ArevaEPRDCPEm Resource

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Subject: U.S. EPR Design Certification Application RAI No. 196 (2260, 2237), FSAR Ch. 9
Attachments: RAI_196_SRSB_2260_SFPT_2237.doc

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on February 26, 2009, and on March 6, 2009, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
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Request for Additional Information No. 196 (2260, 2237), Revision 0

03/06/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.01.01 - Criticality Safety of Fresh and Spent Fuel Storage and Handling
SRP Section: 09.05.01 - Fire Protection Program
Application FSAR Ch. 9

QUESTIONS for Reactor System, Nuclear Performance and Code Review (SRSB)
QUESTIONS for Fire Protection Team (SFPT)

09.01.01-6

Section 4.6.2 of Holtec Technical Report UN-TR-08-001(P) discusses the core operating parameters used in the fuel depletion calculations, and refers to Table 4.6.2 for a list of core parameters. The value of in-core fuel assembly pitch of 21.402 cm (8.426 inches) given in Table 4.6.2 appears inconsistent with the value of 21.5036 cm (8.466 inches) provided in FSAR Table 4.4-1.

In order to verify the appropriate fuel design data were used in the criticality analyses, verify the in-core fuel assembly pitch used in the depletion analyses and any corrections to the analyses made and the application revised, as necessary. This information is required in order to ensure compliance with 10 CFR 50.68(b) and GDC 62.

09.01.01-7

Section 4.6.3 of Holtec Technical Report UN-TR-08-001(P) states that axial burnup distributions for several assembly average burnups are used in the criticality analyses, with reference to Table 4.6.3 of the report. Section 4.8.2.1 states the calculations are performed with a constant axial burnup and with an axial burnup distribution.

The staff has reviewed the axial burnup distributions as provided in Table 4.6.3 of the Holtec report, and finds that the axial burnup distributions are essentially identical and nearly uniform, at differing assembly average burnup levels.

In order to verify the adequacy of the criticality analyses and ensure compliance with 10 CFR 50 Appendix A, General Design Criterion 62, the staff requires the following information:

a) Justify the axial burnup distributions given in Holtec Technical Report UN-TR-08-001(P) Table 4.6.3 adequately bound the range of burnup distributions and assembly average burnups anticipated for the U.S. EPR fuel assembly.

b) Assess the need for a reactivity uncertainty (ΔK_{eff}) to cover possible variations of axial burnup distribution from those assumed in the criticality analyses.

09.01.01-8

Section 4.6.5 of Holtec Technical Report UN-TR-08-001(P) summarizes the Region 1 and Region 2 spent fuel storage rack design, with reference to Table 4.6.4. In comparing the rack design parameters in Table 4.6.4 against the design information provided in Section 2 of Holtec Technical Report UN-TR-08-001(P), the staff notes discrepancies in the reported widths of the poison panels for both Region 1 and Region 2 racks, and in the cell pitch of the Region 2 racks. In addition, there is insufficient fuel storage rack design information in the application for the staff to complete its review.

In order for the staff to complete its verification of the fuel storage rack data used in the criticality analysis per the guidelines of SRP 9.1.1 subsection III, provide the following information for the new fuel storage racks and the Region 1 and Region 2 spent fuel storage racks:

a) Minimum Boron-10 areal density for the Metamic^{TM} neutron poison material.

b) Storage rack design dimensions, including manufacturing tolerances, for the parameters utilized in the criticality analyses, and

c) Justification of any differences in the values used in the criticality analyses, as presented in Table 4.6.4 of the Holtec report.

This information is required in order to ensure compliance with 10 CFR 50.68(b) and GDC 62.

09.01.01-9

In order to comply with the requirements of 10 CFR 50.68(b) and GDC 62, provide a criticality analysis of the new fuel storage facility.

09.01.01-10

The staff notes an apparent discrepancy, as follows. FSAR Section 9.1.2.2.2 states that the normal water level of spent fuel pool is 7.01 m (23 feet) above the tops of the stored fuel. Technical Specification 3.7.14 requires water to be maintained ≥ 7.01 m (≥ 23 feet) only during fuel moves as a protective measure against a fuel handling accident and for shielding during movement of spent fuel.

Resolve the apparent discrepancy between the stated spent fuel pool normal water level and the Technical Specifications spent fuel pool water level requirement.

09.01.01-11

Technical Specification 4.3 contains the following specifications that are inconsistent with the fuel storage design as provided in Sections 2 and 4 of Holtec Technical Report UN-TR-08-001(P):

a) Technical Specification 4.3 specifies a nominal spent fuel storage rack cell pitch of 28.6512 cm (11.28 inches) as compared to values of 27.686 cm (10.9 inches) and

22.9311 cm (9.028 inches) for the Region 1 and Region 2 spent fuel storage racks, respectively per the Holtec report;

b) Technical Specification 4.3 specifies a nominal new fuel storage rack cell pitch of 28.6512 cm (11.28 inches) as compared to a value of 27.686 cm (10.9 inches) per Table 2.5.1 of the Holtec report; and

c) Technical Specification 4.3 specifies a maximum capacity of the spent fuel storage pool of 1,121 fuel assemblies as compared to 1,360 assemblies per the Holtec report.

Resolution of the above discrepancies is necessary in order for the staff to verify that the appropriate fuel storage rack design data were used in the criticality safety analyses and thereby assure compliance with 10 CFR 50.68(b) and GDC 62.

09.01.01-12

Table 4.6.1 of Holtec Technical Report UN-TR-08-001(P) identifies a maximum fuel enrichment of 5 wt% U^{235} used in the spent fuel pool criticality analyses. Technical Specification Bases B 3.7.16 states that the spent fuel racks are designed to accommodate fuel with a maximum nominal enrichment of 5 wt % U^{235} with a maximum tolerance of +/- .05 wt%. Provide the treatment of manufacturing variance in enrichment level in the analyses.

This information is required in order for the staff to complete its verification of the fuel storage rack data used in the criticality analysis per the guidelines of SRP 9.1.1 subsection III and thereby assure compliance with 10 CFR 50.68(b) and GDC 62.

09.01.01-13

In order to demonstrate compliance with 10 CFR 50.68(b) and GDC 62 under credible abnormal conditions, the vertical drop of a 5 wt % U^{235} fuel assembly onto a Region 1 stored fuel assembly must be shown to result in $K_{eff} \leq 0.95$.

Section 4.8.1.5.3 of Holtec Technical Report UN-TR-08-001(P) states that a vertical drop of a fuel assembly onto a Region 1 stored fuel assembly could impart a compressive force onto the stored fuel assembly, reducing the water-to-fuel ratio, and thereby reducing reactivity.

Provide an additional explanation of the effect of the compressed stored fuel assembly on water-to-fuel ratio in order for the staff to complete its evaluation of the dropped fuel assembly event.

09.01.01-14

In order to demonstrate compliance with 10 CFR 50.68(b) and GDC 62 under credible abnormal conditions, the vertical drop of a fresh 5 wt % U^{235} fuel assembly either into a

vacant Region 2 spent fuel storage cell or onto a Region 2 stored fuel assembly must be shown to result in $K_{eff} \leq 0.95$.

Holtec Report UN-TR-08-001(P) Section 4.8.2.8.3 states that the dropped fuel assembly could either slightly compress the stored fuel assembly or deform the storage rack baseplate, resulting in an increase in reactivity. The application states, however, that such reactivity increase would be small compared to that of a misloading of a fresh fuel assembly into the Region 2 racks and is therefore bounded by the misloading event.

Provide either additional justification to support the claim that the Region 2 fuel assembly misloading event bounds the vertical dropped fuel assembly event, or provide explicit analyses of the Region 2 vertical dropped fuel assembly event.

09.01.01-15

In order to demonstrate compliance with 10 CFR 50.68(b) and GDC 62 under credible abnormal conditions, the mislocation of a fresh 5 wt % U^{235} fuel assembly in the Region 2 spent fuel pool must be shown to result in $K_{eff} \leq 0.95$. The application states in Section 4.8.2.8.5 of Holtec Technical Report UN-TR-08-001(P) that a mislocation of a fresh 5 wt % U^{235} fuel assembly outside of the Region 2 spent fuel storage racks is bounded by the mislocation analysis for the Region 1 racks where the mislocated assembly is next to a fresh assembly. This conclusion, however, is not sufficiently justified because the Region 1 racks are designed with a flux trap for added reactivity control, whereas the Region 2 racks are standard non-flux trap design.

Provide either further justification to support the assertion that the Region 1 mislocated assembly analysis bounds the Region 2 mislocated assembly condition, or provide explicit analyses of the Region 2 mislocated assembly condition.

09.01.01-16

The application, including FSAR Section 9.1.1 and Section 4.0 of Holtec Technical Report UN-TR-08-001(P), “Criticality Evaluation,” does not adequately address criticality safety during fuel handling evolutions.

In order to comply with the requirements of 10 CFR 50.68(b) and GDC 62, provide a criticality analysis of the fuel handling system, including normal and credible abnormal configurations during new fuel handling, refueling operations, spent fuel storage operations, and spent fuel transfers to dry cask storage.

09.01.01-17

In the staff’s safety evaluation of Holtec International Report HI-2022871, “Use of Metamic™ in Fuel Pool Applications,” dated June 17, 2003, the staff requires implementation of a coupon sampling program to ensure consistent performance of the

Metamic™ material. Section 3.4 of Holtec Technical Report UN-TR-08-001(P) describes an in-service surveillance program similar to the coupon sampling program prescribed in the staff's earlier safety evaluation; however, certain provisions of the staff's safety evaluation are not explicitly addressed in Holtec Technical Report UN-TR-08-001(P), e.g., technique for measuring initial B_4C content of the coupons, simulation of scratches on the coupons, effects of any fluid movement and temperature fluctuations of the pool water on the coupons.

In order to comply with the staff's safety evaluation of Holtec International Report HI-2022871, "Use of Metamic™ in Fuel Pool Applications," dated June 17, 2003, the applicant's description of the Metamic™ in-service surveillance program must include a discussion of all the aspects of the in-service surveillance program listed in the subject safety evaluation (Reference: "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Holtec International Report HI-2022871 Regarding Use of Metamic in Fuel Pool Applications," Facility Operating License Nos. DPR-51 and NPF-6, Entergy Operations, Inc., Docket No. 50-313 and 50-368, USNRC, June 2003). The description of the Metamic™ in-service surveillance program may be supplied by the COL applicant, in which case a COL Information Item should be added to the DC FSAR.

09.05.01-68

Response to RAI 20 Question 09.05.01-20 states that "An alternative approach to fixed, self-contained eight-hour rated battery powered lighting units is taken for illuminating the MCR and RSS in support of post-fire safe shutdown. Both locations are illuminated by the special emergency lighting system. The special emergency lighting system receives power from redundant emergency diesel generator-backed uninterruptible power supplies, thus providing continuous illumination. Adequate lighting is available in the MCR or RSS, as necessary, to facilitate post-fire safe shutdown of the plant." U.S. EPR FSAR needs to clarify that in the event of a fire that adversely affects special emergency lighting equipment, cables, or power supplies for fire areas outside of the MCR or RSS that adequate special emergency lighting is available in the MCR or RSS, as necessary, to facilitate post-fire safe shutdown of the plant.