
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.: 141-8098
SRP Section: 12.03-12.04 - Radiation Protection Design Features
Application Section: 12.3
Date of RAI Issue: 08/07/2015

Question No. 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.

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.

Response – (Rev. 2)

1. The elevation of the partial plan in DCD Figure 12.3-11 is 77'-0". [In order to clarify the elevation, the title of Figure 12.3-11 was revised in DCD Rev.1. Also, DCD Figure 12.3-10 was updated to label the corridor 063-P11 which is unlabeled in DCD Rev.0. These changes are indicated in Attachment 1.](#)
2. There is no staircase accessible to the room 077-P01. Room 077-P01 is accessible by steel ladder from El. 85'-0" floor through the hatches. The staircase going from El. 63'-0" to 85'-0" is separated from room 077-P01.
3. The other openings are for elevator, stair, electrical riser, piping, HVAC chase, and corridor, which are indicated in Figure 1. The walls around these openings are designed not only for building support but also for shielding of the gamma radiation from the hot pipe way. Therefore, the minimum thicknesses of the walls, floors, and ceilings around these openings are determined for the shielding requirements to maintain doses to adjacent areas ALARA. The required minimum shield thicknesses are provided in Figure 2 below.



Figure 1. Openings of Hot Pipe Way (Room 077-P01)

4. Since room 077-P01 has many rooms adjacent to it, for purpose of clarity, Figure 2 is provided to indicate the minimum shield wall thicknesses. [DCD Table 12.3-4 will be revised to incorporate the detailed shielding information of room 077-P01, as provided in Tables 1, 2, 3 and 4 in this response.](#)

Table 1. Shielding information for the floor of room 077-P01

Room Number	Room Name	Face to (floor)			Minimum Required Shield Thickness (inches)
		Structure	Room Number	Room Name	
Additional Information on the Rooms which Contain Complex Geometries (cont.)					
077-P01	Hot Pipe Way	Slab	063-P27	Chemical Waste Pump Room	14
		Slab	063-P33	Sampling Room	14
		Slab	063-P34	LRS Control Panel Room	14
		Slab	063-P54	Monitor Tank Pump Room	14
		Slab	063-P56	Drop Area & Opening	14
		Slab	063-P57	Sorting Room	14
		Slab	063-P21	Equip. Waste Pump Room	15
		Slab	063-P22	Equip. Waste Pump Room	17
		Slab	063-P25	Floor Drain Pump Room	10
		Slab	063-P26	Normal Sump Pump Room	16
		Slab	063-P38	PSS-solidification & Drum Conveyor Room	16
		Slab	063-P46	Corridor	25
		Slab	063-P11	Corridor	28
		Slab	063-P09	Valve Room	20
		Slab	063-P40	Concentrate pump Room	20
		Slab	063-P41	Concentrate holding tank Room	10
		Slab	063-P42	RO feed pump Room	24
		Slab	063-P43	IX feed pump Room	24
		Slab	063-P44	IX Feed tank Room	23
		Slab	063-P45	Hot tool Room	23
		Slab	063-P04	GRS inlet skid Room	13
		Slab	063-P07	Valve Room	14
		Slab	063-P10	Hot tool Room	24
Slab	063-P16	Corridor ⁽¹⁾	18		
Slab	063-P16	Corridor ⁽²⁾	24		

(1) Section within the column line from 33 to 36 and from PF to PG

(2) Section within the column line from 36 to 37 and from PB to PG

Table 2. Shielding information for the openings of room 077-P01

Room Number	Room Name	Openings for			Minimum Required Shield Thickness (inches)				
		Structure	Room Number	Room Name	North	South	East	West	
Additional Information on the Rooms which Contain Complex Geometries (cont.)									
077-P01	Hot Pipe Way	Wall	063-P26	Normal Sump Room	16	16	16	19	
		Wall	063-P56	Drop Area	14	14	18	14	
		Wall	085-P45	Drum Removal Chase	16	16	16	16	
		Wall	063-P16	Corridor ⁽¹⁾	24	-	24	20	
		Opening within the column line from 36 to 37 and PE to PG							
		Wall	063-P16	Corridor	18	24	-	24	
		Wall	057-P01	Elev. Hoist Way	18	-	34	-	
		Wall	063-P18	Stair	-	32	32	-	
		Opening within the column line from 36 to 37 and PB to PE							
		Wall	063-P16	Corridor	20	20	-	20	
		Wall	063-P19	Elect. Riser	29	-	29	-	
		Wall	063-P39	Spent Resin Long Term Storage Pump Room	18	21	15	21	
		Wall	063-P20	HVAC Chase	-	18	30	-	

(1) Opening within the column line from 36 to 37 and from PA to PB

Table 3. Shielding information for the side wall of room 077-P01 (1 of 2)

Room Number	Room Name	Face to (side wall)			Minimum Required Shield Thickness (inches)
		Structure	Room Number	Room Name	
Additional Information on the Rooms which Contain Complex Geometries (cont.)					
077-P01	Hot Pipe Way	Wall	-	Yard ⁽¹⁾	28
		Wall	063-P23	Equipment Waste Tank Room	15
		Wall	063-P24	Equipment Waste Tank Room	15
		Wall	063-P28	Floor Drain Tank Room	16
		Wall	063-P29	Floor Drain Tank Room	19
		Wall	063-P30	Chemical Waste Tank Room	10
		Wall	063-P31	Chemical Waste Tank Room	10
		Wall	063-P16	Corridor ⁽²⁾	18
		Wall	063-P52	Chemical Drain Sump Pump Room	14
		Wall	062-P02	Mask Decontamination Room	14
		Wall	063-P64	Corridor	14
		Wall	063-P61	Laundry Storage	14
		Wall	063-P51	Stair	17
		Wall	063-P78	Pipe Chase	14
		Wall	063-P32	Detergent Waste Tank & Pump Room	14
		Wall	063-P37	Monitor Tank Room	18
		Wall	063-P16	Corridor ⁽³⁾	18
		Wall	063-P46	Corridor - Wall within the column line from 37 to 38 along the row line PG - Wall within the row line from PG to PH along the column line 38	18 25
		Wall	063-P38	PSS-Solidification	16
		Wall	085-P45	Opening for Drum Removal Chase (West wall)	16
Wall	063-P48	CTS-Dryer Skid Room	17		
Wall	063-P13	Hot Pipe Chase	10		

(1) Exterior wall within the column line from 35 to 36 along the row line PA

(2) Section within the column line from 33 to 35 and from PF to PG

(3) Side wall within the column line from 36 to 37 along the row line PG

Table 3. Shielding information for the side wall of room 077-P01 (2 of 2)

Room Number	Room Name	Face to			Minimum Required Shield Thickness (inches)	
		Structure	Room Number	Room Name		
Additional Information on the Rooms which Contain Complex Geometries (cont.)						
077-P01	Hot Pipe Way	Wall	-	Yard ⁽⁴⁾	38	
		Wall	063-P11	Corridor ⁽⁵⁾		
				- South wall	28	
				- East wall	28	
		Wall	063-P08	Low Activity Spent Resin Tank Room		10
		Wall	063-P06	Future Use Area		32
		Wall	063-P05	Spent Resin Long term Storage Tank Room		32
		Wall	063-P02	GRS Header Drain Tank		24
		Wall	063-P16	Corridor ⁽⁶⁾		24
Wall	063-P01	Hot Pipe Chase		17		
Wall	-	Yard ⁽⁷⁾		32		

- (4) Exterior wall within the row line from PF to PI along the column line 39
- (5) Section within the column line from 38 to 39 and from PE to PF
- (6) Section within the column line from 38 to 39 and from PB to PC
- (7) Exterior wall within the column line from 37 to 38 along the row line PA

Table 4. Shielding information for the ceiling of room 077-P01

Room Number	Room Name	Face to (ceiling)			Minimum Required Shield Thickness (inches)
		Structure	Room Number	Room Name	
Additional Information on the Rooms which Contain Complex Geometries (cont.)					
077-P01	Hot Pipe Way	Slab	085-P14	Corridor ⁽¹⁾	18
		Slab	085-P17	Valve Room	10
		Slab	085-P20	Valve Room	10
		Slab	085-P31	Primary Sampling Room	10
		Slab	085-P32	Primary Sampling Sink Room	10
		Slab	085-P33	Hot Tool Room	16
		Slab	085-P35	Storage	14
		Slab	085-P15	Valve Room	10
		Slab	085-P16	Valve Room	10
		Slab	085-P44	RO Feed Tank Room	21
		Slab	085-P45	Drum Removal Chase	16
		Slab	085-P46	MF Membrane Module Room	20
		Slab	085-P07	Valve Room	16
		Slab	085-P08	Valve Room	22
		Slab	085-P14	Corridor ⁽²⁾	30
		Slab	085-P14	Corridor ⁽³⁾	24
		Slab	085-P42	IX Module Room	16
		Slab	085-P43	IX Module Room	16
		Slab	085-P01	Waste Gas Dryer Skid Room	15
		Slab	085-P02	Waste Gas Dryer Skid Room	16
		Slab	085-P03	Valve Room	19
Slab	085-P04	Charcoal Guard Bed Room	10		
Slab	085-P06	Valve Room	22		
Slab	085-P21	Charcoal Guard Bed Room	10		

(1) Section within the column line from 35 to 37 and from PF to PG

(2) Section within the column line from 37 to 38 and from PE to PF

(3) Section within the column line from 36 to 37 and from PB to PE

TS



Figure 2 Minimum Required Shield Thickness for Room 077-P01

Impact on DCD

DCD Table 12.3-4 will be revised as indicated in Attachment 2.

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.

Security-Related Information - Withhold Under 10 CFR 2.390

Figure 12.3-10 Radiation Zones (Normal) Compound Building El. 63'-0"

Non-Security-Related
Information
Non-Proprietary

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Security-Related Information - Withhold Under 10 CFR 2.390

Figure 12.3-11 Radiation Zones (Normal) Compound Building Partial Plan El. 77'-0"

12.3-75

The title of Figure 12.3-11 was revised in DCD, Rev.1.

Rev. 1

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Table 12.3-4 (9 of 10)

Room Number	Room Name	Face to			Minimum Required Shield Thickness (inches)
		Structure	Room Number	Room Name	
<u>Additional Information on the Rooms which Contain Complex Geometries (cont.)</u>					
077-P01	Hot Pipe Way	Slab	063-P27	Chemical Waste Pump Room	14
		Slab	063-P33	Sampling Room	14
		Slab	063-P34	L.R.S Control Panel Room	14
		Slab	063-P54	Monitor Tank Pump Room	14
		Slab	063-P56	Drop Area & Opening	14
		Slab	063-P57	Sorting Room	14
		Slab	063-P21	Equip. Waste Pump Room	15
		Slab	063-P22	Equip. Waste Pump Room	17
		Slab	063-P25	Floor Drain Pump Room	10
		Slab	063-P26	Normal Sump Pump Room	16
		Slab	063-P26	LRS seal water recycle equipment Room	34
		Slab	063-P38	PSS-solidification & Drum Conveyor Room	16
		Slab	063-P46	Corridor	25
		Slab	063-P11	Corridor	28
		Slab	063-P09	Valve Room	20
		Slab	063-P40	Concentrate pump Room	20
		Slab	063-P41	Concentrate holding tank Room	10
		Slab	063-P42	RO feed pump Room	24
		Slab	063-P43	IX feed pump Room	24
		Slab	063-P44	IX Feed tank Room	23
Slab	063-P45	Hot tool Room	23		
Slab	063-P04	GRS inlet skid Room	13		
Slab	063-P07	Valve Room	14		
Slab	063-P10	Hot tool Room	24		

This table will be replaced with "A" on following pages

Table 12.3-4 (10 of 10)

Room Number	Room Name	Face to			Minimum Required Shield Thickness (inches)
		Structure	Room Number	Room Name	
<u>Additional Information on the Rooms which Contain Complex Geometries (cont.)</u>					
077-P01	Hot Pipe Way	Slab	085-P14	Corridor ⁽¹⁾	18
		Slab	085-P17	Valve Room	10
		Slab	085-P20	Valve Room	10
		Slab	085-P31	Primary Sampling Room	10
		Slab	085-P32	Primary Sampling Sink Room	10
		Slab	085-P33	Hot Tool Room	16
		Slab	085-P35	Storage	14
		Slab	085-P15	Valve Room	10
		Slab	085-P16	Valve Room	10
		Slab	085-P44	RO Feed Tank Room	21
		Slab	085-P45	Drum Removal Chase	16
		Slab	085-P46	MF Membrane Module Room	20
		Slab	085-P07	Valve Room	16
		Slab	085-P08	Valve Room	22
		Slab	085-P14	Corridor ⁽²⁾	30
		Slab	085-P42	IX Module Room	16
		Slab	085-P43	IX Module Room	16
		Slab	085-P01	Waste Gas Dryer Skid Room	15
		Slab	085-P02	Waste Gas Dryer Skid Room	16
		Slab	085-P03	Valve Room	19
Slab	085-P04	Charcoal Guard Bed Room	10		
Slab	085-P06	Valve Room	22		
Slab	085-P21	Charcoal Guard Bed Room	10		

(1) Section within the column line from 32 to 35 and from PF to PJ

(2) Section within the column line from 37 to 38 and from PE to PF

This table will be replaced with "A" on following pages

"A"
(1 of 5)

Table 12.3-4 (9 of 13)

Room Number	Room Name	Face to (floor)			Minimum Required Shield Thickness (inches)
		Structure	Room Number	Room Name	
Additional Information on the Rooms which Contain Complex Geometries (cont.)					
077-P01	Hot Pipe Way	Slab	063-P27	Chemical Waste Pump Room	14
		Slab	063-P33	Sampling Room	14
		Slab	063-P34	LRS Control Panel Room	14
		Slab	063-P54	Monitor Tank Pump Room	14
		Slab	063-P56	Drop Area & Opening	14
		Slab	063-P57	Sorting Room	14
		Slab	063-P21	Equip. Waste Pump Room	15
		Slab	063-P22	Equip. Waste Pump Room	17
		Slab	063-P25	Floor Drain Pump Room	10
		Slab	063-P26	Normal Sump Pump Room	16
		Slab	063-P38	PSS-solidification & Drum Conveyor Room	16
		Slab	063-P46	Corridor	25
		Slab	063-P11	Corridor	28
		Slab	063-P09	Valve Room	20
		Slab	063-P40	Concentrate pump Room	20
		Slab	063-P41	Concentrate holding tank Room	10
		Slab	063-P42	RO feed pump Room	24
		Slab	063-P43	IX feed pump Room	24
		Slab	063-P44	IX Feed tank Room	23
		Slab	063-P45	Hot tool Room	23
		Slab	063-P04	GRS inlet skid Room	13
Slab	063-P07	Valve Room	14		
Slab	063-P10	Hot tool Room	24		
Slab	063-P16	Corridor ⁽¹⁾	18		
Slab	063-P16	Corridor ⁽²⁾	24		

(1) Section within the column line from 33 to 36 and from PF to PG

(2) Section within the column line from 36 to 37 and from PB to PG

"A"
(2 of 5)

Table 12.3-4 (10 of 13)

Room Number	Room Name	Openings for			Minimum Required Shield Thickness (inches)					
		Structure	Room Number	Room Name	North	South	East	West		
Additional Information on the Rooms which Contain Complex Geometries (cont.)										
077-P01	Hot Pipe Way	Wall	063-P26	Normal Sump Room	16	16	16	19		
		Wall	063-P56	Drop Area	14	14	18	14		
		Wall	085-P45	Drum Removal Chase	16	16	16	16		
		Wall	063-P16	Corridor ⁽¹⁾	24	-	24	20		
		Opening within the column line from 36 to 37 and PE to PG								
		Wall	063-P16	Corridor	18	24	-	24		
		Wall	057-P01	Elev. Hoist Way	18	-	34	-		
		Wall	063-P18	Stair	-	32	32	-		
		Opening within the column line from 36 to 37 and PB to PE								
		Wall	063-P16	Corridor	20	20	-	20		
		Wall	063-P19	Elect. Riser	29	-	29	-		
		Wall	063-P39	Spent Resin Long Term Storage Pump Room	18	21	15	21		
		Wall	063-P20	HVAC Chase	-	18	30	-		

(1) Opening within the column line from 36 to 37 and from PA to PB

"A"
(3 of 5)

Table 12.3-4 (11 of 13)

Room Number	Room Name	Face to (side wall)			Minimum Required Shield Thickness (inches)
		Structure	Room Number	Room Name	
Additional Information on the Rooms which Contain Complex Geometries (cont.)					
077-P01	Hot Pipe Way	Wall	-	Yard ⁽¹⁾	28
		Wall	063-P23	Equipment Waste Tank Room	15
		Wall	063-P24	Equipment Waste Tank Room	15
		Wall	063-P28	Floor Drain Tank Room	16
		Wall	063-P29	Floor Drain Tank Room	19
		Wall	063-P30	Chemical Waste Tank Room	10
		Wall	063-P31	Chemical Waste Tank Room	10
		Wall	063-P16	Corridor ⁽²⁾	18
		Wall	063-P52	Chemical Drain Sump Pump Room	14
		Wall	062-P02	Mask Decontamination Room	14
		Wall	063-P64	Corridor	14
		Wall	063-P61	Laundry Storage	14
		Wall	063-P51	Stair	17
		Wall	063-P78	Pipe Chase	14
		Wall	063-P32	Detergent Waste Tank & Pump Room	14
		Wall	063-P37	Monitor Tank Room	18
		Wall	063-P16	Corridor ⁽³⁾	18
		Wall	063-P46	Corridor	
				- Wall within the column line from 37 to 38 along the row line PG	18
				- Wall within the row line from PG to PH along the column line 38	25
Wall	063-P38	PSS-Solidification	16		
Wall	085-P45	Opening for Drum Removal Chase (West wall)	16		
Wall	063-P48	CTS-Dryer Skid Room	17		
Wall	063-P13	Hot Pipe Chase	10		

(1) Exterior wall within the column line from 35 to 36 along the row line PA

(2) Section within the column line from 33 to 35 and from PF to PG

(3) Side wall within the column line from 36 to 37 along the row line PG

"A"
(4 of 5)

Table 12.3-4 (12 of 13)

Room Number	Room Name	Face to			Minimum Required Shield Thickness (inches)
		Structure	Room Number	Room Name	
Additional Information on the Rooms which Contain Complex Geometries (cont.)					
077-P01	Hot Pipe Way	Wall	-	Yard ⁽⁴⁾	38
		Wall	063-P11	Corridor ⁽⁵⁾	
				- South wall	28
				- East wall	28
		Wall	063-P08	Low Activity Spent Resin Tank Room	10
		Wall	063-P06	Future Use Area	32
		Wall	063-P05	Spent Resin Long term Storage Tank Room	32
		Wall	063-P02	GRS Header Drain Tank	24
		Wall	063-P16	Corridor ⁽⁶⁾	24
Wall	063-P01	Hot Pipe Chase	17		
Wall	-	Yard ⁽⁷⁾	32		

- (4) Exterior wall within the row line from PF to PI along the column line 39
(5) Section within the column line from 38 to 39 and from PE to PF
(6) Section within the column line from 38 to 39 and from PB to PC
(7) Exterior wall within the column line from 37 to 38 along the row line PA

"A"
(5 of 5)

Table 12.3-4 (13 of 13)

Room Number	Room Name	Face to (ceiling)			Minimum Required Shield Thickness (inches)
		Structure	Room Number	Room Name	
Additional Information on the Rooms which Contain Complex Geometries (cont.)					
077-P01	Hot Pipe Way	Slab	085-P14	Corridor ⁽¹⁾	18
		Slab	085-P17	Valve Room	10
		Slab	085-P20	Valve Room	10
		Slab	085-P31	Primary Sampling Room	10
		Slab	085-P32	Primary Sampling Sink Room	10
		Slab	085-P33	Hot Tool Room	16
		Slab	085-P35	Storage	14
		Slab	085-P15	Valve Room	10
		Slab	085-P16	Valve Room	10
		Slab	085-P44	RO Feed Tank Room	21
		Slab	085-P45	Drum Removal Chase	16
		Slab	085-P46	MF Membrane Module Room	20
		Slab	085-P07	Valve Room	16
		Slab	085-P08	Valve Room	22
		Slab	085-P14	Corridor ⁽²⁾	30
		Slab	085-P14	Corridor ⁽³⁾	24
		Slab	085-P42	IX Module Room	16
		Slab	085-P43	IX Module Room	16
		Slab	085-P01	Waste Gas Dryer Skid Room	15
		Slab	085-P02	Waste Gas Dryer Skid Room	16
		Slab	085-P03	Valve Room	19
Slab	085-P04	Charcoal Guard Bed Room	10		
Slab	085-P06	Valve Room	22		
Slab	085-P21	Charcoal Guard Bed Room	10		

(1) Section within the column line from 35 to 37 and from PF to PG

(2) Section within the column line from 37 to 38 and from PE to PF

(3) Section within the column line from 36 to 37 and from PB to PE