
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.1)

1. The elevation of the partial plan in DCD Figure 12.3-11 is 77'-0". The title of this figure will be updated [to include this elevation](#).
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. Additional information on the slab thicknesses around room 077-P01 relating to other rooms, including 068-A07A and 068-A10A, will be added to DCD Tier 2 Table 12.3-4. As has been previously discussed, Table 12.3-4 provides the minimum required shield wall thicknesses for these rooms. The actual physical plant design will have shield wall thicknesses as thick or thicker than what is specified in DCD Table 12.3-4.

TS

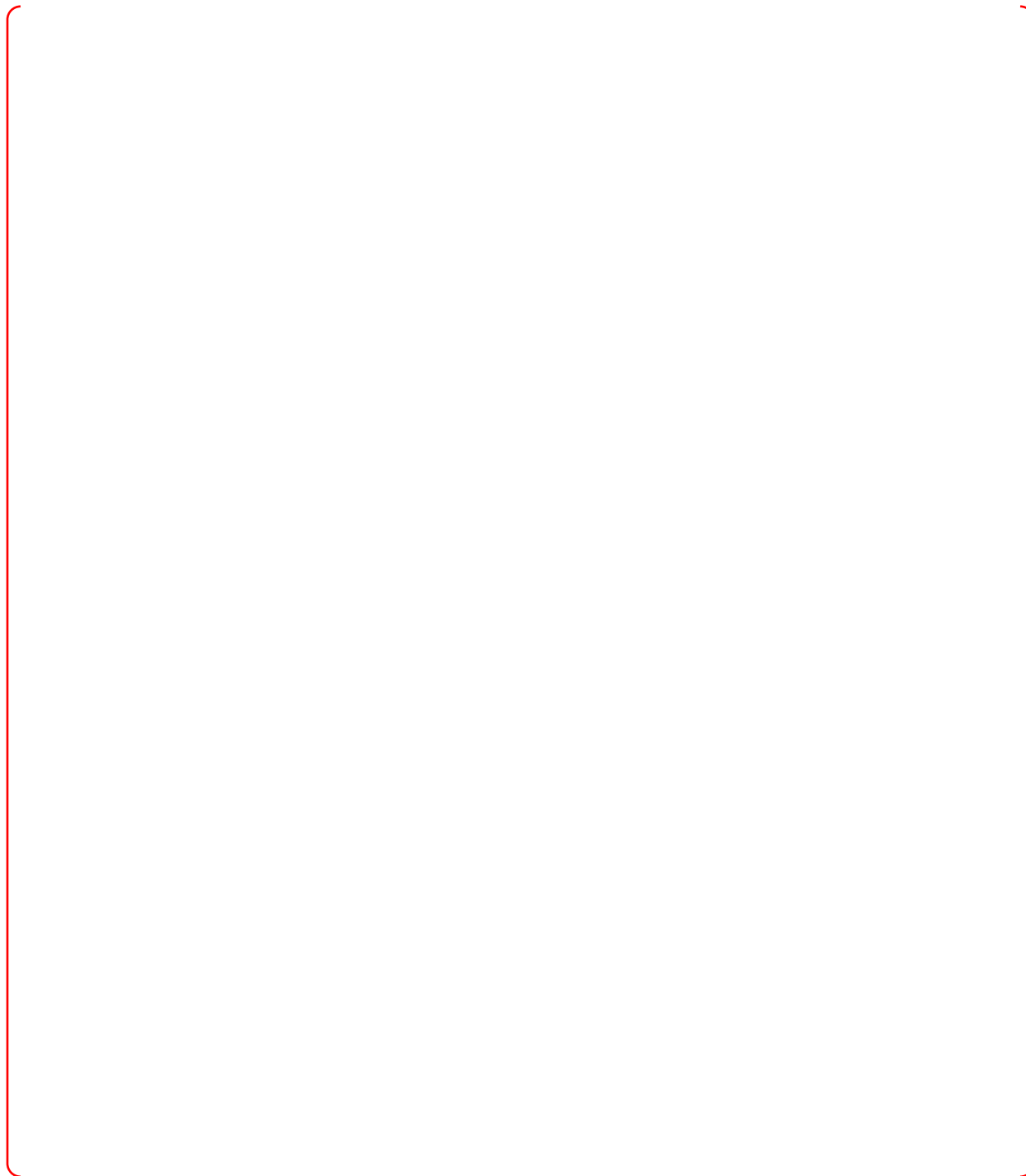


Figure 2 Minimum Required Shield Thickness for Room 077-P01

Impact on DCD

The title of the Figure 12.3-11 and [Table 12.3-4](#) will be revised as indicated in Attachments 1 and 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

El. 77'-0"

Figure 12.3-11 Radiation Zones (Normal) Compound Building Partial Plan

Table 12.3-4 (1 of 7)

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Design Basis Radiation Shield Thicknesses

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Room Number	Room Name	Minimum Required Shield Thickness (inches)					
		North	South	East	West	Floor	Ceiling
<u>Containment Building</u>							
069-C01	ICI Cavity	-	60	79	60	Ground	-
078-C01	Reactor Cavity	80	80	79	79	Ground	-
080-C01	Holdup Volume Tank	36	36	-	79	Ground	-
100-C02	Steam Generator Cavity	36	36	30	36	Ground	-
100-C03	Reactor Drain Tank	24	24	48	24	-	24
100-C04	Letdown HX Room	24	24	48	24	-	24
128-C01	Regenerative HX Room	60	60	48	48	24	48
136-C02	Pressurizer Cavity	33	36	30	33	30	-
<u>Auxiliary Building</u>							
050-A01C	CS Pump & Miniflow HX Room	48	48	10	20	Ground	30
050-A01D	CS Pump & Miniflow HX Room	48	48	10	20	Ground	30
050-A02C	SI Pump Room	48	48	10	10	Ground	30
050-A02D	SI Pump Room	48	48	10	10	Ground	30
050-A03A	SI Pump Room	48	48	10	10	Ground	30
050-A03B	SI Pump Room	48	48	10	10	Ground	30
050-A04A	SC Pump and Miniflow HX Room	48	48	27	10	Ground	30
050-A04B	SC Pump and Miniflow HX Room	48	48	27	10	Ground	30
055-A01C	CS HX Room	10	10	10	10	Ground	10
055-A01D	CS HX Room	10	10	10	10	Ground	10
055-A08C	Floor Drain Sump Pump Room	14	10	14	10	Ground	14
055-A08D	Floor Drain Sump Pump Room	10	14	14	10	Ground	14
055-A14C	Pipe Chase and Valve Room	13	48	20	13	Ground	30
055-A14D	Pipe Chase and Valve Room	48	18	10	48	Ground	30
055-A18A	Pipe Chase and Valve Room	42	48	48	20	Ground	30
055-A18B	Pipe chase and Valve Room	48	42	48	10	Ground	30
055-A21A	Pipe Chase and Valve Room	10	48	25	29	Ground	32

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Room Number	Room Name	Minimum Required Shield Thickness (inches)					
		North	South	East	West	Floor	Ceiling
<u>Auxiliary Building (cont.)</u>							
055-A21B	Pipe Chase and Valve Room	48	10	20	10	Ground	32
055-A22A	Pipe Chase	10	10	33	42	Ground	10
055-A22B	Pipe Chase	10	10	27	42	Ground	10
055-A30A	SC HX Room	22	30	30	22	Ground	25
055-A30B	SC HX Room	30	30	30	22	Ground	28
055-A31B	Chemical Drain Sump Pump Room	27	10	10	10	Ground	20
055-A33A	Equipment Drain Sump Pump Room	10	22	14	10	Ground	14
055-A33B	Equipment Drain Sump Pump Room	19	10	10	10	Ground	17
055-A34A	Floor Drain Sump Pump Room	10	22	10	22	Ground	11
055-A34B	Floor Drain Sump Pump Room	22	10	10	22	Ground	18
055-A38A	Boronometer Room	25	25	34	25	Ground	28
055-A39A	Process Radiation Monitor Room	19	19	11	19	Ground	21
055-A42A	Charging Pump Room	17	24	24	28	Ground	22
055-A43A	Charging Pump Miniflow HX Room	10	18	10	10	Ground	19
055-A45A	Pipe Chase	27	17	25	10	Ground	24
055-A46A	Condensate Return Unit Room	28	37	10	16	Ground	16
055-A47B	Primary Off-Gas Sample Pump Room	16	10	16	15	Ground	10
055-A51B	Equipment Drain Tank Room	12	28	37	26	Ground	24
055-A52B	Reactor Drain Pump Room	13	12	10	13	Ground	17
055-A53B	Reactor Drain Pump Room	13	12	23	10	Ground	17
055-A54B	Aux. Charging Pump Room	10	14	14	12	Ground	13
055-A55B	Charging Pump Room	14	14	14	20	Ground	17
055-A56A	Valve Room	10	18	28	10	Ground	19
055-A56B	Valve Room	14	20	12	10	Ground	10
055-A58A	Pipe Chase	18	10	26	26	Ground	10
055-A59A	Valve Room	19	10	26	34	Ground	24

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Room Number	Room Name	Minimum Required Shield Thickness (inches)					
		North	South	East	West	Floor	Ceiling
<u>Auxiliary Building (cont.)</u>							
068-A06A	Gas Stripper Room	37	35	45	35	30	24
068-A07A	Hot Pipe Way	13	29	31	29	24	24
068-A08B	Hot Pipe Way	33	24	24	20	23	30
068-A09B	Valve Room	19	17	23	19	17	10
068-A10A	Filter and Demin. Valve Area	10	10	33	33	30	24
068-A11A	Filter and Demin. Valve Area	10	24	10	22	24	21
068-A12A	Filter and Demin. Valve Area	10	18	10	18	17	29
077-A01A	Reactor Drain Filter Pit	35	10	10	15	10	23
077-A02A	SFP Cleanup Filter Pit	10	10	10	10	23	23
077-A03A	SFP Demin Filter Pit	10	17	10	24	23	23
077-A04A	SFP Cleanup Filter Pit	10	10	10	10	23	23
077-A05A	SFP Demin. Filter Pit	10	10	10	10	23	23
077-A06A	Purification Filter Pit	10	10	10	10	10	39
077-A07A	Reactor Makeup Water Filter Pit	18	32	24	18	10	10
077-A08A	Purification Filter Pit	10	10	10	10	10	39
077-A09A	SGBD Filter Pit	10	10	10	10	22	23
077-A10A	Seal Injection Filter Pit	10	10	10	11	24	24
077-A11A	SGBD Filter Pit	10	10	10	10	22	23
077-A12A	Seal Injection Filter Pit	10	13	10	10	13	24
077-A13A	SGBD Filter Pit	35	10	10	10	22	23
077-A14A	Boric Acid Filter Pit	13	18	10	29	10	13
077-A15A	Filter Cartridge Storage	32	39	39	39	25	39
078-A21A	Pipe Chase	10	36	48	48	10	24
078-A21B	Pipe Chase	36	10	48	48	10	10
078-A32A	SPF Cleanup Demin. Room	10	22	22	21	12	24
078-A33A	SG Blowdown Demin. Room	33	10	23	10	10	23
078-A34A	Pre-Holdup IX Room	33	15	15	33	15	24
078-A35A	Purification IX Room	12	24	29	43	29	42
078-A36A	Boric Acid IX Room	24	18	18	18	18	18

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Room Number	Room Name	Minimum Required Shield Thickness (inches)					
		North	South	East	West	Floor	Ceiling
<u>Auxiliary Building (cont.)</u>							
078-A37A	Deborating IX Room	15	12	10	24	24	24
078-A38A	SFP Cleanup Pump Room	23	23	23	10	23	32
078-A39A	Gas Stripper Effluent Radiation Monitor Room	23	23	23	10	16	35
078-A40B	Boric Acid Concentrator Room	16	23	23	14	16	16
086-A01A	Filter Area	-	-	18	21	13	10
100-A32B	SFP Cooling HX Room	10	10	10	10	10	10
100-A29B	Pipe and HVAC Chase	10	12	10	66	10	10
100-A13A	Mechanical Penetration Room	48	48	48	48	34	13
100-A13B	Mechanical Penetration Room	48	10	48	48	36	10
100-A16D	Pipe Chase	48	48	48	48	10	23
100-A16C	Pipe Chase	48	48	48	48	13	10
100-A24A	SFP Cooling HX Room	12	10	12	40	24	10
100-A26A	Valve Room	28	41	21	28	32	10
100-A25A	Volume Control Tank Room	42	42	42	47	48	53
111-A01B	Cask Loading Pit	48	14	48	48	42	-
114-A01B	Spent Fuel Pool	62	60	59	68	71	-
119-A01B	Refueling Canal	60	59	62	48	62	-
120-A16B	Mechanical Penetration Room	29	27	33	48	18	29
120-A16A	Mechanical Penetration Room	20	24	20	48	17	19
120-A23A	Valve Room	18	25	18	18	10	18
120-A14A	SG Blowdown Regen. HX Room	12	10	10	21	14	21
137-A19A	SG Blowdown Flash Tank Room	18	18	18	21	18	18
156-A14A	Aux. Bldg Controlled Area (I) Normal Exhaust ACU Room	18	18	18	18	18	18
174-A15B	Containment High- and Low-volume Purge ACU Room	21	21	21	21	15	10
195-A08B	Aux. Bldg. Controlled Area (II) Normal Exhaust ACU Room	18	18	18	18	18	18

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Room Number	Room Name	Minimum Required Shield Thickness (inches)					
		North	South	East	West	Floor	Ceiling
<u>Compound Building</u>							
063-P01	Hot Pipe Chase	10	28	28	10	Ground	17
063-P02	GRS Header Drain Tank Room	35	40	48	36	Ground	18
063-P03	Valve Room	27	30	37	10	Ground	10
063-P04	GRS Inlet Skid Room	21	32	10	21	Ground	13
063-P05	Spent Resin Long-term Storage Tank Room	27	35	48	36	Ground	46
063-P06	Future Use	36	27	48	36	Ground	39
063-P07	Valve Room	16	29	36	30	Ground	14
063-P08	Low-activity Spent Resin Tank Room	27	32	35	10	Ground	10
063-P09	Valve Room	16	36	10	16	Ground	18
063-P13	Hot Pipe Chase	40	33	40	33	Ground	19
063-P14	Hot Tool Room	15	10	10	10	Ground	32
063-P21	Equip. Waste Pump Room	17	19	10	20	Ground	17
063-P22	Equip. Waste Pump Room	10	17	10	21	Ground	17
063-P23	Equip. Waste Tank Room	13	33	20	22	Ground	27
063-P24	Equip. Waste Tank Room	16	13	21	22	Ground	27
063-P25	Floor Drain Pump Room	14	10	11	19	Ground	10
063-P26	Normal Sump Pump Room	14	14	10	19	Ground	16
063-P27	Chemical Waste Pump Room	10	14	10	15	Ground	16
063-P28	Floor Drain Tank Room	16	16	19	20	Ground	29
063-P29	Floor Drain Tank Room	16	16	19	20	Ground	29
063-P30	Chemical Waste Tank Room	10	16	15	10	Ground	15
063-P31	Chemical Waste Tank Room	10	10	15	10	Ground	15
063-P36	DWS Drain Sump Pump Room	10	10	10	10	Ground	10

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Room Number	Room Name	Minimum Required Shield Thickness (inches)					
		North	South	East	West	Floor	Ceiling
<u>Compound Building (cont.)</u>							
063-P37	Monitor Tank Room	10	18	11	18	Ground	10
063-P38	PSS-Solidification & Drum Conveyer Room	17	24	24	21	Ground	14
063-P39	Spent Resin Long-term Storage Tank Sump Pump Room	18	20	18	21	Ground	18
063-P40	Concentrate Pump Room	27	24	20	16	Ground	19
063-P41	Concentrate Holding Tank Room	21	27	33	28	Ground	10
063-P42	RO Feed Pump Room	10	10	28	16	Ground	24
063-P43	IX Feed Pump Room	16	10	16	10	Ground	24
063-P44	IX Feed Tank Room	14	16	11	10	Ground	23
063-P47	CTS HEPA Vacuum Skid Room	24	10	21	10	Ground	10
063-P48	CTS Dryer Skid Room	31	24	17	21	Ground	15
063-P49	CTS Vacuum Skid Room	10	10	21	10	Ground	18
063-P54	Monitor Tank Pump Room	10	10	10	10	Ground	14
063-P73	Instrument Calibrator Facility	36	43	18	48	Ground	36
085-P01	Waste Gas Dryer Skid Room	17	25	25	19	17	22
085-P02	Waste Gas Dryer Skid Room	11	17	10	19	17	22
085-P03	Valve Room	48	11	30	26	18	36
085-P04	Charcoal Guard Bed Room	26	26	34	18	10	23
085-P06	Valve Room	19	26	36	30	19	27
085-P07	Valve Room	27	24	30	30	14	24
085-P08	Valve Room	24	19	22	24	19	24
085-P15	Valve Room	10	21	21	18	10	23
085-P16	Valve Room	10	22	18	19	10	22
085-P17	Valve Room	10	10	10	14	10	17
085-P20	Valve Room	16	16	16	16	10	16
085-P21	Charcoal Guard Bed Room	26	26	18	34	10	23
085-P31	Primary Sampling Room	10	10	10	10	10	10

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Room Number	Room Name	Minimum Required Shield Thickness (inches)					
		North	South	East	West	Floor	Ceiling
<u>Compound Building (cont.)</u>							
085-P32	Primary Sampling Sink Room	10	13	12	12	14	18
085-P42	IX Module Room	10	30	30	27	14	28
085-P43	IX Module Room	30	10	30	30	14	28
085-P44	RO Feed Tank Room	10	27	32	22	19	25
085-P45	Drum Removal Chase	15	15	15	15	-	25
085-P46	MF Membrane Module Room	23	10	20	15	18	16
085-P47	MF Membrane Module Room	23	16	10	12	15	16
085-P48	RO Membrane Module and Valve Skid Room	43	24	43	34	32	36
096-P01	Charcoal Delay Bed Room	22	19	21	14	28	17
096-P02	Charcoal Delay Bed Room	47	44	14	38	36	42
100-P02	GRS Equipment Removal Area	13	11	38	10	23	10
100-P07	Future Extension Area	24	30	36	37	24	31
100-P08	Truck Bay	24	24	36	37	36	31
100-P09	Waste Drum Storage Area	28	24	36	26	34	31
100-P10	Spent Filter Drum Storage Area	36	28	48	37	36	43
120-P01	Gaseous Radwaste Sample Control Panel Room	10	10	10	11	17	25
120-P02	Gaseous Radwaste Sample Valve Rack Room	20	10	25	17	17	25

Table 12.3-4 (8 of 10)

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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</u>					
068-A07A	Hot Pipe Way	Slab	055-A45A	Pipe Chase	10
		Slab	055-A42A	Charging Pump Room	22
		Slab	055-A35A	General Access Area	24
		Slab	055-A39A	Process Radiation Monitor Room	21
		Slab	055-A58A	Pipe Chase	17
		Slab	055-A30A	SC Hx Room	19
		Slab	078-A38A	Spent Fuel Pool Clean up Pump Room	23
		Slab	078-A39A	Gas Stripper Effluents Radiation Monitor Room	16
		Slab	078-A31A	General Access Area	24
068-A10A	Filter and Demin Valve Room	Slab	055-A35A	General Access Area	30
		Slab	055-A36A	CVCS Chemical Package Room	30
		Slab	078-A34A	Pre-Holdup Ion Exchange	15
		Slab	078-A35A	Purification Ion Exchange Room	13
		Slab	078-A37A	Deborating Ion Exchange Room	24
		Slab	077-A01A	Reactor Drain Filter Pit	15
		Slab	077-A06A	Purification Filter Pit	10
		Slab	077-A08A	Purification Filter Pit	10
		Slab	077-A10A	Seal Injection Filter Pit	10

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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		

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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