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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-N23-0035
April 27, 2023

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: 2022 Annual Radioactive Effluent Release Report (ARERR)

As required by 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, LLC, hereby transmits the combined 2022 Annual Radioactive Effluent Release Report (Enclosure), which contains 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, 2022 to December 31, 2022.

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,

Jason Jennings
Director, Site Regulatory Compliance
PSEG Nuclear LLC

Enclosure: 2022 Annual Radioactive Effluent Release Report for Salem and Hope Creek Generating Stations

cc: Administrator - Region I - USNRC
Project Manager – USNRC – Salem/Hope Creek
Jacob Dolecki, Salem Senior Resident Inspector - USNRC
Jiger Patel, Hope Creek Senior Resident Inspector - USNRC
Storm Veunephachan, NRC Inspector - 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-N23-0035

Enclosure

PSEG Nuclear LLC

Salem and Hope Creek Generating Stations

2022 Annual Radioactive Effluent Release Report

(Total Pages 122)

PSEG Nuclear LLC

Salem & Hope Creek Generating Stations

Annual Radioactive Effluent Release Report

2022

Document Number: SGS-71 / HCGS-45

Unit 1 DOCKET NO 50-272 OPERATING LICENSE NO DPR-070	Unit 2 DOCKET NO 50-311 OPERATING LICENSE NO DPR-075	Unit 1 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 80132345

Opr.		
0011	Stephen Gattuso, Salem Chemistry Manager	04/20/2023 Date
0012	Joseph Milo, Hope Creek Chemistry Manager	04/19/2023 Date
0013	William Gropp, Salem Radiation Protection Manager	04/19/2023 Date
0014	Davis Mariaz, Hope Creek Radiation Protection Manager	04/20/2023 Date
0015	William Muffley, Salem Senior Director of Operations	04/19/2023 Date
0016	Joshua Moss, Hope Creek Senior Director of Operations	04/20/2023 Date
0017	Richard DeSanctis, Salem Plant Manager	04/20/2023 Date
0018	Thomas Agster, Hope Creek Plant Manager	04/19/2023 Date

Report Prepared By: 

Rick M. Heathwaite (REMP/REC Program Manager)

1.0 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 2022 were calculated to be very small compared to the limits required by regulation and compared to other sources of radiation dose and pose no health hazard.

In 2022 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 4.90E-01 mrem, to the Bone. This annual dose represents 1.09 percent of the 10 CFR 50, Appendix I guideline of 45 mrem to the Maximum Organ from three Units.

Salem solid radioactive waste shipped offsite for disposal included 1.68E+02 Curies and 3.62E+02 m^3, shipped in 13 shipments. Hope Creek solid radioactive waste shipped offsite for disposal included 2.90E+04 Curies and 3.57E+01 m^3, shipped in 12 shipments.

In addition to monitoring radioactive effluents, Salem & Hope Creek Generating Stations have a Radiological Environmental Monitoring Program (REMP) that monitors for buildup of radioactivity in the offsite environment. Data from the REMP is published in the Annual Radiological Environmental Operating Report (AREOR).

1.1 Summary of Conclusions:

During 2022 all solid, liquid, and gaseous radioactive effluents from Salem & Hope Creek Generating Stations were below regulatory limits. For individual effluent streams, the quarterly limit most closely approached was the Gaseous Effluent Maximum Organ Dose for the third quarter for Hope Creek Unit 1 at 0.70 percent (Table 3, Hope Creek Generating Station Unit 1 Dose Summary, 2022). The majority of this dose was due to the 4.02E+00 Ci of carbon-14 released from the unit in the third quarter (Table 14, Gaseous Effluents Summation of All Releases (HCGS Unit 1).

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 5.93E-03 mrem. The doses from the gaseous and liquid radioactive effluents released from SGS Units 1 and Unit 2 and HCGS Unit 1 in 2022 resulted in a calculated total body and an organ dose of 1.36E-01 mrem and 5.35E-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 1.42E-01 mrem, 1.36E-01 mrem, and 5.35E-01 mrem, respectively. The max organ dose represented 2.14 percent of the 25 mrem limit. The results of these analyses are in Table 5, Total Annual Offsite-Dose Comparison to 40 CFR 190 Regulatory Limits for SGS/HCGS, 2022.

Maximum calculated TEDE dose from ISFSI direct shine and gaseous effluents to Members of the Public working on site was calculated at 1.79E+00 mrem for Sewage Treatment Plant Operators. The Maximum TEDE dose to the Wind Port workers was esitmated at 1.10E+00 mrem. These analyses are in Table 6, Summary of TEDE doses to Members of the Public Due to Activities Inside the Site Boundary, 2022.

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2.0 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. amsl: above mean seal level
3. 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.
4. AREOR: Annual Radiological Environmental Operating Report
5. ARERR: Annual Radioactive Effluent Release Report
6. 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.
7. 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.
8. bgs: below ground surface
9. BWR: Boiling Water Reactor
10. CDE: The committed effective dose equivalent (for internal exposures).
11. cfm: cubic feet per minute
12. 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.
13. 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.
14. Counting Error: An estimate of the two-sigma uncertainty associated with the sample results based on respective count times.
15. 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.
16. Curie (Ci): A measure of radioactivity; equal to 3.7×10^{10} disintegrations per second, or 2.22×10^{12} disintegrations per minute.
17. Direct Radiation Monitoring: The measurement of radiation dose at various distances from the plant is assessed using thermoluminescent dosimeters (TLDs).
18. Grab Sample: A single discrete sample drawn at one point in time.
19. Indicator: A sampling location that is likely to be affected by plant effluents due to its proximity and/or direction from the plant.
20. Ingestion Pathway: The ingestion pathway includes saltwater fish, saltwater invertebrates, cow milk, garden produce, and meat
21. ISFSI: Independent Spent Fuel Storage Installation
22. JFD: Joint Frequency Distribution

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

2.2 Comparison to Regulatory Limits

During 2022 all solid, liquid, and gaseous radioactive effluents from Salem & Hope Creek Generating Stations were below regulatory limits, as summarized in Table 1, Table 2, Table 3, Table 4, and Table 5.

Table 1, Salem Generating Station Unit 1 Dose Summary, 2022[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]	2.78E-03	2.60E-03	3.74E-03	3.67E-03	1.28E-02
	% Of Limit	0.185	0.174	0.249	0.244	0.426
	Limit	**5 mrem**	**5 mrem**	**5 mrem**	**5 mrem**	**10 mrem**
	Maximum Organ Dose[3]	6.75E-03	3.64E-03	3.98E-03	3.72E-03	1.81E-02
	% Of Limit	0.135	0.073	0.080	0.074	0.181
Gaseous Effluents						
	Limit	**5 mrad**	**5 mrad**	**5 mrad**	**5 mrad**	**10 mrad**
	Gamma Air Dose[4]	1.81E-05	8.09E-06	7.33E-06	1.28E-05	4.63E-05
	% Of Limit	0.0004	0.0002	0.0001	0.0003	0.0005
	Limit	**10 mrad**	**10 mrad**	**10 mrad**	**10 mrad**	**20 mrad**
	Beta Air Dose[5]	6.46E-06	5.88E-06	3.23E-06	6.29E-06	2.19E-05
	% Of Limit	0.0001	0.0001	0.0000	0.0001	0.0001
	Limit	**2.5 mrem**	**2.5 mrem**	**2.5 mrem**	**2.5 mrem**	**5 mrem**
	NG Total Body Dose[6]	1.72E-05	7.60E-06	6.94E-06	1.20E-05	4.38E-05
	% Of Limit	0.0007	0.0003	0.0003	0.0005	0.0009
	Limit	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**15 mrem**
	NG Skin Dose[7]	2.52E-05	1.24E-05	1.03E-05	1.81E-05	6.60E-05
	% Of Limit	0.0003	0.0002	0.0001	0.0002	0.0004
	Limit	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**15 mrem**
	Maximum Organ Dose[8]	3.26E-02	3.67E-02	3.56E-02	3.00E-02	1.35E-01
	% Of Limit	0.435	0.489	0.474	0.400	0.899

[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, GI-LIi
[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, Bone

Table 2, Salem Generating Station Unit 2 Dose Summary, 2022[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]	2.76E-03	3.04E-03	6.78E-04	2.35E-03	8.43E-03
	% Of Limit	0.184	0.202	0.045	0.156	0.281
	Limit	**5 mrem**	**5 mrem**	**5 mrem**	**5 mrem**	**10 mrem**
	Maximum Organ Dose[3]	9.16E-03	6.47E-03	1.24E-03	7.75E-03	2.46E-02
	% Of Limit	0.183	0.129	0.025	0.155	0.246
Gaseous Effluents						
	Limit	**5 mrad**	**5 mrad**	**5 mrad**	**5 mrad**	**10 mrad**
	Gamma Air Dose[4]	1.15E-05	1.29E-05	1.37E-05	2.66E-05	6.47E-05
	% Of Limit	0.0002	0.0003	0.0003	0.0005	0.0006
	Limit	**10 mrad**	**10 mrad**	**10 mrad**	**10 mrad**	**20 mrad**
	Beta Air Dose[5]	4.99E-06	6.28E-06	5.88E-06	1.53E-05	3.24E-05
	% Of Limit	4.99E-05	6.28E-05	5.88E-05	1.53E-04	1.62E-04
	Limit	**2.5 mrem**	**2.5 mrem**	**2.5 mrem**	**2.5 mrem**	**5 mrem**
	NG Total Body Dose[6]	0.0000	0.0000	0.0000	0.0000	0.0001
	% Of Limit	4.37E-04	4.87E-04	5.18E-04	1.00E-03	1.22E-03
	Limit	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**15 mrem**
	NG Skin Dose[7]	1.62E-05	1.83E-05	1.92E-05	3.89E-05	9.26E-05
	% Of Limit	0.0002	0.0002	0.0002	0.0005	0.0006
	Limit	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**15 mrem**
	Maximum Organ Dose[8]	3.94E-02	3.71E-02	3.74E-02	3.61E-02	1.50E-01
	% Of Limit	0.525	0.494	0.498	0.482	1.000

[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, GI-Lli
[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, Bone

Table 3, Hope Creek Generating Station Unit 1 Dose Summary, 2022[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]	2.31E-04	7.41E-05	1.87E-04	5.88E-04	1.07E-03
	% Of Limit	0.015	0.005	0.012	0.039	0.036
	Limit	**5 mrem**	**5 mrem**	**5 mrem**	**5 mrem**	**10 mrem**
	Maximum Organ Dose[3]	1.43E-03	2.82E-04	3.54E-04	1.14E-03	3.20E-03
	% Of Limit	0.029	0.006	0.007	0.023	0.032
Gaseous Effluents						
	Limit	**5 mrad**	**5 mrad**	**5 mrad**	**5 mrad**	**10 mrad**
	Gamma Air Dose[4]	1.85E-06	0.00E+00	0.00E+00	0.00E+00	1.85E-06
	% Of Limit	0.0000	0.0000	0.0000	0.0000	0.0000
	Limit	**10 mrad**	**10 mrad**	**10 mrad**	**10 mrad**	**20 mrad**
	Beta Air Dose[5]	2.37E-06	0.00E+00	0.00E+00	0.00E+00	2.37E-06
	% Of Limit	0.0000	0.0000	0.0000	0.0000	0.0000
	Limit	**2.5 mrem**	**2.5 mrem**	**2.5 mrem**	**2.5 mrem**	**5 mrem**
	NG Total Body Dose[6]	1.75E-06	0.00E+00	0.00E+00	0.00E+00	1.75E-06
	% Of Limit	0.0001	0.0000	0.0000	0.0000	0.0000
	Limit	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**15 mrem**
	NG Skin Dose[7]	3.83E-06	0.00E+00	0.00E+00	0.00E+00	3.83E-06
	% Of Limit	0.0001	0.0000	0.0000	0.0000	0.0000
	Limit	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**15 mrem**
	Maximum Organ Dose[8]	5.21E-02	5.08E-02	5.25E-02	5.00E-02	2.05E-01
	% Of Limit	0.695	0.678	0.700	0.667	1.370

[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, GI-Lli
[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, Bone

Table 4, Salem & Hope Creek Generating Stations Site Dose Summary, 2022[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	5.77E-03	5.71E-03	4.61E-03	6.60E-03	2.23E-02
	% Of Limit	0.128	0.127	0.102	0.147	0.248
	Limit	**15 mrem**	**15 mrem**	**15 mrem**	**15 mrem**	**30 mrem**
	Maximum Organ Dose	1.73E-02	1.04E-02	5.57E-03	1.26E-02	4.59E-02
	% Of Limit	0.116	0.069	0.037	0.084	0.153
Gaseous Effluents						
	Limit	**15 mrad**	**15 mrad**	**15 mrad**	**15 mrad**	**30 mrad**
	Gamma Air Dose	3.15E-05	2.10E-05	2.10E-05	3.94E-05	1.13E-04
	% Of Limit	0.0002	0.0001	0.0001	0.0003	0.0004
	Limit	**30 mrad**	**30 mrad**	**30 mrad**	**30 mrad**	**60 mrad**
	Beta Air Dose	1.38E-05	1.22E-05	9.12E-06	2.15E-05	5.66E-05
	% Of Limit	0.0001	0.0000	0.0000	0.0001	0.0001
	Limit	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**7.5 mrem**	**15 mrem**
	NG Total Body Dose	2.99E-05	1.98E-05	1.99E-05	3.71E-05	1.07E-04
	% Of Limit	0.0004	0.0003	0.0003	0.0005	0.0007
	Limit	**22.5 mrem**	**22.5 mrem**	**22.5 mrem**	**22.5 mrem**	**45 mrem**
	NG Skin Dose	4.52E-05	3.07E-05	2.96E-05	5.70E-05	1.63E-04
	% Of Limit	0.0002	0.0001	0.0001	0.0003	0.0004
	Limit	**22.5 mrem**	**22.5 mrem**	**22.5 mrem**	**22.5 mrem**	**45 mrem**
	Maximum Organ Dose	1.24E-01	1.25E-01	1.25E-01	1.16E-01	4.90E-01
	% Of Limit	0.552	0.554	0.558	0.516	1.090

[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, Total Annual Offsite-Dose Comparison to 40 CFR 190 Regulatory Limits for SGS/HCGS, 2022[1]

	Whole Body	Thyroid	Max Organ
Limit	**25 mrem**	**75 mrem**	**25 mrem**
Gaseous[2]			
Salem 1 NG	4.38E-05	4.38E-05	6.60E-05
Salem 1 Particulates/Iodines	3.61E-02	3.61E-02	1.35E-01
Salem 2 NG	6.11E-05	6.11E-05	9.26E-05
Salem 2 Particulates/Iodines	3.28E-02	3.28E-02	1.50E-01
Hope Creek 1 NG	1.75E-06	1.75E-06	3.83E-06
Hope Creek 1 Particulates/Iodines	4.55E-02	4.62E-02	2.05E-01
Liquid			
Salem 1	1.28E-02	1.16E-02	1.81E-02
Salem 2	8.43E-03	4.75E-03	2.46E-02
Hope Creek 1	3.40E-04	1.49E-04	1.65E-03
Total Gas & Liquid mrem[3]	1.36E-01	1.32E-01	5.35E-01
Direct Shine	5.93E-03	N/A	N/A
Other Nearby Facility[4]	N/A	N/A	N/A
Total mrem	1.42E-01	1.32E-01	5.35E-01
% Of Limit	0.57	0.18	2.14

[1] Table 5 is a summation of all Units to show compliance with 40 CFR Part 190 Limits.
[2] Gaseous dose values in Table 2 include total body dose from Noble Gas, Iodine, Tritium, C-14, and particulates.
[3] Individual groups with the highest dose are used: Adult for Liquid, Teen for Noble Gas and Child for particulates. Individual age group sum is lower.
[4] Other fuel cycle sources within 5 miles of the site are considered in this analysis; however, there are none.

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).

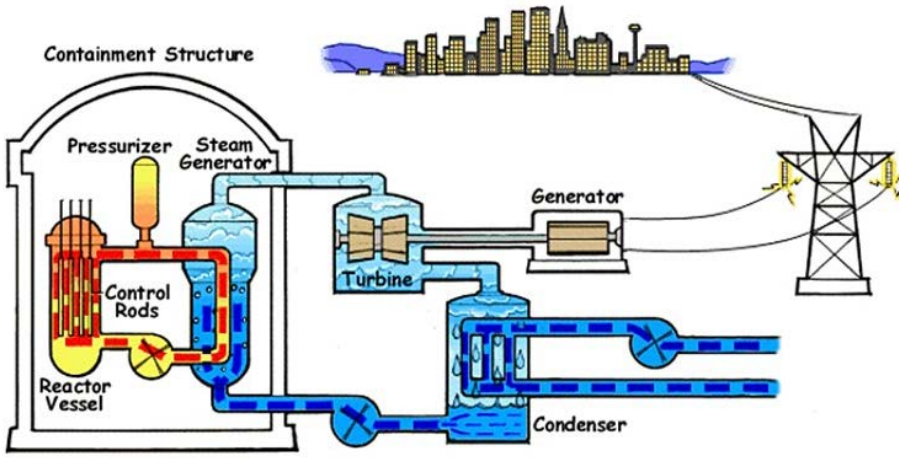

Figure 1, Pressurized Water Reactor (PWR)

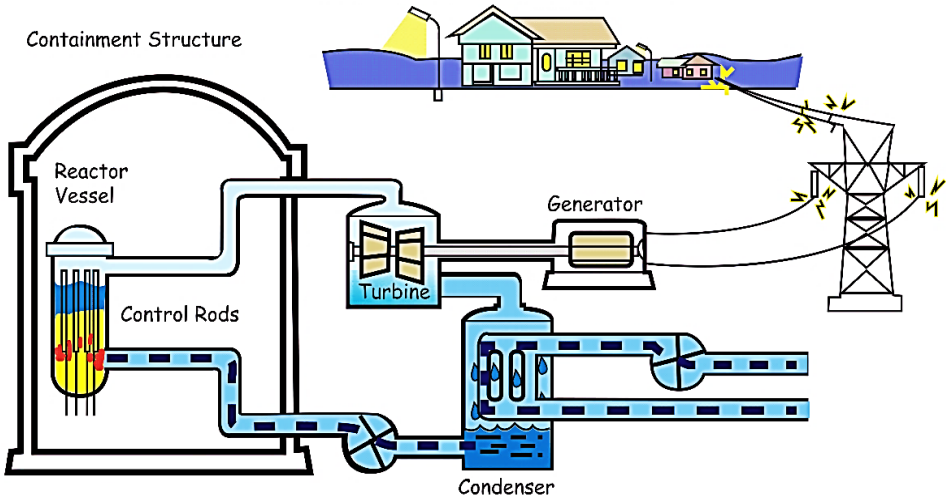

Figure 2, Boiling Water Reactor (BWR)

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 rotates 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.

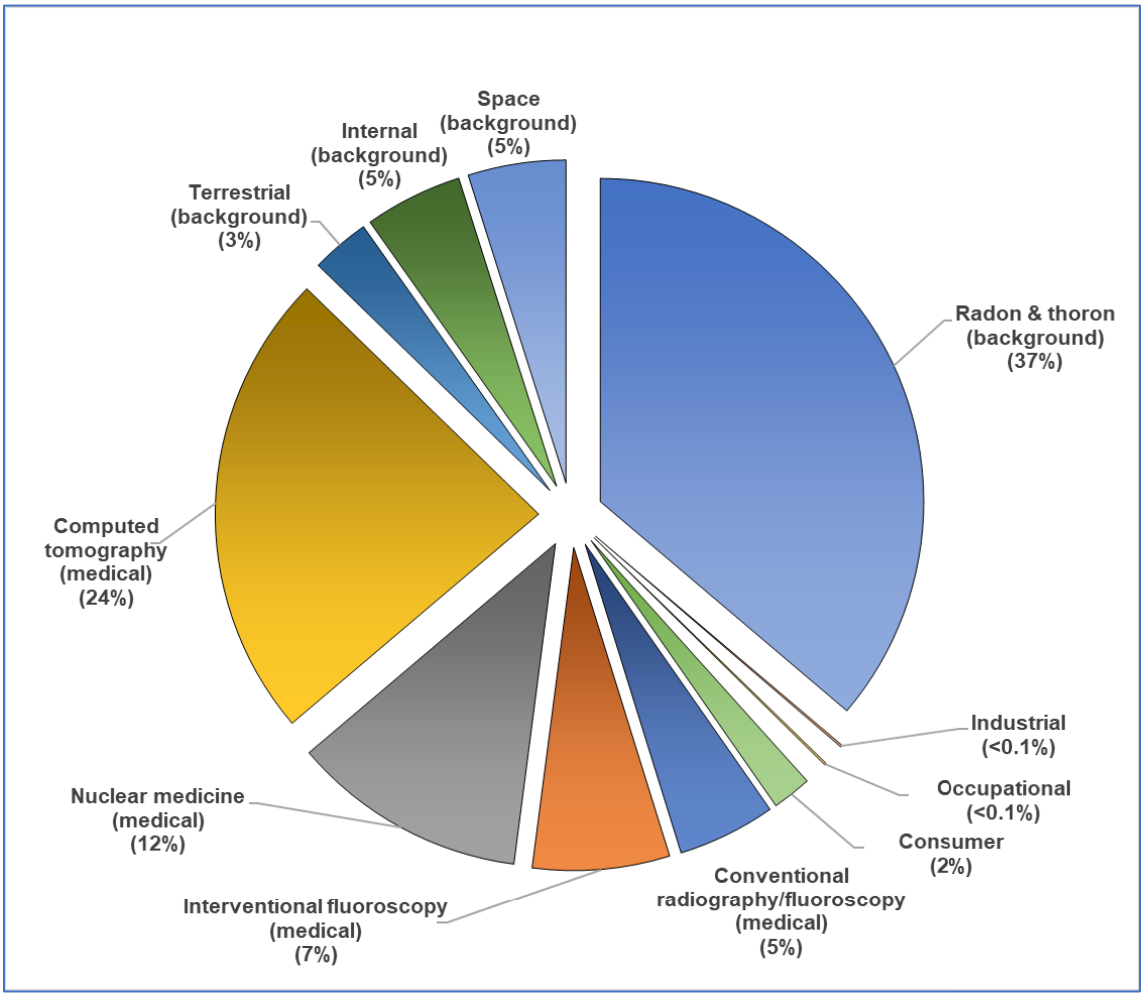

Figure 3, Sources of Radiation Exposure (ICRP Report No. 160) (6)

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

The 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.

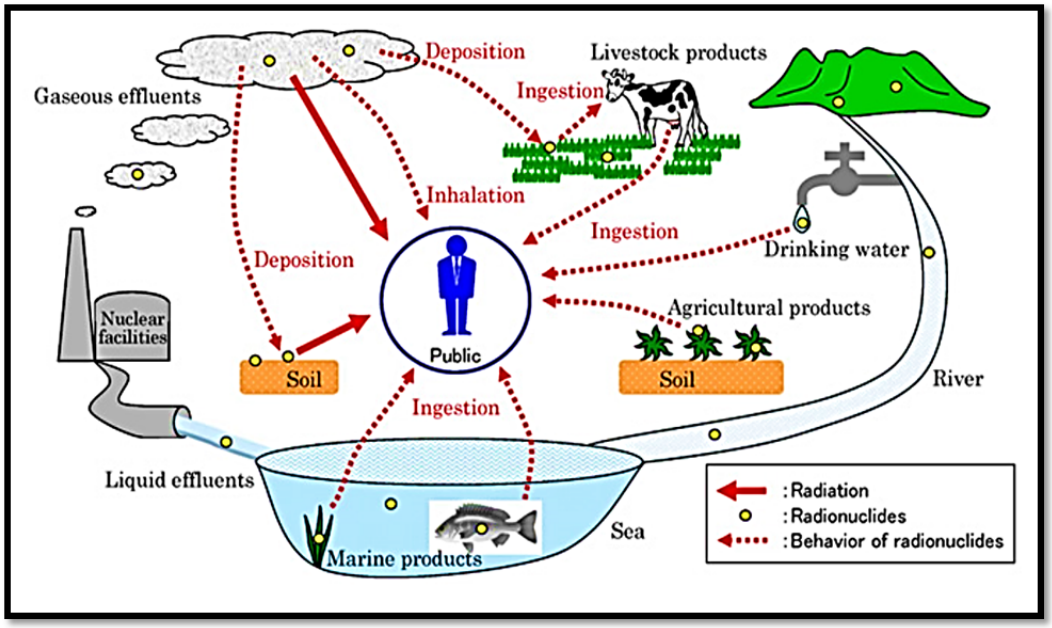

Figure 4, Potential exposure pathways to Members of the Public due to Plant Operations (9)

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 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.

The annual whole body, skin and organ dose was computed using the 2022 source term using the dose calculation methodology provided in the ODCM. The calculated doses due to gaseous effluents to demonstrate compliance with offsite dose limits are presented in Table 1, Salem Generating Station Unit 1 Dose Summary, 2022, Table 2, Salem Generating Station Unit 2 Dose Summary, 2022, Table 3, Hope Creek Generating Station Unit 1 Dose Summary, 2022 and Table 4, Salem & Hope Creek Generating Stations Site Dose Summary, 2022. Total annual dose summary and compared to 40 CFR 190 limits are presented in Table 5, Total Annual Offsite-Dose Comparison to 40 CFR 190 Regulatory Limits for SGS/HCGS, 2022

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

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

b) 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

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

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:

    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 3000 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 34%. The locations for the special dose calculation 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 were computed using the 2022 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. The calculated doses due to gaseous effluents for non-rad workers onsite are presented in Table 6, Summary of TEDE doses to Members of the Public Due to Activities Inside the Site Boundary, 2022 and in Attachment 5, Doses to Onsite Receptors Using NRC Code GASPAR.

Table 6, Summary of TEDE doses to Members of the Public Due to Activities Inside the Site Boundary, 2022

Location	Operating Unit	CDE mrem	Total Body mrem	TEDE mrem	% of Limit (100 mrem) per 10 CFR 20.1301
Sewage Treatment Plant	SGS U1	1.14E-02	1.14E-02		
	SGS U2	5.27E-03	4.25E-03		
	HCGS	2.61E-02	2.34E-02		
	ISFSI	N/A	1.71E+00		
	Total	4.27E-02	1.75E+00	1.79E+00	1.79
Emergency Responders	SGS U1	4.13E-03	4.13E-03		
	SGS U2	1.92E-03	1.54E-03		
	HCGS	2.76E-03	2.48E-03		
	ISFSI	N/A	1.44E-02		
	Total	8.80E-03	2.25E-02	3.13E-02	0.03
Wind Turbine Laydown Areas					
03W2	SGS U1	1.90E-02	1.90E-02		
	SGS U2	8.86E-03	7.13E-03		
	HCGS	1.04E-02	9.33E-03		
	ISFSI	N/A	8.77E-02		
	Total	3.83E-02	1.23E-01	1.61E-01	0.16
16W4	SGS U1	6.99E-03	6.96E-03		
	SGS U2	3.24E-03	2.61E-03		
	HCGS	1.61E-02	1.44E-02		
	ISFSI	N/A	4.99E-01		
	Total	2.63E-02	5.23E-01	5.49E-01	0.55
01W4	SGS U1	6.99E-03	6.95E-03		
	SGS U2	3.24E-03	2.61E-03		
	HCGS	1.10E-02	9.88E-03		
	ISFSI	N/A	1.06E+00		
	Total	2.12E-02	1.08E+00	1.10E+00	1.10
02W5	SGS U1	8.25E-03	8.25E-03		
	SGS U2	3.83E-03	3.08E-03		
	HCGS	1.27E-02	1.14E-02		
	ISFSI	N/A	4.24E-01		
	Total	2.48E-02	4.47E-01	4.72E-01	0.47

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		4	29	6	8	47
2. Total duration of batch releases	minutes	1.30E+05	1.35E+05	1.33E+05	1.33E+05	5.30E+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	3.24E+04	4.65E+03	2.21E+04	1.66E+04	1.13E+04
5. Minimum batch release duration	minutes	1.26E+02	1.60E+01	5.30E+01	3.50E+01	1.60E+01

5.1.2 Salem Unit 2

	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
1. Number of Batch Releases		5	8	8	17	38
2. Total duration of batch releases	minutes	1.30E+05	1.31E+05	1.33E+05	1.34E+05	5.28E+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	2.59E+04	1.64E+04	1.66E+04	7.87E+03	1.39E+04
5. Minimum batch release duration	minutes	3.90E+01	3.10E+01	3.00E+01	7.80E+01	3.00E+01

5.1.3 Hope Creek Unit 1

	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
1. Number of Batch Releases		0	2	1	1	4
2. Total duration of batch releases	minutes	N/A	4.25E+03	1.70E+03	3.37E+03	9.31E+03
3. Maximum batch release duration	minutes	N/A	2.85E+03	1.70E+03	3.37E+03	3.37E+03
4. Average batch release duration	minutes	N/A	2.12E+03	1.70E+03	3.37E+03	2.33E+03
5. Minimum batch release duration	minutes	N/A	1.40E+03	1.70E+03	3.37E+03	1.40E+03

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		10	33	13	8	64
2. Total duration of batch releases	minutes	4.59E+03	1.53E+04	5.49E+03	4.04E+03	2.94E+04
3. Maximum batch release duration	minutes	6.84E+02	1.52E+03	1.11E+03	7.79E+02	1.52E+03
4. Average batch release duration	minutes	4.59E+02	4.63E+02	4.22E+02	5.05E+02	4.59E+02
5. Minimum batch release duration	minutes	2.42E+02	2.50E+01	4.00E+00	1.00E+00	1.00E+00
6. Avg stream flow during periods of release of liquid effluent into a flowing stream	Ft^3/sec	1.51E+04	1.47E+04	6.98E+03	1.94E+04	1.40E+04

5.2.2 Salem Unit 2

	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
1. Number of Batch Releases		8	19	10	13	50
2. Total duration of batch releases	minutes	3.89E+03	8.46E+03	5.16E+03	6.75E+03	2.43E+04
3. Maximum batch release duration	minutes	7.61E+02	6.69E+02	6.68E+02	7.74E+02	7.74E+02
4. Average batch release duration	minutes	4.87E+02	4.45E+02	5.16E+02	5.19E+02	4.85E+02
5. Minimum batch release duration	minutes	2.85E+02	3.14E+02	3.11E+02	3.35E+02	2.85E+02
6. Avg stream flow during periods of release of liquid effluent into a flowing stream	Ft^3/sec	1.51E+04	1.47E+04	6.98E+03	1.94E+04	1.40E+04

5.2.3 Hope Creek Unit 1

	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
1. Number of Batch Releases		38	38	30	72	178
2. Total duration of batch releases	minutes	2.80E+03	3.01E+03	1.89E+03	1.02E+04	1.79E+04
3. Maximum batch release duration	minutes	9.00E+01	9.10E+01	9.30E+01	1.53E+03	1.53E+03
4. Average batch release duration	minutes	7.38E+01	7.92E+01	6.30E+01	1.41E+02	1.00E+02
5. Minimum batch release duration	minutes	2.00E+00	5.20E+01	1.00E+00	3.40E+01	1.00E+00
6. Avg stream flow during periods of release of liquid effluent into a flowing stream	Ft^3/sec	1.51E+04	1.47E+04	6.98E+03	1.94E+04	1.40E+04

5.3 Abnormal Releases

5.3.1 Gaseous Abnormal Releases

1. Salem Unit 1

None

2. Salem Unit 2

None

3. Hope Creek Unit 1

None

5.3.2 Liquid Abnormal Releases

1. Salem Unit 1

None

2. Salem Unit 2

None

3. Hope Creek Unit 1

None

5.4 Land Use Census Changes

The results of the 2022 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. As a result, there were no changes to the radiological effluent control program.

5.5 Meteorological Data

The 2022 meteorological monitoring program had a Joint Frequency Distribution (JFD) recovery rate of 98.6%. 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, which is required to be 90% or greater. 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 2022 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 at 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 2022 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

None

5.6.3 Hope Creek Unit 1

None

5.7 Offsite Dose Calculation Manual (ODCM) Changes

5.7.1 Salem

None

5.7.2 Hope Creek

None

5.7.3 Common REMP

None

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.

5.10 OTHER SUPPLIMENTAL INFORMATION

5.10.1 Salem Unit 2

None

5.10.2 Salem Unit 2

None

5.10.3 Hope Creek Unit 1

5.10.4 During startup of the reactor in October, brackish water from the Delaware River leaked into the condensate system due to failed condenser tubes. As a result of the high conductivity of the saltwater intrusion, the condensate storage tank (CST) had to be discharged to the river without processing through a Radwaste ionic exchange demineralizer. Tritium was the primary isotope present, which would not have been removed through filtration. There were a total of six planned and controlled discharges of condensate water via the A-Floor Drain Sample Tank OAT-346, totaling 560,150 gallons and 28.82 curies. The dose from these six releases totaled 5.59E-04 mrem to the total body, and 1.11E-03 mrem to the adult liver. The curies released are included in Table 24, Batch Mode Liquid Effluents (HGS Unit 1), 2022 and doses are included in Table 3, Hope Creek Generating Station Unit 1 Dose Summary, 2022.

5.10.5 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 are presented in Attachment 4, Radiological Effluent Trends.

5.10.6 Temporary Outside Tanks

In 2022 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.

5.10.7 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. In 2022 five casks were placed on the pad in the third quarter bringing the total to 79 casks.

5.10.8 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 2022 was as follows:

Salem Unit 1	10.34 curies
Salem Unit 2	11.48 curies
Hope Creek Unit 1	15.73 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.

5.10.9 Corrections to Previous Reports

The 2020 and 2021 RGPP Report incorrectly reported the depth of Well BY-V in the Well Construction Details, Investigation and Monitoring Wells. The reported MP Elevation (feet RPD) and MP Elevation (feet amsl) was 93.03 and 9.11, respectively. The corrected values are 103.62 and 13.70, respectively.

6.0 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 2022, 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 2022, the mass flux within the shallow, water bearing unit and deeper groundwater was estimated to be 0.018 Ci and 0.011 Ci, respectively. Therefore, the total potential estimated mass flux of tritium in groundwater reaching the Delaware River during 2022 was 0.029 Ci.

The detailed report is included in 2022 Radiological Groundwater Protection Program (RGPP) Report located in Attachment 6.

Table 7, Groundwater Protection Program Monitoring Well Results for Tritium, 2022

Well Name	Number of Positive Detections	Number of Analysis	Average Concentration[1] pCi/L	Maximum Concentration pCi/L
Well AA	3	3	2,187	3,760
Well AA-V	3	4	592	1,210
Well AB	4	4	5,425	5,890
Well AC	12	12	32,508	46,300
Well AD	2	2	8,630	11,400
Well AE	4	4	17,020	29,200
Well AF	2	2	310	338
Well AF-V	4	4	466	862
Well AG-D	2	2	909	941
Well AG-S	2	2	401	466
Well AH-D	2	2	396	476
Well AH-S	2	2	817	906
Well AI	7	7	16,650	72,900
Well AJ	3	3	4,313	4,690
Well AL	2	2	1,055	1,070
Well AM	4	4	10,228	14,600
Well AN	9	9	14,567	19,900
Well AP	2	2	3,015	4,330
Well AR	4	4	4,283	5,120
Well AS	2	2	5,425	6,480
Well AT	2	2	1,700	1,780
Well BA	0	2	N/D	N/D
Well BB	1	2	228	228
Well BC	9	9	1,128	2,010
Well BD	4	4	505	838
Well BE	4	4	309	359
Well BF	0	2	N/D	N/D
Well BG	1	4	336	336
Well BH	0	4	N/D	N/D
Well BH-V	0	2	N/D	N/D
Well BI	2	4	216	229

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

Table 7, Groundwater Protection Program Monitoring Well Results for Tritium, 2022

Well Name	Number of Positive Detections	Number of Analysis	Average Concentration[1] pCi/L	Maximum Concentration pCi/L
Well BJ	9	9	2,633	2,910
Well BK	0	2	N/D	N/D
Well BL	0	2	N/D	N/D
Well BM	5	5	605	986
Well BM-V	1	2	253	253
Well BN	4	4	523	652
Well BO	2	6	2,743	4,680
Well BP	0	2	N/D	N/D
Well BQ	0	4	N/D	N/D
Well BR-R	0	2	N/D	N/D
Well BS-R	0	2	N/D	N/D
Well BT-R	1	2	273	273
Well BU	0	2	N/D	N/D
Well BY	12	12	93,483	135,000
Well BY-V	4	4	10,728	13,300
Well BZ	2	2	1,830	1,840
Well CA	2	2	1,900	2,180
Well DA	8	8	3,169	4,090
Well DB	4	4	5,820	6,630
Well DC	7	7	5,299	6,700
Well DD	4	4	4,690	5,140
Well DE	4	4	17,875	20,700
Well DF	2	2	1,320	1,340
Well DG	4	4	2,610	2,910
Well DH	4	4	10,433	12,700
Well DI	4	4	3,240	3,830
Well DJ	7	7	2,864	3,830
Well K	0	2	N/D	N/D
Well L	0	2	N/D	N/D
Well M	10	10	21,904	44,900
Well N	4	4	7,540	8,210

Table 7, Groundwater Protection Program Monitoring Well Results for Tritium, 2022

Well Name	Number of Positive Detections	Number of Analysis	Average Concentration[1] pCi/L	Maximum Concentration pCi/L
Well O	4	4	35,650	62,600
Well P	0	2	N/D	N/D
Well R	12	12	7,907	8,870
Well S	2	2	10,045	14,100
Well S-V	4	4	1,565	2,080
Well T	0	4	N/D	N/D
Well U	4	4	469	980
Well V	2	2	334	361
Well W	5	5	3,394	3,980
Well Y	0	2	N/D	N/D
Well Z	5	5	657	985

6.1 VOLUNTARY NOTIFICATION

During 2022, 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

1.0 GASEOUS EFFLUENTS

1.1 Salem Unit 1

Table 8, Gaseous Effluents Summation of All Releases (SGS Unit 1), 2022

A. Fission & Activation Gases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %
1. Total Release	Ci	6.41E-02	1.09E-01	4.63E-02	1.02E-01	3.21E-01	3.40E+01
2. Average release rate for the period	μCi/sec	8.24E-03	1.39E-02	5.83E-03	1.28E-02	1.02E-02	
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	2.18E-05	N/D	N/D	2.18E-05	3.00E+01
2. Average release rate for the period	μCi/sec	N/A	2.78E-06	N/A	N/A	6.93E-07	
D. Tritium							
1. Total Release	Ci	5.49E+01	8.98E+01	4.97E+01	3.84E+02	5.79E+02	3.10E+01
2. Average release rate for the period	μCi/sec	7.06E+00	1.14E+01	6.25E+00	4.83E+01	1.84E+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	2.50E+00	2.81E+00	2.73E+00	2.30E+00	1.03E+01	
2. Average release rate for the period	μCi/sec	3.22E-01	3.57E-01	3.43E-01	2.89E-01	3.28E-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), 2022

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Fission Gases						
Ar-41	Ci	6.16E-02	2.09E-02	2.41E-02	4.11E-02	1.48E-01
Kr-85m	Ci	N/D	5.12E-04	N/D	N/D	5.12E-04
Kr-88	Ci	N/D	3.02E-04	N/D	N/D	3.02E-04
Xe-133m	Ci	N/D	1.01E-03	N/D	N/D	1.01E-03
Xe-133	Ci	2.47E-03	6.96E-02	2.22E-02	5.99E-02	1.54E-01
Xe-135	Ci	N/D	1.68E-02	N/D	6.96E-04	1.75E-02
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	6.41E-02	1.09E-01	4.63E-02	1.02E-01	3.21E-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						
	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	3.44E-01	6.34E-02	2.97E-01	8.40E-01	1.54E+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), 2022

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						
Co-58	Ci	N/D	2.05E-05	N/D	N/D	2.05E-05
Co-60	Ci	N/D	1.15E-06	N/D	N/D	1.15E-06
Cs-137	Ci	N/D	2.09E-07	N/D	N/D	2.09E-07
	Ci					
	Ci					
	Ci					
Total for Period	Ci	N/D	2.18E-05	N/D	N/D	2.18E-05
Tritium						
H-3	Ci	5.46E+01	8.98E+01	4.94E+01	3.83E+02	5.77E+02
Gross Alpha						
Alpha	Ci	N/D	N/D	N/D	N/D	N/D
Carbon-14						
C-14	Ci	2.50E+00	2.81E+00	2.73E+00	2.30E+00	1.03E+01

ARERR Release Summary - RG-1.21 Tables

1.2 Salem Unit 2

Table 11, Gaseous Effluents Summation of All Releases (SGS Unit 2), 2022

A. Fission & Activation Gases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %
1. Total Release	Ci	6.95E-02	1.01E-01	8.15E-02	2.61E-01	5.13E-01	3.40E+01
2. Average release rate for the period	μCi/sec	8.94E-03	1.29E-02	1.03E-02	3.28E-02	1.63E-02	
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	3.10E+01	5.60E+01	4.57E+01	4.67E+01	1.79E+02	3.10E+01
2. Average release rate for the period	μCi/sec	3.99E+00	7.12E+00	5.75E+00	5.87E+00	5.69E+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	3.02E+00	2.84E+00	2.86E+00	2.77E+00	1.15E+01	
2. Average release rate for the period	μCi/sec	3.88E-01	3.61E-01	3.60E-01	3.49E-01	3.65E-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), 2022

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Fission Gases						
Ar-41	Ci	3.81E-02	4.17E-02	4.53E-02	7.88E-02	2.04E-01
Kr-85m	Ci	N/D	N/D	N/D	8.32E-04	8.32E-04
Kr-88	Ci	N/D	N/D	N/D	6.53E-04	6.53E-04
Xe-133	Ci	3.14E-02	5.95E-02	3.62E-02	1.58E-01	2.85E-01
Xe-135	Ci	N/D	N/D	N/D	2.28E-02	2.28E-02
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	6.95E-02	1.01E-01	8.15E-02	2.61E-01	5.13E-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	7.87E-02	1.86E-01	2.46E-01	1.47E-01	6.58E-01
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), 2022

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	3.09E+01	5.58E+01	4.55E+01	4.65E+01	1.79E+02
Gross Alpha						
Alpha	Ci	N/D	N/D	N/D	N/D	N/D
Carbon-14						
C-14	Ci	3.02E+00	2.84E+00	2.86E+00	2.77E+00	1.15E+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), 2022

A. Fission & Activation Gases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %
1. Total Release	Ci	1.42E-02	0.00E+00	0.00E+00	0.00E+00	1.42E-02	3.40E+01
2. Average release rate for the period	μCi/sec	1.83E-03	0.00E+00	0.00E+00	0.00E+00	4.51E-04	
B. Iodine and Halogens							
1. Total Release	Ci	3.14E-03	1.17E-03	5.34E-04	7.67E-04	5.61E-03	3.00E+01
2. Average release rate for the period	μCi/sec	4.04E-04	1.49E-04	6.72E-05	9.65E-05	1.78E-04	
C. Particulates							
1. Total Release	Ci	5.45E-04	5.57E-04	6.04E-04	2.53E-04	1.96E-03	3.00E+01
2. Average release rate for the period	μCi/sec	7.01E-05	7.08E-05	7.60E-05	3.18E-05	6.21E-05	
D. Tritium							
1. Total Release	Ci	1.02E+02	6.87E+01	7.56E+01	2.93E+01	2.76E+02	3.10E+01
2. Average release rate for the period	μCi/sec	1.31E+01	8.74E+00	9.51E+00	3.68E+00	8.74E+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	3.99E+00	3.89E+00	4.02E+00	3.83E+00	1.57E+01	
2. Average release rate for the period	μCi/sec	5.13E-01	4.95E-01	5.06E-01	4.82E-01	4.99E-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), 2022

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					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	N/D	N/D
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						
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	N/D	4.86E-03	4.08E-03	N/D	8.93E-03
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), 2022

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Fission Gases						
Xe-135	Ci	1.42E-02	N/D	N/D	N/D	1.42E-02
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	1.42E-02	N/D	N/D	N/D	1.42E-02
Iodines and Halogens						
Br-82	Ci	9.82E-06	N/D	N/D	N/D	9.82E-06
I-130	Ci	3.29E-04	N/D	N/D	N/D	3.29E-04
I-131	Ci	1.33E-04	6.42E-05	4.90E-05	4.18E-05	2.88E-04
I-133	Ci	2.67E-03	1.11E-03	4.85E-04	7.26E-04	4.98E-03
	Ci					
Total for Period	Ci	3.14E-03	1.17E-03	5.34E-04	7.67E-04	5.61E-03
Particulates						
Na-24	Ci	4.75E-04	5.13E-04	4.61E-04	2.35E-04	1.68E-03
Co-58	Ci	7.14E-06	N/D	N/D	N/D	7.14E-06
Co-60	Ci	4.87E-05	4.42E-05	1.42E-04	1.80E-05	2.53E-04
Zn-65	Ci	1.15E-05	N/D	N/D	N/D	1.15E-05
Cs-137	Ci	2.78E-06	N/D	5.87E-07	N/D	3.36E-06
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	5.45E-04	5.57E-04	6.04E-04	2.53E-04	1.96E-03
Tritium						
H-3	Ci	1.02E+02	6.87E+01	7.56E+01	2.93E+01	2.76E+02
Gross Alpha						
Alpha	Ci	N/D	N/D	N/D	N/D	N/D
Carbon-14						
C-14	Ci	3.99E+00	3.89E+00	4.02E+00	3.83E+00	1.57E+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), 2022

A. Fission & Activation Products	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %
1. Total Release	Ci	6.64E-03	1.96E-03	6.73E-04	1.91E-04	9.46E-03	2.70E+01
2. Average diluted concentration	μCi/mL	1.26E-10	3.86E-11	1.27E-11	3.91E-12	4.61E-11	
B. Tritium							
1. Total Release	Ci	9.93E+01	3.52E+02	7.36E+01	1.34E+02	6.59E+02	2.70E+01
2. Average diluted concentration	μCi/mL	1.88E-06	6.93E-06	1.38E-06	2.76E-06	3.21E-06	
C. Dissolved & Entrained Gases							
1. Total Release	Ci	N/D	4.13E-05	N/D	N/D	4.13E-05	2.70E+01
2. Average diluted concentration	μCi/mL	N/A	8.14E-13	N/A	N/A	2.01E-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	4.247E+07	3.807E+07	4.396E+07	4.304E+07	1.675E+08	
F. Volume of Dilution Water Used During Period	Liters	5.277E+10	5.075E+10	5.313E+10	4.865E+10	2.053E+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), 2022

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Tritium						
H-3	Ci	9.93E+01	3.52E+02	7.35E+01	1.34E+02	6.59E+02
Fission & Activation Products						
Mn-54	Ci	7.57E-05	3.45E-05	N/D	N/D	1.10E-04
Fe-55	Ci	3.17E-03	N/D	N/D	N/D	3.17E-03
Co-58	Ci	3.02E-04	5.25E-04	4.19E-04	5.54E-05	1.30E-03
Co-60	Ci	3.03E-03	1.37E-03	1.62E-04	7.17E-05	4.62E-03
Nb-97	Ci	2.19E-05	N/D	N/D	N/D	2.19E-05
Ag-110m	Ci	2.24E-05	N/D	N/D	N/D	2.24E-05
Sb-125	Ci	2.42E-05	2.16E-05	9.14E-05	4.10E-06	1.41E-04
Cs-137	Ci	N/D	N/D	1.14E-06	5.94E-05	6.06E-05
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	6.64E-03	1.95E-03	6.73E-04	1.91E-04	9.45E-03
Entrained Gases						
Xe-133	Ci	N/D	4.13E-05	N/D	N/D	4.13E-05
	Ci					
	Ci					
Total for Period	Ci	N/D	4.13E-05	N/D	N/D	4.13E-05
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), 2022

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Tritium						
H-3	Ci	3.31E-02	1.58E-02	8.88E-02	6.97E-02	2.07E-01
Fission & Activation Products						
Co-60	Ci	N/D	1.41E-05	N/D	N/D	1.41E-05
	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	1.41E-05	N/D	N/D	1.41E-05
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), 2022

A. Fission & Activation Products	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %
1. Total Release	Ci	1.80E-02	7.46E-03	1.15E-03	8.14E-03	3.48E-02	2.70E+01
2. Average diluted concentration	μCi/mL	6.08E-09	1.19E-09	3.10E-10	1.73E-09	1.97E-09	
B. Tritium							
1. Total Release	Ci	9.15E+01	2.39E+02	8.67E+01	2.25E+02	6.42E+02	2.70E+01
2. Average diluted concentration	μCi/mL	3.09E-05	3.81E-05	2.34E-05	4.77E-05	3.64E-05	
C. Dissolved & Entrained Gases							
1. Total Release	Ci	N/D	N/D	N/D	5.05E-04	5.05E-04	2.70E+01
2. Average diluted concentration	μCi/mL	N/A	N/A	N/A	1.07E-10	1.07E-10	
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	1.43E+07	1.36E+07	1.30E+07	1.32E+07	5.41E+07	
F. Volume of Dilution Water Used During Period	Liters	2.95E+09	6.25E+09	3.69E+09	4.70E+09	1.76E+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), 2022

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Tritium						
H-3	Ci	9.15E+01	2.39E+02	8.67E+01	2.25E+02	6.42E+02
Fission & Activation Products						
Cr-51	Ci	1.20E-04	N/D	N/D	N/D	1.20E-04
Mn-54	Ci	1.63E-04	9.13E-05	N/D	3.07E-04	5.61E-04
Fe-55	Ci	6.59E-03	2.65E-03	N/D	8.46E-04	1.01E-02
Co-57	Ci	3.61E-05	6.27E-06	N/D	N/D	4.23E-05
Co-58	Ci	5.18E-04	8.30E-04	4.45E-04	3.36E-04	2.13E-03
Co-60	Ci	6.56E-03	3.70E-03	5.67E-04	6.15E-03	1.70E-02
Ni-63	Ci	9.21E-04	N/D	N/D	N/D	9.21E-04
Zn-65	Ci	N/D	4.82E-05	N/D	N/D	4.82E-05
Nb-95	Ci	N/D	N/D	N/D	2.86E-05	2.86E-05
Nb-97	Ci	1.23E-05	N/D	N/D	N/D	1.23E-05
Ag-110m	Ci	4.35E-05	N/D	N/D	N/D	4.35E-05
Sb-124	Ci	1.12E-04	N/D	N/D	4.24E-04	5.36E-04
Sb-125	Ci	2.92E-03	1.30E-04	1.38E-04	5.31E-05	3.24E-03
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
	Ci					
Total for Period	Ci	1.80E-02	7.46E-03	1.15E-03	8.14E-03	3.48E-02
Entrained Gases						
Xe-138	Ci	N/D	N/D	N/D	5.05E-04	5.05E-04
	Ci					
	Ci					
Total for Period	Ci	N/D	N/D	N/D	5.05E-04	5.05E-04
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), 2022

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Tritium						
H-3	Ci	N/D	8.57E-03	N/D	N/D	8.57E-03
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					
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), 2022

A. Fission & Activation Products	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual	Est. Total Error %
1. Total Release	Ci	5.82E-03	1.16E-03	8.49E-04	5.91E-03	1.37E-02	2.70E+01
2. Average diluted concentration	μCi/mL	9.33E-10	1.83E-10	1.31E-10	9.24E-10	5.40E-10	
B. Tritium							
1. Total Release	Ci	2.05E+01	2.41E+01	1.17E+01	3.04E+01	8.67E+01	2.70E+01
2. Average diluted concentration	μCi/mL	3.29E-06	3.81E-06	1.80E-06	4.75E-06	3.41E-06	
C. Dissolved & Entrained Gases							
1. Total Release	Ci	N/D	1.67E-05	8.92E-06	2.82E-05	5.38E-05	2.70E+01
2. Average diluted concentration	μCi/mL	N/A	2.64E-12	1.38E-12	4.41E-12	2.11E-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	4.871E+06	5.873E+06	1.050E+07	7.304E+06	2.854E+07	
F. Volume of Dilution Water Used During Period	Liters	6.238E+09	6.324E+09	6.467E+09	6.387E+09	2.542E+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), 2022

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for Year
Tritium						
H-3	Ci	2.05E+01	2.37E+01	1.02E+01	3.03E+01	8.47E+01
Fission & Activation Products						
Cr-51	Ci	N/D	N/D	N/D	2.30E-04	2.30E-04
Mn-54	Ci	5.67E-04	4.22E-05	4.71E-05	8.59E-04	1.51E-03
Mn-56	Ci	N/D	3.89E-07	N/D	N/D	3.89E-07
Fe-59	Ci	N/D	N/D	N/D	5.62E-06	5.62E-06
Co-58	Ci	N/D	N/D	7.32E-05	3.80E-04	4.53E-04
Co-60	Ci	4.90E-03	1.02E-03	6.03E-04	1.44E-03	7.96E-03
Zn-65	Ci	N/D	N/D	1.16E-04	3.52E-04	4.68E-04
Zn-69m	Ci	N/D	N/D	4.06E-06	N/D	4.06E-06
Sb-122	Ci	N/D	N/D	N/D	7.46E-05	7.46E-05
Sb-124	Ci	N/D	N/D	N/D	9.59E-04	9.59E-04
Sb-125	Ci	N/D	N/D	N/D	3.63E-04	3.63E-04
I-134	Ci	N/D	5.04E-07	N/D	N/D	5.04E-07
Cs-134	Ci	9.11E-05	1.92E-05	1.27E-07	3.23E-04	4.33E-04
Cs-136	Ci	N/D	8.77E-07	N/D	N/D	8.77E-07
Cs-137	Ci	2.61E-04	7.72E-05	5.59E-06	9.21E-04	1.26E-03
	Ci					
Total for Period	Ci	5.82E-03	1.16E-03	8.49E-04	5.91E-03	1.37E-02
Entrained Gases						
Xe-133	Ci	N/D	1.26E-05	N/D	1.20E-05	2.46E-05
Xe-135	Ci	N/D	4.08E-06	8.92E-06	1.62E-05	2.92E-05
	Ci					
Total for Period	Ci	N/D	1.67E-05	8.92E-06	2.82E-05	5.38E-05
Gross Alpha						
Gross Alpha	Ci	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), 2022

Radionuclide Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for year
Tritium						
H-3	Ci	5.91E-02	4.37E-01	1.47E+00	3.20E-02	2.00E+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

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

During Period From: 01/01/2022 to 12/31/2022

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	6.21E+02	1.76E+01	3.68E+00	+/-25%
B	2.97E+02	8.41E+00	1.62E+02	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
Unclassified	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	9.18E+02	2.60E+01	1.66E+02	+/-25%

Major Nuclides for Above Table:
H-3, C-14, 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, and Cm-243

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
H-3	11.56%	4.25E-01
C-14	1.07%	3.93E-02
Fe-55	3.51%	1.29E-01
Co-58	1.3%	4.77E-02
Co-60	43.49%	1.60E+00
Ni-63	33.92%	1.25E+00
Sb-125	1.13%	4.15E-02
Cs-137	2.31%	8.49E-02
Waste Class B		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
Fe-55	1.33%	2.15E+00
Co-60	12.43%	2.01E+01
Ni-59	1.12%	1.82E+00
Ni-63	72.54%	1.18E+02
Cs-137	11.93%	1.93E+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
Fe-55	1.37%	2.28E+00
Co-60	13.12%	2.17E+01
Ni-59	1.1%	1.82E+00
Ni-63	71.68%	1.19E+02
Cs-137	11.72%	1.94E+01

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	1.17E+04	3.31E+02	2.43E-01	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
Unclassified	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	1.17E+04	3.31E+02	2.43E-01	+/-25%

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

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
H-3	1.45%	3.52E-03
Cr-51	5.85%	1.42E-02
Mn-54	1.59%	3.86E-03
Fe-55	6.4%	1.55E-02
Co-58	25.22%	6.12E-02
Co-60	26.44%	6.42E-02
Ni-63	23.69%	5.75E-02
Zr-95	1.22%	2.97E-03
Nb-95	1.95%	4.72E-03
Sb-125	2.5%	6.06E-03
Cs-137	2.97%	7.20E-03
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	1.45%	3.52E-03
Cr-51	5.85%	1.42E-02
Mn-54	1.59%	3.86E-03
Fe-55	6.4%	1.55E-02
Co-58	25.22%	6.12E-02
Co-60	26.44%	6.42E-02
Ni-63	23.69%	5.75E-02
Zr-95	1.22%	2.97E-03
Nb-95	1.95%	4.72E-03
Sb-125	2.5%	6.06E-03
Cs-137	2.97%	7.20E-03

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%
Unclassified				+/-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	1.71E+02	4.84E+00	1.99E+00	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
Unclassified	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	1.71E+02	4.84E+00	1.99E+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, and Ce-144

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
H-3	1.77%	3.51E-02
Cr-51	2.76%	5.49E-02
Mn-54	1.33%	2.65E-02
Fe-55	23.36%	4.64E-01
Co-58	21.23%	4.22E-01
Co-60	29.93%	5.95E-01
Ni-63	3.11%	6.19E-02
Nb-95	1.14%	2.27E-02
Sb-125	2.21%	4.39E-02
Cs-137	11.6%	2.30E-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	1.77%	3.51E-02
Cr-51	2.76%	5.49E-02
Mn-54	1.33%	2.65E-02
Fe-55	23.36%	4.64E-01
Co-58	21.23%	4.22E-01
Co-60	29.93%	5.95E-01
Ni-63	3.11%	6.19E-02
Nb-95	1.14%	2.27E-02
Sb-125	2.21%	4.39E-02
Cs-137	11.6%	2.30E-01

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	1.25E+04	3.54E+02	5.90E+00	+/-25%
B	2.97E+02	8.41E+00	1.62E+02	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
Unclassified	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	1.28E+04	3.62E+02	1.68E+02	+/-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, Zr-95, Nb-95, Tc-99, Sb-125, I-129, Cs-137, Ce-144, Pu-238, Pu-239, Pu-241, Am-241, and Cm-243

Waste Class A — **Percent Abundance > 1.0%**

Nuclide Name	Percent Abundance	Curies
H-3	7.85%	4.63E-01
Cr-51	1.17%	6.91E-02
Fe-55	10.31%	6.09E-01
Co-58	8.99%	5.31E-01
Co-60	38.23%	2.26E+00
Ni-63	23.14%	1.37E+00
Sb-125	1.55%	9.15E-02
Cs-137	5.46%	3.23E-01

Waste Class B — **Percent Abundance > 1.0%**

Nuclide Name	Percent Abundance	Curies
Fe-55	1.33%	2.15E+00
Co-60	12.43%	2.01E+01
Ni-59	1.12%	1.82E+00
Ni-63	72.54%	1.18E+02
Cs-137	11.93%	1.93E+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
Fe-55	1.64%	2.76E+00
Co-60	13.33%	2.24E+01
Ni-59	1.08%	1.82E+00
Ni-63	70.8%	1.19E+02
Cs-137	11.7%	1.97E+01

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	1.25E+03	3.53E+01	7.02E+00	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	0.00E+00	0.00E+00	0.00E+00	+/-25%
Unclassified	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	1.25E+03	3.53E+01	7.02E+00	+/-25%

Major Nuclides for Above Table:
H-3, C-14, Mn-54, Fe-55, Co-58, Co-60, Ni-63, Zn-65, Sr-90, Tc-99, I-129, Cs-134, Cs-137, Ce-144, Pu-238, Pu-241, Am-241, Cm-243, and Cm-244

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
H-3	5.01%	3.52E-01
C-14	1.09%	7.63E-02
Mn-54	16.62%	1.17E+00
Fe-55	6.71%	4.71E-01
Co-60	52.72%	3.70E+00
Zn-65	2.79%	1.96E-01
Cs-134	4.66%	3.27E-01
Cs-137	8.1%	5.69E-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	5.01%	3.52E-01
C-14	1.09%	7.63E-02
Mn-54	16.62%	1.17E+00
Fe-55	6.71%	4.71E-01
Co-60	52.72%	3.70E+00
Zn-65	2.79%	1.96E-01
Cs-134	4.66%	3.27E-01
Cs-137	8.1%	5.69E-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%
Unclassified	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	1.51E+01	4.29E-01	2.90E+04	+/-25%
Unclassified	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	1.51E+01	4.29E-01	2.90E+04	+/-25%

Major Nuclides for Above Table:
H-3, C-14, Cr-51, Mn-54, Fe-55, Fe-59, Co-58, Co-60, Ni-59, Ni-63, Zn-65, Sr-90, Nb-94, Tc-99, I-129, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cm-242, Cm-243, and Cm-244

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
Mn-54	3.07%	8.90E+02
Fe-55	51.51%	1.50E+04
Co-60	38.91%	1.13E+04
Ni-63	5.98%	1.74E+03

Total Combined — **Percent Abundance > 1.0%**

Nuclide Name	Percent Abundance	Curies
Mn-54	3.07%	8.90E+02
Fe-55	51.51%	1.50E+04
Co-60	38.91%	1.13E+04
Ni-63	5.98%	1.74E+03

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%
Unclassified	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	1.25E+03	3.53E+01	7.02E+00	+/-25%
B	0.00E+00	0.00E+00	0.00E+00	+/-25%
C	1.51E+01	4.29E-01	2.90E+04	+/-25%
Unclassified	0.00E+00	0.00E+00	0.00E+00	+/-25%
All	1.26E+03	3.57E+01	2.90E+04	+/-25%

Major Nuclides for Above Table:
H-3, C-14, Cr-51, Mn-54, Fe-55, Fe-59, Co-58, Co-60, Ni-59, Ni-63, Zn-65, Sr-90, Nb-94, Tc-99, I-129, Cs-134, Cs-137, Ce-144, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cm-242, Cm-243, and Cm-244

Waste Class A		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
H-3	5.01%	3.52E-01
C-14	1.09%	7.63E-02
Mn-54	16.62%	1.17E+00
Fe-55	6.71%	4.71E-01
Co-60	52.72%	3.70E+00
Zn-65	2.79%	1.96E-01
Cs-134	4.66%	3.27E-01
Cs-137	8.1%	5.69E-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
Mn-54	3.07%	8.90E+02
Fe-55	51.51%	1.50E+04
Co-60	38.91%	1.13E+04
Ni-63	5.98%	1.74E+03
Total Combined		**Percent Abundance > 1.0%**
Nuclide Name	Percent Abundance	Curies
Mn-54	3.07%	8.91E+02
Fe-55	51.5%	1.50E+04
Co-60	38.91%	1.13E+04
Ni-63	5.98%	1.74E+03

Solid Waste Information

2.0 SOLID WASTE DISPOSITION

Table 36, Solid Waste Shipped from the Salem Site

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

Table 37, Solid Waste Shipped from the Hope Creek Site

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

Meteorological Data

Attachment 3, Meteorological Data

Meteorological Data

1.0 Meteorological Data Summary

The backup wind speed/direction sensor had only a 63.4 data recovery. Several sonic sensors were destroyed by Owls pecking the plastic sensor coverers. The new stainless steel covered sensor has been installed eliminating the bird destruction issue.

1.1 Joint Frequency Distributions

1. Period of Record: 01/01/2022 – 12/31/2022
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: 0.06%
   c. Percentage of missing data: 1.4%
   d. JFD Recovery: 98.6%

January – December 2022

Sensor	Missing Hours	**Data Recovery (%)**
33 ft Wind Speed/Direction	121	98.6
150 ft Wind Speed/Direction	506	94.2
197 ft Wind Speed/Direction*	121	98.6
300 ft Wind Speed/Direction	121	98.6
Backup Wind Speed/Direction**	3204	63.4
300 ft Temp*	127	98.6
33 ft Temp	133	98.5
33 ft Dew Point*	1111	87.3
150 ft – 33 ft Delta Temp	135	98.5
197 ft – 33 ft Delta Temp*	137	98.4
300 ft – 33 ft Delta Temp	135	98.5
33 ft Relative Humidity*	121	98.6
300 ft Relative Humidity*	121	98.6
Precipitation	121	98.6
Barometric Pressure*	121	98.6
Solar Radiation*	121	98.6

Note:

* Parameters are not subject to the NRC 90% data recovery requirement.
** Not subject to the NRC 90% data recovery requirement if Primary Sensors are available.

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	0.208	0.266	0.278	1.470	1.632	0.880	0.671	0.787	0.081	0.046	6.32
11.25 – 33.75	NNE	0.000	0.058	0.220	0.359	1.690	1.759	1.343	0.695	0.995	0.104	0.000	7.22
33.75 – 56.25	NE	0.012	0.208	0.266	0.532	1.621	1.181	1.181	0.868	0.776	0.197	0.023	6.86
56.25 – 78.75	ENE	0.000	0.116	0.278	0.509	0.961	0.880	0.532	0.255	0.185	0.058	0.012	3.79
78.75 – 101.25	E	0.000	0.232	0.440	0.417	0.637	0.451	0.197	0.081	0.023	0.000	0.000	2.48
101.25 – 123.75	ESE	0.012	0.185	0.324	0.475	1.019	0.428	0.116	0.035	0.012	0.012	0.000	2.62
123.75 – 146.25	SE	0.012	0.116	0.278	0.266	1.239	1.181	1.354	0.972	1.308	0.232	0.000	6.96
146.25 – 168.75	SSE	0.000	0.069	0.266	0.532	1.736	1.597	1.516	1.655	2.107	0.475	0.104	10.06
168.75 – 191.25	S	0.000	0.081	0.208	0.660	0.926	1.100	0.995	0.695	0.903	0.289	0.127	5.98
191.25 – 213.75	SSW	0.012	0.046	0.174	0.486	1.447	1.227	0.903	0.741	0.637	0.162	0.139	5.97
213.75 – 236.25	SW	0.012	0.023	0.243	0.579	1.736	1.343	1.204	0.451	0.313	0.139	0.000	6.04
236.25 – 258.75	WSW	0.000	0.081	0.243	0.313	1.748	1.887	0.799	0.313	0.150	0.046	0.000	5.58
258.75 – 281.25	W	0.000	0.081	0.208	0.602	1.505	1.609	1.100	0.833	0.451	0.266	0.069	6.73
281.25 – 303.75	WNW	0.000	0.093	0.197	0.394	1.215	1.424	0.961	0.868	1.204	0.255	0.174	6.78
303.75 – 326.25	NW	0.000	0.116	0.266	0.509	1.702	1.771	1.308	1.204	1.343	0.590	0.162	8.97
326.25 – 348.75	NNW	0.000	0.046	0.174	0.440	1.493	1.435	1.215	0.741	1.470	0.532	0.093	7.64
	Total	**0.06**	**1.76**	**4.05**	**7.35**	**22.14**	**20.91**	**15.60**	**11.08**	**12.66**	**3.44**	**0.95**	**100**

MISSING HOURS: 121
JOINT DATA RECOVERY: 98.6%

Meteorological Data

Stability class

Table 39, Classification of Atmospheric Stability

Stability Condition	Pasquill Categories	Percentage
Extremely Unstable	A	8.25
Moderately Stable	B	5.96
Slightly Unstable	C	3.68
Neutral	D	23.15
Slightly Stable	E	39.26
Moderately Stable	F	11.46
Extremely Stable	G	8.23

Meteorological Data

1.2 2022 Annual Average X/Q and D/Q Values for Each Site

1.2.1 Salem Generating Station

Table 40, 2022 Annual Average Salem Ground Level Release Dispersion (X/Q) and Deposition (D/Q) Factors

SPECIFIC POINTS OF INTEREST						
Location	Direction From Site	Distance (mi)	X/Q (Sec/m^3) No Decay Undepleted	X/Q (Sec/m^3) Decay Undepleted	X/Q (Sec/m^3) Decay Depleted	D/Q ($1/m^2$)
SITE BOUNDARY	S	0.17	1.30E-05	1.30E-05	1.30E-05	6.70E-08
SITE BOUNDARY	SSW	0.13	2.50E-05	2.50E-05	2.40E-05	1.10E-07
SITE BOUNDARY	SW	0.11	3.30E-05	3.30E-05	3.20E-05	1.20E-07
SITE BOUNDARY	WSW	0.11	1.90E-05	1.90E-05	1.90E-05	6.90E-08
SITE BOUNDARY	W	0.12	1.70E-05	1.70E-05	1.60E-05	4.10E-08
SITE BOUNDARY	WNW	0.16	1.20E-05	1.20E-05	1.20E-05	3.00E-08
SITE BOUNDARY	NW	0.28	5.80E-06	5.80E-06	5.50E-06	3.30E-08
SITE BOUNDARY	NNW	0.68	1.40E-06	1.40E-06	1.30E-06	1.20E-08
SITE BOUNDARY	N	0.83	7.20E-07	7.20E-07	6.30E-07	5.10E-09
SITE BOUNDARY	NNE	0.89	6.90E-07	6.90E-07	6.10E-07	4.50E-09
SITE BOUNDARY	NE	1.07	5.70E-07	5.70E-07	4.90E-07	3.30E-09
SITE BOUNDARY	ENE	0.88	7.20E-07	7.20E-07	6.30E-07	4.30E-09
SITE BOUNDARY	E	0.89	7.00E-07	7.00E-07	6.10E-07	5.10E-09
SITE BOUNDARY	ESE	0.24	5.00E-06	5.00E-06	4.80E-06	4.10E-08
SITE BOUNDARY	SE	0.15	1.80E-05	1.80E-05	1.70E-05	1.10E-07
SITE BOUNDARY	SSE	0.15	1.40E-05	1.40E-05	1.40E-05	9.40E-08
NEAREST RES	S	5.22	6.80E-08	6.80E-08	5.00E-08	2.10E-10
NEAREST RES	SSW	3.85	1.20E-07	1.20E-07	9.40E-08	4.20E-10
NEAREST RES	SW	4.29	1.10E-07	1.10E-07	8.50E-08	3.30E-10
NEAREST RES	WSW	4.41	6.50E-08	6.50E-08	4.90E-08	1.70E-10
NEAREST RES	W	3.98	7.20E-08	7.20E-08	5.50E-08	1.40E-10
NEAREST RES	WNW	3.42	1.00E-07	1.00E-07	7.80E-08	1.90E-10
NEAREST RES	NW	3.67	1.30E-07	1.30E-07	9.90E-08	4.50E-10
NEAREST RES	NNW	4.23	1.10E-07	1.10E-07	8.10E-08	5.00E-10
NEAREST RES	N	5.65	4.70E-08	4.70E-08	3.50E-08	1.80E-10
NEAREST RES	NNE	4.97	6.00E-08	6.00E-08	4.50E-08	2.20E-10
NEAREST RES	NE	3.85	9.30E-08	9.30E-08	7.20E-08	3.50E-10
NEAREST RES	ENE	3.85	8.90E-08	8.90E-08	6.90E-08	3.30E-10
NEAREST RES	E	5.28	5.60E-08	5.60E-08	4.10E-08	2.20E-10
NEAREST RES	ESE	5.84	4.50E-08	4.50E-08	3.30E-08	1.90E-10
NEAREST RES	SE	9.44	3.40E-08	3.40E-08	2.30E-08	1.10E-10
NEAREST RES	SSE	9.44	2.80E-08	2.80E-08	1.90E-08	9.50E-11
GARDENS	NNW	0.57	1.90E-06	1.90E-06	1.70E-06	1.60E-08
GARDENS	SE	0.18	1.20E-05	1.20E-05	1.20E-05	8.40E-08

Meteorological Data

Table 40, 2022 Annual Average Salem Ground Level Release Dispersion (X/Q) and Deposition (D/Q) Factors

SPECIFIC POINTS OF INTEREST						
Location	Direction From Site	Distance (mi)	X/Q (Sec/m^3) No Decay Undepleted	X/Q (Sec/m^3) Decay Undepleted	X/Q (Sec/m^3) Decay Depleted	D/Q (1/m^2)
GARDENS	N	0.57	1.30E-06	1.30E-06	1.20E-06	9.50E-09
GARDENS	NW	0.58	1.70E-06	1.70E-06	1.60E-06	1.10E-08
GARDENS	SSW	3.9	1.20E-07	1.20E-07	9.20E-08	4.10E-10
GARDENS	NE	4.9	6.70E-08	6.70E-08	5.00E-08	2.30E-10
GARDENS	ENE	5	6.20E-08	6.20E-08	4.60E-08	2.00E-10
GARDENS	NE	5	6.50E-08	6.50E-08	4.80E-08	2.20E-10
GARDENS	E	6	4.70E-08	4.70E-08	3.40E-08	1.80E-10
GARDENS	ENE	6	4.80E-08	4.80E-08	3.50E-08	1.50E-10
GARDENS	ESE	6.3	4.10E-08	4.10E-08	3.00E-08	1.60E-10
GARDENS	NW	7	5.50E-08	5.50E-08	3.90E-08	1.40E-10
GARDENS	NNE	7.5	3.40E-08	3.40E-08	2.40E-08	1.10E-10
GARDENS	NW	8.3	4.40E-08	4.40E-08	3.10E-08	1.10E-10
GARDENS	NE	9.3	2.80E-08	2.80E-08	1.90E-08	7.70E-11
GARDENS	N	10.9	1.90E-08	1.90E-08	1.30E-08	5.90E-11
03W2	NE	0.38	2.70E-06	2.70E-06	2.50E-06	1.80E-08
16W4	NNW	0.67	1.50E-06	1.50E-06	1.30E-06	1.20E-08
01W4	N	0.63	1.10E-06	1.10E-06	9.80E-07	8.10E-09
02W5	NNE	0.6	1.20E-06	1.20E-06	1.10E-06	8.70E-09
DAIRY & CATTL	W	4.9	5.40E-08	5.40E-08	4.10E-08	9.40E-11
DAIRY & CATTL	WNW	8.5	3.10E-08	3.10E-08	2.10E-08	3.80E-11
DAIRY & CATTL	NE	11.3	2.10E-08	2.10E-08	1.40E-08	5.60E-11
DAIRY & CATTL	N	11.7	1.80E-08	1.80E-08	1.10E-08	5.20E-11
DAIRY & CATTL	NNE	11.8	1.80E-08	1.80E-08	1.20E-08	5.10E-11
DAIRY & CATTL	NE	4.2	8.20E-08	8.20E-08	6.30E-08	3.00E-10
DAIRY & CATTL	NE	5.8	5.30E-08	5.30E-08	3.90E-08	1.70E-10
DAIRY & CATTL	SSW	8.3	4.40E-08	4.40E-08	3.10E-08	1.10E-10
DAIRY & CATTL	N	11.5	1.80E-08	1.80E-08	1.20E-08	5.40E-11
DAIRY & CATTL	NE	17.7	1.20E-08	1.20E-08	7.00E-09	2.60E-11
STP	NNW	0.5	2.30E-06	2.30E-06	2.10E-06	2.00E-08

Meteorological Data

1.2.2 Hope Creek Generating Station

Table 41, 2022 Annual Average Hope Creek Ground Level Release Dispersion (X/Q) and Deposition (D/Q) Factors

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	S	0.25	6.30E-06	6.30E-06	5.90E-06	3.60E-08
SITE BOUNDARY	SSW	0.19	1.20E-05	1.20E-05	1.20E-05	6.30E-08
SITE BOUNDARY	SW	0.17	1.60E-05	1.60E-05	1.50E-05	7.00E-08
SITE BOUNDARY	WSW	0.17	9.40E-06	9.40E-06	9.00E-06	3.90E-08
SITE BOUNDARY	W	0.18	8.30E-06	8.30E-06	7.90E-06	2.30E-08
SITE BOUNDARY	WNW	0.22	6.80E-06	6.80E-06	6.50E-06	1.90E-08
SITE BOUNDARY	NW	0.31	5.10E-06	5.10E-06	4.70E-06	2.90E-08
SITE BOUNDARY	NNW	0.55	2.00E-06	2.00E-06	1.80E-06	1.70E-08
SITE BOUNDARY	N	0.5	1.60E-06	1.60E-06	1.40E-06	1.20E-08
SITE BOUNDARY	NNE	0.63	1.10E-06	1.10E-06	1.00E-06	8.00E-09
SITE BOUNDARY	NE	0.74	9.60E-07	9.60E-07	8.50E-07	6.20E-09
SITE BOUNDARY	ENE	0.94	6.40E-07	6.40E-07	5.70E-07	3.80E-09
SITE BOUNDARY	E	0.94	6.40E-07	6.40E-07	5.60E-07	4.60E-09
SITE BOUNDARY	ESE	0.75	8.40E-07	8.40E-07	7.40E-07	6.80E-09
SITE BOUNDARY	SE	0.47	2.30E-06	2.30E-06	2.10E-06	1.90E-08
SITE BOUNDARY	SSE	0.42	2.30E-06	2.30E-06	2.10E-06	2.00E-08
NEAREST RES	S	5.22	6.80E-08	6.80E-08	5.00E-08	2.10E-10
NEAREST RES	SSW	3.85	1.20E-07	1.20E-07	9.30E-08	4.20E-10
NEAREST RES	SW	4.29	1.10E-07	1.10E-07	8.50E-08	3.30E-10
NEAREST RES	WSW	4.41	6.50E-08	6.50E-08	4.90E-08	1.70E-10
NEAREST RES	W	3.98	7.10E-08	7.10E-08	5.50E-08	1.40E-10
NEAREST RES	WNW	3.42	9.90E-08	9.90E-08	7.80E-08	1.90E-10
NEAREST RES	NW	3.67	1.30E-07	1.30E-07	9.90E-08	4.50E-10
NEAREST RES	NNW	4.23	1.10E-07	1.10E-07	8.10E-08	5.00E-10
NEAREST RES	N	5.65	4.70E-08	4.70E-08	3.50E-08	1.80E-10
NEAREST RES	NNE	4.97	6.00E-08	6.00E-08	4.50E-08	2.20E-10
NEAREST RES	NE	3.85	9.30E-08	9.30E-08	7.20E-08	3.50E-10
NEAREST RES	ENE	3.85	8.90E-08	8.90E-08	6.90E-08	3.30E-10
NEAREST RES	E	5.28	5.60E-08	5.60E-08	4.10E-08	2.20E-10
NEAREST RES	ESE	5.84	4.50E-08	4.50E-08	3.30E-08	1.90E-10
NEAREST RES	SE	9.44	3.40E-08	3.40E-08	2.30E-08	1.10E-10
NEAREST RES	SSE	9.44	2.80E-08	2.80E-08	1.90E-08	9.50E-11
GARDENS	NNW	0.57	1.90E-06	1.90E-06	1.70E-06	1.60E-08
GARDENS	SE	0.18	1.20E-05	1.20E-05	1.20E-05	8.40E-08
GARDENS	N	0.57	1.30E-06	1.30E-06	1.20E-06	9.50E-09
GARDENS	NW	0.58	1.70E-06	1.70E-06	1.60E-06	1.10E-08

Meteorological Data

Table 41, 2022 Annual Average Hope Creek Ground Level Release Dispersion (X/Q) and Deposition (D/Q) Factors

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	1.20E-07	1.20E-07	9.20E-08	4.10E-10
GARDENS	NE	4.9	6.60E-08	6.60E-08	5.00E-08	2.30E-10
GARDENS	ENE	5	6.20E-08	6.20E-08	4.60E-08	2.00E-10
GARDENS	NE	5	6.50E-08	6.50E-08	4.80E-08	2.20E-10
GARDENS	E	6	4.70E-08	4.70E-08	3.40E-08	1.80E-10
GARDENS	ENE	6	4.80E-08	4.80E-08	3.50E-08	1.50E-10
GARDENS	ESE	6.3	4.10E-08	4.10E-08	3.00E-08	1.60E-10
GARDENS	NW	7	5.50E-08	5.50E-08	3.90E-08	1.40E-10
GARDENS	NNE	7.5	3.40E-08	3.40E-08	2.40E-08	1.10E-10
GARDENS	NW	8.3	4.40E-08	4.40E-08	3.00E-08	1.10E-10
GARDENS	NE	9.3	2.80E-08	2.80E-08	1.90E-08	7.70E-11
GARDENS	N	10.9	1.90E-08	1.90E-08	1.30E-08	5.90E-11
03W2	E	0.39	2.40E-06	2.40E-06	2.20E-06	2.00E-08
16W4	NW	0.4	3.20E-06	3.20E-06	3.00E-06	1.90E-08
01W4	NE	0.39	2.40E-06	2.40E-06	2.20E-06	1.70E-08
02W5	NNE	0.39	2.60E-06	2.60E-06	2.40E-06	1.80E-08
DAIRY & CATTL	W	4.9	5.40E-08	5.40E-08	4.10E-08	9.40E-11
DAIRY & CATTL	WNW	8.5	3.10E-08	3.10E-08	2.10E-08	3.80E-11
DAIRY & CATTL	NE	11.3	2.10E-08	2.10E-08	1.40E-08	5.60E-11
DAIRY & CATTL	N	11.7	1.80E-08	1.80E-08	1.10E-08	5.20E-11
DAIRY & CATTL	NNE	11.8	1.80E-08	1.80E-08	1.20E-08	5.10E-11
DAIRY & CATTL	NE	4.2	8.20E-08	8.20E-08	6.30E-08	3.00E-10
DAIRY & CATTL	NE	5.8	5.30E-08	5.30E-08	3.80E-08	1.70E-10
DAIRY & CATTL	SSW	8.3	4.40E-08	4.40E-08	3.10E-08	1.10E-10
DAIRY & CATTL	N	11.5	1.80E-08	1.80E-08	1.20E-08	5.40E-11
DAIRY & CATTL	NE	17.7	1.20E-08	1.20E-08	7.00E-09	2.60E-11
STP	NNW	0.25	7.70E-06	7.70E-06	7.30E-06	5.80E-08

Meteorological Data

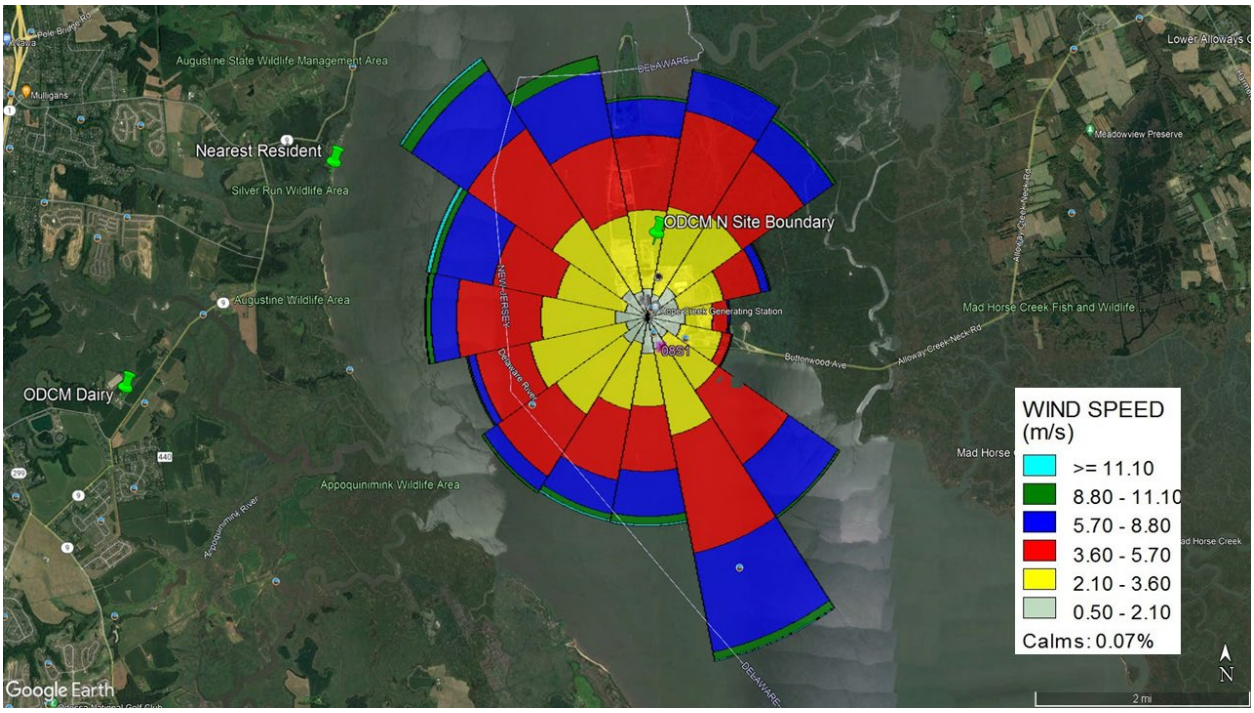

Figure 6, Locations of Dose Calculation Receptors with 2022 Wind Rose Overlay

Radiological Effluent Trends

Attachment 4, Radiological Effluent Trends

Radiological Effluent Trends

1.0 The following trend graphs displays the total curies of liquid and gaseous effluents released for SGS and HCGS from 2010 through 2022.

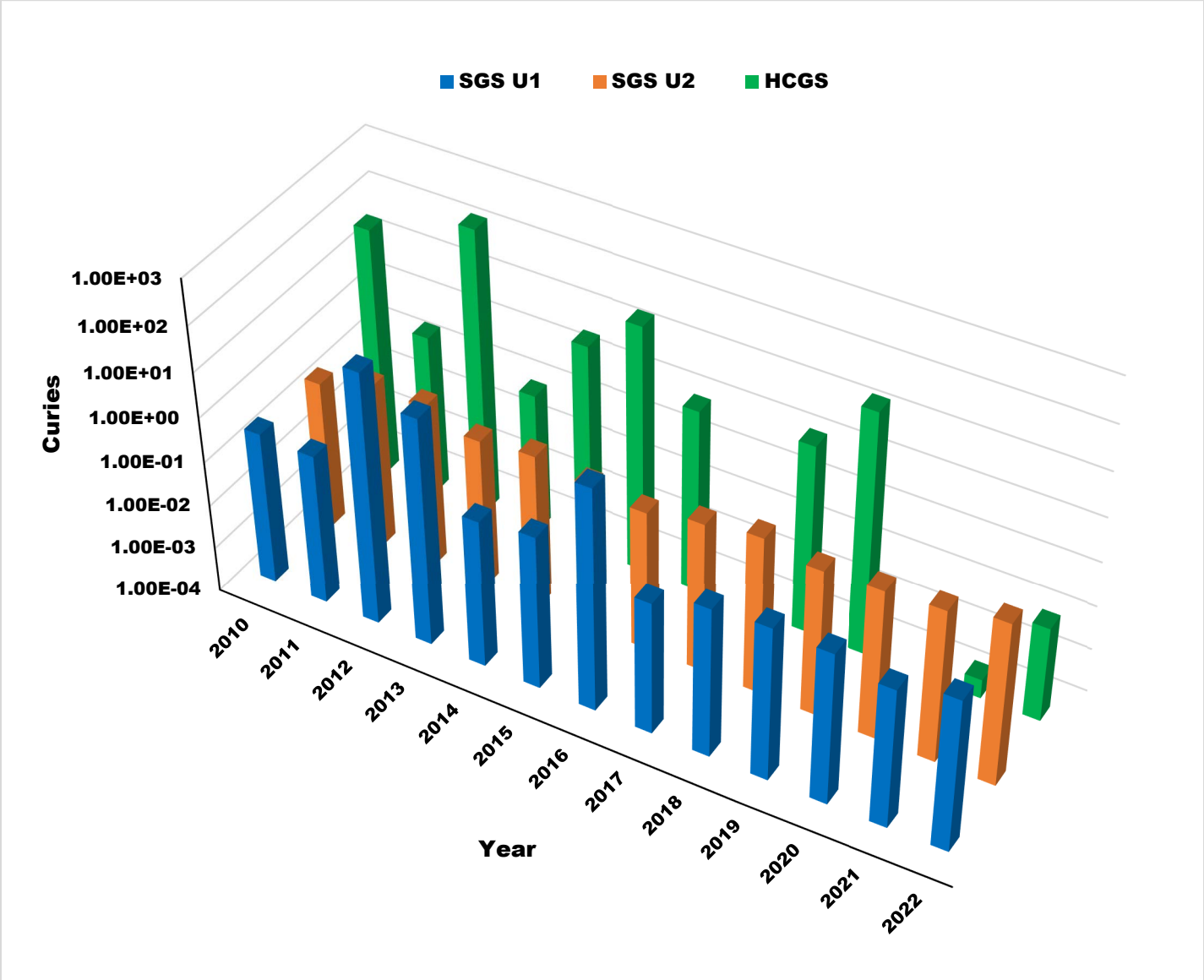

Figure 7, Fission and Activation Gases Released in Gaseous Effluents from Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2010 – 2022

Radiological Effluent Trends

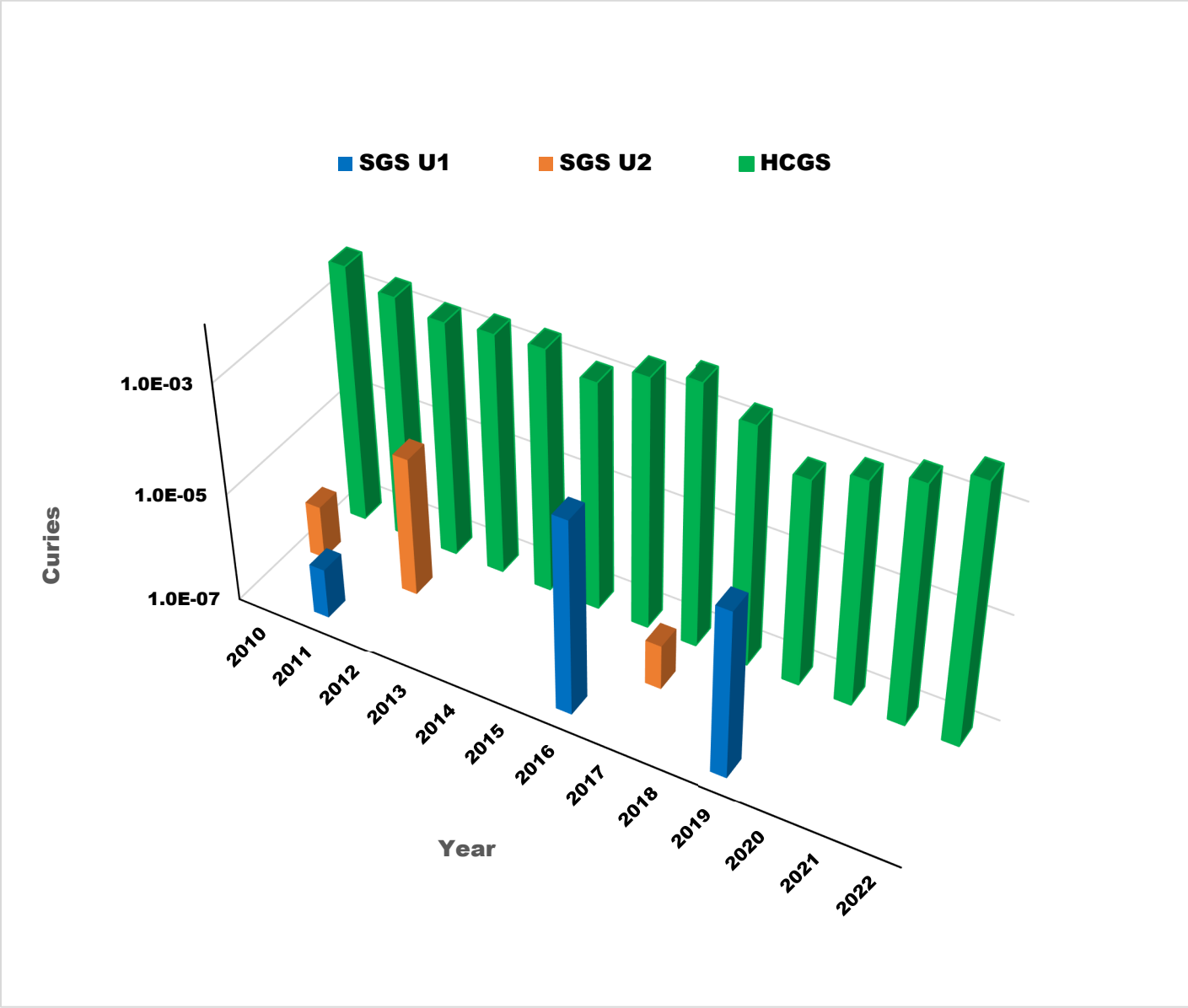

Figure 8, Iodines Released in Gaseous Effluents from Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2010 – 2022

Radiological Effluent Trends

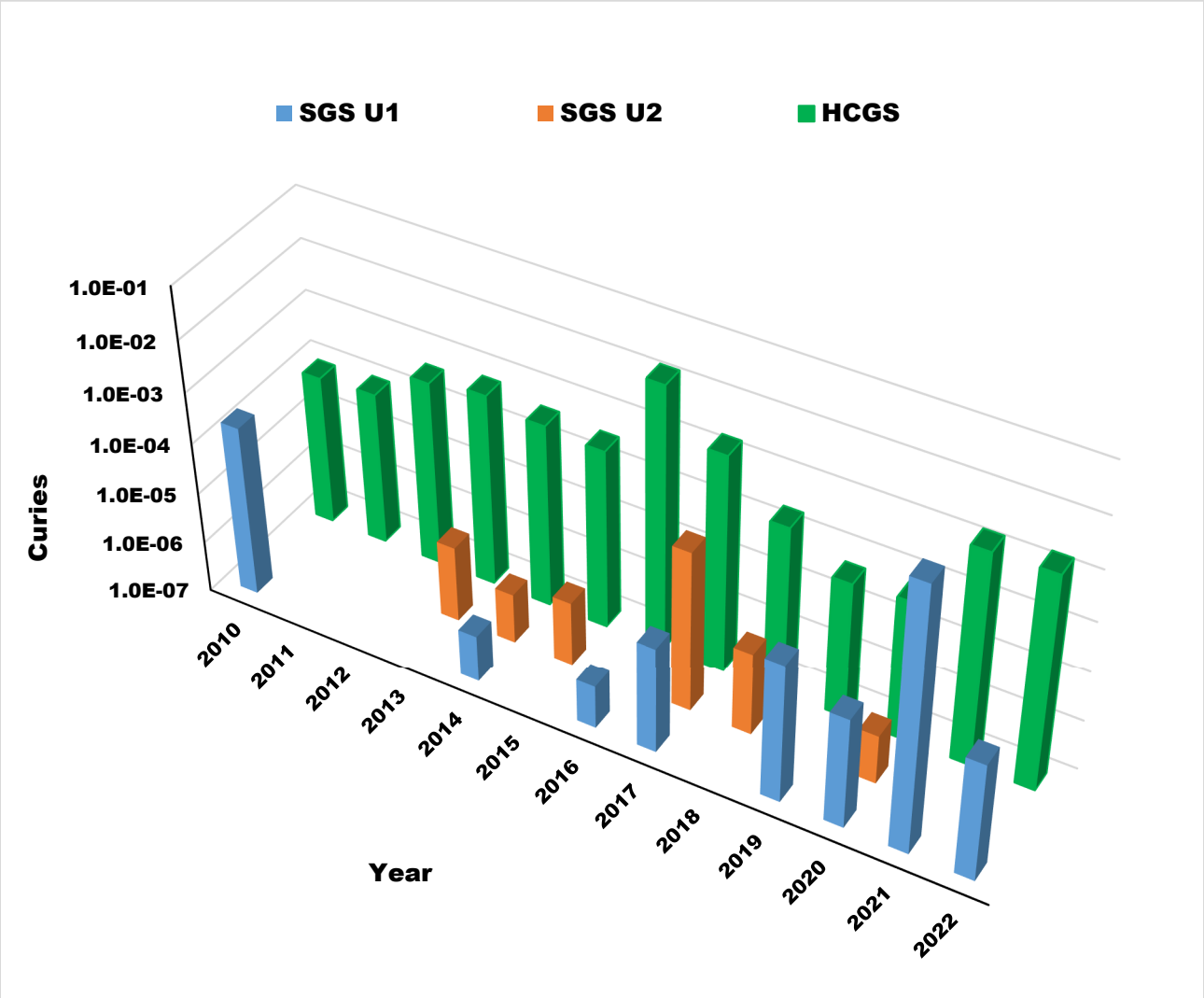

Figure 9, Particulates Released in Gaseous Effluents from Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2010 – 2022

Radiological Effluent Trends

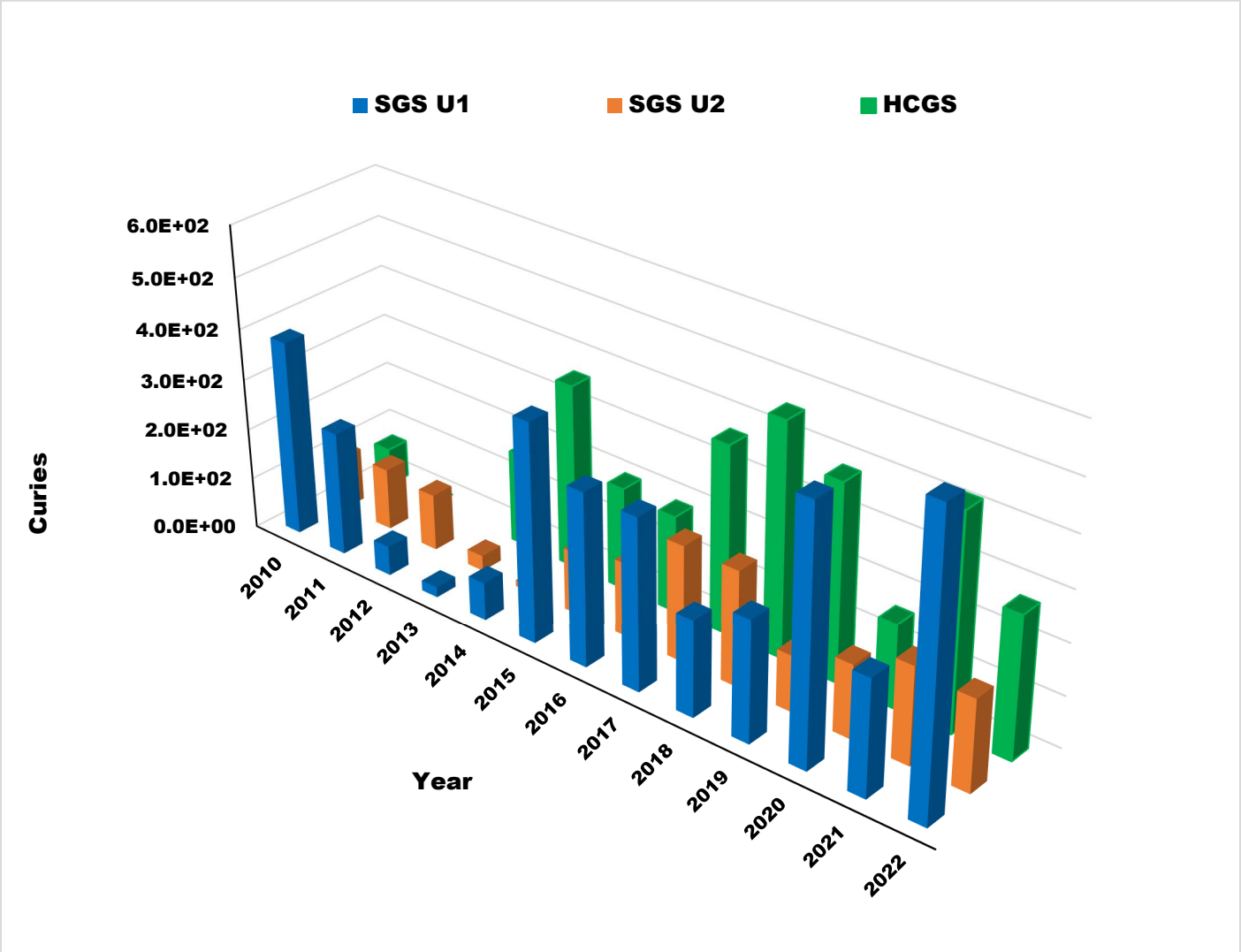

Figure 10, Tritium Released in Gaseous Effluents from Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2010 – 2022

Radiological Effluent Trends

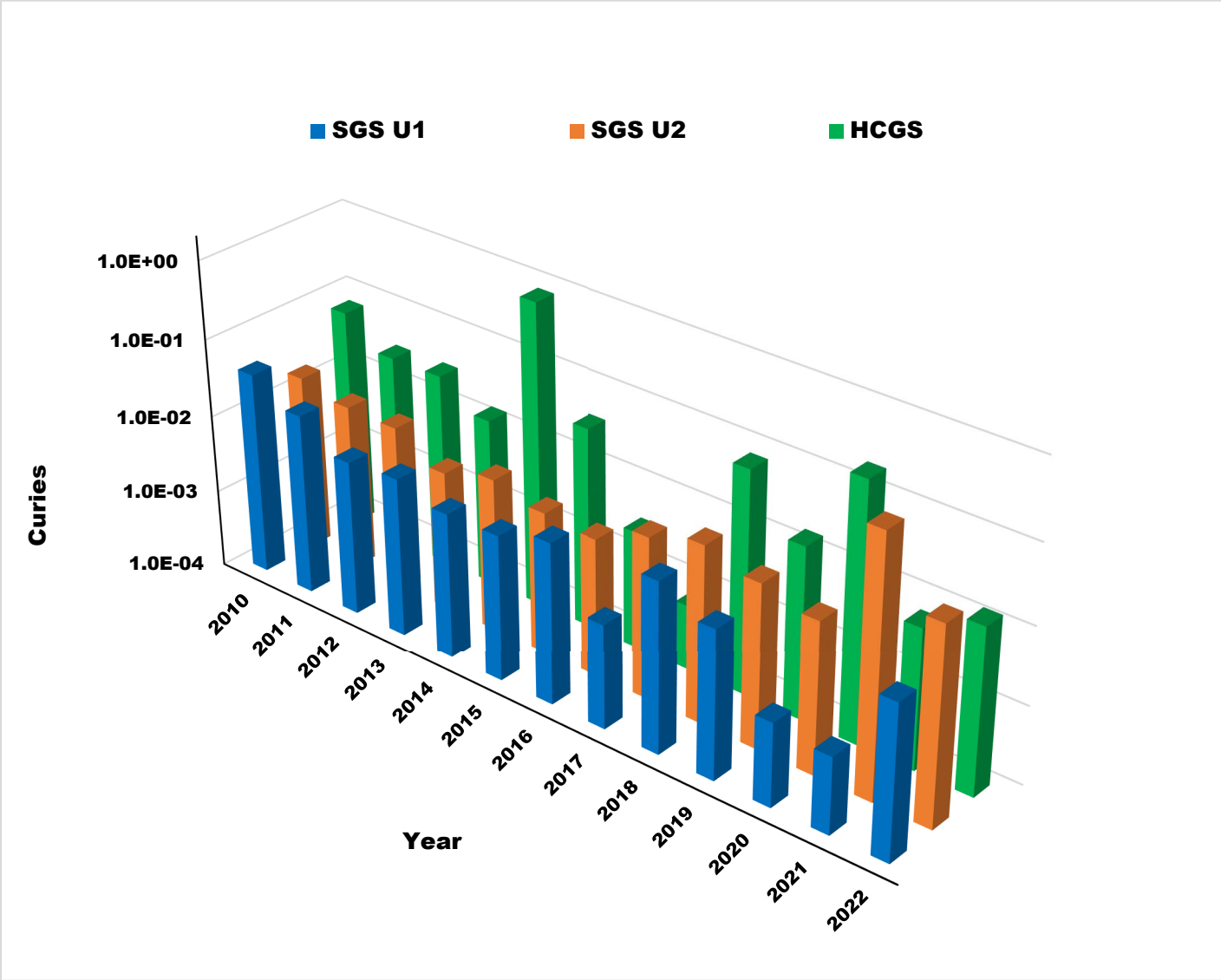

Figure 11, Fission and Activation Products Released in Liquid Effluents, Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2010 – 2022

Radiological Effluent Trends

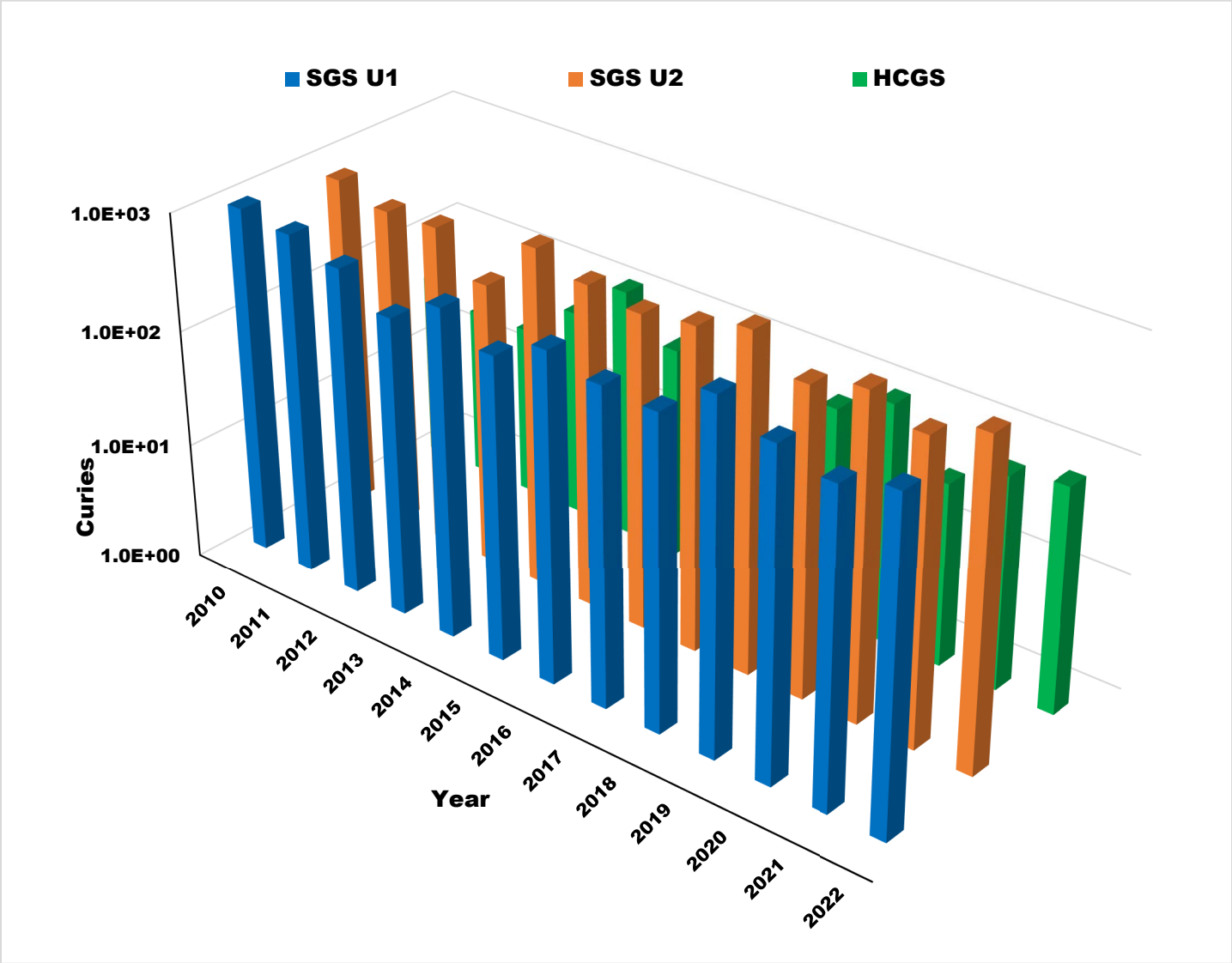

Figure 12, Tritium Released in Liquid Effluents, Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2010 – 2022

Doses to the Onsite Receptors

Attachment 5, Doses to Onsite Receptors Using NRC Code GASPAR

Doses to the Onsite 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 2022 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[1]

Location	Plant	Sector	Distance (miles)	Occupancy Factor[2]	X/Q Undecayed / Undepleted (sec/m^3)	X/Q Decayed / Undepleted (sec/m^3)	X/Q Decayed / Depleted (sec/m^3)	Deposition D/Q ($1/m^2$)
Emergency Personnel[3]	HC	E	0.94	0.34	7.80E-07	8.71E-07	7.67E-07	5.59E-09
	SA	E	0.89	0.34	8.45E-07	8.45E-07	7.41E-07	6.24E-09
03W2[4]	HC	E	0.39	0.34	2.86E-06	2.86E-06	2.73E-06	2.47E-08
	SA	NE	0.38	0.34	3.90E-06	3.90E-06	3.51E-06	2.47E-08
16W4 Parcel A[4]	HC	NW	0.40	0.34	4.55E-06	4.55E-06	4.16E-06	3.25E-08
	SA	NNW	0.67	0.34	1.43E-06	1.43E-06	1.30E-06	1.11E-08
01W4 Parcel C[4]	HC	NNE	0.39	0.34	3.12E-06	3.12E-06	2.86E-06	2.21E-08
	SA	N	0.63	0.34	1.43E-06	1.43E-06	1.29E-06	9.75E-09
02W5[4]	HC	NE	0.39	0.34	3.64E-06	3.64E-06	3.38E-06	2.34E-08
	SA	NNE	0.60	0.34	1.69E-06	1.69E-06	1.43E-06	1.08E-08
STP[5]	HC	NNW	0.25	0.34	7.37E-06	7.37E-06	7.10E-06	4.00E-08
	SA	NNW	0.50	0.34	2.33E-06	2.33E-06	2.10E-06	1.10E-08

[1] X/Q and D/Q values have a plus 30% conservative factor added.
[2] Occupancy Factor represents 3000 working hours per year.
[3] Emergency Workers are considered National Guard, Police, and other personnel necessary during an emergency.
[4] Wind Port Locations.
[5] Sewage Treatment Plant Workers.

Doses to the Onsite Receptors

Table 43, Calculated Doses (mrem) to Emergency Workers (i.e., National Guard, State Police, etc.) (34 Percent Occupancy) from Gaseous Effluents from Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2022

Receptor – Emergency Workers – Salem Unit 1								
ANNUAL BETA AIR DOSE =			6.32E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			1.34E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	8.87E-06	8.87E-06	8.87E-06	8.87E-06	8.87E-06	8.87E-06	8.87E-06	1.48E-05
GROUND	2.50E-06	2.50E-06	2.50E-06	2.50E-06	2.50E-06	2.50E-06	2.50E-06	2.93E-06
INHAL								
ADULT	4.11E-03	4.11E-03	1.71E-03	4.11E-03	4.11E-03	4.11E-03	4.11E-03	3.77E-03
Total	4.13E-03	4.13E-03	1.72E-03	4.13E-03	4.13E-03	4.13E-03	4.13E-03	3.79E-03
Receptor – Emergency Workers – Salem Unit 2								
ANNUAL BETA AIR DOSE =			9.35E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			1.87E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.24E-05	1.24E-05	1.24E-05	1.24E-05	1.24E-05	1.24E-05	1.24E-05	2.07E-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	1.53E-03	1.53E-03	1.90E-03	1.53E-03	1.53E-03	1.53E-03	1.53E-03	1.17E-03
Total	1.54E-03	1.54E-03	1.92E-03	1.54E-03	1.54E-03	1.54E-03	1.54E-03	1.19E-03
Receptor – Emergency Workers – Hope Creek Unit 1								
ANNUAL BETA AIR DOSE =			2.94E-07	MRAD				
ANNUAL GAMMA AIR DOSE =			2.29E-07	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.51E-07	1.51E-07	1.51E-07	1.51E-07	1.51E-07	1.51E-07	1.51E-07	4.01E-07
GROUND	3.57E-04	3.57E-04	3.57E-04	3.57E-04	3.57E-04	3.57E-04	3.57E-04	4.22E-04
INHAL								
ADULT	2.12E-03	2.12E-03	2.40E-03	2.12E-03	2.12E-03	2.24E-03	2.13E-03	1.67E-03
Total	2.48E-03	2.48E-03	2.76E-03	2.48E-03	2.48E-03	2.59E-03	2.49E-03	2.09E-03
Receptor – Emergency Workers – Total All Units								
ANNUAL BETA AIR DOSE =			1.60E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			3.23E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.14E-05	2.14E-05	2.14E-05	2.14E-05	2.14E-05	2.14E-05	2.14E-05	3.59E-05
GROUND	3.59E-04	3.59E-04	3.59E-04	3.59E-04	3.59E-04	3.59E-04	3.59E-04	4.25E-04
INHAL								
ADULT	7.76E-03	7.76E-03	6.01E-03	7.76E-03	7.73E-03	7.88E-03	7.78E-03	6.61E-03
Total	8.14E-03	8.14E-03	6.39E-03	8.14E-03	8.14E-03	8.26E-03	8.16E-03	7.07E-03

Doses to the Onsite Receptors

Table 44, Calculated Doses (mrem) to Sewage Treatment Plant Workers (34 Percent Occupancy) from Gaseous Effluents from Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2022

Receptor – Sewage Treatment Plant – Salem Unit 1								
ANNUAL BETA AIR DOSE =			1.74E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			3.71E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.44E-05	2.44E-05	2.44E-05	2.44E-05	2.44E-05	2.44E-05	2.45E-05	4.08E-05
GROUND	7.17E-06	7.17E-06	7.17E-06	7.17E-06	7.17E-06	7.17E-06	7.17E-06	8.43E-06
INHAL								
ADULT	1.13E-02	1.13E-02	4.69E-03	1.13E-02	1.13E-02	1.13E-02	1.13E-02	1.04E-02
Total	1.14E-02	1.14E-02	4.72E-03	1.14E-02	1.14E-02	1.14E-02	1.14E-02	1.05E-02
Receptor – Sewage Treatment Plant – Salem Unit 2								
ANNUAL BETA AIR DOSE =			2.58E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			5.17E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.40E-05	3.40E-05	3.40E-05	3.40E-05	3.40E-05	3.40E-05	3.43E-05	5.71E-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	4.22E-03	4.22E-03	5.24E-03	4.22E-03	4.22E-03	4.22E-03	4.22E-03	3.23E-03
Total	4.25E-03	4.25E-03	5.27E-03	4.25E-03	4.25E-03	4.25E-03	4.25E-03	3.29E-03
Receptor – Sewage Treatment Plant – Hope Creek Unit 1								
ANNUAL BETA AIR DOSE =			8.16E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			6.37E-06	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.43E-06	1.43E-06	1.43E-06	1.43E-06	1.43E-06	1.43E-06	1.46E-06	3.77E-06
GROUND	3.39E-03	3.39E-03	3.39E-03	3.39E-03	3.39E-03	3.39E-03	3.39E-03	3.98E-03
INHAL								
ADULT	2.00E-02	2.00E-02	2.27E-02	2.00E-02	2.00E-02	2.11E-02	2.01E-02	1.57E-02
Total	2.34E-02	2.34E-02	2.34E-02	2.34E-02	2.34E-02	2.45E-02	2.35E-02	1.97E-02
Receptor – Sewage Treatment Plant – Total All Units								
ANNUAL BETA AIR DOSE =			4.60E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			9.09E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	5.99E-05	5.99E-05	5.99E-05	5.99E-05	5.99E-05	5.99E-05	6.00E-05	1.02E-04
GROUND	3.40E-03	3.40E-03	3.40E-03	3.40E-03	3.40E-03	3.40E-03	3.40E-03	3.99E-03
INHAL								
ADULT	3.56E-02	3.56E-02	3.26E-02	3.56E-02	3.56E-02	3.67E-02	3.57E-02	2.94E-02
Total	3.90E-02	3.90E-02	3.61E-02	3.90E-02	3.90E-02	4.01E-02	3.91E-02	3.35E-02

Doses to the Onsite Receptors

Table 45, Calculated Doses (mrem) to Special Interest Location 03W2 from Gaseous Effluents (34 Percent Occupancy) from Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2022

Receptor: 03W2–Salem Unit 1								
ANNUAL BETA AIR DOSE =			2.91E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			6.19E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	4.08E-05	4.08E-05	4.08E-05	4.08E-05	4.08E-05	4.08E-05	4.11E-05	6.83E-05
GROUND	9.89E-06	9.89E-06	9.89E-06	9.89E-06	9.89E-06	9.89E-06	9.89E-06	1.16E-05
INHAL								
ADULT	1.90E-02	1.90E-02	7.89E-03	1.90E-02	1.90E-02	1.90E-02	1.90E-02	1.75E-02
Total	1.90E-02	1.90E-02	7.94E-03	1.90E-02	1.90E-02	1.90E-02	1.90E-02	1.76E-02
Receptor: 03W2–Salem Unit 2								
ANNUAL BETA AIR DOSE =			4.32E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			8.64E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	5.71E-05	5.71E-05	5.71E-05	5.71E-05	5.71E-05	5.71E-05	5.71E-05	9.55E-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	7.07E-03	7.07E-03	8.81E-03	7.07E-03	7.07E-03	7.07E-03	7.07E-03	5.41E-03
Total	7.13E-03	7.13E-03	8.86E-03	7.13E-03	7.13E-03	7.13E-03	7.13E-03	5.50E-03
Receptor: 03W2–Hope Creek Unit 1								
ANNUAL BETA AIR DOSE =			1.08E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			8.40E-07	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	5.54E-07	5.54E-07	5.54E-07	5.54E-07	5.54E-07	5.54E-07	5.64E-07	1.47E-06
GROUND	1.58E-03	1.58E-03	1.58E-03	1.58E-03	1.58E-03	1.58E-03	1.58E-03	1.86E-03
INHAL								
ADULT	7.75E-03	7.75E-03	8.81E-03	7.75E-03	7.75E-03	8.19E-03	7.82E-03	6.12E-03
Total	9.33E-03	9.33E-03	1.04E-02	9.33E-03	9.33E-03	9.78E-03	9.40E-03	7.98E-03
Receptor: 03W2–Total All Units								
ANNUAL BETA AIR DOSE =			7.34E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			1.49E-04	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	9.85E-05	9.85E-05	9.85E-05	9.85E-05	9.85E-05	9.85E-05	9.88E-05	1.65E-04
GROUND	1.59E-03	1.59E-03	1.59E-03	1.59E-03	1.59E-03	1.59E-03	1.59E-03	1.87E-03
INHAL								
ADULT	3.38E-02	3.38E-02	2.55E-02	3.38E-02	3.38E-02	3.42E-02	3.39E-02	2.90E-02
Total	3.55E-02	3.55E-02	2.72E-02	3.55E-02	3.55E-02	3.59E-02	3.56E-02	3.10E-02

Doses to the Onsite Receptors

Table 46, Calculated Doses (mrem) to Special Interest Location 16W4 from Gaseous Effluents (34 Percent Occupancy) from Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2022

Receptor: 16W4–Salem Unit 1								
ANNUAL BETA AIR DOSE =			1.07E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			2.26E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.50E-05	1.50E-05	1.50E-05	1.50E-05	1.50E-05	1.50E-05	1.50E-05	2.50E-05
GROUND	4.45E-06	4.45E-06	4.45E-06	4.45E-06	4.45E-06	4.45E-06	4.45E-06	5.24E-06
INHAL								
ADULT	6.94E-03	6.94E-03	2.89E-03	6.94E-03	6.94E-03	6.94E-03	6.97E-03	6.43E-03
Total	6.96E-03	6.96E-03	2.91E-03	6.96E-03	6.96E-03	6.96E-03	6.99E-03	6.46E-03
Receptor: 16W4–Salem Unit 2								
ANNUAL BETA AIR DOSE =			1.58E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			3.16E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.09E-05	2.09E-05	2.09E-05	2.09E-05	2.09E-05	2.09E-05	2.10E-05	3.50E-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	2.59E-03	2.59E-03	3.22E-03	2.59E-03	2.59E-03	2.59E-03	2.59E-03	1.98E-03
Total	2.61E-03	2.61E-03	3.24E-03	2.61E-03	2.61E-03	2.61E-03	2.61E-03	2.02E-03
Receptor: 16W4–Hope Creek Unit 1								
ANNUAL BETA AIR DOSE =			2.71E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			1.34E-06	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	8.81E-07	8.81E-07	8.81E-07	8.81E-07	8.81E-07	8.81E-07	9.01E-07	2.34E-06
GROUND	2.08E-03	2.08E-03	2.08E-03	2.08E-03	2.08E-03	2.08E-03	2.08E-03	2.45E-03
INHAL								
ADULT	1.23E-02	1.23E-02	1.40E-02	1.23E-02	1.24E-02	1.30E-02	1.24E-02	9.72E-03
Total	1.44E-02	1.44E-02	1.61E-02	1.44E-02	1.45E-02	1.51E-02	1.45E-02	1.22E-02
Receptor: 16W4–Total All Units								
ANNUAL BETA AIR DOSE =			2.82E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			5.56E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.68E-05	3.68E-05	3.68E-05	3.68E-05	3.68E-05	3.68E-05	3.69E-05	6.23E-05
GROUND	2.09E-03	2.09E-03	2.09E-03	2.09E-03	2.09E-03	2.09E-03	2.09E-03	2.45E-03
INHAL								
ADULT	2.19E-02	2.19E-02	2.01E-02	2.19E-02	2.19E-02	2.25E-02	2.20E-02	1.81E-02
Total	2.40E-02	2.40E-02	2.22E-02	2.40E-02	2.40E-02	2.47E-02	2.41E-02	2.06E-02

Doses to the Onsite Receptors

Table 47, Calculated Doses (mrem) to Special Interest Location 01W4 from Gaseous Effluents (34 Percent Occupancy) from Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2022

Receptor: 01W4– Salem Unit 1								
ANNUAL BETA AIR DOSE =			1.07E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			2.26E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.50E-05	1.50E-05	1.50E-05	1.50E-05	1.50E-05	1.50E-05	1.50E-05	2.50E-05
GROUND	3.91E-06	3.91E-06	3.91E-06	3.91E-06	3.91E-06	3.91E-06	3.91E-06	4.59E-06
INHAL								
ADULT	6.94E-03	6.94E-03	2.89E-03	6.94E-03	6.94E-03	6.94E-03	6.97E-03	6.43E-03
Total	6.95E-03	6.95E-03	2.91E-03	6.95E-03	6.95E-03	6.95E-03	6.99E-03	6.46E-03
Receptor: 01W4–Salem Unit 2								
ANNUAL BETA AIR DOSE =			1.58E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			3.16E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.09E-05	2.09E-05	2.09E-05	2.09E-05	2.09E-05	2.09E-05	2.10E-05	3.50E-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	2.59E-03	2.59E-03	3.22E-03	2.59E-03	2.59E-03	2.59E-03	2.59E-03	1.98E-03
Total	2.61E-03	2.61E-03	3.24E-03	2.61E-03	2.61E-03	2.61E-03	2.61E-03	2.02E-03
Receptor: 01W4–Hope Creek Unit 1								
ANNUAL BETA AIR DOSE =			1.17E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			9.18E-07	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	6.05E-07	6.05E-07	6.05E-07	6.05E-07	6.05E-07	6.05E-07	6.15E-07	1.60E-06
GROUND	1.41E-03	1.41E-03	1.41E-03	1.41E-03	1.41E-03	1.41E-03	1.41E-03	1.67E-03
INHAL								
ADULT	8.47E-03	8.47E-03	9.59E-03	8.47E-03	8.47E-03	8.94E-03	8.53E-03	6.66E-03
Total	9.88E-03	9.88E-03	1.10E-02	9.88E-03	9.88E-03	1.04E-02	9.94E-03	8.33E-03
Receptor: 01W4–Total All Units								
ANNUAL BETA AIR DOSE =			2.77E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			5.52E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.65E-05	3.65E-05	3.65E-05	3.65E-05	3.65E-05	3.65E-05	3.66E-05	6.16E-05
GROUND	1.42E-03	1.42E-03	1.42E-03	1.42E-03	1.42E-03	1.42E-03	1.42E-03	1.67E-03
INHAL								
ADULT	1.80E-02	1.80E-02	1.57E-02	1.80E-02	1.80E-02	1.85E-02	1.81E-02	1.51E-02
Total	1.94E-02	1.94E-02	1.72E-02	1.94E-02	1.94E-02	1.99E-02	1.95E-02	1.68E-02

Doses to the Onsite Receptors

Table 48, Calculated Doses (mrem) to Special Interest Location 02W5 from Gaseous Effluents (34 Percent Occupancy) from Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2022

Receptor: 02W5–Salem Unit 1								
ANNUAL BETA AIR DOSE =			1.26E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			2.68E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.77E-05	1.77E-05	1.77E-05	1.77E-05	1.77E-05	1.77E-05	1.78E-05	2.95E-05
GROUND	4.32E-06	4.32E-06	4.32E-06	4.32E-06	4.32E-06	4.32E-06	4.32E-06	5.07E-06
INHAL								
ADULT	8.23E-03	8.23E-03	3.40E-03	8.23E-03	8.23E-03	8.23E-03	8.23E-03	7.58E-03
Total	8.25E-03	8.25E-03	3.42E-03	8.25E-03	8.25E-03	8.25E-03	8.25E-03	7.62E-03
Receptor: 02W5–Salem Unit 2								
ANNUAL BETA AIR DOSE =			1.87E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			3.74E-05	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.47E-05	2.47E-05	2.47E-05	2.47E-05	2.47E-05	2.47E-05	2.48E-05	4.15E-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	3.06E-03	3.06E-03	3.81E-03	3.06E-03	3.06E-03	3.06E-03	3.06E-03	2.34E-03
Total	3.08E-03	3.08E-03	3.83E-03	3.08E-03	3.08E-03	3.08E-03	3.08E-03	2.38E-03
Receptor: 02W5–Hope Creek Unit 1								
ANNUAL BETA AIR DOSE =			1.37E-06	MRAD				
ANNUAL GAMMA AIR DOSE =			1.07E-06	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	7.07E-07	7.07E-07	7.07E-07	7.07E-07	7.07E-07	7.07E-07	7.21E-07	1.87E-06
GROUND	1.50E-03	1.50E-03	1.50E-03	1.50E-03	1.50E-03	1.50E-03	1.50E-03	1.76E-03
INHAL								
ADULT	9.89E-03	9.89E-03	1.12E-02	9.89E-03	9.89E-03	1.04E-02	9.93E-03	7.79E-03
Total	1.14E-02	1.14E-02	1.27E-02	1.14E-02	1.14E-02	1.19E-02	1.14E-02	9.55E-03
Receptor: 02W5–Total All Units								
ANNUAL BETA AIR DOSE =			5.01E-05	MRAD				
ANNUAL GAMMA AIR DOSE =			1.02E-04	MRAD				
PATHWAY	EFFECTIVE	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	4.31E-05	4.31E-05	4.31E-05	4.31E-05	4.31E-05	4.31E-05	4.33E-05	7.29E-05
GROUND	1.50E-03	1.50E-03	1.50E-03	1.50E-03	1.50E-03	1.50E-03	1.50E-03	1.77E-03
INHAL								
ADULT	2.12E-02	2.12E-02	1.84E-02	2.12E-02	2.12E-02	2.17E-02	2.12E-02	1.77E-02
Total	2.27E-02	2.27E-02	2.00E-02	2.27E-02	2.27E-02	2.33E-02	2.28E-02	1.96E-02

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Attachment 6, 2022 Radiological Groundwater Protection Program (RGPP) Report

2022 RGPP Report

1.0 Results of the Integrated Tritium Management Program with 2022 Radiological Groundwater Protection Program (RGPP), and 2022 Monitoring Well and Remedial Action Work Plan

1.1 Introduction

This report presents results of the 2022 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.

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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 is 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 2022 at the Site. This report also describes any changes made to the monitoring program during the 2022 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.

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- 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 original 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). Modifications have been made to some RGPP wells since and are reflected in the tables. 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 2022. However, RGPP wells BR and BS were slightly relocated due to New Jersey Economic Development Authority Wind Port Project activities. The original wells were decommissioned, and the replacement wells were designated BR-R and BS-R respectively. Further, it is noted that Well BT was decommissioned and replaced with well BT-R in December 2021 but was not sampled until May 2022.

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 or evaluate 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. 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 courtesy communication by telephone or virtual meeting 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 2022 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 2022 from HCGS RGPP monitoring wells are summarized below and are presented in Table 53.

   - Tritium was not detected in groundwater samples collected from 7 of the 13 HCGS RGPP wells (wells BH, BK, BL, BP, BQ, BR-R, and BS-R).

   - Well BI: Tritium concentrations detected in well BI ranged from 203 pCi/L (May) to 229 pCi/L (August) and averaged 216 pCi/L. Tritium was not detected in the samples collected in February or November. 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 2,320 pCi/L (February) to 2,910 pCi/L (May) and averaged 2,633 pCi/L. 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 429 pCi/L (October) to 986 pCi/L (August) and averaged 605 pCi/L. 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 428 pCi/L (May) to 652 pCi/L (August) and averaged 523 pCi/L. Well BN is located

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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 805 pCi/L (February) to 4,680 pCi/L (August) and averaged 2,743 pCi/L. Tritium was not detected in the samples collected in May, September, October, or November. Well BO is located northeast of the Material Center and is a sentinel (source) well for the Auxiliary Boiler building and buried piping.

- Well BT-R: Tritium was detected in one well sample at a concentration of 273 pCi/L (November). Tritium was not detected in the sample collected in May. Well BT-R is located northeast of the turbine building and is considered an upgradient groundwater monitoring well.

Except for tritium, no plant-related radionuclides were detected in any HCGS RGPP well sampled in 2022.

2. SGS RGPP Wells

Tritium analytical results for groundwater samples collected during 2022 from SGS RGPP monitoring wells are summarized below and are presented on Table 54.

- Tritium was not detected in groundwater samples collected from 5 of the 13 SGS RGPP wells (wells BA, BF, BU, T, and Y).

- Well AL: Well AL was sampled in May and November, with results of 1,040 pCi/L and 1,070 pCi/L respectively. Well AL is located south of the SGS Unit 1 reactor building and is a sentinel (source) well.

- Well BB: Tritium was detected in one well sample at a concentration of 228 pCi/L (November). Tritium was not detected in the sample collected in May. Well BB is located southwest of SGS and is a perimeter groundwater monitoring well.

- Well BC: Tritium was detected at concentrations ranging from 754 pCi/L (May) to 2,010 pCi/L (April) and averaged 1,128 pCi/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 332 pCi/L (February) to 838 pCi/L (August) and averaged 505 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 228 pCi/L (November) to 359 pCi/L (February) and averaged 309 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 336 pCi/L (November). Tritium was not detected in the samples collected in February, May, or August. 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 224 pCi/L (May) to 980 pCi/L (August) and averaged 469 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 at concentrations ranging from 451 pCi/L (May) to 985 pCi/L (August) and averaged 657 pCi/L. 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 2022.

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 2022, the mass flux within the shallow, water bearing unit and deeper groundwater was estimated to be 0.018 Ci and 0.011 Ci, respectively. Therefore, the total potential estimated mass flux of tritium in groundwater reaching the Delaware River during 2022 was 0.029 Ci.

The calculated mass flux of 0.029 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, and a series of monitoring wells that were installed to investigate groundwater quality, but are not included as part of the RGPP or RAWP. As mentioned earlier, new wells BR-R and BS-R were installed in 2022 to replace decommissioned wells BR and BS respectively, and new well BT-R was installed in December 2021 to replace decommissioned well BT. All three new wells were initially sampled in May 2022. 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

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In 2022, 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-2006	Sch-40 PVC	4	37.0	27.0 - 37.0	101.16	11.24	Perimeter	NA
Well BI	May-2006	Sch-40 PVC	4	37.0	27.0 - 37.0	103.07	13.15	Source	Facilities; Piping
Well BJ	May-2006	Sch-40 PVC	4	38.0	28.0 - 38.0	102.97	13.05	Source	Condensate Storage & Transfer; Facilities; Piping
Well BK	May-2006	Sch-40 PVC	4	38.5	28.5 - 38.5	101.42	11.50	Perimeter	NA
Well BL	May-2006	Sch-40 PVC	4	37.0	27.0 - 37.0	102.43	12.51	Perimeter	NA
Well BM	May-2006	Sch-40 PVC	4	37.5	27.5 - 37.5	102.75	12.83	Source	Facilities; Piping
Well BN	May-2006	Sch-40 PVC	4	12.5	7.5 - 12.5	102.64	12.72	Source	Auxiliary Boiler Building; Piping
Well BO	May-2006	Sch-40 PVC	4	35.0	25.0 - 35.0	97.98	8.06	Perimeter/Source	Building Sewage
Well BP	May-2006	Sch-40 PVC	4	38.0	28.0 - 38.0	99.06	9.14	Perimeter/Source	Building Sewage
Well BQ	May-2006	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-R[1]	Jan-2022	Sch-40 PVC	4	40.5	30.5 - 40.5	102.18	12.26	Perimeter/Source	Piping; Dry Cask Storage Building
Well BS-R[1]	Jan-2022	Sch-40 PVC	4	35.0	25.0 - 35.0	102.50	12.58	Upgradient	NA
Well BT-R[2]	Nov-2021	Sch-40 PVC	4	38.5	28.5 - 38.5	103.17	13.25	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] Wells BR and BS were decommissioned and replaced with wells BR-R and BS-R respectively in January 2022, and first sampled in May 2022.

[2] Well BT was decommissioned and replaced with well BT-R in December 2021 and first sampled in May 2022.

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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 BR	May-2006	Sch-40 PVC	4	40.5	30.5 - 40.5	104.28	14.36	Perimeter/Source	Piping; Dry Cask Storage Building
Well BS	May-2006	Sch-40 PVC	4	35.0	25.0 - 35.0	100.55	10.63	Upgradient	NA
Well BT	May-2006	Sch-40 PVC	4	38.5	28.5 - 38.5	99.60	9.68	Upgradient	NA
Well T	Jun-2003	Sch-40 PVC	2	31.2	21.2 - 31.2	104.13	14.21	Source	Facilities; House Heating Boiler
Well U[1]	May-2003	Sch-40 PVC	2	32.2	27.2 - 32.2	101.46	11.54	Source	Facilities; House Heating Boiler
Well Y	Sep-2003	Sch-40 PVC	2	37.0	27.0 - 37.0	101.81	11.89	Perimeter	NA
Well Z	Sep-2003	Sch-40 PVC	2	37.5	27.5 - 37.5	101.86	11.94	Perimeter	NA
Well AL	Jan-2004	Sch-40 PVC	2	25.3	15.3 - 25.3	99.13	9.21	Perimeter	NA
Well BA	May-2006	Sch-40 PVC	4	39.5	29.5 - 39.5	101.07	11.15	Perimeter	NA
Well BB[1]	May-2006	Sch-40 PVC	4	47.0	37.0 - 47.0	102.18	12.26	Perimeter	NA
Well BC[2]	May-2006	Sch-40 PVC	4	38.0	28.0 - 38.0	102.29	12.37	Source / Perimeter	Facilities; RAP Tanks; Piping
Well BD	May-2006	Sch-40 PVC	4	40.5	30.5 - 40.5	98.78	8.86	Source	Facilities; RAP Tanks; Piping
Well BE	May-2006	Sch-40 PVC	4	37.0	27.0 - 37.0	98.31	8.39	Perimeter	NA
Well BF[1]	May-2006	Sch-40 PVC	4	42.0	32.0 - 42.0	101.45	11.53	Perimeter	NA
Well BG[1]	May-2006	Sch-40 PVC	4	37.0	27.0 - 37.0	103.34	13.42	Perimeter	NA
Well BU	May-2006	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-2003	Sch-40 PVC	2	80.0	70.0 - 80.0	Vincentown[1]	102.00	12.08
Well L	Jan-2003	Sch-40 PVC	2	80.0	70.0 - 80.0	Vincentown[1]	101.46	11.54
Well M	May-2003	Sch-40 PVC	1	20.0	10.0 - 20.0	Cofferdam[2]	102.17	12.25
Well N	Jan-2003	Sch-40 PVC	2	20.0	10.0 - 20.0	Cofferdam[2]	101.65	11.73
Well O	Jan-2003	Sch-40 PVC	2	20.0	10.0 - 20.0	Cofferdam[2]	101.33	11.41
Well P	Mar-2003	Sch-40 PVC	2	80.0	70.0 - 80.0	Vincentown[1]	101.13	11.21
Well Q[8]	Mar-2003	Sch-40 PVC	2	80.0	70.0 - 80.0	Vincentown[1]	106.59	16.67
Well R	Jun-2003	Sch-40 PVC	1	19.0	9.0 - 19.0	Cofferdam[2]	102.35	12.43
Well S[4]	May-2003	Sch-40 PVC	2	34.7	24.7 - 34.7	Shallow[3]	99.04	9.12
Well S-V	May-2014	Sch-40 PVC	4	85.0	75.0 - 85.0	Vincentown[1]	101.00	11.08
Well V[6]	Jun-2003	Sch-40 PVC	2	79.5	69.5 - 79.5	Vincentown[1]	101.72	11.80
Well W[6]	Jun-2003	Sch-40 PVC	2	35.0	25.0 - 35.0	Shallow[3]	98.49	8.57
Well AA[4]	Sep-2003	Sch-40 PVC	2	36.0	26.0 - 36.0	Shallow[3]	99.07	9.15
Well AA-V	May-2013	Sch-40 PVC	2	85.0	75.0 - 85.0	Vincentown[1]	100.80	10.88
Well AB[4]	Oct-2003	Sch-40 PVC	2	42.0	32.0- 42.0	Shallow[3]	98.93	9.01
Well AC[4]	Sep-2003	Sch-40 PVC	2	24.0	14.0 - 24.0	Cofferdam[2]	98.77	8.85
Well AD[4]	Oct-2003	Sch-40 PVC	6	43.0	33.0 - 43.0	Shallow[3]	98.99	9.07
Well AE	Oct-2003	Sch-40 PVC	2	27.5	17.5 - 27.5	Cofferdam[2]	101.54	11.62
Well AF	Oct-2003	Sch-40 PVC	2	45.0	35.0 - 45.0	Shallow[3]	101.61	11.69
Well AF-V	Nov-2016	Sch-40 PVC	4	91.0	71.0 - 91.0	Vincentown[1]	101.38	11.46
Well AG-Shallow	Feb-2004	Sch-40 PVC	1	24.2	14.2 - 24.2	Shallow[3]	99.29	9.37
Well AG-Deep	Feb-2004	Sch-40 PVC	1	40.0	30.0 - 40.0	Shallow[3]	99.20	9.28
Well AH-Shallow	Feb-2004	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-2004	Sch-40 PVC	1	40.0	30.0 - 40.0	Shallow[3]	102.70	12.78
Well AI	Jan-2004	Sch-40 PVC	4	22.0	12.0 - 22.0	Cofferdam[2]	98.79	8.87
Well AJ	Jan-2004	Sch-40 PVC	4	35.3	15.3 - 35.3	Shallow[3]	98.85	8.93
Well AM	Jan-2004	Sch-40 PVC	4	20.9	10.9 - 20.9	Cofferdam[2]	98.55	8.63
Well AN	Jun-2004	Sch-40 PVC	4	25.0	10.0 - 25.0	Cofferdam[2]	98.76	8.84
Well AO	Jun-2004	Sch-40 PVC	4	21.0	11.0 - 21.0	Cofferdam[2]	98.82	8.90
Well AP	Jun-2004	Sch-40 PVC	4	40.0	15.0 - 40.0	Shallow[3]	98.65	8.73
Well AQ[5]	Jun-2004	Sch-40 PVC	4	45.0	20.0 - 45.0	Shallow[3]	99.05	9.13
Well AR	Jun-2004	Sch-40 PVC	4	43.0	18.0 - 43.0	Shallow[3]	99.22	9.30
Well AS	Jun-2004	Sch-40 PVC	4	41.5	16.5 - 41.5	Shallow[3]	99.44	9.52
Well AT	Jun-2004	Sch-40 PVC	4	44.0	19.0 - 44.0	Shallow[3]	99.25	9.33
Well BH-V	Jun-2019	Sch-40 PVC	4	82.0	62.0 - 82.0	Vincentown[1]	101.83	11.91
Well BM-V	Jun-2019	Sch-40 PVC	4	92.0	72.0 - 92.0	Vincentown[1]	104.95	15.03
Well BW[6,8]	Dec-2006	Sch-40 PVC	1	10.0	5.0 - 10.0	Shallow[3]	101.62	11.70
Well BX[6,8]	Dec-2006	Sch-40 PVC	1	10.0	5.0 - 10.0	Shallow[3]	101.79	11.87
Well BY	Nov-2010	Sch-40 PVC	4	40.0	35.0 - 40.0	Shallow[3]	103.36	13.44
Well BY-V	Jun-2019	Sch-40 PVC	4	82.0	62.0 - 82.0	Vincentown[1]	103.62	13.70
Well BZ	Nov-2010	Sch-40 PVC	4	36.0	31.0 - 36.0	Shallow[3]	104.29	14.37
Well CA[6]	Dec-2006	Sch-40 PVC	4	38.0	28.0 - 38.0	Shallow[3]	101.96	12.04
Well CB[7]	Dec-2006	Sch-40 PVC	2	80.0	70.0 - 80.0	Vincentown[1]	98.98	9.06
Well DA[6]	Nov-2010	Sch-40 PVC	4	17.0	12.0 - 17.0	Cofferdam[2]	99.04	9.12
Well DB	Nov-2010	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-2010	Sch-40 PVC	4	22.0	17.0 - 22.0	Cofferdam[2]	100.90	10.98
Well DD	Nov-2010	Sch-40 PVC	4	19.0	14.0 - 19.0	Cofferdam[2]	101.23	11.31
Well DE	Nov-2010	Sch-40 PVC	4	18.0	13.0 - 18.0	Cofferdam[2]	101.43	11.51
Well DF	Nov-2010	Sch-40 PVC	4	19.0	14.0 - 19.0	Cofferdam[2]	101.32	11.40
Well DG	Nov-2010	Sch-40 PVC	2	13.5	11.5 - 13.5	Cofferdam[2]	98.98	9.06
Well DH	Oct-2010	Sch-40 PVC	4	21.0	16.0 - 21.0	Cofferdam[2]	101.54	11.62
Well DI	Oct-2010	Sch-40 PVC	4	18.0	13.0 - 18.0	Cofferdam[2]	101.64	11.72
Well DJ	Oct-2010	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 2022

Well ID	Sample Date	Tritium Result (pCi/L)
Well BH	2/9/2022	< 198
Well BH	5/4/2022	< 196
Well BH	8/3/2022	< 192
Well BH	11/8/2022	< 173
Well BI	2/8/2022	< 184
Well BI	5/5/2022	**203**
Well BI	8/1/2022	**229**
Well BI	11/8/2022	< 197
Well BJ	1/3/2022	**2,520**
Well BJ	2/7/2022	**2,320**
Well BJ	3/8/2022	**2,530**
Well BJ	4/5/2022	**2,760**
Well BJ	5/2/2022	**2,910**
Well BJ	6/8/2022	**2,800**
Well BJ	7/8/2022	**2,470**
Well BJ	8/4/2022	**2,530**
Well BJ	11/8/2022	**2,860**
Well BK	5/4/2022	< 186
Well BK	11/8/2022	< 188
Well BL	5/4/2022	< 193
Well BL	11/8/2022	< 184
Well BM	2/9/2022	**500**
Well BM	5/5/2022	**515**
Well BM	8/1/2022	**986**
Well BM	10/3/2022	**429**
Well BM	11/8/2022	**594**
Well BN	2/7/2022	**566**
Well BN	5/3/2022	**428**
Well BN	8/3/2022	**652**
Well BN	11/7/2022	**444**
Well BO	2/7/2022	**805**
Well BO	5/3/2022	< 176
Well BO	8/3/2022	**4,680**
Well BO	9/8/2022	< 197
Well BO	10/6/2022	< 189
Well BO	11/7/2022	< 176
Well BP	5/3/2022	< 169

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Table 53, Tritium Analytical Results, HCGS RGPP Wells 2022

Well ID	Sample Date	Tritium Result (pCi/L)
Well BP	11/7/2022	< 190
Well BQ	2/8/2022	< 185
Well BQ	5/5/2022	< 182
Well BQ	8/3/2022	< 185
Well BQ	11/9/2022	< 179
Well BR-R	5/3/2022	< 183
Well BR-R	11/7/2022	< 181
Well BS-R	5/3/2022	< 184
Well BS-R	11/7/2022	< 182
Well BT-R	5/3/2022	< 187
Well BT-R	11/9/2022	**273**

Notes:

pCi/L	Picocuries per liter
<	Tritium not detected above indicated concentration
273	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	5/4/2022	**1,040**
Well AL	11/10/2022	**1,070**
Well BA	5/4/2022	< 180
Well BA	11/9/2022	< 188
Well BB	5/4/2022	< 178
Well BB	11/9/2022	**228**
Well BC	1/6/2022	**1,120**
Well BC	2/8/2022	**1,060**
Well BC	3/7/2022	**992**
Well BC	4/5/2022	**2,010**
Well BC	5/3/2022	**754**
Well BC	6/6/2022	**878**
Well BC	7/6/2022	**865**
Well BC	8/3/2022	**1,210**
Well BC	11/9/2022	**1,260**
Well BD	2/7/2022	**332**
Well BD	5/2/2022	**487**
Well BD	8/1/2022	**838**
Well BD	11/10/2022	**362**
Well BE	2/8/2022	**359**
Well BE	5/3/2022	**322**
Well BE	8/1/2022	**325**
Well BE	11/8/2022	**228**
Well BF	5/2/2022	< 197
Well BF	11/10/2022	< 184
Well BG	2/7/2022	< 183
Well BG	5/2/2022	< 196
Well BG	8/3/2022	< 191
Well BG	11/8/2022	**336**
Well BU	5/3/2022	< 186
Well BU	11/9/2022	< 175
Well T	2/9/2022	< 199
Well T	5/5/2022	< 181
Well T	8/1/2022	< 188
Well T	11/8/2022	< 192

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Table 54, Tritium Analytical Results, SGS RGPP Wells

Well ID	Sample Date	Tritium Result (pCi/L)
Well U	2/8/2022	**246**
Well U	5/5/2022	**224**
Well U	8/1/2022	**980**
Well U	11/8/2022	**427**
Well V	1/6/2022	**361**
Well V	7/6/2022	**307**
Well W	1/6/2022	**3,290**
Well W	4/4/2022	**3,620**
Well W	6/8/2022	**2,870**
Well W	7/5/2022	**3,210**
Well W	10/5/2022	**3,980**
Well Y	5/5/2022	< 180
Well Y	11/9/2022	< 190
Well Z	5/5/2022	**451**
Well Z	6/8/2022	**704**
Well Z	7/7/2022	**481**
Well Z	8/1/2022	**985**
Well Z	11/9/2022	**664**

Notes:

pCi/L	Picocuries per liter
<	Tritium not detected above indicated concentration
664	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	1/4/2022	**3,760**
Well AA	3/8/2022	**1,470**
Well AA	7/7/2022	**1,330**
Well AA-V	1/4/2022	< 188
Well AA-V	4/5/2022	**184**
Well AA-V	7/7/2022	**1,210**
Well AA-V	10/6/2022	**382**
Well AB	1/5/2022	**5,890**
Well AB	4/5/2022	**5,630**
Well AB	7/8/2022	**5,290**
Well AB	10/5/2022	**4,890**
Well AC	1/5/2022	**28,500**
Well AC	2/7/2022	**31,400**
Well AC	3/8/2022	**23,500**
Well AC	4/4/2022	**36,900**
Well AC	5/2/2022	**39,300**
Well AC	6/7/2022	**34,400**
Well AC	7/6/2022	**46,300**
Well AC	8/1/2022	**41,700**
Well AC	9/8/2022	**21,300**
Well AC	10/5/2022	**28,800**
Well AC	11/1/2022	**34,000**
Well AC	12/5/2022	**24,000**
Well AD	7/8/2022	**5,860**
Well AD	10/5/2022	**11,400**
Well AE	1/4/2022	**8,180**
Well AE	4/4/2022	**18,600**
Well AE	7/8/2022	**29,200**
Well AE	10/5/2022	**12,100**
Well AF	1/4/2022	**282**
Well AF	7/7/2022	**338**
Well AF-V	1/4/2022	**263**
Well AF-V	4/5/2022	**261**
Well AF-V	7/7/2022	**476**
Well AF-V	10/6/2022	**862**

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Table 55, Tritium Analytical Results, Investigation & Monitoring Wells

Well ID	Sample Date	Tritium Result (pCi/L)
Well AG-D	1/4/2022	**941**
Well AG-D	7/7/2022	**877**
Well AG-S	1/4/2022	**336**
Well AG-S	7/7/2022	**466**
Well AH-D	1/6/2022	**476**
Well AH-D	7/8/2022	**315**
Well AH-S	1/6/2022	**906**
Well AH-S	7/8/2022	**728**
Well AI	1/5/2022	**5,030**
Well AI	6/7/2022	**72,900**
Well AI	7/5/2022	**6,120**
Well AI	8/2/2022	**2,850**
Well AI	9/8/2022	**3,440**
Well AI	10/3/2022	**4,210**
Well AI	11/2/2022	**22,000**
Well AJ	7/8/2022	**4,120**
Well AJ	10/5/2022	**4,690**
Well AM	1/5/2022	**9,720**
Well AM	4/4/2022	**7,380**
Well AM	7/6/2022	**9,210**
Well AM	10/5/2022	**14,600**
Well AN	1/5/2022	**10,500**
Well AN	2/8/2022	**12,100**
Well AN	3/8/2022	**11,100**
Well AN	7/8/2022	**13,000**
Well AN	8/2/2022	**14,000**
Well AN	9/7/2022	**19,900**
Well AN	10/5/2022	**16,100**
Well AN	11/10/2022	**16,200**
Well AN	12/6/2022	**18,200**
Well AP	1/6/2022	**4,330**
Well AP	7/8/2022	**1,700**
Well AR	1/4/2022	**4,100**
Well AR	4/5/2022	**4,580**
Well AR	7/7/2022	**5,120**
Well AR	10/6/2022	**3,330**
Well AS	1/4/2022	**6,480**

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Table 55, Tritium Analytical Results, Investigation & Monitoring Wells

Well ID	Sample Date	Tritium Result (pCi/L)
Well AS	7/8/2022	**4,370**
Well AT	1/5/2022	**1,620**
Well AT	7/8/2022	**1,780**
Well BH-V	1/5/2022	< 177
Well BH-V	7/6/2022	< 166
Well BM-V	1/5/2022	< 173
Well BM-V	7/8/2022	**253**
Well BY	1/3/2022	**50,800**
Well BY	2/7/2022	**52,300**
Well BY	3/8/2022	**94,800**
Well BY	4/5/2022	**135,000**
Well BY	5/2/2022	**130,000**
Well BY	6/8/2022	**118,000**
Well BY	7/7/2022	**112,000**
Well BY	8/4/2022	**93,800**
Well BY	9/8/2022	**85,900**
Well BY	10/5/2022	**85,100**
Well BY	11/1/2022	**84,700**
Well BY	12/5/2022	**79,400**
Well BY-V	1/3/2022	**12,800**
Well BY-V	4/5/2022	**9,590**
Well BY-V	7/7/2022	**13,300**
Well BY-V	10/5/2022	**7,220**
Well BZ	5/2/2022	**1,840**
Well BZ	11/8/2022	**1,820**
Well CA	1/6/2022	**1,620**
Well CA	7/7/2022	**2,180**
Well DA	1/6/2022	**2,630**
Well DA	2/8/2022	**2,580**
Well DA	3/8/2022	**3,150**
Well DA	4/4/2022	**2,880**
Well DA	5/2/2022	**3,340**
Well DA	6/8/2022	**3,680**
Well DA	7/7/2022	**4,090**
Well DA	10/6/2022	**3,000**
Well DB	1/5/2022	**6,630**
Well DB	4/4/2022	**4,960**

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Table 55, Tritium Analytical Results, Investigation & Monitoring Wells

Well ID	Sample Date	Tritium Result (pCi/L)
Well DB	7/6/2022	**6,360**
Well DB	10/6/2022	**5,330**
Well DC	1/5/2022	**6,700**
Well DC	2/7/2022	**6,640**
Well DC	3/8/2022	**5,370**
Well DC	4/4/2022	**5,690**
Well DC	5/2/2022	**3,370**
Well DC	6/7/2022	**3,950**
Well DC	7/6/2022	**5,370**
Well DD	1/5/2022	**5,140**
Well DD	4/4/2022	**3,810**
Well DD	7/6/2022	**4,970**
Well DD	10/6/2022	**4,840**
Well DE	1/5/2022	**16,600**
Well DE	4/4/2022	**14,400**
Well DE	7/6/2022	**19,800**
Well DE	10/6/2022	**20,700**
Well DF	1/5/2022	**1,300**
Well DF	7/6/2022	**1,340**
Well DG	1/5/2022	**2,880**
Well DG	4/4/2022	**2,450**
Well DG	7/7/2022	**2,910**
Well DG	10/6/2022	**2,200**
Well DH	1/6/2022	**8,660**
Well DH	4/5/2022	**9,470**
Well DH	7/7/2022	**10,900**
Well DH	10/5/2022	**12,700**
Well DI	1/6/2022	**3,830**
Well DI	4/5/2022	**3,640**
Well DI	7/7/2022	**2,610**
Well DI	10/5/2022	**2,880**
Well DJ	1/6/2022	**3,830**
Well DJ	2/8/2022	**2,700**
Well DJ	3/8/2022	**3,610**
Well DJ	4/5/2022	**3,080**
Well DJ	5/2/2022	**2,310**
Well DJ	6/8/2022	**2,290**

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Table 55, Tritium Analytical Results, Investigation & Monitoring Wells

Well ID	Sample Date	Tritium Result (pCi/L)
Well DJ	7/7/2022	**2,230**
Well K	1/6/2022	< 182
Well K	7/6/2022	< 188
Well L	1/6/2022	< 166
Well L	7/6/2022	< 182
Well M	1/6/2022	**4,240**
Well M	4/4/2022	**22,100**
Well M	5/4/2022	**40,900**
Well M	6/7/2022	**44,900**
Well M	7/5/2022	**30,900**
Well M	8/2/2022	**26,100**
Well M	9/8/2022	**11,700**
Well M	10/3/2022	**12,600**
Well M	11/1/2022	**13,700**
Well M	12/5/2022	**11,900**
Well N	1/5/2022	**8,210**
Well N	4/4/2022	**7,140**
Well N	7/6/2022	**7,620**
Well N	10/5/2022	**7,190**
Well O	1/4/2022	**35,400**
Well O	4/4/2022	**62,600**
Well O	7/8/2022	**26,200**
Well O	10/5/2022	**18,400**
Well P	1/5/2022	< 173
Well P	7/7/2022	< 175
Well R	1/6/2022	**8,300**
Well R	2/9/2022	**8,090**
Well R	3/8/2022	**8,560**
Well R	4/4/2022	**8,870**
Well R	5/4/2022	**7,670**
Well R	6/7/2022	**7,090**
Well R	7/5/2022	**8,700**
Well R	8/1/2022	**8,670**
Well R	9/8/2022	**7,860**
Well R	10/5/2022	**7,000**
Well R	11/10/2022	**7,340**
Well R	12/5/2022	**6,730**

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Table 55, Tritium Analytical Results, Investigation & Monitoring Wells

Well ID	Sample Date	Tritium Result (pCi/L)
Well S	1/5/2022	**14,100**
Well S	4/5/2022	**5,990**
Well S-V	1/5/2022	**2,080**
Well S-V	4/5/2022	**1,750**
Well S-V	7/8/2022	**1,600**
Well S-V	10/6/2022	**829**
Well V	1/6/2022	**361**
Well V	7/6/2022	**307**
Well W	1/6/2022	**3,290**
Well W	4/4/2022	**3,620**
Well W	6/8/2022	**2,870**
Well W	7/5/2022	**3,210**
Well W	10/5/2022	**3,980**

Notes:

pCi/L	Picocuries per liter
†	Well EOW-4L was abandoned in May 2020.
<	Tritium not detected above indicated concentration
3,980	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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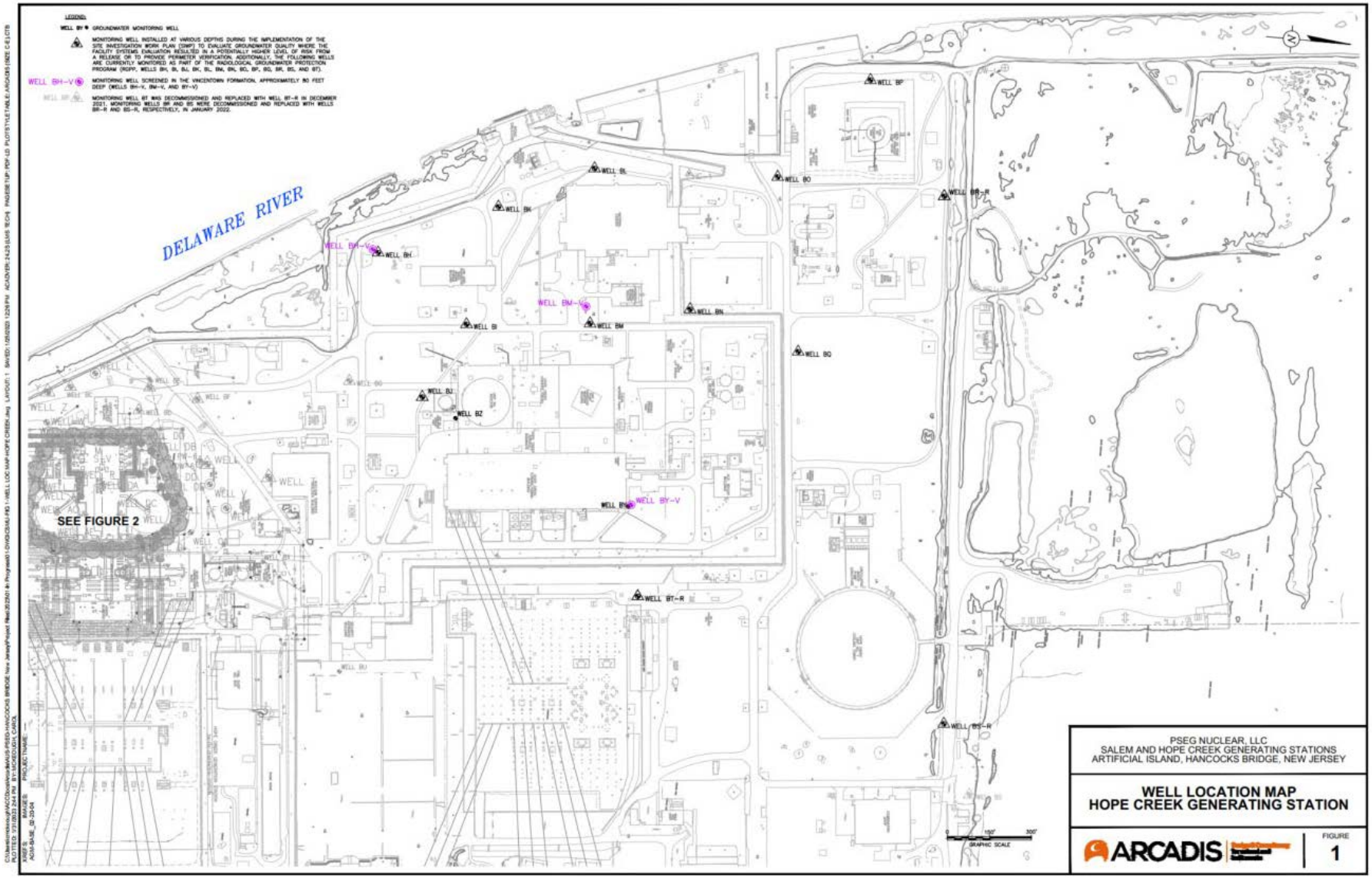

Figure 13, Well Location Map, Hope Creek Generating Station

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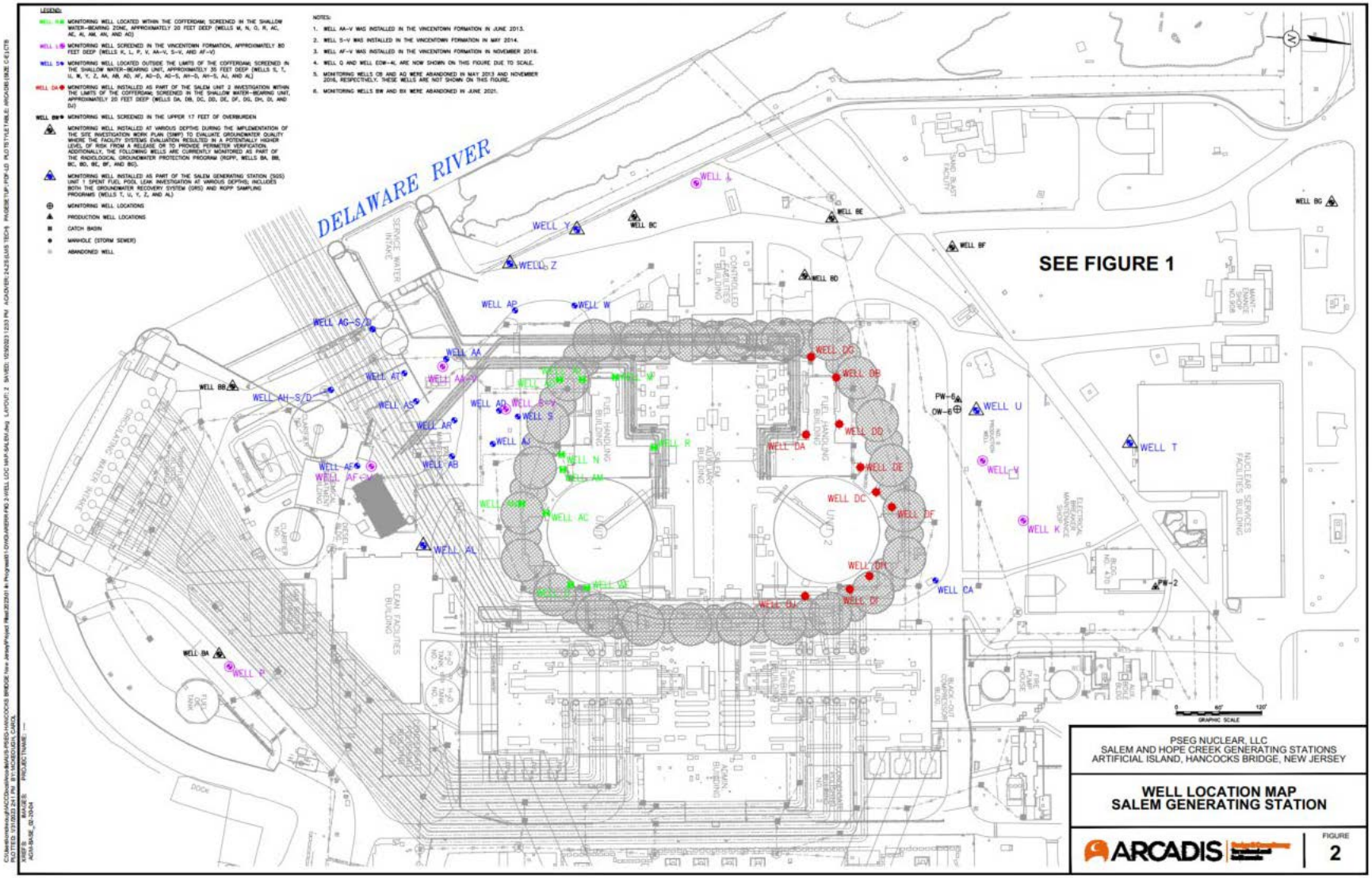

Figure 14, Well Location Map, Salem Generating Station