

VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

February 23, 1994

United States Nuclear Regulatory Commission
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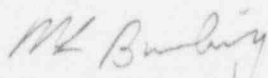
Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNIT NOS. 1 AND 2
RADIOACTIVE EFFLUENT RELEASE REPORT

Pursuant to Technical Specification 6.9.1.9, enclosed is the Radioactive Effluent Release Report for North Anna Power Station Unit Nos. 1 and 2 for the reporting period of July 1, 1993 to December 31, 1993.

If you have any questions or require additional information, please contact us.

Very truly yours,



M. L. Bowling, Manager
Nuclear Licensing and Programs

Enclosure

cc: U. S. Nuclear Regulatory Commission
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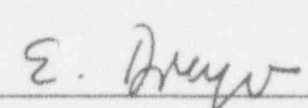
RADIOACTIVE EFFLUENT RELEASE REPORT

NORTH ANNA POWER STATION

(JULY 01, 1993 TO DECEMBER 31, 1993)

PREPARED BY: 

Supervisor
Radiological Analysis

REVIEWED BY: 

Supervisor
Technical Services

APPROVED BY: 

Superintendent
Radiological Protection

F O R W A R D

This report is submitted as required by Appendix A to Operating License Nos. NPF-4 and NPF-7, Technical Specifications for North Anna Power Station, Units 1 and 2, Virginia Electric and Power Company, Docket Nos. 50-338, 50-339, Section 6.9.1.9.

RADIOACTIVE EFFLUENT RELEASE REPORT
FOR THE
NORTH ANNA POWER STATION
JULY 01, 1993 TO DECEMBER 31, 1993

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1.0 PURPOSE AND SCOPE

The Radioactive Effluent Release Report includes, in Attachment 1, a summary of the quantities of radioactive liquid and gaseous effluents and solid waste as outlined 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", Revision 1, June 1974, with data summarized on a quarterly basis following the format of Tables 1, 2 and 3 of Appendix B thereof. The report submitted within 60 days after January 1 of each year includes an assessment of radiation doses to the maximum exposed member of the public due to radioactive liquid and gaseous effluents released from the site during the previous calendar year. The report submitted within 60 days after July 1 of each year has the same sections except for the assessment of radiation doses. The report also includes a list of unplanned releases during the reporting period, in Attachment 6.

As required by Technical Specification 6.15, changes to the Offsite Dose Calculation Manual (ODCM) for the time period covered by this report are included in Attachment 3.

Major changes to radioactive liquid, gaseous and solid waste treatment systems are reported in Attachment 4, as required by the ODCM, section 6.6.2. Information to support the reason(s) for the change(s) and a summary of the 10 CFR 50.59 evaluation are included. In lieu of reporting major changes in this report, major changes to the radioactive waste treatment systems may be submitted as part of the annual FSAR update.

1.0 PURPOSE AND SCOPE (cont).

As required by the ODCM, sections 6.2.2.b.2 and 6.3.2.b.3, a list and explanation for the inoperability of radioactive liquid and/or gaseous effluent monitoring instrumentation is provided in Attachment 5 of this report.

2.0 DISCUSSION

The basis for the calculation of the percent of technical specification for the critical organ in Table 1A of Attachment 1 is the ODCM, section 6.3.1, which requires that the dose rate for iodine-131, for tritium, and for all radionuclides in particulate form with half-lives greater than 8 days shall be less than or equal to 1500 mrem/yr to the critical organ at or beyond the site boundary. The critical organ is the child's thyroid via the inhalation pathway.

The basis for the calculation of percent of technical specification for the total body and skin in Table 1A of Attachment 1 is the ODCM, section 6.3.1, which requires that the dose rate for noble gases to areas at or beyond site boundary shall be less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin.

The basis for the calculation of the percent of technical specification in Table 2A in Attachment 1 is the ODCM, section 6.2.1, which states that the concentrations of radioactive material released in

2.0 DISCUSSION (cont).

liquid effluents to unrestricted areas shall be limited to the concentrations specified in 10 CFR 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to $2.0E-4$ microcuries/ml.

Percent of technical specification calculations are based on the total gaseous or liquid effluents released for that respective quarter.

The annual and quarterly doses, as reported in Attachment 2, were calculated according to the methodology presented in the ODCM. The beta and gamma air doses due to noble gases released from the site were calculated at site boundary. The maximum exposed member of the public from the releases of airborne iodine-131, tritium and all radionuclides in particulate form with half-lives greater than 8 days, is defined as an infant, exposed through the grass-cow-milk pathway, with the critical organ being the thyroid gland. The maximum exposed member of the public from radioactive materials in liquid effluents in unrestricted areas is defined as an adult, exposed by either the invertebrate or fish pathway, with the critical organ being the liver. The total body dose was also determined for this individual.

Presented in Attachment 6 is a list of unplanned gaseous and liquid releases exceeding the ODCM limits of sections 6.3.1 and 6.2.1 respectively.

2.0 DISCUSSION (cont).

The typical Lower Limit of Detection (LLD) capabilities of the radioactive effluent analysis instrumentation are presented in Attachment 7. These LLD values are based upon conservative conditions (i.e., minimum sample volume and maximum delay time prior to analysis). Actual LLD values may be lower. If a radioisotope was not detected when effluent samples were analyzed, then the activity of that radioisotope was reported as Not Detectable (N/D) on Attachment 1 of this report. If an analysis for an isotope was not performed, then the activity was reported as Not Applicable (N/A).

3.0 SUPPLEMENTAL INFORMATION

As required by the ODCM, section 6.5.2, evaluation of the Land Use Census is made to determine if new location(s) have been identified for the radiological environmental monitoring program pursuant to the ODCM, Section 6.5.2 requirements. Evaluation of the Land Use Census conducted in 1993 identified no change in sample locations for the radiological environmental monitoring program.

Section 6.5.1.b.4 of the ODCM requires identification of the cause(s) for the unavailability of milk or leafy vegetation samples, and the identification of new locations for obtaining replacement samples. Milk samples, as required by the ODCM, section 6.5.1, were available during the time period covered by this report. The leafy vegetation samples for vegetation station 14, 15, 16, 21 and 23 were not collected for the months of November and December 1993 due to seasonal unavailability. All other samples were obtained and analyzed as required during the time period covered by this report.

ATTACHMENT 1
EFFLUENT RELEASE DATA
(07/93 - 12/93)

This attachment includes a summary of the quantities of radioactive liquid and gaseous effluents and solid waste, as outlined in Regulatory Guide 1.21, Appendix B.

TABLE 1A
 NORTH ANNA POWER STATION
 SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
 SUMMATION OF ALL GASEOUS EFFLUENT RELEASES FOR (07/93 - 12/93)

	UNITS	3rd QUARTER	4th QUARTER	ESTIMATED TOTAL PERCENT ERROR (%)
A. Fission and Activation Gases:				
1. Total Release.	Curies	9.46E+1	1.36E+1	1.80E+1
2. Average Release Rate for Period	μCi/sec	1.19E+1	1.71E+0	
B. Iodines:				
1. Total Iodine-131 Release.	Curies	1.15E-3	2.70E-4	2.80E+1
2. Average Release Rate for Period	μCi/sec	1.45E-4	3.40E-5	
C. Particulates (T_{1/2} > 8 days):				
1. Total Particulate (T _{1/2} > 8 days) Release	Curies	3.78E-5	3.62E-5	2.80E+1
2. Average Release Rate for Period	μCi/sec	4.74E-6	4.55E-6	
3. Gross Alpha Radioactivity Release	Curies	1.02E-4	5.85E-5	
D. Tritium:				
1. Total Release	Curies	2.37E+1	1.25E+1	3.10E+1
2. Average Release Rate for Period	μCi/sec	2.98E+0	1.57E+0	
E. Percentage of Technical Specification Limits				
1. Total Body Dose Rate	%	4.72E-3	1.63E-2	
2. Skin Dose Rate	%	1.83E-3	3.98E-3	
3. Critical Organ Dose Rate	%	3.44E-3	1.32E-3	

TABLE 1B
 NORTH ANNA POWER STATION
 SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
 MIXED MODE GASEOUS EFFLUENT RELEASES FOR 07/93 - 12/93

NUCLIDES RELEASED	UNITS	CONTINUOUS MODE		BATCH MODE	
		3rd QUARTER	4th QUARTER	3rd QUARTER	4th QUARTER
Fission & Activation Gases:					
Krypton - 85	Ci	N/D	N/D	3.95E-1	2.36E+0
Krypton - 85m	Ci	4.95E-2	N/D	N/D	2.22E-3
Krypton - 87	Ci	N/D	N/D	N/D	N/D
Krypton - 88	Ci	N/D	N/D	N/D	N/D
Xenon - 131m	Ci	N/D	N/D	3.46E-1	2.75E-1
Xenon - 133	Ci	2.62E+1	1.79E+0	1.16E+1	1.35E+0
Xenon - 133m	Ci	N/D	N/D	3.52E-1	N/D
Xenon - 135	Ci	8.19E-2	N/D	N/D	7.45E-3
Xenon - 135m	Ci	N/D	N/D	N/D	N/D
Xenon - 138	Ci	N/D	N/D	N/D	N/D
Other (Specify)					
Argon - 41	Ci	N/D	N/D	N/D	6.01E-3
Total for Period	Ci	2.63E+1	1.79E+0	1.27E+1	4.00E+0
Iodines:					
Iodine - 131	Ci	5.82E-6	1.14E-6	N/D	N/D
Iodine - 133	Ci	5.31E-6	3.27E-6	N/D	N/D
Iodine - 135	Ci	N/D	N/D	N/D	N/D
Total for Period	Ci	1.11E-5	4.41E-6	N/D	N/D
Particulates:					
Manganese - 54	Ci	N/D	N/D	N/D	N/D
Iron - 55	Ci	4.80E-8	1.71E-8	N/A	N/A
Cobalt - 58	Ci	1.23E-8	N/D	N/D	N/D
Iron - 59	Ci	N/D	N/D	N/D	N/D
Cobalt - 60	Ci	2.77E-7	9.29E-8	N/D	N/D
Zinc - 65	Ci	N/D	N/D	N/D	N/D
Strontium - 85	Ci	8.17E-9	N/D	N/D	N/D

TABLE 1B
 NORTH ANNA POWER STATION
 SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
 MIXED MODE GASEOUS EFFLUENT RELEASES FOR 07/93 - 12/93

NUCLIDES RELEASED	UNITS	CONTINUOUS MODE			BATCH MODE	
		3rd QUARTER	4th QUARTER	3rd QUARTER	4th QUARTER	
Particulates: (cont.)						
Strontium - 89	ci	N/D	N/D	N/A	N/A	N/A
Strontium - 90	ci	N/D	N/D	N/A	N/A	N/A
Cesium - 134	ci	N/D	N/D	N/D	N/D	N/D
Cesium - 136	ci	N/D	N/D	N/D	N/D	N/D
Cesium - 137	ci	4.47E-7	2.28E-7	N/D	N/D	N/D
Barium - 140	ci	N/D	N/D	N/D	N/D	N/D
Lanthanum - 140	ci	N/D	N/D	N/D	N/D	N/D
Cerium - 141	ci	N/D	N/D	N/D	N/D	N/D
Cerium - 144	ci	N/D	N/D	N/D	N/D	N/D
Other (Specify)						
Molybdenum - 99 (T _{1/2} < 8 days)	ci	N/D	N/D	N/D	N/D	N/D
Cerium - 143 (T _{1/2} < 8 days)	ci	N/D	3.66E-8	N/D	N/D	N/D
Total for Period (T _{1/2} > 8 days)	ci	7.93E-7	3.21E-7	N/D	N/D	N/D
Total for Period (T _{1/2} < 8 days)	ci	N/D	3.66E-8	N/D	N/D	N/D
Total for Period	ci	7.93E-7	3.58E-7	N/D	N/D	N/D
GROSS ALPHA:	ci	6.59E-9	5.03E-9	N/A	N/A	N/A
TRITIUM:	ci	1.32E+0	1.62E+0	1.75E-2	1.42E-2	

TABLE 1C
 NORTH ANNA POWER STATION
 SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
 GROUND LEVEL GASEOUS EFFLUENT RELEASES FOR 07/93 - 12/93

NUCLIDES RELEASED	UNITS	CONTINUOUS MODE				BATCH MODE
		3rd QUARTER	4th QUARTER	3rd QUARTER	4th QUARTER	
Fission & Activation Gases:						
Krypton - 85	Ci	N/D	N/D	N/D	N/D	N/D
Krypton - 85m	Ci	7.54E-3	N/D	8.52E-3	8.44E-5	8.44E-5
Krypton - 87	Ci	8.14E-3	N/D	2.39E-4	3.26E-4	3.26E-4
Krypton - 88	Ci	1.44E-2	N/D	3.53E-4	3.62E-4	3.62E-4
Xenon - 131m	Ci	N/D	N/D	2.10E-2	N/D	N/D
Xenon - 133	Ci	2.67E+1	N/D	2.77E+1	8.60E-3	8.60E-3
Xenon - 133m	Ci	N/D	N/D	N/D	N/D	N/D
Xenon - 135	Ci	9.58E-1	N/D	1.05E-1	1.13E-3	1.13E-3
Xenon - 135m	Ci	4.53E-2	3.64E-4	9.98E-4	4.28E-4	4.28E-4
Xenon - 138	Ci	6.78E-3	N/D	2.89E-5	1.45E-3	1.45E-3
Other (Specify)						
Argon - 41	Ci	3.72E-2	7.80E+0	1.08E-3	2.93E-2	2.93E-2
Total for Period	Ci	2.78E+1	7.80E+0	2.78E+1	4.17E-2	4.17E-2
Iodines:						
Iodine - 131	Ci	1.14E-3	2.69E-4	2.55E-8	N/D	N/D
Iodine - 132	Ci	N/D	N/D	2.62E-8	N/D	N/D
Iodine - 133	Ci	1.79E-4	N/D	6.98E-8	N/D	N/D
Iodine - 134	Ci	N/D	N/D	6.34E-9	N/D	N/D
Iodine - 135	Ci	N/D	N/D	6.35E-8	N/D	N/D
Total for Period	Ci	1.32E-3	2.69E-4	1.91E-7	N/D	N/D
Particulates:						
Manganese - 54	Ci	N/D	N/D	N/D	N/D	N/D
Iron - 55	Ci	N/D	N/D	N/A	5.85E-6	5.85E-6
Cobalt - 58	Ci	2.68E-5	1.80E-5	4.52E-7	5.26E-11	5.26E-11
Iron - 59	Ci	N/D	N/D	N/D	N/D	N/D
Cobalt - 60	Ci	N/D	N/D	N/D	N/D	N/D
Zinc - 65	Ci	N/D	N/D	N/D	N/D	N/D
Niobium - 95	Ci	N/D	N/D	N/D	3.55E-6	3.55E-6
Zirconium - 95	Ci	N/D	N/D	N/D	3.04E-6	3.04E-6

TABLE 2A
 NORTH ANNA POWER STATION
 SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
 LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES FOR (07/93 - 12/93)

	UNITS	3rd QUARTER	4th QUARTER	ESTIMATED TOTAL PERCENT ERROR (%)
A. Fission and Activation Products:				
1. Total release (not including tritium, noble gas, and gross alpha).	Curies	1.14E-1	1.15E-1	2.00E+1
2. Average diluted concentration during the period.	μCi/ml	1.47E-10	2.01E-10	
3. Percent of applicable limit (T.S.)	%	1.76E-3	4.80E-4	
B. Tritium:				
1. Total release activity.	Curies	1.70E+2	1.98E+2	2.00E+1
2. Average diluted concentration during the period.	μCi/ml	2.20E-7	3.46E-7	
3. Percent of applicable limit (T.S.)	%	7.31E-3	1.15E-2	
C. Dissolved and Entrained Gases:				
1. Total release activity.	Curies	2.96E-3	2.03E-4	2.00E+1
2. Average diluted concentration during the period.	μCi/ml	3.82E-12	3.54E-13	
3. Percent of applicable limit (T.S.)	%	1.91E-6	1.77E-7	
D. Gross Alpha Radioactivity:				
1. Total release activity.	Curies	1.08E-4	5.91E-4	2.00E+1
E. Volume of waste released: (prior to dilution).				
	Liters	6.85E+7	6.02E+7	3.00E+0
F. Total volume of dilution water used during the period.				
	Liters	7.74E+11	5.73E+11	3.00E+0

TABLE 2B
NORTH ANNA POWER STATION
SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
LIQUID EFFLUENT RELEASES FOR 07/93 - 12/93

NUCLIDES RELEASED	UNITS	CONTINUOUS MODE		BATCH MODE	
		3rd QUARTER	4th QUARTER	3rd QUARTER	4th QUARTER
Fission & Activation Products:					
Manganese - 54	Ci	1.48E-3	1.15E-3	N/D	N/D
Iron - 55	Ci	N/D	N/D	N/D	N/D
Cobalt - 58	Ci	2.48E-2	3.57E-2	2.03E-5	1.63E-6
Cobalt - 60	Ci	4.01E-2	2.82E-2	1.15E-5	N/D
Strontium - 89	Ci	N/D	N/D	N/D	N/D
Strontium - 90	Ci	N/D	N/D	N/D	N/D
Niobium - 95	Ci	3.23E-3	3.26E-3	N/D	N/D
Ruthenium - 106	Ci	N/D	6.46E-6	N/D	N/D
Silver - 110m	Ci	1.68E-2	3.61E-2	N/D	N/D
Iodine - 131	Ci	2.33E-3	N/D	N/D	N/D
Iodine - 133	Ci	3.02E-3	N/D	N/D	N/D
Cesium - 134	Ci	2.23E-3	7.10E-4	1.82E-5	N/D
Cesium - 137	Ci	3.63E-3	8.44E-4	2.67E-5	N/D
Barium - 140	Ci	N/D	N/D	N/D	N/D
Lanthanum - 140	Ci	N/D	N/D	N/D	N/D
Cerium - 141	Ci	N/D	N/D	N/D	N/D
Antimony - 125	Ci	3.07E-3	2.59E-5	N/D	N/D
Other (Specify)					
Antimony - 122 ($T_{1/2} < 8$ days)	Ci	1.51E-4	N/D	N/D	N/D
Chromium - 51	Ci	7.85E-3	6.80E-3	N/D	N/D
Iron - 59	Ci	4.66E-3	1.02E-3	N/D	N/D
Zirconium - 95	Ci	4.34E-4	1.21E-3	N/D	N/D
Indium - 113m	Ci	3.72E-5	N/D	N/D	N/D
Zinc - 65	Ci	N/D	N/D	4.10E-7	N/D
Rhodium - 106	Ci	N/D	6.46E-6	N/D	N/D
Cobalt - 57	Ci	9.60E-5	N/D	N/D	N/D
Nickel - 65	Ci	1.80E-4	N/D	N/D	N/D
Technetium - 99m	Ci	9.85E-5	N/D	N/D	N/D
Ruthenium - 103	Ci	1.98E-4	7.35E-5	N/D	N/D
Tin - 113	Ci	3.72E-5	N/D	N/D	N/D
Total for Period	Ci	1.14E-1	1.15E-1	7.71E-5	1.63E-6

TABLE 3
 NORTH ANNA POWER STATION
 RADIOACTIVE EFFLUENT RELEASE REPORT
 SUMMATION OF SOLID RADIOACTIVE WASTE AND IRRADIATED FUEL SHIPMENTS
 FOR 07-01-93 THROUGH 12-31-93

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (NOT IRRADIATED FUEL)

1.	Type of Waste	Unit	6-Month Period	Estimated Total Percent Error (%)
a.	Spent resins, filter sludges, evaporator bottoms, etc.	m ³	8.05E+1*	2.50E+1
		Ci	7.83E+1	2.50E+1
b.	Dry compressible waste, contaminated equipment, etc.	m ³	4.23E+2**	2.50E+1
		Ci	5.59E0	2.50E+1
c.	Irradiated components, control rods, etc.	m ³	0.00E0	0.00E0
		Ci	0.00E0	0.00E0
d.	Other (describe) Waste Oil/Sludge	m ³	1.54E+1***	2.50E+1
		Ci	1.36E-2	2.50E+1

2. Estimate of major nuclide composition (by type of waste)

a.	Fe-55	%	3.61E+1	2.50E+1
	Co-60	%	1.55E+1	2.50E+1
	Ni-63	%	1.70E+1	2.50E+1
	Mn-54	%	1.06E0	2.50E+1
	Co-58	%	2.84E+1	2.50E+1
	Cs-137	%	1.75E0	2.50E+1
		%		
b.	Fe-55	%	1.86E+1	2.50E+1
	Co-60	%	1.15E+1	2.50E+1
	Cs-137	%	1.35E0	2.50E+1
	Ni-63	%	2.67E0	2.50E+1
	Co-58	%	1.33E+1	2.50E+1
	Ce-144	%	1.85E0	2.50E+1
	Zr-95	%	1.71E+1	2.50E+1
	Nb-95	%	3.37E+1	2.50E+1
		%		
c.				

TABLE 3
 NORTH ANNA POWER STATION
 RADIOACTIVE EFFLUENT RELEASE REPORT
 SUMMATION OF SOLID RADIOACTIVE WASTE AND IRRADIATED FUEL SHIPMENTS
 FOR 07-01-93 THROUGH 12-31-93

2. Estimate of major nuclide composition (by type of waste) (cont.)

	Unit	6-Month Period	Estimated Total Percent Error (%)
d. Co-60	%	1.43E+1	2.50E+1
Fe-55	%	1.22E0	2.50E+1
Co-58	%	1.02E0	2.50E+1
Ni-63	%	1.20E0	2.50E+1
Ce-144	%	4.10E+1	2.50E+1
Cs-137	%	2.59E+1	2.50E+1
Cs-134	%	3.25E0	2.50E+1
Sr-90	%	8.83E0	2.50E+1

3. Solid Waste Disposition

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
10	Truck	Barnwell, SC
13	Truck	Oak Ridge, TN (SEG)
2	Truck	Oak Ridge, TN (Quadrex)

B. Irradiated Fuel Shipments (Disposition)

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
N/A	N/A	N/A

- * 3 shipments of resin were shipped from North Anna to a Licensed Waste Processor for volume reduction. Therefore, the volume listed for this type is not representative of actual volume buried. The total volume buried for this reporting period was 39.36 m³.
- ** 12 shipments of dry compressible waste/contaminated equipment were shipped from North Anna to a Licensed Waste Processor for volume reduction. Therefore, the volume listed for this type is not representative of the actual volume buried. The total volume buried for this reporting period was 79.16 m³.
- *** 3 shipments of waste oil/sludge were shipped from North Anna to a Licensed Waste Processor for incineration and volume reduction. Therefore, the volume listed for this type is not representative of the actual volume buried. The total volume buried for this reporting period was 2.0 m³.

Attachment 2

Annual and Quarterly Doses

(07/93 - 12/93)

An assessment of radiation doses to the maximum exposed member of the public due to radioactive liquid and gaseous effluents released from the site for each calendar quarter for the calendar year of the report along with an annual total of each effluent pathway will be made pursuant to ODCM 6.6.2.

Liquid Effluents:

	<u>1st</u> <u>Quarter</u>	<u>2nd</u> <u>Quarter</u>	<u>3rd</u> <u>Quarter</u>	<u>4th</u> <u>Quarter</u>	<u>Annual</u> <u>Total</u>
Total Body					
Dose (mrem)	1.46E-1	7.13E-2	1.43E-1	7.91E-2	4.39E-1
Critical Organ					
Dose (mrem)	1.91E-1	7.75E-2	1.81E-1	8.84E-2	5.38E-1

Gaseous Effluents:

	<u>1st</u> <u>Quarter</u>	<u>2nd</u> <u>Quarter</u>	<u>3rd</u> <u>Quarter</u>	<u>4th</u> <u>Quarter</u>	<u>Annual</u> <u>Total</u>
Noble Gas					
Gamma Dose (mrad)	5.81E-3	1.41E-3	7.04E-3	2.15E-2	3.58E-2
Noble Gas					
Beta Dose (mrad)	1.70E-2	3.38E-3	1.93E-2	7.90E-3	4.76E-2
Critical Organ					
Dose for I-131, H-3, Particulates with $T_{1/2} < 8$ days (mrem)	4.03E-2	7.04E-3	5.40E-2	1.31E-2	1.14E-1

ATTACHMENT 3

REVISIONS TO OFFSITE DOSE CALCULATION MANUAL

(ODCM)

(07/93 - 12/93)

As required by Technical Specification 6.15, changes to the ODCM effective for the time period covered by this report, are summarized in this attachment.

There were no changes to the ODCM during this reporting period. All references to ODCM sections in this report are to Revision 4.

ATTACHMENT 4

MAJOR CHANGES TO RADIOACTIVE LIQUID, GASEOUS, AND SOLID
WASTE TREATMENT SYSTEMS

(07/93 - 12/93)

As required by the ODCM, Section 6.6.2, major changes to radioactive liquid, gaseous and solid waste treatment systems for the time period covered by this report are synopsized in this attachment. Supporting information as to the reason(s) for the change(s) and a summary of the 10 CFR 50.59 evaluation are included, as applicable.

No major changes to the radioactive gaseous and solid waste treatment systems were made for the time period covered by this report.

ATTACHMENT 5

INOPERABILITY OF RADIOACTIVE LIQUID AND GASEOUS

EFFLUENT MONITORING INSTRUMENTATION

(07/93 - 12/93)

As required by the ODCM, Sections 6.2.2.b.2 and 6.3.2.b.3, a list and explanation for extended inoperability of radioactive liquid and/or gaseous effluent monitoring instrumentation is provided in this attachment.

No extended periods of inoperability occurred with any of the Liquid or Gaseous Effluent Monitoring Instrumentation specified in the ODCM, Attachments 2 and 15, for the time period covered by this report.

ATTACHMENT 6

UNPLANNED RELEASES

(07/93 - 12/93)

As required by the ODCM, Section 6.6.2, a list of unplanned releases, from the site to unrestricted areas, of radioactive material in gaseous and liquid effluents occurring during the reporting period, is made in this attachment.

No unplanned releases, as defined by the criteria presented in the ODCM, Section 6.6.2, occurred during the time period covered by this report.

ATTACHMENT 7

LOWER LIMITS OF DETECTION FOR EFFLUENT SAMPLE ANALYSIS

(07/93 - 12/93)

Gaseous Effluents:

Radioisotope	Required L.L.D. ($\mu\text{Ci/ml}$)	Typical L.L.D. ($\mu\text{Ci/ml}$)
Krypton - 87	1.00E-4	3.53E-7 - 4.34E-7
Krypton - 88	1.00E-4	4.79E-7 - 6.28E-7
Xenon - 133	1.00E-4	2.76E-7 - 3.89E-7
Xenon - 133m	1.00E-4	1.15E-6 - 1.51E-6
Xenon - 135	1.00E-4	1.40E-7 - 1.78E-7
Xenon - 135m	1.00E-4	5.34E-7 - 7.54E-7
Xenon - 138	1.00E-4	1.17E-6 - 1.96E-6
Iodine - 131	1.00E-12	5.34E-14 - 7.59E-14
Manganese - 54	1.00E-11	3.64E-14 - 5.32E-14
Cobalt - 58	1.00E-11	4.05E-14 - 5.21E-14
Iron - 59	1.00E-11	7.70E-14 - 1.01E-13
Cobalt - 60	1.00E-11	5.66E-14 - 1.52E-13
Zinc - 65	1.00E-11	1.01E-13 - 1.19E-13
Strontium - 89	1.00E-11	4.00E-15 - 5.00E-15
Strontium - 90	1.00E-11	7.00E-16 - 1.00E-15
Molybdenum - 99	1.00E-11	2.72E-13 - 3.47E-13
Cesium - 134	1.00E-11	1.03E-13 - 1.61E-13
Cesium - 137	1.00E-11	4.70E-14 - 5.77E-14
Cerium - 141	1.00E-11	4.54E-14 - 6.79E-14
Cerium - 144	1.00E-11	1.04E-13 - 3.22E-13
Gross Alpha	1.00E-11	6.90E-15 - 1.20E-14
Tritium	1.00E-6	1.12E-7 - 1.37E-7

ATTACHMENT 7
 LOWER LIMITS OF DETECTION FOR EFFLUENT SAMPLE ANALYSIS
 (07/93 - 12/93)

Liquid Effluents:

Radioisotope	Required L.L.D. ($\mu\text{Ci/ml}$)	Typical L.L.D. ($\mu\text{Ci/ml}$)
Krypton - 87	1.00E-5	6.07E-8 - 7.29E-8
Krypton - 88	1.00E-5	8.85E-8 - 1.16E-7
Xenon - 133	1.00E-5	6.08E-8 - 8.83E-8
Xenon - 133m	1.00E-5	2.04E-7 - 2.69E-7
Xenon - 135	1.00E-5	2.50E-8 - 3.14E-8
Xenon - 135m	1.00E-5	8.95E-8 - 1.19E-7
Xenon - 138	1.00E-5	2.17E-7 - 3.41E-7
Iodine - 131	1.00E-6	2.63E-8 - 3.43E-8
Manganese - 54	5.00E-7	2.45E-8 - 3.93E-8
Iron - 55	1.00E-6	4.00E-7 - 8.00E-7
Cobalt - 58	5.00E-7	2.61E-8 - 3.25E-8
Iron - 59	5.00E-7	4.85E-8 - 5.86E-8
Cobalt - 60	5.00E-7	3.23E-8 - 8.43E-8
Zinc - 65	5.00E-7	5.81E-8 - 6.83E-8
Strontium - 89	5.00E-8	3.00E-8 - 5.00E-8
Strontium - 90	5.00E-8	5.00E-9 - 1.00E-8
Molybdenum - 99	5.00E-7	1.82E-7 - 2.31E-7
Cesium - 134	5.00E-7	5.84E-8 - 1.00E-7
Cesium - 137	5.00E-7	3.32E-8 - 3.79E-8
Cerium - 141	5.00E-7	4.07E-8 - 5.47E-8
Cerium - 144	5.00E-7	1.81E-7 - 2.63E-7
Gross Alpha	1.00E-7	2.15E-8 - 3.72E-8
Tritium	1.00E-5	2.78E-6 - 3.32E-6