October 22, 2018

Docket No. 52-048

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

SUBJECT: NuScale Power, LLC Supplemental Response to NRC Request for Additional Information No. 133 (eRAI No. 8936) on the NuScale Design Certification Application

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 133 (eRAI No. 8936)," dated August 05, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 133 (eRAI No.8936)," dated June 25, 2018
3. NuScale Power, LLC Supplemental Response to NRC "Request for Additional Information No. 133 (eRAI No. 8936)," dated September 6, 2018

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

The Enclosure to this letter contains NuScale's supplemental response to the following RAI Question from NRC eRAI No. 8936:

- 03.07.02-10

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 Marty Bryan at 541-452-7172 or at mbryan@nuscalepower.com.

Sincerely,

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Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8936

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8936

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

eRAI No.: 8936
Date of RAI Issue: 08/05/2017

NRC Question No.: 03.07.02-10

10 CFR 50 Appendix S requires that the safety functions of structures, systems, and components (SSCs) must be assured during and after the vibratory ground motion associated with the Safe Shutdown Earthquake (SSE) through design, testing, or qualification methods.

On Page 3A-1 of the FSAR, the staff noted that a detailed dynamic analysis of the NPM subsystem is performed using a more detailed NPM model and the input time histories obtained from the SSI analysis of the reactor building which included a simplified NPM to account for the coupling of NPMs and the reactor building. The applicant is requested to provide in the FSAR a comparison of the seismic demands (forces and moments) at the NPM upper and bottom support locations interfacing with the RXB obtained from the SASSI analysis of the RXB system model and from the ANSYS analysis of the detailed 3D NPM system model. The applicant should explain any significant differences and confirm that the loads used for the NPM support designs are conservative.

NuScale Response:

During a Public Meeting on October 2, 2018, the NRC requested NuScale submit a supplemental response to this RAI. Further, the NRC provided the following details concerning past submittals for this question and clarification needed in the new supplemental response:

1. In its proposed markup for FSAR Table 3.7.2-34, the applicant added items that account for NPM lug support and NPM skirt support. The staff believes that both lug and skirt supports should include the seismic analysis Identification Codes, 1, 2, and 5, because

the lug and skirt reaction forces from the SASSI RXB model (1, 2) and ANSYS 3D NPM model (5) are considered in the design process of these supports.

NuScale Response: As discussed in the public meeting, not all soil and time history cases have been run in the ANSYS model. As a result, the skirt support was appropriately marked as identification code 5, and the FSAR is being revised to indicate the lug support as identification code 5 as well.

2. In its proposed markup for FSAR Section 3.7.2.1.2.2 (see the last paragraph on Page 3.7-122, Draft Revision 2), the applicant states that “The lug supports are designed for a generic capacity in a detailed submodel and checked against the design loads from the SASSI2010 building model and 3-D model.” The staff believes that “design loads” in this statement is not a correct term; rather “reaction forces”, as used in another markup paragraph (Page 3B-30), should be used. Note that these enveloped lug reaction forces are not used as the design loads but are shown to be bounded by the lug capacity. Also, consider referencing Table 3B-28 at the end of the quoted sentence above.

   NuScale Response: FSAR Section 3.7.2.1.2.2 has been revised to state “The lug supports are designed for a generic capacity in a detailed submodel and checked against the reaction forces from the SASSI2010 building model and 3-D model.”

3. Clarify whether the 10% damping mentioned in item 5 of the RAI response is meant to indicate “10% for reinforced concrete” rather than “10% for prestressed concrete.”

   NuScale Response: The staff is correct. Item 5 in the previous supplement should read “10% for reinforced concrete” and not "prestressed concrete."

Impact on DCA:

FSAR Section 3.7.2.1.2.2 and FSAR Table 3.7.2-34 have been revised as described in the response above and as shown in the markup provided in this response.

Within the SASSI2010 building model, the NPM is represented by a beam model as shown in Figure 3.7.2-28. The beam model was developed to have similar dynamic characteristics as a 3-D ANSYS model of a single NPM bay. To validate the NPM beam model, a modal analysis in three directions was performed in order to tune the simplified model to match the detailed 3-D model response. The skirt support at the base of the containment restricts horizontal and vertical movements. Eight rigid beams arranged like the legs of a spider are modeled to connect the NPM model containment skirt to nodes in the building model located at the interface of the skirt and pool floor. Table 3.7.2-36 and Table 3.7.2-37 outline the NPM beam model to RXB model interface boundary conditions for the SASSI2010 and ANSYS models, respectively.

RAI 03.07.02-10S1

Detailed NuScale Power Module Model Included in the Reactor Building SASSI2010 Model

RAI 03.07.02-10S1

The RXB-NPM interface and NPM specific analyses replace the simplified beam model with a more detailed NPM beam model. The reactor building is structurally similar to the SASSI2010 model previously described. The NPM beam models are replaced with the detailed beam models for selected SSI analyses to evaluate the RXB-NPM interactions. The development and validation of the detailed beam model and the SASSI2010 reactor building model with detailed beam model are provided in Appendix 3A. The RXB analysis produces local acceleration time histories that are used as input to the NPM seismic analysis. The seismic analysis of the NPM is discussed in Appendix 3A.

RAI 03.07.02-10, RAI 03.07.02-10S1, RAI 03.07.02-10S2

At the interface between the NPM and the RXB, the design loads for the skirt supports are defined as the envelope of the SASSI2010 building model and the 3-D model discussed in Appendix 3A and Appendix 3B.2.7. The lug supports are designed for a generic capacity in a detailed submodel and checked against the ~~design loads~~reaction forces from the SASSI2010 building model and 3-D model. This is described in more detail in Appendix 3B.2.7.

3.7.2.1.2.3 Reactor Building Crane

The RBC is a bridge crane used to transport modules between the operating locations and the refueling and disassembly area and the drydock. The RBC travels on rails on the top of the reactor pool walls at EL. 145'-6". When not in use, the RBC is parked over the refueling pool with the trolley at the north end near the dry dock gate. In this position, the RBC is not above either the SFP or the NPMs. The RBC is described in Section 9.1.5.

Reactor Building Crane Model Included in the Reactor Building SASSI2010 Model

RAI 03.07.02-10S1, RAI 03.07.02-10S2, RAI 03.07.02-24

Table 3.7.2-34: SSC Seismic Analysis Identification Code Assignments

SSC	Description	Identification Code
CNTS	containment system	5
SGS	steam generator system	5
RXC	reactor core	5
CRDS	control rod drive system	5
CRA	control rod assembly	5
NSA	neutron source assembly	5
RCS	reactor coolant system	5
CVCS	chemical and volume control system	5
ECCS	emergency core cooling system	5
DHRS	decay heat removal system	5
CRHS	control room habitability system	6
CRVS	normal control room HVAC system	6
MAEB	Module Assembly Equipment - Bolting	3, 4
FHE	fuel handling equipment	3
SFSS	spent fuel storage system	3
RPCS	reactor pool cooling system	3, 4
UHS	ultimate heat sink	3, 4
CES	containment evacuation system	5
MSS	main steam system	5
FWS	feedwater system	5
EDSS	highly reliable DC power system	3[1], 4[1], 6[2]
MPS	module protection system	3[1], 4[1], 6[2]
NMS	neutron monitoring system	3, 4
SDIS	safety display and indication system	6
ICIS	in-core instrumentation system	5
PPS	plant protection system	3[1], 4[1], 6[2]
RMS	radiation monitoring system	3[1], 4[1], 6[2]
RXB	Reactor Building ~~(including Lug Support)~~	1, 2
RXB	Reactor Building - NPM Lug and Skirt Supports	5
RBC	Reactor Building crane	3
RBCM	Reactor Building Components - Pool Liner	1, 2
RBCM	Reactor Building Components - Bioshield	3, 4
CRB	Control Building	7, 8
SMS	seismic monitoring system	3[1], 4[1], 6[2]

[1]Design for SSC located in the Reactor Building

[2]Design for SSC located in the Control Building