



March 21, 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. 9106 (eRAI No. 9106) 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. 9106 (eRAI No. 9106)," dated November 15, 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. 9106:

- 01-57
- 01-58

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 9106 (eRAI No. 9106). 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: Samuel Lee, NRC, OWFN-8G9A
Prosanta Chowdhury NRC, OWFN-8G9A
Bruce Bovol, NRC, OWFN-8G9A

Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9106, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9106, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0318-59231



RAIO-0318-59230

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9106, proprietary

Enclosure 2:

NuScale Response to NRC Request for Additional Information eRAI No. 9106, nonproprietary

Response to Request for Additional Information Docket: PROJ0769

eRAI No.: 9106

Date of RAI Issue: 11/15/2017

NRC Question No.: 01-57

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 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 7.2, "Stability Trend with Variation of Power," of the topical report (TR), TR-0516-49417-P, describes the cold leg feedback and its relationship with decay ratio (DR) with decreasing flow, and subsequently decreasing power. This section also describes scaling of NIST-1 decay ratio test results to the NuScale Power Module (NPM). SRP 15.0.2 states that a scaling analysis be performed that identifies important non-dimensional parameters related to geometry and key phenomena. According to the TR, a dimensionless steam generator (SG) number, S_0 , is considered a scaling parameter that can be used to relate the NPM to the NIST-1 experimental configuration. Two other parameters that are defined in section 7.1, and appear to be important to scaling NIST-1 stability results to NPM are: 'a' and t_0 . It's not clear if similarity of S_0 , a, t_0 , and/or other parameters are the important parameters for scaling NIST-1 results to NPM, and the effect of potential scaling distortions.

SRP 15.0.2 also indicates that sources of code uncertainty, including uncertainties from comparisons to separate effects tests, due to scaling of the basics models and closure relationships, due to plant nodalization and solution techniques, be identified. The combined code and application uncertainty, from all identified uncertainty sources, is to be less than the design margin for the safety parameter of interest. However, it is not clear from section 7.2 how uncertainties in decay ratio (DR) derived from the NIST-1 assessment are used in determining uncertainties in PIM calculations of DR for the NuScale Power Module.

In order to make an affirmative finding NRC staff requests NuScale to describe how the NIST-1 validation is used to determine DR uncertainty. In this description address how DR uncertainties due to scaling distortion between NIST- 1 and the NuScale power module are determined.

NuScale Response:

The issue of scaling the NIST-1 facility to the NPM has been addressed in the response to RAI 9037 Item 1. Essentially, no direct scaling that preserves the decay ratio is possible between the two systems. The scaling parameters identified from first principles analysis are not equal for the two systems. If the scaling parameters were equal, testing in NIST-1 would have been sufficient to establish the stability of the NPM without the benefit of a code such as PIM. Therefore, scaling distortions are not of interest in the way NIST-1 testing is used. NIST-1 is used to provide code benchmarking material where the important phenomena affecting the stability of a natural circulation loop are active, albeit with different relative importance, in the dynamics of both the NPM and the NIST-1 facility.

The one physical phenomenon where the magnitude of the impact on stability in NPM and NIST-1 differ significantly is {{

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

The PIM decay ratio results as function of power for the NIST-1 {{

}}^{2(a),(c)} are presented in Table 1 and plotted in Figure 1. It is observed that decay ratio {{}}^{2(a),(c)} However, for the calculations presented in Figure 1, the lowest power calculation is {{}}^{2(a),(c)} power value reached in the actual tests.

Table 1 PIM calculated decay ratios for NIST-1 at different powers $\{ \{ \}^{2(a),(c)}$

$\{ \{$

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

$\{ \{$

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

Figure 1 PIM calculated decay ratios for NIST-1 at different powers $\{ \{ \}^{2(a),(c)}$



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.

Response to Request for Additional Information Docket: PROJ0769

eRAI No.: 9106

Date of RAI Issue: 11/15/2017

NRC Question No.: 01-58

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 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 7.2, "Stability Trend with Variation of Power," of the topical report (TR), TR-0516-49417-P, Figure 7.1 shows the decay ratio (DR) trend as function of % power for the NuScale Power Modules (NPMs) and the NIST-1 tests. {{

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

In order to make an affirmative finding associated with the above regulatory requirement important to safety, NRC staff requests NuScale provide additional support for the claim that the {{

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

- The response should address the {{
- }}^{2(a),(c)} shown in Figure 7.1.
- It is acceptable to respond to this RAI by: (1) providing references to relevant experimental results published in the peer reviewed literature, (2) providing confirmatory results using alternative, independent analysis methods, (3) providing a detailed discussion of the associated feedback processes in a first-principles rationale explaining why PIM-calculated trend is reasonable, or (4) providing information consistent with a combination of the above approaches.
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NuScale Response:

As mentioned in the response to RAI 9106 Q 1-57, it was not possible to extend the operation of the NIST-1 facility to lower power as the temperature difference between the cold and hot sides

cannot be maintained given the heat transfer across the riser wall. This prevented the experimental demonstration of {{ }}^{2(a),(c)}

{{

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

The lack of experimental demonstration of {{ }}^{2(a),(c)} is compensated for by supplementing PIM results with results from an independent analytical method. This analytical method is the reduced order model RADYA, and the decay ratio variation with power in the range of 1% to 100% of rated power was presented in the response to RAI 9105.

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-0318-59230

Enclosure 3:

Affidavit of Zackary W. Rad, AF-0318-59231

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.

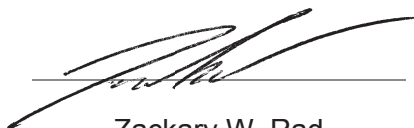
NuScale has performed significant research and evaluation to develop a basis for these methods and has invested significant resources, including the expenditure of a considerable sum of money.

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 No. 9106, eRAI No. 9106. 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 3/21/2018.



Zackary W. Rad