RAIO-0617-54714

June 28, 2017

Docket No. 52-048

U.S. Nuclear Regulatory Commission
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11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 33 (eRAI No. 8824) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 33 (eRAI No. 8824)," dated May 26, 2017

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

The Enclosure to this letter contains NuScale's response to the following RAI Question from NRC eRAI No. 8824:

- 08.04-1

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

If you have any questions on this response, please contact Darrell Gardner at 980-349-4829 or at dgardner@nuscalepower.com.

Sincerely,

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

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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 8824

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 8824

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Response to Request for Additional Information
Docket No. 52-048

eRAI No.: 8824
Date of RAI Issue: 05/26/2017

NRC Question No.: 08.04-1

10 CFR 50.63, “Loss of all alternating current power,” requires that each nuclear power plant be capable of withstanding or coping with, and recovering from a station blackout (SBO) event of a specified duration (known as coping duration), and maintaining adequate core cooling and appropriate containment integrity for the SBO coping duration. RG 1.155 and DSRS Section 8.4 describe guidance acceptable to the staff for meeting the requirements of 10 CFR 50.63 to be applied to the NuScale design. DSRS Section I (page 8.4-2) states that the review should determine that the capability to achieve and maintain safe shutdown and containment integrity during an SBO conform to the guidance provided in Section C.3.2 of RG 1.155, “Station Blackout.”

In Section 8.4.3 of the FSAR Tier 2, the applicant states that the design adequacy and capability of equipment needed to cope with an SBO for the 72-hour duration of the event was evaluated, and the evaluation provides reasonable assurance that the required SBO equipment remains operable, and that no special equipment provisions or operator actions are necessary to ensure the operability of SBO mitigation equipment for the 72-hour duration.

In Section 8.4.3 of the FSAR Tier 2, the applicant states that an SBO transient sensitivity case that considered a simultaneous loss of all AC and DC power was evaluated and demonstrates that the NuScale Power Plant design does not rely on DC power from the EDSS to meet the requirements of 10 CFR 50.63.

In order for the staff to determine NuScale design's compliance with 10 CFR 50.63, the staff requests the following additional information:

1. Please provide the assumptions and a summary of the evaluation that NuScale performed as stated in FSAR Tier 2, Section 8.4.3 as it relates to conformance to RG 1.155, Section C.3.2. In addition, discuss the COL applicant responsibility, if applicable.

2. Please provide the assumptions and a summary of the SBO transient sensitivity evaluation that NuScale performed to show compliance with 10 CFR 50.63.

NuScale Response:

Question 1 Response

The table below provides a summary of conformance with RG 1.155, Section C.3.2 for the NuScale design. The underlying assumption in the coping analysis is that the SBO is mitigated as described in FSAR Sections 8.4.1 and 8.4.2. The coping analysis did not identify any responsibilities for the COL applicant. The detailed design phase may engender some additional analysis for SBO support equipment as indicated in Part 3.2.4 of the table below.

RG 1.155 Section C.3.2 Part and Summary	**Details of Conformance for the NuScale Power Plant Design**
Part 3.2.1: Initial Power History	The design conforms to the power history assumptions of this part as described in FSAR Section 8.4.1.
Part 3.22: System Capability of Systems Required to Perform Core Cooling and Decay Heat Removal	The design heat removal capability of the passive mitigation equipment (DHRS and ECCS) that are relied upon to meet 10 CFR 50.63 are inputs in the transient analysis of FSAR Section 8.4.1, and the capability of these systems was documented in the coping analysis. Natural circulation provides core cooling during an SBO. The capability of the DHRS and ECCS is evident in the plots that demonstrate that the required acceptance criteria for core cooling and containment integrity are met as shown in FSAR Section 8.4. There is no other decay heat removal or core cooling equipment required to meet the requirements of 10 CFR 50.63. Other items in this part such as tank capacity, compressed air capacity, etc. do not apply to the NuScale design. The EDSS performs a monitoring support function during SBO and does not provide a core cooling or decay heat removal mitigation function. Regarding EDSS capability, FSAR Section 8.4.3 cites FSAR Section 8.3.2 for the EDSS design details. As described in FSAR Section 8.3.2.1.1, the EDSS is designed to provide power to the MPS, PAM equipment, and main control room emergency lighting for a minimum of 72 hours in the event of a postulated DBE.
Part 3.2.3: RCS Inventory Control Including Pump Seals	The potential for inventory loss due to letdown is addressed in FSAR Section 8.4.2, and the potential for inventory loss due to reactor coolant pump seal leakage is obviated by the NuScale design, which does not include these pumps.

Part 3.2.4: Design Adequacy of SBO Coping Equipment for the SBO Environmental Conditions	The NuScale coping analysis verified the design adequacy of the mitigation equipment that removes heat and cools the core given the SBO environmental conditions. Regarding the environmental conditions of SBO support equipment that is used to monitor the event, the coping analysis verified the design adequacy of the standard design, which is subject to the detailed-design changes that result from actual equipment characteristics and placement. Detailed design changes include items such as cable routing and the effects of actual equipment type and equipment placement on heat generation, room temperatures, and fire protection response. An evaluation of the environmental conditions for the actual installed SBO support equipment in its final configuration will be done as part of the detailed design phase using the guidance of NUMARC 87-00 Revision 1, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors.
3.2.4 Subpart 1: Potential Failures of Equipment Necessary to Cope with the SBO	The SBO event does not impose a new or different failure mode on SBO mitigation equipment. The coping analysis did not identify any failures of SBO mitigation or support equipment.

3.2.4 Subpart 2: Environmental Effects on SBO Equipment Operability Including Fire Protection Systems	The environmental effects on SBO equipment are summarized in FSAR Section 8.4.3 with additional detail below. Mitigation Equipment Consistent with the provisions of Part 3.2.4, the evaluation of equipment operability during SBO environmental conditions credits the existing design requirements for environmental qualification of the passive safety-related DHRS and ECCS mitigation equipment. Regarding the possible effects of actuation of automatic fire protection systems, the DHRS and ECCS SBO mitigation equipment are located within the reactor pool and is not subject to these effects. Support Equipment Ambient temperatures in the main control room do not result in adverse effects on support equipment operability. See FSAR Table 6.4-3, Main Control Room Temperature Under Passive Cooling Conditions, for main control room temperatures. Support equipment in the main control room includes the post-accident monitoring (PAM) equipment and main control room emergency lighting equipment. The PAM equipment design includes requirements for environmental qualification. The EDSS supplies power to the support equipment. The GDC 4 conformance part of FSAR Section 8.3.2.2 states that the EDSS design accommodates the effects of environmental conditions as reflected in FSAR Reference 8.3-1. Item I.6 in Table 3-1 of this reference requires a design review to confirm that SBO temperatures are within equipment operability limits. NuScale has performed passive cooling analyses of SBO equipment rooms to confirm the temperature analyses requirements of this part are met. The EDSS battery rooms and the main control room do not contain automatic fire suppression. The control room habitability system, which is described in FSAR Section 6.4, is designed to be operable for the duration of the SBO event as cited in FSAR Section 8.4.3.
3.2.4 Subpart 3: Potential Effects of Other Hazards Such as Weather on SBO Response Equipment	The NuScale design does not include auxiliary response equipment for SBO coping and is not subject to this subpart. FSAR Section 8.4.3 includes the following statement. The evaluation provides reasonable assurance that the required SBO equipment remains operable, and that no special equipment provisions or operator actions are necessary to ensure the operability of SBO mitigation equipment for the 72-hour duration.

3.2.4 Subpart 4: Habitability Concerns for Areas Requiring Operator Access	As described in Section 8.4.3, there are no operator actions necessary to mitigate the SBO event for the 72-hour duration. Notwithstanding the above, the main control room is habitable for accident monitoring as discussed in FSAR Section 8.4.3. Ambient temperatures in the main control room do not result in adverse effects on personnel. See FSAR Table 6.4-3, Main Control Room Temperature under Passive Cooling Conditions, for main control room temperatures.
Part 3.2.5 Non-safety Related Equipment to Cope with an SBO	As described in FSAR Section 8.4.3, only safety-related mitigation systems are required to demonstrate that the 10 CFR 50.63 requirements for core cooling and containment integrity are met. EDSS operation is assumed as part of the SBO definition, but this system is not required for event mitigation as described in the Question 2 response below. The EDSS is, however, designed to be operable during an SBO event and is subject to graded quality assurance provisions that meet or exceed the augmented QA provisions of RG 1.155 Appendix A. For more information on EDSS QA, see NuScale's response to RAI question 08.03.02-02 provided in NuScale Power, LLC Submittal of Response to Request for Additional Information Letter No. 8 for the review of Topical Report 0815-16497, "Safety Classification of Passive Nuclear Power Plant Electrical Systems," Revision 0 (CAC NO. RQ6002) dated October 7, 2016 (NRC Project No. 0769), December 5, 2016 (LO-1116-51959).
Part 3.2.6: Timely Operator Actions to Increase Coping Time	As described in FSAR Section 8.4, the NuScale Power Plant is designed to cope with a SBO event for 72 hours, which is consistent with guidance for passive plants contained in SECY 94-084 and SECY 95-132. There are no operator actions that are required to support SBO mitigation for the 72-hour event duration as described in FSAR Section 8.4.3.
Part 3.2.7: Appropriate Containment Integrity	As described in FSAR Section 8.4, the SBO transient evaluation demonstrates that the peak containment parameters are within design values. All open containment isolation valves automatically close at the onset of the SBO independent of ac power and fail closed on a loss of dc power and can be excluded from consideration consistent with this part. The plant is, however, designed such that containment isolation valve position indication is available for the event duration as described in FSAR Section 8.4.3.

Question 2 Response

Consistent with the definition of a Station Blackout in 10 CFR 50.2, the SBO transient analysis identified in FSAR Section 8.4 assumes operation of the EDSS during the event, which in part forms the basis for compliance with 10 CFR 50.63. FSAR Section 8.4 includes the assumptions

and a summary for the analysis of record. The model and assumptions for the sensitivity case are the same as the base case except the sensitivity case includes a simultaneous failure of the EDSS at the outset of the event, which represents an additional failure that is precluded by the SBO definition. Consequently, the sensitivity evaluation is not used to show compliance with 10 CFR 50.63, and NuScale does not believe that the results of the sensitivity study should be included in the FSAR. The analysis that documents the assumptions and results of the sensitivity case can be made available for NRC audit upon request.

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