



February 19, 2018

Docket: PROJ0769

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

**SUBJECT:** NuScale Power, LLC Response to NRC Request for Additional Information No. 9177 (eRAI No. 9177) 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. 9177 (eRAI No. 9177)," dated December 19, 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. 9177:

- 01-64

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 9177 (eRAI No. 9177). 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](mailto:dgardner@nuscalepower.com).

Sincerely,

A handwritten signature in black ink, appearing to read "Zackary W. Rad".

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. 9177, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9177, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0218-58738



RAIO-0218-58737

**Enclosure 1:**

NuScale Response to NRC Request for Additional Information eRAI No. 9177, proprietary



RAIO-0218-58737

**Enclosure 2:**

NuScale Response to NRC Request for Additional Information eRAI No. 9177, nonproprietary

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## Response to Request for Additional Information Docket: PROJ0769

**eRAI No.:** 9177

**Date of RAI Issue:** 12/19/2017

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### **NRC Question No.:** 01-64

Title 10 of the Code of Federal Regulations (CFR), Part 50, Appendix A, General. Design Criterion (GDC) 10, "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 are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences. 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 (SRP) 15.0.2 acceptance criteria with respect to evaluation models includes the requirement 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 8.2.9, "Stability During Non-Nuclear Heatup (Before Criticality)," of topical report (TR), TR-0516-49417-P, provides an analysis of the startup prior to nuclear heating. In Figure 8-57, the primary is flow perturbed (excited) at regular intervals and is shown at two different primary coolant flow locations in Figure 8-57. Figure 8-58 provides an expanded view of the transient for the time interval 8 hr to 9 hr, where the TR indicates power module is stable. A similar expanded view for the excitation at 6 hours is not provided, so it is not clear from Figure 8-57 if the power module maintains any appreciable stability margin during this interval. A visual examination of the results presented in Figure 8-57 appears to indicate that the decay ratio

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

In order to make an affirmative finding associated with the above regulatory requirement important to safety, NRC staff requests NuScale to provide additional details of the stability margin between 6 and 7 hours. These details should provide quantitative analysis results, including decay ratio value a comparison of the decay ratio value to the decay ratio acceptance criterion to demonstrate the magnitude of the stability margin.

## NuScale Response:

The conditions in the 8-9 hours interval shown in the expanded view of Figure 8-58 in the stability topical report, TR-0516-49417-P, are similar to the conditions two hours earlier (6-7 hours). The main difference between the two periods is that the 8-9 hours period represents the flow following an externally-imposed perturbation of the system while undergoing a slow change that is nearly steady state. By contrast, during the period of 6-7 hours, the net heating, as shown in Figure 8-54 of the TR, is reversing from a declining rate to an increasing rate of heating. The changing rate of heating interferes with the system response to oscillations in the 6-7 hour period making the 8-9 hour period a more reliable measure of the stability.

The imposed perturbation at 6 hours decays rather fast, similar to the perturbation imposed at 8 hours as shown in Figure 8-58 of the TR. The expanded view of the period between 6-7 hours is shown in Figure 1 and is magnified in Figure 2 in the range of 6.4 to 7 hours with the non-oscillatory trend removed to improve the accuracy of calculating decay ratio. It is important to notice that there are two perturbations, the first is user-imposed at 6 hours, and the second is a smaller one at 6.4 hours due to the net heating change. Peaks following the second perturbation are used to estimate the decay ratio and period. The estimated decay ratio is  $\{ \{ \dots \} \}^{2(a),(c)}$ , and the corresponding oscillation period is 0.07 hours.

The decay ratio following the imposed perturbation at 8 hours is calculated similarly from the subsequent peaks excluding the one following the perturbation. Since the ratio of successive peak magnitudes fluctuates, a better estimate is obtained from several cycles. Also, the non-oscillatory trend in flow has been removed to improve the accuracy of calculating the decay ratio. The expanded view in the interval of 8.4 to 9 hours is shown in Figure 3 with the non-oscillatory trend removed in order to improve the accuracy of calculating decay ratio. The estimated decay ratio is  $\{ \{ \dots \} \}^{2(a),(c)}$  and the corresponding oscillation period is 0.07 hours (~250 seconds).

The decay ratio obtained by inspecting the flow responses following perturbations at 6 and 8 hours respectively are found to be approximately the same as expected. Even though the decay ratio is within the stability margin, it is noted that the decay ratio margin does not apply to the startup under non-nuclear heating as no Specified Acceptable Fuel Design Limits (SAFDLs) can be violated.

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}}<sup>2(a),(c)</sup>

Figure 1 PIM calculated core flow in the period of 6-7 hours during non-nuclear heatup

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}}<sup>2(a),(c)</sup>

Figure 2: Adjusted core flow between 6.4 and 7 hours with peaks and valleys labeled



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}}<sup>2(a),(c)</sup>

Figure 3: Adjusted core flow between 8.4 and 9 hours with peaks and valleys labeled

**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-0218-58737

**Enclosure 3:**

Affidavit of Zackary W. Rad, AF-0218-58738

**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.

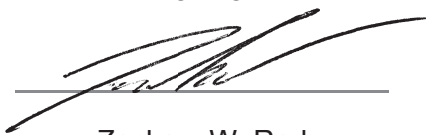
NuScale has performed significant research and evaluation to develop a basis for this methods and has invested significant resources, including the expenditure of a considerable sum of money.

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. 9177, eRAI No. 9177. 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 2/19/2018.

A handwritten signature in black ink, appearing to read 'Zackary W. Rad', is written over a horizontal line.

Zackary W. Rad