

October 11, 2017

Docket: PROJ0769

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

**SUBJECT:** NuScale Power, LLC Response to NRC Request for Additional Information No. 9056 (eRAI No. 9056) 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. 9056 (eRAI No. 9056)," dated August 12, 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 Questions from NRC eRAI No. 9056:

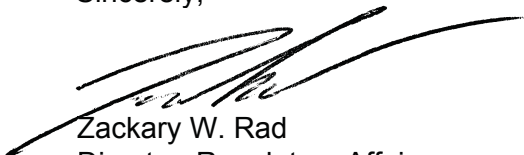
- 01-32
- 01-33

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 9056 (eRAI No. 9056). 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,



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. 9056, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9056, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-1017-56555

**Enclosure 1:**

NuScale Response to NRC Request for Additional Information eRAI No. 9056, proprietary

**Enclosure 2:**

NuScale Response to NRC Request for Additional Information eRAI No. 9056, nonproprietary

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

**eRAI No.:** 9056

**Date of RAI Issue:** 08/12/2017

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### **NRC Question No.: 01-32**

Title 10, of 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.

The supplemental information summary entitled, "The NuScale response to NRC request for supplemental information to TR-0516-49417-P", ADAMS accession number, ML16338A014, provides a discussion of out-of-phase oscillations for multiple steam generator (SG) tubes. On page 7, the supplemental summary indicates that {{

}}<sup>2(a),(c)</sup> Also on page 7 of the supplemental summary, the 2nd paragraph states that "If there were only two tubes oscillating out-of-phase, the double- frequency component of the heat transfer response of the individual tubes would produce a constructive in-phase component that is thought to establish a feedback loop with the primary flow. The staff does not believe that this argument is valid because there are numerous tubes, rather than only two tubes or two groups where each group is made of phase-locked tubes. Because the number of tubes is large, the phase is spread and can be considered random. For random phase, regardless of the waveform of the heat transfer coefficient, the net effect of a large number of tubes is still self-cancelling. A recent article (Reference 4) reported experimental observations of the loss of any particular phase pattern." The experiments described in Reference 4 (Singh et al., Nuclear Science & Engineering, Vol. 184, October 2016) of the supplemental summary are for parallel-multichannel (straight tube) systems in contrast to helical coils.

In order to make an affirmative finding associated NRC staff requests NuScale to provide rationale for applying the Reference 4 (Singh et al.) observations and conclusions for straight tubes to NuScale helical coil steam generator geometry.

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**NuScale Response:**

The 2016 article by Singh et al. was published after the basic work for the stability topical report was completed. NuScale did due diligence by continuing to search for new relevant publications that may reveal additional insights in the topical report. In this particular case, the experimental results presented in the article by Singh et al. strengthen the assertion regarding the behavior of oscillations in many parallel channels as not having coherent in-phase behavior. The point made is of a general qualitative nature and is impacted neither by the particular geometry of the tubes being helical or straight, nor by specific dimensions and operating conditions.

**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.

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

**eRAI No.:** 9056

**Date of RAI Issue:** 08/12/2017

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**NRC Question No.:** 01-33

Title 10, of 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.

The supplemental information summary entitled, "The NuScale response to NRC request for supplemental information to TR-0516-49417-P", ADAMS accession number, ML16338A014, provides a discussion of out-of-phase oscillations. The supplemental summary states, on the last paragraph of page 6, "The following discussion presents and reorganizes material provided in the topical report with additional clarifications based on results of the SG stability test series SIET-TF2. The objective is to strengthen the basis for the conclusion that the dynamic feedback loop between the primary flow and the out-of-phase mode in the SG is broken for all practical considerations. It is not only that finite out-of- phase oscillations are self-cancelling as far as their effect on the primary flow is concerned, but also closure of the feedback loop is missing where a perturbation in the primary flow cannot excite or strengthen an out-of-phase response that may itself be stable or not." There are some merits on the cancelling of out-of-phase oscillation in the secondary tubes. This experimental data does not appear to fully disposition the potential {{

}}<sup>2(a),(c)</sup> While the SIET-TF2 experiments are {{

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

In order to make an affirmative finding NRC staff requests NuScale to provide a discussion that explains why primary-to-secondary side feedback does not reinforce secondary side oscillations.

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**NuScale Response:**

To engage a feedback loop in a dynamical system the loop must be closed. In the case of the interaction between the primary and secondary sides of the steam generator, both the secondary-to-primary and primary-to-secondary parts must be present. One broken link breaks the feedback loop. The question acknowledges that the secondary-to-primary action is absent due to the self-cancelling of the oscillations in the plurality of the tubes. This fact is sufficient to break the feedback loop.

However, it has been also asserted that the primary-to-secondary action is not present. Any primary side flow change cannot be considered to act on the flow inside a steam generator tube by increasing it while simultaneously acting on another tube to decrease its flow. NuScale confirms that this assertion is based on first principles and does not require SIET or any other experimental data to confirm.

It is concluded that both the primary-to-secondary and secondary-to-primary links are absent where it is sufficient for the absence of only one of them to break the feedback loop.

**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.



**Enclosure 3:**

Affidavit of Zackary W. Rad, AF-1017-56555

**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 methodology 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 methodology 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. 9056, eRAI No. 9056. 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 10/11/2017.



Zackary W. Rad