UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 12, 2019

MEMORANDUM TO: Samuel S. Lee, Chief
Licensing Branch 1
Division of Licensing, Siting,
and Environmental Analysis
Office of New Reactors

FROM: Rani L. Franovich, Senior Project Manager ***/RA/***
New Reactor Licensing Branch
Division of New and Renewed Licenses
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF THE JANUARY 9, 2019, MARCH 5, 2019, APRIL 23, 2019, AND AUGUST 12, 2019, PUBLIC TELECONFERENCES WITH NUSCALE POWER, LLC, TO DISCUSS REQUESTS FOR ADDITIONAL INFORMATION IN TOPICAL REPORT TR-0516-49416-P, "NON-LOSS-OF-COOLANT ACCIDENT ANALYSIS METHODOLOGY," (DOCKET PROJ0769)

On January 9, 2019, March 5, 2019, April 23, 2019, and August 12, 2019, representatives of the U.S. Nuclear Regulatory Commission (NRC) and NuScale Power, LLC (NuScale), held a series of public teleconference meetings to discuss several topics related to the Non-loss-of-coolant accident analysis methodology. These topics were the subject of the NRC staff's Requests for Additional Information Nos. 9158, 9351, 9374, 9466, and 9513.

A complete copy of NuScale's Design Certification Application is available on the NRC public Webpage at https://www.nrc.gov/reactors/new-reactors/design-cert/nuscale/documents.html.

Enclosure 1, "Summary of the January 9, 2019, March 5, 2019, April 23, 2019, and August 12, 2019, Teleconference between the NRC Staff and NuScale," provides a summary of the topics discussed during the teleconference.

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The agenda and list of meeting attendees are provided in Enclosures 2 and 3, respectively. The meeting notices are available in the NRC's Agencywide Documents Access and Management System, under Accession Nos. ML18323A468, ML19028A386, ML19067A042, and ML19196A282.

Docket No. 52-048

Enclosures:
1. Meeting Summary
2. Agenda
3. Attendees

SUBJECT: SUMMARY OF THE JANUARY 9, 2019, MARCH 5, 2019, APRIL 23, 2019, AND AUGUST 12, 2019, PUBLIC TELECONFERENCES WITH NUSCALE POWER, LLC, TO DISCUSS REQUESTS FOR ADDITIONAL INFORMATION IN TOPICAL REPORT TR-0516-49416-P, "NON-LOSS-OF-COOLANT ACCIDENT ANALYSIS METHODOLOGY," (DOCKET PROJ0769)
DATED: OCTOBER 12, 2019

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ADAMS Accession No.: ML19289C398 ***via email** **NRC-001**

OFFICE	NRR/DNRL/NRLB: PM	NRR/DNRL/NRLB: LA	NRO/DSRA/SRSB: BC
NAME	RFranovich	MMoore*	RKaras*
DATE	9/27/2019	10/12/2019	10/01/2019

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U.S. NUCLEAR REGULATORY COMMISSION

SUMMARY OF JANUARY 9, 2019, MARCH 5, 2019, APRIL 23, 2019,

AND AUGUST 12, 2019

PUBLIC TELECONFERENCES WITH NUSCALE POWER, LLC

Topical Report TR-0516-49416-P, "Non-Loss-of-Coolant Accident Analysis Methodology" (Non-LOCA LTR)

Request for Additional Information No. 9351

On January 9, 2019, the U.S. Nuclear Regulatory Commission (NRC) staff sought clarification of several items included in the NuScale Power, LLC's (NuScale or the applicant) July 13, 2018, response to Request for Additional Information (RAI) 9351, Question 15.00.02-32 (see Agencywide Documents Access and Management System (ADAMS) Accession No. ML18194A747):

1. Part (b) of the response includes Table B-1, which shows the impact of biasing single parameters on initial steam generator (SG) level and minimum critical heat flux ratio (MCHFR) for the increase in feedwater flow event. The text below the table states that low feedwater temperature and high steam pressure were individually more limiting; however, the individual SG heat transfer bias was less conclusive. The NRC staff requested NuScale to explain this statement and, in addition, explain why the biases for feedwater temperature and steam pressure were deemed conclusive, while the SG heat transfer bias was not. NuScale responded that looking at parameters in Table B-1 of the response, with the exception of SG heat transfer, it is common sense as to which direction will be more limiting with respect to critical heat flux (CHF). Conversely, one cannot determine at first blush what the limiting SG heat transfer bias will be when combined with other parameter biases because the other biases affect SG behavior, as the non-loss-of-coolant accident (non-LOCA) methodology does not impose controls or restrictions on SG level or superheat. Low or nominal SG heat transfer is limiting for CHF when biasing other parameters simultaneously. The staff notes this is in contrast to the single-effects sensitivity study, which showed that when all other parameters are held at their nominal value, biased-high SG heat transfer is limiting. In addition, NuScale noted that one parameter in Table B-1 (SG tube plugging) shouldn't be there. The calculations for the rest of table were performed under nominal conditions; however, tube plugging was not done under nominal conditions. NuScale agreed to supplement the RAI response to more clearly address tube plugging in a new table.

2. Also in part (b) of the response, the statement underneath Table B-1 that the "low level" set of biases caused a trip on low steam superheat and not high steam pressure does not appear consistent with the paragraph underneath Table B-5 of the response or the topical report (TR) markup (page 308), which states that maximum/biased-high SG performance results in a high steam pressure trip rather than a low steam superheat trip. The NRC staff requested NuScale to explain the apparent discrepancy. NuScale agreed with the observation, noting that the high, not low, level set of biases caused a trip on

low steam superheat and not high steam pressure. NuScale agreed to supplement the RAI response to correct the error.

3. The NRC staff requested NuScale to explain the meaning of the negative bias for SG tube plugging in Table B-1 of the response, which seems to imply decreased tube plugging. NuScale clarified that more tubes were plugged for this case and reiterated that a new table will be added to more clearly address tube plugging.

4. Related to part (c) of the response as well as the response to RAI 9483, Question 15.01.01-5, the NRC staff asked NuScale if the bias directions reported in the response to RAI 9483, Question 15.01.01-5, were determined according to the updated increase in feedwater flow methodology presented in the response to RAI 9351, Question 15.00.02-32 (i.e., was SG heat transfer bias varied)? In its response to RAI 9483, Question 15.01.01-5, NuScale showed that a low steam generator heat transfer bias was applied for the increase in feedwater flow event. The staff noted that NuScale had proposed to update the non-LOCA methodology according to the response to RAI 9351, Question 15.00.02-32, such that SG heat transfer is a varied parameter for each final safety analysis report (FSAR) analysis rather than automatically biased low. The NRC staff asked if the updated non-LOCA methodology was applied in identifying the limiting FSAR increase in feedwater flow case (i.e., if NuScale considered varied SG heat transfer biases or considered only the low bias). NuScale responded that the response to RAI 9483 was submitted prior to the response to RAI 9351, Question 15.00.02-32 and, as such, the SG heat transfer bias was not varied to determine the limiting bias direction. NuScale agreed to update the FSAR increase in feedwater flow calculation to vary the SG heat transfer bias and will supplement RAI No. 9483 if necessary.

   It should be noted that a later supplemental response to RAI 9466, Question 15.00.02-6 (ADAMS Accession No. ML19212A796), removed the application of a SG heat transfer bias based on insensitivity of non-LOCA figures of merit to the parameter.

5. Related to part (d) of the response, the NRC staff noted that the current “Basis” for SG tube plugging in TR Table 7-14 (and tables for other events) seemed to explain why SG tube plugging is not varied but did not justify why biasing to the low condition is appropriate. The staff noted that the sensitivity case discussed in part (d) of the RAI response provides a basis, and the NRC staff asked if such a basis could be added to the “Basis” for SG tube plugging in the appropriate event-specific initial conditions, biases, and conservatisms tables. NuScale responded that such a basis could be added and reiterated that the revised RAI response will have a new table that more clearly shows the effect of SG tube plugging.

6. In the markups of TR Table 7-14, the NRC staff noted that it appeared the “Bias/Conservatism” for SG heat transfer should be changed from “low” to “varied” in accordance with the other markups. In addition, one “Basis” note should be clarified for consistency with other entries in the table. NuScale acknowledged and agreed to supplement the RAI response to correct the “Bias/Conservatism” direction for SG heat transfer. NuScale further indicated it would consider clarifying the “Basis” note.

7. The NRC staff observed that the new title of TR Table 7-15 should refer to high SG performance, not low SG performance, as shown in the TR markups. Similarly, it appears that the new title of Table 7-16 should refer to low SG performance, not high SG performance. NuScale acknowledged and agreed to supplement the RAI response to correct the error.

RAI No. 9466

On January 9, 2019, the NRC staff sought clarification of several items included in NuScale's July 3, 2018, response to RAI 9466, Question 15.00.02-7 (see ML18184A589). Specifically, the response refers to the non-LOCA submittal (Section 7.1.5.3 of TR-0516-49416-P), stating that the limiting nature of a specific combination of decay heat curve, decay heat multiplier, and actinide contribution is confirmed for each fuel cycle. While this approach appears appropriate to confirm that the decay heat modeling remains valid from cycle to cycle, it did not provide the staff the desired knowledge of the degree of conservatism in the decay heat standards and modeling assumptions described in TR-0516-49416-P for application to heatup and cooldown events.

1. The NRC staff requested NuScale to discuss whether the use of ANS73 model for decay heat and the ANS79 model for actinides is representative of the NuScale Power Module fuel design and operational condition (e.g., burnup). NuScale responded that the intent of the methodology discussed in TR-0516-49416 is to establish upper and lower decay heat limits that will be imposed on the cycle design when licensing reload cycles. As part of the reload methodology, the decay heat for each cycle design will be evaluated against the decay heat assumptions used in the FSAR analyses. If the actual decay heat for a cycle is not bounded by the assumed decay heat curve/multiplier/actinide contribution combination, the cycle would be redesigned so that it remains bounded. However, NuScale would not expect redesign to be necessary based on the values in TR-0516-49416. NuScale agreed to review TR-0516-49416 to ensure the applicant's intent is clear in the documentation, with the potential for a supplement if needed.

2. The NRC staff asked NuScale to describe what the 1973 ANS decay heat model as adjusted with 1979 actinides and other parameters is compared to for each fuel cycle (e.g., is it compared to decay heat generation as a function of time for a representative cycle?). NuScale responded that the comparison would be made to the decay heat generation as a function of time for the particular reload cycle, which satisfactorily completed the NRC staff's understanding.

3. The staff also sought demonstration that the aforementioned standards, in conjunction with the choice of multiplier values for decay heat (with contributions from actinides) is conservative for both heatup and cooldown non-LOCA events. The staff noted in its Chapter 15 audit that an ORIGEN calculation existed for an equilibrium cycle that appeared to show that the decay heat curves calculated using the minimum and maximum decay heat methodology sandwiched the ORIGEN best-estimate decay heat curve. The staff requested confirmation of whether the staff's interpretation of this calculation is correct. NuScale confirmed that the staff's understanding is correct. This sort of demonstration would be performed as part of a reload analysis. The NRC staff noted that NuScale's confirmation is supported by materials audited by the NRC staff as well as statements in the RAI response and in TR-0516-49416, and completed the NRC staff's understanding.

SIET TF-2 Tests and NRELAP5 Assessment (RAI Nos. 9351 and 9466)

On January 9, 2019, the NRC staff and NuScale discussed these topics, which involved proprietary information and were conducted on a closed bridgeline.

RAI Nos. 9466 and 9513

On January 9, 2019, the NRC staff shared the following administrative and editorial items with NuScale regarding the responses to RAI Nos. 9466 and 9513.

1. The markup provided with the response to RAI 9466, Question 15.00.02-13, is acceptable. However, the topical report number under “NuScale Response,” is TR-0716-50350 instead of TR-0516-49416. The NRC staff did not view an update to this aspect of the response as necessary since the topical report will eventually be updated according to the markup, but if NuScale were to submit an updated response due to other questions in the RAI anyway (additional discussions on RAI No. 9466 are anticipated with talking points under development), perhaps they would consider updating this. NuScale acknowledged the error and agreed to supplement the RAI response.

2. The response to RAI 9513, Question 15.00.02-20, and the attached markups appear acceptable; however, it appears to the staff that a conforming change should be made to FSAR Table 15.0-8, “Reactivity Coefficients,” as the maximum power level listed for the uncontrolled control rod assembly withdrawal from subcritical or low power is 25 percent. NuScale acknowledged the observation and agreed to supplement the RAI response.

3. The response to RAI 9513, Question 15.00.02-21, addressed all requested points except for those involving the non-LOCA topical report Figures 5-36 and 5-37, which appear identical. The NRC staff requested NuScale to supplement the response to address the error. NuScale stated it had already done so, and the NRC staff located the response at ADAMS Accession No. ML18304A328.

During the January 9, 2019, teleconference, NuScale agreed to a follow-up call with the NRC staff to discuss a path forward for the steam generator heat transfer uncertainty concerns (related to RAI 9158, Question 15.00.02-5; RAI 9351, Question 15.00.02-33; and RAI 9466, Question 15.00.02-6). NuScale also agreed to consider revising the non-LOCA topical report with respect to decay heat methodology (related to RAI 9466, Question 15.00.02-7).

The follow-up call was conducted on March 5, 2019. NuScale indicated it had determined that the application of a SG heat transfer bias is not necessary because the sensitivity calculations it performed demonstrated a lack of sensitivity. Therefore, it is desirable to eliminate biasing of the SG heat transfer to the extent possible for the Non-LOCA LTR (TR-0516-49416). In this instance, the bias would be denoted as "nominal" and the basis would be that for the event of interest. NuScale enumerated the events and acceptance criteria of interest and performed a review of the Non-LOCA LTR and associated calculations to assess the resulting changes in steam generator heat transfer and associated basis, thereby demonstrating that the impacts were non-existent or insignificant (see Attachment “CH 15 Questions Non-Prop”).

On April 23, 2019, the NRC staff and NuScale met again to discuss the Non-LOCA LTR, and specifically RAI Nos. 9374 and 9466.

RAI No. 9374

RAI 9374, Question 15.00.02-22, pertains to NIST-1 vs. NuScale Power Module (NPM) nodalization and fluid and structural time constants. The staff questioned aspects of NuScale's September 26, 2018, response (see ADAMS Accession No. ML18269A360). Specifically, the NRC staff sought clarification of how the fluid characteristic time portion of the response addresses the impact of the differences between NIST-1 and NPM modeling on the decay heat removal system (DHRS) response. The staff asked NuScale to quantify the fluid transport time by providing the ratio of nodal length to fluid velocity (in the case of a two-phase mixture, the vapor velocity should be used) for each NIST-1 and NPM DHRS cell in three distinct, representative time frames. NuScale requested the staff to clarify its overarching concern. The staff restated the importance of ensuring that the conclusions of benchmarking studies are preserved when performing the NPM calculation. This includes ensuring that temporal and spatial gradients are preserved between the test facility and the NPM. The applicant reiterated and clarified portions of the RAI response, including that fluid transport times may not be meaningful in a condensing system in a quasi-steady mode. The applicant stated that the steam velocity, node length, and material Courant time are comparable between NIST-1 and the NPM. The user-specified time step is limiting compared to the Courant time step. The staff noted that user-specified time steps would also need to be consistent between NIST-1 and the NPM to ensure preservation of temporal gradients.

The NRC staff and NuScale discussed the structural characteristic time portion of the response and the degree of impact on the DHRS response in a closed portion of the meeting because it involved proprietary information.

The NRC staff expressed concern about the nodalization and geometry differences between NIST-1 and the NPM and the resulting the impact on the predicted DHRS response and requested NuScale to (1) quantify of the overall impact from the nodalization and geometry differences and (2) justify the differences in DHRS response behavior. NuScale reiterated that the purpose of the separate effects tests was to examine steady-state DHRS behavior, although the HP-04 tests involved some limited transient behavior. The applicant performed some nodalization sensitivity calculations as part of the HP-04 assessment and observed no significant impact on the comparison to measured data.

The NRC staff expressed concern that the response did not address the use of the scaled DHRS for the NIST-1 integral effects tests NLT-02a, NLT-02b, and NLT-15p2. The staff had not seen any scaling analyses for the scaled DHRS and asked NuScale to address the questions posed in the RAI and in this follow-up question in terms of the integral effects tests. NuScale responded that DHRS performance is a relatively unimportant sensitivity when calculating margin to acceptance criteria for non-LOCA events. Therefore, the level of detail in DHRS modeling, including temporal effects, is also inconsequential. Even with some variability in DHRS cooling, the overall conclusions on acceptance criteria for non-LOCA events would not change because limiting values for the acceptance criteria typically occur before DHRS actuation. The applicant committed to provide information in the NuScale electronic reading room, including sensitivity cases, to illustrate this point. The applicant also proposed a follow-up call, which the staff agreed would be the best course of action.

RAI No. 9466

RAI 9466, Question 15.00.02-12, pertains to nodalization of test facilities and plant models. The staff questioned NuScale's September 27, 2018, response (see ADAMS Accession No. ML18270A469). Specifically, the NRC staff noted that although NuScale provided nodalization diagrams for KAIST and SIET tests (Figures 1 through 3 of the RAI response), it is preferable to include these figures in Section 5.3 of the TR for completeness of the discussions. The applicant noted that the figures would be appended to the TR in the RAI response. The staff clarified that its comment is a preference and agreed that it is acceptable for the figures to be captured in an appendix to the TR. The NRC staff and NuScale discussed the SG (primary side) nodalization for NIST-1 compared to the NPM in a closed portion of the meeting because it involved proprietary information. Related to Part 3 of the response, the staff requested that the TR be updated to describe the modeling of steam line and feedwater line breaks described in the response since it appeared to be an aspect of the methodology. The applicant agreed to add this information to Section 7.2 of the TR.

RAI 9466, Question 15.00.02-11, pertains to applicability and use of a correlation for pool boiling and was discussed during a closed portion of the meeting because it involved proprietary information.

On August 12, 2019, the NRC staff and NuScale met again to discuss the Non-LOCA LTR, and specifically markups and figures included in NuScale's response to RAI 9158, Question 15.00.02-3. The NRC staff noted that the titles for Figures 5-152 to 5-157 did not clearly indicate where the fluid temperature locations are in reference to the DHRS and/or parts of the cooling pool vessel (CPV), similar to what was done for Figures 5-105 to 5-106. NuScale's clarified that the figures reflect the following regions relative to the DHRS heat exchanger:

- Figure 5-152: below the DHRS heat exchanger
- Figure 5-153: near the bottom of the DHRS heat exchanger
- Figure 5-154: near the midpoint of the DHRS heat exchanger
- Figure 5-155: just above the DHRS heat exchanger
- Figures 5-156 and 5-157: above the DHRS heat exchanger

The NRC staff noted that these regions and their associated numbers were consistent with those in Figures 5-105 to 5-106 and had no further questions regarding Figures 5-152 to 5-157.

Regarding Figures 5-152 and 5-153, the NRC staff asked what the two NRELAP5 series represent (e.g., certain cells/locations)? NuScale responded that the two series represent different cells in the cooling pool, similar to what is shown in the legends for Figures 5-154 through 5-157, except that the cell numbers are progressively lower for Figures 5-152 and 5-153. NuScale indicated that the cell numbers are shown in the calculation note supporting the NLT-15p2 test, and the staff noted that the staff's audit report could discuss the numbering based on the calculation note if needed. NuScale also stated that if they perform any additional editorial work on the non-LOCA topical report, they would look to incorporate the cell numbers in the referenced figure legends.

Lastly, the NRC staff noted several apparent typos that NuScale agreed to correct:

- Figure 5-136 shows 0-2,000 seconds, not 0-500 s as the figure title says. This figure should be switched with Figure 5-142, which shows 0-500 s.
- First sentence in 5.3.3.12 (markup page 252): "DRHS system" should be “DHRS.”
- Markup page 275, last sentence of paragraph 2, “pressurizer pressure” should be “pressurizer level.

U.S. NUCLEAR REGULATORY COMMISSION

SUMMARY OF JANUARY 9, 2019, MARCH 5, 2019, APRIL 23, 2019,

AND AUGUST 12, 2019,

PUBLIC TELECONFERENCE WITH NUSCALE POWER, LLC

MEETING AGENDA

Wednesday, January 9, 2019

Time	Topic	Speaker
3:00 pm – 5:00 pm	Topical Report TR-0516-49416-P, "Non-Loss-of-Coolant Accident Analysis Methodology RAIs 9158, 9351, 9466 and 9513	NuScale/NRC

Tuesday, March 5, 2019

Time	Topic	Speaker
3:30 – 5:00 pm	Follow-up to January 9, 2019, call regarding Topical Report TR-0516-49416-P, "Non-Loss-of-Coolant Accident Analysis Methodology RAIs 9158, 9351, 9466 and 9513	NuScale/NRC

Tuesday, April 23, 2019

Time	Topic	Speaker
1:00 – 2:30 pm	Topical Report TR-0516-49416-P, "Non-Loss-of-Coolant Accident Analysis Methodology RAIs 9374 and 9466	NuScale/NRC

Monday, August 12, 2019

Time	Topic	Speaker
3:00 – 4:30 pm	Topical Report TR-0516-49416-P, "Non-Loss-of-Coolant Accident Analysis Methodology RAI 9158	NuScale/NRC

LIST OF ATTENDEES

NRC Staff	1/9/19	3/5/19	4/23/19	8/12/19
A. Barrett	✓		✓	
R. Franovich	✓	✓	✓	✓
R. Harrington	✓			
R. Karas	✓	✓		
M. Khatib-Rahbar*	✓		✓	
P. Lien	✓			
S. Lu	✓			
J. Schmidt	✓	✓		
A. Siwy	✓	✓	✓	✓
R. Skarda	✓			
W. Tauche*	✓		✓	
NuScale				
A. Brigantic	✓	✓		
B. Bristol	✓	✓	✓	
M. Byram	✓	✓	✓	✓
P. Infanger	✓	✓	✓	
M. McCloskey	✓	✓	✓	✓
M. Presson			✓	✓
P. Sawant			✓	
H. Shen				✓
D. Throckmorton	✓	✓		
B. Wolf	✓			
Y. Yoo	✓		✓	
Public				
None				

* Denotes NRC contractor

✓ Denotes meeting participants