



December 17, 2020

Docket: 99902078
RAIO-1220-73475

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 (RAI No. 9789) on the NuScale Standard Design Approval Application

REFERENCES: 1. NRC Letter eRAI 9789 - Control Room Staffing TR, dated October 21, 2020, RAI# 9789
2. NuScale Topical Report, NuScale Control Room Staffing Plan, dated December 2020, TR-0420-69456

The purpose of this letter is to provide NuScale's response to NRC Requests for Additional Information (RAI), RAI# 9789, noted in the References above. The responses to the individual RAI questions are provided in the attached Enclosure.

This letter contains NuScale's response to the following RAI Questions from NRC RAI# 9789:

- NTR-01 through NTR-15

This letter makes no new regulatory commitments and no revisions to any existing regulatory commitments.

Please contact Jim Osborn at 541-360-0693 or at JOsborn@nuscalepower.com if you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "Carrie Fosaaen".

Carrie Fosaaen
Director, Regulatory Affairs
NuScale Power, LLC

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Enclosure 1: NuScale Response to NRC Request for Additional Information RAI# 9789



Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9789, nonproprietary

Response to Request for Additional Information Docket: 99902078

RAI No.: 9789

Date of RAI Issue: 10/21/2020

NRC Question No.: NTR-01

Background and Regulatory basis:

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 NRC review and approval. The topical report is designed to be used by a NuScale licensee to support exemption requests from the staffing requirements in 10 CFR 50.54(m) or other alternative control room staffing regulations, such as those included in the NuScale design certification rule, and from the requirement in 10 CFR 50.120(b)(2)(iii) to provide training and qualifications for the STA.

The NRC staff reviews such exemption requests and must determine whether the staffing proposals provide 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. NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," provides a process for systematically reviewing and assessing alternatives to licensed operator staffing requirements. NUREG-0711, "Human Factors Engineering Program Review Model," contains guidance the staff uses to evaluate the methodology and results of human factors and staffing plan validation testing.

On August 17-27, 2020, the staff conducted a regulatory audit (audit plan ADAMS Accession No. ML20210M065) in support of the staff's review of the topical report. During the audit, the staff identified information that will require docketing to allow the staff to make conclusion on the whether the staffing proposal will adequately protect the public health and safety. Therefore, the NRC staff requests that NuScale provide additional information regarding the following topics.

Request for Additional Information:

The proposed revised minimum staffing level for a 12-module NuScale plant is shown in the topical report, Table 6- 1, "Minimum Licensed Operator Staffing," as one licensed reactor

operator and two licensed senior reactor operators. During the audit, the NRC staff discussed revisions that need to be made to the table and its notes in the topical report, Section 6.1, "Facility Staff," to improve clarity and ensure the plan can be implemented by a licensee.

1. Please revise Table 6-1 to specify the number of units for which the staffing level applies (e.g., 1-12 units operated from one control room).
2. Please revise Table 6-1 (e.g., in the title) to state that the staffing is onsite staffing.

NuScale Response:

TR-0420-69456, NuScale Control Room Staffing Plan, Section 6.1 "Facility Staff," has been revised as shown below:

6.1 Facility Staff

The minimum licensed operating staffing for licensees referencing an NRC-approved NPP design of up to 12 modules is shown in the following table:

Table 6-1 Minimum Onsite License Operator Staffing

Reactor Operator	Senior Reactor Operator
1	2

a. A person holding a senior operator license for all fueled units at the site who is assigned responsibility for overall plant operation shall be onsite at all times when there is fuel in any reactor vessel.

b. A person holding a senior reactor operator license shall be in the control room at all times when there is fuel in any module. In addition to this senior reactor operator, a licensed reactor operator or senior reactor operator shall be present at the controls at all times.



Impact on Topical Report:

Topical Report TR-0420-69456, NuScale Control Room Staffing Plan has been revised as described in the response above and as shown in the revision provided in LO-1220-73414.

Response to Request for Additional Information Docket: 99902078

RAI No.: 9789

Date of RAI Issue: 10/21/2020

NRC Question No.: NTR-02

Background and Regulatory basis:

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 NRC review and approval. The topical report is designed to be used by a NuScale licensee to support exemption requests from the staffing requirements in 10 CFR 50.54(m) or other alternative control room staffing regulations, such as those included in the NuScale design certification rule, and from the requirement in 10 CFR 50.120(b)(2)(iii) to provide training and qualifications for the STA.

The NRC staff reviews such exemption requests and must determine whether the staffing proposals provide 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. NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," provides a process for systematically reviewing and assessing alternatives to licensed operator staffing requirements. NUREG-0711, "Human Factors Engineering Program Review Model," contains guidance the staff uses to evaluate the methodology and results of human factors and staffing plan validation testing.

On August 17-27, 2020, the staff conducted a regulatory audit (audit plan ADAMS Accession No. ML20210M065) in support of the staff's review of the topical report. During the audit, the staff identified information that will require docketing to allow the staff to make conclusion on the whether the staffing proposal will adequately protect the public health and safety. Therefore, the NRC staff requests that NuScale provide additional information regarding the following topics. Request for Additional Information:

1. Topical Report, Section 4.0, "Additional Staffing Considerations," states, "[t]he three-person crew staffing complement is intended to identify the minimum crew size to support

safe plant operations. An additional requirement is added for at least two of the crew members to have senior operator licenses so that the CRS could leave while the second senior license holder remained in the control room." However, Table 6- 1, Note b says, in part (underline added for emphasis), "A person holding a senior reactor operator license shall be in the control room complex at all times." Absent a definition of "control room complex," it is not clear whether Note b is consistent with the topical report, Section 4.0. Please either (1) revise Note b to delete "complex," or (2) provide a definition of "control room complex" and, if the complex includes area outside the control room, explain how control room supervisors at a NuScale plant could adhere to the guidance of Regulatory Guide (RG) 1.114 or why an alternative to RG 1.114 would be acceptable for a NuScale plant.

2. Please clarify when the licensee is required to establish the staffing discussed in Note b (e.g., when any unit is fueled, a licensed reactor operator or senior operator shall be present at the controls at all times).

NuScale Response:

TR-0420-69456, NuScale Control Room Staffing Plan, Notes a and b of Table 6-1 "Minimum Licensed Operator Staffing," have been revised as shown below:

- a. A person holding a senior operator license for all fueled units at the site who is assigned responsibility for overall plant operation shall be onsite at all times when there is fuel in any reactor vessel.
- b. A person holding a senior reactor operator license shall be in the control room at all times when there is fuel in any reactor vessel. In addition to this senior reactor operator, a licensed reactor operator or senior reactor operator shall be present at the controls at all times when there is fuel in any reactor vessel.

Impact on Topical Report:

Topical Report TR-0420-69456, NuScale Control Room Staffing Plan, has been revised as described in the response above and as shown in the revision provided in LO-1220-73414.

Response to Request for Additional Information Docket: 99902078

RAI No.: 9789

Date of RAI Issue: 10/21/2020

NRC Question No.: NTR-03

Background and Regulatory basis:

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 NRC review and approval. The topical report is designed to be used by a NuScale licensee to support exemption requests from the staffing requirements in 10 CFR 50.54(m) or other alternative control room staffing regulations, such as those included in the NuScale design certification rule, and from the requirement in 10 CFR 50.120(b)(2)(iii) to provide training and qualifications for the STA.

The NRC staff reviews such exemption requests and must determine whether the staffing proposals provide 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. NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," provides a process for systematically reviewing and assessing alternatives to licensed operator staffing requirements. NUREG-0711, "Human Factors Engineering Program Review Model," contains guidance the staff uses to evaluate the methodology and results of human factors and staffing plan validation testing.

On August 17-27, 2020, the staff conducted a regulatory audit (audit plan ADAMS Accession No. ML20210M065) in support of the staff's review of the topical report. During the audit, the staff identified information that will require docketing to allow the staff to make conclusion on the whether the staffing proposal will adequately protect the public health and safety. Therefore, the NRC staff requests that NuScale provide additional information regarding the following topics.
Request for Additional Information:

The topical report, Section 4.0 Additional Staffing Considerations, states in part, "An additional senior license holder is required to support refueling operations." Table 6-1, Note d, states, "Each licensee shall have present, during alteration or movement of the core of a nuclear power



unit (including fuel loading, fuel transfer, or movement of a module that contains fuel), a person holding a senior operator license or a senior operator license limited to fuel handling to directly supervise the activity and, during this time, the licensee shall not assign other duties to this person." Please revise Note d to clarify that the senior operator assigned to supervise alteration or movement of the core of a nuclear power unit is in addition to the two senior operators identified in Table 6-1.

NuScale Response:

TR-0420-69456, NuScale Control Room Staffing Plan, Note d of Table 6-1 "Minimum Licensed Operator Staffing," has been revised as shown below;

d. Each licensee shall have present, during alteration or movement of the core of a nuclear power unit (including fuel loading, fuel transfer, or movement of a module that contains fuel), a person holding a senior operator license or a senior operator license limited to fuel handling to directly supervise the activity and, during this time, the licensee shall not assign other duties to this person. This person is in addition to the two senior operator license holders identified in Table 6-1.

Impact on Topical Report:

Topical Report TR-0420-69456, NuScale Control Room Staffing Plan, has been revised as described in the response above and as shown in the revision provided in LO-1220-73414.

Response to Request for Additional Information Docket: 99902078

RAI No.: 9789

Date of RAI Issue: 10/21/2020

NRC Question No.: NTR-04

Background and Regulatory basis:

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 NRC review and approval. The topical report is designed to be used by a NuScale licensee to support exemption requests from the staffing requirements in 10 CFR 50.54(m) or other alternative control room staffing regulations, such as those included in the NuScale design certification rule, and from the requirement in 10 CFR 50.120(b)(2)(iii) to provide training and qualifications for the STA.

The NRC staff reviews such exemption requests and must determine whether the staffing proposals provide 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. NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," provides a process for systematically reviewing and assessing alternatives to licensed operator staffing requirements. NUREG-0711, "Human Factors Engineering Program Review Model," contains guidance the staff uses to evaluate the methodology and results of human factors and staffing plan validation testing.

On August 17-27, 2020, the staff conducted a regulatory audit (audit plan ADAMS Accession No. ML20210M065) in support of the staff's review of the topical report. During the audit, the staff identified information that will require docketing to allow the staff to make conclusion on the whether the staffing proposal will adequately protect the public health and safety. Therefore, the NRC staff requests that NuScale provide additional information regarding the following topics.

Request for Additional Information:

NUREG-1791, Section 2.0, lists the type of information that is considered part of the concept of operations. In addition to the number of personnel who will have plant monitoring and



operational control responsibilities on each shift, it also includes their individual roles and responsibilities; the interaction of control personnel with automated systems; other mechanisms that enable or support control personnel responsibilities for monitoring, disturbance detection, situation assessment, response planning, response execution, and the management of transitions between automatic and manual control; the interactions of control personnel with each other and with people not directly responsible for the control and safe operation of the plant; and multi-unit operations. Although a major goal of a staffing plan validation test is to confirm that the proposed minimum number of licensed operators on each shift is acceptable, the other elements of the concept of operations are also validated and assessed during a staffing plan test since they govern the ways in which the operators perform their function to operate the plant safely. As such, the staff considers the other elements of the concept of operations to be an important element of the staffing plan.

Reference 8.2.10 in the references section of the topical report is, "Concept of Operations," RP-0215-10815, Revision 3. Revision 3 is for a crew of at least six licensed operators, and it is incorporated by reference in Tier 2 of the NuScale standard design certification document for the 600 MWe, 12 small modular reactor plant design. The information in Revision 3 about the roles and responsibilities of the six-person crew is not applicable to the revised staffing plan. During the August 2020 audit, the staff reviewed draft Revision 4 of the "Concept of Operations," which NuScale revised to account for changes to the concept of operations for the revised staffing plan.

Please either submit Revision 4 of the "Concept of Operations" document or revise the topical report to include the changes to the concept of operations for the revised staffing plan.

NuScale Response:

RP-1020-72177 "Concept of Operation," Revision 1 reflects the changes to the concept of operations for the revised staffing plan that the NRC Staff reviewed during the August 2020 audit. RP-1020-72177, Revision 1 is included with this response for NRC review. Additionally, reference 8.2.10 in the topical report has been revised to show the updated report number and revision number.

Impact on Topical Report:

Topical Report TR-0420-69456, NuScale Control Room Staffing Plan, and RP-1020-72177, Concept of Operations have been revised as described in the response above and are shown



in the revisions provided in submittals LO-1220-73414, Control Room Staffing Plan and LO-1220-73431, Concept of Operations.

Response to Request for Additional Information Docket: 99902078

RAI No.: 9789

Date of RAI Issue: 10/21/2020

NRC Question No.: NTR-05

Background and Regulatory basis:

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 NRC review and approval. The topical report is designed to be used by a NuScale licensee to support exemption requests from the staffing requirements in 10 CFR 50.54(m) or other alternative control room staffing regulations, such as those included in the NuScale design certification rule, and from the requirement in 10 CFR 50.120(b)(2)(iii) to provide training and qualifications for the STA.

The NRC staff reviews such exemption requests and must determine whether the staffing proposals provide 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. NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," provides a process for systematically reviewing and assessing alternatives to licensed operator staffing requirements. NUREG-0711, "Human Factors Engineering Program Review Model," contains guidance the staff uses to evaluate the methodology and results of human factors and staffing plan validation testing.

On August 17-27, 2020, the staff conducted a regulatory audit (audit plan ADAMS Accession No. ML20210M065) in support of the staff's review of the topical report. During the audit, the staff identified information that will require docketing to allow the staff to make conclusion on the whether the staffing proposal will adequately protect the public health and safety. Therefore, the NRC staff requests that NuScale provide additional information regarding the following topics.

Request for Additional Information:

NuScale measured workload of the test participants during the revised staffing plan validation test using the NASA TLX methodology. When using NASA TLX method, it is acceptable to



either apply weighting factors to the measurements or to not apply them. The topical report, Section 5.1, "Staffing Plan Validation Methodology Overview," refers to the "streamlined use" of workload weighting factors. Please clarify what is meant by "streamlined use" of weighting factors.

NuScale Response:

The discussion contained in TR-0420-69456, Section 5.1 "Staffing Plan Validation Methodology Overview," was intended to reflect the elimination of applying weighing factors to the staffing plan validation and verification methodology based on good practices learned during iterative applications of this methodology. NuScale has revised TR-0420-69456, Section 5.1 "Staffing Plan Validation Methodology Overview," as shown below:

This methodology has been used to conduct two validation efforts. These tests are referred to as the control room staffing plan validation (SPV) and the revised staffing plan validation (RSPV). Two improvements to the methodology were made following the SPV, the addition of an independent observer role and the elimination of applying weighting factors to the National Aeronautics and Space Administration Task Load Index (TLX).

Impact on Topical Report:

Topical Report TR-0420-69456, NuScale Control Room Staffing Plan, has been revised as described in the response above and as shown in the revision provided in LO-1220-73414.

Response to Request for Additional Information Docket: 99902078

RAI No.: 9789

Date of RAI Issue: 10/21/2020

NRC Question No.: NTR-06

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 NRC review and approval. The topical report is designed to be used by a NuScale licensee to support exemption requests from the staffing requirements in 10 CFR 50.54(m) or other alternative control room staffing regulations, such as those included in the NuScale design certification rule, and from the requirement in 10 CFR 50.120(b)(2)(iii) to provide training and qualifications for the STA.

The NRC staff reviews such exemption requests and must determine whether the staffing proposals provide 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. NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," provides a process for systematically reviewing and assessing alternatives to licensed operator staffing requirements. NUREG-0711, "Human Factors Engineering Program Review Model," contains guidance the staff uses to evaluate the methodology and results of human factors and staffing plan validation testing.

On August 17-27, 2020, the staff conducted a regulatory audit (audit plan ADAMS Accession No. ML20210M065) in support of the staff's review of the topical report. During the audit, the staff identified information that will require docketing to allow the staff to make conclusion on the whether the staffing proposal will adequately protect the public health and safety. Therefore, the NRC staff requests that NuScale provide additional information regarding the following topics.

Request for Additional Information:

During the audit, the staff observed video recordings of the scenario trials. The staff noticed that at the beginning of all of the scenarios, all three operators were in the control room simulator. However, in accordance with Table 6-1, all three operators may not be in or near the control room at the same time. Please explain whether there is any impact on the results of the RSPV



test by not simulating that one of the three crew members could be elsewhere onsite at the start of a potentially challenging, high workload situation.

NuScale Response:

Due to the overall low operational complexity, simple passive engineered safety features actuation systems that are designed as fail-safe, no required operator actions for design basis events, and the limited number of risk important human actions for beyond design basis events, there is ample time to consider any required operation actions in response to plant transients or other events at a NuScale Power Plant.

Based on these considerations, NuScale judged that starting the scenarios with one operator outside of the main control room (MCR) at the beginning of the scenario would serve primarily as a communications exercise to recall the absent operator to the MCR. As the ability of the MCR staff to communicate with outside personnel was already tested in other parts of the validation, starting one operator outside the MCR was determined to be redundant to other elements of the plan, and therefore was not included.

During the revised staffing plan validation (RSPV) testing, the risk important human actions were completed with margin similar to the results from the integrated system validation and staffing plan validation, and earlier than the required time from the probabilistic risk assessment analysis. Since at least one reactor operator and one senior reactor operator (SRO) are required within the MCR, actions to stabilize the affected modules can begin as soon as the event is recognized. The evaluation of Emergency Action Levels and other remaining emergency planning tasks, including notifications and facility activations, could either be performed by the SRO within the MCR for lower workload events, or may be deferred until the third operator returns to the MCR for higher workload events.

Therefore, there is no impact to the conclusions of the RSPV test by not simulating that one of the three crew members were outside the control room because the required risk important human actions would still occur within the analyzed limits.

Impact on Topical Report:

There are no impacts to the Topical Report TR-0420-69456, NuScale Control Room Staffing Plan, as a result of this response.

Response to Request for Additional Information Docket: 99902078

RAI No.: 9789

Date of RAI Issue: 10/21/2020

NRC Question No.: NTR-07

Background and Regulatory basis:

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 NRC review and approval. The topical report is designed to be used by a NuScale licensee to support exemption requests from the staffing requirements in 10 CFR 50.54(m) or other alternative control room staffing regulations, such as those included in the NuScale design certification rule, and from the requirement in 10 CFR 50.120(b)(2)(iii) to provide training and qualifications for the STA.

The NRC staff reviews such exemption requests and must determine whether the staffing proposals provide 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. NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," provides a process for systematically reviewing and assessing alternatives to licensed operator staffing requirements. NUREG-0711, "Human Factors Engineering Program Review Model," contains guidance the staff uses to evaluate the methodology and results of human factors and staffing plan validation testing.

On August 17-27, 2020, the staff conducted a regulatory audit (audit plan ADAMS Accession No. ML20210M065) in support of the staff's review of the topical report. During the audit, the staff identified information that will require docketing to allow the staff to make conclusion on the whether the staffing proposal will adequately protect the public health and safety. Therefore, the NRC staff requests that NuScale provide additional information regarding the following topics.

Request for Additional Information:

NUREG-1791, Section 3, "Review the Operational Conditions," says the staff reviews the operational conditions selected for the staffing plan validation to "ensure that the operational



conditions which present the greatest potential challenges to the effective and safe performance of control personnel, under the conditions of the requested exemption, were analyzed by the applicant and support the exemption request." The topical report, Section 5.1, states, "There is reasonable assurance that the workload during each of the scenarios bounds the anticipated workload conditions." Please explain how the scenarios selected for the RSPV bound the anticipated workload conditions at a NuScale plant.

NuScale Response:

The scenarios used during the 2016 staffing plan validation were developed to test high workload-conditions using the process described in Control Room Staffing Plan Validation Methodology, RP-1215-20253. The same proven methodology was used to develop the high workload-condition scenarios of the revised staffing plan validation. The methodology provides reasonable assurance that the workload was representative of the highest-workload conditions the operators might face. TR-0420-69456 has been revised to replace the term "bounds" with the phrase "representative of the highest-workload conditions the operators might face", which better reflects the goals of the revised staffing plan validation.

Impact on Topical Report:

Topical Report TR-0420-69456, NuScale Control Room Staffing Plan, has been revised as described in the response above and as shown in the revision provided in LO-1220-73414.

Response to Request for Additional Information Docket: 99902078

RAI No.: 9789

Date of RAI Issue: 10/21/2020

NRC Question No.: NTR-08

Background and Regulatory basis:

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 NRC review and approval. The topical report is designed to be used by a NuScale licensee to support exemption requests from the staffing requirements in 10 CFR 50.54(m) or other alternative control room staffing regulations, such as those included in the NuScale design certification rule, and from the requirement in 10 CFR 50.120(b)(2)(iii) to provide training and qualifications for the STA.

The NRC staff reviews such exemption requests and must determine whether the staffing proposals provide 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. NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," provides a process for systematically reviewing and assessing alternatives to licensed operator staffing requirements. NUREG-0711, "Human Factors Engineering Program Review Model," contains guidance the staff uses to evaluate the methodology and results of human factors and staffing plan validation testing.

On August 17-27, 2020, the staff conducted a regulatory audit (audit plan ADAMS Accession No. ML20210M065) in support of the staff's review of the topical report. During the audit, the staff identified information that will require docketing to allow the staff to make conclusion on the whether the staffing proposal will adequately protect the public health and safety. Therefore, the NRC staff requests that NuScale provide additional information regarding the following topics.

Request for Additional Information:

During the audit, the staff reviewed a list of scenario assumptions in the RSPV Test Report, Section 3.3. In some cases, these scenario assumptions provide limitations and constraints on

the activities that may be assigned to the control room crew. The staff recognizes that it was necessary for NuScale to make staffing assumptions in the absence of a facility licensee, who will be responsible for finalizing the decisions addressed by the staffing assumptions, in order to perform the RSPV test.

The NRC staff also observed that the Conduct of Operations document, Revision 1, Section 3.11, includes a staffing assumption about availability of additional personnel. During the audit, the staff observed during some scenario trials that the control room supervisor/shift manager was heavily involved in phone communications, and the reactor operators were engaged in operations. During situations where multiple units are in a transient, and the reactor operators are engaged in tasks as directed by the plant procedures, the CRS will need to limit the amount of time he or she spends engaged in external communications to ensure he or she maintains the role of providing effective command and control of the shift activities. The staffing assumption in Section 3.11 of the Conduct of Operations document addresses a way for the CRS to manage external communications to ensure he or she can maintain the command and control function in the control room. Additionally, Section 4.0 of the Conduct of Operations document states an expectation for how long it will take the third operator to return to the control room if he or she is outside of the control room (and is still onsite).

Given the topical report is to be used by facility licensee applicants, the facility licensee should confirm that these assumptions remain accurate for its facility, and if not, it should describe the deviations and any impacts to the staffing plan.

1. Please revise the topical report to include a summary of the scenario and staffing assumptions in Section 3.3 of the RSPV Test Report, Bullets 4 and 5, and Sections 3.11 and 4.0 of the Conduct of Operations document.
2. Additionally, in the conditions of applicability section, add that a COL applicant will either verify these assumptions remain valid for its facility or identify and address impacts of any deviations.

NuScale Response:

The assumptions in the revised staffing plan validation (RSPV) test report section 3.3 bullets 4 and 5, section 3.11, and section 4.0 of conduct of operations, were provided to ensure that testing was repeatable and consistent. Performing a representative dynamic simulator validation in the absence of site-specific combined operating license (COL) actions being



completed requires assumptions to be made. For example, a completed Emergency Action Level (EAL) scheme, non-licensed operator (NLO) staffing, and work control procedures are items that are left to the COL applicant to determine in accordance with NUREG-0800, Chapter 13. A COL will develop a comprehensive emergency plan and non-licensed operator staffing requirements to ensure that the plant can be operated safely and reliably. The COL will develop non-licensed operator staffing requirements with a more detailed understanding of the final plant design, programs, processes and procedures that are developed during the COL phase of the plant licensing process.

NuScale has revised the topical report to document relevant staffing assumptions used during staffing plan validation (SPV) and RSPV, in the following new section;

Section 5.2.1 License Operator Staffing Assumptions used during SPV and RSPV:

- Refueling operations and module assembly and disassembly are not directed from the MCR. Refueling is a planned activity and has a dedicated staff assigned for specific performance and oversight. Because the NPM is electrically and mechanically disconnected during refueling, the control room operators have no direct interaction with the refueling team other than operating common system components (e.g., align reactor pool cooling) or to update the SM on refueling status.
- A work control center (WCC) is available to assist the control room with work management during periods of significant workload. This reduces the distractions to the control room crew and is common practice among existing nuclear plants.
- The crew staffing complement includes one non-licensed operator acting as a communicator to offsite agencies during emergencies. The crew responsibilities do not include the fire brigade, supplemental emergency plan responder, or emergency medical team responder.

Additionally, a requirement has been added to Section 1.5, Conditions of Applicability, for an applicant using this topical report to evaluate any deviations from the control room staffing assumptions listed in section 5.2.1 prior to using this alternative staffing plan.

Impact on Topical Report:

Topical Report TR-0420-69456, NuScale Control Room Staffing Plan, has been revised as described in the response above and as shown in the revision provided in LO-1220-73414.

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RAI No.: 9789

Date of RAI Issue: 10/21/2020

NRC Question No.: NTR-09

Background and Regulatory basis:

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 NRC review and approval. The topical report is designed to be used by a NuScale licensee to support exemption requests from the staffing requirements in 10 CFR 50.54(m) or other alternative control room staffing regulations, such as those included in the NuScale design certification rule, and from the requirement in 10 CFR 50.120(b)(2)(iii) to provide training and qualifications for the STA.

The NRC staff reviews such exemption requests and must determine whether the staffing proposals provide 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. NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," provides a process for systematically reviewing and assessing alternatives to licensed operator staffing requirements. NUREG-0711, "Human Factors Engineering Program Review Model," contains guidance the staff uses to evaluate the methodology and results of human factors and staffing plan validation testing.

On August 17-27, 2020, the staff conducted a regulatory audit (audit plan ADAMS Accession No. ML20210M065) in support of the staff's review of the topical report. During the audit, the staff identified information that will require docketing to allow the staff to make conclusion on the whether the staffing proposal will adequately protect the public health and safety. Therefore, the NRC staff requests that NuScale provide additional information regarding the following topics.

Request for Additional Information:

NUREG-0711, Section 11.4.3.3(2) states that "[t]he testbed's HSIs and procedures should be represented with high physical fidelity to the reference design, including the presentation of

alarms, displays, controls, job aids, procedures, communications equipment, interface management tools, layout, and spatial relationships." The staff previously assessed the simulator used for ISV and determined it had sufficient fidelity to the plant design for validation testing. The topical report, Section 5.3.3, states that participant training for the RSPV included classroom training on simulator differences from the ISV. During the audit, the staff reviewed two simulator release notes that document changes to the simulator that occurred following ISV. However, neither the topical report nor the test report discuss whether simulator changes that occurred between the ISV and RSPV were based on plant design changes and, furthermore, whether they improved the fidelity of the simulator to the as-designed HSI (e.g., whether the changes to the simulator following ISV were implemented to ensure the simulator reflected changes to the as-designed control room and HSI).

Additionally, during the audit, the staff reviewed the RSPV Test Report, which describes the simulator testing NuScale conducted prior to the RSPV test to validate the fidelity of the simulator to the plant design. The staff also reviewed documentation of simulator testing that was conducted to verify the scenarios used for the RSPV would perform as planned.

1. Please revise the topical report to state that NuScale conducted simulator performance testing prior to the RSPV to verify the fidelity of the simulator to the plant design, the type of testing that was performed, and whether the results confirmed the simulator for RSPV had adequate fidelity to the as-designed MCR HSI.
2. Please explain whether simulator changes that occurred between the ISV and RSPV were based on plant design changes and whether they improved the fidelity of the simulator to the as-designed HSI.

NuScale Response:

NuScale Response to Question 1:

Detailed testing methodology and results that confirm simulator fidelity and performance are described in Sections 6.2, 6.3, and 6.4 of RP-0419-65209, "Revised Staffing Plan Validation Test Report." RP-0419-65209 is included with this response, and is docketed. TR-0420-69456 Section 5.3.5, "Summary of Revised Staffing Plan Validation Trial Results," summarizes the revised staffing plan validation (RSPV) results and points to the RSPV test report for additional details. No additional changes are needed to TR-0420-69456.



NuScale Response to Question 2:

The simulator was updated with two releases between the integrated system validation (ISV) and the version of the simulator used for the RSPV. The changes were made to address human engineering discrepancies that were generated as a result of the ISV, improvements to the human-system interface (HSI), and procedures based on ISV operator feedback. The second release was to support scenario administration and to complete additional minor improvements to the HSI and procedures based on ISV operator feedback. The changes that support scenario administration were the creation of three new scenario controllers to administer the RSPV test, and an update to the data historian to produce records. These are limited to simulator tools and not part of the MCR design. The additional minor HSI and procedure improvements improve simulator fidelity to the plant design.

Impact Statement:

RP-0419-65205, Revised Staffing Plan Validation Test Report has been revised as described in the response above and as shown in the revisions provided in submittal LO-1220-73411.

Response to Request for Additional Information Docket: 99902078

RAI No.: 9789

Date of RAI Issue: 10/21/2020

NRC Question No.: NTR-10

Background and Regulatory basis:

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 NRC review and approval. The topical report is designed to be used by a NuScale licensee to support exemption requests from the staffing requirements in 10 CFR 50.54(m) or other alternative control room staffing regulations, such as those included in the NuScale design certification rule, and from the requirement in 10 CFR 50.120(b)(2)(iii) to provide training and qualifications for the STA.

The NRC staff reviews such exemption requests and must determine whether the staffing proposals provide 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. NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," provides a process for systematically reviewing and assessing alternatives to licensed operator staffing requirements. NUREG-0711, "Human Factors Engineering Program Review Model," contains guidance the staff uses to evaluate the methodology and results of human factors and staffing plan validation testing.

On August 17-27, 2020, the staff conducted a regulatory audit (audit plan ADAMS Accession No. ML20210M065) in support of the staff's review of the topical report. During the audit, the staff identified information that will require docketing to allow the staff to make conclusion on the whether the staffing proposal will adequately protect the public health and safety. Therefore, the NRC staff requests that NuScale provide additional information regarding the following topics.
Request for Additional Information:

The topical report, Section 1.5, contains the conditions of applicability that are associated with the topical report. This section of the topical report lists several features and states that "an applicant can show the proposed design complies with the conditions of applicability by



performing an evaluation or demonstration of their design to these attributes." The staff understands NuScale intends to submit a standard design approval application for the NuScale 720MWe plant design. During the audit, NuScale explained that the simulator used for the RSPV test was based on the NuScale plant design as described in the design certification application (i.e., the 600MWe plant).

1. Please provide the rationale for the conditions and limitations contained in the topical report and explain why additional conditions and limitations are not needed for COL applicants referencing the NuScale 720 standard design.
2. Given the level of automation in the plant design helps minimize operator workload by performing more tasks, please explain why it was not listed with the other HSI design features listed in the topical report, Section 1.5, "Conditions of Applicability."

NuScale Response:

NuScale Response to Question 1:

The rationale for the conditions contained in Section 1.5, "Conditions of Applicability," of the topical report functionally represent the minimum set of features required to allow the operators to perform tasks important to safe plant operation during challenging, high workload events, so the three person crew can be effective. The conditions of applicability limits the use of this staffing plan to a combined operating license applicant referencing the NuScale small modular reactor design, therefore no further conditions or limitations are required. It is inherent in these conditions that the NuScale small modular reactor plant has a higher margin of safety and low operational complexity as compared to plant designs using the existing staffing regulations.

No operator actions credited during DBEs: The plant design tested during the staffing plan validation exercises cited in this topical report does not have operator actions credited during DBEs. If essential safety-related operator actions are required during DBEs in future design updates, further analysis would be required to verify procedures in place provided sufficient prioritization to direct the sequence of actions on any affected units, and all actions could be accomplished within the required time frame. This element is required as no such analysis is contained within this topical report.

Two important human actions (IHAs) which are easily recognizable and can be completed from the main control room (MCR) by a single licensed operator: The plant

design tested during the staffing plan validation exercises cited in this topical report has only two IHAs, and those can be completed from the MCR by a single licensed operator. Maintaining the limit of two IHAs to future plant design updates is provided to limit the number of conditions that must be monitored by the operators during BDBEs. In the tested design, both IHAs are the result of failure to meet a critical safety function. Direct links with subsequent procedures are provided for both of these conditions by the HSI to alert the operator of the need to take these actions, and provide the procedures to allow timely and proper execution.

The two IHAs are not specifically identified because the IHAs are irrelevant to the staffing plan. The characteristics of the responses to the IHAs are the important factors and potentially impactful. The important considerations are, in order of importance: the IHA actions can be accomplished by a single licensed operator, they can be accomplished from the main control room, and there are only a small number of IHAs (e.g.; two) that are easily recognized by straightforward cues from the HSI. As long as the plant design retains these characteristics as they pertain to IHAs, then adding more operators to the control room staff does not improve the chances of successfully completing the task(s).

The specific time available for completing the IHAs actions are not listed because they do not affect the staffing plan. The important considerations are still that the IHA actions can be accomplished by a single licensed operator from the main control room, without reliance on actions performed in the field by non-licensed operators. The performance data from SPV and RSPV confirmed that the crews were able to complete the IHA actions with significant margin, so the addition of a very long time limit for events having such low probability of occurrence and where analysis of validation test data does not show a vulnerability, does not add value to this parameter. Regardless of the time allowed to complete the IHA, adding more operators to the control room staff does not improve the chances of successfully completing the task within the allowed time.

A human-system interface (HSI) design that retains the following features:

Critical safety function and defense-in-depth monitoring and display, which provide direct links to response procedures: This feature allows operators to assess critical safety status at a glance, efficiently identify actions to mitigate challenges to the safety functions and ensure that defense in depth capabilities are maintained. Directly identifying the procedures assists the operator to take the correct action on the correct unit, and is a key component of the lower operational complexity of the NuScale plant design.



Tiered alarm scheme: This feature assists with prioritization and ensures operators are aware of important alarm conditions that are less challenging than what is identified by critical safety function and defense in depth monitoring.

Computer-based alarm response procedures that are directly linked assist the operator in efficiently locating the correct information: This feature provides the operator with direct access to the actions that address the annunciated condition in a format that is simple to use. It also helps ensure the operator takes actions on the intended unit.

Twelve-module trend monitoring: This feature allows the operator to efficiently identify trends to allow for early mitigation to minimize the severity of transients for up to 12 units using one central operator interface. This reduces the need to look through multiple interfaces and locations to obtain key operational parameters about the plant.

Any changes that occur to the IHA attributes stated in Section 1.5, Conditions of Applicability, can be addressed by the conditional statement included in the section; “An applicant can show the proposed design complies with the conditions of applicability by performing an evaluation or demonstration of their designs to these attributes.”

NuScale Response to Question 2:

The NuScale plant design reduces operator work load due to its lower operational complexity - the design eliminates large complex components (i.e., Reactor Coolant Pumps), and is simpler in the number of systems and number of transient response procedures.

Automations within the control system primarily exist to assist operators in efficient management of the plant to produce electricity. These automations do not, much like the operators, have a substantial impact on safety. This is demonstrated in both deterministic and probabilistic analysis.

The HSI features listed in the topical report are those necessary to ensure the operator maintains situational awareness and can easily and correctly identify the appropriate action to take, to stop, or mitigate a transient or accident condition. During a DBE or BDBE, “normal operations” on unaffected units will not be the focus of the crew, regardless of the level of automation, and therefore automation to minimize operator workload was not listed with the other HSI design features listed in the topical report, Section 1.5, “Conditions of Applicability.”



Impact on Topical Report:

There are no impacts to the Topical Report TR-0420-69456, NuScale Control Room Staffing Plan, as a result of this response.

Response to Request for Additional Information Docket: 99902078

RAI No.: 9789

Date of RAI Issue: 10/21/2020

NRC Question No.: NTR-11

Background and Regulatory basis:

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 NRC review and approval. The topical report is designed to be used by a NuScale licensee to support exemption requests from the staffing requirements in 10 CFR 50.54(m) or other alternative control room staffing regulations, such as those included in the NuScale design certification rule, and from the requirement in 10 CFR 50.120(b)(2)(iii) to provide training and qualifications for the STA.

The NRC staff reviews such exemption requests and must determine whether the staffing proposals provide 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. NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," provides a process for systematically reviewing and assessing alternatives to licensed operator staffing requirements. NUREG-0711, "Human Factors Engineering Program Review Model," contains guidance the staff uses to evaluate the methodology and results of human factors and staffing plan validation testing.

On August 17-27, 2020, the staff conducted a regulatory audit (audit plan ADAMS Accession No. ML20210M065) in support of the staff's review of the topical report. During the audit, the staff identified information that will require docketing to allow the staff to make conclusion on the whether the staffing proposal will adequately protect the public health and safety. Therefore, the NRC staff requests that NuScale provide additional information regarding the following topics.

Request for Additional Information:

The topical report, Section 5.3.2, "Participants in Second Validation Trials," states that RSPV test participants were chosen based on previous experience as crew members during the ISV.

NUREG-0711, Section 11.4.3.4, "Plant Personnel," says there should be variation in age, skill/experience, and qualifications among test personnel, and test participants should not be selected for specific characteristics, such as good performers. Also, test participants should not have access to the test scenarios prior to testing in order to avoid biasing the test results.

1. Please explain the other criteria NuScale used to select the RSPV test participants in order to avoid selecting for specific characteristics such as good performance.
2. Please state whether the test participants had access to the scenario contents prior to the RSPV test.

NuScale Response:

NuScale Response to Question 1:

Selecting participants who had successfully completed the integrated system validation (ISV) training program was a primary consideration to be a revised staffing plan validation (RSPV) crew member, since completing the ISV training program was required to ensure crew members had sufficient knowledge of the NuScale plant design, plant controls, and conduct of operations in order to interact with the HFE design in the same manner as experienced plant personnel. This avoided the need to conduct an additional comprehensive training program, which takes more time, more expense, and is impactful to NuScale resources who would conduct the training. This would have increased the RSPV duration by up to five months, with associated costs. The next criteria used for RSPV candidate selection was logistical and did not include consideration for prior performance during ISV. Candidates were chosen based on availability and geographic location. The three candidates that were employed by NuScale, and were available to participate, were selected first. The two non-employee candidates that lived locally and were available were selected next. The final participant was selected from a small pool of remaining candidates. That candidate was chosen based on availability, as well as contributing to the diversity in age, skills and qualifications among the crews. The resulting crews included individuals with varying ISV performance levels and varying experience, which included commercial operating experience (OE), previous Navy nuclear power OE, and direct input operators that may have a technical or engineering degree, but no nuclear plant operating experience. The overall profile of the participants' background was validated to ensure it included a mix of experience expected of operators of a NuScale power plant and would meet the requirements of NUREG-0711, Section 11.4.3.4.



NuScale Response to Question 2:

Exam security protocol was maintained as described in Section 4.3 of the RSPV Test Report (RP-0419-65209). RSPV participants did not have access to the scenario contents prior to the RSPV test. None of the participants were involved in any aspect of the HFE review elements, as described by NUREG-0711. None of the participants performed activities associated with test development or pilot testing. None of the three participants who worked at NuScale worked in any capacity that would have allowed them access to the contents of the scenarios.

Impact on Topical Report:

There are no impacts to the Topical Report TR-0420-69456, NuScale Control Room Staffing Plan, as a result of this response.

Response to Request for Additional Information Docket: 99902078

RAI No.: 9789

Date of RAI Issue: 10/21/2020

NRC Question No.: NTR-12

Background and Regulatory basis:

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 NRC review and approval. The topical report is designed to be used by a NuScale licensee to support exemption requests from the staffing requirements in 10 CFR 50.54(m) or other alternative control room staffing regulations, such as those included in the NuScale design certification rule, and from the requirement in 10 CFR 50.120(b)(2)(iii) to provide training and qualifications for the STA.

The NRC staff reviews such exemption requests and must determine whether the staffing proposals provide 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. NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," provides a process for systematically reviewing and assessing alternatives to licensed operator staffing requirements. NUREG-0711, "Human Factors Engineering Program Review Model," contains guidance the staff uses to evaluate the methodology and results of human factors and staffing plan validation testing.

On August 17-27, 2020, the staff conducted a regulatory audit (audit plan ADAMS Accession No. ML20210M065) in support of the staff's review of the topical report. During the audit, the staff identified information that will require docketing to allow the staff to make conclusion on the whether the staffing proposal will adequately protect the public health and safety. Therefore, the NRC staff requests that NuScale provide additional information regarding the following topics.

Request for Additional Information:

The topical report, Section 7.0, "Summary and Conclusions," states in part that "a preponderance of evidence shows that individuals, and the crew as a whole, experienced

acceptable levels of workload." During the August 2020 audit, the staff reviewed the NASA TLX workload data for each crew member in each of the scenario trials. The staff also reviewed the results of the situation awareness questionnaires administered to each test participant.

Please revise the topical report to include the following:

1. the range of the average workload for each crew member (i.e., lowest average workload and the highest average workload),
2. the maximum workload measured during all trials and the reason(s) why the workload was high in the specific scenario(s),
3. a statement about the situation awareness results as described in the RSPV Test Report, Section 10.2.2, "Situation Awareness."

NuScale Response:

TR-0420-69456, "NuScale Control Room Staffing Plan," has been revised to include the following information in Section 5.3.5, Workload and Situational Awareness Data for Second Validation Trials:

The range of average workload for each 2019 revised staffing plan validation (RSPV) test crew member is as follows:

Crew Member	Avg.	Lowest Avg. Workload	Highest Avg. Workload
RO1	21	15	28
RO2	13	10	15
CRS	18	11	25

Table 5-1 RSPV Average Workload Data

The maximum workload value measured during all the trials was a raw score of 80. This score was tied to a scenario event that was designed so that the crew would not be successful. During this event, reactor coolant inventory was leaking from the module and the crew had to take action to inject additional inventory. Subsequently, the crew had indications of fuel clad

degradation. In this scenario, their actions were not allowed be successful. Both control room supervisors stated that this no-win situation was very stressful, which was reflected in their higher TLX scores.

Situational awareness questionnaires were used at predetermined points administered in conjunction with TLX workload measures. The figure below shows the actual scores for scenarios 1, 2, and 3 from left to right on the x-axis.

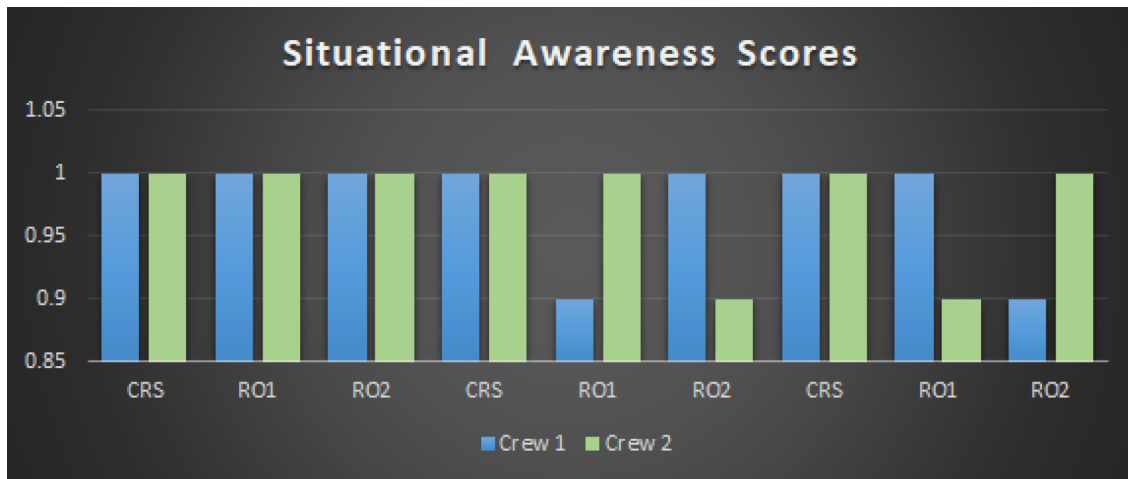


Figure 5-1 RSPV Situational Awareness Scores

The range of scores were 90%-100%. The average situational awareness score was 97%. There was no trend to indicate that one position or person had a deviation of results from any other person or position. No situational awareness comments were generated during the RSPV.

Impact on Topical Report:

Topical Report TR-0420-69456, NuScale Control Room Staffing Plan, has been revised as described in the response above and as shown in the revision provided in LO-1220-73414.

Response to Request for Additional Information Docket: 99902078

RAI No.: 9789

Date of RAI Issue: 10/21/2020

NRC Question No.: NTR-13

Background and Regulatory basis:

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 NRC review and approval. The topical report is designed to be used by a NuScale licensee to support exemption requests from the staffing requirements in 10 CFR 50.54(m) or other alternative control room staffing regulations, such as those included in the NuScale design certification rule, and from the requirement in 10 CFR 50.120(b)(2)(iii) to provide training and qualifications for the STA.

The NRC staff reviews such exemption requests and must determine whether the staffing proposals provide 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. NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," provides a process for systematically reviewing and assessing alternatives to licensed operator staffing requirements. NUREG-0711, "Human Factors Engineering Program Review Model," contains guidance the staff uses to evaluate the methodology and results of human factors and staffing plan validation testing.

On August 17-27, 2020, the staff conducted a regulatory audit (audit plan ADAMS Accession No. ML20210M065) in support of the staff's review of the topical report. During the audit, the staff identified information that will require docketing to allow the staff to make conclusion on the whether the staffing proposal will adequately protect the public health and safety. Therefore, the NRC staff requests that NuScale provide additional information regarding the following topics.
Request for Additional Information:

The RSPV Test Report, Appendix D, says that a readiness assessment was performed prior to RSPV, which used the same scenarios from the 2016 SPV test and the RSPV test participants. It also says all acceptance criteria were met; these included criteria for successful task



performance. During the August 2020 audit, NuScale explained that the readiness assessment used the same test protocol and data collection methods as the RSPV test. The scenario events are included in the SPV Results Technical Report, which is a document that can be accessed by NuScale employees. Thus, NuScale stated it could not guarantee that the RSPV test participants had not reviewed the scenarios prior to the readiness assessment. However, NuScale said it had a high level of confidence that the RSPV participants had not reviewed the scenarios. Although the reviewed documentation indicates that access to the readiness assessment scenarios were not controlled as strictly as the RSPV test scenarios prior to the readiness assessment, the NRC staff believe that there is some confidence that the participants did not have prior knowledge of the readiness assessment scenarios prior to the assessment. As such, reviewing this data provides the staff a reasonable "apples-to-apples" comparison between the SPV and the RSPV that provides support for NuScale's staffing plan.

Please include a description of the RSPV readiness assessment, including a summary of the task performance, workload and situation awareness results and how they compare to the results from the initial SPV test, and why it is unlikely that the test participants reviewed the scenario contents prior to the readiness assessment.

NuScale Response:

A description of the revised staffing plan validation (RSPV) readiness assessment is provided below:

The original staffing plan validation (SPV) scenarios performed in 2016 were not used as the scenarios for the RSPV primarily because the scenario information was not maintained under exam security following the SPV. Therefore, however unlikely, it could not be assured that participants would be unaware of the SPV scenarios. For this reason, new scenarios were generated using the same methodology, Control Room Staffing Plan Validation Methodology, RP-1215-20253, that was used to generate the original SPV scenarios.

The three SPV scenarios were used as the RSPV readiness assessment performed prior to the start of the RSPV testing. The purpose of the readiness assessment was to ensure data collection methods were rehearsed and to ensure participants were ready for the validation test. Additionally, most of the lower tier performance measure data on task timing was collected during the readiness assessment. Using the original SPV scenarios for the readiness assessment allowed benchmarking of the results against the SPV results. Also, because the purpose of the readiness assessment was only to ensure that data collection methods were rehearsed and to ensure participants were ready for the validation test, most, but not all, of the

data on task timing was collected. The three original SPV scenarios were administered in the same manner as they were in 2016 with the exception that no crew observers were present. Workload and situational awareness data are available as well as some crew task performance times, however, no human factors engineering or operations observer comments were generated beyond those of the test lead. The only modification to the scenario guides were to update the handouts used for the crew participants. For example, the format of turnover sheets and work orders had been changed since the SPV, but the content remained the same.

Summary of the crew task performance observed during RSPV readiness assessment:

The acceptance criteria which was also included in the 2016 SPV, was the performance of the important human action (IHA) to inject water into a module. The data showed that the completion times were similar in both the SPV and the RSPV readiness assessment resulting in all crews meeting the acceptance criterion. Table A-1 provides the measured time information for comparison.

	Measured Performance Time (min)	PRA Assumed Maximum Time Allowed (min)	Ratio of measured to PRA Maximum Time Allowed (not to exceed 0.75)
2016 SPV Crew 1	12	56	0.2
2016 SPV Crew 2	14		0.3
2019 Assessment Crew 1	10		0.2
2019 Assessment Crew 2	15		0.3

Table A-1 Acceptance Criterion Comparison

Overall, the data collected showed that measured tasks were completed within the allowed time for both crews. In some instances one, and sometimes both, of the crews in the readiness assessment had better time performance than the SPV crews.

The following figures show a ratio of task time measured as compared to task time available to complete. A threshold of 50% was used during SPV and the same threshold was applied during the readiness assessment. Using a ratio view accentuates results to aid in determining if there is a task or set of tasks that challenges the time available for that task. The following figures show the measured task times from the RSPV readiness assessment (in shades of blue and listed as Pilot Crew 1 and 2) as compared to the measured task times from the 2016 SPV (in shades of green).

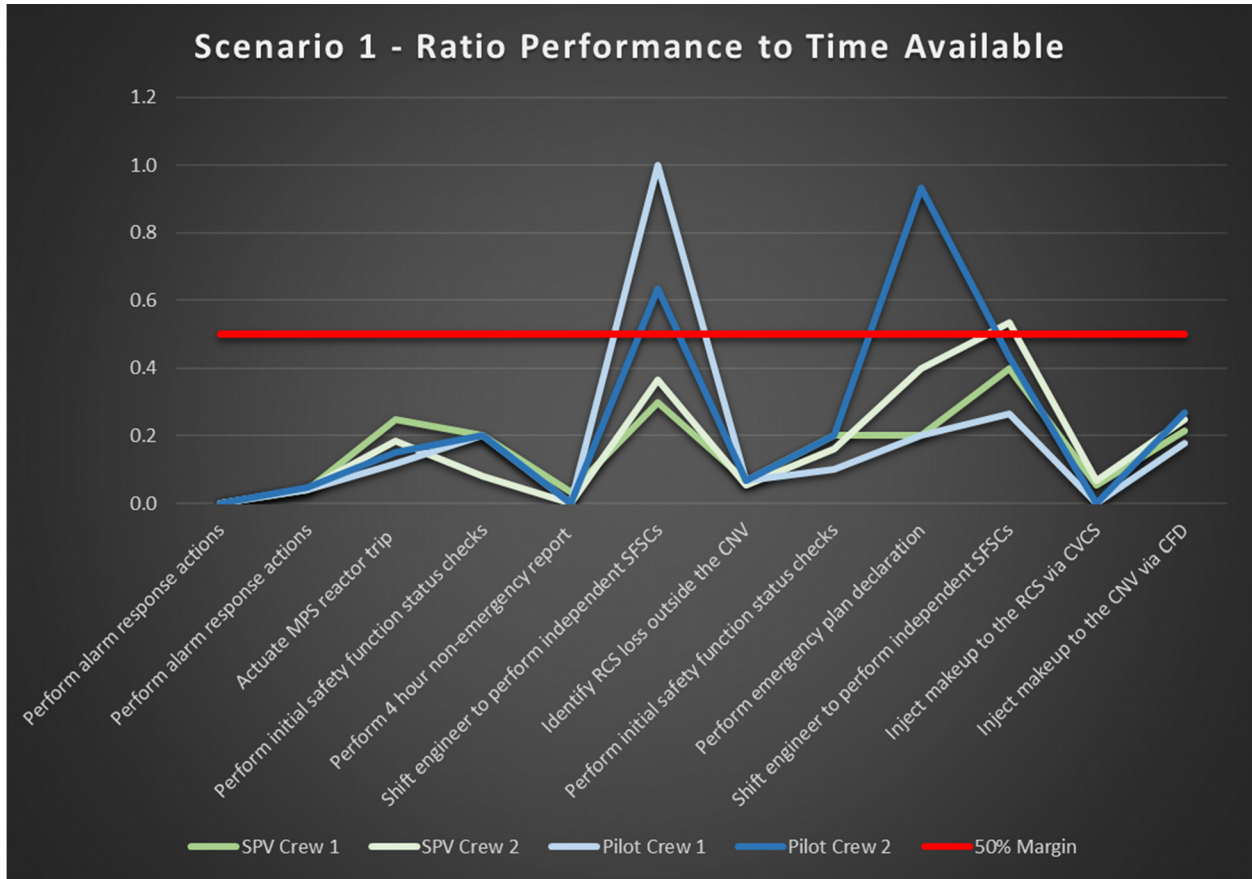


Figure A-2.4 Scenario 1 Task Time Ratios

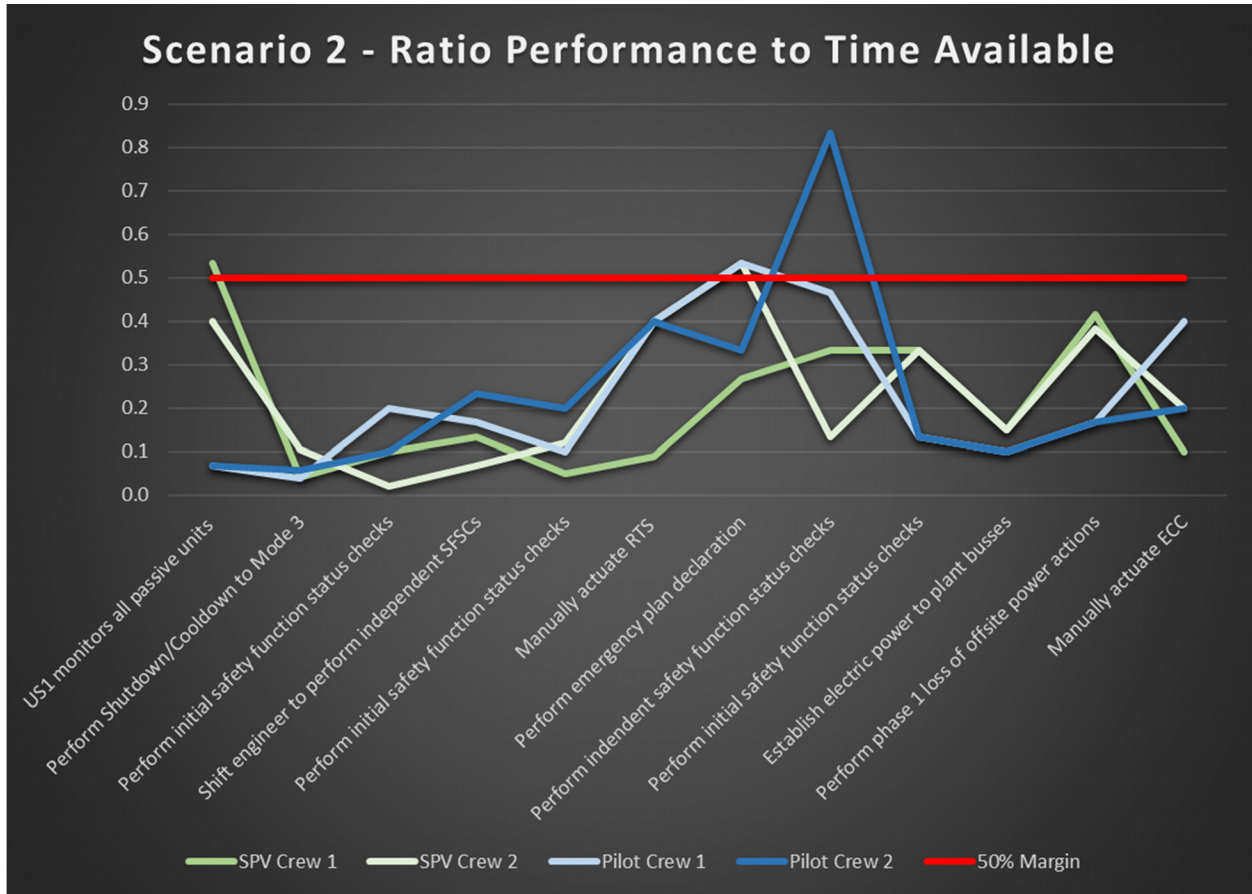


Figure A-2.5 Scenario 2 Task Time Ratios

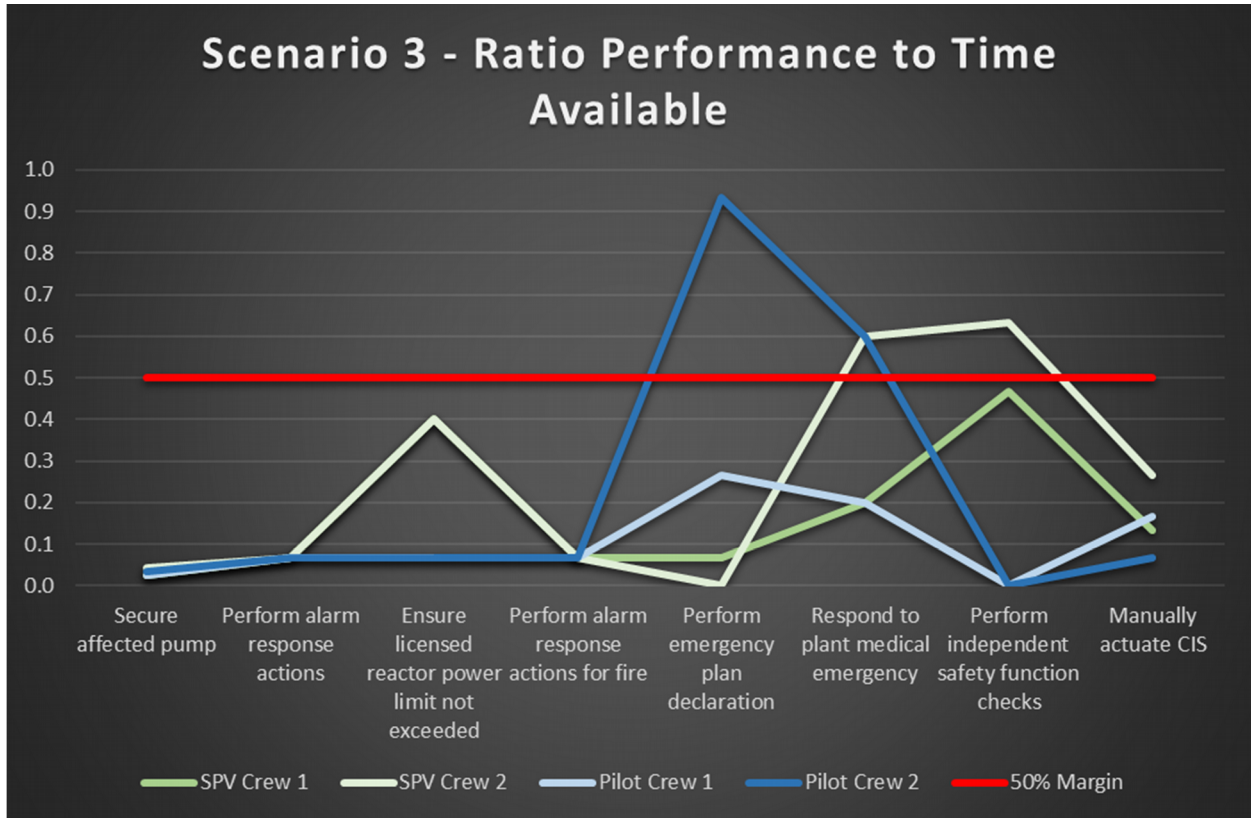


Figure A-2.6 Scenario 3 Task Time Ratios

The task timing ratios for the three scenarios shows, generally, that the RSPV crew data was consistent with the SPV data with all the tasks were performed within the allowed time by all crews.

Summary of workload observed during RSPV readiness assessment:

The average of TLX workload index scores gathered during the RSPV readiness assessment were similar to the 2016 SPV results.

Figure A-2.1 shows a comparison of the average workload measures on a scale of 0-100.

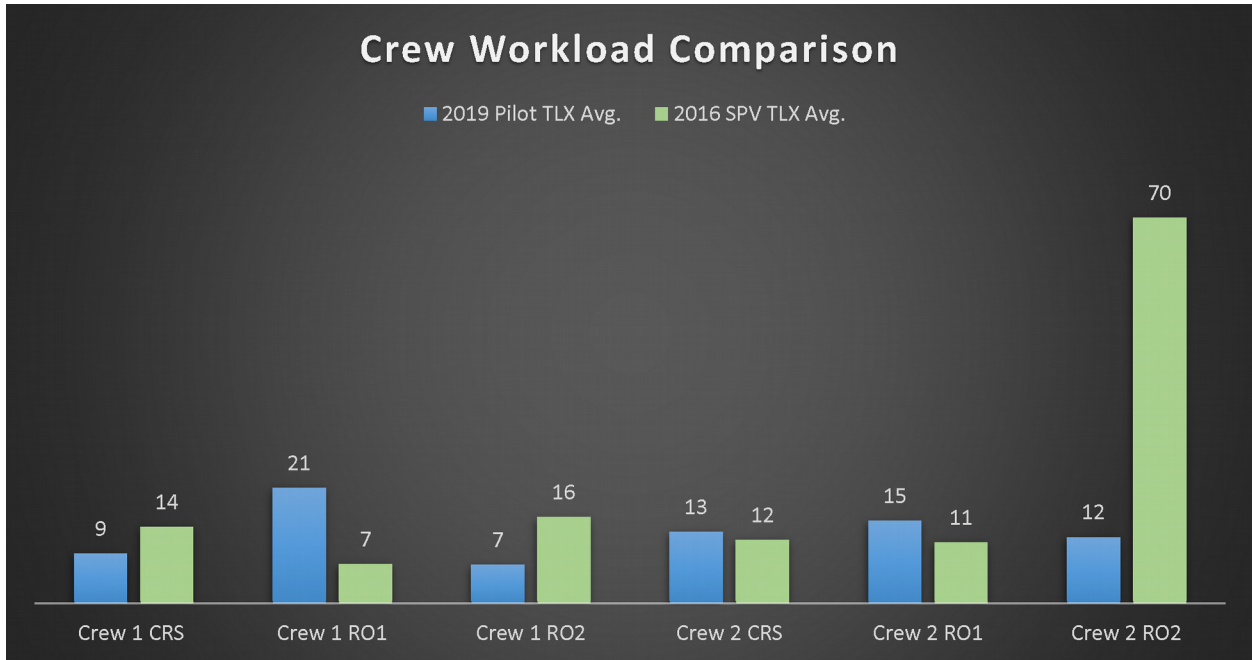


Figure A-2.1 Crew Workload Comparison

In general, the measured workload is consistent between the two tests with the exception of RO2 for crew 2. The 2016 SPV results document this self-observed high level on one of the individuals. That individual had a consistently higher scoring baseline in comparison to others.

Summary of situational awareness question data during RSPV readiness assessment:

The situational awareness question scores gathered during the RSPV readiness assessment were similar to the SPV results. The average situational awareness scores for both the readiness assessment and the SPV were 93%. There was no discernable trend to indicate that one position or person had a significant deviation of results from any other person or position.

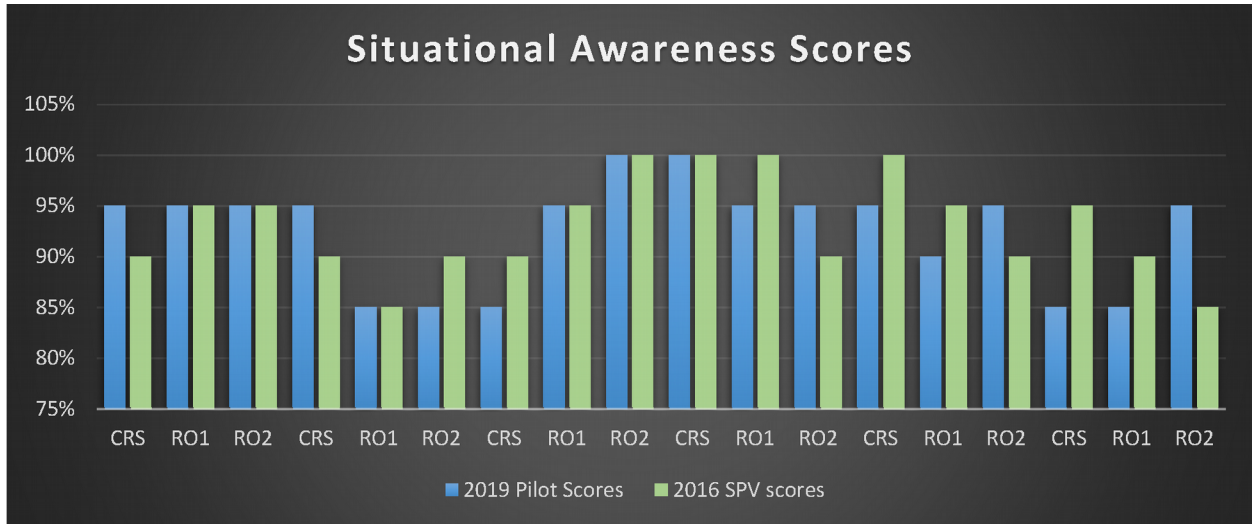


Figure A-2.3 Situational Awareness Scores

Test participant access to the scenarios prior to the RSPV readiness assessment:

Although there were no safeguards in place to ensure participants had not seen the original 2016 SPV scenarios, it was clear through observation of the crew performances that the scenarios were not reviewed by the crews prior to the assessment. The scenario files were maintained on a corporate drive and would only be accessible for someone actively searching for those files. Although not used for official validation purposes, they do provide an opportunity for comparison.

Impact Statement:

RP-0419-65209, Revised Staffing Plan Validation Test Report has been revised as described in the response above and as shown in the revisions provided in submittal LO-1220-73411, Revised Staffing Plan Validation Test Report.

Response to Request for Additional Information Docket: 99902078

RAI No.: 9789

Date of RAI Issue: 10/21/2020

NRC Question No.: NTR-14

Background and Regulatory basis:

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 NRC review and approval. The topical report is designed to be used by a NuScale licensee to support exemption requests from the staffing requirements in 10 CFR 50.54(m) or other alternative control room staffing regulations, such as those included in the NuScale design certification rule, and from the requirement in 10 CFR 50.120(b)(2)(iii) to provide training and qualifications for the STA.

The NRC staff reviews such exemption requests and must determine whether the staffing proposals provide 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. NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," provides a process for systematically reviewing and assessing alternatives to licensed operator staffing requirements. NUREG-0711, "Human Factors Engineering Program Review Model," contains guidance the staff uses to evaluate the methodology and results of human factors and staffing plan validation testing.

On August 17-27, 2020, the staff conducted a regulatory audit (audit plan ADAMS Accession No. ML20210M065) in support of the staff's review of the topical report. During the audit, the staff identified information that will require docketing to allow the staff to make conclusion on the whether the staffing proposal will adequately protect the public health and safety. Therefore, the NRC staff requests that NuScale provide additional information regarding the following topics.

Request for Additional Information:

The topical report, Section 3.1, "Industry Upgrades to Qualifications of Shift Supervisors and Senior Operators," states, "Applicable engineering principles are now an integral part of any



licensed operator training program." The topical report, Section 2.3, "Control Room Staff Level Based on Staffing and Qualification Analysis," also states, "Licensed operators are selected, trained, and qualified consistent with 'Guidelines for Initial Training and Qualification of Licensed Operators,' ACAD 10-001 (Reference 8.2.4)."

ACAD 10-001 is a proprietary document maintained by the Institute of Nuclear Power Operations (INPO) National Academy for Nuclear Training (NANT). Reference 8.2.4 is Revision 0, which has been superseded, and is expired. It is the facility licensee's responsibility to establish the training programs (i.e., training is an operational program and the development of the training program is a COL item). A facility licensee may not seek INPO/NANT accreditation, and therefore, may not have access to ACAD 10-001. Therefore, in addition to using a SAT-based process to develop the operator initial training program based on the tasks operators perform at the plant, the COL applicant should confirm that its initial training program does include the operator generic fundamentals that are relevant to operation of a NuScale power plant.

1. Please revise the topical report to account for a facility licensee that may not use ACAD 10-001 and that the revision listed in Reference 8.2.4 is expired.
2. Please revise the topical report to include a condition for the COL applicant's initial operator training program to be SAT-based and contain relevant generic fundamentals, including the math, physics, thermodynamics, and component design topics that are of specific relevance to the operation of a nuclear power plant.

NuScale Response:

NuScale Response to Question 1:

TR-0420-69456, "NuScale Control Room Staffing Plan," Section 2.3 Control Room Staff Level Based on Staffing and Qualification Analysis has been revised to account for a facility licensee that may not use ACAD 10-001. Reference 8.2.4 has also been updated to reflect the latest revision. The changes are shown below.

2.3 Control Room Staff Level Based on Staffing and Qualification Analysis

Licensed operators are selected, trained, and qualified with standards that are comparable to the approved standards of Guidelines for Initial Training and Qualification of Licensed



Operators, ACAD 10-001 (Reference 8.2.4), and fully comply with the applicable licensed operator training programs described in 10 CFR Part 55 and 10 CFR Part 50.120.

Reference 8.2.4

8.2.4 National Academy for Nuclear Training, "Guidelines for Initial Training and Qualification of Licensed Operators", ACAD 10-001, Rev. 1, November 2016.

NuScale Response to Question 2

The amount and style of mathematical training provided by various academic bodies varies widely from institute to institute. NuScale staff has concluded that the mathematics needed for achieving mastery of an initial operator training program is that engineering mathematics needed to complete the standard industry generic fundamentals training as described in NUREG-0737, TMI Action Plan Requirements.

The incorporation of GFE back into the site specific written examination will not impact this requirement, because it states training program requirement, not an NRC exam requirement.

TR-0420-69456, "NuScale Control Room Staffing Plan," Section 1.5 Conditions of Applicability has been revised to include the attributes to be included in a systematic approach to training based licensed operator training program, and to include the math, physics, thermodynamics, and component design topics that are of specific relevance to the operation of a nuclear power plant. It is important to note that, from the list included in Section 1.5, only a site specific commercial nuclear power plant training program would be guaranteed to include all of these elements. The mitigating core damage, plant systems, plant specific reactor technology (including core physics data), transient and accident analysis, and emergency operating procedure training could only be acquired at a plant specific training program.

There is no impact to not having at least one person on shift who has a technical degree. The initial license operator training programs changes that were put in place by the industry as a whole to comply with NUREG-0737, TMI Action Plan Requirements, provide a specific list of the elements of the engineering expertise that are germane to operating a commercial nuclear power facility. These would already be required training elements for any COL holder, and are repeated as part of the conditions of applicability for use of this alternate staffing plan. They are:

The applicants' licensed operator training programs for the plant include the following attributes and items:

- developed using a systems approach to training, as described in 10 CFR Part 55



- the math, physics, thermodynamics, and component design topics that are of specific relevance to the operation of a nuclear power plant
- training for mitigating core damage
- plant specific training, including:
 - plant systems
 - plant specific reactor technology (including core physics data)
 - plant chemistry and corrosion control
 - reactor plant materials
 - reactor plant thermal cycle
 - transient/accident analysis
 - emergency procedures

It is important to note that, from this list, only a site specific commercial nuclear power plant training program would be guaranteed to include all of these elements. The mitigating core damage, plant systems, plant specific reactor technology (including core physics data), transient and accident analysis, and emergency operating procedure training could ONLY be acquired at a plant specific training program.

Impact on Topical Report:

Topical Report TR-0420-69456, NuScale Control Room Staffing Plan, has been revised as described in the response above and as shown in the revision provided in LO-1220-73414.

Response to Request for Additional Information Docket: 99902078

RAI No.: 9789

Date of RAI Issue: 10/21/2020

NRC Question No.: NTR-15

Background and Regulatory basis:

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 NRC review and approval. The topical report is designed to be used by a NuScale licensee to support exemption requests from the staffing requirements in 10 CFR 50.54(m) or other alternative control room staffing regulations, such as those included in the NuScale design certification rule, and from the requirement in 10 CFR 50.120(b)(2)(iii) to provide training and qualifications for the STA.

The NRC staff reviews such exemption requests and must determine whether the staffing proposals provide 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. NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," provides a process for systematically reviewing and assessing alternatives to licensed operator staffing requirements. NUREG-0711, "Human Factors Engineering Program Review Model," contains guidance the staff uses to evaluate the methodology and results of human factors and staffing plan validation testing.

On August 17-27, 2020, the staff conducted a regulatory audit (audit plan ADAMS Accession No. ML20210M065) in support of the staff's review of the topical report. During the audit, the staff identified information that will require docketing to allow the staff to make conclusion on the whether the staffing proposal will adequately protect the public health and safety. Therefore, the NRC staff requests that NuScale provide additional information regarding the following topics.

Request for Additional Information:

The topical report, Executive Summary, states, "NUREG-0737 (Reference 8.1.6) states 'the need for the STA position may be eliminated when the qualification of the shift supervisors and



senior operators have been upgraded and the man-machine interface in the control room has been acceptably upgraded.' These conditions have been met in the NuScale Power Plant, and the minimum operating crew of three operators does not include the STA role..." Although the STA was initially intended to be an interim or short-term measure implemented following the accident at Three Mile Island, the Commission's Policy Statement on Engineering Expertise on Shift (50 FR 43621), which was issued in October 1985 after NUREG-0737, states, "The STA has proven to be a worthwhile addition to the operating staff by providing an independent engineering and accident assessment capability, and we support continuation of this position."

NUREG-1791, Section 6.2, states that "[t]he task analysis data submitted in support of the exemption request should include the following, as applicable... identification of tasks that may affect the roles, responsibilities, or qualifications for licensed control personnel." During the August 2020 audit, the staff reviewed the results of a task analysis that NuScale performed as part of assessment of eliminating the STA position. The task analysis listed all tasks that were previously assigned to the STA and how they have been dispositioned with the elimination of the STA.

During the audit, the staff observed that some tasks previously assigned to the STA that involve assisting and making recommendations to the CRS and/or SM about whether an emergency action level (EAL) has been exceeded and whether plant equipment included in Technical Specifications is operable were listed as having been consolidated with tasks assigned to the CRS position. In the revised staffing plan, the CRS and SM roles can be combined, and so the individual in the combined CRS/SM position cannot assist or make recommendations to him or herself. Additionally, the staff did not observe any HSI design features that provide recommendations to the CRS/SM that are comparable to an additional operator who has been trained on EALs and Technical Specifications. Ensuring equipment included in technical specifications is operable helps ensure important plant equipment will be available if needed in an emergency, and proper implementation of the emergency plan, including identification of the correct the correct EAL during an abnormal event, helps to protect public health and safety.

1. In support of the proposal to eliminate the STA role, please revise the topical report to include a description of the task analysis NuScale conducted, including a summary of how NuScale dispositioned the tasks that were assigned to the STA, and NuScale's conclusions from the task analysis.
2. Please explain why, when the CRS/SM position is combined, there is not a need for an additional individual who is trained on operability determinations and emergency action



levels to provide independent assessment and advice to the CRS/SM.

NuScale Response:

NuScale Response to Question 1:

TR-0420-69456, "NuScale Control Room Staffing Plan," has been revised to add Section 3.4 "Shift Technical Advisor HFE Task Analysis and Conclusion" to explain how NuScale dispositioned the tasks assigned to the shift technical advisor and the conclusions from the task analysis.

This section discusses eight emergency plan tasks and 2 administrative tasks that were reassigned when the STA position was removed. These tasks were reassigned to the control room supervisor (CRS) when functioning in the dual role shift manager (SM)/CRS capacity, or the SM when the roles are split apart. There are also 25 tasks that are assigned to the SM/CRS that have now been identified that can be delegated to the RO 2/3, who also holds an SRO license.

The conclusion of the STA HFE task analysis has been revised as follows:

"Based on the low number of tasks, the high amount of time available to identify and complete the tasks, and the redundant nature of how specific HFE tasks assigned to the CRS can also be peer checked by the second senior reactor operator on the crew, NuScale has concluded that the control room staff as described in the topical report is adequate to support the task reassignment. There is adequate time for the second on-shift senior reactor operator to independently assess and provide advice to the CRS in a reasonable amount of time to engage off-site or off-shift resources for assistance."

NuScale Response to Question 2:

As part of the combined operating license (COL) applicant's responsibilities, a conduct of operations manual will be developed to establish licensee expectations for use of peer checks, and practices to use independent assessment and additional advice and input when making decisions. It will be the COL holder's responsibility to determine expectations for peer checks of emergency action level (EAL) classification and operability determinations. The human factors engineering task analysis identified that the responsibility for EAL classifications and operability determinations resides with the CRS. The event progression is slower at a NuScale Power Plant with less reliance on operator actions than at a typical large light water nuclear power plant.



There is adequate time for the second on-shift senior reactor operator to independently assess and provide advice to the CRS in a reasonable amount of time or to engage off-site or off-shift resources for assistance.

Initial License Operator Training programs that comply with standards comparable to ACAD 10-001, "Guidelines for Initial Training and Qualification of Licensed Operators," include specific training on the use of human performance tools, and on crew teamwork and dynamics.

Impact on Topical Report:

Topical Report TR-0420-69456, NuScale Control Room Staffing Plan, has been revised as described in the response above and as shown in the revision provided in LO-1220-73414.