U. S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ADDITIONAL INFORMATION FOR

REVIEW OF WESTINGHOUSE ELECTRIC COMPANY [WESTINGHOUSE]

TOPICAL REPORT WCAP-17642-P, REVISION 0, AND WCAP-17642-NP, REVISION 0,

"WESTINGHOUSE PERFORMANCE ANALYSIS AND DESIGN MODEL (PAD5),"

(TAC NO. MF3096)

By letter dated October 29, 2013, Westinghouse Electric Company (Westinghouse), submitted for U.S. Nuclear Regulatory Commission (NRC) staff review of Topical Report, WCAP-17642-P, Revision 0, and WCAP-17642-NP, Revision 0, "Westinghouse Performance Analysis and Design Model (PAD5)," (Proprietary/Non-Proprietary). (Reference 1)

WCAP-17642-P, Revision 0, and WCAP-17642-NP, Revision 0, is a Westinghouse topical report (TR) that describes the fuel performance evaluation methodology and the PAD5 computer code which is the principal design tool for evaluating fuel rod performance and complies with the requirements of Sections 4.2 and 15.02 of NUREG-0800, “Standard Review Plan.” The computer program, PAD5 iteratively calculates the interrelated effects of fuel and cladding deformations including fuel densification, fuel swelling, fuel relocation, fuel rod temperatures, Fission Gas Release , and Rod Internal Pressure as a function of time and linear power. The objective of the methodology is to quantify the fuel design margins to the generic design criteria.

The NRC staff has performed an acceptance review of this TR in accordance with LIC-500, Revision 5, “NRR Office Instruction for Topical Report Process." We have found that the material presented will be sufficient to begin our comprehensive review. As indicated in the NRC acceptance letter dated May 5, 2014, “Westinghouse Performance Analysis and Design Model (PAD5),” the NRC staff is issuing an initial request for additional information listed below. (Reference 4)

1. One of the purposes of this topical report is to address NRC concerns associated with fuel Thermal Conductivity Degradation (TCD) with burnup as documented in NRC Information Notice 2009-23 (Reference 2). The PAD5 fuel performance models in WCAP-17642-P, Revision 0, and WCAP-17642-NP, Revision 0, contain a fuel thermal conductivity model that explicitly accounts for burnup effects.

Section 6.1.2 of the TR describes the update of fuel thermal conductivity model to incorporate thermal conductivity degradation with burnup. The burnup dependent term in Equation 6-4 for fuel thermal conductivity is modeled after the **[**

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Appendix A of the TR describes how the fuel performance models of the TR are independently validated against measured data. The thermal database used to calibrate PAD5 fuel centerline temperature has been expanded from that used in PAD4.0 to include high burnup rods **[**

] It is not explicitly clear to the NRC staff whether Westinghouse has used different high burnup irradiated test rods **[** **]** for the calibration and validation of the thermal conductivity correlation.

Please provide detailed description of how and which set of database **[**

] were used in the formulation of the TCD model, and which other sets of the database were used for the calibration and validation of the TCD model.

2. Section 8.2 of the WCAP-17642-P, Revision 0, and WCAP-17642-NP, Revision 0, describes how the streamline process for fuel Performance Model and Methodology Improvements (MMIP) which is termed as an alternative to Westinghouse Fuel Criteria Evaluation Process may be implemented. The applicability criteria for the MMIP process is stated to be applied to **[**

] of the TR. Also, the applicant has requested that the streamlined MMIP be applicable to **[**

] Section 7.4 lists all major fuel rod design criteria such as clad stress, clad strain, rod internal pressure, clad fatigue, clad oxidation, clad hydrogen pickup, fuel rod axial growth, clad flattening, fuel pellet overheating, and Pellet-Clad Interaction. After a preliminary review of the MMIP, the NRC staff has the following observations and concerns:

- Section 2.3 lists several fuel and cladding material design and safety analyses parameters and their ranges of applicability that will be subject to detailed review. Therefore the applicability of MMIP process on the listed fuel and clad material properties and in reactor performance models would be subject to the final approved ranges of applicability.
- Applicability of MMIP to models and methods listed in Section 7.4 and their safety margins will similarly depend on the outcome of detailed review of the TR including RAIs and confirmatory calculations.

- NRC staff understands the value of the MMIP to expedite the response to a potential safety significant issue; however the staff believes that the process should be developed and approved generically.
- The NRC staff would like the applicant to include the MMIP process in a separate application rather than part of the submitted topical report.
- Westinghouse has asked for a **[**

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This aspect of the application is a major change proposed in the fuel and cladding performance methodology area. Therefore, the NRC staff would like Westinghouse to further explain in detail how the MMIP Process, will be implemented within the regulatory and technical requirements. Also, please specify in detail which of the fuel parameters and operational safety margins are intended to be affected by the MMIP.

REFERENCES

1. Letter LTR-NRC-12-72 from Westinghouse Electric Company to USNRC, Submittal of WCAP-17642-P, Revision 0, "Westinghouse Performance Analysis and Design Model (PAD5)," Enclosure: WCAP-17642-P, Westinghouse, October 29, 2013.

2. NRC Information Notice 2009-23, "Nuclear Fuel Thermal Conductivity Degradation," US NRC, October 8, 2009.

3. **[**

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4. Letter from Anthony J. Mendiola (U.S., NRC) to James A. Gresham (Westinghouse), "Acceptance for Review of WEC Topical Report WCAP-17642-P, Revision 0, Westinghouse Performance Analysis and Design Model (PAD5)," U.S. NRC, May 5, 2014.