



August 28, 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. 9466 (eRAI No. 9466) on the NuScale Topical Report, "Non-Loss of Coolant Accident Analysis Methodology," TR-0516-49416, Revision 1

REFERENCES: 1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 9466 (eRAI No. 9466)," dated May 07, 2018
2. NuScale Topical Report, "Non-Loss of Coolant Accident Analysis Methodology," TR-0516-49416, Revision 1, dated August 2017

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. 9466:

- 15.00.02-11


The response schedule for the remaining questions of RAI No. 9466, eRAI 9466 was provided in an email to NRC (Greg Cranston) dated June 19, 2018.

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 9466 (eRAI No. 9466). 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 Paul Infanger at 541-452-7351 or at pinfanger@nuscalepower.com.

Sincerely,



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. 9466, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9466, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0818-61601

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9466, proprietary

Enclosure 2:

NuScale Response to NRC Request for Additional Information eRAI No. 9466, nonproprietary

Response to Request for Additional Information Docket No. 52-048

eRAI No.: 9466

Date of RAI Issue: 05/07/2018

NRC Question No.: 15.00.02-11

GDC 10 requires that the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that SAFDLs are not exceeded during any condition of normal operation, including the effects of AOOs. In addition, GDC 15 requires that the RCS and associated auxiliary, control, and protection systems shall be designed with sufficient margin to assure that the design conditions of the RCPB are not exceeded during any condition of normal operation, including AOOs.

TR-0516-49416-P supports the conclusions relative to GDC 10 and 15 in the NuScale FSAR, which under 10 CFR 52.47 must describe the facility, present the design bases and the limits on its operation, and present a safety analysis of the structures, systems, and components and of the facility as a whole. DSRS Section 15.0 guides the staff to confirm that the implementation of models or codes are within the applicable ranges and conditions. Furthermore, RG 1.203 describes the EMDAP. Step 4 of the EMDAP (Section 1.1.4) discusses the identification and ranking of key phenomena and processes and states:

“A key feature of the adequacy assessment is the ability of the EM or its component devices to predict appropriate experimental behavior. Once again, the focus should be on the ability to predict key phenomena, as described in the first principle. To a large degree, the calculational devices use collections of models and correlations that are empirical in nature. Therefore, it is important to ensure that they are used within the range of their assessment.”

Page 256 of TR-0516-49416-P states that {{
}}^{2(a),(c)} is used to calculate the heat transfer from the DHRS to the cooling pool. However, the staff notes that several audited documents mention use of {{
}}^{2(a),(c)} to calculate the DHRS heat transfer to the cooling pool. These documents include {{
}}^{2(a),(c)} which provides references for the design inputs in the NRELAP5 model of an NPM; {{
}}^{2(a),(c)} a change to the calculation supporting NuScale FSAR Sections 15.2.1-15.2.3; and {{
}}^{2(a),(c)}

the calculation supporting NuScale FSAR Section 15.1.1. Therefore, it is unclear what correlation is actually used in the non-LOCA methodology.

If the $\rho^2(a), (c)$ is used, it is unclear whether within the range of the assessment, it is appropriate for the pool boiling conditions within the NPM. To justify the adequacy of the use of $\rho^2(a), (c)$ under pool boiling conditions, the applicant performed a sensitivity study in which it changed $\rho^2(a), (c)$

$\rho^2(a), (c)$, among other various sensitivities, and documented the sensitivity study in Section 4.2 of the document $\rho^2(a), (c)$

$\rho^2(a), (c)$ The results of the sensitivity study are shown in Figures 4-7 and 4-8 of $\rho^2(a), (c)$. It appears that the impact on the change in enthalpy across the DHRS resulting from the change $\rho^2(a), (c)$ is larger than the impact of other sensitivity results shown on Figure 4-7, but the co-plotting of the various sensitivity cases makes this unclear. Figure 4-8 appears to show an improved response in the predicted DHRS tube water level $\rho^2(a), (c)$ for the first two-thirds of the transient, before being roughly the same for the final one-third of the calculation. Therefore, if the $\rho^2(a), (c)$ is used, the staff requires additional information to justify whether it is appropriate for the NPM.

In general, if a correlation used in the FSAR analyses differs from those used in the code assessment, the correlation used in the FSAR analyses must be justified and documented. If the Rohsenow correlation $\rho^2(a), (c)$ is used in the FSAR analyses but is not used in the non-LOCA assessments, a basis and justification for the $\rho^2(a), (c)$ must be provided.

In addition, the applicant may re-perform some test simulations in the future to resolve discrepancies or other RAIs. The correlation modeling the heat transfer from the DHRS to the cooling pool should be one that has been validated.

Information Requested:

a. Clarify what correlation is used to model heat transfer from the DHRS to the cooling pool in TR-0516-49416-P and in the FSAR non-LOCA analyses.

b. If $\rho^2(a), (c)$ is used to analyze non-LOCA events,

- o Provide a figure equivalent to $\rho^2(a), (c)$, Figure 4-7, in which only the data, the NRELAP5 base calculation, and the NRELAP5 $\rho^2(a), (c)$

calculation information are shown.

- Provide a figure showing the integrated delta enthalpy (kW) values for the data, the NRELAP5 base calculation, and the NRELAP5 $\{\{ \}^{2(a),(c)}\}$ calculation as a function of time.
 - Provide a more in-depth discussion of the $\{\{ \}^{2(a),(c)}\}$, Figure 4-8 results for the data, the base calculation, and the $\{\{ \}^{2(a),(c)}\}$ calculation, comparing the results, the bases for the differences, and the reason for the approximate agreement between the base calculation and the $\{\{ \}^{2(a),(c)}\}$ calculation after approximately 510 seconds.
 - Based on the above information and the physical dynamics within the NPM, justify the applicability of $\{\{ \}^{2(a),(c)}\}$ to the pool boiling conditions in the NPM.
- c. If $\{\{ \}^{2(a),(c)}\}$ is used to analyze non-LOCA events,
- Provide a basis and justification for use of the revised model, as the non-LOCA TR does not appear to have included this correlation in the assessment studies. Consider all impacted assessment studies. This may include some of the same comparisons as suggested in part (b).
 - Assess the impact of the revised model on uncertainties and margin in the non-LOCA analyses.
- d. Update TR-0516-49416-P and any other affected documentation as appropriate.

NuScale Response:

Response to RAI, part a):

The $\{\{ \}^{2(a),(c)}\}$ is to be used to model heat transfer from the DHRS to the cooling pool per the non-LOCA evaluation model described in TR-0516-49416-P. Sensitivity calculations of representative plant cases, including FSAR limiting cases, demonstrate that the modeling option $\{\{ \}^{2(a),(c)}\}$ in the calculated peak RCS pressure, steam generator pressure, the minimum critical heat flux ratio, or the DHRS cooldown progression.

Response to RAI, part b):

The NRELAP5 assessment of the NIST-1 HP-03 test was revised. The updated assessment

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

Figure 1 shows total DHRS power calculated from the data, and the NRELAP5 calculations for

}}^{2(a),(c)} Figure 2 shows the integrated DHRS power for these cases; {{

}}^{2(a),(c)} Figure 3 shows the

collapsed level in the DHRS tubes.

Figure 1 and Figure 2 show that {{

}}^{2(a),(c)} These results are

consistent with expectations based on the Rosenhow and Chen correlations and how they are implemented in the NRELAP5 code.

{{

Figure 1 - Power transferred across the DHRS heat exchanger right boundary $\}}^{2(a),(c)}$
{{

Figure 2 - Integrated Power transferred across the DHRS heat exchanger right boundary $\}}^{2(a),(c)}$

{{

Figure 3 - Collapsed Liquid Level in DHRS Tubes

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

The Chen flow boiling heat transfer correlation is calculated as the sum of a nucleate boiling contribution and convection heat transfer contribution . The Chen correlation adopts the Forster-Zuber pool boiling heat transfer correlation as its nucleate boiling component, weighted by a boiling suppression factor. In the NRELAP5 code, the convection contribution is determined from {{

}}^{2(a),(c)} for the reasons discussed in the following paragraph.

{{

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

{{

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

relatively more important PIRT figures of merit for the design-basis non-LOCA initiating events. This conclusion is due to the fact that {{

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

Table 1 Case Identification

{{

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

Response to RAI, part c):

As stated in the response to part a) of this RAI, {{}}^{2(a),(c)} is to be used to model heat transfer from the DHRS to the cooling pool per the non-LOCA evaluation model as described in TR-0516-49416-P.

Response to RAI, part d):

Since {{}}^{2(a),(c)} is to be used to model heat transfer from the DHRS to the cooling pool, no revision to the Non-LOCA methodology topical report is necessary. While the calculations supporting some of the FSAR Chapter 15 events were performed using the {{}}^{2(a),(c)}, sensitivity calculations showed an insignificant impact on the NRELAP5 calculation results.

Impact on DCA:

There are no impacts to the DCA as a result of this response.



RAIO-0818-61600

Enclosure 3:

Affidavit of Zackary W. Rad, AF-0818-61601

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 method by which NuScale develops its non-loss of coolant accident analysis methodology.

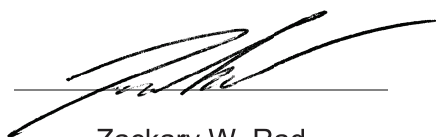
NuScale has performed significant research and evaluation to develop a basis for this method and has invested significant resources, including the expenditure of a considerable sum of money.

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. 9466, eRAI 9466. 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 August 28, 2018.



Zackary W. Rad