



January 31, 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 Response to NRC Request for Additional Information No. 131 (eRAI No. 8970) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 131 (eRAI No. 8970)," dated August 05, 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. 8970:

- 03.08.04-10

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,

A handwritten signature in black ink, appearing to read "Zackary W. Rad".

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. 8970



Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 8970

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

eRAI No.: 8970

Date of RAI Issue: 08/05/2017

NRC Question No.: 03.08.04-10

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment.

DSRS Section 3.8.4 references AISC N690-1994 including Supplement 2 (2004) as being acceptable to the staff for establishing the load and load combinations, design and analysis procedures, and structural acceptance criteria, for seismic Category I Steel Structures. FSAR Sections 3.8.4.2.1, 3.8.4.3, and 3.8.4.5, indicate the use of AISC N690-2012 for the design of seismic Category I structures. Provide specific reasons for using AISC N690-2012 in place of AISC N690-1994 including Supplement 2 (2004).

NuScale Response:

A design code comparison was performed for ANSI/AISC N690-1994 including Supplement 2 (2004) and ANSI/AISC N690-12, specific to design load combinations in the NuScale Power Plant design of Seismic Category I steel structures.

The use of ANSI/AISC N690-12 was to obtain loads from allowable strength design load combinations for use in the analysis of two safety related, Seismic Category I Nuscale Power Module (NPM) steel supports. The NPM is supported at the bottom of containment vessel (CNV) skirt and at the CNV lug locations (located approximately halfway up the NPM). The bottom CNV support is a passive ring that resists horizontal loads from the CNV produced by the safe shutdown earthquake (SSE). The lug supports are also passive supports designed to resist the horizontal loads from the CNV produced by the SSE.

For the design of the NPM supports, the worst load case from the load combinations is applied. To ensure that the governing load case between the codes was used, a check was performed to ensure that the governing load combination from ANSI/AISC N690-12 either matched or enveloped the governing load combination in ANSI/AISC N690-1994. The governing load combination was determined to be ANSI/AISC N690-12 equation NB2-15 due to the high



seismic load transfer from the NPM, and includes DSRS Section 3.8.4 supplemental criteria in the load combination. This load combination does not contain load coefficients, but it does allow for a strength increase of 1.6; 1.5 for fasteners and members experiencing axial tension or shear (1.5 used in the calculation). This is comparable to the related load combination from ANSI/AISC N690-1994, equation 8, which is assigned a stress limit coefficient of 1.6.

The use of ANSI/AISC N690-12 load combination equation NB2-15 as the equation that produces the highest applied loads is an acceptable substitute for ANSI/AISC N690-1994 equation 8. The safety related steel structures using N690-12 are designed for this load combination and concluded to be conservative, safe designs, similar to the same design if produced by use of ANSI/AISC N690-1994 load combinations.

Additionally, in the analysis and design of these two structural steel supports, other NRC accepted codes; ACI 349-06, ASME BPVC Section II, Part D 2013, ASTM design specifications and AISC steel construction manual 14th edition, second printing, were used. NuScale utilizes, when applicable, the latest engineering design codes, standards, and specifications for design. This is considered good engineering practice since using the latest revisions of codes and standards takes advantage of the latest test data and analysis of materials and design procedures to create a more predictable and cost effective solution.

Impact on DCA:

FSAR Tier 2, Section 3.8.4.5 and Table 1.9-3 have been revised as described in the response above and as shown in the markup provided in this response.

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 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	COL Applicability	Comments	Section
SRP 1.0, Rev 2: Introduction and Interfaces	II.1	No Specific Acceptance Criteria	-	-	No Specific Acceptance Criteria.	X
SRP 1.0, Rev 2: Introduction and Interfaces	II.2	SRP Acceptance Criteria Associated with Each Referenced SRP section	Conforms	Applicable	None.	Ch 1
SRP 1.0, Rev 2: Introduction and Interfaces	II.3	Performance of New Safety Features and Design Qualification Testing Requirements	Conforms	Applicable	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	Applicable	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	Applicable	This acceptance criterion is applicable only to COL applicants that do not reference the DCA.	2.0
SRP 2.0, (March 2007): Site Characteristics and Site Parameters	II.3	COL Application Referencing a Certified Design	Not Applicable	Applicable	This acceptance criterion is for COL applicants to meet the design parameters established in the Design Certification Application.	2.0
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	Applicable	This acceptance criterion is for COL applicants to meet the design parameters established in the Design Certification Application.	2.0
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	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	Applicable	NuScale provides design 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	Applicable	NuScale provides design Parameters where applicable.	Table 2.0-1

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

SRP or DSRS Section, Rev: Title	AC	AC Title/Description	Conformance Status	COL Applicability	Comments	Section
SRP 3.5.1.5, Rev 4: Site Proximity Missiles (Except Aircraft)	II.1	Compliance with 10 CFR 100	Not Applicable	Applicable	The NuScale certified design assumes no proximity missiles.	Not Applicable
SRP 3.5.1.5, Rev 4: Site Proximity Missiles (Except Aircraft)	II.2	Compliance with GDC 4	Not Applicable	Applicable	The NuScale certified design assumes no proximity missiles.	Not Applicable
SRP 3.5.1.6, Rev 4: Aircraft Hazards	II.1 and II.2	Various	Not Applicable	Applicable	The NuScale certified design assumes no aircraft hazard missiles.	3.5.1.6
SRP 3.5.1.6, Rev 4: Aircraft Hazards	III.8.B.1	Postulated Site Parameters	Conforms	Applicable	The NuScale certified design assumes no aircraft hazard missiles.	Table 2.0-1
SRP 3.5.1.6, Rev 4: Aircraft Hazards	III.8.B.2	Site Parameters Included as Tier 1 Information	Conforms	Applicable	The NuScale certified design assumes no aircraft hazard missiles.	Table 2.0-1
SRP 3.5.1.6, Rev 4: Aircraft Hazards	III.8.B.3	Site Parameters Summary Table	Conforms	Applicable	The NuScale certified design assumes no aircraft hazard missiles.	Table 2.0-1
SRP 3.5.1.6, Rev 4: Aircraft Hazards	III.8.B.4	Basis for Site Parameters	Conforms	Applicable	The NuScale certified design assumes no aircraft hazard missiles.	Table 2.0-1
SRP 3.5.2, Rev 3: Structures, Systems, and Components to be Protected From Externally-Generated Missiles	II (no number)	Capability of SSCs to Withstand the Effects of Externally Generated Missiles	Conforms	Applicable	None.	3.5.2
SRP 3.5.3, Rev. 3: Barrier Design Procedures	II.1.A	For Local Damage Prediction - Concrete	Conforms	Applicable	None.	3.5.3
SRP 3.5.3, Rev. 3: Barrier Design Procedures	II.1.B	For Local Damage Prediction - Steel	Conforms	Applicable	None.	3.5.3
SRP 3.5.3, Rev. 3: Barrier Design Procedures	II.1.C	For Local Damage Prediction - Composite sections	Not Applicable	Not Applicable	This acceptance criterion specifies provisions when using composite or multi-element barriers. NuScale does not intend to use composite or multi-element barriers.	3.5.3
SRP 3.5.3, Rev. 3: Barrier Design Procedures	II.2	For Overall Damage Prediction	Partially Conforms	Applicable	This acceptance criterion is applicable except for reference to subtier ANSI/AISC N690-1994 with Supplement 2 (2004). NuScale intends to use the 2006 2012 version of this standard.	3.5.3

mass are defined by specifying the multiplier for each load case considered. In this model, all long term loads were assigned a multiplier of 1.0, live loads a multiplier of 0.25, and snow loads a multiplier of 0.75. Live load mass participation requirements for dynamic analyses are given in Section 3.8.4.3.4. Table 3.8.4-9 lists the additional masses to be included from various load cases and its corresponding multipliers, which are considered as one of the mass sources for the CRB SAP2000 models for 1-g and dynamic analyses performed.

Load cases are developed in (or converted to) SAP2000 to address the different design loads discussed in Section 3.8.4.3. These cases are individually evaluated or combined to address the load combinations identified in Table 3.8.4-1 and Table 3.8.4-2 for the CRB.

3.8.4.5 Structural Acceptance Criteria

The load cases for the RXB and CRB are provided in Table 3.8.4-1 and Table 3.8.4-2. These tables identify the design code applied for each load combination.

RAI 03.08.04-25

[Code requirements are outlined in Table 3.8.4-12 which indicates the design codes for each Seismic Category based on the type of structure or loading.](#)

RAI 03.08.04-10

Limits for allowable stresses, strains, deformations and other design criteria for the reinforced concrete structures are in accordance with ACI 349/349R and its appendices as modified by the exceptions specified in RG 1.142. Structural acceptance criteria for the steel components are in accordance with AISC N690 (Reference 3.8.4-6). Load combination 10 from Table 3.8.4-1 has been determined to be the controlling load combination. As such, this load combination was used to assess the adequacy of the structures. [The use of AISC N690 \(Reference 3.8.4-6\) was to obtain loads from allowable strength design load combinations for use in the analysis of safety related, seismic category I steel structures. Load combination comparisons are performed on a case by case basis between AISC N690-1994 including Supplement 2 \(2004\) and AISC N690-2012 for verification that AISC N690-2012 provides the governing case.](#)

Appendix 3B, Reactor Building and Control Building Design Approach and Critical Section Details, provides results for selected sections of both the RXB and CRB.

Section 3.8.5.5 identifies acceptance criteria applicable to additional basemat load combinations.

3.8.4.6 Materials, Quality Control and Special Construction Techniques

3.8.4.6.1 Materials

The principal construction materials for structures are concrete, reinforcing steel, structural steel, stainless steel, bolts, anchor bolts and weld electrodes.

Table 3.8.4-10 provides the specifics of the materials considered for the structural design.