

## KHNPDCDRAIsPEm Resource

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**Sent:** Friday, August 07, 2015 7:46 PM  
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**Cc:** Ciocco, Jeff; Lee, Samuel; McCoppin, Michael; Olson, Bruce; Stutzcage, Edward  
**Subject:** APR1400 Design Certification Application RAI 142-8090 (12.2 - Radiation Sources)  
**Attachments:** image001.jpg; APR1400 DC RAI 142 RPAC 8090.pdf

KHNP,

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs. However, KHNP requests, and we grant, 60 days to respond to the RAI question. We may adjust the schedule accordingly.

Please submit your RAI response to the NRC Document Control Desk.

Thank you,

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## REQUEST FOR ADDITIONAL INFORMATION 142-8090

Issue Date: 08/07/2015  
Application Title: APR1400 Design Certification Review – 52-046  
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.  
Docket No. 52-046  
Review Section: 12.02 - Radiation Sources  
Application Section: 12.2

### QUESTIONS

#### 12.02-13

10 CFR 52.47(a)(5) requires that the FSAR contain the kinds and quantities of radioactive materials expected to be produced in the operation and the means for controlling and limiting radioactive effluents and radiation exposures within the limits set forth in 10 CFR 20.

10 CFR 50, Appendix A, Criterion 61, requires that the fuel storage and handling, radioactive waste, and other systems which may contain radioactivity be designed to assure adequate safety under normal and postulated accident conditions, with suitable shielding for radiation protection, and with appropriate containment, confinement, and filtering systems.

SRP Section 12.2 indicates that the reviewer will consider whether source strengths, concentrations of airborne radioactivity, and quantitative source descriptions are consistent with the assumptions made and the methods used by the applicant. SRP Section 12.2 also indicates that unless described within other sections of the SAR, source descriptions should include the methods, models, and assumptions used as the bases for all values provided in SAR Section 12.2.

In a clarification call with the applicant, to clarify source term information, the applicant verified that the Shield APR computer code, which is used to calculate the inventories of radionuclides within systems and components downstream of the reactor coolant system, does not consider the buildup of daughters within the components from the decay of the parents. Staff review of the purification ion exchanger source term, in FSAR Table 12.2-11, using equations within the Shield APR code manual and staff confirmatory calculations, confirms that for Technetium-99m the source term accounts only for Technetium-99m accumulated in the ion exchanger directly from RCS fluid and not the decay of Molybdenum-99 within the ion exchanger. This appears to result in a Technetium-99m source term significantly lower than what it would be if generation of Technetium-99m from the decay of Molybdenum-99 within the ion exchanger was considered. Similar underestimations appear to occur with other daughter radionuclides.

However, for Ba-137m, which decays from Caesium-137 the applicant does not appear to follow the methodology within the Shield APR manual. For example, if the equations within the Shield APR manual are used, the activity of Barium-137m within the purification ion exchanger would be several orders of magnitude less than what is provided in the FSAR. It appears that the applicant simply assumes that the activity of Barium-137m is equivalent to that of Caesium-137, regardless of the Shield APR code. In reality staff would expect the activity of Barium-137m to be near the same activity as Caesium-137, however, staff could not find any information indicating that the Shield APR code methodology should not be used for Barium-137m (for any other isotopes), or anything saying what assumptions should be made for Barium-137m.

## **REQUEST FOR ADDITIONAL INFORMATION 142-8090**

In addition, there are other anomalies in source term information indicating that the buildup of daughters are not being appropriately accounted for. For example, even though there is Sr-90 in all of the liquid waste and solid waste management systems, the applicant reports a concentration of 0 Bq for Y-90 for most of these components. Since Y-90 is the direct decay product of Sr-90, there is no way there would be no Y-90 within the spent resin storage tank. Similar anomalies occur with other isotopes in the waste management systems, such as Rh-106 (decay product of Ru-106) and Pr-143 (decay product of Ce-143).

Please revise the methodology for calculating source terms to include consideration for the buildup of daughter products within components and revise the Chapter 11 and 12 sources to include the corrected information.