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W3F1-2020-0026

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U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Subject: Annual Radioactive Effluent Release Report - 2019
Waterford Steam Electric Station, Unit 3 (Waterford 3)
Docket No. 50-382
Renewed Facility Operating License No. NPF-38

Attached is the Annual Radioactive Effluent Release Report for the period of January 1 through December 31, 2019. This report is submitted pursuant to the Requirements of Waterford 3 Technical Specification Sections 6.9.1.8 and 6.14.2.c.

This report contains no new commitments. Please contact Paul Wood, Regulatory Assurance Manager, at (504) 464-3786 if you have questions regarding this information.

Respectfully,

A handwritten signature in black ink that reads "Paul Wood".

PW/llb

Attachment: Annual Radioactive Effluent Release Report – 2019

cc: NRC Region IV Regional Administrator
NRC Senior Resident Inspector – Waterford Steam Electric Station Unit
NRC Project Manager
Entergy Legal, General Sr Counsel

Attachment to

W3F1-2020-0026

Annual Radioactive Effluent Release Report
(43 pages)



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| | YEAR: 2019 |
| Document Number: 50-382 | |
| Annual Radioactive Effluent Release Report | |

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Annual Radioactive Effluent Release Report**1.0 INTRODUCTION**

Waterford 3 is a single unit Combustion Engineering nuclear steam supply plant. Both liquid and gaseous effluents are released in accordance with the Offsite Dose Calculation Manual (ODCM). The Annual Radioactive Effluent Release Report is submitted as required by Waterford 3 Technical Specification 6.9.1.8. It covers the period from January 1, 2019 through December 31, 2019, where the plant had an average power level of 74.2%. Information in this report is presented in the format outlined in Appendix B of Regulatory Guide 1.21 and in Section 5.8.1 of the Offsite Dose Calculation Manual (UNT-005-014).

The information contained in this report includes:

- A summary of the quantities of radioactive liquid and gaseous effluents and solid wastes released from the plant during the reporting period.
- A summary of the meteorological data collected during 2019.
- Assessment of radiation doses due to liquid and gaseous radioactive effluents released during 2019.
- A discussion of Unplanned/Abnormal releases that occurred during the reporting period.
- A submittal of changes to the Offsite Dose Calculation Manual and Process Control Program during this reporting period.
- A discussion of why required radioactive effluent monitoring instrumentation was not returned to service within the time specified.
- A discussion of any instances in which effluent samples were not collected within the required frequency.

Annual Radioactive Effluent Release Report**2.0 SUPPLEMENTAL INFORMATION****2.1 Regulatory Limits**

The ODCM (by reference) and the Technical Requirements Manual (TRM) (directly) contain the limits to which Waterford 3 must adhere. Because of the "as low as reasonably achievable" (ALARA) philosophy at Waterford 3, actions are taken to reduce the amount of radiation released to the environment. Liquid and gaseous release data show that the dose from Waterford 3 is considerably below the ODCM/TRM limits. This data reveals that the radioactive effluents have an overall minimal dose contribution to the surrounding environment. The following are the limits required by the ODCM:

1. Fission and activation gases:
 - a. Noble gases dose rate due to radioactive materials released in gaseous effluents from the areas at and beyond the site boundary shall be limited to the following:
 - Less than or equal to 500 mrem/year to the total body
 - Less than or equal to 3000 mrem/year to the skin
 - b. Noble gas air dose due to noble gases released in gaseous effluents to areas at and beyond the site boundary shall be limited to the following:
 - 1) Quarterly
 - Less than or equal to 5 mrad gamma
 - Less than or equal to 10 mrad beta
 - 2) Yearly
 - Less than or equal to 10 mrad gamma
 - Less than or equal to 20 mrad beta
2. Iodine, tritium, and all radionuclides in particulate form with half-lives greater than 8 days.
 - a. The dose rate for Iodine-131, Iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released to areas at and beyond the site boundary shall be limited to the following:
 - Less than or equal to 1500 mrem/yr to any organ
 - b. 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 to areas at and beyond the site boundary shall be limited to the following:
 - 1) Quarterly
 - Less than or equal to 7.5 mrem to any organ
 - 2) Yearly
 - Less than or equal to 15 mrem to any organ

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3. Liquid Effluents Dose
 - a. The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released to unrestricted areas shall be limited to the following:
 - 1) Quarterly
 - Less than or equal to 1.5 mrem total body
 - Less than or equal to 5 mrem any organ
 - 2) Yearly
 - Less than or equal to 3 mrem total body
 - Less than or equal to 10 mrem any organ
4. Total Dose (40CFR190)
 - a. The annual 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 the following:
 - Less than or equal to 25 mrem, Total Body or any Organ except Thyroid.
 - Less than or equal to 75 mrem, Thyroid

2.2 Maximum Permissible Concentrations

1. Fission & Activation Gases, Iodines, and Particulates with Half Lives > Eight (8) Days

For gaseous effluents, maximum permissible concentrations are not directly used in release rate calculations since the applicable limits are expressed in terms of dose rate at the site boundary.

2. Liquid Effluents

The concentration of radioactive material released from the site to unrestricted areas shall be limited to ten times the concentration 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 total concentration released shall be limited to 2.0E-4 microcuries/ml.

2.3 Average Energy

1. This is not applicable to Waterford 3 effluent specifications. E-Bar is not required to be calculated from effluent release data. The average energy (E-Bar) for the Reactor Coolant System (RCS) is supplied as additional information in the report further below.

Annual Radioactive Effluent Release Report**2.4 Measurements & Approximations of Total Radioactivity**

1. The quantification of radioactivity in liquid and gaseous effluents was accomplished by performing the sampling and radiological analysis of effluents in accordance with the requirements of Tables 4.11-1 and 4.11-2 of the Technical Requirements Manual (TRM).

- a. Fission & activation gases

For continuous releases, a gas grab sample was analyzed at least monthly for noble gases using gamma spectroscopy. Each week a Gas Ratio (GR) was calculated according to the following equation:

$$GR = \frac{\text{Average Weekly Noble Gas Monitor Reading}}{\text{Monitor Reading During Noble Gas Sampling}}$$

The monthly sample analysis and weekly Gas Ratio were then used to determine noble gases discharged continuously for the previous week. For gas decay tank and containment purge batch releases, a gas grab sample was analyzed prior to release to determine noble gas concentrations in the batch. In all cases, the total radioactivity in gaseous effluents was determined from measured concentrations of each radionuclide present and the total volume discharged

- b. Iodines and Particulates

Iodines and particulates discharged were sampled using a continuous sampler which contained a charcoal cartridge and a particulate filter. Each week the charcoal cartridge and particulate filter were analyzed for gamma emitters using gamma spectroscopy. The determined radionuclide concentrations and effluent volumes discharged were used to calculate the previous week's activity released. The particulate samples were composited and analyzed quarterly for Sr-89 and Sr-90 by a contract laboratory (Teledyne Brown Engineering). Particulate gross alpha activity was measured weekly using gas-flow proportional counting techniques. The determined activities were used to estimate effluent concentrations in subsequent releases until the next scheduled analysis was performed.

- c. Tritium

Tritium is collected by passing a known volume of the sample stream through a bubbler. The collected samples are analyzed by liquid scintillation. Grab samples of continuous releases were analyzed at least monthly, and containment purge batch releases are analyzed prior to release. The determined concentrations were used to estimate tritium activity in subsequent releases until the next scheduled analysis was performed.

- d. Carbon-14

Carbon-14 release rates were estimated using the annual Carbon-14 production rate obtained from the Waterford 3 Final Safety Analysis Report (FSAR), a gaseous release fraction of 98%, a Carbon-14 carbon dioxide fraction of 30%, and 292 days equivalent full power operation. Release of Carbon-14 was assumed to be continuous. The default Carbon-14 release from the FSAR for 80% full power days was used instead of 74.2% to impart conservatism.

Annual Radioactive Effluent Release Report

e. Liquid Effluents

For continuous releases, samples were collected weekly and analyzed using gamma spectroscopy. The measured concentrations were used to determine radionuclide concentrations in the following week's releases. For batch releases, gamma analysis was performed on the sample prior to release.

For both continuous and batch releases, composite samples were analyzed quarterly by a contract laboratory (Teledyne Brown Engineering) for Sr-89, Sr-90, and Fe-55. Samples were composited and analyzed monthly for tritium and gross alpha using liquid scintillation and gas flow proportional counting techniques, respectively. For radionuclides measured in the composite samples, the measured concentrations in the composite samples from the previous month or quarter were used to estimate released quantities of these isotopes in liquid effluents during the current month or quarter when the analysis results became available.

The total radioactivity in liquid effluent releases was determined from the measured and estimated concentrations of each radionuclide present and the total volume of the effluent discharged.

f. Estimated Total Error Present

Estimates of measurement and analytical error for gaseous and liquid effluents are calculated (bound by a conservative estimate of 25%) as follows:

$$E_T = \sqrt{[(E_1)^2 + (E_2)^2 + \dots (E_n)^2]}$$

Where: E_r = total percent error
 $E_1 \dots E_n$ = percent error due to calibration standards,
Laboratory analysis, instruments, sample flow, etc.

Annual Radioactive Effluent Release Report**2.5 Batch Releases:****2.5.1 Liquid**

1. Number of batch releases: 72
2. Total time period for all batch releases: 19645 min
3. Maximum time period for a batch release: 359 min
4. Average time period for a batch release: 272.8 min
5. Minimum time period for a batch release: 161.0 min
6. Average stream flow during periods of effluent release into flowing streams: 847485 f³/s

2.5.2 Gaseous

1. Number of batch releases: 10
2. Total time period for all batch releases: 6453 min
3. Maximum time period for a batch release: 3773 min
4. Average time period for a batch release: 645.3 min
5. Minimum time period for a batch release: 2 min

2.6 Abnormal Releases

2.6.1 There were no abnormal releases during the reporting period.

2.6.2 Liquid

1. Number of releases: 0
2. Total Activity (Ci) released: N/A

2.6.3 Gaseous

1. Number of releases: 0
2. Total Activity (Ci) released: N/A

2.7 Non-routine, Planned Discharges

1. There were no non-routine, planned discharges for the reporting period.

2.8 Radioactive Waste Treatment System Changes

1. During the reporting period, no major changes were made to any Radioactive Waste Systems. All major changes to Radioactive Waste Systems are included in Waterford 3's FSAR updates.

Annual Radioactive Effluent Release Report**2.9 Land Use Census Changes**

A land use census was last performed in 2018. The land use census performed in 2018 did not identify the need for any changes to locations being used for effluent dose calculations or radiological environmental sampling.

2.10 Effluent Monitor Instrument Inoperability

Technical Requirements Manual (TRM) Specifications 3.3.3.10 and 3.3.3.11 require reporting in the Annual Radioactive Effluent Release Report of why designated inoperable effluent monitoring instrumentation was not restored to operability within the time specified in the Action Statement.

Gaseous Waste System (GWM) Radiation Monitor (PRMIRE0648)

Time Required by Specifications to Restore Operability: 30 Days

Period of Inoperability: 11/18/2018 to 2/14/2019 (88 Days) and 7/26/2019 to present (> 269 days)

Batch releases performed with monitor out of services: (1) 1/13/2019 13:13 to 1/16/2019 12:38 (71 hours)

Cause of Inoperability: The radiation monitor was declared out of services while attempting to discharge a Gas Decay Tank on 11/14/2018 because proper sample flow (2.0 scfm) could not be established. Sample flow would rise to 1.8 scfm upon discharge, however sample pump would trip due to inadequate flow.

Reason Operability Not Restored Within Allotted Time: Following troubleshooting the radiation monitor sample pump was verified functional on 1/27/2019. However, on 1/15/2019 a scheduled electrical bus outage during Refuel 22 caused a communication loop fault which extended the time to fully restore the radiation monitor. Radiation monitor functional tests were performed satisfactorily during the period of inoperability, and ACTION requirements of TRM table 3.3-13 were implemented during release of the Gas Decay Tanks of 1/13/2019 to 1/16/2019. On 7/26/2019, the radiation monitor exhibited an Operate Failure locked in due to flow issues. No releases have occurred during this period of inoperability.

Steam Generator Blowdown Continuous Composite Sampler (BD MVAAA 30313)

Time Required by Specifications to Restore Operability: 30 Days

Period of Inoperability: 1/18/2018 to 11/5/2019 (656 days)

Batch releases performed with monitor out of services: 24.85 hours total

1/6/2019 01:09 to 1/6/2019 05:49 (280 minutes)

1/6/2019 09:59 to 1/6/2019 15:58 (359 minutes)

1/6/2019 20:56 to 1/7/2019 00:10 (194 minutes)

1/28/2019 05:24 to 1/28/2019 09:02 (218 minutes)

Cause of Inoperability: A 60 dpm leak was discovered downstream of BD MVAAA30313, Blowdown Proportional Sample Valve, and it was assumed that the valve must be leaking by its closed seat and therefore unreliable with regard to providing the required sample volume when the BD Composite Sampler is placed in service.

Reason Operability Not Restored Within Allotted Time: The reason that the sampler was not repaired was because the sample valve was obsolete and could not be replaced. However, further assessment of the sampler revealed that functional tests were satisfactory, and the monitor was still capable of delivering a proportional sample. The ACTION requirements of TRM table 3.3-12 were implemented during releases from Steam Generator Blowdown during the equipment unavailability period.

Annual Radioactive Effluent Release Report

2.11 Offsite Dose Calculation Manual Changes

1. There were no changes to the Offsite Dose Calculation Manual, UNT-005-014, in 2019.

2.12 Process Control Program (PCP) Changes

1. There were no changes to the Process Control Program, EN-RW-105, in 2019.

2.13 NON-REMP Groundwater Monitoring Results (NEI 07-07)

1. Groundwater wells were monitored at Waterford 3 during 2019 as part of the NEI Groundwater Protection Initiative; these samples are not part of the Radiological Environmental Monitoring Program. Sampling of the ten installed wells was conducted on a quarterly basis. All results were less than minimum detectable activity for gamma emitters and tritium during 2019. A summary of all groundwater monitoring well sample results for 2019 is presented below:

| 2019 Groundwater Analysis Results (pCi/L) | | | | | | | | | | | | | | |
|---|----------|----------|--------|--------|---------|--------|---------|--------|---------|---------|--------|--------|---------|---------|
| Sample Date Time | Well | Tritium | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Nb-95 | Zr-95 | I-131 | Cs-134 | Cs-137 | Ba-140 | La-140 |
| 3/13/2019 9:21 | MW-3 | < 564.00 | < 4.04 | < 6.91 | < 9.59 | < 6.18 | < 11.81 | < 7.02 | < 11.02 | < 8.99 | < 7.95 | < 6.67 | < 34.08 | < 12.08 |
| 6/6/2019 9:55 | MW-3 | < 581.00 | < 5.55 | < 5.71 | < 11.02 | < 6.97 | < 9.01 | < 4.58 | < 8.73 | < 10.29 | < 5.65 | < 5.89 | < 26.55 | < 9.36 |
| 9/12/2019 8:15 | MW-3 | < 545.00 | < 8.48 | < 7.44 | < 16.92 | < 7.87 | < 18.82 | < 8.95 | < 13.31 | < 11.30 | < 7.28 | < 8.06 | < 35.79 | < 9.97 |
| 12/12/2019 8:35 | MW-3 | < 530.00 | < 5.52 | < 6.34 | < 12.70 | < 5.32 | < 14.30 | < 5.78 | < 9.59 | < 9.07 | < 7.13 | < 6.60 | < 19.70 | < 12.50 |
| 3/13/2019 10:30 | MW-4 | < 563.00 | < 6.20 | < 7.58 | < 14.85 | < 6.22 | < 18.39 | < 7.97 | < 12.76 | < 13.64 | < 7.97 | < 8.28 | < 38.55 | < 11.02 |
| 6/6/2019 13:20 | MW-4 | < 585.00 | < 6.63 | < 7.12 | < 13.32 | < 7.41 | < 16.04 | < 7.21 | < 12.61 | < 10.05 | < 5.07 | < 7.79 | < 32.34 | < 11.76 |
| 9/12/2019 9:20 | MW-4 | < 550.00 | < 7.49 | < 6.10 | < 14.83 | < 6.73 | < 15.85 | < 7.43 | < 10.94 | < 9.61 | < 6.60 | < 7.88 | < 28.35 | < 9.95 |
| 12/12/2019 9:47 | MW-4 | < 528.00 | < 6.14 | < 5.81 | < 10.20 | < 6.77 | < 14.30 | < 5.59 | < 11.90 | < 9.82 | < 6.54 | < 6.53 | < 33.90 | < 12.30 |
| 3/12/2019 18:11 | MW-5 | < 556.00 | < 7.60 | < 7.78 | < 18.17 | < 9.39 | < 19.12 | < 7.34 | < 7.93 | < 12.60 | < 5.98 | < 6.20 | < 29.70 | < 11.42 |
| 6/6/2019 17:05 | MW-5 | < 583.00 | < 5.89 | < 7.04 | < 12.30 | < 8.77 | < 13.87 | < 6.94 | < 11.30 | < 11.86 | < 7.00 | < 6.47 | < 28.51 | < 9.57 |
| 9/11/2019 17:45 | MW-5 | < 544.00 | < 7.50 | < 6.43 | < 14.83 | < 8.67 | < 16.51 | < 6.96 | < 11.01 | < 10.70 | < 7.72 | < 6.93 | < 33.33 | < 12.55 |
| 12/12/2019 14:18 | MW-5 | < 538.00 | < 7.71 | < 6.81 | < 11.30 | < 7.34 | < 19.30 | < 8.54 | < 12.10 | < 13.40 | < 8.04 | < 8.61 | < 37.50 | < 12.40 |
| 12/12/2019 14:50 | MW-5 Dup | < 535.00 | < 6.90 | < 7.12 | < 13.00 | < 6.95 | < 16.20 | < 8.28 | < 11.20 | < 12.50 | < 7.49 | < 6.23 | < 30.30 | < 11.70 |
| 3/13/2019 12:22 | MW-6 | < 560.00 | < 6.39 | < 6.63 | < 18.01 | < 6.14 | < 13.65 | < 6.68 | < 12.43 | < 12.44 | < 7.55 | < 4.49 | < 32.10 | < 11.41 |
| 6/6/2019 17:55 | MW-6 | < 586.00 | < 5.27 | < 5.34 | < 11.69 | < 7.64 | < 10.69 | < 5.84 | < 8.70 | < 8.29 | < 7.76 | < 6.31 | < 30.18 | < 6.38 |
| 9/12/2019 11:21 | MW-6 | < 543.00 | < 7.42 | < 7.75 | < 14.10 | < 9.16 | < 18.72 | < 9.25 | < 14.28 | < 12.03 | < 8.80 | < 8.50 | < 35.40 | < 10.72 |
| 12/11/2019 15:50 | MW-6 | < 528.00 | < 5.16 | < 6.50 | < 8.44 | < 5.34 | < 10.40 | < 6.62 | < 10.30 | < 8.94 | < 4.70 | < 5.18 | < 25.40 | < 8.57 |

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2019 Groundwater Analysis Results (pCi/L)

| Sample Date Time | Well | Tritium | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Nb-95 | Zr-95 | I-131 | Cs-134 | Cs-137 | Ba-140 | La-140 |
|------------------|----------|----------|--------|--------|---------|---------|---------|--------|---------|---------|--------|--------|---------|---------|
| 3/13/2019 11:40 | MW-7 | < 554.00 | < 5.40 | < 5.40 | < 15.11 | < 8.14 | < 13.85 | < 7.20 | < 13.22 | < 12.80 | < 6.41 | < 8.69 | < 27.62 | < 11.08 |
| 6/7/2019 7:45 | MW-7 | < 576.00 | < 7.34 | < 7.25 | < 13.75 | < 7.78 | < 13.44 | < 9.43 | < 13.97 | < 14.78 | < 8.77 | < 6.42 | < 30.98 | < 13.20 |
| 9/11/2019 13:55 | MW-7 | < 553.00 | < 7.83 | < 7.31 | < 10.99 | < 8.75 | < 16.45 | < 7.20 | < 11.82 | < 10.66 | < 8.34 | < 5.88 | < 26.15 | < 11.19 |
| 9/11/2019 14:30 | MW-7 Dup | < 539.00 | < 5.49 | < 6.53 | < 16.89 | < 10.73 | < 10.70 | < 8.17 | < 14.38 | < 8.27 | < 6.29 | < 9.43 | < 33.35 | < 11.75 |
| 12/11/2019 14:35 | MW-7 | < 534.00 | < 4.70 | < 4.34 | < 10.20 | < 4.18 | < 8.35 | < 5.16 | < 8.35 | < 7.26 | < 5.13 | < 4.50 | < 21.70 | < 6.05 |

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|------------------|----------|----------|--------|--------|---------|--------|---------|---------|---------|---------|--------|--------|---------|---------|
| 3/12/2019 14:12 | MW-8 | < 490.00 | < 5.76 | < 5.89 | < 13.56 | < 5.21 | < 13.13 | < 6.00 | < 9.25 | < 10.99 | < 6.46 | < 6.94 | < 29.45 | < 10.66 |
| 6/7/2019 8:45 | MW-8 | < 583.00 | < 6.59 | < 6.63 | < 17.29 | < 6.49 | < 13.78 | < 5.79 | < 10.16 | < 10.06 | < 7.56 | < 6.31 | < 29.96 | < 11.53 |
| 6/7/2019 9:15 | MW-8 Dup | < 580.00 | < 7.50 | < 7.16 | < 13.79 | < 7.34 | < 16.23 | < 6.97 | < 11.48 | < 10.41 | < 8.72 | < 6.44 | < 35.64 | < 9.90 |
| 9/11/2019 16:22 | MW-8 | < 545.00 | < 9.31 | < 7.66 | < 18.38 | < 9.55 | < 19.08 | < 12.42 | < 14.63 | < 13.39 | < 8.35 | < 8.67 | < 40.15 | < 12.52 |
| 12/11/2019 13:41 | MW-8 | < 522.00 | < 4.46 | < 4.66 | < 10.40 | < 5.10 | < 9.35 | < 5.32 | < 7.81 | < 7.80 | < 5.78 | < 4.67 | < 22.10 | < 7.89 |

| | | | | | | | | | | | | | | |
|------------------|------|----------|--------|--------|---------|--------|---------|--------|---------|---------|--------|--------|---------|---------|
| 3/12/2019 14:55 | MW-9 | < 496.00 | < 5.84 | < 6.14 | < 12.79 | < 5.55 | < 12.49 | < 6.55 | < 11.37 | < 10.75 | < 6.41 | < 6.03 | < 30.43 | < 11.77 |
| 6/7/2019 10:20 | MW-9 | < 573.00 | < 5.85 | < 5.80 | < 9.44 | < 5.44 | < 12.13 | < 6.82 | < 11.11 | < 12.18 | < 7.12 | < 6.06 | < 29.63 | < 9.90 |
| 9/11/2019 15:30 | MW-9 | < 541.00 | < 8.44 | < 6.89 | < 15.41 | < 6.25 | < 13.84 | < 6.33 | < 9.62 | < 10.99 | < 8.36 | < 6.44 | < 38.34 | < 10.61 |
| 12/11/2019 12:50 | MW-9 | < 534.00 | < 6.28 | < 6.51 | < 12.90 | < 7.59 | < 11.00 | < 7.09 | < 12.00 | < 8.61 | < 5.70 | < 6.87 | < 23.90 | < 11.50 |

| | | | | | | | | | | | | | | |
|------------------|-----------|----------|--------|--------|---------|---------|---------|---------|---------|---------|--------|--------|---------|---------|
| 3/12/2019 15:40 | MW-10 | < 487.00 | < 5.48 | < 5.58 | < 11.60 | < 5.74 | < 11.61 | < 6.42 | < 11.04 | < 10.60 | < 6.46 | < 6.63 | < 28.18 | < 10.34 |
| 3/12/2019 16:00 | MW-10 Dup | < 494.00 | < 6.82 | < 7.17 | < 12.64 | < 5.81 | < 12.55 | < 7.42 | < 13.57 | < 13.30 | < 7.57 | < 6.91 | < 31.61 | < 11.55 |
| 6/6/2019 14:45 | MW-10 | < 583.00 | < 8.03 | < 6.95 | < 15.91 | < 9.69 | < 20.17 | < 6.72 | < 11.84 | < 12.79 | < 7.81 | < 8.04 | < 31.46 | < 7.57 |
| 9/12/2019 10:32 | MW-10 | < 548.00 | < 9.47 | < 8.49 | < 18.16 | < 11.74 | < 14.00 | < 10.60 | < 11.60 | < 12.80 | < 9.12 | < 8.38 | < 35.73 | < 14.64 |
| 12/12/2019 11:10 | MW-10 | < 530.00 | < 6.41 | < 6.90 | < 12.90 | < 7.38 | < 12.30 | < 7.81 | < 11.10 | < 10.10 | < 8.28 | < 5.88 | < 29.60 | < 7.50 |

| | | | | | | | | | | | | | | |
|------------------|-------|-------|--------|--------|---------|---------|---------|--------|---------|---------|--------|--------|---------|---------|
| 3/12/2019 16:40 | MW-11 | < 495 | < 6.25 | < 6.73 | < 15.06 | < 10.52 | < 10.20 | < 5.46 | < 10.94 | < 12.35 | < 5.12 | < 8.18 | < 29.02 | < 14.54 |
| 6/6/2019 15:40 | MW-11 | < 585 | < 6.42 | < 5.71 | < 11.23 | < 2.39 | < 15.45 | < 7.45 | < 8.11 | < 13.73 | < 7.50 | < 5.54 | < 30.07 | < 9.67 |
| 9/12/2019 12:25 | MW-11 | < 550 | < 7.74 | < 6.67 | < 15.73 | < 6.55 | < 14.99 | < 6.73 | < 8.76 | < 10.11 | < 7.64 | < 5.94 | < 26.56 | < 10.03 |
| 12/12/2019 12:35 | MW-11 | < 527 | < 5.31 | < 5.21 | < 11.80 | < 7.89 | < 11.90 | < 6.25 | < 9.50 | < 9.03 | < 6.97 | < 5.31 | < 2.83 | < 8.96 |

| | | | | | | | | | | | | | | |
|------------------|-------|----------|--------|--------|---------|--------|---------|--------|---------|---------|--------|--------|---------|---------|
| 3/12/2019 13:10 | MW-12 | < 526.00 | < 6.53 | < 6.47 | < 14.72 | < 5.92 | < 12.09 | < 6.66 | < 14.61 | < 12.35 | < 4.77 | < 7.44 | < 31.24 | < 11.07 |
| 6/6/2019 8:35 | MW-12 | < 578.00 | < 6.81 | < 5.39 | < 11.50 | < 6.14 | < 10.26 | < 5.79 | < 11.79 | < 10.25 | < 7.35 | < 5.69 | < 32.05 | < 9.11 |
| 9/11/2019 12:00 | MW-12 | < 552.00 | < 8.23 | < 7.61 | < 12.17 | < 7.45 | < 18.32 | < 8.93 | < 14.60 | < 10.60 | < 8.83 | < 7.07 | < 36.97 | < 9.00 |
| 12/11/2019 11:42 | MW-12 | < 531.00 | < 6.09 | < 5.91 | < 11.00 | < 5.70 | < 14.30 | < 7.60 | < 13.20 | < 10.70 | < 7.24 | < 6.27 | < 32.00 | < 10.80 |

Annual Radioactive Effluent Release Report**2.14 Unprotected Outside Storage Tank Radioactivity Limit**

1. Technical Specification 3/4.11.2.6 specifies that the quantity of radioactivity contained in each unprotected outdoor storage tank be maintained less than or equal to 7.85E-04 Curies (excluding tritium and dissolved and entrained noble gases). At no time during the reporting period was this value exceeded.

2.15 Gaseous Storage Tank Total Radioactivity Limit

1. Technical Specification 3/4.11.2.6 specifies that the quantity of radioactivity contained in each gas storage tank be maintained less than or equal to 8.5E+04 Curies noble gas (considered as Xe-133 equivalent). At no time during the reporting period was this value exceeded.

2.16 Errata/Corrections to Previous ARERRs

1. It was discovered on 3/15/2020 that windspeed direction in section 7.1 was incorrect. Windspeed direction in Tables 14-20, on the 2018 Annual Radioactive Effluent Release Report, states NWN but should read of WNW. The affected pages in their entirety are in Attachment 3 of this report.
2. It was discovered on 4/17/2020 that information regarding radiation monitor inoperability was omitted from the 2018 Annual Radioactive Effluent Release Report. The following should have been included in Section 2.10:

Gaseous Waste System (GWM) Radiation Monitor (PRMIRE0648)

Time Required by Specifications to Restore Operability: 30 Days

Period of Inoperability: 11/18/2018 to 2/14/2019 (88 Days)

Batch releases performed with monitor out of services: (1) 12/20/2018 16:11 to 12/22/2018 16:34 (32 hours)

Cause of Inoperability: The radiation monitor was declared out of services while attempting to discharge a Gas Decay Tank on 11/14/2018 because proper sample flow (2.0 scfm) could not be established. Sample flow would rise to 1.8 scfm upon discharge, however sample pump would trip due to inadequate flow.

Reason Operability Not Restored Within Allotted Time: A radiation monitor functional check was performed on 12/8/2018 with satisfactory results. However, the ACTION requirements of TRM 3.3-13 were implemented during release of Gas Decay Tank C from 12/20/2018 to 12/22/2018.

The affected pages in their entirety are in Attachment 3 of this report.

Annual Radioactive Effluent Release Report**2.17 Other Information**

1. Unavailability of REMP Milk Samples

Due to the unavailability of three milk sampling locations within five kilometers of the plant, Broad Leaf sampling is performed in accordance with Technical Requirements Manual (TRM) Table 3.12-1. Milk is collected, when available, from the control location and one identified sampling location as indicated in UNT-005-014, Offsite Dose Calculation Manual, Attachment 7.13.

2. Activity Released Via Secondary Pathways

The following secondary release paths were continuously monitored for radioactivity:

- The Hot Machine Shop Exhaust (AH-35),
- Decontamination Shop Exhaust (AH-34),
- The RAB H&V Equipment Room Ventilation System Exhaust (E-41A and E-41B);
and,
- The Switchgear/Cable Vault Area Ventilation System (AH-25).

Continuous sampling for these areas is maintained to demonstrate the operability of installed treatment systems and to verify integrity of barriers separating primary and secondary ventilation systems. Sampling for these areas was limited to continuous particulate and iodine sampling and monthly noble gas grab sampling. The activity released via these secondary pathways resulted from routine operations and remained below significant levels.

3. Missed Effluent Samples

Per TRM Section 4.11, continuous charcoal cartridge and particulate sample is required weekly. Samples shall be changed at least once per seven days and analyses shall be completed within 48 hours after changing or removal from sampler.

Plant Stack A and B particulate and charcoal samples were collected on 4/30/2019 (for week of 4/23/2019 - 4/30/2019), and only Plant Stack B was analyzed on 4/30/19. On 5/2/2019, it was discovered that Plant Stack B rad monitor did not have flow due to particulate pump replacement work until 4/26/2019; Plant Stack A did have flow the entire time period. The analysis for Plant Stack A (removed from sampler on 4/30/2019 at 11:21) was completed on 5/2/2019 12:38, 49.3 hours after being removed from the sampler vice the required 48 hours. Both samples had no detectable activity. Minimum detectable activities were less the required LLDs per TRM.

4. Reactor Coolant System Average Energy (E-Bar)

Reactor Coolant System E-Bar calculations were performed on 7/14/2019 and 12/15/2019 with values of 0.0651 and 0.0257 Mev/disintegration, respectively. Reactor Coolant System E-Bar is supplied for information only and is not used for effluent dose calculations.

Annual Radioactive Effluent Release Report

3.0 GASEOUS EFFLUENTS

3.1 Gas Effluent and Waste Disposal Report

Table 1, Gaseous Effluents-Summation of All Releases - Waterford 3

| A. | Fission & Activation Gases | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Est. Total Error % |
|----|-------------------------------------|---------|-----------|-----------|-----------|-----------|--------------------|
| 1. | Total Release | Ci | 2.68E+00 | 2.00E-01 | 4.54E-02 | 4.74E-02 | 2.50E+01 |
| 2. | Average release rate for the period | μCi/sec | 3.45E-01 | 2.55E-02 | 5.71E-03 | 5.97E-03 | |

| B. | Iodine | | | | | | |
|----|-------------------------------------|---------|----------|----------|----------|----------|----------|
| 1. | Total Iodine – 131 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.50E+01 |
| 2. | Average release rate for the period | μCi/sec | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | |

| C. | Particulates | | | | | | |
|----|---------------------------------------|---------|----------|----------|----------|----------|----------|
| 1. | Particulates with half-lives > 8 days | Ci | 1.34E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.50E+01 |
| 2. | Average release rate for the period | μCi/sec | 1.73E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | |

| D. | Tritium | | | | | | |
|----|-------------------------------------|---------|----------|----------|----------|----------|----------|
| 1. | Total Release | Ci | 2.88E+01 | 1.15E+01 | 9.37E+00 | 1.02E+01 | 2.50E+01 |
| 2. | Average release rate for the period | μCi/sec | 3.71E+00 | 1.46E+00 | 1.18E+00 | 1.28E+00 | |

| E. | Carbon-14 | | | | | | |
|----|-------------------------------------|---------|----------|----------|----------|----------|--|
| 1. | Total Release | Ci | 5.41E-01 | 3.27E+00 | 3.04E+00 | 3.28E+00 | |
| 2. | Average release rate for the period | μCi/sec | 6.95E-02 | 4.16E-01 | 3.82E-01 | 4.13E-01 | |

% of limit is on the Radiological Impact on Man Table

Annual Radioactive Effluent Release Report

Table 2, Gaseous Effluents – Ground Level Release - Batch Mode - Waterford 3

| Radionuclide Released | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total |
|-----------------------|------|-----------|-----------|-----------|-----------|----------|
| Fission Gases | | | | | | |
| Ar-41 | Ci | 3.85E-01 | 2.00E-01 | 0.00E+00 | 4.32E-02 | 6.28E-01 |
| Xe-133 | Ci | 8.15E-02 | 0.00E+00 | 4.54E-02 | 4.20E-03 | 1.31E-01 |
| Total for Period | Ci | 4.66E-01 | 2.00E-01 | 4.54E-02 | 4.74E-02 | 7.59E-01 |
| Iodines | | | | | | |
| Total for Period | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Particulates | | | | | | |
| Total for Period | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Tritium | | | | | | |
| H-3 | Ci | 8.86E-01 | 4.15E-01 | 1.26E+00 | 1.83E-01 | 2.74E+00 |
| Gross Alpha | | | | | | |
| Alpha | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

Table 3, Gaseous Effluents – Ground Level Release - Continuous Mode - Waterford 3

| Radionuclide Released | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total |
|-----------------------|------|-----------|-----------|-----------|-----------|----------|
| Fission Gases | | | | | | |
| Ar-41 | Ci | 2.22E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.22E+00 |
| Xe-133 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Total for Period | Ci | 2.22E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.22E+00 |
| Iodines | | | | | | |
| Total for Period | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Particulates | | | | | | |
| Co-58 | Ci | 2.83E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.83E-06 |
| Co-60 | Ci | 3.35E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.35E-07 |
| Cr-51 | Ci | 6.47E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 6.47E-06 |
| Nb-95 | Ci | 2.56E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.56E-07 |
| Os-191 | Ci | 2.32E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.32E-06 |
| Ru-103 | Ci | 1.23E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.23E-06 |
| Total for Period | Ci | 1.34E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.34E-05 |
| Tritium | | | | | | |
| H-3 | Ci | 2.80E+01 | 1.11E+01 | 8.10E+00 | 1.00E+01 | 5.72E+01 |

Annual Radioactive Effluent Release Report

4.0 LIQUID EFFLUENTS

4.1 Liquid Effluent and Waste Disposal Report

Table 4, Liquid Effluents-Summation of All Releases – Waterford 3

| A. | Fission & Activation Products | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Est. Total Error % |
|---|---|--------|-----------|-----------|-----------|-----------|--------------------|
| 1. | Total Release (not including tritium, gases or alpha) | Ci | 7.98E-03 | 7.61E-03 | 6.40E-03 | 4.20E-03 | 2.50E+01 |
| 2. | Average diluted concentration during period | μCi/mL | 2.65E-10 | 3.38E-10 | 1.63E-10 | 1.63E-10 | |
| B. Tritium | | | | | | | |
| 1. | Total Release | Ci | 2.19E+02 | 7.46E+01 | 5.36E+01 | 8.73E+01 | 2.50E+01 |
| 2. | Average diluted concentration during period. | μCi/mL | 7.26E-06 | 3.31E-06 | 1.37E-06 | 3.4E-06 | |
| C. Dissolved & Entrained Gases | | | | | | | |
| 1. | Total Release | Ci | 1.29E-03 | 2.21E-05 | 1.84E-04 | 2.62E-04 | 2.50E+01 |
| 2. | Average diluted concentration during period | μCi/mL | 4.28E-11 | 9.84E-13 | 4.69E-12 | 1.02E-11 | |
| D. Gross Alpha Activity | | | | | | | |
| 1. | Total Release | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.50E+01 |
| E. | | | | | | | |
| | Volume Of Waste Released (prior to dilution) | Liters | 2.77E+07 | 7.24E+06 | 1.19E+07 | 8.57E+06 | |
| F. | | | | | | | |
| | Volume Of Dilution Water Used During Period | Liters | 3.02E+10 | 2.25E+10 | 3.93E+10 | 2.57E+10 | |

% of limit is on the Radiological Impact on Man Table

Annual Radioactive Effluent Release Report

Table 5, Batch Mode Liquid Effluents -Waterford 3

| Nuclides Released | Unit | Batch Mode | | | | |
|-------------------|------|------------|-----------|-----------|-----------|----------|
| | | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total |
| Ag-110m | Ci | 2.12E-05 | 5.03E-06 | 0.00E+00 | 0.00E+00 | 2.62E-05 |
| Br-82 | Ci | 0.00E+00 | 7.66E-06 | 0.00E+00 | 0.00E+00 | 7.66E-06 |
| Co-57 | Ci | 0.00E+00 | 8.13E-06 | 7.38E-06 | 0.00E+00 | 1.55E-05 |
| Co-58 | Ci | 4.57E-03 | 2.09E-03 | 1.15E-03 | 4.24E-04 | 8.23E-03 |
| Co-60 | Ci | 3.94E-04 | 1.22E-03 | 1.10E-03 | 8.65E-04 | 3.58E-03 |
| Cr-51 | Ci | 1.09E-03 | 6.12E-04 | 0.00E+00 | 4.01E-05 | 1.74E-03 |
| Fe-55 | Ci | 6.19E-04 | 1.02E-03 | 1.60E-03 | 2.29E-03 | 5.53E-03 |
| Fe-59 | Ci | 2.96E-05 | 1.36E-04 | 4.32E-05 | 0.00E+00 | 2.09E-04 |
| H-3 | Ci | 2.19E+02 | 7.45E+01 | 5.36E+01 | 8.73E+01 | 4.34E+02 |
| I-131 | Ci | 0.00E+00 | 0.00E+00 | 4.54E-05 | 0.00E+00 | 4.54E-05 |
| I-133 | Ci | 0.00E+00 | 0.00E+00 | 1.51E-05 | 0.00E+00 | 1.51E-05 |
| Mn-54 | Ci | 7.56E-06 | 9.49E-05 | 3.95E-05 | 6.87E-05 | 2.11E-04 |
| Nb-95 | Ci | 8.61E-05 | 8.86E-04 | 4.02E-04 | 2.64E-04 | 1.64E-03 |
| Ni-56 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.67E-06 | 1.67E-06 |
| Sb-124 | Ci | 1.59E-04 | 8.41E-05 | 7.71E-05 | 0.00E+00 | 3.20E-04 |
| Sb-125 | Ci | 9.60E-04 | 9.48E-04 | 1.73E-03 | 1.12E-04 | 3.75E-03 |
| Sn-113 | Ci | 0.00E+00 | 1.39E-05 | 0.00E+00 | 0.00E+00 | 1.39E-05 |
| Zn-65 | Ci | 0.00E+00 | 5.46E-05 | 0.00E+00 | 0.00E+00 | 5.46E-05 |
| Zr-95 | Ci | 2.80E-05 | 4.28E-04 | 1.91E-04 | 1.35E-04 | 7.82E-04 |
| Total for Period | Ci | 2.19E+02 | 7.45E+01 | 5.36E+01 | 8.73E+01 | 4.34E+02 |
| | | | | | | |
| | | | | | | |
| Xe-133 | Ci | 1.24E-03 | 2.21E-05 | 1.64E-04 | 2.62E-04 | 1.69E-03 |
| Xe-135 | Ci | 4.76E-05 | 0.00E+00 | 2.00E-05 | 0.00E+00 | 6.76E-05 |
| Total for Period | Ci | 1.29E-03 | 2.21E-05 | 1.84E-04 | 2.62E-04 | 1.76E-03 |

Annual Radioactive Effluent Release Report

Table 6, Continuous Mode Liquid Effluents – Waterford 3

| Nuclides Released | Unit | Continuous Mode | | | | |
|-------------------|------|-----------------|-----------|-----------|-----------|----------|
| | | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total |
| Ag-110m | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Br-82 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Co-57 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Co-58 | Ci | 4.70E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 4.70E-06 |
| Co-60 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Cr-51 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Fe-55 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Fe-59 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| H-3 | Ci | 1.50E-01 | 1.87E-02 | 2.62E-02 | 3.07E-02 | 2.62E-01 |
| I-131 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| I-133 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Mn-54 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Nb-95 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ni-56 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Sb-124 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Sb-125 | Ci | 8.85E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 8.85E-06 |
| Sn-113 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Zn-65 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Zr-95 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Total for Period | Ci | 1.50E-01 | 1.87E-02 | 2.62E-02 | 3.07E-02 | 2.26E-01 |
| | | | | | | |
| | | | | | | |
| Xe-133 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Xe-135 | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Total for Period | Ci | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

Annual Radioactive Effluent Release Report

5.0 SOLID WASTE SUMMARY

5.1 Solid Waste Shipped Offsite for Burial or Disposal (Not Irradiated Fuel)5.1.1 Types of Waste

Table 7, Types of Solid Waste Summary - Waterford 3

| Types of Waste | Total Quantity (m ³) | Total Activity (Ci) | Est. Total Error (%) |
|--|----------------------------------|---------------------|----------------------|
| a. Spent resins, filter sludges, evaporator bottoms, etc. | 7.23E+01 | 4.59E+02 | 2.50E+01 |
| Waste Class | | | |
| A | 6.64E+01 | 6.63E+00 | |
| B | 5.95E+00 | 4.53E+02 | |
| C | 0.00E+00 | 0.00E+00 | |
| Unclassified | 0.00E+00 | 0.00E+00 | |
| b. Dry compressible waste, contaminated equip, etc. | 6.10E+02 | 1.29E+00 | 2.50E+01 |
| Waste Class | | | |
| A | 6.10E+02 | 1.29E+00 | |
| B | 0.00E+00 | 0.00E+00 | |
| C | 0.00E+00 | 0.00E+00 | |
| Unclassified | 0.00E+00 | 0.00E+00 | |
| c. Irradiated components, control rods, etc. | 0.00E+00 | 0.00E+00 | 2.50E+01 |
| Waste Class | | | |
| A | 0.00E+00 | 0.00E+00 | |
| B | 0.00E+00 | 0.00E+00 | |
| C | 0.00E+00 | 0.00E+00 | |
| Unclassified | 0.00E+00 | 0.00E+00 | |
| d. Other – Used Oil | 1.64E+01 | 1.12E-01 | 2.50E+01 |
| Waste Class | | | |
| A | 1.64E+01 | 1.12E-01 | |
| B | 0.00E+00 | 0.00E+00 | |
| C | 0.00E+00 | 0.00E+00 | |
| Unclassified | 0.00E+00 | 0.00E+00 | |

Annual Radioactive Effluent Release Report

5.1.2 Estimate of major nuclide composition (by waste type) only >1% [Note 1] are reported.

Table 8, Major Nuclides – Waterford 3

| Major Nuclide Composition | % | Curies |
|---|-------|----------|
| a. Spent resins, filter sludges, evaporator bottoms, etc. | | |
| Be-7 | 8.17 | 3.77E+01 |
| Mn-54 | 10.49 | 4.83E+01 |
| Fe-55 | 28.87 | 1.33E+02 |
| Co-58 | 17.79 | 8.20E+01 |
| Co-60 | 20.60 | 9.49E+01 |
| Ni-63 | 8.80 | 4.05E+01 |
| Zn-65 | 2.57 | 1.19E+01 |
| Cs-137 | 1.39 | 6.42E+00 |
| b. Dry compressible waste, contaminated equip, etc. | | |
| C-14 | 1.19 | 1.55E-02 |
| Cr-51 | 9.75 | 1.27E-01 |
| Fe-55 | 9.76 | 1.27E-01 |
| Co-58 | 60.25 | 7.84E-01 |
| Co-60 | 3.71 | 4.83E-02 |
| Ni-63 | 6.08 | 7.91E-02 |
| Zr-95 | 1.36 | 1.77E-02 |
| Nb-95 | 2.30 | 2.99E-02 |
| Cs-137 | 4.14 | 5.38E-02 |
| c. Irradiated components, control rods, etc. | | |
| None | N/A | N/A |
| d. Other | | |
| H-3 | 45.25 | 5.09E-02 |
| Fe-55 | 6.21 | 6.98E-03 |
| Co-58 | 3.91 | 4.40E-03 |
| Co-60 | 4.97 | 5.58E-03 |
| Ni-63 | 30.79 | 3.46E-02 |
| Cs-137 | 7.27 | 8.17E-03 |

[Note 1] – “Major” radionuclide is equivalent to a “principle” radionuclide, i.e. greater than 1 percent of total activity.

Annual Radioactive Effluent Release Report

5.1.3 Solid Waste Disposition

Table 9, Solid Waste Disposition (Specify Site or Unit)

| Number of Shipments | Mode of Transportation | Destination |
|---------------------|------------------------|-------------------------------|
| 24 | Hittman Transport | Energy Solutions, Bear Creek |
| 5 | Hittman Transport | Energy Solutions, Gallaher Rd |
| 1 | Hittman Transport | Energy Solutions, Memphis |
| 1 | Hittman Transport | Energy Solutions LLC. |
| 1 | Hittman Transport | Resin Solutions, Erwin |

Table 10, Irradiated Fuel Shipments Disposition (Specify Site or Unit)

| Number of Shipments | Mode of Transportation | Destination |
|---------------------|------------------------|-------------|
| None | N/A | N/A |

Annual Radioactive Effluent Release Report

6.0 RADIOLOGICAL IMPACT TO MAN

6.1 10CFR Part50, Appendix I Evaluation

Table 11, Dose Assessment – Waterford 3

| | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Annual |
|--|-----------|-----------|-----------|-----------|----------|
| Liquid Effluent Dose Limit, Total Body | 1.5 mrem | 1.5 mrem | 1.5 mrem | 1.5 mrem | 3 mrem |
| Total Body Dose | 3.50E-03 | 7.29E-05 | 4.27E-05 | 7.77E-05 | 3.69E-03 |
| % of Limit | 2.33E-01 | 4.86E-03 | 2.85E-03 | 5.18E-03 | 1.23E-01 |
| Liquid Effluent Dose Limit, Any Organ | 5 mrem | 5 mrem | 5 mrem | 5 mrem | 10 mrem |
| Maximum Organ Dose | 7.21E-03 | 2.07E-04 | 1.05E-04 | 1.32E-04 | 7.66E-03 |
| % of Limit | 1.44E-01 | 4.14E-03 | 2.10E-03 | 2.64E-03 | 7.66E-02 |
| Gaseous Effluent Dose Limit, Gamma Air | 5 mrad | 5 mrad | 5 mrad | 5 mrad | 10 mrad |
| Gamma Air Dose | 1.54E-02 | 1.18E-03 | 1.02E-05 | 2.56E-04 | 1.68E-02 |
| % of Limit | 3.08E-01 | 2.36E-02 | 2.04E-04 | 5.12E-03 | 1.68E-01 |
| Gaseous Effluent Dose Limit, Beta Air | 10 mrad | 10 mrad | 10 mrad | 10 mrad | 20 mrad |
| Beta Air Dose | 5.47E-03 | 4.17E-04 | 3.02E-05 | 9.27E-05 | 6.00E-03 |
| % of Limit | 5.47E-02 | 4.17E-03 | 3.02E-04 | 9.27E-04 | 3.00E-02 |
| Gaseous Effluent Organ Dose Limit (Iodine, Tritium, Particulates with > 8 day half-life) | 7.5 mrem | 7.5 mrem | 7.5 mrem | 7.5 mrem | 15 mrem |
| Gaseous Effluent Organ Dose (Iodine, Tritium, Particulates with > 8 day half-life) | 2.52E-02 | 1.00E-02 | 8.18E-03 | 8.89E-03 | 5.23E-02 |
| % of Limit | 3.36E-01 | 1.33E-01 | 1.09E-01 | 1.19E-01 | 3.49E-01 |

Annual Radioactive Effluent Release Report**6.2 Dose to Members of the Public Inside the Site Boundary**

The Member of the Public inside the site boundary expected to have the maximum exposure due to gaseous effluents would be an employee at the Waterford 1 and 2 fossil fuel plants, located in the NW sector at a distance of approximately 670 meters (0.42 miles) from the reactor building.

The doses for such an individual were determined by scaling the full-time occupancy doses due to airborne effluents by the occupancy time due to a normal working year. Based on an assumed occupancy of 25% (40-hour work week) and the fact that all employees are adults, the calculated doses were determined to be

5.85E-03 mrem to the skin

2.19 E-03 mrem to the maximum exposed organ (Lung)

6.19E-03 mrem to the Total Body

All doses for receptors inside the site boundary were calculated according to the methodology described in

the Waterford 3 Offsite Dose Calculation Manual considering only the inhalation and ground plane exposure pathways.

6.3 Dose to a Member of the Public due to Release of Radioactive Material in Groundwater

There were no releases of radioactive material in groundwater during the reporting period; therefore, there was no additional dose to a MEMBER OF THE PUBLIC associated with off-site releases of licensed radioactive material via groundwater.

Annual Radioactive Effluent Release Report

6.4 40CFR Part 190 Evaluation for an Individual in the Unrestricted Area

Table 12, EPA 40 CFR PART 190 Evaluation

| | Whole Body | Thyroid | Any Other Organ |
|------------|------------|----------|-----------------|
| Dose Limit | 25 mrem | 75 mrem | 25 mrem |
| Dose | 5.95E-01 | 5.95E-01 | 2.61E+00 |
| % of Limit | 2.38E+00 | 7.93E-01 | 1.04E+01 |

Liquid dose, gaseous dose including C14, direct shine from each unit, ISFSI and any other nuclear power related facility within 5 miles of the station are considered when calculating dose compliance with 40 CFR 190

6.5 40CFR Part 190 Calculation

Table 13, EPA 40 CFR Part 190 Calculation

| | Unit | Total Body | Thyroid | Max Organ |
|--|------|------------|----------|-----------|
| Routine Airborne Effluents ^[Note 1] | WF3 | 5.23E-02 | 5.23E-02 | 5.23E-02 |
| Routine Liquid Effluents | WF3 | 3.69E-03 | 3.26E-03 | 7.65E-03 |
| Airborne Releases of C ¹⁴ | WF3 | 5.02E-01 | 5.02E-01 | 2.51E+00 |
| Ground Water & Storm Drain Totals | WF3 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Direct Shine from areas such as dry cask storage, radwaste storage, Equipment Mausoleums | WF3 | 3.72E-02 | 3.72E-02 | 3.72E-02 |
| Total 40 CFR 190 Dose | WF3 | 5.95E-01 | 5.95E-01 | 2.61E+00 |

[Note 1]: Routine airborne dose in this table is mrad expressed as mrem. This addition does not represent a real dose and is listed here solely to help demonstrate compliance with 40 CFR 190.

Annual Radioactive Effluent Release Report

7.0 METEOROLOGICAL DATA

7.1 Joint Frequency Distributions

1. Period of Record: 01/01/2019 – 12/31/2019
2. Elevation: 10 m
3. Total period of calm hours: 0

Table 14, Hours of Each Wind Speed and Direction -Stability A

| Wind Speed (m/s) | | | | | | | | | | | | | |
|------------------|-----------|-----------|----------|---------|---------|---------|---------|---------|----------|-----------|-----------|-------|-------|
| Wind Direction | 0.22-0.50 | 0.51-0.75 | 0.76-1.0 | 1.1-1.5 | 1.6-2.0 | 2.1-3.0 | 3.1-5.0 | 5.1-7.0 | 7.1-10.0 | 10.1-13.0 | 13.1-18.0 | >18.0 | Total |
| N | 0 | 0 | 0 | 0 | 0 | 8 | 14 | 11 | 1 | 0 | 0 | 0 | 34 |
| NNE | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 4 | 0 | 0 | 0 | 0 | 10 |
| NE | 0 | 0 | 0 | 0 | 0 | 18 | 80 | 3 | 0 | 0 | 0 | 0 | 101 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 10 |
| E | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 3 |
| ESE | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 3 |
| SE | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 3 | 0 | 0 | 0 | 0 | 13 |
| SSE | 0 | 0 | 0 | 0 | 0 | 5 | 33 | 7 | 1 | 0 | 0 | 0 | 46 |
| S | 0 | 0 | 0 | 0 | 0 | 5 | 17 | 8 | 2 | 0 | 0 | 0 | 32 |
| SSW | 0 | 0 | 0 | 0 | 1 | 6 | 5 | 5 | 2 | 0 | 0 | 0 | 19 |
| SW | 0 | 0 | 0 | 0 | 1 | 6 | 7 | 3 | 0 | 0 | 0 | 0 | 17 |
| WSW | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 0 | 0 | 0 | 0 | 0 | 9 |
| W | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| WNW | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 0 | 0 | 0 | 0 | 8 |
| NW | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 6 |
| NNW | 0 | 0 | 0 | 0 | 1 | 1 | 12 | 0 | 0 | 0 | 0 | 0 | 14 |
| Total | 0 | 0 | 0 | 0 | 3 | 62 | 208 | 51 | 6 | 0 | 0 | 0 | 330 |

Annual Radioactive Effluent Release Report

1. Period of Record: 01/01/2019 – 12/31/2019
2. Elevation: 10 m
3. Total period of calm hours: 0

Table 15, Hours of Each Wind Speed and Direction -Stability B

| Wind Speed (m/s) | | | | | | | | | | | | | |
|------------------|-----------|-----------|----------|---------|---------|---------|---------|---------|----------|-----------|-----------|-------|-------|
| Wind Direction | 0.22-0.50 | 0.51-0.75 | 0.76-1.0 | 1.1-1.5 | 1.6-2.0 | 2.1-3.0 | 3.1-5.0 | 5.1-7.0 | 7.1-10.0 | 10.1-13.0 | 13.1-18.0 | >18.0 | Total |
| N | 0 | 0 | 0 | 0 | 2 | 15 | 12 | 11 | 0 | 0 | 0 | 0 | 40 |
| NNE | 0 | 0 | 0 | 0 | 0 | 6 | 7 | 3 | 0 | 0 | 0 | 0 | 16 |
| NE | 0 | 0 | 0 | 0 | 2 | 20 | 61 | 5 | 0 | 0 | 0 | 0 | 88 |
| ENE | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 2 | 0 | 0 | 0 | 0 | 12 |
| E | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| ESE | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| SE | 0 | 0 | 0 | 0 | 1 | 4 | 23 | 5 | 0 | 0 | 0 | 0 | 33 |
| SSE | 0 | 0 | 0 | 0 | 1 | 10 | 27 | 16 | 2 | 0 | 0 | 0 | 56 |
| S | 0 | 0 | 0 | 0 | 4 | 11 | 29 | 9 | 1 | 0 | 0 | 0 | 54 |
| SSW | 0 | 0 | 0 | 1 | 2 | 6 | 8 | 12 | 5 | 0 | 0 | 0 | 34 |
| SW | 0 | 0 | 0 | 0 | 1 | 14 | 6 | 6 | 0 | 0 | 0 | 0 | 27 |
| WSW | 0 | 0 | 0 | 0 | 2 | 6 | 5 | 0 | 0 | 0 | 0 | 0 | 13 |
| W | 0 | 0 | 0 | 0 | 3 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 9 |
| WNW | 0 | 0 | 0 | 0 | 0 | 6 | 4 | 1 | 0 | 0 | 0 | 0 | 11 |
| NW | 0 | 0 | 0 | 0 | 1 | 2 | 7 | 1 | 0 | 0 | 0 | 0 | 11 |
| NNW | 0 | 0 | 0 | 0 | 0 | 5 | 8 | 2 | 0 | 0 | 0 | 0 | 15 |
| Total | 0 | 0 | 0 | 1 | 19 | 112 | 211 | 73 | 8 | 0 | 0 | 0 | 424 |

Annual Radioactive Effluent Release Report

1. Period of Record: 01/01/2019 – 12/31/2019
2. Elevation: 10 m
3. Total period of calm hours: 0

Table 16, Hours of Each Wind Speed and Direction -Stability C

| Wind Speed (m/s) | | | | | | | | | | | | | |
|------------------|-----------|-----------|----------|---------|---------|---------|---------|---------|----------|-----------|-----------|-------|-------|
| Wind Direction | 0.22-0.50 | 0.51-0.75 | 0.76-1.0 | 1.1-1.5 | 1.6-2.0 | 2.1-3.0 | 3.1-5.0 | 5.1-7.0 | 7.1-10.0 | 10.1-13.0 | 13.1-18.0 | >18.0 | Total |
| N | 0 | 0 | 0 | 1 | 4 | 13 | 22 | 8 | 1 | 0 | 0 | 0 | 49 |
| NNE | 0 | 0 | 0 | 0 | 4 | 13 | 6 | 2 | 0 | 0 | 0 | 0 | 25 |
| NE | 0 | 0 | 0 | 0 | 4 | 31 | 44 | 4 | 0 | 0 | 0 | 0 | 83 |
| ENE | 0 | 0 | 0 | 0 | 1 | 3 | 23 | 3 | 0 | 0 | 0 | 0 | 30 |
| E | 0 | 0 | 0 | 0 | 1 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 8 |
| ESE | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 8 |
| SE | 0 | 0 | 0 | 1 | 1 | 6 | 19 | 4 | 0 | 0 | 0 | 0 | 31 |
| SSE | 0 | 0 | 0 | 0 | 1 | 11 | 37 | 12 | 2 | 0 | 0 | 0 | 63 |
| S | 0 | 0 | 0 | 0 | 3 | 6 | 26 | 8 | 4 | 0 | 0 | 0 | 47 |
| SSW | 0 | 0 | 0 | 0 | 4 | 4 | 18 | 9 | 10 | 0 | 0 | 0 | 45 |
| SW | 0 | 0 | 0 | 1 | 6 | 10 | 17 | 5 | 0 | 0 | 0 | 0 | 39 |
| WSW | 0 | 0 | 0 | 2 | 6 | 14 | 6 | 0 | 0 | 0 | 0 | 0 | 28 |
| W | 0 | 0 | 0 | 1 | 3 | 15 | 3 | 1 | 0 | 0 | 0 | 0 | 23 |
| WNW | 0 | 0 | 0 | 0 | 3 | 12 | 8 | 0 | 0 | 0 | 0 | 0 | 23 |
| NW | 0 | 0 | 0 | 0 | 1 | 6 | 2 | 2 | 0 | 0 | 0 | 0 | 11 |
| NNW | 0 | 0 | 0 | 1 | 5 | 6 | 8 | 3 | 0 | 0 | 0 | 0 | 23 |
| Total | 0 | 0 | 0 | 7 | 47 | 153 | 250 | 62 | 17 | 0 | 0 | 0 | 536 |

Annual Radioactive Effluent Release Report

1. Period of Record: 01/01/2019 – 12/31/2019
2. Elevation: 10 m
3. Total period of calm hours: 0

Table 17, Hours of Each Wind Speed and Direction -Stability D

| Wind Speed (m/s) | | | | | | | | | | | | | |
|------------------|-----------|-----------|----------|---------|---------|---------|---------|---------|----------|-----------|-----------|-------|-------|
| Wind Direction | 0.22-0.50 | 0.51-0.75 | 0.76-1.0 | 1.1-1.5 | 1.6-2.0 | 2.1-3.0 | 3.1-5.0 | 5.1-7.0 | 7.1-10.0 | 10.1-13.0 | 13.1-18.0 | >18.0 | Total |
| N | 0 | 1 | 0 | 6 | 25 | 76 | 128 | 77 | 15 | 0 | 0 | 0 | 328 |
| NNE | 0 | 1 | 4 | 8 | 23 | 68 | 68 | 43 | 10 | 0 | 0 | 0 | 225 |
| NE | 0 | 0 | 1 | 11 | 26 | 125 | 189 | 27 | 3 | 0 | 0 | 0 | 382 |
| ENE | 0 | 0 | 0 | 2 | 4 | 32 | 55 | 22 | 12 | 0 | 0 | 0 | 127 |
| E | 0 | 0 | 1 | 2 | 2 | 14 | 20 | 5 | 4 | 0 | 0 | 0 | 48 |
| ESE | 0 | 1 | 1 | 1 | 3 | 13 | 23 | 8 | 4 | 0 | 0 | 0 | 54 |
| SE | 0 | 0 | 1 | 0 | 9 | 17 | 65 | 19 | 7 | 0 | 0 | 0 | 118 |
| SSE | 0 | 0 | 3 | 6 | 14 | 61 | 156 | 51 | 12 | 1 | 0 | 0 | 304 |
| S | 0 | 0 | 1 | 7 | 13 | 57 | 153 | 52 | 19 | 2 | 0 | 0 | 304 |
| SSW | 0 | 1 | 0 | 13 | 13 | 48 | 70 | 37 | 18 | 0 | 0 | 0 | 200 |
| SW | 0 | 1 | 2 | 11 | 15 | 37 | 46 | 15 | 1 | 0 | 0 | 0 | 128 |
| WSW | 0 | 0 | 0 | 16 | 18 | 42 | 21 | 3 | 0 | 0 | 0 | 0 | 100 |
| W | 0 | 1 | 3 | 12 | 24 | 29 | 22 | 4 | 0 | 0 | 0 | 0 | 95 |
| WNW | 0 | 1 | 1 | 3 | 13 | 38 | 15 | 5 | 0 | 0 | 0 | 0 | 76 |
| NW | 0 | 1 | 3 | 8 | 7 | 24 | 31 | 10 | 1 | 0 | 0 | 0 | 85 |
| NNW | 0 | 0 | 1 | 10 | 14 | 45 | 69 | 34 | 11 | 0 | 0 | 0 | 184 |
| Total | 0 | 8 | 22 | 116 | 223 | 726 | 1131 | 412 | 117 | 3 | 0 | 0 | 2758 |

Annual Radioactive Effluent Release Report

1. Period of Record: 01/01/2019 – 12/31/2019
2. Elevation: 10 m
3. Total period of calm hours: 1

Table 18, Hours of Each Wind Speed and Direction -Stability E

| Wind Speed (m/s) | | | | | | | | | | | | | |
|------------------|-----------|-----------|----------|---------|---------|---------|---------|---------|----------|-----------|-----------|-------|-------|
| Wind Direction | 0.22-0.50 | 0.51-0.75 | 0.76-1.0 | 1.1-1.5 | 1.6-2.0 | 2.1-3.0 | 3.1-5.0 | 5.1-7.0 | 7.1-10.0 | 10.1-13.0 | 13.1-18.0 | >18.0 | Total |
| N | 1 | 3 | 6 | 19 | 38 | 78 | 72 | 12 | 0 | 0 | 0 | 0 | 229 |
| NNE | 0 | 3 | 10 | 22 | 34 | 109 | 102 | 6 | 0 | 0 | 0 | 0 | 286 |
| NE | 0 | 0 | 2 | 20 | 37 | 128 | 147 | 17 | 0 | 0 | 0 | 0 | 351 |
| ENE | 1 | 0 | 5 | 13 | 12 | 26 | 65 | 26 | 0 | 0 | 0 | 0 | 148 |
| E | 0 | 1 | 9 | 15 | 15 | 34 | 26 | 7 | 0 | 0 | 0 | 0 | 107 |
| ESE | 0 | 1 | 4 | 6 | 8 | 25 | 49 | 13 | 0 | 0 | 0 | 0 | 106 |
| SE | 0 | 3 | 3 | 2 | 19 | 74 | 55 | 14 | 0 | 0 | 0 | 0 | 170 |
| SSE | 0 | 1 | 3 | 9 | 39 | 185 | 98 | 3 | 2 | 0 | 0 | 0 | 340 |
| S | 0 | 7 | 5 | 24 | 77 | 131 | 67 | 2 | 0 | 0 | 0 | 0 | 313 |
| SSW | 1 | 3 | 8 | 46 | 36 | 39 | 27 | 2 | 0 | 0 | 0 | 0 | 162 |
| SW | 0 | 8 | 12 | 41 | 22 | 18 | 11 | 1 | 0 | 0 | 0 | 0 | 113 |
| WSW | 0 | 1 | 21 | 41 | 23 | 13 | 4 | 0 | 0 | 0 | 0 | 0 | 103 |
| W | 1 | 6 | 20 | 45 | 19 | 17 | 7 | 0 | 0 | 0 | 0 | 0 | 115 |
| WNW | 1 | 7 | 08 | 27 | 14 | 5 | 7 | 0 | 0 | 0 | 0 | 0 | 69 |
| NW | 0 | 2 | 7 | 23 | 18 | 27 | 16 | 1 | 0 | 0 | 0 | 0 | 94 |
| NNW | 0 | 2 | 6 | 20 | 24 | 49 | 36 | 1 | 0 | 0 | 0 | 0 | 138 |
| Total | 5 | 48 | 129 | 373 | 435 | 958 | 789 | 105 | 2 | 0 | 0 | 0 | 2844 |

Annual Radioactive Effluent Release Report

1. Period of Record: 01/01/2019 – 12/31/2019
2. Elevation: 10 m
3. Total period of calm hours: 0

Table 19, Hours of Each Wind Speed and Direction -Stability F

| Wind Speed (m/s) | | | | | | | | | | | | | |
|------------------|-----------|-----------|----------|---------|---------|---------|---------|---------|----------|-----------|-----------|-------|-------|
| Wind Direction | 0.22-0.50 | 0.51-0.75 | 0.76-1.0 | 1.1-1.5 | 1.6-2.0 | 2.1-3.0 | 3.1-5.0 | 5.1-7.0 | 7.1-10.0 | 10.1-13.0 | 13.1-18.0 | >18.0 | Total |
| N | 1 | 0 | 5 | 14 | 7 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 36 |
| NNE | 0 | 1 | 3 | 13 | 16 | 14 | 1 | 0 | 0 | 0 | 0 | 0 | 48 |
| NE | 0 | 0 | 5 | 6 | 7 | 31 | 7 | 0 | 0 | 0 | 0 | 0 | 56 |
| ENE | 0 | 1 | 7 | 6 | 6 | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 28 |
| E | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 9 |
| ESE | 0 | 0 | 5 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| SE | 1 | 0 | 4 | 1 | 7 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 18 |
| SSE | 1 | 2 | 3 | 18 | 43 | 63 | 3 | 0 | 0 | 0 | 0 | 0 | 133 |
| S | 1 | 3 | 14 | 47 | 66 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 155 |
| SSW | 1 | 8 | 30 | 100 | 25 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 167 |
| SW | 0 | 15 | 36 | 60 | 11 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| WSW | 0 | 28 | 38 | 54 | 9 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 132 |
| W | 6 | 20 | 24 | 45 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| WNW | 0 | 7 | 15 | 23 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| NW | 1 | 7 | 7 | 16 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 41 |
| NNW | 1 | 5 | 7 | 14 | 8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 37 |
| Total | 14 | 99 | 204 | 419 | 224 | 160 | 23 | 0 | 0 | 0 | 0 | 0 | 1143 |

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1. Period of Record: 01/01/2019 – 12/31/2019
2. Elevation: 10 m
3. Total period of calm hours: 0

Table 20, Hours of Each Wind Speed and Direction -Stability G

| Wind Speed (m/s) | | | | | | | | | | | | | |
|------------------|-----------|-----------|----------|---------|---------|---------|---------|---------|----------|-----------|-----------|-------|-------|
| Wind Direction | 0.22-0.50 | 0.51-0.75 | 0.76-1.0 | 1.1-1.5 | 1.6-2.0 | 2.1-3.0 | 3.1-5.0 | 5.1-7.0 | 7.1-10.0 | 10.1-13.0 | 13.1-18.0 | >18.0 | Total |
| N | 1 | 0 | 5 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| NNE | 0 | 4 | 2 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| NE | 1 | 2 | 3 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| ENE | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| E | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| ESE | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| SE | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| SSE | 0 | 1 | 0 | 5 | 15 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 26 |
| S | 1 | 6 | 3 | 16 | 20 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 51 |
| SSW | 1 | 8 | 14 | 49 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 88 |
| SW | 3 | 14 | 13 | 31 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 69 |
| WSW | 6 | 37 | 34 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 95 |
| W | 8 | 35 | 25 | 36 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 105 |
| WNW | 9 | 19 | 19 | 15 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 63 |
| NW | 2 | 6 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 |
| NNW | 1 | 8 | 8 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| Total | 35 | 144 | 136 | 192 | 66 | 14 | 1 | 0 | 0 | 0 | 0 | 0 | 588 |

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7.2 Stability Class

Table 21, Classification of Atmospheric Stability

| Stability Condition | Pasquill Categories | Hours (Percentage) |
|---------------------|---------------------|--------------------|
| Extremely Unstable | A | 3.83 |
| Moderately Stable | B | 4.92 |
| Slightly Unstable | C | 6.22 |
| Neutral | D | 31.98 |
| Slightly Stable | E | 32.98 |
| Moderately Stable | F | 13.26 |
| Extremely Stable | G | 6.82 |

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Attachment 1

Revised Offsite Dose Calculation Manual

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Attachment 2

Revised Process Control Program

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Attachment 3

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Errata/Corrections to Previous ARERRs

| | | |
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7.0 METEOROLOGICAL DATA**7.1 Joint Frequency Distributions**

1. Period of Record: 01/01/2018 – 12/31/2018
2. Stability Class: A
3. Elevation: 10 m
4. Periods of calm hours: 0

Table 14, Hours of Each Wind Speed and Direction Stability Class A

| Wind Direction | Wind Speed (mps) | | | | | | | | | | | | Total |
|----------------|------------------|-----------|----------|---------|---------|---------|---------|---------|----------|-----------|-----------|-------|-------|
| | 0.22-0.50 | 0.51-0.75 | 0.76-1.0 | 1.1-1.5 | 1.6-2.0 | 2.1-3.0 | 3.1-5.0 | 5.1-7.0 | 7.1-10.0 | 10.1-13.0 | 13.1-18.0 | >18.0 | |
| N | 0 | 0 | 0 | 0 | 0 | 3 | 27 | 6 | 0 | 0 | 0 | 0 | 36 |
| NNE | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 5 |
| NE | 0 | 0 | 0 | 0 | 0 | 8 | 40 | 1 | 0 | 0 | 0 | 0 | 49 |
| ENE | 0 | 0 | 0 | 0 | 0 | 4 | 10 | 3 | 0 | 0 | 0 | 0 | 17 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| ESE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| SE | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 1 | 0 | 0 | 0 | 7 |
| SSE | 0 | 0 | 0 | 0 | 0 | 1 | 30 | 20 | 5 | 0 | 0 | 0 | 56 |
| S | 0 | 0 | 0 | 0 | 0 | 2 | 17 | 4 | 3 | 0 | 0 | 0 | 26 |
| SSW | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 5 | 1 | 0 | 0 | 0 | 13 |
| SW | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 2 | 0 | 0 | 0 | 0 | 17 |
| WSW | 0 | 0 | 0 | 0 | 0 | 5 | 10 | 2 | 0 | 0 | 0 | 0 | 17 |
| W | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| WNW | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 3 | 0 | 0 | 0 | 0 | 10 |
| NW | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 5 | 0 | 0 | 0 | 0 | 10 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 8 |
| Total | 0 | 0 | 0 | 0 | 0 | 26 | 186 | 55 | 10 | 0 | 0 | 0 | 277 |

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Attachment 3

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Errata/Corrections to Previous ARERRs

| | | |
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| Annual Radioactive Effluent Release Report | | |

1. Period of Record: 01/01/2018 – 12/31/2018
2. Stability Class: B
3. Elevation: 10 m
4. Periods of calm hours: 0

Table 15, Hours of Each Wind Speed and Direction Stability Class B

| Wind Direction | Wind Speed (mps) | | | | | | | | | | | | Total |
|----------------|------------------|-----------|----------|---------|---------|---------|---------|---------|----------|-----------|-----------|-------|-------|
| | 0.22-0.50 | 0.51-0.75 | 0.76-1.0 | 1.1-1.5 | 1.6-2.0 | 2.1-3.0 | 3.1-5.0 | 5.1-7.0 | 7.1-10.0 | 10.1-13.0 | 13.1-18.0 | >18.0 | |
| N | 0 | 0 | 0 | 0 | 0 | 4 | 12 | 13 | 1 | 0 | 0 | 0 | 30 |
| NNE | 0 | 0 | 0 | 0 | 2 | 5 | 4 | 2 | 0 | 0 | 0 | 0 | 13 |
| NE | 0 | 0 | 0 | 0 | 1 | 13 | 41 | 2 | 0 | 0 | 0 | 0 | 57 |
| ENE | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 4 | 0 | 0 | 0 | 0 | 18 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 6 |
| ESE | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| SE | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 4 | 0 | 0 | 0 | 0 | 15 |
| SSE | 0 | 0 | 0 | 0 | 0 | 10 | 20 | 16 | 0 | 0 | 0 | 0 | 46 |
| S | 0 | 0 | 0 | 0 | 0 | 4 | 15 | 4 | 3 | 0 | 0 | 0 | 26 |
| SSW | 0 | 0 | 0 | 0 | 0 | 3 | 5 | 3 | 1 | 0 | 0 | 0 | 12 |
| SW | 0 | 0 | 0 | 0 | 0 | 6 | 15 | 4 | 0 | 0 | 0 | 0 | 25 |
| WSW | 0 | 0 | 0 | 0 | 0 | 10 | 7 | 3 | 0 | 0 | 0 | 0 | 20 |
| W | 0 | 0 | 0 | 0 | 0 | 4 | 7 | 1 | 0 | 0 | 0 | 0 | 12 |
| WNW | 0 | 0 | 0 | 0 | 0 | 2 | 10 | 1 | 0 | 0 | 0 | 0 | 13 |
| NW | 0 | 0 | 0 | 0 | 0 | 1 | 15 | 1 | 0 | 0 | 0 | 0 | 17 |
| NNW | 0 | 0 | 0 | 0 | 0 | 3 | 16 | 1 | 0 | 0 | 0 | 0 | 20 |
| Total | 0 | 0 | 0 | 0 | 3 | 74 | 189 | 61 | 5 | 0 | 0 | 0 | 332 |

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1. Period of Record: 01/01/2018 – 12/31/2018
2. Stability Class: C
3. Elevation: 10 m
4. Periods of calm hours: 0

Table 16, Hours of Each Wind Speed and Direction Stability Class C

| Wind Direction | Wind Speed (mps) | | | | | | | | | | | | Total |
|----------------|------------------|-----------|----------|---------|---------|---------|---------|---------|----------|-----------|-----------|-------|-------|
| | 0.22-0.50 | 0.51-0.75 | 0.76-1.0 | 1.1-1.5 | 1.6-2.0 | 2.1-3.0 | 3.1-5.0 | 5.1-7.0 | 7.1-10.0 | 10.1-13.0 | 13.1-18.0 | >18.0 | |
| N | 0 | 0 | 0 | 0 | 2 | 7 | 14 | 8 | 5 | 0 | 0 | 0 | 36 |
| NNE | 0 | 0 | 0 | 0 | 6 | 10 | 4 | 2 | 0 | 0 | 0 | 0 | 22 |
| NE | 0 | 0 | 0 | 0 | 2 | 25 | 56 | 6 | 0 | 0 | 0 | 0 | 89 |
| ENE | 0 | 0 | 0 | 0 | 0 | 8 | 19 | 5 | 0 | 0 | 0 | 0 | 32 |
| E | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 1 | 0 | 0 | 0 | 0 | 9 |
| ESE | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 2 | 0 | 0 | 0 | 0 | 9 |
| SE | 0 | 0 | 0 | 0 | 0 | 4 | 7 | 2 | 0 | 0 | 0 | 0 | 13 |
| SSE | 0 | 0 | 0 | 0 | 2 | 13 | 16 | 17 | 1 | 0 | 0 | 0 | 49 |
| S | 0 | 0 | 0 | 1 | 0 | 14 | 11 | 11 | 5 | 0 | 0 | 0 | 42 |
| SSW | 0 | 0 | 0 | 1 | 5 | 7 | 9 | 7 | 1 | 0 | 0 | 0 | 30 |
| SW | 0 | 0 | 0 | 1 | 2 | 17 | 22 | 1 | 0 | 0 | 0 | 0 | 43 |
| WSW | 0 | 0 | 0 | 0 | 1 | 15 | 16 | 0 | 0 | 0 | 0 | 0 | 32 |
| W | 0 | 0 | 0 | 0 | 7 | 9 | 6 | 1 | 0 | 0 | 0 | 0 | 23 |
| WNW | 0 | 0 | 0 | 0 | 1 | 16 | 10 | 0 | 0 | 0 | 0 | 0 | 27 |
| NW | 0 | 0 | 0 | 0 | 1 | 5 | 12 | 2 | 0 | 0 | 0 | 0 | 20 |
| NNW | 0 | 0 | 0 | 0 | 1 | 8 | 16 | 0 | 0 | 0 | 0 | 0 | 25 |
| Total | 0 | 0 | 0 | 0 | 30 | 164 | 227 | 65 | 12 | 0 | 0 | 0 | 501 |

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1. Period of Record: 01/01/2018 – 12/31/2018
2. Stability Class: D
3. Elevation: 10 m
4. Periods of calm hours: 0

Table 17, Hours of Each Wind Speed and Direction Stability Class D

| Wind Direction | Wind Speed (mps) | | | | | | | | | | | | Total |
|----------------|------------------|-----------|----------|---------|---------|---------|---------|---------|----------|-----------|-----------|-------|-------|
| | 0.22-0.50 | 0.51-0.75 | 0.76-1.0 | 1.1-1.5 | 1.6-2.0 | 2.1-3.0 | 3.1-5.0 | 5.1-7.0 | 7.1-10.0 | 10.1-13.0 | 13.1-18.0 | >18.0 | |
| N | 0 | 0 | 3 | 17 | 32 | 66 | 94 | 60 | 14 | 0 | 0 | 0 | 286 |
| NNE | 2 | 5 | 5 | 19 | 31 | 55 | 68 | 29 | 4 | 0 | 0 | 0 | 218 |
| NE | 0 | 1 | 3 | 15 | 21 | 105 | 157 | 20 | 3 | 0 | 0 | 0 | 325 |
| ENE | 0 | 1 | 0 | 5 | 17 | 53 | 83 | 14 | 0 | 0 | 0 | 0 | 173 |
| E | 0 | 0 | 0 | 2 | 7 | 14 | 43 | 8 | 0 | 0 | 0 | 0 | 74 |
| ESE | 0 | 0 | 1 | 3 | 3 | 16 | 35 | 19 | 0 | 0 | 0 | 0 | 77 |
| SE | 0 | 0 | 0 | 0 | 5 | 21 | 78 | 54 | 6 | 0 | 0 | 0 | 164 |
| SSE | 0 | 2 | 2 | 6 | 10 | 44 | 101 | 62 | 3 | 0 | 0 | 0 | 230 |
| S | 0 | 1 | 0 | 3 | 12 | 57 | 48 | 30 | 6 | 0 | 0 | 0 | 157 |
| SSW | 0 | 0 | 0 | 9 | 18 | 34 | 38 | 8 | 1 | 0 | 0 | 0 | 108 |
| SW | 0 | 0 | 1 | 7 | 24 | 34 | 52 | 2 | 0 | 0 | 0 | 0 | 120 |
| WSW | 0 | 1 | 0 | 6 | 14 | 51 | 50 | 1 | 0 | 0 | 0 | 0 | 123 |
| W | 0 | 0 | 3 | 14 | 41 | 56 | 34 | 1 | 0 | 0 | 0 | 0 | 149 |
| WNW | 0 | 2 | 1 | 6 | 26 | 45 | 29 | 2 | 0 | 0 | 0 | 0 | 111 |
| NW | 0 | 1 | 1 | 11 | 7 | 35 | 46 | 7 | 0 | 0 | 0 | 0 | 108 |
| NNW | 0 | 0 | 4 | 12 | 24 | 42 | 104 | 32 | 0 | 0 | 0 | 0 | 218 |
| Total | 2 | 14 | 24 | 135 | 292 | 728 | 1060 | 349 | 37 | 0 | 0 | 0 | 2641 |

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1. Period of Record: 01/01/2018 – 12/31/2018
2. Stability Class: E
3. Elevation: 10 m
4. Periods of calm hours: 0

Table 18, Hours of Each Wind Speed and Direction Stability Class E

| Wind Direction | Wind Speed (mps) | | | | | | | | | | | | Total |
|----------------|------------------|-----------|----------|---------|---------|---------|---------|---------|----------|-----------|-----------|-------|-------|
| | 0.22-0.50 | 0.51-0.75 | 0.76-1.0 | 1.1-1.5 | 1.6-2.0 | 2.1-3.0 | 3.1-5.0 | 5.1-7.0 | 7.1-10.0 | 10.1-13.0 | 13.1-18.0 | >18.0 | |
| N | 2 | 6 | 7 | 28 | 32 | 69 | 72 | 15 | 0 | 0 | 0 | 0 | 231 |
| NNE | 2 | 5 | 4 | 20 | 33 | 78 | 68 | 5 | 0 | 0 | 0 | 0 | 215 |
| NE | 1 | 4 | 3 | 10 | 34 | 88 | 67 | 13 | 0 | 0 | 0 | 0 | 220 |
| ENE | 3 | 0 | 5 | 15 | 25 | 44 | 88 | 11 | 0 | 0 | 0 | 0 | 191 |
| E | 0 | 3 | 3 | 16 | 20 | 24 | 51 | 12 | 0 | 0 | 0 | 0 | 129 |
| ESE | 0 | 2 | 1 | 8 | 12 | 23 | 74 | 14 | 0 | 0 | 0 | 0 | 134 |
| SE | 0 | 1 | 6 | 4 | 15 | 53 | 98 | 12 | 9 | 2 | 0 | 0 | 200 |
| SSE | 0 | 1 | 3 | 11 | 45 | 149 | 107 | 4 | 0 | 0 | 0 | 0 | 320 |
| S | 0 | 4 | 9 | 40 | 46 | 86 | 52 | 2 | 2 | 0 | 0 | 0 | 241 |
| SSW | 1 | 5 | 8 | 63 | 57 | 56 | 22 | 6 | 0 | 0 | 0 | 0 | 218 |
| SW | 1 | 9 | 3 | 33 | 36 | 51 | 18 | 2 | 0 | 0 | 0 | 0 | 153 |
| WSW | 2 | 4 | 7 | 53 | 52 | 34 | 14 | 0 | 0 | 0 | 0 | 0 | 166 |
| W | 1 | 4 | 10 | 59 | 29 | 13 | 3 | 0 | 0 | 0 | 0 | 0 | 119 |
| WNW | 4 | 2 | 5 | 32 | 23 | 15 | 11 | 0 | 0 | 0 | 0 | 0 | 92 |
| NW | 0 | 0 | 8 | 26 | 18 | 35 | 10 | 5 | 0 | 0 | 0 | 0 | 102 |
| NNW | 0 | 5 | 2 | 20 | 31 | 57 | 64 | 0 | 0 | 0 | 0 | 0 | 179 |
| Total | 17 | 55 | 84 | 438 | 508 | 875 | 819 | 101 | 11 | 2 | 0 | 0 | 2910 |

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1. Period of Record: 01/01/2018 – 12/31/2018
2. Stability Class: F
3. Elevation: 10 m
4. Periods of calm hours: 0

Table 19, Hours of Each Wind Speed and Direction Stability Class F

| Wind Direction | Wind Speed (mps) | | | | | | | | | | | | Total |
|----------------|------------------|-----------|----------|---------|---------|---------|---------|---------|----------|-----------|-----------|-------|-------|
| | 0.22-0.50 | 0.51-0.75 | 0.76-1.0 | 1.1-1.5 | 1.6-2.0 | 2.1-3.0 | 3.1-5.0 | 5.1-7.0 | 7.1-10.0 | 10.1-13.0 | 13.1-18.0 | >18.0 | |
| N | 0 | 6 | 3 | 12 | 16 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 43 |
| NNE | 0 | 3 | 7 | 4 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| NE | 3 | 2 | 3 | 7 | 11 | 17 | 7 | 0 | 0 | 0 | 0 | 0 | 50 |
| ENE | 1 | 0 | 3 | 4 | 7 | 5 | 7 | 0 | 0 | 0 | 0 | 0 | 23 |
| E | 0 | 2 | 3 | 4 | 5 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 27 |
| ESE | 0 | 1 | 2 | 2 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 10 |
| SE | 1 | 1 | 0 | 2 | 3 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 17 |
| SSE | 1 | 6 | 6 | 20 | 45 | 73 | 6 | 0 | 0 | 0 | 0 | 0 | 157 |
| S | 3 | 7 | 20 | 72 | 52 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 176 |
| SSW | 5 | 14 | 40 | 114 | 31 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 212 |
| SW | 4 | 16 | 34 | 53 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 119 |
| WSW | 9 | 14 | 23 | 44 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 101 |
| W | 4 | 24 | 31 | 57 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| WNW | 3 | 12 | 21 | 40 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 88 |
| NW | 2 | 3 | 5 | 20 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 |
| NNW | 1 | 4 | 8 | 7 | 6 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 31 |
| Total | 37 | 115 | 209 | 462 | 223 | 154 | 33 | 0 | 0 | 0 | 0 | 0 | 1233 |

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1. Period of Record: 01/01/2018 – 12/31/2018
2. Stability Class: G
3. Elevation: 10 m
4. Periods of calm hours: 0

Table 20, Hours of Each Wind Speed and Direction Stability Class G

| Wind Direction | Wind Speed (mps) | | | | | | | | | | | | Total |
|----------------|------------------|-----------|----------|---------|---------|---------|---------|---------|----------|-----------|-----------|-------|-------|
| | 0.22-0.50 | 0.51-0.75 | 0.76-1.0 | 1.1-1.5 | 1.6-2.0 | 2.1-3.0 | 3.1-5.0 | 5.1-7.0 | 7.1-10.0 | 10.1-13.0 | 13.1-18.0 | >18.0 | |
| N | 4 | 10 | 3 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| NNE | 2 | 6 | 3 | 3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| NE | 1 | 1 | 3 | 4 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| ENE | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| E | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| ESE | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| SE | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| SSE | 2 | 1 | 3 | 4 | 3 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 19 |
| S | 3 | 4 | 9 | 27 | 10 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 57 |
| SSW | 5 | 10 | 30 | 90 | 26 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 162 |
| SW | 7 | 23 | 29 | 53 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 121 |
| WSW | 17 | 33 | 22 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 87 |
| W | 17 | 36 | 22 | 23 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| WNW | 10 | 19 | 17 | 15 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| NW | 8 | 13 | 12 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 |
| NNW | 5 | 12 | 8 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| Total | 81 | 171 | 163 | 245 | 61 | 14 | 2 | 0 | 0 | 0 | 0 | 0 | 737 |

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2.5.2 Gaseous

1. Number of batch releases: 6
2. Total time period for all batch releases: 2979 min
3. Maximum time period for a batch release: 1903 min
4. Average time period for a batch release: 496.5 min
5. Minimum time period for a batch release: 120 min

2.6 **Abnormal Releases:**

2.6.1 There were no abnormal releases during the reporting period

2.6.2 Liquid

1. Number of releases: 0
2. Total Activity (Ci) released: N/A

2.6.3 Gaseous

1. Number of releases: 0
2. Total Activity (Ci) released: N/A

2.7 **Non-routine, Planned Discharges (if applicable)**

1. There were no non-routine, planned discharges for the reporting period.

2.8 **Radioactive Waste Treatment System Changes**

1. During the reporting period, no major changes were made to any Radioactive Waste Systems. All major changes to Radioactive Waste Systems are included in Waterford 3's FSAR updates.

2.9 **Land Use Census Changes**

A land use census was last performed in 2018. The land use census performed in 2018 did not identify the need for any changes to locations being used for effluent dose calculations or radiological environmental sampling

2.10 **Effluent Monitor Instrument Inoperability**

Technical Requirements Manual (TRM) Specifications 3.3.3.10 and 3.3.3.11 require reporting in the Annual Radioactive Effluent Release Report of why designated inoperable effluent monitoring instrumentation was not restored to operability within the time specified in the Action Statement.

Gaseous Waste System (GWM) Radiation Monitor (PRMIRE0648)

Time Required by Specifications to Restore Operability: 30 Days

Period of Inoperability: 11/18/2018 to 2/14/2019 (88 Days)

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Batch releases performed with monitor out of services: (1) 12/20/2018 16:11 to 12/22/2018 16:34 (32 hours)

Cause of Inoperability: The radiation monitor was declared out of services while attempting to discharge a Gas Decay Tank on 11/14/2018 because proper sample flow (2.0 scfm) could not be established. Sample flow would rise to 1.8 scfm upon discharge, however sample pump would trip due to inadequate flow.

Reason Operability Not Restored Within Allotted Time: A radiation monitor functional check was performed on 12/8/2018 with satisfactory results. However, the ACTION requirements of TRM 3.3-13 were implemented during release of Gas Decay Tank C from 12/20/2018 to 12/22/2018.

2.11 Offsite Dose Calculation Manual Changes

- There were no changes to the Offsite Dose Calculation Manual, UNT-005-014, in 2018.

2.12 Process Control Program (PCP) Changes

- There were no changes to the Process Control Program, EN-RW-105, in 2018.

2.13 NON-REMP Groundwater Monitoring Results (NEI 07-07)

- Groundwater wells were monitored at Waterford 3 during 2018 as part of the NEI Groundwater Protection Initiative; these samples are not part of the Radiological Environmental Monitoring Program. Sampling of the ten installed wells was conducted on a quarterly basis. All results were less than minimum detectable activity for gamma emitters and tritium during 2018. A summary of all groundwater monitoring well sample results for 2018 is presented below:

2018 Groundwater Analysis Results (pCi/L)

| Sample Date/Time | Well | Tritium | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Nb-95 | Zr-95 | I-131 | Cs-134 | Cs-137 | Ba-140 | La-140 |
|------------------|-------------|---------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|
| 2/28/2018 9:05 | MW-3 | 588.00 | 8.94 | 7.99 | 16.20 | 5.98 | 21.40 | 9.23 | 14.10 | 12.90 | 8.24 | 8.26 | 39.20 | 10.70 |
| 2/28/2018 9:45 | MW-3 DUP | 589.00 | 5.66 | 7.85 | 11.60 | 10.40 | 21.70 | 6.21 | 12.70 | 11.60 | 8.70 | 8.02 | 34.00 | 12.00 |
| 5/30/2018 17:07 | MW-3 | 612.00 | 5.92 | 5.55 | 9.33 | 6.33 | 10.20 | 6.57 | 9.79 | 8.25 | 7.19 | 7.38 | 26.10 | 9.50 |
| 9/7/2018 12:50 | MW-3 | 613.00 | 7.14 | 6.61 | 13.00 | 7.36 | 12.00 | 6.11 | 12.70 | 13.90 | 7.13 | 8.39 | 33.10 | 10.10 |
| 12/13/2018 7:50 | MW-3 | 546.00 | 7.91 | 5.16 | 18.34 | 6.89 | 19.14 | 7.80 | 12.88 | 12.20 | 6.91 | 7.74 | 30.61 | 13.68 |
| 2/28/2018 10:55 | MW-4 | 590.00 | 6.21 | 5.73 | 10.90 | 5.84 | 12.30 | 6.49 | 9.77 | 9.70 | 6.52 | 6.38 | 26.10 | 7.52 |
| 5/30/2018 15:27 | MW-4 | 595.00 | 4.05 | 5.19 | 9.61 | 5.53 | 9.31 | 5.08 | 8.13 | 6.23 | 5.52 | 5.54 | 20.00 | 6.35 |
| 9/7/2018 11:45 | MW-4 | 630.00 | 7.30 | 6.98 | 13.80 | 6.87 | 14.00 | 6.28 | 12.30 | 10.70 | 5.97 | 6.18 | 29.90 | 11.70 |
| 12/13/2018 8:35 | MW-4 | 543.00 | 7.79 | 8.18 | 15.01 | 9.09 | 17.17 | 7.55 | 10.14 | 11.93 | 8.71 | 8.21 | 35.40 | 14.38 |
| 2/28/2018 12:45 | MW-5 | 585.00 | 7.93 | 8.30 | 15.20 | 6.97 | 13.80 | 6.46 | 14.50 | 13.50 | 6.65 | 6.83 | 32.70 | 8.90 |
| 5/30/2018 7:48 | MW-5 | 612.00 | 4.82 | 4.48 | 9.87 | 6.44 | 7.81 | 5.38 | 9.00 | 9.75 | 5.79 | 5.97 | 24.90 | 7.74 |
| 9/7/2018 10:50 | MW-5 | 614.00 | 5.91 | 6.05 | 11.70 | 4.94 | 15.90 | 7.37 | 11.30 | 14.50 | 9.65 | 5.15 | 36.50 | 13.10 |