From: Mahesh Chawla
To: Dale.Vincent@nmcco.com
Date: 6/28/05 5:51PM
Subject: LAR TO REVISE THE SPENT FUEL CRITICALITY ANALYSES AND TECHNICAL SPECIFICATIONS (TAC NOs. MC5811 AND MC5812) - Dated 2/1/05

With reference to your above LAR, the NRC staff would like to discuss the following information. Please arrange a teleconference to discuss this request for additional information.

1. In its amendment request, NMC provided a brief synopsis of the licensing basis for the SFP criticality analyses. The acceptance criteria cited by NMC in its discussion are codified in NRC regulations. Title 10 of the Code of Federal Regulations (10 CFR) Section 50.68, "Criticality accident requirements," provides NRC acceptance criteria for the safe storage of fuel in the spent fuel pool. The approval of NMC's amendment request will necessitate a satisfactory demonstration of compliance with all of the 10 CFR 50.68 acceptance criteria. This was not provided in the amendment request. Therefore, the staff requests that the licensee provide a summary of how each of the eight criteria in 10 CFR 50.68(b) will be met in the PINGP spent fuel pools.

2. In Section 1.2, NMC stated that it modeled the unborated moderator (water) with a density equal to 1.0 g/cc. The staff agrees that the assumption of full density moderator is conservative if the moderator temperature coefficient (MTC) is negative under nominal storage conditions in the spent fuel pool. However, Tables 3-4, 3-5, and 3-6 include a pool temperature bias that appears to indicate that full density water does not provide optimum moderating conditions. NRC regulations (10 CFR 50.68) and guidance documents require that the criticality analyses be performed under optimum moderation conditions. Since under some design configurations, the MTC can be positive, the staff requests the licensee describe what analyses it performed to demonstrate that the MTC under the most limiting storage conditions in the spent fuel pool was negative and that the full density moderator assumption was conservative. Additionally, if a bias is appropriate, the staff requests that the licensee justify the use of a bias based on previous criticality analyses that were dependent of different fuel storage conditions.

3. In Section 2.2, NMC described the storage modules in the PINGP spent fuel pools. The licensee stated that, "The modules are separated by a minimum water gap of 1 inch." Since the spacing between fuel assemblies is a key parameter in the analysis of the maximum keff between spent fuel storage modules, the staff requests that the licensee describe how the minimum water gap is assured.

4. In Section 3.1, NMC stated that scoping calculations were performed for the 235U loading and storage configurations considered in the amendment request to determine the most reactive fresh fuel assembly design. However, the licensee did not provide the results for these scoping calculations. Since the proper selection of the design basis fuel assembly is essential for ensuring the maximum keff is calculated and NRC regulations are satisfied, the staff requests that NMC provide a table of the results of the scoping calculations that supports its determination of the most reactive fresh fuel assemblies under the different storage configurations proposed in the amendment.

5. In Section 3.3, NMC stated the following: "The [fuel and moderator temperature] values are based on mid-cycle temperature profiles for Prairie Island Units 1 and 2." The proper selection of fuel and moderator temperatures as well as soluble boron concentrations is critical in the determination of a realistically conservative depletion analysis. Therefore, the staff requests that NMC provide a comparison of the data used in the depletion analyses to historical operating conditions at PINGP. The licensee must demonstrate that the assumptions used in its depletion analysis conservatively bound the historical operating conditions at PINGP.

6. In Section 3.4, NMC described the treatment of fuel rod manufacturing and storage rack fabrication tolerances in its criticality analyses. NMC provided a summary of all of the individual tolerances considered in its analysis of the fuel assemblies and storage racks. Although it

appears that NMC accounted for most of the major contributors in the uncertainty analyses, NMC did not include the contribution of smaller but potentially significant tolerances in the fuel and storage rack designs. NMC's criticality analysis is based on a limiting upper subcriticality limit of 0.999 that provides little safety margin to NRC regulatory limits. Therefore, the staff requests that NMC provide an analysis of the other tolerances not considered in its amendment request to ensure that the keff will remain below NRC regulatory limits.

7. Additionally, in Section 3.4, NMC stated that the tolerance analyzed for the gadolinia concentration is equal to -0.2 weight percent. However, NMC did not provide a basis for the uncertainty assumed in the analysis. The staff requests that NMC provide a technical basis for the uncertainty assumed and a justification for why this uncertainty provides an appropriately conservative result.

8. In Section 3.5, NMC provided a description of the cooling (decay) time credit employed in the criticality analyses. NMC determined cooling time credits on discrete 5-year intervals. Since appropriately classifying assemblies based on cooling time will be essential for ensuring subcriticality margins are maintained, the staff requests that the licensee describe how it will conservatively apply the cooling time credit to assemblies that fall between the discrete intervals calculated (e.g., assemblies with 7.5 or 12.5 years of cooling time).

9. In Section 3.1.2, NMC provides a list of four assumptions that were used to represent the gadolinium in the fresh fuel pellets in the KENO V.a model of the 3x3 storage region. However, the licensee did not provide a basis describing how each of these assumptions will provide a conservative representation of fresh fuel assemblies at PINGP. Therefore, the staff requests that the licensee provide a technical justification demonstrating that each of the assumptions provides conservative margin in the criticality analyses.

10. NMC's proposed TS Figure 4.3.1-1 allows the storage of fresh fuel assemblies in the spent fuel pool with or without gadolinium based on ensuring that adjacent spent fuel assemblies satisfy minimum burnup requirements. However, the licensee did not propose Technical Specification limits that will require a minimum gadolinium loading, in accordance with assumptions used in the criticality analyses, in the fresh fuel prior to placing it in the designated storage locations. Therefore, the staff requests that the licensee provide additional information demonstrating that sufficient controls will be put in place to ensure fresh fuel assemblies loaded in the spent fuel storage racks will be appropriately controlled based on the amount of gadolinium.

11. NMC's proposed Surveillance Requirement (SR) 3.7.17.1 requires that prior to storing or moving a fuel assembly in the spent fuel pool the licensee must "verify by administrative means the initial enrichment, burnup, and decay time of the fuel assembly is in accordance with Figure 3.7.17-1 or Specification 4.3.1.1." However, the licensee did not provide in its amendment request a description of the administrative process it will use to verify the parameters that govern fuel assembly storage requirements. Since the licensee intends to rely on administrative controls for prevention of accidents such as misloading of a fuel assembly, the staff requests that the licensee provide a description of the controls to be implemented and a summary of how they will be developed to minimize the potential for accidents that could result in an inadvertent criticality.

12. NMC's proposed TS Figure 3.7.17-1 provides minimum burnup versus enrichment curves for spent fuel storage in the pool. Proposed TS LCO 3.7.17 requires that assemblies that do not satisfy the TS Figure 3.7.17-1 combination of initial enrichment, burnup, and decay time limits for unrestricted storage must be stored in accordance with TS 4.3.1.1. However the burnup versus enrichment curves provided in TS Figures 4.3.1-3 and 4.3.1-4 require higher burnups for the same initial enrichment and cooling times. Therefore, a spent fuel assembly that does not satisfy the unrestricted storage requirement of TS Figure 3.7.17-1 will not satisfy the acceptability requirements of either TS Figures 4.3.1-3 or 4.3.1-4. Based on this limitation, the staff believes that any assembly that does not satisfy the minimum burnup requirements of TS Figure 3.7.17-1 must be classified as a fresh fuel assembly and stored in accordance with

fresh fuel loading configuration provided in TS Figure 4.3.1-1. The staff requests that the licensee confirm that these "restricted" spent fuel assemblies will be stored in accordance with fresh fuel assembly limitations and configurations.

13. In addition to classifying TS Figure 3.7.17-1 "restricted" spent fuel assemblies as fresh fuel assemblies, low-burnup assemblies (e.g., those that may not have completed a full cycle of irradiation) that initially contained burnable poisons such as gadolinium may have higher residual reactivities than fresh fuel. The staff requests that NMC identify whether this limiting condition was considered in its criticality analyses. If the condition was not considered, the staff requests that NMC describe how low-burnup assemblies will be stored in the PINGP spent fuel pools.

14. In its amendment request, NMC included a reactivity depletion uncertainty in the calculation of the minimum soluble boron concentration requirement. This uncertainty was equal to 1.0 percent Dkeff per 30,000 MWD/MTU of credited assembly burnup. However, it does not appear that a similar uncertainty was incorporated into the unborated maximum keff analyses (Tables 3-4, 3-5, and 3-6). The licensee did include a 5 percent uncertainty in the maximum burnup credited based on the MWD/MTU of burnup. NRC guidance documents (Ref. Kopp Memorandum) suggest an uncertainty of 5 percent of the reactivity decrement to the burnup of interest is an acceptable assumption. The staff requests that the licensee provide a technical justification for not including a reactivity decrement in accordance with NRC guidance documents in the unborated criticality analyses.

15. A major component of NMC's proposed changes to the SFP technical specifications is a reduction in the number of burnup versus enrichment curves that will govern fuel storage configurations. The current technical specifications delineate storage first based on the type of fuel assembly (e.g., Westinghouse Standard, Optimized, etc.), then on the presence and quantity of gadolinium rods, and finally on the burnup as a function of enrichment. The proposed technical specifications eliminate the first step of classifying based on fuel assembly type. Instead, NMC has chosen a more bounding analysis approach that identified the limiting fuel assembly and subsequently developed limiting burnup versus enrichment curves. It is reasonable to conclude that this bounding approach will require higher burnup limits to ensure subcritical storage configurations are established. However, in comparing the current technical specification figures for fuel assembly burnup verses enrichment curves to those in the proposed technical specification figures, it does not appear that the new figures are indeed bounding. For example, current TS Figure 3.7.17-2 provides burnup limits for Westinghouse Standard fuel assemblies for the "All Cell" configuration. In its new criticality analyses, NMC identified the Westinghouse Standard fuel assembly design as the most limiting in the "All Cell" configuration. However, the proposed TS Figure 3.7.17-1 that will govern loading of any assembly type into the "All Cell" configuration requires lower burnups, at given enrichments, than the current TS Figure 3.7.17-2. Similar differences exist between the proposed TS Figures 4.3.1-3 and 4.3.1-4 and the corresponding current TS figures. The staff requests that the license provide a technical justification explaining any differences between the current and new criticality analyses that support the reduced burnup limits proposed.

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