February 14, 2019 Docket No. 52-048

U.S. Nuclear Regulatory Commission
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**SUBJECT:** NuScale Power, LLC Submittal of Changes to Final Safety Analysis Report, Sections 3.7.2, “Seismic System Analysis” and Section 3.8.5, “Foundations”

**REFERENCES:** Letter from NuScale Power, LLC to Nuclear Regulatory Commission, “NuScale Power, LLC Submittal of the NuScale Standard Plant Design Certification Application, Revision 2,” dated October 30, 2018 (ML18311A006)

During a January 23, 2019 public teleconference with Marieliz Vera, NRC Project Manager and Ata Istar of the NRC Staff, NuScale Power, LLC (NuScale) discussed potential updates to the Final Safety Analysis Report (FSAR). As a result of this discussion, NuScale changed Section 3.7.2, “Seismic System Analysis” and Section 3.8.5, “Foundations.” The Enclosure to this letter provides a mark-up of the FSAR pages incorporating revisions in redline/strikeout format. NuScale will include this change as part of a future revision to the NuScale Design Certification Application.

This letter makes no regulatory commitments or revisions to any existing regulatory commitments.

If you have any questions, please feel free to contact Marty Bryan at 541-452-7172 or at mbryan@nuscalepower.com.

Sincerely,

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

Distribution: Samuel Lee, NRC, OWFN-8 H12
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Enclosure: “Changes to NuScale Final Safety Analysis Report Sections 3.7.2, “Seismic System Analysis” and Section 3.8.5, “Foundations”

**Enclosure:**

“Changes to NuScale Final Safety Analysis Report Sections 3.7.2, “Seismic System Analysis” and Section 3.8.5, “Foundations”

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Where:

RAI 03.07.02-15S2

- $P_{addl}$ = equivalent static pressure,
- $P_{hd}$ = hydrodynamic pressure from ANSYS,
- $a_{SASSI}$ = acceleration from SASSI2010 using either soil type 7, 8, or 11; and
- $a_{ANSYS}$ = acceleration from ANSYS.

RAI 03.07.02-15S1

The FSI analysis uses synthetic ground motions based on Capitola seed time histories. Based on the overall building base shear comparison in Table 3.8.5-3, these runs using soil types 7, 8, and 11, and the CSDRS spectrum are more controlling than the soil type 9, CSDRS-HF spectrum case. Therefore, the factors used to convert ANSYS FSI hydrodynamic pressures to equivalent static pressures for soil types 7, 8, and 11 adequately envelope soil type 9.

Once the factors between SASSI2010 and ANSYS acceleration are obtained, the additional equivalent hydrostatic pressure for SASSI2010 can be computed. Table 3.7.2-4 through Table 3.7.2-6 present the average values for each segment and soil type, and includes a weighted value for each wall.

Table 3.7.2-7 compares this equivalent static pressure with the original static pressures obtained from SASSI2010.

**Development of Correction Factor**

RAI 03.07.02-15S1, RAI 03.07.02-15S3

The maximum static wall pressure differences between the ANSYS and SASSI2010 models are summarized in ~~Table 3.7.2-7~~Table 3.7.2-8. The SASSI2010 analysis with lumped water masses does not represent fluid-structure-interaction behavior, and, therefore, underestimates the hydrodynamic pressures on the RXB walls. In order to account for this, an ANSYS FSI analysis, in which the water elements were explicitly modeled, was performed. Based on these results, it was determined that an additional 4.2 psi needed to be included in the SAP2000 RXB model. This added pressure accounts for the missing 3D effects of fluid-impulsive pressure on the pool walls and foundation.

RAI 03.07.02-15S1, RAI 03.07.02-15S2, RAI 03.07.02-15S3

The pressure at the bottom of the pool due to gravity loading of the water is approximately 30 psi (62.4 lb/ft$^3$ * 69 ft depth *1/144 ft$^2$/in$^2$). Consequently, the average pressure on the wall is half this amount, or 15 psi. The pressure of 4.20 psi is 28 percent of the average pressure (4.20 psi/15 psi = 0.28). Therefore, a 1.28g vertical static loading was added to the SAP2000 model to ensure this additional pressure is accounted for in the design. See Figure 3.7.2-129. Increasing the downward acceleration by a factor of 1.28 corrects for the underestimated fluid pressure, due to mass lumping, in the SSI model. Analyses

### 3.8.5.6.4 Settlement

RAI 02.03.01-2, RAI 03.08.05-2, RAI 03.08.05-6

~~Displacement values are provided for selected nodes in the foundation in Table 3.8.5-7a. The location of these nodes is shown in Figure 3.8.5-10. As can be seen from the values in Table 3.8.5-7a and Table 3.8.5-7b, total settlement at any foundation node, tilt settlement, and differential settlement are minimal. The maximum allowable differential settlement between the RXB and CRB, and between the RXB and RWB is 0.5 inch.~~

Displacement values are provided in Table 3.8.5-7a and Table 3.8.5-7b for selected nodes in the foundation shown in Figure 3.8.5-10. Summaries of different settlement types are given in Table 3.8.5-7c and Table 3.8.5-7d. The calculated angle of foundation rotation in these tables is based upon the building foundation dimensions in Table 3.8.5-19.

Total settlement, tilt settlement, and differential settlement are minimal, as shown in Table 3.8.5-7a through Table 3.8.5-7d. The maximum allowable differential settlement between the RXB and CRB, and between the RXB and RWB is 0.5 inch.

RAI 02.03.01-2

The RXB settles approximately 1¾ inch on the west end and approximately 2 inches on the east end. The tilt settlement of 0.25" is less than 1" as cited in Section 3.8.5.6.1. There is negligible tilt north to south. The east end of the building contains the pool and the NPMs.

RAI 02.03.01-2, RAI 03.08.05-22S2

The CRB settles approximately 1¾ inch on the west end and approximately 1 inch on the east end. The tilt settlement of 0.75" is less than the 1" limit cited in Section 3.8.5.6.2. North to south tilt is negligible. The CRB tilts toward the RXB. Differential settlement between the two buildings is on the order of ¼ inch. The displacements at the four corners of the tunnel foundation calculated for the cracked concrete condition are provided in Table 3.8.5-17, and the rotation of the tunnel foundation is –0.0361°, as shown in Table 3.8.5-18. The tunnel foundation has negligible differential settlement in the north-south direction, and the differential settlement over 50 ft length in the east-west direction is -0.36."

The Seismic Category II Radioactive Waste Building settles approximately ½ inch on the west end and approximately 1½ inch on the east end. The RWB tilts toward the RXB. The RWB tilts approximately 1/5 inch in the north-south direction. Differential settlement between the RWB and the RXB is also on the order of ¼ inch.

### 3.8.5.6.5 Thermal Loads

RAI 03.08.04-13