

VIRGINIA ELECTRIC AND POWER COMPANY  
RICHMOND, VIRGINIA 23261

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**VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)**  
**NORTH ANNA POWER STATION UNIT NOS. 1 AND 2**  
**INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI)**  
**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**

Enclosed is the 2006 Annual Radioactive Effluent Release Report. This report is provided pursuant to North Anna Units 1 and 2 Technical Specification 5.6.3 [10 CFR 50.36a] and North Anna Independent Spent Fuel Storage Installation Technical Specification 5.5.2c [10 CFR 72.44(d)(3)].

If you have any questions or require additional information, please contact Page Kemp at (540) 894-2295.

Very truly yours,



D. G. Stoddard  
Site Vice President

Enclosure

Commitments made in this letter: None

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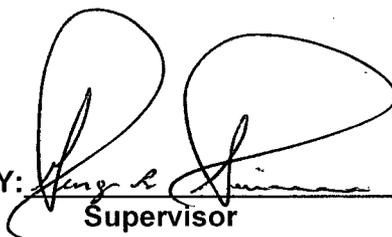
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ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

NORTH ANNA POWER STATION

(JANUARY 01, 2006 TO DECEMBER 31, 2006)

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## FORWARD

This report is submitted in accordance with North Anna Unit 1 and 2 Technical Specification 5.6.3 and North Anna Independent Spent Fuel Storage Installation (ISFSI) Technical Specification 5.5.2.c and 10CFR72.44(d)(3).

**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**  
**FOR THE**  
**NORTH ANNA POWER STATION**  
**JANUARY 01, 2006 TO DECEMBER 31, 2006**

**I N D E X**

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## 1.0 EXECUTIVE SUMMARY

The Annual Radioactive Effluent Release Report describes the radioactive effluent control program conducted at the North Anna Power Station and Independent Spent Fuel Storage Installation (ISFSI) during the 2006 calendar year. This document summarizes the quantities of radioactive liquid and gaseous effluents and solid waste released from the North Anna Power Station and ISFSI in accordance with R.G. 1.21 during the period January 1 through December 31, 2006, and includes an assessment of radiation doses to the maximum exposed member of the public due to radioactive liquid and gaseous effluents. There were no releases from the ISFSI during 2006.

There were no unplanned releases, meeting the reporting criteria of section 6.7.2.a.3 of the Offsite Dose Calculation Manual during this reporting period. Neither were there any spills or leaks meeting the reporting criteria of the NEI Ground Water Protection Initiative

Based on the 2006 effluent release data, 10 CFR 50, Appendix I dose calculations were performed in accordance with the Offsite Dose Calculation Manual. The results of these pathway dose calculations indicate the following:

- a. The total body dose due to liquid effluents was  $3.21E-1$  mrem, which is  $5.35E+0\%$  of the dose limit and the critical organ dose due to liquid effluents was  $5.11E-1$  mrem, which is  $2.56E+0\%$  of the dose limit.
- b. The air dose due to noble gases was  $1.20E-3$  mrad gamma, which is  $6.00E-3\%$  of the annual gamma dose limit, and  $1.70E-3$  mrad beta, which is  $4.25E-3\%$  of the annual beta dose limit.
- c. The critical organ dose for I-131, I-133, H-3, and Particulates with half-lives greater than 8 days was  $2.67E-2$  mrem, which is  $8.90E-2\%$  of the annual dose limit.

There was no major change to radioactive liquid and solid waste treatment systems during this reporting period. Changes to the gaseous waste treatment system are explained in Attachment 4.

There were no revisions to the Offsite Dose Calculation Manual during this reporting period.

## **1.0 EXECUTIVE SUMMARY (cont.)**

Based on the levels of radioactivity observed during this reporting period and the dose calculations performed, the operations of the North Anna Nuclear Power Station Units 1, 2, and ISFSI have resulted in negligible dose consequences to the maximum exposed member of the public in unrestricted areas.

## **2.0 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 for Table 1 and 2 and on an annual basis on Table 3. The report submitted before May 1st 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, any 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 6.7.2.a.4. 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 FSAR updates.

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.

### **3.0 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 & iodine-133, 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 the 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 liquid effluents to unrestricted areas shall be limited to 10 times the concentrations specified in 10 CFR 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to  $2.0E-4$   $\mu\text{Ci/ml}$ .

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 & iodine-133, tritium and all radionuclides in particulate form with half-lives greater than 8 days, is defined as a child, exposed through the vegetation 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 a child. The total body dose was determined for this individual. The critical organ was determined to be the child liver.

As shown in Attachment 6 there were no unplanned releases meeting the requirements of 6.7.2.a.3 of the ODCM.

### 3.0 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).

### 4.0 SUPPLEMENTAL INFORMATION

As required by the ODCM, section 6.6.2, 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. No changes were made.

Section 6.6.1.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 6.6.1, were collected from two stations during the period covered by this report. Milk samples from Station 27 could not be collected during 2006, due to the milch animal no longer being available. The leafy vegetation samples for vegetation stations 14, 15, 16, 21, 23 and 26, as applicable, were not collected for the months of January, February, March, April, October, November and December 2006 due to seasonal unavailability. All other vegetation samples were obtained and analyzed as required during the time period covered by this report.

Typographical errors were identified in the 2005 Radiological Environmental Operating Report. These were:

Table 3-3 Gross Beta Air Particulate:

03/16/2005 Station 05 the value should be 17.8 vice 17.6

08/17/05 Station 21 the error should be  $\pm 4.6$  vice  $\pm 4.4$

08/24/05 Station 21 the error should be  $\pm 4.7$  vice  $\pm 4.3$

Table 3-4 Airborne Iodine:

09/14/05 Station 24 the error should be  $\pm 32$  vice  $\pm 3.2$

Table 3-5 Airborne Particulate Gamma Spectra and Strontium:

2<sup>nd</sup> Quarter Station 01 the Sr-90 value should be 3.4 vice 0.3

2<sup>nd</sup> Quarter Station 24 the Sr-89 error should be  $\pm 9.4$  vice  $\pm 2.4$

3<sup>rd</sup> Quarter Station 01 the Cs-137 error should be  $\pm 0.75$  vice  $\pm 0.7$

#### 4.0 SUPPLEMENTAL INFORMATION (cont.)

Table 3-7 Precipitation Gamma Spectra:

06/28/05 Station 01A I-131 value should be  $-5.4 \pm 4.0$  vice  $-0.9 \pm 2.5$

06/28/05 Station 01A Cs-134 value should be 0.2 vice  $-0.2$

Table 3-8 Milk

09/14/2005 Station 13 Sr-89 value should be  $-0.9$  vice 0.9

Table 3-11 River Water Gamma Spectra, Strontium, and Tritium

01/13/05 Station 11 Cs-137 value should be 0.1 vice  $-0.1$

Table 3-12 Surface Water Gamma Spectra, Strontium, and Tritium

Station 08 sample date should be 01/13/05 vice 01/19/05

Station 09A sample should be 01/13/05 vice 01/19/05

Table 3-14 Shoreline Soil Gamma Spectra and Strontium

10/19/05 Station 08 Sr-89 value should be  $-10 \pm 360$  vice blank

Sr-90 value should be  $80 \pm 150$  vice  $41 \pm 98$

Attachment 8 contains the results of samples associated with ground water protection sampling undertaken at North Anna to voluntarily comply with the Nuclear Energy Institute, NEI, Ground Water Protection Initiative. In addition to the well, river, and surface water samples included as part of the Radiological Environmental Monitoring Program, North Anna obtained subsurface water samples and soil samples from various locations on the site.

**ATTACHMENT 1**  
**EFFLUENT RELEASE DATA**  
**(01/06 - 12/06)**

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, except that in accordance with Step 6.7.2.a.1 of the ODCM liquid and gaseous data is summarized on a quarterly basis and solid waste is summarized on an annual basis.

**TABLE 1A**  
**NORTH ANNA POWER STATION**  
**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**  
**SUMMATION OF ALL GASEOUS EFFLUENT RELEASES FOR (01/06 - 12/06)**

Page 1 of 2

	UNITS	1 ST QUARTER	2 ND QUARTER	ESTIMATED TOTAL PERCENT ERROR (%)
<b>A. <u>Fission and Activation Gases:</u></b>				
1. Total Release	Curies	9.90E+00	1.26E+00	1.80E+1
2. Average Release Rate For Period	μCi/sec	1.27E+00	1.60E-01	
<b>B. <u>Iodines:</u></b>				
1. Total Iodine-131 Release	Curies	5.43E-05	N/D	2.80E+1
2. Average Release Rate For Period	μCi/sec	6.99E-06	N/D	
<b>C. <u>Particulate (T<sub>1/2</sub> &gt; 8 days):</u></b>				
1. Total Particulate (T <sub>1/2</sub> > 8 days) Release	Curies	1.62E-05	2.15E-06	2.80E+1
2. Average Release Rate For Period	μCi/sec	2.09E-06	2.73E-07	
3. Gross Alpha Radioactivity Release	Curies	9.64E-08	3.20E-07	
<b>D. <u>Tritium:</u></b>				
1. Total Release	Curies	1.49E+01	4.63E+00	3.10E+1
2. Average Release Rate For Period	μCi/sec	1.91E+00	5.89E-01	
<b>E. <u>Percentage Of Technical Specification Limits</u></b>				
1. Total Body Dose Rate	%	1.29E-04	6.28E-04	
2. Skin Dose Rate	%	9.74E-05	1.51E-04	
3. Critical Organ Dose Rate	%	1.33E-03	3.87E-04	

**TABLE 1A**  
**NORTH ANNA POWER STATION**  
**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**  
**SUMMATION OF ALL GASEOUS EFFLUENT RELEASES FOR (01/06 - 12/06)**

	UNITS	3 RD QUARTER	4 TH QUARTER	ESTIMATED TOTAL PERCENT ERROR (%)
<b>A. <u>Fission and Activation Gases:</u></b>				
1. Total Release	Curies	4.12E-01	6.39E+00	1.80E+1
2. Average Release Rate For Period	μCi/sec	5.18E-02	8.03E-01	
<b>B. <u>Iodines:</u></b>				
1. Total Iodine-131 Release	Curies	N/D	2.11E-07	2.80E+1
2. Average Release Rate For Period	μCi/sec	N/D	2.65E-08	
<b>C. <u>Particulate (T<sub>1/2</sub> &gt; 8 days):</u></b>				
1. Total Particulate (T <sub>1/2</sub> > 8 days) Release	Curies	4.53E-09	7.32E-09	2.80E+1
2. Average Release Rate For Period	μCi/sec	5.70E-10	9.21E-10	
3. Gross Alpha Radioactivity Release	Curies	6.96E-07	1.28E-07	
<b>D. <u>Tritium:</u></b>				
1. Total Release	Curies	8.69E+00	2.62E+01	3.10E+1
2. Average Release Rate For Period	μCi/sec	1.09E+00	3.30E+00	
<b>E. <u>Percentage Of Technical Specification Limits</u></b>				
1. Total Body Dose Rate	%	4.93E-06	1.07E-04	
2. Skin Dose Rate	%	2.65E-06	4.65E-05	
3. Critical Organ Dose Rate	%	6.56E-04	2.15E-03	

**TABLE 1B**  
**NORTH ANNA POWER STATION**  
**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**  
**MIXED MODE GASEOUS EFFLUENT RELEASES FOR (01/06 - 12/06)**

Page 1 of 4

NUCLIDES RELEASED	UNITS	CONTINUOUS MODE		BATCH MODE	
		1ST QUARTER	2ND QUARTER	1ST QUARTER	2ND QUARTER
Fission & Activation Gases:					
Krypton - 85	Ci	2.34E+00	N/D	1.16E+00	3.78E-01
Krypton - 85m	Ci	N/D	N/D	1.33E-03	N/D
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	3.01E-02	N/D
Xenon - 133	Ci	3.48E+00	N/D	1.59E+00	2.11E-03
Xenon - 133m	Ci	N/D	N/D	1.93E-02	N/D
Xenon - 135	Ci	3.87E-02	N/D	4.22E-02	1.63E-03
Xenon - 135m	Ci	N/D	N/D	N/D	N/D
Xenon - 137	Ci	N/D	N/D	N/D	N/D
Xenon - 138	Ci	N/D	N/D	N/D	N/D
Other (Specify)		N/D	N/D	N/D	N/D
Argon - 41	Ci	N/D	1.43E-02	8.88E-03	2.88E-02
Total For Period	Ci	5.86E+00	1.43E-02	2.85E+00	4.11E-01
Iodines:					
Iodine - 131	Ci	7.09E-07	N/D	N/D	N/D
Iodine - 133	Ci	N/D	N/D	N/D	N/D
Iodine - 135	Ci	N/D	N/D	N/D	N/D
Total For Period	Ci	7.09E-07	N/D	N/D	N/D
Particulates:					
Manganese - 54	Ci	N/D	N/D	N/D	N/D
Cobalt - 58	Ci	N/D	N/D	N/D	N/D
Iron - 59	Ci	N/D	N/D	N/D	N/D
Cobalt - 60	Ci	N/D	N/D	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
Cesium - 134	Ci	N/D	N/D	N/D	N/D
Cesium - 136	Ci	N/D	N/D	N/D	N/D
Cesium - 137	Ci	1.39E-07	7.26E-07	N/D	N/D



**TABLE 1B**  
**NORTH ANNA POWER STATION**  
**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**  
**MIXED MODE GASEOUS EFFLUENT RELEASES FOR (01/06 - 12/06)**

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	1.65E-01	6.44E-01
Krypton - 85m	Ci	N/D	N/D	N/D	N/D
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	N/D	2.66E-02
Xenon - 133	Ci	2.34E-01	2.92E+00	6.51E-04	1.83E+00
Xenon - 133m	Ci	N/D	N/D	N/D	2.36E-02
Xenon - 135	Ci	N/D	2.79E-02	N/D	5.33E-02
Xenon - 135m	Ci	N/D	N/D	N/D	N/D
Xenon - 137	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	9.77E-03	N/D	N/D	N/D
Total For Period	Ci	2.44E-01	2.95E+00	1.66E-01	2.58E+00
Iodines:					
Iodine - 130	Ci	3.51E-07	N/D	N/D	N/D
Iodine - 131	Ci	N/D	2.11E-07	N/D	N/D
Iodine - 133	Ci	N/D	6.30E-08	N/D	N/D
Iodine - 135	Ci	N/D	N/D	N/D	N/D
Total For Period	Ci	3.51E-07	2.74E-07	N/D	N/D
Particulates:					
Manganese - 54	Ci	N/D	N/D	N/D	N/D
Cobalt - 58	Ci	N/D	N/D	N/D	N/D
Iron - 59	Ci	N/D	N/D	N/D	N/D
Cobalt - 60	Ci	N/D	N/D	N/D	N/D
Zinc - 65	Ci	N/D	N/D	N/D	N/D
Strontium - 85	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
Cesium - 134	Ci	N/D	N/D	N/D	N/D
Cesium - 136	Ci	N/D	N/D	N/D	N/D
Cesium - 137	Ci	4.53E-09	7.32E-09	N/D	N/D



**TABLE 1C**  
**NORTH ANNA POWER STATION**  
**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**  
**GROUND LEVEL GASEOUS EFFLUENT RELEASES FOR (01/06 - 12/06)**

NUCLIDES RELEASED	UNITS	CONTINUOUS MODE		BATCH MODE	
		1ST QUARTER	2ND QUARTER	1ST QUARTER	2ND QUARTER
Fission & Activation Gases:					
Krypton - 85	Ci	N/D	N/D	7.72E-02	N/D
Krypton - 85m	Ci	N/D	N/D	1.54E-04	N/D
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	4.90E-03	N/D
Xenon - 133	Ci	N/D	N/D	4.72E-01	1.88E-06
Xenon - 133m	Ci	N/D	N/D	6.33E-01	N/D
Xenon - 135	Ci	N/D	N/D	5.10E-03	N/D
Xenon - 135m	Ci	N/D	8.35E-01	N/D	N/D
Xenon - 138	Ci	N/D	N/D	N/D	N/D
Other (Specify)	Ci			N/D	
Argon - 41	Ci	N/D	N/D	N/D	N/D
<b>Total For Period</b>	<b>Ci</b>	<b>N/D</b>	<b>8.35E-01</b>	<b>1.19E+00</b>	<b>1.88E-06</b>
Iodines:					
Iodine - 130	Ci	N/D	N/D	N/D	N/D
Iodine - 131	Ci	5.07E-05	N/D	2.91E-06	N/D
Iodine - 132	Ci	N/D	N/D	1.32E-07	N/D
Iodine - 133	Ci	N/D	N/D	N/D	N/D
Iodine - 135	Ci	N/D	N/D	N/D	N/D
<b>Total For Period</b>	<b>Ci</b>	<b>5.07E-05</b>	<b>N/D</b>	<b>3.04E-06</b>	<b>N/D</b>
Particulates:					
Manganese - 54	Ci	N/D	N/D	N/D	N/D
Cobalt - 58	Ci	N/D	N/D	1.34E-07	6.56E-08
Iron - 59	Ci	N/D	N/D	N/D	N/D
Cobalt - 60	Ci	N/D	N/D	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
Cesium - 134	Ci	N/D	N/D	N/D	N/D
Cesium - 136	Ci	N/D	N/D	N/D	N/D



**TABLE 1C**  
**NORTH ANNA POWER STATION**  
**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**  
**GROUND LEVEL GASEOUS EFFLUENT RELEASES FOR (01/06 - 12/06)**

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
Krypton - 85m	Ci	N/D	N/D	N/D	6.54E-05
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	N/D	N/D
Xenon - 133	Ci	N/D	N/D	2.42E-03	8.57E-01
Xenon - 133m	Ci	N/D	N/D	N/D	4.93E-04
Xenon - 135	Ci	N/D	N/D	N/D	2.51E-03
Xenon - 135m	Ci	N/D	N/D	N/D	N/D
Xenon - 138	Ci	N/D	N/D	N/D	N/D
Other (Specify)	Ci			N/D	
Argon - 41	Ci	N/D	N/D		N/D
				N/D	
Total For Period	Ci	N/D	N/D	2.42E-03	8.60E-01
Iodines:					
Iodine - 130	Ci	N/D	N/D	N/D	N/D
Iodine - 131	Ci	N/D	N/D	N/D	N/D
Iodine - 132	Ci	N/D	N/D	N/D	N/D
Iodine - 133	Ci	N/D	N/D	8.26E-06	N/D
Iodine - 135	Ci	N/D	N/D	N/D	N/D
Total For Period	Ci	N/D	N/D	8.26E-06	N/D
Particulates:					
Manganese - 54	Ci	N/D	N/D	N/D	N/D
Cobalt - 58	Ci	N/D	N/D	N/D	N/D
Iron - 59	Ci	N/D	N/D	N/D	N/D
Cobalt - 60	Ci	N/D	N/D	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
Cesium - 134	Ci	N/D	N/D	N/D	N/D



**TABLE 2A**  
**NORTH ANNA POWER STATION**  
**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**  
**LIQUID EFFLUENT - SUMMATION OF ALL RELEASES FOR (01/06 - 12/06)**

	UNITS	1 ST QUARTER	2 ND QUARTER	ESTIMATED TOTAL PERCENT ERROR (%)
<b>A. <u>Fission and Activation Products:</u></b>				
1. Total Release (not including tritium, noble gas, and gross alpha).	Curies	1.14E-01	2.33E-02	2.00E+01
2. Average diluted concentration during the period.	μCi/ml	3.88E-10	3.16E-11	
3. Percent of applicable limit (T.S.)	%	6.53E-04	5.24E-05	
<b>B. <u>Tritium:</u></b>				
1. Total release activity.	Curies	2.76E+02	1.24E+01	2.00E+01
2. Average diluted concentration during the period.	μCi/ml	9.39E-07	1.68E-08	
3. Percent of applicable limit (T.S.)	%	9.39E-03	1.68E-04	
<b>C. <u>Dissolved and Entrained Gases:</u></b>				
1. Total release activity.	Curies	2.99E-03	N/D	2.00E+01
2. Average diluted concentration during the period.	μCi/ml	1.02E-11	N/D	
3. Percent of applicable limit (T.S.)	%	5.09E-06	0.00E+00	
<b>D. <u>Gross Alpha Radioactivity:</u></b>				
1. Total release activity.	Curies	N/D	N/D	2.00E+01
<b>E. Volume of waste released: (prior to dilution).</b>				
	Liters	1.45E+08	1.31E+08	3.00E+00
<b>F. Total volume of dilution water used during the period.</b>				
	Liters	2.94E+11	7.38E+11	3.00E+00

**TABLE 2A**  
**NORTH ANNA POWER STATION**  
**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**  
**LIQUID EFFLUENT - SUMMATION OF ALL RELEASES FOR (01/06 - 12/06)**

	UNITS	3 RD QUARTER	4 TH QUARTER	ESTIMATED TOTAL PERCENT ERROR (%)
<b>A. <u>Fission and Activation Products:</u></b>				
1. Total Release (not including tritium, noble gas, and gross alpha).	Curies	1.69E-02	6.85E-02	2.00E+01
2. Average diluted concentration during the period.	μCi/ml	1.96E-11	1.24E-10	
3. Percent of applicable limit (T.S.)	%	3.64E-05	3.65E-04	
<b>B. <u>Tritium:</u></b>				
1. Total release activity.	Curies	4.03E+01	4.67E+02	2.00E+01
2. Average diluted concentration during the period.	μCi/ml	4.67E-08	8.45E-07	
3. Percent of applicable limit (T.S.)	%	4.67E-04	8.45E-03	
<b>C. <u>Dissolved and Entrained Gases:</u></b>				
1. Total release activity.	Curies	1.18E-04	N/D	2.00E+01
2. Average diluted concentration during the period.	μCi/ml	1.37E-13	N/D	
3. Percent of applicable limit (T.S.)	%	6.84E-08	0.00E+00	
<b>D. <u>Gross Alpha Radioactivity:</u></b>				
1. Total release activity.	Curies	N/D	N/D	2.00E+01
<b>E. <u>Volume of waste released: (prior to dilution).</u></b>				
	Liters	1.24E+08	1.34E+08	3.00E+00
<b>F. <u>Total volume of dilution water used during the period.</u></b>				
	Liters	8.63E+11	5.53E+11	3.00E+00

**TABLE 2B**  
**NORTH ANNA POWER STATION**  
**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**  
**LIQUID EFFLUENT RELEASES FOR (01/06 - 12/06)**

NUCLIDES RELEASED	UNITS	CONTINUOUS MODE		BATCH MODE	
		1ST QUARTER	2ND QUARTER	1ST QUARTER	2ND QUARTER
Fission & Activation Products:					
Manganese - 54	Ci	1.15E-03	2.68E-05	N/D	N/D
Iron - 55	Ci	N/D	7.36E-03	N/D	N/D
Cobalt - 58	Ci	9.05E-03	8.60E-04	1.15E-09	N/D
Cobalt - 60	Ci	4.62E-02	9.90E-03	5.66E-09	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	1.31E-03	1.04E-04	N/D	N/D
Ruthenium - 106	Ci	N/D	N/D	N/D	N/D
Silver - 110m	Ci	1.94E-03	9.42E-05	1.25E-09	N/D
Iodine - 131	Ci	N/D	N/D	N/D	N/D
Iodine - 133	Ci	N/D	7.72E-04	N/D	N/D
Cesium - 134	Ci	7.29E-05	N/D	N/D	N/D
Cesium - 136	Ci	N/D	N/D	N/D	N/D
Cesium - 137	Ci	1.04E-03	1.38E-04	N/D	N/D
Barium-Lathanum - 140	Ci	N/D	N/D	N/D	N/D
Cerium - 141	Ci	N/D	N/D	N/D	N/D
Antimony - 124	Ci	5.13E-04	3.54E-04	N/D	N/D
Antimony - 125	Ci	5.13E-02	3.40E-03	8.19E-09	N/D
Other (Specify)	Ci				
Zirconium - 95 (T1/2 > 8 days)	Ci	3.80E-04	N/D	N/D	N/D
Chromium - 51 (T1/2 > 8 days)	Ci	4.13E-04	8.76E-05	N/D	N/D
Iron - 59 (T 1/2 > 8 days)	Ci	9.94E-05	N/D	N/D	N/D
Tin-113 (T1/2 > 8 days)	Ci	4.14E-05	N/D	N/D	N/D
Indium - 113m (T1/2 < 8 days)	Ci	4.14E-05	N/D	N/D	N/D
Antimony-122 (T1/2 < 8 days)		1.49E-04	N/D	N/D	
Silver-108m (T1/2 > 8 days)		5.33E-05	N/D	N/D	
Zirconium - 97 (T1/2 < 8 days)	Ci	N/D	1.73E-04	N/D	N/D
Antimony - 126 (T1/2 > 8 days)	Ci	2.53E-05	N/D	N/D	N/D
Niickel - 63 (T1/2 > 8 days)	Ci	N/A	N/D	N/A	N/A
Total for Period	Ci	1.14E-01	2.33E-02	1.63E-08	N/D







**TABLE 3**  
**NORTH ANNA POWER STATION**  
**RADIOACTIVE EFFLUENT RELEASE REPORT**  
**SUMMATION OF SOLID RADIOACTIVE WASTE AND IRRADIATED FUEL SHIPMENTS**  
**FOR 01-01-06 THROUGH 12-31-06**

Page 1 of 2

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (NOT IRRADIATED FUEL)				
1. Type of Waste	Unit	12-Month Period	Estimated Total Percent Error (%)	
a. Spent resins, sludges, filters sludge, evaporator bottoms, etc.,	m <sup>3</sup>	1.71E+01*	2.50E+01	
	Ci	9.13E+01	2.50E+01	
b. Dry compressible waste, contaminated equipment, etc.,	m <sup>3</sup>	1.63E+02**	2.50E+01	
	Ci	4.26E+00	2.50E+01	
c. Irradiated components, control rods, etc.,	m <sup>3</sup>	0.00E+00	2.50E+01	
	Ci	0.00E+00	2.50E+01	
d. Other (describe) Used Oil, Blast media, Sewage, Gravel, Dessicant, Soil, Construction Debris	m <sup>3</sup>	9.91E+00***	2.50E+01	
	Ci	3.55E-02	2.50E+01	
2. Estimate of major nuclide composition (by type of waste)				
	(%)	(Ci)	Estimated Total Percent Error (%)	
a. Co-58	5.22E+00	4.76E+00	2.50E+01	
	Co-60	2.68E+01	2.45E+01	2.50E+01
	Ni-63	3.52E+01	3.21E+01	2.50E+01
	Fe-55	1.04E+01	9.53E+00	2.50E+01
	Cs-137	1.40E+01	1.28E+01	2.50E+01
	Cs-134	3.49E+00	3.19E+00	2.50E+01
	Mn-54	1.05E+00	9.62E-01	2.50E+01
	Sb-125	1.12E+00	1.02E+00	2.50E+01
	Co-57	1.13E-01	1.03E-01	2.50E+01
	Ce-144	1.43E-01	1.31E-01	2.50E+01
	Ni-59	2.15E-01	1.96E-01	2.50E+01
b. H-3	2.49E+00	1.06E-01	2.50E+01	
	Cs-137	2.17E+01	9.26E-01	2.50E+01
	Co-60	1.80E+01	7.69E-01	2.50E+01
	Ni-63	7.06E+00	3.01E-01	2.50E+01
	Nb-95	4.52E+00	1.93E-01	2.50E+01
	Cs-134	3.12E+00	1.33E-01	2.50E+01
	Co-58	9.50E+00	4.05E-01	2.50E+01
	Zr-95	2.57E+00	1.09E-01	2.50E+01
	Mn-54	9.65E-01	4.11E-02	2.50E+01
	Cr-51	1.06E+01	4.50E-01	2.50E+01
	Fe-55	1.73E+01	7.37E-01	2.50E+01
	Fe-59	7.90E-01	3.37E-02	2.50E+01
	c. No shipments			
d. H-3	9.29E+01	3.30E-02	2.50E+01	
	Cs-137	4.75E+00	1.69E-03	2.50E+01
	Co-60	2.19E+00	7.79E-04	2.50E+01
	Ce-144	1.26E-03	4.48E-07	2.50E+01
	Co-58	1.12E-04	3.98E-08	2.50E+01
Ni-63	5.27E-02	1.87E-05	2.50E+01	

**TABLE 3  
 NORTH ANNA POWER STATION  
 RADIOACTIVE EFFLUENT RELEASE REPORT  
 SUMMATION OF SOLID RADIOACTIVE WASTE AND IRRADIATED FUEL SHIPMENTS  
 FOR 01-01-06 THROUGH 12-31-06**

**3. Solid Waste Disposition**

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
3	Truck	Barnwell, SC
6	Truck	Oak Ridge, TN (Duratek)

**B. Irradiated Fuel Shipments (Disposition)**

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
N/A		
*	(2) shipments containing resins were shipped to a licensed waste processor for processing and/or volume reduction.	
*	(2) shipments of resin/filters were shipped to licensed facility for disposal	
**	(4) shipments containing contaminated equipment, dry compressible waste / incinerable waste were shipped to a licensed waste processor for processing and/or volume reduction.	
**	(1) shipment of dry compressible waste / incinerable waste was shipped to licensed facility for disposal	
***	(1) shipment containing oil/soil and other material was shipped to a licensed waste processor for volume reduction. (Shipment also contained resin accounted for in first asterisk above.)	

**ATTACHMENT 2**  
**ANNUAL AND QUARTERLY DOSES**  
**(01/05 - 12/05)**

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 will be made as required by ODCM Section 6.7.2.

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
<b>Total Body Dose (mrem)</b>	<b>1.03E4</b>	<b>5.39E-3</b>	<b>1.65E-2</b>	<b>1.96E-1</b>	<b>3.21E-1</b>
<b>Critical Organ Dose (mrem)</b>	<b>1.23E4</b>	<b>7.86E-3</b>	<b>2.70E-2</b>	<b>3.53E-1</b>	<b>5.11E-1</b>

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
<b>Noble Gas Gamma Dose (mrad)</b>	<b>1.93E-4</b>	<b>8.42E-4</b>	<b>6.97E-6</b>	<b>1.61E-4</b>	<b>1.20E-3</b>
<b>Noble Gas Beta Dose (mrad)</b>	<b>9.46E4</b>	<b>2.16E-4</b>	<b>2.35E-5</b>	<b>5.15E-4</b>	<b>1.70E-3</b>
<b>Critical Organ Dose for I-131, I-133, H-3, Particulates with T<sub>1/2</sub> &gt; 8 days (mrem)</b>	<b>8.53E-3</b>	<b>2.17E-3</b>	<b>3.77E-3</b>	<b>1.22E-2</b>	<b>2.67E-2</b>

ATTACHMENT 3

REVISIONS TO OFFSITE DOSE CALCULATION MANUAL

(ODCM)

(01/06 - 12/06)

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

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There were no revisions made to the ODCM in 2006.

**ATTACHMENT 4**  
**MAJOR CHANGES TO RADIOACTIVE LIQUID, GASEOUS, AND SOLID**  
**WASTE TREATMENT SYSTEMS**  
**(01/06 - 12/06)**

As required by the ODCM, Section 6.7.2.a.4, major changes to radioactive liquid, gaseous and solid waste treatment systems for the time period covered by this report are synopsisized in this attachment. Supporting information as to the reason(s) for the change(s) and a summary of the 10 CFR 50.59 evaluations are included, as applicable.

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There was no major change to radioactive liquid, gaseous, and solid waste treatment systems for 2006.

**ATTACHMENT 5**  
**INOPERABILITY OF RADIOACTIVE LIQUID AND GASEOUS**  
**EFFLUENT MONITORING INSTRUMENTATION**  
**(01/06 - 12/06)**

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.

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1-BR-LT-112B, level transmitter for "B" Boron Recovery Test Tank was out-of-service from 01 January 2006 through 31 December 2006 due to failure of the transmitter. The transmitter is obsolete and an evaluation is being performed to determine if a replacement transmitter meets all applicable requirements. Upon completion of the evaluation final disposition of the transmitter will be made. There were neither additions to nor discharges from the tank during this period.

**ATTACHMENT 6**

**UNPLANNED RELEASES**

**(01/06 - 12/06)**

As required by the ODCM, Section 6.7.2.a.3, 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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There were no unplanned releases during 2006 meeting the criteria of Section 6.7.2.a.3 of the ODCM from the site to unrestricted area and there were no spills or leaks that required reporting under the criteria of the NEI Ground Water Protection Initiative.

**ATTACHMENT 7**  
**LOWER LIMITS OF DETECTION FOR EFFLUENT SAMPLE ANALYSIS**  
**(01/06 - 12/06)**

**Gaseous Effluents:**

<b>Radioisotope</b>	<b>Required L.L.D. μCi/mL</b>	<b>Typical L.L.D. μCi/mL</b>	
Krypton - 87	1.00E-4	1.20E-8	- 4.10E-8
Krypton - 88	1.00E-4	5.90E-8	- 8.90E-8
Xenon - 133	1.00E-4	2.60E-8	- 6.20E-8
Xenon - 133m	1.00E-4	6.40E-8	- 2.10E-7
Xenon - 135	1.00E-4	1.20E-8	- 3.90E-8
Xenon - 135m	1.00E-4	7.50E-8	- 1.90E-7
Xenon - 138	1.00E-4	1.00E-7	- 3.20E-7
Iodine - 131	1.00E-12	3.30E-14	- 6.80E-14
Iodine - 133	1.00E-10	2.20E-13	- 9.40E-11
Manganese - 54	1.00E-11	4.00E-14	- 6.10E-14
Cobalt - 58	1.00E-11	2.40E-14	- 6.10E-14
Iron - 59	1.00E-11	6.60E-14	- 2.20E-13
Cobalt - 60	1.00E-11	2.80E-14	- 7.50E-14
Zinc - 65	1.00E-11	5.80E-14	- 3.00E-13
Strontium - 89	1.00E-11	1.30E-13	- 1.80E-13
Strontium - 90	1.00E-11	2.50E-14	- 6.00E-14
Molybdenum - 99	1.00E-11	6.20E-13	- 1.10E-14
Cesium - 134	1.00E-11	8.80E-15	- 2.80E-14
Cesium - 137	1.00E-11	4.20E-14	- 6.70E-14
Cerium - 141	1.00E-11	3.20E-14	- 9.10E-14
Cerium - 144	1.00E-11	1.60E-13	- 6.50E-13
Gross Alpha	1.00E-11	5.10E-15	- 7.40E-15
Tritium	1.00E-6	3.90E-9	- 7.70E-9

**ATTACHMENT 7**  
**LOWER LIMITS OF DETECTION FOR EFFLUENT SAMPLE ANALYSIS**  
**(01/06 - 12/06)**

**Liquid Effluents:**

<b>Radioisotope</b>	<b>Required L.L.D.</b> <b>μCi/mL</b>	<b>Typical L.L.D.</b> <b>μCi/mL</b>	
Krypton - 87	1.00E-5	3.20E-8	- 9.50E-8
Krypton - 88	1.00E-5	4.20E-8	- 2.40E-7
Xenon - 133	1.00E-5	3.10E-8	- 8.40E-8
Xenon - 133m	1.00E-5	8.10E-8	- 2.20E-7
Xenon - 135	1.00E-5	5.10E-9	- 1.70E-8
Xenon - 135m	1.00E-5	3.40E-8	- 2.20E-7
Xenon - 138	1.00E-5	8.20E-8	- 7.50E-7
Iodine - 131	1.00E-6	2.80E-8	- 7.10E-8
Manganese - 54	5.00E-7	2.10E-8	- 3.30E-8
Iron - 55	1.00E-6	2.20E-7	- 4.70E-7
Cobalt - 58	5.00E-7	1.10E-8	- 8.30E-8
Iron - 59	5.00E-7	3.00E-8	- 5.70E-8
Cobalt - 60	5.00E-7	2.60E-8	- 7.10E-8
Zinc - 65	5.00E-7	3.70E-8	- 5.90E-8
Strontium - 89	5.00E-8	2.80E-8	- 4.00E-8
Strontium - 90	5.00E-8	2.90E-8	- 4.5 0E-8
Molybdenum - 99	5.00E-7	5.20E-8	- 9.10E-8
Cesium - 134	5.00E-7	8.10E-8	- 2.90E-7
Cesium - 137	5.00E-7	4.60E-8	- 7.20E-8
Cerium - 141	5.00E-7	6.20E-8	- 9.40E-8
Cerium - 144	5.00E-7	1.20E-7	- 4.20E-7
Gross Alpha	1.00E-7	3.20E-8	- 8.10E-8
Tritium	1.00E-5	2.70E-6	- 4.60E-6

**ATTACHMENT 8**  
**RESULTS OF GROUND WATER PROTECTION INITIATIVE SAMPLE ANALYSIS**  
**(01/06 - 12/06)**

Sample	Date	Sample Media	Nuclide	Value	Units
Domestic Water	05/10/06	Water	H-3	<166	pCi/L
Subsurface Drains	05/10/06	Water	H-3	1110	pCi/L
ISFSI Well #1	06/22/06	Water	H-3	<1300	pCi/L
ISFSI Well #1	06/22/06	Water	Gamma Emitters	< MDC	pCi/L
ISFSI Well #1	06/22/06	Water	Sr-89/-90	<MDC	pCi/L
ISFSI Well #4	06/22/06	Water	H-3	<1300	pCi/L
ISFSI Well #4	06/22/06	Water	Gamma Emitters	< MDC	pCi/L
ISFSI Well #4	06/22/06	Water	Sr-89/-90	<MDC	pCi/L
U-1 Mat Sump East	06/27/06	Water	H-3	<725	pCi/L
U-1 Mat Sump South	06/27/06	Water	H-3	<725	pCi/L
U-2 Mat Sump East	06/27/06	Water	H-3	1740	pCi/L
U-2 Mat Sump South	06/27/06	Water	H-3	<726	pCi/L
Discharge Canal Storm Drain	07/11/06	Water	H-3	<417	pCi/L
U-1 Storm Drain	07/11/06	Water	H-3	1120	pCi/L
U-2 Storm Drain	07/11/06	Water	H-3	<417	pCi/L
U-1 Mat Sump East	07/13/06	Water	H-3	476	pCi/L
U-1 Mat Sump South	07/13/06	Water	H-3	1060	pCi/L
U-2 Mat Sump East	07/13/06	Water	H-3	1210	pCi/L
U-2 Mat Sump South	07/13/06	Water	H-3	1180	pCi/L
Subsurface Drains	07/13/06	Water	H-3	689	pCi/L
NANIC Well	07/19/06	Water	H-3	<465	pCi/L
Security Training Well	07/19/06	Water	H-3	<465	pCi/L
Station 01A Well	07/19/06	Water	H-3	<465	pCi/L
Manhole #10	08/31/06	Water	H-3	1320	pCi/L
Manhole #23	09/01/06	Water	H-3	560	pCi/L
Manhole #1	09/01/06	Water	H-3	<471	pCi/L
Manhole #30	09/01/06	Water	H-3	<471	pCi/L
Manhole #31	09/01/06	Water	H-3	<471	pCi/L
Manhole #33	09/01/06	Water	H-3	<471	pCi/L
Manhole # 46	09/01/06	Water	H-3	<471	pCi/L

**ATTACHMENT 8**  
**RESULTS OF GROUND WATER PROTECTION INITIATIVE SAMPLE ANALYSIS**  
**(01/06 - 12/06)**

Sample	Date	Sample Media	Nuclide	Value	Units
Manhole # 41	09/01/06	Water	H-3	520	pCi/L
Manhole # 42	09/01/06	Water	H-3	<463	pCi/L
Manhole # 47	09/01/06	Water	H-3	<463	pCi/L
Manhole # 40	09/01/06	Water	H-3	<469	pCi/L
Soil Sample from U-3 Boring	09/03/06	Soil	Gamma Emitters	<MDC	µCi/kg or Bq/g
WS-2-ISI-Q3	09/15/06	Water	H-3	<469	pCi/L
WS-3-ISI-Q3	09/15/06	Water	H-3	<469	pCi/L
Service Water Vault	10/17/06	Water	H-3	1260	pCi/L
Service Water #4	10/17/06	Water	H-3	<490	pCi/L
Subsurface Drains	11/03/06	Water	H-3	<483	pCi/L
Discharge Canal Storm Drain Outfall	11/09/06	Water	H-3	1740	pCi/L
U-1 Storm Drain Outfall	11/09/06	Water	H-3	<497	pCi/L
U-2 Storm Drain Outfall	11/09/06	Water	H-3	<497	pCi/L
U-1 Mat Sump East	11/10/06	Water	H-3	701	pCi/L
U-1 Mat Sump South	11/10/06	Water	H-3	697	pCi/L
U-2 Mat Sump East	11/11/06	Water	H-3	1430	pCi/L
U-2 Mat Sump South	11/11/06	Water	H-3	764	pCi/L
Aux Bldg GW Monitoring Well	11/11/06	Water	H-3	846	pCi/L
U-2 Valve Pit Ground water	11/13/06	Water	H-3	1880	pCi/L
U-3 Well #901	11/22/06	Water	H-3	<461	pCi/L
U-3 Well #945	11/22/06	Water	H-3	<461	pCi/L
U-3 Well #947	11/22/06	Water	H-3	<461	pCi/L
U-3 Well #950	11/22/06	Water	H-3	<461	pCi/L
U-2 Valve Pit Ground water	11/30/06	Water	H-3	2080	pCi/L
U-1 AFW Tunnel	12/08/06	Water	H-3	<477	pCi/L
U-3 Well #946	11/22/06	Water	H-3	1610	pCi/L
U-3 Well #949	11/22/06	Water	H-3	<477	pCi/L
U-3 Well #951	11/22/06	Water	H-3	500	pCi/L