NRR-PMDAPEm Resource

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Sent:	Wednesday, September 21, 2016 1:08 PM
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Subject:	Request for Additional Information - Duane Arnold Energy Center - LAR - TSCR 159 - To Revise Technical Specifications Fuel Storage Requirements - MF7486

1. By letter dated March 15, 2016 (Agencywide Documents Access Management System (ADAMS) Accession No. ML16077A234), NextEra Energy Duane Arnold, LLC (the licensee), submitted a license amendment request (LAR) for the Duane Arnold Energy Center (DAEC) facility operating license and Technical Specifications (TSs). In the LAR the licensee proposed revisions to TS 4.3.1, "Fuel Storage, Criticality," and TS 4.3.3, "Fuel Storage, Capacity." In addition, the licensee proposed the addition of a new requirement in TS 5.5, "Programs and Manuals," to include a spent fuel pool (SFP) neutron absorber monitoring program. These proposed changes were necessary due to the licensee's revised SFP criticality analysis. The NRC has reviewed the information the licensee provided and determined that the following additional information is required in order to complete the evaluation.

Request for Additional Information

The applicable 10 CFR 50.68 requirement is that the k-effective of the spent fuel pool (SFP) storage racks loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95 percent probability, 95 percent confidence level, if flooded with unborated water. NextEra Duane Arnold, LLC submitted a criticality analysis (Enclosure 4 to the license amendment request (LAR)) performed to demonstrate that this regulatory limit will be met if the proposed Technical Specification (TS) limit on the reactivity for fuel stored in the Duane Arnold Energy Center (DAEC) SFP is satisfied. The staff has identified some instances where it is not clear if the reactivity impact due to specific conditions was adequately addressed in the criticality analysis. The potential reactivity impacts may be positive, so the staff needs additional information to verify the regulatory limit will not be challenged by these potential impacts.

1. In order to allow the NRC staff to verify that the MCNP6 modeling approach and inputs are appropriate for this application, please provide a sample input deck corresponding to a typical criticality calculation performed as documented in Enclosure 4 to the LAR.

2. The proposed TS 4.3.1.1.a revision provides an updated value for the Standard Cold Core Geometry (SCCG) k-infinity limit applicable to the Programmed and Remote Systems Corporation (PaR) SFP racks. The TS is silent regarding which code is to be used to calculate this value, but the DAEC UFSAR indicates that the lattice code used in licensing applications is TGBLA. Please clarify if the SCCG k-infinity values used for comparison to the TS 4.3.1.1.a limit are to be calculated using TGBLA or CASMO-4, and:

   a. If TGBLA is to be used, describe why the analysis performed based on CASMO-4 as described in Enclosure 4 to the LAR would be applicable to SCCG k-infinity values as calculated by TGBLA. Include any considerations due to code-to-code biases and uncertainties.
   b. If CASMO-4 is to be used, describe how the licensing basis and QA control program for DAEC will be updated to reflect this intention.

3. Section 5.1.2 of Enclosure 4 to the LAR states that for the MCNP6 calculations, "[t]he initial source is placed in the highest reactive area of the model." Please clarify how the source distribution was established for different calculations, including the interface and accident conditions. In particular, discuss whether a single point source, multiple point sources, or a distributed source was used.

4. The MCNP6 validation in Appendix A of Enclosure 4 to the LAR includes 131 critical benchmarks from the International Handbook of Evaluated Criticality Safety Benchmark Experiments (IHECSBE) and 53 critical experiments from the French Haut Taux de Combusion (HTC) facility, as evaluated by the NRC in NUREG/CR-6979. The selected IHECSBE benchmarks are all for uranium fuel rods only and do not cover other actinides present in spent fuel (i.e., plutonium). The HTC experiments selected for evaluation contains only one case in which a significant amount of boron is included. The DAEC SFP storage consists of spent fuel with a mix of uranium and plutonium fissile material stored in a configuration that uses neutron absorption in boron as a significant criticality control. Therefore, the set of selected critical benchmarks and critical experiments do not appear to contain many cases that are very similar to the DAEC storage configuration. Please provide an assessment of this apparent validation gap and how it may affect the results of the code validation.

5. Section 6.1 of Enclosure 4 to the LAR discusses sensitivity studies performed to determine limiting conditions to use for depletion. Please confirm that the k-infinity values obtained to determine the reactivity changes are the peak reactivity values from each depletion calculation performed as part of the sensitivity studies.

6. The sensitivity studies documented in Section 6.1 of Enclosure 4 to the LAR appear to have been performed using controlled conditions, and only consider the reactivity impact to the SCCG k-infinity. Please discuss why the results from the sensitivity study would be expected to remain applicable for uncontrolled conditions, and how the determination of limiting depletion conditions for determination of the maximum SCCG k-infinity would translate to limiting depletion conditions for determination of a limiting bound on the correlation between the SCCG k-infinity and the rack k-infinity.

7. Section 6.5 of Enclosure 4 to the LAR discusses calculation of the uncertainties due to manufacturing tolerances. The following manufacturing tolerances do not appear to be discussed: uranium-235 enrichment, gadolinium enrichment, and gadolinium pellet density (if different from U-235 pellet density). Please provide information on how these manufacturing tolerances are addressed or otherwise dispositioned.

8. For the manufacturing tolerances discussed in Section 6.5 of Enclosure 4 to the LAR, please confirm if the tolerances were analyzed in both directions (+/-).

9. Section 6.6 to Enclosure 4 to the LAR discusses calculations performed to assess the impact of eccentric positioning or rotation of fuel assemblies in the SFP rack cells. The report indicates that the calculations used the base model, which the NRC staff interprets to mean that the limiting GNF2 lattice described in Section 6.4 was used, which was based on a unrodded depletion at 0% void. The radial burnup distribution for the fuel lattice may have a significant impact on these configurations, and control

rod insertion would significantly change the radial burnup distribution. There is not sufficient information to evaluate the potential reactivity impact and how it might be offset by any reduction in peak reactivity due to the use of different depletion conditions. Please provide further information regarding the expected reactivity impact for eccentric positioning or rotation in the SFP cells of fuel that has been located in controlled core locations.

10. Section 6.7 of Enclosure 4 to the LAR describes an analysis performed to account for potential blistering on the Boral panels. This possibility is considered to be bounded by the complete displacement of the water between the Boral panels and the surrounding SFP cell walls. Section 9.1.2.2.2 of the DAEC UFSAR indicates that the PaR racks were manufactured in such a way that "[t]he outer can is formed into the inner can at the ends and totally seal welded to isolate the Boral from the pool water." This discussion appears to describe that of an unvented, completely encased installation of the Boral panels in the PaR cell walls. Please discuss whether the UFSAR description is an accurate reflection of the current SFP rack configuration. If it is, Information Notices 1983-29 and 2009-26 describe past incidents where Boral-containing SFP cell walls with this type of configuration experienced issues with bulging. Please address the potential for moderator displacement due to cell wall bulging.

11. Section 6.8 of Enclosure 4 to the LAR discusses the interface between racks. For the interface between PaR racks and the Holtec racks, the criticality analysis report states, "[t]he density of the fuel pellet in the Holtec rack was reduced by 23% so the infinite k_{eff} of both racks was approximately the same…" According to the proposed TS 4.3.1.1.a, the SCCG k-infinity limit for the PaR and Holtec racks would be the same. Therefore, the same limiting fuel lattices could be loaded in both racks. If the Holtec rack configuration is more reactive than the PaR rack configuration, this may impact the interface reactivity by increasing the neutron flux from the Holtec racks into the PaR racks. In addition, this analysis only considered normal conditions. Please provide further discussion of the interface between the PaR racks and Holtec racks, including:

    a. Justification for the analysis approach discussed in Section 6.8 to capture the reactivity impact of the interface condition.
    b. Potential impacts due to any postulated accident conditions in the licensing basis for both racks, such as a missing Boral panel from either rack.

12. Section 6.10 of Enclosure 4 to the LAR discusses the accident conditions that were considered in the criticality analysis. If a Boral panel is missing at the time that the SFP rack module is installed in the SFP, this would become part of the normal condition rather than an accident condition. The NRC staff is not aware of accidents that may result in movement of an entire Boral panel out of the SFP racks. Please clarify the intent for inclusion of this scenario as a potential accident condition, and if necessary, provide information demonstrating how inadvertent non-installment of a Boral panel was precluded from occurring.

Please arrange a teleconference with the NRC staff for clarification purpose. Thanks

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