
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.: 542-8731
SRP Section: 11.02 – Liquid Waste Management System
Application Section: 11.2
Date of RAI Issue: 03/17/2017

Question No. 11.02-11

RAI 13-7856 and RAI 8144 coordination

The staff review of the applicant response to RAI 13-7856, Question 12.02-2 Revision 2 is not in agreement with the information presented for, (1) the coolant inventories for liquid tanks in the Liquid Tank Failure Analysis in DCD section 11.2.3.2 and (2) the radionuclide information presented by the applicant in the response to RAI 8144, Question 11.02-1.

The staff reviewed the updated coolant source terms for the Hold-up Tank, the Reactor Makeup Water Tank and the Boric Acid Storage Tank in revised DCD Table 12.2-13. The response from RAI 13-7856, Question 12.02-2 indicated that these source terms are representative of 0.25% failed fuel. The staff used the information in the revised Table 12.2-13 to develop a source term representative of 0.12% failed fuel in accordance with BTP 11-6 of the Standard Review Plan section 11.2 or one half of the activity presented in the revised Table 12.2-13. The staff reanalyzed the required dilution factor needed to meet 10 CFR Part 20, Appendix B, Table 2 limits and determined a higher dilution factor to meet the 10 CFR Part 20, Appendix B, Table 2 limits.

The applicant response to RAI 8144, Question 11.02-1, highlights the use of ANSI 18.1-1999 to be representative of 0.12% failed fuel. However, the information (currently) presented in the RAI 13-7856, Question 12.02-2 response indicates that the 0.12% failed fuel source term would be greater than the coolant activity described by ANSI 18.1-1999.

The staff requests that the applicant determine and justify the source term for the BTP 11-6 calculation and that the responses to RAI 13-7856, Question 12.02-2 and RAI 8144, Question 11.02-1 use and describe source terms that are correct, coordinated if necessary and justified. Please address these items and provide a markup for the proposed DCD changes.

Response

As the source term calculation methodology was changed in RAI 7856 Question 12.02-2, expected source terms of Holdup Tank, Reactor Makeup Water Tank and Boric Acid Storage Tank are also re-calculated with this methodology. The expected specific activities in the reactor coolant are calculated in accordance with ANSI/ANS 18.1 using an adjustment factor to take into account the normal operating condition. With this expected RCS source terms, CVCS yard tank inventory is calculated. Expected inventory of yard tanks is provided in the Table 1 of this response. The limiting tank is BAST and it is assumed that the 95% of the tank volume is filled. Liquid Tank Failure Analysis is performed with these new source terms and assumed release of all 95% of the entire tank inventory. Since the release assumes no liquid is retained within the tank structure, the calculation could be over-estimated, and that the calculation method is not consistent with the BTP 11-6. However, KHNP is of the opinion that the release dose thus calculated is conservative, and is independent of the liquid volume (i.e., 95% versus 80%) used in the calculation. The results are provided in Table 2 of this response. The required dilution factor is calculated to be 31,200. DCD Table 11.2-9 will be updated with this results.

Table 1. Expected Inventory of CVCS Yard Tanks (μCi)

Nuclide	HUT ⁽¹⁾	BAST ⁽²⁾	RMWT ⁽³⁾	Nuclide	HUT	BAST	RMWT
H-3	2.51E+08	8.11E+08	1.08E+09	Y-91	1.12E+03	5.68E+04	1.97E+00
Br-84	4.88E+00	0.00E+00	5.41E-07	Y-93	2.86E+04	2.65E-09	5.95E-01
I-131	2.82E+04	5.41E+04	1.05E+00	Zr-95	9.07E+02	5.14E+04	1.70E+00
I-132	3.21E+02	0.00E+00	1.51E-04	Nb-95	5.23E+02	1.41E+04	6.76E-01
I-133	4.18E+03	3.24E-03	1.78E-02	Mo-99	1.26E+03	4.59E+01	1.65E-01
I-134	1.78E+02	0.00E+00	3.24E-05	Tc-99m	3.84E+01	0.00E+00	4.86E-04
I-135	1.53E+03	5.41E-17	2.11E-03	Ru-103	1.50E+04	4.59E+05	2.05E+01
Rb-88	1.57E+02	0.00E+00	9.46E-05	Ru-106	2.65E+05	5.68E+07	9.46E+02
Cs-134	9.42E+03	2.51E+06	3.78E+01	Ag-110m	3.84E+03	6.49E+05	1.22E+01
Cs-136	5.23E+02	2.97E+03	2.97E-01	Te-129m	3.28E+02	8.38E+03	4.05E-02
Cs-137	1.29E+04	4.32E+06	5.68E+01	Te-129	1.64E+01	0.00E+00	3.78E-06
Na-24	1.22E+03	2.70E-06	3.78E-02	Te-131m	6.97E+01	3.78E-03	4.05E-04
Cr-51	5.23E+03	1.03E+05	5.68E+00	Te-131	1.85E+00	0.00E+00	1.59E-07
Mn-54	4.53E+03	9.19E+05	1.59E+01	Te-132	3.42E+02	2.97E+01	5.41E-03
Fe-55	3.49E+03	1.00E+06	1.46E+01	Ba-137m	1.29E+04	4.32E+06	5.68E+01
Fe-59	6.28E+02	2.27E+04	9.46E-01	Ba-140	1.33E+04	7.30E+04	7.57E+00
Co-58	1.08E+04	6.76E+05	2.16E+01	La-140	2.48E+03	3.24E+00	2.03E-01
Co-60	1.64E+03	4.86E+05	6.76E+00	Ce-141	2.76E+02	6.49E+03	3.24E-01
Zn-65	1.46E+03	2.51E+05	4.59E+00	Ce-143	2.09E+02	4.59E-02	1.41E-02
Sr-89	3.03E+02	1.27E+04	4.86E-01	Ce-144	1.15E+04	2.16E+06	3.78E+01
Sr-90	3.84E+01	1.22E+04	1.59E-01	W-187	1.22E+02	6.49E-04	5.95E-03
Sr-91	1.43E+01	4.59E-13	2.70E-04	Np-239	3.42E+02	4.86E+00	3.78E-02
Y-91m	2.62E+02	0.00E+00	4.59E-04				

(1) Based on 336,000 gallons (80% of the tank volume of 420,000 gallons).

(2) Based on 237,500 gallons (95% of the tank volume of 250,000 gallons)

(3) Based on 375,250 gallons (95% of the tank volume of 395,000 gallons)

**Table 2. Radioactive Concentrations in Nearest Portable Water
Due to Liquid Waste Containing Tank Failure (1 of 3)**

Holdup tank

Nuclide	Inventory (μCi)	Concentration ⁽¹⁾ ($\mu\text{Ci/cc}$)	Concentration at Nearest Potable Water ⁽²⁾	10 CFR Appendix B ($\mu\text{Ci/cc}$)	Ratio
H-3	2.51E+08	1.97E-01	2.89E-05	1.00E-03	6.27E-01
Br-84	4.88E+00	3.84E-09	1.22E-11	4.00E-04	3.05E-08
I-129 ⁽³⁾	1.76E-03	1.38E-12	4.39E-15	2.00E-07	2.19E-08
I-131	2.82E+04	2.22E-05	7.05E-08	1.00E-06	7.05E-02
I-132	3.21E+02	2.52E-07	8.01E-10	1.00E-04	8.01E-06
I-133	4.18E+03	3.29E-06	1.04E-08	7.00E-06	1.49E-03
I-134	1.78E+02	1.40E-07	4.44E-10	4.00E-04	1.11E-06
I-135	1.53E+03	1.21E-06	3.83E-09	3.00E-05	1.28E-04
Rb-88	1.57E+02	1.23E-07	3.92E-10	4.00E-04	9.79E-07
Cs-134	9.42E+03	7.40E-06	2.35E-08	9.00E-07	2.61E-02
Cs-136	5.23E+02	4.11E-07	1.31E-09	6.00E-06	2.18E-04
Cs-137	1.29E+04	1.01E-05	3.22E-08	1.00E-06	3.22E-02
Na-24	1.22E+03	9.60E-07	3.05E-09	5.00E-05	6.09E-05
Cr-51	5.23E+03	4.11E-06	1.31E-08	5.00E-04	2.61E-05
Mn-54	4.53E+03	3.56E-06	1.13E-08	3.00E-05	3.77E-04
Fe-55	3.49E+03	2.74E-06	8.70E-09	1.00E-04	8.70E-05
Fe-59	6.28E+02	4.94E-07	1.57E-09	1.00E-05	1.57E-04
Co-58	1.08E+04	8.50E-06	2.41E-08	2.00E-05	1.35E-03
Co-60	1.64E+03	1.29E-06	1.73E-08	3.00E-06	1.36E-03
Zn-65	1.46E+03	1.15E-06	8.96E-09	5.00E-06	7.31E-04
Sr-89	3.03E+02	2.39E-07	4.53E-10	8.00E-06	9.47E-05
Sr-90	3.84E+01	3.02E-08	4.34E-10	5.00E-07	1.91E-04
Sr-91	1.43E+01	1.12E-08	1.64E-26	2.00E-05	1.78E-06
Y-91m	2.62E+02	2.06E-07	0.00E+00	2.00E-03	3.26E-07
Y-91	1.12E+03	8.77E-07	2.02E-09	8.00E-06	3.48E-04
Y-93	2.86E+04	2.25E-05	9.44E-23	2.00E-05	3.57E-03
Zr-95	9.07E+02	7.13E-07	1.83E-09	2.00E-05	1.13E-04
Nb-95	5.23E+02	4.11E-07	5.01E-10	3.00E-05	4.35E-05
Mo-99	1.26E+03	9.87E-07	1.64E-12	2.00E-05	5.22E-05
Tc-99 ⁽³⁾	9.17E-07	7.21E-16	0.00E+00	6.00E-05	3.81E-14
Tc-99m	3.84E+01	3.02E-08	0.00E+00	1.00E-03	9.57E-08
Ru-103	1.50E+04	1.18E-05	1.64E-08	3.00E-05	1.25E-03
Ru-106	2.65E+05	2.08E-04	2.02E-06	3.00E-06	2.21E-01
Ag-110m	3.84E+03	3.02E-06	2.31E-08	6.00E-06	1.60E-03
Te-129m	3.28E+02	2.58E-07	2.99E-10	7.00E-06	1.17E-04
Te-129	1.64E+01	1.29E-08	0.00E+00	4.00E-04	1.02E-07
Te-131m	6.97E+01	5.48E-08	1.35E-16	8.00E-06	2.18E-05
Te-131	1.85E+00	1.45E-09	0.00E+00	8.00E-05	5.77E-08

Nuclide	Inventory (μCi)	Concentration ⁽¹⁾ ($\mu\text{Ci}/\text{cc}$)	Concentration at Nearest Potable Water ⁽²⁾	10 CFR Appendix B ($\mu\text{Ci}/\text{cc}$)	Ratio
Te-132	3.42E+02	2.69E-07	1.06E-12	9.00E-06	9.48E-05
Ba-137m	1.29E+04	1.01E-05	1.54E-07		
Ba-140	1.33E+04	1.04E-05	2.60E-09	8.00E-06	5.51E-04
La-140	2.48E+03	1.95E-06	1.16E-13	9.00E-06	6.87E-04
Ce-141	2.76E+02	2.17E-07	2.31E-10	3.00E-05	2.29E-05
Ce-143	2.09E+02	1.65E-07	1.64E-15	2.00E-05	2.61E-05
Ce-144	1.15E+04	9.05E-06	7.71E-08	3.00E-06	9.57E-03
W-187	1.22E+02	9.60E-08	2.31E-17	3.00E-05	1.02E-05
Np-239	3.42E+02	2.69E-07	1.73E-13	2.00E-05	4.27E-05
Sum					6.27E-01

- (1) Calculated based on 336,000 gallons (80% of the tank volume of 420,000 gallons)
- (2) A dilution factor of 315 is required not to exceed 10 CFR20 App.B limits.
- (3) In accordance with NRC's position, two radionuclides of I-129 and Tc-99, which may cause significant potential exposure, are included in the liquid tank failure analysis. The inventories of I-129 and Tc-99 in the holdup tank are determined based on the assumption that they have the same RCS existence ratios to I-131 and Tc-99m with those for a similar PWR. As shown in the results, the impact of these nuclides on the dose contribution is negligible.

**Table 2. Radioactive Concentrations in Nearest Portable Water
Due to Liquid Waste Containing Tank Failure (2 of 3)**

Boric acid storage tank

Nuclide	Inventory (μCi)	Concentration ⁽¹⁾ ($\mu\text{Ci}/\text{cc}$)	Concentration at Nearest Potable Water ⁽²⁾	10 CFR Appendix B ($\mu\text{Ci}/\text{cc}$)	Ratio
H-3	8.11E+08	9.02E-01	2.89E-05	1.00E-03	2.89E-02
Br-84	0.00E+00	0.00E+00	0.00E+00	4.00E-04	0.00E+00
I-129 ⁽³⁾	3.36E-03	3.74E-12	1.20E-16	2.00E-07	5.99E-10
I-131	5.41E+04	6.01E-05	1.93E-09	1.00E-06	1.93E-03
I-132	0.00E+00	0.00E+00	0.00E+00	1.00E-04	0.00E+00
I-133	3.24E-03	3.61E-12	1.16E-16	7.00E-06	1.65E-11
I-134	0.00E+00	0.00E+00	0.00E+00	4.00E-04	0.00E+00
I-135	5.41E-17	6.01E-26	1.93E-30	3.00E-05	6.42E-26
Rb-88	0.00E+00	0.00E+00	0.00E+00	4.00E-04	0.00E+00
Cs-134	2.51E+06	2.80E-03	8.96E-08	9.00E-07	9.96E-02
Cs-136	2.97E+03	3.31E-06	1.06E-10	6.00E-06	1.77E-05
Cs-137	4.32E+06	4.81E-03	1.54E-07	1.00E-06	1.54E-01
Na-24	2.70E-06	3.01E-15	9.64E-20	5.00E-05	1.93E-15
Cr-51	1.03E+05	1.14E-04	3.66E-09	5.00E-04	7.32E-06
Mn-54	9.19E+05	1.02E-03	3.28E-08	3.00E-05	1.09E-03
Fe-55	1.00E+06	1.11E-03	3.57E-08	1.00E-04	3.57E-04
Fe-59	2.27E+04	2.53E-05	8.09E-10	1.00E-05	8.09E-05
Co-58	6.76E+05	7.52E-04	2.41E-08	2.00E-05	1.20E-03
Co-60	4.86E+05	5.41E-04	1.73E-08	3.00E-06	5.78E-03
Zn-65	2.51E+05	2.80E-04	8.96E-09	5.00E-06	1.79E-03
Sr-89	1.27E+04	1.41E-05	4.53E-10	8.00E-06	5.66E-05
Sr-90	1.22E+04	1.35E-05	4.34E-10	5.00E-07	8.67E-04
Sr-91	4.59E-13	5.11E-22	1.64E-26	2.00E-05	8.19E-22
Y-91m	0.00E+00	0.00E+00	0.00E+00	2.00E-03	0.00E+00
Y-91	5.68E+04	6.31E-05	2.02E-09	8.00E-06	2.53E-04
Y-93	2.65E-09	2.95E-18	9.44E-23	2.00E-05	4.72E-18
Zr-95	5.14E+04	5.71E-05	1.83E-09	2.00E-05	9.15E-05
Nb-95	1.41E+04	1.56E-05	5.01E-10	3.00E-05	1.67E-05
Mo-99	4.59E+01	5.11E-08	1.64E-12	2.00E-05	2.73E-08
Tc-99 ⁽³⁾	0.00E+00	0.00E+00	0.00E+00	6.00E-05	0.00E+00
Tc-99m	0.00E+00	0.00E+00	0.00E+00	1.00E-03	0.00E+00
Ru-103	4.59E+05	5.11E-04	1.64E-08	3.00E-05	5.46E-04
Ru-106	5.68E+07	6.31E-02	2.02E-06	3.00E-06	6.74E-01
Ag-110m	6.49E+05	7.21E-04	2.31E-08	6.00E-06	3.85E-03
Te-129m	8.38E+03	9.32E-06	2.99E-10	7.00E-06	4.27E-05
Te-129	0.00E+00	0.00E+00	0.00E+00	4.00E-04	0.00E+00
Te-131m	3.78E-03	4.21E-12	1.35E-16	8.00E-06	1.69E-11
Te-131	0.00E+00	0.00E+00	0.00E+00	8.00E-05	0.00E+00
Te-132	2.97E+01	3.31E-08	1.06E-12	9.00E-06	1.18E-07
Ba-137m	4.32E+06	4.81E-03	1.54E-07		

Nuclide	Inventory (μCi)	Concentration ⁽¹⁾ ($\mu\text{Ci}/\text{cc}$)	Concentration at Nearest Potable Water ⁽²⁾	10 CFR Appendix B ($\mu\text{Ci}/\text{cc}$)	Ratio
Ba-140	7.30E+04	8.12E-05	2.60E-09	8.00E-06	4.34E-05
La-140	3.24E+00	3.61E-09	1.16E-13	9.00E-06	1.28E-08
Ce-141	6.49E+03	7.21E-06	2.31E-10	3.00E-05	7.71E-06
Ce-143	4.59E-02	5.11E-11	1.64E-15	2.00E-05	8.19E-11
Ce-144	2.16E+06	2.40E-03	7.71E-08	3.00E-06	2.57E-02
W-187	6.49E-04	7.21E-13	2.31E-17	3.00E-05	7.71E-13
Np-239	4.86E+00	5.41E-09	1.73E-13	2.00E-05	8.67E-09
Sum					

- (1) Calculated based on 237,500 gallons (95% of the tank volume of 250,000 gallons)
- (2) A dilution factor of 31,200 is required not to exceed 10 CFR20 App.B limits.
- (3) In accordance with NRC's position, two radionuclides of I-129 and Tc-99, which may cause significant potential exposure, are included in the liquid tank failure analysis. The inventories of I-129 and Tc-99 in the holdup tank are determined based on the assumption that they have the same RCS existence ratios to I-131 and Tc-99m with those for a similar PWR. As shown in the results, the impact of these nuclides on the dose contribution is negligible.

**Table 2. Radioactive Concentrations in Nearest Portable Water
Due to Liquid Waste Containing Tank Failure (3 of 3)**

Reactor makeup water tank

Nuclide	Inventory (μCi)	Concentration ⁽¹⁾ ($\mu\text{Ci}/\text{cc}$)	Concentration at Nearest Potable Water ⁽²⁾	10 CFR Appendix B ($\mu\text{Ci}/\text{cc}$)	Ratio
H-3	1.08E+09	7.61E-01	1.00E-03	1.00E-03	1.00E+00
Br-84	5.41E-07	3.81E-16	5.00E-19	4.00E-04	1.25E-15
I-129 ⁽³⁾	6.56E-08	4.62E-17	6.07E-20	2.00E-07	3.03E-13
I-131	1.05E+00	7.42E-10	9.75E-13	1.00E-06	9.75E-07
I-132	1.51E-04	1.07E-13	1.40E-16	1.00E-04	1.40E-12
I-133	1.78E-02	1.26E-11	1.65E-14	7.00E-06	2.36E-09
I-134	3.24E-05	2.28E-14	3.00E-17	4.00E-04	7.50E-14
I-135	2.11E-03	1.48E-12	1.95E-15	3.00E-05	6.50E-11
Rb-88	9.46E-05	6.66E-14	8.75E-17	4.00E-04	2.19E-13
Cs-134	3.78E+01	2.66E-08	3.50E-11	9.00E-07	3.89E-05
Cs-136	2.97E-01	2.09E-10	2.75E-13	6.00E-06	4.58E-08
Cs-137	5.68E+01	4.00E-08	5.25E-11	1.00E-06	5.25E-05
Na-24	3.78E-02	2.66E-11	3.50E-14	5.00E-05	7.00E-10
Cr-51	5.68E+00	4.00E-09	5.25E-12	5.00E-04	1.05E-08
Mn-54	1.59E+01	1.12E-08	1.48E-11	3.00E-05	4.92E-07
Fe-55	1.46E+01	1.03E-08	1.35E-11	1.00E-04	1.35E-07
Fe-59	9.46E-01	6.66E-10	8.75E-13	1.00E-05	8.75E-08
Co-58	2.16E+01	1.52E-08	2.00E-11	2.00E-05	1.00E-06
Co-60	6.76E+00	4.76E-09	6.25E-12	3.00E-06	2.08E-06
Zn-65	4.59E+00	3.23E-09	4.25E-12	5.00E-06	8.50E-07
Sr-89	4.86E-01	3.42E-10	4.50E-13	8.00E-06	5.63E-08
Sr-90	1.59E-01	1.12E-10	1.48E-13	5.00E-07	2.95E-07
Sr-91	2.70E-04	1.90E-13	2.50E-16	2.00E-05	1.25E-11
Y-91m	4.59E-04	3.23E-13	4.25E-16	2.00E-03	2.13E-13
Y-91	1.97E+00	1.39E-09	1.83E-12	8.00E-06	2.28E-07
Y-93	5.95E-01	4.19E-10	5.50E-13	2.00E-05	2.75E-08
Zr-95	1.70E+00	1.20E-09	1.58E-12	2.00E-05	7.88E-08
Nb-95	6.76E-01	4.76E-10	6.25E-13	3.00E-05	2.08E-08
Mo-99	1.65E-01	1.16E-10	1.53E-13	2.00E-05	2.54E-09
Tc-99 ⁽³⁾	1.16E-11	8.19E-21	1.08E-23	6.00E-05	1.79E-19
Tc-99m	4.86E-04	3.42E-13	4.50E-16	1.00E-03	4.50E-13
Ru-103	2.05E+01	1.45E-08	1.90E-11	3.00E-05	6.33E-07
Ru-106	9.46E+02	6.66E-07	8.75E-10	3.00E-06	2.92E-04
Ag-110m	1.22E+01	8.56E-09	1.13E-11	6.00E-06	1.88E-06
Te-129m	4.05E-02	2.85E-11	3.75E-14	7.00E-06	5.36E-09
Te-129	3.78E-06	2.66E-15	3.50E-18	4.00E-04	8.75E-15
Te-131m	4.05E-04	2.85E-13	3.75E-16	8.00E-06	4.69E-11
Te-131	1.59E-07	1.12E-16	1.48E-19	8.00E-05	1.84E-15
Te-132	5.41E-03	3.81E-12	5.00E-15	9.00E-06	5.56E-10
Ba-137m	5.68E+01	4.00E-08	5.25E-11		

Nuclide	Inventory (μCi)	Concentration ⁽¹⁾ ($\mu\text{Ci}/\text{cc}$)	Concentration at Nearest Potable Water ⁽²⁾	10 CFR Appendix B ($\mu\text{Ci}/\text{cc}$)	Ratio
Ba-140	7.57E+00	5.33E-09	7.00E-12	8.00E-06	1.17E-07
La-140	2.03E-01	1.43E-10	1.88E-13	9.00E-06	2.08E-08
Ce-141	3.24E-01	2.28E-10	3.00E-13	3.00E-05	1.00E-08
Ce-143	1.41E-02	9.89E-12	1.30E-14	2.00E-05	6.50E-10
Ce-144	3.78E+01	2.66E-08	3.50E-11	3.00E-06	1.17E-05
W-187	5.95E-03	4.19E-12	5.50E-15	3.00E-05	1.83E-10
Np-239	3.78E-02	2.66E-11	3.50E-14	2.00E-05	1.75E-09
Sum					1.00E+00

- (1) Calculated based on 375,250 gallons (95% of the tank volume of 395,000 gallons)
- (2) A dilution factor of 761 is required not to exceed 10 CFR20 App.B limits.
- (3) In accordance with NRC's position, two radionuclides of I-129 and Tc-99, which may cause significant potential exposure, are included in the liquid tank failure analysis. The inventories of I-129 and Tc-99 in the holdup tank are determined based on the assumption that they have the same RCS existence ratios to I-131 and Tc-99m with those for a similar PWR. As shown in the results, the impact of these nuclides on the dose contribution is negligible.

Impact on DCD

DCD Tier 2 Subsection 11.2.3.2 and Table 11.2-9 will be updated as indicated in attachment.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

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operating conditions. The results of the dose calculation are presented in Table 11.2-5. The values are compared with the corresponding limits of 10 CFR 50, Appendix I (Reference 4). The maximum individual dose to total body is 0.0276 mSv/yr for a child. This value is less than the regulatory limit of 0.03 mSv/yr presented in 10 CFR 50, Appendix I (Reference 4). The maximum dose to any individual organ is 0.0405 mSv/yr, which is the dose to a child's liver. This value is less than the limitation of 0.1 mSv/yr presented in 10 CFR 50, Appendix I (Reference 4).

The COL applicant is to calculate the dose to members of the public following the guidance of NRC RG 1.109 (Reference 30) and NRC RG 1.113 (Reference 31) using site-specific parameters and to compare the doses due to liquid effluents with the numerical design objectives of Appendix I to 10 CFR 50 (Reference 4), 10 CFR 20.1302 (Reference 32), and 40 CFR 190 (Reference 33) (COL 11.2(13)).

11.2.3.2 Radioactive Effluent Release due to Failure of Radioactive Liquid Tank

For the assessment of the impacts of contamination levels on the nearest portable water supply located in an unrestricted area, a tank containing radioactive liquid is postulated to fail. The acceptance criteria and methods used for the assessment follow the guidance in BTP 11-6 (Reference 17) and the radionuclide concentration limits in 10 CFR 20, Appendix B (Reference 3). In addition, the Interim Staff Guidance (ISG) DC/COL-ISG-013 (Reference 34) stipulates that the COL applicant is to identify the site-specific parameters for the evaluation (COL 11.2(14)). In the absence of site-specific requirements, the minimum dilution factors are calculated using 10 percent of 10 CFR 20, Appendix B, Table 2 (Reference 3) concentration limits and compared with the corresponding expected release radionuclide concentration.

In evaluating the postulated liquid-containing tank failure, the CVCS boric acid storage tank is selected because it results in the worst consequence with respect to contamination in the nearest portable water among the liquid waste collection tanks installed in the yard area. Calculations for the three yard tank failure are presented in DCD Table 11.2-9. In accordance with Section B.3 of BTP 11-6 (Reference 17), credit for liquid retention by the tank house surrounding the boric acid storage tank is not taken; ~~and that 95% of the entire volume capacity of the tank is assumed to be released when the boric acid storage tank fails.~~

The radionuclide inventory in the boric acid storage tank is based on the expected fuel defect. The concentration of radioactive liquid after a liquid tank failure is assumed to be

The analysis model assumes the release of the 95% of the entire volume when the boric acid storage tank fails. This analysis is slightly different from the guidance of BTP 11-6 (which stipulates 80% volumetric release), but is more conservative.

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unmitigated and diluted by mixing in receiving water. The concentration after diluted in receiving water is divided by 10 CFR 20 Appendix B (Reference 3) limits. Table 11.2-9 summarizes the results of this evaluation and identifies the minimum dilution factor as 31,200 to sufficiently dilute the failed tank nuclides to the 10 CFR 20 Appendix B (Reference 3) concentration limits. Site-specific hydrologic characteristics related to dilution of liquid tank failure source terms are described in Subsection 2.4.13.

The COL applicant is to provide the site-specific volume of the mixing water and hydrogeological data for analysis; the results of the analysis are to demonstrate that the potential groundwater or surface water contamination concentration resulting from radioactive release due to liquid-containing tank failure meets the requirements in 10 CFR 20, Appendix B, Table 2 (Reference 3) (COL 11.2(14)).

11.2.3.3 Offsite Dose Calculation Manual

The release of the treated liquid effluent is to follow the surveillance, control and operations requirements of the offsite dose calculation manual. The COL applicant is to prepare the site-specific ODCM in accordance with the Nuclear Energy Institute (NEI) 07-09A, Generic FSAR Template Guidance for Offsite Dose Calculation Manual (ODCM) Program Description (Reference 35) (COL 11.2(1)).

11.2.4 Testing and Inspection Requirements

Preoperational testing is described in Section 14.2. Prior to installation, the R/O package is tested to verify that it is functioning properly. The system control panels are shop tested. The remainder of the system components are tested and inspected prior to shipment. After installation, but prior to initial plant startup, the LWMS is tested to verify pressure integrity, flow characteristics at design conditions, and the operability of valves, instrumentation, and controls. During commissioning and initial power operation, samples are taken on a batch basis to verify the load and decontamination efficiency of the R/O package. Instrumentation is recalibrated periodically. The inspection and testing are implemented to enable periodic evaluation of system operability and required performance in accordance with NRC RG 1.143 (Reference 1).

Epoxy coatings in cubicles that contain significant quantities of radioactive material are Service Level II coatings as defined in NRC RG 1.54 (Reference 16), and are subject to the limited QA provisions, selection, qualification, application, testing, maintenance and inspection provisions of NRC RG 1.54 (Reference 16) and standards referenced therein, as

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Table 11.2-9 (1 of 9)

Radioactive Concentrations in Nearest Portable Water Due to Liquid Waste Containing Tank Failure

Nuclide	Expected BAST ⁽¹⁾ Inventory		BAST Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E-04	1.48E+01	0.00E+00
I-129 ⁽⁴⁾	7.56E-05	2.80E+00	8.41E-14	3.11E-09	9.00E-18	3.33E-13	2.00E-07	7.40E-03	4.50E-11
I-131	1.22E+03	4.50E+07	1.35E-06	5.01E-02	1.45E-10	5.36E-06	1.00E-06	3.70E-02	1.45E-04
I-132	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-04	3.70E+00	0.00E+00
I-133	2.97E-04	1.10E+01	3.31E-13	1.22E-08	3.54E-17	1.31E-12	7.00E-06	2.59E-01	5.06E-12
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E-04	1.48E+01	0.00E+00
I-135	5.68E-18	2.10E-13	6.31E-27	2.34E-22	6.76E-31	2.50E-26	3.00E-05	1.11E+00	2.25E-26
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E-04	1.48E+01	0.00E+00
Cs-134	5.41E+03	2.00E+08	6.01E-06	2.22E-01	6.44E-10	2.38E-05	9.00E-07	3.33E-02	7.15E-04
Cs-136	1.43E+03	5.30E+07	1.59E-06	5.90E-02	1.71E-10	6.31E-06	6.00E-06	2.22E-01	2.84E-05
Cs-137	9.19E+03	3.40E+08	1.02E-05	3.78E-01	1.09E-09	4.05E-05	1.00E-06	3.70E-02	1.09E-03
Na-24	1.38E-06	5.10E-02	1.53E-15	5.67E-11	1.64E-19	6.07E-15	5.00E-05	1.85E+00	3.28E-15
Cr-51	4.86E+03	1.80E+08	5.41E-06	2.00E-01	5.79E-10	2.14E-05	5.00E-04	1.85E+01	1.16E-06
Mn-54	3.78E+04	1.40E+09	4.21E-05	1.56E+00	4.51E-09	1.67E-04	3.00E-05	1.11E+00	1.50E-04
Fe-55	4.05E+04	1.50E+09	4.51E-05	1.67E+00	4.83E-09	1.79E-04	1.00E-04	3.70E+00	4.83E-05
Fe-59	1.08E+03	4.00E+07	1.20E-06	4.45E-02	1.29E-10	4.76E-06	1.00E-05	3.70E-01	1.29E-05

Replace this table with "A" after this table

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Table 11.2-9 (2 of 9)

Nuclide	Expected BAST ⁽¹⁾ Inventory		BAST Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Co-58	3.24E+04	1.20E+09	3.61E-05	1.33E+00	3.86E-09	1.43E-04	2.00E-05	7.40E-01	1.93E-04
Co-60	1.95E+04	7.20E+08	2.16E-05	8.01E-01	2.32E-09	8.57E-05	3.00E-06	1.11E-01	7.72E-04
Zn-65	1.05E+05	3.90E+09	1.17E-04	4.34E+00	1.26E-08	4.64E-04	5.00E-06	1.85E-02	2.51E-03
Sr-89	5.95E+03	2.20E+08	6.61E-06	2.45E-01	7.08E-10	2.62E-05	8.00E-06	2.96E-01	8.85E-05
Sr-90	4.86E+03	1.80E+08	5.41E-06	2.00E-01	5.79E-10	2.14E-05	5.00E-07	1.85E-02	1.16E-03
Sr-91	2.35E-13	8.70E-09	2.62E-22	9.68E-18	2.80E-26	1.04E-21	2.00E-05	7.40E-01	1.40E-21
Y-91m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-03	7.40E+01	0.00E+00
Y-91	2.62E+04	9.70E+08	2.92E-05	1.08E+00	3.12E-09	1.16E-04	8.00E-06	2.96E-01	3.90E-04
Y-93	1.32E-09	4.90E-05	1.47E-18	5.45E-14	1.58E-22	5.84E-18	2.00E-05	7.40E-01	7.89E-18
Zr-95	2.38E+04	8.80E+08	2.65E-05	9.79E-01	2.83E-09	1.05E-04	2.00E-05	7.40E-01	1.42E-04
Nb-95	6.76E+03	2.50E+08	7.52E-06	2.78E-01	8.05E-10	2.98E-05	3.00E-05	1.11E+00	2.68E-05
Mo-99	2.35E+01	8.70E+05	2.62E-08	9.68E-04	2.80E-12	1.04E-07	2.00E-05	7.40E-01	4.67E-08
Tc-99 ⁽⁴⁾	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.00E-05	3.70E+01	0.00E+00
Tc-99m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-03	2.22E+00	0.00E+00
Ru-103	2.22E+05	8.20E+09	2.47E-04	9.12E+00	2.64E-08	9.77E-04	3.00E-05	1.11E+00	8.80E-04
Ru-106	2.30E+07	8.50E+11	2.56E-02	9.45E+02	2.74E-06	1.01E-01	3.00E-06	1.11E-01	9.12E-01
Ag-110m	2.70E+05	1.00E+10	3.01E-04	1.11E+01	3.22E-08	1.19E-03	6.00E-06	2.22E-01	5.36E-03
Te-129m	4.05E+03	1.50E+08	4.51E-06	1.67E-01	4.83E-10	1.79E-05	7.00E-06	2.59E-01	6.90E-05
Te-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E-04	1.48E+01	0.00E+00

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Table 11.2-9 (3 of 9)

Nuclide	Expected BAST ⁽¹⁾ Inventory		BAST Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Te-131m	1.81E-03	6.70E+01	2.01E-12	7.45E-08	2.16E-16	7.98E-12	8.00E-06	2.96E-01	2.70E-11
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.00E-05	2.96E+00	0.00E+00
Te-132	1.43E+01	5.30E+05	1.59E-08	5.90E-04	1.71E-12	6.31E-08	9.00E-06	3.33E-01	1.90E-07
Ba-137m	9.19E+03	3.40E+08	1.02E-05	3.78E-01	1.09E-09	4.03E-05			
Ba-140	3.51E+04	1.30E+09	3.91E-05	1.45E+00	4.18E-09	1.55E-04	8.00E-06	2.96E-01	5.23E-04
La-140	1.59E+00	5.90E+04	1.77E-09	6.56E-05	1.90E-13	7.03E-09	9.00E-06	3.33E-01	2.11E-08
Ce-141	3.24E+03	1.20E+08	3.61E-06	1.33E-01	3.86E-10	1.43E-05	3.00E-05	1.11E+00	1.29E-05
Ce-143	2.27E-02	8.40E+02	2.53E-11	9.34E-07	2.70E-15	1.00E-10	2.00E-05	7.40E-01	1.35E-10
Ce-144	8.92E+05	3.30E+10	9.92E-04	3.67E+01	1.06E-07	3.93E-03	3.00E-06	1.11E-01	3.54E-02
W-187	3.24E-04	1.20E+01	3.61E-13	1.33E-08	3.86E-17	1.43E-12	3.00E-05	1.11E+00	1.29E-12
Np-239	2.49E+00	9.20E+04	2.77E-09	1.02E-04	2.96E-13	1.10E-08	2.00E-05	7.40E-01	1.48E-08
H-3	3.24E+08	1.20E+13	3.61E-01	1.33E+04	3.86E-05	7.98E-12	1.00E-03	3.70E+01	3.86E-02
SUM									1.00E+00

(1) Calculated based on 237,500 gallons (95% of the tank volume of 250,000 gallons).

(2) 95% of tank volume (237,500 gallons) is divided to calculate concentration.

(3) A dilution factor of 9,340 is required not to exceed 10 CFR 20 App.B limits.

(4) In accordance with NRC's position, two radionuclides of I-129 and Tc-99, which may cause significant potential exposure, are included in the liquid tank failure analysis. The inventories of I-129 and Tc-99 in the holdup tank are determined based on the assumption that they have the same RCS existence ratios to I-131 and Tc-99m with those for a similar PWR. As shown in the results, the impact of these nuclides on the dose contribution is negligible.

Replace this table with "A" after this table

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Table 11.2-9 (4 of 9)

Nuclide	Expected HUT ⁽¹⁾ Inventory		HUT Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Br-84	4.88E+00	1.81E+05	3.84E-09	1.42E-04	1.39E-11	5.14E-07	4.00E-04	1.48E+01	3.47E-08
I-129 ⁽⁴⁾	7.80E-05	2.89E+00	6.14E-14	2.27E-09	2.22E-16	8.22E-12	2.00E-07	7.40E-03	1.11E-09
I-131	1.26E+03	4.65E+07	9.87E-07	3.65E-02	3.57E-09	1.32E-04	1.00E-06	3.70E-02	3.57E-03
I-132	9.07E+01	3.35E+06	7.13E-08	2.64E-03	2.58E-10	9.55E-06	1.00E-04	3.70E+00	2.58E-06
I-133	7.67E+02	2.84E+07	6.03E-07	2.23E-02	2.18E-09	8.08E-05	7.00E-06	2.59E-01	3.12E-04
I-134	5.23E+01	1.94E+06	4.11E-08	1.52E-03	1.49E-10	5.51E-06	4.00E-04	1.48E+01	3.72E-07
I-135	3.21E+02	1.19E+07	2.52E-07	9.33E-03	9.13E-10	3.38E-05	3.00E-05	1.11E+00	3.04E-05
Rb-88	1.57E+02	5.81E+06	1.23E-07	4.57E-03	4.47E-10	1.65E-05	4.00E-04	1.48E+01	1.12E-06
Cs-134	4.88E+01	1.81E+06	3.84E-08	1.42E-03	1.39E-10	5.14E-06	9.00E-07	3.33E-02	1.54E-04
Cs-136	5.23E+02	1.94E+07	4.11E-07	1.52E-02	1.49E-09	5.51E-05	6.00E-06	2.22E-01	2.48E-04
Cs-137	7.32E+01	2.71E+06	5.76E-08	2.13E-03	2.08E-10	7.71E-06	1.00E-06	3.70E-02	2.08E-04
Na-24	1.22E+03	4.52E+07	9.60E-07	3.55E-02	3.47E-09	1.29E-04	5.00E-05	1.85E+00	6.95E-05
Cr-51	5.23E+03	1.94E+08	4.11E-06	1.52E-01	1.49E-08	5.51E-04	5.00E-04	1.85E+01	2.98E-05
Mn-54	4.53E+03	1.68E+08	3.56E-06	1.32E-01	1.29E-08	4.77E-04	3.00E-05	1.11E+00	4.30E-04
Fe-55	3.49E+03	1.29E+08	2.74E-06	1.01E-01	9.93E-09	3.67E-04	1.00E-04	3.70E+00	9.93E-05
Fe-59	6.28E+02	2.32E+07	4.94E-07	1.83E-02	1.79E-09	6.61E-05	1.00E-05	3.70E-01	1.79E-04

Replace this table with "A" after this table

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Table 11.2-9 (5 of 9)

Nuclide	Expected HUT ⁽¹⁾ Inventory		HUT Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Co-58	1.08E+04	4.00E+08	8.50E-06	3.14E-01	3.08E-08	1.14E-03	2.00E-05	7.40E-01	1.54E-03
Co-60	1.64E+03	6.06E+07	1.29E-06	4.77E-02	4.67E-09	1.73E-04	3.00E-06	1.11E-01	1.56E-03
Zn-65	1.46E+03	5.42E+07	1.15E-06	4.26E-02	4.17E-09	1.54E-04	5.00E-06	1.85E-02	8.34E-04
Sr-89	3.03E+02	1.12E+07	2.39E-07	8.83E-03	8.64E-10	3.20E-05	8.00E-06	2.96E-01	1.08E-04
Sr-90	3.84E+01	1.42E+06	3.02E-08	1.12E-03	1.09E-10	4.04E-06	5.00E-07	1.85E-02	2.18E-04
Sr-91	1.43E+01	5.29E+05	1.12E-08	4.16E-04	4.07E-11	1.51E-06	2.00E-05	7.40E-01	2.03E-06
Y-91m	2.62E+02	9.68E+06	2.06E-07	7.61E-03	7.44E-10	2.75E-05	2.00E-03	7.40E+01	3.72E-07
Y-91	1.12E+03	4.13E+07	8.77E-07	3.25E-02	3.18E-09	1.18E-04	8.00E-06	2.96E-01	3.97E-04
Y-93	2.86E+04	1.06E+09	2.25E-05	8.32E-01	8.14E-08	3.01E-03	2.00E-05	7.40E-01	4.07E-03
Zr-95	9.07E+02	3.35E+07	7.13E-07	2.64E-02	2.58E-09	9.55E-05	2.00E-05	7.40E-01	1.29E-04
Nb-95	5.23E+02	1.94E+07	4.11E-07	1.52E-02	1.49E-09	5.51E-05	3.00E-05	1.11E+00	4.96E-05
Mo-99	1.26E+03	4.65E+07	9.87E-07	3.65E-02	3.57E-09	1.32E-04	2.00E-05	7.40E-01	5.96E-05
Tc-99 ⁽⁴⁾	9.17E-07	3.39E-02	7.21E-16	2.67E-11	2.61E-18	9.66E-14	6.00E-05	3.70E+01	4.35E-14
Tc-99m	3.84E+01	1.42E+06	3.02E-08	1.12E-03	1.09E-10	4.04E-06	1.00E-03	2.22E+00	1.09E-07
Ru-103	1.50E+04	5.55E+08	1.18E-05	4.36E-01	4.27E-08	1.58E-03	3.00E-05	1.11E+00	1.42E-03
Ru-106	2.65E+05	9.81E+09	2.08E-04	7.71E+00	7.54E-07	2.79E-02	3.00E-06	1.11E-01	2.51E-01
Ag-110m	3.84E+03	1.42E+08	3.02E-06	1.12E-01	1.09E-08	4.04E-04	6.00E-06	2.22E-01	1.82E-03
Te-129m	3.28E+02	1.21E+07	2.58E-07	9.54E-03	9.33E-10	3.45E-05	7.00E-06	2.59E-01	1.33E-04
Te-129	1.64E+01	6.06E+05	1.29E-08	4.77E-04	4.67E-11	1.73E-06	4.00E-04	1.48E+01	1.17E-07

Replace this table with "A" after this table

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Table 11.2-9 (6 of 9)

Nuclide	Expected HUT ⁽¹⁾ Inventory		HUT Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Te-131m	6.97E+01	2.58E+06	5.48E-08	2.03E-03	1.99E-10	7.35E-06	8.00E-06	2.96E-01	2.48E-05
Te-131	1.85E+00	6.84E+04	1.45E-09	5.38E-05	5.26E-12	1.95E-07	8.00E-05	2.96E+00	6.58E-08
Te-132	3.42E+02	1.26E+07	2.69E-07	9.94E-03	9.73E-10	3.60E-05	9.00E-06	3.33E-01	1.08E-04
Ba-137m	7.32E+01	2.71E+06	5.76E-08	2.13E-03	2.08E-10	7.71E-06			
Ba-140	1.33E+04	4.90E+08	1.04E-05	3.86E-01	3.77E-08	1.40E-03	8.00E-06	2.96E-01	4.72E-03
La-140	2.48E+03	9.16E+07	1.95E-06	7.20E-02	7.05E-09	2.61E-04	9.00E-06	3.33E-01	7.83E-04
Ce-141	2.76E+02	1.02E+07	2.17E-07	8.01E-03	7.84E-10	2.90E-05	3.00E-05	1.11E+00	2.61E-05
Ce-143	2.09E+02	7.74E+06	1.65E-07	6.09E-03	5.96E-10	2.20E-05	2.00E-05	7.40E-01	2.98E-05
Ce-144	1.15E+04	4.26E+08	9.05E-06	3.35E-01	3.28E-08	1.21E-03	3.00E-06	1.11E-01	1.09E-02
W-187	1.22E+02	4.52E+06	9.60E-08	3.55E-03	3.47E-10	1.29E-05	3.00E-05	1.11E+00	1.16E-05
Np-239	3.42E+02	1.26E+07	2.69E-07	9.94E-03	9.73E-10	3.60E-05	2.00E-05	7.40E-01	4.86E-05
H-3	2.51E+08	9.29E+12	1.97E-01	7.30E+03	7.15E-04	2.64E+01	1.00E-03	3.70E+01	7.15E-01
SUM									1.00E+00

(1) Calculated based on 336,000 gallons (80% of the tank volume of 420,000 gallons).

(2) 62% of tank volume (260,400 gallons) is divided to calculate concentration.

(3) A dilution factor of 276 is required not to exceed 10 CFR 20 App.B limits.

(4) In accordance with NRC's position, two radionuclides of I-129 and Tc-99, which may cause significant potential exposure, are included in the liquid tank failure analysis. The inventories of I-129 and Tc-99 in the holdup tank are determined based on the assumption that they have the same RCS existence ratios to I-131 and Tc-99m with those for a similar PWR. As shown in the results, the impact of these nuclides on the dose contribution is negligible.

Replace this table with "A" after this table

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Table 11.2-9 (7 of 9)

Nuclide	Expected RMWT ⁽¹⁾ Inventory		RMWT Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Br-84	5.41E-07	2.00E-02	3.81E-16	1.41E-11	4.88E-19	1.81E-14	4.00E-04	1.48E+01	1.22E-15
I-129 ⁽⁴⁾	2.86E-09	1.06E-04	2.01E-18	7.44E-14	2.58E-21	9.54E-17	2.00E-07	7.40E-03	1.29E-14
I-131	4.59E-02	1.70E+03	3.23E-11	1.20E-06	4.15E-14	1.53E-09	1.00E-06	3.70E-02	4.15E-08
I-132	4.32E-05	1.60E+00	3.04E-14	1.13E-09	3.90E-17	1.44E-12	1.00E-04	3.70E+00	3.90E-13
I-133	3.24E-03	1.20E+02	2.28E-12	8.45E-08	2.93E-15	1.08E-10	7.00E-06	2.59E-01	4.18E-10
I-134	9.46E-06	3.50E-01	6.66E-15	2.46E-10	8.54E-18	3.16E-13	4.00E-04	1.48E+01	2.13E-14
I-135	4.32E-04	1.60E+01	3.04E-13	1.13E-08	3.90E-16	1.44E-11	3.00E-05	1.11E+00	1.30E-11
Rb-88	9.46E-05	3.50E+00	6.66E-14	2.46E-09	8.54E-17	3.16E-12	4.00E-04	1.48E+01	2.13E-13
Cs-134	2.03E-01	7.50E+03	1.43E-10	5.28E-06	1.83E-13	6.77E-09	9.00E-07	3.33E-02	2.03E-07
Cs-136	2.97E-01	1.10E+04	2.09E-10	7.74E-06	2.68E-13	9.93E-09	6.00E-06	2.22E-01	4.47E-08
Cs-137	3.24E-01	1.20E+04	2.28E-10	8.45E-06	2.93E-13	1.08E-08	1.00E-06	3.70E-02	2.93E-07
Na-24	3.78E-02	1.40E+03	2.66E-11	9.86E-07	3.42E-14	1.26E-09	5.00E-05	1.85E+00	6.83E-10
Cr-51	5.68E+00	2.10E+05	4.00E-09	1.48E-04	5.12E-12	1.90E-07	5.00E-04	1.85E+01	1.02E-08
Mn-54	1.65E+01	6.10E+05	1.16E-08	4.29E-04	1.49E-11	5.51E-07	3.00E-05	1.11E+00	4.96E-07
Fe-55	1.51E+01	5.60E+05	1.07E-08	3.94E-04	1.37E-11	5.05E-07	1.00E-04	3.70E+00	1.37E-07
Fe-59	9.46E-01	3.50E+04	6.66E-10	2.46E-05	8.54E-13	3.16E-08	1.00E-05	3.70E-01	8.54E-08

Replace this table with "A" after this table

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Table 11.2-9 (8 of 9)

Nuclide	Expected RMWT ⁽¹⁾ Inventory		RMWT Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Co-58	2.22E+01	8.20E+05	1.56E-08	5.77E-04	2.00E-11	7.40E-07	2.00E-05	7.40E-01	1.00E-06
Co-60	7.03E+00	2.60E+05	4.95E-09	1.83E-04	6.34E-12	2.35E-07	3.00E-06	1.11E-01	2.11E-06
Zn-65	4.86E+00	1.80E+05	3.42E-09	1.27E-04	4.39E-12	1.62E-07	5.00E-06	1.85E-02	8.78E-07
Sr-89	4.86E-01	1.80E+04	3.42E-10	1.27E-05	4.39E-13	1.62E-08	8.00E-06	2.96E-01	5.49E-08
Sr-90	1.68E-01	6.20E+03	1.18E-10	4.36E-06	1.51E-13	5.60E-09	5.00E-07	1.85E-02	3.02E-07
Sr-91	2.97E-04	1.10E+01	2.09E-13	7.74E-09	2.68E-16	9.93E-12	2.00E-05	7.40E-01	1.34E-11
Y-91m	4.59E-04	1.70E+01	3.23E-13	1.20E-08	4.15E-16	1.53E-11	2.00E-03	7.40E+01	2.07E-13
Y-91	2.00E+00	7.40E+04	1.41E-09	5.21E-05	1.81E-12	6.68E-08	8.00E-06	2.96E-01	2.26E-07
Y-93	5.95E-01	2.20E+04	4.19E-10	1.55E-05	5.37E-13	1.99E-08	2.00E-05	7.40E-01	2.68E-08
Zr-95	1.73E+00	6.40E+04	1.22E-09	4.51E-05	1.56E-12	5.78E-08	2.00E-05	7.40E-01	7.81E-08
Nb-95	6.76E-01	2.50E+04	4.76E-10	1.76E-05	6.10E-13	2.26E-08	3.00E-05	1.11E+00	2.03E-08
Mo-99	1.65E-01	6.10E+03	1.16E-10	4.29E-06	1.49E-13	5.51E-09	2.00E-05	7.40E-01	2.48E-09
Tc-99 ⁽⁴⁾	1.16E-11	4.30E-07	8.19E-21	3.03E-16	1.05E-23	3.88E-19	6.00E-05	3.70E+01	1.75E-19
Tc-99m	4.86E-04	1.80E+01	3.42E-13	1.27E-08	4.39E-16	1.62E-11	1.00E-03	2.22E+00	4.39E-13
Ru-103	2.08E+01	7.70E+05	1.47E-08	5.42E-04	1.88E-11	6.95E-07	3.00E-05	1.11E+00	6.26E-07
Ru-106	9.73E+02	3.60E+07	6.85E-07	2.53E-02	8.78E-10	3.25E-05	3.00E-06	1.11E-01	2.93E-04
Ag-110m	1.24E+01	4.60E+05	8.75E-09	3.24E-04	1.12E-11	4.15E-07	6.00E-06	2.22E-01	1.87E-06
Te-129m	4.05E-02	1.50E+03	2.85E-11	1.06E-06	3.66E-14	1.35E-09	7.00E-06	2.59E-01	5.23E-09
Te-129	3.78E-06	1.40E-01	2.66E-15	9.86E-11	3.42E-18	1.26E-13	4.00E-04	1.48E+01	8.54E-15

Replace this table with "A" after this table

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Table 11.2-9 (9 of 9)

Nuclide	Expected RMWT ⁽¹⁾ Inventory		RMWT Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Te-131m	4.05E-04	1.50E+01	2.85E-13	1.06E-08	2.85E-13	1.35E-11	8.00E-06	2.96E-01	4.57E-11
Te-131	1.59E-07	5.90E-03	1.12E-16	4.15E-12	1.12E-16	5.33E-15	8.00E-05	2.96E+00	1.80E-15
Te-132	5.41E-03	2.00E+02	3.81E-12	1.41E-07	3.81E-12	1.81E-10	9.00E-06	3.33E-01	5.42E-10
Ba-137m	3.24E-01	1.20E+04	2.28E-10	8.45E-06	2.28E-10	1.08E-08			
Ba-140	7.57E+00	2.80E+05	5.33E-09	1.97E-04	5.33E-09	2.53E-07	8.00E-06	2.96E-01	8.54E-07
La-140	2.03E-01	7.50E+03	1.43E-10	5.28E-06	1.43E-10	6.77E-09	9.00E-06	3.33E-01	2.03E-08
Ce-141	3.24E-01	1.20E+04	2.28E-10	8.45E-06	2.28E-10	1.08E-08	3.00E-05	1.11E+00	9.76E-09
Ce-143	1.41E-02	5.20E+02	9.89E-12	3.66E-07	9.89E-12	4.69E-10	2.00E-05	7.40E-01	6.34E-10
Ce-144	4.05E+01	1.50E+06	2.85E-08	1.06E-03	2.85E-08	1.35E-06	3.00E-06	1.11E-01	1.22E-05
W-187	5.95E-03	2.20E+02	4.19E-12	1.55E-07	4.19E-12	1.99E-10	3.00E-05	1.11E+00	1.79E-10
Np-239	3.78E-02	1.40E+03	2.66E-11	9.86E-07	2.66E-11	1.26E-09	2.00E-05	7.40E-01	1.71E-09
H-3	1.11E+09	4.10E+13	7.80E-01	2.89E+04	1.00E-03	3.70E+01	1.00E-03	3.70E+01	1.00E+00
SUM									1.00E+00

(1) Calculated based on 375,250 gallons (95% of the tank volume of 395,000 gallons).

(2) 95% of tank volume (375,250 gallons) is divided to calculate concentration.

(3) A dilution factor of 780 is required not to exceed 10 CFR 20 App.B limits.

(4) In accordance with NRC's position, two radionuclides of I-129 and Tc-99, which may cause significant potential exposure, are included in the liquid tank failure analysis. The inventories of I-129 and Tc-99 in the holdup tank are determined based on the assumption that they have the same RCS existence ratios to I-131 and Tc-99m with those for a similar PWR. As shown in the results, the impact of these nuclides on the dose contribution is negligible.

Replace this table with "A" after this table

"A"
(1 of 9)

Table 11.2-9 (1 of 9)

Radioactive Concentrations in Nearest Portable Water
Due to Liquid Waste Containing Tank Failure

Nuclide	Expected BAST ⁽¹⁾ inventory		BAST Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E-04	1.48E+01	0.00E+00
I-129 ⁽⁴⁾	3.36E-03	1.24E+02	3.74E-12	1.38E-07	1.20E-16	4.43E-12	2.00E-07	7.40E-03	5.99E-10
I-131	5.41E+04	2.00E+09	6.01E-05	2.22E+00	1.93E-09	7.13E-05	1.00E-06	3.70E-02	1.93E-03
I-132	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-04	3.70E+00	0.00E+00
I-133	3.24E-03	1.20E+02	3.61E-12	1.33E-07	1.16E-16	4.28E-12	7.00E-06	2.59E-01	1.65E-11
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E-04	1.48E+01	0.00E+00
I-135	5.41E-17	2.00E-12	6.01E-26	2.22E-21	1.93E-30	7.13E-26	3.00E-05	1.11E+00	6.42E-26
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E-04	1.48E+01	0.00E+00
Cs-134	2.51E+06	9.30E+10	2.80E-03	1.03E+02	8.96E-08	3.32E-03	9.00E-07	3.33E-02	9.96E-02
Cs-136	2.97E+03	1.10E+08	3.31E-06	1.22E-01	1.06E-10	3.92E-06	6.00E-06	2.22E-01	1.77E-05
Cs-137	4.32E+06	1.60E+11	4.81E-03	1.78E+02	1.54E-07	5.70E-03	1.00E-06	3.70E-02	1.54E-01
Na-24	2.70E-06	1.00E-01	3.01E-15	1.11E-10	9.64E-20	3.57E-15	5.00E-05	1.85E+00	1.93E-15
Cr-51	1.03E+05	3.80E+09	1.14E-04	4.23E+00	3.66E-09	1.35E-04	5.00E-04	1.85E+01	7.32E-06
Mn-54	9.19E+05	3.40E+10	1.02E-03	3.78E+01	3.28E-08	1.21E-03	3.00E-05	1.11E+00	1.09E-03
Fe-55	1.00E+06	3.70E+10	1.11E-03	4.12E+01	3.57E-08	1.32E-03	1.00E-04	3.70E+00	3.57E-04
Fe-59	2.27E+04	8.40E+08	2.53E-05	9.34E-01	8.09E-10	2.99E-05	1.00E-05	3.70E-01	8.09E-05

"A"
(2 of 9)

Table 11.2-9 (2 of 9)

Nuclide	Expected BAST ⁽¹⁾ inventory		BAST Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Co-58	6.76E+05	2.50E+10	7.52E-04	2.78E+01	2.41E-08	8.91E-04	2.00E-05	7.40E-01	1.20E-03
Co-60	4.86E+05	1.80E+10	5.41E-04	2.00E+01	1.73E-08	6.42E-04	3.00E-06	1.11E-01	5.78E-03
Zn-65	2.51E+05	9.30E+09	2.80E-04	1.03E+01	8.96E-09	3.32E-04	5.00E-06	1.85E-01	1.79E-03
Sr-89	1.27E+04	4.70E+08	1.41E-05	5.23E-01	4.53E-10	1.68E-05	8.00E-06	2.96E-01	5.66E-05
Sr-90	1.22E+04	4.50E+08	1.35E-05	5.01E-01	4.34E-10	1.60E-05	5.00E-07	1.85E-02	8.67E-04
Sr-91	4.59E-13	1.70E-08	5.11E-22	1.89E-17	1.64E-26	6.06E-22	2.00E-05	7.40E-01	8.19E-22
Y-91m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-03	7.40E+01	0.00E+00
Y-91	5.68E+04	2.10E+09	6.31E-05	2.34E+00	2.02E-09	7.49E-05	8.00E-06	2.96E-01	2.53E-04
Y-93	2.65E-09	9.80E-05	2.95E-18	1.09E-13	9.44E-23	3.49E-18	2.00E-05	7.40E-01	4.72E-18
Zr-95	5.14E+04	1.90E+09	5.71E-05	2.11E+00	1.83E-09	6.77E-05	2.00E-05	7.40E-01	9.15E-05
Nb-95	1.41E+04	5.20E+08	1.56E-05	5.78E-01	5.01E-10	1.85E-05	3.00E-05	1.11E+00	1.67E-05
Mo-99	4.59E+01	1.70E+06	5.11E-08	1.89E-03	1.64E-12	6.06E-08	6.00E-05	2.22E+00	2.73E-08
Tc-99 ⁽⁴⁾	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.00E-05	2.22E+00	0.00E+00
Tc-99m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-03	3.70E+01	0.00E+00
Ru-103	4.59E+05	1.70E+10	5.11E-04	1.89E+01	1.64E-08	6.06E-04	3.00E-05	1.11E+00	5.46E-04
Ru-106	5.68E+07	2.10E+12	6.31E-02	2.34E+03	2.02E-06	7.49E-02	3.00E-06	1.11E-01	6.74E-01
Ag-110m	6.49E+05	2.40E+10	7.21E-04	2.67E+01	2.31E-08	8.56E-04	6.00E-06	2.22E-01	3.85E-03
Te-129m	8.38E+03	3.10E+08	9.32E-06	3.45E-01	2.99E-10	1.11E-05	7.00E-06	2.59E-01	4.27E-05
Te-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E-04	1.48E+01	0.00E+00

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Table 11.2-9 (3 of 9)

Nuclide	Expected BAST ⁽¹⁾ inventory		BAST Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Te-131m	3.78E-03	1.40E+02	4.21E-12	1.56E-07	1.35E-16	4.99E-12	8.00E-06	2.96E-01	1.69E-11
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.00E-05	2.96E+00	0.00E+00
Te-132	2.97E+01	1.10E+06	3.31E-08	1.22E-03	1.06E-12	3.92E-08	9.00E-06	3.33E-01	1.18E-07
Ba-137m	4.32E+06	1.60E+11	4.81E-03	1.78E+02	1.54E-07	5.70E-03	0.00E+00	0.00E+00	0.00E+00
Ba-140	7.30E+04	2.70E+09	8.12E-05	3.00E+00	2.60E-09	9.63E-05	6.00E-05	2.22E+00	4.34E-05
La-140	3.24E+00	1.20E+05	3.61E-09	1.33E-04	1.16E-13	4.28E-09	9.00E-06	3.33E-01	1.28E-08
Ce-141	6.49E+03	2.40E+08	7.21E-06	2.67E-01	2.31E-10	8.56E-06	3.00E-05	1.11E+00	7.71E-06
Ce-143	4.59E-02	1.70E+03	5.11E-11	1.89E-06	1.64E-15	6.06E-11	2.00E-05	7.40E-01	8.19E-11
Ce-144	2.16E+06	8.00E+10	2.40E-03	8.90E+01	7.71E-08	2.85E-03	3.00E-06	1.11E-01	2.57E-02
W-187	6.49E-04	2.40E+01	7.21E-13	2.67E-08	2.31E-17	8.56E-13	3.00E-05	1.11E+00	7.71E-13
Np-239	4.86E+00	1.80E+05	5.41E-09	2.00E-04	1.73E-13	6.42E-09	2.00E-05	7.40E-01	8.67E-09
H-3	8.11E+08	3.00E+13	9.02E-01	3.34E+04	2.89E-05	1.07E+00	1.00E-03	3.70E+01	2.89E-02
SUM									1.00E+00

(1) Calculated based on 237,500 gallons (95% of the tank volume of 250,000 gallons).

(2) 95 % of tank volume (237,500 gallons) is divided to calculate concentration.

(3) A dilution factor of 31,200 is required not to exceed 10 CFR20 App.B limits.

(4) In accordance with NRC's position, two radionuclides of I-129 and Tc-99, which may cause significant potential exposure, are included in the liquid tank failure analysis. The inventories of I-129 and Tc-99 in the holdup tank are determined based on the assumption that they have the same RCS existence ratios to I-131 and Tc-99m with those for a similar PWR. As shown in the results, the impact of these nuclides on the dose contribution is negligible.

"A"
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Table 11.2-9 (4 of 9)

Nuclide	Expected HUT (1) inventory		HUT Concentration (2)		Concentration at Nearest Potable Water (3)		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Br-84	4.88E+00	1.81E+05	3.84E-09	1.42E-04	1.22E-11	4.51E-07	4.00E-04	1.48E+01	3.05E-08
I-129 (4)	1.76E-03	6.50E+01	1.38E-12	5.11E-08	4.39E-15	1.62E-10	2.00E-07	7.40E-03	2.19E-08
I-131	2.82E+04	1.05E+09	2.22E-05	8.22E-01	7.05E-08	2.61E-03	1.00E-06	3.70E-02	7.05E-02
I-132	3.21E+02	1.19E+07	2.52E-07	9.33E-03	8.01E-10	2.96E-05	1.00E-04	3.70E+00	8.01E-06
I-133	4.18E+03	1.55E+08	3.29E-06	1.22E-01	1.04E-08	3.86E-04	7.00E-06	2.59E-01	1.49E-03
I-134	1.78E+02	6.58E+06	1.40E-07	5.17E-03	4.44E-10	1.64E-05	4.00E-04	1.48E+01	1.11E-06
I-135	1.53E+03	5.68E+07	1.21E-06	4.46E-02	3.83E-09	1.42E-04	3.00E-05	1.11E+00	1.28E-04
Rb-88	1.57E+02	5.81E+06	1.23E-07	4.57E-03	3.92E-10	1.45E-05	4.00E-04	1.48E+01	9.79E-07
Cs-134	9.42E+03	3.48E+08	7.40E-06	2.74E-01	2.35E-08	8.70E-04	9.00E-07	3.33E-02	2.61E-02
Cs-136	5.23E+02	1.94E+07	4.11E-07	1.52E-02	1.31E-09	4.83E-05	6.00E-06	2.22E-01	2.18E-04
Cs-137	1.29E+04	4.77E+08	1.01E-05	3.75E-01	3.22E-08	1.19E-03	1.00E-06	3.70E-02	3.22E-02
Na-24	1.22E+03	4.52E+07	9.60E-07	3.55E-02	3.05E-09	1.13E-04	5.00E-05	1.85E+00	6.09E-05
Cr-51	5.23E+03	1.94E+08	4.11E-06	1.52E-01	1.31E-08	4.83E-04	5.00E-04	1.85E+01	2.61E-05
Mn-54	4.53E+03	1.68E+08	3.56E-06	1.32E-01	1.13E-08	4.19E-04	3.00E-05	1.11E+00	3.77E-04
Fe-55	3.49E+03	1.29E+08	2.74E-06	1.01E-01	8.70E-09	3.22E-04	1.00E-04	3.70E+00	8.70E-05
Fe-59	6.28E+02	2.32E+07	4.94E-07	1.83E-02	1.57E-09	5.80E-05	1.00E-05	3.70E-01	1.57E-04

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Table 11.2-9 (5 of 9)

Nuclide	Expected HUT ⁽¹⁾ inventory		HUT Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Co-58	1.08E+04	4.00E+08	8.50E-06	3.14E-01	2.70E-08	9.98E-04	2.00E-05	7.40E-01	1.35E-03
Co-60	1.64E+03	6.06E+07	1.29E-06	4.77E-02	4.09E-09	1.51E-04	3.00E-06	1.11E-01	1.36E-03
Zn-65	1.46E+03	5.42E+07	1.15E-06	4.26E-02	3.66E-09	1.35E-04	5.00E-06	1.85E-01	7.31E-04
Sr-89	3.03E+02	1.12E+07	2.39E-07	8.83E-03	7.57E-10	2.80E-05	8.00E-06	2.96E-01	9.47E-05
Sr-90	3.84E+01	1.42E+06	3.02E-08	1.12E-03	9.57E-11	3.54E-06	5.00E-07	1.85E-02	1.91E-04
Sr-91	1.43E+01	5.29E+05	1.12E-08	4.16E-04	3.57E-11	1.32E-06	2.00E-05	7.40E-01	1.78E-06
Y-91m	2.62E+02	9.68E+06	2.06E-07	7.61E-03	6.53E-10	2.42E-05	2.00E-03	7.40E+01	3.26E-07
Y-91	1.12E+03	4.13E+07	8.77E-07	3.25E-02	2.79E-09	1.03E-04	8.00E-06	2.96E-01	3.48E-04
Y-93	2.86E+04	1.06E+09	2.25E-05	8.32E-01	7.14E-08	2.64E-03	2.00E-05	7.40E-01	3.57E-03
Zr-95	9.07E+02	3.35E+07	7.13E-07	2.64E-02	2.26E-09	8.37E-05	2.00E-05	7.40E-01	1.13E-04
Nb-95	5.23E+02	1.94E+07	4.11E-07	1.52E-02	1.31E-09	4.83E-05	3.00E-05	1.11E+00	4.35E-05
Mo-99	1.26E+03	4.65E+07	9.87E-07	3.65E-02	3.13E-09	1.16E-04	6.00E-05	2.22E+00	5.22E-05
Tc-99 ⁽⁴⁾	9.17E-07	3.39E-02	7.21E-16	2.67E-11	2.29E-18	8.47E-14	6.00E-05	2.22E+00	3.81E-14
Tc-99m	3.84E+01	1.42E+06	3.02E-08	1.12E-03	9.57E-11	3.54E-06	1.00E-03	3.70E+01	9.57E-08
Ru-103	1.50E+04	5.55E+08	1.18E-05	4.36E-01	3.74E-08	1.38E-03	3.00E-05	1.11E+00	1.25E-03
Ru-106	2.65E+05	9.81E+09	2.08E-04	7.71E+00	6.62E-07	2.45E-02	3.00E-06	1.11E-01	2.21E-01
Ag-110m	3.84E+03	1.42E+08	3.02E-06	1.12E-01	9.57E-09	3.54E-04	6.00E-06	2.22E-01	1.60E-03
Te-129m	3.28E+02	1.21E+07	2.58E-07	9.54E-03	8.18E-10	3.03E-05	7.00E-06	2.59E-01	1.17E-04
Te-129	1.64E+01	6.06E+05	1.29E-08	4.77E-04	4.09E-11	1.51E-06	4.00E-04	1.48E+01	1.02E-07

"A"
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Table 11.2-9 (6 of 9)

Nuclide	Expected HUT ⁽¹⁾ inventory		HUT Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Te-131m	6.97E+01	2.58E+06	5.48E-08	2.03E-03	1.74E-10	6.44E-06	8.00E-06	2.96E-01	2.18E-05
Te-131	1.85E+00	6.84E+04	1.45E-09	5.38E-05	4.61E-12	1.71E-07	8.00E-05	2.96E+00	5.77E-08
Te-132	3.42E+02	1.26E+07	2.69E-07	9.94E-03	8.53E-10	3.16E-05	9.00E-06	3.33E-01	9.48E-05
Ba-137m	1.29E+04	4.77E+08	1.01E-05	3.75E-01	3.22E-08	1.19E-03	0.00E+00	0.00E+00	0.00E+00
Ba-140	1.33E+04	4.90E+08	1.04E-05	3.86E-01	3.31E-08	1.22E-03	6.00E-05	2.22E+00	5.51E-04
La-140	2.48E+03	9.16E+07	1.95E-06	7.20E-02	6.18E-09	2.29E-04	9.00E-06	3.33E-01	6.87E-04
Ce-141	2.76E+02	1.02E+07	2.17E-07	8.01E-03	6.88E-10	2.54E-05	3.00E-05	1.11E+00	2.29E-05
Ce-143	2.09E+02	7.74E+06	1.65E-07	6.09E-03	5.22E-10	1.93E-05	2.00E-05	7.40E-01	2.61E-05
Ce-144	1.15E+04	4.26E+08	9.05E-06	3.35E-01	2.87E-08	1.06E-03	3.00E-06	1.11E-01	9.57E-03
W-187	1.22E+02	4.52E+06	9.60E-08	3.55E-03	3.05E-10	1.13E-05	3.00E-05	1.11E+00	1.02E-05
Np-239	3.42E+02	1.26E+07	2.69E-07	9.94E-03	8.53E-10	3.16E-05	2.00E-05	7.40E-01	4.27E-05
H-3	2.51E+08	9.29E+12	1.97E-01	7.30E+03	6.27E-04	2.32E+01	1.00E-03	3.70E+01	6.27E-01
SUM									1.00E+00

(1) Calculated based on 336,000 gallons (80% of the tank volume of 420,000 gallons).

(2) 62 % of tank volume (260,400 gallons) is divided to calculate concentration.

(3) A dilution factor of 315 is required not to exceed 10 CFR20 App.B limits.

(4) In accordance with NRC's position, two radionuclides of I-129 and Tc-99, which may cause significant potential exposure, are included in the liquid tank failure analysis. The inventories of I-129 and Tc-99 in the holdup tank are determined based on the assumption that they have the same RCS existence ratios to I-131 and Tc-99m with those for a similar PWR. As shown in the results, the impact of these nuclides on the dose contribution is negligible.

"A"
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Table 11.2-9 (7 of 9)

Nuclide	Expected RMWT ⁽¹⁾ inventory		RMWT Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Br-84	5.41E-07	2.00E-02	3.81E-16	1.41E-11	5.00E-19	1.85E-14	4.00E-04	1.48E+01	1.25E-15
I-129 ⁽⁴⁾	6.56E-08	2.43E-03	4.62E-17	1.71E-12	6.07E-20	2.24E-15	2.00E-07	7.40E-03	3.03E-13
I-131	1.05E+00	3.90E+04	7.42E-10	2.75E-05	9.75E-13	3.61E-08	1.00E-06	3.70E-02	9.75E-07
I-132	1.51E-04	5.60E+00	1.07E-13	3.94E-09	1.40E-16	5.18E-12	1.00E-04	3.70E+00	1.40E-12
I-133	1.78E-02	6.60E+02	1.26E-11	4.65E-07	1.65E-14	6.11E-10	7.00E-06	2.59E-01	2.36E-09
I-134	3.24E-05	1.20E+00	2.28E-14	8.45E-10	3.00E-17	1.11E-12	4.00E-04	1.48E+01	7.50E-14
I-135	2.11E-03	7.80E+01	1.48E-12	5.49E-08	1.95E-15	7.22E-11	3.00E-05	1.11E+00	6.50E-11
Rb-88	9.46E-05	3.50E+00	6.66E-14	2.46E-09	8.75E-17	3.24E-12	4.00E-04	1.48E+01	2.19E-13
Cs-134	3.78E+01	1.40E+06	2.66E-08	9.86E-04	3.50E-11	1.30E-06	9.00E-07	3.33E-02	3.89E-05
Cs-136	2.97E-01	1.10E+04	2.09E-10	7.74E-06	2.75E-13	1.02E-08	6.00E-06	2.22E-01	4.58E-08
Cs-137	5.68E+01	2.10E+06	4.00E-08	1.48E-03	5.25E-11	1.94E-06	1.00E-06	3.70E-02	5.25E-05
Na-24	3.78E-02	1.40E+03	2.66E-11	9.86E-07	3.50E-14	1.30E-09	5.00E-05	1.85E+00	7.00E-10
Cr-51	5.68E+00	2.10E+05	4.00E-09	1.48E-04	5.25E-12	1.94E-07	5.00E-04	1.85E+01	1.05E-08
Mn-54	1.59E+01	5.90E+05	1.12E-08	4.15E-04	1.48E-11	5.46E-07	3.00E-05	1.11E+00	4.92E-07
Fe-55	1.46E+01	5.40E+05	1.03E-08	3.80E-04	1.35E-11	5.00E-07	1.00E-04	3.70E+00	1.35E-07
Fe-59	9.46E-01	3.50E+04	6.66E-10	2.46E-05	8.75E-13	3.24E-08	1.00E-05	3.70E-01	8.75E-08

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Table 11.2-9 (8 of 9)

Nuclide	Expected RMWT ⁽¹⁾ inventory		RMWT Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Co-58	2.16E+01	8.00E+05	1.52E-08	5.63E-04	2.00E-11	7.40E-07	2.00E-05	7.40E-01	1.00E-06
Co-60	6.76E+00	2.50E+05	4.76E-09	1.76E-04	6.25E-12	2.31E-07	3.00E-06	1.11E-01	2.08E-06
Zn-65	4.59E+00	1.70E+05	3.23E-09	1.20E-04	4.25E-12	1.57E-07	5.00E-06	1.85E-01	8.50E-07
Sr-89	4.86E-01	1.80E+04	3.42E-10	1.27E-05	4.50E-13	1.67E-08	8.00E-06	2.96E-01	5.63E-08
Sr-90	1.59E-01	5.90E+03	1.12E-10	4.15E-06	1.48E-13	5.46E-09	5.00E-07	1.85E-02	2.95E-07
Sr-91	2.70E-04	1.00E+01	1.90E-13	7.04E-09	2.50E-16	9.25E-12	2.00E-05	7.40E-01	1.25E-11
Y-91m	4.59E-04	1.70E+01	3.23E-13	1.20E-08	4.25E-16	1.57E-11	2.00E-03	7.40E+01	2.13E-13
Y-91	1.97E+00	7.30E+04	1.39E-09	5.14E-05	1.83E-12	6.75E-08	8.00E-06	2.96E-01	2.28E-07
Y-93	5.95E-01	2.20E+04	4.19E-10	1.55E-05	5.50E-13	2.04E-08	2.00E-05	7.40E-01	2.75E-08
Zr-95	1.70E+00	6.30E+04	1.20E-09	4.44E-05	1.58E-12	5.83E-08	2.00E-05	7.40E-01	7.88E-08
Nb-95	6.76E-01	2.50E+04	4.76E-10	1.76E-05	6.25E-13	2.31E-08	3.00E-05	1.11E+00	2.08E-08
Mo-99	1.65E-01	6.10E+03	1.16E-10	4.29E-06	1.53E-13	5.64E-09	6.00E-05	2.22E+00	2.54E-09
Tc-99 ⁽⁴⁾	1.16E-11	4.30E-07	8.19E-21	3.03E-16	1.08E-23	3.98E-19	6.00E-05	2.22E+00	1.79E-19
Tc-99m	4.86E-04	1.80E+01	3.42E-13	1.27E-08	4.50E-16	1.67E-11	1.00E-03	3.70E+01	4.50E-13
Ru-103	2.05E+01	7.60E+05	1.45E-08	5.35E-04	1.90E-11	7.03E-07	3.00E-05	1.11E+00	6.33E-07
Ru-106	9.46E+02	3.50E+07	6.66E-07	2.46E-02	8.75E-10	3.24E-05	3.00E-06	1.11E-01	2.92E-04
Ag-110m	1.22E+01	4.50E+05	8.56E-09	3.17E-04	1.13E-11	4.16E-07	6.00E-06	2.22E-01	1.88E-06
Te-129m	4.05E-02	1.50E+03	2.85E-11	1.06E-06	3.75E-14	1.39E-09	7.00E-06	2.59E-01	5.36E-09
Te-129	3.78E-06	1.40E-01	2.66E-15	9.86E-11	3.50E-18	1.30E-13	4.00E-04	1.48E+01	8.75E-15

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Table 11.2-9 (9 of 9)

Nuclide	Expected RMWT ⁽¹⁾ inventory		RMWT Concentration ⁽²⁾		Concentration at Nearest Potable Water ⁽³⁾		10 CFR 20, Appendix B		Ratio
	μCi	Bq	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	μCi/cm ³	Bq/cm ³	
Te-131m	4.05E-04	1.50E+01	2.85E-13	1.06E-08	3.75E-16	1.39E-11	8.00E-06	2.96E-01	4.69E-11
Te-131	1.59E-07	5.90E-03	1.12E-16	4.15E-12	1.48E-19	5.46E-15	8.00E-05	2.96E+00	1.84E-15
Te-132	5.41E-03	2.00E+02	3.81E-12	1.41E-07	5.00E-15	1.85E-10	9.00E-06	3.33E-01	5.56E-10
Ba-137m	5.68E+01	2.10E+06	4.00E-08	1.48E-03	5.25E-11	1.94E-06	0.00E+00	0.00E+00	0.00E+00
Ba-140	7.57E+00	2.80E+05	5.33E-09	1.97E-04	7.00E-12	2.59E-07	6.00E-05	2.22E+00	1.17E-07
La-140	2.03E-01	7.50E+03	1.43E-10	5.28E-06	1.88E-13	6.94E-09	9.00E-06	3.33E-01	2.08E-08
Ce-141	3.24E-01	1.20E+04	2.28E-10	8.45E-06	3.00E-13	1.11E-08	3.00E-05	1.11E+00	1.00E-08
Ce-143	1.41E-02	5.20E+02	9.89E-12	3.66E-07	1.30E-14	4.81E-10	2.00E-05	7.40E-01	6.50E-10
Ce-144	3.78E+01	1.40E+06	2.66E-08	9.86E-04	3.50E-11	1.30E-06	3.00E-06	1.11E-01	1.17E-05
W-187	5.95E-03	2.20E+02	4.19E-12	1.55E-07	5.50E-15	2.04E-10	3.00E-05	1.11E+00	1.83E-10
Np-239	3.78E-02	1.40E+03	2.66E-11	9.86E-07	3.50E-14	1.30E-09	2.00E-05	7.40E-01	1.75E-09
H-3	1.08E+09	4.00E+13	7.61E-01	2.82E+04	1.00E-03	3.70E+01	1.00E-03	3.70E+01	1.00E+00
SUM									1.00E+00

(1) Calculated based on 375,250 gallons (95% of the tank volume of 395,000 gallons).

(2) 95 % of tank volume (375,250 gallons) is divided to calculate concentration.

(3) A dilution factor of 761 is required not to exceed 10 CFR20 App.B limits.

(4) In accordance with NRC's position, two radionuclides of I-129 and Tc-99, which may cause significant potential exposure, are included in the liquid tank failure analysis. The inventories of I-129 and Tc-99 in the holdup tank are determined based on the assumption that they have the same RCS existence ratios to I-131 and Tc-99m with those for a similar PWR. As shown in the results, the impact of these nuclides on the dose contribution is negligible.