



August 23, 2018

Docket No. 52-048

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 310 (eRAI No. 9264) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 310 (eRAI No. 9264)," dated December 22, 2017

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) response to the referenced NRC Request for Additional Information (RAI).

The Enclosure to this letter contains NuScale's response to the following RAI Question from NRC eRAI No. 9264:

- 12.02-4

This letter and the enclosed response make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Carrie Fosaaen at 541-452-7126 or at cfosaaen@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9264

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9264

Response to Request for Additional Information Docket No. 52-048

eRAI No.: 9264

Date of RAI Issue: 12/22/2017

NRC Question No.: 12.02-4

Regulatory Basis

10 CFR 52.47(a)(5) requires applicants to identify the kinds and quantities of radioactive materials expected to be produced in the operation and the means for controlling and limiting radiation exposures within the limits set forth in 10 CFR Part 20. 10 CFR 20.1101(b) and 10 CFR 20.1003, require the use of engineering controls to maintain exposures to radiation as far below the dose limits in 10 CFR Part 20 as is practical. 10 CFR 50.49(e)(4) and 10 CFR Part 50 Appendix A, criterion 4 requires applicants to identify the environmental conditions, including radiation, associated with normal operation. The DSRS Acceptance Criteria section of NuScale DSRS section 12.2, "Radiation Sources," states that the applications should contain the methods, models and assumptions used as the bases for all sources described in DCD Section 12.2. The DSRS Acceptance Criteria 12.3-12.4, "Radiation Protection Design Features," states that the areas inside the plant structures, as well as in the general plant yard, should be subdivided into radiation zones, with maximum design dose rate zones and the criteria used in selecting maximum dose rates identified.

Background

Cs-137 decays, with a 30 year half-life, to Ba-137m, with a 2.5 minute half-life. Since Ba-137m is in secular equilibrium with the parent Cs-137 radionuclide, the specific activity of Ba-137m should be within 94 percent of the Cs-137 specific activity, within 20 minutes. The significant 662 KeV photon associated with the decay of Cs-137 is actually emitted from the decay of Ba-137m, so if Ba-137m is omitted in an analysis, the results would be a significant underestimation of the photon source strength and thus the resultant dose rate.

NuScale DCD Tier 2, Revision 0 Table 12.2-7: "Chemical and Volume Control System Component Source Terms - Radionuclide Content," Ba-137m is not included in the column listing the radionuclide content of the resin transfer line. Also, based on information made available to the staff during the RPAC Chapter 12 Audit, the staff observed that several calculations did not properly account for the equilibrium condition between Cs-137 and Ba-137m. Examples of the types of calculations reviewed during the audit that had this error

include the proposed revision to DCD Table 12.2-20: “Solid Radioactive Waste System Component Source Terms – Source Strengths,” included as part of the applicant’s response to RAI-8860 Question 12.02-2, dated July 10 2017, and the source term associated with the applicant’s response to RAI-8775 Question 12.03-1, dated June 26, 2017, regarding post-accident vital area mission dose calculations.

The radionuclide content of systems and components is used to determine the photon source strength, which is, in turn, used to determine dose rates. The calculated dose rates are then used to establish shielding requirements, radiation zones, doses to equipment and doses to personnel during normal operations, Anticipated Operational Occurrences (AOO) and following accidents. The staff’s analysis confirmed that some of the photon source strength information contained in documents made available to the staff during the audit, were underestimated.

As stated in Regulatory Guide 1.183, “Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors,” Appendix I, “Assumptions for Evaluating Radiation Doses for Equipment Qualification,” in paragraph 7 of section “Dose Model for Containment Atmosphere,” all gamma dose rates should be multiplied by a correction factor of 1.3 to account for the omission of the contribution from the decay chains of the radionuclides. Dose to EQ equipment resulting from gamma emitters during normal operation and from liquids containing post-accident sources of radioactive material should appropriately account for parent-daughter relationships.

Key Issue:

The methodology used to develop the photon source strength from source terms does not account for some principle photon radiation emitting isotopes resulting in underestimates of some dose rates in the DCD.

Question 1

- Please explain omission of BA-137m in determining the isotopic content of components and systems cited above,
- As necessary, revise the calculations used to determine the isotopic content of components and systems to correct Ba-137m, and any other radiologically significant isotopes that are not accurately accounted for,
- As necessary revise tables contained in DCD Section 12.2- to correct Ba-137m, and as necessary other radiologically significant isotopes,
- As necessary, revise the DCD radiation zone maps in DCD Section 12.3 to reflect the changes to the table in DCD section 12.2,
- As necessary, revise the thicknesses of shielding described in the DCD to reflect the increase in the photon strength resulting from the changes to the table in DCD section 12.2,

- As necessary, revise the dose estimates affected by the changes in photon strength caused the changes to the table in DCD section 12.2,
- As necessary, revise the EQ dose estimates and categories described in DCD Table 3C-1: “Environmental Qualification Zones - Reactor Building,” DCD Table 3C-8: “Accident EQ Radiation Dose,” and DCD Table 3C-6: “Normal Operating Environmental Conditions,” affected by the changes in photon strength caused the changes to the table in DCD section 12.2,

OR

Provide the specific alternative approaches used and the associated justification.

NuScale Response:

NuScale has revised its source term calculations, and has ensured the consistent and appropriate accounting of Ba-137m in secular equilibrium with Cs-137. To account for Ba-137m, NuScale has revised FSAR Tables 11.1-5, 11.1-7, 11.2-4, 11.2-5, 11.2-8, 11.3-5, 12.2-7, 12.2-8, 12.2-9, 12.2-10, 12.2-11, 12.2-13a, 12.2-13b, 12.2-14a, 12.2-14b, 12.2-19, and 12.2-20. Also, the radiation zone maps for the Reactor Building (RXB) and the Radioactive Waste Building (RWB) were updated to reflect the source term revisions. The integrated doses reported in Table 3C-2, 3C-6, and 3C-8 appropriately account for the contribution from decay chains of the radionuclides. The most recent changes to these tables were provided in RAI response 8837 questions 03.11-1, 03.11-3, and 03.11-4.

For the changes to Tables 11.1-5, 11.1-7, and 12.2-10, see the NuScale response to RAI 9270.

For the changes to Tables 12.2-7 and 12.2-8, see the NuScale response to RAI 9257.

For the changes to Tables 12.2-13a, 12.2-13b, 12.2-14a, and 12.2-14b, see the NuScale response to RAI 9256.

The updated RXB and RWB radiation zone maps are provided with the NuScale response to RAIs 9281 and 9302, respectively.

Impact on DCA:

FSAR Table 11.2-4, Table 11.2-5, Table 11.2-8, Table 11.3-5, Table 12.2-9, Table 12.2-11, Table



12.2-19, and Table 12.2-20 have been revised as described in the response above and as shown in the markup provided in this response.

RAI 12.02-4

Table 11.2-4: Liquid Effluent Release Calculation Inputs

NuScale Effluent Source Term Model Assumption	Value
Primary coolant source term	Table 11.1-6
CVCS demineralizer decontamination factors:	
- Halogens	100
- Cs, Rb	2
- Others	50
PCUS demineralizer decontamination factors:	
- Halogens	100
- Cs, Rb	2
- Others	50
PCUS filter efficiency	0%
PCUS flow rate	594 gpm
Pool water mass	2.87E+10 grams
Time between refueling outages/NPM disassembly	2 months
CES liquid partition fractions:	
- Noble gases	1
- Halogens	200 100
- Others	1000
Secondary coolant source term	Table 11.1-7
AOO adjustment	0.09 Ci/year
UWS dilution factor	5. 34 56 ft ³ /sec

RAI 12.02-4

Table 11.2-5: Estimated Annual Releases to Liquid Radioactive Waste System Discharge Header-

Nuclide	LRWS-HCW-Sample-Tank-Release (Ci/yr)	LRWS-LCW-Sample-Tank-Release (Ci/yr)	LRWS-Detergent-Tank-Release (Ci/yr)	AOO-Adjustment (Ci/yr)	Total Plant Liquid-Release (Ci/yr)
Br82	1.08E-05	3.90E-10	—	8.52E-07	1.16E-05
Br83	5.28E-05	1.91E-09	—	4.19E-06	5.70E-05
Br84	2.35E-05	8.47E-10	—	1.86E-06	2.53E-05
Br85	2.79E-06	1.01E-10	—	2.22E-07	3.02E-06
H29	2.78E-10	1.02E-14	—	2.20E-11	3.00E-10
H30	8.27E-05	2.98E-09	—	6.56E-06	8.93E-05
H31	2.47E-03	2.13E-07	1.92E-02	1.72E-03	2.34E-02
H32	9.17E-04	3.32E-08	—	7.27E-05	9.90E-04
H33	3.30E-03	1.31E-07	—	2.61E-04	3.56E-03
H34	5.01E-04	1.81E-08	—	3.97E-05	5.40E-04
H35	1.93E-03	6.95E-08	—	1.53E-04	2.08E-03
Rb86m	4.65E-09	1.41E-10	—	3.80E-10	5.17E-09
Rb86	3.54E-05	1.07E-06	—	2.89E-06	3.94E-05
Rb88	4.72E-03	1.43E-04	—	3.86E-04	5.25E-03
Rb89	2.17E-04	6.56E-06	—	1.77E-05	2.41E-04
Cs132	6.72E-07	2.04E-08	—	5.49E-08	7.47E-07
Cs134	6.16E-03	1.87E-04	1.32E-01	1.10E-02	1.49E-01
Cs135m	3.66E-06	1.11E-07	—	2.99E-07	4.07E-06
Cs136	1.29E-03	3.91E-05	4.44E-03	4.57E-04	6.23E-03
Cs137	3.77E-03	1.14E-04	1.92E-01	1.55E-02	2.11E-01
Cs138	1.74E-03	5.28E-05	—	1.42E-04	1.94E-03
P32	2.85E-10	1.80E-14	2.16E-03	1.71E-04	2.33E-03
Co57	2.13E-12	1.35E-16	—	1.69E-13	2.30E-12
Ni63	1.69E-04	6.99E-08	2.04E-02	1.63E-03	2.22E-02
Sr89	2.04E-06	1.29E-10	1.06E-03	8.39E-05	1.15E-03
Sr90	4.60E-07	2.90E-11	1.56E-04	1.24E-05	1.69E-04
Sr91	9.48E-07	5.92E-11	—	7.51E-08	1.02E-06
Sr92	4.76E-07	2.97E-11	—	3.77E-08	5.13E-07
Y90	1.21E-07	7.78E-12	—	9.61E-09	1.31E-07
Y91m	5.18E-07	3.24E-11	—	4.11E-08	5.59E-07
Y91	2.97E-07	1.88E-11	1.01E-03	7.99E-05	1.09E-03
Y92	4.31E-07	2.69E-11	—	3.42E-08	4.65E-07
Y93	2.18E-07	1.36E-11	—	1.73E-08	2.35E-07
Zr95	1.91E-04	7.81E-08	1.32E-02	1.06E-03	1.45E-02
Zr97	3.09E-07	1.93E-11	—	2.45E-08	3.33E-07
Nb95	1.06E-08	6.76E-12	2.28E-02	1.81E-03	2.46E-02
Mo99	5.83E-04	3.66E-08	7.20E-04	1.03E-04	1.41E-03
Mo101	1.76E-05	1.10E-09	—	1.40E-06	1.90E-05
Tc99m	5.42E-04	3.40E-08	—	4.30E-05	5.85E-04
Ru103	5.71E-07	3.61E-11	3.48E-03	2.76E-04	3.76E-03
Ru105	5.65E-06	3.53E-10	—	4.48E-07	6.10E-06
Ru106	3.71E-07	2.34E-11	1.07E-01	8.47E-03	1.15E-01

Table 11.2-5: Estimated Annual Releases to Liquid Radioactive Waste System Discharge Header (Continued)

Nuclide	LRWS-HCW-Sample Tank-Release (Ci/yr)	LRWS-LCW-Sample Tank-Release (Ci/yr)	LRWS-Detergent-Tank-Release (Ci/yr)	AOO-Adjustment (Ci/yr)	Total Plant Liquid-Release (Ci/yr)
Rh103m	5.65E-07	3.57E-11	—	4.48E-08	6.10E-07
Rh105	1.46E-06	9.16E-11	—	1.16E-07	1.58E-06
Rh106	3.71E-07	2.34E-11	—	2.94E-08	4.01E-07
Ag110m	2.57E-07	1.06E-10	1.44E-02	1.14E-03	1.55E-02
Sb124	1.19E-10	1.67E-17	5.16E-03	4.09E-04	5.57E-03
Sb125	1.05E-09	1.47E-16	—	8.31E-11	1.13E-09
Sb127	4.45E-09	6.22E-16	—	3.53E-10	4.80E-09
Sb129	4.74E-09	6.58E-16	—	3.76E-10	5.12E-09
Te125m	1.09E-06	6.88E-11	—	8.65E-08	1.18E-06
Te127m	3.51E-06	2.22E-10	—	2.79E-07	3.79E-06
Te127	1.28E-05	8.01E-10	—	1.01E-06	1.38E-05
Te129m	1.01E-05	6.34E-10	—	7.97E-07	1.09E-05
Te129	1.26E-05	7.93E-10	—	1.00E-06	1.36E-05
Te131m	3.13E-05	1.96E-09	—	2.48E-06	3.37E-05
Te131	1.39E-05	8.70E-10	—	1.10E-06	1.50E-05
Te132	2.34E-04	1.47E-08	—	1.86E-05	2.53E-04
Te133m	1.63E-05	1.02E-09	—	1.29E-06	1.75E-05
Te134	2.30E-05	1.44E-09	—	1.82E-06	2.48E-05
Ba137m	1.60E-03	1.02E-07	—	1.27E-04	1.72E-03
Ba139	6.15E-05	3.84E-09	—	4.87E-06	6.63E-05
Ba140	3.12E-06	1.97E-10	1.09E-02	8.66E-04	1.18E-02
La140	9.71E-07	6.22E-11	—	7.70E-08	1.05E-06
La141	2.08E-07	1.30E-11	—	1.65E-08	2.24E-07
La142	1.09E-07	6.82E-12	—	8.66E-09	1.18E-07
Ce141	4.54E-07	2.87E-11	2.76E-03	2.19E-04	2.98E-03
Ce143	3.30E-07	2.07E-11	—	2.62E-08	3.56E-07
Ce144	3.82E-07	2.41E-11	4.68E-02	3.71E-03	5.05E-02
Pr143	4.04E-07	2.55E-11	—	3.20E-08	4.36E-07
Pr144	3.82E-07	2.41E-11	—	3.03E-08	4.12E-07
Np239	7.06E-06	4.43E-10	—	5.59E-07	7.62E-06
Na24	2.73E-02	2.32E-06	—	2.16E-03	2.95E-02
Cr51	7.55E-06	3.03E-09	5.64E-02	4.47E-03	6.09E-02
Mn54	9.50E-06	3.93E-09	4.56E-02	3.62E-03	4.92E-02
Fe55	7.62E-04	3.16E-07	8.64E-02	6.91E-03	9.41E-02
Fe59	1.88E-04	7.65E-08	2.64E-02	2.11E-03	2.87E-02
Co58	1.16E-03	8.35E-07	9.48E-02	7.61E-03	1.04E-01
Co60	5.04E-05	2.09E-08	1.68E-01	1.33E-02	1.81E-01
W187	1.32E-03	1.78E-07	—	1.05E-04	1.42E-03
Zn65	3.24E-04	1.34E-07	—	2.57E-05	3.50E-04
H3	3.21E+02	1.23E+03	—	—	1.55E+03
C14	7.99E-05	5.05E-09	—	6.34E-06	8.63E-05
N16	0.00E+00	0.00E+00	—	—	0.00E+00
Total	3.21E+02	1.23E+03	1.08E+00	9.04E-02	1.55E+03

RAI 12.02-4

Table 11.2-5: Estimated Annual Releases to Liquid Radioactive Waste System Discharge Header

Nuclide	LRWS LCW Sample Tank Release (Ci/yr)	LRWS HCW Sample Tank Release (Ci/yr)	Plant Liquid Release without AOO Adjustment (Ci/yr)	Total Liquid Release with AOO Adjustment (Ci/yr)
Br82	4.36E-11	1.86E-06	1.86E-06	2.37E-06
Br83	1.73E-25	7.54E-21	7.54E-21	9.60E-21
I129	1.41E-14	5.87E-10	5.87E-10	7.48E-10
I130	3.08E-12	1.34E-07	1.34E-07	1.70E-07
I131	3.42E-07	3.40E-03	3.40E-03	4.33E-03
I132	1.03E-08	1.59E-04	1.60E-04	2.03E-04
I133	2.97E-09	9.97E-05	9.97E-05	1.27E-04
I135	1.24E-13	5.39E-09	5.39E-09	6.86E-09
Rb86	1.83E-06	6.05E-05	6.23E-05	7.94E-05
Cs132	2.42E-08	7.99E-07	8.24E-07	1.05E-06
Cs134	3.85E-04	1.27E-02	1.31E-02	1.66E-02
Cs136	6.17E-05	2.03E-03	2.10E-03	2.67E-03
Cs137	2.37E-04	7.82E-03	8.05E-03	1.03E-02
P32	4.76E-15	7.31E-11	7.31E-11	9.31E-11
Co57	4.55E-17	6.99E-13	6.99E-13	8.90E-13
Sr89	3.65E-09	4.05E-06	4.05E-06	5.16E-06
Sr90	6.21E-11	9.53E-07	9.53E-07	1.21E-06
Sr91	1.26E-14	1.96E-10	1.96E-10	2.49E-10
Sr92	1.63E-25	2.54E-21	2.54E-21	3.23E-21
Y90	5.06E-11	7.75E-07	7.75E-07	9.87E-07
Y91m	8.01E-15	1.25E-10	1.25E-10	1.59E-10
Y91	3.80E-11	5.84E-07	5.84E-07	7.44E-07
Y92	2.79E-21	4.35E-17	4.35E-17	5.53E-17
Y93	4.44E-15	6.91E-11	6.91E-11	8.80E-11
Zr97	2.08E-13	3.23E-09	3.24E-09	4.12E-09
Nb95	1.20E-08	2.36E-05	2.36E-05	3.01E-05
Mo99	2.06E-08	3.18E-04	3.18E-04	4.05E-04
Tc99m	1.99E-08	3.07E-04	3.07E-04	3.91E-04
Tc99	2.32E-12	3.56E-08	3.56E-08	4.53E-08
Ru103	7.03E-11	1.08E-06	1.08E-06	1.38E-06
Ru105	4.09E-20	6.38E-16	6.38E-16	8.12E-16
Ru106	4.97E-11	7.63E-07	7.63E-07	9.71E-07
Rh103m	6.95E-11	1.07E-06	1.07E-06	1.36E-06
Rh105	4.51E-12	6.98E-08	6.98E-08	8.89E-08
Rh106	4.97E-11	7.63E-07	7.63E-07	9.71E-07
Ag110	1.71E-12	3.36E-09	3.36E-09	4.28E-09
Sb124	3.36E-17	2.32E-10	2.32E-10	2.95E-10
Sb125	3.14E-16	2.17E-09	2.17E-09	2.76E-09
Sb127	5.14E-16	3.56E-09	3.56E-09	4.53E-09
Sb129	2.24E-24	1.57E-17	1.57E-17	2.00E-17
Te125m	1.38E-10	2.12E-06	2.12E-06	2.70E-06
Te127m	4.59E-10	7.05E-06	7.05E-06	8.97E-06
Te127	4.50E-10	6.91E-06	6.91E-06	8.80E-06

Table 11.2-5: Estimated Annual Releases to Liquid Radioactive Waste System Discharge Header (Continued)

Nuclide	LRWS LCW Sample Tank Release (Ci/yr)	LRWS HCW Sample Tank Release (Ci/yr)	Plant Liquid Release without AOO Adjustment (Ci/yr)	Total Liquid Release with AOO Adjustment (Ci/yr)
Te129m	1.22E-09	1.87E-05	1.87E-05	2.38E-05
Te129	7.68E-10	1.18E-05	1.18E-05	1.50E-05
Te131m	2.21E-10	3.42E-06	3.42E-06	4.35E-06
Te131	4.97E-11	7.70E-07	7.70E-07	9.80E-07
Te132	1.00E-08	1.55E-04	1.55E-04	1.97E-04
Ba137m	2.24E-04	7.38E-03	7.60E-03	9.68E-03
Ba140	2.97E-10	4.57E-06	4.57E-06	5.82E-06
La140	3.06E-10	4.69E-06	4.69E-06	5.97E-06
La141	2.50E-21	3.89E-17	3.89E-17	4.95E-17
Ce141	5.49E-11	8.42E-07	8.42E-07	1.07E-06
Ce143	3.04E-12	4.71E-08	4.71E-08	6.00E-08
Ce144	5.10E-11	7.82E-07	7.82E-07	9.96E-07
Pr143	4.51E-11	6.93E-07	6.93E-07	8.82E-07
Pr144	5.05E-11	7.75E-07	7.75E-07	9.86E-07
Np239	1.98E-10	3.06E-06	3.06E-06	3.90E-06
Na24	2.50E-09	3.88E-05	3.88E-05	4.94E-05
Cr51	3.26E-09	6.50E-06	6.51E-06	8.28E-06
Mn54	4.72E-09	9.26E-06	9.26E-06	1.18E-05
Fe55	3.82E-07	7.49E-04	7.50E-04	9.55E-04
Fe59	8.62E-08	1.71E-04	1.71E-04	2.17E-04
Co58	9.88E-07	1.20E-03	1.20E-03	1.53E-03
Co60	2.53E-08	4.95E-05	4.95E-05	6.30E-05
Ni63	8.47E-08	1.66E-04	1.66E-04	2.11E-04
Zn65	1.60E-07	3.14E-04	3.14E-04	4.00E-04
Zr95	1.16E-07	2.29E-04	2.29E-04	2.91E-04
Ag110m	1.26E-10	2.47E-07	2.47E-07	3.14E-07
W187	6.44E-09	2.41E-05	2.41E-05	3.07E-05
H3	8.35E+02	2.78E+02	1.11E+03	1.11E+03
C14	2.59E-01	3.37E-02	2.92E-01	3.72E-01
Total	8.35E+02	2.78E+02	1.11E+03	1.11E+03

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Table 11.2-8: Liquid Release Concentration Compared to 10 CFR 20 Appendix B Limits-

Nuclide	Discharge Concentration ($\mu\text{Ci/ml}$)	Concentration Limit ($\mu\text{Ci/ml}$)	Fraction of Limit
Br82	2.33E-12	4.00E-05	5.84E-08
Br83	1.15E-11	9.00E-04	1.27E-08
Br84	5.10E-12	4.00E-04	1.27E-08
Br85	6.07E-13	-	-
H29	6.03E-17	2.00E-07	3.01E-10
H30	1.80E-11	2.00E-05	8.98E-07
H31	4.71E-09	1.00E-06	4.71E-03
H32	1.99E-10	1.00E-04	1.99E-06
H33	7.16E-10	7.00E-06	1.02E-04
H34	1.09E-10	4.00E-04	2.72E-07
H35	4.18E-10	3.00E-05	1.39E-05
Rb86m	1.04E-15	-	-
Rb86	7.92E-12	7.00E-06	1.13E-06
Rb88	1.06E-09	4.00E-04	2.64E-06
Rb89	4.85E-11	9.00E-04	5.39E-08
Cs132	1.50E-13	4.00E-05	3.76E-09
Cs134	3.00E-08	9.00E-07	3.34E-02
Cs135m	8.18E-13	1.00E-03	8.18E-10
Cs136	1.25E-09	6.00E-06	2.09E-04
Cs137	4.25E-08	1.00E-06	4.25E-02
Cs138	3.90E-10	4.00E-04	9.75E-07
P32	4.69E-10	2.00E-09	2.35E-01
Co57	4.64E-19	6.00E-05	7.73E-15
Ni63	4.47E-09	1.00E-04	4.47E-05
Sr89	2.30E-10	8.00E-06	2.87E-05
Sr90	3.40E-11	5.00E-07	6.80E-05
Sr91	2.06E-13	2.00E-05	1.03E-08
Sr92	1.03E-13	4.00E-05	2.58E-09
Y90	2.63E-14	7.00E-06	3.76E-09
Y91m	1.12E-13	2.00E-03	5.62E-11
Y91	2.19E-10	8.00E-06	2.74E-05
Y92	9.35E-14	4.00E-05	2.34E-09
Y93	4.72E-14	2.00E-05	2.36E-09
Zr95	2.91E-09	2.00E-05	1.45E-04
Zr97	6.70E-14	9.00E-06	7.45E-09
Nb95	4.95E-09	3.00E-05	1.65E-04
Mo99	2.83E-10	2.00E-05	1.41E-05
Mo101	3.82E-12	7.00E-04	5.46E-09
Tc99m	1.18E-10	1.00E-03	1.18E-07
Ru103	7.56E-10	3.00E-05	2.52E-05
Ru105	1.23E-12	7.00E-05	1.75E-08
Ru106	2.32E-08	3.00E-06	7.73E-03
Rh103m	1.23E-13	6.00E-03	2.05E-11
Rh105	3.17E-13	5.00E-05	6.35E-09

Table 11.2-8: Liquid Release Concentration Compared to 10 CFR 20 Appendix B Limits (Continued)

Nuclide	Discharge Concentration ($\mu\text{Ci}/\text{ml}$)	Concentration Limit ($\mu\text{Ci}/\text{ml}$)	Fraction of Limit
Rh106	8.06E-14	1.00E-08	8.06E-06
Ag110m	3.13E-09	6.00E-06	5.21E-04
Sb124	1.12E-09	7.00E-06	1.60E-04
Sb125	2.27E-16	3.00E-05	7.58E-12
Sb127	9.67E-16	1.00E-05	9.67E-11
Sb129	1.03E-15	4.00E-05	2.57E-11
Te125m	2.37E-13	2.00E-05	1.18E-08
Te127m	7.63E-13	9.00E-06	8.48E-08
Te127	2.78E-12	1.00E-04	2.78E-08
Te129m	2.18E-12	7.00E-06	3.12E-07
Te129	2.74E-12	4.00E-04	6.86E-09
Te131m	6.79E-12	8.00E-06	8.48E-07
Te131	3.02E-12	8.00E-05	3.78E-08
Te132	5.09E-11	9.00E-06	5.66E-06
Te133m	3.53E-12	9.00E-05	3.92E-08
Te134	4.99E-12	3.00E-04	1.66E-08
Ba137m	3.47E-10	-	-
Ba139	1.33E-11	2.00E-04	6.67E-08
Ba140	2.37E-09	8.00E-06	2.97E-04
La140	2.11E-13	9.00E-06	2.34E-08
La141	4.51E-14	5.00E-05	9.02E-10
La142	2.37E-14	1.00E-04	2.37E-10
Ce141	5.99E-10	3.00E-05	2.00E-05
Ce143	7.17E-14	2.00E-05	3.59E-09
Ce144	1.02E-08	3.00E-06	3.39E-03
Pr143	8.77E-14	2.00E-05	4.39E-09
Pr144	8.30E-14	6.00E-04	1.38E-10
Np239	1.53E-12	2.00E-05	7.66E-08
Na24	5.93E-09	5.00E-05	1.19E-04
Cr51	1.22E-08	5.00E-04	2.45E-05
Mn54	9.90E-09	3.00E-05	3.30E-04
Fe55	1.89E-08	1.00E-04	1.89E-04
Fe59	5.77E-09	1.00E-05	5.77E-04
Co58	2.08E-08	2.00E-05	1.04E-03
Co60	3.65E-08	3.00E-06	1.22E-02
W187	2.86E-10	3.00E-05	9.55E-06
Zn65	7.03E-11	5.00E-06	1.41E-05
H3	3.12E-04	1.00E-03	3.12E-01
C14	1.74E-11	3.00E-05	5.79E-07
N16	0.00E+00	2.00E-09	0.00E+00
		SUM=	6.55E-01

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Table 11.2-8: Liquid Release Concentrations Compared to 10 CFR 20 Appendix B Limits

Nuclide	Discharge Concentration ($\mu\text{Ci/ml}$)	Concentration Limit ($\mu\text{Ci/ml}$)	Fraction of Limit
Br82	4.97E-13	4.00E-05	1.24E-08
I129	1.57E-16	2.00E-07	7.83E-10
I130	3.56E-14	2.00E-05	1.78E-09
I131	9.06E-10	1.00E-06	9.06E-04
I132	4.25E-11	1.00E-04	4.25E-07
I133	2.66E-11	7.00E-06	3.80E-06
I135	1.44E-15	3.00E-05	4.79E-11
Rb86	1.66E-11	7.00E-06	2.37E-06
Cs132	2.20E-13	4.00E-05	5.49E-09
Cs134	3.49E-09	9.00E-07	3.87E-03
Cs136	5.59E-10	6.00E-06	9.32E-05
Cs137	2.15E-09	1.00E-06	2.15E-03
Co57	1.86E-19	6.00E-05	3.11E-15
Sr89	1.08E-12	8.00E-06	1.35E-07
Sr90	2.54E-13	5.00E-07	5.08E-07
Sr91	5.22E-17	2.00E-05	2.61E-12
Y90	2.07E-13	7.00E-06	2.95E-08
Y91m	3.33E-17	2.00E-03	1.66E-14
Y91	1.56E-13	8.00E-06	1.95E-08
Y92	1.16E-23	4.00E-05	2.90E-19
Y93	1.84E-17	2.00E-05	9.21E-13
Zr97	8.63E-16	9.00E-06	9.59E-11
Nb95	6.30E-12	3.00E-05	2.10E-07
Mo99	8.48E-11	2.00E-05	4.24E-06
Tc99m	8.19E-11	1.00E-03	8.19E-08
Tc99	9.49E-15	6.00E-05	1.58E-10
Ru103	2.88E-13	3.00E-05	9.60E-09
Ru105	1.70E-22	7.00E-05	2.43E-18
Ru106	2.03E-13	3.00E-06	6.78E-08
Rh103m	2.85E-13	6.00E-03	4.75E-11
Rh105	1.86E-14	5.00E-05	3.72E-10
Sb124	6.18E-17	7.00E-06	8.83E-12
Sb125	5.77E-16	3.00E-05	1.92E-11
Sb127	9.50E-16	1.00E-05	9.50E-11
Sb129	4.20E-24	4.00E-05	1.05E-19
Te125m	5.66E-13	2.00E-05	2.83E-08
Te127m	1.88E-12	9.00E-06	2.09E-07
Te127	1.84E-12	1.00E-04	1.84E-08
Te129m	4.99E-12	7.00E-06	7.13E-07
Te129	3.15E-12	4.00E-04	7.87E-09
Te131m	9.12E-13	8.00E-06	1.14E-07
Te131	2.05E-13	8.00E-05	2.57E-09
Te132	4.13E-11	9.00E-06	4.58E-06
Ba140	1.22E-12	8.00E-06	1.52E-07

Table 11.2-8: Liquid Release Concentrations Compared to 10 CFR 20 Appendix B Limits (Continued)

Nuclide	Discharge Concentration ($\mu\text{Ci}/\text{ml}$)	Concentration Limit ($\mu\text{Ci}/\text{ml}$)	Fraction of Limit
La140	1.25E-12	9.00E-06	1.39E-07
La141	1.04E-23	5.00E-05	2.07E-19
Ce141	2.25E-13	3.00E-05	7.49E-09
Ce143	1.26E-14	2.00E-05	6.28E-10
Ce144	2.09E-13	3.00E-06	6.95E-08
Pr143	1.85E-13	2.00E-05	9.24E-09
Pr144	2.07E-13	6.00E-04	3.44E-10
Np239	8.17E-13	2.00E-05	4.08E-08
Na24	1.04E-11	5.00E-05	2.07E-07
Cr51	1.74E-12	5.00E-04	3.47E-09
Mn54	2.47E-12	3.00E-05	8.23E-08
Fe55	2.00E-10	1.00E-04	2.00E-06
Fe59	4.55E-11	1.00E-05	4.55E-06
Co58	3.20E-10	2.00E-05	1.60E-05
Co60	1.32E-11	3.00E-06	4.40E-06
Ni63	4.43E-11	1.00E-04	4.43E-07
Zn65	8.38E-11	5.00E-06	1.68E-05
Zr95	6.10E-11	2.00E-05	3.05E-06
Ag110m	6.59E-14	6.00E-06	1.10E-08
W187	6.44E-12	3.00E-05	2.15E-07
H3	2.33E-04	1.00E-03	2.33E-01
C14	7.80E-08	3.00E-05	2.60E-03
Total	2.33E-04	=	2.43E-01

RAI 02.03.01-2, RAI 02.03.05-1, RAI 12.02-4

Table 11.3-5: Gaseous Estimated Discharge for Normal Effluents

Nuclide	GRWS (Ci/yr)	Pool- Evaporatio n (Ci/yr)	AOO-Gas- Leakage (Ci/yr)	Primary- Coolant- Leaks (Ci/yr)	Plant- Exhaust- Stack Total (Ci/yr)	Secondary- Steam- Leaks (Ci/yr)	Condenser- Air- Removal- System (Ci/yr)	Total TGB- Releases (Ci/yr)	Total Plant- Gaseous- Releases (Ci/yr)	Total- Gaseous- Effluent- Concentrat ion at Site -Boundary (μ Ci/ml)	10-CFR-20- Appendix B Limits (μ Ci/ml)	Fraction of Limit
Kr83m	4.60E-09	5.93E-11	2.46E-05	2.76E-03	2.79E-03	1.93E-07	1.29E-03	1.30E-03	4.08E-03	7.02E-15	5.00E-05	1.40E-10
Kr85m	5.97E-04	7.35E-10	1.02E-04	1.15E-02	1.22E-02	8.06E-07	5.40E-03	5.40E-03	1.76E-02	3.03E-14	1.00E-07	3.03E-07
Kr85	2.50E+02	3.01E+00	3.19E-02	3.59E+00	2.57E+02	2.51E-04	1.68E+00	1.68E+00	2.58E+02	4.44E-10	7.00E-07	6.35E-04
Kr87	4.17E-12	—	5.59E-05	6.29E-03	6.34E-03	4.40E-07	2.95E-03	2.95E-03	9.29E-03	1.60E-14	2.00E-08	7.99E-07
Kr88	1.48E-05	1.03E-12	1.63E-04	1.83E-02	1.85E-02	1.28E-06	8.58E-03	8.59E-03	2.71E-02	4.66E-14	9.00E-09	5.18E-06
Kr89	—	0.00E+00	3.72E-06	4.18E-04	4.22E-04	2.93E-08	1.96E-04	1.96E-04	6.18E-04	1.06E-15	1.00E-09	1.06E-06
Xe131m	2.18E-01	1.31E-02	3.95E-04	4.44E-02	2.76E-01	3.11E-06	2.08E-02	2.08E-02	2.97E-01	5.11E-13	2.00E-06	2.55E-07
Xe133m	1.69E-06	1.49E-03	3.62E-04	4.07E-02	4.26E-02	2.85E-06	1.91E-02	1.91E-02	6.17E-02	1.06E-13	6.00E-07	1.77E-07
Xe133	5.40E-01	3.32E-01	2.70E-02	3.03E+00	3.93E+00	2.12E-04	1.42E+00	1.42E+00	5.35E+00	9.20E-12	5.00E-07	1.84E-05
Xe135m	0.00E+00	1.28E-09	3.75E-05	4.21E-03	4.25E-03	2.95E-07	1.97E-03	1.97E-03	6.22E-03	1.07E-14	4.00E-08	2.68E-07
Xe135	4.17E-15	6.80E-06	9.26E-04	1.04E-01	1.05E-01	7.28E-06	4.88E-02	4.88E-02	1.54E-01	2.65E-13	7.00E-08	3.78E-06
Xe137	0.00E+00	0.00E+00	1.20E-05	1.34E-03	1.35E-03	9.40E-08	6.30E-04	6.30E-04	1.98E-03	3.41E-15	1.00E-09	3.41E-06
Xe138	0.00E+00	0.00E+00	4.09E-05	4.60E-03	4.64E-03	3.22E-07	2.16E-03	2.16E-03	6.79E-03	1.17E-14	2.00E-08	5.84E-07
Br82	3.27E-09	1.72E-09	—	3.76E-07	3.81E-07	6.62E-09	1.67E-09	8.29E-09	3.89E-07	6.70E-19	5.00E-09	1.34E-10
Br83	1.61E-08	1.43E-18	—	1.85E-06	1.86E-06	3.14E-08	7.91E-09	3.93E-08	1.90E-06	3.27E-18	9.00E-08	3.64E-11
Br84	7.15E-09	—	—	8.21E-07	8.28E-07	1.23E-08	3.10E-09	1.54E-08	8.44E-07	1.45E-18	8.00E-08	1.81E-11
Br85	8.51E-10	0.00E+00	—	9.77E-08	9.86E-08	5.88E-10	1.48E-10	7.36E-10	9.93E-08	1.71E-19	1.00E-09	1.71E-10
H29	8.45E-14	1.78E-13	—	9.70E-12	9.96E-12	1.71E-13	4.31E-14	2.15E-13	1.02E-11	1.75E-23	4.00E-11	4.38E-13
H30	2.52E-08	1.60E-11	—	2.89E-06	2.92E-06	5.07E-08	1.28E-08	6.35E-08	2.98E-06	5.13E-18	3.00E-09	1.71E-09
H31	7.03E-07	3.09E-05	—	8.07E-05	1.12E-04	1.43E-06	3.59E-07	1.78E-06	1.14E-04	1.96E-16	2.00E-10	9.81E-07
H32	2.80E-07	2.74E-08	—	3.21E-05	3.24E-05	5.45E-07	1.37E-07	6.82E-07	3.31E-05	5.69E-17	2.00E-08	2.84E-09
H33	1.00E-06	3.41E-07	—	1.15E-04	1.16E-04	2.02E-06	5.08E-07	2.53E-06	1.19E-04	2.04E-16	1.00E-09	2.04E-07
H34	1.53E-07	—	—	1.75E-05	1.77E-05	2.80E-07	7.04E-08	3.50E-07	1.80E-05	3.10E-17	6.00E-08	5.17E-10
H35	5.87E-07	5.19E-12	—	6.74E-05	6.80E-05	1.17E-06	2.95E-07	1.47E-06	6.94E-05	1.19E-16	6.00E-09	1.99E-08
Rb86m	—	0.00E+00	—	3.62E-13	3.62E-13	1.99E-13	—	1.99E-13	5.61E-13	9.647E-25	1.00E-09	9.65E-16
Rb86	—	1.11E-09	—	2.75E-09	3.86E-09	1.07E-08	—	1.07E-08	1.46E-08	2.505E-20	1.00E-09	2.50E-11

Table 11.3-5: Gaseous Estimated Discharge for Normal Effluents (Continued)

Nuclide	GRWS (Ci/yr)	Pool- Evaporatio n (Ci/yr)	AOO-Gas- Leakage (Ci/yr)	Primary- Coolant- Leaks (Ci/yr)	Plant- Exhaust- Stack-Total (Ci/yr)	Secondary- Steam- Leaks (Ci/yr)	Condenser- Air- Removal- System (Ci/yr)	Total TGB- Releases (Ci/yr)	Total Plant- Gaseous- Releases (Ci/yr)	Total- Gaseous- Effluent- Concentrat ion-at-Site- Boundary (μ Ci/ml)	10 CFR 20- Appendix B- Limits (μ Ci/ml)	Fraction of Limit
Rb88	—	7.23E-15	—	3.68E-07	3.68E-07	1.06E-06	—	1.06E-06	1.43E-06	2.458E-18	9.00E-08	2.73E-11
Rb89	—	—	—	1.69E-08	1.69E-08	4.66E-08	—	4.66E-08	6.35E-08	1.092E-19	2.00E-07	5.46E-13
Cs132	—	7.28E-12	—	5.23E-11	5.95E-11	2.03E-10	—	2.03E-10	2.63E-10	4.518E-22	6.00E-09	7.53E-14
Cs134	—	4.08E-07	—	4.79E-07	8.87E-07	1.86E-06	—	1.86E-06	2.75E-06	4.727E-18	2.00E-10	2.36E-08
Cs135m	—	—	—	2.85E-10	2.85E-10	9.91E-10	—	9.91E-10	1.28E-09	2.195E-21	3.00E-07	7.32E-15
Cs136	—	3.06E-08	—	1.00E-07	1.31E-07	3.90E-07	—	3.90E-07	5.21E-07	8.959E-19	9.00E-10	9.95E-10
Cs137	—	2.55E-07	—	2.93E-07	5.49E-07	1.14E-06	—	1.14E-06	1.69E-06	2.907E-18	2.00E-10	1.45E-08
Cs138	—	—	—	1.36E-07	1.36E-07	4.45E-07	—	4.45E-07	5.81E-07	9.996E-19	8.00E-08	1.25E-11
P32	—	6.91E-15	—	4.92E-14	5.62E-14	1.74E-13	—	1.74E-13	2.30E-13	3.960E-25	1.00E-15	3.96E-10
Co57	—	1.30E-16	—	3.69E-16	4.99E-16	1.30E-15	—	1.30E-15	1.80E-15	3.104E-27	9.00E-10	3.45E-18
Ni63	—	5.62E-06	—	1.51E-08	5.64E-06	5.33E-08	—	5.33E-08	5.69E-06	9.796E-18	1.00E-09	9.80E-09
Sr89	—	9.85E-11	—	3.53E-10	4.52E-10	1.25E-09	—	1.25E-09	1.70E-09	2.926E-21	2.00E-10	1.46E-11
Sr90	—	2.96E-11	—	7.95E-11	1.09E-10	2.81E-10	—	2.81E-10	3.90E-10	6.713E-22	6.00E-12	1.12E-10
Sr91	—	4.47E-15	—	1.64E-10	1.64E-10	5.74E-10	—	5.74E-10	7.38E-10	1.270E-21	5.00E-09	2.54E-13
Sr92	—	—	—	8.23E-11	8.23E-11	2.81E-10	—	2.81E-10	3.64E-10	6.256E-22	9.00E-09	6.95E-14
Y90	—	2.87E-11	—	2.09E-11	4.96E-11	7.38E-11	—	7.38E-11	1.23E-10	2.124E-22	9.00E-10	2.36E-13
Y91m	—	2.84E-15	—	8.96E-11	8.97E-11	2.85E-10	—	2.85E-10	3.74E-10	6.441E-22	2.00E-07	3.22E-15
Y91	—	1.49E-11	—	5.14E-11	6.63E-11	1.82E-10	—	1.82E-10	2.48E-10	4.265E-22	2.00E-10	2.13E-12
Y92	—	3.70E-19	—	7.46E-11	7.46E-11	2.57E-10	—	2.57E-10	3.31E-10	5.700E-22	1.00E-08	5.70E-14
Y93	—	1.45E-15	—	3.77E-11	3.77E-11	1.32E-10	—	1.32E-10	1.70E-10	2.917E-22	3.00E-09	9.72E-14
Zr95	—	5.10E-06	—	1.74E-08	5.12E-06	6.14E-08	—	6.14E-08	5.18E-06	8.913E-18	4.00E-10	2.23E-08
Zr97	—	2.50E-14	—	5.34E-11	5.34E-11	1.88E-10	—	1.88E-10	2.41E-10	4.151E-22	2.00E-09	2.08E-13
Nb95	—	1.92E-06	—	2.51E-10	1.92E-06	8.86E-10	—	8.86E-10	1.92E-06	3.312E-18	2.00E-09	1.66E-09
Mo99	—	1.69E-09	—	1.01E-07	1.03E-07	3.56E-07	—	3.56E-07	4.59E-07	7.890E-19	2.00E-09	3.94E-10
Mo101	—	0.00E+00	—	3.05E-09	3.05E-09	7.78E-09	—	7.78E-09	1.08E-08	1.863E-20	2.00E-07	9.31E-14
Tc99m	—	1.63E-09	—	9.38E-08	9.54E-08	3.26E-07	—	3.26E-07	4.22E-07	7.256E-19	2.00E-07	3.63E-12
Ru103	—	2.51E-11	—	9.88E-11	1.24E-10	3.49E-10	—	3.49E-10	4.73E-10	8.142E-22	9.00E-10	9.05E-13
Ru105	—	2.59E-17	—	9.78E-10	9.78E-10	3.39E-09	—	3.39E-09	4.36E-09	7.508E-21	2.00E-08	3.75E-13

Table 11.3-5: Gaseous Estimated Discharge for Normal Effluents (Continued)

Nuclide	GRWS (Ci/yr)	Pool- Evaporatio n (Ci/yr)	AOO-Gas- Leakage (Ci/yr)	Primary- Coolant- Leaks (Ci/yr)	Plant- Exhaust- Stack-Total (Ci/yr)	Secondary- Steam- Leaks (Ci/yr)	Condenser- Air- Removal- System (Ci/yr)	Total TGB- Releases (Ci/yr)	Total Plant- Gaseous- Releases (Ci/yr)	Total- Gaseous- Effluent- Concentrat ion-at-Site- Boundary (μ Ci/ml)	10 CFR 20- Appendix B- Limits (μ Ci/ml)	Fraction of Limit
Ru106	—	2.30E-11	—	6.42E-11	8.72E-11	2.27E-10	—	2.27E-10	3.14E-10	5.405E-22	2.00E-11	2.70E-11
Rh103m	—	2.48E-11	—	9.77E-11	1.23E-10	3.14E-10	—	3.14E-10	4.36E-10	7.510E-22	2.00E-06	3.76E-16
Rh105	—	1.84E-12	—	2.53E-10	2.55E-10	8.91E-10	—	8.91E-10	1.15E-09	1.972E-21	8.00E-09	2.46E-13
Rh106	—	2.30E-11	—	6.42E-11	8.72E-11	1.85E-11	—	1.85E-11	1.06E-10	1.818E-22	1.00E-12	1.82E-10
Ag110m	—	2.63E-05	—	7.51E-08	2.64E-05	2.65E-07	—	2.65E-07	2.67E-05	4.590E-17	1.00E-10	4.59E-07
Sb124	—	4.22E-14	—	1.46E-13	1.88E-13	5.15E-13	—	5.15E-13	7.03E-13	1.210E-24	3.00E-10	4.03E-15
Sb125	—	4.73E-13	—	1.29E-12	1.76E-12	4.55E-12	—	4.55E-12	6.30E-12	1.085E-23	7.00E-10	1.55E-14
Sb127	—	1.58E-13	—	5.47E-12	5.62E-12	1.93E-11	—	1.93E-11	2.49E-11	4.289E-23	1.00E-09	4.29E-14
Sb129	—	1.32E-19	—	5.83E-12	5.83E-12	2.02E-11	—	2.02E-11	2.60E-11	4.472E-23	1.00E-08	4.47E-15
Te125m	—	5.39E-11	—	1.89E-10	2.43E-10	6.66E-10	—	6.66E-10	9.09E-10	1.564E-21	1.00E-09	1.56E-12
Te127m	—	1.97E-10	—	6.08E-10	8.04E-10	2.15E-09	—	2.15E-09	2.95E-09	5.078E-21	4.00E-10	1.27E-11
Te127	—	1.93E-10	—	2.21E-09	2.40E-09	7.74E-09	—	7.74E-09	1.01E-08	1.746E-20	2.00E-08	8.73E-13
Te129m	—	4.16E-10	—	1.74E-09	2.15E-09	6.14E-09	—	6.14E-09	8.30E-09	1.428E-20	3.00E-10	4.76E-11
Te129	—	2.62E-10	—	2.19E-09	2.45E-09	7.15E-09	—	7.15E-09	9.60E-09	1.652E-20	9.00E-08	1.84E-13
Te131m	—	1.66E-11	—	5.41E-09	5.43E-09	1.91E-08	—	1.91E-08	2.45E-08	4.213E-20	1.00E-09	4.21E-11
Te131	—	3.74E-12	—	2.41E-09	2.41E-09	6.95E-09	—	6.95E-09	9.37E-09	1.612E-20	2.00E-08	8.06E-13
Te132	—	8.77E-10	—	4.05E-08	4.14E-08	1.43E-07	—	1.43E-07	1.85E-07	3.175E-19	9.00E-10	3.53E-10
Te133m	—	—	—	2.81E-09	2.81E-09	9.03E-09	—	9.03E-09	1.18E-08	2.038E-20	2.00E-08	1.02E-12
Te134	—	—	—	3.98E-09	3.98E-09	1.24E-08	—	1.24E-08	1.64E-08	2.819E-20	7.00E-08	4.03E-13
Ba137m	—	2.41E-07	—	2.76E-07	5.17E-07	3.05E-07	—	3.05E-07	8.21E-07	1.413E-18	1.00E-09	1.41E-09
Ba139	—	—	—	1.06E-08	1.06E-08	3.52E-08	—	3.52E-08	4.59E-08	7.892E-20	4.00E-08	1.97E-12
Ba140	—	6.86E-11	—	5.40E-10	6.08E-10	1.91E-09	—	1.91E-09	2.51E-09	4.326E-21	2.00E-09	2.16E-12
La140	—	7.61E-11	—	1.68E-10	2.44E-10	5.91E-10	—	5.91E-10	8.35E-10	1.437E-21	2.00E-09	7.18E-13
La141	—	1.82E-19	—	3.60E-11	3.60E-11	1.24E-10	—	1.24E-10	1.60E-10	2.754E-22	1.00E-08	2.75E-14
La142	—	—	—	1.89E-11	1.89E-11	6.29E-11	—	6.29E-11	8.18E-11	1.408E-22	3.00E-08	4.69E-15
Ce141	—	1.86E-11	—	7.86E-11	9.72E-11	2.78E-10	—	2.78E-10	3.75E-10	6.450E-22	8.00E-10	8.06E-13
Ce143	—	2.26E-13	—	5.72E-11	5.74E-11	2.01E-10	—	2.01E-10	2.59E-10	4.453E-22	2.00E-09	2.23E-13
Ce144	—	2.33E-11	—	6.61E-11	8.94E-11	2.33E-10	—	2.33E-10	3.23E-10	5.555E-22	2.00E-11	2.78E-11

Table 11.3-5: Gaseous Estimated Discharge for Normal Effluents (Continued)

Nuclide	GRWS (Ci/yr)	Pool- Evaporatio n (Ci/yr)	AOO-Gas- Leakage (Ci/yr)	Primary- Coolant- Leaks (Ci/yr)	Plant- Exhaust- Stack-Total (Ci/yr)	Secondary- Steam- Leaks (Ci/yr)	Condenser- Air- Removal- System (Ci/yr)	Total TGB- Releases (Ci/yr)	Total Plant- Gaseous- Releases (Ci/yr)	Total- Gaseous- Effluent- Concentrat ion-at-Site- Boundary (μ Ci/ml)	10 CFR 20- Appendix B- Limits (μ Ci/ml)	Fraction of Limit
Pr143	—	1.02E-11	—	6.99E-11	8.01E-11	2.47E-10	—	2.47E-10	3.27E-10	5.624E-22	9.00E-10	6.25E-13
Pr144	—	2.31E-11	—	6.61E-11	8.92E-11	1.76E-10	—	1.76E-10	2.65E-10	4.567E-22	2.00E-07	2.28E-15
Np239	—	1.55E-11	—	1.22E-09	1.24E-09	4.31E-09	—	4.31E-09	5.54E-09	9.538E-21	3.00E-09	3.18E-12
Na24	—	1.28E-06	—	4.58E-06	5.86E-06	1.61E-05	—	1.61E-05	2.19E-05	3.774E-17	7.00E-09	5.39E-09
Cr51	—	3.92E-05	—	1.79E-07	3.94E-05	6.33E-07	—	6.33E-07	4.00E-05	6.881E-17	3.00E-08	2.29E-09
Mn54	—	3.24E-05	—	9.13E-08	3.25E-05	3.22E-07	—	3.22E-07	3.28E-05	5.645E-17	1.00E-09	5.64E-08
Fe55	—	2.51E-05	—	6.82E-08	2.51E-05	2.41E-07	—	2.41E-07	2.54E-05	4.365E-17	3.00E-09	1.46E-08
Fe59	—	4.58E-06	—	1.72E-08	4.59E-06	6.09E-08	—	6.09E-08	4.65E-06	8.007E-18	5.00E-10	1.60E-08
Co58	—	7.91E-04	—	2.63E-07	7.91E-04	9.30E-07	—	9.30E-07	7.92E-04	1.363E-15	1.00E-09	1.36E-06
Co60	—	1.12E-05	—	3.02E-08	1.12E-05	1.07E-07	—	1.07E-07	1.13E-05	1.948E-17	5.00E-11	3.90E-07
W187	—	3.19E-07	—	2.06E-07	5.25E-07	7.24E-07	—	7.24E-07	1.25E-06	2.148E-18	1.00E-08	2.15E-10
Zn65	—	1.02E-05	—	2.91E-08	1.02E-05	1.03E-07	—	1.03E-07	1.03E-05	1.775E-17	4.00E-10	4.44E-08
H3	—	7.25E+02	—	5.80E+00	7.31E+02	6.76E+00	—	6.76E+00	7.37E+02	1.269E-09	1.00E-07	1.27E-02
C14	—	5.16E-07	—	1.38E-06	1.90E-06	4.88E-08	—	4.88E-08	1.95E-06	3.350E-18	3.00E-09	1.12E-09
N16	—	0.00E+00	—	0.00E+00	0.00E+00	0.00E+00	—	0.00E+00	0.00E+00	0.000E+00	1.00E-15	0.00E+00
Ar41	1.01E+01	0.00E+00	4.29E-17	1.99E+00	1.21E+01	2.74E-03	9.34E-01	9.36E-01	1.30E+01	2.238E-11	1.00E-08	2.24E-03
Total	2.61E+02	7.28E+02	6.10E-02	1.47E+01	1.00E+03	6.77E+00	4.15E+00	1.09E+01	1.01E+03	1.75E-09	5.84E-05	1.56E-02

Note: The X/Q that was used to calculate the site boundary concentrations is provided in Table 11.3-7.

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Table 11.3-5: Gaseous Estimated Discharge for Normal Effluents

Nuclide	GRWS (Ci/yr)	Pool Evaporation (Ci/yr)	AOO Gas Leakage (Ci/yr)	Primary Coolant Leaks (Ci/yr)	Plant Exhaust Stack Total (Ci/yr)	Secondary Steam Leaks (Ci/yr)	Condenser Air Removal System (Ci/yr)	Total TGB Releases (Ci/yr)	Total Gaseous Effluent Concentration at Site Boundary (μ Ci/ml)	10 CFR 20 Appendix B Limits (μ Ci/ml)	Fraction of Limit
Kr83m	6.94E-07	7.52E-06	5.73E-05	7.35E-03	7.41E-03	5.18E-07	3.44E-03	3.44E-03	4.95E-15	5.00E-05	9.91E-11
Kr85m	2.10E-03	-	2.41E-04	3.09E-02	3.33E-02	2.18E-06	1.45E-02	1.45E-02	2.18E-14	1.00E-07	2.18E-07
Kr85	2.11E+02	-	2.09E-02	2.68E+00	2.14E+02	1.89E-04	1.26E+00	1.26E+00	9.83E-11	7.00E-07	1.40E-04
Kr87	2.14E-11	-	1.32E-04	1.69E-02	1.70E-02	1.19E-06	7.92E-03	7.92E-03	1.14E-14	2.00E-08	5.69E-07
Kr88	5.69E-05	-	3.84E-04	4.92E-02	4.96E-02	3.47E-06	2.31E-02	2.31E-02	3.32E-14	9.00E-09	3.69E-06
Kr89	-	-	8.78E-06	1.13E-03	1.13E-03	7.93E-08	5.27E-04	5.27E-04	7.58E-16	-	-
Xe131m	6.29E-01	8.02E-01	8.69E-04	1.11E-01	1.54E+00	7.84E-06	5.22E-02	5.22E-02	7.28E-13	2.00E-06	3.64E-07
Xe133m	5.92E-06	1.29E+00	8.40E-04	1.08E-01	1.40E+00	7.58E-06	5.04E-02	5.05E-02	6.60E-13	6.00E-07	1.10E-06
Xe133	1.66E+00	1.82E+01	6.15E-02	7.88E+00	2.78E+01	5.55E-04	3.69E+00	3.69E+00	1.44E-11	5.00E-07	2.88E-05
Xe135m	6.58E-05	3.64E-01	8.16E-05	1.05E-02	3.75E-01	7.37E-07	4.90E-03	4.90E-03	1.73E-13	4.00E-08	4.33E-06
Xe135	2.93E-05	2.02E-01	2.14E-03	2.74E-01	4.78E-01	1.93E-05	1.28E-01	1.28E-01	2.77E-13	7.00E-08	3.95E-06
Xe137	-	-	2.82E-05	3.61E-03	3.64E-03	2.54E-07	1.69E-03	1.69E-03	2.43E-15	-	-
Xe138	-	-	9.64E-05	1.24E-02	1.25E-02	8.71E-07	5.79E-03	5.79E-03	8.33E-15	2.00E-08	4.16E-07
Br82	8.68E-09	1.08E-08	-	8.15E-07	8.34E-07	1.45E-08	3.64E-09	1.81E-08	3.89E-19	5.00E-09	7.78E-11
Br83	4.97E-08	3.52E-13	-	4.67E-06	4.72E-06	8.05E-08	2.03E-08	1.01E-07	2.20E-18	9.00E-08	2.44E-11
Br84	2.31E-08	-	-	2.17E-06	2.19E-06	3.39E-08	8.53E-09	4.25E-08	1.02E-18	8.00E-08	1.28E-11
Br85	2.79E-09	-	-	2.62E-07	2.65E-07	1.85E-09	4.66E-10	2.32E-09	1.22E-19	-	-
I129	2.15E-13	6.46E-13	-	2.01E-11	2.10E-11	3.58E-13	9.01E-14	4.49E-13	9.79E-24	4.00E-11	2.45E-13
I130	7.01E-08	1.69E-08	-	6.58E-06	6.67E-06	1.16E-07	2.93E-08	1.46E-07	3.11E-18	3.00E-09	1.04E-09
I131	1.80E-06	4.61E-04	-	1.69E-04	6.32E-04	3.01E-06	7.57E-07	3.77E-06	2.90E-16	2.00E-10	1.45E-06
I132	8.23E-07	1.16E-06	-	7.72E-05	7.92E-05	1.33E-06	3.35E-07	1.67E-06	3.69E-17	2.00E-08	1.85E-09
I133	2.72E-06	5.48E-05	-	2.55E-04	3.13E-04	4.52E-06	1.14E-06	5.66E-06	1.45E-16	1.00E-09	1.45E-07
I134	4.84E-07	7.00E-22	-	4.54E-05	4.59E-05	7.46E-07	1.88E-07	9.33E-07	2.14E-17	6.00E-08	3.56E-10
I135	1.71E-06	4.49E-08	-	1.61E-04	1.62E-04	2.83E-06	7.11E-07	3.54E-06	7.57E-17	6.00E-09	1.26E-08
Rb86m	-	-	-	9.72E-13	9.72E-13	6.61E-13	-	6.61E-13	7.45E-25	-	-
Rb86	-	6.42E-09	-	5.75E-09	1.22E-08	2.25E-08	-	2.25E-08	1.58E-20	1.00E-09	1.58E-11
Rb88	-	-	-	9.83E-07	9.83E-07	3.02E-06	-	3.02E-06	1.83E-18	9.00E-08	2.03E-11

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Table 11.3-5: Gaseous Estimated Discharge for Normal Effluents (Continued)

Nuclide	GRWS (Ci/yr)	Pool Evaporation (Ci/yr)	AOO Gas Leakage (Ci/yr)	Primary Coolant Leaks (Ci/yr)	Plant Exhaust Stack Total (Ci/yr)	Secondary Steam Leaks (Ci/yr)	Condenser Air Removal System (Ci/yr)	Total TGB Releases (Ci/yr)	Total Gaseous Effluent Concentration at Site Boundary (μ Ci/ml)	10 CFR 20 Appendix B Limits (μ Ci/ml)	Fraction of Limit
Rb89	-	-	-	4.51E-08	4.51E-08	1.34E-07	-	1.34E-07	8.17E-20	2.00E-07	4.09E-13
Cs132	-	1.09E-10	-	1.11E-10	2.19E-10	4.34E-10	-	4.34E-10	2.98E-22	6.00E-09	4.97E-14
Cs134	-	1.19E-06	-	9.93E-07	2.18E-06	3.88E-06	-	3.88E-06	2.77E-18	2.00E-10	1.38E-08
Cs135m	-	5.12E-25	-	7.54E-10	7.54E-10	2.70E-09	-	2.70E-09	1.58E-21	3.00E-07	5.26E-15
Cs136	-	2.28E-07	-	2.10E-07	4.39E-07	8.23E-07	-	8.23E-07	5.76E-19	9.00E-10	6.40E-10
Cs137	-	7.28E-07	-	6.08E-07	1.34E-06	2.38E-06	-	2.38E-06	1.70E-18	2.00E-10	8.48E-09
Cs138	-	-	-	3.61E-07	3.61E-07	1.23E-06	-	1.23E-06	7.27E-19	8.00E-08	9.09E-12
P32	-	9.76E-15	-	1.65E-14	2.62E-14	5.85E-14	-	5.85E-14	-	5.00E-10	7.73E-17
Co57	-	7.93E-17	-	1.23E-16	2.02E-16	4.37E-16	-	4.37E-16	-	9.00E-10	3.24E-19
Sr89	-	4.71E-10	-	7.34E-10	1.20E-09	2.61E-09	-	2.61E-09	1.74E-21	2.00E-10	8.70E-12
Sr90	-	1.07E-10	-	1.65E-10	2.72E-10	5.87E-10	-	5.87E-10	3.92E-22	6.00E-12	6.53E-11
Sr91	-	9.74E-12	-	3.82E-10	3.91E-10	1.35E-09	-	1.35E-09	7.93E-22	5.00E-09	1.59E-13
Sr92	-	1.10E-15	-	2.04E-10	2.04E-10	7.07E-10	-	7.07E-10	4.15E-22	9.00E-09	4.62E-14
Y90	-	5.73E-11	-	4.00E-11	9.73E-11	1.42E-10	-	1.42E-10	1.09E-22	9.00E-10	1.21E-13
Y91m	-	6.21E-12	-	2.04E-10	2.11E-10	6.68E-10	-	6.68E-10	4.01E-22	2.00E-07	2.00E-15
Y91	-	6.85E-11	-	1.07E-10	1.75E-10	3.79E-10	-	3.79E-10	2.53E-22	2.00E-10	1.26E-12
Y92	-	7.45E-14	-	1.73E-10	1.73E-10	6.04E-10	-	6.04E-10	3.55E-22	1.00E-08	3.55E-14
Y93	-	2.47E-12	-	8.14E-11	8.39E-11	2.87E-10	-	2.87E-10	1.69E-22	3.00E-09	5.65E-14
Zr97	-	1.21E-11	-	1.20E-10	1.32E-10	4.25E-10	-	4.25E-10	2.54E-22	2.00E-09	1.27E-13
Nb95	-	4.52E-07	-	3.10E-10	4.53E-07	1.10E-09	-	1.10E-09	2.07E-19	2.00E-09	1.04E-10
Mo99	-	8.71E-08	-	2.15E-07	3.02E-07	7.65E-07	-	7.65E-07	4.87E-19	2.00E-09	2.43E-10
Mo101	-	-	-	8.13E-09	8.13E-09	2.22E-08	-	2.22E-08	1.38E-20	2.00E-07	6.92E-14
Tc99m	-	8.40E-08	-	1.99E-07	2.83E-07	7.00E-07	-	7.00E-07	4.49E-19	2.00E-07	2.24E-12
Tc99	-	4.00E-12	-	6.16E-12	1.02E-11	2.19E-11	-	2.19E-11	1.46E-23	8.00E-09	1.83E-15
Ru103	-	1.29E-10	-	2.06E-10	3.35E-10	7.32E-10	-	7.32E-10	4.87E-22	9.00E-10	5.41E-13
Ru105	-	3.95E-14	-	6.76E-11	6.77E-11	2.37E-10	-	2.37E-10	1.39E-22	2.00E-08	6.95E-15
Ru106	-	8.63E-11	-	1.33E-10	2.20E-10	4.75E-10	-	4.75E-10	3.17E-22	2.00E-11	1.58E-11
Rh103m	-	1.28E-10	-	2.03E-10	3.31E-10	6.71E-10	-	6.71E-10	4.57E-22	2.00E-06	2.29E-16
Rh105	-	4.13E-11	-	1.44E-10	1.85E-10	5.10E-10	-	5.10E-10	3.17E-22	8.00E-09	3.97E-14

Table 11.3-5: Gaseous Estimated Discharge for Normal Effluents (Continued)

Nuclide	GRWS (Ci/yr)	Pool Evaporation (Ci/yr)	AOO Gas Leakage (Ci/yr)	Primary Coolant Leaks (Ci/yr)	Plant Exhaust Stack Total (Ci/yr)	Secondary Steam Leaks (Ci/yr)	Condenser Air Removal System (Ci/yr)	Total TGB Releases (Ci/yr)	Total Gaseous Effluent Concentration at Site Boundary (μ Ci/ml)	10 CFR 20 Appendix B Limits (μ Ci/ml)	Fraction of Limit
Rh106	-	8.63E-11	-	1.33E-10	2.20E-10	4.81E-11	-	4.81E-11	1.22E-22	-	-
Ag110	-	5.71E-07	-	9.50E-10	5.72E-07	2.88E-10	-	2.88E-10	2.61E-19	-	-
Sb124	-	1.93E-13	-	3.03E-13	4.96E-13	1.08E-12	-	1.08E-12	7.19E-25	3.00E-10	2.40E-15
Sb125	-	1.73E-12	-	2.67E-12	4.40E-12	9.50E-12	-	9.50E-12	6.35E-24	7.00E-10	9.07E-15
Sb127	-	5.37E-12	-	1.16E-11	1.69E-11	4.12E-11	-	4.12E-11	2.65E-23	1.00E-09	2.65E-14
Sb129	-	7.81E-15	-	1.42E-11	1.43E-11	4.99E-11	-	4.99E-11	2.93E-23	1.00E-08	2.93E-15
Te125m	-	2.49E-10	-	3.92E-10	6.41E-10	1.40E-09	-	1.40E-09	9.29E-22	1.00E-09	9.29E-13
Te127m	-	8.11E-10	-	1.26E-09	2.07E-09	4.49E-09	-	4.49E-09	3.00E-21	4.00E-10	7.49E-12
Te127	-	8.86E-10	-	5.01E-09	5.90E-09	1.77E-08	-	1.77E-08	1.08E-20	2.00E-08	5.38E-13
Te129m	-	2.26E-09	-	3.62E-09	5.88E-09	1.29E-08	-	1.29E-08	8.56E-21	3.00E-10	2.85E-11
Te129	-	1.43E-09	-	5.12E-09	6.55E-09	1.71E-08	-	1.71E-08	1.08E-20	9.00E-08	1.20E-13
Te131m	-	2.72E-09	-	1.18E-08	1.46E-08	4.20E-08	-	4.20E-08	2.58E-20	1.00E-09	2.58E-11
Te131	-	6.12E-10	-	5.83E-09	6.44E-09	1.76E-08	-	1.76E-08	1.10E-20	2.00E-08	5.49E-13
Te132	-	3.73E-08	-	8.62E-08	1.24E-07	3.06E-07	-	3.06E-07	1.96E-19	9.00E-10	2.18E-10
Te133m	-	1.23E-23	-	7.35E-09	7.35E-09	2.42E-08	-	2.42E-08	1.44E-20	2.00E-08	7.21E-13
Te134	-	-	-	1.05E-08	1.05E-08	3.37E-08	-	3.37E-08	2.02E-20	7.00E-08	2.88E-13
Ba137m	-	6.87E-07	-	5.71E-07	1.26E-06	7.45E-07	-	7.45E-07	9.14E-19	-	-
Ba139	-	2.28E-20	-	1.95E-10	1.95E-10	6.58E-10	-	6.58E-10	3.89E-22	4.00E-08	9.73E-15
Ba140	-	6.22E-10	-	1.06E-09	1.68E-09	3.77E-09	-	3.77E-09	2.49E-21	2.00E-09	1.24E-12
La140	-	4.43E-10	-	3.07E-10	7.50E-10	1.09E-09	-	1.09E-09	8.41E-22	2.00E-09	4.20E-13
La141	-	1.39E-14	-	6.04E-11	6.04E-11	2.11E-10	-	2.11E-10	1.24E-22	1.00E-08	1.24E-14
La142	-	2.43E-20	-	2.88E-11	2.88E-11	9.79E-11	-	9.79E-11	5.78E-23	3.00E-08	1.93E-15
Ce141	-	1.02E-10	-	1.63E-10	2.65E-10	5.81E-10	-	5.81E-10	3.86E-22	8.00E-10	4.83E-13
Ce143	-	3.13E-11	-	1.24E-10	1.55E-10	4.39E-10	-	4.39E-10	2.71E-22	2.00E-09	1.36E-13
Ce144	-	8.87E-11	-	1.37E-10	2.26E-10	4.88E-10	-	4.88E-10	3.26E-22	2.00E-11	1.63E-11
Pr143	-	9.05E-11	-	1.45E-10	2.36E-10	5.17E-10	-	5.17E-10	3.43E-22	9.00E-10	3.82E-13
Pr144	-	8.79E-11	-	1.36E-10	2.24E-10	3.86E-10	-	3.86E-10	2.78E-22	2.00E-07	1.39E-15
Np239	-	9.72E-10	-	2.60E-09	3.57E-09	9.23E-09	-	9.23E-09	5.84E-21	3.00E-09	1.95E-12
Na24	-	2.20E-07	-	2.73E-06	2.95E-06	9.66E-06	-	9.66E-06	5.75E-18	7.00E-09	8.22E-10

Table 11.3-5: Gaseous Estimated Discharge for Normal Effluents (Continued)

Nuclide	GRWS (Ci/yr)	Pool Evaporation (Ci/yr)	AOO Gas Leakage (Ci/yr)	Primary Coolant Leaks (Ci/yr)	Plant Exhaust Stack Total (Ci/yr)	Secondary Steam Leaks (Ci/yr)	Condenser Air Removal System (Ci/yr)	Total TGB Releases (Ci/yr)	Total Gaseous Effluent Concentration at Site Boundary (μ Ci/ml)	10 CFR 20 Appendix B Limits (μ Ci/ml)	Fraction of Limit
Cr51	-	9.63E-05	-	1.55E-07	9.65E-05	5.53E-07	-	5.53E-07	4.43E-17	3.00E-08	1.48E-09
Mn54	-	5.17E-05	-	7.99E-08	5.18E-05	2.84E-07	-	2.84E-07	2.38E-17	1.00E-09	2.38E-08
Fe55	-	3.88E-05	-	5.99E-08	3.89E-05	2.13E-07	-	2.13E-07	1.79E-17	3.00E-09	5.95E-09
Fe59	-	9.46E-06	-	1.50E-08	9.48E-06	5.34E-08	-	5.34E-08	4.35E-18	5.00E-10	8.70E-09
Co58	-	1.47E-03	-	2.30E-07	1.47E-03	8.18E-07	-	8.18E-07	6.70E-16	1.00E-09	6.70E-07
Co60	-	1.72E-05	-	2.64E-08	1.72E-05	9.41E-08	-	9.41E-08	7.89E-18	5.00E-11	1.58E-07
Ni63	-	8.58E-06	-	1.32E-08	8.59E-06	4.70E-08	-	4.70E-08	3.94E-18	2.00E-09	1.97E-09
Zn65	-	1.64E-05	-	2.54E-08	1.65E-05	9.05E-08	-	9.05E-08	7.56E-18	4.00E-10	1.89E-08
Zr95	-	1.24E-05	-	1.95E-08	1.24E-05	6.93E-08	-	6.93E-08	5.70E-18	4.00E-10	1.43E-08
Ag110m	-	4.20E-05	-	6.50E-08	4.21E-05	2.31E-07	-	2.31E-07	1.93E-17	1.00E-10	1.93E-07
W187	-	2.43E-05	-	1.39E-07	2.44E-05	4.94E-07	-	4.94E-07	1.14E-17	1.00E-08	1.14E-09
H3	-	6.96E+02	-	5.93E+00	7.01E+02	6.92E+00	-	6.92E+00	3.23E-10	1.00E-07	3.23E-03
C14	2.63E-01	3.01E-03	-	1.33E-03	2.67E-01	2.37E-07	-	2.37E-07	1.22E-13	3.00E-09	4.06E-05
Ar41	1.19E+01	-	1.61E-02	2.07E+00	1.39E+01	1.46E-04	9.69E-01	9.69E-01	6.81E-12	1.00E-08	6.81E-04
Total	2.26E+02	7.16E+02	1.03E-01	1.92E+01	9.62E+02	6.92E+00	6.21E+00	1.31E+01	4.45E-10	5.84E-05	4.14E-03

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Table 12.2-9: Reactor Pool Cooling, Spent Fuel Pool Cooling, Pool Cleanup, and Pool Surge Control Systems Component Source Term Inputs and Assumptions

Model Parameter	Value
Reactor pool cooling heat exchanger; Contents Source term mass <u>Geometry</u> <u>Source dimensions</u> <u>Shielding thickness of steel shell</u>	100% pool water (see Table 12.2-11 and Table 12.2-12) 3.88E+06 grams <u>horizontal cylinder</u> <u>diameter=2'-8"; height=24'-7"</u> <u>1/4"</u>
Spent fuel pool cooling heat exchanger; Contents Source term mass <u>Geometry</u> <u>Source dimensions</u> <u>Shielding thickness of steel shell</u>	100% pool water (see Table 12.2-11 and Table 12.2-12) 3.88E+06 grams <u>horizontal cylinder</u> <u>diameter=2'-8"; height=24'-7"</u> <u>1/4"</u>
Pool cleanup system demineralizer; Decontamination factors Geometry Source dimensions Shielding thickness of steel shell Operation time	100% of pool water inventory vertical cylinder diameter=13'; height=5' <u>1/2"</u> 2 years (12 refuelings)
PCU filters; PCU filter flowrate PCU filter operation time PCU filter efficiency <u>Geometry</u> <u>Source dimensions</u> <u>Shielding thickness of steel shell</u> <u>PCU filter operation time</u>	1250 gpm 1 year (6 refuelings) 9.1% <u>vertical cylinder</u> <u>diameter=2'; height=9'-8"</u> <u>1/2"</u> <u>1 year (6 refuelings)</u>
Reactor and spent fuel pool water Source mass	- 2.87E+10 grams
PSCS Surge Tank Contents Geometry Source dimensions Shielding thickness of steel wall Source volume <u>Source Mass</u>	100% <u>cleaned up</u> pool water vertical cylinder diameter=61'; height=50' 0.25 <u>1/4"</u> 1.46E+05 ft ³ <u>4.14E+09 grams</u>

Note: Assumes the plant consists of 12 NPMs operating on a two-year refueling cycle.

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Table 12.2-11: Reactor Pool Cooling, Spent Fuel Pool Cooling, Pool Cleanup and Pool Surge Control System Component Source Terms – Source Strengths

Energy Group	Energy Boundary (MeV)	RPCS Heat Exchanger (photon/s)	Spent Fuel Pool Cooling Heat Exchanger (photon/s)	PCUS Demineralizer (photon/s)	Reactor Pool Water (photon/s/g)	PSC Surge Tank (photon/s)	PCU Filter (photon/s)
1	1.00E-02 - 2.00E-02	4.74E+06	4.74E+06	4.21E+11	1.22E+00	5.05E+09	7.55E+08
2	2.00E-02 - 3.00E-02	7.83E+06	7.83E+06	6.95E+11	2.02E+00	8.35E+09	8.21E+08
3	3.00E-02 - 4.50E-02	1.60E+08	1.60E+08	1.42E+13	4.13E+01	1.71E+11	3.14E+08
4	4.50E-02 - 6.00E-02	1.50E+06	1.50E+06	1.33E+11	3.87E-01	1.60E+09	2.33E+08
5	6.00E-02 - 7.00E-02	1.49E+06	1.49E+06	1.32E+11	3.84E-01	1.59E+09	1.10E+08
6	7.00E-02 - 7.50E-02	8.16E+05	8.16E+05	7.24E+10	2.10E-01	8.69E+08	4.71E+07
7	7.50E-02 - 1.00E-01	1.35E+08	1.35E+08	1.20E+13	3.49E+01	1.44E+11	1.85E+08
8	1.00E-01 - 1.50E-01	1.43E+06	1.43E+06	1.27E+11	3.68E-01	1.52E+09	2.41E+08
9	1.50E-01 - 2.00E-01	1.13E+06	1.13E+06	1.00E+11	2.92E-01	1.21E+09	1.65E+08
10	2.00E-01 - 2.60E-01	7.35E+05	7.35E+05	6.53E+10	1.90E-01	7.83E+08	1.33E+08
11	2.60E-01 - 3.00E-01	3.21E+06	3.21E+06	2.85E+11	8.28E-01	3.42E+09	4.65E+07
12	3.00E-01 - 4.00E-01	4.40E+07	4.40E+07	3.91E+12	1.13E+01	4.69E+10	6.33E+08
13	4.00E-01 - 4.50E-01	5.36E+05	5.36E+05	4.76E+10	1.38E-01	5.71E+08	1.49E+09
14	4.50E-01 - 5.10E-01	1.28E+06	1.28E+06	1.14E+11	3.30E-01	1.36E+09	2.97E+07
15	5.10E-01 - 5.12E-01	1.22E+08	1.22E+08	1.09E+13	3.15E+01	1.30E+11	1.05E+11
16	5.12E-01 - 6.00E-01	5.90E+06	5.90E+06	5.23E+11	1.52E+00	6.28E+09	2.13E+07
17	6.00E-01 - 7.00E-01	2.14E+07	2.14E+07	1.90E+12	5.51E+00	2.28E+10	4.47E+10
18	7.00E-01 - 8.00E-01	1.15E+07	1.15E+07	1.02E+12	2.96E+00	1.22E+10	2.27E+10
19	8.00E-01 - 9.00E-01	4.11E+08	4.11E+08	3.65E+13	1.06E+02	4.38E+11	4.23E+11
20	9.00E-01 - 1.00E+00	3.98E+06	3.98E+06	3.53E+11	1.03E+00	4.24E+09	1.30E+10
21	1.00E+00 - 1.20E+00	9.22E+06	9.22E+06	8.19E+11	2.38E+00	9.83E+09	4.48E+10
22	1.20E+00 - 1.33E+00	3.92E+06	3.92E+06	3.48E+11	1.01E+00	4.18E+09	1.86E+10
23	1.33E+00 - 1.44E+00	2.97E+07	2.97E+07	2.63E+12	7.65E+00	3.16E+10	2.61E+10
24	1.44E+00 - 1.50E+00	4.90E+05	4.90E+05	4.35E+10	1.26E-01	5.23E+08	1.61E+09
25	1.50E+00 - 1.57E+00	1.70E+06	1.70E+06	1.51E+11	4.39E-01	1.82E+09	5.62E+09
26	1.57E+00 - 1.66E+00	3.64E+03	3.64E+03	3.23E+08	9.37E-04	3.88E+06	9.37E+06
27	1.66E+00 - 1.80E+00	2.03E+06	2.03E+06	1.80E+11	5.23E-01	2.16E+09	1.77E+09
28	1.80E+00 - 2.00E+00	2.69E+03	2.69E+03	2.39E+08	6.94E-04	2.87E+06	6.56E+06
29	2.00E+00 - 2.15E+00	4.16E+02	4.16E+02	3.69E+07	1.07E-04	4.43E+05	4.02E+05
30	2.15E+00 - 2.35E+00	1.95E+02	1.95E+02	1.73E+07	5.03E-05	2.08E+05	3.95E+05
31	2.35E+00 - 2.50E+00	7.78E+01	7.78E+01	6.91E+06	2.01E-05	8.29E+04	8.14E+03
32	2.50E+00 - 2.75E+00	1.29E+07	1.29E+07	1.15E+12	3.33E+00	1.38E+10	3.27E+02
33	2.75E+00 - 3.00E+00	1.18E+07	1.18E+07	1.05E+12	3.04E+00	1.26E+10	2.58E+02
34	3.00E+00 - 3.50E+00	1.99E-01	1.99E-01	1.77E+04	5.13E-08	2.12E+02	-
35	3.50E+00 - 4.00E+00	1.88E+04	1.88E+04	1.67E+09	4.85E-03	2.01E+07	-
36	4.00E+00 - 4.50E+00	2.07E+02	2.07E+02	1.84E+07	5.33E-05	2.20E+05	-
37	4.50E+00 - 5.00E+00	1.27E-04	1.27E-04	1.13E+01	3.27E-11	1.35E-01	-
38	5.00E+00 - 5.50E+00	2.39E-07	2.39E-07	2.12E-02	6.17E-14	2.55E-04	-
39	5.50E+00 - 6.00E+00	-	-	-	-	-	-
40	6.00E+00 - 6.50E+00	-	-	-	-	-	-

Table 12.2-11: Reactor Pool Cooling, Spent Fuel Pool Cooling, Pool Cleanup and Pool Surge Control System Component Source Terms – Source Strengths (Continued)

Energy Group	Energy Boundary (MeV)	RPCS Heat Exchanger (photon/s)	Spent Fuel Pool Cooling Heat Exchanger (photon/s)	PCUS Demineralizer (photon/s)	Reactor Pool Water (photon/s/g)	PSC Surge Tank (photon/s)	PCU Filter (photon/s)
41	6.50E+00 - 7.00E+00	-	-	-	-	-	-
42	7.00E+00 - 7.50E+00	-	-	-	-	-	-
43	7.50E+00 - 8.00E+00	-	-	-	-	-	-
44	8.00E+00 - 1.00E+01	-	-	-	-	-	-
45	1.00E+01 - 1.20E+01	-	-	-	-	-	-
46	1.20E+01 - 1.40E+01	-	-	-	-	-	-
47	1.40E+01 - 2.00E+01	-	-	-	-	-	-
Total		1.01E+09	1.01E+09	8.99E+13	2.61E+02	1.08E+12	7.12E+11

Note: Assumes the plant consists of 12 NPMs operating on a two-year refueling cycle.

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Table 12.2-11: Reactor Pool Cooling, Spent Fuel Pool Cooling, Pool Cleanup, and Pool Surge Control System Component Source Terms - Source Strengths

Energy Group	Energy Boundary (MeV)	PCUS Demineralizer (photon/s)	Reactor Pool Water (photon/s)	PSC Surge Tank (photon/s/g)	PCU Filter (photon/s)
1	1.00E-02 - 2.00E-02	1.23E+10	1.26E+10	1.20E-02	1.08E+09
2	2.00E-02 - 3.00E-02	1.88E+10	4.14E+10	1.75E-02	9.93E+08
3	3.00E-02 - 4.50E-02	2.42E+10	2.56E+10	2.12E-02	4.65E+08
4	4.50E-02 - 6.00E-02	3.84E+09	6.15E+09	4.48E-03	3.54E+08
5	6.00E-02 - 7.00E-02	2.13E+09	1.45E+10	1.47E-02	1.95E+08
6	7.00E-02 - 7.50E-02	9.30E+08	8.81E+09	6.16E-03	9.01E+07
7	7.50E-02 - 1.00E-01	8.77E+09	2.83E+10	1.57E-02	2.80E+08
8	1.00E-01 - 1.50E-01	3.93E+09	1.13E+10	8.13E-03	3.65E+08
9	1.50E-01 - 2.00E-01	3.50E+09	6.27E+09	1.81E-02	2.70E+08
10	2.00E-01 - 2.60E-01	1.84E+09	2.05E+09	1.62E-03	1.58E+08
11	2.60E-01 - 3.00E-01	1.35E+10	6.82E+10	3.42E-02	6.28E+07
12	3.00E-01 - 4.00E-01	1.87E+11	9.29E+11	3.70E-01	1.52E+09
13	4.00E-01 - 4.50E-01	1.75E+10	5.11E+09	3.14E-03	1.44E+09
14	4.50E-01 - 5.10E-01	5.07E+09	1.97E+10	2.04E-02	7.38E+07
15	5.10E-01 - 5.12E-01	1.52E+12	1.01E+12	7.03E-01	1.67E+11
16	5.12E-01 - 6.00E-01	6.15E+10	1.16E+11	1.61E-01	3.28E+07
17	6.00E-01 - 7.00E-01	9.30E+11	2.58E+11	5.91E-01	4.29E+10
18	7.00E-01 - 8.00E-01	5.08E+11	1.23E+11	5.39E-01	2.02E+10
19	8.00E-01 - 9.00E-01	5.85E+12	3.44E+12	2.49E+00	6.13E+11
20	9.00E-01 - 1.00E+00	1.52E+11	3.33E+10	2.30E-02	1.25E+10
21	1.00E+00 - 1.20E+00	5.06E+11	7.94E+10	1.30E-01	3.27E+10
22	1.20E+00 - 1.33E+00	2.07E+11	3.66E+10	4.19E-02	1.29E+10
23	1.33E+00 - 1.44E+00	2.99E+11	4.49E+10	4.55E-02	2.01E+10
24	1.44E+00 - 1.50E+00	1.88E+10	4.08E+09	2.84E-03	1.55E+09
25	1.50E+00 - 1.57E+00	6.54E+10	1.41E+10	9.94E-03	5.39E+09
26	1.57E+00 - 1.66E+00	1.14E+08	3.88E+07	2.53E-05	8.95E+06
27	1.66E+00 - 1.80E+00	2.55E+10	1.70E+10	1.18E-02	2.80E+09
28	1.80E+00 - 2.00E+00	7.77E+07	3.60E+07	1.89E-05	6.26E+06
29	2.00E+00 - 2.15E+00	5.25E+06	9.72E+06	3.94E-06	3.70E+05
30	2.15E+00 - 2.35E+00	4.66E+06	4.82E+06	2.01E-06	2.59E+05
31	2.35E+00 - 2.50E+00	2.66E+05	2.93E+06	1.04E-06	2.32E+02
32	2.50E+00 - 2.75E+00	3.73E+06	2.66E+08	1.85E-04	3.97E+05
33	2.75E+00 - 3.00E+00	3.23E+06	2.42E+08	1.69E-04	3.63E+05
34	3.00E+00 - 3.50E+00	1.54E+03	2.86E+03	1.99E-09	6.95E-04
35	3.50E+00 - 4.00E+00	5.14E+03	3.87E+05	2.70E-07	5.79E+02
36	4.00E+00 - 4.50E+00	5.64E+01	4.25E+03	2.96E-09	6.35E+00
37	4.50E+00 - 5.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
38	5.00E+00 - 5.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
39	5.50E+00 - 6.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	6.00E+00 - 6.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
41	6.50E+00 - 7.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 12.2-11: Reactor Pool Cooling, Spent Fuel Pool Cooling, Pool Cleanup, and Pool Surge Control System Component Source Terms - Source Strengths (Continued)

Energy Group	Energy Boundary (MeV)	PCUS Demineralizer (photon/s)	Reactor Pool Water (photon/s)	PSC Surge Tank (photon/s/g)	PCU Filter (photon/s)
43	7.50E+00 - 8.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
44	8.00E+00 - 1.00E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
45	1.00E+01 - 1.20E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
46	1.20E+01 - 1.40E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
47	1.40E+01 - 2.00E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total	- -	1.04E+13	6.35E+12	5.30E+00	9.38E+11

Note: Assumes the plant consists of 12 NPMs operating on a two-year refueling cycle.

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**Table 12.2-19: Solid Radioactive Waste System Component Source Terms—
Radionuclide Content**

Isotope	SRST (Ci)	PST (Ci)	HIC (Ci)
Kr83m	4.12E-06	1.66E-09	1.69E-09
Kr85	-	7.93E-12	-
Xe131m	1.50E-02	1.55E-05	1.87E-21
Xe133m	2.00E-10	1.75E-06	-
Xe133	1.21E-04	1.11E-04	-
Xe135m	-	5.09E-13	-
Xe135	-	1.57E-09	-
Br82	4.54E-15	8.92E-08	-
I129	1.64E-03	7.65E-09	2.06E-04
I130	-	9.31E-10	-
I131	1.52E-01	1.04E-03	-
I132	1.36E-06	1.97E-05	-
I133	-	2.30E-06	-
I135	-	2.96E-12	-
Rb86	3.25E-02	1.58E-04	1.29E-14
Cs132	2.70E-06	7.76E-07	-
Cs134	6.53E+03	6.28E-01	4.24E+02
Cs136	3.03E-01	3.83E-03	2.00E-18
Cs137	6.98E+03	5.19E-01	8.34E+02
P32	2.19E-07	2.16E-10	2.62E-23
Co57	2.46E-06	3.13E-11	5.01E-08
Ni63	8.82E+01	1.73E-03	1.09E+01
Sr89	8.12E-02	6.92E-06	5.85E-07
Sr90	2.56E+00	1.47E-05	3.06E-01
Sr91	-	7.21E-13	-
Y90	2.56E+00	1.47E-05	3.06E-01
Y91m	-	4.64E-13	-
Y91	1.68E-02	1.10E-06	4.58E-07
Y93	-	3.19E-13	-
Zr95	6.03E+00	3.06E-04	3.40E-04
Zr97	-	5.68E-11	-
Nb95	8.33E+00	3.18E-04	7.50E-04
Mo99	3.15E-07	3.43E-05	-
Tc99m	3.04E-07	3.31E-05	-
Ru103	1.17E-02	1.35E-06	5.08E-09
Ru105	-	1.09E-18	-
Ru106	6.28E-01	6.59E-06	2.08E-02
Rh103m	1.15E-02	1.34E-06	5.03E-09
Rh105	9.87E-16	2.27E-08	-
Rh106	6.28E-01	6.59E-06	2.08E-02
Ag110m	1.24E+02	1.13E-06	2.15E+00
Sb124	5.05E-05	4.41E-10	1.75E-09
Sb125	2.67E-02	2.70E-08	2.04E-03

Table 12.2-19: Solid Radioactive Waste System Component Source Terms—Radionuclide Content (Continued)

Isotope	SRST (Ci)	PST (Ci)	HIC (Ci)
Sb127	1.98E-09	5.17E-10	-
Te125m	6.41E-02	3.86E-06	5.02E-04
Te127m	8.05E-01	2.39E-05	1.09E-03
Te127	7.89E-01	2.34E-05	1.07E-03
Te129m	1.35E-01	2.01E-05	7.11E-09
Te129	8.52E-02	1.27E-05	4.49E-09
Te131m	1.72E-15	2.44E-07	-
Te131	4.51E-16	6.40E-08	-
Te132	1.32E-06	1.91E-05	-
Ba137m	6.61E+03	4.91E-01	7.90E+02
Ba140	1.49E-03	2.07E-06	2.96E-21
La140	1.71E-03	2.35E-06	3.41E-21
Ce141	5.59E-03	8.79E-07	1.80E-10
Ce143	1.83E-17	2.52E-09	-
Ce144	4.69E-01	5.78E-06	1.04E-02
Pr143	2.74E-04	3.15E-07	5.62E-21
Pr144	4.69E-01	5.78E-06	1.04E-02
Np239	2.49E-10	2.88E-07	-
Na24	-	2.32E-07	-
Cr51	1.12E+01	3.75E-06	2.60E-08
Mn54	1.81E+02	4.79E-05	4.66E+00
Fe55	2.74E+02	6.14E-03	2.09E+01
Fe59	2.59E+00	1.58E-04	4.96E-06
Co58	7.03E+02	2.56E-03	8.33E-02
Co60	1.46E+02	4.57E-04	1.41E+01
W187	1.21E-17	3.29E-07	-
Zn65	4.54E+01	1.39E-03	7.52E-01
C14	4.68E+02	2.62E-03	5.85E+01

Note: Assumes the plant consists of 12 NPMs operating on a two-year refueling cycle.

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Table 12.2-19: Solid Radioactive Waste System Component Source Terms - Radionuclide Content

Isotope	SRST (Ci)	PST (Ci)	HIC (Ci)
Kr83m	1.75E-10	-	-
Kr85m	3.98E-11	-	-
Kr85	4.57E-08	1.48E-19	3.37E-09
Xe131m	2.60E-01	2.03E-14	1.03E-19
Xe133m	9.05E-03	-	-
Xe133	7.41E-01	-	-
Xe135m	1.18E-05	-	-
Xe135	7.85E-04	-	-
Br82	4.86E-04	3.22E-07	-
Br83	7.99E-11	1.23E-07	-
Br84	-	1.27E-08	-
Br85	-	1.40E-10	-
I129	3.39E-03	2.81E-09	2.82E-04
I130	9.24E-05	8.99E-07	-
I131	1.14E+01	1.59E-03	-
I132	8.18E-02	4.28E-05	-
I133	8.91E-02	7.42E-05	-
I134	2.43E-08	4.82E-07	-
I135	6.92E-05	1.16E-05	-
Rb86m	1.48E-14	2.10E-12	-
Rb86	1.90E-01	3.30E-04	9.83E-14
Rb88	4.58E-06	3.71E-05	-
Rb89	1.53E-07	1.45E-06	-
Cs132	4.09E-04	2.21E-06	-
Cs134	1.14E+04	1.13E+00	5.01E+02
Cs135m	3.12E-08	8.49E-08	-
Cs136	3.40E+00	8.51E-03	3.78E-17
Cs137	1.22E+04	9.26E-01	9.69E+02
Cs138	5.93E-06	2.56E-05	-
P32	4.11E-07	3.49E-11	7.72E-23
Co57	8.56E-07	4.19E-12	1.21E-08
Sr89	2.48E-01	6.97E-06	1.52E-06
Sr90	5.26E+00	1.21E-05	4.19E-01
Sr91	3.91E-07	2.24E-08	-
Sr92	3.07E-09	3.31E-09	-
Y90	5.26E+00	1.21E-05	4.19E-01
Y91m	2.49E-07	1.41E-08	-
Y91	4.85E-02	9.37E-07	1.09E-06
Y92	1.21E-08	7.05E-09	-
Y93	1.08E-07	5.06E-09	-
Zr97	1.26E-06	1.23E-08	-
Nb95	2.70E+00	2.85E-04	2.08E-04
Mo99	1.36E-01	8.74E-05	-
Mo101	1.02E-09	1.21E-08	-

Table 12.2-19: Solid Radioactive Waste System Component Source Terms - Radionuclide Content (Continued)

<u>Isotope</u>	<u>SRST (Ci)</u>	<u>PST (Ci)</u>	<u>HIC (Ci)</u>
Tc99m	1.31E-01	8.40E-05	=
Tc99	2.06E-01	4.64E-07	1.72E-02
Ru103	4.12E-02	1.20E-06	1.64E-08
Ru105	3.11E-09	1.83E-09	=
Ru106	1.35E+00	5.50E-06	3.11E-02
Rh103m	4.08E-02	1.19E-06	1.62E-08
Rh105	1.86E-05	3.31E-08	=
Rh106	1.35E+00	5.50E-06	3.11E-02
Ag110	7.12E-01	4.39E-05	8.65E-03
Sb124	1.45E-04	2.71E-09	4.08E-09
Sb125	5.55E-02	1.58E-07	2.87E-03
Sb127	1.65E-05	6.60E-09	=
Sb129	6.40E-10	3.82E-10	=
Te125m	1.83E-01	3.38E-06	7.07E-04
Te127m	1.95E+00	2.03E-05	1.97E-03
Te127	1.91E+00	2.01E-05	1.93E-03
Te129m	5.29E-01	1.81E-05	2.67E-08
Te129	3.34E-01	1.14E-05	1.69E-08
Te131m	8.85E-04	2.18E-06	=
Te131	1.99E-04	4.98E-07	=
Te132	7.93E-02	4.09E-05	=
Te133m	1.33E-08	4.14E-08	=
Te134	1.08E-08	4.45E-08	=
Ba137m	1.15E+04	8.74E-01	9.15E+02
Ba139	7.92E-10	1.64E-09	=
Ba140	2.09E-02	2.01E-06	7.24E-20
La140	2.40E-02	2.09E-06	8.33E-20
La141	2.05E-09	1.44E-09	=
La142	1.41E-10	2.67E-10	=
Ce141	2.23E-02	7.90E-07	6.98E-10
Ce143	1.23E-05	2.51E-08	=
Ce144	1.02E+00	4.83E-06	1.57E-02
Pr143	3.58E-03	3.18E-07	1.20E-19
Pr144	1.01E+00	4.78E-06	1.55E-02
Np239	1.12E-03	9.04E-07	=
Na24	1.30E-03	2.49E-05	=
Cr51	5.04E+00	9.47E-04	1.21E-08
Mn54	8.33E+01	4.59E-03	1.49E+00
Fe55	1.44E+02	5.46E-03	7.42E+00
Fe59	9.42E-01	1.49E-04	1.58E-06
Co58	1.53E+02	3.47E-02	1.43E-02
Co60	7.85E+01	2.71E-03	5.10E+00
Ni63	4.92E+01	1.53E-03	4.05E+00
Zn65	1.99E+01	1.24E-03	2.32E-01
Zr95	2.10E+00	2.82E-04	9.54E-05

Table 12.2-19: Solid Radioactive Waste System Component Source Terms - Radionuclide Content (Continued)

Isotope	SRST (Ci)	PST (Ci)	HIC (Ci)
Ag110m	5.24E+01	3.22E-03	6.36E-01
W187	3.21E-02	9.97E-06	-
Total	3.56E+04	2.99E+00	2.40E+03

Note: Assumes the plant consists of 12 NPMs operating on a two-year refueling cycle.

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**Table 12.2-20: Solid Radioactive Waste System Component Source Terms—
Source Strengths**

Energy Group	Energy Boundary (MeV)			Spent Resin- Storage Tank (photon/s)	Phase- Separator Tank (photon/s)	High Integrity- Container (HIC) (photon/s)
1	1.00E-02	-	2.00E-02	1.44E+12	1.17E+08	1.31E+11
2	2.00E-02	-	3.00E-02	8.13E+11	6.30E+07	6.88E+10
3	3.00E-02	-	4.50E-02	1.79E+13	1.38E+09	2.02E+12
4	4.50E-02	-	6.00E-02	3.84E+11	3.10E+07	3.45E+10
5	6.00E-02	-	7.00E-02	1.73E+11	2.09E+07	1.54E+10
6	7.00E-02	-	7.50E-02	7.20E+10	5.79E+06	6.42E+09
7	7.50E-02	-	1.00E-01	2.60E+11	3.04E+07	2.29E+10
8	1.00E-01	-	1.50E-01	2.33E+11	1.96E+07	1.97E+10
9	1.50E-01	-	2.00E-01	1.21E+11	3.19E+07	9.74E+09
10	2.00E-01	-	2.60E-01	1.26E+11	1.12E+07	8.65E+09
11	2.60E-01	-	3.00E-01	2.58E+10	1.95E+07	1.91E+09
12	3.00E-01	-	4.00E-01	1.23E+11	9.72E+07	4.76E+09
13	4.00E-01	-	4.50E-01	1.81E+11	3.45E+05	3.41E+09
14	4.50E-01	-	5.10E-01	3.54E+12	3.42E+08	2.30E+11
15	5.10E-01	-	5.12E-01	7.80E+12	2.97E+07	1.87E+09
16	5.12E-01	-	6.00E-01	5.84E+13	5.62E+09	3.80E+12
17	6.00E-01	-	7.00E-01	4.49E+14	3.77E+10	4.11E+13
18	7.00E-01	-	8.00E-01	2.33E+14	2.22E+10	1.50E+13
19	8.00E-01	-	9.00E-01	4.51E+13	1.17E+09	8.82E+11
20	9.00E-01	-	1.00E+00	1.56E+12	1.73E+05	2.70E+10
21	1.00E+00	-	1.20E+00	1.35E+13	8.00E+08	1.01E+12
22	1.20E+00	-	1.33E+00	2.88E+12	3.93E+07	2.74E+11
23	1.33E+00	-	1.44E+00	1.09E+13	6.99E+08	7.38E+11
24	1.44E+00	-	1.50E+00	1.92E+11	1.79E+04	3.34E+09
25	1.50E+00	-	1.57E+00	6.71E+11	1.70E+05	1.16E+10
26	1.57E+00	-	1.66E+00	1.18E+09	8.30E+04	1.97E+07
27	1.66E+00	-	1.80E+00	1.31E+11	4.79E+05	2.97E+07
28	1.80E+00	-	2.00E+00	8.02E+08	1.45E+04	1.42E+07
29	2.00E+00	-	2.15E+00	5.79E+07	6.07E+03	1.16E+06
30	2.15E+00	-	2.35E+00	1.84E+08	4.77E+03	8.75E+06
31	2.35E+00	-	2.50E+00	1.48E+07	2.00E+03	4.67E+05
32	2.50E+00	-	2.75E+00	5.00E+06	7.87E+03	9.68E+04
33	2.75E+00	-	3.00E+00	1.22E+06	4.18E+03	3.82E+04
34	3.00E+00	-	3.50E+00	4.21E+05	2.83E+01	1.34E+04
35	3.50E+00	-	4.00E+00	1.68E+02	6.55E+00	5.57E+00
36	4.00E+00	-	4.50E+00	3.46E-08	7.19E-02	4.33E-09
37	4.50E+00	-	5.00E+00	1.74E-08	-	2.17E-09
38	5.00E+00	-	5.50E+00	8.74E-09	-	1.09E-09
39	5.50E+00	-	6.00E+00	4.39E-09	-	5.49E-10
40	6.00E+00	-	6.50E+00	2.21E-09	-	2.76E-10
41	6.50E+00	-	7.00E+00	1.11E-09	-	1.39E-10
42	7.00E+00	-	7.50E+00	5.58E-10	-	6.98E-11

**Table 12.2-20: Solid Radioactive Waste System Component Source Terms—
Source Strengths (Continued)**

Energy Group	Energy Boundary (MeV)			Spent Resin Storage Tank (photon/s)	Phase Separator Tank (photon/s)	High Integrity Container (HIC) (photon/s)
43	7.50E+00	-	8.00E+00	2.81E+10	-	3.51E+11
44	8.00E+00	-	1.00E+01	2.55E+10	-	3.19E+11
45	1.00E+01	-	1.20E+01	8.52E+12	-	1.06E+12
46	1.20E+01	-	1.40E+01	-	-	-
47	1.40E+01	-	2.00E+01	-	-	-
Total	-			8.48E+14	7.04E+10	6.54E+13

Note: Assumes the plant consists of 12 NPMs operating on a two-year refueling cycle.

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Table 12.2-20: Solid Radioactive Waste System Component Source Terms - Source Strengths

Energy Group	Energy Boundary (MeV)	Spent Resin Storage Tank (photon/s)	Phase Separator Tank (photon/s)	High Integrity Container (HIC) (photon/s)
1	1.00E-02 : 2.00E-02	2.41E+12	2.11E+08	1.51E+11
2	2.00E-02 : 3.00E-02	1.33E+12	1.14E+08	7.86E+10
3	3.00E-02 : 4.50E-02	3.11E+13	2.46E+09	2.35E+12
4	4.50E-02 : 6.00E-02	6.40E+11	5.64E+07	3.99E+10
5	6.00E-02 : 7.00E-02	2.94E+11	4.08E+07	1.79E+10
6	7.00E-02 : 7.50E-02	1.20E+11	1.06E+07	7.45E+09
7	7.50E-02 : 1.00E-01	4.56E+11	5.53E+07	2.66E+10
8	1.00E-01 : 1.50E-01	3.83E+11	3.70E+07	2.29E+10
9	1.50E-01 : 2.00E-01	2.09E+11	6.70E+07	1.14E+10
10	2.00E-01 : 2.60E-01	2.05E+11	2.08E+07	1.00E+10
11	2.60E-01 : 3.00E-01	7.66E+10	4.11E+07	2.20E+09
12	3.00E-01 : 4.00E-01	5.40E+11	1.95E+08	5.41E+09
13	4.00E-01 : 4.50E-01	8.24E+10	5.31E+06	1.34E+09
14	4.50E-01 : 5.10E-01	6.18E+12	6.16E+08	2.71E+11
15	5.10E-01 : 5.12E-01	1.72E+12	3.84E+08	6.37E+08
16	5.12E-01 : 6.00E-01	1.02E+14	1.01E+10	4.48E+12
17	6.00E-01 : 7.00E-01	7.75E+14	6.77E+10	4.79E+13
18	7.00E-01 : 8.00E-01	4.03E+14	3.99E+10	1.77E+13
19	8.00E-01 : 9.00E-01	2.74E+13	3.48E+09	8.33E+11
20	9.00E-01 : 1.00E+00	6.57E+11	4.08E+07	7.98E+09
21	1.00E+00 : 1.20E+00	1.55E+13	1.53E+09	7.31E+11
22	1.20E+00 : 1.33E+00	1.57E+12	1.17E+08	9.93E+10
23	1.33E+00 : 1.44E+00	1.44E+13	1.32E+09	6.48E+11
24	1.44E+00 : 1.50E+00	8.13E+10	5.07E+06	9.87E+08
25	1.50E+00 : 1.57E+00	2.83E+11	1.78E+07	3.44E+09
26	1.57E+00 : 1.66E+00	1.32E+09	1.08E+05	6.12E+06
27	1.66E+00 : 1.80E+00	2.87E+10	6.56E+06	7.63E+06
28	1.80E+00 : 2.00E+00	4.30E+08	3.63E+05	4.97E+06
29	2.00E+00 : 2.15E+00	6.65E+07	3.20E+04	7.38E+05
30	2.15E+00 : 2.35E+00	3.11E+08	1.63E+05	6.28E+06
31	2.35E+00 : 2.50E+00	3.95E+07	1.04E+04	6.71E+05
32	2.50E+00 : 2.75E+00	6.31E+07	6.04E+05	1.39E+05
33	2.75E+00 : 3.00E+00	2.61E+07	4.44E+05	5.64E+04
34	3.00E+00 : 3.50E+00	1.12E+06	1.15E+04	2.00E+04
35	3.50E+00 : 4.00E+00	3.73E+04	2.63E+03	8.31E+00
36	4.00E+00 : 4.50E+00	4.71E+02	4.30E+02	-
37	4.50E+00 : 5.00E+00	3.22E+02	2.61E+03	-
38	5.00E+00 : 5.50E+00	6.07E-01	4.92E+00	-
39	5.50E+00 : 6.00E+00	-	-	-
40	6.00E+00 : 6.50E+00	-	-	-
41	6.50E+00 : 7.00E+00	-	-	-
42	7.00E+00 : 7.50E+00	-	-	-

Table 12.2-20: Solid Radioactive Waste System Component Source Terms - Source Strengths (Continued)

<u>Energy Group</u>	<u>Energy Boundary (MeV)</u>	<u>Spent Resin Storage Tank (photon/s)</u>	<u>Phase Separator Tank (photon/s)</u>	<u>High Integrity Container (HIC) (photon/s)</u>
43	7.50E+00 : 8.00E+00	-	-	-
44	8.00E+00 : 1.00E+01	-	-	-
45	1.00E+01 : 1.20E+01	-	-	-
46	1.20E+01 : 1.40E+01	-	-	-
47	1.40E+01 : 2.00E+01	-	-	-
Total	-	1.39E+15	1.29E+11	7.54E+13

Note: Assumes the plant consists of 12 NPMs operating on a two-year refueling cycle.