NuScaleTRRaisPEm Resource

From:	Chowdhury, Prosanta
Sent:	Saturday, March 31, 2018 3:04 PM
To:	Request for Additional Information
Cc:	Lee, Samuel; Cranston, Gregory; Karas, Rebecca; Skarda, Raymond; Bavol, Bruce; NuScaleTRRaisPEm Resource
Subject:	Request for Additional Information Letter No. 9439 (eRAI No. 9439) Topical Report, Thermal Hydraulic Stability, 15.09, SRSB
Attachments:	Request for Additional Information No. 9439 (eRAI No. 9439).pdf

Attached please find NRC staff's request for additional information (RAI) concerning review of the NuScale Topical Report.

Please submit your technically correct and complete response within 60 days of the date of this RAI to the NRC Document Control Desk.

If you have any questions, please contact me.

Thank you.

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Request for Additional Information No. 9439 (eRAI No. 9439)

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QUESTIONS

15.09-6

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Appendix A, General Design Criterion (GDC), "Reactor design," requires that the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits (SAFDLs) are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences (AOOs). Title 10 of CFR, Part 50, Appendix A, GDC 12, "Suppression of reactor power oscillations," requires that the reactor core and associated coolant, control, and protection systems shall be designed to assure that power oscillations which can result in conditions exceeding SAFDLs are not possible or can be reliably and readily detected and suppressed.

Standard Review Plan (SRP) Section 15.0.2, "Review of Accident and Transient Analysis Methods," states that the reviewers should confirm that sources of code uncertainty have been addressed, including uncertainties in plant model input parameters for plant operating conditions." SRP 15.0.2 refers to Regulatory Guide 1.203, "Transient and Accident Analysis Methods," which indicates that model and correlation information including original source, supporting database, accuracy and applicability should be documented as part of a models and document evaluation report. SRP 15.0.2 also states that the chosen mathematical models and numerical solution of those models must be able to predict important physical phenomena reasonably well from both qualitative and quantitative points of view.

The staff reviewed the response to the original RAI, RAI 8802, and found that the response was insufficient for the staff to reach a conclusion regarding the adequacy of the stability analysis methodology. The following supplemental information is therefore requested in order to make an affirmative finding associated with the above regulatory requirement important to safety:

1) Explain the methodology by which SIMULATE5 results are used to provide reactivity parameters to determine the kinetics parameters used in PIM. This explanation should include:
    - a description of the SIMULATE5 cases that are run,
    - a listing of the SIMULATE5 outputs that are considered (e.g., multiplication factor, delayed neutron fraction, moderator densitymoderator density coefficient, etc.), and
    - a description of any response surface generated from the SIMULATE5 results.

2) Provide the SIMULATE5 results used to determine the default reactivity coefficient fits and kinetics parameters used in PIM.

3) Using the current results, coefficients, response surface and kinetics parameters (as applicable) as an illustrative example, demonstrate how off-rated conditions are accounted for in the modeling of reactivity feedback in PIM.

The original RAI response appears to disagree with the provisions of the TR (NuScale Topical Report TR-0516-49417, "Evaluation Methodology for Stability Analysis of the NuScale Power Module") in Section 5.6.1 and Section 10.4 of the TR with respect to the source of the nuclear data and evaluating cycle-specific reactivity parameters, respectively. The TR states in Section 5.6.1:

> "These reactivity components can be obtained by fitting CASMO5 lattice code calculations..."

Furthermore, Section 10.4 of the stability TR states:

> "In order to utilize the methodology described in this report, the applicability of the regional exclusion stability protection solution by satisfying the condition that the conservative maximum (positive) MTC is within the value used for the generic analysis and the riser subcooling is within the technical specification value must be confirmed on a cycle-specific basis."

However, the original RAI response states:

> "The neutron kinetics parameters in PIM were prepared by processing SIMULATE5 analyses of a representative NuScale reactor core (RXC) on a generic basis; there is no intention of representing cycle-specific data."

4) Provide clarification and correction of inconsistent language in the stability TR with respect to nuclear data sources and evaluation of cycle-specific reactivity parameters as indicated below:
    - Revise Section 5.6.1 of the TR to clarify that the coefficients are derived from SIMULATE5 analyses of a representative NuScale reactor core on a generic basis.
    - Provide the moderator density reactivity coefficient multiplier used in the generic analysis. Does the multiplier ensure that the generic analysis is conservatively bounding?
    - Reconcile the original RAI response with Section 10.4 by clarifying the following points and update the TR language accordingly:
        - Explicitly confirm that the methodology requires kinetic parameters (e.g., MTC) to be evaluated on a cycle-specific basis and compared to the generic stability analysis value to ensure the applicability of the TR to the cycle-specific core design.
        - Is approval sought to allow a licensee to re-perform the PIM stability analyses on a cycle-specific basis if the MTC is outside of the bounds generically analyzed in the current TR? If such an approval is sought, confirm that the methodology described in Part 1 of this supplemental RAI response is what would be followed on a cycle-specific basis.