**PSEG Nuclear LLC**
P.O. Box 236, Hancocks Bridge, New Jersey 08038-0236

PSEG
*Nuclear LLC*

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

LR-N21-0035
April 23, 2021

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: 2020 Annual Radioactive Effluent Release Report (RERR)

As required with Section 6.9.1.8 of Appendix A to Renewed Facility Operating License Nos. DPR-70 (Unit 1) and DPR-75 (Unit 2) for Salem Nuclear Generating Stations (SGS), and Section 6.9.1.7 of Appendix A to Renewed Facility Operating License NPF-57 for Hope Creek Generating Station (HCGS), PSEG Nuclear hereby transmits one (1) copy of the combined 2020 Annual Radioactive Effluent Release Report (Enclosure 1). Reports SGS RERR-69 and HCGS RERR-43 were combined into one (1) report that summarizes information pertaining to the releases of radioactive materials in liquid, gaseous and solid form from the SGS and the HCGS for the period January 1, 2020 to December 31, 2020.

There are no regulatory commitments contained in this letter.

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

Sincerely,

Richard DeSanctis
Plant Manager
Salem Generating Stations

Steven Poorman
Plant Manager
Hope Creek Generating Station

Enclosure 1: 2020 Annual Radioactive Effluent Release Report for Salem and Hope Creek Generating Stations

cc: Administrator - Region I - USNRC
Project Manager – USNRC – Salem/Hope Creek
Mr. Justin Hawkins, Salem Senior Resident Inspector - USNRC
Mr. Jigar Patel, Hope Creek Senior Resident Inspector - USNRC
Mr. Scott Wilson, NRC Inspector - Region I - USNRC
Chief - NJ Bureau of Nuclear Engineering (NJBNE)
Mr. Lee Marabella, Corporate Commitment Tracking Coordinator - w/o attachment
Mr. Thomas Cachaza, Salem/Hope Creek Commitment Tracking Coordinator - w/o attachment

PSEG Nuclear LLC

Salem & Hope Creek Generating Stations


# Annual Radioactive Effluent Release Report

# 2020

Document Number: SGS-69 / HCGS-43

| Unit 1 | Unit 2 | Unit 1 |
|---|---|---|
| DOCKET NO 50-272 | DOCKET NO 50-311 | DOCKET NO. 50-354 |
| OPERATING LICENSE NO DPR-070 | OPERATING LICENSE NO DPR-075 | 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 80126317

| Opr. | | |
|---|---|---|
| 0011 | Stephen Gattuso,<br>Salem Chemistry Manager | 04/09/2021<br>Date |
| 0012 | Ronald Rattigan,<br>Hope Creek Chemistry Manager | 04/20/2021<br>Date |
| 0013 | William Gropp,<br>Salem Radiation Protection Manager | 04/19/2021<br>Date |
| 0014 | Harold Trimble,<br>Hope Creek Radiation Protection Manager | 04/20/2021<br>Date |
| 0015 | William Muffley,<br>Salem Senior Director of Operations | 04/17/2021<br>Date |
| 0016 | James Priest,<br>Hope Creek Senior Director of Operations | 04/18/2021<br>Date |
| 0017 | Richard DeSanctis,<br>Salem Plant Manager | 04/21/2021<br>Date |
| 0018 | Steven Poorman,<br>Hope Creek Plant Manager | 04/21/2021<br>Date |

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## 1.0 LIST OF ACRONYMS AND DEFINITIONS

1. Airborne Activity Sampling: Sampling of air through the collection of particulates and radionuclides on filter media, collection of noble gases in a container, and collection of water vapor containing tritium.
2. Alpha Particle (α): A charged particle emitted from the nucleus of an atom having a mass and charge equal in magnitude of a helium nucleus.
3. AREOR: Annual Radiological Environmental Operating Report
4. ARERR: Annual Radioactive Effluent Release Report
5. Abnormal Release: is an unplanned or uncontrolled release of licensed radioactive material from the plant. Abnormal releases may be categorized as either batch or continuous depending on the circumstances.
6. Abnormal Discharge: is an unplanned or uncontrolled release of licensed radioactive material to the unrestricted area. Abnormal discharges may also be categorized as either batch or continuous depending on the circumstances.
7. BWR: Boiling Water Reactor
8. 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.
9. 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.
10. Counting Error: An estimate of the two-sigma uncertainty associated with the sample results based on respective count times.
11. 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.
12. Curie (Ci): A measure of radioactivity; equal to 3.7 x 1010 disintegrations per second, or 2.22 x 1012 disintegrations per minute.
13. Direct Radiation Monitoring: The measurement of radiation dose at various distances from the plant is assessed using thermoluminescent dosimeters (TLDs).
14. Grab Sample: A single discrete sample drawn at one point in time.
15. Indicator: A sampling location that is likely to be affected by plant effluents due to its proximity and/or direction from the plant.
16. Ingestion Pathway: The ingestion pathway includes milk, fish, and garden produce. Meat or other food products may also be included
17. ISFSI: Independent Spent Fuel Storage Installation
18. JFD: Joint Frequency Data
19. LUC: Land Use Census
20. Lower Limit of Detection (LLD): The smallest concentration of radioactive material in a sample that will yield a net count (above system background) that will be detected with 95% probability with a 5% probability of a false conclusion that a blank observation represents "real" signal.
21. MDA: Minimum Detectable Activity

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

## 2.0 EXECUTIVE SUMMARY

Salem & Hope Creek Generating Stations (SGS/HCGS) Radiological Effluent Control (REC) Program was established to limit the quantities of radioactive material that may be released based on calculated radiation doses or dose rates. Dose to Members of the Public due to radioactive materials released from the plant is limited by Appendix I of 10 CFR 50 and by 40 CFR 190. Operational doses to the public during 2020 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 2020 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 and Cow Milk. The maximum Annual Organ Dose calculated for this receptor was 4.17E-01 mrem, to the Bone. This annual dose is a minute fraction of the 10 CFR 50, Appendix I guideline of 45 mrem to the Maximum Organ from three (3) Units.

The Annual Radiological Environmental Operating Report (AREOR) provides data obtained through analyses of environmental samples collected at Salem & Hope Creek Generating Stations for the reporting period of January 1st through December 31st, 2020. During that time period 1634 analyses were performed on 1292 samples. In assessing all the data gathered for this report and comparing these results with preoperational data, it was concluded that the operation of Salem & Hope Creek Generating Stations, did result in detection of low level plant related tritium in the environment.

## 2.1 Summary of Conclusions:

During 2020 all solid, liquid, and gaseous radioactive effluents from Salem & Hope Creek Generating Stations were well below regulatory limits. For individual effluent streams, the quarterly limit most closely approached was the Gaseous Effluent Maximum Organ Dose for the first quarter for Hope Creek Unit 1 at 9.33E-01 percent (Table 3, Hope Creek Generating Station Unit 1 Dose Summary). The majority of this dose was due to the 5.36 Ci of carbon-14 released from the unit in the first quarter.

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

The direct shine dose from the ISFSI to the highest dose potential receptor located at 3.7 miles in the NW sector was conservatively estimated at 7.74E-03 mrem. The doses from the gaseous and liquid radioactive effluents released from SGS Units 1 and Unit 2 and HCGS Unit 1 in 2020 resulted in a calculated total body and an organ dose of 1.24E-01 mrem and 5.31E-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 1.32E-01 mrem, 1.05E-01 mrem, and 5.31E-01 mrem, respectively. The max organ dose represented 2.13E+00 percent of the 25 mrem limit. The results of this analysis are in Table 5, Total Annual Offsite-Dose Comparison to 40 CFR 190 Regulatory Limits for SGS/HCGS.

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

| | | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Annual |
|---|---|---|---|---|---|---|
| Liquid Effluent Dose Limit, Total Body | **Limit** | **1.5 mrem** | **1.5 mrem** | **1.5 mrem** | **1.5 mrem** | **3 mrem** |
| | Total Body Dose | 9.55E-03 | 1.20E-03 | 5.22E-04 | 2.30E-03 | 1.36E-02 |
| | % of Limit | 6.37E-01 | 7.98E-02 | 3.48E-02 | 1.53E-01 | 4.52E-01 |
| Liquid Effluent Dose Limit, Any Organ | **Limit** | **5 mrem** | **5 mrem** | **5 mrem** | **5 mrem** | **10 mrem** |
| | Maximum Organ Dose | 1.26E-02 | 1.27E-02 | 5.93E-04 | 3.36E-03 | 2.93E-02 |
| | % of Limit | 2.53E-01 | 2.54E-01 | 1.19E-02 | 6.72E-02 | 2.93E-01 |
| Gaseous Effluent Dose Limit, Gamma Air | **Limit** | **5 mrad** | **5 mrad** | **5 mrad** | **5 mrad** | **10 mrad** |
| | Gamma Air Dose | 2.34E-05 | 1.78E-05 | 5.68E-05 | 2.26E-06 | 1.00E-04 |
| | % of Limit | 4.68E-04 | 3.56E-04 | 1.14E-03 | 4.52E-05 | 1.00E-03 |
| Gaseous Effluent Dose Limit, Beta Air | **Limit** | **10 mrad** | **10 mrad** | **10 mrad** | **10 mrad** | **20 mrad** |
| | Beta Air Dose | 1.21E-05 | 6.65E-06 | 2.36E-05 | 3.83E-06 | 4.61E-05 |
| | % of Limit | 1.21E-04 | 6.65E-05 | 2.36E-04 | 3.83E-05 | 2.31E-04 |
| Gaseous Effluent Organ Dose Limit (Iodine, Tritium, C-14, Particulates with > 8-day half-life) | **Limit** | **7.5 mrem** | **7.5 mrem** | **7.5 mrem** | **7.5 mrem** | **15 mrem** |
| | Maximum Organ Dose | 2.00E-02 | 1.96E-02 | 1.99E-02 | 2.03E-02 | 7.97E-02 |
| | % of Limit | 2.67E-01 | 2.61E-01 | 2.65E-01 | 2.70E-01 | 5.23E-01 |

[1] Table 1 is meant to demonstrate compliance to 10 CFR Part 50, Appendix I Limits.

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

| | | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Annual |
|---|---|---|---|---|---|---|
| Liquid Effluent Dose Limit, Total Body | **Limit** | **1.5 mrem** | **1.5 mrem** | **1.5 mrem** | **1.5 mrem** | **3 mrem** |
| | Total Body Dose | 1.86E-03 | 7.61E-04 | 5.93E-04 | 1.45E-03 | 4.67E-03 |
| | % of Limit | 1.24E-01 | 5.07E-02 | 3.95E-02 | 9.70E-02 | 1.56E-01 |
| Liquid Effluent Dose Limit, Any Organ | **Limit** | **5 mrem** | **5 mrem** | **5 mrem** | **5 mrem** | **10 mrem** |
| | Maximum Organ Dose | 2.26E-02 | 8.15E-03 | 9.41E-04 | 2.40E-03 | 3.40E-02 |
| | % of Limit | 4.51E-01 | 1.63E-01 | 1.88E-02 | 4.81E-02 | 3.40E-01 |
| Gaseous Effluent Dose Limit, Gamma Air | **Limit** | **5 mrad** | **5 mrad** | **5 mrad** | **5 mrad** | **10 mrad** |
| | Gamma Air Dose | 4.98E-05 | 1.51E-05 | 3.29E-05 | 4.53E-05 | 1.43E-04 |
| | % of Limit | 9.97E-04 | 3.03E-04 | 6.59E-04 | 9.05E-04 | 1.43E-03 |
| Gaseous Effluent Dose Limit, Beta Air | **Limit** | **10 mrad** | **10 mrad** | **10 mrad** | **10 mrad** | **20 mrad** |
| | Beta Air Dose | 1.77E-05 | 7.86E-06 | 1.16E-05 | 1.60E-05 | 5.31E-05 |
| | % of Limit | 1.77E-04 | 7.86E-05 | 1.16E-04 | 1.60E-04 | 2.66E-04 |
| Gaseous Effluent Organ Dose Limit (Iodine, Tritium, C-14, Particulates with > 8-day half-life) | **Limit** | **7.5 mrem** | **7.5 mrem** | **7.5 mrem** | **7.5 mrem** | **15 mrem** |
| | Maximum Organ Dose | 2.64E-02 | 2.48E-02 | 2.41E-02 | 2.53E-02 | 1.01E-01 |
| | % of Limit | 3.51E-01 | 3.31E-01 | 3.21E-01 | 3.37E-01 | 6.70E-01 |

[2] Table 2 is meant to demonstrate compliance to 10 CFR Part 50, Appendix I Limits.

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

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

[3] Table 3 is meant to demonstrate compliance to 10 CFR Part 50, Appendix I Limits.

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

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

[4] 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[5]**

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

## 3.0 INTRODUCTION

### 3.1 About Nuclear Power

Commercial nuclear power plants are generally classified as either Boiling Water Reactors (BWRs) or Pressurized Water Reactors (PWRs), based on their design. A BWR includes a single coolant system where water used as reactor coolant boils as it passes through the core and the steam generated is used to turn the turbine generator for power production (4). A PWR, in contrast, includes two separate water systems: radioactive reactor coolant and a secondary system. Reactor coolant is maintained under high pressure, preventing boiling. The high-pressure coolant is passed through a heat exchanger called a steam generator where the secondary system water is boiled, and the steam is used to turn the turbine generator for power production (5).

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

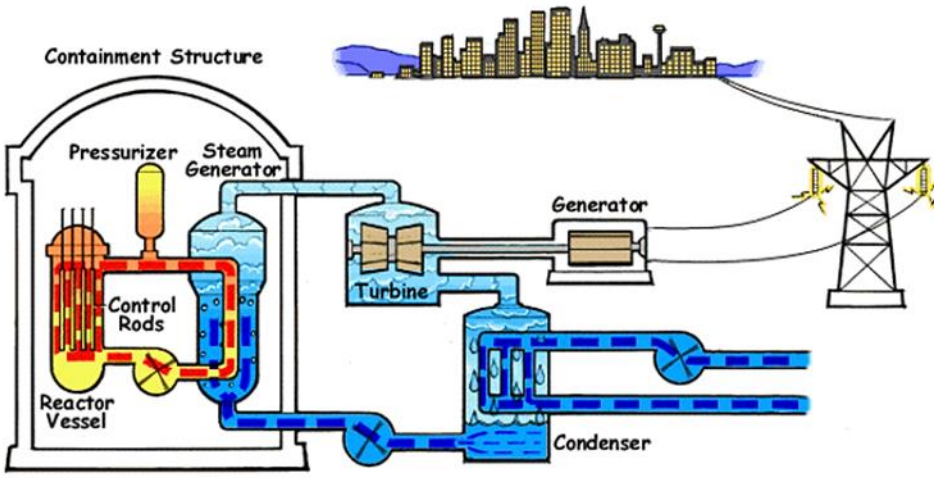


**Figure 1, Pressurized Water Reactor (PWR)**

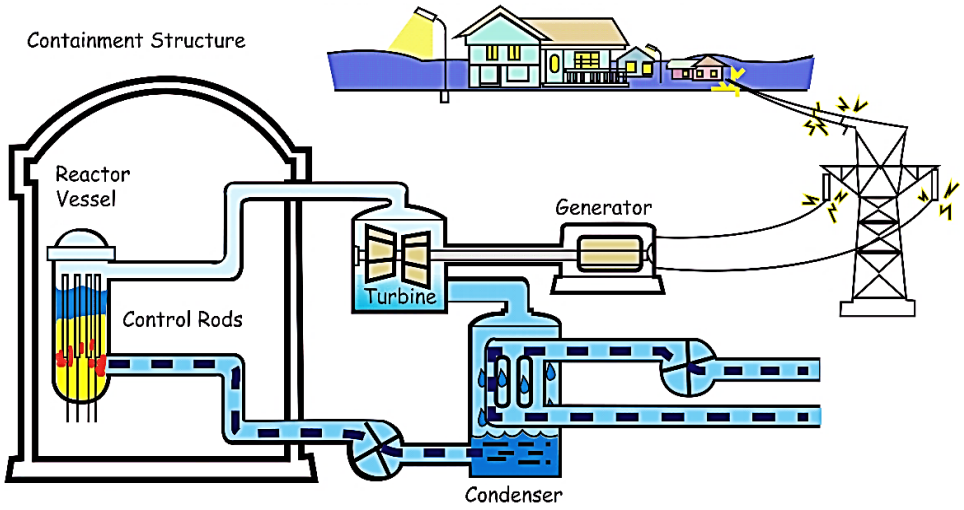


**Figure 2, Boiling Water Reactor (BWR)**

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

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

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

## 3.2 About Radiation Dose

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

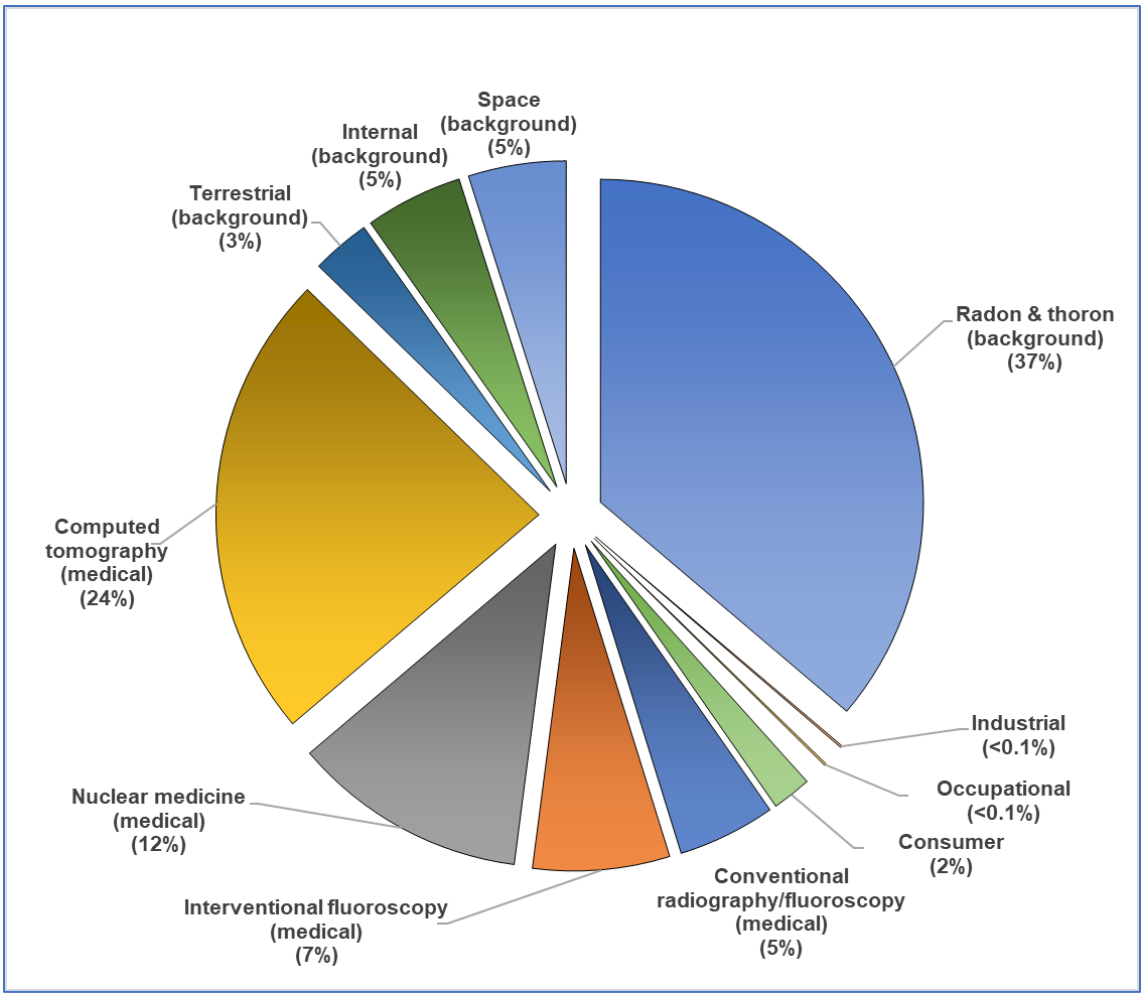


**Figure 3, Sources of Radiation Exposure (ICRP Report No. 160) (6)**

3.2 (Continued)

The National Council on Radiation Protection (NCRP) has evaluated the population dose for the US and determined that the average individual is exposed to approximately 620 mrem per year. There are many sources for radiation dose, ranging from natural background sources to medical procedures, air travel, and industrial processes. Approximately half (310 mrem) of the average exposure is due to natural sources of radiation including exposure to Radon, cosmic radiation, and internal radiation and terrestrial due to naturally occurring radionuclides. The remaining 310 mrem of exposure is due to man-made sources of exposure, with the most significant contributors being medical (48%) due to radiation used in various types of medical scans and treatments. Of the remaining 2% of dose, most is due to consumer activities such as air travel, smoking cigarettes, and building materials. A small fraction of this 2% is due to industrial activities including generation of nuclear power.

Readers that are curious about common sources and effects of radiation dose that they may encounter can find excellent sources of information from the Health Physics Society, including the Radiation Fact Sheets (7), and from the US Nuclear Regulatory Commission website (8).

## 3.3 About Dose Calculation

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

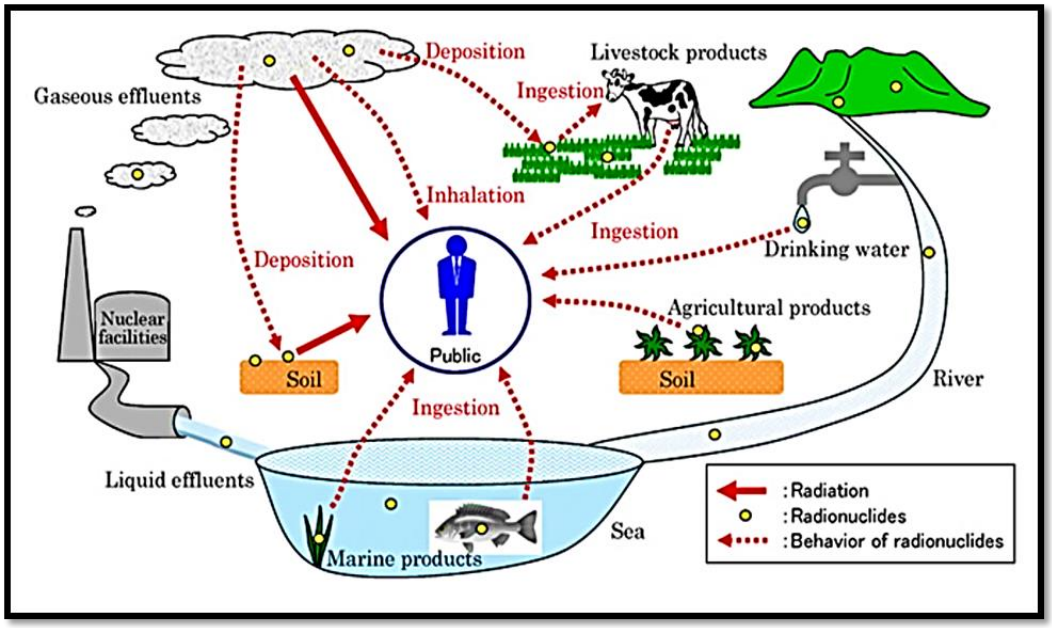


**Figure 4, Potential exposure pathways to Members of the Public due to Plant Operations (9)**

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

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

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

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

## 4.0 DOSE ASSESSMENT FOR PLANT OPERATIONS

### 4.1 Regulatory Limits

Regulatory limits are detailed in Station Licensing documents such as the Offsite Dose Calculation Manual (ODCM) and Selected Licensing Commitments. These documents contain the limits to which SGS/HCGS must adhere. SGS/HCGS drives to maintain the philosophy to keep dose "as low as reasonably achievable" (ALARA) and actions are taken to reduce the amount of radiation released to the environment. Liquid and gaseous release data show that the dose from SGS/HCGS is well below the ODCM limits. The concentration of liquid radioactive material released shall be limited to the Maximum Permissible Concentration specified in 10 CFR 20, Appendix B, Table II, Column 2 (pre 1994), for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the total concentration released shall be limited to 2.0E-04 microcuries/ml. This data reveals that the radioactive effluents have an overall minimal dose contribution to the surrounding environment.

### 4.2 Regulatory Limits for Gaseous Effluent Doses:

1. Fission and activation gases:

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

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

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

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

        1) Quarterly

            a) Less than or equal to 5 mrads gamma

            b) Less than or equal to 10 mrads beta

        2) Yearly

            a) Less than or equal to 10 mrads gamma

            b) Less than or equal to 20 mrads beta

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/yr to any organ

b. The dose to a MEMBER OF THE PUBLIC from iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 DAYS in gaseous effluents released to areas at and beyond the site boundary shall be limited to the following for each unit:

1) Quarterly

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

2) Yearly

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

## 4.3 Regulatory Limits for Liquid Effluent Doses

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

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 40CFR190 Regulatory Dose Limits for a Member of the Public

1. Total Dose (40CFR190)

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

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, Wind Turbine Laydown Area, and Emergency Responders at the Site Security Gate. These workers are considered not to be occupationally exposed, because the work activities are only remotely related to plant-operational activities. Use of a conservative assumption of 2000 hours/year spent inside the site boundary by these groups conservatively represents the most-exposed individual. Doses to these groups are required per Section 3.11.4 of the Stations' ODCMs as clarified in RIS-2002-21 (12).

The annual whole body, skin and organ dose was computed using the 2020 source term using the dose calculation methodology provided in the ODCM and the 2020 annual average meteorological dispersion (X/Q) and deposition (D/Q) data provided for in Attachment 3, Meteorological Data. The calculated doses due to gaseous effluents for non-rad workers onsite are presented in Table 6 and in Attachment 5, Doses to Highest Dose Potential Receptors using 2020 Annual Average Meteorological Data and the NRC Code GASPAR.

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

| Location | Operating Unit | CDE (Thyroid) mrem | Total Body Dose mrem | TEDE mrem | % of Limit (100 mrem) per 10 CFR 20.1301 |
|---|---|---|---|---|---|
| **Sewage Treatment Plant** | SGS U1 | 5.12E-02 | 3.20E-02 | | |
| | SGS U2 | 2.98E-02 | 2.98E-02 | | |
| | HCGS | 1.90E-02 | 1.87E-02 | | |
| | ISFSI | N/A | 2.23E+00 | | |
| | **Total** | **1.00E-01** | **2.31E+00** | **2.41E+00** | **2.41E+00** |
| **Wind Turbine Laydown Area** | SGS U1 | 1.38E-03 | 8.63E-04 | | |
| | SGS U2 | 8.05E-04 | 1.09E-03 | | |
| | HCGS | 1.75E-03 | 3.19E-03 | | |
| | ISFSI | N/A | 1.96E-01 | | |
| | **Total** | **3.94E-03** | **2.01E-01** | **2.05E-01** | **2.05E-01** |
| **Emergency Responders** | SGS U1 | 1.12E-03 | 6.97E-04 | | |
| | SGS U2 | 6.51E-04 | 6.51E-04 | | |
| | HCGS | 8.21E-04 | 8.06E-04 | | |
| | ISFSI | N/A | 1.88E-02 | | |
| | **Total** | **2.59E-03** | **2.09E-02** | **2.35E-02** | **2.35E-02** |

## 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 | | 19 | 7 | 4 | 9 | 39 |
| 2. Total duration of batch releases | minutes | 1.33E+05 | 1.31E+05 | 1.33E+05 | 9.03E+04 | 4.87E+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 | 6.99E+03 | 1.87E+04 | 3.32E+04 | 1.00E+04 | 1.25E+04 |
| 5. Minimum batch release duration | minutes | 1.60E+01 | 3.90E+01 | 1.30E+02 | 1.10E+02 | 1.60E+01 |

#### 5.1.2 Salem Unit 2

| | Units | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Annual |
|---|---|---|---|---|---|---|
| 1. Number of Batch Releases | | 7 | 33 | 5 | 8 | 53 |
| 2. Total duration of batch releases | minutes | 1.31E+05 | 1.37E+05 | 1.33E+05 | 1.33E+05 | 5.33E+05 |
| 3. Maximum batch release duration | minutes | 4.46E+04 | 4.46E+04 | 4.46E+04 | 4.46E+04 | 4.46E+04 |
| 4. Average batch release duration | minutes | 1.88E+04 | 4.14E+03 | 2.65E+04 | 1.66E+04 | 1.01E+04 |
| 5. Minimum batch release duration | minutes | 3.20E+01 | 2.40E+01 | 8.40E+01 | 6.00E+00 | 6.00E+00 |

#### 5.1.3 Hope Creek Unit 1

| | Units | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Annual |
|---|---|---|---|---|---|---|
| 1. Number of Batch Releases | | N/A | N/A | N/A | N/A | N/A |
| 2. Total duration of batch releases | minutes | N/A | N/A | N/A | N/A | N/A |
| 3. Maximum batch release duration | minutes | N/A | N/A | N/A | N/A | N/A |
| 4. Average batch release duration | minutes | N/A | N/A | N/A | N/A | N/A |
| 5. Minimum batch release duration | minutes | N/A | N/A | N/A | N/A | N/A |

## 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 | | 33 | 16 | 8 | 47 | 104 |
| 2. Total duration of batch releases | minutes | 1.68E+04 | 5.53E+03 | 4.45E+03 | 2.69E+04 | 5.36E+04 |
| 3. Maximum batch release duration | minutes | 1.26E+03 | 8.07E+02 | 1.03E+03 | 1.78E+03 | 1.78E+03 |
| 4. Average batch release duration | minutes | 5.09E+02 | 3.45E+02 | 5.57E+02 | 5.71E+02 | 5.16E+02 |
| 5. Minimum batch release duration | minutes | 1.01E+02 | 5.50E+01 | 2.75E+02 | 1.00E+01 | 1.00E+01 |

### 5.2.2 Salem Unit 2

| | Units | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Annual |
|---|---|---|---|---|---|---|
| 1. Number of Batch Releases | | 16 | 27 | 12 | 21 | 76 |
| 2. Total duration of batch releases | minutes | 7.40E+03 | 1.44E+04 | 5.96E+03 | 1.05E+04 | 3.83E+04 |
| 3. Maximum batch release duration | minutes | 6.22E+02 | 1.34E+03 | 6.81E+02 | 7.60E+02 | 1.34E+03 |
| 4. Average batch release duration | minutes | 4.62E+02 | 5.32E+02 | 4.97E+02 | 5.01E+02 | 5.03E+02 |
| 5. Minimum batch release duration | minutes | 3.17E+02 | 1.39E+02 | 3.08E+02 | 2.10E+02 | 1.39E+02 |

### 5.2.3 Hope Creek Unit 1

| | Units | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Annual |
|---|---|---|---|---|---|---|
| 1. Number of Batch Releases | | 41 | 12 | 35 | 36 | 124 |
| 2. Total duration of batch releases | minutes | 3.60E+03 | 9.13E+02 | 2.58E+03 | 2.56E+03 | 9.65E+03 |
| 3. Maximum batch release duration | minutes | 3.23E+02 | 8.80E+01 | 8.60E+01 | 1.37E+02 | 3.23E+02 |
| 4. Average batch release duration | minutes | 8.78E+01 | 7.61E+01 | 7.37E+01 | 7.12E+01 | 7.78E+01 |
| 5. Minimum batch release duration | minutes | 2.00E+00 | 5.40E+01 | 4.80E+01 | 3.70E+01 | 2.00E+00 |

## 5.3 Abnormal Releases

### 5.3.1 Salem Unit 1

None

### 5.3.2 Salem Unit 2

None

### 5.3.3 Hope Creek Unit 1

One abnormal non routine discharge occurred on 07/21/2020 (Notification 20856089) when a vacuum truck used to clean sediment from the stilling well at the cooling tower blowdown radiation monitor was found to contain Co-60 at a concentration of 7.67E-07 µCi/ml and Cs-137 at a concentration of 5.56E-08 µCi/ml. The vacuum truck was sampled per the requirements of HC.CH-TI.ZZ-0012.

The Cs-137 activity was consistent with levels found in the environment. The Co-60 activity was previously permitted during liquid radwaste releases. It was prudent to permit this release as a non-routine liquid discharge. The following information is being provided:

| | |
|---|---|
| Permit No. | L-20200721-563-C |
| Date and time of event | 07/21/2021 10:15 a.m. |
| Duration of event | 15 minutes |
| Location | Cooling Tower Blow Down radiation monitoring stilling well |
| Volume | 1500 gallons |
| Estimated activity of each radionuclide | Co-60 7.67E-07 µCi/ml<br>Cs-137 5.56E-08 µCi/ml |
| Total Activity Released | 4.67E-06 Ci |
| Effluent monitoring result (if any) | N/A |
| On site monitoring results (if any) | N/A |
| Estimated dose to a member of the public | Adult GI-LLI 8.42E-07 mrem<br>Adult T Body 1.14E-07 mrem |
| Regulatory Agencies notified including dates | N/A |

## 5.4 Land Use Census Changes

The results of the 2020 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. Additionally, the ODCM resident-garden-beef dose receptor located at 4.6 miles in the SW sector is no longer present. The next revision of the Stations' ODCMs will reflect this change and doses will no longer be calculated to that location.

## 5.5 Meteorological Data

The 2020 meteorological monitoring program had a Joint Frequency Data (JFD) recovery rate of 95.8% recovery rate. The JFD recovery rate per Reg. Guide 1.23 (13) includes wind speed, wind direction and stability class. A loss of data from any one of these parameters impacts the overall recovery rate. Safety Guide 23 (14), which SGS/HCGS were committed to 2020 includes a requirement to measure dew point. The 10 meter dew point sensor has been out of service for most of 2020. It was returned to service on 09/15/2020. The 20 meter dew point had a recovery rate of 25.0%. The percent recovery rate for each required sensor is detailed in Attachment 3,Meteorological Data

The quarterly JFDs are retained onsite and is 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 annual average dispersion (X/Q) and deposition (D/Q) data.

## 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

Liquid waste process radiation monitor 2R18 failed on 11/02/2020 due to a failed hard drive to the computer. A new replacement drive was procured and reclassified by procurement engineering as non-safety related (PC3). The new drive had software installed and was place in the computer. After successful testing the monitor was returned to service on 12/10/2020 (Notification 20862965).

5.6.3 Hope Creek Unit 1

None

## 5.7 Offsite Dose Calculation Manual (ODCM) Changes

There were no changes to the Salem or Hope Creek ODCMs in 2020

## 5.8 Process Control Program (PCP) Changes

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

## 5.9 Radioactive Waste Treatment System Changes

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

## 6.0 OTHER SUPPLIMENTAL INFORMATION

6.1.1 Hope Creek Unit 1

The Circulating Water Dewatering Sump (CWDS) 1-A-P-168 was found running continuously without meaningfully lowering sump level until 1-B-P-168 started on high-high sump level. Based on the material condition of the pump when investigated by Maintenance, and review of run times logged in the effluent permits, Station Chemistry has determined that effluent volumes released from the CWDS were overestimated. The release volume was calculated based on the pump run time meter and the meter was advancing based on a motor running with reduced or no actual effluent flow. Spot checks of past effluent permits suggest that this condition existed at least as far back as December 2014. A typical value over the last year would have been approximately 100 hours total pump run time per week. Following repair, actual run time is approximately 20 hours per week. (Notification 20869912)

The over estimation of release liquid curies from the sump was well within the ODCM limits. Because the run time meter is inherently a conservative estimate of pump flow, and because there is no technical basis to identify a particular lower flow value as the correct number, permits prior to repair of 1-A-P-168 will not be revised.

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

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

## 6.2 Outside Tanks

In 2020 the SGS/HCGS sites did not utilize temporary outside tanks to hold radioactive materials more than 10 Curies. This requirement does not apply to tritium.

## 6.3 Independent Spent Fuel Storage Installation (ISFSI) Monitoring Program

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

## 6.4 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," (15) 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" (16). 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 $CO_2$ (16).

The estimated generation for Salem & Hope Creek Generating Stations for 2020 was as follows:

| | |
|---|---|
| Salem Unit 1 | 8.15 curies |
| Salem Unit 2 | 10.27 curies |
| Hope Creek Unit 1 | 18.13 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 (16). 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 about 99% of the dose to the Child bone.

## 6.5 Corrections to Previous Reports

Minor issues were identified in the 2019 ARERR. The issues were related to curies released from Hope Creek and the summation of doses to the highest dose receptors. The new values remained a small fraction of the ODCM dose limits.

Changes made to the 2019 ARERR are included in Attachment 6, ERRATA Section from Previous Reports.

## 7.0 NEI 07-07 ONSITE RADIOLOGICAL GROUNDWATER MONITORING PROGRAM

Salem & Hope Creek Generating Stations have developed a Groundwater Protection Initiative (GPI) program in accordance with NEI 07-07, Industry Ground Water Protection Initiative – Final Guidance Document (17). 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 2020, 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 2020, the mass flux within the shallow, water bearing unit and deeper groundwater was estimated to be 0.011 Ci and 0.031 Ci, respectively. Therefore, the total potential estimated mass flux of tritium in groundwater reaching the Delaware River during 2020 was 0.042 Ci.

The detailed report is included in 2020 Radiological Groundwater Protection Program (RGPP) Report.

Table 7, Groundwater Protection Program Monitoring Well Results for Tritium

| Well Name | Number of Positive Detections | Number of Analysis | Average Concentration[6] pCi/L | Maximum Concentration pCi/L |
|---|---|---|---|---|
| Well AA | 5 | 5 | 1,449 | 3,220 |
| Well AA-V | 4 | 4 | 3,140 | 5,730 |
| Well AB | 4 | 4 | 7,463 | 8,440 |
| Well AC | 12 | 12 | 29,700 | 41,700 |
| Well AD | 4 | 4 | 9,640 | 11,500 |
| Well AE | 4 | 4 | 11,533 | 18,300 |
| Well AF | 1 | 2 | 248 | 248 |
| Well AF-V | 3 | 3 | 365 | 512 |
| Well AG-D | 2 | 2 | 845 | 905 |
| Well AG-S | 2 | 2 | 774 | 821 |
| Well AH-D | 2 | 2 | 557 | 627 |
| Well AH-S | 2 | 2 | 538 | 636 |
| Well AI | 2 | 2 | 2,720 | 3,280 |
| Well AJ | 1 | 1 | 292 | 292 |
| Well AL | 2 | 2 | 357 | 428 |
| Well AM | 4 | 4 | 15,703 | 26,400 |
| Well AN | 8 | 8 | 18,750 | 22,600 |
| Well AP | 2 | 2 | 2,470 | 3,210 |
| Well AR | 4 | 4 | 5,518 | 7,060 |
| Well AS | 2 | 2 | 4,385 | 5,070 |
| Well AT | 2 | 2 | 1,550 | 1,660 |
| Well BA | 0 | 2 | N/A | N/A |
| Well BB | 0 | 2 | N/A | N/A |
| Well BC | 12 | 12 | 1,612 | 3,550 |
| Well BD | 4 | 4 | 451 | 764 |
| Well BE | 5 | 5 | 658 | 991 |
| Well BF | 0 | 2 | N/A | N/A |
| Well BG | 1 | 4 | 206 | 206 |
| Well BH | 0 | 4 | N/A | N/A |
| Well BH-V | 1 | 2 | 290 | 290 |
| Well BI | 2 | 4 | 342 | 347 |
| Well BJ | 12 | 12 | 3,330 | 4,810 |

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

Table 7, Groundwater Protection Program Monitoring Well Results for Tritium

| Well Name | Number of Positive Detections | Number of Analysis | Average Concentration[6] pCi/L | Maximum Concentration pCi/L |
|---|---|---|---|---|
| Well BK | 0 | 2 | N/A | N/A |
| Well BL | 0 | 2 | N/A | N/A |
| Well BM | 4 | 4 | 481 | 541 |
| Well BM-V | 0 | 2 | N/A | N/A |
| Well BN | 4 | 4 | 481 | 796 |
| Well BO | 2 | 4 | 423 | 584 |
| Well BP | 0 | 2 | N/A | N/A |
| Well BQ | 0 | 4 | N/A | N/A |
| Well BR | 0 | 2 | N/A | N/A |
| Well BS | 0 | 2 | N/A | N/A |
| Well BT | 0 | 2 | N/A | N/A |
| Well BU | 0 | 2 | N/A | N/A |
| Well BW | 2 | 2 | 697 | 702 |
| Well BX | 2 | 2 | 561 | 567 |
| Well BY | 12 | 12 | 72,933 | 139,000 |
| Well BY-V | 4 | 4 | 8,383 | 11,400 |
| Well BZ | 2 | 2 | 1,360 | 1,410 |
| Well CA | 2 | 2 | 1,350 | 1,400 |
| Well DA | 7 | 7 | 2,933 | 4,920 |
| Well DB | 4 | 4 | 11,575 | 13,300 |
| Well DC | 6 | 6 | 5,565 | 10,300 |
| Well DD | 4 | 4 | 5628 | 6,550 |
| Well DE | 5 | 5 | 18,060 | 19,900 |
| Well DF | 2 | 2 | 1,335 | 1,390 |
| Well DG | 4 | 4 | 3,665 | 4,080 |
| Well DH | 4 | 4 | 10,525 | 12,500 |
| Well DI | 4 | 4 | 2,780 | 3,850 |
| Well DJ | 2 | 2 | 949 | 1,010 |
| Well K | 0 | 2 | N/A | N/A |
| Well L | 0 | 2 | N/A | N/A |
| Well M | 4 | 4 | 4,653 | 5,250 |
| Well N | 4 | 4 | 8,050 | 12,600 |
| Well O | 4 | 4 | 27,825 | 56,100 |

Table 7, Groundwater Protection Program Monitoring Well Results for Tritium

| Well Name | Number of Positive Detections | Number of Analysis | Average Concentration[6] pCi/L | Maximum Concentration pCi/L |
|---|---|---|---|---|
| Well P | 0 | 2 | N/A | N/A |
| Well R | 2 | 2 | 4,020 | 4,150 |
| Well S | 3 | 3 | 12,180 | 15,100 |
| Well S-V | 4 | 4 | 2,455 | 3,000 |
| Well T | 0 | 4 | N/A | N/A |
| Well U | 5 | 5 | 287 | 358 |
| Well V | 4 | 4 | 237 | 271 |
| Well W | 8 | 8 | 2,070 | 2,350 |
| Well Y | 0 | 2 | N/A | N/A |
| Well Z | 2 | 2 | 473 | 495 |

## 8.0 VOLUNTARY NOTIFICATION

During 2020, 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.

## 9.0 BIBLIOGRAPHY

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

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## 1.0 GASEOUS EFFLUENTS

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

| A. Fission & Activation Gases | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Annual | Est. Total Error % |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | 8.44E-02 | 3.30E-02 | 1.23E-01 | 4.21E-02 | 2.83E-01 | 3.40E+01 |
| 2. Average release rate for the period | μCi/sec | 1.07E-02 | 4.19E-03 | 1.55E-02 | 5.30E-03 | 8.95E-03 | |
| B. Iodine | | | | | | | |
| 1. Total Release | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 3.00E+01 |
| 2. Average release rate for the period | μCi/sec | N/A | N/A | N/A | N/A | N/A | |
| C. Particulates | | | | | | | |
| 1. Total Release | Ci | 1.56E-05 | < LLD | < LLD | 9.04E-08 | 1.57E-05 | 3.00E+01 |
| 2. Average release rate for the period | μCi/sec | 1.99E-06 | N/A | N/A | 1.14E-08 | 4.97E-07 | |
| D. Tritium | | | | | | | |
| 1. Total Release | Ci | 4.29E+01 | 1.65E+02 | 3.92E+01 | 4.60E+01 | 2.93E+02 | 3.10E+01 |
| 2. Average release rate for the period | μCi/sec | 5.46E+00 | 2.09E+01 | 4.93E+00 | 5.79E+00 | 9.25E+00 | |
| E. Gross Alpha | | | | | | | |
| 1. Total Release | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 3.00E+01 |
| 2. Average release rate for the period | μCi/sec | N/A | N/A | N/A | N/A | N/A | |
| F. Carbon-14 | | | | | | | |
| 1. Total Release | Ci | 2.05E+00 | 2.00E+00 | 2.03E+00 | 2.07E+00 | 8.15E+00 | |
| 2. Average release rate for the period | μCi/sec | 2.60E-01 | 2.54E-01 | 2.55E-01 | 2.61E-01 | 2.58E-01 | |

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

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

| Radionuclide Released | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total for year |
|---|---|---|---|---|---|---|
| **Fission Gases** | | | | | | |
| Ar-41 | Ci | 3.28E-02 | 2.72E-02 | 8.06E-02 | 9.31E-04 | 1.42E-01 |
| Kr-85m | Ci | < LLD | < LLD | 1.04E-03 | 5.73E-05 | 1.10E-03 |
| Kr-88 | Ci | < LLD | < LLD | 1.40E-03 | < LLD | 1.40E-03 |
| Xe-133m | Ci | 7.63E-04 | < LLD | < LLD | 7.33E-04 | 1.50E-03 |
| Xe-133 | Ci | 4.29E-02 | 5.73E-03 | 2.27E-02 | 3.45E-02 | 1.06E-01 |
| Xe-135 | Ci | 7.94E-03 | < LLD | 1.77E-02 | 5.86E-03 | 3.15E-02 |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | 8.44E-02 | 3.30E-02 | 1.23E-01 | 4.21E-02 | 2.83E-01 |
| **Iodines** | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| **Particulates** | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| **Tritium** | | | | | | |
| H-3 | Ci | 3.77E-01 | 3.04E-01 | 5.72E-01 | 2.47E-02 | 1.28E+00 |
| **Gross Alpha** | | | | | | |
| Alpha | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| **Carbon-14** | | | | | | |
| C-14 | Ci | N/A | N/A | N/A | N/A | N/A |

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

| Radionuclide Released | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total for year |
|---|---|---|---|---|---|---|
| **Fission Gases** | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| **Iodines** | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| **Particulates** | | | | | | |
| Co-58 | Ci | 1.56E-05 | < LLD | < LLD | 9.04E-08 | 1.57E-05 |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | 1.56E-05 | < LLD | < LLD | 9.04E-08 | 1.57E-05 |
| **Tritium** | | | | | | |
| H-3 | Ci | 4.29E+01 | 1.64E+02 | 3.86E+01 | 4.60E+01 | 2.91E+02 |
| **Gross Alpha** | | | | | | |
| Alpha | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| **Carbon-14** | | | | | | |
| C-14 | Ci | 2.05E+00 | 2.00E+00 | 2.03E+00 | 2.07E+00 | 8.15E+00 |

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

| A. Fission & Activation Gases | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Annual | Est. Total Error % |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | 7.81E-02 | 5.59E-02 | 5.08E-02 | 6.98E-02 | 2.55E-01 | 3.40E+01 |
| 2. Average release rate for the period | μCi/sec | 9.93E-03 | 7.11E-03 | 6.39E-03 | 8.78E-03 | 8.05E-03 | |
| B. Iodine | | | | | | | |
| 1. Total Release | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 3.00E+01 |
| 2. Average release rate for the period | μCi/sec | N/A | N/A | N/A | N/A | N/A | |
| C. Particulates | | | | | | | |
| 1. Total Release | Ci | < LLD | 9.42E-07 | < LLD | < LLD | 9.42E-07 | 3.00E+01 |
| 2. Average release rate for the period | μCi/sec | N/A | 1.20E-07 | N/A | N/A | 2.98E-08 | |
| D. Tritium | | | | | | | |
| 1. Total Release | Ci | 8.80E+01 | 2.71E+01 | 4.10E+00 | 2.41E+01 | 1.43E+02 | 3.10E+01 |
| 2. Average release rate for the period | μCi/sec | 1.12E+01 | 3.45E+00 | 5.15E-01 | 3.03E+00 | 4.53E+00 | |
| E. Gross Alpha | | | | | | | |
| 1. Total Release | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 3.00E+01 |
| 2. Average release rate for the period | μCi/sec | N/A | N/A | N/A | N/A | N/A | |
| F. Carbon-14 | | | | | | | |
| 1. Total Release | Ci | 2.69E+00 | 2.54E+00 | 2.46E+00 | 2.58E+00 | 1.03E+01 | |
| 2. Average release rate for the period | μCi/sec | 3.43E-01 | 3.22E-01 | 3.09E-01 | 3.25E-01 | 3.25E-01 | |

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

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

| Radionuclide Released | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total for year |
|---|---|---|---|---|---|---|
| **Fission Gases** | | | | | | |
| Ar-41 | Ci | 7.68E-02 | 2.12E-02 | 5.08E-02 | 6.98E-02 | 2.19E-01 |
| Kr-85m | Ci | < LLD | 8.40E-05 | < LLD | < LLD | 8.40E-05 |
| Xe-133 | Ci | 1.34E-03 | 2.99E-02 | < LLD | < LLD | 3.13E-02 |
| Xe-135 | Ci | < LLD | 4.66E-03 | < LLD | < LLD | 4.66E-03 |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | 7.81E-02 | 5.59E-02 | 5.08E-02 | 6.98E-02 | 2.55E-01 |
| **Iodines** | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| **Particulates** | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| **Tritium** | | | | | | |
| H-3 | Ci | 2.27E-01 | 1.19E-01 | 2.50E-01 | 1.48E+00 | 2.07E+00 |
| **Gross Alpha** | | | | | | |
| Alpha | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| **Carbon-14** | | | | | | |
| C-14 | Ci | N/A | N/A | N/A | N/A | N/A |

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

| Radionuclide Released | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total for year |
|---|---|---|---|---|---|---|
| **Fission Gases** | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| **Iodines** | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| **Particulates** | | | | | | |
| Co-58 | Ci | < LLD | 9.42E-07 | < LLD | < LLD | 9.42E-07 |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | < LLD | 9.42E-07 | < LLD | < LLD | 9.42E-07 |
| **Tritium** | | | | | | |
| H-3 | Ci | 8.77E+01 | 2.70E+01 | 3.85E+00 | 2.26E+01 | 1.41E+02 |
| **Gross Alpha** | | | | | | |
| Alpha | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| **Carbon-14** | | | | | | |
| C-14 | Ci | 2.69E+00 | 2.54E+00 | 2.46E+00 | 2.58E+00 | 1.03E+01 |

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

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

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

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

| Radionuclide Released | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total for year |
|---|---|---|---|---|---|---|
| **Fission Gases** | | | | | | |
| None | Ci | N/A | N/A | N/A | N/A | N/A |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | N/A | N/A | N/A | N/A | N/A |
| **Iodines** | | | | | | |
| None | Ci | N/A | N/A | N/A | N/A | N/A |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | N/A | N/A | N/A | N/A | N/A |
| **Particulates** | | | | | | |
| None | Ci | N/A | N/A | N/A | N/A | N/A |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | N/A | N/A | N/A | N/A | N/A |
| **Tritium** | | | | | | |
| H-3 | Ci | N/A | N/A | N/A | N/A | N/A |
| **Gross Alpha** | | | | | | |
| Alpha | Ci | N/A | N/A | N/A | N/A | N/A |
| **Carbon-14** | | | | | | |
| C-14 | Ci | N/A | N/A | N/A | N/A | N/A |

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

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

## 2.0 LIQUID EFFLUENTS

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

| A. Fission & Activation Products | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Annual | Est. Total Error % |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | 7.57E-03 | 1.71E-03 | 1.69E-04 | 2.33E-03 | 1.18E-02 | 2.70E+01 |
| 2. Average diluted concentration | μCi/mL | 1.24E-10 | 3.22E-11 | 3.19E-12 | 4.70E-11 | 5.43E-11 | |
| **B. Tritium** | | | | | | | |
| 1. Total Release | Ci | 2.82E+02 | 7.88E+01 | 4.42E+01 | 2.33E+02 | 6.38E+02 | 2.70E+01 |
| 2. Average diluted concentration | μCi/mL | 4.60E-06 | 1.48E-06 | 8.33E-07 | 4.71E-06 | 2.94E-06 | |
| **C. Dissolved & Entrained Gases** | | | | | | | |
| 1. Total Release | Ci | < LLD | < LLD | < LLD | 1.87E-04 | 1.87E-04 | 2.70E+01 |
| 2. Average diluted concentration | μCi/mL | N/A | N/A | N/A | 3.77E-12 | 8.61E-13 | |
| **D. Gross Alpha Activity** | | | | | | | |
| 1. Total Release | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 2.70E+01 |
| **E. Volume of Waste Released (prior to dilution)** | Liters | 4.08E+07 | 4.13E+07 | 4.07E+07 | 3.32E+07 | 1.56E+08 | |
| **F. Volume of Dilution Water Used During Period** | Liters | 6.11E+10 | 5.31E+10 | 5.30E+10 | 4.95E+10 | 2.17E+11 | |

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

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

| Radionuclide Released | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total for Year |
|---|---|---|---|---|---|---|
| **Tritium** | | | | | | |
| H-3 | Ci | 2.81E+02 | 7.88E+01 | 4.42E+01 | 2.33E+02 | 6.38E+02 |
| **Fission & Activation Products** | | | | | | |
| Cr-51 | Ci | < LLD | < LLD | < LLD | 7.38E-05 | 7.38E-05 |
| Mn-54 | Ci | 3.50E-05 | < LLD | < LLD | < LLD | 3.50E-05 |
| Co-57 | Ci | 2.35E-06 | < LLD | < LLD | < LLD | 2.35E-06 |
| Co-58 | Ci | 6.91E-03 | 8.01E-04 | 8.12E-05 | 1.59E-03 | 9.38E-03 |
| Co-60 | Ci | 5.53E-04 | 4.65E-04 | 8.16E-05 | 3.80E-04 | 1.48E-03 |
| Zr-95 | Ci | < LLD | 1.55E-04 | < LLD | < LLD | 1.55E-04 |
| Nb-95 | Ci | < LLD | 2.53E-04 | < LLD | 4.22E-06 | 2.57E-04 |
| Ru-105 | Ci | < LLD | 2.26E-05 | < LLD | < LLD | 2.26E-05 |
| Ag-110m | Ci | 3.32E-05 | < LLD | < LLD | < LLD | 3.32E-05 |
| Sb-125 | Ci | 3.05E-05 | 1.13E-05 | 6.57E-06 | 1.19E-04 | 1.68E-04 |
| Cs-137 | Ci | < LLD | < LLD | < LLD | 1.63E-04 | 1.63E-04 |
| Sn-117m | Ci | < LLD | 3.17E-06 | < LLD | < LLD | 3.17E-06 |
| | Ci | | | | | |
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| | Ci | | | | | |
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| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | 7.57E-03 | 1.71E-03 | 1.69E-04 | 2.33E-03 | 1.18E-02 |
| **Entrained Gases** | | | | | | |
| Xe-133 | Ci | < LLD | < LLD | < LLD | 1.87E-04 | 1.87E-04 |
| | Ci | | | | | |
| | | | | | | |
| Total for Period | | < LLD | < LLD | < LLD | 1.87E-04 | 1.87E-04 |

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

| Radionuclide Released | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total for year |
|---|---|---|---|---|---|---|
| **Tritium** | | | | | | |
| H-3 | Ci | 1.55E-01 | 1.58E-02 | 9.43E-03 | 2.14E-02 | 2.02E-01 |
| **Fission & Activation Products** | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| | Ci | | | | | |
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| | Ci | | | | | |
| Total for Period | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| **Entrained Gases** | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| | Ci | | | | | |
| | | | | | | |
| Total for Period | | < LLD | < LLD | < LLD | < LLD | < LLD |

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

| A. Fission & Activation Products | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Annual | Est. Total Error % |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | 2.67E-03 | 3.28E-03 | 7.58E-04 | 2.37E-03 | 9.08E-03 | 2.70E+01 |
| 2. Average diluted concentration | μCi/mL | 5.11E-10 | 3.93E-10 | 1.68E-10 | 3.19E-10 | 3.56E-10 | |
| **B. Tritium** | | | | | | | |
| 1. Total Release | Ci | 2.44E+02 | 9.09E+01 | 8.81E+01 | 1.88E+02 | 6.11E+02 | 2.70E+01 |
| 2. Average diluted concentration | μCi/mL | 4.67E-05 | 1.09E-05 | 1.95E-05 | 2.53E-05 | 2.39E-05 | |
| **C. Dissolved & Entrained Gases** | | | | | | | |
| 1. Total Release | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 2.70E+01 |
| 2. Average diluted concentration | μCi/mL | N/A | N/A | N/A | N/A | N/A | |
| **D. Gross Alpha Activity** | | | | | | | |
| 1. Total Release | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 2.70E+01 |
| **E. Volume of Waste Released (prior to dilution)** | Liters | 2.48E+07 | 1.04E+07 | 1.41E+07 | 1.37E+07 | 6.30E+07 | |
| **F. Volume of Dilution Water Used During Period** | Liters | 5.21E+09 | 8.34E+09 | 4.51E+09 | 7.42E+09 | 2.55E+10 | |

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

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

| Radionuclide Released | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total for Year |
|---|---|---|---|---|---|---|
| **Tritium** | | | | | | |
| H-3 | Ci | 2.44E+02 | 9.09E+01 | 8.81E+01 | 1.88E+02 | 6.11E+02 |
| **Fission & Activation Products** | | | | | | |
| Cr-51 | Ci | 5.51E-05 | < LLD | < LLD | < LLD | 5.51E-05 |
| Fe-59 | Ci | 8.25E-06 | < LLD | < LLD | < LLD | 8.25E-06 |
| Co-58 | Ci | 7.17E-04 | 1.36E-03 | 3.33E-04 | 1.66E-03 | 4.08E-03 |
| Co-60 | Ci | 7.08E-04 | 1.61E-03 | 4.26E-04 | 6.18E-04 | 3.36E-03 |
| Zr-95 | Ci | 3.95E-04 | 1.29E-04 | < LLD | < LLD | 5.24E-04 |
| Nb-95 | Ci | 5.90E-04 | 1.79E-04 | < LLD | < LLD | 7.69E-04 |
| Nb-97 | Ci | 1.69E-05 | < LLD | < LLD | < LLD | 1.69E-05 |
| Ag-110m | Ci | 1.74E-05 | < LLD | < LLD | < LLD | 1.74E-05 |
| Sb-125 | Ci | 3.09E-05 | < LLD | < LLD | 8.87E-05 | 1.20E-04 |
| Cs-134 | Ci | 1.26E-05 | < LLD | < LLD | < LLD | 1.26E-05 |
| Cs-137 | Ci | 1.22E-04 | < LLD | < LLD | < LLD | 1.22E-04 |
| | Ci | | | | | |
| | Ci | | | | | |
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| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | 2.67E-03 | 3.28E-03 | 7.58E-04 | 2.37E-03 | 9.08E-03 |
| **Entrained Gases** | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| | Ci | | | | | |
| | | | | | | |
| Total for Period | | < LLD | < LLD | < LLD | < LLD | < LLD |

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

| Radionuclide Released | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total for year |
|---|---|---|---|---|---|---|
| **Tritium** | | | | | | |
| H-3 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| **Fission & Activation Products** | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| | Ci | | | | | |
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| | Ci | | | | | |
| Total for Period | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| **Entrained Gases** | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| | Ci | | | | | |
| | | | | | | |
| Total for Period | | < LLD | < LLD | < LLD | < LLD | < LLD |

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

| A. Fission & Activation Products | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Annual | Est. Total Error % |
|---|---|---|---|---|---|---|---|
| 1. Total Release | Ci | 1.89E-01 | 2.00E-03 | 1.57E-03 | 1.23E-02 | 2.05E-01 | 2.70E+01 |
| 2. Average diluted concentration | μCi/mL | 3.38E-08 | 3.29E-10 | 2.48E-10 | 1.98E-09 | 8.47E-09 | |
| **B. Tritium** | | | | | | | |
| 1. Total Release | Ci | 1.50E+01 | 6.00E+00 | 1.33E+01 | 4.01E+00 | 3.83E+01 | 2.70E+01 |
| 2. Average diluted concentration | μCi/mL | 2.68E-06 | 9.87E-07 | 2.10E-06 | 6.46E-07 | 1.58E-06 | |
| **C. Dissolved & Entrained Gases** | | | | | | | |
| 1. Total Release | Ci | 1.25E-07 | 2.01E-06 | < LLD | 1.02E-06 | 3.16E-06 | 2.70E+01 |
| 2. Average diluted concentration | μCi/mL | 2.23E-14 | 3.30E-13 | N/A | 1.65E-13 | 1.30E-13 | |
| **D. Gross Alpha Activity** | | | | | | | |
| 1. Total Release | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 2.70E+01 |
| **E. Volume of Waste Released (prior to dilution)** | Liters | 1.19E+07 | 1.57E+07 | 1.81E+07 | 1.01E+07 | 5.58E+07 | |
| **F. Volume of Dilution Water Used During Period** | Liters | 5.58E+09 | 6.06E+09 | 6.32E+09 | 6.19E+09 | 2.42E+10 | |

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

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

| Radionuclide Released | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total for Year |
|---|---|---|---|---|---|---|
| **Tritium** | | | | | | |
| H-3 | Ci | 1.50E+01 | 5.34E+00 | 1.23E+01 | 3.80E+00 | 3.64E+01 |
| **Fission & Activation Products** | | | | | | |
| Na-24 | Ci | 7.82E-06 | < LLD | < LLD | 1.19E-05 | 1.98E-05 |
| Mn-54 | Ci | 4.66E-02 | 4.08E-04 | 1.77E-04 | 1.03E-03 | 4.82E-02 |
| Fe-59 | Ci | 2.43E-07 | < LLD | < LLD | < LLD | 2.43E-07 |
| Co-57 | Ci | 1.01E-04 | < LLD | < LLD | < LLD | 1.01E-04 |
| Co-58 | Ci | 2.03E-02 | 7.29E-05 | 1.03E-04 | 1.52E-04 | 2.06E-02 |
| Co-60 | Ci | 8.91E-02 | 1.17E-03 | 1.13E-03 | 5.36E-03 | 9.68E-02 |
| Zn-65 | Ci | 4.42E-03 | 5.19E-05 | 1.30E-04 | 9.78E-05 | 4.70E-03 |
| Zr-95 | Ci | < LLD | 4.74E-06 | < LLD | < LLD | 4.74E-06 |
| Ag-110m | Ci | < LLD | < LLD | < LLD | 7.64E-06 | 7.64E-06 |
| Sb-125 | Ci | < LLD | < LLD | < LLD | 1.98E-05 | 1.98E-05 |
| I-131 | Ci | 1.70E-07 | < LLD | < LLD | 1.32E-07 | 3.02E-07 |
| Cs-134 | Ci | 1.40E-02 | 1.31E-04 | 1.19E-05 | 2.42E-03 | 1.65E-02 |
| Cs-137 | Ci | 1.47E-02 | 1.64E-04 | 1.64E-05 | 3.19E-03 | 1.81E-02 |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| | Ci | | | | | |
| Total for Period | Ci | 1.89E-01 | 2.00E-03 | 1.56E-03 | 1.23E-02 | 2.05E-01 |
| **Entrained Gases** | | | | | | |
| Ar-41 | Ci | 1.25E-07 | < LLD | < LLD | < LLD | 1.25E-07 |
| Xe-135 | Ci | < LLD | 2.01E-06 | < LLD | 1.02E-06 | 3.03E-06 |
| | | | | | | |
| Total for Period | | 1.25E-07 | 2.01E-06 | < LLD | 1.02E-06 | 3.16E-06 |

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

| Radionuclide Released | Unit | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total for year |
|---|---|---|---|---|---|---|
| **Tritium** | | | | | | |
| H-3 | Ci | 5.52E-02 | 6.56E-01 | 9.84E-01 | 2.10E-01 | 1.90E+00 |
| **Fission & Activation Products** | | | | | | |
| Co-60 | Ci | < LLD | < LLD | 4.35E-06 | < LLD | 4.35E-06 |
| Cs-137 | Ci | < LLD | < LLD | 3.16E-07 | < LLD | 3.16E-07 |
| | Ci | | | | | |
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| | Ci | | | | | |
| Total for Period | Ci | < LLD | < LLD | 4.67E-06 | < LLD | 4.67E-06 |
| **Entrained Gases** | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | < LLD | < LLD |
| | Ci | | | | | |
| | | | | | | |
| Total for Period | | < LLD | < LLD | < LLD | < LLD | < LLD |

**Attachment 2, Solid Waste Information**

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

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 | 7.29E+02 | 2.06E+01 | 8.10E+00 | +/-25% |
| B | 1.96E+02 | 5.55E+00 | 4.32E+01 | +/-25% |
| C | 0.00E+00 | 0.00E+00 | 0.00E+00 | +/-25% |
| | | | | |
| **All** | 9.25E+02 | 2.62E+01 | 5.13E+01 | +/-25% |

Major Nuclides for Above Table:

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

**Resins, Filters and Evaporator Bottoms**

**Waste Class A**

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

**Resins, Filters and Evaporator Bottoms**

**Waste Class B**

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

**Resins, Filters and Evaporator Bottoms**

**Waste Class C**

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

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

| Waste Class | Volume $ft^3$ | Volume $m^3$ | Curies Shipped | % Error (Activity) |
|---|---|---|---|---|
| A | 2.28E+04 | 6.46E+02 | 7.98E-01 | +/-25% |
| B | 0.00E+00 | 0.00E+00 | 0.00E+00 | +/-25% |
| C | 0.00E+00 | 0.00E+00 | 0.00E+00 | +/-25% |
| | | | | |
| **All** | 2.28E+04 | 6.46E+02 | 7.98E-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, Ce-144

**DAW**

**Waste Class A**

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| Cr-51 | 3.2% | 2.56E-02 |
| Mn-54 | 1.57% | 1.25E-02 |
| Fe-55 | 15.1% | 1.20E-01 |
| Co-58 | 25.39% | 2.03E-01 |
| Co-60 | 31.01% | 2.47E-01 |
| Ni-63 | 8.58% | 6.85E-02 |
| Zr-95 | 3.83% | 3.05E-02 |
| Nb-95 | 1.92% | 1.53E-02 |
| Sb-125 | 2.21% | 1.76E-02 |
| Cs-137 | 5.12% | 4.09E-02 |
| | | |

**DAW**

**Waste Class B**

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

**DAW**

**Waste Class C**

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

Table 28, Irradiated Components Summary for the Salem Site

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

Major Nuclides for Above Table:

**Irradiated Components**

**Waste Class A**

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

**Irradiated Components**

**Waste Class B**

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

**Irradiated Components**

**Waste Class C**

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

Table 29, Other Waste Summary for the Salem Site

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

Major Nuclides for Above Table:

**Other Waste**

**Waste Class A**

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

**Other Waste**

**Waste Class B**

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

**Other Waste**

**Waste Class C**

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

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 | 2.35E+04 | 6.66E+02 | 6.71E+00 | +/-25% |
| B | 1.96E+02 | 5.55E+00 | 5.01E+01 | +/-25% |
| C | 0.00E+00 | 0.00E+00 | 0.00E+00 | +/-25% |
| | | | | |
| **All** | 2.37E+04 | 6.72E+02 | 5.68E+01 | +/-25% |

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

**Waste Stream; Sum of All Four Categories**

**Waste Class A**

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| H-3 | 2.6% | 1.75E-01 |
| C-14 | 1.22% | 8.18E-02 |
| Fe-55 | 28.82% | 1.93E+00 |
| Co-58 | 3.82% | 2.56E-01 |
| Co-60 | 22.98% | 1.54E+00 |
| Ni-63 | 26.6% | 1.79E+00 |
| Sb-125 | 1.24% | 8.35E-02 |
| Cs-137 | 10.01% | 6.72E-01 |
| | | |

**Waste Stream; Sum of All Four Categories**

**Waste Class B**

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

**Waste Stream; Sum of All Four Categories**

**Waste Class C**

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

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

| Waste Class | Volume $ft^3$ | Volume $m^3$ | Curies Shipped | % Error (Activity) |
|---|---|---|---|---|
| A | 2.12E+03 | 5.99E+01 | 1.22E+02 | +/-25% |
| B | 0.00E+00 | 0.00E+00 | 0.00E+00 | +/-25% |
| C | 0.00E+00 | 0.00E+00 | 0.00E+00 | +/-25% |
| | | | | |
| **All** | 2.12E+03 | 5.99E+01 | 1.22E+02 | +/-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-242, Cm-243, Cm-244

**Resins, Filters and Evaporator Bottoms**

**Waste Class A**

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| C-14 | 2.3% | 2.81E+00 |
| Mn-54 | 13.34% | 1.63E+01 |
| Fe-55 | 25.4% | 3.10E+01 |
| Co-58 | 2.3% | 2.81E+00 |
| Co-60 | 47.32% | 5.78E+01 |
| Ni-63 | 3.25% | 3.97E+00 |
| Zn-65 | 2.95% | 3.61E+00 |
| Cs-137 | 1.53% | 1.86E+00 |
| | | |

**Resins, Filters and Evaporator Bottoms**

**Waste Class B**

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

**Resins, Filters and Evaporator Bottoms**

**Waste Class C**

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

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 | 1.98E+02 | 5.61E+00 | 1.96E+00 | +/-25% |
| B | 0.00E+00 | 0.00E+00 | 0.00E+00 | +/-25% |
| C | 0.00E+00 | 0.00E+00 | 0.00E+00 | +/-25% |
| | | | | |
| **All** | 1.98E+02 | 5.61E+00 | 1.96E+00 | +/-25% |

Major Nuclides for Above Table:

H-3, C-14, Mn-54, Fe-55, Co-60, Ni-63, Zn-65, Tc-99, I-129, Cs-137

**DAW**

**Waste Class A**

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| Mn-54 | 10.22% | 2.00E-01 |
| Fe-55 | 23.79% | 4.65E-01 |
| Co-60 | 61.34% | 1.20E+00 |
| Zn-65 | 1.59% | 3.11E-02 |
| | | |
| | | |

**DAW**

**Waste Class B**

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

**DAW**

**Waste Class C**

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

Table 33, Irradiated Components Summary for the Hope Creek Site

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

Major Nuclides for Above Table: Percent Cutoff 1%

**Irradiated Components**

**Waste Class A**

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

**Irradiated Components**

**Waste Class B**

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

**Irradiated Components**

**Waste Class C**

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

Table 34, Other Waste Summary for the Hope Creek Site

| Waste Class | Volume $ft^3$ | Volume $m^3$ | Curies Shipped | % Error (Activity) |
|---|---|---|---|---|
| A | 1.10E+03 | 3.11E+01 | 1.10E-05 | +/-25% |
| B | 0.00E+00 | 0.00E+00 | 0.00E+00 | +/-25% |
| C | 0.00E+00 | 0.00E+00 | 0.00E+00 | +/-25% |
| | | | | |
| **All** | 1.10E+03 | 3.11E+01 | 1.10E-05 | +/-25% |

Major Nuclides for Above Table: Percent Cutoff 1%

**Other Waste**

**Waste Class A**

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| Fe-55 | 40.99% | 4.49E-06 |
| Co-60 | 57.26% | 6.28E-06 |
| | | |

**Other Waste**

**Waste Class B**

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

**Other Waste**

**Waste Class C**

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

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 | 3.41E+03 | 9.67E+01 | 1.24E+02 | +/-25% |
| B | 0.00E+00 | 0.00E+00 | 0.00E+00 | +/-25% |
| C | 0.00E+00 | 0.00E+00 | 0.00E+00 | +/-25% |
| | | | | |
| **All** | 3.41E+03 | 9.67E+01 | 1.24E+02 | +/-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-242, Cm-243, Cm-244

**Waste Stream; Sum of All Four Categories**

**Waste Class A**

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| C-14 | 2.27% | 2.81E+00 |
| Mn-54 | 13.29% | 1.65E+01 |
| Fe-55 | 25.38% | 3.15E+01 |
| Co-58 | 2.27% | 2.82E+00 |
| Co-60 | 47.54% | 5.90E+01 |
| Ni-63 | 3.2% | 3.97E+00 |
| Zn-65 | 2.93% | 3.64E+00 |
| Cs-137 | 1.5% | 1.87E+00 |
| | | |

**Waste Stream; Sum of All Four Categories**

**Waste Class B**

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

**Waste Stream; Sum of All Four Categories**

**Waste Class C**

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

## 2.0 SOLID WASTE DISPOSITION

Table 36, Solid Waste Shipped from the Salem Site

| Number of Shipments | Mode of Transportation | Destination |
|---|---|---|
| 7 | Hittman Transport Services, Inc. | Barnwell Processing Facility<br>Energy Solutions, LLC Barnwell Process Facility |
| 10 | Interstate Ventures | UniTech Processing Facility<br>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 |
| 6 | Hittman Transport Services, Inc. | Energy Solutions LLC |
| 2 | Hittman Transport Services, Inc. | Energy Solutions GRF |

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**Attachment 3, Meteorological Data**

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## 1.0 Meteorological Data Summary

### 1.1 Joint Frequency Distributions

1. Period of Record: 01/01/2020 - 12/31/2020
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: 0.012%
   c. Percentage of missing data: 4.2%

**January – December 2020**

| Sensor | Data Recovery (%) |
| --- | --- |
| 33 ft Wind Speed/Direction | 99.9 |
| 150 ft Wind Speed/Direction | 99.9 |
| 300 ft Wind Speed/Direction | 99.5 |
| Backup Wind Speed/Direction | 96.7 |
| 300 ft Temp | 99.9 |
| 33 ft Temp | 99.9 |
| 33 ft Dew Point** | 25.0 |
| 150 ft – 33 ft Delta Temp | 95.9 |
| 300 ft – 33 ft Delta Temp | 99.8 |
| Precipitation | 99.9 |

**Dew Point was returned to service 09/15/20

**Table 38, Percentage of Each Wind Speed/Direction**

| | | 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 | 0.131 | 0.178 | 0.428 | 1.425 | 1.152 | 1.354 | 0.962 | 0.606 | 0.083 | 0.000 | 6.32 |
| 11.25 - 33.75 | NNE | 0.012 | 0.190 | 0.356 | 0.594 | 1.687 | 1.461 | 0.998 | 0.499 | 0.202 | 0.000 | 0.000 | 6.00 |
| 33.75 - 56.25 | NE | 0.000 | 0.166 | 0.677 | 0.855 | 1.710 | 1.140 | 0.630 | 0.249 | 0.202 | 0.036 | 0.000 | 5.67 |
| 56.25 - 78.75 | ENE | 0.000 | 0.202 | 0.618 | 0.677 | 1.271 | 0.618 | 0.285 | 0.154 | 0.214 | 0.000 | 0.000 | 4.04 |
| 78.75 - 101.25 | E | 0.000 | 0.154 | 0.463 | 0.736 | 0.962 | 0.594 | 0.238 | 0.107 | 0.024 | 0.000 | 0.012 | 3.29 |
| 101.25 - 123.75 | ESE | 0.000 | 0.143 | 0.249 | 0.499 | 1.176 | 0.594 | 0.333 | 0.107 | 0.143 | 0.024 | 0.000 | 3.27 |
| 123.75 - 146.25 | SE | 0.000 | 0.131 | 0.154 | 0.511 | 1.805 | 2.233 | 1.948 | 1.734 | 1.580 | 0.273 | 0.238 | 10.61 |
| 146.25 - 168.75 | SSE | 0.000 | 0.083 | 0.321 | 0.535 | 1.520 | 1.532 | 1.176 | 0.891 | 0.736 | 0.178 | 0.083 | 7.06 |
| 168.75 - 191.25 | S | 0.000 | 0.154 | 0.321 | 0.368 | 1.105 | 1.164 | 1.069 | 0.986 | 0.653 | 0.154 | 0.095 | 6.07 |
| 191.25 - 213.75 | SSW | 0.000 | 0.143 | 0.333 | 0.535 | 1.722 | 1.413 | 0.950 | 0.570 | 0.261 | 0.036 | 0.024 | 5.99 |
| 213.75 - 236.25 | SW | 0.000 | 0.095 | 0.321 | 0.594 | 2.043 | 1.330 | 0.713 | 0.392 | 0.238 | 0.024 | 0.000 | 5.75 |
| 236.25 - 258.75 | WSW | 0.000 | 0.119 | 0.238 | 0.546 | 1.592 | 1.592 | 0.938 | 0.594 | 0.297 | 0.048 | 0.000 | 5.96 |
| 258.75 - 281.25 | W | 0.000 | 0.143 | 0.273 | 0.475 | 1.140 | 1.033 | 0.998 | 0.772 | 1.033 | 0.214 | 0.071 | 6.15 |
| 281.25 - 303.75 | WNW | 0.000 | 0.119 | 0.297 | 0.404 | 1.010 | 1.045 | 0.701 | 0.641 | 0.689 | 0.451 | 0.143 | 5.50 |
| 303.75 - 326.25 | NW | 0.000 | 0.071 | 0.333 | 0.570 | 2.055 | 1.924 | 1.402 | 1.318 | 1.473 | 0.748 | 0.071 | 9.97 |
| 326.25 - 348.75 | NNW | 0.000 | 0.119 | 0.309 | 0.380 | 1.437 | 1.699 | 1.342 | 1.140 | 1.413 | 0.523 | 0.012 | 8.37 |

Total 100.00

MISSING HOURS: 365
JOINT DATA RECOVERY: 95.8%

**Stability class**

**Table 39, Classification of Atmospheric Stability**

| Stability Condition | Pasquill Categories | Percentage |
| --- | --- | --- |
| Extremely Unstable | A | 20.23 |
| Moderately Stable | B | 4.11 |
| Slightly Unstable | C | 4.89 |
| Neutral | D | 29.45 |
| Slightly Stable | E | 26.70 |
| Moderately Stable | F | 9.19 |
| Extremely Stable | G | 5.43 |

## 1.2 X/Q and D/Q Values for Each Site

**Table 40, 2020 Salem Ground Level Release Dispersion (X/Q) and Deposition Factors (D/Q)**

| 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 | 0.17 | 1.10E-05 | 1.10E-05 | 1.10E-05 | 6.70E-08 |
| SITE BOUNDARY | SSW | 0.13 | 2.20E-05 | 2.20E-05 | 2.10E-05 | 9.30E-08 |
| SITE BOUNDARY | SW | 0.11 | 2.70E-05 | 2.70E-05 | 2.60E-05 | 1.00E-07 |
| SITE BOUNDARY | WSW | 0.11 | 2.00E-05 | 2.00E-05 | 1.90E-05 | 7.30E-08 |
| SITE BOUNDARY | W | 0.12 | 1.80E-05 | 1.80E-05 | 1.70E-05 | 5.40E-08 |
| SITE BOUNDARY | WNW | 0.16 | 1.10E-05 | 1.10E-05 | 1.00E-05 | 3.80E-08 |
| SITE BOUNDARY | NW | 0.28 | 6.30E-06 | 6.30E-06 | 6.00E-06 | 5.10E-08 |
| SITE BOUNDARY | NNW | 0.68 | 1.10E-06 | 1.10E-06 | 9.80E-07 | 8.50E-09 |
| SITE BOUNDARY | N | 0.83 | 7.20E-07 | 7.20E-07 | 6.40E-07 | 5.10E-09 |
| SITE BOUNDARY | NNE | 0.89 | 7.30E-07 | 7.30E-07 | 6.50E-07 | 4.50E-09 |
| SITE BOUNDARY | NE | 1.07 | 5.30E-07 | 5.30E-07 | 4.60E-07 | 3.20E-09 |
| SITE BOUNDARY | ENE | 0.88 | 6.50E-07 | 6.50E-07 | 5.80E-07 | 4.60E-09 |
| SITE BOUNDARY | E | 0.89 | 5.90E-07 | 5.90E-07 | 5.20E-07 | 4.60E-09 |
| SITE BOUNDARY | ESE | 0.24 | 4.10E-06 | 4.10E-06 | 3.90E-06 | 3.30E-08 |
| SITE BOUNDARY | SE | 0.15 | 1.80E-05 | 1.80E-05 | 1.70E-05 | 1.20E-07 |
| SITE BOUNDARY | SSE | 0.15 | 1.50E-05 | 1.50E-05 | 1.40E-05 | 1.00E-07 |
| NEAREST RES | S | 5.22 | 5.70E-08 | 5.70E-08 | 4.20E-08 | 2.10E-10 |
| NEAREST RES | SSW | 3.85 | 1.00E-07 | 1.00E-07 | 8.10E-08 | 3.50E-10 |
| NEAREST RES | SW | 4.29 | 8.90E-08 | 8.90E-08 | 6.80E-08 | 2.70E-10 |
| NEAREST RES | WSW | 4.41 | 6.20E-08 | 6.20E-08 | 4.70E-08 | 1.90E-10 |
| NEAREST RES | W | 3.98 | 7.20E-08 | 7.20E-08 | 5.50E-08 | 1.80E-10 |
| NEAREST RES | WNW | 3.42 | 8.20E-08 | 8.20E-08 | 6.40E-08 | 2.40E-10 |
| NEAREST RES | NW | 3.67 | 1.30E-07 | 1.30E-07 | 1.00E-07 | 6.80E-10 |
| NEAREST RES | NNW | 4.23 | 7.90E-08 | 7.90E-08 | 6.00E-08 | 3.50E-10 |
| NEAREST RES | N | 5.65 | 4.70E-08 | 4.70E-08 | 3.40E-08 | 1.80E-10 |
| NEAREST RES | NNE | 4.97 | 6.30E-08 | 6.30E-08 | 4.70E-08 | 2.20E-10 |
| NEAREST RES | NE | 3.85 | 8.50E-08 | 8.50E-08 | 6.60E-08 | 3.40E-10 |
| NEAREST RES | ENE | 3.85 | 7.90E-08 | 7.90E-08 | 6.10E-08 | 3.50E-10 |
| NEAREST RES | E | 5.28 | 4.70E-08 | 4.70E-08 | 3.50E-08 | 2.00E-10 |
| NEAREST RES | ESE | 5.84 | 3.70E-08 | 3.70E-08 | 2.70E-08 | 1.50E-10 |
| NEAREST RES | SE | 9.44 | 3.40E-08 | 3.40E-08 | 2.30E-08 | 1.20E-10 |
| NEAREST RES | SSE | 9.44 | 2.70E-08 | 2.70E-08 | 1.90E-08 | 1.00E-10 |

**Table 31, 2020 Salem Ground Level Release Dispersion (X/Q) and Deposition Factors (D/Q) (continued)**

| 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 | NNW | 0.57 | 1.40E-06 | 1.40E-06 | 1.30E-06 | 1.10E-08 |
| GARDENS | SE | 0.18 | 1.30E-05 | 1.30E-05 | 1.20E-05 | 9.40E-08 |
| GARDENS | N | 0.57 | 1.30E-06 | 1.30E-06 | 1.20E-06 | 9.60E-09 |
| GARDENS | NW | 0.58 | 1.90E-06 | 1.90E-06 | 1.70E-06 | 1.60E-08 |
| GARDENS | SSW | 3.9 | 1.00E-07 | 1.00E-07 | 7.90E-08 | 3.40E-10 |
| GARDENS | NE | 4.9 | 6.10E-08 | 6.10E-08 | 4.50E-08 | 2.20E-10 |
| GARDENS | ENE | 5 | 5.50E-08 | 5.50E-08 | 4.10E-08 | 2.20E-10 |
| GARDENS | NE | 5 | 5.90E-08 | 5.90E-08 | 4.40E-08 | 2.10E-10 |
| GARDENS | E | 6 | 3.90E-08 | 3.90E-08 | 2.90E-08 | 1.60E-10 |
| GARDENS | ENE | 6 | 4.30E-08 | 4.30E-08 | 3.10E-08 | 1.60E-10 |
| GARDENS | ESE | 6.3 | 3.30E-08 | 3.30E-08 | 2.40E-08 | 1.30E-10 |
| GARDENS | NW | 7 | 5.60E-08 | 5.60E-08 | 4.00E-08 | 2.10E-10 |
| GARDENS | NNE | 7.5 | 3.50E-08 | 3.50E-08 | 2.50E-08 | 1.10E-10 |
| GARDENS | NW | 8.3 | 4.50E-08 | 4.50E-08 | 3.10E-08 | 1.60E-10 |
| GARDENS | NE | 9.3 | 2.50E-08 | 2.50E-08 | 1.70E-08 | 7.30E-11 |
| GARDENS | N | 10.9 | 1.90E-08 | 1.90E-08 | 1.30E-08 | 5.90E-11 |
| GARDENS | NNE | 13.2 | 1.60E-08 | 1.60E-08 | 1.00E-08 | 4.20E-11 |
| GARDENS | WNW | 12.1 | 1.60E-08 | 1.60E-08 | 1.00E-08 | 2.70E-11 |
| GARDENS | NE | 23.3 | 7.00E-09 | 7.00E-09 | 3.90E-09 | 1.50E-11 |
| GARDENS | SW | 4.6 | 8.10E-08 | 8.10E-08 | 6.10E-08 | 2.40E-10 |
| DAIRY & CATTL | W | 4.9 | 5.50E-08 | 5.50E-08 | 4.10E-08 | 1.30E-10 |
| DAIRY & CATTL | WNW | 8.5 | 2.50E-08 | 2.50E-08 | 1.80E-08 | 4.80E-11 |
| DAIRY & CATTL | NE | 11.3 | 1.90E-08 | 1.90E-08 | 1.20E-08 | 5.30E-11 |
| DAIRY & CATTL | N | 11.7 | 1.80E-08 | 1.80E-08 | 1.10E-08 | 5.30E-11 |
| DAIRY & CATTL | NNE | 11.8 | 1.90E-08 | 1.90E-08 | 1.20E-08 | 5.10E-11 |
| DAIRY & CATTL | NE | 4.2 | 7.50E-08 | 7.50E-08 | 5.70E-08 | 2.90E-10 |
| DAIRY & CATTL | NE | 5.8 | 4.80E-08 | 4.80E-08 | 3.50E-08 | 1.60E-10 |
| DAIRY & CATTL | SSW | 8.3 | 3.70E-08 | 3.70E-08 | 2.60E-08 | 9.20E-11 |
| DAIRY & CATTL | N | 11.5 | 1.80E-08 | 1.80E-08 | 1.20E-08 | 5.40E-11 |
| DAIRY & CATTL | NE | 17.7 | 1.00E-08 | 1.00E-08 | 6.10E-09 | 2.50E-11 |

**Table 41, 2020 Hope Creel Ground Level Release Dispersion (X/Q) and Deposition Factors (D/Q)**

| 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 | 5.20E-06 | 5.20E-06 | 4.90E-06 | 3.60E-08 |
| SITE BOUNDARY | SSW | 0.19 | 1.10E-05 | 1.10E-05 | 1.00E-05 | 5.20E-08 |
| SITE BOUNDARY | SW | 0.17 | 1.30E-05 | 1.30E-05 | 1.20E-05 | 5.80E-08 |
| SITE BOUNDARY | WSW | 0.17 | 9.70E-06 | 9.70E-06 | 9.30E-06 | 4.10E-08 |
| SITE BOUNDARY | W | 0.18 | 8.70E-06 | 8.70E-06 | 8.40E-06 | 3.10E-08 |
| SITE BOUNDARY | WNW | 0.22 | 5.90E-06 | 5.90E-06 | 5.60E-06 | 2.40E-08 |
| SITE BOUNDARY | NW | 0.31 | 5.50E-06 | 5.50E-06 | 5.10E-06 | 4.50E-08 |
| SITE BOUNDARY | NNW | 0.55 | 1.50E-06 | 1.50E-06 | 1.40E-06 | 1.20E-08 |
| SITE BOUNDARY | N | 0.5 | 1.60E-06 | 1.60E-06 | 1.50E-06 | 1.20E-08 |
| SITE BOUNDARY | NNE | 0.63 | 1.20E-06 | 1.20E-06 | 1.10E-06 | 8.00E-09 |
| SITE BOUNDARY | NE | 0.74 | 8.90E-07 | 8.90E-07 | 7.90E-07 | 5.90E-09 |
| SITE BOUNDARY | ENE | 0.94 | 5.90E-07 | 5.90E-07 | 5.20E-07 | 4.10E-09 |
| SITE BOUNDARY | E | 0.94 | 5.50E-07 | 5.50E-07 | 4.80E-07 | 4.20E-09 |
| SITE BOUNDARY | ESE | 0.75 | 6.80E-07 | 6.80E-07 | 6.10E-07 | 5.60E-09 |
| SITE BOUNDARY | SE | 0.47 | 2.40E-06 | 2.40E-06 | 2.20E-06 | 2.10E-08 |
| SITE BOUNDARY | SSE | 0.42 | 2.40E-06 | 2.40E-06 | 2.20E-06 | 2.20E-08 |
| NEAREST RES | S | 5.22 | 5.60E-08 | 5.60E-08 | 4.20E-08 | 2.10E-10 |
| NEAREST RES | SSW | 3.85 | 1.00E-07 | 1.00E-07 | 8.00E-08 | 3.50E-10 |
| NEAREST RES | SW | 4.29 | 8.90E-08 | 8.90E-08 | 6.80E-08 | 2.70E-10 |
| NEAREST RES | WSW | 4.41 | 6.20E-08 | 6.20E-08 | 4.70E-08 | 1.90E-10 |
| NEAREST RES | W | 3.98 | 7.10E-08 | 7.10E-08 | 5.50E-08 | 1.80E-10 |
| NEAREST RES | WNW | 3.42 | 8.20E-08 | 8.20E-08 | 6.40E-08 | 2.40E-10 |
| NEAREST RES | NW | 3.67 | 1.30E-07 | 1.30E-07 | 1.00E-07 | 6.80E-10 |
| NEAREST RES | NNW | 4.23 | 7.90E-08 | 7.90E-08 | 6.00E-08 | 3.50E-10 |
| NEAREST RES | N | 5.65 | 4.70E-08 | 4.70E-08 | 3.40E-08 | 1.80E-10 |
| NEAREST RES | NNE | 4.97 | 6.30E-08 | 6.30E-08 | 4.70E-08 | 2.20E-10 |
| NEAREST RES | NE | 3.85 | 8.50E-08 | 8.50E-08 | 6.60E-08 | 3.40E-10 |
| NEAREST RES | ENE | 3.85 | 7.90E-08 | 7.90E-08 | 6.10E-08 | 3.50E-10 |
| NEAREST RES | E | 5.28 | 4.70E-08 | 4.70E-08 | 3.50E-08 | 2.00E-10 |
| NEAREST RES | ESE | 5.84 | 3.60E-08 | 3.60E-08 | 2.70E-08 | 1.50E-10 |
| NEAREST RES | SE | 9.44 | 3.40E-08 | 3.40E-08 | 2.30E-08 | 1.20E-10 |
| NEAREST RES | SSE | 9.44 | 2.70E-08 | 2.70E-08 | 1.90E-08 | 1.00E-10 |

**Table 32, 2020 Hope Creek Ground Level Release Dispersion (X/Q) and Deposition Factors (D/Q) (continued)**

| 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 | NNW | 0.57 | 1.40E-06 | 1.40E-06 | 1.30E-06 | 1.10E-08 |
| GARDENS | SE | 0.18 | 1.30E-05 | 1.30E-05 | 1.20E-05 | 9.40E-08 |
| GARDENS | N | 0.57 | 1.30E-06 | 1.30E-06 | 1.20E-06 | 9.60E-09 |
| GARDENS | NW | 0.58 | 1.90E-06 | 1.90E-06 | 1.70E-06 | 1.60E-08 |
| GARDENS | SSW | 3.9 | 1.00E-07 | 1.00E-07 | 7.90E-08 | 3.40E-10 |
| GARDENS | NE | 4.9 | 6.00E-08 | 6.00E-08 | 4.50E-08 | 2.20E-10 |
| GARDENS | ENE | 5 | 5.50E-08 | 5.50E-08 | 4.10E-08 | 2.20E-10 |
| GARDENS | NE | 5 | 5.90E-08 | 5.90E-08 | 4.40E-08 | 2.10E-10 |
| GARDENS | E | 6 | 3.90E-08 | 3.90E-08 | 2.90E-08 | 1.60E-10 |
| GARDENS | ENE | 6 | 4.20E-08 | 4.20E-08 | 3.10E-08 | 1.60E-10 |
| GARDENS | ESE | 6.3 | 3.30E-08 | 3.30E-08 | 2.40E-08 | 1.30E-10 |
| GARDENS | NW | 7 | 5.60E-08 | 5.60E-08 | 4.00E-08 | 2.10E-10 |
| GARDENS | NNE | 7.5 | 3.50E-08 | 3.50E-08 | 2.50E-08 | 1.10E-10 |
| GARDENS | NW | 8.3 | 4.50E-08 | 4.50E-08 | 3.10E-08 | 1.60E-10 |
| GARDENS | NE | 9.3 | 2.50E-08 | 2.50E-08 | 1.70E-08 | 7.30E-11 |
| GARDENS | N | 10.9 | 1.90E-08 | 1.90E-08 | 1.30E-08 | 5.90E-11 |
| GARDENS | NNE | 13.2 | 1.60E-08 | 1.60E-08 | 1.00E-08 | 4.20E-11 |
| GARDENS | WNW | 12.1 | 1.60E-08 | 1.60E-08 | 1.00E-08 | 2.70E-11 |
| GARDENS | NE | 23.3 | 7.00E-09 | 7.00E-09 | 3.90E-09 | 1.50E-11 |
| GARDENS | SW | 4.6 | 8.10E-08 | 8.10E-08 | 6.10E-08 | 2.40E-10 |
| DAIRY & CATTL | W | 4.9 | 5.40E-08 | 5.40E-08 | 4.10E-08 | 1.30E-10 |
| DAIRY & CATTL | WNW | 8.5 | 2.50E-08 | 2.50E-08 | 1.70E-08 | 4.80E-11 |
| DAIRY & CATTL | NE | 11.3 | 1.90E-08 | 1.90E-08 | 1.20E-08 | 5.30E-11 |
| DAIRY & CATTL | N | 11.7 | 1.80E-08 | 1.80E-08 | 1.10E-08 | 5.30E-11 |
| DAIRY & CATTL | NNE | 11.8 | 1.90E-08 | 1.90E-08 | 1.20E-08 | 5.10E-11 |
| DAIRY & CATTL | NE | 4.2 | 7.50E-08 | 7.50E-08 | 5.70E-08 | 2.90E-10 |
| DAIRY & CATTL | NE | 5.8 | 4.80E-08 | 4.80E-08 | 3.50E-08 | 1.60E-10 |
| DAIRY & CATTL | SSW | 8.3 | 3.70E-08 | 3.70E-08 | 2.60E-08 | 9.20E-11 |
| DAIRY & CATTL | N | 11.5 | 1.80E-08 | 1.80E-08 | 1.20E-08 | 5.40E-11 |
| DAIRY & CATTL | NE | 17.7 | 1.00E-08 | 1.00E-08 | 6.10E-09 | 2.50E-11 |

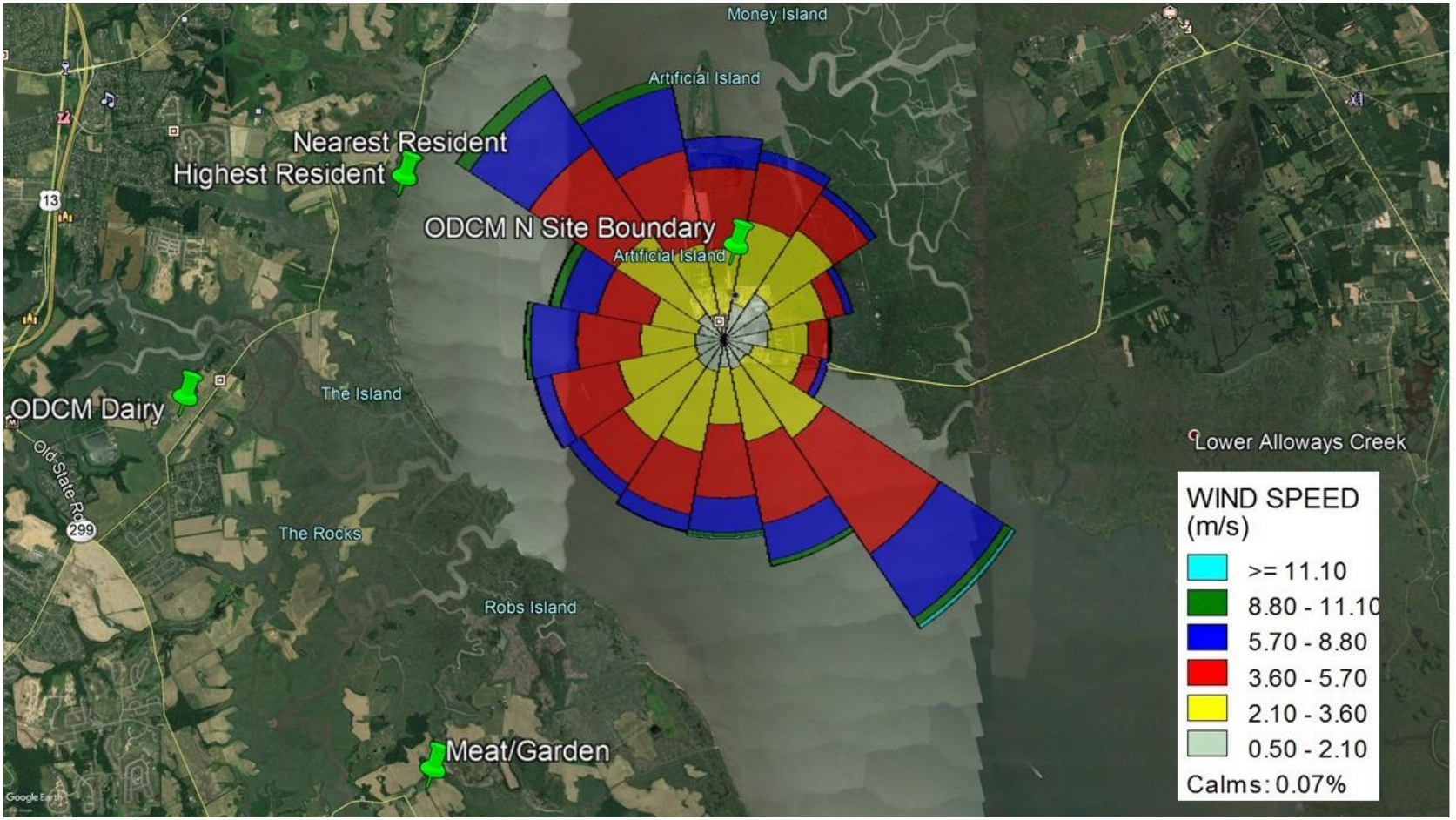


**Figure 5, Locations of Dose Calculation Receptors with 2020 Wind Rose Overlay**

**Attachment 4, Radiological Effluent Trends**

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1.0 The following trend graphs displays the total curies of liquid and gaseous effluents released for SGS and HCGS from 2005 through 2020.

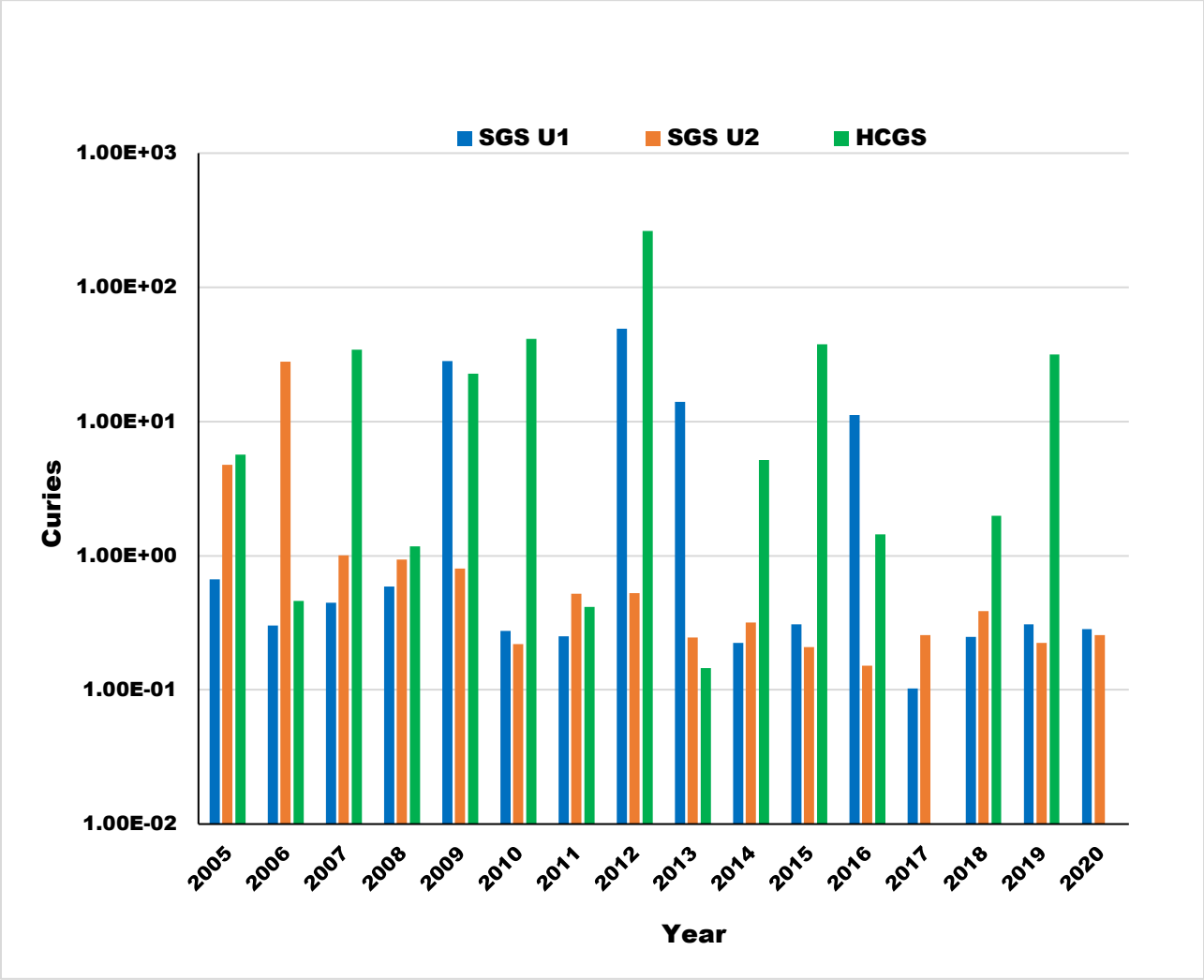


Figure 6, Fission and Activation Gases Released in Gaseous Effluents from Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2005 - 2020

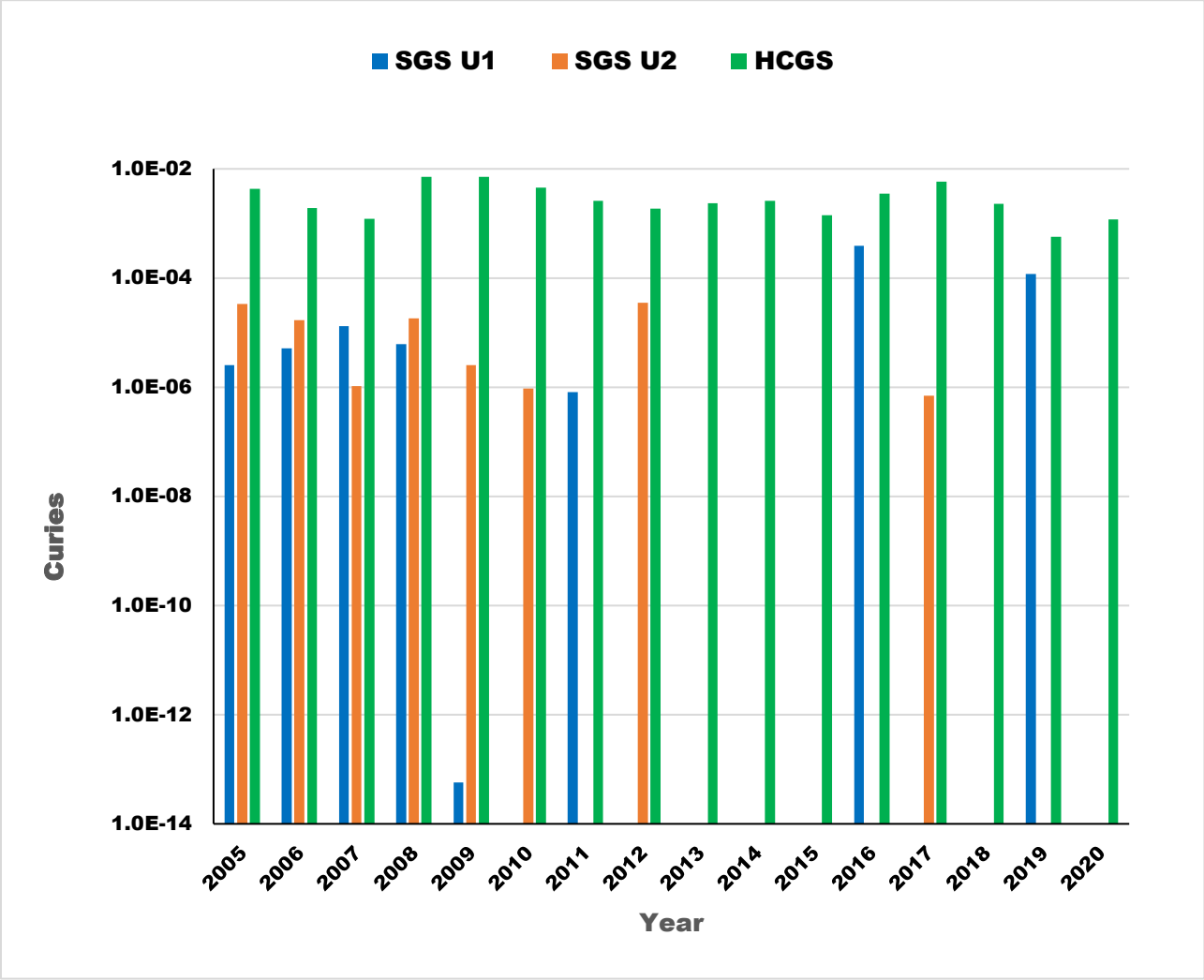


**Figure 7, Iodines Released in Gaseous Effluents from Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2005 – 2020**

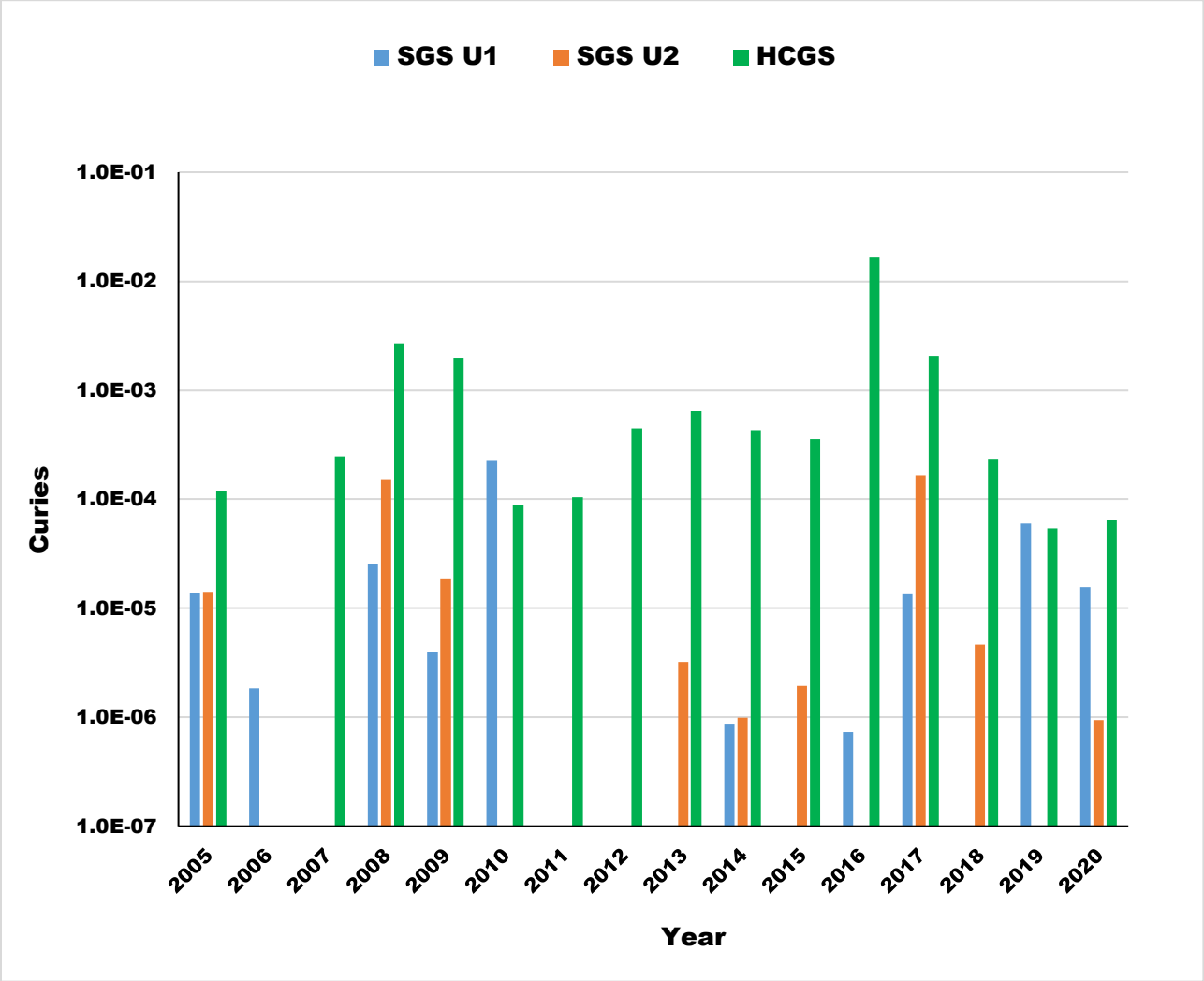


**Figure 8, Particulates Released in Gaseous Effluents from Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2005 – 2020**

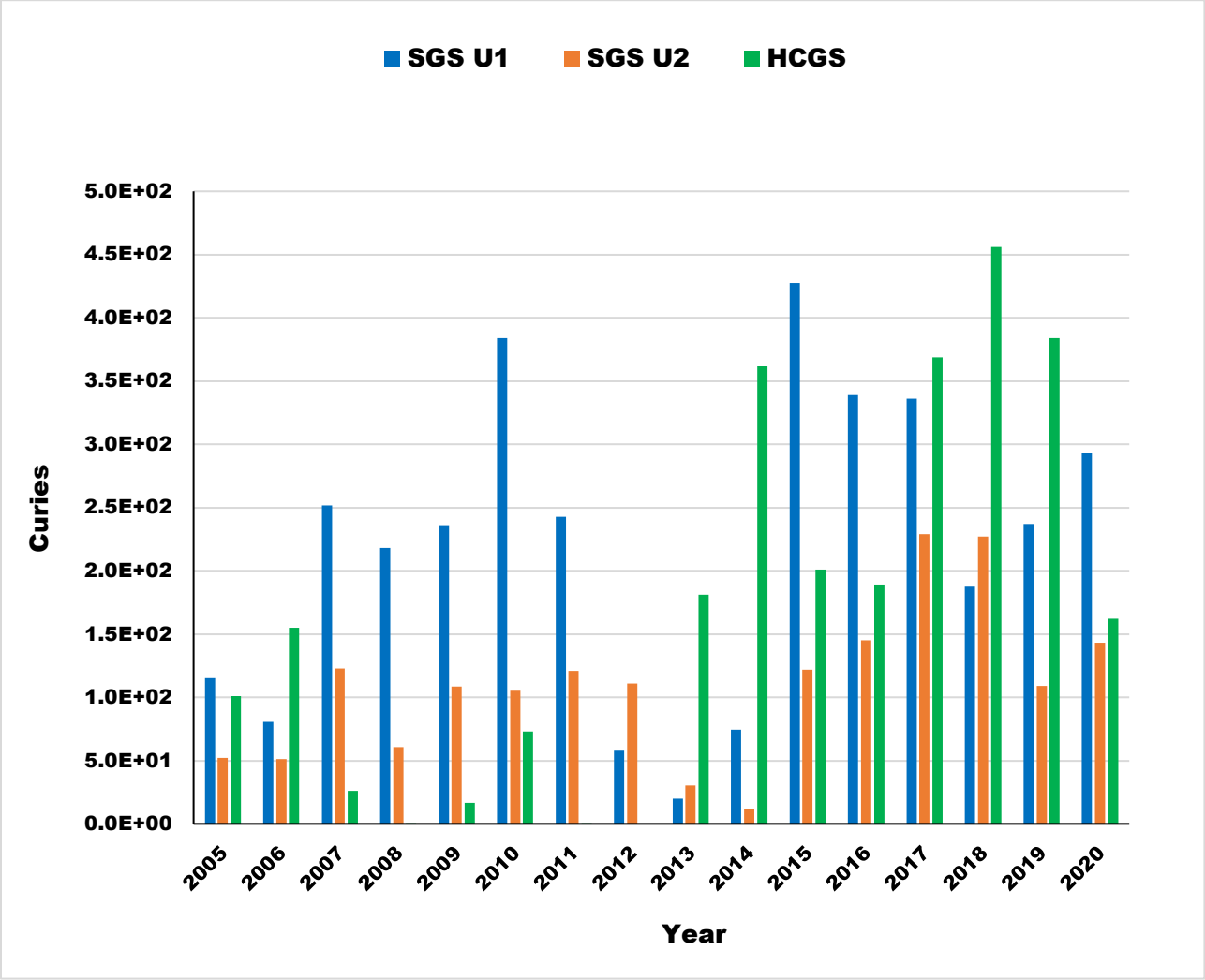


**Figure 9, Tritium Released in Gaseous Effluents from Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2005 – 2020**

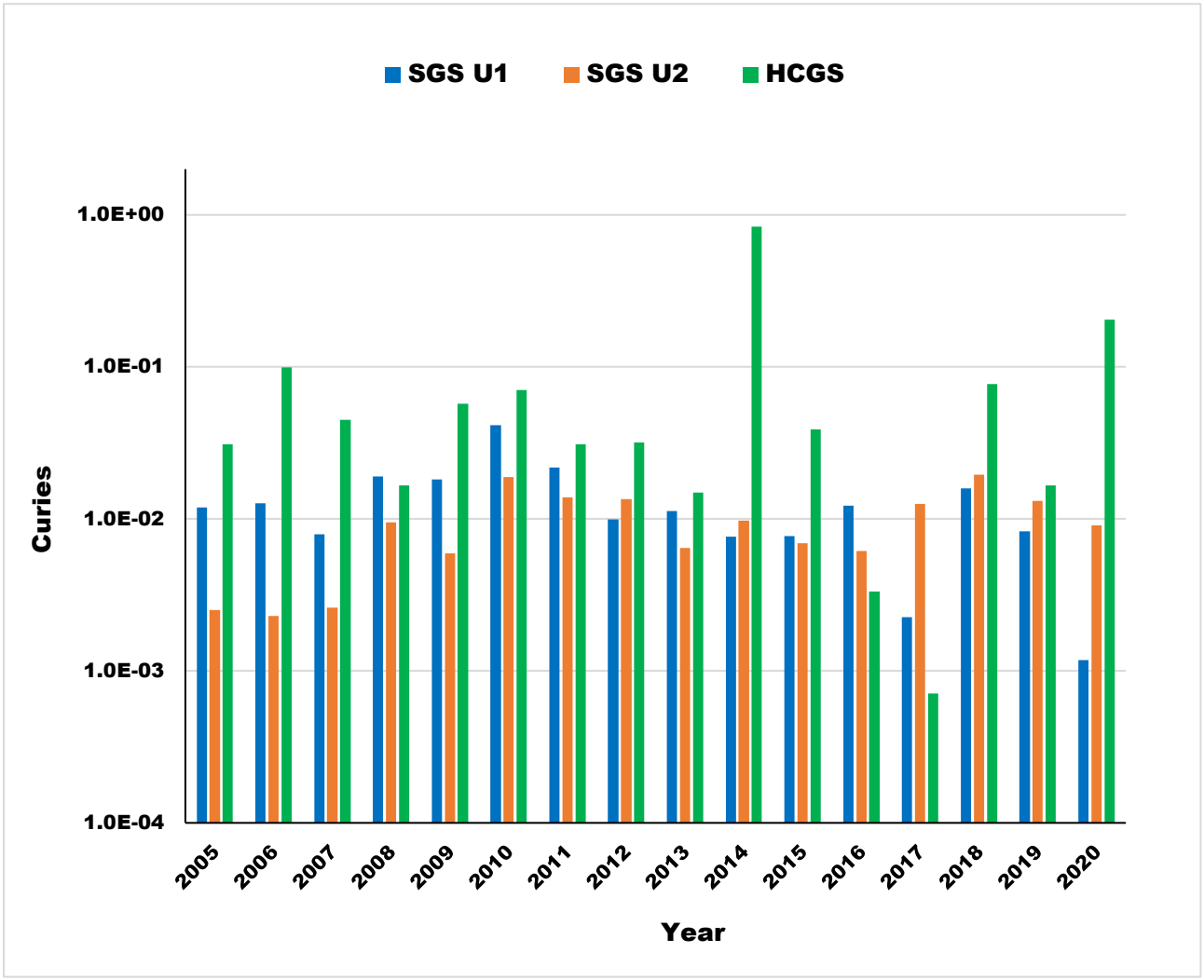


**Figure 10, Fission and Activation Products Released in Liquid Effluents, Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2005 – 2020**

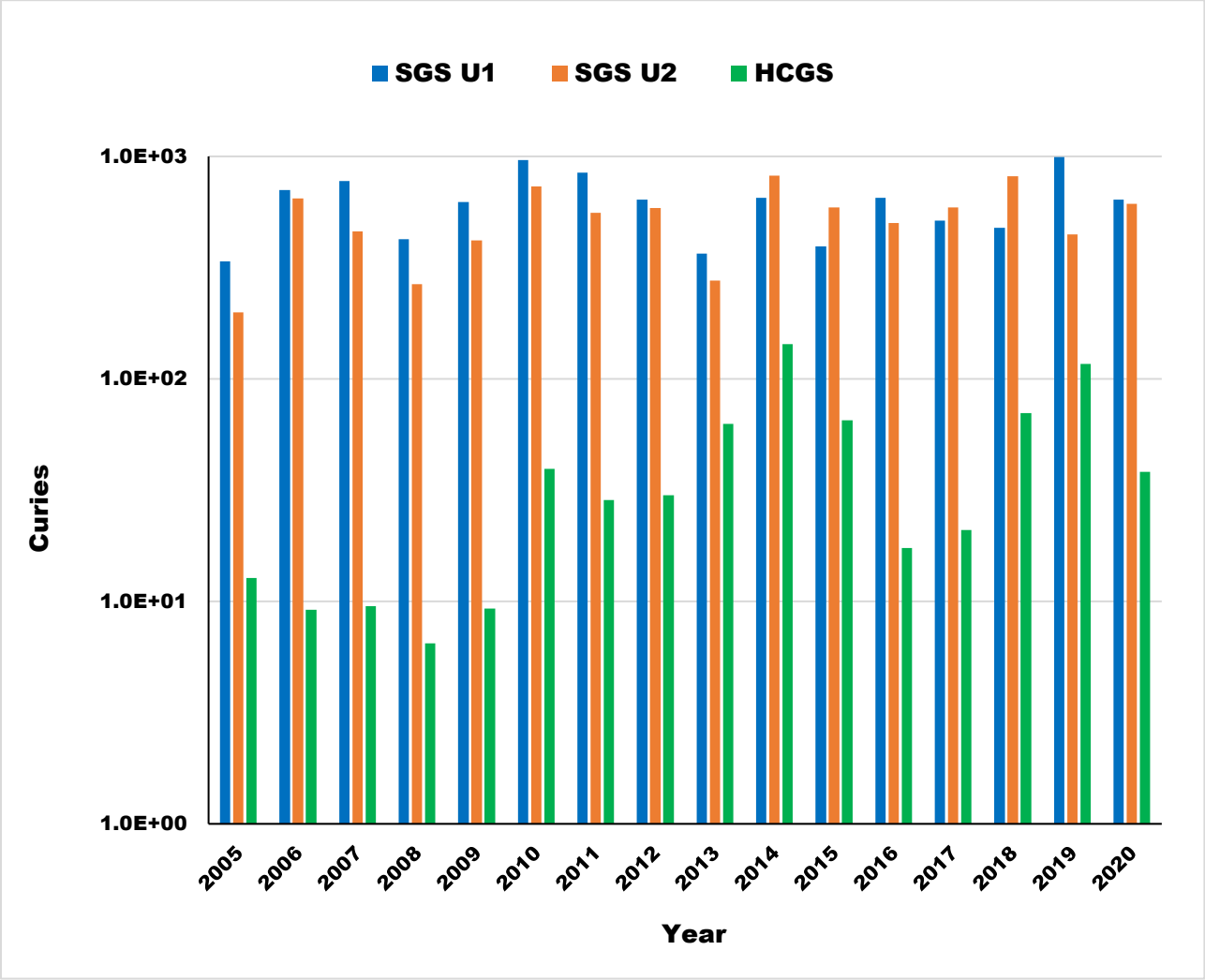


**Figure 11, Tritium Released in Liquid Effluents, Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1, 2005 – 2020**

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

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**1.0 Doses for the following receptors were compiled from gaseous releases from Salem Unit 1, Salem Unit 2 and Hope Creek Unit 1.**

**Table 42, Highest Potential Dose Receptors, Distances from Salem and Hope Creek, Annual Average X/Q, and D/Q Values to Calculate Dose using the NRC Code GASPAR, 2020**

| Receptor | Sector | Distance in Miles from Salem | Distance in Miles from Hope Creek | Occupancy | Salem | | Hope Creek | |
|---|---|---|---|---|---|---|---|---|
| | | | | | X/Q | D/Q | X/Q | D/Q |
| Site Boundary | N | 0.83 | 0.50 | 1 | 7.20E-07 | 5.10E-09 | 1.60E-06 | 1.20E-08 |
| ODCM Dairy | W | 4.90 | 4.90 | 1 | 5.50E-08 | 1.30E-10 | 5.40E-08 | 1.30E-10 |
| Nearest Resident | WNW | 3.45 | 3.42 | 1 | 8.20E-08 | 2.40E-10 | 8.20E-08 | 2.40E-10 |
| Highest Resident | NW | 3.67 | 3.70 | 1 | 1.30E-07 | 6.80E-10 | 1.40E-07 | 5.70E-10 |
| ODCM Resident-Garden-Meat | SW | 4.60 | 4.60 | 1 | 8.10E-08 | 2.40E-10 | 8.10E-08 | 2.40E-10 |
| Onsite Worker | SW | 0.11 | 0.17 | 0.25 | 2.70E-05 | 1.00E-07 | 1.30E-05 | 5.80E-08 |
| Emergency Personnel (National Guard) | E | 0.89 | 0.94 | 0.25 | 5.90E-07 | 4.60E-09 | 5.50E-07 | 4.20E-09 |
| Wind Turbine Laydown Area | NNE | 0.89 | 0.63 | 0.25 | 7.3E-07 | 4.50E-09 | 1.20E-06 | 8.00E-09 |

**Table 43, Calculated Doses at Site Boundary for Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2020**

| Receptor – Site Boundary – Salem Unit 1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 2.18E-05 | 2.18E-05 | 2.18E-05 | 2.18E-05 | 2.18E-05 | 2.19E-05 | 2.18E-05 | 3.65E-05 |
| **GROUND** | 9.64E-07 | 9.64E-07 | 9.64E-07 | 9.64E-07 | 9.64E-07 | 9.64E-07 | 9.64E-07 | 1.13E-06 |
| **INHAL** | | | | | | | | |
| ADULT | 5.44E-03 | 5.44E-03 | 3.38E-03 | 5.44E-03 | 5.44E-03 | 5.44E-03 | 5.44E-03 | 4.80E-03 |
| TEEN | 5.75E-03 | 5.75E-03 | 4.84E-03 | 5.75E-03 | 5.75E-03 | 5.75E-03 | 5.76E-03 | 4.85E-03 |
| CHILD | 5.54E-03 | 5.54E-03 | 6.69E-03 | 5.54E-03 | 5.54E-03 | 5.54E-03 | 5.54E-03 | 4.28E-03 |
| INFANT | 3.45E-03 | 3.45E-03 | 4.93E-03 | 3.45E-03 | 3.45E-03 | 3.45E-03 | 3.45E-03 | 2.46E-03 |
| **TOTAL** | | | | | | | | |
| ADULT | 5.46E-03 | 5.46E-03 | 3.40E-03 | 5.46E-03 | 5.46E-03 | 5.46E-03 | 5.46E-03 | 4.84E-03 |
| TEEN | 5.77E-03 | 5.77E-03 | 4.86E-03 | 5.77E-03 | 5.77E-03 | 5.77E-03 | 5.78E-03 | 4.89E-03 |
| CHILD | 5.56E-03 | 5.56E-03 | 6.71E-03 | 5.56E-03 | 5.56E-03 | 5.56E-03 | 5.56E-03 | 4.32E-03 |
| INFANT | 3.47E-03 | 3.47E-03 | 4.95E-03 | 3.47E-03 | 3.47E-03 | 3.47E-03 | 3.47E-03 | 2.50E-03 |
| **Receptor – Site Boundary – Salem Unit 2** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 3.12E-05 | 3.12E-05 | 3.12E-05 | 3.12E-05 | 3.12E-05 | 3.12E-05 | 3.12E-05 | 5.03E-05 |
| **GROUND** | 5.78E-08 | 5.78E-08 | 5.78E-08 | 5.78E-08 | 5.78E-08 | 5.78E-08 | 5.78E-08 | 6.78E-08 |
| **INHAL** | | | | | | | | |
| ADULT | 4.28E-03 | 3.15E-03 | 3.15E-03 | 3.15E-03 | 3.15E-03 | 3.15E-03 | 3.15E-03 | 2.34E-03 |
| TEEN | 6.12E-03 | 3.51E-03 | 3.51E-03 | 3.51E-03 | 3.51E-03 | 3.51E-03 | 3.51E-03 | 2.37E-03 |
| CHILD | 8.45E-03 | 3.67E-03 | 3.67E-03 | 3.67E-03 | 3.67E-03 | 3.67E-03 | 3.67E-03 | 2.09E-03 |
| INFANT | 6.23E-03 | 2.45E-03 | 2.45E-03 | 2.45E-03 | 2.45E-03 | 2.45E-03 | 2.45E-03 | 1.20E-03 |
| **TOTAL** | | | | | | | | |
| ADULT | 4.31E-03 | 3.18E-03 | 3.18E-03 | 3.18E-03 | 3.18E-03 | 3.18E-03 | 3.18E-03 | 2.39E-03 |
| TEEN | 6.15E-03 | 3.54E-03 | 3.54E-03 | 3.54E-03 | 3.54E-03 | 3.54E-03 | 3.54E-03 | 2.42E-03 |
| CHILD | 8.48E-03 | 3.70E-03 | 3.70E-03 | 3.70E-03 | 3.70E-03 | 3.70E-03 | 3.70E-03 | 2.14E-03 |
| INFANT | 6.26E-03 | 2.48E-03 | 2.48E-03 | 2.48E-03 | 2.48E-03 | 2.48E-03 | 2.48E-03 | 1.25E-03 |
| **Receptor – Site Boundary – Hope Creek Unit 1** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| **GROUND** | 4.12E-04 | 4.12E-04 | 4.12E-04 | 4.12E-04 | 4.12E-04 | 4.12E-04 | 4.12E-04 | 4.82E-04 |
| **INHAL** | | | | | | | | |
| ADULT | 1.67E-02 | 8.97E-03 | 8.96E-03 | 8.97E-03 | 9.14E-03 | 8.97E-03 | 8.96E-03 | 5.83E-03 |
| TEEN | 2.39E-02 | 1.04E-02 | 1.04E-02 | 1.04E-02 | 1.06E-02 | 1.04E-02 | 1.04E-02 | 5.88E-03 |
| CHILD | 3.30E-02 | 1.14E-02 | 1.14E-02 | 1.14E-02 | 1.17E-02 | 1.14E-02 | 1.14E-02 | 5.19E-03 |
| INFANT | 2.43E-02 | 7.87E-03 | 7.87E-03 | 7.87E-03 | 8.13E-03 | 7.87E-03 | 7.87E-03 | 2.99E-03 |
| **TOTAL** | | | | | | | | |
| ADULT | 1.71E-02 | 9.38E-03 | 9.37E-03 | 9.38E-03 | 9.55E-03 | 9.38E-03 | 9.37E-03 | 6.31E-03 |
| TEEN | 2.43E-02 | 1.08E-02 | 1.08E-02 | 1.08E-02 | 1.10E-02 | 1.08E-02 | 1.08E-02 | 6.36E-03 |
| CHILD | 3.34E-02 | 1.18E-02 | 1.18E-02 | 1.18E-02 | 1.21E-02 | 1.18E-02 | 1.18E-02 | 5.67E-03 |
| INFANT | 2.47E-02 | 8.28E-03 | 8.28E-03 | 8.28E-03 | 8.54E-03 | 8.28E-03 | 8.28E-03 | 3.47E-03 |

**Table 43, Calculated Doses at Site Boundary for Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2020 (continue)**

| Receptor – Site Boundary – Total of All Units | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 5.30E-05 | 5.30E-05 | 5.30E-05 | 5.30E-05 | 5.30E-05 | 5.31E-05 | 5.30E-05 | 8.68E-05 |
| **GROUND** | 4.13E-04 | 4.13E-04 | 4.13E-04 | 4.13E-04 | 4.13E-04 | 4.13E-04 | 4.13E-04 | 4.83E-04 |
| **INHAL** | | | | | | | | |
| ADULT | 2.64E-02 | 1.76E-02 | 1.55E-02 | 1.76E-02 | 1.77E-02 | 1.76E-02 | 1.76E-02 | 1.30E-02 |
| TEEN | 3.58E-02 | 1.97E-02 | 1.88E-02 | 1.97E-02 | 1.99E-02 | 1.97E-02 | 1.97E-02 | 1.31E-02 |
| CHILD | 4.70E-02 | 2.06E-02 | 2.18E-02 | 2.06E-02 | 2.09E-02 | 2.06E-02 | 2.06E-02 | 1.16E-02 |
| INFANT | 3.40E-02 | 1.38E-02 | 1.53E-02 | 1.38E-02 | 1.40E-02 | 1.38E-02 | 1.38E-02 | 6.65E-03 |
| **TOTAL** | | | | | | | | |
| ADULT | 2.69E-02 | 1.80E-02 | 1.60E-02 | 1.80E-02 | 1.82E-02 | 1.80E-02 | 1.80E-02 | 1.35E-02 |
| TEEN | 3.62E-02 | 2.01E-02 | 1.92E-02 | 2.01E-02 | 2.03E-02 | 2.01E-02 | 2.01E-02 | 1.37E-02 |
| CHILD | 4.75E-02 | 2.11E-02 | 2.22E-02 | 2.11E-02 | 2.14E-02 | 2.11E-02 | 2.11E-02 | 1.21E-02 |
| INFANT | 3.44E-02 | 1.42E-02 | 1.57E-02 | 1.42E-02 | 1.45E-02 | 1.42E-02 | 1.42E-02 | 7.22E-03 |

**Table 44, Calculated Doses at ODCM Dairy Farm for Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2020**

| Receptor – ODCM Dairy Farm – Salem Unit 1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 1.67E-06 | 1.67E-06 | 1.67E-06 | 1.67E-06 | 1.67E-06 | 1.67E-06 | 1.67E-06 | 2.79E-06 |
| **GROUND** | 2.46E-08 | 2.46E-08 | 2.46E-08 | 2.46E-08 | 2.46E-08 | 2.46E-08 | 2.46E-08 | 2.88E-08 |
| **COW MILK** | | | | | | | | |
| ADULT | 1.27E-03 | 1.27E-03 | 5.21E-03 | 1.27E-03 | 1.27E-03 | 1.27E-03 | 1.27E-03 | 1.27E-03 |
| TEEN | 2.21E-03 | 2.21E-03 | 9.61E-03 | 2.21E-03 | 2.21E-03 | 2.21E-03 | 2.21E-03 | 2.21E-03 |
| CHILD | 5.19E-03 | 5.19E-03 | 2.36E-02 | 5.19E-03 | 5.19E-03 | 5.19E-03 | 5.19E-03 | 5.19E-03 |
| INFANT | 1.06E-02 | 1.06E-02 | 4.63E-02 | 1.06E-02 | 1.06E-02 | 1.06E-02 | 1.06E-02 | 1.06E-02 |
| **INHAL** | | | | | | | | |
| ADULT | 4.15E-04 | 4.15E-04 | 2.58E-04 | 4.15E-04 | 4.15E-04 | 4.15E-04 | 4.16E-04 | 3.67E-04 |
| TEEN | 4.40E-04 | 4.40E-04 | 3.70E-04 | 4.40E-04 | 4.40E-04 | 4.40E-04 | 4.40E-04 | 3.70E-04 |
| CHILD | 4.23E-04 | 4.23E-04 | 5.11E-04 | 4.23E-04 | 4.23E-04 | 4.23E-04 | 4.23E-04 | 3.27E-04 |
| INFANT | 2.64E-04 | 2.64E-04 | 3.77E-04 | 2.64E-04 | 2.64E-04 | 2.64E-04 | 2.64E-04 | 1.88E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 1.69E-03 | 1.69E-03 | 5.47E-03 | 1.69E-03 | 1.69E-03 | 1.69E-03 | 1.69E-03 | 1.64E-03 |
| TEEN | 2.65E-03 | 2.65E-03 | 9.98E-03 | 2.65E-03 | 2.65E-03 | 2.65E-03 | 2.65E-03 | 2.58E-03 |
| CHILD | 5.61E-03 | 5.61E-03 | 2.41E-02 | 5.61E-03 | 5.61E-03 | 5.61E-03 | 5.61E-03 | 5.52E-03 |
| INFANT | 1.09E-02 | 1.09E-02 | 4.67E-02 | 1.09E-02 | 1.09E-02 | 1.09E-02 | 1.09E-02 | 1.08E-02 |
| **Receptor –ODCM Dairy Farm – Salem Unit 2** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 2.38E-06 | 2.38E-06 | 2.38E-06 | 2.38E-06 | 2.38E-06 | 2.39E-06 | 2.38E-06 | 3.85E-06 |
| **GROUND** | 1.47E-09 | 1.47E-09 | 1.47E-09 | 1.47E-09 | 1.47E-09 | 1.47E-09 | 1.47E-09 | 1.73E-09 |
| **COW MILK** | | | | | | | | |
| ADULT | 6.58E-03 | 1.43E-03 | 1.43E-03 | 1.43E-03 | 1.43E-03 | 1.43E-03 | 1.43E-03 | 1.43E-03 |
| TEEN | 1.21E-02 | 2.57E-03 | 2.57E-03 | 2.57E-03 | 2.57E-03 | 2.57E-03 | 2.57E-03 | 2.57E-03 |
| CHILD | 2.99E-02 | 6.20E-03 | 6.20E-03 | 6.20E-03 | 6.20E-03 | 6.20E-03 | 6.20E-03 | 6.20E-03 |
| INFANT | 5.85E-02 | 1.28E-02 | 1.28E-02 | 1.28E-02 | 1.28E-02 | 1.28E-02 | 1.28E-02 | 1.28E-02 |
| **INHAL** | | | | | | | | |
| ADULT | 3.27E-04 | 2.40E-04 | 2.40E-04 | 2.40E-04 | 2.40E-04 | 2.40E-04 | 2.40E-04 | 1.79E-04 |
| TEEN | 4.68E-04 | 2.68E-04 | 2.68E-04 | 2.68E-04 | 2.68E-04 | 2.68E-04 | 2.68E-04 | 1.81E-04 |
| CHILD | 6.45E-04 | 2.81E-04 | 2.81E-04 | 2.81E-04 | 2.81E-04 | 2.81E-04 | 2.81E-04 | 1.60E-04 |
| INFANT | 4.76E-04 | 1.87E-04 | 1.87E-04 | 1.87E-04 | 1.87E-04 | 1.87E-04 | 1.87E-04 | 9.18E-05 |
| **TOTAL** | | | | | | | | |
| ADULT | 6.91E-03 | 1.67E-03 | 1.67E-03 | 1.67E-03 | 1.67E-03 | 1.67E-03 | 1.67E-03 | 1.61E-03 |
| TEEN | 1.26E-02 | 2.84E-03 | 2.84E-03 | 2.84E-03 | 2.84E-03 | 2.84E-03 | 2.84E-03 | 2.75E-03 |
| CHILD | 3.05E-02 | 6.48E-03 | 6.48E-03 | 6.48E-03 | 6.48E-03 | 6.48E-03 | 6.48E-03 | 6.36E-03 |
| INFANT | 5.90E-02 | 1.30E-02 | 1.30E-02 | 1.30E-02 | 1.30E-02 | 1.30E-02 | 1.30E-02 | 1.29E-02 |

**Table 44, Calculated Doses at ODCM Dairy Farm for Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2020 (continued)**

| Receptor – ODCM Dairy Farm – Hope Creek Unit 1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| **GROUND** | 4.46E-06 | 4.46E-06 | 4.46E-06 | 4.46E-06 | 4.46E-06 | 4.46E-06 | 4.46E-06 | 5.23E-06 |
| **COW MILK** | | | | | | | | |
| ADULT | 1.14E-02 | 2.39E-03 | 2.39E-03 | 2.39E-03 | 2.42E-03 | 2.39E-03 | 2.39E-03 | 2.39E-03 |
| TEEN | 2.10E-02 | 4.35E-03 | 4.35E-03 | 4.35E-03 | 4.40E-03 | 4.35E-03 | 4.35E-03 | 4.35E-03 |
| CHILD | 5.15E-02 | 1.06E-02 | 1.06E-02 | 1.06E-02 | 1.06E-02 | 1.06E-02 | 1.06E-02 | 1.06E-02 |
| INFANT | 1.01E-01 | 2.19E-02 | 2.19E-02 | 2.19E-02 | 2.22E-02 | 2.19E-02 | 2.19E-02 | 2.19E-02 |
| **INHAL** | | | | | | | | |
| ADULT | 5.64E-04 | 3.03E-04 | 3.03E-04 | 3.03E-04 | 3.08E-04 | 3.03E-04 | 3.03E-04 | 1.97E-04 |
| TEEN | 8.07E-04 | 3.50E-04 | 3.50E-04 | 3.50E-04 | 3.57E-04 | 3.50E-04 | 3.50E-04 | 1.99E-04 |
| CHILD | 1.11E-03 | 3.84E-04 | 3.84E-04 | 3.84E-04 | 3.93E-04 | 3.84E-04 | 3.84E-04 | 1.75E-04 |
| INFANT | 8.21E-04 | 2.66E-04 | 2.65E-04 | 2.66E-04 | 2.74E-04 | 2.66E-04 | 2.65E-04 | 1.01E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 1.20E-02 | 2.70E-03 | 2.70E-03 | 2.70E-03 | 2.73E-03 | 2.70E-03 | 2.70E-03 | 2.59E-03 |
| TEEN | 2.18E-02 | 4.70E-03 | 4.70E-03 | 4.70E-03 | 4.76E-03 | 4.70E-03 | 4.70E-03 | 4.55E-03 |
| CHILD | 5.26E-02 | 1.10E-02 | 1.10E-02 | 1.10E-02 | 1.10E-02 | 1.10E-02 | 1.10E-02 | 1.08E-02 |
| INFANT | 1.02E-01 | 2.22E-02 | 2.22E-02 | 2.22E-02 | 2.25E-02 | 2.22E-02 | 2.22E-02 | 2.20E-02 |
| **Receptor – ODCM Dairy Farm – Total of All Units** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 4.05E-06 | 4.05E-06 | 4.05E-06 | 4.05E-06 | 4.05E-06 | 4.06E-06 | 4.05E-06 | 6.64E-06 |
| **GROUND** | 4.49E-06 | 4.49E-06 | 4.49E-06 | 4.49E-06 | 4.49E-06 | 4.49E-06 | 4.49E-06 | 5.26E-06 |
| **COW MILK** | | | | | | | | |
| ADULT | 1.93E-02 | 5.09E-03 | 9.03E-03 | 5.09E-03 | 5.12E-03 | 5.09E-03 | 5.09E-03 | 5.09E-03 |
| TEEN | 3.53E-02 | 9.13E-03 | 1.65E-02 | 9.13E-03 | 9.18E-03 | 9.13E-03 | 9.13E-03 | 9.13E-03 |
| CHILD | 8.66E-02 | 2.20E-02 | 4.04E-02 | 2.20E-02 | 2.20E-02 | 2.20E-02 | 2.20E-02 | 2.20E-02 |
| INFANT | 1.70E-01 | 4.53E-02 | 8.10E-02 | 4.53E-02 | 4.56E-02 | 4.53E-02 | 4.53E-02 | 4.53E-02 |
| **INHAL** | | | | | | | | |
| ADULT | 1.31E-03 | 9.58E-04 | 8.01E-04 | 9.58E-04 | 9.63E-04 | 9.58E-04 | 9.59E-04 | 7.43E-04 |
| TEEN | 1.72E-03 | 1.06E-03 | 9.88E-04 | 1.06E-03 | 1.07E-03 | 1.06E-03 | 1.06E-03 | 7.50E-04 |
| CHILD | 2.18E-03 | 1.09E-03 | 1.18E-03 | 1.09E-03 | 1.10E-03 | 1.09E-03 | 1.09E-03 | 6.62E-04 |
| INFANT | 1.56E-03 | 7.17E-04 | 8.29E-04 | 7.17E-04 | 7.25E-04 | 7.17E-04 | 7.16E-04 | 3.81E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 2.06E-02 | 6.06E-03 | 9.84E-03 | 6.06E-03 | 6.09E-03 | 6.06E-03 | 6.06E-03 | 5.84E-03 |
| TEEN | 3.70E-02 | 1.02E-02 | 1.75E-02 | 1.02E-02 | 1.03E-02 | 1.02E-02 | 1.02E-02 | 9.89E-03 |
| CHILD | 8.88E-02 | 2.31E-02 | 4.16E-02 | 2.31E-02 | 2.31E-02 | 2.31E-02 | 2.31E-02 | 2.27E-02 |
| INFANT | 1.72E-01 | 4.60E-02 | 8.18E-02 | 4.60E-02 | 4.63E-02 | 4.60E-02 | 4.60E-02 | 4.57E-02 |

**Table 45, Calculated Doses at Nearest Residence for Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2020**

| Receptor – Nearest Residence – Salem Unit 1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 2.49E-06 | 2.49E-06 | 2.49E-06 | 2.49E-06 | 2.49E-06 | 2.49E-06 | 2.49E-06 | 4.16E-06 |
| **GROUND** | 4.54E-08 | 4.54E-08 | 4.54E-08 | 4.54E-08 | 4.54E-08 | 4.54E-08 | 4.54E-08 | 5.32E-08 |
| **INHAL** | | | | | | | | |
| ADULT | 6.19E-04 | 6.19E-04 | 3.85E-04 | 6.19E-04 | 6.19E-04 | 6.19E-04 | 6.19E-04 | 5.47E-04 |
| TEEN | 6.55E-04 | 6.55E-04 | 5.52E-04 | 6.55E-04 | 6.55E-04 | 6.55E-04 | 6.55E-04 | 5.52E-04 |
| CHILD | 6.30E-04 | 6.30E-04 | 7.61E-04 | 6.30E-04 | 6.30E-04 | 6.30E-04 | 6.30E-04 | 4.88E-04 |
| INFANT | 3.93E-04 | 3.93E-04 | 5.61E-04 | 3.93E-04 | 3.93E-04 | 3.93E-04 | 3.93E-04 | 2.80E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 6.22E-04 | 6.22E-04 | 3.88E-04 | 6.22E-04 | 6.22E-04 | 6.22E-04 | 6.22E-04 | 5.51E-04 |
| TEEN | 6.58E-04 | 6.58E-04 | 5.55E-04 | 6.58E-04 | 6.58E-04 | 6.58E-04 | 6.58E-04 | 5.56E-04 |
| CHILD | 6.33E-04 | 6.33E-04 | 7.64E-04 | 6.33E-04 | 6.33E-04 | 6.33E-04 | 6.33E-04 | 4.92E-04 |
| INFANT | 3.96E-04 | 3.96E-04 | 5.64E-04 | 3.96E-04 | 3.96E-04 | 3.96E-04 | 3.96E-04 | 2.84E-04 |
| **Receptor – Nearest Residence – Salem Unit 2** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 3.55E-06 | 3.55E-06 | 3.55E-06 | 3.55E-06 | 3.55E-06 | 3.55E-06 | 3.56E-06 | 5.73E-06 |
| **GROUND** | 2.72E-09 | 2.72E-09 | 2.72E-09 | 2.72E-09 | 2.72E-09 | 2.72E-09 | 2.72E-09 | 3.19E-09 |
| **INHAL** | | | | | | | | |
| ADULT | 3.58E-04 | 3.58E-04 | 4.87E-04 | 3.58E-04 | 3.58E-04 | 3.58E-04 | 3.58E-04 | 2.67E-04 |
| TEEN | 4.00E-04 | 4.00E-04 | 6.97E-04 | 4.00E-04 | 4.00E-04 | 4.00E-04 | 4.00E-04 | 2.69E-04 |
| CHILD | 4.18E-04 | 4.18E-04 | 9.62E-04 | 4.18E-04 | 4.18E-04 | 4.18E-04 | 4.18E-04 | 2.38E-04 |
| INFANT | 2.79E-04 | 2.79E-04 | 7.09E-04 | 2.79E-04 | 2.79E-04 | 2.79E-04 | 2.79E-04 | 1.37E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 3.62E-04 | 3.62E-04 | 4.91E-04 | 3.62E-04 | 3.62E-04 | 3.62E-04 | 3.62E-04 | 2.73E-04 |
| TEEN | 4.04E-04 | 4.04E-04 | 7.01E-04 | 4.04E-04 | 4.04E-04 | 4.04E-04 | 4.04E-04 | 2.75E-04 |
| CHILD | 4.22E-04 | 4.22E-04 | 9.66E-04 | 4.22E-04 | 4.22E-04 | 4.22E-04 | 4.22E-04 | 2.44E-04 |
| INFANT | 2.83E-04 | 2.83E-04 | 7.13E-04 | 2.83E-04 | 2.83E-04 | 2.83E-04 | 2.83E-04 | 1.43E-04 |

**Table 45, Calculated Doses at Nearest Residence for Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2020 (continued)**

| Receptor – Nearest Residence – Hope Creek Unit 1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| **GROUND** | 8.24E-06 | 8.24E-06 | 8.24E-06 | 8.24E-06 | 8.24E-06 | 8.24E-06 | 8.24E-06 | 9.65E-06 |
| **INHAL** | | | | | | | | |
| ADULT | 4.59E-04 | 4.59E-04 | 8.56E-04 | 4.59E-04 | 4.59E-04 | 4.68E-04 | 4.60E-04 | 2.99E-04 |
| TEEN | 5.31E-04 | 5.31E-04 | 1.23E-03 | 5.31E-04 | 5.31E-04 | 5.42E-04 | 5.31E-04 | 3.01E-04 |
| CHILD | 5.84E-04 | 5.84E-04 | 1.69E-03 | 5.84E-04 | 5.84E-04 | 5.97E-04 | 5.84E-04 | 2.66E-04 |
| INFANT | 4.03E-04 | 4.03E-04 | 1.25E-03 | 4.03E-04 | 4.03E-04 | 4.16E-04 | 4.03E-04 | 1.53E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 4.67E-04 | 4.67E-04 | 8.64E-04 | 4.67E-04 | 4.67E-04 | 4.76E-04 | 4.68E-04 | 3.09E-04 |
| TEEN | 5.39E-04 | 5.39E-04 | 1.24E-03 | 5.39E-04 | 5.39E-04 | 5.50E-04 | 5.39E-04 | 3.11E-04 |
| CHILD | 5.92E-04 | 5.92E-04 | 1.70E-03 | 5.92E-04 | 5.92E-04 | 6.05E-04 | 5.92E-04 | 2.76E-04 |
| INFANT | 4.11E-04 | 4.11E-04 | 1.26E-03 | 4.11E-04 | 4.11E-04 | 4.24E-04 | 4.11E-04 | 1.63E-04 |
| **Receptor – Nearest Residence – Total of All Units** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 6.04E-06 | 6.04E-06 | 6.04E-06 | 6.04E-06 | 6.04E-06 | 6.04E-06 | 6.05E-06 | 9.89E-06 |
| **GROUND** | 8.29E-06 | 8.29E-06 | 8.29E-06 | 8.29E-06 | 8.29E-06 | 8.29E-06 | 8.29E-06 | 9.71E-06 |
| **INHAL** | | | | | | | | |
| ADULT | 1.44E-03 | 1.44E-03 | 1.73E-03 | 1.44E-03 | 1.44E-03 | 1.45E-03 | 1.44E-03 | 1.11E-03 |
| TEEN | 1.59E-03 | 1.59E-03 | 2.48E-03 | 1.59E-03 | 1.59E-03 | 1.60E-03 | 1.59E-03 | 1.12E-03 |
| CHILD | 1.63E-03 | 1.63E-03 | 3.41E-03 | 1.63E-03 | 1.63E-03 | 1.65E-03 | 1.63E-03 | 9.92E-04 |
| INFANT | 1.08E-03 | 1.08E-03 | 2.52E-03 | 1.08E-03 | 1.08E-03 | 1.09E-03 | 1.08E-03 | 5.70E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 1.45E-03 | 1.45E-03 | 1.74E-03 | 1.45E-03 | 1.45E-03 | 1.46E-03 | 1.45E-03 | 1.13E-03 |
| TEEN | 1.60E-03 | 1.60E-03 | 2.49E-03 | 1.60E-03 | 1.60E-03 | 1.61E-03 | 1.60E-03 | 1.14E-03 |
| CHILD | 1.65E-03 | 1.65E-03 | 3.43E-03 | 1.65E-03 | 1.65E-03 | 1.66E-03 | 1.65E-03 | 1.01E-03 |
| INFANT | 1.09E-03 | 1.09E-03 | 2.53E-03 | 1.09E-03 | 1.09E-03 | 1.10E-03 | 1.09E-03 | 5.90E-04 |

**Table 46, Calculated Doses at Highest Residence for Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2020**

| Receptor – Highest Residence – Salem Unit 1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 3.94E-06 | 3.94E-06 | 3.94E-06 | 3.94E-06 | 3.94E-06 | 3.95E-06 | 3.94E-06 | 6.59E-06 |
| **GROUND** | 1.29E-07 | 1.29E-07 | 1.29E-07 | 1.29E-07 | 1.29E-07 | 1.29E-07 | 1.29E-07 | 1.51E-07 |
| **INHAL** | | | | | | | | |
| ADULT | 9.82E-04 | 9.82E-04 | 6.11E-04 | 9.82E-04 | 9.82E-04 | 9.82E-04 | 9.82E-04 | 8.67E-04 |
| TEEN | 1.04E-03 | 1.04E-03 | 8.75E-04 | 1.04E-03 | 1.04E-03 | 1.04E-03 | 1.04E-03 | 8.75E-04 |
| CHILD | 9.99E-04 | 9.99E-04 | 1.21E-03 | 9.99E-04 | 9.99E-04 | 9.99E-04 | 9.99E-04 | 7.73E-04 |
| INFANT | 6.23E-04 | 6.23E-04 | 8.90E-04 | 6.23E-04 | 6.23E-04 | 6.23E-04 | 6.23E-04 | 4.45E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 9.86E-04 | 9.86E-04 | 6.15E-04 | 9.86E-04 | 9.86E-04 | 9.86E-04 | 9.86E-04 | 8.74E-04 |
| TEEN | 1.04E-03 | 1.04E-03 | 8.79E-04 | 1.04E-03 | 1.04E-03 | 1.04E-03 | 1.04E-03 | 8.82E-04 |
| CHILD | 1.00E-03 | 1.00E-03 | 1.21E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 7.80E-04 |
| INFANT | 6.27E-04 | 6.27E-04 | 8.94E-04 | 6.27E-04 | 6.27E-04 | 6.27E-04 | 6.27E-04 | 4.52E-04 |
| **Receptor – Highest Residence – Salem Unit 2** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 5.64E-06 | 5.64E-06 | 5.64E-06 | 5.64E-06 | 5.64E-06 | 5.64E-06 | 5.64E-06 | 9.09E-06 |
| **GROUND** | 7.71E-09 | 7.71E-09 | 7.71E-09 | 7.71E-09 | 7.71E-09 | 7.71E-09 | 7.71E-09 | 9.04E-09 |
| **INHAL** | | | | | | | | |
| ADULT | 7.72E-04 | 5.68E-04 | 5.68E-04 | 5.68E-04 | 5.68E-04 | 5.68E-04 | 5.68E-04 | 4.23E-04 |
| TEEN | 1.11E-03 | 6.34E-04 | 6.34E-04 | 6.34E-04 | 6.34E-04 | 6.34E-04 | 6.34E-04 | 4.27E-04 |
| CHILD | 1.53E-03 | 6.63E-04 | 6.63E-04 | 6.63E-04 | 6.63E-04 | 6.63E-04 | 6.63E-04 | 3.77E-04 |
| INFANT | 1.12E-03 | 4.43E-04 | 4.43E-04 | 4.43E-04 | 4.43E-04 | 4.43E-04 | 4.43E-04 | 2.17E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 7.78E-04 | 5.74E-04 | 5.74E-04 | 5.74E-04 | 5.74E-04 | 5.74E-04 | 5.74E-04 | 4.32E-04 |
| TEEN | 1.12E-03 | 6.40E-04 | 6.40E-04 | 6.40E-04 | 6.40E-04 | 6.40E-04 | 6.40E-04 | 4.36E-04 |
| CHILD | 1.54E-03 | 6.69E-04 | 6.69E-04 | 6.69E-04 | 6.69E-04 | 6.69E-04 | 6.69E-04 | 3.86E-04 |
| INFANT | 1.13E-03 | 4.49E-04 | 4.49E-04 | 4.49E-04 | 4.49E-04 | 4.49E-04 | 4.49E-04 | 2.26E-04 |

**Table 46, Calculated Doses at Highest Residence for Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2020 (continued)**

| Receptor – Highest Residence – Hope Creek Unit 1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| **GROUND** | 1.96E-05 | 1.96E-05 | 1.96E-05 | 1.96E-05 | 1.96E-05 | 1.96E-05 | 1.96E-05 | 2.29E-05 |
| **INHAL** | | | | | | | | |
| ADULT | 1.46E-03 | 7.84E-04 | 7.84E-04 | 7.84E-04 | 7.98E-04 | 7.85E-04 | 7.84E-04 | 5.10E-04 |
| TEEN | 2.09E-03 | 9.07E-04 | 9.07E-04 | 9.07E-04 | 9.25E-04 | 9.07E-04 | 9.07E-04 | 5.15E-04 |
| CHILD | 2.89E-03 | 9.96E-04 | 9.96E-04 | 9.96E-04 | 1.02E-03 | 9.97E-04 | 9.96E-04 | 4.55E-04 |
| INFANT | 2.13E-03 | 6.88E-04 | 6.88E-04 | 6.88E-04 | 7.10E-04 | 6.89E-04 | 6.88E-04 | 2.61E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 1.48E-03 | 8.04E-04 | 8.04E-04 | 8.04E-04 | 8.18E-04 | 8.05E-04 | 8.04E-04 | 5.33E-04 |
| TEEN | 2.11E-03 | 9.27E-04 | 9.27E-04 | 9.27E-04 | 9.45E-04 | 9.27E-04 | 9.27E-04 | 5.38E-04 |
| CHILD | 2.91E-03 | 1.02E-03 | 1.02E-03 | 1.02E-03 | 1.04E-03 | 1.02E-03 | 1.02E-03 | 4.78E-04 |
| INFANT | 2.15E-03 | 7.08E-04 | 7.08E-04 | 7.08E-04 | 7.30E-04 | 7.09E-04 | 7.08E-04 | 2.84E-04 |
| **Receptor – Highest Residence – Total of All Units** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 9.58E-06 | 9.58E-06 | 9.58E-06 | 9.58E-06 | 9.58E-06 | 9.59E-06 | 9.58E-06 | 1.57E-05 |
| **GROUND** | 1.97E-05 | 1.97E-05 | 1.97E-05 | 1.97E-05 | 1.97E-05 | 1.97E-05 | 1.97E-05 | 2.31E-05 |
| **INHAL** | | | | | | | | |
| ADULT | 3.21E-03 | 2.33E-03 | 1.96E-03 | 2.33E-03 | 2.35E-03 | 2.34E-03 | 2.33E-03 | 1.80E-03 |
| TEEN | 4.24E-03 | 2.58E-03 | 2.42E-03 | 2.58E-03 | 2.60E-03 | 2.58E-03 | 2.58E-03 | 1.82E-03 |
| CHILD | 5.42E-03 | 2.66E-03 | 2.87E-03 | 2.66E-03 | 2.68E-03 | 2.66E-03 | 2.66E-03 | 1.61E-03 |
| INFANT | 3.87E-03 | 1.75E-03 | 2.02E-03 | 1.75E-03 | 1.78E-03 | 1.76E-03 | 1.75E-03 | 9.23E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 3.24E-03 | 2.36E-03 | 1.99E-03 | 2.36E-03 | 2.38E-03 | 2.36E-03 | 2.36E-03 | 1.84E-03 |
| TEEN | 4.27E-03 | 2.61E-03 | 2.45E-03 | 2.61E-03 | 2.63E-03 | 2.61E-03 | 2.61E-03 | 1.86E-03 |
| CHILD | 5.45E-03 | 2.69E-03 | 2.90E-03 | 2.69E-03 | 2.71E-03 | 2.69E-03 | 2.69E-03 | 1.64E-03 |
| INFANT | 3.90E-03 | 1.78E-03 | 2.05E-03 | 1.78E-03 | 1.81E-03 | 1.78E-03 | 1.78E-03 | 9.62E-04 |

**Table 47, Calculated Doses at ODCM Resident-Garden-Meat Farm for Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2020**

| Receptor – ODCM Resident-Garden-Meat Farm– Salem Unit 1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 2.45E-06 | 2.45E-06 | 2.45E-06 | 2.45E-06 | 2.45E-06 | 2.46E-06 | 2.45E-06 | 4.11E-06 |
| **GROUND** | 4.54E-08 | 4.54E-08 | 4.54E-08 | 4.54E-08 | 4.54E-08 | 4.54E-08 | 4.54E-08 | 5.32E-08 |
| **Vegetation** | | | | | | | | |
| ADULT | 4.77E-03 | 4.77E-03 | 1.89E-02 | 4.77E-03 | 4.77E-03 | 4.77E-03 | 4.77E-03 | 4.77E-03 |
| TEEN | 7.26E-03 | 7.26E-03 | 3.07E-02 | 7.26E-03 | 7.26E-03 | 7.26E-03 | 7.26E-03 | 7.26E-03 |
| CHILD | 1.65E-02 | 1.65E-02 | 7.40E-02 | 1.65E-02 | 1.65E-02 | 1.65E-02 | 1.65E-02 | 1.65E-02 |
| INFANT | | | | | | | | |
| **COW Meat** | | | | | | | | |
| ADULT | 1.55E-03 | 1.55E-03 | 7.03E-03 | 1.55E-03 | 1.55E-03 | 1.55E-03 | 1.55E-03 | 1.55E-03 |
| TEEN | 1.27E-03 | 1.27E-03 | 5.94E-03 | 1.27E-03 | 1.27E-03 | 1.27E-03 | 1.27E-03 | 1.27E-03 |
| CHILD | 2.34E-03 | 2.34E-03 | 1.12E-02 | 2.34E-03 | 2.34E-03 | 2.34E-03 | 2.34E-03 | 2.34E-03 |
| INFANT | | | | | | | | |
| **INHAL** | | | | | | | | |
| ADULT | 6.12E-04 | 6.12E-04 | 3.81E-04 | 6.12E-04 | 6.12E-04 | 6.12E-04 | 6.12E-04 | 5.40E-04 |
| TEEN | 6.47E-04 | 6.47E-04 | 5.45E-04 | 6.47E-04 | 6.47E-04 | 6.47E-04 | 6.47E-04 | 5.45E-04 |
| CHILD | 6.23E-04 | 6.23E-04 | 7.52E-04 | 6.23E-04 | 6.23E-04 | 6.23E-04 | 6.23E-04 | 4.82E-04 |
| INFANT | 3.88E-04 | 3.88E-04 | 5.55E-04 | 3.88E-04 | 3.88E-04 | 3.88E-04 | 3.88E-04 | 2.77E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 6.93E-03 | 6.93E-03 | 2.63E-02 | 6.93E-03 | 6.93E-03 | 6.93E-03 | 6.93E-03 | 6.86E-03 |
| TEEN | 9.18E-03 | 9.18E-03 | 3.72E-02 | 9.18E-03 | 9.18E-03 | 9.18E-03 | 9.18E-03 | 9.08E-03 |
| CHILD | 1.95E-02 | 1.95E-02 | 8.60E-02 | 1.95E-02 | 1.95E-02 | 1.95E-02 | 1.95E-02 | 1.93E-02 |
| INFANT | 3.90E-04 | 3.90E-04 | 5.57E-04 | 3.90E-04 | 3.90E-04 | 3.91E-04 | 3.90E-04 | 2.81E-04 |
| **Receptor –ODCM Resident-Garden-Meat Farm– Salem Unit 2** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 3.51E-06 | 3.51E-06 | 3.51E-06 | 3.51E-06 | 3.51E-06 | 3.51E-06 | 3.51E-06 | 5.66E-06 |
| **GROUND** | 2.72E-09 | 2.72E-09 | 2.72E-09 | 2.72E-09 | 2.72E-09 | 2.72E-09 | 2.72E-09 | 3.19E-09 |
| **Vegetation** | | | | | | | | |
| ADULT | 2.39E-02 | 5.27E-03 | 5.27E-03 | 5.27E-03 | 5.27E-03 | 5.27E-03 | 5.27E-03 | 5.27E-03 |
| TEEN | 3.88E-02 | 8.31E-03 | 8.31E-03 | 8.31E-03 | 8.31E-03 | 8.31E-03 | 8.31E-03 | 8.31E-03 |
| CHILD | 9.35E-02 | 1.96E-02 | 1.96E-02 | 1.96E-02 | 1.96E-02 | 1.96E-02 | 1.96E-02 | 1.96E-02 |
| INFANT | | | | | | | | |
| **COW Meat** | | | | | | | | |
| ADULT | 8.89E-03 | 1.85E-03 | 1.85E-03 | 1.85E-03 | 1.85E-03 | 1.85E-03 | 1.85E-03 | 1.85E-03 |
| TEEN | 7.51E-03 | 1.54E-03 | 1.54E-03 | 1.54E-03 | 1.54E-03 | 1.54E-03 | 1.54E-03 | 1.54E-03 |
| CHILD | 1.41E-02 | 2.87E-03 | 2.87E-03 | 2.87E-03 | 2.87E-03 | 2.87E-03 | 2.87E-03 | 2.87E-03 |
| INFANT | | | | | | | | |
| **INHAL** | | | | | | | | |
| ADULT | 4.81E-04 | 3.54E-04 | 3.54E-04 | 3.54E-04 | 3.54E-04 | 3.54E-04 | 3.54E-04 | 2.64E-04 |
| TEEN | 6.89E-04 | 3.95E-04 | 3.95E-04 | 3.95E-04 | 3.95E-04 | 3.95E-04 | 3.95E-04 | 2.66E-04 |
| CHILD | 9.51E-04 | 4.13E-04 | 4.13E-04 | 4.13E-04 | 4.13E-04 | 4.13E-04 | 4.13E-04 | 2.35E-04 |
| INFANT | 7.01E-04 | 2.76E-04 | 2.76E-04 | 2.76E-04 | 2.76E-04 | 2.76E-04 | 2.76E-04 | 1.35E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 3.33E-02 | 7.48E-03 | 7.48E-03 | 7.48E-03 | 7.48E-03 | 7.48E-03 | 7.48E-03 | 7.39E-03 |
| TEEN | 4.70E-02 | 1.02E-02 | 1.02E-02 | 1.02E-02 | 1.02E-02 | 1.02E-02 | 1.02E-02 | 1.01E-02 |
| CHILD | 1.09E-01 | 2.29E-02 | 2.29E-02 | 2.29E-02 | 2.29E-02 | 2.29E-02 | 2.29E-02 | 2.27E-02 |
| INFANT | 7.05E-04 | 2.80E-04 | 2.80E-04 | 2.80E-04 | 2.80E-04 | 2.80E-04 | 2.80E-04 | 1.41E-04 |

**Table 47, Calculated Doses at ODCM Resident-Garden-Meat Farm for Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2020 (continued)**

**Receptor – ODCM Resident-Garden-Meat Farm– Hope Creek Unit 1**

| PATHWAY | BONE | LIVER | EFFECTIVE | KIDNEY | THYROID | LUNG | GI-TRACT | SKIN |
|---|---|---|---|---|---|---|---|---|
| **PLUME** | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| **GROUND** | 8.24E-06 | 8.24E-06 | 8.24E-06 | 8.24E-06 | 8.24E-06 | 8.24E-06 | 8.24E-06 | 9.65E-06 |
| **Vegetation** | | | | | | | | |
| ADULT | 4.21E-02 | 8.95E-03 | 8.95E-03 | 8.95E-03 | 8.96E-03 | 8.95E-03 | 8.95E-03 | 8.95E-03 |
| TEEN | 6.82E-02 | 1.43E-02 | 1.43E-02 | 1.43E-02 | 1.43E-02 | 1.43E-02 | 1.43E-02 | 1.43E-02 |
| CHILD | 1.64E-01 | 3.38E-02 | 3.38E-02 | 3.38E-02 | 3.38E-02 | 3.38E-02 | 3.38E-02 | 3.38E-02 |
| INFANT | | | | | | | | |
| **COW Meat** | | | | | | | | |
| ADULT | 1.56E-02 | 3.20E-03 | 3.20E-03 | 3.20E-03 | 3.20E-03 | 3.20E-03 | 3.20E-03 | 3.20E-03 |
| TEEN | 1.32E-02 | 2.68E-03 | 2.68E-03 | 2.68E-03 | 2.69E-03 | 2.68E-03 | 2.68E-03 | 2.68E-03 |
| CHILD | 2.48E-02 | 5.02E-03 | 5.02E-03 | 5.02E-03 | 5.02E-03 | 5.02E-03 | 5.02E-03 | 5.02E-03 |
| INFANT | | | | | | | | |
| **INHAL** | | | | | | | | |
| ADULT | 8.45E-04 | 4.54E-04 | 4.54E-04 | 4.54E-04 | 4.62E-04 | 4.54E-04 | 4.54E-04 | 2.95E-04 |
| TEEN | 1.21E-03 | 5.25E-04 | 5.25E-04 | 5.25E-04 | 5.35E-04 | 5.25E-04 | 5.25E-04 | 2.98E-04 |
| CHILD | 1.67E-03 | 5.77E-04 | 5.76E-04 | 5.77E-04 | 5.90E-04 | 5.77E-04 | 5.76E-04 | 2.63E-04 |
| INFANT | 1.23E-03 | 3.98E-04 | 3.98E-04 | 3.98E-04 | 4.10E-04 | 3.98E-04 | 3.98E-04 | 1.51E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 5.86E-02 | 1.26E-02 | 1.26E-02 | 1.26E-02 | 1.26E-02 | 1.26E-02 | 1.26E-02 | 1.25E-02 |
| TEEN | 8.26E-02 | 1.75E-02 | 1.75E-02 | 1.75E-02 | 1.75E-02 | 1.75E-02 | 1.75E-02 | 1.73E-02 |
| CHILD | 1.90E-01 | 3.94E-02 | 3.94E-02 | 3.94E-02 | 3.94E-02 | 3.94E-02 | 3.94E-02 | 3.91E-02 |
| INFANT | 1.24E-03 | 4.06E-04 | 4.06E-04 | 4.06E-04 | 4.18E-04 | 4.06E-04 | 4.06E-04 | 1.61E-04 |

**Receptor – ODCM Resident-Garden-Meat Farm– Total of All Units**

| PATHWAY | BONE | LIVER | EFFECTIVE | KIDNEY | THYROID | LUNG | GI-TRACT | SKIN |
|---|---|---|---|---|---|---|---|---|
| **PLUME** | 5.96E-06 | 5.96E-06 | 5.96E-06 | 5.96E-06 | 5.96E-06 | 5.97E-06 | 5.96E-06 | 9.77E-06 |
| **GROUND** | 8.29E-06 | 8.29E-06 | 8.29E-06 | 8.29E-06 | 8.29E-06 | 8.29E-06 | 8.29E-06 | 9.71E-06 |
| **Vegetation** | | | | | | | | |
| ADULT | 7.08E-02 | 1.90E-02 | 3.31E-02 | 1.90E-02 | 1.90E-02 | 1.90E-02 | 1.90E-02 | 1.90E-02 |
| TEEN | 1.14E-01 | 2.99E-02 | 5.33E-02 | 2.99E-02 | 2.99E-02 | 2.99E-02 | 2.99E-02 | 2.99E-02 |
| CHILD | 2.74E-01 | 6.99E-02 | 1.27E-01 | 6.99E-02 | 6.99E-02 | 6.99E-02 | 6.99E-02 | 6.99E-02 |
| INFANT | | | | | | | | |
| **COW Meat** | | | | | | | | |
| ADULT | 2.60E-02 | 6.60E-03 | 1.21E-02 | 6.60E-03 | 6.60E-03 | 6.60E-03 | 6.60E-03 | 6.60E-03 |
| TEEN | 2.20E-02 | 5.49E-03 | 1.02E-02 | 5.49E-03 | 5.50E-03 | 5.49E-03 | 5.49E-03 | 5.49E-03 |
| CHILD | 4.12E-02 | 1.02E-02 | 1.91E-02 | 1.02E-02 | 1.02E-02 | 1.02E-02 | 1.02E-02 | 1.02E-02 |
| INFANT | | | | | | | | |
| **INHAL** | | | | | | | | |
| ADULT | 1.94E-03 | 1.42E-03 | 1.19E-03 | 1.42E-03 | 1.43E-03 | 1.42E-03 | 1.42E-03 | 1.10E-03 |
| TEEN | 2.55E-03 | 1.57E-03 | 1.47E-03 | 1.57E-03 | 1.58E-03 | 1.57E-03 | 1.57E-03 | 1.11E-03 |
| CHILD | 3.24E-03 | 1.61E-03 | 1.74E-03 | 1.61E-03 | 1.63E-03 | 1.61E-03 | 1.61E-03 | 9.80E-04 |
| INFANT | 2.32E-03 | 1.06E-03 | 1.23E-03 | 1.06E-03 | 1.07E-03 | 1.06E-03 | 1.06E-03 | 5.63E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 9.88E-02 | 2.70E-02 | 4.64E-02 | 2.70E-02 | 2.70E-02 | 2.70E-02 | 2.70E-02 | 2.67E-02 |
| TEEN | 1.39E-01 | 3.69E-02 | 6.49E-02 | 3.69E-02 | 3.70E-02 | 3.69E-02 | 3.69E-02 | 3.65E-02 |
| CHILD | 3.18E-01 | 8.18E-02 | 1.48E-01 | 8.18E-02 | 8.18E-02 | 8.18E-02 | 8.18E-02 | 8.11E-02 |
| INFANT | 2.33E-03 | 1.08E-03 | 1.24E-03 | 1.08E-03 | 1.09E-03 | 1.08E-03 | 1.08E-03 | 5.82E-04 |

**Table 48, Calculated Doses to Onsite Adult Workers for Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2020**

| Receptor – Onsite Adult Workers – Salem Unit 1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 2.05E-04 | 2.05E-04 | 2.05E-04 | 2.05E-04 | 2.05E-04 | 2.05E-04 | 2.05E-04 | 3.43E-04 |
| **GROUND** | 4.73E-06 | 4.73E-06 | 4.73E-06 | 4.73E-06 | 4.73E-06 | 4.73E-06 | 4.73E-06 | 5.53E-06 |
| **INHAL** | | | | | | | | |
| ADULT | 5.10E-02 | 5.10E-02 | 3.18E-02 | 5.10E-02 | 5.10E-02 | 5.10E-02 | 5.10E-02 | 4.50E-02 |
| **TOTAL** | | | | | | | | |
| ADULT | 5.12E-02 | 5.12E-02 | 3.20E-02 | 5.12E-02 | 5.12E-02 | 5.12E-02 | 5.12E-02 | 4.53E-02 |
| **Receptor – Onsite Adult Workers – Salem Unit 2** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 2.93E-04 | 2.93E-04 | 2.93E-04 | 2.93E-04 | 2.93E-04 | 2.93E-04 | 2.93E-04 | 4.73E-04 |
| **GROUND** | 2.83E-07 | 2.83E-07 | 2.83E-07 | 2.83E-07 | 2.83E-07 | 2.83E-07 | 2.83E-07 | 3.33E-07 |
| **INHAL** | | | | | | | | |
| ADULT | 4.00E-02 | 2.95E-02 | 2.95E-02 | 2.95E-02 | 2.95E-02 | 2.95E-02 | 2.95E-02 | 2.20E-02 |
| **TOTAL** | | | | | | | | |
| ADULT | 4.03E-02 | 2.98E-02 | 2.98E-02 | 2.98E-02 | 2.98E-02 | 2.98E-02 | 2.98E-02 | 2.24E-02 |
| **Receptor – Onsite Adult Workers – Hope Creek Unit 1** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| **GROUND** | 4.98E-04 | 4.98E-04 | 4.98E-04 | 4.98E-04 | 4.98E-04 | 4.98E-04 | 4.98E-04 | 5.83E-04 |
| **INHAL** | | | | | | | | |
| ADULT | 3.40E-02 | 1.82E-02 | 1.82E-02 | 1.82E-02 | 1.86E-02 | 1.82E-02 | 1.82E-02 | 1.19E-02 |
| **TOTAL** | | | | | | | | |
| ADULT | 3.45E-02 | 1.87E-02 | 1.87E-02 | 1.87E-02 | 1.90E-02 | 1.87E-02 | 1.87E-02 | 1.24E-02 |
| **Receptor – Onsite Adult Workers – Total of All Units** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 4.97E-04 | 4.97E-04 | 4.97E-04 | 4.97E-04 | 4.97E-04 | 4.98E-04 | 4.97E-04 | 8.15E-04 |
| **GROUND** | 5.03E-04 | 5.03E-04 | 5.03E-04 | 5.03E-04 | 5.03E-04 | 5.03E-04 | 5.03E-04 | 5.88E-04 |
| **INHAL** | | | | | | | | |
| ADULT | 1.25E-01 | 9.87E-02 | 7.95E-02 | 9.87E-02 | 9.91E-02 | 9.87E-02 | 9.87E-02 | 7.88E-02 |
| **TOTAL** | | | | | | | | |
| ADULT | 1.26E-01 | 9.97E-02 | 8.04E-02 | 9.97E-02 | 1.00E-01 | 9.97E-02 | 9.97E-02 | 8.02E-02 |

**Table 49, Calculated Doses to Emergency Personnel (National Guard) for Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2020**

| Receptor – Emergency Personnel (National Guard) – Salem Unit 1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 4.48E-06 | 4.48E-06 | 4.48E-06 | 4.48E-06 | 4.48E-06 | 4.48E-06 | 4.48E-06 | 7.48E-06 |
| **GROUND** | 2.18E-07 | 2.18E-07 | 2.18E-07 | 2.18E-07 | 2.18E-07 | 2.18E-07 | 2.18E-07 | 2.55E-07 |
| **INHAL** | | | | | | | | |
| ADULT | 1.12E-03 | 1.12E-03 | 6.93E-04 | 1.12E-03 | 1.12E-03 | 1.12E-03 | 1.12E-03 | 9.85E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 1.12E-03 | 1.12E-03 | 6.97E-04 | 1.12E-03 | 1.12E-03 | 1.12E-03 | 1.12E-03 | 9.93E-04 |
| **Receptor – Emergency Personnel (National Guard) – Salem Unit 2** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 6.40E-06 | 6.40E-06 | 6.40E-06 | 6.40E-06 | 6.40E-06 | 6.40E-06 | 6.40E-06 | 1.03E-05 |
| **GROUND** | 1.31E-08 | 1.31E-08 | 1.31E-08 | 1.31E-08 | 1.31E-08 | 1.31E-08 | 1.31E-08 | 1.53E-08 |
| **INHAL** | | | | | | | | |
| ADULT | 8.75E-04 | 6.45E-04 | 6.45E-04 | 6.45E-04 | 6.45E-04 | 6.45E-04 | 6.45E-04 | 4.80E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 8.81E-04 | 6.51E-04 | 6.51E-04 | 6.51E-04 | 6.51E-04 | 6.51E-04 | 6.51E-04 | 4.90E-04 |
| **Receptor – Emergency Personnel (National Guard) – Hope Creek Unit 1** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| **GROUND** | 3.60E-05 | 3.60E-05 | 3.60E-05 | 3.60E-05 | 3.60E-05 | 3.60E-05 | 3.60E-05 | 4.23E-05 |
| **INHAL** | | | | | | | | |
| ADULT | 1.44E-03 | 7.70E-04 | 7.70E-04 | 7.70E-04 | 7.85E-04 | 7.70E-04 | 7.70E-04 | 5.00E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 1.47E-03 | 8.06E-04 | 8.06E-04 | 8.06E-04 | 8.21E-04 | 8.06E-04 | 8.06E-04 | 5.42E-04 |
| **Receptor – Emergency Personnel (National Guard) – Total of All Units** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 1.09E-05 | 1.09E-05 | 1.09E-05 | 1.09E-05 | 1.09E-05 | 1.09E-05 | 1.09E-05 | 1.78E-05 |
| **GROUND** | 3.62E-05 | 3.62E-05 | 3.62E-05 | 3.62E-05 | 3.62E-05 | 3.62E-05 | 3.62E-05 | 4.25E-05 |
| **INHAL** | | | | | | | | |
| ADULT | 3.43E-03 | 2.53E-03 | 2.11E-03 | 2.53E-03 | 2.55E-03 | 2.53E-03 | 2.53E-03 | 1.97E-03 |
| **TOTAL** | | | | | | | | |
| ADULT | 3.47E-03 | 2.58E-03 | 2.15E-03 | 2.58E-03 | 2.59E-03 | 2.58E-03 | 2.58E-03 | 2.03E-03 |

**Table 50, Calculated Doses to Adult Workers in the Wind Turbine Laydown Area for Salem Unit 1, Salem Unit 2, and Hope Creek Unit 1 using the NRC Code GASPAR, 2020**

| Receptor – Turbine Laydown Area – Salem Unit 1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 5.53E-06 | 5.53E-06 | 5.53E-06 | 5.53E-06 | 5.53E-06 | 5.53E-06 | 5.55E-06 | 9.25E-06 |
| **GROUND** | 2.13E-07 | 2.13E-07 | 2.13E-07 | 2.13E-07 | 2.13E-07 | 2.13E-07 | 2.13E-07 | 2.49E-07 |
| **INHAL** | | | | | | | | |
| ADULT | 1.38E-03 | 1.38E-03 | 8.58E-04 | 1.38E-03 | 1.38E-03 | 1.38E-03 | 1.38E-03 | 1.22E-03 |
| **TOTAL** | | | | | | | | |
| ADULT | 1.38E-03 | 1.38E-03 | 8.63E-04 | 1.38E-03 | 1.38E-03 | 1.38E-03 | 1.38E-03 | 1.23E-03 |
| **Receptor – Turbine Laydown Area – Salem Unit 2** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 7.90E-06 | 7.90E-06 | 7.90E-06 | 7.90E-06 | 7.90E-06 | 7.90E-06 | 7.93E-06 | 1.28E-05 |
| **GROUND** | 1.28E-08 | 1.28E-08 | 1.28E-08 | 1.28E-08 | 1.28E-08 | 1.28E-08 | 1.28E-08 | 1.50E-08 |
| **INHAL** | | | | | | | | |
| ADULT | 7.98E-04 | 7.98E-04 | 1.08E-03 | 7.98E-04 | 7.98E-04 | 7.98E-04 | 7.98E-04 | 5.95E-04 |
| **TOTAL** | | | | | | | | |
| ADULT | 8.05E-04 | 8.05E-04 | 1.09E-03 | 8.05E-04 | 8.05E-04 | 8.05E-04 | 8.05E-04 | 6.08E-04 |
| **Receptor – Turbine Laydown Area – Hope Creek Unit 1** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| **GROUND** | 6.88E-05 | 6.88E-05 | 6.88E-05 | 6.88E-05 | 6.88E-05 | 6.88E-05 | 6.88E-05 | 8.05E-05 |
| **INHAL** | | | | | | | | |
| ADULT | 1.68E-03 | 1.68E-03 | 3.13E-03 | 1.68E-03 | 1.68E-03 | 1.71E-03 | 1.68E-03 | 1.09E-03 |
| **TOTAL** | | | | | | | | |
| ADULT | 1.75E-03 | 1.75E-03 | 3.19E-03 | 1.75E-03 | 1.75E-03 | 1.78E-03 | 1.75E-03 | 1.17E-03 |
| **Receptor – Turbine Laydown Area – Total of All Units** | | | | | | | | |
| **PATHWAY** | **BONE** | **LIVER** | **EFFECTIVE** | **KIDNEY** | **THYROID** | **LUNG** | **GI-TRACT** | **SKIN** |
| **PLUME** | 1.34E-05 | 1.34E-05 | 1.34E-05 | 1.34E-05 | 1.34E-05 | 1.34E-05 | 1.35E-05 | 2.20E-05 |
| **GROUND** | 6.90E-05 | 6.90E-05 | 6.90E-05 | 6.90E-05 | 6.90E-05 | 6.90E-05 | 6.90E-05 | 8.08E-05 |
| **INHAL** | | | | | | | | |
| ADULT | 3.86E-03 | 3.86E-03 | 5.07E-03 | 3.86E-03 | 3.86E-03 | 3.89E-03 | 3.86E-03 | 2.91E-03 |
| **TOTAL** | | | | | | | | |
| ADULT | 3.94E-03 | 3.94E-03 | 5.15E-03 | 3.94E-03 | 3.94E-03 | 3.97E-03 | 3.94E-03 | 3.01E-03 |

**Attachment 6, ERRATA Section from Previous Reports**

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# I. Executive Summary

In 2019, Salem Generating Station (SGS) Unit 1 and Unit 2 and Hope Creek Generating Station (HCGS) Unit 1 released to the environment through the radioactive liquid and gaseous effluents 32.15 curies of noble gas, 0.04 curies of fission and activation products, and 2,286 curies of tritium. The dose from both liquid and gaseous effluents was conservatively calculated for the Maximum Exposed Member of the Public. The results of those calculations and their comparison to the allowable limits were as follows:

**Gaseous and liquid radiation doses to members of the public at the highest dose receptor**

| Effluent | Applicable Organ | Estimated Dose | Age Group | Receptor Location | % of Applicable Limit | Limit | Units |
|---|---|---|---|---|---|---|---|
| Noble Gas | Gamma – Air Dose | ~~3.36E-04~~ 2.13E-03 | All | Site Boundary | ~~0.11%~~ < 0.01% | 30 | mRad |
| | Beta – Air Dose | ~~1.42E-04~~ 3.30E-03 | | | ~~0.02%~~ < 0.01% | 60 | |
| Iodine, Particulate, C-14 & Tritium | Bone | 3.22E-01 | Child | 4.6 miles SW | 0.72% | 45 | mrem |
| Liquid | Total Body | 1.83E-02 | Adult | 0.75 mi. N of Salem | 0.41% 0.20% | 9 | mrem |
| | Gi-Lli | 4.51E-02 | | | 0.15% | 30 | |

The calculated doses from the radiological effluents released from the three units were a very small percentage of the allowable limits.

The Total Dose to the Critical Receptor as required by section 3.11.4 of the SGS and HCGS ODCMs was determined to be ~~5.89E-01~~ 5.72E-01 mrem (Table 6). The dose calculated was below the limits of 40 CFR 190 and 10 CFR 72.104 (25 mrem) to the total body and critical organ other than the thyroid.

Maximum TEDE doses to groups of Members of the Public (Sewage Treatment Plant Worker and Security Checkpoint) not having access to the Radiologically Controlled Area (RCA) were calculated as ~~2.47E+00~~ 2.59E+00 mrem and 2.90E-02 mrem, respectively (Table 7). These doses were a small fraction of the 10 CFR 20.1301 dose limit of 100 mrem.

# II. Introduction

This report, SGS-RERR-68/HCGS-RERR-42, summarizes information pertaining to the releases of radioactive materials in liquid, gaseous and solid forms from SGS and HCGS for the period January 1, 2019, to December 31, 2019.

SGS Unit 1 is a Westinghouse Pressurized Water Reactor that has a licensed core thermal power rating of 3,459 $MW_{th}$ and an approximate net electrical output of 1,180 $MW_e$. SGS Unit 1 achieved initial criticality on December 11, 1976, and began commercial operation on June 30, 1977.

SGS Unit 2 is a Westinghouse Pressurized Water Reactor that has a licensed core thermal power rating of 3,459 $MW_{th}$ and an approximate net electrical output of 1,178 $MW_e$. SGS Unit 2 achieved initial criticality on August 2, 1980, and began commercial operation on October 13, 1981.

Table 2
2019 Doses and Percent of the Limits from Gaseous Effluents by Operating Unit (cont.)

| SGS Unit 2 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Gaseous Effluent Parameter | | | Qtr. 1 | Qtr. 2 | Qtr. 3 | Qtr. 4 | Annual |
| Gaseous Dose From Noble Gas | Gamma Air | Dose Limit (mrad) | 5.00E+00 | | | | 1.00E+01 |
| | | Max Gamma Air Dose (mrad) | 3.05E-05 | 2.86E-05 | 2.54E-05 | 4.90E-05 | 1.33E-04 |
| | | % Dose Limit | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| | Beta Air | Dose Limit (mrad) | 1.00E+01 | | | | 2.00E+01 |
| | | Maximum Beta Air Dose (mrad) | 1.11E-05 | 1.01E-05 | 9.88E-06 | 1.73E-05 | 4.83E-05 |
| | | % Dose Limit | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Gaseous Dose From I-131, I-133, H-3, C-14* and Particulate Nuclides with half-life > 8 Days | | Organ Dose Limit (mrem) | 7.50E+00 | | | | 1.50E+01 |
| | * no C-14 Dose | ODCM Critical Receptor (mrem) | 3.27E-04 | 3.40E-03 | 2.67E-03 | 3.29E-03 | 9.69E-03 |
| | | % Dose Limit | < 0.01 | 0.05 | 0.04 | 0.04 | 0.06 |
| | * with C-14 Dose | ODCM Critical Receptor (mrem) | 2.83E-02 | 2.81E-02 | 2.93E-02 | 3.14E-02 | 1.17E-01 |
| | | % Dose Limit | 0.38 | 0.38 | 0.39 | 0.42 | 0.78 |

| HCGS | | | | | | | |
|---|---|---|---|---|---|---|---|
| Gaseous Effluent Parameter | | | Qtr. 1 | Qtr. 2 | Qtr. 3 | Qtr. 4 | Annual |
| Gaseous Dose From Noble Gas | Gamma Air | Dose Limit (mrad) | 5.00E+00 | | | | 1.00E+01 |
| | | Max Gamma Air Dose (mrad) | 2.69E-04 | 6.08E-07 | 1.39E-03 | 2.37E-04 | 1.90E-03 |
| | | % Dose Limit | 0.01 | < 0.01 | 0.03 | ~~0.00~~ < 0.01 | 0.02 |
| | Beta Air | Dose Limit (mrad) | 1.00E+01 | | | | 2.00E+01 |
| | | Maximum Beta Air Dose (mrad) | 2.93E-04 | 1.79E-06 | 2.47E-03 | 4.38E-04 | 3.21E-03 |
| | | % Dose Limit | < 0.01 | < 0.01 | ~~< 0.01~~ 0.02 | < 0.01 | ~~< 0.01~~ 0.02 |
| Gaseous Dose From I-131, I-133, H-3, C-14* and Particulate Nuclides with half-life > 8 Days | | Organ Dose Limit (mrem) | 7.50E+00 | | | | 1.50E+01 |
| | * no C-14 Dose | ODCM Critical Receptor (mrem) | 1.25E-02 | 5.43E-03 | 8.45E-03 | 1.40E-02 | 4.03E-02 |
| | | % Dose Limit | 0.17 | 0.07 | 0.11 | 0.19 | 0.27 |
| | * with C-14 Dose | ODCM Critical Receptor (mrem) | 2.51E-02 | 2.74E-02 | 2.76E-02 | 3.11E-02 | 1.11E-01 |
| | | % Dose Limit | 0.33 | 0.36 | 0.37 | 0.41 | 0.74 |

**Table 2**
**2019 Doses and Percent of the Limits from Gaseous Effluents by Operating Unit (cont.)**

| SGS-HCGS Site Total | | | | | | | |
|---|---|---|---|---|---|---|---|
| Gaseous Effluent Parameter | | | Qtr. 1 | Qtr. 2 | Qtr. 3 | Qtr. 4 | Annual |
| Gaseous Dose From Noble Gas | Gamma Air | Dose Limit (mrad) | 1.50E+01 | | | | 3.00E+01 |
| | | Max Gamma Air Dose (mrad) | 3.37E-04 | 3.96E-05 | 1.44E-03 | 3.15E-04 | 2.13E-03 |
| | | % Dose Limit | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| | Beta Air | Dose Limit (mrad) | 3.00E+01 | | | | 6.00E+01 |
| | | Maximum Beta Air Dose (mrad) | 3.19E-04 | 2.29E-05 | 2.49E-03 | 4.67E-04 | 3.30E-03 |
| | | % Dose Limit | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Gaseous Dose From I-131, I-133, H-3, C-14* and Particulate Nuclides with half-life > 8 Days | | Organ Dose Limit (mrem) | 2.25E+01 | | | | 4.50E+01 |
| | * no C-14 Dose | ODCM Critical Receptor (mrem) | 1.71E-02 | 1.65E-02 | 1.63E-02 | 2.11E-02 | 7.10E-02 |
| | | % Dose Limit | 0.08 | 0.07 | 0.07 | 0.09 | 0.16 |
| | * with C-14 Dose | ODCM Critical Receptor (mrem) | 7.63E-02 | 7.77E-02 | 8.09E-02 | 8.69E-02 | 3.22E-01 |
| | | % Dose Limit | 0.34 | 0.35 | 0.36 | 0.39 | ~~1.43~~ 0.72 |

B. Doses from Liquid Effluent:

Quarterly and Annual Total Body and Critical Organ doses from liquid effluent were calculated using the methodology described in the SGS and HCGS ODCMs at the controlling receptor location of 0.75 miles N of SGS. Usage factors and dose conversion factors used in the liquid dose calculations were those presented in the SGS and HCGS ODCMs.

**Table 3**
**2019 Doses and Percent of the Limits from Liquid Effluents by Operating Unit**

| SGS Unit 1 | | | | | |
|---|---|---|---|---|---|
| Liquid Effluent Parameter | Qtr. 1 | Qtr. 2 | Qtr. 3 | Qtr. 4 | Annual |
| Total Body Dose Limit (mrem) | 1.50E+00 | | | | 3.00E+00 |
| Maximum Total Body Dose (mrem) | 3.42E-03 | 3.14E-03 | 1.93E-03 | 4.99E-03 | 1.35E-02 |
| % Dose Limit | 0.23 | 0.21 | 0.13 | 0.33 | 0.45 |
| Organ Dose Limit (mrem) | 5.00E+00 | | | | 1.00E+01 |
| Maximum Organ Dose (mrem) | 4.11E-03 | 5.01E-03 | 2.52E-03 | 5.11E-03 | 1.67E-02 |
| % Dose Limit | 0.08 | 0.10 | 0.05 | 0.10 | 0.17 |
| **SGS Unit 2** | | | | | |
| Liquid Effluent Parameter | Qtr. 1 | Qtr. 2 | Qtr. 3 | Qtr. 4 | Annual |
| Total Body Dose Limit (mrem) | 1.50E+00 | | | | 3.00E+00 |
| Maximum Total Body Dose (mrem) | 1.27E-03 | 1.01E-03 | 5.58E-04 | 1.15E-03 | 3.99E-03 |
| % Dose Limit | 0.08 | 0.07 | 0.04 | 0.08 | 0.13 |
| Organ Dose Limit (mrem) | 5.00E+00 | | | | 1.00E+01 |
| Maximum Organ Dose (mrem) | 3.53E-03 | 1.89E-02 | 1.62E-03 | 1.94E-03 | 2.60E-02 |
| % Dose Limit | 0.07 | 0.38 | 0.03 | 0.04 | 0.26 |

**Table 3**
**2019 Doses and Percent of the Limits from Liquid Effluents by Operating Unit (cont.)**

| HCGS | | | | | |
|---|---|---|---|---|---|
| **Liquid Effluent Parameter** | **Qtr. 1** | **Qtr. 2** | **Qtr. 3** | **Qtr. 4** | **Annual** |
| **Total Body Dose Limit (mrem)** | **1.50E+00** | | | | **3.00E+00** |
| Maximum Total Body Dose (mrem) | 2.15E-05 | 5.47E-05 | 3.99E-05 | 6.75E-04 | 7.92E-04 |
| % Dose Limit | < 0.01 | < 0.01 | < 0.01 | 0.05 | 0.03 |
| **Organ Dose Limit (mrem)** | **5.00E+00** | | | | **1.00E+01** |
| Maximum Organ Dose (mrem) | 2.37E-05 | 2.80E-04 | 7.44E-05 | 2.04E-03 | 2.41E-03 |
| % Dose Limit | < 0.01 | 0.01 | < 0.01 | 0.04 | 0.02 |
| **SGS Units 1&2 + HCGS Site Total** | | | | | |
| **Liquid Effluent Parameter** | **Qtr. 1** | **Qtr. 2** | **Qtr. 3** | **Qtr. 4** | **Annual** |
| **Total Body Dose Limit (mrem)** | **4.50E+00** | | | | **9.00E+00** |
| Maximum Total Body Dose (mrem) | 4.71E-03 | 4.21E-03 | 2.53E-03 | 6.82E-03 | 1.83E-02 |
| % Dose Limit | 0.10 | 0.09 | 0.06 | 0.15 | ~~0.41~~ 0.20 |
| **Organ Dose Limit (mrem)** | **1.50E+01** | | | | **3.00E+01** |
| Maximum Organ Dose (mrem) | 7.66E-03 | 2.41E-02 | 4.21E-03 | 9.09E-03 | 4.51E-02 |
| % Dose Limit | 0.05 | 0.16 | 0.03 | 0.06 | ~~0.30~~ 0.15 |

C. Doses from Gaseous Effluent using 2019 Annual Average Meteorology:

As a check on the use of conservative historical meteorological dispersion ($\chi$/Q) and deposition values (D/Q), the 2019 gaseous release curies (Tables 1C-1, 1C-2 and 1C-3) for each of the three units and the 2019 annual average dispersion and deposition data (Table 4) were entered into the NRC approved GASPAR computer program to calculate doses to the critical receptors and pathways identified by the 2019 Land Use Census (LUC). The receptor locations for this dose calculation were plotted with the 2019 wind rose overlay (Figure 7). The 2019 annual joint frequency data and calculated $\chi$/Q and D/Q values for SGS and HCGS are detailed in Appendix B. The PSEG meteorological monitoring program achieved 96.0% joint frequency data recovery.

The methods used to determine gaseous doses were consistent with the methods described in SGS and HCGS ODCMs and in NRC Regulatory Guide 1.109. The 2019 LUC did not identify any gardens greater than 500 $ft^2$ within five miles producing broadleaf vegetation; however, that pathway was included in the dose analysis.

Using the 2019 meteorology data the GASPAR calculated doses (Table 5) were lower than those reported in Table 2 for the critical receptor located at 4.6 miles SW using the default ODCM meteorology, except for C-14. The 2019 $\chi$/Q value was higher than that in the ODCM.

| | Organ Dose Excluding C-14 | Organ Dose Including C-14 |
|---|---|---|
| Critical Receptor 4.6 mi SW Table 2 page 20 | 7.10E-02 | 3.22E-01 |
| Critical Receptor 4.6 mi SW Table 5 page 25 | 1.76E-02 | 4.14E-01 |

**Table 5**

**2019 Total Body and Critical Organ Doses at Receptor Locations Using Annual Average X/Q and D/Q Data by Each Operating Unit (continued)**

| Operating Unit | Meat Critical Organ Doses Inhalation, Ground Plane, Meat 4.2 mi NNE | | | |
|---|---|---|---|---|
| | Excluding C-14 | | Including C-14 | |
| | Total Body (mrem) | Organ (mrem) | Total Body (mrem) | Organ (mrem) |
| SGS Unit 1 | 7.52E-04 | 7.55E-04 | 4.23E-03 | 1.80E-02 |
| SGS Unit 2 | 3.49E-04 | 3.51E-04 | 4.81E-03 | 2.26E-02 |
| HCGS | 1.29E-03 | 1.39E-03 | 7.04E-03 | 2.99E-02 |
| **Site Total** | **2.39E-03** | **2.50E-03** | **1.61E-02** | **7.05E-02** |

| Operating Unit | Meat - Garden Critical Organ Doses Inhalation, Ground Plane, Meat, Vegetation 4.6 mi SW | | | |
|---|---|---|---|---|
| | Excluding C-14 | | Including C-14 | |
| | Total Body (mrem) | Organ (mrem) | Total Body (mrem) | Organ (mrem) |
| SGS Unit 1 | 3.08E-03 | 1.26E-02 | 2.13E-02 | 9.67E-02 |
| SGS Unit 2 | 8.78E-04 | 8.80E-04 | 2.52E-02 | 1.22E-01 |
| HCGS | 3.83E-03 | 4.08E-03 | 4.29E-02 | 1.95E-01 |
| **Site Total** | **7.79E-03** | **1.76E-02** | **8.93E-02** | **4.14E-01** |

As set forth in 10CFR50 Appendix I, ALARA requirements for gaseous effluent were met if a licensee demonstrates that the estimated annual external dose from gaseous effluents to any individual in unrestricted areas does not exceed 5 mrem to the total body or 15 mrem to the skin. Compliance with these limits was demonstrated for 2019 gaseous effluents by the calculated total body and skin doses from external exposure pathways (i.e., plume and ground deposition) at the controlling site boundary location in the north sector. The calculated total body dose and skin dose from the combined gaseous releases for the site represent less than ~~0.48%~~ 0.59% (Total Body) and less than ~~0.32%~~ 0.33% (Organ) of the respective dose limits (Table 5 Site Boundary Location). This confirms that no single unit's radioactive gaseous effluent releases exceeded the Appendix I dose limits. These doses (presented below) were calculated using the GASPAR computer program, which was consistent with the methods described in Regulatory Guide 1.109.

| Dose Parameter from Table 5 Site Boundary | Annual Dose (mrem) |
|---|---|
| Total Body Dose from Noble Gases, Iodines, Particulates, H-3 and C-14: | ~~2.20E-02~~ 2.94E-02 |
| Percent of Appendix I Annual Limit (5 mrem): | ~~0.46%~~ 0.59% |
| Organ Dose from Noble Gases, Iodines, Particulates, H-3 and C-14: | ~~4.75E-02~~ 4.90E-02 |
| Percent of Appendix I Annual Limit (15 mrem): | ~~0.32%~~ 0.33% |

## 2. Total Dose to a Member of the Public, Resulting from Radioactive Effluent Releases and Radiation from Uranium Fuel Cycle Sources

40 CFR 190 and 10 CFR 72.104 limit the total dose to a "Real Individual" 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 ANSI/HPS N13.37-2014 (see page 9).

The direct shine dose from the ISFSI to the Critical Receptor located at 4.6 miles in the SW sector was conservatively estimated at ~~4.64E-03~~ 5.02E-03 mrem. The doses from the gaseous and liquid radioactive effluents released from SGS Units 1 and Unit 2 and HCGS in 2019 resulted in a calculated total body and an organ dose of ~~1.08E-01~~ 1.08E-01 mrem and ~~4.58E-01~~ 4.59E-01 mrem, respectively. The majority of dose was from the gaseous dose pathways from C-14. The total dose was calculated as ~~5.80E-01~~ 5.72E-01mrem, which was below the limits of 40 CFR 190 and 10 CFR 72.104.

The results of this Analysis are in Table 6

**Table 6**

**2019 Total Body and Organ Doses due to Liquid and Gaseous Effluents and Direct Shine ISFSI Dose to the Critical Receptor Located at 4.6 miles SW**

| Generating Station | Total Body Dose (mrem) | | Critical Organ Dose (mrem) | | ISFSI (mrem) |
|---|---|---|---|---|---|
| | Liquid | Gaseous* | Liquid | Gaseous* | |
| SGS Unit 1 | 1.35E-02 | 2.13E-02 | 1.67E-02 | 9.67E-02 | |
| SGS Unit 2 | 3.99E-03 | 2.52E-02 | 2.60E-02 | 1.22E-01 | |
| HCGS | 7.92E-04 | ~~4.11E-03~~ 4.29E-02 | 2.41E-03 | ~~1.94E-01~~ 1.95E-01 | |
| Total | 1.83E-02 | ~~8.76E-03~~ 8.93E-02 | 4.51E-02 | ~~4.13E-01~~ 4.14E-01 | |
| **Total of Liquid and Gaseous (mrem)** | ~~1.06E-01~~ 1.08E-01 | | ~~4.50E-01~~ 4.59E-01 | | 5.02E-03 |
| **Total Dose (mrem)** | ~~5.80E-01~~ 5.72E-01 | | | | |

* Includes C-14 dose.

## 3. Dose to Members of the Public Due to Activities inside the Site Boundary

In accordance with 10 CFR 20.1301 Members of the Public may receive up to a limit of 100 mrem Total Effective Dose Equivalent (TEDE) in a year. The TEDE dose is the combined organ Committed Dose Equivalent (CDE) and the Total Body Dose. The Total Body Dose includes the direct shine dose from the ISFSI. There were no liquid or airborne releases from the ISFSI. The dose from radioactive liquid and gaseous effluents to a Member of the Public performing activities inside the site boundary are to be calculated as required by ODCM 6.9.1.8 (SGS) and 6.9.1.7 (HCGS).

Two sets of TEDE doses were calculated to two different members of the public. The first TEDE dose calculation assumes that an adult emergency worker (i.e. National Guard, Police, etc.) was located at the site vehicle Security Checkpoint entrance. The second calculation was to an adult contract worker stationed at the Sewage Treatment Plant (STP). Both sets of members of the public have assigned duties that do not involve exposure to radiation or to radioactive material. Neither group have Radiation Control Access. In addition, exposure time was limited to 2000 hours in a year (0.25 occupancy).

The vehicle Security Checkpoint was located at 0.89 miles E from the gaseous release points for SGS Units 1 and 2, 0.94 miles E from the HCGS and 1.18 miles from the ISFSI. The STP workers were located about 575 feet SW from the ISFSI pad.

The active exposure pathways at both locations were plume immersion, ground deposition and inhalation of airborne radioactivity in gaseous effluent. There was no liquid dose pathway to Members of the Public on site.

The 2019 atmospheric dispersion factors were imputed into the GASPAR computer program to calculate the gaseous effluent doses. For purposes of these calculations the gaseous doses for the STP worker used the highest site boundary sector doses located in the SW sector.

The calculated TEDE dose from gaseous effluents from the three reactors for each location was calculated by summing the total body and highest organ doses from SGS U1, SGS U2 and HCGS. The ISFSI dose was then added to each and then compared to the 10 CFR 20.1301 limit of 100 mrem. The results of this analysis are in Table 7.

**Table 7**

**Summary of TEDE doses to Members of the Public Due to Activities Inside the Site Boundary**

| Location | Operating Unit | CDE (Thyroid) mrem | Total Body Dose mrem | TEDE mrem | % of Limit (100 mrem) per 10 CFR 20.1301 |
|---|---|---|---|---|---|
| Security Checkpoint | SGS U1 | 1.67E-03 | 1.67E-03 | | |
| | SGS U2 | 8.96E-04 | 8.96E-04 | | |
| | HCGS | 2.51E-03 | 2.50E-03 | | |
| | ISFSI | N/A | 1.88E-02 | | |
| | **Total** | **5.08E-03** | **2.39E-02** | **2.90E-02** | **0.03%** |
| STP | SGS U1 | 5.76E-03 | 5.75E-03 | | |
| | SGS U2 | 3.08E-03 | 3.08E-03 | | |
| | HCGS | ~~1.07E-01~~ 1.88E-01 | ~~1.06E-01~~ 1.87E-01 | | |
| | ISFSI | N/A | 2.24E+00 | | |
| | **Total** | ~~1.16E-01~~ 1.77E-01 | ~~2.35E+00~~ 2.42E-01 | ~~2.47E+00~~ 2.59E-01 | 2.47% 2.59% |

N/A Not Applicable

The calculated doses were well below the 100 mrem limit of 10 CFR 20.1301.

TABLE 1C-2

GASEOUS EFFLUENTS – GROUND LEVEL RELEASES

Facility: SGS Unit 2 Period: 2019

| Nuclides Released | | Continuous Mode | | | | | Batch Mode | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Fission gases | Unit | Qtr. 1 | Qtr. 2 | Qtr. 3 | Qtr. 4 | Total | Qtr. 1 | Qtr. 2 | Qtr. 3 | Qtr. 4 | Total |
| Ar-41 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 4.69E-02 | 4.42E-02 | 3.85E-02 | 7.55E-02 | 2.05E-01 |
| Xe-133m | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | 4.65E-04 | < LLD | 4.65E-04 |
| Xe-133 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 4.86E-03 | < LLD | 1.29E-02 | < LLD | 1.78E-02 |
| Xe-135 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | 4.64E-04 | < LLD | 4.64E-04 |
| | | | | | | | | | | | |
| Total for Period | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 5.17E-02 | 4.42E-02 | 5.23E-02 | 7.55E-02 | 2.24E-01 |
| 2. Iodines and Halogens | | | | | | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD |
| | | | | | | | | | | | |
| Total for Period | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD |
| 3. Particulates | | | | | | | | | | | |
| None | Ci | < LLD | < LLD | < LLD | ~~1.28E-08~~< LLD | ~~1.28E-08~~< LLD | < LLD | < LLD | < LLD | < LLD | < LLD |
| | | | | | | | | | | | |
| Total for Period | Ci | < LLD | < LLD | < LLD | ~~4.65E-08~~< LLD | ~~4.65E-08~~< LLD | < LLD | < LLD | < LLD | < LLD | < LLD |
| 4. Tritium | Ci | 3.65E+00 | 3.83E+01 | 3.01E+01 | 3.68E+01 | 1.09E+02 | 3.74E-02 | 1.75E-02 | 6.47E-02 | 3.98E-01 | 5.17E-01 |
| 5. C-14 | Ci | 2.75E+00 | 2.73E+00 | 2.84E+00 | 3.05E+00 | 1.14E+01 | < LLD | < LLD | < LLD | < LLD | < LLD |

Note: Only radionuclides with positive activity reported in this table.

TABLE 3A-2
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
SOLID RADWASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL
(Not Irradiated Fuel)

Facility: SGS Units 1 and 2 Period: 2019

b. Waste Stream; Resins, Filters, and Evaporator Bottoms
Liquid Waste Processing Resin

| Waste Class | Volume $ft^3$ | Volume $m^3$ | Curies Shipped | % Error (Activity) |
|---|---|---|---|---|
| A | 5.50E+02 | 1.56E+01 | 8.49E+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 | 5.50E+02 | 1.56E+01 | 8.49E+00 | +/-25% |

Major Nuclides for Above Table: Percent Cutoff 1%

**Resins, Filters and Evaporator Bottoms**
**Waste Class A**

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| Fe-55 | 4.34% | 3.68E-01 |
| Co-58 | 47.53% | 4.03E+00 |
| Co-60 | 11.14% | 9.45E-01 |
| Ni-63 | 30.89% | 2.62E+00 |
| Sb-125 | 2.39% | 2.03E-01 |
| Cs-137 | 1.52% | 1.29E-01 |

**Resins, Filters and Evaporator Bottoms**
**Waste Class B**

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

**Resins, Filters and Evaporator Bottoms**
**Waste Class C**

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

**Resins, Filters and Evaporator Bottoms**
**Waste Class All**

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| Fe-55 | 4.34% | 3.68E-01 |
| Co-58 | 47.53% | 4.03E+00 |
| Co-60 | 11.14% | 9.45E-01 |
| Ni-63 | 30.89% | 2.62E+00 |
| Sb-125 | 2.39% | 2.03E-01 |
| Cs-137 | 1.52% | 1.29E-01 |

N/A Not Applicable

TABLE 3A-2
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
SOLID RADWASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (continued)
(Not Irradiated Fuel)

f. Waste Stream; Sum of All 4 Categories

| Waste Class | Volume ft³ | Volume m³ | Curies Shipped | % Error (Activity) |
|---|---|---|---|---|
| A | 1.99E+04 | 5.64E+02 | 1.02E+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 | 1.99E+04 | 5.64E+02 | 1.02E+01 | +/-25% |

Major Nuclides for Above Table: Percent Cutoff 1%

**Waste Stream; Sum of All 4 Categories**
**Waste Class A**

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| Fe-55 | 5.43% | 5.55E-01 |
| Co-58 | 43.43% | 4.44E+00 |
| Co-60 | 14.64% | 1.50E+00 |
| Ni-63 | 28.46% | 2.91E+00 |
| Sb-125 | 2.34% | 2.40E-01 |
| Cs-137 | 1.46% | 1.49E-0 |

**Waste Stream; Sum of All 4 Categories**
**Waste Class B**

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

**Waste Stream; Sum of All 4 Categories**
**Waste Class C**

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

**Waste Stream; Sum of All 4 Categories**
**Waste Class All**

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| Fe-55 | 5.43% | 5.55E-01 |
| Co-58 | 43.43% | 4.44E+00 |
| Co-60 | 14.64% | 1.50E+00 |
| Ni-63 | 28.46% | 2.91E+00 |
| Sb-125 | 2.34% | 2.40E-01 |
| Cs-137 | 1.46% | 1.49E-0 |

N/A Not Applicable

2019 SGS AND HCGS ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

## TABLE 1A-3

## GASEOUS EFFLUENTS – SUMMATION OF ALL RELEASES

Facility: HCGS Period: 2019

| A. Fission & Activation Gases | Unit | Qtr. 1 | Qtr. 2 | Qtr. 3 | Qtr. 4 | Total | Est. Total Error % |
|---|---|---|---|---|---|---|---|
| Total Release | Ci | 2.50E+00 | 2.51E-02 | 2.45E+01 | 4.56E+00 | 3.16E+01 | 3.40E+01 |
| Average release rate for the period | µCi/sec | 3.21E-01 | 3.19E-03 | 3.09E+00 | 5.74E-01 | 1.00E+00 | |
| Percent of limit (ODCM 3.11.2.2(a)) | Gamma Air % | See Table 2 on page 18 | | | | | |
| | Beta Air % | | | | | | |
| **B. Iodines and Halogens** | | | | | | | |
| Total Release | Ci | 3.80E-04 | 4.08E-06 | 6.62E-05 | 1.21E-04 | 5.72E-04 | 3.00E+01 |
| Average release rate for the period | µCi/sec | 4.89E-05 | 5.18E-07 | 8.33E-06 | 1.53E-05 | 1.81E-05 | |
| Percent of limit (ODCM 3.11.2.3(a)) | % | * | * | * | * | * | |
| **C. Particulates** | | | | | | | |
| Particulates with half-lives > 8 days | Ci | 4.26E-06 | < LLD | 6.39E-06 | 4.31E-05 | 5.38E-05 | 3.00E+01 |
| Average release rate for the period | µCi/sec | 5.48E-07 | < LLD | 8.04E-07 | 5.43E-06 | 1.71E-06 | |
| Percent of limit (ODCM 3.11.2.3(a)) | % | * | * | * | * | * | |
| Gross alpha radioactivity | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | |
| **D. Tritium** | | | | | | | |
| Total Release | Ci | 1.12E+02 | 1.15E+02 | 1.16E+02 | 4.09E+01 | 3.84E+02 | 3.10E+01 |
| Average release rate for the period | µCi/sec | ~~3.71E-05~~ 1.44E+01 | ~~3.71E-05~~ 1.47E+01 | ~~3.71E-05~~ 1.46E+01 | ~~3.71E-05~~ 5.14E+00 | ~~3.71E-05~~ 1.22E+01 | |
| Percent of limit (ODCM 3.11.2.3(a)) | % | * | * | * | * | * | |
| **E. C-14** | | | | | | | |
| Total Release | Ci | 3.38E+00 | 3.69E+00 | 3.71E+00 | 4.18E+00 | 1.50E+01 | N/A |
| Average release rate for the period | µCi/sec | 4.35E-01 | 4.69E-01 | 4.67E-01 | 5.26E-01 | 4.74E-01 | |
| Percent of limit (ODCM 3.11.2.3(a)) | % | * | * | * | * | * | |
| **F. I-131, I-133, H-3 & Particulates > 8 day half-life** | | | | | | | |
| Percent of limit (ODCM 3.11.2.3(a)) | % | See Table 2 on page 18 | | | | | |
| **G. I-131, I-133, H-3, Particulates > 8 day half-life & C-14** | | | | | | | |
| Percent of limit (ODCM 3.11.2.3(a)) | % | See Table 2 on page 18 | | | | | |

* Iodine, Tritium, C-14, and Particulates were treated as a group. Although listed separately in the above table, the percent ODCM Limit is based on most limiting nuclide and organ dose for the group (even in cases when a sub-group member was not identified in effluent).

[a] It is not necessary to calculate uncertainties for C-14 or to include C-14 uncertainty in any subsequent calculation of overall uncertainty. (Regulatory Guide 1.21 revision 2)

2019 SGS AND HCGS ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

TABLE 2B-3

LIQUID EFFLUENTS

Facility: HCGS Period: 2019

| | | Continuous Mode | | | | | Batch Mode | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nuclides Released | Unit | Qtr. 1 | Qtr. 2 | Qtr. 3 | Qtr. 4 | Total | Qtr. 1 | Qtr. 2 | Qtr. 3 | Qtr. 4 | Total |
| H-3 | Ci | 3.09E-02 | 1.89E-02 | 3.57E-02 | 9.72E-02 | 1.83E-01 | 4.01E+02 | 4.21E+02 | 5.76E+01 | 1.12E+02 | 9.91E+02 |
| **Fission and Activation Products** | | | | | | | | | | | |
| Cr-51 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | 4.58E-05 | 4.58E-05 |
| Mn-54 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 8.02E-08 | 3.49E-05 | 1.30E-05 | 2.49E-03 | 2.54E-03 |
| Co-58 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | 9.53E-06 | 1.91E-03 | 1.92E-03 |
| Co-60 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 1.27E-05 | 8.74E-04 | 1.34E-04 | 4.81E-03 | 5.84E-03 |
| Zn-65 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | 1.79E-05 | 1.50E-04 | 1.68E-04 |
| Sb-122 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | 1.39E-04 | 1.39E-04 |
| Sb-124 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | 3.27E-03 | 3.27E-03 |
| Sb-125 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | 6.48E-04 | 6.48E-04 |
| I-131 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | 3.40E-04 | 3.40E-04 |
| I-133 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | 1.42E-07 | 1.42E-07 |
| Cs-134 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | 8.66E-04 | 8.66E-04 |
| Cs-136 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | 2.18E-05 | 2.18E-05 |
| Cs-137 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | < LLD | 2.45E-05 | < LLD | 7.97E-04 | 8.21E-04 |
| | | | | | | | | | | | |
| Total for Period | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 1.28E-05 | 9.33E-04 | 1.75E-04 | 1.55E-02 | 1.66E-02 |
| **Dissolved and Entrained Noble Gases** | | | | | | | | | | | |
| Xe-133 | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 1.41E-03 | 2.63E-04 | 4.38E-05 | 2.76E-04 | 1.99E-03 |
| Xe-135 | | < LLD | < LLD | < LLD | < LLD | < LLD | 2.70E-05 | ~~9.00E+00~~ < LLD | 1.24E-05 | 1.61E-06 | 4.10E-05 |
| | | | | | | | | | | | |
| Total for Period | Ci | < LLD | < LLD | < LLD | < LLD | < LLD | 1.44E-03 | 2.63E-04 | 5.62E-05 | 2.78E-04 | 2.03E-03 |

Note: Only radionuclides with positive activity reported in this table.

TABLE 3A-3
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
SOLID RADWASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (continued)
(Not Irradiated Fuel)

c. Waste Stream; Irradiated Components

| 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 | 1.58E+01 | 4.48E+01 | 2.68E+04 | +/-25% |
| Unclassified | 0.00E+00 | 0.00E+00 | 0.00E+00 | +/-25% |
| All | 1.58E+01 | 4.48E+01 | 2.68E+04 | +/-25% |

Major Nuclides for Above Table: Percent Cutoff: 1%

**Irradiated Components Waste Class A**

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

**Irradiated Components Waste Class B**

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

**Irradiated Components Waste Class C**

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| Mn-54 | 2.24% | 6.02E+02 |
| Fe-55 | 54.12% | 1.45E+04 |
| Co-60 | 36.88% | 9.90E+03 |
| Ni-63 | 6.39% | 1.72E+03 |

**Irradiated Components Waste Class All**

| Nuclide Name | Percent Abundance | Curies |
|---|---|---|
| Mn-54 | 2.24% | 6.02E+02 |
| Fe-55 | 54.12% | 1.45E+04 |
| Co-60 | 36.88% | 9.90E+03 |
| Ni-63 | 6.39% | 1.72E+03 |

N/A Not Applicable

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**Attachment 7, 2020 Radiological Groundwater Protection Program (RGPP) Report**

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## 1.0 Results of the Integrated Tritium Management Program with 2020 Radiological Groundwater Protection Program (RGPP), and 2020 Monitoring Well and Remedial Action Work Plan

### 1.1 Introduction

This report presents results of the 2020 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 12 and Figure 13, 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.

Well construction details for the Station's RGPP wells are presented on Table 51 and Table 52, respectively. Well construction details for the wells that are not specifically part of the RGPP are presented on Table 53.

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 (17). 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.

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

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

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

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

## 1.2 Radiological Groundwater Protection Program

This section of the annual report is prepared to summarize the status, activities, and groundwater analytical results collected in 2020 at the Site. This report also describes any changes made to the monitoring program during the 2020 reporting year.

### 1.2.1 Objectives of the Radiological Groundwater Protection Program

The long-term sampling program objectives are as follows:

- Identify suitable locations to monitor and evaluate potential impacts from Station operations before significant radiological impact to the environment or potential drinking water sources can occur.
- Refine the conceptual understanding of local hydrogeology and maintain current knowledge of potential flow paths on the surface and in groundwater beneath the Station.
- Evaluate systems, structures, components (SSCs) and work practices, which have the potential to release licensed radioactive material to the groundwater and develop strategies to mitigate potential releases to the environment.
- Perform routine groundwater monitoring and evaluate analytical results.
- Report any leaks, spills, or other detections with potential radiological significance to stakeholders in a timely manner.
- Take necessary corrective actions to protect groundwater resources.

### 1.2.2 Sample Collection

In 2006, the RGPP monitoring wells (Table 51 and Table 52) were installed at the Station as part of site investigation activities. Details pertaining to these activities are documented in the Site Investigation Reports (Arcadis 2006A and 2006B). Groundwater samples are collected from all RGPP monitoring wells at least semi-annually, with additional monitoring conducted as appropriate. The groundwater sample collection schedule is adaptively managed to ensure that representative data are collected to provide the information necessary to evaluate groundwater quality conditions. Monitoring wells are sampled following the low-flow purging and sampling techniques in accordance with the Field Sampling Procedures Manual (NJDEP 2005). This methodology is consistent with protocols established in the RAWP.

### 1.2.3 New RGPP Wells

No new wells were added as part of the RGPP during 2020. Further, all remaining ESP wells, and well Q, were closed/abandoned in 2020.

1.2.4 Sample Analysis

Groundwater samples collected from RGPP wells are analyzed for plant-related gamma emitting radionuclides (semi-annually), total strontium (annually), and iron-55 and nickel-63 (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:

1. Detection limits

   The Offsite Dose Calculation Manual (ODCM) specifies detection capabilities for each isotope that may be produced by the Station. While the detection capability for tritium specified in the ODCM is 3,000 picocuries per liter (pCi/L) in water, RGPP tritium analyses are performed to a lower value of 200 pCi/L at our offsite lab. Lower values for LLDs are used to be consistent with the State of New Jersey where PSEG conducts split samples with the NJDEP-BNE for specific wells. Each well has a statistically derived action level. When an action level is exceeded, PSEG may increase monitoring frequency and evaluates potential sources of the elevated tritium. Relevant groundwater evaluation criteria are listed in Table 54.

2. Laboratory Measurements Uncertainty

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

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

1.2.6 RGPP Data Quality

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

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

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

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

- 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 12 and Figure 13, respectively. Additionally, well construction details for the HCGS RGPP wells and SGS RGPP wells are presented on Table 51 and Table 52, respectively. The relevant radiological parameters used to evaluate the groundwater analytical results are provided in Table 54. The groundwater tritium analytical results for HCGS and SGS are shown on Table 55 and Table 56, respectively.

### 2.1.1 Groundwater Results - RGPP

Groundwater samples were collected from all RGPP monitoring wells during 2020 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 2020 from HCGS RGPP monitoring wells are summarized below and are presented in Table 55.

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

   - Well BI: Tritium concentrations detected in well BI ranged from 336 pCi/L (February 2020) to 347 pCi/L (May 2020) and averaged 342 pCi/L during 2020. Tritium was not detected in the samples collected in August or November 2020. 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 2,190 pCi/L (October 2020) to 4,810 pCi/L (January 2020) and averaged 3,330 pCi/L during 2020. 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 373 pCi/L (February 2020) to 541 pCi/L (November 2020) and averaged 481 pCi/L during 2020. 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 276 pCi/L (August 2020) to 796 pCi/L (May 2020) and averaged 481 pCi/L. Well BN is located northeast of the Materials Control Center and is a sentinel (source) well for the Auxiliary Boiler building and buried piping.

- Well BO: Tritium concentrations detected in well BO ranged from 261 pCi/L (May 2020) to 584 pCi/L (February 2020) and averaged 423 pCi/L. Tritium was not detected in the samples collected in August or November 2020. Well BO is located northeast of the Materials Control Center and is a sentinel (source) well for the Auxiliary Boiler building and buried piping.

- Well BJ was the only HCGS RGPP well where analytical results were greater than 3,000 pCi/L tritium, with a maximum result of 4,810 pCi/L (January 2020).

Except for tritium, no plant-related radionuclides were detected in any HCGS RGPP well sampled in 2020.

2. SGS RGPP Wells

Tritium analytical results for groundwater samples collected during 2020 from SGS RGPP monitoring wells are summarized below and are presented on Table 56.

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

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

- Well BC: Tritium was detected at concentrations ranging from 751 pCi/L (August 2020) to 3,550 pCi/L (November 2020) and averaged 1,612 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 286 pCi/L (February 2020) to 764 pCi/L (November 2020) and averaged 451 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 443 pCi/L (August 2020) to 991 pCi/L (February) and averaged 658 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 206 pCi/L (February 2020). Tritium was not detected in the samples collected in May, August, or November 2020. 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 249 pCi/L (August 2020) to 358 pCi/L (March 2020) and averaged 287 pCi/L. Well U is located north of SGS Unit 2 reactor building and is a sentinel (source) well for the House Heating Boilers.

- Well Z: Tritium was detected in the samples collected in May 2020 and November 2020 at concentrations of 450 pCi/L and 495 pCi/L, respectively. Well Z is located west of the SGS Unit 1 & 2 reactor buildings and is a perimeter well.

- Well BC was the only SGS RGPP well where analytical results were greater than 3,000 pCi/L tritium, with a result of 3,550 pCi/L (November 2020).

Except for tritium, no plant-related radionuclides were detected in any SGS RGPP well sampled in 2020.

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 2020, the mass flux within the shallow, water bearing unit and deeper groundwater was estimated to be 0.011 Ci and 0.031 Ci, respectively. Therefore, the total potential estimated mass flux of tritium in groundwater reaching the Delaware River during 2020 was 0.042 Ci.

The calculated mass flux of 0.042 Ci (total of four quarterly estimates) was included in the Station's liquid effluent discharge and reported in the data tables of the Annual Radiological Effluent Release Report.

2.1.3 Investigations

1. Groundwater Monitoring Well Data (Non-RGPP)

   As previously discussed, PSEG monitors a series of wells located at the Station. The ITMP is comprised of the RGPP wells, the RAWP wells, the ESP wells and a series of monitoring wells that were installed to investigate groundwater quality, but are not included as part of the RGPP, RAWP, or ESP. No new monitoring wells were installed in 2020. Further, all remaining ESP wells, and well Q, were closed/abandoned in 2020. Well construction details and tritium analytical results for the wells described above that are not specifically part of the RGPP are presented on Table 53 and Table 57, respectively.

2. Past Spills and Leaks: Impacts to Groundwater

   In 2020, there were no known active unmonitored or unevaluated releases into the groundwater at the Station.

## 3.0 RGPP 2021 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.

**Table 51, RGPP Well Construction Details, HCGS**

| Well ID | Installation Date | Construction Details | Diameter (inches) | Total Depth (feet bgs) | Monitoring Interval (feet bgs) | MP Elevation (feet RPD) | MP Elevation (feet amsl) | Monitoring Purpose | Source Targets |
|---|---|---|---|---|---|---|---|---|---|
| Well BH | May-06 | Sch-40 PVC | 4 | 37.0 | 27.0 - 37.0 | 101.16 | 11.24 | Perimeter | NA |
| Well BI | May-06 | Sch-40 PVC | 4 | 37.0 | 27.0 - 37.0 | 103.07 | 13.15 | Source | Facilities; Piping |
| Well BJ | May-06 | Sch-40 PVC | 4 | 38.0 | 28.0 - 38.0 | 102.97 | 13.05 | Source | Condensate Storage & Transfer; Facilities; Piping |
| Well BK | May-06 | Sch-40 PVC | 4 | 38.5 | 28.5 - 38.5 | 101.42 | 11.50 | Perimeter | NA |
| Well BL | May-06 | Sch-40 PVC | 4 | 37.0 | 27.0 - 37.0 | 102.69 | 12.77 | Perimeter | NA |
| Well BM | May-06 | Sch-40 PVC | 4 | 37.5 | 27.5 - 37.5 | 102.75 | 12.83 | Source | Facilities; Piping |
| Well BN | May-06 | Sch-40 PVC | 4 | 12.5 | 7.5 - 12.5 | 102.64 | 12.72 | Source | Auxiliary Boiler Building; Piping |
| Well BO | May-06 | Sch-40 PVC | 4 | 35.0 | 25.0 - 35.0 | 97.98 | 8.06 | Perimeter/Source | Building Sewage |
| Well BP | May-06 | Sch-40 PVC | 4 | 38.0 | 28.0 - 38.0 | 99.06 | 9.14 | Perimeter/Source | Building Sewage |
| Well BQ | May-06 | Sch-40 PVC | 4 | 42.0 | 32.0 - 42.0 | 105.62 | 15.70 | Source | Auxiliary Boiler Building; Dry Cask Storage Building; Piping |
| Well BR | May-06 | Sch-40 PVC | 4 | 40.5 | 30.5 - 40.5 | 104.28 | 14.36 | Perimeter/Source | Piping; Dry Cask Storage Building |
| Well BS | May-06 | Sch-40 PVC | 4 | 35.0 | 25.0 - 35.0 | 100.55 | 10.63 | Upgradient | NA |
| Well BT | May-06 | Sch-40 PVC | 4 | 38.5 | 28.5 - 38.5 | 99.60 | 9.68 | Upgradient | NA |

Notes:

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

**Table 52, RGPP Well Construction Details, SGS**

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

Notes:
MP Measuring Point
bgs Below ground surface
RPD Relative to plant datum
amsl Above mean sea level (NAVD 1988)
NA Not applicable
[1] Monitoring wells U, BB, BF, and BG were surveyed in July/August 2013 following retrofitting or repair activities.

Table 53, Well Construction Details, Investigation and Monitoring Wells

| Well ID | Installation Date | Construction Details | Diameter (inches) | Total Depth (feet bgs) | Monitoring Interval (feet bgs) | Monitored Hydrogeologic Unit | MP Elevation (feet RPD) | MP Elevation (feet amsl) |
|---|---|---|---|---|---|---|---|---|
| Well K | Feb-03 | Sch-40 PVC | 2 | 80.0 | 70.0 - 80.0 | Vincentown[1] | 102.00 | 12.08 |
| Well L | Jan-03 | Sch-40 PVC | 2 | 80.0 | 70.0 - 80.0 | Vincentown[1] | 101.46 | 11.54 |
| Well M | May-03 | Sch-40 PVC | 1 | 20.0 | 10.0 - 20.0 | Cofferdam[2] | 102.17 | 12.25 |
| Well N | Jan-03 | Sch-40 PVC | 2 | 20.0 | 10.0 - 20.0 | Cofferdam[2] | 101.65 | 11.73 |
| Well O | Jan-03 | Sch-40 PVC | 2 | 20.0 | 10.0 - 20.0 | Cofferdam[2] | 101.33 | 11.41 |
| Well P | Mar-03 | Sch-40 PVC | 2 | 80.0 | 70.0 - 80.0 | Vincentown[1] | 101.13 | 11.21 |
| Well Q[8] | Mar-03 | Sch-40 PVC | 2 | 80.0 | 70.0 - 80.0 | Vincentown[1] | 106.59 | 16.67 |
| Well EOW-4L[8] | Jan-09 | Sch-40 PVC | 2 | 120.2 | 110.2-120.2 | Vincentown[1] | 112.23 | 22.31 |
| Well R | Jun-03 | Sch-40 PVC | 1 | 19.0 | 9.0 - 19.0 | Cofferdam[2] | 102.35 | 12.43 |
| Well S[4] | May-03 | Sch-40 PVC | 2 | 34.7 | 24.7 - 34.7 | Shallow[3] | 99.04 | 9.12 |
| Well S-V | May-14 | Sch-40 PVC | 4 | 85.0 | 75.0 - 85.0 | Vincentown[1] | 101.00 | 11.08 |
| Well V[6] | Jun-03 | Sch-40 PVC | 2 | 79.5 | 69.5 - 79.5 | Vincentown[1] | 101.72 | 11.80 |
| Well W[6] | Jun-03 | Sch-40 PVC | 2 | 35.0 | 25.0 - 35.0 | Shallow[3] | 98.49 | 8.57 |
| Well AA[4] | Sep-03 | Sch-40 PVC | 2 | 36.0 | 26.0 - 36.0 | Shallow[3] | 99.07 | 9.15 |
| Well AA-V | May-13 | Sch-40 PVC | 2 | 85.0 | 75.0 - 85.0 | Vincentown[1] | 100.80 | 10.88 |
| Well AB[4] | Oct-03 | Sch-40 PVC | 2 | 42.0 | 32.0- 42.0 | Shallow[3] | 98.93 | 9.01 |
| Well AC[4] | Sep-03 | Sch-40 PVC | 2 | 24.0 | 14.0 - 24.0 | Cofferdam[2] | 98.77 | 8.85 |
| Well AD[4] | Oct-03 | Sch-40 PVC | 6 | 43.0 | 33.0 - 43.0 | Shallow[3] | 98.99 | 9.07 |
| Well AE | Oct-03 | Sch-40 PVC | 2 | 27.5 | 17.5 - 27.5 | Cofferdam[2] | 101.54 | 11.62 |
| Well AF | Oct-03 | Sch-40 PVC | 2 | 45.0 | 35.0 - 45.0 | Shallow[3] | 101.61 | 11.69 |
| Well AF-V | Nov-16 | Sch-40 PVC | 4 | 91.0 | 71.0 - 91.0 | Vincentown[1] | 101.38 | 11.46 |
| Well AG-Shallow | Feb-04 | Sch-40 PVC | 1 | 24.2 | 14.2 - 24.2 | Shallow[3] | 99.29 | 9.37 |
| Well AG-Deep | Feb-04 | Sch-40 PVC | 1 | 40.0 | 30.0 - 40.0 | Shallow[3] | 99.20 | 9.28 |
| Well AH-Shallow | Feb-04 | Sch-40 PVC | 1 | 24.5 | 14.5 - 24.5 | Shallow[3] | 102.58 | 12.66 |

Table 53, Well Construction Details, Investigation and Monitoring Wells

| Well ID | Installation Date | Construction Details | Diameter (inches) | Total Depth (feet bgs) | Monitoring Interval (feet bgs) | Monitored Hydrogeologic Unit | MP Elevation (feet RPD) | MP Elevation (feet amsl) |
|---|---|---|---|---|---|---|---|---|
| Well AH-Deep | Feb-04 | Sch-40 PVC | 1 | 40.0 | 30.0 - 40.0 | Shallow[3] | 102.70 | 12.78 |
| Well AI | Jan-04 | Sch-40 PVC | 4 | 22.0 | 12.0 - 22.0 | Cofferdam[2] | 98.79 | 8.87 |
| Well AJ | Jan-04 | Sch-40 PVC | 4 | 35.3 | 15.3 - 35.3 | Shallow[3] | 98.85 | 8.93 |
| Well AM | Jan-04 | Sch-40 PVC | 4 | 20.9 | 10.9 - 20.9 | Cofferdam[2] | 98.55 | 8.63 |
| Well AN | Jun-04 | Sch-40 PVC | 4 | 25.0 | 10.0 - 25.0 | Cofferdam[2] | 98.76 | 8.84 |
| Well AO | Jun-04 | Sch-40 PVC | 4 | 21.0 | 11.0 - 21.0 | Cofferdam[2] | 98.82 | 8.90 |
| Well AP | Jun-04 | Sch-40 PVC | 4 | 40.0 | 15.0 - 40.0 | Shallow[3] | 98.65 | 8.73 |
| Well AQ[5] | Jun-04 | Sch-40 PVC | 4 | 45.0 | 20.0 - 45.0 | Shallow[3] | 99.05 | 9.13 |
| Well AR | Jun-04 | Sch-40 PVC | 4 | 43.0 | 18.0 - 43.0 | Shallow[3] | 99.22 | 9.30 |
| Well AS | Jun-04 | Sch-40 PVC | 4 | 41.5 | 16.5 - 41.5 | Shallow[3] | 99.44 | 9.52 |
| Well AT | Jun-04 | Sch-40 PVC | 4 | 44.0 | 19.0 - 44.0 | Shallow[3] | 99.25 | 9.33 |
| Well BH-V | Jun-19 | Sch-40 PVC | 4 | 82.0 | 62.0 - 82.0 | Vincentown[1] | 101.83 | 11.91 |
| Well BM-V | Jun-19 | Sch-40 PVC | 4 | 92.0 | 72.0 - 92.0 | Vincentown[1] | 104.95 | 15.03 |
| Well BW[6] | Dec-06 | Sch-40 PVC | 1 | 10.0 | 5.0 - 10.0 | Shallow[3] | 101.62 | 11.70 |
| Well BX[6] | Dec-06 | Sch-40 PVC | 1 | 10.0 | 5.0 - 10.0 | Shallow[3] | 101.79 | 11.87 |
| Well BY | Nov-10 | Sch-40 PVC | 4 | 40.0 | 35.0 - 40.0 | Shallow[3] | 103.36 | 13.44 |
| Well BY-V | Jun-19 | Sch-40 PVC | 4 | 82.0 | 62.0 - 82.0 | Vincentown[1] | 99.03 | 9.11 |
| Well BZ | Nov-10 | Sch-40 PVC | 4 | 36.0 | 31.0 - 36.0 | Shallow[3] | 104.29 | 14.37 |
| Well CA[6] | Dec-06 | Sch-40 PVC | 4 | 38.0 | 28.0 - 38.0 | Shallow[3] | 101.96 | 12.04 |
| Well CB[7] | Dec-06 | Sch-40 PVC | 2 | 80.0 | 70.0 - 80.0 | Vincentown[1] | 98.98 | 9.06 |
| Well DA[6] | Nov-10 | Sch-40 PVC | 4 | 17.0 | 12.0 - 17.0 | Cofferdam[2] | 99.04 | 9.12 |
| Well DB | Nov-10 | Sch-40 PVC | 4 | 21.0 | 16.0 - 21.0 | Cofferdam[2] | 101.69 | 11.77 |
| Well DC | Nov-10 | Sch-40 PVC | 4 | 22.0 | 17.0 - 22.0 | Cofferdam[2] | 100.90 | 10.98 |
| Well DD | Nov-10 | Sch-40 PVC | 4 | 19.0 | 14.0 - 19.0 | Cofferdam[2] | 101.23 | 11.31 |

Table 53, 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 DE | Nov-10 | Sch-40 PVC | 4 | 18.0 | 13.0 - 18.0 | Cofferdam[2] | 101.43 | 11.51 |
| Well DF | Nov-10 | Sch-40 PVC | 4 | 19.0 | 14.0 - 19.0 | Cofferdam[2] | 101.32 | 11.40 |
| Well DG | Nov-10 | Sch-40 PVC | 2 | 13.5 | 11.5 - 13.5 | Cofferdam[2] | 98.98 | 9.06 |
| Well DH | Oct-10 | Sch-40 PVC | 4 | 21.0 | 16.0 - 21.0 | Cofferdam[2] | 101.54 | 11.62 |
| Well DI | Oct-10 | Sch-40 PVC | 4 | 18.0 | 13.0 - 18.0 | Cofferdam[2] | 101.64 | 11.72 |
| Well DJ | Oct-10 | Sch-40 PVC | 2 | 11.0 | 6.0 - 11.0 | Cofferdam[2] | 99.03 | 9.11 |

Notes:

MP Measuring point
bgs Below ground surface
RPD Relative to plant datum
amsl Above mean sea level (NAVD 1988)

[1] Monitoring well is screened in the Vincentown Formation.
[2] Monitoring well is screened in the shallow, water-bearing unit at a location within the limits of the cofferdam.
[3] Monitoring well is screened in the shallow, water-bearing unit at a location outside the limits of the cofferdam.
[4] The surface completions of Monitoring Wells S, AA, AB, AC, and AD were converted from above-grade to flush-grade in February 2004.
[5] Monitoring well AQ was abandoned in November 2016.
[6] Monitoring wells BW, BX, CA, DA, V, and W were surveyed in July/August 2013 following retrofitting or repair activities.
[7] Monitoring well CB was abandoned in May 2013
[8] Monitoring wells Q and EOW-4L were abandoned in May 2020.

Table 54, 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-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 |

Table 55, Tritium Analytical Results, HCGS RGPP Wells

| Well ID | Sample Date | Tritium Result (pCi/L) |
|---|---|---|
| Well BH | 2/3/2020 | < 178 |
| Well BH | 5/5/2020 | < 170 |
| Well BH | 8/6/2020 | < 180 |
| Well BH | 11/2/2020 | < 184 |
| Well BI | 2/3/2020 | **336** |
| Well BI | 5/6/2020 | **347** |
| Well BI | 8/3/2020 | < 186 |
| Well BI | 11/4/2020 | < 181 |
| Well BJ | 1/8/2020 | **4,810** |
| Well BJ | 2/3/2020 | **4,140** |
| Well BJ | 3/3/2020 | **4,060** |
| Well BJ | 4/6/2020 | **3,960** |
| Well BJ | 5/6/2020 | **3,690** |
| Well BJ | 6/2/2020 | **3,750** |
| Well BJ | 7/7/2020 | **3,230** |
| Well BJ | 8/3/2020 | **2,430** |
| Well BJ | 9/9/2020 | **2,650** |
| Well BJ | 10/5/2020 | **2,190** |
| Well BJ | 11/2/2020 | **2,350** |
| Well BJ | 12/8/2020 | **2,700** |
| Well BK | 5/5/2020 | < 175 |
| Well BK | 11/2/2020 | < 179 |
| Well BL | 5/5/2020 | < 174 |
| Well BL | 11/4/2020 | < 184 |
| Well BM | 2/3/2020 | **373** |
| Well BM | 5/6/2020 | **490** |
| Well BM | 8/3/2020 | **520** |
| Well BM | 11/4/2020 | **541** |
| Well BN | 2/4/2020 | **573** |
| Well BN | 5/5/2020 | **796** |
| Well BN | 8/5/2020 | **276** |
| Well BN | 11/3/2020 | **279** |
| Well BO | 2/4/2020 | **584** |
| Well BO | 5/5/2020 | **261** |
| Well BO | 8/5/2020 | < 186 |
| Well BO | 11/3/2020 | < 186 |
| Well BP | 5/6/2020 | < 173 |
| Well BP | 11/2/2020 | < 184 |

Table 44, Tritium Analytical Results, HCGS RGPP Wells(continued)

| Well ID | Sample Date | Tritium Result (pCi/L) |
|---|---|---|
| Well BQ | 2/4/2020 | < 180 |
| Well BQ | 5/7/2020 | < 176 |
| Well BQ | 8/6/2020 | < 180 |
| Well BQ | 11/5/2020 | < 184 |
| Well BR | 5/6/2020 | < 173 |
| Well BR | 11/2/2020 | < 183 |
| Well BS | 5/6/2020 | < 170 |
| Well BS | 11/2/2020 | < 185 |
| Well BT | 5/4/2020 | < 173 |
| Well BT | 11/3/2020 | < 185 |

Notes:

| | |
|---|---|
| pCi/L | Picocuries per liter |
| < | Tritium not detected above indicated concentration |
| **261** | Bolded values indicate tritium was detected |

Table 56, Tritium Analytical Results, SGS RGPP Wells

| Well ID | Sample Date | Tritium Result (pCi/L) |
|---|---|---|
| Well AL | 5/4/2020 | **428** |
| Well AL | 11/2/2020 | **285** |
| Well BA | 5/7/2020 | < 187 |
| Well BA | 11/4/2020 | < 184 |
| Well BB | 5/7/2020 | < 184 |
| Well BB | 11/4/2020 | < 183 |
| Well BC | 1/7/2020 | **2,150** |
| Well BC | 2/3/2020 | **2,220** |
| Well BC | 3/3/2020 | **1,580** |
| Well BC | 4/8/2020 | **1,590** |
| Well BC | 5/5/2020 | **2,110** |
| Well BC | 6/2/2020 | **1,820** |
| Well BC | 7/7/2020 | **1,050** |
| Well BC | 8/3/2020 | **751** |
| Well BC | 9/9/2020 | **751** |
| Well BC | 10/8/2020 | **785** |
| Well BC | 11/4/2020 | **3,550** |
| Well BC | 12/10/2020 | **989** |
| Well BD | 2/3/2020 | **286** |
| Well BD | 5/4/2020 | **350** |
| Well BD | 8/3/2020 | **403** |
| Well BD | 11/3/2020 | **764** |
| Well BE | 2/3/2020 | **991** |
| Well BE | 5/5/2020 | **697** |
| Well BE | 6/2/2020 | **608** |
| Well BE | 8/3/2020 | **443** |
| Well BE | 11/3/2020 | **552** |
| Well BF | 5/5/2020 | < 176 |
| Well BF | 11/4/2020 | < 178 |
| Well BG | 2/3/2020 | **206** |
| Well BG | 5/6/2020 | < 176 |
| Well BG | 8/3/2020 | < 155 |
| Well BG | 11/5/2020 | < 178 |
| Well BU | 5/5/2020 | < 179 |
| Well BU | 11/3/2020 | < 186 |
| Well T | 2/4/2020 | < 173 |
| Well T | 5/6/2020 | < 180 |
| Well T | 8/3/2020 | < 160 |
| Well T | 11/5/2020 | < 182 |

Table 45, Tritium Analytical Results, SGS RGPP Wells (continued)

| Well ID | Sample Date | Tritium Result (pCi/L) |
|---|---|---|
| Well U | 2/4/2020 | **295** |
| Well U | 3/3/2020 | **358** |
| Well U | 5/6/2020 | **268** |
| Well U | 8/3/2020 | **249** |
| Well U | 11/5/2020 | **267** |
| Well V | 1/7/2020 | **271** |
| Well V | 7/8/2020 | **203** |
| Well W | 1/7/2020 | **2,350** |
| Well W | 4/8/2020 | **2,210** |
| Well W | 7/8/2020 | **1,860** |
| Well W | 10/5/2020 | **1,860** |
| Well Y | 5/7/2020 | < 182 |
| Well Y | 11/4/2020 | < 186 |
| Well Z | 5/7/2020 | **450** |
| Well Z | 11/4/2020 | **495** |

Notes:

| | |
|---|---|
| pCi/L | Picocuries per liter |
| < | Tritium not detected above indicated concentration |
| **545** | Bolded values indicate tritium was detected |

Table 57, Tritium Analytical Results, Investigation & Monitoring Wells

| Well ID | Sample Date | Tritium Result (pCi/L) |
|---|---|---|
| Well AA | 1/8/2020 | **3,220** |
| Well AA | 4/9/2020 | **982** |
| Well AA | 5/6/2020 | **761** |
| Well AA | 6/2/2020 | **1,190** |
| Well AA | 8/5/2020 | **1,090** |
| Well AA-V | 1/8/2020 | **2,550** |
| Well AA-V | 4/9/2020 | **951** |
| Well AA-V | 7/10/2020 | **3,330** |
| Well AA-V | 10/7/2020 | **5,730** |
| Well AB | 1/9/2020 | **6,350** |
| Well AB | 4/9/2020 | **6,690** |
| Well AB | 7/7/2020 | **8,370** |
| Well AB | 10/7/2020 | **8,440** |
| Well AC | 1/6/2020 | **29,100** |
| Well AC | 2/3/2020 | **22,200** |
| Well AC | 3/3/2020 | **40,500** |
| Well AC | 4/7/2020 | **34,100** |
| Well AC | 5/4/2020 | **41,700** |
| Well AC | 6/2/2020 | **40,200** |
| Well AC | 7/6/2020 | **32,600** |
| Well AC | 8/3/2020 | **23,000** |
| Well AC | 9/9/2020 | **24,600** |
| Well AC | 10/6/2020 | **22,600** |
| Well AC | 11/3/2020 | **16,500** |
| Well AC | 12/10/2020 | **29,300** |
| Well AD | 1/9/2020 | **11,500** |
| Well AD | 4/9/2020 | **9,260** |
| Well AD | 7/7/2020 | **9,460** |
| Well AD | 10/7/2020 | **8,340** |
| Well AE | 1/9/2020 | **9,620** |
| Well AE | 4/6/2020 | **6,610** |
| Well AE | 7/9/2020 | **18,300** |
| Well AE | 10/7/2020 | **11,600** |
| Well AF | 1/9/2020 | < 183 |
| Well AF | 7/9/2020 | **248** |

**Table 46, Tritium Analytical Results, Investigation & Monitoring Wells (continued)**

| Well ID | Sample Date | Tritium Result (pCi/L) |
|---|---|---|
| Well AF-V | 4/8/2020 | **273** |
| Well AF-V | 7/7/2020 | **310** |
| Well AF-V | 10/7/2020 | **512** |
| Well AG-D | 1/7/2020 | **905** |
| Well AG-D | 7/9/2020 | **784** |
| Well AG-S | 1/7/2020 | **821** |
| Well AG-S | 7/9/2020 | **726** |
| Well AH-D | 1/9/2020 | **627** |
| Well AH-D | 7/7/2020 | **487** |
| Well AH-S | 1/9/2020 | **636** |
| Well AH-S | 7/7/2020 | **439** |
| Well AI | 1/7/2020 | **3,280** |
| Well AI | 7/6/2020 | **2,160** |
| Well AJ | 7/7/2020 | **292** |
| Well AM | 1/6/2020 | **26,400** |
| Well AM | 4/7/2020 | **21,400** |
| Well AM | 7/6/2020 | **4,510** |
| Well AM | 10/6/2020 | **10,500** |
| Well AN | 1/9/2020 | **22,600** |
| Well AN | 2/4/2020 | **19,900** |
| Well AN | 4/21/2020 | **17,600** |
| Well AN | 5/4/2020 | **16,400** |
| Well AN | 6/2/2020 | **20,500** |
| Well AN | 7/7/2020 | **19,900** |
| Well AN | 8/3/2020 | **17,700** |
| Well AN | 9/8/2020 | **15,400** |
| Well AP | 1/8/2020 | **3,210** |
| Well AP | 8/5/2020 | **1,730** |
| Well AR | 1/9/2020 | **3,980** |
| Well AR | 4/6/2020 | **5,680** |
| Well AR | 7/9/2020 | **5,350** |
| Well AR | 10/7/2020 | **7,060** |
| Well AS | 1/9/2020 | **3,700** |
| Well AS | 7/9/2020 | **5,070** |
| Well AT | 1/9/2020 | **1,440** |
| Well AT | 7/7/2020 | **1,660** |
| Well BH-V | 1/8/2020 | < 181 |
| Well BH-V | 7/7/2020 | **290** |
| Well BM-V | 1/8/2020 | < 185 |
| Well BM-V | 7/7/2020 | < 195 |

**Table 46, Tritium Analytical Results, Investigation & Monitoring Wells (continued)**

| Well ID | Sample Date | Tritium Result (pCi/L) |
|---|---|---|
| Well BW | 5/4/2020 | **702** |
| Well BW | 11/5/2020 | **691** |
| Well BX | 5/4/2020 | **554** |
| Well BX | 11/5/2020 | **567** |
| Well BY | 1/8/2020 | **139,000** |
| Well BY | 2/4/2020 | **98,100** |
| Well BY | 3/3/2020 | **91,900** |
| Well BY | 4/6/2020 | **82,800** |
| Well BY | 5/6/2020 | **75,000** |
| Well BY | 6/2/2020 | **64,500** |
| Well BY | 7/7/2020 | **66,800** |
| Well BY | 8/6/2020 | **55,400** |
| Well BY | 9/9/2020 | **58,700** |
| Well BY | 10/5/2020 | **57,300** |
| Well BY | 11/5/2020 | **46,300** |
| Well BY | 12/8/2020 | **39,400** |
| Well BY-V | 1/8/2020 | **7,000** |
| Well BY-V | 4/6/2020 | **6,310** |
| Well BY-V | 7/7/2020 | **11,400** |
| Well BY-V | 10/5/2020 | **8,820** |
| Well BZ | 5/6/2020 | **1,410** |
| Well BZ | 11/5/2020 | **1,310** |
| Well CA | 1/9/2020 | **1,400** |
| Well CA | 7/8/2020 | **1,300** |
| Well DA | 1/7/2020 | **2,360** |
| Well DA | 4/7/2020 | **3,010** |
| Well DA | 7/8/2020 | **4,920** |
| Well DA | 9/9/2020 | **2,420** |
| Well DA | 10/8/2020 | **2,250** |
| Well DA | 11/4/2020 | **2,210** |
| Well DA | 12/8/2020 | **3,360** |
| Well DB | 1/6/2020 | **10,400** |
| Well DB | 4/7/2020 | **11,300** |
| Well DB | 7/6/2020 | **13,300** |
| Well DB | 10/6/2020 | **11,300** |
| Well DC | 1/6/2020 | **5,230** |
| Well DC | 7/6/2020 | **10,300** |
| Well DC | 9/9/2020 | **3,450** |
| Well DC | 10/6/2020 | **4,610** |
| Well DC | 11/3/2020 | **3,150** |

**Table 46, Tritium Analytical Results, Investigation & Monitoring Wells (continued)**

| Well ID | Sample Date | Tritium Result (pCi/L) |
|---|---|---|
| Well DC | 12/10/2020 | **6,650** |
| Well DD | 1/6/2020 | **6,550** |
| Well DD | 4/7/2020 | **5,210** |
| Well DD | 7/6/2020 | **5,050** |
| Well DD | 10/6/2020 | **5,700** |
| Well DE | 1/6/2020 | **17,700** |
| Well DE | 4/7/2020 | **14,700** |
| Well DE | 7/6/2020 | **19,900** |
| Well DE | 10/6/2020 | **18,900** |
| Well DE | 11/3/2020 | **19,100** |
| Well DF | 1/6/2020 | **1,390** |
| Well DF | 7/6/2020 | **1,280** |
| Well DG | 1/7/2020 | **4,080** |
| Well DG | 4/8/2020 | **3,450** |
| Well DG | 7/6/2020 | **3,560** |
| Well DG | 10/8/2020 | **3,570** |
| Well DH | 1/9/2020 | **10,500** |
| Well DH | 4/8/2020 | **8,800** |
| Well DH | 7/8/2020 | **10,300** |
| Well DH | 10/8/2020 | **12,500** |
| Well DI | 1/9/2020 | **3,850** |
| Well DI | 4/8/2020 | **3,210** |
| Well DI | 7/8/2020 | **1,820** |
| Well DI | 10/8/2020 | **2,240** |
| Well DJ | 1/9/2020 | **1,010** |
| Well DJ | 7/8/2020 | **888** |
| Well EOW-4L[†] | 1/9/2020 | < 181 |
| Well K | 1/8/2020 | < 181 |
| Well K | 7/8/2020 | < 184 |
| Well L | 1/7/2020 | < 185 |
| Well L | 7/7/2020 | < 151 |
| Well M | 1/7/2020 | **5,070** |
| Well M | 4/9/2020 | **4,020** |
| Well M | 7/6/2020 | **4,270** |
| Well M | 10/5/2020 | **5,250** |
| Well N | 1/6/2020 | **7,110** |
| Well N | 4/7/2020 | **12,600** |
| Well N | 7/6/2020 | **7,760** |
| Well N | 10/6/2020 | **4,730** |
| Well O | 1/9/2020 | **23,500** |

**Table 46, Tritium Analytical Results, Investigation & Monitoring Wells (continued)**

| Well ID | Sample Date | Tritium Result (pCi/L) |
|---|---|---|
| Well O | 4/6/2020 | **56,100** |
| Well O | 7/9/2020 | **16,000** |
| Well O | 10/7/2020 | **15,700** |
| Well P | 1/7/2020 | < 180 |
| Well P | 7/9/2020 | < 149 |
| Well R | 1/7/2020 | **4,150** |
| Well R | 7/6/2020 | **3,890** |
| Well S | 4/21/2020 | **7,640** |
| Well S | 7/7/2020 | **15,100** |
| Well S | 10/7/2020 | **13,800** |
| Well S-V | 1/8/2020 | **3,000** |
| Well S-V | 4/6/2020 | **2,270** |
| Well S-V | 7/7/2020 | **1,980** |
| Well S-V | 10/7/2020 | **2,570** |
| Well V | 1/7/2020 | **271** |
| Well V | 7/8/2020 | **203** |
| Well W | 1/7/2020 | **2,350** |
| Well W | 4/8/2020 | **2,210** |
| Well W | 7/8/2020 | **1,860** |
| Well W | 10/5/2020 | **1,860** |

Notes:

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

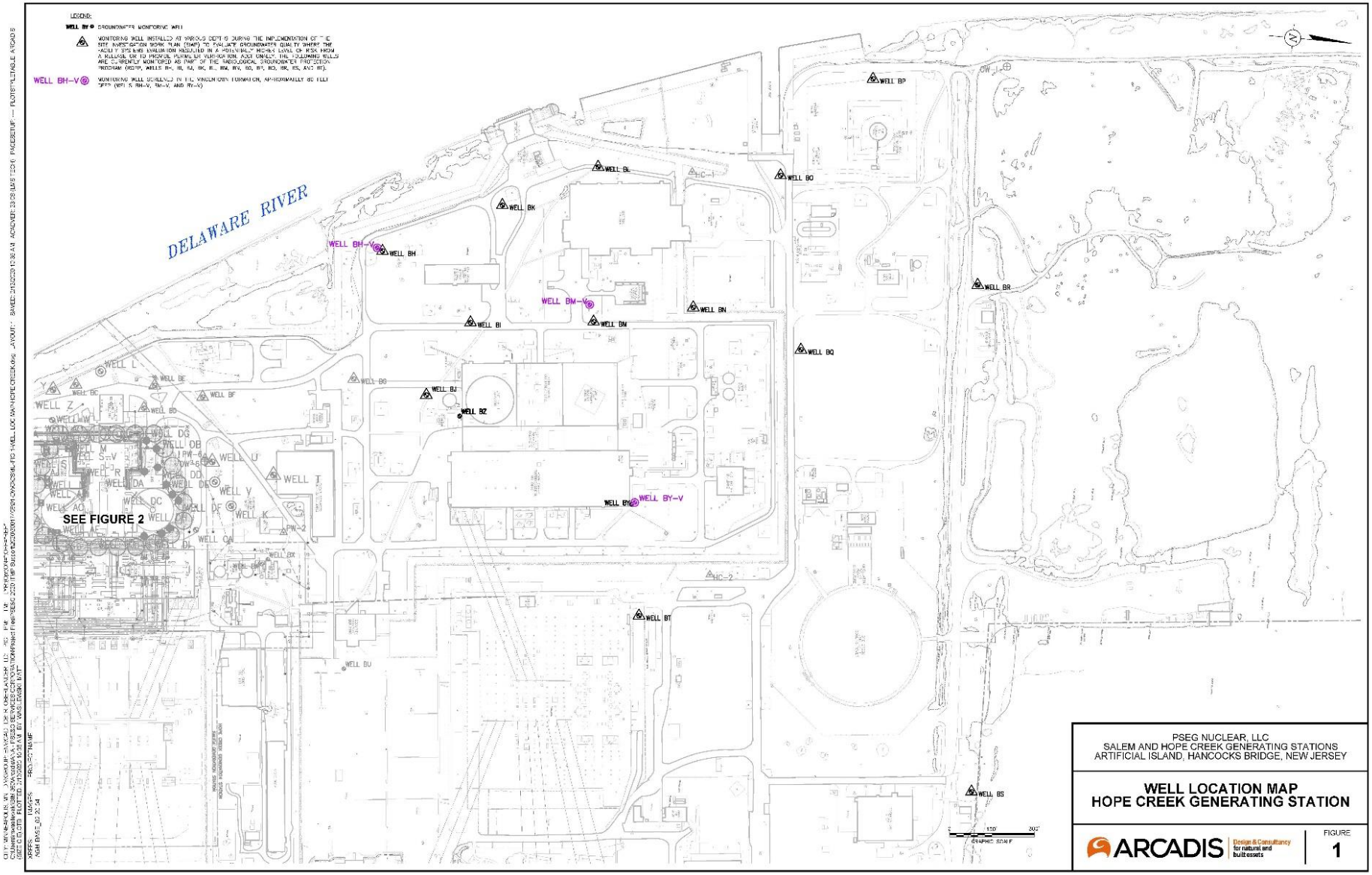


Figure 12, Well Location Map, Hope Creek Generating Station

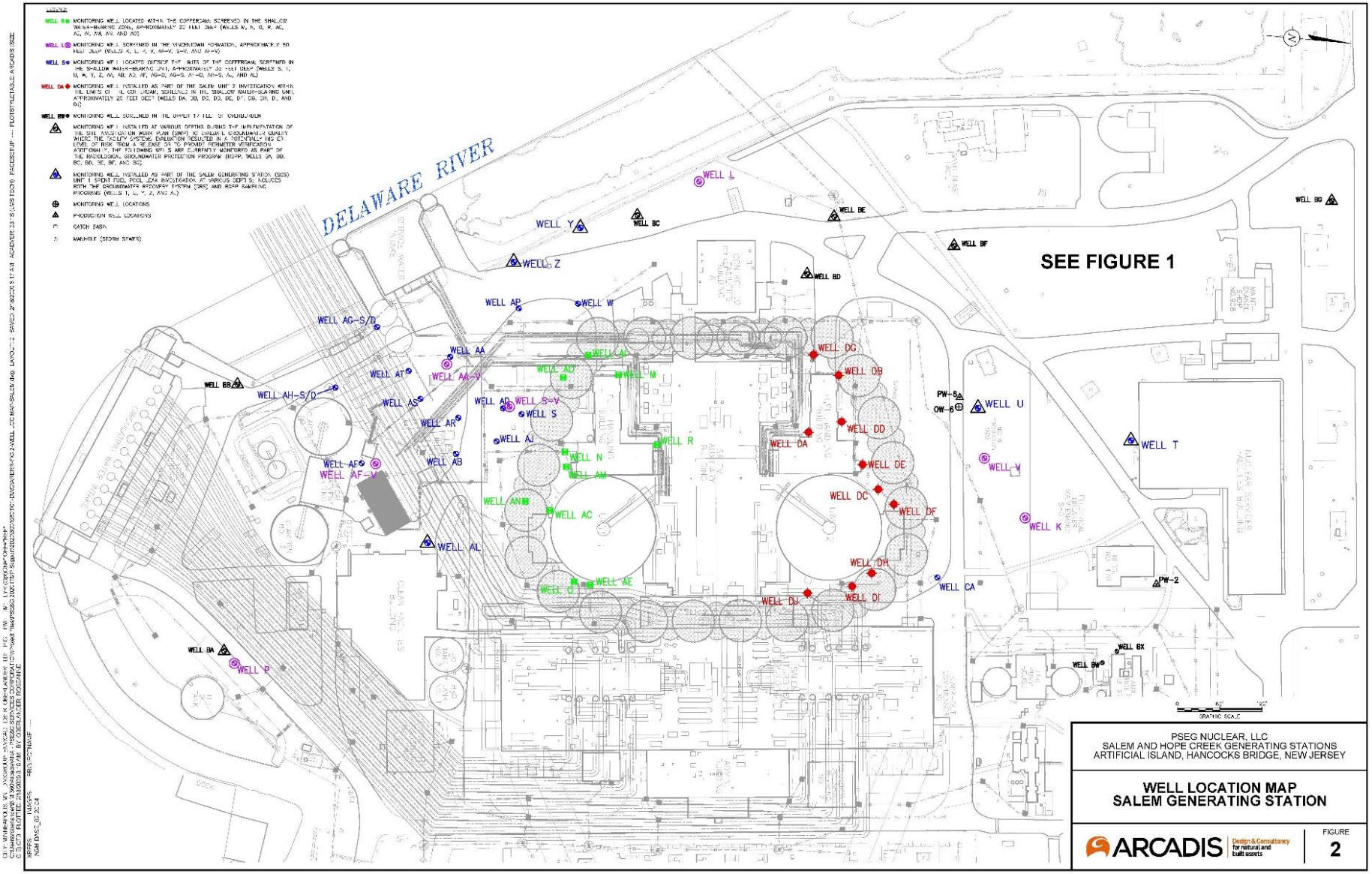


**Figure 13, Well Location Map, Salem Generating Station**