RAIO-0918-61821

September 17, 2018

Docket: PROJ0769

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Supplemental Response to NRC Request for Additional Information No. 8944 (eRAI No. 8944) 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. 8944 (eRAI No. 8944)," dated July 30, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 8944 (eRAI No.8944)," dated September 28, 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. 8944:

- 01-25

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.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

Distribution: Gregory Cranston, NRC, OWFN-8G9A
Samuel Lee, NRC, OWFN-8G9A
Bruce Bavol, NRC, OWFN-8G9A

Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8944

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8944

Response to Request for Additional Information
Docket: PROJ0769

eRAI No.: 8944
Date of RAI Issue: 07/30/2017

NRC Question No.: 01-25

Title 10 of the Code of the 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 Code of Federal Regulations (CFR), Part 50 Appendix A, General Design Criteria (GDC) 12-Suppression of reactor power oscillations requires that oscillations be either not possible or reliably detected and suppressed. The Standard Review Plan (SRP) 15.0.2 and Regulatory Guide (RG 1.203) indicate that closure relationships and the information required for their use should be evaluated to ensure they adequately cover the range of conditions and accident scenarios. This is especially true of empirical correlations that are derived directly from experimental data without recourse to any physical modeling.

The evaporation and condensation correlations in Section 5.5.6.5, "Evaporation and Condensation," of the topical report, TR-0516- 49417-P, include an empirical factor, gamma, which is defined as a user-provided boiling coefficient. A default value for gamma is given in Section 5.5.6.5, however, it is not clear what value of gamma is used in the stability analysis.

In order to make an affirmative finding, NRC staff requests NuScale:

1) Provide the value and/or range of values for gamma that are used for stability analyses
2) Provide the basis for selecting values of gamma.

NuScale Response:

This response supplements the original RAI 01-25 (eRAI 8944) response which was submitted to the NRC on September 28, 2017 (ML17271A237). NuScale has modified Topical Report TR-0516-49417, Evaluation Methodology for Stability Analysis of the NuScale Power Module, Section 10.4 to state that stability analyses shall be performed using the default value of the boiling coefficient, which is 5000 kg/m^3-s, or otherwise preserve the degree of the intended conservatism.

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 γ = 5000 kg/m^3-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: {{

- 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. }}2(a),(c),ECI