RAIO-0817-55367

August 10, 2017

Docket No. 52-048

U.S. Nuclear Regulatory Commission
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SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 61 (eRAI No. 8876) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 61 (eRAI No. 8876)," dated June 13, 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. 8876:

- 19-7

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
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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 8876

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 8876

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

eRAI No.: 8876
Date of RAI Issue: 06/13/2017

NRC Question No.: 19-7

The staff has reviewed section 19.1.5 of the Final Safety Analysis Report (FSAR) which addresses the seismic margins analysis (SMA), and the seismic margins notebook in the NuScale electronic reading room which supports the information presented in the FSAR. From its review the staff determined that nonsafety-related structures, systems and components (SSC) were included in the accident sequence analysis that is part of the seismic margins analysis.

Section 19.3 of the Standard Review Plan, "Regulatory Treatment of Nonsafety Systems for Passive Advanced Light Water Reactor Designs" (RTNSS), states that:

"The staff reviews the applicant's description of the Seismic Margins Analysis (SMA) documented in Chapter 19 of the FSAR to identify any nonsafety-related SSCs that have been credited in the SMA. The staff confirms that any nonsafety-related SSCs that are relied upon to meet the acceptance criteria for the SMA have been included in the scope of the RTNSS program (RTNSS "B")."

There are no nonsafety SSCs identified in Section 19.3 of the FSAR for inclusion in the RTNSS program. Therefore, the staff requests the following additional information. Please identify any nonsafety-related SSCs credited in meeting the acceptance criteria for the SMA. For each of these SSCs please explain why it has not been included in the scope of the RTNSS program.

NuScale Response:

There are no nonsafety-related SSCs credited in meeting the acceptance criteria for the SMA.

Based on the NRC policy statements, NuScale believes the RTNSS B criterion is limited to identifying active, nonsafety-related SSCs that are backup to passive, safety-related SSCs from 72 hours to 7 days after a design basis event. Further, the need to address seismic events consistent with the policy was limited to a consideration of those active, nonsafety-related SSCs that perform a long-term, RTNSS B, function. That is, NuScale believes it was not the intent of the policy to extend RTNSS oversight considerations to all nonsafety-related seismic structural designs (e.g., adverse seismic interaction considerations - classic seismic II over I) where

existing programs and requirements were already in place for all plant designs (active or passive). The SRP "Review Procedure" step identified in the NRC's question requires the staff to confirm identification of any (i.e., not just active) nonsafety-related SSCs relied on the meet the acceptance criterion of the SMA. According to NuScale's understanding of the NRC policy, the RTNSS B criterion was not intended to be applicable to passive, nonsafety-related SSCs and such SSCs would not be subject to the RTNSS program to meet the RTNSS B criterion. Thus, given the inconsistency between the interpretation from SRP Section 19.3 and the NRC policy statements on RTNSS, see Reference 1, the information below describes how SSCs evaluated in the SMA were evaluated for the RTNSS B criterion. The response concludes that none of the nonsafety-related SSCs in the SMA should be classified as RTNSS B.

Safety analyses, PRA insights, and sensitivity studies provide reasonable assurance that core cooling and containment integrity are maintained during the time period of 72 hours to 7 days after a design basis event with only safety-related SSCs. The Technical Report, *Mitigation Strategies for Extended Loss of AC Power Event*, (Reference 2), is a safety analysis demonstrating that the safety functions of core cooling and containment integrity are maintained well beyond 7 days with only safety-related SSCs. That is, active, nonsafety-related SSCs are not needed nor credited to backup passive, safety-related SSCs from 72 hours to 7 days after a design basis event. As such, neither active, nor passive, nonsafety-related SSCs are needed to survive a seismic event to perform a long-term, RTNSS B function.

Nevertheless, NuScale applied the RTNSS B evaluation process to determine if any nonsafety-related SSCs evaluated in the SMA were candidates for additional regulatory oversight. Such oversight would specify additional design requirements for withstanding an earthquake to ensure the SSCs could perform their functions as evaluated in the SMA. Both active and passive, nonsafety-related SSCs were evaluated as described below.

Active, Nonsafety-Related SSCs in the SMA

The following active, nonsafety-related SSCs are included in the SMA:

- Combustion turbine generator
- Backup diesel generators
- Low voltage AC electrical distribution system
- 13.8 kV and switchyard system
- Highly reliable DC power system
- Demineralized water system
- Chemical and volume control system
- Containment flooding and drain system

None of these SSCs are critical to a success path that averts core damage or a large release in the SMA. These SSCs are in the SMA model, but are modeled with high failure rates so there is limited credit for success following a seismic event.

These active, nonsafety-related SSCs do not have a substantial impact on the plant risk because failures of active components (such as pumps, compressors, and switches) to perform during or after a seismic event have no effect on the seismic margin due to the high reliability of

the passive SSCs in the NuScale design. Also, in the NuScale design, the passive mitigating systems fail safe on loss of power. This results in very few component failures that have the potential to contribute to seismic risk. Random failures of safety-related SSCs, such as the emergency core cooling system (ECCS) valves or reactor safety valves (RSVs), would also be required to cause core damage following an earthquake. Because failures of the active, nonsafety-related SSCs listed above do not affect the seismic margin, they have not been included in the scope of the RTNSS program.

Passive, Nonsafety-Related SSCs in the SMA

As described in FSAR Section 19.1.5.1.2, the SMA concludes that the plant design meets the regulatory HCLPF requirement of 1.67 times the safe shutdown earthquake (SSE), or 0.84g. The SMA includes fragility analyses for two nonsafety-related structures: the reactor building crane (RBC) and the bioshields. As described below, there are passive design features for these structures that have the controlling failure mode and are required to maintain structural integrity during and after an SSE to preclude adverse seismic interactions consistent with Regulatory Guide 1.29, Seismic Design Classification for Nuclear Power Plants (Reference 3).

Reactor Building Crane

The RBC is the most important contributor in the SMA and, as shown in FSAR Table 19.1-35, has a HCLPF value of 0.88g, which exceeds the SMA acceptance criteria of 0.84g. The design of the RBC includes seismic restraints and failure of the bridge seismic restraint weldments is the controlling failure mode. The RBC seismic restraints are structural elements that passively prevent the RBC bridge from over-turning or coming off the RBC rails during a seismic event. The RBC seismic restraints perform a passive function to preclude adverse seismic interactions by maintaining structural integrity to prevent the RBC from dropping onto one or more modules during and after an SSE, i.e., the RBC seismic restraints are not required to perform an active function to prevent the RBC from falling during or after an SSE. To ensure that the RBC seismic restraints can perform this passive function, the RBC was designed to meet the applicable regulatory requirements of Regulatory Guide 1.29 to reduce the likelihood of an adverse seismic interaction resulting in the release of radioactive materials.

The RBC (including its seismic restraints) is classified as Seismic Category I, as shown in FSAR Table 3.2-1. This classification provides a high level of confidence that the RBC seismic restraints will perform their function when challenged by a seismic event without any regulatory oversight. That is, regulatory oversight is provided by conformance with the design guidance in Regulatory Guide 1.29.

Regulatory Guide 1.206 (Reference 4) Section C.IV.9.3, *Specific Steps in the Regulatory Treatment of Nonsafety Systems Process* provides guidance on the need for additional regulatory oversight. This section identifies the specific steps established for design certification applicants to implement the RTNSS process. Subsection C.IV.9.3.6 of this Regulatory Guide is titled, *Regulatory Oversight Evaluation*, and provides the following bullets to determine the means of appropriate regulatory oversight for the RTNSS-important nonsafety systems:

- *review the FSAR, the PRA, and audit plant performance calculations to determine*

whether the design of the risk-significant, nonsafety-related SSCs satisfies the performance capabilities and R/A missions

NuScale's evaluation for the RBC is:

The design of the risk-significant, nonsafety-related RBC (and its seismic restraints) satisfies the performance capabilities in the FSAR by meeting Seismic Category I design requirements for precluding adverse seismic interactions during and after the design basis SSE. The RBC also satisfies the performance capabilities in the SMA by meeting the SMA acceptance criteria. Note that the limiting component, the seismic restraints, are passive components and therefore do not have reliability/availability (R/A) missions.

- *review the FSAR information to determine whether it includes the proper design information for the reliability assurance program, including the design information for implementing the Maintenance Rule*

  NuScale's evaluation for the RBC is:

  The RBC is classified Seismic Category I as shown in FSAR Table 3.2-1. The RBC is also included in the Design Reliability Assurance Program (D-RAP) and is classified as B1 (nonsafety-related, risk significant) in FSAR Table 17.4-1. FSAR Section 9.1.5 provides design information for the overhead heavy load handling systems, which includes the RBC.

- *review the FSAR information to determine whether it includes proper short-term availability control mechanisms if required for safety and determined by risk significance*

  NuScale's evaluation for the RBC is:

  Because the limiting component for the RBC in a seismic event is the seismic restraints, which are passive components, short-term availability control mechanisms are not appropriate nor required to ensure availability.

Based on the existing regulatory oversight for the RBC identified above and our understanding of the intent of the NRC policy statements, NuScale believes that the RTNSS program does not apply, nor would inclusion in such a program provide any additional regulatory benefit.

Bioshields

Each reactor module is covered by a removable bioshield that is placed on top of an adjacent bioshield during refueling, and as shown in FSAR Table 19.1-35, the bioshields have a HCLPF value of 1.08g, which exceeds the SMA acceptance criteria of 0.84g. The controlling failure mode involves shear failure of the pool wall anchor bolts.

As a result of the bioshields being located above various Seismic Category I SSCs, and similar to the seismic restraints on the RBC, the bioshields, including their attachment bolts, perform the passive function of precluding adverse seismic interactions by maintaining structural integrity to prevent a bioshield from dropping onto a module or other Seismic Category I SSC during and after an SSE. This is consistent with NRC guidance in Regulatory Guide 1.29 to reduce the likelihood of an adverse seismic interaction resulting in the release of radioactive materials. To ensure that the bioshields can safely perform this passive function, they are classified as Seismic Category II; as such, the design precludes adverse seismic interactions that could degrade the functioning or integrity of a Seismic Category I SSC to an unacceptable level.

The Seismic Category II classification of the bioshields is documented in FSAR Table 3.2-1. The Seismic Category II design requirements provide a high level of confidence that the attachment bolts for each bioshield will perform their passive function of maintaining structural integrity and prevent a drop of a bioshield during and after an SSE without additional regulatory oversight. That is, regulatory oversight is provided by conformance with the design guidance in Regulatory Guide 1.29.

Additional regulatory guidance for using the RTNSS process is provided in Subsection C.IV.9.3.6 of Reference 4. The following provides the NuScale evaluation of the three bulleted items for the bioshields:

- *review the FSAR, the PRA, and audit plant performance calculations to determine whether the design of the risk-significant, nonsafety-related SSCs satisfies the performance capabilities and R/A missions*

  NuScale's evaluation for the bioshields is:

  The Seismic Category II design of the nonsafety-related bioshields satisfies the performance capabilities for precluding adverse seismic interactions during and after the design basis SSE. The bioshields also satisfy the performance capabilities in the SMA by meeting the SMA acceptance criteria. Note that the bioshields are a passive component and therefore do not have R/A missions.

- *review the FSAR information to determine whether it includes the proper design information for the reliability assurance program, including the design information for implementing the Maintenance Rule*

  NuScale's evaluation for the bioshields is:

  The bioshields are classified as Seismic Category II and as B2 (nonsafety-related, not risk significant) in FSAR Table 3.2-1. Although the bioshields are not risk significant, Note 2 of FSAR Table 3.2-1 explains that the pertinent requirements of 10 CFR 50 Appendix B are applicable to SSCs classified as Seismic Category II in accordance with the quality assurance program. These requirements on the bioshields and their attachment bolts

ensure these SSCs are suitable for performing their passive intended function to maintain structural integrity during and after an SSE.

- *review the FSAR information to determine whether it includes proper short-term availability control mechanisms if required for safety and determined by risk significance*

  NuScale's evaluation for the bioshields is:

  Because the bioshields are passive components, short-term availability control mechanisms are not appropriate nor required to ensure availability.

Based on the existing regulatory oversight for the bioshields identified above and our understanding of the intent of the NRC policy statements, NuScale believes that the RTNSS program does not apply, nor would inclusion in such a program provide any additional regulatory benefit.

Conclusion

For active, nonsafety-related SSCs, the SMA shows that failure of these SSCs does not affect the seismic margin. Therefore, they have not been included in the scope of the RTNSS program to meet the RTNSS B criterion.

The passive, nonsafety-related SSCs that meet the HCLPF acceptance criterion in the SMA (the RBC and bioshields) are subject to adequate regulatory controls through other established regulatory processes (i.e., compliance with Regulatory Guide 1.29) to ensure that they have sufficient capacity to preclude adverse seismic interactions during and after an SSE. Thus, additional regulatory oversight for these components was not identified in the scope of the RTNSS program.

FSAR Section 19.3.2.2 has been revised to clarify the evaluation of the RTNSS B criterion with respect to seismic considerations and the SMA.

References

1. U.S. Nuclear Regulatory Commission, "Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems (RTNSS) in Passive Plant Designs (SECY-94-084)," SECY-95-132, May 22, 1995
2. NuScale Power LLC, "Mitigation Strategies for Extended Loss of AC Power Event," Technical Report TR-0816-50797, November 2016
3. U.S. Nuclear Regulatory Commission, "Seismic Design Classification for Nuclear Power Plants," Regulatory Guide 1.29, Revision 5, July 2016
4. U.S. Nuclear Regulatory Commission, "Combined License Applications for Nuclear Power Plants (LWR Edition)," Regulatory Guide 1.206, June 2007

Impact on DCA:

FSAR Section 19.3.2.2 has been revised as described in the response above and as shown in the markup provided in this response.

19.3.2.2 RTNSS B

Nonsafety-related SSC functions identified through the D-RAP process in Section 17.4 are evaluated to determine whether they are relied upon to:

- provide a long term nonsafety-related back-up to passive system functional capability and for a period after 72 hours up to 7 days following an accident.
- meet the acceptance criteria for the seismic margins analysis (SMA).

RAI-19-7

The safety analyses, PRA insights ~~(including SMA)~~, and expert panel considerations (discussed in Chapter 15, Section 19.1, and Section 17.4, respectively) did not identify any nonsafety- related SSC relied on to perform a backup to passive safety functions (i.e., ensure long term safety) in the period of 72 hours to 7 days~~, nor credited for SMA~~.

RAI-19-7

The RTNSS B evaluation process also considered if any nonsafety-related SSC were candidates for additional regulatory oversight from seismic considerations.

RAI-19-7

As described in Section 19.1.5.1, both active and passive, nonsafety-related SSC are modeled in the SMA. None of the active, nonsafety-related SSC in the SMA are critical to a success path that averts core damage or a large release. These SSC are in the SMA model, but are modeled with high failure rates so there is limited credit for success following a seismic event. These active, nonsafety-related SSC do not have a substantial impact on the plant risk because failure of active components (such as pumps, compressors, and switches) to perform during or after a seismic event have no effect on the seismic margin due to the high reliability of the passive SSC in the NuScale design. Also, in the NuScale design, the passive mitigating systems fail safe on loss of power. This results in very few component failures that have the potential to contribute to seismic risk. Random failures of safety-related SSC, such as the emergency core cooling system (ECCS) valves or reactor safety valves (RSVs), would also be required to cause core damage following an earthquake. Because failure of the active, nonsafety-related SSC in the SMA does not affect the seismic margin, they have not been included in the scope of the RTNSS program.

RAI-19-7

For passive, nonsafety-related SSC, the SMA includes fragility analyses for two nonsafety-related structures: the reactor building crane (RBC) and the bioshields. FSAR Section 19.1.5.1.2 provides the results from the SMA, which show that the plant design meets the regulatory requirement for a high confidence of low probability of failure (HCLPF) value that is greater than 1.67 times the design basis safe shutdown earthquake (SSE). FSAR Table 19.1-35 shows that both the RBC and the bioshields have a HCLPF value above the regulatory expectations. As shown in Table 3.2-1, the RBC is classified as Seismic Category I and the bioshields are classified as Seismic Category II so both meet the design requirements of Regulatory Guide 1.29 to ensure that they have sufficient capacity during and after an SSE. Thus, additional regulatory oversight for these components was not identified under the scope of the RTNSS program.

Therefore, no nonsafety-related SSC meet the RTNSS B criteria.