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

December 03, 2020

MEMORANDUM TO: Michael I. Dudek, Chief
New Reactor Licensing Branch
Division of New and Renewed Licenses
Office of Nuclear Reactor Regulation

FROM: Getachew Tesfaye, Senior Project Manager ***/RA/***
New Reactor Licensing Branch
Division of New and Renewed Licenses
Office of Nuclear Reactor Regulation

SUBJECT: AUDIT SUMMARY FOR THE REGULATORY AUDIT OF NUSCALE TOPICAL REPORT TR-0420-69456, REVISION 0, "NUSCALE CONTROL ROOM STAFFING PLAN"

By letter dated June 11, 2020, NuScale Power, LLC (NuScale) submitted licensing Topical Report TR-0420-69456, Revision 0, "NuScale Control Room Staffing Plan" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20163A556), for the U.S. Nuclear Regulatory Commission's (NRC's) review and approval. The topical report documents the technical justification for the NuScale control room staffing plan. It is intended that a license applicant using an NRC-approved NuScale Power Plant design as described by Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52 may use the topical report as an alternate method to establish its minimum licensed operator control room staff.

The purpose of this regulatory audit was to observe video recordings of the validation activities described in the topical report, review validation test data and results, and identify information that would require docketing to support a regulatory finding. Via teleconference, the NRC staff conducted an audit entrance meeting on August 17, 2020, and an exit meeting on September 10, 2020.

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The audit was conducted remotely via NuScale's electronic reading room and via telephone conferences.

Docket No. 999-02078

Enclosure:
As stated

cc w/encl.: DC NuScale Power LLC Listserv

SUBJECT: AUDIT SUMMARY FOR THE REGULATORY AUDIT OF NUSCALE TOPICAL REPORT TR-0420-69456, REVISION 0, "NUSCALE CONTROL ROOM STAFFING PLAN" DECEMBER 3, 2020

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AUDIT SUMMARY FOR THE REGULATORY AUDIT OF NUSCALE TOPICAL REPORT TR-0420-69456, REVISION 0, "NUSCALE CONTROL ROOM STAFFING PLAN"

1.0 BACKGROUND

By letter dated June 11, 2020, NuScale Power, LLC (NuScale) submitted licensing Topical Report TR-0420-69456, Revision 0, "NuScale Control Room Staffing Plan" (Reference 1, Agencywide Documents Access and Management System (ADAMS) Accession No. ML20163A556, non-proprietary version), for the U.S. Nuclear Regulatory Commission's (NRC's) review and approval. The topical report documents the technical justification for the NuScale control room staffing plan. It is intended that a license applicant using an NRC-approved NuScale Power Plant design as described by Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, may use the topical report as an alternate method to establish its minimum licensed operator control room staff.

The purpose of this regulatory audit was to observe video recordings of the validation activities described in the topical report, review validation test data and results, and identify information that would require docketing to support a regulatory finding. The audit entrance meeting was held on August 17, 2020, via teleconference. The audit included the NRC staff's review of docketed and non-docketed information via the NuScale electronic reading room (eRR) and teleconferences with NuScale.

Following the audit and prior to the issuance of this report, the NRC staff issued Request for Additional Information (RAI) 9789 (ADAMS Accession No. ML20296A161) as discussed in more detail in Section 7.0 below.

2.0 REGULATORY AUDIT BASIS

NuScale requests the NRC's approval of the NuScale control room staffing plan described in the topical report in lieu of staffing requirements set forth by 10 CFR Section 50.54(m) or other alternative control room staffing regulations. The NRC staff uses the guidance in NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," to determine whether the staffing proposal provides adequate assurance that public health and safety will be maintained at a level that is comparable to that afforded by compliance with the current regulations.

3.0 AUDIT LOCATION AND DATES

The audit was conducted via NuScale's eRR and a teleconference bridge line.

Dates: August 17 - 27, 2020

Locations: NuScale eRR

4.0 AUDIT TEAM MEMBERS

Brian Green, NRR/ DRO/IOLB
Lauren Nist, NRR/ DRO/IOLB
Maurin Scheetz, NRR/ DRO/IOLB
Jesse Seymour, NRR/ DRO/IOLB
Getachew Tesfaye, NRR/DNRL/NRLB

5.0 APPLICANT PARTICIPANTS

Doug Bowman – Operations
Ryan Flamand – Operations
Pat Leary – Operations
Jim Osborn – Licensing
Nadja Joergensen – Licensing
Deb Luchsinger – Licensing
Tim Tovar – Director, Operations

6.0 AUDIT DOCUMENTS

The staff audited the following documents provided by NuScale in the eRR:

Document Number	Document Title
RP-0215-10815	"Concept of Operations," Draft Revision 4
RP-0316-17617	"Human Factors Engineering Staffing and Qualifications Results Summary Report," Draft Revision 1
SwRN-0004-64804	"NuScale Simulator Release Note 1.0.0," dated May 16,2019
SwRN-0004-65553	"NuScale Simulator Release Note 2.0.0," dated June 5, 2019
n/a	"Revised Staffing Plan Test Data"
n/a	"Revised Staffing Plan Test Data (Original SPV Data)"
RP-0419-65209-P	"Revised Staffing Plan Validation Test Report," Revision 1
RP-1215-19691	"Conduct of Operations," Revision 1
RP-0519-65440	"Reduced Staffing Validation Scenario Based Test Report I," Revision 0
RP-0519-65441	"Reduced Staffing Validation Scenario Based Test Report II," Revision 0
RP-0519-65442	"Reduced Staffing Validation Scenario Based Test Report III," Revision 0
n/a	"Summary of HFE Task Analysis to sunset the STA position and integrate the CRS and SM position," Revision B
n/a	"Opening Statement" regarding Commission Policy Statements of 1985 and 1989

7.0 DESCRIPTION OF AUDIT ACTIVITIES AND SUMMARY OF OBSERVATIONS

The focus areas for the audit and the NRC staff's observations are discussed below.

(1) *The specific licensed operator qualifications and training program elements and the human system interfaces (HSI) design features that support the applicant's proposal to eliminate the STA position for the NuScale design.*

The staff discussed this topic with NuScale during a teleconference on August 27, 2020. NuScale cited information in NUREG-0737, "Clarification of TMI Action Plan Requirement," changes to licensed operator training programs that have occurred since the accident at Three Mile Island Unit 2, technological improvements, early integration of human factors engineering (HFE) in the design of the NuScale control room, and plant design features as justification for elimination of the Shift Technical Advisor (STA) from the NuScale plant design. The NRC staff issued RAI 9789, Question NTR-14, to request a revision to the topical report related to licensed operator training to support the staffing proposal.

(2) *Results of any additional studies or analyses, such as task analysis or qualifications analysis, that were performed in support of the revised staffing plan.*

The NRC staff reviewed the "Summary of HFE Task Analysis to sunset the STA position and integrate the CRS and SM position," detailing how tasks previously assigned to the STA were dispositioned to support the revised control room staffing plan described in the topical report. The following is a summary of the NRC staff's observations of the task analysis:

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RAI 9789, Question NTR-15, requests that NuScale provide a description of the task analysis, including a summary of how NuScale dispositioned the tasks that were assigned to the STA, and NuScale's conclusions from the task analysis on the docket.

(3) Changes to the Concept of Operations and the Conduct of Operations procedures made in support of the revised staffing plan.

During the audit, the NRC staff reviewed "Concept of Operations," draft Revision 4, which was revised to describe the roles and responsibilities of the control room operators in the revised staffing plan. The NRC staff issued RAI 9789, Question NTR-04, to that request information about the roles and responsibilities of the operators in the revised staffing plan, be docketed.

The NRC staff also reviewed "Conduct of Operations," which includes information regarding human performance tools that help to reduce human errors, such as three-way communication and peer-checking, which are commonly used in the commercial nuclear power industry; and information about the crew staffing complement including the need for {{

}}. During some of the scenario trials, the NRC staff observed that both reactor operators were involved in unit operations, and the control room supervisor/shift manager was heavily involved in phone communications with personnel outside the main control room (MCR). The NRC staff considered the availability of a non-licensed person on shift to be an important consideration for a facility licensee to ensure that the control room supervisor/SM can maintain command and control of the plant during abnormal events. As a result, the NRC staff issued RAI 9789, Question NTR-8, to request that this staffing assumption discussed in the "Conduct of Operations" be included in the topical report to support the revised staffing plan.

(4) Changes to the main control room (MCR) HSI and configuration design since the Integrated Systems Validation (ISV) test to support the revised staffing level. Additionally, changes made to the simulator testbed after ISV and prior to or during the revised staffing plan validation (RSPV).

The NRC staff observed that the revised staffing plan does not require HSI design or physical MCR changes.

The NRC staff reviewed the "Revised Staffing Plan Validation Test Report"; "NuScale Simulator Release Note 1.0.0"; and "NuScale Simulator Release Note 2.0.0"; to understand whether any changes to the simulator testbed occurred in between the ISV the RSPV. The RSPV Test Report and simulator software release notes indicate that two production releases were issued after the ISV simulator was certified and that NuScale evaluated the two releases for impact to the ISV simulator certification.

According to the RSPV Test Report and release notes, no changes were made to the plant model during the timeframe between completion of the ISV and performance of the RSPV, and therefore, the NuScale simulator remained certified to perform RSPV testing. The NRC staff noted that some improvements were made to the displays and alarms in the MCR as a result of issues identified during the Integrated System Validation. The NRC staff issued RAI 9789, to request that information from the RSPV Test Report regarding simulator performance testing prior to the RSPV, be included in the topical report.

The NRC staff reviewed the results of the scenario-based testing that was conducted for the RSPV scenarios, as documented in Reduced Staffing Validation Scenario Based Test Reports I, II, and III. These scenario-based testing reports documented the exercise of plant procedures, parameters trends that corresponded with expected responses, and appropriate alarm responses.

The NRC staff noted that the RSPV simulator did not model the power uprate associated with the Standard Design Application (SDA) 720 version of the design. The NRC staff asked NuScale if they anticipate the power uprate to impact the HSI design, operator actions and workload. NuScale stated that it did not expect significant changes to the HSI design and that if there are differences in operator actions, it would likely be related to the PRA assumptions for the SDA 720. The PRA for the SDA 720 has not been completed yet. The NRC staff issued RAI 9789, Question NTR-10, to request that NuScale provide the rationale for the conditions and limitations contained in the topical report and also explain why additional conditions and limitations are not needed for combine license (COL) applicants referencing the NuScale 720 standard design.

(5) Observe how critical safety functions are monitored by control room operators for multiple units during normal operations and plant transients and events.

One feature of the MCR HSI, as detailed in the “Conduct of Operations,” Revision 1, and in RP-0316-17619, “Human-System Interface Design Results Summary Report,” Revision 2, issued April 2019 (ADAMS Accession No. ML19119A397 (non-public version); ML19119A398 (public version)), is automated safety function monitoring, which provides the MCR operators a real-time status of the safety functions and alerts them to changes in safety function status. The “Conduct of Operations,” Revision 1, details the plant conditions, frequency and operator responsibilities for performing “safety function status checks” (SFSCs) of the three NuScale safety functions. The “Conduct of Operations” has not been updated for the reduced staffing plan model and states that the STA verifies safety function status using an electronic plant procedure and the Safety Display and Indication System (SDIS). NuScale stated that it does not plan to revise the “Conduct of Operations” because this is a document that a NuScale plant licensee will develop and maintain. NuScale developed it initially to support the ISV.

According to the RSPV Test Report, each RSPV scenario required the crew to perform SFSCs at least once, and the scenario acceptance criteria ({{ }}) were met with margin during each run of the RSPV scenarios. The average time to perform SFSCs during RSPV was {{ }}. The NRC staff observed the MCR operators perform SFCS in each of the recorded scenario trials. The NRC staff

observed that SFSCs were performed by either the CRS or one of the ROs, and the operators used MCS indications at their sit-down workstations instead of using the SDIS.

The NRC staff asked NuScale whether it was necessary for operators to use only the SDIS for SFSCs. NuScale stated that the MCS indications are just as reliable as the SDIS for SFSCs. SFCS were designed to be performed at the SDIS using an electronic plant procedure on a tablet. However, because of an issue with the tablets, the RSPV operators were directed to perform SFSCs using the MCS indications. NuScale also said that safety functions are automatically monitored by the MCS at all times and that the manual performance of SFSCs was included in the ISV and RSPV scenarios because it is a common task performed at large light water reactors in the United States, and it was used to add to the scenario workload.

(6) Verify that the revised staffing plan validation test was performed using an acceptable methodology.

The NRC staff reviewed the RSPV Test Report to better understand the test protocol and methodology used to conduct the validation as discussed in the topical report, Section 5.1 Staffing Plan Validation Methodology Overview. The NRC staff observed NuScale's implementation of testing methods while watching the validation scenarios and observed that they were consistent with NuScale's test procedures.

(7) Verify the test results support the revised staffing plan.

The NRC staff reviewed Appendix A of the RSPV Test Report, which lists all of the scenario tasks and associated acceptance criteria, whether the tasks were completed for each trial, and the time it took each crew to complete the tasks. The NRC staff also reviewed the measured workload scores collected from each test participant in each of the RSPV test trials. Additionally, the NRC staff reviewed the situation awareness questionnaire results. The NRC staff issued RAI 9789, Question NTR-12, to request a summary of the workload and situation awareness scores be added to the topical report.

(8) Identify any additional information that may support staff decisions about staffing levels and/or justifying the elimination of the STA position.

The RSPV Test Report, Appendix D, discusses an RSPV readiness assessment that was performed prior to the RSPV test. The NRC staff and NuScale discussed the test methods used to perform the readiness assessment and the readiness assessment test results. The NRC staff reviewed workload data from the readiness assessment. The NRC staff issued RAI 9789, Question NTR-13, to request a summary of the readiness assessment methods and results on the docket.

8.0 EXIT BRIEFING

The NRC staff conducted an audit exit meeting via a teleconference on September 10, 2020. The NRC staff summarized their observations and described information needs that would likely be issued in a RAI as a result of the audit.

9.0 OPEN ITEMS AND PROPOSED CLOSURE PATHS

Not applicable.

10.0 DEVIATIONS FROM THE AUDIT PLAN

Not applicable.

11.0 REFERENCES

1. Audit Plan for the Regulatory Audit of the NuScale Power, LLC, Topical Report TR-0420-69456, “NuScale Control Room Staffing Plan,” Revision 0; issued July 31, 2020 (ADAMS Accession No. ML20210M065).

2. Request for Additional Information (RAI) 9789, ADAMS Accession No. ML20296A161.