
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.: 429-8491
SRP Section: 11.03 – Gaseous Waste Management System
Application Section: 11.03
Date of RAI Issue: 03/04/2016

Question No. 11.03-10

REQUIREMENT: 10 CFR 50 Appendix I

GUIDANCE: RG 1.109

ISSUE: The applicant's response to RAI 145-7932, Question 11.03-1, does not indicate the method used to calculate Effluent Concentration Limit (ECL) values reported by KHNP in Table 11.2-10 and Table 11.3-6. The previously received response to RAI 145-7932, question 11.03-1, describes the equation used to calculate the ECLs (Eq. 1 in page 11.03-1-3/5 of Reference 1); however, the staff needs to see a more detailed calculation of all parameters in Table 11.2-10 and Table 11.3-6.

Results obtained by staff confirmatory calculations using the applicant's stated equations found in pages 11.03-1-3/5 and 11.03-1-3/6 of Reference 1 differ from the applicant's tabulated values as provided in the RAI response to question 11.03-1. A detailed calculation description for each of the radionuclides presented below is necessary for staff verification. All parameters in the equations presented by the applicant must be identified and explained.

1. Liquid: Te-129, I-131, Cs-134, Cs-136, Cs-137, and H-3. (Table 11.2-10) (Previously presented as requested information in Example #3 in RAI Question 11.03-1)
2. Gas: Xe-131m, Cs-134, Cs-136, and Cs-137. (Table 11.3-6)

Please address these items by providing the requested information and incorporating the response into the DCD as proposed DCD mark-up changes, including essential explanatory text.

Reference 1: Korea Hydro and Nuclear Power Co., Ltd., Enclosure to "Response to RAI 145-7932," ADAMS Accession Number ML15269A018, dated September 25, 2015.

Response

The design basis gaseous and liquid effluent releases are calculated by using the Multiplication Factors (MF). While the release rates of the PWR-GALE code are based on the expected RCS specific activity, the SRP 11.2 and 11.3 requires the applicant to assume 1% fuel defect for the comparison to the ECL values. Therefore, the MF values are multiplied by the expected effluent releases to convert the expected releases to the design basis releases. MF is defined as the ratio of the RCS specific activity based on 1% fuel defect, which is calculated by the DAMSAM code and presented in DCD Table 11.1-2, to the RCS specific activity calculated by the PWR-GALE code.

There are some exceptions for some nuclides. If the MF values are less than 1.0, which means that the 1% fuel defect RCS specific activity calculated by DAMSAM code is less than the value calculated by the PWR-GALE code, a value of 1.0 is used for conservatism. The MF values for I-131 and Cs-137 are limited to 100 since the calculated MF values are overly conservative.

For the nuclides that were pointed out in this question, the design basis effluent releases are calculated as follows:

1. Liquid: Te-129, I-131, Cs-134, Cs-136, Cs-137, and H-3

Nuclide	PWR-GALE release Rate (Bq/yr) A	RCS Concentration		Multiplication Factor D	Design Basis Release Rate (Bq/yr) E=A*D
		1% Fuel Defect (Bq/cc) B	PWR-GALE (Bq/cc) C		
Te-129	2.29E+06	2.52E+02	9.14E+02	1.00E+00	2.29E+06
I-131	9.99E+07	9.99E+04	8.18E+01	1.00E+02	9.99E+09
Cs-134	4.07E+08	1.41E+01	1.65E+00	8.53E+00	3.47E+09
Cs-136	1.44E+08	1.89E+03	3.85E+01	4.91E+01	7.09E+09
Cs-137	5.92E+08	1.63E+04	2.37E+00	1.00E+02	5.92E+10
H-3	5.40E+13	1.30E+05	-	1.00E+00	5.40E+13

2. Gas: Xe-131m, Cs-134, Cs-136, and Cs-137

Nuclide	PWR-GALE release Rate (Bq/yr) A	RCS Concentration		Multiplication Factor D	Design Basis Release Rate (Bq/yr) E=A*D
		1% Fuel Defect (Bq/cc) B	PWR-GALE (Bq/cc) C		
Xe-131m	8.14E+13	7.40E+03	3.33E+04	1.00E+00	8.14E+13
Cs-134	1.78E+06	1.41E+04	1.65E+00	8.53E+03	1.51E+10
Cs-136	1.22E+06	1.89E+03	3.85E+01	4.91E+01	6.00E+07
Cs-137	3.33E+06	1.63E+04	2.37E+00	6.88E+03	2.29E+10

Since there was a calculation error in the calculation of design basis release for Xe-131m in the response to RAI 145-7932, it is corrected in the above table and the DCD Table 11.3-6 will be updated as well.

Impact on DCD

DCD Tier 2 Table 11.3-6 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 Environment Report.

Table 11.3-6 (1 of 2)

RAI 145-7932 - Question 11.03-1

RAI 429-8491 - Question 11.03-10

Design Basis Gaseous Effluent Concentration at the Site Boundary

Nuclide	Design Basis Release ⁽¹⁾		Effluent Concentration ⁽²⁾		10 CFR 20 Appendix B Limits		Ratio
	μCi/yr	Bq/yr	μCi/m ³	Bq/m ³	μCi/m ³	Bq/m ³	
H-3	5.62E+08	2.08E+13	3.56E-04	1.32E+01	1.00E-01	3.70E+03	3.56E-03
C-14	7.30E+06	2.70E+11	4.63E-06	1.71E-01	3.00E-03	1.11E+02	1.54E-03
Ar-41	3.40E+07	1.26E+12	2.16E-05	7.98E-01	1.00E-02	3.70E+02	2.16E-03
I-131	2.20E+06	8.13E+10	1.39E-06	5.15E-02	2.00E-04	7.40E+00	6.96E-03
I-132	5.55E+05	2.05E+10	3.52E-07	1.30E-02	2.00E-02	7.40E+02	1.76E-05
I-133	3.12E+06	1.15E+11	1.98E-06	7.32E-02	1.00E-03	3.70E+01	1.98E-03
I-134	3.47E+05	1.28E+10	2.20E-07	8.14E-03	6.00E-02	2.22E+03	3.67E-06
I-135	1.66E+06	6.16E+10	1.06E-06	3.90E-02	6.00E-03	2.22E+02	1.76E-04
Kr-85m	3.46E+08	1.28E+13	2.19E-04	8.11E+00	1.00E-01	3.70E+03	2.19E-03
Kr-85	4.90E+09	1.81E+14	3.11E-03	1.15E+02	7.00E-01	2.59E+04	4.44E-03
Kr-87	9.08E+07	3.36E+12	5.75E-05	2.13E+00	2.00E-02	7.40E+02	2.88E-03
Kr-88	5.42E+08	2.01E+13	3.44E-04	1.27E+01	9.00E-03	3.33E+02	3.82E-02
Xe-131m	4.89E+08	1.81E+13	3.10E-04	1.15E+01	2.00E+00	7.40E+04	1.55E-04
Xe-133m	1.30E+08	4.81E+12	8.24E-05	3.05E+00	6.00E-01	2.22E+04	1.37E-04
Xe-133	5.59E+10	2.07E+15	3.54E-02	1.31E+03	5.00E-01	1.85E+04	7.09E-02
Xe-135m	3.73E+07	1.38E+12	2.36E-05	8.74E-01	4.00E-02	1.48E+03	5.91E-04
Xe-135	2.60E+09	9.61E+13	1.65E-03	6.09E+01	7.00E-02	2.59E+03	2.35E-02
Xe-137	1.29E+07	4.79E+11	8.21E-06	3.04E-01	-	-	-
Xe-138	2.55E+07	9.43E+11	1.62E-05	5.98E-01	2.00E-02	7.40E+02	8.08E-04
Cr-51	4.20E+02	1.55E+07	2.66E-10	9.85E-06	3.00E-02	1.11E+03	8.88E-09
Mn-54	5.70E+01	2.11E+06	3.61E-11	1.34E-06	1.00E-03	3.70E+01	3.61E-08
Co-57	8.20E+00	3.03E+05	5.20E-12	1.92E-07	9.00E-04	3.33E+01	5.78E-09
Co-58	4.80E+02	1.78E+07	3.04E-10	1.13E-05	1.00E-03	3.70E+01	3.04E-07
Co-60	1.10E+02	4.07E+06	6.97E-11	2.58E-06	5.00E-05	1.85E+00	1.39E-06
Fe-59	2.80E+01	1.04E+06	1.78E-11	6.57E-07	5.00E-04	1.85E+01	3.55E-08

8.14E+13

2.20E+09

1.39E-03

5.16E+01

6.97E-04