October 24, 2019 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 Submittal of Changes to Final Safety Analysis Report, Tier 1, Chapter 5.0, "Site Parameters," Tier 2, Section 1.8, "Interfaces with Certified Design," Table 1.9-3, "Conformance with NUREG-0800, Standard Review Plan (SRP) and Design Specific Review Standard (DSRS)," Section 2.0, "Site Characteristics and Site Parameters," Section 3.1.1.2, "Criterion 2-Design Bases for Protection Against Natural Phenomena," Section 3.4.2.1, "Probable Maximum Flood," Section 3.5.1.4, "Missiles Generated by Tornadoes and Extreme Winds," Section 3.8.4.3.8, "Operating Thermal Loads (T_o)," and Section 14, "Certified Design Material and Inspections, Tests, Analyses, and Acceptance Criteria"

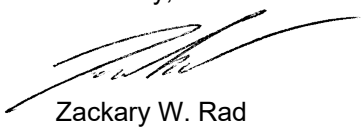
REFERENCES: Letter from NuScale Power, LLC to Nuclear Regulatory Commission, "NuScale Power, LLC Submittal of the NuScale Standard Plant Design Certification Application, Revision 3," dated August 22, 2019 (ML19241A315)

During an August 20, 2019 public meeting with NRC project manager Prosanta Chowdhury and technical staff, NuScale Power, LLC (NuScale) was asked to make minor editorial clarifications to the Final Safety Analysis Report (FSAR). As a result of this request, NuScale has implemented numerous clarification edits to the FSAR Tier 1, Chapter 5.0, "Site Parameters," Tier 2, Section 1.8, "Interfaces with Certified Design," Table 1.9-3, "Conformance with NUREG-0800, Standard Review Plan (SRP) and Design Specific Review Standard (DSRS), Section 2.0, "Site Characteristics and Site Parameters," Section 3.1.1.2, "Criterion 2-Design Bases for Protection Against Natural Phenomena," Section 3.4.2.1, "Probable Maximum Flood," Section 3.5.1.4, "Missiles Generated by Tornadoes and Extreme Winds," Section 3.8.4.3.8, "Operating Thermal Loads (T_o)," and Section 14, "Certified Design Materials and Inspections, Tests, Analyses, and Acceptance Criteria." The Enclosure to this letter provides a mark-up of the FSAR pages incorporating revisions to the affected FSAR Sections in redline/strikeout format. NuScale will include these changes 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 541-457-7172 or mbryan@nuscalepower.com.

Sincerely,



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Enclosure: Changes to NuScale Final Safety Analysis Report Tier 1, Chapter 5.0, “Site Parameters,” Tier 2, Section 1.8, “Interfaces with Certified Design,” Table 1.9-3, “Conformance with NUREG-0800, Standard Review Plan (SRP) and Design Specific Review Standard (DSRS),” Section 2.0, “Site Characteristics and Site Parameters,” Section 3.1.1.2, “Criterion 2-Design Bases for Protection Against Natural Phenomena,” Section 3.4.2.1, “Probable Maximum Flood,” Section 3.5.1.4, “Missiles Generated by Tornadoes and Extreme Winds,” Section 3.8.4.3.8, “Operating Thermal Loads (T_o),” and Section 14, “Certified Design Material and Inspections, Tests, Analyses, and Acceptance Criteria”

Enclosure:

Changes to NuScale Final Safety Analysis Report Tier 1, Chapter 5.0, “Site Parameters,” Tier 2, Section 1.8, “interfaces with Certified Design,” Table 1.9-3, “Conformance with NUREG-0800, Standard Review Plan (SRP) and Design Specific Review Standard (DSRS),” Section 2.0, “Site Characteristics and Site Parameters,” Section 3.1.1.2, “Criterion 2-Design Bases for Protection Against Natural Phenomena,” Section 3.4.2.1, “Probable Maximum Flood,” Section 3.5.1.4, “Missiles Generated by Tornadoes and Extreme Winds,” Section 3.8.4.3.8, “Operating Thermal Loads (T_o),” and Section 14, “Certified Design Material and Inspections, Tests, Analyses, and Acceptance Criteria”

CHAPTER 5 SITE PARAMETERS

5.0 Site Parameters

The NuScale Power Plant design certification may be deployed over a wide variety of sites; therefore, it is necessary to specify a set of ~~design~~ parameters that bound the site conditions that are suitable for NuScale Power Plant operation. A site for construction of a NuScale Power Plant is acceptable if the site-specific characteristics fall within the ~~design~~site parameter values specified in Table 5.0-1 and Figure 5.0-1 through Figure 5.0-4. In case of deviation from these parameters, justification may be provided that the proposed facility is acceptable at the proposed site.

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

Table 5.0-1: Site ~~Design~~ Parameters

Site Characteristic~~/Parameter~~	~~NuScale Design~~Site 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 design basis aircraft hazards
Meteorology	
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 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
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.
Zero percent exceedance value (historical limit excluding peaks <2 hours) Maximum outdoor design dry bulb temperature Minimum outdoor design dry bulb temperature	 115°F -40°F
Accident release χ/Q values at exclusion area boundary and outer boundary of low population zone 0-2 hr 2-8 hr 8-24 hr 24-96 hr 96-720 hr	 6.22E-04 s/m^3 5.27E-04 s/m^3 2.41E-04 s/m^3 2.51E-04 s/m^3 2.46E-04 s/m^3
Accident release χ/Q values at main control room/ technical support center door and heating ventilation and air conditioning intake 0-2 hr 2-8 hr 8-24 hr 1-4 day 4-30 day	<u>Door</u> 6.50E-03 s/m^3 5.34E-03 s/m^3 2.32E-03 s/m^3 2.37E-03 s/m^3 2.14E-03 s/m^3	<u>Heating Ventilation and Air Conditioning Intake</u> 6.50E-03 s/m^3 5.34E-03 s/m^3 2.32E-03 s/m^3 2.37E-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 1.8-1: Summary of NuScale Certified Design Interfaces with Remainder of Plant

System, Structure, or Component	Interface Type	FSAR Section
Turbine Generator Buildings	CDI	1.2.2
Annex Building	CDI	1.2.2
Cooling towers, pump houses, and associated structures, systems, and components (e.g., cooling tower basin, circulating water pumps, cooling tower fans, chemical treatment building, etc.)	CDI	1.2.2, 10.4.5
Security Buildings	CDI	1.2.2
Central Utility Building	CDI	1.2.2
Diesel Generator Buildings	CDI	1.2.2
Offsite power transmission system, main switchyard, and transformer area	CDI	8.2
Auxiliary AC power system	CDI	8.3.1
Site cooling water system	CDI	9.2.7
Circulating water system	CDI	10.4.5
Grounding and lightning protection system	CDI	8.3.1
Plant exhaust stack	CDI	9.4.2
Potable and sanitary water systems	COL	9.2.4
Resin tanks for the condensate polishing system	COL	10.4
Site drainage system	COL	N/A
Raw water system	COL	9.2.9
~~Site-specific design~~Site parameters, geographic and demographic characteristics, meteorological characteristics, nearby industrial, transportation, and military facilities, hydrologic characteristics, geology, seismology, and geotechnical characteristics, weather conditions and site topography, flooding	COL	Table 2.0-1, 2.1, 2.2, 2.3, 2.4, 2.5, 3.3, 3.4
Site-specific communications	COL	9.5.2
Turbine generators	COL	3.5-1
Operational Support Center	COL	13.3

Table 1.8-2: Combined License Information Items

	Item No.	Description of COL Information Item	Section
RAI 02.04.13-1	COL Item 1.1-1:	A COL applicant that references the NuScale Power Plant design certification will identify the site-specific plant location.	1.1
RAI 02.04.13-1	COL Item 1.1-2:	A COL applicant that references the NuScale Power Plant design certification will provide the schedules for completion of construction and commercial operation of each power module.	1.1
RAI 02.04.13-1	COL Item 1.4-1:	A COL applicant that references the NuScale Power Plant design certification will identify the prime agents or contractors for the construction and operation of the nuclear power plant.	1.4
RAI 02.04.13-1	COL Item 1.7-1:	A COL applicant that references the NuScale Power Plant design certification will provide site-specific diagrams and legends, as applicable.	1.7
RAI 02.04.13-1	COL Item 1.7-2:	A COL applicant that references the NuScale Power Plant design certification will list additional site-specific piping and instrumentation diagrams and legends as applicable.	1.7
RAI 02.04.13-1	COL Item 1.8-1:	A COL applicant that references the NuScale Power Plant design certification will provide a list of departures from the certified design.	1.8
RAI 02.04.13-1	COL Item 1.9-1:	A COL applicant that references the NuScale Power Plant design certification will review and address the conformance with regulatory criteria in effect six months before the docket date of the COL application for the site-specific portions and operational aspects of the facility design.	1.9
RAI 02.04.13-1	COL Item 1.10-1:	A COL applicant that references the NuScale Power Plant design certification will evaluate the potential hazards resulting from construction activities of the new NuScale facility to the safety-related and risk significant structures, systems, and components of existing operating unit(s) and newly constructed operating unit(s) at the co-located site per 10 CFR 52.79(a)(31). The evaluation will include identification of management and administrative controls necessary to eliminate or mitigate the consequences of potential hazards and demonstration that the limiting conditions for operation of an operating unit would not be exceeded. This COL item is not applicable for construction activities (build-out of the facility) at an individual NuScale Power Plant with operating NuScale Power Modules.	1.10
RAI 02.04.13-1	COL Item 2.0-1:	A COL applicant that references the NuScale Power Plant design certification will demonstrate that site-specific characteristics are bounded by the ~~design~~site parameters specified in Table 2.0-1. If site-specific values are not bounded by the values in Table 2.0-1, the COL applicant will demonstrate the acceptability of the site-specific values in the appropriate sections of its combined license application.	2.0
RAI 02.04.13-1	COL Item 2.1-1:	A COL applicant that references the NuScale Power Plant design certification will describe the site geographic and demographic characteristics.	2.1
RAI 02.04.13-1	COL Item 2.2-1:	A COL applicant that references the NuScale Power Plant design certification will describe nearby industrial, transportation, and military facilities. The COL applicant will demonstrate that the design is acceptable for each ~~potential accident~~of these potential hazards, or provide site-specific design alternatives.	2.2
RAI 02.04.13-1	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
RAI 02.04.13-1	COL Item 2.4-1:	A COL applicant that references the NuScale Power Plant design certification will investigate and describe the site-specific hydrologic characteristics for Section 2.4.1 through Section 2.4.14, except Section 2.4.8 and Section 2.4.10.	2.4
RAI 02.04.13-1	COL Item 2.5-1:	A COL applicant that references the NuScale Power Plant design certification will describe the site-specific geology, seismology, and geotechnical characteristics for Section 2.5.1 through Section 2.5.5, below.	2.5
RAI 02.04.13-1	COL Item 3.2-1:	A COL applicant that references the NuScale Power Plant design certification will update Table 3.2-1 to identify the classification of site-specific structures, systems, and components.	3.2
RAI 02.04.13-1	COL Item 3.3-1:	A COL applicant that references the NuScale Power Plant design will confirm that nearby structures exposed to severe and extreme (tornado and hurricane) wind loads will not collapse and adversely affect the Reactor Building or Seismic Category I portion of the Control Building.	3.3
RAI 02.04.13-1	COL Item 3.4-1:	A COL applicant that references the NuScale Power plant design certification will confirm the final location of structures, systems, and components subject to flood protection and final routing of piping.	3.4

RAI 03.06.02-6, RAI 03.08.04-10, RAI 05.03.01-3, RAI 06.02.04-8, RAI 08.01-1, RAI 08.01-1S1, RAI 08.02-4, RAI 08.02-6, RAI 08.03.02-1, RAI 09.02.06-1, RAI 09.03.02-3S1, RAI 10.02-3, RAI 10.02.03-1, RAI 10.02.03-2, RAI 10.03.06-4, RAI 10.04.07-1, RAI 14.03.12-2, RAI 14.03.12-3

Table 1.9-3: Conformance with NUREG-0800, Standard Review Plan (SRP) and Design Specific Review Standard (DSRS)

SRP or DSRS Section, Rev: Title	AC	AC Title/Description	Conformance Status	Comments	Section
SRP 1.0, Rev 2: Introduction and Interfaces	II.1	No Specific Acceptance Criteria	-	No Specific Acceptance Criteria.	Not Applicable
SRP 1.0, Rev 2: Introduction and Interfaces	II.2	SRP Acceptance Criteria Associated with Each Referenced SRP section	Conforms	None.	Ch 1
SRP 1.0, Rev 2: Introduction and Interfaces	II.3	Performance of New Safety Features and Design Qualification Testing Requirements	Conforms	None.	Ch 1
SRP 2.0, (March 2007): Site Characteristics and Site Parameters	II.1	Specific SRP Acceptance Criteria Contained in Related SRP Chapter 2 or Other Referenced SRP sections	Conforms	This acceptance criterion is a pointer to other SRP sections.	2.0
SRP 2.0, (March 2007): Site Characteristics and Site Parameters	II.2	COL Application Referencing an Early Site Permit	Not Applicable	This acceptance criterion is applicable only to COL applicants that do not reference the DCA.	Not Applicable
SRP 2.0, (March 2007): Site Characteristics and Site Parameters	II.3	COL Application Referencing a Certified Design	Not Applicable	This acceptance criterion is for COL applicants to meet the design parameters established in the DCA.	Not Applicable
SRP 2.0, (March 2007): Site Characteristics and Site Parameters	II.4	COL Application Referencing an Early Site Permit and a Certified Design	Not Applicable	This acceptance criterion is for COL applicants to meet the design parameters established in the DCA.	Not Applicable
SRP 2.0, (March 2007): Site Characteristics and Site Parameters	II.5	COL Application Referencing Neither an Early Site Permit Nor a Certified Design	Not Applicable	This acceptance criterion is applicable only to COL applicants that do not reference the DCA.	Not Applicable
SRP 2.0, (March 2007): Site Characteristics and Site Parameters	App A	Table 1: Examples of Site Characteristics and Site Parameters	Partially Conforms	NuScale provides ~~design~~site parameters where applicable.	Table 2.0-1
SRP 2.0, (March 2007): Site Characteristics and Site Parameters	App A	Table 2: Examples of Site-Related Design Parameters and Design Characteristics	Partially Conforms	NuScale provides ~~design~~site parameters where applicable.	Table 2.0-1
SRP 2.1.1, Rev 3: Site Location and Description	All	Specification of Location and Site Area Map	Not Applicable	Site-specific.	Not Applicable

CHAPTER 2 SITE CHARACTERISTICS AND SITE PARAMETERS

2.0 Site Characteristics and Site Parameters

RAI 02.03.01-7

The NuScale Power Plant design assumes site parameters that are representative of a reasonable number of potential plant site locations in the United States. A summary of these parameters is provided in Table 2.0-1.

COL Item 2.0-1: A COL applicant that references the NuScale Power Plant design certification will demonstrate that site-specific characteristics are bounded by the ~~design~~site parameters specified in Table 2.0-1. If site-specific values are not bounded by the values in Table 2.0-1, the COL applicant will demonstrate the acceptability of the site-specific values in the appropriate sections of its combined license application.

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 02.03.05-1S2, 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~~Site 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, 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, 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 (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~~Site 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 2.5.4, 3.8.5.3.1, 3.8.5.4.1.2, 3.8.5.5.2, 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 2.5.4, 3.8.5.4.1.4, Table 3.8.5-8
Coefficient of friction (CoF) between walls and soil	≥ 0.50	Section 2.5.4, 3.8.5.4.1.2, 3.8.5.4.1.4, Table 3.8.5-1, Table 3.8.5-8

2.1 Geography and Demography

RAI 02.03.01-2

The certified design assumes that the Exclusion Area Boundary and Low Population Zone outer boundary are as close as 400 feet from the nearest release point. This is a key ~~design~~site parameter and included in Table 2.0-1.

COL Item 2.1-1: A COL applicant that references the NuScale Power Plant design certification will describe the site geographic and demographic characteristics.

2.2 Nearby Industrial, Transportation, and Military Facilities

The NuScale Power Plant certified design does not postulate any hazards from nearby industrial, transportation or military facilities.

COL Item 2.2-1: A COL applicant that references the NuScale Power Plant design certification will describe nearby industrial, transportation, and military facilities. The COL applicant will demonstrate that the design is acceptable for each ~~potential accident~~of these potential hazards, or provide site-specific design alternatives.

2.4 Hydrologic Engineering

The NuScale Power Plant design does not rely upon an external water supply for the ultimate heat sink or safety-related makeup water. This design reduces the influence local hydrologic features have on plant safety. ~~Design~~Site parameters selected to represent site conditions are presented in Table 2.0-1.

COL Item 2.4-1: A COL applicant that references the NuScale Power Plant design certification will investigate and describe the site-specific hydrologic characteristics for Section 2.4.1 through Section 2.4.14, except Section 2.4.8 and Section 2.4.10.

2.4.1 Hydrologic Description

The local hydrology is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1.

2.4.2 Floods

The design assumes that the maximum flood elevation (including wind-induced wave run-up) is one foot below baseline plant elevation. The baseline plant elevation is the top of concrete of the ground floor of the Reactor Building. This maximum flood elevation is a key design parameter.

The potential for flooding is site-specific and is addressed by the COL applicant as part of part of the response to COL Item 2.4-1.

2.4.3 Probable Maximum Flood (PMF) on Streams and Rivers

The probable maximum flood (PMF) is site-specific and is addressed by the COL as part of the response to COL Item 2.4-1.

2.4.4 Potential Dam Failures

The presence of onsite, upstream, and downstream water control structures is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1.

2.4.5 Probable Maximum Surge and Seiche Flooding

The potential for surge or seiche flooding is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1.

2.4.6 Probable Maximum Tsunami Hazards

The potential for tsunamis is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1.

2.4.7 Ice Effects

The design does not rely upon a safety-related intake structure as a makeup source for the reactor pool, which acts as the ultimate heat sink. Therefore, ice effects do not affect safety

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 minimum 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

There are no rigid safety-related connections between the structures and no safety-related connections to other site structures. The maximum allowable total settlement at any foundation node is 4 inches and a maximum allowable differential settlement between the Reactor Building and Control Building, and between the Reactor Building and Radioactive Waste Building is 0.5 inch. 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.

characteristics associated with the natural phenomena of most potential plant sites. The design bases for safety-related SSC reflect this envelope of natural phenomena, including appropriate combinations of the effects of normal operating and accident conditions. The NuScale Power Plant's site ~~design~~ parameters are listed in Table 2.0-1. Seismic and quality group classifications, and other pertinent standards and information are provided in Table 3.2-1.

Conformance or Exception

The NuScale Power Plant design conforms to GDC 2.

Relevant FSAR Chapters and Sections

Chapter 2	Site Characteristics and Site Parameters
Section 3.2	Classification of Structures, Systems, and Components
Section 3.3	Wind and Tornado Loadings
Section 3.4	Water Level (Flood) Design
Section 3.5	Missile Protection
Section 3.7	Seismic Design
Section 3.8	Design of Category I Structures
Section 3.9	Mechanical Systems and Components
Section 3.10	Seismic and Dynamic Qualifications of Mechanical and Electrical Equipment
Section 3.11	Environmental Qualification of Mechanical and Electrical Equipment
Section 3.12	ASME Code Class 1, 2, and 3 Piping Systems, Piping Components and Associated Supports
Chapter 5	Reactor Coolant System and Connecting Systems
Chapter 6	Engineered Safety Features
Section 7.1	Fundamental Design Principles
Section 8.3	Onsite Power Systems
Section 9.1.2	New and Spent Fuel Storage
Section 9.1.3	Spent Fuel Pool Cooling and Cleanup System
Section 9.3	Process Auxiliaries

3.4.2 Protection of Structures Against Flood from External Sources

The design includes the two Seismic Category I structures: the RXB and the CRB. The Radioactive Waste Building (RWB) is Seismic Category II and does not contain any equipment subject to flood protection. There are no other safety-related structures in the design.

3.4.2.1 Probable Maximum Flood

The design is the equivalent of a "Dry Site" as defined in Regulatory Guide 1.102, "Flood Protection for Nuclear Power Plants," Rev. 1. The Seismic Category I structures are protected from external floods and groundwater by establishing the following design parameters:

- The probable maximum flood elevation (including wave action) of the design is one foot below the baseline plant elevation (100'-0).
- The maximum groundwater elevation for the design is two feet below the baseline plant elevation.

RAI 14.03.02-2, RAI 14.03.02-4

- With the exceptions of the subgrade CRB tunnel and a truck ramp on the south side of the Radwaste Building, the finished grade for all building structures is approximately six inches below the baseline plant elevation. The yard is graded with a minimum slope of 1.5 percent away from these structures.

The below grade portions of the Seismic Category I structures provide protection for the safety-related and risk-significant SSC from groundwater intrusion by utilizing the following design features:

- the portions of the buildings that are below grade consider the use of waterstops and waterproofing
- exterior below grade wall or floor penetrations have watertight seals
- waterproofing and dampproofing systems, if used, are applied per the International Building Code Section 1805 (Reference 3.4-3)
- waterproofing and dampproofing materials, if used in horizontal applications, will have a coefficient of static friction equal to or greater than the ~~design~~site parameter established in Table 2.0-1 for all interfaces between the basemat and soil.

The design does not use a permanent dewatering system.

RAI 03.04.02-1, RAI 03.04.02-2, RAI 03.04.02-3

COL Item 3.4-5: A COL applicant that references the NuScale Power Plant design certification will determine the extent of waterproofing and dampproofing needed for the underground portion of the Reactor Building and Control Building based on site-specific conditions. Additionally, a COL applicant will provide the specified design life for waterstops, waterproofing, damp proofing, and watertight seals. If the design life is less than the operating life of the plant, the COL applicant will describe how continued protection will be ensured.

Region I missile spectrums presented in Table 2 of RG 1.76, Rev. 1, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants" for tornado missiles and Table 1 and Table 2 of RG 1.221, Rev. 0, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," for hurricane missiles. These spectra are based on the design basis tornado and hurricane defined in Section 3.3.2 and represent probability of exceedance events of 1×10^{-7} per year for most potential sites.

The selected missiles include

- A massive high-kinetic-energy missile that deforms on impact, such as an automobile.

  The "automobile" missile is 16.4 feet by 6.6 feet by 4.3 feet with a weight of 4000 lbs. and a C_DA/m (drag coefficient x projected area/mass) of 0.0343 ft^2/lb.

  This missile has a horizontal velocity of 135 ft/s and a vertical velocity of 91 ft/s in a tornado; and corresponding velocities of 307 ft/s and 85 ft/s, respectively, in a hurricane.

  The automobile missile is considered capable of impact at all altitudes less than 30 ft above all grade levels within 1/2 mile of the plant structures.

- A rigid missile that tests penetration resistance, such as a six-inch diameter Schedule 40 pipe.

  The "pipe" missile is 6.625 inch diameter by 15 feet long with a weight of 287 lbs. and a C_DA/m of 0.0212 ft^2/lb.

  This missile has a horizontal velocity of 135 ft/s and a vertical velocity of 91 ft/s in a tornado; and corresponding velocities of 251 ft/s and 85 ft/s, respectively, in a hurricane.

- A one-inch diameter solid steel sphere to test the configuration of openings in protective barriers.

  The "sphere" missile is 1 inch in diameter with a weight of 0.147 lbs. and a C_DA/m of 0.0166 ft^2/lb.

  This missile has a horizontal velocity of 26 ft/s and a vertical velocity of 18 ft/s in a tornado; and corresponding velocities of 225 ft/s and 85 ft/s, respectively, in a hurricane.

These missile parameters are key ~~design~~site parameters and are provided in Table 2.0-1.

3.5.1.5 Site Proximity Missiles (Except Aircraft)

As described in Section 2.2, the NuScale Power Plant certified design does not postulate any hazards from nearby industrial, transportation or military facilities. Therefore, there are no proximity missiles.

3.8.4.3.7 Accident Pipe and Equipment Reactions (R_a)

Pipe and equipment reactions under thermal conditions are generated by the postulated pipe break, including (R_o). This includes their dead load, live load, thermal load, seismic load, thrust load, and transient unbalanced internal pressure loads under abnormal or extreme environmental conditions.

The CRB does not have any high energy or high temperature piping. R_a is not a load for the CRB.

3.8.4.3.8 Operating Thermal Loads (T_o)

Thermal loads are caused by a temperature variation through the concrete wall between the interior temperature and the external environmental temperature. In addition, in the RXB, a thermal gradient could occur in the five foot thick walls surrounding the reactor pool. Section 1.3 of ACI 349.1R (Reference 3.8.4-7) states that thermal gradients should be considered in the design of reinforcement for normal conditions to control concrete cracking. However, a thermal gradient less than approximately 100 degrees F need not be analyzed because such gradients will not cause significant stress in the reinforcement or strength deterioration.

RAI 02.03.01-6

As shown in Table 2.0-1, the external temperature ~~design~~site parameters for the NuScale standard structures are zero percent exceedance dry bulb values of -40 degrees F and +115 degrees F. The external soil temperature is assumed to be 21 degrees F in the winter and 40 degrees F in the summer.

RAI 03.08.04-13

The RXB has a design internal air temperature range of 70 degrees F to 130 degrees F, and a design pool temperature range of 65 degrees F to 110 degrees F. These temperatures are used to determine the stresses and displacements.

The CRB has a maximum temperature differential of 110 degrees F, based on an external temperature of -40 degrees F and an internal temperature of 70 degrees F. This gradient has been determined not to affect the design stresses in the building. T_0 is not a load for the CRB.

3.8.4.3.9 Accident Thermal Loads (T_a)

The maximum post accident temperature in the RXB is assumed to be 212 degrees F. This temperature is used in conjunction with the external temperature to determine the stresses and displacements.

The CRB does not have any high energy or high temperature piping. T_a is not a load for the CRB.

so no ITAAC are necessary for site parameters. Chapter 2 provides a discussion of the envelope of site ~~design~~ parameters used for the NuScale Power Plant design. The corresponding Tier 1 Chapter 5 is based on Table 2.0-1. Tier 1 Chapter 5 is limited to a tabular entry; no supporting text material is required.