



January 30, 2018

Docket: PROJ0769

U.S. Nuclear Regulatory Commission  
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Rockville, MD 20852-2738

**SUBJECT:** NuScale Power, LLC Response to NRC Request for Additional Information No. 9149 (eRAI No. 9149) 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. 9149 (eRAI No. 9149)," 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. 9149:

- 15.06.05-10

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 9149 (eRAI No. 9149). 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](mailto: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: Gregory Cranston, NRC, OWFN-8G9A  
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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9149, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9149, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0118-58452



RAIO-0118-58451

**Enclosure 1:**

NuScale Response to NRC Request for Additional Information eRAI No. 9149, proprietary

**Enclosure 2:**

NuScale Response to NRC Request for Additional Information eRAI No. 9149, nonproprietary

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

**eRAI No.:** 9149

**Date of RAI Issue:** 12/01/2017

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**NRC Question No.:** 15.06.05-10

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.” Likewise, 10 CFR Part 50, Appendix K, II.4 – Required Documentation, requires that, “To the extent practicable, predictions of the evaluation model, or portions thereof, shall be compared with applicable experimental information.”

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 EM ultimately determines whether the results are in compliance with applicable regulations. Therefore, the development, assessment, and review processes must consider the entire EM.

During a Loss of Coolant Accident (LOCA), the primary heat transfer processes {{

}}<sup>2(a),(c)</sup> These heat transfer capabilities are critical to cool the reactor core and remove decay heat. The staff noted that NRELAP5 code models that support the LOCA EM topical report (base model EC-A010-1782 and LOCA model EC- 0000-4888) do not include the

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}}<sup>2(a),(c)</sup>. Please (1) justify lack of modeling the {{}}<sup>2(a),(c)</sup> and (2) quantify the conservatism for the figures of merit (e.g., CNV pressure, RPV and CNV level, and critical heat flux ratio for a range of LOCA break sizes and locations). The justification (e.g., the results of a sensitivity analysis) should also indicate if existing phenomena increase in importance (e.g., from medium to high) or the uncertainty increases for existing high-ranked phenomena by the omission of the upper CNV metal mass.

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#### **NuScale Response:**

The heat transfer from the {{

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

Due to its importance in the progression of a postulated loss-of-coolant accident (LOCA) in the NuScale Power Module (NPM) and impact on the figures-of-merit identified in Section 4.3 of Reference 1, the overall {{

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

During the initial part of the blowdown from a postulated break in the NPM before {{

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

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In order to demonstrate the impact of modeling  $\{\{\text{DHR}}\}^{2(a),(c)}$  which is neglected in Section 5 and Section 9 of Reference 1, the charging line break scenario with two different break sizes (100 percent and 10 percent) is considered without crediting the decay heat removal system (DHR), with both AC/DC power available, and with all of the emergency core cooling system (ECCS) valves operational. Note that the LOCA input model described in Section 5 of Reference 1, with changes, is used to perform the sensitivity analysis. The model used is an update from the original and includes corrections of the errors identified since the issuance of the LOCA evaluation model topical report (Reference 1). An important error correction is related to the calculation of the collapsed liquid level above top of the active fuel (TAF). The collapsed level is calculated based on the axial distribution of the free volume and the total liquid inventory inside the reactor pressure vessel (RPV). Other included corrections are not considered to appreciably affect the results from the original model.

Table 1 summarizes the impact of the presence of  $\{\{\text{DHR}}\}^{2(a),(c)}$  in the modeling on the two key LOCA figures of merit; peak containment pressure and minimum collapsed level above TAF. In the sensitivity calculations, the heat transfer to  $\{\{\text{DHR}}\}^{2(a),(c)}$

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

Figure 1 through Figure 4 are also included to demonstrate that the progression of the events are not affected by  $\{\{\text{DHR}}\}^{2(a),(c)}$

$\{\{\text{DHR}}\}^{2(a),(c)}$  does not have significant impact on the progression of LOCA. Therefore, the existing the omission of this heat

$\{\{\text{DHR}}\}^{2(a),(c)}$  It is also important to emphasize that the LOCA evaluation model does not address the most limiting event for the peak CNV pressure, nor is it intended to do so. A broader spectrum of events is analyzed within the scope of Reference 2 where  $\{\{\text{DHR}}\}^{2(a),(c)}$  is explicitly taken into account.

#### References:

1. TR-0516-49422, "Loss-of-Coolant Accident Evaluation Model", Revision 0.
2. TR-0516-49084, "Containment Response Analysis Methodology Technical Report", Revision 0.

Table 1. Effects of  $\beta^{2(a),(c)}$  on Peak Containment Pressure and Collapsed Level Above TAF for 100 percent and 10 percent Charging Line Break Scenarios

$\beta$

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



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

Figure 1. Variation in Peak Containment Pressure during 100 percent Charging Line Break with  
and without {{  
}}<sup>2(a),(c)</sup>

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

Figure 2. Variation in Peak Containment Pressure during 10 percent Charging Line Break with  
and without {{  
}}<sup>2(a),(c)</sup>

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

Figure 3. Variation in Minimum Collapsed Level above TAF during 100 percent Charging Line  
Break with and without {{  
}}<sup>2(a),(c)</sup>

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

Figure 4. Variation in Minimum Collapsed Level above TAF during 10 percent Charging Line  
Break with and without {{  
}}<sup>2(a),(c)</sup>

**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-0118-58451

**Enclosure 3:**

Affidavit of Zackary W. Rad, AF-0118-58452

**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. 9149, eRAI No. 9149. 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 1/30/2018.



Zackary W. Rad