



February 12, 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. 9175 (eRAI No. 9175) 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. 9175 (eRAI No. 9175)," dated December 18, 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. 9175:

- 01-63

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 9175 (eRAI No. 9175). 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,

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
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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9175, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9175, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0218-58622



RAIO-0218-58621

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9175, proprietary



Enclosure 2:

NuScale Response to NRC Request for Additional Information eRAI No. 9175, nonproprietary

Response to Request for Additional Information Docket: PROJ0769

eRAI No.: 9175

Date of RAI Issue: 12/18/2017

NRC Question No.: 01-63

Title 10 of the Code of 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). 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.

Section 8.1.5, "Stability at {{ }}^{2(a),(c)} MW," of topical report (TR), TR-0516-49417-P briefly discusses the effect of feedwater temperature at {{

}}^{2(a),(c)} However, Section 8.1.6, "Stability at {{ }}^{2(a),(c)} MW," of the TR describes results from a low power case ({{ }}^{2(a),(c)} MW) but says that the results are consistent with the {{ }}^{2(a),(c)} MW case results. This appears to be a contradiction as low power and low feedwater temperature (both present in the {{ }}^{2(a),(c)} MW case) should indicate higher decay ratio compared to the {{ }}^{2(a),(c)} MW case. Figures 8-8 and 8-12 do not appear to be consistent.

In order to make an affirmative finding associated with the above regulatory requirement important to safety, NRC staff requests NuScale to:

1. Clarify the stability trends in terms of power and temperature in light of the calculation results.
2. Provide a comparison of the 40 MW results in section 8.1.5 and the 1.6 MW results in section 8.1.6. Describe those characteristics that are consistent between the 40 MW and 1.6 MW sections and those characteristics that are different. Characteristics that should be compared include decay ratios and periods shown in Figures 8-8 and 8- 12, and numerical artifacts (as indicated in section 8.1.6 of the TR).

NuScale Response:**Item 1:**

The stability trend with reactor power can be observed from the results presented in Section 8.1 of TR-0516-49417-P. Specifically, that the higher the power the more stable the system response. The {{ }}^{2(a),(c)} case presented in Section 8.1 of the TR illustrates the impact of feedwater temperature to reactor coolant system (RCS) stability. At {{ }}^{2(a),(c)}, the NPM can be operated with or without the turbine. Feedwater heating is possible when the turbine is engaged, hence two possible feedwater temperatures are used in the calculation: {{ }}^{2(a),(c)}. As stated in the TR (last paragraph of Section 8.1.5), {{ }}^{2(a),(c)} This sensitivity calculation demonstrates the minor impact of feedwater temperature on RCS stability.

Item 2:

During the code development process, numerical artifacts were investigated. For example, the flow oscillations indicative of the state of stability could be discerned only after the initial perturbations decayed, and due to the very stable system particularly at high power, these oscillations could be resolved in the fifth or even sixth significant digit. Round off errors could be a numerical artifact affecting the solution damping; the possibility of which was eliminated with double precision computing in the final PIM version.

Another test to confirm the absence of numerical distortion (artifact) was also provided where instead of a step perturbation (containing all frequencies) a single cycle sine wave of the particular frequency that survived in the step perturbation calculation was imposed; and the results were not changed. The primary flows following step and sine perturbations are shown in the TR Figures 8-7 and 8-8, respectively.

The results of the {{ }}^{2(a),(c)} cases were both examined for the long term response to assure that the surviving oscillation mode (period) is the least stable mode and is not an artifact of the selective initial perturbation. The TR presents the two cases at {{ }}^{2(a),(c)}, which yield consistent results, where a single cycle sine wave initial perturbation and step perturbation produced the same long term surviving mode for their respective state points.

The stability trend from {{ }}^{2(a),(c)} remained consistent with the plurality of the calculations where lower power is associated with higher decay ratio and longer period.



Differences between the two results were discussed in the TR Section 8.1.6. Specifically, for the {{ }}^{2(a),(c)} case, the slightly positive moderator temperature coefficient (due to lower primary temperature) which contributes to a destabilizing effect and the chemical and volume control system (CVCS) flow which bypasses the steam generators making up a significant portion of the primary flow. These two differences between the {{ }}^{2(a),(c)} cases do not alter the trend of decay ratio with power calculated over the entire range of operating power. TR Figures 8-8 and 8-12 are consistent in the sense that the former shows more stable behavior than the latter as expected.

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-0218-58621

Enclosure 3:

Affidavit of Zackary W. Rad, AF-0218-58622

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.

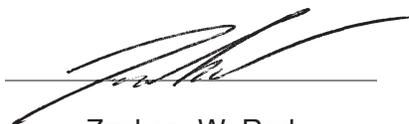
NuScale has performed significant research and evaluation to develop a basis for these methods and has invested significant resources, including the expenditure of a considerable sum of money.

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 RAI No. 9175, eRAI No. 9175. 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 2/12/2018.



Zackary W. Rad