
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.: 116-8054
SRP Section: 14.03.08 – Inspections, Tests, Analyses, and Acceptance Criteria
Application Section: 14.03.08
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Question No. 14.03.08-1

10 CFR 50, GDC 61, requires that the fuel storage and handling, radioactive waste, and other systems which may contain radioactivity shall be designed to assure adequate safety under normal and postulated accident conditions. These systems shall be designed (1) with a capability to permit appropriate periodic inspection and testing of components important to safety, (2) with suitable shielding for radiation protection, (3) with appropriate containment, confinement, and filtering systems, (4) with a residual heat removal capability having reliability and testability that reflects the importance to safety of decay heat and other residual heat removal, and (5) to prevent significant reduction in fuel storage coolant inventory under accident conditions.

SRP Section 14.3 indicates that the purpose of inspections, tests, analysis, and acceptance criteria (ITAAC), is to verify that a facility referencing the design certification is built and operates in accordance with the design certification and applicable regulations.

In addition, SRP Section 14.3.8 indicates that the reviewer should ensure that Tier 1 identifies and describes, commensurate with their safety significance, those SSCs that provide radiation shielding, confinement or containment of radioactivity, ventilation of airborne contamination, or radiation (or radioactivity concentration) monitoring for normal operations and during accidents.

SRP Section 14.3.8 also indicates that the criteria in Tier 1 should ensure that the radiation shielding design (as provided by the plant structures or by permanent or temporary shielding included in the design) is adequate so that the maximum radiation levels in plant areas are commensurate with the areas' access requirements; that adequate shielding is provided for those plant areas that may require occupancy to permit an operator to aid in the mitigation of or the recovery from an accident; and that the contribution of gamma shine to the radiation dose to a member of the public (off site) will be a small fraction of the U.S. Environmental Protection Agency's dose limits in found at 40 CFR Part 190.

Tier 1, Table 2.8-2, "Radiation Protection ITAAC," item 1, is associated with radiation shielding. The acceptance criteria indicates that a report exists which verifies that radiation levels are within those levels specified in Tier 1, Table 2.8-1. Table 2.8-1 only provides the dose rate range for each zone designation and does not provide the specific zoning for any of the rooms in the plant. Therefore, there is no way for anyone to verify that this ITAAC has been completed during facility construction. In addition, Tier 1, Table 2.8-2, item 1, indicates that the plant will be built and then a report will be completed to determine that radiation zoning requirements are met. Therefore, Tier 1, Table 2.8-2, Item 1, is written as a design acceptance criteria (DAC), instead of an ITAAC. It is unclear why a DAC would be needed for radiation shielding when Tier 2 already provides minimum radiation shielding thicknesses for radiation sources large enough to require shielding.

Therefore, Tier 1, Table 2.8-2, item 1 is unacceptable. To provide appropriate ITAAC for radiation shielding, staff suggests the following:

1. The applicant should modify or replace Tier 1, Table 2.8-2, item 1 with an ITAAC to verify that minimum shielding requirements are met for significant radiation sources which require radiation shielding. Using this approach, Tier 1, Section 2.8 and item 1 in Table 2.8-2 should provide the shielding material for each room (for example, concrete) as well as the thickness of each shield, for significant sources which require shielding.
2. If shielding material other than concrete or steel is being relied upon for limiting radiation exposure to workers or members of the public, or for limiting exposure to equipment in the equipment qualification program, the applicant should discuss the material used in Tier 1 and Tier 2 of the application and include an ITAAC to verify that the shield material maintains its integrity during normal operation and accident conditions, as appropriate.
3. Provide figures of the general arrangement of the plant in Tier 1, which should also be referenced in the shielding ITAAC, making it clear what areas of the plant are being shielded and where the major radiation sources are located.
4. Finally, if any doors are required to provide radiation shielding from significant plant sources Tier 1 should discuss the radiation attenuation capabilities of those doors and ITAAC should be provided to verify the attenuation capabilities. The ITAAC should verify that the doors provide equal or greater attenuation than that of the wall to which they are installed.

Response

1. KHNP will revise the ITAAC in Table 2.8-2, item 1 to reflect an inspection and analysis based on the type of construction material used for the shielding and the thickness of the floors and walls for rooms that contain significant radiation sources which require shielding.
2. Steel reinforced concrete is used for all shield walls and floors. The radwaste truck bay door is designed for shielding during waste handling; refer to item 4 below.

3. In addition to general arrangement drawings, other drawings such as radiation zone drawings, radiation shield barrier drawings, and concrete outline drawings are to be used for inspecting the thicknesses of the shield walls and floors. The radiation shield barrier drawings provide clear areas of the facility being shielded, and the minimum shield wall thicknesses are also indicated on the drawings. A paragraph will be added to the end of DCD Tier 1 Subsection 2.8.2 to reference the type of drawings and construction reports (for verification of concrete densities and reinforced steel bars) for inspection and analysis.

Due to the large number of drawings that will be used for the shielding inspections, only the types of drawings are noted in the DCD Tier 1 subsection.

4. The compound building truck bay door is designed to provide shielding during waste loading and unloading operations. The truck bay door will be inspected against the technical specifications for its attenuation capability through the comparison to its manufacturer's test report. An ITAAC will be added to Table 2.8-2 for the compound building truck bay door.

Impact on DCD

DCD Tier 1, Subsection 2.8.1, 2.8.2 and Table 2.8-2 will be revised 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.

APR1400 DCD TIER 12.8 Radiation Protection2.8.1 Design Description

Radiation protection design features in the APR1400 provide the limitation of radiation exposures to plant personnel and to the public complying with the NRC RG and as low as reasonably achievable (ALARA) principles.

The design commitments for radiation protection are as follows:

the minimum shielding requirements for significant radiation sources which require shielding

1. Shielding design of rooms, corridors, cubicles, labyrinth access, and operating areas is commensurate with ~~their access requirement and radiation levels for walls surrounding very high radiation areas and significantly high radiation areas.~~
2. Ventilation systems for the radiological controlled areas are designed to keep the radiation exposure below the limits specified in 10 CFR Part 20, Appendix B.
3. Area and airborne radioactivity monitoring systems are located in the plant areas where personnel access can be restricted by the airborne contamination.
4. Radiation shielding design is provided to protect the operators so that they could take actions to mitigate or recover from the design basis accidents.

2.8.2 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.8-2 provides the inspections, tests, analyses and associated acceptance criteria, which will be undertaken for radiation protection.

5. Compound building truck bay door is provided for radiation shielding during waste loading and unloading operations.

The following drawing types are to be used for inspection and analysis of as-built shield walls and floors as applicable:

- General arrangement drawings
- Radiation zone drawings
- Radiation shield barrier drawings
- Concrete outline drawings
- Construction reports

APR1400 DCD TIER 1

Table 2.8-2

Radiation Protection ITAAC

the minimum shielding requirements for significant radiation sources which require shielding

materials of construction and the thickness of all shield walls and floors are as-built for confirmation of the

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. Shielding design of rooms, corridors, cubicles, labyrinth access, and operating areas is commensurate with their access requirement and radiation levels for walls surrounding very high radiation areas and significantly high radiation areas.	1. Inspections and analysis based upon the as-built shielding structure will be conducted to verify the adequacy of the shielding design in plant area.	1. A report exists and concludes that maximum radiation levels are less than or equal to the radiation levels in the radiation zones specified in Table 2.8-1.
2. Ventilation systems for the radiological controlled areas are designed to keep the radioactivity concentration below the limits specified in 10 CFR Part 20, Appendix B.	2. Analysis will be performed to predict radioactivity and to calculate ventilation by considering flow rates and equipment leakages in the plant areas during normal operations.	2. Analysis exists and ventilation the lower concentrations of airborne radionuclides are in the limit specified in 10 CFR Part 20, Appendix B.
3. Area and airborne radioactivity monitoring systems are located in the plant areas where personnel access can be restricted by the airborne contamination.	3. Refer to Table 2.7.6.4-3 ITAAC # 1 and Table 2.7.6.5-3 ITAAC # 1.	3. Refer to Table 2.7.6.4-3 ITAAC # 1 and Table 2.7.6.5-3 ITAAC # 1.
4. Radiation shielding design is provided to protect the operators so that they could take actions to mitigate or recover from the design basis accidents.	4. Analysis will be performed to predict maximum radiation exposure to the operators during the design basis accidents.	4. A report exists and concludes that maximum radiation exposure dose to operators is less than the limits specified in GDC 19.

in accordance with the shield barrier drawings

the shielding materials and the thicknesses of walls and floors are as-built for the shielding of all radiation areas

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| 5. Compound building truck bay door is provided for radiation shielding during waste loading and unloading operation. | 5. An inspection of the CB truck bay door and its test report will be conducted to verify that the door is built with equal or greater attenuation than that provided in the technical specifications. | 5. A report exists and concludes that the attenuation capability of the as-built door has equal or greater attenuation than that provided in the technical specifications. |
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