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.:	**179-8190**
SRP Section:	**09.01.01 - Criticality Safety of Fresh and Spent Fuel Storage and Handling**
Application Section:	**DCD Tier 2, Section 9.1.1**
Date of RAI Issue:	**09/01/2015**

Question No. 09.01.01-15

RAI 9.1.1-9: Deformation of neutron absorber material

REQUIREMENTS AND GUIDANCE

In 10 CFR Part 50 Appendix A, General Design Criterion (GDC) 62 requires the prevention of criticality in fuel storage and handling. 10 CFR 50.68(b)(4) sets specific requirements for the demonstration of nuclear criticality prevention in wet fuel storage. NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition,” Section 9.1.1, guides the reviewer, in part, to verify that the criticality analysis conservatively incorporates fuel storage rack design data, including materials and dimensional data. In addition, NRC Interim Staff Guidance DSS-ISG-2010-01 states that any degradation in rack materials should be modeled conservatively.

ISSUE

In DCD Section 9.1.1, the applicant states that “only 75 percent of B-10 density in the neutron absorbing materials is assumed in order to reflect the deformation of the neutron absorbing material,” but does not indicate the cause or nature of the material deformation.

INFORMATION NEEDED

The applicant should explain in its response and clarify in the DCD or its incorporated references the purpose of the stated spent fuel rack criticality analysis assumption with regard to the potential existence of material deformation, degradation, or other material characteristics or phenomena (e.g., non-uniform poison concentrations, poison granularity effects of neutron channeling or streaming) that could reduce or degrade the performance of the neutron absorbing material.

Response – (Rev. 1)

The purpose of the assumption with regard to 75 percent of B-10 areal density is to ensure conservative calculation results. 90% of B-10 areal density is a conservative assumption to consider degradation of METAMIC^{TM}. However, 75 percent of B-10 areal density is used for more conservative analysis.

DCD Tier 2, Section 9.1.1 will be revised to clarify the analysis conditions for neutron absorber plates as indicated in the Attachment.

Impact on DCD

DCD Tier 2, Section 9.1.1 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.

Spent Fuel Storage Rack

The following analysis conditions are considered in the design of the spent fuel storage racks:

a. The fuel assembly is assumed to have a maximum enrichment of 5 wt% of U-235 in the criticality calculation for spent fuel storage rack region I. For the normal condition, an infinite array of fresh fuel assemblies is modeled in the criticality calculation. Criticality for damaged fuel assemblies is separately evaluated and the effects of gap between racks are also evaluated.

b. For the region II analyses, an infinite array of 2 × 2 fuel assemblies with various U-235 enrichments, from 1.8 to 5.0 wt%, is used for the criticality calculation. The moderator of pure water is at the temperature (density) within the design limits that yields the largest reactivity. The full density of unborated water is assumed to be 1,000 kg/cm^3 (62.4 lbm/ft^3).

c. Credit is taken for the neutron absorption in the rack structural materials and neutron absorbing materials. The steel plate thickness is conservatively set to a minimum, and only 75 percent of B-10 density in the neutron absorbing materials is ~~assumed in order to reflect the deformation of the neutron absorbing material.~~ credited in the analysis. These assumptions provide additional margin in the event that deformation, degradation, or damage to the neutron absorber occur.

d. The neutron absorption e SFP water are neglected considered for the postulated accidents. The SFP boron concentration is assumed to be about one-half of the minimum concentration level defined in the Technical Specifications.

e. No cooling time is assumed to avoid fission product accumulation and Xe-135 is not included in the criticality calculation to conservatively evaluate the K_{eff}.

f. The nuclear characteristics of the spent fuel are affected by the core operation parameters, such as coolant temperature, soluble boron concentration in the coolant, and axial burnup profile. Thus, the most severe operating conditions are conservatively assumed in the fuel burnup calculation.