Southern Nuclear

Regulatory Affairs

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U. S. Nuclear Regulatory Commission
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Joseph M. Farley Nuclear Plant – Units 1&2
Annual Radioactive Effluent Release Report and Annual Non-Radiological Environmental Operating Report for 2024

Ladies and Gentlemen:

In accordance with section 5.6.3 of the Joseph M. Farley Nuclear Plant (FNP) – Units 1&2 Technical Specifications (TS), Southern Nuclear Operating Company submits the enclosed Annual Radioactive Effluent Release Report for 2024.

Please note that there were no Offsite Dose Calculation Manual (ODCM) revisions during the 2024 reporting period.

Additionally, in accordance with subsection 5.4.1 of the FNP Units 1&2 Environmental Protection Plan (Appendix B to the operating licenses), Southern Nuclear Operating Company submits the Annual Non-Radiological Environmental Operating Report for 2024, also enclosed with this letter.

This letter contains no NRC commitments. If you have any questions, please contact Ryan Joyce at 205.992.6468.

Respectfully submitted,

Jamie Coleman

Jamie M. Coleman
Regulatory Affairs Director

JMC/btr/cbg

Enclosure:
1. FNP - Units 1&2 Annual Radioactive Effluent Release Report for 2024
2. FNP - Units 1&2 Annual Non-Radiological Environmental Operating Report for 2024

cc: Regional Administrator, Region II
NRR Project Manager – Farley Nuclear Plant
Senior Resident Inspector – Farley Nuclear Plant
RTYPE: CGA02.001

Joseph M. Farley Nuclear Plant Unit 1 and 2

Enclosure 1

Annual Radioactive Effluent Release Report for 2024

Southern Nuclear

Joseph M. Farley Nuclear Plant

Annual Radioactive Effluent Release Report

2024

Facility Operating License Nos. NPF-2 & NPF-8

Prepared By: Joseph Pruitt / _____ Date: 4/15/2025

Reviewed By: Antonio Benford / _____ Date: 4-15-2025

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1.0 LIST OF ACRONYMS AND DEFINITIONS

1. Alpha Particle (α): A charged particle emitted from the nucleus of an atom having a mass and charge equal in magnitude of a helium nucleus.
2. BWR: Boiling Water Reactor
3. Composite Sample: A series of single collected portions (aliquots) analyzed as one sample. The aliquots making up the sample are collected at time intervals that are very short compared to the composite period.
4. Control: A sampling station in a location not likely to be affected by plant effluents due to its distance and/or direction from the Plant.
5. Counting Error: An estimate of the two-sigma uncertainty associated with the sample results based on total counts accumulated.
6. Curie (Ci): A measure of radioactivity; equal to 3.7×10^{10} disintegrations per second, or 2.22×10^{12} disintegrations per minute.
7. Direct Radiation Monitoring: The measurement of radiation dose at various distances from the plant is assessed using thermoluminescent dosimeters (TLDs), optically stimulated luminescent dosimeters (OSLDs), and/or pressurized ionization chambers.
8. Grab Sample: A single discrete sample drawn at one point in time.
9. Indicator: A sampling location that is potentially affected by plant effluents due to its proximity and/or direction from the plant.
10. Ingestion Pathway: The ingestion pathway includes milk, fish, drinking water and garden produce. Also sampled (under special circumstances) are other media such as vegetation or animal products when additional information about radionuclides is needed.
11. ISFSI: Independent Spent Fuel Storage Installation
12. LLD: Lower Limit of Detection. An *a priori* measure of the detection capability of a radiochemistry measurement based on instrument setup, calibration, background, decay time, and sample volume. An LLD is expressed as an activity concentration. The MDA is used for reporting results. LLD are specified by a regulator, such as the NRC and are typically listed in the ODCM.
13. MDA: Minimum Detectable Activity. For radiochemistry instruments, the MDA is the *a posteriori* minimum concentration that a counting system detects. The smallest concentration or activity of radioactive material in a sample that will yield a net count above instrument background and that is detected with 95% probability, with only 5% probability of falsely concluding that a blank observation represents a true signal.
14. MDC: Minimum Detectable Concentration. Essentially synonymous with MDA for the purposes of radiological monitoring.
15. Mean: The sum of all the values in a distribution divided by the number of values in the distribution, synonymous with average.

16. Microcurie (µCi): 3.7 x 10^4 disintegrations per second, or 2.22 x10^6 disintegrations per minute.
17. millirem (mrem): 1/1000 rem; a unit of radiation dose equivalent in tissue.
18. Milliroentgen (mR): 1/1000 Roentgen; a unit of exposure to X- or gamma radiation.
19. N/A: Not Applicable
20. NEI: Nuclear Energy Institute
21. NRC: Nuclear Regulatory Commission
22. ODCM: Offsite Dose Calculation Manual
23. OSLD: Optically Stimulated Luminescence Dosimeter
24. Protected Area: A 10 CFR 73 security term is an area encompassed by physical barriers and to which access is controlled for security purposes. The fenced area immediately surrounding the plant and around ISFSI are commonly classified by the licensee as “Protected areas.” Access to the protected area requires a security badge or escort.
25. PWR: Pressurized Water Reactor
26. REC: Radiological Effluent Control
27. REMP: Radiological Environmental Monitoring Program
28. Restricted Area: A 10 CFR 20 defined term where access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials.
29. TEDE: Total Effective Dose Equivalent (TEDE) means the sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).
30. TLD: Thermoluminescent Dosimeter
31. TRM: Technical Requirements Manual
32. TS: Technical Specification
33. Unrestricted Area: An area, access to which is neither limited nor controlled by the licensee.

2.0 EXECUTIVE SUMMARY

Joseph M. Farley Nuclear Plant (FNP) Radiological Effluent Control (REC) Program was established to limit the quantities of radioactive material that may be released based on calculated radiation doses or dose rates. Dose to Members of the Public due to radioactive materials released from the plant is limited by Appendix I of 10 CFR 50 and by 40 CFR 190. Operational doses to the public during 2024 were calculated to be very small compared to the limits required by regulation and compared to other sources of radiation dose and pose no health hazard. These doses are summarized and compared to the regulatory limits in Section 2.1, Comparison to Regulatory Limits, below.

The Annual Radioactive Effluent Release Report (ARERR) is published per REC requirements and provides data related to plant operation, including: quantities of radioactive materials released in liquid and gaseous effluents; radiation doses to members of the public; solid radioactive waste shipped offsite for disposal; and other information as required by site licensing documents.

In 2024, the Land Use Census dose assessments due to radioactive gaseous effluents showed that the critical receptor for Joseph M. Farley Nuclear Plant is a child, due to Ground Plane, Inhalation, Garden Vegetation and the Grass-Cow-Meat pathways in the SW sector at 1.2 miles. The maximum Annual Organ Dose calculated for this receptor 8.88E-04 and 1.51E-03 mrem to the Thyroid. This annual dose is a small fraction (5.92E-03% and 1.01E-02%, respectively) of the 10 CFR 50, Appendix I guideline of 15 mrem to the Maximum Organ per reactor unit.

The dose from liquid releases to the critical receptor for Joseph M. Farley Nuclear Plant is the Adult due to the Potable Water and Fish Pathways. The maximum Annual Total Body Doses calculated for this receptor were 5.63E-03 mrem and 7.45E-03 mrem for Unit 1 and Unit 2, respectively. The maximum Organ Doses calculated to the Adult Lung were 2.63E-02 and 4.36E-02 mrem for Unit 1 and Unit 2, respectively. These doses were also a very small percentage of the Appendix I limits of 3 mrem total body and 10 mrem organ. The above data was obtained from Table 1, Joseph M. Farley Nuclear Plant Dose Summary - Unit 1 and Table 2, Joseph M. Farley Nuclear Plant Dose Summary - Unit 2.

Accounting for the C-14 released from FNP, the total gaseous, liquid and nearby facilities dose for the total body, thyroid, and organ was 7.18E-01%, 2.38E-01%, and 3.58E+00%, respectively of the 40 CFR 190 limits of 25 mrem (total body), 75 mrem (thyroid), and 25 mrem (organ).

Solid radioactive waste shipped offsite for disposal included 3.18E-01 Ci in 1.78E+02 m^3, shipped in 5 shipments. There were 0 shipments of irradiated fuel from the Joseph M. Farley Nuclear Plant.

In addition to monitoring radioactive effluents, FNP has a Radiological Environmental Monitoring Program (REMP) that monitors for buildup of radioactivity in the offsite environment. Data from the REMP is published in the Annual Radiological Environmental Operating Report (AREOR).

2.1 Comparison to Regulatory Limits

During 2024 all liquid and gaseous radioactive effluents from Joseph M. Farley Nuclear Plant were well below regulatory limits, as summarized in Table 1 and Table 2.

Table 1, Joseph M. Farley Nuclear Plant Dose Summary - Unit 1[1]

		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Liquid Effluent Dose Limit, Total Body	Limit	1.5 mrem	1.5 mrem	1.5 mrem	1.5 mrem	3 mrem
	Total Body Dose	2.47E-03	1.99E-03	2.19E-04	9.59E-04	5.63E-03
	% of Limit	1.64E-01	1.33E-01	1.46E-02	6.39E-02	1.88E-01
Liquid Effluent Dose Limit, Any Organ	Limit	5 mrem	5 mrem	5 mrem	5 mrem	10 mrem
	Max Organ Dose	3.47E-03	1.08E-02	4.16E-03	7.90E-03	2.63E-02
	% of Limit	6.94E-02	2.15E-01	8.31E-02	1.58E-01	2.63E-01
Gaseous Effluent Dose Limit, Gamma Air (Noble Gas)	Limit	5 mrad	5 mrad	5 mrad	5 mrad	10 mrad
	Gamma Air Dose	4.81E-04	4.21E-04	1.35E-04	2.40E-04	1.28E-03
	% of Limit	9.62E-03	8.43E-03	2.71E-03	4.80E-03	1.28E-02
Gaseous Effluent Dose Limit, Beta Air (Noble Gas)	Limit	10 mrad	10 mrad	10 mrad	10 mrad	20 mrad
	Beta Air Dose	3.88E-04	1.66E-04	5.04E-05	8.63E-05	6.91E-04
	% of Limit	3.88E-03	1.66E-03	5.04E-04	8.63E-04	3.45E-03
Gaseous Effluent Organ Dose Limit (Iodine, Tritium, Particulates with > 8-day half-life)	Limit	7.5 mrem	7.5 mrem	7.5 mrem	7.5 mrem	15 mrem
	Max Organ Dose	2.27E-04	1.39E-04	3.67E-04	1.55E-04	8.88E-04
	% of Limit	3.03E-03	1.86E-03	4.89E-03	2.07E-03	5.92E-03

[1] Table 1 demonstrates compliance with 10 CFR Part 50, App. I Limits.

Table 2, Joseph M. Farley Nuclear Plant Dose Summary - Unit 2[1]

		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Liquid Effluent Dose Limit, Total Body	Limit	1.5 mrem	1.5 mrem	1.5 mrem	1.5 mrem	3 mrem
	Total Body Dose	1.09E-03	9.30E-04	8.06E-04	4.62E-03	7.45E-03
	% of Limit	7.25E-02	6.20E-02	5.37E-02	3.08E-01	2.48E-01
Liquid Effluent Dose Limit, Any Organ	Limit	5 mrem	5 mrem	5 mrem	5 mrem	10 mrem
	Max Organ Dose	1.74E-03	7.99E-03	6.57E-03	2.74E-02	4.36E-02
	% of Limit	3.48E-02	1.60E-01	1.31E-01	5.48E-01	4.36E-01
Gaseous Effluent Dose Limit, Gamma Air (Noble Gas)	Limit	5 mrad	5 mrad	5 mrad	5 mrad	10 mrad
	Gamma Air Dose	3.66E-05	4.50E-05	2.88E-04	5.24E-05	4.22E-04
	% of Limit	7.33E-04	9.01E-04	5.75E-03	1.05E-03	4.22E-03
Gaseous Effluent Dose Limit, Beta Air (Noble Gas)	Limit	10 mrad	10 mrad	10 mrad	10 mrad	20 mrad
	Beta Air Dose	1.29E-05	1.59E-05	1.01E-04	1.87E-05	1.49E-04
	% of Limit	1.29E-04	1.59E-04	1.01E-03	1.87E-04	7.45E-04
Gaseous Effluent Organ Dose Limit (Iodine, Tritium, Particulates with > 8-day half-life)	Limit	7.5 mrem	7.5 mrem	7.5 mrem	7.5 mrem	15 mrem
	Max Organ Dose	2.16E-04	1.65E-04	9.97E-04	1.32E-04	1.51E-03
	% of Limit	2.88E-03	2.20E-03	1.33E-02	1.76E-03	1.01E-02

[1] Table 2 demonstrates compliance with 10 CFR Part 50, App. I Limits.

Table 3, Total Annual Offsite-Dose Comparison to 40 CFR 190 Limits for FNP[1]

	Whole Body	Thyroid	Max Other Organ
Gaseous[2]	2.37E-03	2.40E-03	2.37E-03
Carbon-14	1.64E-01	1.64E-01	8.22E-01
Liquid	1.31E-02	1.24E-02	6.99E-02
Direct Shine	N/A	N/A	N/A
Total Site Dose	**1.79E-01**	**1.79E-01**	**8.94E-01**
Other Nearby Facility[3]	N/A	N/A	N/A
Total Site and Nearby Facility	**1.79E-01**	**1.79E-01**	**8.94E-01**
Limit	**25 mrem**	**75 mrem**	**25 mrem**
% of Limit	7.18E-01	2.38E-01	3.58E+00

[1] Table 3 is a summation of two Units to show compliance with 40 CFR Part 190 Limits.
[2] Gaseous dose values in Table 3 include organ dose from Noble Gas, Iodine, Tritium, and Particulates.
[3] Other fuel cycle sources within 5 miles of the site are considered in this analysis.

3.0 INTRODUCTION

3.1 About Nuclear Power

Commercial nuclear power plants are generally classified as either Boiling Water Reactors (BWRs) or Pressurized Water Reactors (PWRs), based on their design. A BWR includes a single coolant system where water used as reactor coolant boils as it passes through the core and the steam generated is used to turn the turbine generator for power production. A PWR, in contrast, includes two separate water systems: radioactive reactor coolant and a secondary system. Reactor coolant is maintained under high pressure, preventing boiling. The high-pressure coolant is passed through a heat exchanger called a steam generator where the secondary system water is boiled, and the steam is used to turn the turbine generator for power production.

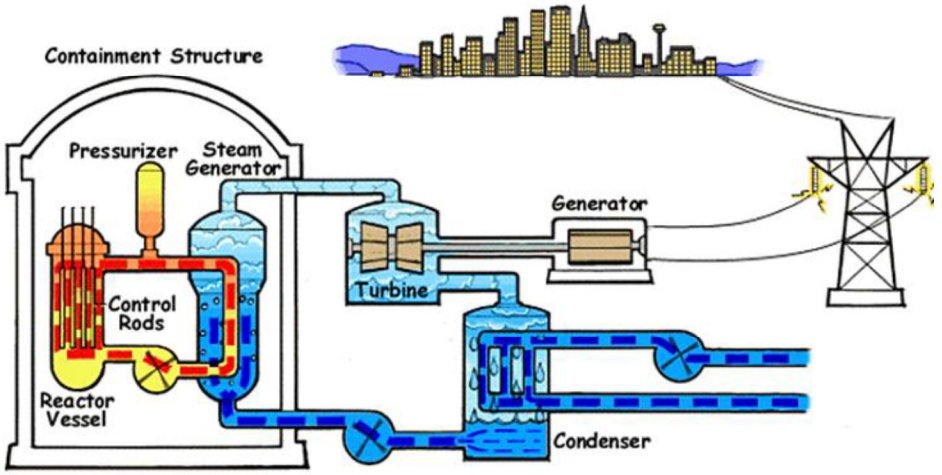

Figure 1, Pressurized Water Reactor (PWR) **[1]**

3.1 (Continued)

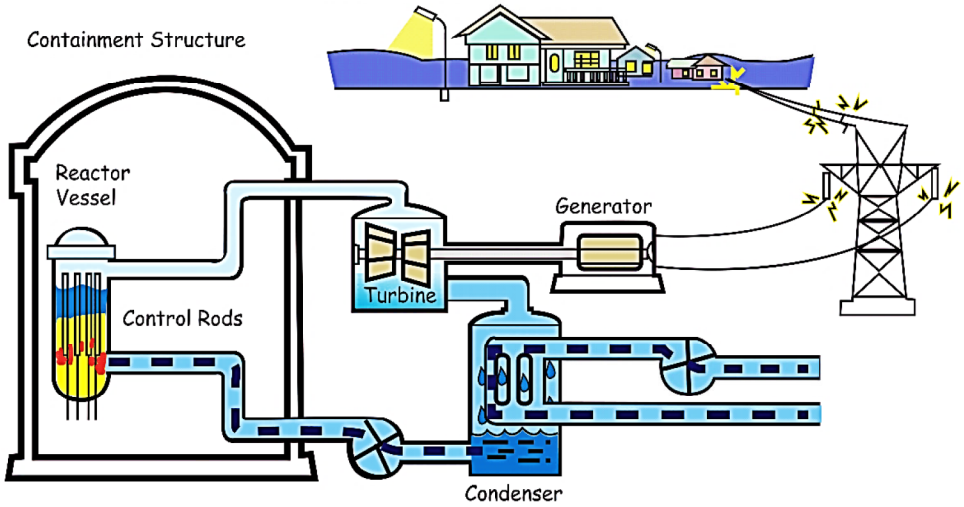

Figure 2, Boiling Water Reactor (BWR) **[2]**

Electricity is generated by a nuclear power plant similarly to the way that electricity is generated at other conventional types of power plants, such as those powered by coal or natural gas. Water is boiled to generate steam; the steam spins a turbine that is attached to a generator and the steam is condensed back into water to be returned to the boiler. What makes nuclear power different from these other types of power plants is that the heat is generated by fission and decay reactions occurring within and around the core containing fissionable uranium (U-235).

Nuclear fission occurs when certain nuclides (primarily U-233, U-235, or Pu-239) absorb a neutron and break into several smaller nuclides (called fission products) as well as producing some additional neutrons.

Fission results in production of radioactive materials including gases and solids that must be contained to prevent release or treated prior to release. These effluents are generally treated by filtration and/or hold-up prior to release. Releases are generally monitored by sampling and by continuously indicating radiation monitors. The effluent release data is used to calculate doses to ensure that dose to the public due to plant operation remains within required limits.

3.2 About Radiation Dose

Ionizing radiation, including alpha, beta, and gamma radiation from radioactive decay, has enough energy to break chemical bonds in tissues and results in damage to tissue or genetic material. The amount of ionization that will be generated by a given exposure to ionizing radiation is quantified as dose. Radiation dose is generally reported in units of millirem (mrem) in the US.

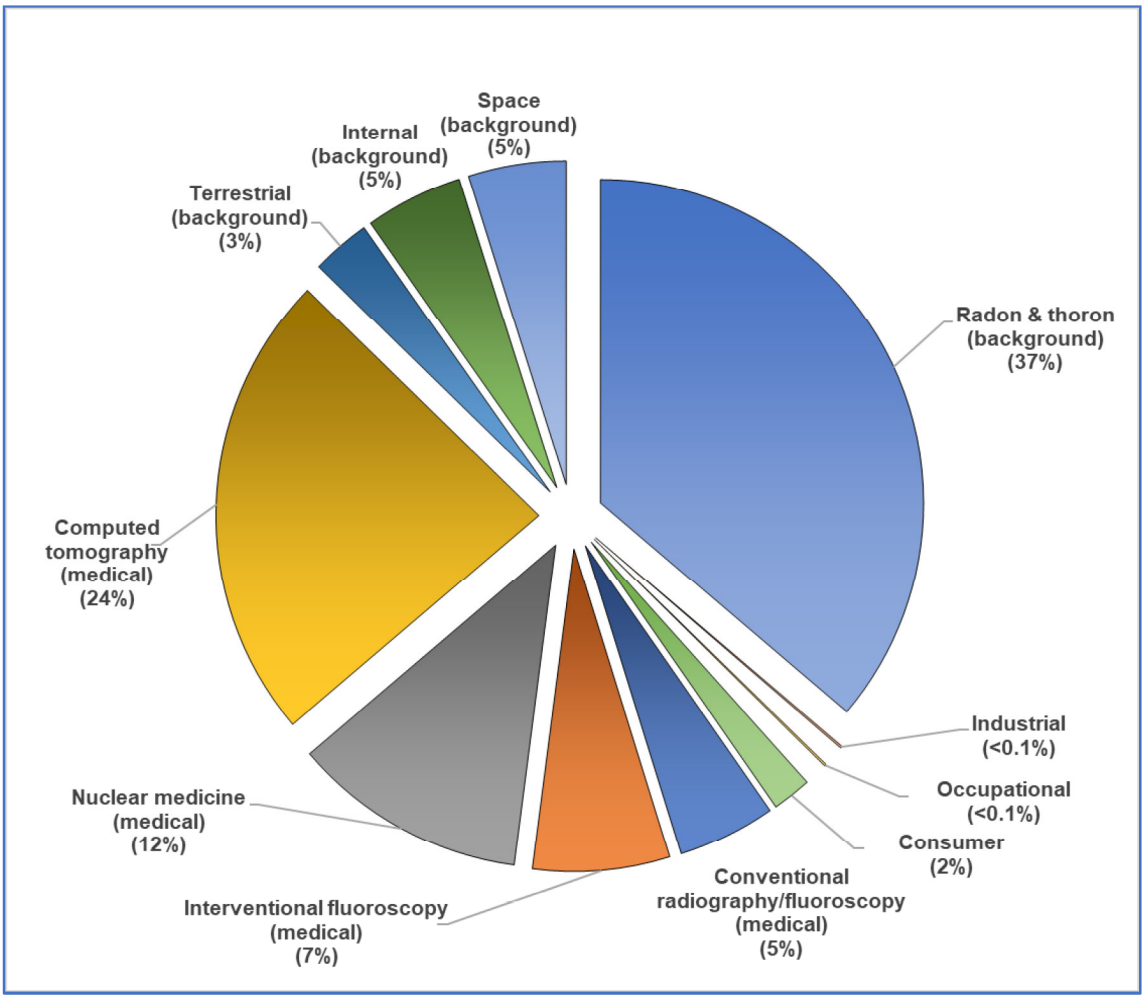

Figure 3, Sources of Radiation Exposure (NCRP Report No. 160) **[3]**

The National Council on Radiation Protection (NCRP) has evaluated the population dose for the US and determined that the average individual is exposed to approximately 620 mrem per year [3]. There are many sources for radiation dose, ranging from natural background sources to medical procedures, air travel, and industrial processes. Approximately half (310 mrem) of the average exposure is due to natural sources of radiation including exposure to radon, cosmic radiation, and internal radiation and terrestrial due to naturally occurring radionuclides. The remaining 310 mrem of exposure is due to man-made sources of exposure, with the most significant contributors being medical (48% of total mrem per year) due to radiation used in various types of medical scans and treatments. Of the remaining 2%

3.2 (Continued)

of dose, most is due to consumer activities such as air travel, smoking cigarettes, and building materials. A small fraction of this 2% is due to industrial activities including the generation of nuclear power.

Readers that are curious about common sources and effects of radiation dose that they may encounter can find excellent sources of information from the Health Physics Society, including the Radiation Fact Sheets [4], and from the US Nuclear Regulatory Commission website [5].

3.3 About Dose Calculation

Concentrations of radioactive material in the environment resulting from plant operations are very small and it is not possible to determine doses directly using measured activities of environmental samples. To overcome this, dose calculations based on measured activities of effluent streams are used to model the dose impact for Members of the Public due to plant operation and effluents. There are several mechanisms that can result in dose to a Members of the Public, including: Ingestion of radionuclides in food or water; Inhalation of radionuclides in air; Immersion in a plume of noble gases; and direct radiation from the ground, the plant or from an elevated plume.

Each plant has an Offsite Dose Calculation Manual (ODCM) that specifies the methodology used to obtain the doses in the Dose Assessment section of this report. The dose assessment methodology in the ODCM is based on NRC Regulatory Guide 1.109 [6] and NUREG-0133 [7]. Doses are calculated by determining what the nuclide concentration will be in air, water, on the ground, or in food products based on plant effluent releases. Release points are continuously monitored to quantify what concentrations of nuclides are being released. For gaseous releases meteorological data is used to determine how much of the released activity will be present at a given location outside of the plant either deposited onto the ground or in gaseous form.

Intake patterns and nuclide bio-concentration factors are used to determine how much activity will be transferred into animal milk or meat. Finally, human ingestion factors and dose factors are used to determine how much activity will be consumed and how much dose the consumer will receive. Inhalation dose is calculated by determining the concentration of nuclides and how much air is breathed by the individual.

For liquid releases, dilution and mixing factors are used to model the environmental concentrations in water. Drinking water pathways are modeled by determining the concentration of nuclides in the water at the point where the drinking water is sourced (e.g., taken from wells, rivers, or lakes). Fish and invertebrate pathways are determined by using concentration at the release point, bioaccumulation factors for the fish or invertebrate and an estimate of the quantity of fish consumed.

Each year a Land Use Census is performed to determine what potential dose pathways currently exist within a five-mile radius around the plant, the area most affected by plant operations. The Annual Land Use Census identifies the locations of vegetable gardens, nearest residences, milk animals and meat animals. The data

3.3 (Continued)

from the census is used to determine who is the likely to be most exposed to radiation dose due to plant operation.

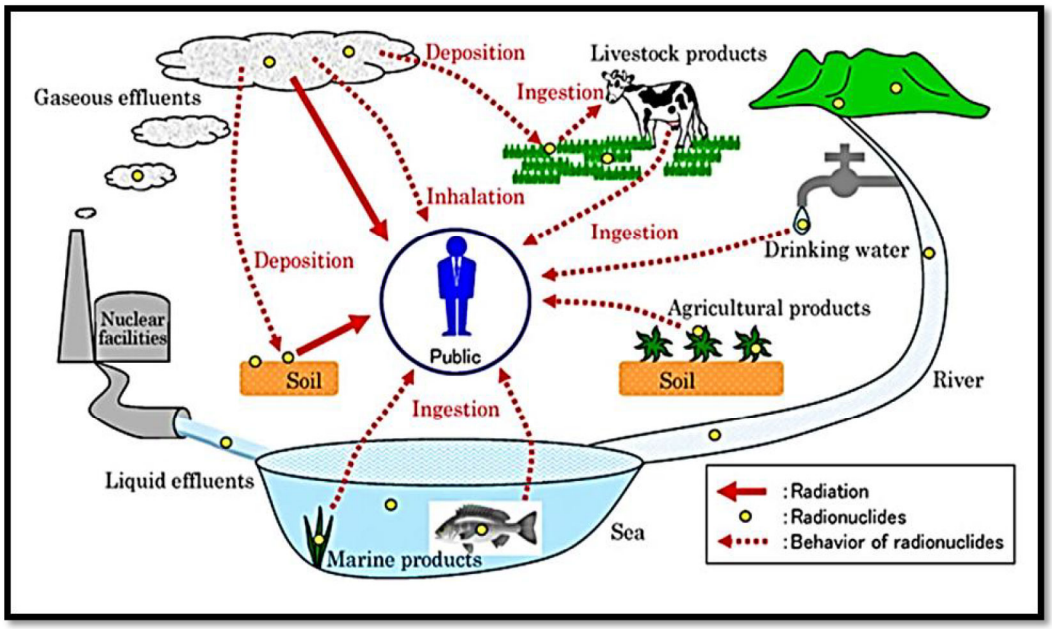

Figure 4, Potential exposure pathways to Members of the Public due to Plant Operations **[8]**

There is significant uncertainty in dose calculation results, due to modeling dispersion of material released and bioaccumulation factors, as well as assumptions associated with consumption and land-use patterns. Even with these sources of uncertainty, the calculations do provide a reasonable estimate of the order of magnitude of the exposure. Conservative assumptions are made in the calculation inputs such as the number of various foods and water consumed, the amount of air inhaled, and the amount of direct radiation exposure from the ground or plume, such that the actual dose received are likely lower than the calculated dose. Even with the built-in conservatism, doses calculated for the maximum exposed individual due to plant operation are a very small fraction of the annual dose that is received due to other sources. The calculated doses due to plant effluents, along with REMP results, serve to provide assurance that radioactive effluents releases are not exceeding safety standards for the environment or people living near the plant.

4.0 DOSE ASSESSMENT FOR PLANT OPERATIONS

4.1 Regulatory Limits

Regulatory limits are detailed in Station Licensing documents such as the Offsite Dose Calculation Manual (ODCM) and Technical Specifications 5.5.1, 5.5.4, 5.6.2 and 5.6.3. These documents contain the limits to which FNP must adhere. FNP drives to maintain the philosophy to keep dose "as low as reasonably achievable" (ALARA) and actions are taken to reduce the amount of radiation released to the environment. Liquid and gaseous release data show that the dose from FNP is well below the ODCM limits. The concentration of liquid radioactive material released 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 2.0×10^{-4} µCi/ml. This data reveals that radioactive effluents have an overall minimal dose contribution to the surrounding environment.

The annual whole body, skin and organ dose was computed using the 2024 source term using the dose calculation methodology provided in the ODCM. The calculated doses due to gaseous effluents to demonstrate compliance with offsite dose limits are presented in Table 1, Joseph M. Farley Nuclear Plant Dose Summary - Unit 1, Table 2, Joseph M. Farley Nuclear Plant Dose Summary - Unit 2, and Table 3, Total Annual Offsite-Dose Comparison to 40 CFR 190 Limits for FNP.

4.2 Regulatory Limits for Gaseous Effluent Doses:

1. Fission and activation gases:

   a. Noble gases dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to the following:

      1) Less than or equal to 500 mrem/year to the total body

      2) Less than or equal to 3000 mrem/year to the skin

   b. Noble gas air dose due to noble gases released in gaseous effluents, from each reactor unit to areas at and beyond the site boundary shall be limited to the following:

      1) Quarterly

         a) Less than or equal to 5 mrads gamma

         b) Less than or equal to 10 mrads beta

      2) Yearly

         a) Less than or equal to 10 mrads gamma

         b) Less than or equal to 20 mrads beta

4.2 (Continued)

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 from the site to areas at and beyond the site boundary shall be limited to the following:

      1) 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, from each reactor unit to areas at and beyond the site boundary shall be limited to the following:

      1) Quarterly

         a) Less than or equal to 7.5 mrem to any organ

      2) Yearly

         a) Less than or equal to 15 mrem to any organ

4.3 Regulatory Limits for Liquid Effluent Doses

1. The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released, from each reactor unit to unrestricted areas shall be limited to the following:

   a. Quarterly

      1) Less than or equal to 1.5 mrem total body

      2) Less than or equal to 5 mrem critical organ

   b. Yearly

      1) Less than or equal to 3 mrem total body

      2) Less than or equal to 10 mrem critical organ

4.4 40 CFR 190 Regulatory Dose Limits for a Member of the Public

1. Total Dose (40 CFR 190)

   a. The annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC in the unrestricted area due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to the following:

4.4 (Continued)

1) Less than or equal to 25 mrem, Total Body or any Organ except Thyroid.

2) Less than or equal to 75 mrem, Thyroid.

4.5 Onsite Doses (Within Site Boundary)

This section evaluates doses to non-occupationally exposed workers and members of the public that may be onsite for various reasons. The report must include any other information as may be required by the Commission to estimate maximum potential annual radiation doses to the public resulting from effluent releases as required by 10 CFR 50.36a(a)(2). While within controlled or restricted areas, the limits from Sections 4.1 through 4.4 do not apply; however, 10 CFR 20.1301 dose limit of 100 mrem per year TEDE and dose rate limit of 2 mrem per hour from external sources continue to apply. Occupancy times within the controlled areas are generally sufficiently low to compensate for the increase in the atmospheric dispersion factor above the site boundary. Groups of concern include the Visitor Center, Service Water Pond, and the River Water Discharge. Use of a conservative assumption of (12, 66 and 100 respectively) hours/year spent inside the site boundary by these groups conservatively represents the most-exposed individual.

Table 4, Onsite Doses (Within Site Boundary)[1]

Location	Sector	Occupancy Hours	Approximate Distance (meters	Dose (mrem)		TEDE
				Total Body	Organ	(mrem)
Visitor Center	WSW	12	306	7.43E-08	7.44E-08	1.49E-07
Service Water Pond	SSW	66	966	4.55E-08	4.56E-08	9.11E-08
River Water discharge	SE	100	1640	4.95E-08	4.96E-08	9.91E-08

[1] Current FNP effluent controls as established by ODCM 6.1 do not require assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY (ODCM Figure 10-1). However, this assessment has been performed for 2024 using the methods described in ODCM 6.2.

5.0 SUPPLEMENTAL INFORMATION

5.1 Gaseous Batch Releases

5.1.1 FNP Unit 1

	Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual
1. Number of Batch Releases		101	52	102	122	377
2. Total duration of batch releases	minutes	1.33E+04	8.40E+03	7.89E+03	8.45E+03	3.80E+04
3. Maximum batch release duration	minutes	1.37E+03	1.31E+03	9.86E+02	1.86E+03	1.86E+03
4. Average batch release duration	minutes	1.32E+02	1.61E+02	7.73E+01	6.93E+01	1.01E+02
5. Minimum batch release duration	minutes	4.00E+00	5.00E+00	4.00E+00	5.00E+00	4.00E+00

5.1.2 FNP Unit 2

	Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual
1. Number of Batch Releases		30	30	26	35	121
2. Total duration of batch releases	minutes	1.50E+03	1.40E+03	1.13E+03	1.69E+03	5.72E+03
3. Maximum batch release duration	minutes	1.93E+02	2.25E+02	1.02E+02	1.28E+02	2.25E+02
4. Average batch release duration	minutes	4.99E+01	4.68E+01	4.36E+01	4.82E+01	4.73E+01
5. Minimum batch release duration	minutes	1.00E+00	4.00E+00	4.00E+00	6.00E+00	1.00E+00

5.1.3 FNP Site

	Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual
1. Number of Batch Releases		131	82	128	157	498
2. Total duration of batch releases	minutes	1.48E+04	9.80E+03	9.02E+03	1.01E+04	4.38E+04
3. Maximum batch release duration	minutes	1.37E+03	1.31E+03	9.86E+02	1.86E+03	1.86E+03
4. Average batch release duration	minutes	1.13E+02	1.19E+02	7.05E+01	6.46E+01	8.79E+01
5. Minimum batch release duration	minutes	1.00E+00	4.00E+00	4.00E+00	5.00E+00	1.00E+00

5.2 Liquid Batch Releases

5.2.1 FNP Unit 1

	Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual
1. Number of Batch Releases		83	90	47	47	267
2. Total duration of batch releases	minutes	9.17E+03	1.02E+04	5.29E+03	5.31E+03	2.99E+04
3. Maximum batch release duration	minutes	1.40E+02	1.47E+02	1.27E+02	1.30E+02	1.47E+02
4. Average batch release duration	minutes	1.10E+02	1.13E+02	1.13E+02	1.13E+02	1.12E+02
5. Minimum batch release duration	minutes	9.50E+01	9.80E+01	1.00E+02	1.00E+02	9.50E+01
6. Average stream flow during periods of release of liquid effluent into a flowing stream[1]	CFS	1.85E+04	7.46E+03	7.84E+03	2.82E+03	9.16E+03

5.2.2 FNP Unit 2

	Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual
1. Number of Batch Releases		65	63	34	94	256
2. Total duration of batch releases	minutes	6.98E+03	6.70E+03	3.45E+03	9.24E+03	2.64E+04
3. Maximum batch release duration	minutes	1.50E+02	1.45E+02	1.20E+02	1.24E+02	1.50E+02
4. Average batch release duration	minutes	1.07E+02	1.06E+02	1.02E+02	9.83E+01	1.03E+02
5. Minimum batch release duration	minutes	7.50E+01	8.20E+01	8.00E+01	3.70E+01	3.70E+01
6. Average stream flow during periods of release of liquid effluent into a flowing stream[1]	CFS	1.85E+04	7.46E+03	7.84E+03	2.82E+03	9.16E+03

5.2.3 FNP Site

	Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual
1. Number of Batch Releases		148	153	81	141	523
2. Total duration of batch releases	minutes	1.61E+04	1.69E+04	8.75E+03	1.45E+04	5.63E+04
3. Maximum batch release duration	minutes	1.50E+02	1.47E+02	1.27E+02	1.30E+02	1.50E+02
4. Average batch release duration	minutes	1.09E+02	1.10E+02	1.08E+02	1.03E+02	1.08E+02
5. Minimum batch release duration	minutes	7.50E+01	8.20E+01	8.00E+01	3.70E+01	3.70E+01
6. Average stream flow during periods of release of liquid effluent into a flowing stream[1]	CFS	1.85E+04	7.46E+03	7.84E+03	2.82E+03	9.16E+03

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

5.3 Abnormal Releases

5.3.1 Gaseous Abnormal Releases

There were no Abnormal Gaseous Releases from the site in 2024.

5.3.2 Liquid Abnormal Releases

There were no Abnormal Liquid Releases from the site in 2024.

5.4 Land Use Census Changes

There were no changes in the Land Use Census. The critical receptor remains in sector 10 (SW) at 1.2 miles. There are no milk producing animals within five miles of the site.

5.5 Meteorological Data

ODCM 7.2.2.2 states in part:

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

In lieu of submission with the Radioactive Effluent Release Report, the licensee has the option of retaining this summary of required meteorological data on site in a file that shall be provided to the NRC upon request. The detailed meteorological data has been retained on site.

In 2024, Plant Farley's meteorological data collection achieved over 90% data recovery for all monitored parameters. A discussion of the meteorological data is in Attachment 3, Meteorological Data.

5.6 Effluent Radiation Monitors Out of Service Greater Than 30 Days

There were no effluent radiation monitors out of service for more than 30 days in 2024.

5.7 Offsite Dose Calculation Manual (ODCM) Changes

There were no changes to the ODCM in 2024.

5.8 Process Control Program (PCP) Changes

There were no changes to the PCP in 2024.

5.9 Radioactive Waste Treatment System Changes (RWTS)

There were no changes to the RWTS in 2024.

5.10 Independent Spent Fuel Storage Installation (ISFSI) Monitoring Program

The ISFSI annual report on radioactive releases is submitted as a separate report.

5.11 Carbon-14

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

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

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

At Plant Farley, the annual quantity of C-14 released in gaseous effluents was estimated to be 9.28 Curies (per unit). Approximately 30% of the C-14 released is in the form of $^{14}CO2$ and is incorporated into plants through photosynthesis. This pathway results in an ingestion dose. The remaining 70% is estimated to be organic. Both the organic and inorganic forms of C-14 contribute to inhalation dose. A child is the maximally exposed individual, and bone dose is the highest organ dose. Using the dose calculation methodology from the Farley ODCM, the resulting bone dose to a child located at the controlling receptor location would be 4.11E-01 mrem per unit (8.22E-01 total) in a year which is 3.29% of the 40 CFR 190 regulatory limit of 25 mrem per year (all units) to any organ except the thyroid due to gaseous effluents. The resulting total body dose to a child located at the controlling receptor location would be 1.64E-01 mrem (all units) in a year which is 0.66% of the regulatory limit of 25 mrem per year total body dose due to gaseous effluents.

C-14 dose is included in dose calculation results in Table 3, Total Annual Offsite-Dose Comparison to 40 CFR 190 Limits for FNP.

5.12 Errata/Corrections to Previous ARERRs

The 2023 ARERR Tables 5, 6, and 7 Gaseous Effluents Summation of All Releases, from Unit 1, Unit 2, and Site, respectively had the wrong headers for iodines. The tables had the header “Iodines and Halogens” and “Total Release”. The correct headers are “Radioiodine” and Total Iodine-131. The data was correct. The corrected tables are in Attachment 5, ERRATA From Previous Reports.

5.13 Other Supplemental Information

5.13.1 Measurements and Approximation of Total Radioactivity Gaseous Effluents

1. The following noble gases are specifically considered in evaluating gaseous effluents, Kr-87, Kr-88, Xe-133m, Xe-133, Xe-135 and Xe-138.

2. The following radioiodines and radioactive materials in particulate form are specifically considered in evaluating gaseous effluents, Mn-54, Fe-59, Co-58, Co-60, Zn-65, Sr-89, Sr-90, Mo-99, I-131, Cs-134, Cs-137, Ce-141, Ce-144 and H-3.

3. Sample collection and Analysis

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

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

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

   Typically achieved minimum detectable concentrations for gaseous effluent sample analyses are reported in Table 20, Minimum Detectable Concentrations Gaseous Sample Analysis.

4. Total Quantities of Radioactivity, Dose Rates, and Cumulative Doses

   a. Fission and Activation Gases

      The released radioactivity is determined using sample analyses results collected as described in section 5.10.13 and the average release flow rates over the period represented by the collected sample.

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

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

   b. Radioiodine, Tritium, and Particulate Releases

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

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

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

      Tritium samples are obtained monthly from the Plant Vent Stack, the Containment Purge when in batch mode, and the Turbine Building Vent (and weekly for Containment Purge when in continuous mode) by passing the sample stream through a cold trap or by using the bubble method.

      The grams of water vapor/cubic meter are measured upstream of the cold trap to alleviate the difficulties in determining water vapor collection efficiencies. The tritium samples are analyzed onsite and

the results furnished in µCi/ml of water. The tritium concentration in water is converted to the tritium concentration in air and this value is input into the composite file of the computer and used in release, dose rate, and individual dose calculations.

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

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

c. Gross Alpha Release

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

5. Total Error Estimation

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

F&A Gases	Iodine	Particulates	Tritium
75%	60%	50%	45%

The average error associated with counting is estimated to be:

F&A Gases	Iodine	Particulates	Tritium
19%	28%	20%	8%

5.13.2 Measurements and Approximation of Total Radioactivity Liquid Effluents

1. The radionuclides listed below are specifically considered when evaluating liquid effluents are Mn-54,Fe-59, Co-58, Co-60, Zn-65, Sr-89, Sr-90, I-131, Cs-134, Cs-137, Ce-141, Ce-144, Mo-99, Fe-55 and H-3.

2. Total Radioactivity Determination

a. Batch Releases:

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

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

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

b. Continuous Releases:

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

Typically achieved liquid effluent sample analyses minimum detectable concentrations are reported in Table 30, 2024 Liquid Effluents – Minimum Detectable Concentration.

3. Total Error Estimation

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

5.13.3 Effluent Sample Analysis Exceeding Minimum Detectable Concentration (MDC)

ODCM 7.2.2.6 states in part that the report shall include deviations from the MDC requirements included in ODCM Tables 2-3 and 3-3. There were no deviations from the MDC requirements in 2024.

5.13.4 Temporary Outside Tanks

No temporary outside tanks exceeded ODCM or Technical Specification Limit of 10 Ci not including tritium.

6.0 NEI 07-07 ONSITE RADIOLOGICAL GROUNDWATER MONITORING PROGRAM

Joseph M. Farley Nuclear Plant has developed a Groundwater Protection Initiative (GPI) program in accordance with NEI 07-07, Industry Ground Water Protection Initiative – Final Guidance Document [9]. The purpose of the GPI is to ensure timely detection and an effective response to situations involving inadvertent radiological releases to groundwater to prevent migration of licensed radioactive material off-site and to quantify impacts on decommissioning. The summary of results of 2024, FNP GPI is in Attachment 4, NEI 07-07 Onsite Radiological Groundwater Monitoring Program.

6.1 Voluntary Notification

During 2024, Joseph M. Farley Nuclear Plant did not make a voluntary NEI 07-07 notification to State/Local officials, NRC, and to other stakeholders required by site procedures.

7.0 BIBLIOGRAPHY

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[17] "Regulatory Guide 4.13 - Performance, Testing, and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications, Revision 2," Nuclear Regulatory Commision, June, 2019.

[18] "Regulatory Guide 4.15 - Quality Assurance for Radiological Monitoring Programs (Inception through Normal Operations to License Termination) -- Effluent Streams and the Environment," Nuclear Regulatory Commission, July, 2007.

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

1.0 GASEOUS EFFLUENTS

Table 5, Gaseous Effluents Summation of All Releases Unit 1[1]

A. Fission & Activation Gases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %[2]
1. Total Release	Ci	4.85E+00	1.71E+00	5.05E-01	8.06E-01	7.87E+00	
2. Average release rate for the period	µCi/sec	6.15E-01	2.17E-01	6.40E-02	1.02E-01	2.50E-01	
B. Radioiodines							
1. Total Iodine-131	Ci	3.03E-07	1.29E-06	0.00E+00	0.00E+00	1.59E-06	
2. Average release rate for the period	µCi/sec	3.85E-08	1.64E-07	0.00E+00	0.00E+00	5.06E-08	
C. Particulates							
1. Particulates (Half-Lives > 8 Days)	Ci	1.11E-08	2.14E-07	7.12E-07	0.00E+00	9.37E-07	
2. Average release rate for the period	µCi/sec	1.40E-09	2.72E-08	9.03E-08	0.00E+00	2.97E-08	
D. Tritium							
1. Total Release	Ci	1.62E+00	8.38E-01	2.68E+00	1.14E+00	6.28E+00	
2. Average release rate for the period	µCi/sec	2.05E-01	1.06E-01	3.40E-01	1.44E-01	1.99E-01	
E. Gross Alpha							
1. Total Release	Ci	5.47E-07	1.03E-06	4.42E-07	5.68E-07	2.59E-06	
2. Average release rate for the period	µCi/sec	6.94E-08	1.30E-07	5.61E-08	7.21E-08	8.19E-08	
F. Carbon-14[3]							
1. Total Release	Ci	2.32E+00	2.32E+00	2.32E+00	2.32E+00	9.28E+00	
2. Average release rate for the period	µCi/sec	2.94E-01	2.94E-01	2.94E-01	2.94E-01	2.94E-01	

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

[1] % of limit is on Table 1, Joseph M. Farley Nuclear Plant Dose Summary - Unit 1.
[2] % error see section 5.13.15 on page 24.
[3] Carbon-14 is calculated in accordance with section 5.11 on page 21. It is a conservative estimate based on maximum power output and does not account for outages when C-14 is not produced.

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 6, Gaseous Effluents Summation of All Releases Unit 2 [1]

A. Fission & Activation Gases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %[2]
1. Total Release	Ci	1.15E-01	1.41E-01	9.03E-01	1.71E-01	1.33E+00	
2. Average release rate for the period	µCi/sec	1.46E-02	1.79E-02	1.15E-01	2.17E-02	4.23E-02	
B. Radioiodines							
1. Total Iodine-131	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
2. Average release rate for the period	µCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
C. Particulates							
1. Particulates (Half-Lives > 8 Days)	Ci	0.00E+00	0.00E+00	0.00E+00	1.21E-08	1.21E-08	
2. Average release rate for the period	µCi/sec	0.00E+00	0.00E+00	0.00E+00	1.53E-09	3.83E-10	
D. Tritium							
1. Total Release	Ci	1.58E+00	1.21E+00	7.29E+00	9.65E-01	1.10E+01	
2. Average release rate for the period	µCi/sec	2.00E-01	1.53E-01	9.24E-01	1.22E-01	3.50E-01	
E. Gross Alpha							
1. Total Release	Ci	7.57E-07	4.20E-07	1.80E-06	4.66E-07	3.44E-06	
2. Average release rate for the period	µCi/sec	9.60E-08	5.33E-08	2.28E-07	5.91E-08	1.09E-07	
F. Carbon-14[3]							
1. Total Release	Ci	2.32E+00	2.32E+00	2.32E+00	2.32E+00	9.28E+00	
2. Average release rate for the period	µCi/sec	2.94E-01	2.94E-01	2.94E-01	2.94E-01	2.94E-01	

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

[1] % of limit is on Table 2, Joseph M. Farley Nuclear Plant Dose Summary - Unit 2.
[2] % error see section 5.13.15 on page 24.
[3] Carbon-14 is calculated in accordance with section 5.11 on page 21. It is a conservative estimate based on maximum power output and does not account for outages when C-14 is not produced.

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 7, Gaseous Effluents Summation of All Releases Site [1]

A. Fission & Activation Gases	**Unit**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Annual**	**Est. Total Error %[2]**
1. Total Release	Ci	4.96E+00	1.85E+00	1.41E+00	9.77E-01	9.20E+00	
2. Average release rate for the period	µCi/sec	6.30E-01	2.35E-01	1.79E-01	1.24E-01	2.92E-01	
B. Radioiodines							
1. Total Iodine-131	Ci	3.03E-07	1.29E-06	0.00E+00	0.00E+00	1.59E-06	
2. Average release rate for the period	µCi/sec	3.85E-08	1.64E-07	0.00E+00	0.00E+00	5.06E-08	
C. Particulates							
1. Particulates (Half-Lives > 8 Days)	Ci	1.11E-08	2.14E-07	7.13E-07	1.21E-08	9.50E-07	
2. Average release rate for the period	µCi/sec	1.40E-09	2.72E-08	9.04E-08	1.53E-09	3.01E-08	
D. Tritium							
1. Total Release	Ci	3.19E+00	2.05E+00	9.97E+00	2.10E+00	1.73E+01	
2. Average release rate for the period	µCi/sec	4.05E-01	2.60E-01	1.26E+00	2.67E-01	5.48E-01	
E. Gross Alpha							
1. Total Release	Ci	1.30E-06	1.45E-06	2.24E-06	1.03E-06	6.02E-06	
2. Average release rate for the period	µCi/sec	1.65E-07	1.84E-07	2.84E-07	1.31E-07	1.91E-07	
F. Carbon-14[3]							
1. Total Release	Ci	4.64E+00	4.64E+00	4.64E+00	4.64E+00	1.86E+01	
2. Average release rate for the period	µCi/sec	5.90E-01	5.90E-01	5.84E-01	5.84E-01	5.87E-01	

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

[1] % of limit is on Table 1 and Table 2.
[2] % error see section 5.13.15 on page 24.
[3] Carbon-14 is calculated in accordance with section 5.11 on page 21. It is a conservative estimate based on maximum power output and does not account for outages when C-14 is not produced.

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 8, Gaseous Effluents – Ground Level Release Batch Mode Unit 1

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
Total for Period	**Ci**	**No Nuclides Found**				
Iodines						
Total for Period	**Ci**	**No Nuclides Found**				
Particulates						
Total for Period	**Ci**	**No Nuclides Found**				
Tritium						
H-3	**Ci**	**No Nuclides Found**				
Gross Alpha						
Alpha	**Ci**	**No Nuclides Found**				
Carbon-14						
C-14	**Ci**	**No Nuclides Found**				

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 9, Gaseous Effluents – Ground Level Release Batch Mode Unit 2

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
Total for Period	**Ci**	**No Nuclides Found**				
Iodines						
Total for Period	**Ci**	**No Nuclides Found**				
Particulates						
Total for Period	**Ci**	**No Nuclides Found**				
Tritium						
H-3	**Ci**	**No Nuclides Found**				
Gross Alpha						
Alpha	**Ci**	**No Nuclides Found**				
Carbon-14						
C-14	**Ci**	**No Nuclides Found**				

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 10, Gaseous Effluents – Ground Level Release Batch Mode Site

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
Total for Period	**Ci**	**No Nuclides Found**				
Iodines						
Total for Period	**Ci**	**No Nuclides Found**				
Particulates						
Total for Period	**Ci**	**No Nuclides Found**				
Tritium						
H-3	**Ci**	**No Nuclides Found**				
Gross Alpha						
Alpha	**Ci**	**No Nuclides Found**				
Carbon-14						
C-14	**Ci**	**No Nuclides Found**				

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 11, Gaseous Effluents – Ground Level Release Continuous Mode Unit 1

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
Total for Period	**Ci**	**No Nuclides Found**				
Iodines						
Total for Period	**Ci**	**No Nuclides Found**				
Particulates						
Total for Period	**Ci**	**No Nuclides Found**				
Tritium						
H-3	**Ci**	**No Nuclides Found**				
Gross Alpha						
Alpha	**Ci**	**No Nuclides Found**				
Carbon-14						
C-14	**Ci**	**No Nuclides Found**				

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 12,Gaseous Effluents – Ground Level Release Continuous Mode Unit 2

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
Total for Period	**Ci**	**No Nuclides Found**				
Iodines						
Total for Period	**Ci**	**No Nuclides Found**				
Particulates						
Total for Period	**Ci**	**No Nuclides Found**				
Tritium						
H-3	**Ci**	**No Nuclides Found**				
Gross Alpha						
Alpha	**Ci**	**No Nuclides Found**				
Carbon-14						
C-14	**Ci**	**No Nuclides Found**				

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 13, Gaseous Effluents – Ground Level Release Continuous Mode Site

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
Total for Period	**Ci**	**No Nuclides Found**				
Iodines						
Total for Period	**Ci**	**No Nuclides Found**				
Particulates						
Total for Period	**Ci**	**No Nuclides Found**				
Tritium						
H-3	**Ci**	**No Nuclides Found**				
Gross Alpha						
Alpha	**Ci**	**No Nuclides Found**				
Carbon-14						
C-14	**Ci**	**No Nuclides Found**				

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 14, Gaseous Effluents – Mixed Level Release Batch Mode Unit 1

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
Ar-41	Ci	4.86E-02	1.87E-01	4.22E-01	7.51E-01	1.41E+00
Kr-85M	Ci	0.00E+00	2.70E-03	0.00E+00	0.00E+00	2.70E-03
Kr-88	Ci	0.00E+00	6.58E-04	0.00E+00	0.00E+00	6.58E-04
Xe-131M	Ci	2.08E-03	0.00E+00	8.87E-04	8.64E-04	3.83E-03
Xe-133M	Ci	1.07E-03	8.24E-03	2.65E-04	2.07E-04	9.78E-03
Xe-133	Ci	1.27E-01	2.86E-01	8.18E-02	5.36E-02	5.48E-01
Xe-135	Ci	2.01E-04	1.28E-01	4.25E-05	2.37E-05	1.28E-01
Total For Period	**Ci**	**1.79E-01**	**6.12E-01**	**5.05E-01**	**8.06E-01**	**2.10E+00**
Iodines						
I-131	Ci	0.00E+00	3.97E-07	0.00E+00	0.00E+00	3.97E-07
I-133	Ci	0.00E+00	1.74E-06	0.00E+00	0.00E+00	1.74E-06
I-135	Ci	0.00E+00	6.64E-07	0.00E+00	0.00E+00	6.64E-07
Total for Period	**Ci**	**0.00E+00**	**2.80E-06**	**0.00E+00**	**0.00E+00**	**2.80E-06**
Particulates						
Cr-51	Ci	9.02E-09	0.00E+00	0.00E+00	0.00E+00	9.02E-09
Y-88	Ci	2.03E-09	3.11E-09	0.00E+00	0.00E+00	5.14E-09
Total For Period	**Ci**	**1.11E-08**	**3.11E-09**	**0.00E+00**	**0.00E+00**	**1.42E-08**
Tritium						
H-3	**Ci**	**3.34E-02**	**7.61E-03**	**1.13E-01**	**1.16E-01**	**2.70E-01**
Gross Alpha						
Alpha	**Ci**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
Carbon-14						
C-14	**Ci**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**

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

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 15, Gaseous Effluents – Mixed Level Release Continuous Mode Unit 1

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
Ar-41	Ci	1.45E+00	1.10E+00	0.00E+00	0.00E+00	2.55E+00
Kr-85	Ci	3.22E+00	0.00E+00	0.00E+00	0.00E+00	3.22E+00
Total for Period	**Ci**	**4.67E+00**	**1.10E+00**	**0.00E+00**	**0.00E+00**	**5.77E+00**
Iodines						
I-131	Ci	3.03E-07	8.96E-07	0.00E+00	0.00E+00	1.20E-06
I-133	Ci	1.37E-06	0.00E+00	0.00E+00	0.00E+00	1.37E-06
Total for Period	**Ci**	**1.67E-06**	**8.96E-07**	**0.00E+00**	**0.00E+00**	**2.57E-06**
Particulates						
Be-7	Ci	0.00E+00	0.00E+00	7.12E-07	0.00E+00	7.12E-07
Co-58	Ci	0.00E+00	1.36E-07	0.00E+00	0.00E+00	1.36E-07
Co-60	Ci	0.00E+00	5.98E-08	0.00E+00	0.00E+00	5.98E-08
Cs-137	Ci	0.00E+00	1.53E-08	0.00E+00	0.00E+00	1.53E-08
Total for Period	**Ci**	**0.00E+00**	**2.11E-07**	**7.12E-07**	**0.00E+00**	**9.23E-07**
Tritium						
H-3	**Ci**	**1.58E+00**	**8.31E-01**	**2.57E+00**	**1.02E+00**	**6.00E+00**
Gross Alpha						
Alpha	**Ci**	**5.47E-07**	**1.03E-06**	**4.42E-07**	**5.68E-07**	**2.59E-06**
Carbon-14						
C-14	**Ci**	**2.32E+00**	**2.32E+00**	**2.32E+00**	**2.32E+00**	**9.28E+00**

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

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 16, Gaseous Effluents –Mixed Level Release Batch Mode Unit 2

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
Ar-41	Ci	1.15E-01	1.41E-01	1.23E-01	1.64E-01	5.43E-01
Xe-133	Ci	4.18E-04	0.00E+00	1.77E-04	7.19E-03	7.79E-03
Xe-135	Ci	0.00E+00	8.16E-05	0.00E+00	0.00E+00	8.16E-05
Total for Period	**Ci**	**1.15E-01**	**1.41E-01**	**1.23E-01**	**1.71E-01**	**5.50E-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**	**5.90E-03**	**2.05E-02**	**2.70E-02**	**2.29E-02**	**7.63E-02**
Gross Alpha						
Alpha	**Ci**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
Carbon-14						
C-14	**Ci**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**

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

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 17, Gaseous Effluents – Mixed Level Release Continuous Mode Unit 2

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
Ar-41	Ci	0.00E+00	0.00E+00	7.80E-01	0.00E+00	7.80E-01
Total for Period	**Ci**	**0.00E+00**	**0.00E+00**	**7.80E-01**	**0.00E+00**	**7.80E-01**
Iodines						
Total for Period	**Ci**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
Particulates						
Sr-90	Ci	0.00E+00	0.00E+00	0.00E+00	1.21E-08	1.21E-08
Total for Period	**Ci**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**1.21E-08**	**1.21E-08**
Tritium						
H-3	**Ci**	**1.57E+00**	**1.19E+00**	**7.26E+00**	**9.42E-01**	**1.10E+01**
Gross Alpha						
Alpha	**Ci**	**7.57E-07**	**4.20E-07**	**1.80E-06**	**4.66E-07**	**3.44E-06**
Carbon-14						
C-14	**Ci**	**2.32E+00**	**2.32E+00**	**2.32E+00**	**2.32E+00**	**9.28E+00**

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

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 18, Gaseous Effluents – Mixed Level Release Batch Mode Site

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
Ar-41	Ci	1.64E-01	3.28E-01	5.44E-01	9.15E-01	1.95E+00
Kr-85M	Ci	0.00E+00	2.70E-03	0.00E+00	0.00E+00	2.70E-03
Kr-88	Ci	0.00E+00	6.58E-04	0.00E+00	0.00E+00	6.58E-04
Xe-131M	Ci	2.08E-03	0.00E+00	8.87E-04	8.64E-04	3.83E-03
Xe-133M	Ci	1.07E-03	8.24E-03	2.65E-04	2.07E-04	9.78E-03
Xe-133	Ci	1.27E-01	2.86E-01	8.20E-02	6.08E-02	5.56E-01
Xe-135	Ci	2.01E-04	1.28E-01	4.25E-05	2.37E-05	1.28E-01
Total for Period	**Ci**	**2.94E-01**	**7.54E-01**	**6.28E-01**	**9.77E-01**	**2.65E+00**
Iodines						
I-131	Ci	0.00E+00	3.97E-07	0.00E+00	0.00E+00	3.97E-07
I-133	Ci	0.00E+00	1.74E-06	0.00E+00	0.00E+00	1.74E-06
I-135	Ci	0.00E+00	6.64E-07	0.00E+00	0.00E+00	6.64E-07
Total for Period	**Ci**	**0.00E+00**	**2.80E-06**	**0.00E+00**	**0.00E+00**	**2.80E-06**
Particulates						
Cr-51	Ci	9.02E-09	0.00E+00	0.00E+00	0.00E+00	9.02E-09
Y-88	Ci	2.03E-09	3.11E-09	0.00E+00	0.00E+00	5.14E-09
Total for Period	**Ci**	**1.11E-08**	**3.11E-09**	**0.00E+00**	**0.00E+00**	**1.42E-08**
Tritium						
H-3	**Ci**	**3.93E-02**	**2.81E-02**	**1.40E-01**	**1.39E-01**	**3.46E-01**
Gross Alpha						
Alpha	**Ci**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
Carbon-14						
C-14	**Ci**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**

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

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 19, Gaseous Effluents – Mixed Level Release Continuous Mode Site

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
Ar-41	Ci	1.45E+00	1.10E+00	7.80E-01	0.00E+00	3.33E+00
Kr-85	Ci	3.22E+00	0.00E+00	0.00E+00	0.00E+00	3.22E+00
Total for Period	**Ci**	**4.67E+00**	**1.10E+00**	**7.80E-01**	**0.00E+00**	**6.55E+00**
Iodines						
I-131	Ci	3.03E-07	8.96E-07	0.00E+00	0.00E+00	1.20E-06
I-133	Ci	1.37E-06	0.00E+00	0.00E+00	0.00E+00	1.37E-06
Total for Period	**Ci**	**1.67E-06**	**8.96E-07**	**0.00E+00**	**0.00E+00**	**2.57E-06**
Particulates						
Be-7	Ci	0.00E+00	0.00E+00	7.12E-07	0.00E+00	7.12E-07
Co-58	Ci	0.00E+00	1.36E-07	0.00E+00	0.00E+00	1.36E-07
Co-60	Ci	0.00E+00	5.98E-08	0.00E+00	0.00E+00	5.98E-08
Sr-90	Ci	0.00E+00	0.00E+00	9.84E-10	1.21E-08	1.31E-08
Cs-137	Ci	0.00E+00	1.53E-08	0.00E+00	0.00E+00	1.53E-08
Total for Period	**Ci**	**0.00E+00**	**2.11E-07**	**7.13E-07**	**1.21E-08**	**9.36E-07**
Tritium						
H-3	**Ci**	**3.15E+00**	**2.02E+00**	**9.83E+00**	**1.96E+00**	**1.70E+01**
Gross Alpha						
Alpha	**Ci**	**1.30E-06**	**1.45E-06**	**2.24E-06**	**1.03E-06**	**6.02E-06**
Carbon-14						
C-14	**Ci**	**4.64E+00**	**4.64E+00**	**4.64E+00**	**4.64E+00**	**1.86E+01**

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

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 20, 2024 Gaseous Effluents – Minimum Detectable Concentration

Isotope	MDC (µCi/cc)
Mn-54	< 8.38E-15
Co-58	< 8.95E-15
Fe-59	< 1.93E-14
Co-60	< 1.11E-14
Zn-65	< 2.05E-14
Mo-99	< 1.18E-13
Cs-134	< 7.42E-15
Cs-137	< 8.21E-15
Ce-141	< 6.83E-15
Ce-144	< 2.72E-14
Kr-87	< 4.45E-08
Kr-88	< 4.67E-08
Xe-133	< 3.57E-08
Xe-133M	< 1.23E-07
Xe-135	< 5.06E-08
Xe-138	< 9.60E-08
I-131	< 9.67E-15
I-133	< 6.61E-14

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

2.0 LIQUID EFFLUENTS

Table 21, Liquid Effluents – Summation of All Releases Unit 1[1]

A. Fission & Activation Products	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %[2]
1. Total Release	Ci	4.49E-03	1.51E-02	1.40E-03	1.63E-03	2.26E-02	
2. Average diluted concentration	µCi/mL	3.64E-09	1.32E-08	2.24E-09	2.62E-09	6.25E-09	
B. Tritium							
1. Total Release	Ci	3.39E+02	2.10E+02	2.80E+01	1.23E+02	7.00E+02	
2. Average diluted concentration	µCi/mL	2.75E-04	1.84E-04	4.48E-05	1.98E-04	1.93E-04	
C. Dissolved & Entrained Gases							
1. Total Release	Ci	4.52E-03	2.55E-03	4.97E-06	5.18E-04	7.59E-03	
2. Average diluted concentration	µCi/mL	3.67E-09	2.23E-09	7.94E-12	8.33E-10	2.10E-09	
D. Gross Alpha Activity							
1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
2. Average diluted concentration	µCi/mL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
E. Volume of Waste Released (prior to dilution)	Liters	1.08E+06	1.18E+06	6.20E+05	6.17E+05	3.50E+06	
F. Volume of Dilution Water Used During Period	Liters	1.23E+09	1.14E+09	6.26E+08	6.21E+08	3.62E+09	

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

[1] Percent of limit is on Table 1, Joseph M. Farley Nuclear Plant Dose Summary - Unit 1.
[2] % error see section 5.13.15 on page 24.

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 22, Liquid Effluents – Summation of All Releases Unit 2[1]

A. Fission & Activation Products	**Unit**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Annual**	**Est. Total Error %[2]**
1. Total Release	Ci	3.97E-03	5.22E-03	2.82E-03	5.29E-03	1.73E-02	
2. Average diluted concentration	µCi/mL	4.14E-09	6.99E-09	7.00E-09	4.92E-09	5.44E-09	
B. Tritium							
1. Total Release	Ci	1.50E+02	1.09E+02	9.98E+01	5.80E+02	9.39E+02	
2. Average diluted concentration	µCi/mL	1.56E-04	1.46E-04	2.48E-04	5.39E-04	2.95E-04	
C. Dissolved &Entrained Gases							
1. Total Release	Ci	1.29E-03	2.49E-03	6.71E-06	4.43E-03	8.22E-03	
2. Average diluted concentration	µCi/mL	1.34E-09	3.33E-09	1.67E-11	4.12E-09	2.58E-09	
D. Gross Alpha Activity							
1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
2. Average diluted concentration	µCi/mL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
E. Volume of Waste Released (prior to dilution)	Liters	8.59E+05	8.51E+05	4.51E+05	1.21E+06	3.37E+06	
F. Volume of Dilution Water Used During Period	Liters	9.59E+08	7.47E+08	4.02E+08	1.07E+09	3.18E+09	

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

[1] Percent of limit is on Table 2, Joseph M. Farley Nuclear Plant Dose Summary - Unit 2.
[2] % error see section 5.13.15 on page 24.

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 23, Liquid Effluents – Summation of All Releases Site[1]

A. Fission & Activation Products	**Unit**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Annual**	**Est. Total Error %[2]**
1. Total Release	Ci	8.46E-03	2.03E-02	4.22E-03	6.92E-03	3.99E-02	
2. Average diluted concentration	µCi/mL	3.86E-09	1.07E-08	4.10E-09	4.08E-09	5.86E-09	
B. Tritium							
1. Total Release	Ci	4.89E+02	3.19E+02	1.28E+02	7.03E+02	1.64E+03	
2. Average diluted concentration	µCi/mL	2.23E-04	1.69E-04	1.24E-04	4.14E-04	2.41E-04	
C. Dissolved & Entrained Gases							
1. Total Release	Ci	5.81E-03	5.04E-03	1.17E-05	4.95E-03	1.58E-02	
2. Average diluted concentration	µCi/mL	2.65E-09	2.67E-09	1.14E-11	2.92E-09	2.32E-09	
D. Gross Alpha Activity							
1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
2. Average diluted concentration	µCi/mL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
E. Volume of Waste Released (prior to dilution)	Liters	1.94E+06	2.03E+06	1.07E+06	1.83E+06	6.87E+06	
F. Volume of Dilution Water Used During Period	Liters	2.19E+09	1.89E+09	1.03E+09	1.69E+09	6.80E+09	

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

[1] Percent of limit is on Table 1 and Table 2.
[2] % error see section 5.13.15 on page 24.

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 24, Batch Mode Liquid Effluents Unit 1

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission and Activation Products						
As-76	Ci	5.65E-07	5.09E-07	0.00E+00	0.00E+00	1.07E-06
Eu-154	Ci	3.23E-06	3.46E-06	0.00E+00	0.00E+00	6.69E-06
Na-22	Ci	5.01E-07	0.00E+00	0.00E+00	0.00E+00	5.01E-07
Nb-97	Ci	1.23E-06	0.00E+00	0.00E+00	0.00E+00	1.23E-06
Nb-95	Ci	1.60E-04	8.86E-04	3.65E-05	4.59E-06	1.09E-03
Cs-137	Ci	8.42E-07	6.06E-06	4.56E-07	1.56E-05	2.30E-05
Fe-55	Ci	8.30E-05	8.06E-05	1.45E-05	0.00E+00	1.78E-04
Co-57	Ci	4.80E-06	1.76E-05	0.00E+00	0.00E+00	2.24E-05
Cr-51	Ci	1.62E-04	1.85E-03	1.50E-05	1.05E-05	2.04E-03
Tc-99M	Ci	1.50E-07	0.00E+00	0.00E+00	4.26E-06	4.41E-06
Ru-103	Ci	7.30E-07	1.18E-05	0.00E+00	0.00E+00	1.25E-05
Zr-97	Ci	0.00E+00	5.42E-07	0.00E+00	0.00E+00	5.42E-07
Sr-85	Ci	4.21E-07	0.00E+00	0.00E+00	0.00E+00	4.21E-07
Sb-122	Ci	0.00E+00	2.97E-07	0.00E+00	0.00E+00	2.97E-07
Ni-56	Ci	0.00E+00	2.54E-07	0.00E+00	0.00E+00	2.54E-07
Sn-113	Ci	1.55E-06	1.43E-05	0.00E+00	0.00E+00	1.59E-05
Mn-54	Ci	6.48E-05	7.19E-05	1.19E-06	1.76E-06	1.40E-04
Ag-110M	Ci	9.30E-07	0.00E+00	0.00E+00	0.00E+00	9.30E-07
Sr-90	Ci	0.00E+00	4.76E-06	0.00E+00	0.00E+00	4.76E-06
I-133	Ci	0.00E+00	0.00E+00	0.00E+00	1.15E-05	1.15E-05
Te-132	Ci	0.00E+00	0.00E+00	0.00E+00	6.33E-07	6.33E-07
Ba-140	Ci	0.00E+00	6.62E-07	0.00E+00	0.00E+00	6.62E-07
Co-58	Ci	9.97E-04	7.91E-03	2.37E-04	5.68E-05	9.20E-03
Sb-124	Ci	8.63E-07	4.29E-05	0.00E+00	0.00E+00	4.38E-05
Nb-95M	Ci	2.67E-06	0.00E+00	0.00E+00	0.00E+00	2.67E-06
I-131	Ci	0.00E+00	0.00E+00	0.00E+00	3.52E-06	3.52E-06
Fe-59	Ci	0.00E+00	1.27E-05	0.00E+00	0.00E+00	1.27E-05
Rh-105	Ci	4.62E-05	4.41E-04	7.85E-06	0.00E+00	4.95E-04
Cs-138	Ci	6.21E-07	3.63E-06	0.00E+00	0.00E+00	4.25E-06
Br-84	Ci	2.14E-06	0.00E+00	0.00E+00	0.00E+00	2.14E-06

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 24, Batch Mode Liquid Effluents Unit 1

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Sb-125	Ci	2.37E-04	1.67E-03	8.34E-04	1.36E-03	4.10E-03
Zr-95	Ci	6.42E-05	4.53E-04	1.03E-05	1.33E-06	5.29E-04
Y-94	Ci	1.38E-06	0.00E+00	0.00E+00	0.00E+00	1.38E-06
Co-60	Ci	2.60E-03	1.55E-03	2.45E-04	1.62E-04	4.56E-03
Zn-65	Ci	5.43E-05	3.85E-05	0.00E+00	0.00E+00	9.28E-05
Total for Period	**Ci**	**4.49E-03**	**1.51E-02**	**1.40E-03**	**1.63E-03**	**2.26E-02**
Tritium						
H-3	**Ci**	**3.39E+02**	**2.10E+02**	**2.80E+01**	**1.23E+02**	**7.00E+02**
Gross Alpha						
Alpha	**Ci**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
Entrained Gases						
Xe-135	Ci	4.22E-05	2.21E-05	3.00E-07	6.77E-05	1.32E-04
Xe-133	Ci	4.34E-03	2.50E-03	4.67E-06	4.46E-04	7.29E-03
Kr-85	Ci	9.31E-05	0.00E+00	0.00E+00	0.00E+00	9.31E-05
Xe-133M	Ci	4.35E-05	2.51E-05	0.00E+00	3.95E-06	7.26E-05
Total for Period	**Ci**	**4.52E-03**	**2.55E-03**	**4.97E-06**	**5.18E-04**	**7.59E-03**

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

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 25, Batch Mode Liquid Effluents Unit 2

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission and Activation Products						
Nd-147	Ci	8.66E-07	9.63E-07	0.00E+00	0.00E+00	1.83E-06
Y-88	Ci	0.00E+00	0.00E+00	0.00E+00	1.58E-07	1.58E-07
Ag-110M	Ci	0.00E+00	3.18E-06	6.83E-07	4.07E-06	7.93E-06
Co-60	Ci	1.82E-03	1.11E-03	1.18E-03	4.37E-04	4.55E-03
Fe-55	Ci	2.15E-04	5.87E-05	0.00E+00	0.00E+00	2.74E-04
Rh-105	Ci	3.46E-05	1.10E-04	0.00E+00	0.00E+00	1.45E-04
I-133	Ci	6.45E-07	0.00E+00	0.00E+00	2.79E-05	2.85E-05
I-131	Ci	0.00E+00	0.00E+00	0.00E+00	3.53E-06	3.53E-06
Cr-51	Ci	3.12E-04	9.86E-04	6.99E-06	1.86E-05	1.32E-03
Ba-140	Ci	6.19E-07	0.00E+00	0.00E+00	0.00E+00	6.19E-07
Na-24	Ci	0.00E+00	0.00E+00	0.00E+00	9.84E-05	9.84E-05
Cs-137	Ci	0.00E+00	3.01E-06	3.64E-06	4.62E-05	5.29E-05
Te-129M	Ci	0.00E+00	3.79E-05	0.00E+00	0.00E+00	3.79E-05
Sr-92	Ci	0.00E+00	0.00E+00	4.12E-07	0.00E+00	4.12E-07
Te-132	Ci	0.00E+00	0.00E+00	0.00E+00	3.98E-07	3.98E-07
Co-57	Ci	2.56E-06	0.00E+00	2.11E-06	0.00E+00	4.67E-06
Sb-125	Ci	1.44E-04	1.44E-03	1.22E-03	4.44E-03	7.24E-03
Nb-97	Ci	2.30E-06	1.36E-06	3.61E-07	1.86E-06	5.88E-06
Fe-59	Ci	0.00E+00	0.00E+00	0.00E+00	4.23E-07	4.23E-07
Sb-124	Ci	0.00E+00	1.01E-05	5.48E-07	1.86E-06	1.25E-05
Mn-54	Ci	7.84E-05	2.21E-05	3.04E-05	3.49E-06	1.34E-04
Tc-99M	Ci	0.00E+00	0.00E+00	0.00E+00	3.36E-06	3.36E-06
Zr-95	Ci	3.54E-05	5.28E-05	3.42E-05	2.44E-06	1.25E-04
Sr-85	Ci	1.75E-06	0.00E+00	0.00E+00	0.00E+00	1.75E-06
Ag-108M	Ci	8.16E-07	0.00E+00	0.00E+00	0.00E+00	8.16E-07
Y-92	Ci	0.00E+00	0.00E+00	0.00E+00	2.29E-06	2.29E-06
Be-7	Ci	0.00E+00	0.00E+00	0.00E+00	8.56E-05	8.56E-05
Hg-203	Ci	0.00E+00	4.27E-07	0.00E+00	0.00E+00	4.27E-07
As-76	Ci	5.40E-07	0.00E+00	0.00E+00	0.00E+00	5.40E-07
Tc-101	Ci	0.00E+00	0.00E+00	0.00E+00	1.68E-06	1.68E-06

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 25, Batch Mode Liquid Effluents Unit 2

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Pr-144	Ci	0.00E+00	1.81E-04	0.00E+00	0.00E+00	1.81E-04
Ru-103	Ci	0.00E+00	4.02E-06	0.00E+00	0.00E+00	4.02E-06
Rb-86	Ci	0.00E+00	0.00E+00	5.28E-06	0.00E+00	5.28E-06
Co-58	Ci	1.19E-03	1.08E-03	2.51E-04	7.87E-05	2.60E-03
Te-127	Ci	0.00E+00	0.00E+00	0.00E+00	1.94E-05	1.94E-05
Zn-65	Ci	8.83E-06	0.00E+00	2.14E-05	2.08E-06	3.23E-05
Sb-122	Ci	0.00E+00	0.00E+00	0.00E+00	3.45E-06	3.45E-06
Total for Period	**Ci**	**3.97E-03**	**5.22E-03**	**2.82E-03**	**5.29E-03**	**1.73E-02**
Tritium						
H-3	**Ci**	**1.50E+02**	**1.09E+02**	**9.98E+01**	**5.80E+02**	**9.39E+02**
Gross Alpha						
Alpha	**Ci**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
Entrained Gases						
Ar-41	Ci	0.00E+00	0.00E+00	0.00E+00	2.03E-05	2.03E-05
Kr-85	Ci	3.84E-04	0.00E+00	0.00E+00	0.00E+00	3.84E-04
Xe-135	Ci	3.26E-06	4.80E-05	0.00E+00	5.37E-04	5.88E-04
Xe-133M	Ci	0.00E+00	3.02E-05	0.00E+00	1.28E-05	4.30E-05
Xe-133	Ci	9.02E-04	2.41E-03	6.71E-06	3.86E-03	7.18E-03
Kr-85M	Ci	0.00E+00	0.00E+00	0.00E+00	7.76E-07	7.76E-07
Total for Period	**Ci**	**1.29E-03**	**2.49E-03**	**6.71E-06**	**4.43E-03**	**8.22E-03**

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

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 26, Batch Mode Liquid Effluents Site

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission and Activation Products						
Fe-55	Ci	2.98E-04	1.39E-04	1.45E-05	0.00E+00	4.52E-04
Cr-51	Ci	4.73E-04	2.84E-03	2.20E-05	2.91E-05	3.36E-03
Zn-65	Ci	6.31E-05	3.85E-05	2.14E-05	2.08E-06	1.25E-04
Y-94	Ci	1.38E-06	0.00E+00	0.00E+00	0.00E+00	1.38E-06
Nb-95M	Ci	2.67E-06	0.00E+00	0.00E+00	0.00E+00	2.67E-06
Cs-137	Ci	8.42E-07	9.07E-06	4.10E-06	6.18E-05	7.58E-05
I-131	Ci	0.00E+00	0.00E+00	0.00E+00	7.05E-06	7.05E-06
Ag-108M	Ci	8.16E-07	0.00E+00	0.00E+00	0.00E+00	8.16E-07
Nb-97	Ci	3.52E-06	1.36E-06	3.61E-07	1.86E-06	7.10E-06
Sb-122	Ci	0.00E+00	2.97E-07	0.00E+00	3.45E-06	3.75E-06
Rh-105	Ci	8.08E-05	5.50E-04	7.85E-06	0.00E+00	6.39E-04
Pr-144	Ci	0.00E+00	1.81E-04	0.00E+00	0.00E+00	1.81E-04
Nd-147	Ci	8.66E-07	9.63E-07	0.00E+00	0.00E+00	1.83E-06
Co-60	Ci	4.42E-03	2.66E-03	1.42E-03	5.98E-04	9.10E-03
Ni-56	Ci	7.93E-07	2.54E-07	0.00E+00	0.00E+00	1.05E-06
Te-132	Ci	0.00E+00	0.00E+00	0.00E+00	1.03E-06	1.03E-06
Sb-124	Ci	8.63E-07	5.30E-05	5.48E-07	1.86E-06	5.63E-05
Ag-110M	Ci	9.30E-07	3.18E-06	6.83E-07	4.07E-06	8.86E-06
Sr-92	Ci	0.00E+00	0.00E+00	4.12E-07	0.00E+00	4.12E-07
Rb-86	Ci	0.00E+00	0.00E+00	5.28E-06	0.00E+00	5.28E-06
Y-88	Ci	0.00E+00	0.00E+00	0.00E+00	1.58E-07	1.58E-07
Fe-59	Ci	0.00E+00	1.27E-05	0.00E+00	4.23E-07	1.31E-05
Sn-113	Ci	1.55E-06	1.43E-05	0.00E+00	0.00E+00	1.59E-05
Nb-95	Ci	2.77E-04	1.01E-03	1.01E-04	1.53E-05	1.40E-03
Br-84	Ci	2.14E-06	0.00E+00	0.00E+00	0.00E+00	2.14E-06
I-133	Ci	6.45E-07	0.00E+00	0.00E+00	3.94E-05	4.00E-05
Hg-203	Ci	0.00E+00	4.27E-07	0.00E+00	0.00E+00	4.27E-07
Ba-140	Ci	6.19E-07	6.62E-07	0.00E+00	0.00E+00	1.28E-06
Te-127	Ci	0.00E+00	0.00E+00	0.00E+00	1.94E-05	1.94E-05
Eu-154	Ci	3.23E-06	3.46E-06	0.00E+00	0.00E+00	6.69E-06
Cs-138	Ci	6.21E-07	3.63E-06	0.00E+00	0.00E+00	4.25E-06

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 26, Batch Mode Liquid Effluents Site

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Tc-101	Ci	0.00E+00	0.00E+00	0.00E+00	1.68E-06	1.68E-06
Sr-85	Ci	2.17E-06	0.00E+00	0.00E+00	0.00E+00	2.17E-06
Co-58	Ci	2.19E-03	8.99E-03	4.88E-04	1.35E-04	1.18E-02
Sb-125	Ci	3.81E-04	3.11E-03	2.06E-03	5.79E-03	1.13E-02
Tc-99M	Ci	1.50E-07	0.00E+00	0.00E+00	7.62E-06	7.77E-06
Zr-95	Ci	9.96E-05	5.05E-04	4.45E-05	3.78E-06	6.53E-04
Ru-103	Ci	7.30E-07	1.58E-05	0.00E+00	0.00E+00	1.65E-05
Mn-54	Ci	1.43E-04	9.41E-05	3.16E-05	5.25E-06	2.74E-04
Co-57	Ci	7.36E-06	1.76E-05	2.11E-06	0.00E+00	2.71E-05
Na-24	Ci	0.00E+00	0.00E+00	0.00E+00	9.84E-05	9.84E-05
Na-22	Ci	5.01E-07	0.00E+00	0.00E+00	0.00E+00	5.01E-07
As-76	Ci	1.10E-06	5.09E-07	0.00E+00	0.00E+00	1.61E-06
Zr-97	Ci	0.00E+00	5.42E-07	0.00E+00	0.00E+00	5.42E-07
Sr-90	Ci	0.00E+00	4.76E-06	0.00E+00	0.00E+00	4.76E-06
Be-7	Ci	0.00E+00	0.00E+00	0.00E+00	8.56E-05	8.56E-05
Te-129M	Ci	0.00E+00	3.79E-05	0.00E+00	0.00E+00	3.79E-05
Y-92	Ci	0.00E+00	0.00E+00	0.00E+00	2.29E-06	2.29E-06
Total for Period	**Ci**	**8.46E-03**	**2.03E-02**	**4.22E-03**	**6.92E-03**	**3.99E-02**
Tritium						
H-3	**Ci**	**4.89E+02**	**3.19E+02**	**1.28E+02**	**7.03E+02**	**1.64E+03**
Gross Alpha						
Alpha	**Ci**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
Entrained Gases						
Xe-133M	Ci	4.35E-05	5.53E-05	0.00E+00	1.67E-05	1.16E-04
Kr-85M	Ci	0.00E+00	0.00E+00	0.00E+00	7.76E-07	7.76E-07
Ar-41	Ci	0.00E+00	0.00E+00	0.00E+00	2.03E-05	2.03E-05
Kr-85	Ci	4.77E-04	0.00E+00	0.00E+00	0.00E+00	4.77E-04
Xe-133	Ci	5.24E-03	4.91E-03	1.14E-05	4.30E-03	1.45E-02
Xe-135	Ci	4.55E-05	7.01E-05	3.00E-07	6.04E-04	7.20E-04
Total for Period	**Ci**	**5.81E-03**	**5.04E-03**	**1.17E-05**	**4.95E-03**	**1.58E-02**

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

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 27 Continuous Mode Liquid Effluents Unit 1

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission and Activation Products						
Total for Period	**Ci**	**No Nuclides Found**				
Tritium						
Total for Period	**Ci**	**No Nuclides Found**				
Gross Alpha						
Total for Period	**Ci**	**No Nuclides Found**				
Entrained Gases						
Total for Period	**Ci**	**No Nuclides Found**				

Table 28, Continuous Mode Liquid Effluents Unit 2

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission and Activation Products						
Total for Period	**Ci**	**No Nuclides Found**				
Tritium						
Total for Period	**Ci**	**No Nuclides Found**				
Gross Alpha						
Total for Period	**Ci**	**No Nuclides Found**				
Entrained Gases						
Total for Period	**Ci**	**No Nuclides Found**				

Table 29, Continuous Mode Liquid Effluents Site

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission and Activation Products						
Total for Period	**Ci**	**No Nuclides Found**				
Tritium						
Total for Period	**Ci**	**No Nuclides Found**				
Gross Alpha						
Total for Period	**Ci**	**No Nuclides Found**				
Entrained Gases						
Total for Period	**Ci**	**No Nuclides Found**				

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 30, 2024 Liquid Effluents – Minimum Detectable Concentration

Isotope	MDC (µCi/ml)
Mn-54	< 3.35E-08
Co-58	< 3.34E-08
Fe-59	< 6.47E-08
Co-60	< 3.64E-08
Zn-65	< 7.89E-08
Mo-99	< 2.60E-07
I-131	< 2.94E-08
Cs-134	< 3.18E-08
Cs-137	< 3.82E-08
Ce-141	< 4.16E-08
Ce-144	< 1.79E-07

Attachment 2, Solid Waste Information

1.0 SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (NOT IRRADIATED FUEL)

Table 31, Resins, Filters, and Evaporator Bottoms Summary from the FNP Site

Waste Class	Volume ft^3	Volume m^3	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

Major Nuclides for Above Table

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A

Waste Class B		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A

Waste Class C		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A

Waste Class Unclassified		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A

Total Combined		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A

Attachment 2, Solid Waste Information

Table 32, Dry Active Waste (DAW) Summary from the FNP Site

Waste Class	**Volume** ft^3	m^3	**Ci Shipped**
A	6.30E+03	1.78E+02	3.18E-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	6.30E+03	1.78E+02	3.18E-01
Major Nuclides for Above Table: H-3, C-14, Cr-51, Mn-54, Fe-55, Co-58, Co-60, Ni-63, Zr-95, Nb-95, Tc-99, Sb-125, I-129, Cs-137			
Waste Class A			**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance		Ci
Cr-51	14.16%		4.50E-02
Fe-55	20.81%		6.61E-02
Co-58	23.42%		7.44E-02
Co-60	9.48%		3.01E-02
Ni-63	6.06%		1.92E-02
Zr-95	7.67%		2.44E-02
Nb-95	13.83%		4.39E-02
Sb-125	1.41%		4.48E-03
Waste Class B			**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance		Ci
None	N/A		N/A
Waste Class C			**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance		Ci
None	N/A		N/A
Total Combined			**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance		Ci
Cr-51	14.16%		4.50E-02
Fe-55	20.81%		6.61E-02
Co-58	23.42%		7.44E-02
Co-60	9.48%		3.01E-02
Ni-63	6.06%		1.92E-02
Zr-95	7.67%		2.44E-02
Nb-95	13.83%		4.39E-02
Sb-125	1.41%		4.48E-03

Attachment 2, Solid Waste Information

Table 33, Irradiated Components Summary from the FNP Site

Waste Class	**Volume** ft^3	m^3	**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

Major Nuclides for Above Table:
None

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A

Waste Class B		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A

Waste Class C		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A

Total Combined		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A

Attachment 2, Solid Waste Information

Table 34, Other Waste Summary from the FNP Site

Waste Class	**Volume** ft^3	m^3	**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

Major Nuclides for Above Table:
None

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A

Waste Class B		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A

Waste Class C		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A

Total Combined		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A

Attachment 2, Solid Waste Information

Table 35, Sum of All Low-Level Waste Shipped from the FNP Site

Waste Class	**Volume** ft^3	m^3	**Ci Shipped**
A	6.30E+03	1.78E+02	3.18E-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	6.30E+03	1.78E+02	3.18E-01

Major Nuclides for Above Table: H-3, C-14, Cr-51, Mn-54, Fe-55, Co-58, Co-60, Ni-63, Zr-95, Nb-95, Tc-99, Sb-125, I-129, Cs-137

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
Cr-51	14.16%	4.50E-02
Fe-55	20.81%	6.61E-02
Co-58	23.42%	7.44E-02
Co-60	9.48%	3.01E-02
Ni-63	6.06%	1.92E-02
Zr-95	7.67%	2.44E-02
Nb-95	13.83%	4.39E-02
Sb-125	1.41%	4.48E-03
Waste Class B		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A
Waste Class C		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A
Waste Class Unclassified		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
None	N/A	N/A
Total Combined		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Ci
Cr-51	14.16%	4.50E-02
Fe-55	20.81%	6.61E-02
Co-58	23.42%	7.44E-02
Co-60	9.48%	3.01E-02
Ni-63	6.06%	1.92E-02
Zr-95	7.67%	2.44E-02
Nb-95	13.83%	4.39E-02
Sb-125	1.41%	4.48E-03

Attachment 2, Solid Waste Information

2.0 Solid Waste Disposition

Table 36, Solid Waste Disposition J. M. Farley Nuclear Plant

Number of Shipments	Mode of Transportation	Destination
5	Hittman Transport Services Inc	Energy Solutions Services, Inc. PO Box 2350 Oak Ridge, TN
5	Total	

3.0 IRRADIATED FUEL DISPOSITION

Table 37, Irradiated Fuel Shipments Disposition for the FNP Site

Number of Shipments	Mode of Transportation	Destination
0		
0		
Total 0		

Attachment 3, Meteorological Data

Data recovery for the year was generally fair, with over 90% availability for most key parameters. However, several critical measurements fell below the required 90% recovery rate: primary 10m wind speed (78.7%), backup 10m wind speed (59.1%), primary 45m wind speed (60.3%), backup 10m wind direction (82.5%), and primary 45m wind direction (65.1%).

To maintain a complete dataset for the year, missing data from primary instruments was supplemented with data from backup instruments. This was particularly necessary for the 45m wind speed and direction, where backup data was used for most of the year. Replacing the missing data resulted in all parameters exceeding the 90% recovery rate requirement.

The joint frequency distributions showed minor variations compared to the recent five-year period, which can be attributed to normal year-to-year climatic changes. In 2024, the predominant wind direction at both the 10m and 45m levels was from the north-northeast. The shift in the 10m wind direction from 2023 is likely due to the data replacement process required to fill in missing information.

Temperatures for the year were above normal, and total annual rainfall at Plant Farley reached 69.86 inches, exceeding the totals recorded at nearby National Weather Service (NWS) stations.

Attachment 3, Meteorological Data

Table 38, FNP Meteorological Data Recovery, 2024

Parameter	6-Year Average Percent Recovery (2012-2017)	6-Year Average Percent Recovery (2018-2023)	Percent Recovery (2024)
Wind Speed 10m	98.5	95.9	94.2**
Wind Speed 45m	98.1	99.7	99.2**
Wind Direction 10m	98.8	99.6	99.2
Wind Direction 45m	99.1	98.9	99.2**
Delta Temperature 60-10m	98.6	99.2	96.7
Temperature 10m	94.6	99.7	99.0
Temperature 60m	98.1*	99.8	98.7
Dew Point Temperature 10m	97.8	99.7	99.5
Relative Humidity 10m	99.4*	98.4	99.6
Precipitation	97.4	99.0	99.7
Composite			
10m Wind Speed and Direction, Delta Temperature 60-10m	98.3	95.3	91.9**
45m Wind Speed and Direction, Delta Temperature 60-10m	97.7	98.2	96.1**

* Not available until 2013

** Data replaced to have a complete year of data

Attachment 3, Meteorological Data

Table 39, Occurrence of Stability Classes in Plant Farley 10 Meter Meteorological Data

Stability Class	5-Year Average Percent Occurrence (2014-2018)	5-Year Average Percent Occurrence (2019-2023)	Percent Occurrence (2024)
A	6.80	9.11	5.35
B	3.48	4.25	2.84
C	4.80	5.36	4.19
D	34.04	30.77	30.17
E	27.47	28.31	31.86
F	12.33	12.29	13.90
G	11.07	9.90	11.70
Total Hours	43,823	43,821	8,784

Attachment 4, NEI 07-07 Onsite Radiological Groundwater Monitoring Program

To ensure compliance with NEI 07-07 (Industry Ground Water Protection Initiative – Final Guidance Document), Southern Nuclear implemented a groundwater protection program which is proceduralized in Nuclear Management Procedure, Radiological Groundwater Protection Program. The procedure contains detailed site-specific monitoring plans, program technical bases, and communications protocol (to ensure that radioactive leaks and spills are addressed and communicated appropriately). To prevent future leaks of radioactive material to groundwater, SNC plants have established buried piping and tanks inspection programs. No changes were made to the Groundwater Protection Program in 2024.

The Farley Nuclear Plant groundwater protection program consists of 21 sample points listed in Table 40. The points are sampled at a frequency that satisfies the requirements of NEI 07-07. Table 41 contains the 2024 analytical results of the FNP groundwater protection program tritium results (in pCi/L). Figure C-1 is a map of the monitoring network.

Table 40, Groundwater Protection Program Monitoring Wells

Sample Point	Aquifer	Monitoring Purpose
R-1	Major Shallow Aquifer	Dilution line
R-2	Major Shallow Aquifer	Dilution line
R-3	Major Shallow Aquifer	Unit 2 RWST
R-4	Major Shallow Aquifer	Unit 1 RWST
R-5	Major Shallow Aquifer	Dilution line
R-6r	Major Shallow Aquifer	Dilution line
R-7	Major Shallow Aquifer	Dilution line
R-8	Major Shallow Aquifer	Dilution line
R-9	Major Shallow Aquifer	Dilution line
R-10	Major Shallow Aquifer	Dilution line
R-11	Major Shallow Aquifer	Background 1
R-13	Major Shallow Aquifer	Dilution line
R-14	Major Shallow Aquifer	Background 2
WSW-2	Major Deep Aquifer	Potable Water
WSW-4	Major Deep Aquifer	Potable Water
WSW-CE	Major Deep Aquifer	Potable Water
WSW-CW	Major Deep Aquifer	Potable Water
WSW-FR	Major Deep Aquifer	Potable Water
SW-1	N/A	Background 3, Surface Water
S.E. Yard Drain	N/A	Surface Water
E. Yard Drain	N/A	Surface Water

Attachment 4, NEI 07-07 Onsite Radiological Groundwater Monitoring Program

Table 41, Groundwater Protection Program 2024 Sample Results

Sample Point	Sampling Period (pCi/L)	
	1Q2024	3Q2024
R-1	NDM	88
R-2	NDM	NDM
R-3	530	491
R-4	NDM	NDM
R-5	275	NDM
R-6r	NDM	NDM
R-7	NDM	NDM
R-8	NDM	168
R-9	NDM	NDM
R-10	NDM	NDM
R-11	NDM	NDM
R-13	NDM	NDM
R-14	NDM	NDM
WSW-2 (PW#2)	NR	NDM
WSW-4 (PW#4)	NDM	NDM
WSW-CE	NDM	NDM
WSW-CW	NR	NDM
WSW-FR	NDM	NDM
SW-1	NDM	NDM
S.E. Yard Drain	NDM	NDM
E. Yard Drain	202	NDM

Notes
NR: Not Required for sampling in accordance with GWPP
NDM: No Detectable Measurement - Less than Minimal Detectable Activity
DRY: No Water in Well Casing

Attachment 4, NEI 07-07 Onsite Radiological Groundwater Monitoring Program

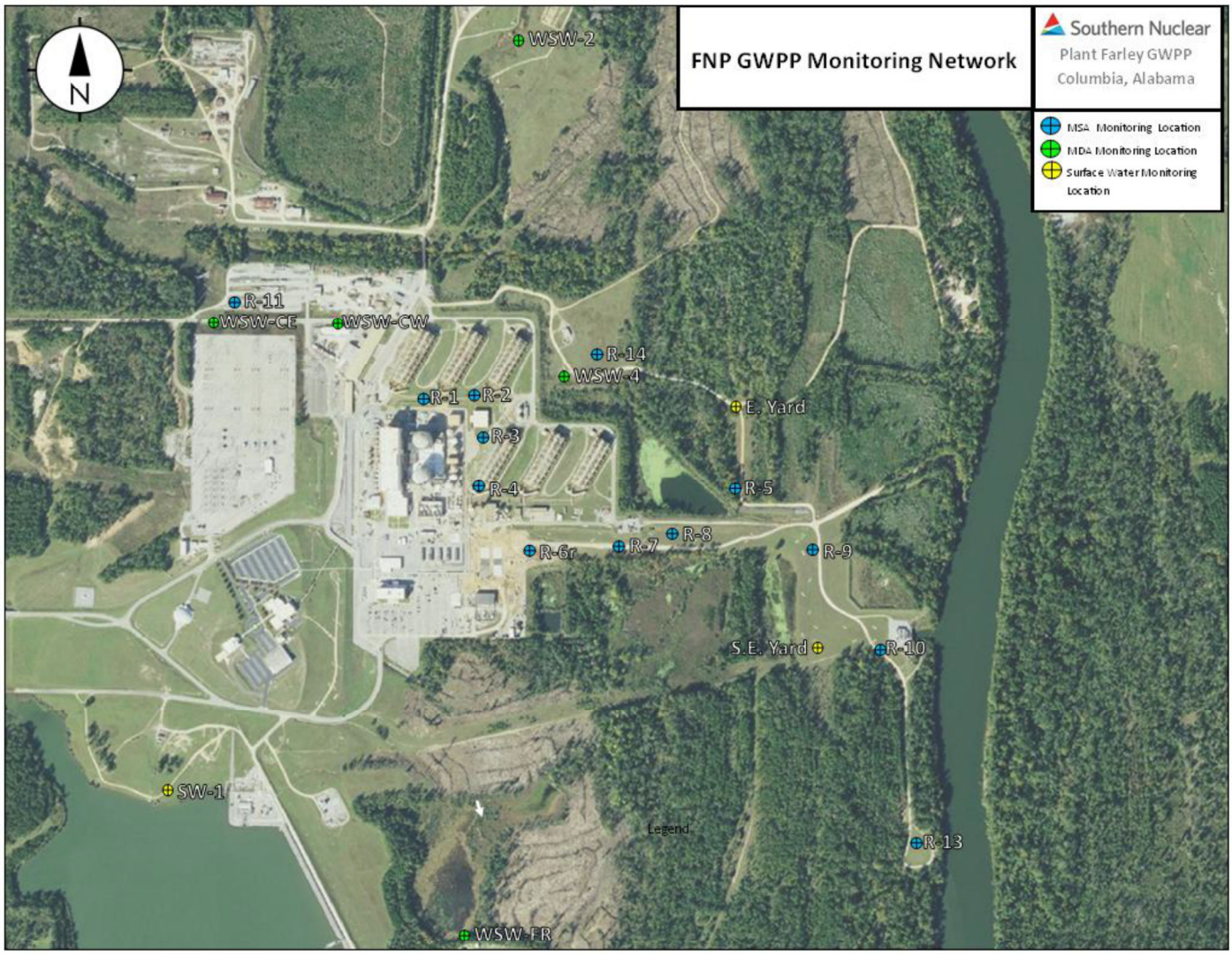

Figure 5, Farley Nuclear Plant GWPP Monitoring Network

Attachment 5, ERRATA From Previous Reports

1.0 Report Year 2023

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

1.0 GASEOUS EFFLUENTS

Table 5, Gaseous Effluents Summation of All Releases Unit 1[1]

A. Fission & Activation Gases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %[2]
1. Total Release	Ci	4.67E-01	1.61E-01	1.53E+00	1.41E-01	2.30E+00	
2. Average release rate for the period	µCi/sec	5.93E-02	2.04E-02	1.94E-01	1.79E-02	7.29E-02	
3. Percent of Limit	%						
B. ~~Iodine and Halogens~~ Radioiodine							
1. Total Iodine-131 ~~Release~~	Ci	0.00E+00	0.00E+00	2.56E-07	0.00E+00	2.56E-07	
2. Average release rate for the period	µCi/sec	0.00E+00	0.00E+00	3.24E-08	0.00E+00	8.12E-09	
3. Percent of Limit	%						
C. Particulates							
1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
2. Average release rate for the period	µCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
3. Percent of Limit	%						
D. Tritium							
1. Total Release	Ci	ND	1.15E+00	9.11E-01	1.54E+00	3.60E+00	
2. Average release rate for the period	µCi/sec	N/A	1.45E-01	1.15E-01	1.95E-01	1.14E-01	
3. Percent of Limit	%						
E. Gross Alpha							
1. Total Release	Ci	4.05E-07	4.04E-07	6.08E-07	1.64E-08	3.08E-08	
2. Average release rate for the period	µCi/sec	5.13E-08	5.12E-08	7.71E-08	2.08E-07	9.69E-08	
3. Percent of Limit	%						
F. Carbon-14[3]							
1. Total Release	Ci	2.32E+00	2.32E+00	2.32E+00	2.32E+00	9.28E+00	
2. Average release rate for the period	µCi/sec	2.94E-01	2.94E-01	2.94E-01	2.94E-01	2.94E-01	
3. Percent of Limit	%						

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

[1] % of limit is on Table 1, Joseph M. Farley Nuclear Plant Unit 1 Dose Summary.
[2] % error see section 5.10.1 on page 21
[3] Carbon-14 is calculated in accordance with section 5.10.6. It is a conservative estimate based on maximum power output and does not account for outages when C-14 is not produced.

Attachment 5, ERRATA From Previous Reports

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 6, Gaseous Effluents Summation of All Releases Unit 2 [1]

A. Fission & Activation Gases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %[2]
1. Total Release	Ci	4.43E-01	1.73E+00	3.30E+00	1.52E+00	6.99E+00	
2. Average release rate for the period	µCi/sec	5.62E-02	2.19E-01	4.19E-01	1.93E-01	2.22E-01	
3. Percent of Limit	%						
B. ~~Iodine and Halogens~~ Radioiodine							
1. Total Iodine-131 ~~Release~~	Ci	0.00E+00	0.00E+00	4.13E-08	3.03E-09	4.43E-08	
2. Average release rate for the period	µCi/sec	0.00E+00	0.00E+00	5.23E-09	3.84E-10	1.41E-09	
3. Percent of Limit	%						
C. Particulates							
1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	3.39E-09	3.39E-09	
2. Average release rate for the period	µCi/sec	0.00E+00	0.00E+00	0.00E+00	4.30E-08	1.07E-10	
3. Percent of Limit	%						
D. Tritium							
1. Total Release	Ci	9.58E-01	2.10E+00	3.87E+00	5.89E+00	1.28E+01	
2. Average release rate for the period	µCi/sec	1.22E-01	2.66E-01	4.91E-01	7.47E-01	4.06E-01	
3. Percent of Limit	%						
E. Gross Alpha							
1. Total Release	Ci	3.69E-07	2.54E-07	9.71E-07	1.36E-06	2.95E-06	
2. Average release rate for the period	µCi/sec	4.68E-08	3.22E-08	1.23E-07	1.72E-07	9.37E-08	
3. Percent of Limit	%						
F. Carbon-14[3]							
1. Total Release	Ci	2.32E+00	2.32E+00	2.32E+00	2.32E+00	9.28E+00	
2. Average release rate for the period	µCi/sec	2.94E-01	2.94E-01	2.94E-01	2.94E-01	2.94E-01	
3. Percent of Limit	%						

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

[1] % of limit is on Table 2, Joseph M. Farley Nuclear Plant Unit 2 Dose Summary.
[2] % error see section 5.10.1 on page 21.
[3] Carbon-14 is calculated in accordance with section 5.10.6. It is a conservative estimate based on maximum power output and does not account for outages when C-14 is not produced.

Attachment 5, ERRATA From Previous Reports

Attachment 1, ARERR Release Summary Tables (RG-1.21 Tables)

Table 7, Gaseous Effluents Summation of All Releases Site [1]

A. Fission & Activation Gases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %[2]
1. Total Release	Ci	9.10E-01	1.89E+00	4.83E+00	1.67E+00	9.30E+00	
2. Average release rate for the period	µCi/sec	1.15E-01	2.39E-01	6.12E-01	2.11E-01	2.95E-01	
3. Percent of Limit	%						
B. ~~Iodine and Halogens~~ Radioiodine							
1. Total Iodine-131 ~~Release~~	Ci	0.00E+00	0.00E+00	2.97E-07	3.03E-09	3.00E-07	
2. Average release rate for the period	µCi/sec	0.00E+00	0.00E+00	3.77E-08	3.84E-10	9.51E-09	
3. Percent of Limit	%						
C. Particulates							
1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	3.39E-07	3.39E-07	
2. Average release rate for the period	µCi/sec	0.00E+00	0.00E+00	0.00E+00	4.30E-08	1.07E-08	
3. Percent of Limit	%						
D. Tritium							
1. Total Release	Ci	2.10E+00	3.01E+00	5.41E+00	8.02E+00	1.85E+01	
2. Average release rate for the period	µCi/sec	2.67E-01	3.81E-01	6.86E-01	1.02E+00	5.88E-01	
3. Percent of Limit	%						
E. Gross Alpha							
1. Total Release	Ci	7.74E-07	6.58E-07	1.58E-06	3.00E-06	6.01E-06	
2. Average release rate for the period	µCi/sec	9.82E-08	8.34E-08	2.00E-07	3.80E-07	1.91E-07	
3. Percent of Limit	%						
F. Carbon-14[3]							
1. Total Release	Ci	4.64E+00	4.64E+00	4.64E+00	4.64E+00	1.86E+01	
2. Average release rate for the period	µCi/sec	5.88E-01	5.88E-01	5.88E-01	5.88E-01	5.89E-01	
3. Percent of Limit	%						

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

[1] % of limit is on Table 1 and Table 2.
[2] % error see section 5.10.1 on page 21.
[3] Carbon-14 is calculated in accordance with section 5.10.6. It is a conservative estimate based on maximum power output and does not account for outages when C-14 is not produced.

Joseph M. Farley Nuclear Plant Unit 1 and 2

Enclosure 2

Annual Non-Radiological Environmental Operating Report for 2024

JOSEPH M. FARLEY NUCLEAR PLANT - UNITS 1 AND 2

I. Introduction

In accordance with Subsection 5.4.1 of the Joseph M. Farley Nuclear Plant Environmental Protection Plan, Appendix B to Facility Operating License Nos. NPF-2 and NPF-8, this report is submitted summarizing implementation of the Environmental Protection Plan for calendar year 2024.

II. Reporting Requirements

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

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

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

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

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

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

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

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

D. EPP Noncompliance and Corrective Actions

There were no EPP noncompliances during the year.

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

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

F. Nonroutine Reports Submitted in Accordance with EPP Section 5.4.2

There were no nonroutine reports submitted during the year.