RAIO-0818-61581

September 14, 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. 300 (eRAI No. 9186) on the NuScale Design Certification Application

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 300 (eRAI No. 9186)," dated December 15, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 300 (eRAI No.9186)," dated February 13, 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. 9186:

- 02.03.01-6

This supplemental replaces the response to sub-part c) of Reference 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
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Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9186

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9186

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

eRAI No.: 9186
Date of RAI Issue: 12/15/2017

NRC Question No.: 02.03.01-6

Regulatory Background

10 CFR Part 50, Appendix A, General Design Criterion (GDC) 2, “Design bases for protection against natural phenomena”, states, in part, that “[s]tructures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena….without loss of capability to perform their safety functions” and that “[t]he design bases for these structures, systems, and components shall reflect….[a]ppropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.”

In addition, 10 CFR 52.47(a)(1) requires a design certification applicant to provide site parameters postulated for its design and an analysis and evaluation of the design in terms of those site parameters.

Further, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (SRP), Section 2.3.1, “Regional Climatology,” establishes criteria that the NRC staff uses to evaluate whether an applicant meets the NRC’s regulations. With respect to its review of the applicant’s postulated design-basis dry- and/or wet-bulb temperature site parameter values, the NRC staff considered, in part, Item 6(e) under Subsection I (Areas of Review) and SRP Acceptance Criterion (7) under Subsection II (Acceptance Criteria) regarding ambient temperature and atmospheric moisture statistics for use in establishing heat loads for the design of normal plant heat sink systems, post-accident containment heat removal systems, and plant heating, ventilating, and air conditioning systems.

Key Issue

This question is seeking clarification on the definitions of the summer and winter outdoor dry- and/or wet-bulb temperatures listed as site parameters in FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.0-1, including providing cross-references to those FSAR sections in which these postulated site parameters are used.

Information Requested

The NRC staff notes that the postulated design-basis summer and winter outdoor dry- and/or wet-bulb temperatures specified in FSAR Tier 1, Table 5.0-1, and Tier 2, Table 2.0-1 are the same numerical values listed in Table 1.2-6, “Envelope of ALWR Plant Site Design Parameters” of the Advanced Light Water Reactor Utility Requirements Document, Volume II – ALWR Evolutionary Plant, Chapter 1 (Overall Requirements), Revision 8, published by EPRI, March 1999. This indicates that there has been no change to the values of these “site design parameters” up through Revision 13 of the EPRI URD, which FSAR Tier 2, Section 2.3.1 cites as the basis for these postulated site parameter values. However, unlike FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.0-1, Revision 8 of the EPRI URD designates these dry- and wet-bulb values as “0% Exceedance Values (historical limit excluding peaks < 2 hours)”.

In order for future potential COL applicants referencing the NuScale SMR plant design certification to be able to consistently develop and compare their climate-related site characteristics with the corresponding site parameter values, the applicant should address the following issues related to the design-basis dry- and/or wet-bulb temperature site parameter values in FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.0-1 and in FSAR Tier 2, Section 2.3.1:

a. Confirm, for each of these site parameters, whether the postulated design-basis summer and winter outdoor dry- and/or wet-bulb temperatures represent 0 percent exceedance values relative to those specific seasons and, if so (considering the potential range of locations that the NuScale SMR plant design might be deployed in), what months define those seasons. If not, then please identify and explain what exceedance probability these site parameter values represent.

b. For each site parameter that represents a 0 percent exceedance value, confirm whether they also represent an absolute maximum or minimum value or, as in the EPRI URD, are based on historical limits excluding peaks less than 2 hours (or some other duration).

c. Define what the coincident wet-bulb temperature value represents (e.g., the overall maximum wet-bulb temperature that is coincident with the indicated dry-bulb temperature, the mean of the wet-bulb temperatures coincident with the indicated dry-bulb temperature, an estimated wet-bulb temperature value assumed to be coincident with the indicated dry-bulb temperature).

d. Consistent with SRP Section 2.3.1, Subsection I (Areas of Review), Item (6), last paragraph, which calls for “[a]ll references to FSAR (Final Safety Analysis Report) sections in which these conditions are used” to be identified by an applicant, please provide cross-references to those FSAR sections in which these postulated site parameters are used.

e. Annotate FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.0-1 to clarify these postulated site parameter values as indicated above, and/or revise FSAR Tier 2, Section 2.3.1 and related discussions under Tier 2, Section 9.4 to further explain what these values represent.

NuScale Response:

a) See previous response to RAI 9186.

b) See previous response to RAI 9186.

c) The coincident wet-bulb temperature value represents the overall maximum wet bulb temperature that is coincident with the indicated dry-bulb temperature. Tier 2 Section 2.3.1 is revised, as shown in the attached markup, to provide clarification. Tier 2 Sections 2.0 and 9.4 have also been revised, as shown in the attached markup, to incorporate editorial changes.

d) See previous response to RAI 9186.

e) See previous response to RAI 9186.

Impact on DCA:

FSAR Tier 2 Sections 2.0, 2.3, and 9.4 have been revised as described in the response above and as shown in the markup provided in this response.

RAI 02.03.01-2, RAI 02.03.01-6, RAI 02.03.01-6S1, RAI 02.03.01-8, RAI 02.03.05-1S1, RAI 03.07.02-24S1, RAI 03.08.05-1, RAI 03.08.05-8

Table 2.0-1: Site Design Parameters

Site Characteristic / Parameter	NuScale Design Parameter	References to Parameter
Geography and Demography (Section 2.1)		
Minimum exclusion area boundary	400 feet from the closest release point	Sections 2.1 and 2.3.4
Minimum outer boundary of low population zone	400 feet from the closest release point	Sections 2.1 and 2.3.4
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	Section 2.2
Aircraft hazards on plant SSC	No design basis aircraft hazards	Sections 2.2 and 3.5.1.6
Meteorology (Section 2.3)		
Maximum precipitation rate	19.4 inches per hour 6.3 inches for a 5 minute period	Sections 3.4.2.2 and 3.8.4.3.10
Normal roof snow load	50 psf	Sections 3.4.2.2, 3.8.4.3.10, 3.8.4.3.11, ~~and 3.8.4.8~~3.8.4.3.16, 3.8.4.4.1, 3.8.4.4.2, 3.8.4.8, and 3.8.5.5.5
Extreme roof snow load	75 psf	Sections 3.4.2.2, 3.8.4.3.10, 3.8.4.3.12, ~~and 3.8.4.8~~3.8.4.3.16, 3.8.4.4.1, 3.8.4.4.2, 3.8.4.8, and 3.8.5.5.5
100-year return period 3-second wind gust speed	145 mph (~~e~~Exposure Category C) with an importance factor of 1.15 for Reactor Building, Control Building, and Radioactive Waste Building	Sections 3.3.1.1, 3.8.4.3.13, and 3.8.4.8
Design basis tornado maximum wind speed translational speed maximum rotational speed radius of maximum rotational speed pressure drop rate of pressure drop	 230 mph 46 mph 184 mph 150 ft 1.2 psi 0.5 psi/sec	Sections 3.1.1.2, 3.3.2.1, 3.3.2.2, 3.3.2.3, 3.8.4.3.14, and 3.8.4.8
Tornado missile spectra	Table 2 of Regulatory Guide 1.76, Revision 1, Region 1	Sections 3.3.2.3, 3.5.1.4, 3.5.2, 3.5.3.1, and 3.5.3.2
Maximum wind speed design basis hurricane	290 mph	Sections 3.1.1.2, 3.3.2.1, 3.3.2.2, 3.3.2.3, 3.8.4.3.14, and 3.8.4.8
Hurricane missile spectra	Tables 1 and 2 of Regulatory Guide 1.221, Revision 0	Section 3.5.1.4, 3.3.2.3, 3.5.2, 3.5.3.1, and 3.5.3.2

Table 2.0-1: Site Design Parameters (Continued)

Site Characteristic / Parameter	NuScale Design Parameter		References to Parameter
Accident release χ/Q values at ~~security owner controlled area fence~~exclusion area boundary and outer boundary of low population zone			
0-2 hr	6.22E-04 s/m^3		Sections 15.0.3.2 and 15.0.3.3.11; Table 15.0-13
2-8 hr	5.27E-04 s/m^3		
8-24 hr	2.41E-04 s/m^3		
24-96 hr	2.51E-04 s/m^3		
96-720 hr	2.46E-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)~~	Door	HVAC Intake	
0-2 hr	6.50E-03 s/m^3	6.50E-03 s/m^3	Section 15.0.3.3.11; Table 15.0-13
2-8 hr	5.34E-03 s/m^3	5.34E-03 s/m^3	
8-24 hr	2.32E-03 s/m^3	2.32E-03 s/m^3	
1-4 day	2.37E-03 s/m^3	2.37E-03 s/m^3	
4-30 day	2.14E-03 s/m^3	2.14E-03 s/m^3	
Routine release χ/Q and D/Q values ~~associated with the bounding offsite dose location~~at restricted area boundary			
undepleted/no decay	~~5.43~~1.44E-05 s/m^3		Tables 11.3-5 and 11.3-6
undepleted/2.26-day decay	~~5.43~~1.44E-05 s/m^3		
depleted/8.00-day decay	~~5.43~~1.44E-05 s/m^3		
D/Q	~~5.43~~1.44E-07 1/m^2		
Zero percent exceedance values (historical limit excluding peaks <2 hours)			Sections 3.8.4.3.8, 3.8.4.8, 9.4.1.1, 20.1.1.4, and 20.1.1.5; Table 9.4.1-1
Maximum outdoor design dry bulb temperature	115°F		
~~Minimum outdoor design dry bulb temperature~~	~~-40°F~~		
Maximum coincident wet bulb temperature	80°F		
Maximum non-coincident wet bulb temperature	81°F		
Minimum outdoor design dry bulb temperature	-40°F		

Table 2.0-1: Site Design Parameters (Continued)

Site Characteristic / Parameter	NuScale Design Parameter	References to Parameter
One percent annual exceedance values Maximum outdoor design dry bulb temperature ~~Minimum outdoor design dry bulb temperature~~ Maximum coincident wet bulb temperature Maximum non-coincident wet bulb temperature Minimum outdoor design dry bulb temperature	 100°F ~~-10°F~~ 77°F 80°F -10°F	Section 9.2.7.2.1; Tables 9.2.7-1, 9.4.2-1, 9.4.3-1, and 10.4-9
Five percent annual exceedance values Maximum outdoor design dry bulb temperature ~~Minimum outdoor design dry bulb temperature~~ Maximum coincident wet bulb temperature Minimum outdoor design dry bulb temperature	 95°F ~~-5°F~~ 77°F -5°F	Table 9.4.4-1
Hydrologic Engineering (Section 2.4)		
Maximum flood elevation ~~p~~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 3.8.5-9
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 3.8.5-9
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

2.3 Meteorology

RAI 02.03.01-7

The NuScale Power Plant is designed using meteorological parameters that are representative of a reasonable number of potential plant site locations in the United States. These parameters are discussed below and presented in Table 2.0-1.

COL Item 2.3-1: A COL applicant that references the NuScale Power Plant design certification will describe the site-specific meteorological characteristics for Section 2.3.1 through Section 2.3.5, as applicable.

2.3.1 Regional Climatology

The design maximum precipitation rate is 19.4 inches per hour and 6.3 inches for a 5 minute period. These values come from NWS HMR #52 (Reference 2.3-1) and address the majority of locations in the contiguous United States.

The design normal roof snow load is 50 psf. For the extreme roof snow load, a value of 150 percent of the normal roof snow load, or 75 psf was selected.

The design basis severe wind is a 3-second gust at 33 ft above ground for exposure category C. The wind speed (W) is 145 mph. The wind speed is increased by an importance factor of 1.15 for the design of the site independent structures. These design parameters are based upon ASCE/SEI 7-05 (Reference 2.3-4).

The parameters provided in Table 2.0-1 for the design basis tornado and tornado missiles are the most severe tornado parameters postulated for the ~~continental~~contiguous United States as identified in RG 1.76, Rev. 1. Similarly, the parameters for the design basis hurricane and hurricane missiles are the most severe parameters postulated in RG 1.221, Rev 0.

RAI 02.03.01-6, RAI 02.03.01-6S1, RAI 02.03.01-8

The design basis dry-bulb and wet bulb temperatures are based on the EPRI Utility Requirements Document (Reference 2.3-2). Pertinent ~~zero-, one-, and five-percent~~zero percent, and one and five percent annual exceedance values assumed in the design are provided in Table 2.0-1. The coincident wet-bulb temperature value represents the ~~mean of the collected~~overall maximum wet bulb temperature~~s~~ that ~~occurred~~is coincident with the indicated dry-bulb temperature.

Regional climatology is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.3-1.

2.3.2 Local Meteorology

Local meteorology is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.3-1.

RAI 02.03.01-6

Table 9.4.1-1: CRVS Outdoor Air Design Conditions

Parameter	Temperature*
Maximum outdoor design dry bulb temperature	115°F
Maximum coincident design wet bulb temperature	80°F
Maximum non-coincident wet bulb temperature	81°F
Minimum outdoor design dry bulb temperature	-40°F
*Table 9.4.1-1 temperatures are zero percent exceedance values (historical limits excluding peaks <2 hours)	

RAI 02.03.01-8

Table 9.4.2-1: Outside Air Temperature Range for Reactor Building Ventilation System

Parameter	Temperature*
Maximum outdoor design dry bulb temperature	100°F
Maximum coincident design wet bulb temperature	77°F
Minimum outdoor design dry bulb temperature	-10°F

*Table 9.4.2-1 temperatures are one percent annual exceedance values

RAI 02.03.01-8

Table 9.4.3-1: Outside Air Design Temperature for the Radioactive Waste Building HVAC System

Parameter	Temperature*
Maximum outdoor design dry bulb temperature	100°F
Maximum coincident design wet bulb temperature	77°F
Minimum outdoor design dry bulb temperature	-10°F

*Table 9.4.3-1 temperatures are one percent annual exceedance values

RAI 02.03.01-8

Table 9.4.4-1: Turbine Building HVAC System Outdoor Air Design Conditions

Parameter	Temperature*
Maximum Outdoor Design Dry Bulb Temperature	95°F
Maximum coincident Design Wet Bulb Temperature	77°F
Minimum Design Dry Bulb Temperature	-5°F

*Table 9.4.4-1 temperatures are five percent annual exceedance values