

September 28, 2017

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. 8937 (eRAI No. 8937) 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. 8937 (eRAI No. 8937)," dated July 30, 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. 8937:

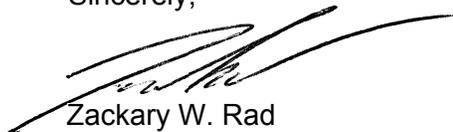
- 01-24

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 8937 (eRAI No. 8937). 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  
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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 8937,  
proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 8937,  
nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0917-56282



**Enclosure 1:**

NuScale Response to NRC Request for Additional Information eRAI No. 8937, proprietary



**Enclosure 2:**

NuScale Response to NRC Request for Additional Information eRAI No. 8937, nonproprietary

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

**eRAI No.:** 8937

**Date of RAI Issue:** 07/30/2017

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**NRC Question No.:** 01-24

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.

Equations for computing a decay ratio, DR, are given in Section 6.2, "Testing Techniques and Results," and Section 7.1.1, "Decay Ratio Estimate and Proof of Unconditional Stability of the Riser Mode," of the topical report, TR-0516-49417-P. However, the approach for calculating decay ratios from PIM results does not appear to be described in Section 5.8, "Numerical Solution," and the method used to compute the decay ratios from results shown in Section 8 of the TR is not clear.

In order to make an affirmative finding, NRC staff requests NuScale describe the method for deriving the decay ratio from PIM output. This description should address considerations of early versus late transient response in the time-domain.

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**NuScale Response:**

Developing an algorithm to automate the determination of decay ratio from PIM is challenging. The reason for this being a challenge is due to the fact that the NuScale NPM is highly stable for a wide range of operational conditions. Another complication is presented by the existence of two main modes (the riser density wave and the steam generator inverted density wave).

In the course of PIM code development, post-processing of the code results applied various techniques from BWR experience and efforts were made to develop new methods for quantifying the system stability. A brief account is presented here.

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## Direct Signal Analysis

In this method, the primary flow signal as function of time is examined and an intermediate time period is identified. Early time is excluded due to interference with initial perturbation, and late time is excluded as the signal diminishes. The intermediate time period exhibits decaying oscillatory behavior which allows for determining a decay ratio sequence calculated from a train of peaks and valleys. In many cases, the decay ratio thus calculated is not monotonic but oscillate between low and high values where the high values may exceed unity. {{

}}<sup>2(a),(c)</sup> As a conclusion, direct signal analysis could not be automated reliably, and decay ratios could be extracted only by visually inspecting individual signals and confirm the decaying of fluctuations.

## Autocorrelation Function Analysis

An automated algorithm installed in PIM is optionally called at the end of the run and is used to fold the flow signal to generate the autocorrelation function. The flow signal is processed prior to calculating the autocorrelation function to filter out high frequency component. The autocorrelation function is then used to calculate decay ratio from successive peaks. {{

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

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



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

In summary, the decay ratio determination of PIM relies on visual inspection of the calculated flow signal instead of automated techniques. The signals are examined to determine a usable segment without the interference of the initial perturbation, and sufficiently long time is allowed for highly stable modes to decay. The decay ratio is calculated from the ratio of two successive peaks. In the case of alternating peaks due to having two surviving modes, the trend of peak amplitude is examined to verify that a high degree of stability existed. {{

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

**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-0917-56281

**Enclosure 3:**

Affidavit of Zackary W. Rad, AF-0917-56282

**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. 8937, eRAI No. 8937. 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 9/27/2017.



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Zackary W. Rad