

50-155

Annual

I. RADIOACTIVE EFFLUENT RELEASES

A. Introduction

Releases of radioactive material both to the atmosphere and to Lake Michigan from January 1, 1976 through December 31, 1976 were well within the facility-licensed limits and the NRC's regulations, particularly Title 10, Code of Federal Regulations, Part 20.

B. Gaseous Effluents

Gaseous releases to the atmosphere are summarized in Tables I-1 and I-2. Table I-1, the January through July effluents, contains several corrections to the effluent data previously submitted. These corrections have been identified by an asterisk.

C. Liquid Effluents

Liquid releases to Lake Michigan are summarized in Tables I-3, January through June, and Table I-4, July through December. No dissolved gaseous radioactivity was detected in any release.

D. Solid Waste

A total of 620,260 curies of radioactive material was shipped off site during the year. Of the total, irradiated cobalt accounted for 574,565 curies, irradiated fuel rods 45,691 curies, and solid radwaste 3.7 curies. The type and disposition, including dates and destination, of the shipments is listed in Table I-5. Total volume of solid waste shipped off site during the first six months of 1976 was approximately 932 ft³, while the total shipped during the second six months was approximately 100 ft³.

Chamber's Ferry Company
Big Rock Point Plant, Period 01-30-55
Atmospheric Release of Radioactive Material

	UNITS	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	TOTAL	YEARS TOTAL
Total Radioactive Gases (including R-131)	Curies	2.31E-02	1.41E-01	1.4E-01	1.10E-01	1.67E-01	1.41E-01	1.77E-01	4.47E-01	7.37E-01	1.37E-01	1.52E-01	1.52E-01	1.52E-01	1.52E-01
Total Helium		3.11E-01	2.37E-01	2.4E-01	7.6E-01	1.67E-01	6.57E-01	1.80E-01	2.77E-01	9.91E-01	1.6E-01	1.6E-01	1.6E-01	1.6E-01	1.6E-01
Total Inert Gases (Total)		2.77E-02	9.4E-01	9.81E-01	1.77E-02	1.77E-01	5.8E-01	7.9E-01	7.61E-01	1.51E-02	1.51E-02	1.51E-02	1.51E-02	1.51E-02	1.51E-02
Total Tritium		1.4E-01	1.10E-01	1.1E-01	2.4E-01	1.1E-01	1.1E-01	1.1E-01	1.4E-01	6.0E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01
Total Inert Gases - Gross Alpha		1.51E-07	1.1E-07	1.1E-07	6.0E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07
Maximum Daily Gas Release Rate	mc/s	4.4E-02	6.7E-02	6.7E-02	6.7E-02	1.8E-01	6.0E-02	4.9E-02	6.0E-02	6.0E-02	6.0E-02	6.0E-02	6.0E-02	6.0E-02	6.0E-02
Percent of Technical Specifications	%	8.0E-01	2.7E-02	9.6E-02	1.9E-02	6.4E-02	1.4E-02	9.1E-02	1.0E-02	4.7E-02	1.0E-02	1.0E-02	1.0E-02	1.0E-02	1.0E-02
		9.0E-02	6.7E-02	2.0E-02	1.9E-02	1.9E-02	6.9E-02	8.7E-02	7.0E-02	7.0E-02	7.0E-02	7.0E-02	7.0E-02	7.0E-02	7.0E-02
		1.6E-01	7.7E-02	1.0E-02	8.7E-02	1.1E-02	6.8E-02	6.8E-02	6.8E-02	6.8E-02	6.8E-02	6.8E-02	6.8E-02	6.8E-02	6.8E-02
Isotopes Released	Curies														
Helium															
H-3		3.11E-01	1.41E-01	1.4E-01	4.0E-01	1.70E-01	7.07E-01	1.90E-01	2.91E-01	4.90E-01	1.0E-01	1.0E-01	1.0E-01	1.0E-01	1.0E-01
H-4		-----	7.5E-01	2.90E-01	2.9E-01	1.90E-01	3.8E-01	1.9E-01	2.0E-01	3.0E-01	3.0E-01	3.0E-01	3.0E-01	3.0E-01	3.0E-01
Inert Gases															
C-13		7.6E-01	1.0E-01	5.3E-01	1.1E-01	1.7E-01	5.5E-01	2.5E-01	4.9E-01	1.1E-01	1.1E-01	1.1E-01	1.1E-01	1.1E-01	1.1E-01
C-14		1.7E-02	4.9E-01	1.5E-01	1.7E-02	4.6E-01	2.6E-01	1.6E-01	7.9E-01	1.0E-02	1.0E-02	1.0E-02	1.0E-02	1.0E-02	1.0E-02
N-13		-----	2.0E-01	4.6E-01	2.3E-01	4.0E-01	1.5E-01	3.6E-01	1.1E-01	1.9E-01	1.9E-01	1.9E-01	1.9E-01	1.9E-01	1.9E-01
O-15		2.5E-01	1.0E-01	6.7E-01	1.0E-01	1.5E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01
O-16		-----	-----	6.9E-01	4.9E-01	-----	1.0E-01	-----	1.0E-01	5.9E-01	5.9E-01	5.9E-01	5.9E-01	5.9E-01	
O-17		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
O-18		8.6E-01	1.0E-01	1.0E-01	4.1E-01	2.7E-01	1.1E-01	1.1E-01	5.0E-01	9.1E-01	9.1E-01	9.1E-01	9.1E-01	9.1E-01	9.1E-01
Radioactive Gases															
R-131		3.6E-01	3.70E-02	4.6E-02	8.9E-02	3.6E-02	4.7E-02	4.7E-02	1.1E-01	2.1E-01	1.4E-01	1.4E-01	1.4E-01	1.4E-01	1.4E-01
R-132		2.9E-01	1.6E-02	1.7E-02	1.70E-02	2.1E-02	1.7E-02	1.7E-02	3.6E-02	9.1E-02	9.1E-02	9.1E-02	9.1E-02	9.1E-02	9.1E-02
R-133		2.40E-01	1.4E-02	1.1E-02	2.7E-02	1.0E-02	1.0E-02	1.0E-02	2.9E-02	3.7E-02	3.7E-02	3.7E-02	3.7E-02	3.7E-02	3.7E-02
R-134		1.19E-01	6.7E-01	9.4E-01	1.4E-02	6.7E-01	6.7E-01	6.7E-01	1.8E-02	3.7E-02	3.7E-02	3.7E-02	3.7E-02	3.7E-02	3.7E-02
R-135		4.0E-01	2.9E-02	2.0E-02	4.6E-02	2.7E-02	2.9E-02	2.9E-02	7.0E-02	2.1E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01
R-136		2.7E-01	1.7E-02	1.1E-02	2.9E-02	1.7E-02	1.7E-02	1.7E-02	8.9E-02	2.9E-02	2.9E-02	2.9E-02	2.9E-02	2.9E-02	2.9E-02
R-137		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
R-138		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
R-139		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
R-140		<1	<1	<1	1.4E-02	<1	<1	<1	2.0E-02	3.4E-02	3.4E-02	3.4E-02	3.4E-02	3.4E-02	
R-141		1.4E-02	8.6E-02	6.7E-02	1.6E-01	8.1E-02	7.7E-02	7.6E-02	2.9E-01	6.0E-01	6.0E-01	6.0E-01	6.0E-01	6.0E-01	
R-142		2.70E-02	1.7E-01	9.9E-02	2.5E-01	1.3E-01	1.5E-01	1.5E-01	3.4E-01	5.9E-01	5.9E-01	5.9E-01	5.9E-01	5.9E-01	
R-143		3.7E-02	1.8E-01	1.4E-01	1.6E-01	1.6E-01	1.6E-01	1.6E-01	5.0E-01	6.6E-01	6.6E-01	6.6E-01	6.6E-01	6.6E-01	
R-144		5.4E-02	1.7E-01	2.3E-01	6.9E-01	1.1E-01	2.9E-01	2.6E-01	8.7E-01	1.9E-01	1.9E-01	1.9E-01	1.9E-01	1.9E-01	
R-145		1.1E-01	6.8E-01	9.7E-01	1.4E-02	6.9E-01	6.9E-01	6.9E-01	1.8E-02	3.1E-02	3.1E-02	3.1E-02	3.1E-02	3.1E-02	
R-146		6.7E-02	1.9E-01	1.0E-01	7.0E-01	1.0E-01	1.5E-01	1.5E-01	1.0E-01	1.8E-02	1.8E-02	1.8E-02	1.8E-02	1.8E-02	
R-147		<1	1.4E-02	2.4E-02	4.7E-02	1.9E-02	1.0E-02	2.0E-02	2.9E-02	1.9E-02	1.9E-02	1.9E-02	1.9E-02	1.9E-02	
R-148		-----	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
R-149		-----	<1	-----	<1	<1	<1	-----	<1	<1	<1	<1	<1	<1	
R-150		9.9E-02	1.1E-02	1.6E-02	1.0E-02	1.7E-02	1.6E-02	1.7E-02	1.1E-02	8.1E-02	8.1E-02	8.1E-02	8.1E-02	8.1E-02	

TABLE 2-3

Consolidated Power Company
Big Bend Point Plant, Unit 20-155
Radioactive Liquid Releases

UNITS	JANUARY	FEBRUARY	MARCH	FIRST QUARTER	APRIL	MAY	JUNE	SECOND QUARTER	SEVEN MONTH TOTAL	
Total Radioactivity Released (except Tritium, Dissolved Gases and Alpha)	Curies	9.54E-02	1.13E-01	5.65E-02	1.97E-01	1.52E-01	5.64E-02	1.59E-01	3.71E-01	9.62E-01
Volume of Waste Discharged	Liters	1.47E-04	8.13E-04	7.93E-04	1.70E-03	5.94E-04	7.77E-04	5.94E-04	1.97E-03	3.57E-03
Average Concentration of Waste Inlet to Storage	µCi/ml	1.77E-03	1.77E-03	7.07E-04	1.17E-03	2.63E-03	7.01E-04	2.67E-03	1.95E-03	1.57E-03
Volume of Circulating Discharge Water	Liters	8.43E-09	3.83E-09	2.56E-09	1.48E-10	8.78E-08	1.90E-09	7.96E-09	1.05E-10	2.52E-10
Average Concentration Released (except Tritium, Dissolved Gases and Alpha)	µCi/ml	3.01E-09	2.95E-08	2.21E-08	1.37E-08	1.78E-07	2.97E-08	2.04E-08	3.54E-08	2.01E-08
Inlet Concentration (except Tritium, Dissolved Gases and Alpha)	µCi/ml	3.41E-07	7.77E-07	1.07E-06	1.07E-06	1.63E-06	8.32E-07	6.90E-06	6.80E-06	6.70E-06
Percent of Applicable Limits	%	4.72E-02	6.13E-03	3.43E-01	2.45E-01	1.21E-01	2.07E-01	1.93E-01	2.70E-01	2.57E-01
Tritium Released	Curies	1.04E-03	5.70E-02	1.45E-02	6.75E-02	1.84E-01	4.84E-01	8.77E-01	1.55E-00	1.61E-00
Average Tritium Concentration Released	µCi/ml	1.23E-10	1.32E-08	5.65E-07	4.56E-07	2.10E-07	2.55E-07	1.33E-07	1.48E-07	6.34E-08
Total Gross Alpha Released	Curies	7.40E-05	7.84E-06	8.05E-06	9.27E-05	6.74E-06	4.34E-06	1.01E-05	2.17E-05	1.14E-04
Average Alpha Concentration	µCi/ml	2.11E-12	2.05E-12	3.14E-12	6.24E-12	7.68E-12	2.40E-12	1.30E-12	2.02E-12	4.47E-12
Identified	Curies									
Cs-137		2.01E-03	1.34E-02	4.19E-03	1.22E-02	2.84E-02	2.24E-03	2.79E-02	6.54E-02	8.57E-02
Cs-134		8.31E-03	2.51E-02	7.70E-03	4.11E-02	8.32E-02	3.04E-02	8.45E-02	1.79E-01	2.64E-01
Sr-90		7.91E-04	1.71E-03	4.36E-03	6.06E-03	4.07E-03	2.37E-03	3.77E-03	1.02E-02	1.70E-02
Pu-239		6.73E-04	2.05E-04	1.03E-03	1.70E-03	1.47E-03	7.06E-04	1.60E-03	3.87E-03	5.63E-03
Co-60		4.54E-03	1.40E-02	1.80E-02	3.53E-02	3.17E-02	1.10E-02	2.06E-02	6.48E-02	9.81E-02
Ba-133		1.52E-03	.....	.....	1.52E-03	.....	.....	.....	.....	1.52E-03
Fe-59		1.70E-02	4.84E-02	2.82E-02	7.87E-02	2.10E-02	2.74E-02	7.77E-02	1.07E-01	1.74E-01
Fe-55		2.27E-03	1.55E-04	1.16E-04	2.94E-04	2.94E-05	6.77E-05	1.07E-04	1.84E-04	4.78E-04
Mn-54		.....	.....	2.11E-04	2.11E-04	3.74E-04	3.02E-05	2.43E-04	8.49E-04	1.07E-03
Fe-57		.....	.....	2.95E-04	2.95E-04	4.00E-04	3.13E-05	1.80E-04	8.79E-04	1.14E-03
Not Identified		4.23E-01	5.91E-02	2.07E-02	8.41E-02	6.16E-01	2.57E-01	1.94E-02	2.83E-02	1.37E-01
Percent of Total Identified	%	43.6	47.4	43.6	54.2	29	29	87.6	92.4	77.3

TABLE 1-4

Consolidated Power Company
 Big Rock Island Plant, (unit No 20-13)
 Radioactive Liquid Releases

	UNIT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL	PERCENT
Total Tritium Released (except Tritium, Dissolved Gases and Alpha)	Curie	1.74E-01	1.66E-02	.....	1.79E-01	1.41E-02	.....	1.62E-02	1.03E-02	2.05E-01	1.72E-01	.....	.....	.....	.....	.....	.....
Volume of Waste Discharged	liters	7.80E-04	2.03E-04	.....	9.81E-04	1.84E-04	.....	2.10E-04	1.94E-04	1.38E-03	4.77E-03	.....	.....	.....	.....	.....	.....
Average Concentration of Waste Prior to Discharge	µCi/ml	2.10E-01	4.94E-04	.....	1.77E-01	7.79E-04	.....	7.70E-04	7.70E-04	1.48E-01	1.54E-01	.....	.....	.....	.....	.....	.....
Volume of Circulating Wastage Water	liters	1.07E-02	8.11E-02	8.72E-02	2.37E-10	8.45E-02	8.16E-02	8.65E-02	2.51E-10	4.87E-10	7.41E-10	.....	.....	.....	.....	.....	.....
Average Concentration Released (except Tritium, Dissolved Gases and Alpha)	µCi/ml	2.15E-08	1.70E-04	.....	7.2E-04	1.70E-02	.....	1.91E-02	1.71E-02	4.20E-02	1.62E-02	.....	.....	.....	.....	.....	.....
Maximum Concentration (except Tritium, Dissolved Gases and Alpha)	µCi/ml	1.15E-05	2.04E-07	.....	1.15E-05	2.03E-07	.....	1.67E-07	1.67E-07	1.15E-05	1.2E-05	.....	.....	.....	.....	.....	.....
Percent of Applicable Limits	%	1.68E-01	1.41E-02	.....	1.71E-02	1.85E-02	.....	1.81E-01	4.71E-02	5.15E-02	1.27E-01	.....	.....	.....	.....	.....	.....
Tritium Released	Curie	7.80E-01	1.47E-02	.....	7.94E-01	2.98E-01	.....	1.97E-01	6.57E-01	8.01E-01	2.41E-01	.....	.....	.....	.....	.....	.....
Average Tritium Concentration Released	µCi/ml	1.10E-07	1.71E-09	.....	1.15E-08	1.05E-10	.....	4.72E-10	2.62E-10	1.64E-08	1.25E-08	.....	.....	.....	.....	.....	.....
Total Gross Alpha Released	Curie	5.61E-06	1.55E-06	.....	7.18E-06	1.98E-06	.....	2.42E-05	2.66E-05	1.38E-05	1.42E-05	.....	.....	.....	.....	.....	.....
Average Alpha Concentration	µCi/ml	7.9E-11	1.86E-11	.....	3.04E-11	2.34E-11	.....	2.91E-12	1.06E-12	6.94E-11	2.62E-12	.....	.....	.....	.....	.....	.....
Isotopes	Curie																
Co-113		1.25E-02	1.17E-01	.....	1.39E-02	6.77E-04	.....	1.16E-01	1.84E-01	1.57E-02	1.21E-01	.....	.....	.....	.....	.....	.....
Co-117		6.98E-02	2.17E-01	.....	7.80E-02	5.71E-01	.....	4.51E-01	1.02E-02	8.27E-02	1.27E-01	.....	.....	.....	.....	.....	.....
Ni-64		4.30E-01	8.12E-04	.....	5.11E-01	1.32E-01	.....	1.02E-01	2.41E-01	7.94E-01	2.47E-02	.....	.....	.....	.....	.....	.....
Zn-75		2.17E-01	.....	.....	2.17E-01	.....	.....	.....	.....	2.17E-01	7.80E-01	.....	.....	.....	.....	.....	.....
Co-60		4.47E-02	1.40E-01	.....	4.21E-02	4.08E-01	.....	4.42E-01	1.06E-02	1.57E-02	1.27E-01	.....	.....	.....	.....	.....	.....
Ni-59		4.05E-04	.....	.....	4.05E-04	.....	.....	.....	.....	4.05E-04	1.55E-01	.....	.....	.....	.....	.....	.....
Sr-90		1.40E-05	2.14E-06	.....	1.66E-05	1.68E-06	.....	BA	1.68E-06	2.03E-05	2.06E-04	.....	.....	.....	.....	.....	.....
Sr-91		4.11E-05	1.30E-05	.....	5.41E-05	7.18E-05	.....	BA	7.18E-05	1.26E-04	6.04E-04	.....	.....	.....	.....	.....	.....
Ba-134		.....	.....	.....	.....	.....	.....	.....	.....	.....	1.52E-05	.....	.....	.....	.....	.....	.....
Pu-239		.....	.....	.....	.....	.....	.....	.....	.....	.....	1.14E-01	.....	.....	.....	.....	.....	.....
Not Identified Beta		2.70E-01	2.25E-01	.....	1.70E-02	2.47E-01	.....	2.92E-02	1.37E-02	1.74E-02	1.34E-01	.....	.....	.....	.....	.....	.....
Percent of Total Identified	%	94.1	77.6	.....	93.1	89.8	.....	89.1	89.4	94.5	89.6	.....	.....	.....	.....	.....	.....

NOTE:

BA - Not available - strontium analysis in progress.
 * Does not include December strontium results.

TABLE I-5

OFF-SITE SHIPMENTS OF RADIOACTIVE MATERIAL

<u>SHIPMENT NUMBER</u>	<u>DATE</u>	<u>TRANSFERRED FROM</u>	<u>TRANSFERRED TO</u>	<u>RADIOACTIVE MATERIAL</u>	<u>VOLUME</u>	<u>DISPOSITION</u>
393	2/20/76	DPR-6	Glenn Station (Exempt Quantity)	Fuel Insp Tools (0.16 μ Ci)	2 ft ³	Reuse
394	3/11/76	DPR-6	Exxon, Richland, WA MW-I-062-1	Fuel Insp Tools (4.98 μ Ci)	6 ft ³	Reuse
395	3/17/76	DPR-6	Battelle, Columbus, OH 34-06854-05	16 Co-60 Rods (287,000 Ci)	<1 ft ³	Processing
396	3/22/76	DPR-6	NEB, Rockville, MD (Exempt Quantity)	Carbon filter crud samples (<100 μ Ci)	1 ft ³	Analysis
397	4/21/76	DPR-6	Battelle, Columbus, OH 34-06854-05	Steam drum relief Valve nozzles (300 μ Ci)	5 ft ³	Examination
398	4/29/76	DPR-6	Battelle, Columbus, Oh 34-06854-05	19 Co-60 Rods (287,565 Ci)	<1 ft ³	Processing
399	5/20/76	DPR-6	NECO, Morehead, KY 16-NEP-1	123 DOT 17H Barrels (0.13 Ci)	918 ft ³	Burial
400	7/15/76	DPR-6	NEB, Rockville, MD (Exempt Quantity)	Carbon, Particulate Filters, Resins(.7 μ Ci)	NA	Analysis
401	9/20/76	DPR-6	ANL, Argonne, IL	5 Irradiated Fuel Rods (29,171 Ci)	NA	Destructive Examination
402	9/22/76	DPR-6	ANL, Argonne, IL	6 Irradiated Fuel Rods (16,520 Ci)	NA	Destructive Examination
403	10/18/76	DPR-6	NECO, Sheffield, IL (16-NEP-1)	Solid Waste, Filters, Etc (2.28 Ci)	50 ft ³	Burial
404	10/22/76	DPR-6	NECO, Sheffield, IL (16-NEP-1)	Solid Waste, Filters Etc (1.28 Ci)	50 ft ³	Burial

II. ENVIRONMENTAL MONITORING

A. Sampling Summary

Table II-1 contains the number of sampling locations, total number of samples collected and the number of locations at which levels were found to be significantly above local concurrent background for each medium sampled. A listing of the highest, lowest and annual average concentrations for the sampling points with the highest average concentrations is presented in Table II-2.

B. Environmental Dose Estimates

The level of radioactive materials in environmental media does not indicate the likelihood of public intake in excess of 1% of that resulting from continuous annual exposure to the concentration values listed in Appendix B, Table II, Part 20.

C. Variation of Environmental Concentrations With Time

1. Air Samples: No significant increase above concurrent background was observed at the air particulate sampling locations. No Iodine-131 activity on the charcoal cartridges was observed above the minimum detectable level. This is consistent with expected results based on actual plant effluents and site meteorology.
2. Lake Water: Table II-3 compares the measured discharge and the Charlevoix (5 miles SW) gross beta radioactivity to that calculated from effluent data. Except for those periods with significant variability in discharge flow, the calculated discharge concentration compares reasonably well with the measured concentrations. Discrepancies between measured and calculated discharge

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The level of radioactive materials in environmental media does not indicate the likelihood of public intake in excess of 1% of that resulting from continuous annual exposure to the concentration values listed in Appendix B, Table II, Part 20.

C. Variation of Environmental Concentrations With Time

1. Air Samples: No significant increase above concurrent background was observed at the air particulate sampling locations. No Iodine-131 activity on the charcoal cartridges was observed above the minimum detectable level. This is consistent with expected results based on actual plant effluents and site meteorology.
2. Lake Water: Table II-3 compares the measured discharge and the Charlevoix (5 miles SW) gross beta radioactivity to that calculated from effluent data. Except for those periods with significant variability in discharge flow, the calculated discharge concentration compares reasonably well with the measured concentrations. Discrepancies between measured and calculated discharge

concentrations is believed to be due to a fixed sampling rate vice a variable discharge flow. The Charlevoix sample is obtained from the city drinking water system. The municipal intake consists of infiltration galleries located at the shore of Lake Michigan. However, a portion of this intake water is groundwater as opposed to Lake Michigan water; therefore, the Charlevoix gross beta radioactivity should not be interpreted as lake background. Table II-4 contains the results of isotopic analysis of lake water samples containing gross beta activity greater than 10 pCi/l.

3. Well Water: Well water samples indicate only the presence of natural background radioactivity.
4. Milk: During October, milk samples were collected weekly in an attempt to monitor fallout from the September 26, 1976 Chinese nuclear test. The following results were obtained.

I-131 in Milk (pCi/l)

	<u>JS</u>	<u>LK</u>	<u>DF</u>	<u>BB</u>
<u>LOCATION</u>	2.3 MI SE	3.5 MI E	4 MI SSE	11 MI E
10/7/76	1.3 ± 0.13	0.5	0.5	0.7 ± 0.1
10/14/76	22.8 ± 1.3	0.5	0.5	4.3 ± 0.4
10/21/76	7.6 ± 0.2	0.5	0.5	0.8 ± 0.1
10/23/76	2.6 ± 0.8	0.5	0.5	0.5

No detectable levels of radiiodine were observed before or after these dates, nor was an increase in radioactivity levels observed for any other nuclide. The elevated levels of I-131 at locations

GS and BS are the result of fallout, not plant discharges.

Theoretically, site boundary I-131 concentration of approximately $2.0E-13$ $\mu\text{Ci/cc}$ results from plant release during October. This level is several orders of magnitude below that needed to cause the above-listed concentrations in milk. The difference in concentrations at the four sampling locations is the direct result of different percentages of feed resulting from grazing.

5. Aquatic Biota: Samples of periphyton, algae, crayfish and shore-mosses are collected semiannually when available. Periphyton samples collected near the discharge area appear to have concentrations of radionuclides higher than those at the remote collection locations. Since the samples contain varying amounts of sand and water, and therefore are not identical, and because the concentration of radionuclides by periphyton is a long-term process, a rigorous statistical analysis correlating this year's effluents with the observed concentrations is not possible. However, an overall decrease in the levels observed when compared to similar samples taken five or six years ago is apparent.
6. Gamma Dose: Total thermoluminescent dosimeters and film are used to monitor the levels of gamma radiation in the vicinity of the site. There were no significant differences in levels observed at the various sampling locations.

TABLE II-1

BIG MACK POINT PLANT
Sampling and Analysis Summary
January 1, 1976 to December 31, 1976

<u>Medium</u>	<u>Description</u>	<u>Location(number)</u>	<u>No of Samples Collected</u>	<u>Type of Analysis</u>	<u>Frequency of Analysis</u>	<u>Number of Locations Significantly Above Concurrent Back-ground</u>
Air	Continuous at Approximately 1 Cfm .	All (7)	371	Gross Beta, I-131	Weekly	None
Tap Water	1 Gallon Composite	ST, CH (3)	36	Gross Beta Tritium	Monthly	1
Well Water	1 Gallon Grab	ST (1)	12	Gross Beta	Monthly	None
Milk	1 Gallon Grab	GS, LK, DV, BB (4)	57	I-131, Isotopic	Monthly	None
Gamma Dose	Continuous	All (13)	180 60	TLD Dose & Film	Monthly Quarterly	None
Aquatic Biota	1 Liter Grab	ST, BM (5) Mt. NoSuba	46	Gross Beta, Isotopic	Semiannually	None

TABLE II-2
HIGH, LOW AND AVERAGE CONCENTRATIONS
FOR HIGHEST AVERAGE SAMPLING LOCATIONS
JANUARY 1, 1976 TO DECEMBER 31, 1976

<u>TYPE</u>	<u>TYPE OF ANALYSIS</u>	<u>UNITS</u>	<u>LOCATION</u>	<u>HIGH</u>	<u>LOW</u>	<u>AVERAGE</u>
Air	Gross Beta (1)	pCi/m ³	EC (12 mi SE)	.61	<MDL	0.05
	I-131 (1)	pCi/m ³	All	---	---	<MDL
Lake Water	Gross Beta	pCi/l	ER ST LMO	129	3	28
	H-3	pCi/l	ER ST LMO	910	180	464
Well Water	Gross Beta	pCi/l	ER ST W	9	<1	3.7
Gamma Dose	TLD (monthly)	μR/day	E(SE site boundary)	177	117	166
	TLD (quarterly)	μR/day	E(SE site boundary)	197	130	164
	Film (monthly)	mR/mo	E(SE site boundary)	9	0	2
Milk	I-131 (1)	pCi/l	GS (2.3 mi SE)	22.8	<MDL	<MDL (2)
	Ca-137		LK (3.5 mi E)	10	3.9	7.8
	Sr-89 (1)		GS (2.3 mi SE)	9	<MDL	<MDL
	Sr-90		LK (3.5 mi E)	16	2.2	10
Biota (3)	Gross Beta	pCi/g(wet)	Discharge	41	6	24
			Discharge	--	--	51
			Discharge	18	6	11
			1/2 mi W	--	--	14
			1/2 mi W	--	--	18
			1/2 mi W	14	13	14
Periphyton						
Algae (5)						
Fish (5)						
Shore Minnows (6)						
Aquatic Grass (4)						
Crayfish						

NOTES:

- (1) Minimum Detectable Level (MDL) - Air, Gross Beta 0.01 pCi/m³; I-131, 0.02 pCi/m³; Milk, I-131 0.5pCi/l, Sr-89 5.0 pCi/l; some samples may have higher MDLs due to extended shipping time.
- (2) Only 4 of 15 samples contained detectable concentrations, therefore a true average cannot be calculated.
- (3) Two samples per location.
- (4) One sample available at this location.
- (5) Only location where fish samples were obtained.

TABLE II-3

COMPARISON OF MEASURED AND CALCULATED LAKE WATER CONCENTRATIONS

SAMPLING PERIOD		GROSS BETA CONCENTRATION				CIRCULATING DISCHARGE		
		MEASURED		CALCULATED DISCHARGE		WATER FLOW RATE (MGD)		
START	FINISH	CHARLEVOIX	DISCHARGE	AVERAGE	MAXIMUM	HIGH	LOW	AVERAGE
1/3/76	2/13/76	7 ± 2	24 ± 3	5.2	340	73.4	2.9	60.5
2/13/76	3/11/76	2 ± 2	129 ± 5	30	1070	68.1	2.9	35.0
3/12/76	4/7/76	3 ± 2	26 ± 3	9.3	420	43.9	0.4	28.5
4/8/76	5/13/76	4 ± 2	67 ± 4	120	1630	37.8	2.9	8.5
5/14/76	6/10/76	2 ± 2	25 ± 3	89	6200	72.0	2.9	34.7
6/11/76	7/7/76	3 ± 1	21 ± 2	17	1350	72.0	40.8	66.1
7/8/76	8/12/76	8 ± 3	18 ± 3	5.3	1270	72.1	2.9	62.4
8/13/76	9/9/76	3 ± 1	11 ± 3	0.8	204	74.4	71.4	73.6
9/10/76	10/14/76	3 ± 2	5 ± 2	5.6	445	74.0	72.0	72.1
10/15/76	11/11/76	2 ± 2	9 ± 2	---	---	72.1	72.0	72.0
11/12/76	12/9/76	2 ± 2	3 ± 2	---	---	72.0	72.0	72.0
Average		3.5	31	26	6200	74.4	0.4	53.2

TABLE II-3

COMPARISON OF MEASURED AND CALCULATED LAKE WATER CONCENTRATIONS

SAMPLING PERIOD		GROSS BETA CONCENTRATION				CIRCULATING DISCHARGE		
		MEASURED		CALCULATED DISCHARGE		WATER FLOW RATE (MGD)		
START	FINISH	CHLORIDE	DISCHARGE	AVERAGE	MAXIMUM	HIGH	LOW	AVERAGE
1/3/76	2/13/76	7 ± 2	24 ± 3	5.2	340	73.4	2.9	60.5
2/13/76	3/11/76	2 ± 2	129 ± 5	30	1070	68.1	2.9	35.0
3/12/76	4/7/76	3 ± 2	26 ± 3	9.3	420	43.9	0.4	28.5
4/8/76	5/13/76	4 ± 2	67 ± 4	120	1630	37.8	2.9	8.5
5/14/76	6/10/76	2 ± 2	25 ± 3	89	6200	72.0	2.9	34.7
6/11/76	7/7/76	3 ± 1	21 ± 2	17	1350	72.0	40.8	66.1
7/8/76	8/12/76	8 ± 3	18 ± 3	5.3	1270	72.1	2.9	62.4
8/13/76	9/9/76	3 ± 1	11 ± 3	0.8	204	74.4	71.4	73.6
9/10/76	10/14/76	3 ± 2	5 ± 2	5.6	445	74.0	72.0	72.1
10/15/76	11/11/76	2 ± 2	9 ± 2	---	---	72.1	72.0	72.0
11/12/76	12/9/76	2 ± 2	3 ± 2	---	---	72.0	72.0	72.0
Average		3.5	31	26	6200	74.4	0.4	53.2

TABLE II-4

BIG ROCK POINT PLANT
Radionuclides in Water Samples Containing Gross Beta
Concentrations in Excess of 10 pCi/l

Collection Date	Location	pCi/l								
		Gross B	Cs-134	Cs-137	Co-60	Mn-54	Other Gamma*	Sr-89	Sr-90	I-131(a)
02/12/76	STLWI	24 ± 3	8 ± 1	20 ± 2	<5	<5	<5	<5	<1	<3.5
02/12/76	STLWO	24 ± 3	5 ± 1	15 ± 2	<5	<5	<5	<5	2 ± 1	<3.5
03/11/76	STLWI	107 ± 11	30 ± 8	90 ± 20	<5	<5	<5	<5	3 ± 1	<5.0
03/11/76	STLWO	129 ± 11	40 ± 5	110 ± 20	<5	<5	<5	<5	2 ± 1	<5.0
04/07/76	STLWO	26 ± 3	<5	<5	<5	<5	<5	<5	<1.3	<0.5
05/13/76	STLWI	13 ± 2	15 ± 2	46 ± 3	<5	<5	<5	<5	2 ± 2	<0.12(b)
05/13/76	STLWO	67 ± 4	2 ± 0.2	6 ± 0.4	<5	<5	<5	<5	3 ± 1	<0.12(b)
06/10/76	STLWO	25 ± 3	6 ± 0.4	19 ± 1.0	<1	<1	<1	<2	<1	<4.2
07/07/76	STLWO	21 ± 2	5 ± 1	14 ± 1	<5	<5	<1	<5	<1	<1.5(d)
08/12/76	STLWI	17 ± 3	<1	2 ± 0.4	<1	<1	<5	<5	<1	<5
08/12/76	STLWO	18 ± 3	<5	7 ± 2	<5	<5	<5	<5	<1	(c)
09/09/76	STLWO	11 ± 3	<5	<5	<5	<5	<5	<5	1.3 ± 0.8	(c)
09/09/76	STLWI	15 ± 3	<5	<5	<5	<5	<5	<5	1.4 ± 0.8	(c)

(a)Corrected to date of collection.

(b)As of 6/23/76.

(c)Insufficient sample remaining for meaningful analysis.

(d)As of date of analysis, insufficient sample remaining for more sensitive analysis.

*The spectrum is computer scanned from ~20 to ~2000 KeV. Specifically included are Co-144, Ba-La-140, Cs-134, Cs-137, Zr-Nb-95, Co-58, Co-60, Mn-54, Zn-65. Naturally occurring gamma emitters such as K-40 and Ra daughters are frequently detected but not listed here. Data listed as "<" are at the 3σ level, others are 2σ. Listed concentration is for Cs-137 and may be slightly more or less sensitive for other nuclides.