January 30, 2019 Docket No. 52-048

U.S. Nuclear Regulatory Commission
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11555 Rockville Pike
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SUBJECT: NuScale Power, LLC Submittal of Changes to Final Safety Analysis Report, Sections 2.0, “Site Characteristics and Site Parameters,” Section 2.5.4, “Geology, Seismology, and Geotechnical Engineering,” and Section 3.8.5, “Design of Category I Structures”

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 December 3, 2018 audit meeting with Marieliz Vera, NRC Project Manager and Ata Istar of the NRC Staff, NuScale Power, LLC (NuScale) agreed to revise Tier 2, Table 2.0-1, “Site Design Parameters,” Section 2.5.4 “Geology, Seismology, and Geotechnical Engineering,” and Section 3.8.5.3.1, “Design of Category I Structures.” 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,

Carrie Fosaaen
Supervisor, Licensing
NuScale Power, LLC

Distribution: Samuel Lee, NRC, OWFN-8G9A
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Enclosure: “Changes to NuScale Final Safety Analysis Report Sections 2.0, “Site Characteristics and Site Parameters,” Section 2.5.4, “Geology, Seismology, and Geotechnical Engineering,” and Section 3.8.5, “Design of Category I Structures”

Enclosure:

"Changes to NuScale Final Safety Analysis Report Sections 2.0, "Site Characteristics and Site Parameters," Section 2.5.4, "Geology, Seismology, and Geotechnical Engineering," and Section 3.8.5, "Design of Category I Structures"

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Table 2.0-1: Site Design Parameters (Continued)

Site Characteristic / Parameter	NuScale Design Parameter	References to Parameter
Five percent annual exceedance values Maximum outdoor design dry bulb temperature Maximum coincident wet bulb temperature Minimum outdoor design dry bulb temperature	 95°F 77°F -5°F	Table 9.4.4-1
Hydrologic Engineering (Section 2.4)		
Maximum flood elevation Probable maximum flood and coincident wind wave and other effects on max flood level	1 foot below the baseline plant elevation	Sections 2.4.2 and 3.4.2.1; Table 3.8.5-8
Maximum elevation of groundwater	2 feet below the baseline plant elevation	Sections 2.4.12, 3.4.2.1, 3.8.4.3.22.1, and 3.8.4.8; Table 3.8.5-8
Geology, Seismology, and Geotechnical Engineering (Section 2.5)		
Ground motion response spectra /safe shutdown earthquake	See Figures 3.7.1-1 and 3.7.1-2 for horizontal and vertical certified seismic design response spectra (CSDRS) for all Seismic Category I SSC. See Figures 3.7.1-3 and 3.7.1-4 for horizontal and vertical high frequency certified seismic design response spectra (CSDRS-HF) for Reactor Building and Control Building.	Sections 3.7.1.1, 3.8.4.3.16, and 3.8.4.8
Fault displacement potential	No fault displacement potential	Section 2.5.3
Minimum soil bearing capacity (Q_{ult}) beneath safety-related structures	75 ksf	Sections 2.5.4, 3.8.5.6.3, and 3.8.5.6.7
Lateral soil variability	Uniform site (< 20 degree dip)	Section 2.5.4
Minimum soil angle of internal friction	30 degrees	Sections 2.5.4 and 3.8.5.3.1; Table 3.8.5-1
Minimum shear wave velocity	≥ 1000 fps at bottom of foundation	Section 2.5.4
Liquefaction potential	No liquefaction potential	Section 2.5.4
Coefficient of friction (CoF) between concrete foundation and soil	≥ 0.58 where CoF = tan (φ)	Section 3.8.5.3.1, 3.8.5.4.1.2, Table 3.8.5-1, Table 3.8.5-8
Coefficient of friction (CoF) between concrete foundation and soil (CRB nonlinear analysis)	0.55	Section 3.8.5.4.1.4, Table 3.8.5-8
Coefficient of friction (CoF) between walls and soil	0.50	Section 3.8.5.4.1.2, 3.8.5.4.1.4, Table 3.8.5-1, Table 3.8.5-8

and greater than 2.0 for dynamic bearing pressure. Bearing pressures for the Reactor Building and Control Building are provided in Section 3.8.5.

- The soil column is uniform (i.e., the site layers dip less than 20 degrees). As described in NUREG/CR-0693, the use of horizontal layers for soil-structure interaction analysis is acceptable if the layers dip less than 20 degrees.
- There is no potential for soil liquefaction. This analysis may be performed with the site-specific safe shutdown earthquake.
- The minimum coefficient of static friction at the interfaces between the basemat and the soil is 0.58. The minimum coefficient of friction at the interface between the basemat and the soil for Control Building nonlinear analyses is 0.55. In addition, the coefficient of friction between the walls and soil is 0.50. The friction is defined between concrete and clean gravel, gravel-sand mixture, or coarse sand with a friction angle of 30 degrees (Reference 2.5-1).
- The minimum soil angle of internal friction is 30 degrees.

RAI 03.08.05-1

Settlement is not a concern for the NuScale Power Plant design. There are no rigid safety-related connections between the structures and no safety-related connections to other site structures. A settlement tilt limit of 1 inch total or half an inch per 50 feet has been established. This tilt (< 0.1 degree) is small enough that it does not affect the structural analysis.

The following are key design parameters:

- minimum shear wave velocity
- minimum ultimate bearing capacity
- uniformity of soil layers
- potential for soil liquefaction
- minimum coefficient of static friction
- minimum soil angle of internal friction
- settlement tilt

Characteristics of the subsurface materials are site-specific and are discussed by the COL applicant as part of the response to COL Item 2.5-1.

2.5.5 Stability of Slopes

The standard plant layout assumes a uniform, graded site as shown in Figure 1.2-4. Therefore, no slope failure potential is a key design parameter.

Stability of slopes on or near the site are confirmed by the COL applicant as part of the response to COL Item 2.5-1. This analysis may be performed with the site-specific safe shutdown earthquake.

3.8.5.3.1 Lateral Soil Force and Seismic Loads

The RXB and CRB are embedded structures and, therefore, the surrounding soil contributes significantly to the stability of the structures. The surrounding soil imposes lateral soil pressures. The seismic inertia loads cause sliding and overturning forces. These pressures are calculated using the backfill soil which has a density of 130 pcf and an assumed angle of internal friction, f, of 30°. The coefficient of friction (COF) used for the calculation of friction resistance between soil and basemat is 0.58. The COF between the foundation and soil used for the nonlinear analysis of the CRB is 0.55 as described in Section 3.8.5.4.1.4. The friction is defined between concrete and clean gravel, gravel-sand mixture, or coarse sand with a friction angle of 30°. Thus, the COF = tan (30°) = 0.57735, which rounds to 0.58.

The static lateral soil pressure values on walls are established in Section 3.8.4.3. The RXB values are converted to force in accordance with the following example for the static effective soil force on the RXB North (F_{y1}) (or South (F_{y2})) wall:

$$F_{y1} = K_o \times \left[0.250 \times H + \frac{1}{2} \times (0.13 - 0.0624) \times H \times H\right] \times EW \qquad \text{Eq. 3.8-1}$$

$$= 46{,}967 \text{ kips}$$

where

K_0	Soil Coefficient of Pressure at rest = 0.5 (Table 3.8.5-1)
H	RXB Embedment = 86' (Table 3.8.5-1)
EW	RXB East-West Length between Exterior Faces of 5' Walls = 346' (Table 3.8.5-1)
0.250 ksf	Surcharge (Table 3.8.5-1)
0.13 kcf	Soil Density
0.0624 kcf	Water Density

Substituting the North-South length of 150.5' between exterior faces, the RXB East and West Walls experience a static effective soil force of 20,429 kips.

The CRB static effective soil forces are calculated similarly, as for the CRB East or West walls:

$$F_{y1} = K_o \times \left[0.250 \times H + \frac{1}{2} \times (0.13 - 0.0624) \times H \times H\right] \times NS \qquad \text{Eq. 3.8-2}$$

$$= 6{,}914 \text{ kips}$$