RAIO-1017-56544

October 11, 2017

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 Response to NRC Request for Additional Information No. 167 (eRAI No. 8964) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 167 (eRAI No. 8964)," dated August 12, 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. 8964:

- 03.08.05-1

The response to question 03.08.05-2 will be provided by August 30, 2018.

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

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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 8964

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 8964

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

eRAI No.: 8964
Date of RAI Issue: 08/12/2017

NRC Question No.: 03.08.05-1

10 CFR Part 50, Appendix A, GDC 1, 2, 4 and 5 provide the regulatory requirements for the design of the seismic Category I structures. DSRS Section 3.8.5 provides review guidance pertaining to the settlement on foundations.

FSAR Tier 1, Table 5.0-1, “Site Design Parameters,” and FSAR Tier 2, Table 2.0-1, “Site Design Parameters,” uses an acceptance criterion for a tilt settlement of the basemats as “1 inch per 50 feet in any direction.” FSAR Tier 2, Section 3.8.5.6.1, “RXB Stability,” uses a tilt settlement of ½ inch per 50 feet in any direction for the RXB and CRB basemats. The tilt settlement values listed in FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.0-1 are inconsistent with Section 3.8.5.6.1. Reconcile this discrepancy, and list a consistent value in the FSAR Tier 1 and Tier 2.

NuScale Response:

The maximum allowable tilt settlement for the Radioactive Waste Building, Reactor Building, and Control Building shall be 1" total or 1/2" per 50 feet in any direction at any point in any of the structures. The maximum allowable differential settlement for the Radioactive Waste Building, Reactor Building, and Control Building shall be 1/2" between the Reactor Building and Control Building, and Reactor Building and Radioactive Waste Building. These values are revised in FSAR Tier 1, Table 5.0-1 and FSAR Tier 2, Table 2.0-1.

Impact on DCA:

FSAR Tier 1, Table 5.0-1 and FSAR Tier 2, Table 2.0-1 have been revised as described in the response above and as shown in the markup provided in this response.

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Table 5.0-1: Site Design Parameters

Site Characteristic/Parameter	NuScale Design Parameter
Nearby Industrial, Transportation, and Military Facilities	
External hazards on plant structures, systems, and components (SSC) (e.g., explosions, fires, release of toxic chemicals and flammable clouds, pressure effects) on plant SSC	No external hazards
Aircraft hazards on plant SSC	No aircraft hazards
Meteorology	
Maximum precipitation rate	19.4 in. per hour 6.3 in. for a 5-minute period
Normal roof snow load	50 psf
Extreme roof snow load	75 psf
100-year return period 3-second wind gust speed	145 mph (Exposure Category C) with an importance factor of 1.15 for Reactor Building, Control Building, and Radioactive Waste Building
Design Basis Tornado • maximum horizontal wind speed • maximum translational speed • maximum rotational speed • maximum radius of rotational speed • maximum pressure differential • maximum rate of pressure drop	 230 mph 46 mph 184 mph 150 ft 1.2 psi 0.5 psi/sec
Tornado missile spectra	Table 2 of Regulatory Guide 1.76, Revision 1, Region 1.
Maximum wind speed design basis hurricane	290 mph
Hurricane missile spectra	Tables 1 and 2 of Regulatory Guide1.221, Revision 0.
Summer outdoor design dry bulb temperature	115°F
Winter outdoor design dry-bulb temperature	-40°F
Summer outdoor wet bulb temperature coincident non-coincident	 80°F 81°F
Accident release χ/Q values at security owner controlled area fence 0-2 hr 2-8 hr 8-24 hr 24-96 hr 96-720 hr	 5.72E-04 s/m^3 4.85E-04 s/m^3 2.14E-04 s/m^3 2.15E-04 s/m^3 1.95E-04 s/m^3
Accident release χ/Q values at main control room/ technical support center door and heating ventilation and air conditioning intake (approximately 112 feet from source) 0-2 hr 2-8 hr 8-24 hr 1-4 day 4-30 day	Door / Heating Ventilation and Air Conditioning Intake 6.50E-03 s/m^3 / 6.50E-03 s/m^3 5.34E-03 s/m^3 / 5.34E-03 s/m^3 2.32E-03 s/m^3 / 2.32E-03 s/m^3 2.37E-03 s/m^3 / 2.37E-03 s/m^3 2.14E-03 s/m^3 / 2.14E-03 s/m^3
Hydrologic Engineering	
Maximum flood elevation Probable maximum flood and coincident wind wave and other effects on maximum flood level	 1 foot below the baseline plant elevation
Maximum elevation of groundwater	2 feet below the baseline plant elevation

Table 5.0-1: Site Design Parameters (Continued)

Site Characteristic/Parameter	NuScale Design Parameter
Geology, Seismology, and Geotechnical Engineering	
Ground motion response spectra/safe shutdown earthquake	See Figure 5.0-1 and Figure 5.0-2 for horizontal and vertical certified seismic design response spectra. and See Figure 5.0-3 and Figure 5.0-4 for horizontal and vertical high frequency certified seismic design response spectra.
Fault displacement potential	No fault displacement potential
Minimum soil bearing capacity (Q_{ult}) beneath safety-related structures	75 ksf
Lateral soil variability	Uniform site (± 20 degree dip)
Soil angle of internal friction	30 degrees
Coefficient of Friction (COF) Between Concrete Foundation and Soil~~Minimum coefficient of static friction (all interfaces between basemat and soil)~~	0.58
Coefficient of Friction (COF) Between Concrete Walls and Soil	0.5
Minimum shear wave velocity	≥ 1000 fps at bottom of foundation
Maximum settlement for the Reactor Building, Control Building, and Radioactive Waste Building: • total settlement • tilt settlement • differential settlement (between Reactor Building and Control Building, and Reactor Building and Radioactive Waste Building)	 ~~No limit~~4 inches ~~1 inch per 50 feet in any direction~~Maximum of 0.5 inch per 50 feet of building length or 1 inch total in any direction at any point in these structures ~~No limit~~0.5 inch
Slope failure potential	No slope failure potential

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Table 2.0-1: Site Design Parameters

Site Characteristic / Parameter	NuScale Design Parameter
Geography and Demography (Section 2.1)	
Minimum exclusion area boundary	Security owner controlled area fence
Minimum outer boundary of low population zone	Security owner controlled area fence
Nearby Industrial, Transportation, and Military Facilities (Section 2.2)	
External hazards on plant systems, structures, and components (SSC) (e.g., explosions, fires, release of toxic chemicals and flammable clouds, pressure effects) on plant SSC	No external hazards
Aircraft hazards on plant SSC	No design basis aircraft hazards
Meteorology (Section 2.3)	
Maximum precipitation rate	19.4 inches per hour 6.3 inches for a 5 minute period
Normal roof snow load	50 psf
Extreme roof snow load	75 psf
100-year return period 3-second wind gust speed	145 mph (exposure Category C) with an importance factor of 1.15 for Reactor Building, Control Building and Radioactive Waste Building
Design basis tornado maximum horizontal wind speed maximum translational speed maximum rotational speed maximum radius of rotational speed maximum pressure differential maximum rate of pressure drop	 230 mph 46 mph 184 mph 150 ft 1.2 psi 0.5 psi/sec
Tornado missile spectra	Table 2 of Regulatory Guide 1.76, Revision 1, Region 1
Maximum wind speed design basis hurricane	290 mph
Hurricane missile spectra	Tables 1 and 2 of Regulatory Guide 1.221, Revision 0
Summer outdoor design dry bulb temperature	115°F
Winter outdoor design dry-bulb temperature	-40°F
Summer outdoor wet bulb temperature coincident non-coincident	 80°F 81°F
Accident airborne effluent release point characteristics for offsite receptors release height adjacent building height adjacent building cross-sectional area	 ground level (0 meters) negligible negligible (0.1 square meters)
Accident release χ/Q values at security owner controlled area fence 0-2 hr 2-8 hr 8-24 hr 24-96 hr 96-720 hr	 5.72E-04 s/m^3 4.85E-04 s/m^3 2.14E-04 s/m^3 2.15E-04 s/m^3 1.95E-04 s/m^3
Accident release χ/Q values at main control room/technical support center door and HVAC intake (approximately 112 feet from source) 0-2 hr 2-8 hr	Door / HVAC Intake 6.50E-03 s/m^3 / 6.50E-03 s/m^3 5.34E-03 s/m^3 / 5.34E-03 s/m^3

Table 2.0-1: Site Design Parameters (Continued)

Site Characteristic / Parameter	NuScale Design Parameter
Maximum settlement for the Reactor Building, Control Building, and Radioactive Waste Building	
total settlement	~~no limit~~4 inches
tilt settlement	~~1 inch per 50 feet in any direction~~Maximum of 0.5 inch per 50 feet of building length or 1 inch total in any direction at any point in these structures
differential settlement (between Reactor Building and Control Building, and Reactor Building and Radioactive Waste Building)	~~no limit~~0.5 inch
Slope failure potential	No slope failure potential
Source Terms	
Design basis accident source term	Accident source term is addressed in Section 15.0.3
Inventory of radionuclides that could potentially seep into the groundwater	Potential inventory of radionuclides and compliance with Branch Technical Position 11-06 are described in Sections 11.2.3.2 and 12.2

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 all interfaces between the basemat and the soil is 0.58. 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.

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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.

2.5.6 References

2.5-1 Department of the Navy, "Design Manual 7.2 - Foundation and Earth Structures," NAVFAC DM-7.2, Alexandria, VA, May 1982.