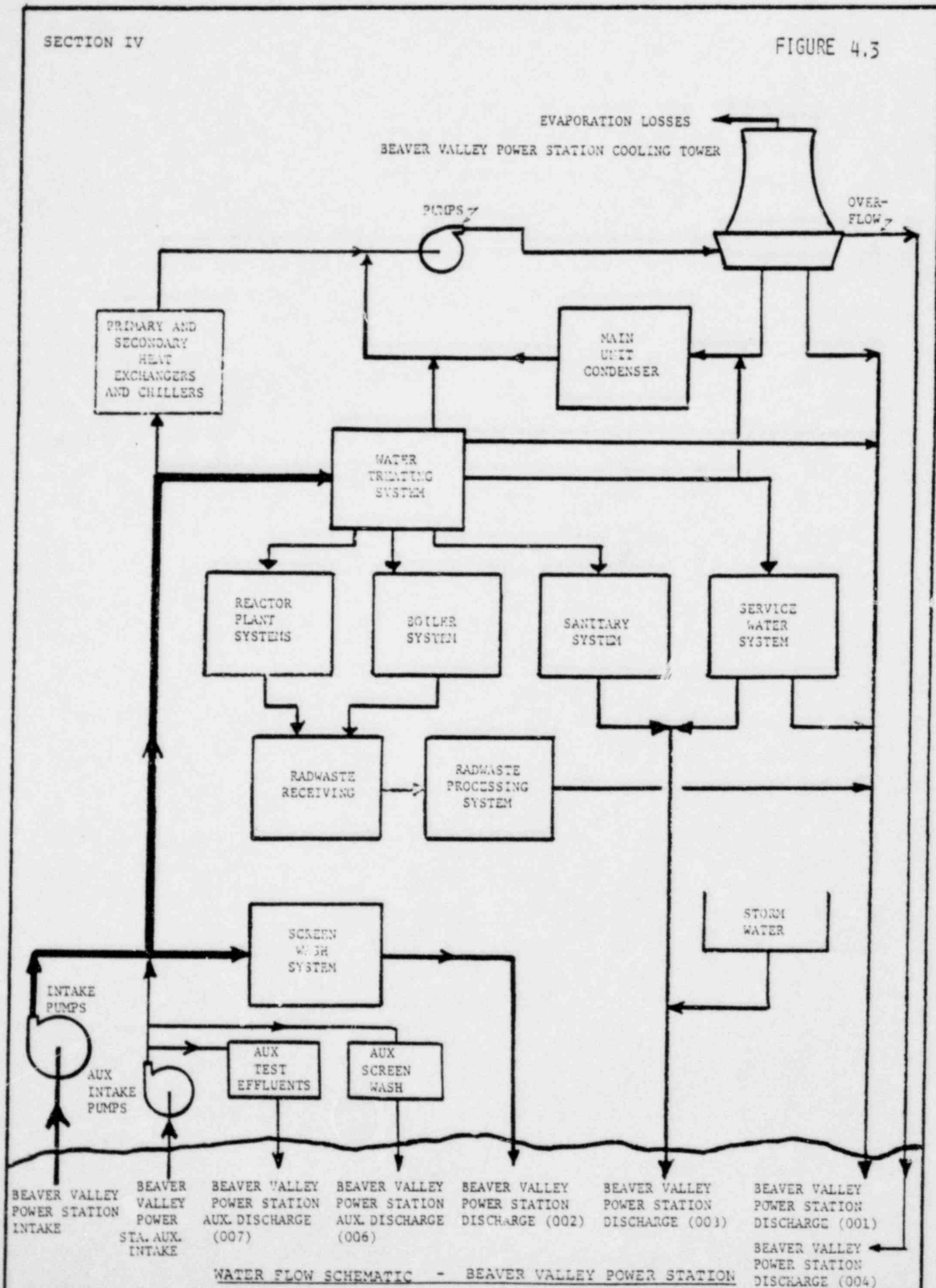

WATER FLOW SCHEMATIC - BEAVER VALLEY POWER STATION

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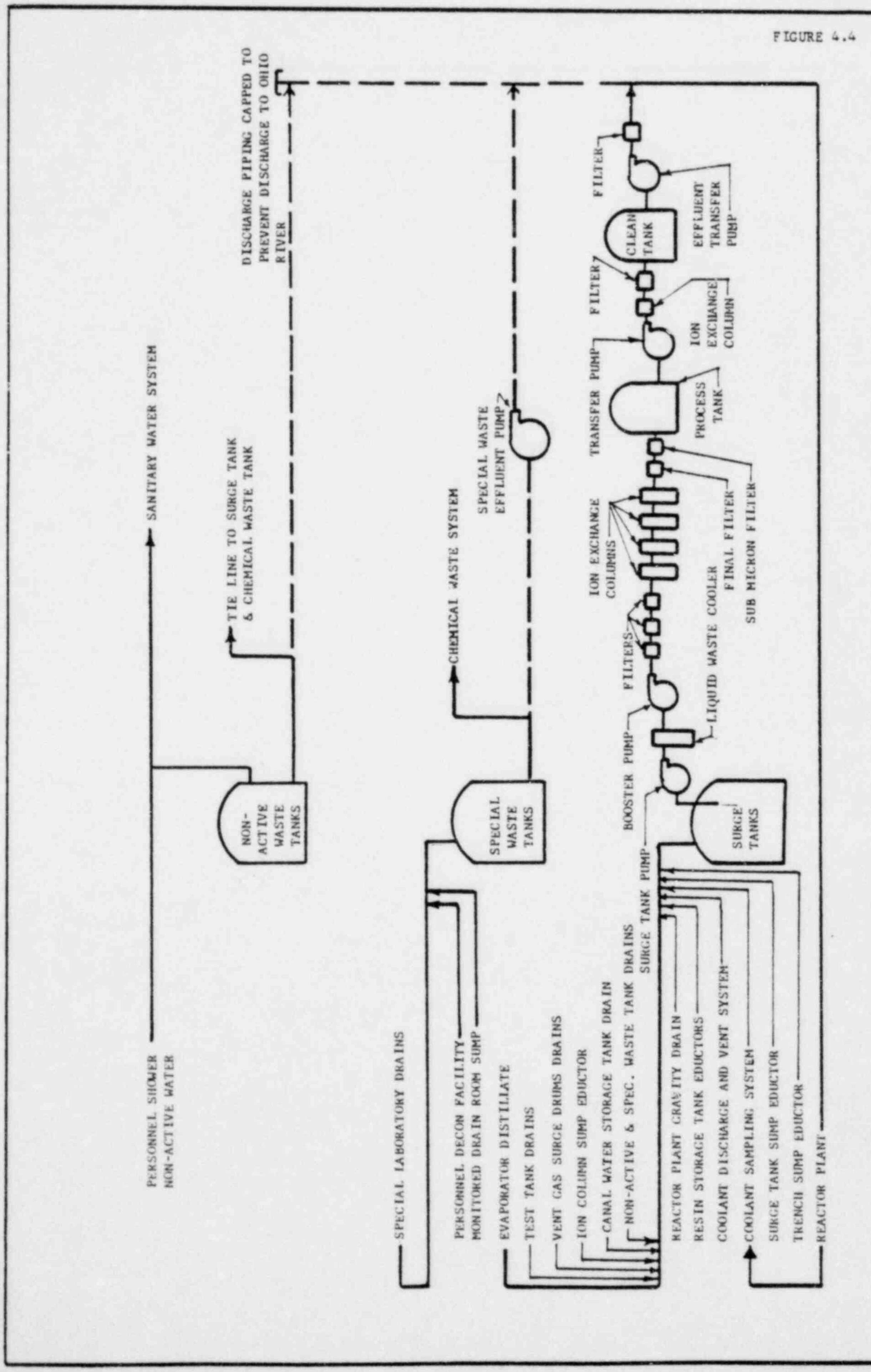

SHIPPINGPORT ATOMIC POWER STATION - LIQUID RADIOACTIVE WASTE SYSTEMS
FIGURE 4.4

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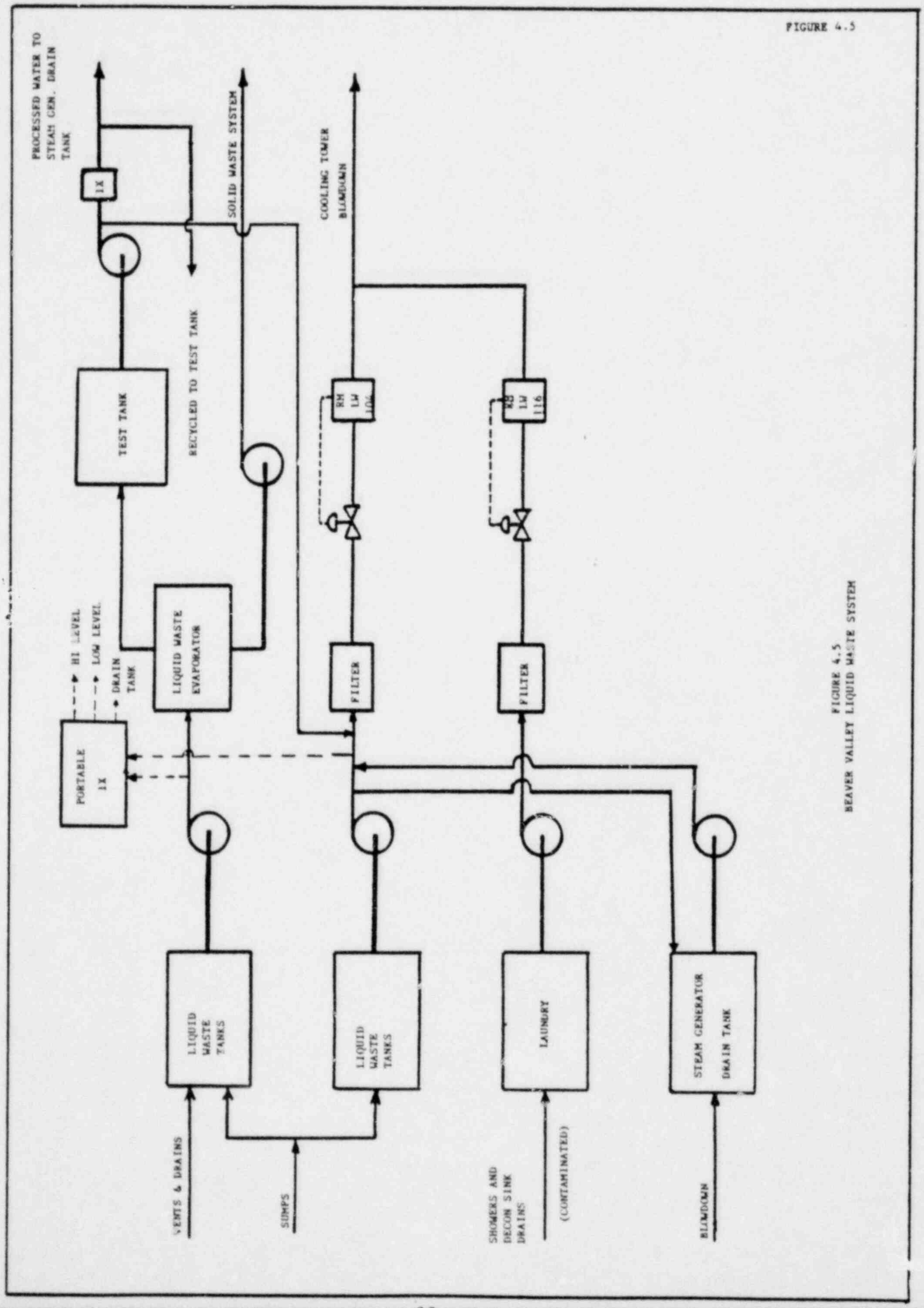

FIGURE 4.5
BEAVER VALLEY LIQUID WASTE SYSTEM

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TABLE IV.A.1

1. Effluent Treatment, Sampling and Analytical Procedures - Shippingport

	Effluent Type	Treatment, Sampling and/or Monitoring	Standard and/or Analytical Procedures
(a)	Steam System Blowdown	Directed to radwaste system if radioactive. Normally directed to discharge channel where it is diluted by circulating cooling water.	Secondary water is sampled for any radioactive contamination. A 1000 ml sample counted in a multichannel analyzer for 10 minutes for gross activity. The counter can measure a minimum detectable activity (MDA) of 8.4×10^{-8} µCi/ml.
(b)	Radioactive Waste Liquids	Collected, segregated and processed as one of two types of liquid wastes: (a) special waste (b) radioactive waste. Sample taken of batch before processing to remove radioactivity and reuse in plant systems. See Figure 4.4.	A 3000 ml sample is counted for gross activity. The counter can measure a minimum detectable activity (MDA) of 5×10^{-8} µCi/ml.

TABLE IV.A.2

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	Concentration of radioactive materials released in waste effluents shall not exceed values specified in 10 CFR 20, Appendix B, Table II for unrestricted areas, and the Environmental Technical Specifications.	Procedures adhere to requirements of Technical Specifications.

TABLE IV.A.3

2. Results: Shippingport

Effluent Type	Results for 1981
(a) Steam System Blowdown	The boilers were periodically blown down. The boilers are sampled prior to each blowdown. There was no radioactive liquid discharged in 1981.
(b) Radioactive Waste Liquids	Since Shippingport first went into operation in 1957, the total activity of liquid waste discharged each year has decreased more or less continuously from a high of 0.53 Ci in 1965 to a low of less than 0.001 Ci in the years 1974, 1975, 1976, and 1977. There was no radioactive liquid discharged in 1978, 1979, 1980, or 1981.

TABLE IV.A.4

2. Results: Beaver Valley

Effluent Type	Results for 1981
(a) Steam System Blowdown	The Steam System Blowdown was recycled or directed to the Radwaste System where it was monitored and discharged. No radioactivity was found in the water.
(b) Radioactive Waste Liquids	Liquid effluents from the Beaver Valley Power Station were released in accordance with conditions noted in the Environmental Technical Specifications. No limits were exceeded. These values have been reported in the Beaver Valley Power Station Semiannual Effluent Reports for 1981.

IV. MONITORING EFFLUENTS

B. Monitoring of Airborne Effluents

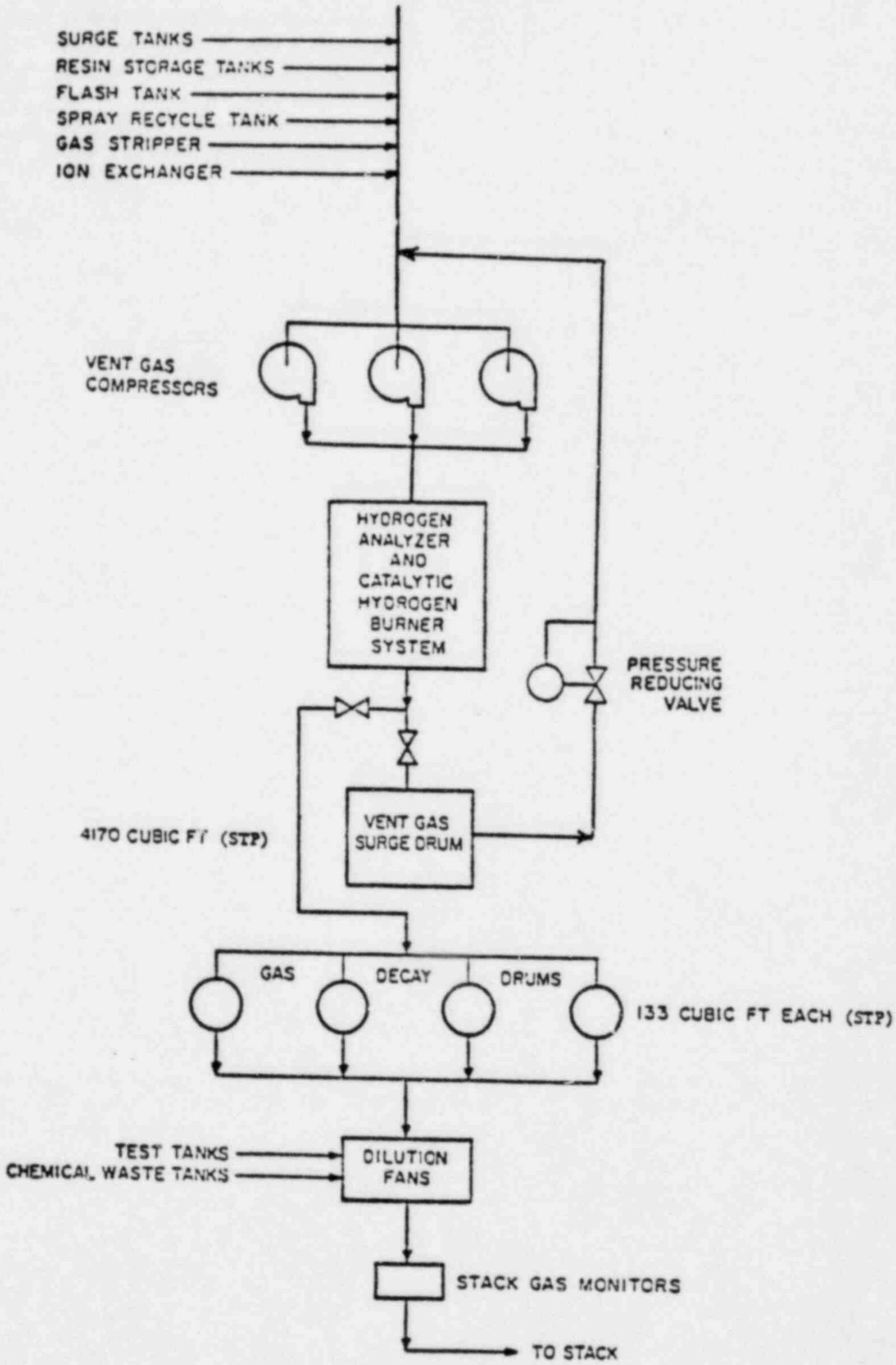
1. Description of Airborne Effluents/Sources

a. Shippingport Atomic Power Station

The potential source of airborne radioactivity associated with the Shippingport station is the radioactivity contained in the reactor coolant system. This system contains the activated corrosion and wear products, activated impurities in reactor coolant, and small quantities of fission products originating from naturally occurring uranium impurity and could become airborne from reactor coolant, sampling operations, and maintenance and overhaul operations which require opening the system or working on contaminated components removed from the system. Stringent radiological controls which have been developed during 24 years of operations at Shippingport are exercised during these operations to prevent radioactivity from becoming airborne. Cobalt-60 is the nuclide of primary concern because of its long radioactive half-life and its concentration in reactor coolant. This radionuclide, present in the form of minute insoluble particles, could become airborne during maintenance operations on contaminated components removed from this system. However, strict radiological surveillance is maintained throughout the operating plant, including continuous monitoring of airborne radioactivity in the operating spaces to ensure that concentrations are less than the uncontrolled area limits specified in DOE Order 5484.1. In addition, air exhausted from potentially contaminated areas, such as decontamination and maintenance areas, is passed through high-efficiency particulate air filters. These filters are routinely serviced, changed, and tested in-place.

The principle environmental release point for the Shippingport Atomic Power Station is the containment ventilation exhaust. This point is continuously monitored, and analyses are performed on charcoal cartridges weekly for I-131 and monthly for I-133 and I-135. Additionally weekly continuous air samples are obtained on fixed filter papers which are analyzed weekly for gross beta, and composited monthly to identify gamma emitting isotopes. Composite of the particulate filters are also analyzed monthly for gross alpha determinations and quarterly for Sr-89 and Sr-90. A monthly gas sample is also obtained and analyzed for tritium.

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report



Shippingport Atomic Power Station Gaseous Radioactive Waste Processing System

FIGURE 4.6

IV. MONITORING EFFLUENTS

a. Shippingport Atomic Power Station (continued)

Reactor plant exhausts from the Decontamination Room, Sample Preparation Room, Laundry Room, Radiochemistry Laboratory, Gaseous Waste System, and Compacting Station are continuously sampled with fixed filter samplers. These samples are analyzed weekly for gross beta, and composited monthly to identify gamma emitting isotopes.

Processing of noble gases (predominantly short lived Xe-133) is accomplished by collecting and storing the gases in Shippingport RWP vent gas system. After sampling and analysis, the gases are released when the storage tanks are full. Figure 4.6 shows a schematic diagram of the gaseous waste system in the radioactive waste disposal system at Shippingport.

b. Beaver Valley Power Station (BVPS)

The Beaver Valley Power Station identifies isotopes according to the Environmental 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 include noble gases, iodines, and particulates. Figure 4.7 shows the gaseous radwaste system at Beaver Valley Power Station.

The environmental release points also require specific nuclide identification. These points include the Process Vent located on top of the Cooling Tower, the Ventilation Vent located on the top of the Auxiliary Building, and Supplementary Leak Collection and Release System (SLCRS) Vent located on top of the Containment. These points are continuously monitored. Principal gamma emitters and tritium are analyzed on a monthly basis. Analysis is also done on charcoal cartridges for I-131, I-133, and I-135 that have continuously sampled the gas stream for a week. Weekly continuous samples are also obtained on filter paper to identify the particulates gamma emitting isotopes. Composites of the particulate samples are analyzed monthly for gross alpha determinations and quarterly for Sr-89 and Sr-90.

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report

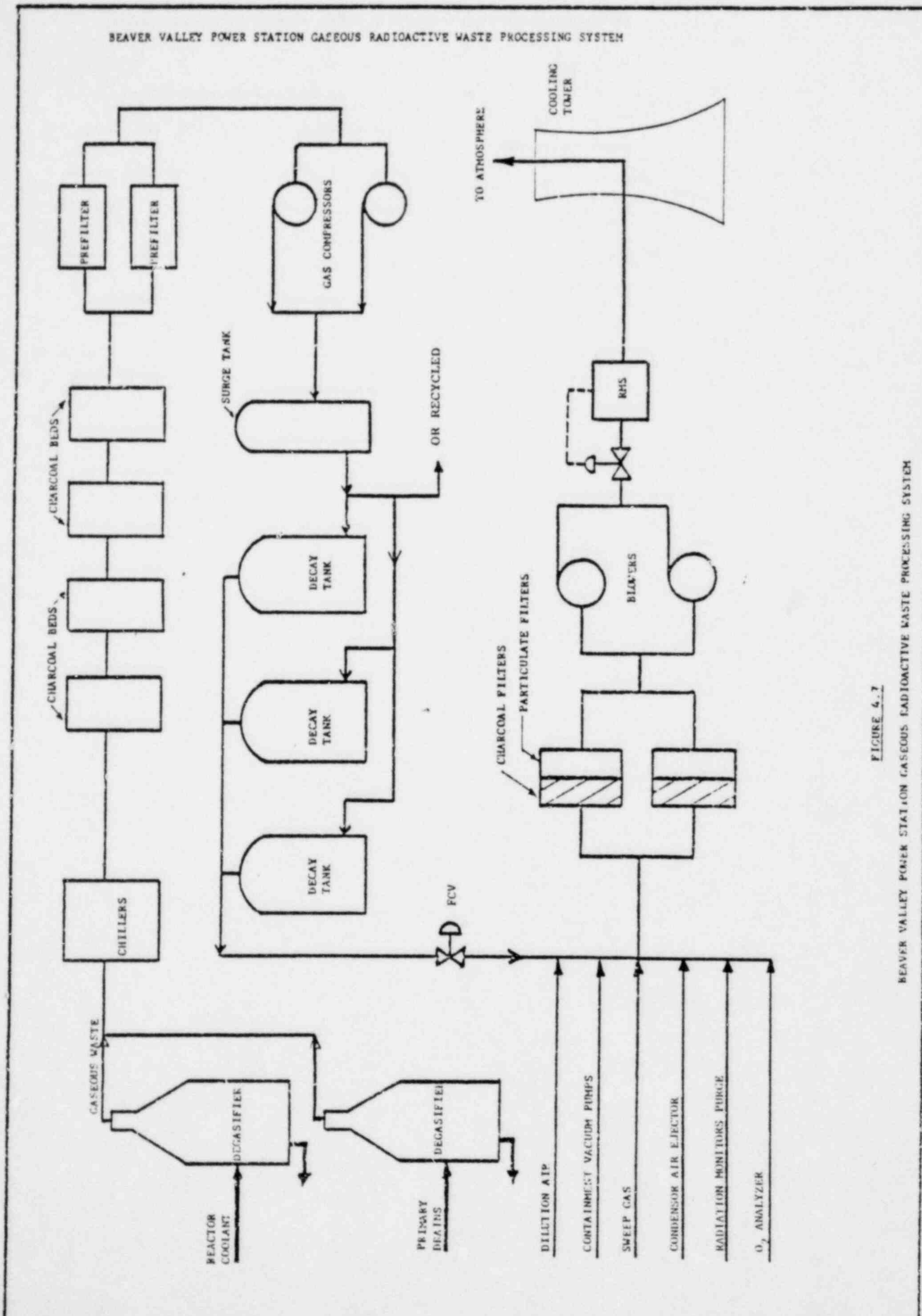


FIGURE 4.7

BEAVER VALLEY POWER STATION GASEOUS RADIOACTIVE WASTE PROCESSING SYSTEM

IV. MONITORING EFFLUENTS

2. Airborne Effluent Treatment and Sampling

a. Shippingport Atomic Power Station

Gaseous wastes stripped from the reactor coolant at the Shippingport Station are circulated through a hydrogen analyzer and catalytic hydrogen burner system where the hydrogen is removed. The gases are initially stored in a vent gas surge drum, and subsequently compressed and transferred to one of four gas storage drums. The decayed gases are sampled prior to release. In addition, the exhaust from the containment is equipped with high efficiency particulate air filters and monitoring devices to prevent releases of radioactive particulates. Protective devices are utilized in the event of high airborne activity to automatically seal off the primary containment to prevent an inadvertent release of radioactivity. Reactor plant exhausts from the Decontamination Room, Sample Preparation Room, Laundry Room, Radiochemistry Laboratory, and Compacting Station are also equipped with high efficiency particulate air filters, and are continuously monitored for radioactive particulates by the use of fixed filter monitors. Exhausts from the Gaseous Waste System are filtered and sampled for radioactivity at the release point also. Continuous air monitors are located within the containers, and other plant areas to constantly monitor the condition of the air. A stack release diagram is shown in Figure 4.8 identifying ventilation and gaseous release points for the Shippingport Atomic Power Station.

b. Beaver Valley Power Station

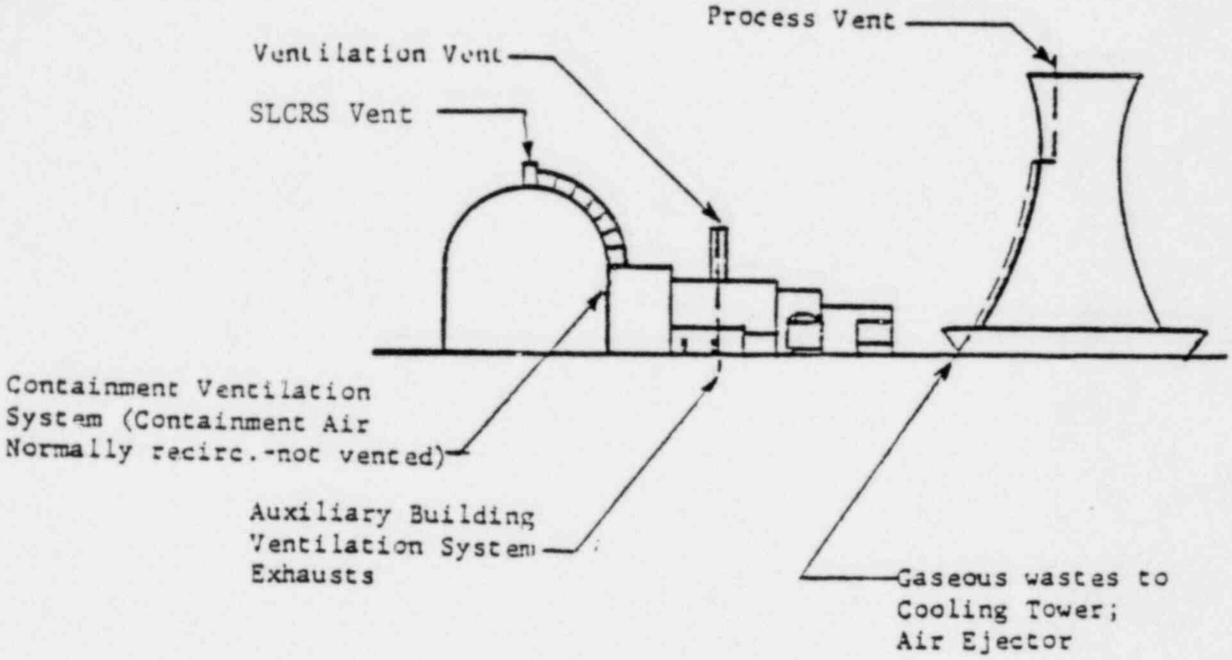
Radioactive gases enter the gaseous waste disposal system from the degasifier vent chiller of the boron recovery system, and are directed to the gaseous waste charcoal delay subsystem upstream of the overhead gas compressor where the gas is chilled to condense most of the water vapor. Gases from the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

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report

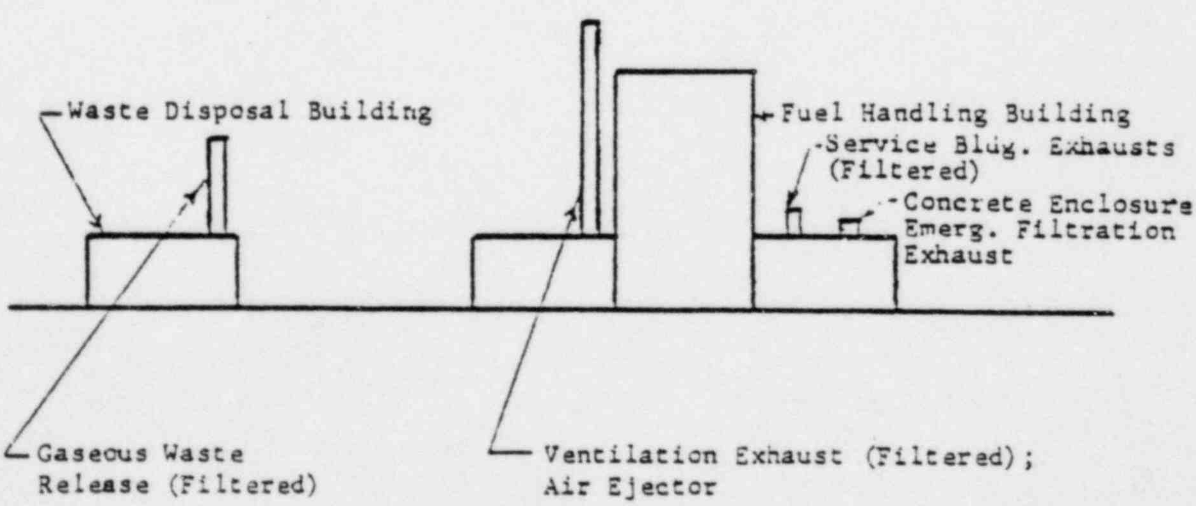
SECTION IV

FIGURE 4.8

DISCHARGE POINTS - GASEOUS WASTES



GASEOUS RELEASE POINTS - BEAVER VALLEY POWER STATION



GASEOUS RELEASE POINTS - SHIPPINGPORT ATOMIC POWER STATION

FIGURE 4.8

IV. MONITORING EFFLUENTS

b. Beaver Valley Power Station (continued)

The overhead gas compressor directs the radioactive gas stream to a gas surge tank. The system is designed to return most of the gas to the volume control tank in the Chemical and Volume Control System (CVC System). A quantity of gas is periodically discharged from the surge tank to one of the three (3) decay tanks for eventual release to the atmosphere via the process vent on top of the cooling tower. After the decay tanks are sampled and authorization obtained for discharge, the flow of the waste gases from the decay tanks is recorded and rapidly diluted with about 1000 scfm of air in order to limit hydrogen concentration. The gases are then combined with the containment vacuum system exhaust, aerated vents of the vent and drain system, and the main air ejector effluent. 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 cooling tower. The radioactivity levels of the stream are monitored continuously. Samples are also taken to determine the rate of activity released to the atmostphere. 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 decay tanks.

During a shutdown period after the containment has been sampled and the activity levels determined, the containment may be purged through the Supplementary Leak Collection Release System (SLCRS) Vent or, if the activity is low level, through the ventilation vent located on top of the Auxiliary Building.

Areas in the 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 and sampled periodically. Upon a high radiation 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. Release points are shown in Figure 4.8 for the Beaver Valley Power Station.

IV. MONITORING EFFLUENTS

b. Beaver Valley Power Station (continued)

Each 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.

3. Analytical Procedures for Sampling Airborne Effluents

a. Shippingport Atomic Power Station

The following tabulates the gaseous sampling and analysis schedule:

Vent Gas Decay Tank Releases

Sample Type	Sampling Frequency	Type Of Activity Analysis	Detectable Concentration
Gas From Decay Tank	Prior to Discharge	Gamma Ray Spectrum of Gas Sample *	1×10^{-8} µCi/cc
Gas from Decay Tank	Prior to Discharge	H-3	2×10^{-7} µCi/cc
Gas from Decay Tank	Prior to Discharge	C-14	1×10^{-7} µCi/cc

* A gas sample of measured volume is counted in a multi-channel analyzer for 10 minutes for gross activity. The counter has a minimum detectable activity (MDA) of 1×10^{-8} µCi/cc for the predominant nuclide of Xe-133.

IV. MONITORING EFFLUENTS

3. Analytical Procedures for Sampling Airborne Effluents (continued)

Air Exhausts

	Sample Type	Sampling Frequency	Type Of Activity Analysis	Dectectable Limits
(1)	Air from the Plant Ventilation Exhaust Effluent Stream	Continuous	Gross Gamma	1.2×10^{-6} µCi/cc (Gas, Channel 8 ORMS)* 5×10^{-10} µCi/cc (Particulate; Channel 12 ORMS)*
(2)	Particulate Filter in Plant Ventilation Effluent Stream	Continuous	Gross Beta Weekly Sample	1×10^{-14} µCi/cc (Particulate)
	Particulate Filter in Plant Ventilation Effluent Stream	Continuous	Principle Gamma Monthly Composite (Weekly if Gross Beta $\geq 1 \times 10^{-13}$)	1×10^{-14} µCi/cc Particulate
	Particulate Filter in Plant Ventilation Effluent Stream	Continuous	Gross Alpha Monthly	2×10^{-15} µCi/cc Particulate
	Particulate Filter in Plant Ventilation Effluent Stream	Continuous	Sr-89, Sr-90 Quarterly	5×10^{-14} µCi/ml (Sr-89) 1×10^{-14} µCi/ml (Sr-90) Particulate
(3)	Charcoal Cartridge in Plant Ventilation Effluent Stream	Continuous	I-131 Weekly	1×10^{-13} µCi/ml
	Charcoal Cartridge in Plant Ventilation Effluent Stream	Monthly	I-133, I-135 Monthly	1×10^{-13} µCi/ml (I-133) 1×10^{-12} µCi/ml (I-135)
(4)	Evacuated Bomb Sample In Plant Ventilation Effluent Stream	Monthly	H^3	2×10^{-7} µCi/ml
(5)	Particulate Filter in Reactor Plant Exhaust from Decontamination Room, Sample Preparation Room, Laundry Room, Radio-Chemistry Laboratory, Gaseous Waste System, and Compacting Station.	Continuous	Gross Beta Weekly	1×10^{-14} µCi/cc Particulate
	Particulate filter in Reactor Plant Exhaust from Decontamination Room, Sample Preparation Room, Laundry Room, Radio-chemistry Laboratory, and Compacting Station.	Continuous	Principal Gamma Monthly Composite (Weekly if Gross Beta $\geq 1 \times 10^{-13}$)	1×10^{-14} µCi/cc Particulate

ORMS - Operational Radiation Monitoring System

* Although the ORMS Channels have no specific function as far as effluent monitoring and reporting is concerned, these two (2) channels are being listed for information purposes. It is also noted that these channels provide alarm functions in the Main Control Room when levels of 1.2×10^{-6} µCi/cc are reached on Channel 8, or 1×10^{-9} µCi/cc on Channel 12. Additionally, they shut the ventilation system butterfly valves when levels of 1.2×10^{-6} µCi/cc are reached on Channel 8 or 1×10^{-7} µCi/cc on Channel 12.

IV. MONITORING EFFLUENTS

3. Analytical Procedures for Sampling Airborne Effluents (continued)

b. Beaver Valley Power Station

The following tabulates the gaseous sampling and analysis schedule:

Gaseous Source	Sampling Frequency	Type Of Activity Analysis	Detectable Concentrations (µCi/ml)[a]
(1) Waste Gas Decay Tank Releases	Each Tank	Principal Gamma Emitters	10^{-4}[b]
		H-3	10^{-6}
(2) Containment Purge Releases	Each Purge	Principal Gamma Emitters	10^{-4}[c]
		H-3	10^{-6}
(3) Environmental Release Points	Monthly (Gas Samples)	Principal Gamma Emitters	10^{-4}[b,c]
		H-3	10^{-6}
	Weekly (Charcoal Sample)	I-131	10^{-12}
	Weekly (Charcoal Sample)	I-133, I-135	10^{-10}
	Weekly[d] (Particulates)	Principal Gamma Emitters (Ba-La-140, I-131, and others)	10^{-11}
	Monthly Composite[d] (Particulates)	Gross α	10^{-11}
	Quarterly Composite[d] (Particulates)	Sr-90 and Sr-89	10^{-11}

[a] The above detectability limits for activity analysis are based on technical feasibility and on the potential significance in the environment of the quantities released. For some nuclides, lower detection limits may be readily achievable, and when nuclides are measured below the stated limits, they should also be reported.

[b] For certain mixtures of gamma emitters, it may not be possible to measure radionuclides at levels near their sensitivity limits when other nuclides are present in the sample at much higher levels. Under these circumstances, it will be more appropriate to calculate the levels of such radionuclides using observed ratios with those radionuclides which are measurable.

[c] Analyses shall also be performed following each refueling, startup, or similar operational occurrence which could alter the mixture of nuclides.

[d] To be representative of the average quantities and concentrations of radioactive materials in particulate form released in gaseous effluents, samples should be collected in proportion to the rate of flow of the effluent stream.

IV. MONITORING EFFLUENTS

4. Results

a. Shippingport Atomic Power Station

Analyses for the particulate airborne radioactivity in the plant effluents indicated that the gross alpha and beta activity concentrations were at or very near the Lower Limit of Detection (LLD). Analytical results of charcoal filter samples showed that there were no instances of radioiodine concentrations above LLD.

Specific gamma analyses of weekly and monthly composite air filter samples were also performed. Results showed naturally occurring radioactivity typical of "background air" and nuclides attributable to worldwide fallout from nuclear weapons testing. During 1981, there were two instances where activity, attributable to plant operations, was measured.

In the first instance, Manganese 54 activity was measured in the Decontamination Room Ventilation Exhaust. The total amount of Mn-54 activity released was 0.00000000383 curies at a concentration of 1.60×10^{-15} μCi/cc. In the second instance, Cobalt 60 activity was measured in the Sample Preparation Room Ventilation Exhaust. The total amount of C0-60 activity released was 0.0000000371 curies at a concentration of 3.30×10^{-15} μCi/cc.

Radiostrontium analyses of quarterly composite air filter samples showed Sr-89 and Sr-90 concentrations in air which were at or near the minimum detectable concentrations of 5×10^{-14} μCi/ml, and 1×10^{-14} μCi/ml, respectively. The levels of Sr-89 and Sr-90 observed were extremely low and are typical of "background air" radiostrontium levels. Also tritium and carbon-14 gaseous releases in the effluents were estimated based on analyses of primary coolant and found to be below the predicted levels presented in the LWBR Program Environmental Impact Statement.

There were two (2) releases of gaseous radioactivity from the Shippingport Atomic Power Station during 1981. The total releases of gaseous radioactivity from the Shippingport Atomic Power Station during 1981 were approximately 0.0002361 curies Xe-133 and 0.0000006 curies of Kr-85. These

amounts of radioactivity released from the Shippingport Atomic Power Station during 1981 are extremely small and had a negligible effect on the environment as shown in Section V.6.

b. Beaver Valley Power Station

Gaseous effluents from the Beaver Valley Power Station were released in accordance with conditions noted in the Environmental Technical Specifications. No limits were exceeded. These values have been reported in the Beaver Valley Power Station Semi-Annual Effluent Reports for 1981.

IV. MONITORING EFFLUENTS

C. Solid Waste Disposal at the Shippingport and Beaver Valley Power Stations

During normal operations and periodic maintenance, Shippingport and Beaver Valley Power Station generated small quantities of radioactive solid waste materials 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.

At Shippingport Atomic Power Station and the Beaver Valley Power Station, the compactable wastes were segregated and compressed in a 55-gallon compactor to minimize disposal volumes. The compressed waste, plus other drums of noncompactable waste, were then shipped offsite for disposal at a site owned by the Department of Energy or 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 was buried at the Shippingport or 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 and the Nuclear Regulatory Commission. Shipments offsite were made in accordance with Department of Transportation regulations. Figure 4.9 depicts solid waste handling at the site.

In 1981, the Shippingport plant disposed of a total of 5719 cubic feet of radioactive solid waste having a total radioactivity of about 120 curies. This included six (6) shipments of low level wastes and 14 shipments of ion exchange resin.

At Beaver Valley Power Station approximately 7,517.5 cubic feet of radioactive solid waste were shipped offsite in 1981. The thirty-six (36) shipments contained a total activity of 92.9 curies.

Industrial solid wastes from both plants were collected in portable bins, and removed to an approved offsite burial ground. No burning or burial of wastes was conducted at either the Beaver Valley or Shippingport plant.

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report

SECTION IV SOLID WASTE DISPOSAL DIAGRAM FIGURE 4.9

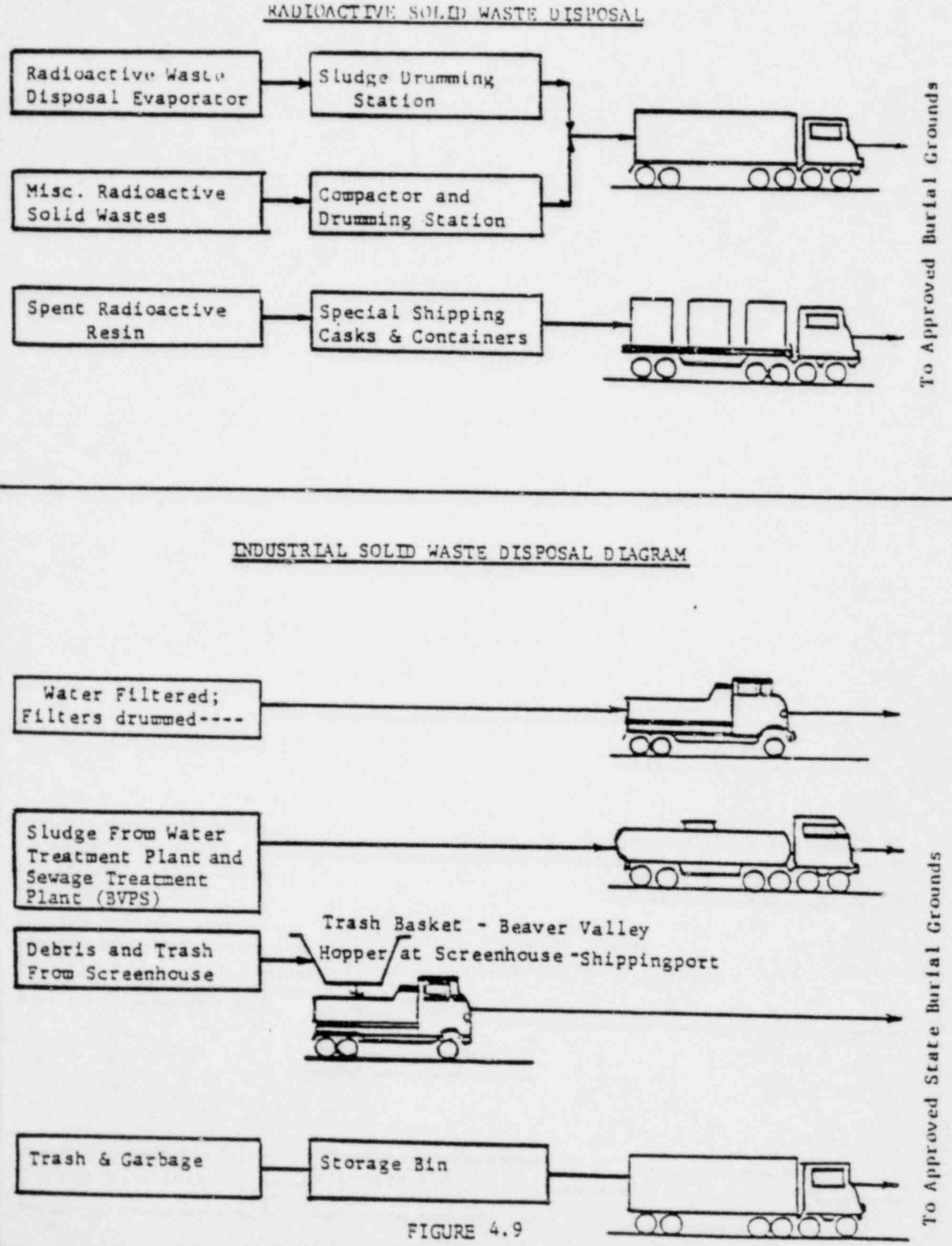


FIGURE 4.9

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 (Soil Monitoring is required every 3 years and was not required in 1981.)

V-D - Vegetation and Foodcrops

V-E - Cow's Milk

V-F - Environmental Radiation Monitoring

V-G - Fish

V-H - Surface, Drinking and Well Waters

V-I - Estimates of Radiation Dose to Man

2. China's Nuclear Test Fallout

Several media monitored by this program showed increased radioactivity which is attributable to fallout from nuclear weapon tests performed by China on October 16, 1980. These are discussed in the summaries of media affected in Section V-B through V-H. Specific results for samples collected during the months when fallout from this test increased activities above normal background levels are shown in Table V.A.2. A summary of the background levels, are shown in Table V.A.2. A summary of the 1981 operational environmental data (ranges and means) for each sampling media is found in Table V.A.3.

TABLE V.A.1

CONSOLIDATED RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Type of Sample	DLC Sample Points	Sample Point Description	Sample Frequency	Sample Preparation	Analysis Frequency	Analysis (b)
1. Air Particulate and Radioiodine	13.	Meyer's Farm	Continous Sampling with sample collection at least weekly.	Weekly Composite (d)		Gross β, (c) I-131
	30	Shippingport, PA. (S.S.)		Monthly Composite (d)		γ -scan
	46.1	Industry, PA (Tire Co.)		Quarterly Composite (d)		Sr-89, 90
	32	Midland, PA (S.S.)				
	48(a)	Weirton, WV (a)				
	51	Aliquippa, PA (S.S.)				
	47	East Liverpool, OH				
	27	Brunton's Farm				
	28	Sherman's Farm				
	29B	Beaver County Hospital				
2. Direct Radiation	13	Meyer's Farm	Continous (TLD)	Quarterly (k) Annually (K)		γ-Dose
	46	Industry, PA (Church)				
	32	Midland, PA (S.S.)				
	48(a)	Weirton, WV (a)				
	45.1	Raccoon Twp, PA Kennedy's Crnrs.				
	51	Aliquippa, PA (S.S.)				
	47	East Liverpool, OH				

DLC#		DLC#		Sample Frequency	Sample Preparation	Analysis
70	West. Bvr. School	80	Raccoon Park	Continuous (TLD)	Quarterly (k) Annually	γ-Dose
28	Sherman's Farm	81	Southside School			
71	Brighton Twp. School	82	Hanover Municipal Bldg.			
72	Logan School	83	Mill Creek Rd			
29B	Beaver County Hospital	14	Hookstown			
73	Potter Twp. School	84	Hancock Co. Children Home			
74	Comm. Col-Center Twp.	85	Rts. 8 & 30 Intersection			
75	Holt Road	86	E. Liverpool Cahills House			
76	Raccoon Twp. School	92	Georgetown Rd.			
77	Green Garden Rd (Wayne's)	87	Calcutta Road			
59	Irons	88	Midland Heights			
78	Raccoon Mun. Bldg.	89	Ohioville			
27	Brunton's Farm	90	Fairview School			
79	Rt. 18 & Rt. 151	10	Shippingport Boro, PA			
15	Georgetown	45	Mt. Pleasant Church			
46.1	Industry PA Tire Co.	60	Haney's Farm			
91	Pine Grove Rd and Doyle Rd.	93	Sunset Hills, Midland			
94	McCleary Rd, Wilson	95	McCleary Rd, Hollie Williams			

S.S. - Substation

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

Type of Sample	DLC Sample Points	Sample Point Description	Sample Frequency	Sample Preparation	Analysis Frequency	Analysis (b)
3. Surface Water	49.1	Arco Polymers (a)	Intermittent	Monthly Composite of		Gross β
	2.1	Downstream (Midland)Crucible	Composite Samples(j) Collected Weekly	Weekly Sample (d)		Gross α γ-scan
	3	Shippingport Atomic Power Station Discharge	Weekly Grab Samples Only	Quarterly Composite		Co-60, H-3 Sr-89, Sr-90
	49(a)	Montgomery Dam (Upstream)				
	2A	Downstream BVPS Outfall				
	5	East Liverpool (raw water)	Daily Grab Sample Only - Collected Weekly (j)			
4. Groundwater	13	Meyer's Farm				
	14	Hookstown, PA				
	15	Georgetown, PA				
	11	Shippingport Boro	Quarterly	Quarterly		γ-scan, Gross β Gross α, H-3
5. Drinking	4	Midland, PA (Midland Water) Treatment Plant)	Intermittent(e) Sample Collected Weekly	Weekly Composite of Daily Sample (d)		γ-scan, I-131
				Monthly Composite (d)		Gross α, Gross β
	5	East Liverpool, OH (East Liverpool Water Treatment Plant)		Quarterly Composite (d)		H-3, Co-60, Sr-89, 90
6. Shoreline Sediment	2A	Downstream BVPS Outfall	Semiannual	Semiannual		γ - scan, Gross β Gross α Uranium Isotopic Sr-89, 90
	3	Vicinity SAPS Discharge				
	49	Upstream Side of Montgomery Dam (a)				
	50	Upstream side of New Cumberland Dam				
7. Milk	25	Searight's Dairy	Weekly (f)	Weekly sample from Searight's only		I-131
	61*	Allison				
	62*	Lyon	Biweekly (g) When animals are on pasture; monthly at other times.	Biweekly (grazing) Monthly (indoors)		γ - scan Sr-89, 90 I-131, Cs-137
	65*	Belun				
	66*	Straight				
	67*	Szatowski				
	69*	Collins				
	27	Brunton's Dairy (h)	Monthly	Monthly		γ - scan Sr-89, 90 I-131, Cs-137
	29(a)	Nicol's Dairy (h)				

* Additional dairies required by Environmental Technical Specification 3.2.1.D.2. In addition to Searight's (Site 25), three dairies are selected when milk is available based on highest deposition factors. Sites 27 and 29A are required for the Shippingport program.

TABLE V.A.1

CONSOLIDATED RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

(Continued)

Type of Sample	DLC Sample Points	Sample Point Description	Sample Frequency	Sample Preparation	Analysis Frequency	Analysis (b)
8. Fish	2	Vicinity of BVPS #1 Station Discharge and Shippingport Dis. Sta.	Semiannual	Composite of edible parts by species (i)		γ-scan on edible portions
	49(a)	Upstream Side of Montgomery Dam				
9. Food Crops (Shipp.)	10	(Three locations within 5 miles Selected by Company)	Annual at harvest if available	Composite of each sample species		γ-scan I-131 on green leafy vegetables
(Georg.)	15					
(Indus.)	46					
	48(a)	Weirton, WV				
10. Feedstuff and Summer Forage	25	Searight's Dairy Farm	Monthly	Monthly		γ-scan
			Quarterly	Quarterly Composite		Sr-90
11. Soil	13	Meyer's Farm	Every 3 years (1982, 1985, etc.)	12 Core Samples 3" Deep (3" Dia. at each location (approx. 10' radius)		γ-scan Sr-90 Gross β Gross α Uranium Isotopic
	30	Shippingport, Pa.				
	46	Industry, Pa.				
	32	(North of Site) Midland				
	48(a)	Weirton, W. Va.				
	51	Aliquippa, Pa.				
	47	E. Liverpool, Oh.				
	27	Brunton's Dairy				
	22	South of BVPS Site				
	29A	Nichol's Dairy				

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 Gamma Spectrometry are shown in Table V.A.5.

(c) In these cases a gamma isotopic analysis is done if the gross beta activity exceeds the reporting level of 0.53p Ci/m^3.

(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) TLD's are collected quarterly and annually from each monitoring location. Several TLD's were lost or stolen during the year.

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.

TABLE V.A.2

Environmental Data -- Chinese Nuclear Weapons Test (10/16/80) Fallout

The Chinese nuclear weapons test on October 16, 1980 produced measurable and elevated levels of radioactivity in the atmosphere of the Eastern U.S. from the end of October 1980 through the end of September 1981. Since a large number of samples were affected the listing below represents averages in many cases.

SAMPLE MEDIUM	SAMPLING PERIOD	(pCi/m^3) GROSS BETA
1. Air Particulate		
10 stations	12/29/80-03/30/81	0.13 (a)
10 stations	03/30/81-06/29/81	0.24 (a)
10 stations	06/29/81-09/28/81	0.072 (a)
		Sr-89
10 stations	12/29/80-03/30/81	0.011
10 stations	03/30/81-06/29/81	0.014
01 station	06/29/81-09/28/81	0.0029
		Mn-54
01 occurrence (b)	12/29/80-03/30/81	0.00091
15 occurrences	03/30/81-06/29/81	0.0021
05 occurrences	06/29/81-09/28/81	0.0016
		Zr-95/Nb-95
30 occurrences	12/29/80-03/30/81	0.047
30 occurrences	03/30/81-06/29/81	0.071
12 occurrences	06/29/81-09/28/81	0.019
		Ru-103
30 occurrences	12/29/80-03/30/81	0.019
30 occurrences	03/30/81-06/29/81	0.010
05 occurrences	06/29/81-09/28/81	0.0030

		Ru-106
02 occurrences	12/29/80-03/30/81	0.015
19 occurrences	03/30/81-06/29/81	0.027
02 occurrences	06/29/81-09/28/81	0.013
01 occurrence	09/28/81-12/28/81	0.0089
		Cs-137) (c)
08 occurrences	12/29/80-03/30/81	0.0023
30 occurrences	03/30/81-06/29/81	0.0039
13 occurrences	06/29/81-09/28/81	0.0026
04 occurrences	09/28/81-12/28/81	0.0012
		Ce-141 (d)
30 occurrences	12/29/80-03/30/81	0.014
26 occurrences	03/30/81-06/29/81	0.011
04 occurrences	06/29/81-09/28/81	0.0030
		Ce-144
26 occurrences	12/29/80-03/30/81	0.022
30 occurrences	03/30/81-06/29/81	0.061
18 occurrences	06/29/81-09/28/81	0.022
01 occurrence	09/28/81-12/28/81	0.0041

2. Feed and Forage

		(pCi/g (dry) Mn-54
02 occurrences	03/30/81-09/28/81	0.072
		Zr-95/Nb-95
04 occurrences	03/30/81-09/28/81	4.3
		Ru-103
02 occurrences	03/30/81-09/28/81	0.12

		Ru-106
01 occurrences	03/30/81-09/28/81	0.53
		Ce-141
02 occurrences	03/30/81-09/28/81	0.10
		Ce-144
04 occurrences	03/30/81-09/28/81	1.4

3. Milk

		(pCi/liter) Sr-89
15 occurrences	05/03/81-07/13/81	6.2

(a) In comparison the average gross beta activity in the third quarter of 1980 (before the nuclear test) and in the fourth quarter of 1981 (nearly a year after the nuclear test) was 0.028 and 0.027, respectively.

(b) The word occurrence means monthly observation. For a quarter of a year and with 10 stations, the maximum occurrences could be 30.

(c) There is a long term Cs-137 component due to atomspheric weapons test of past years. For example Cs-137 was observed 5 times out of a possible 30 in the third quarter of 1980.

(d) Similarly, Ce-141 was observed once in the third quarter of 1980.

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Duquesne Light Company Docket No. 50-334

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1981

Medium or Pathway Sampled (Unit of Measurement)	Analysis & Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations **Mean (f) **Range	Location with Highest Quar. Mean Name Distance & Directions	**Mean (f) **Range	Control Locations **Mean (f) **Range	Number of Nonroutine Reported Measurements***
Air Particulates and Radioiodine ($X10^{-3}$ pCi/Cu. M.)	Gross (510) Beta	2.5	117(510/510) (15-380)	Industry, Pa #46 2.0 miles -- NNE	121(51/51) (17-380)	Weirton, WV #48 115(51/51) (20-370)	0
	Sr-89 (40)	2	12(21/40) (2.9-18)	Beaver Co. Hosp. #29B 8 miles -- ENE	17(2/4) (16-18)	14(2/4) (12-16)	0
	Sr-90 (40)	0.3	0.82(29/40) (0.31-2.0)	Weirton, WV #48 20 miles -- SW	0.89(3/4) (0.31-2.0)	Same as High Location	0
	I-131 (515)	10	LLD	--	--	--	-
	Gamma (120)						
	Be-7	20	104(120/120) (58-172)	East Liverpool, OH#47 6.5 miles - W	115(12/12) (81-172)	101(12/12) (71-133)	0
	K-40	10	29(27/120) (13-94)	Weirton, WV #48 20 miles - SW	49(3/12) (25-94)	Same as High Location	0
	Mn-54	0.8	2.1(20/120) (0.91-3.4)	Midland, PA #32 0.9 mile - NNW	2.6(2/12) (2.6-2.7)	LLD --	0
	Zr-95/Nb-95	0.8	51(72/120) (7.9-128)	East Liverpool, OH#47 6.5 miles - W	68(7/12) (11.4-128)	33(8/12) (8.1-66)	0
	Ru-103	0.8	17(68/120) (2.0-32)	Brunton Dairy #27	19(6/12) (6.9-30)	15(7/12) (4.4-25)	0
	Ru-106	8	26(24/120) (8.9-54)	Brunton Dairy #27	39(3/12) (23-54)	23(3/12) (16-36)	0

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

TABLE V.A.3

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Duquesne Light Company Docket No. 50-334

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1981

Medium or Pathway Sampled (Unit of Measurement)	Analysis & Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Quar. Mean Name Distance & Directions	**Mean(f) **Range	Control Locations **Mean(f) **Range	Number of Nonroutine Reported Measurements***
Air Particulates and Radioiodine ($X10^{-3}$ pCi/Cu.M.) (continued)	Cs-137	0.6	3.2(55/120) (0.92-6.7)	East Liverpool,OH#47 6.5 miles -- W	4.2(5/12) (2.7-6.7)	Weirton, WV #48 2.6(6/12) (1.7-4.0)	0
	Ce-141	1	12(60/120) (2.5-19)	Meyers Dairy #13 1.6 miles -- SW	15(5/12) (9.3-19)	11(6/12) (3.6-15)	0
	Ce-144	3	38(74/120) (4.1-97)	Industry, PA #46 2.0 miles -- NNE	44(6/12) (18-86)	33(8/12) (9.0-64)	0
	Ra-226	10	19(1/120) --	Industry, PA #46 2.0 miles -- NNE	19(1/12) --	LLD --	0
	Th-228	1	2.9(14/120) (0.41-5.8)	Sherman Dairy #28	4.6(1/12) --	LLD --	0
	Others	Table V.A.5	LLD	--	--	--	-

* Nominal Lower Limit of Detection (LLD)

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

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

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Duquesne Light Company Docket No. 50-334

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1981

Medium or Pathway Sampled (Unit of Measurement)	Analysis & Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Quar. Mean: Name Distance & Directions	Location with Highest Quar. Mean: **Mean(f) **Range	Control Locations **Mean(f) **Range	Number of Nonroutine Reported Measurements***
Sediment (pCi/g) (dry)	Gross (8) Alpha	0.3	17(8/8) (10-23)	SAPS Discharge #03 River Mile -- 34.8	20(2/2) (17-23)	Montgomery Dam #49 15(2/2) (14-16)	0
	Gross (8) Beta	1.0	43(8/8) (31-59)	BVPS Discharge #02A River Mile -- 35.0	52(2/2) (46-59)	38(2/2) (31-45)	0
	Sr-89 (8)	0.2	LLD	-	-	-	-
	Sr-90 (8)	0.05	0.061(5/8) (0.048-0.098)	BVPS Discharge #02A River Mile -- 35.0	0.098(1/2) -	0.054(1/2) -	0
	U-233 and (8) U-234	0.01	0.55(8/8) (0.34-0.80)	New Cumberland Dam#50 River Mile -- 54.0	0.63(2/2) (0.46-0.80)	0.45(2/2) (0.34-0.57)	0
	U-235 (8)	0.01	0.025(8/8) (0.012-0.037)	SAPS Discharge #03 River Mile -- 34.8	0.034(2/2) (0.030-0.037)	0.018(2/2) (0.012-0.023)	0
	U-238 (8)	0.01	0.39(8/8) (0.25-0.51)	New Cumberland Dam#50 River Mile -- 54.0	0.42(2/2) (0.33-0.51)	0.33(2/2) (0.25-0.41)	0
	Gamma (8) Be-7	0.2	1.6(5/8) (0.45-3.8)	BVPS Discharge #02A River Mile -- 35.0	3.8(1/2) -	0.8[illegible](2/2) (0.45-1.3)	0
	K-40	0.5	15(8/8) (12-20)	BVPS Discharge #02A River Mile -- 35.0	16(2/2) (13-20)	14(2/2) (12-16)	0
	Mn-54	0.03	0.081(2/8) (0.072-0.091)	BVPS Discharge #02A River Mile -- 35.0	0.081(2/2) (0.072-0.091)	LLD	0

* Nominal Lower Limit of Detection (LLD)

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

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

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Duquesne Light Company Docket No. 50-334

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1981

Medium or Pathway Sampled (Unit of Measurement)	Analysis & Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Quar. Mean Name Distance & Directions	**Mean(f) **Range	Control Locations **Mean(f) **Range	Number of Nonroutine Reported Measurements***
Sediment (pCi/g) (dry) (continued)	Co-58	0.03	0.098(1/8) --	BVPS Discharge #02A River Mile -- 35.0	0.098(1/2) --	Montgomery Dam#49 LLD	0
	Co-60	0.03	0.40(3/8) (0.1-0.91)	BVPS Discharge #02A River Mile -- 35.0	.50(2/2) (0.1-.91)	LLD	0
	Zr-95/Nb-95	0.03	0.80 (7/8) (0.050-2.0)	BVPS Discharge #02A River Mile -- 35.0	1.2(2/2) (0.44-2.0)	1.1(2/2) (0.35-2.0)	0
	Ru-103	0.02	0.30(4/8) (0.078-0.55)	BVPS Discharge #02A River Mile -- 35.0	0.55(1/2) --	0.33(1/2) --	0
	Cs-137	0.02	0.42(8/8) (0.26-0.74)	BVPS Discharge #02A River Mile -- 35.0	0.68(2/2) (0.63-0.74)	0.33(2/2) (0.32-0.33)	0
	Ce-141	0.03	0.34(3/8) (0.28-0.41)	BVPS Discharge #02A River Mile -- 35.0	0.41(1/2) --	0.35(1/2) --	0
	Ce-144	0.09	1.3(5/8) (0.34-2.4)	BVPS Discharge #02A River Mile -- 35.0	1.9(2/2) (1.5-2.4)	0.70(2/2) (0.34-1.1)	0
	Ra-226	0.1	2.7(8/8) (1.9-4.2)	New Cumberland Dam#50 River Mile -- 54.0	3.5(2/2) (2.8-4.2)	2.2(2/2) (1.9-2.5)	0
	Th-228	0.02	1.4(8/8) (1.2-1.9)	BVPS Discharge #02A River Mile -- 35.0	1.6(2/2) (1.4-1.9)	1.4(2/2) (1.4-1.4)	0
	Others	Table V.A.5	LLD	--	--	--	-

* Nominal Lower Limit of Detection (LLD)

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

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

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Duquesne Light Company Docket No. 50-334

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1981

Medium or Pathway Sampled (Unit of Measurement)	Analysis & Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Quar. Mean Name Distance & Directions	**Mean (f) **Range	Control Locations **Mean(f) **Range	Number of Nonroutine Reported Measurements***
Feed and Forage (pCi/g) (dry)	Sr-90 (6)	0.003	0.10(6/6) (0.0057-0.25)	Searight Dairy #25 2.4 miles -- SW	--	One Sample Location	0
	Gamma (12)						
	Be-7	0.3	4.1(8/12) (0.76-11)	--	--	--	0
	K-40	0.5	18(12/12) (7.4-35)	--	--	--	0
	Mn-54	0.01	0.072(2/12) (0.040-0.11)	--	--	--	0
	Zr-95/Nb-95	0.02	1.0(4/12) (0.32-2.3)	--	--	--	0
	Ru-103	0.02	0.12(2/12) (0.092-0.16)	--	--	--	0
	Ru-106	0.2	0.53(1/12) --	--	--	--	0
	Cs-137	0.03	0.12(5/12) (0.070-0.21)	--	--	--	0
	Ce-141	0.03	0.10(2/12) (0.084-0.13)	--	--	--	0
	Ce-144	0.1	1.4(4/12) (0.68-2.9)	--	--	--	0
	Others	Table V.A.5	LLD	--	--	--	-

* Nominal Lower Limit of Detection (LLD)

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

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

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Duquesne Light Company Docket No. 50-334

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1981

Medium or Pathway Sampled (Unit of Measurement)	Analysis & Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Quar. Mean Name Distance & Directions	**Mean(f) **Range	Control Locations **Mean(f) **Range	Number of Nonroutine Reported Measurements***
						Weirton, WV #48	
Food and Garden Crops (pCi/gm) WET Weight	I-131	0.006	LLD	--			
	Gamma (13)						
	Be-7	0.3	0.33(4/13) (0.087-0.75)	Shippingport, PA #10	0.53(2/3) (0.32-0.75)	0.19(1/2) --	0 -
	K-40	0.5	5.2(12/13) (2.1-14)	Industry, PA #46	8.2(3/4) (2.8-14)	5.7(2/2) (3.5-7.9)	0
	Cs-137	0.01	0.021(4/13) (0.011-0.039)	Georgetown, PA #15	.025(3/4) (0.015-0.039)	0.011(1/2) --	0
	Others	Table V.A.	LLD	--	--	--	-

* Nominal Lower Limit of Detection (LLD)

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

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

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Duquesne Light Company Docket No. 50-334

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1981

Medium or Pathway Sampled (Unit of Measurement)	Analysis & Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Quar. Mean: Name Distance & Directions	Location with Highest Quar. Mean: **Mean (f) **Range	Control Locations **Mean (f) **Range	Number of Nonroutine Reported Measurements***
Milk (pCi/liter)	I-131 (140)	0.2	LLD	--		Brunton Dairy #27 --	-
	Sr-89 (108)	2	5.61(15/108) (1.7-17)	Belan #65	9.4(4/8) (2.7-17)	LLD	0
	Sr-90 (108)	1	5.0(108/108) (0.71-14)	Collins #69	9.2(18/18) (3.2-14)	3.1(14/14) (2.0-3.8)	0
	Gamma (108) K-40	100	1232(108/108) (727-1900)	Collins #69	1572(18/18) (1130-1900)	1310(14/14) (1000-1660)	0
	Cs-137	5	7.9(33/108) (4.9-19)	Brunton Dairy #27	9.8(2/14) (7.1-12)	Same as High Location	0
	Th-228	5	12(2/108) (8.3-16)	Allison Farm #61	16(1/15) --	LLD	0
	Others	Table V.A.5	LLD	--	--	--	-

* Nominal Lower Limit of Detection (LLD)

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

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

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Duquesne Light Company   Docket No. 50-334

Location of Facility Beaver, Pennsylvania (County, State)   Reporting Period Annual 1981

Medium or Pathway Sampled (Unit of Measurement)	Analysis & Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Mean: Name Distance & Directions	Location with Highest Mean: **Mean(f) **Range	Control Locations **Mean(f) **Range	Number of Nonroutine Reported Measurements
External Radiation (mR/day)	γ(171quarterly)	0.05	0.18(171/171) (0.12-0.23)	Calcutta, #87 7.0 miles - NW	0.21(4/4) (0.20-0.22)	Weirton, WV #48 0.17(4/4) --	0
	γ(42 annual)	0.05	0.18(42/42) (0.14-0.22)	Haney Farm #60	0.22(1/1) --	0.18(1/1) --	0
Fish (pCi/g) (wet weight)	Gamma (6) K-40	0.5	3.0(6/6) (2.5-4.0)	BVPS Discharge #02A River Mile -- 35.0	3.2(3/3) (2.5-4.0)	Montgomery Dam#49 2.8(3/3) (2.6-2.9)	0
	Cs-137	0.01	0.014(1/6) --	Montgomery Dam #49 River Mile -- 31.0	0.014(1/3) --	Same as High Location	0
	Others	Table V.A.5	LLD	--	--	--	-

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

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Duquesne Light Company Docket No. 50-334

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1981

Medium or Pathway Sampled (Unit of Measurement)	Analysis & Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Quar. Mean Name Distance & Directions	Location with Highest Quar. Mean **Mean (f) **Range	Control Locations **Mean (f) **Range	Number of Nonroutine Reported Measurements***
Surface Water (pCi/liter)	Gross (72) Alpha	2	LLD	--	--	Montgomery Dam #49 --	-
	Gross (72) Beta	1	5.8(72/72) (2.5-15)	BVPS Discharge #02A River Mile -- 35.0	8.1(12/12) (3.9-15)	6.1(12/12) (3.7-8.3)	0
	Gamma (72) Co-60	5	9.2(1/72) --	BVPS Discharge #02A River Mile -- 35.0	9.2(1/12) --	-- --	0
	Th-228	5	16(2/72) (13-19)	BVPS Discharge #02A River Mile -- 35.0	19(1/12) --	LLD --	0
	Others	Table V.A.5	LLD	--	--	--	-
	Sr-89 (24)	1.5	LLD	--	--	--	-
	Sr-90 (24)	0.5	0.61(2/24) (.5-.73)	BVPS Discharge #02A River Mile -- 35.0	0.73(1/4) --	LLD	0
	Co-60 (24)(a)	1	2.1(1/24) --	BVPS Discharge #02A River Mile -- 35.0	2.1(1/4) --	LLD	0
	Tritium (24)	80	460(24/24) (80-3870)	BVPS Discharge #02A River Mile -- 35.0	1970(4/4) (270-3870)	150(4/4) (80-190)	3

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

* Nominal Lower Limit of Detection (LLD)

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

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

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Duquesne Light Company Docket No. 50-334

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1981

Medium or Pathway Sampled (Unit of Measurement)	Analysis & Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Quar. Mean Name Distance & Directions	Location with Highest Quar. Mean **Mean (f) **Range	Control Locations **Mean (f) **Range	Number of Nonroutine Reported Measurements***
Drinking Water (pCi/liter)	I-131 (104)	0.2	0.23(1/104) --	Midland, Pa #04 River Mile -- 36.3	0.23(1/52) --	--	-
	Gross (24) Alpha	0.6	LLD	--	--	--	-
	Gross (24) Beta	1	4.9(24/24) (1.7-7.3)	Midland, Pa #04 River Mile -- 36.3	5.0(12/12) (1.7-7.0)	--	0
	Gamma (104)	Table V.A.5	LLD	--	--	--	-
	Sr-89 (8)	1.5	LLD	--	--	--	-
	Sr-90 (8)	0.4	LLD	--	--	--	-
	Co-60 (8)(a)	1	LLD	--	--	--	-
	Tritium (8)	90	190(8/8) (130-270)	Midland, Pa #04 River Mile -- 36.3	200(4/4) (130-270)	--	0

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

* Nominal Lower Limit of Detection (LLD)

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

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

TABLE V.A.3

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Duquesne Light Company Docket No. 50-334

Location of Facility Beaver, Pennsylvania (County, State) Reporting Period Annual 1981

Medium or Pathway Sampled (Unit of Measurement)	Analysis & Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Quar. Mean Name Distance & Directions	**Mean(f) **Range	Control Locations **Mean(f) **Range	Number of Nonroutine Reported Measurements***
Ground Water (pCi/liter)	Gross (16) Alpha	2	LLD	--	--	Georgetown, Pa #15 --	-
	Gross (16) Beta	1	2.6(15/16) (1.1-5.7)	Georgetown, PA #15 4.6 miles -- WNW	3.0(4/4) (1.6-5.7)	Same as High Location	0
	Gamma (16) Th-228	5	25(1/16) --	Shippingport, PA #11 0.8 mile -- NE	25(1/4) --	LLD --	0 -
	Other	Table V.A.5	LLD	--	--	--	-
	Tritium (16)	90	180(13/16) (90-300)	Georgetown, PA #15 4.6 miles -- WNW	215(4/4) (180-300)	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 (December 1975) and the Beaver Valley Power Station Technical Specifications (Appendix B)

V. ENVIRONMENTAL MONITORING

A. Environmental Radioactivity Monitoring Program (continued)

3. Summary of Results

All results of this monitoring program are summarized in Table V.A.3. 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 B, Environmental Technical Specifications). Summarizes 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.4 summaries 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 in good agreement for both periods of time.

In the few cases where activity was detected, some of the activity was directly attributable to the October 1980 Chinese weapons test and the remaining detected activities were near the lower limit of their detection (LLD) and are attributable to the normal statistical fluctuation near the LLD level.

The conclusion from all program data is that the operation of the Shippingport and Beaver Valley Power Station has not resulted in any detectable changes to the environment attributable to either station.

4. Quality Control Program

The Quality Control Program implemented by Duquesne Light Company to assure reliable performance by 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.5.

TABLE V.A.4 (Page 1 of 4)
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Shippingport Atomic Power Station Docket No. Not Applicable
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 - 0.004
	Gross Beta	(927)	0.006	0.07	927/927	0.02 - 0.32
	Sr-89	(0)			—	
	Sr-90	(0)			—	
	I-131	(816)	0.04	0.08	2/816	0.07 - 0.08
	Gamma	(197)				
	ZrNb-95		0.005	0.04	122/197	0.01 - 0.16
	Ru-106		0.010	0.04	50/197	0.02 - 0.09
	Ce-141		0.010	0.02	3/197	0.01 - 0.04
	Ce-144		0.010	0.02	44/197	0.01 - 0.04
	Others				< LLD	

TABLE V.A.4 (Page 2 of 4)
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Shippingport Atomic Power Station Docket No. Not Applicable
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 a	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 - 2.4
	Co-60		0.1	0.2	1/8	—
	Others				< LLD	

TABLE V.A.4 (Page 3 of 4)
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Shippingport Atomic Power Station Docket No. Not Applicable
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 - 0.81
	Gamma	(81)				
	K-40		1	19	75/81	5 - 46
	Cs-137		0.1	0.5	6/81	0.2 - 1.6
	Ce-144		0.3	1.5	5/81	0.9 - 2.6
	ZrNb-95		0.05	0.8	13/81	0.2 - 1.8
	Ru-106 (b)		0.3	1.4	12/81	0.6 - 2.3
	Others				< LLD	

TABLE V.A.4 (Page 4 of 4)
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Shippingport Atomic Power Station Docket No. Not Applicable
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
	Cs-137		0.08	0.05	1/17	—
	Other					< LLD

(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.5

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	0.05	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.
*** 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-89/90 analysis. In order to reduce interference from natural radon and thoron radioactivities, all filters are allowed to decay for a few days after collection prior to counting for beta in a low background counting system.

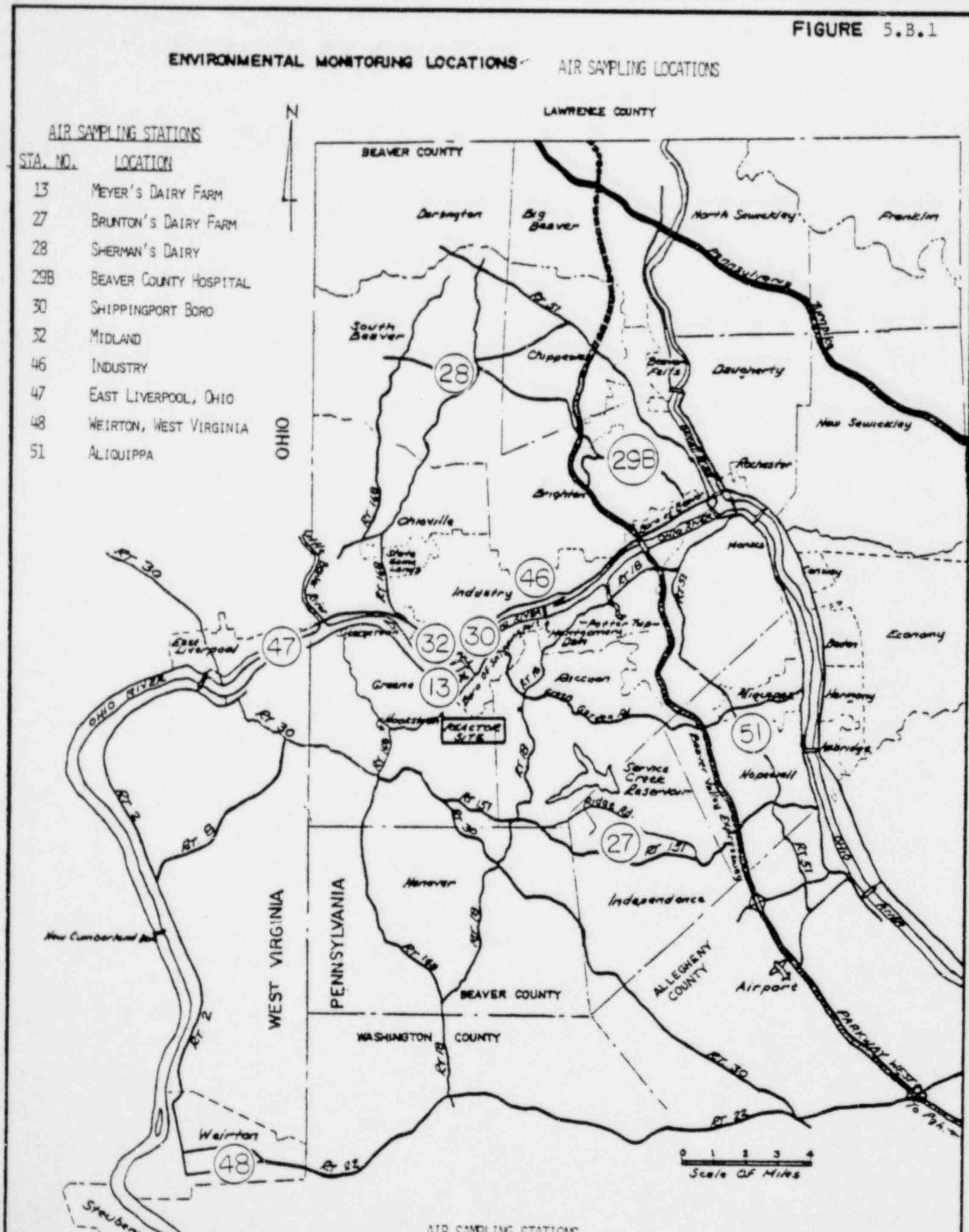
b. Procedures

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

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

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report



AIR SAMPLING STATIONS

FIGURE 5.B.1

V. ENVIRONMENTAL MONITORING

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 .'anchet and is counted in a low level beta counter to infer strontium-90 activity. Strontium-89 activity is determined by precipitating $SrCo_3$ from the sample after yttrium separation. This precipitate is mounted on a nylon planchet and is covered with 80 mg/cm^2 aluminum absorber for level beta counting.

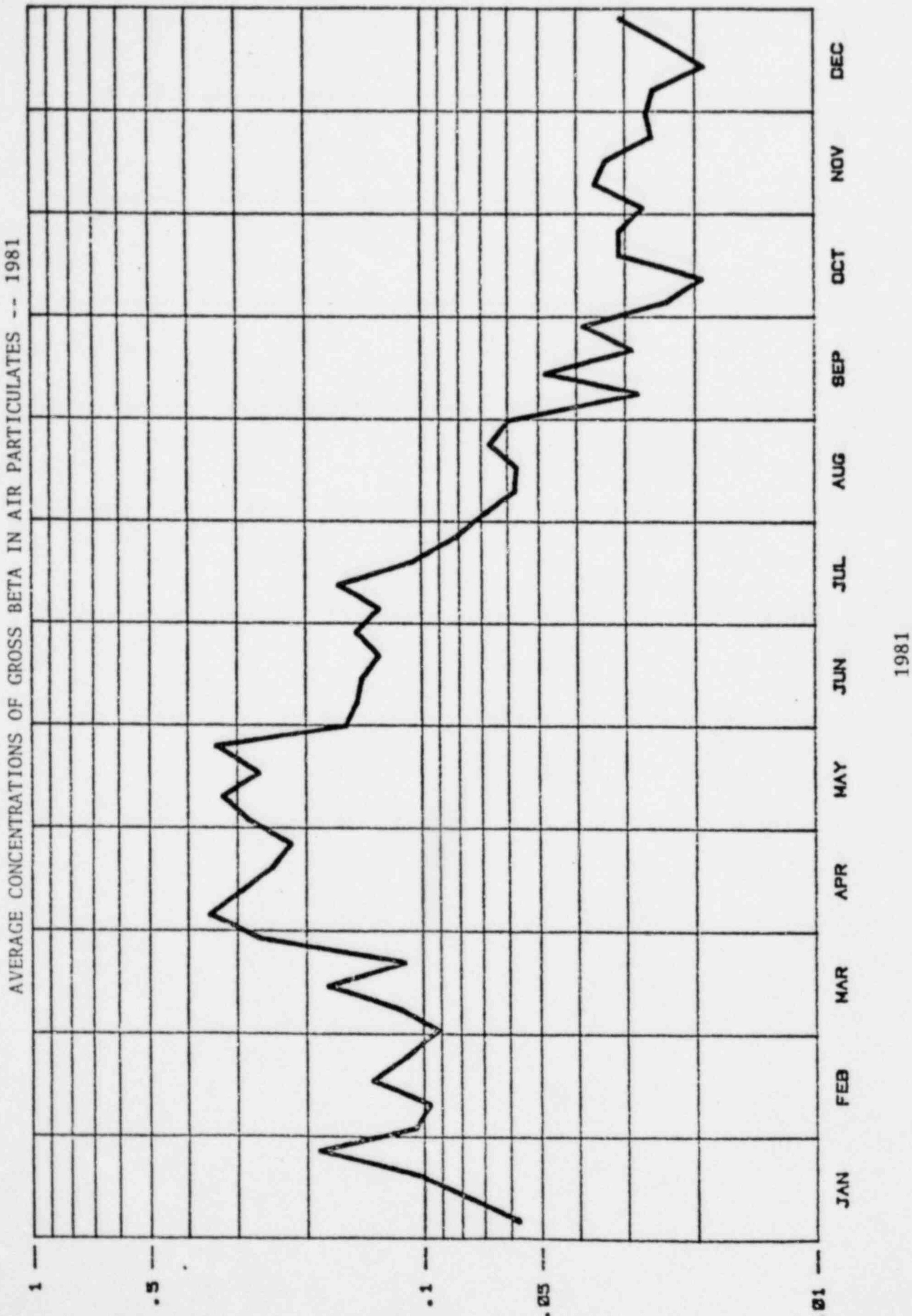
3. Results and Conclusions

A summary of data is presented in Table V.A.3.

a. Airborne Radioactive Particulates

A total of five hundred ten (510) weekly samples from ten (10) locations was analyzed for gross beta (Ten samples were lost in transit). Results were comparable to previous years; however, there were increases in January - August due to the test of a nuclear weapons device by China on 10-16-80. Figure 5.B.2 illustrates the average concentration of gross beta in air particulates.

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report



V. ENVIRONMENTAL MONITORING

a. Airborne Radioactive Particulates (continued)

The weekly air particulate samples were composited to one hundred and 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 nuclides were present. Some were natural, others were residual from previous and recent nuclear weapons tests. These are listed in the summary Table V.A.2. Examination of effluent data from the Beaver Valley Power Station and the Shippingport Atomic Power Station demonstrated that none of the slightly elevated results are attributable to the operation of either power station.

A total of forty (40) quarterly samples were each analyzed for Sr-89, and Sr-90. Some results were slightly elevated to those in previous years, which is attributed to the Chinese nuclear test.

Based on the analytical results, the operation of Beaver Valley Power Station and Shippingport Atomic Power Station did not contribute to any increase in air particulate radioactivity during CY 1981.

b. Radioiodine

A total of five hundred and fifteen (515) weekly charcoal filter samples were analyzed for I-131. (Five samples were lost in transit.) No detectable concentrations were found at any locations.

Based on analytical results, the operation of Beaver Valley Power Station and Shippingport Atomic Power Station did not contribute to any increase in airborne radioiodine during CY 1981.

V. ENVIRONMENTAL MONITORING

C. Monitoring of Sediments and Soils (Soil Monitoring is required every 3 years and was not required in 1981.)

1. Characterization of Stream Sediments

The stream sediments consist largely of sand and silt.

2. Sampling Program and Analytical Techniques

a. Program

River bottom sediments were collected quarterly 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, and the gamma-emmitting radionuclides.

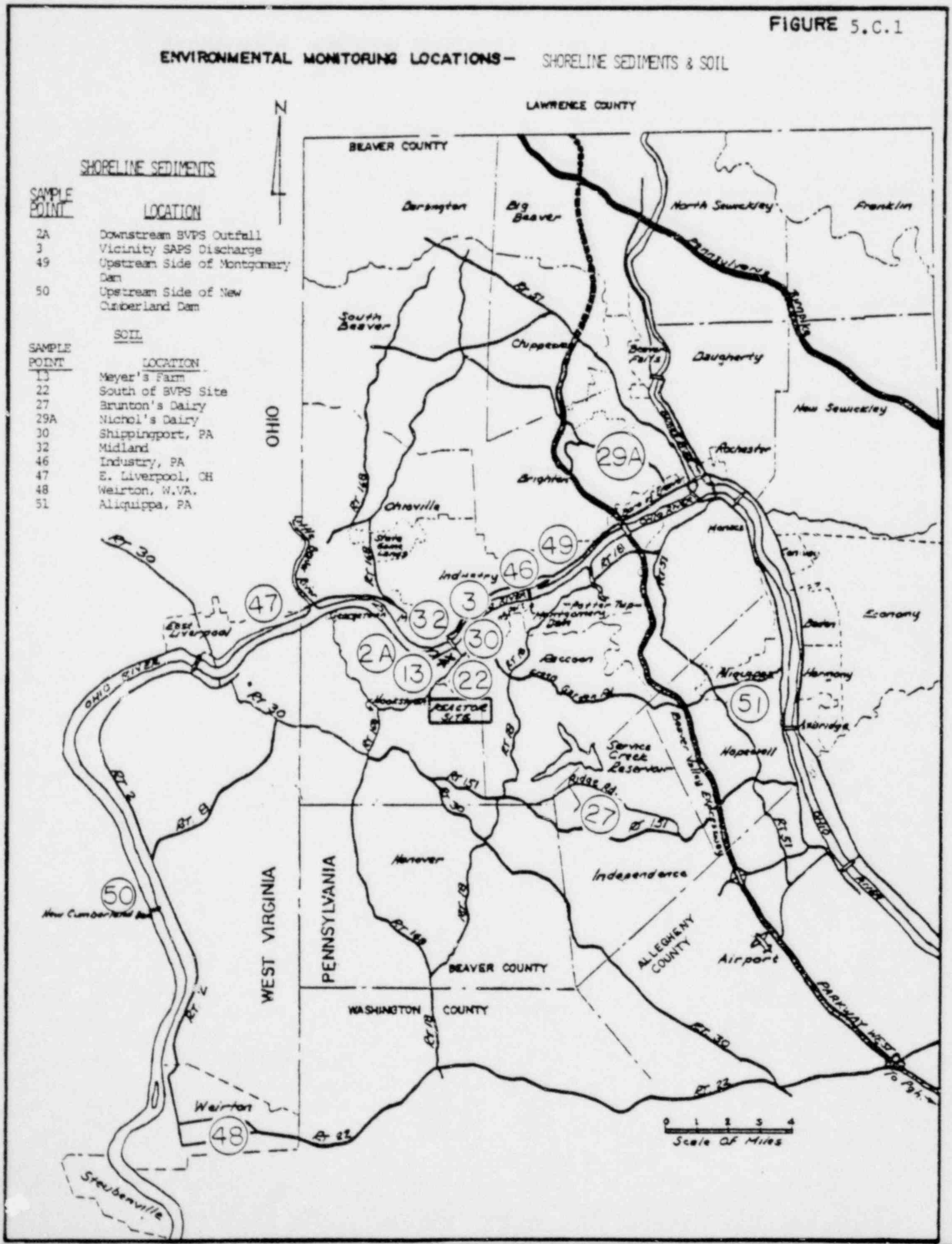
b. Analytical Procedures

Gross beta - sediments 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 is analyzed in the same manner as gross beta except that the counter is set up to count only alpha.

Gamma analysis of sediment is performed in a 100 ml plastic bottle which is counted by a gamma spectrometer.

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report



V. ENVIRONMENTAL MONITORING

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 samples were performed by alpha spectrometry after leaching and isolation of the uranium by anion exchange chromatography plus mercury cathode electrolysis, then electroplated onto a planchet.

3. Results and Conclusions

a. Results

The results of sediment analysis are summarized in Table V.A.3.

There were no significant differences between these current levels and those previously detected in both upstream and downstream sediment samples.

V. ENVIRONMENTAL MONITORING

3. Results and Conclusions (continued)

a. Results (continued)

Uranium isotopic analyses were performed by alpha spectroscopy. The results suggest that only naturally occurring U-234 and U-238 were present since the activities were nearly always the same in each sample and the levels are within the expected range of natural uranium activities. In equilibrium, U-234 and U-238 have the same activity.

b. Conclusion

Other than a very small amount of Co-58, Co-60, and Mn-54 at the outfall of Beaver Valley Power Station, the sediment analyses do not indicate any increased radioactivity attributable to Beaver Valley Power Station. Since Shippingport Atomic Power Station did not release any radioactive liquid waste during 1981, it did not contribute to any changes in river sediment radioactivity. Small amounts of Cs-137 from weapons testing fallout was found in all river sediment samples including those upstream above Montgomery Dam which are unaffected by plant effluents.

V. ENVIRONMENTAL MONITORING

D. Monitoring of Feedcrops and Foodcrops

1. Characterization of Vegetation and Foodcrops

According to a survey made in 1981, there were approximately 650 farms in Beaver County. The principle source of revenue for the farms was in dairy products which amounted to nearly $4,659,000.00. Revenues from other farm products were as follows:

Crops	$2,143,000.00
Horticulture	$ 551,000.00
Meat	$1,274,000.00
Poultry	$ 392,000.00

The percentage of crop land in Beaver County is approximately 17%, pasture land - 6 5%, forest land - 47.8%, and other land uses - 28.7%.

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.

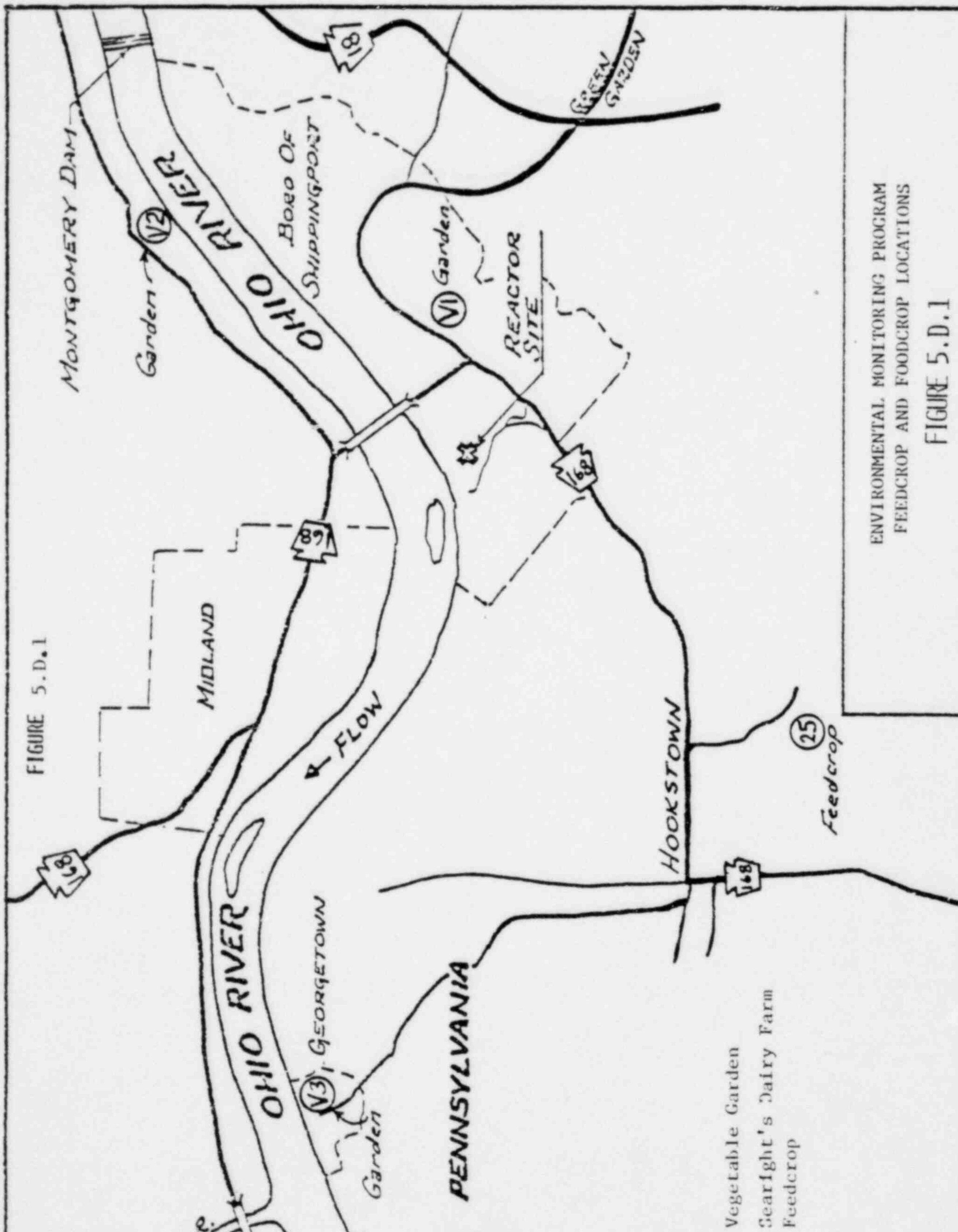
Foodcrops (vegetables) were collected at garden locations during the summer of 1981. Cabbage and lettuce were obtained from Shippingport, PA, and Weirton, WV. Cabbage, lettuce, and swiss chard were collected from Georgetown, PA, and cabbage, lettuce, and escarole were collected from Industry, PA. All samples were analyzed for gamma emitters (including I-131 by gamma spectrometry).

b. Procedures

<u>Gamma</u> 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.

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

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report



V. ENVIRONMENTAL MONITORING

3. Results and Conclusions

A summary of results is provided in Table V.A.3. The predominant isotope detected was naturally occurring K-40 in both food and feed. Other activity is attributable to residuals from previous nuclear weapons tests or naturally occurring radionuclides. All results were consistent with (or lower than) those obtained in the pre-operational program. These data confirm that Shippingport Atomic Power Station and 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, 1981 is shown in Figure 5.E.1.

2. Sampling Program and Analytical Techniques

a. Program

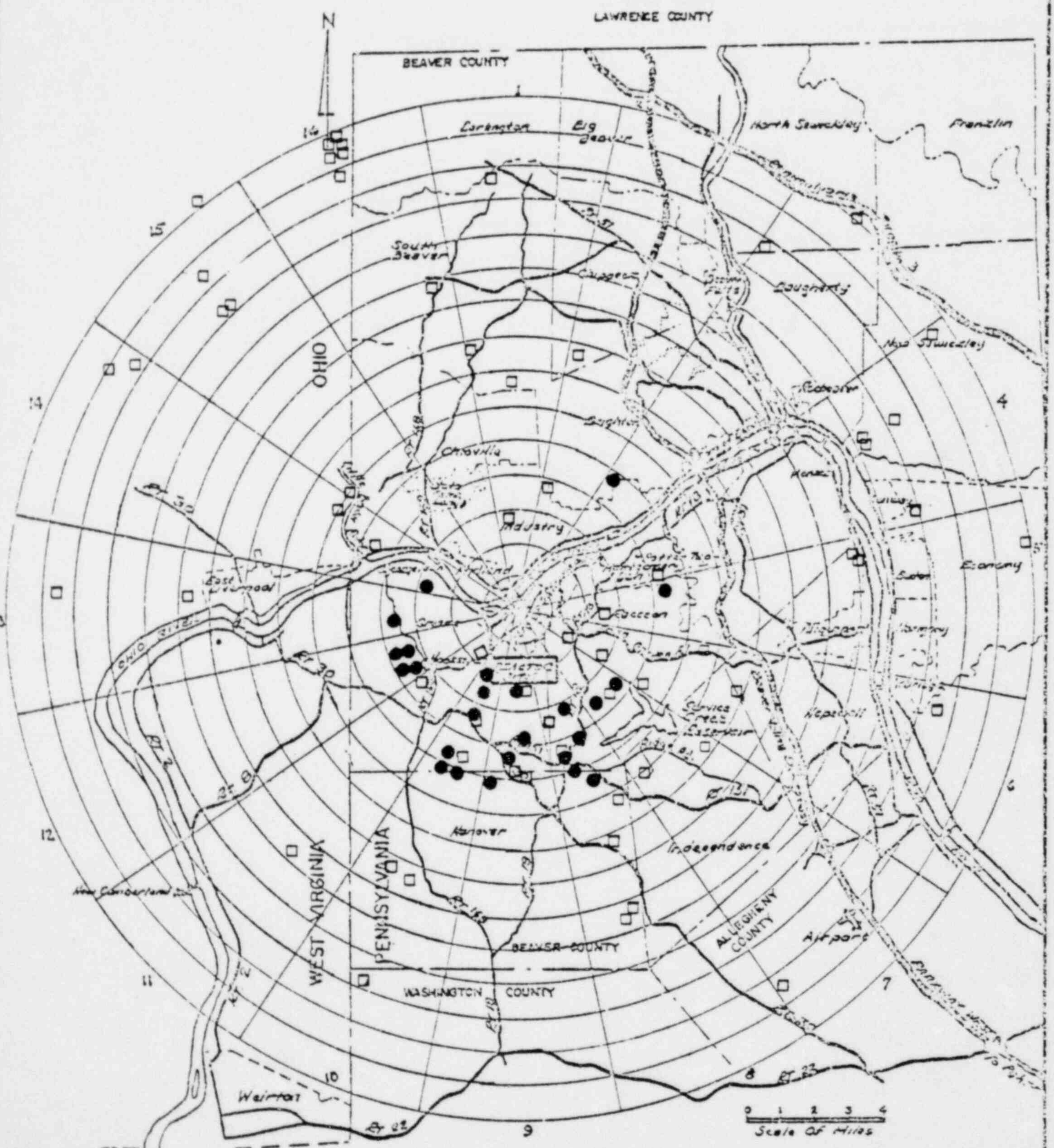
Milk was collected from three (3) reference dairy farms within a 10-mile radius of the site. Additional dairies, which represent the highest potential milk pathway for radioiodine based on milch animal surveys and meteorological data were selected and sampled. These dairies are subject to change when more recent data (including 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	Distance and Direction From Site	Collection Period
25	Searight	47 Cows	2.1 miles-south/sw.	Jan. - Dec.
27	Brunton	80 Cows	7.3 miles-southeast	Jan. - Dec.
29A	Nichol	45 Cows	8.0 miles-northeast	Jan. - Dec.
61	Allison	40 Cows	3.2 miles-west/sw.	Jan. - Dec.
62	Lyon	26Cows	3.3 miles-west/sw.	Jan.-Mar-Sept.
65	Belan	3 Goats*	3.5 miles-south/sw.	May - Aug.
66	Straight	1 Cow*	3.1 miles-south/se.	Jan. - Feb. Aug. - Dec.
67	Szatowski	2 Cows*	4.3 miles-south	April - July
69	Collins	13 Goats	3.6 miles-southeast	Mar - Dec.

*Milk Usage - Home Only.

FIGURE 5. E. 1

COW & GOAT SURVEY - SUMMER, 1981



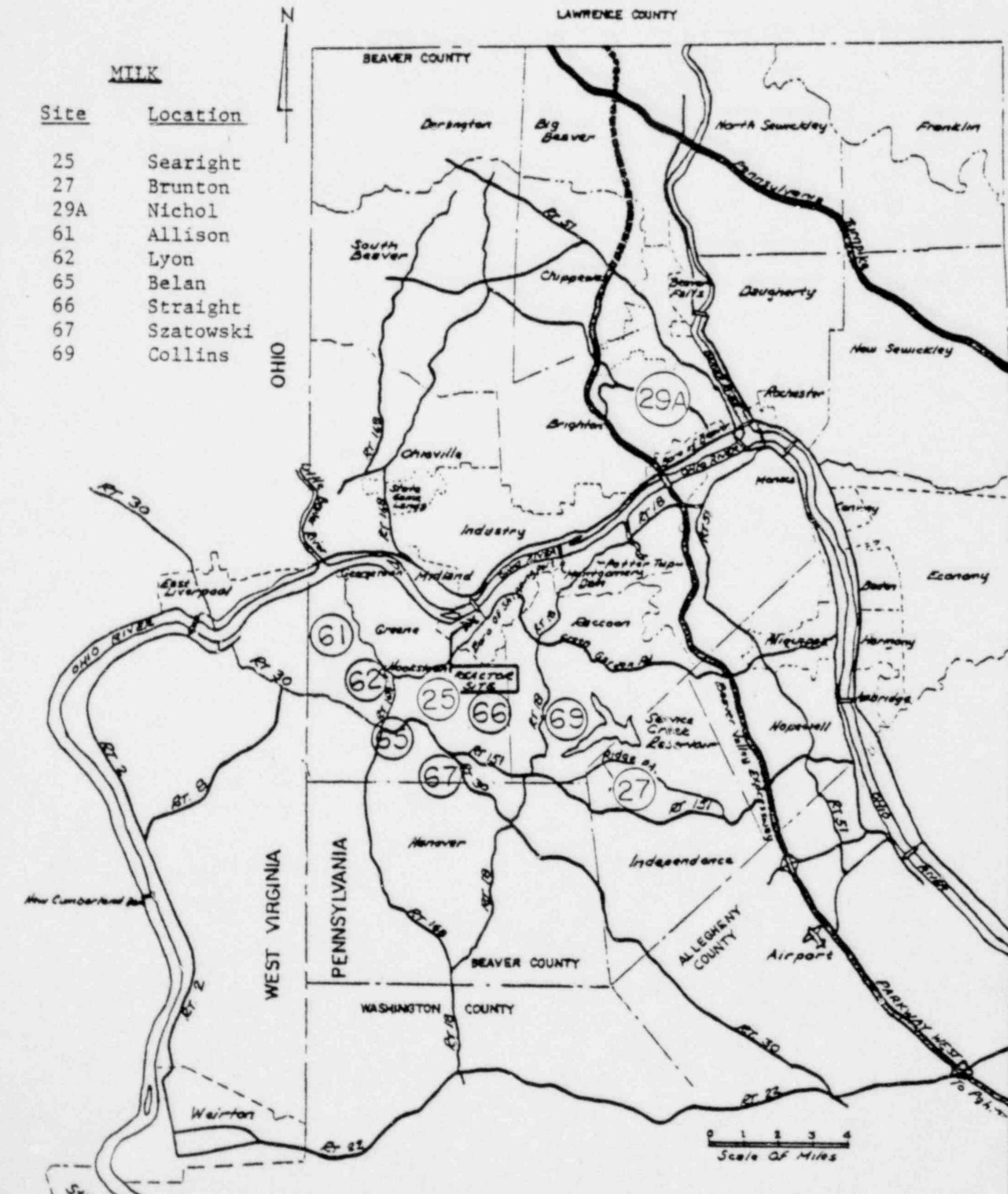
□ GOATS
● COWS

SUMMER 1981

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report

FIGURE 5.E.2

ENVIRONMENTAL MONITORING LOCATIONS— MILK



MILK LOCATIONS

FIGURE 5.E.2

V. ENVIRONMENTAL MONITORING

E. Monitoring of Local Cow's Milk (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 beta-gamma coincidence 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 total of one hundred and forty (140) samples were analyzed for I-131 during 1981. All I-131 activities in milk were below the minimum detectable level (0.3 pCi/l).

A total of one hundred and eight (108) samples were analyzed by gamma spectrometry and for strontium. The Cs-137, Sr-89 and Sr-90 levels were elevated as a result of the Chinese nuclear test in October 1980. It should be noted that in the case of these nuclides, the levels did not increase immediately after the fallout from the October, 1980 test. These delays are typical due to the variables of farming practices, pasture conditions, and use of stored feed. For example, the uptake and subsequent inclusion of these radionuclides in the milk may not occur if pasture conditions are excellent or supplemental feed, subjected to fallout exposure, are not required. Thus, the activity of these

longer half-life isotopes in milk may not reach its peak level when the pasture is growing rapidly, but instead will occur as pasture conditions degenerate with the approach of hotter and/or dryer weather of the summer. Because of the limited inventory of fallout activity deposited, these activity levels gradually return to normal. In addition to pasture conditions, herd size and milch animal type and breed result in variations from location to location. All available data support the conclusion that levels of radioactivity in milk are not attributable to either Beaver Valley Power Station or Shippingport Atomic Power Station.

V. ENVIRONMENTAL MONITORING

F. Environmental Radiation Monitoring

1. Description of Regional Background Radiation Levels and Sources

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

The principal geologic features of the region are nearly flat-lying 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 to 12 μR/hr. Results for 1981 indicated that background radiation continued in this range.

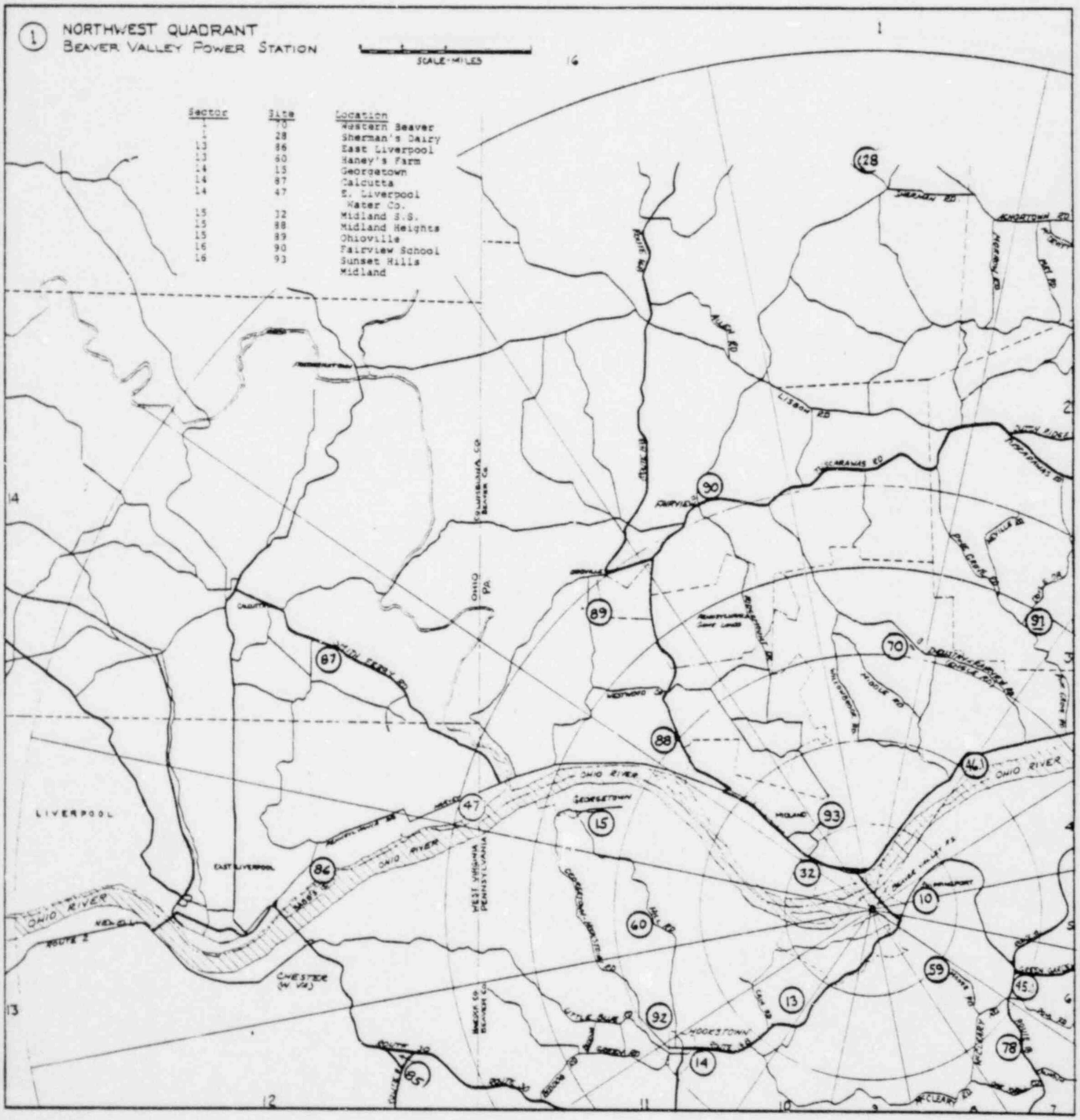
2. Locations & Analytical Procedures

Ambient external radiation levels at the site were measured using thermoluminescent dosimeters (TLDs). There were three (3) types used in the Duquesne Light Company Radiological Environmental Monitoring Program. They are calcium sulphate dysprosium, $CaSo_4$ (Dy) in teflon matrix, lithium fluoride (LiF), and thulium activated calcium sulfate ($CaSo_4$:Tm).

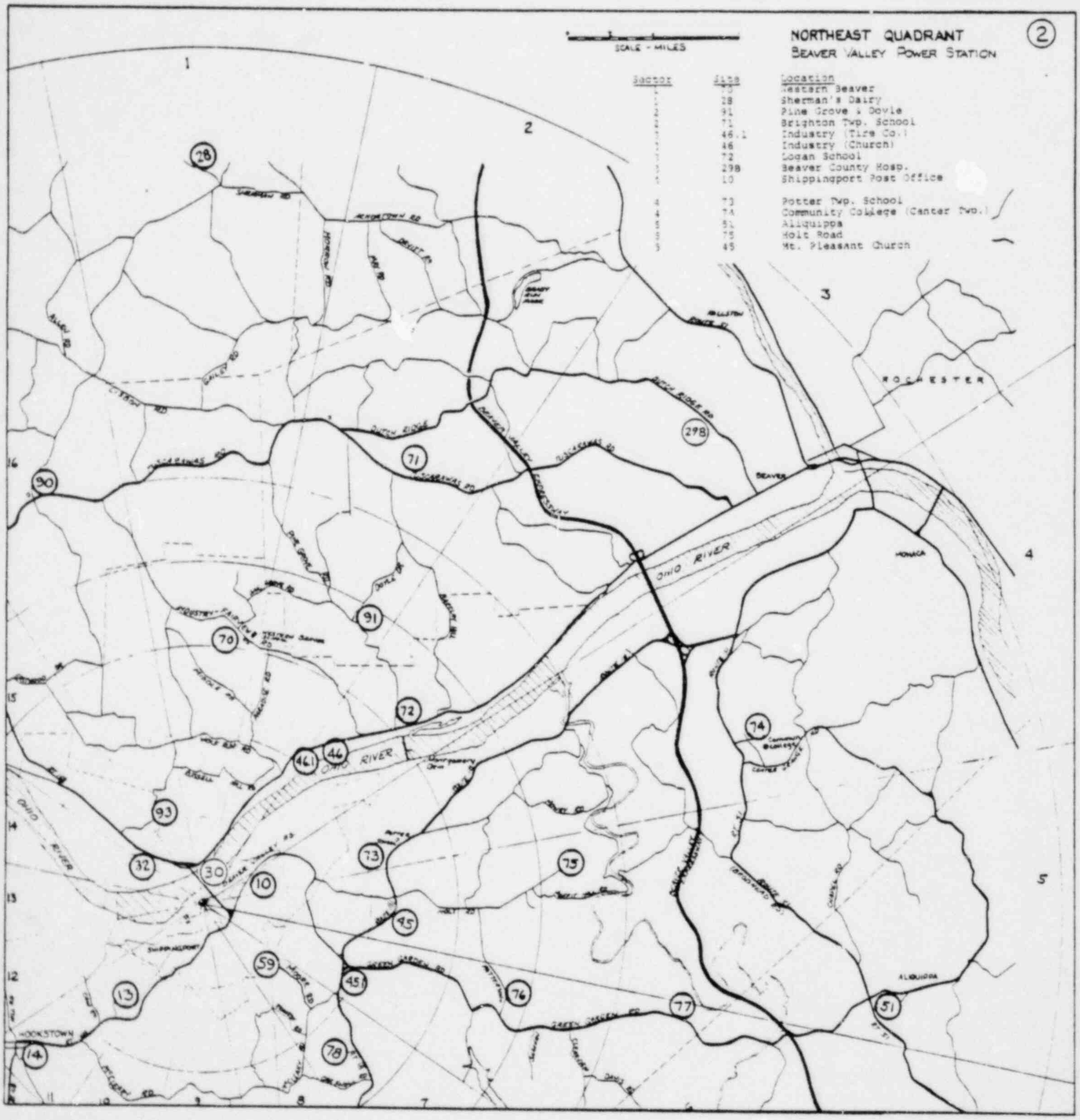
The lithium fluoride TLDs were posted and analyzed by a laboratory of the Department of Energy (DOE) as an independent check of environmental radioactivity levels. The $CaSO_4$:Tm TLDs were used as a back-up and as a QC program. The locations of the TLDs are shown in Figures 5.F.1 thru 4. Comparisons of TLD results are presented in Table III.1.

In 1977, 1978 and 1979, there were a total of thirteen (13) off-site environmental TLD locations. In 1980 and 1981, the total of off-site TLD locations was increased to forty-three (43) to comply with the pending requirements of the Nuclear Regulatory Commission's version of the standardized Effluent Technical Specifications for PWR's.

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report



DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report



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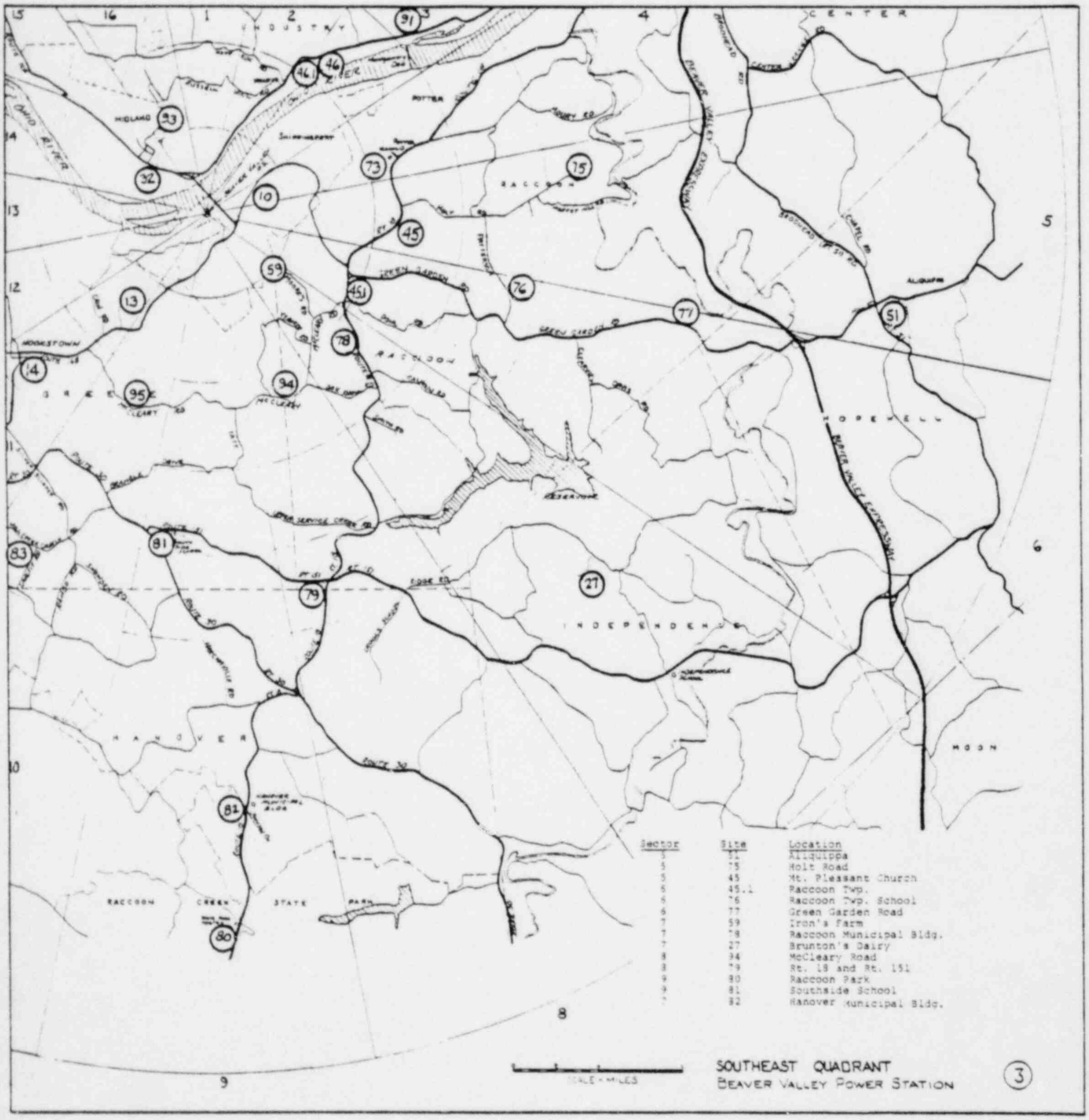
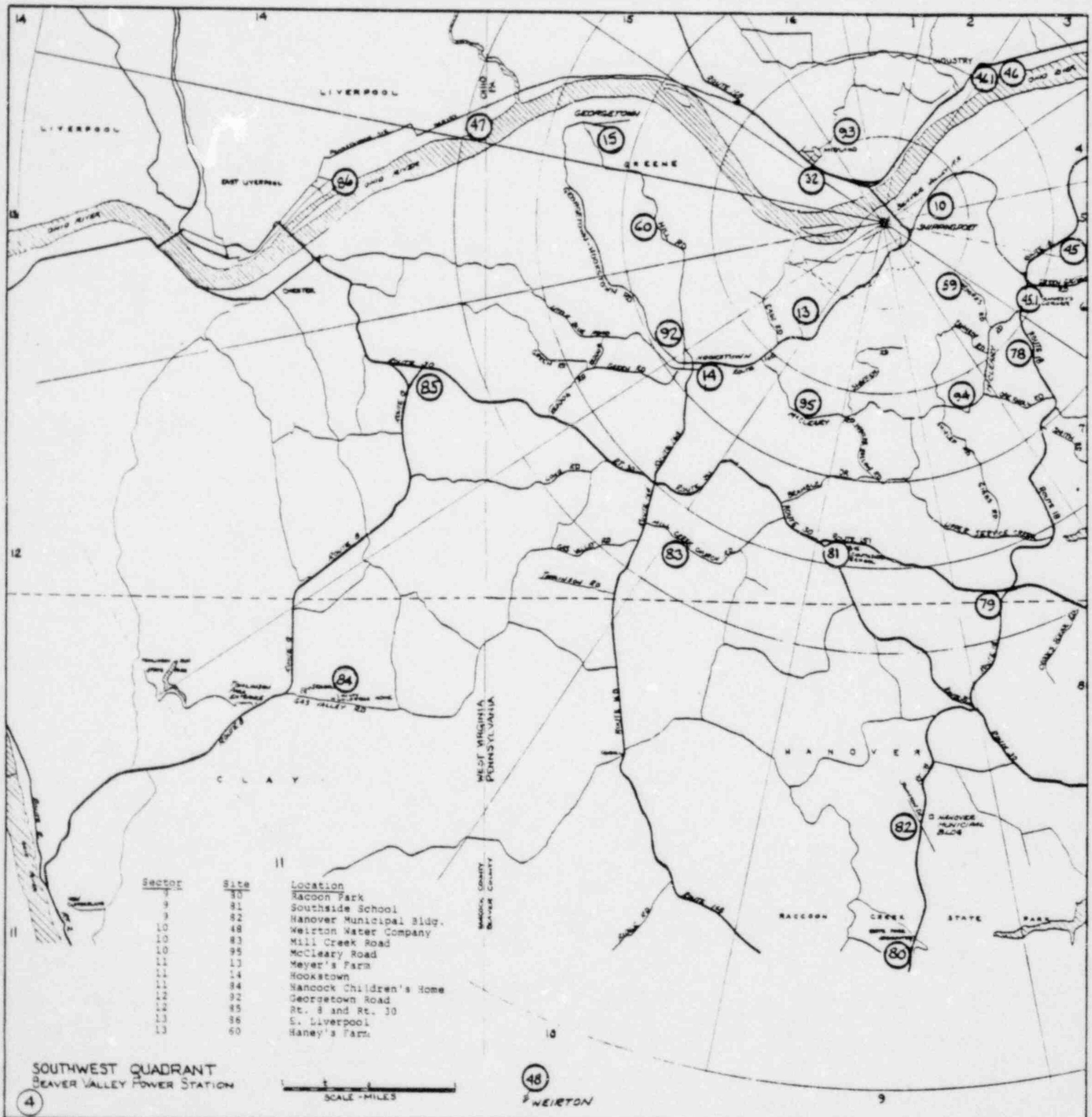
1981 Annual Radiological Environmental Report



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

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report



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

V. ENVIRONMENTAL MONITORING

2. Locations & Analytical Procedures (continued)

The lithium fluoride (LiF) TLDs used for environmental purposes are pre-selected and annealed at least 5 working days prior to use. The radiation dose accumulated from the anneal date to the date of posting is accounted for utilizing background readings from five (5) TLD chips which are processed within 24 hours of the posting date. The calibration of the TLD reader is performed within 24 hours of processing the posted environmental TLDs. The environmental TLDs are processed after retrieval and a background correction is made to account for the background radiation accumulated from the date of retrieval to the date of processing.

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, then 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.

3. Results and Conclusions

Data obtained with the contractor TLD ($CaSO_4$:Dy in teflon) during 1981 are summarized in Table V.A.3, and the quality control TLD results are listed in Table III.1.

The annual exposure rate of all off-site TLD's averaged .18 mR/day in 1981. As in previous years, there was some variation among locations and seasons as would be expected.

In 1981, ionizing radiation dose determinations averaged approximately 66 mR for the year. This is comparable to previous years. There was no evidence of anomalies that could be attributed to the operation of either Beaver Valley Power Station or Shippingport Atomic Power Station. Three sets of TLDs of different types, each provided and analyzed by a separate laboratory, demonstrate good agreement and confirm that changes from natural radiation levels, if any, are neglible.

Lessons learned from the Three Mile Island incident indicated the need for more radiation monitors in all sectors surrounding the plant. Engineering and procurement are in progress for 16 Reuter-Stokes Pressurized Ion Chamber environmental radiation monitors to be used to circle the plant site, one in each of the 16 sectors. Installation of the monitors for system operation which was begun in 1981 will continue through 1982. Engineering is also in progress to upgrade and modify the BVPS meteorological system to meet requirements in U.S. NRC Regulatory Guide 1.23, Rev. 1, and U.S. NUREG-0654, Appendix 2. The Reuter Stokes radiation monitors and the upgraded meteorological system will be tied into a new computer network to help meet some of the requirements set forth in U.S. NRC NUREG-0654 (Criteria for Preparational Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants) and U.S. NRC NUREG-0737 (TMI Action Plan Requirements). The complete meteorological system modifications and new computer network are still in the planning stage and a preliminary operational date is currently scheduled for December 1982.

V. ENVIRONMENTAL MONITORING

G. Monitoring of Fish

1. Description

Fish collected near the site are generally scrap fish. During 1981, fish collected for the radiological monitoring program included carp and catfish.

2. Sampling Program and Analytical Techniques

a. Program

Fish samples are collected semi-annually in the New Cumberland pool of the Ohio River at the Beaver Valley and Shippingport effluent discharge points 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

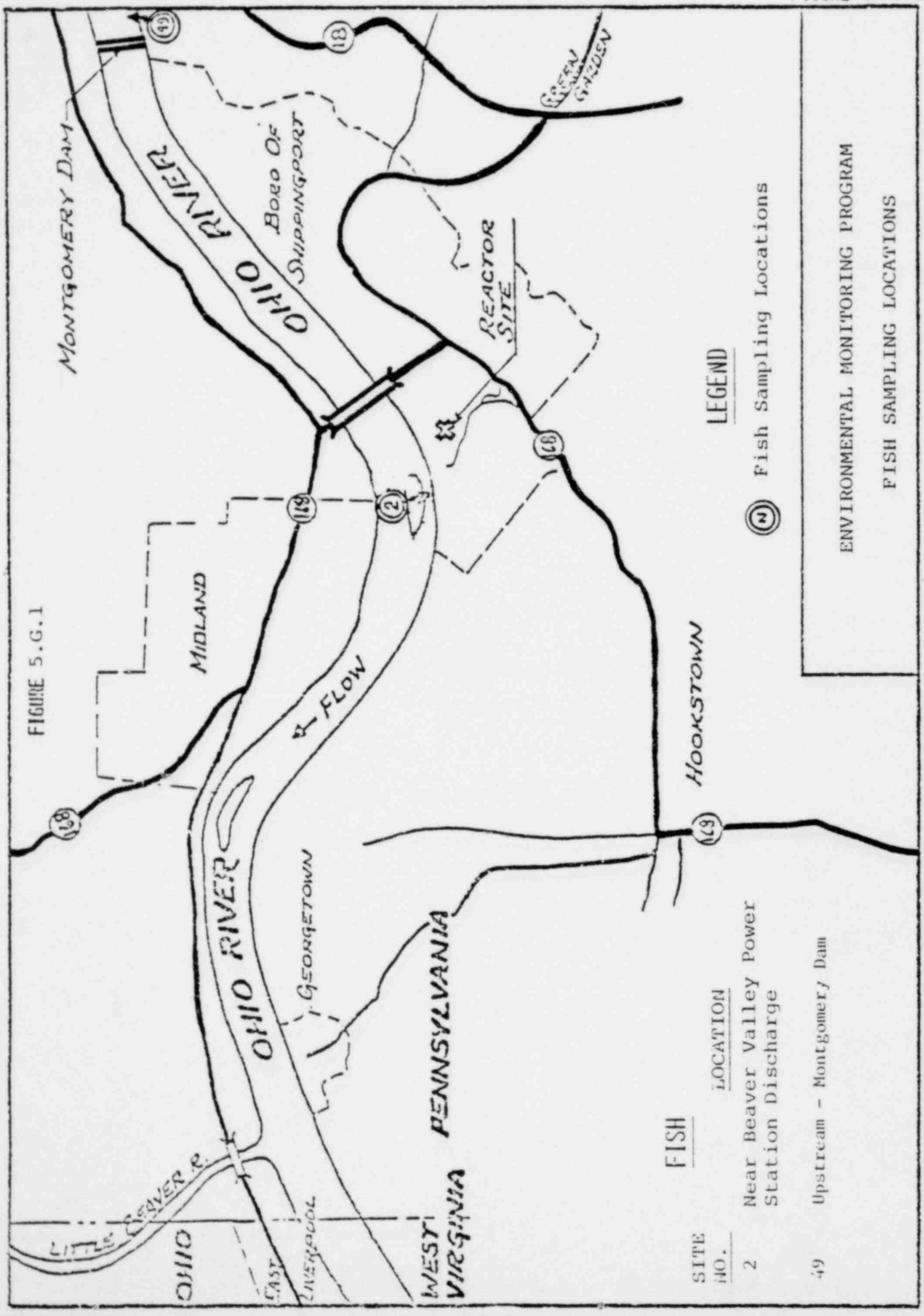
A sample is prepared in a standard tared 300 ml plastic bottle and scanned for gamma emitting nuclides with gamma spectrometry system which utilizes a Ge(Li) detector.

3. Results and Conclusions

A summary of the results of the fish monitoring data is provided in Table V.A.3. Four (4) fish were caught in June. Eight (8) more samples were caught in September. Except for naturally occurring K-40, the only gamma emitter which was detected in any samples was a trace of Cs-137 in one sample. Cesium-137 is a long lived fission product and some residual activity persists from previous weapons testing programs. This indicates that the operation of the Shippingport Atomic Power Station and the Beaver Valley Power Station has not resulted in radioactivity in fish in the Ohio River.

DUQUESNE LIGHT COMPANY
1981 Annual Radiological Environmental Report

FIGURE 5.G.1



V. ENVIRONMENTAL MONITORING

H. Monitoring of Surface, Drinking, and Well Waters

1. Description of Water Sources

The Ohio River is the main body of water in the area. It is used by both the Beaver Valley and Shippingport plants for water make-up and receiving plant liquid effluents. In addition, river water is used for cooling purposes at the Shippingport Atomic Power Station and make-up for the cooling tower at the Beaver Valley Power Station.

Ohio River water is a source of water for some towns both upstream and downstream of the Beaver Valley and Shippingport plant sites. 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 users are East Liverpool, Ohio, and Chester, West Virginia, which are approximately 6 and 7 miles downstream, respectively. 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.

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 following locations: Upstream of Montgomery Dam [River Mile 31.8]; at discharge from Shippingport Atomic Power Station [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 Crucible Steel's river water intake [River Mile 36.2]. The automatic sampler takes a 20 ml to 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 monthly composites are analyzed for gross alpha, gross beta, and gamma emitters. The quarterly composites are analyzed for tritium (H-3), strontium 89 (Sr-89), strontium 90 (Sr-90), and cobalt 60 (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 20-50 milliliters every 20 minutes. These intermittent samples are then composited into a weekly sample. The weekly sample from each location is analyzed by gamma spectrometry. The weekly samples are also analyzed for radioiodine (I-131).

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

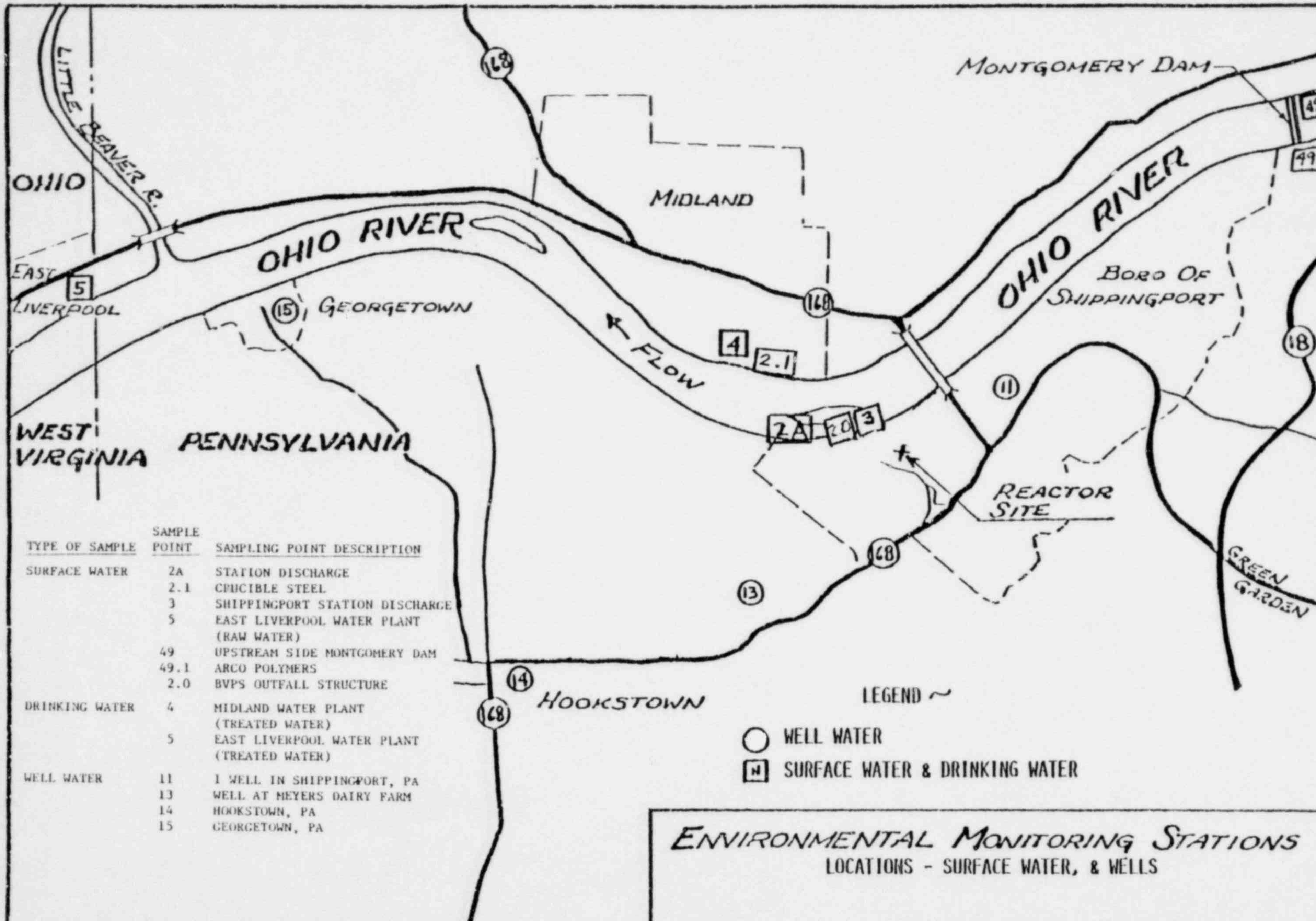
One (1) well at Shippingport, PA

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

One (1) well in Hookstown, PA

One (1) well in Georgetown, PA

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



TYPE OF SAMPLE	SAMPLE POINT	SAMPLING POINT DESCRIPTION
SURFACE WATER	2A	STATION DISCHARGE
	2.1	CRUCIBLE STEEL
	3	SHIPPINGPORT STATION DISCHARGE
	5	EAST LIVERPOOL WATER PLANT (RAW WATER)
	49	UPSTREAM SIDE MONTGOMERY DAM
	49.1	ARCO POLYMERS
	2.0	BVPS OUTFALL STRUCTURE
DRINKING WATER	4	MIDLAND WATER PLANT (TREATED WATER)
	5	EAST LIVERPOOL WATER PLANT (TREATED WATER)
WELL WATER	11	1 WELL IN SHIPPINGPORT, PA
	13	WELL AT MEYERS DAIRY FARM
	14	HOOKSTOWN, PA
	15	GEORGETOWN, PA

ENVIRONMENTAL MONITORING STATIONS
LOCATIONS - SURFACE WATER, & WELLS

V. ENVIRONMENTAL MONITORING

2. Sampling and Analytical Techniques (continued)

d. Procedure

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.

V. ENVIRONMENTAL MONITORING

3. Results and Conclusions

A summary of results of all analyses of water samples (surface, drinking, and ground) are provided by sample type and analysis in Table V.A.3. These are discussed below.

a. Surface Water

A total of seventy-two (72) samples were each analyzed for gross alpha, gross beta, and gamma activity. Twenty-four (24) quarterly composited samples were analyzed for tritium (H-3) and radiostrontium (Sr-89 and Sr-90) as well as a high sensitivity analysis for Co-60.

No alpha or Sr-89 were detected in surface water during CY 1981. All beta activities were within normal range. Other than the naturally occurring radionuclide of TH-228 which was detected in two samples, the only other gamma emitter detected was Co-60 at 9.18 ± 4.19 pCi/l in a BVPS discharge sample composited for February. This is a very low-level activity and is less than 10% of the Environmental Technical Specification Reporting Level. The activity is attributed to an unusually high sediment content contained in the sample. See Section V.C.3, Monitoring of Sediments and Soils. Co-60 was not detected in any other downstream surface water or drinking water sample during the same period of time.

The tritium levels in Beaver Valley Power Station outfall were elevated above preoperational levels during the first, second, and fourth quarters, but none of these data suggests detectable increases over preoperational levels downstream of the station. The tritium activity at the Beaver Valley Power Station outfall is consistent with station data of authorized radioactive discharges from Beaver Valley Power Station and were well within limits permitted by NRC license.

V. ENVIRONMENTAL MONITORING

3. Results and Conclusions (continued)

A trace amount of Sr-90 was detected in a fourth quarter downstream sample. The result of 0.73 ± 0.71 pCi/liter is only slightly above the minimum detectable activity of 0.5 pCi/liter. This positive result could not be attributed to station discharges. The result may be attributed to expected variability in the analyses results of very low levels of activity or to fallout from the Chinese nuclear test.

No detectable increase in radioactivity in the Ohio River can be attributed to Shippingport Atomic Power Station since it did not discharge radioactive liquids during 1981.

b. Drinking Water

A total of twenty-four (24) samples were analyzed for gross alpha and gross beta. All results were within preoperational data ranges.

A total of eight (8) samples were analyzed for tritium (H-3), radiostrontium (Sr-89 and Sr-90), and cobalt (Co-60). No Sr-89, Sr-90, or Co-60 were detected. The tritium data were within the preoperational range indicative of normal environmental levels.

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

A total of one hundred and four (104) samples were analyzed for radioiodine (I-131) using a highly sensitive technique. A detectable level of I-131 was measured in one (1) weekly sample collected on July 21, 1981, at Midland. The result of 0.23 pCi/liter for this sample is only slightly above the minimum detectable activity of 0.2 pCi/liter. This positive result could not be attributed to station discharges. The result may be attributed to expected variability in the analyses results of very low levels of activity. In addition, surface water analysis for the same period did not indicate the presence of (I-131).

V. ENVIRONMENTAL MONITORING

3. Results and Conclusions (continued)

c. Well Water

A total of sixteen (16) samples were each analyzed for gross alpha, gross beta, tritium and by gamma spectrometry. No alpha activity was detected in any of the samples. The gross beta and tritium data are within preoperational ranges. In one sample the naturally occurring gamma emitter thorium was detected.

d. Summary

The data from water analyses demonstrate that neither Beaver Valley Power Station nor Shippingport Atomic Power Station contributed a significant increase of radioactivity in local river, drinking or well waters. The few positive results which could be attributable to authorized releases from 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 maximum detected activity attributable to Beaver Valley Power Station was only a small fraction (0.46%) of the concentration (averaged over a year) permitted by the Federal Regulations for water consumed by the public. The Ohio River further reduced this concentration prior to its potential use by members of the public.

V. ENVIRONMENTAL MONITORING

I. Estimates of Radiation Dose to Man

1. Pathways to Man - Beaver Valley Power Station

a. Calculational Models - Beaver Valley Power Station

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 Beaver Valley Power Station Environmental Technical Specifications 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 B of the BVPS license, were used as the radionuclide activity input.

Each radionuclide contained in the semi-annual effluent report format of Regulatory Guide 1.21 was considered. Certain radionuclides which were not detected in the effluents were not included in dose calculations when the inventory of such nuclides available for discharge was judged to be negligible. As a result, only noble gases, radioiodines, strontium, and tritium were included as source terms based on the lower detectable limits of analysis (all sensitivities for analysis at Beaver Valley were equal to or better than required by the Beaver Valley license).

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 1.09. 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

a. Calculational Models - Beaver Valley Power Station (continued)

All potentially radioactive liquid effluents, including steam generator blowdown, are released by batch mode after analysis by gamma spectrometry using a GeLi detector. 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. The maximum 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 - Beaver Valley Power Station Liquid Releases

a. Liquid Pathway - Maximum Individual

The doses which are calculated, based on the model presented above in V.I.1, are summarized and compared to Beaver Valley Power Station license limits below. An additional breakdown of these doses by pathway and organ is provided in Table V.I.1. For these calculations, a hypothetical maximum individual(s) was located at Midland since this is the nearest location which significant exposure of a member of the public could potentially occur.

TABLE V.I.1
1981 Radiation Dose to Maximum Individual[a], mrem/yr.
Beaver Valley Power Station - Liquid Releases

PATHWAY	CRITICAL GROUP	USAGE FACTOR	SKIN	ORGAN	THYROID	BONE	WHOLE BODY
Fish Consumption[b]	Adult	21 kg	N/A	0.0409 (Liver)	0.00088	0.0254	0.0292
Drinking Water[c]	Infant	510 l	N/A	0.013 (Liver)	0.0178	0.00289	0.0104
Shoreline Activities	Teen	67 hr.	0.0019	--	--	--	0.0016
TOTAL	MREM CRITICAL INDIVIDUAL		0.0019 (Teen)	0.0476 (Adult) (Liver)	0.0178 (Infant)	0.0335 (Child)	0.0358 (Adult)

DOSE TO INDIVIDUALS DURING 1981 FROM NATURAL RADIATION EXPOSURE

Ambient Gamma Radiation:	69[d]
Radionuclides in Body :	18[e]
Global Fallout :	4[e]
TOTAL mrem	91

[a] Located at Midland Drinking Water Intake

[b] Child - Usage Factor 6.9 kg/yr.

[c] Adult - Usage Factor 730 l/yr.

[d] Pre-operational average ambient gamma radiation

[e] National Academy of Sciences, "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation", BEIR Report, 1972.

V. ENVIRONMENTAL MONITORING

2. Results of Calculated Radiation Dose to Man - Beaver Valley Power Station Liquid Releases (continued)

Actual Doses (mrem/yr.) - Calculated Using Site Effluents Appendix I * Analysis Dose - Calculated Using NRC Model Effluents Regulatory Limit Doses - NRC Staff Guidelines RM50-2

	Calculated (1.21 Reported Releases	Appendix I Report (Conservative Non-accident Doses)	RM50-2 (Re. Limit w/o Cost/Benefit Analysis)	Ratio of Calculated Dose vs. Reg. Limit
TOTAL BODY				
Adult	0.0358	2.78	5.0	0.00716
Teen	0.0199	0.712	5.0	0.00398
Child	0.0134	Not Reported	5.0	0.00268
Infant	0.0104	Not Reported	5.0	0.00208
ANY ORGAN				
Adult	0.0476 (Liver)	Not Reported	5.0	0.00952
Teen	0.045 (Liver)	Not Reported	5.0	0.009
Child	0.0439 (Liver)	Not Reported	5.0	0.00878
Infant	0.0178 (Thyroid)	Not Reported	5.0	0.0026

Maximum Total Body Dose - Capsule Summary

	mrem
1981 Calculated	0.0358
Appendix I Estimated	2.78
Final Environmental Statement	0.112

Thyroid Dose - (Largest Expected Organ Dose)

1981 Calculated	0.0178
Final Environmental Statement	0.96

* 10 CFR 50 Appendix I

V. ENVIRONMENTAL MONITORING

2. Results of Calculated Radiation Dose to Man - Beaver Valley Power Station Liquid Releases (continued)

b. Population Doses

The 1981 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	79.9	H-3 70.8 mrem Co-60 3.5 mrem CS-137 3.2 mrem
THYROID	95.0	H-3 70.8 mrem I-131 22.6 mrem

The estimated quarterly dose in the NRC Final Environmental Statement is 104 Man-Millirem. The Calculated Dose is less than the background annual dose received by two (2) people of the 4 million people evaluated. The increased dose to this population is less than 0.0001% of normal background dose already received.

3. Airborne Pathway - (Beaver Valley Power Station)

The doses to the public for Beaver Valley Power Station airborne radioactive effluents during 1981 are provided in Table V.I.2. They include the contribution of all pathways. Tritium is the primary radionuclide contribution to these doses. The data demonstrate compliance with 10CFR50, Appendix I design objective limits.

4. Conclusions - (Beaver Valley Power Station)

The calculated doses to the public from the operation of Beaver Valley Power Station - Unit NO. 1 are below 10CFR50, Appendix I design objectives, 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.2

Results of Calculated Radiation Dose to Man (1981)

Beaver Valley Power Station - Airborne Radioactivity

ORGAN	MAXIMUM EXPOSURE INDIVIDUAL, mrem	APPENDIX I* DESIGN OBJECTIVE mrem	PERCENT OF APPENDIX I	50-MILE POPULATION DOSE man rem
TOTAL BODY	0.4081	5	8.16%	0.412
SKIN	1.130	15	7.53%	1.43
LUNG	0.413	--	--	0.44
THYROID	2.922	--	--	0.922

* 10CFR50, Appendix I

V. ENVIRONMENTAL MONITORING

5. Dose Pathways to Man - Shippingport Atomic Power Station

The radiation doses to man as a result of operations at the Shippingport Atomic Power Station during 1981 were calculated for the liquid and gaseous effluent pathways. There were no radioactive liquid discharges from the Shippingport Atomic Power Station during 1981.

Effluent monitoring at the Shippingport Station during 1981 has shown that the radioactivity releases were substantially below the Federal radioactivity concentration guides. The environmental monitoring program has demonstrated that the radiation exposure to the general public from the Shippingport Station operations was too low to measure and could only be estimated with the calculational models described below using measured or estimated effluent radioactivity data.

a. Calculational Models - Shippingport Atomic Power Station

The radiation doses to man from Shippingport Atomic Power Station operations were estimated using calculational models recommended by the International Commission on Radiological Protection (ICRP Publ. 2, 1959) and employ the general guidelines of the Nuclear Regulatory Commission (Regulatory Guide 1.109) established to maintain compliance with 10CFR50 Appendix I.

The air dose pathways considered were inhalation, immersion in gaseous and suspended particulate activity, and the ingestion of food and milk produced in the Shippingport vicinity. It was conservatively assumed that food products consumed by the public were produced in the Shippingport area throughout CY 1981. The maximum potentially exposed individual for the air pathways was located at the site boundary. It was conservatively assumed that the maximum individual resides continually at the site boundary.

V. ENVIRONMENTAL MONITORING

5. Dose Pathways to Man - Shippingport Atomic Power Station (continued)

Modeling parameters and usage factors used in the pathway calculations were consistent with values recommended by the Nuclear Regulatory Commission (NRC Regulatory Guide 1.109). The population distribution within 50 miles of the site was based on census data as provided in the LWBR Program Environmental Impact Statement (ERDA 1541). Furthermore, the air pathway calculation employed site-specific meteorological and wind direction data.

6. Results and Conclusions - Shippingport Atomic Power Station

Evaluation of the radiation dose-to-man calculations for the airborne effluents show that the maximum annual radiation exposure potentially received by an individual residing at the site boundary is less than 0.1 mrem. The maximum dose to an individual is well below the 10CFR50 Appendix I dose limits. Furthermore, the radiation exposure to the entire population of 4 million persons within 50 miles of the Shippingport Station was less than 1 person-rem. This dose is negligible compared to the typical general use of more than 360,000 person-rem received by all individuals from typical background radiation.

In conclusion, the radiation exposure received from the Shippingport Station during CY 1981 by any member of the general public is a very small fraction of the background radiation and has, therefore, no significant effect on the general public.

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