REVISED 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.:	**321-8353**
SRP Section:	**12.02 radiation Sources**
Application Section:	**12.2**
Date of RAI Issue:	**11/25/2015**

Question No. 12.02-20

This is a follow-up to the response to RAI 7929, Question 12.02-7, Revision 1.

The staff noted inconsistencies, apparent inaccurate assumptions, and assumptions provided without justification or a basis in this response. Therefore, the staff has the following questions related to the response to Question 12.02-7.

1. In Part 1 of the response, the applicant compares the partition factors assumed for calculating airborne Iodine concentrations in the plant as a result of piping leaks to guidance which provides Iodine partition factors during steam generator tube rupture accidents. However, it is still unclear why the values chosen for the partition factors for Iodine are appropriate for equipment leaks to the plant atmosphere during operation. The guidance of RG 1.183, Appendix A, Paragraph 5.5, provides guidance for iodine release fractions from ESF piping leaks with a temperature less than 212 degrees Fahrenheit. This guidance appears more relevant than the guidance for steam generator tube ruptures for leaks of liquid less than 212 degrees Fahrenheit. In addition, the applicant uses the criteria from RG 1.183, to determine airborne tritium partition factors, so it is unclear why it would not be used for Iodine partition factors. Therefore, please provide additional justification for why the values used for airborne Iodine partition factors are appropriate, or revise the partition factors, calculations, and associated information in the FSAR, as appropriate.

2. In Part 1 of the response, the applicant indicates that the partition factor is 0.0 for all radionuclides not specifically mentioned in the response. However, for the airborne activity concentrations in containment (FSAR Table 12.2- 23 (1 of 4) and Table 12.2-23 (2 of 4)) other radionuclides than those mentioned are considered to be airborne in the containment atmosphere. Please indicate how those airborne activity concentrations were calculated and what partition factors were used and the basis for those values.

3. In Part 1 of the response, the applicant indicates that the partition factor is 0.0 for all radionuclides not specifically mentioned in the response. Please provide data to justify using a value of 0.0 for all other radionuclides or provide data supporting that the airborne activity from all other isotopes would be negligible compared to halogens, noble gasses, and tritium.

4. In reviewing the cubicle designations provided in FSAR Tables 12.2-23 and 12.2-26, it is unclear which rooms some of the designations are referring to. For example, there are several "Filter and Demin. Valve Areas" in the Auxiliary Building (rooms 068-A10A, 068-A11A, and 068-A12A) therefore, it is unclear which one of these areas Tables 12.2-23 and 12.2-26 is referring to when it states "Filter and Demin. Valve Area." Therefore, please include the room designations of rooms in Tables 12.2-23 or 12.2-26, or otherwise make it clear which rooms are being referred to in the FSAR and ensure that all relevant rooms that could be expected to contain airborne radioactivity contain an appropriate airborne radiation source term.

5. In Part 3.b of the response the applicant indicates that there are six flanges in the charging pump room, however, FSAR Table 12.2-26 indicates that there are three flanges. Please correct this discrepancy.

6. The applicant did not fully describe how the tritium levels in the fuel handling area were calculated in Part 7 of the response. Specifically, neither the response nor the FSAR indicate what the ventilation flow rate is for the fuel handling area. Please update the FSAR to provide this information.

7. 10 CFR 20.1701 requires that the licensee use to the extent practical, process or other engineering controls to control the concentration of radioactive material in air and 10 CFR 20.1702 requires that when it is not practical to apply process or other engineering controls to control airborne radioactivity within those that define an airborne radioactivity area, the licensee shall increase monitoring and limit intakes by other methods. The airborne radioactivity concentrations calculated in FSAR Table 12.2-23 for certain rooms outside containment would be within the definition of airborne radioactivity areas.

   Please describe why it is acceptable for the ventilation flow rates provided for these rooms to not limit the estimated airborne activity levels to below that of an airborne radioactivity area or update the minimum ventilation flow rates in these areas, as appropriate. If the minimum ventilation flow rates for these rooms are not updated, update the FSAR to describe how the requirements of 10 CFR 20.1701 and 10 CFR 20.1702 will be met for these areas.

8. SRP 12.2 specifies that the applicant should specify the methods, models, and assumptions used in developing source terms. Therefore, when the above issues regarding the partition factor have been resolved, please update the FSAR to provide the assumed partition factor values for all radionuclides.

Response – (Rev. 2)

1. The APR1400 design uses the guidance from the Korean nuclear power plant design practice (KHNP/KEPCO E&C Design Criteria Manual (safety-related)), which is consistent with the NUREG-0409 and the European Commission Report (EUR 15615), as discussed in our earlier response on RAI 23-7929 Question No. 12.02-7. The use of this partition factor is also consistent with the guidance in *WASH 1258, Volume 2, Analytical Models and Calculations* of the *Numerical Guides for Design Objectives and Limiting conditions for Operation to meet the Criterion "As Low As Practicable" for Radioactive Material in Light-Water Cooled Nuclear Power Reactor Effluents*, Appendix B, Subsection 6.c, which stipulates:

   PF (partition factor for halogens) Cold = 0.001.

   Please refer to responses to items 2 and 3 below for more discussions on use of partition factors for halogens, and the reference for the Korean design guidance.

   The above discussion does not impact the partition factor for airborne source term calculations for the reactor containment building, which uses the flashing fractions stipulated in RG 1.183.

2. Airborne radioactivity concentrations and Derived Air Concentration (DAC) fraction in the Auxiliary Building and the Compound Building were recalculated using the partition factor of 0.005 for other nuclides (primarily particulates) in accordance with NUREG-0017. DCD Table 12.2-23 and 12.2-26 will be updated with the recalculated results. In case of Valve Rm 085-P16, the minimum required ventilation flow is increased from 1,444 m^3/hr to 1,530 m^3/hr to maintain a DAC fraction under 0.1. The other cubicle's minimum required ventilation flow remains the same.

   To prevent backflow, HVAC system is designed to keep the pressure of the areas with a potential for airborne contamination negative with respect to surrounding areas. Also, flow direction is maintained from the less to the more contaminated areas. This description is provided in DCD Section 9.4.5.2.3.1.

   The partition factor for other nuclides (primarily particulates) for airborne activity in the reactor containment building is calculated using the flashing fraction (ff), based on RG 1.183.

   KHNP confirms that Table 12.2-23, Pages 1 and 2 of 4, includes the other nuclides in the containment atmosphere for normal operation and 48 hours after shutdown, respectively; and that Table 12.2-23, Page 3 of 4, does not include activity for the other nuclides in the auxiliary building atmosphere.

   Notes are added to this Table to indicate the calculation basis.

3. By considering the NRC staff's comment on partition factor for other nuclides, the airborne radioactivity concentrations and the derived air concentration fractions in the Auxiliary Building and the Compound Building are recalculated as described in the

response to Item No.2. A partition factor of 0.005 is used for other nuclides (primarily particulates) in accordance with NUREG-0017.

4. KHNP agrees with staff's comment on room designations, and will revise Table 12.2-23 and 12.2-26 to include room designations.

5. Part 3.b of the response to RAI 23-7929 regarding the number of flanges for the charging pump room is correct. Table 12.2-26 has been revised in the response to RAI 207-8247 Question 12.02-18 to state that there are 6 flanges.

6. The HVAC flow for the fuel handling area is 28,450 CFM. This information will be added to DCD Table 12.2-26, Page 2 of 8. A note will also be added to this table to indicate the areas covered by the ventilation flow.

7. Please refer to the response to RAI 8420 Question No. 12.02-24, which discusses the HVAC flow requirements.

8. Based on the discussion in items 1, 2, and 3, the basis, methods, and assumptions for the partition factors used in developing source terms will be added at the end of DCD Subsection 12.2.2.3.

   In addition, KHNP will revise DCD Tier 2 Section 12.2.2.4 to correct editorial error.

Impact on DCD

DCD Tier 2 Section 12.2.2.4 will be updated as indicated in the 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.

Table 12.2-23 provides the airborne radioactivity concentrations and DAC fractions for the main cubicles in the reactor containment, auxiliary building, and compound building.

Equilibrium airborne radioactivity concentrations in rooms, cubicles, and other areas during normal operation are calculated based on the following equation:

$$C_A = \frac{LCP}{(\lambda V + F)}$$

Where:

C_A = airborne concentration in each cubicle (Bq/cm^3)

L = leak rate (cm^3/min)

C = radioactive concentration of liquid or gas (Bq/cm^3)

P = fraction of activity released to air

λ = decay constant (min^{-1})

V = enclosed room volume (cm^3)

F = air exhaust flow rate (cm^3/min)

The equation above represents the solution of a differential equation in equilibrium conditions in which there is no airborne radioactivity in the ventilation airflow(s) entering the area under consideration. To accommodate situations in which airborne radioactivity is in one or more ventilation airflow streams entering the area of concern, additional term(s) are added to the basic differential equation. Assumptions and parameters used in the airborne source term calculations are provided in Table 12.2-26.

Insert "A"

12.2.3 Sources Used in NUREG-0737 Post-Accident Shielding Analysis

Item II.B.2.3 of NUREG-0737 (Reference 4) clarifies the requirement for providing reasonable assurance that areas that require post-accident personnel access or contain safety-related equipment are adequately shielded in the vicinity of systems that may contain highly radioactive materials as a result of a DBA.

RAI 321-8353 - Question 12.02-20

RAI 321-8353 - Question 12.02-20_Rev.1

RAI 321-8353 - Question 12.02-20_Rev.2

A

12.2.2.4 Basis and Assumptions for Partition Factors

a. Reactor Containment Building

The partition factors for airborne activity in the reactor containment building are calculated as follows:

- 1.0 for noble gases
- All other nuclides: use flashing fraction (ff), based on the enthalpy difference in accordance with RG 1.183.

b. Auxiliary Building and Compound Building

The partition factors for airborne activity in the auxiliary building are calculated as follows:

- 1.0 for noble gases
- 1 x10^{-3} for halogens in cold liquid (<120 ^{o}F) and 0.1 for halogens in a hot liquid (>120 ^{o}F)
- 0.53 for H^3 in primary coolant and 0.1 for H^3 in cold liquids
- ~~0.0~~ 0.005 for all other nuclides

Table 12.2-23 (1 of 4)

(1)

Airborne Radioactivity Concentrations

Note 1

Reactor Containment Building (Normal Operation)

Nuclide	Airborne Concentration (Bq/cm^3)	10 CFR 20 Appendix B (Bq/cm^3)	DAC Fraction	Nuclide	Airborne Concentration (Bq/cm^3)	10 CFR 20 Appendix B (Bq/cm^3)	DAC Fraction
Kr-85m	8.60E-02	7.40E-01	1.16E-01	Zn-65	9.83E-02	3.70E-03	2.66E+01
Kr-85	7.13E+02	3.70E+00	1.93E+02	Sr-89	4.15E-02	2.22E-03	1.87E+01
Kr-87	1.92E-02	1.85E-01	1.04E-01	Sr-90	2.05E-02	7.40E-05	2.77E+02
Kr-88	1.19E-01	7.40E-02	1.61E+00	Sr-91	4.80E-04	3.70E-02	1.30E-02
Xe-131m	2.34E+01	1.48E+01	1.58E+00	Y-91m	2.45E-05	2.59E+00	9.45E-06
Xe-133m	2.62E-01	3.70E+00	7.09E-02	Y-91	7.09E-03	1.85E-03	3.83E+00
Xe-133	6.73E+02	3.70E+00	1.82E+02	Y-93	1.22E-05	3.70E-02	3.30E-04
Xe-135m	2.79E-03	3.33E-01	8.38E-03	Zr-95	2.48E-02	1.85E-03	1.34E+01
Xe-135	9.95E-01	3.70E-01	2.69E+00	Nb-95	4.60E-03	1.85E-02	2.48E-01
Xe-138	2.26E-03	1.48E-01	1.53E-02	Mo-99	1.95E-01	2.22E-02	8.79E+00
Br-84	1.09E-04	7.40E-01	1.47E-04	Tc-99m	1.03E-02	2.22E+00	4.66E-03
I-131	5.04E+00	7.40E-04	6.81E+03	Ru-103	1.73E-03	1.11E-02	1.56E-01
I-132	1.61E-02	1.11E-01	1.45E-01	Ru-106	4.43E-03	1.85E-04	2.39E+01
I-133	7.71E-01	3.70E-03	2.08E+02	Ag-110m	2.53E-01	1.48E-03	1.71E+02
I-134	3.75E-03	7.40E-01	5.07E-03	Te-129m	5.02E-02	3.70E-03	1.36E+01
I-135	1.39E-01	2.59E-02	5.36E+00	Te-129	7.67E-05	1.11E+00	6.91E-05
Rb-88	7.13E-03	1.11E+00	6.43E-03	Te-131m	8.87E-03	7.40E-03	1.20E+00
Cs-134	2.65E+01	1.48E-03	1.79E+04	Te-131	4.88E-05	7.40E-02	6.59E-04
Cs-136	1.59E-01	1.11E-02	1.44E+01	Te-132	1.61E-01	3.33E-03	4.84E+01
Cs-137	3.83E+01	2.22E-03	1.73E+04	Ba-140	1.31E-02	2.22E-02	5.92E-01
Na-24	2.86E-02	7.40E-02	3.86E-01	La-140	5.81E-04	1.85E-02	3.14E-02
Cr-51	3.84E-01	2.96E-01	1.30E+00	Ce-141	1.25E-03	7.40E-03	1.69E-01
Mn-54	3.52E-01	1.11E-02	3.17E+01	Ce-143	1.41E-04	2.59E-02	5.46E-03
Fe-55	3.75E-01	2.96E-02	1.27E+01	Ce-144	2.34E-02	2.22E-04	1.06E+02
Fe-59	1.35E-02	3.70E-03	3.65E+00	W-187	2.44E-03	1.48E-01	1.65E-02
Co-58	3.24E-01	1.11E-02	2.92E+01	Np-239	5.44E-03	3.33E-02	1.63E-01
Co-60	1.83E-01	3.70E-04	4.94E+02	H-3	7.92E-01	7.40E-01	1.07E+00
						Sum of DAC fractions	4.39E+04

(1)

~~Note 1~~: the airborne activity for other nuclides (primarily particulates) in the containment building is calculated based on the calculation of flashing fraction.

Table 12.2-23 (3 of 4)

Auxiliary Building Cubicles (Normal Operation)

Cubicle	Airborne Radioactivity Concentration (Bq/cm^3) ~~Note2~~				Derived Air Concentration (DAC) Fraction				
	Kr, Xe	Br, I	H-3	Others	Kr, Xe	Br, I	H-3	Others	Total
CS Pump and Miniflow HX Rm (050-A01C,D)	7.37E-02	4.92E-07	9.82E-03	2.86E-06	1.99E-02	5.18E-04	1.33E-02	1.40E-03	3.50E-02
SI Pump Rm (050-A02C,D)	1.16E-01	7.81E-07	1.55E-02	4.54E-06	3.13E-02	8.18E-04	2.09E-02	2.19E-03	5.52E-02
Floor Drain Sump Pump Rm (055-A34A,B,C,D)	1.84E+00	5.34E-05	4.10E-02	1.05E-04	7.99E-01	2.61E-02	5.54E-02	1.55E-02	8.96E-01
Pipe Chase and Valve Rm (055-A14C)	9.44E-02	6.20E-07	1.27E-02	3.75E-06	2.54E-02	6.64E-04	1.72E-02	1.82E-03	4.50E-02
Shutdown Cooling HX Rm (055-A30A,B)	3.63E-02	2.39E-07	4.88E-03	1.44E-06	9.77E-03	2.55E-04	6.59E-03	6.98E-04	1.73E-02
Charging Pump Rm (055-A55B)	1.58E+00	2.68E-07	3.56E-02	1.12E-05	6.44E-01	1.39E-04	4.81E-02	3.47E-03	6.95E-01
Charging Pump Miniflow HX Rm (055-A43A)	4.49E-01	1.23E-05	1.01E-02	3.07E-06	1.81E-01	6.37E-03	1.37E-02	9.87E-04	2.02E-01
Equipment Drain Tank Rm (055-A51B)	8.48E-02	1.77E-06	3.59E-04	2.53E-06	3.62E-02	1.03E-03	4.85E-04	7.14E-04	3.84E-02
Reactor Drain Pump Rm (055-A52A, A53B)	2.70E+00	8.76E-06	2.11E-03	1.75E-05	7.95E-01	5.20E-03	2.85E-03	3.93E-03	8.07E-01
Gas Stripper Rm (068-A06A)	2.14E+00	6.11E-07	3.53E-07		9.02E-01	3.04E-04	4.76E-07		9.02E-01
Filter and Demin. Valve Area (068-A10A)	1.90E+00	4.85E-05	3.67E-02	9.76E-05	7.92E-01	2.37E-02	4.96E-02	1.42E-02	8.79E-01
SFP Cleanup Pump Rm (078-A38A)	4.16E-02	2.87E-07	5.17E-03	1.53E-06	1.12E-02	3.00E-04	6.99E-03	7.33E-04	1.92E-02
Reactor Makeup Water Pump Rm (078-A49B)	2.49E-07	1.36E-12	1.20E-02	1.95E-10	6.57E-08	1.81E-09	1.63E-02	9.88E-08	1.63E-02
Holdup Pump Rm (078-A50B)	5.29E-04	5.88E-08	1.19E-02	1.11E-07	2.95E-04	6.30E-04	1.61E-02	4.05E-05	1.65E-02
Volume Control Tank Rm (100-A25A)	1.06E+00	1.62E-07	2.41E-02	5.66E-06	3.88E-01	9.22E-05	3.26E-02	2.37E-03	4.23E-01
Valve Rm (120-A23A)	1.81E-01	5.27E-06	5.01E-03	1.06E-05	7.89E-02	2.58E-03	6.78E-03	1.73E-03	9.00E-02
Fuel Handling Area (Normal Operation)			2.40E-02				3.20E-02		3.20E-02
Fuel Handling Area (Refueling)			5.70E-02				7.70E-02		7.70E-02

~~Note 2 : The partition factor for other nuclides (primarily particulates) for airborne activity in the auxiliary building is 0.0.~~

Table 12.2-23 (4 of 4)

Compound Building Cubicles (Normal Operation)

Cubicle	Airborne Radioactivity Concentration (Bq/cm^3)				Derived Air Concentration (DAC) Fraction				
	Kr, Xe	Br, I	H-3	Others	Kr, Xe	Br, I	H-3	Others	Total
Valve Rm (063-P07)	1.62E+00	1.03E-04	8.29E-02	1.55E-04	6.66E-01	5.24E-02	1.12E-01	3.13E-02	8.62E-01
Equipment Waste Pump Rm (063-P21,P22)	1.30E+00	3.72E-05	2.92E-02	6.29E-05	5.52E-01	1.85E-02	3.94E-02	1.10E-02	6.21E-01
Equipment Waste Tank Rm (063-P23,P24)	1.73E-01	4.87E-06	7.33E-04	7.60E-06	7.20E-02	2.46E-03	9.91E-04	1.47E-03	7.69E-02
Floor Drain Pump Rm (063-P25)	2.17E+00	5.93E-05	4.89E-02	8.40E-05	8.71E-01	3.08E-02	6.61E-02	1.84E-02	9.87E-01
Normal Sump Pump Rm (063-P26)	1.90E-01	5.52E-06	4.23E-03	1.09E-05	8.26E-02	2.69E-03	5.72E-03	1.60E-03	9.26E-02
Chemical Waste Pump Rm (063-P27)	5.50E-02	1.46E-06	1.13E-03	2.73E-06	2.18E-02	7.16E-04	1.52E-03	4.26E-04	2.45E-02
Floor Drain Tank Rm (063-P29)	4.74E-01	1.30E-05	1.07E-02	1.88E-05	1.92E-01	6.73E-03	1.44E-02	4.02E-03	2.17E-01
Chemical Waste Tank Rm (063-P30,P31)	1.07E-02	2.83E-07	2.42E-04	3.80E-07	4.15E-03	1.51E-04	3.27E-04	9.13E-05	4.72E-03
Detergent Waste Tank and Pump Rm (063-P32)	0.00E+00	5.85E-08	1.02E-05	3.21E-08	0.00E+00	3.33E-05	1.38E-05	8.59E-06	5.57E-05
Chemical Drain Sump Pump Rm (063-P36)	1.00E-01	2.92E-06	2.24E-03	5.79E-06	4.37E-02	1.42E-03	3.02E-03	8.44E-04	4.90E-02
Monitor Tank Rm (063-P37)	0.00E+00	1.08E-08	0.00E+00	1.44E-07	0.00E+00	1.00E-05	0.00E+00	7.51E-05	8.52E-05
Monitor Tank Pump Rm (063-P54)	0.00E+00	2.07E-07	0.00E+00	2.58E-06	0.00E+00	1.84E-04	0.00E+00	1.34E-03	1.53E-03
Valve Rm (085-P06)	0.00E+00	1.98E-05	1.62E-02	2.86E-05	0.00E+00	1.02E-02	2.19E-02	6.10E-03	3.81E-02
Valve Rm (085-P15)	0.00E+00	4.61E-05	3.64E-02	7.48E-05	0.00E+00	2.31E-02	4.92E-02	1.37E-02	8.61E-02
Valve Rm (085-P16)	2.06E-01	5.96E-06	4.59E-03	1.08E-05	8.91E-02	2.92E-03	6.21E-03	1.64E-03	9.45E-02

Table 12.2-26 (2 of 8)

Fuel Handling Area in Auxiliary Building

Assumptions/Parameters	Values
Surface Area of SFP	1.3852E+02 m^2
SFP Water Volume	1.72E+03 m^3 (=649,000 gal)
SFP Temperature	49 °C (120 °F) (during power operation) 60 °C (140 °F) (during refueling and shutdown)
Fuel Handling Area HVAC flow ~~(Note 1)~~ (1)	28,450 cfm
Air Pressure Above SFP	1.033 kg/cm^2
Air Temperature Above SFP	25 °C (77 °F)
Relative Humidity Above SFP	70 %
Wind Speed on the Water Surface	0.101 m/s (20 ft/min)
RCS Water Mass	3.0E+05 kg
Tritium Production Rate in Reactor Coolant	9.92E+13 Bq/1.5 yr (=6.613E+13 Bq/yr)
RCS Water Density	700 kg/m^3
Evaporation Rate of SFP	1.697E-02 m^3/hr

(1) ~~Note 1:~~ The SFP area includes the spent fuel pool, cask loading pits, fuel loading & unloading, refueling canal, and new fuel container laydown & inspection area

Table 12.2-26 (3 of 8)

Auxiliary and Compound Building

Cubicle	Volume (m^3)	Leak Sources and Number of Sources	Leak Rate (L/min)	Source Terms (1), (2)	~~HVAC Flow~~ Minimum Required Ventilation Flow (m^3/hr)
CS Pump and Miniflow HX Rm (050-A01C,D)	461	Pump seal (1) Flange (4) Valve 1″ (4) Valve 4″ (2) Valve 14″ (1)	~~1.67E-04~~ 8.33E-04 2.00E-03 6.66E-04 1.33E-03 2.33E-03	IRWST	170
SI Pump Rm (050-A02C,D)	~~762~~ 610	Pump seal (1) Flange (3) Valve 4″ (4) Valve 10″ (1)	~~1.67E-04~~ 1.67E-02 ~~1.40E-03~~ 1.50E-03 2.66E-03 1.67E-03	IRWST	~~850~~ 340
Floor Drain Sump Pump Rm (055-A34A,B,C,D)	94.9	Evaporation from sump	6.74E-02	0.1 PCA	680
Pipe Chase and Valve Rm (055-A14C)	~~1,246~~ 996	Valve 18″ (2) Valve 20″ (1)	~~5.98E-03~~ 6.00E-03 3.33E-03	IRWST	170
Shutdown Cooling HX Rm (055-A30A,B)	~~1,155~~ 925	Valve 1.5″ (1) Valve 10″ (2)	2.50E-04 3.33E-03	IRWST	170

Table 12.2-26 (4 of 8)

Cubicle	Volume (m^3)	Leak Sources and Number of Sources	Leak Rate (L/min)	Source Terms (1), (2)	~~HVAC Flow~~ Minimum Required Ventilation Flow (m^3/hr)
Charging Pump Rm ~~(A55B)~~ (055-A55B)	~~1,156~~ 833	Pump Seal (1) Flange (~~3~~ 6) Valve 1″ (1) Valve 3″ (4) Valve 4″ (2)	8.33E-04 ~~1.40E-03~~ 3.00E-03 1.67E-04 2.00E-03 1.33E-03	VCT – Halogens RCS – NG	850
Charging Pump Miniflow HX Rm (055-A43A	187	Valve 2.5″ (1)	4.16E-04	VCT – Halogens RCS – NG	170
Equipment Drain Tank Rm (055-A51B)	501	Flange (2) Valve 1″ (1) Valve 6” (1)	9.99E-04 1.67E-03 4 9.99E-04	EDT	170
Reactor Drain Pump Rm (055-A52B,A53B)	200	Pump Seal (1) Flange (4)	8.33E-04 2.00E-03	RDT	850
Gas Stripper Rm (068-A06A)	697	Flange (1)	5.00E-04	Gas Stripper	1,444
Filter and Demi. Valve Area (068-A10A)	174	Valve 3″ (1) Valve 3″ (27)	5.00E-04 ~~1.40E-02~~ 1.35E-02	RDT 1.0 PCA	1,529

Table 12.2-26 (5 of 8)

Cubicle	Volume (m^3)	Leak Sources and Number of Sources	Leak Rate (L/min)	Source Terms (1), (2)	~~HVAC Flow~~ Minimum Required Ventilation Flow (m^3/hr)
SFP Cleanup Pump Rm (078-A38A)	224	Flange (6) Valve 4″ (3) Valve 6″ (4)	5.00E-03 2.00E-03 4.01E-03	SFP	510
Reactor Makeup Water Pump Rm (078-A49B)	168	Flange (8) Pump Seal (2)	~~1.67E-03~~ 4.00E-03 ~~4.01E-03~~ 1.67E-03	RMWT	340
Holdup Pump Rm (078-A50B)	~~11,000~~ 311	Flange (8) Pump Seal (2)	~~1.67E-03~~ 4.00E-03 ~~4.01E-03~~ 1.67E-03	Holdup Tank	340
Valve Rm (120-A23A)	~~331~~ 77	Valve 3″ (1) Valve 3″ (1) Valve 3″ (1)	5.00E-04 5.00E-04 5.00E-04	1.0 PCA RMWT BAST	510
Valve Rm (063-P07)	~~762~~ 275	Flange (6) Valve 2” (9) Valve 2.5” (2)	3.00E-03 3.00E-03 8.33E-04	1.0 PCA	340
Equipment Waste Pump Rm (063-P21,P22)	138	Pump Seal (1) Flange (6) Valve 2″ (2) Valve 3″ (6)	~~8.44E-03~~ 8.33E-04 3.00E-03 6.66E-04 3.00E-03	0.32 PCA	~~510~~ 340
Equipment Waste Tank Rm (063-P23,P24)	221	Flange (2)	9.99E-04	Equipment Waste Tank	~~510~~ 340

Table 12.2-26 (6 of 8)

Cubicle	Volume (m^3)	Leak Sources and Number of Sources	Leak Rate (L/min)	Source Terms (1), (2)	~~HVAC Flow~~ Minimum Required Ventilation Flow (m^3/hr)
Floor Drain Pump Rm (063-P25)	413	Pump seal (1) Flange (2) Valve 2″ (4) Valve 3″ (12)	~~1.67E-02~~ 8.33E-04 ~~5.98E-03~~ 9.99E-04 1.33E-03 ~~5.98E-03~~ 6.00E-03	0.44 PCA	~~1,359~~ 340
Normal Sump Pump Rm (063-P26)	68.5	Flange (4) Valve 3″ (2) Evaporation from sump	2.00E-03 9.99E-04 4.92E-02	0.01 PCA	~~1,019~~ 510
Chemical Waste Pump Rm (063-P27)	215	Pump seal (2) Flange (10) Valve 3″ (11) Valve 2″ (2)	1.67E-02 5.00E-03 5.49E-03 6.66E-04	0.01 PCA	~~1,104~~ 1,020
Floor Drain Tank Rm (063-P28,P29)	184	Flange (2)	9.99E-04	Floor Drain Tank	170
Chemical Waste Tank Rm (063-P30,P31)	331	Flange (2)	9.99E-04	Chemical Waste Tank	170

Table 12.2-26 (7 of 8)

Cubicle	Volume (m^3)	Leak Sources and Number of Sources	Leak Rate (~~m^3~~ L/min)	Source Terms (1), (2)	~~HVAC Flow~~ Minimum Required Ventilation Flow (m^3/hr)
Detergent Waste Tank and Pump Rm (063-P32)	657	Pump seal (2) Flange (4) Valve 2″ (2) Valve 3″ (3) Valve 4″ (7) Evaporation from sump	~~1.67E-05~~ 1.67E-02 ~~2.00E-06~~ 2.00E-03 ~~6.66E-07~~ 6.66E-04 ~~1.50E-06~~ 1.50E-03 ~~4.66E-06~~ 4.66E-03 ~~3.51E-05~~ 3.51E-02	Detergent Waste Tank	170
Chemical Drain Sump Pump Rm (063-P36)	119	Flange (2) Valve 2″ (1) Evaporation from sump	~~8.93E-07~~ 9.99E-04 ~~3.33E-07~~ 3.33E-04 ~~4.92E-05~~ 4.92E-02	0.01 PCA	934
Monitor Tank Rm (063-P37)	~~88.6~~ 885	Flange (4)	~~2.00E-06~~ 2.00E-03	Monitor Tank	170
Monitor Tank Pump Rm (063-P54)	197	Pump seal (2) Flange (10) Valve 2.5″ (9) Valve 3″ (2) Valve 4″ (14)	~~1.53E-05~~ 1.67E-02 ~~5.00E-06~~ 5.00E-03 ~~3.75E-06~~ 3.75E-03 ~~9.99E-07~~ 9.99E-04 ~~9.31E-06~~ 9.33E-03	Monitor Tank	170
Valve Rm (085-P06)	180	Valve 4” (1)	~~6.66E-07~~ 6.66E-04	1.0 PCA (Except for NG)	170

Table 12.2-26 (8 of 8)

Cubicle	Volume (m^3)	Leak Sources and Number of Sources 1	Leak Rate (~~m^3~~ L/min)	Source Terms [(1), (2)]	~~HVAC Flow~~ Minimum Required Ventilation Flow (m^3/hr)
Valve Rm (085-P15)	263	Valve 3″ (2) Valve 6″ (4)	~~5.00E-07~~ 5.00E-04 ~~4.01E-06~~ 5.00E-03	1 PCA (Except for NG)	510
Valve Rm (085-P16)	269	Valve 4″ (1) Valve 6″ (2) Valve 6″ (3) Valve 6″ (1) Valve 4″ (2)	~~6.66E-07~~ 6.66E-04 ~~2.00E-06~~ 2.00E-03 ~~3.00E-06~~ 3.00E-03 ~~9.99E-07~~ 9.99E-04 ~~1.33E-06~~ 1.33E-03	0.32 PCA 0.32 PCA 0.1 PCA 0.44 PCA 0.01 PCA	~~1,444~~ 1,530

(1) PCA: Fraction of primary coolant activity concentrations

(2) NG: Noble gases

(3) The HVAC flows listed in this table represent the actual minimum flow rates required for the ventilation for the corresponding rooms