

## KHNPDCDRAIsPEm Resource

---

**From:** Ward, William  
**Sent:** Friday, August 07, 2015 7:39 PM  
**To:** 'apr1400rai@khnp.co.kr'; KHNPDCDRAIsPEm Resource; 'Chang, Harry'; 'Yunho Kim (yshh8226@gmail.com)'; jiyong.oh5@gmail.com; daegeun.ahn@gmail.com; Tyree, Christopher (christopher.tyree@aecom.com)  
**Cc:** Ciocco, Jeff; Lee, Samuel; McCoppin, Michael; Olson, Bruce; Stutzcage, Edward  
**Subject:** APR1400 Design Certification Application RAI 141-8098 (12.3-12.4 Radiation Protection Design Features)  
**Attachments:** image001.jpg; APR1400 DC RAI 141 RPAC 8098.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, 45 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,

**William R. Ward, P.E.**  
**Senior Project Manager**  
**U.S. Nuclear Regulatory Commission**  
**m/s T6-D38M**  
**Washington, DC, 20555-0001**  
NRO/DNRL/Licensing Branch 2  
ofc T6-D31  
ofc (301) 415-7038 fax (301) 415-6350



Please consider the environment before printing this email.

**Hearing Identifier:** KHNP\_APR1400\_DCD\_RAI\_Public  
**Email Number:** 150

**Mail Envelope Properties** (5d5ff5c16f234053a85812e33610b2db)

**Subject:** APR1400 Design Certification Application RAI 141-8098 (12.3-12.4 Radiation Protection Design Features)  
**Sent Date:** 8/7/2015 7:38:32 PM  
**Received Date:** 8/7/2015 7:38:36 PM  
**From:** Ward, William

**Created By:** William.Ward@nrc.gov

**Recipients:**

"Ciocco, Jeff" <Jeff.Ciocco@nrc.gov>  
Tracking Status: None  
"Lee, Samuel" <Samuel.Lee@nrc.gov>  
Tracking Status: None  
"McCoppin, Michael" <Michael.McCoppin@nrc.gov>  
Tracking Status: None  
"Olson, Bruce" <Bruce.Olson@nrc.gov>  
Tracking Status: None  
"Stutzcage, Edward" <Edward.Stutzcage@nrc.gov>  
Tracking Status: None  
"apr1400rai@khnp.co.kr" <apr1400rai@khnp.co.kr>  
Tracking Status: None  
"KHNPDCDRAIsPEM Resource" <KHNPDCDRAIsPEM.Resource@nrc.gov>  
Tracking Status: None  
"Chang, Harry" <hyunseung.chang@gmail.com>  
Tracking Status: None  
"Yunho Kim (yshh8226@gmail.com)" <yshh8226@gmail.com>  
Tracking Status: None  
"jiyong.oh5@gmail.com" <jiyong.oh5@gmail.com>  
Tracking Status: None  
"daegeun.ahn@gmail.com" <daegeun.ahn@gmail.com>  
Tracking Status: None  
"Tyree, Christopher (christopher.tyree@aecom.com)" <christopher.tyree@aecom.com>  
Tracking Status: None

**Post Office:** HQPWMSMRS05.nrc.gov

Files	Size	Date & Time
MESSAGE	777	8/7/2015 7:38:36 PM
image001.jpg	4205	
APR1400 DC RAI 141 RPAC 8098.pdf		95114

**Options**

**Priority:** Standard  
**Return Notification:** No  
**Reply Requested:** No  
**Sensitivity:** Normal  
**Expiration Date:**  
**Recipients Received:**



## REQUEST FOR ADDITIONAL INFORMATION 141-8098

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: 12.03-12.04 - Radiation Protection Design Features  
Application Section: 12.3

### QUESTIONS

#### 12.03-8

#### REQUIREMENT

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.

#### INFORMATION NEEDED

SRP 12.3-12.4 indicates that the shielding should be specified for each of the radiation sources identified in Chapter 11 and Section 12.2, and other applicable sections. Staff has identified the following shielding information that is missing or incorrect.

1. While FSAR Table 12.3-4 identifies design basis radiation shield thicknesses for plant rooms for which shielding is necessary, there are several rooms containing significant sources, or significant dose rates (some of them potentially greater than 100 Rad/hour), for which no shielding thicknesses are provided. Please provide the minimum required shield thicknesses for the following rooms in FSAR Table 12.3-4 or justify why they are not needed (if an area is inaccessible then minimum shielding thicknesses are not needed):
  - a. Room 089-C01 (Core Debris Chamber, Figure 12.3-3)
  - b. Room 086-A01A (Filter Area, Figure 12.3-3)
  - c. Room 063-P38 (Solidification and Drum Conveyor Room, Figure 12.3-10)
  - d. Room 085-P32 (Primary Sampling Sink Room, Figure 12.3-12)
  - e. Room 085-P45 (Drum Removal Chase, Figures 12.3-11 through 12.3-12)
  - f. Room 100-P02 (GRS Equipment Removal Area, Figure 12.3-13)
  - g. Room 100-P10 (Spent Filter Drum Storage Area, Figure 12.3-13)
  - h. Room 120-P01 (Gaseous Radwaste Sample Control Panel Room, Figure 12.3-14)
  - i. Room 120-P02 (Gaseous Radwaste Sample Valve Rack Room, Figure 12.3-14)
2. In FSAR Table 12.3-4 Room 063-005 is labeled "Future Use" and Room 063-P06 is labeled "Spent Resin Long-term Storage Tank Room" however, in FSAR Figure 12.3-12 Room 063-005 is labeled "Spent Resin Long-Term Storage Tank Room" and Room 063-P06 is labeled "Future Use." Please correct this discrepancy.
3. While the FSAR indicates that there are four gaseous radwaste system delay beds, it is unclear which rooms each delay bed is located. FSAR Table 12.3-4 indicates that Rooms 096-P01 and 096-P02 are delay bed rooms. Please specify in the FSAR which rooms each of the delay beds (1, 2, 3, and 4) are located.

## REQUEST FOR ADDITIONAL INFORMATION 141-8098

### 12.03-9

#### REQUIREMENT

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 20.1101(b) indicates in part that engineering controls should be used to maintain radiation exposures ALARA.

10 CFR 50, Appendix A, Criterion 61 requires in part that radioactive waste systems and other systems which may contain radioactivity contain suitable shielding for radiation protection.

#### GUIDANCE

SRP 12.3-12.4 indicates that the shielding should be specified for each of the radiation sources identified in Chapter 11 and Section 12.2, and other applicable sections.

SRP 12.3-12.4 also indicates that the acceptability of the facility design will be based on evidence that the applicant has fulfilled the dose limiting requirements. The SRP indicates that this includes evidence that major exposure accumulating functions (maintenance, refueling, radioactive material handling and processing, inservice inspection, calibration, decommissioning, and recovery from accidents) have been considered in plant design that the evidence should also include radiation protection features incorporated into the design, taking into account the state of technology, that will keep potential radiation exposure from these activities ALARA in accordance with 10 CFR 20.1101(b).

Finally, SRP 12.3-12.4 states that, the areas inside the plant structures, as well as in the general plant yard, should be subdivided into radiation zones, with maximum design dose rate zones and the criteria used in selecting maximum dose rates identified. Maximum zone dose rates should be defined for each zone, depending on anticipated occupancy and access control. Regulatory Guide 8.8 provides guidance on minimizing radiation exposure to the extent practicable and on appropriate plant shielding design.

#### INFORMATION NEEDED

Based on a review of the Chapter 12 normal operation radiation zone figures, staff has several questions related to the figures including, the minimum shield thicknesses provided in FSAR Table 12.3-4 as well as several questions related to access routes and zoning for certain areas. The questions are as follows:

1. In FSAR Figure 12.3-1 there is a door in room 055-A18A (the tendon gallery entrance area). Please indicate if this is an entrance into containment.
2. In FSAR Figure 12.3-1 please indicate how a worker would be expected to get from room 055-A07D to room 055-A08D and from room 055-A07C to room 055-A57C (all radiological areas). It is not clear that there is access between these areas without going through emergency exits through clean (non-radiological) areas.

## REQUEST FOR ADDITIONAL INFORMATION 141-8098

3. In FSAR Figure 12.3-9 most of room 195-A08B (Auxiliary Building Controlled Area (II) Normal Exhaust Accumulation Room) is labeled as between a 0.20 mSv/hour and 1 mSv/hour radiation area, except for two areas in the south east and south west corners of the room which are labeled less than 0.0025 mSv/hour. The 0.0025 mSv/hour area in the south east corner also extends into a large portion of the room to the east on that same elevation, room 156-A08B (new fuel container laydown and inspection area). The lines separating the areas are irregular and do not appear to indicate any kind of shielding or any particular distance from sources that would result in a dose drop. Please explain why the areas in the southeast and southwest corners of room 195-A08B and southern portion of room 156-A08A are labeled as less than 0.0025 mSv/hour.
4. In FSAR Figure 12.3-10, room 063-P73 (Instrument Calibrator Facility), labeled as an area where dose rates could potentially exceed 5 Sv/hour, is surrounded by rooms with dose rates labeled as less than 0.05 mSv/hour or less. In FSAR Table 12.3-4, the north, south, west, and ceiling of 063-P73 all have minimum concrete thicknesses of 36 inches or greater (the south and west walls are 48 inches), however, the east wall only has a minimum thickness of 18 inches. Please describe how the 18 inch shield thickness for the east wall was determined. Since room 063-P73 is a potentially very high radiation area, if unique assumptions for the shielding for room 063-P73 were used, please update the FSAR with this information.
5. In FSAR Figure 12.3-10, Note 1 is included in corridor (063-P46). However, the FSAR does not provide any notes for Figure 12.3-10. Please indicate what this note represents in the FSAR.
6. FSAR Figure 12.3-13 includes note 1 indicating that the truck bays (100-P08) and future extension area (100-P07) will be reclassified from zone 2 to zone 7 during transfer and drumming of spent filter and spent resin. Staff has the following questions regarding this:
  - a. In order for the note to be more clearly identified, please write "Note 1" in the truck bays and future extension area.
  - b. While FSAR Table 12.3-4 provides shielding for the truck bays which appears appropriate for a zone 7 room, FSAR Table 12.3-4 provides no minimum shielding thicknesses for the future extension area. Please provide this information.
7. The purpose of the waste drum transfer room (100-P60) is unclear. It does not appear to be discussed in Chapters 11 and 12 of the FSAR. It appears on FSAR Figure 12.3-13, elevation 100 foot, and appears to be separated from the waste drum storage area (100-P09) and truck bays (100-P08) by a solid wall and it is unclear if the crane servicing the waste drum storage area and truck bays is capable of servicing the waste drum transfer room, particular because the waste drum transfer room does not extend up to elevation 120 foot, as the drum storage area and truck bays do. Please discuss the purpose of the waste drum transfer room and how drums are transferred from this room to the waste drum storage area and the truck bays.
8. FSAR Table 12.3-4 indicates that no shielding is needed east of the holdup volume tank. Please indicate why no shielding is needed in this area.

## REQUEST FOR ADDITIONAL INFORMATION 141-8098

9. In reviewing FSAR Table 12.3-4, staff notes that none of the rooms in containment require shielding above or below them. Please discuss why shielding is not needed above or below these sources.
10. Please update the FSAR to discuss any shielding around the pressurizer, steam generators, and reactor coolant pumps. For example, please discuss any shielding between these components and the operating floor and the containment annulus area.
11. Please indicate in the FSAR if containment entries are allowed during operation and if so identify which areas are accessible.
12. Many of the walls in the Chapter 12 radiation zone figures include two unknown symbols. One symbol resembles an "X" with a box around it. For example, in FSAR Figure 12.3-1, on the wall between rooms 055-A07D and 055-A01D there is one of these symbols. In addition, on the wall between room 055-A07D and 050-A01D, there are two of these symbols.

The other symbol has a bunch of dots, usually with three lines going through the dots. For example on Figure 12.3-1 between rooms 050-A01D and 055-A14D there is one of these symbols.

It is unclear if these symbols could represent some kind of removable shield wall, door, or some other design feature pertinent to the radiological review. Please identify what these symbols represent and include their meaning on the legend for each of the figures.

13. Many of the rooms with the more significant radiation sources include continuous and dashed lines that would appear to indicate some type of shielding. For example, in Figure 12.3-1, the Room 055-A51B (Equipment Drain Tank Room), on the south side leading from the door, there are continuous and dashed lines. They appear to be denoting some type of shield wall for a labyrinth entrance way into the room, however, it is unclear why some lines are dashed and some are continuous. In addition, it is unclear how thick these walls are or how any description in the FSAR of how thick these labyrinth walls have to be to achieve the desired appropriate radiation levels at the entrance to the room or within the labyrinth. Please update the FSAR to include this information.

### 12.03-10

#### REQUIREMENT

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 in part that radioactive waste systems and other systems which may contain radioactivity contain suitable shielding for radiation protection.

## REQUEST FOR ADDITIONAL INFORMATION 141-8098

### GUIDANCE

SRP 12.3-12.4 indicates that the shielding should be specified for each of the radiation sources identified in Chapter 11 and Section 12.2, and other applicable sections.

Regulatory Guide 8.8 and the SRP indicates that radiation shielding should be based on an assumed 0.25% fuel cladding failure and that shield design features should reflect consideration to maintain occupational radiation exposure ALARA.

### ISSUE

FSAR Figure 12.3-11 includes room 077-P01 (Hot Pipe Way) which covers a large portion of the Compound Building at that elevation. Although the elevation of the figure is not labeled, FSAR Table 12.3-5 indicates that it is the 77 foot elevation. It is located between elevation 63 (Figure 12.3-10) foot and elevation 85 foot (Figure 12.3-12) so that rooms on the 63 foot elevation that do not have the hot pipe way overhead (or one of a few other small areas on Figure 12.3-11) would appear to have a higher ceiling expanding to the 85 foot elevation. 077-P01 is identified as an area that could potentially exceed 1 Gray/hour. FSAR Table 12.3-4 lists minimum shield wall thicknesses for the north, south, east, and west of the room, however, 077-P01 is not rectangular and it is unclear which walls the values in Table 12.3-4 even apply to. In addition, in reviewing Figures 12.3-10 and 12.3-12 there appears to be a staircase going from elevation 63 foot to elevation 85 foot through the center of 077-P01, which is not indicated on Figure 12.3-11. There are also other openings or areas where columns go through 077-P01 (it is unclear what these openings represent). It does not appear that the shielding design or zoning even considers these openings, including the stairwell. Because of these vagueness and missing information, it is impossible for staff to conduct a shielding review for room 077-P01. Based on this and the above mentioned requirements and guidance, staff requests the following information:

### INFORMATION REQUESTED:

1. All other Chapter 12 figures include the elevation in the figure title. Please specify the elevation of Figure 12.3-11 in the title or on the figure.
2. Please identify the staircase going from elevation 63 foot to elevation 85 foot through 077-P01, in FSAR Figure 12.3-11.
3. For the other openings going through 077-P01, please indicate if they are for building supports, openings to the room below, etc., so that it is clear to staff if these areas require shielding.
4. Please clearly indicate the minimum wall thicknesses for each wall of room 077-P01, including the walls between room 077-P01 and the staircase going through it and any of the other openings that open to the rooms below or for which shielding would be required to maintain doses to adjacent areas ALARA. Due to the unique configuration of room 077-P01, and the number of walls associated with it, staff suggests providing the specific wall thicknesses for each wall on FSAR Figure 12.3-11. In any case, the FSAR should be clear what the thickness for each wall is that requires shielding.