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.:	**209-8218**
SRP Section:	**03.11 - Environmental Qualification of Mechanical and Electrical Equipment**
Application Section:	**03.11**
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Question No. 03.11-16

10 CFR 50.49 and 10 CFR 50, Appendix A, criterion 4 require that certain components important to safety be designed to withstand environmental conditions, including the effects of radiation, associated with design basis events, including normal operation, anticipated operational occurrences, and design basis accidents.

SRP 3.11 indicates that, “The radiation environment must be based on the integrated effects of the normally expected radiation environment over the equipment's installed life, plus the effects associated with the most severe design basis event during or following which the equipment is required to remain functional.” Similar criteria is found in RGs 1.89 and 1.183.

However, FSAR Section 3.11.5.2 indicates that for equipment used only during refueling operations that the total integrated dose (TID) is calculated assuming that the radiation sources only effect the equipment during the refueling period (1 month every 18 months). It is unclear why only the radiation dose during refueling is considered, when the equipment could still be exposed to radiation when not in use. For example, equipment in containment which is not used during normal operations but is used for refueling may be exposed to radiation from the normal radiological conditions in containment during operation, even when not in use. Therefore, in accordance with the above guidance and requirements:

1. Please specify for which equipment the radiation dose is only calculated during refueling.

2. For equipment whose dose is only considered during refueling, please specify why it is acceptable to not account for radiation exposure during operation (non-refueling plant operation). Please provide more information in the FSAR as to why it is acceptable to not account for dose during operation (non-refueling plant operation), for these components.

3, Please indicate in FSAR Section 3.11.5.2 if the equipment for which the normal operation TID only considers refueling, also considers dose contributions from accident conditions. If not, please indicate why it is acceptable to not include accident dose.

Response

1. The equipment used only during refueling operation includes the fuel transfer tube and equipment in the cask loading pit. Since these areas do not contain any radioactive sources during normal operation, it is not necessary for the radiation TID calculations to include contributions from normal operation.

2. The TID values for this equipment are calculated assuming that the source terms in those areas exist only during the refueling period. One (1) month refueling period is assumed for every 18 months of normal operation. The integrated dose in these areas during normal operation is considered negligible since the dose contributions are estimated to be 0.01% and 0.02% of the total TID for the fuel transfer tube and cask loading pit, respectively. These dose contributions due to normal operation are calculated based on the upper dose rate limit of 0.025 mSv/hr since they are classified as Radiation Zone 2 during normal operation. Therefore, the TID for these areas are calculated based on 40 months of total refueling duration during a plant life of 60 years as described in Subsection 3.11.5.2. The FSAR will be updated to provide additional information why it is acceptable to consider only doses during refueling.

3. Safety related systems and components are designed to withstand the normal TID plus accident TID. However, the components associated with fuel transfer tube and cask loading pit are not designed to perform any safety related functions. Therefore, it is not necessary to include the accident TID for this equipment. The FSAR will be updated to provide additional information as to why it is acceptable not to include accident TID.

Impact on DCD

DCD Section 3.11.5.2 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 Environmental Reports.

In accordance with NRC RG 1.89, the source terms based on 1 percent fuel defect are used to calculate the TID during normal operation. The TID is calculated at a distance of 30.48 cm (1 ft) away from the equipment surface, and 60 years of continuous operation at full power is assumed.

located in fuel transfer tube and cask loading pit that is

For the equipment used only during the refueling operation, the TID is calculated assuming that the radiation sources affect the equipment only during the refueling period. A 1-month duration refueling period is assumed for every 18 months of normal operation. Therefore, the TID is calculated based on 40 months of refueling operation during the plant life of 60 years. An additional safety margin of 20 percent is applied to the normal TID considering the potential contribution of radiation from adjacent cubicles. This margin bounds the dose contributions from adjacent sources for most of the cubicles. In cases where the sum of the dose contributions is greater than the margin, the actual dose rates are taken into account in determining the normal TID of the corresponding area.

Radiation environments for the components for which the most adverse accident conditions are post-LOCA, are based on the source term assumptions consistent with NRC RG 1.183. Radiation environments for the components for which the most adverse accident conditions are other than the LOCA, such as main steam line break, feedwater line break, or control element assembly (CEA) ejection, are based on conservative estimates of the fuel assembly gap activities and maximum reactor coolant specific activities as discussed in Section 11.1.

Post-accident ESF system and component radiation exposures are dependent on equipment location. In the containment and control room area, exposures are based on a postulated design basis LOCA. Source terms and other accident parameters are presented in Subsection 12.2.2 and Chapter 15 and are consistent with the recommendations of NRC RG 1.183.

The TID during normal operation in these areas is negligible since no radiation source exists. Since these equipment do not perform safety related functions, dose contributions from accident conditions are not considered.

In the auxiliary building, exposures are based on the assumption that significant portion of the core fission product inventory are recirculated in the containment sump water plus other post-accident airborne radioactivities as presented in Table 12.2-20. In the fuel handling area, exposures are based on a fuel handling accident. Source terms and other accident parameters are presented in Chapter 15.

Organic materials that are within the containment are identified in Subsection 6.1.2. The design radiation exposures are based on gamma and beta radiation.