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W3F1-2019-0029

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

Subject: Annual Radioactive Effluent Release Report -2018
Waterford Steam Electric Station, Unit 3 (Waterford 3)
Docket No. 50-382
License No. NPF-38

Attached is the Annual Radioactive Effluent Release Report for the period of January 1 through December 31, 2018. 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 "P. Wood".

PW/llb

Attachment: Annual Radioactive Effluent Release Report – 2018

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

Enclosure to

W3F1-2019-0029

Annual Radioactive Effluent Release Report - 2018

(34 pages)



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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, 2018 through December 31, 2018, where the plant had an average power level of 99.87%. 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 2018.
- Assessment of radiation doses due to liquid and gaseous radioactive effluents released during 2018.
- 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) contains 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/TRM:

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.

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).

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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, a gaseous release fraction of 98%, a Carbon-14 carbon dioxide fraction of 30%, and 364.5 days equivalent full power operation. Release of Carbon-14 was assumed to be continuous.

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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 as follows:

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

Where: E_T = total percent error

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

2.5 Batch Releases:2.5.1 Liquid

1. Number of batch releases: 59
2. Total time period for all batch releases: 16922 min
3. Maximum time period for a batch release: 553 min
4. Average time period for a batch release: 286.8 min
5. Minimum time period for a batch release: 205.0 min
6. Average stream flow during periods of release of effluent into flowing streams: 646308 f³/s

Annual Radioactive Effluent Release Report**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.

During the reporting period, all instrumentation was restored to operability within the time specified.

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2.11 Offsite Dose Calculation Manual Changes

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

2.12 Process Control Program (PCP) Changes

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

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

1. 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
12/12/2018 14:15	MW-5	< 545.00	< 5.62	< 7.60	< 13.23	< 10.07	< 15.54	< 8.47	< 11.30	< 12.74	< 7.06	< 7.17	< 33.89	< 14.45
2/27/2018 16:20	MW-6	< 584.00	< 7.89	< 7.43	< 18.20	< 9.34	< 16.90	< 9.68	< 12.90	< 12.90	< 8.08	< 8.17	< 34.90	< 14.70
5/30/2018 9:05	MW-6	< 604.00	< 6.18	< 5.33	< 7.90	< 6.70	< 11.90	< 5.92	< 10.80	< 7.92	< 5.66	< 5.18	< 24.10	< 8.43
9/6/2018 9:16	MW-6	< 618.00	< 6.20	< 6.39	< 10.50	< 5.87	< 14.40	< 7.89	< 12.70	< 11.80	< 8.16	< 7.11	< 32.30	< 10.90
12/12/2018 11:25	MW-6	< 546.00	< 6.36	< 6.32	< 16.93	< 7.11	< 13.48	< 7.39	< 10.37	< 11.14	< 5.31	< 6.75	< 26.05	< 6.17
2/27/2018 15:03	MW-7	< 585.00	< 7.55	< 6.70	< 12.80	< 6.61	< 11.00	< 8.13	< 14.20	< 13.40	< 8.14	< 6.64	< 33.10	< 12.50
5/29/2018 16:40	MW-7	< 604.00	< 5.30	< 5.57	< 12.20	< 6.10	< 12.30	< 6.85	< 11.20	< 9.62	< 7.42	< 5.66	< 27.00	< 6.55

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2018 Groundwater Analysis Results (pCi/L)

9/7/2018 8:00	MW-7	<	<	<	<	<	<	<	<	<	<	<	<	<
		616.00	7.24	7.75	16.40	8.69	16.80	8.10	12.30	12.90	9.17	6.36	34.60	11.00
12/12/2018 12:35	MW-7	<	<	<	<	<	<	<	<	<	<	<	<	<
		541.00	6.30	6.99	16.48	7.83	10.25	4.83	14.67	9.90	6.25	6.04	34.90	13.01
2/27/2018 14:02	MW-8	<	<	<	<	<	<	<	<	<	<	<	<	<
		605.00	7.35	6.32	13.80	8.00	19.10	8.21	13.70	12.30	8.16	8.58	33.00	11.50
5/29/2018 15:10	MW-8	<	<	<	<	<	<	<	<	<	<	<	<	<
		611.00	5.52	6.19	11.30	5.17	8.33	4.98	9.28	9.01	5.07	6.73	25.60	8.42
9/6/2018 16:30	MW-8	<	<	<	<	<	<	<	<	<	<	<	<	<
		621.00	6.89	7.71	15.00	5.66	12.40	6.95	11.30	13.00	6.95	5.96	29.60	12.70
12/12/2018 15:15	MW-8	<	<	<	<	<	<	<	<	<	<	<	<	<
		542.00	9.43	8.50	16.59	7.03	15.73	7.36	12.49	10.43	7.96	5.52	30.08	8.33
2/27/2018 13:30	MW-9	<	<	<	<	<	<	<	<	<	<	<	<	<
		587.00	7.32	7.80	17.70	9.70	14.80	8.97	14.60	11.60	8.55	7.59	29.90	12.20
5/29/2018 14:00	MW-9	<	<	<	<	<	<	<	<	<	<	<	<	<
		615.00	5.59	5.34	12.70	6.15	8.89	5.64	9.98	11.50	6.73	7.34	28.60	11.00
9/6/2018 15:47	MW-9	<	<	<	<	<	<	<	<	<	<	<	<	<
		628.00	5.07	5.43	12.00	6.56	11.00	5.85	10.60	9.21	5.05	6.22	28.50	10.20
12/12/2018 16:05	MW-9	<	<	<	<	<	<	<	<	<	<	<	<	<
		551.00	7.55	8.95	15.09	7.81	17.58	7.95	13.95	14.29	8.97	8.63	35.93	11.23
12/12/2018 16:20	MW-9 DUP	<	<	<	<	<	<	<	<	<	<	<	<	<
		543.00	6.42	5.29	12.55	5.66	16.22	6.72	9.78	12.85	6.57	6.30	32.48	14.08
2/28/2018 14:11	MW-10	<	<	<	<	<	<	<	<	<	<	<	<	<
		585.00	7.91	6.82	13.20	7.51	15.00	6.80	14.90	11.60	7.23	7.95	39.10	14.20
5/30/2018 14:07	MW-10	<	<	<	<	<	<	<	<	<	<	<	<	<
		602.00	6.72	7.02	12.40	7.06	12.50	6.26	11.70	8.80	6.51	5.98	25.90	10.80
9/6/2018 13:11	MW-10	<	<	<	<	<	<	<	<	<	<	<	<	<
		635.00	6.33	6.66	11.40	4.60	9.94	7.51	14.30	11.40	6.48	7.92	28.80	11.80
12/13/2018 9:30	MW-10	<	<	<	<	<	<	<	<	<	<	<	<	<
		549.00	7.35	7.92	13.80	7.06	16.91	8.05	13.12	13.79	8.75	8.59	34.99	10.99
2/28/2018 15:05	MW-11	< 667	<	<	<	<	<	<	<	<	<	<	<	<
			7.52	8.22	14.40	9.54	18.70	10.20	14.70	11.30	7.66	7.85	27.10	12.60
5/30/2018 11:00	MW-11	< 614	<	<	<	<	<	<	<	<	<	<	<	<
			4.33	5.13	11.90	5.84	9.73	5.32	8.72	8.17	5.75	5.22	21.20	8.08
5/30/2018 12:20	MW-11 DUP	< 609	<	<	<	<	<	<	<	<	<	<	<	<
			5.37	5.13	12.20	5.27	9.26	5.74	9.50	8.19	6.43	5.36	23.80	8.09
9/6/2018 13:57	MW-11	< 615	<	<	<	<	<	<	<	<	<	<	<	<
			8.18	6.36	16.00	6.98	17.00	7.12	12.60	12.30	6.01	6.88	35.80	12.80
12/13/2018 10:15	MW-11	< 537	<	<	<	<	<	<	<	<	<	<	<	<
			7.02	7.51	14.23	9.33	10.88	6.89	11.41	13.42	6.67	6.54	34.31	12.57
2/27/2018 11:45	MW-12	<	<	<	<	<	<	<	<	<	<	<	<	<
		599.00	9.53	8.44	18.60	12.50	17.40	9.42	12.30	13.90	9.65	10.00	38.90	11.10
5/29/2018 11:57	MW-12	<	<	<	<	<	<	<	<	<	<	<	<	<
		607.00	5.76	6.58	13.50	7.16	13.50	6.46	11.10	10.00	6.25	7.00	30.00	11.50
9/6/2018 10:00	MW-12	<	<	<	<	<	<	<	<	<	<	<	<	<
		629.00	6.66	6.35	12.00	7.41	13.80	6.37	11.90	11.50	6.45	6.02	28.60	11.50
9/6/2018 10:20	MW-12 DUP	<	<	<	<	<	<	<	<	<	<	<	<	<
		615.00	4.06	5.57	14.10	6.24	13.60	5.81	11.20	11.80	6.12	6.08	31.60	8.36
12/12/2018 10:15	MW-12	<	<	<	<	<	<	<	<	<	<	<	<	<
		538.00	6.42	7.25	14.63	6.88	14.31	7.45	12.36	13.15	7.95	6.67	37.04	11.98

2.14 Unprotected Outside Storage Tank Radioactivity Limit

1. Technical Specification 3/4.11.2.6 specifies that the quantity of radioactive material contained in each unprotected outdoor tank be maintained less than or equal to 7.85E-04 Curies (excluding tritium and dissolved and entrained noble gases). During this reporting period, there were no instances in which this limit was exceeded.

Annual Radioactive Effluent Release Report**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. None

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 in order 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

During the reporting period, no incident occurred for which effluent samples were not sampled and/or analyzed as required by the ODCM/TRM.

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

Reactor Coolant System E-Bar calculations were performed on 1/29/18, 8/2/18, and 12/3/18 with values of 0.1550, 0.0357, and 0.2079 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)

Type of Effluent	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Est. Total Error, %
A. Fission & Activation Gases						
1. Total Release	Curies	1.87E-01	0.00E+00	0.00E+00	2.35E-01	2.50E+01
2. Average Release Rate for Period	μCi/sec	2.40E-02	0.00E+00	0.00E+00	2.96E-02	
3. Percent of Applicable Limit	%	3.31E-02	0.00E+00	0.00E+00	4.14E-02	
B. Iodines						
1. Total Iodine-131	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E+01
2. Average Release Rate for Period	μCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
3. Percent of Applicable Limit	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
C. Particulates						
1. Total Particulates (Half-lives>8 days)	Curies	0.00E+00	0.00E+00	0.00E+00	4.68E-07	2.50E+01
2. Average Release Rate for Period	μCi/sec	0.00E+00	0.00E+00	0.00E+00	5.89E-08	
3. Percent of Applicable Limit	%	0.00E+00	0.00E+00	0.00E+00	2.52E-04	
4. Gross Alpha Activity	Curies	1.20E-07	1.70E-08	3.78E-08	9.47E-09	2.50E+01
D. Tritium						
1. Total Release	Curies	6.54E+00	2.31E+00	3.86E+00	3.81E+00	2.50E+01
2. Average Release Rate for Period	μCi/sec	8.42E-01	2.94E-01	4.86E-01	4.79E-01	
3. Percent of Applicable Limit	%	9.00E-02	3.18E-02	5.31E-02	5.23E-02	
D. C-14						
1. Total Release	Curies	3.04E+00	3.03E+00	3.04E+00	3.04E+00	2.50E+01
2. Average Release Rate for Period	μCi/sec	3.91E-01	3.85E-01	3.82E-01	3.82E-01	

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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	1.87E-01	0.00E+00	0.00E+00	2.34E-01	4.21E-01
Xe-133	Ci	0.00E+00	0.00E+00	0.00E+00	1.09E-03	1.09E-03
Total for Period	Ci	1.87E-01	0.00E+00	0.00E+00	2.35E-01	4.22E-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	1.76E+00	0.00E+00	0.00E+00	4.22E-01	2.18+00
Gross Alpha						
Alpha	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Fission Gases						
Total for Period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines						
Total for Period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates						
Cs-137	Ci	0.00E+00	0.00E+00	0.00E+00	4.68E-07	4.68E-07
Total for Period	Ci	0.00E+00	0.00E+00	0.00E+00	4.68E-07	4.68E-07
Tritium						
H-3	Ci	4.78E+00	2.31E+00	3.86E+00	3.38E+00	1.43E+01
Gross Alpha						
Alpha	Ci	1.20E-07	1.70E-08	3.78E-08	9.47E-09	1.84E-07

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4.0 LIQUID EFFLUENTS

4.1 Liquid Effluent and Waste Disposal Report

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

Type of Effluent	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Est. Total Error, %
A. Fission & Activation Products						
1. Total Release (not including Tritium, Gases, and Alpha)	Curies	1.60E-03	1.22E-02	6.36E-03	5.76E-03	2.50E+01
2. Average Diluted Concentration During Period	µCi/ml	9.13E-11	5.36E-10	2.65E-10	2.35E-10	
3. Percent of Applicable Limit	%	3.20E-02	2.44E-01	1.27E-01	1.15E-01	
B. Tritium						
1. Total Release	Curies	1.88E+01	9.24E+01	4.22E+01	5.24E+02	2.50E+01
2. Average Diluted Concentration During Period	µCi/ml	1.07E-06	4.07E-06	1.75E-06	2.13E-05	
3. Percent of Applicable Limit	%	1.07E-01	4.07E-01	1.75E-01	2.13E+00	
C. Dissolved and Entrained Gases						
1. Total Release	Curies	0.00E+00	1.00E-04	0.00E+00	2.14E-03	2.50E+01
2. Average Diluted Concentration During Period	µCi/ses	0.00E+00	4.40E-12	0.00E+00	8.71E-11	
3. Percent of Applicable Limit	%	0.00E+00	2.20E-06	0.00E+00	4.36E-05	
D. Gross Alpha Radioactivity						
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E+01
E. Waste Volume Released (Pre-Dilution)						
F. Volume of Dilution Water Used	Liters	6.00E+06	5.02E+06	3.55E+06	5.19E+06	2.50E+01
	Liters	1.75E+10	2.27E+10	2.40E+10	2.46E+10	2.50E+01

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Table 5, Batch Mode Liquid Effluents (Waterford 3)

Nuclides Released	Unit	Batch Mode				
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Cr-51	Ci	0.00E+00	1.60E-05	0.00E+00	0.00E+00	1.60E-05
Mn-54	Ci	9.84E-05	2.49E-05	8.62E-06	1.06E-05	1.43E-04
Fe-55	Ci	0.00E+00	1.15E-02	6.01E-03	1.72E-03	1.92E-02
Fe-59	Ci	0.00E+00	0.00E+00	0.00E+00	2.16E-05	2.16E-05
Co-58	Ci	1.69E-04	5.03E-05	8.64E-05	3.55E-03	3.86E-03
Co-60	Ci	6.91E-04	3.38E-04	1.51E-04	2.90E-04	1.47E-03
Nb-95	Ci	1.38E-04	2.99E-05	1.88E-05	4.49E-05	2.32E-04
Zr-95	Ci	7.35E-05	1.34E-06	9.60E-06	0.00E+00	8.44E-05
Zn-65	Ci	1.94E-05	1.12E-06	0.00E+00	0.00E+00	2.05E-05
Ag-110m	Ci	2.18E-04	2.20E-05	8.89E-06	0.00E+00	2.49E-04
Sn-113	Ci	0.00E+00	0.00E+00	0.00E+00	4.40E-05	4.40E-05
Sb-125	Ci	1.90E-04	1.72E-04	6.39E-05	7.76E-05	5.04E-04
Cs-137	Ci	1.60E-06	0.00E+00	0.00E+00	0.00E+00	1.60E-06
H-3	Ci	1.88E+01	9.24E+01	4.21E+01	5.24E+02	6.77E+02
Total for Period	Ci	1.88E+01	9.24E+01	4.21E+01	5.24E+02	6.77E+02
Ar-41	Ci	0.00E+00	0.00E+00	0.00E+00	9.77E-06	9.77E-06
Kr-85M	Ci	0.00E+00	0.00E+00	0.00E+00	9.21E-06	9.21E-06
Xe-133	Ci	0.00E+00	9.88E-05	0.00E+00	1.68E-03	1.78E-03
Xe-133m	Ci	0.00E+00	0.00E+00	0.00E+00	2.36E-05	2.36E-05
Xe-135	Ci	0.00E+00	1.19E-06	0.00E+00	4.15E-04	4.16E-04
Total for Period	Ci	0.00E+00	1.00E-04	0.00E+00	2.14E-03	2.24E-03

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Table 6, Continuous Mode Liquid Effluents (Waterford 3)

Nuclides Released	Unit	Continuous Mode				
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
H-3	Ci	5.91E-02	6.04E-02	2.76E-02	3.18E-02	1.79E-01
Total for Period	Ci	5.91E-02	6.04E-02	2.76E-02	3.18E-02	1.79E-01

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)

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.				25
Waste Class	ft³	m³	Ci Shipped	
A	8.17E+02	2.31E+01	1.02E+01	
B	1.00E+02	2.83E+00	1.17E+02	
C	0.00E+00	0.00E+00	0.00E+00	
Unclassified	0.00E+00	0.00E+00	0.00E+00	
All	9.17E+02	2.60E+01	1.27E+02	
b. Dry compressible waste, contaminated equip, etc.				25
Waste Class	ft³	m³	Ci Shipped	
A	2.47E+04	6.99E+02	3.30E-01	
B	0.00E+00	0.00E+00	0.00E+00	
C	0.00E+00	0.00E+00	0.00E+00	
Unclassified	0.00E+00	0.00E+00	0.00E+00	
All	2.47E+04	6.99E+02	3.30E-01	
c. Irradiated components, control rods, etc.				25
Waste Class	ft³	m³	Ci Shipped	
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	
Unclassified	0.00E+00	0.00E+00	0.00E+00	
All	0.00E+00	0.00E+00	0.00E+00	
d. Other (used oil)				25
Waste Class	ft³	m³	Ci Shipped	
A	8.96E+02	2.54E+01	5.55E-02	
B	0.00E+00	0.00E+00	0.00E+00	
C	0.00E+00	0.00E+00	0.00E+00	
Unclassified	0.00E+00	0.00E+00	0.00E+00	
All	8.96E+02	2.54E+01	5.55E-02	

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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.				
Nuclide Name		Abundance	Activity (Ci)	
Mn-54		3.93%	5.00E+00	
Fe-55		15.41%	1.96E+01	
Co-57		0.69%	8.84E-01	
Co-58		7.75%	9.87E+00	
Co-60		17.3%	2.20E+01	
Ni-63		42.08%	5.36E+01	
Zn-65		0.27%	3.38E-01	
Sb-125		1.24%	1.58E+00	
Cs-137		9.5%	1.21E+01	
b. Dry compressible waste, contaminated equip, etc.				
Nuclide Name		Abundance	Activity (Ci)	
Cr-51		1.38%	4.58E-03	
Fe-55		58.4%	1.94E-01	
Co-58		4.98%	1.66E-02	
Co-60		8.99%	2.99E-02	
Ni-63		19.18%	6.38E-02	
Nb-95		1.38%	4.59E-03	
Cs-137		2.02%	6.72E-03	
c. Irradiated components, control rods, etc.				
None				
d. Other (used oil)				
Nuclide Name		Abundance	Activity (Ci)	
Fe-55		65.67%	3.64E-02	
Co-58		5.23%	2.90E-03	
Co-60		9.26%	5.14E-03	
Ni-63		13.66%	7.58E-03	
Cs-137		1.57%	8.74E-04	

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

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5.1.3 Solid Waste Disposition

Table 9, Solid Waste Disposition (Waterford 3)

Number of Shipments	Mode of Transportation	Destination
18	Hittman Transport	Energy Solutions Bear Creek
1	Hittman Transport	Energy Solutions, Gallaher Rd
6	Hittman Transport	Energy Solutions-Memphis
1	Hittman Transport	Resin Solutions, Erwin

Table 10, Irradiated Fuel Shipments Disposition (Waterford 3)

Number of Shipments	Mode of Transportation	Destination
None		

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	2.52E-05	7.32E-05	3.80E-05	4.72E-04	6.08E-04
% of Limit	1.68E-03	4.88E-03	2.53E-03	3.15E-02	2.03E-02
Liquid Effluent Dose Limit, Any Organ	5 mrem	5 mrem	5 mrem	5 mrem	10 mrem
Maximum Organ Dose	5.75E-05	9.26E-05	4.95E-05	5.20E-04	7.18E-04
% of Limit	1.15E-03	1.85E-03	9.90E-04	1.04E-02	7.18E-03
Gaseous Effluent Dose Limit, Gamma Air	5 mrad	5 mrad	5 mrad	5 mrad	10 mrad
Gamma Air Dose	1.65E-03	0.00E+00	0.00E+00	2.07E-03	3.72E-03
% of Limit	3.30E-02	0.00E+00	0.00E+00	4.14E-02	3.72E-02
Gaseous Effluent Dose Limit, Beta Air	10 mrad	10 mrad	10 mrad	10 mrad	20 mrad
Beta Air Dose	5.83E-04	0.00E+00	0.00E+00	7.30E-04	1.31E-03
% of Limit	5.83E-03	0.00E+00	0.00E+00	7.30E-03	6.55E-03
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)	6.75E-03	2.39E-03	3.98E-03	3.94E-03	1.71E-02
% of Limit	9.00E-02	3.19E-02	5.31E-02	5.25E-02	1.14E-01

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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

2.75E-04 mrem to the skin

6.05 E-04 mrem to the maximum exposed organ (Liver)

7.94E-04 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 ground water.

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	7.87E-01	7.87E-01	3.64E+00
% of Limit	3.15E+00	1.05E+00	1.46E+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

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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	1.70E-02	1.70E-02	1.71E-02
Routine Liquid Effluents	WF3	6.08E-04	5.81E-04	7.18E-04
Airborne Releases of C ¹⁴	WF3	7.10E-01	7.10E-01	3.56E+00
Ground Water & Storm Drain Totals	WF3	0.00E+0	0.00E+0	0.00E+0
Direct Shine from areas such as dry cask storage, radwaste storage, Equipment Mausoleums	WF3	5.92E-02	5.92E-02	5.92E-02
Total 40 CFR 190 Dose	WF3	7.87E-01	7.87E-01	3.64E+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.

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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 Speed (mps)													
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	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
NWN	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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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
NWN	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
NWN	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

Annual Radioactive Effluent Release Report

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
NWN	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

Annual Radioactive Effluent Release Report

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 Speed (mps)													
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	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
NWN	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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7.2 Stability Class

Table 21, Classification of Atmospheric Stability

Stability Condition	Pasquill Categories	Hours (Percentage)
Extremely Unstable	A	3.2
Moderately Stable	B	3.8
Slightly Unstable	C	5.8
Neutral	D	30.6
Slightly Stable	E	33.7
Moderately Stable	F	14.3
Extremely Stable	G	8.5

Annual Radioactive Effluent Release Report

Attachment 1

Revised Offsite Dose Calculation Manual

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Attachment 2

Revised Process Control Program

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Attachment 3

Errata/Corrections to Previous ARERRs

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