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April 24, 2019
Serial: RA-19-0135

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Shearon Harris Nuclear Power Plant, Unit 1
Docket No. 50-400/Renewed License No. NPF-63

Subject: Annual Radioactive Effluent Release Report

Ladies and Gentlemen:

In accordance with Harris Nuclear Plant Technical Specification 6.9.1.4, Duke Energy Progress, LLC, is providing the enclosed Annual Radioactive Effluent Release Report for 2018.

This submittal contains no regulatory commitments. Please refer any questions regarding this submittal to Sarah McDaniel at (919) 362-2002.

Sincerely,

A handwritten signature in black ink that reads 'Brian C. McCabe'.

Brian C. McCabe

Enclosure

cc: J. Zeiler, NRC Sr. Resident Inspector, HNP
P. Cox, RAM Branch - Environmental, N.C. DHSR
M. Barillas, NRC Project Manager, HNP
NRC Regional Administrator, Region II



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Shearon Harris Nuclear Power Plant Unit 1

Annual Radioactive Effluent Release Report

January 1, 2018 through December 31, 2018

Docket 50-400



Introduction

The Annual Radioactive Effluent Release Report is pursuant to Shearon Harris Nuclear Power Plant Technical Specification 6.9.1.4 and ODCM Section F.2. The below listed attachments to this report provide the required information. In addition, the ODCM is included pursuant to Shearon Harris Nuclear Power Plant Technical Specification 6.14.

- Attachment 1 Summary of Gaseous and Liquid Effluents
- Attachment 2 Supplemental Information
- Attachment 3 Solid Radioactive Waste Disposal
- Attachment 4 Meteorological Data
- Attachment 5 Unplanned Offsite Releases
- Attachment 6 Assessment of Radiation Dose from Radioactive Effluents to Members of the Public
- Attachment 7 Information to Support the NEI Ground Water Protection Initiative
- Attachment 8 Inoperable Equipment
- Attachment 9 Summary of Changes to the Offsite Dose Calculation Manual
- Attachment 10 Summary of Changes to the Process Control Program
- Attachment 11 Summary of Major Modifications to the Radioactive Waste Treatment Systems
- Attachment 12 Errata to a Previous Year's ARERR

Attachment 1
Summary of Gaseous and Liquid Effluents

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

ATTACHMENT 1

Summary of Gaseous and Liquid Effluents

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

Attachment 1
Summary of Gaseous and Liquid Effluents

Shearon Harris Nuclear Power Plant Unit 1
 Period 1/1/2018 - 12/31/2018

Gaseous Effluents - Summation of All Releases

	<u>Units</u>	<u>Qtr 1</u>	<u>Qtr 2</u>	<u>Qtr 3</u>	<u>Qtr 4</u>	<u>Year</u>
A. Fission and Activation Gases						
1. Total Release	Ci	0.00E+00	9.13E-02	3.45E-02	3.96E-03	1.30E-01
2. Avg. Release Rate	μCi/sec	0.00E+00	1.16E-02	4.35E-03	4.99E-04	4.11E-03
B. Iodine-131						
1. Total Release	Ci	0.00E+00	8.76E-08	0.00E+00	0.00E+00	8.76E-08
2. Avg. Release Rate	μCi/sec	0.00E+00	1.11E-08	0.00E+00	0.00E+00	2.78E-09
C. Particulates Half-Life ≥ 8 days						
1. Total Release	Ci	0.00E+00	1.11E-05	0.00E+00	0.00E+00	1.11E-05
2. Avg. Release Rate	μCi/sec	0.00E+00	1.42E-06	0.00E+00	0.00E+00	3.52E-07
D. Tritium						
1. Total Release	Ci	3.56E+01	3.08E+01	2.82E+01	2.08E+01	1.15E+02
2. Avg. Release Rate	μCi/sec	4.58E+00	3.92E+00	3.55E+00	2.62E+00	3.66E+00
E. Gross Alpha						
1. Total Release	Ci	0.00+00	0.00+00	0.00+00	0.00+00	0.00E+00
2. Avg. Release Rate	μCi/sec	0.00+00	0.00+00	0.00+00	0.00+00	0.00E+00

Attachment 1
Summary of Gaseous and Liquid Effluents

Shearon Harris Nuclear Power Plant Unit 1
 Period 1/1/2018 - 12/31/2018

Gaseous Effluents - Elevated Releases - Continuous Mode *

	<u>Units</u>	<u>Qtr 1</u>	<u>Qtr 2</u>	<u>Qtr 3</u>	<u>Qtr 4</u>	<u>Year</u>
A. Fission and Activation Gases						
N/A	Ci	-	-	-	-	-
Total for Period	Ci	-	-	-	-	-
B. Iodines						
N/A	Ci	-	-	-	-	-
Total for Period	Ci	-	-	-	-	-
C. Particulates Half-Life \geq 8 days						
N/A	Ci	-	-	-	-	-
Total for Period	Ci	-	-	-	-	-
D. Tritium						
N/A	Ci	-	-	-	-	-
E. Gross Alpha						
Total for Period	Ci	-	-	-	-	-

* Shearon Harris Nuclear Power Plant Unit 1 does not have elevated releases.

Attachment 1
Summary of Gaseous and Liquid Effluents

Shearon Harris Nuclear Power Plant Unit 1
 Period 1/1/2018 - 12/31/2018

Gaseous Effluents - Elevated Releases - Batch Mode *

	<u>Units</u>	<u>Qtr 1</u>	<u>Qtr 2</u>	<u>Qtr 3</u>	<u>Qtr 4</u>	<u>Year</u>
A. Fission and Activation Gases						
N/A	Ci	-	-	-	-	-
Total for Period	Ci	-	-	-	-	-
B. Iodines						
N/A	Ci	-	-	-	-	-
Total for Period	Ci	-	-	-	-	-
C. Particulates Half-Life \geq 8 days						
N/A	Ci	-	-	-	-	-
Total for Period	Ci	-	-	-	-	-
D. Tritium						
N/A	Ci	-	-	-	-	-
E. Gross Alpha						
Total for Period	Ci	-	-	-	-	-

* Shearon Harris Nuclear Power Plant Unit 1 does not have elevated releases.

Attachment 1
Summary of Gaseous and Liquid Effluents

Shearon Harris Nuclear Power Plant Unit 1
 Period 1/1/2018 - 12/31/2018

Gaseous Effluents - Ground Releases - Continuous Mode

	<u>Units</u>	<u>Qtr 1</u>	<u>Qtr 2</u>	<u>Qtr 3</u>	<u>Qtr 4</u>	<u>Year</u>
A. Fission and Activation Gases						
Xe-133	Ci	0.00+00	0.00+00	3.45E-02	3.95E-03	3.85E-02
Total for Period	Ci	0.00+00	0.00+00	3.45E-02	3.95E-03	3.85E-02
B. Iodines						
None	Ci	-	-	-	-	-
Total for Period	Ci	0.00+00	0.00+00	0.00+00	0.00+00	0.00E+00
C. Particulates Half-Life ≥ 8 days						
None	Ci	-	-	-	-	-
Total for Period	Ci	0.00+00	0.00+00	0.00+00	0.00+00	0.00E+00
D. Tritium						
H-3	Ci	3.54E+01	3.03E+01	2.82E+01	2.08E+01	1.15E+02
E. Gross Alpha						
Total for Period	Ci	0.00+00	0.00+00	0.00+00	0.00+00	0.00E+00

Attachment 1
Summary of Gaseous and Liquid Effluents

Shearon Harris Nuclear Power Plant Unit 1
 Period 1/1/2018 - 12/31/2018

Gaseous Effluents - Ground Releases - Batch Mode

	<u>Units</u>	<u>Qtr 1</u>	<u>Qtr 2</u>	<u>Qtr 3</u>	<u>Qtr 4</u>	<u>Year</u>
A. Fission and Activation Gases						
Ar-41	Ci	0.00+00	9.11E-02	0.00+00	0.00+00	9.11E-02
Xe-131M	Ci	0.00+00	5.78E-05	0.00+00	0.00+00	5.78E-05
Xe-133	Ci	0.00+00	1.24E-04	7.55E-06	1.34E-05	1.45E-04
Total for Period	Ci	0.00+00	9.13E-02	7.55E-06	1.34E-05	9.13E-02
B. Iodines						
I-131	Ci	0.00+00	8.76E-08	0.00+00	0.00+00	8.76E-08
Total for Period	Ci	0.00+00	8.76E-08	0.00+00	0.00+00	8.76E-08
C. Particulates Half-Life ≥ 8 days						
Cr-51	Ci	0.00+00	4.51E-06	0.00+00	0.00+00	4.51E-06
Mn-54	Ci	0.00+00	3.49E-07	0.00+00	0.00+00	3.49E-07
Fe-59	Ci	0.00+00	8.00E-08	0.00+00	0.00+00	8.00E-08
Co-58	Ci	0.00+00	2.05E-06	0.00+00	0.00+00	2.05E-06
Co-60	Ci	0.00+00	1.44E-06	0.00+00	0.00+00	1.44E-06
Zr-95	Ci	0.00+00	1.04E-06	0.00+00	0.00+00	1.04E-06
Nb-95	Ci	0.00+00	1.64E-06	0.00+00	0.00+00	1.64E-06
Ru-103	Ci	0.00+00	1.71E-08	0.00+00	0.00+00	1.71E-08
Sb-125	Ci	0.00+00	2.13E-08	0.00+00	0.00+00	2.13E-08
Total for Period	Ci	0.00+00	1.11E-05	0.00+00	0.00+00	1.11E-05
D. Tritium						
H-3	Ci	1.74E-01	4.87E-01	1.36E-04	1.02E-04	6.61E-01
E. Gross Alpha						
Total for Period	Ci	0.00+00	0.00+00	0.00+00	0.00+00	0.00E+00

Attachment 1
Summary of Gaseous and Liquid Effluents

Shearon Harris Nuclear Power Plant Unit 1
 Period 1/1/2018 - 12/31/2018

Gaseous Effluents - Mixed-Mode Releases - Continuous Mode *

	<u>Units</u>	<u>Qtr 1</u>	<u>Qtr 2</u>	<u>Qtr 3</u>	<u>Qtr 4</u>	<u>Year</u>
A. Fission and Activation Gases						
N/A	Ci	-	-	-	-	-
Total for Period	Ci	-	-	-	-	-
B. Iodines						
N/A	Ci	-	-	-	-	-
Total for Period	Ci	-	-	-	-	-
C. Particulates Half-Life \geq 8 days						
N/A	Ci	-	-	-	-	-
Total for Period	Ci	-	-	-	-	-
D. Tritium						
N/A	Ci	-	-	-	-	-
E. Gross Alpha						
Total for Period	Ci	-	-	-	-	-

* Shearon Harris Nuclear Power Plant Unit 1 does not have mixed-mode releases.

Attachment 1
Summary of Gaseous and Liquid Effluents

Shearon Harris Nuclear Power Plant Unit 1
 Period 1/1/2018 - 12/31/2018

Gaseous Effluents - Mixed-Mode Releases - Batch Mode *

	<u>Units</u>	<u>Qtr 1</u>	<u>Qtr 2</u>	<u>Qtr 3</u>	<u>Qtr 4</u>	<u>Year</u>
A. Fission and Activation Gases						
N/A	Ci	-	-	-	-	-
Total for Period	Ci	-	-	-	-	-
B. Iodines						
N/A	Ci	-	-	-	-	-
Total for Period	Ci	-	-	-	-	-
C. Particulates Half-Life \geq 8 days						
N/A	Ci	-	-	-	-	-
Total for Period	Ci	-	-	-	-	-
D. Tritium						
N/A	Ci	-	-	-	-	-
E. Gross Alpha						
Total for Period	Ci	-	-	-	-	-

* Shearon Harris Nuclear Power Plant Unit 1 does not have mixed-mode releases.

Attachment 1
Summary of Gaseous and Liquid Effluents

Shearon Harris Nuclear Power Plant Unit 1
 Period 1/1/2018 - 12/31/2018

Liquid Effluents - Summation of All Releases

	<u>Units</u>	<u>Qtr 1</u>	<u>Qtr 2</u>	<u>Qtr 3</u>	<u>Qtr 4</u>	<u>Year</u>
A. Fission and Activation Products *						
1. Total Release	Ci	3.22E-03	3.81E-03	5.31E-04	3.05E-04	7.87E-03
2. Avg. Diluted Conc.	µCi/ml	6.43E-10	8.14E-10	1.06E-10	5.97E-11	3.97E-10
B. Tritium						
1. Total Release	Ci	3.11E+02	8.05E+01	2.23E+01	1.41E+01	4.28E+02
2. Avg. Diluted Conc.	µCi/ml	6.22E-05	1.72E-05	4.44E-06	2.75E-06	2.16E-05
C. Dissolved & Entrained Gases						
1. Total Release	Ci	1.86E-03	0.00E+00	0.00E+00	0.00E+00	1.86E-03
2. Avg. Diluted Conc.	µCi/ml	3.72E-10	0.00E+00	0.00E+00	0.00E+00	9.38E-11
D. Gross Alpha						
1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2. Avg. Diluted Conc.	µCi/ml	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E. Volume of Liquid Waste						
1. Batch Releases	liters	1.24E+06	1.28E+06	1.05E+06	4.65E+05	4.04E+06
2. Continuous Releases	liters	1.36E+07	1.37E+07	1.30E+07	1.20E+07	5.22E+07
F. Volume of Dilution Water						
1. Batch Releases	liters	5.01E+09	4.68E+09	5.02E+09	5.12E+09	1.98E+10
2. Continuous Releases	liters	5.01E+09	4.68E+09	5.02E+09	5.12E+09	1.98E+10

* Excludes tritium, dissolved and entrained noble gases, and gross alpha.

**Attachment 1
Summary of Gaseous and Liquid Effluents**

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

Liquid Effluents - Continuous Mode

	<u>Units</u>	<u>Qtr 1</u>	<u>Qtr 2</u>	<u>Qtr 3</u>	<u>Qtr 4</u>	<u>Year</u>
A. Fission and Activation Products						
None	Ci	-	-	-	-	-
Total for Period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
B. Tritium						
H-3	Ci	1.32E-02	7.10E-02	4.98E-02	4.11E-02	1.75E-01
C. Dissolved & Entrained Gases						
None	Ci	-	-	-	-	-
Total for Period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
D. Gross Alpha						
Total for Period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Attachment 1
Summary of Gaseous and Liquid Effluents

Shearon Harris Nuclear Power Plant Unit 1
 Period 1/1/2018 - 12/31/2018

Liquid Effluents - Batch Mode

	<u>Units</u>	<u>Qtr 1</u>	<u>Qtr 2</u>	<u>Qtr 3</u>	<u>Qtr 4</u>	<u>Year</u>
A. Fission and Activation Products						
Cr-51	Ci	6.35E-05	1.28E-03	0.00+00	0.00+00	1.34E-03
Mr-54	Ci	1.06E-04	5.45E-05	0.00+00	6.43E-06	1.67E-04
Fe-55	Ci	9.75E-04	4.75E-04	0.00+00	1.33E-04	1.58E-03
Fe-59	Ci	0.00+00	8.53E-06	0.00+00	0.00+00	8.53E-06
Co-58	Ci	3.03E-04	5.81E-04	8.42E-05	6.72E-06	9.75E-04
Co-60	Ci	1.06E-03	9.39E-04	1.96E-04	1.59E-04	2.35E-03
Ni-63	Ci	3.34E-04	8.55E-05	2.51E-04	0.00+00	6.71E-04
As-76	Ci	4.02E-05	0.00+00	0.00+00	0.00+00	4.02E-05
Zr-95	Ci	7.07E-05	1.18E-04	0.00+00	0.00+00	1.89E-04
Nb-95	Ci	1.32E-04	2.21E-04	0.00+00	0.00+00	3.53E-04
Sb-124	Ci	9.95E-06	0.00+00	0.00+00	0.00+00	9.95E-06
Sb-125	Ci	1.23E-04	3.59E-05	0.00+00	0.00+00	1.59E-04
Cs-137	Ci	0.00+00	2.72E-06	0.00+00	0.00+00	2.72E-06
Total for Period	Ci	3.22E-03	3.81E-03	5.31E-04	3.05E-04	7.87E-03
B. Tritium						
H-3	Ci	3.11E+02	8.05E+01	2.23E+01	1.41E+01	4.28E+02
C. Dissolved & Entrained Gases						
Xe-133	Ci	1.86E-03	0.00+00	0.00+00	0.00+00	1.86E-03
Total for Period	Ci	1.86E-03	0.00+00	0.00+00	0.00+00	1.86E-03
Gross Alpha						
D. Total for Period	Ci	0.00+00	0.00+00	0.00+00	0.00+00	0.00E+00

**Attachment 2
Supplemental Information**

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

ATTACHMENT 2

Supplemental Information

This attachment includes supplemental information to the gaseous and liquid effluents report.

**Attachment 2
Supplemental Information**

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

I. Regulatory Limits - Per Unit

A. Noble Gases - Air Dose

- | | | |
|--------------------------------|---|---------|
| 1. Calendar Quarter Gamma Dose | = | 5 mRAD |
| 2. Calendar Quarter Beta Dose | = | 10 mRAD |
| 3. Calendar Year Gamma Dose | = | 10 mRAD |
| 4. Calendar Year Beta Dose | = | 20 mRAD |

B. Liquid Effluents - Dose

- | | | |
|-------------------------------------|---|----------|
| 1. Calendar Quarter Total Body Dose | = | 1.5 mREM |
| 2. Calendar Quarter Organ Dose | = | 5 mREM |
| 3. Calendar Year Total Body Dose | = | 3 mREM |
| 4. Calendar Year Organ Dose | = | 10 mREM |

C. Gaseous Effluents - Iodine-131 & 133, Tritium, and Particulates with Half-lives > 8 days

- | | | |
|--------------------------------|---|----------|
| 1. Calendar Quarter Organ Dose | = | 7.5 mREM |
| 2. Calendar Year Organ Dose | = | 15 mREM |

II. Maximum Permissible Effluent Concentrations

A. Gaseous Effluents

1. Information found in Offsite Dose Calculation Manual

B. Liquid Effluents

1. Information found in 10 CFR Part 20, Appendix B, Table 2, Column 2

III. Average Energy

(not applicable)

IV. Measurements and Approximations of Total Radioactivity

Analyses of specific radionuclides in selected or composited samples as described in the ODCM are used to determine the radionuclide composition of the effluent. A summary description of the method used for estimating overall errors associated with radioactivity measurements is provided as part of this attachment.

**Attachment 2
Supplemental Information**

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

V. Batch Releases

A. Liquid Effluents

		Jan - Jun	Jul - Dec
1. Number of Batch Releases	=	33	20
2. Total Time Period for Batch Releases	=	2.66E+04 min	1.56E+04 min
3. Maximum Time Period for a Batch Release	=	8.86E+02 min	1.08E+03 min
4. Average Time Period for a Batch Release	=	8.05E+02 min	7.81E+02 min
5. Minimum Time Period for a Batch Release	=	7.00E+02 min	5.37E+02 min
6. Average Stream Flow During Release Periods	=	9.55E+03 gpm	9.84E+03 gpm

B. Gaseous Effluents

		Jan - Jun	Jul - Dec
1. Number of Batch Releases	=	29	4
2. Total Time Period for Batch Releases	=	2.25E+04 min	1.25E+03 min
3. Maximum Time Period for a Batch Release	=	5.51E+03 min	3.46E+02 min
4. Average Time Period for a Batch Release	=	7.77E+02 min	3.13E+02 min
5. Minimum Time Period for a Batch Release	=	8.90E+01 min	2.67E+02 min

VI. Abnormal Releases

See Attachment 5, Unplanned Offsite Releases.

Attachment 2 Supplemental Information

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

Carbon-14

The Shearon Harris Nuclear Power Plant 2018 ARERR contains estimates of C-14 radioactivity released in 2018, and estimates of public dose resulting from the C-14 effluent. The concentration and offsite dose from C-14 has been estimated by using a calculation approach, assuming typical or maximum values for the various calculation parameters. Because the dose contribution of C-14 from liquid radioactive waste is much less than that contributed by gaseous radioactive waste, evaluation of C-14 in liquid radioactive waste is not required (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 (Ref. Reg. Guide 1.21, Rev. 2). The Shearon Harris Nuclear Power Plant UFSAR Section 11.1.5 states the expected C-14 generation to be 7.3 Curies assuming 292 effective full power days (EFPD) in a calendar year. For the Shearon Harris Nuclear Power Plant 2018 ARERR, a source term scaling factor using actual EFPD of 324.808 days is assumed. Using the source term scaling factor from Shearon Harris Nuclear Power Plant in 2018 results in a site total C-14 gaseous release estimate to the environment of 8.12 Curies. Due to the reducing environment of a Pressured Water Reactor, only 30% of the C-14 is assumed to be released in the Carbon Dioxide (CO₂) form. Dose is not expected from other forms (methane, etc). 70% of the C-14 gaseous effluent is assumed to be from batch releases and the remaining 30% is assumed to be from continuous releases through the plant vent (ref. IAEA Technical Reports Series no. 421, "Management of Waste Containing Tritium and Carbon-14", 2004).

The resultant offsite doses were based upon this source term and the dose calculations described in NRC Regulatory Guide 1.109, Revision 1, and the Shearon Harris Nuclear Power Plant ODCM. The estimated C-14 dose impact on the maximum organ dose from airborne effluents released from Shearon Harris Nuclear Power Plant in 2018 is well below the 10CFR 50, Appendix I, ALARA design objective (i.e., 15 mrem/yr per unit).

	<u>Units</u>	<u>1st Qtr</u>	<u>2nd Qtr</u>	<u>3rd Qtr</u>	<u>4th Qtr</u>	<u>Year</u>
1. EFPD	Days	84.822	56.078	91.936	91.972	324.808
2. C-14 Activity Released	Ci	2.12E+00	1.40E+00	2.30E+00	2.30E+00	8.12E+00
3. C-14 Total Body Dose	mREM	8.69E-03	5.81E-03	9.73E-03	9.51E-03	3.37E-02
4. C-14 Organ Dose	mREM	4.36E-02	2.92E-02	4.88E-02	4.77E-02	1.69E-01

Receptor Location **2.82 km W**
Critical Age **CHILD**
Critical Organ **BONE**

Attachment 2 Supplemental Information

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

Dose from Returned/Re-used of Previously Discharge Plant Effluents

Cooling Tower Plume

Tritium in Cooling Tower plume creates an exposure pathway to a member of the public. Murray and Trettle, Inc. was contracted to perform an evaluation of the dose to a member of the public from exposure to tritium in the Cooling Tower plume. Results of the plume exposure are contained in report "*Impact of Tritium Release from the Cooling Tower at the Harris Nuclear Plant for 2018*". Using the methodology described in ODCM 2.3.2, the following is a summary of tritium activity released through the Cooling Tower plume and resulting dose for 2018.

	<u>Units</u>	<u>Qtr 1</u>	<u>Qtr 2</u>	<u>Qtr 3</u>	<u>Qtr 4</u>	<u>Year</u>
1. H-3 Activity Released	Ci	7.65E-01	5.71E-01	7.18E-01	4.27E-01	2.48E+00
2. H-3 Dose	mREM	9.74E-04	7.35E-04	9.34E-04	5.55E-04	3.20E-03

Receptor Location **2.91 km NNE**
Critical Age **CHILD**
Critical Organ **N/A ***

Harris Lake Evaporation

Evaporation of water containing tritium in Harris Lake creates an exposure pathway to a member of the public. Murray and Trettle, Inc. was contracted to perform an evaluation of the dose to a member of the public from evaporation of tritium in Harris Lake. Results of the evaluation are contained in report "*Impact of Tritium Release from the Water Reservoir (Lake Harris) at the Harris Nuclear Plant for 2018*". Using the methodology described in ODCM 2.3.3, the following is a summary of tritium activity released through evaporation and resulting dose for 2018.

	<u>Units</u>	<u>Qtr 1</u>	<u>Qtr 2</u>	<u>Qtr 3</u>	<u>Qtr 4</u>	<u>Year</u>
1. H-3 Activity Released	Ci	3.73E+01	6.53E+01	4.65E+01	1.35E+01	1.63E+02
2. H-3 Dose	mREM	1.30E-02	2.28E-02	1.57E-02	4.37E-03	5.59E-02

Receptor Location **6.65 km SSW**
Critical Age **CHILD**
Critical Organ **N/A ***

Drinking Water at Harris Plant and the Harris Energy and Environmental (HE&EC) Training Centers

Concentrations of radionuclides used in this specific drinking water pathway are determined by averaging the monthly concentrations detected in environmental location (REMP) DW-51. In 2018, no plant related gamma emitting radionuclides were detected. Tritium was detected each month, as expected. Using the methodology described in ODCM 2.3.1, the following is a summary of average concentration consumed and resulting dose for 2018.

	<u>Units</u>	<u>Year</u>
1. Avg. H-3 Concentration	pCi/L	3.23E+03
2. H-3 Dose	mREM	8.86E-02

Critical Age **ADULT**
Critical Organ **N/A ***

* The dose factor for H-3 is the same for all organs and Total Body (with the exception of Bone, which is 0.00E+00).

Attachment 2 Supplemental Information

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

Tritium in Fish from Harris Lake

Concentrations of radionuclides used in this specific fish consumption pathway are determined by averaging the monthly concentrations detected in environmental location (REMP) SW-26. In 2018, no plant related gamma emitting radionuclides were detected. Tritium was detected each month, as expected. Since tritium is consistently detected in Harris Lake REMP samples, tritium concentration in the fish is assumed to be in equilibrium with Harris Lake. Using the methodology and data described in NRC Regulatory Guide 1.109, Rev.1, October 1977, Equation A-1, Table E-5, and Table E-11, the following is a summary of average concentration consumed and resulting dose for 2018.

	<u>Units</u>	<u>Year</u>
1. Avg. H-3 Concentration	pCi/L	7.47E+03
2. H-3 Dose	mREM	1.48E-02

Critical Age **ADULT**
Critical Organ **N/A** *

* The dose factor for H-3 is the same for all organs and Total Body (with the exception of Bone, which is 0.00E+00).

Attachment 2 Supplemental Information

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

Overall Estimate of Error for Gaseous Effluent Radioactivity Release Reported

The estimated percentage of overall error for Noble Gases in Gaseous effluent release data at Shearon Harris Nuclear Power Plant has been determined to be $\pm 52.68\%$. This value was derived by taking the square root of the sum of the squares of the following discrete individual estimates of error:

- | | | |
|--|---|--------------|
| 1. Counting Standard (20000 counts/energy % error) | = | $\pm 0.1\%$ |
| 2. Calibration Standard | = | $\pm 5.0\%$ |
| 3. Acceptable Counting Statistic for Nuclide ID (R.E.) | = | $\pm 25.0\%$ |
| 4. Sample Volume Variability | = | $\pm 5.0\%$ |
| 5. Stack Flow Rates (Non-steady Release Rates) | = | $\pm 10.0\%$ |
| 6. Rad Monitor Calibration | = | $\pm 20.0\%$ |
| 7. Net Activity Determination from Rad Monitors | = | $\pm 40.0\%$ |

The estimated percentage of overall error for Air Particulates in Gaseous effluent release data at Shearon Harris Nuclear Power Plant has been determined to be $\pm 33.75\%$. This value was derived by taking the square root of the sum of the squares of the following discrete individual estimates of error:

- | | | |
|--|---|--------------|
| 1. Counting Standard (20000 counts/energy % error) | = | $\pm 0.1\%$ |
| 2. Calibration Standard | = | $\pm 5.0\%$ |
| 3. Acceptable Counting Statistic for Nuclide ID (R.E.) | = | $\pm 25.0\%$ |
| 4. Sample Flow (Sample Volume) | = | $\pm 10.0\%$ |
| 5. Potential Sample Line Losses | = | $\pm 8.0\%$ |
| 6. Stack Flow Rates (Non-steady Release Rates) | = | $\pm 10.0\%$ |
| 7. Chemical Yield Factors (Sr-89, 90) | = | $\pm 15.0\%$ |

The estimated percentage of overall error for Iodine on Charcoal Filters in Gaseous effluent release data at Shearon Harris Nuclear Power Plant has been determined to be $\pm 30.38\%$. This value was derived by taking the square root of the sum of the squares of the following discrete individual estimates of error:

- | | | |
|--|---|--------------|
| 1. Counting Standard (20000 counts/energy % error) | = | $\pm 0.1\%$ |
| 2. Calibration Standard | = | $\pm 5.0\%$ |
| 3. Acceptable Counting Statistic for Nuclide ID (R.E.) | = | $\pm 25.0\%$ |
| 4. Sample Flow (Sample Volume) | = | $\pm 10.0\%$ |
| 5. Potential Sample Line Losses | = | $\pm 8.0\%$ |
| 6. Stack Flow Rates (Non-steady Release Rates) | = | $\pm 10.0\%$ |
| 7. Collection Efficiency | = | $\pm 3.0\%$ |

The estimated percentage of overall error for Tritium in Gaseous effluent release data at Shearon Harris Nuclear Power Plant has been determined to be $\pm 52.20\%$. This value was derived by taking the square root of the sum of the squares of the following discrete individual estimates of error:

- | | | |
|--|---|--------------|
| 1. Counting Standard (20000 counts/energy % error) | = | $\pm 0.1\%$ |
| 2. Calibration Standard | = | $\pm 5.0\%$ |
| 3. Acceptable Counting Statistic for Nuclide ID (R.E.) | = | $\pm 50.0\%$ |
| 4. Stack Flow Rates (Non-steady Release Rates) | = | $\pm 10.0\%$ |
| 5. Collection Efficiency | = | $\pm 10.0\%$ |

Attachment 2
Supplemental Information

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

Overall Estimate of Error for Liquid Effluent Radioactivity Release Reported

The estimated percentage of overall error for Fission and Activation Products in Liquid effluent release data at Shearon Harris Nuclear Power Plant has been determined to be $\pm 32.79\%$. This value was derived by taking the square root of the sum of the squares of the following discrete individual estimates of error:

- | | | |
|--|---|--------------|
| 1. Counting Standard (20000 counts/energy % error) | = | $\pm 0.1\%$ |
| 2. Calibration Standard | = | $\pm 5.0\%$ |
| 3. Acceptable Counting Statistic for Nuclide ID (R.E.) | = | $\pm 25.0\%$ |
| 4. Sample (sample volume between techs) | = | $\pm 5.0\%$ |
| 5. Volume Determinations (Tank Level) | = | $\pm 20.0\%$ |

The estimated percentage of overall error for Tritium in Liquid effluent release data at Shearon Harris Nuclear Power Plant has been determined to be $\pm 54.31\%$. This value was derived by taking the square root of the sum of the squares of the following discrete individual estimates of error:

- | | | |
|--|---|--------------|
| 1. Counting Standard (20000 counts/energy % error) | = | $\pm 0.1\%$ |
| 2. Calibration Standard | = | $\pm 5.0\%$ |
| 3. Acceptable Counting Statistic for Nuclide ID (R.E.) | = | $\pm 50.0\%$ |
| 4. Sample (sample volume between techs) | = | $\pm 5.0\%$ |
| 5. Volume Determinations (Tank Level) | = | $\pm 20.0\%$ |

Attachment 2
Supplemental Information

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

Overall Estimate of Error for Solid Waste Radioactivity Reported

The estimated percentage of overall error for Solid Waste data at Shearon Harris Nuclear Power Plant has been determined to be $\pm 96\%$. This value was derived by taking the square root of the sum of the squares of the following discrete individual estimates of error:

- | | | |
|--|---|---------------|
| 1. Counting Standard (20000 counts/energy % error) | = | < $\pm 0.1\%$ |
| 2. Calibration Standard | = | $\pm 5.0\%$ |
| 3. Acceptable Counting Statistic for Nuclide ID (R.E.) | = | $\pm 95.0\%$ |
| 4. Sample Volume Variability | = | $\pm 0.001\%$ |
| 5. Instrument Errors | = | $\pm 5.0\%$ |
| 6. Dose Rate Measurement | = | $\pm 10.0\%$ |
| 7. Geometry | = | $\pm 5.0\%$ |
| 8. Volume Determinations | = | $\pm 5.0\%$ |
| 9. RADMAN Database (sample analysis variance) | = | $\pm 0.96\%$ |

Attachment 2 Supplemental Information

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

Summary of Changes in Land Use Census Affecting Effluent Dose Calculations

The 2018 Land Use Census was performed July 24-25, 2018. The following are changes to residences, gardens, and milk animals from the previous year.

RESIDENCES

- The residence in the NE Sector (2.43 miles) was replaced by a new residence at 2.29 miles.

GARDENS

NOTE: There were no gardens identified by the census as being irrigated from Harris Lake (Shearon Harris Reservoir).

- The garden in the ENE sector (2.06 miles) was not cultivated this year (2018) and a replacement garden could not be located in this sector.
- The garden in the W sector (2.75 miles) was not cultivated this year (2018) and was replaced with a garden at 4.19 miles.
- The garden in the WNW sector (4.33 miles) was replaced with a garden at 3.75 miles.

MEAT ANIMALS

NOTE: Meat animals were only identified at the nearest garden or closer in each sector, and poultry and egg laying animals were not classified as meat animals for the 2018 census.

- The meat animals (goats) in the SE sector at 4.11 miles were no longer present.

MILK ANIMALS

- The milk animals (goats) located in the N sector (4.14 miles) were still present, and the owner indicated they are now processing enough milk to participate in the REMP. This dairy is not required to be added to the REMP due to HNP already having a dairy within 5 km (3.11 miles) and the dose being <1.0 mRem/year.
- The milk animals (goats) located in the W sector (2.82 miles) were still present, and currently participate in the HNP REMP Environmental Program. The goat milk is used to feed goat kids during the breeding months, and the remainder is consumed by the family. They also give the non-consumable milk to someone who makes soap.

No other changes to environmental monitoring locations in each sector.

Attachment 3
Solid Radioactive Waste Disposal

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

ATTACHMENT 3

Solid Radioactive Waste Disposal

This attachment includes a summary of the solid waste shipped off-site for burial and/or disposal, including:

- Container volume
- Total Curie content
- Principal Radionuclides
- Source/Type of waste
- Solidification agent or absorbent
- Type of shipping container
- Number of shipments
- Other relevant information as necessary

Attachment 3 Solid Radioactive Waste Disposal

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

1. Solid Waste Shipped for Burial or Disposal (WASTE CLASS A)

NOTE: Values reported in Table 3 section 1.A.a, b, c & 1.B.a, b, c refer to radioactive solid waste materials shipped in 2018 to a vendor for processing and subsequent burial.

A. Type of Waste

a. Spent resins.

Note: * No waste of this type was shipped during the report period.

b. Dry Active Waste (DAW), mechanical filters, contaminated equipment, etc.
Note: Waste shipped in 2018 for processing and subsequent burial.

Number of Shipments	4
Activity Shipped	5.97 E-01 Curies
Estimated Total Error	96%
Quantity Shipped	152.094 m ³
Solidification Agent	N/A
Container Type	General Design
Shipment Form	Compacted, Non-Compacted

c. Irradiated components, control rods, etc. (Ex-core detector)
Note: Waste shipped in 2018 for processing and subsequent burial.

Number of Shipments	1
Activity Shipped	6.78 E-02 Curies
Estimated Total Error	96%
Quantity Shipped	0.02 m ³
Solidification Agent	N/A
Container Type	General Design
Shipment Form	Macro-Encapsulation

d. Other: GAC Vessels
Note: Waste shipped in 2018 for processing and subsequent burial.

Number of Shipments	1
Activity Shipped	2.01 E-01 Curies
Estimated Total Error	96%
Quantity Shipped	1.26 m ³
Solidification Agent	N/A
Container Type	General Design
Shipment Form	Dewatered, Non- Compacted

Attachment 3 Solid Radioactive Waste Disposal

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

1. Solid Waste Shipped for Burial or Disposal (WASTE CLASS A)

B. Estimate of Major Nuclide Composition (by type of Waste)

a. Spent Radwaste Bead Resin.

* No waste of this type was shipped during this report period.

b. Dry Active Waste (DAW), mechanical filters, contaminated equipment, etc.

Note: Waste shipped in 2018 for processing and subsequent burial.

Class A DAW Totals			
Isotope	Activity(mci)	Activity (Ci)	Abundance
C-14	2.46E+00	2.46E-03	0.41%
Ce-144	3.28E+00	3.28E-03	0.55%
Co-58	1.31E+01	1.31E-02	2.20%
Co-60	9.81E+01	9.81E-02	16.42%
Cr-51	2.73E+01	2.73E-02	4.56%
Cs-137	5.53E+00	5.53E-03	0.93%
Fe-55	1.28E+02	1.28E-01	21.38%
H-3	4.58E+01	4.58E-02	7.67%
I-129	1.61E-01	1.61E-04	0.03%
Mn-54	7.15E+00	7.15E-03	1.20%
Nb-95	1.38E+02	1.38E-01	23.03%
Ni-63	1.33E+01	1.33E-02	2.22%
Sb-125	1.72E+00	1.72E-03	0.29%
Sr-90	1.34E-01	1.34E-04	0.02%
Tc-99	1.99E+00	1.99E-03	0.33%
Zr-95	1.12E+02	1.12E-01	18.75%
Grand Total	5.97E+02	5.97E-01	100.00%

Attachment 3 Solid Radioactive Waste Disposal

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

1. Solid Waste Shipped for Burial or Disposal (WASTE CLASS A)
 - B. Estimate of Major Nuclide Composition (by type of Waste)
 - c. Irradiated components, control rods, etc.

Note: Waste shipped in 2018 for processing and subsequent burial.

Irradiated Components Total			
Isotope	Activity(mci)	Activity (Ci)	Abundance
C-14	1.55E-02	1.55E-05	0.02%
Co-58	9.00E-03	9.00E-06	0.01%
Co-60	5.25E+01	5.25E-02	77.46%
Cr-51	3.89E-01	3.89E-04	0.57%
Cs-137	5.12E-06	5.12E-09	0.00%
Fe-55	8.60E+00	8.60E-03	12.69%
Fe-59	2.63E-02	2.63E-05	0.04%
H-3	2.75E-05	2.75E-08	0.00%
I-129	1.31E-07	1.31E-10	0.00%
Mn-54	2.85E-02	2.85E-05	0.04%
Nb-95	1.72E-05	1.72E-08	0.00%
Ni-63	1.84E-01	1.84E-04	0.27%
Tc-99	1.52E-06	1.52E-09	0.00%
Zr-95	8.76E-06	8.76E-09	0.00%
Ni-59	1.35E-03	1.35E-06	0.00%
Zn-65	6.02E+00	6.02E-03	8.88%
Nb-94	1.21E-04	1.21E-07	0.00%
Grand Total	6.78E+01	6.78E-02	100.00%

Attachment 3 Solid Radioactive Waste Disposal

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

1. Solid Waste Shipped for Burial or Disposal (WASTE CLASS A)
 - B. Estimate of Major Nuclide Composition (by type of Waste)
 - d. Other

Note: Waste shipped in 2018 for processing and subsequent burial.

GAC Total			
Isotope	Activity(mci)	Activity (Ci)	Abundance
C-14	1.81E+00	1.81E-03	0.90%
Ce-144	2.00E-01	2.00E-04	0.10%
Co-58	2.38E+00	2.38E-03	1.18%
Co-60	3.93E+01	3.93E-02	19.55%
Cs-137	2.15E-01	2.15E-04	0.11%
Fe-55	3.24E+01	3.24E-02	16.11%
H-3	3.72E+01	3.72E-02	18.50%
I-129	8.76E-03	8.76E-06	0.00%
Mn-54	1.14E+00	1.14E-03	0.57%
Nb-95	1.19E-01	1.19E-04	0.06%
Ni-63	8.49E+01	8.49E-02	42.23%
Sb-125	7.38E-01	7.38E-04	0.37%
Tc-99	8.28E-02	8.28E-05	0.04%
Am-241	2.86E-02	2.86E-05	0.01%
Pu-241	5.43E-01	5.43E-04	0.27%
Grand Total	2.01E+02	2.01E-01	100.00%

C. Solid Waste Disposal

Number of Shipments 6
 Mode of Transportation Truck
 Destination Energy Solutions

Note: Waste shipped in 2018 for processing and subsequent burial

Attachment 3
Solid Radioactive Waste Disposal

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

2. Solid Waste Shipped for Burial or Disposal (WASTE CLASS B)
 - A. Type of Waste
 - a. Spent resins.
No waste of this type was shipped during this Report Period.
 - b. Dry Active Waste (DAW), mechanical filters, contaminated equipment, etc.
* No waste of this type was shipped during this Report Period.
 - c. Irradiated components, control cods, etc.
* No waste of this type was shipped during this Report Period.
 - d. Other (Describe)
* No waste of this type was shipped during this Report Period.
 - B. Estimate of Major Nuclide Composition (by type of Waste)
 - a. Dry Active Waste (DAW), mechanical filters, contaminated equipment, etc.
* No waste of this type was shipped during this Report Period.
 - C. Solid Waste Disposal
* No waste of this type was shipped during this Report Period.

Attachment 3
Solid Radioactive Waste Disposal

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

3. Solid Waste Shipped for Burial or Disposal (WASTE CLASS C)

A. Type of Waste

- a. Spent resins, filter sludge's, evaporator bottoms, etc.

No waste of this type was shipped during this Report Period.

- b. Dry Active Waste (DAW), mechanical filters, contaminated equipment, etc.

No waste of this type was shipped during this Report Period.

- c. Irradiated Components, Control Rods, etc.

No waste of this type was shipped during this Report Period.

- d. Other (Describe)

No waste of this type was shipped during this Report Period.

B. Estimate of Major Nuclide Composition (by type of Waste)

* No waste of this type was shipped during this Report Period.

C. Solid Waste Disposal

* No waste of this type was shipped during this Report Period.

**Attachment 4
Meteorological Data**

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

ATTACHMENT 4

Meteorological Data

This attachment includes a summary of meteorological joint frequency distributions of wind speed, wind direction, and atmospheric stability (hours of occurrence).

Attachment 4 Meteorological Data

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

Stability Class	Wind Speed (m/s)	Hours of Occurrence															
		Sector															
		N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
A	0.50-0.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0.76-1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1.01-1.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1.26-1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1.51-2.00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
	2.01-3.00	0	0	1	8	3	0	0	0	1	0	0	0	0	0	0	
	3.01-4.00	1	0	4	0	1	1	0	0	2	2	0	2	1	1	0	
	4.01-5.00	0	1	0	1	0	0	0	0	0	2	6	0	1	0	0	
	5.01-6.00	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	
	6.01-8.00	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	
	8.01-10.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	10.01-Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B	0.50-0.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0.76-1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1.01-1.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1.26-1.50	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2	
	1.51-2.00	0	0	1	4	4	7	2	0	5	1	1	2	2	3	2	
	2.01-3.00	4	11	8	17	18	2	2	4	17	4	2	9	3	4	7	
	3.01-4.00	3	12	8	4	1	0	2	5	14	7	4	3	2	3	4	
	4.01-5.00	2	6	0	0	0	0	0	1	0	3	8	7	2	2	3	
	5.01-6.00	2	0	0	0	0	0	0	0	0	2	5	4	0	1	4	
	6.01-8.00	0	0	0	0	0	0	0	0	0	1	1	1	0	1	4	
	8.01-10.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	10.01-Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Attachment 4 Meteorological Data

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

Stability Class	Wind Speed (m/s)	Hours of Occurrence															
		Sector															
		N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
C	0.50-0.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.76-1.00	0	1	0	0	1	0	0	0	1	0	0	0	1	0	0	1
	1.01-1.25	0	1	2	1	1	1	0	1	1	1	2	2	1	2	0	0
	1.26-1.50	0	3	0	3	2	4	4	1	2	4	4	4	2	1	4	2
	1.51-2.00	2	5	7	17	6	11	7	14	10	7	14	10	14	7	3	9
	2.01-3.00	14	18	14	15	15	13	6	15	32	26	20	43	17	13	21	16
	3.01-4.00	8	13	3	5	2	0	0	2	16	14	22	27	15	9	13	6
	4.01-5.00	4	6	3	1	0	0	0	1	4	6	15	7	5	17	10	10
	5.01-6.00	0	0	0	0	0	0	0	0	0	8	3	6	0	3	5	1
	6.01-8.00	0	0	0	0	0	0	0	0	0	1	0	1	0	0	2	1
	8.01-10.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10.01-Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D	0.50-0.75	5	9	10	5	3	3	3	5	3	11	3	6	5	4	7	6
	0.76-1.00	7	19	12	7	13	8	6	9	8	14	14	24	12	6	4	9
	1.01-1.25	12	14	24	14	21	5	18	16	14	14	21	16	14	11	8	8
	1.26-1.50	26	11	33	29	15	14	18	26	27	22	22	27	17	19	18	15
	1.51-2.00	48	62	73	54	42	28	29	55	45	64	44	43	40	26	28	36
	2.01-3.00	87	99	100	53	34	30	28	55	122	108	119	106	71	47	48	72
	3.01-4.00	61	48	38	11	13	15	1	11	56	42	61	49	21	45	33	49
	4.01-5.00	21	21	13	7	3	10	2	4	12	37	28	16	9	12	22	20
	5.01-6.00	3	6	4	0	0	3	1	1	4	24	12	9	2	6	6	8
	6.01-8.00	0	9	0	0	0	0	1	1	5	4	0	3	0	1	2	4
	8.01-10.00	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
10.01-Max	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	

Attachment 4 Meteorological Data

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

Stability Class	Wind Speed (m/s)	Hours of Occurrence															
		Sector															
		N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
E	0.50-0.75	11	17	17	13	13	8	8	8	7	14	11	13	13	6	8	11
	0.76-1.00	9	16	33	18	21	22	16	13	11	16	13	19	12	14	6	12
	1.01-1.25	27	21	27	29	20	19	15	23	20	20	14	9	8	8	4	11
	1.26-1.50	21	19	22	28	24	11	13	18	26	33	20	13	16	6	9	14
	1.51-2.00	41	29	22	19	18	11	13	29	37	50	43	29	22	21	16	17
	2.01-3.00	21	12	13	11	10	4	4	21	58	100	37	27	10	22	18	23
	3.01-4.00	1	1	1	3	5	1	0	4	15	37	11	5	1	6	1	3
	4.01-5.00	0	1	4	19	1	0	0	0	4	10	7	3	1	4	0	0
	5.01-6.00	0	1	2	3	0	0	0	0	0	2	0	0	0	3	0	0
	6.01-8.00	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	8.01-10.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10.01-Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F	0.50-0.75	14	28	25	19	16	9	2	6	6	4	8	4	3	4	6	13
	0.76-1.00	11	16	20	33	13	8	12	8	5	10	7	7	6	6	4	6
	1.01-1.25	8	8	10	11	4	2	6	7	5	4	4	4	10	6	4	4
	1.26-1.50	14	6	0	3	1	1	3	1	1	3	6	4	1	4	2	5
	1.51-2.00	12	4	2	3	0	0	0	1	2	3	0	2	3	3	1	1
	2.01-3.00	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
	3.01-4.00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	4.01-5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5.01-6.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6.01-8.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8.01-10.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10.01-Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Attachment 4 Meteorological Data

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

Stability Class	Wind Speed (m/s)	Hours of Occurrence															
		Sector															
		N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
G	0.50-0.75	42	35	48	40	12	8	12	6	1	3	1	8	10	9	17	27
	0.76-1.00	14	10	13	12	11	1	4	1	2	6	5	6	1	4	8	18
	1.01-1.25	3	2	4	4	1	0	0	0	0	0	1	3	1	0	6	6
	1.26-1.50	2	2	0	3	1	0	1	0	0	1	0	0	0	0	2	1
	1.51-2.00	1	1	2	0	0	0	0	0	0	1	1	1	0	0	1	1
	2.01-3.00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3.01-4.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4.01-5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5.01-6.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6.01-8.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8.01-10.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10.01-Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

**Attachment 5
Unplanned Offsite Releases**

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

ATTACHMENT 5

Unplanned Offsite Releases

This attachment includes a summary of the unplanned offsite releases of gaseous and liquid radioactive effluents.

Attachment 5
Unplanned Offsite Releases

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

Shearon Harris Nuclear Power Plant had zero (0) unplanned liquid release in 2018.

Shearon Harris Nuclear Power Plant had zero (0) unplanned gaseous release in 2018.

Attachment 6
Assessment of Radiation Dose from Radioactive Effluents to Members of the Public

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

ATTACHMENT 6

Assessment of Radiation Dose from Radioactive Effluents to Members of the Public

(includes fuel cycle dose calculation results)

This attachment 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 for each calendar quarter for the calendar year of the report as well as the total dose for the calendar year.

This attachment also includes an assessment of radiation doses to the maximum exposed member of the public from all uranium fuel cycle sources within 8 km of the site for the calendar year of this report to show conformance with 40 CFR Part 190.

Methods for calculating the dose contribution from liquid and gaseous effluents are given in the Offsite Dose Calculation Manual (ODCM).

Attachment 6
Assessment of Radiation Dose from Radioactive Effluents to Members of the Public

Shearon Harris Nuclear Power Plant Unit 1
 Period 1/1/2018 - 12/31/2018

Gaseous Effluents Dose Summary

	<u>Units</u>	<u>Qtr 1</u>	<u>Qtr 2</u>	<u>Qtr 3</u>	<u>Qtr 4</u>	<u>Year</u>
A. Noble Gases						
1. Maximum Gamma Air	mRAD	0.00E+00	4.84E-04	6.96E-06	7.98E-07	4.91E-04
(a) Limit	mRAD	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
(b) % of Limit		0.00E+00	9.67E-03	1.39E-04	1.60E-05	4.91E-03
2. Maximum Beta Air	mRAD	0.00E+00	1.71E-04	2.07E-05	2.37E-06	1.94E-04
(a) Limit	mRAD	1.00E+01	1.00E+01	1.00E+01	1.00E+01	2.00E+01
(b) % of Limit		0.00E+00	1.71E-03	2.07E-04	2.37E-05	9.69E-04

Receptor Location **2.14 km SW**

B. Iodine, H-3, & Particulates						
1. Maximum Organ Dose	mREM	1.42E-01	1.23E-01	1.12E-01	8.29E-02	4.60E-01
(a) Limit	mREM	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
(b) % of Limit		1.89E+00	1.64E+00	1.50E+00	1.11E+00	3.06E+00

Receptor Location **2.14 km SW**

Critical Age **CHILD**

Critical Organ **LUNG**

Attachment 6
Assessment of Radiation Dose from Radioactive Effluents to Members of the Public

Shearon Harris Nuclear Power Plant Unit 1
 Period 1/1/2018 - 12/31/2018

Liquid Effluents Dose Summary

	<u>Units</u>	<u>Qtr 1</u>	<u>Qtr 2</u>	<u>Qtr 3</u>	<u>Qtr 4</u>	<u>Year</u>
A. Batch Mode						
1. Maximum Organ Dose	mREM	2.22E-02	2.53E-02	8.76E-04	2.16E-04	4.86E-02
(a) Limit	mREM	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
(b) % of Limit		4.44E-01	5.06E-01	1.75E-02	4.32E-03	4.86E-01
2. Maximum Total Body Dose	mREM	1.33E-02	4.73E-03	8.43E-04	1.97E-04	1.91E-02
(a) Limit	mREM	1.50E+00	1.50E+00	1.50E+00	1.50E+00	3.00E+00
(b) % of Limit		8.86E-01	3.15E-01	5.62E-02	1.32E-02	6.35E-01

Critical Age **ADULT**
Critical Organ **GILLI**

Attachment 6
Assessment of Radiation Dose from Radioactive Effluents to Members of the Public

Shearon Harris Nuclear Power Plant Unit 1
 Period 1/1/2018 - 12/31/2018

40 CFR Part 190 Uranium Fuel Cycle Dose Calculation Results

In accordance with the requirements of 40 CFR Part 190, the annual dose commitment to any member of the general public shall be calculated to assure that doses are limited to 25 millirem to the total body or any organ with the exception of the thyroid which is limited to 75 millirem. The fuel cycle dose assessment for Shearon Harris Nuclear Power Plant includes liquid and gaseous effluent dose contributions from the plant. Direct and air-scatter dose from the reactor building and other onsite structures does not contribute measurable dose to the maximum exposed individual based on review of the 2018 environmental TLD data. No other uranium fuel cycle facility contributes significantly to the maximum exposed individual. Included below is an estimate of the dose contributed by Carbon-14 (Ref. Attachment 2, Supplemental Information, of this report for further information). Also included is dose from H-3 in the Shearon Harris Nuclear Power Plant Cooling Tower plume, evaporation of H-3 in Harris Lake, H-3 in on-site drinking water, and H-3 in fish from Harris Lake. The combined dose to a maximum exposed individual from effluent releases, combined with the additional dose pathways, is below 40 CFR Part 190 limits as shown by the following summary.

Note: The 40 CFR Part 190 effluent dose analysis to the maximum exposed individual from liquid and gas releases does not include the dose from noble gases (i.e., total body and skin) due to the low significance compared to other dose pathways.

40 CFR Part 190 Effluent Dose Summary																																																																																																																																													
<p>A. Gaseous Effluent Dose</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 30%;">1. Location</td><td style="width: 30%;">2.14 km SW</td><td style="width: 30%;"></td><td style="width: 10%;"></td></tr> <tr><td>2. Critical Age</td><td>CHILD</td><td></td><td></td></tr> <tr><td>3. Critical Organ</td><td>LUNG</td><td></td><td></td></tr> <tr><td>4. Organ Dose (mREM)</td><td>4.60E-01</td><td></td><td></td></tr> <tr><td>5. Total Body Dose (mREM)</td><td>4.60E-01</td><td></td><td></td></tr> </table> <p>B. Liquid Effluent Dose</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 30%;">1. Location</td><td style="width: 30%;">2.19 km S</td><td style="width: 30%;"></td><td style="width: 10%;"></td></tr> <tr><td>2. Critical Age</td><td>ADULT</td><td></td><td></td></tr> <tr><td>3. Critical Organ</td><td>GI-LLI</td><td></td><td></td></tr> <tr><td>4. Organ Dose (mREM)</td><td>4.86E-02</td><td></td><td></td></tr> <tr><td>5. Total Body Dose (mREM)</td><td>1.91E-02</td><td></td><td></td></tr> </table> <p>C. Carbon-14 Dose</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 30%;">1. Location</td><td style="width: 30%;">2.82 km W</td><td style="width: 30%;"></td><td style="width: 10%;"></td></tr> <tr><td>2. Critical Age</td><td>CHILD</td><td></td><td></td></tr> <tr><td>3. Critical Organ</td><td>BONE</td><td></td><td></td></tr> <tr><td>4. Organ Dose (mREM)</td><td>1.69E-01</td><td></td><td></td></tr> <tr><td>5. Total Body Dose (mREM)</td><td>3.37E-02</td><td></td><td></td></tr> </table> <p>D. Cooling Tower Plume H-3 Dose</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 30%;">1. Location</td><td style="width: 30%;">2.91 km NNE</td><td style="width: 30%;"></td><td style="width: 10%;"></td></tr> <tr><td>2. Critical Age</td><td>CHILD</td><td></td><td></td></tr> <tr><td>3. Critical Organ</td><td>N/A</td><td></td><td></td></tr> <tr><td>4. Organ Dose (mREM)</td><td>3.20E-03</td><td></td><td></td></tr> <tr><td>5. Total Body Dose (mREM)</td><td>3.20E-03</td><td></td><td></td></tr> </table>	1. Location	2.14 km SW			2. Critical Age	CHILD			3. Critical Organ	LUNG			4. Organ Dose (mREM)	4.60E-01			5. Total Body Dose (mREM)	4.60E-01			1. Location	2.19 km S			2. Critical Age	ADULT			3. Critical Organ	GI-LLI			4. Organ Dose (mREM)	4.86E-02			5. Total Body Dose (mREM)	1.91E-02			1. Location	2.82 km W			2. Critical Age	CHILD			3. Critical Organ	BONE			4. Organ Dose (mREM)	1.69E-01			5. Total Body Dose (mREM)	3.37E-02			1. Location	2.91 km NNE			2. Critical Age	CHILD			3. Critical Organ	N/A			4. Organ Dose (mREM)	3.20E-03			5. Total Body Dose (mREM)	3.20E-03			<p>E. Harris Lake Evaporation H-3 Dose</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 30%;">1. Location</td><td style="width: 30%;">6.65 km SSW</td><td style="width: 30%;"></td><td style="width: 10%;"></td></tr> <tr><td>2. Critical Age</td><td>CHILD</td><td></td><td></td></tr> <tr><td>3. Critical Organ</td><td>N/A</td><td></td><td></td></tr> <tr><td>4. Organ Dose (mREM)</td><td>5.59E-02</td><td></td><td></td></tr> <tr><td>5. Total Body Dose (mREM)</td><td>5.59E-02</td><td></td><td></td></tr> </table> <p>F. Drinking Water H-3 Dose</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 30%;">1. Location</td><td style="width: 30%;">Harris Plant</td><td style="width: 30%;"></td><td style="width: 10%;"></td></tr> <tr><td>2. Critical Age</td><td>ADULT</td><td></td><td></td></tr> <tr><td>3. Critical Organ</td><td>N/A</td><td></td><td></td></tr> <tr><td>4. Organ Dose (mREM)</td><td>8.86E-02</td><td></td><td></td></tr> <tr><td>5. Total Body Dose (mREM)</td><td>8.86E-02</td><td></td><td></td></tr> </table> <p>G. H-3 in Fish from Harris Lake</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 30%;">1. Location</td><td style="width: 30%;">Harris Lake</td><td style="width: 30%;"></td><td style="width: 10%;"></td></tr> <tr><td>2. Critical Age</td><td>ADULT</td><td></td><td></td></tr> <tr><td>3. Critical Organ</td><td>N/A</td><td></td><td></td></tr> <tr><td>4. Organ Dose (mREM)</td><td>1.48E-02</td><td></td><td></td></tr> <tr><td>5. Total Body Dose (mREM)</td><td>1.48E-02</td><td></td><td></td></tr> </table>	1. Location	6.65 km SSW			2. Critical Age	CHILD			3. Critical Organ	N/A			4. Organ Dose (mREM)	5.59E-02			5. Total Body Dose (mREM)	5.59E-02			1. Location	Harris Plant			2. Critical Age	ADULT			3. Critical Organ	N/A			4. Organ Dose (mREM)	8.86E-02			5. Total Body Dose (mREM)	8.86E-02			1. Location	Harris Lake			2. Critical Age	ADULT			3. Critical Organ	N/A			4. Organ Dose (mREM)	1.48E-02			5. Total Body Dose (mREM)	1.48E-02		
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Attachment 6
Assessment of Radiation Dose from Radioactive Effluents to Members of the Public

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

Total dose from liquid and gaseous effluents from Shearon Harris Nuclear Power Plant and the additional pathways mentioned above is conservatively estimated to be less than 2 mrem/yr for total body and organ. It is recognized summing dose for different organs and age groups is not entirely accurate. However, the sum of the organ and age specific doses will always be less than the sum of the maximums of each. Therefore, summing the maximum values of each provides the most conservative value to ensure compliance with 40 CFR 190. The dose from all pathways related to operation of Shearon Harris Nuclear Power Plant meets the 40 CFR Part 190 requirements of an annual dose commitment to any member of the general public of less than 25 mrem total body or any organ and 75 mrem to the thyroid.

Attachment 7
Information to Support the NEI Ground Water Protection Initiative

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

ATTACHMENT 7

Information to Support the NEI Ground Water Protection Initiative

This attachment includes a summary of voluntary reports made in accordance with the NEI Ground Water Protection Initiative and a summary of ground water well sample data.

Attachment 7
Information to Support the NEI Ground Water Protection Initiative

Shearon Harris Nuclear Power Plant Unit 1
 Period 1/1/2018 - 12/31/2018

Samples were taken at various locations throughout the plant in support of the Groundwater Protection Initiative. Samples included Groundwater Monitoring Wells along the Cooling Tower Blowdown Line, Storm Drains, Vaults and Yard Drains that could potentially affect groundwater. None of the vaults, yard drains, or storm drains indicated plant related gamma emitters or tritium above the investigation limit. HNP Self Assessment (AR-0202000) determined Groundwater Monitoring location #76 did not meet the requirements for waterborne monitoring, so in September 2016 it was removed from the site's Radiological Environmental Monitoring Program (REMP). The well is located within the protected area and is not used as a source of drinking water or irrigation, thus is not a potential dose pathway. In addition, in June 2015 12 new groundwater monitoring wells were installed near the site's Waste Neutralization Basin. These wells are not listed in the ODCM or part of the REMP. The data for these wells are located below. Per NEI 07-07 the results of the Groundwater Monitoring Wells were included in the REMP and are not listed in this report but included in the AREOR.

Results from sampling during 2018 are shown in the table below.

Well #	Tritium Concentration (pCi/L)				# Samples
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	
76	404	350	<MDA	242	4
HMW1S	430	453	291	289	4
HMW2S	250	<MDA	<MDA	<MDA	4
HMW3S	<MDA	<MDA	<MDA	<MDA	4
HMW4D	<MDA	<MDA	<MDA	<MDA	4
HMW4S	173	<MDA	<MDA	<MDA	4
HMW5S	<MDA	<MDA	<MDA	<MDA	4
HMW6S	330	318	226	274	4
HMW7S	<MDA	<MDA	<MDA	<MDA	4
HMW8S	<MDA	188	<MDA	<MDA	4
HMW9S	<MDA	<MDA	<MDA	<MDA	4
HMW10S	<MDA	<MDA	<MDA	<MDA	4
HMW11S	<MDA	<MDA	<MDA	<MDA	4

NOTE: Minimum Detectable Activity (MDA) for monitoring wells is approximately 185 pCi/L

Zero (0) events meeting the criteria for voluntary notification per NEI 07-07, Industry Ground Water Protection Initiative, occurred at Shearon Harris Nuclear Power Plant in 2018.

**Attachment 8
Inoperable Equipment**

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

ATTACHMENT 8

Inoperable Equipment

This attachment includes an explanation of inoperable instruments related to effluent monitoring in excess of allowed time defined by licensing bases and an explanation of temporary outside liquid storage tanks exceeding 10 Curies total activity (excluding tritium and dissolved or entrained noble gases).

Attachment 8 Inoperable Equipment

Shearon Harris Nuclear Power Plant Unit 1 Period 1/1/2018 - 12/31/2018

On December 15, 2017, the Radwaste Control Room's radiation monitor computer system (RM-11) failed and was unable to be rebooted (NCR 2172597). The loss of the RM-11 required making seven effluent radiation monitors inoperable due to the inability of the RM-11 computer system to indicate an alarm condition. The affected effluent radiation monitors were: REM-01SW-3500A (WPB Service Water Return), REM-1WL-3540 (TL&HS Tank Effluent), REM-21WL-3541 (Waste Monitor Tank Effluent), REM-21WS-3542 (Secondary Waste Sample Tank Effluent), REM-1WV-3546 (Stack 5 PIG), REM-1WV-3546-1 (Stack 5 WRGM), REM-1WV-3547-1 (Stack 5A WRGM). The RM-11 computer system was repaired and the monitors returned to service on January 5, 2018 (Work Order 20219799). None of the affected radiation monitors were out of service in excess of 30 days.

On March 21, 2018 at 00:54 the radiation monitor REM-1MD-3528 (Turbine Building Drains) was declared inoperable to support the installation of temporary power for Refueling Outage 21. The temporary power prevented the radiation monitor from isolating industrial waste releases and shutting down the Turbine Building Sump Pumps (LCOTR T-18-00264). The ability for the radiation monitor to provide its trip function is a required function for this monitor in ODCM Table 3.3-12. The temporary power was removed and the monitor's trip function was restored to service on April 28, 2018 at 07:16.

Shearon Harris Nuclear Power Plant did not experience temporary outside liquid storage tanks exceeding 10 Curies total activity (excluding tritium and dissolved or entrained noble gases) during 2018.

Attachment 9
Summary of Changes to the Offsite Dose Calculation Manual

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

ATTACHMENT 9

Summary of Changes to the Offsite Dose Calculation Manual

This attachment includes a summary of changes to the ODCM.

Attachment 9
Summary of Changes to the Offsite Dose Calculation Manual

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

The Offsite Dose Calculation Manual (ODCM) was not revised in 2018.

Attachment 10
Summary of Changes to the Process Control Program

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

ATTACHMENT 10

Summary of Changes to the Process Control Program

This attachment includes a summary of changes to the PCP.

Attachment 10
Summary of Changes to the Process Control Program

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

The Process Control Program (PCP) was not revised in 2018.

Attachment 11
Summary of Major Modifications to the Radioactive Waste Treatment Systems

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

ATTACHMENT 11

Summary of Major Modifications to the Radioactive Waste Treatment Systems

This attachment includes a description of major modifications to the radioactive waste treatment systems that are anticipated to affect effluent releases.

Attachment 11
Summary of Major Modifications to the Radioactive Waste Treatment Systems

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

There were no major modifications to Shearon Harris Nuclear Power Plant liquid or solid waste treatment systems in 2018.

Attachment 12
Errata to a Previous Year's ARERR

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

ATTACHMENT 12

Errata to a Previous Year's ARERR

This attachment includes any amended pages from a previous year's ARERR.

Attachment 12
Errata to a Previous Year's ARERR

Shearon Harris Nuclear Power Plant Unit 1
Period 1/1/2018 - 12/31/2018

There were no changes to a previous year's Annual Radiological Effluent Release Report.