NRR-PMDAPEm Resource

From: Lingam, Siva
Sent: Thursday, July 14, 2016 4:27 PM
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Cc: Pascarelli, Robert; Dean, Jeremy; Wood, Kent; Michael.Dilorenzo@aps.com; Carl.Stephenson@aps.com; Watford, Margaret
Subject: Palo Verde 1, 2, and 3 - Official RAIs from SNPB for LAR that Requested Revision to TSs to Incorporate Updated Criticality Safety Analysis (CAC Nos. MF7138, MF7139, and MF7140)

By letter dated November 25, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15336A087), as supplemented by letters dated January 29 and June 30, 2016 (ADAMS Accession Nos. ML16043A361 and ML16182A519, respectively), Arizona Public Service Company (APS, the licensee) requested a license amendment request (LAR) to amend Facility Operating License Nos. NPF-41, NPF-51, and NPF-74, and revise the Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3, Technical Specifications (TSs). The proposed amendment proposes to install the NETCO-SNAP-IN® neutron absorbing rack inserts into some spent fuel pool (SFP) storage rack cells coupled with six classifications of fuel by initial enrichment, burnup, and decay time in six storage configurations for criticality control. Approval of this license amendment allows the licensee to meet the effective neutron multiplication factor (k-effective or k_{eff}) criticality control requirements. The U.S. Nuclear Regulatory Commission (NRC) Nuclear Performance and Code Review Branch (SNPB) has the following **official** requests for additional information (RAIs). We transmitted draft RAIs to you on June 20, 2016, and we had a clarification call on July 13, 2016. Please provide your RAI responses within 60 days from the date of this e-mail, and submit the revised Westinghouse report WCAP-18030-P/NP, "Criticality Safety Analysis for Palo Verde Nuclear Generating Station Units 1, 2, and 3," including the affidavit, along with TS revisions within 90 days from this e-mail (as notified by APS on July 14, 2016). Your timely responses will allow the NRC staff to complete its review on schedule.

1. WCAP-18030-P, Revision 0, "Criticality Safety Analysis for Palo Verde Nuclear Generating Station Units 1, 2, and 3 (Proprietary)," dated September 2015, fuel assembly reconstitution as normal condition is described as follows, "Fuel assembly reconstitution is defined as either pulling damaged fuel rods [pins] out of an assembly and reinserting intact rods with less reactivity than the damaged rod, or as removing undamaged rods from a damaged assembly for insertion in a new assembly. In most cases damaged rods will be replaced with stainless steel rods. Natural uranium rods may also be used. Additional information is provided in Section 5.4.2 of WCAP-18030-P." Please provide a full description of the fuel assembly reconstitution process, which includes at least the following:

    a. The description initially seems to be saying that damaged fuel pins could be replaced with fuel pins from another assembly, but then states that damaged fuel pins would only be replaced with either stainless steel or natural uranium pins. Provide clarification.
    b. If the intention is to allow damaged fuel pins to be replaced with intact fuel pins with less reactivity from another assembly, provide the methodology that will be used to identify the replacement fuel pins. Please clarify what will replace the intact fuel pins being moved.
    c. Please clarify where in the SFP does the fuel assembly reconstitution activity take place.
    d. What is the maximum number of fuel pins that can be missing for a given reconstituted assembly at one time? Please justify any limitation or lack thereof.
    e. Please clarify whether or not there is any limitation on the number of pins in any fuel assembly that are not part of its initial construction. Please justify any limitation or lack thereof.
    f. In WCAP-18030 Section 5.4.2 it states, "If a fuel assembly has a rod removed and the lattice location is left empty, that fuel assembly shall be treated as fresh fuel until the location is filled or

analysis is performed demonstrating that the fuel assembly is bounded by the design basis assembly at the same burnup and initial enrichment levels." Please provide the methodology that will be used to perform the analysis. Please provide the analysis that demonstrates it is acceptable to store fuel with missing fuel pins as fresh. Please justify any limitations or lack thereof.

g. Please provide a licensing commitment to incorporate requirements, resulting from reconstitution limitations, into the licensee's procedures.

2. The burnup requirement coefficients given in WCAP-18030, Revision 0, Tables 6-2, 6-4, 6-6, and 6-8 are derived, by a curve fitting procedure, using the results from a series of depletion calculations that correspond to a specific average fuel assembly burnup and fuel enrichment. Please provide the burnup values used to define the burnup requirement coefficients given in WCAP-18030, Revision 0, Tables 6-2, 6-4, 6-6, and 6-8 so that the validity of the coefficients can be confirmed.

3. What isotopes were used in the nuclear criticality safety analysis? Please justify the use of any short lived or volatile isotopes.

4. Please describe how the licensee will ensure future cycles are bounded by the reactor operating parameters assumed in WCAP-18030-P. Please provide a commitment to incorporate that process into the licensee's procedures.

5. WCAP-18030-P Section 5.4.1 states, "The SFP as a single system is over moderated. A single fuel assembly however, is significantly under-moderated, and reducing the interstitial [heatup] H/U ratio has a negative impact on the system k_{eff}." With respect to these statements, please provide the following:

    a. The results of the SFP temperature bias sensitivity study mentioned in WCAP-18030-P Section 5.2.3.1.8 so that it can be confirmed that all proposed storage arrays for PVNGS are over moderated.
        i. If one or more proposed storage arrays for PVNGS are not over moderated adjust the analysis accordingly or justify not making any adjustments.
    b. If the second sentence in the above quote is accurate, then several aspects of the analysis are potentially non-conservative.
        i. Justify the assumptions and/or modeling simplifications that artificially reduce the interstitial H/U ratio.
        ii. Justify bias and uncertainty determinations that only consider aspects that reduce the interstitial H/U ratio.

6. WCAP-18030-P Section 5.4.1 also states, "It has been shown in WCAP- 16541-NP, "Point Beach Units 1 and 2 Spent Fuel Pool Criticality Safety Analysis" (Reference 13) that even storage of fuel pins in [guide tubes] GTs has a negative reactivity impact. Similar calculations have been performed for Palo Verde previously which resulted in the same conclusion as the Point Beach study. These studies demonstrate that individual fuel assembly lattices are significantly under moderated in the SFP environment and further reducing the H/U ratio will decrease reactivity." With respect to these statements:

    a. Please provide the calculations that were performed for PVNGS.

b. Point Beach uses a [Westinghouse Electric Company LLC] WEC 14x14 fuel design whereas Palo Verde uses a [Combustion Engineering] CE 16x16 fuel design. Please provide justification as to why Point Beach a valid precedent for Palo Verde?
c. Please clarify whether or not storage of fuel pins in instrument tubes is being requested as part of this LAR.
d. The Point Beach WCAP-16541 was not a bounding analysis for all fuel pins stored in Point Beach's WEC 14x14 guide tubes. Please describe any limitations on storing fuel pins in PVNGS's CE 16x16 guide tubes and the justification for those limitations.

7. In Section 5.5 of WCAP-18030-P, it is not clear how k-effective for the soluble boron cases was calculated. The limiting accident isn't necessarily the one with the largest reactivity increase, but rather the one which requires the most soluble boron to offset the reactivity increase. A storage array with a lower soluble boron worth could take more soluble boron to offset the reactivity increase, even with a smaller reactivity increase. Please demonstrate that the array configuration selected in determining the minimum soluble boron requirements corresponds to the limiting configuration.

    a. The values in Note 2 of Table 5-12 and Section 5.2.3.1.9 do not agree. Please provide clarification on this apparent discrepancy.

8. Section 5.2.3.2 of WCAP-18030-P makes reference to a study that Westinghouse performed to support its treatment of biases and uncertainties. Please provide the study or reference where the study has previously been submitted to the NRC.

9. The uncertainty in the SCALE 6.1.2 validation was performed on the uncertainty of the mean instead of the uncertainty of the population, which is inconsistent with NUREG/CR-6698, "Guide for Validation of Nuclear Criticality Safety Calculated Methodology," as referenced. Please revise the SCALE 6.1.2 validation to include the uncertainty of the population.

    a. Please provide Tables A-3, A-4, A-5, A-6, and A-7 in spreadsheet format so that the NRC can perform confirmatory analysis.

10. Do the fuel assembly grids expand over the course of their utilization in the reactor? If they do expand, how does this affect the nuclear criticality safety analysis for the SFP?

11. Section 5.2.3.1.1 of WCAP-18030-P discusses the manufacturing tolerances. The information provided in Figures 5-2 and 5-3 appears to be too limited to support the conclusions drawn from them. With respect to Figures 5-2 and 5-3, please provide the following:

    a. What is the source of the information presented in Figures 5-2 and 5-3? Please justify its applicability for PVNGS.
    b. Please justify the use of the information under full and optimum moderation scenarios for new fuel storage.
    c. Please justify not applying an instrument tube uncertainty.

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