



September 13, 2018

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. 377 (eRAI No. 9380) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 377 (eRAI No. 9380)," dated March 02, 2018

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. 9380:

- 06.02.01.01.A-6

The response to questions 06.02.01.01.A-5 and 06.02.01.01.A-7 will be provided by a separate transmittal. NuScale RAIO-0918-61764, No. 398, eRAI 9317 is referenced within this response.

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 377 (eRAI No. 9380). 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
Omid Tabatabai, NRC, OWFN-8G9A
Samuel Lee, NRC, OWFN-8G9A



Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9380, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9380, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0918-61765



Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9380, proprietary



Enclosure 2:

NuScale Response to NRC Request for Additional Information eRAI No. 9380, nonproprietary

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

eRAI No.: 9380

Date of RAI Issue: 03/02/2018

NRC Question No.: 06.02.01.01.A-6

NIST-1 HP-02 is a separate effects, high pressure steam condensation test. During the HP-02 test, steam is introduced into the NIST-1 containment vessel (CNV) resulting in a slowly increasing steam pressure. The steam condenses to liquid on the NIST-1 CNV wall at a temperature approximately equal to the saturation temperature at the time of condensation. Thus, the condensate temperature increases with time during the test as the NIST-1 CNV pressure increases. The staff's review of the HP-02 test data shows that this process {{

}}2(a),(c)

- a. While Staff recognizes that the temperature stratification in the NIST-1 HP-02 tests did not result from the same mechanism as discussed for the NPM, the staff requests to audit the NRELAP5 computer code calculations in order to gain better understanding of how NRELAP5 calculates the temperature stratification. Specifically, the applicant is requested to provide technical justification that the NRELAP5 code is capable of adequately representing thermal stratification in the CNV and justify the nodalization used in the model. For example, the applicant may use the standard NRELAP5 model for NIST-1 HP-02 tests to compute liquid temperature versus time at the same elevations as the temperature measurements made for HP-02 Runs 1, 2, and 3. If additional NRELAP5

analysis is performed, the applicant should consider modifying the standard NRELAP5 model with sufficiently fine hydrodynamic noding below the final liquid level occurring at the end of the HP-02 test runs to capture the thermally stratified distribution of subcooled water in the containment vessel. The applicant is requested to provide comparison plots to show the impact of node size on the computed temperature stratification of the liquid and CNV pressure vs. the HP-02 test data for any additional analyses performed. Provide an evaluation showing whether NRELAP5 correctly calculates the temperature stratification observed in the HP-02 tests and demonstrate that NRELAP5 does not allow the cooler stratified water to act as a heat sink and reduce the temperature and pressure of the steam.

- b. Staff noticed that there was no pre-heating of NIST-1 containment wall in HP-02 test that suggests that condensation also took place on the containment wall besides the heat transfer plate (HTP). This would lead to a heat loss to the ambient air through the containment wall, in addition to the heat transfer across the HTP to the reactor cooling pool. Since the objective of the experiment is to validate the condensation heat transfer in a pressurized environment, failure to model the heat loss and the pool heat transfer will distort the pressure response inside the containment. {{

}}2(a),(c)

NuScale Response:

The NRELAP5 assessment of the NIST-1 HP-02 test was revised. The revised assessment was performed with NRELAP v1.4, addressed instrument non-conformances identified after the prior assessment work was complete, corrected minor modeling errors, and included additional information to respond to requests for additional information. The response to this RAI shows results from the revised assessment calculations.



Part (a):

Note that as part of the updated assessment calculations, a diabatic boundary condition was applied to assess the impact of including shell wall heat losses on the containment pressure response, as described in response to RAI 9317, Question 06.02.01.01.A-8, transmitted by Nuscale letter RAIO-0918-61764, dated, September 13, 2018. The base case results presented in this RAI response model the containment shell wall heat losses.

Sensitivity calculations were performed to assess impact of thermal stratification behavior on the overall CNV pressure response for the HP-02 tests. NRELAP5 cannot model the local temperature gradients within a cell. Thus when the pool surface falls within a cell, the cell bulk temperature is used as the pool surface temperature for purposes of calculating interfacial condensation. Larger nodes could result in under-prediction of the pool surface temperature over time, promoting more condensation, whereas using smaller nodes allows thermal stratification to be modeled in more detail and results in a bulk temperature predictions near the liquid surface that are closer to the expected pool surface temperature (i.e., saturation conditions), decreasing the potential for over-predicted interfacial condensation.

The base case uses {{

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



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

Based on these results it was concluded that the base nodalization scheme is sufficient to capture the mass transfer mechanism in the CNV for the HP-02 test.



Table 1 - CNV, HTP, and CPV axial nodalization

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

Table 2 - CNV pressure response from CNV axial nodalization sensitivity

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

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

Figure 1 - CNV pressure response from CNV axial nodalization sensitivity (Runs 1-3)

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

Figure 2 - CNV axial temperature response from CNV axial nodalization sensitivity at 2,000 seconds (Runs 1-3)

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

Figure 3 -CNV nodalization sensitivity on integrated mass transfer rates in CNV (Run 3)



Part (b):

As part of the updated assessment calculations, a diabatic boundary condition was applied to assess the impact of including shell wall heat losses on the containment pressure response. The response to eRAI 9317, Question 06.02.01.01.A-8, transmitted by NuScale letter RAIO-0918-61674, dated September 13, 2018, describes the approach used to calculate the ambient heat loss occurring during the HP-02 tests and to model the diabatic boundary condition. As discussed in response to RAI 9317, Question 06.02.01.01.A-8, sensitivity calculation results show {{

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

The response to eRAI 9317, Question 06.02.01.01.A-9, transmitted by NuScale letter RAIO-0918-61674, dated September 13, 2018, discusses heat transfer through the heat transfer plate to the cooling pool. The heat transfer coefficients for condensation on the shell side and convection on the pool side were estimated from the measured data during the pseudo-steady state period and compared to the NRELAP5 calculated values. {{

}}^{2(a),(c)} Considering instrumentation and other measurement uncertainties and the NRELAP5 modeling simplifications, the results are considered reasonable, confirming the accuracy of the NRELAP5 heat transfer coefficient calculations.

Impact on DCA:

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



RAIO-0918-61763

Enclosure 3:

Affidavit of Zackary W. Rad, AF-0918-61765

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 analyses by which NuScale develops its NIST-1 HP-02 testing.

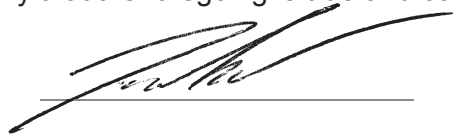
NuScale has performed significant research and evaluation to develop a basis for this analyses and has invested significant resources, including the expenditure of a considerable sum of money.

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. 377, eRAI No. 9380. 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 September 13, 2018.



Zackary W. Rad