RAIO-0518-59875

May 08, 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 Supplemental Response to NRC Request for Additional Information No. 9093 (eRAI No. 9093) 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. 9093 (eRAI No. 9093)," dated September 10, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 9093 (eRAI No.9093)," dated November 09, 2017
3. 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) supplemental response to the referenced NRC Request for Additional Information (RAI).

The Enclosures to this letter contain NuScale's supplemental response to the following RAI Question from NRC eRAI No. 9093:

- 01-39

Enclosure 1 is the proprietary version of the NuScale Supplemental Response to NRC RAI No. 9093 (eRAI No. 9093). 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 Paul Infanger at 541-452-7351 or at pinfanger@nuscalepower.com.

Sincerely,

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

Distribution: Samuel Lee, NRC, OWFN-8G9A
Prosanta Chowdhury NRC, OWFN-8G9A
Bruce Bavol, NRC, OWFN-8G9A

Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9093, proprietary

Enclosure 2: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9093, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0518-59876

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9093, proprietary

NuScale Power, LLC
1100 NE Circle Blvd., Suite 200 Corvalis, Oregon 97330, Office: 541.360.0500, Fax: 541.207.3928
www.nuscalepower.com

Enclosure 2:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9093, nonproprietary

NuScale Power, LLC
1100 NE Circle Blvd., Suite 200 Corvalis, Oregon 97330, Office: 541.360.0500, Fax: 541.207.3928
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Response to Request for Additional Information
Docket: PROJ0769

eRAI No.: 9093
Date of RAI Issue: 09/10/2017

NRC Question No.: 01-39

Title 10, 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 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. The Standard Review Plan (SRP) 15.0.2 acceptance criteria with respect to accident scenario identification states that the process must include evaluation of physical phenomena to identify those that are important in determining the figure of merit for the scenario.

In section 4.4 “ Phenomena Identification and Ranking Table (PIRT),” of the topical report (TR), TR-0516-49417-P, the TR states, under the Table 4.1 "Instability in SG tubes" entry, that "Density waves in the SG tubes are excluded by design via the proper inlet throttling of individual tubes as verified by the experimental data."

In order to make an affirmative finding NRC staff requests NuScale to describe the process for demonstrating that the SG tubes are designed with sufficiently tight inlet orifices to preclude density wave instability.

NuScale Response:

NuScale is supplementing its response to RAI 9093 (Question 01-39) originally provided in letter RAIO-1117-57040 dated November 9, 2017. The Supplemental Response replaces the original response in its entirety. In particular, the second paragraph of NuScale's original response is modified to eliminate the last sentence as shown in the Supplemental Response. The stability analysis methodology is unaffected by the magnitude of the steam generator oscillations.

Original Response

Density wave oscillations (DWO) in the steam generator (SG) tubes are not excluded, rather the possibility of their occurrence and consequences thereof are accounted for in Appendix A of the topical report (TR), TR-0516-49417-P, "Evaluation Methodology for Stability Analysis of the NuScale Power Module." However, any destabilizing influence of the SG tube oscillations on the primary side stability is excluded. This clarification is included as an update to TR Table 4-1 "Phenomena Identification and Ranking," in the row entitled, “Instability in SG tubes.”

NuScale has performed extensive tests partly to quantify secondary DWO and to improve the NRELAP5 stability modeling predictions. These flow fluctuations, if not controlled in magnitude, would impact the mechanical performance of the SG tubes due to thermal stresses, and degrade thermal performance by allowing moisture carryover at the SG exit. These performance issues are maintained within acceptable limits by throttling the inlets of the SG tubes. The maximum acceptable level of secondary flow oscillation magnitude (OM) is limited to 10% about the mean value as determined by the mass flow rate at the SG tube inlet.

NuScale DCA Tier 2 Steam Generator Design Basis Section 5.4.1.3 has been revised to clarify the selection of the current inlet loss coefficient design value as pertaining to these performance issues and not the stability of the primary flow or core power oscillations.

Supplemental Response

Density wave oscillations (DWO) in the steam generator (SG) tubes are not excluded, rather the possibility of their occurrence and consequences thereof are accounted for in Appendix A of the topical report (TR), TR-0516-49417-P, "Evaluation Methodology for Stability Analysis of the NuScale Power Module." However, any destabilizing influence of the SG tube oscillations on the primary side stability is excluded. This clarification is included as an update to TR Table 4-1 "Phenomena Identification and Ranking," in the row entitled, “Instability in SG tubes.”

NuScale has performed extensive tests partly to quantify secondary DWO and to improve the NRELAP5 stability modeling predictions. These flow fluctuations, if not controlled in magnitude, would impact the mechanical performance of the SG tubes due to thermal stresses, and degrade thermal performance by allowing moisture carryover at the SG exit. These performance issues are maintained within acceptable limits by throttling the inlets of the SG tubes.

NuScale DCA Tier 2 Steam Generator Design Basis Section 5.4.1.3 has been revised to clarify the selection of the current inlet loss coefficient design value as pertaining to these performance issues and not the stability of the primary flow or core power oscillations.

Impact on Topical Report:

Topical Report TR-0516-49417, Evaluation Methodology for Stability Analysis of the NuScale Power Module, has been revised as described in the response above and as shown in the

markup provided in this response.

density head. {{

}}2(a),(c),~~ECI~~

3. Power generation in the core is represented by a point kinetics model. Accordingly, the axial power shape is invariant, which is a reasonable approximation given that only minimal subcooled voiding is possible.
4. {{

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

5. The flow in the primary coolant loop is modeled as non-equilibrium two-phase flow in which a drift flux formulation accounts for mechanical (velocity) differences between the liquid phase and the vapor phase if vapor exists. Thermal non-equilibrium allows the liquid to be in a subcooled, saturated, or superheated state, but the vapor is restricted to the saturation state. Closing relations governing mass, momentum, and energy exchange between the phases and the solid structures are adaptations from commonly used correlations. The algorithms do not account for the possibility of reverse flow.
6. The flow in the secondary side of the SG is modeled {{

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

7. The pressurizer is not modeled. Pressure is specified by input and the dependence of thermodynamic properties on pressure is uniform. This approximation implies that pressure waves cannot be simulated where the sound speed is infinite. Given the long transport times for fluid transit around the primary coolant loop and the low frequency of the oscillations following any perturbation of the steady state, the impact of this approximation on the stability calculation is negligible. {{

}}2(a),(c)

Enclosure 3:

Affidavit of Zackary W. Rad, AF-0518-59876

NuScale Power, LLC
1100 NE Circle Blvd., Suite 200 Corvalis, Oregon 97330, Office: 541.360.0500, Fax: 541.207.3928
www.nuscalepower.com

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.

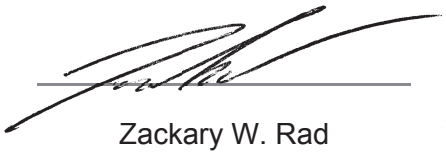
    NuScale has performed significant research and evaluation to develop a basis for this methods and has invested significant resources, including the expenditure of a considerable sum of money.

    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. 9093, eRAI 9093. 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 5/7/2018.



Zackary W. Rad