

RADIOACTIVE EFFLUENT RELEASE REPORT

NORTH ANNA POWER STATION

(JULY 01, 1991 TO DECEMBER 31, 1991)

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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.

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FOR THE  
NORTH ANNA POWER STATION  
JULY 01, 1991 TO DECEMBER 31, 1991

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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 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 change in this report, major changes to the radioactive waste treatment systems may be submitted a 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 this report, in Attachment 5.

## 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. The ODCM, Section 6.3.1 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; 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. The ODCM, Section 6.3.1, 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 of Attachment 1 is the ODCM. The ODCM, Section 6.2.1, states that the concentrations of radioactive

2.0 DISCUSSION (cont.)

material released in 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. 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 is not detected when analyzing effluent samples, the activity of that radioisotope will be reported as Not Detectable (N/D) on Attachment 1 of this report. On Attachment 1, an entry of "N/A", not applicable, indicates that no analysis is performed for that isotope. When used in conjunction with totals, such an entry indicates that all radioisotopes for that particular quarter and release mode are less than LLD.

3.0 SUPPLEMENTAL INFORMATION

As required by the ODCM, evaluation of the Land Use Census is to be made for identifying the new location(s) for the environmental monitoring program pursuant to the ODCM, Section 6.5.2 requirements. Evaluation of the Land Use Census conducted in 1991 identified one new sample location for the Environmental Monitoring Program. The location of the broad leaf vegetation sampling station number 15 was changed, due to higher calculated deposition source strength (D/Q) values at the new sample location. The Environmental Monitoring Program procedure, HP-3051.10, was revised to include the change in sample location. No changes to the ODCM airborne effluent dose factors were necessary.

As required by the ODCM, the identification of the causes of the unavailability of milk or leafy vegetation samples, required by the ODCM, Section 6.5 and Attachment 21, and the identification of the new location(s) for obtaining replacement samples are listed. Milk samples, as required by the ODCM, Section 6.5 and Attachment 21, were available during the time period covered by this report. The leafy vegetation samples for vegetation stations 14, 15, 16, 21 and 23 were not collected for the months of November and December 1991 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

(07/91 - 12/91)

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 1991

	UNITS	3rd QUARTER	4th QUARTER	ESTIMATED TOTAL PERCENT ERROR (%)
<b>A. Fission and Activation Gases:</b>				
1. Total Release.	Curies	6.66E+2	5.15E+2	1.80E+1
2. Average Release Rate for Period.	μCi/sec	8.38E+1	6.48E+1	
<b>B. Iodines:</b>				
1. Total Iodine-131 Release.	Curies	6.17E-4	1.16E-3	2.80E+1
2. Average Release Rate for Period.	μCi/sec	7.76E-5	1.46E-4	
<b>C. Particulates (T<sub>1/2</sub> &gt; 8 days):</b>				
1. Total Particulate (T <sub>1/2</sub> > 8 days) Release.	Curies	4.91E-5	1.58E-5	2.80E+1
2. Average Release Rate for Period.	μCi/sec	6.18E-6	1.99E-6	
3. Gross Alpha Radioactivity Release	Curies	N/D	N/D	
<b>D. Tritium:</b>				
1. Total Release.	Curies	5.99E+0	9.90E+0	3.10E+1
2. Average Release Rate for Period.	μCi/sec	7.54E-1	1.25E+0	
<b>E. Percentage of Technical Specification Limits:</b>				
1. Total Body Dose Rate.	%	3.21E-2	2.50E-2	
2. Skin Dose Rate.	%	1.19E-2	8.02E-3	
3. Critical Organ Dose Rate.	%	1.27E-3	2.30E-3	

N/D is Not Detectable & N/A is Not Applicable

TABLE 1B  
 NORTH ANNA POWER STATION  
 SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT  
 MIXED MODE GASEOUS EFFLUENT RELEASES FOR 1991

Page 1 of 2

NUCLIDES RELEASED	UNITS	CONTINUOUS MODE		BATCH MODE	
		3rd QUARTER	4th QUARTER	3rd QUARTER	4th QUARTER
<b>Fission and Activation Gases:</b>					
Krypton - 85	Ci	N/D	N/D	1.62E-1	4.26E+0
Krypton - 85m	Ci	N/D	N/D	3.05E-2	N/D
Krypton - 87	Ci	N/D	6.87E-2	N/D	N/D
Krypton - 88	Ci	N/D	9.97E-2	2.70E-2	N/D
Xenon - 131m	Ci	5.55E-1	4.71E-1	1.16E+0	2.17E+0
Xenon - 133	Ci	2.90E+2	1.82E+2	1.05E+2	2.07E+2
Xenon - 133m	Ci	6.87E-1	3.38E-1	8.20E-1	1.43E+0
Xenon - 135	Ci	1.68E+0	1.54E+0	6.08E-1	2.46E-1
Xenon - 135m	Ci	N/D	N/D	N/D	N/D
Xenon - 138	Ci	N/D	N/D	N/D	N/D
<b>Other (Specify)</b>					
Argon - 41	Ci	9.50E-3	2.02E+0	1.33E-2	N/D
<b>Total for Period</b>	<b>Ci</b>	<b>2.93E+2</b>	<b>1.87E+2</b>	<b>1.08E+2</b>	<b>2.15E+2</b>
<b>Iodines:</b>					
Iodine - 130	Ci	N/D	N/D	N/A	N/A
Iodine - 131	Ci	1.33E-5	2.75E-5	N/A	N/A
Iodine - 132	Ci	N/D	N/D	N/A	N/A
Iodine - 133	Ci	2.61E-6	5.99E-6	N/A	N/A
Iodine - 134	Ci	N/D	N/D	N/A	N/A
Iodine - 135	Ci	N/D	N/D	N/A	N/A
<b>Total for Period</b>	<b>Ci</b>	<b>1.59E-5</b>	<b>2.65E-5</b>	<b>N/A</b>	<b>N/A</b>
<b>Particulates:</b>					
Manganese - 54	Ci	N/D	N/D	N/A	N/A
Iron - 55	Ci	4.45E-7	2.92E-7	N/A	N/A
Cobalt - 58	Ci	N/D	N/D	N/A	N/A
Iron - 59	Ci	N/D	N/D	N/A	N/A
Cobalt - 60	Ci	1.61E-6	8.87E-7	N/A	N/A
Zinc - 65	Ci	N/D	N/D	N/A	N/A
Strontium - 89	Ci	N/D	N/D	N/A	N/A
Strontium - 90	Ci	N/D	N/D	N/A	N/A
Silver - 110m	Ci	N/D	N/D	N/A	N/A

N/D is Not Detectable & N/A is Not Applicable

TABLE 1B  
 NORTH ANNA POWER STATION  
 SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT  
 MIXED MODE GASEOUS EFFLUENT RELEASES FOR 1991

NUCLIDES RELEASED	UNITS	CONTINUOUS MODE		BATCH MODE	
		3rd QUARTER	4th QUARTER	3rd QUARTER	4th QUARTER
Particulates (cont.):					
Cesium - 134	Ci	5.23E-7	2.77E-7	N/A	N/A
Cesium - 136	Ci	N/D	N/D	N/A	N/A
Cesium - 137	Ci	3.13E-6	1.59E-6	N/A	N/A
Barium - 140	Ci	N/D	N/D	N/A	N/A
Cerium - 141	Ci	N/D	N/D	N/A	N/A
Cerium - 144	Ci	N/D	N/D	N/A	N/A
Other (Specify)					
Sodium - 24 ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	N/A	N/A
Iodine - 88 ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	N/A	N/A
Iodine - 89 ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	N/A	N/A
Molybdenum - 99 ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	N/A	N/A
Technetium - 99m ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	N/A	N/A
Antimony - 122 ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	N/A	N/A
Antimony - 124	Ci	1.09E-8	N/D	N/A	N/A
Tellurium - 131m ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	N/A	N/A
Cesium - 138 ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	N/A	N/A
Lanthanum - 140	Ci	N/D	N/D	N/A	N/A
Total for Period ( $T_{1/2} > 8$ days)	Ci	5.72E-6	3.04E-6	N/A	N/A
Total for Period ( $T_{1/2} < 8$ days)	Ci	N/A	N/A	N/A	N/A
Total for Period	Ci	5.72E-6	3.04E-6	N/A	N/A
GROSS ALPHA:	Ci	N/D	N/D	N/A	N/A
TRITIUM:	Ci	3.65E-1	3.39E-1	1.14E-3	1.07E-3

N/D is Not Detectable & N/A is Not Applicable

TABLE 1C  
 NORTH ANNA POWER STATION  
 SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT  
 GROUND LEVEL GASEOUS EFFLUENT RELEASES FOR 1991

NUCLIDES RELEASED	UNITS	CONTINUOUS MODE		BATCH MODE	
		3rd QUARTER	4th QUARTER	3rd QUARTER	4th QUARTER
<b>Fission and Activation Gases:</b>					
Krypton - 85	Ci	N/D	N/D	N/D	N/D
Krypton - 85m	Ci	3.46E-2	9.85E-2	N/D	5.89E-5
Krypton - 87	Ci	3.18E-2	1.14E-1	N/D	7.13E-5
Krypton - 88	Ci	6.75E-2	1.93E-1	N/D	N/D
Xenon - 131m	Ci	N/D	1.70E-2	N/D	N/D
Xenon - 133	Ci	2.16E+2	9.42E+1	2.82E+1	7.43E+0
Xenon - 133m	Ci	N/D	N/D	3.45E-1	N/D
Xenon - 135	Ci	1.90E+1	5.44E+0	4.38E-2	4.11E-2
Xenon - 135m	Ci	2.38E-1	4.02E-1	4.26E-4	N/D
Xenon - 138	Ci	5.10E-2	1.13E-1	N/D	N/D
<b>Other (Specify)</b>					
Argon - 41	Ci	1.45E+0	4.89E+0	N/D	7.65E-5
<b>Total for Period</b>	<b>Ci</b>	<b>2.37E+2</b>	<b>1.05E+2</b>	<b>2.86E+1</b>	<b>7.47E+0</b>
<b>Iodines:</b>					
Iodine - 130	Ci	N/D	N/D	N/D	N/D
Iodine - 131	Ci	5.45E-4	1.08E-3	5.97E-5	5.78E-5
Iodine - 132	Ci	N/D	N/D	1.66E-5	2.94E-7
Iodine - 133	Ci	4.17E-4	1.19E-3	5.69E-5	2.91E-6
Iodine - 134	Ci	N/D	N/D	6.64E-6	1.71E-7
Iodine - 135	Ci	N/D	N/D	3.92E-5	8.05E-7
<b>Total for Period</b>	<b>Ci</b>	<b>9.62E-4</b>	<b>2.28E-3</b>	<b>1.79E-4</b>	<b>6.20E-5</b>
<b>Particulates:</b>					
Manganese - 54	Ci	N/D	N/D	N/D	4.38E-10
Iron - 55	Ci	N/D	N/D	N/D	N/D
Cobalt - 58	Ci	N/D	1.07E-5	N/D	8.03E-10
Iron - 59	Ci	N/D	N/D	N/D	N/D
Cobalt - 60	Ci	N/D	N/D	9.64E-7	N/D
Zinc - 65	Ci	N/D	N/D	N/D	N/D
Strontium - 89	Ci	N/D	N/D	N/D	N/D
Strontium - 90	Ci	N/D	N/D	N/D	N/D
Silver - 110m	Ci	N/D	N/D	N/D	N/D
Cesium - 134	Ci	N/D	N/D	1.26E-5	1.49E-8
Cesium - 136	Ci	N/D	N/D	8.94E-10	3.21E-9

N/D is Not Detectable & N/A is Not Applicable

TABLE 1C  
 NORTH ANNA POWER STATION  
 SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT  
 GROUND LEVEL GASEOUS EFFLUENT RELEASES FOR 1991

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NUCLIDES RELEASED	UNITS	CONTINUOUS MODE		BATCH MODE	
		3rd QUARTER	4th QUARTER	3rd QUARTER	4th QUARTER
Particulates (cont.):					
Cesium - 137	Ci	4.79E-6	1.94E-6	2.50E-5	2.15E-8
Barium - 140	Ci	N/D	N/D	N/D	N/D
Cerium - 141	Ci	N/D	N/D	N/D	N/D
Cerium - 144	Ci	N/D	N/D	N/D	N/D
Other (Specify)					
Sodium - 24 ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	1.96E-5	5.51E-9
Bromine - 84 ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	N/D	N/D
Rubidium - 88 ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	N/D	1.43E-7
Rubidium - 89 ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	N/D	N/D
Molybdenum - 99 ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	N/D	N/D
Technetium - 99m ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	N/D	N/D
Ruthenium - 106	Ci	N/D	N/D	N/D	9.52E-9
Antimony - 122 ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	4.44E-10	N/D
Tellurium - 131m ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	N/D	N/D
Cesium - 138 ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	N/D	2.49E-7
Cerium - 143 ( $T_{1/2} < 8$ days)	Ci	N/D	N/D	2.36E-6	N/D
Lanthanum - 140	Ci	N/D	N/D	N/D	N/D
Total for Period ( $T_{1/2} > 8$ days)	Ci	4.79E-6	1.27E-5	3.86E-5	5.04E-8
Total for Period ( $T_{1/2} < 8$ days)	Ci	N/A	N/A	2.20E-5	3.97E-7
Total for Period	Ci	4.79E-6	1.27E-5	6.06E-5	4.48E-7
GROSS ALPHA:	Ci	N/D	N/D	N/D	N/D
TRITIUM:	Ci	5.48E+0	5.52E+0	1.34E-1	4.02E-2

N/D is Not Detectable & N/A is Not Applicable

TABLE 2A  
 NORTH ANNA POWER STATION  
 SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT  
 LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES FOR (1991)

	UNITS	3rd QUARTER	4th QUARTER	ESTIMATED TOTAL PERCENT ERROR (%)
<b>A. Fission and Activation Products:</b>				
1. Total release (not including tritium, noble gases, and gross alpha).	Curies	8.51E-2	7.38E-2	2.00E+1
2. Average diluted concentration during the period.	µCi/ml	9.95E-11	1.07E-10	
3. Percent of applicable limit (T.S.).	%	5.78E-3	1.20E-2	
<b>B. Tritium:</b>				
1. Total release activity.	Curies	3.49E+2	2.65E+2	2.00E+1
2. Average diluted concentration during the period.	µCi/ml	4.08E-7	3.82E-7	
3. Percent of applicable limit (T.S.).	%	1.36E-2	1.27E-2	
<b>C. Dissolved and Entrained Gases:</b>				
1. Total release activity.	Curies	7.90E-1	1.45E+0	2.00E+1
2. Average diluted concentration during the period.	µCi/ml	9.23E-10	2.09E-9	
3. Percent of applicable limit (T.S.).	%	4.62E-4	1.05E-3	
<b>D. Gross Alpha Radioactivity:</b>				
1. Total release activity.	Curies	N/D	N/D	2.00E+1
<b>E. Volume of waste released: (prior to dilution).</b>				
	Liters	8.25E+7	8.44E+7	3.00E+0
<b>F. Volume of dilution water used during period.</b>				
	Liters	8.55E+11	6.93E+11	3.00E+0

N/D is Not Detectable & N/A is Not Applicable

TABLE 2B  
 NORTH ANNA POWER STATION  
 SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT  
 LIQUID EFFLUENT RELEASES FOR 1991

Page 1 of 2

NUCLIDES RELEASED	UNITS	CONTINUOUS MODE		BATCH MODE	
		3rd QUARTER	4th QUARTER	3rd QUARTER	4th QUARTER
<b>Fission and Activation Products:</b>					
Manganese - 54	Ci	5.46E-4	7.04E-5	N/D	N/D
Iron - 55	Ci	N/D	N/D	N/D	N/D
Cobalt - 58	Ci	6.27E-3	8.00E-3	N/D	N/D
Cobalt - 60	Ci	2.94E-2	1.50E-2	N/D	N/D
Zinc - 65	Ci	N/D	N/D	N/D	N/D
Strontium - 89	Ci	N/D	N/D	N/D	N/D
Strontium - 90	Ci	N/D	N/D	N/D	N/D
Silver - 110m	Ci	1.63E-2	6.57E-3	N/D	N/D
Iodine - 131	Ci	7.3E-3	1.96E-2	1.67E-3	N/D
Iodine - 132	Ci	7.86E-5	N/D	N/D	N/D
Iodine - 133	Ci	9.06E-3	1.70E-2	3.10E-4	N/D
Iodine - 134	Ci	N/D	N/D	N/D	N/D
Iodine - 135	Ci	N/D	N/D	N/D	N/D
Cesium - 134	Ci	1.46E-3	7.35E-4	2.78E-4	N/D
Cesium - 136	Ci	2.30E-4	N/D	7.75E-5	N/D
Cesium - 137	Ci	4.01E-3	2.08E-3	2.68E-4	1.64E-5
Barium - 140	Ci	9.60E-5	N/D	N/D	N/D
Cerium - 141	Ci	N/D	N/D	N/D	N/D
Cerium - 144	Ci	N/D	N/D	N/D	N/D
<b>Other (specify)</b>					
Sodium - 24 (T <sub>1/2</sub> < 8 days)	Ci	1.46E-4	N/D	N/D	N/D
Chromium - 51	Ci	N/D	N/D	N/D	N/D
Cobalt - 57	Ci	N/D	N/D	N/D	N/D
Iron - 59	Ci	N/D	N/D	N/D	N/D
Rubidium - 88 (T <sub>1/2</sub> < 8 days)	Ci	N/D	N/D	N/D	N/D
Strontium - 85	Ci	1.60E-4	N/D	N/D	N/D
Zirconium - 95	Ci	N/D	N/D	N/D	N/D
Niobium - 95 (T <sub>1/2</sub> < 8 days)	Ci	2.34E-3	8.85E-4	N/D	N/D
Molybdenum - 99 (T <sub>1/2</sub> < 8 days)	Ci	N/D	N/D	N/D	N/D
Technetium - 99m (T <sub>1/2</sub> < 8 days)	Ci	N/D	N/D	N/D	N/D
Cadmium - 109	Ci	N/D	N/D	N/D	N/D
Antimony - 122 (T <sub>1/2</sub> < 8 days)	Ci	N/D	N/D	1.87E-5	N/D
Antimony - 124	Ci	3.19E-4	N/D	N/D	N/D
Antimony - 125	Ci	2.38E-3	3.58E-3	N/D	N/D

N/D is Not Detectable & N/A is Not Applicable



TABLE 2B  
NORTH ANNA POWER STATION  
SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT  
LIQUID EFFLUENT RELEASES FOR 1991

NUCLIDES RELEASED Fission and Activation Products: (cont.)	UNITS	CONTINUOUS MODE				BATCH MODE
		3rd QUARTER	4th QUARTER	3rd QUARTER	4th QUARTER	
Cesium - 138 (T <sub>1/2</sub> < 8 days)	Ci	N/D	N/D	N/D	N/D	N/D
Barium - 139 (T <sub>1/2</sub> < 8 days)	Ci	N/D	2.66E-4	N/D	N/D	N/D
Lanthanum - 140	Ci	N/D	N/D	N/D	N/D	N/D
<b>Total for Period</b>	Ci	<b>8.25E-2</b>	<b>7.38E-2</b>	<b>2.62E-3</b>	<b>1.64E-5</b>	
<b>Dissolved &amp; Entrained Noble Gases:</b>						
Xenon - 131m	Ci	N/D	9.39E-3	N/D	N/D	N/D
Xenon - 133	Ci	7.53E-1	1.44E+0	1.62E-4		N/D
Xenon - 133m	Ci	N/D	6.09E-3	N/D	N/D	N/D
Xenon - 135	Ci	3.91E-4	4.90E-4	N/D	N/D	N/D
Xenon - 135m	Ci	N/D	2.30E-4	N/D	N/D	N/D
<b>Other (specify)</b>						
Argon - 41	Ci	N/D	3.63E-5	N/D	N/D	N/D
Krypton - 85	Ci	3.71E-2	N/D	N/D	N/D	N/D
Krypton - 85m	Ci	N/D	N/D	N/D	N/D	N/D
<b>Total for Period</b>	Ci	<b>7.90E-1</b>	<b>1.45E+0</b>	<b>1.62E-4</b>	<b>N/A</b>	
TRITIUM	Ci	3.49E+2	2.65E+2	4.78E-2		N/D
GROSS ALPHA	Ci	N/D	N/D	N/D		N/D

N/D is Not Detectable & N/A is Not Applicable

TABLE 3  
 NORTH ANNA POWER STATION  
 SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT  
 SUMMATION OF SOLID RADIOACTIVE WASTE AND IRRADIATED FUEL SHIPMENTS  
 FOR 07-01-91 THROUGH 12-31-91

Page 1 of 2

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 <sup>3</sup> Ci	4.79E+1 1.40E+2	2.50E+1 2.50E+1
b. Dry compressible waste, contaminated equipment, etc.	m <sup>3</sup> Ci	1.09E+2* 9.84E-2	2.50E+1 2.50E+1
c. Irradiated components, control rods, etc.	m <sup>3</sup> Ci	0.00E+0 0.00E+0	0.00E+0 0.00E+0
d. Other (describe)	m <sup>3</sup> Ci	0.00E+0 0.00E+0	0.00E+0 0.00E+0

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

a. C-14	%	1.78E+0	2.50E+1
Mn-54	%	1.34E+0	2.50E+1
Fe-55	%	1.10E+1	2.50E+1
Co-58	%	1.60E+0	2.50E+1
Co-60	%	3.50E+1	2.50E+1
Ni-63	%	3.85E+1	2.50E+1
Cs-134	%	3.14E+0	2.50E+1
Cs-137	%	6.99E+0	2.50E+1

b. Fe-55	%	4.07E+1	2.50E+1
Co-58	%	9.94E+0	2.50E+1
Co-60	%	2.37E+1	2.50E+1
Ni-63	%	9.09E+0	2.50E+1
Sb-125	%	1.01E+0	2.50E+1
Zr-95	%	2.81E+0	2.50E+1
Nb-95	%	5.83E+0	2.50E+1
Cs-134	%	1.27E+0	2.50E+1
Cs-137	%	3.39E+0	2.50E+1

TABLE 3  
 NORTH ANNA POWER STATION  
 SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT  
 SUMMATION OF SOLID RADIOACTIVE WASTE AND IRRADIATED FUEL SHIPMENTS  
 FOR 07-01-91 THROUGH 12-31-91

2. Estimate of major nuclide composition (by type of waste) (cont.)	UNIT	6-MONTH PERIOD	ESTIMATED TOTAL PERCENT ERROR (%)
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c. NONE

d. NONE

3. Solid Waste Disposition

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
7	Truck	Barnwell, S.C.
3	Truck	Oak Ridge, T.N. (SEG)

B. IRRADIATED FUEL SHIPMENTS (Disposition)

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

\* 3 shipments of Dry Active Waste were shipped from North Anna to a licensed waste processor for volume reduction. Therefore, the volume as listed for this type is not representative of the actual volume buried. The total volume buried for this reporting period was 31.8 m<sup>3</sup>.

ATTACHMENT 2ANNUAL AND QUARTERLY DOSES

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 this report, along with an annual total of each effluent pathway is made pursuant to the ODCM, Section 6.6.2 requirements.

Liquid Effluents:

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Total Body Dose (mRem)	1.24E-1	9.53E-2	1.91E-1	1.17E-1	5.27E-1
Critical Organ Dose (mRem)	1.56E-1	1.00E-1	2.33E-1	1.37E-1	6.26E-1

Gaseous Effluents:

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Noble Gas Gamma Dose (mRad)	1.03E-2	5.89E-2	4.65E-2	3.51E-2	1.51E-1
Noble Gas Beta Dose (mRad)	2.94E-2	1.43E-1	1.08E-1	5.76E-2	3.38E-1
Critical Organ Dose for I-131, H-3, Particulates with $T_{1/2} > 8$ days (mRem)	1.94E-2	1.75E-2	2.84E-2	5.36E-2	1.19E-1

ATTACHMENT 3

REVISIONS TO OFFSITE DOSE CALCULATION MANUAL

(ODCM)

(07/91 - 12/91)

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

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Revision 1 to the Virginia Power Offsite Dose Calculation Manual was effective July 01, 1991.

Revision 2 to the Virginia Power Offsite Dose Calculation Manual was effective September 01, 1991.

A copy of Revision 2 of the Offsite Dose Calculation Manual is attached. Changes made effective with Revision 1 and Revision 2 are indicated by marking the borders of the revised areas with the effective date of the change. All changes marked "Rev. 1" were effective July 01, 1991. All changes marked "Rev. 2" were effective September 01, 1991.

Additionally, changes were made in the presentation of text. Effective with Revision 1, formulas or equations within the ODCM were assigned a number. Future references to the equation are made via this equation number. Also effective with Revision 1, words or phrases that were capitalized in Revision 0, if they were defined by Technical Specifications, were un-capitalized.

Punctuation, spelling and other grammatical errors were corrected in Revision 1 and Revision 2. These minor changes are not specifically identified, as they do not affect the text content. Page numbers were changed as required, to reflect the relocation of text by Revision 1 and Revision 2.

ATTACHMENT 4

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

(07/91 - 12/91)

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.

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No major changes to the radioactive liquid, 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

(07/91 - 12/91)

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 this attachment.

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No extended periods of inoperability occurred with any of the Liquid or Gaseous Effluent Monitoring Instrumentaiton for the time period covered by this report.

ATTACHMENT 6

UNPLANNED RELEASES

(07/91 - 12/91)

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.

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



ATTACHMENT 7  
 LOWER LIMITS OF DETECTION FOR EFFLUENT SAMPLE ANALYSIS  
 (07/91 - 12/91)

## Gaseous Effluents:

Radioisotope	Required L.L.D. ( $\mu\text{Ci/ml}$ )	Typical L.L.D. ( $\mu\text{Ci/ml}$ )
Krypton - 87	1.00E-4	4.62E-8 - 4.25E-7
Krypton - 88	1.00E-4	4.36E-8 - 5.68E-7
Xenon - 133	1.00E-4	4.72E-8 - 4.20E-7
Xenon - 133m	1.00E-4	1.64E-7 - 1.41E-6
Xenon - 135	1.00E-4	1.93E-8 - 1.67E-7
Xenon - 135m	1.00E-4	8.26E-8 - 6.72E-7
Xenon - 138	1.00E-4	2.31E-7 - 1.96E-6
Iodine - 131	1.00E-12	5.92E-14 - 6.51E-14
Manganese - 54	1.00E-11	3.98E-14 - 4.29E-14
Cobalt - 58	1.00E-11	3.34E-14 - 4.78E-14
Iron - 59	1.00E-11	9.09E-14 - 9.96E-14
Cobalt - 60	1.00E-11	6.75E-14 - 7.14E-14
Zinc - 65	1.00E-11	1.08E-13 - 1.19E-13
Strontium - 89	1.00E-11	4.00E-15 - 1.00E-11
Strontium - 90	1.00E-11	8.00E-16 - 8.00E-12
Molybdenum - 99	1.00E-11	2.60E-13 - 3.69E-13
Cesium - 134	1.00E-11	4.24E-14 - 4.77E-14
Cesium - 137	1.00E-11	4.83E-14 - 5.43E-14
Cerium - 141	1.00E-11	3.94E-14 - 6.58E-14
Cerium - 144	1.00E-11	1.92E-13 - 2.95E-13
Gross Alpha	1.00E-11	1.54E-14 - 5.06E-14
Tritium	1.00E-6	1.62E-7

ATTACHMENT 7  
 LOWER LIMITS OF DETECTION FOR EFFLUENT SAMPLE ANALYSIS  
 (07/91 - 12/91)  
 (cont.)

Liquid Effluents:

Radioisotope	Required L.L.D. ( $\mu\text{Ci/ml}$ )	Typical L.L.D. ( $\mu\text{Ci/ml}$ )
Krypton - 87	1.00E-5	6.27E-8 - 7.09E-8
Krypton - 88	1.00E-5	7.83E-8 - 1.04E-7
Xenon - 133	1.00E-5	6.68E-8 - 8.26E-8
Xenon - 133m	1.00E-5	2.27E-7 - 2.53E-7
Xenon - 135	1.00E-5	2.71E-8 - 2.98E-8
Xenon - 135m	1.00E-5	1.07E-7 - 1.21E-7
Xenon - 138	1.00E-5	3.22E-7 - 3.62E-7
Iodine - 131	1.00E-6	2.82E-8 - 2.90E-8
Manganese - 54	5.00E-7	2.31E-8 - 2.75E-8
Iron - 55	1.00E-6	3.00E-7 - 1.00E-6
Cobalt - 58	5.00E-7	2.17E-8 - 2.91E-8
Iron - 59	5.00E-7	4.96E-8 - 6.02E-8
Cobalt - 60	5.00E-7	3.65E-8 - 4.29E-8
Zinc - 65	5.00E-7	5.99E-8 - 7.22E-8
Strontium - 89	5.00E-8	2.00E-8 - 5.00E-8
Strontium - 90	5.00E-8	1.00E-8 - 2.00E-8
Molybdenum - 99	5.00E-7	1.86E-7 - 2.47E-7
Cesium - 134	5.00E-7	2.51E-8 - 3.12E-8
Cesium - 137	5.00E-7	3.29E-8 - 3.64E-8
Cerium - 141	5.00E-7	3.43E-8 - 5.02E-8
Cerium - 144	5.00E-7	1.68E-7 - 2.27E-7
Gross Alpha	1.00E-7	8.44E-9 - 2.92E-8
Tritium	1.00E-5	4.45E-6