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. 12.03-31

10 CFR 100.11(a)(1) requires that the exclusion area boundary dose be limited to 25 rem in 2 hours following the onset of a postulated fission product release.

FSAR Section 12.3.2.1 Paragraph a.2.b. indicates that shielding is adequate to keep direct and scattered radiation below the 100.11(a)(1) limit (which is referenced in 10 CFR 50.34) and the limits in Chapter 15 during an accident. However, the 25 rem limit is a dose limit from a combination of all sources. Please revise FSAR Section 12.3.2.1, Paragraph a.2.b. to specify that the shielding is adequate to ensure that the total radiation dose to the whole body does not exceed the dose requirements. If the shielding design is inadequate to ensure that the exclusion area dose will remain below 25 rem from all sources, during the worst case design basis accident, increase plant shielding thicknesses, as appropriate.

Response – (Rev. 1)

The TEDE dose limit of 250 mSv in 10CFR50.34(a)(1)(ii) is applied to APR1400. As indicated by staff, the combination of all sources due to a postulated LOCA should not exceed 250 mSv TEDE. The radiological consequences of a large break LOCA is analyzed to be 204 mSv at the EAB (DCD Table 15.6.5-14), and that the calculated direct dose at a distance of 800 meters from the LOCA sources inside the containment is 2.6 mSv, the total dose at the EAB is 206.6 mSv. Hence, the shielding is considered adequate.

Based on a follow-up public conference call held on April 26, 2017 regarding the response to RAI 235-8275 Q12.03-31, KHNP agrees that the reference in DCD Section 12.3.2.1 Paragraph a.2.b should be changed from 10 CFR 50.34 to 10 CFR 52.47. Hence, DCD Section 12.3.2.1 Paragraph a.2.b and Sections 12.3.4 and 12.3.7 will be revised as indicated in the Attachment.

Impact on DCD

DCD Section 12.3.2.1 Paragraph a.2.b and DCD Sections 12.3.4 and 12.3.7 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.

For shielding design, normal station operating conditions are considered to include conditions generally known as AOOs. Two modes of normal station operation are:

a) Normal power operation of the reactor

b) AOOs (startup, shutdown, and refueling of the reactor)

Shielding is designed to provide a protective function under such conditions. Normal operation zone designations are provided in Table 12.3-2.

2) Accident conditions

Shielding provides protection to plant operating personnel and the general public under postulated DBA conditions as defined in Chapter 15.

a) MCR habitability

The MCR and associated areas are designed according to the design requirements in 10 CFR Part 50, Appendix A, GDC 19, and are shielded so that, after a postulated DBA, radiation exposure in the MCR for the duration of the accident does not exceed the TEDE of 50 mSv, including dose contributions from ingress and egress of the MCR.

The radiation shielding protecting the MCR and associated areas is designed based on the anticipated radiation environment resulting from the postulated DBA.

b) Direct offsite doses

effective dose equivalent

10 CFR 52.47 (Reference 31)

Adequate shielding is provided to limit the total ~~radiation doses to the whole body~~ not to exceed the limits specified in ~~10 CFR 50.34 (Reference 11)~~ and Chapter 15 of the Standard Review Plan (SRP) (Reference 12). The shielding is designed adequately that the radiation dose to an individual located at the exclusion area boundary for a duration of 2 hours during a postulated DBA does not exceed 25 rem.

TEDE

b. Seismic and safety classification

HVAC systems are described in Section 9.4.

12.3.4 Area Radiation and Airborne Radioactivity Monitoring Instrumentation

The area radiation monitoring system (ARMS) supplements the personnel and area radiation survey provisions of the plant health physics program described in Section 12.5 and provides reasonable assurance of conformance with the personnel radiation protection requirements of 10 CFR 20, 10 CFR Part 50, 10 CFR Part 70 (Reference 19); the guidelines of NRC RGs 1.21 (Reference 20), 1.97, 8.2 (Reference 21), 8.25 (Reference 5), and 8.8 (Reference 1); and American National Standards Institute (ANSI) N13.1-1999 (Reference 22) and Institute of Electrical and Electronics Engineers (IEEE) Std. 497-2002 (Reference 23). The ARMS is in conformance with ANSI/ANS HPSSC-6.8.1 (Reference 24).

The process and effluent radiation monitoring system and sampling systems are described in Section 11.5.

Portable instruments are used and the associated training and procedures are provided to accurately determine the airborne iodine concentration in areas within the facility where plant personnel could be present during an accident in accordance with the requirements of 10 CFR 50.34(f)(2)(xxvii) and the criteria in Item III.D.3.3 of NUREG-0737. (Reference 11) Portable instruments are also used as needed during normal operation in accordance with the guidelines of RG 8.8. The COL applicant is to provide portable instruments and the associated training and procedures in accordance with 10 CFR 50.34(f)(2)(xxvii) and the criteria in Item III.D.3.3 of NUREG-0737 as well as the guidelines of RG 8.8 (COL 12.3(4)).

With regard to the criticality accident monitoring, the requirements in 10 CFR 50.68(b) (Reference 25) are followed to prevent criticality as described in Subsection 9.1.1.

12.3.4.1 Area Radiation Monitoring System

12.3.4.1.1 Design Objective

The ARMS monitors the radiation levels in selected areas throughout the plant. Most area monitors are designed to warn operators and station personnel through visible and audible alarms when unusual radiological events occur. Some area monitors are designed to monitor the post-accident radiation level in areas where access to equipment that is

27. ANSI/ISA-67.04-1994, “Setpoints for Nuclear Safety-Related Instrumentation,” International Society of Automation, 1994.

28. IEEE Std. 323-2003, “IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations,” Institute of Electrical and Electronics Engineers, 2003.

29. IEEE Std. 344-2004, “IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations,” Institute of Electrical and Electronics Engineers, 2004.

30. IEEE Std. 603-1991, “IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations,” Institute of Electrical and Electronics Engineers, 1991.

31. 10 CFR Part 52.47, "Contents of Applications; Technical Information," U.S. Nuclear Regulatory Commission.