

September 17, 2018

Docket: PROJ0769

U.S. Nuclear Regulatory Commission  
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**SUBJECT:** NuScale Power, LLC Supplemental Response to NRC Request for Additional Information No. 8867 (eRAI No. 8867) on the NuScale Topical Report, "Evaluation Methodology for Stability Analysis of the NuScale Power Module," TR-0516-49417, Revision 0

**REFERENCES:** 1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 8867 (eRAI No. 8867)," dated June 23, 2017  
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 8867 (eRAI No.8867)," dated August 01, 2017  
3. NuScale Topical Report, "Evaluation Methodology for Stability Analysis of the NuScale Power Module," TR-0516-49417, Revision 0, dated July 2016

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) supplemental response to the referenced NRC Request for Additional Information (RAI).

The Enclosure to this letter contains NuScale's supplemental response to the following RAI Question from NRC eRAI No. 8867:

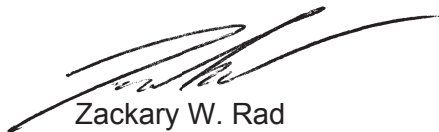
- 01-10

This supplemental response is associated with a July 11, 2018 teleconference.

This letter and the enclosed response make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Paul Infanger at 541-452-7351 or at [pinfanger@nuscalepower.com](mailto:pinfanger@nuscalepower.com).

Sincerely,



Zackary W. Rad  
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NuScale Power, LLC

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Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8867

**Enclosure 1:**

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8867

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## **Response to Request for Additional Information Docket: PROJ0769**

**eRAI No.:** 8867

**Date of RAI Issue:** 06/23/2017

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**NRC Question No.:** 01-10

In accordance with 10 CFR 50 Appendix A GDC 10, "Reactor design," the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences. The SRP 15.0.2 acceptance criteria with respect to evaluation models specifies 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.

Section 8.0, "Stability Demonstration within Allowable Conditions and Settings," of the topical report, TR-0516-49417-P, states that the stability at BOC and EOC conditions are verified, but it is not clear from the TR what is specifically verified, or if this verification is cycle-specific.

In order to make an affirmative finding associated with the above regulatory requirement important to safety, NRC staff requests NuScale to describe how stability is verified at BOC and EOC conditions, and confirm if verifications are performed on a cycle-specific basis.

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### **NuScale Response:**

This response supplements the original RAI 01-10 (eRAI 8867) response which was submitted to the NRC on August 1, 2017 (ML17213B040). NuScale has modified Topical Report TR-0516-49417, Evaluation Methodology for Stability Analysis of the NuScale Power Module, Section 10.4 to clarify that the nuclear parameters used in the stability analysis must be the limiting values over the entire cycle. This clarification accounts for the possibility of the most limiting point in the cycle occurring between the beginning of cycle and the end of cycle.



**Impact on Topical Report:**

Topical Report TR-0516-49417, Evaluation Methodology for Stability Analysis of the NuScale Power Module, has been revised as described in the response above and as shown in the markup provided in this response.

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.

#### 10.4.1 Stability Analysis Application Methodology Conditions

The following conditions and limitations must be met for a stability analysis using the methodology in this report:

- Fuel designs that are different than the reference design used in this topical report must be hydraulically compatible with the reference fuel design.
- The assumed decay heat must be a conservative value for the conditions at which stability is being calculated as described in Section 10.4.
- A default boiling coefficient value of  $\gamma = 5000 \text{ kg/m}^3\text{-s}$  must be used. Any modification to the boiling model must preserve the degree of the intended conservatism which reduces subcooled boiling in a single-channel core application.
- A core average pellet-clad gap conductance must be determined in accordance with the methodology defined in Section 5.6.4.3 of this topical report. Different gap conductance values are used if obtained from a qualified thermo-mechanical code calculation.
- Nuclear parameters used in the stability analysis must be the limiting values over the entire cycle, whether this is beginning of cycle (BOC), end of cycle (EOC), or any time during the cycle.

### 11.0 Summary and Conclusions

A methodology for the evaluation of the stability of the NPM has been presented. The stability phenomena are considered from the fundamental level and screened for applicability to NPM. The ranking of these phenomena is the guide for the computational models developed for the stability analysis and is assessed versus NIST-1 data and supported by first principles analysis of trends.

No assumptions are made with regard to stability trends being in any way similar to past experience, particularly with BWRs. Important differences between BWR and the NPM stability trends are identified, namely: ~~ff~~

- Negative moderator reactivity feedback is stabilizing in the case of the NPM, unlike BWRs. Note that a small positive moderator reactivity coefficient, which is destabilizing, is possible in principle for low exposure high boron and low-moderator temperature. ~~ff~~<sup>2(a),(e),ECI</sup>