

VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

April 22, 2013

United States Nuclear Regulatory Commission
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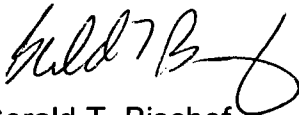
Serial No. 13-176
NAPS/JHL
Docket Nos. 50-338/339
72-16
72-56
License Nos. NPF-4/7
SNM-2507

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 2012 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,



Gerald T. Bischof
Site Vice President

Enclosure

Commitments made in this letter: None

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IE48
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North Anna Power Station
2012 Annual
Radioactive Effluent
Release Report

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

NORTH ANNA POWER STATION

(JANUARY 01, 2012 TO DECEMBER 31, 2012)

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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, 2012 TO DECEMBER 31, 2012

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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 2012 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, 2012, 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 2012.

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 voluntary communication criteria of the NEI Ground Water Protection Initiative. This will be discussed in Attachment 6.

Based on the 2012 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 $2.68E-1$ mrem, which is 4.46% of the dose limit and the critical organ dose due to liquid effluents was $2.78E-1$ mrem, which is 1.39% of the dose limit.
- b. The air doses due to noble gases was $1.37E-5$ mrad gamma, which is $6.85E-5\%$ of the annual gamma dose limit, and $3.52E-5$ mrad beta, which is $8.80E-5\%$ 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 including C-14 was 1.02 mrem, which is 3.40% of the annual dose limit. The bases of these calculations are described in Attachment 9.
- d. The critical organ dose for I-131, I-133, H-3, and Particulates with half-lives greater than 8 days not including C-14 was $7.74E-4$ mrem, which is 2.58-3% of the annual dose limit.

There were no major changes to either the radioactive liquid waste treatment system, or to the gaseous, and solid waste treatment systems during this reporting period.

There were three 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 and 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 bone if C-14 is included and child's thyroid if C-14 is not included both 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, including carbon-14 is defined as a child, exposed through the vegetation pathway, with the critical organ being the bone. If carbon-14 is excluded from these calculations, 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, excluding carbon-14, 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 for calculation of total body dose from radioactive materials in liquid effluents released to unrestricted areas is defined as a child, and also as a child for the calculation of critical organ dose, which was determined to be the liver. The age group is exposed via the drinking water and fish ingestion pathways.

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. There were no new sampling locations added. There were five (5) changes made to the land use census in 2012. The nearest resident in the ENE sector changed from 2.2 miles out to 2.37 miles out. The meat animal in the ESE sector was removed. The garden in the SSW sector moved from 3.07 miles to 2.34 miles out. The nearest resident and garden in the SW have both moved to 1.65 miles out from 1.7 miles out and 2.64 miles respectively.

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. All milk samples were collected as required. Vegetation samples were not collected from stations 14B, 15, 16, 23 and 26 from January through March and from November through December due to seasonal unavailability. All other vegetation samples were obtained.

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 from various locations on the site.

Attachment 9 contains an explanation of the bases for the carbon-14 calculations performed to assess doses due to carbon-14. Doses and %TS for gaseous releases are displayed with C-14 included and without for comparison of the values.

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

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 (01/11 - 12/11)

	UNITS	1 ST QUARTER	2 ND QUARTER	ESTIMATED TOTAL PERCENT ERROR (%)
A. <u>Fission and Activation Gases</u>				
1. Total Release	Curies	2.14E-01	5.30E-03	1.80E+1
2. Average Release Rate For Period	μCi/sec	2.72E-02	6.74E-04	
B. <u>Iodines:</u>				
1. Total Iodine-131 Release	Curies	1.69E-06	0.00E+00	2.80E+1
2. Average Release Rate For Period	μCi/sec	2.15E-07	0.00E+00	
C. <u>Particulate (T_{1/2} > 8 days):</u>				
1. Total Particulate (T _{1/2} > 8 days) Release	Curies	5.39E-05	2.41E-06	2.80E+1
2. Average Release Rate For Period	μCi/sec	6.86E-06	3.07E-07	
3. Gross Alpha Radioactivity Release	Curies	0.00E+00	9.59E-08	
D. <u>Tritium:</u>				
1. Total Release	Curies	7.30E+00	2.81E+00	3.10E+1
2. Average Release Rate For Period	μCi/sec	9.29E-01	3.57E-01	
E. <u>Carbon-14</u>				
1. Total Release	Curies	1.12E+01	2.76E-01	
2. Average Release Rate For Period	μCi/sec	1.42E+00	3.51E-02	
F. <u>Percentage Of Technical Specification Limits</u>				
1. Total Body Dose Rate	%	5.00E-06	5.67E-08	
2. Skin Dose Rate	%	2.04E-06	2.42E-08	
3. Critical Organ Dose Rate (with C-14)	%	8.89E-03	1.26E-04	
Critical Organ Dose Rate (without C-14)	%	6.24E-04	1.73E-04	

TABLE 1A
NORTH ANNA POWER STATION
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
SUMMATION OF ALL GASEOUS EFFLUENT RELEASES FOR (01/11 - 12/11)

Page 2 of 2

	UNITS	3 RD QUARTER	4 TH QUARTER	ESTIMATED TOTAL PERCENT ERROR (%)
A. <u>Fission and Activation Gases</u>				
1. Total Release	Curies	4.96E-03	2.79E-01	1.80E+1
2. Average Release Rate For Period	μCi/sec	6.24E-04	3.51E-02	
B. <u>Iodines:</u>				
1. Total Iodine-131 Release	Curies	0.00E+00	0.00E+00	2.80E+1
2. Average Release Rate For Period	μCi/sec	0.00E+00	0.00E+00	
C. <u>Particulate (T_{1/2} > 8 days):</u>				
1. Total Particulate (T _{1/2} > 8 days) Release	Curies	0.00E+00	2.22E-08	2.80E+1
2. Average Release Rate For Period	μCi/sec	0.00E+00	2.79E-09	
3. Gross Alpha Radioactivity Release	Curies	3.54E-07	2.15E-07	
D. <u>Tritium:</u>				
1. Total Release	Curies	7.93E+00	3.02E+00	3.10E+1
2. Average Release Rate For Period	μCi/sec	9.98E-01	3.80E-01	
F. <u>Carbon-14</u>				
1. Total Release	Curies	2.58E-01	1.45E+01	
2. Average Release Rate For Period	μCi/sec	3.25E-02	1.82E+00	
F. <u>Percentage Of Technical Specification Limits</u>				
1. Total Body Dose Rate	%	8.77E-07	3.51E-06	
2. Skin Dose Rate	%	2.83E-07	1.30E-06	
3. Critical Organ Dose Rate (with C-14)	%	7.23E-04	5.88E-03	
Critical Organ Dose Rate (without C-14)	%	6.05E-04	2.05E-04	

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

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	4.25E-05	N/D
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	6.46E-06	N/D
Xenon - 133	Ci	1.58E-02	N/D	1.60E-01	5.11E-03
Xenon - 133m	Ci	N/D	N/D	7.11E-04	N/D
Xenon - 135	Ci	N/D	N/D	N/D	N/D
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	N/D	N/D	N/D
Total For Period	Ci	1.58E-02	N/D	1.61E-01	5.11E-03
Iodines:					
Iodine - 131	Ci	5.97E-08	N/D	N/D	N/D
Iodine - 132	Ci	N/D	N/D	N/D	N/D
Iodine - 133	Ci	N/D	N/D	N/D	N/D
Iodine - 134	Ci	N/D	N/D	N/D	N/D
Iodine - 135	Ci	N/D	N/D	N/D	N/D
Total For Period	Ci	5.97E-08	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	N/D	N/D	N/D	N/D

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

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	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	N/D
Xenon - 133	Ci	N/D	1.71E-02	N/D	2.57E-01
Xenon - 133m	Ci	N/D	N/D	N/D	N/D
Xenon - 135	Ci	N/D	N/D	N/D	N/D
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	N/D	N/D	N/D
Total For Period	Ci	N/D	1.71E-02	N/D	2.57E-01
Iodines:					
Iodine - 131	Ci	N/D	N/D	N/D	N/D
Iodine - 132		N/D	N/D	N/D	N/D
Iodine - 133	Ci	N/D	N/D	N/D	N/D
Iodine - 134		N/D	N/D	N/D	N/D
Iodine - 135	Ci	N/D	N/D	N/D	N/D
Total For Period	Ci	N/D	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 - 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	N/D	1.12E-08	N/D	N/D

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

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	1.31E-03	3.17E-05
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	3.10E-04	1.19E-05
Xenon - 133	Ci	N/D	N/D	3.26E-02	1.48E-04
Xenon - 133m	Ci	N/D	N/D	6.85E-04	N/D
Xenon - 135	Ci	N/D	N/D	2.55E-03	N/D
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	N/D	N/D	N/D	N/D
Total For Period	Ci	N/D	N/D	3.75E-02	1.92E-04
Iodines:					
Iodine - 131	Ci	N/D	N/D	1.63E-06	N/D
Iodine - 132	Ci	N/D	N/D	N/D	N/D
Iodine - 133	Ci	N/D	N/D	N/D	N/D
Iodine - 134	Ci	N/D	N/D	N/D	N/D
Iodine - 135	Ci	N/D	N/D	N/D	N/D
Total For Period	Ci	N/D	N/D	1.63E-06	N/D
Particulates:					
Manganese - 54	Ci	N/D	N/D	5.69E-07	N/D
Cobalt - 58	Ci	N/D	N/D	5.51E-06	N/D
Iron - 59	Ci	N/D	N/D	N/D	1.12E-06
Cobalt - 60	Ci	N/D	N/D	1.22E-05	4.73E-07
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 1C
NORTH ANNA POWER STATION
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
GROUND LEVEL GASEOUS EFFLUENT RELEASES FOR (01/12 - 12/12)

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	5.86E-06
Krypton - 85m	Ci	N/D	N/D	N/D	4.65E-06
Krypton - 87	Ci	N/D	N/D	N/D	N/D
Krypton - 88	Ci	N/D	N/D	N/D	3.16E-06
Xenon - 131m	Ci	N/D	N/D	N/D	N/D
Xenon - 133	Ci	N/D	N/D	4.30E-03	4.08E-03
Xenon - 133m	Ci	N/D	N/D	N/D	7.83E-05
Xenon - 135	Ci	N/D	N/D	4.83E-04	5.69E-04
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)	Ci				
Argon - 41	Ci	N/D	N/D	1.81E-04	2.53E-04
Total For Period	Ci	N/D	N/D	4.96E-03	4.99E-03
Iodines:					
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	N/D	N/D
Iodine - 134	Ci	N/D	N/D	N/D	N/D
Iodine - 135	Ci	N/D	N/D	N/D	N/D
Total For Period	Ci	N/D	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

TABLE 2A
NORTH ANNA POWER STATION
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
LIQUID EFFLUENT - SUMMATION OF ALL RELEASES FOR (01/11 - 12/11)

Page 1 of 2

	UNITS	1 ST QUARTER	2 ND QUARTER	ESTIMATED TOTAL PERCENT ERROR (%)
A. <u>Fission and Activation Products:</u>				
1. Total Release (not including tritium, noble gas, and gross alpha).	Curies	4.75E-03	2.75E-03	2.00E+01
2. Average diluted concentration during the period.	μCi/ml	1.63E-11	3.94E-12	
3. Percent of applicable limit (T.S.)	%	5.44E-05	9.54E-06	
B. <u>Tritium:</u>				
1. Total release activity.	Curies	2.39E+02	1.49E+02	2.00E+01
2. Average diluted concentration during the period.	μCi/ml	8.21E-07	2.14E-07	
3. Percent of applicable limit (T.S.)	%	8.21E-03	2.14E-03	
C. <u>Dissolved and Entrained Gases:</u>				
1. Total release activity.	Curies	0.00E+00	0.00E+00	2.00E+01
2. Average diluted concentration during the period.	μCi/ml	0.00E+00	0.00E+00	
3. Percent of applicable limit (T.S.)	%	0.00E+00	0.00E+00	
D. <u>Gross Alpha Radioactivity:</u>				
1. Total release activity.	Curies	0.00E+00	0.00E+00	2.00E+01
E. <u>Volume of waste released: (prior to dilution).</u>				
	Liters	1.18E+08	1.51E+08	3.00E+00
F. <u>Total volume of dilution water used during the period.</u>				
	Liters	2.91E+11	6.96E+11	3.00E+00

TABLE 2A
NORTH ANNA POWER STATION
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
LIQUID EFFLUENT - SUMMATION OF ALL RELEASES FOR (01/11 - 12/11)

Page 2 of 2

	UNITS	3 RD QUARTER	4 TH QUARTER	ESTIMATED TOTAL PERCENT ERROR (%)
A. <u>Fission and Activation Products:</u>				
1. Total Release (not including tritium, noble gas, and gross alpha).	Curies	7.61E-03	8.40E-04	2.00E+01
2. Average diluted concentration during the period.	μCi/ml	8.70E-12	1.53E-12	
3. Percent of applicable limit (T.S.)	%	2.69E-05	3.08E-06	
B. <u>Tritium:</u>				
1. Total release activity.	Curies	3.89E+01	3.24E+02	2.00E+01
2. Average diluted concentration during the period.	μCi/ml	4.45E-08	5.90E-07	
3. Percent of applicable limit (T.S.)	%	4.45E-04	5.90E-03	
C. <u>Dissolved and Entrained Gases:</u>				
1. Total release activity.	Curies	0.00E+00	0.00E+00	2.00E+01
2. Average diluted concentration during the period.	μCi/ml	0.00E+00	0.00E+00	
3. Percent of applicable limit (T.S.)	%	0.00E+00	0.00E+00	
D. <u>Gross Alpha Radioactivity:</u>				
1. Total release activity.	Curies	0.00E+00	0.00E+00	2.00E+01
E. Volume of waste released: (prior to dilution).				
	Liters	1.42E+08	1.46E+08	3.00E+00
F. Total volume of dilution water used during the period.				
	Liters	8.74E+11	5.49E+11	3.00E+00

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

NUCLIDES RELEASED	UNITS	CONTINUOUS MODE		BATCH MODE	
		1ST QUARTER	2ND QUARTER	1ST QUARTER	2ND QUARTER
Fission & Activation Products:					
Manganese - 54	Ci	N/D	N/D	N/A	N/A
Iron - 55	Ci	N/D	N/D	N/A	N/A
Cobalt - 58	Ci	1.27E-04	8.88E-04	N/A	N/A
Cobalt - 60	Ci	4.57E-03	1.86E-03	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
Niobium - 95	Ci	N/D	N/D	N/A	N/A
Ruthenium - 106	Ci	N/D	N/D	N/A	N/A
Silver - 110m	Ci	N/D	N/D	N/A	N/A
Iodine - 131	Ci	N/D	N/D	N/A	N/A
Iodine - 133	Ci	N/D	N/D	N/A	N/A
Cesium - 134	Ci	N/D	N/D	N/A	N/A
Cesium - 137	Ci	5.28E-05	N/D	N/A	N/A
Barium-Lathanum - 140	Ci	N/D	N/D	N/A	N/A
Cerium - 141	Ci	N/D	N/D	N/A	N/A
Other (Specify)	Ci				
Niickel - 63 (T1/2 > 8 days)	Ci	N/D	N/D	N/A	N/A
Total for Period	Ci	4.75E-03	2.75E-03	N/A	N/A

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

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 ³	1.60E+01 *	2.50E+01	
	Ci	1.59E+02	2.50E+01	
b. Dry compressible waste, contaminated equipment, etc.,	m ³	2.88E+02 **	2.50E+01	
	Ci	3.14E-01	2.50E+01	
c. Irradiated components, control rods, etc.,	m ³	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 Animal Carcasses	m ³	3.31E+00 ****	2.50E+01	
	Ci	2.43E-03	2.50E+01	
2. Estimate of major nuclide composition				
(by type of waste)	(%)	(Ci)	Estimated Total Percent Error (%)	
a.	Co-60	0.00E+00	5.96E+04	2.50E+01
	Co-58	0.00E+00	3.27E+04	2.50E+01
	Fe-55	0.00E+00	1.83E+04	2.50E+01
	Cs-137	0.00E+00	1.44E+04	2.50E+01
	Cs-134	0.00E+00	1.43E+04	2.50E+01
	Ni-63	0.00E+00	9.84E+03	2.50E+01
	Mn-54	3.75E+01	6.93E+03	2.50E+01
	H-3	2.06E+01	5.38E+02	2.50E+01
	C-14	1.15E+01	4.52E+02	2.50E+01
	Ni-59	9.04E+00	3.68E+02	2.50E+01
	b.	Co-60	3.01E+01	9.47E+01
Cr-51		1.57E+01	4.93E+01	2.50E+01
Co-58		1.52E+01	4.77E+01	2.50E+01
Nb-95		1.33E+01	4.19E+01	2.50E+01
Zr-95		1.03E+01	3.25E+01	2.50E+01
Fe-55		5.05E+00	1.59E+01	2.50E+01
Cs-137		3.92E+00	1.23E+01	2.50E+01
Mn-54		2.46E+00	7.74E+00	2.50E+01
Ni-63		1.54E+00	4.85E+00	2.50E+01
H-3		9.82E-01	3.09E+00	2.50E+01
Fe-59		6.11E-01	1.92E+00	2.50E+01
c.	NONE			
d.	H-3	3.48E+01	8.47E-01	2.50E+01
	Co-60	3.13E+01	7.60E-01	2.50E+01
	Co-58	7.82E+00	1.90E-01	2.50E+01
	Cs-137	4.80E+00	1.17E-01	2.50E+01
	Nb-95	3.96E+00	9.63E-02	2.50E+01
	Zr-95	2.97E+00	7.23E-02	2.50E+01
	Fe-55	2.50E+00	6.08E-02	2.50E+01
	Cr-51	2.20E+00	5.35E-02	2.50E+01
	C-14	1.46E+00	3.55E-02	2.50E+01
	Mn-54	1.10E+00	2.67E-02	2.50E+01
	Ni-63	1.00E+00	2.44E-02	2.50E+01
	Zn-65	1.82E-01	4.41E-03	2.50E+01
	Fe-59	8.40E-02	2.04E-03	2.50E+01
	Co-57	5.45E-02	1.32E-03	2.50E+01
	Cs-134	3.38E-02	8.22E-04	2.50E+01
	Sb-125	1.86E-02	4.51E-04	2.50E+01

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

3. Solid Waste Disposition

<u>Number of Shipments</u>	<u>Mode of Transportator</u>	<u>Destination</u>
1	Truck	Clive, UT
1	Truck	Erwin, TN
8	Truck	Oak Ridge, TN

B. Irradiated Fuel Shipments (Disposition)

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

* (1) shipment containing resins was shipped to a licensed waste processor for processing.

* (1) shipment of mechanical filters was shipped to a licensed disposal facility
- shipment included DAW, blast media, soil/gravel, sand, and charcoal

* (1) shipment of resin was shipped to a licensed waste processor for disposal.

** (6) shipments of dry compactable waste were shipped to a licensed processor.
- 1 shipment contained resins.
- 3 shipments contained biological material
- 3 shipments contained mechanical filters

**** (1) shipment of used oil was shipped to a licensed waste facility for disposal.

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

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
Total Body Dose (mrem)	8.47E-2	5.26E-2	1.58E-2	1.14E-1	2.68E-1
Critical Organ Dose (mrem)	8.56E-2	5.26E-2	2.55E-2	1.14E-1	2.78E-1

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Noble Gas Gamma Dose (mrad)	7.29E-6	8.45E-8	1.22E-6	5.14E-6	1.37E-5
Noble Gas Beta Dose (mrad)	2.02E-5	2.72E-7	1.86E-6	1.29E-5	3.25E-5
Critical Organ (Child bone) Dose for I-131, I-133, H-3, Particulates with T_{1/2} > 8 days (including C-14) (mrem)	5.06E-1	9.53E-3	2.84E-2	4.80E-1	1.02E+0

Critical Organ (Child thyroid) Dose for I-131, I-133, H-3, Particulates with T_{1/2} > 8 days (excluding C-14) (mrem)	2.98E-3	8.77E-4	2.95E-3	1.03E-3	7.83E-3
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ATTACHMENT 3

REVISIONS TO OFFSITE DOSE CALCULATION MANUAL

(ODCM)

(01/12 - 12/12)

As required by Technical Specification 5.5.1, revisions to the ODCM, effective for the time period covered by this report, are summarized in this attachment.

There were three revisions made to the ODCM in 2012.

Revision 19 was effective 01-25-2012, Revision 20 was effective 05-15-2012, and Revision 21 was effective 11-27-2012. Neither Revision 19, Revision 20, nor Revision 21 changed any sampling locations due to land use census dose calculations.

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

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 synopsized 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.

There were no major changes to the radioactive liquid, gaseous, and solid waste treatment systems for 2012.

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

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.

There was no radioactive liquid and/or gaseous effluent monitoring instrumentation out-of-service for more than 30 days during 2012.

ATTACHMENT 6

UNPLANNED RELEASES

(01/12 - 12/12)

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.

There were no unplanned releases during 2012 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 voluntary communication under the criteria of the NEI Ground Water Protection Initiative, NEI 07-07. Elevated results indicated in attachment 8 are a result of the on-going investigation/ mitigation for the voluntary communication made in 2010. The hydrological modeling indicates the horizontal groundwater movement around well #6 is < 1 inch per day so plume mitigation will take several months.

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

Gaseous Effluents:

Radioisotope	Required L.L.D. μCi/mL	Typical L.L.D. μCi/mL		
Krypton - 87	1.00E-4	2.50E-8	-	7.50E-8
Krypton - 88	1.00E-4	1.00E-7	-	4.50E-7
Xenon - 133	1.00E-4	5.00E-8	-	1.00E-7
Xenon - 133m	1.00E-4	2.00E-7	-	4.00E-7
Xenon - 135	1.00E-4	2.00E-8	-	5.00E-8
Xenon - 135m	1.00E-4	5.00E-8	-	2.00E-7
Xenon - 138	1.00E-4	1.00E-7	-	5.00E-7
Iodine - 131	1.00E-12	6.00E-14	-	1.00E-13
Iodine - 133	1.00E-10	1.00E-14	-	7.00E-13
Manganese - 54	1.00E-11	6.00E-14	-	8.00E-14
Cobalt - 58	1.00E-11	5.00E-14	-	8.00E-14
Iron - 59	1.00E-11	9.00E-14	-	2.00E-13
Cobalt - 60	1.00E-11	5.00E-14	-	2.00E-13
Zinc - 65	1.00E-11	9.00E-14	-	3.00E-13
Strontium - 89	1.00E-11	3.00E-14	-	8.00E-12
Strontium - 90	1.00E-11	3.00E-15	-	9.00E-12
Molybdenum - 99	1.00E-11	7.00E-14	-	2.00E-13
Cesium - 134	1.00E-11	5.00E-14	-	1.00E-13
Cesium - 137	1.00E-11	5.00E-14	-	8.00E-14
Cerium - 141	1.00E-11	5.00E-14	-	2.00E-13
Cerium - 144	1.00E-11	2.00E-13	-	5.00E-13
Gross Alpha	1.00E-11	7.00E-15	-	2.00E-14
Tritium	1.00E-6	4.00E-09	-	9.00E-09

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

Liquid Effluents:

Radioisotope	Required L.L.D. μCi/mL	Typical L.L.D. μCi/mL		
Krypton - 87	1.00E-5	4.00E-8	-	1.00E-7
Krypton - 88	1.00E-5	1.00E-7	-	1.00E-6
Xenon - 133	1.00E-5	7.00E-8	-	1.50E-7
Xenon - 133m	1.00E-5	9.00E-8	-	3.00E-7
Xenon - 135	1.00E-5	9.00E-9	-	5.00E-8
Xenon - 135m	1.00E-5	3.00E-8	-	2.00E-7
Xenon - 138	1.00E-5	1.00E-7	-	1.00E-6
Iodine - 131	1.00E-6	1.00E-8	-	5.00E-8
Manganese - 54	5.00E-7	2.00E-8	-	5.00E-8
Iron - 55	1.00E-6	3.00E-7	-	8.00E-7
Cobalt - 58	5.00E-7	2.00E-8	-	6.00E-8
Iron - 59	5.00E-7	3.00E-8	-	7.00E-8
Cobalt - 60	5.00E-7	1.00E-8	-	5.50E-8
Zinc - 65	5.00E-7	3.00E-8	-	6.00E-8
Strontium - 89	5.00E-8	1.00E-8	-	4.00E-8
Strontium - 90	5.00E-8	5.00E-9	-	9.00E-9
Molybdenum - 99	5.00E-7	2.00E-8	-	6.00E-8
Cesium - 134	5.00E-7	2.00E-8	-	5.00E-8
Cesium - 137	5.00E-7	3.00E-8	-	6.00E-8
Cerium - 141	5.00E-7	3.00E-8	-	9.00E-8
Cerium - 144	5.00E-7	1.00E-7	-	5.00E-7
Gross Alpha	1.00E-7	2.00E-8	-	7.00E-8
Tritium	1.00E-5	2.00E-6	-	5.00E-6

ATTACHMENT 8

RESULTS OF GROUND WATER PROTECTION INITIATIVE SAMPLE ANALYSIS (01/12 - 12/12)

The Ground Water Protection Program was established to improve North Anna's management of and response to instances where the inadvertent release of radioactive substances may result in low but detectible levels of plant-related materials in subsurface soils and water. It complies with the requirements of NEI 07-07, INDUSTRY GROUND WATER PROTECTION INITIATIVE - FINAL GUIDANCE DOCUMENT. The industry initiative is intended to improve public trust and confidence in the nuclear industry through sampling and analysis of ground water and timely and effective communication with stakeholders, including the public and local, state, and federal officials.

Samples are obtained from monitoring wells installed outside the restricted area on a quarterly basis and analyzed by Teledyne Brown Engineering Laboratories. Additional samples are obtained from wells located inside the restricted area and analyzed by Teledyne Brown. Samples are obtained from sumps and yard drains on a quarterly basis and analyzed onsite. Finally, samples may be obtained more frequently than normal, if required. These samples may be analyzed on-site or by a vendor such as Teledyne Brown. The required Lower Limits of Detection, LLDs, and reporting limits for the ground water detection program are those associated with the radiological environmental program as listed in Attachments 11 & 12 to VPAP-2103N, which is attached to this document.

On the following pages is a summary of the samples and results of the ground water protection program taken for calendar year 2012. All liquid results are reported in pCi/L, while soil results for tritium are reported in pCi/g of soil, wet. An "N/A" indicates a sample analysis was not performed for that sample. An "ND" indicates an analysis was performed but the result was less than the Minimum Detectable Activity, MDA, and the required LLD. If a result is greater than the MDA, but less than the LLD the result is listed. Some of these results may be false positives, due to the analysis software or interferences from naturally occurring radioactivity. In these cases, instead of the value, an explanatory footnote is provided.

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

1st Quarter 2012

Sample	Date	Sample Media	H-3 (pCi/L)	Gamma - Emitting Particulates	I-131	Sr-89/90	Fe-55	Ni-63	Alpha TRU	Pu-241
GWP-6	01/06/12	Water	44711	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	01/13/12	Water	41163	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-2	01/19/12	INSUFFICIENT VOLUME TO SAMPLE								
PZ-1	01/19/12	INSUFFICIENT VOLUME TO SAMPLE								
GWP-3	01/19/12	Water	< 1380	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	01/19/12	Water	< 1380	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-4	01/19/12	Water	< 1380	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-5A	01/19/12	Water	< 1380	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	01/19/12	Water	54466	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-7	01/19/12	Water	< 1380	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-8	01/19/12	Water	< 1380	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-9	01/19/12	Water	< 1380	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	01/25/12	Water	46372	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Discharge Canal Storm Drain Outfall	02/03/12	Water	3599	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 Intake Storm Drain Outfall	02/03/12	Water	< 1400	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 Intake Storm Drain Outfall	02/03/12	Water	< 1400	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	02/03/12	Water	< 1380	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-4	02/03/12	Water	< 1380	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	02/03/12	Water	42851	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	02/09/12	Water	< 1353	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-4	02/09/12	Water	< 1353	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	02/09/12	Water	48741	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	02/17/12	Water	< 1342	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-4	02/17/12	Water	< 1342	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	02/17/12	Water	45169	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-2	02/23/12	INSUFFICIENT VOLUME TO SAMPLE								
PZ-1	02/23/12	INSUFFICIENT VOLUME TO SAMPLE								
GWP-3	02/23/12	Water	< 1364	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	02/23/12	Water	< 1364	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-4	02/23/12	Water	< 1364	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-5A	02/23/12	Water	< 1364	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	02/23/12	Water	48078	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-7	02/23/12	Water	< 1364	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-8	02/23/12	Water	< 1364	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-9	02/23/12	Water	< 1364	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	02/27/12	Water	47538	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	03/01/12	Water	< 1388	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-4	03/01/12	Water	< 1388	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

1st Quarter 2012

Sample	Date	Sample Media	H-3	Gamma – Emitting Particulates	I-131	Sr-89/90	Fe-55	Ni-63	Alpha TRU	Pu-241
GWP-6	03/01/12	Water	43948	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	03/05/12	Water	53703	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 Auxiliary/Fuel Building Ground Water Monitoring Sump	03/07/12	Water	<1362	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 Auxiliary/Fuel Building Ground Water Monitoring Sump	03/07/12	Water	<1362	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 Outside Mat Sump	03/07/12	Water	<1362	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 Inside Mat Sump	03/07/12	Water	<1362	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 Mat Sump South	03/07/12	Water	<1362	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 Mat Sump East	03/07/12	Water	<1362	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	03/08/12	Water	57439	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	03/12/12	Water	1532	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	03/12/12	Water	63293	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	03/15/12	Water	1518	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	03/15/12	Water	69384	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-3	03/19/12	Water	< 1365	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	03/19/12	Water	< 1365	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-4	03/19/12	Water	< 1365	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-5A	03/19/12	Water	< 1365	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	03/19/12	Water	3530	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-8	03/19/12	Water	< 1365	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AFW Tunnel Sump #1	03/19/12	Water	< 1365	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AFW Tunnel Sump #1	03/19/12	Water	< 1365	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AFW Tunnel Sump #1	03/19/12	Water	< 1365	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-2	03/22/12	Water	< 1391	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-1	03/22/12	INSUFFICIENT VOLUME TO SAMPLE								
GWP-3	03/22/12	Water	< 1391	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	03/22/12	Water	12828	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-7	03/22/12	Water	< 1391	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-9	03/22/12	Water	< 1391	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

1st Quarter 2012

Sample	Date	Sample Media	H-3	Gamma – Emitting Particulates	I-131	Sr-89/90	Fe-55	Ni-63	Alpha TRU	Pu-241
PZ-2 ⁽¹⁾	03/22/12	Water	< 1340	ND	ND	N/A	N/A	N/A	N/A	N/A
GWP-6 ⁽¹⁾	03/25/12	Water	18800	ND	ND	N/A	N/A	N/A	N/A	N/A
PZ-3 ⁽¹⁾	03/25/12	Water	11500	ND	ND	N/A	N/A	N/A	N/A	N/A
PZ-3 ⁽²⁾	03/25/12	Water	13400	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BTW-1 ⁽¹⁾	03/25/12	Water	< 1340	ND	ND	N/A	N/A	N/A	N/A	N/A
BTW-2 ⁽¹⁾	03/25/12	Water	< 1330	ND	ND	N/A	N/A	N/A	N/A	N/A
BTW-4 ⁽¹⁾	03/25/12	Water	< 1300	ND	ND	N/A	N/A	N/A	N/A	N/A
TTW-1 ⁽¹⁾	03/25/12	INSUFFICIENT VOLUME TO SAMPLE								
TTW-2 ⁽¹⁾	03/25/12	Water	< 1340	ND	ND	N/A	N/A	N/A	N/A	N/A
TTW-3 ⁽¹⁾	03/25/12	Water	< 1300	ND	ND	N/A	N/A	N/A	N/A	N/A
TTW-4 ⁽¹⁾	03/25/12	Water	< 1320	ND	ND	N/A	N/A	N/A	N/A	N/A
TTW-5 ⁽¹⁾	03/25/12	Water	< 1330	ND	ND	N/A	N/A	N/A	N/A	N/A
GWP-6	03/26/12	Water	38634	N/A	N/A	N/A	N/A	N/A	N/A	N/A

- (1) Vendor Analyses
(2) Vendor 2nd analysis

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

2nd Quarter 2012

Sample	Date	Sample Media	H-3	Gamma –Emitting Particulates	I-131	Sr-89/90	Fe-55	Ni-63	Alpha TRU	Pu-241
GWP-6	04/02/2012	WATER	54,704	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	04/05/2012	WATER	60252	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	04/09/2012	WATER	60471	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	04/12/2012	WATER	64047	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	04/16/2012	WATER	58642	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	04/19/2012	WATER	< 1368	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-4	04/19/2012	WATER	< 1368	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-5	04/19/2012	WATER	< 1368	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	04/19/2012	WATER	42590	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-7	04/19/2012	WATER	< 1368	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3 ⁽¹⁾	04/19/2012	WATER	1360	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	04/23/2012	WATER	49207	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 MAT SUMP EAST	04/23/2012	WATER	< 1370	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 MAT SUMP SOUTH	04/23/2012	WATER	< 1370	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 ABGWMS	04/23/2012	WATER	< 1370	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 ABGWMS	04/23/2012	WATER	< 1370	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 MAT SUMP INSIDE	04/23/2012	WATER	< 1370	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 MAT SUMP OUTSIDE	04/23/2012	WATER	< 1370	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	04/26/2012	WATER	32500	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WATER FROM 1-QS-59 CARBOY ⁽²⁾	04/29/12	WATER	3.59E+7	Co-58 1.99E+4 Co-60 6.39E+4 Ag-110M 5.53E+3 Sb-124 7.53E+3 Nb-95 6.56E+3 Zr-95 2.77E+3 Cs-137 4.15E+3	ND	N/A	N/A	N/A	N/A	N/A
PZ-3	04/30/2012	WATER	< 1403	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	04/30/2012	WATER	50364	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	05/03/2012	WATER	< 1397	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	05/03/2012	WATER	51380	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	05/07/2012	WATER	< 1339	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	05/07/2012	WATER	43299	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	05/10/2012	WATER	< 1411	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	05/10/2012	WATER	40120	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	05/14/2012	WATER	< 1419	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	05/14/2012	WATER	39718	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 QSPH ROOF DRAINS	05/14/2012	WATER	< 1419	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SUBSURFACE DRAINS	05/14/2012	WATER	< 1419	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 OUTFALL	05/14/2012	WATER	< 1419	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 OUTFALL	05/14/2012	WATER	< 1419	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(1) Vendor Analysis

(2) Results are not ground water results, but sample was from installed catch container.

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

2nd Quarter 2012

Sample	Date	Sample Media	H-3	Gamma –Emitting Particulates	I-131	Sr-89/90	Fe-55	Ni-63	Alpha TRU	Pu-241
DISCHARGE CANAL OUTFALL	05/14/2012	WATER	2255	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	05/17/2012	WATER	< 1331	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	05/17/2012	WATER	55404	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	05/21/2012	WATER	< 1353	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	05/21/2012	WATER	55852	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	05/24/2012	WATER	< 1306	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	05/24/2012	WATER	53909	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	05/29/2012	WATER	45777	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	05/31/2012	WATER	45809	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	06/04/2012	WATER	46546	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	06/07/2012	WATER	42942	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 MAT SUMP EAST	06/07/2012	WATER	< 1362	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 MAT SUMP SOUTH	06/07/2012	WATER	< 1362	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 ABGWMS	06/07/2012	WATER	< 1362	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 ABGWMS	06/07/2012	WATER	< 1362	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 MAT SUMP INSIDE	06/07/2012	WATER	< 1362	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 MAT SUMP OUTSIDE	06/07/2012	WATER	< 1362	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-2 ⁽¹⁾	06/07/2012	WATER	< 805	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6 ⁽¹⁾	06/07/2012	WATER	46100	ND	ND	N/A	N/A	N/A	N/A	N/A
BTW-1 ⁽¹⁾	06/10/2012	WATER	< 831	ND	ND	N/A	N/A	N/A	N/A	N/A
BTW-2 ⁽¹⁾	06/10/2012	WATER	<805	ND	ND	N/A	N/A	N/A	N/A	N/A
BTW-4 ⁽¹⁾	06/10/2012	WATER	< 823	ND	ND	N/A	N/A	N/A	N/A	N/A
TTW-1 ⁽¹⁾	06/10/2012	WATER	Insufficient volume to sample							
TTW-2 ⁽¹⁾	06/10/2012	WATER	< 805	ND	ND	N/A	N/A	N/A	N/A	N/A
TTW-3 ⁽¹⁾	06/10/2012	WATER	< 802	ND	ND	N/A	N/A	N/A	N/A	N/A
TTW-4 ⁽¹⁾	06/10/2012	WATER	< 823	ND	ND	N/A	N/A	N/A	N/A	N/A
TTW-5 ⁽¹⁾	06/10/2012	WATER	< 812	ND	ND	N/A	N/A	N/A	N/A	N/A
PZ-1 ⁽¹⁾	06/11/2012	WATER	Insufficient volume to sample							
PZ-3 ⁽¹⁾	06/11/2012	WATER	1070	ND	ND	N/A	N/A	N/A	N/A	N/A
PZ-2	06/11/2012	WATER	< 1374	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	06/11/2012	WATER	< 1374	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-3	06/11/2012	WATER	< 1374	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-4	06/11/2012	WATER	< 1374	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-5A	06/11/2012	WATER	< 1374	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	06/11/2012	WATER	50616	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-7	06/11/2012	WATER	< 1374	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-8	06/11/2012	WATER	< 1374	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-9	06/11/2012	WATER	< 1374	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(1) Vendor analyses

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

2nd Quarter 2012

Sample	Date	Sample Media	H-3	Gamma -Emitting Particulates	I-131	Sr-89/90	Fe-55	Ni-63	Alpha TRU	Pu-241
GWP-6	06/14/2012	WATER	49678	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	6/18/2012	WATER	50464	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	6/21/2012	WATER	49527	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	6/25/2012	WATER	50648	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	6/28/2012	WATER	52180	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

3rd Quarter 2012

Sample	Date	Sample Media	H-3	Gamma -Emitting Particulates	I-131	Sr-89/90	Fe-55	Ni-63	Alpha TRU	Pu-241
GWP-6	07/02/2012	WATER	52532	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	07/05/2012	WATER	46660	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WATER FROM RWST BASE	07/05/2012	WATER	< 1267	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	07/09/2012	WATER	54306	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-3 Well 8 ¹	07/11/12	WATER	< 717	ND	ND	N/A	N/A	N/A	N/A	N/A
U-3 Well 8	07/12/12	WATER	< 1419	ND	ND	N/A	N/A	N/A	N/A	N/A
GWP-6	07/12/2012	WATER	42073	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	07/16/2012	WATER	40313	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-3 Well SS-1 (SWITCHYARD)	07/18/2012	WATER	< 993	ND	ND	N/A	N/A	N/A	N/A	N/A
U-3 Well SS-1 (SWITCHYARD)	07/18/2012	WATER	< 1310	ND	ND	N/A	N/A	N/A	N/A	N/A
GWP-6	07/19/2012	WATER	50145	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ISFSI Well #1 ⁽³⁾	07/19/25	WATER	< 999	ND	< 7.69	Sr-89/90: < 1.95 < 0.707	N/A	N/A	N/A	N/A
ISFSI Well #4 ⁽³⁾	07/19/25	WATER	< 996	ND	< 9.42	Sr-89/90: < 2.00 < 0.639	N/A	N/A	N/A	N/A
GWP-6	07/23/2012	WATER	39741	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	07/26/2012	WATER	52912	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6 -5"	07/30/2012	WATER	35410	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6 -2.25'	07/30/2012	WATER	54055	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	07/30/2012	WATER	65136	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Condensation from RWST HX	08/02/2012	WATER	< 1411	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6 -5"	08/02/2012	WATER	40601	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6 -2.25'	08/02/2012	WATER	57188	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	08/02/2012	WATER	65268	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6 (upper 5")	08/07/2012	WATER	86831	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	08/09/2012	WATER	61747	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 INTAKE YARD DRAIN OUTFALL	08/09/2012	WATER	< 1288	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 INTAKE YARD DRAIN OUTFALL	08/09/2012	WATER	< 1288	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DISCHARGE CANAL YARD DRAIN OUTFALL	08/09/2012	WATER	1578	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SUBSURFACE DRAINS	08/09/2012	WATER	< 1288	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	08/13/2012	WATER	60022	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	08/16/2012	WATER	57178	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	08/20/2012	WATER	50982	N/A	N/A	N/A	N/A	N/A	N/A	N/A
VACUUM PRIMING HOUSE DRAIN LINE ²	08/21/12	WATER	< 3370	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	08/23/2012	WATER	54261	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1-QS-35 Catch Container ²	08/23/2012	WATER	27768	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	08/27/2012	WATER	53918	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	08/30/2012	WATER	44543	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(1) Vendor Analysis

(2) Not a ground water sample

(3) Sample taken as part of agreement with Louisa County, VA. Not a GWPP program sample

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

3rd Quarter 2012

Sample	Date	Sample Media	H-3	Gamma -Emitting Particulates	I-131	Sr-89/90	Fe-55	Ni-63	Alpha TRU	Pu-241
GWP-6	09/03/2012	WATER	55390	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	09/07/2012	WATER	60745	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	09/10/2012	WATER	65799	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	09/13/2012	WATER	67043	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	09/17/2012	WATER	70930	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 AB/FB GWMS	09/17/2012	WATER	< 1338	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 AB/FB GWMS	09/17/2012	WATER	< 1338	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 MAT SUMP EAST	09/17/2012	WATER	< 1338	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 MAT SUMP SOUTH	09/17/2012	WATER	< 1338	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 MAT SUMP OUTSIDE	09/17/2012	WATER	< 1338	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 MAT SUMP INSIDE	09/17/2012	WATER	< 1338	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BTW-1 ¹	09/17/2012	WATER	< 749	ND	ND	N/A	N/A	N/A	N/A	N/A
BTW-2 ¹	09/17/2012	WATER	< 788	ND	ND	N/A	N/A	N/A	N/A	N/A
BTW-4 ¹	09/17/2012	WATER	< 803	ND	ND	N/A	N/A	N/A	N/A	N/A
TTW-1 ¹	09/17/2012	WATER	Insufficient volume to sample							
TTW-2 ¹	09/17/2012	WATER	< 787	ND	ND	N/A	N/A	N/A	N/A	N/A
TTW-3 ¹	09/17/2012	WATER	< 794	ND	ND	N/A	N/A	N/A	N/A	N/A
PZ-2	09/20/12	WATER	Insufficient volume to sample							
PZ-1	09/20/12	WATER	Insufficient volume to sample							
GWP-3	09/20/12	WATER		N/A	ND	N/A	N/A	N/A	N/A	N/A
PZ-3 ¹	09/20/12	WATER	< 1610	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3 ¹	09/20/12	WATER	1120	ND	ND	N/A	N/A	N/A	N/A	N/A
PZ-3	09/20/12	WATER	< 1327	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-4	09/20/12	WATER	< 1327	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-5A	09/20/12	WATER	< 1327	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	09/20/12	WATER	71387	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6 ¹	09/20/12	WATER	67000	ND	ND	ND	ND	ND	ND	ND
GWP-7	09/20/12	WATER	< 1327	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-8	09/20/12	WATER	< 1327	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-9	09/20/12	WATER	< 1327	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	09/24/12	WATER	59726	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	09/27/12	WATER	52120	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TTW-4 ²	10/01/2012	WATER	< 804	ND	ND	N/A	N/A	N/A	N/A	N/A
TTW-5 ²	10/01/2012	WATER	< 802	ND	ND	N/A	N/A	N/A	N/A	N/A

(1) Vendor analyses

(2) 3rd Quarter sample. Scheduled for 15th September. Sample taken within grace period.

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

3rd Quarter 2012

Sample	Date	Sample Media	Boron µg/L
U-1 AB/FB GWMS	09/17/2012	Water	187
U-2 AB/FB GWMS	09/17/2012	Water	93.0
U-1 MAT SUMP EAST	09/17/2012	Water	196
U-1 MAT SUMP SOUTH	09/17/2012	Water	176
U-2 MAT SUMP INSIDE	09/17/2012	Water	114
U-2 MAT SUMP OUTSIDE	09/17/2012	Water	101
GWP-3	09/20/2012	Water	96.1
PZ-3	09/20/2012	Water	181
GWP-4	09/20/2012	Water	59.3
GWP-5A	09/20/2012	Water	61.9
GWP-6	09/20/2012	Water	8440
GWP-7	09/20/2012	Water	47.9
GWP-8	09/20/2012	Water	73.4
GWP-9	09/20/2012	Water	77.9

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

4th Quarter 2012

Sample	Date	Sample Media	H-3 ⁽¹⁾	% Moisture	Gamma – Emitting Particulates	I-131	Sr-89/90	Fe-55	Ni-63	Alpha TRU	Pu-241
GWP-6	10/01/12	WATER	56959	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1-4	10/03/12	SOIL ⁽²⁾	< 2.45	16.67	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1-8	10/03/12	SOIL ⁽²⁾	< 4.11	15.71	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3-3	10/03/12	SOIL ⁽²⁾	< 2.10	8.46	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-3	10/03/12	SOIL ⁽²⁾	< 2.13	7.47	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6-4	10/04/12	SOIL ⁽²⁾	33.6	8.90	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6-8	10/04/12	SOIL ⁽²⁾	< 4.10	9.88	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7-4	10/04/12	SOIL ⁽²⁾	< 3.45	9.88	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7-8	10/04/12	SOIL ⁽²⁾	< 2.96	9.98	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9-4	10/04/12	SOIL ⁽²⁾	< 2.85	11.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9-8	10/04/12	SOIL ⁽²⁾	< 2.82	9.14	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10-4	10/04/12	SOIL ⁽²⁾	36.3	11.86	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10-8	10/04/12	SOIL ⁽²⁾	< 2.55	8.81	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11-4	10/04/12	SOIL ⁽²⁾	17.8	12.89	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11-8	10/04/12	SOIL ⁽²⁾	< 2.51	8.13	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12-4	10/04/12	SOIL ⁽²⁾	<3.38	13.31	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12-8	10/04/12	SOIL ⁽²⁾	< 2.62	9.45	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13-2	10/04/12	SOIL ⁽²⁾	<2.93	6.87	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14-2	10/04/12	SOIL ⁽²⁾	< 2.21	12.51	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15-2	10/04/12	SOIL ⁽²⁾	< 2.10	13.92	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16-2	10/04/12	SOIL ⁽²⁾	< 3.02	12.91	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	10/04/12	WATER	63896	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	10/08/12	WATER	43582	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	10/11/12	WATER	41341	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	10/15/12	WATER	35785	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	10/18/12	WATER	32026	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	10/22/12	WATER	27590	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	10/25/12	WATER	28710	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	11/01/12	WATER	28043	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	11/01/12	WATER	< 1363	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 INTAKE STORM DRAINS	11/01/12	WATER	< 1363	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 INTAKE STORM DRAINS	11/01/12	WATER	< 1363	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DISCHARGE CANAL STORM DRAINS	11/01/12	WATER	1784	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	11/05/12	WATER	28774	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	11/08/12	WATER	40619	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	11/13/12	WATER	33567	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(1) pCi/L for water samples, pCi/g for soil
(2) Vendor Analysis

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

4th Quarter 2012

Sample	Date	Sample Media	H-3	Gamma -Emitting Particulates	I-131	Sr-89/90	Fe-55	Ni-63	Alpha TRU	Pu-241
GWP-6	11/15/12	WATER	35671	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 Mat Sump South	11/15/12	WATER	<1350	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 Mat Sump east	11/15/12	WATER	<1350	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-1 AB/FB GWMS	11/15/12	WATER	<1350	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 Inside Mat Sump	11/15/12	WATER	<1350	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 Outside Mat Sump	11/15/12	WATER	<1350	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-2 AB/FB GWMS	11/15/12	WATER	<1350	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Subsurface drains	11/15/12	WATER	2296	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	11/19/12	WATER	36366	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	11/28/12	WATER	34573	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	12/04/12	WATER	28491	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BTW-4 ⁽¹⁾	12/04/12	WATER	< 784	ND	ND	N/A	N/A	N/A	N/A	N/A
TTW-4 ⁽¹⁾	12/04/12	WATER	< 833	ND	ND	N/A	N/A	N/A	N/A	N/A
TTW-5 ⁽¹⁾	12/04/12	WATER	< 784	ND	ND	N/A	N/A	N/A	N/A	N/A
BTW-1 ⁽¹⁾	12/05/12	WATER	< 788	ND	ND	N/A	N/A	N/A	N/A	N/A
BTW-2 ⁽¹⁾	12/05/12	WATER	< 792	ND	ND	N/A	N/A	N/A	N/A	N/A
TTW-1 ⁽¹⁾	12/05/12	WATER	Insufficient volume to sample							
TTW-3 ⁽¹⁾	12/05/12	WATER	< 841	ND	ND	N/A	N/A	N/A	N/A	N/A
TTW-2 ⁽¹⁾	12/06/12	WATER	< 782	ND	ND	N/A	N/A	N/A	N/A	N/A
PZ-2 ⁽¹⁾	12/09/12	WATER	Insufficient volume to sample							
PZ-1 ⁽¹⁾	12/09/12	WATER	Insufficient volume to sample							
GWP-3 ⁽¹⁾	12/09/12	WATER	< 926	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3 ⁽¹⁾	12/09/12	WATER	< 928	ND	ND	N/A	N/A	N/A	N/A	N/A
GWP-4 ⁽¹⁾	12/09/12	WATER	< 842	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-5A ⁽¹⁾	12/09/12	WATER	< 830	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6 ⁽¹⁾	12/09/12	WATER	22900	ND	ND	N/A	N/A	N/A	N/A	N/A
GWP-7 ⁽¹⁾	12/09/12	WATER	< 836	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-8 ⁽¹⁾	12/09/12	WATER	< 841	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-9 ⁽¹⁾	12/09/12	WATER	< 925	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	12/09/12	WATER	17438	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-3	12/09/12	WATER	< 1298	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PZ-3	12/09/12	WATER	1303	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-4	12/09/12	WATER	< 1298	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-5A	12/09/12	WATER	< 1298	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-7	12/09/12	WATER	< 1298	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-8	12/09/12	WATER	< 1298	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-9	12/09/12	WATER	< 1298	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	12/11/12	WATER	19655	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	12/20/12	WATER	13500	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GWP-6	12/27/12	WATER	14040	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(1) Vendor Analyses

ATTACHMENT 9
CARBON-14 CALCULATIONS
(01/12 - 12/12)

Carbon-14, C-14, is a naturally occurring isotope of carbon produced by cosmic ray interactions in the atmosphere. Nuclear weapons testing in the 1950s and 1960s significantly increased the amount of C-14 in the atmosphere. Due to its long half-life, 5730 years, a significant portion of the C-14 from this testing is still present in the environment. C-14 is also produced in commercial nuclear reactors, but the amounts produced are much less than those produced naturally or from weapons testing.

In Regulatory Guide 1.21, Revision 2, "Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste", the NRC has recommended that U.S. nuclear power plants evaluate whether C-14 is a "principal radionuclide", and if so, report the amount of C-14 released. At North Anna, improvements over the years in fuel performance have resulted in a decrease in the amount and distribution radionuclides released to the environment in gaseous effluents. As a result, C-14 has become a "principal radionuclide" for the gaseous effluent pathway at North Anna, as defined in Regulatory Guide 1.21, Rev. 2. Because the dose contribution of C-14 to liquid radioactive waste is a small fraction of the dose compared to other nuclides, evaluation of C-14 in liquid effluents is not required by Ref. Reg. Guide 1.21, Rev. 2.

The quantity of gaseous C-14 released to the environment can be estimated by use of a C-14 source term scaling factor based on power generation. North Anna utilized methodology in EPRI Report, Estimation of C-14 in Nuclear Power Gaseous Effluents. Based on this document, at full capacity, North Anna would generate and release about 23 Ci of C-14 per year. Since the units did not operate at full power for 100% of the year, this value was corrected for the capacity factor of each unit yielding an estimated 16.1 Ci of C-14 produced and released. North Anna assumed that the fractional release of gaseous C-14 in any quarter and pathway could be approximated by the fraction of noble gasses released via that pathway in that quarter.

Most C-14 species initially produced in a PWR are organic, e.g., methane. C-14 releases in PWRs occur primarily as a mix of organic carbon and carbon dioxide released from the waste gas system. C-14 in the primary coolant is essentially all organic with a large fraction as a gaseous species. Any time the RCS liquid or gas is exposed to an oxidizing environment, a slow transformation from an organic to an inorganic chemical form can occur. Various studies documenting measured C-14 releases from PWRs suggest a range of 70% to 95% organic. North Anna used a value of 70% organic and 30% CO₂ in its calculations.

- Public dose estimates from airborne C-14 were performed using dose models in NUREG-0133 and Regulatory Guide 1.109. The estimated C-14 dose impact on the maximum organ dose from airborne effluents released at North Anna is estimated to be $2.34E-1$ mrem from the inhalation pathway, or $1.56E-02\%$ TS of the 1500 mrem/yr dose rate limit and 1.02 mrem from the ingestion pathway or 3.40% TS of the 10CFR50, Appendix I, ALARA design objective of 15 mrem/yr per unit. In both cases the critical organ was determined to be the child's bone.



Miscellaneous

There were two entries on the Annual Effluent Release Report Log for 2012. 12-001 there was a typographical error on the 2010 Annual Radioactive Effluent Report where "2009" vice "2010" was reported for the year of the Land Use Census. 12-002 there was a footnote on Table 3 in the 2011 report that should have used (4) asterisks, when in fact it did not. This has been fixed for the 2012 Report.