Southern Nuclear

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

Edwin I. Hatch Nuclear Plant – Units 1&2
Joseph M. Farley Nuclear Plant – Units 1&2
Vogtle Electric Generating Plant – Units 1&2
Annual Non-Radiological Environmental Operating Reports and Annual Radioactive Effluent Release Reports for 2019

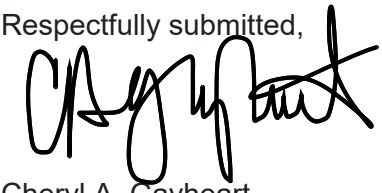
Ladies and Gentlemen:

In accordance with subsection 5.4.1 of the referenced plants' Environmental Protection Plans (Appendix B to the operating licenses), Southern Nuclear Operating Company hereby submits the Annual Non-Radiological Environmental Operating Reports for 2019.

In accordance with section 5.6.3 of the referenced plants' Technical Specifications, Southern Nuclear Operating Company hereby submits the Annual Radioactive Effluent Release Reports for 2019. Technical Specification 5.5.1.c for each plant requires that the Offsite Dose Calculation Manual (ODCM) be provided as part of, or concurrent with, the Radioactive Effluent Release Report for the period of the report in which any change in the ODCM was made. During the reporting period for the Annual Radioactive Effluent Release Reports for 2019, there were no ODCM revisions.

This letter contains no NRC commitments. If you have any questions, please contact Jamie Coleman at 205.992.6611.

Respectfully submitted,



Cheryl A. Gayheart
Regulatory Affairs Director

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Enclosures:

1. Edwin I. Hatch Nuclear Plant – Units 1&2 Annual Non-Radiological Environmental Operating Report for 2019

2. Joseph M. Farley Nuclear Plant – Units 1&2 Annual Non-Radiological Environmental Operating Report for 2019

3. Vogtle Electric Generating Plant – Units 1&2 Annual Non-Radiological Environmental Operating Report for 2019

4. Edwin I. Hatch Nuclear Plant – Units 1&2 Annual Radioactive Effluent Release Report for 2019

5. Joseph M. Farley Nuclear Plant – Units 1&2 Annual Radioactive Effluent Release Report for 2019

6. Vogtle Electric Generating Plant – Units 1&2 Annual Radioactive Effluent Release Report for 2019

cc: Regional Administrator, Region ll
NRR Project Manager – Farley, Hatch, Vogtle 1&2
Senior Resident Inspector – Farley, Hatch, Vogtle 1&2
RType: CGA02.001

Edwin I. Hatch Nuclear Plant – Units 1&2
Joseph M. Farley Nuclear Plant – Units 1&2
Vogtle Electric Generating Plant – Units 1&2
Annual Non-Radiological Environmental Operating Reports and Annual Radioactive Effluent Release Reports for 2019

Enclosure 1

Edwin I. Hatch Nuclear Plant – Units 1&2
Annual Non-Radiological Environmental Operating Report for 2019

EDWIN I. HATCH NUCLEAR PLANT – UNITS 1 AND 2

I. Introduction

This report is submitted in accordance with Subsection 5.4.1 of the Edwin I. Hatch Nuclear Plant Environmental Protection Plan, Appendix B to Facility Operating Licenses DPR-57 and NPF-5. This report describes implementation of the Environmental Protection Plan for the calendar year 2019.

II. Reporting Requirements

A. Summaries and Analyses of Results of Environmental Protection Activities Required by Subsection 4.2 of the Environmental Protection Plan (EPP) for the Reporting Period

1. Aquatic Monitoring - Liquid effluent monitoring was performed in accordance with the State of Georgia National Pollutant Discharge Elimination System (NPDES) Permit GA0004120; there was no additional requirement for aquatic monitoring during the year.

2. Terrestrial Monitoring - Terrestrial monitoring is not required.

3. Maintenance of Transmission Line Corridors – There is no reporting requirement associated with this condition.

B. Comparisons of the Year's Monitoring Activities with Preoperational Studies, Operational Controls, and Previous Nonradiological Environmental Monitoring Reports

These comparisons were not required because no nonradiological environmental monitoring programs were conducted during the reporting period beyond those performed in accordance with NPDES Permit No. GA0004120.

C. Assessment of the Observed Impacts of Plant Operation on the Environment

There were no significant adverse environmental impacts associated with plant operation during the year.

D. EPP Noncompliance and Corrective Actions

There were no EPP noncompliances during the year.

E. Changes in Station Design or Operation, Tests, or Experiments Made in Accordance with EPP Subsection 3.1 Which Involved a Potentially Significant Unreviewed Environmental Question

There were no changes in station design or operation, tests, or experiments which involved a potentially significant, unreviewed environmental question.

F. Nonroutine Reports Submitted in Accordance with EPP Section 5.4.2

There were no nonroutine reports submitted during the year.

Edwin I. Hatch Nuclear Plant – Units 1&2
Joseph M. Farley Nuclear Plant – Units 1&2
Vogtle Electric Generating Plant – Units 1&2
Annual Non-Radiological Environmental Operating Reports and Annual Radioactive Effluent Release Reports for 2019

Enclosure 2

Joseph M. Farley Nuclear Plant – Units 1&2
Annual Non-Radiological Environmental Operating Report for 2019

JOSEPH M. FARLEY NUCLEAR PLANT - UNITS 1 AND 2

I. Introduction

In accordance with Subsection 5.4.1 of the Joseph M. Farley Nuclear Plant Environmental Protection Plan, Appendix B to Facility Operating License Nos. NPF-2 and NPF-8, this report is submitted summarizing implementation of the Environmental Protection Plan for calendar year 2019.

II. Reporting Requirements

A. Summaries and Analyses of Results of Environmental Protection Activities Required by Subsection 4.2 of the Environmental Protection Plan (EPP) for the Reporting Period

1. Aerial Remote Sensing - Aerial Remote Sensing is no longer required.

2. Herbicide Application - There is no reporting requirement associated with this condition.

3. Land Management - There is no reporting requirement associated with this condition.

B. Comparison of the Year's Monitoring Activities with Preoperational Studies, Operational Controls, and Previous Non-Radiological Monitoring Reports

These comparisons were not required because no nonradiological environmental monitoring programs were conducted during the reporting period beyond those performed in accordance with NPDES Permit No. AL0024619.

C. Assessment of the Observed Impacts of Plant Operation on the Environment

There were no significant adverse environmental impacts associated with plant operation during the year.

D. EPP Noncompliance and Corrective Actions

There were no EPP noncompliances during the year.

E. Changes in Station Design or Operation, Tests, or Experiments Made in Accordance with EPP Section 3.1 Which Involved a Potentially Significant Unreviewed Environmental Question

There were no changes in station design or operation, tests, or experiments which involved a potentially significant, unreviewed environmental question.

F. Nonroutine Reports Submitted in Accordance with EPP Section 5.4.2

There were no nonroutine reports submitted during the year.

Edwin I. Hatch Nuclear Plant – Units 1&2
Joseph M. Farley Nuclear Plant – Units 1&2
Vogtle Electric Generating Plant – Units 1&2
Annual Non-Radiological Environmental Operating Reports and Annual Radioactive Effluent Release Reports for 2019

Enclosure 3

Vogtle Electric Generating Plant – Units 1&2
Annual Non-Radiological Environmental Operating Report for 2019

VOGTLE ELECTRIC GENERATING PLANT - UNITS 1 AND 2

I. Introduction

In accordance with Subsection 5.4.1 of the Vogtle Electric Generating Plant (VEGP) Environmental Protection Plan (Nonradiological), Appendix B to Facility Operating License Nos. NPF-68 and NPF-81, this report is submitted describing implementation of the Environmental Protection Plan for the calendar year 2019.

II. Reporting Requirements

A. Summaries and Analyses of Results of Environmental Protection Activities Required by Subsection 4.2 of the Environmental Protection Plan (EPP) for the Reporting Period

1. Aquatic Monitoring - Liquid effluent monitoring was performed in accordance with State of Georgia National Pollutant Discharge Elimination System (NPDES) Permit GA0026786; there was no additional requirement for aquatic monitoring during the year.

2. Terrestrial Monitoring - Terrestrial monitoring is not required.

3. Maintenance of Transmission Line Corridors – There is no reporting requirement associated with this condition.

4. Noise Monitoring - There were no complaints reported regarding noise along the VEGP-related, high-voltage transmission lines.

B. Comparison of the Year's Monitoring Activities with Preoperational Studies, Operational Controls, and Previous Monitoring Reports

These programs were not required because no nonradiological environmental monitoring programs were conducted during the reporting period beyond those performed in accordance with NPDES Permit No. GA0026786 referenced in Section A above.

C. Assessment of the Observed Impacts of Plant Operation on the Environment

There were no significant adverse environmental impacts associated with plant operation during the year.

D. EPP Noncompliance and Corrective Actions

There were no EPP noncompliances during the year.

E. Changes in Station Design or Operation, Tests, or Experiments Made in Accordance with EPP Subsection 3.1 Which Involved a Potentially Significant Unreviewed Environmental Question

There were no changes in station design or operation, tests, or experiments which involved a potentially significant, unreviewed environmental question.

F. Nonroutine Reports Submitted in Accordance with EPP Section 5.4.2

There were no nonroutine reports submitted during the year.

Edwin I. Hatch Nuclear Plant – Units 1&2
Joseph M. Farley Nuclear Plant – Units 1&2
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Annual Non-Radiological Environmental Operating Reports and Annual Radioactive Effluent Release Reports for 2019

Enclosure 4

Edwin I. Hatch Nuclear Plant – Units 1&2
Annual Radioactive Effluent Release Report for 2019

SOUTHERN COMPANY

E. I. HATCH NUCLEAR PLANT – UNITS 1 AND 2

NRC DOCKET NOS. 50-321 AND 50-366

FACILITY OPERATING LICENSE NOS. DPR-57 AND NPF-5

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

FOR

JANUARY 1, 2019 TO DECEMBER 31, 2019

Prepared by: Brianna Hughes

Reviewed by: Jamie Johnson

ACKNOWLEDGEMENT OF OWNERSHIP

The contents of this Annual Radioactive Effluent Release Report, contained herein, are true and accurate to the best of my knowledge. I understand that I am ultimately responsible for the information that has been captured within these pages.

Jamie Johnson 

Chemistry Manager

SOUTHERN COMPANY

E. I. HATCH NUCLEAR PLANT

UNITS NO. 1 & 2

ANNUAL REPORT

PLANT RADIOACTIVE EFFLUENT RELEASES

JANUARY 1, 2019 THROUGH DECEMBER 31, 2019

APPENDIX:

SOUTHERN COMPANY

E. I. HATCH NUCLEAR PLANT

UNITS NO. 1 & 2

ANNUAL REPORT

PLANT RADIOACTIVE EFFLUENT RELEASES

TABLE	*LIST OF TABLES*	*PAGE*

TABLE	*LIST OF TABLES*	*PAGE*

1.0 Liquid Effluents

1.1 Regulatory Requirements

1.1.1 Concentration Limits

The concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS shall be limited to ten times the 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 1E-04 microcuries/ml total activity.

1.1.2 Dose Limits

The dose or dose commitment, to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released from each unit to UNRESTRICTED AREAS, shall be limited:

a. During any calendar quarter, to less than or equal to 1.5 mrems to the whole body and to less than or equal to 5 mrems to any organ, and

b. During any calendar year, to less than or equal to 3 mrems to the whole body and to less than or equal to 10 mrems to any organ.

1.2 Effluent Concentration Limit

ECL values used in determining allowable liquid radwaste release rates and concentrations, for principal gamma emitters, I-131, tritium, Sr-89, Sr-90 and Fe-55, are taken from 10 CFR Part 20, Appendix B, Table 2, Column 2.
A tolerance factor of up to 10 is utilized to allow flexibility in establishing practical monitor set points which can accommodate effluent releases at concentrations higher than the ECL values stated in 10 CFR 20, Appendix B, Table 2, Column 2.

For dissolved or entrained noble gases in liquid radwaste, the ECL is 1E-04 uCi/ml total activity.

For gross alpha in liquid radwaste, the ECL is 2E-09 uCi/ml.

Furthermore, for all the above radionuclides, or categories of radioactivity, the overall ECL fraction is determined in accordance with 10 CFR Part 20, Appendix B.

The method utilizing the ECL fraction to determine liquid radwaste release rates and effluent radiation monitor set points is described in Subsection 1.3 of this report.

The method utilizing the ECL fraction to determine the dose released from groundwater outfalls is described in Subsection 1.4 of this report.

1.3 Measurements and Approximations of Total Radioactivity for Liquid Radwaste

Prior to the release of any tank containing liquid radwaste, following the required recirculations, samples are collected and analyzed in accordance with the Edwin I. Hatch Nuclear Plant Offsite Dose Calculation Manual (ODCM) Table 2-3. A sample from each tank planned for release is analyzed for principal gamma emitters, I-131, and dissolved and entrained noble gases, by gamma spectroscopy. Monthly and quarterly composites are prepared for analysis by extracting aliquots from each sample taken from the tanks released. Liquid radwaste sample analyses are performed as described in Section 1.3.1.

1.3.1 Total Radioactivity Determination for Liquid Radwaste

MEASUREMENT	FREQUENCY	METHOD
1. Gamma Isotopic	Each Batch	Gamma Spectroscopy with computerized data reduction.
2. Dissolved or entrained noble gas	Each Batch	Gamma Spectroscopy with computerized data reduction.
3. Tritium	Monthly Composite	Distillation and liquid scintillation counting
4. Gross Alpha	Monthly Composite	Gas flow proportional counting
5. Sr-89 & Sr-90	Quarterly Composite	Chemical separation and gas flow proportional or scintillation counting
6. Fe-55	Quarterly Composite	Chemical separation and liquid scintillation counting

Gamma isotopic measurements are performed in-house using germanium detectors with a resolution of 2.0 keV or lower. The detectors are shielded by four inches of lead. A liquid radwaste sample is typically counted for 2000 seconds and a peak search of the resulting gamma ray spectrum is performed. Energy and net count data for all significant peaks are determined and a quantitative reduction or MDC calculation is performed to ensure that the MDC's are met for the nuclides specified in the ODCM Chapter 10 (i.e., Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141 and Ce-144). The quantitative calculations, corrections for counting time, decay time, sample volume, sample geometry, detector efficiency, baseline counts, branching ratio and MDC calculations, are made based on the counts at the location in the spectrum where the peak for that radionuclide would be located, if present. Typically achieved liquid effluent sample analyses minimum detectable concentrations are reported in Table 1-4.

Tritium, Gross Alpha, Sr-89, Sr-90 and Fe-55 are, in some cases, analyzed offsite.

The radionuclide concentrations determined by gamma spectroscopic analysis of samples taken from tanks planned for release, in addition to the most current sample analysis results available for tritium, gross alpha, Sr-89, Sr-90 and Fe-55, are used along with the corresponding ECL values to determine the ECL fraction for these tanks. This ECL fraction is then used, with the appropriate safety factors, tolerance factors, and the expected dilution stream flow to calculate maximum permissible release rate and a liquid effluent monitor setpoint. The monitor setpoint is calculated to assure that the limits of the ODCM are not exceeded.

A monitor reading in excess of the calculated setpoint will result in an automatic termination of the liquid radwaste discharge. Liquid effluent discharge is also automatically terminated if the dilution stream flow rate falls below the minimum assured dilution flow rate used in the setpoint calculations and established as a setpoint on the dilution stream flow monitor.

Radionuclide concentrations, safety factors, dilution stream flow rate, and the liquid effluent radiation monitor calibration factor, are entered into the computer and a pre-release printout is generated. If the release is not permissible, appropriate warnings will be displayed on the computer screen. If the release is permissible, it is approved by the Chemistry Foreman on duty. The pertinent information is transferred manually from the prerelease printout to a one-page release permit, which is forwarded to Radwaste Operations. When the release is completed, the release permit is returned from Radwaste Operations to Chemistry with the actual release data provided. These data are input into the computer and a post-release printout is generated. The post release printout contains the actual release rates, the actual release concentrations and quantities, the actual dilution flow, and the calculated doses to a Member of the Public.

1.4 Measurements and Approximations of Total Radioactivity for Groundwater Outfalls – Y22N003A/12B and Y22N008A

Samples are collected and analyzed in accordance with the Edwin I. Hatch Nuclear Plant Offsite Dose Calculation Manual (ODCM) Table 2-3. Weekly, monthly and quarterly composites are prepared for analysis by extracting aliquots from each outfall's automatic sampler, which collects a composite sample over a seven-day period. Sample analyses are performed as described in Section 1.4.1.

1.4.1 Total Radioactivity Determination for Groundwater Outfalls

MEASUREMENT	FREQUENCY	METHOD
1. Gamma Isotopic	Weekly Composite	Gamma Spectroscopy with computerized data reduction.
2. Tritium	Weekly Composite	Distillation and liquid scintillation counting
3. Gross Beta *	Quarterly Composite	Chemical separation and gas flow proportional or scintillation counting
4. Sr-89 & Sr-90 **	Quarterly Composite (as required)	Chemical separation and gas flow proportional or scintillation counting

* Gross Beta analysis is used for sample screening.
** If the Gross Beta analysis yields a detectable value above background, a Sr-89/90 analysis will be performed.

Gamma isotopic measurements are performed in-house using germanium detectors with a resolution of 2.0 keV or lower. The detectors are shielded by four inches of lead. A weekly composite sample is typically counted to Environmental MDC's and a peak search of the resulting gamma ray spectrum is performed. Energy and net count data for all significant peaks are determined and a quantitative reduction or MDC calculation is performed to ensure that the MDC's are met for the nuclides specified in the ODCM Chapter 10 (i.e., Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141 and Ce-144). The quantitative calculations, corrections for counting time, decay time, sample volume, sample geometry, detector efficiency, baseline counts, branching ratio and MDC calculations, are made based on the counts at the location in the spectrum where the peak for that radionuclide would be located, if present. Typically achieved liquid effluent sample analyses minimum detectable concentrations are reported in Table 1-4.

Tritium, Gross Beta, Sr-89 and Sr-90 are, in some cases, analyzed offsite.

The radionuclide concentrations determined by gamma spectroscopic analysis of the weekly composite sample, in addition to the most current sample analysis results available for tritium, gross beta, Sr-89 and Sr-90, are used along with the corresponding ECL values to determine the ECL fraction for these composite samples. This ECL fraction is then used, with the appropriate safety factors, tolerance factors, and the expected dilution stream flow to calculate projected dose released.

Radionuclide concentrations, safety factors and dilution stream flow rate are entered into the computer and a pre-release printout is generated for each release period. When the release period is complete, the release permit is updated with the actual release data collected during the release period. These data are input into the computer and a post-release printout is generated. The post release printout contains the actual release rates, the actual release concentrations and quantities, the actual dilution flow, and the calculated doses to a Member of the Public. Cumulative dose results are tabulated along with the percent of the ODCM limit for each release period, for the current quarter and year.

1.5 Total Error Estimation

The maximum error associated with volume and flow measurements, based upon plant calibration practice, is estimated to be + or - 10%. The average error associated with counting is estimated to be less than + or - 15%. Therefore, the total error estimation is + or - 18%.

1.6 Liquid Effluent Release Data

Regulatory Guide 1.21, Tables 2A and 2B are found in this report as Table 1-1A, for Unit 1, Table 1-1B, for Unit 2 and Table 1-1C, for the site; and Table 1-2A, for Unit 1, 1-2B, for Unit 2, and Table 1-2C, for the site. Typical liquid minimum detectable concentrations (MDC's) used for analyses are found in Table 1-4.

The evaluation for the release of radioactive RHR Service Water for 2019 can be found in Appendix A of this report.

The values for the four categories of Tables 1-1A, and 1-1B, and 1-1C, are calculated and the Tables completed as follows:

1. Fission and activation products - The total release values (not including tritium, gases, and alpha) are comprised of the sum of the measured individual radionuclide activities. This sum is for each batch released to the river for the respective quarter.

2. Tritium - The measured tritium concentrations in the monthly composite samples are used to calculate the total release and average diluted concentration during each period.

3. Dissolved and entrained gases - Concentrations of dissolved and entrained gases in liquid effluents are measured by germanium spectroscopy using a one liter sample from each liquid radwaste batch. The measured concentrations are used to calculate the total release and the average diluted concentration during the period. Radioisotopes of iodine in any form are also determined during the isotopic analysis for each batch; therefore, a separate analysis for possible gaseous forms is not performed because it would not provide additional information.

4. Gross alpha radioactivity - The measured gross alpha concentrations in the monthly composite samples are used to calculate the total release of alpha radioactivity.

1.7 Radiological Impact Due to Liquid Releases

Doses to a Member of the Public due to radioactivity in liquid effluents were calculated in accordance with the Offsite Dose Calculation Manual. Results are presented in Table 1-3A for Unit 1, and 1-3B for Unit 2, for all four quarters.

1.8 Liquid Effluents - Batch Releases

Batch Release information for Units 1 and 2 is summarized in the following tables:

Unit 1 Liquid Batch Releases:	Table 1-5A
Unit 2 Liquid Batch Releases:	Table 1-5B

1.9 Liquid Effluents - Continuous Releases

Continuous Release information is summarized in the following tables:

Unit 1 Liquid Continuous Releases:	Table 1-2A
Unit 2 Liquid Continuous Releases:	Table 1-2B
Hatch Site Conitinuous Releases:	Table 1-2C

1.10 Liquid Effluents - Abnormal Releases

There were no abnormal liquid releases for this reporting period.

Table 1-1A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents - Summation Of All Releases

Unit: 1

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Products					
1. Total Release (not including tritium, gases, alpha)	Curies	8.41E-05	5.38E-04	2.55E-04	9.25E-04
2. Average diluted concentration during period	uCi/mL	2.43E-10	1.19E-09	2.79E-10	1.00E-09
3. Percent of Applicable Limit	%	*	*	*	*
B. Tritium					
1. Total Release	Curies	7.00E+00	1.23E+01	1.62E+01	2.33E+01
2. Average diluted Concentration during period	uCi/mL	2.02E-05	2.73E-05	1.77E-05	2.52E-05
3. Percent of Applicable Limit	%	*	*	*	*
C. Dissolved and Entrained Gases					
1. Total Release	Curies	1.82E-05	3.16E-05	1.07E-05	3.48E-05
2. Average diluted Concentration during period	uCi/mL	5.26E-11	7.00E-11	1.17E-11	3.76E-11
3. Percent of Applicable Limit	%	*	*	*	*
D: Gross Alpha Radioactivity					
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E: Waste Vol Release (Pre-Dilution)	Liters	1.55E+06	2.07E+06	3.39E+06	4.30E+06
F. Volume of Dilution Water Used	Liters	3.46E+08	4.51E+08	9.13E+08	9.25E+08

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

Table 1-1B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents - Summation Of All Releases

Unit: 2

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Products					
1. Total Release (not including tritium, gases, alpha)	Curies	3.65E-04	2.43E-04	3.13E-04	6.91E-04
2. Average diluted concentration during period	uCi/mL	7.36E-11	4.19E-11	4.86E-11	1.48E-10
3. Percent of Applicable Limit	%	*	*	*	*
B. Tritium					
1. Total Release	Curies	2.66E+00	8.23E+00	1.23E+01	6.66E+00
2. Average diluted Concentration during period	uCi/mL	5.37E-07	1.42E-06	1.91E-06	1.42E-06
3. Percent of Applicable Limit	%	*	*	*	*
C. Dissolved and Entrained Gases					
1. Total Release	Curies	1.84E-05	3.30E-05	5.05E-05	6.58E-05
2. Average diluted Concentration during period	uCi/mL	3.71E-12	5.69E-12	7.85E-12	1.41E-11
3. Percent of Applicable Limit	%	*	*	*	*
D: Gross Alpha Radioactivity					
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E: Waste Vol Release (Pre-Dilution)	Liters	5.38E+06	4.74E+06	5.86E+06	5.93E+06
F. Volume of Dilution Water Used	Liters	4.95E+09	5.80E+09	6.43E+09	4.68E+09

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

Table 1-1C

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents - Summation Of All Releases

Unit: Site

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Products					
1. Total Release (not including tritium, gases, alpha)	Curies	4.49E-04	7.81E-04	5.68E-04	1.62E-03
2. Average diluted concentration during period	uCi/mL	8.47E-11	1.25E-10	7.73E-11	2.88E-10
3. Percent of Applicable Limit	%	*	*	*	*
B. Tritium					
1. Total Release	Curies	9.66E+00	2.05E+01	2.85E+01	3.00E+01
2. Average diluted Concentration during period	uCi/mL	1.82E-06	3.28E-06	3.87E-06	5.35E-06
3. Percent of Applicable Limit	%	*	*	*	*
C. Dissolved and Entrained Gases					
1. Total Release	Curies	3.66E-05	6.46E-05	6.12E-05	1.01E-04
2. Average diluted Concentration during period	uCi/mL	6.91E-12	1.03E-11	8.34E-12	1.80E-11
3. Percent of Applicable Limit	%	*	*	*	*
D: Gross Alpha Radioactivity					
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E: Waste Vol Release (Pre-Dilution)	Liters	6.93E+06	6.81E+06	9.25E+06	1.02E+07
F. Volume of Dilution Water Used	Liters	5.30E+09	6.25E+09	7.35E+09	5.60E+09

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

Table 1-2A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents

Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission & Activation Products					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dissolved And Entrained Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-2A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents

Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission & Activation Products					
Cs-137	Curies	8.65E-06	2.04E-05	1.93E-05	1.19E-04
Cr-51	Curies	0.00E+00	1.93E-05	3.89E-06	0.00E+00
Sb-124	Curies	0.00E+00	3.85E-05	0.00E+00	4.31E-07
Zn-69M	Curies	0.00E+00	4.27E-06	8.09E-07	5.08E-07
Co-58	Curies	3.77E-06	2.52E-05	7.47E-06	1.96E-05
Co-60	Curies	3.32E-05	1.58E-04	1.26E-04	2.33E-04
Zn-65	Curies	4.69E-06	4.86E-05	2.34E-05	1.63E-04
Mn-54	Curies	1.29E-05	6.26E-05	5.28E-05	5.09E-05
Ag-110M	Curies	3.08E-06	2.12E-05	7.03E-07	9.31E-06
Sr-90	Curies	1.37E-05	0.00E+00	0.00E+00	0.00E+00
As-76	Curies	0.00E+00	1.37E-05	1.58E-06	1.30E-05
Fe-55	Curies	0.00E+00	0.00E+00	0.00E+00	1.90E-04
Na-24	Curies	4.14E-06	3.58E-05	1.91E-05	1.27E-04
Sr-89	Curies	0.00E+00	8.95E-05	0.00E+00	0.00E+00
Sr-92	Curies	0.00E+00	9.03E-07	0.00E+00	0.00E+00
Total For Period	**Curies**	**8.41E-05**	**5.38E-04**	**2.55E-04**	**9.25E-04**
Tritium					
H-3	Curies	7.00E+00	1.23E+01	1.62E+01	2.33E+01

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-2A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents

Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Dissolved And Entrained Gases					
Xe-135	Curies	1.71E-05	2.99E-05	8.97E-06	2.25E-05
Xe-131M	Curies	0.00E+00	0.00E+00	0.00E+00	9.95E-06
Xe-133	Curies	1.17E-06	1.68E-06	1.75E-06	2.36E-06
Total For Period	**Curies**	**1.82E-05**	**3.16E-05**	**1.07E-05**	**3.48E-05**
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-2B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents

Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission & Activation Products					
Fe-55	Curies	0.00E+00	4.06E-05	1.37E-04	0.00E+00
Total For Period	**Curies**	**0.00E+00**	**4.06E-05**	**1.37E-04**	**0.00E+00**
Tritium					
H-3	Curies	6.98E-03	6.40E-03	9.81E-03	1.57E-02
Dissolved And Entrained Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-2B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents

Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission & Activation Products					
Cs-137	Curies	4.82E-06	1.21E-06	3.87E-06	6.88E-06
Co-58	Curies	3.75E-05	8.52E-06	4.58E-06	4.12E-05
Sb-124	Curies	2.12E-05	0.00E+00	3.11E-07	0.00E+00
La-140	Curies	0.00E+00	0.00E+00	1.43E-05	7.98E-06
Sr-89	Curies	0.00E+00	0.00E+00	0.00E+00	3.17E-05
Co-60	Curies	1.64E-04	1.23E-04	9.85E-05	3.18E-04
Zn-69M	Curies	0.00E+00	0.00E+00	0.00E+00	3.37E-07
Sr-92	Curies	0.00E+00	2.75E-06	0.00E+00	6.24E-06
Nb-97	Curies	0.00E+00	2.69E-06	0.00E+00	0.00E+00
Sr-90	Curies	1.07E-05	0.00E+00	0.00E+00	0.00E+00
Cr-51	Curies	7.71E-06	3.79E-06	0.00E+00	2.24E-05
Mn-54	Curies	6.45E-05	2.91E-05	1.55E-05	1.01E-04
Zn-65	Curies	2.38E-05	7.40E-07	9.24E-06	7.04E-05
Na-24	Curies	0.00E+00	1.40E-05	3.80E-06	0.00E+00
Ag-110M	Curies	3.05E-05	1.71E-05	2.52E-05	8.56E-05
Total For Period	**Curies**	**3.65E-04**	**2.03E-04**	**1.75E-04**	**6.91E-04**
Tritium					
H-3	Curies	2.65E+00	8.22E+00	1.23E+01	6.65E+00
Dissolved And Entrained Gases					
Xe-135	Curies	9.75E-07	1.87E-05	3.08E-05	3.43E-05
Xe-133	Curies	1.74E-05	1.43E-05	1.97E-05	3.16E-05
Total For Period	**Curies**	**1.84E-05**	**3.30E-05**	**5.05E-05**	**6.58E-05**

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-2B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents

Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Nuclides Released	Unit	Batch Mode			
		1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-2C

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents

Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission & Activation Products					
Fe-55	Curies	0.00E+00	4.06E-05	1.37E-04	0.00E+00
Total For Period	**Curies**	**0.00E+00**	**4.06E-05**	**1.37E-04**	**0.00E+00**
Tritium					
H-3	Curies	6.98E-03	6.40E-03	9.81E-03	1.57E-02
Dissolved And Entrained Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-2C

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents

Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Nuclides Released	Unit	Batch Mode			
		1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission & Activation Products					
Na-24	Curies	4.14E-06	4.99E-05	2.29E-05	1.27E-04
Co-58	Curies	4.12E-05	3.37E-05	1.21E-05	6.09E-05
Nb-97	Curies	0.00E+00	2.69E-06	0.00E+00	0.00E+00
Cs-137	Curies	1.35E-05	2.16E-05	2.31E-05	1.26E-04
Zn-69M	Curies	0.00E+00	4.27E-06	8.09E-07	8.44E-07
Sr-89	Curies	0.00E+00	8.95E-05	0.00E+00	3.17E-05
Sr-92	Curies	0.00E+00	3.65E-06	0.00E+00	6.24E-06
La-140	Curies	0.00E+00	0.00E+00	1.43E-05	7.98E-06
As-76	Curies	0.00E+00	1.37E-05	1.58E-06	1.30E-05
Co-60	Curies	1.97E-04	2.80E-04	2.25E-04	5.51E-04
Sb-124	Curies	2.12E-05	3.85E-05	3.11E-07	4.31E-07
Cr-51	Curies	7.71E-06	2.31E-05	3.89E-06	2.24E-05
Ag-110M	Curies	3.35E-05	3.83E-05	2.59E-05	9.49E-05
Fe-55	Curies	0.00E+00	0.00E+00	0.00E+00	1.90E-04
Zn-65	Curies	2.85E-05	4.93E-05	3.27E-05	2.33E-04
Mn-54	Curies	7.74E-05	9.17E-05	6.83E-05	1.52E-04
Sr-90	Curies	2.44E-05	0.00E+00	0.00E+00	0.00E+00
Total For Period	**Curies**	**4.49E-04**	**7.40E-04**	**4.30E-04**	**1.62E-03**
Tritium					
H-3	Curies	9.65E+00	2.05E+01	2.84E+01	2.99E+01

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-2C

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents

Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Dissolved And Entrained Gases					
Xe-133	Curies	1.86E-05	1.60E-05	2.15E-05	3.39E-05
Xe-131M	Curies	0.00E+00	0.00E+00	0.00E+00	9.95E-06
Xe-135	Curies	1.80E-05	4.86E-05	3.98E-05	5.67E-05
Total For Period	**Curies**	**3.66E-05**	**6.46E-05**	**6.12E-05**	**1.01E-04**
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-3A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses to a member of the public due to Liquid Releases

Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Organ	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Total Body	1.50E+00	mRem	8.08E-05	5.39E-03	1.53E-04	1.02E-02	1.52E-04	1.01E-02	5.99E-04	4.00E-02
Lung	5.00E+00	mRem	4.98E-05	9.96E-04	8.93E-05	1.79E-03	1.01E-04	2.02E-03	2.40E-04	4.79E-03
Bone	5.00E+00	mRem	5.68E-05	1.14E-03	7.53E-05	1.51E-03	5.75E-05	1.15E-03	4.49E-04	8.97E-03
Kidney	5.00E+00	mRem	6.00E-05	1.20E-03	1.20E-04	2.39E-03	1.23E-04	2.46E-03	4.12E-04	8.23E-03
Thyroid	5.00E+00	mRem	4.53E-05	9.06E-04	7.95E-05	1.59E-03	9.26E-05	1.85E-03	1.73E-04	3.46E-03
Liver	5.00E+00	mRem	8.80E-05	1.76E-03	1.87E-04	3.74E-03	1.79E-04	3.58E-03	8.27E-04	1.65E-02
GI-Lli	5.00E+00	mRem	7.06E-05	1.41E-03	2.04E-04	4.08E-03	1.58E-04	3.17E-03	3.68E-04	7.36E-03

Cumulative Doses per Year

Organ	ODCM Lmt	Units	Year to Ending Date	% ODCM	Receptor	Limit
Bone	1.00E+01	mRem	6.38E-04	6.38E-03	MAX INDIVIDUAL LIQUID / Adult	Ann Cum Organ Liq Dose
Liver	1.00E+01	mRem	1.28E-03	1.28E-02	MAX INDIVIDUAL LIQUID / Adult	Ann Cum Organ Liq Dose
Thyroid	1.00E+01	mRem	3.91E-04	3.91E-03	MAX INDIVIDUAL LIQUID / Adult	Ann Cum Organ Liq Dose
Kidney	1.00E+01	mRem	7.14E-04	7.14E-03	MAX INDIVIDUAL LIQUID / Adult	Ann Cum Organ Liq Dose
Lung	1.00E+01	mRem	4.80E-04	4.80E-03	MAX INDIVIDUAL LIQUID / Adult	Ann Cum Organ Liq Dose
GI-Lli	1.00E+01	mRem	8.01E-04	8.01E-03	MAX INDIVIDUAL LIQUID / Adult	Ann Cum Organ Liq Dose
Total Body	3.00E+00	mRem	9.85E-04	3.28E-02	MAX INDIVIDUAL LIQUID / Adult	Ann Cum Tot Body Liq Dose

Table 1-3B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses to a member of the public due to Liquid Releases

Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Organ	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Total Body	1.50E+00	mRem	6.59E-05	4.39E-03	7.93E-05	5.29E-03	1.21E-04	8.07E-03	1.22E-04	8.12E-03
Thyroid	5.00E+00	mRem	2.57E-05	5.13E-04	6.58E-05	1.32E-03	9.83E-05	1.97E-03	5.68E-05	1.14E-03
Bone	5.00E+00	mRem	4.79E-05	9.57E-04	5.19E-06	1.04E-04	1.72E-05	3.43E-04	4.20E-05	8.40E-04
GI-Lli	5.00E+00	mRem	1.97E-04	3.95E-03	1.74E-04	3.49E-03	1.97E-04	3.93E-03	4.41E-04	8.81E-03
Lung	5.00E+00	mRem	2.86E-05	5.72E-04	6.66E-05	1.33E-03	1.01E-04	2.02E-03	6.13E-05	1.23E-03
Kidney	5.00E+00	mRem	4.15E-05	8.30E-04	6.88E-05	1.38E-03	1.08E-04	2.17E-03	9.18E-05	1.84E-03
Liver	5.00E+00	mRem	6.88E-05	1.38E-03	7.79E-05	1.56E-03	1.27E-04	2.54E-03	1.41E-04	2.83E-03

Cumulative Doses per Year

Organ	ODCM Lmt	Units	Year to Ending Date	% ODCM	Receptor	Limit
Bone	1.00E+01	mRem	1.12E-04	1.12E-03	MAX INDIVIDUAL LIQUID / Adult	Ann Cum Organ Liq Dose
Liver	1.00E+01	mRem	4.15E-04	4.15E-03	MAX INDIVIDUAL LIQUID / Adult	Ann Cum Organ Liq Dose
Thyroid	1.00E+01	mRem	2.47E-04	2.47E-03	MAX INDIVIDUAL LIQUID / Adult	Ann Cum Organ Liq Dose
Kidney	1.00E+01	mRem	3.10E-04	3.10E-03	MAX INDIVIDUAL LIQUID / Adult	Ann Cum Organ Liq Dose
Lung	1.00E+01	mRem	2.57E-04	2.57E-03	MAX INDIVIDUAL LIQUID / Adult	Ann Cum Organ Liq Dose
GI-Lli	1.00E+01	mRem	1.01E-03	1.01E-02	MAX INDIVIDUAL LIQUID / Adult	Ann Cum Organ Liq Dose
Total Body	3.00E+00	mRem	3.88E-04	1.29E-02	MAX INDIVIDUAL LIQUID / Adult	Ann Cum Tot Body Liq Dose

Table 1-4
E. I. HATCH NUCLEAR PLANT
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
MINIMUM DETECTABLE CONCENTRATIONS - LIQUID SAMPLE ANALYSES
STARTING: 1-Jan-2019 ENDING: 31-Dec-2019

The values in this table represent a priori Minimum Detectable Concentrations (MDC) that are typically achieved in laboratory analyses of liquid radwaste samples.

RADIONUCLIDE	***MDC***	***UNITS***
Mn-54	1.97E-08	uCi/ml
Fe-59	3.94E-08	uCi/ml
Co-58	1.59E-08	uCi/ml
Co-60	1.72E-08	uCi/ml
Zn-65	2.92E-08	uCi/ml
Mo-99	1.20E-07	uCi/ml
Cs-134	1.75E-08	uCi/ml
Cs-137	1.62E-08	uCi/ml
Ce-141	1.92E-08	uCi/ml
Ce-144	8.83E-08	uCi/ml
I-131	1.43E-08	uCi/ml
Xe-135	1.03E-08	uCi/ml
Fe-55	2.34E-08	uCi/ml
Sr-89	1.44E-08	uCi/ml
Sr-90	8.50E-09	uCi/ml
H-3	6.00E-07	uCi/ml

Table 1-5A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents - Batch Release Summary

Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Liquid Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of batch releases		46	61	98	120	325
2. Total time period for Batch releases	(Minutes)	5.87E+03	7.50E+03	1.37E+04	1.78E+04	4.48E+04
3. Maximum time period for a batch release	(Minutes)	1.65E+02	1.59E+02	1.75E+02	1.76E+02	1.76E+02
4. Average time period for a batch release	(Minutes)	1.28E+02	1.23E+02	1.40E+02	1.48E+02	1.38E+02
5. Minimum time period for a batch release	(Minutes)	8.10E+01	9.10E+01	9.10E+01	8.00E+01	8.00E+01
6. Average stream flow during periods of release of liquid effluent into a flowing stream *	(CFS)	24.82E+03	9.13E+03	2.74E+03	6.60E+03	10.82E+03

* Data obtained from United States Geological Survey (USGS) website

Table 1-5B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents - Batch Release Summary

Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Liquid Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of batch releases		39	49	74	63	225
2. Total time period for Batch releases	(Minutes)	4.36E+03	5.61E+03	8.98E+03	7.02E+03	2.60E+04
3. Maximum time period for a batch release	(Minutes)	1.56E+02	1.29E+02	2.36E+02	1.45E+02	2.36E+02
4. Average time period for a batch release	(Minutes)	1.12E+02	1.15E+02	1.21E+02	1.11E+02	1.15E+02
5. Minimum time period for a batch release	(Minutes)	7.70E+01	6.00E+00	1.03E+02	2.60E+01	6.00E+00
6. Average stream flow during periods of release of liquid effluent into a flowing stream *	(CFS)	24.82E+03	9.13E+03	2.74E+03	6.60E+03	10.82E+03

* Data obtained from United States Geological Survey (USGS) website

Table 1-6A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents - Abnormal Release Summary

Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Liquid Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 1-6B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents - Abnormal Release Summary

Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Liquid Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 1-6C

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Liquid Effluents - Abnormal Release Summary

Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Liquid Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

2.0 *Gaseous Effluents*

2.1 Regulatory Requirements

The ODCM Specifications presented in this section are for Unit 1 and Unit 2.

2.1.1 Dose Rate Limits

The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY shall be limited to the following:

a. For noble gases: Less than or equal to 500 mrems/yr. to the whole body and less than or equal to 3000 mrems/yr. to the skin and,

b. For Iodine-131, Iodine-133, tritium and for all radionuclides in particulate form with half lives greater than 8 days: Less than or equal to 1500 mrems/yr. to any organ.

2.1.2 Air Doses Due To Noble Gases in Gaseous Effluents

The air dose due to noble gases released in gaseous effluents, from each unit, to areas at and beyond the SITE BOUNDARY, shall be limited to the following:

a. During any calendar quarter: Less than or equal to 5 mrads for gamma radiation and less than or equal to 10 mrads for beta radiation, and

b. During any calendar year: Less than or equal to 10 mrads for gamma radiation and less than or equal to 20 mrads for beta radiation.

2.1.3 Doses To A Member of the Public

The dose to a MEMBER OF THE PUBLIC from Iodine-131, Iodine-133, tritium and all radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents released from each unit, to areas at and beyond the SITE BOUNDARY, shall be limited to the following.

a. During any calendar quarter: Less than or equal to 7.5 mrems to any organ.

b. During any calendar year: Less than or equal to 15 mrems to any organ.

2.2 Measurements and Approximations of Total Radioactivity

Waste gas release at Plant Hatch is confined to four paths: main stack (also called the offgas vent), Unit 1 reactor building vent; Unit 2 reactor building vent, and the recombiner building vent. Each of these four paths is continuously monitored for gaseous radioactivity.

2.2.1 Sample Collection and Analysis

Each of the four gaseous effluent paths is equipped with an integrating-type sample collection device for collecting particulates and iodines. Unless required more frequently under certain circumstances, samples are collected as follows:

1. Noble gas samples are collected by grab sampling monthly.

2. Tritium samples are collected by grab sampling monthly.

3. Radioiodine samples are collected by pulling the sample stream through a charcoal cartridge over a 7-day period.

4. Particulates are collected by pulling the sample stream through a particulate filter over a 7-day period.

5. The 7-day particulate filters above are analyzed for gross alpha activity.

6. Quarterly composite samples are prepared from the particulate filters collected over the previous quarter and the samples are analyzed for Sr-89 and Sr-90.

Sample analyses results and release flow rates from the four release points form the basis for calculating released quantities of radionuclide-specific radioactivity, the dose rates associated with gaseous releases, and the cumulative doses for the current quarter and year. This task is normally performed with computer assistance.

The noble gas grab sample analysis results are used along with maximum expected release flow rates from each of the four vents to calculate monitor setpoints for the gaseous effluent monitors serving the four release points. Calculation of monitor setpoints is described in the ODCM. Typically achieved minimum detectable concentrations for gaseous effluents sample and analyses are reported in Table 2-6.

For each release period, released radioactivity, dose rates, and cumulative doses are calculated. Cumulative dose results are tabulated along with the percent of the ODCM limit for each release, for the current quarter and year.

2.2.2 Total Quantities of Radioactivity, Dose Rates, and Cumulative Doses

The methods for determining release quantities of radioactivity, dose rates, and cumulative doses follow:

2.2.2.1 Fission and Activation Gases

The released radioactivity is determined using sample analyses results collected as described above and the average release flow rates over the period represented by the collected sample.

Dose rates due to noble gases, radioiodines, tritium, and particulates are calculated (with computer assistance). The calculated dose rates are compared to the dose rate limits specified in ODCM 3.1.2 for noble gases, radioiodine, tritium, and particulates. Dose rate calculation methodology is presented in the ODCM.

Beta and gamma air doses due to noble gases are calculated for the location in the unrestricted area with the potential for the highest exposure due to gaseous releases. Air doses are calculated for each release period and cumulative totals are kept for each unit for the calendar quarter and year. Cumulative air doses are compared to the dose limits specified in ODCM 3.1.3. The current percent of the ODCM limits are shown on the printout for each release period. Air dose calculation methodology is presented in the ODCM.

2.2.2.2 Radioiodine, Tritium and Particulate Releases

Released quantities of radioiodines are determined using the weekly samples and release flow rates for the four release points. Radioiodine concentrations are determined by gamma spectroscopy.

Release quantities of particulates are determined using the weekly (filter) samples and release flow rates for the four release points. Gamma spectroscopy is used to quantify concentrations of principal gamma emitters.

After each quarter, the particulate filters from each vent are combined, fused, and a strontium separation is performed. Since sample flows and vent flows are almost constant over each quarterly period the filters from each vent can be dissolved together. Decay corrections are performed back to the middle of the quarterly collection period. If Sr-89 or Sr-90 is not detected, MDC's are calculated. Strontium concentrations are input into the composite file of the computer and used for release dose rate and dose calculations for a Member of the Public.

Tritium samples are obtained monthly from each vent by passing the sample stream through a cold trap. The grams of water vapor/cubic foot is measured upstream of the cold trap in order to alleviate the difficulties in determining water vapor collection efficiencies. The tritium samples are analyzed by an independent laboratory and the results are furnished in uCi/ml of water. The tritium concentration in water is converted to the tritium concentration in air and this value is input into the composite file of the computer and used in release, dose rate, and individual dose calculations.

Dose rates due to radioiodine, tritium and particulates are calculated for a hypothetical child exposed to the inhalation pathway at the location in the unrestricted area where the potential dose rate is expected to be the highest. Dose rates are calculated, for each release point for each release period, and the dose rates from each release point are compared to the dose rate limits as described in ODCM 3.1.2 Doses due to radioiodine, tritium and particulates are calculated for the controlling receptor, which is described in the ODCM. Doses to a Member of the Public are calculated for each release period, and cumulative totals are kept for each unit, for the current calendar quarter and year. Cumulative doses are compared to the dose limits specified in ODCM 3.1.4. The current percent of ODCM limits are shown on the printout for each release period.

2.2.2.3 Gross Alpha Release

The gross alpha release is computed each month by counting the particulate filters, for each week for gross alpha activity in a proportional counter. The four or five weeks' numbers are then recorded on a data sheet and the activity is summed at the end of the month. The summed activity is then divided by the total monthly volume to determine the concentration. This concentration is input into the composite file of the computer and used for release calculations.

2.2.3 Total Error Estimation

The total or maximum error associated with the effluent measurement will include the cumulative errors resulting from the total process of sampling and measurement. Due to the difficulty with assigning error terms for each parameter affecting the final measurement, detailed statistical evaluation of error is not suggested. The objective is to obtain an overall estimate of the error associated with measurements of radioactive materials released in liquid and gaseous effluents and solid waste.

Estimated errors are associated with counting equipment calibration, counting statistics, vent-flow rates, vent sample flow rates, non steady release rates, chemical yield factors and sample losses for such items as charcoal cartridges.

Fission and activation total release was calculated from sample analysis results and release point flow rates.

Statistical error	60%
Counting equipment calibration	10%
Vent flow rates	10%
Non-steady release rates	20%
TOTAL ERROR	65%

I-131 releases were calculated from each weekly sample.

Statistical error	60%
Counting equipment calibration	10%
Vent flow rates	10%
Vent sample flow rates	10%
Non-steady release rates	10%
Losses from charcoal cartridges	10%
TOTAL ERROR	64%

Particulates with half lives greater than 8 days releases were calculated from sample analysis results and release point flow rates.

Statistical error	60%
Counting equipment calibration	10%
Vent flow rates	10%
Vent sample flow rates	10%
Non-steady release rates	10%
TOTAL ERROR	63%

Total tritium releases were calculated from sample analysis results and release point flow rates.

Water vapor in sample stream determination	20%
Vent flow rates	10%
Counting calibration and statistics	10%
Non-steady release rates	50%
TOTAL ERROR	56%

Gross Alpha radioactivity was calculated from sample analysis results and release point flow rates.

Statistical error	60%
Counting equipment calibration	10%
Vent flow rates	10%
Vent sample flow rates	10%
Non-steady release rates	10%
TOTAL ERROR	63%

2.3 Gaseous Effluent Release Data

Regulatory Guide 1.21 Tables 1A, 1B, and 1C are found in this report as Tables 2-1A, 2-1B, 2-1C, 2-2A, ,2-2B, 2-2C, 2-3A, 2-3B, 2-3C. Data is presented on a quarterly basis as required by Regulatory Guide 1.21 for all quarters.

To complete table 2-1A, 2-1B, and 2-1C, total release for each of the four categories (fission and activation gases, iodines, particulates, and tritium) was divided by the number of seconds in the quarter to obtain a release rate in uCi/second for each category for each quarter. However, the percent of the ODCM limits are not applicable because we have no curie limits for gaseous releases. Applicable limits are expressed in terms of dose. Noble gases are limited as specified in ODCM 3.1.2. The other three categories (tritium, radioiodines, and particulates) are limited as a group as specified in ODCM 3.1.2.

Dose rates due to noble gas releases, and due to radioiodine, tritium, and particulates were calculated as part of the pre-release and post-release permits on individual permits. No limits were exceeded for this reporting period.

Gross alpha radioactivity is reported in Table 2-1A, 2-1B, and 2-1C, as curies released in each quarter.

Limits for cumulative beta and gamma air doses due to noble gases are specified in ODCM 3.1.3. Cumulative air doses are presented in Table 2-4A and 2-4B, along with percent of ODCM limits.

Limits for cumulative doses to a Member of the Public due to radioiodine, tritium and particulates, are specified in ODCM 3.1.4. Cumulative doses to a Member of the Public doses are presented in Table 2-5A, and 2-5B, along with percent of ODCM limits.

2.4 Radiological Impact Due to Gaseous Releases

Dose rates due to noble gas release were calculated for the site in accordance with ODCM 3.1.2. Dose rates due to radioiodine, tritium, and particulates in gaseous releases were calculated in accordance with ODCM 3.1.2.

These dose rates were calculated as part of the pre-release and post release on individual release permits. No limits were exceeded for this reporting period.

Cumulative air doses due to noble gas releases were calculated for each unit in accordance with ODCM 3.1.3. These results are presented in Tables 2-4A and 2-4B.

Cumulative doses to a Member of the Public due to radioiodine, tritium and particulates in gaseous releases were calculated for each unit in accordance with ODCM 3.1.4. These results are presented in Tables 2-5A and 2-5B.

Dose rates and doses were calculated using the methodology presented in the ODCM.

2.5 Gaseous Effluents - Batch Releases

There are no gaseous batch releases from Plant Hatch.

2.6 Gaseous Effluents - Abnormal Releases

There were no unplanned or uncontrolled gaseous releases during this reporting period.

Table 2-1A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Summation Of All Releases

Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Gases					
1. Total Release	Curies	1.93E-01	6.82E-01	4.25E-01	5.10E-01
2. Average Release rate for period	uCi/sec	2.45E-02	8.64E-02	5.39E-02	6.47E-02
3. Percent of Applicable Limit	%	*	*	*	*
B. Radioiodines					
1. Total Iodine-131	Curies	2.94E-05	7.03E-06	9.46E-06	5.70E-06
2. Average Release rate for period	uCi/sec	3.73E-06	8.92E-07	1.20E-06	7.23E-07
3. Percent of Applicable Limit	%	*	*	*	*
C. Particulates					
1. Particulates (Half-Lives > 8 Days)	Curies	2.24E-06	2.93E-06	1.79E-06	2.66E-06
2. Average Release rate for period	uCi/sec	2.84E-07	3.72E-07	2.27E-07	3.379E-07
3. Percent of Applicable Limit	%	*	*	*	*
D. Tritium					
1. Total Release	Curies	5.88E+00	6.58E+00	5.18E+00	6.52E+00
2. Average Release rate for period	uCi/sec	7.46E-01	8.35E-01	6.57E-01	8.27E-01
3. Percent of Applicable Limit	%	*	*	*	*
E. Gross Alpha					
1. Total Release	Curies	3.01E-07	7.27E-08	5.41E-08	8.37E-07
2. Average Release rate for period	uCi/sec	3.82E-08	9.22E-09	6.86E-09	1.06E-07

* Applicable limits are expressed in terms of dose. See Tables 2-4A, 2-4B, 2-5A, 2-5B of this report.

Table 2-1B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Summation Of All Releases

Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Gases					
1. Total Release	Curies	1.93E-01	6.82E-01	3.22E-01	5.10E-01
2. Average Release rate for period	uCi/sec	2.45E-02	8.64E-02	4.08E-02	6.47E-02
3. Percent of Applicable Limit	%	*	*	*	*
B. Radioiodines					
1. Total Iodine-131	Curies	1.82E-05	8.82E-06	5.70E-06	1.80E-05
2. Average Release rate for period	uCi/sec	2.31E-06	1.12E-06	7.23E-07	2.29E-06
3. Percent of Applicable Limit	%	*	*	*	*
C. Particulates					
1. Particulates (Half-Lives > 8 Days)	Curies	2.62E-06	3.09E-06	2.26E-06	3.74E-06
2. Average Release rate for period	uCi/sec	3.32E-07	3.92E-07	2.87E-07	4.745E-07
3. Percent of Applicable Limit	%	*	*	*	*
D. Tritium					
1. Total Release	Curies	4.51E+00	6.31E+00	7.55E+00	9.57E+00
2. Average Release rate for period	uCi/sec	5.72E-01	8.00E-01	9.58E-01	1.21E+00
3. Percent of Applicable Limit	%	*	*	*	*
E. Gross Alpha					
1. Total Release	Curies	2.70E-07	7.85E-08	1.38E-07	2.45E-07
2. Average Release rate for period	uCi/sec	3.42E-08	9.95E-09	1.75E-08	3.11E-08

* Applicable limits are expressed in terms of dose. See Tables 2-4A, 2-4B, 2-5A, 2-5B of this report.

Table 2-1C

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Summation Of All Releases

Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Gases					
1. Total Release	Curies	3.86E-01	1.36E+00	7.47E-01	1.02E+00
2. Average Release rate for period	uCi/sec	4.90E-02	1.73E-01	9.47E-02	1.29E-01
3. Percent of Applicable Limit	%	*	*	*	*
B. Radioiodines					
1. Total Iodine-131	Curies	4.76E-05	1.59E-05	1.52E-05	2.37E-05
2. Average Release rate for period	uCi/sec	6.03E-06	2.01E-06	1.92E-06	3.01E-06
3. Percent of Applicable Limit	%	*	*	*	*
C. Particulates					
1. Particulates (Half-Lives > 8 Days)	Curies	4.86E-06	6.03E-06	4.24E-06	6.41E-06
2. Average Release rate for period	uCi/sec	6.16E-07	7.64E-07	5.38E-07	8.124E-07
3. Percent of Applicable Limit	%	*	*	*	*
D. Tritium					
1. Total Release	Curies	1.04E+01	1.29E+01	1.42E+01	1.61E+01
2. Average Release rate for period	uCi/sec	1.32E+00	1.64E+00	1.80E+00	2.04E+00
3. Percent of Applicable Limit	%	*	*	*	*
E. Gross Alpha					
1. Total Release	Curies	5.71E-07	1.51E-07	2.19E-07	1.08E-06
2. Average Release rate for period	uCi/sec	7.24E-08	1.92E-08	2.78E-08	1.37E-07

* Applicable limits are expressed in terms of dose. See Tables 2-4A, 2-4B, 2-5A, 2-5B of this report.

Table 2-2A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Elevated Level Releases

Unit: 1

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
Ar-41	Curies	1.93E-01	6.82E-01	3.76E-01	4.89E-01
Kr-85M	Curies	0.00E+00	0.00E+00	4.87E-02	2.13E-02
Total For Period	**Curies**	**1.93E-01**	**6.82E-01**	**4.25E-01**	**5.10E-01**
Iodines					
I-131	Curies	5.36E-06	2.14E-06	5.04E-06	1.64E-06
I-133	Curies	2.40E-05	4.89E-06	4.43E-06	4.06E-06
Total For Period	**Curies**	**2.94E-05**	**7.03E-06**	**9.46E-06**	**5.70E-06**
Particulates					
Mn-54	Curies	0.00E+00	3.63E-08	0.00E+00	0.00E+00
Co-58	Curies	0.00E+00	1.88E-08	0.00E+00	0.00E+00
Co-60	Curies	1.41E-07	2.64E-07	6.44E-08	2.13E-07
Zn-65	Curies	1.36E-07	3.43E-08	0.00E+00	0.00E+00
Sr-89	Curies	1.26E-06	1.27E-06	1.35E-06	1.55E-06
Sr-90	Curies	1.42E-08	3.16E-09	0.00E+00	9.79E-09
Cs-137	Curies	0.00E+00	0.00E+00	0.00E+00	2.37E-08
Ba-140	Curies	0.00E+00	1.04E-07	0.00E+00	0.00E+00
Total For Period	**Curies**	**1.55E-06**	**1.73E-06**	**1.42E-06**	**1.79E-06**
Tritium					
H-3	Curies	1.09E-01	2.46E-01	2.49E-01	6.45E-01

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Elevated Level Releases

Unit: 1

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Gross Alpha					
G-Alpha	Curies	2.77E-08	9.11E-09	1.69E-08	3.31E-08
Total For Period	**Curies**	**2.77E-08**	**9.11E-09**	**1.69E-08**	**3.31E-08**

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Elevated Level Releases

Unit: 1

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Mixed Mode Level Releases

Unit: 1

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Mixed Mode Level Releases

Unit: 1

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Elevated Level Releases

Unit: 2

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
Ar-41	Curies	1.93E-01	6.82E-01	2.98E-01	4.89E-01
Kr-85M	Curies	0.00E+00	0.00E+00	2.34E-02	2.13E-02
Total For Period	**Curies**	**1.93E-01**	**6.82E-01**	**3.22E-01**	**5.10E-01**
Iodines					
I-131	Curies	1.17E-06	3.48E-06	1.44E-06	1.64E-06
I-133	Curies	3.96E-06	5.34E-06	3.79E-06	4.06E-06
Total For Period	**Curies**	**5.13E-06**	**8.82E-06**	**5.23E-06**	**5.70E-06**
Particulates					
Mn-54	Curies	0.00E+00	9.75E-08	0.00E+00	0.00E+00
Co-58	Curies	0.00E+00	7.51E-08	0.00E+00	0.00E+00
Co-60	Curies	0.00E+00	5.15E-07	6.44E-08	2.13E-07
Zn-65	Curies	0.00E+00	1.02E-07	0.00E+00	0.00E+00
Sr-89	Curies	3.36E-07	1.40E-06	1.14E-06	1.55E-06
Sr-90	Curies	3.77E-09	3.48E-09	0.00E+00	9.79E-09
Cs-137	Curies	0.00E+00	0.00E+00	0.00E+00	2.37E-08
Ba-140	Curies	0.00E+00	1.04E-07	0.00E+00	0.00E+00
Total For Period	**Curies**	**3.39E-07**	**2.30E-06**	**1.20E-06**	**1.79E-06**
Tritium					
H-3	Curies	4.85E-02	2.66E-01	2.06E-01	6.45E-01

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Elevated Level Releases

Unit: 2

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Gross Alpha					
G-Alpha	Curies	7.28E-09	1.03E-08	1.29E-08	3.31E-08
Total For Period	**Curies**	**7.28E-09**	**1.03E-08**	**1.29E-08**	**3.31E-08**

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Elevated Level Releases

Unit: 2

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Mixed Mode Level Releases

Unit: 2

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Mixed Mode Level Releases

Unit: 2

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2C

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Elevated Level Releases

Unit: Site

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
Ar-41	Curies	3.86E-01	1.36E+00	6.75E-01	9.78E-01
Kr-85M	Curies	0.00E+00	0.00E+00	7.21E-02	4.25E-02
Total For Period	**Curies**	**3.86E-01**	**1.36E+00**	**7.47E-01**	**1.02E+00**
Iodines					
I-131	Curies	6.53E-06	5.63E-06	6.47E-06	3.29E-06
I-133	Curies	2.80E-05	1.02E-05	8.22E-06	8.12E-06
Total For Period	**Curies**	**3.45E-05**	**1.59E-05**	**1.47E-05**	**1.14E-05**
Particulates					
Mn-54	Curies	0.00E+00	1.34E-07	0.00E+00	0.00E+00
Co-58	Curies	0.00E+00	9.39E-08	0.00E+00	0.00E+00
Co-60	Curies	1.41E-07	7.79E-07	1.29E-07	4.26E-07
Zn-65	Curies	1.36E-07	1.36E-07	0.00E+00	0.00E+00
Sr-89	Curies	1.60E-06	2.67E-06	2.49E-06	3.09E-06
Sr-90	Curies	1.79E-08	6.64E-09	0.00E+00	1.96E-08
Cs-137	Curies	0.00E+00	0.00E+00	0.00E+00	4.74E-08
Ba-140	Curies	0.00E+00	2.09E-07	0.00E+00	0.00E+00
Total For Period	**Curies**	**1.89E-06**	**4.02E-06**	**2.62E-06**	**3.59E-06**
Tritium					
H-3	Curies	1.58E-01	5.13E-01	4.54E-01	1.29E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2C

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Elevated Level Releases

Unit: Site

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Gross Alpha					
G-Alpha	Curies	3.49E-08	1.94E-08	2.98E-08	6.61E-08
Total For Period	**Curies**	**3.49E-08**	**1.94E-08**	**2.98E-08**	**6.61E-08**

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2C

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Elevated Level Releases

Unit: Site

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2C

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Mixed Mode Level Releases

Unit: Site

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2C

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Mixed Mode Level Releases

Unit: Site

Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-3A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Ground Level Releases

Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
Mn-54	Curies	0.00E+00	3.67E-07	0.00E+00	0.00E+00
Co-60	Curies	0.00E+00	7.10E-07	0.00E+00	0.00E+00
Sr-89	Curies	6.87E-07	0.00E+00	3.69E-07	8.71E-07
Sr-90	Curies	0.00E+00	1.28E-07	0.00E+00	0.00E+00
Total For Period	**Curies**	**6.87E-07**	**1.20E-06**	**3.69E-07**	**8.71E-07**
Tritium					
H-3	Curies	5.77E+00	6.34E+00	4.93E+00	5.87E+00
Gross Alpha					
G-Alpha	Curies	2.74E-07	6.35E-08	3.72E-08	8.04E-07
Total For Period	**Curies**	**2.74E-07**	**6.35E-08**	**3.72E-08**	**8.04E-07**

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-3A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Ground Level Releases

Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Nuclides Released	Unit	Batch Mode			
		1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-3B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Ground Level Releases

Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
I-131	Curies	4.57E-06	0.00E+00	4.73E-07	1.43E-06
I-133	Curies	8.50E-06	0.00E+00	0.00E+00	1.09E-05
Total For Period	**Curies**	**1.31E-05**	**0.00E+00**	**4.73E-07**	**1.23E-05**
Particulates					
Sr-89	Curies	2.28E-06	6.43E-07	1.06E-06	1.95E-06
Sr-90	Curies	0.00E+00	1.55E-07	0.00E+00	0.00E+00
Total For Period	**Curies**	**2.28E-06**	**7.98E-07**	**1.06E-06**	**1.95E-06**
Tritium					
H-3	Curies	4.46E+00	6.04E+00	7.35E+00	8.92E+00
Gross Alpha					
G-Alpha	Curies	2.62E-07	6.81E-08	1.25E-07	2.12E-07
Total For Period	**Curies**	**2.62E-07**	**6.81E-08**	**1.25E-07**	**2.12E-07**

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-3B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Ground Level Releases

Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Nuclides Released	Unit	Batch Mode			
		1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-3C

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Ground Level Releases

Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
I-131	Curies	4.57E-06	0.00E+00	4.73E-07	1.43E-06
I-133	Curies	8.50E-06	0.00E+00	0.00E+00	1.09E-05
Total For Period	**Curies**	**1.31E-05**	**0.00E+00**	**4.73E-07**	**1.23E-05**
Particulates					
Mn-54	Curies	0.00E+00	3.67E-07	0.00E+00	0.00E+00
Co-60	Curies	0.00E+00	7.10E-07	0.00E+00	0.00E+00
Sr-89	Curies	2.96E-06	6.43E-07	1.62E-06	2.82E-06
Sr-90	Curies	0.00E+00	2.83E-07	0.00E+00	0.00E+00
Total For Period	**Curies**	**2.96E-06**	**2.00E-06**	**1.62E-06**	**2.82E-06**
Tritium					
H-3	Curies	1.02E+01	1.24E+01	1.38E+01	1.48E+01
Gross Alpha					
G-Alpha	Curies	5.36E-07	1.32E-07	1.90E-07	1.02E-06
Total For Period	**Curies**	**5.36E-07**	**1.32E-07**	**1.90E-07**	**1.02E-06**

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-3C

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Ground Level Releases

Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-4A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Air Doses Due to Gaseous Releases

Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Type of Radiation	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Gamma Air	5.00E+00	mRad	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma Air	5.00E+00	mRad	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beta Air	1.00E+01	mRad	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beta Air	1.00E+01	mRad	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Cumulative Doses Per Year

Type of Radiation	ODCM Lmt	Units	Year to End Date	% ODCM	Receptor	Limit
Gamma Air	1.00E+01	mRad	0.00E+00	0.00E+00	SITE BOUNDARY / Child	U1 Ann Cum Gamma Airdose
Gamma Air	1.00E+01	mRad	0.00E+00	0.00E+00	SITE BOUNDARY / Child	U2 Ann Cum Gamma Airdose
Beta Air	2.00E+01	mRad	0.00E+00	0.00E+00	SITE BOUNDARY / Child	U1 Ann Cum Beta Airdose
Beta Air	2.00E+01	mRad	0.00E+00	0.00E+00	SITE BOUNDARY / Child	U2 Ann Cum Beta Airdose

Table 2-4B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Air Doses Due to Gaseous Releases

Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Type of Radiation	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Gamma Air	5.00E+00	mRad	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma Air	5.00E+00	mRad	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beta Air	1.00E+01	mRad	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beta Air	1.00E+01	mRad	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Cumulative Doses Per Year

Type of Radiation	ODCM Lmt	Units	Year to End Date	% ODCM	Receptor	Limit
Gamma Air	1.00E+01	mRad	0.00E+00	0.00E+00	SITE BOUNDARY / Child	U1 Ann Cum Gamma Airdose
Gamma Air	1.00E+01	mRad	0.00E+00	0.00E+00	SITE BOUNDARY / Child	U2 Ann Cum Gamma Airdose
Beta Air	2.00E+01	mRad	0.00E+00	0.00E+00	SITE BOUNDARY / Child	U1 Ann Cum Beta Airdose
Beta Air	2.00E+01	mRad	0.00E+00	0.00E+00	SITE BOUNDARY / Child	U2 Ann Cum Beta Airdose

Table 2-5A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses To A Member Of The Public Due To Radioiodines, Tritium, and Particulates in Gaseous Releases

Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Organ	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Bone	7.50E+00	mRem	9.89E-06	1.32E-04	5.26E-05	7.01E-04	6.01E-06	8.01E-05	1.20E-05	1.60E-04
Liver	7.50E+00	mRem	2.99E-03	3.98E-02	3.29E-03	4.39E-02	2.56E-03	3.41E-02	3.05E-03	4.06E-02
Total Body	7.50E+00	mRem	2.99E-03	3.99E-02	3.30E-03	4.40E-02	2.56E-03	3.41E-02	3.05E-03	4.07E-02
Thyroid	7.50E+00	mRem	3.00E-03	4.00E-02	3.29E-03	4.39E-02	2.57E-03	3.42E-02	3.05E-03	4.07E-02
Kidney	7.50E+00	mRem	2.99E-03	3.98E-02	3.29E-03	4.39E-02	2.56E-03	3.41E-02	3.05E-03	4.06E-02
Lung	7.50E+00	mRem	2.99E-03	3.98E-02	3.29E-03	4.39E-02	2.56E-03	3.41E-02	3.05E-03	4.07E-02
GI-Lli	7.50E+00	mRem	2.99E-03	3.99E-02	3.29E-03	4.39E-02	2.56E-03	3.41E-02	3.05E-03	4.07E-02

Cumulative Doses per Year

Organ	ODCM Lmt	Units	Year to Ending Date	% ODCM	Receptor	Limit
Bone	1.500E+01	mRem	8.052E-05	5.368E-04	MAX IND. AIRBORNE / Child	Ann Cum Iod/Part Airdose
Liver	1.500E+01	mRem	1.188E-02	7.922E-02	MAX IND. AIRBORNE / Child	Ann Cum Iod/Part Airdose
Total Body	1.500E+01	mRem	1.190E-02	7.931E-02	MAX IND. AIRBORNE / Child	Ann Cum Iod/Part Airdose
Thyroid	1.500E+01	mRem	1.191E-02	7.943E-02	MAX IND. AIRBORNE / Child	Ann Cum Iod/Part Airdose
Kidney	1.500E+01	mRem	1.188E-02	7.922E-02	MAX IND. AIRBORNE / Child	Ann Cum Iod/Part Airdose
Lung	1.500E+01	mRem	1.188E-02	7.923E-02	MAX IND. AIRBORNE / Child	Ann Cum Iod/Part Airdose
GI-Lli	1.500E+01	mRem	1.189E-02	7.924E-02	MAX IND. AIRBORNE / Child	Ann Cum Iod/Part Airdose

Table 2-5B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses To A Member Of The Public Due To Radioiodines, Tritium, and Particulates in Gaseous Releases

Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Organ	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Bone	7.50E+00	mRem	2.44E-05	3.26E-04	6.47E-05	8.63E-04	1.26E-05	1.68E-04	2.32E-05	3.10E-04
Liver	7.50E+00	mRem	2.31E-03	3.08E-02	3.13E-03	4.18E-02	3.81E-03	5.08E-02	4.63E-03	6.17E-02
Total Body	7.50E+00	mRem	2.31E-03	3.08E-02	3.15E-03	4.19E-02	3.81E-03	5.08E-02	4.63E-03	6.17E-02
Thyroid	7.50E+00	mRem	2.38E-03	3.18E-02	3.14E-03	4.18E-02	3.82E-03	5.09E-02	4.66E-03	6.21E-02
Kidney	7.50E+00	mRem	2.31E-03	3.08E-02	3.13E-03	4.18E-02	3.81E-03	5.08E-02	4.63E-03	6.17E-02
Lung	7.50E+00	mRem	2.31E-03	3.08E-02	3.13E-03	4.18E-02	3.81E-03	5.08E-02	4.63E-03	6.17E-02
GI-Lli	7.50E+00	mRem	2.32E-03	3.09E-02	3.13E-03	4.18E-02	3.81E-03	5.08E-02	4.63E-03	6.17E-02

Cumulative Doses per Year

Organ	ODCM Lmt	Units	Year to Ending Date	% ODCM	Receptor	Limit
Bone	1.500E+01	mRem	1.250E-04	8.331E-04	MAX IND. AIRBORNE / Child	Ann Cum Iod/Part Airdose
Liver	1.500E+01	mRem	1.387E-02	9.249E-02	MAX IND. AIRBORNE / Child	Ann Cum Iod/Part Airdose
Total Body	1.500E+01	mRem	1.389E-02	9.259E-02	MAX IND. AIRBORNE / Child	Ann Cum Iod/Part Airdose
Thyroid	1.500E+01	mRem	1.400E-02	9.332E-02	MAX IND. AIRBORNE / Child	Ann Cum Iod/Part Airdose
Kidney	1.500E+01	mRem	1.387E-02	9.249E-02	MAX IND. AIRBORNE / Child	Ann Cum Iod/Part Airdose
Lung	1.500E+01	mRem	1.387E-02	9.250E-02	MAX IND. AIRBORNE / Child	Ann Cum Iod/Part Airdose
GI-Lli	1.500E+01	mRem	1.388E-02	9.255E-02	MAX IND. AIRBORNE / Child	Ann Cum Iod/Part Airdose

TABLE 2-6
E. I. HATCH NUCLEAR PLANT
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
MINIMUM DETECTABLE CONCENTRATIONS - GASEOUS SAMPLE
ANALYSES STARTING: 1-Jan-2019 ENDING: 31-Dec-2019

The values in this table represent a priori Minimum Detectable Concentration (MDC) that are typically achieved in laboratory analyses of gaseous radwaste samples.

RADIONUCLIDE	***MDC***	***UNITS***
Kr-87	2.94E-08	uCi/cc
Kr-88	3.22E-08	uCi/cc
Xe-133	2.30E-08	uCi/cc
Xe-133m	7.30E-08	uCi/cc
Xe-135	8.73E-09	uCi/cc
Xe-138	1.99E-07	uCi/cc
I-131	1.34E-13*	uCi/cc
I-133	1.53E-13*	uCi/cc
Mn-54	1.62E-13*	uCi/cc
Fe-59	3.42E-13*	uCi/cc
Co-58	1.30E-13*	uCi/cc
Co-60	1.54E-13*	uCi/cc
Zn-65	2.54E-13*	uCi/cc
Mo-99	9.61E-13*	uCi/cc
Cs-134	1.42E-13*	uCi/cc
Cs-137	1.28E-13*	uCi/cc
Ce-141	1.26E-13*	uCi/cc
Ce-144	5.64E-13*	uCi/cc
Sr-89	1.10E-16	uCi/cc
Sr-90	6.70E-16	uCi/cc
H-3	4.00E-07	uCi/cc

** Based on an estimated sample quantity of 4.078E+07 cc's.*

Table 2-7A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Batch Release Summary

Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Gaseous Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of batch releases		0	0	0	0	0
2. Total time period for batch releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum time period for a batch release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average time period for a batch release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum time period for a batch release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 2-7B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Batch Release Summary

Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Gaseous Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of batch releases		0	0	0	0	0
2. Total time period for batch releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum time period for a batch release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average time period for a batch release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum time period for a batch release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 2-8A

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Abnormal Release Summary

Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Gaseous Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 2-8B

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Abnormal Release Summary

Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Gaseous Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 2-8C

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Abnormal Release Summary

Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Gaseous Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

3.0 Solid Waste

3.1 Regulatory Requirements

The Process Control Program (PCP) and the ODCM requirements presented in this section are for Unit 1 and Unit 2 and are stated in part.

3.1.1 Solid Radioactive Waste System

PCP Section A.3.1 Solid Radioactive Waste System control states:

The solid radwaste system shall be used in accordance with the PROCESS CONTROL PROGRAM to provide for the SOLIDIFICATION of wet solid wastes and for the SOLIDIFICATION and packaging of other radioactive wastes, as required, to ensure that they meet requirements of 10 CFR Parts 20 and 71, prior to shipment of radioactive wastes from the site.

3.1.2 Reporting Requirements

Technical Specification 5.6.3 requires in part:

The Radioactive Effluent Release Report covering the operation of the unit shall be submitted in accordance with 10 CFR 50.36a. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit. The material provided shall be consistent with the objectives outlined in the ODCM and the Process Control Program and in conformance with 10 CFR 50.36a and 10 CFR 50, Appendix I, Section IV.B.1.

PCP Section A.4.1 states in part:

The Radioactive Effluent Release Report, submitted in accordance with Technical Specification 5.6.3, shall include a summary of the quantities of solid radwaste released from the units as outlined in Regulatory Guide 1.21, “Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants,” Revision 1, June 1974, with data summarized on a 6 month basis following the format of Appendix B thereof.

For each type of solid radwaste shipped offsite during the report period, the report shall include the following information:

a. Container volume.

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

c. Principal radionuclides (specify whether determined by measurement or estimate).

d. Type of waste (such as spent resin, compacted dry waste, evaporator bottoms).

e. Type of container (such as LSA, type A, type B, large quantity).

f. Solidification agent (such as cement).

Major changes to the solid radioactive waste treatment system shall be reported to the Nuclear Regulatory Commission in the Radioactive Effluent Release Report for the period in which the evaluation was reviewed and accepted by the PRB.

3.2 Solid Waste Data

Regulatory Guide 1.21, Table 3 is found in this report as Table 3-1.

TABLE 3-1
E. I. HATCH NUCLEAR PLANT
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
UNIT 1 AND 2
STARTING: 1-Jan-2019 ENDING: 30-Jun-2019

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not irradiated fuel)

1. Type of waste	UNIT	6 month period	Est. Total ERROR %
a. Spent resins, filter sludges, evaporator	m^3	6.710E+01	
bottoms, etc.	Ci	3.390E+02	1.00 E+01
b. Dry compressible waste, contaminated equip.	m^3	6.670E+02	
etc.	Ci	2.93E-01	2.00 E+01
c. Irradiated components, control rods,	m^3		
	Ci		
d. Control Rod Drive Filters	m^3		
	Ci		
e. Other (describe)	m^3		
Equip. etc.	Ci		

2. Estimate of major nuclide composition (by type of waste)

ISOTOPE	PERCENT	CURIES
a.Fe-55	29.92	1.01E+02
Co-60	41.95	1.42E+02
Zn-65	10.27	3.48E+01
Mn-54	23.8	1.968E+02
Co-58	3.86	1.31E+01
Other	7.82	1.35E+01
b.Fe-55	59.04	1.73E-01
Co-60	31.59	2.978E+00
Mn-54	2.36	6.93E-03
Zn-65	1.21	3.54E-03
Other	7.01	2.055E-02
c.		
d.		
e.		

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
All waste sent to processors	N/A	N/A

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
0	N/A	N/A

TABLE 3-1
E. I. HATCH NUCLEAR PLANT
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
UNIT 1 AND 2
STARTING: 1-Jul-2019 ENDING: 31-Dec-2019

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not irradiated fuel)

1. Type of waste	UNIT	6 month period	Est. Total ERROR %
a. Spent resins, filter sludges, evaporator	m^3	5.01E+01	
bottoms, etc.	Ci	8.50E+01	1.00 E+01
b. Dry compressible waste, contaminated equip.	m^3	3.10E+02	
etc.	Ci	2.98E-02	2.00 E+01
c. Irradiated components, control rods,	m^3		
	Ci		
d. Control Rod Drive Filters	m^3		
	Ci		
e. Other (describe)	m^3	7.65E+00	
Equip. etc.	Ci	4.52E-06	2.00E+01

2. Estimate of major nuclide composition (by type of waste)

ISOTOPE	PERCENT	CURIES
a.Fe-55	19.92	1.69E+01
Co-60	41.34	3.51E+01
Zn-65	9.65	8.20E+00
Mn-54	10.3	8.76E+00
Other	18.78	1.60E+01
b.Fe-55	61.33	1.83E-02
Co-60	31.06	9.25E-03
Mn-54	1.53	4.56E-04
Ni-63	3.41	1.02E-03
Other	2.67	7.94E-04
c.		
d. Fe-55	56.95	2.58E-06
Co-60	28.6	1.29E-06
Cs-137	8.19	3.70E-07
Other	6.26	2.83E-07
e.		

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
All waste sent to processors	N/A	N/A

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
0	N/A	N/A

TABLE 3-1
E. I. HATCH NUCLEAR PLANT
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
UNIT 1 AND 2
STARTING: 1-Jan-2019 ENDING: 30-Jun-2019

TYPE OF WASTE	CURIE QUANTITY/ DETERMINED	PRINCIPAL NUCLIDES/ DETERMINATION	BURIAL CONTAINER DESCRIPTION	NUMBER OF CONTAINERS SHIPPED	VOLUME OF EACH CONTAINER CUBIC FEET (FT 3)	TYPE SHIPMENT/ CONTAINER	SOLIDIFICATION AGENT
Dewatered Resins	339	Zn-65,Fe-55,Co-60 Mn-54, Co-58, Ag-110m, C-14, Cr-51	High Intergrity Container	14 * See Note	207.4, 125.2	LSA-II, Type B	N/A
Dry Active Waste	0.293	Fe-55,Co-60,Mn-54 Zn-65, Ni-63, Cs-137, Co-58, Cr-51	B-25 Boxes/High Integrity Container	73 * See Note	90, 1040, 2080	LSA-I, SCO-II, LSA-I/SCO-II	N/A

*** Note: The actual size and number of the containers may vary from the recorded values due to the use of different containers by waste processors.**

TABLE 3-1
E. I. HATCH NUCLEAR PLANT
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
UNIT 1 AND 2
STARTING: 1-JUL-2019 ENDING:31-DEC-2019

TYPE OF WASTE	CURIE QUANTITY/ DETERMINED	PRINCIPAL NUCLIDES/ DETERMINATION	BURIAL CONTAINER DESCRIPTION	NUMBER OF CONTAINERS SHIPPED	VOLUME OF EACH CONTAINER CUBIC FEET (FT 3)	TYPE SHIPMENT/ CONTAINER	SOLIDIFICATION AGENT
Dewatered Resins	850	Zn-65,Fe-55,Co-60 Mn-54, C-14, Ni-63 Co-58, Cs-137, H-3	High Intergrity Container	10 * See Note	207.4	LSA-II, Type B	N/A
Dry Active Waste	2.98E-02	Fe-55,Co-60,Mn-54 Zn-65, Cs-137, Ni-63, Co-58	B-25 Boxes/High Integrity Container	22 * See Note	96/2080/ 1040	LSA-I, SCO-II	N/A
Oil	4.52E-06	Fe-55,Co-60,Mn-54 Zn-65, Cs-137, Ni-63, Co-58	N/A	1 * See Note	335	Exempt	N/A

*** Note: The actual type, size and number of the containers may vary from the recorded values due to the use of different containers by waste processors for final disposal of processed resin and DAW.**

4.0 Doses to Members of the Public Inside the Site Boundary

4.1 Regulatory Requirements

ODCM 7.2.2.3 states in part that the Radioactive Effluent Release Report shall also include an assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY during the report period; this assessment must be performed in accordance with the ODCM.

4.2 Demonstration of Compliance

The locations of concern within the site boundary are the Roadside Park, the Camping Area, the Recreation Area, and the Visitors Center. Listed in Table 4-1 are: The distance and direction from a point midway between the center of Unit 1 and the Unit 2 reactors, the dispersion and deposition factors for any releases from the Main Stack (elevated) and from the reactor building (ground level); and the estimated maximum occupancy factor for an individual and the assumed age group of this individual.

The source term is not listed in Table 4-1 . The source term is listed in Tables 2-2A and 2-2B, for the elevated releases. Similarly the source term is listed in Tables 2-3A and 2-3B for the ground level releases.

The maximum doses in units of mrem accumulated by an individual MEMBER OF THE PUBLIC due to their activities inside the site boundary during the reporting period are presented in Table 4-1.

Table 4-1

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses to a Member of the Public Due to Activities Inside the Site Boundary

Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Location Name: ROADSIDE PARK
Distance (kilometers): 1.18E+00
Sector: WNW
Occupancy Factor: 2.28E-04
Age Group: Child

Elevated Release	Particulate and Radioiodine	X/Q (sec/m3): 2.37E-08	D/Q (m-2): 1.29E-09
Elevated Release	Noble Gas	X/Q (sec/m3): 2.42E-08	
Ground Level Release	Particulate and Radioiodine	X/Q (sec/m3): 7.00E-06	D/Q (m-2): 2.01E-08
Ground Level Release	Noble Gas	X/Q (sec/m3): 7.83E-06	

	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year
Total Body	mRem	5.83E-09	7.08E-09	7.85E-09	8.44E-09	2.92E-08
GI-Lli	mRem	5.86E-09	7.08E-09	7.85E-09	8.44E-09	2.92E-08
Lung	mRem	5.84E-09	7.09E-09	7.86E-09	8.44E-09	2.92E-08
Kidney	mRem	5.83E-09	7.08E-09	7.85E-09	8.44E-09	2.92E-08
Skin	mRem	2.31E-12	2.90E-11	5.54E-13	2.15E-12	3.40E-11
Bone	mRem	3.92E-12	3.93E-11	9.88E-13	3.30E-12	4.75E-11
Thyroid	mRem	5.89E-09	7.08E-09	7.86E-09	8.47E-09	2.93E-08
Liver	mRem	5.83E-09	7.08E-09	7.85E-09	8.44E-09	2.92E-08

Table 4-1

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses to a Member of the Public Due to Activities Inside the Site Boundary

Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Location Name: CAMPING AREA
Distance (kilometers): 1.27E+00
Sector: WNW
Occupancy Factor: 5.48E-03
Age Group: Child

Elevated Release	Noble Gas	X/Q (sec/m3): 2.38E-08	
Ground Level Release	Noble Gas	X/Q (sec/m3): 7.03E-06	
Elevated Release	Particulate and Radioiodine	X/Q (sec/m3): 2.33E-08	D/Q (m-2): 2.01E-08
Ground Level Release	Particulate and Radioiodine	X/Q (sec/m3): 6.27E-06	D/Q (m-2): 1.80E-08

	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year
Total Body	mRem	1.26E-07	1.53E-07	1.69E-07	1.82E-07	6.30E-07
Skin	mRem	2.08E-10	1.33E-09	2.02E-10	4.73E-10	2.21E-09
Lung	mRem	1.26E-07	1.53E-07	1.69E-07	1.82E-07	6.30E-07
GI-Lli	mRem	1.26E-07	1.53E-07	1.69E-07	1.82E-07	6.31E-07
Bone	mRem	2.20E-10	1.44E-09	1.85E-10	4.35E-10	2.28E-09
Liver	mRem	1.26E-07	1.53E-07	1.69E-07	1.82E-07	6.30E-07
Thyroid	mRem	1.27E-07	1.53E-07	1.69E-07	1.83E-07	6.32E-07
Kidney	mRem	1.26E-07	1.53E-07	1.69E-07	1.82E-07	6.30E-07

Table 4-1

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses to a Member of the Public Due to Activities Inside the Site Boundary

Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Location Name: RECREATION AREA
Distance (kilometers): 1.03E+00
Sector: SSE
Occupancy Factor: 2.37E-02
Age Group: Child

Ground Level Release	Particulate and Radioiodine	X/Q (sec/m3): 5.73E-06	D/Q (m-2): 2.36E-08
Elevated Release	Noble Gas	X/Q (sec/m3): 3.30E-08	
Ground Level Release	Noble Gas	X/Q (sec/m3): 6.42E-06	
Elevated Release	Particulate and Radioiodine	X/Q (sec/m3): 3.21E-08	D/Q (m-2): 1.56E-09

	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year
Total Body	mRem	4.96E-07	6.04E-07	6.68E-07	7.18E-07	2.49E-06
Thyroid	mRem	5.01E-07	6.04E-07	6.69E-07	7.21E-07	2.49E-06
Lung	mRem	4.97E-07	6.04E-07	6.69E-07	7.19E-07	2.49E-06
Bone	mRem	4.09E-10	4.26E-09	1.04E-10	3.53E-10	5.13E-09
Liver	mRem	4.97E-07	6.04E-07	6.68E-07	7.18E-07	2.49E-06
GI-Lli	mRem	4.99E-07	6.04E-07	6.68E-07	7.18E-07	2.49E-06
Skin	mRem	2.84E-10	3.54E-09	6.96E-11	2.67E-10	4.16E-09
Kidney	mRem	4.96E-07	6.04E-07	6.68E-07	7.18E-07	2.49E-06

Table 4-1

Hatch Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses to a Member of the Public Due to Activities Inside the Site Boundary

Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Location Name: VISITORS CENTER
Distance (kilometers): 6.94E-01
Sector: WSW
Occupancy Factor: 4.57E-04
Age Group: Child

Elevated Release	Particulate and Radioiodine	X/Q (sec/m3): 4.97E-08	D/Q (m-2): 2.26E-09
Elevated Release	Noble Gas	X/Q (sec/m3): 5.00E-08	
Ground Level Release	Particulate and Radioiodine	X/Q (sec/m3): 1.72E-05	D/Q (m-2): 5.47E-08
Ground Level Release	Noble Gas	X/Q (sec/m3): 1.87E-05	

	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year
Liver	mRem	2.87E-08	3.49E-08	3.87E-08	4.16E-08	1.44E-07
Lung	mRem	2.88E-08	3.49E-08	3.87E-08	4.16E-08	1.44E-07
Bone	mRem	1.96E-11	2.03E-10	4.21E-12	1.52E-11	2.42E-10
Kidney	mRem	2.87E-08	3.49E-08	3.87E-08	4.16E-08	1.44E-07
Total Body	mRem	2.87E-08	3.49E-08	3.87E-08	4.16E-08	1.44E-07
Thyroid	mRem	2.90E-08	3.49E-08	3.87E-08	4.17E-08	1.44E-07
Skin	mRem	1.17E-11	1.54E-10	1.97E-12	9.37E-12	1.77E-10
GI-Lli	mRem	2.89E-08	3.49E-08	3.87E-08	4.16E-08	1.44E-07

5.0 Total Dose from Uranium Fuel Cycle (40 CFR 190)

5.1 Regulatory Requirements

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 less than or equal to 25 mrems to the whole body or to any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

5.2 Demonstration of Compliance

No dose limits stated in ODCM Sections 2.1.3, 3.1.3, and 3.1.4 were exceeded. Therefore, compliance with 40 CFR 190 dose limits was demonstrated in accordance with the requirements of ODCM Section 5.1.3.

6.0 Meteorological Data

The Radioactive Effluent Release Report, to be submitted by May 1 of each year, shall include an annual summary of hourly meteorological data collected over the previous year. This annual summary may be either in the form of an hour-by-hour listing of wind speed, wind direction, atmospheric stability, and precipitation (if measured), on magnetic tape, or, in the form of joint frequency distributions of wind speed, wind direction and atmospheric stability.

In lieu of submission with the Radioactive Effluent Release Report, the licensee has retained this summary of required meteorological data on site in a file. It will be provided to the NRC upon request.

7.0 Program Deviations

7.1 Inoperable Liquid or Gaseous Effluent Monitoring Instrumentation

7.1.1 Regulatory Requirements

ODCM, Chapter 7, Section 7.2.2.6.2 states that the Radioactive Effluent Release Report shall include deviations from the liquid and gaseous effluent monitoring instrumentation operability requirements included in Sections 2.1.1 and 3.1.1, respectively.

7.1.2 Description of Deviations

There were no deviations from the liquid and gaseous effluent monitoring instrumentation operability requirements during this reporting period.

7.2 Tanks Exceeding Curie Content Limits

7.2.1 Regulatory Requirements

ODCM 7.2.2.6 states in part that the report shall include notifications if the contents within any outside temporary tank, for liquids, exceed the limit of Technical Specification 5.5.8.b.

7.2.2 Description of Deviations

There were no outside temporary tanks, for liquids, that exceeded the limit of Technical Specification 5.5.8.b during this reporting period.

7.3 Effluent Sample Analysis Exceeding Minimum Detectable Concentration (MDC)

7.3.1 Regulatory Requirements

ODCM 7.2.2.6 states in part that deviations from MDC(s) required in Table 3-3 shall be included in the Radioactive Effluent Release Report.

7.3.2 Description of Deviation

There were no deviations from MDC(s) required in Table 3-3 during this reporting period.

8.0 Changes to the Plant Hatch Offsite Dose Calculation Manual (ODCM)

8.1 Regulatory Requirements

Pursuant to Technical Specification 5.5.1 and ODCM Section 7.2.2.5, licensee initiated changes shall be submitted to the NRC in the form of a complete, legible copy of the entire ODCM as part of or concurrent with the Radioactive Effluent Release Report for the period of the report in which any change in the ODCM was made. Each change shall be identified by markings in the margin of the affected pages, clearly indicating the area of the page that was changed, and shall indicate the date (i.e., month and year) the change was implemented.

8.2 Description of Changes

There were no changes to the Hatch ODCM in 2019.

9.0 Major Changes to Liquid, Gaseous, or Solid Radwaste Treatment Systems

No major changes were made to the Liquid, Gaseous, or Solid Radwaste Treatment Systems.

9.1 Regulatory Requirements

The Radioactive Effluent Release Report shall include any major change to liquid, gaseous, or solid radwaste treatment systems pursuant to ODCM Chapter 7, Section 7.2.2.7.

9.2 Description of Major Changes

Gaseous Radwaste System

There were no major changes to the gaseous radwaste system during this reporting period.

Solid Radwaste System

There were no major changes to the solid radwaste system during this reporting period.

Liquid Radwaste System

There were no major changes to the Liquid Radwaste Treatment System during this reporting period.

SOUTHERN COMPANY

E. I. HATCH NUCLEAR PLANT

UNITS NO. 1 & 2

ANNUAL REPORT

JANUARY 1, 2019 - DECEMBER 31, 2019

APPENDIX A

Hatch Nuclear Plant
Appendix A

CARBON-14

Carbon-14 (C-14) is a naturally-occurring radionuclide with a 5730 year half life. Nuclear weapons testing in the 1950s and 1960s significantly increased the amount of C-14 in the atmosphere. Nuclear power plants also produce C-14, but the amount is infinitesimal compared to what has been distributed in the environment due to weapons testing and what is produced by natural cosmic ray interactions.

As nuclear plants have improved gaseous waste processing systems and improved fuel performance, the percentages of "principal radionuclides" in gaseous effluents have changed, and C-14 has become a larger percentage. "Principal radionuclides" are determined based on public dose contribution or the amount of activity discharged compared to other radionuclides of the same effluent type. In Revision 2 (June 2009) of Regulatory Guide 1.21 (RG 1.21), "Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste," the NRC recommended re-evaluating "principal radionuclides" and reporting C-14 as appropriate. In 2010 Radioactive Effluent Release Reports, virtually all U. S. nuclear power plants will report C-14 amounts released and resulting doses to the maximally exposed member of the public.

Because C-14 is considered a hard-to-detect radionuclide which must be chemically separated from the effluent stream before it can be measured, RG 1.21 provides the option of calculating the C-14 source term based on power generation. The Electric Power Research Institute (EPRI) developed an accepted methodology for calculating C-14, and published the results in Technical Report 1021106 (December 2010), "Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents." Evaluation of C-14 in radioactive liquid effluents is not required because the quantity and dose contribution has been determined to be insignificant.

At Plant Hatch, the quantity of C-14 released in gaseous effluents in 2010 was estimated to be 14.16 Curies (per unit). Approximately 95% of the C-14 released is in the form of $^{14}CO_2$ and is incorporated into plants through photosynthesis. Ingestion dose results from this pathway. The remaining 5% is estimated to be organic. Both the organic and inorganic forms of C-14 contribute to inhalation dose. A child is the maximally exposed individual, and bone dose is the highest organ dose. Using the dose calculation methodology from the Hatch ODCM, the resulting bone dose to a child located at the controlling receptor location would be 1.59E-01 mrem in a year which is 1.06% of the regulatory limit of 15 mrem per year (per unit) to any organ due to gaseous effluents. The resulting total body dose to a child located at the controlling receptor location would be 3.18E-02 mrem in a year which is 0.21% of the regulatory limit of 15 mrem per year (per unit) total body dose due to gaseous effluents.

Edwin I. Hatch Nuclear Plant – Units 1&2
Joseph M. Farley Nuclear Plant – Units 1&2
Vogtle Electric Generating Plant – Units 1&2
Annual Non-Radiological Environmental Operating Reports and Annual Radioactive Effluent Release Reports for 2019

Enclosure 5

Joseph M. Farley Nuclear Plant – Units 1&2
Annual Radioactive Effluent Release Report for 2019

ACKNOWLEDGEMENT OF OWNERSHIP

The contents of this Annual Radioactive Effluent Release Report, contained herein, are true and accurate to the best of my knowledge. I understand that I am ultimately responsible for the information that has been captured within these pages.

Valencia Flowers

Farley Chemistry Manager

Leonard Worthy

Chemistry Superintendent

ACKNOWLEDGEMENT OF OWNERSHIP

The contents of this Annual Radioactive Effluent Release Report, contained herein, are true and accurate to the best of my knowledge. I understand that I am ultimately responsible for the information that has been captured within these pages.

Valencia Flowers

Farley Chemistry Manager

Shawn Lux

Chemistry Supervisor

SOUTHERN NUCLEAR OPERATING COMPANY
FARLEY NUCLEAR PLANT UNIT NO. ONE
LICENSE NO. NPF-2
AND
FARLEY NUCLEAR PLANT UNIT NO. TWO
LICENSE NO. NPF-8

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
CALENDAR YEAR 2019

FARLEY NUCLEAR PLANT

ANNUAL RADIOACTIVE EFFLUENT

RELEASE REPORT

FARLEY NUCLEAR PLANT

ANNUAL RADIOACTIVE EFFLUENT

RELEASE REPORT

FARLEY NUCLEAR PLANT

ANNUAL RADIOACTIVE EFFLUENT

RELEASE REPORT

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FARLEY NUCLEAR PLANT

ANNUAL RADIOACTIVE EFFLUENT

RELEASE REPORT

FARLEY NUCLEAR PLANT

ANNUAL RADIOACTIVE EFFLUENT

RELEASE REPORT

LIST OF TABLES

1.0 LIQUID EFFLUENTS

This section contains applicable ODCM limits for liquid effluents as well as the quantities of radioactive liquid effluents released during 2019. These quantities are summarized on a quarterly basis and include any unplanned releases. A tabulation of the total body and organ doses which were calculated in accordance with ODCM 2.4 are presented to show conformance with the limits of ODCM 2.1.3.

1.1 Regulatory Requirements

1.1.1 Concentration Limits

Technical Specifications 5.5.4.b and 5.5.4.c state that the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS (see ODCM Figure 10-1) shall be limited at all times to ten times the concentrations specified in 10CFR20, 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 1.0E-04 µCi/ml total activity.

1.1.2 Dose Limits

Technical Specifications 5.5.4.d and 5.5.4.e state that the dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released, from each unit, to UNRESTRICTED AREAS (see ODCM Figure 10-1) shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrem to the total body and to less than or equal to 5 mrem to any organ, and

b. During any calendar year to less than or equal to 3 mrem to the total body and to less than or equal to 10 mrem to any organ.

1.2 Effluent Concentration Limit (ECL)

ECL values used in determining allowable liquid radwaste release rates and concentrations, for principal gamma emitters, I-131, tritium, Sr-89, Sr-90, and Fe-55, are taken from 10CFR Part 20, Appendix B, Table 2, Column 2. A tolerance factor of 10 is utilized to allow flexibility in establishing practical monitor setpoints which can accommodate effluent releases at concentrations higher than the ECL values stated in 10CFR20, Appendix B, Table 2, Column 2.

For dissolved or entrained noble gases in liquid radwaste, the ECL is 1.0E-04 uCi/ml total activity.

For gross alpha in liquid radwaste, the ECL is 2.0E-09 uCi/ml.

Furthermore, for all the above radionuclides, or categories of radioactivity, the overall ECL fraction is determined in accordance with 10CFR Part 20, Appendix B.

1.3 Measurements and Approximation of Total Radioactivity

The radionuclides listed below are specifically considered when evaluating liquid effluents:

MN-54	CS-134
FE-59	CS-137
CO-58	CE-141
CO-60	CE-144
ZN-65	MO-99
SR-89	FE-55
SR-90	H-3
I-131	

1.3.1 Total Radioactivity Determination

Batch Releases: Representative pre-release grab samples are obtained and analyzed in accordance with ODCM Table 2-3. Isotopic analyses are performed by the computerized pulse height analysis system utilizing high resolution germanium detectors. Isotopic radionuclide concentrations thus obtained are used for release rate calculations as specified in the ODCM. Only those nuclides that are detected are used in the calculations. All Gross Alpha, Strontium, and Iron-55, samples are sent offsite to the Georgia Power Environmental Laboratory for analysis. Gross beta determinations are made using 2 pi gas flow proportional counters. Tritium determinations are made using liquid scintillation techniques. Dissolved gases are determined employing grab sampling techniques and then counting on the gamma spectrometry system.

The sample analyses results are used along with the ECL values to determine the ECL fraction for the planned release. The ECL fraction is then used, with the appropriate safety factors, and the expected dilution stream flow, to calculate the maximum permissible release rate and a liquid effluent monitor setpoint. The monitor setpoint is calculated to assure that the limits of the ODCM are not exceeded. A monitor reading in excess of the calculated setpoint will result in automatic termination of the liquid radwaste discharge.

Radionuclide concentrations, safety factors, dilution stream flow rate, and liquid effluent radiation monitor calibration factors are used by the computer to generate a pre-release printout. If the release is not permissible, appropriate warnings will be displayed on the computer screen and on the printout. If the release is permissible, it is approved by a Chemistry Technician. The release permit is transferred from the Chemistry Department to the Operations Department for release. When the release is completed, the actual release data are provided to the Chemistry Department. These release data, including release rate and release duration, are input into the computer and a post-release printout is generated. This printout contains the actual release rates, radionuclide concentrations and quantities, dilution flow, and calculated doses to an individual.

Continuous Releases: Continuous releases are analogous to batch releases except that they are analyzed on a weekly composite basis in accordance with ODCM Table 2-3.

Typically achieved liquid effluent sample analyses minimum detectable concentrations are reported in Table 1-4.

1.3.2 Total Error Estimation

The maximum error associated with volume and flow measurements, based upon plant calibration practice is estimated to be + or - 10%. The average error associated with counting is estimated to be less than + or - 15%.

1.4 Liquid Effluent Release Data

Summaries of all radioactive liquid effluents released from Units 1 and 2 during 2019 are presented in accordance with Regulatory Guide 1.21 Tables 2A and 2B. Information required by Table 2A is found in this report in Tables 1-1A, 1-1B, and 1-1C; Table 2-B information is presented in Tables 1-2A, 1-2B, and 1-2C. Data is presented on a quarterly basis as required by Regulatory Guide 1.21 for all four quarters.

1.5 Radiological Impact Due to Liquid Releases

The total body and organ doses for Units 1 and 2 are provided in the following tables in order to show conformance with the limits of ODCM 2.1.3:

Unit 1 2019 Doses to a Member of the Public due to Liquid Releases: Table 1-3A

Unit 2 2019 Doses to a Member of the Public due to Liquid Releases: Table 1-3B

1.6 Liquid Effluents - Batch Releases

Batch release information for Units 1 and 2 is summarized in the following tables:

Unit 1 2019 Liquid Effluents - Batch Release Summary: Table 1-5A

Unit 2 2019 Liquid Effluents - Batch Release Summary: Table 1-5B

1.7 Liquid Effluents - Abnormal Releases

There were no abnormal releases during 2019.

Abnormal release information for Units 1 and 2 is summarized in the following tables:

Unit 1 2019 Liquid Effluents - Abnormal Release Summary: Table 1-6A

Unit 2 2019 Liquid Effluents - Abnormal Release Summary: Table 1-6

Table 1-1A

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Summation of All Releases

Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Products					
1. Total Release (not including tritium, gases, alpha)	Curies	4.86E-03	2.63E-03	2.11E-03	3.41E-03
2. Average diluted concentration during period	uCi/mL	2.78E-09	2.54E-09	1.76E-09	3.50E-09
3. Percent of Applicable Limit	%	*	*	*	*
B. Tritium					
1. Total Release	Curies	2.79E+02	1.54E+02	2.07E+02	7.41E+01
2. Average diluted Concentration during period	uCi/mL	1.59E-04	1.49E-04	1.73E-04	7.62E-05
3. Percent of Applicable Limit	%	*	*	*	*
C. Dissolved and Entrained Gases					
1. Total Release	Curies	8.32E-04	8.83E-05	5.37E-04	6.03E-04
2. Average diluted Concentration during period	uCi/mL	4.77E-10	8.54E-11	4.49E-10	6.19E-10
3. Percent of Applicable Limit	%	*	*	*	*
D: Gross Alpha Radioactivity					
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E: Waste Vol Release (Pre-Dilution)	Liters	1.56E+06	1.02E+06	1.04E+06	8.92E+05
F. Volume of Dilution Water Used	Liters	1.74E+09	1.03E+09	1.19E+09	9.72E+08

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

Table 1-1B

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Summation of All Releases

Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Products					
1. Total Release (not including tritium, gases, alpha)	Curies	1.17E-02	1.40E-02	1.42E-03	1.93E-03
2. Average diluted concentration during period	uCi/mL	6.98E-09	9.87E-09	1.11E-09	2.29E-09
3. Percent of Applicable Limit	%	*	*	*	*
B. Tritium					
1. Total Release	Curies	3.60E+02	1.02E+02	1.06E+02	1.39E+02
2. Average diluted Concentration during period	uCi/mL	2.15E-04	7.19E-05	8.28E-05	1.65E-04
3. Percent of Applicable Limit	%	*	*	*	*
C. Dissolved and Entrained Gases					
1. Total Release	Curies	4.93E-04	8.99E-05	5.53E-04	6.02E-04
2. Average diluted Concentration during period	uCi/mL	2.94E-10	6.34E-11	4.33E-10	7.15E-10
3. Percent of Applicable Limit	%	*	*	*	*
D: Gross Alpha Radioactivity					
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E: Waste Vol Release (Pre-Dilution)	Liters	1.41E+06	1.30E+06	8.49E+05	7.46E+05
F. Volume of Dilution Water Used	Liters	1.67E+09	1.42E+09	1.28E+09	8.42E+08

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

Table 1-1C

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Summation of All Releases

Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Products					
1. Total Release (not including tritium, gases, alpha)	Curies	1.65E-02	1.66E-02	3.53E-03	5.34E-03
2. Average diluted concentration during period	uCi/mL	4.84E-09	6.78E-09	1.43E-09	2.94E-09
3. Percent of Applicable Limit	%	*	*	*	*
B. Tritium					
1. Total Release	Curies	6.38E+02	2.56E+02	3.13E+02	2.13E+02
2. Average diluted Concentration during period	uCi/mL	1.87E-04	1.04E-04	1.26E-04	1.18E-04
3. Percent of Applicable Limit	%	*	*	*	*
C. Dissolved and Entrained Gases					
1. Total Release	Curies	1.32E-03	1.78E-04	1.09E-03	1.20E-03
2. Average diluted Concentration during period	uCi/mL	3.87E-10	7.27E-11	4.41E-10	6.64E-10
3. Percent of Applicable Limit	%	*	*	*	*
D: Gross Alpha Radioactivity					
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E: Waste Vol Release (Pre-Dilution)	Liters	2.98E+06	2.32E+06	1.89E+06	1.64E+06
F. Volume of Dilution Water Used	Liters	3.42E+09	2.45E+09	2.47E+09	1.81E+09

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

Table 1-2A

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents

Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission & Activation Products					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dissolved And Entrained Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicate that no radioactivity was present at detectable levels.

See Table 1-4 for typical minimum detectable concentrations.

Table 1-2A

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents

Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Batch Mode

Nuclides Released	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission & Activation Products					
Cr-51	Curies	3.81E-06	0.00E+00	0.00E+00	3.06E-04
Te-131M	Curies	0.00E+00	1.41E-07	0.00E+00	0.00E+00
Ba-133	Curies	0.00E+00	1.69E-08	0.00E+00	0.00E+00
Sn-113	Curies	0.00E+00	0.00E+00	0.00E+00	1.45E-06
Co-58	Curies	8.43E-05	6.73E-05	1.14E-04	1.04E-03
Ni-56	Curies	1.18E-06	8.74E-07	0.00E+00	0.00E+00
Co-60	Curies	2.85E-03	1.60E-03	1.14E-03	7.23E-04
Ce-141	Curies	0.00E+00	0.00E+00	0.00E+00	8.42E-07
Ag-108M	Curies	7.78E-06	0.00E+00	0.00E+00	3.02E-06
I-131	Curies	0.00E+00	1.31E-06	0.00E+00	0.00E+00
Ni-63	Curies	4.49E-04	5.29E-04	3.18E-04	3.16E-04
Mo-101	Curies	0.00E+00	7.29E-07	0.00E+00	0.00E+00
Sb-125	Curies	1.02E-03	3.67E-04	4.03E-04	2.16E-04
Cs-138	Curies	1.40E-06	0.00E+00	0.00E+00	0.00E+00
Zr-95	Curies	0.00E+00	0.00E+00	2.42E-06	1.92E-04
Nb-97	Curies	1.11E-05	1.05E-06	2.54E-06	6.94E-07
Zn-65	Curies	1.46E-05	0.00E+00	0.00E+00	2.64E-06
Sr-89	Curies	0.00E+00	0.00E+00	0.00E+00	2.06E-05
Nb-95	Curies	4.52E-06	0.00E+00	1.63E-05	3.41E-04
Sn-117M	Curies	1.59E-06	0.00E+00	0.00E+00	0.00E+00
Sr-92	Curies	0.00E+00	4.77E-07	0.00E+00	0.00E+00
Rh-105	Curies	0.00E+00	0.00E+00	0.00E+00	1.19E-05
La-142	Curies	0.00E+00	0.00E+00	5.55E-07	0.00E+00
As-76	Curies	0.00E+00	1.08E-06	0.00E+00	0.00E+00
Ru-103	Curies	0.00E+00	0.00E+00	0.00E+00	1.01E-06
Ag-110M	Curies	0.00E+00	0.00E+00	1.92E-06	9.81E-06
Mn-54	Curies	2.24E-05	1.07E-05	6.49E-06	1.39E-05
Fe-55	Curies	1.12E-04	5.07E-05	6.25E-05	1.94E-04

Y-91	Curies	1.52E-04	0.00E+00	0.00E+00	0.00E+00
Te-125M	Curies	8.87E-05	0.00E+00	0.00E+00	0.00E+00
Cs-137	Curies	2.86E-05	0.00E+00	2.25E-05	1.09E-05
I-132	Curies	0.00E+00	6.42E-07	0.00E+00	4.09E-06
Sb-124	Curies	0.00E+00	0.00E+00	0.00E+00	2.72E-06
Pm-149	Curies	0.00E+00	0.00E+00	5.27E-06	0.00E+00
Te-129M	Curies	0.00E+00	0.00E+00	1.44E-05	0.00E+00
Total For Period	**Curies**	**4.86E-03**	**2.63E-03**	**2.11E-03**	**3.41E-03**
Tritium					
H-3	Curies	2.79E+02	1.54E+02	2.07E+02	7.41E+01
Dissolved And Entrained Gases					
Xe-133	Curies	8.31E-04	8.60E-05	5.37E-04	6.02E-04
Ar-41	Curies	0.00E+00	2.24E-06	0.00E+00	4.76E-07
Xe-135	Curies	1.57E-06	1.21E-07	0.00E+00	0.00E+00
Total For Period	**Curies**	**8.32E-04**	**8.83E-05**	**5.37E-04**	**6.03E-04**
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicate that no radioactivity was present at detectable levels.

See Table 1-4 for typical minimum detectable concentrations.

Table 1-2B

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents

Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Nuclides Released	Units	Continuous Mode 1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission & Activation Products					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dissolved And Entrained Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicate that no radioactivity was present at detectable levels.

See Table 1-4 for typical minimum detectable concentrations.

Table 1-2B

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents

Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Batch Mode

Nuclides Released	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission & Activation Products					
Ni-63	Curies	3.87E-04	1.30E-03	1.74E-04	3.19E-04
Zr-95	Curies	5.77E-06	2.04E-04	4.23E-06	7.87E-05
I-132	Curies	0.00E+00	0.00E+00	0.00E+00	5.79E-07
Tc-99M	Curies	0.00E+00	4.76E-07	0.00E+00	0.00E+00
Fe-55	Curies	1.19E-04	1.67E-04	1.00E-04	1.58E-04
Ce-141	Curies	6.21E-07	0.00E+00	2.77E-07	1.21E-06
Nb-95	Curies	4.46E-05	3.94E-04	1.75E-05	1.29E-04
Y-90M	Curies	0.00E+00	0.00E+00	1.70E-07	0.00E+00
Co-58	Curies	2.27E-04	5.37E-03	2.87E-04	3.08E-04
Ru-106	Curies	5.18E-06	0.00E+00	0.00E+00	0.00E+00
Nb-97	Curies	1.18E-05	1.83E-05	2.13E-06	1.55E-06
Hg-203	Curies	8.86E-07	0.00E+00	0.00E+00	0.00E+00
Cs-137	Curies	2.80E-06	7.99E-07	0.00E+00	0.00E+00
Sb-124	Curies	0.00E+00	2.49E-05	3.23E-07	0.00E+00
Ag-108M	Curies	2.81E-05	3.79E-06	0.00E+00	0.00E+00
Te-125M	Curies	5.80E-05	9.45E-05	4.55E-05	0.00E+00
Ni-56	Curies	8.83E-07	7.58E-07	0.00E+00	0.00E+00
Sn-117M	Curies	2.63E-06	9.38E-07	0.00E+00	0.00E+00
Co-60	Curies	9.36E-03	4.63E-03	6.38E-04	6.93E-04
Ag-110M	Curies	3.67E-05	0.00E+00	0.00E+00	6.19E-06
Tc-101	Curies	0.00E+00	0.00E+00	3.82E-07	0.00E+00
Sb-125	Curies	1.13E-03	6.88E-04	1.42E-04	1.42E-04
Sn-113	Curies	0.00E+00	1.25E-05	0.00E+00	2.17E-06
Mn-54	Curies	1.25E-04	8.94E-05	4.47E-06	1.02E-05
Rh-106	Curies	5.18E-06	0.00E+00	0.00E+00	0.00E+00
Sr-92	Curies	1.48E-05	9.61E-07	0.00E+00	0.00E+00

Cr-51	Curies	0.00E+00	9.02E-04	0.00E+00	7.62E-05
Zn-65	Curies	1.05E-04	6.70E-05	3.01E-06	0.00E+00
Ce-144	Curies	1.45E-06	0.00E+00	0.00E+00	0.00E+00
Co-57	Curies	0.00E+00	1.31E-05	0.00E+00	0.00E+00
Nb-95M	Curies	0.00E+00	0.00E+00	1.57E-06	0.00E+00
Te-131	Curies	1.55E-06	0.00E+00	3.89E-07	0.00E+00
Total For Period	**Curies**	**1.17E-02**	**1.40E-02**	**1.42E-03**	**1.93E-03**

Zeroes in this table indicate that no radioactivity was present at detectable levels.

See Table 1-4 for typical minimum detectable concentrations.

Tritium					
H-3	Curies	3.60E+02	1.02E+02	1.06E+02	1.39E+02
Dissolved And Entrained Gases					
Xe-133	Curies	4.92E-04	8.31E-05	5.51E-04	6.02E-04
Ar-41	Curies	0.00E+00	5.65E-06	1.08E-06	0.00E+00
Xe-135	Curies	4.06E-07	1.16E-06	1.64E-06	6.65E-07
Total For Period	**Curies**	**4.93E-04**	**8.99E-05**	**5.53E-04**	**6.02E-04**
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicate that no radioactivity was present at detectable levels.

See Table 1-4 for typical minimum detectable concentrations.

Table 1-2C

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents

Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission & Activation Products					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dissolved And Entrained Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicate that no radioactivity was present at detectable levels.

See Table 1-4 for typical minimum detectable concentrations.

Table 1-2C
Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents

Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Batch Mode

Nuclides Released	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission & Activation Products					
Sr-89	Curies	0.00E+00	0.00E+00	0.00E+00	2.06E-05
Co-60	Curies	1.22E-02	6.23E-03	1.77E-03	1.42E-03
Sr-92	Curies	1.48E-05	1.44E-06	0.00E+00	0.00E+00
Co-57	Curies	0.00E+00	1.31E-05	0.00E+00	0.00E+00
Hg-203	Curies	8.86E-07	0.00E+00	0.00E+00	0.00E+00
Nb-95M	Curies	0.00E+00	0.00E+00	1.57E-06	0.00E+00
Zr-95	Curies	5.77E-06	2.04E-04	6.65E-06	2.71E-04
Sb-125	Curies	2.16E-03	1.05E-03	5.45E-04	3.59E-04
Tc-99M	Curies	0.00E+00	4.76E-07	0.00E+00	0.00E+00
Cs-138	Curies	1.40E-06	0.00E+00	0.00E+00	0.00E+00
Ru-103	Curies	0.00E+00	0.00E+00	0.00E+00	1.01E-06
Ru-106	Curies	5.18E-06	0.00E+00	0.00E+00	0.00E+00
Tc-101	Curies	0.00E+00	0.00E+00	3.82E-07	0.00E+00
Nb-97	Curies	2.29E-05	1.94E-05	4.66E-06	2.25E-06
Cs-137	Curies	3.14E-05	7.99E-07	2.25E-05	1.09E-05
Ag-110M	Curies	3.67E-05	0.00E+00	1.92E-06	1.60E-05
I-131	Curies	0.00E+00	1.31E-06	0.00E+00	0.00E+00
Y-90M	Curies	0.00E+00	0.00E+00	1.70E-07	0.00E+00
La-142	Curies	0.00E+00	0.00E+00	5.55E-07	0.00E+00
Mn-54	Curies	1.48E-04	1.00E-04	1.10E-05	2.41E-05
Te-125M	Curies	1.47E-04	9.45E-05	4.55E-05	0.00E+00
Ce-144	Curies	1.45E-06	0.00E+00	0.00E+00	0.00E+00
Ag-108M	Curies	3.59E-05	3.79E-06	0.00E+00	3.02E-06
Sb-124	Curies	0.00E+00	2.49E-05	3.23E-07	2.72E-06
Nb-95	Curies	4.92E-05	3.94E-04	3.38E-05	4.70E-04
Rh-105	Curies	0.00E+00	0.00E+00	0.00E+00	1.19E-05
Sn-117M	Curies	4.22E-06	9.38E-07	0.00E+00	0.00E+00
Pm-149	Curies	0.00E+00	0.00E+00	5.27E-06	0.00E+00
Fe-55	Curies	2.32E-04	2.18E-04	1.63E-04	3.52E-04

I-132	Curies	0.00E+00	6.42E-07	0.00E+00	4.67E-06
As-76	Curies	0.00E+00	1.08E-06	0.00E+00	0.00E+00
Rh-106	Curies	5.18E-06	0.00E+00	0.00E+00	0.00E+00
Te-131M	Curies	0.00E+00	1.41E-07	0.00E+00	0.00E+00
Cr-51	Curies	3.81E-06	9.02E-04	0.00E+00	3.82E-04
Ni-63	Curies	8.36E-04	1.83E-03	4.92E-04	6.34E-04
Ba-133	Curies	0.00E+00	1.69E-08	0.00E+00	0.00E+00
Ce-141	Curies	6.21E-07	0.00E+00	2.77E-07	2.05E-06
Y-91	Curies	1.52E-04	0.00E+00	0.00E+00	0.00E+00
Ni-56	Curies	2.06E-06	1.63E-06	0.00E+00	0.00E+00
Te-129M	Curies	0.00E+00	0.00E+00	1.44E-05	0.00E+00
Sn-113	Curies	0.00E+00	1.25E-05	0.00E+00	3.62E-06
Zn-65	Curies	1.20E-04	6.70E-05	3.01E-06	2.64E-06
Co-58	Curies	3.11E-04	5.44E-03	4.01E-04	1.35E-03
Te-131	Curies	1.55E-06	0.00E+00	3.89E-07	0.00E+00
Mo-101	Curies	0.00E+00	7.29E-07	0.00E+00	0.00E+00
Total For Period	**Curies**	**1.65E-02**	**1.66E-02**	**3.53E-03**	**5.34E-03**
Tritium					
H-3	Curies	6.38E+02	2.56E+02	3.13E+02	2.13E+02
Dissolved And Entrained Gases					
Xe-135	Curies	1.98E-06	1.29E-06	1.64E-06	6.65E-07
Ar-41	Curies	0.00E+00	7.89E-06	1.08E-06	4.76E-07
Xe-133	Curies	1.32E-03	1.69E-04	1.09E-03	1.20E-03
Total For Period	**Curies**	**1.32E-03**	**1.78E-04**	**1.09E-03**	**1.20E-03**
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicate that no radioactivity was present at detectable levels.

See Table 1-4 for typical minimum detectable concentrations.

Table 1-3A

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses to a member of the public due to Liquid Releases
Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Organ	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Total Body	5.00E+00	mRem	3.78E-03	7.56E-02	1.91E-03	3.82E-02	2.25E-03	4.49E-02	9.35E-04	1.87E-02
Total Body	1.50E+00	mRem	3.78E-03	2.52E-01	1.91E-03	1.27E-01	2.25E-03	1.50E-01	9.35E-04	6.23E-02
Total Body	5.00E+00	mRem	3.78E-03	7.56E-02	1.91E-03	3.82E-02	2.25E-03	4.49E-02	9.35E-04	1.87E-02
Total Body	1.50E+00	mRem	3.78E-03	2.52E-01	1.91E-03	1.27E-01	2.25E-03	1.50E-01	9.35E-04	6.23E-02
GI-Lli	5.00E+00	mRem	5.22E-03	1.04E-01	2.54E-03	5.08E-02	2.78E-03	5.57E-02	1.50E-03	3.01E-02
Kidney	5.00E+00	mRem	3.76E-03	7.52E-02	1.82E-03	3.63E-02	2.27E-03	4.54E-02	8.62E-04	1.72E-02
Liver	5.00E+00	mRem	3.77E-03	7.54E-02	1.91E-03	3.82E-02	2.26E-03	4.52E-02	9.63E-04	1.93E-02
Thyroid	5.00E+00	mRem	3.60E-03	7.20E-02	1.82E-03	3.64E-02	2.17E-03	4.34E-02	8.55E-04	1.71E-02
Bone	5.00E+00	mRem	7.88E-04	1.58E-02	8.01E-04	1.60E-02	4.94E-04	9.88E-03	5.52E-04	1.10E-02
Lung	5.00E+00	mRem	8.88E-03	1.78E-01	3.77E-03	7.55E-02	4.09E-03	8.18E-02	2.01E-03	4.01E-02

Cumulative Doses per Year

Organ	ODCM Lmt	Units	Year to Ending Date	% ODCM	Receptor	Limit
Lung	1.00E+01	mRem	1.88E-02	1.88E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Bone	1.00E+01	mRem	2.64E-03	2.64E-02	Maximum Individual Liquid	Liquid Effluent Organ Annual
Thyroid	1.00E+01	mRem	8.45E-03	8.45E-02	Maximum Individual Liquid	Liquid Effluent Organ Annual
Liver	1.00E+01	mRem	8.90E-03	8.90E-02	Maximum Individual Liquid	Liquid Effluent Organ Annual
Kidney	1.00E+01	mRem	8.71E-03	8.71E-02	Maximum Individual Liquid	Liquid Effluent Organ Annual
GI-Lli	1.00E+01	mRem	1.20E-02	1.20E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Total Body	1.00E+01	mRem	8.87E-03	8.87E-02	Maximum Individual Liquid	Liquid Effluent Organ Annual
Total Body	3.00E+00	mRem	8.87E-03	2.96E-01	Maximum Individual Liquid	Liquid Effluent TB Annual

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* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

Table 1-3B

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses to a member of the public due to Liquid Releases
Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Organ	ODCM **Lmt**	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Total Body	5.00E+00	mRem	4.01E-03	8.01E-02	1.34E-03	2.69E-02	1.09E-03	2.18E-02	1.43E-03	2.86E-02
Total Body	1.50E+00	mRem	4.01E-03	2.67E-01	1.34E-03	8.96E-02	1.09E-03	7.26E-02	1.43E-03	9.54E-02
Total Body	5.00E+00	mRem	4.01E-03	8.01E-02	1.34E-03	2.69E-02	1.09E-03	2.18E-02	1.43E-03	2.86E-02
Total Body	1.50E+00	mRem	4.01E-03	2.67E-01	1.34E-03	8.96E-02	1.09E-03	7.26E-02	1.43E-03	9.54E-02
Lung	5.00E+00	mRem	8.87E-03	1.77E-01	4.58E-03	9.16E-02	1.73E-03	3.45E-02	2.06E-03	4.11E-02
Bone	5.00E+00	mRem	6.01E-04	1.20E-02	1.78E-03	3.56E-02	2.61E-04	5.23E-03	4.45E-04	8.90E-03
Kidney	5.00E+00	mRem	3.80E-03	7.59E-02	1.18E-03	2.37E-02	1.12E-03	2.23E-02	1.39E-03	2.77E-02
Thyroid	5.00E+00	mRem	3.71E-03	7.42E-02	1.05E-03	2.10E-02	1.06E-03	2.11E-02	1.39E-03	2.77E-02
GI-Lli	5.00E+00	mRem	6.50E-03	1.30E-01	3.71E-03	7.42E-02	1.39E-03	2.77E-02	1.71E-03	3.43E-02
Liver	5.00E+00	mRem	3.90E-03	7.80E-02	1.31E-03	2.62E-02	1.10E-03	2.20E-02	1.45E-03	2.91E-02

Cumulative Doses per Year

Organ	ODCM Lmt	Units	Year to Ending Date	% ODCM	Receptor	Limit
Liver	1.00E+01	mRem	7.76E-03	7.76E-02	Maximum Individual Liquid	Liquid Effluent Organ Annual
GI-Lli	1.00E+01	mRem	1.33E-02	1.33E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Thyroid	1.00E+01	mRem	7.20E-03	7.20E-02	Maximum Individual Liquid	Liquid Effluent Organ Annual
Kidney	1.00E+01	mRem	7.48E-03	7.48E-02	Maximum Individual Liquid	Liquid Effluent Organ Annual
Bone	1.00E+01	mRem	3.09E-03	3.09E-02	Maximum Individual Liquid	Liquid Effluent Organ Annual
Lung	1.00E+01	mRem	1.72E-02	1.72E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Total Body	1.00E+01	mRem	7.87E-03	7.87E-02	Maximum Individual Liquid	Liquid Effluent Organ Annual
Total Body	3.00E+00	mRem	7.87E-03	2.62E-01	Maximum Individual Liquid	Liquid Effluent TB Annual

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

TABLE 1-4
Joseph M. Farley Nuclear Plant
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
MINIMUM DETECTABLE CONCENTRATION - LIQUID SAMPLE ANALYSES

The values in this table represent a priori Minimum Detectable Concentrations (MDC) that are typically achieved in laboratory analyses of liquid radwaste samples.

Nuclide	**MDC(µCi/ML)**
Mn-54	3.09E-08
Co-58	3.83E-08
Fe-59	7.00E-08
Co-60	5.29E-08
Zn-65	1.16E-07
Mo-99	2.29E-07
I-131	3.02E-08
Cs-134	2.34E-08
Cs-137	4.29E-08
Ce-141	4.41E-08
Ce-144	1.68E-07

Table 1-5A

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Batch Release Summary

Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Liquid Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of batch releases		118	77	77	66	338
2. Total time period for Batch releases	(Minutes)	1.50E+04	9.67E+03	1.02E+04	8.62E+03	4.36E+04
3. Maximum time period for a batch release	(Minutes)	1.65E+02	1.80E+02	1.70E+02	1.75E+02	1.80E+02
4. Average time period for a batch release	(Minutes)	1.27E+02	1.26E+02	1.33E+02	1.31E+02	1.29E+02
5. Minimum time period for a batch release	(Minutes)	1.06E+02	1.00E+02	1.18E+02	1.10E+02	1.00E+02
6. Average stream flow during periods of release of liquid effluent into						
a flowing stream *	(CFS)	1.55E+04	1.93E+04	1.09E+04	3.82E+03	1.24E+04

Replace this text in the Station Parameters

*Average River Flow Rate, taken at Walter F. George Lock and Dam, located 30.7 miles above Farley Nuclear Plant.

Table 1-5B

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Batch Release Summary

Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Liquid Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of batch releases		106	97	64	56	323
2. Total time period for Batch releases	(Minutes)	1.34E+04	1.19E+04	8.04E+03	6.90E+03	4.02E+04
3. Maximum time period for a batch release	(Minutes)	2.06E+02	1.70E+02	1.80E+02	2.40E+02	2.40E+02
4. Average time period for a batch release	(Minutes)	1.26E+02	1.23E+02	1.26E+02	1.23E+02	1.24E+02
5. Minimum time period for a batch release	(Minutes)	1.00E+01	9.00E+01	9.00E+01	9.50E+01	1.00E+01
6. Average stream flow during periods of release of liquid effluent into						
a flowing stream *	(CFS)	1.55E+04	1.93E+04	1.09E+04	3.82E+03	1.24E+04

Replace this text in the Station Parameters

*Average River Flow Rate, taken at Walter F. George Lock and Dam, located 30.7 miles above Farley Nuclear Plant.

Table 1-6A

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Abnormal Release Summary

Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Liquid Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 1-6B

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Abnormal Release Summary

Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Liquid Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

2.0 GASEOUS EFFLUENTS

This section contains applicable ODCM limits for gaseous effluents as well as the quantities of radioactive gaseous effluents released during 2019. These quantities are summarized on a quarterly basis and include any unplanned releases. Tabulations are provided of the offsite air doses calculated in accordance with ODCM 3.4.2 to show conformance with the limits of ODCM 3.1.3, and the offsite organ doses to a member of the public calculated in accordance with ODCM 3.4.3 to show conformance with ODCM 3.1.4.

2.1 Regulatory Requirements

The requirements presented in this section are for Unit 1 and Unit 2.

2.1.1 Dose Rate Limits

The dose rates due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY shall be limited to the following:

a. For noble gases: Less than or equal to 500 mrem/yr. to the whole body and less than or equal to 3000 mrem/yr. to the skin, and

b. For Iodine-131, Iodine-133, tritium and for all radionuclides in particulate form with half-lives greater than 8 days: Less than or equal to 1500 mrem/yr. to any organ.

2.1.2 Air Doses Due to Noble Gases in Gaseous Releases

Technical Specifications 5.5.4.e and 5.5.4.h state that the air dose due to noble gases released in gaseous effluents, from each reactor unit, to areas at and beyond the SITE BOUNDARY (see ODCM Figure 10-1) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation, and

b. During any calendar year: Less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

2.1.3 Doses to a Member of the Public

Technical Specifications 5.5.4.e and 5.5.4.i state that the dose to a MEMBER OF THE PUBLIC from I-131, I-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released, from each reactor unit, to areas at and beyond the SITE BOUNDARY (see ODCM Figure 10-1) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 7.5 mrem to any organ, and

b. During any calendar year: Less than or equal to 15 mrem to any organ.

2.2 Measurements and Approximation of Total Radioactivity

The following noble gases are specifically considered in evaluating gaseous effluents:

KR-87	XE-133
KR-88	XE-135
XE-133M	XE-138

The following radioiodines and radioactive materials in particulate form are specifically considered in evaluating gaseous effluents:

MN-54	MO-99
FE-59	I-131
CO-58	CS-134
CO-60	CS-137
ZN-65	CE-141
SR-89	CE-144
SR-90	H-3

2.2.1 Sample collection and Analysis

Periodic grab samples from plant effluent streams are analyzed by a computerized pulse height analyzer system utilizing high resolution germanium detectors. Samples are obtained and analyzed in accordance with ODCM Table 3-3. Isotopic values thus obtained are used for release rate calculations as specified in ODCM 3.4.2 and ODCM 3.4.3. Only those nuclides which are detected are used in calculations. For radioiodines and particulates, in addition to the nuclides listed above other nuclides with half-lives greater than 8 days which are identified are also considered.

Continuous Releases: Continuous sampling is performed on the continuous release points (i.e. the Plant Vent Stack, Containment Purge when in continuous mode, and the Turbine Building Vent). Particulate material is collected by filtration. At least weekly, these filters are removed and analyzed on the pulse height analyzer to identify and quantify radioactive materials collected on the filters. Particulate filters are then analyzed for gross alpha and strontium as required. All gross alpha, Sr-89 and Sr-90 samples are sent offsite to the Georgia Power Environmental Laboratory for analysis.

Batch Releases: The processing of batch type releases (from Containment when in batch mode, or Waste Gas Decay Tanks) is analogous to continuous releases, except that the release is not commenced until samples have been obtained and analyzed. Containment Purge batch releases were commenced at FNP beginning in 2006 in order to take advantage of additional decay time for short lived radionuclides.

Typically achieved minimum detectable concentrations for gaseous effluent sample analyses are reported in Table 2-6.

2.2.2 Total Quantities of Radioactivity, Dose Rates, and Cumulative Doses

The methods for determining release quantities of radioactivity, dose rates, and cumulative doses follow:

2.2.2.1 Fission and Activation Gases

The released radioactivity is determined using sample analyses results collected as described in section 2.2.1 and the average release flow rates over the period represented by the collected sample.

Dose rates due to noble gases, radioiodines, tritium, and particulates are calculated (with computer assistance). The calculated dose rates are compared to the dose rate limits specified in ODCM 3.1.2 for noble gases, radioiodine, tritium, and particulates. Dose rate calculation methodology is presented in the ODCM.

Beta and gamma air doses due to noble gases are calculated for the location in the unrestricted area with the potential for the highest exposure due to gaseous releases. Air doses are calculated for each release period and cumulative totals are kept for each unit for the calendar quarter and year. Cumulative air doses are compared to the dose limits specified in ODCM 3.1.3. The current percent of the ODCM limits are shown on the printout for each release period. Air dose calculation methodology is presented in the ODCM.

2.2.2.2 Radioiodine, Tritium, and Particulate Releases

Released quantities of radioiodines are determined using the weekly samples and release flow rates for the applicable release points. Radioiodine concentrations are determined by gamma spectroscopy.

Release quantities of particulates are determined using the weekly (filter) samples and release flow rates for the applicable release points. Gamma spectroscopy is used to quantify the concentrations of principal gamma emitters.

After each quarter, the particulate filters from each applicable vent (plant vent stack and containment purge) are combined, fused, and a strontium separation is performed. Since sample flows and vent flows are almost constant over each quarterly period the filters from each vent can be dissolved together. Decay corrections are performed back to the middle of the quarterly collection period. If Sr-89 or Sr-90 is not detected, MDCs are calculated. Strontium concentrations are input into the composite file of the computer and used for release dose rate and individual dose calculations.

Tritium samples are obtained monthly from the Plant Vent Stack, the Containment Purge when in batch mode, and the Turbine Building Vent (and weekly for Containment Purge when in continuous mode) by passing the sample stream through a cold trap or by using the bubble method. The grams of water vapor/cubic meter are measured upstream of the cold trap in order to alleviate the difficulties in determining water vapor collection efficiencies. The tritium samples are analyzed onsite and the results furnished in µCi/ml of water. The tritium concentration in water is converted to the tritium concentration in air and this value is input into the composite file of the computer and used in release, dose rate, and individual dose calculations.

Dose rates due to radioiodine, tritium and particulates are calculated for a hypothetical child exposed to the inhalation pathway at the location in the unrestricted area where the potential dose rate is expected to be the highest. Dose rates are calculated, for each release point for each release period, and the dose rates from each release point is compared to the dose rate limits specified in ODCM 3.1.2, allocated for each release point as described in ODCM 3.3.2.

Doses to a Member of the Public (individual doses) due to radioiodine, tritium and particulates are calculated for the controlling receptor, which is described in the ODCM. Individual doses are calculated for each release period, and cumulative totals are kept for each unit, for the current calendar quarter and year. Cumulative individual doses are compared to the dose limits specified in ODCM 3.1.4. The current percent of ODCM limits are shown on the printout for each release period.

2.2.2.3 Gross Alpha Release

The gross alpha release is computed each month by counting the particulate filters, for each week for gross alpha activity in a proportional counter. The highest concentration calculated for any of these weeks is used for the monthly value. This value is input into the composite file of the computer and used for release calculations.

2.2.3 Total Error Estimation

The maximum errors associated with monitor readings, sample flow, vent flow, sample collection, monitor calibration and laboratory procedure are collectively estimated to be:

Fission and Activation Gases	Iodine	Particulates	Tritium
75%	60%	50%	45%

The average error associated with counting is estimated to be:

Fission and Activation Gases	Iodine	Particulates	Tritium
19%	28%	20%	8%

2.3 Gaseous Effluent Release Data

Regulatory Guide 1.21 Tables 1A, 1B and 1C are found in this report as Tables 2-1A, 2-1B, 2-1C, 2-2A, 2-2B, 2-2C, 2-3A, 2-3B, and 2-3C. Data are presented on a quarterly basis as required by Regulatory Guide 1.21.

To complete Tables 2-1A and 2-1B, the total release for each of the four categories (fission and activation gases, radioiodines, particulates and tritium) was divided by the number of seconds in the quarter to obtain a release rate in µCi/second for each category. However, the percent of the ODCM limits are not applicable because FNP has no curie limit for gaseous releases. Applicable limits are expressed in terms of dose. Noble gases are limited as specified in ODCM 3.1.2. The other three categories (tritium, radioiodines, and particulates) are limited as a group as specified in ODCM 3.1.2.

Dose rates due to noble gas releases and due to radioiodines, tritium and particulate releases were calculated as part of the pre-release and post-release permits. No limits were exceeded for this reporting period.

Gross alpha radioactivity is reported in Tables 2-1A, 2-1B and 2-1C as curies released in each quarter.

Limits for cumulative beta and gamma air doses due to noble gases are presented in Tables 2-4A and 2-4B along with the percent of ODCM limits.

Limits for cumulative doses to an individual due to radioiodines, tritium and particulates are specified in ODCM 3.1.4. Cumulative individual doses are presented in Tables 2-5A and 2-5B along with percent of ODCM limits.

2.4 Radiological Impact Due to Gaseous Releases

The air doses due to noble gases and doses to a Member of the Public due to radioiodines, tritium and particulates in gaseous effluents for Units 1 and 2 are provided in the following tables in order to show conformance with the limits of ODCM 3.1.3 and ODCM 3.1.4:

Unit 1 2019 Air Doses Due to Noble Gases in Gaseous Releases: Table 2-4A

Unit 2 2019 Air Doses Due to Noble Gases in Gaseous Releases: Table 2-4B

Unit 1 2019 Doses to a Member of the Public Due to Radioiodines, Tritium, and Particulates in Gaseous Releases: Table 2-5A

Unit 2 2019 Doses to a Member of the Public Due to Radioiodines, Tritium, and Particulates in Gaseous Releases: Table 2-5B

2.5 Gaseous Effluents - Batch Releases

Batch release information for Units 1 and 2 is summarized in the following tables:

Unit 1 2019 Gaseous Effluents - Batch Release Summary: Table 2-7A

Unit 2 2019 Gaseous Effluents - Batch Release Summary: Table 2-7B

2.6 Gaseous Effluents - Abnormal Releases

There were no abnormal releases on Unit 1 or Unit 2 during 2019.

Abnormal release information for Units 1 and 2 is summarized in the following tables:

Unit 1 2019 Gaseous Effluents - Abnormal Release Summary: Table 2-8A

Unit 2 2019 Gaseous Effluents - Abnormal Release Summary: Table 2-8B

Table 2-1A
Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Summation Of All Releases
Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Gases					
1. Total Release	Curies	4.01E-01	4.09E-01	2.98E-01	1.02E+00
2. Average Release rate for period	uCi/sec	5.08E-02	5.19E-02	3.77E-02	1.29E-01
3. Percent of Applicable Limit	%	*	*	*	*
B. Radioiodines					
1. Total Iodine-131	Curies	0.00E+00	8.49E-05	0.00E+00	5.95E-06
2. Average Release rate for period	uCi/sec	0.00E+00	1.08E-05	0.00E+00	7.55E-07
3. Percent of Applicable Limit	%	*	*	*	*
C. Particulates					
1. Particulates (Half-Lives > 8 Days)	Curies	1.63E-07	4.37E-07	2.46E-08	7.19E-07
2. Average Release rate for period	uCi/sec	2.07E-08	5.54E-08	3.12E-09	9.115E-08
3. Percent of Applicable Limit	%	*	*	*	*
D. Tritium					
1. Total Release	Curies	4.90E+00	1.87E+00	4.39E+00	2.99E+00
2. Average Release rate for period	uCi/sec	6.21E-01	2.37E-01	5.57E-01	3.79E-01
3. Percent of Applicable Limit	%	*	*	*	*
E. Gross Alpha					
1. Total Release	Curies	1.93E-06	5.94E-07	1.32E-06	8.91E-07
2. Average Release rate for period	uCi/sec	2.45E-07	7.53E-08	1.68E-07	1.13E-07

* Applicable limits are expressed in terms of dose. See Tables 2-4A, 2-4B, 2-5A, 2-5B of this report.

Table 2-1B
Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Summation Of All Releases
Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Gases					
1. Total Release	Curies	1.25E+00	1.39E-01	2.92E+00	1.52E+00
2. Average Release rate for period	uCi/sec	1.58E-01	1.76E-02	3.70E-01	1.93E-01
3. Percent of Applicable Limit	%	*	*	*	*
B. Radioiodines					
1. Total Iodine-131	Curies	0.00E+00	6.96E-07	0.00E+00	0.00E+00
2. Average Release rate for period	uCi/sec	0.00E+00	8.83E-08	0.00E+00	0.00E+00
3. Percent of Applicable Limit	%	*	*	*	*
C. Particulates					
1. Particulates (Half-Lives > 8 Days)	Curies	0.00E+00	1.11E-07	6.11E-08	0.00E+00
2. Average Release rate for period	uCi/sec	0.00E+00	1.40E-08	7.75E-09	0.000E+00
3. Percent of Applicable Limit	%	*	*	*	*
D. Tritium					
1. Total Release	Curies	2.91E+00	2.63E+00	2.94E+00	3.22E+00
2. Average Release rate for period	uCi/sec	3.69E-01	3.33E-01	3.73E-01	4.09E-01
3. Percent of Applicable Limit	%	*	*	*	*
E. Gross Alpha					
1. Total Release	Curies	1.44E-06	4.36E-07	8.15E-07	5.12E-07
2. Average Release rate for period	uCi/sec	1.83E-07	5.54E-08	1.03E-07	6.49E-08

* Applicable limits are expressed in terms of dose. See Tables 2-4A, 2-4B, 2-5A, 2-5B of this report.

Table 2-1C
Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Summation Of All Releases
Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Gases					
1. Total Release	Curies	1.65E+00	5.48E-01	3.21E+00	2.54E+00
2. Average Release rate for period	uCi/sec	2.09E-01	6.95E-02	4.08E-01	3.22E-01
3. Percent of Applicable Limit	%	*	*	*	*
B. Radioiodines					
1. Total Iodine-131	Curies	0.00E+00	8.56E-05	0.00E+00	5.95E-06
2. Average Release rate for period	uCi/sec	0.00E+00	1.09E-05	0.00E+00	7.55E-07
3. Percent of Applicable Limit	%	*	*	*	*
C. Particulates					
1. Particulates (Half-Lives > 8 Days)	Curies	1.63E-07	5.47E-07	8.57E-08	7.19E-07
2. Average Release rate for period	uCi/sec	2.07E-08	6.94E-08	1.09E-08	9.115E-08
3. Percent of Applicable Limit	%	*	*	*	*
D. Tritium					
1. Total Release	Curies	7.81E+00	4.49E+00	7.33E+00	6.21E+00
2. Average Release rate for period	uCi/sec	9.90E-01	5.70E-01	9.30E-01	7.88E-01
3. Percent of Applicable Limit	%	*	*	*	*
E. Gross Alpha					
1. Total Release	Curies	3.37E-06	1.03E-06	2.14E-06	1.40E-06
2. Average Release rate for period	uCi/sec	4.28E-07	1.31E-07	2.71E-07	1.78E-07

* Applicable limits are expressed in terms of dose. See Tables 2-4A, 2-4B, 2-5A, 2-5B of this report.

Table 2-2A

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Mixed Mode Level Releases
Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Continuous Mode

Nuclides Released	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
Ar-41	Curies	0.00E+00	0.00E+00	6.51E-02	2.01E-01
Total For Period	**Curies**	**0.00E+00**	**0.00E+00**	**6.51E-02**	**2.01E-01**
Iodines					
I-131	Curies	0.00E+00	4.06E-06	0.00E+00	4.45E-06
I-133	Curies	0.00E+00	8.09E-05	0.00E+00	0.00E+00
Total For Period	**Curies**	**0.00E+00**	**8.49E-05**	**0.00E+00**	**4.45E-06**
Particulates					
Cr-51	Curies	0.00E+00	0.00E+00	0.00E+00	1.40E-07
Co-58	Curies	0.00E+00	0.00E+00	0.00E+00	1.57E-07
Co-60	Curies	0.00E+00	0.00E+00	0.00E+00	1.69E-07
Sr-89	Curies	1.63E-07	4.37E-07	6.50E-09	3.87E-09
Zr-95	Curies	0.00E+00	0.00E+00	0.00E+00	9.29E-08
Nb-95	Curies	0.00E+00	0.00E+00	0.00E+00	1.51E-07
Eu-155	Curies	0.00E+00	0.00E+00	1.81E-08	0.00E+00
Total For Period	**Curies**	**1.63E-07**	**4.37E-07**	**2.46E-08**	**7.14E-07**
Tritium					
H-3	Curies	4.76E+00	1.75E+00	4.35E+00	2.96E+00
Gross Alpha					
G-Alpha	Curies	1.93E-06	5.94E-07	1.32E-06	8.91E-07
Total For Period	**Curies**	**1.93E-06**	**5.94E-07**	**1.32E-06**	**8.91E-07**

Table 2-2A
Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Mixed Mode Level Releases

Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
Ar-41	Curies	3.99E-01	4.09E-01	2.32E-01	4.96E-01
Kr-85M	Curies	0.00E+00	0.00E+00	0.00E+00	1.39E-03
Kr-87	Curies	0.00E+00	0.00E+00	0.00E+00	4.21E-04
Kr-88	Curies	0.00E+00	0.00E+00	0.00E+00	1.58E-03
Xe-131M	Curies	0.00E+00	0.00E+00	0.00E+00	2.71E-03
Xe-133M	Curies	0.00E+00	0.00E+00	0.00E+00	3.94E-03
Xe-133	Curies	1.97E-03	6.62E-04	2.66E-05	2.57E-01
Xe-135	Curies	0.00E+00	0.00E+00	0.00E+00	5.25E-02
Total For Period	**Curies**	**4.01E-01**	**4.09E-01**	**2.32E-01**	**8.16E-01**
Iodines					
I-131	Curies	0.00E+00	0.00E+00	0.00E+00	3.92E-07
I-133	Curies	0.00E+00	0.00E+00	0.00E+00	1.11E-06
I-135	Curies	0.00E+00	0.00E+00	0.00E+00	2.69E-07
Total For Period	**Curies**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**1.77E-06**
Particulates					
Co-58	Curies	0.00E+00	0.00E+00	0.00E+00	4.33E-09
Total For Period	**Curies**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**4.33E-09**
Tritium					
H-3	Curies	1.39E-01	1.15E-01	3.56E-02	2.99E-02
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* If Not Detected, Nuclide is Not Reported. Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-6 for typical minimum detectable concentrations.

Table 2-2B

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Mixed Mode Level Releases
Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
Ar-41	Curies	0.00E+00	0.00E+00	2.57E+00	1.32E+00
Xe-133	Curies	7.16E-01	0.00E+00	0.00E+00	0.00E+00
Total For Period	**Curies**	**7.16E-01**	**0.00E+00**	**2.57E+00**	**1.32E+00**
Iodines					
I-131	Curies	0.00E+00	6.90E-07	0.00E+00	0.00E+00
Total For Period	**Curies**	**0.00E+00**	**6.90E-07**	**0.00E+00**	**0.00E+00**
Particulates					
Co-58	Curies	0.00E+00	1.05E-07	0.00E+00	0.00E+00
Sr-89	Curies	0.00E+00	5.05E-09	6.11E-08	0.00E+00
Total For Period	**Curies**	**0.00E+00**	**1.11E-07**	**6.11E-08**	**0.00E+00**
Tritium					
H-3	Curies	2.88E+00	2.62E+00	2.85E+00	3.19E+00
Gross Alpha					
G-Alpha	Curies	1.44E-06	4.36E-07	8.15E-07	5.12E-07
Total For Period	**Curies**	**1.44E-06**	**4.36E-07**	**8.15E-07**	**5.12E-07**

* If Not Detected, Nuclide is Not Reported. Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-6 for typical minimum detectable concentrations.

Table 2-2B

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Mixed Mode Level Releases

Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
Ar-41	Curies	5.32E-01	1.34E-01	3.51E-01	2.02E-01
Xe-133	Curies	0.00E+00	4.38E-03	1.02E-04	0.00E+00
Total For Period	**Curies**	**5.32E-01**	**1.39E-01**	**3.51E-01**	**2.02E-01**
Iodines					
I-131	Curies	0.00E+00	5.62E-09	0.00E+00	0.00E+00
Total For Period	**Curies**	**0.00E+00**	**5.62E-09**	**0.00E+00**	**0.00E+00**
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
H-3	Curies	3.21E-02	8.35E-03	9.29E-02	3.40E-02
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* If Not Detected, Nuclide is Not Reported. Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-6 for typical minimum detectable concentrations.

Table 2-2C

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Mixed Mode Level Releases
Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Continuous Mode

Nuclides Released	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
Ar-41	Curies	0.00E+00	0.00E+00	2.63E+00	1.52E+00
Xe-133	Curies	7.16E-01	0.00E+00	0.00E+00	0.00E+00
Total For Period	**Curies**	**7.16E-01**	**0.00E+00**	**2.63E+00**	**1.52E+00**
Iodines					
I-131	Curies	0.00E+00	4.75E-06	0.00E+00	4.45E-06
I-133	Curies	0.00E+00	8.09E-05	0.00E+00	0.00E+00
Total For Period	**Curies**	**0.00E+00**	**8.56E-05**	**0.00E+00**	**4.45E-06**
Particulates					
Cr-51	Curies	0.00E+00	0.00E+00	0.00E+00	1.40E-07
Co-58	Curies	0.00E+00	1.05E-07	0.00E+00	1.57E-07
Co-60	Curies	0.00E+00	0.00E+00	0.00E+00	1.69E-07
Sr-89	Curies	1.63E-07	4.42E-07	6.76E-08	3.87E-09
Zr-95	Curies	0.00E+00	0.00E+00	0.00E+00	9.29E-08
Nb-95	Curies	0.00E+00	0.00E+00	0.00E+00	1.51E-07
Eu-155	Curies	0.00E+00	0.00E+00	1.81E-08	0.00E+00
Total For Period	**Curies**	**1.63E-07**	**5.47E-07**	**8.57E-08**	**7.14E-07**
Tritium					
H-3	Curies	7.64E+00	4.37E+00	7.20E+00	6.15E+00
Gross Alpha					
G-Alpha	Curies	3.37E-06	1.03E-06	2.14E-06	1.40E-06
Total For Period	**Curies**	**3.37E-06**	**1.03E-06**	**2.14E-06**	**1.40E-06**

Table 2-2C

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Mixed Mode Level Releases

Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
Ar-41	Curies	9.30E-01	5.43E-01	5.83E-01	6.99E-01
Kr-85M	Curies	0.00E+00	0.00E+00	0.00E+00	1.39E-03
Kr-87	Curies	0.00E+00	0.00E+00	0.00E+00	4.21E-04
Kr-88	Curies	0.00E+00	0.00E+00	0.00E+00	1.58E-03
Xe-131M	Curies	0.00E+00	0.00E+00	0.00E+00	2.71E-03
Xe-133M	Curies	0.00E+00	0.00E+00	0.00E+00	3.94E-03
Xe-133	Curies	1.97E-03	5.04E-03	1.28E-04	2.57E-01
Xe-135	Curies	0.00E+00	0.00E+00	0.00E+00	5.25E-02
Total For Period	**Curies**	**9.32E-01**	**5.48E-01**	**5.83E-01**	**1.02E+00**
Iodines					
I-131	Curies	0.00E+00	5.62E-09	0.00E+00	3.92E-07
I-133	Curies	0.00E+00	0.00E+00	0.00E+00	1.11E-06
I-135	Curies	0.00E+00	0.00E+00	0.00E+00	2.69E-07
Total For Period	**Curies**	**0.00E+00**	**5.62E-09**	**0.00E+00**	**1.77E-06**
Particulates					
Co-58	Curies	0.00E+00	0.00E+00	0.00E+00	4.33E-09
Total For Period	**Curies**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**4.33E-09**
Tritium					
H-3	Curies	1.71E-01	1.24E-01	1.28E-01	6.39E-02
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* If Not Detected, Nuclide is Not Reported. Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-6 for typical minimum detectable concentrations.

Table 2-3A

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Ground Level Releases

Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Nuclides Released	Units	Continuous Mode 1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* If Not Detected, Nuclide is Not Reported. Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-6 for typical minimum detectable concentrations.

Table 2-3A

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Ground Level Releases

Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Batch Mode

Nuclides Released	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* If Not Detected, Nuclide is Not Reported. Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-6 for typical minimum detectable concentrations.

Table 2-3B

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Ground Level Releases

Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Nuclides Released	Units	Continuous Mode 1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* If Not Detected, Nuclide is Not Reported. Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-6 for typical minimum detectable concentrations.

Table 2-3B

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Ground Level Releases

Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Batch Mode

Nuclides Released	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* If Not Detected, Nuclide is Not Reported. Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-6 for typical minimum detectable concentrations.

Table 2-3C

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Ground Level Releases

Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Nuclides Released	Units	Continuous Mode 1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* If Not Detected, Nuclide is Not Reported. Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-6 for typical minimum detectable concentrations.

Table 2-3C

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Ground Level Releases

Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Batch Mode

Nuclides Released	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* If Not Detected, Nuclide is Not Reported. Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-6 for typical minimum detectable concentrations.

Table 2-4A

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Air Doses Due to Gaseous Releases

Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Type of Radiation	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Gamma Air	5.00E+00	mRad	1.27E-04	2.54E-03	1.30E-04	2.60E-03	9.48E-05	1.90E-03	2.30E-04	4.59E-03
Beta Air	1.00E+01	mRad	4.49E-05	4.49E-04	4.59E-05	4.59E-04	3.34E-05	3.34E-04	9.27E-05	9.27E-04

Cumulative Doses Per Year

Type of Radiation	ODCM Lmt	Units	Year to End Date	% ODCM	Receptor	Limit
Gamma Air	1.00E+01	mRad	5.82E-04	5.82E-03	Site Boundary SSE Mixed Mode R	Air Dose Gamma Annual
Beta Air	2.00E+01	mRad	2.17E-04	1.08E-03	Site Boundary SSE Mixed Mode R	Air Dose Beta Annual

Table 2-4B

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Air Doses Due to Gaseous Releases

Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Type of Radiation	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Gamma Air	5.00E+00	mRad	1.78E-04	3.56E-03	4.28E-05	8.56E-04	9.29E-04	1.86E-02	4.84E-04	9.68E-03
Beta Air	1.00E+01	mRad	8.55E-05	8.55E-04	1.52E-05	1.52E-04	3.28E-04	3.28E-03	1.71E-04	1.71E-03

Cumulative Doses Per Year

Type of Radiation	ODCM Lmt	Units	Year to End Date	% ODCM	Receptor	Limit
Gamma Air	1.00E+01	mRad	1.63E-03	1.63E-02	Site Boundary SSE Mixed Mode R	Air Dose Gamma Annual
Beta Air	2.00E+01	mRad	5.99E-04	3.00E-03	Site Boundary SSE Mixed Mode R	Air Dose Beta Annual

Table 2-5A

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses To A Member Of The Public Due To Radioiodines, Tritium, and Particulates in Gaseous Releases
Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Organ	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
GI-Lli	7.50E+00	mRem	6.70E-04	8.93E-03	2.56E-04	3.41E-03	6.00E-04	8.01E-03	4.10E-04	5.47E-03
Bone	7.50E+00	mRem	1.98E-06	2.64E-05	5.75E-06	7.67E-05	7.90E-08	1.05E-06	1.59E-06	2.11E-05
Liver	7.50E+00	mRem	6.70E-04	8.93E-03	2.56E-04	3.41E-03	6.00E-04	8.01E-03	4.10E-04	5.47E-03
Total Body	7.50E+00	mRem	6.70E-04	8.93E-03	2.56E-04	3.41E-03	6.00E-04	8.01E-03	4.10E-04	5.47E-03
Thyroid	7.50E+00	mRem	6.70E-04	8.93E-03	3.59E-04	4.78E-03	6.00E-04	8.01E-03	4.98E-04	6.64E-03
Lung	7.50E+00	mRem	6.70E-04	8.93E-03	2.56E-04	3.41E-03	6.00E-04	8.01E-03	4.10E-04	5.47E-03
Kidney	7.50E+00	mRem	6.70E-04	8.93E-03	2.56E-04	3.42E-03	6.00E-04	8.01E-03	4.10E-04	5.47E-03

Cumulative Doses per Year

Organ	ODCM Lmt	Units	Year to Ending Date	% ODCM	Receptor	Limit
GI-Lli	1.500E+01	mRem	1.937E-03	1.291E-02	Gas Controlling Receptor	Iodine/Part Dose Annual
Bone	1.500E+01	mRem	9.399E-06	6.266E-05	Gas Controlling Receptor	Iodine/Part Dose Annual
Liver	1.500E+01	mRem	1.937E-03	1.291E-02	Gas Controlling Receptor	Iodine/Part Dose Annual
Total Body	1.500E+01	mRem	1.937E-03	1.291E-02	Gas Controlling Receptor	Iodine/Part Dose Annual
Thyroid	1.500E+01	mRem	2.127E-03	1.418E-02	Gas Controlling Receptor	Iodine/Part Dose Annual
Lung	1.500E+01	mRem	1.936E-03	1.291E-02	Gas Controlling Receptor	Iodine/Part Dose Annual
Kidney	1.500E+01	mRem	1.937E-03	1.291E-02	Gas Controlling Receptor	Iodine/Part Dose Annual

Table 2-5B

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses To A Member Of The Public Due To Radioiodines, Tritium, and Particulates in Gaseous Releases
Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Organ	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Lung	7.50E+00	mRem	3.98E-04	5.31E-03	3.59E-04	4.79E-03	4.02E-04	5.36E-03	4.41E-04	5.88E-03
Thyroid	7.50E+00	mRem	3.98E-04	5.31E-03	3.72E-04	4.96E-03	4.02E-04	5.36E-03	4.41E-04	5.88E-03
GI-Lli	7.50E+00	mRem	3.98E-04	5.31E-03	3.59E-04	4.79E-03	4.02E-04	5.36E-03	4.41E-04	5.88E-03
Bone	7.50E+00	mRem	0.00E+00	0.00E+00	1.17E-07	1.55E-06	7.43E-07	9.91E-06	0.00E+00	0.00E+00
Liver	7.50E+00	mRem	3.98E-04	5.31E-03	3.59E-04	4.79E-03	4.02E-04	5.36E-03	4.41E-04	5.88E-03
Kidney	7.50E+00	mRem	3.98E-04	5.31E-03	3.59E-04	4.79E-03	4.02E-04	5.36E-03	4.41E-04	5.88E-03
Total Body	7.50E+00	mRem	3.98E-04	5.31E-03	3.59E-04	4.79E-03	4.02E-04	5.36E-03	4.41E-04	5.88E-03

Cumulative Doses per Year

Organ	ODCM Lmt	Units	Year to Ending Date	% ODCM	Receptor	Limit
Lung	1.500E+01	mRem	1.600E-03	1.067E-02	Gas Controlling Receptor	Iodine/Part Dose Annual
Thyroid	1.500E+01	mRem	1.612E-03	1.075E-02	Gas Controlling Receptor	Iodine/Part Dose Annual
GI-Lli	1.500E+01	mRem	1.600E-03	1.067E-02	Gas Controlling Receptor	Iodine/Part Dose Annual
Bone	1.500E+01	mRem	8.595E-07	5.730E-06	Gas Controlling Receptor	Iodine/Part Dose Annual
Liver	1.500E+01	mRem	1.600E-03	1.067E-02	Gas Controlling Receptor	Iodine/Part Dose Annual
Kidney	1.500E+01	mRem	1.600E-03	1.067E-02	Gas Controlling Receptor	Iodine/Part Dose Annual
Total Body	1.500E+01	mRem	1.600E-03	1.067E-02	Gas Controlling Receptor	Iodine/Part Dose Annual

TABLE 2-6
Joseph M. Farley Nuclear Plant
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
MINIMUM DETECTABLE CONCENTRATIONS - GASEOUS EFFLUENT ANALYSES

The values in this table represent a priori Minimum Detectable Concentrations (MDC) that are typically achieved in laboratory analyses of gaseous radwaste samples.

Nuclide	MDC(uCi/ML)	Nuclide	MDC(uCi/ML)
MN-54	3.32E-13	KR-87	4.69E-08
CO-58	2.31E-13	KR-88	4.32E-08
FE-59	3.97E-13	XE-133	3.37E-08
CO-60	4.30E-13	XE-133M	1.33E-07
ZN-65	6.59E-13	XE-135	1.58E-08
MO-99	1.44E-12	XE-138	6.87E-08
CS-134	1.67E-13	I-131	2.15E-13
CS-137	1.45E-13	I-133	3.85E-13
CE-141	2.06E-13		
CE-144	6.78E-13		

Table 2-7A

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Batch Release Summary
Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Gaseous Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of batch releases		95	92	54	95	336
2. Total time period for batch releases	(Minutes)	4.48E+03	4.05E+03	8.71E+03	1.07E+04	2.80E+04
3. Maximum time period for a batch release	(Minutes)	2.05E+02	1.15E+02	9.18E+02	1.08E+03	1.08E+03
4. Average time period for a batch release	(Minutes)	4.72E+01	4.40E+01	1.61E+02	1.13E+02	8.33E+01
5. Minimum time period for a batch release	(Minutes)	1.00E+00	1.00E+00	1.00E+00	4.00E+00	1.00E+00

Table 2-7B

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Gaseous Effluents - Batch Release Summary
Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Gaseous Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of batch releases		59	39	28	44	170
2. Total time period for batch releases	(Minutes)	2.98E+03	4.17E+03	1.66E+03	2.13E+03	1.09E+04
3. Maximum time period for a batch release	(Minutes)	4.08E+02	4.41E+02	2.58E+02	1.60E+02	4.41E+02
4. Average time period for a batch release	(Minutes)	5.05E+01	1.07E+02	5.94E+01	4.83E+01	6.43E+01
5. Minimum time period for a batch release	(Minutes)	2.00E+00	4.00E+00	3.00E+00	3.00E+00	2.00E+00

Table 2-8A

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Abnormal Release Summary

Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Gaseous Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 2-8B

Joseph M Farley Nuclear Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Abnormal Release Summary

Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Gaseous Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

3.0 SOLID WASTE

3.1 Regulatory Requirements

3.1.1 Solid Radioactive Waste System

FNP-0-M-30, PROCESS CONTROL PROGRAM, step B.3.1 states that the radwaste solidification system shall be OPERABLE and used, as applicable in accordance with a PROCESS CONTROL PROGRAM, for the SOLIDIFICATION and packaging of radioactive wastes to ensure meeting the requirements of 10 CFR Part 20 and 10 CFR Part 71 prior to shipment of radioactive wastes from the site.

3.1.2 Reporting Requirements

FNP-0-M-30, PROCESS CONTROL PROGRAM, step B.5.1 states that the Annual Radioactive Effluent Release Report, submitted in accordance with Technical Specifications 5.6.2 and 5.6.3, shall include a summary of the quantities of solid radwaste released from the units as outlined in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste," Revision 2, issued June 2009 , with data summarized on an annual basis following the format of Table A-3 thereof.

3.2 Solid Waste Data

Regulatory Guide 1.21 Revision 2 Table A-3 is found in the report as Table 3-1.

TABLE 3-1
Joseph M. Farley Nuclear Plant
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2019
SOLID RADIOACTIVE WASTE SHIPPED FOR PROCESSING OR DISPOSAL

Starting 01-Jan-2019 Ending 31-Dec-2019

Resins, Filters, and Evaporator Bottoms	**Volume**		**Curies Shipped**
Waste Class	ft^3	m^3	
A	2.42E+01	6.84E-01	1.01E+00
B	1.45E+02	4.11E+00	1.54E+02
C	2.75E+01	7.79E-01	2.81E+00
Unclassified	3.29E+01	9.31E-01	2.73E+01
ALL	1.97E+02	5.57E+00	1.58E+02

Major Nuclides for the Above Table:

Waste Class "A":	C-14 2.1%	Be-7 1.04%	Co-58 20.14%	Co-60 25.21%	Fe-55 21.98%
	Ni-63 8.18%	Sb-125 1.02%	Cr-51 9.9%	Zr-95 2.88%	Nb-95 4.74%
Waste Class "B":	Fe-55 8.35%	Co-60 43.66%	Ni-63 42.59%	Sb-125 2.6%	
Waste Class "C":	C-14 3.62%	Fe-55 38.95%	Co-58 4.43%	Co-60 37.04%	
	Ni-63 7.68%	Sb-125 1.23%	Zr-95 1.17%	Nb-95 2.2%	
Unclassified:	H-3 2.29%	C-14 7.3%	Fe-55 51.7%	Co-58 1.76%	
	Ni-63 9.95%	Nb-95 1.15%	Sb-125 1.26%	Co-60 22.45%	
ALL:	C-14 1.59%	Fe-55 15.28%	Co-60 40.33%	Ni-63 37.01%	
	Sb-125 2.37%				

Dry Active Waste	**Volume**		**Curies Shipped**
Waste Class	ft^3	m^3	
A	1.96E+04	5.55E+02	1.91E+00
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
ALL	1.96E+04	5.55E+02	1.91E+00

Major Nuclides for the Above Table:

Waste Class "A":	H-3 13.15%	Sb-125 1.19%	Cr-51 3.98%	Fe-55 10.82%
	Co-58 12.09%	Co-60 12.53%	Ni-63 10.6%	Zr-95 12.53%
	Nb-95 16.7%	Tc-99 2.9%		
Waste Class "B" N/A				
Waste Class "C" N/A				
ALL:	H-3 13.15%	Sb-125 1.19%	Cr-51 3.98%	Fe-55 10.82%
	Co-58 12.09%	Co-60 12.53%	Ni-63 10.6%	Zr-95 12.53%
	Nb-95 16.7%	Tc-99 2.9%		

Irradiated Components	**Volume**		**Curies Shipped**
Waste Class	ft^3	m^3	
A	0.00E+00	0.00E+00	0.00E+00
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
ALL	0.00E+00	0.00E+00	0.00E+00

Major Nuclides for the Above Table:

(Continued)

Other Waste	**Volume**		**Curies Shipped**
Waste Class	ft^3	m^3	
A	0.00E+00	0.00E+00	0.00E+00
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
ALL	0.00E+00	0.00E+00	0.00E+00

Major Nuclides for the Above Table:

Waste Class "A": N/A
Waste Class "B": N/A
Waste Class "C": N/A
ALL: N/A

Sum of All Low-Level Waste Shipped from Site	**Volume**		**Curies Shipped**
Waste Class	ft^3	m^3	
A	1.96E+04	5.56E+02	2.92E+00
B	1.45E+02	4.11E+00	1.54E+02
C	2.75E+01	7.79E-01	2.81E+00
Unclassified	3.29E+01	9.31E-01	2.73E+01
ALL	1.98E+04	5.61E+02	1.60E+02

Major Nuclides for the Above Table:

Waste Class "A":	H-3 8.58%	Cr-51 6.04%	Ni-63 9.76%	Co-58 14.89%
	Co-60 16.93%	Fe-55 14.7%	Zr-95 9.18%	Nb-95 12.55%
	Sb-125 1.13%	Tc-99 1.92%		
Waste Class "B":	Fe-55 8.35%	Co-60 43.66%	Ni-63 42.59%	Sb-125 2.6%
Waste Class "C":	Sb-125 1.23%	C-14 3.62%	Fe-55 38.95%	Co-58 4.43%
	Co-60 37.04%	Ni-63 7.68%	Zr-95 1.17%	Nb-95 2.2%
Unclassified	H-3 2.29%	C-14 7.3%	Fe-55 51.7%	Co-58 1.76%
	Co-60 22.45%	Ni-63 9.59%	Nb-95 1.15%	Sb-125 1.26%
ALL:	C-14 1.58%	Fe-55 15.24%	Sb-125 2.36%	Co-60 40.05%
	Ni-63 36.74%			

4.0 DOSES TO MEMBERS OF THE PUBLIC INSIDE THE SITE BOUNDARY

4.1 Regulatory Requirements

Current FNP effluent controls as established by ODCM 6.1 do not require assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY (ODCM Figure 10-1).

4.2 Demonstration of Compliance

However, this assessment has been performed for 2019 using the methods described in ODCM 6.2 and is included in this section as Table 4-1.

Table 4-1

Joseph M Farley Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Doses to a Member of the Public Due to Activities Inside the Site Boundary
Starting: 1-Jan- 2019 Ending: 31-Dec-2019
Unit: Site

Location Name: Visitor Center
Distance (kilometers): 3.06E-01
Sector: N
Occupancy Factor: 1.37E-03

Age Group: Child

Mixed Mode Release	Noble Gas	X/Q (sec/m3): 8.80E-06	
Mixed Mode Release	Particulate and Radioiodine	X/Q (sec/m3): 8.80E-06	D/Q (m-2): 6.20E-08
Ground Level Release	Particulate and Radioiodine	X/Q (sec/m3): 1.04E-04	D/Q (m-2): 4.80E-07
Ground Level Release	Noble Gas	X/Q (sec/m3): 1.04E-04	

	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year
Liver	mRem	3.35E-08	1.93E-08	3.14E-08	2.67E-08	1.11E-07
Thyroid	mRem	3.35E-08	2.08E-08	3.14E-08	2.70E-08	1.13E-07
Bone	mRem	3.74E-13	1.56E-11	1.55E-13	1.04E-10	1.20E-10
Total Body	mRem	3.35E-08	1.93E-08	3.14E-08	2.67E-08	1.11E-07
Skin	mRem	1.10E-16	1.04E-11	4.57E-17	1.21E-10	1.32E-10
Kidney	mRem	3.35E-08	1.93E-08	3.14E-08	2.67E-08	1.11E-07
Lung	mRem	3.35E-08	1.93E-08	3.14E-08	2.67E-08	1.11E-07
GI-Lli	mRem	3.35E-08	1.93E-08	3.14E-08	2.67E-08	1.11E-07

Table 4-1

Joseph M Farley Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Doses to a Member of the Public Due to Activities Inside the Site Boundary
Starting: 1-Jan- 2019 Ending: 31-Dec-2019
Unit: Site

Location Name: Service Water Pond
Distance (kilometers): 9.66E-01
Sector: N
Occupancy Factor: 7.57E-03

Age Group: Child

Mixed Mode Release	Noble Gas	X/Q (sec/m3): 9.75E-07	
Mixed Mode Release	Particulate and Radioiodine	X/Q (sec/m3): 9.75E-07	D/Q (m-2): 2.78E-08
Ground Level Release	Noble Gas	X/Q (sec/m3): 4.74E-05	
Ground Level Release	Particulate and Radioiodine	X/Q (sec/m3): 4.74E-05	D/Q (m-2): 1.31E-07

	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year
Total Body	mRem	2.05E-08	1.18E-08	1.92E-08	1.66E-08	6.81E-08
Liver	mRem	2.05E-08	1.18E-08	1.92E-08	1.66E-08	6.81E-08
Thyroid	mRem	2.05E-08	1.27E-08	1.92E-08	1.68E-08	6.92E-08
Skin	mRem	2.73E-16	2.58E-11	1.13E-16	3.00E-10	3.26E-10
Kidney	mRem	2.05E-08	1.18E-08	1.92E-08	1.66E-08	6.81E-08
Lung	mRem	2.05E-08	1.18E-08	1.92E-08	1.66E-08	6.81E-08
GI-Lli	mRem	2.05E-08	1.18E-08	1.92E-08	1.66E-08	6.81E-08
Bone	mRem	2.29E-13	2.56E-11	9.50E-14	2.56E-10	2.82E-10

Table 4-1

Joseph M Farley Nuclear Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Doses to a Member of the Public Due to Activities Inside the Site Boundary
Starting: 1-Jan- 2019 Ending: 31-Dec-2019
Unit: Site

Location Name: River Water Discharge - Air
Distance (kilometers): 1.64E+00
Sector: N
Occupancy Factor: 1.14E-02

Age Group: Child

Ground Level Release	Noble Gas	X/Q (sec/m3): 1.63E-05	
Mixed Mode Release	Noble Gas	X/Q (sec/m3): 7.05E-07	
Mixed Mode Release	Particulate and Radioiodine	X/Q (sec/m3): 7.05E-07	D/Q (m-2): 1.39E-08
Ground Level Release	Particulate and Radioiodine	X/Q (sec/m3): 1.63E-05	D/Q (m-2): 4.55E-08

	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year
Kidney	mRem	2.23E-08	1.29E-08	2.10E-08	1.79E-08	7.41E-08
Skin	mRem	2.05E-16	1.95E-11	8.52E-17	2.26E-10	2.46E-10
Lung	mRem	2.23E-08	1.29E-08	2.10E-08	1.79E-08	7.41E-08
GI-Lli	mRem	2.23E-08	1.29E-08	2.10E-08	1.79E-08	7.41E-08
Total Body	mRem	2.23E-08	1.29E-08	2.10E-08	1.79E-08	7.41E-08
Liver	mRem	2.23E-08	1.29E-08	2.10E-08	1.79E-08	7.41E-08
Thyroid	mRem	2.23E-08	1.39E-08	2.10E-08	1.82E-08	7.53E-08
Bone	mRem	2.49E-13	2.08E-11	1.03E-13	1.93E-10	2.14E-10

5.0 TOTAL DOSE FROM URANIUM FUEL CYCLE (40CFR190)

5.1 Regulatory Requirements

Technical Specification 5.5.4.j states that the dose or dose commitment to any MEMBER OF THE PUBLIC over a calendar year, due to releases of radioactivity and to radiation from uranium fuel cycle sources, shall be limited to less than or equal to 25 mrem to the total body or to any organ, except the thyroid, which shall be limited to less than or equal to 75 mrem (as stated in ODCM 5.1).

With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of ODCM 2.1.3, 3.1.3, or 3.1.4, calculations shall be made according to ODCM 5.2 methods to determine whether the above (ODCM 5.1) limits have been exceeded (as stated in ODCM 5.1.2).

5.2 Demonstration of Compliance

Since none of the ODCM 2.1.3, 3.1.3, or 3.1.4 limits were exceeded during 2019, no calculations were required.

6.0 METEOROLOGICAL DATA

Meteorological data are retained onsite; these data are available to the NRC upon request. The meteorological data include annual summaries of hourly measurements of wind speed, wind direction and atmospheric stability in the form of joint frequency distribution tables.

7.0 PROGRAM DEVIATIONS

7.1 Inoperable Liquid or Gaseous Effluent Monitoring Instrumentation

7.1.1 Regulatory Requirements

ODCM 7.2.2.6 states in part that the Annual Radioactive Effluent Release Report (the report) shall include deviations from the liquid and gaseous effluent monitoring instrumentation operability requirements included in Sections 2.1.1 and 3.1.1 of the ODCM. The report must also include an explanation as to why the inoperability was not corrected in a timely manner.

7.1.2 Description of Deviations

1. Unit 2, R60C Main steam line radiation monitor OOS for greater than 30 days due to a slave link fault. This is a new monitor that required vendor support and long lead time parts to repair.
2. Unit-1 RE-23B was declared inoperable on 6/27/19. Thirty days later (7/27/19), the rad-monitor (SGBD dilution radiation monitor) was still not restored to operable status as required by the ODCM. This was discovered to be a power supply issue. No replacement parts were available within the required time frame.

7.2 Effluent Sample Analysis Exceeding Minimum Detectable Concentration (MDC)

7.2.1 Regulatory Requirements

ODCM 7.2.2.6 states in part that the report shall include deviations from the MDC requirements included in ODCM Tables 2-3 and 3-3.

7.2.2 Description of Deviations

There were no deviations during 2019.

7.3 Incorrect Compositing of Liquid or Gaseous Effluent Samples

7.3.1 Regulatory Requirements

ODCM 7.2.2.6 states in part that the report shall include deviations from composite sampling requirements included in ODCM Tables 2-3 and 3-3.

7.3.2 Description of Deviations

There were no deviations during 2019.

8.0 CHANGES TO THE PLANT FARLEY ODCM

8.1 Regulatory Requirements

Pursuant to Technical Specification 5.5.1.c and ODCM 7.2.2.5, licensee initiated changes to the ODCM shall be submitted to the Nuclear Regulatory Commission as a part of or concurrent with the Annual Radioactive Effluent Release Report for the period in which any changes were made. Included are changes to the radiological environmental monitoring program sampling locations or dose calculation locations or pathways, including any changes made pursuant to ODCM 4.1.2.2.2 (land use census).

8.2 Description of Changes

No ODCM changes made during 2019

9.0 MAJOR CHANGES TO LIQUID, GASEOUS, OR SOLID RADWASTE TREATMENT SYSTEMS

9.1 Regulatory Requirements

ODCM 7.2.2.7 states in part that, as required by ODCM 2.1.5 and 3.1.6, licensee initiated MAJOR CHANGES TO RADIOACTIVE WASTE TREATMENT SYSTEMS (liquid and gaseous) shall be reported to the Nuclear Regulatory Commission in the Annual Radioactive Effluents Release Report covering the period in which the change was reviewed and accepted for implementation.

Process Control Program (PCP) B.5.1.2 states that licensee initiated major changes to the solid radioactive waste treatment system shall be reported to the Nuclear Regulatory Commission in the Annual Radioactive Effluent Release Report for the period in which the change was implemented. The discussion of each change shall include the information specified in PCP B.4.1.

9.2 Description of Major Changes

Changes to the Process Control Program during 2019:

LDCR19-040

1. Added statement to clarify the PCP purpose applies to waste processed on-site and shipped directly to a disposal facility.
2. Removed vendor procedure embeds and referenced those by title. The PCP directs use of those procedures which are approved by the Vendor Procedure Approval Process.
3. Added Vendor Procedure to references for Dewatering Bead Resin and Activated carbon and added PCP guidance to direct used of this procedure.
4. Added NEI 07-010A, Engineering Test Instruction & Test Report, and CNS Topical Report for dewatering process contains to references.

Justification:

1. NEI 07.010A PCP Template which is approved by the NRC states the PCP does not apply to radwaste shipments sent to vendors for processing instead of directly to a disposal facility. This is consistent with SNC Fleet and the Industry.
2. The Vendor Procedure Approval Process Is the correct method to get Vendor Procedures into Documentum.
3. Procedure for Dewatering Bead Resin & Activated Carbon needed to be added to the PCP.
4. NEI 07-010A Is a generic guidance document for PCP development. Other references added as background documents that demonstrate compliance with 10CFR61 requirements •

Farley Nuclear Plant
Appendix A

CARBON-14

Carbon-14 (C-14) is a naturally-occurring radionuclide with a 5730 year half-life. Nuclear weapons testing in the 1950s and 1960s significantly increased the amount of C-14 in the atmosphere. Nuclear power plants also produce C-14, but the amount is infinitesimal compared to what has been distributed in the environment due to weapons testing and what is produced by natural cosmic ray interactions.

As nuclear plants have improved gaseous waste processing systems and improved fuel performance, the percentages of "principal radionuclides" in gaseous effluents have changed, and C-14 has become a larger percentage. "Principal radionuclides" are determined based on public dose contribution or the amount of activity discharged compared to other radionuclides of the same effluent type. In Revision 2 (June 2009) of Regulatory Guide 1.21 (RG 1.21), "Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste," the NRC recommended re-evaluating "principal radionuclides" and reporting C-14 as appropriate. In 2010 Radioactive Effluent Release Reports, virtually all U. S. nuclear power plants started reporting C-14 amounts released and resulting doses to the maximally exposed member of the public.

Because C-14 is considered a hard-to-detect radionuclide which must be chemically separated from the effluent stream before it can be measured, RG 1.21 provides the option of calculating the C-14 source term based on power generation. The Electric Power Research Institute (EPRI) developed an accepted methodology for calculating C-14, and published the results in Technical Report 1021106 (December 2010), "Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents." Evaluation of C-14 in radioactive liquid effluents is not required because the quantity and dose contribution has been determined to be insignificant.

At Plant Farley, the annual quantity of C-14 released in gaseous effluents was estimated to be 9.28 Curies (per unit). Approximately 30% of the C-14 released is in the form of $^{14}CO_2$ and is incorporated into plants through photosynthesis. Ingestion dose results from this pathway. The remaining 70% is estimated to be organic. Both the organic and inorganic forms of C-14 contribute to inhalation dose. A child is the maximally exposed individual, and bone dose is the highest organ dose. Using the dose calculation methodology from the Farley ODCM, the resulting bone dose to a child located at the controlling receptor location would be 4.11E-01 mrem in a year which is 2.74% of the regulatory limit of 15 mrem per year (per unit) to any organ due to gaseous effluents. The resulting total body dose to a child located at the controlling receptor location would be 8.21E-02 mrem in a year which is 0.54% of the regulatory limit of 15 mrem per year (per unit) total body dose due to gaseous effluents.

Farley Nuclear Plant
Appendix B

Correction to 2018 Annual Radioactive Effluent Release Report: N/A

Edwin I. Hatch Nuclear Plant – Units 1&2
Joseph M. Farley Nuclear Plant – Units 1&2
Vogtle Electric Generating Plant – Units 1&2
Annual Non-Radiological Environmental Operating Reports and Annual Radioactive Effluent Release Reports for 2019

Enclosure 6

Vogtle Electric Generating Plant – Units 1&2
Annual Radioactive Effluent Release Report for 2019

SOUTHERN NUCLEAR COMPANY

VOGTLE ELECTRIC GENERATING PLANT – UNITS 1 AND 2

NRC DOCKET NOS. 50-424 AND 50-425

FACILITY OPERATING LICENSE NOS. NPF-68 AND NPF-81

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

FOR

JANUARY 1, 2019 TO DECEMBER 31, 2019

Prepared by: Betsy Hart / / 4-23-20

Reviewed by: Jessica Osborne / /4-23-20

VOGTLE ELECTRIC GENERATING PLANT
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
TABLE OF CONTENTS

1.0 Liquid Effluents

1.1 Regulatory Requirements

The ODCM Specifications presented in this section are for Unit 1 and Unit 2.

1.1.1 Concentration Limits

In accordance with Technical Specification 5.5.4.b, the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS shall be limited at all times to ten times the concentrations specified in 10 CFR 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 1 E-04 μCi/ml total activity.

1.1.2 Dose Limits

The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released, from each unit, to UNRESTRICTED AREAS shall be limited as follows:

a. During any calendar quarter to less than or equal to 1.5 mrems to the whole body and to less than or equal to 5 mrems to any organ, and

b. During any calendar year to less than or equal to 3 mrems to the whole body and to less than or equal to 10 mrems to any organ.

1.2 Effluent Concentration Limit (ECL)

ECL values used for determining the allowable liquid radwaste release rates and concentrations for the principal gamma emitters, I-131, tritium, Sr-89, Sr-90 and Fe-55 are taken from 10 CFR Part 20, Appendix B, Table 2, Column 2. A tolerance factor of up to 10 is utilized to allow flexibility in establishing practical monitor set points which can accommodate effluent releases at concentrations higher than the ECL values stated in 10 CFR 20, Appendix B, Table 2, Column 2.

For dissolved or entrained noble gases in liquid radwaste, the ECL is 1E-04 μCi/ml total activity.

For gross alpha in liquid radwaste, the ECL is 2 E-09 μCi/ml.

For all the above radionuclides or categories of radioactivity, the overall ECL fraction is determined in accordance with 10 CFR Part 20, Appendix B. The method utilizing the ECL fraction to determine release rates and liquid radwaste effluent radiation monitor set points is described in Subsection 1.3 of this report.

1.3 Measurements and Approximations of Total Radioactivity

1.3.1 Total Radioactivity Determination

Prior to the release of any tank containing liquid radwaste, and following the required recirculation, samples are collected and analyzed in accordance with the Vogtle Electric Generating Plant Offsite Dose Calculation Manual (ODCM) Table 2-3 “Radioactive Liquid Waste Sampling and Analysis Program”. A sample from each tank which is planned for release is analyzed for principal gamma emitters, I-131, and dissolved and entrained noble gases by gamma spectroscopy. Monthly and quarterly composites are prepared for analysis by extracting aliquots from each sample taken from the tanks, which are released. Liquid radwaste sample analyses are performed as follows:

	MEASUREMENT	FREQUENCY	METHOD
1.	Gamma Isotopic	Each Batch	Gamma Spectroscopy with computerized data reduction.
2.	Dissolved or entrained noble gases	Each Batch	Gamma Spectroscopy with computerized data reduction
3.	Tritium	Monthly Composite	Distillation and liquid scintillation counting
4.	Gross Alpha	Monthly Composite	Gas flow proportional counting (1)
5.	Sr-89 & Sr-90	Quarterly Composite	Chemical separation and gas flow proportional or scintillation counting (1)
6.	Fe-55	Quarterly Composite	Chemical separation and liquid scintillation Counting (1)
7.	Ni-63	Quarterly Composite	Chemical separation and liquid scintillation Counting (1)

(1) Analysis performed by an off-site laboratory

1.3.1 Total Radioactivity Determination cont'd

Gamma isotopic measurements are performed using germanium detectors with a resolution of 2.1 keV or lower. A peak search of the resulting gamma ray spectrum is performed by the computer system. Energy and net count data for all significant peaks are determined, and a quantitative reduction or MDC calculation is performed. This ensures that the MDC's are met for the nuclides specified in ODCM Chapter 10 (i.e., Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141 and Ce-144). The quantitative calculations, corrections for counting time, decay time, sample volume, sample geometry, detector efficiency, baseline counts, branching ratio and MDC calculations, are made based on the counts at the location in the spectrum where the peak for that radionuclide would be located, if present.

ECL fraction is determined using radionuclide concentrations of a tank planned for release, the most current results available for tritium, gross alpha, Sr-89, Sr-90, Fe-55 and Ni-63 and the corresponding ECL values.
This ECL fraction is used, with appropriate safety factors, tolerance factors, and the minimum assured dilution stream flow to calculate maximum permissible release rates and a liquid effluent monitor setpoint. The monitor setpoint is calculated to assure that the limits of the Offsite Dose Calculation Manual (ODCM) are not exceeded.

A monitor reading in excess of the calculated setpoint results in an automatic termination of the liquid radwaste discharge. Liquid effluent discharge is also automatically terminated if the dilution stream flow rate falls below the minimum assured dilution flow rate used in the setpoint calculations and established as a setpoint on the dilution stream flow monitor.

Radionuclide concentrations, safety factors, dilution stream flow rate, and liquid effluent radiation monitor calibrations are entered into the computer and a pre-release printout is generated. If the release is not permissible, appropriate warnings will be displayed on the computer screen. If the release is permissible, it is approved by the Chemistry Department and sent to the Operations Department for release. When the release is completed, the necessary data from the release (i.e., release volume, etc.) is provided by the Operations Department to the Chemistry Department. This data is inputed to the computer and a post-release printout is generated. The post release printout contains the actual release rates, release concentrations and quantities, actual dilution flow, and calculated doses to an individual.

Typically achieved liquid effluent sample analyses minimum detectable concentrations are reported in Table 1-4.

1.3.2 Total Error Estimation

The total or maximum error associated with the effluent measurement includes the cumulative errors resulting from the total operation of sampling and measurement. Because it may be very difficult to assign error terms for each parameter affecting the final measurement, detailed statistical evaluation of error is not suggested. The objective should be to obtain an overall estimate of the error associated with measurements of radioactive materials released in effluents (Reference Reg. Guide 1.21 Rev 1). Total Error is calculated by the root mean square method. The root mean square value is the square root of the arithmetic mean (average) of the squares of the original values.

a. Fission and activation total release was calculated from sample analysis results and release point flow rates.

Sampling and statistical error	10%
Counting Equipment Calibration	10%
Tank Volumes and System Flow Rates	20%
TOTAL ERROR	24.5%

b. Total Tritium release was calculated from sample analysis results and release point volumes.

Sampling and statistical errors	10%
Counting equipment calibration	10%
Tank volumes and system flow rate	20%
TOTAL ERROR	24.5%

c. Dissolved and entrained gases were calculated from sample analysis results and release point volumes.

Sampling and statistical error	20%
Counting equipment calibration	10%
Tank volumes and system flow rate	20%
TOTAL ERROR	30%

d. Gross alpha radioactivity was calculated from sample analysis results and release point volumes.

Sampling and statistical error	10%
Counting Equipment calibration	10%
Tank volumes and system flowrates	20%
TOTAL ERROR	24.5%

1.3.2 Total Error Estimation cont'd

e. Volume of waste prior to dilution was calculated from level indicators on the tanks and pump discharge flow rates and times.

Level Indicator error	10%
Operator Interpretation of gauge	10%
TOTAL ERROR	14%

f. Volume of dilution water used was calculated from flow totalizers and pump discharge flow rates and times.

Flow totalizer error	10%
Operator interpretation of gauge	10%
TOTAL ERROR	14%

g. Gross alpha, Sr-89, Sr-90, Fe-55, Ni-63 and H-3 radioactivity has an additional error associated with sample compositing.

Compositing sample error	5%

1.4 Liquid Effluent Release Data

Regulatory Guide 1.21 Rev. 1 Tables 2A and 2B are found in this report as Tables 1-1A, 1-1B, 1-1C, 1-2A, 1-2B and 1-2C. Data is presented on a quarterly basis as required by Regulatory Guide 1.21 Rev. 1 for all four quarters.

1.5 Radiological Impact Due to Liquid Releases

Doses to an individual due to radioactivity in liquid effluent were calculated in accordance with the Offsite Dose Calculation Manual. Results are presented in Table 1-3A for Unit 1 and 1-3B for Unit 2, for all four quarters.

1.6 Liquid Effluents – Batch Releases

Batch release information for liquid effluents is presented in Table 1-5A for Unit 1 and Table 1-5B for Unit 2.

1.7 Liquid Effluents - Abnormal Releases

There were no abnormal liquid releases during 2019

.

Table 1-1A

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Summation Of All Releases
Unit: 1
Starting: 1-Jan- 2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Products					
1. Total Release (not including tritium, gases, alpha)	Curies	5.32E-03	4.64E-03	1.60E-03	2.83E-02
2. Average diluted concentration during period	uCi/mL	9.05E-10	2.02E-09	8.00E-10	8.22E-09
3. Percent of Applicable Limit	%	*	*	*	*
B. Tritium					
1. Total Release	Curies	4.03E+02	1.91E+02	1.39E+02	9.96E+01
2. Average diluted Concentration during period	uCi/mL	6.85E-05	8.34E-05	6.93E-05	2.89E-05
3. Percent of Applicable Limit	%	*	*	*	*
C. Dissolved and Entrained Gases					
1. Total Release	Curies	3.43E-03	1.79E-03	2.51E-04	1.00E-04
2. Average diluted Concentration during period	uCi/mL	5.83E-10	7.81E-10	1.25E-10	2.90E-11
3. Percent of Applicable Limit	%	*	*	*	*
D: Gross Alpha Radioactivity					
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E: Waste Vol Release (Pre-Dilution)	Liters	2.74E+07	2.51E+07	2.64E+07	2.52E+07
F. Volume of Dilution Water Used	Liters	5.85E+09	2.27E+09	1.97E+09	3.42E+09

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

Table 1-1B

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Summation Of All Releases
Unit: 2
Starting: 1-Jan- 2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Products					
1. Total Release (not including tritium, gases, alpha)	Curies	3.56E-03	5.16E-04	8.81E-05	1.07E-03
2. Average diluted concentration during period	uCi/mL	5.60E-10	2.34E-10	4.59E-11	3.18E-10
3. Percent of Applicable Limit	%	*	*	*	*
B. Tritium					
1. Total Release	Curies	2.97E+02	5.55E+01	6.93E+01	4.09E+01
2. Average diluted Concentration during period	uCi/mL	4.68E-05	2.52E-05	3.61E-05	1.22E-05
3. Percent of Applicable Limit	%	*	*	*	*
C. Dissolved and Entrained Gases					
1. Total Release	Curies	2.71E-03	3.88E-04	2.76E-04	0.00E+00
2. Average diluted Concentration during period	uCi/mL	4.27E-10	1.76E-10	1.44E-10	0.00E+00
3. Percent of Applicable Limit	%	*	*	*	*
D: Gross Alpha Radioactivity					
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E: Waste Vol Release (Pre-Dilution)	Liters	2.36E+07	1.38E+07	2.18E+07	2.20E+07
F. Volume of Dilution Water Used	Liters	6.33E+09	2.19E+09	1.90E+09	3.33E+09

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

Table 1-1C

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Summation Of All Releases
Unit: Site
Starting: 1-Jan- 2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Products					
1. Total Release (not including tritium, gases, alpha)	Curies	8.87E-03	5.16E-03	1.69E-03	2.94E-02
2. Average diluted concentration during period	uCi/mL	7.25E-10	1.15E-09	4.30E-10	4.32E-09
3. Percent of Applicable Limit	%	*	*	*	*
B. Tritium					
1. Total Release	Curies	7.00E+02	2.47E+02	2.08E+02	1.41E+02
2. Average diluted Concentration during period	uCi/mL	5.72E-05	5.49E-05	5.30E-05	2.07E-05
3. Percent of Applicable Limit	%	*	*	*	*
C. Dissolved and Entrained Gases					
1. Total Release	Curies	6.14E-03	2.18E-03	5.27E-04	1.00E-04
2. Average diluted Concentration during period	uCi/mL	5.02E-10	4.85E-10	1.34E-10	1.47E-11
3. Percent of Applicable Limit	%	*	*	*	*
D: Gross Alpha Radioactivity					
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E: Waste Vol Release (Pre-Dilution)	Liters	5.10E+07	3.88E+07	4.82E+07	4.72E+07
F. Volume of Dilution Water Used	Liters	1.22E+10	4.46E+09	3.87E+09	6.75E+09

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

Table 1-2A

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents
Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Nuclides Released	Unit	Continuous Mode			
		1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission & Activation Products					
Fe-55	Curies	0.00E+00	0.00E+00	0.00E+00	2.70E-02
Total For Period	**Curies**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**2.70E-02**
Tritium					
H-3	Curies	9.17E-02	8.15E-02	1.40E-01	1.12E-01
Dissolved And Entrained Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-2A

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents
Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission & Activation Products					
Co-58	Curies	1.67E-03	1.96E-03	3.64E-04	1.98E-04
Cs-137	Curies	0.00E+00	0.00E+00	3.86E-06	8.65E-06
Sb-125	Curies	0.00E+00	0.00E+00	2.23E-05	1.52E-05
Fe-59	Curies	0.00E+00	1.50E-05	0.00E+00	0.00E+00
Cr-51	Curies	0.00E+00	3.18E-04	3.09E-05	0.00E+00
Fe-55	Curies	7.26E-04	6.97E-04	1.39E-04	2.26E-04
Co-60	Curies	6.19E-04	7.86E-04	4.30E-04	2.79E-04
Mn-54	Curies	1.60E-05	5.34E-05	3.36E-05	1.78E-05
Nb-95	Curies	3.99E-06	1.54E-04	6.18E-05	1.02E-05
Ni-63	Curies	5.35E-04	5.79E-04	4.78E-04	6.13E-04
Zr-95	Curies	0.00E+00	8.11E-05	3.65E-05	0.00E+00
Sn-117M	Curies	3.36E-06	0.00E+00	0.00E+00	0.00E+00
Co-57	Curies	1.05E-06	0.00E+00	0.00E+00	2.05E-06
Y-88	Curies	3.08E-08	0.00E+00	0.00E+00	0.00E+00
Te-125M	Curies	1.74E-03	0.00E+00	0.00E+00	0.00E+00
Total For Period	**Curies**	**5.32E-03**	**4.64E-03**	**1.60E-03**	**1.37E-03**
Tritium					
H-3	Curies	4.03E+02	1.91E+02	1.38E+02	9.95E+01
Dissolved And Entrained Gases					
Xe-135	Curies	1.62E-05	0.00E+00	0.00E+00	0.00E+00
Xe-133	Curies	3.41E-03	1.79E-03	2.51E-04	1.00E-04
Total For Period	**Curies**	**3.43E-03**	**1.79E-03**	**2.51E-04**	**1.00E-04**

Table 1-2A

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents
Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-2B

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents
Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Nuclides Released	Unit	Continuous Mode			
		1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission & Activation Products					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
H-3	Curies	5.65E-02	3.27E-02	1.03E-01	1.44E-01
Dissolved And Entrained Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-2B

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents
Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission & Activation Products					
Cs-137	Curies	0.00E+00	0.00E+00	0.00E+00	6.47E-06
Co-58	Curies	8.91E-04	2.99E-04	2.91E-05	4.40E-05
Fe-55	Curies	4.64E-04	4.48E-05	1.69E-05	6.31E-05
Ni-63	Curies	2.67E-04	9.24E-05	2.16E-05	1.30E-04
Sr-90	Curies	3.93E-06	0.00E+00	0.00E+00	0.00E+00
Te-125M	Curies	0.00E+00	0.00E+00	0.00E+00	7.43E-04
Nb-95	Curies	1.53E-05	0.00E+00	0.00E+00	0.00E+00
Mn-54	Curies	7.50E-05	0.00E+00	0.00E+00	4.77E-06
Co-57	Curies	6.89E-06	0.00E+00	0.00E+00	0.00E+00
Co-60	Curies	1.83E-03	7.97E-05	2.06E-05	7.58E-05
Total For Period	**Curies**	**3.56E-03**	**5.16E-04**	**8.81E-05**	**1.07E-03**
Tritium					
H-3	Curies	2.97E+02	5.55E+01	6.92E+01	4.08E+01
Dissolved And Entrained Gases					
Xe-135	Curies	1.10E-06	0.00E+00	0.00E+00	0.00E+00
Xe-133	Curies	2.71E-03	3.88E-04	2.76E-04	0.00E+00
Total For Period	**Curies**	**2.71E-03**	**3.88E-04**	**2.76E-04**	**0.00E+00**
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-2C

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents
Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission & Activation Products					
Fe-55	Curies	0.00E+00	0.00E+00	0.00E+00	2.70E-02
Total For Period	**Curies**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**2.70E-02**
Tritium					
H-3	Curies	1.48E-01	1.14E-01	2.43E-01	2.56E-01
Dissolved And Entrained Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-2C

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents
Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Nuclides Released	Unit	Batch Mode 1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission & Activation Products					
Fe-55	Curies	1.19E-03	7.42E-04	1.56E-04	2.89E-04
Cr-51	Curies	0.00E+00	3.18E-04	3.09E-05	0.00E+00
Nb-95	Curies	1.93E-05	1.54E-04	6.18E-05	1.02E-05
Sb-125	Curies	0.00E+00	0.00E+00	2.23E-05	1.52E-05
Te-125M	Curies	1.74E-03	0.00E+00	0.00E+00	7.43E-04
Co-60	Curies	2.45E-03	8.65E-04	4.50E-04	3.54E-04
Cs-137	Curies	0.00E+00	0.00E+00	3.86E-06	1.51E-05
Co-57	Curies	7.94E-06	0.00E+00	0.00E+00	2.05E-06
Sn-117M	Curies	3.36E-06	0.00E+00	0.00E+00	0.00E+00
Zr-95	Curies	0.00E+00	8.11E-05	3.65E-05	0.00E+00
Y-88	Curies	3.08E-08	0.00E+00	0.00E+00	0.00E+00
Ni-63	Curies	8.02E-04	6.72E-04	5.00E-04	7.43E-04
Fe-59	Curies	0.00E+00	1.50E-05	0.00E+00	0.00E+00
Co-58	Curies	2.56E-03	2.26E-03	3.93E-04	2.42E-04
Mn-54	Curies	9.11E-05	5.34E-05	3.36E-05	2.25E-05
Sr-90	Curies	3.93E-06	0.00E+00	0.00E+00	0.00E+00
Total For Period	**Curies**	**8.87E-03**	**5.16E-03**	**1.69E-03**	**2.44E-03**
Tritium					
H-3	Curies	7.00E+02	2.47E+02	2.08E+02	1.40E+02

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-2C

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents
Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Dissolved And Entrained Gases					
Xe-133	Curies	6.12E-03	2.18E-03	5.27E-04	1.00E-04
Xe-135	Curies	1.73E-05	0.00E+00	0.00E+00	0.00E+00
Total For Period	**Curies**	**6.14E-03**	**2.18E-03**	**5.27E-04**	**1.00E-04**
Gross Alpha Radioactivity					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

Table 1-3A

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Doses to a member of the public due to Liquid Releases
Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Organ	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Total Body	1.50E+00	mRem	1.57E-02	1.05E+00	5.56E-03	3.71E-01	6.51E-03	4.34E-01	1.21E-02	8.08E-01
Thyroid	5.00E+00	mRem	1.57E-02	3.13E-01	5.52E-03	1.10E-01	6.45E-03	1.29E-01	4.17E-03	8.33E-02
Liver	5.00E+00	mRem	1.57E-02	3.14E-01	5.59E-03	1.12E-01	6.55E-03	1.31E-01	3.80E-02	7.61E-01
GI-Lli	5.00E+00	mRem	1.60E-02	3.19E-01	5.84E-03	1.17E-01	6.61E-03	1.32E-01	2.36E-02	4.72E-01
Lung	5.00E+00	mRem	1.57E-02	3.14E-01	5.53E-03	1.11E-01	6.54E-03	1.31E-01	2.30E-02	4.61E-01
Bone	5.00E+00	mRem	5.71E-04	1.14E-02	6.23E-04	1.25E-02	5.34E-04	1.07E-02	4.94E-02	9.89E-01
Kidney	5.00E+00	mRem	1.59E-02	3.17E-01	5.52E-03	1.10E-01	6.47E-03	1.29E-01	4.20E-03	8.40E-02

Cumulative Doses per Year

Organ	ODCM Lmt	Units	Year to Ending Date	% ODCM	Receptor	Limit
Kidney	1.00E+01	mRem	3.20E-02	3.20E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Bone	1.00E+01	mRem	5.12E-02	5.12E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Lung	1.00E+01	mRem	5.08E-02	5.08E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
GI-Lli	1.00E+01	mRem	5.20E-02	5.20E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Liver	1.00E+01	mRem	6.59E-02	6.59E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Thyroid	1.00E+01	mRem	3.18E-02	3.18E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Total Body	3.00E+00	mRem	3.99E-02	1.33E+00	Maximum Individual Liquid	Liquid Effluent TB Annual

Table 1-3B

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Doses to a member of the public due to Liquid Releases
Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Organ	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Kidney	5.00E+00	mRem	1.20E-02	2.40E-01	2.65E-03	5.31E-02	2.92E-03	5.84E-02	2.37E-03	4.75E-02
Thyroid	5.00E+00	mRem	1.20E-02	2.40E-01	2.65E-03	5.31E-02	2.92E-03	5.84E-02	2.18E-03	4.35E-02
Total Body	1.50E+00	mRem	1.20E-02	8.02E-01	2.66E-03	1.77E-01	2.92E-03	1.95E-01	2.24E-03	1.49E-01
Lung	5.00E+00	mRem	1.20E-02	2.40E-01	2.66E-03	5.32E-02	2.93E-03	5.85E-02	2.18E-03	4.36E-02
Liver	5.00E+00	mRem	1.20E-02	2.40E-01	2.66E-03	5.32E-02	2.92E-03	5.85E-02	2.29E-03	4.58E-02
Bone	5.00E+00	mRem	3.44E-04	6.88E-03	1.03E-04	2.06E-03	2.03E-05	4.06E-04	2.52E-04	5.04E-03
GI-Lli	5.00E+00	mRem	1.22E-02	2.44E-01	2.68E-03	5.36E-02	2.93E-03	5.86E-02	2.36E-03	4.72E-02

Cumulative Doses per Year

Organ	ODCM Lmt	Units	Year to Ending Date	% ODCM	Receptor	Limit
GI-Lli	1.00E+01	mRem	2.02E-02	2.02E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Bone	1.00E+01	mRem	7.19E-04	7.19E-03	Maximum Individual Liquid	Liquid Effluent Organ Annual
Liver	1.00E+01	mRem	1.99E-02	1.99E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Lung	1.00E+01	mRem	1.98E-02	1.98E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Total Body	3.00E+00	mRem	1.99E-02	6.62E-01	Maximum Individual Liquid	Liquid Effluent TB Annual
Thyroid	1.00E+01	mRem	1.97E-02	1.97E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Kidney	1.00E+01	mRem	1.99E-02	1.99E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual

Table 1-3C

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Doses to a member of the public due to Liquid Releases
Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Organ	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Thyroid	5.00E+00	mRem	2.77E-02	5.53E-01	8.17E-03	1.63E-01	9.37E-03	1.87E-01	6.34E-03	1.27E-01
Bone	5.00E+00	mRem	9.15E-04	1.83E-02	7.26E-04	1.45E-02	5.54E-04	1.11E-02	4.97E-02	9.94E-01
Lung	5.00E+00	mRem	2.77E-02	5.54E-01	8.19E-03	1.64E-01	9.47E-03	1.89E-01	2.52E-02	5.04E-01
GI-Lli	5.00E+00	mRem	2.81E-02	5.63E-01	8.52E-03	1.70E-01	9.54E-03	1.91E-01	2.59E-02	5.19E-01
Kidney	5.00E+00	mRem	2.78E-02	5.57E-01	8.17E-03	1.63E-01	9.39E-03	1.88E-01	6.58E-03	1.32E-01
Total Body	1.50E+00	mRem	2.77E-02	1.85E+00	8.22E-03	5.48E-01	9.44E-03	6.29E-01	1.44E-02	9.57E-01
Liver	5.00E+00	mRem	2.77E-02	5.55E-01	8.25E-03	1.65E-01	9.47E-03	1.89E-01	4.03E-02	8.07E-01

Cumulative Doses per Year

Organ	ODCM Lmt	Units	Year to Ending Date	% ODCM	Receptor	Limit
Liver	1.00E+01	mRem	8.58E-02	8.58E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Total Body	3.00E+00	mRem	5.97E-02	1.99E+00	Maximum Individual Liquid	Liquid Effluent TB Annual
Kidney	1.00E+01	mRem	5.20E-02	5.20E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
GI-Lli	1.00E+01	mRem	7.22E-02	7.22E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Lung	1.00E+01	mRem	7.06E-02	7.06E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Bone	1.00E+01	mRem	5.19E-02	5.19E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual
Thyroid	1.00E+01	mRem	5.15E-02	5.15E-01	Maximum Individual Liquid	Liquid Effluent Organ Annual

Table 1-4

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
MINIMUM DETECTABLE CONCENTRATIONS – LIQUID SAMPLE ANALYSES

Starting: 1-Jan-2019 Ending: 31-Dec-2019

The values in this table represent a priori Minimum Detectable Concentrations (MDC) that are typically achieved in laboratory analyses of liquid radwaste samples.

RADIONUCLIDE	MDC	UNITS
Mn-54	2.73E-08	μCi/ml
Fe-59	8.33E-08	μCi/ml
Co-58	3.78E-08	μCi/ml
Co-60	6.76E-08	μCi/ml
Zn-65	1.32E-07	μCi/ml
Mo-99	4.31E-07	μCi/ml
Cs-134	3.06E-08	μCi/ml
Cs-137	4.51E-08	μCi/ml
Ce-141	6.99E-08	μCi/ml
Ce-144	2.95E-07	μCi/ml
I-131	5.97E-08	μCi/ml
Xe-133	9.11E-08	μCi/ml
Xe-135	4.27E-08	μCi/ml
Fe-55	1.00E-06	μCi/ml
Sr-89	5.00E-08	μCi/ml
Sr-90	7.00E-09	μCi/ml
H-3	2.00E-06	μCi/ml
Gross Alpha	7.00E-08	μCi/m

Table 1-5A

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Batch Release Summary
Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Liquid Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of batch releases		11	8	5	4	28
2. Total time period for Batch releases	(Minutes)	3.56E+03	2.37E+03	2.32E+03	1.76E+03	1.00E+04
3. Maximum time period for a batch release	(Minutes)	5.44E+02	3.23E+02	7.99E+02	6.06E+02	7.99E+02
4. Average time period for a batch release	(Minutes)	3.24E+02	2.96E+02	4.64E+02	4.39E+02	3.57E+02
5. Minimum time period for a batch release	(Minutes)	2.01E+02	2.78E+02	2.16E+02	2.66E+02	2.01E+02
6. Average stream flow during periods of release of liquid effluent into a flowing stream *	(CFS)	2.0957E+04	1.0516E+04	6.1573E+03	6.2110E+03	1.0960E+04

Average river flowrate taken from USGS Monitoring Station 02197500, Savannah River at Burton's Ferry Bridge near Millhaven, GA. 32 miles downstream

Table 1-5B

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Batch Release Summary
Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Liquid Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of batch releases		10	4	2	2	18
2. Total time period for Batch releases	(Minutes)	2.37E+03	1.17E+03	1.10E+03	5.29E+02	5.17E+03
3. Maximum time period for a batch release	(Minutes)	4.46E+02	4.38E+02	9.11E+02	2.99E+02	9.11E+02
4. Average time period for a batch release	(Minutes)	2.37E+02	2.93E+02	5.49E+02	2.65E+02	2.87E+02
5. Minimum time period for a batch release	(Minutes)	5.10E+01	7.20E+01	1.87E+02	2.30E+02	5.10E+01
6. Average stream flow during periods of release of liquid effluent into a flowing stream *	(CFS)	2.0957E+04	1.0516E+04	6.1573E+03	6.2110E+03	1.0960E+04

Average river flowrate taken from USGS Monitoring Station 02197500, Savannah River at Burton's Ferry Bridge near Millhaven, GA. 32 miles downstream

Table 1-5C

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Batch Release Summary
Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Liquid Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of batch releases		21	12	7	6	46
2. Total time period for Batch releases	(Minutes)	5.93E+03	3.54E+03	3.42E+03	2.29E+03	1.52E+04
3. Maximum time period for a batch release	(Minutes)	5.44E+02	4.38E+02	9.11E+02	6.06E+02	9.11E+02
4. Average time period for a batch release	(Minutes)	2.83E+02	2.95E+02	4.88E+02	3.81E+02	3.30E+02
5. Minimum time period for a batch release	(Minutes)	5.10E+01	7.20E+01	1.87E+02	2.30E+02	5.10E+01
6. Average stream flow during periods of release of liquid effluent into a flowing stream *	(CFS)	2.0957E+04	1.0516E+04	6.1573E+03	6.2110E+03	1.0960E+04

Average river flowrate taken from USGS Monitoring Station 02197500, Savannah River at Burton's Ferry Bridge near Millhaven, GA. 32 miles downstream

Table 1-6A

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Abnormal Release Summary
Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Liquid Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 1-6B

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Abnormal Release Summary
Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Liquid Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 1-6C

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Liquid Effluents - Abnormal Release Summary
Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Liquid Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

2.0 Gaseous Effluents

2.1 Regulatory Requirements

The ODCM Specifications presented in this section are for Unit 1 and Unit 2.

2.1.1 Dose Rate Limits

The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY shall be limited to the following:

a. For noble gases, Less than or equal to 500 mrems/yr. to the whole body and less than or equal to 3000 mrems/yr. to the skin and,

b. For Iodine-131, for Iodine-133, for tritium and for all radionuclides in particulate form with half lives greater than 8 days: Less than or equal to 1500 mrems/yr. to any organ.

2.1.2 Air Doses Due to Noble Gases in Gaseous Releases

The air dose due to noble gases released in gaseous effluents, from each unit, to areas at and beyond the SITE BOUNDARY shall be limited to the following:

a. During any calendar quarter: Less than or equal to 5 mrads for gamma radiation and less than or equal to 10 mrads for beta radiation, and

b. During any calendar year: Less than or equal to 10 mrads for gamma radiation and less than or equal to 20 mrads for beta radiation.

2.1.3 Doses to a Member of the Public

The dose to a MEMBER OF THE PUBLIC from Iodine-131, Iodine-133, tritium and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released, from each unit, to areas at and beyond the SITE BOUNDARY shall be limited to the following.

a. During any calendar quarter: Less than or equal to 7.5 mrems to any organ.

b. During any calendar year: Less than or equal to 15 mrems to any organ.

2.2 Measurements and Approximations of Total Radioactivity

2.2.1 Sample Collection and Analysis

Gaseous Effluents at the Vogtle Electric Generating Plant are currently confined to five paths: plant vents (Unit 1 and Unit 2), the condenser air ejector, the steam packing exhauster systems (Unit 1 and Unit 2), and the Radwaste Processing Facility (RPF).

Waste gas decay tanks are batch released through the Unit 1 plant vent. The containment purges are released through their respective plant vents. Containment atmosphere is also released via the containment equipment hatch during periods when the equipment hatch is open with containment purge/vent being stopped. Approval was granted by the NRC to open the equipment hatch during fuel movement; a release permit is generated when the equipment hatch is opened and the containment exhaust fan is not discharging to the plant vent. Any detected activity in the containment equipment hatch permit is included in the Ground Release Table of the effluent report.

All of the paths with the exception of the RPF can be continuously monitored for gaseous radioactivity. The RPF is equipped with an integrated-type sample collection device for collecting particulates. Plant vent, containment, steam jet air ejector, steam-packing exhauster are equipped with an integrated-type sample collection device for collecting particulates and iodines. During this reporting period, there were no continuous radioactive releases through the condenser air ejector and the steam packing exhauster system vents. Batch Waste Gas Decay Tank releases are analyzed for noble gases before each release. The containment atmosphere is analyzed for noble gases prior to each release and for tritium at least on a monthly basis.

Sample analysis results and release flow rates form the basis for calculating released quantities of radionuclide specific radioactivity, dose rates associated with gaseous releases, and cumulative doses for the current quarter and year.

With each release period and batch release, radioactivity, dose rates, and cumulative doses are calculated. Cumulative dose results are tabulated, along with the percent of the ODCM limits for each release for the current quarter and year.

Typically achieved minimum detectable concentrations for gaseous effluent sample analyses are reported in Table 2-6.

2.2.2 Total Quantities of Radioactivity, Dose Rates, and Cumulative Doses

The methods for determining release quantities of radioactivity, dose rates, and cumulative doses are as follows:

2.2.2.1 Fission and Activation Gases

The released radioactivity is determined from sample analysis results collected as described above and average release flow rates over the period represented by the collected sample. Dose rates due to noble gases, radioiodines, tritium, and particulates are calculated. Calculated dose rates are compared to the dose rate limits specified in ODCM 3.1.2 for noble gases, radioiodines, tritium, and particulates. Dose rate calculation methodology is presented in the ODCM.

Beta and gamma air doses due to noble gases are calculated for the location in the unrestricted area with the potential for the highest exposure due to gaseous releases. Air doses are calculated for each release period and cumulative totals are kept for each unit for the calendar quarter and year. Cumulative air doses are compared with the dose limits specified in ODCM 3.1.3. Current percent of the ODCM limits are shown on the printout for each release period. Air dose calculation methodology is presented in the ODCM.

2.2.2.2 Radioiodines, Tritium and Particulate Releases

The released quantities of radioiodines, tritium and particulates are determined using the weekly samples and release flow rates for the two plant vent release points.

After each quarter, the particulate filters from each plant vent are combined, for strontium analysis. Strontium concentrations are input to the composite file of the computer to be used for release dose rate and individual dose calculations.

Doses to a Member of the Public due to radioiodines, tritium and particulates are calculated for the controlling receptor, which is described in Table 3-7of the ODCM. Doses are calculated for each release period, and cumulative totals are kept for each unit for the current calendar quarter and year. Cumulative doses are compared to the dose limits specified in ODCM 3.1.4.

Current percent of ODCM limits are shown in this report for each release period.

2.2.2.3 Gross Alpha Release

The gross alpha release is calculated each month by counting the particulate filters for each week for gross alpha activity. The four or five weeks' numbers are then recorded on a data sheet and the activity is summed at the end of the month. This concentration is used for release calculations.

2.2.3 Total Error Estimation

The total or maximum error associated with the effluent measurement will include the cumulative errors resulting from the total operation of sampling and measurement. Because it may be very difficult to assign error terms for each parameter affecting the final measurement, detailed statistical evaluation of error are not suggested. The objective should be to obtain an overall estimate of the error associated with measurements of radioactive materials released in liquid and gaseous effluents and solid waste.

Estimated errors are based on errors in counting equipment calibration, counting statistics, vent-flow rates, vent sample flow rates, non-steady release rates, chemical yield factors, and sample losses for such items as charcoal cartridges. Total Error is calculated by the root mean square method. The root mean square value is the square root of the arithmetic mean (average) of the squares of the original values.

a. Fission and activation total release was calculated from sample analysis results and release point flow rates.

Sampling and statistical error in counting	10%
Counting equipment calibration	10%
Vent flow Rates	10%
Non-steady release rates	20%
TOTAL ERROR	26.5%

b. I-131 releases were calculated from each weekly sample:

Statistical error in counting	10%
Counting equipment calibration	10%
Vent Flow Rates	10%
Vent Sample Flow Rates	50%
Non-Steady release rates	10%
Losses from charcoal cartridges	10%
TOTAL ERROR	55%

c. Particulates with half-lives greater than 8 day releases were calculated from sample and analysis results and release point flow rates.

Statistical error at MDC concentration	10%
Counting equipment calibration	10%
Vent flow rates	10%
Vent sample flow rates	50%
Non steady release rates	10%
TOTAL ERROR	54%

2.2.3 Total Error Estimation cont'd

d. Total tritium releases were calculated from sample analysis results and release point flow rates.

Water vapor in sample stream determination	10%
Vent flow rates	10%
Counting calibration and statistics	10%
Non-steady release rates	10%
TOTAL ERROR	20%

e. Gross Alpha radioactivity was calculated from sample analysis results and release point flow rates.

Statistical error at MDC concentration	10%
Counting equipment calibration	10%
Vent flow rates	10%
Vent sample flow rates	50%
Non Steady release rates	10%
TOTAL ERROR	55%

2.3 Gaseous Effluent Release Data

Regulatory Guide 1.21 Rev. 1 Tables 1A, 1B, and 1C are found in this report as Tables 2-1A, 2-1B, 2-1C, 2-2A, 2-2B, 2-2C, 2-3A, 2-3B, and 2-3C. Data are presented on a quarterly basis as required by Regulatory Guide 1.21 Rev. 1.

To complete table 2-1A, and 2-1B, the total release for each of the four categories (fission and activation gases, iodines, particulates, and tritium) was divided by the number of seconds in the quarter to obtain a release rate in μCi/second for each category. However, the percent of the ODCM limits are not applicable because VEGP has no curie limits for gaseous releases. Applicable limits are expressed in terms of dose. Noble gases are limited as specified in ODCM 3.1.2. The other three categories (tritium, radioiodines, and particulates) are limited as a group as specified in ODCM 3.1.2.

Dose rates due to noble gas releases and due to radioiodines, tritium, and particulate releases were calculated as part of the pre-release and post-release permits. No limits were exceeded for this reporting period.

Gross alpha radioactivity is reported in Table 2-1A and 2-1B as curies released in each quarter.

Limits for cumulative beta and gamma air doses due to noble gases are specified in ODCM 3.1.3. Cumulative air doses are presented in Table 2-4A, and 2-4B along with the percent of the ODCM limits.

Limits for cumulative doses to a Member of the Public due to radioiodines, tritium and particulates, are specified in ODCM 3.1.4. Cumulative doses to a Member of the Public are presented in Table 2-5A, and 2-5B along with percent of ODCM limits.

2.4 Radiological Impact Due to Gaseous Releases

Dose rates due to the release of noble gases were calculated for the site in accordance with ODCM 3.4.1.1. Dose rates due to radioiodines, tritium, and particulates in gaseous releases were calculated in accordance with ODCM 3.4.1.2.

Dose rates were calculated as part of pre-release and post release permits. No limits were exceeded for this reporting period.

Cumulative air doses due to noble gas releases were calculated for each unit in accordance with ODCM 3.4.2. These results are presented in Tables 2-4A and 2-4B.

Cumulative doses to a Member of the Public were calculated for each unit in accordance with ODCM 3.4.3. These results are presented in Tables 2-5A and 2-5B.

Dose rates and doses were calculated using the methodology presented in the Vogtle Electric Generating Plant Offsite Dose Calculation Manual.

2.5 Gaseous Effluents - Batch Releases

Other data pertinent to batch releases of radioactive gaseous effluent from Unit 1 and Unit 2 are listed in Table 2-7A and 2-7B.

2.6 Gaseous Effluents - Abnormal Releases

There were no abnormal releases for 2019.

Table 2-1A

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Summation Of All Releases
Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Gases					
1. Total Release	Curies	2.04E+01	1.86E+01	4.97E+01	6.21E+01
2. Average Release rate for period	uCi/sec	2.59E+00	2.35E+00	6.31E+00	7.87E+00
3. Percent of Applicable Limit	%	*	*	*	*
B. Radioiodines					
1. Total Iodine-131	Curies	2.19E-08	0.00E+00	0.00E+00	0.00E+00
2. Average Release rate for period	uCi/sec	2.78E-09	0.00E+00	0.00E+00	0.00E+00
3. Percent of Applicable Limit	%	*†	*	*	*
C. Particulates					
1. Particulates (Half-Lives > 8 Days)	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2. Average Release rate for period	uCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Percent of Applicable Limit	%	*	*	*	*
D. Tritium					
1. Total Release	Curies	5.73E+01	5.15E+00	1.55E+01	1.72E+01
2. Average Release rate for period	uCi/sec	7.27E+00	6.54E-01	1.97E+00	2.18E+00
3. Percent of Applicable Limit	%	*	*	*	*
E. Gross Alpha					
1. Total Release	Curies	1.52E-06	1.34E-06	1.36E-06	1.27E-06
2. Average Release rate for period	uCi/sec	1.93E-07	1.70E-07	1.72E-07	1.61E-07

* Applicable limits are expressed in terms of dose. See Tables 2-4A, 2-4B, 2-5A, 2-5B of this report.

† A Unit 1 fuel leak, which developed in October 2018, explains increases in radioisotopic concentrations between 2019 and 2018.

Table 2-1B

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Summation Of All Releases
Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Gases					
1. Total Release	Curies	4.64E-01	2.34E-02	1.41E+00	3.20E-02
2. Average Release rate for period	uCi/sec	5.89E-02	2.97E-03	1.79E-01	4.06E-03
3. Percent of Applicable Limit	%	*	*	*	*
B. Radioiodines					
1. Total Iodine-131	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2. Average Release rate for period	uCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Percent of Applicable Limit	%	*	*	*	*
C. Particulates					
1. Particulates (Half-Lives > 8 Days)	Curies	7.96E-05	0.00E+00	0.00E+00	3.68E-08
2. Average Release rate for period	uCi/sec	1.01E-05	0.00E+00	0.00E+00	4.67E-09
3. Percent of Applicable Limit	%	*	*	*	*
D. Tritium					
1. Total Release	Curies	2.43E+01	5.13E-03	7.37E+00	7.72E+00
2. Average Release rate for period	uCi/sec	3.09E+00	6.51E-04	9.34E-01	9.79E-01
3. Percent of Applicable Limit	%	*	*	*	*
E. Gross Alpha					
1. Total Release	Curies	1.05E-06	6.17E-07	7.87E-07	4.88E-07
2. Average Release rate for period	uCi/sec	1.33E-07	7.83E-08	9.99E-08	6.19E-08

* Applicable limits are expressed in terms of dose. See Tables 2-4A, 2-4B, 2-5A, 2-5B of this report.

Table 2-1C

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Summation Of All Releases
Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Type of Effluent	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
A. Fission And Activation Gases					
1. Total Release	Curies	2.09E+01	1.86E+01	5.12E+01	6.21E+01
2. Average Release rate for period	uCi/sec	2.65E+00	2.36E+00	6.49E+00	7.88E+00
3. Percent of Applicable Limit	%	*	*	*	*
B. Radioiodines					
1. Total Iodine-131	Curies	2.19E-08	0.00E+00	0.00E+00	0.00E+00
2. Average Release rate for period	uCi/sec	2.78E-09	0.00E+00	0.00E+00	0.00E+00
3. Percent of Applicable Limit	%	*†	*	*	*
C. Particulates					
1. Particulates (Half-Lives > 8 Days)	Curies	7.96E-05	0.00E+00	0.00E+00	3.68E-08
2. Average Release rate for period	uCi/sec	1.01E-05	0.00E+00	0.00E+00	4.67E-09
3. Percent of Applicable Limit	%	*	*	*	*
D. Tritium					
1. Total Release	Curies	8.16E+01	5.16E+00	2.29E+01	2.49E+01
2. Average Release rate for period	uCi/sec	1.04E+01	6.54E-01	2.90E+00	3.16E+00
3. Percent of Applicable Limit	%	*	*	*	*
E. Gross Alpha					
1. Total Release	Curies	2.57E-06	1.96E-06	2.14E-06	1.75E-06
2. Average Release rate for period	uCi/sec	3.26E-07	2.49E-07	2.72E-07	2.22E-07

* Applicable limits are expressed in terms of dose. See Tables 2-4A, 2-4B, 2-5A, 2-5B of this report.

† A Unit 1 fuel leak, which developed in October 2018, explains increases in radioisotopic concentrations between 2019 and 2018.

Table 2-2A

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Mixed Mode Level Releases
Unit: 1
Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
Xe-133	Curies	1.03E+01	1.43E+01	4.38E+01	5.49E+01
Total For Period	**Curies**	**1.03E+01** †	**1.43E+01** †	**4.38E+01** †	**5.49E+01** †
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
H-3	Curies	9.79E+00	5.09E+00	1.47E+01	1.63E+01
Gross Alpha					
G-Alpha	Curies	1.44E-06	1.34E-06	1.36E-06	1.26E-06
Total For Period	**Curies**	**1.44E-06**	**1.34E-06**	**1.36E-06**	**1.26E-06**

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.
† A Unit 1 fuel leak, which developed in October 2018, explains increases in radioisotopic concentrations between 2019 and 2018.

Table 2-2A

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Mixed Mode Level Releases
Unit: 1
Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
Ar-41	Curies	6.73E-02	6.26E-02	7.77E-02	8.85E-02
Xe-131M	Curies	1.46E-01	3.56E-02	1.17E-01	1.27E-01
Xe-133M	Curies	7.72E-02	2.15E-02	2.55E-02	3.40E-02
Xe-133	Curies	9.76E+00	4.18E+00	5.71E+00	6.94E+00
Xe-135	Curies	1.55E-02	2.18E-03	1.61E-03	3.39E-03
Total For Period	**Curies**	**1.01E+01** †	**4.30E+00** †	**5.93E+00** †	**7.19E+00** †
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
H-3	Curies	5.87E-02	3.18E-02	3.51E-02	4.00E-02
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.
† A Unit 1 fuel leak, which developed in October 2018, explains increases in radioisotopic concentrations between 2019 and 2018.

Table 2-2B

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Mixed Mode Level Releases
Unit: 2
Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
Xe-133	Curies	0.00E+00	0.00E+00	1.38E+00	0.00E+00
Total For Period	**Curies**	**0.00E+00**	**0.00E+00**	**1.38E+00**	**0.00E+00**
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
Co-60	Curies	2.22E-07	0.00E+00	0.00E+00	0.00E+00
Sr-90	Curies	0.00E+00	0.00E+00	0.00E+00	3.68E-08
Total For Period	**Curies**	**2.22E-07**	**0.00E+00**	**0.00E+00**	**3.68E-08**
Tritium					
H-3	Curies	2.42E+01	0.00E+00	7.36E+00	7.71E+00
Gross Alpha					
G-Alpha	Curies	1.05E-06	6.17E-07	7.87E-07	4.88E-07
Total For Period	**Curies**	**1.05E-06**	**6.17E-07**	**7.87E-07**	**4.88E-07**

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2B

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Mixed Mode Level Releases
Unit: 2
Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
Ar-41	Curies	2.11E-01	2.24E-02	2.14E-02	2.55E-02
Xe-133	Curies	2.18E-01	1.04E-03	7.84E-03	6.12E-03
Xe-135	Curies	2.70E-02	0.00E+00	0.00E+00	3.19E-04
Total For Period	**Curies**	**4.56E-01**	**2.34E-02**	**2.92E-02**	**3.20E-02**
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
H-3	Curies	1.09E-01	5.13E-03	4.70E-03	6.43E-03
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-2C

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Mixed Mode Level Releases
Unit: Site
Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
Xe-133	Curies	1.03E+01	1.43E+01	4.52E+01	5.49E+01
Total For Period	**Curies**	**1.03E+01** †	**1.43E+01** †	**4.52E+01** †	**5.49E+01** †
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
Co-60	Curies	2.22E-07	0.00E+00	0.00E+00	0.00E+00
Sr-90	Curies	0.00E+00	0.00E+00	0.00E+00	3.68E-08
Total For Period	**Curies**	**2.22E-07**	**0.00E+00**	**0.00E+00**	**3.68E-08**
Tritium					
H-3	Curies	3.40E+01	5.09E+00	2.21E+01	2.40E+01
Gross Alpha					
G-Alpha	Curies	2.49E-06	1.96E-06	2.14E-06	1.75E-06
Total For Period	**Curies**	**2.49E-06**	**1.96E-06**	**2.14E-06**	**1.75E-06**

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.
† A Unit 1 fuel leak, which developed in October 2018, explains increases in radioisotopic concentrations between 2019 and 2018.

Table 2-2C

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Mixed Mode Level Releases
Unit: Site
Starting: 1-Jan- 2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
Ar-41	Curies	2.78E-01	8.50E-02	9.90E-02	1.14E-01
Xe-131M	Curies	1.46E-01	3.56E-02	1.17E-01	1.27E-01
Xe-133M	Curies	7.72E-02	2.15E-02	2.55E-02	3.40E-02
Xe-133	Curies	9.98E+00	4.18E+00	5.72E+00	6.95E+00
Xe-135	Curies	4.25E-02	2.18E-03	1.61E-03	3.71E-03
Total For Period	**Curies**	**1.05E+01** †	**4.32E+00** †	**5.96E+00** †	**7.23E+00** †
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
H-3	Curies	1.68E-01	3.69E-02	3.98E-02	4.64E-02
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.
† A Unit 1 fuel leak, which developed in October 2018, explains increases in radioisotopic concentrations between 2019 and 2018.

Table 2-3A

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Ground Level Releases
Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
I-131	Curies	2.19E-08	0.00E+00	0.00E+00	0.00E+00
Total For Period	**Curies**	**2.19E-08** †	**0.00E+00**	**0.00E+00**	**0.00E+00**
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
H-3	Curies	1.03E-01	2.73E-02	9.98E-02	3.23E-01
Gross Alpha					
G-Alpha	Curies	8.27E-08	3.27E-09	6.53E-10	7.03E-09
Total For Period	**Curies**	**8.27E-08**	**3.27E-09**	**6.53E-10**	**7.03E-09**

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.
† A Unit 1 fuel leak, which developed in October 2018, explains increases in radioisotopic concentrations between 2019 and 2018.

Table 2-3A

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Ground Level Releases
Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Nuclides Released	Unit	Batch Mode 1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
H-3	Curies	4.74E+01 †	0.00E+00	6.42E-01 †	5.47E-01 †
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.
† A Unit 1 fuel leak, which developed in October 2018, explains increases in radioisotopic concentrations between 2019 and 2018.

Table 2-3B

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Ground Level Releases
Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Nuclides Released	Unit	Continuous Mode			
		1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-3B

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Ground Level Releases
Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
Ar-41	Curies	8.43E-04	0.00E+00	0.00E+00	0.00E+00
Xe-133	Curies	6.37E-03	0.00E+00	0.00E+00	0.00E+00
Xe-135	Curies	1.06E-03	0.00E+00	0.00E+00	0.00E+00
Total For Period	**Curies**	**8.28E-03**	**0.00E+00**	**0.00E+00**	**0.00E+00**
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
Co-58	Curies	3.33E-05	0.00E+00	0.00E+00	0.00E+00
Co-60	Curies	4.61E-05	0.00E+00	0.00E+00	0.00E+00
Total For Period	**Curies**	**7.94E-05**	**0.00E+00**	**0.00E+00**	**0.00E+00**
Tritium					
H-3	Curies	1.25E-03	0.00E+00	0.00E+00	0.00E+00
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

Table 2-3C

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Ground Level Releases
Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Continuous Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
I-131	Curies	2.19E-08	0.00E+00	0.00E+00	0.00E+00
Total For Period	**Curies**	**2.19E-08** †	**0.00E+00**	**0.00E+00**	**0.00E+00**
Particulates					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
H-3	Curies	1.03E-01	2.73E-02	9.98E-02	3.23E-01
Gross Alpha					
G-Alpha	Curies	8.27E-08	3.27E-09	6.53E-10	7.03E-09
Total For Period	**Curies**	**8.27E-08**	**3.27E-09**	**6.53E-10**	**7.03E-09**

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.
† A Unit 1 fuel leak, which developed in October 2018, explains increases in radioisotopic concentrations between 2019 and 2018.

Table 2-3C

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Ground Level Releases
Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

		Batch Mode			
Nuclides Released	**Unit**	**1ST Quarter**	**2ND Quarter**	**3RD Quarter**	**4TH Quarter**
Fission Gases					
Ar-41	Curies	8.43E-04	0.00E+00	0.00E+00	0.00E+00
Xe-133	Curies	6.37E-03	0.00E+00	0.00E+00	0.00E+00
Xe-135	Curies	1.06E-03	0.00E+00	0.00E+00	0.00E+00
Total For Period	**Curies**	**8.28E-03**	**0.00E+00**	**0.00E+00**	**0.00E+00**
Iodines					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
Co-58	Curies	3.33E-05	0.00E+00	0.00E+00	0.00E+00
Co-60	Curies	4.61E-05	0.00E+00	0.00E+00	0.00E+00
Total For Period	**Curies**	**7.94E-05**	**0.00E+00**	**0.00E+00**	**0.00E+00**
Tritium					
H-3	Curies	4.74E+01 †	0.00E+00	6.42E-01 †	5.47E-01 †
Gross Alpha					
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not Reported. Zeroes in this table indicates that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.
† A Unit 1 fuel leak, which developed in October 2018, explains increases in radioisotopic concentrations between 2019 and 2018.

Table 2-4A

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Air Doses Due to Gaseous Releases
Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Type of Radiation	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Gamma Air	5.00E+00	mRad	1.14E-04	2.28E-03	1.04E-04	2.08E-03	2.67E-04	5.34E-03	3.32E-04	6.64E-03
Beta Air	1.00E+01	mRad	3.17E-04	3.17E-03	2.88E-04	2.88E-03	7.68E-04	7.68E-03	9.58E-04	9.58E-03

Cumulative Doses Per Year

Type of Radiation	ODCM Lmt	Units	Year to End Date	% ODCM	Receptor	Limit
Gamma Air	1.00E+01	mRad	8.18E-04	8.18E-03	Site Boundary / Child	Air Dose Gamma Annual 1.21
Beta Air	2.00E+01	mRad	2.33E-03	1.17E-02	Site Boundary / Child	Air Dose Beta Annual 1.21

Table 2-4B

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Air Doses Due to Gaseous Releases
Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Type of Radiation	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Gamma Air	5.00E+00	mRad	3.16E-05	6.32E-04	3.06E-06	6.11E-05	1.01E-05	2.02E-04	3.52E-06	7.04E-05
Beta Air	1.00E+01	mRad	1.54E-05	1.54E-04	1.09E-06	1.09E-05	2.24E-05	2.24E-04	1.33E-06	1.33E-05

Cumulative Doses Per Year

Type of Radiation	ODCM Lmt	Units	Year to End Date	% ODCM	Receptor	Limit
Gamma Air	1.00E+01	mRad	4.83E-05	4.83E-04	Site Boundary / Child	Air Dose Gamma Annual 1.21
Beta Air	2.00E+01	mRad	4.03E-05	2.01E-04	Site Boundary / Child	Air Dose Beta Annual 1.21

Table 2-4C

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Air Doses Due to Gaseous Releases
Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Type of Radiation	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Gamma Air	5.00E+00	mRad	1.46E-04	2.92E-03	1.07E-04	2.14E-03	2.77E-04	5.54E-03	3.36E-04	6.71E-03
Beta Air	1.00E+01	mRad	3.32E-04	3.32E-03	2.89E-04	2.89E-03	7.90E-04	7.90E-03	9.59E-04	9.59E-03

Cumulative Doses Per Year

Type of Radiation	ODCM Lmt	Units	Year to End Date	% ODCM	Receptor	Limit
Gamma Air	1.00E+01	mRad	8.66E-04	8.66E-03	Site Boundary / Child	Air Dose Gamma Annual 1.21
Beta Air	2.00E+01	mRad	2.37E-03	1.19E-02	Site Boundary / Child	Air Dose Beta Annual 1.21

Table 2-5A

Vogtle Electric Generating Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses To A Member Of The Public Due To Radioiodines, Tritium, and Particulates in Gaseous Releases

Unit: 1

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Organ	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Total Body	7.50E+00	mRem	8.27E-03	1.10E-01	5.24E-05	6.98E-04	2.65E-04	3.54E-03	3.02E-04	4.02E-03
Lung	7.50E+00	mRem	8.27E-03	1.10E-01	5.24E-05	6.98E-04	2.65E-04	3.54E-03	3.02E-04	4.02E-03
Thyroid	7.50E+00	mRem	8.27E-03	1.10E-01	5.24E-05	6.98E-04	2.65E-04	3.54E-03	3.02E-04	4.02E-03
Bone	7.50E+00	mRem	3.64E-10	4.86E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GI-Lli	7.50E+00	mRem	8.27E-03	1.10E-01	5.24E-05	6.98E-04	2.65E-04	3.54E-03	3.02E-04	4.02E-03
Kidney	7.50E+00	mRem	8.27E-03	1.10E-01	5.24E-05	6.98E-04	2.65E-04	3.54E-03	3.02E-04	4.02E-03
Liver	7.50E+00	mRem	8.27E-03	1.10E-01	5.24E-05	6.98E-04	2.65E-04	3.54E-03	3.02E-04	4.02E-03

Cumulative Doses per Year

Organ	ODCM Lmt	Units	Year to Ending Date	% ODCM	Receptor	Limit
Total Body	1.500E+01	mRem	8.889E-03	5.926E-02	Units 3&4 Construction	Iodine/Part Dose Annual 1.21
Lung	1.500E+01	mRem	8.889E-03	5.926E-02	Units 3&4 Construction	Iodine/Part Dose Annual 1.21
Thyroid	1.500E+01	mRem	8.889E-03	5.926E-02	Units 3&4 Construction	Iodine/Part Dose Annual 1.21
Bone	1.500E+01	mRem	3.645E-10	2.430E-09	Maximum Individual / Child	Iodine/Part Dose Annual 1.21
GI-Lli	1.500E+01	mRem	8.889E-03	5.926E-02	Units 3&4 Construction	Iodine/Part Dose Annual 1.21
Kidney	1.500E+01	mRem	8.889E-03	5.926E-02	Units 3&4 Construction	Iodine/Part Dose Annual 1.21
Liver	1.500E+01	mRem	8.889E-03	5.926E-02	Units 3&4 Construction	Iodine/Part Dose Annual 1.21

Table 2-5B

Vogtle Electric Generating Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses To A Member Of The Public Due To Radioiodines, Tritium, and Particulates in Gaseous Releases

Unit: 2

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Organ	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Thyroid	7.50E+00	mRem	6.15E-04	8.20E-03	1.11E-07	1.48E-06	1.59E-04	2.12E-03	1.67E-04	2.22E-03
Lung	7.50E+00	mRem	6.23E-04	8.30E-03	1.11E-07	1.48E-06	1.59E-04	2.12E-03	1.67E-04	2.22E-03
Bone	7.50E+00	mRem	2.18E-04	2.91E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.53E-08	3.37E-07
GI-Lli	7.50E+00	mRem	6.27E-04	8.36E-03	1.11E-07	1.48E-06	1.59E-04	2.12E-03	1.67E-04	2.22E-03
Liver	7.50E+00	mRem	6.17E-04	8.23E-03	1.11E-07	1.48E-06	1.59E-04	2.12E-03	1.67E-04	2.22E-03
Total Body	7.50E+00	mRem	6.22E-04	8.29E-03	1.11E-07	1.48E-06	1.59E-04	2.12E-03	1.67E-04	2.23E-03
Kidney	7.50E+00	mRem	6.15E-04	8.20E-03	1.11E-07	1.48E-06	1.59E-04	2.12E-03	1.67E-04	2.22E-03

Cumulative Doses per Year

Organ	ODCM Lmt	Units	Year to Ending Date	% ODCM	Receptor	Limit
Thyroid	1.500E+01	mRem	9.416E-04	6.277E-03	Maximum Individual / Child	Iodine/Part Dose Annual 1.21
Lung	1.500E+01	mRem	9.487E-04	6.325E-03	Maximum Individual / Child	Iodine/Part Dose Annual 1.21
Bone	1.500E+01	mRem	2.179E-04	1.453E-03	Units 3&4 Construction	Iodine/Part Dose Annual 1.21
GI-Lli	1.500E+01	mRem	9.533E-04	6.355E-03	Maximum Individual / Child	Iodine/Part Dose Annual 1.21
Liver	1.500E+01	mRem	9.437E-04	6.291E-03	Maximum Individual / Child	Iodine/Part Dose Annual 1.21
Total Body	1.500E+01	mRem	9.481E-04	6.321E-03	Maximum Individual / Child	Iodine/Part Dose Annual 1.21
Kidney	1.500E+01	mRem	9.416E-04	6.277E-03	Maximum Individual / Child	Iodine/Part Dose Annual 1.21

Table 2-5C

Vogtle Electric Generating Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses To A Member Of The Public Due To Radioiodines, Tritium, and Particulates in Gaseous Releases

Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Cumulative Doses Per Quarter

Organ	ODCM Lmt	Units	1ST Qtr	% ODCM	2ND Qtr	% ODCM	3RD Qtr	% ODCM	4TH Qtr	% ODCM
Kidney	7.50E+00	mRem	8.71E-03	1.16E-01	5.24E-05	6.99E-04	3.34E-04	4.45E-03	3.73E-04	4.98E-03
GI-Lli	7.50E+00	mRem	8.71E-03	1.16E-01	5.24E-05	6.99E-04	3.34E-04	4.45E-03	3.73E-04	4.98E-03
Thyroid	7.50E+00	mRem	8.71E-03	1.16E-01	5.24E-05	6.99E-04	3.34E-04	4.45E-03	3.73E-04	4.98E-03
Total Body	7.50E+00	mRem	8.71E-03	1.16E-01	5.24E-05	6.99E-04	3.34E-04	4.45E-03	3.73E-04	4.98E-03
Lung	7.50E+00	mRem	8.73E-03	1.16E-01	5.24E-05	6.99E-04	3.34E-04	4.45E-03	3.73E-04	4.98E-03
Liver	7.50E+00	mRem	8.71E-03	1.16E-01	5.24E-05	6.99E-04	3.34E-04	4.45E-03	3.73E-04	4.98E-03
Bone	7.50E+00	mRem	2.18E-04	2.91E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.53E-08	3.37E-07

Cumulative Doses per Year

Organ	ODCM Lmt	Units	Year to Ending Date	% ODCM	Receptor	Limit
Kidney	1.500E+01	mRem	9.473E-03	6.316E-02	Units 3&4 Construction	Iodine/Part Dose Annual 1.21
GI-Lli	1.500E+01	mRem	9.474E-03	6.316E-02	Units 3&4 Construction	Iodine/Part Dose Annual 1.21
Thyroid	1.500E+01	mRem	9.473E-03	6.316E-02	Units 3&4 Construction	Iodine/Part Dose Annual 1.21
Total Body	1.500E+01	mRem	9.473E-03	6.316E-02	Units 3&4 Construction	Iodine/Part Dose Annual 1.21
Lung	1.500E+01	mRem	9.489E-03	6.326E-02	Units 3&4 Construction	Iodine/Part Dose Annual 1.21
Liver	1.500E+01	mRem	9.473E-03	6.316E-02	Units 3&4 Construction	Iodine/Part Dose Annual 1.21
Bone	1.500E+01	mRem	2.179E-04	1.453E-03	Units 3&4 Construction	Iodine/Part Dose Annual 1.21

Table 2-6

Vogtle Electric Generating Plant

RADIOACTIVE EFFLUENT RELEASE REPORT – 2019

MINIMUM DETECTABLE CONCENTRATIONS GASEOUS SAMPLE ANALYSES

Starting: 1-Jan-2019 Ending: 31-Dec-2019

RADIONUCLIDE	MDC	UNITS
Kr-87	1.82E-08	μCi/ml
Kr-88	2.53E-08	μCi/ml
Xe-133	2.05E-08	μCi/ml
Xe-133m	8.63E-08	μCi/ml
Xe-135	7.12E-08	μCi/ml
Xe-138	1.05E-07	μCi/ml
I-131	7.93E-15*	μCi/ml
Mn-54	3.94E-14*	μCi/ml
Fe-59	2.45E-14*	μCi/ml
Co-58	1.39E-14*	μCi/ml
Co-60	1.75E-14*	μCi/ml
Zn-65	2.82E-14*	μCi/ml
Mo-99	9.57E-14*	μCi/ml
Cs-134	1.12E-14*	μCi/ml
Cs-137	8.71E-15*	μCi/ml
Ce-141	8.62E-15*	μCi/ml
Ce-144	2.77E-14*	μCi/ml
Sr-89	1.00E-13	μCi/ml
Sr-90	1.00E-13	μCi/ml
H-3	9.00E-08	μCi/ml
Gross Alpha	1.00E-13	μCi/ml

* Based on an estimated sample volume of 5.7E+08 mls for particulate filters and charcoal cartridges

Table 2-7A

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Batch Release Summary
Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Gaseous Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of batch releases		54	52	58	56	220
2. Total time period for batch releases	(Minutes)	4.62E+03	2.08E+03	2.74E+03	2.87E+03	1.23E+04
3. Maximum time period for a batch release	(Minutes)	2.16E+03	9.80E+01	1.23E+02	1.56E+02	2.16E+03
4. Average time period for a batch release	(Minutes)	8.55E+01	4.00E+01	4.73E+01	5.13E+01	5.60E+01
5. Minimum time period for a batch release	(Minutes)	8.00E+00	9.00E+00	1.10E+01	9.00E+00	8.00E+00

Table 2-7B

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Batch Release Summary
Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Gaseous Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of batch releases		30	16	17	18	81
2. Total time period for batch releases	(Minutes)	2.29E+04	7.02E+02	6.36E+02	8.09E+02	2.51E+04
3. Maximum time period for a batch release	(Minutes)	6.01E+03	1.24E+02	6.80E+01	8.30E+01	6.01E+03
4. Average time period for a batch release	(Minutes)	7.64E+02	4.39E+01	3.74E+01	4.49E+01	3.10E+02
5. Minimum time period for a batch release	(Minutes)	3.00E+00	2.20E+01	9.00E+00	2.60E+01	3.00E+00

Table 2-7C

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Batch Release Summary
Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Gaseous Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of batch releases		84	68	75	74	301
2. Total time period for batch releases	(Minutes)	2.75E+04	2.78E+03	3.38E+03	3.68E+03	3.74E+04
3. Maximum time period for a batch release	(Minutes)	6.01E+03	1.24E+02	1.23E+02	1.56E+02	6.01E+03
4. Average time period for a batch release	(Minutes)	3.28E+02	4.09E+01	4.50E+01	4.98E+01	1.24E+02
5. Minimum time period for a batch release	(Minutes)	3.00E+00	9.00E+00	9.00E+00	9.00E+00	3.00E+00

Table 2-8A

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Abnormal Release Summary
Unit: 1
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Gaseous Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 2-8B

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Abnormal Release Summary
Unit: 2
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Gaseous Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 2-8C

Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2019
Gaseous Effluents - Abnormal Release Summary
Unit: Site
Starting: 1-Jan-2019 Ending: 31-Dec-2019

Gaseous Releases	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

3.0 Solid Waste

3.1 Regulatory Requirements

The ODCM requirements presented in this section are stated in part for Unit 1 and Unit 2.

3.1.1 Solid Radioactive Waste System

10.2.1 Process Control Program (PCP)

Radioactive wastes shall be solidified or dewatered in accordance with the PCP to meet shipping and transportation requirements during transit and disposal site requirements when received at the disposal site.

3.1.2 Reporting Requirements

12.1 PCP states in part:

The Radioactive Effluent Release Report, submitted in accordance with Technical Specification 5.6.3, shall include a summary of the quantities of solid radwaste released from the units, as outlined in Regulatory Guide 1.21 Rev 2.

3.2 Solid Waste Data

Regulatory Guide 1.21 Rev 2, Table 3 is found in this report as Table 3-1. GEL Laboratories performs hard-to-detect analysis for solid waste. Final calculations for nuclides include sample analysis performed on resin from High Integrity Containers. For Gaseous and Liquid composites, the Georgia Power Environmental Laboratory performs hard-to-detect analysis.

Table 3-1
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT AND WASTE DISPOSAL REPORT - 2019
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

JANUARY 1, 2019 THROUGH JUNE 30, 2019

Regulatory Guide 1.21: Effluent and Waste Disposal Semi-Annual Report of Solid Waste and Irradiated Fuel Shipments

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not irradiated fuel)

1. Type of waste – **NRC Waste Class A**	UNIT	6 month Period	Est. Total ERROR %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m^3	2.89E+00	+/- 10
	Ci	1.48+00	+/- 10
b. Dry compressible waste, contaminated equip. etc.	m^3	2.11+02	+/- 25
	Ci	6.22E-01	+/- 25
c. Irradiated components, control rods,	m^3	-N/A-	-N/A-
	Ci	-N/A-	-N/A-
d. Control Rod Drive Filters	m^3	-N/A-	-N/A-
	Ci	-N/A-	-N/A-
e. Other (describe) Steam Generator Blowdown Resin (GIC)	m^3	1.78E+01	-N/A-
	Ci	5.96E-03	-N/A-

1. Type of waste – **NRC Waste Class B**	UNIT	6 month period	Est. Total ERROR %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m^3	2.69E+00	+/- 10
	Ci	1.00E+02	+/- 10
b. Dry compressible waste, contaminated equip. etc.	m^3	-N/A-	-N/A-
	Ci	-N/A-	-N/A-
c. Irradiated components, control rods,	m^3	-N/A-	-N/A-
	Ci	-N/A-	-N/A-
d. Control Rod Drive Filters	m^3	-N/A-	-N/A-
	Ci	-N/A-	-N/A-
e. Other (describe) equip. etc.	m^3	-N/A-	-N/A-
	Ci	-N/A-	-N/A-

2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION:

NRC WASTE CLASS A (≥1% Percent)

	ISOTOPE	PERCENT	CURIES
a.	^{3}H	4.18	6.19E-02
	^{14}C	1.39	2.06E-02
	^{55}Fe	16.23	2.40E-01
	^{58}Co	11.82	1.75E-01
	^{60}Co	8.56	1.27E-01
	^{63}Ni	19.12	2.83E-01
	^{125}Sb	35.88	5.31E-01
b.	^{51}Cr	6.58	4.09E-02
	^{54}Mn	1.42	8.85E-03
	^{55}Fe	30.84	1.92E-01
	^{58}Co	28.24	1.76E-01
	^{60}Co	14.26	8.86E-02
	^{63}Ni	11.69	7.27E-02
	^{95}Zr	1.6	9.93E-03
	^{95}Nb	3.23	2.01E-02
c.	-N/A-	-N/A-	-N/A-
d.	-N/A-	-N/A-	-N/A-
e.	^{51}Cr	6.64	3.96E-04
	^{54}Mn	1.42	8.47E-05
	^{55}Fe	30.76	1.83E-03
	^{58}Co	28.31	1.69E-03
	^{60}Co	14.22	8.47E-04
	^{63}Ni	11.66	6.95E-04
	^{95}Zr	1.6	9.55E-05
	^{95}Nb	3.24	1.93E-04

2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION:

NRC WASTE CLASS B (≥1% Percent)

	ISOTOPE	PERCENT	CURIES
a.	^{54}Mn	2.68	2.69E+00
	^{55}Fe	15.06	1.51E+01
	^{58}Co	7.69	7.71E+00
	^{60}Co	27.05	2.71E+01
	^{63}Ni	44.72	4.48E+01
b.	-N/A-	-N/A-	-N/A-
c.	-N/A-	-N/A-	-N/A-
d.	-N/A-	-N/A-	-N/A-
e.	-N/A-	-N/A-	-N/A-

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
6	Hittman Transport	Energy Solutions – Bear Creek
1	Hittman Transport	Energy Solutions – Gallaher Rd
1	Interstate Ventures	WCS

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
-N/A-	-N/A-	-N/A

Table 3-1
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT AND WASTE DISPOSAL REPORT - 2019
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

JULY 1, 2019 THROUGH DECEMBER 31, 2019

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not irradiated fuel)

1. Type of waste – **NRC Waste Class A**	UNIT	6 month period	Est. Total ERROR %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m^3	8.01E+00	+/- 10
	Ci	1.12E+02	+/- 10
b. Dry compressible waste, contaminated equip. etc.	m^3	6.34E+01	+/- 25
	Ci	9.68E-01	+/- 25
c. Irradiated components, control rods,	m^3	-N/A-	-N/A-
	Ci	-N/A-	-N/A-
d. Control Rod Drive Filters	m^3	-N/A-	-N/A-
	Ci	-N/A-	-N/A-
e. Other (describe) Steam Generator Blowdown Resin	m^3	-N/A-	-N/A-
	Ci	-N/A-	-N/A-

1. Type of waste – **NRC Waste Class B**	UNIT	6 month period	Est. Total ERROR %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m^3	-N/A-	-N/A-
	Ci	-N/A-	-N/A-
b. Dry compressible waste, contaminated equip. etc.	m^3	-N/A-	-N/A-
	Ci	-N/A-	-N/A-
c. Irradiated components, control rods,	m^3	-N/A-	-N/A-
	Ci	-N/A-	-N/A-
d. Control Rod Drive Filters	m^3	-N/A-	-N/A-
	Ci	-N/A-	-N/A-
e. Other (describe) equip. etc.	m^3	-N/A-	-N/A-
	Ci	-N/A-	-N/A-

2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION:

NRC WASTE CLASS A (≥1% Percent)

	ISOTOPE	PERCENT	CURIES
a.	^{14}C	1.3	1.45E+00
	^{54}Mn	2.22	2.48E+00
	^{55}Fe	46.55	5.20E+01
	^{58}Co	2.6	2.90E+00
	^{60}Co	37.39	4.17E+01
	^{63}Ni	4.79	5.35E+00
	^{125}Sb	2.68	2.99E+00
	^{137}Cs	1.17	1.31E+00

b.	^{51}Cr	6.58	6.37E-02
	^{54}Mn	1.42	1.38E-02
	^{55}Fe	30.83	2.98E-01
	^{58}Co	28.24	2.73E-01
	^{60}Co	14.25	1.38E-01
	^{63}Ni	11.69	1.13E-01
	^{95}Zr	1.6	1.55E-02
	^{95}Nb	3.24	3.13E-02
c.	-N/A-	-N/A-	-N/A-
d.	-N/A-	-N/A-	-N/A-
e.	-N/A-	-N/A-	-N/A-

2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION:

NRC WASTE CLASS B (≥1% Percent)

	ISOTOPE	PERCENT	CURIES
a.	^{54}Mn	3.77	4.32E+00
	^{55}Fe	25.46	2.91E+01
	^{58}Co	4.13	4.73E+00
	^{60}Co	25.03	2.86E+01
	^{63}Ni	35.01	4.01E+01
	^{65}Zn	1.02	1.16E+00
	^{125}Sb	3.24	3.71E+00
b.	-N/A-	-N/A-	-N/A-
c.	-N/A-	-N/A-	-N/A-
d.	-N/A-	-N/A-	-N/A-
e.	-N/A-	-N/A-	-N/A-

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
5	Hittman Transport	Energy Solutions – Bear Creek

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
N/A	N/A	N/A

4.0 Doses to Members of the Public inside the Site Boundary

4.1 Regulatory Requirements

ODCM 7.2.2.3 states in part:

"The report shall also include assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY during the report period; this assessment must be performed in accordance with Chapter 6. All assumptions used in making these assessments (i.e., specific activity, exposure time, and location) shall be included in the report".

4.2 Demonstration of Compliance

The location of concern within the site boundary is the Visitors Center. The activities at the Visitor Center consist of occasional attendance at meetings and/or short visits for informational purposes.

There will be no radiation dose at this location due to radioactive liquid effluents. Delineated in Table 4-1 for this location are the values of the basic data assumed in the dose assessment due to radioactive gaseous effluents. Listed in this table are distance and direction from a point midway between the center of Unit 1 and the Unit 2 reactors, the dispersion and deposition factors for any releases from the plant vent (mixed mode) and from the turbine building (ground level), and the estimated maximum occupancy factor for an individual and the assumed age group of this individual.

The source term is listed in Tables 2-2A, and 2-2B for the mixed mode releases. Similarly, it is listed in Tables 2-3A and 2-3B for the ground level releases.

The maximum doses in units of mrem to a MEMBER OF THE PUBLIC due to their activities inside the site boundary during the reporting period are presented in Table 4-1.

Table 4-1

Vogtle Electric Generating Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses to a Member of the Public Due to Activities Inside the Site Boundary

Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Location Name: Visitor's Center Receptor
Distance (kilometers): 4.47E-01
Sector: SE
Occupancy Factor: 4.57E-04
Age Group: Child

Ground Level Release	Particulate and Radioiodine	X/Q (sec/m3): 5.58E-06	D/Q (m-2): 2.28E-08
Mixed Mode Release	Particulate and Radioiodine	X/Q (sec/m3): 6.74E-07	D/Q (m-2): 5.77E-09
Mixed Mode Release	Noble Gas	X/Q (sec/m3): 7.12E-07	
Ground Level Release	Noble Gas	X/Q (sec/m3): 5.93E-06	

	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year
GI-Lli	mRem	5.32E-08	6.23E-10	3.29E-09	3.64E-09	6.08E-08
Bone	mRem	3.32E-09	0.00E+00	0.00E+00	3.64E-13	3.32E-09
Thyroid	mRem	5.32E-08	6.23E-10	3.29E-09	3.64E-09	6.08E-08
Lung	mRem	5.35E-08	6.23E-10	3.29E-09	3.64E-09	6.11E-08
Skin	mRem	3.91E-09	0.00E+00	0.00E+00	0.00E+00	3.91E-09
Liver	mRem	5.32E-08	6.23E-10	3.29E-09	3.64E-09	6.08E-08
Kidney	mRem	5.32E-08	6.23E-10	3.29E-09	3.64E-09	6.08E-08
Total Body	mRem	5.32E-08	6.23E-10	3.29E-09	3.64E-09	6.08E-08

Table 4-1

Vogtle Electric Generating Plant

RADIOACTIVE EFFLUENT RELEASE REPORT - 2019

Doses to a Member of the Public Due to Activities Inside the Site Boundary

Unit: Site

Starting: 1-Jan-2019 Ending: 31-Dec-2019

Location Name: Units 3&4 Construction
Distance (kilometers): 4.83E-01
Sector: SW
Occupancy Factor: 2.37E-01
Age Group: Adult

Mixed Mode Release	Noble Gas	X/Q (sec/m3): 9.75E-07	
Mixed Mode Release	Particulate and Radioiodine	X/Q (sec/m3): 0.00E+00	
Ground Level Release	Particulate and Radioiodine	X/Q (sec/m3): 6.96E-06	D/Q (m-2): 2.88E-08
Ground Level Release	Particulate and Radioiodine	X/Q (sec/m3): 6.93E-06	D/Q (m-2): 2.88E-08
Ground Level Release	Noble Gas	X/Q (sec/m3): 1.81E-05	
Mixed Mode Release	Particulate and Radioiodine	X/Q (sec/m3): 9.17E-07	D/Q (m-2): 7.14E-09
Mixed Mode Release	Noble Gas	X/Q (sec/m3): 0.00E+00	

	Units	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	Year
Kidney	mRem	8.71E-05	5.24E-07	3.34E-06	3.73E-06	9.47E-05
GI-Lli	mRem	8.71E-05	5.24E-07	3.34E-06	3.73E-06	9.47E-05
Skin	mRem	2.56E-06	0.00E+00	0.00E+00	0.00E+00	2.56E-06
Thyroid	mRem	8.71E-05	5.24E-07	3.34E-06	3.73E-06	9.47E-05
Total Body	mRem	8.71E-05	5.24E-07	3.34E-06	3.73E-06	9.47E-05
Lung	mRem	8.73E-05	5.24E-07	3.34E-06	3.73E-06	9.49E-05
Liver	mRem	8.71E-05	5.24E-07	3.34E-06	3.73E-06	9.47E-05
Bone	mRem	2.18E-06	0.00E+00	0.00E+00	2.53E-10	2.18E-06

5.0 Total Dose from Uranium Fuel Cycle (40CFR190)

5.1 Regulatory Requirements

ODCM 5.1 states in part that 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 less than or equal to 25 mrems to the whole body or to any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

5.2 Demonstration of Compliance

No dose limits stated in ODCM Sections 2.1.3, 3.1.3, and 3.1.4 were exceeded. Therefore, compliance with 40 CFR 190 dose limits was demonstrated in accordance with the requirements of ODCM Section 5.1.3.

6.0 Meteorological Data

ODCM 7.2.2.2 states in part:

The Radioactive Effluent Release Report shall include an annual summary of hourly meteorological data collected over the previous year. This annual summary may be either in the form of an hour-by-hour listing of wind speed, wind direction, atmospheric stability, and precipitation (if measured) on magnetic tape; or in the form of joint frequency distributions of wind speed, wind direction and atmospheric stability.

In lieu of submission with the Radioactive Effluent Release Report, the licensee has the option of retaining this summary of required meteorological data on site in a file that shall be provided to the NRC upon request.

7.0 Program Deviations

7.1 Inoperable Liquid or Gaseous Effluent Monitoring Instrumentation

7.1.1 Regulatory Requirement

ODCM 7.2.2.6 states in part that the report shall include deviations from the liquid and gaseous effluent monitoring instrumentation operability requirements included in Sections 2.1.1 and 3.1.1,

respectively. The report shall include an explanation as to why the inoperability of liquid or gaseous effluent monitoring instrumentation was not corrected within the specified time requirement.

7.1.2 Description of Deviations

(1) The inoperability of liquid and gaseous effluent monitors not corrected within the specified time for this reporting period is detailed below. When applicable, compensatory measures were utilized per ODCM Action Statements:

a. 2FT-0021
This flow transmitter was out of service greater than 30 days because the flow transmitter failed and needs to be replaced. It was removed from service December 12, 2016 and currently awaiting Design Change implementation. Work Order SNC832477 is closed. Work Orders SNC1048033 and SNC1048612 are tracking the design change and implementation. This was omitted in the 2017 ARERR. Stated here as an amendment to the 2017 ARERR.

7.2 Tanks Exceeding Curie Content Limits

7.2.1 Regulatory Requirements

ODCM 7.2.2.6 states in part that the report shall include a description of the events leading to liquid holdup tanks or gas storage tanks exceeding the limits of Technical Specifications 5.5.12.

7.2.2 Description of Deviations

Limits for outdoor liquid hold-up tanks used for radioactive liquids were not exceeded during this reporting period.
Limits for the gas storage tanks were not exceeded during this reporting period.

8.0 Changes to the Vogtle Electric Generating Plant Offsite Dose Calculation Manual (ODCM)

8.1 Regulatory Requirements

ODCM 7.2.2.5 states in part that changes to the ODCM shall be submitted with the Radioactive Effluent Release Report. These changes may be due to changes in the radiological environmental monitoring program sampling locations as required by ODCM 4.1.1.2.3 or changes to dose calculation locations as required by ODCM 4.1.2.2.2. Land uses and dose calculation locations within five miles of VEGP must be determined by a land use census as required by ODCM 4.1.2.

8.2 Description of Changes

No changes made to VEGP ODCM in 2019.

9.0 Major Changes to Liquid, Gaseous, or Solid Radwaste Treatment Systems

9.1 Regulatory Requirements

ODCM 7.2.2.7 states in part:

As required by Sections 2.1.5 and 3.1.6, licensee initiated MAJOR CHANGES TO RADIOACTIVE WASTE TREATMENT SYSTEMS (liquid and gaseous) shall be reported to the Nuclear Regulatory Commission in the Radioactive Effluent Release Report covering the period in which the change was reviewed and accepted for implementation.

Note 1: In lieu of inclusion in the Radioactive Effluents Release Report, this same information may be submitted as part of the annual FSAR update.

PCP 12.1 states in part:

Licensee major initiated changes to the solid radioactive waste treatment system shall be reported to the Nuclear Regulatory Commission in the Radioactive Effluent Release Report for the period in which the change was implemented.

9.2 Description of Major Changes

Gaseous Radwaste System

There were no major changes to the gaseous radwaste systems in the 2019 assessment period.

Liquid Radwaste System

There were no major changes to the liquid radwaste systems occurred during the 2019 assessment period.

Solid Radwaste System

There were no major changes to the solid radwaste systems in the 2019 assessment period.

Appendix A
Vogtle Electric Generating Plant

CARBON-14

Carbon-14 (C-14) is a naturally-occurring radionuclide with a 5730 year half life. Nuclear weapons testing in the 1950s and 1960s significantly increased the amount of C-14 in the atmosphere. Nuclear power plants also produce C-14, but the amount is infinitesimal compared to what has been distributed in the environment due to weapons testing and what is produced by natural cosmic ray interactions.

As nuclear plants have improved gaseous waste processing systems and improved fuel performance, the percentages of "principal radionuclides" in gaseous effluents have changed, and C-14 has become a larger percentage. "Principal radionuclides" are determined based on public dose contribution or the amount of activity discharged compared to other radionuclides of the same effluent type. In Revision 2 (June 2009) of Regulatory Guide 1.21 (RG 1.21), "Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste," the NRC recommended re-evaluating "principal radionuclides" and reporting C-14 as appropriate. In 2010 Radioactive Effluent Release Reports, virtually all U. S. nuclear power plants started reporting C-14 amounts released and resulting doses to the maximally exposed member of the public.

Because C-14 is considered a hard-to-detect radionuclide which must be chemically separated from the effluent stream before it can be measured, RG 1.21 provides the option of calculating the C-14 source term based on power generation. The Electric Power Research Institute (EPRI) developed an accepted methodology for calculating C-14, and published the results in Technical Report 1021106 (December 2010), "Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents." Evaluation of C-14 in radioactive liquid effluents is not required because the quantity and dose contribution has been determined to be insignificant.

At Plant Vogtle, the annual quantity of C-14 released in gaseous effluents was estimated to be 12.08 Curies (per unit). Approximately 30% of the C-14 released is in the form of $^{14}CO_2$ and is incorporated into plants through photosynthesis. Ingestion dose results from this pathway. The remaining 70% is estimated to be organic. Both the organic and inorganic forms of C-14 contribute to inhalation dose. A child is the maximally exposed individual, and bone dose is the highest organ dose. Using the dose calculation methodology from the Vogtle ODCM, the resulting bone dose to a child located at the controlling receptor location would be 8.46E-02 mrem in a year which is 0.56% of the regulatory limit of 15 mrem per year (per unit) to any organ due to gaseous effluents. The resulting total body dose to a child located at the controlling receptor location would be 1.69E-02 mrem in a year which is 0.11% of the regulatory limit of 15 mrem per year (per unit) total body dose due to gaseous effluents.