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.:	**235-8275**
SRP Section:	**12.03 – 12.04 Radiation Protection Design Features**
Application Section:	**12.3 – 12.4**
Date of RAI Issue:	**10/07/2015**

Question No. 12.03-34

10 CFR 20.1602 requires that in addition to the requirements in 10 CFR 20.1601, the licensee shall institute additional measures to ensure that an individual is not able to gain unauthorized or inadvertent access to areas in which radiation levels could be encountered at 500 rads or more in 1 hour at 1 meter from a radiation source or any surface through which the radiation penetrates.

SRP 12.3-12.4 indicates that the staff will review the design features provided to control access to radiologically restricted areas (including potentially very high radiation areas) and that the staff's review will emphasize areas potentially greater than 100 Rad/hour.

In addition SRP 12.5 indicates that the staff will review the description of physical and administrative measures for controlling access to, and work within, radiation areas, high-radiation areas, and very high radiation areas.

In FSAR Table 12.3-5, the applicant lists areas in the plant that could potentially be greater than 100 Rad/hour. Many of these areas are also very high radiation areas (greater than 500 Rad/hour), as indicated in the normal radiation zone figures in FSAR Section 12.3.

While the applicant specifies design features to control access to a few of these significant radiation areas in FSAR Section 12.3.2.3, the applicant does not discuss design features to control access to the other areas. Please update the FSAR to discuss design features to control access for all areas potentially greater than 100 Rad/hour.

Response - (Rev. 1)

As described in DCD Subsection 12.3.2.3 and Table 12.3-5, the APR1400 design contains areas identified to be high radiation areas (areas potentially greater than 100 rad/hr (1 Gy/hr)) and very high radiation areas (areas potentially greater than 500 rad/hr (5 Gy/hr)) which are provided with access control features to prevent inadvertent high radiation exposure to plant

personnel. DCD Subsection 12.3.2.3 addresses the shielding design features for radiation protection, and a Subsection 12.3.2.4 will be added to describe the design features provided for access control for the rooms and areas listed in Table 12.3-5.

Impact on DCD

DCD Subsection 12.3.2.4 will be added, and Table 12.3-5 will be modified 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 Environment Report.

pipe chase. The resin transfer lines are also provided with a flushing capability to minimize the potential for hot spots in the piping.

The ICI chase is potentially a high-radiation area (greater than 1 Gy/hr) during ICI withdrawal. Stringent access control is provided to this area during movement of the ICI. A lockable access door is provided with a warning light. During withdrawal of the ICI, the warning light illuminates, providing indication that the ICI is being moved. An area radiation monitor is located in the ICI chase to provide indication of radiation levels and to alarm the personnel when the ICI is being withdrawn. Emergency egress from the area is also provided from the ICI chase.

Components that handle a significant amount of radioactive materials, such as LWMS floor drain tanks and equipment waste tanks, are located in shielded cubicles separated from the pump and valve galleries that are provided with labyrinths for access to the galleries. This design approach minimizes radiation streaming and scattering but permits inspection and maintenance access and removal of smaller items such as pumps, valves, and instruments for repair in lower-radiation areas. This design approach meets the requirements of NRC RG 8.8 2.b(4). The plant shielding is designed not only to maintain personnel occupational exposure ALARA, but also to maintain exposure to the general public ALARA.

The APR1400 shielding design has target dose rates that are below the limits for radiation zone designations provided in Table 12.3-2 to provide a sufficient margin in maintaining radiation exposure to plant personnel and the public ALARA.

12.3.3 Ventilation

The spread of airborne contamination within the plant is minimized by the design of the plant HVAC systems to provide airflow from areas of lower potential for airborne contamination to areas of greater potential for airborne contamination. For building compartments with the potential for contamination, the exhaust from the areas is designed with pressure and flow balances to minimize the amount of uncontrolled exfiltration from these areas. These design features provide reasonable assurance that the average concentration of radioactive material in the air in the areas that are normally occupied is less than the small fraction of DAC prescribed in 10 CFR Part 20 Appendix B. Therefore,

DCD subsection 12.3.2.4 will be added to include "A" in next page

"A"

12.3.2.4 Access Control to High Radiation and Very High Radiation Areas.

The high radiation and very high radiation areas, areas potentially greater than 1 Gy/hr and 5Gy/hr, respectively, as identified in Table 12.3-5, which are located in the containment building have multiple features of access control to prevent inadvertent radiation exposure to plant personnel. These very high radiation areas include the ICI cavity, the hold-up volume tank, the core debris chamber, the reactor cavity, the steam generator cavity, and the reactor drain tank room. Access to the containment building is strictly controlled and built-in design features to prevent inadvertent access include a secure air lock as the only point of entry for personnel, the door to which is locked and equipped with a security alarm. In addition to the access control provided at the point of entry into the containment building, separate barriers with individual locked doors are provided for each of these very high radiation areas in accordance with the guidance of RG 8.38 (Reference 18).

The high radiation areas on Elevations 78' and 86' of the auxiliary building are located within a block where thick concrete walls are provided as shielding to the surrounding areas. There are no doors provided to allow access to the high radiation cubicles within this block. These cubicles include the pre-holdup ion exchanger pit, the purification ion exchanger pit, the purification filter pit, and the filter area. This block of filters and ion exchangers can only be accessed from the elevation 100' level via manway, which are locked at all times and are further under administrative controls to prevent unauthorized access. Also on Elevations 100' and 120' of the auxiliary building is the volume control tank cubicle, which is a potentially high radiation area. This cubicle, which is not normally accessed by personnel, is locked and can only be opened by key from the outside.

The areas listed in Table 12.3-5 at the Elevation 120' level of the auxiliary building, which are high radiation areas during refueling operations, include the transfer tube inspection area, the cask loading pit, the refueling canal, and the spent fuel pool. The cask loading pit and refueling canal, and the spent fuel pool do not allow for inadvertent personnel access as these areas do not have an entrance for personal entry, and since the transfer tube access area is locked normally, the transfer tube inspection area cannot be accessed.

The areas listed in Table 12.3-5 as high radiation areas within the compound building are all provided with access control in the form of locked doors. These rooms are provided with a latch bolt operated by key from the outside or by a rotating inside knob/lever. The two exceptions to this form of access control are the hot pipe way on Elevation 77' and the charcoal delay bed room. The hot pipe way and the charcoal delay bed room are not provided with a door for personnel access. The only accesses to these areas are via the hatches provided on Elevation 85' and 120', respectively. Since these hatches are intended for maintenances or equipment removal, and are equipped with heavy concrete blocks, unauthorized access is not possible.

Table 12.3-5 (1 of 2)

Areas Potentially Greater than 1 Gy/hr(1)

Auxiliary and Containment Building El. 55ft; see Figure 12.3-1

Area	Coordinates
ICI Cavity	AF-AG, 18-19

Auxiliary and Containment Building El. 78ft; see figures 12.3-2 and 3

Area	Coordinates
Hold-Up Volume Tank	AE-AG, 20-21
Core Debris Chamber	AE-AG, 17-18
Pre-Holdup Ion Exchanger Pit	AC-AD, 23-24
Purification Ion Exchanger Pit	AB-AC, 23-24
Purification Filter Pit	AC-AD, 24-25
Filter Area	AA-AB, 24-25

Auxiliary and Containment Building El. 100ft; see Figure 12.3-4

Area	Coordinates
Reactor Cavity	AE-AG, 18-20
Steam Generator Cavity	AD-AE & AG-AH, 19
Reactor Drain Tank Room	AE-AF, 16-17
Volume Control Tank Room	AD-AE, 24-25

Auxiliary and Reactor Containment Building El. 120.0 ft; see Figure 12.3-5

Area	Coordinates
Refueling Pool Area	AE-AG, 17-21
Fuel Transfer Tube(2)	AF-AG, 21-23
Spent Fuel Pool(2)	AG-AH, 23-25
Cask Loading Pit(2)	AH-AI, 23-24
Refueling Canal(2)	AF-AG, 23-25

(1) During normal operating conditions and AOOs

(2) Only when fuel is in the area

Replace this table with "B"

Table 12.3-5 (2 of 2)

Compound Building El. 63ft; see Figure 12.3-10

Area	Coordinates
GRS Header Drain Tank Room	PB-PC, 38-39
Spent Resin Long Term Storage Tank Room	PC-PD, 38-39
Future Use	PD-PE, 38-39
Hot Pipe Chase	PI-PJ, 38-39

Compound Building El. 77ft; see Figure 12.3-11

Area	Coordinates
Hot Pipe Way	PA-PI, 33-39

Compound Building El. 85ft; see Figure 12.3-12

Area	Coordinates
R/O Membrane Module & Valve Skid Room	PI-PJ, 37-39

Compound Building El. 100ft; see Figure 12.3-13

Area	Coordinates
Charcoal Delay Bed Room	PB-PC, 38-39
Spent Filter Drum Storage Area	PI-PJ, 38-39
Truck Bay(3)	PF-PG, 37-39
Future Extension Area(3)	PE-PF, 37-39

(3) Only during transfer and drumming of spent filter and spent resin

Replace this table with "B"

B

Table 12.3-5 (1 of 2)

Areas Potentially Greater than 1 Gy/hr(1)

Auxiliary and Containment Building El. 55ft; see Figure 12.3-1

Area	Coordinates	HRA / VHRA(3)	Access Control
ICI Cavity	AF-AG, 18-19	VHRA	Locked Door

Auxiliary and Containment Building El. 78ft; see figures 12.3-2 and 3

Area	Coordinates	HRA / VHRA	Access Control
Hold-Up Volume Tank	AE-AG, 20-21	HRA	Locked Door
Core Debris Chamber VH	AE-AG, 17-18	VHRA	Locked Door
Pre-Holdup Ion Exchanger Pit	AC-AD, 23-24	HRA	Hatch
Purification Ion Exchanger Pit VH	AB-AC, 23-24	VHRA	Hatch
Purification Filter Pit VH	AC-AD, 24-25	VHRA	Hatch
Filter Cartridge Storage VH	AA-AB, 24-25	VHRA	Hatch

Auxiliary and Containment Building El. 100ft; see Figure 12.3-4

Area	Coordinates	HRA / VHRA	Access Control
Reactor Cavity VH	AE-AG, 18-20	VHRA	Locked Door
Steam Generator Cavity	AD-AE & AG-AH, 19	HRA	Locked Door
Reactor Drain Tank Room	AE-AF, 16-17	HRA	Locked Door
Volume Control Tank Room VH	AD-AE, 24-25	VHRA	Locked Door

Auxiliary and Reactor Containment Building El. 120.0 ft; see Figure 12.3-5

Area	Coordinates	HRA / VHRA	Access Control
Refueling Pool Area(2)	AE-AG, 17-21	VHRA	No Entrance
Transfer Tube Inspection Area(2)	AF-AG, 21-23	VHRA	Locked Door
Spent Fuel Pool(2)	AG-AH, 23-25	VHRA	No Entrance
Cask Loading Pit(2)	AH-AI, 23-24	VHRA	No Entrance
Refueling Canal(2)	AF-AG, 23-25	VHRA	No Entrance

(1) During normal operating conditions and AOOs

(2) Only when fuel is in the area

(3) HRA : High Radiation Area,
VHRA : Very High Radiation Area (Greater than 5 Gy/hr)

B

Table 12.3-5 (2 of 2)

Compound Building El. 63ft; see Figure 12.3-10

Area	Coordinates	HRA / VHRA	Access Control
GRS Header Drain Tank Room	PB-PC, 38-39	HRA	Locked Door
Spent Resin Long Term Storage Tank Room	PC-PD, 38-39	VHRA	Locked Door
Future Use	PD-PE, 38-39	VHRA	Locked Door
Hot Pipe Chase	PI-PJ, 38-39	HRA	Locked Door

Compound Building El. 77ft; see Figure 12.3-11

Area	Coordinates	HRA / VHRA	Access Control
Hot Pipe Way	PA-PI, 33-39	HRA	Hatch

Compound Building El. 85ft; see Figure 12.3-12

Area	Coordinates	HRA / VHRA	Access Control
R/O Membrane Module & Valve Skid Room	PI-PJ, 37-39	HRA	Locked Door

Compound Building El. 100ft; see Figure 12.3-13

Area	Coordinates	HRA / VHRA	Access Control
Charcoal Delay Bed Room	PB-PC, 38-39	VHRA	Hatch
Spent Filter Drum Storage Area	PI-PJ, 38-39	VHRA	Locked Door
Truck Bay(4)	PF-PG, 37-39	HRA	Locked Door
Future Extension Area(4)	PE-PF, 37-39	HRA	Locked Door

(4) Only during transfer and drumming of spent filter and spent resin

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Docket No. 52-046

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SRP Section:	**12.03 – 12.04 – Radiation Protection Design Features**
Application Section:	**12.03 – 12.04**
Date of RAI Issue:	**10/07/2015**

Question No. 12.03-35

10 CFR 20.1101(b) requires that the licensee use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA).

10 CFR 20.1406(b) requires that applicants for standard design certifications describe in the application how facility design will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.

FSAR Section 12.3.1.2, item p, indicates that high-pressure demineralized water will be used to decontaminate equipment that has been in the spent fuel pool. Please discuss in the FSAR how the spread of contamination and the generation of airborne radioactive material will be minimized while using this equipment.

Response - (Rev. 1)

The high pressure demineralized water is intended to be used for the decontamination of the SFP, refueling pool, and any components (bulky items such as storage racks) that cannot be decontaminated in the decontamination facility. When high pressure demineralized water is used to decontaminate the SFP, refueling pool, or bulky components, protective covers are required to be used to minimize the spread of contamination. High pressure demineralized water is not to be used in open areas above the pool. The requirement for the use of covers to minimize the spread of contamination will be added to the DCD for clarification.

Impact on DCD

DCD Tier 2 Section 12.3.1.2, item p, 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 Environment Report.

quick-application type buckle fasteners. After the necessary panels are removed, remote equipment can be used to perform the required inspections.

n. Blanket-type thermal insulation

Blanket-type thermal insulation with hook-and-loop fasteners is selected where needed for components and piping containing radioactive fluids. A metal jacket around the insulation is provided. This jacket is held in place by quick-application type buckle fasteners. This insulation is easily removable to facilitate the performance of inservice weld inspections. This minimizes personnel exposures received during ISI.

o. Electrical service and lighting

The APR1400 design provides quality lighting and convenient electrical services to facilitate maintenance and inspection and reduce anticipated personnel exposure. Reliable lamps of extended service life are used in high-radiation areas whenever possible to minimize the frequency of maintenance/replacement. These features are included in the facility layout design in accordance with the guidance of NRC RG 8.8, Position C.2.i.

p. Spent fuel pool (SFP) decontamination

The APR1400 design provides the capability to use high-pressure demineralized water for the decontamination in the SFP. Alternative methods of decontamination, such as a strippable coating, may be evaluated by the operator for practicality.

and refueling pool

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q. Snubbers

Mechanical snubbers, rather than hydraulic snubbers, are used in radiation areas to minimize the frequency of required maintenance and inspections.

When high pressure demineralized water is used to decontaminate the SFP or bulky components, protective covers are required to be used to minimize the spread of contamination. High pressure demineralized water is not to be used in open areas above the pool.