



Bentley K. Jones  
Director, Organizational Effectiveness  
Harris Nuclear Plant  
5413 Shearon Harris Rd  
New Hill, NC 27562-9300

919-362-2305

APR 27 2016

Serial: HNP-16-023

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, Inc., doing business as Duke Energy Progress, LLC, is providing the enclosed Annual Radioactive Effluent Release Report for 2015.

This submittal contains no regulatory commitments. Please refer any questions regarding this submittal to John Caves, Manager – Regulatory Affairs, at (919) 362-2406.

Sincerely,

A handwritten signature in black ink, appearing to read "Bentley K. Jones", written over a horizontal line.

Bentley K. Jones

Enclosure

cc: Mr. J. D. Austin, NRC Sr. Resident Inspector, HNP  
Ms. M. Barillas, NRC Project Manager, HNP  
NRC Regional Administrator, Region II



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Ms. M. Barillas, NRC Project Manager, HNP  
NRC Regional Administrator, Region II



# **Shearon Harris Nuclear Power Plant Unit 1**

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## **Annual Radioactive Effluent Release Report**

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**January 1, 2015 through December 31, 2015**

**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 1/1/2015 - 12/31/2015

**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 1/1/2015 - 12/31/2015

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	1.19E-01	4.96E-03	3.87E-02	2.45E-01	4.08E-01
2. Avg. Release Rate	μCi/sec	1.53E-02	6.30E-04	4.87E-03	3.08E-02	1.29E-02
B. Iodine-131						
1. Total Release	Ci	0.00E+00	1.35E-05	0.00E+00	0.00E+00	1.35E-05
2. Avg. Release Rate	μCi/sec	0.00E+00	1.72E-06	0.00E+00	0.00E+00	4.29E-07
C. Particulates Half-Life ≥ 8 days						
1. Total Release	Ci	0.00E+00	1.17E-05	0.00E+00	0.00E+00	1.17E-05
2. Avg. Release Rate	μCi/sec	0.00E+00	1.48E-06	0.00E+00	0.00E+00	3.69E-07
D. Tritium						
1. Total Release	Ci	2.53E+01	5.32E+01	2.46E+01	3.58E+01	1.39E+02
2. Avg. Release Rate	μCi/sec	3.26E+00	6.76E+00	3.09E+00	4.50E+00	4.40E+00
E. Gross Alpha						
1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2. Avg. Release Rate	μCi/sec	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 1/1/2015 - 12/31/2015

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 1/1/2015 - 12/31/2015

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 1/1/2015 - 12/31/2015

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	1.19E-01	4.94E-03	3.87E-02	1.53E-01	3.16E-01
Total for Period	Ci	1.19E-01	4.94E-03	3.87E-02	1.53E-01	3.16E-01
B. Iodines						
I-131	Ci	0.00E+00	4.49E-06	0.00E+00	0.00E+00	4.49E-06
Total for Period	Ci	0.00E+00	4.49E-06	0.00E+00	0.00E+00	4.49E-06
C. Particulates Half-Life ≥ 8 days						
None	Ci	-	-	-	-	-
Total for Period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
D. Tritium						
H-3	Ci	2.53E+01	5.30E+01	2.46E+01	3.58E+01	1.39E+02
E. 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 1/1/2015 - 12/31/2015

### 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	0.00E+00	0.00E+00	0.00E+00	4.80E-04	4.80E-04
Kr-85M	Ci	0.00E+00	0.00E+00	0.00E+00	5.66E-04	5.66E-04
Kr-85	Ci	0.00E+00	0.00E+00	0.00E+00	3.09E-03	3.09E-03
Kr-87	Ci	0.00E+00	0.00E+00	0.00E+00	1.72E-04	1.72E-04
Kr-88	Ci	0.00E+00	0.00E+00	0.00E+00	7.17E-04	7.17E-04
Xe-131M	Ci	0.00E+00	0.00E+00	0.00E+00	1.30E-04	1.30E-04
Xe-133M	Ci	0.00E+00	0.00E+00	0.00E+00	1.82E-03	1.82E-03
Xe-133	Ci	0.00E+00	1.28E-05	4.30E-06	6.94E-02	6.94E-02
Xe-135	Ci	0.00E+00	0.00E+00	0.00E+00	1.54E-02	1.54E-02
Total for Period	Ci	0.00E+00	1.28E-05	4.30E-06	9.17E-02	9.17E-02
B. Iodines						
I-131	Ci	0.00E+00	8.99E-06	0.00E+00	0.00E+00	8.99E-06
Total for Period	Ci	0.00E+00	8.99E-06	0.00E+00	0.00E+00	8.99E-06
C. Particulates Half-Life ≥ 8 days						
Cr-51	Ci	0.00E+00	5.39E-06	0.00E+00	0.00E+00	5.39E-06
Mn-54	Ci	0.00E+00	3.57E-07	0.00E+00	0.00E+00	3.57E-07
Fe-59	Ci	0.00E+00	1.96E-07	0.00E+00	0.00E+00	1.96E-07
Co-58	Ci	0.00E+00	2.72E-06	0.00E+00	0.00E+00	2.72E-06
Co-60	Ci	0.00E+00	1.33E-06	0.00E+00	0.00E+00	1.33E-06
Se-75	Ci	0.00E+00	3.83E-08	0.00E+00	0.00E+00	3.83E-08
Zr-95	Ci	0.00E+00	6.47E-07	0.00E+00	0.00E+00	6.47E-07
Nb-95	Ci	0.00E+00	9.10E-07	0.00E+00	0.00E+00	9.10E-07
Cs-137	Ci	0.00E+00	5.68E-08	0.00E+00	0.00E+00	5.68E-08
Total for Period	Ci	0.00E+00	1.17E-05	0.00E+00	0.00E+00	1.17E-05
D. Tritium						
H-3	Ci	2.59E-05	1.90E-01	7.24E-05	9.54E-05	1.90E-01
E. 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 1/1/2015 - 12/31/2015

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 1/1/2015 - 12/31/2015

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 1/1/2015 - 12/31/2015

### 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	2.17E-03	1.16E-02	2.40E-03	1.86E-03	1.80E-02
2. Avg. Diluted Conc.	µCi/ml	4.48E-10	2.10E-09	5.48E-10	3.76E-10	9.14E-10
B. Tritium						
1. Total Release	Ci	2.38E+02	2.61E+02	2.98E+01	1.61E+02	6.90E+02
2. Avg. Diluted Conc.	µCi/ml	4.93E-05	4.71E-05	6.79E-06	3.25E-05	3.50E-05
C. Dissolved & Entrained Gases						
1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	1.10E-03	1.10E-03
2. Avg. Diluted Conc.	µCi/ml	0.00E+00	0.00E+00	0.00E+00	2.22E-10	5.58E-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	1.05E+06	1.39E+06	8.43E+05	9.28E+05	4.21E+06
2. Continuous Releases	liters	7.34E+06	1.20E+07	1.40E+07	8.02E+06	4.13E+07
F. Volume of Dilution Water						
1. Batch Releases	liters	4.84E+09	5.55E+09	4.39E+09	4.95E+09	1.97E+10
2. Continuous Releases	liters	4.84E+09	5.55E+09	4.39E+09	4.95E+09	1.97E+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 1/1/2015 - 12/31/2015

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	8.57E-02	7.24E-02	5.42E-02	7.91E-02	2.91E-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 1/1/2015 - 12/31/2015

### 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	0.00E+00	3.98E-04	0.00E+00	0.00E+00	3.98E-04
Mn-54	Ci	9.75E-05	7.70E-05	0.00E+00	4.84E-05	2.23E-04
Co-58	Ci	5.39E-05	8.08E-03	9.03E-04	2.98E-04	9.33E-03
Co-60	Ci	1.22E-03	1.44E-03	3.97E-04	6.23E-04	3.68E-03
Ni-63	Ci	6.82E-04	1.21E-03	6.98E-04	5.43E-04	3.13E-03
Se-75	Ci	0.00E+00	1.94E-05	0.00E+00	0.00E+00	1.94E-05
Zr-95	Ci	0.00E+00	2.87E-05	1.16E-05	7.16E-06	4.75E-05
Nb-95	Ci	1.50E-05	1.01E-04	2.41E-05	9.16E-05	2.32E-04
Sb-124	Ci	0.00E+00	4.08E-05	3.48E-05	1.15E-05	8.71E-05
Sb-125	Ci	7.73E-05	1.75E-04	2.73E-04	2.34E-04	7.59E-04
Cs-134	Ci	0.00E+00	0.00E+00	1.47E-05	0.00E+00	1.47E-05
Cs-137	Ci	1.73E-05	8.38E-05	4.88E-05	2.99E-06	1.53E-04
Total for Period	Ci	2.17E-03	1.16E-02	2.40E-03	1.86E-03	1.80E-02
B. Tritium						
H-3	Ci	2.38E+02	2.61E+02	2.98E+01	1.61E+02	6.90E+02
C. Dissolved & Entrained Gases						
Xe-133	Ci	0.00E+00	0.00E+00	0.00E+00	1.10E-03	1.10E-03
Total for Period	Ci	0.00E+00	0.00E+00	0.00E+00	1.10E-03	1.10E-03
D. Gross Alpha						
Total for Period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

**Attachment 2**  
**Supplemental Information**

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

**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 1/1/2015 - 12/31/2015

### 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.

### V. Batch Releases

#### A. Liquid Effluents

		Jan - Jun	Jul - Dec
1. Total Number of Batch Releases	=	3.20E+01	2.30E+01
2. Total Time (min) for Batch Releases	=	2.71E+04	1.82E+04
3. Maximum Time (min) for a Batch Release	=	1.52E+03	8.67E+02
4. Average Time (min) for Batch Releases	=	8.47E+02	7.93E+02
5. Minimum Time (min) for a Batch Release	=	5.82E+02	7.47E+02
6. Average Dilution Water Flow During Release (gpm)	=	1.09E+04	9.17E+03

#### B. Gaseous Effluents

		Jan - Jun	Jul - Dec
1. Total Number of Batch Releases	=	3.00E+01	8.00E+00
2. Total Time (min) for Batch Releases	=	2.62E+04	3.50E+04
3. Maximum Time (min) for a Batch Release	=	3.01E+03	2.49E+04
4. Average Time (min) for Batch Releases	=	8.75E+02	4.38E+03
5. Minimum Time (min) for a Batch Release	=	1.20E+02	2.92E+02

### VI. Abnormal Releases

See Attachment 5, Unplanned Offsite Releases.

## Attachment 2 Supplemental Information

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

### Carbon-14

The Shearon Harris Nuclear Power Plant 2015 ARERR contains estimates of C-14 radioactivity released in 2015, 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 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 2015 ARERR, a source term scaling factor using actual EFPD of 314.365 days is assumed. Using the source term scaling factor from Shearon Harris Nuclear Power Plant in 2015 results in a site total C-14 gaseous release estimate to the environment of 7.86 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 (CO<sub>2</sub>) form. Dose is not expected from other forms (methane, etc). 70% of the C-14 gaseous effluent is assumed to be from batch releases (e.g. WGDs), 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 2015 is well below the 10CFR50, Appendix I, ALARA design objective (i.e., 15 mrem/yr per unit).

	<u>Units</u>	<u>Year</u>
1. C-14 Activity Released	Ci	7.86E+00
2. C-14 Total Body Dose	mREM	9.45E-02
3. C-14 Organ Dose	mREM	4.75E-01

Receptor Location **3.07 km NNE**  
Critical Age **CHILD**  
Critical Organ **BONE**

## Attachment 2 Supplemental Information

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

### 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 2015*". 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 2015.

	<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	2.41E+01	1.67E+01	2.72E+01	2.33E+01	9.13E+01
2. H-3 Dose	mREM	8.20E-04	5.74E-04	9.23E-04	7.93E-04	3.11E-03

Receptor Location **3.07 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 2015*". Using the methodology described in ODCM 2.3.3, the following is a summary of tritium activity released through evaporation and resulting dose for 2015.

	<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	2.43E+01	4.39E+01	3.92E+01	1.72E+01	1.25E+02
2. H-3 Dose	mREM	1.48E-02	2.68E-02	2.39E-02	1.05E-02	7.60E-02

Receptor Location **6.12 km SSW**

Critical Age **CHILD**

Critical Organ **N/A \***

#### Drinking Water for Wake County Fire and 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 2015, 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 2015.

	<u>Units</u>	<u>Year</u>
4. Avg. H-3 Concentration	pCi/L	4.69E+03
5. H-3 Dose	mREM	1.284E-01

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 1/1/2015 - 12/31/2015

#### Tritium in Fish from Harris Lake <sup>NOTE</sup>

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 2015, 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 2015.

	<u>Units</u>	<u>Year</u>
1. Avg. H-3 Concentration	pCi/L	6.17E+03
2. H-3 Dose	mREM	1.36E-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).*

**NOTE:** This information was previously included in the Shearon Harris Nuclear Power Plant AREOR. DRR 2008147 was written to include the fish dose calculation methodology in a future ODCM revision, and report in the ARERR.

## Attachment 2 Supplemental Information

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

### **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 1/1/2015 - 12/31/2015

**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 1/1/2015 - 12/31/2015

**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  $\pm 96.05\%$ . 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)	=	$\pm 0.93\%$

## **Attachment 2 Supplemental Information**

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

### **Summary of Changes in Land Use Census Affecting Effluent Dose Calculations**

The 2015 Land Use Census was performed August 11-13, 2015, and the results were certified and made available for use on October 5, 2015. The following are changes to residences, gardens, and milk animals from the previous year.

#### **Residences**

The residence in the SW sector at 2.80 miles was replaced by a residence at 2.76 miles.  
The residence in the WNW sector at 2.33 miles was replaced by a residence at 2.13 miles.

#### **Gardens**

The garden in the NNE sector at 1.81 miles was replaced by a non-irrigated garden at 1.91 miles.  
A new garden irrigated with water not receiving plant effluents in the NE sector at 3.22 miles was identified.  
A new garden irrigated with water not receiving plant effluents in the ENE sector at 2.06 miles was identified.  
A new non-irrigated garden in the SSW sector at 4.20 miles was identified.  
The garden in the WNW sector at 4.68 miles was replaced by an irrigated garden at 3.39 miles.  
The garden in the NW sector at 2.24 miles was replaced by an irrigated garden at 3.17 miles.

#### **Meat Animals**

The meat animal in the NNE sector at 1.81 miles was replaced by a meat animal at 1.91 miles.  
A new meat animal in the NE sector at 3.22 miles was identified.  
The meat animal in the E sector at 1.98 miles was removed and no other meat animal was identified.  
The meat animal in the ESE sector at 4.72 miles was replaced by a meat animal at 2.74 miles.  
A new meat animal in the SSE sector at 4.57 miles was identified.  
The meat animal in the W sector at 4.12 miles was replaced by a meat animal at 3.26 miles.  
The meat animal in the WNW sector at 4.68 miles was replaced by a meat animal at 2.13 miles.

#### **Milk Animals**

No changes to nearest milk animal in each sector.

#### **Environmental Monitoring Locations**

No changes to environmental monitoring locations in each sector.



**Attachment 3**  
**Solid Radioactive Waste Disposal**

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

**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 1/1/2015 - 12/31/2015

Type of Waste Shipped	Number of Shipments	Number of Containers	Waste Class	Container Type	Solidification Agent	Burial Volume (m <sup>3</sup> )	Total Activity (Curies)
<b>1. <u>Waste from Liquid Systems</u></b>							
a. Dewatered Spent Resins (compacted)	2	2	A	NRC Approved	N/A	8.04	2.92E-01
b. Evaporator Concentrates	0	-	-	-	-	-	-
c. Dewatered Demineralizers	0	-	-	-	-	-	-
d. Solidified (cement) Acids, Oils, Sludge	0	-	-	-	-	-	-
<b>2. <u>Dry Solid Waste</u></b>							
a. Dry Active Waste (compacted)	0	-	-	-	-	-	-
b. Dry Active Waste (dewatered, non-compacted)	5	5	A	NRC Approved	N/A	294	6.45E-01
c. Dry Active Waste (brokered)	0	-	-	-	-	-	-
d. Irradiated Components (dewatered, non-compacted)	1	1	A	NRC Approved	N/A	294	1.39E-01
<b>3. <u>Total Solid Waste</u></b>	<b>8</b>	<b>8</b>				<b>596.04</b>	<b>1.08E+00</b>

### Attachment 3 Solid Radioactive Waste Disposal

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

Type of Waste Shipped	Radionuclide	% Abundance
<b>1. <u>Waste from Liquid Systems</u></b>		
a. Dewatered Spent Resins	C-14	0.31
	Ce-144D	2.40
	Co-58	0.59
	Co-60	14.60
	Cs-137D	22.36
	H-3	7.13
	I-129	0.09
	Mn-54	8.79
	Ni-63	43.24
	Tc-99	0.50
b. Evaporator Concentrates	N/A	N/A
c. Dewatered Demineralizers	N/A	N/A
d. Solidified (cement) Acids, Oils, Sludge	N/A	N/A
<b>2. <u>Dry Solid Waste</u></b>		
a. Dry Active Waste (compacted)	N/A	N/A
b. Dry Active Waste (dewatered, non-compacted)	C-14	0.18
	Ce-144D	0.41
	Co-57	0.01
	Co-58	1.30
	Co-60	12.53
	Cr-51	1.83
	Cs-137D	0.11
	Fe-55	15.80
	H-3	6.22
	I-129	0.01
	Mn-54	0.99
	Nb-95	26.07
	Ni-63	9.39
	Sb-125	1.21
	Sr-90	0.01
	Sr-90D	0.06
	Tc-99	0.07
	Zr-95	23.80
c. Dry Active Waste (brokered)	N/A	N/A

### Attachment 3 Solid Radioactive Waste Disposal

#### Shearon Harris Nuclear Power Plant Unit 1 Period 1/1/2015 - 12/31/2015

d. Irradiated Components (dewatered, non-compacted)	C-14	0.03
	Ce-144	0.00
	Co-58	0.01
	Co-60	78.59
	Cr-51	0.00
	Cs-137	0.00
	Fe-55	12.29
	Fe-59	0.04
	H-3	0.00
	I-129	0.00
	Mn-54	0.04
	Nb-94	0.00
	Nb-95	0.00
	Ni-59	0.00
	Ni-63	0.35
	Sb-125	0.00
	Sr-90	0.00
	Tc-99	0.00
	Zn-65	8.64
	Zr-95	0.00

**Attachment 4**  
**Meteorological Data**

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

**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 1/1/2015 - 12/31/2015

Stability Class	Wind Speed (mph)	Hours of Occurrence															
		Sector															
		N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
A	0.75-3.50	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	3.51-7.50	0	0	0	3	0	0	0	0	0	1	0	0	0	0	0	0
	7.51-12.50	0	5	0	1	0	0	0	0	2	0	0	0	0	0	0	0
	12.51-18.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	18.51-25.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B	0.75-3.50	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0
	3.51-7.50	2	4	5	8	5	2	0	1	11	3	0	0	1	1	3	5
	7.51-12.50	1	2	4	3	0	0	0	0	0	3	2	2	2	3	3	7
	12.51-18.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	18.51-25.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C	0.75-3.50	4	2	4	6	12	3	2	2	4	3	1	2	3	0	1	1
	3.51-7.50	28	31	30	15	11	7	5	9	38	18	9	16	8	13	25	28
	7.51-12.50	3	12	2	3	0	1	0	0	3	9	20	12	6	5	14	6
	12.51-18.50	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1
	18.51-25.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D	0.75-3.50	103	85	84	57	53	42	45	66	74	98	79	55	53	36	62	74
	3.51-7.50	277	294	190	89	47	44	59	86	176	182	176	155	76	56	105	130
	7.51-12.50	47	141	21	10	4	4	2	0	32	68	69	37	11	19	31	48
	12.51-18.50	1	0	0	0	0	0	0	0	0	0	6	1	0	2	3	3
	18.51-25.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	25+	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 1/1/2015 - 12/31/2015

Stability Class	Wind Speed (mph)	Hours of Occurrence															
		Sector															
		N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
E	0.75-3.50	102	89	89	106	52	43	76	94	78	85	67	87	43	31	42	53
	3.51-7.50	66	107	74	26	16	9	10	43	98	146	82	77	6	20	16	31
	7.51-12.50	5	1	3	0	2	0	0	0	7	17	14	3	1	3	1	5
	12.51-18.50	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0
	18.51-25.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F	0.75-3.50	55	64	71	49	29	26	13	16	19	23	21	27	23	34	17	33
	3.51-7.50	14	7	4	2	1	1	0	1	8	12	7	9	7	4	0	5
	7.51-12.50	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	12.51-18.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	18.51-25.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G	0.75-3.50	52	54	61	37	15	13	9	12	3	7	7	7	19	13	13	36
	3.51-7.50	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
	7.51-12.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	12.51-18.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	18.51-25.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25+	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 1/1/2015 - 12/31/2015

**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 1/1/2015 - 12/31/2015

Shearon Harris Nuclear Power Plant had no unplanned liquid releases in 2015.

Shearon Harris Nuclear Power Plant had two (2) unplanned gaseous releases in 2015. Summaries in this attachment include:

- Detailed description of event.
- Total Curies released.
- Anticipated dose consequences.

## Attachment 5 Unplanned Offsite Releases

### Shearon Harris Nuclear Power Plant Unit 1 Period 1/1/2015 - 12/31/2015

#### Waste Gas Decay Tank (WGDT) 'G' 10/11/2015: Nuclear Condition Report (NCR) 1963137

On 10/11/15 at 08:13 the Main Control Room (MCR) received a notification from the Radwaste Control Room (RWCR) that the 'G' WGDT pressure was lowering unexpectedly. Upon review of waste gas trend the 'G' WGDT pressure began lowering at 05:39. The tank had already lowered about 18 psig, from 79 psig to 61 psig by OSI-PI. The stack 5 Wide Range Gas Monitor (WRGM) (REM-3546-1 low range) had risen by about one decade. The MCR entered AOP-009 "Accidental Release of Waste Gas" and directed the waste gas system to be secured.

The contents of the "G" waste gas decay tank was sampled on 10/13/15 12:50 and analyzed in accordance of plant procedures. According to Radiation Protection, during the drop of the tank pressure, the Waste Processing Building Stack 5 WRGM (REM-3546-1 low range) rose by about one decade, suggesting that the release occurred to the unrestricted area through that vent stack. Operations observed a 35.3 psi lost in pressure over 344 minutes time period; hence the release occurred at a rate of 4.04 cfm. During the period of the release the Waste Processing Building Stack flow was 145876 cfm with no other releases occurring simultaneously. Thus, this release pathway diluted the waste gas effluent by a factor of 36470.

Isotope	Concentration ( $\mu\text{Ci/cc}$ )	Post Dilution Concentration ( $\mu\text{Ci/cc}$ )	Activity Released (Ci)
H-3	3.061E-07	8.49E-12	1.205E-5
Xe-131M	2.142E-06	5.94E-11	8.430E-5
Xe-133M	2.117E-05	5.87E-10	8.334E-4
Xe-133	8.382E-04	2.32E-08	3.299E-2
Xe-135	1.336E-05	3.71E-10	5.260E-4
<b>Total</b>			3.44E-02

In order to determine the dose to a member of the public from the release of the "G" waste gas decay tank was calculated using the radiological effluent software (OpenEMS) and compared against 10 CFR Part 50 Appendix I limits. The maximum receptor dose for particulates, iodine, and tritium (PIT) from this release, including cow milk, ground plane, inhalation, meat, and vegetation pathways, was determined to be a child at the site boundary with a limiting organ of liver. The noble gas from all gamma and beta emitter in the air was computed, as well as the annual dose rate to the skin and total body. The result were documented in Gaseous Release Permit G-2015-0204 and listed in the table below.

Name	Dose	Limit	% QTR	% Annual
<b>Total Body (PIT)</b>	6.13E-08 mrem	7.5 mrem/qtr 15 mrem/yr	8.17E-07	4.09E-07
<b>Organ (PIT)</b>	6.13E-08 mrem	7.5 mrem/qtr 15 mrem/yr	8.17E-07	4.09E-07
<b>Skin Dose Rate (NG)</b>	2.92E-02 mrem/yr	3000 mrem/yr	N/A	9.72E-04
<b>Total Body Dose Rate (NG)</b>	1.21E-02 mrem/yr	500 mrem/yr	N/A	2.42E-03
<b>Gamma Air Dose</b>	9.44E-06 mrad	5 mrad/qtr 10 mrad/yr	1.89E-04	9.44E-05
<b>Beta Air Dose</b>	2.72E-05 mrad	10 mrad/qtr 20 mrad/yr	2.72E-04	1.36E-04

In each instance, the dose was < 0.01% of the dose limits and thus did not exceed any of the limits at or near the site boundary. Finally, the cumulative gaseous dose from all release (including all stacks and waste gas decay tank releases) is computed, the cumulative maximum individual organ dose is 0.26% of the quarterly limits. Thus, the dose calculations from this release were well beneath any regulatory limits.

## Attachment 5 Unplanned Offsite Releases

### Shearon Harris Nuclear Power Plant Unit 1 Period 1/1/2015 - 12/31/2015

#### WGDT 'G' 12/28/2015: NCR 1986988

On 12/28/15 the MCR received a notification from the RWCR that the 'G' WGDT pressure was lowering unexpectedly. Upon review of waste gas trend the 'G' WGDT pressure began lowering on 12/11/15. The tank had already lowered about 9 psig, from 41 psig to 32 psig by OSI-PI. The MCR entered AOP-009 "Accidental Release of Waste Gas" and directed the waste gas system to be secured and WR 20017505 was issued.

The contents of the "G" waste gas decay tank was sampled on 12/28/15 12:25 (#153071) and analyzed in accordance of plant procedures. Note: The "G" waste gas decay tank was the in service tank and recipient of Reactor Coolant System (RCS) gases from 12/11/15 to 12/28/15. The RCS activity was stable during this period, without any unusual changes or evidence of fuel failure; therefore, the sample obtained on 12/28/15 at 12:25 is representative of the entire time period. According to Radiation Protection, during the drop of the tank pressure, the Waste Processing Building Stack 5 WRGM (REM-3546-1 low range) rose by about less than one decade, suggesting that the release occurred to the unrestricted area through that vent stack. Operations observed a 9 psi lost in pressure over a 24,866 min time period; hence the release occurred at a rate of 1.49E-02 cfm. During the period of the release the Waste Processing Building Stack flow rate fluctuated from 116037 cfm to 145815 cfm (average value 128,670 cfm). Thus, this release pathway diluted the waste gas effluent by a factor of about 8,600,000.

Isotope	Concentration ( $\mu\text{Ci/cc}$ )	Post Dilution Concentration ( $\mu\text{Ci/cc}$ )	Activity Released (Ci)
Ar-41	4.580E-05	5.30E-12	4.800E-04
Kr-85m	5.396E-05	6.24E-12	5.655E-04
Kr-85	2.948E-04	3.41E-11	3.090E-03
Kr-87	1.639E-05	1.90E-12	1.718E-04
Kr-88	6.837E-05	7.91E-12	7.166E-04
Xe-133m	9.374E-05	1.08E-11	9.824E-04
Xe-133	3.413E-03	3.95E-10	3.577E-02
Xe-135	1.415E-03	1.64E-10	1.483E-02
H-3	5.330E-07	6.17E-14	5.586E-06
Rb-88	1.902E-05	2.20E-12	1.993E-04
<b>Total</b>			5.68E-02

In order to determine the dose to a member of the public from the release of the "G" waste gas decay tank was calculated using the radiological effluent software (OpenEMS) and compared against 10 CFR Part 50 Appendix I limits. The maximum receptor dose for particulates, iodine, and tritium (PIT) from this release, including cow milk, ground plane, inhalation, meat, and vegetation pathways, was determined to be a child at the site boundary with a limiting organ of liver. The noble gas from all gamma and beta emitter in the air was computed, as well as the annual dose rate to the skin and total body. The result were documented in Gaseous Release Permit G-2015-0254 and listed in the table below.

Name	Dose	Limit	% QTR	% Annual
<b>Total Body (PIT)</b>	2.84E-08 mrem	7.5 mrem/qtr 15 mrem/yr	3.79E-07	1.89E-07
<b>Organ (PIT)</b>	2.84E-08 mrem	7.5 mrem/qtr 15 mrem/yr	3.79E-07	1.89E-07
<b>Skin Dose Rate (NG)</b>	1.75E-03 mrem/yr	3000 mrem/yr	N/A	5.83E-05
<b>Total Body Dose Rate (NG)</b>	8.34E-04 mrem/yr	500 mrem/yr	N/A	1.67E-04
<b>Gamma Air Dose</b>	4.27E-05 mrad	5 mrad/qtr 10 mrad/yr	8.54E-04	4.27E-04
<b>Beta Air Dose</b>	6.42E-05 mrad	10 mrad/qtr 20 mrad/yr	6.42E-04	3.21E-04

In each instance, the dose was <0.01% of the dose limits and thus did not exceed any of the limits at or near the site boundary. Finally, the cumulative Particulate/Iodine/Tritium gaseous dose from all release (including all stacks and waste gas decay tank releases) is computed, the cumulative maximum individual organ dose is 2.45% of the quarterly limits and 4.73% of the annual limits. Thus, the dose calculations from this release were well beneath any regulatory limits.

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

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

**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 1/1/2015 - 12/31/2015

**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>
<b>A. Noble Gases</b>						
1. Maximum Gamma Air	mRAD	3.05E-05	1.28E-06	9.96E-06	9.17E-05	1.34E-04
(a) Limit	mRAD	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
(b) % of Limit		6.11E-04	2.55E-05	1.99E-04	1.83E-03	1.34E-03
2. Maximum Beta Air	mRAD	9.09E-05	3.80E-06	2.96E-05	2.09E-04	3.33E-04
(a) Limit	mRAD	1.00E+01	1.00E+01	1.00E+01	1.00E+01	2.00E+01
(b) % of Limit		9.09E-04	3.80E-05	2.96E-04	2.09E-03	1.67E-03

Receptor Location **2.14 km SW**

**B. Iodine, H-3, & Particulates**

1. Maximum Organ Dose	mREM	1.29E-01	2.72E-01	1.25E-01	1.82E-01	7.08E-01
(a) Limit	mREM	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
(b) % of Limit		1.72E+00	3.63E+00	1.67E+00	2.43E+00	4.72E+00

Receptor Location **2.14 km SW**

Critical Age **CHILD**

Critical Organ **THYROID**

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

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

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>
<b>A. Batch Mode</b>						
1. Maximum Organ Dose	mREM	1.13E-02	2.25E-02	2.26E-03	1.14E-02	4.74E-02
(a) Limit	mREM	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
(b) % of Limit		2.26E-01	4.49E-01	4.53E-02	2.27E-01	4.74E-01
2. Maximum Total Body Dose	mREM	9.86E-03	1.51E-02	1.70E-03	5.95E-03	3.26E-02
(a) Limit	mREM	1.50E+00	1.50E+00	1.50E+00	1.50E+00	3.00E+00
(b) % of Limit		6.57E-01	1.00E+00	1.13E-01	3.97E-01	1.09E+00

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 1/1/2015 - 12/31/2015

#### 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 millirems to the total body or any organ with the exception of the thyroid which is limited to 75 millirems. 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 2015 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			
<b>A. Gaseous Effluent Dose</b>		<b>E. Harris Lake Evaporation H-3 Dose</b>	
1. Location	2.14 km SW	1. Location	6.12 km SSW
2. Critical Age	CHILD	2. Critical Age	CHILD
3. Critical Organ	THYROID	3. Critical Organ	N/A
4. Organ Dose (mREM)	7.08E-01	4. Organ Dose (mREM)	7.60E-02
5. Total Body Dose (mREM)	7.06E-01	5. Total Body Dose (mREM)	7.60E-02
<b>B. Liquid Effluent Dose</b>		<b>F. Training Center Drinking Water H-3 Dose</b>	
1. Location	2.19 km S	1. Location	OCA
2. Critical Age	ADULT	2. Critical Age	ADULT
3. Critical Organ	GI-LLI	3. Critical Organ	N/A
4. Organ Dose (mREM)	4.74E-02	4. Organ Dose (mREM)	1.28E-01
5. Total Body Dose (mREM)	3.26E-02	5. Total Body Dose (mREM)	1.28E-01
<b>C. Carbon-14 Dose</b>		<b>G. H-3 in Fish from Harris Lake</b>	
1. Location	3.07 km NNE	1. Location	Lake
2. Critical Age	CHILD	2. Critical Age	ADULT
3. Critical Organ	BONE	3. Critical Organ	N/A
4. Organ Dose (mREM)	4.75E-01	4. Organ Dose (mREM)	1.36E-02
5. Total Body Dose (mREM)	9.45E-02	5. Total Body Dose (mREM)	1.36E-02
<b>D. Cooling Tower Plume H-3 Dose</b>			
1. Location	3.07 km NNE		
2. Critical Age	CHILD		
3. Critical Organ	N/A		
4. Organ Dose (mREM)	3.11E-03		
5. Total Body Dose (mREM)	3.11E-03		

## **Attachment 6**

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

#### **Shearon Harris Nuclear Power Plant Unit 1** **Period 1/1/2015 - 12/31/2015**

Dose contributions from Carbon-14 in gaseous effluents have been determined from ODCM 3.3.2, Carbon-14. The maximum dose rate to the nearest real individual from the release of Carbon-14 in batch and continuous gaseous effluents is conservatively calculated to be less than  $4.75\text{E-}01$  mrem/yr based on 7.86 Curies released in 2015 (Ref. Attachment 2, Supplemental Information, of this report).

Dose contributions from Tritium in the Shearon Harris Nuclear Power Plant Cooling Tower plume have been determined from ODCM 2.3, Doses from Return/Re-use of Previously Discharged Radioactive Effluents. The maximum dose rate to the nearest real individual from the release of TRITIUM in the plume is conservatively calculated to be less than  $3.11\text{E-}03$  mrem/yr based on 91.27 Curies released in 2015 (Ref. Attachment 2, Supplemental Information, of this report).

Dose contributions from evaporation of Tritium Harris Lake have been determined from ODCM 2.3, Doses from Return/Re-use of Previously Discharged Radioactive Effluents. The maximum dose rate to the nearest real individual from evaporation of Tritium in Harris Lake is conservatively calculated to be less than  $7.60\text{E-}02$  mrem/yr based on 124.58 Curies released in 2015 (Ref. Attachment 2, Supplemental Information, of this report).

Dose contributions from Tritium in drinking water at the Wake County Fire and HE&EC Training Centers have been determined from 2.3, Doses from Return/Re-use of Previously Discharged Radioactive Effluents. The maximum dose rate to the nearest real individual from consuming the drinking water is conservatively calculated to be less than  $1.28\text{E-}01$  mrem/yr based on an average concentration of  $4.69\text{E+}03$  pCi/L consumed in 2015 (Ref. Attachment 2, Supplemental Information, of this report).

Dose contributions from Tritium in fish in Harris Lake have been determined using NRC Regulatory Guide 1.109, Rev.1, October 1977, Equation A-1, and data from REMP location SW-26. This information was previously included in the Shearon Harris Nuclear Power Plant AREOR. DRR 2008147 was written to include the fish dose calculation methodology in a future ODCM revision, and report in the ARERR. The maximum dose rate to the nearest real individual from consuming the fish in Harris Lake is conservatively calculated to be less than  $1.31\text{E-}02$  mrem/yr based on an average concentration of  $6.17\text{E+}03$  pCi/L consumed in 2015 (Ref. Attachment 2, Supplemental Information, of this report).

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 1/1/2015 - 12/31/2015

**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 1/1/2015 - 12/31/2015

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. 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 remaining Groundwater Monitoring Wells are included in the REMP and reported in the 2015 Shearon Harris Nuclear Power Plant AREOR. The results of the remaining wells are not listed in this report.

Results from sampling during 2015 are shown in the table below.

Tritium Concentration (pCi/L)			
Well #	3rd Qtr	4th Qtr	# Samples
HMW1	<MDA	1.87E+02	2
HMW2	<MDA	<MDA	2
HMW3	<MDA	<MDA	2
HMW4D	<MDA	<MDA	2
HMW4S	<MDA	<MDA	2
HMW5	<MDA	<MDA	2
HMW6	<MDA	<MDA	2
HMW7	<MDA	<MDA	2
HMW8	<MDA	<MDA	2
HMW9	<MDA	<MDA	2
HMW10	<MDA	<MDA	2
HMW11	<MDA	<MDA	2

NOTE: MDA for monitoring wells 185 pCi/L

One (1) event meeting the criteria for voluntary notification per NEI 07-07, Industry Ground Water Protection Initiative, occurred at Shearon Harris Nuclear Power Plant in 2015. Summary of the event is as follows:

#### NCR 733114 (EN 50829) Spill from Settling Basin.

On 2/16/15 2200 during an Waste Neutralization Basin transfer, the Waste Processing Building operator noticed that water was flowing through an drain hole on the northwest corner of the basin and >100 gallons of Settling Basin water flowing to the ground. The water was determined to contain 9,415 pCi/L of licensed tritium with no plant related gamma emitters. Some of the water was observed flowing towards the Auxiliary Reservoir Intake through an adjacent storm drain pipe. The water was sampled and found to contain 3,066 pCi/L. This storm drains pipe tunnels under the Protected Area fence and adjacent plant road and discharges into a field directly west of the Settling Basin. There is a drainage culver in the field which ultimately drainages into the Emergency Intake Structure (Storm Water 7) approximately 0.4 miles south-southwest of the site. There was no risk to the public from the release and the release did not create a new dose pathway.

**Attachment 8**  
**Inoperable Equipment**

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

**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 1/1/2015 - 12/31/2015

Shearon Harris Nuclear Power Plant did not experience inoperable equipment relevant to effluent monitoring in excess of ODCM limits during 2015.

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 2015.

**Attachment 9**  
**Summary of Changes to the Offsite Dose Calculation Manual**

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

**ATTACHMENT 9**

**Summary of Changes to the Offsite Dose Calculation Manual Example**

This attachment includes a summary of changes to the ODCM and Radiological Effluent Controls.

**Attachment 9**  
**Summary of Changes to the Offsite Dose Calculation Manual**

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

**ODCM Revision 25**

The Shearon Harris Nuclear Power Plant ODCM was not revised in 2015. The most recent revision is 25 and was provided with the 2014 ARERR.

**Attachment 10**  
**Summary of Changes to the Process Control Program**

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

**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 1/1/2015 - 12/31/2015

The Shearon Harris Nuclear Power Plant PCP was not revised in 2015.



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

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

**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 1/1/2015 - 12/31/2015

No major modifications to Shearon Harris Nuclear Power Plant liquid, gaseous, solid, or mobile radioactive waste treatment systems occurred in 2015.

**Attachment 12**  
**Errata to a Previous Year's ARERR Example**

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

**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 Example**

Shearon Harris Nuclear Power Plant Unit 1  
Period 1/1/2015 - 12/31/2015

There are no changes to a previous year's ARERR.