DUKE ENERGY®

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U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Subject: Duke Energy Carolinas, LLC
Oconee Nuclear Station,
Docket Nos. 50-269, 50-270 and 50-287
2015 Annual Radioactive Effluent Release Report (ARERR)

Pursuant to Oconee Nuclear Station Technical Specification (TS) 5.6.3 and Selected Licensee Commitment 16.11-9, please find attached the Annual Radioactive Effluent Release Report for the period of January 1, 2015 through December 31, 2015. In accordance with TS 5.5.1, the Offsite Dose Calculation Manual (ODCM) is included in this submittal.

| | |
|---|---|
| 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 |
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| Attachment 11 | Summary of Major Modifications to the Radioactive Waste Treatment Systems |
| Attachment 12 | Errata to a Previous Year's ARERR Example |

IE48
NRR

Enclosure 2015 Offsite Dose Calculation Manual (Compact Disc)

Any questions concerning this report should be directed to Pam Metler at 864-873-3856.

Sincerely,

Scott Batson
Site Vice President
Oconee Nuclear Station

Attachments (12)
Enclosure (1)

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DUKE ENERGY®

# Oconee Nuclear Station
# Units 1, 2, and 3

# Annual Radioactive Effluent Release Report

## January 1, 2015 through December 31, 2015

### Dockets 50-269, 50-270, and 50-287

# Introduction

The Annual Radioactive Effluent Release Report is pursuant to Oconee Nuclear Station Technical Specification 5.6.3 and Selected Licensee Commitment 16.11-9. The below listed attachments to this report provide the required information. In addition, the ODCM is included pursuant to Oconee Nuclear Station Technical Specification 5.5.1.

| | |
|---|---|
| Attachment 1 | Summary of Gaseous and Liquid Effluents |
| Attachment 2 | Supplemental Information |
| Attachment 3 | Solid Radioactive Waste Disposal |
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| Attachment 12 | Errata to a Previous Year's ARERR |

# 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

### Gaseous Effluents - Summation of All Releases

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year |
|---|---|---|---|---|---|---|
| A. Fission and Activation Gases | | | | | | |
| 1. Total Release | Ci | 3.00E+00 | 1.57E+00 | 1.36E+00 | 7.02E-01 | 6.63E+00 |
| 2. Avg. Release Rate | µCi/sec | 3.85E-01 | 2.00E-01 | 1.71E-01 | 8.83E-02 | 2.10E-01 |
| B. Iodine-131 | | | | | | |
| 1. Total Release | Ci | 7.68E-10 | 0.00E+00 | 0.00E+00 | 3.72E-10 | 1.14E-09 |
| 2. Avg. Release Rate | µCi/sec | 9.88E-11 | 0.00E+00 | 0.00E+00 | 4.67E-11 | 3.61E-11 |
| C. Particulates Half-Life ≥ 8 days | | | | | | |
| 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 |
| D. Tritium | | | | | | |
| 1. Total Release | Ci | 3.60E+01 | 2.31E+01 | 8.76E+01 | 3.34E+01 | 1.80E+02 |
| 2. Avg. Release Rate | µCi/sec | 4.63E+00 | 2.93E+00 | 1.10E+01 | 4.20E+00 | 5.71E+00 |
| E. Carbon-14 | | | | | | |
| 1. Total Release | Ci | 5.98E+00 | 6.10E+00 | 5.97E+00 | 5.51E+00 | 2.36E+01 |
| 2. Avg. Release Rate | µCi/sec | 7.68E-01 | 7.76E-01 | 7.51E-01 | 6.93E-01 | 7.47E-01 |
| F. 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Gaseous Effluents - Elevated Releases - Continuous Mode

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year |
|---|---|---|---|---|---|---|
| A. Fission and Activation Gases | | | | | | |
| AR-41 | Ci | 3.39E-01 | 2.70E-01 | 5.19E-01 | 0.00E+00 | 1.13E+00 |
| KR-85M | Ci | 1.11E-03 | 2.44E-03 | 0.00E+00 | 0.00E+00 | 3.55E-03 |
| KR-87 | Ci | 0.00E+00 | 2.61E-03 | 0.00E+00 | 0.00E+00 | 2.61E-03 |
| KR-88 | Ci | 0.00E+00 | 4.62E-03 | 0.00E+00 | 0.00E+00 | 4.62E-03 |
| XE-133 | Ci | 1.90E+00 | 1.17E+00 | 7.81E-01 | 6.65E-01 | 4.51E+00 |
| XE-135 | Ci | 1.28E-02 | 3.51E-02 | 3.01E-02 | 0.00E+00 | 7.80E-02 |
| XE-135M | Ci | 2.61E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.61E-03 |
| Total for Period | Ci | 2.26E+00 | 1.48E+00 | 1.33E+00 | 6.65E-01 | 5.73E+00 |
| B. Iodines | | | | | | |
| None | Ci | - | - | - | - | - |
| Total for Period | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| 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 | 3.38E+01 | 2.04E+01 | 8.22E+01 | 2.64E+01 | 1.63E+02 |
| E. Carbon-14 | | | | | | |
| C-14 | Ci | 1.79E+00 | 1.83E+00 | 1.79E+00 | 1.65E+00 | 7.05E+00 |
| F. Gross Alpha | | | | | | |
| Total for Period | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| G. Others | | | | | | |
| C-11 | Ci | 0.00E+00 | 4.29E-03 | 0.00E+00 | 0.00E+00 | 4.29E-03 |
| Total for Period | Ci | 0.00E+00 | 4.29E-03 | 0.00E+00 | 0.00E+00 | 4.29E-03 |

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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Gaseous Effluents - Elevated Releases - Batch Mode

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year |
|---|---|---|---|---|---|---|
| A. Fission and Activation Gases | | | | | | |
| AR-41 | Ci | 0.00E+00 | 4.93E-02 | 1.90E-02 | 4.21E-05 | 6.84E-02 |
| KR-85 | Ci | 4.14E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 4.14E-03 |
| KR-85M | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 4.88E-06 | 4.88E-06 |
| XE-131M | Ci | 0.00E+00 | 3.27E-04 | 8.28E-05 | 0.00E+00 | 4.10E-04 |
| XE-133 | Ci | 7.36E-01 | 4.05E-02 | 1.28E-02 | 3.67E-02 | 8.26E-01 |
| XE-133M | Ci | 0.00E+00 | 3.99E-04 | 1.88E-04 | 0.00E+00 | 5.86E-04 |
| XE-135 | Ci | 0.00E+00 | 2.64E-04 | 1.23E-05 | 1.84E-04 | 4.60E-04 |
| Total for Period | Ci | 7.40E-01 | 9.09E-02 | 3.22E-02 | 3.69E-02 | 9.00E-01 |
| B. Iodines | | | | | | |
| I-131 | Ci | 7.68E-10 | 0.00E+00 | 0.00E+00 | 3.72E-10 | 1.14E-09 |
| Total for Period | Ci | 7.68E-10 | 0.00E+00 | 0.00E+00 | 3.72E-10 | 1.14E-09 |
| 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 | 3.93E-05 | 6.08E-02 | 4.22E-02 | 4.91E-02 | 1.52E-01 |
| E. Carbon-14 | | | | | | |
| C-14 | Ci | 4.19E+00 | 4.27E+00 | 4.18E+00 | 3.86E+00 | 1.65E+01 |
| F. 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**

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Gaseous Effluents - Ground Releases - Continuous Mode

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year |
|---|---|---|---|---|---|---|
| A. Fission and Activation Gases | | | | | | |
| None | Ci | - | - | - | - | - |
| Total for Period | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| B. Iodines | | | | | | |
| None | Ci | - | - | - | - | - |
| Total for Period | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| 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 | 2.13E+00 | 2.62E+00 | 5.35E+00 | 6.93E+00 | 1.70E+01 |
| E. Carbon-14 | | | | | | |
| C-14 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| F. 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Gaseous Effluents - Ground Releases - Batch Mode

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year |
|---|---|---|---|---|---|---|
| A. Fission and Activation Gases | | | | | | |
| None | Ci | - | - | - | - | - |
| Total for Period | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| B. Iodines | | | | | | |
| None | Ci | - | - | - | - | - |
| Total for Period | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| 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 | 6.03E-02 | 1.34E-02 | 1.77E-02 | 4.43E-02 | 1.36E-01 |
| E. Carbon-14 | | | | | | |
| C-14 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| F. 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Liquid Effluents - Summation of All Releases

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year |
|---|---|---|---|---|---|---|
| A. Fission and Activation Products * | | | | | | |
| 1. Total Release | Ci | 2.59E-04 | 1.13E-03 | 9.48E-04 | 1.93E-03 | 4.27E-03 |
| 2. Avg. Diluted Conc. | µCi/ml | 4.82E-14 | 2.59E-13 | 2.82E-13 | 5.48E-13 | 2.72E-13 |
| 3. Batch Releases | µCi/ml | 3.10E-11 | 1.34E-10 | 1.11E-10 | 2.25E-10 | 1.26E-10 |
| B. Tritium | | | | | | |
| 1. Total Release | Ci | 2.04E+02 | 1.86E+02 | 3.90E+02 | 2.59E+02 | 1.04E+03 |
| 2. Avg. Diluted Conc. | µCi/ml | 6.83E-08 | 7.28E-08 | 1.48E-07 | 1.21E-07 | 1.02E-07 |
| 3. Batch Releases | µCi/ml | 2.44E-05 | 2.20E-05 | 4.55E-05 | 3.02E-05 | 3.06E-05 |
| C. Dissolved & Entrained Gases | | | | | | |
| 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 |
| 3. Batch Releases | µCi/ml | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| 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 |
| 3. Batch Releases | µCi/ml | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| E. Volume of Liquid Waste | | | | | | |
| 1. Continuous Releases | liters | 6.04E+08 | 5.24E+08 | 5.57E+08 | 1.04E+09 | 2.73E+09 |
| 2. Batch Releases | liters | 9.41E+05 | 1.02E+06 | 1.42E+06 | 2.54E+06 | 5.92E+06 |
| F. Volume of Dilution Water | | | | | | |
| 1. Continuous Releases | liters | 8.37E+09 | 8.44E+09 | 8.55E+09 | 8.55E+09 | 3.39E+10 |
| 2. Batch Releases | liters | 8.37E+09 | 8.44E+09 | 8.55E+09 | 8.55E+09 | 3.39E+10 |

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

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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Liquid Effluents - Continuous Mode

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year |
|---|---|---|---|---|---|---|
| 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 | 2.73E-01 | 2.71E-01 | 3.00E-01 | 4.63E-01 | 1.31E+00 |
| 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Liquid Effluents - Batch Mode

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year |
|---|---|---|---|---|---|---|
| A. Fission and Activation Products | | | | | | |
| AG-110M | Ci | 0.00E+00 | 2.62E-05 | 9.91E-05 | 0.00E+00 | 1.25E-04 |
| CO-58 | Ci | 5.77E-05 | 7.17E-04 | 6.66E-04 | 1.04E-03 | 2.48E-03 |
| CO-60 | Ci | 0.00E+00 | 6.16E-05 | 4.48E-05 | 0.00E+00 | 1.06E-04 |
| CR-51 | Ci | 0.00E+00 | 5.71E-05 | 0.00E+00 | 0.00E+00 | 5.71E-05 |
| CS-137 | Ci | 1.40E-04 | 6.64E-05 | 0.00E+00 | 0.00E+00 | 2.07E-04 |
| FE-55 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 8.56E-04 | 8.56E-04 |
| I-131 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.04E-06 | 5.04E-06 |
| NB-95 | Ci | 0.00E+00 | 6.21E-05 | 0.00E+00 | 0.00E+00 | 6.21E-05 |
| NB-97 | Ci | 0.00E+00 | 1.16E-05 | 0.00E+00 | 0.00E+00 | 1.16E-05 |
| NI-63 | Ci | 6.15E-05 | 1.15E-04 | 1.38E-04 | 2.80E-05 | 3.43E-04 |
| ZR-97 | Ci | 0.00E+00 | 1.16E-05 | 0.00E+00 | 0.00E+00 | 1.16E-05 |
| Total for Period | Ci | 2.59E-04 | 1.13E-03 | 9.48E-04 | 1.93E-03 | 4.27E-03 |
| B. Tritium | | | | | | |
| H-3 | Ci | 2.04E+02 | 1.86E+02 | 3.89E+02 | 2.58E+02 | 1.04E+03 |
| 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 2

## Supplemental Information

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

# Attachment 2
# Supplemental Information

## Oconee Nuclear Station Units 1, 2, & 3
## 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 Selected Licensee Commitments 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**

| | | | |
|---|---|---|---|
| 1. | Total Number of Batch Releases | = | 6.70E+01 |
| 2. | Total Time (min) for Batch Releases | = | 1.34E+04 |
| 3. | Maximum Time (min) for a Batch Release | = | 2.25E+02 |
| 4. | Average Time (min) for Batch Releases | = | 2.00E+02 |
| 5. | Minimum Time (min) for a Batch Release | = | 5.90E+01 |
| 6. | Average Dilution Water Flow During Release (gpm) | = | 1.70E+04 |

**B. Gaseous Effluents**

| | | | |
|---|---|---|---|
| 1. | Total Number of Batch Releases | = | 4.90E+01 |
| 2. | Total Time (min) for Batch Releases | = | 5.88E+04 |
| 3. | Maximum Time (min) for a Batch Release | = | 1.62E+04 |
| 4. | Average Time (min) for Batch Releases | = | 1.20E+03 |
| 5. | Minimum Time (min) for a Batch Release | = | 3.50E+01 |

**VI. Abnormal Releases**

See Attachment 5, Unplanned Offsite Releases.

## Attachment 2
## Supplemental Information

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

## Carbon-14

Carbon-14 (C-14), with a half-life of 5730 years, is a naturally occurring isotope of carbon produced by cosmic ray interactions in the atmosphere. Nuclear weapons testing in the 1950s and 1960s significantly increased the amount of C-14 in the atmosphere. C-14 is also produced in commercial nuclear reactors, but the amounts produced are much less than those produced naturally or from weapons testing.

In Regulatory Guide 1.21, Revision 2, "Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste", the NRC recommends U.S. nuclear power plants evaluate whether C-14 is a "principal radionuclide", and if so, report the amount of C-14 released. Improvements over the years in effluent management practices and fuel performance have resulted in a decrease in gaseous radionuclide (non-C-14) concentrations, and a change in the distribution of gaseous radionuclides released to the environment. As a result, many sites show C-14 has become a "principal radionuclide" for the gaseous effluent pathway, as defined in Regulatory Guide 1.21, Rev. 2. Oconee Nuclear Station 2015 ARERR contains estimates of C-14 radioactivity released in 2015, and estimates of public dose resulting from the C-14 effluent.

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). Many documents provide information related to the magnitude of C-14 in typical effluents from commercial nuclear power plants. Those documents suggest that nominal annual releases of C-14 in gaseous effluents are approximately 5 to 7.3 curies from PWRs (Ref. Reg. Guide 1.21, Rev. 2). A more recent study recommends a higher C-14 gaseous source term scaling factor of approximately 9.0 to 9.8 Ci/GWe-yr for a PWR (Westinghouse) (Ref. EPRI 1021106). For the Oconee Nuclear Station 2015 ARERR a source term scaling factor of 9.4 Ci/GWe-yr is assumed. Using a source term scaling factor of 9.4 Ci/GWe-yr and actual electric generation (MWe-hrs) from Oconee Nuclear Station in 2015 results in a site total C-14 gaseous release estimate to the environment of 23.54 Curies. 70% of the C-14 gaseous effluent is assumed to be from batch releases (e.g. WGDTs), and 30% of C-14 gaseous effluent is assumed to be from continuous releases through the unit vents (ref. IAEA Technical Reports Series no. 421, "Management of Waste Containing Tritium and Carbon-14", 2004).

C-14 releases in PWRs occur primarily as a mix of organic carbon and carbon dioxide released from the waste gas system. Since the PWR operates with a reducing chemistry, most, if not all, of the C-14 species initially produced are organic (e.g., methane). As a general rule, C-14 in the primary coolant is essentially all organic with a large fraction as a gaseous species. Any time the RCS liquid or gas is exposed to an oxidizing environment (e.g. during shutdown or refueling), a slow transformation from an organic to an inorganic chemical form can occur. Various studies documenting measured C-14 releases from PWRs suggest a range of 70% to 95% organic with an average of 80% organic with the remainder being $CO_2$ (Ref. EPRI TR-105715). For the Oconee Nuclear Station 2015 ARERR a value of 80% organic C-14 is assumed.

Public dose estimates from airborne C-14 are performed using dose models in NUREG-0133 and Regulatory Guide 1.109. The dose models and assumptions used are documented in the Oconee ODCM. The estimated C-14 dose impact on the maximum organ dose from airborne effluents released from Oconee Nuclear Station in 2015 is well below the 10CFR50, Appendix I, ALARA design objective (i.e., 15 mrem/yr per unit).

## Attachment 2
## Supplemental Information

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

### Overall Estimate of Error for Effluent Radioactivity Release Reported

The estimated percentage of overall error for both Liquid and Gaseous effluent release data at Oconee Nuclear Station has been determined to be ± 30.3%. This value was derived by taking the square root of the sum of the squares of the following discrete individual estimates of error:

1. Flow Rate Determining Devices = ± 20%
2. Counting Statistical Error = ± 20%
3. Calibration Error = ± 10%
4. Calibration Source Error = ± 2.5%
5. Sample Preparation Error = ± 3%

## Attachment 2
## Supplemental Information

Oconee Nuclear Station Units 1, 2, & 3
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 May 19-20, 2015, and the results were certified and made available for use on June 4, 2015. The following are changes to residences, gardens, and milk animals from the previous year.

Residences

No changes to nearest residence in each sector.

Gardens

Broad leaf vegetation samples are taken in lieu of a garden census for Oconee Nuclear Station. For dose calculation purposes a garden is assumed to exist at the site boundary and beyond for every sector since a garden location cannot be ruled out.

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

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

## Oconee Nuclear Station Units 1, 2, & 3
## 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 ($m^3$) | Total Activity (Curies) |
|---|---|---|---|---|---|---|---|---|
| 1. | **Waste from Liquid Systems** | | | | | | | |
| | a. Dewatered Secondary Resins | 4 | 12 | AU | GDP | N/A | 70.48 | 1.677 |
| | b. Dewatered Primary Resins | 6 | 6 | 5 - B<br>1 - AS | Type A<br>GDP | N/A | 20.44 | 176.38 |
| | c. Evaporator Concentrates | 0 | - | - | - | - | - | - |
| | d. Dewatered Mechanical Filters | 2 | 2 | C | Type A | N/A | 6.81 | 8.48 |
| | e. Dewatered Demineralizers | 0 | - | - | - | - | - | - |
| | f. Solidified (cement) Acids, Oils, Sludge | 0 | - | - | - | - | - | - |
| 2. | **Dry Solid Waste** | | | | | | | |
| | a. Dry Active Waste (compacted) | 0 | - | - | - | - | - | - |
| | b. Dry Active Waste (non-compacted) | 19 | 38 | 37-AU<br>1 - AS | GDP | N/A | 890.64 | 177.686 |
| | c. Dry Active Waste (brokered) | 0 | - | - | - | - | - | - |
| | d. Irradiated Components | 0 | - | - | - | - | - | - |
| 3. | **Total Solid Waste** | **31** | **58** | | | | **988.37** | **364.223** |

# Attachment 3
# Solid Radioactive Waste Disposal

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

| Type of Waste Shipped | | Radionuclide | % Abundance |
|---|---|---|---|
| 1. **Waste from Liquid Systems** | | | |
| a. Dewatered Secondary Resins | | | |
| | **15-2007** | AG-110m | 0.0768 |
| | | C-14 | 7.9182 |
| | | CE-144 | 0.0348 |
| | | CO-57 | 0.0284 |
| | | CO-58 | 0.0379 |
| | | CO-60 | 2.3048 |
| | | CS-134 | 0.0998 |
| | | CS-137 | 0.7230 |
| | | FE-55 | 12.7509 |
| | | H-3 | 55.5762 |
| | | MN-54 | 0.1093 |
| | | NI-63 | 19.8885 |
| | | SB-125 | 0.4721 |
| | **15-2008** | AG-110m | 0.0425 |
| | | C-14 | 6.1575 |
| | | CE-144 | 0.0218 |
| | | CO-57 | 0.0150 |
| | | CO-58 | 0.0018 |
| | | CO-60 | 1.5776 |
| | | CS-134 | 0.1961 |
| | | CS-137 | 1.1074 |
| | | FE-55 | 7.7088 |
| | | H-3 | 67.3031 |
| | | MN-54 | 0.0494 |
| | | NI-63 | 15.3938 |
| | | SB-125 | 0.4558 |
| | **15-2024** | AG-110m | 0.1287 |
| | | C-14 | 5.0592 |
| | | CE-144 | 0.0182 |
| | | CO-57 | 0.0203 |
| | | CO-58 | 0.0825 |
| | | CO-60 | 1.4527 |
| | | CS-134 | 0.0530 |
| | | CS-137 | 0.4142 |
| | | FE-55 | 5.7692 |
| | | H-3 | 73.9645 |
| | | MN-54 | 0.1059 |
| | | NB-95 | 0.0006 |
| | | NI-63 | 12.6923 |
| | | SB-125 | 0.2379 |
| | | ZN-65 | 0.0340 |
| | **15-2025** | AG-110m | 0.0329 |
| | | C-14 | 2.8774 |
| | | CE-144 | 0.0358 |
| | | CO-57 | 0.0262 |
| | | CO-58 | 0.0994 |
| | | CO-60 | 0.8355 |
| | | CS-134 | 0.0926 |
| | | CS-137 | 0.6613 |
| | | FE-55 | 4.5806 |
| | | H-3 | 82.9032 |
| | | NB-95 | 0.0025 |
| | | NI-63 | 7.2258 |
| | | SB-125 | 0.3774 |
| | | ZN-65 | 0.0209 |

# Attachment 3
# Solid Radioactive Waste Disposal

## Oconee Nuclear Station Units 1, 2, & 3
## Period 1/1/2015 - 12/31/2015

b. Dewatered Primary Resins

| | | |
|---|---|---|
| **15-2001** | AG-110m | 0.0566 |
| | AM-241 | 0.0002 |
| | C-14 | 1.3411 |
| | CE-144 | 0.0177 |
| | CM-243/44 | 0.0002 |
| | CO-57 | 0.5430 |
| | CO-58 | 7.6159 |
| | CO-60 | 4.4702 |
| | CS-134 | 1.7980 |
| | CS-137 | 7.4834 |
| | FE-55 | 18.0464 |
| | H-3 | 0.3175 |
| | I-129 | 0.0005 |
| | MN-54 | 0.8212 |
| | NI-59 | 0.3709 |
| | NI-63 | 56.9536 |
| | SB-125 | 0.1298 |
| | SR-89 | 0.0006 |
| | SR-90 | 0.0338 |
| | TC-99 | 0.0053 |
| | ZN-65 | 0.0573 |
| **15-2010** | AG-110m | 0.0631 |
| | AM-241 | 0.0012 |
| | C-14 | 1.8803 |
| | CE-144 | 0.0631 |
| | CM-242 | 0.0004 |
| | CM-243/44 | 0.0012 |
| | CO-57 | 0.5676 |
| | CO-58 | 18.4556 |
| | CO-60 | 6.6409 |
| | CS-134 | 0.7626 |
| | CS-137 | 3.7066 |
| | FE-55 | 14.7683 |
| | FE-59 | 0.0263 |
| | MN-54 | 1.2259 |
| | NB-95 | 0.0772 |
| | NI-63 | 50.3861 |
| | SB-124 | 0.2954 |
| | SB-125 | 0.5097 |
| | SR-90 | 0.0392 |
| | ZN-65 | 0.2297 |
| | ZR-95 | 0.0595 |

## Attachment 3
## Solid Radioactive Waste Disposal

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

| | | |
|---|---|---|
| **15-2018** | AG-110m | 0.0652 |
| | Be-7 | 3.2879 |
| | C-14 | 0.3561 |
| | CE-144 | 0.0220 |
| | CM-242 | 0.0001 |
| | CM-243/44 | 0.0001 |
| | CO-57 | 0.6561 |
| | CO-58 | 18.4848 |
| | CO-60 | 4.6970 |
| | CS-134 | 0.4212 |
| | CS-137 | 2.1364 |
| | FE-55 | 17.1212 |
| | FE-59 | 0.0270 |
| | H-3 | 0.1432 |
| | I-129 | 0.0002 |
| | MN-54 | 2.4242 |
| | NB-95 | 0.0703 |
| | NI-59 | 0.2727 |
| | NI-63 | 49.3939 |
| | PU-238 | 0.0003 |
| | PU-241 | 0.0049 |
| | SB-124 | 0.0134 |
| | SR-89 | 0.0261 |
| | SR-90 | 0.0161 |
| | TC-99 | 0.0014 |
| | ZN-65 | 0.2152 |
| | ZR-95 | 0.0491 |
| **15-2023** | AG-110m | 0.1014 |
| | AM-241 | 0.0001 |
| | Be-7 | 1.3264 |
| | C-14 | 0.3069 |
| | CE-144 | 0.0254 |
| | CM-242 | 0.0001 |
| | CM-243/44 | 0.0001 |
| | CO-57 | 0.5938 |
| | CO-58 | 12.7778 |
| | CO-60 | 4.7917 |
| | CS-134 | 0.9479 |
| | CS-137 | 5.1389 |
| | FE-55 | 16.7014 |
| | H-3 | 0.0090 |
| | MN-54 | 1.7951 |
| | NI-59 | 0.3083 |
| | NI-63 | 54.5139 |
| | PU-238 | 0.0004 |
| | PU-241 | 0.0090 |
| | SB-124 | 0.0462 |
| | SB-125 | 0.0816 |
| | SR-89 | 0.0111 |
| | SR-90 | 0.0340 |
| | TC-99 | 0.0022 |
| | ZN-65 | 0.1681 |

## Attachment 3
## Solid Radioactive Waste Disposal

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

| | | | |
|---|---|---|---|
| | **15-2026** | AG-110m | 0.1680 |
| | | AM-241 | 0.0003 |
| | | Be-7 | 0.3688 |
| | | C-14 | 1.5156 |
| | | CE-144 | 0.0452 |
| | | CM-242 | 0.0005 |
| | | CM-243/44 | 0.0004 |
| | | CO-57 | 0.5422 |
| | | CO-58 | 9.2188 |
| | | CO-60 | 6.3438 |
| | | CS-134 | 0.8125 |
| | | CS-137 | 4.6406 |
| | | FE-55 | 20.0000 |
| | | I-129 | 0.0007 |
| | | MN-54 | 1.7344 |
| | | NB-95 | 0.1930 |
| | | NI-59 | 0.3484 |
| | | NI-63 | 52.9688 |
| | | PU-238 | 0.0011 |
| | | PU-241 | 0.0179 |
| | | SB-124 | 0.0805 |
| | | SB-125 | 0.1656 |
| | | SR-90 | 0.0341 |
| | | TC-99 | 0.0019 |
| | | ZN-65 | 0.2797 |
| | | ZR-95 | 0.1336 |
| | **15-2039** | AG-110m | 0.1302 |
| | | AG-108m | 0.0389 |
| | | Be-7 | 0.1398 |
| | | C-14 | 0.0015 |
| | | CE-144 | 0.0802 |
| | | CM-242 | 0.0003 |
| | | CM-243/44 | 0.0004 |
| | | CO-57 | 0.4551 |
| | | CO-58 | 5.7485 |
| | | CO-60 | 5.0299 |
| | | CS-134 | 1.2395 |
| | | CS-137 | 7.6048 |
| | | FE-55 | 10.8683 |
| | | H-3 | 0.0078 |
| | | I-129 | 0.0001 |
| | | MN-54 | 1.6287 |
| | | NB-95 | 0.0461 |
| | | NI-59 | 0.6886 |
| | | NI-63 | 65.8683 |
| | | PU-238 | 0.0001 |
| | | PU-241 | 0.0179 |
| | | SB-124 | 0.0162 |
| | | SB-125 | 0.0832 |
| | | SR-89 | 0.0003 |
| | | SR-90 | 0.0012 |
| | | TC-99 | 0.0062 |
| | | ZN-65 | 0.1964 |
| c. | Evaporator Concentrates | N/A | N/A |

# Attachment 3
# Solid Radioactive Waste Disposal

## Oconee Nuclear Station Units 1, 2, & 3
## Period 1/1/2015 - 12/31/2015

| | | | |
|---|---|---|---|
| d. Dewatered Mechanical Filters | | | |
| | **15-2006** | AG-110m | 0.0240 |
| | | C-14 | 16.6167 |
| | | CE-144 | 0.7944 |
| | | CO-57 | 0.2377 |
| | | CO-58 | 8.3298 |
| | | CO-60 | 26.5525 |
| | | CR-51 | 0.0040 |
| | | CS-134 | 8.8865 |
| | | CS-137 | 25.4818 |
| | | FE-55 | 2.6124 |
| | | FE-59 | 0.0010 |
| | | H-3 | 0.0042 |
| | | MN-54 | 4.0685 |
| | | NB-95 | 0.1015 |
| | | NI-63 | 4.2398 |
| | | SB-125 | 0.0621 |
| | | SR-90 | 0.0098 |
| | | ZN-65 | 1.2355 |
| | | ZR-95 | 0.7794 |
| | **15-2040** | AG-110m | 0.6010 |
| | | C-14 | 7.3228 |
| | | CE-144 | 0.6378 |
| | | HF-181 | 0.0003 |
| | | SC-46 | 0.0010 |
| | | CO-57 | 0.4672 |
| | | CO-58 | 9.2651 |
| | | CO-60 | 18.8714 |
| | | CR-51 | 0.4908 |
| | | CS-134 | 0.0745 |
| | | CS-137 | 1.5171 |
| | | FE-55 | 46.7192 |
| | | FE-59 | 0.0491 |
| | | H-3 | 0.0596 |
| | | I-129 | 0.2074 |
| | | MN-54 | 4.8556 |
| | | NB-95 | 0.2580 |
| | | NI-63 | 4.7769 |
| | | SB-124 | 0.0352 |
| | | SN-113 | 0.0003 |
| | | SR-90 | 0.0073 |
| | | TC-99 | 0.8110 |
| | | ZN-65 | 2.3333 |
| | | ZR-95 | 0.9895 |
| e. Dewatered Demineralizers | | N/A | N/A |
| f. Solidified (cement) Acids, Oils, Sludge | | N/A | N/A |
| **2. Dry Solid Waste** | | | |
| a. Dry Active Waste (compacted) | | N/A | N/A |

# Attachment 3
# Solid Radioactive Waste Disposal

## Oconee Nuclear Station Units 1, 2, & 3
## Period 1/1/2015 - 12/31/2015

b. Dry Active Waste (non-compacted)

| | | |
|---|---|---|
| **15-2002** | C-14 | 0.2781 |
| | CE-144 | 0.2933 |
| | CO-57 | 0.3337 |
| | CO-58 | 81.4050 |
| | CO-60 | 1.6405 |
| | CR-51 | 1.9656 |
| | CS-137 | 0.0844 |
| | FE-55 | 5.1694 |
| | FE-59 | 0.2317 |
| | MN-54 | 0.2559 |
| | NB-95 | 1.1598 |
| | NI-63 | 5.9118 |
| | TC-99 | 0.1605 |
| | ZR-95 | 1.0179 |
| **15-2003** | C-14 | 0.2329 |
| | CE-144 | 0.2573 |
| | CO-57 | 0.2934 |
| | CO-58 | 82.4883 |
| | CO-60 | 1.3873 |
| | CR-51 | 2.5869 |
| | CS-137 | 0.0705 |
| | FE-55 | 4.3897 |
| | FE-59 | 0.2606 |
| | MN-54 | 0.2099 |
| | NB-95 | 1.4047 |
| | NI-63 | 4.9484 |
| | TC-99 | 0.1344 |
| | ZR-95 | 1.0516 |
| **15-2004** | C-14 | 0.3228 |
| | CE-144 | 0.3263 |
| | MO-99 | 0.2711 |
| | CO-57 | 0.3709 |
| | CO-58 | 80.4825 |
| | CO-60 | 1.8921 |
| | CR-51 | 1.4737 |
| | CS-137 | 0.0978 |
| | FE-55 | 5.6667 |
| | FE-59 | 0.2089 |
| | MN-54 | 0.2711 |
| | NB-95 | 0.9588 |
| | NI-63 | 6.8526 |
| | TC-99 | 0.1854 |
| | ZR-95 | 0.9856 |
| **15-2005** | C-14 | 0.2696 |
| | CE-144 | 0.2872 |
| | CO-57 | 0.3264 |
| | CO-58 | 82.2336 |
| | CO-60 | 1.5916 |
| | CR-51 | 2.0047 |
| | CS-137 | 0.0817 |
| | FE-55 | 5.0215 |
| | FE-59 | 0.2365 |
| | MN-54 | 0.2510 |
| | NB-95 | 1.1879 |
| | NI-63 | 5.7234 |
| | TC-99 | 0.6879 |
| | ZR-95 | 1.0299 |

## Attachment 3
## Solid Radioactive Waste Disposal

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

| | | |
|---|---|---|
| **15-2009** | C-14 | 0.3090 |
| | CE-144 | 0.3164 |
| | CO-57 | 0.3589 |
| | CO-58 | 80.5104 |
| | CO-60 | 1.8167 |
| | CR-51 | 1.5394 |
| | CS-137 | 0.0959 |
| | FE-55 | 5.6961 |
| | FE-59 | 0.2110 |
| | MN-54 | 0.2769 |
| | NB-95 | 0.9942 |
| | NI-63 | 6.5661 |
| | TC-99 | 0.1774 |
| | ZR-95 | 0.2065 |
| **15-2013** | AG-110m | 0.0354 |
| | C-14 | 2.9454 |
| | CE-144 | 0.1250 |
| | CO-57 | 0.0605 |
| | CO-58 | 5.9876 |
| | CO-60 | 2.4101 |
| | CR-51 | 0.2236 |
| | CS-137 | 0.4985 |
| | FE-55 | 69.7786 |
| | FE-59 | 0.0199 |
| | MN-54 | 0.2043 |
| | NB-95 | 0.1214 |
| | NI-63 | 16.9773 |
| | SB-125 | 0.3151 |
| | ZR-95 | 0.1352 |
| **15-2014** | C-14 | 0.3451 |
| | CE-144 | 0.3422 |
| | CO-57 | 0.3862 |
| | CO-58 | 79.5519 |
| | CO-60 | 2.0170 |
| | CR-51 | 1.2759 |
| | CS-137 | 0.1042 |
| | FE-55 | 6.3100 |
| | FE-59 | 0.1948 |
| | MN-54 | 0.3005 |
| | NB-95 | 0.8719 |
| | NI-63 | 7.3252 |
| | TC-99 | 0.1986 |
| | ZR-95 | 0.9656 |
| **15-2015** | C-14 | 0.2933 |
| | CE-144 | 0.3053 |
| | CO-57 | 0.3465 |
| | CO-58 | 81.1321 |
| | CO-60 | 1.7324 |
| | CR-51 | 1.7015 |
| | CS-137 | 0.0889 |
| | FE-55 | 5.4374 |
| | FE-59 | 0.2196 |
| | MN-54 | 0.2676 |
| | NB-95 | 1.0635 |
| | NI-63 | 6.2264 |
| | TC-99 | 0.1690 |
| | ZR-95 | 1.0069 |

## Attachment 3
## Solid Radioactive Waste Disposal

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

| | | |
|---|---|---|
| **15-2016** | C-14 | 0.3373 |
| | CE-144 | 0.3369 |
| | CO-57 | 0.3827 |
| | CO-58 | 79.52 |
| | CO-60 | 1.9801 |
| | CR-51 | 1.3150 |
| | CS-137 | 0.1023 |
| | FE-55 | 6.1774 |
| | FE-59 | 0.1974 |
| | MN-54 | 0.2954 |
| | NB-95 | 0.8914 |
| | NI-63 | 7.1713 |
| | TC-99 | 0.1945 |
| | ZR-95 | 0.9709 |
| **15-2017** | C-14 | 0.2330 |
| | CE-144 | 0.2577 |
| | CO-57 | 0.2924 |
| | CO-58 | 82.6667 |
| | CO-60 | 1.3861 |
| | CR-51 | 2.5805 |
| | CS-137 | 0.0706 |
| | FE-55 | 4.3813 |
| | FE-59 | 0.2609 |
| | MN-54 | 0.2240 |
| | NB-95 | 1.4048 |
| | NI-63 | 4.9547 |
| | TC-99 | 0.1341 |
| | ZR-95 | 1.0611 |
| **15-2019** | C-14 | 0.2013 |
| | CE-144 | 0.2314 |
| | CO-57 | 0.2642 |
| | CO-58 | 83.3724 |
| | CO-60 | 1.2064 |
| | CR-51 | 3.2682 |
| | CS-137 | 0.0613 |
| | FE-55 | 3.8411 |
| | FE-59 | 0.2867 |
| | MN-54 | 0.2013 |
| | NB-95 | 1.6419 |
| | NI-63 | 4.2839 |
| | TC-99 | 0.1161 |
| | ZR-95 | 1.0793 |
| **15-2020** | C-14 | 0.3053 |
| | CE-144 | 0.3113 |
| | CO-57 | 0.3537 |
| | CO-58 | 80.4000 |
| | CO-60 | 1.7943 |
| | CR-51 | 1.8323 |
| | CS-137 | 0.0925 |
| | FE-55 | 5.5967 |
| | FE-59 | 0.2203 |
| | MN-54 | 0.2723 |
| | NB-95 | 1.0883 |
| | NI-63 | 6.4667 |
| | TC-99 | 0.1754 |
| | ZR-95 | 0.9963 |

## Attachment 3
## Solid Radioactive Waste Disposal

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

| | | |
|---|---|---|
| **15-2027** | C-14 | 0.3578 |
| | CE-144 | 0.3499 |
| | CO-57 | 0.3979 |
| | CO-58 | 79.053 |
| | CO-60 | 2.0787 |
| | CR-51 | 1.1958 |
| | CS-137 | 0.1112 |
| | FE-55 | 6.4912 |
| | FE-59 | 0.1892 |
| | MN-54 | 0.3074 |
| | NB-95 | 0.8331 |
| | NI-63 | 7.5762 |
| | TC-99 | 0.2056 |
| | ZR-95 | 0.9583 |
| **15-2028** | C-14 | 0.2371 |
| | CE-144 | 0.2343 |
| | CO-57 | 0.2676 |
| | CO-58 | 83.3333 |
| | CO-60 | 1.2296 |
| | CR-51 | 3.2579 |
| | CS-137 | 0.0624 |
| | FE-55 | 3.9057 |
| | FE-59 | 0.2843 |
| | MN-54 | 0.2031 |
| | NB-95 | 1.6415 |
| | NI-63 | 4.3679 |
| | TC-99 | 0.1182 |
| | ZR-95 | 1.0786 |
| **15-2029** | C-14 | 0.1851 |
| | CE-144 | 0.2172 |
| | CO-57 | 0.2406 |
| | CO-58 | 85.5227 |
| | CO-60 | 1.1108 |
| | CR-51 | 3.7500 |
| | CS-137 | 0.0563 |
| | FE-55 | 3.5653 |
| | FE-59 | 0.3017 |
| | MN-54 | 0.1879 |
| | NB-95 | 1.7997 |
| | NI-63 | 3.9631 |
| | TC-99 | 0.1065 |
| | ZR-95 | 1.0895 |

## Attachment 3
## Solid Radioactive Waste Disposal

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

| | | |
|---|---|---|
| **15-2032** | AG-110m | 0.0033 |
| | CM-243 | 0.0006 |
| | AM-241 | 0.0015 |
| | C-14 | 0.5523 |
| | CE-144 | 0.0044 |
| | CM-242 | 0.0218 |
| | CO-57 | 0.0033 |
| | CO-58 | 0.1753 |
| | CO-60 | 1.0483 |
| | CR-51 | 0.0147 |
| | CS-137 | 0.0031 |
| | FE-55 | 94.0805 |
| | FE-59 | 0.0943 |
| | MN-54 | 0.0493 |
| | NB-94 | 0.0024 |
| | NB-95 | 0.0270 |
| | NI-63 | 3.8621 |
| | PU-238 | 0.0011 |
| | PU-239/40 | 0.0006 |
| | PU-241 | 0.0248 |
| | SB-124 | 0.0096 |
| | SB-125 | 0.0532 |
| | SN-113 | 0.0021 |
| | SR-90 | 0.0063 |
| | ZN-65 | 0.0224 |
| | ZR-95 | 0.0137 |
| **15-2033** | AG-110m | 0.0280 |
| | CM-243 | 0.0005 |
| | AM-241 | 0.0014 |
| | C-14 | 0.0080 |
| | CO-57 | 0.0009 |
| | CO-58 | 0.2366 |
| | CO-60 | 1.1066 |
| | CR-51 | 0.0145 |
| | CS-134 | 0.0185 |
| | CS-137 | 0.0539 |
| | FE-55 | 89.7971 |
| | FE-59 | 0.0315 |
| | H-3 | 3.0368 |
| | I-129 | 0.0605 |
| | MN-54 | 0.0605 |
| | NB-94 | 0.0023 |
| | NB-95 | 0.0329 |
| | NI-63 | 4.5882 |
| | PU-238 | 0.0011 |
| | PU-239/40 | 0.0006 |
| | PU-241 | 0.0234 |
| | SB-124 | 0.0092 |
| | SB-125 | 0.0823 |
| | SN-113 | 0.0020 |
| | SR-90 | 0.0065 |
| | ZN-65 | 0.0260 |
| | ZR-95 | 0.0132 |

## Attachment 3
## Solid Radioactive Waste Disposal

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

| | | | |
|---|---|---|---|
| | **15-2034** | AG-110m | 0.0033 |
| | | CM-243 | 0.0006 |
| | | AM-241 | 0.0015 |
| | | C-14 | 0.0044 |
| | | CM-242 | 0.0001 |
| | | CO-57 | 0.0032 |
| | | CO-58 | 0.1743 |
| | | CO-60 | 1.0457 |
| | | CR-51 | 0.0146 |
| | | CS-137 | 0.0031 |
| | | FE-55 | 93.9948 |
| | | FE-59 | 0.0939 |
| | | MN-54 | 0.0493 |
| | | NB-94 | 0.0024 |
| | | NB-95 | 0.0269 |
| | | NI-63 | 3.8538 |
| | | PU-238 | 0.0001 |
| | | PU-239/40 | 0.0006 |
| | | PU-241 | 0.0143 |
| | | SB-124 | 0.0095 |
| | | SB-125 | 0.0531 |
| | | SN-113 | 0.0021 |
| | | SR-90 | 0.0069 |
| | | ZN-65 | 0.0224 |
| | | ZR-95 | 0.0136 |
| | **15-2038** | AG-110m | 0.0030 |
| | | CM-243 | 0.0002 |
| | | AM-241 | 0.0015 |
| | | C-14 | 0.5695 |
| | | CE-144 | 0.0041 |
| | | CO-57 | 0.0030 |
| | | CO-58 | 0.1363 |
| | | CO-60 | 1.0605 |
| | | CR-51 | 0.0101 |
| | | CS-137 | 0.0032 |
| | | FE-55 | 94.1406 |
| | | FE-59 | 0.0685 |
| | | MN-54 | 0.0465 |
| | | NB-94 | 0.0025 |
| | | NB-95 | 0.0191 |
| | | NI-63 | 3.9805 |
| | | PU-238 | 0.0012 |
| | | PU-239/40 | 0.0006 |
| | | PU-241 | 0.0253 |
| | | SB-124 | 0.0073 |
| | | SB-125 | 0.0532 |
| | | SN-113 | 0.0018 |
| | | SR-90 | 0.0071 |
| | | ZN-65 | 0.0207 |
| | | ZR-95 | 0.0105 |
| c. | Dry Active Waste (brokered) | N/A | N/A |
| d. | Irradiated Components | N/A | N/A |

# 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Lower Level

| 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 | 0.46-0.75 | 0 | 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 | 0 |
| | 1.01-1.25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1.26-1.50 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 |
| | 1.51-2.00 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 22 | 2 | 2 | 4 | 1 | 0 |
| | 2.01-3.00 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 1 | 23 | 69 | 15 | 5 | 1 | 1 | 2 |
| | 3.01-4.00 | 0 | 0 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 3 | 8 | 1 | 2 | 1 | 0 | 0 |
| | 4.01-5.00 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | 5.01-6.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| | 6.01-8.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 3 | 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 |
| B | 0.46-0.75 | 0 | 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 | 0 |
| | 1.01-1.25 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 1.26-1.50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 2 | 0 |
| | 1.51-2.00 | 3 | 2 | 1 | 3 | 2 | 1 | 0 | 0 | 1 | 14 | 33 | 9 | 6 | 2 | 2 | 0 |
| | 2.01-3.00 | 2 | 1 | 6 | 10 | 6 | 1 | 0 | 2 | 6 | 42 | 61 | 33 | 3 | 3 | 2 | 0 |
| | 3.01-4.00 | 1 | 2 | 2 | 3 | 3 | 0 | 0 | 0 | 0 | 16 | 13 | 1 | 1 | 3 | 0 | 1 |
| | 4.01-5.00 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 5.01-6.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 3 | 1 | 0 |
| | 6.01-8.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 4 | 3 | 2 |
| | 8.01-10.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| | 10.01-max | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

# Attachment 4
# Meteorological Data

## Oconee Nuclear Station Units 1, 2, & 3
## Period 1/1/2015 - 12/31/2015

Lower Level

| 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 |
| C | 0.46-0.75 | 0 | 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 | 0 |
| | 1.01-1.25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 1.26-1.50 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 5 | 3 | 1 | 2 | 2 | 1 |
| | 1.51-2.00 | 4 | 7 | 5 | 6 | 2 | 4 | 1 | 3 | 7 | 16 | 33 | 22 | 9 | 5 | 8 | 3 |
| | 2.01-3.00 | 0 | 1 | 13 | 22 | 12 | 7 | 6 | 5 | 6 | 55 | 36 | 23 | 3 | 4 | 2 | 0 |
| | 3.01-4.00 | 0 | 3 | 1 | 2 | 3 | 0 | 0 | 0 | 2 | 16 | 17 | 4 | 0 | 4 | 3 | 0 |
| | 4.01-5.00 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 6 | 0 | 2 | 5 | 0 | 2 |
| | 5.01-6.00 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 3 | 4 | 2 |
| | 6.01-8.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 11 | 2 | 1 |
| | 8.01-10.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 10.01-max | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 0.46-0.75 | 0 | 0 | 2 | 1 | 0 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| | 0.76-1.00 | 12 | 11 | 12 | 10 | 5 | 3 | 3 | 0 | 4 | 8 | 14 | 17 | 16 | 15 | 9 | 13 |
| | 1.01-1.25 | 28 | 21 | 10 | 8 | 9 | 7 | 8 | 12 | 8 | 15 | 21 | 29 | 26 | 23 | 14 | 39 |
| | 1.26-1.50 | 19 | 28 | 29 | 31 | 25 | 19 | 22 | 21 | 25 | 44 | 52 | 46 | 32 | 22 | 19 | 32 |
| | 1.51-2.00 | 19 | 38 | 61 | 99 | 75 | 30 | 36 | 48 | 42 | 67 | 89 | 76 | 49 | 21 | 15 | 17 |
| | 2.01-3.00 | 22 | 21 | 139 | 197 | 78 | 24 | 25 | 16 | 29 | 136 | 161 | 85 | 33 | 15 | 13 | 14 |
| | 3.01-4.00 | 4 | 10 | 54 | 67 | 5 | 1 | 0 | 0 | 1 | 54 | 74 | 45 | 23 | 22 | 8 | 8 |
| | 4.01-5.00 | 0 | 1 | 16 | 9 | 0 | 0 | 0 | 0 | 0 | 8 | 25 | 31 | 14 | 23 | 10 | 3 |
| | 5.01-6.00 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 23 | 7 | 14 | 13 | 0 |
| | 6.01-8.00 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 6 | 8 | 1 | 0 |
| | 8.01-10.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Lower Level

| 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 | 0.46-0.75 | 19 | 9 | 12 | 11 | 6 | 9 | 3 | 3 | 8 | 7 | 11 | 10 | 13 | 19 | 19 | 11 |
| | 0.76-1.00 | 87 | 58 | 46 | 42 | 46 | 33 | 35 | 18 | 26 | 34 | 26 | 49 | 55 | 85 | 134 | 138 |
| | 1.01-1.25 | 64 | 35 | 47 | 47 | 43 | 38 | 41 | 34 | 36 | 36 | 31 | 41 | 38 | 63 | 79 | 89 |
| | 1.26-1.50 | 41 | 30 | 52 | 54 | 50 | 46 | 43 | 44 | 40 | 40 | 45 | 31 | 20 | 34 | 48 | 32 |
| | 1.51-2.00 | 35 | 23 | 65 | 88 | 67 | 37 | 43 | 73 | 49 | 50 | 60 | 27 | 15 | 27 | 23 | 19 |
| | 2.01-3.00 | 9 | 14 | 75 | 89 | 41 | 11 | 10 | 18 | 30 | 45 | 85 | 45 | 20 | 12 | 11 | 10 |
| | 3.01-4.00 | 2 | 4 | 26 | 8 | 1 | 2 | 2 | 1 | 3 | 15 | 33 | 28 | 14 | 2 | 0 | 1 |
| | 4.01-5.00 | 1 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 10 | 9 | 3 | 2 | 2 | 0 |
| | 5.01-6.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 2 | 0 |
| | 6.01-8.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 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 | 0.46-0.75 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 6 | 1 | 0 |
| | 0.76-1.00 | 5 | 2 | 2 | 3 | 3 | 1 | 1 | 3 | 1 | 2 | 3 | 9 | 14 | 22 | 20 | 8 |
| | 1.01-1.25 | 2 | 2 | 3 | 3 | 2 | 6 | 0 | 2 | 1 | 2 | 0 | 3 | 4 | 30 | 15 | 1 |
| | 1.26-1.50 | 1 | 0 | 1 | 1 | 3 | 6 | 1 | 1 | 0 | 2 | 4 | 2 | 2 | 25 | 22 | 3 |
| | 1.51-2.00 | 0 | 0 | 1 | 2 | 2 | 8 | 3 | 1 | 3 | 3 | 3 | 1 | 1 | 2 | 9 | 0 |
| | 2.01-3.00 | 0 | 1 | 4 | 4 | 1 | 1 | 1 | 0 | 1 | 1 | 5 | 2 | 2 | 0 | 1 | 2 |
| | 3.01-4.00 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 0 | 0 | 0 |
| | 4.01-5.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Lower Level

| 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 |
| G | 0.46-0.75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0.76-1.00 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 4 | 0 |
| | 1.01-1.25 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 4 | 0 |
| | 1.26-1.50 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 4 | 0 |
| | 1.51-2.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 |
| | 2.01-3.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Upper Level

| 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 | 0.46-0.75 | 0 | 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 | 0 |
| | 1.01-1.25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 1.26-1.50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 1.51-2.00 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 3 | 1 | 0 |
| | 2.01-3.00 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 11 | 34 | 10 | 2 | 2 | 1 | 1 |
| | 3.01-4.00 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 20 | 28 | 6 | 0 | 0 | 1 | 1 |
| | 4.01-5.00 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 6 | 13 | 1 | 0 | 0 | 0 | 0 |
| | 5.01-6.00 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 4 | 10 | 0 | 2 | 1 | 0 | 0 |
| | 6.01-8.00 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 2 | 1 | 0 |
| | 8.01-10.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 5 | 3 | 0 |
| | 10.01-max | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| B | 0.46-0.75 | 0 | 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 | 0 |
| | 1.01-1.25 | 0 | 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 | 1 | 0 | 0 | 1 | 0 | 0 |
| | 1.51-2.00 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 8 | 2 | 5 | 2 | 2 | 2 |
| | 2.01-3.00 | 2 | 3 | 2 | 3 | 4 | 1 | 1 | 3 | 2 | 15 | 53 | 21 | 5 | 1 | 0 | 0 |
| | 3.01-4.00 | 0 | 1 | 1 | 4 | 6 | 0 | 0 | 0 | 7 | 27 | 18 | 8 | 0 | 0 | 0 | 0 |
| | 4.01-5.00 | 2 | 1 | 1 | 5 | 9 | 0 | 0 | 0 | 1 | 17 | 12 | 2 | 0 | 1 | 2 | 0 |
| | 5.01-6.00 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 10 | 14 | 2 | 1 | 0 | 2 | 1 |
| | 6.01-8.00 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 3 | 0 | 0 |
| | 8.01-10.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 3 | 0 |
| | 10.01-max | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 3 | 3 | 2 |

# Attachment 4
# Meteorological Data

## Oconee Nuclear Station Units 1, 2, & 3
## Period 1/1/2015 - 12/31/2015

Upper Level

| 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 |
| C | 0.46-0.75 | 0 | 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 | 0 |
| | 1.01-1.25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| | 1.26-1.50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 1 | 1 | 2 | 1 | 0 |
| | 1.51-2.00 | 3 | 4 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 4 | 17 | 13 | 8 | 2 | 3 | 3 |
| | 2.01-3.00 | 1 | 3 | 7 | 11 | 5 | 5 | 3 | 7 | 10 | 21 | 29 | 23 | 0 | 2 | 0 | 3 |
| | 3.01-4.00 | 0 | 1 | 3 | 16 | 9 | 3 | 2 | 3 | 8 | 31 | 13 | 1 | 2 | 0 | 3 | 0 |
| | 4.01-5.00 | 0 | 2 | 1 | 7 | 9 | 2 | 0 | 0 | 2 | 16 | 13 | 3 | 1 | 0 | 3 | 0 |
| | 5.01-6.00 | 0 | 1 | 1 | 3 | 1 | 0 | 0 | 0 | 2 | 10 | 11 | 1 | 0 | 4 | 3 | 0 |
| | 6.01-8.00 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 16 | 2 | 2 | 4 | 3 | 2 |
| | 8.01-10.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 4 | 0 | 8 | 3 | 3 |
| | 10.01-max | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 3 | 4 | 0 |
| D | 0.46-0.75 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 2 | 0 | 1 | 1 |
| | 0.76-1.00 | 0 | 4 | 2 | 2 | 0 | 1 | 0 | 1 | 1 | 1 | 3 | 3 | 8 | 4 | 2 | 7 |
| | 1.01-1.25 | 9 | 12 | 8 | 1 | 2 | 1 | 6 | 0 | 3 | 8 | 12 | 13 | 12 | 16 | 13 | 7 |
| | 1.26-1.50 | 11 | 18 | 7 | 11 | 7 | 0 | 5 | 9 | 7 | 12 | 26 | 24 | 22 | 16 | 15 | 23 |
| | 1.51-2.00 | 35 | 27 | 29 | 13 | 28 | 9 | 25 | 29 | 16 | 42 | 54 | 46 | 24 | 17 | 15 | 33 |
| | 2.01-3.00 | 30 | 50 | 58 | 63 | 83 | 28 | 38 | 47 | 52 | 71 | 68 | 64 | 30 | 25 | 26 | 28 |
| | 3.01-4.00 | 16 | 25 | 83 | 94 | 76 | 20 | 13 | 16 | 31 | 57 | 87 | 42 | 14 | 15 | 9 | 12 |
| | 4.01-5.00 | 5 | 8 | 95 | 74 | 43 | 3 | 1 | 2 | 3 | 52 | 76 | 29 | 19 | 18 | 3 | 11 |
| | 5.01-6.00 | 4 | 9 | 47 | 41 | 13 | 0 | 0 | 0 | 3 | 26 | 70 | 29 | 12 | 19 | 10 | 6 |
| | 6.01-8.00 | 1 | 0 | 37 | 23 | 3 | 0 | 1 | 0 | 1 | 14 | 81 | 49 | 15 | 40 | 20 | 5 |
| | 8.01-10.00 | 0 | 1 | 13 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 18 | 15 | 10 | 12 | 11 | 0 |
| | 10.01-max | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 11 | 3 | 1 | 0 |

# Attachment 4
# Meteorological Data

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Upper Level

| 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 | 0.46-0.75 | 2 | 1 | 3 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 4 | 0 | 1 | 0 | 1 | 3 |
| | 0.76-1.00 | 10 | 6 | 4 | 3 | 2 | 5 | 5 | 4 | 4 | 3 | 4 | 10 | 11 | 13 | 13 | 11 |
| | 1.01-1.25 | 25 | 16 | 17 | 8 | 7 | 9 | 4 | 8 | 3 | 8 | 12 | 8 | 25 | 20 | 30 | 29 |
| | 1.26-1.50 | 50 | 32 | 13 | 10 | 14 | 5 | 7 | 6 | 14 | 12 | 15 | 18 | 22 | 35 | 49 | 63 |
| | 1.51-2.00 | 134 | 84 | 33 | 34 | 26 | 18 | 13 | 18 | 13 | 15 | 27 | 36 | 32 | 42 | 72 | 119 |
| | 2.01-3.00 | 232 | 182 | 110 | 75 | 50 | 31 | 31 | 39 | 45 | 50 | 101 | 68 | 30 | 22 | 35 | 126 |
| | 3.01-4.00 | 44 | 42 | 87 | 69 | 35 | 22 | 23 | 23 | 59 | 40 | 78 | 28 | 11 | 11 | 24 | 17 |
| | 4.01-5.00 | 11 | 18 | 46 | 33 | 27 | 5 | 4 | 10 | 18 | 30 | 61 | 17 | 11 | 10 | 14 | 3 |
| | 5.01-6.00 | 1 | 5 | 36 | 6 | 6 | 1 | 1 | 2 | 9 | 21 | 42 | 20 | 15 | 12 | 5 | 5 |
| | 6.01-8.00 | 1 | 1 | 15 | 7 | 1 | 2 | 0 | 2 | 1 | 8 | 35 | 27 | 14 | 5 | 2 | 0 |
| | 8.01-10.00 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 2 | 2 | 1 | 1 | 0 |
| | 10.01-max | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| F | 0.46-0.75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0.76-1.00 | 3 | 2 | 3 | 0 | 0 | 2 | 0 | 2 | 1 | 0 | 1 | 0 | 2 | 1 | 0 | 0 |
| | 1.01-1.25 | 1 | 1 | 3 | 0 | 1 | 1 | 2 | 1 | 1 | 3 | 1 | 2 | 1 | 1 | 2 | 2 |
| | 1.26-1.50 | 7 | 1 | 3 | 4 | 2 | 0 | 3 | 3 | 3 | 1 | 1 | 3 | 1 | 4 | 2 | 3 |
| | 1.51-2.00 | 18 | 13 | 6 | 4 | 1 | 4 | 3 | 1 | 1 | 1 | 1 | 1 | 5 | 2 | 1 | 6 |
| | 2.01-3.00 | 21 | 22 | 5 | 5 | 5 | 3 | 4 | 4 | 2 | 3 | 8 | 6 | 7 | 2 | 6 | 4 |
| | 3.01-4.00 | 4 | 4 | 0 | 4 | 0 | 2 | 1 | 1 | 1 | 2 | 9 | 5 | 1 | 0 | 1 | 4 |
| | 4.01-5.00 | 1 | 1 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 4 | 3 | 2 | 1 | 0 | 1 | 0 |
| | 5.01-6.00 | 0 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 1 |
| | 6.01-8.00 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 2 | 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Upper Level

| 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 |
| G | 0.46-0.75 | 0 | 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 | 1 | 0 | 1 | 0 |
| | 1.01-1.25 | 0 | 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 | 1 | 0 | 1 | 0 | 2 | 0 |
| | 1.51-2.00 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 2 | 1 | 2 | 2 | 0 |
| | 2.01-3.00 | 2 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 0 |
| | 3.01-4.00 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 2 |
| | 4.01-5.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 1 |
| | 5.01-6.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 6.01-8.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 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

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

# Attachment 5
# Unplanned Offsite Releases

## Oconee Nuclear Station Units 1, 2, & 3
## Period 1/1/2015 - 12/31/2015

Oconee Nuclear Station had zero (0) unplanned liquid offsite release radioactive effluents.

Oconee Nuclear Station had one (1) unplanned gaseous offsite release of radioactive effluents. Summary is provided below.

**Unplanned release of "3B" Gaseous Waste Decay Tank: Reference NCR 01907276**

**Event Summary:**

On 1/27/15, during venting of U3 Let Down Storage Tank (LDST) to the 3B Gaseous Waste Decay Tank (GWDT), an increase in counts was observed on the unit vent normal range radiation monitor, 3 RIA 45, at 23:26 hours. The LDST venting was terminated and the 3B GWDT was isolated. Once isolated the 3B GWDT pressure was observed to be decreasing and the GWDT radiation monitor, 3 RIA 37, had increased counts indicating the contents were being released to the unit vent. Radiation monitor 3RIA-45 exhibited increased count rates due to the release, but no setpoints or instantaneous release rate limits were exceeded. The unplanned release was terminated when 3B GWDT reached 0 psig at 07:00 on 1/28/15. Investigation identified that a 3B GWDT relief valve failed to seat, causing the 3B GWDT to lose pressure. The GWD valve was repaired and an additional test was added to the preventative maintenance procedure to prevent recurrence.

A separate release permit, 2015004, was created to account for the release activity and related dose. The release volume and activity were determined using count rates and flow rates for 3RIA-37. The release volume from the 3B tank was 4500 cubic feet based on the initial tank pressure of 45 psig and tank volume chart in OP/0/A/1108/001, Curves and General Information. The total activity of the unplanned release was 0.735 Curies.

**Safety Significance**:

The health and safety of the public were not compromised by this event. The total activity released was 0.735 Curies. Calculated dose and dose rates to the Total Body, Skin, Gamma Air, and Beta Air were all well below the limits specified by Selected Licensee Commitments

# 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Gaseous Effluents Dose Summary

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year |
|---|---|---|---|---|---|---|
| A. Noble Gases | | | | | | |
| 1. Maximum Gamma Air | mRAD | 2.18E-04 | 1.88E-04 | 2.83E-04 | 1.32E-05 | 7.03E-04 |
| (a) Limit | mRAD | 1.50E+01 | 1.50E+01 | 1.50E+01 | 1.50E+01 | 3.00E+01 |
| (b) % of Limit | | 1.46E-03 | 1.26E-03 | 1.89E-03 | 8.78E-05 | 2.34E-03 |
| 2. Maximum Beta Air | mRAD | 2.08E-04 | 1.30E-04 | 1.42E-04 | 3.91E-05 | 5.19E-04 |
| (a) Limit | mRAD | 3.00E+01 | 3.00E+01 | 3.00E+01 | 3.00E+01 | 6.00E+01 |
| (b) % of Limit | | 6.93E-04 | 4.33E-04 | 4.72E-04 | 1.30E-04 | 8.64E-04 |
| Receptor Location ***1.0*** miles ***SW*** | | | | | | |
| B. Iodine, H-3, & Particulates | | | | | | |
| 1. Maximum Organ Dose | mREM | 8.90E-02 | 9.08E-02 | 8.88E-02 | 8.20E-02 | 3.51E-01 |
| (a) Limit | mREM | 2.25E+01 | 2.25E+01 | 2.25E+01 | 2.25E+01 | 4.50E+01 |
| (b) % of Limit | | 3.95E-01 | 4.04E-01 | 3.95E-01 | 3.64E-01 | 7.79E-01 |

Receptor Location ***1.0*** miles ***SW***
Critical Age ***CHILD***
Critical Organ ***BONE***
Critical Pathway ***VEGETATION***

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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Liquid Effluents Dose Summary

| | Units | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Year |
|---|---|---|---|---|---|---|
| A. Batch Mode | | | | | | |
| 1. Maximum Organ Dose | mREM | 4.62E-02 | 4.93E-02 | 5.41E-02 | 3.60E-02 | 1.71E-01 |
| (a) Limit | mREM | 1.50E+01 | 1.50E+01 | 1.50E+01 | 1.50E+01 | 3.00E+01 |
| (b) % of Limit | | 3.08E-01 | 3.29E-01 | 3.61E-01 | 2.40E-01 | 5.69E-01 |
| (c) Critical Age | | Adult | Adult | Child | Child | Child |
| (d) Critical Organ | | Liver | GILLI | Liver | Liver | Liver |
| (e) Critical Pathway | | Fish | Fish | Pt. Water | Pt. Water | Pt. Water |
| 2. Maximum Total Body Dose | mREM | 3.97E-02 | 3.09E-02 | 5.41E-02 | 3.59E-02 | 1.57E-01 |
| (a) Limit | mREM | 4.50E+00 | 4.50E+00 | 4.50E+00 | 4.50E+00 | 9.00E+00 |
| (b) % of Limit | | 8.81E-01 | 6.86E-01 | 1.20E+00 | 7.98E-01 | 1.75E+00 |
| (c) Critical Age | | Adult | Adult | Child | Child | Adult |
| (d) Critical Pathway | | Fish | Fish | Pt. Water | Pt. Water | Fish |
| B. Continuous Mode | | | | | | |
| 1. Maximum Organ Dose | mREM | 3.53E-05 | 3.54E-05 | 3.90E-05 | 5.73E-05 | 1.68E-04 |
| (a) Limit | mREM | 1.50E+01 | 1.50E+01 | 1.50E+01 | 1.50E+01 | 3.00E+01 |
| (b) % of Limit | | 2.35E-04 | 2.36E-04 | 2.60E-04 | 3.82E-04 | 5.59E-04 |
| (c) Critical Age | | Child | Child | Child | Child | Child |
| (d) Critical Organ | | Liver | Liver | Liver | Liver | Liver |
| (e) Critical Pathway | | Pt. Water | Pt. Water | Pt. Water | Pt. Water | Pt. Water |
| 2. Maximum Total Body Dose | mREM | 3.53E-05 | 3.54E-05 | 3.90E-05 | 5.73E-05 | 1.68E-04 |
| (a) Limit | mREM | 4.50E+00 | 4.50E+00 | 4.50E+00 | 4.50E+00 | 9.00E+00 |
| (b) % of Limit | | 7.85E-04 | 7.87E-04 | 8.67E-04 | 1.27E-03 | 1.86E-03 |
| (c) Critical Age | | Child | Child | Child | Child | Child |
| (d) Critical Pathway | | Pt. Water | Pt. Water | Pt. Water | Pt. Water | Pt. Water |

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

Oconee Nuclear Station Units 1, 2, & 3
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 Oconee Nuclear Station includes liquid and gaseous effluent dose contributions from Oconee Nuclear Station and direct and air-scatter dose from the onsite ISFSI. No other uranium fuel cycle facility contributes significantly to the maximum exposed individual. Included in the gaseous effluent dose calculations is an estimate of the dose contributed by Carbon-14 (Ref. Attachment 2, Supplemental Information, of this report for further information). The combined dose to a maximum exposed individual from effluent releases and direct and air-scatter dose from the ISFSI 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 includes the dose from noble gases (i.e., total body and skin).*

### 40 CFR Part 190 Effluent Dose Summary

| | |
|---|---|
| A. Maximum Organ Dose (other than TB) | 3.82E-01 mREM |
| 1. Location | 1.0 miles SW |
| 2. Critical Age | CHILD |
| 3. Critical Organ | BONE |
| 4. Gas Contribution % | 8.26% |
| 5. Liquid Contribution % | 91.74% |
| B. Maximum Total Body Dose | 2.74E-01 mREM |
| 1. Location | 1.0 miles SW |
| 2. Critical Age | CHILD |
| 3. Gas non-NG Contribution % | 45.73% |
| 4. Gas Contribution % | 0.24% |
| 5. Liquid Contribution % | 54.03% |

Direct and air-scatter radiation dose contributions from the onsite ISFSI have been determined from 10 CFR 72.212 Evaluation Report for Phase VII Standardized NUHOMS® Cask System Rev. 00. The maximum dose rate to the nearest real individual from the ISFSI is conservatively calculated to be less than 7 mrem/yr.

The attached excerpt from the 10 CFR 72.212 Evaluation Report for Phase VII Standardized NUHOMS® Cask System Rev. 00 is provided to document the method used to calculate the dose from ISFSI as less than 7 mrem/yr to the nearest real individual.

Total dose from liquid and gaseous effluents from Oconee Nuclear Station and direct and air-scatter dose from the onsite ISFSI is conservatively estimated to be less than 8 mrem/yr to the nearest real individual. This 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 6
# Assessment of Radiation Dose from Radioactive Effluents to Members of the Public

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

## 6.0 10 CFR 72.212(b)(5)(iii) - Radioactive Materials in Effluents and Direct Radiation

### 6.1 Purpose

10 CFR 72.212(b)(5)(iii) requires the general licensee to perform written evaluations, before use and before applying the changes authorized by an amended CoC to a cask loaded under the initial CoC or an earlier amended CoC, that establish that the requirements of 10 CFR 72.104 have been met. A copy of this record shall be retained until spent fuel is no longer stored under the general license issued under 10 CFR 72.210.

10 CFR 72.104 provides the regulatory criteria for radioactive materials in effluents and direct radiation from an independent spent fuel storage installation (ISFSI) during normal operation and anticipated occurrences. Specifically, 10 CFR 72.104(a) limits the annual dose equivalent to any real individual who is located beyond the controlled area to 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other critical organ. This dose equivalent must include contributions from (1) planned discharges of radioactive materials (radon and its decay products excepted) to the general environment, (2) direct radiation from ISFSI operations, and (3) any other radiation from uranium fuel cycle operations within the region. In addition, 10 CFR 72.104(b) requires that operational restrictions be established to meet as low as is reasonably achievable (ALARA) objectives for radioactive materials in effluents and direct radiation levels associated with ISFSI operations. Also, 10 CFR 72.104(c) requires that operational limits be established for radioactive materials in effluents and direct radiation levels associated with ISFSI operations to meet the above-mentioned dose limits.

This section provides the written evaluation required by 10 CFR 72.212(b)(5)(iii), demonstrating Duke Energy's compliance with the requirements of 10 CFR 72.104 for the ONS ISFSI.

### 6.2 Evaluation

This evaluation addresses the radiological dose rate from a composite population of all ONS ISFSI cask types.

#### 6.2.1 §72.104(a) – Dose Limits

10 CFR 72.104, as clarified by ISG-13[1], stipulates that the licensee perform dose evaluations which establish that any real individual beyond the controlled area boundary not sustain a dose equivalent in excess of 0.25 mSv (25 mrem) due to direct radiation from the Independent Spent Fuel Storage Installation and other fuel cycle operations in the area. This same dose limit is stipulated by the EPA for the fuel cycle in 40 CFR 190.10(a). Also operational restrictions for ALARA and limits for effluents must be established.

In accordance with these requirements, Duke Energy Corporation has performed dose calculations that model the characteristics (initial enrichment, burnup and cooling time) of existing fuel in Phases I – V and loaded canisters in Phase VI of the Oconee ISFSI, together with the characteristics of assumed "design basis" fuel for unloaded canisters in Phase VI and Phase VII of the Oconee ISFSI[2]. Calculation OSC-8675[3] develops the radiation source terms used in subsequent shielding and skyshine calculations using the SCALE Code System.

More specifically, the SAS2 Module of the SCALE Code System[4] was used to create a problem-dependent pin-cell model for the purpose of building cell-weighted, multigroup cross section sets for use in subsequent depletion calculations. The ORIGEN-S Module[5] of the SCALE Code System was used to perform the fuel depletion and characterization calculations using the cross section sets created by SAS2. These characterization calculations yielded the photon and neutron source terms to be used as input to subsequent shielding calculations. As mentioned above, problem-dependent cross section sets were developed for these analyses since ORIGEN-S was used within the SAS[2] sequence. Duke Energy Corporation Radiological Engineering is experienced in the use of the SCALE Code System, and the SCALE Code System is installed and maintained under the purview of the pertinent software and data quality assurance program.

The results of the radiation source term calculation were used as input to Calculation OSC-8706[6] to evaluate the shielding characteristics of a single Horizontal Storage Module. The MCNP Monte Carlo particle transport computer code[7] was used to perform the transport calculations and to write a surface flux file for use in subsequent skyshine calculations.

Appropriate software quality controls have been implemented for the computer codes and data used in these analyses (specifically, Calculation DPC 1201.30 00 0010[8] contains the verification and validation for MCNP5, while SDQA-30269-NGO[9] documents the quality control measures in place for MCNP5).

### 6.2.2 §72.104(b) – Operational Restrictions

Operational restrictions must be established to meet ALARA objectives for direct radiation levels associated with ISFSI.

Calculation OSC-8716[10], Table 23.1-1, summarizes dose rate versus distance, showing a dose rate of 6.84 mRem per year at 500 meters, which is the longest distance at which results converge. The closest residence to the ISFSI is in the SW-SSW direction approximately 1 mile (~1600 meters) from the ISFSI, or 1.36 miles from the centerline of the site.[11] This is conservatively farther than the distance used for computation of dose rates. The 2009 40CFR190 Uranium Fuel Cycle Dose Calculation Results for the ONS site show a maximum total body dose of less than 1 mrem per year (last reported dose was 0.266 mrem[12]). The total dose rate from all operations to the nearest real individual is therefore less than 8 mRem per year.

This calculation need not consider any effluent from Phase VII. The Phase VII HSMs use the NUHOMS-24PHB DSCs, which are designed as "leak-tight." Per Appendix N, Section N.11.2.8 of the NUHOMS FSAR[13], accidental releases are not credible.

### 6.2.3 §72.104(c) – Operational Limits

Operational limits must be established for direct radiation levels associated with ISFSI to meet the limits given in 72.104(a).
The ISFSI is sited in such a way that direct radiation to the surroundings are minimized.

The station Radiation Protection Program limits for ISFSI boundary dose rates are established to maintain dose rates surrounding the ISFSI and at the owner control fence.

Calculation OSC-8716[10] uses the surface flux files developed in OSC-8706[6] in a repeating array. A skyshine calculation is performed to obtain near- and far-field dose results the Oconee ISFSI.

This calculation need not consider any effluent from Phase VII. The Phase VII HSMs use the NUHOMS-24PHB DSCs, which are designed as "leak-tight." Per Appendix N, Section N.11.2.8 of the NUHOMS FSAR[13], accidental releases are not credible.

### 6.3 Regulatory Compliance/Conclusion

The evaluation summarized above demonstrates that Duke Energy meets the requirements of 10 CFR 72.212(b)(5)(iii) and 10 CFR 72.104 for the ONS ISFSI.

### 6.4 References

1. United States Nuclear Regulatory Commission, Spent Fuel Project Office, Interim Staff Guidance - 13, "Real Individual."
2. "Design Basis" fuel (considering fuel burnup and initial enrichment) is assumed to reside in unloaded HSMs for Phase VI-VII of the Oconee ISFSI. The assumption of 5 years cooling time applies only to the most recent eight dry storage casks, while the balance of the casks are assumed to have been loaded one year earlier to be consistent with reasonable engineering practice.
3. Calculation OSC-8675, "Oconee ISFSI Spent Fuel Radiation Source Terms," Revision 2.
4. O. W. Hermann, C. V. Parks, "SAS2H: A Coupled One-Dimensional Depletion and Shielding Analysis Module," NUREG/CR-0200, Revision 6, Volume 1, Section S2, ORNLINUREG/CSD-2N21R6.
5. O. W. Hermann, R. M. Westfall, "ORIGEN-S: SCALE System Module to Calculate Fuel Depletion, Actinide Transmutation, Fission Product Buildup and Decay, and Associated Radiation Source Terms," NUREG/CR-0200, Revision 6, Volume 2, Section F7, ORNLINUREG/CSD-2N21R6.
6. Calculation OSC-8706, "Oconee Horizontal Storage Module Shielding Evaluation," Revision 1.
7. LA-UR-03-1987, "MCNP - A General Purpose Monte Carlo N-Particle Transport Code, Version 5 (Volume 1: Overview and Theory, Volume II: User's Guide, Volume III: Developer's Guide).
8. Calculation DPC-1201.30-00-0010, Revision 0, "MCNP5 Computer Code Verification and Validation."
9. SDQA-30269-NGO, MCNP 5 Version 1.4
10. Calculation OSC-8716, "Oconee ISFSI Dose Rate Evaluations," Revision 1.
11. Dale E. Holden to Libby Wehrman, "2005 Oconee Annual Land Use Census," August 31, 2005, File No: OS-778.05 (Oconee Master File Record Retention No. 000377).
12. Scott L. Batson to U.S. Nuclear Regulatory Commission, "2014 Annual Radioactive Effluent Release Report (ARERR)", April 30, 2014.
13. NUH-003, "Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel," Revision 9.

# 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Duke Energy implemented a Ground Water Protection program in 2007. This initiative was developed to ensure timely and effective management of situations involving inadvertent releases of licensed material to ground water. As part of this program, Oconee Nuclear Station monitored 67 wells in 2015. Tritium activity in wells GM-7R and GM-7DR was reported according to NEI 07-07, Industry Ground Water Protection Initiative, in February 2010. The probable source of this activity was determined to be discharges from the turbine building sumps to Chemical Treatment Pond #3 through the east yard drain. Discharges from the turbine building sump through this pathway were discontinued in 2008. Installation of a recovery well, currently RW-1, in 2011 has resulted in decreased tritium concentrations in well GM-7DR to below MDA.

Wells are typically sampled quarterly or semi-annually. Ground water samples are regularly analyzed for tritium and gamma emitters, with select wells being analyzed for difficult-to-detect radionuclides. No gamma or difficult-to-detect radionuclides, other than naturally occurring radionuclides, were identified in well samples during 2015. Results from sampling during 2015 confirmed existing knowledge of tritium concentrations in site ground water.

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

No events meeting the criteria for voluntary notification per NEI 07-07, Industry Ground Water Protection Initiative, occurred at Oconee Nuclear Station in 2015.

*Key to below table.*

| | | |
|---|---|---|
| NS | - | Not scheduled to be sampled, not sampled due to insufficient volume in well, or well inaccessible during outage. |
| pCi/l | - | picocuries per liter. |
| < MDA | - | less than minimum detectable activity, typically 250 pCi/l. |
| 20,000 pCi/l | - | the Environmental Protection Agency drinking water standard for tritium. This standard applies only to water used for drinking. |
| 1,000,000 pCi/l | - | the 10 CFR Part 20, Appendix B, Table 2, Column 2, Effluent Concentration Limit for tritium. |

## Attachment 7
## Information to Support the NEI Ground Water Protection Initiative

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

| Well Name | Location / Description | Tritium Concentration (pCi/l) 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr | # of Samples |
|---|---|---|---|---|---|---|
| A-1 | ONS GWPI / A-1 / CTP 1/2 | 2.13E+02 | <MDA | <MDA | <MDA | 4 |
| A-10 | ONS GWPI / A-10 / CTP 3 | 4.01E+02 | 3.23E+02 | 3.79E+02 | 4.46E+02 | 4 |
| A-11 | ONS GWPI / A-11 / CTP 3 | <MDA | <MDA | <MDA | <MDA | 4 |
| A-12 | ONS GWPI / A-12 / CTP 3 | NS | <MDA | NS | <MDA | 2 |
| A-13 | ONS GWPI / A-13 / CTP 1/2 | 5.72E+02 | 5.32E+02 | 4.74E+02 | 5.57E+02 | 4 |
| A-14 | ONS GWPI / A-14 / CTP 1/2 | <MDA | <MDA | 2.02E+02 | <MDA | 4 |
| A-17 | ONS GWPI / A-17 / CTP 1/2 | <MDA | <MDA | 2.43E+02 | 1.94E+02 | 4 |
| A-18 | ONS GWPI / A-18 / CTP 1/2 | <MDA | <MDA | <MDA | 2.19E+02 | 4 |
| A-2 | ONS GWPI / A-2 / CTP 1/2 | <MDA | <MDA | <MDA | 2.32E+02 | 4 |
| A-9 | ONS GWPI / A-9 / CTP 1/2 | <MDA | 2.48E+02 | 2.15E+02 | <MDA | 4 |
| BG-4 | ONS GWPI / BG-4 / Ball Field | <MDA | <MDA | <MDA | <MDA | 4 |
| GM-10 | ONS GWPI / GM-10 / 525 kv Sw Yard | NS | <MDA | NS | <MDA | 2 |
| GM-10R | ONS GWPI / GM-10R / 525 kv Sw Yard | NS | <MDA | NS | <MDA | 2 |
| GM-11 | ONS GWPI / GM-11 / ONS Garage | NS | <MDA | NS | <MDA | 2 |
| GM-11R | ONS GWPI / GM-11R / ONS Garage | NS | <MDA | NS | <MDA | 2 |
| GM-12 | ONS GWPI / GM-12 / E of Access Rd. | NS | <MDA | NS | <MDA | 2 |
| GM-12R | ONS GWPI / GM-12R / E of Access Rd. | NS | <MDA | NS | <MDA | 2 |
| GM-13 | ONS GWPI / GM-13 / 525 kv Sw Yard | NS | <MDA | NS | <MDA | 2 |
| GM-13R | ONS GWPI / GM-13R / 525 kv Sw Yard | NS | <MDA | NS | <MDA | 2 |
| GM-14 | ONS GWPI / GM-14 / Mnt. Trg. Facility | NS | <MDA | NS | <MDA | 2 |
| GM-14R | ONS GWPI / GM-14R / Mnt. Trg. Facility | NS | <MDA | NS | <MDA | 2 |
| GM-15 | ONS GWPI / GM-15 | <MDA | NS | NS | 2.02E+02 | 2 |
| GM-15R | ONS GWPI / GM-15R | <MDA | NS | NS | 2.36E+02 | 2 |
| GM-16DDR | ONS GWPI / GM-16DDR | NS | 2.07E+02 | 4.25E+02 | 3.66E+02 | 3 |
| GM-16DR | ONS GWPI / GM-16DR | 8.61E+03 | 8.20E+03 | 7.47E+03 | 7.04E+03 | 4 |
| GM-16R | ONS GWPI / GM-16R | NS | NS | 1.28E+03 | 1.25E+03 | 2 |
| GM-17DR | ONS GWPI / GM-17DR | 2.51E+03 | 2.58E+03 | 2.37E+03 | 2.30E+03 | 4 |
| GM-17R | ONS GWPI / GM-17R | 1.14E+03 | 1.18E+03 | 1.26E+03 | 1.15E+03 | 4 |
| GM-18R | ONS GWPI / GM-18R | 6.30E+03 | 5.89E+03 | 5.73E+03 | 5.39E+03 | 4 |
| GM-19 | ONS GWPI / GM-19 | 1.78E+03 | 1.84E+03 | 1.84E+03 | 1.97E+03 | 4 |
| GM-19R | ONS GWPI / GM-19R | 5.02E+02 | 7.15E+02 | 8.49E+02 | 7.17E+02 | 4 |
| GM-1R | ONS GWPI / GM-1R / CTP 1/2 | <MDA | <MDA | <MDA | <MDA | 4 |
| GM-20 | ONS GWPI / GM-20 | <MDA | <MDA | <MDA | <MDA | 4 |
| GM-20R | ONS GWPI / GM-20R | <MDA | <MDA | <MDA | <MDA | 4 |
| GM-21 | ONS GWPI / GM-21 | NS | <MDA | NS | <MDA | 2 |
| GM-22 | ONS GWPI / GM-22 | NS | <MDA | NS | <MDA | 2 |
| GM-23 | ONS GWPI / GM-23 | 3.47E+02 | NS | NS | 2.07E+02 | 2 |
| GM-24R | ONS GWPI / GM-24R | NS | 1.27E+03 | 1.24E+03 | 1.28E+03 | 3 |
| GM-25R | ONS GWPI / GM-25R | 2.66E+02 | 3.21E+02 | 3.84E+02 | NS | 3 |
| GM-2DR | ONS GWPI / GM-2DR / U-1/2 SFP | <MDA | 2.69E+02 | 1.97E+02 | <MDA | 4 |
| GM-2R | ONS GWPI / GM-2R / U-1/2 SFP | 3.96E+02 | 1.04E+03 | 6.03E+02 | 6.00E+02 | 4 |
| GM-3DR | ONS GWPI / GM-3DR / U-3 SFP | 3.87E+02 | 2.97E+02 | 3.12E+02 | 2.51E+02 | 4 |
| GM-3R | ONS GWPI / GM-3R / U-3 SFP | 2.36E+02 | 3.20E+02 | 2.87E+02 | 2.26E+02 | 4 |
| GM-4 | ONS GWPI / GM-4 / Rad. Mat. WH | 5.23E+02 | 4.61E+02 | 4.57E+02 | 4.82E+02 | 4 |

## Attachment 7
## Information to Support the NEI Ground Water Protection Initiative

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

| Well Name | Location / Description | Tritium Concentration (pCi/l) 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr | # of Samples |
|---|---|---|---|---|---|---|
| GM-5 | ONS GWPI / GM-5 / Rdwst. Bldg. | 2.00E+02 | 2.02E+02 | 2.30E+02 | <MDA | 4 |
| GM-5R | ONS GWPI / GM-5R / Rdwst. Bldg. | <MDA | <MDA | <MDA | <MDA | 4 |
| GM-6 | ONS GWPI / GM-6 / Outflow to CTP-3 | <MDA | <MDA | NS | NS | 2 |
| GM-6R | ONS GWPI / GM-6R / Outflow to CTP-3 | <MDA | <MDA | NS | NS | 2 |
| GM-7 | ONS GWPI / GM-7 / 525 kv Sw Yard | 2.30E+02 | 2.63E+02 | 4.02E+02 | 2.70E+02 | 4 |
| GM-7DR | ONS GWPI / GM-7DR | <MDA | <MDA | <MDA | <MDA | 4 |
| GM-7R | ONS GWPI / GM-7R / 525 kv Sw Yard | 2.50E+03 | 2.28E+03 | 1.91E+03 | 1.68E+03 | 4 |
| GM-8 | ONS GWPI / GM-8 / E of U-3 TB | 2.48E+02 | 2.94E+02 | 2.77E+02 | <MDA | 4 |
| GM-8R | ONS GWPI / GM-8R / E of U-3 TB | <MDA | 2.75E+02 | 2.11E+02 | <MDA | 4 |
| GM-9 | ONS GWPI / GM-9 / E of U-2 TB | 3.34E+02 | 3.54E+02 | 3.35E+02 | 3.21E+02 | 4 |
| GM-9R | ONS GWPI / GM-9R / E of U-2 TB | NS | <MDA | <MDA | <MDA | 3 |
| MW-11 | ONS GWPI / MW-11 / Landfill | <MDA | NS | <MDA | NS | 2 |
| MW-11D | ONS GWPI / MW-11D / Landfill | <MDA | NS | <MDA | NS | 2 |
| MW-13 | ONS GWPI / MW-13 / Landfill | <MDA | NS | <MDA | NS | 2 |
| MW-16 | ONS GWPI / MW-16 / Landfill | <MDA | NS | <MDA | NS | 2 |
| MW-3 | ONS GWPI / MW-3 / Landfill | <MDA | NS | <MDA | NS | 2 |
| MW-RP01 | ONS GWPI / MW-RP01 / Landfarm/Burial | NS | <MDA | NS | NS | 1 |
| MW-RP02 | ONS GWPI / MW-RP02 / Landfarm/Burial | NS | <MDA | NS | NS | 1 |
| MW-RP03 | ONS GWPI / MW-RP03 / Landfarm/Burial | NS | <MDA | NS | NS | 1 |

| Well Name | Location / Description | Tritium Concentration (pCi/l) 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr | # of Samples |
|---|---|---|---|---|---|---|
| 011 | ONS / 011 / Ball Field | <MDA | <MDA | <MDA | <MDA | 4 |
| 013 | ONS / 013 / WH 5 | <MDA | <MDA | <MDA | <MDA | 4 |
| 015 | ONS / 015 / Brown's Bottom | NS | <MDA | <MDA | <MDA | 3 |

| Well Name | Location / Description | Tritium Concentration (pCi/l) Min | Avg | Max | # of Samples |
|---|---|---|---|---|---|
| RW-1[(1)] | 525 kv Sw. Yard | 1.01E+03 | 1.29E+03 | 1.59E+03 | 13 |

*(1) Monthly sampling performed for this location during 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 permanent or temporary outside liquid storage tanks exceeding 10 Curies total activity (excluding tritium and dissolved or entrained noble gases).

## Attachment 8
## Inoperable Equipment

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Oconee Nuclear Station did not experience inoperable equipment relevant to effluent monitoring in excess of SLC limits during 2015.

Oconee Nuclear Station did not experience permanent or 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 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

### ODCM Revision 57

ODCM Revision 57 is provided in entirety on the enclosed CD.

All ODCM changes are reviewed by knowledgeable individual(s), and approved by either the Station Manager or Radiation Protection Manager. The below changes do not adversely impact the accuracy or reliability of effluent, dose, or setpoint calculations.

ODCM Revision 57 was approved by the Station Manager on March 7, 2016. Some changes reflected in ODCM Revision 57 were implemented prior to March 7, 2016 under a different change and approval process (e.g., land use census), and in those cases the implementation date is noted below.

Executive Summary - Page 1
Revised bottom statement from:
"The methodology and parameters used to assure compliance with the dose limitaions described above shall be used to prepare the radioactive liquid and gaseous effluent reports required by the SCLs and Technical Specifications."
to:
"The methodology and parameters used to assure compliance with the dose limitations described above shall be used to prepare the radioactive liquid and gaseous effluent reports required by the SLCs and Technical Specifications."

Revision made to correct typos to "limitaions" and "SCLs" to "limitations" and "SLCs".

Section 3 - Page 7
Deleted paragraphs:
"In addition to High setpoints, Oconee uses "Alert" setpoints that, in total, are based on 10% of the reporting requirement from 10CFR50.73(a)(2)(viii)(A), which allows 20 times a Xe-133 Effluent Concentration (EC) value of 5.0E-07 µCi/ml at the site boundary. Accounting for the percent apportioned to each monitored release point, each unit vent Alert setpoint is based on 60% of the Xe-133 EC. The Radwaste Facility and Interim Radwaste Building Alert setpoints are both based on 10% of the Xe-133 EC. The method used to calculate the Alert setpoints is similar to that used to calculate the maximum setpoints except the limit is based on concentration rather than dose rate. The Alert setpoints are approximately 42% of the maximum setpoints.

ONS ODCM revision 43 implemented a change to remove the residential structure shielding factor of 0.7 from Ki, the total body dose factor due to exposure from a semi-infinite cloud of noble gases. KXe-133 was changed from 206 to 294 mrem/yr per µCi/m3. Since Alert setpoints are based on concentration and not dose rate, but concentration will affect dose, the setpoints are multiplied by a unit-less factor of 206/294 (0.7) to account for the added risk of exposure."

Added paragraph:
"In addition to High setpoints, Oconee uses "Alert" setpoints that are approximately 1/3 of the High setpoint for each specific release point. Alert setpoints provide early indication to plant operating staff of increased radioactivity."

Previous paragraphs deleted and replaced with new paragraph describing improved Alert setpoint methodology. Previous methodology was confusing, requiring extensive explanation, and prone to error. New methodology provides clarity and still satisfies previous identified issue from PIP O-05-965 where general observations from NRC inspectors in Component Design Basis Inspections, not related to the ODCM, resulted in minor violations due to lack of clearly documented figure or equations. This change does not adversely impact setpoint calculations, as the new setpoints are more conservative.

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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Section 3 - Page 8
Revised RIA-45 and RIA-46 Alert setpoint methodology from:

$$RIA-45_{unit\ \text{vent, alert}} = \frac{3.0\text{E-}07}{4.72\text{E-}04 \times 6.5\text{E+}04 \times 1.672\text{E-}06 \times 7.09\text{E-}08} \times \frac{206}{294}$$

$$RIA-45_{unit\ \text{vent, alert}} \cong 5.8\text{E+}04\ \text{cpm} + \text{bkg}$$

where:

3.0E-07 = 60% of Xe-133 EC value of 5.0E-07 µCi/ml.
4.72E-04 = Conversion factor, (1 min/60 sec)*(1 m3/35.314 ft3).
206 = Previous KXe-133, total body dose factor due to gamma emissions for Xe-133, in mrem/year per µCi/m3, using shielding factor of 0.7.

All other factors were previously defined.

to:

$$RIA-45_{unit\ vent,\ alert} = RIA-45_{unit\ \text{vent, high}} \times \frac{1}{3}$$

$$RIA-45_{unit\ \text{vent, alert}} \cong 4.66\text{E+}04\ \text{cpm} + \text{bkg}$$

$$RIA-46_{unit\ vent,\ alert} = RIA-46_{unit\ \text{vent, high}} \times \frac{1}{3}$$

$$RIA-46_{unit\ \text{vent, alert}} \cong 10\ \text{cpm} + \text{bkg}$$

1/3 = divisor to account for each of 3 unit vent release points, dimensionless.

Previous methodology was confusing, requiring extensive explanation, and prone to error. New methodology provides clarity and still satisfies previous identified issue from PIP O-05-965 where general observations from NRC inspectors in Component Design Basis Inspections, not related to the ODCM, resulted in minor violations due to lack of clearly documented figure or equations. This change does not adversely impact setpoint calculations, as the new setpoints are more conservative.

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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Section 3 - Page 9
Revised 4RIA-45high setpoint units from "µCi/ml" to "µCi/cc".

Revised statement of 4RIA-45 units from:
"4RIA-45 reads in units of concentration, µCi/ml."
to:
"4RIA-45 reads in units of concentration, µCi/cc."

Revisions made to match units 4RIA-45 displays explicitly.

Revised 4RIA-45 Alert setpoint methodology from:

$$4RIA-45_{\text{alert}} = \frac{5.0\text{E-}08}{4.72\text{E}-04 \times 1.297\text{E}+05 \times 7.308\text{E}-06} \times \frac{206}{294}$$
$$4RIA-45_{\text{alert}} \cong 7.7\text{E-}05\ \mu\text{Ci/ml}$$

where:
5.0E-08 = 10% of Xe-133 EC value of 5.0E-07 □Ci/ml.
All other factors were previously defined."

to:

$$4RIA-45_{alert} = 4RIA-45_{\text{high}} \times \frac{1}{3}$$
$$4RIA-45_{\text{alert}} \cong 6.33\text{E}-05\ \mu\text{Ci/cc} + \text{bkg}$$

All factors were previously defined."

Previous methodology was confusing, requiring extensive explanation, and prone to error. New methodology provides clarity and still satisfies previous identified issue from PIP O-05-965 where general observations from NRC inspectors in Component Design Basis Inspections, not related to the ODCM, resulted in minor violations due to lack of clearly documented figure or equations. This change does not adversely impact setpoint calculations, as the new setpoints are more conservative.

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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Section 3 - Page 10
Revised RIA-53 Alert setpoint methodology from:

$$RIA-53_{alert} = \frac{5.0E-08}{4.72E-04 \times 1.5E+04 \times 7.308E-06 \times 3.4E-08} \times \frac{206}{294}$$

$$RIA-53_{alert} \cong 2.0E+04\ cpm\ +\ bkg$$

to:

$$RIA-53_{alert} = RIA-53_{high} \times \frac{1}{3}$$

$$RIA-53_{alert} \cong 1.6E+04\ cpm\ +\ bkg$$

Previous methodology was confusing, requiring extensive explanation, and prone to error. New methodology provides clarity and still satisfies previous identified issue from PIP O-05-965 where general observations from NRC inspectors in Component Design Basis Inspections, not related to the ODCM, resulted in minor violations due to lack of clearly documented figure or equations. This change does not adversely impact setpoint calculations, as the new setpoints are more conservative.

Section 6 – Page 3
Changed Table 6.0-2 Site # 024 Distance from "0.79 miles" to "0.81 miles".

Change made to update distance based on new GPS data.

Section 6 – Page 4
Changed title of Table 6.0-3 to: "Oconee 2015 Land Use Census Results."

Land use census dates were changed to reflect 2015 census dates. The 2015 land use census was performed May 19-20, 2015, and the results were certified and made available for use on June 4, 2015. No changes were required from the 2015 land use census.

Reformatted notes into table. Change made for clarity.

Section 6 - Page 7
Changed title of Figure 6.0-3 to "ONS 2015 Land Use Census Map."

Figure 6.0-3 was regenerated using ESRI ArcGIS Version 9.3.1 software by Orbis, Incorporated, Charlotte, NC.

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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

Radiological Effluent Controls (SLC 16.11)

The Oconee Nuclear Station Radiological Effluent Controls are contained in SLC 16.11 as follows:

## 16.11 RADIOLOGICAL EFFLUENTS CONTROL

### 16.11.1 Radioactive Liquid Effluents

COMMITMENT Establish conditions for the controlled release of radioactive liquid effluents. Implement the requirements of 10 CFR 20, 10 CFR 50.36a, Appendix A to 10 CFR 50, Appendix I to 10 CFR 50, 40 CFR 141 and 40 CFR 190.

a. Concentration

The concentration of radioactive material released at anytime from the site boundary for liquid effluents to Unrestricted Areas [denoted in Figure 2-5 of the Oconee Nuclear Station Updated Final Safety Analysis Report] shall be limited to 10 times the effluent concentrations specified in 10 CFR Part 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases the concentration shall be limited to $2 \times 10^{-4}$ μCi/ml total activity.

b. Dose

The dose or dose commitment to a Member Of The Public from radioactive materials in liquid effluents to Unrestricted Areas shall be limited to:

1. during any calendar quarter:

   ≤ 4.5 mrem to the total body

   ≤ 15 mrem to any organ; and

2. during any calendar year:

   ≤ 9 mrem to the total body

   ≤ 30 mrem to any organ.

c. Liquid Waste Treatment

The appropriate subsystems of the liquid radwaste treatment system shall be used to reduce the radioactive materials in liquid waste prior to their discharge, if the projected dose due to liquid effluent releases to unrestricted areas, when averaged over 31 days would exceed 0.18 mrem to the total body or 0.6 mrem to any organ.

Radioactive Liquid Effluents
16.11.1

----------NOTE----------
Appendix I dose limits for radioactive liquid effluent releases are applicable only during normal operating conditions which include expected operational occurrences, and are not applicable during unusual operating conditions that result in activation of the Oconee Emergency Plan.
---

APPLICABILITY: At all times

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. Concentration of radioactive material released in liquid effluents to Unrestricted Areas exceeds the limits specified in Commitment a. | A.1 Restore concentration to within the limit. | Immediately |

Radioactive Liquid Effluents
16.11.1

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| B. Calculated dose from the release of radioactive materials in liquid effluents exceeds any of the limits in Commitment b. | B.1 ----------NOTE---------- Not required during unusual operating conditions that result in activation of the Oconee Emergency Plan. ---------- | |
| | Submit report to the regional NRC Office which includes the following:<br>a. Cause(s) for exceeding the limit(s).<br>b. A description of the program of corrective action initiated to: reduce the releases of radioactive materials in liquid effluents, and to keep these levels of radioactive materials in liquid effluents in compliance with the above limits, or as low as reasonably achievable.<br>c. Results of radiological analyses of the drinking water source and the radiological impact on finished drinking water supplies with regard to the requirements of 40 CFR 141. | 30 days from the end of the quarter during which the release occurred |

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| C. Radioactive liquid waste is discharged without treatment and in excess of the specified limit. | C.1 Submit report to the regional NRC Office which includes the following:<br>a. Cause of equipment or subsystem inoperability.<br>b. Corrective action to restore equipment and prevent recurrence. | 30 days |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | FREQUENCY |
|---|---|
| SR 16.11.1.1 N/A | N/A |

BASES

The concentration commitment is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site to unrestricted areas will be less than 10 times the effluent concentration levels specified in 10 CFR Part 20, Appendix B, Table 2, Column 2. The concentration limit for noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its EC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

The basic requirements for Selected Licensee Commitments concerning effluent from nuclear power reactors are stated in 10 CFR 50.36a. Compliance with effluent Selected Licensee Commitments will ensure that average annual releases of radioactive material in effluents will be small percentages of the limits specified in the old 10 CFR 20.106 (new 10 CFR 20.1302). The requirements contained in 10 CFR 50.36a further indicate that operational flexibility is allowed, compatible with considerations of health and safety, which may temporarily result in releases higher than such small percentages, but still within the limits specified in the old 10 CFR 20.106 which references Appendix B, Table II concentrations (MPCs). These referenced concentrations are specific values which relate to an annual dose of 500 mrem. It is further indicated in 10 CFR 50.36a that when using operational flexibility, best efforts shall be exerted to keep levels of radioactive materials in effluents as low as reasonably achievable (ALARA) as set forth in 10 CFR 50 Appendix I. Also, for fresh water sites with drinking water supplies which can be potentially affected by plant operations, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are in excess of the requirements of 40 CFR 141. Therefore, to accommodate operational flexibility needed for effluent releases, the limits associated with this SLC are based on ten times the instantaneous dose rate value of 50 mrem/year to apply at all times. Compliance with the limits of the new 10 CFR 20.1001 will be demonstrated by operating within the limits of 10 CFR 50, Appendix I, 40 CFR 141 and 4O CFR 190.

Section I of Appendix I of 10 CFR 50 states that this appendix provides specific numerical guides for design objectives and limiting conditions for operation, to assist holders of licenses for light water cooled nuclear power reactors in meeting the requirements to keep releases of radioactive material to unrestricted areas as low as practical and reasonably achievable, during normal reactor operations, including expected operational occurrences. Using the flexibility granted during unusual operating conditions, and the stated applicability of the design objectives for the Oconee Nuclear Station, Appendix I dose limits for radioactive liquid effluent releases are concluded to be not applicable during unusual operating conditions that result in the activation of the Oconee Emergency Plan.

For units with shared radwaste treatment systems, the liquid effluents from the shared system are proportioned among the units sharing that system.

The requirements that the appropriate portions of this system be used when specified provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable." This SLC implements the requirements of 10 CFR Part 50.36a. General Design Criterion 60 of Appendix A to 10 CFR Part 50 and design objective Section II.D of Appendix A to 10 CFR Part 50.

REFERENCES:

1. 10 CFR Part 20, Appendix B.
2. 40 CFR Part 141.
3. 10 CFR Part 50, Appendices A and I.
4. 40 CFR Part 190.
5. Offsite Dose Calculation Manual.
6. Regulatory Guide 1.109.
7. NUREG-1301

## 16.11 RADIOLOGICAL EFFLUENTS CONTROL

### 16.11.2 Radioactive Gaseous Effluents

COMMITMENT Establish conditions for the controlled release of radioactive gaseous effluents. Implement the requirements of 10 CFR 20, 10 CFR 50.36a, Appendix A to 10 CFR 50, Appendix I to 10 CFR 50, and 40 CFR 190.

a. Dose Rate

The instantaneous dose rate at the site (exclusion area) boundary for gaseous effluents [Figure 2.1-4(a) of the Oconee Nuclear Station Updated Final Safety Analysis Report] due to radioactive materials released in gaseous effluents from the site shall be limited to the following values:

1. The dose rate limit for noble gases shall be:

   ≤ 500 mrem/yr to the total body

   ≤ 3000 mrem/yr to the skin; and

2. The dose rate limit for all radioiodines and for all radioactive materials in particulate form and radionuclides other than noble gases with half-lives greater than 8 days shall be ≤ 1500 mrem/yr to any organ.

b. Dose

1. The air dose due to noble gases released in gaseous effluent from the site shall be limited to the following:

   i. During any calendar quarter:

      ≤ 15 mrad for gamma radiation

      ≤ 30 mrad for beta radiation

   ii. During any calendar year:

      ≤ 30 mrad for gamma radiation

      ≤ 60 mrad for beta radiation

2. The dose to a Member Of The Public from radioiodines, tritium and radioactive materials in particulate form with half-lives greater than 8 days in gaseous effluents released from the site, shall be limited to the following:

i. During any calendar quarter:

≤ 22.5 mrem to any organ

ii. During any calendar year:

≤ 45 mrem to any organ.

c. Gaseous Radwaste Treatment

1. The Gaseous Radwaste Treatment System shall be used to reduce the noble gases in gaseous wastes prior to their discharge, if the projected gaseous effluent air dose due to gaseous effluent release from the site, when averaged over 31 days exceeds 0.6 mrad for gamma radiation and 1.2 mrad for beta radiation.

2. The Ventilation Treatment Exhaust System shall be used to reduce radioactive materials other than noble gases in gaseous waste prior to their discharge when the projected doses due to effluent releases to unrestricted areas when averaged over 31 days would exceed 0.9 mrem to any organ.

d. Used Oil Incineration

During incineration of used oil contaminated by radioactive material in the Station Auxiliary Boiler, the dose to a Member Of The Public from radioiodines, tritium and radioactive materials in particulate form with half-lives greater than 8 days in gaseous effluents released from the Station Auxiliary Boiler shall be ≤ 0.045 mrem to any organ in any calendar year.

----------NOTE----------
The requirement of c.2 does not apply to the Auxiliary Building Exhaust System since it is not "treated" prior to release.
---

APPLICABILITY: At all times

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. Dose rate exceeds the limits specified in Commitment a. | A.1 Restore release rate to within limits. | Immediately |
| B. Calculated dose exceeds specified limits. | B.1 Submit report to the regional NRC Office which includes the following:<br>a. Cause(s) for exceeding the limit(s), and<br>b. A description of the program of corrective action initiated to: reduce the releases of radioactive materials in gaseous effluents, and to keep these levels of radioactive materials in gaseous effluents in compliance with the specified limits or as low as reasonably achievable. | 30 days from the end of the quarter during which the release occurred |

Radioactive Gaseous Effluents
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| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| C. Radioactive gaseous waste is discharged greater than limits specified in Commitment c.1 or c.2.<br><br>AND<br><br>Radioactive gaseous waste is discharged without treatment for more than 31 days. | C.1 Submit a report to the regional NRC Office which includes the following:<br><br>a. Cause of equipment or subsystems inoperability, and<br><br>b. Corrective action to restore equipment and prevent recurrence. | 30 days |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | FREQUENCY |
|---|---|
| SR 16.11.2.1 N/A | N/A |

BASES

The basic requirements for Selected Licensee Commitments concerning effluent from nuclear power reactors are stated in l0CFR50.36. Compliance with effluent Selected Licensee Commitments will ensure that average annual releases of radioactive material in effluents will be small percentages of the limits specified in the old l0CFR20.106 (new l0CFR20.1302). The requirements contained in l0CFR50.36a further indicate that operational flexibility is allowed, compatible with considerations of health and safety, which may temporarily result in releases higher than such small percentages, but still within the limits specified in the old l0CFR20.106 which references Appendix B, Table II concentrations (MPCs). These referenced concentrations are specific values which relate to an annual dose of 500 mrem to the total body, 3000 mrem to the skin, and 1500 mrem to an infant via the milk animal-milk-infant pathway. It is further indicated in l0CFR50.36a that when using operational flexibility, best efforts shall be exerted to keep levels of radioactive materials in effluents as low as reasonably achievable (ALARA) as set forth in l0CFR50 Appendix I. Therefore, to accommodate operational flexibility needed for effluent releases, the limits associated with gaseous release rate SLCs will be maintained at the current instantaneous dose rate limit for noble gases of 500 mrem/year to the total body and 3000 mrem/year to the skin; and for Iodine-131, for Iodine-133, for tritium, and for all radionuclides in particulate form with half-lives greater than 8 days. an instantaneous dose rate limit of 1500 mrem/year.

The ODCM calculational methods for calculating the doses due to the actual release rates of the subject materials will be consistent with the methodology provided in Regulatory Guide 1.109, "Calculating of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1,. October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors."

Equations in the ODCM are provided for determining the actual doses based upon the historical average atmospheric conditions. The release rate commitments for radioiodines, radioactive material in particulate form and radionuclides other than noble gases are dependent on the existing radionuclide pathways to man, in the unrestricted area. The pathways which are examined in the development of these calculations are: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides into green leafy vegetation with subsequent consumption by man, 3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and 4) deposition on the ground with subsequent exposure of man.

The requirement that the appropriate portions of these systems be used when specified provides reasonable assurance that the release of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." This commitment implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and design objective Section IID of Appendix I to 10 CFR Part 50.

REFERENCES:

1 10 CFR Part 20, Appendix 8.
2. 10 CFR Part 50, Appendices A and I.
3. Regulatory Guide 1.109.
4. 40 CFR Part 190.
5. Offsite Dose Calculation Manual.

16.11 RADIOLOGICAL EFFLUENTS CONTROL

16.11.3 Radioactive Effluent Monitoring Instrumentation

COMMITMENT Radioactive Effluent Monitoring Instrumentation shall be OPERABLE as follows:

a. Liquid Effluents

The radioactive liquid effluent monitoring instrumentation channels shown in Table 16.11.3-1 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of SLC 16.11.1.a are not exceeded.

b. Gaseous Process and Effluents

The radioactive gaseous process and effluent monitoring instrumentation channels shown in Table 16.11.3-2 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of SLC 16.11.2.a are not exceeded.

c. The setpoints shall be determined in accordance with the methodology described in the ODCM and shall be recorded.

----------NOTE----------
Correction to setpoints determined in accordance with Commitment c may be permitted without declaring the channel inoperable.
---

APPLICABILITY: According to Table 16.11.3-1 and Table 16.11.3-2.

ACTIONS

| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| A. Alarm/trip setpoint less conservative than required for one or more effluent monitoring instrument channels. | A.1 | Declare channel inoperable. | Immediately |
| | OR | | |
| | A.2 | Suspend release of effluent monitored by the channel. | Immediately |

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| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| B. One or more required liquid effluent monitoring instrument channels inoperable. | B.1 | Enter the Condition referenced in Table 16.11.3-1 for the function. | Immediately |
| | AND | | |
| | B.2 | Restore the instrument(s) to OPERABLE status. | 30 days |
| C. One or more required gaseous effluent monitoring instrument channels inoperable. | C.1 | Enter the Condition referenced in Table 16.11.3-2 for the function. | Immediately |
| | AND | | |
| | C.2 | Restore the instrument(s) to OPERABLE status. | 30 days |
| D. Required Action and associated Completion Time of Required Action B.2 or C.2 not met. | D.1 | Explain in next Annual Radiological Effluent Release Report why inoperability was not corrected in a timely manner. | April 30 of following calendar year |

Radioactive Effluent Monitoring Instrumentation
16.11.3

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| E. As required by Required Action B.1 and referenced in Table 16.11.3-1. (RIA-33) | E.1.1 Analyze two independent samples in accordance with SLC 16.11.4. | Prior to initiating subsequent release |
| | AND | |
| | E.1.2 Conduct two independent data entry checks for release rate calculations | Prior to initiating subsequent release |
| | AND | |
| | E.1.3 Conduct two independent valve lineups of the effluent pathway. | Prior to initiating subsequent release |
| | OR | |
| | E.2 Suspend release of radioactive effluents by this pathway. | Immediately |
| F. As required by Required Action B.1 and referenced in Table 16.11.3-1. (RIA-54) | F.1 Suspend release of radioactive effluents by this pathway. | Immediately |
| | OR | |
| | F.2 Collect and analyze grab samples for gross radioactivity (beta and/or gamma) at a lower limit of detection of at least $10^{-7}$ µCi/ml. | Prior to each discrete release of the sump |

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| G. As required by Required Action B.1 and referenced in Table 16.11.3-1. (Liquid Radwaste Effluent Line Flow Rate Monitor) | ----------NOTE----------<br>Not required during short, controlled outages of liquid effluent monitoring instrumentation. Short controlled outages are defined as planned removals from service for durations not to exceed 1 hour, for purposes of sample filter changeouts, setpoint adjustments, service checks, and/or routine maintenance procedures. This guidance may be applied successively, provided that time between successive short, controlled outages is always at least equal to duration of immediately preceding outage.<br>---------- | |
| | G.1 Suspend release of radioactive effluents by this pathway.<br><br>OR | Immediately |
| | G.2 Estimate flow rate during actual releases. | Immediately<br><br>AND<br><br>Once per 4 hours thereafter |

Radioactive Effluent Monitoring Instrumentation
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| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| H. As required by Required Action B.1 and referenced in Table 16.11.3-1. (RIA-35, #3 Chemical Treatment Pond Composite Sampler and Sampler Flow Monitor (Turbine Building Sumps Effluent)) | ----------NOTE----------<br>Not required during short, controlled outages of liquid effluent monitoring instrumentation. Short controlled outages are defined as planned removals from service for durations not to exceed 1 hour, for purposes of sample filter changeouts, setpoint adjustments, service checks, and/or routine maintenance procedures. This guidance may be applied successively, provided that time between successive short, controlled outages is always at least equal to duration of immediately preceding outage.<br>---------- | |
| | H.1 Suspend release of radioactive effluents by this pathway. | Immediately |
| | OR | |
| | H.2 Collect and analyze grab samples for gross radioactivity (beta and/or gamma) at a lower limit of detection of at least $10^{-7}$ µCi/ml. | Immediately<br>AND<br>Once per 12 hours thereafter |

Radioactive Effluent Monitoring Instrumentation
16.11.3

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| I. As required by Required Action C.1 and referenced in Table 16.11.3-2 for effluent releases from waste gas tanks (RIA-37, RIA-38) or containment purges (RIA-45). | ----------NOTE----------<br>Not required during short, controlled outages of gaseous effluent monitoring instrumentation. Short controlled outages are defined as planned removals from service for durations not to exceed 1 hour, for purposes of sample filter changeouts, setpoint adjustments, service checks, and/or routine maintenance procedures. This guidance may be applied successively, provided that time between successive short, controlled outages is always at least equal to duration of immediately preceding outage.<br>---------- | |
| | I.1.1 Analyze two independent samples. | Prior to initiating subsequent release |
| | AND | |
| | I.1.2 Conduct two independent data entry checks for release rate calculations | Prior to initiating subsequent release |
| | AND | |
| | I.1.3 Conduct two independent valve lineups of the effluent pathway. | Prior to initiating subsequent release |
| | OR | |
| | I.2 Suspend release of radioactive effluents by this pathway. | Immediately |

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| J. As required by Required Action C.1 and referenced in Table 16.11.3-2. (Effluent Flow Rate Monitor (Unit Vent, Containment Purge, Interim Radwaste Exhaust, Hot Machine Shop Exhaust, Radwaste Facility Exhaust, Waste Gas Discharge)) | ----------NOTE----------<br>Not required during short, controlled outages of gaseous effluent monitoring instrumentation. Short controlled outages are defined as planned removals from service for durations not to exceed 1 hour, for purposes of sample filter changeouts, setpoint adjustments, service checks, and/or routine maintenance procedures. This guidance may be applied successively, provided that time between successive short, controlled outages is always at least equal to duration of immediately preceding outage.<br>----------<br>J.1 Suspend release of radioactive effluents by this pathway.<br><br>OR<br><br>J.2 Estimate flow rate | Immediately<br><br>Immediately<br><br>AND<br><br>Once per 4 hours thereafter |

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| K. As required by Required Action C.1 and referenced in Table 16.11.3-2. (RIA-45, RIA-53, 4RIA-45) | ----------NOTE----------<br>Not required during short, controlled outages of gaseous effluent monitoring instrumentation. Short controlled outages are defined as planned removals from service for durations not to exceed 1 hour, for purposes of sample filter changeouts, setpoint adjustments, service checks, and/or routine maintenance procedures. This guidance may be applied successively, provided that time between successive short; controlled outages is always at least equal to duration of immediately preceding outage.<br>---------- | |
| | K.1 Suspend release of radioactive effluents by this pathway. | Immediately |
| | OR | |
| | K.2.1 Collect grab sample. | Immediately<br>AND<br>Once per 8 hours |
| | AND | |
| | K.2.2 Analyze grab samples for gross activity (beta and/or gamma). | 24 hours from collection of sample |

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| L. As required by Required Action C.1 and referenced in Table 16.11.3-2. (Unit Vent Monitoring Iodine Sampler, Unit Vent Monitoring Particulate Sampler, Interim Radwaste Building Ventilation Monitoring Iodine Sampler, Interim Radwaste Building Ventilation Monitoring Particulate Sampler, Hot Machine Shop Iodine Sampler, Hot Machine Shop Particulate Sampler, Radwaste Facility Iodine Sampler, Radwaste Facility Particulate Sampler) | ----------NOTE----------<br>Not required during short, controlled outages of gaseous effluent monitoring instrumentation. Short controlled outages are defined as planned removals from service for durations not to exceed 1 hour, for purposes of sample filter changeouts, setpoint adjustments, service checks, and/or routine maintenance procedures. This guidance may be applied successively, provided that time between successive short, controlled outages is always at least equal to duration of immediately preceding outage.<br>----------<br>L.1 Suspend release of radioactive effluents by this pathway. | Immediately |
| | OR | |
| | L.2.1 ----------NOTE----------<br>The collection time of each sample shall not exceed 7 days.<br>----------<br>Collect samples continuously using auxiliary sampling equipment. | Immediately |
| | AND | |
| | L.2.2 Analyze each sample. | 48 hours from end of each sample collection |

Radioactive Effluent Monitoring Instrumentation
16.11.3

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| M. As required by Required Action C.1 and referenced in Table 16.11.3-2 for effluent from ventilation system or condenser air ejectors. (RIA-40) | ----------NOTE----------<br>Not required during short, controlled outages of gaseous effluent monitoring instrumentation. Short controlled outages are defined as planned removals from service for durations not to exceed 1 hour, for purposes of sample filter changeouts, setpoint adjustments, service checks, and/or routine maintenance procedures. This guidance may be applied successively, provided that time between successive short, controlled outages is always at least equal to duration of immediately preceding outage.<br>---------- | |
| | M.1 Continuously monitor release through the unit vent. | Immediately |
| | OR | |
| | M.2 Suspend release of radioactive effluents by this pathway. | Immediately |
| | OR | |
| | M.3.1 Collect grab sample. | Immediately<br>AND<br>Once per 8 hours |
| | AND | |
| | M.3.2 Analyze grab sample for gross activity (beta and/or gamma). | 24 hours from collection of grab sample |

Radioactive Effluent Monitoring Instrumentation
16.11.3

SURVEILLANCE REQUIREMENTS

| | SURVEILLANCE | FREQUENCY |
|---|---|---|
| SR 16.11.3.1 | ----------NOTE----------<br>The Channel Response check shall consist of verifying indications during periods of release. Channel response checks shall be made at least once per calendar day on days in which continuous, periodic or batch releases are made.<br>----------<br>Perform Channel Response Check. | During each release via this pathway |
| SR 16.11.3.2 | ----------NOTE----------<br>The Channel Response check shall consist of verifying indications during periods of release. Channel response checks shall be made at least once per calendar day on days in which continuous, periodic or batch releases are made.<br>----------<br>Perform Channel Response Check. | 24 hours |
| SR 16.11.3.3 | Perform Source Check. | 24 hours |
| SR 16.11.3.4 | Perform Source Check. | 31 days |
| SR 16.11.3.5 | Perform Source Check. | 92 days |

| | SURVEILLANCE | FREQUENCY |
|---|---|---|
| SR 16.11.3.6 | ----------NOTE----------<br>The CHANNEL FUNCTIONAL TEST shall also demonstrate that automatic isolation of this pathway and control room annunciation occurs if any of the following conditions exist:<br>1. Instrument indicates measured levels above the alarm/trip setpoint.<br>2. Circuit failure (downscale only).<br>----------<br>Perform CHANNEL FUNCTIONAL TEST. | 92 days |
| SR 16.11.3.7 | ----------NOTE----------<br>The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room annunciation occurs if any of the following conditions exist:<br>1. Instrument indicates measured levels above the alarm/trip setpoint.<br>2. Circuit failure (downscale only).<br>----------<br>Perform CHANNEL FUNCTIONAL TEST. | 92 days |
| SR 16.11.3.8 | Perform CHANNEL FUNCTIONAL TEST. | 92 days |

| | SURVEILLANCE | FREQUENCY |
|---|---|---|
| SR 16.11.3.9 | ----------NOTE----------<br>The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Bureau of Standards or using standards that have been obtained from suppliers that participate in measurement assurance activities with the National Institute of Standards and Technology (NIST). The standards shall permit calibrating the system over its intended range of energy and measurement. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used. (Operating plants may substitute previously established calibration procedures for these requirements.)<br>----------<br>Perform CHANNEL CALIBRATION. | 12 months |
| SR 16.11.3.10 | Perform CHANNEL CALIBRATION. | 12 months |
| SR 16.11.3.11 | Perform leak test. | When cylinder gates or wicket gates are reworked |
| SR 16.11.3.12 | Perform Source Check. | Within 24 hours prior to each release via associated pathway |

## Radioactive Effluent Monitoring Instrumentation
## 16.11.3

Table 16.11.3-1
LIQUID EFFLUENT MONITORING INSTRUMENTATION
OPERATING CONDITIONS AND SURVEILLANCE REQUIREMENTS

| | INSTRUMENT | MINIMUM OPERABLE CHANNELS | APPLICABILITY | SURVEILLANCE REQUIREMENTS | CONDITION REFERENCED FROM REQUIRED ACTION B.1 |
|---|---|---|---|---|---|
| 1. | Monitors Providing Automatic Termination of Release | | | | |
| | a. Liquid Radwaste Effluent Line Monitor, RIA-33 | 1 | At all times | SR 16.11.3.1<br>SR 16.11.3.3<br>SR 16.11.3.6<br>SR 16.11.3.9 | E |
| | b. Turbine Building Sump, RIA-54 | 1 | At all times | SR 16.11.3.2<br>SR 16.11.3.4<br>SR 16.11.3.7<br>SR 16.11.3.9 | F |
| 2. | Monitors not Providing Automatic Termination of Release | | | | |
| | Low Pressure Service Water RIA-35 | 1 | At all times | SR 16.11.3.2<br>SR 16.11.3.4<br>SR 16.11.3.7<br>SR 16.11.3.9 | H |
| 3. | Flow Rate Measuring Devices | | | | |
| | a. Liquid Radwaste Effluent Line Flow Rate Monitor (0LW CR0725 or 0LW SS0920) | 1 | At all times | SR 16.11.3.1<br>SR 16.11.3.10 | G |
| | b. Liquid Radwaste Effluent Line Minimum Flow Device | NA | NA | SR 16.11.3.1<br>SR 16.11.3.10 | NA |
| | c. Turbine Building Sump Minimum Flow Device | NA | NA | SR 16.11.3.1<br>SR 16.11.3.10 | NA |
| | d. Low Pressure Service Water Minimum Flow Device | NA | NA | SR 16.11.3.1<br>SR 16.11.3.10 | NA |

Table 16.11.3-1
LIQUID EFFLUENT MONITORING INSTRUMENTATION
OPERATING CONDITIONS AND SURVEILLANCE REQUIREMENTS

| | INSTRUMENT | MINIMUM OPERABLE CHANNELS | APPLICABILITY | SURVEILLANCE REQUIREMENTS | CONDITION REFERENCED FROM REQUIRED ACTION B.1 |
|---|---|---|---|---|---|
| e. | Keowee Hydroelectric Tailrace Discharge [(a)] | NA | NA | SR 16.11.3.11 | NA |
| 4. | Continuous Composite Sampler | | | | |
| | #3 Chemical Treatment Pond Composite Sampler and Sampler Flow Monitor (Turbine Building Sumps Effluent) | 1 | At all times | SR 16.11.3.2<br>SR 16.11.3.10 | H |

(a) Flow is determined from the number of hydro units operating. If no hydro units are operating, leakage flow will be assumed to be 38 cfs based on historical data.

Table 16.11.3-2
GASEOUS EFFLUENT MONITORING INSTRUMENTATION
OPERATING CONDITIONS AND SURVEILLANCE REQUIREMENTS

| | INSTRUMENT | MINIMUM OPERABLE CHANNELS (PER RELEASE PATH) | APPLICABILITY | SURVEILLANCE REQUIREMENTS | CONDITION REFERENCED FROM REQUIRED ACTION C.1 |
|---|---|---|---|---|---|
| 1. | Unit Vent Monitoring System | | | | |
| a. | Noble Gas Activity Monitor Providing Alarm and Automatic Termination of Containment Purge Release (RIA-45 - Purge Isolation Function) | 1 | At All Times | SR 16.11.3.2<br>SR 16.11.3.4<br>SR 16.11.3.7<br>SR 16.11.3.9 | I |
| b. | Noble Gas Activity Monitor Providing Alarm. (RIA-45 - Vent Stack Monitor Function) | 1 | At all times | SR 16.11.3.2<br>SR 16.11.3.4<br>SR 16.11.3.7<br>SR 16.11.3.9 | K |
| c. | Iodine Sampler | 1 | At All Times | SR 16.11.3.2 | L |
| d. | Particulate Sampler | 1 | At All Times | SR 16.11.3.2 | L |
| e. | Effluent Flow Rate Monitor (Unit Vent Flow) (MSC CR0001) | 1 | At All Times | SR 16.11.3.2<br>SR 16.11.3.10 | J |
| f. | Sampler Flow Rate Monitor [(a)] (Annunciator) | 1 | At All Times | SR 16.11.3.2<br>SR 16.11.3.10 | NA |
| g. | Effluent Flow Rate Monitor (Containment Purge)(MSC CR0001) | 1 | During Containment Purge Operation | SR 16.11.3.2<br>SR 16.11.3.10 | J |
| h. | CSAE Off Gas Monitor (RIA-40) | 1 | During Operation of CSAE | SR 16.11.3.2<br>SR 16.11.3.5<br>SR 16.11.3.8<br>SR 16.11.3.9 | M |
| 2. | Interim Radwaste Building Ventilation Monitoring System | | | | |
| a. | Noble Gas Activity Monitor (RIA - 53) | 1 | At All Times | SR 16.11.3.2<br>SR 16.11.3.4<br>SR 16.11.3.7<br>SR 16.11.3.9 | K |
| b. | Iodine Sampler | 1 | At All Times | SR 16.11.3.2 | L |
| c. | Particulate Sampler | 1 | At All Times | SR 16.11.3.2 | L |
| d. | Effluent Flow Rate Monitor (Interim Radwaste Exhaust) (GWD FT0082) | 1 | At All Times | SR 16.11.3.2<br>SR 16.11.3.10 | J |
| e. | Sampler Flow Rate Monitor[(a)] (Annunciator) | 1 | At All Times | SR 16.11.3.2<br>SR 16.11.3.10 | NA |

Table 16.11.3-2
GASEOUS EFFLUENT MONITORING INSTRUMENTATION
OPERATING CONDITIONS AND SURVEILLANCE REQUIREMENTS

| | INSTRUMENT | MINIMUM OPERABLE CHANNELS (PER RELEASE PATH) | APPLICABILITY | SURVEILLANCE REQUIREMENTS | CONDITION REFERENCED FROM REQUIRED ACTION C.1 |
|---|---|---|---|---|---|
| 3. | Hot Machine Shop Ventilation Sampling System | | | | |
| a. | Iodine Sampler | 1 | At All Times | SR 16.11.3.2 | L |
| b. | Particulate Sampler | 1 | At All Times | SR 16.11.3.2 | L |
| c. | Effluent Flow Rate Monitor (Hot Machine Shop Exhaust) (Totalizer) | 1 | At All Times | SR 16.11.3.2<br>SR 16.11.3.10 | J |
| d. | Sampler Flow Rate Monitor [(a)] (Annunciator) | 1 | At All Times | SR 16.11.3.2<br>SR 16.11.3.10 | NA |
| 4. | Radwaste Facility Ventilation Monitoring System | | | | |
| a. | Noble Gas Activity Monitor (4-RIA-45) | 1 | At All Times | SR 16.11.3.2<br>SR 16.11.3.4<br>SR 16.11.3.7<br>SR 16.11.3.9 | K |
| b. | Iodine Sampler | 1 | At All Times | SR 16.11.3.2 | L |
| c. | Particulate Sampler | 1 | At All Times | SR 16.11.3.2 | L |
| d. | Effluent Flow Rate Monitor (Radwaste Facility Exhaust) (0VS CR2060) | 1 | At All Times | SR 16.11.3.2<br>SR 16.11.3.10 | J |
| e. | Sampler Flow Rate Monitor [(a)] (Annunciator) | 1 | At All Times | SR 16.11.3.2<br>SR 16.11.3.10 | NA |
| 5. | Waste Gas Holdup Tanks | | | | |
| a. | Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release (RIA-37,-38)[b] | 1 | During Waste Gas Holdup Tank Releases | SR 16.11.3.1<br>SR 16.11.3.6<br>SR 16.11.3.9<br>SR 16.11.3.12 | I |
| b. | Effluent Flow Rate Monitor (Waste Gas Discharge Flow) (MSC CR0001) | 1 | During Waste Gas Holdup Tank Releases | SR 16.11.3.1<br>SR 16.11.3.10 | J |

(a)Alarms indicating low flow may be substituted for flow measuring devices.
(b)Either Normal or High Range monitor is required dependent upon activity in tank being released.

BASES

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases. The alarm/trip setpoints for these instruments shall be calculated in accordance with NRC approved methods in the ODCM to assure that the alarm/trip will occur prior to exceeding 10 times the limits of 10 CFR Part 20. The operability and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases. The alarm/trip setpoints for these instruments shall be calculated in accordance with NRC approved methods in the ODCM to assure that the alarm/trip will occur prior to exceeding applicable dose limits in SLC 16.11.2. The operability end use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

For certain applicable cases, grab samples or flow estimates are required at frequencies between every 4 hours end every 12 hours upon RIA removal from service. SLC 16.11.3 does not explicitly require Action (grab samples or flow estimates) to be initiated immediately upon RIA removal from service, when removal is for the purposes of sample filter changeouts, setpoint adjustments, service checks, or routine maintenance. Therefore, during the defined short, controlled outages, Action is not required.

For the cases in which Action is defined as continuous sampling by auxiliary equipment (Action L) initiation of continuous sampling by auxiliary sampling equipment requires approximately 1 hour. One hour is the accepted reasonable time to initiate collect and change samples. Therefore. for the defined short, controlled outages (not to exceed 1 hour), Action is not required.

Failures such as blown instrument fuses, defective indicators, and faulted amplifiers are, in many cases, revealed by alarm or annunciator action. Comparison of output and/or state of independent channels measuring the same variable supplements this type of built-in surveillance. Based on experience in operation of both conventional and nuclear systems, when the unit is in operation, the minimum checking frequency stated is deemed adequate.

REFERENCES:

1. 10 CFR Part 20.
2. 10 CFR Part 50, Appendix A.
3. Offsite Dose Calculation Manual.
4. UFSAR, Section 7.2.3.4.

16.11 RADIOLOGICAL EFFLUENTS CONTROL

16.11.4 Operational Safety Review

COMMITMENT Required sampling should be performed as detailed in Table 16.11.4-1.

APPLICABILITY: At all times

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. NA | A.1 NA | NA |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | FREQUENCY |
|---|---|
| SR 16.11.4.1 N/A | N/A |

## Table 16.11.4-1
## Minimum Sampling Frequency and Analysis Program

| Item | | Check | | Frequency | Lower Limit of Detection[b] of Lab Analysis for Waste |
|---|---|---|---|---|---|
| 1. | Decant Monitor Tank, Turbine Building Sump Monitor Tanks, Waste and Recycle Monitor Tanks | a. | Principal Gamma Emitters[c] including Dissolved Noble Gases | Composite Grab Sample prior to release of each batch[h] | <5E-06 µCi/ml (Ce-144)<br><5E-07 µCi/ml (Other Gamma Nuclides)<br><1E-05 µCi/ml (Dissolved Gases)<br><1E-06 µCi/ml (I-131) |
| | | b. | Radiochemical Analysis Sr-89 and Sr-90 | Quarterly from all composited batches[f] | <5E-08 µCi/ml |
| | | c. | Tritium | Monthly Composite | <1E-05 µCi/ml |
| | | d. | Gross Alpha Activity | Monthly Composite | <1E-07 µCi/ml |
| 2. | Unit Vent Sampling (Includes Waste Gas Decay Tanks, Reactor Building Purges, Auxiliary Building Ventilation, Spent Fuel Pool Ventilation, Air Ejectors) | a. | Iodine Spectrum[a] | Continuous monitor, weekly sample[e] | <1E-10 µCi/cc (I-133)[j]<br><1E-12 µCi/cc (I-131)[j] |
| | | b. | Particulates[a] | | |
| | | i. | Ce-144 & Mo-99 | Weekly Composite[e] | <5E-10 µCi/cc[j][k] |
| | | ii. | Other Principle Gamma Emitters[d] | Weekly Composite[e] | <1E-11 µCi/cc[j] |
| | | iii. | Gross Alpha Activity | Monthly, using composite samples of one week | <1E-11 µCi/cc |
| | | iv. | Radiochemical Analysis Sr-89, Sr-90 | Quarterly Composite | <1E-11 µCi/cc |
| | | c. | Gases by Principle Gamma Emitters[d] | Weekly Grab Sample | <1E-04 µCi/cc |
| | | d. | Tritium | Weekly Grab Sample | <1E-06 µCi/cc |
| 3. | Waste Gas Decay Tank | a. | Principle Gamma Emitters[d] | Grab Sample prior to release of each batch | <1E-04 µCi/cc (gases)<br><1E-10 µCi/cc (particulates and iodines)<br><5E-09 µCi/cc (Ce-144 and Mo-99) |
| | | b. | Tritium | Grab Sample prior to release of each batch | <1E-06 µCi/cc |
| 4. | Reactor Building | a. | Principle Gamma Emitters[d] | Grab sample each purge | <1E-04 µCi/cc (gases)<br><1E-10 µCi/cc (particulates and iodines)<br><5E-09 µCi/cc (Ce-144 and Mo-99) |
| | | b. | Tritium | Grab sample each purge | <1E-06 µCi/cc |

## Table 16.11.4-1
## Minimum Sampling Frequency and Analysis Program

| Item | | Check | | Frequency | Lower Limit of Detection[b] of Lab Analysis for Waste |
|---|---|---|---|---|---|
| 5. | Not Used | | | | |
| 6. | #3 Chemical Treatment Pond Effluent[i] | a. | Principle Gamma Emitters[c] | Weekly Continuous Composite[g] | <5E-07 µCi/ml |
| | | b. | I-131 | Weekly Continuous Composite[g] | <1E-06 µCi/ml |
| | | c. | Tritium | Monthly Continuous Composite[g] | <1E-05 µCi/ml |
| | | d. | Gross Alpha Activity | Monthly Continuous Composite[g] | <1E-07 µCi/ml |
| | | e. | Sr-89 & Sr-90 | Quarterly Continuous Composite[g] | <5E-08 µCi/ml |
| | | f. | Dissolved and Entrained gases (Gamma Emitters) | Monthly Grab | <1E-05 µCi/ml |
| 7. | Radwaste Facility Ventilation | a. | Iodine Spectrum[a] | Continuous monitor, weekly sample[e] | (I-133) <1E-09 µCi/cc<br>(I-131) <1E-11 µCi/cc |
| | | b. | Particulate[a] | | |
| | | i. | Ce-144 and Mo-99 | Weekly Composite[e] | <5E-10 µCi/cc[j] |
| | | ii. | Other Principle Gamma Emitters[d] | Weekly Composite[e] | <1E-11 µCi/cc[j] |
| | | iii. | Gross Alpha Activity | Monthly, using composite samples of one week | <1E-11 µCi/cc |
| | | iv. | Radiochemical Analysis Sr-89, Sr-90 | Quarterly Composite | <1E-11 µCi/cc |
| | | c. | Gases by Principle Gamma[d] Emitters | Weekly Grab Sample | <1E-04 µCi/cc |
| | | d. | Tritium | Weekly Grab Sample | <1E-06 µCi/cc |

Operational Safety Review
16.11.4

## Table 16.11.4-1
## Minimum Sampling Frequency and Analysis Program

| Item | Check | Frequency | Lower Limit of Detection[b] of Lab Analysis for Waste |
|---|---|---|---|
| 8. Hot Machine Shop Ventilation | a. Iodine Spectrum | Weekly Sample[e] | (I-133) <1E-10 µCi/cc[j]<br>(I-131) <1E-12 µCi/cc[j] |
| | b. Particulate | | |
| | i. Ce-144 and Mo-99 | Weekly Composite[e] | <5E-10 µCi/cc[j][k] |
| | ii. Other Principle Gamma Emitters[d] | Weekly Composite[e] | <1E-11 µCi/cc[j] |
| | iii. Gross Alpha Activity | Monthly, using composite samples of one week | <1E-11 µCi/cc |
| | iv. Radiochemical Analysis Sr-89, Sr-90 | Quarterly Composite | <1E-11 µCi/cc |
| | c. Gases by Principle Gamma Emitters | NA | NA |
| | d. Tritium | NA | NA |
| 9. Interim Radwaste Building Ventilation | a. Iodine Spectrum | Weekly sample[e] | (I-133) <1E-10 µCi/cc[j]<br>(I-131) <1E-12 µCi/cc[j] |
| | b. Particulate | | |
| | i. Ce-144 and Mo-99 | Weekly Composite[e] | <5E-10 µCi/cc[j] |
| | ii. Other Principle Gamma Emitters[d] | Weekly Composite[e] | <1E-11 µCi/cc[j] |
| | iii. Gross Alpha Activity | Monthly, using composite samples of one week | <1E-11 µCi/cc |
| | iv. Radiochemical Analysis Sr-89, Sr-90 | Quarterly Composite | <1E-11 µCi/cc |
| | c. Gases by Principle Gamma[d] Emitters | Weekly Grab Sample | <1E-04 µCi/cc |
| | d. Tritium | Weekly Grab Sample | <1E-06 µCi/cc |

## Operational Safety Review
## 16.11.4

(a) Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing, or after removal from sampler. Sampling shall also be performed at least once per 24 hours for at least 7 days following each shutdown, startup, or THERMAL POWER change exceeding 15% of RATED THERMAL POWER within a 1-hour period and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement does not apply if (1) analyses show that the DOSE EQUIVALENT I-131 concentration in the reactor coolant has not increased more than a factor of 3; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of 3.

(b) The LLD is defined for purposes of these commitments as the smallest concentration of radioactive material in a sample that would be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation) :

$$LLD = \frac{(2.71 / T) + 4.65\, s_b}{E \times V \times 2.22E06 \times Y \times \exp(-\lambda \Delta t)}$$

Where:

LLD is the "a priori" lower limit of detection as defined above (as micro Curies per unit mass or volume),

$s_b$ is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute),

E is the counting efficiency (as counts per disintegration),

V is the sample size (in units of mass or volume),

2.22E06 is the number of disintegrations per minute per micro Curie,

Y is the fractional radiochemical yield (when applicable),

$\lambda$ is the radioactive decay constant for the particular nuclide

$\Delta$ t is the elapsed time between midpoint of sample collection and time of counting (for plant effluents, not environmental samples). NOTE: This assumes decay correction is applied (at the time of analysis) for the duration of sample collection, for the time between collection and analysis, and for the duration of the counting. Additionally, it does not apply to isolated systems such as Waste Gas Decay Tanks and Waste Monitor Tanks.

T is the sample counting time in minutes

Typical values of E, V, Y and $\Delta$ t should be used in the calculation.

It should be recognized that the LLD is an a priori (before the fact) limit representing the capability of a measurement system and not an a posteriori (after the fact) limit for a particular measurement.

(c) The principal gamma emitters for which the LLD control applies include the following radionuclides: Mn-54. Fe-59, Co-58, Co-60. Zn-65, Mo-99, Cs-134, Cs-137. and Ce-141. Ce-144 shall also be measured, but with a LLD of 5E-06 µCi/ml. This list does not mean that only these nuclides are to be considered. 0ther gamma peaks that are identifiable, together with the above nuclides shall also be analyzed and reported in the Annual Radioactive Effluent Release Report.

(d) The principal gamma emitters for which the LLD commitment applies exclusively are the following radionuclides: Kr-87. Kr-88, Xe-133. Xe-133m, Xe-135. and Xe-138 for gaseous emissions and Mn-54, Fe-59. Co-58, Co-60, Zn-65. Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144 for particulates. This list does not mean that only these nuclides are to be detected and reported. 0ther peaks which are measurable and identifiable, together with the above nuclides shall also be identified and reported.

(e) The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with SLC 16.11.2.a, SLC 16.11.2.b.1, and SLC 16.11.2.b.2.

(f) A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.

(g) To be representative of the quantities and concentrations of radioactive materials in liquid effluents, samples shall be collected continuously in proportion to the rate of flow of the effluent stream. Prior to analysis, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluent release.

(h) A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analysis, each batch shall be isolated, and then thoroughly mixed, to assure representative sampling.

(i) A continuous release is the discharge of liquid wastes of a non-discrete volume, e.g., from a volume of a system that has an input flow during the continuous release. Samples shall be analyzed within 48 hours after changing (on or after removal from sampler).

(j) When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. Samples shall be analyzed within 48 hours after changing (on or after removal from sampler).

(k) Ce-144 and Mo-99 LLD as approved by NRC SER dated January 16, 1984 (Reference 1).

BASES

N/A

REFERENCES:

1. Safety Evaluation Report dated January 16, 1984, supporting Amendment Nos. 125, 125, and 122 for Oconee Nuclear Station to revise Technical Specifications to incorporate changes to the Radiological Effluent Technical Specifications (RETS) in order to bring them into compliance with Appendix I of 10 CFR Part 50.

## 16.11 RADIOLOGICAL EFFLUENTS CONTROL

### 16.11.5 Solid Radioactive Waste

COMMITMENT

Radioactive wastes shall be processed and packaged to ensure compliance with the applicable requirements of 10 CFR Part 20, 10 CFR Part 61, 10 CFR Part 71, and State regulations governing the transportation and disposal of radioactive wastes.

The Solid Radwaste System or an approved alternative process shall be used in accordance with a Process Control Program (PCP), for the solidification of liquid or wet radioactive wastes or the dewatering of wet radioactive wastes to be shipped for direct disposal at a 10 CFR 61 licensed disposal site. Wastes shipped for off site processing in accordance with the processor's specifications and transportation requirements are not required to be solidified or dewatered to meet disposal requirements.

- The PCP describes administrative and operational controls used for the solidification of liquid or wet solid radioactive wastes in order to meet applicable 10 CFR 61 waste form requirements.
- The PCP describes the administrative and operational controls used for the dewatering of wet radioactive wastes to meet 10 CFR 61 free standing water requirements.
- The process parameters used in establishing the PCP shall be based on demonstrated processing of actual or simulated liquid or wet solid wastes and must adequately verify that the final product of solidification or dewatering meets all applicable Federal, State and disposal site requirements.

APPLICABILITY: At all times

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. Applicable regulatory requirements for solidified or dewatered wastes are not satisfied. | A.1 Suspend shipments of defectively packaged solid radioactive wastes from the site.<br><br>AND<br><br>A.2 Initiate action to correct PCP, procedures, or solid waste equipment as necessary to prevent recurrence. | Immediately<br><br>Prior to next shipment for disposal of solidified or dewatered wastes |
| B. A solidification test as described in the PCP fails to verify Solidification. | B.1 Suspend solidification of the batch under test and follow PCP guidance for test failures until solidification of the batch is verified by subsequent tests.<br><br>AND<br><br>B.2 The PCP shall be modified as required to assure Solidification of subsequent batches of waste. | Immediately<br><br>Prior to next solidification for shipment of waste for disposal at a 10 CFR 61 disposal site |

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| C. With solidification or dewatering for disposal not performed in accordance with the PCP. | C.1 Reprocess or repackage the waste in accordance with PCP requirements.<br><br>OR<br><br>C.2 Follow PCP or procedure guidance for alternative free standing liquid verification to ensure the waste in each container meets disposal requirements and take appropriate administrative action to prevent recurrence. | Prior to shipment for disposal of the inadequately processed waste that requires solidification or dewatering |
| D. With the solid waste equipment incapable of meeting commitment or not in service. | D.1 Restore the equipment to OPERABLE status or provide for alternative capability to process wastes as necessary to satisfy all applicable disposal requirements. | In a time frame that supports the commitment |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 16.11.5.1 | The Process Control Program shall be used to verify the solidification of at least one representative test specimen from at least every tenth batch of each type of radioactive waste to be solidified for disposal at a 10 CFR 61 disposal site. | Every tenth batch of each type of radioactive waste to be solidified. |

BASES

This commitment implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of 10 CFR Part 50, Appendix A and requirements to use a Process Control Program to meet applicable 10CFR61 waste form criteria for solidified and dewatered radioactive wastes.

REFERENCES:

1. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities".
2. 10 CFR Part 50, Appendix A.
3. 10 CFR20, "Standards for Protection Against Radiation".
4. 10 CFR61, "Licensing Requirements for Land Disposal of Radioactive Waste".
5. 10 CFR71, "Packaging and Transportation of Radioactive Materials".
6. DPCo Process Control Program Manual.
7. NRC Generic Letter 87-12, "Compliance with 10 CFR Part 61 And Implementation Of the Radiological Effluent Technical Specifications (Rets) and Attendant Process Control Program (PCP)".
8. NRC Generic Letter 89-01, "Implementation of Programmatic Controls for Radiological Effluent Technical Specifications In the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of Rets to the Offsite Dose Calculation Manual or to the Process Control Program".

16.11 RADIOLOGICAL EFFLUENTS CONTROL

16.11.6 Radiological Environmental Monitoring

COMMITMENT

a. The radiological environmental monitoring samples shall be collected in accordance with Table 16.11.6-1 and shall be analyzed pursuant to the requirements of Tables 16.11.6-1 and 16.11.6-2.

b. A land use census shall be conducted and shall identify the location of the nearest milk animal and the nearest residence in each of the 16 meteorological sectors within a distance of eight kilometers (five miles). Broad leaf vegetation sampling shall be performed at the site boundary in the direction sector with the highest D/Q in lieu of the garden census.

c. Analyses shall be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program. A summary of the results obtained as part of the Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental Operating Report. The Interlaboratory Comparison Program shall be described in the Annual Radiological Environmental Operating Report.

d. The results of the land use census shall be included in the Annual Radiological Environmental Operating Report.

----------NOTE----------
If samples required by Commitment part a, become permanently unavailable from any of the required sample locations, the locations from which samples were unavailable may then be deleted from the program provided replacement samples were obtained and added to the environmental monitoring program, if available. These new locations will be identified in the Annual Radioactive Effluent Release Report.
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APPLICABILITY: At all times

ACTIONS

| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| A. Radiological environmental monitoring program is not conducted as required. | A.1 | Submit a description of the reason for not conducting the program as required and plans to prevent a recurrence shall be included in the Annual Radiological Environmental Operating Report. | May 15 of following calendar year |
| B. Land use census identifies a Location which yields a calculated dose or dose commitment (via the same exposure pathway) 20% greater than a location from which samples are currently being obtained. | B.1 | ----------NOTE----------<br>The sampling location having the lowest calculated dose or dose commitment (via the same exposure pathway) may be deleted from this monitoring program after October 31 of the year in which this land use census was conducted.<br>----------<br>Add new location to the radiological environmental monitoring program. | 30 days |
| | AND | | |
| | B.2 | Identify new locations in the next Annual Radioactive Effluent Release Report. | April 30 of following calendar year |

ACTIONS (continued)

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| C. Interlaboratory Comparison Program analyses not performed as required. | C.1 Report corrective actions in the Annual Radiological Environmental Operating Report. | May 15 of following calendar year |
| D. Radioactivity level resulting from plant effluents in environmental sampling medium at a specified location in excess of reporting limits of Table 16.11.6-3 when averaged over a calendar quarter. | D.1 Prepare and submit a Special report that identifies the cause for exceeding the limits and defines the corrective actions to be taken to reduce radioactive effluents so that the potential annual dose to a MEMBER OF THE PUBLIC is less than the calendar year limits of SLC 16.11.1 or 16.11.2. | 30 days |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 16.11.6.1 | Conduct land use census during growing season using that information that will provide the best results, such as by a door-to-door survey, aerial survey, or by consulting local agriculture authorities. | 12 months |

## Table 16.11.6-1
## Radiological Environmental Monitoring Program

| Exposure Pathway and/or Sample | Number of Sample Locations (b) | Sampling and Collection Frequency (d) | Time and Frequency of Analysis |
|---|---|---|---|
| 1. AIRBORNE | | | |
| Radioiodine and Particulates | 5 | Continuous sampler operation with sample collection weekly, or more frequently if required by dust loading. | Radioiodine canister: I-131 analysis weekly. Particulate sampler: Gross beta radioactivity analysis following filter change; and gamma isotopic analysis of composite (by location) quarterly. (c) |
| 2. DIRECT RADIATION | 40 | Quarterly. | Gamma dose quarterly. |
| 3. WATERBORNE | | | |
| a. Surface | 2 | Composite (a) sample over a 1-month period. | Gamma isotopic analysis monthly.<br>Composite for tritium analysis quarterly. |
| b. Drinking | 3 | Composite (a) sample over a 1-month period. | Composite for gross beta and gamma isotopic analyses monthly.<br>Composite for tritium analysis quarterly. |
| c. Sediment from Shoreline | 2 | Semiannually. | Gamma isotopic analysis semiannually. |

## Table 16.11.6-1
## Radiological Environmental Monitoring Program

| Exposure Pathway and/or Sample | Number of Sample Locations (b) | Sampling and Collection Frequency (d) | Time and Frequency of Analysis |
|---|---|---|---|
| 4. INGESTION | | | |
| a. Milk | 4(e) | Semimonthly when animals are on pasture; monthly at other times. | Gamma isotopic and I-131 analysis semimonthly when animals are on pasture; monthly at other times. |
| b. Fish | 2 | Semiannually. One sample each commercially and recreationally important species. | Gamma isotopic analysis semiannually on edible portion. |
| c. Broad-leaf Vegetation | 2 | Monthly. | Gamma isotopic analysis monthly. |

(a) Composite samples shall be collected by collecting an aliquot at intervals not exceeding 2 hours.

(b) Sample locations are identified in the ODCM.

(c) Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than 10 times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.

(d) Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, or to malfunction of automatic sampling equipment. If the latter, every effort shall be made to complete corrective action prior to the end of the next sampling period.

(e) Samples from milking animals in three locations within 5 km distance having the highest dose potential. If there are none, then one sample from milking animals in each of three areas between 5 to 8 km distant where doses are calculated to be greater than 1 mrem per year. One sample from milking animals at a control location, as for example 15 to 30 km distant and in the least prevalent wind direction.

Radiological Environmental Monitoring
16.11.6

## Table 16.11.6-2
## Maximum Values for the Lower Limits of Detection (LLD) (a) (c)

| Analysis | Water (pCi/l) | Airborne Particulate or Gases ($pCi/m^3$) | Fish (pCi/kg, wet) | Milk (pCi/l) | Broad-leaf Vegetation (pCi/kg, wet) | Sediment (pCi/kg, dry) |
|---|---|---|---|---|---|---|
| Gross Beta | 4 | 1E-02 | | | | |
| $H_3$ | 2,000 | | | | | |
| Mn-54 | 15 | | 130 | | | |
| Fe-59 | 30 | | 260 | | | |
| Co-58 | 15 | | 130 | | | |
| Co-60 | 15 | | 130 | | | |
| Zn-65 | 30 | | 260 | | | |
| Zr-95 | 15 | | | | | |
| Nb-95 | 15 | | | | | |
| I-131 | 15(b) | 7E-02 | | 1 | 60 | |
| Cs-134 | 15 | 5E-02 | 130 | 15 | 60 | 150 |
| Cs-137 | 18 | 6E-02 | 150 | 18 | 80 | 180 |
| Ba-140 | 15 | | | 60 | | |
| La-140 | 15 | | | 15 | | |

(a) The LLD is defined, for purposes of these commitments, as the smallest concentration of radioactive material in a sample with 95% probability of detection and with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{(2.71 / T) + 4.65\, s_b}{E \times V \times 2.22 \times Y \times \exp(-\lambda \Delta t)}$$

Where:

LLD is the lower limit of detection as defined above (as pCi per unit mass or volume)

Sb is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)

## Table 16.11.6-2
## Maximum Values for the Lower Limits of Detection (LLD) (a) (c)

E is the counting efficiency (as counts per disintegration)

V is the sample size (in units of mass or volume)

2.22 is the number of disintegrations per minute per picocurie

Y is the fractional radiochemical yield (when applicable)

$\lambda$ is the radioactive decay constant for the particular radionuclide

$\Delta$ t is the elapsed time between sample collection (or end of the sample collection period) and time of counting

T is the sample counting time in minutes

Typical values of E, V, Y and $\Delta$ t should be used in the calculation.

The LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as a posteriori (after the fact) limit for a particular measurement.

Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances, may render these LLDs unachievable. In such cases, the contributing factors will be identified and described in the Annual Radiological Environmental Operating Report.

(b) LLD for gamma isotopic analysis for I-131 in drinking water samples. Low level I-131 analysis on drinking water will not be routinely performed because the calculated dose from I-131 in drinking water at all locations is less than 1 mrem per year. Low level I-131 analyses will be performed if abnormal releases occur which could reasonably result in > 1 pCi/liter of I-131 in drinking water. For low level analyses of I-131 an LLD of 1 pCi/liter will be achieved.

(c) Other peaks which are measurable and identifiable, together with the radionuclides in Table 16.11.6-2, shall be identified and reported.

## Table 16.11.6-3
## Reporting Levels for Radioactivity Concentrations in Environmental Samples (c) (d)

| Analysis | Water (pCi/l) | Airborne Particulate or Gases ($pCi/m^3$) | Fish (pCi/kg, wet) | Milk (pCi/l) | Broad-leaf Vegetation (pCi/kg, wet) |
|---|---|---|---|---|---|
| H-3 | 2E04(a) | | | | |
| Mn-54 | 1E03 | | 3E04 | | |
| Fe-59 | 4E02 | | 1E04 | | |
| Co-58 | 1E03 | | 3E04 | | |
| Co-60 | 3E02 | | 1E04 | | |
| Zn-65 | 3E02 | | 2E04 | | |
| Zr-Nb-95 | 4E02 | | | | |
| I-131 | 2(b) | 0.9 | | 3 | 1E02 |
| Cs-134 | 30 | 10 | 1E03 | 60 | 1E03 |
| Cs-137 | 50 | 20 | 2E03 | 70 | 2E03 |
| Ba-La-140 | 2E02 | | | 3E02 | |

(a) For drinking water samples. This is 40 CFR Part 141 value.

(b) If low level I-131 analyses are performed.

(c) Report shall be submitted when any single radionuclide exceeds the reporting level in Table 16.11.6-3 or when more than one of the radionuclides in Table 16.11.6-3 are detected in sampling medium and

$$\frac{\text{concentration (1)}}{\text{reporting level (1)}} + \frac{\text{concentration (2)}}{\text{reporting level (2)}} + \ldots \geq 1.0$$

(d) Report shall be submitted when radionuclides other than those in table 16.11.6-3 are detected and are the result of plant effluents if the potential annual dose to a MEMBER OF THE PUBLIC from all radionuclides is equal to or greater than the calendar year limits of SLC 16.11.1 or 16.11.2.

BASES

The environmental monitoring program required by this commitment provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides which lead to the highest potential radiation exposures of individuals resulting from the station operation. This monitoring program thereby supplements the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of exposure pathways. The initially specified monitoring program will be effective for at least the first three years of commercial operation. Following this period, program changes may be initiated based on operational experience.

The detection capabilities required by Table 16.11.6-2 are considered optimum for routine environmental measurements in industrial laboratories. The specified lower limits of detection correspond to less than the 10 CFR 50. Appendix I, design objective dose-equivalent of 45 mrem/year for atmospheric releases to the most sensitive organ and individual. The land use census commitment is provided to assure that changes in the use of unrestricted areas are identified and that modifications to the monitoring program are provided if required by the results of this census.

The requirements for participation in an Interlaboratory Comparison Program is provided to assure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of a quality assurance program for environmental monitoring in order to demonstrate that the results are reasonably valid.

With the level of radioactivity in an environmental sampling medium at a specified location exceeding the reporting levels of Table 16.11.6-3 when averaged over any calendar quarter, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days a Special Report that defines the corrective action to be taken to reduce radioactive effluents so that the potential annual dose to a MEMBER OF THE PUBLIC is less than the calendar year limits of SLC 16.11.1 or SLC 16.11.2. When more than one of the radionuclides in Table 16.11.6-3 are detected in the sampling medium, this report shall be submitted if

$$\frac{\text{concentration (1)}}{\text{reporting level (1)}} + \frac{\text{concentration (2)}}{\text{reporting level (2)}} + \ldots \geq 1.0$$

When radionuclides other than those in Table 16.11.6-3 are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose to a MEMBER OF THE PUBLIC from all radionuclides is equal to or greater than the calendar year limits of SLC 16.11.1 or SLC 16.11.2. This report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report required by Technical Specification 5.6.2. The methodology and parameters used to estimate the potential annual dose to a MEMBER OF THE PUBLIC shall be indicated in the 30-day Special Report.

Radiological Environmental Monitoring
16.11.6

The following requirement(s) were relocated from the CTS 6.4.4.f during the conversion to ITS.

The station shall have a program to monitor the radiation and radionuclides in the environs of the plant. The program shall provide (1) representative measurements of radioactivity in the highest potential exposure pathways, and (2) verification of the accuracy of the effluent monitoring program and modeling of environmental exposure pathways. The program shall (1) be contained in UFSAR Chapter 16, (2) conform to the guidance of Appendix I to 10 CFR Part 50, and (3) include the following:

1. Monitoring, sampling, analysis, and reporting of radiation and radionuclides in the environment in accordance with the methodology and parameters in the ODCM;

2. A Land Use Census to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the monitoring program are made if required by the results of this census; and,

3. Participation in an Interlaboratory Comparison Program to ensure that independent checks on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring.

REFERENCES:

1. 10 CFR Part 50, Appendix I.
2. Offsite Dose Calculation Manual.

16.11 RADIOLOGICAL EFFLUENTS CONTROL

16.11.7 Dose Calculations

COMMITMENT The annual (calendar year) dose or dose commitment, to any Member of the Public due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to ≤ 25 mrems to the total body or to any organ, except the thyroid, which shall be limited to ≤ 75 mrems.

APPLICABILITY: At all times

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. Calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of SLC 16.11.1.b, SLC 16.11.2.b.1, or SLC 16.11.2.b.2 | A.1 Determine by calculation, including direct radiation contributions from the reactor units and from outside storage tanks, whether the limits of Commitment 16.11.7 have been exceeded. | None |

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| B. Calculated dose exceeds limits of Commitment 16.11.7. | ----------NOTE----------<br>This Special Report, as defined in 10 CFR Part 20.2203(a), shall include an analysis that estimates the radiation exposure (dose) to a Member of the Public from uranium fuel cycle sources, (including all effluent pathways and direct radiation), for the calendar year that includes the release(s) covered by this report. It shall also describe the levels of radiation and concentration of radioactive material involved, and the cause of the exposure levels or concentrations.<br>----------<br>B.1 Prepare and submit to the Commission a Special Report that defines the corrective action to be taken to reduce subsequent releases to prevent recurrence of exceeding the specified limits and includes the schedule for achieving conformance with the specified limits. | 30 days |

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| C. Calculated dose exceeds limit of Commitment 16.11.7.<br><br>AND<br><br>Release condition resulting in violation of 40 CFR 190 not corrected at time of report submittal. | C.1 ----------NOTE----------<br>Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.<br>----------<br><br>Include a request for a variance in accordance with the provisions of 40 CFR Part 190. | 30 days from exceeding the limit |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 16.11.7.1 | Determine cumulative dose contributions from liquid effluents in accordance with Offsite Dose Calculation Manual. | 31 days |
| SR 16.11.7.2 | Determine cumulative dose contributions from gaseous effluents in accordance with Offsite Dose Calculation Manual. | 31 days |

BASES

The dose commitment is provided to assure that the release of radioactive material in liquid and gaseous effluents will be kept "as low as is reasonably achievable." The dose calculations in the ODCM implement the requirements in Section III.A of Appendix I in that conformance with the guides of Appendix I is to be shown by calculations and procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated.

REFERENCES:

1. 10 CFR Part 20.
2. 40 CFR Part 190.
3. Offsite Dose Calculation Manual.
4. 10 CFR Part 50, Appendix I.

16.11 RADIOLOGICAL EFFLUENTS CONTROL

16.11.8 Reports

COMMITMENT Special reports shall be submitted to the Regional Administrator, Region II, within the time period specified for each report. These reports shall be submitted covering the activities identified below pursuant to the requirements of the applicable SLC:

a. Radioactive Liquid Effluents,
Dose, SLC 16.11.1.b
Liquid Waste Treatment, SLC 16.11.1.c

b. Radioactive Gaseous Effluents,
Dose, SLC 16.11.2.b
Gaseous Radwaste Treatment, SLC 16.11.2.c

c. Radiological Environmental Monitoring Program, SLC 16.11.6.a, b, and c

d. Land Use Census, SLC 16.11.6.d

e. Dose Calculations, SLC 16.11.7

APPLICABILITY: At all times.

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. Individual milk samples show I-131 concentrations of 10 picocuries per liter or greater. | A.1 Submit plan advising the NRC of the proposed action to ensure the plant related annual doses will be within the design objective of 45 mrem/yr to the thyroid of any individual. | 7 days |

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| B. Milk samples collected over a calendar quarter show I-131 average concentrations of 4.8 picoCuries per liter or greater | B.1 Submit a plan advising the NRC of the proposed action to ensure the plant related annual doses will be within the design objective of 45 mrem/yr to the thyroid of any individual. | 30 days |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | FREQUENCY |
|---|---|
| SR 16.11.8.1 NA | NA |

BASES

Reference applicable commitments.

REFERENCES:

1. 10 CFR Part 20.
2. 40 CFR Part 190.
3. Offsite Dose Calculation Manual.

16.11 RADIOLOGICAL EFFLUENTS CONTROL

16.11.9 Radioactive Effluent Release Report

COMMITMENT

The Annual Radioactive Effluent Release Report covering the operation of the unit during the previous calendar year shall be submitted before May 1 of each year.

A single submittal may be made for a multiple unit station. The submittal shall combine those sections that are common to all units at the station; however, for units with separate radwaste systems, the submittal shall specify the release of radioactive material from each unit.

The Annual Radioactive Effluent Release Report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the station during the reporting period.

The annual Radioactive Effluent Release Report shall include a summary of the meteorological conditions concurrent with the release of gaseous effluents during each quarter.

The Annual Radioactive Effluent Release Report shall include the following information for all unplanned releases to unrestricted areas of radioactive materials in gaseous and liquid effluents:

a. A description of the event and equipment involved;

b. Cause(s) for the unplanned release;

c. Actions taken to prevent recurrence; and,

d. Consequences of the unplanned release.

The Annual Radioactive Effluent Release Report shall include an assessment of radiation doses from the radioactive liquid and gaseous effluents released from the station during each calendar quarter. In addition, the unrestricted area boundary maximum noble gas gamma air and beta air doses shall be evaluated. The annual average meteorological conditions shall be used for determining the gaseous pathway doses. Approximate and conservative approximate methods are acceptable. The assessment of radiation doses shall be performed in accordance with the Offsite Dose Calculation Manual.

The Annual Radioactive Effluent Release Report shall include an explanation of why the inoperability of liquid or gaseous effluent monitoring instrumentation out of service for greater than 30 days was not corrected in a timely manner per SLC 16.11.3.

Radioactive Effluent Release Report
16.11.9

The Annual Radioactive Effluent Release Report shall include the following information for each type of solid waste shipped offsite during the report period:

a. Total container volume (cubic meters);

b. Total curie quantity (determined by measurement or estimate);

c. Principal radionuclides (determined by measurement or estimate);

d. Type of waste, (e.g., spent resin, compacted dry waste evaporator bottoms);

e. Number of shipments; and,

f. Solidification agent (e.g., cement, or other approved agents (media)).

The Annual Radioactive Effluent Release Report shall include a list and description of unplanned releases from the site to Unrestricted Areas of radioactive materials in gaseous and liquid effluents made during the reporting period.

The Annual Radioactive Effluent Release Report shall include any changes made during the reporting period to the Offsite Dose Calculation Manual (ODCM), as well as a listing of new locations for dose calculations and/or environmental monitoring identified by the land use census.

The Annual Radioactive Effluent Release Report shall also include an assessment of radiation doses to the likely most exposed Member of the Public from reactor releases and other nearby uranium fuel cycle sources (including doses from primary effluent pathways and direct radiation) for the previous calendar year to show conformance with 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operation. Methods for calculating the dose contribution from liquid and gaseous effluents are given in the ODCM.

APPLICABILITY: At all times.

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. N/A | A.1 N/A | N/A |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | FREQUENCY |
|---|---|
| SR 16.11.9.1 N/A | N/A |

BASES

N/A

REFERENCES:

1. Oconee ITS.
2. Offsite Dose Calculation Manual.

## 16.11 RADIOLOGICAL EFFLUENTS CONTROL

### 16.11.10 Radiological Environmental Operating Report

COMMITMENT

Routine Radiological Environmental Operating Reports covering the operation of the unit during the previous calendar year shall be submitted by May 15 of each year.

The Annual Radiological Environmental Operating Report shall include summaries, interpretations. and statistical evaluation of the results of the radiological environmental surveillance activities for the report period, including a comparison with preoperational studies, operational controls (as appropriate), and previous environmental surveillance reports and an assessment of the observed impacts of the plant operation on the environment. The reports shall also include the results of the land use censuses. If harmful effects are detected by the monitoring, the report shall provide an analysis of the problem and a planned course of action to alleviate the problem.

The Annual Radiological Environmental Operating Report shall include a summary of the results obtained as part of the required Interlaboratory Comparison Program. The Interlaboratory Comparison Program shall be described in the Annual Radiological Environmental Operating Report.

The Annual Radiological Environmental Operating Report shall include summarized and tabulated results of the radiological environmental samples required by SLCs taken during the report period. In the event that some results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted as soon as practical in a supplementary report.

The initial report shall also include the following: a summary description of the radiological environmental monitoring program including sampling methods for each sample type, size and physical characteristics of each sample type, sample preparation methods, analytical methods, and measuring equipment used; a map of all sampling locations keyed to a table giving distances and directions from one reactor; and, the result of land use censuses. Subsequent reports shall describe all substantial changes in these aspects.

APPLICABILITY: At all times.

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. NA | A.1 NA | NA |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | FREQUENCY |
|---|---|
| SR 16.11.10.1 NA | NA |

BASES

NA

REFERENCES:

1. Oconee ITS
2. Offsite Dose Calculation Manual

16.11 RADIOLOGICAL EFFLUENTS CONTROL

16.11.11 Iodine Radiation Monitoring Filters

COMMITMENT Assure that the iodine radiation monitoring filters perform their intended function.

APPLICABILITY: At all times.

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. NA | A.1 NA | NA |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 16.11.11.1 | Remove and replace iodine radiation monitoring filters in RIA-44. | 30 days of operation |
| SR 16.11.11.2 | Discard spare iodine radiation monitoring filters. | After 24 months of shelf life. |

BASES

The purpose of this commitment is to assure the reliability of the iodine radiation monitoring charcoal filters.

REFERENCES:

1. Oconee CTS Amendment No. 3/3 SER date July, 1974.

Radioactive Material in Outside Temporary Tanks Exceeding Limit
16.11.12

16.11 RADIOLOGICAL EFFLUENTS CONTROL

16.11.12 Radioactive Material in Outside Temporary Tanks Exceeding Limit

COMMITMENT The quantity of radioactive material in outside temporary storage tanks shall not exceed the limit specified in ITS 5.5.13.c.

APPLICABILITY: At all times.

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. The quantity of radioactive material in outside temporary storage tank not within limit. | A.1 Suspend addition of radioactive material to tank. | Immediately |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 16.11.12.1 | Verify the quantity of radioactive material contained in each of the outside temporary tanks is within the limit by analyzing a representative sample of the tanks' contents. | Within 7 days after addition of radioactive materials to an outside temporary tank |
| | OR | |
| | Verify the quantity of radioactive material in each of the outside temporary tanks does not result in exceeding the limit by analyzing a representative sample of radioactive material to be added. | Prior to addition of radioactive materials to an outside temporary tank. |

Radioactive Material in Outside Temporary Tanks Exceeding Limit
16.11.12

BASES

The requirement(s) of this SLC section were relocated from CTS 3.9.1.c during the conversion to ITS.

The tanks included in this specification are all those outdoor radwaste liquid storage tanks that are not surrounded by liners, dikes, or walls capable of holding the tank contents and that do not have tank overflows and surrounding area drains connected to the liquid radwaste treatment system. Restricting the quantity of radioactive material contained in the specified tanks provides assurance that in the event of an uncontrolled release of a tank's contents, the resulting concentrations would be less than the limits of 10CFR Part 20, Appendix B, Table II, Column 2, at the nearest potable water supply and the nearest surface water supply in an UNRESTRICTED AREA.

REFERENCES

N/A

Radioactive Material in Waste Gas Holdup tank Exceeding Limit
16.11.13

16.11 RADIOLOGICAL EFFLUENTS CONTROL

16.11.13 Radioactive Material in Waste Gas Holdup Tank Exceeding Limit

COMMITMENT The quantity of radioactive material in the Waste Gas Holdup tanks shall not exceed the limit specified in ITS 5.5.13.b.

APPLICABILITY: At all times.

ACTIONS

----------NOTE----------
Separate Condition Entry is allowed for each tank.
---

| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| A. The quantity of radioactive material in the Waste Gas Holdup tank not within limit. | A.1 | Suspend addition of radioactive material to tank. | Immediately |
| | AND | | |
| | A.2 | Reduce tank contents to within limit. | 48 hours |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 16.11.13.1 | Verify quantity of radioactive materials in each tank is within limit. | 24 hours when tank is being filled |

BASES

The requirement(s) of this SLC section were relocated from CTS 3.10.1.b and 3.10.1.c during the conversion to ITS.

Radioactive Material in Waste Gas Holdup tank Exceeding Limit
16.11.13

Restricting the quantity of radioactivity contained in each waste gas holdup tank provides assurance that in the event of an uncontrolled release of the tank contents, the resulting total body exposure to an individual at the exclusion area boundary will not exceed 0.5 rem.

REFERENCE

UFSAR, Section 15.10

16.11 RADIOLOGICAL EFFLUENTS CONTROL

16.11.14 Explosive Gas Mixture

COMMITMENT The concentration of Hydrogen in the Waste Gas Holdup Tanks shall be ≤ 3% by volume.

APPLICABILITY: At all times.

ACTIONS

----------NOTE----------
Separate Condition Entry is allowed for each tank.
---

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. Concentration of Hydrogen in Waste Gas Holdup tank is > 3% and ≤ 4% by volume. | A.1 Reduce Concentration of Hydrogen to within limit. | 48 hours |
| B. Concentration of Hydrogen in Waste Gas Holdup tank is > 4% by volume. | B.1 Suspend addition of waste gases to tank.<br>AND<br>B.2 Reduce Concentration of Hydrogen to within limit. | Immediately<br><br>24 hours |

Explosive Gas Mixture
16.11.14

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 16.11.14.1 | Verify Hydrogen concentration in Waste Gas Holdup Tank is ≤ 3% by volume. | 5 times/week on each tank when in service<br><br>AND<br><br>once within 24 hours after isolation of the tank |

BASES

The requirement(s) of this SLC section were relocated from CTS 3.10.2 and Table 4.1-3, Item 13 during the conversion to ITS.

This Commitment is provided to ensure that the concentration of potentially explosive gas mixtures contained in the Waste Gas Holdup Tanks is maintained below the flammability limits of hydrogen. (Administrative controls are used to prevent the hydrogen concentrations from reaching the flammability limit.) These controls include sampling each tank 5 times a week while in service, and/or once in 24 hours after isolation of the tank; injection of dilutants to reduce the concentration of hydrogen below its flammability limits provides assurance that the releases of radioactive material will be controlled in conformance with the requirements of GDC 60 of Appendix A to CFR Part 50.

REFERENCES

N/A

# 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

The Oconee Nuclear Station PCP was not revised in 2015. The most recent revision was provided with the Oconee Nuclear Station 2014 ARERR.

# 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

No major modifications to Oconee Nuclear Station liquid, gaseous, solid, or mobile radioactive waste treatment systems occurred in 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

Oconee Nuclear Station Units 1, 2, & 3
Period 1/1/2015 - 12/31/2015

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