PSEG Nuclear LLC
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PSEG
Nuclear LLC

Technical Specification Section 6.9.1.8 (Salem)
Technical Specification Section 6.9.1.7 (Hope Creek)

LR-N22-0041

April 28, 2022

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington DC 20555-001

Salem Nuclear Generating Station, Unit Nos. 1 and 2
Renewed Facility Operating License Nos. DPR-70 and DPR-75
NRC Docket Nos. 50-272 and 50-311

Hope Creek Generating Station
Renewed Facility Operating License No. NPF-57
NRC Docket No. 50-354

Subject: 2021 Annual Radioactive Effluent Release Report (RERR)

As required with Section 6.9.1.8 of Appendix A to Renewed Facility Operating License Nos. DPR-70 (Unit 1) and DPR-75 (Unit 2) for Salem Nuclear Generating Stations (SGS), and Section 6.9.1.7 of Appendix A to Renewed Facility Operating License NPF-57 for Hope Creek Generating Station (HCGS), PSEG Nuclear hereby transmits one (1) copy of the combined 2021 Annual Radioactive Effluent Release Report (Enclosure). Reports SGS RERR-70 and HCGS RERR-44 were combined into one (1) report that summarizes information pertaining to the releases of radioactive materials in liquid, gaseous and solid form from the SGS and the HCGS for the period January 1, 2021 to December 31, 2021.

There are no regulatory commitments contained in this letter.

If you have any questions or comments on this transmittal, please contact Mr. Rick Heathwaite at (856) 279-1239 (cell), or Rick.Heathwaite@PSEG.com.

Sincerely,

Richard DeSanctis
Plant Manager
Salem Generating Stations

Steven Poorman
Plant Manager
Hope Creek Generating Station

Enclosure: 2021 Annual Radioactive Effluent Release Report for Salem and Hope Creek Generating Stations

cc: Administrator - Region I - USNRC
Project Manager – USNRC – Salem/Hope Creek
Salem Senior Resident Inspector - USNRC
Hope Creek Senior Resident Inspector - USNRC
NRC Inspector (RP) - Region I - USNRC
Chief - NJ Bureau of Nuclear Engineering (NJBNE)
Corporate Commitment Tracking Coordinator - w/o attachment
Salem/Hope Creek Commitment Tracking Coordinator - w/o attachment

LR-N22-0041

Enclosure

PSEG Nuclear LLC

Salem and Hope Creek Generating Stations

2021 Annual Radioactive Effluent Release Report

PSEG Nuclear LLC

Salem & Hope Creek Generating Stations

Annual Radioactive Effluent Release Report

2021

Document Number: SGS-70 / HCGS-44

Unit 1	Unit 2	Unit 1
DOCKET NO 50-272 OPERATING LICENSE NO DPR-070	DOCKET NO 50-311 OPERATING LICENSE NO DPR-075	DOCKET NO. 50-354 OPERATING LICENSE NO. NPF-057

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ARERR (REC) Review and Approval Confirmation in SAP (I.A.W. AD-AA-1006 SIGNATURE AUTHORITY)

SAP 80130945

Opr.		
0011	Stephen Gattuso, Salem Chemistry Manager	04/20/2022 Date
0012	Scott Kozink, Hope Creek Chemistry Manager	04/18/2022 Date
0013	William Gropp, Salem Radiation Protection Manager	04/21/2022 Date
0014	Mariaz Davis, Hope Creek Radiation Protection Manager	04/19/2022 Date
0015	William Muffley, Salem Senior Director of Operations	04/19/2022 Date
0016	James Priest, Hope Creek Senior Director of Operations	04/12/2022 Date
0017	Richard DeSanctis, Salem Plant Manager	04/18/2022 Date
0018	Steven Poorman, Hope Creek Plant Manager	04/19/2022 Date

Report Prepared By: 

Rick M. Heathwaite (REMP/REC Program Manager)

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1.0 LIST OF ACRONYMS AND DEFINITIONS

1. Airborne Activity Sampling: Sampling of air through the collection of particulates and radionuclides on filter media, collection of noble gases in a container, and collection of water vapor containing tritium.
2. 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.
3. AREOR: Annual Radiological Environmental Operating Report
4. ARERR: Annual Radioactive Effluent Release Report
5. Abnormal Release: is an unplanned or uncontrolled release of licensed radioactive material from the plant. Abnormal releases may be categorized as either batch or continuous depending on the circumstances.
6. Abnormal Discharge: is an unplanned or uncontrolled release of licensed radioactive material to the unrestricted area. Abnormal discharges may also be categorized as either batch or continuous depending on the circumstances.
7. BWR: Boiling Water Reactor
8. cfm: cubic feet per minute
9. 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.
10. 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.
11. Counting Error: An estimate of the two-sigma uncertainty associated with the sample results based on respective count times.
12. Critical Receptor: Represents the MEMBER(S) of the Public in the Unrestricted Area who as a result of the combination of age group and existing local dose exposure pathways has the potential to receive the highest dose.
13. Curie (Ci): A measure of radioactivity; equal to 3.7×10^{10} disintegrations per second, or 2.22×10^{12} disintegrations per minute.
14. Direct Radiation Monitoring: The measurement of radiation dose at various distances from the plant is assessed using thermoluminescent dosimeters (TLDs).
15. Grab Sample: A single discrete sample drawn at one point in time.
16. Indicator: A sampling location that is likely to be affected by plant effluents due to its proximity and/or direction from the plant.
17. Ingestion Pathway: The ingestion pathway includes milk, fish, and garden produce. meat or other food products may also be included
18. ISFSI: Independent Spent Fuel Storage Installation
19. JFD: Joint Frequency Data
20. Lower Limit of Detection (LLD): The smallest concentration of radioactive material in a sample that will yield a net count (above system background) that will be detected with 95% probability with a 5% probability of a false conclusion that a blank observation represents "real" signal.
21. LUC: Land Use Census

22. m/s: Meters per second
23. MDA: Minimum Detectable Activity
24. MDC: Minimum Detectable Concentration, essentially synonymous with MDA for the purposes of radiological monitoring.
25. Mean: The average, i.e., the sum of results divided by the number of results.
26. Microcurie (µCi): 3.7×10^4 disintegrations per second, or 2.22×10^6 disintegrations per minute.
27. millirem (mrem): 1/1000 rem; a unit of radiation dose equivalent in tissue.
28. Milliroentgen (mR): 1/1000 Roentgen; a unit of exposure to X- or gamma radiation.
29. MWe: Megawatts Electric
30. MWTh: Megawatts Thermal
31. N/A: Not Applicable
32. N/D: Not Detectable
33. NEI: Nuclear Energy Institute
34. Nonroutine, planned discharge—An effluent release from a release point that is not defined in the ODCM but that has been planned, monitored, and discharged in accordance with 10 CFR 20.2001.
35. NRC: Nuclear Regulatory Commission
36. ODCM: Offsite Dose Calculation Manual
37. Protected Area: The fenced area immediately surrounding the Plant. Access to the protected area requires a security badge or escort.
38. PWR: Pressurized Water Reactor
39. RCA: Radiation Controlled Area
40. REC: Radiological Effluent Control
41. REMP: Radiological Environmental Monitoring Program
42. Restricted Area: Any area where access is controlled for the purpose of protecting individuals from exposure to radiation or radioactive materials
43. RGPP: Radiological Ground Water Protection Program
44. SLCs: Selected Licensee Commitments
45. TLD: Thermoluminescent Dosimeter
46. TRM: Technical Requirements Manual
47. TS: Technical Specification
48. Unrestricted Area: an area, access to which is neither limited nor controlled by the licensee.

2.0 EXECUTIVE SUMMARY

Salem & Hope Creek Generating Stations (SGS/HCGS) 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 2021 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.

In 2021 Dose assessments showed that the critical dose receptor for Salem & Hope Creek Generating Stations was the Child at the Dairy Farm located 4.9 miles in the W sector, due to the pathways of Inhalation, Ground Plane, Meat, Vegetation, and Cow Milk. The maximum Annual Organ Dose calculated for this receptor was 4.74E-01 mrem, to the Bone. This annual dose represents 1.05E+00 percent of the 10 CFR 50, Appendix I guideline of 45 mrem to the Maximum Organ from three Units.

The Annual Radiological Environmental Operating Report (AREOR) provides data obtained through analyses of environmental samples collected at Salem & Hope Creek Generating Stations for the reporting period of January 1st through December 31st, 2021. During that time period 1662 analyses were performed on 1306 samples. In assessing all the data gathered for this report and comparing these results with preoperational data, it was concluded that the operation of Salem & Hope Creek Generating Stations, did not result in detection of low level plant related radionuclides in the environment.

2.1 Summary of Conclusions:

During 2021 all solid, liquid, and gaseous radioactive effluents from Salem & Hope Creek Generating Stations were well below regulatory limits. For individual effluent streams, the quarterly limit most closely approached was the Gaseous Effluent Maximum Organ Dose for the first quarter for Hope Creek Unit 1 at 7.05E-01 percent (Table 3, Hope Creek Generating Station Unit 1 Dose Summary). The majority of this dose was due to the 4.05E+00 Ci of carbon-14 released from the unit in the first quarter.

40 CFR 190 (1) and 10 CFR 72.104 (2) limit the total dose to a the maximum exposed Member of the Public to 25 mrem to the total body, 75 mrem to the thyroid and 25 mrem to other organs other than the thyroid. The maximum annual total body and organ doses from gaseous and liquid pathways with all other uranium fuel cycle sources present on site were calculated as required by section 3.11.4 of the SGS and HCGS ODCMs. The direct dose from the ISFSI pad was determined using the Radiological Environmental Monitoring Program (REMP) and the guidance provided in Regulatory Guide 4.13 (3).

The direct shine dose from the ISFSI to the highest dose potential receptor located at 3.7 miles in the NW sector was conservatively estimated at 7.42E-03 mrem. The doses from the gaseous and liquid radioactive effluents released from SGS Units 1 and Unit 2 and HCGS Unit 1 in 2021 resulted in a calculated total body and an organ dose of 1.33E-01 mrem and 5.03E-01 mrem, respectively. The majority of dose was from the gaseous dose pathways was from C-14. Adding in the direct shine dose from the ISFSI, then the total dose to the Total Body, Thyroid and Max Organ were calculated as 1.40E-01 mrem, 1.33E-01 mrem, and 5.03E-01 mrem, respectively. The max organ dose represented 2.01E+00 percent of the 25 mrem limit. The results of these analyses are in Table 5, 2021Total Annual Offsite-Dose Comparison to 40 CFR 190 Regulatory Limits for SGS/HCGS.

Table 1, Salem Generating Station Unit 1 Dose Summary[1]

		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Liquid Effluents						
	Limit	**1.5 mrem**	**1.5 mrem**	**1.5 mrem**	**1.5 mrem**	**3 mrem**
	Total Body Dose[2]	3.34E-03	5.98E-03	7.83E-03	4.39E-03	2.15E-02
	% Of Limit	2.23E-01	3.99E-01	5.22E-01	2.93E-01	7.18E-01
	Limit	**5 mrem**	**5 mrem**	**5 mrem**	**5 mrem**	**10 mrem**
	Maximum Organ Dose[3]	3.52E-03	6.13E-03	7.84E-03	4.46E-03	2.19E-02
	% Of Limit	7.05E-02	1.23E-01	1.57E-01	8.91E-02	2.19E-01
Gaseous Effluents						
	Limit	**5 mrad**	**5 mrad**	**5 mrad**	**5 mrad**	**10 mrad**
	Gamma Air Dose[4]	3.45E-05	1.02E-05	9.18E-09	1.81E-05	6.27E-05
	% Of Limit	6.89E-04	2.04E-04	1.84E-07	3.61E-04	6.27E-04
	Limit	**10 mrad**	**10 mrad**	**10 mrad**	**10 mrad**	**20 mrad**
	Beta Air Dose[5]	1.23E-05	3.59E-06	2.73E-08	6.44E-06	2.24E-05
	% Of Limit	1.23E-04	3.59E-05	2.73E-07	6.44E-05	1.12E-04
	Limit	**2.5 mrem**	**2.5 mrem**	**2.5 mrem**	**2.5 mrem**	**5 mrem**
	NG Total Body Dose[6]	3.28E-05	9.68E-06	7.64E-09	1.72E-05	5.96E-05
	% Of Limit	1.31E-03	3.87E-04	3.06E-07	6.87E-04	1.19E-03
	Limit	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**15 mrem**
	NG Skin Dose[7]	4.79E-05	1.41E-05	1.81E-08	2.51E-05	8.72E-05
	% Of Limit	6.39E-04	1.89E-04	2.41E-07	3.35E-04	5.81E-04
	Limit	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**15 mrem**
	Maximum Organ Dose[8]	3.12E-02	3.87E-02	3.80E-02	3.77E-02	1.46E-01
	% Of Limit	4.16E-01	5.16E-01	5.07E-01	5.03E-01	9.71E-01

[1] Table 1 is meant to demonstrate compliance to 10 CFR Part 50, Appendix I Limits.
[2] 0.75 mi. N of Salem / Adult
[3] 0.75 mi. N of Salem / Adult
[4] SB 0.83 mi. N / All Age Groups
[5] SB 0.83 mi. N / All Age Groups
[6] SB 0.83 mi. N / All Age Groups
[7] SB 0.83 mi. N / All Age Groups
[8] Dairy 4.9 mi. W / Child

Table 2, Salem Generating Station Unit 2 Dose Summary[1]

		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Liquid Effluents						
	Limit	**1.5 mrem**	**1.5 mrem**	**1.5 mrem**	**1.5 mrem**	**3 mrem**
	Total Body Dose[2]	3.45E-04	1.41E-03	8.63E-04	9.50E-04	3.57E-03
	% Of Limit	2.30E-02	9.40E-02	5.75E-02	6.33E-02	1.19E-01
	Limit	**5 mrem**	**5 mrem**	**5 mrem**	**5 mrem**	**10 mrem**
	Maximum Organ Dose[3]	6.05E-04	1.70E-03	1.75E-03	1.26E-03	5.32E-03
	% Of Limit	1.21E-02	3.40E-02	3.49E-02	2.53E-02	5.32E-02
Gaseous Effluents						
	Limit	**5 mrad**	**5 mrad**	**5 mrad**	**5 mrad**	**10 mrad**
	Gamma Air Dose[4]	5.54E-05	2.54E-05	2.13E-05	1.02E-05	1.12E-04
	% Of Limit	1.11E-03	5.08E-04	4.26E-04	2.03E-04	1.12E-03
	Limit	**10 mrad**	**10 mrad**	**10 mrad**	**10 mrad**	**20 mrad**
	Beta Air Dose[5]	1.97E-05	9.00E-06	7.53E-06	4.06E-06	4.03E-05
	% Of Limit	1.97E-04	9.00E-05	7.53E-05	4.06E-05	2.02E-04
	Limit	**2.5 mrem**	**2.5 mrem**	**2.5 mrem**	**2.5 mrem**	**5 mrem**
	NG Total Body Dose[6]	5.27E-05	2.42E-05	2.03E-05	9.64E-06	1.07E-04
	% Of Limit	2.11E-03	9.66E-04	8.11E-04	3.86E-04	2.14E-03
	Limit	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**15 mrem**
	NG Skin Dose[7]	7.71E-05	3.53E-05	2.96E-05	1.42E-05	1.56E-04
	% Of Limit	1.03E-03	4.71E-04	3.95E-04	1.90E-04	1.04E-03
	Limit	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**15 mrem**
	Maximum Organ Dose[8]	2.83E-02	3.30E-02	3.26E-02	3.19E-02	1.26E-01
	% Of Limit	3.77E-01	4.39E-01	4.34E-01	4.25E-01	8.38E-01

[1] Table 2 is meant to demonstrate compliance to 10 CFR Part 50, Appendix I Limits.
[2] 0.75 mi. N of Salem / Adult
[3] 0.75 mi. N of Salem / Adult
[4] SB 0.83 mi. N / All Age Groups
[5] SB 0.83 mi. N / All Age Groups
[6] SB 0.83 mi. N / All Age Groups
[7] SB 0.83 mi. N / All Age Groups
[8] Dairy 4.9 mi. W / Child

Table 3, Hope Creek Generating Station Unit 1 Dose Summary[1]

		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Liquid Effluents						
	Limit	**1.5 mrem**	**1.5 mrem**	**1.5 mrem**	**1.5 mrem**	**3 mrem**
	Total Body Dose[2]	7.83E-05	6.33E-05	4.82E-05	1.50E-04	3.40E-04
	% Of Limit	5.22E-03	4.22E-03	3.21E-03	1.00E-02	1.13E-02
	Limit	**5 mrem**	**5 mrem**	**5 mrem**	**5 mrem**	**10 mrem**
	Maximum Organ Dose[3]	3.03E-04	2.07E-04	1.18E-04	1.02E-03	1.65E-03
	% Of Limit	6.06E-03	4.14E-03	2.35E-03	2.04E-02	1.65E-02
Gaseous Effluents						
	Limit	**5 mrad**	**5 mrad**	**5 mrad**	**5 mrad**	**10 mrad**
	Gamma Air Dose[4]	0.00E+00	9.82E-08	1.48E-08	0.00E+00	1.13E-07
	% Of Limit	0.00E+00	1.96E-06	2.96E-07	0.00E+00	1.13E-06
	Limit	**10 mrad**	**10 mrad**	**10 mrad**	**10 mrad**	**20 mrad**
	Beta Air Dose[5]	0.00E+00	3.46E-08	1.89E-08	0.00E+00	5.36E-08
	% Of Limit	0.00E+00	3.46E-07	1.89E-07	0.00E+00	2.68E-07
	Limit	**2.5 mrem**	**2.5 mrem**	**2.5 mrem**	**2.5 mrem**	**5 mrem**
	NG Total Body Dose[6]	0.00E+00	9.33E-08	1.39E-08	0.00E+00	1.07E-07
	% Of Limit	0.00E+00	3.73E-06	5.57E-07	0.00E+00	2.14E-06
	Limit	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**15 mrem**
	NG Skin Dose[7]	0.00E+00	1.36E-07	3.06E-08	0.00E+00	1.67E-07
	% Of Limit	0.00E+00	1.82E-06	4.08E-07	0.00E+00	1.11E-06
	Limit	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**15 mrem**
	Maximum Organ Dose[8]	5.29E-02	5.26E-02	4.82E-02	4.91E-02	2.03E-01
	% Of Limit	7.05E-01	7.02E-01	6.43E-01	6.55E-01	1.35E+00

[1] Table 3 is meant to demonstrate compliance to 10 CFR Part 50, Appendix I Limits.
[2] 0.75 mi. N of Salem / Adult
[3] 0.75 mi. N of Salem / Adult
[4] SB 0.5 mi. N / All Age Groups
[5] SB 0.5 mi. N / All Age Groups
[6] SB 0.5 mi. N / All Age Groups
[7] SB 0.5 mi. N / All Age Groups
[8] Dairy 4.9 mi. W / Child

Table 4, Salem & Hope Creek Generating Stations Site Dose Summary[1]

		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Liquid Effluents						
	Limit	**4.5 mrem**	**4.5 mrem**	**4.5 mrem**	**4.5 mrem**	**9 mrem**
	Total Body Dose	3.77E-03	7.46E-03	8.75E-03	5.49E-03	2.55E-02
	% Of Limit	8.37E-02	1.66E-01	1.94E-01	1.22E-01	2.83E-01
	Limit	**15 mrem**	**15 mrem**	**15 mrem**	**15 mrem**	**30 mrem**
	Maximum Organ Dose	4.43E-03	8.04E-03	9.70E-03	6.74E-03	2.89E-02
	% Of Limit	2.95E-02	5.36E-02	6.47E-02	4.49E-02	9.64E-02
Gaseous Effluents						
	Limit	**15 mrad**	**15 mrad**	**15 mrad**	**15 mrad**	**30 mrad**
	Gamma Air Dose	8.99E-05	3.57E-05	2.13E-05	2.82E-05	1.75E-04
	% Of Limit	5.99E-04	2.38E-04	1.42E-04	1.88E-04	5.84E-04
	Limit	**30 mrad**	**30 mrad**	**30 mrad**	**30 mrad**	**60 mrad**
	Beta Air Dose	3.20E-05	1.26E-05	7.57E-06	1.05E-05	6.27E-05
	% Of Limit	1.07E-04	4.21E-05	2.52E-05	3.50E-05	1.05E-04
	Limit	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**15 mrem**
	NG Total Body Dose	8.55E-05	3.39E-05	2.03E-05	2.68E-05	1.66E-04
	% Of Limit	1.14E-03	4.52E-04	2.70E-04	3.57E-04	1.11E-03
	Limit	**22.5 mrem**	**22.5 mrem**	**22.5 mrem**	**22.5 mrem**	**45 mrem**
	NG Skin Dose	1.25E-04	4.96E-05	2.97E-05	3.94E-05	2.44E-04
	% Of Limit	5.56E-04	2.20E-04	1.32E-04	1.75E-04	5.41E-04
	Limit	**22.5 mrem**	**22.5 mrem**	**22.5 mrem**	**22.5 mrem**	**45 mrem**
	Maximum Organ Dose	1.12E-01	1.24E-01	1.19E-01	1.19E-01	4.74E-01
	% Of Limit	4.99E-01	5.52E-01	5.28E-01	5.28E-01	1.05E+00

[1] Compliance to 10 CFR Part 50, Appendix I Limits is demonstrated from Tables 1 to 3 for each unit. Table 4 is a summary of the cumulative dose from all three units.

Table 5, 2021Total Annual Offsite-Dose Comparison to 40 CFR 190 Regulatory Limits for SGS/HCGS[1]

	Whole Body	Thyroid	Max Organ
Limit	**25 mrem**	**75 mrem**	**25 mrem**
Gaseous			
Salem 1 NG	5.96E-05	N/A	N/A
Salem 1 Particulates/Iodines	3.27E-02	3.27E-02	1.46E-01
Salem 2 NG	1.07E-04	N/A	N/A
Salem 2 Particulates/Iodines	2.80E-02	2.80E-02	1.26E-01
Hope Creek 1 NG	1.07E-07	N/A	N/A
Hope Creek 1 Particulates/Iodines	4.65E-02	4.70E-02	2.03E-01
Liquid			
Salem 1	2.15E-02	2.15E-02	2.19E-02
Salem 2	3.57E-03	3.38E-03	5.32E-03
Hope Creek 1	3.40E-04	1.49E-04	1.65E-03
Total Gas & Liquid mrem	1.33E-01	1.33E-01	5.03E-01
Direct Shine	7.42E-03	N/A	N/A
Total mrem	1.40E-01	1.33E-01	5.03E-01
% Of Limit	5.61E-01	1.77E-01	2.01E+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 (4). 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 (5).

[1] Table 5 is a summation of all Units to show compliance with 40 CFR Part 190 Limits.

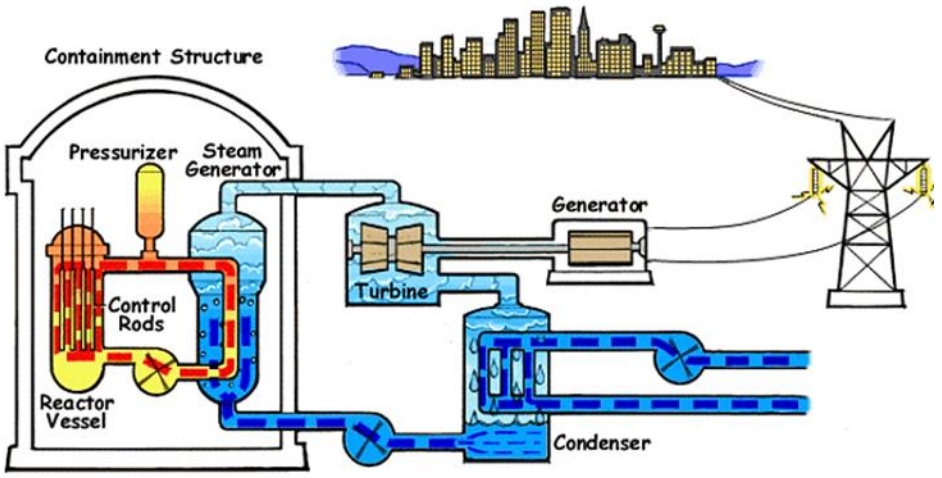

Figure 1, Pressurized Water Reactor (PWR)

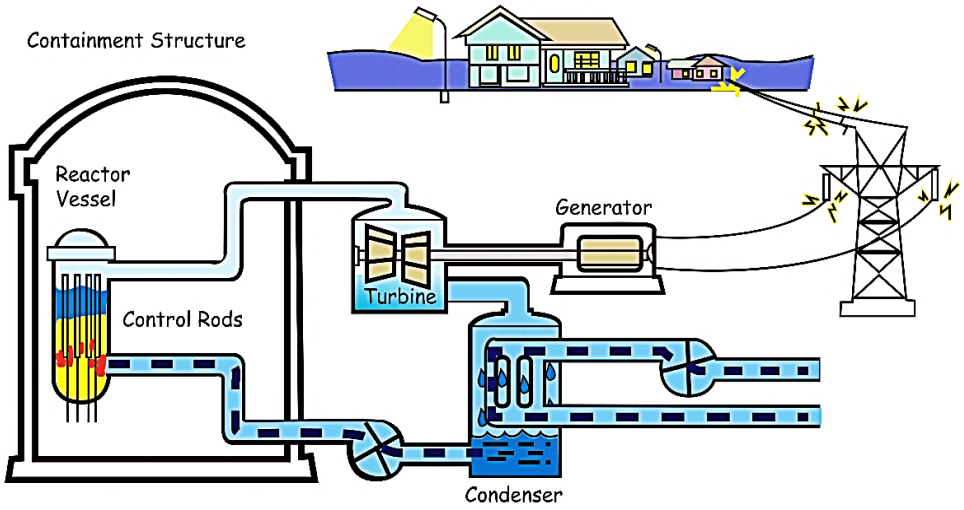

Figure 2, Boiling Water Reactor (BWR)

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 driven 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 some additional neutrons.

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

3.2 About Radiation Dose

Ionizing radiation, including alpha, beta, and gamma radiation from radioactive decay, has enough energy to break chemical bonds in tissues and 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. The units for dose are generally given in millirem (mrem) in the US.

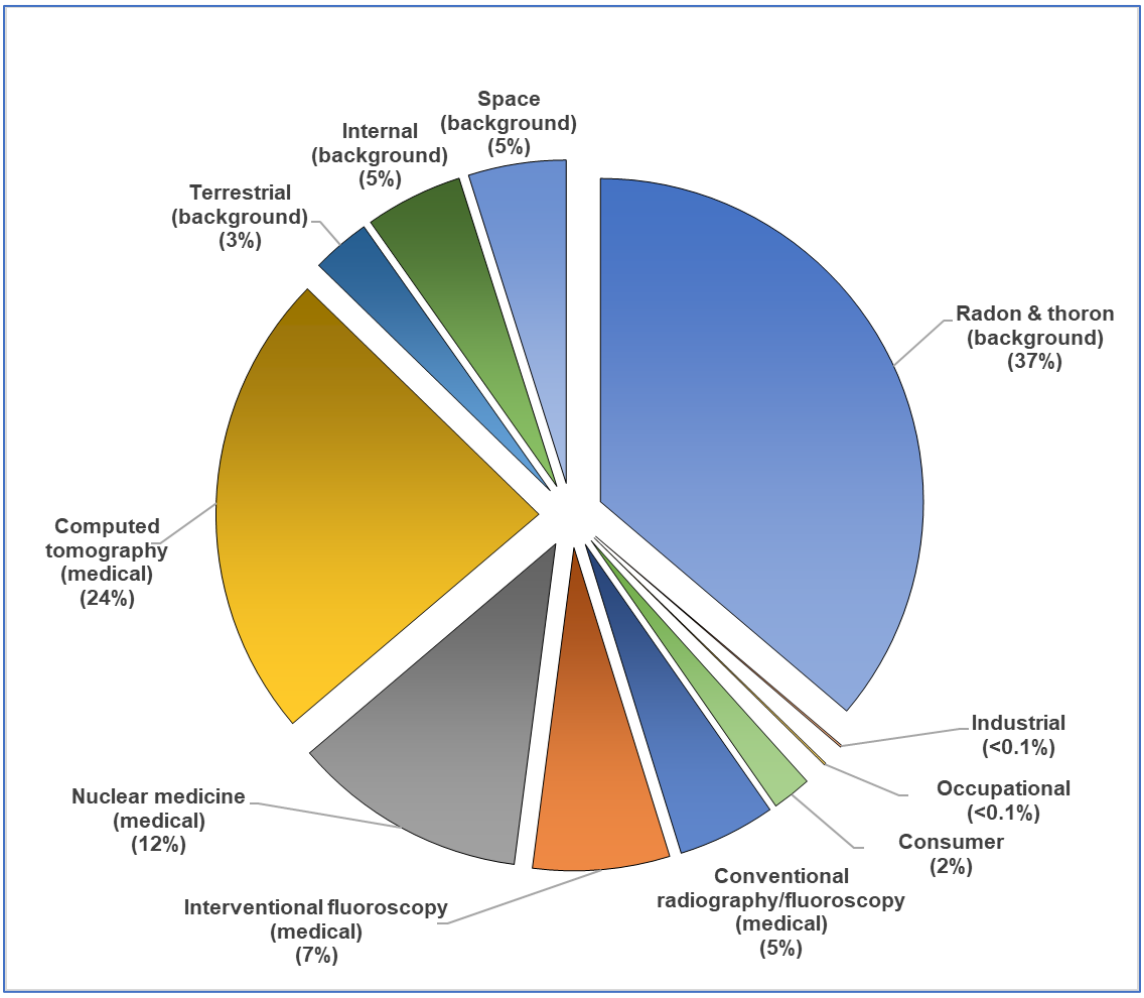

Figure 3, Sources of Radiation Exposure (ICRP Report No. 160) (6)

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. 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%) 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 (7), and from the US Nuclear Regulatory Commission website (8).

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.

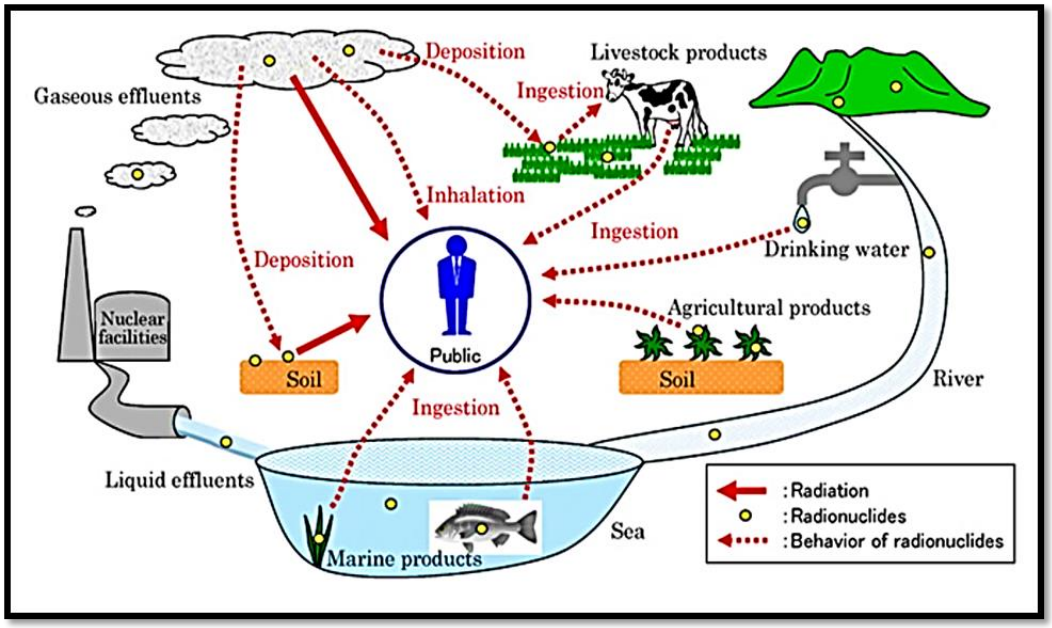

Figure 4, Potential exposure pathways to Members of the Public due to Plant Operations (9)

The Offsite Dose Calculation Manual (ODCM) specifies the methodology used to obtain the doses in the Dose Assessment section of this report. The methodology in the ODCM is based on NRC Regulatory Guide 1.109 (10) and NUREG-0133 (11). Doses are calculated by determining what the nuclide concentration will be in air, water, on the ground, or in food products based on plant effluent releases. Release points are continuously monitored to quantify what concentrations of nuclides are being released. For gaseous releases meteorological data is used to determine how much of the released activity will be present at a given location outside of the plant either deposited onto the ground or in gaseous form. Intake patterns and nuclide bio-concentration factors are used to determine how much activity will be transferred into animal milk or meat. Finally, human ingestion factors and dose factors are used to determine how much activity will be consumed and how much dose the consumer will receive. Inhalation dose is calculated by determining the concentration of nuclides and how much air is breathed by the individual.

For liquid releases, dilution and mixing factors are used to model the environmental concentrations in water. Drinking water pathways are modeled by determining the concentration of nuclides in the water at the point where the drinking water is sourced. 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 exist within a five-mile radius from the plant, which are the areas 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 most likely to be exposed to radiation dose due to plant operations.

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 highest hypothetical exposed individual due to plant operation are a very small fraction of the annual dose that is received due to other sources. The low calculated doses due to plant effluents, along with REMP results indicating low levels of detectible radioactive material due to plant operations, serve to provide assurance that the site is not having a negative impact on the environment or people living near the plant.

4.0 DOSE ASSESSMENT FOR PLANT OPERATIONS

4.1 Regulatory Limits

Regulatory limits are detailed in Station Licensing documents such as the Offsite Dose Calculation Manual (ODCM) and Selected Licensing Commitments. These documents contain the limits to which SGS/HCGS must adhere. SGS/HCGS drives to maintain the philosophy to keep dose "as low as reasonably achievable" (ALARA) and actions are taken to reduce the amount of radiation released to the environment. Liquid and gaseous release data show that the dose from SGS/HCGS is well below the ODCM limits. The concentration of liquid radioactive material released shall be limited to the Maximum Permissible Concentration specified in 10 CFR 20, Appendix B, Table II, Column 2 (pre 1994), 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 microcuries/ml. This data reveals that the radioactive effluents have an overall minimal dose contribution to the surrounding environment.

4.2 Regulatory Limits for Gaseous Effluent Doses:

1. Fission and activation gases:

    a. Noble gases dose rate due to radioactive materials released in gaseous effluents from the areas at and beyond the site boundary shall be limited to the following for the three (3) units:

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

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

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

1) Quarterly

a) Less than or equal to 5 mrads gamma

b) Less than or equal to 10 mrads beta

c) Less than or equal to 2.5 mrem total body[1]

d) Less than or equal to 7.5 mrem skin[1]

2) Yearly

a) Less than or equal to 10 mrads gamma

b) Less than or equal to 20 mrads beta

c) Less than or equal to 5 mrem total body[1]

d) Less than or equal to 15 mrem skin[1]

2. Iodine, tritium, carbon-14, 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 for the three (3) units:

1) Less than or equal to 1500 mrem/year to any organ

b. The dose to a MEMBER OF THE PUBLIC from iodine-131, iodine-133, tritium, carbon-14, 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 for each unit:

1) Quarterly

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

2) Yearly

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

4.3 Regulatory Limits for Liquid Effluent Doses

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

[1] 10 CFR 50, Appendix I, B.2(b)

a. Quarterly

1) Less than or equal to 1.5 mrem total body

2) Less than or equal to 5 mrem critical organ

b. Yearly

1) Less than or equal to 3 mrem total body

2) Less than or equal to 10 mrem critical organ

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

1. Total Dose (40 CFR 190)

a. The annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC 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.

4.5 Onsite Doses (Within Site Boundary)

This section evaluates dose to non-occupationally exposed workers that may be onsite for various reasons. Groups of concern include plant personnel that are not RCA badged including Sewage Treatment Plant Operators, Emergency Responders (National Guard, State Police, etc.) at the Site Security Gate, and various areas that cover the Wind Turbine Laydown Areas. These workers are considered not to be occupationally exposed, because the work activities are not related to plant-operational activities. Use of a conservative assumption of 2000 hours/year spent inside the site boundary by these groups conservatively represents the most-exposed individual. Doses to these groups are required per Section 3.11.4 of the Stations' ODCMs as clarified in RIS-2002-21 (12) to meet the 10 CFR 20.1301 Member of the Public Dose Limit of 100 mrem.

Available dose pathways for these receptors were noble gas plume dose, ground plane dose and inhalation dose. The age group adult was the only age group considered. In addition the doses calculated were adjusted for an occupancy of 25%. The special dose calculations for the Wind Turbine Laydown Area are in Figure 5, Special Wind Turbine Laydown Areas, 16W4, 01W4, 02W5, and 03W2.

The annual total body and organ doses was computed using the 2021 gaseous source terms from Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1 using the NRC dose code GASPAR and the 2015 - 2020 five-year annual average meteorological dispersion (X/Q) and deposition (D/Q) data provided in Attachment 3, Meteorological Data. The calculated doses due to gaseous effluents for non-rad workers onsite are presented in Table 6 and in Attachment **5**, Doses to Highest Dose Potential Receptors using the 2015 – 2020 Five Year Annual Average Meteorological Data and the NRC Code GASPAR

Table 6, Summary of TEDE doses to Members of the Public Due to Activities Inside the Site Boundary

Location	Operating Unit	CDE mrem	Total Body mrem	TEDE mrem	% of Limit (100 mrem) per 10 CFR 20.1301
Sewage Treatment Plant	SGS U1	7.94E-01	6.04E-01		
	SGS U2	4.26E-02	3.96E-02		
	HCGS	4.29E-02	4.21E-02		
	ISFSI	N/A	2.14E+00		
	Total	**8.80E-01**	**2.83E+00**	**3.71E+00**	**3.71E+00**
Emergency Responders	SGS U1	2.92E-02	2.53E-02		
	SGS U2	9.54E-04	8.89E-04		
	HCGS	1.91E-03	1.87E-03		
	ISFSI	N/A	1.80E-02		
	Total	**3.21E-02**	**4.61E-02**	**7.81E-02**	**7.81E-02**
Wind Turbine Laydown Areas					
03W2	SGS U1	1.19E-01	1.01E-01		
	SGS U2	4.42E-03	4.12E-03		
	HCGS	7.12E-03	7.02E-03		
	ISFSI	N/A	1.10E-01		
	Total	**1.31E-01**	**2.22E-01**	**3.52E-01**	**3.52E-01**
16W4	SGS U1	5.17E-02	4.48E-02		
	SGS U2	1.62E-03	1.51E-03		
	HCGS	1.11E-02	1.09E-02		
	ISFSI	N/A	6.24E-01		
	Total	**6.44E-02**	**6.81E-01**	**7.46E-01**	**7.46E-01**
01W4	SGS U1	4.65E-02	3.98E-02		
	SGS U2	1.62E-03	1.51E-03		
	HCGS	7.61E-03	7.48E-03		
	ISFSI	N/A	1.33E+00		
	Total	**5.57E-02**	**1.38E+00**	**1.43E+00**	**1.43E+00**
02W5	SGS U1	5.16E-02	4.41E-02		
	SGS U2	1.91E-03	1.78E-03		
	HCGS	8.80E-03	8.65E-03		
	ISFSI	N/A	5.31E-01		
	Total	**6.23E-02**	**5.85E-01**	**6.47E-01**	**6.47E-01**

Figure 5, Special Wind Turbine Laydown Areas, 16W4, 01W4, 02W5, and 03W2

5.0 SUPPLEMENTAL INFORMATION

5.1 Gaseous Batch Releases

5.1.1 Salem Unit 1

	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
1. Number of Batch Releases		6	3	11	5	25
2. Total duration of batch releases	minutes	1.30E+05	1.31E+05	1.33E+05	1.33E+05	5.26E+05
3. Maximum batch release duration	minutes	4.46E+04	4.46E+04	4.46E+04	4.46E+04	4.46E+04
4. Average batch release duration	minutes	2.16E+04	4.37E+04	1.21E+04	2.65E+04	2.11E+04
5. Minimum batch release duration	minutes	5.10E+01	4.32E+04	7.00E+00	5.30E+01	7.00E+00

5.1.2 Salem Unit 2

	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
1. Number of Batch Releases		9	7	4	23	43
2. Total duration of batch releases	minutes	1.30E+05	1.31E+05	1.33E+05	1.11E+05	5.05E+05
3. Maximum batch release duration	minutes	4.46E+04	4.46E+04	4.46E+04	4.46E+04	4.46E+04
4. Average batch release duration	minutes	1.45E+04	1.88E+04	3.31E+04	4.81E+03	1.17E+04
5. Minimum batch release duration	minutes	1.00E+01	3.10E+01	1.05E+02	1.50E+01	1.00E+01

5.1.3 Hope Creek Unit 1

	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
1. Number of Batch Releases		0	6	2	0	8
2. Total duration of batch releases	minutes	N/A	9.13E+03	3.00E+03	N/A	1.21E+04
3. Maximum batch release duration	minutes	N/A	2.32E+03	1.60E+03	N/A	2.32E+03
4. Average batch release duration	minutes	N/A	1.52E+03	1.50E+03	N/A	1.52E+03
5. Minimum batch release duration	minutes	N/A	3.76E+02	1.41E+03	N/A	3.76E+02

5.2 Liquid Batch Releases

5.2.1 Salem Unit 1

	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
1. Number of Batch Releases		13	12	10	13	48
2. Total duration of batch releases	minutes	6.28E+03	5.75E+03	4.91E+03	5.31E+03	2.23E+04
3. Maximum batch release duration	minutes	6.98E+02	6.52E+02	8.43E+02	6.81E+02	8.43E+02
4. Average batch release duration	minutes	4.83E+02	4.79E+02	4.91E+02	4.09E+02	4.64E+02
5. Minimum batch release duration	minutes	2.75E+02	2.33E+02	2.83E+02	2.61E+02	2.33E+02

5.2.2 Salem Unit 2

	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
1. Number of Batch Releases		11	12	10	30	63
2. Total duration of batch releases	minutes	6.42E+03	7.10E+03	6.43E+03	1.16E+04	3.16E+04
3. Maximum batch release duration	minutes	1.06E+03	8.00E+02	9.13E+02	8.10E+02	1.06E+03
4. Average batch release duration	minutes	5.83E+02	5.91E+02	6.43E+02	3.88E+02	5.01E+02
5. Minimum batch release duration	minutes	3.27E+02	4.22E+02	4.78E+02	1.00E+01	1.00E+01

5.2.3 Hope Creek Unit 1

	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
1. Number of Batch Releases		80	92	52	27	251
2. Total duration of batch releases	minutes	4.61E+03	6.33E+03	4.17E+03	1.75E+03	1.69E+04
3. Maximum batch release duration	minutes	8.70E+01	1.01E+02	9.30E+01	8.90E+01	1.01E+02
4. Average batch release duration	minutes	5.77E+01	6.88E+01	8.03E+01	6.47E+01	6.72E+01
5. Minimum batch release duration	minutes	2.80E+01	3.80E+01	2.50E+01	2.00E+00	2.00E+00

5.3 Abnormal Releases

5.3.1 Salem Unit 1

None

5.3.2 Salem Unit 2

None

5.3.3 Hope Creek Unit 1

None

5.4 Land Use Census Changes

The results of the 2021 Land Use Census showed no changes in nearest residences and milk farms. There were no gardens of greater than 500 ft^2 within five miles of the SGS/HCGS site.

5.5 Meteorological Data

The 2021 meteorological monitoring program had a Joint Frequency Data (JFD) recovery rate of 93.2% recovery rate. The JFD recovery rate per Reg. Guide 1.23 (13) includes wind speed, wind direction and stability class. A loss of data from any one of these parameters impacts the overall recovery rate. In November 2021 the meteorology tower instrumentation, wiring and computer systems were upgraded. The tower instrumentation was down for approximately 20.17 days. The percent recovery rate for each required sensor is detailed in Attachment 3,Meteorological Data. The quarterly JFDs are retained onsite and available upon request.

Attachment 3,Meteorological Data includes the annual JFD for all stability classes, percent by stability class, and Salem's and Hope Creek's five year (2016 – 2020) annual average dispersion (X/Q) and deposition (D/Q) data.

A graphical representation of the annual JFD using the Lakes, Inc., software WRPLOT VIEW. This software graphically presents the JFD data in only six windspeeds in meters per second. The data in Table **38**, Percentage of Each Wind Speed and Direction All Stability Classes, which is in 10 windspeed categories was converted to the six windspeed categories as required by the Lakes software. This graphical representation is presented in Figure 6, Locations of Dose Calculation Receptors with 2021 Wind Rose Overlay.

5.6 Effluent Radiation Monitors Out of Service Greater Than 30 Days

5.6.1 Salem Unit 1

None

5.6.2 Salem Unit 2

The 2R13A CFCU Service Water radiation monitor was declared out-of-service on 8/2/2021 and was returned to service on 12/15/2021, The monitor was not able to be restored within 30 days due to failure of the standpipe. Repairs were made and the standpipe was installed in the 30 day period but would not pass a channel/detector calibration due to elevated background counts following standpipe repairs. (Notifications 20854801, 20883470)

5.6.3 Hope Creek Unit 1

None

5.7 Offsite Dose Calculation Manual (ODCM) Changes

5.7.1 Salem

Revision 29 of the Salem REC ODCM was issued in March 2021

5.7.2 Hope Creek

Revision 29 of the Hope Creek REC ODCM was issued in March 2021

5.7.3 Common REMP

Revision 0 of this Common REMP ODCM was issued in March 2021

See Attachment 8, 2021 Change Summary to the Salem and Hope Creek ODCMs for a summary description of the changes.

5.8 Process Control Program (PCP) Changes

The PCP Procedure RW-AA-100, revision 10 was last revised in 2015.

5.9 Radioactive Waste Treatment System Changes

There were no changes to the Radioactive Waste Treatment Systems for either Salem Unit 1, Salem Unit 2, or Hope Creek Unit 1.

6.0 OTHER SUPPLIMENTAL INFORMATION

6.1 Salem Unit 2

None

6.2 Salem Unit 2

None

6.3 Hope Creek Unit 1

The North Plant Vent (NPV) weekly tritium sample collected 12/28/2021 - 1/04/2022 showed activity at a concentration of 5.05E-06 uCi/cc, which is approximately 500 to 1,000 times higher than the typical H-3 concentration observed at this collection point. Given the release flowrate of air discharged through this vent (4.175E+04 cfm), a Gaseous Effluent Permit was issued with a total weekly release of tritium of 60.1 curies. This one week's release was equal to 66% of the total tritium released from the NPV for all of 2021. The result is not believed to be valid because 1) tritium is not normally expected in significant concentration in the NPV, and 2) two weekly NPV samples have been collected since the result in question; one sample was <MDA and the other one was 2.7E-07 uCi/ml (Notification 20895079).

6.4 Data Trend for Curies Released from the SGS/HCGS Site

Graphical trends of the curies released from the SGS/HCGS site in gaseous and liquid effluents presented in Attachment 4, Radiological Effluent Trends.

6.5 Outside Tanks

In 2021 the SGS/HCGS sites did not utilize temporary outside tanks to hold radioactive materials more than 10 Curies. This requirement does not apply to tritium.

6.6 Independent Spent Fuel Storage Installation (ISFSI) Monitoring Program

There have been no gaseous or liquid releases from the Independent Spent Fuel Storage Installation (ISFSI) since it was placed in service in the summer of 2006.

6.7 Carbon-14

Carbon-14 (C-14) is a naturally occurring radionuclide with a 5,730-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," (14) 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" (15). The assessment methodology used to estimate the quantity of C-14 discharged in gaseous effluent from SGS/HCGS involved the use of a normalized C-14 source term and scaling factors based on power generation. The following assumptions were incorporated into the method:

- Only C-14 in the form of CO_2 was incorporated into vegetation through photosynthesis, which causes dose via the ingestion exposure pathways.
- The concentration of C-14 in vegetation was proportional to the concentration of C-14 in air (per equation C-8 in Regulatory Guide 1.109).
- 95% of C-14 released from a BWR (i.e., HCGS) and 30% of C-14 released from a PWR (i.e., SGS Units 1 and 2) was in the form of CO_2 (15).

The estimated generation for Salem & Hope Creek Generating Stations for 2021 was as follows:

Salem Unit 1	11.64 curies
Salem Unit 2	10.10 curies
Hope Creek Unit 1	15.54 curies

Public dose estimates were performed using methodology from the ODCM which is based on Regulatory Guide 1.109 methodology (10). Carbon dioxide is assumed to make up 95% and 30% of the Carbon-14 gaseous emissions from Hope Creek and Salem stations, respectively based upon available references (15). Carbon-14 is the highest dose contributor of all radionuclides released in gaseous effluents. Annual dose resulting from Carbon-14 releases in gaseous effluents is estimated to be 99% of the dose to the Child bone and 87% to the other organs.

6.8 Corrections to Previous Reports

Minor issues were identified in the 2020 ARERR. The issues were related to: (1) not properly accounting for the curies released to the environment from the Hope Creek turbine lube oil vents (TLOV) system. (2) The total curies shipped from Hope Creek were incorrect due to a typographical error. The detailed changes made to the 2020 ARERR are included in Attachment 6, ERRATA Section from Previous Reports.

7.0 NEI 07-07 ONSITE RADIOLOGICAL GROUNDWATER MONITORING PROGRAM

Salem & Hope Creek Generating Stations have developed a Groundwater Protection Initiative (GPI) program in accordance with NEI 07-07, Industry Ground Water Protection Initiative – Final Guidance Document (16). The purpose of the GPI is to ensure timely detection and an effective response to situations involving inadvertent radiological releases to groundwater to prevent migration of licensed radioactive material off-site and to quantify impacts on decommissioning. During 2021, SGS/HCGS collected and analyzed groundwater samples in accordance with the requirements of site procedures.

Monitoring wells installed as part of Groundwater Protection Initiative (GPI) (NEI 07-07) program are sampled either monthly, quarterly, or annually and analyzed for various radionuclides.

During 2021, the mass flux within the shallow, water bearing unit and deeper groundwater was estimated to be 0.012 Ci and 0.036 Ci, respectively. Therefore, the total potential estimated mass flux of tritium in groundwater reaching the Delaware River during 2021was 0.048 Ci.

The detailed report is included in 2021 Radiological Groundwater Protection Program (RGPP) Report.

Table 7, Groundwater Protection Program Monitoring Well Results for Tritium

Well Name	Number of Positive Detections	Number of Analysis	Average Concentration[1] pCi/L	Maximum Concentration pCi/L
Well AA	4	4	1,470	2,360
Well AA-V	4	4	3,386	6,880
Well AB	1	1	5,420	5,420
Well AC	12	12	30,183	40,900
Well AD	3	3	7,980	8,520
Well AE	4	4	15,775	20,800
Well AF	2	2	312	411
Well AF-V	3	4	316	400
Well AG-D	2	2	897	905
Well AG-S	2	2	737	845
Well AH-D	2	2	570	605
Well AH-S	2	2	506	522
Well AI	2	2	938	1,510
Well AJ	3	3	10,513	11,100
Well AL	2	2	385	415
Well AM	4	4	16,818	27,700
Well AN	12	12	16,325	21,700
Well AP	2	2	1,470	1,680
Well AR	4	4	5,233	6,530
Well AS	2	2	5,505	6,210
Well AT	2	2	2,030	2,060
Well BA	0	2	N/D	N/D
Well BB	0	2	N/D	N/D
Well BC	12	12	1,764	2,970
Well BD	4	4	405	559
Well BE	5	5	705	1,370
Well BF	0	2	N/D	N/D
Well BG	1	4	209	209
Well BH	0	4	N/D	N/D
Well BH-V	0	2	N/D	N/D
Well BI	1	4	455	455

[1] Tritium results < MDA are not included in the average concentration calculation.

Table 7, Groundwater Protection Program Monitoring Well Results for Tritium

Well Name	Number of Positive Detections	Number of Analysis	Average Concentration[1] pCi/L	Maximum Concentration pCi/L
Well BJ	12	12	2,470	2,880
Well BK	0	2	N/D	N/D
Well BL	0	2	N/D	N/D
Well BM	4	4	459	520
Well BM-V	2	2	215	220
Well BN	4	4	780	1,710
Well BO	3	3	392	521
Well BP	0	2	N/D	N/D
Well BQ	0	4	N/D	N/D
Well BR	0	2	N/D	N/D
Well BS	0	2	N/D	N/D
Well BT	0	2	N/D	N/D
Well BU	0	2	N/D	N/D
Well BW	1	1	650	650
Well BX	1	1	674	674
Well BY	12	12	58,458	68,100
Well BY-V	4	4	5,916	11,700
Well BZ	2	2	1,325	1,510
Well CA	2	2	1,570	1,810
Well DA	9	9	2,873	3,600
Well DB	4	4	5,868	6,770
Well DC	8	8	3,300	5,250
Well DD	4	4	5,218	5,920
Well DE	4	4	16,575	17,000
Well DF	2	2	1,170	1,190
Well DG	4	4	2,830	3,180
Well DH	4	4	10,463	11,900
Well DI	4	4	2,708	4,420
Well DJ	5	5	3,558	4,250
Well K	0	2	N/D	N/D
Well L	0	2	N/D	N/D
Well M	4	4	6,045	8,480
Well N	4	4	8,265	10,400

Table 7, Groundwater Protection Program Monitoring Well Results for Tritium

Well Name	Number of Positive Detections	Number of Analysis	Average Concentration[1] pCi/L	Maximum Concentration pCi/L
Well O	4	4	28,798	52,600
Well P	0	2	N/D	N/D
Well R	12	12	7,738	10,300
Well S	1	1	8,160	8,160
Well S-V	4	4	2,280	2,720
Well T	0	4	N/D	N/D
Well U	4	4	309	359
Well V	2	2	210	221
Well W	4	4	2,113	2,500
Well Y	0	2	N/D	N/D
Well Z	2	2	425	427

8.0 VOLUNTARY NOTIFICATION

During 2021, Salem & Hope Creek Generating Stations did not make any voluntary NEI 07-07 notification to State/Local officials, NRC, or to other stakeholders required by site procedures.

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ARERR Release Summary - RG-1.21 Tables

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

ARERR Release Summary - RG-1.21 Tables

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ARERR Release Summary - RG-1.21 Tables

1.0 GASEOUS EFFLUENTS

1.1 Salem Unit 1

Table 8, Gaseous Effluents Summation of All Releases (SGS Unit 1)

A. Fission & Activation Gases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %
1. Total Release	Ci	5.51E-02	3.47E-02	8.24E-04	6.40E-02	1.55E-01	3.40E+01
2. Average release rate for the period	μCi/sec	7.09E-03	4.41E-03	1.04E-04	8.05E-03	4.90E-03	
B. Iodines and Halogens							
1. Total Release	Ci	N/D	N/D	N/D	N/D	N/D	3.00E+01
2. Average release rate for the period	μCi/sec	N/A	N/A	N/A	N/A	N/A	
C. Particulates							
1. Total Release	Ci	N/D	N/D	1.85E-02	N/D	1.85E-02	3.00E+01
2. Average release rate for the period	μCi/sec	N/A	N/A	2.33E-03	N/A	5.87E-04	
D. Tritium							
1. Total Release	Ci	3.17E+01	4.41E+01	5.38E+01	9.76E+01	2.27E+02	3.10E+01
2. Average release rate for the period	μCi/sec	4.08E+00	5.61E+00	6.76E+00	1.23E+01	7.20E+00	
E. Gross Alpha							
1. Total Release	Ci	N/D	N/D	N/D	N/D	N/D	3.00E+01
2. Average release rate for the period	μCi/sec	N/A	N/A	N/A	N/A	N/A	
F. Carbon-14							
1. Total Release	Ci	2.89E+00	2.97E+00	2.89E+00	2.89E+00	1.16E+01	
2. Average release rate for the period	μCi/sec	3.71E-01	3.77E-01	3.64E-01	3.64E-01	3.69E-01	

% of limit is on Table 1, Salem Generating Station Unit 1 Dose Summary

ARERR Release Summary - RG-1.21 Tables

Table 9, Gaseous Effluents – Ground Level Release Batch Mode (SGS Unit 1)

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Fission Gases						
Ar-41	Ci	5.31E-02	3.47E-02	N/D	6.15E-02	1.49E-01
Xe-133	Ci	2.06E-03	N/D	8.24E-04	2.47E-03	5.36E-03
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	5.51E-02	3.47E-02	8.24E-04	6.40E-02	1.55E-01
Iodines and Halogens						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
Particulates						
Ag-110m	Ci	N/D	N/D	1.85E-02	N/D	1.85E-02
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	1.85E-02	N/D	1.85E-02
Tritium						
H-3	Ci	1.19E-01	1.01E+00	1.60E+00	9.30E-01	3.65E+00
Gross Alpha						
Alpha	Ci	N/D	N/D	N/D	N/D	N/D
Carbon-14						
C-14	Ci	N/A	N/A	N/A	N/A	N/A

ARERR Release Summary - RG-1.21 Tables

Table 10, Gaseous Effluents – Ground Level Release Continuous Mode (SGS Unit 1)

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Fission Gases						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
Iodines and Halogens						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
Particulates						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
Tritium						
H-3	Ci	3.16E+01	4.31E+01	5.22E+01	9.66E+01	2.23E+02
Gross Alpha						
Alpha	Ci	N/D	N/D	N/D	N/D	N/D
Carbon-14						
C-14	Ci	2.89E+00	2.97E+00	2.89E+00	2.89E+00	1.16E+01

ARERR Release Summary - RG-1.21 Tables

1.2 Salem Unit 2

Table 11, Gaseous Effluents Summation of All Releases (SGS Unit 2)

A. Fission & Activation Gases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %
1. Total Release	Ci	9.07E-02	8.80E-02	7.29E-02	5.00E-02	3.02E-01	3.40E+01
2. Average release rate for the period	μCi/sec	1.17E-02	1.12E-02	9.17E-03	6.30E-03	9.57E-03	
B. Iodine and Halogens							
1. Total Release	Ci	N/D	N/D	N/D	N/D	N/D	3.00E+01
2. Average release rate for the period	μCi/sec	N/A	N/A	N/A	N/A	N/A	
C. Particulates							
1. Total Release	Ci	N/D	N/D	N/D	N/D	N/D	3.00E+01
2. Average release rate for the period	μCi/sec	N/A	N/A	N/A	N/A	N/A	
D. Tritium							
1. Total Release	Ci	1.82E+01	9.72E+00	6.25E+01	9.95E+01	1.90E+02	3.10E+01
2. Average release rate for the period	μCi/sec	2.34E+00	1.24E+00	7.86E+00	1.25E+01	6.02E+00	
E. Gross Alpha							
1. Total Release	Ci	N/D	N/D	N/D	N/D	N/D	3.00E+01
2. Average release rate for the period	μCi/sec	N/A	N/A	N/A	N/A	N/A	
F. Carbon-14							
1. Total Release	Ci	2.63E+00	2.53E+00	2.50E+00	2.44E+00	1.01E+01	
2. Average release rate for the period	μCi/sec	3.39E-01	3.21E-01	3.14E-01	3.07E-01	3.20E-01	

% of limit is on Table 2, Salem Generating Station Unit 2 Dose Summary

ARERR Release Summary - RG-1.21 Tables

Table 12, Gaseous Effluents – Ground Level Release Batch Mode (SGS Unit 2)

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Fission Gases						
Ar-41	Ci	8.54E-02	8.66E-02	7.26E-02	3.40E-02	2.79E-01
Xe-133	Ci	5.32E-03	1.41E-03	2.73E-04	1.57E-02	2.27E-02
Xe-135	Ci	3.47E-05	N/D	N/D	3.58E-04	3.92E-04
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	9.07E-02	8.80E-02	7.29E-02	5.00E-02	3.02E-01
Iodines and Halogens						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
Particulates						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
Tritium						
H-3	Ci	2.31E-01	5.67E-01	3.74E-01	4.54E-01	1.63E+00
Gross Alpha						
Alpha	Ci	N/D	N/D	N/D	N/D	N/D
Carbon-14						
C-14	Ci	N/A	N/A	N/A	N/A	N/A

ARERR Release Summary - RG-1.21 Tables

Table 13, Gaseous Effluents – Ground Level Release Continuous Mode (SGS Unit 2)

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Fission Gases						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
Iodines and Halogens						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
Particulates						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
Tritium						
H-3	Ci	1.79E+01	9.18E+00	6.21E+01	9.91E+01	1.88E+02
Gross Alpha						
Alpha	Ci	N/D	N/D	N/D	N/D	N/D
Carbon-14						
C-14	Ci	2.63E+00	2.53E+00	2.50E+00	2.44E+00	1.01E+01

ARERR Release Summary - RG-1.21 Tables

1.3 Hope Creek Unit 1

Table 14, Gaseous Effluents Summation of All Releases (HCGS Unit 1)

A. Fission & Activation Gases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %
1. Total Release	Ci	N/D	1.56E-04	1.13E-04	N/D	2.69E-04	3.40E+01
2. Average release rate for the period	µCi/sec	N/A	1.98E-05	1.43E-05	N/A	8.53E-06	
B. Iodine and Halogens							
1. Total Release	Ci	2.48E-04	1.16E-04	8.29E-04	1.14E-03	2.34E-03	3.00E+01
2. Average release rate for the period	µCi/sec	3.19E-05	1.48E-05	1.04E-04	1.44E-04	7.41E-05	
C. Particulates							
1. Total Release	Ci	3.81E-05	4.56E-04	4.60E-04	8.52E-04	1.81E-03	3.00E+01
2. Average release rate for the period	µCi/sec	4.90E-06	5.80E-05	5.79E-05	1.07E-04	5.73E-05	
D. Tritium							
1. Total Release	Ci	1.22E+02	7.49E+01	7.46E+01	1.47E+02	4.19E+02	3.10E+01
2. Average release rate for the period	µCi/sec	1.57E+01	9.53E+00	9.38E+00	1.85E+01	1.33E+01	
E. Gross Alpha							
1. Total Release	Ci	N/D	N/D	N/D	N/D	N/D	3.00E+01
2. Average release rate for the period	µCi/sec	N/A	N/A	N/A	N/A	N/A	
F. Carbon-14							
1. Total Release	Ci	4.05E+00	4.03E+00	3.69E+00	3.76E+00	1.55E+01	
2. Average release rate for the period	µCi/sec	5.21E-01	5.13E-01	4.65E-01	4.74E-01	4.93E-01	

% of limit is on Table 3, Hope Creek Generating Station Unit 1 Dose Summary

ARERR Release Summary - RG-1.21 Tables

Table 15, Gaseous Effluents – Ground Level Release Batch Mode (HCGS Unit 1)

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Fission Gases						
Ar-41	Ci	N/D	1.56E-04	N/D	N/D	1.56E-04
Xe-135	Ci	N/D	N/D	1.13E-04	N/D	1.13E-04
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	N/D	1.56E-04	1.13E-04	N/D	2.69E-04
Iodines						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
Particulates						
Mn-54	Ci	N/D	3.03E-04	N/D	N/D	3.03E-04
Co-60	Ci	N/D	8.16E-07	N/D	N/D	8.16E-07
Cs-137	Ci	N/D	3.84E-07	N/D	N/D	3.84E-07
	Ci					
	Ci					
	Ci					
Total for Period	Ci	N/D	3.04E-04	N/D	N/D	3.04E-04
Tritium						
H-3	Ci	N/D	2.15E-02	2.34E-02	N/D	4.49E-02
Gross Alpha						
Alpha	Ci	N/D	N/D	N/D	N/D	N/D
Carbon-14						
C-14	Ci	N/A	N/A	N/A	N/A	N/A

ARERR Release Summary - RG-1.21 Tables

Table 16, Gaseous Effluents – Ground Level Release Continuous Mode (HCGS Unit 1)

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Fission Gases						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
Iodines and Halogens						
I-131	Ci	3.37E-05	8.38E-06	3.62E-05	7.32E-05	1.51E-04
I-133	Ci	2.15E-04	1.08E-04	7.93E-04	1.07E-03	2.19E-03
	Ci					
Total for Period	Ci	2.48E-04	1.16E-04	8.29E-04	1.14E-03	2.34E-03
Particulates						
Na-24	Ci	N/D	N/D	4.09E-04	8.03E-04	1.21E-03
Cr-51	Ci	N/D	1.40E-05	N/D	N/D	1.40E-05
Mn-54	Ci	N/D	3.75E-05	N/D	N/D	3.75E-05
Fe-59	Ci	N/D	1.04E-05	N/D	N/D	1.04E-05
Co-58	Ci	N/D	2.55E-06	N/D	N/D	2.55E-06
Co-60	Ci	3.46E-05	8.66E-05	5.04E-05	4.44E-05	2.16E-04
Nb-95	Ci	N/D	4.87E-07	N/D	N/D	4.87E-07
Cs-137	Ci	3.47E-06	N/D	N/D	4.79E-06	8.26E-06
	Ci					
Total for Period	Ci	3.81E-05	1.52E-04	4.60E-04	8.52E-04	1.50E-03
Tritium						
H-3	Ci	1.22E+02	7.49E+01	7.45E+01	1.47E+02	4.19E+02
Gross Alpha						
Alpha	Ci	N/D	N/D	N/D	N/D	N/D
Carbon-14						
C-14	Ci	4.05E+00	4.03E+00	3.69E+00	3.76E+00	1.55E+01

ARERR Release Summary - RG-1.21 Tables

2.0 LIQUID EFFLUENTS

2.1 Salem Unit 1

Table 17, Liquid Effluents – Summation of All Releases (SGS Unit 1)

A. Fission & Activation Products	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %
1. Total Release	Ci	5.20E-04	2.75E-04	6.21E-05	1.15E-04	9.71E-04	2.70E+01
2. Average diluted concentration	μCi/mL	1.04E-11	5.51E-12	1.08E-12	2.34E-12	4.71E-12	
B. Tritium							
1. Total Release	Ci	5.89E+01	7.45E+01	2.13E+02	1.37E+02	4.83E+02	2.70E+01
2. Average diluted concentration	μCi/mL	1.17E-06	1.49E-06	3.71E-06	2.79E-06	2.34E-06	
C. Dissolved & Entrained Gases							
1. Total Release	Ci	7.14E-06	N/D	N/D	N/D	7.14E-06	2.70E+01
2. Average diluted concentration	μCi/mL	1.42E-13	N/A	N/A	N/A	3.46E-14	
D. Gross Alpha Activity							
1. Total Release	Ci	N/D	N/D	N/D	N/D	N/D	2.70E+01
E. Volume of Waste Released (prior to dilution)	Liters	4.19E+07	4.23E+07	4.35E+07	4.31E+07	1.71E+08	
F. Volume of Dilution Water Used During Period	Liters	5.01E+10	4.99E+10	5.72E+10	4.90E+10	2.06E+11	

% of limit is on the Table 1, Salem Generating Station Unit 1 Dose Summary

ARERR Release Summary - RG-1.21 Tables

Table 18, Batch Mode Liquid Effluents (SGS Unit 1)

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Tritium						
H-3	Ci	5.88E+01	7.43E+01	2.12E+02	1.37E+02	4.82E+02
Fission & Activation Products						
Co-58	Ci	3.38E-04	7.62E-05	N/D	4.86E-05	4.63E-04
Co-60	Ci	9.39E-05	1.99E-04	4.82E-06	6.00E-05	3.57E-04
Sn-117m	Ci	N/D	N/D	N/D	6.10E-06	6.10E-06
Sb-125	Ci	8.73E-05	N/D	5.73E-05	N/D	1.45E-04
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	5.20E-04	2.75E-04	6.21E-05	1.15E-04	9.71E-04
Entrained Gases						
Xe-133	Ci	7.14E-06	N/D	N/D	N/D	7.14E-06
	Ci					
	Ci					
Total for Period	Ci	7.14E-06	N/D	N/D	N/D	7.14E-06
Gross Alpha						
Gross Alpha	Ci	N/D	N/D	N/D	N/D	N/D

ARERR Release Summary - RG-1.21 Tables

Table 19, Continuous Mode Liquid Effluents (SGS Unit 1)

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Tritium						
H-3	Ci	7.63E-02	1.31E-01	1.39E-01	7.04E-02	4.17E-01
Fission & Activation Products						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
Entrained Gases						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
Gross Alpha						
Gross Alpha	Ci	N/D	N/D	N/D	N/D	N/D

ARERR Release Summary - RG-1.21 Tables

2.2 Salem Unit 2

Table 20, Liquid Effluents – Summation of All Releases (SGS Unit 2)

A. Fission & Activation Products	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %
1. Total Release	Ci	5.53E-04	5.79E-04	3.43E-04	6.43E-04	2.12E-03	2.70E+01
2. Average diluted concentration	μCi/mL	1.19E-10	1.14E-10	7.01E-11	9.26E-11	9.83E-11	
B. Tritium							
1. Total Release	Ci	4.50E+01	9.23E+01	1.27E+02	1.46E+02	4.10E+02	2.70E+01
2. Average diluted concentration	μCi/mL	9.72E-06	1.81E-05	2.60E-05	2.10E-05	1.90E-05	
C. Dissolved & Entrained Gases							
1. Total Release	Ci	N/D	N/D	3.42E-05	N/D	3.42E-05	2.70E+01
2. Average diluted concentration	μCi/mL	N/A	N/A	7.00E-12	N/A	1.59E-12	
D. Gross Alpha Activity							
1. Total Release	Ci	N/D	N/D	N/D	N/D	N/D	2.70E+01
E. Volume of Waste Released (prior to dilution)	Liters	1.31E+07	1.32E+07	1.25E+07	9.51E+06	4.83E+07	
F. Volume of Dilution Water Used During Period	Liters	4.61E+09	5.07E+09	4.87E+09	6.93E+09	2.15E+10	

% of limit is on the Table 2, Salem Generating Station Unit 2 Dose Summary

ARERR Release Summary - RG-1.21 Tables

Table 21, Batch Mode Liquid Effluents (SGS Unit 2)

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Tritium						
H-3	Ci	4.50E+01	9.22E+01	1.27E+02	1.46E+02	4.10E+02
Fission & Activation Products						
Fe-59	Ci	N/D	N/D	3.93E-05	N/D	3.93E-05
Co-58	Ci	2.51E-04	3.95E-04	1.35E-04	1.20E-04	9.02E-04
Co-60	Ci	3.02E-04	1.84E-04	1.07E-04	4.47E-04	1.04E-03
Nb-95	Ci	N/D	N/D	9.00E-06	N/D	9.00E-06
Sn-113	Ci	N/D	N/D	3.39E-06	N/D	3.39E-06
Sn-117m	Ci	N/D	N/D	N/D	1.17E-05	1.17E-05
Sb-124	Ci	N/D	N/D	N/D	6.83E-06	6.83E-06
Sb-125	Ci	N/D	N/D	4.91E-05	5.60E-05	1.05E-04
Cs-137	Ci	N/D	N/D	N/D	6.82E-07	6.82E-07
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	5.53E-04	5.79E-04	3.43E-04	6.43E-04	2.12E-03
Entrained Gases						
Xe-133	Ci	N/D	N/D	3.42E-05	N/D	3.42E-05
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	3.42E-05	N/D	3.42E-05
Gross Alpha						
Gross Alpha	Ci	N/D	N/D	N/D	N/D	N/D

ARERR Release Summary - RG-1.21 Tables

Table 22, Continuous Mode Liquid Effluents (SGS Unit 2)

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Tritium						
H-3	Ci	N/D	1.50E-02	N/D	N/D	1.50E-02
Fission & Activation Products						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
Entrained Gases						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
Total for Period		N/D	N/D	N/D	N/D	N/D
Gross Alpha						
Gross Alpha	Ci	N/D	N/D	N/D	N/D	N/D

ARERR Release Summary - RG-1.21 Tables

2.3 Hope Creek Unit 1

Table 23, Liquid Effluents – Summation of All Releases (HGS Unit 1)

A. Fission & Activation Products	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %
1. Total Release	Ci	1.07E-03	9.31E-04	5.10E-04	3.95E-03	6.46E-03	2.70E+01
2. Average diluted concentration	μCi/mL	1.73E-10	1.65E-10	7.76E-11	6.43E-10	2.63E-10	
B. Tritium							
1. Total Release	Ci	1.74E+01	2.31E+01	1.95E+01	9.21E+00	6.92E+01	2.70E+01
2. Average diluted concentration	μCi/mL	2.83E-06	4.09E-06	2.97E-06	1.50E-06	2.82E-06	
C. Dissolved & Entrained Gases							
1. Total Release	Ci	6.32E-06	N/D	4.04E-06	N/D	1.04E-05	2.70E+01
2. Average diluted concentration	μCi/mL	1.03E-12	N/A	6.15E-13	N/A	4.23E-13	
D. Gross Alpha Activity							
1. Total Release	Ci	N/D	N/D	N/D	N/D	N/D	2.70E+01
E. Volume of Waste Released (prior to dilution)	Liters	1.34E+07	6.82E+06	1.13E+07	3.40E+06	3.49E+07	
F. Volume of Dilution Water Used During Period	Liters	6.15E+09	5.63E+09	6.56E+09	6.14E+09	2.45E+10	

% of limit is on the Table 3, Hope Creek Generating Station Unit 1 Dose Summary

ARERR Release Summary - RG-1.21 Tables

Table 24, Batch Mode Liquid Effluents (HGS Unit 1)

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Tritium						
H-3	Ci	1.66E+01	2.28E+01	1.77E+01	8.99E+00	6.60E+01
Fission & Activation Products						
Cr-51	Ci	N/D	1.17E-04	N/D	N/D	1.17E-04
Mn-54	Ci	1.05E-04	1.59E-04	8.16E-05	1.96E-04	5.42E-04
Co-58	Ci	4.52E-06	2.18E-05	3.49E-05	N/D	6.12E-05
Co-60	Ci	8.69E-04	5.82E-04	3.63E-04	3.58E-03	5.39E-03
Y-91m	Ci	9.66E-08	N/D	N/D	N/D	9.66E-08
Sb-124	Ci	N/D	4.74E-05	N/D	N/D	4.74E-05
Sb-125	Ci	2.50E-06	N/D	N/D	N/D	2.50E-06
I-131	Ci	3.82E-07	6.42E-08	N/D	N/D	4.46E-07
I-133	Ci	4.86E-06	1.97E-06	N/D	N/D	6.83E-06
Cs-134	Ci	3.29E-05	N/D	4.47E-06	4.66E-05	8.39E-05
Cs-137	Ci	4.79E-05	1.66E-06	2.65E-05	1.26E-04	2.02E-04
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	1.07E-03	9.31E-04	5.10E-04	3.95E-03	6.45E-03
Entrained Gases						
Xe-133	Ci	3.21E-06	N/D	N/D	N/D	3.21E-06
Xe-135	Ci	3.11E-06	N/D	4.04E-06	N/D	7.15E-06
	Ci					
Total for Period		6.32E-06	N/D	4.04E-06	N/D	1.04E-05
Gross Alpha						
Gross Alpha		N/D	N/D	N/D	N/D	N/D

ARERR Release Summary - RG-1.21 Tables

Table 25, Continuous Mode Liquid Effluents (HGS Unit 1)

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Tritium						
H-3	Ci	8.27E-01	2.90E-01	1.88E+00	2.17E-01	3.21E+00
Fission & Activation Products						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
Entrained Gases						
None	Ci	N/D	N/D	N/D	N/D	N/D
	Ci					
Total for Period		N/D	N/D	N/D	N/D	N/D
Gross Alpha						
Gross Alpha		N/D	N/D	N/D	N/D	N/D

Solid Waste Information

Attachment 2, Solid Waste Information

Solid Waste Information

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Solid Waste Information

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

During Period From: 01/01/2021 to 12/31/2021

Table 26, Resins, Filters, and Evaporator Bottoms Summary for the Salem Site

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Activity)
A	6.64E+02	1.88E+01	6.35E+00	+/-25%
B	9.40E+01	2.66E+00	2.22E+01	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	7.58E+02	2.15E+01	2.85E+01	+/-25%

Major Nuclides for Above Table:
H-3, C-14, Mn-54, Fe-55, Co-58, Co-60, Ni-59, Ni-63, Sr-90, Tc-99, Sb-125, I-129, Cs-137, Ce-144, Pu-238, Pu-239, Pu-241, Am-241, Cm-243

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
H-3	3.67%	2.33E-01
Fe-55	10.05%	6.38E-01
Co-58	1.09%	6.93E-02
Co-60	22.43%	1.42E+00
Ni-63	35.51%	2.25E+00
Sb-125	17.23%	1.09E+00
Cs-137	7.37%	4.68E-01
Waste Class B		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
Mn-54	1.35%	2.99E-01
Fe-55	11.57%	2.57E+00
Co-60	32.99%	7.32E+00
Ni-63	47.34%	1.05E+01
Sb-125	1.19%	2.64E-01
Cs-137	4.50%	9.97E-01
Waste Class C		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Total Combined		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
Mn-54	1.26%	3.60E-01
Fe-55	11.23%	3.20E+00
Co-60	30.64%	8.74E+00
Ni-63	44.70%	1.27E+01
Sb-125	4.76%	1.36E+00
Cs-137	5.14%	1.47E+00

Solid Waste Information

Table 27, Dry Active Waste (DAW) Summary for the Salem Site

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Activity)
A	1.45E+04	4.10E+02	2.21E+00	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	1.45E+04	4.10E+02	2.21E+00	+/-25%

Major Nuclides for Above Table:
H-3, C-14, Cr-51, Mn-54, Fe-55, Co-58, Co-60, Ni-63, Nb-95, Tc-99, Sb-125, I-129, Cs-137, Ce-144

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
H-3	1.97%	4.37E-02
Cr-51	1.26%	2.79E-02
Mn-54	1.35%	3.00E-02
Fe-55	25.45%	5.63E-01
Co-58	15.64%	3.46E-01
Co-60	33.15%	7.33E-01
Ni-63	3.50%	7.75E-02
Sb-125	2.41%	5.33E-02
Cs-137	13.02%	2.88E-01
Waste Class B		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Waste Class C		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Total Combined		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
H-3	1.97%	4.37E-02
Cr-51	1.26%	2.79E-02
Mn-54	1.35%	3.00E-02
Fe-55	25.45%	5.63E-01
Co-58	15.64%	3.46E-01
Co-60	33.15%	7.33E-01
Ni-63	3.50%	7.75E-02
Sb-125	2.41%	5.33E-02
Cs-137	13.02%	2.88E-01

Solid Waste Information

Table 28, Irradiated Components Summary for the Salem Site

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Activity)
A	0.00E+00	0.00E+00	0.00E+00	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	0.00E+00	0.00E+00	0.00E+00	+/-25%

Major Nuclides for Above Table:

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Waste Class B		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Waste Class C		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Total Combined		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A

Solid Waste Information

Table 29, Other Waste Summary for the Salem Site

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Activity)
A	0.00E+00	0.00E+00	0.00E+00	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	0.00E+00	0.00E+00	0.00E+00	+/-25%

Major Nuclides for Above Table:

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Waste Class B		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Waste Class C		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Total Combined		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A

Solid Waste Information

Table 30, Sum of All Low-Level Waste Shipped from the Salem Site

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Activity)
A	1.51E+04	4.29E+02	8.56E+00	+/-25%
B	9.40E+01	2.66E+00	2.22E+01	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	1.52E+04	4.31E+02	3.07E+01	+/-25%

Major Nuclides for Above Table:
H-3, C-14, Cr-51, Mn-54, Fe-55, Co-58, Co-60, Ni-59, Ni-63, Sr-90, Nb-95, Tc-99, Sb-125, I-129, Cs-137, Ce-144, Pu-238, Pu-239, Pu-241, Am-241, Cm-243

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
H-3	3.23%	2.76E-01
Mn-54	1.07%	9.16E-02
Fe-55	14.03%	1.20E+00
Co-58	4.85%	4.15E-01
Co-60	25.20%	2.16E+00
Ni-63	27.24%	2.33E+00
Sb-125	13.40%	1.15E+00
Cs-137	8.83%	7.56E-01
Waste Class B		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
Mn-54	1.35%	2.99E-01
Fe-55	11.57%	2.57E+00
Co-60	32.99%	7.32E+00
Ni-63	47.34%	1.05E+01
Sb-125	1.19%	2.64E-01
Cs-137	4.50%	9.97E-01
Waste Class C		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Total Combined		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
Mn-54	1.27%	3.90E-01
Fe-55	12.26%	3.77E+00
Co-58	1.35%	4.16E-01
Co-60	30.82%	9.47E+00
Ni-63	41.74%	1.28E+01
Sb-125	4.59%	1.41E+00
Cs-137	5.71%	1.75E+00

Solid Waste Information

Table 31, Resins, Filters, and Evaporator Bottoms Summary for the Hope Creek Site

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Activity)
A	2.38E+03	6.75E+01	1.11E+01	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	2.38E+03	6.75E+01	1.11E+01	+/-25%

Major Nuclides for Above Table:
H-3, C-14, Mn-54, Fe-55, Co-58, Co-60, Ni-63, Zn-65, Tc-99, I-129, Cs-134, Cs-137, Ce-144

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
H-3	6.30%	6.97E-01
C-14	11.35%	1.25E+00
Mn-54	11.38%	1.26E+00
Fe-55	13.53%	1.50E+00
Co-58	1.01%	1.12E-01
Co-60	43.97%	4.86E+00
Zn-65	3.04%	3.36E-01
Cs-134	2.62%	2.90E-01
Cs-137	3.96%	4.38E-01
Ce-144	1.65%	1.83E-01
Waste Class B		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Waste Class C		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Total Combined		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
H-3	6.30%	6.97E-01
C-14	11.35%	1.25E+00
Mn-54	11.38%	1.26E+00
Fe-55	13.53%	1.50E+00
Co-58	1.01%	1.12E-01
Co-60	43.97%	4.86E+00
Zn-65	3.04%	3.36E-01
Cs-134	2.62%	2.90E-01
Cs-137	3.96%	4.38E-01
Ce-144	1.65%	1.83E-01

Solid Waste Information

Table 32, Dry Active Waste (DAW) Summary for the Hope Creek Site

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Activity)
A	0.00E+00	0.00E+00	0.00E+00	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	0.00E+00	0.00E+00	0.00E+00	+/-25%

Major Nuclides for Above Table:

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

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

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

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

Solid Waste Information

Table 33, Irradiated Components Summary for the Hope Creek Site

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Activity)
A	0.00E+00	0.00E+00	0.00E+00	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	0.00E+00	0.00E+00	0.00E+00	+/-25%

Major Nuclides for Above Table:

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Waste Class B		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Waste Class C		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Total Combined		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A

Solid Waste Information

Table 34, Other Waste Summary for the Hope Creek Site

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Activity)
A	0.00E+00	0.00E+00	0.00E+00	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	0.00E+00	0.00E+00	0.00E+00	+/-25%

Major Nuclides for Above Table:

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Waste Class B		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Waste Class C		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A
Total Combined		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
None	N/A	N/A

Solid Waste Information

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

Waste Class	Volume ft^3	Volume m^3	Curies Shipped	% Error (Activity)
A	2.38E+03	6.75E+01	1.11E+01	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	2.38E+03	6.75E+01	1.11E+01	+/-25%

Major Nuclides for Above Table:
H-3, C-14, Mn-54, Fe-55, Co-58, Co-60, Ni-63, Zn-65, Tc-99, I-129, Cs-134, Cs-137, Ce-144

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
H-3	6.30%	6.97E-01
C-14	11.35%	1.25E+00
Mn-54	11.38%	1.26E+00
Fe-55	13.53%	1.50E+00
Co-58	1.01%	1.12E-01
Co-60	43.97%	4.86E+00
Zn-65	3.04%	3.36E-01
Cs-134	2.62%	2.90E-01
Cs-137	3.96%	4.38E-01
Ce-144	1.65%	1.83E-01

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

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

Total Combined		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
H-3	6.30%	6.97E-01
C-14	11.35%	1.25E+00
Mn-54	11.38%	1.26E+00
Fe-55	13.53%	1.50E+00
Co-58	1.01%	1.12E-01
Co-60	43.97%	4.86E+00
Zn-65	3.04%	3.36E-01
Cs-134	2.62%	2.90E-01
Cs-137	3.96%	4.38E-01
Ce-144	1.65%	1.83E-01

Solid Waste Information

2.0 SOLID WASTE DISPOSITION

Table 36, Solid Waste Shipped from the Salem Site

Number of Shipments	Mode of Transportation	Destination
1	Hittman Transport Services Inc	Barnwell Disposal Facility Operated by Chem-Nuclear Systems, Inc.
6	Hittman Transport Services Inc	Barnwell Processing Facility Energy Solutions, LLC Barnwell Process Facility
1	Hittman Transport Services Inc	UniTech Processing Facility 2323 Zirconium Road
5	Interstate Ventures	UniTech Processing Facility 2323 Zirconium Road

Table 37, Solid Waste Shipped from the Hope Creek Site

Number of Shipments	Mode of Transportation	Destination
11	Hittman Transport Services, Inc.	Energy Solutions BDF Barnwell Disposal Facility

Solid Waste Information

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Meteorological Data

Attachment 3, Meteorological Data

Meteorological Data

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Meteorological Data

1.0 Meteorological Data Summary

In November 2021 the meteorology tower instrumentation, wiring and computer systems were upgraded. The tower instrumentation was down for approximately 20.17 days.

1.1 Joint Frequency Distributions

1. Period of Record: 01/01/2021 - 12/31/2021
2. Elevation:
   a. Tower height (91 m)
   b. Wind Level (10 m)
3. Variable
   a. Delta T: (46-10 m)
   b. Total period of calm hours: 0.098%
   c. Percentage of missing data: 6.8%

January – December 2021

Sensor	Data Recovery (%)
33 ft Wind Speed/Direction	93.3
150 ft Wind Speed/Direction	93.0
197 ft Wind Speed/Direction	93.4
300 ft Wind Speed/Direction	93.0
Backup Wind Speed/Direction	87.4
300 ft Temp	94.5
33 ft Temp	94.3
33 ft Dew Point**	94.4
150 ft – 33 ft Delta Temp	94.3
197 ft – 33 ft Delta Temp	92.3
300 ft – 33 ft Delta Temp	94.3
33 ft Relative Humidity	11.2
300 ft Relative Humidity	94.5
Precipitation	60.8
Barometric Pressure	94.5
Solar Radiation	94.5

Meteorological Data

Table 38, Percentage of Each Wind Speed and Direction All Stability Classes

		WIND SPEED GROUPS (m/sec)											
WIND DIRECTION		< 0.5	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	> 10.0	Total
(Degrees)	Sect.												
348.75 - 11.25	N	0.000	0.196	0.551	0.748	2.243	1.471	0.625	0.282	0.196	0.049	0.000	6.36
11.25 - 33.75	NNE	0.000	0.172	0.466	0.735	1.789	1.238	0.576	0.404	0.208	0.037	0.000	5.63
33.75 - 56.25	NE	0.025	0.196	0.539	0.858	2.047	1.066	0.576	0.270	0.110	0.000	0.000	5.69
56.25 - 78.75	ENE	0.000	0.221	0.600	0.674	1.115	0.355	0.184	0.025	0.037	0.000	0.000	3.21
78.75 - 101.25	E	0.000	0.159	0.490	0.772	0.846	0.172	0.049	0.012	0.049	0.000	0.000	2.55
101.25 - 123.75	ESE	0.000	0.135	0.257	0.453	0.895	0.711	0.257	0.061	0.049	0.000	0.000	2.82
123.75 - 146.25	SE	0.037	0.061	0.208	0.343	1.115	1.789	1.936	1.887	1.164	0.257	0.270	9.07
146.25 - 168.75	SSE	0.000	0.086	0.245	0.466	1.250	1.225	0.944	1.115	0.674	0.025	0.025	6.05
168.75 - 191.25	S	0.000	0.037	0.282	0.441	1.532	0.895	0.993	0.564	0.723	0.147	0.012	5.63
191.25 - 213.75	SSW	0.012	0.110	0.404	0.699	2.206	1.409	0.919	0.478	0.233	0.086	0.000	6.56
213.75 - 236.25	SW	0.012	0.135	0.257	0.748	2.684	1.765	0.625	0.135	0.135	0.049	0.000	6.54
236.25 - 258.75	WSW	0.000	0.086	0.306	0.613	1.998	2.279	0.784	0.343	0.061	0.025	0.000	6.50
258.75 - 281.25	W	0.000	0.123	0.331	0.429	1.373	1.115	0.980	0.429	0.282	0.049	0.012	5.12
281.25 - 303.75	WNW	0.000	0.184	0.417	0.870	1.507	1.409	1.140	0.650	0.735	0.270	0.025	7.21
303.75 - 326.25	NW	0.012	0.184	0.417	0.748	2.181	2.022	2.108	1.985	2.169	0.502	0.000	12.33
326.25 - 348.75	NNW	0.000	0.196	0.404	0.625	2.194	1.752	1.127	1.103	1.225	0.123	0.000	8.75

Total 100.00

MISSING HOURS: 600
JOINT DATA RECOVERY: 93.2%

Meteorological Data

Stability class

Table 39, Classification of Atmospheric Stability

Stability Condition	Pasquill Categories	Percentage
Extremely Unstable	A	4.90
Moderately Stable	B	2.25
Slightly Unstable	C	3.22
Neutral	D	30.65
Slightly Stable	E	41.62
Moderately Stable	F	11.92
Extremely Stable	G	5.43

Meteorological Data

1.2 Five Year X/Q and D/Q Values for Each Site

1.2.1 Salem Generating Station

Table 40, Five Year Salem Ground Level Release Dispersion (X/Q) and Deposition Factors (D/Q) (2016 -2020)

SPECIFIC POINTS OF INTEREST						
Location	Direction From Site	Distance (mi)	X/Q (Sec/M^3) No Decay Undepleted	X/Q (Sec/m^3) No Decay Undepleted	X/Q (Sec/m^3) No Decay Depleted	D/Q ($1/m^2$)
SITE BOUNDARY	SSW	0.13	2.30E-05	2.30E-05	2.20E-05	9.50E-08
SITE BOUNDARY	SW	0.11	2.90E-05	2.90E-05	2.80E-05	1.10E-07
SITE BOUNDARY	WSW	0.11	2.50E-05	2.50E-05	2.50E-05	8.70E-08
SITE BOUNDARY	W	0.12	2.00E-05	2.00E-05	1.90E-05	5.90E-08
SITE BOUNDARY	WNW	0.16	1.10E-05	1.10E-05	1.10E-05	4.00E-08
SITE BOUNDARY	NW	0.28	6.30E-06	6.30E-06	5.90E-06	4.30E-08
SITE BOUNDARY	NNW	0.68	1.10E-06	1.10E-06	1.00E-06	8.40E-09
SITE BOUNDARY	N	0.83	7.30E-07	7.30E-07	6.40E-07	4.70E-09
SITE BOUNDARY	NNE	0.89	7.00E-07	7.00E-07	6.20E-07	4.30E-09
SITE BOUNDARY	NE	1.07	6.30E-07	6.30E-07	5.50E-07	3.40E-09
SITE BOUNDARY	ENE	0.88	7.50E-07	7.50E-07	6.60E-07	4.60E-09
SITE BOUNDARY	E	0.89	6.50E-07	6.50E-07	5.70E-07	4.80E-09
SITE BOUNDARY	ESE	0.24	5.20E-06	5.20E-06	5.00E-06	4.10E-08
SITE BOUNDARY	SE	0.15	1.80E-05	1.80E-05	1.70E-05	1.20E-07
SITE BOUNDARY	SSE	0.15	1.50E-05	1.50E-05	1.40E-05	8.90E-08
NEAREST RES	S	5.22	6.90E-08	6.90E-08	5.10E-08	2.20E-10
NEAREST RES	SSW	3.85	1.10E-07	1.10E-07	8.70E-08	3.60E-10
NEAREST RES	SW	4.29	1.00E-07	1.00E-07	7.60E-08	3.00E-10
NEAREST RES	WSW	4.41	8.50E-08	8.50E-08	6.40E-08	2.20E-10
NEAREST RES	W	3.98	8.70E-08	8.70E-08	6.70E-08	2.00E-10
NEAREST RES	WNW	3.42	9.40E-08	9.40E-08	7.30E-08	2.50E-10
NEAREST RES	NW	3.67	1.40E-07	1.40E-07	1.10E-07	5.80E-10
NEAREST RES	NNW	4.23	8.20E-08	8.20E-08	6.30E-08	3.50E-10
NEAREST RES	N	5.65	4.80E-08	4.80E-08	3.50E-08	1.60E-10
NEAREST RES	NNE	4.97	6.10E-08	6.10E-08	4.50E-08	2.10E-10
NEAREST RES	NE	3.85	1.00E-07	1.00E-07	8.00E-08	3.60E-10
NEAREST RES	ENE	3.85	9.20E-08	9.20E-08	7.10E-08	3.50E-10
NEAREST RES	E	5.28	5.10E-08	5.10E-08	3.80E-08	2.10E-10
NEAREST RES	ESE	5.84	4.70E-08	4.70E-08	3.40E-08	1.90E-10
NEAREST RES	SE	9.44	3.40E-08	3.40E-08	2.30E-08	1.20E-10
NEAREST RES	SSE	9.44	2.80E-08	2.80E-08	1.90E-08	8.90E-11
GARDENS	NNW	0.57	1.50E-06	1.50E-06	1.30E-06	1.10E-08
GARDENS	SE	0.18	1.20E-05	1.20E-05	1.20E-05	9.10E-08
GARDENS	N	0.57	1.30E-06	1.30E-06	1.20E-06	8.80E-09
GARDENS	NW	0.58	1.90E-06	1.90E-06	1.70E-06	1.40E-08

Meteorological Data

Table 40, Five Year Salem Ground Level Release Dispersion (X/Q) and Deposition Factors (D/Q) (2016 -2020)

SPECIFIC POINTS OF INTEREST						
Location	Direction From Site	Distance (mi)	X/Q (Sec/M^3) No Decay Undepleted	X/Q (Sec/m^3) No Decay Undepleted	X/Q (Sec/m^3) No Decay Depleted	D/Q ($1/m^2$)
GARDENS	SSW	3.9	1.10E-07	1.10E-07	8.60E-08	3.50E-10
GARDENS	NE	4.9	7.40E-08	7.40E-08	5.50E-08	2.40E-10
GARDENS	ENE	5	6.40E-08	6.40E-08	4.70E-08	2.20E-10
GARDENS	NE	5	7.20E-08	7.20E-08	5.30E-08	2.30E-10
GARDENS	E	6	4.30E-08	4.30E-08	3.10E-08	1.70E-10
GARDENS	ENE	6	4.90E-08	4.90E-08	3.60E-08	1.60E-10
GARDENS	ESE	6.3	4.20E-08	4.20E-08	3.10E-08	1.60E-10
GARDENS	NW	7	5.80E-08	5.80E-08	4.10E-08	1.80E-10
GARDENS	NNE	7.5	3.40E-08	3.40E-08	2.40E-08	1.00E-10
GARDENS	NW	8.3	4.60E-08	4.60E-08	3.20E-08	1.40E-10
GARDENS	NE	9.3	3.00E-08	3.00E-08	2.10E-08	7.80E-11
GARDENS	N	10.9	1.90E-08	1.90E-08	1.30E-08	5.50E-11
03W2	NE	0.38	3.00E-06	3.00E-06	2.70E-06	1.90E-08
16W4	NNW	0.67	1.10E-06	1.10E-06	1.00E-06	8.50E-09
01W4	N	0.63	1.10E-06	1.10E-06	9.90E-07	7.50E-09
02W5	NNE	0.6	1.30E-06	1.30E-06	1.10E-06	8.30E-09
DAIRY & CATTL	W	4.9	6.50E-08	6.50E-08	4.90E-08	1.40E-10
DAIRY & CATTL	WNW	8.5	2.80E-08	2.80E-08	1.90E-08	5.10E-11
DAIRY & CATTL	NE	11.3	2.30E-08	2.30E-08	1.50E-08	5.70E-11
DAIRY & CATTL	N	11.7	1.70E-08	1.70E-08	1.10E-08	4.90E-11
DAIRY & CATTL	NNE	11.8	1.80E-08	1.80E-08	1.20E-08	4.90E-11
DAIRY & CATTL	NE	4.2	9.10E-08	9.10E-08	7.00E-08	3.10E-10
DAIRY & CATTL	NE	5.8	5.80E-08	5.80E-08	4.30E-08	1.70E-10
DAIRY & CATTL	SSW	8.3	4.00E-08	4.00E-08	2.80E-08	9.30E-11
DAIRY & CATTL	N	11.5	1.80E-08	1.80E-08	1.20E-08	5.00E-11
DAIRY & CATTL	NE	17.7	1.30E-08	1.30E-08	7.50E-09	2.60E-11

Meteorological Data

1.2.2 Hope Creek Generating Station

Table 41, Five Year Hope Creek Ground Level Release Dispersion (X/Q) and Deposition Factors (D/Q) (2016 -2020)

SPECIFIC POINTS OF INTEREST						
Location	Direction From Site	Distance (mi)	X/Q (Sec/M^3) No Decay Undepleted	X/Q (Sec/m^3) No Decay Undepleted	X/Q (Sec/m^3) No Decay Depleted	D/Q ($1/m^2$)
SITE BOUNDARY	SSW	0.13	2.30E-05	2.30E-05	2.20E-05	9.50E-08
SITE BOUNDARY	SW	0.11	2.90E-05	2.90E-05	2.80E-05	1.10E-07
SITE BOUNDARY	WSW	0.11	2.50E-05	2.50E-05	2.50E-05	8.70E-08
SITE BOUNDARY	W	0.12	2.00E-05	2.00E-05	1.90E-05	5.90E-08
SITE BOUNDARY	WNW	0.16	1.10E-05	1.10E-05	1.10E-05	4.00E-08
SITE BOUNDARY	NW	0.28	6.30E-06	6.30E-06	5.90E-06	4.30E-08
SITE BOUNDARY	NNW	0.68	1.10E-06	1.10E-06	1.00E-06	8.40E-09
SITE BOUNDARY	N	0.83	7.30E-07	7.30E-07	6.40E-07	4.70E-09
SITE BOUNDARY	NNE	0.89	7.00E-07	7.00E-07	6.20E-07	4.30E-09
SITE BOUNDARY	NE	1.07	6.30E-07	6.30E-07	5.50E-07	3.40E-09
SITE BOUNDARY	ENE	0.88	7.50E-07	7.50E-07	6.60E-07	4.60E-09
SITE BOUNDARY	E	0.89	6.50E-07	6.50E-07	5.70E-07	4.80E-09
SITE BOUNDARY	ESE	0.24	5.20E-06	5.20E-06	5.00E-06	4.10E-08
SITE BOUNDARY	SE	0.15	1.80E-05	1.80E-05	1.70E-05	1.20E-07
SITE BOUNDARY	SSE	0.15	1.50E-05	1.50E-05	1.40E-05	8.90E-08
NEAREST RES	S	5.22	6.90E-08	6.90E-08	5.10E-08	2.20E-10
NEAREST RES	SSW	3.85	1.10E-07	1.10E-07	8.70E-08	3.60E-10
NEAREST RES	SW	4.29	1.00E-07	1.00E-07	7.60E-08	3.00E-10
NEAREST RES	WSW	4.41	8.50E-08	8.50E-08	6.40E-08	2.20E-10
NEAREST RES	W	3.98	8.70E-08	8.70E-08	6.70E-08	2.00E-10
NEAREST RES	WNW	3.42	9.40E-08	9.40E-08	7.30E-08	2.50E-10
NEAREST RES	NW	3.67	1.40E-07	1.40E-07	1.10E-07	5.80E-10
NEAREST RES	NNW	4.23	8.20E-08	8.20E-08	6.30E-08	3.50E-10
NEAREST RES	N	5.65	4.80E-08	4.80E-08	3.50E-08	1.60E-10
NEAREST RES	NNE	4.97	6.10E-08	6.10E-08	4.50E-08	2.10E-10
NEAREST RES	NE	3.85	1.00E-07	1.00E-07	8.00E-08	3.60E-10
NEAREST RES	ENE	3.85	9.20E-08	9.20E-08	7.10E-08	3.50E-10
NEAREST RES	E	5.28	5.10E-08	5.10E-08	3.80E-08	2.10E-10
NEAREST RES	ESE	5.84	4.70E-08	4.70E-08	3.40E-08	1.90E-10
NEAREST RES	SE	9.44	3.40E-08	3.40E-08	2.30E-08	1.20E-10
NEAREST RES	SSE	9.44	2.80E-08	2.80E-08	1.90E-08	8.90E-11
GARDENS	NNW	0.57	1.50E-06	1.50E-06	1.30E-06	1.10E-08
GARDENS	SE	0.18	1.20E-05	1.20E-05	1.20E-05	9.10E-08
GARDENS	N	0.57	1.30E-06	1.30E-06	1.20E-06	8.80E-09
GARDENS	NW	0.58	1.90E-06	1.90E-06	1.70E-06	1.40E-08
GARDENS	SSW	3.9	1.10E-07	1.10E-07	8.60E-08	3.50E-10

Meteorological Data

Table 41, Five Year Hope Creek Ground Level Release Dispersion (X/Q) and Deposition Factors (D/Q) (2016 -2020)

SPECIFIC POINTS OF INTEREST						
Location	Direction From Site	Distance (mi)	X/Q (Sec/M^3) No Decay Undepleted	X/Q (Sec/m^3) No Decay Undepleted	X/Q (Sec/m^3) No Decay Depleted	D/Q ($1/m^2$)
GARDENS	NE	4.9	7.40E-08	7.40E-08	5.50E-08	2.40E-10
GARDENS	ENE	5	6.40E-08	6.40E-08	4.70E-08	2.20E-10
GARDENS	NE	5	7.20E-08	7.20E-08	5.30E-08	2.30E-10
GARDENS	E	6	4.30E-08	4.30E-08	3.10E-08	1.70E-10
GARDENS	ENE	6	4.90E-08	4.90E-08	3.60E-08	1.60E-10
GARDENS	ESE	6.3	4.20E-08	4.20E-08	3.10E-08	1.60E-10
GARDENS	NW	7	5.80E-08	5.80E-08	4.10E-08	1.80E-10
GARDENS	NNE	7.5	3.40E-08	3.40E-08	2.40E-08	1.00E-10
GARDENS	NW	8.3	4.60E-08	4.60E-08	3.20E-08	1.40E-10
GARDENS	NE	9.3	3.00E-08	3.00E-08	2.10E-08	7.80E-11
GARDENS	N	10.9	1.90E-08	1.90E-08	1.30E-08	5.50E-11
03W2	NE	0.38	3.00E-06	3.00E-06	2.70E-06	1.90E-08
16W4	NNW	0.67	1.10E-06	1.10E-06	1.00E-06	8.50E-09
01W4	N	0.63	1.10E-06	1.10E-06	9.90E-07	7.50E-09
02W5	NNE	0.6	1.30E-06	1.30E-06	1.10E-06	8.30E-09
DAIRY & CATTL	W	4.9	6.50E-08	6.50E-08	4.90E-08	1.40E-10
DAIRY & CATTL	WNW	8.5	2.80E-08	2.80E-08	1.90E-08	5.10E-11
DAIRY & CATTL	NE	11.3	2.30E-08	2.30E-08	1.50E-08	5.70E-11
DAIRY & CATTL	N	11.7	1.70E-08	1.70E-08	1.10E-08	4.90E-11
DAIRY & CATTL	NNE	11.8	1.80E-08	1.80E-08	1.20E-08	4.90E-11
DAIRY & CATTL	NE	4.2	9.10E-08	9.10E-08	7.00E-08	3.10E-10
DAIRY & CATTL	NE	5.8	5.80E-08	5.80E-08	4.30E-08	1.70E-10
DAIRY & CATTL	SSW	8.3	4.00E-08	4.00E-08	2.80E-08	9.30E-11
DAIRY & CATTL	N	11.5	1.80E-08	1.80E-08	1.20E-08	5.00E-11
DAIRY & CATTL	NE	17.7	1.30E-08	1.30E-08	7.50E-09	2.60E-11

Meteorological Data

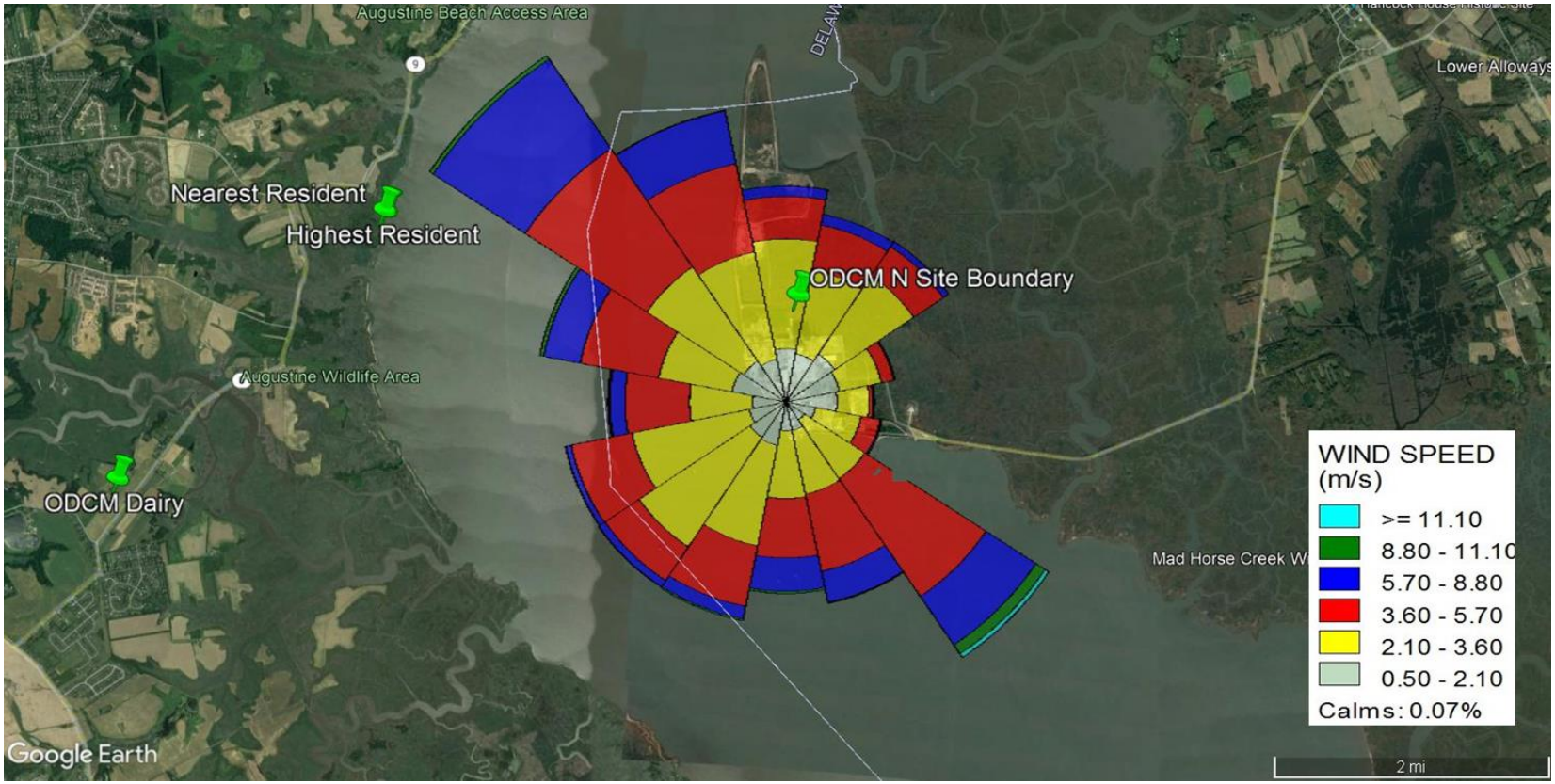

Figure 6, Locations of Dose Calculation Receptors with 2021 Wind Rose Overlay

Radiological Effluent Trends

Attachment 4, Radiological Effluent Trends

Radiological Effluent Trends

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Radiological Effluent Trends

1.0 The following trend graphs displays the total curies of liquid and gaseous effluents released for SGS and HCGS from 2005 through 2021.

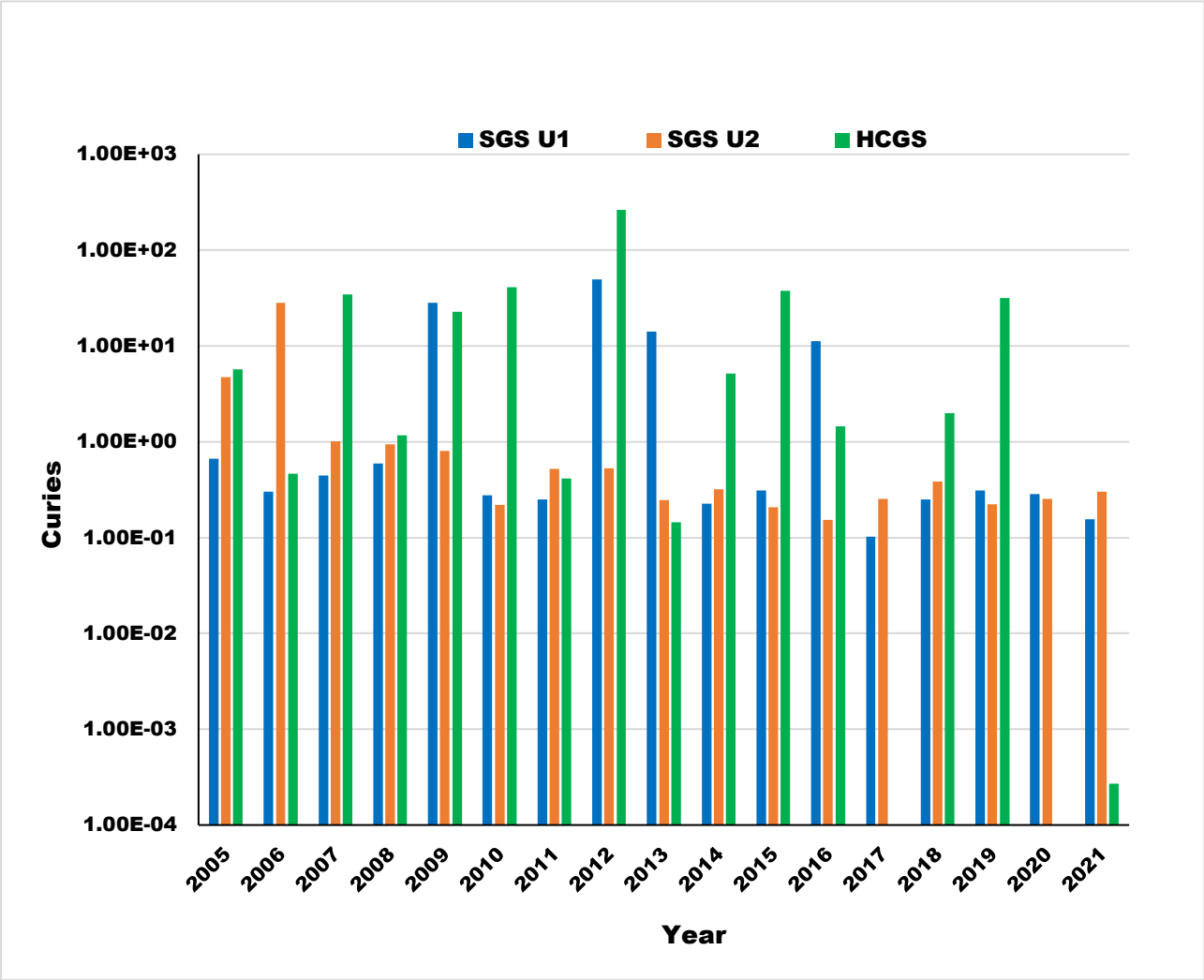

Figure 7, Fission and Activation Gases Released in Gaseous Effluents from Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2005 - 2021

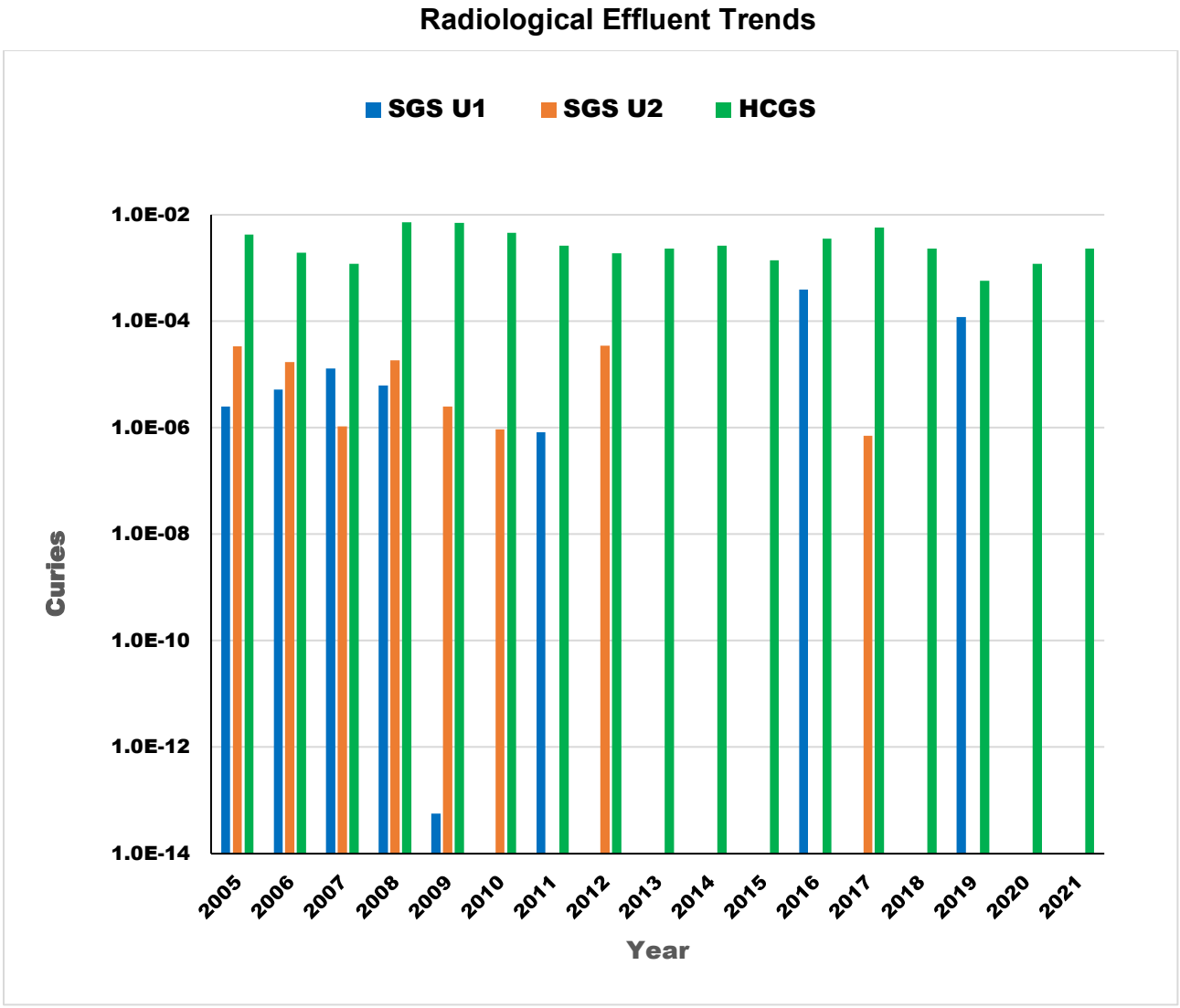

Figure 8, Iodines Released in Gaseous Effluents from Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2005 – 2021

Radiological Effluent Trends

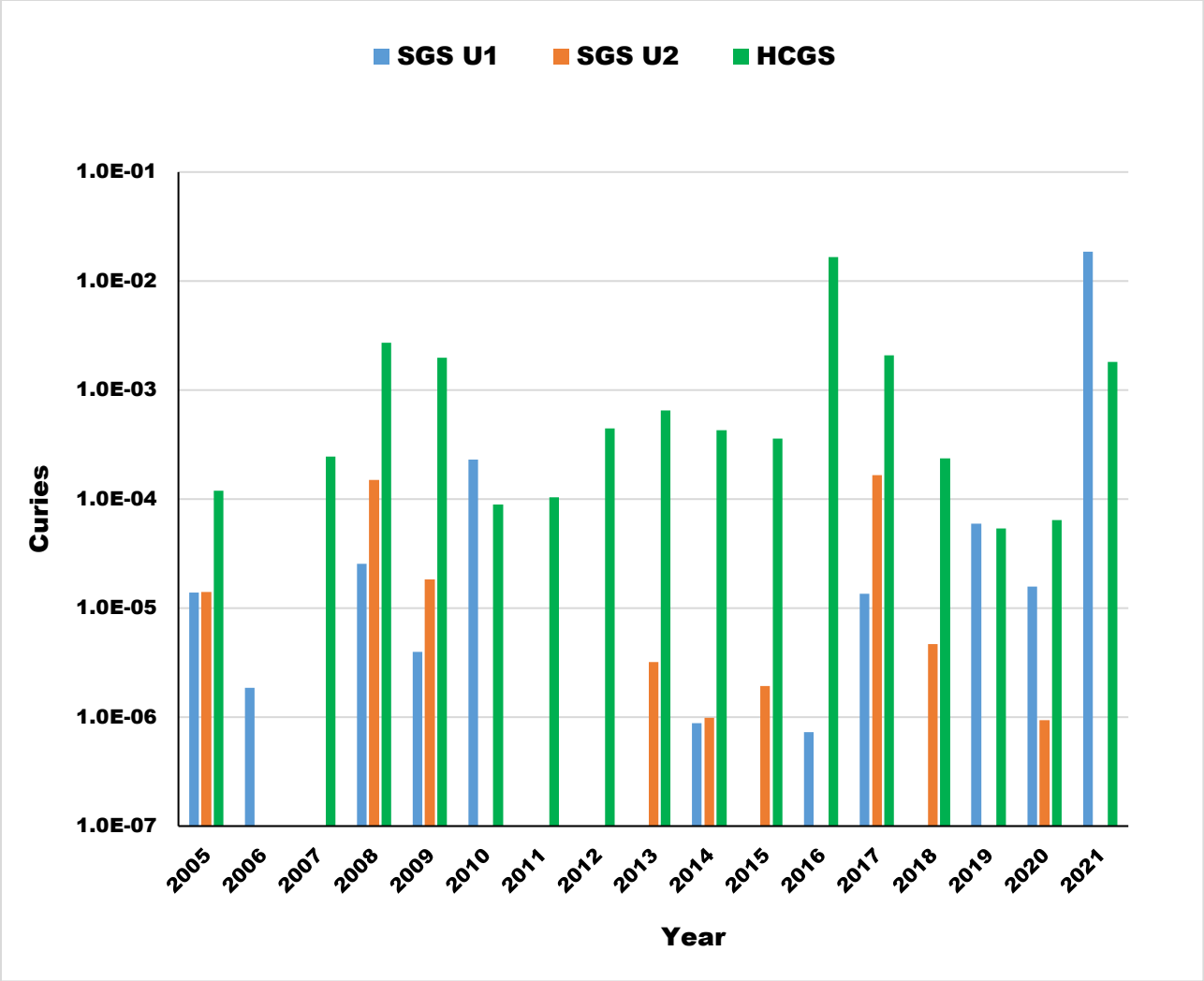

Figure 9, Particulates Released in Gaseous Effluents from Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2005 – 2021

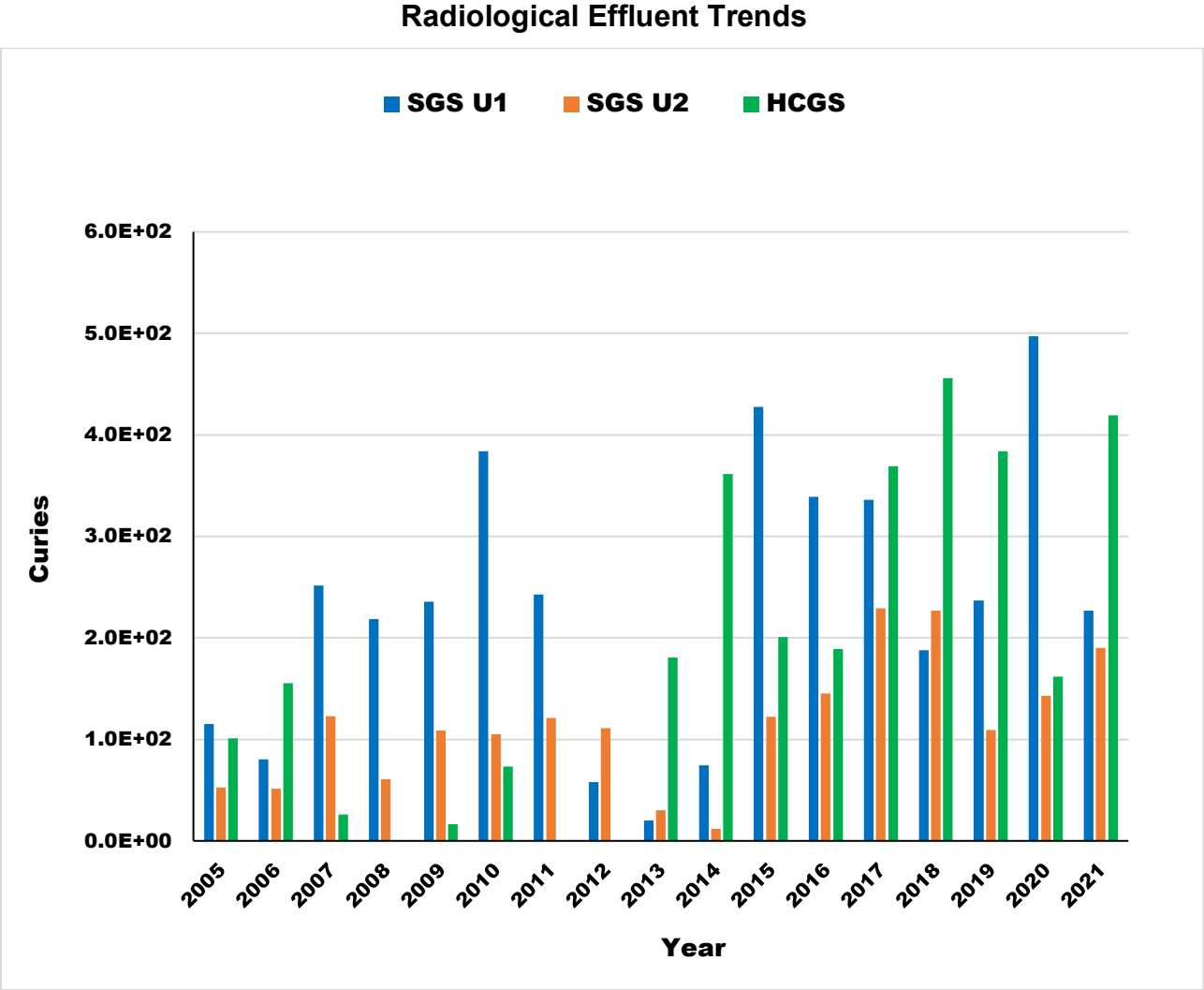

Figure 10, Tritium Released in Gaseous Effluents from Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2005 – 2021

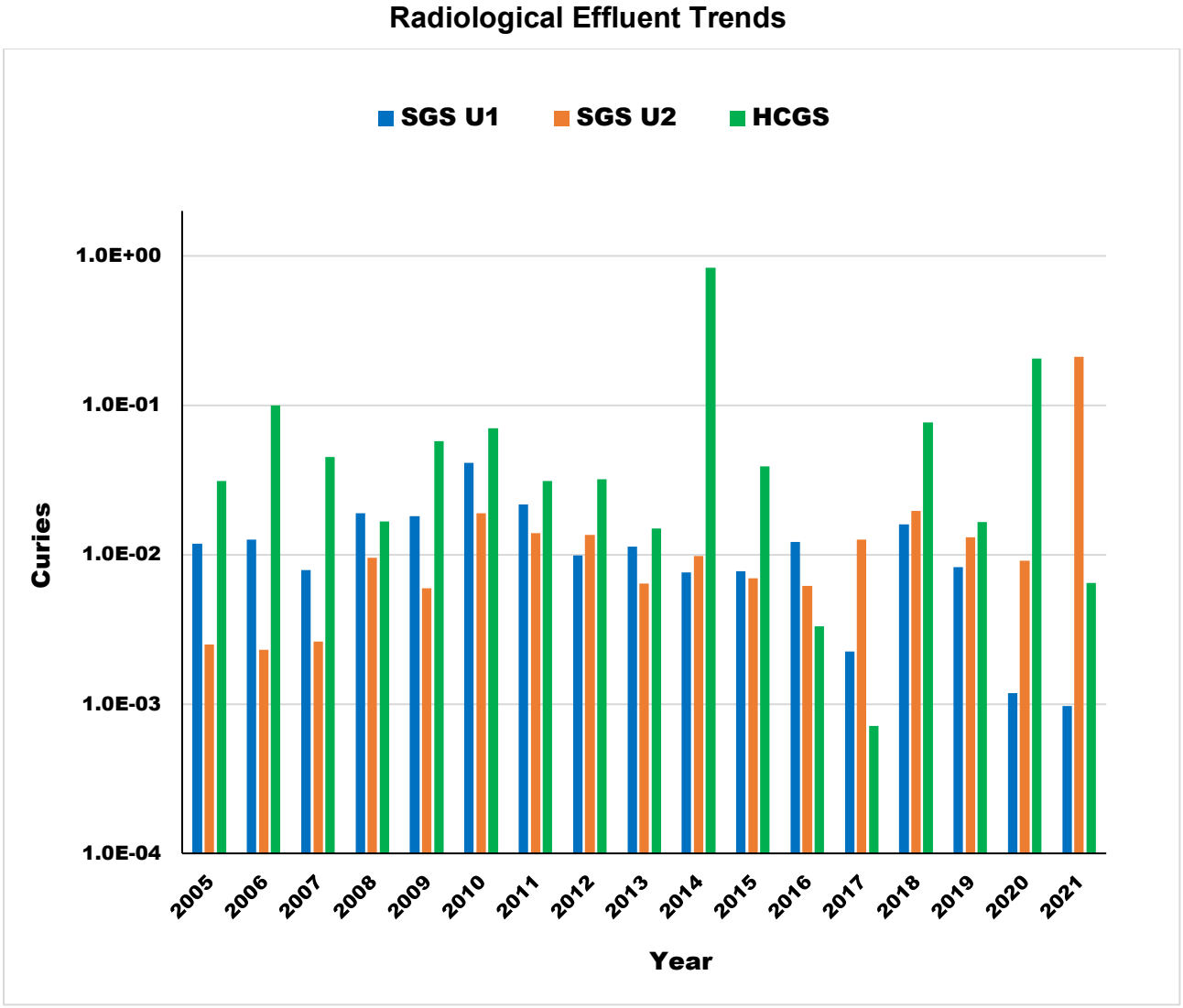

Figure 11, Fission and Activation Products Released in Liquid Effluents, Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2005 – 2021

Radiological Effluent Trends

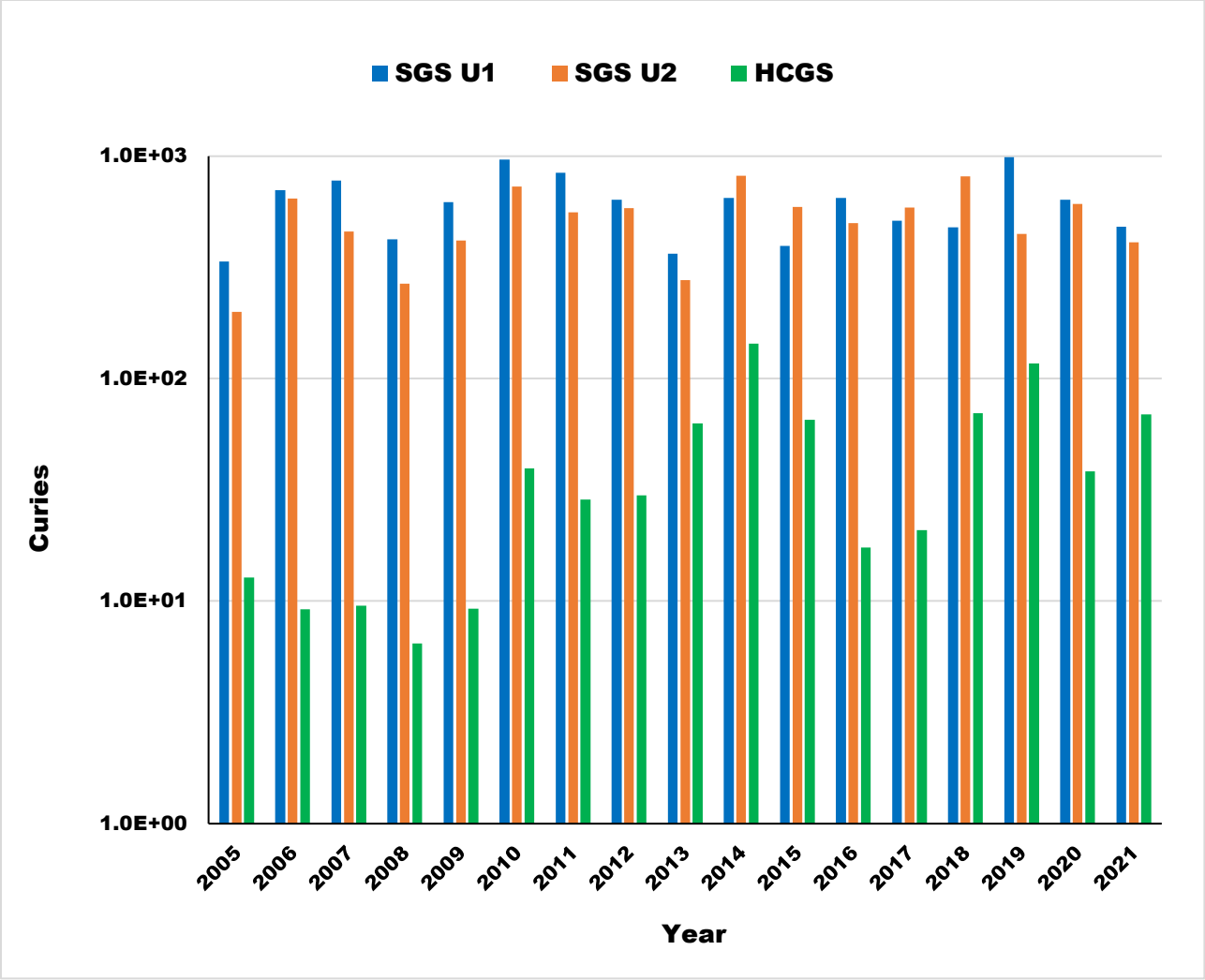

Figure 12, Tritium Released in Liquid Effluents, Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2005 – 2021

Dose to Highest Dose Potential Receptors

Attachment 5, Doses to Highest Dose Potential Receptors using the 2015 – 2020 Five Year Annual Average Meteorological Data and the NRC Code GASPAR

Dose to Highest Dose Potential Receptors

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Dose to Highest Dose Potential Receptors

1.0 Doses for the following receptors were compiled from gaseous releases from Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1 in 2021 and 2015 - 2020 five-year meteorological dispersion and deposition data.

Table 42, Highest Potential Onsite Dose Receptors, Distances from Salem, and Hope Creek, and 2015 – 2020 Five Year Annual Average X/Q, and D/Q Values

Receptor	Sector SA/HC	Distance in Miles from Salem	Distance in Miles from Hope Creek	Occupancy	Salem		Hope Creek	
					X/Q	D/Q	X/Q	D/Q
Onsite Worker	SW	0.11	0.17	0.25	2.9E-05	1.1E-07	1.4E-05	6.4E-08
Emergency Personnel (National Guard)	E	0.89	0.94	0.25	6.5E-07	4.8E-09	6.0E-07	4.3E-09
Wind Turbine Laydown Areas								
03W2	NE/E	0.38	0.39	0.25	3.0E-06	1.9E-08	2.2E-06	1.9E-08
16W4	NNW/NW	0.67	0.40	0.25	1.1E-06	8.5E-09	3.5E-06	2.5E-08
01W4	N/NNE	0.63	0.39	0.25	1.1E-06	7.5E-09	2.4E-06	1.7E-08
02W5	NNE/NE	0.60	0.39	0.25	1.3E-06	8.3E-09	2.8E-06	1.8E-08

Dose to Highest Dose Potential Receptors

Table 43, Calculated Doses (mrem) to Onsite Non Radiation Workers (25 Percent Occupancy) from Gaseous Effluents from Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2021

Receptor – Onsite Non Radiation Worker – Salem Unit 1								
ANNUAL BETA AIR DOSE =			1.14E-04	MRAD				
ANNUAL GAMMA AIR DOSE =			3.20E-04	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.12E-04	2.12E-04	2.12E-04	2.12E-04	2.12E-04	2.12E-04	2.12E-04	3.40E-04
GROUND	5.58E-01	5.58E-01	5.58E-01	5.58E-01	5.58E-01	5.58E-01	5.58E-01	6.50E-01
INHAL								
ADULT	4.68E-02	5.90E-02	4.90E-02	4.70E-02	4.75E-02	4.65E-02	2.37E-01	3.75E-02
Total	6.04E-01	6.17E-01	6.07E-01	6.05E-01	6.05E-01	6.04E-01	7.94E-01	6.88E-01
Receptor – Onsite Non Radiation Worker – Salem Unit 2								
ANNUAL BETA AIR DOSE =			2.16E-04	MRAD				
ANNUAL GAMMA AIR DOSE =			5.98E-04	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.98E-04	3.98E-04	3.98E-04	3.98E-04	3.98E-04	3.98E-04	3.98E-04	6.40E-04
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INHAL								
ADULT	3.93E-02	3.93E-02	4.23E-02	3.93E-02	3.93E-02	3.93E-02	3.93E-02	3.13E-02
Total	3.96E-02	3.96E-02	4.26E-02	3.96E-02	3.96E-02	3.96E-02	3.96E-02	3.19E-02
Receptor – Onsite Non Radiation Worker – Hope Creek Unit 1								
ANNUAL BETA AIR DOSE =			8.75E-08	MRAD				
ANNUAL GAMMA AIR DOSE =			1.85E-07	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.23E-07	1.23E-07	1.23E-07	1.23E-07	1.23E-07	1.23E-07	1.23E-07	2.14E-07
GROUND	2.85E-03	2.85E-03	2.85E-03	2.85E-03	2.85E-03	2.85E-03	2.85E-03	3.35E-03
INHAL								
ADULT	3.93E-02	3.93E-02	3.13E-02	3.93E-02	3.93E-02	4.00E-02	3.95E-02	3.35E-02
Total	4.21E-02	4.21E-02	3.41E-02	4.21E-02	4.21E-02	4.29E-02	4.24E-02	3.69E-02
Receptor – Onsite Non Radiation Worker – Total All Units								
ANNUAL BETA AIR DOSE =			3.30E-04	MRAD				
ANNUAL GAMMA AIR DOSE =			9.18E-04	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	6.10E-04	6.10E-04	6.10E-04	6.10E-04	6.10E-04	6.10E-04	6.10E-04	9.80E-04
GROUND	5.60E-01	5.60E-01	5.60E-01	5.60E-01	5.60E-01	5.60E-01	5.60E-01	6.53E-01
INHAL								
ADULT	1.25E-01	1.38E-01	1.23E-01	1.26E-01	1.26E-01	1.26E-01	3.16E-01	1.02E-01
Total	6.86E-01	6.98E-01	6.83E-01	6.86E-01	6.87E-01	6.87E-01	8.76E-01	7.57E-01

Dose to Highest Dose Potential Receptors

Table 44, Calculated Doses (mrem) to Emergency Workers (i.e. National Guard, State Police, etc.) (25 Percent Occupancy) from Gaseous Effluents from Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2021

Receptor – Emergency Workers – Salem Unit 1								
ANNUAL BETA AIR DOSE =			2.55E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			7.15E-06	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	4.75E-06	4.75E-06	4.75E-06	4.75E-06	4.75E-06	4.75E-06	4.75E-06	7.63E-06
GROUND	2.43E-02	2.43E-02	2.43E-02	2.43E-02	2.43E-02	2.43E-02	2.43E-02	2.83E-02
INHAL								
ADULT	1.05E-03	1.30E-03	1.10E-03	1.05E-03	1.06E-03	1.05E-03	4.93E-03	8.40E-04
Total	2.53E-02	2.56E-02	2.54E-02	2.53E-02	2.53E-02	2.53E-02	2.92E-02	2.91E-02
Receptor – Emergency Workers – Salem Unit 2								
ANNUAL BETA AIR DOSE =			4.85E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			1.34E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	8.93E-06	8.93E-06	8.93E-06	8.93E-06	8.93E-06	8.93E-06	8.93E-06	1.43E-05
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INHAL								
ADULT	8.80E-04	8.80E-04	9.45E-04	8.80E-04	8.80E-04	8.80E-04	8.80E-04	7.03E-04
Total	8.89E-04	8.89E-04	9.54E-04	8.89E-04	8.89E-04	8.89E-04	8.89E-04	7.17E-04
Receptor – Emergency Workers – Hope Creek Unit 1								
ANNUAL BETA AIR DOSE =			6.63E-08	MRAD				
ANNUAL GAMMA AIR DOSE =			1.83E-07	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.21E-07	1.21E-07	1.21E-07	1.21E-07	1.21E-07	1.21E-07	1.22E-07	1.96E-07
GROUND	1.92E-04	1.92E-04	1.92E-04	1.92E-04	1.92E-04	1.92E-04	1.92E-04	2.26E-04
INHAL								
ADULT	1.68E-03	1.68E-03	1.34E-03	1.68E-03	1.68E-03	1.72E-03	1.69E-03	1.43E-03
Total	1.87E-03	1.87E-03	1.53E-03	1.87E-03	1.87E-03	1.91E-03	1.88E-03	1.66E-03
Receptor – Emergency Workers – Total All Units								
ANNUAL BETA AIR DOSE =			7.47E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			2.07E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.38E-05	1.38E-05	1.38E-05	1.38E-05	1.38E-05	1.38E-05	1.38E-05	2.21E-05
GROUND	2.45E-02	2.45E-02	2.45E-02	2.45E-02	2.45E-02	2.45E-02	2.45E-02	2.85E-02
INHAL								
ADULT	3.61E-03	3.86E-03	3.38E-03	3.62E-03	3.62E-03	3.65E-03	7.50E-03	2.98E-03
Total	2.81E-02	2.83E-02	2.79E-02	2.81E-02	2.81E-02	2.81E-02	3.20E-02	3.15E-02

Dose to Highest Dose Potential Receptors

Table 45, Calculated Doses (mrem) to Special Interest Location 03W2 from Gaseous Effluents (25 Percent Occupancy) from Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2021

Receptor: 03W2–Salem Unit 1								
ANNUAL BETA AIR DOSE =			1.18E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			3.30E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.20E-05	2.20E-05	2.20E-05	2.20E-05	2.20E-05	2.20E-05	2.20E-05	3.53E-05
GROUND	9.60E-02	9.60E-02	9.60E-02	9.60E-02	9.60E-02	9.60E-02	9.60E-02	1.12E-01
INHAL								
ADULT	4.85E-03	6.03E-03	5.05E-03	4.85E-03	4.90E-03	4.83E-03	2.32E-02	3.88E-03
Total	1.01E-01	1.02E-01	1.01E-01	1.01E-01	1.01E-01	1.01E-01	1.19E-01	1.16E-01
Receptor: 03W2–Salem Unit 2								
ANNUAL BETA AIR DOSE =			2.24E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			6.20E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	4.13E-05	4.13E-05	4.13E-05	4.13E-05	4.13E-05	4.13E-05	4.13E-05	6.60E-05
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INHAL								
ADULT	4.08E-03	4.08E-03	4.38E-03	4.08E-03	4.08E-03	4.08E-03	4.08E-03	3.25E-03
Total	4.12E-03	4.12E-03	4.42E-03	4.12E-03	4.12E-03	4.12E-03	4.12E-03	3.32E-03
Receptor: 03W2–Hope Creek Unit 1								
ANNUAL BETA AIR DOSE =			1.38E-08	MRAD				
ANNUAL GAMMA AIR DOSE =			2.90E-08	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.93E-08	1.93E-08	1.93E-08	1.93E-08	1.93E-08	1.93E-08	1.94E-08	3.35E-08
GROUND	8.48E-04	8.48E-04	8.48E-04	8.48E-04	8.48E-04	8.48E-04	8.48E-04	9.98E-04
INHAL								
ADULT	6.18E-03	6.18E-03	4.93E-03	6.18E-03	6.18E-03	6.28E-03	6.20E-03	5.25E-03
Total	7.02E-03	7.02E-03	5.77E-03	7.02E-03	7.02E-03	7.12E-03	7.05E-03	6.25E-03
Receptor: 03W2–Total All Units								
ANNUAL BETA AIR DOSE =			3.41E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			9.50E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	6.32E-05	6.32E-05	6.32E-05	6.32E-05	6.32E-05	6.32E-05	6.32E-05	1.01E-04
GROUND	9.68E-02	9.68E-02	9.68E-02	9.68E-02	9.68E-02	9.68E-02	9.68E-02	1.13E-01
INHAL								
ADULT	1.51E-02	1.63E-02	1.44E-02	1.51E-02	1.52E-02	1.52E-02	3.34E-02	1.24E-02
Total	1.12E-01	1.13E-01	1.11E-01	1.12E-01	1.12E-01	1.12E-01	1.30E-01	1.25E-01

Dose to Highest Dose Potential Receptors

Table 46, Calculated Doses (mrem) to Special Interest Location 16W4 from Gaseous Effluents (25 Percent Occupancy) from Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2021

Receptor: 16W4–Salem Unit 1								
ANNUAL BETA AIR DOSE =			4.30E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			1.21E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	8.05E-06	8.05E-06	8.05E-06	8.05E-06	8.05E-06	8.05E-06	8.05E-06	1.29E-05
GROUND	4.30E-02	4.30E-02	4.30E-02	4.30E-02	4.30E-02	4.30E-02	4.30E-02	5.03E-02
INHAL								
ADULT	1.78E-03	2.21E-03	1.86E-03	1.78E-03	1.80E-03	1.77E-03	8.55E-03	1.42E-03
Total	4.48E-02	4.52E-02	4.49E-02	4.48E-02	4.48E-02	4.48E-02	5.16E-02	5.17E-02
Receptor: 16W4–Salem Unit 2								
ANNUAL BETA AIR DOSE =			8.20E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			2.27E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.51E-05	1.51E-05	1.51E-05	1.51E-05	1.51E-05	1.51E-05	1.51E-05	2.43E-05
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INHAL								
ADULT	1.49E-03	1.49E-03	1.60E-03	1.49E-03	1.49E-03	1.49E-03	1.49E-03	1.19E-03
Total	1.51E-03	1.51E-03	1.62E-03	1.51E-03	1.51E-03	1.51E-03	1.51E-03	1.21E-03
Receptor: 16W4–Hope Creek Unit 1								
ANNUAL BETA AIR DOSE =			2.19E-08	MRAD				
ANNUAL GAMMA AIR DOSE =			4.63E-08	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.08E-08	3.08E-08	3.08E-08	3.08E-08	3.08E-08	3.08E-08	3.08E-08	5.35E-08
GROUND	1.12E-03	1.12E-03	1.12E-03	1.12E-03	1.12E-03	1.12E-03	1.12E-03	1.31E-03
INHAL								
ADULT	9.83E-03	9.83E-03	7.83E-03	9.83E-03	9.83E-03	1.00E-02	9.85E-03	8.35E-03
Total	1.09E-02	1.09E-02	8.94E-03	1.09E-02	1.09E-02	1.11E-02	1.10E-02	9.66E-03
Receptor: 16W4–Total All Units								
ANNUAL BETA AIR DOSE =			1.25E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			3.48E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	3.72E-05
GROUND	4.41E-02	4.41E-02	4.41E-02	4.41E-02	4.41E-02	4.41E-02	4.41E-02	5.16E-02
INHAL								
ADULT	1.31E-02	1.35E-02	1.13E-02	1.31E-02	1.31E-02	1.33E-02	1.99E-02	1.10E-02
Total	5.72E-02	5.77E-02	5.54E-02	5.72E-02	5.72E-02	5.74E-02	6.40E-02	6.26E-02

Dose to Highest Dose Potential Receptors

Table 47, Calculated Doses (mrem) to Special Interest Location 01W4 from Gaseous Effluents (25 Percent Occupancy) from Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2021

Receptor: 01W4– Salem Unit 1								
ANNUAL BETA AIR DOSE =			4.30E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			1.21E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	8.05E-06	8.05E-06	8.05E-06	8.05E-06	8.05E-06	8.05E-06	8.05E-06	1.29E-05
GROUND	3.80E-02	3.80E-02	3.80E-02	3.80E-02	3.80E-02	3.80E-02	3.80E-02	4.43E-02
INHAL								
ADULT	1.78E-03	2.21E-03	1.86E-03	1.78E-03	1.80E-03	1.77E-03	8.50E-03	1.42E-03
Total	3.98E-02	4.02E-02	3.99E-02	3.98E-02	3.98E-02	3.98E-02	4.65E-02	4.57E-02
Receptor: 01W4–Salem Unit 2								
ANNUAL BETA AIR DOSE =			8.20E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			2.27E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.51E-05	1.51E-05	1.51E-05	1.51E-05	1.51E-05	1.51E-05	1.51E-05	2.43E-05
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INHAL								
ADULT	1.49E-03	1.49E-03	1.60E-03	1.49E-03	1.49E-03	1.49E-03	1.49E-03	1.19E-03
Total	1.51E-03	1.51E-03	1.62E-03	1.51E-03	1.51E-03	1.51E-03	1.51E-03	1.21E-03
Receptor: 01W4–Hope Creek Unit 1								
ANNUAL BETA AIR DOSE =			1.50E-08	MRAD				
ANNUAL GAMMA AIR DOSE =			3.18E-08	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.11E-08	2.11E-08	2.11E-08	2.11E-08	2.11E-08	2.11E-08	2.11E-08	3.68E-08
GROUND	7.58E-04	7.58E-04	7.58E-04	7.58E-04	7.58E-04	7.58E-04	7.58E-04	8.93E-04
INHAL								
ADULT	6.73E-03	6.73E-03	5.35E-03	6.73E-03	6.73E-03	6.85E-03	6.78E-03	5.73E-03
Total	7.48E-03	7.48E-03	6.11E-03	7.48E-03	7.48E-03	7.61E-03	7.53E-03	6.62E-03
Receptor: 01W4–Total All Units								
ANNUAL BETA AIR DOSE =			1.25E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			3.48E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	3.72E-05
GROUND	3.88E-02	3.88E-02	3.88E-02	3.88E-02	3.88E-02	3.88E-02	3.88E-02	4.51E-02
INHAL								
ADULT	9.99E-03	1.04E-02	8.81E-03	1.00E-02	1.00E-02	1.01E-02	1.68E-02	8.34E-03
Total	4.88E-02	4.92E-02	4.76E-02	4.88E-02	4.88E-02	4.89E-02	5.55E-02	5.35E-02

Dose to Highest Dose Potential Receptors

Table 48, Calculated Doses (mrem) to Special Interest Location 02W5 from Gaseous Effluents (25 Percent Occupancy) from Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2021

Receptor: 02W5–Salem Unit 1								
ANNUAL BETA AIR DOSE =			5.10E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			1.43E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	9.50E-06	9.50E-06	9.50E-06	9.50E-06	9.50E-06	9.50E-06	9.50E-06	1.53E-05
GROUND	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.20E-02	4.90E-02
INHAL								
ADULT	2.10E-03	2.58E-03	2.19E-03	2.11E-03	2.12E-03	2.09E-03	9.55E-03	1.68E-03
Total	4.41E-02	4.46E-02	4.42E-02	4.41E-02	4.41E-02	4.41E-02	5.16E-02	5.07E-02
Receptor: 02W5–Salem Unit 2								
ANNUAL BETA AIR DOSE =			9.68E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			2.68E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.79E-05	1.79E-05	1.79E-05	1.79E-05	1.79E-05	1.79E-05	1.79E-05	2.88E-05
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INHAL								
ADULT	1.76E-03	1.76E-03	1.89E-03	1.76E-03	1.76E-03	1.76E-03	1.76E-03	1.41E-03
Total	1.78E-03	1.78E-03	1.91E-03	1.78E-03	1.78E-03	1.78E-03	1.78E-03	1.44E-03
Receptor: 02W5–Hope Creek Unit 1								
ANNUAL BETA AIR DOSE =			1.75E-08	MRAD				
ANNUAL GAMMA AIR DOSE =			3.70E-08	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.46E-08	2.46E-08	2.46E-08	2.46E-08	2.46E-08	2.46E-08	2.47E-08	4.28E-08
GROUND	8.03E-04	8.03E-04	8.03E-04	8.03E-04	8.03E-04	8.03E-04	8.03E-04	9.45E-04
INHAL								
ADULT	7.85E-03	7.85E-03	6.25E-03	7.85E-03	7.85E-03	8.00E-03	7.90E-03	6.68E-03
Total	8.65E-03	8.65E-03	7.05E-03	8.65E-03	8.65E-03	8.80E-03	8.70E-03	7.62E-03
Receptor: 02W5–Total All Units								
ANNUAL BETA AIR DOSE =			1.48E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			4.11E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.74E-05	2.74E-05	2.74E-05	2.74E-05	2.74E-05	2.74E-05	2.74E-05	4.40E-05
GROUND	4.28E-02	4.28E-02	4.28E-02	4.28E-02	4.28E-02	4.28E-02	4.28E-02	4.99E-02
INHAL								
ADULT	7.85E-03	7.85E-03	6.25E-03	7.85E-03	7.85E-03	8.00E-03	7.90E-03	6.68E-03
Total	8.65E-03	8.65E-03	7.05E-03	8.65E-03	8.65E-03	8.80E-03	8.70E-03	7.62E-03

Dose to Highest Dose Potential Receptors

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ERRATA from Previous Reports

Attachment 6, ERRATA Section from Previous Reports

ERRATA from Previous Reports

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ERRATA from Previous Reports

Hope Creek Unit 1

The 2020 ARERR had incorrect information reported. Table 3 reported the Gamma Air and Beta Air dose from 2019. In 2020 no noble gas was reported. Changes were insignificant and did not impact dose to man. Changes are marked in red.

Table 3, Hope Creek Generating Station Unit 1 Dose Summary (2020)

		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Liquid Effluent Dose Limit, Total Body	**Limit**	**1.5 mrem**	**1.5 mrem**	**1.5 mrem**	**1.5 mrem**	**3 mrem**
	Total Body Dose	1.52E-02	1.33E-04	2.33E-04	9.53E-04	1.65E-02
	% of Limit	1.01E+00	8.85E-03	1.55E-02	6.35E-02	5.51E-01
Liquid Effluent Dose Limit, Any Organ	**Limit**	**5 mrem**	**5 mrem**	**5 mrem**	**5 mrem**	**10 mrem**
	Maximum Organ Dose	4.82E-02	4.03E-04	5.05E-04	2.15E-03	5.13E-02
	% of Limit	9.64E-01	8.07E-03	1.01E-02	4.30E-02	5.13E-01
Gaseous Effluent Dose Limit, Gamma Air	**Limit**	**5 mrad**	**5 mrad**	**5 mrad**	**5 mrad**	**10 mrad**
	Gamma Air Dose	~~2.69E-04~~ 0.00E+00	~~6.08E-07~~ 0.00E+00	~~1.39E-03~~ 0.00E+00	~~2.37E-04~~ 0.00E+00	~~1.90E-03~~ 0.00E+00
	% of Limit	~~5.38E-03~~ 0.00E+00	~~1.22E-05~~ 0.00E+00	~~2.79E-02~~ 0.00E+00	~~4.73E-03~~ 0.00E+00	~~1.90E-02~~ 0.00E+00
Gaseous Effluent Dose Limit, Beta Air	**Limit**	**10 mrad**	**10 mrad**	**10 mrad**	**10 mrad**	**20 mrad**
	Beta Air Dose	~~2.93E-04~~ 0.00E+00	~~1.79E-06~~ 0.00E+00	~~2.47E-03~~ 0.00E+00	~~4.38E-04~~ 0.00E+00	~~3.20E-03~~ 0.00E+00
	% of Limit	~~2.93E-03~~ 0.00E+00	~~1.79E-05~~ 0.00E+00	~~2.47E-02~~ 0.00E+00	~~4.38E-03~~ 0.00E+00	~~1.60E-02~~ 0.00E+00
Gaseous Effluent Organ Dose Limit (Iodine, Tritium, C-14, Particulates with > 8-day half-life)	**Limit**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**15 mrem**
	Maximum Organ Dose	7.00E-02	5.55E-02	4.20E-02	6.91E-02	2.37E-01
	% of Limit	9.33E-01	7.39E-01	5.61E-01	9.21E-01	1.58E+00

ERRATA from Previous Reports

Table 4, Salem & Hope Creek Generating Stations Site Dose Summary (2020)

		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Liquid Effluent Dose Limit, Total Body	Total Body Dose	2.66E-02	2.09E-03	1.35E-03	4.70E-03	3.48E-02
Liquid Effluent Dose Limit, Any Organ	Maximum Organ Dose	8.34E-02	2.13E-02	2.04E-03	7.91E-03	1.15E-01
Gaseous Effluent Dose Limit, Gamma Air	Gamma Air Dose	~~3.42E-04~~ 7.32E-05	~~3.36E-05~~ 3.30E-05	~~1.48E-03~~ 8.97E-05	~~2.84E-04~~ 4.75E-05	~~2.14E-03~~ 2.43E-04
Gaseous Effluent Dose Limit, Beta Air	Beta Air Dose	~~3.22E-04~~ 2.97E-05	~~1.63E-05~~ 1.45E-05	~~2.51E-03~~ 3.52E-05	~~4.58E-04~~ 1.98E-05	~~3.30E-03~~ 9.92E-05
Gaseous Effluent Organ Dose Limit (Iodine, Tritium, C-14, Particulates with > 8-day half-life)	Maximum Organ Dose	1.16E-01	9.98E-02	8.60E-02	1.15E-01	4.17E-01

ERRATA from Previous Reports

Table 5, Total Annual Offsite-Dose Comparison to 40 CFR 190 Regulatory Limits for SGS/HCGS (2020)

	Whole Body	Thyroid	Max Organ
Limit	**25 mrem**	**75 mrem**	**25 mrem**
Gaseous			
Salem 1 NG	9.50E-05	N/A	N/A
Salem 1 Particulates/Iodines	~~1.84E-02~~ 1.80E-02	~~1.84E-02~~ 1.80E-02	~~7.97E-02~~ 7.82E-02
Salem 2 NG	1.36E-04	N/A	N/A
Salem 2 Particulates/Iodines	2.08E-02	2.08E-02	1.01E-01
Hope Creek 1 NG	~~1.74E-03~~ 0.00E+00	N/A	N/A
Hope Creek 1 Particulates/Iodines	4.83E-02	4.87E-02	2.37E-01
Liquid			
Salem 1	1.36E-02	1.30E-02	2.93E-02
Salem 2	4.67E-03	4.20E-03	3.40E-02
Hope Creek 1	1.65E-02	8.71E-05	5.13E-02
Total Gas & Liquid mrem	**~~1.24E-01~~ 1.22E-01**	**1.05E-01**	**~~5.31E-01~~ 5.30E-01**
Direct Shine	**7.74E-03**	N/A	N/A
Total mrem	**~~1.32E-01~~ 1.30E-01**	**1.05E-01**	**~~5.31E-01~~ 5.30E-01**
% of Limit	**~~5.28E-01~~ 5.19E-01**	**1.40E-01**	**~~2.13E+00~~ 2.12E+00**

Abnormal Releases (2020)

The gaseous tritium releases from the Turbine Lube Oil Vents (TLOV) were not reported in the 2020 ARERR. An additional 7.88E+00 curies of tritium, bringing the total Hope Creek gaseous tritium released to 1.68E+02 Ci. The dose from this additional tritium had no impact on the total dose to man, which was due to the calculated carbon-14 released from the Station. The 2020 ARERR was updated with this data as follows:

Abnormal Releases						
A. Liquid Releases	**Units**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Annual**
1. Number of abnormal Releases				1		1
2. Total Activity	Ci			4.668E-06		4.668E-06
B. Gaseous Releases	**Units**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Annual**
1. Number of abnormal Releases		3	3	3	3	12
2. Total Activity	Ci	2.30E+00	1.83E+00	1.31E+00	2.44E+00	7.88E+00

ERRATA from Previous Reports

Table 14 Gaseous Effluents Summation of All Releases (HCGS Unit 1) (2020)

A. Fission & Activation Gases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %
1. Total Release	Ci	< LLD	< LLD	< LLD	< LLD	< LLD	3.40E+01
2. Average release rate for the period	µCi/sec	N/A	N/A	N/A	N/A	N/A	
B. Iodine							
1. Total Release	Ci	9.91E-05	3.67E-04	3.39E-04	3.99E-04	1.20E-03	3.00E+01
2. Average release rate for the period	µCi/sec	1.26E-05	4.67E-05	4.27E-05	5.02E-05	3.81E-05	
C. Particulates							
1. Total Release	Ci	1.22E-05	1.34E-07	< LLD	5.22E-05	6.45E-05	3.00E+01
2. Average release rate for the period	µCi/sec	1.55E-06	1.70E-08	< LLD	6.57E-06	2.04E-06	
D. Tritium							
1. Total Release	Ci	~~3.08E+01~~ 3.31E+01	~~3.21E+01~~ 3.39E+01	~~3.88E+01~~ 4.01E+01	~~5.83E+01~~ 6.08E+01	~~1.60E+02~~ 1.68E+02	3.10E+01
2. Average release rate for the period	µCi/sec	~~3.91E+00~~ 4.20E+00	~~4.08E+00~~ 4.32E+00	~~4.88E+00~~ 5.05E+00	~~7.33E+00~~ 7.65E+00	~~5.06E+00~~ 5.31E+00	
E. Gross Alpha							
1. Total Release	Ci	< LLD	< LLD	< LLD	< LLD	< LLD	3.00E+01
2. Average release rate for the period	µCi/sec	N/A	N/A	N/A	N/A	N/A	
F. Carbon-14							
1. Total Release	Ci	5.36E+00	4.25E+00	3.22E+00	5.29E+00	1.81E+01	
2. Average release rate for the period	µCi/sec	6.82E-01	5.41E-01	4.05E-01	6.66E-01	5.73E-01	

% of limit is on Table 3, Hope Creek Generating Station Unit 1 Dose Summary

ERRATA from Previous Reports

Table 15 Gaseous Effluents – Ground Level Release Continuous Mode (HCGS Unit 1) (2020)

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Fission Gases						
None	Ci	< LLD	< LLD	< LLD	< LLD	< LLD
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	< LLD	< LLD	< LLD	< LLD	< LLD
Iodines						
I-131	Ci	8.75E-06	3.00E-05	4.67E-05	1.60E-05	1.01E-04
I-133	Ci	9.03E-05	3.37E-04	2.93E-04	3.83E-04	1.10E-03
	Ci					
Total for Period	Ci	9.91E-05	3.67E-04	3.39E-04	3.99E-04	1.20E-03
Particulates						
Co-60	Ci	1.22E-05	< LLD	< LLD	1.16E-05	2.37E-05
Cs-137	Ci	< LLD	1.34E-07	< LLD	4.07E-05	4.08E-05
	Ci					
	Ci					
Total for Period	Ci	1.22E-05	1.34E-07	< LLD	5.22E-05	6.45E-05
Tritium						
H-3	Ci	~~3.08E+01~~ 3.31E+01	~~3.21E+01~~ 3.39E+01	~~3.88E+01~~ 4.01E+01	~~5.83E+01~~ 6.08E+01	~~1.60E+02~~ 1.68E+02
Gross Alpha						
Alpha	Ci	< LLD	< LLD	< LLD	< LLD	< LLDN/D
Carbon-14						
C-14	Ci	5.36E+00	4.25E+00	3.22E+00	5.29E+00	1.81E+01

ERRATA from Previous Reports

RGPP

The 2020 Ground Water Protection Program Report that was included in the 2020 ARERR reported an incorrect collection date. The correct date is marked in red.

Well AL: Well AL was sampled in May and November ,~~2019~~ 2020 with results of 428 pCi/L and 285 pCi/L respectively. Well AL is located south of the SGS Unit 1 reactor building and is a sentinel (source) well.

Page 131, Table 44, Tritium Analytical Results, HCGS RGPP Wells(continued) should have labeled as Table 55.

Page 133, Table 45, Tritium Analytical Results, SGS RGPP Wells (continued) should have labeled as Table 56.

Pages 135 – 138, Table 46, Tritium Analytical Results, Investigation & Monitoring Wells (continued) should have labeled as Table 57.

ERRATA from Previous Reports

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

The 2020 Rad Waste Shipment Totals were incorrectly summed. The corrections are as follow:

Table 49, Resins, Filters, and Evaporator Bottoms Summary for the Salem Site (2020)

Waste Class	Volume ft³	Volume m³	Curies Shipped	% Error (Activity)
A	7.29E+02	2.06E+01	~~8.10E+00~~ 5.92E+00	+/-25%
B	1.96E+02	5.55E+00	~~4.32E+01~~ 5.01E+01	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	9.25E+02	2.62E+01	~~5.13E+01~~ 5.60E+01	+/-25%

Major Nuclides for Above Table:
H-3, C-14, Mn-54, Fe-55, Co-58, Co-60, Ni-59, Ni-63, Sr-90, Tc-99, Sb-125, I-129, Cs-137, Ce-144, Cm-243

Resins, Filters and Evaporator Bottoms

Waste Class A

Nuclide Name	Percent Abundance	Curies
H-3	2.86%	1.69E-01
C-14	1.38%	8.18E-02
Fe-55	30.67%	1.81E+00
Co-60	21.9%	1.30E+00
Ni-63	29.03%	1.72E+00
Sb-125	1.11%	6.59E-02
Cs-137	10.66%	6.31E-01

Resins, Filters and Evaporator Bottoms

Waste Class B

Nuclide Name	Percent Abundance	Curies
Mn-54	1.13%	5.65E-01
Fe-55	23.31%	1.17E+01
Co-60	21.05%	1.05E+01
Ni-63	43.31%	2.17E+01
Cs-137	7.74%	3.88E+00

Resins, Filters and Evaporator Bottoms

Waste Class C

Nuclide Name	Percent Abundance	Curies
None	N/A	N/A

2021 RGPP Report

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Attachment 7, 2021 Radiological Groundwater Protection Program (RGPP) Report

2021 RGPP Report

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2021 RGPP Report

1.0 Results of the Integrated Tritium Management Program with 2021 Radiological Groundwater Protection Program (RGPP), and 2021 Monitoring Well and Remedial Action Work Plan

1.1 Introduction

This report presents results of the 2021 groundwater monitoring activities performed by PSEG Nuclear at both the Hope Creek Generating Station (HCGS) and Salem Generating Station (SGS); collectively referred to as "the Station". Well locations at the Station are shown on Figure 13 and Figure 14, respectively. To link the various groundwater monitoring programs at the Station, PSEG implemented the Integrated Tritium Management Program (ITMP) which integrates the following four broad programs:

- The Radiological Groundwater Protection Program (RGPP) is a program that was developed to ensure the timely detection of an unpermitted release of radioactive material.
- The Remedial Action Work Plan (RAWP) is a program that monitors the remediation of the historical release from the SGS Unit 1 Spent Fuel Pool.
- Investigation wells were installed as part of independent investigations into groundwater quality, that are not included as part of the RGPP or RAWP.
- Early Site Permit (ESP) wells which are periphery wells that were installed outside of the protected area to support the potential licensing of a new nuclear plant. These wells were decommissioned in 2020 and therefore will no longer be discussed in future ARERRs.

Well construction details for the Station's RGPP wells are presented on Table 49 and Table 50, respectively. Well construction details for the wells that are not specifically part of the RGPP are presented on Table 51.

PSEG initiated the RGPP in 2006 to characterize groundwater at, and in the vicinity of, the Station with respect to historical releases of radionuclides and to provide the mechanism to detect such releases if one were to occur. The RGPP is a voluntary program implemented by PSEG in conjunction with the nuclear industry initiatives and associated guidance NEI 07-07 (16). The other key elements that comprise the RGPP and contribute to public safety are spill/leak prevention, effective remediation of spills and leaks, and effective stakeholder communication.

2021 RGPP Report

In 2002, PSEG operations personnel at SGS identified a release of tritiated water from the SGS Unit 1 Spent Fuel Pool to the environment. PSEG developed a RAWP to remediate the tritium in groundwater, which was reviewed by the United States Nuclear Regulatory Commission (USNRC) and approved by the New Jersey Department of Environmental Protection (NJDEP) Bureau of Nuclear Engineering (BNE). A Groundwater Recovery System (GRS) was installed to control the migration of groundwater in the shallow, water-bearing unit and to reduce the remaining mass of tritiated groundwater. The operation and performance of the GRS is documented in the Remedial Action Progress Reports (RAPRs) provided to the NRC and NJDEP-BNE by PSEG. PSEG generates an effluent release permit for the residual tritium in groundwater discharging to the Delaware River. The permit values are included in the liquid effluent data reported earlier in this document.

The Station located in a flat, largely undeveloped region of southern New Jersey, which is bordered to the west and south by the Delaware River and to the east and north by extensive marshlands. The Station obtains cooling water from the Delaware River.

The Station is underlain by over 1,000 feet of inter-layered sand, silt, and clay. PSEG owns seven production/potable wells, which range in depth from 270 feet below ground surface (bgs) to 1135 feet bgs. These wells are installed in deeper formations isolated by confining units beneath the Vincentown Formation.

The results from a computer based well search identified the nearest off-site permitted potable well is located approximately 3.5 miles away. Shallow groundwater and the Vincentown aquifer (the two most shallow water bearing units underlying the Station) flow toward and discharge to the Delaware River, thus reducing the potential that Station operations have or will influence off-site potable wells.

1.2 Radiological Groundwater Protection Program

This section of the annual report is prepared to summarize the status, activities, and groundwater analytical results collected in 2021 at the Site. This report also describes any changes made to the monitoring program during the 2021 reporting year.

1.2.1 Objectives of the Radiological Groundwater Protection Program

The long-term sampling program objectives are as follows:

- Identify suitable locations to monitor and evaluate potential impacts from Station operations before significant radiological impact to the environment or potential drinking water sources can occur.

- Refine the conceptual understanding of local hydrogeology and maintain current knowledge of potential flow paths on the surface and in groundwater beneath the Station.

- Evaluate systems, structures, components (SSCs) and work practices, which have the potential to release licensed radioactive material to the groundwater and develop strategies to mitigate potential releases to the environment.

- Perform routine groundwater monitoring and evaluate analytical results.

- Report any leaks, spills, or other detections with potential radiological significance to stakeholders in a timely manner.

- Take necessary corrective actions to protect groundwater resources.

1.2.2 Sample Collection

In 2006, the RGPP monitoring wells (Table 49 and Table 50) were installed at the Station as part of site investigation activities. Details pertaining to these activities are documented in the Site Investigation Reports (Arcadis 2006A and 2006B). Groundwater samples are collected from all RGPP monitoring wells at least semi-annually, with additional monitoring conducted as appropriate. The groundwater sample collection schedule is adaptively managed to ensure that representative data are collected to provide the information necessary to evaluate groundwater quality conditions. Monitoring wells are sampled following the low-flow purging and sampling techniques in accordance with the Field Sampling Procedures Manual (NJDEP 2005). This methodology is consistent with protocols established in the RAWP.

1.2.3 New RGPP Wells

No new wells were added as part of the RGPP during 2021. Further, all remaining ESP wells, and well Q, were decommissioned in 2021 and well BC was converted from flush grade to above grade.

1.2.4 Sample Analysis

Groundwater samples collected from RGPP wells are analyzed for plant-related gamma emitting radionuclides (semi-annually), total strontium (annually), nickel-63 and iron-55 (biennially), and tritium (every sample) by an off-site radiochemical analytical laboratory.

The samples are maintained under chain of custody procedures throughout sample handling, screening, shipping, and laboratory analysis process. Samples are submitted to the respective Station's on-site chemistry laboratory for radiological analysis screening prior to shipment to Teledyne Brown Engineering (TBE) located in Knoxville, Tennessee, for radiological analysis. Analytical laboratories are subject to internal quality assurance programs and inter-laboratory cross-check programs. Station personnel review and evaluate analytical data obtained from the laboratory.

1.2.5 Data Evaluation

Analytical results are reviewed for adverse trends or anomalies. Investigations and corrective action program notifications (CAP) are made as required by program procedures. The radiological data collected since the inception of the RGPP program is the basis for the baseline statistical evaluation to which current operational data are compared. Several factors are important in the interpretation and evaluation of the radiological data:

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1. Detection limits

   The Offsite Dose Calculation Manual (ODCM) specifies detection capabilities for each isotope that may be produced by the Station. While the detection capability for tritium specified in the ODCM is 3,000 picocuries per liter (pCi/L) in water, RGPP tritium analyses are performed to a lower value of 200 pCi/L at our offsite lab. Lower values for LLDs are used to be consistent with the State of New Jersey where PSEG conducts split samples with the NJDEP-BNE for specific wells. Each well has a statistically derived action level. When an action level is exceeded, PSEG may increase monitoring frequency and evaluates potential sources of the elevated tritium. Relevant groundwater evaluation criteria are listed in Table 52.

2. Laboratory Measurements Uncertainty

   Statistically, the value of a measurement is expressed as a range with a stated level of confidence. PSEG is required to report results with a 95% level of confidence.

   Analytical uncertainties are reported at the 95% confidence level in this report and are consistent with the methodologies used to report data in the Annual Radiological Environmental Operating Report.

1.2.6 RGPP Data Quality

Groundwater samples consist of up to four aliquots. One of the aliquots is submitted to the respective Site's on-site chemistry laboratory for initial screening, which includes tritium and gamma spectroscopy analysis. The second aliquot is sent to TBE for tritium analysis. In accordance with NJDEP request, the third aliquot is collected from specific wells and submitted for split sample analysis to GEL Laboratories located in Charleston, South Carolina. The fourth aliquot is held as a back-up, "retained" sample until all the analytical results are received and determined to be valid.

All radionuclide results are compared to the following limitations defined as part of the RGPP:

- Internal Administrative Control Limits are defined within the RGPP procedures. They are developed based on a statistical analysis of the historical baseline concentrations of tritium in each specific well and are used to identify tritium concentrations that warrant further investigation for that specific well. Solely exceeding an Administrative Control Limit does not initiate external communication unless the external reporting limit is also exceeded.

- The Courtesy Communication Limit is a tritium concentration, below regulatory requirements, based on agreements with NJDEP-BNE, USNRC and other stakeholders ensuring the stakeholders are cognizant of potential issues. If a confirmed tritium result, collected from a RGPP well, exceeds the Courtesy Communication Limit of 3,000 pCi/L, PSEG provides a courtesy communication by telephone no later than the end of the next business day to NJDEP-BNE. The NRC Site Resident is also informed. This is not a regulatory required communication.

  NOTE: It is not expected that a courtesy communication be generated when a subsequent sample(s) is documented to be from the same source/mechanism/event. Documentation shall be created to show that the subsequent sample(s) is all part of the same source/mechanism/event.

- Voluntary Communication Limits are those concentrations of radionuclides that require voluntary communication and reporting to regulators and/or stakeholders based on NEI 07-07, the ODCMs, and Site procedures.

2.0 Discussion

The locations of the RGPP monitoring wells located at HCGS and SGS are depicted on Figure 13 and Figure 14, respectively. Additionally, well construction details for the HCGS RGPP wells and SGS RGPP wells are presented on Table 49 and Table 50, respectively. The relevant radiological parameters used to evaluate the groundwater analytical results are provided in Table 52. The groundwater tritium analytical results for HCGS and SGS are shown on Table 53 and Table 54, respectively.

2.1.1 Groundwater Results - RGPP

Groundwater samples were collected from all RGPP monitoring wells during 2021 in accordance with the Station and PSEG's Laboratory and Testing Services (LTS) procedures for the RGPP. Sample results are discussed below.

1. HCGS RGPP Wells

   Tritium analytical results for groundwater samples collected during 2021 from HCGS RGPP monitoring wells are summarized below and are presented in Table 53.

   - Tritium was not detected in groundwater samples collected from 8 of the 13 HCGS RGPP wells (wells BH, BK, BL, BP, BQ, BR, BS, and BT).

   - Well BI: Tritium concentrations detected in one well sample at a concentration of 455 pCi/L (May 2021). Tritium was not detected in the samples collected in February, August, or November 2021. Well BI is located west of the reactor containment and is a sentinel (source) well for facilities and buried piping.

- Well BJ: Tritium concentrations detected in well BJ ranged from 2,100 pCi/L (June 2021) to 2,880 pCi/L (November 2021) and averaged 2,470 pCi/L during 2021. Well BJ is located near the HCGS main permitted gaseous effluent vent (i.e., south plant vent).

- Well BM: Tritium was detected at concentrations ranging from 390 pCi/L (February 2021) to 520 pCi/L (August 2021) and averaged 459 pCi/L during 2021. Well BM is located northwest of the reactor containment and is a sentinel (source) well for facilities and buried piping.

- Well BN: Tritium concentrations detected in well BN ranged from 178 pCi/L (November 2021) to 1,710 pCi/L (May 2021) and averaged 780 pCi/L. Well BN is located northeast of the Materials Control Center and is a sentinel (source) well for the Auxiliary Boiler building and buried piping.

- Well BO: Tritium concentrations detected in well BO ranged from 267 pCi/L (November 2021) to 521 pCi/L (May 2021) and averaged 392 pCi/L. Tritium was not detected in the samples collected in February 2021. Well BO is located northeast of the Materials Control Center and is a sentinel (source) well for the Auxiliary Boiler building and buried piping.

Except for tritium, no plant-related radionuclides were detected in any HCGS RGPP well sampled in 2021.

2. SGS RGPP Wells

Tritium analytical results for groundwater samples collected during 2021 from SGS RGPP monitoring wells are summarized below and are presented on Table 54.

- Tritium was not detected in groundwater samples collected from 6 of the 13 SGS RGPP wells (wells BA, BB, BF, BU, T, and Y).

- Well AL: Well AL was sampled in May and November 2021, with results of 354 pCi/L and 415 pCi/L respectively. Well AL is located south of the SGS Unit 1 reactor building and is a sentinel (source) well.

- Well BC: Tritium was detected at concentrations ranging from 993 pCi/L (January 2021 to 2,970 pCi/L (June 2021) and averaged 1,764pCi/L. Well BC is a sentinel (source)/perimeter well located southwest of Facilities, Refueling Water Storage Tank, Auxiliary Feedwater Storage Tank and Primary Water Storage Tank (RAP) tanks and piping.

- Well BD: Tritium was detected at concentrations ranging from 252 pCi/L (November 2021) to 559 pCi/L (May 2021) and averaged 405 pCi/L. Well BD is located to the west of SGS Unit 2 reactor building and is a sentinel (source) well for Facilities, RAP tanks, and piping.

- Well BE: Tritium was detected at concentrations ranging from 394 pCi/L (February 2021) to 1,370 pCi/L (May 2021) and averaged 705 pCi/L. Well BE is located to the west of SGS Unit 2 reactor building and is a perimeter well.

- Well BG: Tritium was detected at a concentration of 209 pCi/L (November 2021). Tritium was not detected in the samples collected in February, May, or August 2021. Well BG is located northwest of SGS Unit 2 reactor building and is a perimeter well.

- Well U: Tritium was detected at concentrations ranging from 234pCi/L (February 2021) to 359 pCi/L (November 2021) and averaged 309 pCi/L. Well U is located north of SGS Unit 2 reactor building and is a sentinel (source) well for the House Heating Boilers.

- Well Z: Tritium was detected in the samples collected in May 2021 and November 2021 at concentrations of 422 pCi/L and 427 pCi/L, respectively. Well Z is located west of the SGS Unit 1 & 2 reactor buildings and is a perimeter well.

- Except for tritium, no plant-related radionuclides were detected in any SGS RGPP well sampled in 2021.

2.1.2 Mass Flux Estimation of Tritium to the Delaware River

PSEG uses transect methods to calculate the mass flux of tritium to the Delaware River in the shallow, water bearing unit and the deeper basal sand unit and Vincentown Formation. To calculate the mass flux, the tritium concentration was conservatively estimated using the average concentration detected in monitoring wells located nearest to the Delaware River during each quarter. During 2021, the mass flux within the shallow, water bearing unit and deeper groundwater was estimated to be 0.012 Ci and 0.036 Ci, respectively. Therefore, the total potential estimated mass flux of tritium in groundwater reaching the Delaware River during 2021 was 0.048 Ci.

The calculated mass flux of 0.048 Ci (total of four quarterly estimates) was included in the Station's liquid effluent discharge and reported in the data tables of the Annual Radiological Effluent Release Report.

2.1.3 Investigations

1. Groundwater Monitoring Well Data (Non-RGPP)

   As previously discussed, PSEG monitors a series of wells located at the Station. The ITMP is comprised of the RGPP wells, the RAWP wells, the ESP wells and a series of monitoring wells that were installed to investigate groundwater quality, but are not included as part of the RGPP, RAWP, or ESP. No new monitoring wells were installed in 2021. Salem well BC was retrofitted from flush mount to stick mount. Well construction details and tritium analytical results for the wells described above that are not specifically part of the RGPP are presented on Table 51 and Table 55, respectively.

2. Past Spills and Leaks: Impacts to Groundwater

   In 2021, there were no known active unmonitored or unevaluated releases into the groundwater at the Station.

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3.0 RGPP 2022 Status

The RGPP long-term sampling program will be modified as required to meet the RGPP objectives. Baseline sampling and analysis of groundwater is planned to continue the following schedule:

- Tritium will be analyzed at least semi-annually each calendar year to a detection capability less than or equal to 200 pCi/L,
- Plant-related gamma emitters will be analyzed at least semi-annually to the environmental detection limits specified in the ODCM,
- RGPP monitoring well sample frequency will be adjusted as needed based on analytical results.

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Table 49, RGPP Well Construction Details, HCGS

Well ID	Installation Date	Construction Details	Diameter (inches)	Total Depth (feet bgs)	Monitoring Interval (feet bgs)	MP Elevation (feet RPD)	MP Elevation (feet amsl)	Monitoring Purpose	Source Targets
Well BH	May-06	Sch-40 PVC	4	37.0	27.0 - 37.0	101.16	11.24	Perimeter	NA
Well BI	May-06	Sch-40 PVC	4	37.0	27.0 - 37.0	103.07	13.15	Source	Facilities; Piping
Well BJ	May-06	Sch-40 PVC	4	38.0	28.0 - 38.0	102.97	13.05	Source	Condensate Storage & Transfer; Facilities; Piping
Well BK	May-06	Sch-40 PVC	4	38.5	28.5 - 38.5	101.42	11.50	Perimeter	NA
Well BL	May-06	Sch-40 PVC	4	37.0	27.0 - 37.0	102.43	12.51	Perimeter	NA
Well BM	May-06	Sch-40 PVC	4	37.5	27.5 - 37.5	102.75	12.83	Source	Facilities; Piping
Well BN	May-06	Sch-40 PVC	4	12.5	7.5 - 12.5	102.64	12.72	Source	Auxiliary Boiler Building; Piping
Well BO	May-06	Sch-40 PVC	4	35.0	25.0 - 35.0	97.98	8.06	Perimeter/Source	Building Sewage
Well BP	May-06	Sch-40 PVC	4	38.0	28.0 - 38.0	99.06	9.14	Perimeter/Source	Building Sewage
Well BQ	May-06	Sch-40 PVC	4	42.0	32.0 - 42.0	105.62	15.70	Source	Auxiliary Boiler Building; Dry Cask Storage Building; Piping
Well BR	May-06	Sch-40 PVC	4	40.5	30.5 - 40.5	104.28	14.36	Perimeter/Source	Piping; Dry Cask Storage Building
Well BS	May-06	Sch-40 PVC	4	35.0	25.0 - 35.0	100.55	10.63	Upgradient	NA
Well BT	May-06	Sch-40 PVC	4	38.5	28.5 - 38.5	99.60	9.68	Upgradient	NA

Notes:

MP	Measuring Point
bgs	Below ground surface
RPD	Relative to plant datum
amsl	Above mean sea level (NAVD 1988)
NA	Not applicable

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Table 50, RGPP Well Construction Details, SGS

Well ID	Installation Date	Construction Details	Diameter (inches)	Total Depth (feet bgs)	Monitoring Interval (feet bgs)	MP Elevation (feet RPD)	MP Elevation (feet amsl)	Monitoring Purpose	Source Targets
Well T	Jun-03	Sch-40 PVC	2	31.2	21.2 - 31.2	104.13	14.21	Source	Facilities; House Heating Boiler
Well U[1]	May-03	Sch-40 PVC	2	32.2	27.2 - 32.2	101.46	11.54	Source	Facilities; House Heating Boiler
Well Y	Sep-03	Sch-40 PVC	2	37.0	27.0 - 37.0	101.81	11.89	Perimeter	NA
Well Z	Sep-03	Sch-40 PVC	2	37.5	27.5 - 37.5	101.86	11.94	Perimeter	NA
Well AL	Jan-04	Sch-40 PVC	2	25.3	15.3 - 25.3	99.13	9.21	Perimeter	NA
Well BA	May-06	Sch-40 PVC	4	39.5	29.5 - 39.5	101.07	11.15	Perimeter	NA
Well BB[1]	May-06	Sch-40 PVC	4	47.0	37.0 - 47.0	102.18	12.26	Perimeter	NA
Well BC[2]	May-06	Sch-40 PVC	4	38.0	28.0 - 38.0	102.29	12.37	Source / Perimeter	Facilities; RAP Tanks; Piping
Well BD	May-06	Sch-40 PVC	4	40.5	30.5 - 40.5	98.78	8.86	Source	Facilities; RAP Tanks; Piping
Well BE	May-06	Sch-40 PVC	4	37.0	27.0 - 37.0	98.31	8.39	Perimeter	NA
Well BF[1]	May-06	Sch-40 PVC	4	42.0	32.0 - 42.0	101.45	11.53	Perimeter	NA
Well BG[1]	May-06	Sch-40 PVC	4	37.0	27.0 - 37.0	103.34	13.42	Perimeter	NA
Well BU	May-06	Sch-40 PVC	4	36.0	26.0 - 36.0	100.16	10.24	Upgradient	NA

Notes:

MP Measuring Point
bgs Below ground surface
RPD Relative to plant datum
amsl Above mean sea level (NAVD 1988)
NA Not applicable

[1] Monitoring wells U, BB, BF, and BG were surveyed in July/August 2013 following retrofitting or repair activities.
[2] Monitoring well BC was converted from flush-grade to above-grade (stick mount) in June 2021.

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Table 51, Well Construction Details, Investigation and Monitoring Wells

Well ID	Installation Date	Construction Details	Diameter (inches)	Total Depth (feet bgs)	Monitoring Interval (feet bgs)	Monitored Hydrogeologic Unit	MP Elevation (feet RPD)	MP Elevation (feet amsl)
Well K	Feb-03	Sch-40 PVC	2	80.0	70.0 - 80.0	Vincentown[1]	102.00	12.08
Well L	Jan-03	Sch-40 PVC	2	80.0	70.0 - 80.0	Vincentown[1]	101.46	11.54
Well M	May-03	Sch-40 PVC	1	20.0	10.0 - 20.0	Cofferdam[2]	102.17	12.25
Well N	Jan-03	Sch-40 PVC	2	20.0	10.0 - 20.0	Cofferdam[2]	101.65	11.73
Well O	Jan-03	Sch-40 PVC	2	20.0	10.0 - 20.0	Cofferdam[2]	101.33	11.41
Well P	Mar-03	Sch-40 PVC	2	80.0	70.0 - 80.0	Vincentown[1]	101.13	11.21
Well Q[8]	Mar-03	Sch-40 PVC	2	80.0	70.0 - 80.0	Vincentown[1]	106.59	16.67
Well R	Jun-03	Sch-40 PVC	1	19.0	9.0 - 19.0	Cofferdam[2]	102.35	12.43
Well S[4]	May-03	Sch-40 PVC	2	34.7	24.7 - 34.7	Shallow[3]	99.04	9.12
Well S-V	May-14	Sch-40 PVC	4	85.0	75.0 - 85.0	Vincentown[1]	101.00	11.08
Well V[6]	Jun-03	Sch-40 PVC	2	79.5	69.5 - 79.5	Vincentown[1]	101.72	11.80
Well W[6]	Jun-03	Sch-40 PVC	2	35.0	25.0 - 35.0	Shallow[3]	98.49	8.57
Well AA[4]	Sep-03	Sch-40 PVC	2	36.0	26.0 - 36.0	Shallow[3]	99.07	9.15
Well AA-V	May-13	Sch-40 PVC	2	85.0	75.0 - 85.0	Vincentown[1]	100.80	10.88
Well AB[4]	Oct-03	Sch-40 PVC	2	42.0	32.0- 42.0	Shallow[3]	98.93	9.01
Well AC[4]	Sep-03	Sch-40 PVC	2	24.0	14.0 - 24.0	Cofferdam[2]	98.77	8.85
Well AD[4]	Oct-03	Sch-40 PVC	6	43.0	33.0 - 43.0	Shallow[3]	98.99	9.07
Well AE	Oct-03	Sch-40 PVC	2	27.5	17.5 - 27.5	Cofferdam[2]	101.54	11.62
Well AF	Oct-03	Sch-40 PVC	2	45.0	35.0 - 45.0	Shallow[3]	101.61	11.69
Well AF-V	Nov-16	Sch-40 PVC	4	91.0	71.0 - 91.0	Vincentown[1]	101.38	11.46
Well AG-Shallow	Feb-04	Sch-40 PVC	1	24.2	14.2 - 24.2	Shallow[3]	99.29	9.37
Well AG-Deep	Feb-04	Sch-40 PVC	1	40.0	30.0 - 40.0	Shallow[3]	99.20	9.28
Well AH-Shallow	Feb-04	Sch-40 PVC	1	24.5	14.5 - 24.5	Shallow[3]	102.58	12.66

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Table 51, Well Construction Details, Investigation and Monitoring Wells

Well ID	Installation Date	Construction Details	Diameter (inches)	Total Depth (feet bgs)	Monitoring Interval (feet bgs)	Monitored Hydrogeologic Unit	MP Elevation (feet RPD)	MP Elevation (feet amsl)
Well AH-Deep	Feb-04	Sch-40 PVC	1	40.0	30.0 - 40.0	Shallow[3]	102.70	12.78
Well AI	Jan-04	Sch-40 PVC	4	22.0	12.0 - 22.0	Cofferdam[2]	98.79	8.87
Well AJ	Jan-04	Sch-40 PVC	4	35.3	15.3 - 35.3	Shallow[3]	98.85	8.93
Well AM	Jan-04	Sch-40 PVC	4	20.9	10.9 - 20.9	Cofferdam[2]	98.55	8.63
Well AN	Jun-04	Sch-40 PVC	4	25.0	10.0 - 25.0	Cofferdam[2]	98.76	8.84
Well AO	Jun-04	Sch-40 PVC	4	21.0	11.0 - 21.0	Cofferdam[2]	98.82	8.90
Well AP	Jun-04	Sch-40 PVC	4	40.0	15.0 - 40.0	Shallow[3]	98.65	8.73
Well AQ[5]	Jun-04	Sch-40 PVC	4	45.0	20.0 - 45.0	Shallow[3]	99.05	9.13
Well AR	Jun-04	Sch-40 PVC	4	43.0	18.0 - 43.0	Shallow[3]	99.22	9.30
Well AS	Jun-04	Sch-40 PVC	4	41.5	16.5 - 41.5	Shallow[3]	99.44	9.52
Well AT	Jun-04	Sch-40 PVC	4	44.0	19.0 - 44.0	Shallow[3]	99.25	9.33
Well BH-V	Jun-19	Sch-40 PVC	4	82.0	62.0 - 82.0	Vincentown[1]	101.83	11.91
Well BM-V	Jun-19	Sch-40 PVC	4	92.0	72.0 - 92.0	Vincentown[1]	104.95	15.03
Well BW[6,8]	Dec-06	Sch-40 PVC	1	10.0	5.0 - 10.0	Shallow[3]	101.62	11.70
Well BX[6,8]	Dec-06	Sch-40 PVC	1	10.0	5.0 - 10.0	Shallow[3]	101.79	11.87
Well BY	Nov-10	Sch-40 PVC	4	40.0	35.0 - 40.0	Shallow[3]	103.36	13.44
Well BY-V	Jun-19	Sch-40 PVC	4	82.0	62.0 - 82.0	Vincentown[1]	99.03	9.11
Well BZ	Nov-10	Sch-40 PVC	4	36.0	31.0 - 36.0	Shallow[3]	104.29	14.37
Well CA[6]	Dec-06	Sch-40 PVC	4	38.0	28.0 - 38.0	Shallow[3]	101.96	12.04
Well CB[7]	Dec-06	Sch-40 PVC	2	80.0	70.0 - 80.0	Vincentown[1]	98.98	9.06
Well DA[6]	Nov-10	Sch-40 PVC	4	17.0	12.0 - 17.0	Cofferdam[2]	99.04	9.12
Well DB	Nov-10	Sch-40 PVC	4	21.0	16.0 - 21.0	Cofferdam[2]	101.69	11.77

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Table 51, Well Construction Details, Investigation and Monitoring Wells

Well ID	Installation Date	Construction Details	Diameter (inches)	Total Depth (feet bgs)	Monitoring Interval (feet bgs)	Monitored Hydrogeologic Unit	MP Elevation (feet RPD)	MP Elevation (feet amsl)
Well DC	Nov-10	Sch-40 PVC	4	22.0	17.0 - 22.0	Cofferdam[2]	100.90	10.98
Well DD	Nov-10	Sch-40 PVC	4	19.0	14.0 - 19.0	Cofferdam[2]	101.23	11.31
Well DE	Nov-10	Sch-40 PVC	4	18.0	13.0 - 18.0	Cofferdam[2]	101.43	11.51
Well DF	Nov-10	Sch-40 PVC	4	19.0	14.0 - 19.0	Cofferdam[2]	101.32	11.40
Well DG	Nov-10	Sch-40 PVC	2	13.5	11.5 - 13.5	Cofferdam[2]	98.98	9.06
Well DH	Oct-10	Sch-40 PVC	4	21.0	16.0 - 21.0	Cofferdam[2]	101.54	11.62
Well DI	Oct-10	Sch-40 PVC	4	18.0	13.0 - 18.0	Cofferdam[2]	101.64	11.72
Well DJ	Oct-10	Sch-40 PVC	2	11.0	6.0 - 11.0	Cofferdam[2]	99.03	9.11

Notes:

MP Measuring point
bgs Below ground surface
RPD Relative to plant datum
amsl Above mean sea level (NAVD 1988)
[1] Monitoring well is screened in the Vincentown Formation.
[2] Monitoring well is screened in the shallow, water-bearing unit at a location within the limits of the cofferdam.
[3] Monitoring well is screened in the shallow, water-bearing unit at a location outside the limits of the cofferdam.
[4] The surface completions of Monitoring Wells S, AA, AB, AC, and AD were converted from above-grade to flush-grade in February 2004.
[5] Monitoring well AQ was abandoned in November 2016.
[6] Monitoring wells BW, BX, CA, DA, V, and W were surveyed in July/August 2013 following retrofitting or repair activities.
[7] Monitoring well CB was abandoned in May 2013
[8] Monitoring wells BW and BX were abandoned in June 2021.

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Table 52, Relevant Groundwater Evaluation Criteria, SGS and HCGS

Isotope	RGPP LLD (pCi/L)	PSEG Reporting Level (pCi/L)
Tritium	200	30,000
Total Strontium	2	8
Mn-54	15	1,000
Fe-55	200	1000
Fe-59	30	400
Co-58	15	1,000
Co-60	15	300
Zn-65	30	300
Nb-95	15	400
Zr-95	15	400
Cs-134	15	30
Cs-137	18	50
Ba-140	60	200
La-140	15	200
Ni-63	530	1000

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Table 53, Tritium Analytical Results, HCGS RGPP Wells 2021

Well ID	Sample Date	Tritium Result (pCi/L)
Well BH	2/3/2021	< 184
Well BH	5/3/2021	<183
Well BH	8/4/2021	< 191
Well BH	11/3/2021	< 170
Well BI	2/3/2021	< 181
Well BI	5/3/2021	**455**
Well BI	8/4/2021	< 188
Well BI	11/3/2021	< 167
Well BJ	1/5/2021	**2190**
Well BJ	2/3/2021	**2180**
Well BJ	3/3/2021	**2630**
Well BJ	4/7/2021	**2770**
Well BJ	5/3/2021	**2280**
Well BJ	6/9/2021	**2100**
Well BJ	7/7/2021	**2270**
Well BJ	8/3/2021	**2110**
Well BJ	9/8/2021	**2800**
Well BJ	10/4/2021	**2740**
Well BJ	11/2/2021	**2880**
Well BJ	12/7/2021	**2690**
Well BK	5/3/2021	< 189
Well BK	11/3/2021	< 177
Well BL	5/3/2021	< 187
Well BL	11/3/2021	< 177
Well BM	2/3/2021	**390**
Well BM	5/3/2021	**501**
Well BM	8/3/2021	**520**
Well BM	11/3/2021	**424**
Well BN	2/4/2021	**502**
Well BN	5/3/2021	**1710**
Well BN	8/4/2021	**729**
Well BN	11/1/2021	**178**
Well BO	2/4/2021	< 185
Well BO	5/3/2021	**521**
Well BO	8/4/2021	**389**
Well BO	11/1/2021	**267**
Well BP	5/3/2021	< 185

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Table 53, Tritium Analytical Results, HCGS RGPP Wells 2021

Well ID	Sample Date	Tritium Result (pCi/L)
Well BP	5/3/2021	< 178
Well BQ	2/4/2021	< 180
Well BQ	5/5/2021	< 183
Well BQ	8/3/2021	< 191
Well BQ	11/3/2021	< 193
Well BR	5/6/2021	< 189
Well BR	11/1/2021	< 189
Well BS	5/6/2021	< 190
Well BS	11/1/2021	< 197
Well BT	5/6/2021	< 193
Well BT	11/1/2021	< 180

Notes:

pCi/L	Picocuries per liter
<	Tritium not detected above indicated concentration
267	Bolded values indicate tritium was detected

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Table 54, Tritium Analytical Results, SGS RGPP Wells

Well ID	Sample Date	Tritium Result (pCi/L)
Well AL	5/6/2021	**354**
Well AL	11/2/2021	**415**
Well BA	5/5/2021	< 189
Well BA	11/4/2021	< 183
Well BB	5/5/2021	< 193
Well BB	11/4/2021	< 186
Well BC	1/5/2021	**993**
Well BC	2/4/2021	**1,570**
Well BC	3/3/2021	**2,180**
Well BC	4/6/2021	**1,400**
Well BC	5/4/2021	**1,880**
Well BC	6/9/2021	**2,970**
Well BC	7/7/2021	**2,730**
Well BC	8/3/2021	**1,890**
Well BC	9/8/2021	**1,450**
Well BC	10/6/2021	**1,320**
Well BC	11/2/2021	**1,230**
Well BC	12/7/2021	**1,560**
Well BD	2/4/2021	**433**
Well BD	5/4/2021	**559**
Well BD	8/2/2021	**377**
Well BD	11/2/2021	**252**
Well BE	2/4/2021	**394**
Well BE	5/4/2021	**1,370**
Well BE	7/6/2021	**705**
Well BE	8/2/2021	**653**
Well BE	11/4/2021	**405**
Well BF	5/4/2021	< 185
Well BF	11/4/2021	< 178
Well BG	2/3/2021	< 182
Well BG	5/3/2021	< 186
Well BG	8/2/2021	< 186
Well BG	11/4/2021	**209**
Well BU	5/6/2021	< 185
Well BU	11/1/2021	< 186

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Table 54, Tritium Analytical Results, SGS RGPP Wells

Well ID	Sample Date	Tritium Result (pCi/L)
Well T	2/5/2021	< 181
Well T	5/52021	< 179
Well T	8/2/2021	< 193
Well T	11/4/2021	< 168
Well U	2/5/2021	**234**
Well U	5/5/2021	**333**
Well U	8/2/2021	**308**
Well U	11/4/2021	**359**
Well V	1/5/2021	**198**
Well V	7/7/2021	**221**
Well W	1/6/2021	**1,890**
Well W	4/5/2021	**2,050**
Well W	7/6/2021	**2,010**
Well W	10/4/2021	**2,500**
Well Y	5/6/2021	< 182
Well Y	11/3/2021	< 167
Well Z	5/6/2021	**422**
Well Z	11/3/2021	**427**

Notes:

pCi/L	Picocuries per liter
<	Tritium not detected above indicated concentration
427	Bolded values indicate tritium was detected

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Table 55, Tritium Analytical Results, Investigation & Monitoring Wells

Well ID	Sample Date	Tritium Result (pCi/L)
Well AA	1/6/2021	**2,360**
Well AA	3/2/2021	**1,700**
Well AA	4/6/2021	**819**
Well AA	7/8/2021	**1,000**
Well AA-V	1/6/2021	**6,880**
Well AA-V	4/6/2021	**4,140**
Well AA-V	7/8/2021	**2,120**
Well AA-V	10/7/2021	**404**
Well AB	10/29/2021	**5,420**
Well AC	1/4/2021	**33,400**
Well AC	2/4/2021	**39,500**
Well AC	3/3/2021	**40,900**
Well AC	4/6/2021	**33,000**
Well AC	5/4/2021	**38,900**
Well AC	6/9/2021	**30,900**
Well AC	7/6/2021	**30,400**
Well AC	8/2/2021	**29,300**
Well AC	9/8/2021	**19,200**
Well AC	10/4/2021	**26,900**
Well AC	11/2/2021	**17,000**
Well AC	12/6/2021	**22,800**
Well AD	1/7/2021	**7,270**
Well AD	4/7/2021	**8,520**
Well AD	7/7/2021	**8,150**
Well AE	1/6/2021	**20,800**
Well AE	4/5/2021	**18,600**
Well AE	7/8/2021	**13,200**
Well AE	10/6/2021	**10,500**
Well AF	1/6/2021	**213**
Well AF	7/7/2021	**411**
Well AF-V	1/6/2021	**400**
Well AF-V	4/7/2021	**183**
Well AF-V	7/7/2021	< 183
Well AF-V	10/7/2021	**365**
Well AG-D	1/5/2021	**888**
Well AG-D	7/8/2021	**905**
Well AG-S	1/5/2021	**845**
Well AG-S	7/8/2021	**628**
Well AH-D	1/4/2021	**605**
Well AH-D	7/8/2021	**535**
Well AH-S	1/4/2021	**522**
Well AH-S	7/8/2021	**490**

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Table 55, Tritium Analytical Results, Investigation & Monitoring Wells

Well ID	Sample Date	Tritium Result (pCi/L)
Well AI	1/4/2021	**1,510**
Well AI	7/6/2021	**366**
Well AJ	1/7/2021	**3,030**
Well AJ	4/7/2021	**11,100**
Well AJ	7/7/2021	**11,000**
Well AJ	10/5/2021	**9,440**
Well AM	1/4/2021	**27,700**
Well AM	4/6/2021	**23,100**
Well AM	7/6/2021	**9,390**
Well AM	10/4/2021	**7,080**
Well AN	1/7/2021	**13,100**
Well AN	2/3/2021	**17,700**
Well AN	3/2/2021	**19,200**
Well AN	4/7/2021	**19,900**
Well AN	5/5/2021	**13,600**
Well AN	6/9/2021	**19,000**
Well AN	7/7/2021	**14,300**
Well AN	8/3/2021	**14,700**
Well AN	9/7/2021	**15,000**
Well AN	10/29/2021	**12,000**
Well AN	11/2/2021	**21,700**
Well AN	12/6/2021	**15,700**
Well AP	1/7/2021	**1,680**
Well AP	7/7/2021	**1,260**
Well AR	1/7/2021	**5,220**
Well AR	4/7/2021	**4,610**
Well AR	7/7/2021	**4,570**
Well AR	10/7/2021	**6,530**
Well AS	1/7/2021	**6,210**
Well AS	7/7/2021	**4,800**
Well AT	1/7/2021	**2,060**
Well AT	7/7/2021	**2,000**
Well BH-V	1/5/2021	< 178
Well BH-V	7/6/2021	< 192
Well BM-V	1/5/2021	**220**
Well BM-V	7/6/2021	**209**
Well BW	5/5/2021	**650**
Well BX	5/5/2021	**674**
Well BY	1/5/2021	**39,100**
Well BY	2/3/2021	**49,700**
Well BY	3/2/2021	**62,400**
Well BY	4/5/2021	**60,500**

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Table 55, Tritium Analytical Results, Investigation & Monitoring Wells

Well ID	Sample Date	Tritium Result (pCi/L)
Well BY	5/3/2021	**64,400**
Well BY	6/9/2021	**63,200**
Well BY	7/6/2021	**62,500**
Well BY	8/2/2021	**65,400**
Well BY	9/8/2021	**57,400**
Well BY	10/4/2021	**68,100**
Well BY	11/2/2021	**62,500**
Well BY	12/6/2021	**46,300**
Well BY-V	1/5/2021	**723**
Well BY-V	4/5/2021	**1,140**
Well BY-V	7/6/2021	**10,100**
Well BY-V	10/4/2021	**11,700**
Well BZ	5/4/2021	**1,510**
Well BZ	11/2/2021	**1,140**
Well CA	1/7/2021	**1,330**
Well CA	7/7/2021	**1,810**
Well DA	1/4/2021	**3,570**
Well DA	2/3/2021	**3,600**
Well DA	4/5/2021	**2,850**
Well DA	7/6/2021	**2,710**
Well DA	8/2/2021	**2,570**
Well DA	9/8/2021	**2,640**
Well DA	10/6/2021	**2,640**
Well DA	11/3/2021	**2,370**
Well DA	12/6/2021	**2,910**
Well DB	1/4/2021	**6,770**
Well DB	4/6/2021	**5,270**
Well DB	7/6/2021	**5,910**
Well DB	10/5/2021	**5,520**
Well DC	1/4/2021	**4,170**
Well DC	2/4/2021	**3,350**
Well DC	7/6/2021	**1,620**
Well DC	8/2/2021	**1,710**
Well DC	9/8/2021	**2,330**
Well DC	10/5/2021	**3,130**
Well DC	11/2/2021	**4,840**
Well DC	12/6/2021	**5,250**
Well DD	1/4/2021	**5,920**
Well DD	4/6/2021	**5,330**
Well DD	7/6/2021	**4,340**
Well DD	10/5/2021	**5,280**
Well DE	1/4/2021	**16,600**

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Table 55, Tritium Analytical Results, Investigation & Monitoring Wells

Well ID	Sample Date	Tritium Result (pCi/L)
Well DE	4/6/2021	**17,000**
Well DE	7/6/2021	**16,600**
Well DE	10/5/2021	**16,100**
Well DF	1/4/2021	**1,150**
Well DF	7/6/2021	**1,190**
Well DG	1/5/2021	**2,650**
Well DG	4/5/2021	**2,810**
Well DG	7/6/2021	**2,680**
Well DG	10/6/2021	**3,180**
Well DH	1/7/2021	**9,980**
Well DH	4/5/2021	**9,870**
Well DH	7/7/2021	**10,100**
Well DH	10/6/2021	**11,900**
Well DI	1/7/2021	**4,420**
Well DI	4/5/2021	**3,190**
Well DI	7/7/2021	**1,510**
Well DI	10/6/2021	**1,710**
Well DJ	1/7/2021	**1,890**
Well DJ	7/7/2021	**4,110**
Well DJ	10/6/2021	**4,250**
Well DJ	11/3/2021	**3,880**
Well DJ	12/7/2021	**3,660**
Well K	1/5/2021	< 192
Well K	7/7/2021	< 179
Well L	1/5/2021	< 182
Well L	7/7/2021	< 192
Well M	1/7/2021	**4,080**
Well M	4/6/2021	**8,480**
Well M	7/6/2021	**6,110**
Well M	10/5/2021	**5,510**
Well N	1/4/2021	**10,400**
Well N	4/6/2021	**6,130**
Well N	7/6/2021	**7,650**
Well N	10/4/2021	**8,880**
Well O	1/6/2021	**52,600**
Well O	4/5/2021	**42,600**
Well O	7/8/2021	**12,600**
Well O	10/6/2021	**7,390**
Well P	1/6/2021	< 180
Well P	7/7/2021	< 193
Well R	1/7/2021	**10,300**
Well R	2/3/2021	**5,860**

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Table 55, Tritium Analytical Results, Investigation & Monitoring Wells

Well ID	Sample Date	Tritium Result (pCi/L)
Well R	3/3/2021	**6,820**
Well R	4/5/2021	**6,800**
Well R	5/6/2021	**9,200**
Well R	6/9/2021	**7,130**
Well R	7/6/2021	**7,810**
Well R	8/2/2021	**8,630**
Well R	9/8/2021	**7,000**
Well R	10/5/2021	**7,150**
Well R	11/4/2021	**8,300**
Well R	12/6/2021	**7,850**
Well S	10/29/2021	**8,160**
Well S-V	1/7/2021	**2,720**
Well S-V	4/7/2021	**2,240**
Well S-V	7/8/2021	**2,280**
Well S-V	10/7/2021	**1,880**
Well V	1/5/2021	**198**
Well V	7/7/2021	**221**
Well W	1/6/2021	**1,890**
Well W	4/5/2021	**2,050**
Well W	7/6/2021	**2,010**
Well W	10/4/2021	**2,500**

Notes:

pCi/L	Picocuries per liter
†	Well EOW-4L was abandoned in May 2020.
<	Tritium not detected above indicated concentration
1,860	Bolded values indicate tritium was detected
20,000	Tritium was detected above the New Jersey Department of Environmental Protection (NJDEP) Class II-A Groundwater Quality Standard (GWQS) of 20,000 pCi/L.

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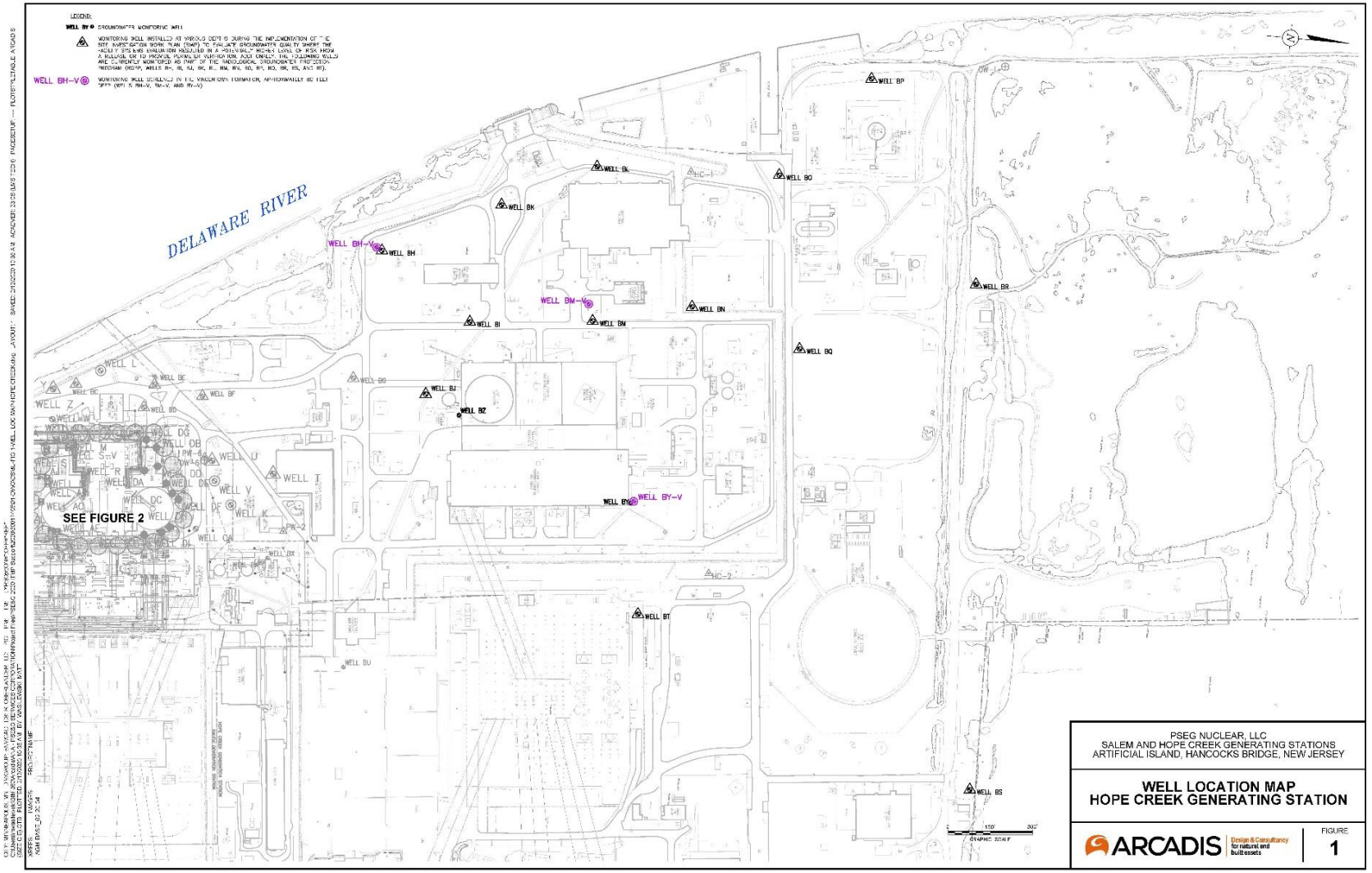

Figure 13, Well Location Map, Hope Creek Generating Station

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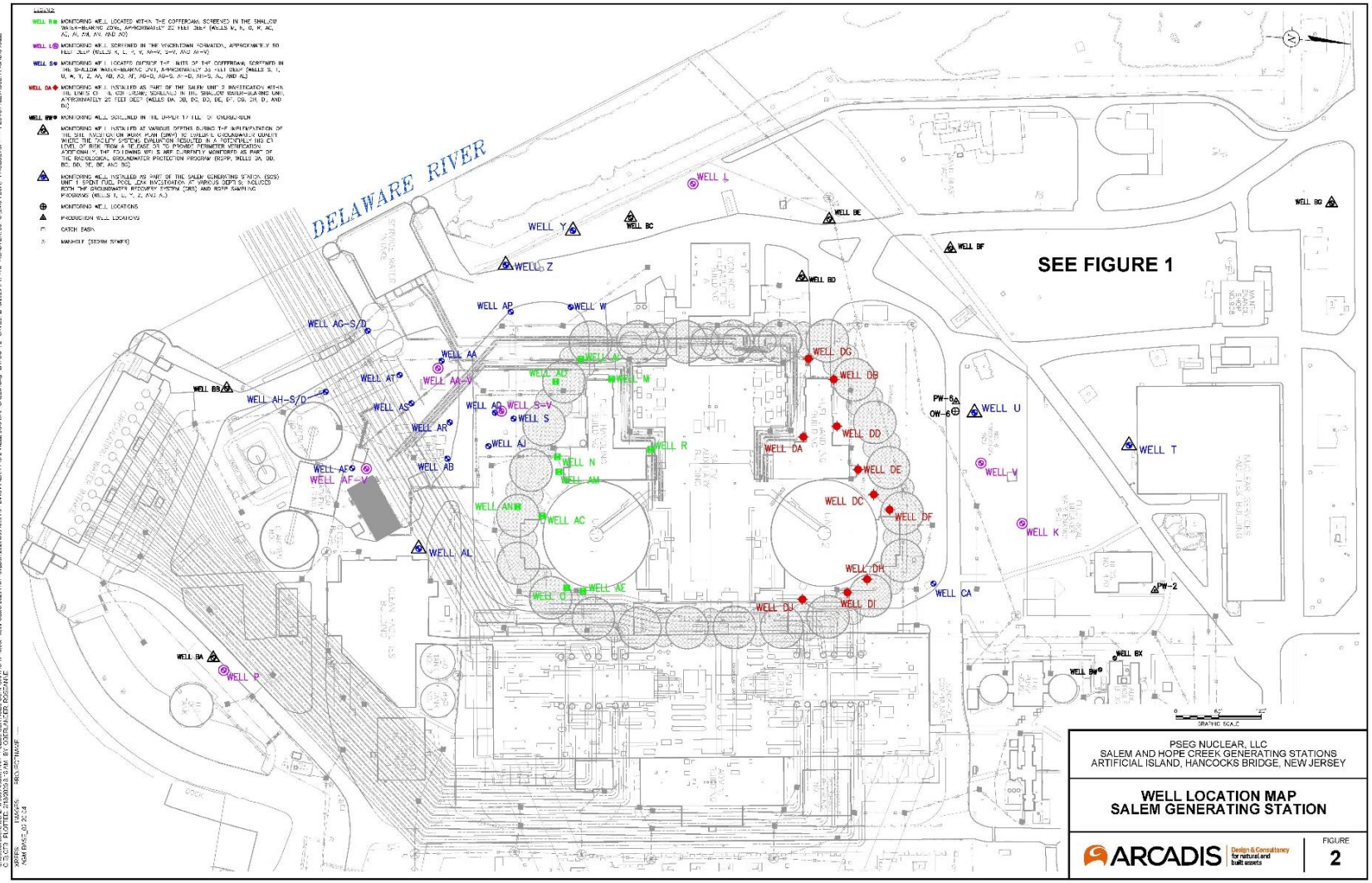

Figure 14, Well Location Map, Salem Generating Station

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2021 Change Summary – Salem and Hope Creek ODCMs

Attachment 8, 2021 Change Summary to the Salem and Hope Creek ODCMs

2021 Change Summary – Salem and Hope Creek ODCMs

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2021 Change Summary – Salem and Hope Creek ODCMs

1.0 Salem REC ODCM Revision 29

Item No.	Rev. 28 Page No.	Rev. 29 Page No.	Description of Change	Type of Change
1.	All	All	Changed revision number from 28 to 29	Editorial
2.	14	1	Added the following statement to the end of the last paragraph: "References to 10 CFR 20 tables that us roman numerals are the "old" revision of Part 20". Reason: Clarifies that the Salem Radiological Effluent Control Program uses MPCs and not ECL for liquid effluents (CAP 80113172 Op 610)	Editorial
3.	16	3	Added definition 1.3 for ALARM ANNUNCIATION ALARM ANNUNCIATION includes both visual and audible alarms Reason: Fulfils a request from Operation (CAP 70200353 Op10)	Editorial
4.	26, 32	10, 16	Liquid and Gaseous Radiation Monitoring Instrumentation Changed ACTION Statement for CONTROL 3.3.7.10 and CONTROL 3.3.7.11 FROM: b. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 3.3-12 (Table 3.3-13 gaseous instrumentation). Exert best efforts to return the instrument to OPERABLE status within 30 days and, if unsuccessful, explain in the next radioactive effluent release report why the inoperability was not corrected in a timely manner. TO: b. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 3.3-12 (Table 3.3-13 gaseous instrumentation). c. Exert best efforts to return the instrument to OPERABLE status within 30 days and, if unsuccessful, explain in the next radioactive effluent release report why the inoperability was not corrected in a timely manner. Reason: This change removes confusion between performing the required ACTION in either Table 3.3-12 (liquid instrumentation) or Table 3.3-13 (gaseous instrumentation) and the requirement to report instrumentation that was out of service for more than 30 days should the minimum number of channels not be met.	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	Rev. 28 Page No.	Rev. 29 Page No.	Description of Change	Type of Change
5.	27	11	REVISED Table 3.3-12 Radioactive Liquid Effluent Monitoring Instrumentation to add a designation to identify which radiation monitor belong to which Unit. Reason: Adopted similar format as reported for Containment Fan Coolers – Service Water Line Discharge in the Salem ODCM	Editorial
6.	33	17	Revised Table 3.3-13 Radioactive Gaseous Effluent Monitoring Instrumentation to add a designation to identify which radiation monitor belong to which Unit. Reason: Adopted similar format as reported for Containment Fan Coolers – Service Water Line Discharge in the Salem ODCM Table 3.3-12.	Editorial
7.	39	23	Table 4.11-1: Radioactive Liquid Waste Sampling and Analysis Program 1. Removed the requirement to analyze one batch or grab per month for Dissolved and entrained gases (gamma emitters). P ¶ One Batch/M ¶ ¤ | M ¤ | Dissolve and ¶ Entrained Gases ¶ (Gamma Emitters) ¤ | $1x10^{-5}$ ¤ ¤ Reason: This is because each sample that is collected is also analyzed for the dissolved and entrained gases at the required LLD of 1E-05 μCi/cc. 2. Added the wording (Gamma Emitters) to the words Dissolved and Entrained Gasses to the Steam Generator Blowdown. 3. Added Steam Generator Blowdown to Batch Waste Release. 4. Added Miscellaneous Releases to both Batch Releases and Continuous Releases. 5. Added Containment Fan Coil Unit Cooling Water to Continuous Releases. Reason: Clarification to match wording in table.	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	Rev. 28 Page No.	Rev. 29 Page No.	Description of Change	Type of Change
8.	39, 45	24	Added a footnote to Table 4.11-1 Radioactive Liquid Waste Sampling and Analysis Program 1. A statistically positive activity detected at or below the required LLD shall be considered a true value and shall be accounted for and reported in the Annual Radioactive Effluent Release Report. 2. See Table 1-1.3: Batch and Continuous Liquid Effluent Release Sources. Reason: Footnote 1 has been added to specify that any statistically significant result that is below or at the required LLD is considered as a "real" number and therefore must be accounted for in the effluent tracking program and reported in the Annual Radioactive Effluent Release Report. Footnote 2 provides direction to a new table in the ODCM where sources for batch and continuous liquid releases are detailed.	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	Rev. 28 Page No.	Rev. 29 Page No.	Description of Change	Type of Change
9.	40	24	Revised the LLD Equation FROM: $LLD = \frac{4.66 * S_b}{E * V * 2.22E6 * Y * \exp(-\lambda \Delta t)}$ TO: $LLD = \frac{\frac{2.71}{T} + (4.66 * S_b)}{E * V * 2.22E6 * Y * \exp(-\lambda \Delta t)}$ 1. Defined 2.71 as the Poisson-Normal approximation 2. Defined T as the sample count time in minutes 3. Added to the 2.22E6 term "If T is in seconds (i.e. gamma spec), then 3.77E4 is the number of disintegrations per second per microcurie. 4. Added T to Typical values 5. Added footnote 1 Lloyd A. Currie, Limits for Qualitative Detection and Quantitative Determination: Application to Radiochemistry, Anal. Chem. 40, 586-593 (1968). Reason: This correct an error in the original LLD equation from NUREG 1302 that prevents the calculation of an LLD when background S_b is 0. The gamma spectroscopy system uses the 2.71/T in the determination of LLD. Clarified that should count time be in seconds that the disintegrations per second per microcurie changes to 3.77E4.	Editorial
10.	45 N/A	29 30	Revised Table 4.11-2 Radioactive Gaseous Waste Sampling and Analysis Program 1. Split Containment Releases into Purges and Pressure Relief. Reason: The release of noble gases via pressure relief valves were not covered by this table. 2. Renamed E. Containment Hatch when open during outages to E. Miscellaneous Releases Sources. 3. Added Table 2-3.3 Batch and Continuous Gaseous Release Sources 4. Added footnote "h." Miscellaneous release sources are sources that typically contribute less than one percent of the activity discharged from all the release points for a particular type of effluent considered. Reason: There are several miscellaneous release sources that would not be covered unless they were identified in Table 4.11-2.	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	Rev. 28 Page No.	Rev. 29 Page No.	Description of Change	Type of Change
			Adding Table 2-1.3 identifies the routine defined release sources. Footnote "h." defines what a miscellaneous release is. This definition modified from Reg. Guide 1.21, Rev 2 for less-significant release point.	
11.	49 108	33, 72	CHANGED: − 0.3 mrad to any organ to a MEMBER OF THE PUBLIC TO: − 0.3 mrem to any organ to a MEMBER OF THE PUBLIC Reason: Typo in units. Correct units are mrem.	Editorial
12.	70	42	Revised BASES Section 3/4.11.1.1 Concentration first Paragraph FROM: The CONTROL is provided to ensure that the concentration of radioactive materials released in liquid waste effluents will be less than the concentration levels specified in the "old" 10 CFR Part 20, Appendix B Table II, Column 2 (ODCM Appendix F). This limitation provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC and (2) the limits of 10 CFR Part 20.106(a) to the population. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2. The required detection capabilities for radioactive materials in liquid waste samples are tabulated in terms of the lower limits of detection (LLDs). TO: The CONTROL is provided to ensure that the summation of concentration of radioactive materials released in liquid waste effluents to UNRESTRICTED AREAS will be less than the concentration levels specified in the pre-1994 (old) 10 CFR Part 20, Appendix B Table II, Column 2 (ODCM Appendix F). This CONTROL is achieved when the following equation is met after dilution: $\frac{Concentration_a}{MPC_a} + \frac{Concentration_b}{MPC_b} + \frac{Concentration_c}{MPC_c} + \cdots \leq 1$ The MPC Ratio Limit of 1 represents the Instantaneous Release Dose Limit of 500 mrem/yr (10 CFR Part 20.105). This limitation	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	Rev. 28 Page No.	Rev. 29 Page No.	Description of Change	Type of Change
			provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC and (2) the limits of 10 CFR Part 20.106(a) to the population. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2. The required detection capabilities for radioactive materials in liquid waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits can be found in Currie, L. A., "Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements," NUREG/CR-4007 (September 1984), and the HASL Procedures Manual, HASL-300 (revised annually). Reason: These words were added to the BASES for clarification that it is the sum of the concentration/MPC ratios must be ≤1. The one represents the instantaneous release rate limit of 500 mrem/yr.	
13.	82 - 84 108	49 - 50 73	Added the word "Annual" to the Radioactive Effluent Release Report. Also added the acronym "ARERR" in place of the words "Radioactive Effluent Release Report" Changed the following words FROM: Radioactive Effluent Release Report (RERR)" TO: Annual Radioactive Effluent Release Report (ARERR)" (ARERR)" Reason: All submittals to the NRC regarding the Radioactive Effluent Release Report is presented as the Annual Radioactive Effluent Release Report	Editorial
14.	82	49	Updated the reference to Regulatory Guide 1.21 Revision 1 to Revision 2. Reason: The ARERR has been following the guidance for reporting annual effluent data using guidance provided in Revision 2 (CAP 70213330 Op 110)	Editorial
15.	88 -	54 -	Reordered the following Sections in Part II Calculational	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	Rev. 28 Page No.	Rev. 29 Page No.	Description of Change	Type of Change
	91	56	Methodologies FROM: 1.2 Liquid Effluent Monitor Setpoint Determination 1.2.1 Liquid Effluent Monitors (Radwaste, Steam Generator Blowdown, Chemical Waste Basin and Service Water 1.2.2 Conservative Default Values 1.3 Liquid Effluent Concentration Limits – 10 CFR 20 TO: 1.2 Liquid Effluent Concentration Limits – 10 CFR 20 1.3 Liquid Effluent Monitor Setpoint Determination 1.3.1 Liquid Effluent Monitors (Radwaste, Steam Generator Blowdown, Chemical Waste Basin and Service Water 1.3.2 Conservative Default Values Reason: The order was changed, because meeting the Liquid Effluent Concentration Limits is the most critical step in determining that the tank may be released.	

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	Rev. 28 Page No.	Rev. 29 Page No.	Description of Change	Type of Change
16.	90	56 - 57	CHANGED: 6.05-6 µCi/ml (Unit 1) and 4.81E-6 µCi/ml (Unit 2) substitution of the I-131 MPC value of **3-7** µCi/ml for the R19 Steam Generator Blowdown monitors TO: 6.05**E-0**6 µCi/ml (Unit 1) and 4.81E-**0**6 µCi/ml (Unit 2) substitution of the I-131 MPC value of **3.0E 07** µCi/ml for the R19 Steam Generator Blowdown monitors Reason: Corrected typos	Editorial
17.	92	58	Added clarifying information when a setpoint change is required. That information is as follows: Procedural controls exist to verify the setpoint utilized is at or below what is required. Should the calculated setpoint be more conservative by more than 25%, then one of the following will be performed: a. Increase CW or Reduce RR until calculated setpoint is ≥ the default setpoint. b. Install new setpoint. c. Reprocess the tank. Reason: Current Chemistry practice is to make changes to setpoints with each release. This clarification provides guidance on what steps are required to meet the ODCM requirements for using a default setpoint.	Editorial
18.	92	58	CHANGED: 1.672 = Conversion factor (hr/min) TO: 1.67E-02 = Conversion factor (hr/min) Reason: Corrected a typo	Editorial

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Item No.	Rev. 28 Page No.	Rev. 29 Page No.	Description of Change	Type of Change
19.	95	60 - 61	Revised the following paragraph FROM: Because the release rate from the secondary system is indirect (e.g., SG blowdown is normally routed to condenser where the condensate clean-up system will remove much of the radioactive material), samples should be collected from the release point (i.e., Chemical Waste Basin) for quantifying the radioactive material releases. However, for conservatism and ease of controlling and quantifying all potential release paths, it is prudent to sample the SG blowdown and to assume all radioactive material is released directly to the environment via the Chemical Waste Basin. This approach while not exact is conservative and ensures timely analysis for regulatory compliance. Accounting for radioactive material retention of the condensate clean-up system ion exchange resins may be needed to more accurately account for actual releases. TO: Because the release rate from the secondary system is indirect (e.g., SG blowdown is normally routed to SGBD demineralizer system/condensate clean-up system where the ion exchange system will remove much of the radioactive material), samples should be collected from the release point (i.e., Chemical Waste Basin) for quantifying the radioactive material releases. However, for conservatism and ease of controlling and quantifying all potential release paths, it is prudent to sample the SG blowdown before releasing any radioactive material directly to the environment via the Chemical Waste Basin (from the regeneration of SG demineralizers or condensate polishers). This approach while not exact is conservative and ensures timely analysis for regulatory compliance. Accounting for radioactive material retention of the SG demineralizer/condensate clean-up system ion exchange resins may be needed to more accurately account for actual releases. Reason: The changes in this paragraph matches the wording provide in DCP 80077303	Editorial
20.	96	61	REVISED: 31d TO: 31 Reason: The use of 31d did not match what was in equations 1.9 and 1.10.	Editorial

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Item No.	Rev. 28 Page No.	Rev. 29 Page No.	Description of Change	Type of Change
21.	104	69	Revised reference to Table 2-4 to Table 2-4 to Table 2-8 Reason: The original Table 2-4 was split into four separate tables by pathway (inhalation, cow milk, vegetation, and ground plane). Table 2-7 (meat pathway) is a new table added with this revision.	Editorial
22.	104	69	Revised the following paragraph FROM: For evaluating the maximum exposed individual, only the controlling pathways and age group as identified in Table 2-3 need be evaluated for compliance with ODCM CONTROL 3.11.2.3. TO: For evaluating the maximum exposed individual, the infant age group is controlling for the milk pathway. Should the Effluent Tracking Software not be available, then only the controlling age group as identified in Table 2-3 need be evaluated for compliance with ODCM CONTROL 3.11.2.3. Reason: This change was made, because the current software in place calculates dose to all age groups and all organs and selects the highest dose value.	Editorial
23.	104, 105	69 - 70	Revised both Section 2.5.1 and 2.5.2 to modify the formula definition for SFp SFp = Annual seasonal correction factor to account for fraction of the year that the applicable exposure pathway does not exist. 1. For milk and vegetation exposure pathways: A six month fresh vegetation and grazing season (May through Oct) = 0.5 2. For inhalation and ground plane exposure pathways: = 1.0 SF_p was changed to 1. Reason: The Effluent Tracking Software never applied a 0.5 reduction factor to calculated doses. Additionally, there is no practical methodology to implement the SF_p value based upon time frame. Using a value of 1 is more conservative.	Editorial

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Item No.	Rev. 28 Page No.	Rev. 29 Page No.	Description of Change	Type of Change
24.	108	72	Revised Equations 2.17, 2.18 and 2.19 FROM: $D_{gp} = (D_g/d) * 31d$ (2.17) $D_{dp} = (D_d/d) * 31d$ (2.18) $D_{maxp} = (D_{max}/d) * 31d$ (2.14) TO: $D_{gp} = (D_g/d)*31$ → (2.17)¶ $D_{dp} = (D_d/d)*31$ → (2.18)¶ $D_{maxp} = (D_{max}/d)*31$ → (2.19)¶ Reason: The use of 31d in the equation was misleading. One could assume that to solve the equation the "d" value (the number of days in the current calendar quarter at the end of the release) would be multiplied by 31. The value of 31 is the number of days that the dose is to be projected. Corrected equation number from 2.14 to 2.19 (typo)	Editorial
25.	113 114	75 76	Updated Figure 1-1: Liquid Release Flow Path Unit 1 to meet the changes to the liquid radwaste processing by DCP 80077303R0 Updated Figure 1-2: Liquid Release Flow Path Unit 2 to meet the changes to the liquid radwaste processing by DCP 80077303R0	Editorial
26.	NA NA	80 89	Added Table 1-1.3 Batch and Continuous Liquid Release Sources Added Table 2-2.3 Batch and Continuous Gaseous Release Sources Reason: Adding these two table define the release sources for each type of liquid or gaseous releases defined in Table 4.11-1 and Table 4.11-2.	Editorial

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Item No.	Rev. 28 Page No.	Rev. 29 Page No.	Description of Change	Type of Change
27.	126	90	Updated Table 2-3: Controlling Locations, Pathways And Atmospheric Dispersion For Dose Calculations. The significant changes WERE: a. Removed the dose pathway Ground plane from Site Boundary for ODCM CONTROL 3.11.2.1b Dose Rate Limits b. Added Location Site Boundary to ODCM CONTROL 3.11.2.3 Dose with the dose pathways of Ground plane and Inhalation c. Removed the dose pathway location Residence/Garden/Beef at 4.6 miles SW Sector. Added the pathways Meat and Vegetation to the Residence/Dairy at 4.9 miles W sector to remain conservative for the dose from C-14. d. Added footnote 3 to infant "When dose from C-14 is determined, then Child will become the Controlling Age Group." Reason: Per dose rate equation 2.6 in section 2.3.2 Site Boundary Dose Rate – Radioiodine and Particulates the dose parameter is to the child inhalation pathway. The ground plane was added to the site boundary for the calculation of dose.	Editorial
28.	126	90	Corrected the reference from NUREG-0157 to NUREG-0517. Added reference to the source for the revised meteorological data. Reason: Typo corrected and updated reference to revise meteorological data.	Editorial
29.	127 - 138	91 - 104	DIVIDED: Table 2-4 into the following tables: TABLE 2-4: Pathway Dose Factors – Atmospheric Releases $R_{(io)}$, Inhalation Pathway Dose Factors TABLE 2-5: Pathway Dose Factors – Atmospheric Releases $R_{(io)}$, Grass-Cow-Milk Pathway Dose Factors TABLE 2-6: Pathway Dose Factors – Atmospheric Releases $R_{(io)}$, Vegetation Pathway Dose Factors TABLE 2-7: Pathway Dose Factors – Atmospheric Releases $R_{(io)}$, Meat Pathway Dose Factors TABLE 2-8: Pathway Dose Factors – Atmospheric Releases $R_{(io)}$, Ground Plane Pathway Dose Factors Reason: Each pathway is now in its own table. Table 2-7 for the meat pathway added to the ODCM.	Editorial

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Item No.	Rev. 28 Page No.	Rev. 29 Page No.	Description of Change	Type of Change
30.	138	105	Added dose factors for Skin for all nuclides and added dose factors for Co-57 to Table 2-8 Reason: Skin dose factors are needed to correctly calculate dose from ground plane dose pathway. The effluent tracking software has the correct skin factors.	Editorial
31.	139-143	106 - 111	Extensive revision to Appendix A: Evaluation of Default MPC Value for Liquid Effluents. This is the detailed section in the ODCM that justifies using default liquid radiation monitor setpoints. No changes were made to the default MPC_e value used for setpoint determination for liquid releases. The data from 1994 remains conservative. Reason: The ODCM requires a periodic review of Appendix A to determine that the calculated MPC_e value used for setpoint determination remain conservative.	Editorial
32.	14	1	Removed referenced to Annual Radiological Environmental Operating Report and to Tech Spec 6.9.1.7 Part II also contains a list and graphical description of the specific sample locations for the radiological environmental monitoring program (REMP), and the liquid and gaseous waste treatment systems REVISED TO: Part II also graphical description of the liquid and gaseous waste treatment systems.	Technical A
	18	4	Changed Definition Wording for 1.10 OFFSITE DOSE CALCULATION MANUAL (ODCM) FROM: The OFFSITE DOSE CALCULATION MANUAL (ODCM) shall contain the methodology and parameters used in the calculation of offsite doses due to radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring alarm/trip setpoints, and in the conduct of the environmental radiological monitoring program. The ODCM shall also contain (1) the Radioactive Effluent Controls and Radiological Environmental Monitoring Programs required by Technical Specification Section 6.8.4 and (2) descriptions of the information that should be included in the Annual Radiological Environmental Operating and the Radioactive Effluent Release Reports required by Technical Specification Sections 6.9.1.7 and 6.9.1.8, respectively. TO: The OFFSITE DOSE CALCULATION MANUAL (ODCM) is	

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Item No.	Rev. 28 Page No.	Rev. 29 Page No.	Description of Change	Type of Change
			separated into two separate documents. The first document, the Salem Generating Station ODCM, shall contain the methodology and parameters used in the calculation of offsite doses due to radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring alarm/trip setpoints, The ODCM shall also contain (1) the Radioactive Effluent Controls Program required by Technical Specification Section 6.8.4 and (2) descriptions of the information that should be included in the Annual Radioactive Effluent Release Reports required by Technical Specification Section 6.9.1.8. The second document, The Salem and Hope Creek Generating Stations Common Radiological Environmental Monitoring Program ODCM, shall contain the conduct of the environmental radiological monitoring program. The Common ODCM shall also contain (1) the Radiological Environmental Monitoring Program required by Technical Specification Section 6.8.4 and (2) descriptions of the information that should be included in the Annual Radiological Environmental Operating required by Technical Specification Section 6.9.1.7.	
	51 - 65	35 - 37	Removed Controls 3/4.12.1 Monitoring Program Removed Controls 3/4.12.2 Land Use Census Removed Controls 3/4.12.3 Interlaboratory Comparison Program	
	76-77	46	Removed the BASES for 3/4.12.1 (Monitoring Program), 3/4.12.2 (Land Use Census) and 3/4.12.3 (Interlaboratory Comparison Program)	
	82	49	Removed the Administrative Control 6.9.1.7 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT	
	112	75	Removed Section 4.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM	
	158-170	127	Removed APPENDIX E Radiological Environmental Monitoring Program Sample Type, Location and Analysis <u>Reason</u>: The Controls for the Radiological Environmental Monitoring Program, Land Use Census and for the Interlaboratory Comparison Program was removed from the ODCM and added to the common Salem and Hope Creek Radiological Environmental Monitoring Program ODCM. The REMP ODCM is a new document that will be approved by a joint PORC from both Salem and Hope Creek. Having a joint PORC for the REMP will facilitate implementation of changes to the REMP.	
33.	28	12	Changed the Bolded Text <u>FROM</u>: ACTION 27 - With the number of channels OPERABLE less than	Technical B

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			required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided grab samples are analyzed for principal gamma emitters, I-131, and dissolved and entrained gases at the lower limits of detection required in ODCM CONTROL Table 4.11-1.B, and the ODCM Surveillance Requirement 4.11.1.1.2 is performed: a. At least once per **8** hours when the specific activity of the secondary coolant is greater than 0.01 microcuries/gram DOSE EQUIVALENT I-131, or b. At least once per 24 hours when the specific activity of the secondary coolant is less than or equal to 0.01 microcuries/gram DOSE EQUIVALENT I-131. TO: ACTION 27 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided grab samples are analyzed for principal gamma emitters, I-131, and dissolved and entrained gases at the lower limits of detection required in ODCM CONTROL Table 4.11-1.B, and the ODCM Surveillance Requirement 4.11.1.1.2 is performed: a. At least once per **12** hours when the specific activity of the secondary coolant is greater than 0.01 microcuries/gram DOSE EQUIVALENT I-131, or At least once per 24 hours when the specific activity of the secondary coolant is less than or equal to 0.01 microcuries/gram DOSE EQUIVALENT I-131. Reason: This definition change meets the requirements of NUREG 1301 ACTION 36 to collect samples and analyze compensatory samples within 12 hours.	
	28	17	Changed the Bolded Text FROM: ACTION 28 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided that: a. At least once per 8 hours, local monitor readouts for the affected channels are verified to be below their alarm setpoints, or b. With a Service Water System leak (inside containment) on the Containment Fan Coil Unit associated with the inoperable monitor either: 1. At least once per **8** hours, grab samples are to be collected and analyzed for principal gamma emitters, I-	

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Item No.	Rev. 28 Page No.	Rev. 29 Page No.	Description of Change	Type of Change
			131, and dissolved and entrained gases at the lower limits of detection specified in ODCM CONTROL Table 4.11-1.B, and the ODCM Surveillance Requirement 4.11.1.1.2 is performed, or 2. Isolate the release pathway. c. With no identified service water leakage (inside containment) on the Containment Fan Coil Unit associated with the inoperable monitor, at least once per 24 hours, collect grab samples and analyze for principal gamma emitters, I-131, and dissolved and entrained gases at the lower limits of detection specified in ODCM CONTROL Table 4.11-1.B, and the ODCM Surveillance Requirement 4.11.1.1.2 is performed. TO: ACTION 28 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided that: a. At least once per 8 hours, local monitor readouts for the affected channels are verified to be below their alarm setpoints, or b. With a Service Water System leak (inside containment) on the Containment Fan Coil Unit associated with the inoperable monitor either: 1. At least once per **12** hours, grab samples are to be collected and analyzed for principal gamma emitters, I-131, and dissolved and entrained gases at the lower limits of detection specified in ODCM CONTROL Table 4.11-1.B, and the ODCM Surveillance Requirement 4.11.1.1.2 is performed, or 2. Isolate the release pathway. c. With no identified service water leakage (inside containment) on the Containment Fan Coil Unit associated with the inoperable monitor, at least once per 24 hours, collect grab samples and analyze for principal gamma emitters, I-131, and dissolved and entrained gases at the lower limits of detection specified in ODCM CONTROL Table 4.11-1.B, and the ODCM Surveillance Requirement 4.11.1.1.2 is performed. Reason: This definition change meets the requirements of NUREG 1301 ACTION 37 to collect and analyze compensatory samples at least once per 12 hours.	

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<table>
<tr><th>Item No.</th><th>Rev. 28 Page No.</th><th>Rev. 29 Page No.</th><th>Description of Change</th><th>Type of Change</th></tr>
<tr><td></td><td>34</td><td>18</td><td>Changed the Bolded Text <u>FROM</u>:
ACTION 33 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided grab samples are taken at least once per 8 hours and these samples are analyzed for gaseous principal gamma emitters at the lower limits of detection required in ODCM CONTROL TABLE 4.11-2.A, B, or C within 24 hours. Otherwise, suspend release of radioactive effluents via this pathway.
<u>TO</u>:
ACTION 33 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided grab samples are taken at least once per 12 hours and these samples are analyzed for gaseous principal gamma emitters at the lower limits of detection required in ODCM CONTROL TABLE 4.11-2.A, B, or C within 24 hours. Otherwise, suspend release of radioactive effluents via this pathway.
<u>Reason</u>: This definition change meets the requirements of NUREG 1301 ACTION 47 to collect and analyze compensatory samples once per 12 hours.</td><td></td></tr>
<tr><td>34.</td><td>126</td><td>95</td><td>Updated Table 2-3: Controlling Locations, Pathways And Atmospheric Dispersion For Dose Calculations. The significant changes <u>WERE</u>:
a. Update X/Q and D/Q values as follows:
<table>
<tr><td>Location</td><td>Rev 28 X/Q</td><td>Rev 29 X/Q</td><td>Rev 28 D/Q</td><td>Rev 29 D/Q</td></tr>
<tr><td>Site Boundary</td><td>2.2E-06</td><td>No Change</td><td>N/A</td><td>6.36E-09</td></tr>
<tr><td>4.9 Miles W</td><td>5.4E-08</td><td>No Change</td><td>2.1E-10</td><td>1.32E-10</td></tr>
<tr><td>4.6 Miles SW</td><td>8.0E-08</td><td>1.03E-07</td><td>2.4E-10</td><td>2.88E-10</td></tr>
</table>
<u>Reason</u>: The Meteorological data has been updated due to a historical error previously identified (70031635). The error was that the original data in the HC UFSAR was TO and not FROM as normally reported. Therefore, the original data for 4.9 miles W was that data for the E direction. No changes were made previously because the E direction data was more conservative. The new data represents a five year (2011 – 2015) annual average X/Q and D/Q output from the NRC code XOQDOQ.</td><td>Technical C</td></tr>
</table>

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2.0 Hope Creek REC ODCM Revision 29

Item No.	(old) Rev. 28 page No.	(new) Rev. 29 page No.	Description of Change	Type of Change
1.	12	1	INTRODUCTION Removed the word “nuclear” from the title Hope Creek Nuclear Generating Station Offsite Dose Calculation Manual. Reason: The word “nuclear” is not used in the title.	Editorial
		2	Added the following statement “Revisions to the ODCM shall be made in accordance with the Technical Specifications Section 6.14.” Reason: This ensures that revisions to the HCGS ODCM meet the requirements of TS 6.14.	
2.	24, 29	11, 17	Liquid and Gaseous Radiation Monitoring Instrumentation Changed ACTION Statement for CONTROL 3.3.7.10 and CONTROL 3.3.7.11 from b. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 3.3.7.10-1 (Table 3.3.7.11-1 gaseous instrumentation). Exert best efforts to return the instrument to OPERABLE status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release report why the inoperability was not corrected in a timely manner. To b. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 3.3.7.10-1 (Table 3.3.7.11-1 gaseous instrumentation). c. Exert best efforts to return the instrument to OPERABLE status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release report why the inoperability was not corrected in a timely manner. Reason: This change removes confusion between performing the required ACTION in either Table 3.3.7.10-1 (liquid instrumentation) or Table 3.3.7.11-1 (gaseous instrumentation) and the requirement to report instrumentation that was out of service for more than 30 days should the minimum number of channels not met.	Editorial

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Item No.	(old) Rev. 28 page No.	(new) Rev. 29 page No.	Description of Change	Type of Change
3.	25 30	12 18	Updated Table 3.3.7.10-1 Radioactive Liquid Effluent Monitoring Instrumentation to add the instrument numbers. Updated Table 3.3.7.11-1 Radioactive Gaseous Effluent Monitoring Instrumentation to add the instrument numbers. Reason: Adopted similar format as reported in the Salem ODCM.	Editorial
4.	26	13	Added the following footnote to clarify Compensatory ACTIONS 110 and 111: IF an RMS monitor is inoperable solely as the result of the loss of Control Room alarm annunciation, THEN one of the following actions is acceptable to satisfy the ODCM action statement compensatory surveillance requirement: 1. TAKE Grab Samples and conduct radiometric analysis per the specific monitors ACTION statement, OR 2. TAKE local monitor readings at a frequency equal to or greater (more frequently) than the ACTION statement. Reason: Action 110 pertains to the monitor for the Turbine Building Circulating Water Dewatering Sump Discharge Line and Action 111 pertains to the monitor for the Cooling Tower Blowdown. Both monitors have local readout capability should Control Room annunciation be lost.	Editorial
5.	31	19	Added the following footnote to clarify Compensatory ACTIONS 123: IF an RMS monitor is inoperable solely as the result of the loss of Control Room alarm annunciation, THEN one of the following actions is acceptable to satisfy the ODCM action statement compensatory surveillance requirement: A. TAKE Grab Samples and conduct radiometric analysis per the specific monitors ACTION statement, OR B. TAKE local monitor readings at a frequency equal to or greater (more frequently) than the ACTION statement. Reason: Action 123 pertains to the noble gas monitors for FRVMS, SPVMS and NPVMS. These monitors have local readout capability should Control Room annunciation be lost.	Editorial

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Item No.	(old) Rev. 28 page No.	(new) Rev. 29 page No.	Description of Change	Type of Change
6.	35	23	Revised Table 4.11.1.1.1-1 Radioactive Liquid Waste Sampling and Analysis Program to remove the requirement to analyze one batch or grab per month for Dissolve and Entrained Gases (Gamma Emitters), Reason: Each sample that is collected is also analyzed for the dissolved and entrained gases at the required LLD of 1E-05 uCi/cc. Corrected a typo from Revision 27 where Fe-55 analysis with a required LLD of 1E-06 µCi/ml was inadvertently removed from the table.	Editorial
7.	35, 40	23, 29	Added a footnote to Table 4.11.1.1.1-1 Radioactive Liquid Waste Sampling and Analysis Program and to Table 4.11.2.1.2-1 Radioactive Gaseous Waste Sampling and Analysis Program (1) A statistically positive activity detected at or below the required LLD shall be considered a true value and shall be accounted for and reported in the Annual Radioactive Effluent Release Report. Reason: This footnote has been added to specify that any statistically significant result that is below or at the required LLD is considered as a "real" number and therefore must be accounted for in the effluent tracking program and reported in the Annual Radioactive Effluent Release Report.	Editorial
8.	36	24	Revised the LLD Equation Added reference Lloyd A. Currie for this equation change. Reason: This correct an error in the original LLD equation from NUREG 1302 that prevents the calculation of an LLD when background S_b is 0. The gamma spectroscopy uses the 2.71/T in the determination of LLD.	Editorial
9.	40	29	Revised Table 4.11.2.1.2-1 Radioactive Gaseous Waste Sampling and Analysis Program to: 1. Removed "(oxide) from H-3. Reason: tritiated water is a radioactive form of water where the usual protium atoms are replaced with tritium. In its pure form it may be called tritium oxide (T_2O or ^3H_2O) or super-heavy water. Diluted, tritiated water is mainly H_2O plus some ^3H_2O. The use of the word (oxide) Is meaningless for the analysis being performed. 2. Consolidated the second column of the table from Five "Continuous" Sampling Frequency to one.	Editorial

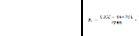
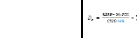
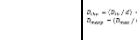
2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	(old) Rev. 28 page No.	(new) Rev. 29 page No.	Description of Change	Type of Change
			Reason: Simplified the table.	
10.	64	43	Revised BASES Section 3/4.11.1.1 Concentration first Paragraph from: This CONTROL is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to UNRESTRICTED AREAS will be less than the concentration levels specified in (pre 1994) 10 CFR Part 20, Appendix B, Table II, Column 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC and (2) the limits of 10 CFR Part 20.106(a) to the population. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2. TO: This CONTROL is provided to ensure that the summation of concentrations of radioactive materials released in liquid waste effluents to UNRESTRICTED AREAS will be less than the concentration levels specified in the pre-1994 (old) 10 CFR Part 20, Appendix B, Table II, Column 2. This CONTROL is achieved when the following equation is met after dilution: $\frac{Concentration_a}{MPC_a} + \frac{Concentration_b}{MPC_b} + \frac{Concentration_c}{MPC_c} + \cdots \leq 1$ The MPC Ratio Limit of 1 represents the Instantaneous Release Dose Limit of 500 mrem/yr (10 CFR Part 20.105). This limitation provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC and (2) the limits of 10 CFR Part 20.106(a) to the population. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	(old) Rev. 28 page No.	(new) Rev. 29 page No.	Description of Change	Type of Change
			Reason: These words were added to the BASES for clarification that it is the sum of the concentration/MPC ratios must be ≤1. The one represents the instantaneous release rate limit of 500 mrem/yr.	
11.	75 - 76	51 - 52	Added the Word "ANNUAL" to Administrative CONTROL 6.9.1.7 RADIOACTIVE EFFLUENT RELEASE REPORT. Additionally, added the acronym "ARERR" to replace the Annual Radioactive Effluent Release Report. Reason: This was for clarification because the subject report is referred as ARERR and not RERR.	Editorial
12.	75	51	Revised the reference to Regulatory Guide 1.21 from revision 1, 1974 to revision 2, 2009. Reason: Revision 2 of this Reg. Guide includes information on carbon 14 and provides improved data reporting requirements. Using this revision does not invoke any backfit rule. A UFSAR revision detailing this change is identified in CAP Order 70213104	Editorial
13.	79 - 83	55 - 57	Reordered the following Sections in Part II Calculational Methodologies FROM: 1.1 Radiation Monitoring Instrumentation and Controls 1.2 Liquid Effluent Monitor Setpoint Determination 1.2.1 Liquid Effluent Monitors 1.2.2 Conservative Default Values 1.3 Liquid Effluent Concentration Limits – 10 CFR 20 TO: 1.1 Liquid Effluent Concentration Limits – 10 CFR 20 1.2 Radiation Monitoring Instrumentation and Controls 1.3 Liquid Effluent Monitor Setpoint Determination 1.3.1 Liquid Effluent Monitors 1.3.2 Liquid Effluent Monitor Correction Factors 1.3.3 Conservative Default Values Reason: The order was changed, because meeting the Liquid Effluent Concentration Limits is the most critical step in determining that the tank may be released.	Editorial
14.	79, 83, 85	55, 58, 59	Revised the definition CTBD in the formulas 1.1, 1.5, 1.7, 1.8 FROM: Average Cooling-Tower Blowdown discharge rate during release period (gal/min). TO: Average Cooling-Tower Blowdown or other dilution source	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	(old) Rev. 28 page No.	(new) Rev. 29 page No.	Description of Change	Type of Change
			discharge rate during release period (gal/min). Reason: This will clarify that concentration limits and dose calculation for CST Dike releases to the Delaware River may be performed without cooling tower blowdown dilution water available.	
15.	NA	57	Added clarifying information when a setpoint change is required. That information is as follows: Procedural controls exist to verify the setpoint utilized is at or below what is required. Should the calculated setpoint be more conservative by more than 25%, then one of the following will be performed: d. Increase CTBD or Reduce RR until calculated setpoint is ≥ the default setpoint. e. Install new setpoint. f. Reprocess the tank. Reason: Current Chemistry practice is to make no changes to setpoints, which is contrary to the ODCM requirements. This clarification provides guidance on how to meet the ODCM requirements.	Editorial
16.	84	58	Revised Equation 1.5 to include RR – Release Rate (GPM). The formula changes is a follows:  To  Reason: This change makes the actual calculation being performed accurate. RR is a small fraction of CTBD and has minimal impact on the final value. The use of RR is used in equations 1.1, 1.3 and 1.4. This change also allows releases from the CST Dike without using any dilution water.	Editorial
17.	86	59	Revised Equations 1.9 and 1.10 as follows:  To  Reason: The use of 31d in the equation was misleading. One could assume that to solve the equation the “d” value (the number of days in the current calendar quarter at the end of the release) would be multiplied by 31. The value of 31 is the number of days that the dose is to be projected to.	Editorial
18.	94, 98	66 ,68	Replaced Table 2-4 with Table 2-4 through Table 2-8	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	(old) Rev. 28 page No.	(new) Rev. 29 page No.	Description of Change	Type of Change
			Reason: The original Table 2-4 was split into four separate tables by pathway (inhalation, cow milk, vegetation, meat, and ground plane). Table 2-7 (meat pathway) is a new table added with this revision.	
19.	94, 95	66	Revised both Section 2.5.1 and 2.5.2 to modify the formula definition for SFp SFp = Annual seasonal correction factor to account for fraction of the year that the applicable exposure pathway does not exist. 1. For milk and vegetation exposure pathways: A six month fresh vegetation and grazing season (May through Oct) = 0.5 2. For inhalation and ground plane exposure pathways: = 1.0 SF_p was changed to 1. Reason: The Effluent Tracking Software never applied a 0.5 reduction factor to calculated doses. Additionally, there is no practical methodology to implement the SF_p value based upon time frame.	Editorial
20.	94	66	Revised the following Paragraph: For evaluating the maximum exposed individual, the infant age group is controlling for the milk pathway. Only the controlling age group as identified in Table 2-3 need be evaluated for compliance with Control 3.11.2.3 To: For evaluating the maximum exposed individual, the infant age group is controlling for the milk pathway. Should the Effluent Tracking Software not be available, then only the controlling age group as identified in Table 2-3 need be evaluated for compliance with Control 3.11.2.3. Reason: This change was made, because the current software in place calculates dose to all age groups and all organs and selects the highest dose value.	Editorial
21.	95	66	Replaced the D/Q value of 2.87E-10 $1/m^2$ TO (See Table 2-3). Reason: Updating Meteorological data to one table in the ODCM prevents an error likely situation. In this manner, only one area of the ODCM needs to be updated when a change is made.	Editorial
22.	95	67	Changed 0.3 mrad to any organ of a Member of the Public.	Editorial

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Item No.	(old) Rev. 28 page No.	(new) Rev. 29 page No.	Description of Change	Type of Change
			To: 0.3 mrem to any organ of a Member of the Public. Reason: Typo	
23.	96	67	Revised Equation 2.13, 2.14 and 2.15 Reason: The use of 31d in the equation was misleading. One could assume that to solve the equation the "d" value (the number of days in the current calendar quarter at the end of the release) would be multiplied by 31. The value of 31 is the number of days that the dose is to be projected.	Editorial
24.	101	69	Deleted the following 5.0 HCGS EXPLOSIVE GAS MONITORING PROGRAM The Hope Creek Explosive Gas Monitoring program was moved within the Hope Creek Technical Specifications to section 6.8.4.d. This was performed in Technical Specification Amendment 91. Details of the Hope Creek Explosive Gas Monitoring program are maintained in station implementing procedures and are controlled by the 50.59 safety evaluation and procedure processes. Reason: Approved Technical Specification Amendment 91 (February 6, 1996) removed TS Section ¾.11.2.6, "Explosive Gas Mixture from TSs and relocates the Bases to the Hope Creek Updated Final Safety Analysis Report and the Surveillance Requirements to the applicable surveillance procedures. The Limiting Conditions for Operation were eliminated. The Amendment also established a new administrative control TS 6.8.4.d, which requires that combustible gas limits for the offgas system be maintained and surveillances requirements met. The Controls, Actions and surveillance requirements are maintained in OP-HC-103-104.	Editorial
25.	113-124	81-95	Divided Table 2-4 into the following tables: Table 2-4: Pathway Dose Factors – Atmospheric Releases $R_{(Io)}$, Inhalation Pathway Dose Factors Table 2-5: Pathway Dose Factors – Atmospheric Releases $R_{(Io)}$, Grass-Cow-Milk Pathway Dose Factors Table 2- 6: Pathway Dose Factors – Atmospheric Releases $R_{(Io)}$, Vegetation Pathway Dose Factors Table 2- 7: Pathway Dose Factors – Atmospheric Releases $R_{(Io)}$, Meat Pathway Dose Factors Table 2- 8: Pathway Dose Factors – Atmospheric Releases	Editorial

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Item No.	(old) Rev. 28 page No.	(new) Rev. 29 page No.	Description of Change	Type of Change
			$R_{(lo)}$, Ground Plane Pathway Dose Factors Reason: Each pathway is now in its own table	
26.	124	95	Added dose factors for Skin to Table 2-8	Editorial
27.	159	119	Appendix F Corrected a typo for the reference year for the old 10 CFR 20. Changed 1998 to 1988	Editorial
28.	12	1	Deleted reference to the Radiological Environmental Monitoring Program, Radiological Environmental Operating Report, Technical Specification 6.9.1.6 and specific sample locations for the radiological environmental monitoring program (REMP).	Technical A
	12	5	Revised the following Definition 1.10 Offsite Dose Calculation Manual (ODCM) FROM: The OFFSITE DOSE CALCULATION MANUAL (ODCM) shall contain the methodology and parameters used in the calculation of offsite doses due to radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring alarm/trip setpoints, and in the conduct of the environmental radiological monitoring program. The ODCM shall also contain (1) the Radioactive Effluent Controls and Radiological Environmental Monitoring Programs required by Technical Specification Section 6.8.4 and (2) descriptions of the information that should be included in the Annual Radiological Environmental Operating and the Radioactive Effluent Release Reports required by Technical Specification Sections 6.9.1.7 and 6.9.1.8, respectively. TO: The Hope Creek Generating Station OFFSITE DOSE CALCULATION MANUAL (ODCM) is separated into two separate documents. The first document, the Hope Creek Generating Station Radioactive Effluent Controls (REC) ODCM, shall contain the methodology and parameters used in the calculation of offsite doses due to radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring alarm/trip setpoints, The REC ODCM shall also contain (1) the Radioactive Effluent Controls Program required by Technical Specification Section 6.8.4.g and (2) descriptions of the information that should be included in the Annual Radioactive Effluent Release Reports required by Technical Specification Section 6.9.1.7.	

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	(old) Rev. 28 page No.	(new) Rev. 29 page No.	Description of Change	Type of Change
			The second document, the Salem and Hope Creek Generating Stations Common Radiological Environmental Monitoring Program (REMP) ODCM, shall contain the conduct of the environmental radiological monitoring program. The Common ODCM shall also contain (1) the Radiological Environmental Monitoring Program required by Technical Specification Section 6.8.4.h and (2) descriptions of the information that should be included in the Annual Radiological Environmental Operating Report required by Technical Specification Section 6.9.1.6.	
	49 - 59	37	Deleted 3/4.12.1 Radiological Environmental Monitoring Program.	
	60	38	Deleted 3/4.12.2 Land Use Census.	
	61	39	Deleted 3/4.12.3 Interlaboratory Comparison Program.	
	69 - 70	47	Deleted the BASES Sections 3/4.12 Radiological Environmental Monitoring, 3/4.12.1 Monitoring Program, 3/4.12.1 Land Use Census and 3/4.12.3 Interlaboratory Comparison Program.	
	74	51	Deleted Administrative CONTROL 6.9.1.6 Annual Radiological Environmental Operating Report.	
	76, 95, 98	52, 67, 68, 80, 115	Revised (CONTROL 3.12.2) To (Salem and Hope Creek Generating Stations Common Radiological Environmental Monitoring Program ODCM CONTROL 3.12.2).	
	100	69	Section 4.0 Radiological Environmental Monitoring Program has been removed.	
	145-157	116-117	Appendix E: Radiological Environmental Monitoring Program Sample Type, Location, and Analysis relocated to Revision 0 of the Salem and Hope Creek Generating Stations Common Radiological Environmental Monitoring Program ODCM. <u>Reason:</u> The Controls for the Radiological Environmental Monitoring Program, Land Use Census and for the Interlaboratory Comparison Program were removed from the ODCM and added to the common Salem and Hope Creek Radiological Environmental Monitoring Program ODCM. The REMP ODCM is a new document that will be approved by a joint PORC from both Salem and Hope Creek. Having a joint PORC for the REMP will facilitate implementation of changes to the REMP.	

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	(old) Rev. 28 page No.	(new) Rev. 29 page No.	Description of Change	Type of Change
29.	35	23	Revised Table 4.11.1.1.1-1 to add Condensate Storage Tank Spill Retention Dike / Turbine Building Roof Catch Basins via the CST Spill Retention Dike as a new batch release source. Added Ground Water Remediation as a continuous release source.	Technical B
	102	70	Revise FIGURE 1-1: LIQUID RADWASTE TREATMENT AND MONITORING SYSTEM to add the discharge pathway through the NPDES storm water drainage system outfall DSN463A for the release sources CST Spill Retention Dike/TB roof Catch containments and Ground Water Well Mitigation. Reason: These two new release sources are added to allow releases through the normal stormwater runoff discharge system to the River.	
30.	126-131	96-102	Extensive revision to Appendix A: Evaluation of Default MPC Value for Liquid Effluents. This is the detailed section in the ODCM that justifies using default liquid radiation monitor setpoints as described in Items 15, 16 and 26 above. Reason: The ODCM requires a periodic review of Appendix A to determine that the calculated MPC_e value used for setpoint determination remain conservative.	Technical C
	104	72	Updated Table 1-1 Parameters For Liquid Alarm Setpoint Determination for the following Parameters: Parameter / Revision 28 / Revision 29 MPC_e / 4.09E-05 / 3.40E-05 Default Rad Waste Discharges and Cooling Tower Blowdown Setpoints RE4861 / 5.58E-04 / 4.63E-04 RE8817 / 8.18E-06 / 6.80E-06 Default Condensate Storage Tank Releases Parameter / Revision 28 / Revision 29 RE4861 / 7.55E-05 / 6.28E-05 RE8817 / 8.18E-06 / 6.80E-06 Reason: A detailed discussion regarding setpoints is in Appendix A. The new setpoints are lower based upon a review of the 2016 - 2018 liquid effluent releases. This periodic review is required by the ODCM. The new setpoints are more conservative	
31.	112	80	Updated Table 2-3: Controlling Locations, Pathways and	Technical D

2021 Change Summary – Salem and Hope Creek ODCMs

<table>
<tr><th>Item No.</th><th>(old) Rev. 28 page No.</th><th>(new) Rev. 29 page No.</th><th>Description of Change</th><th>Type of Change</th></tr>
<tr><td></td><td></td><td></td><td>
Atmospheric Dispersion For Dose Calculations. The significant changes were:
e. Removed the dose pathway Ground plane from Site Boundary for ODCM CONTROL 3.11.2.1b Dose Rate Limits
f. Added Location Site Boundary to ODCM CONTROL 3.11.2.3 Dose with the dose pathways of Ground plane and Inhalation
Reason: Per dose rate equation 2.6 in section 2.3.2 Site Boundary Dose Rate – Radioiodine and Particulates the dose parameter is to the child inhalation pathway. The ground plane was added to the site boundary for the calculation of dose.
g. Removed the dose pathway location Residence/Garden/Beef at 4.6 miles SW Sector. Added the pathways Meat and Vegetation to the Residence/Dairy at 4.9 miles W sector to remain conservative for the dose from C-14.
h. Added footnote 3 to infant “When dose from C-14 is determined, then Child will become the Controlling Age Group.”
3.
Reason: This receptor site has gone out of business and therefore dose no longer needs to be calculated there. Adding the pathways Meat and Vegetation to the milk farm will ensure that those pathways are covered.
i. Update X/Q and D/Q values as follows
<table>
<tr><td>Location</td><td>Rev 28 X/Q</td><td>Rev 29 X/Q</td><td>Rev 28 D/Q</td><td>Rev 29 D/Q</td></tr>
<tr><td>Site Boundary</td><td>2.14E-06</td><td>No Change</td><td>N/A</td><td>1.44E-08</td></tr>
<tr><td>4.9 Miles W</td><td>7.20E-08</td><td>No Change</td><td>2.87E-10</td><td>1.32E-10</td></tr>
</table>
Reason: The Meteorological data has been updated due to a historical error previously identified (70031635). The error was that the original data in the HC UFSAR was to and not from as normally reported. Therefore, the original data for 4.9 miles W was that data for the E direction. No changes were made previously because the E direction data was more conservative. The new data represents a five year (2011 – 2015) annual average X/Q and D/Q output from the NRC code XOQDOQ.
</td><td></td></tr>
</table>

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Item No.	(old) Rev. 28 page No.	(new) Rev. 29 page No.	Description of Change	Type of Change
32.	40	32-33	Added the TLOV to Table 4.11.2.1.3-1 Radioactive Gaseous Waste Sampling and Analysis Program Reason: The TLOV is a gaseous release source where the activity released is determined by calculation.	Technical E
	NA	125-128	Added new Appendix G: APPENDIX G MISCELANEOUS TRITIUM AND NOBLE GAS RELEASES – CALCULATIONAL METHODOLOGY Reason: This section explains the detailed analyses performed for the miscellaneous gaseous release sources turbine lube oil system.	

3.0 Salem and Hope Creek ODCM for the Common REMP Revision 0

The PSEG Common Radiological Environmental Monitoring Program Offsite Dose Calculation Manual (REMP ODCM) for Salem Generating Station (SGS) and Hope Creek Generating Station (HCGS) is a supporting document to the Salem and Hope Creek Technical Specifications.

Historically Salem and Hope Creek had individual ODCMs that included site-specific Radioactive Effluent Controls (REC) and Radiological Environmental Monitoring Program (REMP) Controls. Both stations sit on the same site and share a common REMP that was duplicated in its entirety in each stations' ODCM. Any revision to the REMP program needed to be revised in both stations' ODCM, and they needed to be implemented simultaneously.

A substantial document change and revision occurred In Salem and Hope Creek Generating Stations' ODCM Revision 29. To improve efficiency of ODCM revisions, the ODCM collection is now broken down into three manuals:

- Salem Generating Station's Radioactive Effluent Controls (REC) ODCM
- Hope Creek Generating Station's Radioactive Effluent Controls (REC) ODCM
- PSEG Nuclear's Common Radiological Environmental Monitoring Program (REMP) ODCM.

This document (REMP ODCM) contains controls, surveillances, and the bases found in ODCM section 3/4.12 (RADIOLOGICAL ENVIRONMENTAL MONITORING) and the applicable Parts, Sections, and Appendices of the ODCM supporting the REMP. This document conforms to the requirements of 10CFR20, 10CFR72.44 and 40CFR190 as well as the guidance of Regulatory Guides 4.1, 4.13, 4.15, and NUREGs 1301 & 1302, and includes the items required by Tech Spec or Generic Letter 89-01, as applicable.

The following revision summary does not detail the omission of sections 3/4.3 (INSTRUMENTATION) and 3/4.11 (RADIOACTIVE EFFLUENTS) nor their applicable Bases, Parts, Sections, and Appendices of the ODCM supporting the REC program, which remain in the individual stations' REC ODCM.

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	(old) Rev. 28 page No.		(new) Rev. 0 page No.	Description of Change(s)	Type of Change
	SA	HC			
1	N/A	N/A	1	Cover page: New Title indicating PSEG Nuclear Common REMP ODCM Justification: To improve efficiency of ODCM revisions, the ODCM collection is now broken down into three manuals (Salem REC, Hope Creek REC, and ***PSEG Nuclear Common REMP***)	Editorial
2	14	12	3 & 4	Introduction: added Common REMP and re-worded specific to the REMP Program. Provides Clarification between the REC and REMP programs, and where to find REC program details. Justification: To improve efficiency of ODCM revisions, the ODCM collection is now broken down into three manuals (Salem REC, Hope Creek REC, and ***PSEG Nuclear Common REMP***)	Editorial
3	17 - 20	15 - 18	7 - 12	Definitions: Added the following definitions • a priori • Analysis • APV • AREOR • ARERR • Deviation • Ground Level Release • Lower Limit of Detection (LLD) • Minimum Detectable Concentration / Activity (MDC / MDA) • REC • REMP • Sample Justification: Document enhancement relative to the REMP.	Editorial

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Item No.	(old) Rev. 28 page No.		(new) Rev. 0 page No.	Description of Change(s)	Type of Change
	SA	HC			
4	17 - 20	15 - 18	7 - 12	Definitions: Removed the following definitions • Channel Calibration • Channel Check • Channel Functional Test • Dose Equivalent Iodine-131 • Off-Gas RadWaste Treatment *(HC only)* • Operational Mode *(SA only)* • Purge / Purging • Source Check • Ventilation Exhaust Treatment *(SA only)* • Venting *(SA only)* • Waste Gas Holdup *(SA only)* Justification: Document enhancement; these terms were specific to the REC programs and are not relevant to the Common REMP. These terms remain in the individual stations' REC ODCM.	Editorial
5	21	20	13	Removed Operational Conditions/Modes Tables Table 1.1 Operability Modes *(SA Only)* Table 1.2 Operability Conditions *(HC Only)* Justification: Document enhancement; these tables were specific to the REC programs and are not relevant to the Common REMP. These tables remain in the individual stations' REC ODCM.	Editorial

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Item No.	(old) Rev. 28 page No.		(new) Rev. 0 page No.	Description of Change(s)	Type of Change
	SA	HC			
6	53	51	18	Table 3.12-1 Radiological Monitoring Program: Section 1. Direct Radiation (TLD's) was reduced from 58 to 57 Justification: Reflecting the actual number of program TLDs. Additionally, guidance was provided regarding the regulatory program requirement from NUREG 1301 and 1302 pertaining to the number of TLDs, and relief due to geographic limitations.	Technical
6	53	51	18	Table 3.12-1 Radiological Monitoring Program: Section 1. Direct Radiation (TLD's) was reduced from 58 to 57 Justification: Reflecting the actual number of program TLDs. Additionally, guidance was provided regarding the regulatory program requirement from NUREG 1301 and 1302 pertaining to the number of TLDs, and relief due to geographic limitations.	Technical
7	54	52	19	Table 3.12-1 Radiological Monitoring Program: Section 2. Airborne (particulate and Iodine) was reformatted Justification: Document enhancement to reduce ambiguity within the table.	Editorial
8	56	54	21	Table 3.12-1 Radiological Monitoring Program: Section 4. Ingestion (a. Milk) was reformatted. Justification: Document enhancement to reduce ambiguity within the table.	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	(old) Rev. 28 page No.		(new) Rev. 0 page No.	Description of Change(s)	Type of Change
	SA	HC			
9	56	54	21	Table 3.12-1 Radiological Monitoring Program: Section 4. Ingestion (c. Food products) was reformatted. Justification: Document enhancement to reduce ambiguity within the table.	Editorial
10	58	55	23	Table 3.12-1 Radiological Monitoring Program: Table Notation #2 Replaced ANSI 545 with ANSI N13.37 Justification: This is the new standard as endorsed by the NRC under Regulatory Guide 4.13 Rec 2 (June 2019).	Editorial
11	58	55	23	Table 3.12-1 Radiological Monitoring Program: Table Notation #2 Replaced ANSI 545 with ANSI N13.37 and corrects the number of program TLDs from 58 to 57. Justification: This is the new standard as endorsed by the NRC under Regulatory Guide 4.13 Rec 2 (June 2019). The change in quantity of TLDs reflects the actual number of program TLDs. Additionally, guidance was provided regarding the regulatory program requirement from NUREG 1301 and 1302 pertaining to the minimum required number of TLDs (40), and relief due to geographic limitations.	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	(old) Rev. 28 page No.		(new) Rev. 0 page No.	Description of Change(s)	Type of Change
	SA	HC			
12	59	56	24	Table 3.12-1 Radiological Monitoring Program: Added Table Notation #12 *The PSEG-operated gardens may be Management Audit samples due to the fact that they are not required while milk sampling is being performed. However, if there is an inadequate milk sampling program, then these locations are required by the REMP.* Justification: Table previously lacked detail regarding the REMP garden program. The addition of the note provides details on PSEG-operated REMP Garden Requirements (when, where, and how).	Technical
13	60	57	25	Table 3.12-2 ENVIRONMENTAL LOWER LIMITS OF DETECTION (LLD), Table Note #1 revised to include “or downstream” Justification: Table previously lacked detail regarding the possibility of downstream use for municipal or private drinking water.	Technical
14	60	57	27	Table 4.12-2 REPORTING LEVELS, Table Note #3 revised to include “or downstream” Justification: Table previously lacked detail regarding the possibility of downstream use for municipal or private drinking water.	Technical

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	(old) Rev. 28 page No.		(new) Rev. 0 page No.	Description of Change(s)	Type of Change
	SA	HC			
15	60	57	27	Table 4.12-2 REPORTING LEVELS, Table Note #4 revised to include For low count rates, a value of $[\frac{2.71}{t}]$ may be added to the numerator, where **t** = count time (sec). Justification: There is a statistical basis for adding the term to the numerator for backgrounds below 70 cpm. As the background increases above 70 cpm, then the "2.71/T" term has a lessening impact on the LLD/MDA calculation.	Technical
16	64	60	28	3.12.2 LAND USE CENSUS Reworded to include Salem Units 1 & 2 AND Hope Creek. Technical Specification sections for both stations were included in this section (i.e. "CONTROL 6.9.1.8 & 6.9.1.7 for Salem and Hope Creek respectively") Justification: To improve efficiency of ODCM revisions, the ODCM collection is now broken down into three manuals (Salem REC, Hope Creek REC, and PSEG Nuclear Common REMP) Deleted reference to elevated releases in accordance with Reg Guide 1.111.	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	(old) Rev. 28 page No.		(new) Rev. 0 page No.	Description of Change(s)	Type of Change
	SA	HC			
17	64	60	28	3.12.2 LAND USE CENSUS Deleted reference to elevated releases in accordance with Reg Guide 1.111. Justification: Salem and Hope Creek do not have elevated releases as defined in Reg Guide 1.111, which are both considered to be Ground - Level Releases by this definition due to insufficient height and vertical exit velocity. Ground Level Releases as taken from Regulatory Guide 1.111, “where effluents released from points less than the height of adjacent solid structures; or from vents or other points at or above the level of adjacent solid structures, but that the effluent plume vertical exit velocity is less than five times the horizontal wind speed at the height of release”	Editorial
18	64	60	28	3.12.2 LAND USE CENSUS Corrected reference from 4.11.2.3 to 3.11.2.3. Justification: The Surveillance (4.) was referenced instead of the Control (3.)	Editorial
19	65	61	29	3.12.3 INTERLABORATORY COMPARISON PROGRAM Deleted “The provisions of CONTROL 3.0.3 are not applicable” Justification: Document enhancement; these terms were specific to the REC programs and are not relevant to the Common REMP. Controls 3.0.3 pertain to Operational Conditions and Modal Action Requirements, which remain in the individual stations’ REC ODCM.	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	(old) Rev. 28 page No.		(new) Rev. 0 page No.	Description of Change(s)	Type of Change
	SA	HC			
20	65	61	29	3/4.12.3 INTERLABORATORY COMPARISON Reworded to include Salem Units 1 & 2 AND Hope Creek. Tech Spec references for both stations were included in this section (i.e. "CONTROL 6.9.1.7 & 6.9.1.6 for Salem and Hope Creek respectively") Justification: To improve efficiency of ODCM revisions, the ODCM collection is now broken down into three manuals (Salem REC, Hope Creek REC, and **PSEG Nuclear Common REMP**)	Editorial
21	80	73	35	Figure 5.1-1 AREA PLOT OF SITE Created an updated site plot with sector lines based on Google Earth images. Justification: Enhancement – No changes made to site.	Editorial
22	82	74	37	6.0 ADMINISTRATIVE CONTROLS Reworded to include references for Salem Units 1 & 2 AND Hope Creek. Tech Spec references for both stations were included in this section (i.e. "…Technical Specifications 6.9.1.7 & 6.9.1.6 for Salem 1&2 and Hope Creek respectively") Justification: To improve efficiency of ODCM revisions, the ODCM collection is now broken down into three manuals (Salem REC, Hope Creek REC, and **PSEG Nuclear Common REMP**)	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	(old) Rev. 28 page No.		(new) Rev. 0 page No.	Description of Change(s)	Type of Change
	SA	HC			
23	159-160	146-147	51-52	Appendix E: REMP SAMPLE TYPE, LOCATION AND ANALYSIS Reformatted the page structure and table to make it read easier. Justification: Document enhancement. No instruction, methodology, or data was altered.	Editorial
24	160	147	52	Appendix E: REMP SAMPLE TYPE, LOCATION AND ANALYSIS Added a radius code X and Q. Justification: Performed a REMP sample location remap to get all points on a common geodesic model. In doing so, some of the locations in Table E-1 were renamed. At this point the points on the site boundary are now being designated with an X and special interest with a Q.	Editorial
25	160	147	53	Appendix E: REMP SAMPLE TYPE, LOCATION AND ANALYSIS Reworded Sampling Locations to distinguish between Management Audit locations and REMP samples. Justification: Prior revisions had Management Audit samples in the ODCM. This revision removes the Management Audit samples and puts them in REMP implementation EN-AA-170-1000.	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	(old) Rev. 28 page No.		(new) Rev. 0 page No.	Description of Change(s)	Type of Change
	SA	HC			
26	N/A	N/A	54-56	Appendix E: REMP SAMPLE TYPE, LOCATION AND ANALYSIS Added discussion on REMP Sample Rationale. Justification: Prior revisions did not have a section that discussed the rationale / philosophy for program deviations from the Reg Guides/NUREGS, or why we shaped our program in a certain way. This section relieves us of the ambiguous and arbitrary. For instance, it previously had been left to personal knowledge to disposition why PSEG did not collect certain samples (i.e. why sectors 9 & 13 do not have TLDs, or how we cope with not having a reliable milk supply, or what broad leaf vegetation we should grow).	Editorial
27	161-166	148-153	57-61	Table E-1: REMP SAMPLE LOCATIONS Reformatted Table to make it read easier. Several location GPS coordinates were updated as a result of the REMP location remapping effort to get all locations on the same geodesic model. As a result of the remapping, several sample locations changed name to correspond with the Radius or sector relative to the site. A table was provided to LTS to update their locations. Management Audit sample locations (non-REMP) were removed from the table. Justification: Document enhancement; no locations were actually moved, just the names to correspond to their actual locations. A table is included so that legacy data is not lost.	Editorial

2021 Change Summary – Salem and Hope Creek ODCMs

Item No.	(old) Rev. 28 page No.		(new) Rev. 0 page No.	Description of Change(s)	Type of Change
	SA	HC			
28	167	154	62	Table E-2: REMP SAMPLE COLLECTIONS AND ANALYSIS Reformatted Table to make it read easier. Justification: Document enhancement	Editorial
29	N/A	N/A	63	Added Table E-3: REMP SAMPLE LOCATION NAME CHANGES Justification: For ODCM Rev 29 all REMP sample locations were re-mapped. As a result, some locations were re-named to maintain consistency with respect to the sector and radius they are in. This table is provided as a historical cross reverence when comparing prior data.	Editorial
29	168-170	155-157	64-66	Figures E-1, E-2, and E-3 REMP LOCATION MAPS Justification: Updated Maps to reflect Table E-1 with new location names and updated images with sector grids on Google Earth.	Editorial