

PNP 2022-003

April 25, 2022

10 CFR 50.36a

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

Subject: 2021 Annual Radioactive Effluent Release and Waste Disposal Report

Palisades Nuclear Plant
Docket 50-255
Renewed Facility License No. DPR-20

Big Rock Point
Dockets 50-155 and 72-043
License No. DPR-6

Attached are the Entergy Nuclear Operations, Inc. 2021 Annual Radioactive Effluent Release and Waste Disposal Reports for Palisades Nuclear Plant (PNP) and Big Rock Point (BRP) Independent Spent Fuel Storage Installation (ISFSI). These reports are submitted in accordance with 10 CFR 50.36a(a)(2).

Attachment 1 contains the report for PNP. Attachment 2 contains the report for the BRP ISFSI. Attachment 3 contains ERRATA to Palisades 2020 Annual Radioactive Effluent Release Report.

These reports provide a summary of the quantities of radioactive liquid and gaseous effluent releases and solid radioactive waste processed during the period of January 1, 2021 through December 31, 2021.

This letter contains no new commitments and no revisions to existing commitments.

Respectfully,



BED/mrp



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Attachment 1: Palisades Nuclear Plant 2019 Radioactive Effluent Release Report

**Attachment 2: Big Rock Point Independent Spent Fuel Storage Installation 2021
Radioactive Effluent Release Report**

Attachment 3: ERRATA to Palisades 2020 Annual Radioactive Effluent Release Report.

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Annual Radioactive Effluent Release Report	

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Annual Radioactive Effluent Release Report**1.0 INTRODUCTION**

This report covers the 2021 calendar year for Palisades Nuclear Power Plant (license No. DPR-20) and the decommissioned nuclear facility Big Rock Point (license No. DPR-6). Palisades is a Combustion Engineering Pressurized Water Reactor. Palisades generated 7,014,805.56 MWh of net electrical energy during 2021.

This report is a summary of the effluent data in accordance with Technical Specification (TS) 5.6.3. Both liquid and gaseous effluents are released in accordance with the Offsite Dose Calculation Manual (ODCM). All releases in the reporting period were well below the limits defined in the ODCM.

2.0 SUPPLEMENTAL INFORMATION**2.1 Regulatory Limits**

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

1. Fission and activation gases:
 - a. Dose rates due to noble gas effluents released in gaseous form from the site to areas at and beyond the site boundary shall be limited to the following:
 - Less than or equal to 500 mrem/year to the total body
 - Less than or equal to 3000 mrem/year to the skin
 - b. Air dose due to noble gases released in gaseous effluents to areas at and beyond the site boundary shall be limited to the following:
 - 1) Quarterly
 - Less than or equal to 5 mrad gamma
 - Less than or equal to 10 mrad beta
 - 2) Yearly
 - Less than or equal to 10 mrad gamma
 - Less than or equal to 20 mrad beta

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2. Iodine, tritium, and all radionuclides in particulate form with half-lives greater than 8 days.
 - a. The dose rate for Iodine-131, Iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released to areas at and beyond the site boundary shall be limited to the following:
 - Less than or equal to 1500 mrem/yr to any organ
 - b. The dose to a MEMBER OF THE PUBLIC from Iodine-131, Iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released to areas at and beyond the site boundary shall be limited to the following:
 - 1) Quarterly
 - Less than or equal to 7.5 mrem to any organ
 - 2) Yearly
 - Less than or equal to 15 mrem to any organ
3. Liquid Effluents Dose
 - a. The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released to unrestricted areas shall be limited to the following:
 - 1) Quarterly
 - Less than or equal to 1.5 mrem total body
 - Less than or equal to 5 mrem to any organ
 - 2) Yearly
 - Less than or equal to 3 mrem total body
 - Less than or equal to 10 mrem to any organ
4. Total Dose (40CFR190)
 - a. The annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to the following:
 - Less than or equal to 25 mrem, Total Body or any Organ except Thyroid.

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- Less than or equal to 75 mrem, Thyroid

2.2 Maximum Permissible Concentrations

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

The above limits (section 2.1.1 and 2.1.2) are provided to ensure that radioactive material discharged in gaseous effluents will not result in the exposure of an individual in an unrestricted area to annual average concentrations exceeding the limits of 10 CFR 20, Appendix B, Table 2, Column 1.

2. Liquid Effluents

The concentration of radioactive material released shall be limited to ten times the concentration specified in 10 CFR 20, Appendix B, Table 2, Column 2, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the total concentration released shall be limited to 2.0E-04 microCurie/ml.

2.3 Average Energy

The average energy (\bar{E}) of the radionuclide mixture in releases of fission and activation gases as defined in Regulatory Guide 1.21, Appendix B, Section A.3 is not applicable because the limits used for gaseous releases are based on calculated dose to members of the public.

2.4 Measurements & Approximations of Total Radioactivity

Palisades' gamma spectroscopy system uses 0.25 keV per channel with a range of 0-2000 keV. All analyses are performed to achieve the required lower limit of detection as specified in Palisades' Offsite Dose Calculation Manual (ODCM).

- a. Fission and Activation Gases

Noble gas activity is continuously monitored via a beta scintillation detector on the main stack release point. Additional radiation monitors are located upstream for all likely radiological pathways. Data is reviewed and quantified weekly in accordance with the ODCM.

- b. Airborne Iodine

Iodine is continuously collected on a charcoal cartridge filter via an isokinetic sampling assembly from the main stack release point. Filters are analyzed once per week in accordance with the ODCM.

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c. Airborne Particulates (half-lives > 8 days)

Particulates are continuously collected on a filter paper via an isokinetic sampling assembly on the main stack release point. Filters are analyzed once per week in accordance with the ODCM.

d. Airborne Tritium

Gaseous tritium effluent is calculated monthly in accordance with the ODCM considering spent fuel pool evaporation rate. When the reactor head is removed and the reactor cavity is flooded, reactor cavity evaporation rate is also factored into this calculation.

e. Airborne Carbon-14

Carbon-14 release values were estimated using the methodology included in the EPRI Technical Report 1021106, using the normalized Carbon-14 production rate of 3.9 Ci/GW_{th}yr (Curie per gigawatt-thermal-year), a gaseous release fraction of 98%, a Carbon-14 carbon dioxide fraction of 30%, a reactor power rating of 2565.4 MW_{th}, and equivalent full power operation of 310.29 days.

f. Airborne Sr-89 and Sr-90

A composite, made up of each weekly stack filter paper, is analyzed on a quarterly frequency for the radionuclide Sr-89 and Sr-90.

g. Airborne Gross Alpha

A composite, made up of each weekly stack filter paper, is analyzed on a monthly frequency for gross alpha activity.

h. Liquid Gamma Emitters

Continuous effluent pathways are sampled by a compositor approximately each hour. Weekly, the composite sample for each continuous release pathway is analyzed for gamma emitters. Additionally a monthly grab sample from each continuous effluent pathway is analyzed for gamma emitters. Each processed liquid radiological batch is analyzed for gamma emitters prior to release.

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i. Liquid Tritium, Gross Alpha Activity, and Gross Beta Activity

Continuous effluent pathways are sampled by a compositor approximately each hour. Monthly, a composite sample for each continuous release pathway is analyzed for tritium and gross alpha activity. Service water effluent is also composited and analyzed monthly for gross beta activity. Each processed liquid radiological batch is analyzed for tritium prior to release. Each processed liquid radiological batch is analyzed as a monthly composite for tritium and gross alpha activity.

j. Liquid Sr-89, Sr-90, Ni-63, and Fe-55

Quarterly a composite from each continuous effluent pathway and a composite of processed liquid radiological batches are analyzed for Sr-89, Sr-90, Ni-63, and Fe-55.

k. Estimated Total Error Present

Estimates of measurement and analytical error for gaseous and liquid effluents are calculated as follows:

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

Where:

E_T = total percent error

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

2.5 Batch Releases:

1. Liquid

- a. Number of batch releases: 5
- b. total time period for batch releases: 62.4 hours
- c. Maximum time period for a batch release: 26.3 hours
- d. Average time period for a batch release: 12.5 hours
- e. Minimum time period for a batch release: 7.75 hours

Annual Radioactive Effluent Release Report2. Gaseous

- a. Number of batch releases: 7
- b. Total time period for batch releases: 11.6 hours
- c. Maximum time period for a batch release: 2.10 hours
- d. Average time period for a batch release: 1.66 hours
- e. Minimum time period for a batch release: 1.17 hours

2.6 **Continuous Releases:**1. Liquid

- a. Palisades continuously monitors one common continuous release discharge point (the mixing basin) using radiation monitors and sample analysis in accordance with Palisades ODCM. The major input pathways to the mixing basin include the service water effluent, turbine building sump effluent, processed liquid radiological effluent, and dilution water effluent. All major input pathways are also continuously monitored using radiation monitors and/or sample analysis in accordance with Palisades ODCM. Palisades contracts an independent laboratory to perform redundant and specialized analysis.

2. Gaseous

- a. Palisades continuously monitors one common continuous release discharge point (the plant stack) using radiation monitors and sample analysis in accordance with Palisades ODCM. The major input pathways to the plant stack include the auxiliary building, containment building, condenser off gas system, and waste gas decay tanks. All major input pathways are also continuously monitored using radiation monitors and/or sample analysis in accordance with Palisades ODCM. Palisades contracts an independent laboratory to perform redundant and specialized analysis.

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2.7 Abnormal Releases**1. Gaseous**

- a. Number of releases: 1
- b. Total Activity (Ci) released: 1.80E-02 Ci of H-3 and 1.15E-06 Ci of I-133
- c. On 7/28/2021, operations began a down-power to support maintenance for a condensate pump. Later on this date, a relief valve on the steam generator blowdown flash tank lifted, as designed, due to increased pressure in this system. This resulted in secondary plant steam being released to the environment. Secondary plant steam contains very low radiological activity. Sampling and analysis requirements were performed for this release in accordance with Palisades' offsite dose calculation manual (ODCM). The release was conservatively assumed to be from when the plant started the down-power until it was validated that the relief valve was no longer lifting (7/28/2021 08:45 through 7/31/2021 13:49). The activity in the effluent was conservatively assumed to be the highest measured activity for each nuclide among all samples collected over the course of the release. This activity was 5.18E-05 uCi/ml of H-3 and 3.33E-09 uCi/ml of I-133. The release rate was conservatively assumed to be the entire difference between flowrate going to the blowdown vent tank and flowrate downstream of the relief valve (demineralizer effluent). This release rate was 19.8 gpm of water. It was therefore calculated that 1.80E-02 Ci of H-3 and 1.15E-06 Ci of I-133 was released. The release rate was significantly below regulatory limits listed in the ODCM. This release accounts for roughly 0.2% of the total gaseous H-3 and 1% of the total gaseous iodine (including all isotopes) released from Palisades in 2021. Similarly this release accounted for a small fraction of the total offsite dose due to gaseous effluents from Palisades. As shown in Table 11 and Table 12 of this report offsite dose is well below regulatory limits.

2. Liquid

- a. Number of releases: 1
- b. Total Activity (Ci) released: 2.90E-01 Ci of H-3 was released in 2020 and 1.11E+00 Ci of H-3 was released in 2021.
- c. On 03/19/2021 it was identified that the pathway by which a condensate receiver tank (T-927) was sending condensate to the mixing basin, was bypassing radiological monitoring equipment. This was immediately corrected upon discovery. A conservative calculation was performed to quantify the maximum amount of all radiological material which could have been discharged from this condition.

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T-927 receives secondary system condensate which contains low level tritium. The duration of time T-927 was sending water to the mixing basin was conservatively assumed to be continuously from 11/17/2020 at 13:21 to 03/19/2021 at 16:44. The fraction of the release for 2020 is being added to this report under the ERRATA to show this impact of this release on 2020 reporting values. The flow rate of the release was calculated conservatively to be 98.0 gallons per minute based on the head pressure of an assumed full tank and physical restrictions to the downstream flow (such as piping length and diameter). The activity was conservatively assumed to be equal to the greatest measured activity for all nuclide from a secondary system condensate receiver tank over the duration of the release. This activity was 1.22E-05 uCi/ml of H-3 in 2020 and 2.68E-05 uCi/ml of H-3 in 2021. It was therefore calculated that 2.90E-01 Ci of H-3 was released in the 2020 and 1.11E+00 Ci of H-3 was released in 2021. This accounts for 0.04% and 0.2% of the total liquid H-3 released from Palisades in 2020 and 2021 respectively. Similarly this release accounted for a small fraction of the total offsite dose due to liquid effluents from Palisades. As shown in Table 11 and Table 12 of this report offsite dose is well below regulatory limits.

2.8 Non-routine, Planned Discharges

1. Gaseous non-routine planned discharge of effluents accounted for a total of 4.92E-06 curies of activity associated with the category "Iodine, tritium, and all radionuclides in particulate form with half-lives greater than 8 days". This accounted for 0.000005% of the total activity of this category. These discharges are from radiological controlled areas which are not ventilated to the stack (such as Tool Decontamination Room and Hot Machine shop). These areas are considered less-significant release points in accordance with Regulatory Guide 1.21 Revision 3.

2.9 Land Use Census Changes

1. The 2021 Land Use Census resulted in no changes to critical receptor locations (i.e. routes of exposure). The critical resident and garden are within 1 mile of the plant in the S and SSE sectors. The critical livestock are within 3 miles of the plant in the ESE sectors. The critical receptors are used in conjunction with meteorological data to model dose consequence of Palisades' effluent.

Annual Radioactive Effluent Release Report**2.10 Effluent Monitor Instrument Inoperability**

1. During 2021 there was one instance of an effluent radiation monitor which exceeded 30 consecutive days being non-functional. This radiation monitor was the steam generator blowdown ventilation monitor (RIA-2320) which was non-functional from 11/05/2020 through 9/1/2021. The long duration for this monitor being non-functional is due to damage in the detector well which required a custom part to repair. During this period there was one release to the environment via this pathway during which time sampling and analysis was performed in accordance with the ODCM. This release was associated with relief valve cycling and was discussed in Section 2.7.1, Abnormal Releases.

2.11 Offsite Dose Calculation Manual (ODCM) Changes

1. Palisades ODCM was not revised in 2021.

2.12 Process Control Program (PCP) Changes

1. No major radwaste system modifications (as defined in the ODCM) were implemented in 2021.
2. There were no changes to the procedure (EN-RW-105) governing the PCP in 2021 and therefore no copy of EN-RW-105 is being provided in this report.

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

Groundwater is routinely sampled onsite in support of the Groundwater Protection Initiative (GPI). These samples are not part of the Radiological Environmental Monitoring Program. A summary of the sample results are listed in Table 2.13A. All groundwater monitoring wells in Table 2.13A are located within the owner controlled area to allow for prompt detection of leaks from plant systems. The minimum, maximum, and average concentration of tritium listed in Table 2.13A are for all samples which contained detectable concentrations of tritium.

Palisades has 23 groundwater monitoring wells (which have the prefix "MW"). Palisades also monitors 16 temporary wells (which have the prefix "TW") in addition to the 23 monitoring wells to provide additional monitoring in strategic locations. Table 2.13A indicates that temporary wells TW-2, TW-3, TW-4, TW-5, TW-6, TW-7, TW-9, TW-10, TW-13, TW-14, TW-16, TW-17 and monitoring wells MW-3, and MW-13 all contained detectable tritium in 2021. All of the monitoring wells and temporary wells which detected tritium in 2021 are located within an area approximately 140 feet wide (north to south) and 90 feet long (east to west).

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Radiological effluents via groundwater are quantified in accordance with the methodology described in Regulatory Guide 4.25, "Assessment of Abnormal Radionuclide Discharges in Ground Water to the Unrestricted Area at Nuclear Power Plant Sites". The groundwater monitoring wells used for this analysis are those on the western perimeter of the site (between the site and Lake Michigan) and include MW1, MW1A, MW2, MW3, MW3A, MW4, MW5, MW11, MW12, MW13, TW9, and TW10. The total tritium activity discharged via groundwater to Lake Michigan was 1.16E-01 Curies in 2021. This is a very small percentage (0.02%) of the total liquid tritium activity discharged from Palisades in 2021. Palisades total liquid effluents (including effluent via groundwater) is well below the limits specified in the ODCM.

Palisades made no NEI 07-07 voluntary notifications in 2021.

In 2021 Palisades implemented several plant enhancements to mitigate and correct the potential release of tritium to groundwater. These enhancements included the lining of below-grade pipes and sumps which contain secondary plant water and the installation of a "flap" (or one-way valve) on the discharge of below grade piping going to the mixing basin.

Palisades continues to implement the GPI in accordance with NEI 07-07 with the goal of prompt identification and correction of leaks from plant systems.

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Table 2.13A, Non-REMP Groundwater Monitoring Results Summary

Well Number	Total Samples	Samples with Detectable Tritium	Minimum Tritium (pCi/L)	Maximum Tritium (pCi/L)	Average Tritium (pCi/L)
MW1	4	0	NA	NA	NA
MW1A	4	0	NA	NA	NA
MW2	4	0	NA	NA	NA
MW3	11	4	823	3350	1656
MW3A	5	0	NA	NA	NA
MW4	4	0	NA	NA	NA
MW5	4	0	NA	NA	NA
MW6	4	0	NA	NA	NA
MW7	4	0	NA	NA	NA
MW8	5	0	NA	NA	NA
MW9	4	0	NA	NA	NA
MW9A	4	0	NA	NA	NA
MW10	4	0	NA	NA	NA
MW11	6	0	NA	NA	NA
MW-12	3	0	NA	NA	NA
MW-13	9	5	3522	19552	11350
MW14	4	0	NA	NA	NA
MW15	4	0	NA	NA	NA
MW16	4	0	NA	NA	NA
MW17	4	0	NA	NA	NA
MW18	4	0	NA	NA	NA
MW19	4	0	NA	NA	NA
MW20	4	0	NA	NA	NA
TW1	4	0	NA	NA	NA
TW2	11	7	724	36870	17796
TW3	10	9	1417	49197	27581
TW4	13	11	4773	45858	19381
TW5	11	6	1088	3724	1746
TW6	10	6	1475	3509	2049
TW7	7	5	628	3687	1925
TW9	11	8	592	4340	1226
TW10	8	7	736	9073	2787
TW11	4	0	NA	NA	NA
TW13	13	9	571	47054	30969
TW14	9	8	15385	43007	29627
TW15	5	0	NA	NA	NA
TW16	6	1	734	734	734
TW17	13	11	589	41988	21074
TW18	3	0	NA	NA	NA

Annual Radioactive Effluent Release Report**2.14 Outside Tanks**

1. All outdoor tanks as described in the ODCM were maintained within the ODCM limit of less than 1,000 times the effluent concentration (EC), excluding tritium and noble gases, as listed in 10 CFR Part 20, Appendix B, Table 2, Column 2.

2.15 Errata/Corrections to Previous ARERRs

1. Due to the discovery of the abnormal release described in Section 2.7.2 the activity from the fraction of the release which occurred in 2020 is being added to the ERRATA section (Attachment 3) of this report.
2. The errors in the 2020 ARERR resulted in an underestimate of the total liquid tritium effluent by approximately 0.04% for that reporting year. This resulted in an underestimate of the annual offsite dose consequence by approximately 0.01% for organ dose via liquid effluents. There was no change to the reported whole body dose via liquid effluents in 2020. As shown in the revised Table 11 in Attachment 3 of this report, liquid dose is a very small fraction of the most restrictive regulatory limits (10 CFR Part 50 Appendix I design objective).
3. The affected pages of the 2020 ARERR include page 17, 19, and 23. These pages contain Table 4, Table 6, and Table 11. The changed pages are in Attachment 3 of this report.

2.16 Table Notes for Tables 1 through Table 14 –

1. The “annual total” column for all Tables in this report may not be equal to exactly the sum of the four quarters due to rounding differences and the three significant figure format for reporting.
2. The annual dose values may not be equal to the sum of the four quarters due to different critical receptors and critical age groups between different quarters.
3. Table notation “ND” means “not detected”
4. Table notation “NA” means “not applicable”

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3.0 GASEOUS EFFLUENTS

3.1 Gaseous Effluent and Waste Disposal Report

Table 1, Gaseous Effluents-Summation of All Releases - Palisades

A. Fission and Activation Gases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total	Est. Total Error %
1. Total Release	Ci	3.44E-01	1.85E+00	5.81E-01	1.27E+00	4.05E+00	1.11E+01
2. Average release rate for the period	μCi/sec	4.43E-02	2.35E-01	7.30E-02	1.60E-01	1.28E-01	
B. Iodine							
1. Total I-131	Ci	1.19E-05	1.44E-05	3.17E-05	2.27E-05	8.08E-05	3.09E+01
2. Average release rate for the period	μCi/sec	1.53E-06	1.84E-06	3.99E-06	2.86E-06	2.56E-06	
C. Particulates							
1. Particulates with half-lives > 8 days	Ci	3.95E-08	1.28E-07	3.70E-07	3.45E-11	5.38E-07	2.83E+01
2. Average release rate for the period	μCi/sec	5.08E-09	1.63E-08	4.66E-08	4.34E-12	1.71E-08	
D. Tritium							
1. Total Release	Ci	2.90E+00	3.21E+00	2.43E+00	2.41E+00	1.09E+01	8.75E+00
2. Average release rate for the period	μCi/sec	3.73E-01	4.08E-01	3.05E-01	3.03E-01	3.47E-01	
E. Gross Alpha							
1. Total Release	Ci	ND	ND	ND	ND	ND	NA
2. Average release rate for the period	μCi/sec	NA	NA	NA	NA	NA	
F. Carbon-14							
1. Total Release	Ci	2.41E+00	2.44E+00	2.43E+00	2.47E+00	9.75E+00	
2. Average release rate for the period	μCi/sec	3.11E-01	3.11E-01	3.05E-01	3.11E-01	3.09E-01	

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

Radionuclide Released	Unit	Quarter 1	Quarter 2	(Note 1)Quarter 3	Quarter 4	Total
Fission Gases						
Kr-85	Ci	ND	6.46E-04	1.71E-04	8.14E-04	1.63E-03
Xe-133	Ci	6.25E-06	4.17E-06	ND	ND	1.04E-05
Total	Ci	6.25E-06	6.50E-04	1.71E-04	8.14E-04	1.64E-03
Iodines						
Total	Ci	ND	ND	ND	ND	ND
Particulates						
Total	Ci	ND	ND	ND	ND	ND
Tritium						
H-3	Ci	NA	NA	NA	NA	NA

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

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Fission Gases						
Ar-41	Ci	9.20E-02	5.32E-01	1.78E-01	4.91E-01	1.29E+00
Kr-85m	Ci	ND	1.29E-02	3.34E-03	1.81E-02	3.42E-02
Kr-87	Ci	2.14E-03	7.38E-02	3.05E-02	4.44E-02	1.51E-01
Kr-88	Ci	4.94E-04	6.36E-02	1.00E-02	2.24E-02	9.65E-02
Xe-133	Ci	1.83E-03	3.79E-02	1.89E-02	5.94E-02	1.18E-01
Xe-135	Ci	6.43E-02	3.91E-01	1.05E-01	2.31E-01	7.90E-01
Xe-135m	Ci	4.33E-03	5.65E-03	6.68E-03	5.71E-03	2.24E-02
Xe-137	Ci	9.20E-02	2.15E-01	9.15E-02	9.44E-02	4.93E-01
Xe-138	Ci	8.71E-02	5.18E-01	1.37E-01	3.03E-01	1.05E+00
Total	Ci	3.44E-01	1.85E+00	5.80E-01	1.27E+00	4.04E+00
Iodines						
I-131	Ci	1.19E-05	1.44E-05	3.17E-05	2.27E-05	8.08E-05
I-133	Ci	5.63E-06	1.11E-05	4.66E-05	1.00E-05	7.33E-05
Total	Ci	1.75E-05	2.55E-05	7.83E-05	3.28E-05	1.54E-04
Particulates						
Co-60	Ci	3.95E-08	1.28E-07	2.86E-07	3.45E-11	4.54E-07
Ag-110m	Ci	ND	ND	8.43E-08	ND	8.43E-08
Total	Ci	3.95E-08	1.28E-07	3.70E-07	3.45E-11	5.38E-07
Tritium						
H-3	Ci	2.90E+00	3.21E+00	2.43E+00	2.41E+00	1.09E+01
Gross Alpha						
Alpha	Ci	ND	ND	ND	ND	ND
Carbon-14						
C-14	Ci	2.41E+00	2.44E+00	2.43E+00	2.47E+00	9.75E+00

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4.0 LIQUID EFFLUENTS

4.1 Liquid Effluent and Waste Disposal Report

Table 4, Liquid Effluents-Summation of All Releases - Palisades

A. Fission and Activation Products		Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total	Est. Total Error %
1.	Total Release (not including tritium, gases or alpha)	Ci	ND	1.07E-04	1.08E-04	1.25E-05	2.27E-04	3.53E+01
2.	Average diluted concentration during period	μCi/mL	NA	2.73E-12	2.69E-12	3.14E-13	1.44E-12	
B. Tritium								
1.	Total Release	Ci	1.25E+00	9.00E+01	2.78E+02	1.19E+02	4.88E+02	6.37E+00
2.	Average diluted concentration during period	μCi/mL	3.19E-08	2.29E-06	6.95E-06	2.99E-06	3.08E-06	
C. Dissolved and Entrained Gases								
1.	Total Release	Ci	ND	ND	1.82E-05	ND	1.82E-05	5.56E+01
2.	Average diluted concentration during period	μCi/mL	NA	NA	4.54E-13	NA	1.15E-13	
D. Gross Alpha Activity								
1.	Total Release	Ci	ND	ND	ND	ND	ND	NA
2.	Average diluted concentration during period	μCi/mL	NA	NA	NA	NA	NA	
E.	Volume of Waste Released (prior to dilution)	Liters	5.19E+07	7.29E+06	7.78E+06	8.17E+06	7.51E+07	

Annual Radioactive Effluent Release Report

Table 4, Liquid Effluents-Summation of All Releases - Palisades

	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
F. Volume of Dilution Water Used During Period	Liters	3.92E+10	3.92E+10	4.00E+10	3.97E+10	1.58E+11

Annual Radioactive Effluent Release Report

Table 5, Batch Mode Liquid Effluents

Nuclides Released	Unit	Batch Mode				Total
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	
Fission Products						
Co-60	Ci	NA	1.51E-05	4.11E-05	ND	5.61E-05
Ag-108m	Ci	NA	7.52E-06	ND	ND	7.52E-06
Ag-110m	Ci	NA	8.45E-05	5.76E-05	1.25E-05	1.55E-04
Total	Ci	NA	1.07E-04	9.87E-05	1.25E-05	2.18E-04
Dissolved and Entrained Gases						
Xe-133	Ci	NA	ND	1.82E-05	ND	1.82E-05
Total	Ci	NA	ND	1.82E-05	ND	1.82E-05
Tritium						
H-3	Ci	NA	8.98E+01	2.78E+02	1.18E+02	4.86E+02
Gross Alpha						
Alpha	Ci	NA	ND	ND	ND	ND

Annual Radioactive Effluent Release Report

Table 6, Continuous Mode Liquid Effluents

Nuclides Released	Unit	Continuous Mode				
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Fission and Activation Products						
Co-58	Ci	ND	ND	9.02E-06	ND	9.02E-06
Cs-137	Ci	ND	ND	1.19E-04	ND	1.19E-04
Total	Ci	ND	ND	9.02E-06	ND	9.02E-06
Dissolved and Entrained Gases						
Total	Ci	ND	ND	ND	ND	ND
Tritium						
H-3	Ci	1.25E+00	1.81E-01	1.78E-01	2.16E-01	1.83E+00
Gross Alpha						
Alpha	Ci	ND	ND	ND	ND	ND

Annual Radioactive Effluent Release Report

5.0 SOLID WASTE SUMMARY

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

Table 7, Types of Solid Waste Summary

Types of Waste	Total Quantity (m ³)	Total Activity (Ci)	Est. Total Error (%)
a. Spent resins, filter sludges, evaporator bottoms, etc.	1.94E+01	1.63E+02	25
b. Dry compressible waste, contaminated equip, etc.	1.65E+02	1.01E+00	25
c. Irradiated components, control rods, etc.	0.00E+00	0.00E+00	NA
d. Other (sludge, used oil, water, etc.)	0.00E+00	0.00E+00	NA

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

Table 8, Major Nuclides

Major Nuclide Composition	%	Curies
a. Spent resins, filter sludges, evaporator bottoms, etc.		
Fe-55	20.83	3.40E+01
Co-58	9.51	1.55E+01
Co-60	47.49	7.75E+01
Ni-63	13.39	2.19E+01
Zn-65	1.30	2.12E+00
Nb-95	1.22	1.99E+00
b. Dry compressible waste, contaminated equip, etc.		
C-14	2.40	2.43E-02
C-51	1.32	1.34E-02
Co-58	18.01	1.82E-01
Co-60	25.23	2.55E-01

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Table 8, Major Nuclides

Ni-63	25.00	2.53E-01
Zr-95	1.56	1.57E-02
Nb-95	2.99	3.02E-02
Ag-110m	5.73	5.80E-02
c. Irradiated components, control rods, etc.		
NA	NA	NA
d. Other (sludge, used oil, water, etc.)		
NA	NA	NA

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

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5.1.3 Solid Waste Disposition

Table 9, Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
11	Hittman Transport	Energy Solutions Bear Creek Facility 1560 Bear Creek Road
1	Hittman Transport	Erwin ResinSolutions, LLC 151 T.C. Runion Road

Table 10, Irradiated Fuel Shipments Disposition

Number of Shipments	Mode of Transportation	Destination
0	NA	NA

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6.0 RADIOLOGICAL IMPACT TO MAN

6.1 10CFR Part50, Appendix I Evaluation

Table 11, Dose Assessment

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Liquid Effluent Dose Limit, Total Body	1.5 mrem	1.5 mrem	1.5 mrem	1.5 mrem	3 mrem
Total Body Dose (mrem)	9.37E-07	7.03E-05	3.66E-04	9.03E-05	5.29E-04
% of Limit	6.25E-05	4.69E-03	2.44E-02	6.02E-03	1.76E-02
Liquid Effluent Dose Limit, Any Organ	5 mrem	5 mrem	5 mrem	5 mrem	10 mrem
Maximum Organ Dose (mrem)	9.37E-07	7.07E-05	4.45E-04	9.03E-05	6.08E-04
% of Limit	1.87E-05	1.41E-03	8.90E-03	1.81E-03	6.08E-03
Gaseous Effluent Dose Limit, Gamma Air	5 mrad	5 mrad	5 mrad	5 mrad	10 mrad
Gamma Air Dose (mrad)	1.46E-04	9.14E-04	2.71E-04	6.42E-04	1.97E-03
% of Limit	2.92E-03	1.83E-02	5.42E-03	1.28E-02	1.97E-02
Gaseous Effluent Dose Limit, Beta Air	10 mrad	10 mrad	10 mrad	10 mrad	20 mrad
Beta Air Dose (mrad)	1.54E-04	6.65E-04	2.26E-04	4.06E-04	1.45E-03
% of Limit	1.54E-03	6.65E-03	2.26E-03	4.06E-03	7.25E-03
Gaseous Effluent Organ Dose Limit (Iodine, Tritium, Particulates with > 8 day half-life)	7.5 mrem	7.5 mrem	7.5 mrem	7.5 mrem	15 mrem
Gaseous Effluent Organ Dose (Iodine, Tritium, Particulates with > 8 day half-life) (mrem)	2.73E-03	3.59E-03	3.63E-03	3.34E-03	1.33E-02
% of Limit	3.63E-02	4.79E-02	4.84E-02	4.45E-02	8.87E-02

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6.2 40CFR Part 190 Evaluation for an Individual in the Unrestricted Area

Table 12, EPA 40 CFR PART 190 Evaluation			
	Whole Body	Thyroid	Any Other Organ
Dose Limit	25 mrem	75 mrem	25 mrem
Dose (mrem)	1.12E-01	1.17E-01	5.22E-01
% of Limit	4.49E-01	1.56E-01	2.09E+00

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

Annual Radioactive Effluent Release Report

7.0 METEOROLOGICAL DATA

7.1 Joint Frequency Distributions

1. Period of Record: 01/01/2021 - 12/31/2021
2. Elevation: 10 meter

Table 13, Hours of Each Wind Speed and Direction

Wind Direction	Wind Speed (m/s)							Total
	0.1 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0	5.1 and greater	Speed not available	
N	19	139	132	75	29	8	3	405
NNE	20	107	74	29	8	0	0	238
NE	24	118	127	35	10	2	0	316
ENE	23	74	125	83	39	24	0	368
E	28	44	30	43	16	43	0	204
ESE	21	56	29	19	11	10	0	146
SE	29	77	149	151	112	208	0	726
SSE	50	351	434	275	127	105	0	1342
S	67	406	180	40	19	1	0	713
SSW	42	124	122	37	11	6	0	342
SW	42	137	224	221	88	27	0	739
WSW	45	147	150	88	46	27	0	503
W	48	138	89	75	48	59	0	457
WNW	61	154	159	121	52	40	0	587
NW	51	209	218	171	96	49	0	794
NNW	30	158	274	192	87	73	0	814

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3. Variables

- a. There were 65 calm hours in 2021.
- b. From January 1 through July 1 of 2021 data recovery was 97.4% for all parameters. The missing data was the 10 meter temperature data and the cause for the loss of data was a connection issue between the sensor and the computer which has been fixed. The joint control room availability of at least one wind speed, one wind direction, and one stability parameter, from January 1 through July 1 of 2021 was 4344/4344 or 100.0%.
- c. From July 1 through December 31 of 2021 data recovery was 99.8% for all parameters. The missing data was the 10 meter temperature data and the cause for the loss of data is unknown. Most of the missing data was recoverable and therefore the joint control room availability of at least one wind speed, one wind direction, and one stability parameter, from July 1 through December 31 of 2021 was 4415/4416 or 99.98%.

7.2 Stability Class

Table 14, Classification of Atmospheric Stability

Stability Condition	Pasquill Categories	Hours (Percentage)
Extremely Unstable	A	21.4
Moderately Stable	B	4.5
Slightly Unstable	C	5.7
Neutral	D	34.7
Slightly Stable	E	19.5
Moderately Stable	F	7.8
Extremely Stable	G	4.9
Data not available	N/A	1.4

Palisades' meteorological data is maintained on-site and available for review upon request

Attachment 1

Palisades Offsite Dose Calculation Manual (ODCM)

Not applicable, there was no ODCM revision in the reporting year

Attachment 2

**Big Rock Point Independent Spent Fuel Storage Installation 2021 Annual Radioactive
Effluent Release Report**

7 pages to follow

ATTACHMENT 2
BIG ROCK POINT INDEPENDENT SPENT FUEL STORAGE INSTALLATION
2021 RADIOACTIVE EFFLUENT RELEASE REPORT

This report provides information relating to radioactive effluent releases and solid radioactive waste disposal at Big Rock Point (BRP) for the year 2021. The report format is detailed in the BRP Offsite Dose Calculation Manual (ODCM). Effluent releases from BRP are controlled by the Defueled Technical Specifications and the ODCM requirements.

2021 Operating History

On January 8, 2007, the Nuclear Regulatory Commission (NRC) approved release of the former BRP Nuclear Plant property for unrestricted use in accordance with the BRP License Termination Plan¹. On April 11, 2007, the license for BRP, DPR-06, was transferred to Entergy Nuclear Operations, Inc.

During 2021, normal independent spent fuel storage installation (ISFSI) operations continued. There were no operational activities that generated any solid radioactive waste.

Liquid and gaseous effluent monitoring is no longer conducted as the former BRP nuclear plant property has been released from the license. Short-lived radionuclides, including iodines and noble gas, are neither expected nor reported.

1. Supplemental Information

A. Batch Releases

There were no batch releases of gaseous or liquid effluents during 2021. All batch releases of radioactive liquids as described in the ODCM ceased in 2004. Reference Table 1.

B. Abnormal Releases

There were no abnormal releases from BRP during 2021.

C. Radioactive Effluent Monitoring Instrumentation

All plant-installed liquid and gaseous radioactive effluent monitoring instrument channels have been permanently removed and dismantled.

¹ Letter from the USNRC dated January 8, 2007, "Release of Land from Part 50 License for Unrestricted Use"

2. Gaseous Effluents

There were no gaseous effluents released during 2021. Table 2 lists and summarizes gaseous effluent releases in accordance with the ODCM.

3. Liquid Effluents

There were no liquid effluent batch releases during 2021. Table 3 lists and summarizes liquid effluent releases in accordance with the ODCM.

4. Solid Waste

There was no solid radioactive waste generated or shipped during 2021.

5. Summary of Radiological Impact on Man

The ODCM specifies that the annual effluent release report provide potential dose calculations based on measured effluent to liquid and gaseous pathways, if estimates of dose exceed one millirem to an organ or total body of any individual or more than one person-rem to the population within 50 miles. During 2021, there were no releases. Therefore, no calculations were required.

6. Offsite Dose Calculation Manual

The ODCM describes the radiological release requirements for the BRP site. There were no revisions to the ODCM in 2021.

7. Process Control Program (PCP)

The Process Control Program (PCP) describes solid waste processing and disposal methods utilized at the BRP site. Changes to the fleet procedure governing the PCP have no effect on the BRP site in 2021.

TABLE 1
Big Rock Point
Batch Releases
 January 1, 2021 to December 31, 2021

A. GASEOUS	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
Number of Releases		N/A	N/A	N/A	N/A
Total Release Time	Minutes	N/A	N/A	N/A	N/A
Maximum Release Time	Minutes	N/A	N/A	N/A	N/A
Average Release Time	Minutes	N/A	N/A	N/A	N/A
Minimum Release Time	Minutes	N/A	N/A	N/A	N/A

B. LIQUID	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
Number of Releases		N/A	N/A	N/A	N/A
Total Release Time	Minutes	N/A	N/A	N/A	N/A
Maximum Release Time	Minutes	N/A	N/A	N/A	N/A
Average Release Time	Minutes	N/A	N/A	N/A	N/A
Minimum Release Time	Minutes	N/A	N/A	N/A	N/A

TABLE 2
Big Rock Point
Gaseous Effluent Releases
 January 1, 2021 to December 31, 2021

A. FISSION AND ACTIVATION GASES	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR	Est Total Error %
1. Total release	Ci	N/A	N/A	N/A	N/A	N/A
2. Average release rate for period	μCi/sec	N/A	N/A	N/A	N/A	
3. Percent of annual avg EC	%	N/A	N/A	N/A	N/A	

B. IODINES	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR	Est Total Error %
1. Total iodine	Ci	N/A	N/A	N/A	N/A	N/A
2. Average release rate for period	μCi/sec	N/A	N/A	N/A	N/A	
3. Percent of annual avg EC	%	N/A	N/A	N/A	N/A	

C. PARTICULATES	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR	Est Total Error %
1. Particulates with half-life >8 day	Ci	N/A	N/A	N/A	N/A	N/A
2. Average release rate for period	μCi/sec	N/A	N/A	N/A	N/A	
3. Percent of annual avg EC	%	N/A	N/A	N/A	N/A	
4. Gross alpha radioactivity	Ci	N/A	N/A	N/A	N/A	

D. TRITIUM	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR	Est Total Error %
1. Total Release	Ci	N/A	N/A	N/A	N/A	N/A
2. Average release rate for period	μCi/sec	N/A	N/A	N/A	N/A	
3. Percent of annual avg EC	%	N/A	N/A	N/A	N/A	

E. WHOLE BODY DOSE	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR	Est Total Error %
1. Beta Air dose at Site Boundary due to Noble Gases (ODCM Section 1, 1.3.2 a (1) (2))	mrad	N/A	N/A	N/A	N/A	N/A
2. Percent limit	%	N/A	N/A	N/A	N/A	
3. Gamma Air dose at Site Boundary due to Noble Gas (ODCM Section 1, 1.3.2 a (1) (2))	mrad	N/A	N/A	N/A	N/A	
4. Percent limit	%	N/A	N/A	N/A	N/A	

F. ORGAN DOSE (ODCM Section 1, 1.3.2b (1) (2))	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR	Est Total Error %
1. Maximum organ dose to public based on Critical Receptors (child bone)	mrem	N/A	N/A	N/A	N/A	N/A
2. Percent of limit (7.5 mrem/quarter)	%	N/A	N/A	N/A	N/A	

TABLE 2
Big Rock Point
Gaseous Effluent Releases
 January 1, 2021 to December 31, 2021

1. NUCLIDES RELEASED	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
Fission & Activation Gases	Ci	N/A	N/A	N/A	N/A
Iodines	Ci	N/A	N/A	N/A	N/A
Particulates*	Ci	N/A	N/A	N/A	N/A

* Particulates with half-life >8 days

TABLE 3
Big Rock Point
Liquid Effluent Releases
 January 1, 2021 to December 31, 2021

A. FISSION AND ACTIVATION PRODUCTS	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR	Est Total Error %
1. Total release (not including tritium, gases, alpha)	Ci	N/A	N/A	N/A	N/A	N/A
2. Average diluted concentration during period	µCi/ml	N/A	N/A	N/A	N/A	
3. Percent of EC	%	N/A	N/A	N/A	N/A	

B. TRITIUM	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR	Est Total Error %
1. Total release	Ci	N/A	N/A	N/A	N/A	N/A
2. Average diluted concentration during period	µCi/ml	N/A	N/A	N/A	N/A	
3. Percent of EC	%	N/A	N/A	N/A	N/A	

C. DISSOLVED AND ENTRAINED GASES	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR	Est Total Error %
1. Total release	Ci	N/A	N/A	N/A	N/A	N/A
2. Average diluted concentration during period	µCi/ml	N/A	N/A	N/A	N/A	
3. Percent of EC	%	N/A	N/A	N/A	N/A	

D. GROSS ALPHA RADIOACTIVITY	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
	Ci	N/A	N/A	N/A	N/A

E. VOLUME OF WASTE RELEASED (Prior to dilution)	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
	Liters	N/A	N/A	N/A	N/A

F. VOLUME OF DILUTION WATER USED DURING PERIOD	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
	Liters	N/A	N/A	N/A	N/A

G. MAXIMUM DOSE COMMITMENT WHOLEBODY	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
	mrem	N/A	N/A	N/A	N/A
Percent of ODCM Section 1, 2.3.2 a (1.5 mrem)	%	N/A	N/A	N/A	N/A

H. MAXIMUM DOSE COMMITMENT – ORGAN	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
	Mrem	N/A	N/A	N/A	N/A
Percent of ODCM Section 1, 2.3.2 b (3.0 mrem)	%	N/A	N/A	N/A	N/A

TABLE 3
Big Rock Point
Liquid Effluent Releases
 January 1, 2021 to December 31, 2021

1. NUCLIDES RELEASED	Units	1ST QTR	2ND QTR	3RD QTR	4TH QTR
Fission & Activation Product Total	Ci	N/A	N/A	N/A	N/A
Dissolved and Entrained gases	Ci	N/A	N/A	N/A	N/A
Tritium	Ci	N/A	N/A	N/A	N/A

Plant: Palisades	Year: 2021	Page 31 of 31
Annual Radioactive Effluent Release Report		

Attachment 3

ERRATA to Palisades 2020 Annual Radioactive Effluent Release Report

3 pages to follow

4.0 LIQUID EFFLUENTS

4.1 Liquid Effluent and Waste Disposal Report

Table 4, Liquid Effluents-Summation of All Releases - Palisades

A. Fission and Activation Products	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total	Est. Total Error %
1. Total Release (not including tritium, gases or alpha)	Ci	5.57E-03	7.46E-04	3.32E-03	2.45E-03	1.21E-02	1.91E+01%
2. Average diluted concentration during period	μCi/mL	1.40E-10	1.89E-11	1.21E-10	6.96E-11	8.53E-11	
B. Tritium					4.85E+01		
1. Total Release	Ci	2.07E+02	2.50E+02	3.16E+02	4.82E+01	8.21E+02	5.05E+00%
2. Average diluted concentration during period	μCi/mL	5.22E-06	6.33E-06	1.15E-05	1.37E-06 1.38E-06	5.79E-06	
C. Dissolved and Entrained Gases							
1. Total Release	Ci	ND	ND	6.02E-04	ND	6.02E-04	1.97E+01%
2. Average diluted concentration during period	μCi/mL	NA	NA	2.20E-11	NA	4.25E-12	
D. Gross Alpha Activity							
1. Total Release	Ci	ND	ND	4.77E-04	3.91E-05	5.16E-04	2.00E+00%
E. Volume of Waste Released (prior to dilution)					3.28E+07	5.45E+07	
	Liters	6.78E+06	8.33E+06	6.52E+06	9.09E+06	3.07E+07	
F. Volume of Dilution Water Used During Period							
	Liters	3.97E+10	3.95E+10	2.74E+10	3.52E+10	1.42E+11	

6.0 RADIOLOGICAL IMPACT TO MAN

6.1 10CFR Part50, Appendix I Evaluation

Table 11, Dose Assessment					
	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Liquid Effluent Dose Limit, Total Body	1.5 mrem	1.5 mrem	1.5 mrem	1.5 mrem	3 mrem
Total Body Dose (mrem)	4.25E-04	3.89E-04	8.44E-04	2.09E-04	1.73E-03
% of Limit	2.83E-02	2.59E-02	5.63E-02	1.39E-02	5.77E-02
Liquid Effluent Dose Limit, Any Organ	5 mrem	5 mrem	5 mrem	5 mrem	10 mrem
Maximum Organ Dose (mrem)	8.98E-03	5.42E-04	9.32E-04	4.42E-04 4.43E-04	1.06E-02
% of Limit	1.80E-01	1.08E-02	1.86E-02	8.84E-03 8.86E-03	1.06E-01
Gaseous Effluent Dose Limit, Gamma Air	5 mrad	5 mrad	5 mrad	5 mrad	10 mrad
Gamma Air Dose (mrad)	5.33E-04	2.38E-04	1.51E-03	3.87E-04	2.67E-03
% of Limit	1.07E-02	4.76E-03	3.02E-02	7.74E-03	2.67E-02
Gaseous Effluent Dose Limit, Beta Air	10 mrad	10 mrad	10 mrad	10 mrad	20 mrad
Beta Air Dose (mrad)	5.21E-04	1.75E-04	9.82E-04	2.10E-04	1.89E-03
% of Limit	5.21E-03	1.75E-03	9.82E-03	2.10E-03	9.45E-03
Gaseous Effluent Organ Dose Limit (Iodine, Tritium, Particulates with > 8 day half-life)	7.5 mrem	7.5 mrem	7.5 mrem	7.5 mrem	15 mrem
Gaseous Effluent Organ Dose (Iodine, Tritium, Particulates with > 8 day half-life) (mrem)	4.35E-03	3.94E-03	6.58E-03	3.00E-03	1.78E-02
% of Limit	5.80E-02	5.25E-02	8.78E-02	4.00E-02	1.19E-01

Table 6, Continuous Mode Liquid Effluents

Nuclides Released	Unit	Continuous Mode				
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Fission and Activation Products						
Cs-137	Ci	6.19E-05	1.17E-04	4.72E-05	ND	2.26E-04
Total	Ci	6.19E-05	1.17E-04	4.72E-05	ND	2.26E-04
Tritium						
H-3	Ci	1.40E-01	1.93E-01	2.72E-01	1.26E-01	7.40E-01
					4.24E-01	1.03E+00