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RAIO-0819-66823

August 28, 2019

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. 8990 (eRAI No. 8990) 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. 8990 (eRAI No. 8990)," dated September 19, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 8990 (eRAI No.8990)," dated November 20, 2017
3. 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) 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. 8990:

- 15.06.05-7

Enclosure 1 is the proprietary version of the NuScale Supplemental Response to NRC RAI No. 8990 (eRAI No. 8990). 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 Matthew Presson at 541-452-7531 or at mpresson@nuscalepower.com.

Sincerely,

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

Distribution: Gregory Cranston, NRC, OWFN-8H12
Samuel Lee, NRC, OWFN-8H12
Rani Franovich, NRC, OWFN-8H12
Michael Dudek, NRC, OWFN-8H12

Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8990, proprietary

Enclosure 2: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8990, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0819-66824

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8990, proprietary

Enclosure 2:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8990, nonproprietary

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

Response to Request for Additional Information
Docket: PROJ0769

eRAI No.: 8990

Date of RAI Issue: 09/19/2017

NRC Question No.: 15.06.05-7

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, the primary heat transfer processes include condensation heat transfer to the containment vessel (CNV) inside wall, conductive heat transfer though the CNV wall and convective heat transfer from the CNV outside wall to the reactor cooling pool. These heat transfer capabilities are critical to cool the reactor core and remove decay heat. The Loss-of-Coolant Accident (LOCA) Evaluation Model topical report did not clearly define how each of these heat transfer processes are calculated in the NRELAP5 code models and did not clearly describe the impact of uncertainty in these models and processes on ability of the CNV to function and provide emergency core cooling system (ECCS) condensate flow back to the reactor pressure vessel (RPV).

During any RPV liquid space LOCA, part of the high energy fluid released from the RPV will flash to steam and expand into the CNV volume. During any RPV steam space LOCA, the high pressure RPV steam will expand into the CNV volume. Regardless of the break location, blowdown ensues and when the differential pressure difference between the RPV and CNV reaches the design blocking pressure, the Reactor Recirculation Valves (RRV) and Reactor Vent Valves (RVV) are all designed to open to equalize the pressure and initiate the ECCS function of the CNV. After these valves open, the added rapid liquid volume flows from the RRVs and steam volume flows from the RVVs, causing the pressures between these two volumes to equalize in a short time {{ }}2(a)(c).

NuScale uses their version of RELAP5-3D (NRELAP5) to evaluate the single and two phase liquid flows between the RPV and CNV. However, the application of RELAP5 to the unique NuScale design, which incorporates a high pressure CNV space that functions as both a containment and ECCS, is a new application of RELAP5 that requires detailed and complete descriptions of the models, equations and methods used to calculate (1) steam temperature and pressure in the CNV, and (2) heat transfer from the CNV steam space via condensation to the CNV wall.

In the LOCA evaluation model topical report and the NRELAP5 theory manual (SwUM-0304-17023, Revision 4), the application of the condensation heat transfer correlations is not sufficiently clear. The staff needs more information on the NRELAP5 wall heat transfer computation processes. An initial list of items needed is as follows:

1. NuScale has indicated that the {{

}}[2(a)(c)] of application to theNuScale power module (NPM). Please provide detailed numerical calculation procedures on how the Shah and {{

}}[2(a)(c)] are actually used in the NRELAP5 code. Please provide Re#, film thickness, Nu#, condensation heat transfer correlation (HTC), and overall HTC calculations for three consecutive nodes in the top, middle, and bottom portions of the CNV where steam is condensing on the CNV wall and then flowing down the CNV wall as a thin film.

2. Please identify the specific CNV nodes in the LOCA results where the majority of the condensation is occurring (i.e., for nodes 500-22, 500-21, and 500-20, which are linked with heat structures (HSs) 5104-014, 5014-013, and 5014-012, respectively) and provide the following for those nodes:

   a. Describe the method used to calculate the Reynolds number for the node as an input for the determination of the steam condensation heat transfer coefficient;

   b. Provide equations used to calculate the heat transfer coefficient, film flow and thickness, and total steam condensation rate from the top to the bottom and the node average heat removal based on the dimensionless vapor velocity parameter, J_g;

   c. Provide boundary conditions used to ensure that the correct film flow rate per unit periphery is determined at each node interface and is then transferred to the next node down the CNV;

   d. Specify any limits imposed on steam condensation heat transfer or heat removal rate; and

   e. Describe how NRELAP5 calculates heat convection and conduction to the CNV wall surfaces below the liquid water level inside the CNV.

3. The staff needs to better understand event progression during the period just after ECCS opens and peak CNV pressure is reached for a liquid space LOCA (e.g., chemical volume and control system [CVCS] 100% break). For the three CNV nodes and associated HSs identified in Item 2, list key calculation steps used in the NRELAP5 code with results and show how computations are implemented for equations in Section 2.6.2.5 of the theory manual for condensation heat transfer.

4. Describe the equations, models and methods used in NRELAP5 to calculate the transient heat flow from the inside surface of the CNV to the ultimate heat sink pool outside the CNV. Describe the initial boundary conditions applied to solving the transient heat conduction equation for the CNV. For the heat structures referenced above, describe how heat energy is conducted through the CNV wall to the pool and provide an assessment of the number of mesh points used.

5. Repeat the process (items 1-4) for a similar location of the NIST-1 heat transfer plate (HTP) with three corresponding nodes from the representative test, HP-06b "CVCS discharge pipe break," where condensation heat transfer is highest.

6. Since the {{ }}2(a)(c), please provide an uncertainty band based on the uncertainty analysis using NuScale-specific experimental data or any other applicable and credible separate effects test data.

7. The {{ }}2(a)(c) did not have enough resolution for NRC staff to reach a conclusion. In particular the NRC staff seeks a better understanding of the period before the peak CNV pressure is reached for a liquid space LOCA (CVCS 100% break). Please demonstrate the relative effects of heat transfer mechanisms on the peak containment pressure {{ }}2(a)(c) with better resolution.

NuScale Response:

This response provides information which supplements the original response to eRAI No. 8990, found in RAIO-1117-57291 (ML17324B392), November 20, 2017. The markups to Topical Report (LTR), "Loss-of-Coolant Accident Evaluation Model," TR-0516-49422, Revision 0 overlap with the supplemental reponse to RAI 9208, which is being submitted concurrently. Therefore, the same markups to the LTR are being submitted with both supplemental responses.

Sections 6.8, 8.2, and 8.3 have been updated to clarify that the condensation on the containment vessel (CNV) inside surface is expected to be dominated by turbulent film condensation. However, the extended Shah correlation in NRELAP5 conservatively uses laminar film condensation based on the Nusselt theory. Additional discussion is provided in Section 6.8 on how the liquid film Reynolds number is calculated in NRELAP5. The film Reynolds number used in the laminar part of the extended Shah correlation is consistent with the liquid film Reynolds number definition in the Nusselt laminar film condensation correlation.

Additional updates provided in Section 8.2.8 and Tables 8-18 and 8-19 provide validation of the NRELAP5 approach for calculation of condensation in CNV based on the assessments against the NIST-1 integral effects test (IET) and separate effects test (SET) data. Descriptions of testing done in HP-43 and HP-49 are addded to Table 7-6.

Footnotes added to Tables 8-1, 8-18 and 8-19 to clarify that the high ranked phenomenon “Heat Transfer to/from/in CNV” includes film condensation and pool convection at the CNV inside surface, conduction through the CNV wall, and convection and boiling at the CNV outer surface.

Section 8.3.5 is added to summarize the high ranked phenomena affecting the peak containment pressure. A reference was added for the technical report, "Containment Response Analysis Methodology," TR-0516-49084, Rev. 1. Minor updates were also made to the discussions in Sections 7.5 and 8.4.

Impact on Topical Report:

Topical Report TR-0516-49422, Loss-of-Coolant Accident Evaluation Model, Sections 6.8, 7.5, 8.2, 8.3, and 8.4; Table 6-1, Table 6-2, Table 7-6, Table 8-1, Table 8-18, and Table 8-19; Figure 6-3, Figure 8-1, and Figure 8-2, have been revised as described in the response above and as shown in the markup provided in this response.

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}}2(a),(c)

6.8 Wall Heat Transfer and Condensation

Due to the significance of CNV wall heat transfer in reactor core cooling and decay heat removal during a postulated NPM LOCA (see Section 8.2.8), a detailed discussion is presented in this section on NRELAP5 wall heat transfer and condensation models. {{

}}2(a),(c)

As described below, the {{

}}2(a),(c)

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}}2(a),(c)

Section 6.8.1 below provides further discussion on NRELAP5 evaluation of the wall heat transfer with film condensation. The discussion includes the definition of the liquid (film) Reynolds number, partitioning of the total wall heat flux between liquid and vapor phases, and handling the effect of the non-condensable gases that may be present in the hydrodynamic volume. Section 6.8.2 summarizes the extended Shah correlation used in NRELAP5 for wall condensation.

6.8.1 NRELAP5 Solution Approach for Wall Condensation Heat Transfer

NRELAP5 solves {{

}}2(a),(c)

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}}2(a),(c)

Figure 6-3. {{ }}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

6.8.2 Wall Condensation Correlation

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}}2(a),(c)

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}}2(a),(c)

Table 6-1. Extended Shah dimensionless vapor velocity transition criteria

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}}2(a),(c)

Table 6-2. Extended Shah condensation heat transfer coefficients dependent on regime

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}}2(a),(c)

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

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

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}}^2(a),(c)

~~Table 6-1. Dimensionless vapor velocity transition criteria for condensation~~

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}}^2(a),(c)

~~Table 6-2. Regime Nusselt relations for condensation~~

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}}^2(a),(c)

7.5.3 Facility Test Matrix

This NIST-1 facility is used to perform design certification IETs and SETs for the purpose of validating NuScale computer codes, model development and assessment, correlation development, verifying compliance with design requirements, demonstrating design features and capabilities, and addressing regulatory concerns.

This section briefly describes the test matrix for the NIST-1 facility. Descriptions of tests used for NRELAP5 code validation are provided in Table 7-6. These are the NIST-1 tests that are the essential subset of tests required to validate NRELAP5 for NPM LOCA calculations.

Table 7-6. Facility high priority tests for NRELAP5 code validation

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

{{

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

Tests NIST-1 HP-06, HP-07 and HP-09 are the IETs that are used for validating the NRELAP5 EM for LOCA applications. Test HP-09 is included because spurious opening of an RVV results in the bounding RPV depressurization rate. Tests NIST-1 HP-43 and HP-49 were performed to support the extension of LOCA EM for the analysis of transients initiated due to inadvertent opening of RPV valves. Further discussion on the NRELAP5 validation results against these tests is provided in Appendix B. These tests also supported the containment response analysis methodology.

7.5.4 Separate Effect High Pressure Condensation Tests

The NIST-1 facility HP-02 test was used to assess the capability of NRELAP5 to predict condensation rates at high pressure test conditions by comparing experimental data and NRELAP5 predictions.

7.5.4.1 Facility Description

The HP-02 test is an SET performed at the NIST-1 facility. The test involves injecting steam at known conditions into the CNV and measuring the CNV pressure, level, and temperature response. Only the CNV, CPV, and interconnecting HTP are important to this test. During testing, the RPV was pressurized and heated using core heat to supply superheated steam from the SG to the CNV at the desired mass flow rate.

The feedwater flowrate was measured with individual Coriolis flowmeters to each of the three SG inlet tube banks. Also, one Coriolis meter measured the total SG feedwater inlet flow and one vortex flowmeter measured the total steam flow at the SG exit. The Coriolis flowmeter measuring the combined inlet flow was used as a mass flow boundary

Table 8-1. Dominant NRELAP5 models and correlations

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}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

Table 8-2 is a summary of the estimated range of key parameters over which each dominant model or correlation should be applicable for the NPM steady-state and design basis LOCA. Parameter ranges obtained are intended to identify the minimum range that needs to be covered; the applicability of models and correlations are not restricted to these ranges. Several sources are used to obtain the values of the ranges. This includes design values, proposed technical specification limits, and limiting initial and boundary conditions. The ranges for some parameters are obtained from NRELAP5 LOCA break spectrum calculations described in Section 9.0. An explanation of how each limiting range was determined is provided in the Comments column of Table 8-2.

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}}2(a),(c)

8.2.8 {{ }}2(a),(c)

8.2.8.1 Background

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

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

8.2.8.2 Technical Evaluation

Figure 8-1 shows a schematic of the major heat transfer modes governing the heat transfer across the CNV wall. {{

}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

Figure 8-1. CNV wall heat transfer modes

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}}2(a),(c)

Figure 8-2. Thermal resistance network between CNV and UHS

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}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

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

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}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

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

8.2.9 {{ }}2(a),(c)

8.2.9.1 Background

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}}2(a),(c)

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}}2(a),(c)

In addition to the above IETs, two more IETs were performed in the NIST-1 facility; HP-43 (Inadvertent opening of RVV without DHRS) and HP-49 (Inadvertent opening of RRV without DHRS) (see Table 7-6). The results of NRELAP5 assessment against these test data are available in Appendices B and C. As shown in Sections 7.5.5 to 7.5.8 and Appendices A and B, in general, NRELAP5 predicted the NIST-1 IET data with excellent agreement. This shows that NRELAP5 is capable of predicting the phenomena and process occurring in the NIST-1 facility including system interactions. Further, evaluations of these assessments for each high-ranked PIRT phenomenon are summarized in Table 8-19~~Table 8-14~~.

8.3.4 Evaluation of NuScale Integral Effects Tests~~Facility~~ Distortions and NRELAP5 Scalability

The scaling and distortion analysis summarized in Section 8.3.2.4 identified and quantified scaling distortions in the as-built NIST-1 facility {{

}}2(a),(c)

The NuScale NRELAP5 LOCA EM was updated to simulate NIST-1 IETs HP-05, HP-06, HP-06b, HP-07, and HP-09 in the NPM. {{

}}2(a),(c)

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}}2(a),(c)ECI

~~Figure 8-22. Comparison of HP-06 containment vessel liquid level to test data~~

8.3.5 Calculation of Peak CNV pressure

Since containment is integral part of the NPM ECCS, Section 4.3 identifies peak containment pressure as one of the LOCA EM FOMs. However, as identified earlier in Sections 4.3, the peak containment pressure and temperature for containment performance are calculated with a different methodology (see the Containment Response Analysis Methodology - Reference 109). The top-down scaling analysis of Π groups representing the inventory and energy balance equations (see Section 8.3.2) can be used to provide more insights on the processes/phenomena governing the peak containment pressure. It was observed that the CNV pressurization during Phase 1a of the liquid space break is governed by {{

}}2(a),(c). As described in Section 9 of this report, the peak CNV pressure occurs following ECCS actuation in liquid space breaks. It was observed that the major processes that contribute to CNV pressurization during the early part of Phase 1b are {{

}}2(a),(c)

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}}2(a),(c)

8.4 Summary of Adequacy Findings

8.4.1 Findings from Bottom-Up Evaluation

The bottom-up evaluation focused on determining the pedigree, applicability, fidelity to SET data, and scalability of the NRELAP5 closure relations and correlations that model the high-ranked phenomena as determined by the PIRT panel.

The pedigree of the identified closure relations and correlations was first established based on their historical development and subsequent assessment in the literature. Assessment cases were then identified to demonstrate the capability of NRELAP5 to predict the experimental data responses with reasonable-to-excellent agreement. Applicability of NRELAP5 to model the subject phenomena is established by demonstrating that the assessment cases cover the range of parameters that approximates the NPM range. The scalability evaluation was limited to whether the specific model or correlation is applicable for the NPM configuration over the range of conditions encountered in LOCA events.

Results of the bottom up evaluation are summarized in Table 8-18~~Table 8-13~~.

Table 8-18. Summary of bottom-up evaluation of NRELAP5 models and correlations

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}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

Table 8-19. Applicability summary for high-ranked phenomena

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}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

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}}2(a),(c)

8.4.3 Summary of Biases and Uncertainties

The NRELAP5 based LOCA EM was evaluated for applicability to analyzing LOCA events in the NPM. The applicability evaluation confirmed that the models and correlations in the NuScale LOCA EM are acceptable for simulating the important, i.e., high ranked, phenomena that determine the NPM response. Results of the LOCA EM applicability evaluation based on the bottom-up approach are summarized in Table 8-18~~Table 8-13~~. The overall evaluation of NRELAP5 applicability based on the top down approach is summarized in Table 8-19~~Table 8-14~~. The summaries in these tables show that the code is applicable for predicting LOCA response for the high-ranked phenomena that govern LOCA response in the NPM. A key element of the applicability confirmation is provided by SET and IET assessments that demonstrate reasonable-to-excellent agreement between NRELAP5 predictions and relevant experimental data.

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97. Saha, P., and N. Zuber, "Point of Net Vapor Generation and Vapor Void Fraction in Subcooled Boiling," *Proceedings Fifth International Heat Transfer Conference*, September 3-7, 1974, Tokyo, Japan: 4:175-179.
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100. U.S. Nuclear Regulatory Commission, "Design-Specific Review Standard for NuScale SMR Design," Chapter 15, Section 15.6.6, Rev.0, June 2016.
101. U.S. Nuclear Regulatory Commission, NUREG-0800, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition, Section 15.6.1, Revision 2, March 2007.
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104. U.S. Nuclear Regulatory Commission, NUREG-0800, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition, Section 5.2.3, Revision 2, March 2007.
105. GE Nuclear Energy, “ABWR Design Control Document,” Revision 4, March 1997.
106. U.S. Nuclear Regulatory Commission, “Applying Statistics,” NUREG-1475, Rev. 1, March 2011.
107. U.S. Nuclear Regulatory Commission, "Design-Specific Review Standard for NuScale SMR Design," Chapter 15, Section 15.0, Rev. 0. June 2016.
108. U.S. Nuclear Regulatory Commission, NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design, Main Report," July 1994
109. NuScale Power, LLC, "Technical Report: Containment Response Analysis Methodology," TR-0516-49084, Rev. 1, June 2019.

Enclosure 3:

Affidavit of Zackary W. Rad, AF-0819-66824

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 loss of coolant accident analysis.

    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. 8990, eRAI No. 8990. 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, 2019.

Zackary W. Rad