NuScaleTRRaisPEm Resource

From:	Chowdhury, Prosanta
Sent:	Monday, March 19, 2018 9:27 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. 9440 (eRAI No. 9440) Topical Report Thermal Hydraulic Stability, 15.09, SRSB
Attachments:	Request for Additional Information No. 9440 (eRAI No. 9440).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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Division of New Reactor Licensing
Office of New Reactors
U.S. Nuclear Regulatory Commission
301-415-164

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Request for Additional Information No. 9440 (eRAI No. 9440)
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Application Title: NuScale Topical Report
Operating Company: NuScale
Docket No. PROJ0769
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Application Section:

QUESTIONS

15.09-1

Title 10 of the Code of Federal Regulations (CFR), Part 50, Appendix A, General Design Criterion (GDC) 10 – Reactor Design, states 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 the CFR, Appendix A, GDC 12 states that the reactor core and associated coolant, control, and protection system 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. The SRP 15.0.2 acceptance criteria with respect to evaluation models states that the chosen mathematical models and the numerical solution of those models must be able to predict the important physical phenomena reasonably well from both qualitative and quantitative points of view.

The staff reviewed the response to the original RAI, RAI 8808 Question 29740, and found that the response was insufficient for the staff to reach a conclusion regarding the adequacy of the stability analysis methodology. Specifically, the applicant responded that a quasi-steady state model is sufficient to model fuel heat conduction, presumably for performing stability analysis with PIM. The applicant's response also states that consideration for the conduction dynamics in the licensing methodology is used but not required for stability calculation accuracy.

In order to make an affirmative finding associated with the above regulatory requirement important to safety, NRC staff requests NuScale to provide the following supplemental information:

1) If the intent of the RAI 8808 response is to apply a quasi-steady heat conduction model in place of the conduction dynamics model currently described in section 5.6.4.1 of the NuScale Topical Report (TR) TR-0516-49417, "Evaluation Methodology for Stability Analysis of the NuScale Power Module" then:

    - Revise the stability TR accordingly, and
    - Justify the quasi-steady approximation using quantitative arguments

2) If the intent of the RAI response is to apply PIM's dynamic conduction model as currently discussed in section 5.6.4.1 of the stability TR then:

- Provide the technical basis for the fuel thermal time constant correlation. It is acceptable to respond by providing a technical reference, such as a peer reviewed scientific paper.
- Confirm that the correlation is not fuel-design specific.
- Clarify which terms in Equation 5-92 are exposure dependent.
- Because density, heat capacity, conductivity, and diameter change with exposure, explain what values are used if the exposure dependence is ignored.
- Confirm that the core average exposure is used to evaluate exposure dependent quantities.

15.09-2

Title 10 of the Code of Federal Regulations (CFR), Part 50, Appendix A, General Design Criterion (GDC) 10 – Reactor Design, states 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). GDC 12 – Suppression of reactor power oscillations, states that the reactor core and associated coolant, control, and protection system shall be designed to assure that power oscillation which can result in conditions exceeding SAFDLs are not possible or can be reliably and readily detected and suppressed. The Standard Review Plan 15.0.2 acceptance criteria with respect to evaluation models states that the chosen mathematical models and the numerical solution of those models must be able to predict the important physical phenomena reasonably well from both qualitative and quantitative points of view.

The staff reviewed the response to the original RAI, RAI 8808 Question 29741, and found that the response was insufficient for the staff to reach a conclusion regarding the adequacy of the stability analysis methodology in NuScale Topical Report (TR) TR-0516-49417, "Evaluation Methodology for Stability Analysis of the NuScale Power Module".

In order to make an affirmative finding with regard to the above regulatory requirement important to safety, the NRC staff requests the following supplemental information:

1. Provide the temperature weighting factor (ω) from Equation 5-102 of the stability TR.
2. Explain why the value of the temperature weighting factor is appropriate.
3. Explain why the burnup-dependent factor (a) from Equation 5-109 of the stability TR is appropriate for stability analysis, generically.

   It is acceptable to respond by either:
   - Providing a technical reference that forms the basis for the burnup-dependent factor, such as a peer-reviewed scientific paper, or such as a peer-reviewed scientific paper, or
   - Providing validation of the model against applicable experimental data and demonstrating that the model provides reasonable agreement with the data.