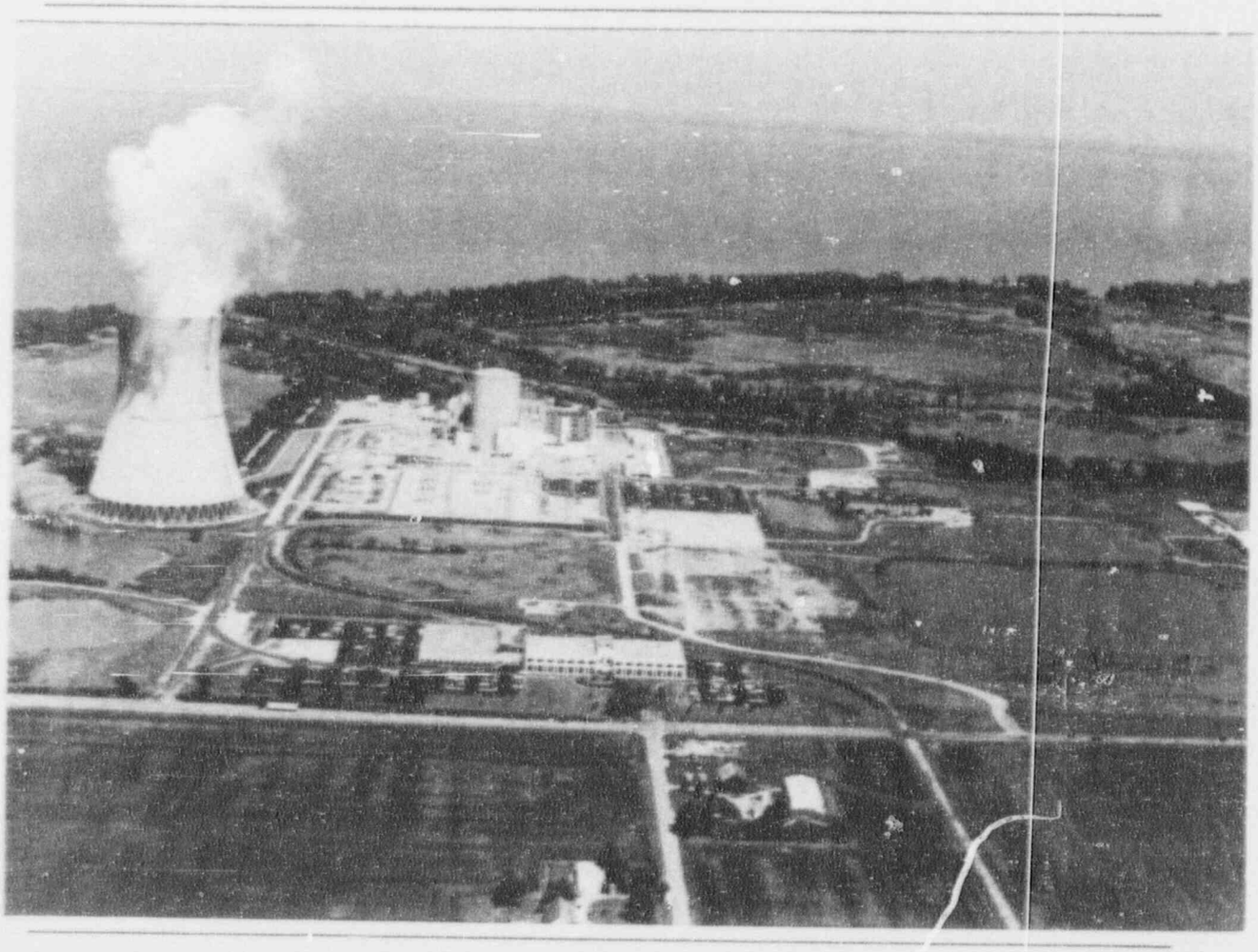
The Davis-Besse Nuclear Power Station Semiannual Radioactive Effluent and Waste Disposal Report

January 1 - June 30, 1993



TOLEDO EDISON

Radiation Protection Department

SEMIANNUAL EFFLUENT AND WASTE DISPOSAL REPORT

Davis-Besse Nuclear Power Station

Unit No. 1

January 1, 1993 through June 30, 1993

Docket Number 50-346
License Number NPF-3

Toledo Edison Company
300 Madison Avenue
Toledo, Ohio 43652

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SUMMARY

The Semiannual Effluent and Waste Disposal Report is a detailed listing of radioactivity released from the Davis-Besse Nuclear Power Station during the period from January 1, 1993 through June 30, 1993.

This report provides the following information:

- Summation of the quantities of radioactivity released in gaseous and liquid effluents,
- Summation of the quantities of radioactivity contained in solid waste packaged and shipped for offsite disposal at federally approved sites, and
- A listing of all radioactive effluent monitoring instrumentation required by the Offsite Dose Calculation Manual (ODCM), but which was inoperable for more than 30 days.

Environmental samples were available from the normal collection locations during this reporting period. The locations used for dose calculations and environmental monitoring were those identified by the 1992 Land Use Census.

During the period of January 1 through June 30, 1993, the maximum individual offsite dose due to radioactivity released in effluents was:

Liquid Effluents:

- 5.77E-02 mrem, whole body
- 7.85E-02 mrem, liver

Gaseous Effluents:

Noble Gas:

- 3.04E-03 mrem, whole body
- 1.66E-02 mrem, skin

Iodine-131, Tritium, and Particulates with Half-lives Greater Than 8 Days:

- 2.05E-02 mrem, whole body
- 2.13E-01 mrem, thyroid

These doses represent an extremely small fraction of the limits set by the NRC in the Davis-Besse ODCM.

Additional normal release pathways from the secondary system exist. For gaseous effluents, these pathways include the auxiliary feed pump turbine exhausts, the main steam safety valve system and the atmospheric vent valve system. For liquid effluents, the additional pathways include the Turbine Building drains via the settling basins. Releases via these pathways are included in the normal release tables in this report. There were no abnormal gaseous nor abnormal liquid releases this reporting period.

No changes to the ODCM nor to the Process Control Program (PCP) occurred during this reporting period.

SUPPLEMENTAL INFORMATION

1. REGULATORY LIMITS

A. Gaseous Effluents

1. In accordance with 10CFR20, Appendix B, Table II, dose rates due to radioactivity released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to the following:

a. Noble gases:

- Less than or equal to 500 mrem/year to the whole body. (Davis-Besse ODCM limit is 50 mrem/year)

- Less than or equal to 3000 mrem/year to the skin.

b. Iodine-131, tritium, and all radionuclides in particulate form with half-lives greater than 8 days:

- Less than or equal to 1500 mrem/year to any organ.

2. In accordance with 10CFR50, Appendix I, Sec. IB, air dose due to noble gases released in gaseous effluents to areas at and beyond the site boundary shall be limited to the following:

a. Less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation during any calendar quarter.

b. Less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation during any calendar year.

3. In accordance with 10CFR50, Appendix I, Sec. IIC, dose to a member of the public from Iodine-131, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released to areas at and beyond the site boundary shall be limited to the following:

a. Less than or equal to 7.5 mrem to any organ during any calendar quarter.

b. Less than or equal to 15 mrem to any organ during any calendar year.

B. Liquid Effluents

In accordance with 10CFR50, Appendix I, Sec IIA, the dose or dose commitment to a member of the public from radioactivity in liquid effluents released to unrestricted areas shall be limited to:

1. Less than or equal to 1.5 mrem to the total body and less than or equal to 5 mrem to any organ during any calendar quarter.

2. Less than or equal to 3 mrem to the total body and less than or equal to 10 mrem to any organ during any calendar year.

2. EFFLUENT CONCENTRATION LIMITS

The Effluent Concentration Limits (ECs) for liquid and gaseous effluents at and beyond the site boundary are listed in 10 CFR 20, Appendix B, Table II, Column 2, with the most restrictive EC being used in all cases. For dissolved and entrained gases the EC of 2.0E-04 µCi/ml is applied. This EC is based on the Xe-135 MPC in air (submersion dose) converted to an equivalent concentration in water as discussed in the International Commission on Radiological Protection (ICRP), Publication 2.

3. AVERAGE ENERGY

The Davis-Besse ODCM limits the dose equivalent rates due to the release of fission and activation products to less than or equal to 50 mrem/year to the total body and less than or equal to 3000 mrem/year to the skin. Therefore, the average beta and gamma energies (E) for gaseous effluents as described in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," is not applicable.

4. MEASUREMENTS AND APPROXIMATIONS OF TOTAL ACTIVITY

A. Fission and Activation Gases:

1. These gases, excluding tritium, are collected in a marinelli beaker specially modified for gas sampling, steel bombs, or glass vials and are counted on a germanium detector for principal gamma emitters. Detected radionuclides are quantified via gamma spectroscopy.

2. Tritium gas is collected using a bubbler apparatus and counted by liquid scintillation.

B. Iodines are collected on a charcoal cartridge filter and counted on a germanium detector. Specific quantification of each iodine radionuclide is via gamma spectroscopy.

C. Particulates are collected on filter paper and counted on a germanium detector. Specific quantification of each radionuclide present on the filter paper is via gamma spectroscopy.

D. Liquid Effluents are collected in a marinelli beaker and counted on a germanium detector. Specific quantification of each radionuclide present in liquid samples is via gamma spectroscopy.

5. BATCH RELEASES

A. Liquid from 1/1/93 to 6/30/93

1. Number of batch releases:	49
2. Total time period for the batch releases:	7.98E+01 hours
3. Maximum time period for a batch release:	2.12E+02 minutes
4. Minimum time period for batch releases:	6.10E+01 minutes
5. Average time period for a batch release:	9.77E+01 minutes

B. Gaseous from 1/1/93 to 6/30/93

1. Number of batch releases:	12
2. Total time period for the batch releases:	1.37E+02 hours
3. Maximum time period for a batch release:	1.43E+03 minutes
4. Minimum time period for a batch release:	2.14E+02 minutes
5. Average time period for batch releases:	6.86E+02 minutes

6. ABNORMAL RELEASES

There were no abnormal releases during this reporting period.

7. PERCENT OF ODCM RELEASE LIMITS

The following table presents the ODCM dose limits and the associated offsite dose to the public, in percent of limits, for January through June, 1993.

SPECIFICATION	LIMIT	PERCENT OF LIMITS
A. First Quarter, 1993: Gaseous		
Noble gases (gamma)	5.0 mrad	2.20E-02
Noble gases (beta)	10.0 mrad	5.66E-02
I-131, tritium, and particulates with half-lives greater than 8 days	7.5 mrem	7.57E-02
B. Second Quarter, 1993: Gaseous		
Noble gases (gamma)	5.0 mrad	3.44E-04
Noble gases (beta)	10.0 mrad	2.51E-03
I-131, tritium, and particulates with half-lives greater than 8 days	7.5 mrem	2.15E-03
C. Calendar year, 1993: Gaseous		
Noble gases (gamma)	10.0 mrad	1.12E-02
Noble gases (beta)	20.0 mrad	2.96E-02
I-131, tritium, and particulates with half-lives greater than 8 days	15.0 mrem	3.89E-02
D. First Quarter, 1993: Liquid		
Total body	1.5 mrem	2.40E+00
Any organ (liver)	5.0 mrem	9.66E-01
E. Second Quarter, 1993: Liquid		
Total body	1.5 mrem	1.44E+00
Any organ (liver)	5.0 mrem	6.04E-01
F. Calendar year, 1993: Liquid		
Total body:	3.0 mrem	1.92E+00
Any organ (liver)	10.0 mrem	7.85E-01

8. DOSE ASSESSMENT

Sources of input data include:

A. Water Usage: Appendix I analysis, NRC Docket 50-346, "Evaluation of Compliance with Appendix I to 10 CFR 50, June 4, 1976, Davis-Besse Nuclear Power Station."

B. 0-50 mile meat, milk, vegetable production, and population data: 1982 Annual Environmental Operating Report, report entitled, "Evaluation of Compliance with Appendix I to 10 CFR 50: Updated Population, Agricultural, Meat - Animal, and Milk Production Data Tables for 1982." This evaluation was based on the 1980 census; the Agricultural Ministry of Ontario 1980 report entitled, "Agricultural Statistics and Livestock Marketing Account, 1980"; the Agricultural Ministry of Ontario 1980 report entitled, "Agricultural Statistics for Ontario - 1980 Publication 21, 1980"; the Michigan Department of Agriculture, July, 1981 report entitled, "Michigan Agricultural Statistics, 1981"; the Ohio Crop Reporting Service, 1981 report entitled, "Ohio Agricultural Statistics, 1981."

C. Gaseous and liquid source terms: Tables 1 through 7 of this report.

D. Location of the nearest individuals and pathways by sector out to 5 miles: Report entitled, "1992 Land Use Census," included in the 1992 Annual Environmental Operating Report for Davis-Besse.

9. DOSE TO PUBLIC DUE TO ACTIVITIES INSIDE THE SITE BOUNDARY

In accordance with ODCM Section 7.2, the Semiannual Effluent and Waste Disposal Report includes an assessment of radiation doses from radioactivity released in liquid and gaseous effluents to members of the public due to activities inside the site boundary.

In special instances, members of the public are permitted access to the Radiologically Restricted Area within the Davis-Besse station. Tours for the public are conducted with the assurance that no individual will receive an appreciable dose due to radioactivity released in gaseous or liquid effluents (i.e., not more than a small fraction of the 40 CFR 190 dose standards).

The Visitor Center located inside the Davis-Besse Administration Building (DBAB) is also accessible to members of the public. Considering the frequency and duration of the visits, the resultant dose would be a small fraction of the calculated maximum site boundary dose. The dose from gaseous effluents as modeled for the DBAB Visitor Center is considered the controlling factor when evaluating doses to members of the public from activities inside the site boundary. For purposes of assessing the dose to members of the public in accordance with ODCM Section 7.2, the following exposure assumptions are used:

- Exposure time for maximumally-exposed visitors is 20 hours (4 visits, 5 hours per visit is a maximum).

- Annual average meteorological dispersion (conservative, default use of maximum site boundary dispersion).

The equations in the ODCM may be used for calculating the potential dose to a member of the public for activities inside the site boundary. Based on these assumptions, this dose would be at least a factor of 400 less than the maximum site boundary air dose as calculated in the ODCM.

There are no areas onsite accessible to the public where exposure to liquid effluents could occur. Therefore, the modeling of the ODCM conservatively estimates the maximum potential dose to members of the public.

10. **INOPERABLE RADIOACTIVE EFFLUENT MONITORING EQUIPMENT**

The following radioactive effluent monitoring equipment, required to be operable by ODCM Sections 2.1 and 3.1 was inoperable for more than 30 days during this reporting period.

- Total Dilution Flow Computer Point F-201 was unavailable for greater than thirty days due to planned service water system maintenance. The scheduled repairs were not made within 30 days because of the large amount of the service water piping which was replaced. Upon completion of the service water system modification, the computer point was returned to service. During the time period that the computer point was out of service, total dilution flow was estimated using other means.

11. **CHANGES TO THE ODCM & PCP**

There were no revisions to the ODCM nor to the PCP during this reporting period.

TABLE 1. GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

	TYPE	UNIT	FIRST QUARTER	SECOND QUARTER	EST. TOTAL PERCENT ERROR
A.	Fission and Activation Gases				
	1. Total Release	Ci	3.24E+02	4.03E+00	2.50E+01
	2. Average Release Rate for Period	µCi/sec	4.16E+01	5.12E-01	
	3. Percent of ODCM Limits	%	See Supplemental Information, Section 7		
B.	Iodines				
	1. Total Iodine	Ci	8.06E-03	3.16E-04	2.50E+01
	2. Average Release Rate for Period	µCi/sec	1.04E-03	4.01E-05	
	3. Percent of ODCM Limits	%	See Supplemental Information, Section 7		
C.	Particulates				
	1. Particulates with half-lives greater than 8 days	Ci	2.59E-04	1.72E-04	2.50E+01
	2. Average Release Rate for Period	µCi/sec	3.33E-05	2.18E-05	
	3. Percent of ODCM Limits	%	See Supplemental Information, Section 7		
	4. Gross Alpha Activity	Ci	5.68E-07	3.49E-07	2.50E+01
D.	Tritium				
	1. Total Release	Ci	4.72E+00	5.60E+00	2.50E+01
	2. Average Release Rate for Period	µCi/sec	6.08E-01	7.12E-01	
	3. Percent of ODCM Limits	%	See Supplemental Information, Section 7		

TABLE 2. GASEOUS EFFLUENTS - GROUND-LEVEL RELEASES[a]

NUCLIDES	UNIT	CONTINUOUS MODE[c] FIRST QUARTER	CONTINUOUS MODE[c] SECOND QUARTER	BATCH MODE[c] FIRST QUARTER	BATCH MODE[c] SECOND QUARTER
1. Fission Gases	Ci				
Kr-85		LLD[b]	LLD	N/A	N/A
Kr-85m		LLD	LLD	N/A	N/A
Kr-87		LLD	LLD	N/A	N/A
Kr-88		LLD	LLD	N/A	N/A
Xe-133		LLD	LLD	N/A	N/A
Xe-135		LLD	LLD	N/A	N/A
Xe-135m		LLD	LLD	N/A	N/A
Xe-138		LLD	LLD	N/A	N/A
Total for Period:		N/A	N/A	N/A	N/A
2. Iodines	Ci				
I-131		LLD	LLL	N/A	N/A
I-133		LLD	LLD	N/A	N/A
I-135		LLD	LLD	N/A	N/A
Total for Period:		N/A	N/A	N/A	N/A
3. Particulates	Ci				
H-3		3.40E-06	1.08E-06	N/A	N/A
Sr-89		LLD	LLD	N/A	N/A
Sr-90		LLD	LLD	N/A	N/A
Cs-134		LLD	LLD	N/A	N/A
Cs-137		6.38E-07	9.65E-06	N/A	N/A
Total for Period:		4.04E-06	1.07E-05	N/A	N/A

[a] Includes Atmospheric Vent Valve weepage, Auxiliary Feed Pump Turbine tests, and Main Steam safety valve testing which are listed as continuous releases. All batch releases are mixed-mode.

[b] These radionuclides were not identified in concentrations above the lower limit of detection (LLD) listed below:

H-3:	<3.6E-06	µCi/ml	Ar-41:	<2.2E-08	µCi/ml
Xe-133:	<4.6E-08	µCi/ml	Kr-85:	<6.2E-06	µCi/ml
Xe-133m:	<1.6E-07	µCi/ml	Kr-85m:	<2.0E-08	µCi/ml
Xe-135:	<1.9E-08	µCi/ml	Kr-87:	<3.5E-08	µCi/ml
Xe-135m:	<9.9E-08	µCi/ml	Kr-88:	<6.7E-08	µCi/ml
Xe-138:	<2.5E-07	µCi/ml	I-131:	<1.0E-06	µCi/ml
Cs-134:	<2.1E-08	µCi/ml	I-133:	<2.1E-08	µCi/ml
I-135:	<6.8E-08	µCi/ml	Sr-89:	<5.0E-08	µCi/ml
Sr-90:	<6.0E-09	µCi/ml			

[c] LLDs are applicable to both batch and continuous modes.

TABLE 3. GASEOUS EFFLUENTS - MIXED-MODE RELEASES[a]

NUCLIDES	UNIT	CONTINUOUS MODE FIRST QUARTER	CONTINUOUS MODE SECOND QUARTER	BATCH MODE FIRST QUARTER	BATCH MODE SECOND QUARTER
1. Fission Gases	Ci				
Ar-41		LLD[b]	LLD	LLD	1.28E-01
Kr-85		LLD	LLD	2.65E+02	2.61E+00
Kr-85m		LLD	LLD	LLD	LLD
Kr-87		LLD	LLD	LLD	LLD
Kr-88		LLD	LLD	LLD	LLD
Xe-131m		LLD	LLD	9.12E+00	1.25E-02
Xe-133		1.22E+01	LLD	3.50E+01	1.24E+00
Xe-133m		LLD	LLD	2.21E+00	LLD
Xe-135		LLD	LLD	6.48E-02	4.27E-02
Xe-135m		LLD	LLD	LLD	LLD
Total for Period:		1.22E+01	N/A	3.11E+02	4.03E+00
2. Iodines	Ci				
I-131		8.00E-04	7.33E-05	6.09E-03	7.01E-05
I-132		N/A	N/A	3.60E-05	1.24E-05
I-133		1.44E-04	3.36E-05	9.95E-04	7.73E-05
I-135		LLD	LLD	LLD	4.91E-05
Total for Period:		9.44E-04	1.07E-04	7.12E-03	2.09E-04
3. Particulates	Ci				
H-3		4.63E+00	5.17E+00	9.10E-02	4.34E-01
Mn-54		LLD	LLD	2.51E-06	LLD
Co-58		LLD	LLD	6.89E-05	1.14E-05
Co-60		LLD	LLD	6.64F-06	LLD
Sr-89[c,d]		LLD(C1)	LLD(C2)	NA	NA
Sr-90[c,d]		LLD(C1)	LLD(C2)	NA	NA
Ru-103		2.26E-06	LLD	LLD	LLD
Cs-134		1.11E-06	LLD	7.50E-05	5.69E-05
Cs-137		3.15E-06	1.95E-06	8.51E-05	9.12E-05
Ba-140		LLD	LLD	1.24E-05	LLD
Ce-144		LLD	9.87E-07	LLD	LLD
Total for Period:		4.63E+00	5.17E+00	9.12E-02	4.34E-01

TABLE 3. GASEOUS EFFLUENTS - MIXED-MODE RELEASES[a] (continued)

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[a] Abnormal releases not included.

[b] These radionuclides were not identified in concentrations above the lower limit of detection (LLD) listed below. The largest LLD value is listed.

Continuous Mode			Batch Mode		
Ar-41:	<2.9 E-08	µCi/ml	Ar-41:	<2.9 E-06	µCi/ml
Kr-85:	<3.3 E-06	µCi/ml	Kr-85m:	<2.2 E-06	µCi/ml
Kr-85m:	<1.3 E-08	µCi/ml	Kr-87:	<4.5 E-06	µCi/ml
Kr-87:	<6.0 E-08	µCi/ml	Kr-88:	<6.6 E-06	µCi/ml
Kr-88:	<6.0 E-08	µCi/ml	Xe-133m:	<1.8 E-05	µCi/ml
Xe-131m:	<4.4 E-07	µCi/ml	Xe-135m:	<1.4 E-05	µCi/ml
Xe-133m:	<7.2 E-08	µCi/ml	I-135:	<1.0 E-05	µCi/ml
Xe-133:	<2.0 E-08	µCi/ml	Co-60:	<3.7 E-06	µCi/ml
Xe-135m:	<5.9 E-06	µCi/ml	Ru-103:	<2.8 E-06	µCi/ml
Xe-135:	<1.1 E-08	µCi/ml	Ba-140:	<1.1 E-05	µCi/ml
I-135:	<3.9 E-10	µCi/ml	Ce-144:	<1.4 E-05	µCi/ml
Mn-54:	<2.6 E-14	µCi/ml	Mn-54:	<2.6 E-14	µCi/ml
Co-58:	<1.6 E-14	µCi/ml			
Co-60:	<2.5 E-14	µCi/ml			
Sr-89(C1):	<9.3 E-16	µCi/ml			
Sr-89(C2):	<8.0 E-16	µCi/ml			
Sr-90(C1):	<3.1 E-16	µCi/ml			
Sr-90(C2):	<3.0 E-16	µCi/ml			
Cs-134:	<1.8 E-14	µCi/ml			
Ba-140:	<8.4 E-14	µCi/ml			
Ce-144:	<1.2 E-13	µCi/ml			
Ru-103:	<2.4 E-14	µCi/ml			

[c] Quarterly composite sample for continuous mode.

[d] Analysis not required for batch release.

Note: numbers in parenthesis are for the quarter of occurence

TABLE 4. GASEOUS EFFLUENTS - ABNORMAL RELEASES

	NUCLIDES	UNIT	FIRST QUARTER	SECOND QUARTER
1.	Fission Gases	Ci		
	Total fcr Period:		N/A	N/A
2.	Iodines	Ci		
	Total for Period:		N/A	N/A
3.	Particulates	Ci		
	Total for Period:		N/A	N/A

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a

There were no abnormal gaseous releases during the first and second quarters of 1993.

TABLE 5. LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

	TYPE	UNIT	FIRST QUARTER	SECOND QUARTER	EST. TOTAL PERCENT ERROR
A.	Fission And Activation Products				
	1. Total Release (without Tritium, Gases, Alpha)	Ci	1.52E-02	2.45E-02	2.00E+01
	2. Average Diluted Concentration During Period [a]	µCi/ml	2.17E-09	3.65E-09	
	3. Percent of ODCM Limit	%	See Supplemental Information, Section 7		
	4. Percent of 10CFR20 Limit	%	2.41E-01	4.06E-01	
B.	Tritium				
	1. Total Release	Ci	1.11E+02	7.81E+00	2.00E+01
	2. Average Diluted Concentration During Period [a]	µCi/ml	1.57E-05	1.16E-06	
	3. Percent of 10CFR20 Limit	%	1.57E+00	1.16E-01	
C.	Dissolved and Entrained Gases				
	1. Total Release	Ci	2.57E-01	5.53E-06	2.00E+01
	2. Average Diluted Concentration During Period [a]	µCi/ml	3.65E-08	8.24E-13	
	3. Percent of Limit	%	1.82E-02	4.12E-07	
D.	Gross Alpha				
	1. Total Release	Ci	1.61E-02	2.76E-03	2.00E+01
E.	Volume of Waste Released (prior to dilution)	liters	1.10E+08	6.27E+07	2.00E+01
F.	Volume of Dilution Water (used during releases)	liters	7.04E+09	6.71E+09	2.00E+01
G.	Total Volume of Water Released	liters	7.15E+09	6.77E+09	2.00E+01

[a] Based on volume of dilution water used during releases (Item F).

TABLE 6. LIQUID EFFLUENTS - NUCLIDES RELEASED[a]

NUCLIDES	CONTINUOUS MODE (Ci)[d] FIRST QUARTER	CONTINUOUS MODE (Ci)[d] SECOND QUARTER	BATCH MODE (Ci)[d] FIRST QUARTER	BATCH MODE (Ci)[d] SECOND QUARTER
1. Fission and Activation Products				
Na-24	LLD(b)	LLD	1.46E-05	LLD
CR-51	LLD	LLD	1.20E-04	1.14E-04
Mn-54	LLD	LLD	3.71E-06	5.07E-05
Fe-55[c]	LLD(C1)	LLD(C2)	LLD(C1)	3.92E-03(C2)
Fe-59	LLD	LLD	LLD	3.74E-05
Co-57	LLD	LLD	2.84E-06	5.00E-05
Co-58	LLD	LLD	2.98E-03	1.23E-02
Co-60	LLD	LLD	8.96E-04	1.50E-03
Zn-65	LLD	LLD	LLD	LLD
Sr-89c	LLD(C1)	LLD(C2)	LLD(C1)	LLD(C2)
Sr-90c	LLD(C1)	LLD(C2)	LLD(C1)	LLD(C2)
Zr-95	LLD	LLD	LLD	2.65E-04
Zr-97	LLD	LLD	1.11E-05	8.54E-05
Nb-95	LLD	LLD	LLD	4.79E-04
Nb-97	LLD	LLD	5.28E-06	1.21E-05
Mo-99	LLD	LLD	LLD	LLD
Tc-99m	LLD	LLD	1.70E-06	LLD
Ru-103	LLD	LLD	2.50E-05	1.70E-04
Ru-106	LLD	LLD	9.08E-05	LLD
Ag-110m	LLD	LLD	3.38E-04	1.81E-03
Sb-124	LLD	LLD	7.61E-04	5.07E-06
Sb-125	LLD	LLD	4.32E-03	4.28E-04
Sn-113	LLD	LLD	5.05E-05	5.18E-04
I-131	LLD	LLD	1.29E-04	1.97E-06
I-132	LLD	LLD	5.21E-04	LLD
I-133	LLD	LLD	LLD	2.47E-06
Te-132	LLD	LLD	5.22E-04	7.33E-07
Cs-134	LLD	LLD	1.76E-03	1.03E-03
Cs-137	LLD	LLD	2.61E-03	1.65E-03
Ba-140	LLD	LLD	LLD	LLD
Ce-141	LLD	LLD	LLD	LLD
Ce-144	LLD	LLD	LLD	5.24E-05
Np-239	LLD	LLD	7.94E-05	LLD
Total for period:	N/A	N/A	1.52E-02	2.45E-02
2. Tritium	1.54E+00	1.55E-01	1.09E+02	7.65E+00
3. Dissolved and Entrained Gases				
Kr-85	LLD	LLD	2.81E-02	LLD
Xe-131m	LLD	LLD	2.36E-03	LLD
Xe-133	LLD	LLD	2.25E-01	5.53E-06
Xe-133m	LLD	LLD	1.01E-03	LLD
Xe-135	LLD	LLD	9.19E-05	LLD
Total for Period:	N/A	N/A	2.57E-01	5.53E-06

TABLE 6. LIQUID EFFLUENTS - NUCLIDES RELEASED[a] (continued)

[a] Abnormal releases not included.

[b] These radionuclides were not identified in concentrations above the lower limit of detection (LLD) listed below. The largest LLD value is used for each radionuclide.

Na-24:	<2.0 E-08 µCi/ml	I-131:	<2.5 E-08 µCi/ml
Cr-51:	<1.7 E-07 µCi/ml	I-132:	<2.2 E-08 µCi/ml
Mn-54:	<2.1 E-08 µCi/ml	I-133:	<2.1 E-08 µCi/ml
Fe-55(C1):	<7.0 E-07 µCi/ml	Kr-85:	<6.2 E-06 µCi/ml
Fe-55(C2):	<5.0 E-07 µCi/ml	Xe-131m:	<7.7 E-07 µCi/ml
Fe-59:	<4.2 E-08 µCi/ml	Xe-133:	<4.6 E-08 µCi/ml
Co-57:	<1.6 E-08 µCi/ml	Xe-133m:	<1.6 E-07 µCi/ml
Co-58:	<1.9 E-08 µCi/ml	Xe-135:	<1.9 E-08 µCi/ml
Co-60:	<2.5 E-08 µCi/ml		
Zn-65:	<5.2 E-08 µCi/ml		
Sr-89(C1):	<3.0 E-08 µCi/ml		
Sr-89(C2):	<2.0 E-08 µCi/ml		
Sr-90(C1):	<6.0 E-09 µCi/ml		
Sr-90(C2):	<8.0 E-09 µCi/ml		
Zr-95:	<4.0 E-08 µCi/ml		
Zr-97:	<2.5 E-08 µCi/ml		
Nb-95:	<2.1 E-08 µCi/ml		
Nb-97:	<2.5 E-08 µCi/ml		
Mo-99:	<1.6 E-07 µCi/ml		
Tc-99m:	<1.8 E-08 µCi/ml		
Ru-103:	<2.2 E-08 µCi/ml		
Ru-106:	<2.1 E-07 µCi/ml		
Ag-110m:	<2.5 E-08 µCi/ml		
Sn-113:	<2.8 E-08 µCi/ml		
Sb-124:	<1.7 E-08 µCi/ml		
Sb-125:	<1.7 E-08 µCi/ml		
Te-132:	<1.8 E-08 µCi/ml		
Ce-141:	<3.0 E-08 µCi/ml		
Ce-144:	<1.7 E-07 µCi/ml		
Cs-134:	<2.1 E-08 µCi/ml		
Cs-136:	<2.8 E-08 µCi/ml		
Cs-137:	<2.7 E-08 µCi/ml		
Ba-140:	<7.0 E-08 µCi/ml		
Np-239:	<1.2 E-07 µCi/ml		

[c] Quarterly composite sample.

[d] LLDs are applicable to both batch and continuous modes due to identical sample and analysis methods.

Note: numbers in parenthesis are for the quarter of occurence

TABLE 7. LIQUID EFFLUENTS - ABNORMAL RELEASES[a]

NUCLIDES	UNIT	FIRST QUARTER	SECOND QUARTER
1. Fission and Activation Products			
Total for Period:	Ci	N/A	N/A
2. Tritium			
Total for Period:	Ci	N/A	N/A
3. Dissolved and Entrained Gases			
Total for Period:	Ci	N/A	N/A

[a] There were no abnormal liquid releases during the first and second quarters of 1993.

TABLE 8. SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

A. Solid Waste Shipped Offsite for Burial or Disposal (not irradiated fuel)

1. Type of Waste	EST. TOTAL UNIT	QUANTITY	PERCENT ERROR
a. Spent resins, filter sludges,	m^3	5.93E+00	
evaporator bottoms, etc.	Ci	4.16E-01	2.5 E+01
b. Dry compressible waste,	m^3	8.90E+00	
contaminated equipment, etc.	Ci	2.94E-01	2.5 E+01
c. Irradiated components, control	m^3	0.0 E+00	
rods, etc.	Ci	0.0 E+00	2.5 E+01
d. Other:			
1. Dewatered Primary	m^3	0.0 E+00	
System Cartridge Filters	Ci	0.0 E+00	2.5 E+01

2. Estimate of Major Nuclide Composition (by type of waste)

		PERCENT ABUNDANCE
Type a.	Fe-55	6.40E+00
	Co-58	6.67E+01
	Co-60	7.10E+00
	Ni-63	3.30E+00
	Cs-134	4.90E+00
	Cs-137	8.00E+00
	Ag-110m	1.60E+00
Type b.	Fe-55	7.00E+00
	Co-58	7.00E+01
	Co-60	2.30E+01

3. Solid Waste Disposition

Number of Shipments: 1
Mode of Transportation: Truck
Destination: Barnwell, S.C.
Type of Container (Container Volume): 1 Resin HIC ($5.8m^3$)
Solidification Agents: None

Number of Shipments: 4
Mode of Transportation: Truck
Destination: Scientific Ecology Group, Oak Ridge, TN.
Type of Container (Container Volume): 8-20 foot sealands of dry activated waste and contaminated metal (8.9m3) buried
Solidification Agents: None

TABLE 8. SOLID WASTE AND IRRADIATED FUEL SHIPMENTS (continued)

Number of Shipments: 2
Mode of Transportation: Truck
Destination: Quadrex Recycle Center, Oak Ridge, TN.
Type of Container: 1 shipment of contaminated metal for decontamination and processing (0 m3) buried
Solidification Agents: None

B. Irradiated Fuel Shipments

There were no shipments of irradiated fuel.

TABLE 9. SEMIANNUAL DOSES DUE TO GASEOUS RELEASES

A. **Maximum Individual Doses Due to I-131, H-3, and Particulates with Half-lives Greater Than 8 Days[a]**

1. Whole Body Dose

	SECTOR	DISTANCE(m)	AGE	DOSE(mrem)
Quarter 1	W	980	TEEN	5.16E-03
Quarter 2	W	1750	ADULT	1.59E-02
Semiannual	W	1750	CHILD	2.05E-02

2. Significant Organ Dose

	SECTOR	DISTANCE(m)	AGE	ORGAN	DOSE(mrem)
Quarter 1	W	6530	INFANT	Thyroid	1.46E-01
Quarter 2	W	6530	INFANT	Thyroid	6.68E-02
Semiannual	W	6530	INFANT	Thyroid	2.13E-01

B. **Maximum Individual Doses Due to Noble Gas[a]**

1. Whole Body Dose

	SECTOR	DISTANCE(m)	AGE	DOSE(mrem)
Quarter 1	W	980	NA	2.87E-03
Quarter 2	W	980	NA	1.75E-04
Semiannual	W	980	NA	3.04E-03

2. Skin Dose

	SECTOR	DISTANCE(m)	AGE	DOSE(mrem)
Quarter 1	W	980	NA	1.56E-02
Quarter 2	W	980	NA	1.03E-03
Semiannual	W	980	NA	1.66E-02

C. **Population Doses due to I-131, H-3, and Particulates with Half-lives Greater than 8 Days[a]**

	ORGAN	TOTAL INTEGRATED POPULATION DOSE (person rem)	AVERAGE DOSE TO INDIVIDUALS IN POPULATION (mrem)
Quarter 1	W/body	3.42E-03	1.54E-06
Quarter 2	W/body	6.17E-04	2.77E-06
Semiannual	W/body	4.03E-03	4.31E-06

TABLE 9. SEMIANNUAL DOSES DUE TO GASEOUS RELEASES (continued)

D. Population Doses due to Noble Gas*

	ORGAN	TOTAL INTEGRATED POPULATION DOSE (person rem)	AVERAGE DOSE TO INDIVIDUALS IN POPULATION (mrem)
Quarter 1	W/body	5.42E-03	2.44E-06
Quarter 2	W/body	1.76E-05	7.92E-08
Semiannual	W/body	5.44E-03	2.52E-06

E. Abnormal Releases due to Testing of the Main Steam System

1. Maximum Individual Dose due to I-131, H-3, and Particulates with Half-lives Greater than 8 Days

A. Whole Body Dose

	SECTOR	DISTANCE(m)	AGE	DOSE(mrem)
Quarter 1	NE	900	TEEN	1.92E-13
Quarter 2	N/A	N/A	N/A	N/A
Semiannual	NE	900	TEEN	1.92E-13

B. Significant Organ Dose

	SECTOR	DISTANCE(m)	AGE	ORGAN	DOSE(mrem)
Quarter 1	NE	900	TEEN	LIVER	1.92E-13
Quarter 2	N/A	N/A	N/A	N/A	N/A
Semiannual	NE	900	TEEN	LIVER	1.92E-13

2. Maximum Individual Dose due to Noble Gas

SECTOR	DISTANCE(m)	AGE	ORGAN	DOSE(mrem)
N/A	N/A	N/A	N/A	N/A

* Does not include abnormal releases.

TABLE 10. SEMIANNUAL DOSES DUE TO LIQUID RELEASES

A. Maximum Individual Whole Body Dose

	SECTOR	DISTANCE(mi)	AGE	DOSE(mrem)
Quarter 1	NW	0.6	Adult	3.61E-02
Quarter 2	NW	0.6	Adult	2.16E-02
Semiannual	NW	0.6	Adult	5.77E-02

B. Maximum Individual Significant Organ Dose

	SECTOR	DISTANCE(mi)	AGE	ORGAN	DOSE(mrem)
Quarter 1	NW	0.6	Teen	Liver	4.83E-02
Quarter 2	NW	0.6	Teen	Liver	3.02E-02
Semiannual	NW	0.6	Teen	Liver	7.85E-02

C. Population Dose

	ORGAN	TOTAL INTEGRATED POPULATION DOSE (person rem)	AVERAGE DOSE TO INDIVIDUALS IN POPULATION (mrem)
Quarter 1	W/body	3.18E-01	1.43E-04
Quarter 2	W/body	1.27E-01	5.71E-05
Semiannual	W/body	4.45E-01	2.00E-04

TABLE 11. 1993 SEMIANNUAL DOSE TO THE MOST-EXPOSED MEMBER OF THE PUBLIC

	SEMIANNUAL DOSE (mrem)	40 CFR 190 LIMITS (mrem)	PERCENT OF LIMITS
Whole Body Dose			
- Noble Gas	3.04E-03		
- Iodine, Tritium, Particulates	2.05E-02		
- Liquid	5.77E-02		
Total Whole Body Dose	8.12E-02	25	3.25E-01
Thyroid Dose			
-Iodine,Tritium, Particulates	2.13E-01	75	2.84E-01
Skin Dose			
- Noble Gas	1.66E-02	25	6.64E-02
Liver Dose			
- Liquid	7.85E-02	25	3.14E-01

METEOROLOGICAL DATA

Meteorological data on magnetic tape for January through June, 1993 has been submitted with this document to the U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, D.C. 20555.