



January 31, 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. 9126 (eRAI No. 9126) on the NuScale Topical Report, "Loss-of-Coolant Accident Evaluation Model," TR-0516-49422, Revision 0

REFERENCES: 1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 9126 (eRAI No. 9126)," dated December 01, 2017
2. NuScale Topical Report, "Loss-of-Coolant Accident Evaluation Model," TR-0516-49422, Revision 0, dated December 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. 9126:

- 15.06.05-9

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 9126 (eRAI No. 9126). 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', written over a horizontal line.

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. 9126, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9126, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0118-58483



RAIO-0118-58482

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9126, proprietary

Enclosure 2:

NuScale Response to NRC Request for Additional Information eRAI No. 9126, nonproprietary

Response to Request for Additional Information Docket: PROJ0769

eRAI No.: 9126

Date of RAI Issue: 12/01/2017

NRC Question No.: 15.06.05-9

Title 10 of the Code of Federal Regulations (10 CFR) Part 52, Section 47 (a)(2) states, “A description and analysis of the structures, systems, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification therefor, upon which these requirements have been established, and the evaluations required to show that safety functions will be accomplished.” Regulatory Guide 1.203 describes a process that the staff of the U.S. Nuclear Regulatory Commission (NRC) considers acceptable for use in developing and assessing evaluation models that may be used to analyze transient and accident behavior that is within the design basis of a nuclear power plant.

As stated in RG 1.203, an evaluation model (EM) is the calculational framework for evaluating the behavior of the reactor system during a postulated transient or design-basis accident. As such, the EM may include one or more computer programs, special models, and all other information needed to apply the calculational framework to a specific event, as illustrated by the following examples:

- (1) procedures for treating the input and output information (particularly the code input arising from the plant geometry and the assumed plant state at transient initiation)
- (2) specification of those portions of the analysis not included in the computer programs for which alternative approaches are used
- (3) all other information needed to specify the calculational procedure

The entirety of an evaluation model (EM) ultimately determines whether the results are in compliance with applicable regulations. Therefore, the development, assessment, and review processes must consider the entire EM.

Page 51 of the LOCA Evaluation Model Topical Report (TR-0516-4942-P, Rev. 0), {{

}}^{2(a),(c)} and page 322 of the LOCA Evaluation Model



Topical Report also states {{

}}^{2(a),(c)} The applicant then implies that the adequacy of this modeling approach is supported by performing

{{

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

Analysis to support the statement of conservatism for this {{ }}^{2(a),(c)} could not be found in the referenced document, Subchannel Analysis Methodology (TR-0915-17564-P). Further staff review of {{

}}^{2(a),(c)} because it is not possible to determine if the conservative result occurs from {{

}}^{2(a),(c)} Adequate computation of CHF is important because the NuScale LOCA safety analysis is based on a {{ }}^{2(a),(c)}.

NuScale is requested to provide additional information on the following relative to EC-0000-4487:

(1) Please provide an assessment of {{ }}^{2(a),(c)} so staff can understand more clearly differences (to determine if {{ }}^{2(a),(c)} has been adequately addressed per App. K - I.C.7) and include plots of {{

}}^{2(a),(c)}.
(2) Staff noted the document does not identify NRELAP5 model options in regard to CHF correlations used in the NRELAP5 computations, and staff needs to confirm that appropriate App. K CHF correlations are used and find that the {{

}}^{2(a),(c)}. Please provide additional plots of specific parameters more closely coupled with CHF (e.g., heat flux) to better understand the conservatisms in the Section 4.3 {{ }}^{2(a),(c)}.

NuScale Response:**1. Background**

The NuScale loss-of-coolant accident (LOCA) phenomena identification and ranking table (PIRT) identifies {{

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

As discussed in Section 5.1.2.2.1 and Section 8.2.16 of the LOCA evaluation model (EM) topical report (Reference 1), the core in the NuScale power module (NPM) LOCA model is represented by {{

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

As discussed in Section 8.2.16 of the LOCA EM topical report (Reference 1), the adequacy of this modeling approach was substantiated by performing {{

}}^{2(a),(c)} Section 2 of this response summarizes the results of additional calculations performed using {{

}}^{2(a),(c)} as used in the NRELAP5 LOCA model is conservative.

Furthermore, additional information on NRELAP5 and {{}}^{2(a),(c)} is provided in Section 3 to show that the CHF correlation used in the NRELAP5 LOCA EM satisfies the Appendix K requirements and the NRELAP5 and {{

}}^{2(a),(c)} produce consistent results.

2. Conservatism of $\gamma^{2(a),(c)}$

The calculations are performed using the $\gamma^{2(a),(c)}$

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

The NuScale Subchannel Analysis Methodology (Reference 2) $\gamma^{2(a),(c)}$

$\gamma^{2(a),(c)}$ LOCA scenario. The NRELAP5 calculation results for this scenario are presented in Section 9 of the LOCA EM topical report (Reference 1). The transient conditions for the core inlet flow and temperature distribution and the core exit pressure calculated by NRELAP5 are $\gamma^{2(a),(c)}$

$\gamma^{2(a),(c)}$ in the base case and the sensitivity cases. Figure 7 through Figure 9 show the axial variation of mass flow rate, void fraction, and CHF in the CHF subchannel (i.e., subchannel 2) at 6.6 seconds.

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

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

{{

}}^{2(a),(c)} to satisfy 10 CFR 50, Appendix K, Section I.C.7.a.

3. CHF Correlations in NRELAP5 and VIPRE-01

Section 6.11 of the LOCA EM topical report (Reference 1) describes the CHF correlations used in the NuScale LOCA EM. Two CHF correlations are used to monitor for CHF occurrence, {{

}}^{2(a),(c)} See Sections 6.11.3 and 6.11.4 of Reference 1 for description of these correlations. Section 7.3 of the LOCA EM topical report (Reference 1) describes the assessment of NRELAP5 against NuScale CHF data obtained in the Stern facility. The assessment results presented in Section 7.3.6 of the LOCA EM topical report (Reference 1) show that the NRELAP5 predictions conservatively envelopes the Stern CHF data with a 1.29 limit. This is used as a safety limit for the NuScale LOCA EM.

Furthermore, the NuScale LOCA EM ensures that the physical parameters are within the range of parameters specified for use of the correlations. As described in Table 2-2 of the LOCA EM topical report (Reference 1) the selected CHF correlations are consistent with the applicable requirements specified in 10 CFR 50, Appendix K, Section I.C.4.

NRELAP5 has been assessed against the CHF data for the NuFuel-HTP2™ fuel design



obtained from Framatome's (formerly Areva) KATHY test loop in 2016. The NRELAP5 predictions conservatively envelope the KATHY CHF data with a 1.12 limit, which is lower than the safety limit for the NuScale LOCA EM.

The VIPRE-01 subchannel analysis referenced in Section 8.2.16 of the LOCA EM topical report (Reference 1) was performed using the NSP2 CHF correlation. This CHF correlation is based on the same Stern CHF data that was used for the assessment of the NRELAP5 CHF correlation. The NSP4 CHF correlation used for the VIPRE-01 subchannel analysis calculations presented in this response has been developed based on the KATHY CHF data for the NuFuel-HTP2™ fuel. VIPRE-01 with the NSP2 and NSP4 correlations has been assessed against the KATHY CHF data with CHF correlation limits of 1.19 and 1.21 (i.e., 95/95 limit), respectively. Note that CHF analysis limits used for licensing subchannel calculations include exterior uncertainty penalties and therefore are higher (1.262 and 1.284 for NSP2 and NSP4, respectively).

Since the NRELAP5 CHF correlation and VIPRE-01 CHF correlations have assessed against the same CHF data, they are expected to provide consistent results.

4. References

1. TR-0516-49422, Revision 0, "Loss-of-Coolant Accident Evaluation Model"
2. TR-0915-17564, Revision 1, "Subchannel Analysis Methodology"

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Figure 1 {{

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

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

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

Figure 2 {{

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

{{

Figure 3 {{

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

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

{{

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

Figure 4 {{

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

{{

Figure 5 {{

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

{{

Figure 6 {{

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

{{

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

Figure 7 {{

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

{{

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

Figure 8 {{

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

{{

Figure 9 {{

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

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

{{

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

Figure 10 {{

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

{{

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

Figure 11 {{

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

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Figure 12 {{

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

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

Impact on Topical Report:

There are no impacts to the Topical Report TR-0516-49422, Loss-of-Coolant Accident Evaluation Model, as a result of this response.



RAIO-0118-58482

Enclosure 3:

Affidavit of Zackary W. Rad, AF-0118-58483

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 loss-of-coolant accident analysis.

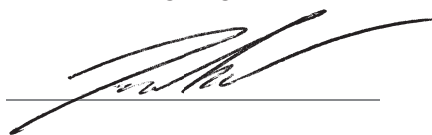
NuScale has performed significant research and evaluation to develop a basis for these methods and has invested significant resources, including the expenditure of a considerable sum of money.

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. 9126, eRAI No. 9126. 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 1/31/2018.



Zackary W. Rad