RAIO-0518-60154

May 23, 2018

Docket No. 52-048

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 400 (eRAI No. 9409) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 400 (eRAI No. 9409)," dated March 26, 2018

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) response to the referenced NRC Request for Additional Information (RAI).

The Enclosures to this letter contain NuScale's response to the following RAI Questions from NRC eRAI No. 9409:

- 18-36
- 18-37
- 18-38
- 18-39
- 18-40

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 400 (eRAI No. 9409). NuScale requests that the proprietary version be withheld from public disclosure in accordance with the requirements of 10 CFR § 2.390. The proprietary enclosures have been deemed to contain Export Controlled Information. This information must be protected from disclosure per the requirements of 10 CFR § 810. The enclosed affidavit (Enclosure 3) supports this request. Enclosure 2 is the nonproprietary version of the NuScale response.

This letter and the enclosed responses make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Steven Mirsky at 240-833-3001 or at smirsky@nuscalepower.com.

Sincerely,

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

Distribution: Gregory Cranston, NRC, OWFN-8G9A
Samuel Lee, NRC, OWFN-8G9A

Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9409, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9409, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0518-60155

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9409, proprietary

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Enclosure 2:

NuScale Response to NRC Request for Additional Information eRAI No. 9409, nonproprietary

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Response to Request for Additional Information
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eRAI No.: 9409
Date of RAI Issue: 03/26/2018

NRC Question No.: 18-36

Title 10 of the *Code of Federal Regulations* (10 CFR), Section 52.47(a)(8) requires an applicant for a design certification to provide a final safety analysis report (FSAR) that includes the information necessary to demonstrate compliance with any technically relevant portions of the Three Mile Island requirements set forth in 10 CFR 50.34(f), except paragraphs (f)(1)(xii), (f)(2)(ix), and (f)(3)(v). Section 10 CFR 50.34(f)(2)(iii) requires an applicant to provide, for Commission review, a control room design that reflects state-of-the-art human factor principles prior to committing to fabrication or revision of fabricated control room panels and layouts. Chapter 18, “Human Factors Engineering,” of NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition,” and NUREG-0711, "Human Factors Engineering Program Review Model,” identify criteria the staff uses to evaluate whether an applicant meets the regulation. The FSAR, Tier 2, Section 18.0, "Human Factors Engineering – Overview," indicates that the HFE program incorporates the applicable guidance provided in NUREG-0711, Revision 3. This regulatory basis applies to all questions in this request for additional information.

NUREG-0711, Review Criterion 5.4(9), states, in part, that the applicant should provide an analysis of the feasibility and reliability of important human actions (HAs) that address the following:

- The analysis establishes the time available using an analysis method and acceptance criteria consistent with the regulatory guidance associated with the actions. The basis for the time available is documented.
- The analysis of the time required is based on a documented sequence of operator actions (based on task analysis, vendor-provided generic technical guidelines for emergency operating procedure (EOP) development, or plant-specific EOPs, depending on the maturity of the design.
- Techniques to minimize bias are used when estimates of time required are derived using methods that are dependent on expert judgment. Uncertainties in the analysis of time required are identified and assessed.
- The sequence of actions uses only alarms, controls, and displays that would be available and operable during the assumed scenario(s).
- The estimated time for operators to complete the credited action is sufficient to allow

successful execution of applicable steps in the EOPs.
- Staffing for analysis is justified, and if credited manual actions require additional operators beyond the assumed staffing, the justification for timely availability of the additional staffing is provided and the estimate of time required includes any time needed for calling in additional personnel.
- The analysis of the action sequence is conducted at a level of detail sufficient to identify individual task components, including cognitive elements such as diagnosis and selection of appropriate response.
- The analysis identified a time margin to be added to the time required and the basis for the adequacy of the margin.

The Treatment of Important Human Actions Results Summary Report (TIHA RSR), Section 4.1, "Identification of Risk Important Human Actions from the PRA/HRA [Probabilistic Risk Assessment / Human Reliability Analysis]," states that two important human actions (IHAs) associated with the NuScale Power plant design have been identified. Section 4.3.4, “Staffing and Qualification Analysis,” states that the Chemical and Volume Control System (CVCS) and the Containment Flooding and Drain System (CFDS) IHAs were included in the scenarios used during the staffing plan validation.

The FSAR, Chapter 19, “Probabilistic Risk Assessment,” documents the results of a Human Reliability Analysis, which was performed to identify potential human failure events and to systematically estimate the probability of those events. Table 19.1-14, “Modeled Human Actions (Post-Initiator),” identified several post-initiator human actions that are performed by the operator to place a mitigating system in service, including manual operation of a component and manual initiation as backup to auto-initiation. For two of the human actions listed in this Table, CFDS-HFE-0001C-FOP-N (operator fails to un-insolate and initiate CFDS injection) and CVCS-HFE-0001C-FOP-N (operator fails to un-isolate and initiate CVCS injection through either the injection line or the pressurizer spray line), the corresponding end note reads:
“For diagnosis, the operators have at least 30 minutes (based on thermal hydraulic analysis), and the time available to perform the action is nominal (i.e., greater than the time required to perform the action).”

The Human Factors Engineering Staffing and Qualifications Results Summary Report (S&Q RSR), Section 3.3.2, “Staffing Plan Validation Scenario Development” provides information regarding the time available to perform the important HAs, based on the most limiting probabilistic risk assessment (PRA) sequence. The same information is also provided in the Control Room Staffing Plan Validation Results (SPV Results) document, Appendix D, “Scenario 1 Description and Basis.” The information regarding the time available to perform the IHAs provided in the S&Q RSR and the SPV Results document does not appear to be consistent with the information provided in the FSAR Chapter 19.

It is not clear how the time available as shown in the S&Q RSR and the SPV Results document was determined, based on the PRA/HRA information provided in the FSAR,
Chapter 19. Provide additional information regarding the time available to perform the IHAs, as follows:

a. Explain the apparent inconsistency between the time available as shown in the S&Q RSR and the SPV Results document, and the time available (30 minutes) determined by the PRA/HRA information provided in the FSAR, Chapter 19.
b. If the time available was determined by means other than the PRA/HRA analysis, describe the analysis method and acceptance criteria used to determine the time available to perform the IHAs identified in the TIHA RSR. In your response, identify the applicable regulatory guidance that was used for the chosen analysis method and acceptance criteria, if any.
c. Provide the time available that was determined for each IHA, using the analysis method and acceptance criteria discussed above.

NuScale Response:

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}}2(a),(c)

Impact on DCA:

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

NuScale Power™

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NRC Question No.: 18-37

The TIHA RSR, Section 4.1, “Identification of Risk Important Human Actions from the PRA/HRA,” stated that two IHAs associated with the NuScale Power plant design have been identified. The same IHAs are also discussed in the Task Analysis Results Summary Report (TA RSR), Section 4.5, “Important Human Action Results.”

The S&Q RSR, Section 3.1.4, “Treatment of Important Human Actions,” states that the important HAs are identified as described in the TIHA RSR. It further states: “Detailed [Task Analysis] (TA) determined the feasibility and reliability of IHAs.” TA also performs a workload assessment, time margin assessment, and determines the number of people required to accomplish a task as well as the knowledge and abilities that determine qualifications.” Section 3.3.2, “Staffing Plan Validation Scenario Development,” provides additional information, indicating that the number of important HAs was revised and no longer corresponds to the information provided in the TIHA RSR and TA RSR. Furthermore, the SPV Results document, Appendix D, “Scenario 1 Description and Basis,” describes the inclusion of important HAs in the scenario, which is consistent with the information provided in the S&Q RSR, but inconsistent with the TA RSR and TIHA RSR.

Provide additional information explaining the apparent inconsistency in the identification and evaluation of the important HAs as described in the above referenced documents.

NuScale Response:

The following time line is provided to clarify how updates of the PRA model results were used as inputs to HFE activities:

1. Prior to May 17, 2016, the NuScale PRA identified two important human actions:

- {{

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

{{

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

2. On May 17, 2016, the NuScale PRA group issued an update to their PRA model results which showed only one important human action,{{
}}2(a),(c), ECI This was the basis for the Staffing Plan Validation (SPV) scenario development, testing and results.
3. The Staffing Plan Validation (SPV) was performed August 16-19, 2016.
4. On August 17, 2016, an update to the NuScale PRA results, in part, added the action {{ }}2(a),(c), ECI back to the important human actions list.
5. The Task Analysis (TA) Results Summary Report (RSR) (RP-0316-17616, Revision 0) was approved and submitted to the NRC in December 2016.
6. The Treatment of Important Human Actions (TIHA) RSR (RP-0316-17618, Revision 0) was approved and submitted to the NRC in December 2016.
7. The Staffing and Qualification (S&Q) RSR (RP-0316-17617 Revision 0) was approved and submitted to the NRC in December 2016.

Section 3.3.2 of the S&Q RSR summarizes SPV scenario development, and includes the history of PRA changes, because these PRA updates resulted in a reevaluation of the SPV scenarios. The reevaluation concluded that no SPV scenario changes were needed. The SPV scenarios focused on creating a high workload. To accomplish this, one scenario already included both of the important human actions originally identified prior to May 17, 2016. The scenario remained as it was originally designed in order to maximize work load.

The PRA revisions are discussed in Section 3.3.2 of the S&Q RSR in the context of *SPV scenario development only*. The ultimate result is that there are 2 important human actions in the NuScale design which is consistent with Section 4.1 of the TIHA RSR and Section 4.5 of the TA RSR. RP-0516-49116, Rev. 1, Control Room Staffing Plan Validation Results, is a historical document. Appendix D does not define or establish the PRA important human actions for the NuScale design.

Impact on DCA:

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

NuScale Power™

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NRC Question No.: 18-38

The TA RSR, Section 3.7, “Analysis of Feasibility and Reliability for Important Human Actions,” stated, in part, that the time-required calculation was based on an understanding of the sequence of operator actions and took into account secondary tasks. It further stated that the time-required estimates for important human actions were simulated and measured when feasible, or obtained through operator and expert interviews, software modeling of human behavior during tasks, and OERs.

a. Provide the results of the analysis that was performed to determine the time required to complete each important HA, based on a documented sequence of operator actions. If estimates of time required were derived using methods that are dependent on expert judgement, clarify what techniques to minimize bias were used and how uncertainties in the analysis of time required were identified and assessed.
b. Provide additional information clarifying whether the sequence of actions that were analyzed for the purpose of determining the feasibility and reliability for important HAs used only alarms, controls, and displays that would be available and operable during the assumed scenarios.

NuScale Response:

The time required to complete each Important Human Action (IHA) was determined by embedding the IHAs in a scenario and running the scenario on the NuScale simulator. The sequence of operator actions was dictated by procedures that operators followed in response to the scenario. {{

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

The simulator contained all the alarms, controls, displays and operator aids needed for the IHAs. By using the simulator to determine the time required to accomplish the IHAs, NuScale also verified that all necessary alarms, controls, and displays were functional and that their configuration supported an efficient and effective response.

This testing was done as part of the Staffing Plan Validation described in RP-0516-49116

"Control Room Staffing Plan Validation Results."

Impact on DCA:

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

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NRC Question No.: 18-39

The SPV Results document, Section 6.2.1, “Scenario Completion Acceptability,” discussed the criteria that were used to determine the staffing plan scenario testing success, including the ratio of the time required to the time available to perform actions. Appendix A, “Scenario Results Report,” Section A.1, “Results Summary,” documented evaluation of the simulation results against the criteria defined in Section 6.2.1 of the document.

Section 6.1.1, “Time Analysis,” discussed the time measurement analysis, including a time margin to be added to be added to the time required. The time ratio discussed in Section 6.1.1 is more conservative than the criteria described in Section 6.2.1.

Provide additional information regarding the basis for the adequacy of the margin to be added to the time required, as discussed in Section 6.1.1 of the SPV Results document. In your response, clarify why the less conservative time ratio described in Section 6.2.1 was used, as opposed to the more conservative value identified in Section 6.1.1.

NuScale Response:

RP-0516-49116, Control Room Staffing Plan Validation Results, Section 6.1.1, paragraph 2 states that {{

}}2(a),(c)

In Section 6.2.1 of the Control Room Staffing Plan Validation, the {{

}}2(a)(c)

The same measures will be applied in the same manner for the Integrated System Validation.

Impact on DCA:

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

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eRAI No.: 9409
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NRC Question No.: 18-40

The S&Q RSR, Section 4.7, “Staffing Plan Validation Results Analysis,” indicates a time the PRA assumes is the most limiting completion time for these actions, and that time is greater than 30 minutes. The same section in the S&Q RSR also identifies the times it took crews to complete these two actions in the simulator during the staffing plan validation and the time margin determined by comparing the crews’ times to the time assumed in the PRA.

Please explain whether the responses to Questions 1 and 4 above impact the conclusion discussed in the last paragraph of the S&Q RSR, Section 4.7 and the conclusions discussed in the SPV Results document, Section 6.1.1, “Time Analysis,” and if so, please revise the S&Q RSR, Section 4.7 as necessary.

NuScale Response:

The responses to eRAI 9409 Questions 18-36 and 18-39 do not change the conclusions of RP-0316-17617, Human Factors Engineering Staffing and Qualifications Results Summary Report, Section 4.7, “Staffing Plan Validation Results Analysis,” or RP-0516-49116, Control Room Staffing Plan Validation Results, Section 6.1.1, “Time Analysis.”

Impact on DCA:

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

Enclosure 3:

Affidavit of Zackary W. Rad, AF-0518-60155

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NuScale Power, LLC

AFFIDAVIT of Zackary W. Rad

I, Zackary W. Rad, state as follows:

1. I am the Director, Regulatory Affairs of NuScale Power, LLC (NuScale), and as such, I have been specifically delegated the function of reviewing the information described in this Affidavit that NuScale seeks to have withheld from public disclosure, and am authorized to apply for its withholding on behalf of NuScale.
2. I am knowledgeable of the criteria and procedures used by NuScale in designating information as a trade secret, privileged, or as confidential commercial or financial information. This request to withhold information from public disclosure is driven by one or more of the following:
    a. The information requested to be withheld reveals distinguishing aspects of a process (or component, structure, tool, method, etc.) whose use by NuScale competitors, without a license from NuScale, would constitute a competitive economic disadvantage to NuScale.
    b. The information requested to be withheld consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), and the application of the data secures a competitive economic advantage, as described more fully in paragraph 3 of this Affidavit.
    c. Use by a competitor of the information requested to be withheld would reduce the competitor's expenditure of resources, or improve its competitive position, in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.
    d. The information requested to be withheld reveals cost or price information, production capabilities, budget levels, or commercial strategies of NuScale.
    e. The information requested to be withheld consists of patentable ideas.
3. Public disclosure of the information sought to be withheld is likely to cause substantial harm to NuScale's competitive position and foreclose or reduce the availability of profit-making opportunities. The accompanying Request for Additional Information response reveals distinguishing aspects about the method by which NuScale develops its human factors verification and validation.

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

    The precise financial value of the information is difficult to quantify, but it is a key element of the design basis for a NuScale plant and, therefore, has substantial value to NuScale.

    If the information were disclosed to the public, NuScale's competitors would have access to the information without purchasing the right to use it or having been required to undertake a similar expenditure of resources. Such disclosure would constitute a misappropriation of NuScale's intellectual property, and would deprive NuScale of the opportunity to exercise its competitive advantage to seek an adequate return on its investment.

4. The information sought to be withheld is in the enclosed response to NRC Request for Additional Information No. 400, eRAI 9409. The enclosure contains the designation "Proprietary" at the top of each page containing proprietary information. The information considered by NuScale to be proprietary is identified within double braces, "{{ }}" in the document.
5. The basis for proposing that the information be withheld is that NuScale treats the information as a trade secret, privileged, or as confidential commercial or financial information. NuScale relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC § 552(b)(4), as well as exemptions applicable to the NRC under 10 CFR §§ 2.390(a)(4) and 9.17(a)(4).
6. Pursuant to the provisions set forth in 10 CFR § 2.390(b)(4), the following is provided for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld:
    a. The information sought to be withheld is owned and has been held in confidence by NuScale.
    b. The information is of a sort customarily held in confidence by NuScale and, to the best of my knowledge and belief, consistently has been held in confidence by NuScale. The procedure for approval of external release of such information typically requires review by the staff manager, project manager, chief technology officer or other equivalent authority, or the manager of the cognizant marketing function (or his delegate), for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside NuScale are limited to regulatory bodies, customers and potential customers and their agents, suppliers, licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or contractual agreements to maintain confidentiality.
    c. The information is being transmitted to and received by the NRC in confidence.
    d. No public disclosure of the information has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or contractual agreements that provide for maintenance of the information in confidence.
    e. Public disclosure of the information is likely to cause substantial harm to the competitive position of NuScale, taking into account the value of the information to NuScale, the amount of effort and money expended by NuScale in developing the information, and the difficulty others would have in acquiring or duplicating the information. The information sought to be withheld is part of NuScale's technology that provides NuScale with a competitive advantage over other firms in the industry. NuScale has invested significant human and financial capital in developing this technology and NuScale believes it would be difficult for others to duplicate the technology without access to the information sought to be withheld.

I declare under penalty of perjury that the foregoing is true and correxecuted on 5/23/2018.

Zackary W. Rad