



January 19, 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 Response to NRC Request for Additional Information No. 9089 (eRAI No. 9089) 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. 9089 (eRAI No. 9089)," dated September 27, 2017
2. 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) response to the referenced NRC Request for Additional Information (RAI).

The Enclosures to this letter contain NuScale's response to the following RAI Question from NRC eRAI No. 9089:

- 01-49

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 9089 (eRAI No. 9089). NuScale requests that the proprietary version be withheld from public disclosure in accordance with the requirements of 10 CFR § 2.390. The enclosed affidavit (Enclosure 3) supports this request. Enclosure 2 is the nonproprietary version of the NuScale response.

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

If you have any questions on this response, please contact Darrell Gardner at 980-349-4829 or at dgardner@nuscalepower.com.

Sincerely,

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

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

Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9089, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9089, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0118-58264

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9089, proprietary

Enclosure 2:

NuScale Response to NRC Request for Additional Information eRAI No. 9089, nonproprietary

Response to Request for Additional Information Docket: PROJ0769

eRAI No.: 9089

Date of RAI Issue: 09/27/2017

NRC Question No.: 01-49

Title 10, the code of federal regulations (CFR), Part 50, Appendix A, General Design Criterion (GDC) 12- Suppression of reactor power oscillations, requires that oscillations be either not possible or reliably detected and suppressed. The Design-Specific Review Standard (DSRS), 15.9.A, "Design-Specific Review Standard for NuScale SMR Design, Thermal Hydraulic Stability Review Responsibilities," indicates that the applicant's analyses should correctly and accurately identify all factors that could potentially cause instabilities and their consequences. The analyses should also demonstrate that design features that are implemented prevent unacceptable consequences to the fuel.

In section 8.2.7, "Effect of Oscillating Feedwater," of topical report (TR), TR-0516-49417-P presents PIM stability results for feedwater flow perturbations at 20% nominal power level (32 MW). Corrections to this section were provided as part of Enclosure 3 of the TR Supplement, ML16338A014. The simulation results presented in section 8.2.7 were presented to demonstrate system response to feedwater flow forced oscillations at approximately resonance frequency. However, it appears that the period applied to the feedwater flow was at the transit time, 122 seconds, which is not the period corresponding to the damped natural frequency. Based on review of the TR and the TR supplement, the natural period appears to be roughly half of the transit time based on the PIM calculations provided in the Stability TR. The staff considered a positive temperature perturbation in a localized pulse to the RCS flow, which would have a positive effect on the flow while the temperature perturbation traverses the reactor core and riser, but would have a negative effect on the flow while the temperature perturbation traverses the steam generator tube annulus and downcomer. This appears to be consistent with section 8.1.5 of the TR which indicates that the damped unforced period of the system, at a power of $\{ \{ \} \}^{2(a),(c)}$. Accordingly, it would make sense for the natural period to correspond with half of the transit time. To assess the susceptibility of the primary system to resonant effects, the calculations should be performed with a feedwater flow perturbation applied at approximately the resonant frequency, in addition to a small band around the natural frequency of the primary side.

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

- 1) Provide PIM results that are similar to those presented in Section 8.2.7 of the TR but at the four different feedwater flow oscillation periods indicated below.

$\{\{$ $\}\}^{2(a),(c)}$
 $\{\{$ $\}\}^{2(a),(c)}$
 $\{\{$ $\}\}^{2(a),(c)}$
 $\{\{$ $\}\}^{2(a),(c)}$

- 2) Analyze the results and describe the impact of resonant excitation on primary side oscillations and oscillation growth.
- 3) As applicable, on the basis of the analysis, disposition the topic of resonant interaction for the NuScale power module.

NuScale Response:

Item 1:

PIM results for the primary flow oscillation magnitude in response to feedwater flow (FW) oscillations at different frequencies are presented in Figure 1. The results represent continuous variation of the FW flow oscillation frequency (reciprocal of oscillation period), with a wide range that includes the specific periods requested. For the sake of completeness, the calculations were performed for BOC, MOC and EOC conditions so that the impact of different reactivity feedback coefficients is resolved.

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$\}\}^{2(a),(c)}$

Figure 1 Primary Flow Oscillation Amplitudes for BOC, MOC, and EOC as a Function of Feedwater Flow Perturbation Frequency

Item 2:

The results shown in Figure 1 depict flat resonances (large width) and low amplitude. The amplitude of the primary flow resonances is either lower than or slightly higher than the DC response (zero frequency limit).

To quantify the primary flow oscillation resonant response, consider as an example the FW oscillation case for BOC at a period of $\{\{ \quad \} \}^{2(a),(c)}$. The FW flow is $\{\{ \quad \} \}^{2(a),(c)}$ with an imposed oscillation magnitude of $\{\{ \quad \} \}^{2(a),(c)}$ (peak-to-peak). The calculated primary flow rate is 330.4 kg/s with an oscillatory component of $\{\{ \quad \} \}^{2(a),(c)}$ (peak-to-peak). In relative terms, the primary flow response is $\{\{ \quad \} \}^{2(a),(c)}$ of the FW flow forcing excitation.

Item 3:

It can be concluded from the results that an externally imposed FW flow oscillation, even at a resonant frequency, produces a mild response in the primary flow.

Impact on Topical Report:

There are no impacts to the Topical Report TR-0516-49417, Evaluation Methodology for Stability Analysis of the NuScale Power Module, as a result of this response.



RAIO-0118-58263

Enclosure 3:

Affidavit of Zackary W. Rad, AF-0118-58264

NuScale Power, LLC
AFFIDAVIT of Zackary W. Rad

I, Zackary W. Rad, state as follows:

1. I am the Director, Regulatory Affairs of NuScale Power, LLC (NuScale), and as such, I have been specifically delegated the function of reviewing the information described in this Affidavit that NuScale seeks to have withheld from public disclosure, and am authorized to apply for its withholding on behalf of NuScale.
2. I am knowledgeable of the criteria and procedures used by NuScale in designating information as a trade secret, privileged, or as confidential commercial or financial information. This request to withhold information from public disclosure is driven by one or more of the following:
 - a. The information requested to be withheld reveals distinguishing aspects of a process (or component, structure, tool, method, etc.) whose use by NuScale competitors, without a license from NuScale, would constitute a competitive economic disadvantage to NuScale.
 - b. The information requested to be withheld consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), and the application of the data secures a competitive economic advantage, as described more fully in paragraph 3 of this Affidavit.
 - c. Use by a competitor of the information requested to be withheld would reduce the competitor's expenditure of resources, or improve its competitive position, in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.
 - d. The information requested to be withheld reveals cost or price information, production capabilities, budget levels, or commercial strategies of NuScale.
 - e. The information requested to be withheld consists of patentable ideas.
3. Public disclosure of the information sought to be withheld is likely to cause substantial harm to NuScale's competitive position and foreclose or reduce the availability of profit-making opportunities. The accompanying Request for Additional Information response reveals distinguishing aspects about the methods by which NuScale develops its stability analysis of the NuScale power module.

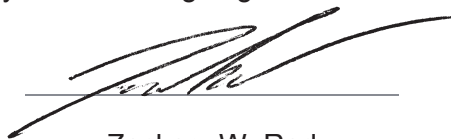
NuScale has performed significant research and evaluation to develop a basis for this methods and has invested significant resources, including the expenditure of a considerable sum of money.

The precise financial value of the information is difficult to quantify, but it is a key element of the design basis for a NuScale plant and, therefore, has substantial value to NuScale.

If the information were disclosed to the public, NuScale's competitors would have access to the information without purchasing the right to use it or having been required to undertake a similar expenditure of resources. Such disclosure would constitute a misappropriation of NuScale's intellectual property, and would deprive NuScale of the opportunity to exercise its competitive advantage to seek an adequate return on its investment.

4. The information sought to be withheld is in the enclosed response to NRC Request for Additional Information No. 9089, eRAI No. 9089. The enclosure contains the designation "Proprietary" at the top of each page containing proprietary information. The information considered by NuScale to be proprietary is identified within double braces, "{{ }}" in the document.
5. The basis for proposing that the information be withheld is that NuScale treats the information as a trade secret, privileged, or as confidential commercial or financial information. NuScale relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC § 552(b)(4), as well as exemptions applicable to the NRC under 10 CFR §§ 2.390(a)(4) and 9.17(a)(4).
6. Pursuant to the provisions set forth in 10 CFR § 2.390(b)(4), the following is provided for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld:
 - a. The information sought to be withheld is owned and has been held in confidence by NuScale.
 - b. The information is of a sort customarily held in confidence by NuScale and, to the best of my knowledge and belief, consistently has been held in confidence by NuScale. The procedure for approval of external release of such information typically requires review by the staff manager, project manager, chief technology officer or other equivalent authority, or the manager of the cognizant marketing function (or his delegate), for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside NuScale are limited to regulatory bodies, customers and potential customers and their agents, suppliers, licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or contractual agreements to maintain confidentiality.
 - c. The information is being transmitted to and received by the NRC in confidence.
 - d. No public disclosure of the information has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or contractual agreements that provide for maintenance of the information in confidence.
 - e. Public disclosure of the information is likely to cause substantial harm to the competitive position of NuScale, taking into account the value of the information to NuScale, the amount of effort and money expended by NuScale in developing the information, and the difficulty others would have in acquiring or duplicating the information. The information sought to be withheld is part of NuScale's technology that provides NuScale with a competitive advantage over other firms in the industry. NuScale has invested significant human and financial capital in developing this technology and NuScale believes it would be difficult for others to duplicate the technology without access to the information sought to be withheld.

I declare under penalty of perjury that the foregoing is true and correct. Executed on 1/19/2018.



Zackary W. Rad