RAIO-1018-62158

October 16, 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 Supplemental Response to NRC Request for Additional Information No. 200 (eRAI No. 9021) on the NuScale Design Certification Application

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 200 (eRAI No. 9021)," dated August 25, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 200 (eRAI No.9021)," dated August 02, 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. 9021:

- 03.09.03-2

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,

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

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

Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9021

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9021

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

eRAI No.: 9021
Date of RAI Issue: 08/25/2017

NRC Question No.: 03.09.03-2S1

10 CFR 50 Appendix S IV(a)(1)(iii) 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) ground motion through design, testing, or qualification methods. GDC 2 and 10 CFR 50, Appendix S, as they relate to safety-related structures and components being designed to withstand the effects of earthquakes combined with the effects of normal or accident conditions without loss of capability to perform their safety functions. Pursuant to GDC 2, mechanical components are designed to withstand the loads generated by natural phenomena as discussed Section 3.7.1.

For seismic loads, the applicant performed a detailed dynamic analysis of the nuclear power module (NPM) subsystem using a 3D NPM ANSYS model applying acceleration time histories resulting from composite reactor building (RXB) seismic analysis. The staff reviewed technical report TR-0916-51502, "NuScale Power Module Seismic Analysis." for the seismic loads and stresses. As a result, the applicant is requested to provide discussion and clarification for the following:

1. Considering a subsystem seismic analysis for NPM as stated above, based on RG 1.61, Table 6, Damping Values for Mechanical and Electrical Components, 3 percent damping should be used in lieu of 7 percent damping used in the TR, for pressure vessels (i.e., CNV and RPV). Therefore, the applicant is requested to provide justification or test data for use of higher than 3 percent damping for CNV and RPV for the SSE event as given in Table 6 of RG 1.61.

2. Provide the damping values used for the reactor pool water inside and outside the CNV and the basis using these damping values in the SSE analysis.

3. Confirm whether there is or is not uplift of CNV and RPV modules during the SSE event considering the buoyancy force and the bearing support at the bottom of CNV and RPV.

4. Discuss whether and how the condition of an SSE event is not considered for the design of CNV and RPV during the refueling outage, when the vessel halves are separated.

5. Describe boundary conditions of the 3-D NPM analysis at the supporting skirt location where the prescribed acceleration time histories were applied. Also to how the motion transmitting from the pool bottom to the skirt and to the NPM when the contact was sliding during SSE.

NuScale Response:

In a follow up closed meeting with the NRC on September 19, 2018, it was requested that NuScale provide additional technical justification for the use of 4% composite damping for the NPM. In addition, it was requested that a discussion of how the pool water may affect the composite damping be included in the supplemental response.

This information supplements the initial response to RAI 9021 Question 03.09.03-2, provided by RAIO-0818-61204 dated August 2, 2018.

1. The NPM comprises major components and sub-systems other than vessels, such as control rod drive mechanisms, welded support structures, sliding connections, sliding supported SG, piping systems, fuel, conduit systems, cable tray systems, and other components that are not considered vessels per Table 6 of RG 1.61.

The average composite structural damping of the NPM includes structures that are composed of vessels and more flexible components. As shown in TR-0916-51502 Figure 2-7, there are two major load paths within the NPM and to the reactor building, where large dissipative friction forces occur during a seismic event. The vertical and horizontal structural load paths are only two examples of the many routes through which loads are transmitted between the NPM sub-components. They illustrate that the NPM as a whole behaves more like a bearing-bolted structure than a welded or slip-critical bolted structure, and could support the selection of a

composite structural damping higher than 4%. However, as stated in the initial response, NuScale chose the conservatively bounding lower value of 4% per Table 1 of RG 1.61. This is documented in TR-0916-51502 Section 8.1.

2. The pool water transfers load between the NPM and the reactor building, in addition to the main structural load paths discussed above. Structural damping is provided by the pool floor that has a specified absorption coefficient, as stated in TR-0916-51502 Section 3.1.1. The absolute viscosity of water at 100 degrees F and atmospheric pressure is low, 0.00001424 lbf-s/ft^2, and its effect on the NPM composite damping can therefore be neglected.

Impact on DCA:

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