

August 03, 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. 18 (eRAI No. 8814) 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. 18 (eRAI No. 8814)," dated June 08, 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. 8814:

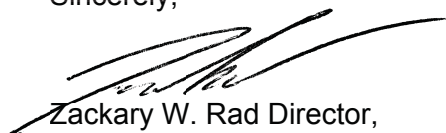
- 29768

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 18 (eRAI No. 8814). 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@nuscalspower.com.

Sincerely,



Zackary W. Rad Director,
Regulatory Affairs NuScale
Power, LLC



Distribution: Gregory Cranston, NRC, OWFN-8G9A
Samuel Lee, NRC, OWFN-8G9A
Bruce Bavol, NRC, OWFN-8G9A

Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 8814, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 8814, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0817-55272



RAIO-0817-55271

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 8814, proprietary



Enclosure 2:

NuScale Response to NRC Request for Additional Information eRAI No. 8814, nonproprietary

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

eRAI No.: 8814

Date of RAI Issue: 06/08/2017

NRC Question No.: 29768

Title 10 Code of Federal Regulations, 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.

Section 8.2 of topical report, TR-0516-49417-P, states that decreases in primary system flow rate are not considered credible for stability analysis. During postulated anticipated operational occurrences (AOOs), the staff considers that event sequences could exist that could involve inadvertent operation of components related to the chemical and volume control system (CVCS) that could lead to reduced or increased primary system flow (such as CVCS pump overspeed, or pump trip). Since the CVCS is essentially external to the primary flow circuit, such AOOs could impact reactor coolant system flow without other effects.

Based on the docketed information, the staff is unable to determine the acceptability of the completeness of the applicant's identified scenarios that could cause instabilities. The staff requests the applicant to provide additional justification for the rationale for considering changes in flow events as incredible, considering mal-operation of the CVCS as an initiator for an AOO.

NuScale Response:

TR-0516-49417-P (Reference 1) Section 8.2.3 discusses loss of flow events and identifies that {{ }}^{2(a),(c),ECI} As described in Reference 1, Section 4.1, in the NuScale power module (NPM) design, the primary coolant flow is driven by natural circulation. The density difference between the relatively high temperature flow exiting the core and the lower temperature flow returning through the downcomer annulus, where the steam generator is the heat sink, creates the natural circulation



driving head. The chemical and volume control system (CVCS) injection line is located in the riser region and the CVCS discharge line is located in the downcomer region; therefore any CVCS malfunction affects the reactor coolant system (RCS) heat balance. As discussed in the following paragraphs, the effect of CVCS flow on the RCS heat balance is small at full power operation; conversely, the CVCS is used to induce RCS flow during startup and has a correspondingly larger effect on the RCS heat balance.

The impact of the CVCS flow on the RCS heat balance is small at full power operation. For example, TR-0516-49416-P (Reference 2) Section 8.4 provides an example calculation for an increase in RCS inventory event. The CVCS provides approximately 5.5 lbm/s makeup flow and approximately 3 lbm/s recirculation pump flow; the total CVCS flow rate into the RCS is less than 10 lbm/s, compared to the total minimum RCS flow rate of more than 1150 lbm/s at full power. Since the CVCS flow is less than 1 percent of the total RCS flow rate, the impact of the flow on the RCS heat balance is small.

During startup, the CVCS, in conjunction with the module heatup system, is used to provide a non-nuclear heat source to increase primary system temperature and induce primary system flow as discussed in Reference 1, Section 8.2.9. Therefore, in the startup scenario, the effect of the CVCS on the RCS flow is greater. Reference 1, Figure 8-57 shows the predicted RCS flow rate during startup, with the flow rate perturbed at regular intervals in order to excite oscillations and examine the stability of the flow. Reference 1, Figure 8-57 shows {{

}}^{2(a),(c), ECI} Reference 1,

Figure 8-57 and Figure 8-58 show the damping of the artificial perturbations, and demonstrate the stability of the flow.

In the NPM design, the selected stability protection solution is regional exclusion. The region is defined by a single point specifying riser subcooling margin. Riser subcooling is protected by the module protection system, which actuates reactor trip if the RCS riser hot temperature limit is exceeded. This protection is independent of CVCS operation. It is also noted that during startup when the CVCS is used to provide a non-nuclear heat source to induce RCS flow, if the CVCS malfunctions before core power and RCS flow are sufficient, the module protection system will actuate reactor trip if the low low RCS flow limit is reached.

In the NPM design, a CVCS malfunction that results in more mass being injected to the riser region than removed from the downcomer region will result in an increase in RCS inventory. Reference 1, Section 8.2.4 discusses {{

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



Based on the NPM natural circulation design, small CVCS flow rates and corresponding effect on the RCS heat balance at full power conditions, the regional exclusion stability solution defined by riser subcooling margin, and analysis of startup conditions demonstrating the stability of RCS flow in response to flow perturbations, decrease in RCS flow rates due to CVCS malfunction during power operation are not considered a credible event requiring separate stability analysis.

References:

1. TR-0516-49417-P, Revision 0, "Evaluation Methodology for Stability Analysis of the NuScale Power Module," July 2016.
2. TR-0516-49416-P, Revision 0, "Non-Loss-of-Coolant Accident Analysis Methodology," January 2017.

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-0817-55271

Enclosure 3:

Affidavit of Zackary W. Rad, AF-0817-55272

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 18 - eRAI No. 8814 - RAI Question No. 29768. 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 8/3/2017.



Zackary W. Rad