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Constellation.

10 CFR 50.36a
10 CFR 72.44(d)(3)
Technical Specifications

NMP1L3581
April 30, 2024

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Nine Mile Point Nuclear Station, Units 1 and 2
Renewed Facility Operating License Nos. DPR-63 and NPF-69
NRC Docket Nos. 50-220 and 50-410

Independent Spent Fuel Storage Installation (ISFSI)
ISFSI Docket No. 72-1036

Subject: 2023 Radioactive Effluent Release Report for Nine Mile Point Units 1 and 2

In accordance with 10 CFR 50.36a, and the Nine Mile Point Unit 1 (NMP1) and Nine Mile Point Unit 2 (NMP2) Technical Specifications, enclosed are the Radioactive Effluent Release Reports for NMP1 and NMP2 for the period of January through December 2023. This letter also satisfies the annual effluent reporting requirements for the ISFSI required by 10 CFR 72.44(d)(3).

The format used for the effluent data is outlined in Appendix B of Regulatory Guide 1.21, Revision 1. During the reporting period, NMP1, NMP2, and the ISFSI did not exceed any 10 CFR 20, 10 CFR 50, 10 CFR 72, Technical Specification, or ODCM limits for gaseous or liquid effluents.

Should you have questions regarding the information in this submittal, please contact Jeremy Kerling, Manager, Site Chemistry and Radwaste, at (315) 349-5226.

Sincerely,

Nicholas A. Tryt
Director Site Operations

For Carl Crawford
Plant Manager, Nine Mile Point Nuclear Station
Constellation Generation Company, LLC

NAT/EEK

IE48
NMSS26
NRR
NMSS

Enclosures: (1) Nine Mile Point Nuclear Station, Unit 1
Radioactive Effluent Release Report, January – December 2023

(2) Nine Mile Point Nuclear Station, Unit 2
Radioactive Effluent Release Report, January – December 2023

Cc: NRC Regional Administrator, Region 1
NRC Project Manager
NRC Resident Inspector
R. Rolph, NRC

Constellation

PRIDE IN THE POINT

Nine Mile Point Clean Energy Center

Unit 1

2023 Radioactive Effluent Release Report

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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. Critical Organ (Max Organ): That part of the body that is most susceptible to radiation damage under the specific conditions under consideration.

7. Curie (Ci): A measure of radioactivity; equal to 3.7×10^{10} disintegrations per second, or 2.22×10^{12} disintegrations per minute.

8. 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.

9. Grab Sample: A single discrete sample drawn at one point in time.

10. Indicator: A sampling location that is potentially affected by plant effluents due to its proximity and/or direction from the plant.

11. 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 particular radionuclides is needed.

12. ISFSI: Independent Spent Fuel Storage Installation

13. Lower Limit of Detection (LLD): 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. LLDs are specified by a regulator, such as the NRC, and are typically listed in the ODCM.

14. Minimum Detectable Activity (MDA): 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.

15. Minimum Detectable Concentration (MDC): Essentially synonymous with MDA for the purposes of radiological monitoring.

16. Mean: The sum of all of the values in a distribution divided by the number of values in the distribution, synonymous with average.

17. Microcurie (μCi): 3.7 x 10^4 disintegrations per second, or 2.22 x10^6 disintegrations per minute.

18. millirem (mrem): 1/1000 rem; a unit of radiation dose equivalent in tissue.

19. milliroentgen (mR): 1/1000 Roentgen; a unit of exposure to X- or gamma radiation.

20. N/A: Not Applicable

21. NEI: Nuclear Energy Institute

22. NRC: Nuclear Regulatory Commission

23. ODCM: Offsite Dose Calculation Manual

24. OSLD: Optically Stimulated Luminescence Dosimeter

25. Protected Area: The fenced area immediately surrounding the Plant. Access to the protected area requires a security badge or escort.

26. PWR: Pressurized Water Reactor

27. REC: Radiological Effluent Control

28. REMP: Radiological Environmental Monitoring Program

29. Restricted Area: Any area to which access is limited by the licensee for the protection of individuals from exposure to radiation and radioactive materials.

30. Total Effective Dose Equivalent (TEDE): The sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

31. TLD: Thermoluminescent Dosimeter

32. TRM: Technical Requirements Manual

33. Technical Specifications (TS): Part of an NRC license authorizing the operation of a nuclear production or utilization facility. A Technical Specification establishes requirements for items such as safety limits, limiting safety system settings, limiting control settings, limiting conditions for operation, surveillance requirements, design features, and administrative controls.

34. Unrestricted Area: Any area to which access is neither limited nor controlled by the licensee.

2.0 EXECUTIVE SUMMARY

The Nine Mile Point (NMP) Radiological Effluent Control (REC) Program was established to ensure compliance with NMP Technical Specifications, 10 CFR 20, 10 CFR 50, and 40 CFR 190, and to assure that the release of radioactive materials in plant effluents and the resultant dose to members of the public is kept "as low as reasonably achievable" (ALARA). The dose calculation methodology implemented by the station as described in the Offsite Dose Calculation Manual(s) (ODCMs) is consistent with the methodology provided in the following US NRC Regulatory Guidance for Power Reactors:

- Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1
- Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," Revision 1
- Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors," Revision 1

Doses to members of the public as a result of plant operation during 2023 were calculated to be a fraction of the applicable regulatory limits and pose no health hazard. These doses are summarized and compared to the regulatory limits in Section 2.1, Comparison to Regulatory Limits.

The Annual Radioactive Effluent Release Report (ARERR) is published per REC requirements, NMP Technical Specifications, and 10 CFR 50.36(a). The ARERR 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 processing or direct disposal, and other information as required by site licensing documents.

In addition to monitoring radioactive effluents, Nine Mile Point and James A. FitzPatrick Clean Energy Center (JAF) share a Radiological Environmental Monitoring Program (REMP). The REMP is a comprehensive surveillance program, which is implemented to assess the impact of site operations on the environment and compliance with 10 CFR 20, 40 CFR 190, and 10 CFR 72. Samples are collected from the aquatic and terrestrial pathways applicable to the JAF/NMP site. Aquatic pathways include fish from Lake Ontario, surface water, and lakeshore sediment. Terrestrial pathways include airborne particulate and radioiodine, milk, food products, and direct radiation.

Data from the REMP is published in the JAF/NMP Annual Radiological Environmental Operating Report (AREOR), which can be found on the NRC's website: https://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/nmp1-2.html

2.1 Comparison to Regulatory Limits

Table 1 provides a summary of the maximum dose received by a member of the public in an unrestricted area in 2023 from all gaseous and liquid effluents from Nine Mile Point Unit 1 in comparison with 10 CFR 50 Appendix I limits.

Table 1, Nine Mile Point Unit 1 Dose Comparison to 10 CFR 50 Appendix I Limits[1]

		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual[2]
Liquid Effluent Dose Limit, Total Body	Limit	1.5 mrem	1.5 mrem	1.5 mrem	1.5 mrem	3 mrem
	Total Body Dose	*	*	*	*	*
	% of Limit	*	*	*	*	*
Liquid Effluent Dose Limit, Any Organ	Limit	5 mrem	5 mrem	5 mrem	5 mrem	10 mrem
	Max Organ Dose[2]	*	*	*	*	*
	% of Limit	*	*	*	*	*
Gaseous Effluent Dose Limit, Gamma Air (Noble Gas)	Limit	5 mrad	5 mrad	5 mrad	5 mrad	10 mrad
	Gamma Air Dose	*	*	*	*	*
	% of Limit	*	*	*	*	*
Gaseous Effluent Dose Limit, Beta Air (Noble Gas)	Limit	10 mrad	10 mrad	10 mrad	10 mrad	20 mrad
	Beta Air Dose	*	*	*	*	*
	% of Limit	*	*	*	*	*
Gaseous Effluent Organ Dose Limit (Iodine-131, Iodine-133, 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]	6.58E-02	2.52E-02	4.44E-02	4.87E-02	1.84E-01
	% of Limit	8.78E-01	3.36E-01	5.92E-01	6.50E-01	1.23E+00

1 Doses based on quarterly and annual limits, on a per reactor basis.
2 The sum of quarterly max organ doses may not equal the annual max organ dose if the quarterly max organ differs from the annual max organ.
3 If activity was not detected for the period in question, (*) indicates no dose.

Table 2 provides a summary of the maximum dose received by a member of the public in an unrestricted area in 2023 as a result of operations at NMP1, NMP2, and JAF, evaluated against 40 CFR 190 limits.

Table 2, Maximum Dose Received by a Member of the Public in an Unrestricted Area During 2023 Compared to EPA 40 CFR 190 Limits

	Whole Body	Thyroid	Any Other Organ
Dose Limit	25 mrem	75 mrem	25 mrem
All Liquid Effluents	6.89E-06	6.89E-06	6.89E-06
All Gaseous Effluents, excluding C-14	9.08E-02	2.29E-01	2.29E-01
Gaseous C-14	4.16E-02	2.08E-01	2.08E-01
Direct Radiation	2.69E-01	2.69E-01	2.69E-01
Total Dose from All Sources	4.01E-01	7.06E-01	7.06E-01
% of Dose Limit	1.61E+00	9.41E-01	2.82E+00

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.

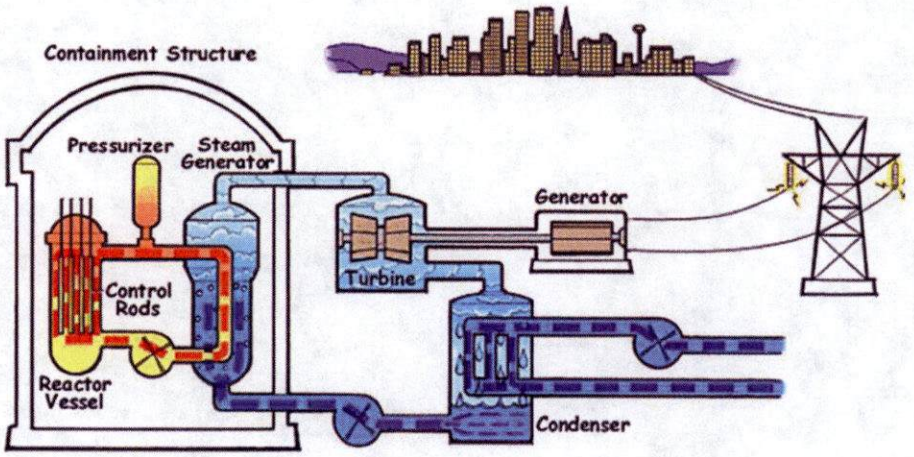

Figure 1, Pressurized Water Reactor (PWR) **[1]**

3.1 (Continued)

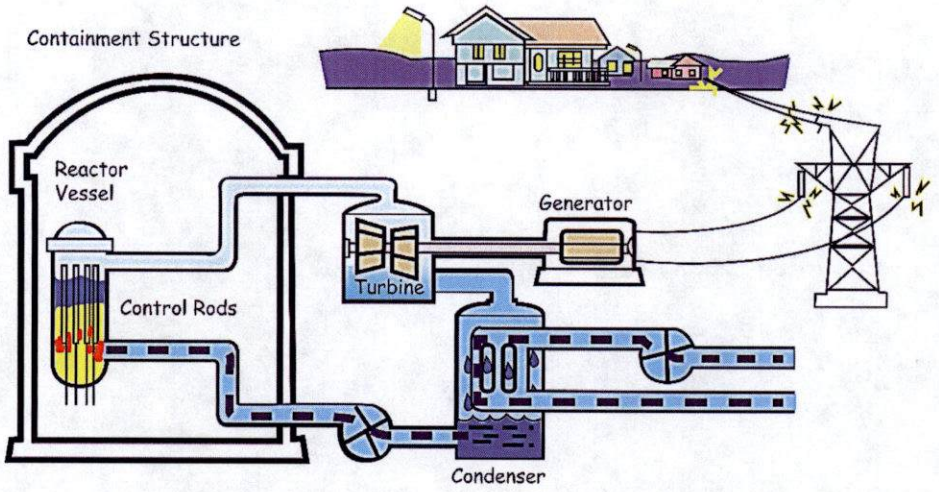

Figure 2, Boiling Water Reactor (BWR) **[2]**

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 turns 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 in order 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 result 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.

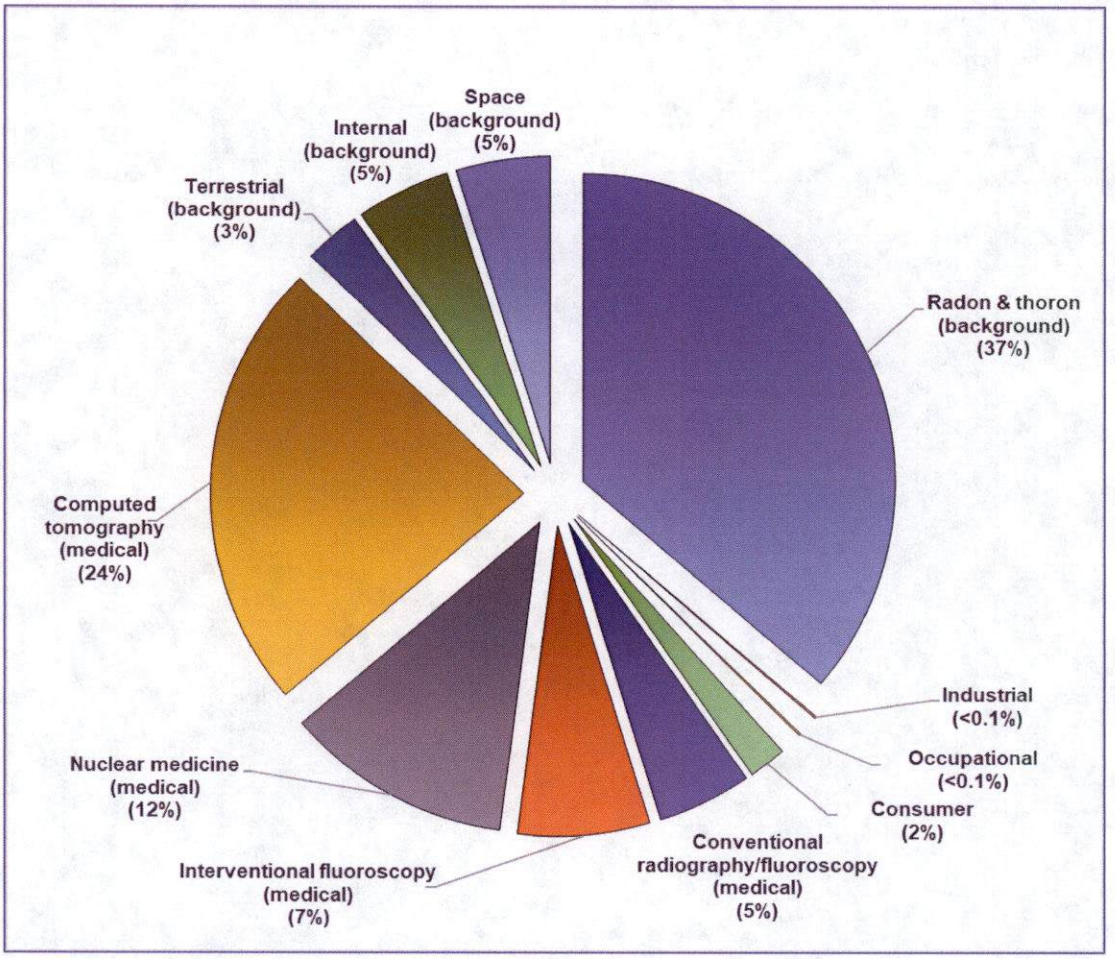

Figure 3, Sources of Radiation Exposure (NCRP Report No. 160) **[3]**

3.2 (Continued)

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% 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 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 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.

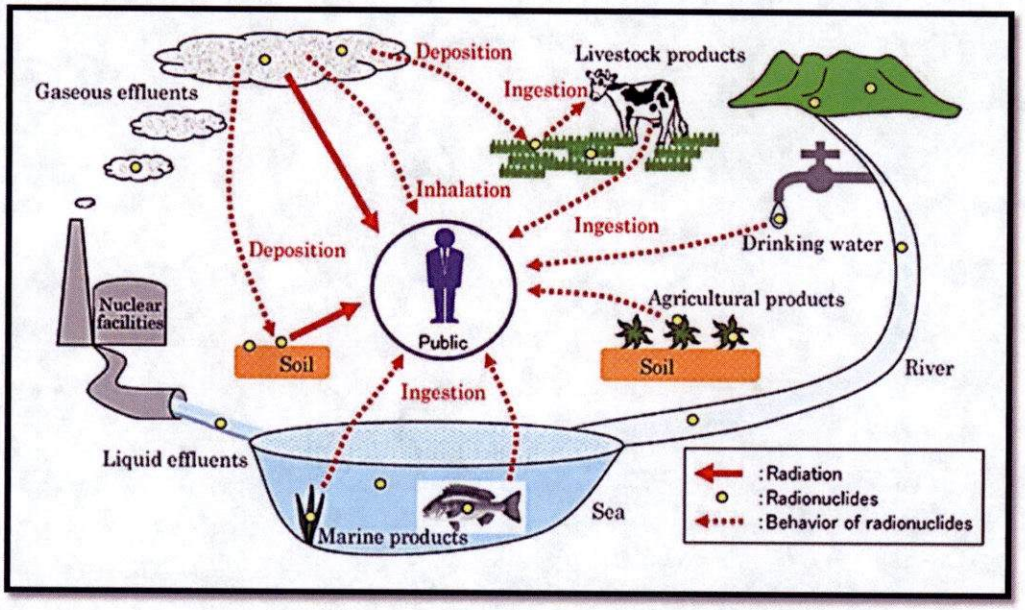

Figure 4, Potential exposure pathways to Members of the Public due to Plant Operations **[6]**

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 [7] and NUREG-0133 [8]. 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.

3.3 (Continued)

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 from the census is used to determine who is the likely to be most exposed to radiation dose as a result of plant operation.

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 for Gaseous and Liquid Effluent Doses

1. Fission and Activation gases:

   a. The dose rate limit of noble gases released in gaseous effluents from the site to areas at and beyond the site boundary shall be:

      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. The 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

2. Tritium, Iodines, and Particulates with Half Lives > 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

3. Liquid Effluents

   a. The concentration of radioactive material released in liquid effluents to unrestricted areas shall be limited to ten times the concentrations specified in 10 CFR Part 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2E-04 microcuries/ml total activity.

   b. 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:

      1) Quarterly

         a) Less than or equal to 1.5 mrem total body

         b) Less than or equal to 5 mrem to any organ

      2) Yearly

         a) Less than or equal to 3 mrem total body

         b) Less than or equal to 10 mrem to any organ

4.2 40 CFR 190 Regulatory Dose Limits for a Member of the Public

1. For any member of the public as the result of exposures to planned discharges of radioactive materials, radon and its daughters excepted, to the general environment from uranium fuel cycle operations and to radiation from these operations, the annual dose equivalent shall not exceed:

   a. 25 millirems to the Whole Body

   b. 75 millirems to the Thyroid

   c. 25 millirems to any other organ

4.3 Measurements and Approximations of Total Radioactivity

Described below are the methods used to measure or approximate the total radioactivity and radionuclide composition in effluents.

1. Fission and Activation Gases
   Noble gas effluent activity is determined by on-line gross activity monitoring (calibrated against gamma isotopic analysis of a 4.0L Marinelli grab sample) of an isokinetic stack sample stream.

2. Iodines
   Iodine effluent activity is determined by gamma spectroscopic analysis (at least weekly) of charcoal cartridges sampled from an isokinetic stack sample stream.

3. Particulates
   Activity released from the main stack is determined by gamma spectroscopic analysis (at least weekly) of particulate filters sampled from an isokinetic sample stream and composite analysis of the filters for non-gamma emitters.

4. Tritium
   Tritium effluent activity is measured by liquid scintillation of monthly samples taken with an air sparging/water trap apparatus. Tritium effluent activity is measured during purge and weekly when fuel is offloaded until stable tritium release rates are demonstrated.

5. Emergency Condenser Vent Effluents
   The effluent curie quantities are estimated based on the isotopic distribution in the Condensate Storage Tank water and the Emergency Condenser shell water. Actual isotopic concentrations are found via gamma spectroscopy. Initial release rates of Sr-89, Sr-90 and Fe-55 are estimated by applying scaling factors to release rates of gamma emitters and actual release rates are determined from post offsite analysis results. The activity of fission and activation gases released due to tube leaks is based on reactor steam leak rates using offgas isotopic analyses.

6. Liquid Effluents
   Isotopic contents of liquid effluents are determined by isotopic analysis of a representative sample of each batch and composite analysis of non-gamma emitters. Tritium activity is estimated on the most recent analysis of the Condensate Storage Tank water. Initial release rates of Sr-89, Sr-90, and Fe-55 are estimated by applying scaling factors to release rates of gamma emitters and actual release rates are determined from post offsite analysis results.

7. Solid Effluents
   Isotopic contents of waste shipments are determined by gamma spectroscopy analysis of a representative sample of each batch. Scaling factors established from primary composite sample analyses conducted off site are applied, where appropriate, to find estimated concentration of non-gamma emitters. For low activity trash shipments, curie content is estimated by dose rate measurement and application of appropriate scaling factors.

8. C-14
   The production of C-14 and the effluent dose consequences are estimates based on EPRI methodology provided in EPRI Report 1021106, Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents, December 2010 and NUREG-0016, Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents for Boiling Water Reactors (BWR-GALE Code).

4.4 Onsite Doses (Within Site Boundary)

Prior to September 11, 2001, the public had access to the Nine Mile Point Nuclear Learning Center (NLC; formerly known as the Energy Information Center) for purposes of observing the educational displays or for picnicking and associated activities. Fishing also occurred near the shoreline adjacent to the Nine Mile Point (NMP) site. Fishing near the shoreline adjacent to the NMP site was the onsite activity that resulted in the potential maximum dose received by a member of the public.

Following September 11, 2001, public access to the NLC has been restricted and fishing by members of the public at locations on site was prohibited. Although fishing was not conducted onsite by members of the public during 2023, the annual dose to a hypothetical fisherman was still evaluated to provide continuity of data for the location.

It is conservatively assumed that the maximum exposed individual spends an average of 8 hours per week from April to December fishing from the shoreline at a location between the NLC and NMP1.

4.4.1 Dose Pathways for Evaluation of Doses to Members of the Public Within the Site Boundary

The pathways considered for the evaluation include the inhalation pathway, the ground dose pathway with the resultant whole body and skin dose and the direct radiation dose pathway with the associated whole body dose. The direct radiation dose pathway includes gamma plume shine, gamma plume submersion, direct shine from the NMP1, NMP2, and JAF facilities, and ground plane deposition, and is evaluated by average environmental TLD readings at the shoreline fishing location between the NLC and NMP1.

Other pathways, such as the ingestion pathway, are not applicable since these doses are included under calculations for doses to members of the public outside of the site boundary. In addition, pathways associated with water related recreational activities, other than fishing, are not applicable here. These include swimming, boating and wading which are prohibited at the facility.

Table 3, Onsite Doses (Within Site Boundary)

Exposure Pathway Dose (mrem)			Total (mrem)
Ground	Inhalation (Max Organ: Thyroid)	Direct Radiation	
0.00E+00	5.66E-03	4.03E-01	4.09E-01

5.0 SUPPLEMENTAL INFORMATION

5.1 Land Use Census Changes

In 2022, three new gardens were planted in the E, ESE, and SE sectors of the JAF owner-controlled area (OCA) which have since served as indicator locations for broad-leaf vegetation sampling. The gardens were planted due to a decline in local personal gardens in recent years and less sample availability.

Based on the 2023 annual land use census, there were no changes to critical receptors and no new sampling locations were required.

5.2 Meteorological Data

NMP and JAF share a joint meteorological monitoring program. During 2023, 74,574 hours of data were captured out of a possible 78,840 parameter hours, which represents an overall data recovery rate of 94.6%. Atmospheric stability classes as measured by 200'-30' vertical temperature difference (ΔT) and joint frequency tables of wind speed and wind direction for each stability class are provided in Attachment 3.

5.3 Effluent Monitoring System Inoperability

Liquid radwaste discharge radiation monitors 11 and 12 are retired in place and were inoperable for all of 2023, as liquid batch discharges are no longer expected to occur and were not performed at NMP1 during 2023. No other effluent radiation monitors or equipment required by the ODCM were inoperable for more than 30 days in 2023.

5.4 Offsite Dose Calculation Manual (ODCM) Changes

No changes to the NMP1 ODCM were made in 2023.

5.5 Process Control Program (PCP) Changes

There were no changes to the PCP in 2023.

5.6 Radioactive Waste Treatment System Changes

There were no changes or modifications to the gaseous radioactive waste treatment system or the liquid radioactive waste treatment system in 2023.

5.7 Independent Spent Fuel Storage Installation (ISFSI) Monitoring Program

Information concerning the ISFSI monitoring program and 2023 annual dose can be found in the 2023 JAF/NMP Annual Radiological Environmental Operating Report, which is published on the NRC's website:
https://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/nmp1-2.html

5.8 Carbon-14

Carbon (C)-14 is a naturally occurring isotope of carbon. Nuclear weapons testing in the 1950s and 1960s significantly increased the amount of C-14 in the atmosphere. Commercial nuclear reactors also produce C-14 but in much lower amounts than those produced naturally or from weapons testing. IAEA Report Number 421 provides relevant information on C-14 releases. In BWRs such as NMP1, NMP2, and JAF, C-14 is primarily formed via neutron activation of ^{17}O in light-water reactor coolant and subsequent alpha decay to ^{14}C (abbreviated as the $^{17}O_{(n,\alpha)}$ ^{14}C nuclear reaction). In BWRs, the majority of the C-14 produced (>95%) is released as gaseous carbon dioxide ($^{14}CO_2$) from the Main Stack(s).

Regulations in 10 CFR 50.36a require that operating procedures be developed for the control of effluents and that quantities of principal radionuclides be reported. The radioactive effluents from commercial nuclear power plants over time has decreased to the point that C-14 is likely to have become a principal radionuclide in gaseous effluents.

Estimation of gaseous release of C-14 from the NMP1 and NMP2 Main Stack(s) is determined using the methodology described in EPRI Report 1021106, *Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents* (December 2010). The estimate is based on a normalized C-14 production rate of 5.1 Ci/GWt-yr, a gaseous release fraction of 0.99, a $^{14}CO_2$ release fraction of 0.95, and rated thermal power and Equivalent Full Power Days (EFPD) of operation for each reactor unit during 2023.

The estimated C-14 activity released from each BWR during 2023 is summarized below.

Table 4, Estimated C-14 Activity Released From NMP1, NMP2, and JAF in 2023

BWR	Gaseous Release Fraction	$^{14}CO_2$ Form Release Fraction	EFPD	Total Release (Ci)	$^{14}CO_2$ Release (Ci)
NMP1	0.99	0.95	317	8.12	7.72
NMP2			356	19.63	18.64
JAF			364	10.80	10.26

5.9 Errata/Corrections to Previous ARERRs

For the 2021 NMP1 and NMP2 ARERRs, the groundwater tritium results for 2020 were erroneously submitted. The 2021 groundwater tritium results are included in Attachment 4, Errata and Corrections to the 2021 NMP1 and NMP2 ARERRs.

Multiple errata were identified in the 2022 NMP1 ARERR. A full summary of all errata and the corrected pages in their entirety are included in Attachment 5, Errata and Corrections to the 2022 NMP1 ARERR.

5.10 Other Information

An external vendor performs particulate gross alpha measurements for NMP and participates in a quarterly crosscheck program. In the 3rd Quarter of 2023, for a gross alpha crosscheck sample, a disagreement was discovered between the result obtained by the vendor and the reference value. The gross alpha crosscheck is a particulate filter with a mylar cover that seals the sample to the filter. The vendor only measured the filter and the majority of the spike sample which remained on the mylar cover was not included in the reported result. Following investigation, the vendor identified that the sample was incorrectly analyzed. This was confirmed after analysis of the mylar cover was performed. When summing the results from the filter and mylar cover, the total concentration agreed with the reference value.

6.0 NEI 07-07 ONSITE RADIOLOGICAL GROUNDWATER MONITORING PROGRAM

Nine Mile Point 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 in order to prevent migration of licensed radioactive material off-site and to quantify impacts on decommissioning. Monitoring wells installed as part of GPI program are sampled and analyzed for Tritium (H-3) annually and quarterly.

Table 5, Groundwater Protection Program Monitoring Well Results

Nine Mile Point 1 and 2 Groundwater Tritium Results			**Reporting Period: January - December 2023**	
Well Identification Number	# Samples Collected	# Positive Samples	Minimum H-3 Concentration (pCi/L)	Maximum H-3 Concentration (pCi/L)
GMX-MW1*	1	0	<176	<176
MW-1	1	0	<172	<173
MW-5	4	0	<175	<191
MW-6	1	0	<179	<179
MW-7	1	0	<195	<195
MW-8	4	0	<176	<193
MW-9[1]	4	0	<177	<197
MW-10[1]	1	0	<197	<197
MW-11	1	0	<194	<194
MW-12	1	0	<196	<196
MW-13	1	0	<192	<192
MW-14*	1	0	<198	<198
MW-15	4	0	<173	<198
MW-16	1	0	<194	<194
MW-17	4	0	<174	<196
MW-18	4	0	<175	<198
MW-19	1	0	<194	<194
MW-20	1	0	<199	<199
MW-21	1	0	<198	<198
PZ-1	2	0	<180	<197
PZ-7	4	0	<176	<195
PZ-8	4	0	<177	<198

* Control Location
[1] Sentinel well location

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Attachment 1, Effluent Summary Tables

Table 6, Average Energies, Batch & Abnormal Releases

Average Energy (Fission and Activation gases - MeV):

Qrtr.1	Eγ	=	N/A	Eβ	=	N/A
Qrtr.2	Eγ	=	N/A	Eβ	=	N/A
Qrtr.3	Eγ	=	N/A	Eβ	=	N/A
Qrtr.4	Eγ	=	N/A	Eβ	=	N/A

Liquid:

	Radwaste	EC Vent
Number of Batch Releases	0	0
Total Time Period for Batch Releases (hrs)	0	0
Maximum Time Period for a Batch Release (hrs)	0	0
Average Time Period for a Batch Release (hrs)	0	0
Minimum Time Period for a Batch Release (hrs)	0	0

Total volume of water used to dilute the liquid effluent during release period (L)

	1st	2nd	3rd	4th
Radwaste	N/A	N/A	N/A	N/A
EC Vent	N/A	N/A	N/A	N/A

Total volume of water available to dilute the liquid effluent during report period (L)

	1st	2nd	3rd	4th
Radwaste	1.05E+11	1.08E+11	1.36E+11	1.33E+11
EC Vent	N/A	N/A	N/A	N/A

Gaseous (Emergency Condenser Vent):

Number of Batch Releases	0
Total Time Period for Batch Releases (hrs)	0
Maximum Time Period for a Batch Release (hrs)	0
Average Time Period for a Batch Release (hrs)	0
Minimum Time Period for a Batch Release (hrs)	0

Gaseous (Primary Containment Purge):

Number of Batch Releases	0
Total Time Period for Batch Releases (hrs)	0
Maximum Time Period for a Batch Release (hrs)	0
Average Time Period for a Batch Release (hrs)	0
Minimum Time Period for a Batch Release (hrs)	0

Abnormal Releases:

A. Liquids:

Number of Releases	0	
Total Activity Released	N/A	Ci

B. Gaseous:

Number of Releases	0	
Total Activity Released	N/A	Ci

Table 7, Gaseous Effluents – Summation of All Releases, Elevated and Ground Level

		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	EST. TOTAL ERROR %
A. Fission & Activation Gases (1)						
1. Total Release	Ci	**	**	**	**	5.00E+01
2. Average Release Rate for Period	µCi/sec	**	**	**	**	
B. Iodines (1)						
1. Total Iodine - 131	Ci	2.51E-03	4.46E-04	1.38E-03	1.89E-03	3.00E+01
2. Average Release Rate for Period	µCi/sec	3.23E-04	5.68E-05	1.73E-04	2.37E-04	
C. Particulates (1)						
1. Particulates with Half-lives>8 days	Ci	4.71E-03	7.36E-03	7.63E-03	7.71E-03	3.00E+01
2. Average Release Rate for Period	µCi/sec	6.06E-04	9.36E-04	9.60E-04	9.70E-04	
3. Gross Alpha Radioactivity	Curies	**	**	**	**	2.50E+01
D. Tritium (1)						
1. Total Release	Ci	4.58E+00	2.89E+00	5.35E+00	5.48E+00	5.00E+01
2. Average Release Rate for Period	µCi/sec	5.89E-01	3.67E-01	6.74E-01	6.89E-01	

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Table 8, Gaseous Effluents – Elevated Release Continuous Mode

Nuclides Released		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Fission Gases (1)					
Ar-41	Ci	**	**	**	**
Kr-85	Ci	**	**	**	**
Kr-85m	Ci	**	**	**	**
Kr-87	Ci	**	**	**	**
Kr-88	Ci	**	**	**	**
Xe-131m	Ci	**	**	**	**
Xe-133	Ci	**	**	**	**
Xe-133m	Ci	**	**	**	**
Xe-135	Ci	**	**	**	**
Xe-135m	Ci	**	**	**	**
Xe-137	Ci	**	**	**	**
Xe-138	Ci	**	**	**	**
Iodines (1)					
I-131	Ci	2.51E-03	4.46E-04	1.38E-03	1.89E-03
I-133	Ci	9.13E-03	7.01E-03	1.67E-02	2.10E-02
I-135	Ci	1.18E-03	4.61E-03	2.61E-02	4.38E-02
Particulates (1)					
Cr-51	Ci	1.46E-04	6.98E-05	**	**
Mn-54	Ci	2.47E-04	5.94E-04	3.89E-04	3.71E-04
Fe-55	Ci	6.35E-04	1.41E-03	1.31E-03	9.66E-04
Fe-59	Ci	**	2.85E-05	**	**
Co-58	Ci	8.43E-04	1.22E-03	1.54E-03	1.64E-03
Co-60	Ci	2.29E-03	3.41E-03	2.94E-03	3.18E-03
Zn-65	Ci	4.43E-04	5.59E-04	1.14E-03	1.04E-03
Sr-89	Ci	**	**	**	**
Sr-90	Ci	**	**	**	**
Nb-95	Ci	**	**	**	**
Cs-134	Ci	2.51E-06	**	**	**
Cs-136	Ci	**	**	**	**
Cs-137	Ci	1.09E-05	3.88E-06	1.93E-05	**
Ba-140	Ci	4.68E-05	4.22E-05	2.95E-04	5.02E-04
La-140	Ci	**	**	**	**
Ce-141	Ci	**	**	**	1.28E-05
Ce-144	Ci	**	**	**	**
Nd-147	Ci	**	**	**	**
Sb-124	Ci	4.12E-05	2.00E-05	**	**
H-3 (1)	Ci	3.94E+00	2.42E+00	4.53E+00	4.97E+00

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Table 9, Gaseous Effluents – Elevated Release Batch Mode

Nuclides Released		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Fission Gases (1)					
Ar-41	Ci	**	**	**	**
Kr-85	Ci	**	**	**	**
Kr-85m	Ci	**	**	**	**
Kr-87	Ci	**	**	**	**
Kr-88	Ci	**	**	**	**
Xe-131m	Ci	**	**	**	**
Xe-133	Ci	**	**	**	**
Xe-133m	Ci	**	**	**	**
Xe-135	Ci	**	**	**	**
Xe-135m	Ci	**	**	**	**
Xe-137	Ci	**	**	**	**
Xe-138	Ci	**	**	**	**
Iodines (1)					
I-131	Ci	**	**	**	**
I-133	Ci	**	**	**	**
I-135	Ci	**	**	**	**
Particulates (1)					
Cr-51	Ci	**	**	**	**
Mn-54	Ci	**	**	**	**
Fe-55	Ci	**	**	**	**
Fe-59	Ci	**	**	**	**
Co-58	Ci	**	**	**	**
Co-60	Ci	**	**	**	**
Zn-65	Ci	**	**	**	**
Sr-89	Ci	**	**	**	**
Sr-90	Ci	**	**	**	**
Nb-95	Ci	**	**	**	**
Cs-134	Ci	**	**	**	**
Cs-136	Ci	**	**	**	**
Cs-137	Ci	**	**	**	**
Ba-140	Ci	**	**	**	**
La-140	Ci	**	**	**	**
Ce-141	Ci	**	**	**	**
Ce-144	Ci	**	**	**	**
Nd-147	Ci	**	**	**	**
H-3 (1)	Ci	**	**	**	**

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Table 10, Gaseous Effluents – Ground Release Continuous Mode

Nuclides Released		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Fission Gases (1)					
Ar-41	Ci	**	**	**	**
Kr-85	Ci	**	**	**	**
Kr-85m	Ci	**	**	**	**
Kr-87	Ci	**	**	**	**
Kr-88	Ci	**	**	**	**
Xe-131m	Ci	**	**	**	**
Xe-133	Ci	**	**	**	**
Xe-133m	Ci	**	**	**	**
Xe-135	Ci	**	**	**	**
Xe-135m	Ci	**	**	**	**
Xe-137	Ci	**	**	**	**
Xe-138	Ci	**	**	**	**
Iodines (1)					
I-131	Ci	**	**	**	**
I-133	Ci	**	**	**	**
I-135	Ci	**	**	**	**
Particulates (1)					
Cr-51	Ci	**	**	**	**
Mn-54	Ci	**	**	**	**
Fe-55	Ci	**	**	**	**
Fe-59	Ci	**	**	**	**
Co-58	Ci	**	**	**	**
Co-60	Ci	**	**	**	**
Zn-65	Ci	**	**	**	**
Sr-89	Ci	**	**	**	**
Sr-90	Ci	**	**	**	**
Nb-95	Ci	**	**	**	**
Cs-134	Ci	**	**	**	**
Cs-136	Ci	**	**	**	**
Cs-137	Ci	**	**	**	**
Ba-140	Ci	**	**	**	**
La-140	Ci	**	**	**	**
Ce-141	Ci	**	**	**	**
Ce-144	Ci	**	**	**	**
Nd-147	Ci	**	**	**	**
H-3 (1)	Ci	6.46E-01	4.64E-01	8.23E-01	5.07E-01

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Table 11, Gaseous Effluents – Ground Release Batch Mode

Nuclides Released		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Fission Gases (1)					
Ar-41	Ci	**	**	**	**
Kr-85	Ci	**	**	**	**
Kr-85m	Ci	**	**	**	**
Kr-87	Ci	**	**	**	**
Kr-88	Ci	**	**	**	**
Xe-131m	Ci	**	**	**	**
Xe-133	Ci	**	**	**	**
Xe-133m	Ci	**	**	**	**
Xe-135	Ci	**	**	**	**
Xe-135m	Ci	**	**	**	**
Xe-137	Ci	**	**	**	**
Xe-138	Ci	**	**	**	**
Iodines (1)					
I-131	Ci	**	**	**	**
I-133	Ci	**	**	**	**
I-135	Ci	**	**	**	**
Particulates (1)					
Cr-51	Ci	**	**	**	**
Mn-54	Ci	**	**	**	**
Fe-55	Ci	**	**	**	**
Fe-59	Ci	**	**	**	**
Co-58	Ci	**	**	**	**
Co-60	Ci	**	**	**	**
Zn-65	Ci	**	**	**	**
Sr-89	Ci	**	**	**	**
Sr-90	Ci	**	**	**	**
Nb-95	Ci	**	**	**	**
Cs-134	Ci	**	**	**	**
Cs-136	Ci	**	**	**	**
Cs-137	Ci	**	**	**	**
Ba-140	Ci	**	**	**	**
La-140	Ci	**	**	**	**
Ce-141	Ci	**	**	**	**
Ce-144	Ci	**	**	**	**
Nd-147	Ci	**	**	**	**
H-3 (1)	Ci	**	**	**	**

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Table 12, Liquid Effluents – Summation of All Releases

		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	EST. TOTAL ERROR %
A. Fission & Activation Products						
1. Total Release (not including Tritium, gases, alpha)	Curies	No Releases	No Releases	No Releases	No Releases	5.00E+01
2. Average diluted concentration during the reporting period	µCi/ml	No Releases	No Releases	No Releases	No Releases	
B. Tritium						
1. Total Release	Curies	No Releases	No Releases	No Releases	No Releases	5.00E+01
2. Average diluted concentration during the reporting period	µCi/ml	No Releases	No Releases	No Releases	No Releases	
C. Dissolved & Entrained Gases						
1. Total Release	Curies	No Releases	No Releases	No Releases	No Releases	5.00E+01
2. Average diluted concentration during the reporting period	µCi/ml	No Releases	No Releases	No Releases	No Releases	
D. Gross Alpha						
1. Total Release	Curies	No Releases	No Releases	No Releases	No Releases	5.00E+01
E. Volumes						
1. Prior to Dilution	Liters	No Releases	No Releases	No Releases	No Releases	5.00E+01
2. Volume of dilution water used during release period	Liters	No Releases	No Releases	No Releases	No Releases	5.00E+01
3. Volume of dilution water available during reporting period - Cooling	Liters	1.05E+11	1.08E+11	1.36E+11	1.33E+11	5.00E+01
F. Percent of Tech. Spec. Limits						
Percent of Quarterly Whole Body Dose Limit (1.5 mrem)	%	No Releases	No Releases	No Releases	No Releases	
Percent of Annual Whole Body Dose Limit to Date (3 mrem)	%	No Releases	No Releases	No Releases	No Releases	
Percent of Quarterly Organ Dose Limit (5 mrem)	%	No Releases	No Releases	No Releases	No Releases	
Percent of Annual Organ Dose Limit to Date (10 mrem)	%	No Releases	No Releases	No Releases	No Releases	
Percent of 10CFR20 Concentration Limit	%	No Releases	No Releases	No Releases	No Releases	
Percent of Dissolved or Entrained Noble Gas Limit (2.00E-04 uCi/ml)	%	No Releases	No Releases	No Releases	No Releases	

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Table 13, Liquid Effluents Released Batch Mode

Nuclides Released		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Fission & Activation Products					
Na-24	Ci	No Releases	No Releases	No Releases	No Releases
Cr-51	Ci	No Releases	No Releases	No Releases	No Releases
Mn-54	Ci	No Releases	No Releases	No Releases	No Releases
Mn-56	Ci	No Releases	No Releases	No Releases	No Releases
Fe-55	Ci	No Releases	No Releases	No Releases	No Releases
Fe-59	Ci	No Releases	No Releases	No Releases	No Releases
Co-60	Ci	No Releases	No Releases	No Releases	No Releases
Ni-65	Ci	No Releases	No Releases	No Releases	No Releases
Cu-64	Ci	No Releases	No Releases	No Releases	No Releases
Zn-65	Ci	No Releases	No Releases	No Releases	No Releases
Sr-89	Ci	No Releases	No Releases	No Releases	No Releases
Sr-90	Ci	No Releases	No Releases	No Releases	No Releases
Zr-95	Ci	No Releases	No Releases	No Releases	No Releases
Nb-95	Ci	No Releases	No Releases	No Releases	No Releases
Mo-99	Ci	No Releases	No Releases	No Releases	No Releases
I-133	Ci	No Releases	No Releases	No Releases	No Releases
Cs-134	Ci	No Releases	No Releases	No Releases	No Releases
Cs-136	Ci	No Releases	No Releases	No Releases	No Releases
Cs-137	Ci	No Releases	No Releases	No Releases	No Releases
Ba-140	Ci	No Releases	No Releases	No Releases	No Releases
La-140	Ci	No Releases	No Releases	No Releases	No Releases
Ce-141	Ci	No Releases	No Releases	No Releases	No Releases
Ce-144	Ci	No Releases	No Releases	No Releases	No Releases
Dissolved or Entrained	Ci	No Releases	No Releases	No Releases	No Releases
H-3	Ci	No Releases	No Releases	No Releases	No Releases

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Table 14, Liquid Effluents Released Continuous Mode

Nuclides Released		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Fission & Activation Products					
Na-24	Ci	No Releases	No Releases	No Releases	No Releases
Cr-51	Ci	No Releases	No Releases	No Releases	No Releases
Mn-54	Ci	No Releases	No Releases	No Releases	No Releases
Mn-56	Ci	No Releases	No Releases	No Releases	No Releases
Fe-55	Ci	No Releases	No Releases	No Releases	No Releases
Fe-59	Ci	No Releases	No Releases	No Releases	No Releases
Co-60	Ci	No Releases	No Releases	No Releases	No Releases
Ni-65	Ci	No Releases	No Releases	No Releases	No Releases
Cu-64	Ci	No Releases	No Releases	No Releases	No Releases
Zn-65	Ci	No Releases	No Releases	No Releases	No Releases
Sr-89	Ci	No Releases	No Releases	No Releases	No Releases
Sr-90	Ci	No Releases	No Releases	No Releases	No Releases
Zr-95	Ci	No Releases	No Releases	No Releases	No Releases
Nb-95	Ci	No Releases	No Releases	No Releases	No Releases
Mo-99	Ci	No Releases	No Releases	No Releases	No Releases
I-133	Ci	No Releases	No Releases	No Releases	No Releases
Cs-134	Ci	No Releases	No Releases	No Releases	No Releases
Cs-136	Ci	No Releases	No Releases	No Releases	No Releases
Cs-137	Ci	No Releases	No Releases	No Releases	No Releases
Ba-140	Ci	No Releases	No Releases	No Releases	No Releases
La-140	Ci	No Releases	No Releases	No Releases	No Releases
Ce-141	Ci	No Releases	No Releases	No Releases	No Releases
Ce-144	Ci	No Releases	No Releases	No Releases	No Releases
Dissolved or Entrained	Ci	No Releases	No Releases	No Releases	No Releases
H-3	Ci	No Releases	No Releases	No Releases	No Releases

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Attachment 2, Solid Waste Information

NRC Regulatory Guide 1.21 Report

Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream

During Period From: 01/01/2023 to 12/31/2023

Resins, Filters, And Evaporator Bottoms			
Waste Class	Volume ft³	Volume m³	Curies Shipped
A	1.35E+03	3.81E+01	2.25E+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	1.35E+03	3.81E+01	2.25E+01

Major Nuclides for the Above Table:
H-3, C-14, Mn-54, Fe-55, Co-60, Ni-63, Zn-65, Sr-90, Tc-99, I-129, Cs-137, Pu-238, Pu-239, Pu-241, Am-241,
Cm-242, Cm-244

Dry Active Waste (DAW)			
Waste Class	Volume ft³	Volume m³	Curies Shipped
A	1.22E+04	3.47E+02	1.06E+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	1.22E+04	3.47E+02	1.06E+01

Major Nuclides for the Above Table:
H-3, C-14, Cr-51, Mn-54, Fe-55, Fe-59, Co-58, Co-60, Ni-63, Zn-65, Sr-90, Tc-99, I-129, Cs-137, Pu-238, Pu-239, Pu-241, Am-241, Cm-242, Cm-244

Irradiated Components			
Waste Class	Volume ft³	Volume m³	Curies 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 the Above Table:

NRC Regulatory Guide 1.21 Report

Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream

During Period From: 01/01/2023 to 12/31/2023

Other Waste

Waste Class	Volume ft³	Volume m³	Curies 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 the Above Table:

Sum Of All Low-Level Waste Shipped From Site

Waste Class	Volume ft³	Volume m³	Curies Shipped
A	1.36E+04	3.85E+02	3.31E+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	1.36E+04	3.85E+02	3.31E+01

Major Nuclides for the Above Table:

H-3, C-14, Cr-51, Mn-54, Fe-55, Fe-59, Co-58, Co-60, Ni-63, Zn-65, Sr-90, Tc-99, I-129, Cs-137, Pu-238, Pu-239, Pu-241, Am-241, Cm-242, Cm-244

NRC Regulatory Guide 1.21 Activity Report

Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Shipment, Package, and Category

During Period From: 01/01/2023 to 12/31/2023 Percent Cutoff: 1.0%

Dry Active Waste

Waste Class A

Nuclide Name	Abundance	Activity (Ci)
Cr-51	70.64%	7.52E+00
Mn-54	2.23%	2.37E-01
Fe-55	5.01%	5.33E-01
Co-60	19.28%	2.05E+00

Total Combined

Nuclide Name	Abundance	Activity (Ci)
Cr-51	70.64%	7.52E+00
Mn-54	2.23%	2.37E-01
Fe-55	5.01%	5.33E-01
Co-60	19.28%	2.05E+00

Resins, Filters, and Evap Bottoms

Waste Class A

Nuclide Name	Abundance	Activity (Ci)
Fe-55	2.67%	6.00E-01
Co-60	90.34%	2.03E+01
Ni-63	1.56%	3.51E-01
Zn-65	1.72%	3.86E-01
Cs-137	1.66%	3.74E-01

Total Combined

Nuclide Name	Abundance	Activity (Ci)
Fe-55	2.67%	6.00E-01
Co-60	90.34%	2.03E+01
Ni-63	1.56%	3.51E-01
Zn-65	1.72%	3.86E-01
Cs-137	1.66%	3.74E-01

NRC Regulatory Guide 1.21 Activity Report

Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Shipment, Package, and Category

During Period From: 01/01/2023 to 12/31/2023 Percent Cutoff: 1.0%

Sum of All 4 Categories

Waste Class A

Nuclide Name	Abundance	Activity (Ci)
Cr-51	22.69%	7.52E+00
Mn-54	1.35%	4.48E-01
Fe-55	3.42%	1.13E+00
Co-60	67.52%	2.24E+01
Ni-63	1.2%	3.98E-01
Zn-65	1.31%	4.32E-01
Cs-137	1.27%	4.19E-01

Total Combined

Nuclide Name	Abundance	Activity (Ci)
Cr-51	22.69%	7.52E+00
Mn-54	1.35%	4.48E-01
Fe-55	3.42%	1.13E+00
Co-60	67.52%	2.24E+01
Ni-63	1.2%	3.98E-01
Zn-65	1.31%	4.32E-01
Cs-137	1.27%	4.19E-01

Total Shipments by Carrier

Number of Shipments per each carrier

Number of Shipments	Mode of Transportation	Destination
11	Hittman Transport	Energy Solutions (CVRF) Bear Creek Operations
6	Hittman Transport	Energy Solutions Clive CWF Containerized Waste Facility

WMG Suite 9.6.2

Report date: 3/12/2024

NRC Regulatory Guide 1.21 Report
Shipment and Package Summary

Solid Waste Shipped Offsite for Disposal

During Period from: 1/1/2023 to 12/31/2023

Shipment Date	Manifest ID	Destination	Package Name	Category Name	NRC Class	DOT Type
2/1/2023	23-1029	Energy Solutions (CVRF)	685207-1	Dry Active Waste	A	Type A
2/2/2023	22-1168	Energy Solutions (CVRF)	ESUU500022	Dry Active Waste	A	A LSA-II
2/6/2023	23-1032	Energy Solutions (CVRF)	685207-3	Dry Active Waste	A	Type A
2/8/2023	23-1040	Energy Solutions (CVRF)	685207-2	Dry Active Waste	A	Type A
3/16/2023	23-1034	Energy Solutions (CVRF)	ESUU400021	Dry Active Waste	A	Type A
3/24/2023	23-1088	Energy Solutions (CVRF)	ESUU500027	Dry Active Waste	A	A LSA-II
3/31/2023	23-1107	Energy Solutions (CVRF)	ESUU400076	Dry Active Waste	A	A LSA-II
6/6/2023	23-1083	Energy Solutions (CVRF)	ESUU300608	Dry Active Waste	A	A LSA-II
6/6/2023	23-1086	Energy Solutions (CVRF)	ESUU300689	Dry Active Waste	A	A LSA-II
6/13/2023	23-1119	Energy Solutions (CVRF)	ESUU400049	Dry Active Waste	A	A LSA-II
6/15/2023	1039-C-0073	Energy Solutions Clive CWF	PO703215-18	Resins, Filters, and Evap Bottoms	A	Type A
6/22/2023	1039-C-0075	Energy Solutions Clive CWF	PO708125-5	Resins, Filters, and Evap Bottoms	A	Type A
8/14/2023	1039-C-0081	Energy Solutions Clive CWF	PO708125-13	Resins, Filters, and Evap Bottoms	A	Type A
8/21/2023	1039-C-0082	Energy Solutions Clive CWF	PO708125-6	Resins, Filters, and Evap Bottoms	A	Type A
8/28/2023	1039-C-0083	Energy Solutions Clive CWF	PO705952-31	Resins, Filters, and Evap Bottoms	A	Type A

WMG Suite 9.6.2

Report date: 3/12/2024

NRC Regulatory Guide 1.21 Report
Shipment and Package Summary

Solid Waste Shipped Offsite for Disposal

During Period from: 1/1/2023 to 12/31/2023

9/6/2023	NMP-2023-1210	Energy Solutions (CVRF)	ESUU600070	Other Waste	A	Type A
11/13/2023	1039-C-0086	Energy Solutions Clive CWF	PO709436-45	Resins, Filters, and Evap Bottoms	A	Type A

Constellation

PRIDE IN THE POINT

Nine Mile Point Clean Energy Center

Unit 2

2023 Radioactive Effluent Release Report

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TABLES

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. Critical Organ (Max Organ): That part of the body that is most susceptible to radiation damage under the specific conditions under consideration.

7. Curie (Ci): A measure of radioactivity; equal to 3.7×10^{10} disintegrations per second, or 2.22×10^{12} disintegrations per minute.

8. 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.

9. Grab Sample: A single discrete sample drawn at one point in time.

10. Indicator: A sampling location that is potentially affected by plant effluents due to its proximity and/or direction from the plant.

11. 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 particular radionuclides is needed.

12. ISFSI: Independent Spent Fuel Storage Installation

13. Lower Limit of Detection (LLD): 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. LLDs are specified by a regulator, such as the NRC, and are typically listed in the ODCM.

14. Minimum Detectable Activity (MDA): 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.

15. Minimum Detectable Concentration (MDC): Essentially synonymous with MDA for the purposes of radiological monitoring.

16. Mean: The sum of all of the values in a distribution divided by the number of values in the distribution, synonymous with average.

17. Microcurie (μCi): 3.7×10^4 disintegrations per second, or 2.22×10^6 disintegrations per minute.

18. millirem (mrem): 1/1000 rem; a unit of radiation dose equivalent in tissue.

19. milliroentgen (mR): 1/1000 Roentgen; a unit of exposure to X- or gamma radiation.

20. N/A: Not Applicable

21. NEI: Nuclear Energy Institute

22. NRC: Nuclear Regulatory Commission

23. ODCM: Offsite Dose Calculation Manual

24. OSLD: Optically Stimulated Luminescence Dosimeter

25. Protected Area: The fenced area immediately surrounding the Plant. Access to the protected area requires a security badge or escort.

26. PWR: Pressurized Water Reactor

27. REC: Radiological Effluent Control

28. REMP: Radiological Environmental Monitoring Program

29. Restricted Area: Any area to which access is limited by the licensee for the protection of individuals from exposure to radiation and radioactive materials.

30. Total Effective Dose Equivalent (TEDE): The sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

31. TLD: Thermoluminescent Dosimeter

32. TRM: Technical Requirements Manual

33. Technical Specifications (TS): Part of an NRC license authorizing the operation of a nuclear production or utilization facility. A Technical Specification establishes requirements for items such as safety limits, limiting safety system settings, limiting control settings, limiting conditions for operation, surveillance requirements, design features, and administrative controls.

34. Unrestricted Area: Any area to which access is neither limited nor controlled by the licensee.

2.0 EXECUTIVE SUMMARY

The Nine Mile Point (NMP) Radiological Effluent Control (REC) Program was established to ensure compliance with NMP Technical Specifications, 10 CFR 20, 10 CFR 50, and 40 CFR 190, and to assure that the release of radioactive materials in plant effluents and the resultant dose to members of the public is kept "as low as reasonably achievable" (ALARA). The dose calculation methodology implemented by the station as described in the Offsite Dose Calculation Manual(s) (ODCMs) is consistent with the methodology provided in the following US NRC Regulatory Guidance for Power Reactors:

- Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1
- Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," Revision 1
- Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors," Revision 1

Doses to members of the public as a result of plant operation during 2023 were calculated to be a fraction of the applicable regulatory limits and pose no health hazard. These doses are summarized and compared to the regulatory limits in Section 2.1, Comparison to Regulatory Limits.

The Annual Radioactive Effluent Release Report (ARERR) is published per REC requirements, NMP Technical Specifications, and 10 CFR 50.36(a). The ARERR 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 processing or direct disposal, and other information as required by site licensing documents.

In addition to monitoring radioactive effluents, Nine Mile Point and James A. FitzPatrick Clean Energy Center (JAF) share a Radiological Environmental Monitoring Program (REMP). The REMP is a comprehensive surveillance program, which is implemented to assess the impact of site operations on the environment and compliance with 10 CFR 20, 40 CFR 190, and 10 CFR 72. Samples are collected from the aquatic and terrestrial pathways applicable to the JAF/NMP site. Aquatic pathways include fish from Lake Ontario, surface water, and lakeshore sediment. Terrestrial pathways include airborne particulate and radioiodine, milk, food products, and direct radiation.

Data from the REMP is published in the JAF/NMP Annual Radiological Environmental Operating Report (AREOR), which can be found on the NRC's website: https://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/nmp1-2.html

2.1 Comparison to Regulatory Limits

Table 1 provides a summary of the maximum dose received by a member of the public in an unrestricted area in 2023 from all gaseous and liquid effluents from Nine Mile Point Unit 2 in comparison with 10 CFR 50 Appendix I limits.

Table 1, Nine Mile Point Unit 2 Dose Comparison to 10 CFR 50 Appendix I Limits[1]

		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual[2]
Liquid Effluent Dose Limit, Total Body	Limit	1.5 mrem	1.5 mrem	1.5 mrem	1.5 mrem	3 mrem
	Total Body Dose	*	*	*	*	*
	% of Limit	*	*	*	*	*
Liquid Effluent Dose Limit, Any Organ	Limit	5 mrem	5 mrem	5 mrem	5 mrem	10 mrem
	Max Organ Dose[2]	*	*	*	*	*
	% of Limit	*	*	*	*	*
Gaseous Effluent Dose Limit, Gamma Air (Noble Gas)	Limit	5 mrad	5 mrad	5 mrad	5 mrad	10 mrad
	Gamma Air Dose	*	*	1.66E-08	*	1.66E-08
	% of Limit	*	*	3.31E-07	*	1.66E-07
Gaseous Effluent Dose Limit, Beta Air (Noble Gas)	Limit	10 mrad	10 mrad	10 mrad	10 mrad	20 mrad
	Beta Air Dose	*	*	4.33E-10	*	4.33E-10
	% of Limit	*	*	4.33E-09	*	2.17E-09
Gaseous Effluent Organ Dose Limit (Iodine-131, Iodine-133, 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]	8.37E-04	7.80E-04	1.45E-03	6.48E-04	3.58E-03
	% of Limit	1.12E-02	1.04E-02	1.94E-02	8.63E-03	2.38E-02

1 Doses based on quarterly and annual limits, on a per reactor basis.
2 The sum of quarterly max organ doses may not equal the annual max organ dose if the quarterly max organ differs from the annual max organ.
3 If activity was not detected, (*) indicates no dose for the period.

Table 2 provides a summary of the maximum dose received by a member of the public in an unrestricted area in 2023 as a result of operations at NMP1, NMP2, and JAF, evaluated against 40 CFR 190 limits.

Table 2, Maximum Dose Received by a Member of the Public in an Unrestricted Area During 2023 Compared to EPA 40 CFR 190 Limits

	Whole Body	Thyroid	Any Other Organ
Dose Limit	25 mrem	75 mrem	25 mrem
All Liquid Effluents	6.89E-06	6.89E-06	6.89E-06
All Gaseous Effluents, excluding C-14	9.08E-02	2.29E-01	2.29E-01
Gaseous C-14	4.16E-02	2.08E-01	2.08E-01
Direct Radiation	2.69E-01	2.69E-01	2.69E-01
Total Dose from All Sources	4.01E-01	7.06E-01	7.06E-01
% of Dose Limit	1.61E+00	9.41E-01	2.82E+00

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.

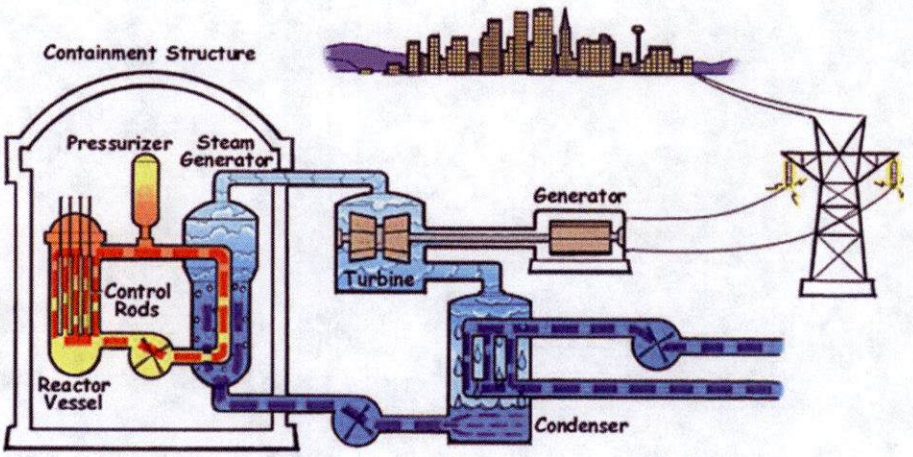

Figure 1, Pressurized Water Reactor (PWR) **[1]**

3.1 (Continued)

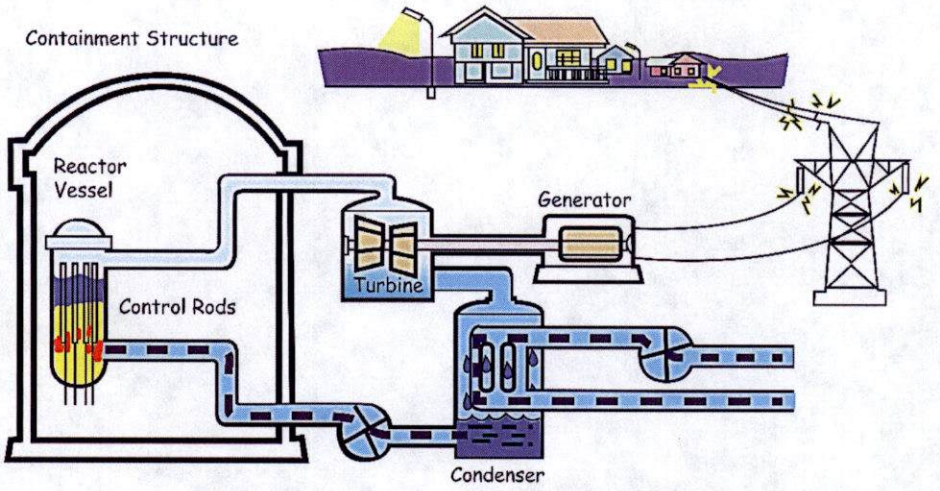

Figure 2, Boiling Water Reactor (BWR) **[2]**

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 turns 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 in order 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 result 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.

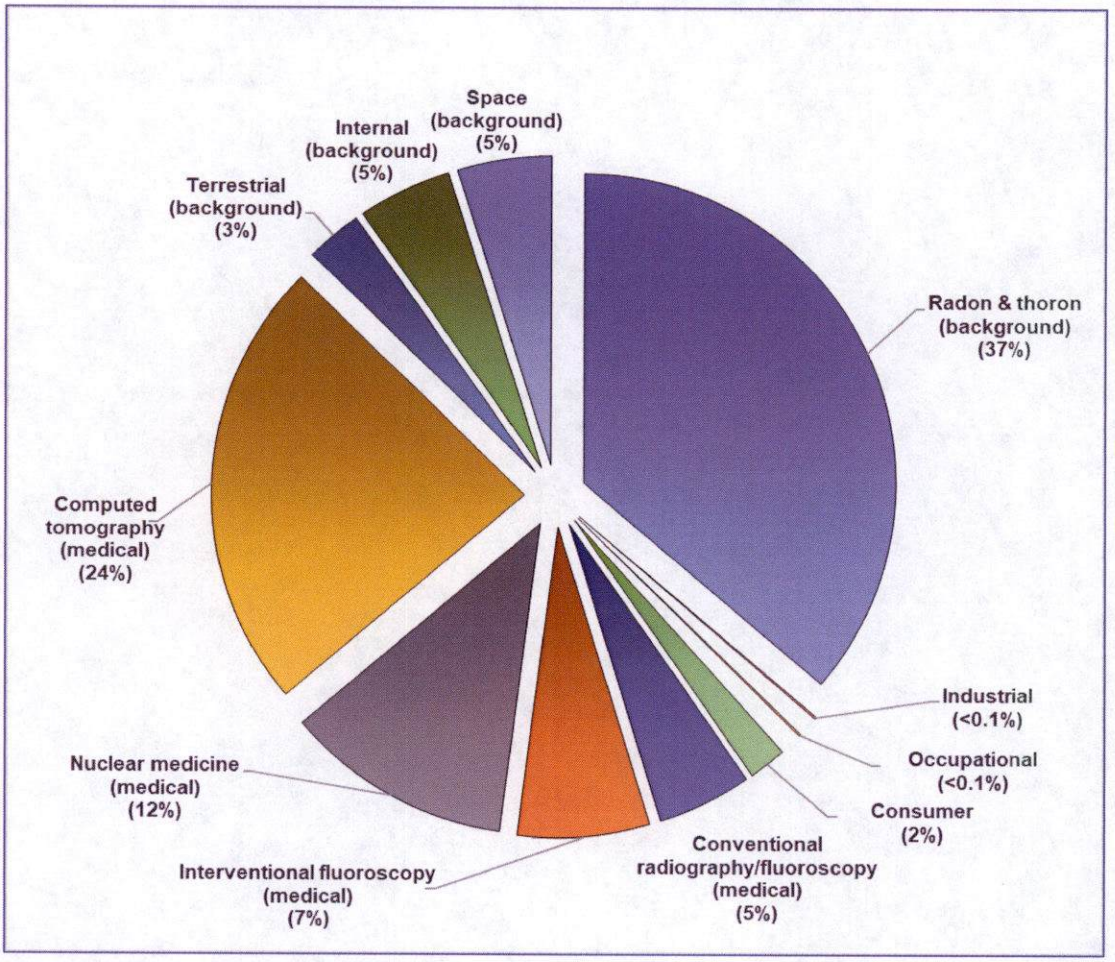

Figure 3, Sources of Radiation Exposure (NCRP Report No. 160) **[3]**

3.2 (Continued)

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% 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 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 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.

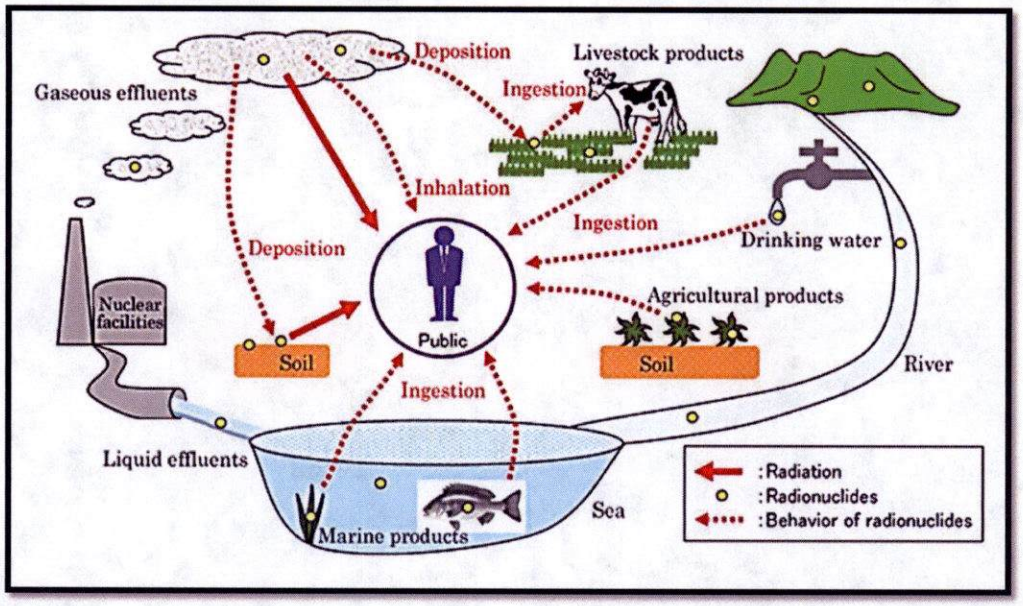

Figure 4, Potential exposure pathways to Members of the Public due to Plant Operations **[6]**

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 [7] and NUREG-0133 [8]. 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.

3.3 (Continued)

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 from the census is used to determine who is the likely to be most exposed to radiation dose as a result of plant operation.

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 for Gaseous and Liquid Effluent Doses

1. Fission and Activation gases:

   a. The dose rate limit of noble gases released in gaseous effluents from the site to areas at and beyond the site boundary shall be:

      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. The 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

2. Tritium, Iodines, and Particulates with Half Lives > 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

3. Liquid Effluents

   a. The concentration of radioactive material released in liquid effluents to unrestricted areas shall be limited to ten times the concentrations specified in 10 CFR Part 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2E-04 microcuries/ml total activity.

   b. 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:

      1) Quarterly

         a) Less than or equal to 1.5 mrem total body

         b) Less than or equal to 5 mrem to any organ

      2) Yearly

         a) Less than or equal to 3 mrem total body

         b) Less than or equal to 10 mrem to any organ

4.2 40 CFR 190 Regulatory Dose Limits for a Member of the Public

1. For any member of the public as the result of exposures to planned discharges of radioactive materials, radon and its daughters excepted, to the general environment from uranium fuel cycle operations and to radiation from these operations, the annual dose equivalent shall not exceed:

   a. 25 millirems to the Whole Body

   b. 75 millirems to the Thyroid

   c. 25 millirems to any other organ

4.3 Measurements and Approximations of Total Radioactivity

Described below are the methods used to measure or approximate the total radioactivity and radionuclide composition in effluents.

1. Fission and Activation Gases
   Noble gas effluent activity is determined by on-line gross activity monitoring (calibrated against gamma isotopic analysis of a 4.0L Marinelli grab sample) of an isokinetic stack sample stream.

2. Iodines
   Iodine effluent activity is determined by gamma spectroscopic analysis (at least weekly) of charcoal cartridges sampled from an isokinetic stack sample stream.

3. Particulates
   Activity released from the main stack is determined by gamma spectroscopic analysis (at least weekly) of particulate filters sampled from an isokinetic sample stream and composite analysis of the filters for non-gamma emitters.

4. Tritium
   Tritium effluent activity is measured by liquid scintillation of monthly samples taken with an air sparging/water trap apparatus. Tritium effluent activity is measured during purge and weekly when fuel is offloaded until stable tritium release rates are demonstrated.

5. Emergency Condenser Vent Effluents
   The effluent curie quantities are estimated based on the isotopic distribution in the Condensate Storage Tank water and the Emergency Condenser shell water. Actual isotopic concentrations are found via gamma spectroscopy. Initial release rates of Sr-89, Sr-90 and Fe-55 are estimated by applying scaling factors to release rates of gamma emitters and actual release rates are determined from post offsite analysis results. The activity of fission and activation gases released due to tube leaks is based on reactor steam leak rates using offgas isotopic analyses.

6. Liquid Effluents
   Isotopic contents of liquid effluents are determined by isotopic analysis of a representative sample of each batch and composite analysis of non-gamma emitters. Tritium activity is estimated on the most recent analysis of the Condensate Storage Tank water. Initial release rates of Sr-89, Sr-90, and Fe-55 are estimated by applying scaling factors to release rates of gamma emitters and actual release rates are determined from post offsite analysis results.

7. Solid Effluents
   Isotopic contents of waste shipments are determined by gamma spectroscopy analysis of a representative sample of each batch. Scaling factors established from primary composite sample analyses conducted off site are applied, where appropriate, to find estimated concentration of non-gamma emitters. For low activity trash shipments, curie content is estimated by dose rate measurement and application of appropriate scaling factors.

8. C-14
   The production of C-14 and the effluent dose consequences are estimates based on EPRI methodology provided in EPRI Report 1021106, Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents, December 2010 and NUREG-0016, Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents for Boiling Water Reactors (BWR-GALE Code).

4.4 Onsite Doses (Within Site Boundary)

Prior to September 11, 2001, the public had access to the Nine Mile Point Nuclear Learning Center (NLC; formerly known as the Energy Information Center) for purposes of observing the educational displays or for picnicking and associated activities. Fishing also occurred near the shoreline adjacent to the Nine Mile Point (NMP) site. Fishing near the shoreline adjacent to the NMP site was the onsite activity that resulted in the potential maximum dose received by a member of the public.

Following September 11, 2001, public access to the NLC has been restricted and fishing by members of the public at locations on site was prohibited. Although fishing was not conducted onsite by members of the public during 2023, the annual dose to a hypothetical fisherman was still evaluated to provide continuity of data for the location.

It is conservatively assumed that the maximum exposed individual spends an average of 8 hours per week from April to December fishing from the shoreline at a location between the NLC and NMP1.

4.4.1 Dose Pathways for Evaluation of Doses to Members of the Public Within the Site Boundary

The pathways considered for the evaluation include the inhalation pathway, the ground dose pathway with the resultant whole body and skin dose and the direct radiation dose pathway with the associated whole body dose. The direct radiation dose pathway includes gamma plume shine, gamma plume submersion, direct shine from the NMP1, NMP2, and JAF facilities, and ground plane deposition, and is evaluated by average environmental TLD readings at the shoreline fishing location between the NLC and NMP1.

Other pathways, such as the ingestion pathway, are not applicable since these doses are included under calculations for doses to members of the public outside of the site boundary. In addition, pathways associated with water related recreational activities, other than fishing, are not applicable here. These include swimming, boating and wading which are prohibited at the facility.

Table 3, Onsite Doses (Within Site Boundary)

Exposure Pathway Dose (mrem)			Total (mrem)
Ground	Inhalation (Max Organ: Thyroid)	Direct Radiation	
0.00E+00	5.66E-03	4.03E-01	4.09E-01

5.0 SUPPLEMENTAL INFORMATION

5.1 Land Use Census Changes

In 2022, three new gardens were planted in the E, ESE, and SE sectors of the JAF owner-controlled area (OCA) which have since served as indicator locations for broad-leaf vegetation sampling. The gardens were planted due to a decline in local personal gardens in recent years and less sample availability.

Based on the 2023 annual land use census, there were no changes to critical receptors and no new sampling locations were required.

5.2 Meteorological Data

NMP and JAF share a joint meteorological monitoring program. During 2023, 74,574 hours of data were captured out of a possible 78,840 parameter hours, which represents an overall data recovery rate of 94.6%. Atmospheric stability classes as measured by 200'-30' vertical temperature difference (ΔT) and joint frequency tables of wind speed and wind direction for each stability class are provided in Attachment 3.

5.3 Effluent Monitoring System Inoperability

Liquid discharge radiation monitor 2LWS-CAB206 and associated discharge flow rate measuring devices 2LWS-FT330 and 2LWS-FT331 are retired in place and were inoperable for all of 2023, as liquid batch discharges are no longer expected to occur and were not performed at NMP2 during 2023. No other effluent radiation monitors or equipment required by the ODCM were inoperable for more than 30 days in 2023.

5.4 Offsite Dose Calculation Manual (ODCM) Changes

No changes to the NMP2 ODCM were made in 2023.

5.5 Process Control Program (PCP) Changes

There were no changes to the PCP in 2023.

5.6 Radioactive Waste Treatment System Changes

There were no changes or modifications to the gaseous radioactive waste treatment system or the liquid radioactive waste treatment system in 2023.

5.7 Independent Spent Fuel Storage Installation (ISFSI) Monitoring Program

Information concerning the ISFSI monitoring program and 2023 annual dose can be found in the 2023 JAF/NMP Annual Radiological Environmental Operating Report, which is published on the NRC's website:
https://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/nmp1-2.html

5.8 Carbon-14

Carbon (C)-14 is a naturally occurring isotope of carbon. Nuclear weapons testing in the 1950s and 1960s significantly increased the amount of C-14 in the atmosphere. Commercial nuclear reactors also produce C-14 but in much lower amounts than those produced naturally or from weapons testing. IAEA Report Number 421 provides relevant information on C-14 releases. In BWRs such as NMP1, NMP2, and JAF, C-14 is primarily formed via neutron activation of ^{17}O in light-water reactor coolant and subsequent alpha decay to ^{14}C (abbreviated as the $^{17}O_{(n,\alpha)}$ ^{14}C nuclear reaction). In BWRs, the majority of the C-14 produced (>95%) is released as gaseous carbon dioxide ($^{14}CO_2$) from the Main Stack(s).

Regulations in 10 CFR 50.36a require that operating procedures be developed for the control of effluents and that quantities of principal radionuclides be reported. The radioactive effluents from commercial nuclear power plants over time has decreased to the point that C-14 is likely to have become a principal radionuclide in gaseous effluents.

Estimation of gaseous release of C-14 from the NMP1 and NMP2 Main Stack(s) is determined using the methodology described in EPRI Report 1021106, *Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents* (December 2010). The estimate is based on a normalized C-14 production rate of 5.1 Ci/GWt-yr, a gaseous release fraction of 0.99, a $^{14}CO_2$ release fraction of 0.95, and rated thermal power and Equivalent Full Power Days (EFPD) of operation for each reactor unit during 2023.

The estimated C-14 activity released from each BWR during 2023 is summarized below.

Table 4, Estimated C-14 Activity Released From NMP1, NMP2, and JAF in 2023

BWR	Gaseous Release Fraction	$^{14}CO_2$ Form Release Fraction	EFPD	Total Release (Ci)	$^{14}CO_2$ Release (Ci)
NMP1	0.99	0.95	317	8.12	7.72
NMP2			356	19.63	18.64
JAF			364	10.80	10.26

5.9 Errata/Corrections to Previous ARERRs

For the 2021 NMP1 and NMP2 ARERRs, the groundwater tritium results for 2020 were erroneously submitted. The 2021 groundwater tritium results are included in Attachment 4, Errata and Corrections to the 2021 NMP1 and NMP2 ARERRs.

Multiple errata were identified in the 2022 NMP2 ARERR. A full summary of all errata and the corrected pages in their entirety are included in Attachment 6, Errata and Corrections to the 2022 NMP2 ARERR.

5.10 Other Information

An external vendor performs particulate gross alpha measurements for NMP and participates in a quarterly crosscheck program. In the 3rd Quarter of 2023, for a gross alpha crosscheck sample, a disagreement was discovered between the result obtained by the vendor and the reference value. The gross alpha crosscheck is a particulate filter with a mylar cover that seals the sample to the filter. The vendor only measured the filter and the majority of the spike sample which remained on the mylar cover was not included in the reported result. Following investigation, the vendor identified that the sample was incorrectly analyzed. This was confirmed after analysis of the mylar cover was performed. When summing the results from the filter and mylar cover, the total concentration agreed with the reference value.

6.0 NEI 07-07 ONSITE RADIOLOGICAL GROUNDWATER MONITORING PROGRAM

Nine Mile Point 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 in order to prevent migration of licensed radioactive material off-site and to quantify impacts on decommissioning. Monitoring wells installed as part of GPI program are sampled and analyzed for Tritium (H-3) annually and quarterly.

Table 5, Groundwater Protection Program Monitoring Well Results

Nine Mile Point 1 and 2 Groundwater Tritium Results			**Reporting Period: January - December 2023**	
Well Identification Number	# Samples Collected	# Positive Samples	Minimum H-3 Concentration (pCi/L)	Maximum H-3 Concentration (pCi/L)
GMX-MW1*	1	0	<176	<176
MW-1	1	0	<172	<173
MW-5	4	0	<175	<191
MW-6	1	0	<179	<179
MW-7	1	0	<195	<195
MW-8	4	0	<176	<193
MW-9[1]	4	0	<177	<197
MW-10[1]	1	0	<197	<197
MW-11	1	0	<194	<194
MW-12	1	0	<196	<196
MW-13	1	0	<192	<192
MW-14*	1	0	<198	<198
MW-15	4	0	<173	<198
MW-16	1	0	<194	<194
MW-17	4	0	<174	<196
MW-18	4	0	<175	<198
MW-19	1	0	<194	<194
MW-20	1	0	<199	<199
MW-21	1	0	<198	<198
PZ-1	2	0	<180	<197
PZ-7	4	0	<176	<195
PZ-8	4	0	<177	<198

* Control Location
[1] Sentinel well location

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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, Effluent Summary Tables

Table 6, Average Energies, Batch & Abnormal Releases

Average Energy (Fission and Activation gases - MeV):

Qrtr.1	Eγ	=	N/A	Eβ	=	N/A
Qrtr.2	Eγ	=	N/A	Eβ	=	N/A
Qrtr.3	Eγ	=	1.62E-04	Eβ	=	2.07E-04
Qrtr.4	Eγ	=	N/A	Eβ	=	N/A

Liquid:

	Radwaste
Number of Batch Releases	0
Total Time Period for Batch Releases (hrs)	0
Maximum Time Period for a Batch Release (hrs)	0
Average Time Period for a Batch Release (hrs)	0
Minimum Time Period for a Batch Release (hrs)	0

Total volume of water used to dilute the liquid effluent during release period (L)		1st	2nd	3rd	4th
	Radwaste	N/A	N/A	N/A	N/A

Total volume of water available to dilute the liquid effluent during report period (L)		1st	2nd	3rd	4th
	Radwaste	9.12E+09	9.69E+09	1.22E+10	1.06E+10

Gaseous (Primary Containment Purge):

Number of Batch Releases	4
Total Time Period for Batch Releases (hrs)	8.47
Maximum Time Period for a Batch Release (hrs)	2.12
Average Time Period for a Batch Release (hrs)	2.12
Minimum Time Period for a Batch Release (hrs)	2.12

Abnormal Releases:

A. Liquids:

Number of Releases	0	
Total Activity Released	N/A	Ci

B. Gaseous:

Number of Releases	0	
Total Activity Released	N/A	Ci

Table 7, Gaseous Effluents – Summation of All Releases, Elevated and Ground Level

		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	EST. TOTAL ERROR %
A. Fission & Activation Gases (1)						
1. Total Release	Ci	**	**	6.55E-04	**	5.00E+01
2. Average Release Rate for Period	µCi/sec	**	**	8.23E-05	**	
B. Iodines (1)						
1. Total Iodine - 131	Ci	**	**	2.93E-05	**	3.00E+01
2. Average Release Rate for Period	µCi/sec	**	**	3.69E-06	**	
C. Particulates (1)						
1. Particulates with Half-lives>8 days	Ci	3.06E-04	2.73E-04	3.76E-04	2.15E-04	3.00E+01
2. Average Release Rate for Period	µCi/sec	3.94E-05	3.48E-05	4.73E-05	2.71E-05	
3. Gross Alpha Radioactivity	Curies	**	**	**	**	2.50E+01
D. Tritium (1)						
1. Total Release	Ci	2.01E+01	2.16E+01	2.35E+01	1.95E+01	5.00E+01
2. Average Release Rate for Period	µCi/sec	2.59E+00	2.74E+00	2.95E+00	2.46E+00	

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Table 8, Gaseous Effluents – Elevated Release Continuous Mode

Nuclides Released		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Fission Gases (1)					
Ar-41	Ci	**	**	**	**
Kr-85	Ci	**	**	**	**
Kr-85m	Ci	**	**	**	**
Kr-87	Ci	**	**	**	**
Kr-88	Ci	**	**	**	**
Xe-131m	Ci	**	**	**	**
Xe-133	Ci	**	**	**	**
Xe-133m	Ci	**	**	**	**
Xe-135	Ci	**	**	**	**
Xe-135m	Ci	**	**	**	**
Xe-137	Ci	**	**	**	**
Xe-138	Ci	**	**	**	**
Xe-127	Ci	**	**	**	**
Iodines (1)					
I-131	Ci	**	**	2.93E-05	**
I-133	Ci	**	**	2.57E-04	1.75E-05
I-135	Ci	**	**	**	**
Particulates (1)					
Cr-51	Ci	**	**	**	**
Mn-54	Ci	**	**	5.26E-07	**
Fe-55	Ci	**	**	**	**
Fe-59	Ci	**	**	**	**
Co-58	Ci	**	**	**	**
Co-60	Ci	1.08E-04	9.93E-05	1.27E-04	8.90E-05
Zn-65	Ci	**	**	**	**
Sr-89	Ci	**	**	**	**
Sr-90	Ci	**	**	**	**
Nb-95	Ci	**	**	**	**
Cs-134	Ci	**	**	**	**
Cs-136	Ci	**	**	**	**
Cs-137	Ci	**	**	**	**
Ba-140	Ci	**	**	**	**
La-140	Ci	**	**	**	**
Ce-141	Ci	**	**	**	**
Ce-144	Ci	**	**	**	**
Nd-147	Ci	**	**	**	**
H-3 (1)	Ci	1.38E+01	1.56E+01	1.60E+01	1.37E+01

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Table 9, Gaseous Effluents – Elevated Release Batch Mode

Nuclides Released		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Fission Gases (1)					
Ar-41	Ci	**	**	**	**
Kr-85	Ci	**	**	**	**
Kr-85m	Ci	**	**	**	**
Kr-87	Ci	**	**	**	**
Kr-88	Ci	**	**	**	**
Xe-131m	Ci	**	**	**	**
Xe-133	Ci	**	**	**	**
Xe-133m	Ci	**	**	**	**
Xe-135	Ci	**	**	6.55E-04	**
Xe-135m	Ci	**	**	**	**
Xe-137	Ci	**	**	**	**
Xe-138	Ci	**	**	**	**
Xe-127	Ci	**	**	**	**
Iodines (1)					
I-131	Ci	**	**	**	**
I-133	Ci	**	**	**	**
I-135	Ci	**	**	**	**
Particulates (1)					
Cr-51	Ci	**	**	**	**
Mn-54	Ci	**	**	**	**
Fe-55	Ci	**	**	**	**
Fe-59	Ci	**	**	**	**
Co-58	Ci	**	**	**	**
Co-60	Ci	**	**	2.36E-05	**
Zn-65	Ci	**	**	**	**
Sr-89	Ci	**	**	**	**
Sr-90	Ci	**	**	**	**
Nb-95	Ci	**	**	**	**
Cs-134	Ci	**	**	**	**
Cs-136	Ci	**	**	**	**
Cs-137	Ci	**	**	6.23E-06	**
Ba-140	Ci	**	**	**	**
La-140	Ci	**	**	**	**
Ce-141	Ci	**	**	**	**
Ce-144	Ci	**	**	**	**
Nd-147	Ci	**	**	**	**
H-3 (1)	Ci	**	1.52E-01	1.52E-01	**

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Table 10, Gaseous Effluents – Ground Release Continuous Mode

Nuclides Released		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Fission Gases (1)					
Ar-41	Ci	**	**	**	**
Kr-85	Ci	**	**	**	**
Kr-85m	Ci	**	**	**	**
Kr-87	Ci	**	**	**	**
Kr-88	Ci	**	**	**	**
Xe-131m	Ci	**	**	**	**
Xe-133	Ci	**	**	**	**
Xe-133m	Ci	**	**	**	**
Xe-135	Ci	**	**	**	**
Xe-135m	Ci	**	**	**	**
Xe-137	Ci	**	**	**	**
Xe-138	Ci	**	**	**	**
Xe-127	Ci	**	**	**	**
Iodines (1)					
I-131	Ci	**	**	**	**
I-133	Ci	**	**	**	**
I-135	Ci	**	**	**	**
Particulates (1)					
Cr-51	Ci	**	**	**	**
Mn-54	Ci	3.25E-06	**	**	**
Fe-55	Ci	**	**	**	**
Fe-59	Ci	**	**	**	**
Co-58	Ci	**	**	**	**
Co-60	Ci	1.95E-04	1.74E-04	2.19E-04	1.26E-04
Zn-65	Ci	**	**	**	**
Sr-89	Ci	**	**	**	**
Sr-90	Ci	**	**	**	**
Nb-95	Ci	**	**	**	**
Cs-134	Ci	**	**	**	**
Cs-136	Ci	**	**	**	**
Cs-137	Ci	**	**	**	**
Ba-140	Ci	**	**	**	**
La-140	Ci	**	**	**	**
Ce-141	Ci	**	**	**	**
Ce-144	Ci	**	**	**	**
Nd-147	Ci	**	**	**	**
H-3 (1)	Ci	6.36E+00	5.86E+00	7.27E+00	5.89E+00

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Table 11, Gaseous Effluents – Ground Release Batch Mode

Nuclides Released		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Fission Gases (1)					
Ar-41	Ci	**	**	**	**
Kr-85	Ci	**	**	**	**
Kr-85m	Ci	**	**	**	**
Kr-87	Ci	**	**	**	**
Kr-88	Ci	**	**	**	**
Xe-131m	Ci	**	**	**	**
Xe-133	Ci	**	**	**	**
Xe-133m	Ci	**	**	**	**
Xe-135	Ci	**	**	**	**
Xe-135m	Ci	**	**	**	**
Xe-137	Ci	**	**	**	**
Xe-138	Ci	**	**	**	**
Xe-127	Ci	**	**	**	**
Iodines (1)					
I-131	Ci	**	**	**	**
I-133	Ci	**	**	**	**
I-135	Ci	**	**	**	**
Particulates (1)					
Cr-51	Ci	**	**	**	**
Mn-54	Ci	**	**	**	**
Fe-55	Ci	**	**	**	**
Fe-59	Ci	**	**	**	**
Co-58	Ci	**	**	**	**
Co-60	Ci	**	**	**	**
Zn-65	Ci	**	**	**	**
Sr-89	Ci	**	**	**	**
Sr-90	Ci	**	**	**	**
Nb-95	Ci	**	**	**	**
Cs-134	Ci	**	**	**	**
Cs-136	Ci	**	**	**	**
Cs-137	Ci	**	**	**	**
Ba-140	Ci	**	**	**	**
La-140	Ci	**	**	**	**
Ce-141	Ci	**	**	**	**
Ce-144	Ci	**	**	**	**
Nd-147	Ci	**	**	**	**
H-3 (1)	Ci	**	**	**	**

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Table 12, Liquid Effluents – Summation of All Releases

		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	EST. TOTAL ERROR %
A. Fission & Activation Products						
1. Total Release (not including Tritium, gases, alpha)	Curies	No Releases	No Releases	No Releases	No Releases	5.00E+01
2. Average diluted concentration during the reporting period	µCi/ml	No Releases	No Releases	No Releases	No Releases	
B. Tritium						
1. Total Release	Curies	No Releases	No Releases	No Releases	No Releases	5.00E+01
2. Average diluted concentration during the reporting period	µCi/ml	No Releases	No Releases	No Releases	No Releases	
C. Dissolved & Entrained Gases						
1. Total Release	Curies	No Releases	No Releases	No Releases	No Releases	5.00E+01
2. Average diluted concentration during the reporting period	µCi/ml	No Releases	No Releases	No Releases	No Releases	
D. Gross Alpha						
1. Total Release	Curies	No Releases	No Releases	No Releases	No Releases	5.00E+01
E. Volumes						
1. Prior to Dilution	Liters	No Releases	No Releases	No Releases	No Releases	5.00E+01
2. Volume of dilution water used during release period	Liters	No Releases	No Releases	No Releases	No Releases	5.00E+01
3. Volume of dilution water available during reporting period - Cooling	Liters	9.12E+09	9.69E+09	1.22E+10	1.06E+10	5.00E+01
F. Percent of Tech. Spec. Limits						
Percent of Quarterly Whole Body Dose Limit (1.5 mrem)	%	No Releases	No Releases	No Releases	No Releases	
Percent of Annual Whole Body Dose Limit to Date (3 mrem)	%	No Releases	No Releases	No Releases	No Releases	
Percent of Quarterly Organ Dose Limit (5 mrem)	%	No Releases	No Releases	No Releases	No Releases	
Percent of Annual Organ Dose Limit to Date (10 mrem)	%	No Releases	No Releases	No Releases	No Releases	
Percent of 10CFR20 Concentration Limit	%	No Releases	No Releases	No Releases	No Releases	
Percent of Dissolved or Entrained Noble Gas Limit (2.00E-04 uCi/ml)	%	No Releases	No Releases	No Releases	No Releases	

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Table 13, Liquid Effluents Released Batch Mode

Nuclides Released		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Fission & Activation Products					
Na-24	Ci	No Releases	No Releases	No Releases	No Releases
Cr-51	Ci	No Releases	No Releases	No Releases	No Releases
Mn-54	Ci	No Releases	No Releases	No Releases	No Releases
Mn-56	Ci	No Releases	No Releases	No Releases	No Releases
Fe-55	Ci	No Releases	No Releases	No Releases	No Releases
Fe-59	Ci	No Releases	No Releases	No Releases	No Releases
Co-60	Ci	No Releases	No Releases	No Releases	No Releases
Ni-65	Ci	No Releases	No Releases	No Releases	No Releases
Cu-64	Ci	No Releases	No Releases	No Releases	No Releases
Zn-65	Ci	No Releases	No Releases	No Releases	No Releases
Sr-89	Ci	No Releases	No Releases	No Releases	No Releases
Sr-90	Ci	No Releases	No Releases	No Releases	No Releases
Zr-95	Ci	No Releases	No Releases	No Releases	No Releases
Nb-95	Ci	No Releases	No Releases	No Releases	No Releases
Mo-99	Ci	No Releases	No Releases	No Releases	No Releases
I-133	Ci	No Releases	No Releases	No Releases	No Releases
Cs-134	Ci	No Releases	No Releases	No Releases	No Releases
Cs-136	Ci	No Releases	No Releases	No Releases	No Releases
Cs-137	Ci	No Releases	No Releases	No Releases	No Releases
Ba-140	Ci	No Releases	No Releases	No Releases	No Releases
La-140	Ci	No Releases	No Releases	No Releases	No Releases
Ce-141	Ci	No Releases	No Releases	No Releases	No Releases
Ce-144	Ci	No Releases	No Releases	No Releases	No Releases
Dissolved or Entrained	Ci	No Releases	No Releases	No Releases	No Releases
H-3	Ci	No Releases	No Releases	No Releases	No Releases

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Table 14, Liquid Effluents Released Continuous Mode

Nuclides Released		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Fission & Activation Products					
Na-24	Ci	No Releases	No Releases	No Releases	No Releases
Cr-51	Ci	No Releases	No Releases	No Releases	No Releases
Mn-54	Ci	No Releases	No Releases	No Releases	No Releases
Mn-56	Ci	No Releases	No Releases	No Releases	No Releases
Fe-55	Ci	No Releases	No Releases	No Releases	No Releases
Fe-59	Ci	No Releases	No Releases	No Releases	No Releases
Co-60	Ci	No Releases	No Releases	No Releases	No Releases
Ni-65	Ci	No Releases	No Releases	No Releases	No Releases
Cu-64	Ci	No Releases	No Releases	No Releases	No Releases
Zn-65	Ci	No Releases	No Releases	No Releases	No Releases
Sr-89	Ci	No Releases	No Releases	No Releases	No Releases
Sr-90	Ci	No Releases	No Releases	No Releases	No Releases
Zr-95	Ci	No Releases	No Releases	No Releases	No Releases
Nb-95	Ci	No Releases	No Releases	No Releases	No Releases
Mo-99	Ci	No Releases	No Releases	No Releases	No Releases
I-133	Ci	No Releases	No Releases	No Releases	No Releases
Cs-134	Ci	No Releases	No Releases	No Releases	No Releases
Cs-136	Ci	No Releases	No Releases	No Releases	No Releases
Cs-137	Ci	No Releases	No Releases	No Releases	No Releases
Ba-140	Ci	No Releases	No Releases	No Releases	No Releases
La-140	Ci	No Releases	No Releases	No Releases	No Releases
Ce-141	Ci	No Releases	No Releases	No Releases	No Releases
Ce-144	Ci	No Releases	No Releases	No Releases	No Releases
Dissolved or Entrained	Ci	No Releases	No Releases	No Releases	No Releases
H-3	Ci	No Releases	No Releases	No Releases	No Releases

(1) Concentrations less than the lower limit of detection of the counting system used are indicated with a double asterisk.

Attachment 2, Solid Waste Information

NRC Regulatory Guide 1.21 Report

Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream

During Period From: 01/01/2023 to 12/31/2023

Resins, Filters, And Evaporator Bottoms			
Waste Class	Volume ft³	Volume m³	Curies Shipped
A	3.17E+03	8.98E+01	6.57E+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	3.17E+03	8.98E+01	6.57E+01

Major Nuclides for the Above Table:
H-3, C-14, Mn-54, Fe-55, Co-58, Co-60, Ni-63, Zn-65, Sr-90, Zr-95, Nb-95, Tc-99, Sn-113, Sb-125, I-129, Cs-137, Pu-238, Pu-239, Pu-241, Am-241, Cm-244

Dry Active Waste (DAW)			
Waste Class	Volume ft³	Volume m³	Curies Shipped
A	2.50E+04	7.08E+02	1.57E+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	2.50E+04	7.08E+02	1.57E+00

Major Nuclides for the Above Table:
H-3, C-14, Cr-51, Mn-54, Fe-55, Fe-59, Co-60, Ni-63, Zn-65, Sr-90, Nb-95, Tc-99, I-129, Cs-137, Pu-238, Pu-241, Am-241, Cm-242, Cm-244

Irradiated Components			
Waste Class	Volume ft³	Volume m³	Curies Shipped
A	4.90E+00	1.39E-01	4.76E+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	4.90E+00	1.39E-01	4.76E+00

Major Nuclides for the Above Table:
H-3, C-14, Fe-55, Co-60, Ni-59, Ni-63, Sr-90, Nb-94, Tc-99, I-129, Cs-137, Pu-238, Pu-241, Am-241, Cm-242,
Cm-244

NRC Regulatory Guide 1.21 Report

Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Waste Class and Stream

During Period From: 01/01/2023 to 12/31/2023

Other Waste			
Waste Class	Volume ft³	Volume m³	Curies Shipped
A	1.55E+03	4.40E+01	1.54E+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	1.55E+03	4.40E+01	1.54E+01

Major Nuclides for the Above Table:

H-3, C-14, Cr-51, Mn-54, Fe-55, Fe-59, Co-60, Ni-63, Zn-65, Sr-90, Nb-95, Tc-99, I-129, Cs-137, Pu-238, Pu-241, Am-241, Cm-242, Cm-244

Sum Of All Low-Level Waste Shipped From Site			
Waste Class	Volume ft³	Volume m³	Curies Shipped
A	2.97E+04	8.42E+02	8.74E+01
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
Unclassified	0.00E+00	0.00E+00	0.00E+00
All	2.97E+04	8.42E+02	8.74E+01

Major Nuclides for the Above Table:

H-3, C-14, Cr-51, Mn-54, Fe-55, Fe-59, Co-58, Co-60, Ni-59, Ni-63, Zn-65, Sr-90, Zr-95, Nb-94, Nb-95, Tc-99, Sn-113, Sb-125, I-129, Cs-137, Pu-238, Pu-239, Pu-241, Am-241, Cm-242, Cm-244

NRC Regulatory Guide 1.21 Activity Report

Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Shipment, Package, and Category

During Period From: 01/01/2023 to 12/31/2023 Percent Cutoff: 1.0%

Dry Active Waste

Waste Class A

Nuclide Name	Abundance	Activity (Ci)
Mn-54	2.46%	3.87E-02
Fe-55	9.68%	1.52E-01
Co-60	85.41%	1.34E+00
Zn-65	1.23%	1.92E-02

Total Combined

Nuclide Name	Abundance	Activity (Ci)
Mn-54	2.46%	3.87E-02
Fe-55	9.68%	1.52E-01
Co-60	85.41%	1.34E+00
Zn-65	1.23%	1.92E-02

Irradiated Components

Waste Class A

Nuclide Name	Abundance	Activity (Ci)
Fe-55	42.41%	2.02E+00
Co-60	47%	2.24E+00
Ni-63	10.27%	4.88E-01

Total Combined

Nuclide Name	Abundance	Activity (Ci)
Fe-55	42.41%	2.02E+00
Co-60	47%	2.24E+00
Ni-63	10.27%	4.88E-01

NRC Regulatory Guide 1.21 Activity Report

Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Shipment, Package, and Category

During Period From: 01/01/2023 to 12/31/2023 Percent Cutoff: 1.0%

Other Waste

Waste Class A

Nuclide Name	Abundance	Activity (Ci)
Cr-51	2.11%	3.26E-01
Mn-54	3.09%	4.77E-01
Fe-55	7.61%	1.17E+00
Co-60	82.43%	1.27E+01
Zn-65	2.23%	3.44E-01

Total Combined

Nuclide Name	Abundance	Activity (Ci)
Cr-51	2.11%	3.26E-01
Mn-54	3.09%	4.77E-01
Fe-55	7.61%	1.17E+00
Co-60	82.43%	1.27E+01
Zn-65	2.23%	3.44E-01

Resins, Filters, and Evap Bottoms

Waste Class A

Nuclide Name	Abundance	Activity (Ci)
Mn-54	2.9%	1.90E+00
Fe-55	13.18%	8.65E+00
Co-60	63.3%	4.16E+01
Zr-95	5.37%	3.53E+00
Nb-95	11.78%	7.73E+00

Total Combined

Nuclide Name	Abundance	Activity (Ci)
Mn-54	2.9%	1.90E+00
Fe-55	13.18%	8.65E+00
Co-60	63.3%	4.16E+01
Zr-95	5.37%	3.53E+00
Nb-95	11.78%	7.73E+00

NRC Regulatory Guide 1.21 Activity Report

Solid Waste Shipped Offsite for Disposal and Estimates of Major Nuclides by Shipment, Package, and Category

During Period From: 01/01/2023 to 12/31/2023 Percent Cutoff: 1.0%

Sum of All 4 Categories

Waste Class A

Nuclide Name	Abundance	Activity (Ci)
Mn-54	2.78%	2.43E+00
Fe-55	13.73%	1.20E+01
Co-60	66.19%	5.79E+01
Ni-63	1.1%	9.60E-01
Zn-65	1.06%	9.26E-01
Zr-95	4.03%	3.53E+00
Nb-95	8.98%	7.85E+00

Total Combined

Nuclide Name	Abundance	Activity (Ci)
Mn-54	2.78%	2.43E+00
Fe-55	13.73%	1.20E+01
Co-60	66.19%	5.79E+01
Ni-63	1.1%	9.60E-01
Zn-65	1.06%	9.26E-01
Zr-95	4.03%	3.53E+00
Nb-95	8.98%	7.85E+00

WMG Suite 9.6.2

Report date: 3/12/2024

NRC Regulatory Guide 1.21 Report
Shipment and Package Summary

Solid Waste Shipped Offsite for Disposal

During Period from: 1/1/2023 to 12/31/2023

Shipment Date	Manifest ID	Destination	Package Name	Category Name	NRC Class	DOT Type
2/9/2023	23-2002	Energy Solutions (CVRF)	685221-1	Dry Active Waste	A	Type A
2/13/2023	23-2003	Energy Solutions (CVRF)	685221-4	Dry Active Waste	A	Type A
2/15/2023	22-2073	Energy Solutions (CVRF)	ESUU600125	Other Waste	A	A LSA-II
2/16/2023	23-2004	Energy Solutions (CVRF)	685221-5	Dry Active Waste	A	Type A
3/2/2023	1039-C-0062	Energy Solutions Clive CWF	PO708125-3	Resins, Filters, and Evap Bottoms	A	Type A
3/6/2023	1039-C-0063	Energy Solutions Clive CWF	PO701178-14	Resins, Filters, and Evap Bottoms	A	Type A
3/9/2023	1039-C-0064	Energy Solutions Clive CWF	PO701178-9	Resins, Filters, and Evap Bottoms	A	Type A
3/13/2023	1039-C-0065	Energy Solutions Clive CWF	PO703215-38	Resins, Filters, and Evap Bottoms	A	Type A
3/16/2023	1039-C-0066	Energy Solutions Clive CWF	PO708125-4	Resins, Filters, and Evap Bottoms	A	Type A
3/20/2023	1039-C-0067	Energy Solutions Clive CWF	PO705952-27	Resins, Filters, and Evap Bottoms	A	Type A
3/22/2023	19-2020	Energy Solutions (CVRF)	692070-3	Irradiated Components	A	Type A
3/23/2023	1039-C-0068	Energy Solutions Clive CWF	PO702141-31	Resins, Filters, and Evap Bottoms	A	Type A
3/27/2023	1039-C-0069	Energy Solutions Clive CWF	PO703215-15	Resins, Filters, and Evap Bottoms	A	Type A
3/30/2023	1039-C-0070	Energy Solutions Clive CWF	PO701178-13	Resins, Filters, and Evap Bottoms	A	Type A
4/3/2023	1039-C-0071	Energy Solutions Clive CWF	PO703215-19	Resins, Filters, and Evap Bottoms	A	Type A

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Report date: 3/12/2024

NRC Regulatory Guide 1.21 Report
Shipment and Package Summary

Solid Waste Shipped Offsite for Disposal

During Period from: 1/1/2023 to 12/31/2023

4/5/2023	1039-C-0072	Energy Solutions Clive CWF	PO703215-39	Resins, Filters, and Evap Bottoms	A	Type A
4/20/2023	23-2006	Energy Solutions (CVRF)	ESUU600123	Other Waste	A	A LSA-II
5/30/2023	NMP-2023-2011	Energy Solutions (CVRF)	2023-2011	Other Waste	A	Type A
6/12/2023	NMP-2023-2009	Energy Solutions (CVRF)	ESUU300682	Dry Active Waste	A	A LSA-II
6/19/2023	1039-C-0074	Energy Solutions Clive CWF	PO701178-15	Resins, Filters, and Evap Bottoms	A	Type A
6/26/2023	1039-C-0076	Energy Solutions Clive CWF	PO705952-25	Resins, Filters, and Evap Bottoms	A	Type A
6/29/2023	1039-C-0077	Energy Solutions Clive CWF	PO709436-46	Resins, Filters, and Evap Bottoms	A	Type A
7/24/2023	1039-C-0078	Energy Solutions Clive CWF	PO711398-89	Resins, Filters, and Evap Bottoms	A	Type A
7/31/2023	1039-C-0079	Energy Solutions Clive CWF	PO711398-27	Resins, Filters, and Evap Bottoms	A	Type A
8/7/2023	1039-C-0080	Energy Solutions Clive CWF	PO711398-93	Resins, Filters, and Evap Bottoms	A	Type A
8/16/2023	NMP-2023-2018	Energy Solutions (CVRF)	ESUU300636	Dry Active Waste	A	A LSA-II
8/23/2023	NMP-2023-2020	Energy Solutions (CVRF)	2023-2020	Other Waste	A	Type A
10/30/2023	23-2007	Energy Solutions (CVRF)	PO710636-38	Other Waste	A	Type A
10/30/2023	19-2002	Energy Solutions (CVRF)	PO674444-18	Other Waste	A	Type A
11/6/2023	1039-C-0065	Energy Solutions Clive CWF	PO711398-94	Resins, Filters, and Evap Bottoms	A	Type A
11/6/2023	1039-C-0084	Energy Solutions Clive CWF	2023-2027	Resins, Filters, and Evap Bottoms	A	Type A

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Report date: 3/12/2024

NRC Regulatory Guide 1.21 Report
Shipment and Package Summary

Solid Waste Shipped Offsite for Disposal

During Period from: 1/1/2023 to 12/31/2023

11/9/2023	20-2064	Energy Solutions (Memphis)	NMP-023	Dry Active Waste	A	A LSA-II
			NMP-067	Dry Active Waste	A	Limited Quantity
11/9/2023	20-2065	Energy Solutions (Memphis)	NMP-032	Dry Active Waste	A	A LSA-II
			NMP-037	Dry Active Waste	A	A LSA-II
11/9/2023	20-2066	Energy Solutions (Memphis)	NMP-033	Dry Active Waste	A	A LSA-II
			300168	Dry Active Waste	A	A LSA-II
11/16/2023	20-2069	Energy Solutions (Memphis)	NMP-064	Dry Active Waste	A	A LSA-II
			NMP-012	Dry Active Waste	A	A LSA-II
11/16/2023	20-2068	Energy Solutions (Memphis)	55113	Dry Active Waste	A	A LSA-II
			NMP-046	Dry Active Waste	A	A LSA-II
11/16/2023	20-2067	Energy Solutions (Memphis)	NMP-059	Dry Active Waste	A	A LSA-II
			NMP-017	Dry Active Waste	A	A LSA-II
11/29/2023	NMP-2023-2015	Energy Solutions (CVRF)	ESUU400056	Dry Active Waste	A	A LSA-II
11/30/2023	20-2070	Energy Solutions (Memphis)	NMP-011	Dry Active Waste	A	A LSA-II
			288008	Dry Active Waste	A	A LSA-II
11/30/2023	20-2071	Energy Solutions (Memphis)	NMP-053	Dry Active Waste	A	A LSA-II
			NMP-007	Dry Active Waste	A	A LSA-II

Total Shipments by Carrier

Number of Shipments per each carrier

Number of Shipments	Mode of Transportation	Destination
13	Hittman Transport	Energy Solutions (CVRF) Bear Creek Operations
8	Hittman Transport	Energy Solutions (Memphis) 1790 Dock Street
19	Hittman Transport	Energy Solutions Clive CWF Clive Disposal Site - Containerized Waste Facility

Attachment 3

Classification of Atmospheric Stability and Joint Frequency Tables for 2023

Table 5

Atmospheric Stability Classes

Class	Differential Temperature Interval (in °C/100m) [1]	Differential Temperature Interval (in °F over the 100-30ft. range) [2]	Differential Temperature Interval (in °F over the 200-30ft. range) [2]
Extremely Unstable	$\Delta T \leq -1.9$	$\Delta T \leq -0.7$	$\Delta T \leq -1.8$
Moderately Unstable	$-1.9 < \Delta T \leq -1.7$	$-0.7 < \Delta T \leq -0.6$	$-1.8 < \Delta T \leq -1.6$
Slightly Unstable	$-1.7 < \Delta T \leq -1.5$	$-0.6 < \Delta T \leq -0.5$	$-1.6 < \Delta T \leq -1.4$
Neutral	$-1.5 < \Delta T \leq -0.5$	$-0.5 < \Delta T \leq -0.2$	$-1.4 < \Delta T \leq -0.5$
Slightly Stable	$-0.5 < \Delta T \leq 1.5$	$-0.2 < \Delta T \leq 0.5$	$-0.5 < \Delta T \leq 1.4$
Moderately Stable	$1.5 < \Delta T \leq 4.0$	$0.5 < \Delta T \leq 1.5$	$1.4 < \Delta T \leq 3.7$
Extremely Stable	$4.0 < \Delta T$	$1.5 < \Delta T$	$3.7 < \Delta T$

[1] from NRC Regulatory Guide 1.23, Revision 1
[2] Reg Guide 1.23, Rev 1 intervals scaled for instrument heights on the Nine Mile Point meteorological tower

2023

Joint Frequency Tables

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

All Stabilities

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	10	16	39	86	98	77	43	31	1	0	401
NNE	0	8	16	34	121	152	71	20	2	0	0	424
NE	2	16	32	67	128	80	15	1	0	0	0	341
ENE	3	22	63	52	48	4	0	0	0	0	0	192
E	4	37	67	62	47	16	0	0	0	0	0	233
ESE	6	39	73	83	143	91	40	12	5	0	0	492
SE	8	62	111	96	254	309	122	57	32	0	0	1051
SSE	5	57	82	108	240	206	73	26	8	0	0	805
S	2	16	48	72	195	220	55	35	5	0	0	648
SSW	4	14	33	47	90	114	14	7	0	0	0	323
SW	2	19	34	33	75	83	36	53	23	6	0	364
WSW	0	12	30	26	169	247	98	52	108	39	35	816
W	0	11	26	26	95	138	72	48	96	126	159	797
WNW	5	10	39	35	85	82	38	34	88	66	75	557
NW	3	9	22	35	62	94	54	57	91	53	18	498
NNW	2	8	24	40	63	57	43	30	48	14	4	333
Tot	46	350	716	855	1901	1991	808	475	537	305	291	8275

Hours of Calm 11
Hours of Variable Direction 0
Hours of Valid Data 8286
Hours of Missing Data . . . 474
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

Stability Class A Extremely Unstable based on Lapse Rate

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	0	6	10	15	10	13	1	0	55
NNE	0	0	0	0	2	21	6	2	1	0	0	32
NE	0	0	0	1	2	0	0	0	0	0	0	3
ENE	0	0	1	0	1	0	0	0	0	0	0	2
E	0	0	1	1	1	0	0	0	0	0	0	3
ESE	0	0	0	0	1	0	1	0	0	0	0	2
SE	0	0	0	0	2	1	1	0	0	0	0	4
SSE	0	0	0	0	1	3	1	0	0	0	0	5
S	0	0	0	0	2	2	0	0	0	0	0	4
SSW	0	0	0	1	0	2	0	0	0	0	0	3
SW	0	0	0	0	0	1	1	1	0	0	0	3
WSW	0	0	0	0	11	35	5	0	10	6	3	70
W	0	0	0	3	13	25	6	1	5	16	20	89
WNW	0	0	5	16	34	17	2	3	14	13	17	121
NW	0	0	3	5	21	18	4	9	5	21	12	98
NNW	0	0	0	3	17	8	9	10	15	6	1	69
Tot	0	0	10	30	114	143	51	36	63	63	53	563

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 563
Hours of Missing Data . . . 474
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

Stability Class B Moderately Unstable based on Lapse Rate

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	1	7	7	15	16	8	0	0	54
NNE	0	0	0	0	4	14	9	4	0	0	0	31
NE	0	0	0	0	3	2	2	0	0	0	0	7
ENE	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	1	3	3	1	0	0	0	0	8
SE	0	0	0	0	4	12	2	1	5	0	0	24
SSE	0	0	0	0	8	6	0	2	0	0	0	16
S	0	0	0	0	1	7	0	0	0	0	0	8
SSW	0	0	0	0	1	0	0	0	0	0	0	1
SW	0	0	0	1	1	3	2	1	1	0	0	9
WSW	0	0	0	1	11	17	6	3	2	2	7	49
W	0	0	0	2	6	17	8	10	9	15	14	81
WNW	0	0	3	1	7	10	8	6	13	11	23	82
NW	0	0	0	4	5	5	4	11	16	9	4	58
NNW	0	0	1	1	4	3	7	5	5	3	0	29
Tot	0	0	4	12	65	106	64	59	59	40	48	457

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 457
Hours of Missing Data . . . 474
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

Stability Class C Slightly Unstable based on Lapse Rate

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	1	6	8	18	29	9	5	0	0	76
NNE	0	0	1	0	14	18	21	7	0	0	0	61
NE	0	0	2	1	7	11	1	0	0	0	0	22
ENE	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	3	3	0	0	0	0	0	0	6
ESE	0	0	1	1	8	5	0	2	0	0	0	17
SE	0	0	2	1	3	9	4	3	2	0	0	24
SSE	0	0	2	1	9	3	4	1	1	0	0	21
S	0	0	0	2	3	12	3	4	2	0	0	26
SSW	0	0	0	1	6	3	0	1	0	0	0	11
SW	0	0	0	3	2	3	0	2	1	0	0	11
WSW	0	0	0	0	12	28	7	4	19	6	6	82
W	0	0	1	1	7	24	14	12	18	20	32	129
WNW	0	0	4	2	10	21	5	4	19	14	18	97
NW	0	0	2	4	4	19	11	11	49	15	1	116
NNW	0	0	3	7	5	18	14	8	18	1	0	74
Tot	0	0	19	33	101	192	113	68	134	56	57	773

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 773
Hours of Missing Data . . . 474
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

Stability Class D Neutral based on Lapse Rate

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	3	7	24	42	61	17	8	5	0	0	167
NNE	0	2	5	22	79	89	35	7	1	0	0	240
NE	1	9	14	41	81	60	12	1	0	0	0	219
ENE	0	7	32	39	35	4	0	0	0	0	0	117
E	1	5	22	32	28	14	0	0	0	0	0	102
ESE	0	6	16	24	72	60	38	10	3	0	0	229
SE	1	4	6	23	92	171	96	43	19	0	0	455
SSE	1	3	7	15	64	75	35	14	7	0	0	221
S	0	1	9	27	55	71	31	23	2	0	0	219
SSW	1	3	8	18	22	64	12	4	0	0	0	132
SW	0	4	9	12	42	45	20	33	14	2	0	181
WSW	0	2	7	9	60	95	44	23	46	18	15	319
W	0	3	9	9	50	52	33	16	42	61	78	353
WNW	0	6	8	10	25	30	20	17	34	27	17	194
NW	1	3	6	12	30	45	33	26	19	8	1	184
NNW	0	6	9	18	28	25	13	7	10	4	3	123
Tot	6	67	174	335	805	961	439	232	202	120	114	3455

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 3455
Hours of Missing Data . . . 474
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

Stability Class E Slightly Stable based on Lapse Rate

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	5	8	6	8	1	1	0	0	0	0	29
NNE	0	5	5	5	9	3	0	0	0	0	0	27
NE	1	3	11	15	16	7	0	0	0	0	0	53
ENE	2	9	23	11	10	0	0	0	0	0	0	55
E	0	21	29	15	10	2	0	0	0	0	0	77
ESE	1	12	23	26	40	22	0	0	2	0	0	126
SE	2	11	20	32	103	108	19	10	6	0	0	311
SSE	1	12	18	28	52	101	32	9	0	0	0	253
S	0	5	14	18	68	95	21	8	1	0	0	230
SSW	1	7	18	17	47	39	2	2	0	0	0	133
SW	1	7	15	15	28	29	13	16	7	3	0	134
WSW	0	4	13	11	60	52	28	16	26	5	4	219
W	0	5	11	7	13	12	9	8	22	14	15	116
WNW	2	1	12	4	5	2	3	4	8	1	0	42
NW	1	4	7	7	0	6	1	0	2	0	0	28
NNW	1	2	9	6	5	3	0	0	0	0	0	26
Tot	13	113	236	223	474	482	129	73	74	23	19	1859

Hours of Calm 6
Hours of Variable Direction 0
Hours of Valid Data 1865
Hours of Missing Data . . . 474
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

Stability Class F Moderately Stable based on Lapse Rate

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	0	2	9	1	0	0	0	0	0	13
NNE	0	1	3	6	3	7	0	0	0	0	0	20
NE	0	1	5	8	10	0	0	0	0	0	0	24
ENE	1	5	3	2	2	0	0	0	0	0	0	13
E	0	7	12	8	4	0	0	0	0	0	0	31
ESE	1	12	15	22	17	0	0	0	0	0	0	67
SE	1	11	11	19	34	6	0	0	0	0	0	82
SSE	3	9	18	28	35	8	1	0	0	0	0	102
S	0	6	18	19	44	25	0	0	0	0	0	112
SSW	2	2	5	9	14	6	0	0	0	0	0	38
SW	1	6	7	2	2	2	0	0	0	1	0	21
WSW	0	5	8	4	11	17	7	5	5	2	0	64
W	0	3	4	4	5	7	1	1	0	0	0	25
WNW	1	2	6	0	2	0	0	0	0	0	0	11
NW	1	1	4	3	0	1	0	0	0	0	0	10
NNW	1	0	2	3	3	0	0	0	0	0	0	9
Tot	12	72	121	139	195	80	9	6	5	3	0	642

Hours of Calm 4
Hours of Variable Direction 0
Hours of Valid Data 646
Hours of Missing Data . . . 474
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

Stability Class G Extremely Stable based on Lapse Rate

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	0	0	6	0	0	0	0	0	0	7
NNE	0	0	2	1	10	0	0	0	0	0	0	13
NE	0	3	0	1	9	0	0	0	0	0	0	13
ENE	0	1	4	0	0	0	0	0	0	0	0	5
E	3	4	3	3	1	0	0	0	0	0	0	14
ESE	4	9	18	9	2	1	0	0	0	0	0	43
SE	4	36	72	21	16	2	0	0	0	0	0	151
SSE	0	33	37	36	71	10	0	0	0	0	0	187
S	2	4	7	6	22	8	0	0	0	0	0	49
SSW	0	2	2	1	0	0	0	0	0	0	0	5
SW	0	2	3	0	0	0	0	0	0	0	0	5
WSW	0	1	2	1	4	3	1	1	0	0	0	13
W	0	0	1	0	1	1	1	0	0	0	0	4
WNW	2	1	1	2	2	2	0	0	0	0	0	10
NW	0	1	0	0	2	0	1	0	0	0	0	4
NNW	0	0	0	2	1	0	0	0	0	0	0	3
Tot	15	98	152	83	147	27	3	1	0	0	0	526

Hours of Calm 1
Hours of Variable Direction 0
Hours of Valid Data 527
Hours of Missing Data . . . 474
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

All Stabilities

Elevations:: Winds 200ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	3	9	21	35	87	42	59	88	60	66	470
NNE	2	4	8	9	40	84	67	44	99	71	73	501
NE	0	3	11	15	67	98	53	31	55	10	6	349
ENE	0	5	10	13	61	50	19	4	1	0	0	163
E	2	4	13	16	45	50	21	13	11	0	0	175
ESE	2	4	7	13	35	75	55	33	59	15	2	300
SE	1	6	6	7	28	95	100	121	315	102	32	813
SSE	2	2	6	7	27	91	90	112	239	86	22	684
S	3	7	6	6	39	94	67	79	154	59	3	517
SSW	1	6	11	11	37	77	77	91	132	7	0	450
SW	1	6	15	18	53	96	76	63	105	14	5	452
WSW	2	5	7	16	64	155	130	132	221	103	162	997
W	0	2	9	14	61	157	88	67	114	79	293	884
WNW	0	5	10	12	55	80	62	32	74	71	190	591
NW	2	4	16	8	52	60	50	42	111	76	116	537
NNW	0	5	8	16	32	57	34	42	82	59	66	401
Tot	18	71	152	202	731	1406	1031	965	1860	812	1036	8284

Hours of Calm 2
Hours of Variable Direction 0
Hours of Valid Data 8286
Hours of Missing Data . . . 474
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

Stability Class A Extremely Unstable based on Lapse Rate

Elevations:: Winds 200ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	0	0	8	9	4	14	8	21	64
NNE	0	0	0	0	0	1	1	4	7	7	14	34
NE	0	0	0	0	1	1	2	0	0	0	0	4
ENE	0	0	0	0	1	0	0	1	0	0	0	2
E	0	0	0	0	1	1	0	0	0	0	0	2
ESE	0	0	0	0	0	1	1	0	0	0	0	2
SE	0	0	0	0	0	1	1	0	3	0	0	5
SSE	0	0	0	0	0	0	4	0	0	1	0	5
S	0	0	0	0	0	2	1	1	0	0	0	4
SSW	0	0	0	0	0	0	1	0	0	0	0	1
SW	0	0	0	0	1	0	0	0	2	1	0	4
WSW	0	0	0	0	0	2	15	17	16	1	13	64
W	0	0	0	0	3	13	16	10	3	4	32	81
WNW	0	0	0	0	9	23	17	6	7	11	27	100
NW	0	0	0	0	15	16	18	5	5	4	40	103
NNW	0	0	0	0	3	14	9	7	17	15	23	88
Tot	0	0	0	0	34	83	95	55	74	52	170	563

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 563
Hours of Missing Data . . . 474
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

Stability Class B Moderately Unstable based on Lapse Rate

Elevations:: Winds 200ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	0	3	3	2	3	11	10	14	46
NNE	0	0	0	0	0	6	9	4	5	10	10	44
NE	0	0	0	0	0	2	0	0	2	0	0	4
ENE	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	2	4	0	0	0	0	6
SE	0	0	0	0	0	3	4	2	10	0	6	25
SSE	0	0	0	0	1	10	3	0	0	2	0	16
S	0	0	0	0	0	1	5	2	0	0	0	8
SSW	0	0	0	0	0	1	0	1	0	0	0	2
SW	0	0	0	0	1	0	0	0	2	1	0	4
WSW	0	0	0	0	0	4	7	10	14	6	6	47
W	0	0	0	1	2	8	8	7	17	6	24	73
WNW	0	1	0	1	1	7	4	10	12	11	37	84
NW	0	0	0	0	4	5	1	2	14	14	21	61
NNW	0	0	0	0	2	3	2	2	8	11	9	37
Tot	0	1	0	2	14	55	49	43	95	71	127	457

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 457
Hours of Missing Data . . . 474
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

Stability Class C Slightly Unstable based on Lapse Rate

Elevations:: Winds 200ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	0	6	8	7	13	23	18	13	88
NNE	0	0	0	0	2	9	4	7	15	16	12	65
NE	0	0	0	0	3	4	2	6	2	4	0	21
ENE	0	0	0	0	1	0	0	0	0	0	0	1
E	0	0	0	0	2	1	1	0	0	0	0	4
ESE	0	0	0	0	2	3	4	2	0	2	0	13
SE	0	0	0	3	0	4	3	4	6	3	2	25
SSE	0	0	0	1	2	7	2	0	6	1	0	19
S	0	0	0	0	0	7	3	9	7	4	1	31
SSW	0	0	0	1	1	3	4	0	1	0	0	10
SW	0	0	0	0	3	0	4	1	2	0	1	11
WSW	0	0	0	0	0	8	6	14	20	5	20	73
W	0	0	0	1	3	19	9	10	24	11	47	124
WNW	0	0	1	1	5	13	9	2	10	11	37	89
NW	0	0	0	0	4	7	7	7	25	34	31	115
NNW	0	0	1	3	3	7	4	14	23	14	15	84
Tot	0	0	2	10	37	100	69	89	164	123	179	773

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 773
Hours of Missing Data . . . 474
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

Stability Class D Neutral based on Lapse Rate

Elevations:: Winds 200ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	3	8	17	53	21	30	32	12	12	189
NNE	0	1	2	5	27	54	42	26	58	33	27	275
NE	0	2	3	6	37	62	39	22	41	6	5	223
ENE	0	0	2	2	28	32	10	2	0	0	0	76
E	0	0	4	5	18	21	8	3	7	0	0	66
ESE	0	1	4	5	13	32	24	15	30	13	2	139
SE	0	2	2	2	14	48	51	60	159	84	22	444
SSE	0	0	1	1	8	34	48	56	92	46	8	294
S	1	1	4	2	18	42	26	25	56	26	2	203
SSW	1	0	1	2	21	20	30	34	42	2	0	153
SW	0	3	2	5	8	19	21	15	37	9	2	121
WSW	0	0	1	4	17	44	50	51	103	46	60	376
W	0	0	3	4	15	65	34	27	39	36	141	364
WNW	0	1	5	5	14	20	24	11	28	23	75	206
NW	0	0	4	1	13	22	21	23	61	21	21	187
NNW	0	0	4	7	16	20	12	14	30	16	19	138
Tot	2	12	45	64	284	588	461	414	815	373	396	3454

Hours of Calm 1
Hours of Variable Direction 0
Hours of Valid Data 3455
Hours of Missing Data . . . 474
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

Stability Class E Slightly Stable based on Lapse Rate

Elevations:: Winds 200ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	3	9	4	7	1	7	2	6	1	41
NNE	0	0	5	2	2	6	8	1	9	0	1	34
NE	0	0	6	3	18	20	9	2	6	0	0	64
ENE	0	3	1	7	19	14	6	0	1	0	0	51
E	1	0	4	1	9	16	8	8	1	0	0	48
ESE	0	0	0	3	10	18	13	10	14	0	0	68
SE	0	2	2	1	8	24	30	39	107	14	2	229
SSE	0	1	1	2	5	21	18	44	113	35	14	254
S	0	3	1	3	9	16	22	30	68	28	0	180
SSW	0	0	3	1	7	28	27	35	71	5	0	177
SW	0	0	3	4	13	27	30	23	29	3	2	134
WSW	0	0	1	6	15	48	28	33	52	41	53	277
W	0	0	0	2	13	34	17	8	24	17	44	159
WNW	0	2	2	3	11	9	5	3	13	14	13	75
NW	0	2	8	4	11	8	2	4	4	2	0	45
NNW	0	1	0	3	5	7	4	4	3	2	0	29
Tot	1	15	40	54	159	303	228	251	517	167	130	1865

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 1865
Hours of Missing Data . . . 474
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

Stability Class F Moderately Stable based on Lapse Rate

Elevations:: Winds 200ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	0	1	3	3	2	1	3	4	1	19
NNE	0	1	1	1	6	4	3	2	4	4	2	28
NE	0	0	1	4	6	7	1	1	3	0	1	24
ENE	0	1	3	2	11	3	2	1	0	0	0	23
E	0	4	0	4	8	6	3	2	2	0	0	29
ESE	0	0	1	2	8	11	4	4	12	0	0	42
SE	0	2	2	0	3	5	8	7	18	0	0	45
SSE	0	0	2	1	5	6	8	11	19	1	0	53
S	0	2	0	0	5	7	5	4	15	1	0	39
SSW	0	1	4	2	3	8	7	14	16	0	0	55
SW	0	0	4	3	9	25	15	17	29	0	0	102
WSW	0	1	1	0	14	26	14	6	13	4	9	88
W	0	1	2	1	13	13	4	4	6	5	4	53
WNW	0	0	0	1	8	7	1	0	4	1	0	22
NW	1	0	2	3	3	1	1	1	1	0	0	13
NNW	0	3	1	0	2	3	0	1	1	0	0	11
Tot	1	17	24	25	107	135	78	76	146	20	17	646

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 646
Hours of Missing Data . . . 474
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2023 - 2023

Stability Class G Extremely Stable based on Lapse Rate

Elevations:: Winds 200ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	3	3	2	5	0	1	3	2	4	23
NNE	2	2	0	1	3	4	0	0	1	1	7	21
NE	0	1	1	2	2	2	0	0	1	0	0	9
ENE	0	1	4	2	1	1	1	0	0	0	0	10
E	1	0	5	6	7	5	1	0	1	0	0	26
ESE	2	3	2	3	2	8	5	2	3	0	0	30
SE	1	0	0	1	3	10	3	9	12	1	0	40
SSE	2	1	2	2	6	13	7	1	9	0	0	43
S	2	1	1	1	7	19	5	8	8	0	0	52
SSW	0	5	3	5	5	17	8	7	2	0	0	52
SW	1	3	6	6	18	25	6	7	4	0	0	76
WSW	2	4	4	6	18	23	10	1	3	0	1	72
W	0	1	4	5	12	5	0	1	1	0	1	30
WNW	0	1	2	1	7	1	2	0	0	0	1	15
NW	1	2	2	0	2	1	0	0	1	1	3	13
NNW	0	1	2	3	1	3	3	0	0	1	0	14
Tot	14	26	41	47	96	142	51	37	49	6	17	526

Hours of Calm 1
Hours of Variable Direction 0
Hours of Valid Data 527
Hours of Missing Data . . . 474
Hours in Period 8760

Attachment 4

Errata and Corrections to the 2021 NMP1 and NMP2 ARERRs

For both the NMP1 and NMP2 ARERRs for 2021, the groundwater tritium data for 2020 was erroneously provided instead of for 2021. The 2021 groundwater tritium data is provided on the next page in its entirety.

Nine Mile Point 1 and 2 Groundwater Tritium Results			Reporting Period: Janaury - December 2021	
Well Identification Number	**# Samples Collected**	**# Positive Samples**	**Minimum Concentration (pCi/l)**	**Maximum Concentration (pCi/l)**
GMX-MW1*	1	0	<199	<199
MW-1	1	0	<196	<196
MW-5	4	0	<171	<190
MW-6	1	0	<197	<197
MW-7	1	0	<191	<191
MW-8	4	0	<182	<195
MW-9[1]	4	0	<188	<196
MW-10[1]	1	0	<198	<198
MW-11	1	0	<185	<185
MW-12	1	0	<191	<191
MW-13	1	0	<188	<188
MW-14*	1	0	<192	<192
MW-15	4	0	<181	<202
MW-16	1	0	<192	<192
MW-17	4	0	<179	<191
MW-18	4	0	<182	<191
MW-19	1	0	<187	<187
MW-20	1	0	<188	<188
MW-21	1	0	<192	<192
NMP2 MAT[2,3]	1	0	<199	<199
PZ-1	2	0	<187	<195
PZ-7	4	0	<183	<196
PZ-8	4	0	<189	<194

Notes:

* - Control Location
[1] - Sentinel well location
[2] - NMP2 Groundwater Depression Cone
[3] - Samples collected from storm drain system which includes precipitation
[4] - No samples were collected during 2nd due to Covid-19

Attachment 5
Errata and Corrections to the 2022 NMP1 ARERR

Summary of Identified Errata and Corrections

Multiple errata were identified in the 2022 ARERR submittal for NMP1. The corrections are summarized below, and the corrected pages are included in their entirety in the order in which they are listed, unless otherwise noted.

Corrections are indicated with revision bars on the right-hand side of the page. Corrected activities, doses, and numbers are ***bolded and italicized.***

For all errata described below, dose was originally over-reported, and the corrected doses are lower.

1. On pages 5 and 19, the James A. FitzPatrick Nuclear Power Plant (JAFNPP) is erroneously referred to as "John A. FitzPatrick Nuclear Power Plant". This is a typographical-only error.

2. Page 7, Table 2, Dose Potentially Received by the Likely Most Exposed Member of the Public Outside the Site Boundary During 2022:

   Gaseous effluent dose (excluding C-14) for both units slightly changed as a result of corrections to gaseous activity released in the 2022 NMP2 ARERR (Tables 7, 8, and 9).

3. Page 16, Table 3, Onsite Doses (Within Site Boundary)
   Several issues were identified:
   a) Dose from Iodine, Particulate, C-14 & H-3 was significantly overreported.
   b) In accordance with the NMP1 and NMP2 ODCMs, dose from Noble Gas releases is evaluated by TLD measurement at the shoreline fishing location.
   c) The incorrect TLDs were used for reporting dose at the shoreline fishing location.
   d) The corrected table, for both units, also encompasses slight changes to calculated dose as a result of the over-reported Fe-55, Sr-89, Sr-90, and omitted Primary Containment Purges from NMP2 during 2022.

4. Page 18, Section 5.4, Land Use Census Changes

   In 2022, three new gardens were planted in the E, ESE, and SE sectors of the JAF owner-controlled area (OCA) which have since served as indicator locations for broad-leaf vegetation sampling. Vegetation samples were obtained from these gardens in 2022, and results were included in the JAF/NMP 2022 AREOR in Table 6-12 on Page 6-23.

5. Page 18, Section 5.6, Effluent Radiation Monitors Out of Service Greater Than 30 Days:

   At both NMP1 and NMP2, Liquid Radwaste Discharge Radiation Monitors have been retired in place and were inoperable for all of 2022, as liquid batch discharges are no longer expected to occur, and were not performed at either unit for the year. This information has historically been included in ARERR submittals.

6. Pages 33-34, Attachment 3, Meteorological Data:

   The only joint frequency table included is for the 200 ft Wind elevation for All Stability Classes as determined by 200-30 ft Vertical Temperature Difference (ΔT). Historically, Nine Mile Point has not included meteorological joint frequency distributions in ARERR submittals, which would be provided to the NRC upon request per both NMP1 and NMP2 ODCMs. As a correction, Attachment 7 to the 2023 ARERR contains classifications of atmospheric stability and meteorological joint frequency tables for 2022.

7. Page 31, Table 14, Major Nuclides NMP Unit 1:

   Under "a. Spent resins, filter sludges, evaporator bottoms, etc." the nuclides C-14 and Zn-65 were not listed under the "Isotope", "%", and "Curies" columns, and "Zn-65 <1% 93.02E-01 curies)" should read "Zn-65 <1% (3.02E-01 curies)

2.0 EXECUTIVE SUMMARY

Nine Mile Point Unit 1 (NMP1) 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 2022 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 2022 the Land Use Census dose assessments due to radioactive gaseous effluents showed that the critical receptor for Nine Mile Point Unit 1 is child, due to C-14, at the nearest resident. The maximum Annual Organ Dose calculated for this receptor was 3.67E-01 mrem to the bone. This annual dose is a small fraction of the 10 CFR 50, Appendix I guideline of 15 mrem to the Maximum Organ per reactor unit.

Solid radioactive waste shipped offsite for disposal included 3.47E+02 Curies and 3.30E+01 m^3, shipped in eight shipments.

In addition to monitoring radioactive effluents, NMP 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 James A. FitzPatrick Nuclear Power Plant and Nine Mile Point Nuclear Station Annual Radiological Environmental Operating Report (AREOR).

Table 2, Dose Potentially Received by the Likely Most Exposed Member of the Public Outside the Site Boundary During 2022

Exposure Pathway	Dose Type	Dose (mrem)
Fish and Vegetation Consumption	Total Whole Body	No Dose
	Total Maxium Organ	No Dose
Shoreline Sediment	Total Whole Body	No Dose
	Total Skin of Whole Body	No Dose
Gaseous Effluents (excluding C-14)	Total Whole Body	***1.46E-01***
	Thyroid	***1.49E-01***
	Maximum Organ	Skin: 1.60E-01
	Bone	***1.38E-01***
Gaseous Effluent (C-14 only)	Total Whole Body	4.52E-02
	Maximum Organ	Bone: 2.27E-01
Direct Radiation	Total Whole Body	0.66E+00

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:

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

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

2. In accordance with NRC memorandum[19] HPPOS-140 PDR-9111210378, Guidance on Reporting Dose to Members of the Public from Normal Operations, updated October 17, 2017, NMP1 dose to the public is less than (<) 2.25 mrem dose to any organ or the total body and less than (<) 1.75 mrem dose to the thyroid. Memorandum can be found on the NRC website: https://www.nrc.gov/about-nrc/radiation/protects-you/hppos/hppos140.html.

4.5 Onsite Doses (Within Site Boundary)

This section evaluates dose 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 increase in the atmospheric dispersion factor above the site boundary. Groups of concern include fishermen, visitors, and daily contractors. Use of a conservative assumption for fishermen is 8 hours per week for 39-weeks spent inside the site boundary by these groups conservatively represents the most-exposed individual.

Table 3, Onsite Doses (Within Site Boundary)

Effluent Source	Sector	Approx. Distance (Meters)	X/Q s/m^3 (Vent)	X/Q s/m^3 (Stack)	***Inhalation Dose (mrem)***	***External Dose***	Total
					Iodine, Particulate, C-14 & H-3	TLD and Gamma	
Combined	W	805	2.80E-06	9.60E-07	***5.40E-03 (Bone)***	***4.33E-01***	***4.38E-01***
Note: combined refers to the combined dose from the stack and reactor building and radwaste. EC – Emergency Condenser							

5.4 Land Use Census Changes

In 2022, three new gardens were planted in the E, ESE, and SE sectors of the JAF owner-controlled area (OCA) which have since served as indicator locations for broad-leaf vegetation sampling. The gardens were planted due to a decline in local personal gardens in recent years and less sample availability. Aside from the addition of the three on-site gardens, no changes to receptors or sampling locations were identified from the annual land use census.

5.5 Meteorological Data

Meteorology data provided via Murray and Trettel, Inc. report. The Nine Mile Point meteorology tower was used to collect meteorology for both the JAF and NMP power plants. Accordingly, NMP meteorological monitoring program produced 77,447 hours of valid data out of 78,840 parameter hours during 2022. Data recovery was 98.2%. Calibrations were performed in May, August, and October. Specific sensor and data collection errors are available upon request.

5.6 Effluent Radiation Monitors Out of Service Greater Than 30 Days

Liquid radwaste discharge radiation monitors 11 and 12 are retired in place and were inoperable for all of 2022, as liquid batch discharges are no longer expected to occur and were not performed at NMP1 during 2022. No other effluent radiation monitors required by the ODCM were inoperable for more than 30 days in 2022.

5.7 Offsite Dose Calculation Manual (ODCM) Changes

NMP Unit 1 ODCM, CY-NM-170-301 Revision 38 was valid January to December 2022 with no changes required.

5.8 Process Control Program (PCP) Changes

There were no changes to PCP in 2022.

5.9 Radioactive Waste Treatment System Changes

There were no changes to the radioactive waste treatment system in 2022.

5.10 Other Supplemental Information

During 2022, Nine Mile Point Units 1 and 2 had two non-emergency notifications to the NRC:

1. Event 55821 was completed on April 5, 2022.
2. Event 56089 was completed on September 4, 2022.

5.10.2 Independent Spent Fuel Storage Installation (ISFSI) Monitoring Program

Information concerning the ISFSI monitoring program and 2022 annual dose can be found in the 2022 James A. FitzPatrick Nuclear Power Plant and Nine Mile Point Nuclear Station Annual Radiological Environmental Operating Report published on the Nuclear Regulatory Commission website: https://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/nmp1-2.html.

5.10.3 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.

In accordance with Regulatory Guide 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. Carbon-14 production and release estimates were calculated using EPRI Report 1021106, "Estimation of Carbon-14 in Nuclear Plant Gaseous Effluents". This calculation uses active core coolant mass, average neutron flux by energy and reactor coolant nitrogen concentrations to determine Carbon-14 generation based upon an effective full power year. The estimated generation for NMP Unit 1 during 2022 was 8.84E+00 curies.

Public dose estimates were performed using methodology from the ODCM which is based on Regulatory Guide 1.109 methodology. Carbon dioxide is assumed to make up 20-30% of the Carbon-14 gaseous emissions from the station based upon available references and on-site testing.

5.10.4 Errata/Corrections to Previous ARERRs

There are no corrections to prior ARERRs.

Attachment 2, Solid Waste Information

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

Table 13, Types of Solid Waste Summary NMP Unit 1

Types of Waste	Total Volume (m3)	Total Activity (Ci)	Est. Total Error (%)
a. Spent resins, filter sludges, evaporator bottoms, etc.	3.30E+01	3.47E+02	25
b. Dry compressible waste, contaminated equip, etc.	0.00E+00	0.00E+00	25
c. Irradiated components, control rods, etc.	0.00E+00	0.00E+00	25
d. Other (None reported)	0.00E+00	0.00E+00	25

2.0 ESTIMATE OF MAJOR NUCLIDE COMPOSITION (BY WASTE TYPE) ONLY >1% ARE REPORTED. [NOTE 1]

Table 14, Major Nuclides NMP Unit 1

Major Nuclide Composition	Isotope	%	Curies
a. Spent resins, filter sludges, evaporator bottoms, etc.	Co-60	79.39	2.75E+02
	Fe-55	13.2	4.58E+01
	Cs-137	3.09	1.07E+01
	Mn-54	2.31	8.00E+00
	C-14	***<1%***	***3.33E-01***
	Zn-65	***<1%***	***3.02E-01***
b. Dry compressible waste, contaminated equip, etc.	*	0	00E+00
c. Irradiated components, control rods, etc.	*	0	00E+00
d. Other (describe)	*	0	00E+00

Attachment 6
Errata and Corrections to the 2022 NMP2 ARERR

Summary of Identified Errata and Corrections

Multiple errata were identified in the 2022 ARERR submittal for NMP2. The corrections are summarized below, and the corrected pages are included in their entirety in the order in which they are listed, unless otherwise noted.

Corrections are indicated with revision bars on the right-hand side of the page. Corrected activities, doses, and numbers are ***bolded and italicized.***

For all errata described below, dose was originally over-reported, and the corrected doses are lower.

1. On pages 5 and 19, the James A. FitzPatrick Nuclear Power Plant (JAFNPP) is erroneously referred to as "John A. FitzPatrick Nuclear Power Plant". This is a typographical-only error.

2. Page 7, Table 2, Dose Potentially Received by the Likely Most Exposed Member of the Public Outside the Site Boundary During 2022:

   Gaseous effluent dose (excluding C-14) for both units slightly changed as a result of corrections to gaseous activity released in the 2022 NMP2 ARERR (Tables 7, 8, and 9).

3. Page 16, Table 3, Onsite Doses (Within Site Boundary)
   Several issues were identified:
   a) Dose from Iodine, Particulate, C-14 & H-3 was significantly overreported.
   b) In accordance with the NMP1 and NMP2 ODCMs, dose from Noble Gas releases is evaluated by TLD measurement at the shoreline fishing location.
   c) The incorrect TLDs were used for reporting dose at the shoreline fishing location.
   d) The corrected table, for both units, also encompasses slight changes to calculated dose as a result of the over-reported Fe-55, Sr-89, Sr-90, and omitted Primary Containment Purges from NMP2 during 2022.

4. Page 18, Section 5.4, Land Use Census Changes

   In 2022, three new gardens were planted in the E, ESE, and SE sectors of the JAF owner-controlled area (OCA) which have since served as indicator locations for broad-leaf vegetation sampling. Vegetation samples were obtained from these gardens in 2022, and results were included in the JAF/NMP 2022 AREOR in Table 6-12 on Page 6-23.

5. Page 18, Section 5.6, Effluent Radiation Monitors Out of Service Greater Than 30 Days:

   At both NMP1 and NMP2, Liquid Radwaste Discharge Radiation Monitors have been retired in place and were inoperable for all of 2022, as liquid batch discharges are no longer expected to occur, and were not performed at either unit for the year. This information has historically been included in ARERR submittals.

6. Pages 33-34, Attachment 3, Meteorological Data:

   The only joint frequency table included is for the 200 ft Wind elevation for All Stability Classes as determined by 200-30 ft Vertical Temperature Difference (ΔT). Historically, Nine Mile Point has not included meteorological joint frequency distributions in ARERR submittals, which would be provided to the NRC upon request per both NMP1 and NMP2 ODCMs. As a correction, Attachment 7 to the 2023 ARERR contains classifications of atmospheric stability and meteorological joint frequency tables for 2022.

7. Page 18, Section 5.7, Offsite Dose Calculation Manual (ODCM) Changes:

   CY-AA-170-3100 is incorrectly listed as the NMP2 ODCM procedure. N2-ODCM is the correct procedure.

8. Total activity of Noble Gases, Particulates with half-lives > 8 days, and Tritium were incorrectly reported in the following sections:

   a) Page 23 – Gaseous Effluents Summation of All Releases NMP2

   b) Page 25 – Gaseous Effluents – Ground Level Release Continuous Mode NMP2

   c) Page 26 – Gaseous Effluents – Elevated Level Release Batch Mode NMP2

   d) Page 27 – Gaseous Effluents – Elevated Level Release Continuous Mode NMP2

   e) Fe-55, Sr-89, and Sr-90 were overreported in 1st Quarter 2022 on Page 25 and in 1st and 2nd Quarter 2022 on Page 27. Activity was identified in two purges of the Primary Containment, which occurred in 2nd and 3rd Quarter 2022, that was omitted from Page 17, 5.1 Gaseous Batch Releases, and also from Page 26, Table 8 Gaseous Effluents – Elevated Level Release Batch Mode NMP2.

   Due to these identified errata (2a through 2e above), dose included in several tables was recalculated. In addition to corrections made on Page 7, Table 2 and Page 16, Table 3 for both NMP1 and NMP2 ARERRs for 2022 as previously mentioned above, Page 6, Table 1, Nine Mile Point Unit 2 Dose Summary, was corrected as well.

2.0 EXECUTIVE SUMMARY

Nine Mile Point Unit 2 (NMP2) 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 2022 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 2022 the Land Use Census dose assessments due to radioactive gaseous effluents showed that the critical receptor for Nine Mile Point Unit 2 is child, due to C-14, at the nearest resident. The maximum Annual Organ Dose calculated for this receptor was 3.67E-01 mrem to the bone. This annual dose is a small fraction of the 10 CFR 50, Appendix I guideline of 15 mrem to the Maximum Organ per reactor unit.

Solid radioactive waste shipped offsite for disposal included 1.89E+01 Curies and 5.73E+02 m^3, shipped in twenty-one shipments.

In addition to monitoring radioactive effluents, NMP 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 James A. FitzPatrick Nuclear Power Plant and Nine Mile Point Nuclear Station Annual Radiological Environmental Operating Report (AREOR).

Table 2, Dose Potentially Received by the Likely Most Exposed Member of the Public Outside the Site Boundary During 2022

Exposure Pathway	Dose Type	Dose (mrem)
Fish and Vegetation Consumption	Total Whole Body	No Dose
	Total Maxium Organ	No Dose
Shoreline Sediment	Total Whole Body	No Dose
	Total Skin of Whole Body	No Dose
Gaseous Effluents (excluding C-14)	Total Whole Body	***1.46E-01***
	Thyroid	***1.49E-01***
	Maximum Organ	Skin: 1.60E-01
	Bone	***1.38E-01***
Gaseous Effluent (C-14 only)	Total Whole Body	4.52E-02
	Maximum Organ	Bone: 2.27E-01
Direct Radiation	Total Whole Body	0.66E+00

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:

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

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

2. In accordance with NRC memorandum[19] HPPOS-140 PDR-9111210378, Guidance on Reporting Dose to Members of the Public from Normal Operations, updated October 17, 2017, NMP2 dose to the public is less than (<) 2.25 mrem dose to any organ or the total body and less than (<) 1.75 mrem dose to the thyroid. Memorandum can be found on the NRC website: https://www.nrc.gov/about-nrc/radiation/protects-you/hppos/hppos140.html.

4.5 Onsite Doses (Within Site Boundary)

This section evaluates dose 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 increase in the atmospheric dispersion factor above the site boundary. Groups of concern include fishermen, visitors, and daily contractors. Use of a conservative assumption for fishermen is 8 hours per week for 39-weeks spent inside the site boundary by these groups conservatively represents the most-exposed individual.

Table 3, Onsite Doses (Within Site Boundary)

Effluent Source	Sector	Approx. Distance (Meters)	X/Q s/m^3 (Vent)	X/Q s/m^3 (Stack)	***Inhalation Dose (mrem)***	***External Dose***	Total
					Iodine, Particulate, C-14 & H-3	TLD and Gamma	
Combined	W	805	2.80E-06	9.60E-07	***5.40E-03 (Bone)***	***4.33E-01***	***4.38E-01***
Note: combined refers to the combined dose from the stack and reactor building and radwaste.							

5.4 Land Use Census Changes

In 2022, three new gardens were planted in the E, ESE, and SE sectors of the JAF owner-controlled area (OCA) which have since served as indicator locations for broad-leaf vegetation sampling. The gardens were planted due to a decline in local personal gardens in recent years and less sample availability. Aside from the addition of the three on-site gardens, no changes to receptors or sampling locations were identified from the annual land use census.

5.5 Meteorological Data

Meteorology data provided via Murray and Trettel, Inc. report. The Nine Mile Point meteorology tower was used to collect meteorology for both the JAF and NMP power plants. Accordingly, NMP meteorological monitoring program produced 77,447 hours of valid data out of 78,840 parameter hours during 2022. Data recovery was 98.2%. Calibrations were performed in May, August, and October. Specific sensor and data collection errors are available upon request.

5.6 Effluent Radiation Monitors Out of Service Greater Than 30 Days

Liquid discharge radiation monitor 2LWS-CAB206 and associated discharge flow rate measuring devices 2LWS-FT330 and 2LWS-FT331 are retired in place and were inoperable for all of 2022, as liquid batch discharges are no longer expected to occur and were not performed at NMP2 during 2022. No other effluent radiation monitors required by the ODCM were inoperable for more than 30 days in 2022.

5.7 Offsite Dose Calculation Manual (ODCM) Changes

NMP Unit 2 ODCM, N2-ODCM Revision 37 was valid January to December 2022 with no changes required.

5.8 Process Control Program (PCP) Changes

There were no changes to PCP in 2022.

5.9 Radioactive Waste Treatment System Changes

There were no changes to the radioactive waste treatment system in 2022.

5.10 Other Supplemental Information

a. During 2022, Nine Mile Point Units 1 and 2 had two non-emergency notifications to the NRC:

   1. Event 55821 was completed on April 5, 2022.

   2. Event 56089 was completed on September 4, 2022.

5.10.1 Outside Tanks

During 2022, there were no external water storage tanks containing radioactive material that leaked onto the ground or storm drain.

5.10.2 Independent Spent Fuel Storage Installation (ISFSI) Monitoring Program

Information concerning the ISFSI monitoring program and 2022 annual dose can be found in the 2022 James A. FitzPatrick Nuclear Power Plant and Nine Mile Point Nuclear Station Annual Radiological Environmental Operating Report published on the Nuclear Regulatory Commission website: https://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/nmp1-2.html.

5.10.3 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.

In accordance with Regulatory Guide 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. Carbon-14 production and release estimates were calculated using EPRI Report 1021106, "Estimation of Carbon-14 in Nuclear Plant Gaseous Effluents". This calculation uses active core coolant mass, average neutron flux by energy and reactor coolant nitrogen concentrations to determine Carbon-14 generation based upon an effective full power year. The estimated generation for unit 2 during 2022 was 1.68E+01 curies.

Public dose estimates were performed using methodology from the ODCM which is based on Regulatory Guide 1.109 methodology. Carbon dioxide is assumed to make up 20-30% of the Carbon-14 gaseous emissions from the station based upon available references and on-site testing.

5.10.4 Errata/Corrections to Previous ARERRs

There are no corrections to prior ARERRs.

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

1.0 GASEOUS EFFLUENTS

Table 5, Gaseous Effluents Summation of All Releases NMP2

A.	Fission & Activation Gases	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Est. Total Error %
1.	Total Release	Ci	*	***4.21E-07***	2.82E+00	*	5.00E+01
2.	Average release rate for the period	µCi/sec	*	***5.36E-08***	3.55E-01	*	
B.	Iodine						
1.	Total Iodine – 131	Ci	1.61E-06	2.61E-06	*	*	3.00E+01
2.	Average release rate for the period	µCi/sec	2.07E-07	3.32E-07	*	*	
C.	Particulates						
1.	Particulates with half-lives > 8 days	Ci	***1.59E-04***	***2.51E-04***	6.44E-02	5.87E-02	3.00E+01
2.	Average release rate for the period	µCi/sec	***2.04E-05***	***3.19E-05***	8.11E-03	7.39E-03	
D.	Tritium						
1.	Total Release	Ci	1.80E+01	***2.08E+01***	***1.93E+01***	1.93E+01	5.00E+01
2.	Average release rate for the period	µCi/sec	2.32E+00	***2.65E+00***	***2.43E+00***	2.43E+00	
E.	Gross Alpha						
1.	Total Release	Ci	*	*	*	*	5.00E+01
2.	Average release rate for the period	µCi/sec	*	*	*	*	
F.	Carbon-14						
1.	Total Release	Ci	3.34E+00	4.52E+00	4.15E+00	4.82E+00	5.00E+01
2.	Average release rate for the period	µCi/sec	3.18E-03	4.30E-03	3.95E-03	4.59E-03	

% of limit is on Table 1, Nine Mile Point Unit 2 Dose Summary

Table 7, Gaseous Effluents – Ground Level Release Continuous Mode NMP2

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
Ar-41	Ci	*	*	*	*	*
Kr-85	Ci	*	*	*	*	*
Kr-85m	Ci	*	*	*	*	*
Kr-87	Ci	*	*	*	*	*
Kr-88	Ci	*	*	*	*	*
Xe-133	Ci	*	*	*	*	*
Xe-135	Ci	*	*	*	*	*
Xe-135m	Ci	*	*	*	*	*
Xe-138	Ci	*	*	*	*	*
Total for Period	**Ci**	*	*	*	*	*
Iodines						
I-131	Ci	*	*	*	*	*
I-133	Ci	*	*	*	*	*
I-135	Ci	*	*	*	*	*
Total for Period	**Ci**	*	*	*	*	*
Particulates						
Co-58	Ci	4.24E-06	*	9.76E-06	*	1.40E-05
Co-60	Ci	1.21E-04	1.75E-04	2.90E-04	3.12E-04	8.98E-04
Sr-89	Ci	***(Corrected)**	*	*	*	***(Corrected)**
Sr-90	Ci	***(Corrected)**	*	*	*	***(Corrected)**
Cs-137	Ci	*	6.27E-06	*	*	6.27E-06
Fe-55	Ci	***(Corrected)**	*	*	*	***(Corrected)**
Mn-54	Ci	*	7.01E-06	*	*	7.01E-06
Total for Period	Ci	***1.25E-06***	1.88E-04	3.00E-04	3.12E-04	***8.01E-04***
Tritium						
H-3	Ci	5.93E+00	4.67E+00	5.74E+00	6.39E+00	2.27E+01
Gross Alpha						
Alpha	Ci	*	*	*	*	*
Carbon-14						
C-14	Ci	*	*	*	*	*

Table 8, Gaseous Effluents – Elevated Level Release Batch Mode NMP2

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
Ar-41	Ci	*	***4.21E-07***	*	*	***4.21E-07***
Kr-85	Ci	*	*	*	*	*
Kr-85m	Ci	*	*	*	*	*
Kr-87	Ci	*	*	*	*	*
Kr-88	Ci	*	*	*	*	*
Xe-133	Ci	*	*	*	*	*
Xe-135	Ci	*	*	*	*	*
Xe-135m	Ci	*	*	*	*	*
Xe-138	Ci	*	*	*	*	*
Total for Period	**Ci**	*	***4.21E-07***	*	*	***4.21E-07***
Iodines						
I-131	Ci	*	*	*	*	*
I-133	Ci	*	*	*	*	*
I-135	Ci	*	*	*	*	*
Total for Period	**Ci**	*	*	*	*	*
Particulates						
Co-58	Ci	*	*	*	*	*
Co-60	Ci	*	2.72E-12	*	*	2.72E-12
Sr-89	Ci	*	***5.76E-08***	*	*	***5.76E-08***
Sr-90	Ci	*	***7.20E-09***	*	*	***7.20E-09***
Cs-137	Ci	*	1.20E-11	*	*	1.20E-11
Fe-55	Ci	*	***8.00E-09***	*	*	***8.00E-09***
Total for Period	**Ci**	*	***7.28E-08***	*	*	***7.28E-08***
Tritium						
H-3	Ci	7.62E-02	***1.06E-01***	***7.62E-02***	*	***2.58E-01***
Gross Alpha						
Alpha	Ci	*	*	*	*	*
Carbon-14						
C-14	Ci	*	*	*	*	*

Table 9, Gaseous Effluents – Elevated Level Release Continuous Mode NMP2

Radionuclide Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
Ar-41	Ci	*	*	2.40E+00	*	2.40E+00
Kr-85	Ci	*	*	*	*	*
Kr-85m	Ci	*	*	*	*	*
Kr-87	Ci	*	*	*	*	*
Kr-88	Ci	*	*	*	*	*
Xe-133	Ci	*	*	*	*	*
Xe-135	Ci	*	*	*	*	*
Xe-135m	Ci	*	*	*	*	*
Xe-138	Ci	*	*	4.20E-01	*	4.20E-01
Total for Period	**Ci**	*	*	2.82E+00	*	2.82E+00
Iodines						
I-131	Ci	1.61E-06	2.61E-06	*	*	4.22E-06
I-133	Ci	8.70E-05	1.41E-04	*	*	2.28E-04
I-135	Ci	*	*	*	*	*
Total for Period	**Ci**	8.86E-05	1.44E-04	*	*	2.32E-04
Particulates						
Co-58	Ci	*	*	*	*	*
Co-60	Ci	3.38E-05	5.93E-05	6.41E-02	5.84E-02	1.23E-01
Sr-89	Ci	***(Corrected)**	***(Corrected)**	*	*	***(Corrected)**
Sr-90	Ci	***(Corrected)**	***(Corrected)**	*	*	***(Corrected)**
Cs-134	Ci	*	*	*	*	*
Mn-54	Ci	*	1.93E-06	*	2.35E-06	4.28E-06
Fe-55	Ci	***(Corrected)**	***1.30E-06***	4.24E-05	*	***4.37E-05***
Zn-65	Ci	*	*	*	*	*
Cs-137	Ci	*	*	*	1.84E-09	***1.84E-09***
Ni-63	Ci	*	*	*	*	*
Ag-110m	Ci	*	*	*	*	*
Total for Period	**Ci**	***3.38E-05***	***6.25E-05***	6.41E-02	5.84E-02	***1.23E-01***
Tritium						
H-3	Ci	1.19E+01	1.61E+01	1.35E+01	1.29E+01	5.44E+01
Gross Alpha						
Alpha	Ci	*	*	*	*	*
Carbon-14						
C-14	Ci	3.34E+00	4.52E+00	4.15E+00	4.82E+00	1.68E+01

5.0 SUPPLEMENTAL INFORMATION

5.1 Gaseous Batch Releases

5.1.1 NMP Unit 2

Number of batch releases	***6***
Total time period for batch releases	***608 minutes***
Maximum time period for a batch release	127 minutes
Average time period for a batch release	***101 minutes***
Minimum time period for a batch release	50 minutes

5.2 Liquid Batch Releases

5.2.1 NMP Unit 2

Number of batch releases	0
Total time period for batch releases	0 minutes
Maximum time period for a batch release	0 minutes
Average time period for a batch release	0 minutes
Minimum time period for a batch release	0 minutes
Average total flow during period of release	0 gpm

5.3 Abnormal Releases

5.3.1 Gaseous Abnormal Releases

Number of releases	0
Total activity released	0 Ci

5.3.2 Liquid Abnormal Releases

Number of releases	0
Total activity released	0 Ci

2.1 Comparison to Regulatory Limits

During 2022 all solid, liquid, and gaseous radioactive effluents from Nine Mile Point Unit 2 were well below regulatory limits, as summarized in Table 1 and Table 2.

Table 1, Nine Mile Point Unit 2 Dose Summary[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	00E+00	00E+00	00E+00	00E+00	00E+00
	% of Yearly Limit	*	*	*	*	*
Liquid Effluent Dose Limit, Any Organ	Limit	5 mrem	5 mrem	5 mrem	5 mrem	10 mrem
	Max Organ Dose	00E+00	00E+00	00E+00	00E+00	00E+00
	% of Yearly Limit	*	*	*	*	*
Gaseous Effluent Dose Limit, Gamma Air (Noble Gas)	Limit	5 mrad	5 mrad	5 mrad	5 mrad	10 mrad
	Gamma Air Dose	00E+00	***6.79E-11***	***4.41E-04***	00E+00	***4.41E-04***
	% of Yearly Limit	*	***1.36E-09***	***8.82E-03***	*	***4.41E-03***
Gaseous Effluent Dose Limit, Beta Air (Noble Gas)	Limit	10 mrad	10 mrad	10 mrad	10 mrad	20 mrad
	Beta Air Dose	00E+00	***3.72E-13***	***1.41E-05***	00E+00	***1.41E-05***
	% of Yearly Limit	*	***3.72E-12***	***1.41E-04***	*	***7.05E-05***
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	***6.43E-04***	***7.32E-04***	***1.32E-01***	***1.21E-03***	***1.33E-01***
	% of Yearly Limit	***8.57E-03***	***9.76E-03***	***1.76E+00***	***1.61E-02***	***8.87E-01***

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

Attachment 7

Classification of Atmospheric Stability and Joint Frequency Tables for 2022

Table 5

Atmospheric Stability Classes

Class	Differential Temperature Interval (in °C/100m) [1]	Differential Temperature Interval (in °F over the 100-30ft. range) [2]	Differential Temperature Interval (in °F over the 200-30ft. range) [2]
Extremely Unstable	$\Delta T \leq -1.9$	$\Delta T \leq -0.7$	$\Delta T \leq -1.8$
Moderately Unstable	$-1.9 < \Delta T \leq -1.7$	$-0.7 < \Delta T \leq -0.6$	$-1.8 < \Delta T \leq -1.6$
Slightly Unstable	$-1.7 < \Delta T \leq -1.5$	$-0.6 < \Delta T \leq -0.5$	$-1.6 < \Delta T \leq -1.4$
Neutral	$-1.5 < \Delta T \leq -0.5$	$-0.5 < \Delta T \leq -0.2$	$-1.4 < \Delta T \leq -0.5$
Slightly Stable	$-0.5 < \Delta T \leq 1.5$	$-0.2 < \Delta T \leq 0.5$	$-0.5 < \Delta T \leq 1.4$
Moderately Stable	$1.5 < \Delta T \leq 4.0$	$0.5 < \Delta T \leq 1.5$	$1.4 < \Delta T \leq 3.7$
Extremely Stable	$4.0 < \Delta T$	$1.5 < \Delta T$	$3.7 < \Delta T$

[1] from NRC Regulatory Guide 1.23, Revision 1
[2] Reg Guide 1.23, Rev 1 intervals scaled for instrument heights on the Nine Mile Point meteorological tower

2022

Joint Frequency Tables

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

All Stabilities

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	1	10	16	34	82	64	31	20	21	3	0	282
NNE	0	8	15	29	83	118	59	53	30	0	0	395
NE	4	10	20	42	101	78	33	10	12	0	0	310
ENE	6	31	41	40	27	8	0	0	0	0	0	153
E	6	31	67	59	40	20	0	0	0	0	0	223
ESE	5	39	63	99	124	72	32	8	4	5	1	452
SE	4	52	92	98	264	347	128	64	38	1	0	1088
SSE	6	29	59	82	292	337	154	65	38	0	0	1062
S	4	22	29	61	258	362	103	48	43	7	0	937
SSW	2	18	14	17	108	168	72	28	34	0	0	461
SW	0	10	12	26	52	96	51	32	17	1	0	297
WSW	3	10	17	29	110	198	105	80	94	27	44	717
W	3	7	21	24	84	109	83	56	171	107	147	812
WNW	2	6	26	32	49	66	56	55	99	58	94	543
NW	1	11	20	36	50	75	65	55	114	59	25	511
NNW	1	4	26	40	51	56	48	28	41	11	2	308
Tot	48	298	538	748	1775	2174	1020	602	756	279	313	8551

Hours of Calm 21
Hours of Variable Direction 0
Hours of Valid Data 8572
Hours of Missing Data . . . 188
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

Stability Class A Extremely Unstable based on Lapse Rate

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	3	22	16	7	5	8	1	0	62
NNE	0	0	0	1	3	17	6	22	13	0	0	62
NE	0	0	0	0	3	5	1	0	0	0	0	9
ENE	0	0	0	0	0	1	0	0	0	0	0	1
E	0	0	0	0	1	0	0	0	0	0	0	1
ESE	0	0	1	0	0	2	4	0	0	0	0	7
SE	0	0	0	3	5	19	10	4	8	0	0	49
SSE	0	0	0	1	11	24	10	2	0	0	0	48
S	0	0	1	1	8	16	4	3	1	0	0	34
SSW	0	0	0	0	5	7	0	1	0	0	0	13
SW	0	0	0	0	4	3	1	0	1	0	0	9
WSW	0	0	0	1	12	40	14	8	13	7	10	105
W	0	0	3	2	25	41	26	9	33	20	40	199
WNW	0	0	5	20	18	8	13	7	16	19	33	139
NW	0	0	5	17	26	9	10	12	19	25	17	140
NNW	0	0	2	13	27	19	5	6	14	5	0	91
Tot	0	0	17	62	170	227	111	79	126	77	100	969

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 969
Hours of Missing Data . . . 188
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

Stability Class B Moderately Unstable based on Lapse Rate

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	7	7	3	2	1	3	0	0	23
NNE	0	0	0	1	9	11	10	11	12	0	0	54
NE	0	0	1	0	2	3	0	0	0	0	0	6
ENE	0	0	1	1	0	0	0	0	0	0	0	2
E	0	0	0	0	1	0	0	0	0	0	0	1
ESE	0	0	1	2	2	4	1	1	0	0	0	11
SE	0	0	1	1	7	18	4	1	0	0	0	32
SSE	0	0	0	2	9	17	5	2	0	0	0	35
S	0	0	0	1	5	14	11	5	0	0	0	36
SSW	0	0	1	0	4	5	1	0	0	0	0	11
SW	0	0	0	2	4	2	0	0	0	0	0	8
WSW	0	0	0	0	4	12	4	6	5	5	4	40
W	0	0	0	1	5	9	4	5	21	25	17	87
WNW	0	1	2	4	4	4	8	8	17	11	12	71
NW	0	2	1	5	2	14	13	9	36	18	4	104
NNW	0	0	3	4	2	3	10	6	13	4	2	47
Tot	0	3	11	31	67	119	73	55	107	63	39	568

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 568
Hours of Missing Data . . . 188
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

Stability Class C Slightly Unstable based on Lapse Rate

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	2	1	4	7	9	13	5	6	2	0	49
NNE	0	0	1	5	9	8	15	12	5	0	0	55
NE	0	0	1	3	2	3	1	0	10	0	0	20
ENE	0	0	0	1	2	0	0	0	0	0	0	3
E	0	0	3	3	1	0	0	0	0	0	0	7
ESE	0	0	0	0	2	3	0	2	0	0	0	7
SE	0	1	1	1	2	20	6	3	2	0	0	36
SSE	0	0	0	1	7	13	11	4	4	0	0	40
S	0	0	1	2	6	26	7	2	2	0	0	46
SSW	0	0	1	1	4	5	0	1	0	0	0	12
SW	0	0	1	1	1	4	4	1	1	0	0	13
WSW	0	0	0	0	4	14	12	13	14	3	6	66
W	0	0	1	2	11	10	14	11	22	21	33	125
WNW	0	0	4	1	3	12	7	18	28	10	13	96
NW	0	1	3	2	7	8	19	11	38	11	0	100
NNW	1	0	0	3	1	5	18	8	8	1	0	45
Tot	1	4	18	30	69	140	127	91	140	48	52	720

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 720
Hours of Missing Data . . . 188
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

Stability Class D Neutral based on Lapse Rate

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	1	6	7	13	26	31	8	8	2	0	0	102
NNE	0	3	9	11	45	75	27	8	0	0	0	178
NE	1	4	9	17	73	64	31	10	2	0	0	211
ENE	2	11	18	16	15	6	0	0	0	0	0	68
E	0	7	18	21	16	17	0	0	0	0	0	79
ESE	0	7	10	14	37	44	23	4	4	1	0	144
SE	0	4	7	16	78	118	69	43	24	0	0	359
SSE	0	0	10	12	57	108	66	42	27	0	0	322
S	1	3	12	17	80	122	46	26	31	7	0	345
SSW	0	6	2	5	40	101	66	24	34	0	0	278
SW	0	1	5	4	19	60	40	29	14	1	0	173
WSW	1	3	7	9	43	86	51	44	49	9	24	326
W	1	3	8	7	20	36	36	26	83	35	53	308
WNW	1	2	5	6	20	32	25	19	29	16	36	191
NW	0	4	3	7	11	34	23	22	21	5	4	134
NNW	0	2	12	14	12	23	13	8	6	1	0	91
Tot	8	66	142	189	592	957	524	313	326	75	117	3309

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 3309
Hours of Missing Data . . . 188
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

Stability Class E Slightly Stable based on Lapse Rate

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	5	6	14	0	1	1	2	0	0	30
NNE	0	3	3	6	8	2	1	0	0	0	0	23
NE	1	5	6	14	11	2	0	0	0	0	0	39
ENE	2	11	16	13	6	1	0	0	0	0	0	49
E	2	11	29	23	15	3	0	0	0	0	0	83
ESE	3	10	17	27	51	17	4	1	0	4	1	135
SE	0	6	21	20	88	155	39	13	4	1	0	347
SSE	1	9	8	21	96	154	62	15	7	0	0	373
S	2	7	6	18	69	150	35	12	9	0	0	308
SSW	0	3	5	6	37	49	5	2	0	0	0	107
SW	0	6	2	17	20	27	4	2	1	0	0	79
WSW	1	5	4	14	37	41	18	6	9	2	0	137
W	1	4	5	5	17	10	3	5	11	6	4	71
WNW	0	3	4	0	3	9	3	2	9	2	0	35
NW	1	4	2	1	3	7	0	1	0	0	0	19
NNW	0	2	5	2	8	5	2	0	0	0	0	24
Tot	14	90	138	193	483	632	177	60	52	15	5	1859

Hours of Calm 18
Hours of Variable Direction 0
Hours of Valid Data 1877
Hours of Missing Data . . . 188
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

Stability Class F Moderately Stable based on Lapse Rate

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	3	0	3	4	0	0	0	0	0	11
NNE	0	2	2	3	4	2	0	0	0	0	0	13
NE	2	1	2	5	8	1	0	0	0	0	0	19
ENE	1	4	3	5	3	0	0	0	0	0	0	16
E	1	9	15	9	3	0	0	0	0	0	0	37
ESE	2	11	18	33	17	2	0	0	0	0	0	83
SE	3	17	16	20	44	13	0	0	0	0	0	113
SSE	2	10	11	20	47	16	0	0	0	0	0	106
S	0	6	7	14	50	28	0	0	0	0	0	105
SSW	0	4	5	3	17	1	0	0	0	0	0	30
SW	0	2	4	2	4	0	1	0	0	0	0	13
WSW	1	0	5	3	6	5	6	3	3	1	0	33
W	1	0	0	2	3	3	0	0	1	0	0	10
WNW	0	0	4	1	1	1	0	1	0	0	0	8
NW	0	0	1	2	0	3	0	0	0	0	0	6
NNW	0	0	2	3	0	1	0	0	0	0	0	6
Tot	13	67	98	125	210	80	7	4	4	1	0	609

Hours of Calm 1
Hours of Variable Direction 0
Hours of Valid Data 610
Hours of Missing Data . . . 188
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

Stability Class G Extremely Stable based on Lapse Rate

Elevations:: Winds 30ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	1	3	1	0	0	0	0	0	5
NNE	0	0	0	2	5	3	0	0	0	0	0	10
NE	0	0	1	3	2	0	0	0	0	0	0	6
ENE	1	5	3	4	1	0	0	0	0	0	0	14
E	3	4	2	3	3	0	0	0	0	0	0	15
ESE	0	11	16	23	15	0	0	0	0	0	0	65
SE	1	24	46	37	40	4	0	0	0	0	0	152
SSE	3	10	30	25	65	5	0	0	0	0	0	138
S	1	6	2	8	40	6	0	0	0	0	0	63
SSW	2	5	0	2	1	0	0	0	0	0	0	10
SW	0	1	0	0	0	0	1	0	0	0	0	2
WSW	0	2	1	2	4	0	0	0	1	0	0	10
W	0	0	4	5	3	0	0	0	0	0	0	12
WNW	1	0	2	0	0	0	0	0	0	0	0	3
NW	0	0	5	2	1	0	0	0	0	0	0	8
NNW	0	0	2	1	1	0	0	0	0	0	0	4
Tot	12	68	114	118	184	19	1	0	1	0	0	517

Hours of Calm 2
Hours of Variable Direction 0
Hours of Valid Data 519
Hours of Missing Data . . . 188
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

All Stabilities

Elevations:: Winds 200ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	4	12	17	40	58	43	27	54	19	44	318
NNE	1	2	8	9	38	67	34	47	99	50	116	471
NE	0	4	12	20	50	51	46	44	40	25	12	304
ENE	0	3	10	21	39	47	10	4	6	0	0	140
E	0	2	10	11	58	65	22	12	17	0	0	197
ESE	1	4	3	13	37	65	55	42	48	17	7	292
SE	0	3	9	10	35	96	103	113	303	116	38	826
SSE	0	1	6	10	27	114	80	132	355	125	44	894
S	0	5	3	11	25	95	109	132	344	108	45	877
SSW	1	3	6	6	31	76	109	133	210	21	1	597
SW	1	4	6	15	25	74	68	86	163	48	20	510
WSW	0	4	9	11	38	104	82	106	206	110	150	820
W	0	4	7	18	37	103	63	70	143	123	288	856
WNW	1	3	9	12	34	67	34	23	101	82	221	587
NW	1	5	4	9	38	42	40	41	116	84	141	521
NNW	1	3	12	13	43	44	34	26	82	45	46	349
Tot	7	54	126	206	595	1168	932	1038	2287	973	1173	8559

Hours of Calm 12
Hours of Variable Direction 0
Hours of Valid Data 8571
Hours of Missing Data . . . 189
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

Stability Class A Extremely Unstable based on Lapse Rate

Elevations:: Winds 200ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	0	11	16	8	4	12	7	9	67
NNE	0	0	0	1	1	8	3	4	9	7	34	67
NE	0	0	0	0	0	2	1	1	3	1	0	8
ENE	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	1	0	1	0	0	0	2
ESE	0	0	0	1	0	0	1	0	3	0	0	5
SE	0	0	0	0	1	4	4	8	19	5	4	45
SSE	0	0	0	0	2	13	10	7	8	6	0	46
S	0	0	0	0	3	8	4	7	13	5	0	40
SSW	0	0	0	0	1	2	6	2	0	1	0	12
SW	0	0	0	0	0	0	3	2	3	0	0	8
WSW	0	0	0	1	0	14	14	23	29	11	29	121
W	0	0	0	1	8	22	17	20	29	23	60	180
WNW	0	0	1	0	11	26	13	2	14	12	63	142
NW	0	0	0	2	13	21	4	2	17	15	47	121
NNW	0	0	0	6	17	14	11	6	10	13	28	105
Tot	0	0	1	12	68	151	99	89	169	106	274	969

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 969
Hours of Missing Data . . . 189
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

Stability Class B Moderately Unstable based on Lapse Rate

Elevations:: Winds 200ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	2	1	7	0	2	1	3	2	6	24
NNE	0	0	0	2	4	6	3	3	9	9	18	54
NE	0	0	0	1	3	1	0	3	0	1	1	10
ENE	0	0	0	1	0	0	0	0	0	0	0	1
E	0	0	0	1	1	0	0	0	0	0	0	2
ESE	0	0	0	1	1	1	2	0	1	1	0	7
SE	0	0	0	0	1	8	3	3	11	1	0	27
SSE	0	0	0	0	4	8	8	6	12	1	0	39
S	0	0	0	1	3	6	3	8	17	0	0	38
SSW	0	0	0	1	1	4	4	2	3	0	0	15
SW	0	0	0	0	1	1	2	0	2	0	0	6
WSW	0	0	0	0	0	2	2	8	9	8	12	41
W	0	0	0	0	2	7	4	4	7	18	40	82
WNW	0	0	1	1	3	4	1	1	18	11	29	69
NW	0	0	2	1	3	2	9	5	21	18	45	106
NNW	0	0	0	2	5	1	1	3	15	9	11	47
Tot	0	0	5	13	39	51	44	47	128	79	162	568

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 568
Hours of Missing Data . . . 189
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

Stability Class C Slightly Unstable based on Lapse Rate

Elevations:: Winds 200ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	3	1	2	1	3	4	16	5	9	45
NNE	0	0	0	1	8	5	3	3	13	8	27	68
NE	0	0	0	1	6	2	2	3	1	1	0	16
ENE	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	3	0	0	0	0	0	0	3
ESE	0	0	0	1	4	1	0	0	0	2	0	8
SE	0	0	0	0	1	4	9	6	13	6	1	40
SSE	0	0	0	2	0	4	3	6	14	4	1	34
S	0	0	0	0	2	9	8	7	15	3	1	45
SSW	0	0	0	0	3	5	2	5	3	0	0	18
SW	0	0	0	0	2	0	1	0	5	1	1	10
WSW	0	0	0	0	2	5	3	7	23	13	17	70
W	0	0	0	1	3	7	9	9	23	15	53	120
WNW	0	0	0	2	4	5	7	2	17	23	38	98
NW	0	0	0	0	3	2	6	6	32	35	18	102
NNW	0	0	0	0	1	3	0	5	27	5	4	45
Tot	0	1	3	9	44	53	56	63	202	121	170	722

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 722
Hours of Missing Data . . . 189
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

Stability Class D Neutral based on Lapse Rate

Elevations:: Winds 200ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	2	6	9	19	22	16	18	2	14	109
NNE	0	1	4	3	18	26	18	33	60	23	23	209
NE	0	1	8	7	19	25	39	34	33	20	9	195
ENE	0	1	5	6	15	12	2	2	4	0	0	47
E	0	0	2	0	18	17	6	2	12	0	0	57
ESE	0	2	1	5	9	20	16	14	18	10	6	101
SE	0	0	2	4	7	40	45	46	115	60	21	340
SSE	0	1	3	2	8	42	27	43	92	56	29	303
S	0	1	0	3	6	38	55	54	106	43	31	337
SSW	0	0	2	1	9	26	54	60	76	17	1	246
SW	0	2	2	3	7	18	15	36	101	43	19	246
WSW	0	1	2	2	15	22	29	33	97	62	73	336
W	0	0	2	7	10	32	18	25	65	58	115	332
WNW	0	0	2	5	5	15	11	14	43	29	79	203
NW	1	2	1	3	6	6	16	25	39	11	29	139
NNW	0	0	7	4	10	17	19	9	24	13	3	106
Tot	1	13	45	61	171	375	392	446	903	447	452	3306

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 3306
Hours of Missing Data . . . 189
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

Stability Class E Slightly Stable based on Lapse Rate

Elevations:: Winds 200ft . Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	2	4	6	10	5	1	2	2	4	36
NNE	0	0	2	1	4	16	5	2	6	3	6	45
NE	0	0	1	4	11	16	2	2	2	0	0	38
ENE	0	1	2	2	11	18	3	1	2	0	0	40
E	0	1	4	2	10	25	7	4	4	0	0	57
ESE	0	1	0	1	9	17	11	18	15	4	1	77
SE	0	1	3	2	8	21	27	32	111	41	12	258
SSE	0	0	1	2	2	22	17	46	169	58	14	331
S	0	2	0	2	3	20	30	46	158	57	13	331
SSW	1	1	0	0	5	11	16	46	100	3	0	183
SW	1	0	0	2	2	20	22	20	29	4	0	100
WSW	0	2	3	4	8	30	17	20	45	15	13	157
W	0	1	2	3	8	24	10	10	17	6	18	99
WNW	1	0	2	3	3	11	1	4	9	7	11	52
NW	0	2	1	1	7	4	5	3	6	2	1	32
NNW	0	2	2	0	7	6	1	3	4	4	0	29
Tot	3	14	25	33	104	271	179	258	679	206	93	1865

Hours of Calm 12
Hours of Variable Direction 0
Hours of Valid Data 1877
Hours of Missing Data . . . 189
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

Stability Class F Moderately Stable based on Lapse Rate

Elevations:: Winds 200ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	3	3	3	8	2	0	1	1	2	24
NNE	0	0	1	1	1	3	0	1	2	0	5	14
NE	0	0	3	5	3	4	2	0	1	2	2	22
ENE	0	1	2	5	7	9	2	1	0	0	0	27
E	0	0	1	3	15	13	6	2	1	0	0	41
ESE	0	1	1	1	4	13	15	6	5	0	0	46
SE	0	0	3	1	6	9	3	11	19	2	0	54
SSE	0	0	0	2	9	10	10	11	50	0	0	92
S	0	1	3	4	6	5	3	3	27	0	0	52
SSW	0	1	1	0	4	5	9	11	23	0	0	54
SW	0	2	2	3	5	13	10	17	18	0	0	70
WSW	0	0	1	2	7	16	8	12	3	1	6	56
W	0	2	1	3	5	7	3	2	2	3	1	29
WNW	0	0	3	0	4	3	1	0	0	0	1	12
NW	0	1	0	0	1	2	0	0	1	3	1	9
NNW	0	1	0	1	0	3	2	0	1	0	0	8
Tot	0	11	25	34	80	123	76	77	154	12	18	610

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 610
Hours of Missing Data . . . 189
Hours in Period 8760

Joint Frequency Distribution

Site:: Nine Mile Point

Period:: Months Jan - Dec for years 2022 - 2022

Stability Class G Extremely Stable based on Lapse Rate

Elevations:: Winds 200ft Stability 200ft

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	0	2	2	4	1	1	2	0	0	13
NNE	1	1	1	0	2	3	2	1	0	0	3	14
NE	0	3	0	2	8	1	0	1	0	0	0	15
ENE	0	0	1	7	6	8	3	0	0	0	0	25
E	0	1	3	5	11	9	3	3	0	0	0	35
ESE	1	0	1	3	10	13	10	4	6	0	0	48
SE	0	2	1	3	11	10	12	7	15	1	0	62
SSE	0	0	2	2	2	15	5	13	10	0	0	49
S	0	1	0	1	2	9	6	7	8	0	0	34
SSW	0	1	3	4	8	23	18	7	5	0	0	69
SW	0	0	2	7	8	22	15	11	5	0	0	70
WSW	0	1	3	2	6	15	9	3	0	0	0	39
W	0	1	2	3	1	4	2	0	0	0	1	14
WNW	0	3	0	1	4	3	0	0	0	0	0	11
NW	0	0	0	2	5	5	0	0	0	0	0	12
NNW	1	0	3	0	3	0	0	0	1	1	0	9
Tot	3	15	22	44	89	144	86	58	52	2	4	519

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 519
Hours of Missing Data . . . 189
Hours in Period 8760