

August 07, 2017

Docket No. 52-048

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. 16 (eRAI No. 8801) 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. 16 (eRAI No. 8801)," dated June 06, 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. 8801:

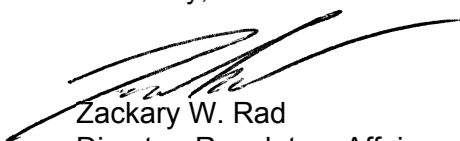
- 29730

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 16 (eRAI No. 8801). NuScale requests that the proprietary version be withheld from public disclosure in accordance with the requirements of 10 CFR § 2.390. The proprietary enclosures have been deemed to contain Export Controlled Information. This information must be protected from disclosure per the requirements of 10 CFR § 810. 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. 8801, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 8801, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0817-55332



RAIO-0817-55331

**Enclosure 1:**

NuScale Response to NRC Request for Additional Information eRAI No. 8801, proprietary



**Enclosure 2:**

NuScale Response to NRC Request for Additional Information eRAI No. 8801, nonproprietary

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

**eRAI No.:** 8801

**Date of RAI Issue:** 06/06/2017

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**NRC Question No.:** 29730

Title 10 Code of Federal Regulations (CFR), Part 50, Appendix A, General Design Criterion (GDC), "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 (SAFDLs) are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences (AOOs). Title 10 CFR, Part 50, Appendix A, GDC 12, "Suppression of Reactor Power Oscillations," requires 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. Title 10 CFR Part 52.47, "Contents of applications; technical information,"

Standard Review Plan (SRP) Section 15.0.2, "Review of Transient and Accident Analysis Method," and Regulatory Guide (RG) 1.203, "Transient and Accident Methods," provide guidance for complying with GDCs 10 and 12. Standard Review Plan 15.0.2 and RG 1.203 state that documentation must include a complete description of the code assessment, including showing a model nodalization diagram and all code options used for the calculations. Assessments must also compare code predictions to analytical solutions, where possible, to show the accuracy of the numerical methods in the mathematical models. RG 1.203 states that numerical solution convergence studies, including the basis for the time steps used and the chosen convergence criteria should be provided. Section 5.8 of topical report, TR-0516-49417- P, describes the numerical solution, but, does not provide sufficient detail about the required nodalization or time step size. Therefore to demonstrate compliance with GDCs 10 and 12:

1. Provide complete and detailed nodalization diagrams for calculations used to assess and validate the stability methodology.
  2. Provide the time step size used for the calculations provided in the TR.
  3. Provide a description of the nodalization and time step size selection methodology that is used for licensing applications.
  4. Justify the nodalization and time step size. This justification should consider numerical diffusion and, where applicable, provide velocity field information and Courant number.
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**NuScale Response:**

The nodalization scheme used for the stability assessment calculations is provided in Figure 1 and the table below:

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

For lower power levels, the mass flow rate is also reduced and the fluid transit time through a core node increases (inversely proportional to the flow rate). The time step is also increased to preserve the same limiting Courant number. For example, for power of {{

}}<sup>2(a),(c)</sup> An approximate relationship between the time step and power was used in the calculations reported in the topical report, namely,

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

where  $P$  is core power, MW.

Sensitivity studies of nodalization and time step were performed in the course of code development and concluded that no significant effects of the corresponding Courant number variations were identified. These sensitivities include:

- Using the standard nodalization, the time step was reduced by 50 percent. This reduced



Courant number by the same ratio, but no effect on stability was identified.{{

}}<sup>2(a),(c)</sup> The calculated stability results remain close to the base calculation confirming the insensitivity of the calculations to time step or Courant number.{{

}}<sup>2(a),(c)</sup>  
The stability results remain insensitive to this variation.

The insensitivity of the PIM code results to Courant number (time step and nodalization effects) may be {{  
}}<sup>2(a),(c)</sup> (Reference 1). NuScale's study of numerical diffusion effect on stability concluded that the spread (diffusion) of an important parameter such as fluid density is {{

}}<sup>2(a),(c)</sup> The PIM code applies an explicit integration scheme, which is less diffusive compared with implicit schemes. Also, sufficiently large number of nodes is used.

**Reference:**

1. J. G. M. Anderson et al., "TRACG Time Domain Analysis of Thermal Hydraulic Stability Sensitivity to Numerical Method and Comparison to Data," Stability Symposium, Organized by Idaho National Engineering Laboratory, August 10-11, 1989, Idaho Falls, Idaho.



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

Figure 1 Nodalization Scheme





**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-0817-55331

**Enclosure 3:**

Affidavit of Zackary W. Rad, AF-0817-55332

**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 Request for Additional Information RAI Set Number 16 - eRAI No. 8801 - RAI Question No. 29730. 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 8/7/2017.



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Zackary W. Rad